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Foreword

The need for information and the craving for knowledge are timeless and universal. The *Britannica Concise Encyclopedia* satisfies the essence of both these needs. This volume represents the distillation of essential information into a compact and eminently useful single volume.

This latest version of *Britannica Concise Encyclopedia* answers today's need for a portable, convenient reference work covering history, geography, the sciences, religion, sports, entertainment, technology, and the arts. We hope it will become a favourite source for helping students with their homework, for background to news events, for writers and crossword-puzzle enthusiasts, for solving disputes, and for random browsing.

This printing of *Britannica Concise Encyclopedia* has been broadly revised. Among the 2.8 million words that make up the nearly 28,000 entries are many new titles and many that have been updated. In the 16-page colour plates section, you will find the newest versions of national flags as well as a world map, maps of world religions and population characteristics, a selection of World Heritage sites, and a useful world map depicting international time zones. More than 30 tables catalog everything from Nobel Prize winners to chemical elements to popes to the International System of Units of measurement and their U.S. equivalents. Many of the more than 190 maps have been revised, and all of the more than 150 illustrations have been redrawn. The more than 2,000 photographs enhance both the appearance and content of *Britannica Concise*.

The editors of Encyclopædia Britannica are proud to present the *Britannica Concise Encyclopedia*. We hope that you will consult it often and that it will both satisfy your immediate need for information and lead you to the in-depth information of the 40 million words of the *Encyclopædia Britannica*. Creating the highest level of reference works has been our goal for 238 years, and we are pleased to welcome you to the Britannica family.

Anita Wolff
Editor

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Explanatory Notes

Alphabetization. The articles are alphabetized word by word, with further alphabetizing letter by letter within a word. A "word" is here defined as a unit of one or more characters set off from other words by spaces, dashes, hyphens, or other symbols. Entry titles consisting of more than one word are arranged in alphabetical order of the succeeding words. Titles with identical spellings are arranged in the order (1) persons, (2) places, and (3) things. The following list illustrates the word-by-word principle:

horn
Horn, Cape
Horn of Africa
hornbill
Horne, Lena
horned toad
Hornsby, Rogers

Further alphabetization rules include the following: (1) Diacritics, apostrophes, dashes, periods, and ampersands are ignored in alphabetization. (2) Names of monarchs and popes that are identical except for the Roman numeral following the name are ordered numerically. (3) Names beginning with *Mac-* and *Mc-* are ordered literally, all names beginning with *Mac-* preceding (by a number of pages) all names beginning with *Mc-*. (4) Entry headwords beginning with numbers are alphabetized as if they were spelled out.

Entry headword style. Variant spellings or versions of the encyclopedia's entry headwords are printed in boldface type when they are in common use; more obscure variants are printed in ordinary roman type. No effort has been made to be exhaustive in listing variants.

Several italicized terms are used to discriminate among the variants. The label *or* simply indicates a common alternative name or spelling. The label *orig.* precedes the birth name of a person who is entered under a name that was adopted or acquired subsequently. When a person's original surname is different from the name in the principal headword, the entire birth name is given, not enclosed in parentheses. The label *known as* precedes a common way of referring to a person that may never have had formal status. The label *formerly* indicates an older and generally discarded name for an entity, usually a geographical locale. The label *officially* indicates a formal or legal version of a name. The label *in full* precedes a fully spelled-out version of a name that is usually encountered in its shorter form. A label consisting of a language name precedes a native version or spelling of a name or term.

Biographical entry headwords in particular may employ parentheses in several ways. Parentheses may enclose portions of a person's name that are rarely used, a person's original given name or names, a later addition such as a title, or translations of titles or epithets.

drum *or* **croaker**
Odin *or* **Wotan**
Bacall, Lauren *orig.* **Betty Joan Perske**
O'Connell, Daniel *known as* **the Liberator**
Iqaluit *formerly* **Frobisher Bay**
Latvia *officially* **Republic of Latvia**
OCR *in full* **optical character recognition**
fax *in full* **facsimile**
Magellan, Strait of *Spanish* **Estrecho de Magallanes**
Odysseus *Roman* **Ulysses**
Connelly, Marc(us Cook)
Doctorow, E(dgar) L(aurence)
Hughes, (James Mercer) Langston
Basil II *known as* **Basil Bulgaroctonus ("Slayer of the Bulgars")**

Pronunciations. Entries for terms and names whose pronunciation the encyclopedia's likely users might hesitate over are supplied with pronunciations. Foreign names or terms that are pronounced in a markedly different way by native speakers and English-speakers are frequently provided with two pronunciations, one of them preceded by a language label (e.g., *English, French, Spanish).* Thus, for Hassan II we provide the pronunciations \'hà-sən, *English* ha-'sän\. The symbols employed and the sounds they represent are listed on page x.

Romanization of foreign languages. Words from languages that do not use the Western (Roman) alphabet generally reflect the spellings most commonly seen in English-language contexts.

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Chinese names are almost always transcribed according to the Pinyin system. Where a Chinese name or term appears as a headword, the older Wade-Giles spelling is given as an *or* variant. Placenames and biographical names on Taiwan, however, are generally listed in their Wade-Giles spelling, with the Pinyin spelling as a variant. A few Chinese names widely used in English (e.g., Confucius) retain their traditional English spelling.

Japanese names and terms are generally transcribed according to the Hepburn system but without macrons to indicate vowel length.

Russian names and terms generally observe traditional Western spellings and follow the diacritic-free system employed by the U.S. Board on Geographic Names.

Arabic names and terms generally follow the best-established Western usage. Except in a few well-established Western transliterations, the *l* in the article *al-* or *el-* ("the") is not assimilated to a following consonant (thus, we employ the spelling *Hārūn al-Rashīd*, not *Hārūn ar-Rashīd*), even though such assimilation reflects Arabic pronunciation and is sometimes encountered in English sources.

Cross-references. Cross-references to other articles are indicated by small capitals in sans-serif type for the alphabetized element of the term or name. Thus, "J. VON NEUMANN" sends the reader to the V's, "J. W. von GOETHE" to the G's; "CAPE BRETON ISLAND" sends the reader to the C's, "Cape of GOOD HOPE" to the G's; and so on. In the case of personal names in which there is no ambiguity as to alphabetical placement, the entire name appears in small capitals.

A term is cross-referenced only when it is likely that the reader of the article within which the cross-reference appears would want to be notified about the additional article. Hence many terms for which there are corresponding entries are not highlighted as references. For instance, in the article on Tim Berners-Lee, we have cross-referenced "World Wide Web" (whose invention was his principal achievement) but not "Internet," which is naturally cross-referenced within the "World Wide Web" article. Because cross-referencing of this kind is discretionary, readers should not assume that a noun lacks its own entry simply because it is not referenced within the article being read.

For the sake of saving space, many people who receive their own entries have their given names abbreviated and their surnames in small capitals when they are mentioned in an article, regardless of how likely the reader of the article is to want to be alerted to the biographical entry. The names of countries, U.S. states, and Canadian provinces, by contrast, are virtually never referenced, regardless of their centrality to a given article, on the presumption that readers will correctly assume that the encyclopedia contains articles on all such entities.

Some 3,000 cross-references are provided at their own alphabetical place, to direct the reader who has looked up a variant version of the name or has expected an entry to be alphabetized according to an element other than the one actually used.

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Abbreviations

AD	anno Domini
Adm.	Admiral
Ala.	Alabama
Amer.	American
Ariz.	Arizona
Ark.	Arkansas
BC	before Christ
C	Celsius
c.	circa
Cal.	California
Capt.	captain
cc	cubic centimetre(s)
cent.	century, centuries
cm	centimetre(s)
Co.	Company, County
Col.	Colorado, Colonel
Conn.	Connecticut
Corp.	Corporation
cu	cubic
D.C.	District of Columbia
Del.	Delaware
Dr.	Doctor
E	East
e.g.	exempli gratia (for example)
est.	estimate, estimated
Eth.	Ethiopia
F	Fahrenheit
fl.	flourished
Fla.	Florida
ft	foot, feet
g	gram(s)
Ga.	Georgia
Gen.	General
Gov.	Governor
i.e.	id est (that is)
Ill.	Illinois
in.	inch(es)
Ind.	Indiana
Jr.	Junior
K	Kelvin
Kan.	Kansas
kg	kilogram(s)
km	kilometre(s)
kph	kilometres per hour
Ky.	Kentucky
La.	Louisiana
lb, lbs	pound, pounds
m	metre(s)
M.A.	Master of Arts
Maj.	Major
Mass.	Massachusetts
Md.	Maryland
Me.	Maine
mi	mile(s)
Mich.	Michigan
Minn.	Minnesota
Miss.	Mississippi
ml	millilitre(s)
mm	millimetre(s)
Mo.	Missouri
Mont.	Montana
mph	miles per hour
N	North
N.C.	North Carolina
N.D.	North Dakota
NE	northeastern
Neb.	Nebraska
Nev.	Nevada
N.H.	New Hampshire
N.J.	New Jersey
N.M.	New Mexico
NW	northwestern
N.Y.	New York
Okla.	Oklahoma
Ore.	Oregon
oz	ounce(s)
Pa.	Pennsylvania
Ph.D.	Doctor of Philosophy
Pres.	President
Queen.	Queensland
r.	reigned, ruled
Rev.	Reverend
R.I.	Rhode Island
S	South
S.C.	South Carolina
S.D.	South Dakota
SE	southeastern
Sen.	Senator
sq	square
St.	Saint
SW	southwestern
Tenn.	Tennessee
UN	United Nations
U.S.	United States
Va.	Virginia
vs.	versus
Vt.	Vermont
W	West
W.V.	West Virginia
Wash.	Washington
Wisc.	Wisconsin
Wy.	Wyoming

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Pronunciation Symbols

ə	b**a**nan**a**, c**o**llide, **a**but, h**u**mdr**u**m
ᵊ	preceding \l\, \n\, \m\, \ŋ\, as in batt**le**, mitt**en**, eat**en**, lock and key \-ᵊŋ-\; following \l\, \m\, \r\, as in French tab**le**, pris**me**, tit**re**
ər	f**ur**th**er**, m**er**g**er**, b**ir**d
a	m**a**t, g**a**g
ā	d**a**y, f**a**de, **a**orta
ä	b**o**ther, c**o**t, f**a**ther, c**a**rt
ȧ	f**a**ther as pronounced by speakers who do not rhyme it with *bother*; French p**a**tte
aů	n**ow**, l**ou**d, **ou**t
b	**b**a**b**y, ri**b**
ch	**ch**in, nature \'nā-chər\
d	**d**i**d**, a**dd**er
e	b**e**t, b**e**d, p**e**ck
ē	b**ea**t, **ea**sy
f	**f**i**ff**y, cu**ff**
g	**g**o, bi**g**
h	**h**at, a**h**ead
i	t**i**p, ban**i**sh
ī	s**i**te, b**u**y
j	**g**em, **j**u**dge**
k	**k**in, c**oo**k, a**ch**e
k̲	German i**ch**, Bu**ch**
l	**l**i**l**y, poo**l**
m	**m**ur**m**ur, di**m**
n	**n**o, ow**n**
ⁿ	indicates that a preceding vowel or diphthong is pronounced with the nasal passages open, as in French *un bon vin blanc* \œⁿ-bōⁿ-vaⁿ-blämⁿ\
ŋ	si**ng**\'siŋ\, si**ng**er\'siŋ-ər\, fi**n**ger\'fiŋ-gər\, i**n**k\'iŋk\
ō	b**o**ne, kn**ow**, b**eau**
ȯ	s**aw**, **a**ll, c**augh**t
œ	French b**oeu**f, German H**ö**lle
œ̄	French f**eu**, German H**öh**le
ȯi	c**oi**n, destr**oy**
p	**p**e**pp**er, li**p**
r	**r**ed, ca**r**, **r**arity
s	**s**our**c**e, le**ss**
sh	**sh**y, mi**ss**ion, ma**ch**ine, spe**ci**al
t	**t**ie, a**tt**ack, la**t**e, la**tt**er
th	**th**in, e**th**er
t̲h̲	**th**en, ei**th**er, **th**is
ü	r**u**le, y**ou**th, union \'yün-yən\, few \'fyü\
u̇	p**u**ll, w**oo**d, b**oo**k
ue	German f**ü**llen, h**ü**bsch
ūe	French r**ue**, German f**üh**len
v	**v**i**v**id, gi**ve**
w	**w**e, a**w**ay
y	**y**ard, cue \'kyü\, un**i**on \'yün-yən\
ʸ	indicates that during the articulation of the sound represented by the preceding character the front of the tongue has substantially the position it has when pronouncing *y*, as in French *digne* \dēnʸ\
z	**z**one, rai**se**
zh	vi**si**on, azure \'a-zhər\
ˈ	precedes a syllable with primary (strongest) stress: \ˈpen-mən-ˌship\
ˌ	precedes a syllable with secondary (medium) stress: \ˈpen-mən-ˌship\
-	marks syllable division
( )	indicate that what is enclosed is pronounced by some but not by others: *factory* \ˈfak-t(ə-)rē\

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Guide to Plates

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World Indigenous Skin Color Map	*Plate*	*13*
World Heritage sites	*Plates*	*14 – 15*
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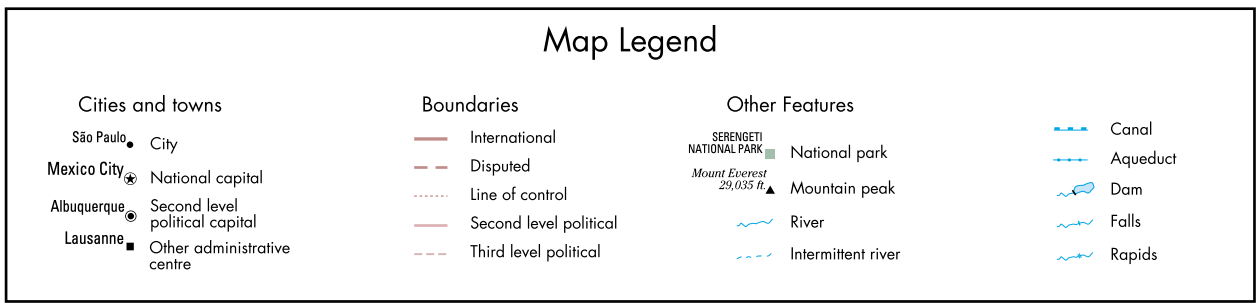
Map Legend



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A Coruña \ˌä-kō-ˈrü-nyä\ *Spanish* **La Coruña** City (pop., 2003 est.: 243,902), northwestern Spain. A seaport on the Atlantic Ocean, it is believed to antedate Roman times. A point of departure for the Spanish Armada in 1588, it was sacked by Sir Francis Drake in 1589. In the Peninsular War, it was the site of a notable victory by the English over the French. It is now a large fishing centre and one of northern Spain's most important shipping ports.

A&P See Great Atlantic & Pacific Tea Co.

a posteriori See a priori

a priori \ˌä-prē-ˈōr-ē, ˌā-prī-ˈōr-ī\ In epistemology, knowledge that is independent of all particular experiences, as opposed to a posteriori (or empirical) knowledge, which derives from experience. The terms have their origins in the medieval Scholastic debate over Aristotelian concepts (see Scholasticism). Immanuel Kant initiated their current usage, pairing the analytic-synthetic distinction with the a priori–a posteriori distinction to define his theory of knowledge.

Aachen \ˈä-k̲ən\ *French* **Aix-la-Chapelle** \ˌeks-lä-shä-ˈpel\ City (pop., 1995 est.: 247,000), western Germany, southwest of Cologne. It was inhabited by Romans in the 1st century AD. A center of Carolingian culture, and the second city of Charlemagne's empire, it was the site of his great palace. The cathedral built by Charlemagne c. 800 saw the coronation of most German kings of the 10th–16th century; his chapel, with his tomb, remains as part of the larger Gothic cathedral today. Aachen was part of France 1801–15. It is famous for its many spas.

Aaiún, El See Laayoune

Aalto \ˈäl-tō**, (Hugo) Alvar (Henrik)** (b. Feb. 3, 1898, Kuortane, Fin., Russian Empire—d. May 11, 1976, Helsinki) Finnish architect and designer. He graduated from the Technical Institute of Helsinki and in 1925 married Aino Marsio, who served as his collaborator. His reputation rests on a distinctive style that blends classic Modernism, indigenous materials (especially timber), and personal expression. His unique blending of Modernism and informal regional character was perhaps best expressed in his civic centre in Säynätsalo (1950–52), with its simple forms in red brick, wood, and copper. He remains one of the Modern movement's most popular architects; reproductions of his bent laminated wood furniture appear in households worldwide.

aardvark *or* **African ant bear** Heavily built mammal (*Orycteropus afer*) of sub-Saharan forests and plains. Its stout, piglike body ("aardvark" is Afrikaans for "earth pig") may be as long as 6 ft (1.8 m), including a 2-ft (60-cm) tail. It has a long snout, rabbitlike ears, short legs, and long toes with large, flattened claws. It feeds at night by ripping open ant and termite nests and lapping up the insects with a long (1-ft, or 30-cm), sticky tongue. Though not aggressive, it uses claws to fight off attackers. Its classification with regard to other mammals is uncertain.

Aardvark (*Orycteropus afer*).
SHOSTAL ASSOCIATES

Aare River \ˈär-ə\ *or* **Aar River** River, central and northern Switzerland. The longest river entirely within Switzerland, it flows northwest from the Bernese Alps and passes through the Gorge of the Aare and by the city of Bern before flowing northeast to enter the Rhine at Koblenz, after a course of 183 mi (294 km).

Aarhus See Arhus

Aaron (fl. 14th century BC) Brother of Moses and traditional founder and head of the priesthood of ancient Israel. According to the Bible, he was the spokesman for Moses and played a central role in forcing the pharaoh to allow the Israelites to leave Egypt. God charged Aaron and Moses with commemorating the event at Passover, and Aaron and his sons were given priestly authority by Moses. Though Aaron is a pivotal figure in Exodus, he nearly fades from view thereafter. He is mentioned as the one responsible for the Israelites' idolatrous worship of the golden calf while Moses was on Mount Sinai receiving the Law from God. His death at age 123 is noted in Numbers.

Aaron, Hank *byname of* **Henry Louis Aaron** (b. Feb. 5, 1934, Mobile, Ala., U.S.) U.S. baseball player, one of the greatest in professional baseball. After playing briefly in the Negro leagues and then in the minor leagues, Aaron was moved up to the majors as an outfielder with the Milwaukee Braves in 1954. By the time the Braves moved to Atlanta, Ga., in 1965, Aaron had hit 398 home runs; in 1974 he hit his 715th, breaking Babe Ruth's record. He played his final two seasons (1975–76) with the Milwaukee Brewers. Aaron's records for career home runs (755), extra-base hits (1,477), and runs batted in (2,297) remain unbroken, and only Ty Cobb and Pete Rose exceed him in career hits (3,771). Aaron is renowned as one of the greatest hitters of all time.

Hank Aaron.
PICTORIAL PARADE

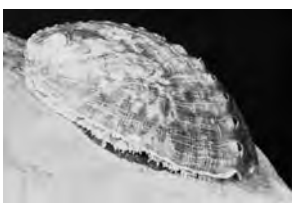
AARP *formerly* **American Association of Retired Persons** Nonprofit, nonpartisan organization that addresses the needs and interests of Americans aged 50 and older. It was founded in 1958 by a retired teacher, Ethel Andrus, and merged in 1982 with the National Retired Teachers Association, also founded by Andrus (1947). Its bimonthly magazine, *Modern Maturity*, has the largest circulation of any U.S. periodical. Its membership exceeds 35 million. Its members' reliably high turnout at the polls has made it one of the most powerful lobbying groups in the country.

abacus Calculating instrument that uses beads that slide along a series of wires or rods set in a frame to represent the decimal places. Probably of Babylonian origin, it is the ancestor of the modern digital calculator. Used by merchants in the Middle Ages throughout Europe and the Arabic world, it was gradually replaced by arithmetic based on Hindu-Arabic numerals. Though rarely used in Europe past the 18th century, it is still used in the Middle East, China, and Japan.

Abahai See Hongtaiji

Abakanowicz \ˌä-bä-ˈkän-ō-ˌwits**, Magdalena** (b. June 20, 1930, Falenty, Pol.) Polish sculptor. A descendant of nobility, she graduated from Warsaw's Academy of Fine Arts in 1955. She became the pioneer and leading exponent of sculpture made of woven fabrics, calling her three-dimensional weavings "Abakans" (from her surname). She produced series of fabric forms called *Heads* (1975), *Backs* (1976–80), *Embryology* (1980), and *Catharsis* (1986). She has also exhibited paintings, drawings, and sculptures in other media internationally and has been widely imitated in Europe and the U.S.

abalone \ˌa-bə-ˈlō-nē\ Any of several marine snail species (genus *Haliotis*, family Haliotidae), found in warm seas worldwide. The outer surface of the single shell has a row of small holes, most of which fill in as the animal grows; some remain open as outlets for waste products. Abalones range from 4 to 10 in. (10–25 cm) across and up to 3 in. (8 cm) deep. The largest is the 12 in. (30 cm) abalone (*H. rufescens*). The shell's lustrous, iridescent interior is used in ornaments, and the large muscular foot is eaten as a delicacy. Commercial abalone fisheries exist in California, Mexico, Japan, and South Africa.



Abalone (*Haliotis*)
JACQUES SIX

Abate, Niccolo dell' See Niccolo dell'Abbate

Abbado \ä-ˈbä-dō**, Claudio** (b. June 26, 1933, Milan, Italy) Italian conductor. Abbado studied piano, composition, and conducting at the

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Giuseppe Verdi Conservatory before beginning to conduct in Vienna. He was long associated with Milan's La Scala (1968–86), as principal conductor and ultimately as artistic director, as well as with the Vienna Philharmonic and the London Symphony Orchestra. In 1989 he succeeded Herbert von Karajan as permanent conductor and artistic director of the Berlin Philharmonic. He is known for his commitment to adventurous programming, including much modern music.

ʿAbbās I *known as* **ʿAbbās the Great** (b. Jan. 27, 1571—d. Jan. 19, 1629) Shah of Persia (1587–1629). Succeeding his father, Muḥammad Shah, he strengthened the Ṣafavid dynasty by expelling Ottoman and Uzbek troops and creating a standing army. ʿAbbās made Eṣfahan Persia's capital, and under him it became one of the world's most beautiful cities. Persian artistic achievement reached a high point during his reign; illuminated manuscripts, ceramics, and painting all flourished, and the Portuguese, Dutch, and English competed for trade relations with Persia. Tolerant in public life (he granted privileges to Christian groups) and concerned for his people's welfare, his fear for his personal security led him to act ruthlessly against his immediate family.

ʿAbbās I, detail of a painting by the Mughal school of Jahāngīr, c. 1620; in the Freer Gallery of Art, Washington, D.C.

COURTESY OF THE SMITHSONIAN INSTITUTION, FREER GALLERY OF ART, WASHINGTON, D.C.

ʿAbbās \ȧb-'bas\ **I** (b. 1813—d. July 13, 1854, Banhā, Egypt) Viceroy of Egypt (1848–54) under the Ottoman Empire. His rule was one of consolidation, when many of the Western-style reforms begun by his grandfather, Muhammad ʿAlī, were either discontinued or neglected. Though generally distrusting of foreigners, he allowed the British to construct a railroad between Alexandria and Cairo in 1851. The British, in turn, assisted him in disputes with his Ottoman overlords, whom he nonetheless aided by sending troops to fight in the Crimean War (1853). A recluse, he was murdered by two servants at his palace in Banhā.

Abbas, Ferhat (b. Aug. 24, 1899, Taher, Alg.—d. Dec. 24, 1985, Algiers) Algerian political leader who served as first president of the provisional government of the Algerian Republic (1958). Originally a Francophile, he became disillusioned with France, and during World War II (1939–45) he issued a condemnation of French rule, demanding a constitution that would grant equality to all Algerians. He joined the National Liberation Front (FLN), which helped achieve independence from France (1958–62). He was elected president of the Algerian Constituent Assembly in 1962 but resigned in 1963 following a dispute within the FLN. See also Young Algerians.

Abbas, Mahmoud *also called* **Abu Mazen** (b. 1935, Zefat, Palestine [now in Israel]) Palestinian leader. Abbas earned a law degree from the University of Damascus and a doctorate in history from Moscow State University. In the late 1950s he was one of the founders of Fatah, which spearheaded the Palestinian armed struggle and dominated the Palestine Liberation Organization. In the 1990s Abbas shaped Palestinian negotiating strategy in peace talks that led in 1993 to the Oslo Accords, in which Israel and the Palestinians extended to each other mutual recognition and which called for Israel to cede some authority over the West Bank and Gaza Strip to the Palestinians. He briefly served as prime minister of the Palestinian Authority in 2003 and was elected its president in 2005.

ʿAbbāsid \ə-'ba-səd\ **dynasty** (750–1258) The second of the two great Sunnite dynasties of the Islamic Caliphate. The ʿAbbāsids took their name from an uncle of the Prophet Muhammad, al-ʿAbbās, whose descendants formed one of several groups agitating for change under the Umayyad dynasty. The Umayyad enforcement of a brand of Arab chauvinism, wherein non-Arab Muslims were relegated to a lower status, led to a revolution in which the ʿAbbāsids claimed the Caliphate and enforced a more universal community of believers. This was symbolized by their movement of the caliphal capital from Damascus to Baghdad, an area closer to the geographic centre of the empire and nearer the Persian hinterland. Under their rule, Islamic culture flourished, new heights in philosophy and science were attained, and the period was widely seen as the "golden age" of the Islamic world. During that time, however, the Caliphate's authority slowly began to erode as regional power centres developed throughout the empire. Although central authority was intermittently reasserted by strong-willed caliphs, by the 13th century ʿAbbāsid authority was largely spiritual. The last ʿAbbāsid caliph was executed by Mongol invaders, but a shadow Caliphate (of dubious authenticity) continued into the early 20th century. See also Abū Muslim.

Abbate \äb-'bä-tā**, Niccolo dell'** *or* **Niccolo dell'Abate** (b. c. 1512, Modena, Duchy of Modena—d. 1571, Fontainebleau, Fr.) Italian painter. He was trained in Modena and developed his mature style under the influence of his contemporaries Correggio and Parmigianino in Bologna (1544–52). There he painted portraits and decorated palaces with frescoes of landscapes and figure compositions in the Mannerist style. In 1552 he was invited by Henry II of France to work under Primaticcio at the Palace of Fontainebleau, where he executed immense murals (most now lost). He remained in France the rest of his life. His mythological landscapes were a principal source of the French Classical landscape tradition, and he was a precursor of Claude Lorrain and Nicolas Poussin.

Abbe \'ab-ē**, Cleveland** (b. Dec. 3, 1838, New York, N.Y., U.S.—d. Oct. 28, 1916, Chevy Chase, Md.) U.S. meteorologist. He was trained as an astronomer and appointed director of the Cincinnati Observatory in 1868. His interest turned to meteorology, and he inaugurated a public weather service that served as a model for the national weather service, which was organized shortly thereafter as a branch of the (U.S. Army) Signal Service. In 1871 he was appointed chief meteorologist of the branch, which in 1891 was reorganized under civilian control as the U.S. Weather Bureau (later the National Weather Service), and he served in that capacity more than 45 years.

abbey Complex of buildings housing a monastery or convent under the direction of an abbot or abbess, serving the needs of a self-contained religious community. The first abbey was Monte Cassino in Italy, founded in 529 by St. Benedict of Nursia. The cloister linked the most important elements of an abbey together. The dormitory was often built over the dining hall on the eastern side of the cloister and linked to the central church. The western side of the cloister provided for public dealings, with the gatehouse controlling the only opening to the outer, public courtyard. On the southern side of the cloister were a central kitchen, brewery, and workshops. The novitiate and infirmary were housed in a building with its own chapel, bathhouse, dining hall, kitchen, and garden. In the 12th–13th century, many abbeys were built throughout Europe, especially in France.

The ruins of Fountains Abbey, a Cistercian monastery founded in the 12th century, near Ripon, North Yorkshire, England

ANDY WILLIAMS

Abbey, Edward (b. Jan. 29, 1927, Home, Pa., U.S.—d. March 14, 1989, Oracle, Ariz.) U.S. writer and environmentalist. Abbey worked as a park ranger and fire lookout for the National Park Service. He wrote a number of volumes on consumer culture's encroachment on the American wilderness. *Desert Solitaire* (1968), one of his best-known, is set in southeastern Utah. His 1975 novel *The Monkey Wrench Gang*, describing the exploits of a band of guerrilla environmentalists, inspired numerous real-life activists.

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Abbey Theatre Dublin theatre. It developed from the Irish Literary Theatre, founded in 1899 by William Butler Yeats and Lady Augusta Gregory to foster Irish drama. After moving the troupe to a renovated theatre on Abbey Street in 1904, they codirected its productions with John Millington Synge, staged their own plays, and commissioned works by Sean O'Casey and others. Important premieres included Synge's *The Playboy of the Western World* (1907) and O'Casey's *The Plough and the Stars* (1926). The Abbey became the first state-subsidized theatre in the English-speaking world in 1924. A fire destroyed the original playhouse in 1951, and a new theatre was built in 1966.

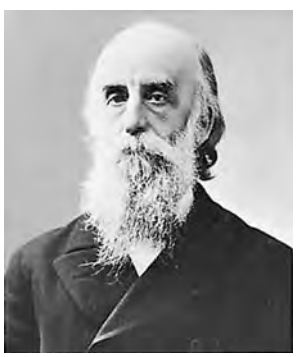
Abbott, Berenice (b. July 17, 1898, Springfield, Ohio, U.S.—d. Dec. 9, 1991, Monson, Maine) U.S. photographer. She left the American Midwest in 1918 to study in New York City, Paris, and Berlin. In Paris she became an assistant to Man Ray and Eugène Atget. In 1925 she set up her own studio and made portraits of Parisian expatriates, artists, writers, and collectors. She retrieved and catalogued Atget's prints and negatives after his death. In the 1930s she photographed New York's neighbourhoods for the WPA Federal Art Project, documenting its changing architecture; many of the photographs were published in *Changing New York* (1939).

Abbott, Bud; and Costello, Lou *orig.* **William Alexander Abbott** *and* **Louis Francis Cristillo** (respectively b. Oct. 2, 1899, Asbury Park, N.J., U.S.—d. April 24, 1974, Woodland Hills, Calif.; b. March 6, 1906, Paterson, N.J.—d. March 3, 1959, East Los Angeles, Calif.) U.S. comedy team, prominent in vaudeville from 1931 and on radio from 1938. Their first successful film, *Buck Privates* (1941), was followed by more than 30 other slapstick comedies, with Abbott playing a bullying straight man to Costello's childlike buffoon. Their famous routine "Who's on First?" was first performed in the film *The Naughty Nineties* (1945). The collaboration ended in 1957.

Abbott, George (Francis) (b. June 25, 1887, Forestville, N.Y., U.S.—d. Jan. 31, 1995, Miami Beach, Fla.) U.S. theatre director, producer, and playwright. In 1913 he began acting on Broadway, and he soon turned to writing and directing plays, achieving his first of many hits with *The Fall Guy* (1925). He also wrote, directed, or produced many popular musicals, including *The Boys from Syracuse* (1938), *Pal Joey* (1940), *Where's Charley* (1948), *Wonderful Town* (1953), and *Damn Yankees* (1955). He was active in the theatre into the 1980s, directing a revival of *On Your Toes* at age 95.

Abbott, Grace (b. Nov. 17, 1878, Grand Island, Neb., U.S.—d. June 19, 1939, Chicago, Ill.) U.S. social worker, public administrator, educator, and reformer. She graduated from Grand Island College and did graduate work at the University of Nebraska and the University of Chicago, receiving a Ph.D. in political science in 1909. In 1908 she began working at Jane Addams's Hull House in Chicago, where she cofounded the Immigrants' Protective League. As director of the U.S. Children's Bureau (1921–34), she fought to end child labour through legislation and restrictions on federal contracts. She worked to win public approval of a constitutional amendment prohibiting child labour; though submitted to the states in 1924, the amendment was never ratified. Her best-known book is *The Child and the State* (2 vol., 1938).

Abbott, Lyman (b. Dec. 18, 1835, Roxbury, Mass., U.S.—d. Oct. 22, 1922, New York, N.Y.) U.S. minister. Son of the writer Jacob Abbott (1803–79), he left law practice to study theology and was ordained in 1860. He became editor of the *Illustrated Christian Weekly* in 1870 and editor in chief of Henry Ward Beecher's *Christian Union* in 1881. In 1888 he succeeded to Beecher's pulpit in Brooklyn. A leading exponent of the Social Gospel movement, he sought to apply Christianity to social and industrial problems, rejecting both socialism and laissez-faire economics. On other problems Abbott presented the viewpoint of liberal evangelical Protestantism.



Lyman Abbott, 1901.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Abbott, Sir John (Joseph Caldwell) (b. March 12, 1821, St. Andrews, Lower Canada—d. Oct. 30, 1893, Montreal, Que., Can.) Canadian prime minister (1891–92). Educated at McGill University in Montreal, he became a lawyer in 1847 and was made queen's counsel in 1862. He was dean of McGill University law school from 1855 to 1880. After serving in the legislative assembly (1857–74, 1880–87), he was appointed to the Senate and became government leader. Upon the death of John Macdonald, he became the compromise choice for prime minister. Ill health forced his resignation in 1892.

abbreviation Shortened form of a written word or phrase used in place of the whole. Abbreviations began to proliferate in the 19th century and have been prevalent since; they are employed to reduce the time required for writing or speaking, especially when referring to the myriad new organizations, bureaucratic entities, and technological products typical of industrial societies. An abbreviation can now easily become a word, either as an initialism in which the letters are pronounced individually (e.g., TV or FBI) or as an acronym in which the letters are combined into syllables (e.g., scuba, laser, or NAFTA).

ABC *in full* **American Broadcasting Co.** Major U.S. television network. It began when the expanding national radio network NBC split into the separate Red and Blue networks in 1928. To avoid a communications monopoly, NBC was forced to sell the Blue network in 1941. Its buyer, Edward J. Noble, maker of Life-Savers candies, gave the company its present name. After merging with United Paramount Theaters in 1953, ABC expanded into the emerging television industry and soon became one of the three top networks. It specialized in sports broadcasting and developed the instant replay in 1961. It was bought by Capital Cities Communications in 1985 and by the Walt Disney Co. in 1995.

ʿAbd al-ʿAzīz ibn ʿAbd al-Raḥmān ibn Fayṣal Āl Saʿūd See Ibn Saʿūd

ʿAbd al-Malik ibn Marwān \ˌab-dəl-ˈmal-ik-ˌib-ən-mär-ˈwan\ (b. 646/647, Medina, Arabia—d. Oct. 705, Damascus) Fifth caliph (685–705) of the Umayyad dynasty. ʿAbd al-Malik was forced to flee his hometown of Medina during an uprising against Umayyad rule in 683. Two years later he succeeded to the caliphate and—with the help of his infamous lieutenant al-Ḥajjāj ibn Yūsuf—began a seven-year campaign to defeat all rebellions against the Umayyads and reunify the Muslim world. He resumed the conquest of North Africa, winning the Berbers to his side and capturing Carthage (697) from the Byzantine Empire. His good relations with the clergy of Medina led many to abandon their opposition to the Umayyads. He made Arabic the language of government throughout his domains, struck Islamic gold coins to replace Byzantine ones, and built the Dome of the Rock in Jerusalem.

ʿAbd al-Muʾmin ibn ʿAlī \ˌab-dəl-ˈmü-min-ˌib-ən-ä-ˈlē\ (b. 1094, Tāgrā, kingdom of the Ḥammādids—d. 1163, Rabat, Almohad empire) Berber caliph (1130–63) of the Almohad dynasty. Around 1117 he fell under the sway of Ibn Tūmart, founder of the Almohad religious movement, and joined him in opposing to the ruling Almoravid dynasty. He succeeded Ibn Tūmart on the latter's death in 1130 and for the next 17 years carried on the struggle against the Almoravids. After defeating them at Marrakech in 1147, he massacred many of the city's inhabitants, made Marrakech his home base, and conquered all of North Africa west of Egypt.

ʿAbd al-Nāṣir, Jamāl See Gamal Abdel Nasser

ʿAbd al-Raḥmān \ˌab-dəl-räk̲-ˈmän\ **III** (b. January 891—d. Oct. 15, 961, Córdoba, Andalusian Spain) First caliph and greatest ruler of the Umayyad Arab Muslim dynasty of Spain. He succeeded his grandfather ʿAbd Allāh as emir of Córdoba in 912. He set out immediately to subdue Muslim rebels in their mountain fortresses, which became an annual task until the Umayyad's took Toledo in 933. Addressing the Christian threat to the north, he led the campaigns of Muez (920) and Navarra (924). In 928 he declared himself caliph. By 958 he had Christian kings paying him homage. During his rule, Córdoba was exemplary for its social, political, and cultural development; Christian and Jewish communities flourished, and the city's fame rivaled that of the Byzantine capital, Constantinople.

ʿAbd al-Ṣamad (fl. 16th century) Persian miniature painter. Born in Iran, he traveled to India and became one of the first members of the imperial atelier there. Through their teachings in India, he and fellow countryman Mīr Sayyid ʿAlī played a strong role in the foundation of the school of Mughal painting. ʿAbd al-Ṣamad supervised the majority of illustrations in the Mughal manuscript *Dāstān-e Amīr Ḥamzeh*, or *Hamzan-*

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ama, which included about 1,400 paintings. Favoured at court, in 1576 he was appointed master of the mint, and in 1584 he was made *dīwān* (revenue commissioner) of Multan.

ʿAbd Allāh \ˌäb-důl-ˈlä\ **(ibn Muḥammad al-Taʿʾishī)** *or* **ʿAbdullahi** \əb-ˌdůl-ä-ˈhē\ (b. 1846, Sudan—d. Nov. 24, 1899, Kordofan) Political and religious leader who succeeded Muḥammad Aḥmad (al-Mahdī) as head of the Mahdist movement in the Sudan in 1885. He launched attacks against the Ethiopians and invaded Egypt, securing his position by 1891. In 1896 Anglo-Egyptian forces began to reconquer the Sudan. ʿAbd Allāh resisted until 1898, when he was forced to flee Omdurman. He died in battle one year later.

Abd el-Krim \ˌab-dəl-ˈkrēm\ *in full* **Muḥammad ibn ʿAbd al-Karīm al-Khaṭṭābī** (b. 1882, Ajdir, Mor.—d. Feb. 6, 1963, Cairo, Egypt) Berber resistance leader against Spanish and French rule in northern Morocco. He was chief Muslim judge for Morocco's Melilla district. He became disillusioned with Spanish policies and eventually led a resistance movement with his brother. He set up the Republic of the Rif in 1921 and became its president. In 1926 he was forced to surrender when faced by a combined French and Spanish army. Exiled to the island of Réunion, in 1947 he received permission to live in France but took asylum in Egypt while en route. When Morocco became independent (1956), Muhammad V invited him to return, but he refused because of the continued presence of French troops in North Africa.

Abdelkader \ˌab-dəl-ˈkäd-ər\ *in full* **ʿAbd al-Qādir ibn Muḥyī al-Dīn ibn Muṣṭafā al-Ḥasanī al-Jazāʾirī** (b. Sept. 6, 1808, near Mascara, Alg.—d. May 26, 1883, Damascus, Syria) Founder of modern Algeria and leader of its struggle against the French. His father had led a harassment campaign against the French, who invaded Algeria in 1830. Abdelkader succeeded his father as emir in 1832; by 1837, through battles and treaties, he had established his rule over most of Algeria's interior, leaving the French in control of some port cities. He organized a true state, imposing equal taxes and suppressing the privileges of the warlike tribes. He fortified the interior towns, opened arsenals and workshops, and expanded education. The French overpowered his forces and arrested him by 1846. Upon his parole in 1853, he chose a life of exile, eventually settling in Damascus. Revered for his exemplary life and ideals, in 1860 he showed himself to be a model of decency and probity when, at great risk to his own safety, he sheltered thousands of Christians during a Druze uprising. He died respected by both French and Algerians (and by many others throughout the world), and he remains the Algerian national hero.

Abdera \ab-ˈdir-ə\ City of ancient Thrace on the Aegean Sea nearly opposite Thasos. First settled in the 7th century BC, it was colonized a second time c. 540 BC. A prosperous member of the Delian League, it was crippled in the 4th century BC by Thracian invasions. It was the home of Democritus and Protagoras.

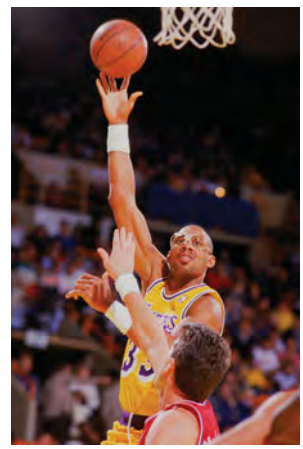
abdominal cavity Largest hollow space of the body, between the diaphragm and the top of the pelvic cavity and surrounded by the spine and the abdominal muscles and others. It contains most of the alimentary canal, the liver and pancreas, the spleen, the kidneys, and the adrenal glands. It is lined by the peritoneum, a membrane covering the cavity's inside wall (parietal peritoneum) and each organ or structure in it (visceral peritoneum). Disorders include ascites (fluid in the peritoneal cavity) and peritonitis.

abdominal muscle Any of the muscles of the front and side walls of the abdominal cavity. Three flat layers—the external oblique, internal oblique, and transverse abdominis muscles—extend from each side of the spine between the lower ribs and the hipbone. The abdominal muscles attach to aponeuroses, connective tissue sheaths that merge toward the midline, sheathing the rectus abdominis muscle on each side of the midline. The abdominal muscles support and protect the internal organs and take part in exhaling, coughing, urinating, defecating, childbirth, and motion of the trunk, groin, and lower limbs.

ʿAbduh \ˈab-dü**, Muḥammad** Egyptian religious scholar, jurist, and liberal reformer. As a student in Cairo, he came under the influence of Jamāl al-Dīn al-Afghānī. He was exiled for political radicalism (1882–88); he began his judicial career when he returned to Egypt. He rose from judge to muftī (legal counselor) in 1899. In his *Treatise on the Oneness of God,* he argued that Islam was superior to Christianity because it was more receptive to science and civilization. He liberalized Islamic law and administration, promoting considerations of equity, welfare, and common sense, even when this meant disregarding the literal texts of the Qur'ān.

Abdul Kalam, A(vul) P(akir) J(ainulabdeen) (b. Oct. 15, 1931, Rameswaram, India) Indian president (from 2002). After graduating from the Madras Institute of Technology, Kalam played a leading role in the development of India's missile and nuclear weapons programs. He planned a program that produced a number of successful missiles, helping earn him the nickname "Missile Man." Beginning in the early 1990s, he also served as scientific adviser to the government, and his prominent role in India's 1998 nuclear weapons tests established Kalam as a national hero. In 2002 the pro-Hindu National Democratic Alliance nominated Kalam, a Muslim, to succeed outgoing President K.R. Narayanan. Kalam easily won the elections in 2002, and in the largely ceremonial post he sought to use science and technology to transform India into a developed country.

Abdul-Jabbar \ˌab-dəl-jə-ˈbär**, Kareem** *orig.* **(Ferdinand) Lew(is) Alcindor** (b. April 16, 1947, New York, N.Y., U.S.) U.S. basketball player. During his college career at UCLA, the team lost only two games, and he led it to three national championships (1966–68). He then joined the Milwaukee Bucks; in 1975 he was traded to the Los Angeles Lakers. Standing 7 ft 1⅜ in. (2 m 17 cm), he was the dominant centre of his time and helped his teams to six NBA titles. By the time he retired in 1989, he had scored a record 38,387 points. He also set the record for most field goals (15,837) and most minutes played (57,446). He was voted Most Valuable Player a record six times.



Kareem Abdul-Jabbar, 1987.
STEPHEN DUNN/GETTY IMAGES

Abdul Rahman Putra Alhaj \ˈab-dül-rä-ˈmän-ˈpůt-rə-al-ˈhaj**, Prince** (b. Feb. 8, 1903, Alor Star, Kedah, Malaya—d. Dec. 6, 1990, Kuala Lumpur, Malaysia) First prime minister of independent Malaya (1957–63) and then of Malaysia (1963–70). He was educated in England and served in the Malayan Federal Legal Department (1949–51) before pursuing a career in politics. As president of the United Malays National Organization, Abdul Rahman brought Chinese and Indian political groups into the Alliance Party, which won an overwhelming majority in the 1955 election. He negotiated for Malayan independence from Britain (achieved in 1957); the federation of Malaysia was formed in 1963.

Abdülhamid \ˌab-dəl-ha-ˈmēd\ **II** (b. Sept. 21, 1842, Constantinople—d. Feb. 10, 1918, Constantinople) Sultan (1876–1909) of the Ottoman Empire under whose rule the Tanzimat reform movement reached its climax. After initially promoting the first Ottoman constitution (primarily to ward off foreign intervention), he suspended it 14 months later and ruled thereafter as a despot. He used Pan-Islamism to rally Muslim opinion outside his empire; the Hejaz Railway was built with foreign contributions. Discontent with his absolutist rule and resentment over European intervention in the Balkans resulted in his overthrow by the Young Turks in 1908. See also Mustafa Kemal Atatürk; Enver Pasha; Midhat Pasha.

Abdullahi See Abd Allah

Abel See Cain and Abel

Abelard, Peter (b. 1079, Le Pallet, near Nantes, Brittany—d. April 21, 1142, Priory of Saint-Marcel, near Chalon-sur-Saône, Burgundy) French theologian and philosopher. The son of a knight, he abandoned his inheritance to study philosophy. He became private tutor to Héloïse, niece of a canon in Paris, c. 1114. They fell in love; Héloïse became pregnant, and they married secretly. Her uncle had Abelard castrated, after which he became a monk and Héloïse became a nun. Abelard's *Theologia* was condemned as heretical in 1121. He accepted election as abbot of a monastery in Brittany in 1125, but his relations with the community deteriorated and he had to flee for his life. From c. 1135 Abelard taught at Mont-

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Sainte-Geneviève, where he wrote *Ethica*, in which he analyzed the notion of sin. In 1140 he was again condemned for heresy, and he withdrew to the monastery at Cluny. His influential *Sic et non*, a collection of apparently contradictory writings by church fathers on various topics, was intended to bring readers to the truth by wrestling with divergent opinions. He also wrote an autobiography, *Historia calamitatum*, and his best-known work is the series of letters he exchanged with Héloïse after they retired to monasteries.

Abenaki \ˌa-bə-ˈnä-kē\ *or* **Abnaki** Confederacy of Algonquian-speaking North American Indian peoples living mostly in Quebec, Can., and Maine, U.S. The contemporary Abenaki consider their home territory to be southern Quebec and the U.S. states of Vermont and New Hampshire, as well as parts of Maine and New York. Their name means "people of the dawn" or "easterners." The name is applied to a number of groups—including Androscoggin, Kennebec, Maliseet, Ouarastegouiak, Passamaquoddy, Patsuiket, Penobscot, Pigwacket, Micmac, Pennacook, Rocameca, Sokoni, and Wewenoc—who formed the Abenaki confederation in order to resist the Iroquois Confederacy, especially the Mohawk. In the 17th century the Abenaki sided with the French against the English, but, after severe defeats, they withdrew to Canada, many eventually settling at Saint-François-du-Lac and Becancour, near Trois-Rivières, in Quebec. There are also reservations in Maine and in New Brunswick, Can. The total population of Abenaki is about 12,000.

Abeokuta \ä-ˈbā-ō-ˌkü-tä\ City (pop., 2002 est.: 529,700), southwestern Nigeria. Located about 50 mi (80 km) north of Lagos, Abeokuta was established c. 1830 as a refuge from intertribal wars. It was the chief town of the Egba, who long maintained a working relationship with the British; not until 1914 was it incorporated into British Nigeria. The modern town is an agricultural and exporting centre.

Aberdeen City, council area (pop., 2001: 212,125), and commercial port on the North Sea, eastern Scotland. It constitutes the council area of Aberdeen, an enclave within the surrounding council area of Aberdeenshire, which was also the name of the historic county of which Aberdeen was the seat. Situated at the mouths of the Rivers Dee and Don, it is the chief port of northern Scotland. It was a royal burgh from the 12th century and a Scottish royal residence in the 12th–14th centuries. It supported Robert the Bruce in wars for Scottish independence, and for a time it was the headquarters of Edward I. From the 1970s Aberdeen developed rapidly as the principal British centre of the North Sea oil industry and its associated service and supply industries.

Aberdeen, George Hamilton-Gordon, 4th earl of (b. Jan. 28, 1784, Edinburgh, Scot.—d. Dec. 14, 1860, London, Eng.) British foreign secretary and prime minister (1852–55). As special ambassador to Austria in 1813, he helped form the coalition that defeated Napoleon. As foreign secretary (1828–30, 1841–46), he settled boundary disputes between Canada and the U.S. with the Webster-Ashburton Treaty and the Oregon Treaty (see Oregon Question). As prime minister, he formed a coalition government, but his indecision hampered peacekeeping efforts and led to Britain's involvement in the Crimean War. Constitutionally responsible for the mistakes of British generals in the war, he resigned in 1855.

Aberhart \ˈā-bər-ˌhärt**, William** (b. Dec. 30, 1878, Kippen, Ont., Can.—d. May 23, 1943, Vancouver, B.C.) Canadian politician and the country's first Social Credit Party premier (Alberta, 1935–43). Aberhart was a high school principal in Calgary, Alta. (1915–35). An active lay preacher, he founded the Calgary Prophetic Bible Institute (1918). In 1932 he used his evangelical rhetoric to promote monetary-reform theories to solve the economic problems created in Alberta by the Great Depression, proposing to issue dividends (social credit) to each person, based on the real wealth of the province. When his party won a majority in the 1935 provincial election, he became premier and minister of education, but his social-credit proposals were disallowed by the federal government.

Abernathy \ˈab-ər-ˌnath-ē**, Ralph David** (b. March 11, 1926, Linden, Ala., U.S.—d. April 17, 1990, Atlanta, Ga.) U.S. pastor and civil rights leader. He was educated at Alabama State University and Atlanta University. Ordained a Baptist minister in 1948, he became pastor of the First Baptist Church in Montgomery, Ala., in 1951. He met Martin Luther King, Jr., a few years later when the latter became pastor of another Baptist church in Montgomery. In 1955–56 the two men organized a nonviolent boycott of the city bus system, marking the beginning of the U.S. civil rights movement. In 1957 they founded the Southern Christian Leadership Conference. Abernathy became its president on King's assassination in 1968; in 1977 he resigned to resume work as a pastor in Atlanta. His autobiography, *And the Walls Came Tumbling Down*, appeared in 1989.

aberration Deviation of light rays by lenses or curved mirrors which causes the images to be blurred. Spherical aberration occurs because curvature in a lens or mirror causes rays falling on the outer edges to be brought to a focus at a different point than those falling on the middle. This makes the images formed appear blurred. Chromatic aberration, which occurs in lenses but not mirrors, is the failure of a lens to focus all colours (wavelengths) of light in the same plane; the image appears blurred and shows rainbow-coloured fringes around the edges. See also astigmatism.

aberration of starlight Apparent displacement of a star or other celestial body resulting from Earth's orbital motion around the Sun. The maximum displacement is about 20.49 seconds of arc. It depends on the ratio of Earth's orbital speed to the speed of light and Earth's direction of motion and thus provides confirmation that Earth orbits the Sun rather than the reverse.

Aberystwyth \ˌa-bə-ˈris-ˌtwith\ Town (pop., 1991: 11,154) on Cardigan Bay, western Wales. The medieval walled town was built around a 13th-century fortress. It later became the exporter for the once-flourishing local lead mines. A principal stronghold of Welsh culture, it has grown as a seaside resort.

Abhayagiri \ȧb-ˈyä-gə-rē\ Theravada Buddhist monastic center built at Anuradhapura, then capital of Ceylon, by King Vattagamani Abhaya (r. 29–17 BC). Originally associated with the nearby Mahavihara ("Great Monastery"), it soon seceded in a dispute over the relations between monks and the lay community and the use of Sanskrit works to augment Pali texts as scripture. It gained wealth and power under the patronage of Gajabahu I (AD 113–35) and flourished until Anuradhapura was abandoned in the 13th century. Two of its main colleges operated into the 16th century.

Abhidhamma Pitaka \ˌä-bi-ˈdä-mə-ˈpē-tə-kə\ Third and latest collection of texts comprising the Pali canon (see Tripitaka) of Theravada Buddhism. The first two collections, Sutta Pitaka and Vinaya Pitaka, are attributed to the Buddha. Abhidhamma Pitaka texts are ascribed to later disciples and scholars; they deal with ethics, psychology, and epistemology.

Abhidharmakosa \ˌä-bi-ˌdär-mə-ˈkō-sə\ Buddhist scholarly work that provides an introduction to the seven Abhidharma treatises in the Sarvastivada canon and a digest of their contents. It was composed by the Buddhist monk Vasubandhu (fl. 4th or 5th century), who lived in northwestern India. It systematizes Sarvastivada doctrine and shows the influence of Mahayana, to which Vasubandhu later converted. It provides much information on doctrinal differences among the ancient Buddhist schools.

abhijna \ə-ˈbij-nə\ In Buddhist philosophy, the miraculous powers obtained through meditation and wisdom. They include the ability to travel any distance or take any form at will, to see everything, to hear everything, to read minds, and to recall former existences. A sixth miraculous power, available only to Buddhas and arhats (saints), is freedom by undefiled wisdom (Enlightenment). The powers are signs of spiritual progress but their indulgence is a distraction from the path toward Enlightenment.

Abidjan \ˌä-bē-ˈjän\ Largest city (pop., 1999 est.: 3,199,000) and chief port of Côte d'Ivoire. Abidjan was a rail terminus from 1904; after its lagoon was opened to the sea to create a port (1950), the city became the financial centre of French West Africa. Though it was once the country's capital and remains its seat of government, the official capital was moved to Yamoussoukro in 1983. Abidjan has a museum of traditional Ivorian art, a national library, and several research institutes.

Abilene Town (pop., 2000: 6,543), Kansas, U.S. It lies on the Smoky Hill River east of Salina. Settled in 1858, it gained importance when it became the railway terminus for overland Texas cattle drives. With the prosperity of the cattlemen came an era of lawlessness; Wild Bill Hickok was its marshal in 1871. Pres. Dwight D. Eisenhower spent his boyhood there and is buried at the Eisenhower Center, which includes his family home and library.

Abilene City (pop., 2000: 115,930), west-central Texas, U.S. Founded in 1881 as the new railhead for the overland Texas cattle drives, it took the business of the previous railhead, Abilene, Kan. It is the site of several educational institutions, the West Texas Fair, and the reconstructed Old Abilene Town.

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Abnaki See Abenaki

abnormal psychology *or* **psychopathology** Branch of psychology. It is concerned with mental and emotional disorders (e.g., neurosis, psychosis, mental deficiency) and with certain incompletely understood normal phenomena (such as dreams and hypnosis). The chief tool used in classifying psychological disorders is the American Psychiatric Assn.'s *Diagnostic and Statistical Manual of Mental Disorders* 4th edition (*DSM-IV*).

ABO blood-group system Classification of human blood according to whether red blood cells (erythrocytes) have or lack the inherited antigens called A (including A1 and A2) and B on their surface. Blood can be type O (lacking both), type A (having only A), type B (having only B), or type AB (having both). The ABO antigens make certain blood types incompatible for transfusion. They are developed well before birth and remain through life. The frequencies of blood groups vary among different racial groups and in different geographic areas. Certain diseases are rarer in persons with particular blood groups.

abolitionism (c. 1783–1888) Movement to end the slave trade and emancipate slaves in western Europe and the Americas. The slave system aroused little protest until the 18th century, when rationalist thinkers of the Enlightenment criticized it for violating the rights of man, and Quaker and other evangelical religious groups condemned it as un-Christian. Though antislavery sentiments were widespread by the late 18th century, they had little immediate effect on the centres of slavery themselves—the West Indies, South America, and the southern U.S. In 1807 the importation of African slaves was banned in the U.S. and the British colonies. Slavery was abolished in the British West Indies by 1838 and in the French possessions 10 years later. In the 11 Southern states of the U.S., however, slavery was a social and economic institution. American abolitionism laboured under the handicap that it threatened the harmony of North and South in the Union, and it also ran counter to the U.S. Constitution, which left the question of slavery to the individual states. The abolitionist movement in the North was led by agitators such as William Lloyd Garrison, founder of the American Anti-Slavery Society, writers such as John Greenleaf Whittier, former slaves such as Frederick Douglass, and Harriet Beecher Stowe. The election of Abraham Lincoln, who opposed the spread of slavery to the West, marked a turning point in the movement. Convinced that their way of life was threatened, the Southern states seceded from the Union (see secession), which led to the American Civil War. In 1863 Lincoln (who had never been an abolitionist) issued the Emancipation Proclamation, which freed slaves held in the Confederate states; the 13th Amendment to the U.S. Constitution (1865) prohibited slavery throughout the country. Slavery was abolished in Latin America by 1888. In some parts of Africa and in much of the Islamic world, it persisted as a legal institution well into the 20th century.

Abominable Snowman *Tibetan* **Yeti** Mythical monster believed to inhabit the Himalayas near the snow line. The Yeti is thought to resemble an oversized man covered with shaggy fur. Reported sightings are rare; evidence of its existence consists largely of unusual footprints left in the snow, probably the tracks of bears. At certain gaits, bears place the hind-foot partly over the imprint of the forefoot, thus creating tracks that resemble the footprints of a very large primate heading in the opposite direction.

Aborigine See Australian Aboriginal

abortion Expulsion of a fetus from the uterus before it can survive on its own. Spontaneous abortion at earlier stages of pregnancy is called miscarriage. Induced abortions often occur through intentional medical intervention and are performed to preserve the woman's life or health, to prevent the completion of a pregnancy resulting from rape or incest, to prevent the birth of a child with serious medical problems, or because the woman does not believe she is in a position to rear a child properly. The drug RU-486, if taken within a few weeks of conception, will trigger a miscarriage. Up to about 19 weeks of pregnancy, injections of saline solutions or hormones may be used to stimulate uterine contractions that will expel the fetus. Surgical removal of the contents of the uterus may be performed in the second trimester or later. Intact dilation and extraction procedures may occur in the third trimester; sometimes critically referred to as "partial-birth abortions," they have been very controversial. Other abortion procedures include manual vacuum aspiration (extraction by manual syringe) and dilation and suction curettage (extraction by machine-operated suction), both of which can be performed in early pregnancy. The social acceptability of abortion as a means of population control has varied from time to time and place to place throughout history. It was apparently a common method of family limitation in the Greco-Roman world, but Christian theologians early and vehemently condemned it. It became widely accepted in Europe in the Middle Ages. Severe criminal sanctions to deter abortion became common in the 19th century, but in the 20th century those sanctions were gradually modified in many countries. In the U.S. the 1973 *Roe v. Wade* decision had the effect of legalizing abortion during the first three months of pregnancy; states were able to implement restrictions on access to abortion after the first trimester, though within constraints set by the courts. Since that decision, there has been a fierce debate between supporters and opponents of a liberalized abortion policy.

Abraham (fl. early 2nd millennium bc) First of the Hebrew patriarchs, revered by Judaism, Christianity, and Islam. Genesis tells how Abraham, at 75, left Ur with his barren wife, Sarai (later Sarah), and others to found a new nation in Canaan. There God made a covenant with him, promising that his descendants would inherit the land and become a great nation. Abraham fathered Ishmael by Sarah's maidservant Hagar; Sarah herself bore Isaac, who inherited the covenant. Abraham's faith was tested when God ordered him to sacrifice Isaac; he was prepared to obey but God relented. In Judaism he is a model of virtue, in Christianity he is the father of all believers, and in Islam he is an ancestor of Muhammad and a model (in Sufism) of generosity.

Abraham, Karl (b. May 3, 1877, Bremen, Ger.—d. Dec. 25, 1925, Berlin) German psychoanalyst. He helped establish the first branch of the International Psychoanalytic Institute in 1910 and pioneered the psychoanalytic treatment of manic-depressive psychosis (bipolar disorder). He suggested that the sexual drive develops in six stages and that if development is arrested at any of the earlier stages, mental disorders will likely result from fixation at that level. His most important work was *A Short Study of the Development of the Libido* (1924).

Abraham, Plains of Plateau located west of the old walled city of Quebec, Canada. On Sept. 13, 1759, it was the scene of the decisive battle of the French and Indian War, in which the British under James Wolfe defeated the French under the marquis de Montcalm. U.S. forces held the plateau (1775–76) in their siege of Quebec during the American Revolution. It is now a park within Quebec city limits.

abrasion platform See wave-cut platform

abrasives Sharp, hard materials used to wear away the surface of softer, less resistant materials. Abrasives are indispensable to the manufacture of the highly precise components and ultrasmooth surfaces required in the manufacture of automobiles, airplanes and space vehicles, mechanical and electrical appliances, and machine tools. Abrasives may be natural (e.g., diamond, corundum, emery) or synthetic (e.g., silicon carbide or Carborundum, synthetic diamond, alumina—a synthetic form of corundum). They range from the relatively soft particles used in household cleansers and jeweler's polish to diamonds.

Abruzzo \ä-'brüt-sō\ *or* **Abruzzi** \ä-'brüt-sē\ Region (pop., 2004 est.: 1,285,896), central Italy. Its capital is L'Aquila. Most of the region is mountainous or hilly, traversed by the Apennines. The ancient Italic tribes of the region long resisted conquest by the Romans. The Normans established themselves in the 12th century, and the region later sided with the Hohenstaufens against the papacy. As Abruzzi e Molise, the area became part of the Kingdom of Italy in 1860–61; in 1965 it was divided into the separate regions of Abruzzo and Molise. The economy is primarily agricultural.

Absalom (fl. c. 1020 bc, Palestine) In ancient Israel, the third and most beloved son of David. His story is told in 2 Samuel 13–19. An attractive but lawless man, he killed his half brother Amnon as revenge for the latter's rape of Tamar, Absalom's sister, and was banished from the kingdom for a time. He later raised a rebellion against his father, capturing Jerusalem but meeting defeat in the forest of Ephraim, where he was killed by his cousin Joab, who found him caught by the hair in an oak tree. Despite Absalom's treachery, David greatly lamented his son's death.

Absaroka \ab-'sär-ə-kə\ **Range** Range of the Rocky Mountains in the U.S. It extends from southern Montana into northwestern Wyoming, crossing portions of Gallatin, Shoshone, and Custer national forests, as well as the northeastern portion of Yellowstone National Park. The range is about 175 mi (280 km) long; its highest point is Franks Peak, at 13,140 ft (4,005 m).

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abscess \'ab-ˌses\ Localized collection of pus in a cavity in the deeper layers of the skin or within the body, formed from tissues broken down by white blood cells (LEUKOCYTES) in response to INFLAMMATION caused by bacteria. A wall develops, separating the thick yellowish pus from the extracellular fluid of nearby healthy tissues. Rupture of the abscess allows the pus to escape and relieves swelling and pain. Treatment consists of cutting into the wall to drain the pus and giving antibiotics. If infective contents enter the bloodstream, they may be carried to remote tissues, seeding new abscesses.

absentee ownership Ownership of land by those who do not live on it but who enjoy income from it. Criticized for centuries as an economic injustice, absentee ownership was a feature of pre-Revolutionary France and English rule of Ireland. Ending the practice continues to be a goal of LAND REFORM programs in many developing countries.

absolute value Measure of the magnitude of a REAL NUMBER, COMPLEX NUMBER, or VECTOR. Geometrically, the absolute value represents (absolute) displacement from the origin (or zero) and is therefore always nonnegative. If a real number a is positive or zero, its absolute value is itself; if a is negative, its absolute value is $-a$. A complex number z is typically represented by an ordered pair (a, b) in the complex plane. Thus, the absolute value (or modulus) of z is defined as the real number $\sqrt{a^2 + b^2}$, which corresponds to z's distance from the origin of the complex plane. Vectors, like arrows, have both magnitude and direction, and their algebraic representation follows from placing their "tail" at the origin of a multidimensional space and extracting the corresponding coordinates, or components, of their "point." The absolute value (magnitude) of a vector is then given by the square root of the sum of the squares of its components. For example, a three-dimensional vector $\mathbf{v}$, given by (a, b, c), has absolute value $\sqrt{a^2 + b^2 + c^2}$. Absolute value is symbolized by vertical bars, as in $|x|$, $|z|$, or $|\mathbf{v}|$, and obeys certain fundamental properties, such as $|a \cdot b| = |a| \cdot |b|$ and $|a + b| \leq |a| + |b|$.

absolute zero Temperature at which a thermodynamic system (see THERMODYNAMICS) has the lowest ENERGY, 0 kelvin (K). It corresponds to –459.67°F (–273.15°C) and is the lowest possible temperature theoretically achievable by a system. A gas at constant pressure contracts as the temperature is decreased. A PERFECT GAS would reach zero volume at absolute zero. However, a real gas condenses to a liquid or a solid at a temperature higher than absolute zero. At absolute zero, the system's molecular energy is minimal and none is available for transfer to other systems. The Kelvin temperature scale has absolute zero as its zero point, and its fundamental unit is the kelvin.

absolution In Christianity, a pronouncement of forgiveness of SINS made to a person who has repented. This rite is based on the forgiveness that JESUS extended to sinners during his ministry. In the early church, the priest absolved repentant sinners after they had confessed and performed their penance in public. During the Middle Ages, it became the custom for priests to hear CONFESSION and grant absolution privately. In ROMAN CATHOLICISM penance is a SACRAMENT, and the priest has the power to absolve a contrite sinner who promises to make satisfaction to God. In Protestant churches, the confession of sin is usually made in a formal prayer by the whole congregation, after which the minister announces their absolution.

absolutism Political doctrine and practice of unlimited, centralized authority and absolute sovereignty, especially as vested in a monarch. Its essence is that the ruling power is not subject to regular challenge or check by any judicial, legislative, religious, economic, or electoral agency. Though it has been used throughout history, the form that developed in early modern Europe (16th–18th century) became the prototype; LOUIS XIV is seen as the epitome of European absolutism. Religious authority was assumed by the monarch, who became the head of the church as well as the state, on the basis that the right to rule came from God (see DIVINE KINGSHIP). See also AUTHORITARIANISM, DICTATORSHIP, TOTALITARIANISM.

absorption Transfer of ENERGY from a wave to the medium through which it passes. The energy of the wave can be reflected, transmitted, or absorbed. If the medium absorbs only a fraction of the energy, it is said to be transparent to that energy. When all energy is absorbed, the medium is opaque. All substances absorb energy to some extent. For instance, the ocean appears transparent to sunlight near the surface, but becomes opaque with depth. Substances absorb specific types of RADIATION. Rubber is transparent to INFRARED RADIATION and X RAYS, but opaque to visible LIGHT. Green glass is transparent to green light but absorbs red and blue light. Absorption of SOUND is fundamental to ACOUSTICS; a soft material absorbs sound energy as the waves strike it.

abstract art *or* **nonobjective art** *or* **nonrepresentational art** Art, including painting, sculpture, and graphic art, that does not represent recognizable objects. In the late 19th century the traditional European conception of art as the imitation of nature was abandoned in favour of the imagination and the unconscious. Abstraction developed in the early 20th century with such movements as FAUVISM, EXPRESSIONISM, CUBISM, and FUTURISM. VASILY KANDINSKY is credited as the first modern artist to paint purely abstract pictures, c. 1910. PIET MONDRIAN's De Stijl group in The Netherlands widened the spectrum c. 1915–20. Abstraction continued to flourish between the two world wars, and after the 1930s it was the most characteristic feature of Western art. After World War II, ABSTRACT EXPRESSIONISM emerged in the U.S. and had a great influence on European and American painting and sculpture. By the turn of the 21st century, artistic output was varied, with abstract art prominent alongside figurative and conceptual work.

Abstract Expressionism Movement in U.S. painting that began in the late 1940s. Its development was influenced by the radical work of ARSHILE GORKY and HANS HOFMANN and by the immigration in the late 1930s and early '40s of many European avant-garde artists to New York. The Abstract Expressionist movement itself is generally regarded as having begun with the paintings done by JACKSON POLLOCK and WILLEM DE KOONING in the late 1940s and early '50s. Other artists who came to be associated with the style include FRANZ KLINE, MARK ROTHKO, CLYFFORD STILL, Philip Guston, HELEN FRANKENTHALER, BARNETT NEWMAN, Adolph Gottlieb, ROBERT MOTHERWELL, LEE KRASNER, and AD REINHARDT. The movement comprised many styles but shared several characteristics. The works were usually abstract (i.e., they depicted forms not found in the natural world); they emphasized freedom of emotional expression, technique, and execution; they displayed a single unified, undifferentiated field, network, or other image in unstructured space; and the canvases were large, to enhance the visual effect and project monumentality and power. The movement had a great impact on U.S. and European art in the 1950s; it marked the shift of the creative centre of modern painting from Paris to New York. See also ABSTRACT ART; ACTION PAINTING.

Abū al-Ḥasan al-Ashʿarī See Abū al-Ḥasan al-ASHʿARĪ

Abū ʿAlī Ḥasan ibn ʿAlī See NIẒĀM AL-MULK

Abū Bakr \ə-ˌbü-'bä-kər\ (b. c. 573, Mecca, Hejaz, Arabian Peninsula—d. Aug. 23, 634, Medina) One of the close COMPANIONS OF THE PROPHET Muhammad and the first Muslim CALIPH. Some Muslim traditions say he was the first male convert to Islam after Muhammad. He became caliph after Muhammad's death in 632, and during his two years in that office he consolidated central Arabia under Muslim control, engaging in the wars of apostasy (*riddah*). He also realized the urgency of expanding the regions under Muslim control in order to maintain peace among Arab tribes.

Abu Dhabi *Arabic* **Abū Ẓabī** City (pop., 1995: 398,695), capital of ABŪ ẒABĪ emirate and national capital of the UNITED ARAB EMIRATES. It occupies most of the small island of Abū Ẓabī, which is connected to the mainland by a bridge. Settled in 1761, it was of little importance until the discovery of oil in 1958. Oil royalties thereafter revolutionized its political and economic position, and it has grown into a modern city.

Abū Ḥanīfah \ə-ˌbü-hä-'nē-fə\ **(al-Nuʿmān ibn Thābit)** (b. 699, Kūfah, Iraq—d. 767, Baghdad) Muslim jurist and theologian. The son of a merchant in Kūfah, he gained wealth in the silk trade and studied law under the noted jurist Ḥammād. After Ḥammād's death (738), Abū Ḥanīfah became his successor. He was the first to develop systematic legal doctrines from the accumulated Islamic legal tradition. Primarily a scholar, he neither accepted a judgeship nor took direct part in court politics; he supported the successors of ʿALĪ over the ruling UMAYYAD and ʿABBĀSID dynasties. His doctrinal system became one of four canonical schools of Islamic law (SHARIA) and is still widely followed in India, Pakistan, Turkey, Central Asia, and Arab countries.

Abū Muslim \ə-ˌbü-'mùs-lim\ (d. 755) Leader of a revolutionary movement in KHORĀSĀN whose efforts brought down the UMAYYAD DYNASTY. Born into the *mawālī* (non-Arab Muslim) class and of humble origins, he met an agent of the ʿAbbāsid family while in prison (741). After his arranged release, he was sent to Khorāsān (745–746) to instigate a revolt. Recruit-

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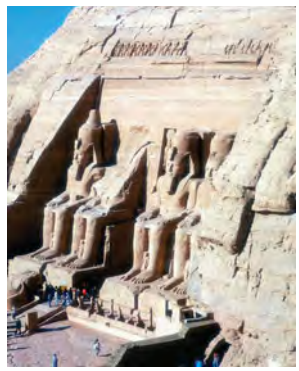
ing from various discontented groups, he succeeded in overthrowing the last Umayyad caliph, Marwān II (750), and was rewarded with the governorship of Khorāsān. His popularity led the second ʿAbbāsid caliph, al-Manṣūr, to view him as a threat and have him put to death. See also ʿABBĀSID DYNASTY.

Abū Qīr \ˌä-bü-ˈkēr\ **Bay** Inlet of the Mediterranean Sea, lying near the Rosetta mouth of the NILE along the coast of Egypt. It was the scene of the BATTLE OF THE NILE (1798), in which an English fleet under HORATIO NELSON defeated the French fleet of NAPOLEON I.

Abu Simbel Site of two temples built by RAMSES II in the 13th century BC. The area, at the southern frontier of pharaonic Egypt, lies near Egypt's current border with THE SUDAN. The temples were unknown to the outside world until their rediscovery in 1813. The larger temple displays four 67-ft (20-m) seated figures of Ramses; the smaller was dedicated to Queen Nefertari. When the reservoir created by the building of ASWĀN HIGH DAM threatened to submerge the site in the early 1960s, an international team disassembled both temples and reconstructed them 200 ft (60 m) above the riverbed.



Sandstone figures of Ramses II in front of the main temple at Abu Simbel near Aswān, Egypt.
© SPECTRUM COLOUR LIBRARY/HERITAGE-IMAGES

Abū Ẓabī *or* **Abu Dhabi** Largest constituent emirate (pop., 2003 est.: 1,591,000) of the UNITED ARAB EMIRATES. Bounded to the north and west by the PERSIAN GULF, to the south and southwest by SAUDI ARABIA, and to the east by OMAN, it has an area of 28,210 sq mi (73,060 sq km). It has numerous offshore islands, and internally it partially surrounds DUBAYY and has a short boundary with Al-Shāriqah (Sharjah). Since the 18th century the Āl Bū Falāḥ, a clan of the Banū Yās confederation, has held power. In 1761 they found wells of potable water at the site of ABU DHABI city, and they made their headquarters there from 1795. In the 19th century territorial conflicts with Muscat (Masqat) and Oman and with the ancestors of the SAʿŪD DYNASTY (which now rules Saudi Arabia) led to border disputes that have remained largely unsettled. Abū Ẓabī signed an agreement with Great Britain in 1892, placing its foreign affairs under British control. When Britain withdrew from the Persian Gulf in 1968, the emirate and the other Trucial States formed the United Arab Emirates. Its rich oil fields make it and Dubayy the federation's two most prosperous emirates.

Abū Zayd \ab-ü-ˈzīd**, Naṣr Ḥāmid** (b. Oct. 7, 1943, Ṭanṭā, Egypt) Egyptian scholar. He attended Cairo University and received a Ph.D. in Arab and Islamic studies. His research and writings on Quranic exegesis, including his well-known *Critique of Islamic Discourse* (1995), offended some Islamic fundamentalists. In 1993 a colleague denounced him in a major Cairo mosque, and Islamic radicals successfully sought a nullification of his marriage from an Egyptian family court on the grounds that his writings demonstrated his apostasy (and under Egyptian law a Muslim woman may not be married to a non-Muslim man). Though the court declined to pass judgment, an appeals court divorced Abū Zayd and his wife, a decision confirmed by the Egyptian Supreme Court. The case attracted widespread concern among intellectuals and human rights groups. Since 1995 Abū Zayd and his wife have lived in exile in The Netherlands.

Abuja \ä-ˈbü-jä\ City (pop., 2003 est.: 452,000), federal capital of Nigeria. Construction of the city, at a site chosen for its healthful climate and central location about 300 mi (480 km) northeast of LAGOS, began in 1976 under the architect TANGE Kenzo. It officially replaced Lagos as the capital in 1991.

Abydos \ə-ˈbī-dəs\ Sacred city, one of the most important archaeological sites of ancient Egypt. It was a royal necropolis of the first two dynasties and later a pilgrimage centre for the worship of OSIRIS. The pharaohs, including THUTMOSE III and RAMSES III, embellished the temple to Osiris, and some pharaohs had CENOTAPHS at Abydos. The temple of Seti I, one of the most beautiful, has helped decode Egyptian history: in a long gallery is a relief, the so-called Abydos list of kings, showing Seti and his son Ramses making offerings to the cartouches of 76 dead predecessors.

Abydos Ancient Anatolian town northeast of modern Çanakkale, Turkey, on the eastern side of the DARDANELLES. It was colonized c. 670 BC by the Milesians (see MILETUS). XERXES I crossed the strait on a bridge of boats to invade Greece in 480 BC. Abydos is celebrated for its resistance to PHILIP V of Macedon in 200 BC and for the legend of HERO AND LEANDER.

abyssal plain \ə-ˈbis-əl\ Flat seafloor area at a depth of 10,000–20,000 ft (3,000–6,000 m), generally adjacent to a continent. The larger plains are hundreds of miles wide and thousands of miles long. The plains are largest and most common in the Atlantic Ocean, less common in the Indian Ocean, and even rarer in the Pacific Ocean, where they occur mainly as small, flat floors of marginal seas or as long, narrow bottoms of trenches. They are thought to be the upper surfaces of land-derived sediment that accumulates in abyssal depressions.

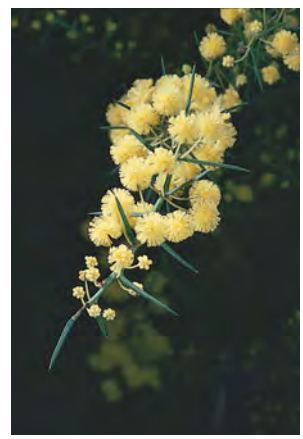
Abyssinia See ETHIOPIA

Abyssinian cat \ˌab-ə-ˈsi-nē-ən\ Breed of DOMESTIC CAT, considered more similar to the sacred cat of ancient Egypt than any other living cat. It is lithe and has slender legs and a long, tapering tail. Its short, finely textured coat is ruddy reddish brown, with individual hairs distinctively ticked, or tipped, with bands of black or brown. The nose is red, and the tail tip and backs of the hindlegs are black. The Abyssinian is affectionate and quiet, though generally shy with strangers.

Abzug \ˈab-zəg**, Bella** *orig.* **Bella Savitzky** (b. July 24, 1920, New York, N.Y., U.S.—d. March 31, 1998, New York City) U.S. lawyer and politician. She studied law at Columbia University and subsequently took on numerous union, civil liberties, and civil rights cases, representing several people charged by Sen. JOSEPH MCCARTHY. She founded and chaired (1961–70) the antiwar Women Strike for Peace and later the National Women's Political Caucus. In the House of Representatives (1971–77), she was known for her flamboyant style, her opposition to the Vietnam War, and her outspoken support for the Equal Rights Amendment, abortion rights, and child-care legislation.

AC See ALTERNATING CURRENT

acacia \ə-ˈkā-shə\ Any of the approximately 800 species of trees and shrubs that make up the genus *Acacia*, of the MIMOSA family. Acacias are native to tropical and subtropical regions of the world, particularly Australia and Africa. Sweet acacia (*A. farnesiana*) is native to the southwestern U.S. Acacias have distinctive, finely divided leaflets, and their leafstalks may bear thorns or sharp spines at their base. Their small, often fragrant, yellow or white flowers have many stamens apiece, giving each a fuzzy appearance. On the plains of southern and eastern Africa, acacias are common features of the landscape. Several species are important economically, yielding substances such as gum arabic and TANNIN, as well as valuable timber.



Spreading wattle (*Acacia genistifolia*), an Australian acacia in which the leafstalks are flattened and function as leaves
C. RALPH AND DAPHNE KELLER/AUSTRALASIAN NATURE TRANSPARENCIES

academic degree See academic DEGREE

Académie Française \ä-kä-dā-ˈmē-frä^{n}-ˈsez\ Literary academy in France. The Académie Française was established by Cardinal RICHELIEU in 1634 to maintain standards of literary taste and to establish the literary language. In modern times it has endeavoured (somewhat absurdly) to purify French of foreign loanwords. Its membership is limited to 40. Despite its conservatism, most of France's great writers, including PIERRE CORNEILLE, JEAN RACINE, VOLTAIRE, and VICTOR HUGO, have been members.

academy Society of learned individuals organized to advance art, science, literature, music, or some other cultural or intellectual area of endeavour. The word comes from the name of an olive grove outside

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ancient Athens, the site of PLATO's famous school of philosophy in the 4th century BC. Academies appeared in Italy in the 15th century and reached their greatest influence in the 17th–18th centuries. Their purpose generally was to provide training and, when applicable, to create exhibiting or performance opportunities for their members or students. Most European countries now have at least one academy sponsored by or otherwise connected with the state. See also ACADÉMIE FRANÇAISE.

Academy Awards Annual awards of merit in the U.S. presented by the Academy of Motion Picture Arts and Sciences. The Academy was formed in 1927 by LOUIS B. MAYER and others to raise the standards of film production, and its first awards were presented in 1929. The awards (nicknamed Oscars) recognize excellence in acting, directing, screenwriting, and other activities related to film production.

Acadia North American possession of France in the 17th–18th century, centred in what is now NOVA SCOTIA. Acadia was probably intended to include the other present MARITIME PROVINCES as well as parts of Maine and Quebec. The first European settlement was founded by Samuel de Champlain and Pierre du Gast in 1604. The area at times was also claimed by the British and was contested often in the 18th-century colonial wars; in 1713 Nova Scotia came under British rule. In 1755 many French-speaking Acadians were deported by the British because of imminent war with France; several thousand settled in French-ruled Louisiana, where their descendants were known as CAJUNS. The event was the theme for Henry W. Longfellow's *Evangeline*.

Acadia National Park Preserve on the coast of Maine, U.S. It has an area of 65 sq mi (168 sq km). Originally established as Sieur de Monts National Monument (1916), it became the first national park in the eastern U.S. as Lafayette National Park (1919) and was renamed Acadia in 1929. It consists mainly of a forested area on Mount Desert Island, dominated by Cadillac Mountain.

Acadia University Privately endowed university in Wolfville, Nova Scotia, Canada. Founded in 1838, it took its current name and status in 1891. It has faculties of arts, professional studies, science, theology, education, and graduate studies. Acadia ranks among the country's top undergraduate institutions.

Acadian orogeny \ə-ˈkā-dē-ən-ȯ-ˈrä-jə-nē\ Mountain-building event that affected the northern portion of the APPALACHIAN GEOSYNCLINE from present-day New York to Newfoundland during the DEVONIAN PERIOD. The orogeny was most intense in northern New England. Its origin has been ascribed to the collision of the northeastern portion of the North American Plate with western Europe. Evidence for the orogeny includes deformation of pre-Devonian and Devonian rocks.

acanthus \ə-ˈkan-thəs\ Any of the more than 2,500 plant species that make up the family Acanthaceae, of the FIGWORT order. Acanthus are found mostly in tropical and subtropical regions. Most are herbaceous plants or shrubs that grow in tropical rainforests; some are climbers (vines) or trees. Acanthus have simple leaves arranged in opposite pairs on the twigs and enlarged cells called cystoliths in streaks or protuberances in the vegetative parts. The bisexual flowers are bilaterally symmetrical and usually crowded together in clusters. Individual flowers are enclosed by leaflike bracts, which are often coloured and large. Acanthus are mainly of horticultural interest and include some ornamentals.

Acapulco *in full* **Acapulco de Juárez** City and port (pop., 2000: 619,253), southwestern Mexico. Situated on a deep semicircular bay, it has the best harbour on Mexico's Pacific coast. It was discovered by HERNÁN CORTÉS in 1531, and a settlement was founded in 1550. Until 1815 it was a main depot for Spanish colonial fleets going to the Far East. It has become a major international resort for tourists attracted by its scenic beauty, climate, and excellent beaches.

Acarnania \ˌa-kər-ˈnā-nē-ə\ District, ancient Greece, bounded by the Ionian Sea, the Ambracian Gulf, and the ACHELOUS RIVER. First settled in the 7th–6th centuries BC, it developed into a federal state by the late 5th century BC; its capital was Stratus. It later came under Athenian, Theban, and Macedonian rule. Part of Acarnania recovered its independence in 231 BC and began an alliance with PHILIP V of Macedon. Rome overthrew the Macedonian dynasty in 167 BC, and Acarnania survived until AUGUSTUS incorporated many Acarnanians into his new city Nicopolis Actia.

acceleration Rate of change of VELOCITY. Acceleration, like velocity, is a VECTOR quantity: it has both magnitude and direction. The velocity of an object moving on a straight path can change in magnitude only, so its acceleration is the rate of change of its speed. On a curved path, the velocity may or may not change in magnitude, but it will always change in direction, which means that the acceleration of an object moving on a curved path can never be zero. If velocity is stated in metres per second (m/s) and the time interval in seconds (s), then the units of acceleration are metres per second per second (m/s/s, or m/s^2). See also CENTRIPETAL ACCELERATION.

accelerator, particle See PARTICLE ACCELERATOR

accelerometer \ik-ˌse-lə-ˈrä-mə-tər\ Instrument that measures ACCELERATION. Because it is difficult to measure acceleration directly, the device measures the FORCE exerted by restraints placed on a reference mass to hold its position fixed in an accelerating body. The output is usually either a varying electrical voltage or displacement of a moving pointer over a fixed scale. Specially designed accelerometers are used in varied applications: control of industrial vibration test equipment, detection of earthquakes (seismographs), and input to navigational and inertial guidance systems.

accent In PROSODY, a rhythmically significant stress on the syllables of a verse, usually at regular intervals. Though the term is often used interchangeably with *stress*, some prosodists use *accent* to mean the emphasis determined by normal language usage and *stress* to mean emphasis determined by metrical pattern.

acceptance Short-term credit instrument consisting of a written order that requires a buyer to pay a specified sum to the seller at a given date, signed by the buyer as a promise to honor the obligation. Acceptances are often used in export/import transactions: an exporter may require a buyer to sign and return an acceptance, which the exporter can then sell to the bank at a discount, thereby obtaining payment promptly. The buyer then has until the bill's maturity date to dispose of the goods and pay the promised sum (now owed to the bank). See also BILL OF EXCHANGE; PROMISSORY NOTE.

acclimatization Any of numerous gradual, long-term responses of an individual organism to changes in its environment. The responses are more or less habitual and reversible should conditions revert to an earlier state. These criteria differentiate acclimatization from HOMEOSTASIS; from growth and development (which cannot be reversed); and from evolutionary adaptation (which occurs in a population over generations). Acclimatization can occur in anticipation of a change and enable organisms to survive conditions beyond their natural experience. Examples include adaptations to seasonal changes and adjustments to changes in altitude.

accordion Portable musical instrument that uses a hand-pumped bellows and two keyboards to sound free reeds, small metal tongues that vibrate when air flows past them. The keyboards on either side of the bellows effectively resemble individual reed organs. The right-hand keyboard plays the treble line or lines. Most of the keys on the left-hand (bass) keyboard sound three-note chords; "free-bass" accordions permit the playing of single-note lines. A prototype accordion, using buttons rather than keys, was patented in Berlin in 1822 by Friedrich Buschmann (also inventor of the HARMONICA). The instrument gained wide popularity in dance bands and as a folk instrument. See also CONCERTINA.

Italian accordion, 19th century
RICHARD SAUNDERS—SCOPE ASSOCIATES, INC.

account payable Any amount owed as the result of a purchase of goods or services on a credit basis. Although a firm making a purchase issues no written promise of payment, it enters the amount owed as a current liability in its accounts. Companies often incur this type of short-term DEBT in order to finance their inventories, especially in industries where inventory turnover is rapid. See also ACCOUNT RECEIVABLE.

account receivable Any amount owed to a business as the result of a purchase of goods or services from it on a credit basis. Although the firm making the sale receives no written promise of payment, it enters the amount due as a current asset in its books. Accounts receivable constitute a major portion of the assets of many companies, and they may even be sold or pledged as collateral to obtain loans. See also ACCOUNT PAYABLE; FACTORING.

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accounting Systematic development and analysis of information about the economic affairs of an organization. The actual recording and summarizing of financial transactions is known as BOOKKEEPING. When the data thus produced are abstracted in reports (usually quarterly or annually) for the use of persons outside the organization, the process is called financial accounting. Three reports are typically generated in financial accounting: the BALANCE SHEET, which summarizes the firm's assets and liabilities; the income statement, which reports the firm's gross proceeds, expenses, and profit or loss; and the statement of CASH FLOW, which analyzes the flow of cash into and out of the firm. The creation of reports (usually monthly) for internal planning and decision-making is called managerial accounting. Its aim is to provide managers with reliable information on the costs of operations and on standards with which those costs can be compared, to assist them in budgeting.

Accra \'ä-krə, ə-'krä\ Capital and largest city (pop., 2001 est.: 1,551,200) of Ghana, on the Gulf of GUINEA. When the Portuguese first settled on the coast in 1482, the site was occupied by the Ga people. Three fortified trading posts were built 1650–80 by the Danes, the Dutch, and the British. The Danes and Dutch left the region in 1850 and 1872, respectively, and in 1877 Accra became the capital of the British GOLD COAST colony. The city became Ghana's administrative, economic, and educational centre after the country gained its independence in 1957. Tema, 17 mi (27 km) east, has taken over Accra's former port functions.

acculturation See CULTURE CONTACT

accused, rights of the In law, the rights and privileges of a person accused of a crime. In most modern legal systems these include the presumption of innocence until proved guilty, trial by JURY, representation by counsel, the right to present witnesses and evidence to establish one's innocence, and the right to cross-examine one's accusers. Also important are a prohibition against an unreasonable SEARCH AND SEIZURE, the right to a speedy trial, and guarantees of freedom from DOUBLE JEOPARDY and of the right to APPEAL. In the U.S. a person accused of a crime must be notified immediately of the right to secure counsel and the right to refuse to answer questions if answering might be incriminating (see *MIRANDA V. ARIZONA*).

acetaminophen \ə-ˌsē-tə-'min-ə-fən\ Drug used to relieve mild headache or muscle and joint pain and to reduce fever. An organic compund, it relieves pain by inhibiting PROSTAGLANDIN synthesis in the central nervous system and reduces fever by acting on the temperature-regulating centre of the brain. Unlike ASPIRIN, it has no anti-inflammatory effect. It also is much less likely to irritate the stomach and cause PEPTIC ULCERS, is not linked with REYE SYNDROME, and can be taken by persons using ANTICOAGULANTS or allergic to aspirin. Overdosages can cause fatal liver damage. A common brand name in much of the world is Tylenol. See also IBUPROFEN.

acetate $C_2H_3O_2^-$ ion, a SALT, ESTER, or acylal derived from ACETIC ACID. Acetates are important in the biochemical synthesis of fats from carbohydrates in plants and animals. Industrially, metal acetates are used in printing, vinyl acetate in plastic production, cellulose acetate in photographic films and TEXTILES (one of the first synthetic fibres, often called simply acetate), and volatile organic esters as solvents.

acetic acid \ə-'sē-tik\ Most important CARBOXYLIC ACID (CH_3COOH). Pure ("glacial") acetic acid is a clear, syrupy, corrosive liquid that mixes readily with water. VINEGAR is its dilute solution, from FERMENTATION and oxidation (see OXIDATION-REDUCTION) of natural products. Its SALTS and ESTERS are ACETATES. It occurs naturally as a metabolic intermediate in body fluids and plant juices. Industrial production is either synthetic, from ACETYLENE, or biological, from ETHANOL. Industrial chemicals made from it are used in printing and as plastics, photographic films, textiles, and solvents.

acetone \'a-sə-ˌtōn\ *or* **dimethyl ketone** \dī-'me-thəl-'kē-ˌtōn\ Simplest and most important KETONE (CH_3COCH_3). It is a colourless, flammable liquid, boiling at 133 °F (56.2 °C). Many fats, RESINS, and organic materials dissolve easily in it, so it is used to make artificial fibres, explosives, resins, paints, inks, cosmetics (including nail-polish remover), coatings, and adhesives. Acetone is used as a chemical intermediate in pharmaceuticals and many other compounds.

acetylcholine \ə-ˌsē-tᵊl-'kō-lēn\ Ester of CHOLINE and ACETIC ACID, a NEUROTRANSMITTER active at many nerve SYNAPSES and at the motor end plate of vertebrate voluntary MUSCLES. It affects several of the body's systems, including the CARDIOVASCULAR SYSTEM (decreases heart rate and contraction strength, dilates blood vessels), gastrointestinal system (increases PERISTALSIS in the stomach and amplitude of digestive contractions), and URINARY SYSTEM (decreases bladder capacity, increases voluntary voiding pressure). It also affects the RESPIRATORY SYSTEM and stimulates secretion by all GLANDS that receive parasympathetic nerve impulses (see AUTONOMIC NERVOUS SYSTEM). It is important in memory and learning and is deficient in the brains of those with late-stage ALZHEIMER DISEASE.

acetylene *or* **ethyne** \'e-ˌthīn\ Simplest alkyne, C_2H_2. A colourless, flammable, explosive gas, it is used as a fuel in welding and cutting metals and as a raw material for many organic compounds and plastics. It is produced by reaction of water with calcium carbide, passage of a hydrocarbon through an electric arc, or partial combustion of methane. Decomposing it liberates heat; depending on degree of purity, it is also an explosive. An acetylene torch reaches about 6,000 °F (3,300 °C), hotter than combustion of any other known gas mixture. See also HYDROCARBON.

Achaean Any member of an ancient Greek people identified in HOMER as those who, with the Danaoi and the Argeioi, attacked Troy. Some identify them with the MYCENAEANS of the 14th–13th century BC; others say that they arrived in the 12th-century DORIAN invasions. They may have held power only a few generations before being replaced by the Dorians. HERODOTUS claims the later Achaeans of the northern Peloponnese (see ACHAEAN LEAGUE) were descended from these earlier Achaeans.

Achaean League \ə-'kē-ən\ 3rd-century BC confederation of towns of Achaea, an area in the northern Peloponnese of ancient Greece. Twelve cities had joined together by the 4th century BC to combat piracy, but they disbanded after the death of ALEXANDER THE GREAT. Ten cities renewed the league in 280 BC, later admitting non-Achaean cities to defend themselves against Macedonia, then Sparta, and finally Rome. Rome dissolved the league after defeating it in 146 BC. Later a smaller league was formed that existed into the Roman imperial age.

Achaemenian \ˌa-kə-'mē-nē-ən\ **dynasty** (559–330 BC) Early Persian dynasty. It derives its name from Achaemenes, who is thought to have lived in the early 7th century BC. From his son Teispes were descended two lines of kings. The older line included Cyrus I, Cambyses I, CYRUS II (the Great), and Cambyses II; the junior line began with DARIUS I and ended with the death of Darius III after his defeat by ALEXANDER THE GREAT (330 BC). Its greatest rulers were Cyrus II (r. 559–c. 529 BC), who actually established the Persian empire and from whose reign it is dated; Darius I, who secured the borders from external threats; and XERXES I, who completed many of Darius's public works. At its height, the Achaemenian Empire reached from Macedonia to northern India and from the Caucasus Mountains to the Persian Gulf. The ruins of one of its capitals, PERSEPOLIS, survive from its golden age.

Achebe \ä-'chā-bā**, (Albert) Chinua(lumogu)** (b. Nov. 16, 1930, Ogidi, Nigeria) Nigerian Igbo novelist. Concerned with emergent Africa at its moments of crisis, he is acclaimed for depictions of the disorientation accompanying the imposition of Western customs and values on traditional African society. *Things Fall Apart* (1958) and *Arrow of God* (1964) portray traditional Igbo life as it clashes with colonialism. *No Longer at Ease* (1960), *A Man of the People* (1966), and *Anthills of the Savannah* (1988) deal with corruption and other aspects of postcolonial African life. *Home and Exile* (2000) is in part autobiographical, in part a defense of Africa against Western distortions.

Achelous River \ˌa-kə-'lō-əs\ Longest river in Greece. It rises in the Pindus Mountains and flows south 140 mi (220 km) to the Ionian Sea. Hydroelectric dams harness its waters at Kastraki and Kremasta. In ancient mythology, Achelous was a protean river god, who was vanquished by Hercules.

Acheson \'a-chə-sən**, Dean (Gooderham)** (b. April 11, 1893, Middletown, Conn., U.S.—d. Oct. 12, 1971, Sandy Spring, Md.) U.S. secretary of state (1949–53). After graduating from Yale University and Harvard Law School, he practiced law in Washington, D.C. In 1941 he joined the State Department, where he later served as undersecretary (1945–47). In 1947 he helped design the TRUMAN DOCTRINE and the MARSHALL PLAN. As secretary of state under HARRY S. TRUMAN, he promoted the formation of NATO and was a principal creator of U.S. foreign policy in the early years of the Cold War. During congressional hearings held by Sen. JOSEPH MCCARTHY, Acheson refused to fire any alleged subversives in the State Department, including ALGER HISS. He established the policies of nonrecognition of China and aid to the regime of CHIANG KAI-SHEK in Taiwan, and he supported U.S. aid to the French colonial regime in Indo-

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china. After leaving office, he continued to advise successive presidents. His memoir *Present at the Creation* won a 1970 Pulitzer Prize.

Acheson, Edward Goodrich (b. March 9, 1856, Washington, Pa., U.S.—d. July 6, 1931, New York, N.Y.) U.S. inventor. He helped develop the INCANDESCENT LAMP and in 1881 installed the first electric lights for THOMAS ALVA EDISON in Italy, Belgium, and France. Attempting to produce artificial diamonds, he created instead the highly effective ABRASIVE material CARBORUNDUM. He later found that the silicon vaporizes from Carborundum at 7,500 °F (4,150 °C), leaving graphitic carbon, and patented his GRAPHITE-making process in 1896.

Acheulean \ə-'shü-lē-ən\ **industry** STONE-TOOL INDUSTRY of the Lower PALEOLITHIC PERIOD characterized by bifacial stone tools with round cutting edges and typified especially by an almond-shaped (amygdaloid) flint hand ax measuring 8–10 in. (20–25 cm) in length and flaked over its entire surface. Other implements include cleavers, borers, knives, and choppers. The name derives from the site near St.-Acheul, in northern France, where such tools were first discovered. Acheulean industry was extremely long-lived (1,500,000–110,000 years ago) and is associated with both HOMO ERECTUS and archaic HOMO SAPIENS.

Achilles \ə-'ki-lēz\ In GREEK MYTHOLOGY, the bravest and strongest of the Greek warriors in the TROJAN WAR. Because his mother dipped him into the River STYX, he was invulnerable except at the heel by which she held him. During the war against Troy Achilles took 12 nearby cities, but after a quarrel with AGAMEMNON he refused further service. He allowed his beloved cousin Patroclus to fight in his armor, and when HECTOR slew Patroclus, Achilles returned to battle, killed Hector, and dragged his body around the walls of Troy. HOMER mentions Achilles' funeral but not the circumstances of his death; the later poet Arctinus relates that PARIS killed Achilles with an arrow guided by APOLLO.

Achilles Painter (fl. 5th century BC) Greek vase painter, named for an amphora decorated with a painting of Achilles and Briseis attributed to him. He was active in Athens in the time of PERICLES and was a contemporary of PHIDIAS. His Achilles vase (c. 450 BC) is among the finest surviving examples of RED-FIGURE POTTERY from the Classical period. He is also known for his *lekythoi* (funerary vases with coloured figures on a white background), which are regarded as the most reliable documentation of monumental Greek paintings. Over 200 extant vase paintings are attributed to him.

Achinese \ˌa-chə-'nēz\ One of the main ethnic groups on the island of Sumatra, Indon. In the 13th century the Achinese became the first people in the archipelago to adopt Islam. After expelling the Portuguese in the 17th century, the sultanate of Acheh was dominant in northern Sumatra until it was conquered by the Dutch in 1904 (see ACHINESE WAR). Now part of the Indonesian republic, the Achinese are restive and are administered within a special district. They trace their descent through both maternal and paternal lines. Women have a high social position, and they do not wear veils. The group numbers roughly 2.1 million.

Achinese War (1873–1904) Armed conflict between The Netherlands and the Muslim sultanate of Acheh in northern SUMATRA. The Dutch considered the sultanate to be within their northern Sumatran sphere of influence and invaded it. Although the sultan capitulated, the Achinese people engaged the Dutch in a prolonged and costly guerrilla war, which the Dutch were able to win only by researching the area and devising a new "castle strategy" that relied on fortified bases.

acid Any substance that in water solution tastes sour, changes the colour of acid-base indicators (e.g., LITMUS), reacts with some METALS (e.g., iron) to yield HYDROGEN gas, reacts with BASES to form SALTS, and promotes certain CHEMICAL REACTIONS (e.g., acid CATALYSIS). Acids contain one or more hydrogen atoms that, in solution, dissociate as positively charged hydrogen IONS. Inorganic, or mineral, acids include SULFURIC ACID, NITRIC ACID, HYDROCHLORIC ACID, and phosphoric acid. Organic acids include CARBOXYLIC ACIDS, PHENOLS, and sulfonic acids. Broader definitions of acids cover situations in which water is not present. See also ACID-BASE THEORY.

acid and basic rocks Division of IGNEOUS ROCKS on the basis of their SILICATE MINERAL content, these minerals usually being the most abundant in such rocks. Rocks are described as acid, intermediate, basic, and ultrabasic, in order of decreasing silica content, because it was earlier thought that silica is present in rock MAGMAS in the form of silicic acid. In modern usage the terms do not refer to acidity in the chemical sense. In general, the gradation from acid to basic corresponds to an increase in colour (i.e., light to dark).

acid-base theory Any of several theories that give rise to alternative definitions of ACIDS and BASES. The original theory was based on SVANTE ARRHENIUS's electrolytic theory of solutions and involved the DISSOCIATION of water into hydrogen and hydroxide IONS. To explain the behaviour of a chemical, particularly if water is not present, two other theories were developed. The most widely accepted and useful is the Brønsted-Lowry definition (1923): An acid is a chemical that tends to lose a PROTON (H^+), and a base is a chemical that tends to gain a proton. Another is the Lewis definition (also 1923): An acid (see ELECTROPHILE) is a chemical that can accept an ELECTRON pair from a base (see NUCLEOPHILE), which they share to form a COVALENT BOND. The three theories have superficial similarities but subtle and important differences for certain applications.

acid rain Any precipitation, including snow, that contains a heavy concentration of SULFURIC and NITRIC acids. This form of pollution is a serious environmental problem in the large urban and industrial areas of North America, Europe, and Asia. Automobiles, certain industrial operations, and electric power plants that burn FOSSIL FUELS emit the gases sulfur dioxide and nitrogen oxide into the atmosphere, where they combine with water vapour in clouds to form sulfuric and nitric acids. The highly acidic precipitation from these clouds may contaminate lakes and streams, damaging fish and other aquatic species; damage vegetation, including agricultural crops and trees; and corrode the outsides of buildings and other structures (historic monuments are especially vulnerable). Though usually most severe around large urban and industrial areas, acid precipitation may also occur at great distances from the source of the pollutants.

Ackermann, Konrad Ernst (baptized Feb. 4, 1712, Schwerin, Mecklenburg—d. Nov. 13, 1771, Hamburg) German actor-manager. After training with a theatre company that specialized in German adaptations of French plays, he led a troupe on tour throughout Europe in the 1750s. He became known for domestic drama and for playing roles that combined the comic and the sentimental. In 1765 he opened a theatre in Hamburg, considered the first German national theatre, and later turned its management over to his stepson, Friedrich L. Schröder (1744–1816), who brought Shakespeare to the German stage. See also ACTOR-MANAGER SYSTEM.

ACLU See AMERICAN CIVIL LIBERTIES UNION

acne \'ak-nē\ Inflammatory disease of the oil glands of the skin. Acne vulgaris, probably the most frequent chronic skin disorder, results from an interplay of hereditary factors, hormones, and bacteria, beginning in the teen years when overactive SEBACEOUS GLANDS are stimulated by high levels of ANDROGENS. Its primary lesion, the blackhead, may be open or closed; it consists of a plug of skin oil (sebum), cell debris, and microorganisms in a hair follicle. Acne has four grades of severity, with increasing degrees of spread, inflammation, pustule formation, and scarring. Methods of treatment vary from skin medication to antibiotics and hormones; many cases eventually resolve spontaneously.

Acoma \'ä-kō-mə\ Indian pueblo, west-central New Mexico, U.S. It is located on a reservation west of ALBUQUERQUE and is known as the "Sky City." Its people live in terraced dwellings made of stone and adobe atop a sandstone butte 357 ft (109 m) high. Settled in the 10th century, it is believed to be the oldest continuously inhabited place in the U.S. In 1540 Spanish explorer Francisco Vazquez de CORONADO described it as the strongest defensive position in the world.

Aconcagua \ˌä-kōn-'kä-gwä**, Mount** Mountain, western Argentina, on the Chilean border. Located in the ANDES MOUNTAINS at an elevation of 22,834 ft (6,960 m), it is widely considered the highest peak in the Western Hemisphere. It is of volcanic origin but is not itself an active volcano. The summit was first reached in 1897.

aconite \'a-kə-ˌnīt\ Any member of two genera of perennial herbaceous plants of the BUTTERCUP family: *Aconitum* (monkshood or wolfsbane), consisting of summer-flowering poisonous plants, and *Eranthis* (winter aconite), consisting of spring-flowering ornamentals. The dried tuberous root of *A. napellus* was formerly used as a sedative and a painkiller.

acorn NUT of the OAK. Acorns are usually seated in or surrounded by a woody cupule. They mature within one to two seasons, and their appearance varies depending on the species of oak. Acorns provide food for wildlife and are used to fatten swine and poultry.

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Acosta \ä-'kō-stä**, Uriel** *orig.* **Gabriel da Costa** (b. c. 1585, Oporto, Port.—d. April 1640, Amsterdam, Neth.) Portuguese Jewish freethinker. Born into a MARRANO family, he came to feel that there was no salvation through the Roman Catholic church and converted to Judaism. His mother and brother also converted, and he and his family fled to Amsterdam. In 1616 he attacked RABBINIC JUDAISM as nonbiblical and was excommunicated. When he enlarged on his criticisms in 1623–24, denying the immortality of the soul, he was arrested and fined. He recanted but was later excommunicated again. He recanted publicly in 1640, after which he wrote a short autobiography, *Example of a Human Life*, and shot himself.

acoustics \ə-'kü-stiks\ Science of production, control, transmission, reception, and effects of SOUND. Its principal branches are ARCHITECTURAL, environmental, musical, and engineering acoustics, and ULTRASONICS. Environmental acoustics focuses on controlling noise produced by aircraft engines, factories, construction machinery, and general traffic. Musical acoustics deals with the design and use of musical instruments and how musical sounds affect listeners. Engineering acoustics concerns sound recording and reproduction systems. Ultrasonics deals with ultrasonic waves, which have frequencies above the audible range, and their applications in industry and medicine.

acoustics, architectural Relationship between sound produced in a space and its listeners, of particular concern in the design of concert halls and auditoriums. Good acoustic design takes into account such issues as reverberation time; sound absorption of the finish materials; echoes; acoustic shadows; sound intimacy, texture, and blend; and external noise. Architectural modifications (e.g., orchestral shells, canopies, and undulating or angled ceilings and walls) may act as focusing elements to improve sound quality.

acquired immunodeficiency syndrome See AIDS

Acre See ʿAKKO

acrobatics Art of jumping, tumbling, and balancing. The art is of ancient origin; acrobats performed leaps, somersaults, and vaults at Egyptian and Greek events. Acrobatic feats were featured in the COMMEDIA DELL′ARTE theatre in Europe and in JINGXI ("Peking opera") in China. The later use of apparatuses such as poles, tightropes, and flying trapezes made acrobatics a major attraction in CIRCUS performances. Its popularity increased in the 20th century with such performers as the Flying Wallendas (see KARL WALLENDA).

acromegaly \ˌa-krō-'me-gə-lē\ Growth and metabolic disorder in which the skeletal extremities enlarge when a PITUITARY GLAND tumor causes overproduction of GROWTH HORMONE after maturity. It is often associated with pituitary GIGANTISM. Acromegaly is characterized by gradual enlargement of hands and feet, exaggeration of facial features, skin thickening, and enlargement of most internal organs, along with headaches, excessive sweating, and high blood pressure. Acromegalic individuals are likely to develop congestive heart failure, muscle weakness, joint pain, osteoporosis, and often diabetes mellitus and visual problems, including blindness. If treatment with surgery and/or radiation fails, then hormone therapy is used. Treatment can cause hormone deficiency, necessitating hormone replacement therapy; spontaneous events may also cause hormone deficiency.

acropolis (Greek: "city at the top") Central, defensively oriented district in ancient Greek cities, located on the highest ground and containing the chief municipal and religious buildings. The renowned Athens Acropolis (5th century BC), atop a craggy walled hill, is home to four main edifices—the Propylaea (see PROPYLAEUM), PARTHENON, Erechtheum (Ionic temple noted for its CARYATID porch), and Temple of Athena Nike—all built from white marble plentiful in the region. See photograph opposite.

acrostic Originally, a short verse composition, constructed so that one or more sets of letters (such as the initial, middle, or final letters of the lines), taken consecutively, form words. An acrostic in which the initial letters form the alphabet is called an abecedarius. Ancient Greek and Latin writers, medieval monks, and Renaissance poets are among those who devised acrostics. Today the term is used for a type of word puzzle utilizing the acrostic principle. A popular form is double acrostics, puzzles constructed so that the middle or last, as well as initial, letters of lines may form words.

acrylic compound Any of a class of synthetic plastics, resins, and oils used to manufacture many products. By varying the starting reagents (such as acrylic acid, $C_3H_4O_2$, or acrylonitrile, C_3H_3N) and the process of forming, a material may be produced that is hard and transparent, soft and resilient, or a viscous liquid. Acrylic compounds are used to make molded structural and optical parts, jewelry, adhesives, coating compounds, and textile fibres. Lucite and Plexiglas are trademarks used for glasslike acrylic materials.

acrylic \ə-'kri-lik\ **painting** Painting executed in the medium of acrylic resins—synthetic resins that dry rapidly, are water-soluble, and serve as a vehicle for any pigment. Its effects may range from the transparent brilliance of watercolour to the density of oil paint. Acrylics are less affected by heat and deterioration than oils. They were first used by artists in the 1940s but became popular with POP artists when they were produced commercially in the 1960s.

Act of Union See Act of UNION (1707), Act of UNION (1800)

Acta *Latin* **"Acts"** In ancient Rome, the daily minutes of public business and a record of political and social events. JULIUS CAESAR in 59 BC ordered that the SENATE's daily doings (*acta diurna*, *commentaria Senatus*) be made public; CAESAR AUGUSTUS later prohibited publication, though the Senate's acts continued to be recorded and could be read with special permission. There were also public registers (*acta diurna urbis*, "daily minutes of the city") of the acts of the popular assemblies and the courts as well as births, deaths, marriages, and divorces. These constituted a daily gazette, a prototype of the modern newspaper.

ACTH *in full* **adrenocorticotropic** \ə-'drē-nō-ˌkór-ti-kō-'trō-pik\ **hormone** Polypeptide HORMONE made in the PITUITARY GLAND. It regulates the activity of part of the adrenal cortex (see ADRENAL GLANDS), the production site of important STEROID hormones that affect ELECTROLYTE and water balance and the METABOLISM of fats, carbohydrates, and proteins. ACTH is found in vertebrates (except jawless fishes); in mammals it contains 39 AMINO ACIDS. Overproduction of ACTH is one cause of CUSHING SYNDROME.

actin One of two PROTEINS responsible for contraction of MUSCLE cells and the motility of other cells. It occurs as a MONOMER, G-actin, a globular protein, and in living cells as a POLYMER, F-actin, which resembles two strings of beads twisted around each other into thin filaments. The filaments occur in regular structures, alternated and interwoven with thick filaments that contain myosin, the other major muscle protein. The thick and thin filaments slide past each other, under the control of CALCIUM ions, resulting in contraction (shortening) and relaxation (lengthening) of the muscle cells.

acting Art of representing a character on a stage or before a camera by means of movement, gesture, and intonation. Acting in the Western tradition originated in Greece in the 6th century BC; the tragedian THESPIS is traditionally regarded as founder of the profession. ARISTOTLE defined acting as "the right management of the voice to express various emotions" and declared it a natural gift that he doubted could be taught. Acting declined as an art in the Middle Ages, when Christian LITURGICAL DRAMA was performed by craft guilds and amateurs. Modern professional acting emerged in the 16th century with Italy's COMMEDIA DELL′ARTE troupes. It

The Acropolis, Athens.
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flourished during the era of William Shakespeare. Not until the 18th century, however, was acting considered a profession to be taken seriously, through the efforts in England of the actor-manager David Garrick and the talents of actors such as Sarah Siddons, Edmund Kean, and Henry Irving. Modern acting styles have been influenced by Konstantin Stanislavsky's emphasis on the actor's identification with his role and by Bertolt Brecht's insistence on the objectivity and discipline of the actor. The Stanislavsky method was adopted in the U.S. by Lee Strasberg and Stella Adler (1901–92) and is the basis of most contemporary training, which features the cultivation of emotional and sense memory, physical and vocal training, and improvisation.

actinide \'ak-tə-ˌnīd\ Any of the series of 15 consecutive chemical elements in the periodic table from actinium to lawrencium (atomic numbers 89–103). All are radioactive heavy metals; and only the first four (actinium, thorium, protactinium, and uranium) occur in nature in appreciable quantities. The other 11 (the transuranium elements) are unstable and are produced only artificially. Actinides are transition elements, so their atoms have similar configurations and similar physical and chemical behaviour; the most usual valences are 3 and 4.

actinolite \ak-'ti-nᵊl-ˌīt\ Colourless to green amphibole mineral, darkening with increased iron content from green to black. It has a prismatic and splintery texture and is abundant in regionally metamorphosed (see metamorphism) rocks such as schists. Actinolite has a monoclinic crystal structure, and it may alter to chlorite. See also asbestos.

actinomycete \ˌak-ti-nō-'mī-sēt\ Any of a group of generally low-oxygen–utilizing bacteria identified by a branching growth pattern that results in large threadlike structures. The filaments may break apart to form rods or spheroidal shapes. Some actinomycetes can form spores. Many species occur in soil and are harmless to animals and higher plants; others are important disease-causing agents. For diagnostic purposes in human infections, the presence of sulfur granules is used.

Action Française \ȧk-sē-'ōⁿ-fräⁿ-'sez\ ("French Action") Influential right-wing antirepublican group in early 20th-century France, whose views were promoted in a newspaper of the same name. The Action Française movement, led by Charles Maurras, espoused the antiparliamentarian, anti-Semitic, and strongly nationalist views inspired by the Alfred Dreyfus Affair. The movement peaked after World War I, when nationalist feeling was strong. It was denounced by the papacy in 1926, and ceased to exist after World War II because of its association with the collaborationist Vichy government (see Vichy France).

action painting Direct, instinctual, dynamic style of painting that involves the spontaneous application of vigorous, sweeping brush strokes and the chance effects of dripping and spilling paint onto the canvas. The term characterizes the work of Jackson Pollock, Willem de Kooning, and Franz Kline. The "automatic" techniques developed in Europe by the Surrealists in the 1920s and '30s had great influence on U.S. artists, who regarded a picture not merely as a finished product but as a record of the process of its creation. It was a major force in Abstract Expressionism in the 1950s. See also automatism, Tachism.

action potential Brief (about one-thousandth of a second) reversal of electric polarization of the membrane of a nerve or muscle cell. Stimulation of the cell by certain chemicals or by sensory receptor cells causes depolarization of the membrane, permitting an impulse to move along the nerve fibre (in nerve cells) or causing the cell to contract (in muscle cells).

Actium \'ak-shē-əm**, Battle of** (31 BC) Naval battle off Acarnania, Greece, between Octavian (later Augustus) and Mark Antony. With 500 ships and 70,000 infantry, Antony camped at Actium, between the Ionian Sea and the Ambracian Gulf. Octavian, with 400 ships and 80,000 infantry, cut Antony's line of communication from the north. Desertion by allies and a lack of supplies forced Antony to act. Outmaneuvered on land, he followed Cleopatra's advice to attack Octavian at sea. Antony's larger fleet included his own and Cleopatra's ships. In the heat of battle Cleopatra fled with her galleys, and Antony followed with a few ships. His fleet surrendered immediately, his army a week later. Octavian's victory left him undisputed ruler of the Roman world.

activation energy Minimum amount of energy (heat, electromagnetic radiation, or electrical energy) required to activate atoms or molecules to a condition in which it is equally likely that they will undergo chemical reaction or transport as it is that they will return to their original state. Chemists posit a transition state between the initial conditions and the product conditions and theorize that the activation energy is the amount of energy required to boost the initial materials "uphill" to the transition state; the reaction then proceeds "downhill" to form the product materials. Catalysts (including enzymes) lower the activation energy by altering the transition state. Activation energies are determined by experiments that measure them as the constant of proportionality in the equation describing the dependence of reaction rate on temperature, proposed by Svante Arrhenius. See also entropy, heat of reaction.

active galactic nucleus Small region at the centre of a galaxy that emits a prodigious amount of energy in the form of radio, optical, X-ray, or gamma radiation or high-speed particle jets. Many classes of "active galaxies" have been identified; they appear similar in many respects to quasars. Astronomers suspect that the observed energy is generated as matter accretes onto a supermassive black hole with a mass millions or even billions of times that of the Sun. The accreting matter can outshine the rest of the galaxy as it is heated in very high-speed collisions outside the black hole's event horizon. It is believed that many galaxies harbour these central black holes and that they might have been quasars in their early history, although they now appear to be dormant unless orbiting matter is accreting onto the black hole.

activity coefficient Number expressing the ratio of a substance's chemical activity to its molar concentration (see mole). The measured concentration of a substance may not be an accurate indicator of its chemical effectiveness as represented by the equation for a particular reaction; in such cases, the activity is calculated by multiplying the concentration by the activity coefficient. In solutions, the activity coefficient is a measure of how much the solution differs from an ideal solution.

Acton (of Aldenham), John Emerich Edward Dahlberg Acton, 1st Baron (b. Jan.10, 1834, Naples, Kingdom of Naples—d. June 19, 1902, Tegernsee, Bavaria, German Empire) English historian. He served in the House of Commons (1859–65). Editor of the Roman Catholic monthly *The Rambler* (1859–64), he resigned because of papal criticism of his scientific approach to history. An adviser to William E. Gladstone from 1865, he was raised to the peerage in 1869. In 1895 he was appointed Regius Professor of Modern History at the University of Cambridge. He later coordinated the massive publication project of *The Cambridge Modern History*. A critic of nationalism, he coined the familiar aphorism "Power tends to corrupt, and absolute power corrupts absolutely."

actor-manager system Method of theatrical production prevalent in 19th-century England and the U.S. In this system, an actor formed a theatre company, chose the plays he wanted to produce, played the leading roles in them, and managed the company's business arrangements. The first actor-managers emerged in the 17th century, and in the 18th century actor-managers such as Colley Cibber and David Garrick gained prominence. The system produced high performance standards, typified by 19th-century figures such as William Macready, Henry Irving, and Herbert Tree. It waned as actor-managers were replaced first by stage managers and later by directors.

Actors Studio Professional actors' workshop based in New York City. Founded in 1947 by the directors Cheryl Crawford, Elia Kazan, and Robert Lewis as a leading centre of the Stanislavsky method, it was directed by Lee Strasberg from 1948 to 1982. In 1962 it launched a company, and a workshop was established in Los Angeles in 1966. Actors work together without the pressures of commercial production. Membership is by invitation; six or seven new members are chosen yearly from 1,000 auditions. Members have included Marlon Brando, Marilyn Monroe, Paul Newman, and Robert De Niro.

actuary One who calculates insurance risks and premiums. Actuaries compute the probability of the occurrence of such events as birth, marriage, illness, accidents, and death. They also evaluate the hazards of property damage or loss and the legal liability for the safety and well-being of others. Usually employed by insurance companies, actuaries set premium rates based on statistical studies, establish underwriting procedures, and determine the amounts of money required to assure the payment of benefits.

Acuff \'ā-kəf**, Roy (Claxton)** (b. Sept. 15, 1903, Maynardsville, Tenn., U.S.—d. Nov. 23, 1992, Nashville, Tenn.) U.S. singer, songwriter, and fiddler. He turned to music after an aborted baseball career and gained immediate popularity with his recordings of "The Great Speckled Bird" and "The Wabash Cannonball." Reasserting the mournful musical tradi-

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tions of Southeastern rural whites, he became a national radio star on the "Grand Ole Opry" broadcasts. In 1942 he and songwriter Fred Rose founded Acuff-Rose Publishing, the first publishing house exclusively for country music. In 1962 Acuff was elected the first living member of the Country Music Hall of Fame.

acupressure *or* **shiatsu** \shē-'ät-sü\ Alternative-medicine practice in which pressure is applied to points on the body aligned along 12 main meridians (pathways), usually for a short time, to improve the flow of vital force (qi). Though often referred to by its Japanese name, shiatsu, it originated in China thousands of years ago. A single point may be pressed to relieve a specific symptom or condition, or a series of points can be worked on to promote overall well-being. Some studies suggest that acupressure can be effective for certain health problems, including nausea, pain, and stroke-related weakness. Risks are minimal with cautious use. See also acupuncture.

acupuncture Medical technique in which needles are inserted into the skin and underlying tissues, devised in China before 2500 BC. One or more small metal needles are inserted at precise points along 12 meridians (pathways) in the body, through which the vital life force (qi) is believed to flow, in order to restore yin-yang balance and treat disease caused by yin-yang imbalance. Acupuncture appears to relieve pain and is used as an anesthetic for surgery. Theories to explain its effects include stimulation of release of natural opiates, blockage of pain-signal transmission, and a placebo effect. See also acupressure.

Ada \'ā-də\ High-level computer programming language whose development was initiated in 1975 by the U.S. Dept. of Defense and standardized in 1983. Ada (named for the countess of Lovelace) was intended to be a common language for use on the department's computers, which were produced by many different manufacturers. It is similar to Pascal but contains many additional features convenient for the development of large-scale, multiplatform programs. The 1995 revision, called Ada 95, supports object-oriented programming.

Adad \ä-'dȧd\ Babylonian and Assyrian god of weather, the son of Anu (sometimes called the son of Bel). He was known as the Lord of Abundance for rains that made the land bloom, but he sent death-dealing storms to his enemies. He was also the god of oracles and divination. Though widely worshiped, he was a minor god and appears to have had no cult center of his own.

Adal \'ä-dəl\ Historical Islamic state, eastern Africa, southwest of the Gulf of Aden, with its capital at Harer (now in Ethiopia). Its rivalry with Christian Ethiopia began in the 14th century. In the early 16th century Adal launched a series of attacks. By 1533 Adal, now led by Ahmed Grañ, succeeded in gaining control of most of central Ethiopia. Grañ was killed in battle in 1543, and the Oromo invasions of the later 16th century ended Adal's power.

Adalbert \'ad-ᵊl-ˌbərt**, Saint** *orig.* **Vojtěch** (b. 956, Libice?, Bohemia—d. April 23, 997, near Gdańsk, Pol.; feast day April 23) Czech prelate. Descended from the princes of Bohemia, he was trained in theology at Magdeburg. Elected the first native bishop of Prague in 982, he promoted the political aims of the Bohemian prince by extending the influence of the church beyond the Czech kingdom. Failing to convert his people, he retired in 988 to a monastery near Rome. On papal orders, he returned in 992 to find little change. Disillusioned, he left Bohemia in 994 to become a missionary along the Baltic coast, where he was martyred in 997. An account of his life was written by his friend and disciple St. Bruno of Querfurt. He was recognized as a saint soon after his death.

Adam, Robert (b. July 3, 1728, Kirkcaldy, Fife, Scot.—d. March 3, 1792, London, Eng.) Scottish architect and designer. Son of the architect William Adam, he apprenticed in his father's offices. He traveled in Europe in 1754–58, studying architectural theory and Roman ruins. On his return to London, he and his brother James (1732–94) developed an essentially decorative style—known as the Adam style—that was marked by a new lightness and freedom in the use of the Classical elements of architecture. This style is most remembered for its application in interiors, which were characterized by contrasting room shapes and delicate Classical ornaments. Robert Adam's executed works, mainly remodeled interiors and exteriors of private houses, include Osterley Park (1761–80) in Middlesex and Kedleston Hall (c. 1765–70) in Derbyshire. Other works include the Adelphi development in London (1768–72) and the University of Edinburgh (1789). He was also a leading furniture designer; his style, popularized by designer George Hepplewhite, was meant to harmonize with his interior architecture down to the last detail.

Adam and Eve In the Judeo-Christian and Islamic traditions, the parents of the human race. Genesis gives two versions of their creation. In the first, God creates "male and female in his own image" on the sixth day. In the second, Adam is placed in the Garden of Eden, and Eve is later created from his rib to ease his loneliness. For succumbing to temptation and eating the fruit of the forbidden tree of knowledge of good and evil, God banished them from Eden, and they and their descendants were forced to live lives of hardship. Cain and Abel were their children. Christian theologians developed the doctrine of original sin based on the story of their transgression; in contrast, the Quran teaches that Adam's sin was his alone and did not make all people sinners.

Adamawa \ˌä-dä-'mä-wä\ Traditional emirate centered in what is now Adamawa state, eastern Nigeria. It was founded by Modibbo Adama in the early 19th century. He moved the capital several times before finally settling it in 1841 in Yola. The British Royal Niger Company established trading posts there; when the emir tried to force them out in 1901, they captured the town. Adamawa was partitioned in 1901 between British Northern Nigeria and German Kamerun (Cameroon). In 1919 the Cameroon portion was divided between the French and the British. The emirate's territories eventually came to form almost all of northern Cameroon and part of eastern Nigeria.

Adamawa-Ubangi \ˌad-ə-'mä-wə-ü-'baŋ-gē\ **languages** *formerly* **Adamawa-Eastern languages** Branch of the huge Niger-Congo language family. Adamawa-Ubangi languages are spoken in eastern Nigeria, northern Cameroon, southwestern Chad, and western Central African Republic. The branch has two divisions, Adamawa in the west and Ubangi in the east. The Adamawa group comprises 80 languages, the least-studied languages in the Niger-Congo family. Nearly all have fewer than 100,000 speakers. The Ubangi group includes 40 languages and extends across a much broader region, from northern Cameroon across the Central Africa Republic to adjacent parts of southern Sudan and northern Congo (Kinshasa). Ubangi languages with more than a million speakers include those of the Banda, Gbaya, Ngbaka, and Zande peoples. Sango, a restructured form of one or more languages of the Ngbandi group of Ubangi, has become a lingua franca of the Central African Republic.

Adamov \ə-'dȧ-məv**, Arthur** (b. Aug. 23, 1908, Kislovodsk, Russia—d. March 16, 1970, Paris, France) Russian-born French playwright. He settled in Paris in 1924, and his first major work, written after suffering a nervous breakdown, was his autobiography, *The Confession* (1938–43). Influenced by August Strindberg and Franz Kafka, he began writing plays in 1947. *Professor Taranne* (1953) and *Ping-Pong* (1955) expressed a view of life's meaninglessness that was characteristic of the Theatre of the Absurd. In *Paolo Paoli* (1957) and later plays, he abandoned Absurdism for radical political theatre influenced by Bertolt Brecht. He died from a drug overdose, an apparent suicide.

Adams, Abigail *orig.* **Abigail Smith** (b. Nov. 22, 1744, Weymouth, Mass.—d. Oct. 28, 1818, Quincy, Mass., U.S.) U.S. first lady. She was the daughter of a Congregational minister. Educated entirely at home, she became an avid reader of history. She married John Adams in 1764 and raised four children, including John Quincy Adams, in Quincy, Mass. In 1774 she began a prolific correspondence with her husband, who was attending the Continental Congress in Philadelphia; she described daily life and discussed public affairs during the American Revolution with wit and political acuity. She continued her letters to family and friends while in Europe (1784–88) and Washington, D.C. (1789–1801), during her husband's diplomatic and presidential careers. She was considered an influential adviser to him.

Adams, Ansel (b. Feb. 20, 1902, San Francisco, Calif., U.S.—d. April 22, 1984, Carmel, Calif.) U.S. photographer. In 1927 he published *Parmelian Prints of the High Sierras*, photographs that imitated Impressionist painting by suppressing detail in favour of soft, misty effects achieved in the darkroom. Adams was known for his dramatic images of mountain landscapes. He became one of the outstanding technicians in the history of photography; *Making a Photograph* (1935) was the first of his many books on photographic technique. He worked consistently to foster public awareness of photography as a fine art. In 1940 he helped organize the first public collection of photographs, at the Museum of Modern Art, and in 1946 he established, at the California School of Fine Arts, the first academic photography department.

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Adams, Charles Francis (b. Aug. 18, 1807, Boston, Mass., U.S.—d. Nov. 21, 1886, Boston) U.S. diplomat. The son of John Quincy Adams and the grandson of John Adams, he served in the Massachusetts legislature and edited a Whig journal. He helped form the antislavery Free-Soil Party and in 1848 was chosen its candidate for U.S. vice president. As ambassador to Britain (1861–68) he was instrumental in securing Britain's neutrality during the American Civil War and in promoting the arbitration of the *Alabama* claims.

Charles Francis Adams
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Adams, Gerry *orig.* **Gerard Adams** (b. Oct. 6, 1948, Belfast, N.Ire.) Irish nationalist and president of Sinn Féin, the political wing of the Irish Republican Army (IRA). He was interned without trial as a suspected terrorist in 1972, 1973–76, and 1978. He became vice president of Sinn Féin in 1978 and persuaded the group to enter candidates in the 1981 elections. Elected to the British House of Commons in 1983, he refused to take the oath of allegiance and never took his seat. In 1991, as Sinn Féin's president (from 1983), he began to shift its strategy toward negotiation; his efforts led to indirect talks with the British government and a 1993 agreement (the Downing Street Declaration) by the British and Irish prime ministers to consider the future of Northern Ireland. He was credited with the IRA's 1994 cease-fire announcement and was pivotal in winning support for the Good Friday Agreement (1998), which led to the creation of a power-sharing assembly in Northern Ireland.

Adams, Henry (Brooks) (b. Feb. 16, 1838, Boston, Mass., U.S.—d. March 27, 1918, Washington, D.C.) U.S. historian and man of letters. A product of Boston's elite Brahmin class and a descendant of two presidents, he was infused with disgust for American politics of his time. As a young newspaper correspondent and editor, he called for social and political reforms, but he later became disillusioned with a world he characterized as devoid of principle. That loss of faith was reflected in his novel *Democracy* (1880). His study of U.S. democracy culminated in his nine-volume *History of the United States of America* (1889–91), which received immediate acclaim. In *Mont-Saint-Michel and Chartres* (1913) he described the medieval worldview as reflected in its architecture. *The Education of Henry Adams* (1918), his best-known work and one of the outstanding autobiographies of Western literature, traced his confrontations with the uncertainties of the 20th century.

Adams, John (b. Oct. 30, 1735, Braintree, Mass.—d. July 4, 1826, Quincy, Mass., U.S.) U.S. politician, first vice president (1789–97) and second president (1797–1801) of the U.S. After graduating from Harvard College in 1755, he practiced law in Boston. In 1764 he married Abigail Smith (see Abigail Adams). Active in the American independence movement, he was elected to the Massachusetts legislature and served as a delegate to the Continental Congress (1774–78), where he was appointed to a committee with Thomas Jefferson and others to draft the Declaration of Independence. In 1776–78 he was appointed to many congressional committees, including one to create a navy and another to review foreign affairs. He served as a diplomat in France, the Netherlands, and England (1778–88). In the first U.S. presidential election, he received the second largest number of votes and became vice president under George Washington. Adams's term as president was marked by controversy over his signing of the Alien and Sedition Acts in 1798 and by his alliance with the conservative Federalist Party. In 1800 he was defeated for reelection by Jefferson and retired to live a secluded life in Massachusetts. In 1812 he overcame his bitterness toward Jefferson, with whom he began an illuminating correspondence. Both men died on July 4, 1826, the Declaration's 50th anniversary. John Quincy Adams was his son.

John Adams, oil painting by Gilbert Stuart, 1826; in the National Collection of Fine Arts, Washington, D.C.
COURTESY OF THE NATIONAL COLLECTION OF FINE ARTS, SMITHSONIAN INSTITUTION, WASHINGTON D.C.

Adams, John (Coolidge) (b. Feb. 15, 1947, Worcester, Mass., U.S.) U.S. composer. After studying at Harvard University he taught at the San Francisco Conservatory and conducted widely. His compositions, initially strongly influenced by minimalism, became tempered by expressive elements. His *Nixon in China* (1987) and *The Death of Klinghoffer* (1991) are two of the best-known operas of the late 20th century. Other celebrated works include *Harmonium* (1980), *Grand Pianola Music* (1982), and *Harmonielehre* (1984–85).

Adams, John Quincy (b. July 11, 1767, Braintree, Mass.—d. Feb. 23, 1848, Washington, D.C., U.S.) Sixth president of the U.S. (1825–29). He was the eldest son of John Adams, second president of the U.S., and Abigail Adams. He accompanied his father to Europe on diplomatic missions (1778–80) and was later appointed U.S. minister to the Netherlands (1794) and to Prussia (1797). In 1801 he returned to Massachusetts and served in the U.S. Senate (1803–08). Resuming his diplomatic service, he became U.S. minister to Russia (1809–11) and to Britain (1815–17). Appointed secretary of state (1817–24), he was instrumental in acquiring Florida from Spain and in drafting the Monroe Doctrine. He ran for the presidency in 1824 against three other candidates; none received a majority of the electoral votes, though Andrew Jackson received a plurality. By constitutional design, the selection of the president went to the House of Representatives, where Adams was elected after receiving crucial support from Henry Clay, who had finished third in the initial balloting. He appointed Clay secretary of state, which further angered Jackson. Adams's presidency was unsuccessful; when he ran for reelection, Jackson defeated him. In 1830 he was elected to the House, where he served until his death. He was outspoken in his opposition to slavery; in 1839 he proposed a constitutional amendment forbidding slavery in any new state admitted to the Union. Southern congressmen prevented discussion of antislavery petitions by passing gag rules (repealed in 1844 as a result of Adams's persistence). In 1841 he successfully defended the slaves in the *Amistad* mutiny case.

Adams, Samuel (b. Sept. 27, 1722, Boston, Mass.—d. Oct. 2, 1803, Boston, Mass., U.S.) American Revolutionary leader. A cousin of John Adams, he graduated from Harvard College in 1740 and briefly practiced law. He became a strong opponent of British taxation measures and organized resistance to the Stamp Act. He was a member of the state legislature (1765–74), and in 1772 he helped found the Committees of Correspondence. He influenced reaction to the Tea Act of 1773, organized the Boston Tea Party, and led opposition to the Intolerable Acts. A delegate to the Continental Congress (1774–81), he continued to call for separation from Britain and signed the Declaration of Independence. He helped draft the Massachusetts constitution in 1780 and served as the state's governor (1794–97).

Adams, Walter S(ydney) (b. Dec. 20, 1876, Syria—d. May 11, 1956, Pasadena, Calif., U.S.) Syrian-born U.S. astronomer. He returned to the U.S. with his missionary parents when he was eight and studied at Dartmouth College, the University of Chicago, and the University of Munich. Using spectroscopy, he investigated sunspots and the rotation of the Sun, the velocities and distances of thousands of stars, and planetary atmospheres. In 1904 he joined the original staff of Mount Wilson Observatory, where he served as director (1923–46). He took an important part in planning the 200-in. (5-m) telescope for the Palomar Observatory.

Adam's Peak Mountain, south-central Sri Lanka. Standing 7,360 ft (2,243 m) high, it is sacred and a place of pilgrimage to Buddhists, Muslims, and Hindus. On its summit, it has a large hollow, 5 ft (1.5 m) long, that is venerated as the footprint of Buddha, Adam, and Shiva, respectively. Many pilgrims of all faiths visit the peak every year.

Adamson, Joy *orig.* **Joy-Friederike Victoria Gessner** (b. Jan. 20, 1910, Troppau, Silesia, Austria-Hungary—d. Jan. 3, 1980, Shaba National Reserve, Kenya) Czech-born British naturalist. Educated in Vienna, she moved to Kenya in 1939. She became known worldwide for books describing how she and her husband, George, raised a lion cub, Elsa, and returned it to its natural habitat: *Born Free* (1960), *Living Free* (1961), and *Forever Free* (1962). The books were adapted into two films.

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She later repeated her rehabilitation success with cheetah and leopard cubs. In addition to writing other books, she founded the Elsa Wild Animal Appeal (1961), an international conservation fund. She was killed by a disgruntled employee.

Adamson, Robert See Hill, David Octavius, and Robert Adamson

Adana \ˌä-dä-ˈnä\ City (pop., 1997: 1,041,509), south-central Turkey, on the Seyhan River. An agricultural and industrial centre and one of Turkey's largest cities, it probably overlies a Hittite settlement that dates from c. 1400 BC. Conquered by Alexander the Great in 335–334 BC, it was later a Roman military station. It came under the rule of the ʿAbbāsid dynasty at the end of the 7th century AD and changed hands intermittently until the late 14th century, when it fell into the hands of the Ramazan dynasty, a Turkmen group that remained influential even after the city's conquest by the Ottoman Empire in1516. Adana's prosperity has long derived from the fertile valleys behind it and its position as a bridgehead on the trade routes connecting Anatolia and the Arabian Peninsula.

Adanson \à-dä^{n}-sō^{n}**, Michel** (b. April 7, 1727, Aix-en-Provence, France—d. Aug. 3, 1806, Paris) French botanist. He studied theology, classics, and philosophy in Paris before traveling to Senegal, where he lived several years. He returned with a large collection of plant specimens, now in the National Museum of Natural History. In *Families of Plants* (1763), he described his classification system; it was opposed by Carolus Linnaeus, whose system eventually prevailed. He was the first to classify mollusks. He also studied electricity in torpedo fish and the effects of electrical current on regenerating frog legs and heads. He is now known mainly for introducing the use of statistical methods in botanical studies.

Adapa \ə-ˈdä-pə\ Legendary sage of the Sumerian city of Eridu. Endowed with great intelligence by Ea but still mortal, he was the hero of the Sumerian myth of the Fall of Man. Adapa was fishing when he was blown into the sea by the southern wind, whose wings he broke in rage. The heavenly doorkeepers Tammuz and Ningishzida interceded for him when he was summoned before Anu for punishment, but when Anu offered him the bread and water of eternal life, he refused, and humankind thus became mortal.

adaptation In biology, the process by which an animal or plant becomes fitted to its environment. It is the result of natural selection acting on inherited variation. Even simple organisms must be adapted in many ways, including structure, physiology, and genetics; movement or dispersal; means of defense and attack; and reproduction and development. To be useful, adaptations must often occur simultaneously in different parts of the body.

ADD See attention deficit disorder

Adda River \ˈäd-dä\ River, Lombardy region, Italy. It flows southward 194 mi (313 km) through Lake Como and across the Lombardy Plain before joining the Po River above Cremona. It is used extensively for hydroelectric power in its upper course and for irrigation on the plain. Historically, it has served as a strategic defense line in wars dating back to the Roman period.

Addams, Charles (Samuel) (b. Jan. 7, 1912, Westfield, N.J., U.S.—d. Sept. 29, 1988, New York, N.Y.) U.S. cartoonist. He worked briefly as a commercial artist before selling his first cartoon to *The New Yorker* in 1933. He became famous for darkly humorous cartoons depicting morbid behaviour by sinister-looking characters, especially a family of ghouls whose activities travestied those of a conventional family; in one popular image, they prepare to pour boiling oil on a group of Christmas carolers. These evolved into *The Addams Family*, a 1960s television series that generated two Hollywood films.

Addams, Jane (b. Sept. 6, 1860, Cedarville, Ill., U.S.—d. May 21, 1935, Chicago, Ill.) U.S. social reformer. Addams graduated from Rockford Female Seminary in Illinois in 1881 and was granted a degree the following year when the institution became Rockford College. During a trip to Europe in 1887–88 she visited the Toynbee Hall settlement house in London, which sparked her interest in social reform. Determined to create something like Toynbee Hall in the U.S., in 1889 she cofounded Hull House in Chicago, one of the first settlement houses in North America to provide practical services and educational opportunities for the poor. She subsequently championed social reforms such as juvenile-court law, justice for immigrants and African Americans, worker's rights and compensation, and women's suffrage. In 1910 she became the first female president of the National Conference of Social Work. An ardent pacifist, she served in 1915 as chair of the International Congress of Women and helped form the Women's International League for Peace and Freedom and the American Civil Liberties Union. In 1931 she shared the Nobel Prize for Peace with Nicholas M. Butler.

adder Any of several venomous snakes of the viper family (Viperidae) and the death adder, a viperlike elapid. Vipers include the common adder, puff adders, and night adders. Adders occur in Europe, Asia, Africa, and Australia. They range in length from 18 in. to 5 ft (45 cm to 1.5 m). The puff adder of Africa and the death adder of Australia and the nearby islands are particularly venomous, with a bite potentially lethal to humans. The name is also used for other snakes (e.g., the hognose snake).

Puff adder (*Bitis arietans*)
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Adderley, Cannonball *orig.* **Julian Edwin Adderley** (b. Sept. 15, 1928, Tampa, Fla., U.S.—d. Aug. 8, 1975, Gary, Ind.) U.S. jazz saxophonist. He worked as a music teacher and led army bands before moving to New York City in the mid-1950s. Acclaimed as a stylistic heir of Charlie Parker, he was also influenced by the more traditional rhythm-and-blues phrasing of Benny Carter. He performed with trumpeter Miles Davis from 1957 to 1959, then led an ensemble with his brother, cornetist Nat Adderley (1931–2000). In the 1960s he introduced gospel-music harmonies to his music.

Addis Ababa \ˈäd-dis-ˈä-bä-ˌbä, ˈa-dəs-ˈa-bə-bə\ Capital and largest city (pop., 1994: 2,112,737) of Ethiopia. It lies on a plateau in the country's geographic centre at an altitude of about 8,000 ft (2,450 m). The city was founded as the capital in 1887 because of the unsatisfactory location of the former capital, Entoto. Addis Ababa was the capital of Italian East Africa 1935–41. It has become the national centre for higher education, banking and insurance, and trade. Several international organizations have their headquarters there, including the Organization of African Unity. In recent decades it has suffered unrest and extensive damage as a result of the country's political instability.

Addison, Joseph (b. May 1, 1672, Milston, Wiltshire, Eng.—d. June 17, 1719, London) English essayist, poet, and dramatist. His poem on the Battle of Blenheim, *The Campaign* (1705), brought him to the attention of leading Whigs and paved the way to important government posts (including secretary of state) and literary fame. With Richard Steele, he was a leading contributor to and guiding spirit of the periodicals *The Tatler* (1709–11) and *The* Spectator (1711–12, 1714). One of the most admired masters of English prose, he brought to perfection the periodical essay. His *Cato* (1713), a highly successful play with political overtones, is one of the important tragedies of the 18th century.

Joseph Addison, oil painting by Michael Dahl, 1719; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Addison disease Disease in which gradual atrophy of the adrenal cortex causes the adrenal glands to produce insufficient quantities of the steroid hydrocortisone while causing the pituitary gland to produce excess quantities of pituitary hormones. Most of the cortex tissue is destroyed by the time symptoms (including weakness, abnormal coloration, weight loss, and hypotension) appear. Hydrocortisone-replacement therapy is often successful, usually given with other hormones to stabilize sodium levels. More than half of cases are believed to be due to an autoimmune reaction (see autoimmune disease); the remainder are caused by destruction of the adrenal gland by granuloma (e.g., tuberculosis).

additive In foods, any of various chemical substances added to produce desirable effects. Additives include such substances as artificial or natural colourings and flavourings; stabilizers, emulsifiers, and thickeners;

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preservatives and humectants (moisture-retainers); and supplementary nutrients. Though many additives are harmless or even beneficial, others reduce nutritional value or conceal inferior raw materials or processing.

Adelaide City (pop., 2004 est.: 1,124,315) and capital, SOUTH AUSTRALIA. Adelaide lies at the base of the Mount Lofty Ranges on the Torrens River, near its harbour facilities at Port Adelaide. Founded in 1836, it was incorporated in 1840 as Australia's first municipal government. Its rise as an agricultural marketing centre and the proximity of natural mineral deposits contributed to its economic growth. It is an industrial centre and has petroleum refineries as well as connections by pipeline to natural gas fields. Landmarks include the University of Adelaide, Parliament House, Government House, and two cathedrals.

Aden \'ä-dən, 'ā-dən\ Seaport city (pop., 2004 prelim.: 580,000), southern YEMEN, on the GULF OF ADEN. It was a principal terminus of the spice road of western Arabia for about 1,000 years before the 3rd century AD. It then became a trading centre under Yemeni, Ethiopian, and Arab control. The OTTOMAN EMPIRE captured the city in 1538, and the British (who established a garrison there around 1800) governed it from India (1839–1937). It grew in importance as a coaling station and transshipment point after the opening of the SUEZ CANAL. It was made a crown colony in 1937, incorporated in the Federation of South Arabia (1963–67), and served as the capital of South Yemen until that republic's merger with North Yemen in 1990.

Aden, Gulf of Arm of the Indian Ocean between the ARABIAN PENINSULA and Somalia. To the west, it narrows into the Gulf of Tadjoura; its eastern limit is the meridian of Cape Guardafui. In these terms it is about 550 mi (885 km) long; geologically, it extends a total of 920 mi (1,480 km), to the eastern limits of the continental shelf beyond the KHURIYYĀ MURIYYĀ islands to the north and the island of SOCOTRA to the south. Its marine life is rich in quantity and variety. Its coastline lacks large-scale fishing facilities but supports many fishing towns, as well as the major ports ADEN and DJIBOUTI.

Adena \ə-'dē-nə\ **culture** Culture of various communities of ancient North American Indians who occupied the middle Ohio River valley c. 500 BC–AD 100. The Adena usually lived in villages containing circular houses constructed of poles and bark. They subsisted by hunting, fishing, and gathering wild plant foods, and they used a variety of stone tools and simple pottery. Adena ornaments of copper, mica, and seashells indicate trade with faraway peoples. See also WOODLAND CULTURE.

Adenauer \'a-dᵊn-aůr**, Konrad** (b. Jan. 15, 1876, Cologne, German Empire—d. April 19, 1967, Rhöndorf, W.Ger.) German statesman, first chancellor of the Federal Republic of Germany (West Germany). Elected to the Cologne city council (1906), he served as the city's lord mayor (1917–33). He was elected to the Prussian Staatsrat (state council) in 1920 and served as its speaker (1928–33). He lost his posts when the Nazis came to power, and in 1944 he was sent to a concentration camp. As World War II drew to a close, he played an important role in the formation of the CHRISTIAN DEMOCRATIC UNION. As chancellor from 1949, Adenauer stressed individualism under the rule of law. His fear of Soviet expansion made him a strong supporter of NATO. He worked hard to reconcile Germany with its former enemies, especially France. He retired his post in 1963.

Konrad Adenauer.
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adenine \'a-dᵊn-ˌēn\ Organic compound of the PURINE family, often called a base, consisting of two rings, each containing both nitrogen and carbon atoms, and an amino group. It occurs free in tea and in combined form in NUCLEIC ACIDS, ATP, VITAMIN B_{12}, and several COENZYMES. In DNA its complementary base is THYMINE. It or its corresponding NUCLEOSIDE or NUCLEOTIDE may be prepared from nucleic acids by selective techniques of HYDROLYSIS.

adenoids \'a-dᵊn-ˌóidz\ *or* **pharyngeal tonsils** \ˌfar-ən-'jē-əl, fə-'rin-jē-əl\ Mass of LYMPHOID TISSUE, similar to the (palatine) TONSILS, on the back wall of the nasal PHARYNX. If the adenoids become infected in childhood, their inflammation can obstruct nasal breathing and SINUS drainage (promoting SINUSITIS) and block the eustachian tubes that connect to the middle ear (setting the stage for OTITIS). Surgical removal of enlarged or infected adenoids is frequently recommended.

adenosine triphosphate See ATP

adenovirus \ˌa-dᵊn-ō-'vī-rəs\ Any of a group of spheroidal VIRUSES, made up of DNA wrapped in a protein coat, that cause sore throat and fever in humans, HEPATITIS in dogs, and several diseases in fowl, mice, cattle, pigs, and monkeys. An adenovirus develops within the nucleus of an infected cell. In humans, adenoviruses, like cold viruses, may cause infections of the upper respiratory tract, the eyes, and frequently the lymph nodes. Like cold viruses, adenoviruses are often found in inactive infections in clinically healthy persons. Because only a few adenoviruses commonly cause illness in humans, vaccines against them are possible.

Adès \'ad-əs**, Thomas** (b. March 1, 1971, London, Eng.) British composer. Trained as a pianist at the Guildhall School, he later attended King's College, Cambridge. Initial recognition came for his virtuoso piano playing, but he started to write music in 1990 (*Five Eliot Landscapes*) and was instantly acclaimed as a major composer for his inventiveness and remarkably assured technique. His controversial opera *Powder Her Face* (1995), about a 20th-century divorce scandal, attracted international attention, as did his large symphonic work *Asyla* (1997).

ADHD See ATTENTION DEFICIT DISORDER

Adi Granth \ˌä-dē-'grənth\ (Punjabi: "First Book") Sacred scripture of SIKHISM. Composed of nearly 6,000 hymns of the Sikh GURUS and Hindu and Islamic saints, it is the central object of worship in all GURDWARAS (temples). It is ritually opened and closed daily and is read continuously on special occasions. First compiled in 1604 by ARJAN, it included his own hymns and those of his predecessors and the devotional songs of saints. In 1704 the last Guru, GOBIND SINGH, added more hymns and decreed that after his death the Granth would take the place of the Guru. Written mostly in Punjabi or Hindi, it contains the *Mul Mantra* (basic prayer), *Japji* (the most important scripture, written by NANAK), and hymns arranged according to the RAGAS in which they are to be sung.

Adige \'ä-dē-ˌjā\ **River** River, 255 mi (410 km) long, the longest in Italy after the PO. It rises below the Resia Pass and flows southeast through the Venosta valley. After receiving the Isarco River at Bolzano, it turns south across the Po lowlands to enter the ADRIATIC SEA south of Chioggia. It supplies hydroelectric power in its upper Alpine section and irrigation for the VENETO. Its floods, notably those of 1951 and 1966, do great damage and require constant control of the riverbank. The Adige has been the scene of many battles, especially in the Austrian-Italian campaign of 1916.

adipose tissue *or* **fatty tissue** CONNECTIVE TISSUE consisting mainly of fat cells, specialized to synthesize and contain large globules of FAT, within a structural network of fibres. It is found mainly under the skin but also in deposits between the muscles, in the intestines and in their membrane folds, around the heart, and elsewhere. The fat stored in this tissue comes from dietary fats or is produced in the body. It acts as a fuel reserve for times of starvation or great exertion, helps conserve body heat, and forms pads between organs.

Adirondack \ˌa-də-'rän-ˌdak\ **Mountains** Mountains in northeastern New York state, U.S. They extend south from the ST. LAWRENCE RIVER valley and Lake CHAMPLAIN to the MOHAWK RIVER valley. The Adirondack region covers more than 6 million acres (2.4 million hectares). It has more than 40 summits higher than 4,000 ft (1,219 m); the tallest, Mount Marcy (5,344 ft [1,629 m]), is the state's highest. SAMUEL DE CHAMPLAIN became the first European to sight the Adirondacks in 1609. The area was sparsely settled when in 1892 the state legislature created Adirondack Park, which has grown over the years to become, at more than 5 million acres (2 million hectares), the largest U.S. state or national park outside of Alaska.

Adler, Alfred (b. Feb. 7, 1870, Penzing, Austria—d. May 28, 1937, Aberdeen, Aberdeenshire, Scot.) Austrian psychiatrist. He earned his medical degree in Vienna, and from his earliest years as a physician he stressed consideration of the individual in relation to his total environment. A student and associate of SIGMUND FREUD (1902–11), he eventually broke with Freud over the importance of early-childhood sexual conflicts

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in the development of psychopathology. With his followers he developed the school of individual psychology—the humanistic study of drives, feelings, emotions, and memory in the context of the individual's overall life plan. Adler advanced the theory of the INFERIORITY COMPLEX to explain cases of psychopathology; Adlerian psychotherapy sought to direct patients emotionally disabled by inferiority feelings toward maturity, common sense, and social usefulness. He established the first child guidance clinic in 1921 in Vienna. He taught in the U.S. (at Columbia University and the Long Island College of Medicine) from 1927 until his death. His works include *Understanding Human Nature* (1927) and *What Life Should Mean to You* (1931).

Adler, Guido (b. Nov. 1, 1855, Eibenschütz, Moravia, Austrian Empire—d. Feb. 15, 1941, Vienna, Austria) Austrian musicologist. After studying music theory and composition at the Vienna Conservatory, he studied music history at the University of Vienna under Eduard Hanslick (1825–1904), whom he succeeded as professor. He worked with Philipp Spitta (1841–94) and FRIEDRICH CHRYSANDER in founding MUSICOLOGY as an academic discipline. Among his distinguished students were Karl Geiringer (1899–1989), Knud Jeppesen (1892–1974), ANTON WEBERN, and Egon Wellesz (1885–1974).

Adler, Larry *orig.* **Lawrence Cecil Adler** (b. Feb. 10, 1914, Baltimore, Md., U.S.—d. Aug. 7, 2001, London, Eng.) U.S. harmonica player. Though he was initially unable to read music, he learned classical compositions by ear and became the first person to perform concert music on the harmonica. His musicality attracted many composers to write especially for him, including DARIUS MILHAUD and Ralph VAUGHAN WILLIAMS. Accused of communist sympathies and blacklisted in the early 1950s, he was unable to find work in the U.S. and took up residence in England.

Adler, Mortimer J(erome) (b. Dec. 28, 1902, New York, N.Y., U.S.—d. June 28, 2001, San Mateo, Calif.) U.S. philosopher, educator, and editor. He earned a doctorate in philosophy from Columbia University (1928) and taught philosophy of law from 1930 at the University of Chicago, where with ROBERT M. HUTCHINS he promoted the idea of liberal education through regular discussions of the great books. Together they edited the 54-volume *Great Books of the Western World* (1952); for ENCYCLOPÆDIA BRITANNICA, Inc., they edited an annual, *The Great Ideas Today* (from 1961), and the 10-volume *Gateway to the Great Books* (1963). In 1969 Adler became director of planning for the 15th edition of *Encyclopædia Britannica*, published in 1974. His many books include *How to Read a Book* (1940), *How to Think About God* (1980), *Six Great Ideas* (1981), and *Ten Philosophical Mistakes* (1985).

administrative law Law regulating the powers, procedures, and acts of public administration. It applies to all public officials and public agencies. As distinguished from legislative and judicial authority, administrative authority entails the power to issue rules and regulations based on statutes, grant licenses and permits to facilitate the conduct of government business, initiate investigations of and provide remedies for complaints or problems, and issue orders directing parties to conform to governing statutes or rules. An administrative-law judge is a government official with quasi-judicial powers, including the authority to conduct hearings, make findings of fact, and recommend resolution of disputes concerning the agency's actions.

admiral butterfly Any of several species of BUTTERFLIES (family Nymphalidae) that are colourful, fast-flying, and much prized by collectors. The migratory red admiral (*Vanessa atalanta*), widespread in Europe, Scandinavia, North America, and North Africa, feeds on stinging nettles. The Indian red admiral (*V. indica*) is found in the Canary Islands and India. The white admiral (*Limenitis camilla*, or *Basilarchia arthemis*), a Eurasian and North American species, feeds on honeysuckle.

Admiralty, High Court of See HIGH COURT OF ADMIRALTY

Admiralty Islands Island group (pop., 2000 est.: 41,748), Papua New Guinea. An extension of the BISMARCK ARCHIPELAGO comprising about 40 islands, the Admiralty Islands lie about 190 mi (300 km) north of the mainland of Papua New Guinea in the South Pacific Ocean. Most of the land area of the islands is contained in Manus Island, which is the site of Lorengau, the islands' principal settlement. First sighted by the Dutch explorer Willem Schouten in 1616, it was named by the British captain Philip Carteret in 1767. Subsequently ruled by the Germans, Australians, and Japanese, the islands were made part of the UN Trust Territory of New Guinea in 1946. When Papua New Guinea attained independence in 1975, the islands became part of that country.

admiralty law See MARITIME LAW

adobe \ə-'dō-bē\ Handmade sun-dried bricks formed from a mixture of heavy clay and straw found in arid regions. As a building material, adobe dates back thousands of years and is found in many parts of the world. Molds for shaping the bricks were brought to the New World by the Spanish. Excellent insulating properties make adobe an ideal material for both dwellings and ovens; home interiors retain heat in winter and stay cool in summer. The adobe buildings at Taos, N.M., are typical of Native American PUEBLO dwellings.

adolescence Period of life from PUBERTY to ADULTHOOD (roughly ages 12–20) characterized by marked physiological changes, development of sexual feelings, efforts toward the construction of identity, and a progression from concrete to abstract thought. Adolescence is sometimes viewed as a transitional state, during which youths begin to separate themselves from their parents but still lack a clearly defined role in society. It is generally regarded as an emotionally intense and often stressful period.

Adonis \ə-'dä-nəs\ In GREEK MYTHOLOGY, a youth of remarkable beauty, the favorite of APHRODITE. As a child he was put in the care of PERSEPHONE, who refused to allow him to return from the underworld. ZEUS ruled that he should spend a third of the year with Persephone, a third with Aphrodite, and a third on his own. He became a hunter and was killed by a boar. In answer to Aphrodite's pleas, Zeus allowed him to spend half the year with her and half in the underworld. Mythically, Adonis represents the cycle of death and resurrection in winter and spring. He is identified with the Babylonian god TAMMUZ.

adoption Act of transferring parental rights and duties to someone other than the adopted person's biological parents. The practice is ancient and occurs in all cultures. Traditionally, its goal was to continue the male line for the purposes of inheritance and succession; most adoptees were male (and sometimes adult). Contemporary laws and practices aim to promote child welfare and the development of families. In the latter part of the 20th century, there was a relaxation of traditional restrictions on age differences between adoptive parents and children, on the parents' minimum income level, on the mother's employment outside the home, and on placements across religious and ethnic lines. Single-parent adoptions and adoptions by same-sex couples also became more acceptable. Beginning in the 1970s, a growing adoptees-rights movement in the United States called for the repeal of confidentiality laws in most states that prevented adoptees as adults from viewing their adoption records, including their original birth certificates.

Adorno \ä-'dȯr-nō**, Theodor (Wiesengrund)** (b. Sept. 11, 1903, Frankfurt am Main, Ger.—d. Aug. 6, 1969, Visp, Switz.) German philosopher. He immigrated to England in 1934 to escape Nazism. He lived for 10 years in the U.S. (1938–48) before returning to Frankfurt, where he taught and headed the Frankfurt Institute for Social Research (see FRANKFURT SCHOOL). He is notable for his books and essays on philosophy, literature, psychology, sociology, and music (which he studied with ALBAN BERG). For Adorno, the great task of modernist music, literature, and art was to keep alive the possible social alternatives to capitalism, which philosophy and political theory could no longer imagine. His works include *Dialectic of Enlightenment* (1947; with MAX HORKHEIMER), *Minima Moralia* (1951), and *Notes to Literature* (4 vols., 1958–74).

Adour \ə-'dür\ **River** River, southwestern France. Flowing northwest from the PYRENEES, it traverses the scenic Campan valley; beyond Tarbes it feeds irrigation canals, most importantly the Canal d'Alaric. After a course of 208 mi (335 km), it empties into the Bay of BISCAY below Bayonne.

adrenal \ə-'drē-nᵊl\ **gland** *or* **suprarenal** \ˌsü-prə-'rē-nᵊl\ **gland** Either of two small, triangular endocrine GLANDS over the kidneys. In humans, each gland weighs about 0.15 oz (4.5 g) and consists of an inner medulla, which produces the catecholamine hormones EPINEPHRINE and norepinephrine, and an outer cortex (about 90% of the gland), which secretes the STEROID hormones aldosterone, cortisol, and ANDROGENS (the last two in response to ACTH from the PITUITARY GLAND). Diseases of the adrenal glands include pheochromocytoma (a tumour of the medulla) and the cortical disorders ADDISON DISEASE, adrenal hypertrophy, CUSHING SYNDROME, and primary aldosteronism.

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adrenaline See EPINEPHRINE

Adrian \'ā-drē-ən\ **IV** *orig.* **Nicholas Breakspear** (b. 1100?, Abbot's Langley, near St. Albans, Hertfordshire, Eng.—d. Sept. 1, 1159, Anagni, near Rome [Italy]) Pope (1154–59), the only Englishman ever to hold the office. He served in France and Italy before a successful mission to Scandinavia led to his election as pope. Adrian crowned FREDERICK I BARBAROSSA emperor in 1155, after Frederick had turned over Arnold of Brescia, leader of a revolt in Rome. The relationship quickly soured, however, as a result of Adrian's policy toward the Normans of southern Italy and his assertion that Frederick had received the imperial crown as a benefice. His controversial bull *Laudabiliter* supposedly gave Ireland to HENRY II of England, a claim that was later refuted. Adrian's refusal to recognize the king of Sicily, William I, stirred revolt in the Campania.

Adrian, Edgar Douglas *later 1st* **Baron Adrian of Cambridge** (b. Nov. 30, 1889, London, Eng.—d. Aug. 4, 1977, London) British electrophysiologist. He amplified electrical potential variations in nerve impulses from sense organs to record ever smaller changes, eventually recording impulses from single sensory endings and motor nerve fibres. His work clarified the physical basis of sensation and the mechanism of muscular control. Adrian's later studies of brain electrical activity included investigations into epilepsy and the location of cerebral lesions. He shared a 1932 Nobel Prize with CHARLES SHERRINGTON.

Adrianople, Battle of *or* **Battle of Hadrianopolis** (AD 378) Battle fought in what is now Edirne, Tur., that marked the beginning of serious Germanic incursions into Roman territory. It pitted the Roman army under the emperor VALENS against the horsemen of the VISIGOTHS, OSTROGOTHS, and other Germanic tribes. The Roman army was annihilated and Valens died on the battlefield. His successor, THEODOSIUS I, and the GOTHS agreed in 382 that the Goths would help with imperial defenses in exchange for food subsidies. The treaty set the pattern for later barbarian intrusions.

Adrianople, Treaty of see Treaty of EDIRNE

Adriatic Sea Arm of the MEDITERRANEAN SEA, lying between Italy and the Balkan Peninsula. It is about 500 mi (800 km) long, with an average width of 110 mi (175 km), a maximum depth of 4,035 ft (1,324 m), and an area of 50,590 sq mi (131,050 sq km). The Italian coast is relatively straight and continuous, having no islands, but the Balkan coast is full of islands, generally running parallel to the shore. The Strait of Otranto at its southeasterly limit links it with the Ionian Sea.

adsorption Capability of a SOLID substance (adsorbent) to attract to its surface MOLECULES of a GAS or SOLUTION (adsorbate) with which it is in contact. Physical adsorption depends on VAN DER WAALS FORCES of attraction between molecules and resembles condensation of liquids. In chemical adsorption (often called chemisorption; see CATALYSIS), the gas is held to the surface by chemical forces specific to the chemicals involved, and formation of the bond may require an ACTIVATION ENERGY.

'Adullam \ə-'dəl-əm\ Ancient village, ISRAEL, about 15 mi (24 km) southwest of JERUSALEM. A cave in its vicinity was from early times a place of refuge; it is mentioned several times in the Bible (e.g., as the place where David hid from Saul).

adult education See CONTINUING EDUCATION

adultery Sexual relations between a married person and someone other than his or her spouse. Prohibitions against adultery are found in virtually every society; Jewish, Christian, and Islamic traditions all condemn it, and in some Islamic countries it is still punishable by death. Attitudes toward adultery in different cultures have varied widely. Under the Code of HAMMURABI (18th century BC) in Babylonia it was punishable by death by drowning, and in ancient Rome an offending woman could be killed, though men were not severely punished. In western Europe and North America, adultery by either spouse is a ground for DIVORCE, though in the U.S. the shift to no-fault divorce significantly reduced the importance of adultery as an element in divorce proceedings. The spread of Western ideas of equality in marriage has resulted in pressure for equal marital rights for women in traditional African and Southeast Asian societies.

adulthood Period in the human life span in which full physical and intellectual maturity have been attained. Adulthood is commonly thought of as beginning at age 20 or 21. It includes middle age (commencing around age 40) and old age (from about age 60). Physically, it is characterized by the peaking (around age 30) and gradual decline of bodily functioning; the postpeak phase includes diminished acuity of the senses, reduction in muscular and skeletal mass, buildup of CHOLESTEROL in the arteries, weakening of the heart muscle, and diminished production of hormones. Some slowing in the rate of central-nervous-system processing also begins with middle age, but it is generally compensated for by an increased capacity to retain practical information and apply accumulated cultural knowledge. In old age, most individuals experience a significant decline in physical capacity, and many eventually also suffer impaired mental function.

Advaita \əd-'vī-tə\ (Sanskrit: "Nondualism") Most influential school of VEDANTA. It originated with Gaudapada's 7th-century commentary on the Mandukya UPANISHAD. Gaudapada builds on the MAHAYANA Buddhist philosophy of emptiness, asserting that there is no duality; the mind, awake or dreaming, moves through MAYA (illusion). The mind's ignorance conceals the truth that there is no becoming and no individual soul or self (JIVA), only a temporary delineation from the ATMAN (all-soul). In the 8th century SANKARA developed Advaita further, arguing that the world is unreal and that the Upanishads teach the nature of BRAHMAN, the only reality. The extensive Advaita literature influences modern Hindu thought.

Advent In the Christian calendar, the first season of the church year, a period of preparation for the birth of JESUS. Advent begins on the Sunday nearest to November 30 and continues until CHRISTMAS. Viewed as a penitential season, it is also considered a time of preparation for the Second Coming of Christ. The origin of Advent is unknown, but it was observed as early as the 6th century. In many countries it is celebrated with popular customs such as the lighting of Advent candles.

Adventist Member of any of a group of Protestant churches that arose in the U.S. in the 19th century and believe that the Second Coming of Christ is close at hand. Adventism was founded during a period marked by MILLENNIALISM by William Miller (1782–1849), a former U.S. army officer, who asserted that Christ would return to separate saints from sinners and inaugurate his 1,000-year kingdom on earth sometime in the year before March 21, 1844. After that date passed, Miller and his followers set a new date, Oct. 22, 1844. The "Great Disappointment" was followed by a Mutual Conference of Adventists in 1845. Those who persisted concluded that Miller had misinterpreted the signs and that, though Christ had begun the "cleansing of the heavenly sanctuary," he would not appear until he had completed that task. These Millerites founded the Seventh-Day Adventists in 1863; other Adventist groups include the Evangelical Adventists and the Advent Christian Church. Seventh-Day Adventists observe Saturday as the SABBATH and avoid eating meat and using narcotics or stimulants.

adversary procedure In Anglo-American law, the principal method of offering evidence in court. It requires the opposing sides to present pertinent information and to introduce and cross-examine witnesses before a jury and/or a judge. Each side must conduct its own investigation. In criminal proceedings, the prosecution represents the government and has at its disposal the police department with its investigators and laboratories; the defense must arrange and pay for its own investigation. (Legal aid is available for the poor.) In civil (noncriminal) proceedings the adversary system works similarly, except that both sides engage private attorneys to prepare their cases. Skillful questioning often produces testimony that can be interpreted in various ways; in cross-examination, lawyers seek to alter the jury's initial perception of the testimony.

adverse possession In Anglo-American property law, holding of real property (see REAL AND PERSONAL PROPERTY) with the knowledge and against the will of one who has a superior ownership interest in it. Statutes of limitation in most U.S. states allow an adverse possessor to acquire legal title if the owner does not seek timely possession.

advertising Techniques and practices used to bring products, services, opinions, or causes to public notice for the purpose of persuading the public to respond in a certain way. Weekly newspapers in London first carried advertisements in the 17th century; by the 18th century such advertising was flourishing. The first advertising agencies were established in the 19th century to broker for space in newspapers, and by the early 20th century agencies were producing the advertising message itself, including copy and artwork. Most advertising promotes goods for sale, but similar methods are used in public service messages to promote causes, charities, or political candidates. In many countries, advertising is the most important source of income for the media through which it is conducted. In addition to newspapers, magazines, and broadcast media, advertising media

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include direct mail (see DIRECT-MAIL MARKETING), billboards and posters, transit advertising, the Internet, and promotional items such as matchbooks or calendars. Advertisers attempt to choose media that are favoured by the advertisers' target audience. See also MARKETING; MERCHANDISING.

Adwa \'äd-ə-wə**, Battle of** *or* **Battle of Adowa** (March 1, 1896) Military clash at Adwa, in north-central Ethiopia, between the Ethiopian army of King MENILEK II and Italian forces. The decisive Ethiopian victory produced independence for Ethiopia and checked Italy's attempt to build an empire in Africa comparable to that of the French or British. The colony of ERITREA was carved out in the ensuing peace negotiations.

adze *or* **adz** Hand tool for shaping wood. A handheld stone chipped to form a blade, it is one of the earliest tools, and was used widely in the PALEOLITHIC and NEOLITHIC periods. By Egyptian times, it had acquired a wooden haft (handle) with a copper or BRONZE blade set flat at the top of the haft to form a T. In this form but with a steel blade, it continued to be the prime hand tool for shaping and trimming wood; the carpenter stands on or astride a log or other piece of timber, swinging the adze like a pick, down and between the legs.

Æ \'ā-'ē\ *orig.* **George William Russell** (b. April 10, 1867, Lurgan, County Armagh, Ire.—d. July 17, 1935, Bournemouth, Hampshire, Eng.) Irish poet and mystic. A leading figure in the IRISH LITERARY RENAISSANCE, he published many books of verse, including *Homeward* (1894). Though initially considered by many to be the equal of WILLIAM BUTLER YEATS, he did not develop as a poet, and many critics found him facile, vague, and monotonous. His pseudonym arose from a proofreader's query about an earlier pseudonym, Æon.

Aegean \ē-'jē-ən\ **civilizations** The Bronze Age civilizations that arose and flourished c. 3000–1000 BC in the region bordering the Aegean Sea. They included CRETE, the CYCLADES, the Greek mainland south from Thessaly, including the Peloponnese, and MACEDONIA, THRACE, and western Anatolia. The most significant were the MINOAN and MYCENAEAN civilizations. The term also sometimes refers to NEOLITHIC civilizations in the same region c. 7000–3000 BC.

Aegean \ē-'jē-ən\ **Islands** Greek islands in the AEGEAN SEA, particularly the CYCLADES, Sporades, and Dodecanese groups. The Cyclades consist of about 30 islands. The Dodecanese, or Southern Sporades, include Kálimnos, Kárpathos, Cos, Léros, Pátmos, RHODES, and Símí. The Sporades, or Northern Sporades, include Skyros, Skópelos, and Skíathos.

Aegean Sea Arm of the MEDITERRANEAN SEA, lying between Greece and Turkey. About 380 mi (610 km) long and 186 mi (300 km) wide, it has a total area of some 83,000 sq mi (214,000 sq km) and a maximum depth of 11,627 ft (3,543 m). The straits of the DARDANELLES, the Sea of MARMARA, and the BOSPORUS connect it with the BLACK SEA. The Aegean was the cradle of the great early civilizations of Crete and Greece. THÍRA, one of its numerous islands, has been linked with the legend of ATLANTIS.

Aegina \ē-'jī-nə\ Island in the Saronic group of Greece. Located 16 mi (26 km) southwest of Piraeus, it has an area of 32 sq mi (83 sq km). Its chief town and port, Aegina, lies over the ancient town of the same name. Inhabited since c. 3000 BC, it became a maritime power after the 7th century BC; its period of glory, reflected in PINDAR's poetry, was in the 5th century BC. Its economic rivalry with Athens led to frequent warfare, and in 431 BC the Athenians deported all its population. It came under Roman rule in 133 BC. It was briefly the capital of independent Greece (1826–28). See photograph opposite.

aegirine \'ā-gə-ˌrēn\ PYROXENE mineral, sodium and iron silicate ($NaFe^{+3}Si_2O_6$), commonly found in alkaline igneous rocks, particularly in syenites (composed of an alkali feldspar and a ferromagnesian mineral) and syenite PEGMATITES. It also occurs in SCHISTS. Aegirine is generally dark green to greenish black.

Aegirine crystals from Magnet Cove, Arkansas

BY COURTESY OF THE FIELD MUSEUM OF NATURAL HISTORY, CHICAGO; PHOTOGRAPH, JOHN H. GERARD

aegis \'ē-jəs\ In ancient Greece, the leather cloak or breastplate associated with ZEUS. It was worn most prominently by Zeus's daughter ATHENA (whose aegis bore the head of MEDUSA) but occasionally also by other gods (e.g., APOLLO in the *Iliad*).

Aegospotami \ˌē-gə-'spä-tə-ˌmī**, Battle of** (405 BC) Naval victory of Sparta over Athens in the final battle of the PELOPONNESIAN WAR. The Spartans under LYSANDER surprised the Athenians at anchor off Aegospotami, in Thrace, and defeated them decisively. The Athenians escaped with only 20 of 180 ships, and the Spartans put almost 4,000 captured Athenians to death. The victory led the Spartans to march on Athens, and the Athenians surrendered in 404 BC.

Aehrenthal \'e-rən-ˌtäl**, Aloys, Count Lexa von** (b. Sept. 27, 1854, Gross-Skal, Bohemia—d. Feb. 17, 1912, Vienna, Austria-Hungary) Austro-Hungarian diplomat. As foreign minister of Austria-Hungary (1906–12), he aggressively revived the empire's dormant foreign policy. His proclamation of the annexation of Bosnia and Herzegovina in 1908 provoked fears of war with Russia, inflamed Serbia's Austrophobe passions, and drew international censure, leading to the BOSNIAN CRISIS.

Aeneas \i-'nē-əs\ Mythical hero of Troy and Rome. He was the son of APHRODITE and Anchises, a member of Trojan royal family. According to HOMER, he was second only to his cousin HECTOR in defending Troy during the TROJAN WAR. VIRGIL's *Aeneid* tells of Aeneas's escape after Troy's fall, carrying his elderly father on his back, and of his journey to Italy, where his descendants became the rulers of Rome. See also DIDO.

Aeolian harp \ē-'ō-lē-ən\ Stringed instrument played by the wind (named for the wind god AEOLUS). It is usually a long, narrow, shallow box with soundholes and 10 or 12 strings strung lengthwise between two bridges. The strings are of the same length but different thicknesses and are all tuned to the same pitch; the wind makes them vibrate in successively higher HARMONICS. The harp may be hung, or set horizontally under a window sash. The first known Aeolian harp was constructed c. 1650 by Athanasius Kircher (1601–1680).

Aeolus \'ē-ə-ləs\ Greek god of the winds. In the *Odyssey* HOMER represents Aeolus as the mortal ruler of the floating island of Aeolia. He gives ODYSSEUS a favourable wind for his voyage and a bag in which the unfavourable winds are confined, but Odysseus's careless companions open the bag, releasing the winds and driving their ship back to shore. Later writers depicted Aeolus as a minor god rather than a human being. The AEOLIAN HARP is named for him.

aeon *or* **eon** \'ē-ˌän\ In GNOSTICISM or MANICHAEISM, one of the orders of spirits, or spheres of being, emanating from the godhead. The first aeon emanated directly from unmanifested divinity and was charged with divine force. Aeons increased in number and decreased in divine energy with increased remoteness from the divinity. At sufficient remoteness, error became possible and was the source of the material universe. Aeons may be viewed positively, as embodiments of the divine, or negatively, as media through which the soul must pass to reach its divine origin.

aepyornis \ˌē-pē-'ȯr-nəs\ *or* **elephant bird** Any of a group of giant flightless birds in the extinct genus *Aepyornis*, found as fossils in Pleis-

The temple of Aphaea, Aegina, Greece

SUSAN MCCARTNEY-PHOTO RESEARCHERS

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tocene and post-Pleistocene deposits on Madagascar. Most were massively constructed (some stood more than 10 ft, or 3 m, high) and had a small skull and a long slim neck. Remains of aepyornis and its eggs (as large as 3 ft, or 1 m, in circumference) are common. Its ancestry is uncertain.

aerarium (Saturni) Central treasury of ancient Rome, housed in the Temple of Saturn. During the republic (509–27 BC), two QUAESTORS managed the treasury and the Senate controlled it. All revenues were paid into the *aerarium*, and approved payments were made from it. Under the principate (27 BC–AD 305) the *aerarium* lost funds and importance as emperors and magistrates bypassed Senate control and drew directly from the *fisci* (provincial treasuries). From AD 6 AUGUSTUS used taxes to fund the *aerarium militare*, a public treasury, to reward veterans, and the *aerarium Saturni* became the treasury of the city of Rome.

aerial See ANTENNA

aerial perspective Method of producing a sense of depth in a painting by imitating the effect of atmosphere that makes objects look paler, bluer, and hazier or less distinct in the middle and far distance. The term was coined by LEONARDO DA VINCI, but the technique can be seen in ancient Greco-Roman wall paintings (e.g., at POMPEII). It was discovered that dust and moisture in the atmosphere caused the scattering of light passing through it; short-wavelength light (blue) is scattered most and long-wavelength light (red) least. Italian painters in Leonardo's time used the device; it was exploited by 15th-century northern European artists and later by J.M.W. TURNER.

aerobatics Sport of performing maneuvers such as rolls, loops, stalls, spins, and dives with an airplane. As an organized sport, rather than as an air show attraction ("stunt flying"), aerobatics began international competition in 1960 under the auspices of the Fédération Aéronautique Internationale.

aerobics System of physical conditioning for increasing the efficiency of the body's intake of oxygen. Aerobic exercises (e.g., running, jogging, swimming, dancing) stimulate heart and lung activity. To produce a benefit, aerobic training must raise the heart rate (pulse) to the exerciser's target level for at least 20 minutes and include at least three sessions a week. The concept of aerobics was pioneered by Kenneth H. Cooper and popularized in his books *Aerobics* (1968) and *The Aerobics Way* (1977).

aerodynamics Branch of physics concerned with the forces acting on bodies passing through air and other gaseous fluids. It explains the principles of flight of aircraft, rockets, and missiles. It is also involved in the design of automobiles, trains, and ships, and even stationary structures such as bridges and tall buildings, which must withstand high winds. Aerodynamics emerged as a discipline around the time of WILBUR AND ORVILLE WRIGHT's first powered flight in 1903. Developments in the field have led to major advances in turbulence theory and supersonic flight.

Aeroflot \,ar-ə-'flȯt\ -Russian Airlines National airline of the former Soviet Union. Founded in 1928 as Dobroflot, it was reorganized as Aeroflot in 1932. During the Soviet era Aeroflot was the world's largest airline, with about 15% of all civil air traffic. After the 1991 breakup of the Soviet Union, Aeroflot surrendered its monopoly over commercial air travel in the former Soviet states. It was renamed Aeroflot-Russian Airlines in June 2000.

aerosol System of tiny liquid or solid particles evenly distributed in a finely divided state through a gas, usually air. Aerosol particles participate in chemical processes and influence the electrical properties of the atmosphere. Though true aerosol particles range in diameter from a few nanometres to about one micrometre, the term is commonly used to refer to fog or cloud droplets and dust particles, which can have diameters of more than 100 micrometres. See also COLLOID; EMULSION.

aerospace engineering Field concerned with the development, design, construction, testing, and operation of AIRPLANES and SPACECRAFT. The field has its roots in BALLOON flight, GLIDERS, and AIRSHIPS, and in the 1960s it was broadened to include space vehicles. Principal technologies are those of AERODYNAMICS, propulsion, structure and stability, and control. Aerospace engineers in academic, industrial, and government research centres cooperate in designing new products. Flight testing of prototypes follows, and finally quantity production and operation take place. Important developments in aerospace engineering include the metal monocoque fuselage, the cantilevered monoplane wing, the JET ENGINE, supersonic flight, and spaceflight.

aerospace medicine Branch of medicine, pioneered by PAUL BERT, dealing with atmospheric flight (aviation medicine) and space flight (space medicine). Intensive preflight simulator training and attention to design of equipment and spacecraft promote the safety and effectiveness of humans exposed to the stresses of flight and can prevent some problems. The world's first unit for space research was established in the U.S. in 1948. Physicians trained in aerospace medicine are known as flight surgeons.

Aeschines \'es-kə-,nēz\ (b. 390 BC—d. c. 314 BC) Athenian orator. He and DEMOSTHENES, who later became his bitter opponent, participated in 346 BC in forging a peace between Athens and Macedonia. Demosthenes later accused Aeschines of treason because he had promoted the Macedonian cause during the negotiations. At a trial (343) Aeschines was acquitted by a narrow majority. In 339 he helped incite the war that led to the Battle of CHAERONEA and to Macedonian control of central Greece. In 336 he opposed as illegal a motion to honour Demosthenes; the matter came to trial in 330, and Aeschines suffered an overwhelming defeat.

Aeschylus \'es-kə-,ləs\ (b. 525/524—d. 456/455 BC, Gela, Sicily) Greek tragic dramatist. He fought with the Athenian army at Marathon (490) and in 484 achieved the first of his many victories at the major dramatic competition in Athens. He wrote over 80 plays, but only 7 are extant; the earliest of these, *Persians*, was performed in 472 BC. Other plays that survive are the *Oresteia* trilogy (*Agamemnon*, *The Libation Bearers*, and *The Eumenides*), *Seven Against Thebes*, *The Suppliants*, and *Prometheus Bound*. Considered the father of Greek tragic drama, he added a second actor to the performance, an innovation that enabled the later development of dialogue and created true dramatic action. He was the first of the three great Greek tragedians, preceding SOPHOCLES and EURIPIDES.

Aesculapius See ASCLEPIUS

Aesir \'ā-zir\ In GERMANIC RELIGION, one of the two main groups of deities, the other being the VANIR. ODIN, his wife FRIGG, Tyr (the god of war), and THOR were the four Aesir common to the Germanic nations. BALDER and LOKI were considered Aesir by other peoples. The Aesir were a warlike race and were originally dominant over the Vanir, but after numerous defeats in battle they were forced to grant the Vanir equal status. The poet-god KVASIR was born out of the peace ritual in which the two races mingled their saliva in the same vessel.

Aesop \'ē-,säp\ Supposed author of a collection of Greek FABLES, almost certainly a legendary figure. Though HERODOTUS, in the 5th century BC, said that he was an actual personage, "Aesop" was probably no more than a name invented to provide an author for fables centring on beasts. Aesopian fables emphasize the social interactions of human beings, and the morals they draw tend to embody advice on how to deal with the competitive realities of life. The Western fable tradition effectively begins with these tales. Modern editions list some 200 Aesopian fables.

Aesop, with a fox, from the central medallion of a kylix, c. 470 BC; in the Gregorian Etruscan Museum, the Vatican
ALINARI/ART RESOURCE

Aestheticism \es-'thet-ə-,siz-əm\ Late 19th-century European arts movement that centred on the doctrine that art exists for the sake of its beauty alone. It began in reaction to prevailing utilitarian social philosophies and to the perceived ugliness and philistinism of the industrial age. Its philosophical foundations were laid by IMMANUEL KANT, who proposed that aesthetic standards could be separated from morality, utility, or pleasure. JAMES MCNEILL WHISTLER, OSCAR WILDE, and STÉPHANE MALLARMÉ raised the movement's ideal of the cultivation of refined sensibility to perhaps its highest point. Aestheticism had affinities with French SYMBOLISM and was a precursor of ART NOUVEAU.

aesthetics \es-'thet-iks\ Philosophical study of the qualities that make something an object of aesthetic interest and of the nature of aesthetic value and judgment. It encompasses the philosophy of art, which is chiefly concerned with the nature and value of art and the principles by which it should be interpreted and evaluated. Three broad approaches to the sub-

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ject have been taken, each distinguished by the types of questions it treats as foremost: (1) the study of aesthetic concepts, often specifically through the examination of uses of aesthetic language; (2) the study of the states of mind—responses, attitudes, emotions—held to be involved in aesthetic experience; and (3) the study of objects deemed aesthetically interesting, with a view to determining what about them makes them so. Seminal works in the field include the *Symposium* of Plato; the *Rhetoric* of Aristotle; *Inquiry into the Original of Our Ideas of Beauty and Virtue* (1725), by Francis Hutcheson (1694–1746); "Of the Standard of Taste" (in *Four Dissertations* [1757]), by David Hume; *On the Sublime and Beautiful* (1757), by Edmund Burke; *Critique of Judgment* (1790), by Immanuel Kant; *The Sense of Beauty* (1896), by George Santayana; *The Psychology of Imagination* (1948), by Jean-Paul Sartre; and two works by Ludwig Wittgenstein, *Lectures and Conversations on Aesthetics, Psychology, and Religious Belief* (1966) and *Culture and Value* (1977).

Aethelberht I See Ethelbert I

Aethelred Unraed See Ethelred II

Aetolia \ē-'tō-lē-ə\ District north of the Gulf of Corinth, ancient Greece. Aetolia figures prominently in early legend. By 367 BC it had been organized by various tribes into a federal state comprising the Aetolian League. Coming under Roman rule, it was incorporated into the province of Achaea (see Achaean League) in 27 BC by Augustus. Governed later by Albania and Venice, it came under Turkish rule in AD 1450. It was the scene of fierce fighting in the War of Greek Independence (1821–29). Modern Aetolia is linked with Acarnania as a department of Greece.

Aetolian \ē-'tō-lē-ən\ **League** Federal state of ancient Aetolia in central Greece, probably based on a looser tribal community. A leading power by c. 340 BC, the Aetolian League resisted invasions by Macedonia in 322 and 314–311, expanded into Delphi, and allied with Boeotia c. 300. It fended off the Gauls in 279 and formed an alliance with Macedonia (c. 270–240). The league's power in central Greece was confirmed with the defeat of the Boeotians (245). From the late 3rd century Aetolia began to lose power and territory to Macedonia, culminating in the sacking of the league's federal capital, Thermum, by Philip V in 220. The league then allied with Rome against Macedonia and defeated Philip at Cynoscephalae (197). Rome later forced it into a permanent alliance (189) that cost it territory, power, and independence.

Afars and Issas, French Territory of the See Djibouti

Affair of the Diamond Necklace (1785) Scandal at the court of Louis XVI that discredited the French monarchy on the eve of the French Revolution. An adventuress, the countess de la Motte, schemed to acquire a valuable diamond necklace by duping cardinal de Rohan into believing that Queen Marie-Antoinette wanted to obtain it surreptitiously and that he could gain her favour by facilitating its purchase. When the plot came to light, Louis XVI had the cardinal arrested. Though acquitted, the arbitrary treatment of the cardinal deepened impressions of the autocratic nature of the king's government.

affective disorder Mental disorder characterized by dramatic changes or extremes of mood. Affective disorders may include manic or depressive episodes less severe than those of bipolar disorder, such as anxiety and depression. Symptoms include elevated, expansive, or irritable moods, with hyperactivity, pressured (rapid and forced) speech, and inflated self-esteem; or dejected moods, characterized by lack of interest in life, sleep disturbances, agitation, and feelings of worthlessness or guilt.

affenpinscher \'a-fən-ˌpin-chər\ Sturdy breed of toy dog, known since the 17th century. Standing 10 in. (26 cm) high or less and weighing 7–8 lbs (3–3.5 kg), it is a terrier-like dog with small, erect ears, round black eyes, and a short, docked tail. Its wiry, preferably black coat is short on parts of the body but longer on the legs and face, where it produces the monkeylike expression for which the breed is named (from German *Affe*, "ape").

affidavit \ˌa-fə-'dā-vət\ Written statement made voluntarily, confirmed by the oath or affirmation of the party making it, and signed before an officer empowered to administer such oaths. It usually names the place of execution and certifies that the person making it states certain facts and appeared before the officer on a certain date and "subscribed and swore" to the statement.

affirmative action In the U.S., the effort to improve the employment and educational opportunities of women and members of minority groups through preferential treatment in job hiring, college admissions, the awarding of government contracts, and the allocation of other social benefits. First undertaken at the federal level following passage of the landmark Civil Rights Act of 1964, affirmative action was designed to counteract the lingering effects of generations of past discrimination. The main criteria for inclusion in affirmative action programs are race, sex, ethnic origin, religion, disability, and age. The Supreme Court of the United States placed important limitations on affirmative action programs in its 1978 ruling in *Regents of the University of California* v. *Bakke*; several subsequent Supreme Court decisions (e.g., *Adarand Constructors* v. *Pena* in 1995 and *Texas* v. *Hopwood* in 1996) imposed further restrictions. In 1996 California voters passed Proposition 209, which prohibited government agencies and institutions from discriminating against or giving preferential treatment to individuals or groups on the basis of race, sex, colour, ethnicity, or national origin. Similar measures were subsequently passed in other states. In 2003, in two landmark rulings involving admission to the University of Michigan and its law school, the U.S. Supreme Court reaffirmed the constitutionality of affirmative action but ruled that race could not be the preeminent factor in such decisions.

Affleck, Thomas (b. 1745, Aberdeen, Scot.—d. 1795, Philadelphia, Pa., U.S.) Scottish-born U.S. cabinetmaker. Trained in England, he moved to Philadelphia, where he produced outstanding furniture in the Chippendale style for Gov. John Penn and other leading citizens. The Marlborough-style leg (straight, grooved, with a block foot) and elaborate carving characterize his work.

afforestation See deforestation

Afghan hound Breed of dog developed as a hunter in the hill country of Afghanistan. It was brought to Europe in the late 19th century by British soldiers returning from the Indian-Afghan border wars. It hunts by sight, and in Afghanistan it has been used to pursue leopard and gazelle. Its high, wide hipbones are well adapted to rough country. It stands 24–28 in. (61–71 cm) high and weighs 50–60 lbs (23–27 kg). It has floppy ears, a long topknot, and a long silky coat of various colours.

Afghan hound
SALLY ANNE THOMPSON

Afghan wars Series of wars in Afghanistan during the 19th, 20th, and early 21st centuries. In the 19th century Britain twice invaded Afghanistan (the first and second Anglo-Afghan Wars; 1839–40 and 1878–80). The British were unable to fully subdue the country, and the third Anglo-Afghan War (1919) led to its full independence. The outbreak of civil war in 1978 led to an invasion by the Soviet Union the following year (the Afghan War). For the next 10 years the Soviets supported the communist government against a coalition of Islamic insurgents, the mujahideen, who toppled the regime in 1992. A group of disaffected fighters known as the Taliban had taken control of most of the country by 1996. The ensuing stalemate was broken in 2001 when the U.S. overthrew the Taliban for supporting international terrorism.

Afghānī, Jamāl al-Dīn al- See Jamāl al-Dīn al-Afghānī

Afghanistan *officially* **Islamic State of Afghanistan** Country, south-central Asia. Area: 249,347 sq mi (645,807 sq km). Population (2005 est.: 23,867,000). Capital: Kabul. About two-fifths of the people belong to the Pashtun ethnic group; other ethnic groups include Tajiks, Uzbeks, and Ḥazāra. Languages: Pashto, Persian (both official). Religions: Islam (official; predominantly Sunni); also Zoroastrianism. Currency: afghani. Afghanistan has three distinctive regions: the northern plains are the major agricultural area; the southwestern plateau consists primarily of desert and semiarid landscape; and the central highlands, including the Hindu Kush, separate these regions. Afghanistan has a developing economy based largely on agriculture; its significant mineral resources remain largely untapped because of the Afghan War of the 1980s and subsequent fighting. Traditional handicrafts remain important; woolen carpets are a major export. The area was part of the Persian Achaemenian Empire in the 6th century BC and was conquered by Alexander the Great in the 4th century BC. Hindu influence entered with the Hephthalites and Sāsānians; Islam became entrenched during the rule of the Ṣaffārids, c. AD 870.

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Afghanistan was divided between the Mughal Empire of India and the Ṣafavid empire of Persia until the 18th century, when other Persians under Nādir Shah took control. Britain fought several wars in the area in the 19th century. From the 1930s the country had a stable monarchy, which was overthrown in the 1970s. Marxist reforms sparked rebellion, and Soviet troops invaded. Afghan guerrillas prevailed, and the Soviets withdrew in 1989. In 1992 rebel factions overthrew the government and established an Islamic republic. In 1996 the Taliban militia took power in Kabul and enforced a harsh Islamic order. The militia's unwillingness to extradite extremist leader Osama bin Laden and members of his al-Qaeda militant organization following the September 11 attacks in 2001 led to military conflict with the U.S. and allied nations, the overthrow of the Taliban, and the establishment of an interim government.

AFL-CIO *in full* **American Federation of Labor-Congress of Industrial Organizations** U.S. federation of labour unions formed in 1955 by the merger of the AFL and the CIO. The AFL was founded in 1886 as a loose federation of craft unions under the leadership of Samuel Gompers. Member unions retained autonomy and received protection of their workers and jurisdiction over a certain industrial territory. The CIO was founded in 1935 as the Committee for Industrial Organization by a splinter group of AFL unions whose leaders believed in organizing skilled and unskilled workers across entire industries; at its first convention in 1938, it adopted its current name and elected John L. Lewis president. For two decades the AFL and CIO were bitter rivals for the leadership of the U.S. labour movement, but they formed an alliance in the increasingly conservative, antilabour climate of the postwar era, and in 1955 they merged under the leadership of George Meany. AFL-CIO membership reached 17 million in the late 1970s but declined from the 1980s as the U.S. manufacturing sector shrank. AFL-CIO activities include recruiting and organizing members, conducting educational campaigns, and supporting political candidates and legislation deemed beneficial to labour. See also Lane Kirkland; Knights of Labor; Walter Reuther.

'Aflaq \'äf-läk**, Michel** (b. 1910, Damascus, Syria—d. June 23, 1989, Paris, France) Syrian social and political leader. While studying at the University of Paris (1929–34), he came to believe that the Arab nationalist struggle had to oppose both the native aristocracy and foreign rulers. Hoping to unite all the Arab states into a single socialist nation through nonviolence, he helped establish the Baʿth Party in 1946 and served as its teacher, theorist, and organizer. He persuaded the Syrian government to form the United Arab Republic with Egypt in 1958, but Syria withdrew from it in 1961. His career in Syrian politics ended in 1966 when he moved to Lebanon. See also Pan-Arabism.

aflatoxin \ˌa-flə-'täk-sən\ Complex of toxins formed by molds of the genus *Aspergillus*, which frequently contaminate improperly stored nuts (especially peanuts), grains, meals, and certain other foods. Discovered after an outbreak of "turkey X disease" in England in 1960, aflatoxins may cause liver disease and cancer and may trigger Reye syndrome.

Afonso I *known as* **Afonso the Conqueror** (b. 1109/11, Guimarães, Port.—d. Dec. 6, 1185, Coimbra) First king of Portugal (1139–85). He defeated his mother to take the throne (1128), ruling first as a vassal of his cousin Alfonso VII of León but later securing Portuguese independence and gaining the title of king (1139). He defeated nearby Muslims and imposed tribute on them, then took Lisbon (1147) with the help of Crusaders. Afonso eventually extended Portugal beyond the Tagus River. He shared power with his son Sancho I and left him a stable, independent monarchy.

Afonso III (b. May 5, 1210, Coimbra, Port.—d. Feb. 16, 1279, Lisbon) King of Portugal (1248–79). He emigrated to France and became, by marriage, count of Boulogne. He gained the Portuguese crown when his older brother Sancho II was deposed by order of the pope. As king, Afonso regained control of the district of Faro (1249) and completed the reconquest of the Algarve from the Muslims. His reign saw the first admission of commoners to the Portuguese Cortes (parliament). Afonso's assertion of the royal right to repossess church lands led to his excommunication by the pope.

Afonso the Great See Afonso de Albuquerque

Africa Second largest continent on Earth. It is bounded by the Mediterranean Sea, the Atlantic Ocean, the Red Sea, and the Indian Ocean and is divided almost equally by the Equator. Area: 11,717,370 sq mi (30,348,110 sq km). Population (2001 est.): 816,524,000. Africa is composed largely of a rigid platform of ancient rocks that underlies vast plateau regions in the interior. Its average elevation is about 2,200 ft (670 m), but elevations range from 19,340 ft (5,895 m) at Mount Kilimanjaro to 515 ft (157 m) below sea level at Lake Assal. The Sahara, the world's largest contiguous desert, occupies more than one-fourth of the total land area. The continent's hydrology is dominated by the Nile River in the north, the Niger River in the west, and the Congo River in central Africa. Less than one-tenth of the land area is arable, while nearly one-fourth is forested or wooded. The peoples of Africa probably speak more languages than those of any other continent. Arabic is predominant from Egypt to Mauritania and in The Sudan. Northern Africans speak a family of languages known as Afro-Asiatic. The vast majority of sub-Saharan peoples speak Bantu languages of the Niger-Congo family, while smaller numbers in central Africa speak Nilo-Saharan languages and in southern Africa Khoisan languages. Peoples of European descent are found mostly in the south; Dutch (Boer) migrations began in the 17th century, and the English first settled in what is now Kenya and Zimbabwe in the 19th century. Africa as a whole is a developing region. Agriculture is the key sector of the economy in most countries. Diamond and gold mining are especially important in the south, while petroleum and natural gas are produced particularly in the west. Most African governments are controlled by the military or a single party. Many legal systems combine laws introduced by European powers during the colonial era with traditional law, though North African countries derive many laws from Islam. African leaders have sought to develop a pan-African approach to the continent's political and military affairs through the Organization of African Unity and its successor, the African Union. Africa is widely recognized as the birthplace of humankind. Archaeological evidence indicates that the continent has been inhabited by humans and their hominid forebears for some 4,000,000 years or more. Anatomically modern humans are believed to have appeared about 100,000 years ago in the eastern region of sub-Saharan Africa. Somewhat later these early humans spread into northern Africa and the Middle East and, ultimately, to the rest of the world. Africa's first great historical kingdom, Egypt, arose along the Nile c. 3000 BC and flourished for nearly 3,000 years. The Phoenicians established a colony at Carthage and controlled the western Mediterranean for nearly 600 years. While northern Africa was dominated by the Romans for several centuries, the first known empire in western Africa was Ghana (5th–11th century AD). Muslim empires included those of Mali (c. 1250–1400) and Songhai (c. 1400–1591). In eastern and central Africa the emphasis was on trade with Arabia, and several powerful city-states, including Mogadishu and Mombasa, were established. The Portuguese explored the western coast in the 15th century. Before the late 19th century, Europe showed little interest in colonizing Africa, but by 1884 European countries had

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begun a scramble to partition the continent, and by 1920 much of it was under colonial rule. Anticolonial sentiment developed gradually, becoming widespread after 1950, and one by one the colonies became independent, the last in 1990. Political instability, refugee problems, famine, and AIDS are the chief problems facing the continent at the start of the 21st century. See map on following page.

Africa Proconsular Roman province. It was founded after Rome defeated Carthage in 146 BC and was subsequently extended to include Numidia and the northern part of modern Libya. Between 30 BC and AD 180, other parts of northern Africa, including Cyrenaica and Mauretania, became part of the Roman Republic and Empire. In the 5th century the region was taken by the Vandals, though areas were later reconquered by the Byzantine (Eastern Roman) Empire; the Muslims conquered the area in the late 7th century.

Africa, Horn of See Horn of Africa

African ant bear See aardvark

African arts Visual, performing, and literary arts of sub-Saharan Africa. What gives art in Africa its special character is the generally small scale of most of its traditional societies, in which one finds a bewildering variety of styles. The earliest evidence of visual art is provided by figures scratched and painted on rocks c. 3000 BC. Pastoral cultures in the east emphasize personal adornment; sculpture predominates in the agricultural societies in the west and south. Clay figurines found in Nigeria date to 500 BC. Metalworking was practiced from the 9th century AD. Sculptures in stone, ivory, and wood date from the 16th–17th centuries; some of the finest wood sculptures date from the 20th century. Architecture dominates the arts of the north and of the eastern coast, where Islam and Christianity exerted their influence; important work includes magnificent mosques built of mud and rock-hewn churches. Perhaps the most distinctive features of African music are the complexity of rhythmic patterning achieved by a great variety of drums and the relationship between melodic form and language tone structure. Without this the text of a song is rendered meaningless; but, even in purely instrumental music, melodic pattern is likely to follow speech tone. Dances are realized in radically different styles throughout Africa. Movement patterns often depend upon the way in which environmental, historical, and social circumstances have been articulated in working, social, and recreational movements. Often there is no distinction between ritual celebration and social recreation. The masquerade is a complex art form employing many media; masquerades may entertain, be used to fight disease, be consulted as oracles, initiate boys to manhood, impersonate ancestors, judge disputes, or execute criminals. The mask is essentially a dramatic device enabling performers to stand apart from their everyday role in the community. The content and style of urban African theatre are influenced by both African dramatic traditions and Western theatre. The literary arts of Africa—especially its oral traditions—are immensely rich and varied. They include myths, praise songs, epic poetry, folktales, riddles, spells, and proverbs. Written literatures have existed for several centuries in Hausa, Swahili, and Amharic. In the 20th century, written literatures in other African languages also developed, alongside those in English, French, and Portuguese. See also Buli style; déblé; segoni-kun; telum figure; trickster tale; and African authors by name, such as Chinua Achebe; Aimé Césaire; Birago Diop; Athol Fugard; Nadine Gordimer; Wole Soyinka; Amos Tutuola.

African languages Languages indigenous to Africa that belong to the Niger-Congo, Nilo-Saharan, Khoisan, and Afro-Asiatic language phyla. Africa is the most polyglot continent; estimates of the number of African languages range from 1,000 to more than 1,500. Many have numerous dialects. Distinctions in tone play a significant role in nearly all sub-Saharan languages. Contact between people who do not speak the same language has necessitated the development of lingua francas such as Swahili in East Africa, Lingala in the Congo River basin (see Bantu languages), Sango in the Central African Republic (see Adamawa-Ubangi languages), and Arabic across much of the Sahel.

African lily *or* **lily of the Nile** Perennial evergreen herbaceous plant (*Agapanthus africanus*) of the lily family, native to Africa. In summer, long stalks bear many funnel-shaped flowers. The attractive, thick, dark green leaves are sword-shaped. There are many varieties, some with white or purple flowers and others with patterned leaves. If grown in a climate with frost, they must be kept in containers and moved indoors to survive the cold weather.

African lion dog See Rhodesian ridgeback

African Methodist Episcopal Church (AME Church) African American Methodist denomination formally organized in 1816. It originated with a group of black Philadelphians who withdrew in 1787 from St. George's Methodist Episcopal Church (see Methodism) because of racial discrimination and built Bethel African Methodist Church. In 1799 Richard Allen became minister of Bethel, and in 1816 he was consecrated bishop of the newly organized African Methodist Episcopal Church. Limited at first to the Northern states, the church spread rapidly in the South after the Civil War. It founded many colleges and seminaries, notably Wilberforce University (1856) in Ohio. In the late 20th century the church claimed 3,500,000 members and 8,000 congregations. Its headquarters are in Washington, D.C.

African National Congress (ANC) South African political party and black nationalist organization. Founded in 1912 (as the South African Native National Congress), the ANC was long dedicated to the elimination of apartheid. In response to government massacres of demonstrators at Sharpeville (1960) and Soweto (1976), it carried out acts of sabotage and guerrilla warfare. The campaign was largely ineffective because of stringent South African internal security measures, including an official ban on the ANC between 1960 and 1990. In 1991, with the ban lifted, Nelson Mandela succeeded Oliver Tambo as ANC president. In 1994 the party swept the country's first elections based on universal suffrage; the ANC led a coalition government that initially included members of its longtime rival, the National Party, and Mandela became South Africa's president. In 1999 Thabo Mbeki replaced him as president of the ANC and of South Africa. See also Inkatha Freedom Party; Albert Lutuli; Pan-African movement.

African religions Indigenous religions of the African continent. The introduced religions of Islam (in northern Africa) and Christianity (in southern Africa) are now the continent's major religions, but traditional religions still play an important role, especially in the interior of sub-Saharan Africa. The numerous traditional African religions have in common the notion of a creator god, who made the world and then withdrew, remaining remote from the concerns of human life. Prayers and sacrificial offerings are usually directed toward secondary divinities, who are intermediaries between the human and sacred realms. Ancestors also serve as intermediaries (see ancestor worship). Ritual functionaries include priests, elders, rainmakers, diviners, and prophets. Rituals are aimed at maintaining a harmonious relationship with cosmic powers, and many have associated myths that explain their significance. Animism is a common feature of African religions, and misfortune is often attributed to witchcraft and sorcery.

African Union (AU) African intergovernmental organization. It is the successor to the Organization of African Unity (OAU). The AU was established in 2002 to promote unity and solidarity among African states, spur economic development, and promote international cooperation. The OAU was established in 1963 with similar goals, and during its tenure the group mediated several border disputes on the African continent. More economic in nature and with a stronger mandate to intervene in conflicts, the AU replaced the OAU in 2002. In 2004 the AU's Pan-African Parliament was inaugurated, and the organization agreed to create a peacekeeping force. The AU's headquarters are in Addis Ababa, Eth.

African violet Any plant of the genus *Saintpaulia*, of the gesneriad family, especially *S. ionantha*. African violets are native to high elevations in tropical eastern Africa. They are small, hairy, usually stemless herbaceous plants with crowded, long-stalked leaves. The violet, white, or pink flowers bloom most of the year. They are popular houseplants, and hundreds of varieties have been developed, including half-sized miniatures.

Afrikaans \ˌaf-ri-ˈkänz\ **language** Germanic language of South Africa. It was developed from 17th-century Dutch by descendants of European settlers, indigenous Khoisan-speaking peoples, and African and Asian slaves in the Dutch colony at the Cape of Good Hope. It differs from Dutch in its sound system, in some grammatical simplification, and in vocabulary. Afrikaans is spoken as a first language by close to six million South Africans and as a second or third language by several million more; there are also about 150,000 Afrikaans speakers in Namibia. Standard Afrikaans was formally separated from Dutch and made an official language in South Africa in 1925; it is one of 11 official South African languages.

Afrikaner \ˌaf-ri-ˈkän-ər\ *formerly* **Boer** Historically, any South African of Dutch or Huguenot descent whose native language is Afrikaans. Beginning in the late 20th century, the term also was used for all Afri-

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kaans speakers, regardless of ethnicity. The Afrikaners were originally called Boers ("farmers"), since many Dutch and Huguenot settlers of the old Cape Colony (founded 1652) became frontier farmers in the Transvaal and the Orange Free State. They established self-sufficient patriarchal communities, developed their own language and subculture, and were committed to a policy of racial segregation, later referred to as apartheid. They fought a bitter war with the British (the South African War, 1899–1902) over the right to govern the frontier territories. Though defeated, they retained their old language and culture and eventually attained politically the power they had failed to win militarily. They dominated South African politics for most of the 20th century but were obliged to give up national power after the first elections based on universal suffrage in 1994. See also Cape Town; Great Trek; National Party.

Afro-Asiatic languages *formerly* **Hamito-Semitic languages** Family of about 250 languages spoken in North Africa, parts of sub-Saharan African, and the Middle East. It includes such languages as Arabic, Hebrew, Amharic, and Hausa. The total number of speakers is estimated to be more than 250 million. The major branches of Afro-Asiatic are Semitic, Berber, Egyptian, Cushitic, Omotic, and Chadic. Berber languages are spoken by perhaps 15 million people in enclaves scattered across North Africa from Morocco to northwestern Egypt and in parts of the western Sahara. Cushitic consists of some 30 languages spoken by more than 30 million people in northeastern Sudan, Eritrea, Ethiopia, Somalia, Djibouti, Kenya, and a few areas of northeastern Tanzania. Omotic, formerly classified as part of Cushitic, is a cluster of perhaps more than 30 languages spoken by 2–3 million people, most of whom live near the Omo River in southwestern Ethiopia. Chadic comprises about 140 languages, spoken in northern Nigeria, southern Niger, southern Chad, and northern Cameroon; except for Hausa, it is likely that no individual Chadic language has more than half a million speakers.

Afro-Caribbean, Afro-Brazilian, and Afro-American religions Religions among persons of African ancestry in the Caribbean, Brazil, and U.S. These include Haitian vodun, the Jamaican Rastafarian movement, Santería, and Candomblé and other Macumba sects in Brazil. Similarly syncretistic religions appeared in the U.S. during the era of slavery. The Nation of Islam combines black nationalism with an unorthodox version of Islam. Black Protestant churches (especially Baptist and Pentecostal) have imported some forms of lively worship from Africa.

Afrocentrism Cultural, political, and ideological movement. Most Afrocentrists are African Americans who regard all blacks as syncretic Africans and who believe that their worldview should positively reflect traditional African values. Afrocentrists argue that for centuries blacks and other nonwhites have been dominated, through slavery and colonization, by Europeans and that European culture is either irrelevant or hostile to efforts by non-Europeans to achieve self-determination. Rooted in historical black nationalist movements such as Ethiopianism, Pan-Africanism, and Negritude, Afrocentrism asserts the cultural primacy of ancient Egypt and is seen as a spur to political activism. In addition to emphasizing cooperation and spirituality, it champions contemporary African American expressive culture (language, cuisine, music, dance, and clothing). Coined by Molefi Asante in the 1980s, the term Afrocentrism was popularized by such books as *Black Athena: The Afroasiatic Roots of Classical Civilization*, 2 vol. (1987–91), by Martin Bernal. The book remains controversial among mainstream scholars who charge it with historical inaccuracy, scholarly ineptitude, and racism—prompting countercharges of racism from some of its defenders.

afterburner Second combustion chamber in a turbojet or turbofan engine, immediately in front of the engine's exhaust nozzle. The injection and combustion of extra fuel in this chamber provide additional thrust for takeoff or supersonic flight; in most cases, the afterburner can nearly double the thrust of a turbojet engine. The jet nozzle must be larger when using the afterburner, so an automatic, adjustable nozzle is an essential component of the afterburner system. Because the afterburner sharply increases fuel consumption and is generally less effective at subsonic speeds, its use is usually restricted to supersonic military aircraft.

afterpiece Supplementary entertainment offered after a full-length play in 18th-century England. A short comedy, farce, or pantomime was presented to lighten the five-act Neoclassical tragedy that was commonly performed. A reduced admission price for latecomers, usually after the third act, enabled less-sophisticated playgoers and working people to see the end of the drama and the one-act afterpiece.

aftosa See foot-and-mouth disease

Aga Khan \ˌä-gə-'kän\ *Persian* **Āghā Khān** *or* **Āqā Khān** Title of the imams of the Nizārī Ismāʿīlī sect of Shiʿite Islam. The title was first granted in 1818 to Ḥasan ʿAlī Shah (1800–81) by the shah of Iran. As Aga Khan I, he later revolted against Iran (1838) and, defeated, fled to India. His eldest son, ʿAlī Shah (d. 1885), was briefly Aga Khan II. ʿAlī Shah's son Sultan Sir Moḥammed Shah (1877–1957) became Aga Khan III. He acquired a leading position among India's Muslims, served as president of the All-India Muslim League, and played an important part in the Round Table conferences on Indian constitutional reform (1930–32); in 1937 he was appointed president of the League of Nations. He chose as his successor his grandson Karīm al-Ḥusayn Shah (b. 1937), who, as Aga Khan IV, became a strong leader; he founded the Aga Khan Foundation, an international philanthropic organization, and other agencies offering educational and other services.

Agadir \ˌä-gä-'dir\ Seaport city (pop., 1994: 155,240), southwestern Morocco on the Atlantic coast. It was occupied in the 16th century by the Portuguese but later became an independent Moroccan port. After the 1911 Moroccan Crisis, it was occupied by French troops in 1913. Modern growth began with the port's construction in 1914 and the development of the fishing industry. In 1960 the city was virtually destroyed by a pair of earthquakes, a tidal wave, and a fire; a new city centre was rebuilt south of its original location. It is also a marketplace for the surrounding agricultural area.

Agamemnon \ˌa-gə-'mem-ˌnän\ In Greek legend, the son of Atreus, brother of Menelaus, and king of Mycenae and commander of the Greek forces that attacked Troy. By his wife, Clytemnestra, Agamemnon had a son, Orestes, and three daughters. When Paris carried off Menelaus's wife, Helen, Agamemnon called on the Greeks to unite in a war of revenge against the Trojans. Artemis sent a calm or contrary winds to prevent the Greek fleet from sailing, and Agamemnon sacrificed his daughter Iphigeneia to appease the goddess. After the Trojan War he returned home, where he was killed by his wife and her lover, Aegisthus. His murder was avenged by Orestes. These events formed the basis of Aeschylus' great dramatic trilogy the *Oresteia*.

Agana See Hagåtña

agape \ä-'gä-pā\ In the New Testament, the fatherly love of God for humans and their reciprocal love for God. The term extends to the love of one's fellow humans. The Church Fathers used the Greek term to designate both a rite using bread and wine and a meal of fellowship that included the poor. The historical relationship between this meal, the Lord's Supper, and the Eucharist, the meal of fellowship and the sacrament, is uncertain.

agaric \'a-gər-ik\ Any fungus of the family Agaricaceae, including the familiar commercially grown mushroom. Agarics have spore-bearing cells (basidia) located on thin sheets called gills. Best known of the agarics is the genus *Agaricus* (*Psalliota*), which includes some 60 species, the most prominent being the edible meadow, or field, mushroom, *A. campestris*, and the common cultivated mushroom, *A. bisporus.*

Agartala \ə-'gər-tə-lə\ City (pop., 2001 prelim.: 189,387), capital of Tripura state, India. It lies near the Bangladesh border on the Haroa River in an intensively cultivated plain. The commercial centre of the area, it also contains a maharaja's palace, a temple, and several colleges affiliated with the University of Calcutta.

Agassi \'a-gə-sē**, Andre (Kirk)** (b. April 29, 1970, Las Vegas, Nev., U.S.) U.S. tennis player. Agassi won the Wimbledon men's singles in 1992, the U.S. Open in 1994, and the Australian Open in 1995. By 1997 he had dropped to 122 in the international rankings, but he recovered to become the world's top-ranked player by 2000. In 2001 he married retired German tennis player Steffi Graf. Agassi is known for his aggressive style and demeanour on and off the court.

Agassiz \'a-gə-sē**, Alexander (Emmanuel Rodolphe)** (b. Dec. 17, 1835, Neuchâtel, Switz.—d. March 27, 1910, at sea, mid-Atlantic Ocean) Swiss-born U.S. marine zoologist, oceanographer, and mining engineer. The son of Louis Agassiz, he emigrated in 1849 to the U.S., where he conducted significant systematic zoological work on echinoderms (e.g., starfish). He developed and supervised what became the world's foremost copper mine (Calumet, Mich.) while also improving conditions for miners. He also pursued marine and coral reef studies. His observations made

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on an 1875 trip to the western coast of South America led him to challenge Charles Darwin's theory of coral reef formation.

Agassiz, Elizabeth Cabot *orig.* **Elizabeth Cabot Cary** (b. Dec. 5, 1822, Boston, Mass., U.S.—d. June 27, 1907, Arlington Heights, Mass.) U.S. naturalist and educator. She was educated at home, and in 1850 she married Louis Agassiz. She helped organize and manage several of his field expeditions, and together they founded a marine laboratory in Buzzards Bay, Mass. After his death she pursued her idea of a college for women to be taught by the Harvard University faculty. She was instrumental in launching the Society for the Collegiate Instruction of Women (1882); she served as its president until 1894, when it was renamed Radcliffe College, and she continued as president until 1899.

Agassiz \'a-gə-sē**, (Jean) Louis (Rodolphe)** (b. May 28, 1807, Motier, Switz.—d. Dec. 14, 1873, Cambridge, Mass., U.S.) Swiss-born U.S. naturalist, geologist, and teacher. After studies in Switzerland and Germany, he moved to the U.S. in 1846. He did landmark work on glacier activity and extinct fishes. He became famous for his innovative teaching methods, which encouraged learning through direct observation of nature, and his term as a zoology professor at Harvard University revolutionized the study of natural history in the U.S.; every notable American teacher of natural history in the late 19th century was a pupil either of Agassiz or of one of his students. In addition, he was an outstanding science administrator, promoter, and fund-raiser. He was a lifelong opponent of Charles Darwin's theory of evolution. His second wife, Elizabeth Agassiz, cofounder and first president of Radcliffe College, and his son, Alexander Agassiz, were also noted naturalists.

agate \'a-gət\ Common, semiprecious silica mineral, a variety of chalcedony that occurs in bands of varying colour and transparency. Varieties are characterized by peculiarities in the shape and colour of the bands, which are seen in sections cut at right angles to the layers. Agate is found throughout the world, commonly in cavities in eruptive rocks and in geodes. Brazil and Uruguay are major producers of agates; they are also found in Oregon, Washington, Idaho, Montana, and other western U.S. states. Agate is essentially quartz. Much commercial agate is artificially dyed to make the naturally dull-gray stones more colourful.

Banded agate
B.M. SHAUB

Agate Fossil Beds National Monument Natural "depository" of an extinct animal community on the Niobrara River, northwestern Nebraska, U.S. The beds, laid down as sedimentary deposits 20 million years ago, bear the remains of prehistoric mammals. Discovered c. 1878, the site was named for its proximity to rock formations containing agates. A national monument since 1965, it covers 2,269 acres (918 hectares).

Agatha, Saint (fl. 3rd century AD?, Sicily; feast day February 5) Legendary Christian martyr. Born in Palermo or Catania, she resisted the advances of a Roman prefect sent to govern Sicily. After brutal torture she was sent to the stake, but as the fire was lit a great earthquake occurred, and the crowd demanded her release. She was led away to prison, where she died. Though she appears in lists of martyrs as early as the 6th century, the legend may be unfounded.

Agathocles \ə-'ga-thə-klēz\ (b. 361 BC, Thermae Himeraeae, Sicily—d. 289) Tyrant of Syracuse (317–304?) and self-styled king of Sicily (304?–289). He moved to Syracuse as a youth and served in its army. After two failed attempts, he overthrew the Syracusan oligarchy (317) and took power. He waged wars with other Sicilian Greek cities (316–313?) and with Carthage (311), almost capturing Carthage itself before he was defeated (307). He concluded a favourable treaty (306) that curtailed Carthaginian expansion in Sicily. Harsh domestic measures kept him in power, and he declared himself king of Sicily; his reign was peaceful thereafter. He restored Syracusan liberty in his will, but after his death the Carthaginians were once again a power in Sicily.

agave \ə-'gä-vē\ **family** Family Agavaceae of the lily order (Liliales), comprising more than 700 species of short-stemmed, often woody plants found in tropical, subtropical, and temperate areas. They have narrow, lance-shaped, sometimes fleshy or toothed leaves, which are clustered at the base of the plant. Most have large flower clusters. The fruit is a capsule or berry. Plants of the genus *Agave* are important primarily for the fibres obtained from their leaves. Sisal hemp, from *A. sisalana*, is the most valuable hard fibre. Some species of *Agave* contain a sap that is fermented to produce the intoxicating drinks known as tequila, pulque, and mescal. Many species of yucca are popular as ornamentals; other ornamentals in the agave family include plants of the genera *Dasylirion*, *Nolina*, *Cordyline*, *Dracaena*, and *Sansevieria*.

age set Formally organized social group consisting of every male (or female) of comparable age. In societies where the practice traditionally occurs (e.g., the Nuer of the southern Sudan or the Masai of Kenya and Tanzania), a person belongs, either from birth or from a determined age, to a named age set that passes through a series of life stages, or age grades, each of which has a distinctive status or social and political role. See also rite of passage; social status.

Agee \'ā-jē**, James** (b. Nov. 27, 1909, Knoxville, Tenn., U.S.—d. May 16, 1955, New York, N.Y.) U.S. poet and novelist. Agee attended Harvard University. In the 1930s and '40s, film reviews for *Time* and *The Nation* made him a pioneer in serious film criticism. His lyrical *Let Us Now Praise Famous Men* (1941), with photographs by Walker Evans, documents the daily lives of poverty-stricken Alabama sharecroppers. After 1948 Agee worked mainly as a screenwriter, notably on *The African Queen* (1951) and *The Night of the Hunter* (1955). He is best known for his autobiographical novel *A Death in the Family* (1957, Pulitzer Prize).

Agenais \àzh-'ne, à-zhə-'nā\ *or* **Agenois** \à-zhe-'nwä\ Historical region, southwestern France. In ancient Gaul, Agenais was the country of the Nitiobriges, then a Gallo-Roman *civitas*, whose limits became those of the diocese of Agen. It was acquired by the dukes of Aquitaine in 1036. When Eleanor of Aquitaine married the future Henry II of England in 1152, Agenais became the possession of the English kings. It alternated between French and British rule until it was reunited to the French crown in 1615.

Agence France-Presse \à-zhäⁿs-fräⁿs-'pres\ **(AFP)** French cooperative news agency. Based in Paris, it has roots in the Bureau Havas, created in 1832, which in 1835 became the Agence Havas, the world's first true news agency. The Agence Havas was active until the German occupation of France in 1940, when many of its personnel went underground. After the liberation of Paris in 1944, underground journalists emerged to form AFP. The French government assigned the assets of Agence Havas to AFP, which quickly became one of the world's leading wire news services. AFP operates bureaus in Africa, Asia-Pacific countries, Latin America, the Middle East, North America, and Europe.

agency In law, a relationship in which one party (the agent) acts on behalf of and under the control of another (the principal) in dealing with third parties. It has its roots in ancient servant-master relations. Agency becomes a legal issue when the agent injures or wrongs a third party. In Anglo-American law, principals are bound by and liable for the acts of such agents as stockbrokers, business agents, contractors, real-estate agents, lawyers, union representatives, managing partners, and private detectives. See also regulatory agency.

agenesis \ā-'je-nə-səs\ Failure of all or part of an organ to develop during embryonic growth. Many forms of agenesis are lethal, such as absence of the entire brain (anencephaly), but agenesis of one organ of a pair may cause little problem. Agenesis of a kidney, bladder, testicle, ovary, thyroid, and lung are known. Agenesis of the arms or legs is called meromelia (absence of one or both hands or feet), phocomelia (normal hands and feet but no arms or legs), and amelia (complete absence of a limb or limbs). Agenesis may be caused by absence of embryonic tissue or by chemical exposure in the uterus, and it is often associated with other congenital disorders.

Agent Orange Mixture of herbicides. It contains approximately equal amounts of esters of 2,4-D (2,4-dichlorophenoxyacetic acid) and 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) and trace amounts of dioxin. About 13 million gallons were sprayed by U.S. military forces onto Vietnam's forests and crops during the Vietnam War, with the dual purpose of destroying cover for enemy movements and destroying food sources. Exposure to Agent Orange has been blamed for an abnormally high incidence of miscarriages, skin diseases, cancers, birth defects, and malformations among Vietnamese and of cancers and other disorders in U.S., Australian, and New Zealand servicemen and their families.

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ageratum \ˌa-jə-ˈrā-təm\ Any plant of the genus *Ageratum*, of the COMPOSITE FAMILY, native to tropical South America. Ageratum have toothed, oval leaves that are opposite each other on the stem; compact clusters of blue, pink, lilac, or white flowers; and small, dry fruits. Dwarf varieties are used as edging plants. Some ageratum are variously known as flossflower and pussyfoot.

Agesilaus \ə-ˌje-sə-ˈlā-əs\ **II** (b. c. 444 BC—d. 360, Cyrene, Cyrenaica) King of SPARTA (399–360) and commander of its army during most of the era of Spartan supremacy (404–371). A member of the Eurypontid family, he took the throne with LYSANDER's help while Sparta was fighting Persia. He defeated the allied Thebes, Athens, Argos, and Corinth in the Corinthian War (395–387), despite losing some ground in central Greece and a battle with the Persian fleet in 394. He dissolved the Boeotian League, but battles against the Boeotian Confederacy (371) and Thebes (370, 361) ended Sparta's ascendancy. He died en route to Sparta from a mercenary engagement in Egypt.

agglomerate \ə-ˈglä-mə-rət\ Large, coarse, angular rock fragments associated with lava flow that are ejected during explosive volcanic eruptions. Although they may appear to resemble sedimentary CONGLOMERATES, agglomerates are IGNEOUS ROCKS that consist almost wholly of angular or rounded lava fragments of varying size and shape. Some geologists sort agglomerates into BOMBS, blocks, and BRECCIA. Bombs are ejected in a molten state, becoming rounded upon solidification, and blocks are erupted as solid fragments. Upon accumulation and solidification of the angular fragments (also known as pyroclastics), they form agglomerates.

aggressive behaviour Any action of an animal intended to injure an opponent or prey animal or to cause an opponent to retreat. Aggression may be caused by various stimuli. Within its own group, an animal must display aggressive postures to maintain its position within the hierarchy (e.g., the PECKING ORDER of chickens). A threat by itself, as in ruffled feathers or teeth revealed in a snarl, is usually sufficient to maintain an already-established social order. Aggression often occurs just before mating season, when males win their choice of females and territories.

Āghā Khān See AGA KHAN

Aghlabid \ˈäg-lə-bid\ **dynasty** (800–909) Arab Muslim dynasty that ruled Ifrīqiyyah (Tunisia and eastern Algeria) through a succession of 11 emirs. Nominally subject to the ʿABBĀSID DYNASTY, they in fact were independent. High points of Aghlabid rule included the conquest of Sicily (827–829), the flowering of their capital city, KAIROUAN (9th century), and naval control of the central Mediterranean Sea. Public works included a system for conserving and distributing water.

Agiads \ˈā-jē-ədz\ Line of Spartan kings named after Agis I (11th century BC?). Agis was traditionally held to be the son of one of the legendary twins who founded SPARTA. Agis II (d. 400/398 BC) commanded the Spartan army during most of the PELOPONNESIAN WAR (431–404) against Athens. Agis III (d. 331 BC) led the Greek cities in an unsuccessful revolt against ALEXANDER THE GREAT. The last of the line was Agis IV (d. 241 BC), who failed in his attempt to reform the unequal distribution of land and wealth in Sparta, ultimately losing his crown and his life to Leonidas II.

Agincourt \ˈa-jin-kōrt**, Battle of** (October 25, 1415) Battle resulting in the decisive victory of the English over the French in the HUNDRED YEARS' WAR. In pursuit of his claim to the French throne, HENRY V invaded Normandy with an army of 11,000 men in August 1415. The English took Harfleur in September, but with their forces cut in half by battle and disease, they resolved to return to England. At Agincourt they were cornered by a French army of 20,000–30,000 men, including many mounted knights in heavy armor. On a cramped battlefield where the superior French numbers offered little advantage, Henry made skillful use of his lightly equipped, mobile archers. The French were disastrously defeated, losing over 6,000 men, while the English lost fewer than 450.

aging Gradual change in an organism that leads to increased risk of weakness, disease, and death. It takes place in a cell, an organ, or the total organism over the entire adult life span of any living thing. There is a decline in biological functions and in ability to adapt to metabolic stress. Changes in organs include the replacement of functional cardiovascular cells with fibrous tissue. Overall effects of aging include reduced IMMUNITY, loss of muscle strength, decline in memory and other aspects of cognition, and loss of colour in the hair and elasticity in the skin. In women, the process accelerates after MENOPAUSE. See also GERONTOLOGY AND GERIATRICS.

agitprop \ˈa-jət-ˌpräp\ Political strategy in which techniques of agitation and propaganda are used to influence public opinion. Originally described by the Marxist theorist GEORGY PLEKHANOV and then by VLADIMIR ILICH LENIN, it called for both emotional and reasoned arguments. The term, a shortened form for the Agitation and Propaganda Section of the COMMUNIST PARTY in the former Soviet Union, has been used in English, typically with a negative connotation, to describe any work—especially in drama and other art forms—that aims to indoctrinate the public and achieve political goals.

Agnes, Saint (fl. 4th century, Rome; feast day January 21) Legendary Christian martyr, the patron saint of girls. According to tradition, she was a beautiful virgin who turned away all suitors, declaring that she could have no spouse but JESUS. The rejected suitors informed Roman officials that she was a Christian, and she was punished by being exposed in a brothel. There she was left miraculously unharmed; the only man who attempted to violate her was struck blind, and she healed him with prayer. She was later murdered during the persecutions ordered by DIOCLETIAN.

Agnew, Spiro T(heodore) (b. Nov. 9, 1918, Baltimore, Md., U.S.—d. Sept. 17, 1996, Berlin, Md.) U.S. politician, the only vice president forced to resign. He studied law at the University of Baltimore and began a law practice in a Baltimore suburb in 1947. He was elected Baltimore county executive in 1962 and then governor of Maryland in 1967. In 1968 and 1972 he was elected vice president on the Republican ticket headed by RICHARD NIXON. His sometimes colourful denunciations of Vietnam War protesters and other opponents of the Nixon administration brought him much attention in the news media. Investigated for extortion, bribery, and income-tax violations allegedly committed during his governorship, he resigned the vice presidency in 1973 and pleaded no contest to a single income-tax charge. He was fined $10,000 and sentenced to three years of unsupervised probation. Disbarred in 1974, he became a consultant to foreign businesses.

Agni Hindu god of fire, second only to INDRA in Vedic mythology. He is the fire of the sun, of lightning, and of the hearth of worship, and is the divine personification of the fire of sacrifice. He is thus the messenger between human and divine orders. Agni is described as ruddy-hued and with two faces, one beneficent and one malignant. In the RIG VEDA he is sometimes identified with Rudra, the forerunner of SHIVA.

Agnon \äg-ˈnōn**, S.Y.** *orig.* **Shmuel Yosef Halevi Czaczkes** (b. July 17, 1888, Buczacz, Galicia, Austria-Hungary—d. Feb. 17, 1970, Reḥovot, Israel) Israeli writer. Born into a Polish Galician family, Agnon settled in Palestine in 1907 and chose Hebrew as his literary language. *The Day Before Yesterday* (1945), perhaps his greatest novel, examines the problem facing the Westernized Jew who immigrates to Israel. Other works include the novels *The Bridal Canopy* (1919) and *A Guest for the Night* (1938). He is regarded as one of the greatest modern Hebrew novelists and short-story writers. In 1966 he and NELLY SACHS shared the Nobel Prize for Literature.

agnosticism \ag-ˈnäs-tə-ˌsiz-əm\ Doctrine that one cannot know the existence of anything beyond the phenomena of experience. It is popularly equated with religious skepticism, and especially with the rejection of traditional Christian beliefs under the impact of modern scientific thought. T.H. HUXLEY popularized philosophical agnosticism after coining the term agnostic (as opposed to gnostic) in 1869, to designate one who repudiated traditional Judeo-Christian THEISM but was not a doctrinaire atheist (see ATHEISM). Agnosticism may mean no more than the suspension of judgment on ultimate questions because of insufficient evidence, or it may constitute a rejection of traditional Christian tenets.

agora \ˈa-gə-rə\ In ancient Greek cities, an open space serving as an assembly area and backdrop for commercial, civic, social, and religious activities. Use of the agora varied in different periods. Located in the middle of the city or near the harbor, it was often enclosed by public buildings, COLONNADES containing shops, and STOAS for protection from sun and bad weather. The highest honor for a citizen was to be granted a tomb in the agora. See photograph on following page.

Agoracritus *or* **Agorakritos** \ˌa-gə-ˈrak-rə-təs\ (fl. 5th century BC) Greek sculptor. A student of PHIDIAS, his most notable work was the colossal marble statue of Nemesis at Rhamnus. A fragment of the head is in the British Museum, and fragments of the pedestal reliefs are in Athens.

agouti \ə-ˈgü-tē\ Any of several species (genus *Dasyprocta*) of rabbit-sized RODENTS that occur in the American tropics (southern Mexico to

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Plaster model of the Agora, Athens, as it might have appeared in the 2nd century AD
AMERICAN SCHOOL OF CLASSICAL STUDIES AT ATHENS

Agouti (*Dasyprocta*).
WARREN GARST/TOM STACK & ASSOCIATES

northern South America). Agoutis are 16–24 in. (40–60 cm) long and have a long body, small ears, either a vestigial tail or none at all, and slender feet with long, hooflike claws. Their wiry fur is reddish brown to blackish, with individual hairs banded in what is called the agouti pattern. Agoutis generally live in forests and eat roots, leaves, and fruit.

Agra \'ä-grə\ City (pop., 2001: 1,275,134), west-central Uttar Pradesh state, India. It was founded by Sikandar Lodi in the early 16th century on the Yamuna River southeast of Delhi and was intermittently the Mughal capital. The city fell successively to the Jats and the Marathas in the late 18th century and finally to the British in 1803. It is the site of the Taj Mahal and the imperial tomb of Akbar.

Agramonte \ä-grä-'mōn-tā\ **(y Simoni), Aristides** (b. June 3, 1868, Camagüey, Cuba—d. Aug. 19, 1931, New Orleans, La., U.S.) Cuban-born U.S. physician, pathologist, and bacteriologist. Reared in New York City, he received his M.D. from Columbia University. He was a member of the U.S. Army's Reed Yellow Fever Board, which discovered in 1901 the role of mosquitoes in transmitting yellow fever. As a professor at the University of Havana (1900–30), he became an influential leader of scientific medicine in Cuba.

Ağrı Dağı See Mount Ararat

agribusiness Agriculture operated by business; specifically, that part of a modern national economy devoted to the production, processing, and distribution of food and fibre products and byproducts. Commercial farming has largely supplanted the family farm in production of cash crops. Some food-processing firms that operate farms have begun to market fresh produce under their brand names. In recent years, conglomerates involved in nonagricultural businesses have entered agribusiness by buying and operating large farms.

Agricola \ə-'gri-kə-lə**, Georgius** *orig.* **Georg Bauer** (b. March 24, 1494, Clauchau, Saxony—d. Nov. 21, 1555, Chemnitz) German scholar and scientist known as the father of mineralogy. A town physician in Saxony (1527–33), he was among the first to found a natural science upon observation as opposed to speculation. His *De re metallica* (1556) dealt chiefly with mining and smelting; his *De natura fossilium* (1546), considered the first mineralogy textbook, presented the first scientific classification of minerals (based on their physical properties) and described many new minerals, their occurrence, and mutual relationships.

Agricola \ə-'grik-ə-lə**, Gnaeus Julius** (b. June 13, AD 40, Forum Julii, Gallia Narbonensis—d. Aug. 23, 93) Roman general. After Agricola served as tribune and quaestor in Britain and Asia, Vespasian appointed him governor of Britain (77/78–84). In that role he conquered parts of Wales and northern England, then advanced into Scotland and set a frontier between the Firths of Clyde and Forth. In 83 he crossed the Forth and defeated the Caledonians at Mons Graupius; he then occupied Scotland to the fringe of the Highlands, with forts at the main passes and a fortress at Inchtuthil. Recalled to Rome, Agricola was offered the proconsulship of Asia but chose retirement. His life is known through the writings of his son-in-law Tacitus.

Agricultural Adjustment Administration (AAA) New Deal program to restore U.S. agricultural prosperity during the Great Depression. Established by an act of Congress in 1933, the AAA sought to curtail farm production of certain staples, in order to raise prices. It also established the Commodity Credit Corp., to make loans to farmers and to purchase and store crops in order to maintain farm prices. The program had limited success before it was declared unconstitutional in 1936.

Agricultural Revolution Gradual transformation of the traditional agricultural system that began in Britain in the 18th century. Aspects of this complex transformation, which was not completed until the 19th century, included the reallocation of land ownership to make farms more compact and an increased investment in technical improvements, such as new machinery, better drainage, scientific methods of breeding, and experimentation with new crops and systems of crop rotation. The agricultural revolution was an essential prelude to the Industrial Revolution.

agriculture Science or art of cultivating the soil, growing and harvesting crops, and raising livestock. Agriculture probably first developed in South Asia and Egypt, then spread to Europe, Africa, the rest of Asia, the islands of the central and South Pacific, and finally to North and South America. Agriculture in the Middle East is believed to date from 9000–7000 BC. Early cultivated crops include wild barley (Middle East), domesticated beans and water chestnuts (Thailand), and pumpkins (the Americas). Domestication of animals occurred during roughly the same period. Slash-and-burn land–clearing methods and crop rotation were early agricultural techniques. Steady improvements in tools and methods over the centuries increased agricultural output, as did mechanization, selective breeding and hybridization, and, in the 20th century, the use of herbicides and insecticides. More of the world's aggregate manpower is devoted to agriculture than to all other occupations combined.

agrimony \'a-grə-ˌmō-nē\ Any plant of the genus *Agrimonia*, of the rose family, especially *A. eupatoria*. This species is a herbaceous, hardy perennial native to Europe but widespread in other northern temperate regions, where it grows in hedge banks and the borders of fields. Its leaves yield a yellow dye. The leaflets are oval with toothed margins; the small, stalkless yellow flowers are borne in a long terminal spike. The fruit is a tiny burr. *A. gryposepala*, a similar species, is widespread in the U.S.

Agrippa \ə-'grip-ə**, Marcus Vipsanius** (b. 63 BC?—d. March, 12 BC, Campania) Powerful deputy of Augustus. He helped Octavian (later Augustus) take power after Julius Caesar's murder (44 BC), defeating Sextus Pompeius in 36 and Mark Antony at the Battle of Actium in 31. He went on to quell rebellions, found colonies, administer parts of the empire, and give to Rome funds for public works and buildings. In 23 Augustus seemed to make him heir, and Agrippa married Augustus's daughter, Julia. His administrative and military skills were particularly directed to the eastern empire, where in 15 he met with and made an ally of Herod of Judaea. Agrippa's writings (now lost) influenced Strabo and Pliny the Elder. His daughter Agrippina the Elder (14? BC–AD 33) was the wife of Germanicus Caesar, mother of Caligula and Agrippina the Younger, and grandmother of Nero.

Marcus Vipsanius Agrippa, marble portrait bust, early 1st century BC; in the Louvre, Paris.
CLICHE MUSEES NATIONAUX, PARIS

Agrippina \ˌag-ri-'pī-nə\ **the Younger** (b. AD 15—d. 59) Mother of Nero and a major influence in the early years of his reign. Daughter of Agrippina the Elder (c. 14 BC–AD 33) and sister of Caligula, she was exiled (39–41) for conspiring against Caligula. Her first husband, Gnaeus Domitius Ahenobarbus, was Nero's father. Accused of poisoning her second husband (49), she married Claudius, her uncle, and had him adopt Nero

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as his heir instead of his own son. She poisoned her son's rivals, and when Claudius died in 54 she was suspected of having poisoned him. She became regent when Nero took the throne at age 16, but she gradually lost power. He tried to murder her when she opposed one of his affairs, and he finally had her put to death at her country house.

agrochemical Any chemical used in AGRICULTURE, including chemical FERTILIZERS, HERBICIDES, and INSECTICIDES. Most are mixtures of two or more chemicals; active ingredients provide the desired effects, and inert ingredients stabilize or preserve the active ingredients or aid in application. Together with other technological advances, including tractors, mechanical harvesters, and irrigation pumps, agrochemicals have increased the per-acre productivity of regions such as the Great Plains by 200–300% since the 1930s. Their long-term effects on the environment and the stability of agricultural systems that use them are hotly debated.

agronomy Branch of AGRICULTURE that deals with field CROP production and soil management. Agronomists generally work with crops that are grown on a large scale (e.g., small grains) and that require relatively little management. Agronomic experiments focus on a variety of factors relating to crop plants, including yield, diseases, cultivation, and sensitivity to factors such as climate and soil.

Aguán \ä-'gwän\ **River** River, northern Honduras. It rises in the central highlands west of Yoro, descends northeast to the coastal lowlands for a distance of 150 mi (240 km), and empties into the Caribbean Sea near Santa Rosa de Aguán. The lands along the river are used primarily for agriculture but are susceptible to floods and hurricanes.

Aguascalientes \ˌä-gwäs-käl-'yen-tās\ State (pop., 2000: 944,285), central Mexico. With an area of 2,112 sq mi (5,471 sq km), it is one of the country's smallest states. It occupies part of the central plateau. It was explored by Spaniards in the 16th century and became a colonial mining centre. During the revolution of 1910–20 it was the scene of bitter fighting. Today it is a fertile agricultural area and is noted for its mineral production. Its capital is the city of AGUASCALIENTES.

Aguascalientes City (pop., 2000: 594,056), capital of AGUASCALIENTES state, Mexico. Located on the Aguascalientes River, it was founded as a mining settlement in 1575 and became the state capital in the 1850s. It is sometimes called La Ciudad Perforada ("The Perforated City") because of an underground labyrinth of tunnels built by an unknown pre-Columbian people. It is an agricultural centre, with several industries. Several notable churches possess outstanding examples of colonial religious art.

Aguinaldo \ˌä-gē-'näl-dō**, Emilio** (b. March 23, 1869, near Cavite, Luzon, Phil.—d. Feb. 6, 1964, Manila) Philippine independence leader. He was born of Chinese and Tagalog parentage and was educated at the University of Santo Tomás, Manila. He became a leader of the Katipunan, a revolutionary society that fought the Spanish. Philippine independence was declared in 1898, and Aguinaldo became president, but within months Spain signed a treaty ceding the islands to the U.S. Aguinaldo fought U.S. forces until he was captured in 1901. After taking an oath of allegiance to the U.S., he was induced to retire from public life. He collaborated with the Japanese during World War II. After the war he was briefly imprisoned; released by presidential amnesty, he was vindicated by his appointment to the Council of State in 1950. In his later years he promoted nationalism, democracy, and improvement of relations between the U.S. and the Philippines.

Emilio Aguinaldo.
BROWN BROTHERS

Agulhas \ə-'gəl-əs**, Cape** Cape, southernmost point of the African continent. Its name, Portuguese for "needles," refers to the rocks and reefs that have wrecked many ships. The cape's meridian of 20°E is the official boundary between the Indian and Atlantic oceans.

Agusan River \ə-'gü-ˌsän\ River, MINDANAO, Philippines. Rising in the southeast and flowing north 240 mi (390 km) to enter Butuan Bay of the Bohol Sea, it forms a fertile valley 40–50 mi (65–80 km) wide between the Central Mindanao Highlands and the Pacific Cordillera. It is navigable for 160 mi (260 km). Despite early Spanish contacts in the 17th century, most of the valley has remained sparsely settled by native peoples.

Ahab \'ā-ˌhab\ (fl. 9th century BC) Seventh king of the northern kingdom of Israel (r. c. 874–853 BC). He inherited a realm that included territory east of the Jordan River, in GILEAD and probably BASHAN, and also the tributary kingdom of MOAB. His marriage to JEZEBEL revived an alliance with the PHOENICIANS, but her efforts to establish BAAL worship provoked bitter opposition from ELIJAH. Ahab's reign was dominated by a fierce border war with Syria; he died in an attempt to recover Ramoth-Gilead from the Syrians.

Ahaggar \ə-'hä-gər, ˌä-hə-'gär\ *or* **Hoggar** \'häg-ər, ȯ-'gȧr\ **Mountains** High plateau region, southern Algeria. Located in the central SAHARA, it extends about 970 mi (1,550 km) from north to south and 1,300 mi (2,100 km) from east to west. Its mean elevation is above 3,000 ft (900 m); its highest peak is Mount Tahat (9,573 ft [2,918 m]). The main caravan route to KANO (Nigeria) passes along its western margin.

Ahidjo \ä-'hi-jō**, Ahmadou** (b. August 1924, Garoua, Cameroon—d. Nov. 30, 1989, Dakar, Senegal) First president of Cameroon, 1960–82. He presided over one of the few successful attempts at African unity: the joining of the southern half of the former British Cameroons with the larger French-speaking Cameroun. In 1982, after managing to build up a stable, relatively prosperous nation (through single-party rule), he went into exile after being implicated in a plot against his successor, Paul Biya.

ahimsa \ə-'him-sä\ (Sanskrit: "noninjury") Fundamental ethical virtue of JAINISM, also respected in BUDDHISM and HINDUISM. In Jainism ahimsa is the standard by which all actions are judged. It requires a householder observing the small vows (*anuvrata*) to refrain from killing any animal life. An ascetic observing the great vows (*mahavrata*) is expected to take the greatest care not to injure any living substance, even unknowingly. To do so interrupts that being's spiritual progress and increases one's own karma, delaying liberation from the cycle of rebirth. In the 20th century MOHANDAS K. GANDHI extended ahimsa into the political sphere as satyagraha.

Aḥmad, Mīrzā Ghulām See MĪRZĀ GHULĀM AḤMAD

Aḥmad ibn Ḥanbal \'äk-məd-ˌib-ən-'kan-bəl\ (b. 780, Baghdad, Iraq—d. 855, Baghdad) Muslim theologian and jurist. He began to study the ḤADĪTH (Traditions) at age 15. He traveled widely to study with the great masters and made five pilgrimages to Mecca. In 833–835 he bravely endured floggings and imprisonment rather than subscribe to the MUʿTAZILĪ doctrine of a created (rather than eternal) Qur'ān, and he is remembered as a staunch upholder of Muslim traditionalism. He compiled the Traditions of Muhammad and is the eponym of the Ḥanbalī school, the most traditional of the four orthodox Islamic schools of law. Opposing codification of the law, he believed jurists needed the freedom to derive legal solutions from the Qur'ān and the SUNNA. He is revered as one of the fathers of Islam.

Ahmad Khan \'am-ad-'kän**, Sir Sayyid** (b. Oct. 17, 1817, Delhi—d. March 27, 1898, Aligarh, India) Indian educator and jurist. Born into a family of officials in the MUGHAL DYNASTY, he worked for the British East India Co. and held various judicial posts. He supported the British in the 1857 Indian Mutiny but criticized their errors in his influential pamphlet *Causes of the Indian Revolt*. His other works include *Essays on the Life of Mohammed* (1870) and commentaries on the BIBLE and QUR'ĀN. He founded schools at Muradabad and Ghazipur, established the Scientific Society, sought to strengthen the Muslim community through the reform journal *Tahdhib al-Akhlaq*, and was active in founding a Muslim college, the Anglo-Mohammedan Oriental College, in 1877 at Aligarh.

Aḥmad Shah Durrānī \'äk-məd-'shä-důr-'ä-nē\ (b. c. 1722, Multan, Punjab—d. Oct. 16?, 1772, Toba Maʿrūf, Afg.) Founder of modern Afghanistan. The son of an Afghan chief, he became shah in 1747 on the death of the Persian conqueror NĀDIR SHAH, in whose army he had served. He proceeded to invade India nine times over the next 22 years in an attempt to control the trade routes between northern India and central and western Asia and became ruler of an empire that extended from the AMU DARYA to the Indian Ocean and from Khorāsān to present-day northern India. His hold on the Punjab, governed by his son Tīmūr Shah, was weakened by rebellions at home, and he ultimately lost control of it to the Sikhs. Much of his empire disintegrated after his death.

Aḥmad Sirhindī \sir-'hin-dē\ (b. 1564?, Sirhind, Patiala, India—d. 1624, Sirhind) Indian mystic and theologian who is responsible for the

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revival of Sunnite Islam in India. He traced his descent from ʿUmar ibn al-Khaṭṭāb. After a traditional Muslim education, he joined an important Sufi order and devoted himself to preaching against the tendencies of Akbar and his successor, Jahāngīr, toward pantheism and Shiʿite Islam. His views are outlined in his most famous work, *Maktūbāt*, a compilation of his letters. His burial place at Sirhind is a site of pilgrimage.

Aḥmadiyyah \ˌäh-mə-'dē-ə\ Islamic sect, founded in India in 1889 by Mirzā Ghulām Aḥmad. It holds that Jesus feigned death and resurrection and escaped to India and that jihad is a peaceful battle against nonbelievers. Following the death of Ghulām Aḥmad's successor (1914), the Aḥmadiyyah split. The Qadiani, based in Rabwah, Pak., recognize Ghulām Aḥmad as a prophet; they are zealous missionaries, preaching Aḥmadi beliefs as the one true Islam. A Lahore-based sect regards Ghulām Aḥmad merely as a reformer and seeks to make converts to Islam generally. The term Aḥmadiyyah is also used to describe various Sufi orders (see Sufism), particularly that founded by Aḥmad al-Badawī (d. 1276). One of the most popular orders in Egypt, it has branches throughout the Islamic world.

Ahmadu Seku \a-'mad-ü-'sā-kü\ (d. 1898, Sokoto, Northern Nigeria) Second and last ruler of the Tukulor empire in West Africa. Succeeding his father, al-Ḥājj ʿUmar, in 1864, Ahmadu ruled over a great empire centred on the ancient Bambara kingdom of Segu, in present Mali. In 1887 he was forced to abandon Segu and accept French protectorate status. By 1891 most of his strongholds had been seized.

Ahmed Yesevi \äk̲-'met-ˌye-se-'vē\ *or* **Ahmad Yasawi** \äk̲-'med-ˌyä-sä-'vē\ (b. 11th century, Sayrām—d. 1166, Yasī, Turkistan) Turkish poet and Sufi mystic. When he was young his family moved to Yasī, where he began his teaching. The *Book of Wisdom*, a collection of mystical poetry, is traditionally attributed to him. He established a mystical order whose rituals preserved Islamic and ancient Turco-Mongol customs, and promoted the spread of mysticism throughout the Turkish-speaking world. His poetry influenced Turkish literature and led to the development of mystical folk literature. He was revered as a saint, and Timur erected a magnificent mausoleum over his grave in 1397/98.

Ahmedabad \'ä-mə-də-ˌbäd\ *or* **Ahmadabad** City (pop., 2001: metro. area, 4,525,013), Gujarat state, west-central India. It is located on the Sabarmati River 275 mi (440 km) north of Mumbai (Bombay). Founded in 1411 by Sultan Aḥmad Shah, Ahmedabad reached its height later that century but subsequently declined. It was revived under Mughal emperors in the 17th century and came under British rule in 1818. With the opening of cotton mills in the mid-19th century, it became India's largest inland industrial centre. The city is associated with Indian nationalism; Mohandas K. Gandhi's political agitation began there in 1930. In 2001 the city was struck by a violent earthquake that took many lives.

Aḥsāʾī \äk̲-'sä-ē**, Ahmad al-** *in full* **Shaykh Aḥmad ibn Zayn al-Dīn Ibrahim al-Aḥsāʾī** (b. 1753, Al-Hasa, Arabia—d. 1826, near Medina) Founder of the heterodox Shīʿite Muslim Shaykhī sect of Iran. He traveled widely in Persia and the Middle East. In 1808 he settled in Yazd, Persia, where he attracted followers with his interpretation of Shīʿism. He claimed knowledge from visions of Muhammad and the imams and contended that the imams were originally beings of divine light who participated in the creation of the world. Orthodox Shīʿite theologians declared him an apostate in 1824; he died two years later on pilgrimage to Mecca, but the Shaykhī sect survived him.

Ahura Mazda \'ä-hůr-ə-'mäz-də\ Supreme god of ancient Iranian religion, especially Zoroastrianism. Ahura Mazda was worshiped by Darius I and his successors as the greatest god and the protector of the just king. Zoroaster taught that Ahura Mazda created the universe and maintains the cosmic order, and that the history of the world consists of the battle between two spirits he created—the beneficent Spenta Mainyu and the destructive Angra Mainyu. The Avesta identifies Ahura Mazda himself with the beneficent spirit and represents him as bountiful, all-knowing, and the creator of everything good. In late sources (from the 3rd century), Zurvan ("Time") is the father of the twins Ormazd (Ahura Mazda) and Ahriman (Angra Mainyu), who in orthodox Mazdaism (Zoroastrianism and Parsiism) reign alternately over the world until Ormazd's ultimate victory.

Ai \'ā-ˌī\ Town, eastern Canaan, ancient Palestine. In the Bible (Joshua 7–8), it was destroyed by the Israelites under Joshua. Biblical references agree in locating Ai just east of Bethel (modern Baytīn) in the West Bank, at the Early Bronze Age site now called Al-Tall. Excavations at Ai in 1933–35 uncovered a temple of the 3rd millennium BC. The biblical events at Ai are assigned to the period c. 1400–1200 BC, when evidence indicates it was not in fact occupied; early tradition may have identified the Canaanite town under Bethel with the nearby ruins of Al-Tall.

Aidan \'ād-ᵊn**, Saint** (b. Ireland—d. Aug. 31, 651, Bamburgh, Northumberland, Eng.; feast day August 31) Apostle of Northumbria and founder of Lindisfarne. He was a monk at Iona in Scotland when King Oswald of Northumbria requested that he be made bishop of the newly converted Northumbrians. He established his church, see, and monastery on the island of Lindisfarne, not far from the royal stronghold of Bamburgh. From there he evangelized northern England, founding churches, monasteries, and a school. Bede praised him for his learning, charity, and simplicity of life.

aide-de-camp \ˌād-di-'kamp\ Officer on the personal staff of a general, admiral, or other high-ranking commander who acts as a confidential secretary. Today they are usually of junior rank, and their duties are largely social. The term also denotes a high-ranking military officer who acts as an aide to a chief of state.

AIDS *in full* **acquired immunodeficiency syndrome** Transmissible disease of the immune system caused by HIV. AIDS is the last stage of HIV infection, during which time the individual develops frequently fatal infections and cancers, including *Pneumocystis carinii* pneumonia, cytomegalovirus (CMV), lymphoma, and Kaposi sarcoma. The first AIDS cases were identified in 1981, HIV was isolated in 1983, and blood tests were developed by 1985. According to the UN's 2004 report on AIDS, some 38 million people are living with HIV, approximately 5 million people become infected annually, and about 3 million people die each year from AIDS. Some 20 million people have died of the disease since 1981. Sub-Saharan Africa accounts for some 70 percent of all HIV infections. Rates of infection are lower in other parts of the world, but the epidemic is spreading rapidly in eastern Europe, India, South and Southeast Asia, Latin America, and the Caribbean.

Aiken \'ā-kən**, Conrad (Potter)** (b. Aug. 5, 1889, Savannah, Ga., U.S.—d. Aug. 17, 1973, Savannah) U.S. writer. Aiken was traumatized as a child when his father killed Aiken's mother and then himself. Educated at Harvard University, Aiken wrote most of his fiction in the 1920s and '30s. His works are influenced by early psychoanalytic theory. Generally more successful than his novels were his short stories, notably "Strange Moonlight" from *Bring! Bring!* (1925) and "Silent Snow, Secret Snow" and "Mr. Arcularis" from *Among the Lost People* (1934). His best poetry, including "Preludes to Definition," is in his *Collected Poems* (1953).

Aiken, Howard H(athaway) (b. March 9, 1900, Hoboken, N.J., U.S.—d. March 14, 1973, St. Louis, Mo.) U.S. mathematician and inventor. He received his Ph.D. from Harvard University. With three other engineers, he began work in 1939 on an automatic calculating machine that could perform any selected sequence of five arithmetical operations (addition, subtraction, multiplication, division, and reference to previous results) without human intervention. The first such machine, the Harvard Mark I (1944), was 51 ft (15 m) long and 8 ft (2.4 m) high, and weighed 35 tons (31,500 kg).

aikido \ˌī-ki-'dō, ī-'kē-dō\ Japanese art of self-defense. It employs locks and holds and utilizes the principle of nonresistance to cause an opponent's own momentum to work against him or her. Aikido emphasizes the importance of achieving complete mental calm and control of one's own body to master an opponent's attack. There are no offensive moves. It traces its origins to Japanese martial (samurai) traditions dating to the 14th century, and it was developed as a modern form in the early 20th century by Ueshiba Morihei. See martial art.

ailanthus \ā-'lan-thəs\ Any of the flowering plants that make up the genus *Ailanthus*, in the quassia family (Simaroubaceae), native to eastern and southern Asia and northern Australia and naturalized in subtropical and temperate regions elsewhere. Ailanthus leaves alternate along the stem and are composed of multiple leaflets arranged along an axis. The most familiar species is the tree of heaven.

Ailey \'ā-lē**, Alvin, Jr.** (b. Jan. 5, 1931, Rogers, Texas, U.S.—d. Dec. 1, 1989, New York, N.Y.) U.S. dancer and choreographer. In 1942 he moved to Los Angeles, where he studied dance and choreography (1949–54). He then moved to New York, where he performed in various theatrical productions. In 1958 he founded the Alvin Ailey American Dance Theater, composed primarily of blacks. The numerous works he choreo-

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graphed for the company included its signature *Revelations* (1960), set to black spirituals. From the 1960s to the 1980s, the company toured worldwide, and Ailey became one of the best-known U.S. choreographers.

Alvin Ailey, Jr., 1960.
COURTESY OF ZACHARY FREYMAN

Ailly \á-ˈyē**, Pierre d'** (b. 1350, Compiègne, Fr.—d. Aug. 9, 1420, Avignon) French theologian and cardinal. D'Ailly worked to end the WESTERN SCHISM. He advocated the doctrine of conciliarism (see CONCILIAR MOVEMENT), which maintained that supreme authority in the church was held by a general council. He was active at the Council of Pisa (1409), which deposed both pope and ANTIPOPE in favour of the new conciliar pope, Alexander V, but failed to end the schism. He was also involved in the Council of Constance (1414–18), which called for the abdication of the antipope John XXIII (r. 1410–15) and the election of another pope (MARTIN V) and ended the schism. His writings included a geographical treatise, *Image of the World*, used by CHRISTOPHER COLUMBUS.

Aintab See GAZIANTEP

Ainu \ˈī-nü\ Indigenous people of what is now Japan. Pushed north by the Japanese people over the last 2,000 years, the few remaining pure Ainu today live principally in northern Hokkaido, Sakhalin, and the Kuril Islands. Once physically and culturally distinct from the Japanese, their origins and their role in Japanese history and prehistory have been the subject of scholarly debate. Many contemporary Ainu claim some connection to the prehistoric JŌMON CULTURE. The Ainu language, which has no known relationship to any other language, is virtually extinct, being supplanted by JAPANESE. The Ainu were traditionally hunters, fishermen, and trappers; their religion centred on spirits believed to be present in animals and the natural world.

Ainu couple in ceremonial dress, Hokkaido, Japan.
COURTESY OF THE CONSULATE GENERAL OF JAPAN, NEW YORK CITY

air Mixture of gases constituting the earth's atmosphere. Some gases occur in steady concentrations. The most important are molecular nitrogen (N_2), 78% by volume, and molecular oxygen (O_2), 21%. Small amounts of argon (Ar; 1.9%), neon (Ne), helium (He), methane (CH_4), krypton (Kr), hydrogen (H_2), nitrous oxide (N_2O), and xenon (Xe) are also present in almost constant proportions. Other gases occur in variable concentrations: water vapour (H_2O), ozone (O_3), carbon dioxide (CO_2), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2). Air also contains trace amounts of ammonia and hydrogen sulfide. The variable constituents are important for maintaining life. Water vapour is the source for all forms of precipitation and is an important absorber and emitter of infrared radiation. Carbon dioxide is necessary for photosynthesis and is also an important absorber and emitter of infrared radiation. Ozone in the STRATOSPHERE (see OZONE LAYER) is an effective absorber of ultraviolet radiation from the Sun but at ground-level is a corrosive pollutant and a major constituent of smog.

air brake Either of two kinds of braking systems. The first, used by trains, trucks, and buses, operates by a piston driven by compressed air from reservoirs connected to BRAKE cylinders (see PISTON AND CYLINDER). When air pressure in the brake pipe is reduced, air is automatically admitted into the brake cylinder. The first practical air brake for railroads was invented in the 1860s by GEORGE WESTINGHOUSE. The second type, used by aircraft and race cars, consists of a flap or surface that can be mechanically projected into the airstream to increase the resistance of the vehicle to air and lower its speed.

air-conditioning Control of temperature, humidity, purity, and motion of air in an enclosed space, independent of outside conditions. In a self-contained air-conditioning unit, air is heated in a boiler unit or cooled by being blown across a refrigerant-filled coil and then distributed to a controlled indoor environment. Central air-conditioning in a large building generally consists of a main plant located on the roof or mechanical floor and intermittently spaced air-handling units, or fans that deliver air through ducts to zones within the building. The air then returns to the central air-conditioning machinery through spaces called plenums to be recooled (or reheated) and recirculated. Alternate systems of cooling use chilled water, with water cooled by a refrigerant at a central location and circulated by pumps to units with fans that circulate air locally.

air-cushion vehicle *or* **hovercraft** Vehicle supported above the surface of land or water by an air cushion, produced by downwardly directed fans, enclosed within a flexible skirt beneath the hull. The concept was first proposed by John Thornycroft in the 1870s, but a working model was not produced until 1955, when Christopher Cockerell solved the problem of keeping the air cushion from escaping from under the vehicle, and formed Hovercraft Ltd. to manufacture prototypes. Problems with skirt design and engine maintenance have restricted the vehicle's commercial application; today hovercraft are used mainly as ferries.

air force Military organization that has the primary responsibility for conducting AIR WARFARE. The air force must gain control of the air, support ground forces (e.g., by attacking enemy ground forces), and accomplish strategic-bombing objectives. Its basic weapons platforms are FIGHTERS, BOMBERS, attack aircraft, and early warning and control aircraft. Since the mid-20th century, some air forces have also been responsible for land-based nuclear missiles as well as nuclear-armed bombers. The army and naval branches of a state's armed forces may also operate aircraft.

Air France *in full* **Compagnie Internationale Air France** French passenger and cargo airline with more than 200 destinations in some 80 countries. It introduced supersonic CONCORDE service in 1976, but financial loss led the company to cease its Concorde operations in 2003. The French government began privatizing the former national airline in July 2002. In 2004 Air France acquired the Dutch airline KLM to create Air France-KLM, one of the largest air carriers in the world. The two airlines, however, continued to operate as separate companies, retaining their own hubs, flights, and logos.

air mass In meteorology, a large body of air having nearly uniform conditions of temperature and humidity at any given altitude. Such a mass has distinct boundaries and may extend hundreds or thousands of miles horizontally and sometimes as high as the top of the TROPOSPHERE. An air mass forms whenever the atmosphere remains in contact with a large, relatively uniform land or sea surface long enough to acquire its temperature and moisture properties. The Earth's major air masses all originate in polar or subtropical latitudes. The middle latitudes constitute essentially a zone of modification, interaction, and mixing of the polar and tropical air masses.

air pollution Release into the atmosphere of gases, finely divided solids, or finely dispersed liquid aerosols at rates that exceed the capacity of the atmosphere to dissipate them or to dispose of them through incorporation into the BIOSPHERE. Dust storms in desert areas and smoke from forest and grass fires contribute to particulate and chemical air pollution. Volcanic activity is the major natural source of air pollution, pouring huge amounts of ash and toxic fumes into the atmosphere. Air pollution may affect humans directly, causing irritation of the eyes or coughing. More indirectly, its effects can be measured far from the source, as, for example, the fallout of tetraethyl lead from automobile exhausts, which has been observed in the oceans and on the Greenland ice sheet. Still less direct are possible effects on global climates. See also SMOG.

air warfare Military operations conducted by airplanes, helicopters, or other aircraft against aircraft or targets on the ground and in the water. Air warfare did not become important until World War I (1914–18). The British, French, German, Russian, and Italian armed forces had flying units, including biplanes armed with machine guns for "dogfights" with enemy FIGHTER AIRCRAFT. ZEPPELINS and larger airplanes carried out bombing raids. The 1920s and '30s saw the development of the monoplane, the all-metal fuselage, and the AIRCRAFT CARRIER. During World War II (1939–45), the BATTLE OF BRITAIN was the first fought exclusively in the air, the Battle of the Coral Sea was the first between carrier-based aircraft, and the atomic bombings of Hiroshima and Nagasaki were the first use of

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nuclear-armed bombers. In the jet age, air power has continued to be used in strategic bombing of an enemy's home territory (as in the Vietnam War, 1965–74), destroying enemy air forces (as in the Arab-Israeli wars), attacking and defending carrier-based naval fleets (as in the Falkland Islands War, 1982), and supporting ground forces (as in the Persian Gulf War, 1990–91).

airbrush PNEUMATIC DEVICE for developing a fine, small-diameter spray of paint, protective coating, or liquid colour (see AEROSOL). The airbrush can be a pencil-shaped atomizer used for various highly detailed activities such as shading drawings and retouching photographs; in contrast, a spray gun is usually used for covering large surfaces with paint.

Airbus S.A.S. European aircraft manufacturer that is the world's second largest maker of commercial aircraft (after BOEING CO.). It is co-owned by the German-French-Spanish EUROPEAN AERONAUTIC DEFENCE AND SPACE COMPANY (EADS), with an 80% interest, and Britain's BAE SYSTEMS, with 20%. Airbus was formed as a consortium in 1970 by French and German aerospace firms (later joined by Spanish and British companies) to fill a market niche for short- to medium-range, high-capacity jetliners and to compete with long-established American manufacturers. Its first product, the A300, entered service in 1974. It was the first wide-body jetliner equipped with only two engines for more economical operation. The twin-engine A320 (entered service 1988) incorporated numerous technical innovations, notably fly-by-wire (electric rather than mechanically linked), computer-based flight controls. The four-engine A340 (1993) and smaller, twin-engine A330 (1994) were long-range airliners. In 2000 Airbus launched development of the A380, intended to be the world's largest passenger jet with a typical seating of 555 people. The consortium integrated into a single company in 2001.

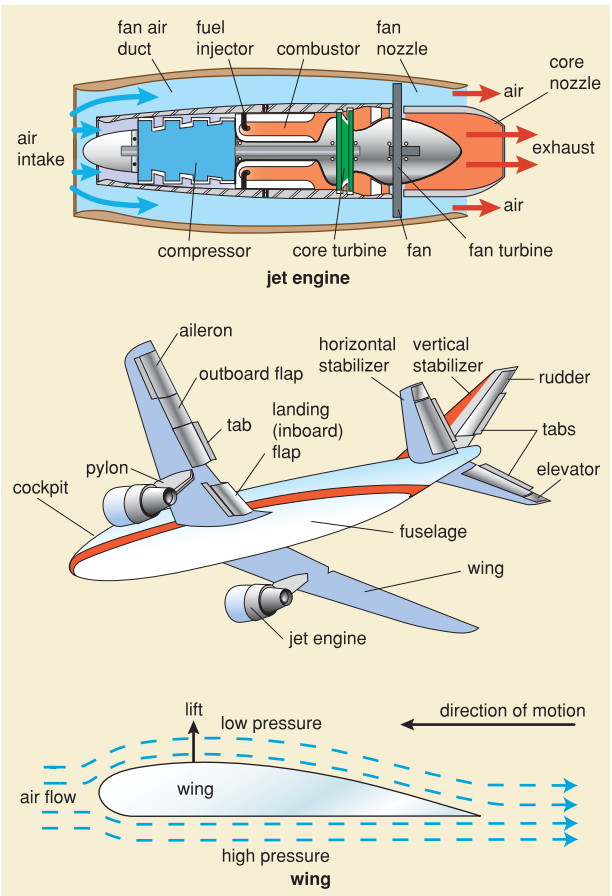
aircraft carrier Naval vessel equipped with a platform that allows airplanes to take off and land. Takeoffs are facilitated by the use of catapults or by a ramp at the end of the flight deck. For landing, aircraft are fitted with retractable hooks that engage arresting wires on the deck, or they are built with vectored-thrust engines that allow them to be landed vertically. Britain's Royal Navy developed the first true aircraft carrier near the end of World War I, and carriers played leading roles in World War II naval engagements such as the Pearl Harbor attack and the Battles of MIDWAY and the Coral Sea. The largest modern carriers are 1,000-ft (300-m) nuclear-powered vessels of the U.S. Navy, which can carry 100 jet aircraft. Other types include the light carrier, equipped for anti-submarine warfare and ground attack, and the helicopter carrier, intended for conducting amphibious assault.

Airedale terrier Dog breed that is the largest of the TERRIERS, probably descended from the otterhound and the extinct Old English terrier. It stands about 23 in. (58 cm) high, weighs 40–50 lbs (18–23 kg), and has a boxy appearance, with a long, squared muzzle. Its coat is dense and wiry, with a black saddle and tan legs, muzzle, and underparts. Intelligent and courageous, powerful and affectionate (though reserved with strangers), the Airedale has been used as a wartime dispatch carrier, police dog, guard, and big-game hunter.

Airedale terrier
SALLY ANNE THOMPSON/EB INC.

airfoil Shaped surface, such as an AIRPLANE wing, tail, or PROPELLER blade, that produces LIFT and DRAG when moved through the air. An airfoil produces a lifting FORCE that acts at right angles to the airstream and a dragging force that acts in the same direction as the airstream. High-speed aircraft usually employ thin, low-drag, low-lift airfoils; slow aircraft that carry heavy loads use thicker airfoils with high drag and high lift.

airplane Fixed-wing aircraft that is heavier than air, propelled by a screw PROPELLER or a high-velocity jet, and supported by the dynamic reaction of the air against its wings. An airplane's essential components are the body or fuselage, a flight-sustaining wing system, stabilizing tail surfaces, altitude-control devices such as rudders, a thrust-providing power source, and a landing support system. Beginning in the 1840s, several British and French inventors produced designs for engine-powered aircraft, but the first powered, sustained, and controlled flight was only achieved by WILBUR AND ORVILLE WRIGHT in 1903. Later airplane design was affected by the development of the JET ENGINE; most airplanes today have a long nose section, swept-back wings with jet engines placed behind the plane's midsection, and a tail stabilizing section. Most airplanes are designed to operate from land; SEAPLANES are adapted to touch down on water, and carrier-based planes are modified for high-speed short takeoff and landing. See also AIRFOIL; AVIATION; GLIDER; HELICOPTER.



Two physical forces essential to airplane flight are thrust and lift. Jet engines, such as the turbofan shown, provide forward thrust by taking in air through the front of the engine, compressing it, and burning it with fuel in the combustor. Hot exhaust gases and air are then expelled at high speed from the rear of the engine. Lift is generated by the flow of air past the wings. Air flowing over the rounded upper surface of a wing moves faster than air flowing past the flat lower surface; as a result, the air above the wing exerts a lower pressure than the air below, producing a net upward force, or lift. Both lift and drag (friction caused by the plane moving through air) can be adjusted by the movement of ailerons, landing flaps, and tabs on the wings' edges. At the rear of the plane, the elevator, located on the horizontal stabilizer, controls the airplane's movement around the lateral axis. Both the elevator and the rudder, located on the vertical stabilizer, help to control turning movements initiated by the ailerons.
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airport Site and installations for the takeoff and landing of aircraft. Early airports were open, grass-covered fields, called landing fields, that allowed a pilot to head directly into the wind to aid a plane's lift on takeoff and to decrease its speed on landing. In the 1930s heavier airplanes required paved runway surfaces. Larger planes needed longer runways, which today can reach 15,000 ft (4,500 m) to accommodate the largest jet aircraft. Air traffic is regulated from control towers and regional centres. Passenger and cargo terminals include baggage-movement and passenger-transit operations.

airship *or* **dirigible** Lighter-than-air aircraft with steering and propulsion systems. Airships could be nonrigid (blimps), semirigid, or rigid.

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They all included a large cigar-shaped bag or balloon filled with a gas such as HYDROGEN or HELIUM, a car or gondola suspended below the balloon that held the crew and passengers, engines to drive the propellers, and rudders for steering. Attempts to control the flight of balloons began soon after their invention in the 1780s. The first propeller-driven airship, built by Henri Giffard, flew in 1852 in France; design improvements led to construction of the rigid ZEPPELIN (1900). The nonrigid helium-filled blimp was principally developed by Alberto Santos-Dumont (1873–1932). In 1928 Germany began regular transatlantic airship passenger service. Several explosions, particularly the 1937 *HINDENBURG* DISASTER, and AIRPLANE developments made the airship commercially obsolete. See also BALLOON.

ʿĀʾishah \ʿä-ēshə\ **(bint Abī Bakr)** (b. 614, Mecca, Arabia—d. July 678, Medina) Third wife of MUHAMMAD. The daughter of his supporter ABŪ BAKR, she became Muhammad's favourite wife. Left a childless widow at 18, she became politically active during the reign of the third caliph, ʿUTHMĀN IBN ʿAFFĀN, leading the opposition that resulted in his murder in 656. She led an army against his successor, ʿAlī, who defeated her in the Battle of the Camel. She was allowed to live her remaining years quietly in Medina and is credited with transmitting more than a thousand ḤADĪTH.

Aitken, William Maxwell See Baron BEAVERBROOK

Aix-en-Provence \ˌeks-äⁿ-prō-ˈväⁿs\ City (pop., 1999: 134,222), southeastern France. Founded as a military colony by the Romans c. 123 BC, it was the scene of the defeat of the Teutons by MARIUS in 102 BC. Visigoths, Franks, Lombards, and finally Muslim invaders from Spain successively plundered the town. As the capital of PROVENCE, it was a centre of culture during the Middle Ages; it became part of France in 1486. It is now a residential suburb of MARSEILLE; its industries include tourism, food processing, and the manufacturing of electrical machinery.

Aix-la-Chapelle See AACHEN

Aix-la-Chapelle \ˌeks-lä-shə-ˈpel**, Congress of** (Oct. 1–Nov. 15, 1818) First of four congresses held by Britain, Austria, Prussia, Russia, and France to address European problems following the NAPOLEONIC WARS. At Aix-la-Chapelle (now Aachen, Ger.), the participants accepted an offer by France to pay most of the war indemnity owed to the allies in exchange for the withdrawal of their armies of occupation. France was also admitted to the new Quintuple Alliance.

Aix-la-Chapelle, Treaty of (Oct. 18, 1748) Treaty that ended the War of the AUSTRIAN SUCCESSION. The treaty, negotiated largely by Britain and France, was marked by the mutual restitution of conquests, including the fortress of Louisbourg (in Nova Scotia) to France and Madras (now Chennai; in India) to England. It preserved MARIA THERESA's right to the Austrian lands, but the Habsburgs were weakened by Prussia's retention of SILESIA. The treaty did not resolve any issues in the commercial colonial struggle between England and France and thus did not lead to a lasting peace.

Aizawl \ī-ˈzau̇l\ City (pop., 2001 prelim.: 229,714), capital of MIZORAM state, India. It is situated on a ridge at an elevation of about 2,950 ft (900 m) The surrounding region is part of the Assam-Myanmar geologic province, with steeply inclined hill ranges. Many in the population are from Myanmar. In the 1970s Aizawl was the scene of an armed attack on the government treasury by members of the Mizo National Front. Manufactures include aluminum utensils, handloom textiles, and furniture.

Ajax Greek hero of the TROJAN WAR. In the *Iliad* HOMER described him as of great stature and second only to ACHILLES in strength and bravery. He fought HECTOR in single combat and rescued the body of Achilles from the hands of the Trojans. When Achilles's armour was awarded to ODYSSEUS, he was so enraged that he went mad. According to several Greek and Roman poets, Ajax slaughtered a flock of sheep he mistook for his enemies, then returned to his senses and killed himself out of shame.

Ajodhya See AYODHYA

AK \ˈā-ˈkā\ **-47** Soviet ASSAULT RIFLE. Designed by Mikhail T. Kalashnikov (its name stands for "automatic Kalashnikov 1947"), it had both semiautomatic and automatic capabilities and fired intermediate-power 7.62-mm ammunition. It was manufactured in the former Soviet Union and Soviet-bloc countries and soon became the basic shoulder weapon for virtually all communist armies as well as for many guerrilla and nationalist movements. In the Soviet military it was replaced in the 1960s by the AKM, which featured a lighter, cheaper stamped-metal receiver, and in the 1970s by the AK-74, which fired a high-velocity 5.45-mm round. See also M16 RIFLE.

Akal Takht \ə-ˈkäl-ˈtək-tə\ Chief centre of religious authority for Indian Sikhs, located in Amritsar opposite the GOLDEN TEMPLE. It also serves as the headquarters of the AKALI PARTY. Since the line of GURUS came to an end in 1708, the Sikh community has settled religious and political disputes at meetings in front of the Akal Takht. In the 20th century local congregations began to pass resolutions on matters of Sikh doctrine and rules of conduct; disputed resolutions may be appealed to the Akal Takht. It was badly damaged during the assault on the Golden Temple by the Indian army in 1984 and had to be rebuilt. See also SIKHISM.

Akali Party \ə-ˈkä-lē\ Sikh political party in India. The term Akali was first applied to suicide squads that appeared in the Sikh armies c. 1690 in response to Mughal persecution. The Akali name was revived in the 1920s during the GURDWARA reform movement to refer to a semimilitary corps of volunteers opposed to British rule. Akalis took the lead in agitation for a Punjabi-speaking Sikh-majority state, a goal achieved in 1966 with the establishment of the Indian state of PUNJAB. The modern Akali Party participates in national elections but is mainly concerned with the status of the Sikhs in Punjab.

Akan \ˈä-ˌkän\ Cluster of peoples inhabiting southern Ghana, eastern Côte d'Ivoire, and parts of Togo. Their languages are of the KWA branch of NIGER-CONGO LANGUAGES. In the 14th–18th centuries several Akan states, notably the FANTE confederacy and the ASANTE empire, formed in regions where gold was produced and traded. Many of the Akan, who number some 16 million, work in urban districts.

Akbar *in full* **Abū al-Fatḥ Jalāl al-Dīn Muḥammad Akbar** (b. Oct. 15, 1542, Umarkot, Sind, India—d. 1605, Agra) Greatest of the Mughal emperors (see MUGHAL DYNASTY) of India (r. 1556–1605). Akbar, whose ancestors included TIMUR and GENGHIS KHAN, ascended the throne as a youth. Initially his rule extended only over the Punjab and the area around Delhi. The Rajput raja of Amber (Jaipur) acknowledged his suzerainty in 1562, and other Rajput rajas followed suit. Akbar included Rajput princes and other Hindus in the highest ranks of his government and reduced discrimination against non-Muslims. He continued his conquests, taking Gujarat in the west (1573) and Bengal in the east (annexed in 1576). Toward the end of his reign he conquered Kashmir (1586) and moved south into the Deccan. Administratively, he strengthened central power, establishing that all military officers and civil administrators were to be appointed by the emperor. He encouraged scholars, poets, painters, and musicians, making his court a centre of culture. He had Sanskrit classics translated into Persian and was enthusiastic about the European paintings presented to him by Jesuit missionaries. His reign was often portrayed as a model by later governments—strong, benevolent, tolerant, and enlightened. See also BĀBUR.

Akerlof, George A. (b. June 17, 1940, New Haven, Conn., U.S.) U.S. economist. He studied at Yale University (B.A., 1962) and the Massachusetts Institute of Technology (Ph.D., 1966) and in 1966 began teaching at the University of California, Berkeley, becoming Goldman Professor of Economics in 1980. Akerlof's research often drew on other disciplines, including psychology, anthropology, and sociology, and he played an important role in the development of behavioral economics. His landmark study on asymmetric information in the used car market demonstrated how markets malfunction when sellers have more information than buyers. Akerlof shared the 2001 Nobel Prize for Economics with A. MICHAEL SPENCE and JOSEPH E. STIGLITZ.

Akhenaton, detail of the sandstone pillar statue from the Aton temple at Karnak, c. 1370 BC; in the Egyptian Museum, Cairo.
HIRMER FOTOARCHIV, MUNCHEN

Akhenaton *or* **Akhnaton** \äk-ˈnä-tᵊn\ *orig.* **Amenhotep** \ˈä-mən-ˈhō-ˌtep\ **IV** (r. 1353–36 BC) Egyptian pharaoh of the 18th dynasty (1539–1292 BC). He came to power during a period of Egyptian preeminence, with Egypt controlling Palestine, Phoenicia, and Nubia.

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Shortly after his reign began, he began to encourage the exclusive worship of the little-known deity ATON, a sun god he regarded as the source of all blessings. Assuming the name Akhenaton ("One Useful to Aton"), he moved his capital from Thebes to present-day TELL EL-AMARNA to escape established religious powers and make a fresh start. A new art style that focused on the details of actual life rather than on timeless conditions became popular. In government, Akhenaton tried to recapture the old authority of the ruler, which had been largely diverted to bureaucrats and officials, but his focus on his new religion to the exclusion of affairs of state resulted in the disintegration of Egypt's Asian empire. He was succeeded by two of his sons-in-law, Smenkhkare and TUTANKHAMEN, but after Tutankhamen's early death the army took over the throne, and Akhenaton's new religion was abandoned.

Akhmatova \ə-ˈkmä-tə-və**, Anna** *orig.* **Anna Andreyevna Gorenko** (b. June 23, 1889, Bolshoy Fontan, near Odessa, Ukraine, Russian Empire—d. March 5, 1966, Domodedovo, near Moscow) Russian poet. She won fame with her first poetry collections (1912, 1914). Soon after the Revolution of 1917, Soviet authorities condemned her work for what they perceived as its narrow preoccupation with love and God, and in 1923, after the execution of her former husband on conspiracy charges, she entered a long period of literary silence. After World War II she was again denounced and expelled from the Writers Union. Following JOSEPH STALIN's death in 1953, she was slowly rehabilitated. In her later years she became the influential centre of a circle of younger Russian poets. Her longest work, *Poem Without a Hero*, is regarded as one of the great poems of the 20th century. Regarded today as one of the greatest of all Russian poets, she is also admired for her translations of other poets' works and for her memoirs.

Anna Akhmatova.
NOVOSTI PRESS AGENCY

Akiba ben Joseph \ä-ˈkē-vä-ben-ˈjō-zəf\ (b. AD 40—d. c. 135, Caesarea, Palestine) Jewish sage, one of the founders of RABBINIC JUDAISM. He is said to have been an illiterate shepherd who began to study after age 40. He believed that Scripture contained many implied meanings in addition to its overt meaning, and he regarded written law (Torah) and oral law (Halakhah) as ultimately one. He collected and systematized the oral traditions concerning the conduct of Jewish social and religious life, thus laying the foundation of the MISHNA. He may have been involved in BAR KOKHBA's unsuccessful rebellion against Rome; he gave the rebel leader his title and recognized him as the MESSIAH. He was imprisoned by the Romans and martyred for his public teaching. See also ISHMAEL BEN ELISHA.

Akihito \ä-ˈkē-hē-ˌtō\ *or* **Heisei** \ˈhā-ˈsā\ **emperor** (b. Dec. 23, 1933, Tokyo, Japan) Emperor of Japan from 1989. Son of HIROHITO, his role, like that of his father after 1945, has been largely ceremonial. He is the first Japanese emperor to have married a commoner, in what was hailed at the time as a love match rather than the customary arranged marriage. His children are Crown Prince Naruhito, Prince Akishino, and Princess Nori.

Akita \ə-ˈkē-tə\ Breed of working dog that originated in the mountains of northern Japan. In 1931 the Japanese government designated the breed as a national treasure. It is a powerful, muscular dog with a broad head, erect pointed ears, and a large curved tail carried over the back or curled against the flank. Colours and markings vary, including all-white, brindle, and pinto. All but the white akitas bear a distinct mask (dark area around the muzzle). Males stand 26–28 in. (66–71 cm) high, females 24–26 in. (60–66 cm).

Akkad \ˈa-kad\ Ancient region, central Iraq. Akkad was the northern division of ancient BABYLONIA (SUMER was the southern division). Its name was taken from the city of Agade, founded by the conqueror SARGON c. 2300 BC. Sargon united the city-states in the region and extended the empire to much of MESOPOTAMIA, including Sumer, ELAM, and the upper TIGRIS. The empire waned in the 22nd century BC. Under the kings of Akkad, their Semitic language, AKKADIAN, became a literary language, and great art was fostered.

Akkadian \ə-ˈkā-dē-ən\ **language** *or* **Assyro-Babylonian language** SEMITIC LANGUAGE spoken in Mesopotamia in the 3rd–1st millennia BC. It is known from a great many inscriptions, seals, and clay tablets in CUNEIFORM WRITING. Akkadian supplanted Sumerian as the major spoken language of southern Mesopotamia by 2000 BC and about this time split into an Assyrian dialect spoken in the northeast and a Babylonian dialect spoken in the south. Akkadian died out as a vernacular in the first half of the 1st millennium BC, being effectively replaced by ARAMAIC in Mesopotamia, though it continued to be written until about the 1st century AD.

ʿAkko \ˈä-kō\ *or* **Acre** \ˈä-krə, ˈä-kər\ Seaport town (pop., 2000 est.: 45,737), northwestern ISRAEL. First mentioned in an Egyptian text from the 19th century BC, it was long a Canaanite and Phoenician city. After its conquest by Alexander the Great (336 BC), it was a Greek polity (called Philadelphus), and for several centuries it remained part of the Roman Republic and Empire. The Persians (614) and Arabs (638) conquered the town, but it was ruled by the Turkish SELJŪQ DYNASTY when the Crusaders captured it in 1104. The Crusaders renamed the city St. Jean d'Acre and made it their last capital (see CRUSADES). Except for brief intervals, it was under the rule of the OTTOMAN EMPIRE from 1516 until British forces took it in 1918. It was part of Palestine under the British mandate and became part of Israel in 1948, when most of its Arab inhabitants fled. Notable structures include the Great Mosque and the Crypt of St. John. It is the burial place of BAHĀʾ ULLĀH, the founder of the BAHĀʾĪ FAITH.

Akmola See ASTANA

Akron City (pop., 2000: 217,074), northeastern Ohio, U.S., on the CUYAHOGA RIVER. At 1,200 ft (370 m) above sea level, Akron was named for its "high place" (Greek: *acros*) on the watershed between the MISSISSIPPI RIVER and the GREAT LAKES. Laid out in 1825, the town was assured substantial growth by the completion of two canals (1827, 1840). The abundant water supply and the arrival of the railroads prompted Benjamin Franklin Goodrich to move a rubber factory there in 1871. Akron became known as "rubber capital of the world," although by the 21st century much production had moved from the area.

Aksum *or* **Axum** \ˈäk-ˌsüm\ Ancient kingdom, northern Ethiopia. At its apogee (3rd–6th century AD), Aksum merchants traded as far as ALEXANDRIA and beyond the NILE RIVER. The modern town of Aksum (pop., 1994: 27,148), once the kingdom's capital, is a religious centre best known for its antiquities. It has long been regarded as a holy city for the ETHIOPIAN ORTHODOX CHURCH; according to tradition, King Menilek I, son of SOLOMON and the Queen of SHEBA, brought the ARK OF THE COVENANT there from Jerusalem. Aksum's antiquities have made it a tourist centre.

Akwamu \ˈäk-wä-mü\ Historical state of western Africa's GOLD COAST (now Ghana). Founded by an AKAN people c. 1600, it grew rich on the sale of gold. At its height in the early 18th century, Akwamu stretched more than 250 mi (400 km) along the coast, from Whydah (now Ouidah, Benin) in the east to beyond Winneba (now in Ghana) in the west. By 1710 the state was being pressured by other groups (including the ASANTE) that had grown powerful in the area, and by 1731 it had ceased to exist.

Āl Among Arab groups, a term denoting a tribe, clan, family, or other patrilineal filiation. It often refers to a ruling line or dynasty and generally precedes a substantive name (e.g., Āl Saʿūd) but is not connected by a hyphen; it is unrelated to the Arabic definite article, *al-*. In *Britannica Concise Encyclopedia*, entries for Arab tribal and dynastic groups are alphabetized under the substantive (e.g., for Āl Saʿūd, see SAʿŪD DYNASTY).

al- Arabic definite article, meaning "the." It prefixes Arabic nouns, from which it is generally separated by a hyphen when rendered in Latin script. In *Britannica Concise Encyclopedia*, entries are alphabetized under the noun the article modifies (e.g., see AZHAR UNIVERSITY, AL-).

Al-Jazīrah See GEZIRA

al-Khwārizmī \al-ˈkwär-iz-mē\ *Arabic in full* **Muḥammad ibn Mūsā al-Khwārizmī** (b. c. 780, Baghdad, Iraq—d. c. 850) Muslim mathematician and astronomer. He lived in Baghdad during the golden age of Islamic science and, like EUCLID, wrote mathematical books that collected and arranged the discoveries of earlier mathematicians. His *Al-Kitāb al-mukhtaṣar fī ḥisāb al-jabr wa'l-muqābala* ("The Compendious Book on Calculation by Completion and Balancing") is a compilation of rules for solving linear and QUADRATIC EQUATIONS, as well as problems of geometry and PROPORTION. Its translation into Latin in the 12th century provided the link between the great Hindu and Arab mathematicians and

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European scholars. A corruption of the book's title resulted in the word *algebra*; a corruption of the author's own name resulted in the term *algorithm*.

Alabama State (pop., 2000: 4,447,000), southern central U.S. It is bordered by Tennessee, Georgia, Florida, and Mississippi; the Gulf of Mexico lies to the southwest. Covering 51,718 sq mi (133,950 sq km), its capital is Montgomery. Its original inhabitants included Cherokee, Chickasaw, Choctaw, and Creek Indians; evidence of their activity can be found near Tuscaloosa. Hernando de Soto traveled there, and the French founded a settlement at Fort Louis in 1702. The Alabama Territory was created in 1817, and statehood was granted in 1819. Alabama seceded from the Union in 1861, becoming part of the Confederacy; it was readmitted in 1868. Efforts during Reconstruction to include blacks in government failed, and Alabama remained segregationist until the 1960s. Dependent on cotton until the early 20th century, the state has since diversified its agricultural production and developed industrially, especially at Birmingham; Mobile has become a major ocean terminal.

Alabama claims U.S. maritime grievances against Britain in the American Civil War. Although Britain had declared official neutrality in the war, it allowed the Confederate cruiser *Alabama*, which later destroyed 68 Union ships, to be constructed in England. U.S. ambassador Charles Francis Adams demanded that the British take responsibility for these damages, and he advocated arbitration to settle the matter. In May 1871 the parties signed the Treaty of Washington, which established certain wartime obligations of neutrals. The tribunal also held Britain liable for losses and awarded the U.S. damages of $15.5 million.

Alabama River River, southern Alabama, U.S. Formed by the Coosa and Tallapoosa rivers northeast of Montgomery, it winds westward to Selma and then flows southward. The river's navigable length is 305 mi (491 km). It is joined above Mobile by the Tombigbee River to form the Mobile and Tensaw rivers, which flow into Mobile Bay. Mobile and Montgomery became major cities largely because they were on this important artery.

alabaster Fine-grained gypsum that has been used for centuries for statuary, carvings, and other ornaments. It normally is snow-white and translucent but can be artificially dyed; it may be made opaque and similar in appearance to marble by heat treatment. Florence, Livorno, Milan, and Berlin are important centres of the alabaster trade. The alabaster of the ancients was a brown or yellow onyx marble.

Alaca Hüyük \ˌä-lä-ˈjä-hē̆-ˌyük\ Ancient Anatolian site, north-central Turkey. It lies northeast of the old Hittite capital of Bogazköy. Traces of a Hittite building were found in the early 20th century and below them a royal necropolis of tombs from c. 2500 BC. There is evidence of the advanced accomplishments of Copper Age metallurgy in the form of jewelry, bowls, and jugs. Though the ethnic identity of the preliterate inhabitants is uncertain, they probably belonged to the non-Indo-European population that preceded the Hittites.

Aladdin Hero of a well-known story in *The Thousand and One Nights*. The son of a poor widow, Aladdin is a lazy, careless boy who meets an African magician claiming to be his uncle. He sends Aladdin into a cave to find a magic lamp, but Aladdin refuses to hand over the lamp until he is safely out of the cave. The angry magician shuts the boy in the cave and departs, but Aladdin discovers that he can summon powerful genies (jinn) by rubbing the lamp. The genies grant his every wish, and Aladdin becomes rich, marries the sultan's beautiful daughter, and reigns for many years.

Alamein, Battles of El See Battles of El Alamein

Alamgīr \ˈäl-əm-ˌgēr\ **II** *in full* **ʿAzīz al-Dīn ʿAlamgīr II** (b. June 6, 1699, Multan, India—d. Nov. 29, 1769, Delhi) Mughal emperor of India (1754–59). He was placed on the throne by the imperial vizier Imād al-Mulk Ghāzī al-Dīn and was always the puppet of more powerful men, including the Afghan ruler Ahmad Shah Durrānī, whose agents occupied Delhi in 1757 and made Alamgīr the nominal emperor of Hindustan. He was murdered by Ghāzi al-Dīn, who feared Alamgīr might be captured and used against him in another Afghan invasion.

Alamo Eighteenth-century mission in San Antonio, Texas, site of a historic siege of a small group of Texans by a Mexican army (1836) during the Texas war for independence from Mexico. The abandoned mission was occupied occasionally by Spanish troops, who named it the Alamo ("cottonwood") after the surrounding trees. At the start of the war in December 1835, volunteers occupied the Alamo and vowed to fight to the death any attempt to recapture it. In February 1836 a Mexican army of several thousand began a siege that lasted 13 days. The Texan force of about 180, led by Jim Bowie and including Davy Crockett, was overrun; nearly all the defenders were killed (about 15 persons, mostly women and children, were spared). Mexican casualties were at least 600. "Remember the Alamo!" became a rallying cry for Texans through the remainder of the war.

Alanbrooke (of Brookeborough), Alan Francis Brooke, 1st Viscount (b. July 23, 1883, Bagnères-de-Bigorre, France—d. June 17, 1963, Hartley Wintney, Hampshire, Eng.) British military leader. He served in World War I and later became director of military training (1936–37) and an expert on gunnery. In World War II he began as commander of a corps in France and covered the Dunkirk evacuation. After serving as commander of the British home forces (1940–41), he was promoted to chief of staff (1941–46). He established good relations with the U.S. forces and exercised a strong influence on Allied strategy. He was promoted to field marshal in 1944 and created a viscount in 1946.

Åland \ˈō-ˌländ\ **Islands** Archipelago, southwestern Finland, constituting Ahvenanmaan autonomous *kunta* (commune). It consists of about 35 inhabited islands (pop., 2002 est.: 26,000) and more than 6,000 uninhabited ones, with a total land area of 599 sq mi (1,552 sq km). Åland, the largest island, is the location of Mariehamn, the administrative capital and chief seaport. The islands were Christianized by 12th-century Swedish missionaries. When Finland declared its independence in 1917, the Ålanders sought to become part of Sweden. Though the archipelago remains with Finland, it has been given unique autonomy.

alanine \ˈa-lə-nēn\ Either of two organic compounds. Alpha-alanine is one of the nonessential amino acids, found in most proteins and particularly abundant in fibroin, the protein in silk. It is used in research and as a dietary supplement. Beta-alanine is a naturally occurring amino acid not found in proteins. It is an important constituent of the vitamin pantothenic acid and is used in its synthesis, as well as in biochemical research, electroplating, and organic synthesis.

Alaric \ˈa-lə-rik\ **I** (b. c. 370, Peuce Island—d. 410, Cosentia, Bruttium) Chief of the Visigoths (395–410). He commanded Gothic troops in the Roman army before leaving to become chief of the Visigoths. He led his tribe into Greece, sacking cities until placated by the Eastern emperor (397). He twice led invasions of Italy, the second time extorting a large payment from the Roman Senate. Alaric's forces grew after the Romans massacred the wives and children of Visigoths serving in the Roman army. He besieged Rome (408, 409), proclaiming Priscus Attalus as Western emperor. In 410 Alaric occupied and plundered Rome, the first time the city had been captured by a foreign enemy in 800 years. See also Goths.

Alaska State (pop., 2000: 626,932) of the U.S., lying at the northwest extremity of North America. It is the largest in area of the U.S. states, covering 587,875 sq mi (1,522,595 sq km). Bordered by Canada to the east and southeast and facing Siberia across the Bering Strait and Bering Sea to the west, it has the highest point on the continent, Mount McKinley. Its capital is Juneau. The original inhabitants, Indians and Eskimos, are thought to have migrated over the Bering Land Bridge as well as from the Arctic. The first European settlement was established in the late 18th century by Russian fur traders on Kodiak Island. Hudson's Bay Co. traders were also interested in the same area, and Russian-Canadian trade rivalry lasted well into the 19th century. In 1867 William Seward negotiated Alaska's sale from the Russians to the U.S., and the subsequent discovery of gold stimulated American settlement. Alaska was a U.S. territory from 1912 until it was admitted as the 49th state in 1959. Its economy has become increasingly centred on oil and natural gas: since the opening of the Trans-Alaska Pipeline in 1977, Alaska has become second only to Texas in the U.S. production of crude oil.

Alaska, Gulf of Broad inlet, southern Alaska, U.S. Situated between the Alaska Peninsula and the Alexander Archipelago, it receives the Susitna and Copper rivers. Ports on the gulf include Anchorage, Seward, and Valdez; the last is North America's northernmost year-round harbour and the Trans-Alaska Pipeline's terminal. In 1741 a Russian expedition led by Vitus Bering, a Dane, became the first Europeans to enter the Gulf.

Alaska Highway *formerly* **Alcan Highway** Road through the Yukon, connecting Dawson Creek, British Columbia, with Fairbanks,

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Alaska, a distance of 1,523 mi (2,451 km). It was constructed by U.S. Army engineers in 1942 as an emergency war measure to provide an overland military supply route to Alaska. It is a scenic route now open year-round.

Alaska Peninsula Peninsula, southwestern Alaska, U.S. It stretches about 500 mi (800 km) between the Pacific Ocean and Bristol Bay. The volcanic Aleutian Range runs along its entire length. It is the site of Katmai National Park and Preserve, Aniakchak National Monument and Preserve, and the Becherof, Alaska Peninsula, and Izembek national wildlife refuges.

Alaska Pipeline See Trans-Alaska Pipeline

Alaska Purchase Acquisition in 1867 by the U.S. from Russia of 586,412 sq mi (1.5 million sq km) at the northwestern tip of North America, comprising the current U.S. state of Alaska. The territory, held by Russia since 1741, was considered an economic liability, and in 1866 it was offered for sale. Pres. Andrew Johnson's secretary of state, William Seward, negotiated its purchase for $7.2 million, or about two cents per acre. Critics labeled the purchase "Seward's Folly." Congressional opposition delayed the appropriation until 1868, when extensive lobbying and bribes by the Russian minister to the U.S. secured the required votes.

Alaska Range Mountain range, southern Alaska, U.S. A segment of the Pacific mountain system, it extends in an arc from the Aleutian Range on the Alaska Peninsula to the Yukon Territory boundary. Mount McKinley, near the centre of the range, in Denali National Park and Preserve, is the highest point in North America. Many nearby peaks exceed 13,000 ft (4,000 m), including Mounts Silverthrone, Hunter, Hayes, and Foraker. The range is crossed at Isabel Pass by the Trans-Alaska Pipeline.

Alaskan king crab See king crab

Alaskan malamute Sled dog developed by the Malemiut, an Eskimo group. It is a strongly built dog with a broad head, erect ears, and a plumelike tail carried over its back. Its thick coat is usually gray and white or black and white, the colours frequently forming a caplike or masklike marking on the head. It stands 23–25 in. (58–64 cm) tall and weighs 75–85 lbs (34–39 kg). Characteristically loyal and friendly, it has served on expeditions to the Antarctic.

Alaungpaya \ä-ˌlä-ůŋ-'pī-ə\ **dynasty** *or* **Konbaung** \ˌkòn-bå-'ůŋ\ **dynasty** (1752–1885) Last ruling dynasty of Myanmar. In the face of the fragmentation of the Toungoo dynasty, Alaungpaya (1714–60), headman in a village near Mandalay, raised an army and subdued the separatist Mon people in southern Myanmar and then conquered the northeastern Shan states. He attacked the Siamese capital of Ayutthaya (now in Thailand) but was forced to retreat. His son Hsinbyushin, the third king of the dynasty (r. 1763–76), sent armies into neighbouring kingdoms and successfully rebuffed four retaliatory Chinese invasions. The sixth king, Bodawpaya (r. 1782–1819), mounted a number of unsuccessful campaigns against the Siamese and moved the capital to Amarapura. He also conquered the kingdom of Arakan. His incursions into Assam aroused the ire of the British, and under Bagyidaw (r. 1819–37) Myanmar (subsequently Burma) was defeated in the first Anglo-Burmese War. From then on the dynasty's hold on Myanmar gradually declined, ending in total annexation by the British in 1885.

Alawites See ʿAlawiyyah

ʿAlawiyyah \'å-lå-wē-'ya\ *or* **Alawite** \a-lə-'wēt\ *or* **Nuṣayriyyah** \nü-sī-rē-'ya\ Minority sect of Shiʿite Islam. The sect, which exists mainly in Syria, traces its roots to the teachings of Muḥammad ibn Nuṣayr al-Namīrī (fl. 850) and was chiefly established by Ḥusayn ibn Ḥamdān al-Khaṣībī (d. 957/958). Its basic doctrine includes a deification of ʿAlī and an interpretation of the five Pillars of Islam as symbolic. Some of the group's religious practices are secret; it celebrates some Islamic and some Christian holidays.

Alba, Fernando Álvarez de Toledo (y Pimentel), 3rd duke de (b. Oct. 29, 1507, Piedrahita, Old Castile, Spain—d. Dec. 11, 1582, Lisbon) Spanish soldier. He commanded Charles V's imperial armies to defeat the Schmalkaldic League in 1547, and he served as viceroy of Naples (1556–59). As a chief minister to Philip II, Alba became notorious for his tyranny as governor-general of the Netherlands (1567–73), where he instituted the Council of Troubles. That court set aside local laws and condemned some 12,000 people for rebellion. Recalled to Spain in 1573, Alba later conducted a brilliant campaign against Portugal (1580) but never regained Philip's favor. See photograph above.

Fernando Álvarez de Toledo, 3rd duke de Alba, oil painting by Sir Antony More, 1549; in the Royal Museums of Fine Arts of Belgium, Brussels.
COURTESY OF THE MUSÉES ROYAUX DES BEAUX-ARTS, BRUSSELS

albacore Large oceanic tuna (*Thunnus alalunga*) that is noted for its fine flesh. The streamlined bodies of these voracious predators are adapted to fast and continuous swimming. They occur in both the Atlantic and Pacific oceans and migrate long distances. The bluefin tuna is also sometimes called albacore.

Albani, Francesco *or* **Francesco Albano** (b. March 17, 1578, Bologna, Papal States—d. October 1660, Bologna) Italian painter. He trained with the Carracci family in Bologna then moved to Rome in 1601 and collaborated with Annibale Carracci and Domenichino on the decoration of the Farnese Palace. While in Rome he established his own studio and painted frescoes in various churches and palaces. In 1617 he returned to Bologna and produced altarpieces, allegorical paintings, and idyllic landscapes. His best-known paintings are of mythological and poetic subjects.

Albania *officially* **Republic of Albania** Country, Balkan Peninsula, southeastern Europe. Area: 11,082 sq mi (28,703 sq km). Population (2005 est.): 3,130,000. Capital: Tiranë. Language: Albanian (official).

Albanians comprise two major subgroups: Gegs (Ghegs) and Tosks. Religions: Islam, Christianity. Currency: lek. Albania may be divided into two major regions: a mountainous highland and, to the west, an Adriatic coastal lowland that contains the country's agricultural lands and most of its population. Albania has a developing free-market economy that until 1991 was shaped by a socialist system of state ownership. The Albanians are descended from the Illyrians, an ancient Indo-European people who lived in central Europe and migrated south by the beginning of the Iron Age (see Illyria). The Gegs settled in the north and the Tosks in the south, along with Greek colonizers. The area was under Roman rule by the 1st century BC; after AD 395 it was connected administratively to Constantinople. Turkish invasion began in the 14th century and continued into the 15th; though the national hero, Skanderbeg, was able to resist them for a time, after his death (1468) the Turks consolidated their rule. The coun-

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try achieved independence in 1912 and was admitted into the League of Nations in 1920. It was briefly a republic (1925–28), then became a monarchy under Zog I, whose initial alliance with Italy deteriorated into that country's invasion of Albania in 1939. After the war a socialist government under Enver Hoxha was installed, and gradually Albania cut itself off from the nonsocialist international community and eventually from all other countries, including China, its last political ally. By 1990 economic hardship had fomented antigovernment demonstrations that led to the election of a noncommunist government in 1992 and the end of Albania's international isolation. Early in the 21st century, Albania continued to experience economic uncertainty and ethnic turmoil, the latter involving Albanian minorities in Serbia and Montenegro (see Kosovo conflict) and Macedonia.

Albanian language Indo-European language spoken by five to six million people in Albania, Kosovo in Serbia and Montenegro, western Macedonia, and enclaves elsewhere, including southern Italy and southern Greece. There are two main dialect groups, Gheg (Geg) in the north, including Kosovo and Macedonia, and Tosk in the south. Albanian is the only extant representative of a distinct branch of Indo-European, whose pre-Roman Balkan ancestry is uncertain. The earliest written attestation is from the 15th century, though a standard orthography using the Latin alphabet was not adopted until 1909. The core vocabulary of Albanian is native, though in the course of its history it has absorbed many loanwords from Greek, Latin, Balkan Romance languages (see Romanian), Slavic languages, and Turkish.

Albany \'ȯl-bə-nē\ City (pop., 2000: 95,658), capital of New York state, U.S. It lies along the Hudson River 145 mi (230 km) north of New York City. The first permanent settlement, named Beverwyck, was built in 1624 by the Dutch. When the British took the area in 1664, the village was renamed to honour the duke of York and Albany. In 1754 the Albany Congress adopted Benjamin Franklin's "Plan of Union." In the 19th century Albany became a major transportation centre. Its focal point today is Empire State Plaza, a governmental, cultural, and convention complex.

Albany Congress Conference convened by the British Board of Trade in 1754 at Albany, N.Y. They advocated a union of the British colonies in North America, in part to secure a defensive union against the French before the outbreak of the French and Indian War. In addition to colonial delegates, several representatives of the Iroquois Confederacy were present. Delegates including Benjamin Franklin supported a plan to unify the seven colonies, but it was never adopted. The plan became a model for proposals made during the American Revolution.

"Join, or Die," the first known American cartoon, published by Benjamin Franklin in his *Pennsylvania Gazette*, 1754, to support his plan for colonial union presented at the Albany Congress
THE GRANGER COLLECTION, NEW YORK

albatross Any of more than a dozen species of large seabirds (family Diomedeidae). Albatrosses are among the most spectacular gliders of all birds; in windy weather they can stay aloft for hours without flapping their wings. They drink seawater and usually eat squid. Albatrosses come ashore only to breed, in colonies typically established on remote oceanic islands. Adults of common species attain wingspans of 7–11 ft (200–350 cm). Albatrosses live long and may be among the few birds to die of old age. They were once held in awe by seamen, who held that killing one would bring bad luck.

albedo \al-'bē-dō\ Fraction of light reflected by a body or surface, commonly used in astronomy to describe the reflective properties of planets, natural satellites, and asteroids. "Normal" albedo (the relative brightness of a surface when illuminated and observed from directly above) is often used to determine the surface compositions of satellites and asteroids. The albedo, diameter, and distance of such objects together determine their brightness.

Albee \'ȯl-bē**, Edward (Franklin)** (b. March 12, 1928, Virginia, U.S.) U.S. playwright. He was the adopted grandson and namesake of a well-known vaudeville theatre manager. His first one-act play, *The Zoo Story* (1959), and other early plays, including *The Sandbox* (1960) and *The American Dream* (1961), were characteristic of the Theatre of the Absurd. His *Who's Afraid of Virginia Woolf* (1962; film, 1966) was widely acclaimed. He won Pulitzer prizes for *A Delicate Balance* (1966), *Seascape* (1975), and *Three Tall Women* (1991). He has also adapted other writers' works for the stage, including Vladimir Nabokov's *Lolita* (1981).

Albemarle \'al-bə-ˌmärl\ **Sound** Coastal inlet, northeastern North Carolina, U.S. Protected from the Atlantic Ocean by the Outer Banks, it is about 50 mi (80 km) long and 5–14 mi (8–23 km) wide. It is connected with Chesapeake Bay by the Dismal Swamp Canal and the Albemarle and Chesapeake Canal. Elizabeth City is its chief port. Explored by Ralph Lane in 1586, it was later named for George Monck, duke of Albemarle.

Albéniz \äl-'bā-nēth**, Isaac (Manuel Francisco)** (b. May 29, 1860, Camprodón, Spain—d. May 18, 1909, Cambo-les-Bains, France) Spanish composer. A piano prodigy by age four, he later studied in Leipzig and Brussels, returned to Spain to teach in Barcelona and Madrid, and then moved to France in 1893. His fame rests on his piano pieces, which, under the influence of Felipe Pedrell, utilize the melodic styles, rhythms, and harmonies of Spanish folk music. *Iberia* (1905–09) is a set of 12 virtuoso piano pieces; other piano works include the *Suite española* (1886), *Cantos de España* (1896), and five sonatas. He also wrote several operas.

Albers, Josef (b. March 19, 1888, Bottrop, Ger.—d. March 25, 1976, New Haven, Conn., U.S.) German-U.S. painter, poet, teacher, and theoretician. He studied and taught at the Bauhaus and in 1933 became one of the first Bauhaus teachers to immigrate to the U.S., where he taught at Black Mountain College and later at Yale. He developed a painting style characterized by abstract rectilinear patterns and primary colours as well as black and white. His best-known series of paintings, *Homage to the Square* (begun in 1950 and continued until his death), restricts its repertory of forms to coloured squares superimposed onto each other. The arrangement of these squares is carefully calculated so that the colour of each square optically alters the sizes, hues, and spatial relationships of the others. His research into colour theory was published in the influential *Interaction of Color* (1963).

Josef Albers, photograph by Arnold Newman, 1948.
© ARNOLD NEWMAN

Albert, prince consort of Great Britain and Ireland *orig.* **Franz Albrecht August Karl Emanuel, prince von Sachsen-Coburg-Gotha** (b. Aug. 26, 1819, Schloss Rosenau, near Coburg, Saxe-Coburg-Gotha—d. Dec. 14, 1861, Windsor Castle, Berkshire, Eng.) Prince consort of Queen Victoria of Britain and father of Edward VII. Albert married Victoria, his first cousin, in 1840 and became in effect her private secretary and chief confidential adviser. Their domestic happiness helped assure the continuation of the monarchy, which had been somewhat uncertain. Though the German-born Albert was undeservedly unpopular, the British public belatedly recognized his worth after his death at age 42 from typhoid fever. In the ensuing years the grief-stricken queen made policy decisions based on what she thought Albert would have done.

Albert, Lake Lake, east-central Africa. Lying at an altitude of 2,021 ft (616 m), it is 100 mi (160 km) long and has an average width of about 20 mi (32 km). In the southwest, the Semliki River brings into the lake the waters of Lake Edward; at its northeastern corner, just below Murchison Falls, it receives the Victoria Nile from Lake Victoria. In 1864 the lake's first European visitor, Samuel Baker, named it after Queen Victoria's consort. Initially part of Uganda, it now forms part of the Uganda-Congo border.

Albert I (b. April 8, 1875, Brussels, Belg.—d. Feb. 17, 1934, Marches-les-Dames, near Namur) King of the Belgians (1909–34). He succeeded his uncle, King Leopold II, in 1909. He strengthened the army while reaffirming Belgian neutrality in 1914, rejecting William II's demand (Aug. 2, 1914) for free passage of German troops across Belgium. Following the Armistice he sought to abolish Belgian neutrality, supported universal male suffrage, and guided the country's rebuilding effort.

Albert National Park See Virunga National Park

Albert the Great, Saint See Saint Albertus Magnus

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Alberta Province (pop., 2001: 2,974,807), Canada, westernmost of three Prairie Provinces. With an area of 255,287 sq mi (661,190 sq km), Alberta is bordered by Saskatchewan, British Columbia, the Northwest Territories, and the U.S. Its capital is EDMONTON. Long inhabited by various Indian peoples, the area was explored by Europeans in the 1750s. It eventually came under the rule of the HUDSON'S BAY CO., which transferred it to the Dominion of Canada in 1870. It was made part of the Northwest Territories in 1882. Its population grew with the coming of the railroads and the expansion of wheat farming. Alberta was made a province in 1905. Once dependent on agriculture, it underwent economic growth with the discovery of oil in 1947 and the ensuing discovery of other major oil and gas deposits.

Alberta, University of Canadian public university in Edmonton. Opened in 1908, it is one of Canada's five largest research universities. It offers undergraduate and graduate programs in liberal arts, agriculture and forestry, science and engineering, business, law, education, and the health professions. Special programs include the School of Native Studies and the Faculté Saint-Jean, which conducts all study in French and also offers a bilingual Bachelor of Commerce degree.

Alberti, Leon Battista (b. Feb. 14, 1404, Genoa—d. April 25, 1472, Rome) Italian architect, art theorist, and humanist. After pursuing a literary career as papal secretary, in 1438 Alberti was encouraged to direct his talents toward the field of architecture. His designs for the Palazzo Rucellai (c. 1445–51) and the facade of Santa Maria Novella (1456–70), both in Florence, are noted for their harmonic proportions. His central-plan church of Sant'Andrea, Mantua (begun 1472), with its triumphal-arch motif, is an early Renaissance masterpiece. Alberti was one of the foremost theorists on Renaissance architecture and art, known for codifying the principles of linear perspective (in *On Painting*, 1436). A prototype of the Renaissance man, he also made contributions to moral philosophy, cartography, and cryptography.

Albertus Magnus, Saint (b. c. 1200, Lauingen on the Danube, near Ulm, Bavaria—d. Nov. 15, 1280, Cologne; canonized Dec. 16, 1931; feast day November 15) German cleric, theologian, and philosopher. Son of a wealthy German lord, he studied at Padua, where he joined the DOMINICAN order (1223). At the University of Paris he was introduced to the works of ARISTOTLE and to AVERROËS' commentaries and decided to present to his contemporaries the entire body of human knowledge as seen by Aristotle and his commentators. For 20 years he worked on his *Physica*, which encompassed natural science, logic, rhetoric, mathematics, astronomy, ethics, economics, politics, and metaphysics. He believed that many points of Christian doctrine were recognizable both by faith and by reason. In 1248 he organized the first Dominican *studium generale* ("general house of studies," a precursor to the university) in Germany, at Cologne. THOMAS AQUINAS, who had been with Albertus in Paris and joined him in Cologne, was his chief disciple at this time. His works represented the entire body of European knowledge of his time, and he contributed greatly to the development of natural science.

Albertus Magnus, detail of a fresco by Tommaso da Modena, *c.* 1352; in the Church of San Nicolo, Treviso, Italy.
ALINARI—ART RESOURCE/EB INC.

Albigensian \ˌal-bə-ˈjen-shən\ **Crusade** (1209–29) Crusade called by Pope INNOCENT III against the heretical CATHARI of southern France. The war pitted the nobility of northern France against that of southern France, and it eventually involved the king of France who established his authority over the south. The Crusade ended with the TREATY OF PARIS (1229), which took away the independence of the southern princes and largely destroyed the culture of PROVENCE. The Crusade caused much devastation and injustice, which Innocent came to regret, but did not bring about the extirpation of the Albigensian heresy (named for its center in the town of Albi, France). The heresy lingered on into the 13th–14th centuries and became the object of the INQUISITION.

Albigensians See CATHARI

albinism \ˈal-bə-ˌni-zəm, al-ˈbī-ˌni-zəm\ Absence of the pigment melanin in the eyes, skin, hair, scales, or feathers. It arises from a genetic defect and occurs in humans and other vertebrates. Because they lack the pigments that normally provide protective coloration and screen against the sun's ultraviolet rays, albino animals rarely survive in the wild. Humans have long intentionally bred certain albino animals (e.g., rabbits) for their appearance. In humans with generalized, or total, albinism, the affected person has milk-white skin and hair; the iris of the eye appears pink, the pupil red. Vision abnormalities such as astigmatism, nystagmus (rapid involuntary oscillation of the eye), and photophobia (extreme sensitivity to light) are common. Generalized albinism occurs throughout the world in about one in 20,000 persons.

Albinoni \ˌal-bə-ˈnō-nē**, Tomaso (Giovanni)** (b. June 8/14, 1671, Venice—d. Jan. 17, 1751, Venice) Italian composer. Born to a wealthy Venetian family, he was not obliged to work for a living and became a highly prolific composer. He had more than 50 operas successfully produced between 1694 and 1741, though few survive. His approximately 60 concertos became popular; he also wrote more than 80 sonatas for various instrumental combinations and many solo cantatas. These works are distinguished above all by their melodic charm.

Albinus \ˈäl-ˈbē-nəs**, Bernard Siegfried** (b. Feb. 24, 1697, Frankfurt an der Oder, Brandenburg—d. Sept. 9, 1770, Leiden, Neth.) German-born Dutch anatomist. A professor at the University of Leiden, he is best known for the excellent engravings in his *Tables of the Skeleton and Muscles of the Human Body* (1747). He was the first to show the connection of the vascular systems of mother and fetus. With HERMANN BOERHAAVE, he edited the works of ANDREAS VESALIUS and WILLIAM HARVEY.

albite Common FELDSPAR mineral, a sodium aluminosilicate ($NaAlSi_3O_8$) that occurs most widely in PEGMATITES and acid igneous rocks such as granites. It may also be found in low-grade metamorphic rocks (those formed under relatively low temperature and pressure conditions) and in certain sedimentary rocks. Albite usually forms brittle, glassy crystals that may be colourless, white, yellow, pink, green, or black. It is used in the manufacture of glass and ceramics, but its primary geologic importance is as a rock-forming mineral.

Albright, Ivan (Le Lorraine) (b. Feb. 20, 1897, North Harvey, Ill., U.S.—d. Nov. 18, 1983, Woodstock, Vt.) U.S. painter. He was the son of a painter. Independently wealthy, he studied at various institutions, developing a meticulously detailed style and often spending several years of painstaking work on a single painting. With pinpoint exactness and hallucinatory hyperclarity, he repeatedly depicted decay, corruption, and the wreckage of age, often with great emotional intensity. Among his important works is *That Which I Should Have Done I Did Not Do* (1931–41). He gained fame with his portrait (1943–44) of the title character in the film *The Picture of Dorian Gray* (1945), depicting the final stage of Gray's dissolute life.

albumin \ˈal-ˈbyü-mən\ Any of a diverse class of PROTEINS historically defined by their ability to dissolve in water and in a half-saturated (see SATURATION) solution of ammonium sulfate. They are readily coagulated by heating. Examples include serum albumin, a major component of PLASMA; α-lactalbumin, found in milk; ovalbumin, which makes up about half the proteins of egg white; and conalbumin, another egg-white protein. Ovalbumin is used commercially in the food, wine, adhesives, paper coatings, pharmaceutical, and other industries and in research.

Albuquerque \ˈal-bə-ˌkər-kē\ City (pop., 2000: 448,607), New Mexico, U.S. The state's largest city, it lies on the RIO GRANDE southwest of Santa Fe. Founded by the governor of New Mexico, it was named for the duke de Alburquerque (the first *r* was later dropped), the viceroy of NEW SPAIN. After 1800 growing commerce on the SANTA FE TRAIL brought an influx of settlers; an army post was established following U.S. occupation in 1846. With the coming of the railroad in 1880, the population expanded. The characteristically Spanish "old town" and its mission church (1706) have survived. Since the 1930s many defense-related federal agencies have been established there.

Albuquerque \ˌäl-bü-ˈkər-kə**, Afonso de** *or* **Afonso the Great** (b. 1453, Alhandra, near Lisbon—d. Dec. 15, 1515, at sea, off Goa, India) Portuguese soldier, conqueror of Goa (1510) and of Melaka (1511). He gained military experience as a soldier in North Africa for 10 years but made his reputation fighting in Asia. He paved the way for Portuguese domination in Southeast Asia through efforts to gain control of all the

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main maritime trade routes of the East and to build permanent fortresses with settled populations. His conquests were inspired by the Crusading spirit of King John II, rather than by considerations of mercantile gain.

Alcaeus \al-'sē-əs\ *or* **Alkaios** \al-'kā-əs\ (b. c. 620 BC, Mytilene, Lesbos—d. c. 580 BC) Greek lyric poet. Only fragments and quotations survive from his work, consisting of hymns in honour of gods and heroes, love poetry, drinking songs, and political poems. Many reflect Alcaeus's vigorous involvement in the life of his native Mytilene, particularly its political life. His poetry was a favorite model for HORACE, who adapted from him his own alcaic stanza.

Alcalá Zamora, Niceto (b. July 6, 1877, Priego, Spain—d. Feb. 18, 1949, Buenos Aires, Arg.) Spanish politician. After serving as minister of works (1917) and minister of war (1922), he opposed the dictatorship of Miguel PRIMO DE RIVERA and joined the Republican movement. As leader of the revolutionary committee that successfully demanded the abdication of ALFONSO XIII, he became head of the government in 1931 and was elected president of Spain's Second Republic that same year. He tried to moderate the policies of the extremist factions, but he was deposed in 1936 after the election of the Popular Front and went into exile to France and then to Argentina.

Alcamenes *or* **Alkamenes** \al-'kam-ə-ˌnēz\ (b. 5th century BC, Lemnos, in the Aegean Sea, and Athens) Greek sculptor. A younger contemporary of PHIDIAS, he was noted for the delicacy and finish of his works, among which a Hephaestus and an *Aphrodite of the Gardens* are noteworthy. A copy of the head of his *Hermes Propylaeus at Pergamum* has been identified by an inscription, and he is said by the Greek traveler Pausanias (2nd century AD) to have been the creator of one of the pediments of the Temple of Zeus at Olympia.

Alcan Highway See ALASKA HIGHWAY

Alcatraz Island Rocky island in SAN FRANCISCO BAY, California, U.S. It has an area of 22 acres (9 hectares) and is located 1.5 mi (2 km) offshore from the city of SAN FRANCISCO. The site of the first lighthouse (1854) on the California coast, it became an army garrison (1859) and a military prison (1868). From 1934 to 1963 it served as a federal prison for dangerous civilian prisoners. Its famous inmates included AL CAPONE, George "Machine Gun" Kelly, and Robert Stroud, the "Birdman of Alcatraz." It is now open to the public.

alcazar \al-'kā-zər\ *Spanish* **alcázar** Form of military architecture of medieval Spain, generally rectangular with defensible walls and massive corner towers. Inside was an open space (patio) surrounded by chapels, salons, hospitals, and sometimes gardens. The finest surviving example from the Moorish period is Sevilla's Alcázar Palace; begun in 1181 under the ALMOHADS and continued by the Christians, it exhibits both Moorish and Gothic features, including a decagonal brick tower, the Torre del Oro.

Toledo alcazar, 14th century, renovated 16th century, severely damaged during the Spanish Civil War and later restored.

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Alcestis \al-'ses-təs\ In Greek legend, the beautiful daughter of Pelias, king of Ioclos. Admetus, son of the king of Pherae, sought her hand. To win her he was required to harness a lion and a boar to a chariot, and he succeeded with the aid of APOLLO. When Apollo learned that Admetus had not long to live, he persuaded the FATES to prolong his life, on condition someone else die in his stead. As a loyal wife Alcestis consented to do so, but was rescued by HERACLES, who wrestled with Death at her grave. Her story is told in EURIPIDES' *ALCESTIS*.

alchemy Pseudoscience focused on the attempt to change base metals into gold. Ancient alchemists believed that, under the correct astrological conditions, lead could be "perfected" into gold. They tried to hasten this transformation by heating and refining the metal in a variety of chemical processes, most of which were kept secret. Alchemy was practiced in much of the ancient world, from China and India to Greece. It migrated to Egypt during the Hellenistic period and was later revived in 12th-century Europe through translations of Arabic texts into Latin. Medieval European alchemists made some useful discoveries, including mineral acids and alcohol. The revival led to the development of PHARMACOLOGY under the influence of PARACELSUS and to the rise of modern CHEMISTRY. Not until the 19th century were the gold-making processes of alchemists finally discredited.

Alcibiades \ˌal-sə-'bī-ə-ˌdēz\ (b. c. 450 BC, Athens—d. 404, Phrygia) Athenian politician and commander. PERICLES was his guardian, his father having died in battle. Alcibiades grew up without much guidance, but as a youth he was drawn to SOCRATES' moral strength and keen mind. Socrates, in turn, was attracted to the youth's physical beauty and intellectual promise. They served together in the PELOPONNESIAN WAR, saving each other's life in battle, yet eventually Alcibiades was led by his own unscrupulous ambition. By 420 he was a general. Recalled from a Sicilian expedition in 415 on charges of sacrilege, he fled to Sparta. Though he aided the Spartan cause against Athens, he was eventually rejected and sought haven with the Persian governor at Sardis. The Athenian fleet eventually recalled him, and he directed Athenian victories 411–408. Though he achieved hero status, his enemies forced him to leave. From Thrace he warned Athens presciently of danger at the Battle of AEGOSPOTAMI. He fled from Thrace to Phrygia, where the Spartans conspired to have him murdered. His political agitation was a decisive factor in the defeat of Athens in the Peloponnesian War. His notorious behaviour helped strengthen the charges brought against Socrates in 399.

Alcmaeon *or* **Alcmeon** \alk-'mē-ən\ In GREEK MYTHOLOGY, the son of the seer Amphiaraus. The seer had been persuaded by his wife to join the expedition of the Seven Against THEBES. On realizing that he would die, he charged Alcmaeon and his other sons with avenging his death. Alcmaeon led the sons of the seven in the destruction of Thebes and then obeyed his father's injunction to kill his mother, a crime for which the FURIES drove him mad. He was purified by King Phegeus of Psophis, whose daughter he married but subsequently killed. Following the advice of an oracle, he settled on an island at the mouth of the Achelous River, where he married again, but was killed by Phegeus and his sons.

Alcmaeonid family \alk-'mē-ən-id\ Athenian family important in the 6th–5th century BC. During the archonship (magistracy) of the Alcmaeonid Megacles (632? BC), the family was banished for murder; it returned twice to oust the tyrant PEISISTRATUS before again being exiled. Megacles' son CLEISTHENES became archon in 525/524, but in 514 Peisistratus' son Hippias again exiled the family for murdering his brother. The family reestablished itself after the Spartans drove out the Peisistratids in 510. The next generation may have aided the Persians at the Battle of MARATHON (490). ALCIBIADES and PERICLES were both Alcmaeonids.

Alcoa U.S. company, the world's largest producer of aluminum. Established in Pittsburgh, Pa., in 1888, it adopted the name Aluminum Co. of America in 1907. Alcoa introduced aluminum foil in 1910 and found uses for aluminum in the emerging aviation and automobile industries. In 1913 it established the town of Alcoa in eastern Tennessee as a planned industrial community. A 1945 federal antitrust ruling obliged it to sell its Canadian subsidiary (now Alcan Aluminum Ltd., its strongest competitor). In 1998 Alcoa acquired Alumax Inc. Alcoa's other products include plastic containers and packaging equipment.

alcohol Any of a class of common organic compounds that contain one or more hydroxyl groups (—OH) attached to one or more of the carbon atoms in a HYDROCARBON chain. The number of other substituent groups (R) on that carbon atom make the alcohol a primary (RCH_2OH), second-

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ary (R_2CHOH), or tertiary (R_3COH) alcohol. Many alcohols occur naturally and are valuable intermediates in the synthesis of other compounds because of the characteristic CHEMICAL REACTIONS of the hydroxyl group. Oxidation (see OXIDATION-REDUCTION) of primary alcohols yields ALDEHYDES and (if taken further) CARBOXYLIC ACIDS; oxidation of secondary alcohols, KETONES. Tertiary alcohols break down on oxidation. Alcohols generally react with carboxylic acids to produce ESTERS. They may also be converted to ETHERS and OLEFINS. Products of these numerous reactions include fats and waxes, detergents, plasticizers, emulsifiers, lubricants, emollients, and foaming agents. ETHANOL (grain alcohol) and METHANOL (wood alcohol) are the best-known alcohols with one hydroxyl group. GLYCOLS (e.g., ethylene glycol, or antifreeze) contain two hydroxyl groups, GLYCEROL three, and polyols three or more. See also ALCOHOLIC BEVERAGE, ALCOHOLISM.

alcoholic beverage Any fermented liquor, such as WINE, BEER, or DISTILLED LIQUOR, that contains ethyl alcohol, or ETHANOL, as an intoxicating agent. When an alcoholic beverage is ingested, the alcohol is rapidly absorbed in the stomach and intestines because it does not undergo any digestive processes. It is distributed to the rest of the body through the blood and has a pronounced depressant action on the brain. Under the influence of alcohol, the drinker is less alert, less able to discern objects in the environment, slower in reacting to stimuli, and generally prone to sleep.

Alcoholics Anonymous (AA) Voluntary fellowship of people suffering from ALCOHOLISM who seek to become and stay sober through mutual self-help by meeting in local, independent groups to share their common experience. Anonymity, confidentiality, and understanding of alcoholism as a disease free members to speak frankly. Many consider AA to be the most successful method of coping with alcoholism; participation raises the chances of success of other treatments. Its 12 steps to recovery include acknowledgment of the problem, faith in a "higher power" as understood by each individual, self-examination, and a desire to change for the better and to help others recover. Begun in 1935 by two alcoholics, AA has grown to some 2 million members worldwide. Similar organizations for abusers of other substances and for habitual gamblers and debtors are based on its principles.

alcoholism Excessive habitual consumption of alcoholic beverages despite physical, mental, social, or economic harm (e.g., CIRRHOSIS, drunk driving and accidents, family strife, frequently missing work). Persons who drink large amounts of alcohol over time become tolerant to its effects. Alcoholism is usually considered an addiction and a disease. The causes are unclear, but there may be a genetic predisposition. It is more common in men, but women are more likely to hide it. Treatment may be physiological (with drugs that cause vomiting and a feeling of panic when alcohol is consumed; not an effective long-term treatment), psychological (with therapy and rehabilitation), or social (with group therapies). Group therapies such as ALCOHOLICS ANONYMOUS are the most effective treatments. Suddenly stopping heavy drinking can lead to withdrawal symptoms, including DELIRIUM TREMENS.

Alcott, (Amos) Bronson (b. Nov. 29, 1799, Wolcott, Conn., U.S.—d. March 4, 1888, Concord, Mass.) U.S. teacher and philosopher. The self-educated son of a poor farmer, Alcott worked as a peddler before establishing a series of innovative but ultimately unsuccessful schools for children. He traveled to Britain with money borrowed from RALPH WALDO EMERSON and came back with the mystic Charles Lane, with whom he founded the short-lived utopian community Fruitlands outside Boston. Alcott is credited with establishing the first parent-teacher association in Concord, Mass., while he was superintendent of schools there. A prominent member of the Transcendentalists, he wrote a number of books but did not become financially secure until his daughter LOUISA MAY ALCOTT achieved success.

Alcott, Louisa May (b. Nov. 29, 1832, Germantown, Pa., U.S.—d. March 6, 1888, Boston, Mass.) U.S. author. Daughter of the reformer BRONSON ALCOTT, she grew up in Transcendentalist circles in Boston and Concord, Mass. She began writing to help support her mother and sisters. An ardent abolitionist, she volunteered as a nurse during the American Civil War, where she contracted the typhoid that damaged her health the rest of her life; her letters, published as *Hospital Sketches* (1863), first brought her fame. With the huge success of the autobiographical *Little Women* (1868–69), she finally escaped debt. *An Old-Fashioned Girl* (1870), *Little Men* (1871), and *Jo's Boys* (1886) also drew on her experiences as an educator. See photograph above.

Louisa May Alcott, portrait by George Healy; in the Louisa May Alcott Memorial Association collection, Concord, Mass.
COURTESY OF LOUISA MAY ALCOTT MEMORIAL ASSOCIATION

Alcuin \'al-ˌkwēn\ (b. c. 732, in or near York, Yorkshire, Eng.—d. May 9, 804, Tours, France) Anglo-Latin poet, educator, and cleric. As head of CHARLEMAGNE's Palatine school, he introduced the traditions of Anglo-Saxon humanism into western Europe and was the foremost scholar of the revival of learning known as the Carolingian Renaissance. He also made important reforms in the Roman Catholic liturgy, prepared an important new edition of the Vulgate Bible, wrote a number of poems, and left more than 300 Latin letters, a valuable source for the history of his time. Although traditionally identified as the author of the Caroline books and as the creator of Carolingian miniscule, Alcuin is now recognized as having played a less important role in the creation of both. He was also an important political adviser and confidant of Charlemagne.

aldehyde Any of a class of organic compounds that contain a carbonyl group (—C═O; see FUNCTIONAL GROUP) in which the carbon atom is bonded to at least one hydrogen atom. Many have characteristic odours. Oxidation (see OXIDATION-REDUCTION) of aldehydes yields ACIDS; reduction produces ALCOHOLS. They participate in many CHEMICAL REACTIONS and readily undergo POLYMERIZATION into chains containing tens of thousands of the MONOMER molecule. The combination of aldehydes (e.g., FORMALDEHYDE) with other molecules results in several familiar PLASTICS. Many aldehydes are large-scale industrial materials, useful as solvents, monomers, perfume ingredients, and intermediates. Many SUGARS are aldehydes, as are several natural and synthetic HORMONES and compounds such as retinal (a derivative of VITAMIN A, important in vision) and pyridoxal phosphate (a form of VITAMIN B_6).

Alden, John (b. 1599?, England—d. Sept. 12, 1687, Duxbury, Mass.) British-born American pilgrim. He was hired as a cooper by the London merchants who funded the *Mayflower*'s expedition to the New World in 1620. Alden signed the MAYFLOWER COMPACT and held various civic positions in the colony, including assistant to the governor (1623–41, 1650–86). He was mythologized as the first PILGRIM to set foot on Plymouth Rock and as the stand-in for MYLES STANDISH in his suit for Priscilla Mullens's hand in marriage in the poem "The Courtship of Miles Standish" (1858) by HENRY W. LONGFELLOW. Alden in fact married Mullens in 1623.

alder Any of about 30 species of ornamental shrubs and trees in the genus *Alnus*, of the BIRCH family, found throughout the Northern Hemisphere and western South America on cool, wet sites. Alders are distinguished from birches by their usually stalked winter buds and by CONES that remain on the branches after the small, winged nutlets are released. Alders have scaly bark, oval leaves that fall without changing colour, and separate male and female flowers (CATKINS) borne on the same tree. Some familiar North American alders are the red alder (*A. rubra* or *A. oregona*); the white, or Sierra, alder (*A. rhombifolia*); and the speckled alder (*A. rugosa*). Alder wood is fine-textured and durable, even under water; it is useful for furniture, cabinetry, and lathe work and in charcoal manufacture and millwork. Alders' spreading root systems and tolerance of moist soils lend them to planting on stream banks for flood and erosion control.

Alder (*Alnus glutinosa*)
EARL L. KUBIS—ROOT RESOURCES

Aldrich, Nelson W(ilmarth) (b. Nov. 6, 1841, Foster, R.I., U.S.—d. April 16, 1915, New York, N.Y.) U.S. senator and financier. He served in the U.S. House of Representatives (1879–81) and the Senate (1881–1911). His work as chair of the National Monetary Commission (1908–12)

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helped prepare the way for the Federal Reserve System (1913). He also invested profitably in banking, electricity, gas, rubber, and sugar.

Aldrich \'ȯl-drich**, Robert** (b. Aug. 9, 1918, Cranston, R.I., U.S.—d. Dec. 5, 1983, Los Angeles, Calif.) U.S. film director and producer. He held various jobs at RKO from 1941, working under such directors as Jean Renoir and Charlie Chaplin. After directing his first feature film, *The Big Leaguer* (1953), he formed his own production company and earned a reputation for socially conscious yet often violent films, including *Apache* (1954), *Kiss Me Deadly* (1955), *What Ever Happened to Baby Jane?* (1962), and *The Dirty Dozen* (1967).

Aldrich \'ȯl-drich**, Thomas Bailey** (b. Nov. 11, 1836, Portsmouth, N.H., U.S.—d. March 19, 1907, Boston, Mass.) U.S. poet, short-story writer, and editor. Aldrich left school at age 13 and soon began to contribute to newspapers and magazines. He was editor of *The* Atlantic Monthly 1881–90. He drew on his childhood for his classic children's novel *The Story of a Bad Boy* (1870). His use of the surprise ending influenced the development of the short story in the U.S. Aldrich's poems reflect New England culture and his experiences visiting Europe.

Aldrin \'ȯl-drən**, Edwin Eugene, Jr.** *known as* **Buzz Aldrin** (b. Jan. 20, 1930, Montclair, N.J., U.S.) U.S. astronaut. He graduated from West Point and flew 66 combat missions in the Korean War. In 1963 he received a Ph.D. from MIT and was chosen as an astronaut. In 1966 he joined James A. Lovell, Jr. (b. 1928) on the four-day Gemini 12 flight. Aldrin's 5½-hour walk in space proved that humans can function effectively in the vacuum and weightlessness of space. In July 1969, on the Apollo 11 mission, he became the second human to walk on the Moon.

ale Fermented malt beverage, full-bodied and somewhat bitter, with strong flavour of hops. Until the 17th century it was an unhopped brew of yeast, water, and malt, beer being the same brew with hops added. Modern ale (now largely synonymous with beer) is made with top-fermenting yeast and processed at higher temperatures than lager beer. Pale ale has up to 5% alcohol content; the darker strong ale contains up to 6.5%.

Alea \ä-'lā-ə**, Tomás Gutiérrez** (b. Dec. 11, 1928, Havana, Cuba—d. April 16, 1996, Havana) Cuban film director. After earning a law degree in Cuba, he studied filmmaking in Rome (1951–53). A supporter of Fidel Castro, he helped develop Cuba's film industry after 1959 and made the Communist regime's first official feature film, *Stories of the Revolution* (1960). Later he worked within the restrictions of the regime to satirize and explore various aspects of life in postrevolutionary Cuba in such internationally acclaimed films as *Death of a Bureaucrat* (1966), *Memories of Underdevelopment* (1968), *The Survivors* (1978), and *Strawberry and Chocolate* (1993). He is regarded as the finest director Cuba has produced.

aleatory \'ā-lē-ə-ˌtōr-ē\ **music** (from Latin, *alea*: "dice game") Any 20th-century music, particularly that of the 1950s and '60s, the composition or performance of which incorporates elements of chance. In aleatory music aspects such as the ordering of a piece's sections, its rhythms, and even its pitches are decided at the moment of performance. When not purely improvising, players follow lists of arbitrary rules or interpreted "graphic" notation that merely suggest the sounds. Charles Ives and Henry Cowell had used such techniques, but John Cage became the principal figure in aleatory; other aleatory composers include Earle Brown (1926–2002), Morton Feldman (1926–87), and Pierre Boulez.

Aleichem, Sholem See Sholem Aleichem

Aleixandre \ˌä-lā-'sän-drā**, Vicente** (b. April 26, 1898, Sevilla, Spain—d. Dec. 14, 1984, Madrid) Spanish poet. A member of the group of Spanish writers known as the Generation of 1927, he was strongly influenced by Surrealism. His first major book, *Destruction or Love* (1935), won the National Prize for Literature. Other works include *Historia del corazón* (1954), *En un vasto dominio* (1962), and *Diálogos del conocimiento* (1974). He received the Nobel Prize for Literature in 1977.

Aleksandrovsk See Zaporizhzhya

Alekseyev \ə-lyi-'ksyā-yif**, Vasiliy** (b. Jan. 7, 1942, Pokrovo-Shishkino, Russia, U.S.S.R.) Soviet weight lifter. A superheavyweight, he broke 80 world records between 1970 and 1978 and won Olympic gold medals in 1972 and 1976. He was the first man ever to lift more than 500 lbs (227 kg) in the clean and jerk. He retired after failing to win a third gold medal in the 1980 Olympics.

Alemán \ˌä-lā-'män**, Mateo** (baptized Sept. 28, 1547, Sevilla, Spain—d. c. 1614, Mexico) Spanish novelist. Descended from Jews who had been forcibly converted to Roman Catholicism, he expressed many aspects of the experiences and feelings of the New Christians in 16th-century Spain. His most important literary work is *Guzmán de Alfarache* (1599, 1604), one of the earliest picaresque novels, which brought him fame throughout Europe but little profit.

Alembert \à-lä^{n}-'ber**, Jean Le Rond d'** (b. Nov. 17, 1717, Paris, France—d. Oct. 29, 1783, Paris) French mathematician, scientist, philosopher, and writer. In 1743 he published a treatise on dynamics containing "d'Alembert's principle," relating to Isaac Newton's laws of motion. He developed partial differential equations and published findings of his research on integral calculus. He was associated with the Encyclopédie of Denis Diderot from c. 1746 as editor of its mathematical and scientific articles; he contributed articles on music as well, and he also published treatises on acoustics. He was elected to the Académie Française in 1754.

Alentejo \à-lā^{n}n-'tā-zhù\ *formerly* **Alemtejo** Historical province, Portugal. Lying southeast of the Tagus River, it borders Spain and the Atlantic Ocean. The region produces two-thirds of the world's cork. Until the Portuguese revolution of 1974, Alentejo contained vast estates, mostly owned by absentee landlords; many have since been divided among the Alentejanos.

alenu \à-'lā-nü\ (Hebrew: "it is our duty") Opening words of a Jewish prayer recited at the end of the three periods of daily prayer since the Middle Ages. The first section is a prayer of thanks for Israel's being chosen for God's service; the second expresses hope for the coming messianic age. Though traditionally ascribed to Joshua, it is often credited to Abba Arika, a Jewish scholar in Babylonia in the 3rd century AD.

Aleppo \ə-'le-pō\ *Arabic* **Ḥalab** \'hå-låb\ City (pop., 2004 est.: 1,975,200), northwestern Syria. Syria's largest city, it is about 30 mi (48 km) from the Turkish border. Lying at the crossroads of great commercial routes, it has long been inhabited and is first mentioned at the end of the 3rd millennium BC. It subsequently came under the control of many kingdoms, including the Hittites (17th–14th centuries BC). Controlled by the Persian Achaemenian dynasty in the 6th–4th centuries BC, it soon came under the control of the Hellenistic Seleucid dynasty, under which it was renamed Beroea. It was absorbed into the Roman Empire in the 1st century BC and it prospered for several centuries. In AD 637 it was conquered by the Arabs, under whom it reverted to its old name, Ḥalab. The city successfully defended itself from the Crusaders (1124), fell to the Mongols (1260), and finally was incorporated into the Ottoman Empire (1516). Modern Aleppo is an industrial and intellectual centre rivaling the Syrian capital, Damascus. Its historic structures were designated a UNESCO World Heritage site in 1986.

Alessandri Palma \à-lā-'sän-drē-'päl-mä**, Arturo** (b. Dec. 20, 1868, Longavi, Chile—d. Aug. 24, 1950, Santiago) President of Chile (1920–25, 1932–38). He was the son of an Italian immigrant, and his election in 1920 represented the urban classes' first successful challenge to Chile's oligarchy. When he defended workers' groups and attempted liberal reforms, he encountered stiff opposition in Congress. A coup led by Carlos Ibáñez forced him into exile, but he was soon recalled and drafted a new constitution that increased the president's power. He became president again in 1932 during the Great Depression, dependent for support on the political right. His declaration of a state of siege in response to widespread strikes cost him his labour and middle-class support.

Alessandro de' Medici See Alessandro de' Medici

Aleut \ˌa-lē-'üt\ Any native of the Aleutian Islands and western portion of the Alaska Peninsula. The name Aleut, used in 1745 by Russian fur traders from the Kamchatka Peninsula, refers primarily to the people of the Aleutian Islands, who call themselves Unangan or Unangas, but also by extension to the Pacific Yupik, who call themselves Alutiit (plural of Alutiiq), an adaptation of the Russian name. Aleuts speak two main dialects and are physically and culturally closely related to the Eskimo. Traditional Aleut villages were located on the seashore near fresh water, where the people hunted marine mammals, fish, birds, caribou, and bear. Aleut women wove fine grass basketry; stone, bone, and ivory were also worked. After the arrival of the Russians in the 18th century, their population declined drastically. Some 6,600 people claimed sole Aleut ancestry in the 2000 U.S. census.

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Aleutian \ə-ˈlü-shən\ **Islands** Chain of small islands, Alaska, U.S. They form a border of the Bering Sea, extending in an arc about 1,100 mi (1,800 km) west from the tip of the Alaska Peninsula to Attu Island. The major island groups, from east to west, are the Fox Islands (including Unimak and Unalaska), Islands of the Four Mountains, Andreanof Islands (including Adak), and Near Islands (including Attu). The main settlements are on Unalaska and Adak. Originally inhabited by Aleuts, the islands were explored by Russian-sponsored ships in 1741. As Siberian fur hunters moved eastward through the islands, the Russians gained a foothold in North America but nearly caused the extinction of the Aleuts. Russia sold the islands, with the rest of Alaska, to the U.S. in 1867.

alewife Important North American food fish (*Pomolobus*, or *Alosa*, *pseudoharengus*) of the herring family. The alewife grows to about 1 ft (30 cm). Most populations spend several years along North America's Atlantic coast before ascending freshwater streams to spawn each spring in ponds or sluggish rivers.

Alexander, Harold (Rupert Leofric George) Alexander, 1st Earl (b. Dec. 10, 1891, London, Eng.—d. June 16, 1969, Slough, Buckinghamshire) British field marshal in World War II. In 1940 he helped direct the Dunkirk evacuation and was the last man to leave the beaches. Appointed British commander in chief in the Mediterranean theatre in 1942, he helped lead the North Africa Campaign against the Germans. He directed the invasions of Sicily and Italy, then became commander in chief of Allied forces in Italy. After the war, he served as governor-general of Canada (1946–52) and as Britain's minister of defense (1952–54).

Alexander, Severus See Severus Alexander

Alexander, William See William Alexander, 1st earl of Stirling

Alexander I *Russian* **Aleksandr Pavlovich** (b. Dec. 23, 1777, St. Petersburg, Russia—d. Dec. 1, 1825, Taganrog) Tsar of Russia (1801–25). He became tsar in 1801 after the assassination of his father, Paul I. He and his advisers corrected many of the injustices of the preceding reign but failed to carry out the abolition of serfdom. During the Napoleonic Wars he alternately fought and befriended Napoleon and helped form the coalition that finally defeated him. Alexander also participated in the Congress of Vienna (1814–15) and formed the Holy Alliance (1815). After his sudden death in 1825, a legend sprang up that he had simply "departed" to a Siberian retreat.

Alexander I (b. Dec. 4, 1888, Cetinje, Montenegro —d. Oct. 9, 1934, Marseille, France) King of Yugoslavia (1921–34). After commanding Serbian forces in World War I, Alexander succeeded his father, Peter I, as king of the Kingdom of Serbs, Croats, and Slovenes in 1921. In 1929 he abolished the constitution and established a royal dictatorship. As part of his efforts to unify his subjects, he changed the name of the country to Yugoslavia; outlawed political parties based on ethnic, religious, or regional distinctions; reorganized the state; and standardized legal systems, school curricula, and national holidays. In 1934 he was assassinated by an agent of Croatian separatists.

Alexander II *Russian* **Aleksandr Nikolayevich** (b. April 29, 1818, Moscow, Russia—d. March 13, 1881, St. Petersburg) Tsar of Russia (1855–81). He succeeded to the throne at the height of the Crimean War, which revealed Russia's backwardness on the world stage. In response, he undertook drastic reform, improving communications, government, and education, and most importantly, emancipating the serfs (1861). His reforms reduced class privilege and fostered humanitarian progress and economic development. Though sometimes described as a liberal, Alexander was in reality a firm upholder of autocratic principles, and an assassination attempt in 1866 strengthened his commitment to conservatism. A period of repression after 1866 led to a resurgence of revolutionary terrorism, and in 1881 he was killed in a plot sponsored by the terrorist organization People's Will.

Alexander II (b. Aug. 24, 1198, Haddington, Lothian—d. July 8, 1249, Kerrera Island) King of Scotland (1214–49). He came to the throne on the death of his father, William I (the Lion). In 1215 he supported the rebellious English barons against King John, hoping to regain land in northern England. After the rebellion collapsed (1217), he did homage to Henry III and in 1221 married Henry's sister, Joan. He consolidated royal authority in Scotland and subdued Argyll in 1222. In 1237 he concluded the Peace of York with Henry by which he abandoned his claim to land in England and received in exchange several English estates.

Alexander III See Alexander the Great

Alexander III *orig.* **Rolando Bandinelli** (b. c. 1105, Siena, Tuscany—d. Aug. 30, 1181, Rome) Pope (1159–81). A member of the group of cardinals who feared the growing strength of the Holy Roman Empire, he helped draw up an alliance with the Normans (1156). As the representative of Pope Adrian IV, he angered Frederick I (Frederick Barbarossa) by referring to the empire as a "benefice," implying that it was a gift of the pope. On Alexander's election as pope in 1159, a minority of cardinals supported by Frederick elected the first of several antipopes, and imperial opposition obliged Alexander to flee to France (1162). A vigorous defender of papal authority, he supported St. Thomas Becket against Henry II of England. He returned to Rome in 1165 but was exiled again the following year. He gained support with the formation of the Lombard League, which defeated Frederick at Legnano in 1176, paving the way for the Peace of Venice and the end of the papal schism. Alexander stood in the reform tradition and presided at the third Lateran Council (1179).

Alexander III *Russian* **Aleksandr Aleksandrovich** (b. March 10, 1845, St. Petersburg, Russia—d. Nov. 1, 1894, Livadiya, Crimea) Tsar of Russia (1881–94). He assumed the throne after the assassination of his father, Alexander II. The internal reforms he instituted were designed to correct what he saw as the too-liberal tendencies of his father's reign. He thus opposed representative government and ardently supported Russian nationalism. His political ideal was a nation containing a single nationality, language, religion, and form of administration, and accordingly he instituted programs such as the Russification of national minorities in the Russian Empire and the persecution of non-Orthodox religious groups.

Alexander III (b. Sept. 2, 1241—d. March 18/19, 1286, near Kinghorn, Fife, Scot.) King of Scotland (1249–86). Son of Alexander II, he came to the throne at age 7. In 1251 he was married to Margaret, daughter of England's King Henry III, who sought to gain control over Scotland. In 1255 Alexander was seized by a pro-English party in Scotland; in 1257 the anti-English party gained control of the government until he came of age (1262). In 1263 he repulsed a Norwegian invasion, and in 1266 he acquired the Hebrides and the Isle of Man from Norway. His reign was later viewed as a golden age by Scots caught up in the long conflict with England.

Alexander VI *orig.* **Rodrigo de Borja y Doms** (b. 1431, Játiva, Aragon—d. Aug. 18, 1503, Rome) Pope (1492–1503). Born into the Spanish branch of the Borgia family, he amassed great wealth and lived scandalously, fathering four illegitimate children (before his election as pope), who played an important role in his complicated dynastic plans. He warred against the Ottoman Turks and forced the French to abandon their effort to seize Naples. The murder of his son Juan (1497) prompted Alexander's short-lived attempt to restrain the corruption of the papal court. His political ambitions, however, were revived with the marriage of his son Cesare, whose military campaigns brought northern Italy under Borgia control. He concluded an alliance with Spain and negotiated the Treaty of Tordesillas (1494). A patron of the arts, he embellished the Vatican palaces and commissioned Michelangelo to draw up plans for the rebuilding of St. Peter's Basilica.

Alexander VI, detail of a fresco by Pinturicchio, 1492–94; in the Vatican.
ALINARI/ART RESOURCE, NEW YORK

Alexander Archipelago Group of about 1,100 islands, southeastern Alaska, U.S. Extending southward from Glacier Bay, the chief islands are Chichagof, Admiralty, Baranof, Kupreanof, Prince of Wales, and Revillagigedo. The chief towns are Sitka (on Baranof) and Ketchikan (on Revillagigedo). The islands are separated from the mainland by deep, narrow channels that form part of the Inside Passage. The archipelago's name, given in 1867, honours Tsar Alexander II.

Alexander Island Island in Bellingshausen Sea, separated from the Antarctic mainland by George VI Sound. An extremely rugged region with peaks as high as 9,800 ft (3,000 m), it is 270 mi (435 km) long and up to 125 mi (200 km) wide, with an area of 16,700 sq mi (43,250 sq km). The Russian explorer F.G. von Bellingshausen discovered the land in 1821 and named it after Tsar Alexander. It was believed part of the

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mainland until 1940, when a U.S. expedition proved it to be an island, connected to the continent by a huge floating ice shelf. It has been claimed by Britain (since 1908), Chile (1940), and Argentina (1942).

Alexander Nevsky \'nev-skē**, Saint** (b. c. 1220, Vladimir, Grand Principality of Vladimir—d. Nov. 14, 1263, Gorodets) Prince of Novgorod (1236–52) and Kiev (1246–52) and grand prince of Vladimir (1252–63). He fought off invading Swedes in 1240 at the Neva River (resulting in the epithet Nevsky). He was called back to service to defeat the Teutonic Knights in 1242 and also won victories over the Lithuanians and Finns. He collaborated with the Golden Horde in imposing Mongol rule on Russia, and the Great Khan made him grand prince of Vladimir. Alexander continued to rule Novgorod through his son. He helped the Mongols impose taxes, interceding with the Khan to prevent reprisals when rebellions broke out. A national hero, he was canonized by the Russian Orthodox church.

Alexander the Great *or* **Alexander III** (b. 356 BC, Pella, Macedonia—d. June 13, 323 BC, Babylon) King of Macedonia (336–323) and the greatest military leader of antiquity. The son of Philip II of Macedonia, he was taught by Aristotle. He soon showed military brilliance, helping win the Battle of Chaeronea at age 18. He succeeded his assassinated father in 336 and promptly took Thessaly and Thrace; he brutally razed Thebes except for its temples and the house of Pindar. Such destruction was to be his standard method, and other Greek states submitted meekly. In 334 he crossed to Persia and defeated a Persian army at the Granicus River. He is said to have cut the Gordian knot in Phrygia (333), by which act, according to legend, he was destined to rule all Asia. At the Battle of Issus in 333, he defeated another army, this one led by the Persian king Darius III, who managed to escape. He then took Syria and Phoenicia, cutting off the Persian fleet from its ports. In 332 he completed a seven-month siege of Tyre, considered his greatest military achievement, and then took Egypt. There he received the pharaohs' double crown, founded Alexandria, and visited the oracle of the god Amon, the basis of his claim to divinity. In control of the eastern Mediterranean coast, in 331 he defeated Darius in a decisive battle at Gaugamela, though Darius again escaped. He next took the province of Babylon. He burnt Xerxes' palace at Persepolis, Persia, in 330, and he envisioned an empire ruled jointly by Macedonians and Persians. He continued eastward, quashing real or imagined conspiracies among his men and taking control to the Oxus and Jaxartes rivers, founding cities (most named Alexandria) to hold the territory. Conquering what is now Tajikistan, he married the princess Roxana and embraced Persian absolutism, adopting Persian dress and enforcing Persian court customs. By 326 he reached the Hyphasis in India, where his weary men mutinied; he turned back, marching and pillaging down the Indus, and reached Susa with much loss of life. He continued to promote his unpopular policy of racial fusion, a seeming attempt to form a Persian-Macedonian master race. When his favourite, Hephaestion (324), died, Alexander gave him a hero's funeral and demanded that divine honours be given at his own funeral. He fell ill at Babylon after long feasting and drinking and died at age 33. He was buried in Alexandria, Egypt. His empire, the greatest that had existed to that time, extended from Thrace to Egypt and from Greece to the Indus valley.

Alexanderson, Ernst F(rederik) W(erner) (b. Jan. 25, 1878, Uppsala, Swed.—d. May 14, 1975, Schenectady, N.Y., U.S.) Swedish-born U.S. electrical engineer and television pioneer. He emigrated to the U.S. in 1901 and spent most of the next five decades at General Electric; from 1952 he worked for RCA. He developed a high-frequency alternator that was capable of producing continuous radio waves, revolutionizing radio communication. His completed alternator (1906) greatly improved transoceanic communication and firmly established the use of wireless devices in shipping and warfare. He also developed a sophisticated control system (1916) used to automate intricate manufacturing processes and operate antiaircraft guns. He was awarded his 321st patent in 1955 for the colour TV receiver he developed for RCA.

Alexandra *Russian* **Aleksandra Fyodorovna** *orig.* **Alix, Princess von Hesse-Darmstadt** (b. June 6, 1872, Darmstadt, German Empire—d. July 16/17, 1918, Yekaterinburg, Russia) Consort of Russia's Tsar Nicholas II. A granddaughter of Queen Victoria, she married Nicholas in 1894 and sought to restore absolute power in the monarchy. Desperate to help her hemophiliac son, Alexis, she turned to the hypnotic powers of Grigory Rasputin, who became her spiritual adviser. In 1915 Nicholas left Moscow to command Russian forces in World War I, and Alexandra dismissed capable ministers and replaced them with nonentities favored by Rasputin. Her misrule contributed to the collapse of the imperial government. After the Bolshevik takeover in the Russian Revolution of 1917, the royal family was imprisoned and later executed.

Alexandria *Arabic* **Al-Iskandarīyah** City (metro. area pop., 2004 est.: 3,755,900) and chief seaport, northern Egypt. It lies on a strip of land between the Mediterranean Sea and Lake Mareotis. The ancient island of Pharos, whose lighthouse was one of the Seven Wonders of the World, is now a peninsula connected to the mainland. Alexandria's modern harbour is west of the peninsula. The city was founded in 332 BC by Alexander the Great and was noted as a centre of Hellenistic culture. Its library (destroyed early centuries AD) was the greatest in ancient times; a new library was opened in 2002. The city was captured by the Arabs in AD 642 and by the Ottoman Empire in 1517. After a long period of decline, caused by the rise of Cairo, Alexandria was revived commercially when Muḥammad ʿAlī joined it by a canal to the Nile River in the early 19th century. Modern Alexandria is a thriving commercial community; cotton is its chief export, and important oil fields lie nearby. Other cultural institutions include the Museum of Alexandria.

Alexandria City (pop., 2000: 128,283), northern Virginia, U.S., on the Potomac River. The site was settled in the late 17th century, and in 1749 it was named for John Alexander, the land's original grantee. It was part of Washington, D.C., from 1801 to 1847, after which it was ceded back to Virginia. Many colonial buildings survive in Alexandria's Old Town; George Washington's estate, Mount Vernon, is nearby.

Alexandria, Library of Most famous library of classical antiquity. It was part of the Alexandrian Museum, a research institute at Alexandria, Egypt. The museum and library were founded and maintained by a succession of Ptolemies from the early 3rd century BC. The library aspired to the ideal of an international library—incorporating all Greek literature and also translations into Greek—but it is uncertain how close this ideal came to being realized. A bibliography of the library compiled by Callimachus, lost in the Byzantine period, was long a standard reference work. The museum and library were destroyed in civil war in the late 3rd century AD; a subsidiary library was destroyed by Christians in AD 391.

Alexandria, Museum of Ancient centre of Classical learning at Alexandria, Egypt. It was a research institute, organized into faculties and headed by a president-priest, with a renowned library. It was built near the royal palace either by Ptolemy II Philadelphus c. 280 BC or by his father, Ptolemy I Soter. The best surviving description is by Strabo. In AD 270 its buildings were destroyed, although its educational and research functions seem to have continued until the 5th century.

Alexandrina \ˌa-lig-ˌzan-'drē-nə**, Lake** Lagoon, southeastern South Australia. The lake covers 220 sq mi (570 sq km) and is about 23 mi (37 km) long and 13 mi (21 km) wide. With Lake Albert and the Coorong lagoon, it forms the mouth of the Murray River. In 1830 the explorer Charles Sturt named the lake after Princess Alexandrina (later Queen Victoria). Five barrages built in the 1940s across the lake's exits prevent the intrusion of seawater upstream, allowing for the development of irrigated agriculture in that area.

alexandrine \ˌal-ek-'zan-drən\ Verse form that is the most popular measure in French poetry. It consists of a line of 12 syllables with a pause after the sixth syllable, major stresses on the sixth and the last syllable, and one secondary accent in each half line. It is a flexible form, adaptable to a wide range of subjects. It became the preeminent French verse form for dramatic and narrative poetry in the 17th century and reached its highest development in the tragedies of Pierre Corneille and Jean Racine.

Alexandrists Italian Renaissance philosophers, led by Pietro Pomponazzi (1462–1525), who followed the explanation of Aristotle's *De anima* given by Alexander of Aphrodisias (2nd–3rd century AD). Alexander held that *De anima* denied individual immortality, considering the soul a material and therefore a mortal entity, organically connected with the body. The Alexandrists disagreed with Thomas Aquinas and his followers, who interpreted Aristotle as saying that the individual soul is immortal, and with the Latin Averroists (see Averroës), who held that the individual intellect is reabsorbed after death into the eternal intellect.

Alexis *Russian* **Aleksey Mikhaylovich** (b. March 9, 1629, Moscow, Russia—d. Jan. 29, 1676, Moscow) Tsar of Russia (1645–76). Son of Michael, the first Romanov monarch of Russia, Alexis acceded to the throne at age 16. He encouraged trade with the West, which brought an upsurge in foreign influences. During his reign the peasants were enserfed,

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the land assemblies fell into gradual disuse, the professional bureaucracy and regular army grew in importance, and patriarch NIKON's reforms of the Russian Orthodox church were adopted. Though reportedly warm-hearted and popular, Alexis was a weak ruler who sometimes entrusted matters of state to incompetent favourites.

Alexius I Comnenus \käm-'nē-nəs\ (b. 1048, Constantinople—d. Aug. 15, 1118) Byzantine emperor (1081–1118). An experienced military leader, he seized the Byzantine throne in 1081, driving back the invading NORMANS and Turks and founding the Comnenian dynasty. Alexius increased Byzantine strength in Anatolia and in the eastern Mediterranean but failed to curb the power of the landed magnates who had divided the empire in the past. He protected the Eastern Orthodox church but did not hesitate to seize its assets when in financial need. His appeal for Western support in 1095 was a factor in Pope URBAN II's call for the First CRUSADE. Alexius's relations with the Crusaders were difficult, and from 1097 onward the Crusades frustrated his foreign policy.

Alexius I Comnenus, detail of an illumination from a Greek manuscript; in the Vatican Library (Cod. Vat. Gr. 666)
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Alexius V Ducas Mourtzouphlus \thü-käs-'mùrt-sù-flòs\ (d. 1204, Constantinople) Byzantine emperor. In 1204 he led a Greek revolt against his coemperors ISAAC II and Alexius IV, who had been supported by the Fourth Crusade, and he became the last Greek emperor of united Byzantium before its overthrow and partition by the Crusaders. He imprisoned Alexius IV and demanded the Crusaders leave Constantinople, but they instead besieged the city. He fled to join the fugitive Alexius III (his father-in-law), who, instead of allying with him, had him blinded. Captured by the Crusaders, he was thrown from the top of a column to his death.

alfalfa Perennial, CLOVER-like LEGUME (*Medicago sativa*). It is widely grown primarily for hay, pasturage, and silage. It is known for its tolerance of drought, heat, and cold, and for its improvement of soil by nitrification (see NITRIFYING BACTERIA) due to bacteria associated with its roots. The plant, which grows 1–3 ft (30–90 cm) tall, develops numerous stems that arise from a much-branched crown at soil level, each bearing many three-leaved leaflets. Its long primary root—as long as 50 ft (15 m) in some plants—accounts for its unusual ability to tolerate drought. Its remarkable capacity for regeneration of dense growths of new stems and leaves following cutting makes possible as many as 13 crops of hay in one growing season. Alfalfa hay is very nutritious and palatable, high in protein, minerals, and vitamins.

Alfasi \äl-'fä-sē**, Isaac ben Jacob** (b. 1013, near Fès, Mor.—d. 1103, Lucena, Spain) Moroccan Jewish scholar. He spent most of his life in Fès, but in 1088 he was denounced to the government and was obliged to flee to Spain. He became head of the Jewish community in Lucena and established a noted Talmudic academy, provoking a rebirth of Talmudic study in Spain. His codification of the Talmud, *Sefer ha-Halakhot* ("Book of Laws"), deals with HALAKHAH (Hebrew law) and ranks with the works of MAIMONIDES and KARO. It was crucial in establishing the primacy of the Babylonian Talmud over the Palestinian Talmud.

Alferov, Zhores (Ivanovich) (b. March 15, 1930, Vitebsk, Belorussia, U.S.S.R.) Soviet physicist. He received a Ph.D. from the A.F. Ioffe Physico-Technical Institute in 1970 and became director of the institute in 1987. With a research team, he developed the first practical heterostructure electronic device in 1966 and went on to pioneer electronic components made from heterostructures, including the first heterostructure laser. His work led to great advances in communications technology. In 2000 he shared the Nobel Prize for Physics with HERBERT KROEMER and JACK S. KILBY.

Alfieri \äl-'fyā-rē**, Vittorio, Count** (b. Jan. 16, 1749, Asti, Piedmont—d. Oct. 8, 1803, Florence) Italian tragic poet and playwright. Through his lyrics and dramas he helped revive the national spirit of Italy. After a period of travel in which he experienced English political liberty and read the works of MONTESQUIEU and other French writers, he left the military and began writing. His tragedies almost always present the struggle between a champion of liberty and a tyrant. Of the 19 tragedies that he approved for publication in an edition of 1787–89, the best are *Filippo*, *Antigone*, *Oreste*, *Mirra*, and his masterpiece, *Saul*, often considered the most powerful drama in the Italian theatre. His autobiography (1804) is his chief prose work.

Alfonsín \äl-fōn-'sēn\ **(Foulkes), Raúl (Ricardo)** (b. March 13, 1926/7, Chascomús, Buenos Aires, Arg.) Civilian president of Argentina (1983–89). He took a degree in law and founded a newspaper before entering politics in 1953. After Argentina lost the FALKLAND ISLANDS WAR, the discredited military permitted free elections, and Alfonsín defeated the PERONIST candidate. He prosecuted members of the armed forces for human rights violations, but military pressure (including several armed revolts) led him to pardon most convicted officers. His presidency was plagued by high inflation, a huge national debt, labour disputes, and a discontented military. Constitutionally barred from a second term, he was succeeded by CARLOS MENEM.

Alfonso I (Portugal) See AFONSO I

Alfonso III (Portugal) See AFONSO III

Alfonso V *known as* **Alfonso the Magnanimous** (b. 1396—d. June 27, 1458, Naples) King of ARAGON (1416–58) and of NAPLES (as Alfonso I, 1442–58). He followed a policy of Mediterranean expansion, pacifying Sardinia and Sicily and attacking Corsica (1420). Taken prisoner by the Genoese (1435) while preparing to attack Naples, he persuaded his captors into an alliance and conquered Naples (1442), to which he transferred his court. He engaged in much diplomatic and military activity in Africa, the Balkans, and the eastern Mediterranean in order to protect his commerce with the East and defend Christendom against the Turks. He died during an assault on Genoa.

Alfonso VI *known as* **Alfonso the Brave** (b. before June 1040—d. 1109, Toledo, Castile) King of LEÓN (1065–70) and of CASTILE AND LEÓN (1072–1109). He inherited León from his father, Ferdinand I, and warred with his envious brother Sancho II. On Sancho's death he inherited Castile (1072); he also occupied Galicia and imprisoned his brother García, its rightful ruler. In 1077 Alfonso proclaimed himself emperor of all Spain. He took Toledo from the Muslims, but his demands for tribute led to the invasion of Spain by the North African ALMORAVIDS, and he was defeated at Zallaqah (1086). The CID became an ally and defended eastern Spain, but Alfonso continued to lose ground against the Berber armies.

Alfonso X *known as* **Alfonso the Wise** (b. Nov. 23, 1221, Burgos, Castile—d. April, 2, 1284, Sevilla) King of Castile and León (1252–84). He crushed revolts by Muslims (1252) and nobles (1254), and he annexed Murcia after repelling an invasion by Morocco, Granada, and Murcia (1264). He claimed the title of Holy Roman emperor (1256), but GREGORY X persuaded him to renounce the claim. His second son became his successor as SANCHO IV. Alfonso's court was a center of culture, producing an influential law code, the Siete Partidas, and establishing the form of modern Castilian Spanish.

Alfonso XII (b. Nov. 28, 1857, Madrid, Spain—d. Nov. 25, 1885, Madrid) Spanish king whose reign (1874–85) inspired hopes for a stable constitutional monarchy. Alfonso followed his mother, ISABELLA II, into exile following her deposition by the revolution of 1868. He was proclaimed king in 1874 and returned to Spain the next year. His reign was marked by unaccustomed tranquillity. The most urgent problems—ending the civil war with the Carlists (see CARLISM) and drafting a constitution—were settled in 1876. Alfonso was popular, and his early death from tuberculosis disappointed those who desired a constitutional monarchy.

Alfonso XIII (b. May 17, 1886, Madrid, Spain—d. Feb. 28, 1941, Rome, Italy) Spanish king (1886–1931). The posthumous son of ALFONSO XII, he was immediately proclaimed king under his mother's regency and assumed full authority at 16. He relished power, and after World War I

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he moved toward a system of more personal rule, even seeking to rid himself of the Cortes (parliament). He associated himself with the dictatorship of Miguel Primo de Rivera (1923–30), but after the latter's fall the freely elected Republicans demanded Alfonso's abdication, and he was forced to leave Spain. His grandson became Spain's sovereign as Juan Carlos I in 1975.

Alfred *known as* **Alfred the Great** (b. 849—d. 899) King of Wessex (871–99) in southwestern England. He joined his brother Ethelred I in confronting a Danish army in Mercia (868). Succeeding his brother as king, Alfred fought the Danes in Wessex in 871 and again in 878, when he was the only West Saxon leader to refuse to submit to their authority and was driven from the kingdom to the island of Athelney. He defeated the Danes at the Battle of Edington (878) and saved Kent from another Danish invasion in 885. The next year he took the offensive and captured London, a success that brought all the English not under Danish rule to accept him as king. The conquest of the Danelaw by his successors was enabled by his strategy, which included the construction of forts and a naval fleet and the reformation of the army. Alfred drew up an important code of laws (see Anglo-Saxon law) and promoted literacy and learning, personally translating Latin works by Boethius, Pope Gregory I, and St. Augustine of Hippo into Anglo-Saxon. The compilation of the Anglo-Saxon Chronicle was begun under his reign.

algae \'al-jē\ Members of a group of mostly aquatic, photosynthetic organisms (see photosynthesis) that defy precise definition. They range in size from the microscopic flagellate *Micromonas* to giant kelp that reach 200 ft (60 m) in length. Algae provide much of Earth's oxygen, serve as the food base for almost all aquatic life, and provide foods and industrial products, including petroleum products. Their photosynthetic pigments are more varied than those of plants, and their cells have features not found among plants and animals. The classification of algae is changing rapidly because new taxonomic information is being discovered. Algae were formerly classified into three major groups—the red, brown, and green seaweeds—based on the pigment molecules in their chloroplasts. Many more than three groups are now recognized, each sharing a common set of pigment types. Algae are not closely related to each other in an evolutionary sense. Specific groups can be distinguished from protozoans and fungi (see fungus) only by the presence of chloroplasts and by their ability to carry out photosynthesis; these specific groups thus have a closer evolutionary relationship with the protozoa or fungi than with other algae. Algae are common on "slimy" rocks in streams (see diatoms) and as green sheens on pools and ponds. Use of algae is perhaps as old as humankind; many species are eaten by coastal societies.

Algardi, Alessandro (b. 1595, Bologna, Papal States—d. June 10, 1654, Rome) Italian sculptor. He trained in Bologna under the Carracci family and in 1625 moved to Rome, where he designed the stucco decorations in San Silvestro al Quirinale. He later became the most outstanding Baroque sculptor in Rome after Gian Lorenzo Bernini. He was a prolific sculptor of portrait busts, and his colossal marble relief of the *Meeting of Attila and Pope Leo* (1646–53) in St. Peter's Basilica influenced the development and popularity of illusionistic reliefs. His work as a restorer of antique statuary brought him some notoriety.

"Meeting of Attila and Pope Leo," colossal marble relief by Alessandro Algardi, 1646–53; in St. Peter's, Rome
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algebra, linear See linear algebra

algebra and algebraic structures Generalized version of arithmetic that uses variables to stand for unspecified numbers. Its purpose is to solve algebraic equations or systems of equations. Examples of such solutions are the quadratic formula (for solving a quadratic equation) and Gauss-Jordan elimination (for solving a system of equations in matrix form). In higher mathematics, an "algebra" is a structure consisting of a class of objects and a set of rules (analogous to addition and multiplication) for combining them. Basic and higher algebraic structures share two essential characteristics: (1) calculations involve a finite number of steps and (2) calculations involve abstract symbols (usually letters) representing more general objects (usually numbers). Higher algebra (also known as modern or abstract algebra) includes all of elementary algebra, as well as group theory, theory of rings, field theory, manifolds, and vector spaces.

algebraic equation Mathematical statement of equality between algebraic expressions. An expression is algebraic if it involves a finite combination of numbers and variables and algebraic operations (addition, subtraction, multiplication, division, raising to a power, and extracting a root). Two important types of such equations are linear equations, in the form $y = ax + b$, and quadratic equations, in the form $y = ax^2 + bx + c$. A solution is a numerical value that makes the equation a true statement when substituted for a variable. In some cases it may be found using a formula; in others the equation may be rewritten in simpler form. Algebraic equations are particularly useful for modeling real-life phenomena.

algebraic geometry Study of geometric objects expressed as equations and represented by graphs in a given coordinate system. In contrast to Euclidean geometry, algebraic geometry represents geometric objects using algebraic equations (e.g., a circle of radius r is defined by $x^2 + y^2 = r^2$). Objects so defined can then be analyzed for symmetries, intercepts, and other properties without having to refer to a graph.

algebraic topology Field of mathematics that uses algebraic structures to study transformations of geometric objects. It uses functions (often called maps in this context) to represent continuous transformations (see topology). Taken together, a set of maps and objects may form an algebraic group, which can be analyzed by group-theory methods. A well-known topic in algebraic topology is the four-colour map problem.

Algeciras \,al-jə-'sir-əs\ **Conference** (Jan. 16–April 7, 1906) Conference held at Algeciras, Spain, that resolved the first of the Moroccan crises. In 1905 William II objected to France's efforts to exert influence in Morocco, prompting a conference of the European powers and the U.S. Superficially, the Act of Algeciras (1906) seemed to limit French penetration, but the conference's real significance was the diplomatic support that Britain and the U.S. gave France, foreshadowing their roles in World War I.

Alger \'al-jər**, Horatio, Jr.** (b. Jan. 13, 1832, Chelsea, Mass., U.S.—d. July 18, 1899, Natick, Mass.) U.S. writer. The son of a Unitarian minister, Alger graduated from Harvard with honours and then earned a degree from its divinity school. Forced to leave his pulpit after two years because of allegations of improper activities with youths, he took up writing. Beginning with *Ragged Dick* (1868), he wrote more than 100 books that were almost alike in preaching that through honesty, cheerful perseverance, and hard work a poor but virtuous lad would have his just reward (though it was almost always precipitated by good luck). His books sold more than 20 million copies, despite consistently weak plots and dialogue, and Alger was one of the most popular and socially influential writers of the late 19th century.

Algeria *officially* **People's Democratic Republic of Algeria** Country, North Africa. Area: 919,595 sq mi (2,381,741 sq km). Population (2005 est.): 32,854,000. Capital: Algiers. Most of the population is ethnically and linguistically Arab, with a large Berber (Amazigh) minority. Languages: Arabic, Berber (both official), French. Religion: Islam (official; predominantly Sunni). Currency: Algerian dinar. Algeria has the second largest land area (after The Sudan) on the continent. The coastline has numerous bays, and the country's rivers are small and generally seasonal. Northern Algeria is mountainous and is crossed from east to west by the Atlas Mountains; its highest point, elevation 7,638 ft (2,328 m), is Mount Chélia. In central and southern Algeria is much of the northern Sahara. Algeria has a developing economy based primarily on the production and export of petroleum and natural gas. After achieving independence, the country nationalized much of its economy but since the 1980s has privatized parts of the economy. Algeria is a republic with two legislative bodies; its chief of state is the president, and its head of government is the prime minister. Phoenician traders settled there early in the 1st millennium BC; several centuries later the Romans invaded, and by AD 40 they had control of the Mediterranean coast. The fall of Rome in the 5th century led to an invasion by the Vandals and later to a reoccupation by the Byzantine (Eastern Roman) Empire. The Islamic invasion began in the 7th century; by 711 all of northern Africa was under the control of the caliphs of the Umayyad dynasty. Several Islamic Berber empires fol-

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lowed, most prominently the Almoravid (c. 1054–1130), which extended its domain to Spain, and the Almohad (c. 1130–1269). The Barbary Coast pirates menaced Mediterranean trade for centuries; their raids served as a pretext for France to enter Algeria in 1830. By 1847 France had established military control over most of the region and by the late 19th century had instituted civil rule. Popular protest against French rule resulted in the bloody Algerian War (1954–61); independence was achieved following a referendum in 1962. Beginning in the early 1990s, Islamic fundamentalist opposition to secular rule led to an outbreak in civil violence between the army and various Islamic extremist groups.

Algerian Reformist 'Ulamā' \ù-lä-'mä**, Association of** Group of Muslim religious scholars founded in 1931 that worked to create an Algerian Muslim identity. The 'Ulamā' opened schools and promoted the teaching of Arabic. It was opposed by the French-educated elite and the traditional Muslim establishment, which felt threatened by its religious purist tendencies. It joined the National Liberation Front during the war of independence (1954–62) and later had a seat in Algeria's provisional government. See also Young Algerians.

Algerian War *or* **Algerian War of Independence** (1954–62) War for Algerian independence from France. The movement for independence began during World War I (1914–18) and gained momentum after French promises of greater self-rule in Algeria went unfulfilled after World War II (1939–45). In 1954 the National Liberation Front (FLN) began a guerrilla war against France and sought diplomatic recognition at the UN to establish a sovereign Algerian state. Although Algerian fighters operated in the countryside—particularly along the country's borders—the most serious fighting took place in and around Algiers, where FLN fighters launched a series of violent urban attacks that came to be known as the Battle of Algiers (1956–57). French forces (that increased to 500,000 troops) managed to regain control but only through brutal measures, and the ferocity of the fighting sapped the political will of the French to continue the conflict. In 1959 Charles de Gaulle declared that the Algerians had the right to determine their own future. Despite terrorist acts by French Algerians opposed to independence and an attempted coup in France by elements of the French army, an agreement was signed in 1962, and Algeria became independent. See also Raoul Salan.

Algiers *Arabic* **Al-Jazā'ir** *French* **Alger** \àl-'zhā\ City (pop., 1998: 1,519,570), chief seaport and capital of Algeria. Located along the Bay of Algiers and first settled by Phoenicians, it was later ruled by the Romans. It was destroyed by the Vandals in the 5th century AD but revived under a Berber dynasty in the 10th century. When the Spanish threatened it in the early 16th century, the local emir appealed to the Ottoman corsair Barbarossa, who expelled the Spanish and placed Algiers under the rule of the Ottoman Empire. Algiers became the major base for the Barbary Coast pirates for 300 years; their activities were finally curtailed in 1818 by an American force led by Stephen Decatur. The French took the city in 1830 and made it headquarters for their African colonial empire. In World War II (1939–45), it became the Allied headquarters in northern Africa and for a time the provisional capital of France. In the 1950s it was the focal point in the drive for Algeria's independence; after independence, Algiers grew as the country's political, economic, and cultural centre.

ALGOL \'al-ˌgȯl\ High-level algebraic computer programming language developed in the late 1950s as an international language for the expression of algorithms (its name is derived from ALGOrithmic Language) between humans as well as between humans and machines. Used especially in mathematical and scientific applications, ALGOL was more popular in Europe than in the U.S., but it was an important precursor of Pascal and it influenced the development of C language.

Algonquian \al-'gän-kwē-ən\ **languages** *or* **Algonkian** \al-'gäŋ-kē-ən\ **languages** Family of 25–30 North American Indian languages spoken or formerly spoken across a broad area of eastern and central North America. They are divided conventionally into three geographic groups. Eastern Algonquian languages, spoken from the Gulf of St. Lawrence south to coastal North Carolina, include Micmac, East and West Abenaki, Delaware, Massachusett, and Powhatan (or Virginia Algonquian)—the latter two now long extinct. Central Algonquian languages include Shawnee, Miami-Illinois, Sauk, Kickapoo, Potawatomi, Menominee (all spoken around the Great Lakes), Ojibwa (around the upper Great Lakes and north from eastern Quebec through Manitoba), and Cree-Montagnais-Naskapi (spoken from Labrador west to Hudson Bay and Alberta). Plains Algonquian includes the languages of the Cheyenne, Arapaho, Atsina (Gros Ventres), and Blackfoot (spoken in the central and northern Great Plains).

algorithm \'al-gə-ˌri-thəm\ Procedure that produces the answer to a question or the solution to a problem in a finite number of steps. An algorithm that produces a yes or no answer is called a decision procedure; one that leads to a solution is a computation procedure. A mathematical formula and the instructions in a computer program are examples of algorithms. Euclid's *Elements* (c. 300 BC) contained an algorithm for finding the greatest common divisor of two integers. Manipulation of lists (searching for, inserting, and removing items) can be done efficiently by using algorithms.

algorithms, analysis of Basic computer-science discipline that aids in the development of effective programs. Analysis of algorithms provides proof of the correctness of algorithms, allows for the accurate prediction of program performance, and can be used as a measure of computational complexity. See also Donald Knuth.

Algren \'ȯl-grən**, Nelson** *orig.* **Nelson Ahlgren Abraham** (b. March 28, 1909, Detroit, Mich., U.S.—d. May 9, 1981, Sag Harbor, N.Y.) U.S. writer. The son of a machinist, Algren grew up in Chicago and worked his way through the University of Illinois during the Great Depression. His novels of the poor skillfully capture the mood of the city's underside and are lifted from routine naturalism by his vision of his characters' pride, humour, and unquenchable yearnings. Among his popular successes were *The Man with the Golden Arm* (1949; film, 1956) and *A Walk on the Wild Side* (1956; film, 1962). He also published an admired short-story collection, *The Neon Wilderness* (1947).

Alhambra \äl-'äm-brə\ Palace of the Moorish monarchs of Granada, Spain, built (1238–1358) on a plateau above the city. Its name (Arabic: "the red") may refer to the colour of the sun-dried bricks used in its outer walls. The Alhambra, only three parts of which remain intact, is made up of a series of rooms and gardens clustered around three principal courts, with extensive use of fountains and water basins. Its surfaces are astoundingly ornate and varied, with outstanding examples of stalactite work.

'Alī (ibn Abī Ṭālib) (b. c. 600, Mecca—d. January 661, Al-Kūfah, Iraq) Cousin and son-in-law of the Prophet Muhammad and fourth caliph (656–661). 'Alī was a ward of Muhammad, just as Muhammad himself had been a ward of 'Alī's father, Abū Ṭālib. An early convert to Islam, he helped foil an assassination plot against Muhammad and, following the Hijrah to Medina (622), fought beside him against his enemies, gaining renown as a soldier. Since some in the early Muslim community claimed that Muhammad did not name any successor and others claimed that he

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named ʿAlī, the controversy over ʿAlī's claim to the caliphate resulted in the fundamental schism in Islam that eventually led to the creation of the Shīʿite (from *shīʿat ʿAlī*, "party of ʿAlī") and Sunnite branches of the religion. His willingness to compromise with his adversaries during the first FITNAH led some of his troops to desert and form the KHĀRIJITE sect, one of whose members later assassinated ʿAlī. In later Islamic hagiography, ʿAlī was held up as the paradigm of youthful chivalry and virtue by both Shīʿites and Sunnites. See also al-ḤUSAYN IBN ʿALĪ; Battle of KARBALĀʾ; MUʿĀWIYAH.

Ali, Muhammad *orig.* **Cassius (Marcellus) Clay** (b. Jan. 17, 1942, Louisville, Ken., U.S.) U.S. boxer. Cassius Clay took up boxing at the age of 12 and rose through the amateur ranks to win the Olympic light heavyweight crown in 1960. His first professional heavyweight title win was against Sonny Liston in 1964. After defending the title nine times between 1965 and 1967, he was stripped of it for refusing induction into the armed forces following his acceptance of the teachings of the NATION OF ISLAM. It was then that he changed his name to Muhammad Ali. In 1974 Ali regained his title after defeating the former champion Joe Frazier and the then-current champion GEORGE FOREMAN. He lost to Leon Spinks in 1978 but later that year regained the title a third time, becoming the first heavyweight champion ever to do so. He retired in 1979, having lost only three of 59 fights. Attempted comebacks in 1980 and 1981 failed. Throughout his career Ali was known for his aggressive charm, invincible attitude, and colourful boasts, often expressed in doggerel verse. "I am the greatest" was his personal credo. Ali's later years have been marked by physical decline. Damage to his brain, caused by blows to the head, has resulted in slurred speech, slowed movement, and other symptoms of Parkinson disease.

Muhammad Ali (right) fighting Ernie Terrell, 1967.
UPI

Aliákmon \äl-ˈyäk-mȯn\ **River** River, north-central Greece. Rising in the Grammos Mountains and flowing southeast then northeast for 185 mi (297 km) into the upper Gulf of Thérmai, it is the longest river in Greek Macedonia. Throughout history it has served as a natural line of defense against invaders from the north.

Alicante \ˌä-lē-ˈkän-tā\ City (pop., 2001: 284,580), southeastern Spain, located on Alicante Bay of the Mediterranean Sea. It was founded as a Greek colony in 325 BC and was captured in 201 BC by the Romans, who called it Lucentum. After being ruled by the Moors (718–1249), it was later incorporated into the kingdom of ARAGON in 1265. The city was besieged by the French in 1709 and by the Federalists of CARTAGENA in 1873. Its economy is based on tourism and the export of wine and produce.

Alice Springs Town (pop., 2001 prelim.: 26,990), Northern Territory, Australia. It lies between DARWIN and ADELAIDE, virtually in the centre of the continent. It originated in the 1870s as a station on the Overland Telegraph Line. Because of its location, it has become a major shipping point. Its mild winter climate makes it a popular tourist destination.

alien In law, one who resides in a country without becoming naturalized, retaining instead the citizenship of another country. The laws of most nations have long afforded aliens certain minimum standards of civilized treatment but have also restricted their employment and ownership of property. Under U.S. law, all aliens have had to register since 1940. Registration cards ("green cards") entitle them to obtain employment. Like citizens, aliens are protected by the U.S. Constitution, including the Bill of Rights and the due-process clause of the 14th Amendment. They remain subject to limitations under local laws, and residence in the U.S. is not a right but a privilege granted by Congress.

Alien and Sedition Acts Four laws passed by the U.S. Congress in 1798, in anticipation of war with France. The acts, precipitated by the XYZ AFFAIR, restricted aliens and curtailed press criticism of the government. Aimed at French and Irish immigrants (who were mostly pro-France), they increased the waiting period for naturalization and authorized expulsion of aliens considered dangerous. The Alien and Sedition Acts were opposed by THOMAS JEFFERSON and helped propel him to the presidency. They were repealed or had expired by 1802.

alienation In the social sciences context, the state of feeling estranged or separated from one's milieu, work, products of work, or self. The concept appears implicitly or explicitly in the works of ÉMILE DURKHEIM, FERDINAND TÖNNIES, MAX WEBER, and GEORG SIMMEL but is most famously associated with KARL MARX, who spoke of workers being alienated from their work and its products under CAPITALISM. In other contexts the term alienation, like ANOMIE, can suggest a sense of powerlessness, meaninglessness, normlessness, social isolation, or cultural- or self-estrangement brought on by the lack of fit between individual needs or expectations and the social order.

alimentary canal *or* **digestive tract** Pathway along which food travels when it is eaten and from which solid wastes are expelled. It includes the MOUTH, PHARYNX, ESOPHAGUS, STOMACH, SMALL INTESTINE, LARGE INTESTINE, and ANAL CANAL. See also DIGESTION.

alimony See MARRIAGE LAW

Alitalia Italian international airline with headquarters in Rome. Although the airline no longer commands monopoly status in its country, as of 2002 the Italian government still owned a majority share of the company.

Alito, Samuel A., Jr. *in full* **Samuel Anthony Alito, Jr.** (b. April 1, 1950, Trenton, N.J., U.S.) U.S. jurist. He earned a bachelor's degree (1972) from Princeton University and law degree (1975) from Yale University. He served as an assistant to the U.S. solicitor general (1981–85), deputy assistant to the U.S. attorney general (1985–87), and U.S. attorney for the district of New Jersey (1987–90). In 1990 he was appointed by U.S. Pres. GEORGE BUSH to serve as a judge on the U.S. Court of Appeals for the Third Circuit, establishing a conservative judicial record. In 2005 he was appointed associate justice of the U.S. Supreme Court by Pres. GEORGE W. BUSH to fill the seat of retiring justice SANDRA DAY O'CONNOR; he was confirmed by the U.S. Senate the following year.

aliyah \ä-ˈlē-yä\ *Hebrew* **"ascending"** In Judaism, the honour, accorded to a worshiper, of being called up to read an assigned passage from the Torah at Sabbath morning services; or Jewish immigration to Israel. Because the passage assigned for each Sabbath morning service is subdivided into a minimum of seven sections, at least seven different persons are called up for these readings. Aliyah in the sense of immigration to Israel is ongoing but also occurs in waves. The first two waves of immigration occurred in 1882–1914, the next three in 1919–39. The sixth aliyah (1945–48) brought many HOLOCAUST survivors. Later waves of immigration included FALASHA from Ethiopia, émigrés from the former Soviet Union, and others. See also ZIONISM.

Alkaios See ALCAEUS

alkali \ˈal-kə-ˌlī\ Inorganic compound, any soluble HYDROXIDE (—OH) of the ALKALI METALS: LITHIUM, SODIUM, POTASSIUM, rubidium, and CESIUM. More broadly, ammonium hydroxide (see AMMONIA) and soluble hydroxides of the ALKALINE EARTH METALS are also called alkalies. Strong BASES that turn LITMUS paper blue, they react with ACIDS to yield SALTS, are caustic, and in concentrated form corrode tissues. Sodium hydroxide (CAUSTIC SODA) and potassium hydroxide (caustic potash) are very important industrial chemicals, used in the manufacture of soaps, glass, and many other products. The MINERAL trona, a compound of sodium carbonate and bicarbonate, is one naturally occurring alkali. It may be mined or recovered from dry lake beds.

alkali feldspar Any of several common SILICATE MINERALS that often occur as whitish to variously coloured, glassy crystals. The alkali FELDSPARS may be regarded as mixtures of sodium aluminosilicate ($NaAlSi_3O_8$) and potassium aluminosilicate ($KAlSi_3O_8$). Both the sodium and potassium aluminosilicates have several distinct forms, each with a different structure. Alkali feldspars are used in the manufacture of glass and ceramics; transparent, highly coloured, or iridescent varieties are sometimes used as gemstones. They are primarily important, however, as constituents of rocks (see PLAGIOCLASE).

alkali metal Any of the six chemical ELEMENTS in the leftmost group of the PERIODIC TABLE (LITHIUM, SODIUM, POTASSIUM, rubidium, CESIUM, and francium). They form ALKALIES when they combine with other elements. Because their

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ATOMS have only one ELECTRON in the outermost shell, they are very reactive chemically (they react rapidly, even violently, with water), form numerous compounds, and are never found free in nature.

alkaline earth metal Any of the six chemical ELEMENTS in the second leftmost group of the PERIODIC TABLE (BERYLLIUM, MAGNESIUM, CALCIUM, STRONTIUM, BARIUM, and RADIUM). Their name harks back to medieval ALCHEMY. Their ATOMS have two ELECTRONS in the outermost shell, so they react readily, form numerous compounds, and are never found free in nature.

alkaloid Basic (see BASE) organic compounds of plant origin, containing combined NITROGEN. Alkaloids are AMINES, so their names usually end in "ine" (e.g., CAFFEINE, NICOTINE, MORPHINE, QUININE). Most have complex chemical structures of multiple ring systems. They have diverse, important physiological effects on humans and other animals, but their functions in the plants that produce them are poorly understood. Some plants (e.g., OPIUM POPPY, ERGOT fungus) produce many different alkaloids, but most produce only one or a few. Certain plant families, including the POPPY FAMILY (Papaveraceae) and the NIGHTSHADE FAMILY (Solanaceae), are particularly rich in them. Alkaloids are extracted by dissolving the plant in dilute ACID.

Alkamenes See ALCAMENES

alkane *or* **paraffin** Any of a class of HYDROCARBONS whose MOLECULES consist only of carbon and hydrogen atoms joined by single COVALENT BONDS (general formula $C_nH_{(2n\ +\ 2)}$). The simplest is METHANE (CH_4). Alkanes with more than three carbon atoms may have straight and branched ISOMERS. Cycloalkanes have ring structures (but are not AROMATIC COMPOUNDS) with two fewer hydrogen atoms per molecule than the corresponding alkane; many have more than one ring. Commercial sources include PETROLEUM and NATURAL GAS. Uses, often as mixtures, include fuels, SOLVENTS, and raw materials. See also PARAFFIN.

alkene See OLEFIN

All Saints' Day In Christianity, a day commemorating all the saints of the church, known and unknown. It is celebrated on November 1 in the Western churches and on the first Sunday after PENTECOST in the Eastern churches. The first general observance of All Saints' Day was ordered by Pope Gregory IV in 837. In medieval England the festival was called All Hallows, and its eve is still known as HALLOWEEN.

All Souls' Day In the Roman Catholic church, a day commemorating all the Christians believed to be in PURGATORY. Celebrated on November 2, it was first established by Odilo (d. 1049), abbot of Cluny, in the 11th century, and it was widely celebrated by the 13th century. The date follows ALL SAINTS' DAY, with the idea that remembering the saints in heaven should be followed by remembering the souls awaiting release from purgatory. Roman Catholic doctrine holds that the prayers of the faithful on earth will help cleanse these souls in order to prepare them for heaven.

Allah *Arabic* **"God"** Standard Arabic word for God, used by Arab Christians as well as by Muslims. According to the QUR'ĀN, Allah is the creator and judge of humankind, omnipotent, compassionate, and merciful. The Muslim profession of faith affirms that there is no deity but God and emphasizes that he is inherently one: "nothing is like unto him." Everything that happens occurs by his commandment; submission to God is the basis of ISLAM. The Qur'ān and the ḤADĪTH contain the 99 "most beautiful names" of God, including the One and Only, the Living One, the Real Truth, the Hearer, the Seer, the Benefactor, and the Constant Forgiver.

Allahabad \'ä-lä-hä-ˌbäd\ *ancient* **Prayag** City (pop., 2001: metro. area, 1,042,229), south-central UTTAR PRADESH state, northern India, on the GANGES (Ganga) and YAMUNA rivers. An ancient holy city sacred to Hindu pilgrims, it is the site of the Pillar of Ashoka (erected c. 240 BC). The Mughal emperor AKBAR founded the present-day city in 1583; it was ceded to the British in 1801. Allahabad was the scene of a serious outbreak in the 1857 INDIAN MUTINY. As the home of the NEHRU family, it was later a centre of the Indian independence movement. It is the site of the Jami Masjid (Great Mosque) and the University of Allahabad.

Allbutt, Sir Thomas Clifford (b. July 20, 1836, Dewsbury, Yorkshire, Eng.—d. Feb. 22, 1925, Cambridge, Cambridgeshire) English physician. He introduced the modern clinical thermometer (the thermometer had previously been a foot-long instrument that required 20 minutes to register temperature) and outlined the use of the ophthalmoscope to inspect the interior of the eye. He demonstrated the aortic origin of angina pectoris. His investigations improved treatment of arterial diseases and resulted in, among other works, *Diseases of the Arteries* (1915). His chief publication was *Systems of Medicine* (8 vol., 1896–99).

Alleghenian orogeny \ˌal-ə-'gā-nē-ən-ȯ-'rä-jə-nē\ *formerly* **Appalachian Revolution** Mountain-building event that affected the APPALACHIAN GEOSYNCLINE in the late PERMIAN PERIOD (c. 286–248 million years ago). The Alleghenian orogeny is most pronounced in the central and southern Appalachian Mountains and produced the different effects in various subregions: compressional folding and faulting of the Valley and Ridge Province, westward thrusting of the Blue Ridge, and folding and minor metamorphism and igneous intrusion in the Piedmont Province. It may have resulted from the collision (see PLATE TECTONICS) of the central and southern Appalachian continental margin with that of North Africa in the Permian period.

Allegheny \ˌal-ə-'gā-nē\ **Mountains** Ranges of the APPALACHIAN system in Pennsylvania, Maryland, Virginia, and West Virginia, U.S., west of and generally parallel to the BLUE RIDGE Mountains. Part of the Allegheny Plateau that spans the entire upland area from the Cumberland Plateau to the Mohawk Valley in New York, the Allegheny Mountains extend some 500 mi (800 km) south-southwestward, with heights of more than 4,800 ft (1,460 m). The eastern slope is sometimes called the Allegheny Front.

Allegheny River River in Pennsylvania and New York, U.S. It rises in Potter county, Pa., loops northwest into New York, turns back into Pennsylvania, and unites with the MONONGAHELA to form the OHIO RIVER at PITTSBURGH, Pa. It is 325 mi (523 km) long; its chief tributaries are the Clarion, the Kiskiminetas, and French Creek. Several dams make the river navigable from Pittsburgh to East Brady, Pa.

allegory Work of written, oral, or visual expression that uses symbolic figures, objects, and actions to convey truths or generalizations about human conduct or experience. It encompasses such forms as the FABLE and parable. Characters often personify abstract concepts or types, and the action of the narrative usually stands for something not explicitly stated. Symbolic allegories, in which characters may also have an identity apart from the message they convey, have frequently been used to represent political and historical situations and have long been popular as vehicles for SATIRE. EDMUND SPENSER's long poem *The Faerie Queen* is a famous example of a symbolic allegory.

allele \ə-'lēl\ Any one of two or more alternative forms of a GENE that may occur alternatively at a given site on a CHROMOSOME. Alleles may occur in pairs, or there may be multiple alleles affecting the expression of a particular trait. If paired alleles are the same, the organism is said to be homozygous for that trait; if they are different, the organism is heterozygous. A dominant allele will override the traits of a recessive allele in a heterozygous pairing (see DOMINANCE and RECESSIVENESS). In some traits, alleles may be codominant (i.e., neither acts as dominant or recessive). An individual cannot possess more than two alleles for a given trait. All genetic traits are the result of the interactions of alleles.

allemande \'al-ə-ˌmand\ Processional couple dance with stately flowing steps, fashionable in the 16th century, especially in France. A line of couples extended their paired hands forward and paraded back and forth the length of the ballroom. It was revived in the 18th century as a figure dance for four couples, in which each pair performed intricate turns under each other's arms, a figure that partly survives in the "allemand" of the U.S. SQUARE DANCE. In the late 17th century a stylized version of the dance in ¾ time began to be used by composers as the first movement of the SUITE.

Allen, Ethan (b. Jan. 21, 1738, Litchfield, Conn.—d. Feb. 12, 1789, Burlington, Vt., U.S.) American soldier and frontiersman. After fighting in the FRENCH AND INDIAN WAR (1754–63), he settled in what is now Vermont. At the outbreak of the AMERICAN REVOLUTION, his force of Green Mountain Boys (organized in 1770) helped defeat the British in the Battle of TICONDEROGA (1775). As a volunteer with troops commanded by Gen. PHILIP SCHUYLER, he attempted to take Montreal but was captured by the British and held prisoner until 1778. He returned to Vermont, where he worked for statehood. Failing to achieve this, he attempted to negotiate the annexation of Vermont to Canada.

Allen, Mel *orig.* **Melvin Allen Israel** (b. Feb. 14, 1913, Birmingham, Ala., U.S.—d. June 16, 1996, Greenwich, Conn.) U.S. sports broadcaster. As lead announcer for the New York Yankees baseball team (1940–64), he was known for his congeniality and his catchphrase "How about

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that!" He hosted the television program *This Week in Baseball* (1977–95). In 1978 Allen and Red Barber became the first broadcasters elected to the Baseball Hall of Fame.

Allen, Richard (b. Feb. 14, 1760, Philadelphia, Pa.—d. March 26, 1831, Philadelphia) U.S. religious leader. He was born to slave parents, and his family was sold to a Delaware farmer. A Methodist convert at 17, he was licensed to preach five years later. By 1786 he had purchased his freedom and settled in Philadelphia, where he joined St. George's Methodist Episcopal Church. Racial discrimination prompted him to withdraw in 1787, and he turned an old blacksmith shop into the first black church in the U.S. Allen and his followers built the Bethel African Methodist Church, and in 1799 he was ordained as its minister. In 1816 he organized a conference of black leaders to form the African Methodist Episcopal Church, of which he was named the first bishop.

Allen, Steve *orig.* **Stephen Valentine Patrick William Allen** (b. Dec. 26, 1921, New York, N.Y., U.S.—d. Oct. 30, 2000, Encino, Calif.) U.S. entertainer and songwriter. He appeared as a comedian on radio in the 1940s before moving to late-night television, where he created and hosted *The Tonight Show* (1954–57) and *The Steve Allen Show* (1956–60). He hosted several other television shows, including *Meeting of Minds* (1977–81). He composed over 3,000 songs, including "Picnic" and "Impossible," and appeared in films such as *The Benny Goodman Story* (1955).

Allen, Woody *orig.* **Allen Stewart Konigsberg** (b. Dec. 1, 1935, Brooklyn, N.Y., U.S.) U.S. film director, screenwriter, and actor. After writing routines for comedians and performing as a nightclub comic, he wrote the Broadway play *Don't Drink the Water* (1966). His early films, such as *Bananas* (1971) and *Sleeper* (1973), combined highbrow comedy and slapstick. Later romantic comedies such as *Annie Hall* (1977), which won him two Academy Awards, and *Manhattan* (1979) offered a bittersweet view of New York life. He continued making films into the 21st century, most notably *Hannah and Her Sisters* (1986), *Crimes and Misdemeanors* (1989), and *Bullets over Broadway* (1994).

Allenby (of Megiddo and of Felixstowe), Edmund Henry Hynman Allenby, 1st Viscount (b. April 23, 1861, Brackenhurst, near Southwell, Nottinghamshire, Eng.—d. May 14, 1936, London) British field marshal. He fought in the South African War and served as inspector general of cavalry (1910–14). In World War I, he commanded with distinction in the Middle East. His victory over the Turks at Gaza (1917) led to the capture of Jerusalem, and his victory at Megiddo, along with his capture of Damascus and Aleppo, ended Ottoman power in Syria. His success was partly due to his innovative use of cavalry and other mobile forces, and he is remembered as the last great British leader of mounted cavalry. As high commissioner for Egypt (1919–25), he steered that country to recognition as a sovereign state (1922).

Allende \ä-'yen-dā\ **(Gossens), Salvador** (b. July 26, 1908, Valparaiso, Chile—d. Sept. 11, 1973, Santiago) Socialist president of Chile (1970–73). Of upper-middle-class background, Allende took a degree in medicine and in 1933 helped found Chile's Socialist Party. He ran for president unsuccessfully three times before winning narrowly in 1970. He attempted to restructure Chilean society along socialist lines while retaining democracy, civil liberties, and due process of law, but his efforts to redistribute wealth resulted in stagnant production, food shortages, rising inflation, and widespread strikes. His inability to control his radical supporters further alienated the middle class. His policies dried up foreign credit and led to a covert campaign by the U.S. Central Intelligence Agency to destabilize the government. He was overthrown in a violent military coup, during which he died by gunshot, reportedly self-inflicted. He was replaced by Gen. Augusto Pinochet. See also Eduardo Frei.

Allentown City (pop., 2000: 106,632), eastern Pennsylvania, U.S. It was laid out along the Lehigh River in 1762 and named Northampton by William Allen, later the state's chief justice; its name was changed in 1838 to honour Allen. During the American Revolution, the Liberty Bell was moved there for safekeeping. It is a major iron and mining centre.

allergy Exaggerated reaction by the body to foreign substances that are harmless to most people. Those substances, called allergens or antigens, may include pollens, drugs, dusts, foods, and other items. Immediate allergic reactions result from genetic predisposition or sensitization by previous exposure. Blood vessels dilate and bronchial air passages constrict. A severe reaction (anaphylaxis) can obstruct breathing and may be fatal. Delayed allergic responses (e.g., contact dermatitis) appear 12 hours or more after exposure. Avoiding allergens and taking antihistamines can prevent or treat allergies. When avoidance is not feasible and antihistamines do not relieve symptoms, desensitization can be attempted.

alliance In international politics, a union for joint action of various powers or states. Examples include the alliance of the European powers and the U.S. against Germany and its allies during World War II and the alliance of the NATO states against the Soviet Union and its allies during the Cold War. Many alliances rest on the principle of collective security, through which an attack on one member is considered an attack on all members. Major alliances formed after World War II include the ANZUS Pact, the Arab League, ASEAN, the Organization of American States, the Southeast Asia Treaty Organization, and the Warsaw Pact.

Alliance for Progress International development program. Initiated by the U.S. and joined by 22 Latin American countries in 1961, it aimed to strengthen democratic government and promote social and economic reforms in Latin America. The program, which provided loans and aid from the U.S. and the international financial community, built some schools and hospitals, but by the early 1970s it was widely viewed as a failure. Significant land reform was not achieved, population growth outstripped gains in health and welfare, and the U.S. willingness to support military dictators to prevent communism from gaining a foothold sowed distrust and undermined the reforms the Alliance was intended to promote.

Alliance Israélite Universelle \ål-'yäⁿs-is-rä-el-'ēt-ū-nē-ver-'sel\ Political organization founded in France in 1860 for the purpose of providing assistance to Jews. Its founders were a group of French Jews who had the resources to help those who were poor, offering political support, helping individuals emigrate, and eventually setting up Jewish education programs in eastern Europe, the Middle East, and North Africa. In 1945 it expressed support for political Zionism (the establishment of a Jewish state), and in 1946 its diplomatic activities were taken over by the Consultative Council of Jewish Organizations in New York City.

Allied Powers *or* **Allies** Nations allied in opposition to the Central Powers in World War I or to the Axis Powers in World War II. The original Allies in World War I—the British Empire, France, and the Russian Empire—were later joined by many other countries, including Portugal, Japan, and Italy. Other nations joining the Allies, including the U.S. after 1917, were called Associated Powers, a term emphasized by Pres. Woodrow Wilson to preserve the U.S.'s free hand in the war. In World War II the major Allied Powers were Britain, France, the Soviet Union, the U.S., and China. More generally, the Allies included all the wartime members of the United Nations, the 1942 signatories to the Declaration of the UN.

alligator Either of two species of long-snouted reptiles constituting the genus *Alligator* (family Alligatoridae, order Crocodilia). Alligators differ from crocodiles in snout shape and tooth placement. Living in large bodies of water such as lakes, swamps, and rivers, these lizardlike carnivores use their powerful tail for defense and swimming. The eyes, ears, and nostrils, located on top of the long head, project above the water's surface. Alligators dig burrows in which they shelter from danger and hibernate in cold weather. The once-endangered American alligator of the southeastern U.S. may grow to 19 ft (5.7 m) long but usually ranges from 6 to 12 ft (1.8 to 3.7 m) long. The Chinese alligator of the Chang (Yangtze) River region, which grows to 5 ft (1.5 m), is critically endangered.

Alligator (*Alligator mississippiensis*)
P. MORRIS/WOODFIN CAMP AND ASSOCIATES

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Allingham \'al-iŋ-əm**, Margery (Louise)** (b. May 20, 1904, London, Eng.—d. June 30, 1966, Colchester, Essex) British detective-story writer. She published her first story at age 8, her first novel at 19, and her first detective story in her early 20s. Her stories about the fictional detective Albert Campion became very popular, and such novels as *Tiger in the Smoke* (1952) and *The China Governess* (1962), with their intellectual style and psychological insight, helped win detective fiction consideration as a serious literary genre. The BBC produced adaptations of eight of her novels in the late 1980s.

alliteration *or* **head rhyme** Repetition of consonant sounds in two or more neighbouring words or syllables. A frequently used poetic device, it is often discussed with assonance (the repetition of stressed vowel sounds within two or more words with different end consonants) and consonance (the repetition of end or medial consonants).

allium Any plant of a large genus (*Allium*) of bulbous, onion- or garlic-scented herbs of the LILY FAMILY, including the ONION, GARLIC, CHIVE, LEEK, and SHALLOT. *Allium* species are found in most regions of the world except the tropics and New Zealand and Australia. Some are cultivated as ornamental border plants.

allocation of resources Apportionment of productive assets among different uses. The issue of resource allocation arises as societies seek to balance limited resources (CAPITAL, LABOUR, LAND) against the various and often unlimited wants of their members. Mechanisms of resource allocation include the price system in free-market economies and government planning, either in state-run economies or in the public sectors of mixed economies. The aim is always to allocate resources in such a way as to obtain the maximum possible output from a given combination of resources.

Allosaurus \ˌal-ə-'sȯr-əs\ Large carnivorous dinosaur of a group similar to the TYRANNOSAURS, found as fossils primarily in Late Jurassic rocks of North America. It weighed 2 tons (1,800 kg) and grew to 35 ft (10.5 m) long. Its well-developed tail, half of its total body length, probably functioned as a counterbalance for the body. *Allosaurus* walked on its two hind limbs and probably used the much smaller forelimbs for grasping. Equipped with powerful, flexible jaws, allosaurs likely preyed on medium-sized dinosaurs; they were possibly scavengers that hunted in groups. Some related allosaurs (*Giganotosaurus, Carcharodonotosaurus*) may have been larger than *Tyrannosaurus rex*.

allosteric control \ˌa-lō-'ster-ik\ Inhibition or activation of an ENZYME by a small regulatory molecule that interacts with the enzyme at a site (allosteric site) other than the active site (at which catalytic activity occurs). The interaction changes the shape of the enzyme, thus affecting the active site of the usual complex between the enzyme and its substrate (the substance on which the enzyme acts). As a result, the enzyme's ability to catalyze a reaction (see CATALYSIS) is either inhibited or enhanced. If the regulatory molecule inhibits an enzyme in the pathway of its own synthesis, the control is said to be FEEDBACK INHIBITION. Allosteric control enables the cell to regulate needed substances rapidly.

allotrope \'a-lə-ˌtrōp\ Any of two or more forms of the same chemical ELEMENT. They may have different arrangements of ATOMS in CRYSTALS of the solid—for example, GRAPHITE and DIAMOND for CARBON—or different numbers of atoms in their MOLECULES—for example, ordinary OXYGEN (O_2) and OZONE (O_3). Other elements that have allotropes include TIN, SULFUR, ANTIMONY, ARSENIC, SELENIUM, and PHOSPHORUS.

alloy Metallic substance composed of two or more elements, as either a mixture, compound, or solid solution. The components of alloys are ordinarily themselves METALS, though CARBON is an essential nonmetal component of STEEL. Alloys are usually produced by melting the mixture of ingredients. The value of alloys was discovered in very ancient times; BRASS (copper and zinc) and BRONZE (copper and tin) were especially important. Today the most important are the alloy steels, which have a wide range of special properties, including hardness, toughness, corrosion resistance, magnetizability, and workability.

Allport, Gordon W(illard) (b. Nov. 11, 1897, Montezuma, Ind., U.S.—d. Oct. 9, 1967, Cambridge, Mass.) U.S. psychologist. He taught at Harvard University (1930–67), becoming noted for his theory of personality, which focused on the adult self rather than on childhood or infantile emotions and experiences, set forth in books such as *Personality* (1937). In *The Nature of Prejudice* (1954) he made important contributions to the analysis of prejudice.

allspice Tropical EVERGREEN tree (*Pimenta dioica*) of the MYRTLE family, native to the West Indies and Central America and valued for its berries, the source of a highly aromatic spice. Allspice was so named because the flavour of the dried berry resembles a combination of cloves, cinnamon, and nutmeg. It is widely used in baking. The name is applied to several other aromatic shrubs as well, including Carolina allspice (*Calycanthus floridus*), Japanese allspice (*Chimonanthus praecox*), and wild allspice, or SPICEBUSH.

Allspice (*Pimenta diocia*)
J.E. CRUISE

Allston, Washington (b. Nov. 5, 1779, Allston plantation, Brook Green Domain on Waccamaw River, S.C., U.S.—d. July 9, 1843, Cambridgeport, Mass.) U.S. painter and writer. He studied at Harvard University and at London's Royal Academy (with BENJAMIN WEST). He settled in Massachusetts in 1830 and became the most important first-generation U.S. Romantic painter. His large landscapes depict the mysterious and dramatic aspects of nature. He later relied on mood and reverie in smaller, more dreamlike images. He also wrote poetry and fiction, and his theories on art were published posthumously as *Lectures on Art* (1850).

alluvial deposit Material deposited by rivers. It consists of SILT, SAND, CLAY, and GRAVEL, as well as much organic matter. Alluvial deposits are usually most extensive in the lower part of a river's course, forming floodplains and DELTAS, but they may form at any point where the river overflows its banks or where the flow of a river is checked. They yield very fertile soils, such as those of the deltas of the Mississippi, Nile, Ganges and Brahmaputra, and Huang (Yellow) rivers. They contain most of the world's supply of tin ore, as well as, in some regions, gold, platinum, and gemstones.

Almagest \'al-mə-ˌjest\ Astronomical and mathematical encyclopedia compiled c. AD 140 by PTOLEMY. It served as the basic guide for Arab and European astronomers until the 17th century. The name derives from the Arabic for "the greatest." Its 13 books cover such topics as the geocentric (Earth-centred), or Ptolemaic, model of the solar system; eclipses; the coordinates and sizes of certain fixed stars; and the distances to the Sun and the Moon.

Almagro \äl-'mä-grō**, Diego de** (b. 1475, Almagro, Castile—d. 1538, Cuzco, Peru) Spanish soldier who played a leading role in the Spanish conquest of Peru. Following service in the Spanish navy, he arrived in South America in 1524 and, with FRANCISCO PIZARRO, led the expedition that conquered the INCA empire in what is now Peru. Bitter enmity arose between the two men, and Almagro imprisoned Pizarro's two brothers for insubordination during an Indian rebellion. Pizarro then defeated Almagro's army and had his former friend put to death.

almanac Book or table containing a calendar of a given year, with a record of various astronomical phenomena, often with weather prognostications, seasonal suggestions for farmers, and other information. The first printed almanac appeared in the mid 15th century. BENJAMIN FRANKLIN began his famous *Poor Richard's* almanacs in 1732. A form of folk literature, 18th-century almanacs furnished useful and entertaining information where reading matter was scarce; a surviving example is the *Old Farmer's Almanac*. Modern almanacs are often annual publications containing statistical, tabular, and general information.

Alma-Tadema \'al-mə-'ta-də-mə**, Sir Lawrence** (b. Jan. 8, 1836, Dronrijp, Neth.—d. June 25, 1912, Wiesbaden, Ger.) Dutch-British painter. After studies at the Antwerp Academy, he visited Italy (1863) and became enamoured of Greco-Roman antiquity and Egyptian archaeology; the ancient world was to provide his primary themes. After settling in London in 1870, he excelled at the accurate re-creation of ancient scenes, exotic costumes, and the sensuous depiction of beautiful women against backgrounds of marble, bronze, and silk. Such figurative images combined sentimentality and anecdote. He was elected to the Royal Academy in 1879 and knighted in 1899. Alma-Tadema's work was immensely popular in his day, but it went out of favour after his death.

Almaty \əl-'mä-tē\ *formerly* **Alma-Ata** \əl-'mä-ə-'tä\ City (pop., 1999: 1,129,400), southeastern KAZAKHSTAN. Formerly the capital of Kazakhstan, it lost its capital status in 1995 to Aqmola (now ASTANA). The modern city

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was founded in 1854, when the Russians established a military fortification on the site of the ancient city of Almaty, destroyed by the Mongols in the 13th century. With the coming of the railroad in 1930, its population grew rapidly. In World War II (1939–45), heavy industry expanded widely as factories were evacuated to the site from European Russia. The city remains a major industrial centre.

Almendros \äl-'men-drōs**, Nestor** (b. Oct. 30, 1930, Barcelona, Spain—d. March 4, 1992, New York, N.Y., U.S.) Spanish cinematographer. In 1948 he emigrated from Spain to Cuba, where he worked with documentary filmmakers. After moving to France in 1961, he collaborated with Eric Rohmer on *My Night at Maud's* (1969) and *Claire's Knee* (1970), and with François Truffaut on *The Wild Child* (1970). His work in the U.S. includes *Sophie's Choice* (1982), and *Billy Bathgate* (1991).

Almohad \'al-mō-ˌhad\ **dynasty** *Arabic* **al-Muwaḥḥidūn ("Unitarians")** (1130–1269) Berber confederation born out of religious opposition to the Islamic doctrines of the Almoravid dynasty. The Almohad leader Ibn Tūmart began his rebellion in the 1120s. Marrakech was captured in 1147 under the leadership of his successor ʿAbd al-Muʾmin. By the 1170s all of the Maghrib was under unified control for the only time in its history, and the Almohads also controlled Muslim Spain. Their rule was marked by, on the one hand, the cultivation of science and philosophy and, on the other, efforts at religious unification by compelling Jews and Christians to convert or emigrate. They lost control of Spain to the Christians in 1212 and of their North African provinces to the Ḥafṣid dynasty in Tunis (1236) and the Marīnids in Marrakech (1269).

almond Tree (*Prunus dulcis*) in the rose family, native to South Asia; also its edible seed, or nut. The tree, growing somewhat larger and living longer than the peach, is strikingly beautiful when in flower. The nuts are either sweet or bitter. Sweet almonds are the edible type consumed as nuts and used in cooking. The extracted oil of bitter almonds is used to make flavouring extracts for foods and liqueurs. Almonds provide small amounts of protein, iron, calcium, phosphorus, and B vitamins and are high in fat. They are commonly used in confectionery baking and in marzipan, a traditional European candy.

Almoravid \ˌal-mə-'rä-vəd\ **dynasty** *Arabic* **al-Murābiṭūn** (1056–1147) Berber confederation that succeeded the Fāṭimid dynasty in the Maghrib. It flourished in the 11th and early 12th centuries. Its founder, ʿAbd Allāh ibn Yasīn, was a Muslim scholar of the Mālikī school who used religious reform as a means of gaining followers in the mid-11th century. The Almoravids took over Morocco and then the rest of the Maghrib following the decline of the Zīrid dynasty. By 1082 they ruled Algiers. By 1110 they also controlled Muslim Spain, but the Christians began to win back territory in 1118. In the 1120s another Berber coalition, the Almohads, started a rebellion, eventually displacing the Almoravids.

aloe Any shrubby succulent plant of the genus *Aloe,* in the lily family. Native to Africa, most of the 200 or so species have a rosette of leaves at the base but no stem. Several are cultivated as ornamentals. The juice of some species, especially the popular potted plant known as true aloe (*Aloe vera*), is used as an ingredient in cosmetics, as a purgative, and as a treatment for burns.

aloe, American See century plant

Alonso, Alicia *orig.* **Alicia Martínez Hoyo** (b. Dec. 21, 1921, Havana, Cuba) Cuban ballerina, choreographer, and director. She studied in Havana and New York, where she danced with Ballet Theatre (later American Ballet Theatre; 1940–41, 1943–48, 1950–55, 1958–59). In 1948 she formed her own company, Ballet Alicia Alonso (renamed Ballet Nacional de Cuba in 1959), with which she performed frequently on tour in Latin America. Despite failing eyesight, she continued for many years to dance leading roles as a guest artist with American Ballet Theatre and other companies.

alpaca \al-'pa-kə\ South American species (*Lama pacos*) in the camel family (Camelidae). The alpaca, guanaco, llama, and vicuña are closely related and are known collectively as lamoids. Domesticated several thousand years ago by Indians of the Andes Mountains, the alpaca has a slender body, a long neck and legs, a small head, a short tail, and large, pointed ears. Alpacas stand about 35 in. (90 cm) at the shoulder and weigh 120–145 lbs (54–65 kg). They are found in central and southern Peru and western Bolivia, on marshy ground at high altitudes. They are the most important of the lamoids for wool production.

Alp-Arslan \'älp-är-'slän\ (b. c. 1030—d. November? 1072/January 1073) Second sultan of the Seljūq dynasty, who added Georgia, Armenia, and much of Anatolia to his domains of Khorāsān and western Iran. He preferred conquest to governing and left the administration of his empire to his famous vizier, Niẓām al-Mulk. In 1071 his victory over the Byzantine Empire at the Battle of Manzikert opened the door for the eventual Turkish conquest of Anatolia. He died a year later when mortally wounded by a prisoner during a quarrel.

Alpha Centauri Triple star in the constellation Centaurus, the faintest component of which, Proxima Centauri, is currently the closest star to the Sun (about 4.2 light-years away). The two brighter components are about 0.2 light-year farther from the Sun. As seen from Earth, the system is the third brightest star (after Sirius and Canopus); Proxima is indistinguishable as a separate star to the unaided eye. Alpha Centauri can be seen from Earth's surface only from points south of about 40° N.

alpha decay Type of radioactive disintegration (see radioactivity) in which some unstable atomic nuclei dissipate excess energy by spontaneously ejecting an alpha particle. Alpha particles have two positive charges and a mass of four atomic mass units; they are identical to helium nuclei. Though they are emitted at speeds about one-tenth that of light, they are not very penetrating and have ranges in air of about 1–4 in. (2.5–10 cm). Alpha decay commonly occurs in elements with atomic numbers greater than 83 (bismuth), but can occur in some rare-earth elements in the atomic-number range of 60 (neodymium) to 71 (lutetium). Alpha decay half-lives range from about a microsecond (10^{-6} second) to billions of years (10^{17} seconds).

alphabet Set of symbols or characters that represent language's sounds in writing. Each character usually represents a simple vowel, a diphthong (two vowels), or one or two consonants. A writing system in which one character represents a whole syllable is called a syllabary. The first alphabet is believed to have been the North Semitic, which originated in the eastern Mediterranean region between 1700 and 1500 BC. Alphabets that arose in the next 500 years included the Canaanite and Aramaic, from which the modern Hebrew and Arabic alphabets descended, and the Greek (ancestor of the Latin alphabet), considered the first true alphabet because it includes both consonants and vowels. Scholars have attempted to establish an exact correspondence between each sound and its symbol in new alphabets such as the International Phonetic Alphabet.

Alpheus \al-'fē-əs\ **River** River, southern Greece. About 75 mi (120 km) long, it is the longest river in the Peloponnese. It rises in Arcadia and flows northwest through southern Elias into the Ionian Sea. Olympia is on its northern bank. It shares its name with the ancient river god, and it figures in Greek legend, including Hercules' cleaning of the Augean stables, and in Samuel Taylor Coleridge's poem "Kubla Khan."

Alpine orogeny \ò-'rä-jə-nē\ Mountain-building event that affected a broad segment of southern Europe and the Mediterranean region during the middle Tertiary period. It produced intense metamorphism, crumpling of rock strata, and uplift accompanied by faulting. It was responsible for the elevation of the present Alps, from which the name derives, the uplifting of plateaus in the Balkan Peninsula and in Corsica and Sardinia, and volcanic activity in England, France, Iceland, and parts of Italy.

Alpine skiing Class of competitive ski events consisting of speed events (the downhill and the supergiant slalom) and technical events (the slalom and giant slalom). Speed events are contested in single runs down longer, steeper, faster courses, with fewer turns than those featured in the technical events. Alpine skiing was first included in the Olympic Games in 1936. See also cross-country skiing; Nordic skiing.

Alps Mountain system, south-central Europe. The Alps extend in a crescent about 750 mi (1,200 km) from the Mediterranean coast between France and Italy to Vienna and cover more than 80,000 sq mi (207,000 sq km). Several peaks rise above 10,000 ft (3,000 m); the highest is Mont Blanc. The Alps form a divide between the Atlantic Ocean, the Mediterranean Sea, and the Black Sea and give rise to several major European rivers, including the Rhône, Danube, and Po. Glaciers cover about 1,500 sq mi (3,900 sq km), mostly at elevations above 10,000 ft (3,000 m). The Saint Gotthard Pass is one of the Alps's notable tunnels. Grenoble, Innsbruck, and Bolzano are major Alpine cities.

Alsace-Lorraine \al-'sas-lò-'rān\ Area, eastern France. It is now usually considered to include the present-day French departments of Haut-Rhin, Bas-Rhin, and Moselle. The area was ceded by France to Germany

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in 1871 after the Franco-Prussian War. It was returned to France after World War I, occupied by the Germans in World War II, then again restored to France. French prewar governmental policies that had clashed with the region's particularism have since been modified. The German dialect known as Alsatian remains the lingua franca, and both French and German are taught in the schools.

Alsatian See German shepherd

Altai Mountains *Russian* **Altay** \al-'tī\ *Chinese* **Altay Shan** \al-'tī-'shän\ *Mongol* **Altayn Nuruu** Mountain system, Central Asia. The range extends about 1,200 mi (2,000 km) in a southeast-northwest direction from the Gobi Desert to the West Siberian Plain, through parts of China, Mongolia, Russia, and Kazakhstan. The highest point is the Russian peak Belukha, 14,783 ft (4,506 m) in elevation. The mountains are the source of the Irtysh and Ob rivers and are notable for their mining and hydroelectrical potential.

Altaic \al-'tā-ik\ **languages** Group of more than 50 languages, comprising the Turkic, Mongolian, and Manchu-Tungus subfamilies. Altaic languages are spoken across Eurasia by more than 140 million people (the overwhelming majority of whom speak Turkic languages). Most scholars consider Altaic itself to be a family, of proven genetic relationship, though a minority attribute similarities in the languages to borrowings and areal convergence. The Uralic and Altaic language families were once believed to form a superfamily, but reliable sound correspondences have not been demonstrated, and the numerous similarities between the two are now attributed to areal influences.

Altamira \ˌal-tə-'mir-ə\ Cave near Santander, northern Spain, famous for its magnificent prehistoric paintings and engravings. The paintings, dating to 14,000–12,000 BC, were first described in 1880. Altamira cave is 890 ft (270 m) long. The roof of the main chamber is covered with paintings, chiefly of bison, in vivid red, black, and violet. Other figures, in a simpler style, include wild boars, horses, and a hind, as well as eight engraved anthropomorphic figures and various handprints and hand outlines. Engraved artifacts and other material remains suggest that the site may have been a centre for seasonal gatherings. See also Magdalenian culture; rock art.

Altan \'äl-tän\ *or* **Anda** \'än-dä\ (d. 1583, Mongolia) Mongol khan who terrorized China in the 16th century. He established a Chinese-style government in his homeland and concluded a peace treaty with Ming-dynasty China in 1571. He converted the Mongols to the reformed, or Dge-lugs-pa, sect of Tibetan Buddhism. In 1578 Altan granted the head of the sect the title of Dalai Lama. With Mongol military aid, later Dalai Lamas crushed the more established Karma-pa (Red Hat) sect in Tibet to become Tibet's spiritual and temporal rulers. See also Gtsang dynasty.

altar Raised structure or place used for sacrifice, worship, or prayer. Altars probably originated with the belief that objects or places (e.g., a tree or spring) were inhabited by spirits or deities worthy of prayers or gifts. Sacrifice to deities required a structure on which the victim could be killed and blood channeled off or flesh burned. In ancient Israel, the altar was a rectangular stone with a hollowed-out basin on top. The ancient Greeks placed altars (see baetylus) in homes, marketplaces, public buildings, and sacred groves. Roman altars were similarly ubiquitous and were often decorated with relief sculptures. Christians at first did not use altars, but by the 3rd century the table on which the Eucharist was celebrated was regarded as an altar. It became the focus of the mass in Christian churches and in Western churches was often adorned by a baldachin and an altarpiece.

altarpiece Painting, relief, sculpture, screen, or decorated wall standing on or behind an altar in a Christian church. The images depict holy personages, saints, and biblical subjects. There are two types of altarpieces: the reredos, which rises from the floor behind the altar, and the retable, which stands on the altar itself or on a pedestal behind it. The diptych is an altarpiece consisting of two panels; a triptych, three panels; and a polyptych, four or more panels. Altarpieces vary in size; some are small and portable, some are huge and stationary, and some have movable wings that can be opened and closed. The practice of erecting sculptural altarpieces dates from the 11th century; altar paintings became common in the 14th century.

Altdorfer \'ält-ˌdȯr-fər**, Albrecht** (b. c. 1480—d. Feb. 12, 1538, Regensburg) German painter and printmaker. He was the leading artist of the Danube school. Most of his works depict religious subjects, but he was one of the first artists to develop landscape painting as an independent genre, specializing in sunset lighting and ruins in twilight. His drawings demonstrate these skills in black with white highlights on dark paper. The influence of Albrecht Dürer is evident in his miniature engravings and woodcuts. From 1526 until his death he was town architect of Regensburg; no architectural work of his is known to have survived.

Alte Pinakothek \'äl-tə-ˌpē-nä-kō-'tek\ *German* **"Old Museum of Painting"** Art museum, one of several collections within the Bavarian State Picture Galleries in Munich, Germany, and one of the great museums of the world. It specializes in European painting from the Middle Ages through the late 18th century; its core collections once belonged to several early Bavarian electors palatine. The building is a 1957 reconstruction of the original 19th-century gallery, destroyed in World War II. Other state museums include the Neue ("New") Pinakothek, which is based on the private collections of Bavarian kings and features 18th–20th-century European paintings and sculpture; the Schack Gallery collection of late Romantic German painting; and the State Gallery of Modern Art.

alternating current (AC) Flow of electric charge that reverses periodically, unlike direct current. It starts from zero, grows to a maximum, decreases to zero, reverses, reaches a maximum in the opposite direction, returns again to zero, and repeats the cycle indefinitely. The time taken to complete one cycle is called the period (see periodic motion), and the number of cycles per second is the frequency; the maximum value in either direction is the current's amplitude. Low frequencies (50–60 cycles per second) are used for domestic and commercial power, but frequencies of around 100 million cycles per second (100 megahertz) are used in television and of several thousand megahertz in radar and microwave communication. A major advantage of alternating current is that the voltage can be increased and decreased by a transformer for more efficient transmission over long distances. Direct current cannot use transformers to change voltage. See also electric current.

alternation of generations In biology, alternation of a sexual phase (gametophyte) and a nonsexual phase (sporophyte) in the life cycle of an organism. The two phases, or generations, are often distinct in structure and sometimes in chromosome makeup. Alternation of generations is common in algae, fungi (see fungus), mosses, ferns, and seed plants. The character and extent of the two phases vary greatly among different groups of plants and algae. During the course of evolution, the gametophyte stage has been progressively reduced. Thus in higher (vascular) plants, the sporophyte is the dominant phase; in more primitive, nonvascular plants the gametophyte is dominant. Among animals, many invertebrates (e.g., protozoans, jellyfish, flatworms) have an alternation of sexual and asexual generations.

alternative energy Any of various renewable power sources to use in place of fossil fuels and uranium. Fusion devices (see nuclear fusion) are believed by some to be the best long-term option, because their primary energy source would be deuterium, abundant in ordinary water. Other technologies include solar energy, wind power, tidal power, wave power, hydroelectric power, and geothermal energy. The amount of energy in such renewable and virtually pollution-free sources is large in relation to world energy needs, yet at present only a small portion of it can be converted to electric power at reasonable cost.

alternative medicine *or* **complementary medicine** Any of a broad range of healing approaches not used in conventional Western medicine. Many are holistic (see holistic medicine); many also emphasize prevention and education. Alternative therapies include acupuncture, aromatherapy, Ayurveda medicine, Chinese medicine, chiropractic, herbal medicine, homeopathy, massage, meditation, naturopathy, therapeutic touch, and Yoga. Though considered alternative in the West, such medicine is the main source of health care for up to 80% of people in less-developed countries. Some alternative-medicine practices are useless or harmful; others are effective and may offer treatments in areas where conventional approaches have not succeeded (e.g., chronic disorders).

alternator Source of direct electric current in modern vehicles for ignition, lights, fans, and other uses. The electric power is generated by an alternator mechanically coupled to the engine, with a rotor field coil supplied with current through slip rings, and a stator with a three-phase winding. A rectifier converts the power from alternating to direct form. A regulator ensures that the output voltage is properly matched to the bat-

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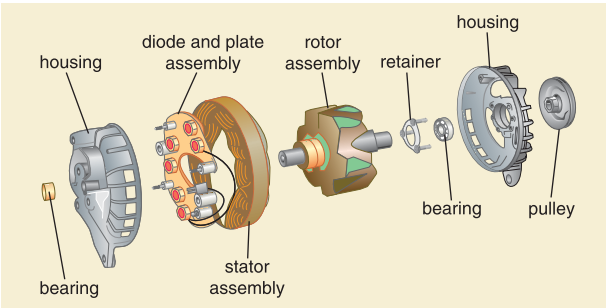
tery voltage as engine speed varies. An inductor alternator is a special kind of synchronous generator in which both the field and the output winding are on the stator.



Exploded view of an automotive alternator. The engine's turning crankshaft, connected to the alternator's pulley by a belt, turns the magnetic rotor inside the stationary stator assembly, generating an alternating current. The diode assembly rectifies the alternating current, producing direct current, which is used to meet the demands of the vehicle's electrical system, including recharging the battery.
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Altgeld, John Peter (b. Dec. 30, 1847, Niederselters, Prussia—d. March 12, 1902, Joliet, Ill., U.S.) German-born U.S. politician, governor of Illinois (1893–97). He emigrated from Germany as a child. In the 1870s he moved to Chicago, where he accumulated a small fortune in real estate and became active in Democratic Party politics. In 1892 he won the governorship as a reformist candidate. In 1893, at the urging of CLARENCE DARROW and labour leaders, he granted clemency to three men convicted of complicity in the HAYMARKET RIOT. The controversial pardon provoked an outcry from conservatives and contributed to his defeat for reelection in 1896, though Altgeld's decision later gained wide approval in judicial circles.

altimeter \al-'tim-ət-ər\ Instrument that measures the altitude of the land surface or of any object, such as an airplane. The mechanical pressure altimeter measures atmospheric pressure relative to sea level through a series of bellows, gears, and springs, which move pointers on a dial. Radio altimeters measure the distance of an aircraft above the ground rather than above sea level by indicating the time a pulse of RADIO energy takes to travel from the aircraft to the ground and back; they are used in automatic navigation and blind-landing systems.

Altiplano \ˌal-ti-'plä-nō\ *Spanish* **"High Plateau"** Region, southeastern Peru and western Bolivia. Comprising a series of intermontane basins, it originates northwest of LAKE TITICACA in southern Peru and extends southeast to southwestern Bolivia. The region's wildlife originally included alpacas and llamas, both now bred for wool. The cities of Puno and Juliaca (Peru) and LA PAZ (Bolivia) are located in the Lake Titicaca basin, an area that has been populated since ancient times.

altitude and azimuth \'az-məth\ Two coordinates describing the position of an object above Earth in a COORDINATE SYSTEM called the altazimuth, or horizon, system, and used in astronomy, gunnery, navigation, surveying, and other fields. Altitude in this sense is expressed as angle of elevation (up to 90°) above the horizon. Azimuth, in astronomical measurement, is the number of degrees clockwise from due north to the point on the horizon directly below the object.

altitude sickness *or* **mountain sickness** Acute reaction to a change from low altitudes to altitudes above 8,000 ft (2,400 m). Most people gradually adapt, but some have a severe reaction that can be fatal unless they return to low altitude. Normal adaptations to the reduced oxygen at high altitude (e.g., breathlessness, racing heartbeat) are exaggerated; other manifestations include headache, gastrointestinal upsets, and weakness. Pulmonary EDEMA is quickly reversed with oxygen and evacuation to a lower area.

Altman \'ȯlt-mən**, Robert (B.)** (b. Feb. 20, 1925, Kansas City, Mo., U.S.) U.S. film director. He learned filmmaking by directing industrial films, then directed several television series before making his first feature film, *Countdown* (1967). The successful antiwar comedy *M*A*S*H* (1970) established his reputation as an independent director whose work emphasizes character and atmosphere over plot. His most acclaimed films include *McCabe and Mrs. Miller* (1971), *Nashville* (1976), *The Player* (1992), and *Short Cuts* (1993).

Altman, Sidney (b. May 7, 1939, Montreal, Que., Can.) Canadian-born U.S. molecular biologist. He studied at MIT and the University of Colorado and has taught at Yale University since 1971. Working independently, Altman and THOMAS CECH discovered that RNA, previously believed to be simply a passive carrier of genetic codes between different parts of the living cell, could also initiate and carry out (i.e., catalyze) some reactions, opening up new fields of research and biotechnology. The two shared a 1989 Nobel Prize.

alto *or* **contralto** Voice or register that extends approximately from the F below middle C to the second D above it. The second-highest part in four-part music, it is normally sung by women. The name derives from *contratenor altus*, the part above the TENOR part. It is used for some instruments that play principally in the alto range (alto saxophone, alto flute, etc.). See also COUNTERTENOR.

Altria Group, Inc. U.S. HOLDING COMPANY with interests in tobacco, foods, and financial services. Formerly called Philip Morris Cos., Inc., the group changed its name to Altria in January 2003. Its holdings include KRAFT FOODS, INC. (including Nabisco), Philip Morris International Inc., and Philip Morris USA Inc. (see PHILIP MORRIS TOBACCO COMPANIES), and an interest in SABMiller PLC, which was created in 2002 from the merger of South African Breweries PLC and Miller Brewing Co. Philip Morris had acquired the Miller Brewing Co. in 1969. It continued to reduce its dependence on tobacco by acquiring General Foods (1985), Kraft Foods (1988), and Nabisco (2000), among others. In 1998, as part of the settlement of a suit brought against it and other cigarette manufacturers by 46 U.S. states, the company agreed to participate in paying more than $200 billion to the states for smoking-related health-care costs.

altruism Ethical theory that regards the good of others as the end of moral action; by extension, the disposition to take the good of others as an end in itself. The term (French, *altruisme*, derived from Latin *alter*: "other") was coined in the 19th century by AUGUSTE COMTE and adopted generally as a convenient antithesis to EGOISM. Most altruists have held that each person has an obligation to further the pleasures and alleviate the pains of other people. The same argument holds if happiness, rather than pleasure, is taken as the end of life.

alum \'a-ləm\ Inorganic compound, any of a class of hydrated double SALTS, usually consisting of ALUMINUM sulfate, water of hydration (an essential part of the CRYSTAL makeup), and the SULFATE of another element. The most important alums are those of potassium sulfate (potassium alum, or potash alum, $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$), ammonium sulfate, and sodium sulfate. Alums occur naturally in various minerals and can be prepared and purified by crystallization from their solutions. Most are white crystals with an astringent, acid taste. They are used as paper-sizing agents, flocculating agents in water treatment, mordants in dyeing, and in pickles, baking powder, fire extinguishers, and medicines.

aluminum Metallic chemical ELEMENT, chemical symbol Al, atomic number 13. A lightweight, silvery white METAL, it is so reactive chemically that it always occurs in compounds. It is the most abundant metallic element in Earth's crust, chiefly in BAUXITE (its principal ORE), FELDSPARS, MICAS, CLAY MINERALS, and LATERITE. It also occurs in gemstones, such as TOPAZ, GARNET, and chrysoberyl; EMERY, CORUNDUM, RUBY, and SAPPHIRE are crystalline aluminum OXIDE. Aluminum was first isolated in 1825, became commercially available in the late 19th century, and is now the most widely used metal after IRON. Its surface oxidizes at once to a hard, tough film, deterring further corrosion. Uses include building and construction, corrosion-resistant chemical equipment, auto and aircraft parts, power transmission lines, photoengraving plates, cookware and other consumer goods, and tubes for ointments and pastes. Important compounds include ALUMS; alumina (aluminum oxide), useful as corundum and as a carrier for many catalysts; aluminum chloride, a widely used catalyst for organic syntheses; and aluminum hydroxide, used to waterproof fabrics.

Alvarado \ˌäl-vä-'rä-thō**, Pedro de** (b. c. 1485, Badajoz, Castile—d. 1541, in or near Guadalajara, New Spain) Spanish soldier and colonial administrator. In 1519 he accompanied the army led by HERNÁN CORTÉS that conquered Mexico. In 1522 he became the first mayor of Tenochtitlán (Mexico City). In 1523 he conquered the native peoples of Guatemala and founded the city (modern Antigua) that became the first capital of the Guatemala region, which later included much of Central America.

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He was governor of Guatemala in 1527–31. In 1539 he began an exploration of central Mexico, but died while quelling an Indian uprising.

Alvarez \'al-və-ˌrez**, Luis W(alter)** (b. June 13, 1911, San Francisco, Calif., U.S.—d. Sept. 1, 1988, Berkeley, Calif.) U.S. experimental physicist. He joined the faculty of the University of California at Berkeley in 1936, where he would remain until 1978. In 1938 he discovered that some radioactive elements decay when an orbital electron merges with the atom's nucleus, producing an element with an atomic number smaller by one, a form of BETA DECAY. In 1939 he and Felix Bloch (1905–83) made the first measurement of the magnetic moment of the neutron. During World War II he developed a radar guidance system for landing aircraft and participated in the Manhattan Project to develop the atomic bomb. He later helped construct the first proton LINEAR ACCELERATOR and constructed the liquid hydrogen BUBBLE CHAMBER. With his son, the geologist Walter Alvarez (b. 1940), he helped develop the theory that links the dinosaurs' extinction with a giant asteroid or comet impact. For work that included the discovery of many subatomic particles, he received the Nobel Prize for Physics in 1968.

Luis Alvarez
BY COURTESY OF THE LAWRENCE RADIATION LABORATORY, THE UNIVERSITY OF CALIFORNIA, BERKELEY

alveolus See PULMONARY ALVEOLUS

Alzheimer \'älts-ˌhī-mər\ **disease** Degenerative brain disorder. It occurs in middle to late adult life, destroying neurons and connections in the CEREBRAL CORTEX and resulting in significant loss of brain mass. The most common form of DEMENTIA, Alzheimer disease progresses from short-term memory impairment to further memory loss; deterioration of language, perceptual, and motor skills; mood instability; and, in advanced stages, unresponsiveness, with loss of mobility and control of body functions; death typically ensues in 5–10 years. Originally described in 1906 by the German neuropathologist Alois Alzheimer (1864–1915) with reference to a 55-year-old person and regarded as a presenile dementia, Alzheimer disease is now recognized as accounting for much of the senile dementia once thought normal with aging. The 10% of cases that begin before age 60 result from an inherited mutation. Neuritic plaques and neurofibrillary tangles in the brain on autopsy are the primary features used for diagnosis. No cure has been found. Most treatment targets the depression, behavioral problems, and sleeplessness that often accompany the disease.

AM *in full* **amplitude modulation** Variation of the amplitude of a carrier wave (commonly a RADIO WAVE) in correspondence to fluctuations in the audio or video signal being transmitted. AM is the oldest method of broadcasting radio programs. Commercial AM stations operate in the frequency range of 535 to 1605 kHz. Because radio waves of these frequencies are reflected back to the Earth's surface by the ionosphere, they can be detected by receivers hundreds of miles away. In addition to commercial radio broadcasting, AM is also employed in short-wave radio broadcasts, and in transmitting the video portion of television programs. See also FM.

AMA See AMERICAN MEDICAL ASSOCIATION

Amadeus \ˌam-ə-'dā-əs\ **VI** *known as* **Amadeus the Green Count** (b. 1334, Chambéry, Savoy [France]—d. March 1, 1383, Castropignano [Italy]) Count of SAVOY (1343–83). Ruler of Savoy from age 9, he significantly extended his kingdom's territory and power. By the 1350s, after adding lands on the Italian side, he held nearly the entire western Alps. He joined a Crusade against the Turks (1366) and restored JOHN V PALAEOLOGUS to the Byzantine throne. A mediator of quarrels among Italian powers, he set out to rescue Queen JOAN I of Naples from her enemies (1382) but died of plague during the expedition.

Amado \ä-'mä-dü**, Jorge** (b. Aug. 10, 1912, Ferradas, near Ilhéus, Braz.—d. Aug. 6, 2001, Salvador, Bahia) Brazilian novelist. Amado was born and reared on a cacao plantation. He published his first novel at age 20. His early works, including *The Violent Land* (1942), explore the exploitation and suffering of plantation workers. Despite imprisonment and exile for leftist activities, he continued to produce novels, many of which have been banned in Brazil and Portugal. Later works such as *Gabriela, Clove and Cinnamon* (1958), *Dona Flor and Her Two Husbands* (1966), and *The War of the Saints* (1993) preserve Amado's political attitude in their more subtle satire; many of his books were adapted for film and television.

Amalfi \ä-'mäl-fē\ Town (pop., 2000: commune, 5,527), southern Italy, on the Gulf of Salerno. It was of little importance until the mid-6th century, when it fell under Byzantine control. It grew into one of the first Italian maritime republics in the 9th century, becoming a rival of VENICE and GENOA. Annexed by ROGER II of Sicily in 1131, it was sacked by PISA in 1135 and 1137 and rapidly declined in importance, though its maritime code, the Tavola Amalfitana, was recognized in the Mediterranean until 1570. Amalfi is now a notable tourist resort.

amalgam \ə-'mal-gəm\ ALLOY of MERCURY and one or more other METALS. Those of silver, gold, and palladium occur naturally. Those with a very high mercury content are liquid; others are crystalline. Amalgams of silver and tin, with minor amounts of copper and zinc, are used in dentistry to fill teeth. Sodium amalgam is used in manufacturing chlorine and sodium hydroxide by electrolysis of brine. Amalgams are used to recover silver and gold from their ores: The ore is shaken with mercury, the amalgam is separated and heated until the mercury distills off (see DISTILLATION), and the precious metal is the residue. Amalgams are also used to silver mirrors and apply other metal coatings.

Amalric \ə-'mal-rik, 'am-əl-rik\ **I** (b. 1136—d. July 11, 1174) King of Jerusalem (1163–74). Amalric was a strong ruler who helped break the unity of Muslims surrounding the Holy Land. He passed a law giving vassals the right to appeal to the High Court against unjust treatment by their lords. His invasion of Egypt (1163) led to a war with Nureddin of Syria, which Amalric lost despite help from MANUEL I COMNENUS. Though the effort to conquer Egypt failed, the Palestinian-Byzantine alliance continued.

Amalric II (b. c. 1155—d. April 1, 1205) King of Cyprus (1194–1205) and of Jerusalem (1197–1205). Amalric inherited the kingdom of Cyprus on the death of his brother, Guy of Lusignan, and formed a close alliance with the ruler of Palestine. He also became the vassal of Holy Roman Emperor HENRY VI. When the ruler of Palestine died, Amalric married his widow and became king of Jerusalem. He administered Jerusalem separately from his other lands and made peace with his Muslim neighbours after SALADIN's death (1193).

amanita \ˌam-ə-'nē-tə\ Any MUSHROOM of the genus *Amanita*, containing about 100 species, some of which are poisonous to humans. Among the deadliest of all mushrooms are the large, white destroying angels (*A. bispongera*, *A. ocreata*, *A. verna*, and *A. virosa*), which are found in forests during wet periods in summer and autumn. The green or brown death cap (*A. phalloides*), also deadly, is found in woods in summer or early autumn. The poisonous fly agaric (*A. muscaria*), found in pastures and fields in summer, was once used as a fly poison. Common edible species include *A. caesarea*, *A. rubescens*, and *A. vaginata*.

Fly agaric (*Amanita muscaria*)
LARRY C. MOON—TOM STACK & ASSOCIATES

Amar Das \'əm-är-'däs\ (b. 1479, Khadur?, India—d. 1574, Goindwal) Third Sikh GURU. Much revered for his wisdom and piety, he became Guru at age 73. He was noted for his missionary efforts to spread SIKHISM and for the division of the PUNJAB into 22 dioceses. To strengthen the faith, he ordered three great Sikh festivals each year, and he made the city of Goindwal a centre of Sikh learning. He extended the casteless *langar* ("free kitchen") and required that anyone wanting to see him must first eat there. Advocating a middle way between the extremes of asceticism and sensuous pleasure, he purified Sikhism of Hindu practices, encouraged intercaste marriages, allowed widows to remarry, and prohibited SUTTEE (self-immolation of a widow on her husband's funeral pyre).

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amaranth \'a-mə-ˌranth\ **family** Family Amaranthaceae, which contains about 60 genera and more than 800 species of herbaceous plants and a few shrubs, trees, and vines, native to tropical America and Africa. Globe amaranth (*Gomphrena*) and cockscomb (*Celosia*) are cultivated as ornamentals. The large genus *Amaranthus* contains the ornamentals love-lies-bleeding (*A. caudatus*) and Joseph's-coat (*A. tricolor*), as well as many weedy plants known as pigweed, especially *A. retroflexus*. Some *Amaranthus* species are TUMBLEWEEDS, and some are potential high-protein grain crops.

Amarāvatī \ˌä-mə-'rä-və-tē\ **sculpture** Style of sculpture found in the Andhra region of southeastern India. It flourished there from about the 2nd century BC to the end of the 3rd century AD, during the rule of the Sātavāhana dynasty. Carved in relief on greenish-white limestone, these sculptures depict events in the life of the BUDDHA. The compositions are dynamic, sensuous, and dramatic, with overlapping figures and diagonals suggesting depth. The style spread from the Amarāvatī ruins west to Mahārāshtra Pradesh, to Sri Lanka (Ceylon), and to much of South Asia. The Amarāvatī stupa was one of the largest in Buddhist India; it was largely destroyed in the 19th century by building contractors to make lime mortar.

Amarillo City (pop., 2000: 173,627), northern Texas, U.S. The chief city of the Texas Panhandle, it originated in 1887 with the coming of the railroad. After it grew to become one of the world's busiest cattle-shipping sites in the 1890s, agriculture became important in the region. The discovery of petroleum and natural gas in the 1920s further promoted Amarillo's development.

Amarna, Tell el- Ancient city, Egypt. Located midway between THEBES and MEMPHIS on the Nile River, it was built in the 14th century BC by the Egyptian king (pharaoh) AKHENATON, who moved his subjects there in order to found a new monotheistic religion. Artifacts discovered there in the 19th century included hundreds of CUNEIFORM tablets. Archaeological finds of the late 20th century included sculptures and paintings.

amaryllis \ˌam-ə-'ril-əs\ **family** Family Amaryllidaceae of the order Liliales, containing about 65 genera and at least 835 species of perennial herbaceous plants, found mostly in tropical and subtropical regions and prized for their showy flowers, which are borne on smooth, hollow stalks with few or no leaves. Many species are cultivated as garden ornamentals. Many tropical lilylike plants also belong to the family, including the genera *Haemanthus* (Cape tulip, or blood lily), *Alstroemeria* (Peruvian lily), and *Hippeastrum*. Some are grown as houseplants.

Amaterasu \ˌam-ə-'ter-ə-sü\ **(Omikami)** In SHINTŌ, the sun goddess from whom the Japanese royal family traditionally claims descent. She was given domain over heaven while her brother, the storm god Susanoo, was set to rule over the sea. The two produced children together, but Susanoo began to behave rudely and destructively, and Amaterasu withdrew in protest into a cave, plunging the world into darkness. She was lured out by the other gods and goddesses, and a rope was placed over its entrance to prevent her return. Her chief place of worship is the Grand Shrine of ISE, Shintō's most important shrine.

Amati family Family of Italian violin makers in Cremona in the 16th and 17th centuries. Andrea (c. 1520–c. 1578) set the form of the modern violin. His two sons Antonio (c. 1550–1638) and Girolamo (1561–1630) worked together and were known as the brothers Amati. Girolamo's son Nicolò (1596–1684), who like his forebears worked in Cremona, is regarded as the family's finest craftsman. Among his famous pupils were ANDREA GUARNERI and ANTONIO STRADIVARI; Nicolò was succeeded by his son Girolamo (1649–1740). The great contribution of the Amatis to the development of the violin was their evolution of the flat, shallow model, which, as improved by Stradivari, is capable of producing a brilliant soprano tone.

Amazon In GREEK MYTHOLOGY, a member of a race of women warriors. One of the labours of HERACLES was to obtain the girdle of the Amazon queen Hippolyte. In another tale, THESEUS attacked the Amazons, and they responded by invading Attica, where they were defeated; Theseus married the Amazon Antiope. In ancient Greek art, Amazons resembled ATHENA (with weapons and helmet) and later ARTEMIS (in a thin dress girded high for speed).

Amazon River *Portuguese* **Rio Amazonas** River, northern South America. It is the largest river in the world in volume and area of drainage basin; only the NILE RIVER of eastern and northeastern Africa exceeds it in length. It originates within 100 mi (160 km) of the Pacific Ocean in the Peruvian ANDES MOUNTAINS and flows some 4,000 mi (6,400 km) across northern Brazil into the Atlantic Ocean. Its Peruvian length is called the Marañón River; the stretch of river from the Brazilian border to the mouth of the NEGRO RIVER is the Solimões River. Its more than 1,000 known tributaries rise in the Guiana Highlands, the Brazilian Highlands, and (principally) the Andes; 7 of these are longer than 1,000 mi (1,600 km), and the MADEIRA RIVER exceeds 2,000 mi (3,200 km). The Amazon can accommodate large freighters as far upriver as the city of MANAUS, Braz., 1,000 mi (1,600 km) from the Atlantic. The first European descent was made by Francisco de Orellana in 1541–42; he is said to have given the river its name after reporting battles with tribes of women, whom he likened to the AMAZONS of Greek legend. Pedro Teixeira achieved the first ascent in 1637–38, but the river remained little explored until the mid-19th century. Many indigenous peoples originally lived along the river, but they moved inland as exploring parties and raiders (see *BANDEIRA*) sought to enslave them. The river was opened to world shipping in the mid-19th century; traffic increased exponentially with the coming of the rubber trade, which reached its height c. 1910 but soon declined. Its basin encompasses the world's most extensive rainforest and is home to an extraordinary diversity of birds, mammals, and other wildlife. Since the 1960s the effects of economic exploitation on the region's ecology and the destruction of the rainforest have generated worldwide concern.

Amazonia National Park Park, north-central Brazil, about halfway between the cities of MANAUS and BELÉM, along the TAPAJÓS RIVER. Established in 1974, it has gradually expanded to cover about 3,300 sq mi (8,600 sq km) and contains an immense diversity of flora and fauna.

amban *Manchu* **"minister"** Representative of China's QING emperor who lived in the territory of a tributary state or dependency. In 1793 the Qing emperor QIANLONG changed the procedure for selecting the DALAI LAMA, and the Tibetans had to persuade the *amban* that they had complied. In 1904, when the British were trying to force Tibet to sign a trade treaty, the *amban* said he was powerless to negotiate for the Tibetans, an admission that called into question the degree of control China exercised over Tibet. The *amban*s' role and authority continues to be debated by the Chinese government and advocates of Tibetan independence in the attempt to support their conflicting claims for Tibet's status.

ambassador Highest-ranking diplomatic representative of one government to another or to an international organization. As formally defined and recognized at the Congress of VIENNA (1815), ambassadors were originally regarded as personal representatives of their country's chief executive rather than of the whole country, and their rank entitled them to meet personally with the head of state of the host country. Originally, only the principal monarchies exchanged ambassadors; the U.S. did not appoint ambassadors until 1893. Since 1945 all nations have been recognized as equals, and ambassadors or their equivalents are sent to all countries with which diplomatic relations are maintained. Before the development of modern communications, ambassadors were entrusted with extensive powers; they have since been reduced to spokespeople for their foreign offices.

amber Fossil tree resin that occurs as irregular nodules, rods, or drop-like shapes in all shades of yellow with nuances of orange, brown, and, rarely, red. Milky-white opaque varieties are called bone amber. Hundreds of species of insects and plants are found as fossils in amber. Deeply coloured translucent to transparent amber is prized as gem material, and numerous ornamental carved objects and beads are made from amber. Amber has been found throughout the world, but the largest deposits occur along the shores of the Baltic Sea.

ambergris \'am-bər-ˌgris, 'am-bər-ˌgrē\ Waxy substance (about 80% CHOLESTEROL) formed in the intestine of SPERM WHALES, used chiefly as a spice in the East and for fixing the scent of fine PERFUMES in the West. It is thought to form as a collection of feces around indigestible parts of squid and other prey of the whale. Fresh ambergris is soft, black, and smelly; exposed to sunlight, air, and seawater, it hardens, fades, and develops a pleasant scent. It may wash ashore or be found floating or in the bodies of slaughtered whales. Pieces are usually small, but the largest have weighed almost 1,000 lb (450 kg).

amberjack Any of various popular marine game fishes (genus *Seriola*), members of the JACK family (Carangidae). Amberjacks are found worldwide. The greater amberjack of the tropical Atlantic is one of the largest jack species, often attaining a length of 6 ft (1.8 m).

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Ambler, Eric (b. June 28, 1909, London, Eng.—d. Oct. 22, 1998, London) British author of espionage and crime novels. Among his works are *The Dark Frontier* (1936), *Epitaph for a Spy* (1938), *A Coffin for Dimitrios* (1939), *Journey into Fear* (1940; film, 1942), and *The Light of Day* (1962). In contrast to earlier British spy stories, in which xenophobic, romantic heroes defeated vast conspiracies to dominate the world, Ambler's tales were of ordinary, educated Englishmen thrust by chance or curiosity into danger. Notable for its gritty realism, Ambler's fiction was a major influence on writers such as GRAHAM GREENE and JOHN LE CARRÉ.

Ambon \äm-'bōn\ Island of the MOLUCCAS, Indonesia. Located in the MALAY ARCHIPELAGO, it is 31 mi (50 km) long and 10 mi (16 km) wide, with an area of 294 sq mi (761 sq km). Its chief port is also called Ambon (pop., 2000: 205,664). The island is subject to earthquakes and volcanic activity; Mount Salhatu (3,405 ft [1,038 m]) is its highest point. The clove trade first attracted the Portuguese, who founded a settlement in 1521. The Dutch ousted the Portuguese in 1605, took over the spice trade, and in 1623 killed English settlers in the Amboina Massacre. The British captured Ambon in 1796 and 1810, but it was restored to the Dutch in 1814. The Japanese occupied it during World War II. Retaken by the Dutch in 1945, it became part of Indonesia in 1949. A short-lived independence movement there in 1950 was soon suppressed.

Ambrose, Saint (b. 339, Augusta Treverorum, Belgica, Gaul—d. 397, Milan; feast day December 7) Bishop of Milan. Raised in Rome, he became a Roman provincial governor. As a compromise candidate, he was unexpectedly elevated from unbaptized layman to bishop of Milan in 374. He established the medieval concept of the Christian emperor as subject to episcopal advice and censure when he forced the emperor Theodosius to seek forgiveness from the bishop, and he opposed tolerance for adherents of ARIANISM. He wrote theological treatises influenced by Greek philosophy, including *On the Holy Spirit* and *On the Duties of Ministers,* as well as a series of hymns. His brilliant sermons and personal example converted St. AUGUSTINE.

St. Ambrose, detail from a stained-glass window; in St. Michael's Church, Kirby-le-Soken, Essex, Eng.
E & E IMAGE LIBRARY/HERITAGE-IMAGES

AMC See AMERICAN MOTORS CORP.

AME Church See AFRICAN METHODIST EPISCOPAL CHURCH

Amelung \'am-ə-ləŋ\ **glass** U.S. glass produced between 1784 and c. 1795 by John Frederick Amelung. Born in Bremen, Ger., he founded the New Bremen Glass Manufactory near Frederick, Md., U.S., with financial support from German and U.S. promoters. He attempted to set up a crafts community, importing glassworkers and other craftsmen from Germany, but the industry failed when Congress defeated Amelung's petition for a loan in 1790. Few authentic pieces of Amelung glass survive, most of them presentation pieces decorated with restrained engraving.

amen Expression of agreement or confirmation used in worship by Jews, Christians, and Muslims. The word derives from a Semitic root meaning "fixed" or "sure." The Greek Old Testament usually translates it as "so be it"; in the English Bible it is often translated as "verily" or "truly." By the 4th century BC, it was a common response to a doxology or other prayer in the Jewish temple liturgy. By the 2nd century AD, Christians had adopted it in the liturgy of the Eucharist, and in Christian worship a final amen now often sums up and confirms a prayer or HYMN. Though less common in Islam, it is used after reading of the first SURA.

Amen See AMON

Amenemhet \'ä-mə-nəm-'het\ **I** (fl. 20th century BC) Egyptian pharaoh (r. 1938–08 BC) who founded the 12th dynasty (1938–1756) and, with provincial governors, restored unity to Egypt after the civil war that followed the death of his predecessor, Montuhotep IV. He moved the capital from Thebes to near modern-day Al-Lisht, south of Memphis. He extended Egyptian control up the Nile and fortified the delta. Reaffirming the Egyptian monarchy's claim to divinity, he also enlarged the Temple of AMON at Thebes. In 1918 BC he made his son, Sesostris I, his coruler. He was assassinated 10 years later.

Amenhotep \'ä-mən-'hō-ˌtep\ **II** (fl. 15th century BC) Egyptian pharaoh (r. 1514–1493 BC), son and successor of Ahmose I. Amenhotep extended Egyptian rule southward to the Third Cataract of the Nile while also maintaining rule in the northeast. He pioneered the transition away from pyramidal tombs to rock-cut tombs in the Valley of the KINGS in western Thebes. The royal mortuary temples were erected at the edge of the desert during his reign, though the location of his own tomb is unknown.

Amenhotep II offering sacrifices, statue, 15th century BC; in the Egyptian Museum, Cairo
BY COURTESY OF THE EGYPTIAN MUSEUM; PHOTOGRAPH, HIRMER FOTOARCHIV, MUNCHEN

Amenhotep III (fl. 14th century BC) Egyptian pharaoh (r. 1390–53 BC) during a time of prosperity. Early in his reign he led a military campaign south of Egypt, but otherwise his rule was peaceful. His reign is noted for the expansion of diplomacy with Syria, Cyprus, Babylon, and Assyria, and the construction of public buildings in Memphis, Thebes, and Nubia, including portions of the temples at Luxor and Karnak. He broke with tradition by marrying Tiy, a commoner, with whom he shared his rule. He was succeeded by his son AKHENATON.

Amenhotep III, head of a statue from western Thebes, *c.* 1390 BC
REPRODUCED BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Amenhotep IV See AKHENATON

amenorrhea \ā-ˌmen-ə-'rē-ə\ Lack of MENSTRUATION. Signs of primary amenorrhea (failure to start menstruating by age 16) include infantile reproductive organs, lack of breasts and pubic hair, dwarfism, and deficient muscle development. In secondary amenorrhea (abnormal cessation of cycles once started), the genitals atrophy and pubic hair diminishes. Not itself a disease, amenorrhea reflects a failure in the balance among the hypothalamus, pituitary gland, ovaries, and uterus; tumours, injuries, or diseases of these can lead to amenorrhea. Other causes include systemic diseases, emotional shock, stress, hormone over- or underproduction, anorexia nervosa, absence of ovaries or uterus, pregnancy, lactation, and menopause. Infrequent menstruation or amenorrhea not resulting from organic disease is not harmful.

America See CENTRAL AMERICA, NORTH AMERICA, SOUTH AMERICA

America Online See AOL TIME WARNER INC.

American Airlines Major U.S. airline. American was created through a merger of several smaller U.S. airlines and incorporated in 1934. It continued to buy the routes of other airlines, becoming an international carrier in the 1970s; its routes include South America, the Caribbean, Europe, and the western Pacific. Its parent company, AMR Corp., also has holdings in food services, hotels, and airport ground services. The company acquired TRANS WORLD AIRLINES in 2001.

American aloe See CENTURY PLANT

American Anti-Slavery Society Main activist arm of the U.S. abolition movement, which sought an immediate end to slavery in the coun-

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try (see ABOLITIONISM). Cofounded in 1833 by WILLIAM LLOYD GARRISON and ARTHUR TAPPAN, it promoted the formation of state and local auxiliaries to agitate for abolition. Despite violent opposition, by 1840 the group had 2,000 auxiliaries and more than 150,000 members, including THEODORE WELD and WENDELL PHILLIPS. Its most effective public meetings featured testimony by former slaves, including FREDERICK DOUGLASS and WILLIAM WELLS BROWN. In 1839 it split into two factions: a radical group led by Garrison that denounced the Constitution as supportive of slavery and a moderate faction led by Tappan that led to the birth of the LIBERTY PARTY.

American Association of Retired Persons See AARP

American Ballet Theatre Prominent ballet company based in New York City. It was founded in 1939 as the Ballet Theatre (the name was changed in 1958) by Lucia Chase and Richard Pleasant to promote works "American in character." Oliver Smith replaced Pleasant as codirector in 1945; MIKHAIL BARYSHNIKOV served as artistic director from 1980 to 1989 after dancing with the company in the 1970s. New ballets were created for the company by AGNES DE MILLE, JEROME ROBBINS, TWYLA THARP, and ANTONY TUDOR; MICHEL FOKINE revived many of his earlier works for them as well. Principal dancers have included ALICIA ALONSO, ERIK BRUHN, ANTON DOLIN, and NATALIA MAKAROVA.

American Bar Association (ABA) Voluntary association (founded 1878) of U.S. lawyers, judges, and other legal professionals. The largest bar association in the U.S., it seeks to improve the legal profession, ensure the availability of legal services to all citizens, and improve the administration of justice. It conducts educational and research projects, sponsors professional meetings, and publishes a monthly journal. At the beginning of the 21st century its membership exceeded 400,000.

American Broadcasting Co. See ABC

American Civil Liberties Union (ACLU) Organization founded by ROGER BALDWIN and others in New York City in 1920 to champion constitutional liberties in the U.S. It works for three basic concepts: freedom of expression, conscience, and association; DUE PROCESS of law; and EQUAL PROTECTION under the law. From its founding it has initiated test cases and intervened in cases already in the courts. It may provide legal counsel, or it may file an AMICUS CURIAE brief. The SCOPES TRIAL was one of its test cases; it provided counsel for the SACCO-VANZETTI CASE. In the 1950s and '60s it opposed the blacklisting of supposed left-wing subversives and worked to guarantee freedom of worship and the rights of the ACCUSED. Its work is performed by volunteers and full-time staff, including lawyers who provide free legal counsel. See also CIVIL LIBERTY.

American Civil War *or* **Civil War** *or* **War Between the States** (1861–65) Conflict between the U.S. federal government and 11 Southern states that fought to secede from the Union. It arose out of disputes over the issues of slavery, trade and tariffs, and the doctrine of states' rights. In the 1840s and '50s, Northern opposition to slavery in the Western territories caused the Southern states to fear that existing slaveholdings, which formed the economic base of the South, were also in danger. By the 1850s ABOLITIONISM was growing in the North, and when the antislavery Republican candidate ABRAHAM LINCOLN was elected president in 1860, the Southern states seceded to protect what they saw as their right to keep slaves. They were organized as the CONFEDERATE STATES OF AMERICA under JEFFERSON DAVIS. The Northern states of the federal Union, under Lincoln, commanded more than twice the population of the Confederacy and held greater advantages in manufacturing and transportation capacity. The war began in Charleston, S.C., when Confederate artillery fired on FORT SUMTER on April 12, 1861. Both sides quickly raised armies. In July 1861, 30,000 Union troops marched toward the Confederate capital at Richmond, Va., but were stopped by Confederate forces in the Battle of BULL RUN and forced to retreat to Washington, D.C. The defeat shocked the Union, which called for 500,000 more recruits. The war's first major campaign began in February 1862, when Union troops under ULYSSES S. GRANT captured Confederate forts in western Tennessee. Union victories at the battles of SHILOH and NEW ORLEANS followed. In the East, ROBERT E. LEE won several Confederate victories in the SEVEN DAYS' BATTLES and, after defeat at the Battle of ANTIETAM, in the Battle of FREDERICKSBURG (December 1862). After the Confederate victory at the Battle of CHANCELLORSVILLE, Lee invaded the North and engaged Union forces under GEORGE MEADE at the momentous Battle of GETTYSBURG. The war's turning point in the West occurred in July 1863 with Grant's success in the VICKSBURG CAMPAIGN, which brought the entire Mississippi River under Union control. Grant's command was expanded after the Union defeat at the Battle of CHICKAMAUGA, and in March 1864 Lincoln gave him supreme command of the Union armies. He began a strategy of attrition and, despite heavy Union casualties at the battles of the WILDERNESS and Spotsylvania, began to surround Lee's troops in Petersburg, Va. (see PETERSBURG CAMPAIGN). Meanwhile WILLIAM T. SHERMAN captured Atlanta in September (see ATLANTA CAMPAIGN), set out on a destructive march through Georgia, and soon captured Savannah. Grant captured Richmond on April 3, 1865, and accepted Lee's surrender on April 9 at APPOMATTOX COURT HOUSE. On April 26 Sherman received the surrender of JOSEPH JOHNSTON, thereby ending the war. The mortality rates of the war were staggering—there were about 620,000 deaths out of a total of 2.4 million soldiers. The South was devastated. But the Union was preserved, and slavery was abolished.

American Express Co. U.S. credit card and travel services company. Founded in 1850 as an express-transportation company, American Express originally provided rapid transport of goods across New York and the Midwest. The company introduced traveler's checks in 1891 and opened its first European office in Paris in 1895. Its contemporary businesses include credit cards and payment-processing systems, international banking, and services for travelers (including trip planning, tour packages, and business travel management).

American Federation of Labor–Congress of Industrial Organizations See AFL–CIO

American Fur Co. Enterprise formed by JOHN JACOB ASTOR in 1808 that dominated the U.S. fur trade early in the 19th century. The company, considered the first U.S. business monopoly, absorbed or drove out rivals throughout the central and western U.S. Exploration by its trappers and traders helped open the frontier to settlement. By 1834, when Astor sold his company, it had become the largest commercial organization in the U.S.

American Indian *or* **Native American** *or* **Amerindian** Any member of the various aboriginal peoples of the Western Hemisphere, with the exception of the ESKIMOS (Inuit) and the ALEUTS. Though the term Native American is today often preferred over American Indian, particularly in the U.S., many Native American peoples continue to prefer American Indian (or Indian). In Canada the name First Nation is preferred. The ancestors of the American Indians were nomadic hunters of northeast Asia who migrated over the Bering Strait land bridge into North America probably during the last glacial period (20,000–30,000 years ago). By c. 10,000 BC they had occupied much of North, Central, and South America. See also ANASAZI CULTURE; ANDEAN CIVILIZATION; CLOVIS COMPLEX; EASTERN WOODLANDS INDIAN; FOLSOM COMPLEX; HOHOKAM CULTURE; HOPEWELL CULTURE; MESOAMERICAN CIVILIZATION; MISSISSIPPIAN CULTURE; MOGOLLON CULTURE; NORTHWEST COAST INDIAN; PLAINS INDIAN; PUEBLO INDIAN; SOUTHEASTERN INDIAN; SOUTHWEST INDIAN; WOODLAND CULTURE.

American Indian languages Languages spoken by the original inhabitants of the Americas and the West Indies and by their modern descendants. They display an extraordinary structural range, and no attempt to unite them into a small number of genetic groupings has won general acceptance. Before the arrival of Columbus, more than 300 distinct languages were spoken in North America north of Mexico by an estimated population of two to seven million. Today fewer than 170 languages are spoken, of which the great majority are spoken fluently only by older adults. A few widespread language families (ALGONQUIAN, IROQUOIAN, SIOUAN, MUSKOGEAN, ATHABASKAN, UTO-AZTECAN, SALISHAN) account for many of the languages of eastern and interior North America, though the far west was an area of extreme diversity (see HOKAN; PENUTIAN). It is estimated that in Mexico and northern Central America (Mesoamerica), an estimated 15–20 million people spoke more than 300 languages before Columbus. The large OTOMANGUEAN and MAYA families and a single language, NAHUATL, shared Mesoamerica with many smaller families and language isolates. More than 10 of these languages and language complexes still have more than 100,000 speakers. South America and the West Indies had an estimated pre-Columbian population of 10–20 million, speaking more than 500 languages. Important language families include Chibchan in Colombia and southern Central America, QUECHUAN and Aymaran in the Andean region, and ARAWAKAN, CARIBAN, and TUPIAN in northern and central lowland South America. Aside from Quechuan and Aymaran, with about 10 million speakers, and the TUPIAN language Guaraní, most remaining South American Indian languages have very few speakers, and some face certain extinction.

American Indian Movement (AIM) Civil rights organization founded in 1968, originally to help urban AMERICAN INDIANS displaced by

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government programs. It later broadened its efforts to include demands for economic independence, autonomy over tribal areas, restoration of illegally seized lands, and protection of Indian legal rights and traditional culture. Some of its protest activities involved violence and were highly publicized (see WOUNDED KNEE). Internal strife and the imprisonment of some leaders led to the disbanding of its national leadership in 1978, though local groups have continued to function.

American Indian religions, North Religious beliefs and practices of the indigenous peoples of North America. They are characterized by a conviction that spirit moves through all things, animate and inanimate, and that the living are intimately connected with the souls of the dead. They discover recognizable beings in the natural world of animals, plants, and trees, as well as in natural features such as mountains, lakes, and clouds. Because North American religions were so highly localized, it is impossible to determine how many have existed, and their beliefs have varied widely. Whereas IROQUOIS elders speak of a perfectly wise and good Creator who planned the universe, the Koyukon envision the creator as Raven, a trickster god who is only one of many powerful spirits. Whereas nearly all NAVAJO ceremonies are performed on behalf of individuals in response to specific needs, most PUEBLO ceremonies are performed communally and scheduled according to the cycles of nature. However, all native North American religions share certain features: ancestral lands and locally sacred spots are important; access to some knowledge is restricted, and initiation is required to acquire it; kinship obligations are central; the oral tradition includes narratives that record human interaction with nonhuman powers; and generosity is a religious act. Contact with Europeans led to development of new religious movements, including the GHOST DANCE tradition and the NATIVE AMERICAN CHURCH. See also MESOAMERICAN RELIGIONS.

American Indian religions, South Religious beliefs and practices of the indigenous peoples of South America. The ancient ANDEAN CIVILIZATIONS of the CHIMU and the INCA had highly developed religions. The Inca religion combined complex ceremonies, animistic beliefs, belief in objects having magical powers, nature worship, and sun worship. The Incas built monumental temples, occupied by priests and Chosen Women. Priests conducted divination, and sacrifices were offered on every important occasion. Human sacrifice was offered when the need was extreme. In present-day South America, as many as 1,500 distinct native cultures have been described, and religious beliefs vary greatly. Creation mythologies are of major importance, often describing the origin of the first world and its fate as well as the creation and destruction of subsequent worlds. Ceremonial initiation into adulthood is widely practiced, both for males and females, with the initiation ceremony often acting out events from the dawn of creation. Initiations are also used to mark the ascent of individuals into positions of religious authority, with priests, diviners, and spirit mediums playing special roles. The SHAMAN specializes in inducing states of ecstasy, controlling the passage of the soul out of and back into the body. Ritual fires, musical instruments (especially the rattle), esoteric languages, and sacred songs may be used in a theatrical performance designed to demonstrate the shaman's command of invisible powers. Christianity has come to be a strong component of folk belief among many native peoples, but it continues to be interpreted in the light of local tradition, and elements of traditional religion continue to survive. See also MESOAMERICAN RELIGIONS.

American Labor Party Minor political party organized in New York state in 1936. It was founded by the labour leaders SIDNEY HILLMAN and DAVID DUBINSKY and by liberal Democrats and old-line socialists. The party supported FRANKLIN D. ROOSEVELT's NEW DEAL programs and backed candidates who endorsed liberal social legislation. Though influential in New York City elections, after 1940 it was plagued by divisions between pro- and anti-communist factions. It was dissolved in 1956.

American League (AL) One of the two associations of professional BASEBALL teams in the U.S. and Canada designated as major leagues; the other is the NATIONAL LEAGUE (NL). The AL was founded in 1900, and, beginning in 1903, the champions of the AL and NL have engaged in an annual WORLD SERIES competition. There are now three divisions in the AL: Eastern (comprising the Baltimore Orioles, Boston Red Sox, New York Yankees, Tampa Bay Devil Rays, and Toronto Blue Jays), Central (Chicago White Sox, Cleveland Indians, Detroit Tigers, Kansas City Royals, and Minnesota Twins), and Western (Los Angeles Angels of Anaheim, Oakland Athletics, Seattle Mariners, and Texas Rangers).

American Legion Organization of U.S. war veterans. Founded in 1919, it works for the care of disabled and sick veterans and promotes compensation and pensions for the disabled, widows, and orphans. Nonpolitical and nonsectarian, its membership requirement is honourable service and an honourable discharge. It was instrumental in establishing veterans' hospitals, and it sponsored the creation of the U.S. Veterans Administration in 1930. In 1944 it played an important role in the passage of the GI BILL. The American Legion claims about three million members in some 15,000 local posts, or groups.

American Medical Association (AMA) Organization of U.S. physicians. It was founded in 1847 "to promote the science and art of medicine and the betterment of public health." It has about 250,000 members, about half of all practicing U.S. physicians. It disseminates information to its members and the public, operates as a lobbying group, and helps set medical education standards. Its publications include *Journal of the American Medical Association*, *American Medical News*, and journals on medical specialties.

American Motors Corp. (AMC) Former U.S. automobile manufacturer. AMC was formed in 1954 from the merger of two pioneering auto manufacturers, Nash-Kelvinator Corp. (successor to Nash Motor Co., founded 1916) and Hudson Motor Car Co. (founded 1909). AMC produced AMC compact cars, AM General trucks and buses, and, until 1968, Kelvinator appliances. Jeeps joined the product line after AMC purchased the Kaiser-Jeep Corp. (dating to 1903) in 1970. AMC became a subsidiary of CHRYSLER CORP. in 1987, which in turn merged with Daimler-Benz in 1998 to form DAIMLERCHRYSLER AG.

American Museum of Natural History Major centre of research and education on the natural sciences, established in New York City in 1869. It pioneered in staging field expeditions and creating dioramas and other lifelike exhibits showing natural habitats and their plant and animal life. Its research collections contain tens of millions of specimens, and its fossil and insect collections are among the largest in the world. It conducts research in anthropology, astronomy, entomology, herpetology, ichthyology, invertebrate biology, mammalogy, mineralogy, ornithology, and vertebrate paleontology, and it maintains permanent research stations in The Bahamas and the U.S. states of New York, Florida, and Arizona. It also contains one of the world's largest planetariums.

American Party See KNOW-NOTHING PARTY

American Protective Association (APA) Secret anti-Catholic, anti-immigrant society formed in Iowa in 1887. Its membership, consisting mainly of farmers who feared the growth and political power of immigrant-populated cities, rose to more than two million in the 1890s. Membership dwindled after the election of 1896 and the return of agricultural prosperity in the Midwest. By 1911 the society had disappeared.

American Renaissance *or* **New England Renaissance** Period from the 1830s roughly until the end of the American Civil War in which U.S. literature came of age as an expression of a national spirit. The literary scene was dominated by New England Brahmin writers, notably HENRY WADSWORTH LONGFELLOW, Oliver Wendell HOLMES, and James Russell LOWELL. Also influential were the Transcendentalists (see TRANSCENDENTALISM), including Ralph Waldo EMERSON and Henry David THOREAU, as well as the great imaginative writers NATHANIEL HAWTHORNE, HERMAN MELVILLE, WALT WHITMAN, and Edgar Allan POE.

American Revolution *or* **United States War of Independence** (1775–83) War that won political independence for 13 of Britain's North American colonies, which formed the UNITED STATES of America. After the end of the costly FRENCH AND INDIAN WAR (1763), Britain imposed new taxes (see STAMP ACT; SUGAR ACT) and trade restrictions on the colonies, fueling growing resentment and strengthening the colonists' objection to their lack of representation in the British Parliament. Determined to achieve independence, the colonies formed the Continental Army, composed chiefly of MINUTEMEN, to challenge Britain's large, organized militia. The war began when Britain sent a force to destroy rebel military stores at Concord, Mass. After fighting broke out on April 19, 1775 (see Battles of LEXINGTON AND CONCORD), rebel forces began a siege of Boston that ended when American forces under HENRY KNOX forced out the British troops under WILLIAM HOWE on March 17, 1776 (see Battle of BUNKER HILL). Britain's offer of pardon in exchange for surrender was refused by the Americans, who declared themselves independent on July 4, 1776 (see DECLARATION OF INDEPENDENCE). British forces retaliated by driv-

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ing the army of George Washington from New York to New Jersey. On December 25, Washington crossed the Delaware River and won the battles of Trenton and Princeton. The British army split to cover more territory, a fatal error. In engaging the Americans in Pennsylvania, notably in the Battle of the Brandywine, they left the troops in the north vulnerable. Despite a victory in the Battle of Ticonderoga, British troops under John Burgoyne were defeated by Horatio Gates and Benedict Arnold in the Battle of Saratoga (Oct. 17, 1777). Washington quartered his 11,000 troops through a bleak winter at Valley Forge, where they received training from Frederick Steuben that gave them victory in Monmouth, N.J., on June 28, 1778. British forces in the north thenceforth chiefly concentrated near New York. France, which had been secretly furnishing aid to the Americans since 1776, finally declared war on Britain in June 1778. French troops assisted American troops in the south, culminating in the successful Siege of Yorktown, where Charles Cornwallis surrendered his forces on Oct. 19, 1781, bringing an end to the war on land. War continued at sea, fought chiefly between Britain and the U.S.'s European allies. The navies of Spain and the Netherlands contained most of Britain's navy near Europe and away from the fighting in America. The last battle of the war was won by the American navy under John Barry in March 1783 in the Straits of Florida. With the Treaty of Paris (Sept. 3, 1783), Britain recognized the independence of the U.S. east of the Mississippi River and ceded Florida to Spain.

American Saddlebred *or* **American Saddle Horse** Breed of light horse that originated in the U.S. The breed was developed by crossing Thoroughbreds, Morgans, and Standardbreds on native mares having an easy gait. It stands 15–16 hands (5–5.3 ft [1.5–1.6 m]) high, and its colours are bay, brown, black, gray, and chestnut. Two show categories are for three-gaited and five-gaited horses. The three natural gaits are walk, trot, and canter; the five-gaited horse also has two trained gaits, the rack and the slow gait, or running walk. The American Saddlebred is also well known as a fine harness horse for show.

American Samoa *officially* **Territory of American Samoa** Unincorporated U.S. territory (pop., 2000: 57,291), southwest-central Pacific Ocean. It includes the islands of Tutuila (the largest, with over two-thirds of the territory's land area and almost all of the population), Aunuu, Rose, Swains, and the Manua group. Area: 77 sq mi (199 sq km). Capital: Fagatogo (Pago Pago; on Tutuila). Languages: Samoan, English (both official). Religion: Christianity (mostly Protestant; also Roman Catholic, other Christians). Currency: U.S. dollar. Most of the islands are rocky, formed from extinct volcanoes, and are surrounded by coral reefs. Tutuila and the islands of Manua are dominated by central mountain ranges. Fishing and tourism are major industries, but the U.S. administration is the main employer. The majority of the population is of Samoan ancestry. The islands were probably inhabited by Polynesians 3,000 years ago. Dutch explorers became the first Europeans to visit the islands in 1722. Missionaries began arriving in the islands in the 1830s. The U.S. gained the right to establish a naval station at Pago Pago in 1878, and the U.S., Britain, and Germany administered a tripartite protectorate in 1889–99. The high chiefs ceded the eastern islands to the U.S. in 1904. American Samoa was administered by the U.S. Department of the Navy until 1951 and afterward by the Department of the Interior. Its current constitution was approved in 1967, and in 1978 the territory's first elected governor took office.

American Stock Exchange (AMEX) Stock exchange in the U.S. Originally known as "the Curb," it began as an outdoor marketplace in New York City c. 1850. It moved indoors to its present location in the Wall Street area in 1921. Once a marketplace for securities not reputable enough for the New York Stock Exchange, it became equally respectable, with its own listing admissions requirements. In 1998 it merged with the National Association of Securities Dealers (NASD), then-owner of the NASDAQ exchange, to form the Nasdaq-Amex Market Group. After NASD sold its interest in the NASDAQ in 2000, AMEX remained a NASD subsidiary.

American System of manufacture Production of many identical parts and their assembly into finished products. Though Eli Whitney has been credited with this development, the ideas had appeared earlier in Europe and were being practiced in arms factories in the U.S. (see armoury practice). Marc Brunel, while working for the British Admiralty (1802–08), devised a process for producing wooden pulley blocks by sequential machine operations, whereby 10 men (rather than the 110 needed previously) could make 160,000 pulley blocks per year. Not until London's Crystal Palace exhibition (1851) did British engineers, viewing exhibits of machines used in the U.S. to produce interchangeable parts, begin to apply the system. Within 25 years, the American System was being widely used in making a host of industrial products. See also assembly line; factory.

American Telephone and Telegraph Co. See AT&T

America's Cup Most prestigious trophy in international yachting competition. First offered under another name in Britain in 1851, the cup was won easily by the *America* from New York and subsequently became known as the America's Cup. The America's Cup race, held about every four years, is between one defending vessel and one challenging vessel; each must be designed and built in the country it represents. The 22.6-mi (36.4-km) racecourse is divided into eight legs. The U.S. completely dominated the competition until 1983, when it was defeated by Australia. New Zealand won the Cup in 1995 and retained it in 2000 by defeating a challenger from Italy in the first competition without a U.S. participant.

americium \ˌam-ə-ˈri-shē-əm\ Synthetic radioactive chemical element, chemical symbol Am, atomic number 95. The fourth transuranium element discovered, it was first produced in 1944 from plutonium-239 in a nuclear reactor. The isotope americium-241 has been prepared in kilogram quantities and is used in a variety of measuring applications that utilize its gamma radiation. Its most familiar use is in household smoke detectors.

Amerindian See American Indian

Ames, Fisher (b. April 9, 1758, Dedham, Mass.—d. July 4, 1808, Dedham, Mass., U.S.) U.S. essayist and Federalist politician. He graduated from Harvard College in 1774 and taught school for five years before turning to the law; he was admitted to the bar in 1781. Supporting the creation of a strong central government, Ames argued for ratification of the new U.S. Constitution at the Massachusetts constitutional convention. He became known for his uncompromising advocacy of the rights of property and his protective attitude toward commercial interests, which he defended in trenchant writing and commanding speech. In 1788 he defeated Samuel Adams for a seat in the first session of the U.S. House of Representatives; he was reelected three times. His eloquent support of the treaty negotiated by John Jay to preserve peace with England (1794) convinced the House to pass an enabling appropriation.

Ames, Winthrop (b. Nov. 25, 1870, North Easton, Mass., U.S.—d. Nov. 3, 1937, Boston, Mass.) U.S. theatrical producer and manager. Born into a wealthy New England family, he traveled to Europe in 1904 to study the management of 60 opera and theatre companies. After comanaging a Boston theatre, he became managing director of New York City's New Theatre (1908–11). He founded the Little Theatre and the Booth Theatre, where he produced and directed such successful plays as *The Philanderer* (1913), *Beggar on Horseback* (1924), and a series of Gilbert and Sullivan revivals (1926–29). His *Snow White* (1913) was the first play produced in the U.S. especially for children.

amesha spenta \ä-ˈmesh-ə-ˈspen-tə\ In Zoroastrianism, any of the six divine beings (three male, three female) created by Ahura Mazda to help govern creation. They are worshiped separately, and each has a special month, festival, and flower. The most important are Asha Vahishta ("Truth"), who presides over the sacred fire and holds out the path of justice and spiritual knowledge, and Vohu Manah ("Good Mind"), who welcomes the blessed into paradise. Khshathra Vairya ("Desirable Dominion") presides over metal, Spenta Armaiti ("Beneficent Devotion") over earth, and Haurvatat ("Wholeness") and Ameretat ("Immortality") over water and plants. In later Zoroastrianism, each is opposed by a specific archfiend.

amethyst Transparent, coarse-grained variety of quartz that is valued as a semiprecious gem for its violet colour. It contains a little more iron oxide (Fe_2O_3) than any other variety of quartz, and its colour probably arises from this iron content. Heating removes the colour or changes it to the yellow of citrine; most commercial citrine is made in this manner. Notable deposits are found in Brazil, Uruguay, Ontario, and North Carolina. The birthstone for February, amethyst is usually faceted with step cuts or emerald cuts but also has been used since ancient times for carved intaglios. See photograph on opposite page.

AMEX See American Stock Exchange

Amhara \am-ˈhä-rə\ People of the Ethiopian central highlands. The Amhara number some 18 million and compose almost three-tenths of

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Ethiopia's population. Their language is Amharic, a Semitic language of the Afro-Asiatic family, and their religion is Ethiopian Orthodox. The Amhara, who have dominated the history of their country, descend from ancient Semitic conquerors who mingled with indigenous Cushitic peoples. They are agriculturalists and place great value on land ownership.

Amharic \am-'hä-rik\ **language** Semitic language of Ethiopia. Amharic is spoken by more than 18 million people as a first language and is used as a lingua franca throughout much of central highland Ethiopia. Its status as a de facto national language is largely due to the long dominance of the Ethiopian monarchy by Amhara sovereigns. Amharic is written in a modified form of the partly syllabic, partly alphabetic script used to write Ge'ez, the classical language of Christian Ethiopian civilization (see Ethiopic languages). Though manuscripts in Amharic are known from the 14th century, the language has only recently been used as a general medium for literature, journalism, and education.

Amherst, Jeffery Amherst, 1st Baron (b. Jan. 29, 1717, Sevenoaks, Kent, Eng.—d. Aug. 3, 1797, Sevenoaks) British army commander. In the French and Indian War, he took the French fort at Louisbourg, Cape Breton Island, in 1758 and was promoted to chief of command in America. In 1760 he directed the campaign that captured Quebec and Montreal, and in 1761 he quelled the Indian uprising under Pontiac. Having secured Canada for Britain, he remained there as governor-general until 1763. Returning to England, he served as commander in chief of the British army (1772–95), but his tenure was marred by failure in the war with the American colonies and by serious abuses in the army. He was created a baron in 1776 and a field marshal in 1796. Several U.S. towns and Amherst College are named for him.

Amherst \'am-ərst\ **College** Private liberal arts college in Amherst, Massachusetts, U.S., chartered in 1825. Noah Webster was one of its founders. Consistently ranked as one of the finest colleges in the U.S., it offers a wide range of courses in the humanities, social sciences, and natural sciences. Originally a men's college, it became coeducational in 1975. It participates in an exchange program with nearby Hampshire, Mount Holyoke, and Smith colleges and the University of Massachusetts.

amicus curiae \ə-'mē-kəs-'kyůr-ē-ī, ə-'mī-kəs-'kyůr-ē-ē\ (Latin: "friend of the court") One who assists a court by furnishing information or advice regarding questions of law or fact. A person (or other entity, such as a state government) who is not a party to a particular lawsuit but nevertheless has a strong interest in it may be allowed, by leave of the court, to file an amicus curiae brief, a statement of particular views on the subject matter of the lawsuit. Such briefs are often filed in cases involving public-interest matters (e.g., entitlement programs, consumer protection, civil rights).

Amida See Amitabha

amide \'a-ˌmīd\ Any member of either of two classes of nitrogen-containing organic compounds related to ammonia and amines and containing a carbonyl group (—C═O; see functional group). The first class, covalent amides are formed by replacing the hydroxyl group (—OH) of an acid with an amino group ($—NR_2$, in which R may represent a hydrogen atom or an organic combining group, such as methyl). Amides formed from carboxylic acids, called carboxamides, are solids except for the simplest, formamide, a liquid. They do not conduct electricity, have high boiling points, and (when liquid) are good solvents. There are no practical natural sources of simple covalent amides, but the peptides and proteins in living systems are long chains (polymers) with peptide bonds (see covalent bond), which are amide linkages. Urea is an amide with two amino groups. Commercially important covalent amides include several used as solvents; others are the sulfa drugs and nylon. The second class, ionic (salt-like) amides (see ionic bond), are made by treating a covalent amide, an amine, or ammonia with a reactive metal (e.g., sodium) and are strongly alkaline.

White-tipped amethyst from Guerrero, Mexico
LEE BOLTIN

Amiens \ȧm-'yeⁿ\ *ancient* **Samarobriva** *later* **Ambianum** City (pop., 1999: 135,801), northern France. Located on the Somme River, it became a Roman stronghold. The chief city of a medieval county, it passed to Burgundy in 1435 and was captured by the Spanish in 1597. Recovered by Henry IV, it served as the capital of Picardy until 1790. The Prussians captured the city in 1870, and the Germans held it briefly in 1914; it gave its name to a successful Allied counteroffensive against Germany in 1918. The Germans occupied it during World War II. It has been a major centre of the French textile industry since the 16th century and is the site of the Gothic cathedral of Notre-Dame, the largest church in France.

Amiens \ȧm-'yaⁿ**, Treaty of** (March 27, 1802) Agreement signed at Amiens, France, by Britain, France, Spain, and the Batavian Republic (The Netherlands). By the treaty, France and its allies recovered most of their colonies, despite their military reverses overseas. The treaty ignored continuing trade differences between Britain and France, but it achieved a peace in Europe for 14 months during the Napoleonic Wars.

Amin \ä-'mēn\ **(Dada Oumee), Idi** (b. 1924/25, Koboko, Ugan.—d. Aug. 16, 2003, Jiddah, Saud.Ar.) Military officer and president (1971–79) of Uganda. A member of the small Kakwa ethnic group and a Muslim, he was closely associated during his military career with Milton Obote, Uganda's first prime minister and president. In 1971 he staged a coup against Obote. He expelled all Asians from Uganda in 1972, reversed Uganda's amicable relations with Israel, was personally involved in the Palestinian hijacking of a French airliner to Entebbe (see Entebbe raid), and ordered the torture and murder of 100,000–300,000 Ugandans. In 1978 he ordered an attack on Tanzania, but Tanzanian troops, aided by Ugandan nationalists, were able to overpower the invaders. As the Tanzanian-led forces neared Kampala, Uganda's capital, Amin fled to Libya and eventually settled in Saudi Arabia.

Idi Amin.
JANET GRIFFITH/BLACK STAR

amine \ə-'mēn\ Any of a class of nitrogen-containing organic compounds derived, either in principle or in practice, from ammonia (NH_3). Almost all their chemical names end in *-ine*. Replacement of one, two, or all three of the hydrogen atoms in ammonia with organic groups yields primary, secondary, or tertiary amines, respectively. Addition of a fourth hydrogen with an accompanying positive charge on the nitrogen atom results in a quaternary amine. Naturally occurring amines include alkaloids, present in certain plants; some neurotransmitters, including dopamine and epinephrine; and histamine. Industrially important amines include aniline, ethanolamine, and others, used in making rubber, dyes, pharmaceuticals, and synthetic resins and fibres and in a host of other applications. A nitrogen atom with one or two hydrogens is often referred to as an amino group.

amino acid \ə-'mē-nō\ Any of a class of organic compounds in which a carbon atom has bonds to an amino group ($—NH_2$), a carboxyl group (—COOH), a hydrogen atom (—H), and an organic side group (called —R). They are therefore both carboxylic acids and amines. The physical and chemical properties unique to each result from the properties of the R group, particularly its tendency to interact with water and its charge (if any). Amino acids joined linearly by peptide bonds (see covalent bond) in a particular order make up peptides and proteins. Of over 100 natural amino acids, each with a different R group, only 20 make up the proteins of all living organisms. Humans can synthesize 10 of them (by interconversions) from each other or from other molecules of intermediary metabolism, but the other 10 (essential amino acids: arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine) must be consumed in the diet.

Amis \'ā-mis**, Martin** (b. Aug. 25, 1949, Oxford, Oxfordshire, Eng.) British writer and critic. The son of writer Kingsley Amis, he graduated from Oxford University in 1971. He worked for the *Times Literary Supplement* and the *New Statesman* before becoming a full-time writer. His works—including the novels *Money* (1984), *London Fields* (1989), and *Night Train* (1998) as well as the short-story collection *Heavy Water*

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(1999)—feature inventive word play and often scabrous humour as they satirize the horrors of modern urban life. Amis also published an acclaimed autobiography, *Experience* (2000), and an idiosyncratic volume centred on Joseph Stalin, *Koba the Dread* (2002).

Amis, Sir Kingsley (William) (b. April 16, 1922, London, Eng.—d. Oct. 22, 1995, London) British novelist, poet, critic, and teacher. His first novel, *Lucky Jim* (1954; film, 1957), was a hugely successful comic masterpiece. He was often characterized as an Angry Young Man, a label he rejected. Notable among his more than 40 books (including four volumes of poetry) are the mordantly humorous novels *That Uncertain Feeling* (1955; film, *Only Two Can Play*, 1962), *The Green Man* (1959; film, 1957), *Jake's Thing* (1978), and *The Old Devils* (1986, Booker Prize). He was the father of Martin Amis.

Amish \'ä-mish\ Member of a conservative Christian group in North America known as the Old Order Amish Mennonite Church. The Amish originated in 1693–97 as followers of the Mennonite elder Jakob Ammann (1644?–c. 1730) in Switzerland, Alsace, and Germany. He taught that lying was grounds for excommunication (which meant being shunned by all other Mennonites), that clothing should be uniform and beards untrimmed, and that the state church should be avoided. Migration to North America and assimilation eliminated the Amish in Europe. They settled in Pennsylvania in the 18th century. After 1850 they split into "Old Order" (traditional) and "New Order" (now the Mennonite churches). Old Order Amish now live in Pennsylvania, Ohio, Indiana, Iowa, Illinois, and Kansas. Adults are baptized and admitted to formal church membership at age 17 to 20. Services are in Pennsylvania Dutch (a German dialect) and some English. Though similar in theology to Mennonites, Amish wear modest, old-fashioned clothing and generally reject modern technology, including automobiles and telephones.

Amistad mutiny (July 2, 1839) Slave rebellion aboard the schooner *Amistad*. The revolt took place off the coast of Cuba when 53 Africans who had been abducted from Sierra Leone for the slave trade, seized control of the ship, killed the captain and cook, and ordered the navigator to sail for Africa. Pretending to do so, he sailed generally northward instead, and the ship was intercepted two months later off New York. Despite attempts by Pres. Martin Van Buren to send the Africans to Cuba, abolitionists demanded a trial, contending the men were free under international law. A federal judge agreed, and the government appealed to the U.S. Supreme Court, where in 1841 defending counsel John Quincy Adams successfully argued that the men should be freed. Donations helped the 35 survivors to return to Sierra Leone in 1842.

Amitabha \ˌam-i-'tä-bə\ *Japanese* **Amida** Saviour deity worshiped by followers of Pure Land Buddhism in Japan. According to the *Sukhavati-vyuha-sutra* (Pure Land sutra), the monk Dharmakara vowed many ages ago that once he attained buddhahood, all who believed in him and called upon his name would be born into his paradise (the Pure Land) and reside there until achieving nirvana. The cult of Amitabha came to the forefront in China c. 650 and then spread to Japan, where it led to the formation of the Pure Land and True Pure Land sects. In Tibet and Nepal, Amitabha is regarded as one of the five eternal buddhas (rather than as a saviour), who manifested himself as the earthly Buddha Gautama and as the bodhisattva Avalokitesvara.

Great bronze Amida (Daibutsu) at Kamakura, Japan, 1252.
GAVIN HELLIER—ROBERT HARDING PICTURE LIBRARY/GETTY IMAGES

Amman \ä-'man\ City (pop., 2000 est.: 1,147,447), capital of Jordan. It lies 25 mi (40 km) northeast of the Dead Sea. Amman is by far the largest city of Jordan. Fortified settlements have existed in the area from remote antiquity; the earliest date from the Chalcolithic Period (c. 4000–3000 BC). As Rabbah, it became the capital of the Ammonites. It was conquered by Egypt's Ptolemy II (Ptolemy Philadelphus), who renamed it Philadelphia, a name it retained through Roman times. Taken by the Arabs in AD 635, it later went into decline and subsequently disappeared. In 1878 the Ottoman Empire resettled it. When the British established the country of Transjordan in 1921, Amman became its capital. Its modern development was furthered by the independence of Transjordan in 1946. Along with the rest of Jordan (the country's name from 1949), Amman has had to absorb a large number of Arab refugees that fled Palestine during the Arab-Israeli wars.

Ammannati \ˌäm-än-'nä-tē**, Bartolommeo** *or* **Bartolommeo Ammanati** (b. June 18, 1511, Settignano, near Florence—d. April 22, 1592, Florence) Italian sculptor and architect active chiefly in Florence. He trained under Baccio Bandinelli in Florence and Jacopo Sansovino in Venice. In 1550 he went to Rome, where he collaborated with Giorgio Vasari and Giacomo da Vignola on the Villa Giulia. In 1555 he returned to Florence, where he spent the rest of his career working for the Medicis. He finished the Laurentian Library, begun by Michelangelo, but is best known for the Bridge of Santa Trinità and his additions to Filippo Brunelleschi's Pitti Palace, including the courtyard. His buildings mark the transition from the Classicizing Renaissance to the more exuberant Baroque style.

ammonia \ə-'mō-nyə\ Colourless, pungent gas composed of nitrogen and hydrogen, chemical formula NH_3. Easily liquefied by compression or cooling for use in refrigerating and air-conditioning equipment, it is manufactured in huge quantities. Ammonia is made by the Haber-Bosch process (see Fritz Haber). Its major use is as a fertilizer, applied directly to soil from tanks of the liquefied gas. Also employed as fertilizers are salts of ammonia, including ammonium phosphate and ammonium nitrate (the latter used in high explosives as well). Ammonia has many other industrial uses as a raw material, catalyst, and alkali. It dissolves readily in water to form ammonium hydroxide, an alkaline solution (see base) familiar as a household cleaner.

ammonia-soda process See Solvay process

ammonoid \'am-ə-ˌnȯid\ Any of a group of extinct shelled cephalopods, related to the modern pearly nautilus, that are commonly found as fossils in marine rocks of the Devonian through Cretaceous periods (410–65 million years ago). Most ammonoids were predators. The shells, either straight or coiled, served as protective and supportive structures and enabled the animals to compensate for varying water depths. Ammonoids are important index fossils because of their wide geographic distribution in shallow marine waters, rapid evolution, and easily recognizable features. See also belemnoid.

amnesia \am-'nē-zhə\ Loss of memory as a result of brain injury or deterioration, shock, fatigue, senility, drug use, alcoholism, anesthesia, illness, or neurotic reaction. Amnesia may be anterograde (in which events following the causative trauma or disease are forgotten) or retrograde (in which events preceding the trauma or disease are forgotten). It can often be traced to a severe emotional shock, in which case personal memories (in effect, identity) rather than such abilities as language skills are affected. Such amnesia seems to represent an escape from disturbing memories and is thus an example of repression; these memories can generally be recovered through psychotherapy or after the amnesic state has ended. Amnesia may occasionally last for weeks, months, or even years, a condition known as fugue.

amnesty In criminal law, a sovereign act of oblivion or forgetfulness (from Greek *amnestia*, "forgetfulness") granted by a government, especially to a group of persons who are guilty of (usually political) crimes in the past. It is often conditional upon the group's return to obedience and duty within a prescribed period. See also pardon.

Amnesty International (AI) International human-rights organization. It was founded in 1961 by Peter Benenson, a London lawyer who organized a letter-writing campaign calling for amnesty for "prisoners of conscience." AI seeks to inform the public about violations of human rights, especially abridgments of freedom of speech and religion and the imprisonment and torture of political dissidents. It actively seeks the release of political prisoners and support of their families when necessary. Its members and supporters are said to number one million people in some 140 countries. Its first director, Sean MacBride, won the 1974 Nobel Prize for Peace; AI itself won the award in 1977.

amniocentesis \ˌam-nē-ō-sen-'tē-səs\ Surgical insertion of a hollow needle through the abdominal wall into the uterus of a pregnant female to extract fluid from the amniotic sac for analysis of fluid and fetal cells. This can reveal the fetus's sex (important when sex-linked genetic disease is possible), chromosomal disorders, and other problems. First per-

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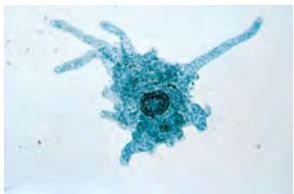
formed in the 1930s, amniocentesis is generally done under local anesthesia in the 15th–17th week of gestation.

amoeba \ə-'mē-bə\ One-celled PROTOZOAN that can form temporary extensions of CYTOPLASM (pseudopodia) in order to move about. Some amoebas are found on the bottom of freshwater streams and ponds. Others live in the human digestive system; one type causes amebic DYSENTERY in humans. Each amoeba contains a small mass of jellylike cytoplasm with VACUOLES and a NUCLEUS. Food is taken in and material is excreted at any point on the cell surface. Amoebas are used extensively in cell research for determining the relative functions and interactions of the nucleus and the cytoplasm.



Amoeba (magnified).
RUSS KINNE/PHOTO RESEARCHERS

Amon \'ä-ˌmän\ *or* **Amen** Egyptian deity revered as king of the gods. Amon may have originated as a local deity at Khmun in Middle Egypt. His cult spread to Thebes, where he became patron of the pharaohs by Mentuhotep I's reign (2008–1957 BC) and was identified with the sun god RE. Represented as a human, a ram, or both, Amon-Re was worshiped with the goddess MUT and the youthful god KHONS. AKHENATON directed his reforms against the cult of Amon, but with little success, and Amon's status was restored in the 14th–13th century BC. In the New Kingdom, Amon came to be seen as one of a triad with PTAH and Re, and in the 11th–10th century BC as a universal god who intervened in affairs of state by speaking through oracles.

amortization \ˌam-ər-ti-'zā-shən\ In finance, the systematic repayment of a DEBT; in accounting, the systematic writing off of some account over a period of years. An example of the first meaning is a home mortgage, which may be repaid in monthly installments that include interest and a gradual reduction of the principal. Such systematic reduction is safer for the lender, since it is easier for the borrower to repay a series of small amounts than a single lump sum. In the second sense, a firm may gradually reduce the balance-sheet valuation of a depreciable asset such as a building, machine, or mine. The U.S. government has sometimes permitted accelerated amortization of assets, which encourages industrial development by decreasing a company's tax burden in the years immediately after a purchase.

Amos (fl. 8th century BC) Earliest Hebrew PROPHET (one of the 12 Minor Prophets) to have a biblical book named for him. Born in Tekoa in Judah, he was a shepherd. According to the book of Amos, he traveled to the richer and more powerful northern kingdom of Israel to preach his visions of divine destruction and the message that God's absolute sovereignty required justice for rich and poor alike and that God's chosen people were not exempt from the moral order. He foretold the destruction of the northern kingdom and Judah and anticipated the predictions of doom by later biblical prophets.

Amos 'n' Andy See Freeman and Charles Correll GOSDEN

amosite \'a-mə-ˌsīt\ Variety of the silicate mineral cummingtonite, which is a source of asbestos. Cummingtonite is an AMPHIBOLE mineral, an iron and magnesium silicate that occurs in metamorphic rocks in the form of long needlelike, fibrous crystals.

Ampère \ä^{n}-'per**, André Marie** (b. Jan. 22, 1775, Lyon, France—d. June 10, 1836, Marseille) French physicist, founder of the science of electromagnetism. A prodigy who mastered the entire known field of mathematics by age 12, he became a professor of physics, chemistry, and mathematics. He formulated a law of electromagnetism, called AMPÈRE'S LAW, that describes the magnetic force between two electric currents. An instrument he devised to measure the flow of electricity was later refined as the GALVANOMETER. His chief published work was *Memoir on the Mathematical Theory of Electrodynamic Phenomena* (1827). The ampere (A) unit of electric current was named for him.

Ampère's law Law of ELECTROMAGNETISM that describes mathematically the MAGNETIC FORCE between two ELECTRIC CURRENTS. It was named after A.-M. AMPÈRE, who discovered that such forces exist. If two currents flow in the same direction, the force between the two wires is attractive; if they flow in opposite directions, the force is repulsive. In each case, the force is directly proportional to the currents.

amphetamine \am-'fe-tə-ˌmēn\ Organic compound, prototype of a class of synthetic amphetamine drugs (e.g., Benzedrine, Dexedrine, methamphetamine), that stimulates the central NERVOUS SYSTEM. It was first synthesized in 1887. Amphetamines cause wakefulness, euphoria, decreased fatigue, and increased ability to concentrate. Since they dull the appetite, they have been used for weight reduction. Often called "speed," they are used (often illicitly) to stay awake. In children with attention deficit (hyperactivity) disorder, they have a calming effect, helping them concentrate. Undesirable effects include overstimulation, with paranoia, restlessness, insomnia, tremor, and irritability, and a deep DEPRESSION when the drug wears off. This, along with rapid development of tolerance requiring increased doses, can lead to DRUG ADDICTION.

amphibian Any member of a class (Amphibia) of cold-blooded VERTEBRATE animals that includes more than 4,400 species in three groups: FROGS and TOADS (order Anura), SALAMANDERS (order Caudata), and CAECILIANS (order Apoda). Probably evolved from certain fish species of the Early DEVONIAN PERIOD (417–391 million years ago), amphibians were the first vertebrates to move from an aquatic environment to land. Most species have an aquatic larval, or TADPOLE, stage that metamorphoses into a terrestrial adult, but a few species spend their entire life in water. Amphibians are found worldwide, the majority in the tropics.

amphibious warfare Military operations directed against hostile shores and characterized by attacks launched from the sea by naval and landing forces. It has been conducted since ancient times. The Greeks attacking Troy (1200 BC) had to make a shore landing, as did the Persian invaders of Greece prior to the Battle of MARATHON (490 BC). The British-led landings at GALLIPOLI (1915) were the main amphibious assault in World War I. The Allies of World War II found amphibious tactics essential in the island-hopping Pacific campaign and in the famous D-Day of the NORMANDY CAMPAIGN, which still ranks as the greatest amphibious assault in history. Amphibious warfare's greatest advantage is its mobility and flexibility; its greatest limitation is that the attacker must start from nothing to build up strength ashore. Modern amphibious forces attempt to overcome this by fielding larger and more efficient landing vessels and also by using helicopters and short-takeoff and -landing airplanes to deploy troops beyond the hostile shore.

amphibole \'am-fə-ˌbōl\ Any of a group of common rock-forming hydrous SILICATE MINERALS. Amphiboles occur in many igneous rocks as minor and major constituents and form the major component in many GNEISSES and SCHISTS. Some highly fibrous forms are collectively called ASBESTOS.

amphibole asbestos Collective term for three highly fibrous (asbestiform) varieties of amphibole: CROCIDOLITE, AMOSITE, and ACTINOLITE. All have long, silky to splintery fibres with appreciable tensile strength and are of economic importance as ASBESTOS.

amphibolite \am-'fi-bə-ˌlīt\ Igneous or metamorphic rock composed largely or dominantly of AMPHIBOLE minerals. For igneous rocks, the term hornblendite is usually used and is more restrictive; HORNBLENDE is the most common amphibole. Metamorphic amphibolites are more widespread and variable than igneous ones. Typically, they are medium- to coarse-grained and are composed of hornblende and PLAGIOCLASE. Basic igneous rocks such as basalts and gabbros (see ACID AND BASIC ROCKS) can be the parent rocks of amphibolite.

amphibolite facies \'fā-shēz\ One of the major divisions of the mineral facies classification of METAMORPHIC ROCKS, encompassing rocks that formed under conditions of moderate to high temperatures (950°F, or 500°C, maximum) and pressures. Less-intense temperatures and pressures form rocks of the EPIDOTE-AMPHIBOLITE FACIES, and more-intense temperatures and pressures form rocks of the GRANULITE FACIES. Amphibole, diopside, epidote, plagioclase, certain types of garnet, and wollastonite are minerals typically found in amphibolite facies rocks. They are widely distributed in Precambrian gneisses and probably formed in the deeper parts of folded mountain belts.

Amphion and Zethus \'am-fē-ən...'zē-thəs\ In GREEK MYTHOLOGY, twin sons of ZEUS by the mortal Antiope. As infants the two were left to die on Mount Cithaeron, but were found and raised by a shepherd. Amphion grew up to become a great musician and singer, while Zethus became a hunter and herdsman. According to legend, they built the city of THEBES

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after the stone blocks arranged themselves into walls at the sound of Amphion's lyre. Amphion became king of Thebes, and he married Niobe, with whom he had six sons and six daughters. When their children were killed by the gods, he committed suicide.

amphioxus \ˌam-fē-ˈäk-səs\ *or* **lancelet** \ˈlan-slət\ Any of certain small marine chordates (invertebrate subphylum Cephalochordata) found widely on tropical and subtropical coasts and less commonly in temperate waters. Seldom more than 3 in. (8 cm) long, they resemble small, slender fishes without eyes or a definite head. They are grouped in several species in two genera (*Branchiostoma* or *Amphioxus*, and *Epigonichthyes* or *Asymmetron*). They spend much of their time buried in gravel or mud on the ocean bottom, though they are able to swim, and feed by filtering food particles from water passing through their gill slits. They have no brain or distinct heart.

Amphipolis \am-ˈfi-pə-ləs\ Ancient city, eastern Macedonia, near the mouth of the Struma River. Amphipolis was a strategic transportation centre, controlling the bridge over the river and the route from northern Greece to the Dardanelles. Colonized by Athens in 437 BC, it was taken by Sparta in 424 BC. It soon received its independence, only to be taken by Philip II of Macedon in 358 BC. Later, under Roman rule, it was the headquarters of the Roman governor of Macedonia.

amphitheater Freestanding, open-air round or oval structure with a central arena and tiers of concentric seats. The amphitheater originated in ancient Italy (Etruria and Campania) and reflects the entertainment forms popular there, including gladiatorial games and contests of animals with one another or of men with animals. The earliest extant amphitheater is one built at Pompeii (c. 80 BC). Examples survive throughout the former provinces of the Roman empire, the most famous being Rome's Colosseum.

amplifier Device that responds to a small input signal (voltage, current, or power) and delivers a larger output signal with the same waveform features. Amplifiers are used in radio and television receivers, high-fidelity audio equipment, and computers. Amplification can be provided by electromechanical devices (e.g., transformers and generators) and vacuum tubes, but most electronic systems now employ solid-state microcircuits. One amplifier is usually insufficient, so its output is fed into a second, whose output is fed to a third, and so on, until the output level is satisfactory.

amplitude modulation See AM

amputation Removal of any part of the body, usually surgical removal of part or all of a limb. Congenital amputation means lack of a limb at birth (see agenesis). Surgical amputation may be a lifesaving measure to prevent excessive blood loss from injury or to check the spread of infection, gangrene, or malignant soft-tissue or bone tumours. Reconstructive surgery, prompt treatment with blood and plasma, and rehabilitation have made amputation rarer than in the past. Prostheses reduce handicaps for amputees, whose surgery may have been designed with a prosthesis in mind.

ʿAmr ibn al-ʿĀṣ \ˈäm-ər-ˌib-ən-əl-ˈäs\ (d. 663, Al-Fusṭāṭ, Egypt) Arab conqueror of Egypt. After accepting Islam (c. 630), he led a force to Oman, where he converted the region's rulers. He was a leader in the Muslim force that conquered southwestern Palestine in the 630s but gained fame when, on his own initiative, he set out to conquer Egypt, succeeding (642) after a two-year campaign. A good administrator and politician, late in his career he aided the governor of Syria, Muʿāwiyah I, against ʿAlī, Islam's fourth caliph. He was rewarded with the governorship of Egypt at the beginning of the Umayyad dynasty (661).

Amritsar \ˌəm-ˈrit-sər**, Massacre of** (1919) Incident in which British troops fired on a crowd of Indian protesters. In 1919 the British government of India enacted the Rowlatt Acts, extending its World War I emergency powers to combat subversive activities. On April 13 a large crowd gathered at Amritsar in the Punjab to protest the measures; troops opened fire, killing about 379 and wounding some 1,200. The massacre permanently scarred relations between India and Britain and was the prelude to Mohandas K. Gandhi's noncooperation movement of 1920–22.

Amsterdam City (pop., 2005 est.: city, 739,295; metro. area, 1,017,332), western Netherlands. It lies at the head of the IJsselmeer. It is the nominal capital of The Netherlands, whose seat of government is at The Hague. Originally a fishing village, it received its charter as a town in 1306. It joined the Hanseatic League in 1369 and grew steadily in the 14th and 15th centuries. After the decline of Antwerp at the end of the 16th century, Amsterdam became the source of growing Dutch commercial and naval power. It was the centre for the Dutch East India and West India companies and became the leading trade metropolis of Europe. It became part of the Kingdom of Holland, which entered the Kingdom of the Netherlands in 1815. After suffering a partial decline in the 18th century, its prosperity increased when it became connected by canal to the North Sea in the late 19th century. It was occupied by Germany in World War II. After the war Amsterdam became known as a place of tolerance and liberalism. The city is now a major European port and a hub for international finance and trade.

Amtrak *formally* **National Railroad Passenger Corp.** Federally supported corporation that operates nearly all intercity passenger trains in the U.S. It was established by Congress in 1970 in the face of private railroads' heavy financial losses. Routes were cut back severely, with service maintained only in highly populated areas and between the largest cities. Amtrak pays the railroads to run passenger trains and compensates them for the use of tracks and terminals. Amtrak bears all administrative costs and manages scheduling, route planning, and ticket sales. Despite income from tickets and mail-carrying services, Amtrak requires federal support to cover its operating costs. See also Conrail; Railway Express Agency.

Amu Darya \ˈä-mü-ˈdär-yə\ *ancient* **Oxus River** River, Central Asia. It is one of the longest rivers in Central Asia, 1,578 mi (2,540 km) long measured from the remotest sources of the Panj River; its other headstream is the Vakhsh. It flows west-northwest to its mouth on the Aral Sea. It forms part of Afghanistan's borders with Tajikistan, Uzbekistan, and Turkmenistan and part of Uzbekistan's border with Turkmenistan.

Amundsen \ˈä-můn-sən**, Roald (Engelbregt Gravning)** (b. July 16, 1872, Borge, near Oslo, Nor.—disappeared June 18, 1928?, Arctic Ocean) Norwegian explorer, leader of the first group to reach the South Pole. In 1897 he took part in a Belgian expedition that was the first to winter in the Antarctic. In 1903–05 he was the first to navigate the Northwest Passage. He planned an expedition to the North Pole, but, after learning that Robert E. Peary had reached that goal, he set off for the South Pole in 1910. He prepared his trip carefully and in October 1911 set out with four men, 52 dogs, and four sledges. He reached the South Pole in December 1911, one month before Robert Falcon Scott's ill-fated attempt. He returned to Norway and established a successful shipping business. In 1926 he and Umberto Nobile (1885–1978) passed over the North Pole in a dirigible. Amundsen disappeared in 1928 while flying to rescue Nobile from a dirigible crash.

Roald Amundsen, 1923.
UPI/BETTMANN

Amundsen \ˈä-mən-sən\ **Gulf** Southeastern extension of the Beaufort Sea of the Arctic Ocean. Extending about 250 mi (400 km), the gulf is bordered by Victoria Island on the east and separates Banks Island (north) from the Canadian mainland (south). In 1850 the gulf was entered from the west by the British explorer Robert McClure. It is named for Roald Amundsen.

Amur \ä-ˈmür\ **River** *Chinese* **Heilong** \ˈhā-ˈlůng\ **Jiang** *or* **Heilung Chiang** River, northeastern Asia. The Amur proper begins at the confluence of the Shilka and Argun rivers and is 1,755 mi (2,824 km) long. It flows east-southeast along the Russian-Chinese border to Khabarovsk, Siberia, then northeast across Russian territory to empty into the Tatar Strait. Among its tributaries are the Zeya, Bureya, and Ussuri rivers. From the 18th century, Russians have settled to the north of the river and Chinese to the south, a situation which at times has provoked border clashes.

amygdule \ə-ˈmig-ˌdyül\ Secondary deposit of minerals found in a rounded, elongated, or almond-shaped cavity in volcanic rock. The cavities (vesicles) were created by the expansion of gas bubbles or steam within lava. Because gas bubbles tend to rise through the lava, amyg-

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dules are most common near the tops of flows. Many minerals have been found as amygdules, including some spectacular museum specimens of ZEOLITES.

amyotrophic lateral sclerosis (ALS) \ˌā-ˌmī-ə-'trō-fik...sklə-'rō-səs\ *or* **Lou Gehrig disease** Degenerative NERVOUS-SYSTEM disorder causing muscle wasting and paralysis. The disease usually occurs after age 40, more often in men. Most victims die within two to five years from respiratory muscle ATROPHY. ALS affects motor NEURONS; the muscles they control become weak and atrophied, with debility usually beginning in the hands and creeping slowly up to the shoulders. The lower limbs become weak and spastic. Variants include progressive muscular atrophy and progressive bulbar palsy. In 1993 the defective gene that accounts for 5–10% of cases was discovered; it produces an ineffective version of an enzyme that neutralizes free radicals, which destroy motor neurons.

An Hyang See AN YU

An Lushan \'än-'lü-'shän\ **Rebellion** Rebellion beginning in 755 in China led by An Lushan (703–757), a general of non-Chinese origin. An Lushan rose through the ranks of the TANG-DYNASTY army in the 740s, becoming a military governor and a favourite of the emperor, XUANZONG. In 755 he turned his troops on the eastern capital city, Luoyang, and after taking it he proclaimed himself emperor. Six months later his forces took CHANG′AN, the western capital. He was murdered in 757, and the rebellion was put down in 763. The Tang government was much weakened, however, and the second half of the Tang dynasty and the subsequent FIVE DYNASTIES period were troubled by chronic warlordism.

An Yu \'än-'yü\ *or* **An Hyang** \'än-'hyäŋ\ (b. 1243—d. 1306) Korean Neo-Confucian scholar and educator. In 1287 he accompanied King Chungnyol to the Mongol court in Beijing (Peking), where he encountered the texts of ZHU XI. Returning to Korea, An Yu used Neo-Confucian thought as the basis for promoting education. He helped reconstitute the National Academy and established a state treasury for national education. Eventually he became director of the Munmyo, the Korean national shrine to culture. Known as an opponent of Sŏn (Zen) Buddhism in Korea, he was the most famous Confucian scholar of his era. See also NEO-CONFUCIANISM.

Anabaena \ˌan-ə-'bē-nə\ Genus of blue-green algae (CYANOBACTERIA). Found as PLANKTON in shallow water and on moist soil, they occur in both solitary and colonial forms and are capable of nitrogen fixation. In northern latitudes in summer, extensive growth of *Anabaena* may form water blooms that remain suspended instead of forming a surface scum. A toxic substance produced is fatal to cattle and other animals if present in drinking water in sufficient concentration.

Anabaptist Member of a movement of the Protestant REFORMATION characterized by adult BAPTISM. Anabaptists held that infants were not punishable for SIN because they had no awareness of good and evil and thus could not yet exercise free will, repent, and accept baptism. Denying the validity of infant baptism, they accepted adult baptism, which was regarded as a second baptism by those outside the group who identified them as Anabaptists (from the Greek for rebaptizers). Confident of living at the end of time, early Anabaptists sought to restore the institutions and spirit of the primitive church. The first adult baptisms took place outside Zürich in early 1525. Most Anabaptists were pacifists and refused to swear civil oaths. THOMAS MÜNTZER advocated a more violent eschatology that called for the overthrow of the rich by the poor and was executed after leading the Thuringian peasant revolt (1525). Another group of Anabaptists, led by John of Leiden, took control of the city of Münster and sought to establish the millennial kingdom. Their excesses led to their violent suppression in 1535 and further persecution and martyrdom of the Anabaptists. Many Anabaptists settled in Moravia, where they stressed the community of goods modeled on the primitive church at Jerusalem. This branch continues as the HUTTERITE movement, primarily in the western U.S. and Canada. Increasingly persecuted throughout Europe, Anabaptists in the Netherlands and northern Germany rallied under the leadership of MENNO SIMONSZ. and survive as the MENNONITES.

anabolic \ˌa-nə-'bä-lik\ **steroid** STEROID HORMONE that increases tissue growth. Anabolic steriods are given to elderly or postoperative patients to promote muscle growth and tissue regeneration. Unsupervised use by athletes to build muscle and improve strength can have serious harmful effects, including coronary heart disease, sexual and reproductive disorders, immunodeficiencies, liver damage, stunted growth, aggressive behaviour, susceptibility to connective-tissue injury, and (in females) irreversible masculinization.

Anacletus \ˌan-ə-'klēt-əs\ **II** *orig.* **Pietro Pierleoni** (b. Rome—d. Jan. 25, 1138, Rome) ANTIPOPE (1130–38). Named a cardinal at Rome in 1116, he was elected pope by a majority of cardinals in 1130, while a minority created a schism by choosing Innocent II. Anacletus forced the rival pope to flee to France, where Innocent was supported by a church council and, especially, by BERNARD OF CLAIRVAUX. Innocent's supporters, including the Holy Roman and Byzantine emperors, invaded Italy in an unsuccessful effort to restore him. A second expedition in 1136 eroded support for Anacletus, who died before the issue was resolved by the submission of his successor to Innocent.

anaconda Either of two South American snake species in the genus *Eunectes* (family Boidae) that constrict their prey. The heavily built giant anaconda, or great water boa, is usually not more than 16 ft (5 m) long but can be longer than 24 ft (7.5 m), rivaling the largest PYTHONS in length. The yellow anaconda is much smaller. Typically dark green with alternating oval black spots, the giant anaconda lives along tropical rivers east of the Andes and in Trinidad. It kills at night by lying in wait in water; it constricts prey as large as young pigs or caimans and occasionally forages in trees for birds. It may bear 75 live young at a time.

Giant anaconda (*Eunectes murinus*)
© Z. LESZCZYNSKI/ANIMALS ANIMALS

Anacreon *or* **Anakreon** \ə-'nak-rē-ən\ (b. c. 582 BC, Teos, Ionia—d. c. 485) Last great lyric poet of Asian Greece. Only fragments of his poetry have survived. Though he may have written serious poems, the poems quoted by later writers are chiefly in praise of love, wine, and revelry. His sentiments and style were widely imitated, and the anacreontic metre in poetry was named for him.

Anadolu See ANATOLIA

Anaheim City (pop., 2000: 328,014), southwestern California, U.S. Lying on the plain of the Santa Ana River 25 mi (40 km) southeast of Los Angeles, it was founded by German immigrants in 1857 as a cooperative agricultural community. After 1950 its citrus groves and vineyards had all but disappeared in the Los Angeles-Orange Co. urban-industrial expansion. WALT DISNEY's first amusement park, Disneyland, opened there in 1955. Today it is a prominent convention site.

anal canal End portion of the ALIMENTARY CANAL, distinguished from the RECTUM by the transition from an internal mucous membrane layer to one of skinlike tissue and by its narrower diameter. Waste products move from the rectum to the anal canal. The human anal canal is 1–1.5 in. (2.5–4 cm) long and has three parts: upper, with longitudinal folds (rectal columns); lower, with involuntary and voluntary constrictive muscles (sphincters) to control discharge of feces; and the anal opening itself. Enlargements of the ends of rectal and anal veins are called HEMORRHOIDS.

Analects See LUNYU

analgesic \ˌan-əl-'jē-zik\ Drug that relieves pain without blocking nerve impulse conduction or markedly altering sensory function (see NERVOUS SYSTEM). Two classes are defined by the type of pain-relieving action. Opioids (opiates and synthetic NARCOTICS; see OPIUM) act on BRAIN receptors to inhibit pain impulses. They may be used for short- or long-term pain relief, usually by prescription, but carry a risk of DRUG ADDICTION. Nonopioids, used mostly for short-term relief and modest pain, are available without prescription. They include NSAIDs (including ASPIRIN and IBUPROFEN) and ACETAMINOPHEN; all act by inhibiting synthesis of PROSTAGLANDINS, molecules involved in the peripheral perception of pain.

analog computer COMPUTER in which continuously variable physical quantities, such as electrical potential, fluid pressure, or mechanical motion, are used to represent (analogously) the quantities in the problem to be solved. The analog system is set up according to initial conditions and then allowed to change freely. Answers to the problem are obtained by measuring the variables in the analog model. Analog computers are especially well suited to simulating dynamic systems; such simulations

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may be conducted in real time or at greatly accelerated rates, allowing experimentation by performing many runs with different variables. They have been widely used in simulating the operation of aircraft, nuclear power plants, and industrial chemical processes. See also DIGITAL COMPUTER.

analysis In chemistry, the determination of the properties and composition of samples of materials; qualitative analysis establishes what is there, and quantitative analysis measures how much. A large body of systematic procedures (analytical chemistry) has evolved in close association with other branches of the physical sciences since their beginnings. A sample of a single COMPOUND may be analyzed to establish its elemental composition (see ELEMENT, MOLECULAR WEIGHT) or molecular structure; many measurements use SPECTROSCOPY and SPECTROPHOTOMETRY. A mixed sample is usually analyzed by separating, detecting, and identifying its components by methods that depend on differences in their properties (e.g., volatility, mobility in an electric or gravitational field, distribution between liquids that do not mix). The many types of CHROMATOGRAPHY are increasingly useful, particularly with biological and biochemical samples.

analysis Field of mathematics that incorporates the methods of ALGEBRA and CALCULUS—specifically of LIMITS, CONTINUITY, and INFINITE SERIES—to analyze classes of FUNCTIONS and EQUATIONS having general properties (e.g., differentiability). Analysis builds on the work of G.W. LEIBNIZ and ISAAC NEWTON by exploring the applications of the DERIVATIVE and the INTEGRAL. Several distinct but related subfields have developed, including the calculus of variations, DIFFERENTIAL EQUATIONS, Fourier analysis (see FOURIER TRANSFORM), complex analysis, vector and TENSOR ANALYSIS, real analysis, and FUNCTIONAL ANALYSIS. See also NUMERICAL ANALYSIS.

analytic geometry Investigation of geometric objects using COORDINATE SYSTEMS. Because RENÉ DESCARTES was the first to apply algebra to geometry, it is also known as Cartesian geometry. It springs from the idea that any point in two-dimensional space can be represented by two numbers and any point in three-dimensional space by three. Because lines, circles, spheres, and other figures can be thought of as collections of points in space that satisfy certain equations, they can be explored via equations and formulas rather than graphs. Most of analytic geometry deals with the CONIC SECTIONS. Because these are defined using the notion of fixed distance, each section can be represented by a general equation derived from the DISTANCE FORMULA.

analytic philosophy Philosophical tradition that emphasizes the logical analysis of concepts and the study of the language in which they are expressed. It has been the dominant approach in philosophy in the English-speaking world from the early 20th century. With respect to its problems, methods, and style, it is often contrasted with CONTINENTAL PHILOSOPHY, though the significance of the opposition has been widely challenged. Analytic philosophers have differed regarding the nature of so-called "ordinary" language and the methodological value of appeals to ordinary usage in the logical analysis of concepts. Those known as formalists hold that, because ordinary language is potentially a source of conceptual confusion, philosophy and science should be conducted in a logically transparent formal language based on modern mathematical, or symbolic, logic. Those known as informalists reject this view, arguing that attempts to "improve" ordinary language in this way inevitably oversimplify or falsify it, thereby creating conceptual confusion of just the sort that the formalists are concerned to avoid. Three figures conventionally recognized as founders of the tradition are GOTTLOB FREGE, G.E. MOORE, and BERTRAND RUSSELL. Other major figures include LUDWIG WITTGENSTEIN, A.J. AYER, RUDOLF CARNAP, J.L. AUSTIN, W.V.O. QUINE, and David Lewis (1941–2001). See also LOGICAL POSITIVISM; VIENNA CIRCLE.

analytic psychology Psychoanalytic method of CARL JUNG as he distinguished it from that of SIGMUND FREUD. Jung attached less importance than did Freud to the role of childhood sexual conflicts in the development of NEUROSIS. Moreover, he defined the unconscious to include both the individual's own unconscious and that inherited, partly in the form of ARCHETYPES, from his or her ancestors (the "collective unconscious"). He classified people into INTROVERT AND EXTRAVERT types and further distinguished them according to four primary functions of the mind—thinking, feeling, sensation, and intuition—one or more of which predominated in any given person.

analytic-synthetic distinction In both LOGIC and EPISTEMOLOGY, the distinction (derived from IMMANUEL KANT) between statements whose predicate is included in the subject (analytic statements) and statements whose predicate is not included in the subject (synthetic statements). Some philosophers prefer to define as analytic all statements whose denial would be self-contradictory, and to define the term synthetic as meaning "not analytic." The distinction, introduced by Kant in *The Critique of Pure Reason*, aroused extensive debate in the mid-20th century, particularly in view of objections raised by W.V.O. QUINE.

anamorphosis \ˌan-ə-mȯr-ˈfō-sis\ Drawing or painting technique that gives a distorted image of the subject when seen from the usual viewpoint, but when viewed from a particular angle or reflected in a curved mirror shows it in true proportion. Its purpose is to amuse or mystify. It was a curious by-product of the discovery of PERSPECTIVE in the 14th–15th century and was regarded as a display of technical virtuosity. The first examples appear in LEONARDO DA VINCI's notebooks.

Ananda \ˈä-nən-də\ (fl. 6th century BC, India) First cousin and disciple of the BUDDHA. A monk who served as the Buddha's personal attendant, he became known as the "beloved disciple." It was Ananda who persuaded the Buddha to allow women to become nuns. By tradition, he was the only intimate disciple of the Buddha who had not attained enlightenment before his master's death; he attained that state just before the first Buddhist Council (c. 544 or 480 BC), when he recited from memory the SUTTA PITAKA. He is represented as the author of several Buddhist discourses.

anaphylaxis \ˌan-ə-fī-ˈlak-sis\ Severe, immediate, potentially fatal bodily reaction to contact with a substance (ANTIGEN) to which the individual has previously been exposed. Often triggered by antiserum, antibiotics, or insect stings, the reaction's symptoms include skin flushing, bronchial swelling (with difficulty breathing), and loss of consciousness. SHOCK may follow. Milder cases may involve HIVES and severe headache. Treatment, consisting of injection of EPINEPHRINE, followed by ANTIHISTAMINES, CORTISONE, or similar drugs, must begin within minutes. Anaphylaxis may be caused by extremely small amounts of antigen.

anarchism \ˈan-ər-ˌkiz-əm\ Political theory holding all forms of government authority to be unnecessary and undesirable and advocating a society based on voluntary cooperation and free association of individuals and groups. The word was used only pejoratively until PIERRE-JOSEPH PROUDHON, now regarded as the founder of anarchism, adopted it in *What is Property?* (1840). The anarchist MIKHAIL BAKUNIN clashed with KARL MARX at the FIRST INTERNATIONAL; when it was dissolved in 1872, Bakunin's followers retained control of workers' organizations in Latin countries such as Spain and Italy. Even anarchists who believed that the transition to a government-free society required violent revolution disagreed on the nature of the transition. Anarcho-SYNDICALISM, which developed in the late 1880s, emphasized labour unions (*syndicats*) and called for general strikes to paralyze the state. In the 19th and 20th centuries, anarchism also inspired experimental communities, including New Lanark in Britain and BROOK FARM in the U.S. During the early months of the SPANISH CIVIL WAR, anarchist militias were in virtual control of much of eastern Spain, where they established hundreds of anarchist collectives. Suppressed as an organized movement by fascism in the 1930s, anarchism reemerged in the 1950s and '60s through its influence on the CIVIL RIGHTS MOVEMENT and the student movements in the U.S. and Europe. The radical ECOLOGY movement in the 1970s also was inspired by anarchist ideas. Beginning in 1999, anarchist-led street demonstrations against the WORLD BANK and INTERNATIONAL MONETARY FUND received unprecedented publicity and inspired new anarchist groups, periodicals, and Internet sites. Anarchist themes are reflected in the work of many 20th-century artists, writers, and musicians, including PABLO PICASSO, the American poets of the BEAT MOVEMENT, the Spanish Surrealist filmmaker LUIS BUÑUEL, and the American composer JOHN CAGE.

Anasazi \ˌä-nə-ˈsä-zē\ **culture** North American Indian civilization that developed from c. AD 100 to historic times, centring on the area where the present-day boundaries of the U.S. states of Arizona, New Mexico, Colorado, and Utah intersect. Anasazi is the Navajo word for "Ancient Enemy"; the Hopi prefer the term Hisatsinom, meaning "Ancient People." Anasazi is the term most commonly used to refer to the ancestors of contemporary PUEBLO INDIAN peoples. Anasazi civilization is customarily divided into several periods: Basket Maker (AD 100–500), Modified Basket Maker (500–700), Developmental Pueblo (700–1050), Classic Pueblo (1050–1300), Regressive Pueblo (1300–1700), and Modern Pueblo (1700–the present). As among present-day Pueblo peoples, religion in the Anasazi culture was highly developed and centred on rites partly conducted in underground circular chambers called KIVAS. The best-known Anasazi ruins are the cliff dwellings at MESA VERDE (Colo.) and Chaco Canyon (N.M.).

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Anastasia *Russian* **Anastasiya Nikolayevna** (b. June 18, 1901, Peterhof, Russia—d. July 16/17, 1918, Yekaterinburg) Grand duchess of Russia and youngest daughter of Tsar Nicholas II. She was executed at age 17 with the other members of her immediate family by the Bolsheviks in the Russian Revolution of 1917. After the executions several women outside Russia claimed her identity, making her the subject of periodic popular conjecture and publicity. Some also claimed to be heir to the Romanov fortune held in Swiss banks. The most famous was Anna Anderson (d. 1984), a Pole married to a U.S. history professor; her claim was finally rejected in 1970, and later genetic tests proved there was no connection between Anderson and the Romanovs.

Anastasius \ˌan-ə-'stā-zhəs\ **I** (b. 430?, Dyrrhachium, Epirus Vetus—d. July 9, 518, Constantinople) Byzantine emperor (491–518). Originally a bodyguard to Zeno, he succeeded Zeno as emperor and married his widow. Anastasius reformed the monetary and taxation systems and expelled rebel tribes from Constantinople, building a wall to protect the capital against raiders. He recognized Theodoric's rule in Italy (497) but later sent a fleet to ravage the Italian coast. War with Persia (502–5) ended when he agreed to pay tribute to the Persian king. Anastasius accepted the Monophysite doctrine, a stand that caused unrest in Byzantium but fostered peace with Egypt and Syria.

Anath \'an-ath\ Chief western Semitic goddess of love and war, sister and helpmate to Baal, whom she retrieved from the land of the dead. One of the best-known of Canaanite deities, she was famous for her youthful vigour and ferocity in battle. In Egypt she was depicted nude, holding flowers and standing on a lion. During the Hellenistic Age, Anath and Astarte were merged into Atargatis.

Anatolia *or* **Asia Minor** *Turkish* **Anadolu** \ˌä-nä-'dō-lü\ Peninsula forming the western extremity of Asia. It is bounded by the Black Sea to the north, the Mediterranean Sea to the south, and the Aegean Sea to the west. Its eastern boundary is generally marked by the Anti-Taurus Mountains. Anatolia is roughly contiguous with the Asian portion of the modern Republic of Turkey. Because of its location at the point where Asia and Europe meet, it has long been the scene of numerous migrations and conquests. It was the original location of the kingdom of Hittites (c. 1700–1180 BC). Later, Indo-European peoples, possibly Thracian, established the Phrygian kingdom. In the 6th century BC the Persian Achaemenian dynasty came to rule the area; it was conquered by Alexander the Great in 334 BC. Beginning in the 1st century BC, the area was absorbed into the Roman Republic and Empire. When the empire split in AD 395, Anatolia became part of the Byzantine Empire. The area endured invasions by Arabs, Turks, Crusaders, Mongols, and the Turkic army of Timur before the Ottoman Empire established full control in the 15th century. From 1923 its history was that of modern Turkey.

Anatolian languages Branch of the Indo-European language family spoken in Anatolia in the 2nd–1st millennia BC. The attested Anatolian languages are Hittite, Palaic, Luwian (Luvian), Hieroglyphic Luwian, Lycian, and Lydian. Hittite, by far the most copiously attested of the group, is known chiefly from a vast archive of cuneiform tablets found in 1905 at Hattusas (now Bogazköy, in north-central Turkey), the capital of the Hittite empire; Hittite texts date from the 16th to 13th century BC. By the late Roman or early Byzantine period at the latest, Anatolian languages had all become extinct. Several non-Indo-European languages of ancient Anatolia, all known from cuneiform texts, are also sometimes considered Anatolian languages: Hattic, spoken in central Anatolia before the coming of the Hittites and known solely from words and texts preserved by Hittite scribes; Hurrian, spoken in the 2nd millennium BC in northern Mesopotamia and southeastern Anatolia; and Urartian (Urartean), known from northwestern Anatolian texts of the 9th–7th centuries BC.

anatomy Biological field that deals with bodily structures as revealed by dissection. Herophilus first laid the factual groundwork for gross anatomy, the study of structures large enough to see without a microscope. Galen's ideas were the authority for anatomy in Europe until Andreas Vesalius's methods placed it on a firm foundation of observed fact. The microscope permitted the discovery of tiny structures (e.g., capillaries and cells), the subject of microscopic anatomy. Crucial advances in this area—including the microtome, which slices specimens into extremely thin sections, and staining—led to the new fields of cytology and histology. Electron microscopy opened up the study of subcellular structures, and X-ray diffraction gave rise to the new subspecialty of molecular anatomy. Comparative anatomy compares similar structures in different animals to see how they have changed with evolution.

Anaxagoras \ˌan-ak-'sag-ə-rəs\ (b. c. 500, Clazomenae, Anatolia—d. c. 428 BC, Lampsacus) Greek philosopher. Though only a few fragments of his writings have survived, he is remembered for his cosmology and for his discovery of the true cause of eclipses. His cosmology grew out of the efforts of earlier pre-Socratics to explain the physical universe in terms of a single element. The most original aspect of his system was his doctrine of *nous* ("mind," or "reason"), according to which the cosmos, including all living things, was created by mind in a process of attraction of "like to like"; mind also accounts for the power of living things to extract nourishment from surrounding substances.

Anaximander \ə-'nak-sə-ˌman-dər\ (b. 610 BC, Miletus—d. 546/545 BC) Greek philosopher, often called the founder of astronomy. He apparently wrote treatises on geography, astronomy, and cosmology that survived for several centuries and made a map of the known world. He was the first thinker to develop a cosmology. A rationalist, he prized symmetry and used geometry and mathematical proportions to help map the heavens; his theories thus departed from earlier, more mystical conceptions and foreshadowed the achievements of later astronomers. Whereas earlier theories had suggested Earth was suspended or supported from elsewhere in the heavens, Anaximander asserted that Earth remained unsupported at the centre of the universe because it had no reason to move in any direction.

Anaximander, represented with a sundial, mosaic, 3rd century AD; in the Rhineland Museum, Trier, Ger.
BY COURTESY OF THE LANDESMUSEUM, TRIER, GER.

Anaximenes \ˌan-ak-'sim-ə-ˌnēz\ (fl. c. 545 BC) Greek philosopher of nature. With Thales and Anaximander, he is one of three Milesian thinkers (see Miletus) traditionally considered the first philosophers of the Western world. He defined the essence of matter as *aer* ("air") and explained the densities of various types of matter in terms of varying degrees of condensation of moisture. His writings no longer exist except as quoted by later authors.

ANC See African National Congress

ancestor worship Religious beliefs or practices that involve addressing prayers or offerings to the spirits of dead relatives. It existed among the ancient Greeks, other Mediterranean peoples, and the ancient Europeans; it also plays a major role in traditional African religions. The dead are related to the family, clan, tribe, or village; mythical ancestors may be included. They may be friendly, or they may be displeased and require propitiation. Commemorative ceremonies are sometimes held at graves or monuments and may include prayers, offerings, sacrifices, and festivals of honor. Worship of individual ancestors is common; it may be combined with communal forms of worship, as in the case of the Roman emperor cult. An ancestor whose deeds are heroic may attain the status of a god. In China and Japan, ancestor worship (more accurately, ancestor reverence) has declined with the decline in the size and importance of kinship groups.

Anchorage Seaport, largest city (pop., 2000: 260,283), and chief commercial centre of Alaska, U.S. It lies at the head of Cook Inlet near the base of the Kenai Peninsula. It was founded in 1914 as a construction camp for the building of a railroad to Fairbanks. It became a key aviation and defense centre in World War II and is now a regular stop on air routes from the U.S. to East Asia. Anchorage experienced rapid population growth in the late 20th century. In 1964 a severe earthquake caused a number of deaths and extensive property damage.

anchovy Any of more than 100 species of schooling saltwater fishes (family Engraulidae) related to the herring. Anchovies are distinguished by a large mouth, almost always extending behind the eye, and by a pointed snout. Most species live in shallow tropical or warm temperate seas, where they often enter brackish water around river mouths. Adults are 4–10 in. (10–25 cm) long. Temperate species such as the northern and

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European anchovies are important food fishes; tropical species such as the tropical anchovy, or anchoveta, are important bait fishes. See also SCHOOLING BEHAVIOUR.

Anchovies (*Engraulis mordax*)
TOM MCHUGH—PHOTO RESEARCHERS

ancien régime \äⁿs-yaⁿ-rā-ˈzhēm\ (French: "old order") Political and social system of France prior to the FRENCH REVOLUTION. Under the regime, everyone was a subject of the king of France as well as a member of an estate and province. All rights and status flowed from the social institutions, divided into three orders: clergy, nobility, and others (the THIRD ESTATE). There was no national citizenship.

Ancona Seaport (pop., 2001: 100,402), capital of the Marche region, central Italy. Founded by colonists from SYRACUSE c. 390 BC, it was taken by Rome in the 2nd century BC. It became a flourishing port particularly favoured by TRAJAN, who enlarged the harbour. It was attached to the Holy Roman Empire in the 12th century; in the 16th century it came under papal protection, which was largely maintained until Ancona became part of Italy in 1861. It underwent severe bombing in World War II, but many notable Roman and medieval landmarks survive.

Anda See ALTAN

Andalusia \ˌan-də-lü-ˈsē-ə\ *Spanish* **Andalucía** Autonomous community (pop., 2001: 7,357,558) and historic region, southern Spain. It occupies an area of 33,821 sq mi (87,597 sq km); the capital is SEVILLA. It is traversed by mountain ranges, including the Sierra Morena and Sierra Nevada; its main river is the GUADALQUIVIR. Andalusia has a long history of inhabitation: by the Phoenicians (9th century BC), the Carthaginians (5th century BC), and the Romans (3rd century BC). The Arabic name Al-Andalus was originally applied by the Moors to the whole Iberian Peninsula. When the UMAYYAD DYNASTY established its court at CÓRDOBA, this area became the peninsula's intellectual and political centre. It returned to Spanish Christian rule in 1492 and remained a province until divided in 1833 into the eight modern provinces. A mining and agricultural region, Andalusia also features beaches along the Costa del Sol that attract the tourist trade.

Andaman and Nicobar \ˈan-də-mən...ˈnik-ō-ˌbär\ **Islands** Union territory (pop., 2001: 356,152), INDIA. It consists of two groups of islands in the Bay of BENGAL about 800 mi (1,300 km) east of the Indian subcontinent and Sri Lanka; the total area is 3,185 sq mi (8,249 sq km). The chief islands are North Andaman, Middle Andaman, and South Andaman (known collectively as Great Andaman), and Little Andaman. The Nicobar group includes Car Nicobar, Camorta (Kamorta) and Nancowry, and Great Nicobar. Most of the population lives in the Andaman group. PORT BLAIR on South Andaman, established by the British in 1858, is the territorial capital.

Andaman Sea Sea, eastern extension of the Bay of BENGAL. Bounded by the ANDAMAN AND NICOBAR ISLANDS, MYANMAR, the MALAY PENINSULA, and the Strait of MALACCA and SUMATRA, it covers some 308,000 sq mi (798,000 sq km). Trading vessels have plied the sea since ancient times. Part of the early coastal trade route between India and China, from the 8th century it formed a route between India (and Sri Lanka) and Myanmar. Its largest modern ports are George Town (Malaysia) and YANGÔN (Myanmar). A large earthquake-generated TSUNAMI in 2004 inundated many of the sea's coastal areas.

Andania mysteries Ancient Greek mystery cult, held in honor of the goddess DEMETER and her daughter Kore (PERSEPHONE) at Andania in Messenia. It was performed by "holy ones" of both sexes from various tribes. Initiation was open to all. Costumes were plain and inexpensive, except for those costumed as deities. There was a procession, and a pageant or drama may have been performed; sacrifices were made to several deities before the main ceremony.

Andean bear See SPECTACLED BEAR

Andean civilization Complex of aboriginal cultures that evolved in the Andean region (see ANDES MOUNTAINS) of western South America before the arrival of the Spanish CONQUISTADORES in the 16th century. Unlike the peoples of the MESOAMERICAN CIVILIZATION to the north, none of the aboriginal Andean peoples developed a system of writing, though the INCA devised a sophisticated system of recording numbers. In its level of cultural development and technical expertise in the arts and crafts, however, this civilization constitutes a New World counterpart to those of ancient Egypt, China, and Mesopotamia. See also CHIBCHA; CHIMÚ; MOCHE; TIAHUANACO.

Andean Geosyncline Linear trough in the Earth's CRUST in which rocks were deposited in South America in the MESOZOIC ERA (248–65 million years ago) and CENOZOIC ERA (65 million years ago to the present). A complex history of volcanism, uplift, block faulting, and erosion led eventually to the present configuration of the Andes Mountains.

Andersen, Hans Christian (b. April 2, 1805, Odense, near Copenhagen, Den.—d. Aug. 4, 1875, Copenhagen) Danish writer of FAIRY TALES. Though reared in poverty, he received a university education. In his many collections of tales, published 1835–72, he broke with literary tradition and employed the idioms and constructions of spoken language. His stories are imaginative combinations of universal elements from folk legend and include such favourites as "The Ugly Duckling" and "The Emperor's New Clothes." While some reveal an optimistic belief in the ultimate triumph of goodness and beauty (e.g., "The Snow Queen"), others are deeply pessimistic. Part of what makes his tales compelling is the way they identify with the unfortunate and outcast. He also wrote plays, novels, poems, travel books, and several autobiographies.

Anderson, Dame Judith *orig.* **Frances Margaret Anderson** (b. Feb. 10, 1898, Adelaide, S.Aus., Australia—d. Jan. 3, 1992, Santa Barbara, Calif., U.S.) Australian-born U.S. actress. She made her stage debut in Sydney in 1915 and first appeared in New York City in 1918. She was noted for roles such as Lavinia in *Mourning Becomes Electra* (1932), Gertrude in *Hamlet* (1936), Lady Macbeth in *Macbeth* (1937, 1941), and the title role in *Medea* (1947). She appeared in over 25 films, usually playing an evil or sinister figure, including Mrs. Danvers in *Rebecca* (1940) and Ann Treadwell in *Laura* (1944).

Anderson, Elizabeth Garrett (b. June 9, 1836, Aldeburgh, Suffolk, Eng.—d. Dec. 17, 1917, Aldeburgh) British physician. Denied admission to medical schools, she studied privately with physicians and in London hospitals and was the first woman licensed as a physician in Britain (1865). Appointed general medical attendant to St. Mary's Dispensary (1866), later the New Hospital for Women, she created a medical school for women, and in 1918 the hospital was named for her.

Anderson, Laurie (b. June 5, 1947, Wayne, Ill., U.S.) U.S. performance artist. After studying at Barnard College and Columbia University, she began giving performances in New York City in 1973 while teaching art history at the City University of New York. Combining elements of music, theatre (dance, mime), film, technology, and speech, she satirized media and mass culture, using the tools they themselves provide. The pop-music success of her song "O Superman" (1980) led her to record two albums, *Big Science* (1982) and *Mister Heartbreak* (1984). Her major 1980s piece was the multimedia extravaganza *United States*. Other works include *Stories from the Nerve Bible* (1993) and a multimedia work (1999) based on *Moby Dick*.

Anderson, Leroy (b. June 29, 1908, Cambridge, Mass., U.S.—d. May 18, 1975, Woodbury, Conn.) U.S. composer of light orchestral music. He studied composition and German and Scandinavian languages at Harvard; fluent in nine languages, he was an army interpreter in two wars. In 1936 he began a long association with ARTHUR FIEDLER and the Boston Pops Orchestra, and pieces such as "Syncopated Clock," "Sleigh Ride," "Bugler's Holiday," and the *Irish Suite* became standards.

Anderson, Lindsay (b. April 17, 1923, Bangalore, India—d. Aug. 30, 1994, near Angoulême, Fr.) English critic and director. He was a founding editor of the film magazine *Sequence*, and from 1948 he directed a series of documentaries, including *Thursday's Children* (1955, Academy Award). He coined the term "Free Cinema" for the British cinematic movement inspired by JOHN OSBORNE's play *Look Back in Anger*. His first feature film, *This Sporting Life* (1963), is a classic of the British social realist cinema. He directed several theatrical productions before making his next film, *If…* (1968). After directing the premieres of David Storey's plays, he went on to make such films as *O Lucky Man!* (1973) and *The Whales of August* (1987).

Anderson, Marian (b. Feb. 27, 1897, Philadelphia, Pa., U.S.—d. April 8, 1993, Portland, Ore.) U.S. singer. She was immediately recognized for the beauty of her voice and her artistry at her New York City

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debut in 1924, but the fact that she was black made a concert or opera career in the U.S. impossible. Her London debut in 1930 and tours of Scandinavia established her in Europe, where she worked exclusively until 1935. When she was denied use of Constitution Hall in Washington, D.C., by the Daughters of the American Revolution in 1939, Eleanor Roosevelt arranged for her to sing at the Lincoln Memorial, and the concert was broadcast to great acclaim. Her debut at the Metropolitan Opera, the first performance there by a black singer, took place in 1955, when she was in her late 50s.

Marian Anderson.
COURTESY OF RCA RECORDS

Anderson, (James) Maxwell (b. Dec. 15, 1888, Atlantic, Pa., U.S.—d. Feb. 28, 1959, Stamford, Conn.) U.S. playwright. He worked as a journalist before cowriting his first successful play, *What Price Glory?* (1924), which was followed by *Saturday's Children* (1927). His verse dramas *Elizabeth the Queen* (1930) and *Mary of Scotland* (1933) were later adapted for film. He returned to prose for the satire *Both Your Houses* (1933, Pulitzer Prize) and the tragedy *Winterset* (1935), then turned to verse again for *High Tor* (1936), a romantic comedy. He collaborated with Kurt Weill on the musicals *Knickerbocker Holiday* (1938) and *Lost in the Stars* (1949). His last play, *The Bad Seed* (1954), became a successful film.

Anderson, Sherwood (b. Sept. 13, 1876, Camden, Ohio, U.S.—d. March 8, 1941, Colon, Pan.) U.S. author. Anderson was irregularly schooled. Having married, he abruptly left his family and business career to become a writer in Chicago. *Winesburg, Ohio* (1919), a collection of interrelated sketches and tales about the obscure lives of the citizens of a small town, was his first mature book and made his reputation. His short stories were collected in *The Triumph of the Egg* (1921), *Horses and Men* (1923), and *Death in the Woods* (1933). His prose style, based on everyday speech and influenced by the experimental writing of Gertrude Stein, in turn influenced such writers as Ernest Hemingway and William Faulkner.

Andersonville Village, southwest-central Georgia, U.S. It was the site of a Confederate military prison in 1864–65 during the American Civil War. Notorious for its dreadful conditions, it provided only makeshift shelter for the Union prisoners, more than one-fourth of whom died. The Andersonville National Cemetery, which includes the prison site, contains the graves of 12,920 Union prisoners who perished there. In 1865 Capt. Henry Wirz, commander of the prison, was tried by a military commission and hanged. Andersonville is also the site of the National Prisoner of War Museum.

Andes Mountains Mountain system, western South America. One of the great natural features of the globe, the Andes extend north-south about 5,500 mi (8,900 km). They run parallel to the Caribbean Sea coast in Venezuela before turning southwest and entering Colombia. There they form three distinct massifs: the Cordilleras Oriental, Central, and Occidental. In Ecuador they form two parallel cordilleras, one facing the Pacific and the other descending toward the Amazon River basin. These ranges continue southward into Peru; the highest Peruvian peak is Mount Huascarán (22,205 ft [6,768 m]) in the Cordillera Blanca. In Bolivia the Andes again form two distinct regions; between them lies the Altiplano. Along the border of Chile and Argentina, they form a complex chain that includes their highest peak, Mount Aconcagua, which reaches an elevation of 22,834 ft (6,960 m). In southern Chile part of the cordillera descends beneath the sea and forms numerous islands. The Andes are studded with a number of volcanoes that form part of the Circum-Pacific chain known as the Ring of Fire. The Andes mountain system is the source of many rivers, including the Amazon and Pilcomayo.

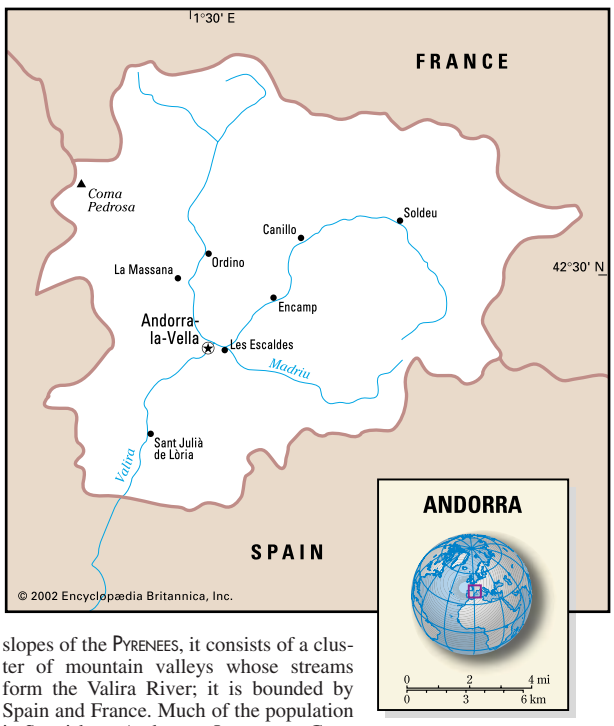
andesite \'an-də-ˌzīt\ Any member of a large family of rocks that occur in most of the world's volcanic areas, mainly as surface deposits and to a lesser extent as dikes and small plugs. The Andes, where the name was first applied, and most of the cordillera (parallel mountain chains) of Central and North America consist largely of andesites. They also occur in abundance in volcanoes along practically the entire margin of the Pacific basin. Andesites are most often porphyritic (having distinct crystals in a fine-grained base) rocks.

Andhra Pradesh \ˌän-drə-prə-'desh\ State (pop., 2001: 76,210,007), southeastern India. Located on the Bay of Bengal, it is bordered by Tamil Nadu, Karnataka, Maharashtra, Chhattisgarh, and Orissa states. Covering 106,204 sq mi (275,068 sq km), it was created in 1953 and achieved its present-day form in 1960; its capital is Hyderabad. Its name derives from the Telugu-speaking Andhra people, who have long inhabited the area. Many dynasties have flourished here, dating to the 3rd century BC. The area came under British influence in the 17th century; in the 19th century the Andhras played a decisive role in the rise of Indian nationalism. The state's economy, once primarily agricultural, has become one of the most industrialized in India.

Andijon \ˌan-di-'jän\ *or* **Andizhan** \ˌan-di-'zhan\ City (pop., 1998 est.: 288,000), eastern Uzbekistan. Dating to at least the 9th century AD, it was an important trading centre in the 15th century because of its location on the Silk Road. Part of the khanate of Kokand (see Qo'qon) in the 18th century, it was captured by the Russians in 1876. The surrounding area is the most densely populated part of Uzbekistan and the country's main petroleum-producing region.

Andocides \an-'dä-si-ˌdēz\ (b. c. 440—d. c. 390 BC) Athenian orator and politician. He went into exile (415–403 BC) after being implicated in and having informed on those responsible for the mutilation of the sacred busts of Hermes just before the Athenian expedition to Sicily. He returned after the restoration of Athenian democracy. He helped arrange a treaty with Sparta in the Corinthian War (392), but Athens rejected it and exiled him and the other ambassadors.

Andorra *officially* **Principality of Andorra** Independent coprincipality, southwestern Europe. Area: 179 sq mi (464 sq km). Population (2005 est.): 74,800. Capital: Andorra la Vella. Lying on the southern



slopes of the Pyrenees, it consists of a cluster of mountain valleys whose streams form the Valira River; it is bounded by Spain and France. Much of the population is Spanish or Andorran. Language: Catalan (official). Religion: Christianity (predominantly Roman Catholic; also other Christians). Currency: euro. Andorra's independence is traditionally ascribed to Charlemagne, who recovered the region from the Muslims in AD 803. It was placed under the joint suzerainty of the French counts of Foix and the Spanish bishops of Urgel in 1278, and it was subsequently governed jointly by the Spanish bishop of Urgel and the French head of state. This feudal system of government, the last in Europe, continued until 1993, when a constitution was adopted that transferred most of the coprinces' powers to the Andorran General Council, which is elected by universal suffrage. Andorra has long had a strong affinity with Catalonia;

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its institutions are based in Catalonian law, and it is part of the diocese of Urgel (Spain). The traditional economy was based on sheep raising, but tourism grew in importance since the 1950s and became central to Andorra's economy by the early 21st century.

Andorra la Vella \an-'dȯr-ə-lä-'vel-yä\ Town (pop., 2001 est.: 20,800), capital of Andorra. It lies near the confluence of the Valira and Valira del Norte rivers. The town long remained relatively isolated from the outside world, but its population began to grow after World War II as tourists began arriving at the nearby sports areas. Because of its country's duty-free status, the town has become a retail shopping centre for other Europeans.

Andrada e Silva \a^{n}-'drä-thä-ē-'sil-vä**, José Bonifácio de** *known as* **José Bonifácio** \zhü-'ze-ˌbō-ni-'fä-sē-ō\ (b. c. 1763, Santos, Braz.—d. April 6, 1838, Niterói) Chief architect of Brazil's independence from Portugal. Andrada was born in Brazil but educated in Portugal, where he became a distinguished scholar. On returning to Brazil in 1819, he functioned as chief minister of the Portuguese prince regent (later the emperor Pedro I), who had fled Portugal with the rest of the royal family to escape Napoleon. Andrada was the leading intellectual advocate of independence. After Pedro I declared Brazil independent in 1822, he served as prime minister and as tutor to the child emperor Pedro II, who became an effective and enlightened monarch.

Andrássy \'än-ˌdrä-sē\ **Gyula, Count** (b. March 3, 1823, Kassa, Hung., Austrian Empire—d. Feb. 18, 1890, Volosco, Istria, Austria-Hungary) Hungarian politician. A follower of Kossuth Lajos, Andrássy helped lead the unsuccessful revolt of 1848–49, then fled into exile until 1857. He supported the creation of the Dual Monarchy of Austria-Hungary and played a major role in negotiating the Compromise of 1867. He served as Hungary's first prime minister (1867–71) and later as foreign minister (1871–79), in which he helped strengthen Austria-Hungary's international position. Just before resigning, he signed the fateful Austro-German Alliance (1879) that linked those two powers until the end of World War I.

Andre, Carl (b. Sept. 16, 1935, Quincy, Mass., U.S.) U.S. sculptor. The son of a draftsman for a shipbuilding firm, he attended Phillips Andover Academy and Northeastern University. He moved to New York City in 1957 and soon was producing large-scale horizontal sculptures out of steel plates, slabs of granite, styrofoam planks, bricks, and cement blocks, using a grid system based on simple mathematical principles. His work from this period was often intended to be placed directly on the gallery or museum floor; its monumental austerity was central to the Minimalist movement. Beginning in the 1970s he also experimented with large-scale wood sculpture.

André \'an-drē**, John** (b. May 2, 1750, London, Eng.—d. Oct. 2, 1780, Tappan, N.Y., U.S.) British army officer and spy. From 1774 he was the chief intelligence officer of the British commander Henry Clinton at New York. In 1779 André began corresponding with Gen. Benedict Arnold, who had become disillusioned with the American cause. In 1780 he obtained Arnold's agreement to surrender the West Point fort. André was captured while returning to New York, and incriminating papers were found in his boot; he was found guilty of espionage and hanged.

Andrea del Sarto \än-'drā-ə-del-'sär-tō\ *orig.* **Andrea d'Agnolo** (b. July 16, 1486, Florence—d. Sept. 28, 1530, Florence) Italian painter active in Florence. After an apprenticeship with Piero di Cosimo, he became established as one of the outstanding painters of Florence, most notably as a fresco decorator and painter of altarpieces in the style of the High Renaissance. His feeling for colour and atmosphere was unrivaled among Florentine painters. One of his most striking achievements was the series of grisaille frescoes on the life of St. John the Baptist (1511–26) in the Chiostro dello Scalzo. His work is noted particularly for its technical perfection. See photograph above.

Andreanof \ˌan-drē-'a-nȯf\ **Islands** Group of the Aleutian Islands, southwestern Alaska, U.S. Lying between the Pacific Ocean and the Bering Sea, the islands extend east to west about 270 mi (430 km) between the Fox and Rat island groups. They were strategically important in World War II, when U.S. military bases were developed, especially on Adak Island. Other islands in the group include Atka, Tanaga, and Kanaga.

Andreini \ˌän-drā-'ē-nē\ **family** Italian actors. After their marriage, Francesco Andreini (1548–1624) and Isabella Canali Andreini (1562–1604) founded the Compagnia dei Gelosi, one of the earliest and most famous of the commedia dell'arte troupes. Their son Giovambattista Andreini (1579?–1654) acted in his parents' company until c. 1601, when he formed his own troupe, the Compagnia dei Fedeli. This troupe was invited to the French court in Paris, where Giovambattista Andreini wrote the play *Adamo* (1613), supposedly the inspiration for English poet John Milton's *Paradise Lost*.

Marriage of St. Catherine, oil on panel by Andrea del Sarto, 1512–13; in the Gemäldegalerie Alte Meister, Dresden, Ger.

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Andretti, Mario (Gabriel) (b. Feb. 28, 1940, Montona, Italy) Italian-born U.S. automobile-racing driver. He became interested in racing in Italy before moving to the U.S. in 1955. His notable wins include the United States Automobile Club (USAC) championship (1965–66, 1969), the Daytona Beach 500 stock-car race (1967), the Sebring Grand Prix (1967, 1970), the Indianapolis 500 (1969), and the Formula I world driving championship (1978). He retired from competition in 1994.

Andrew, Saint (d. AD 60/70, Patras, Achaia; feast day November 30) One of the Twelve Apostles, brother of St. Peter, and patron saint of Scotland and Russia. According to the Gospels, he was a fisherman and a disciple of John the Baptist. Early Byzantine tradition calls Andrew *protokletos*, "first called." He and Peter were called from their fishing by Jesus, who promised to make them fishers of men. Early church legends tell of Andrew's missionary work around the Black Sea. A 4th-century tradition says he was crucified; 13th-century tradition states that the cross was X-shaped. His relics were moved several times after his death; his head was kept in St. Peter's in Rome from the 15th century until 1964, when the pope returned it to Greece as a gesture of goodwill.

Andrew II *Hungarian* **Endre** (b. 1175—d. Oct. 26, 1235) King of Hungary (1205–35). His reign was marked by controversy with the landed nobility, who drained royal funds and reduced Hungary to a state of near anarchy. Rebellious nobles murdered his first wife, Gertrude of Meran, in 1213. Andrew led a Crusade to the Holy Land in 1217. On his return he agreed to the Golden Bull of 1222, limiting royal rights, guaranteeing justice, promising improved coinage, and giving nobles the right to resist royal decrees. His daughter was St. Elizabeth of Hungary.

Andrews, Dame Julie *orig.* **Julia Elizabeth Wells** (b. Oct. 1, 1935, Walton-on-Thames, Surrey, Eng.) British-U.S. actress and singer. She made her London debut at 12 in a revue and her New York City stage debut in *The Boy Friend* (1954). A major star of the Broadway musical, she originated the roles of Eliza Doolittle in *My Fair Lady* (1956) and Guinevere in *Camelot* (1960). She also starred in films such as *Mary Poppins* (1964, Academy Award), and *Victor/Victoria* (1982), one of several films she made with her husband, director Blake Edwards. In 2000 she was made a Dame of the British Empire.

Andrews, Roy Chapman (b. Jan. 26, 1884, Beloit, Wis., U.S.—d. March 11, 1960, Carmel, Calif.) U.S. naturalist, explorer, and author. In 1906 he joined the staff of the American Museum of Natural History, where he would spend much of his working life. There he assembled one of the best collections of cetaceans in the world before turning his attention to Asiatic exploration. He led expeditions to Tibet, southwestern China, and Burma (1916–17); northern China and Outer Mongolia (1919); and Central Asia. Important discoveries included the first known dinosaur eggs, skeleton parts of *Baluchitherium* (the largest known land mammal), and evidence of prehistoric human life. His many books for the general public include *Across Mongolian Plains* (1921) and *This Amazing Planet* (1940).

Andrić \'än-drich**, Ivo** (b. Oct. 10, 1892, Dolac, near Travnik, Bosnia—d. March 13, 1975, Belgrade, Yugos.) Bosnian writer. He established his reputation with *Ex Ponto* (1918), which he wrote while interned for nationalist political activities in World War I. He later served as a Yugoslavian diplomat. Collections of his short stories were published from 1920 onward. Of his three novels, written during World War II,

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two—*The Bridge on the Drina* (1945) and *Bosnian Story* (1945)—are about the history of Bosnia. He was awarded the Nobel Prize for Literature in 1961.

androgen \'an-drə-jən\ Any of a group of HORMONES that mainly influence the development of the male REPRODUCTIVE SYSTEM. The main and most active androgen is TESTOSTERONE, produced by cells in the TESTES. Androgens produced in smaller quantities, mainly by the ADRENAL GLAND but also by the testes, support the functions of testosterone. Androgens cause the normal changes of PUBERTY in boys' bodies and then influence sperm-cell formation, sexual interest and behaviour, and male pattern baldness. Females produce trace quantities of androgens, mostly in the adrenal glands, as well as in the ovaries.

Andromeda \an-'drä-mə-də\ In GREEK MYTHOLOGY, the wife of PERSEUS. She was the daughter of King Cepheus and Queen Cassiope of Joppa in Palestine (called Ethiopia). Her mother boasted that Andromeda was more beautiful than the NEREIDS, and POSEIDON punished her by sending a sea monster to devastate Joppa. To appease the gods, Andromeda was chained to a rock and left to be devoured by the monster. Perseus flew by on PEGASUS, fell in love with Andromeda, and slew the monster. She married him and bore him six sons and a daughter. After her death she became a constellation.

Andromeda \an-'drò-mə-də\ **Galaxy** *or* **M31** Great spiral GALAXY in the constellation Andromeda. It is the nearest spiral galaxy outside the MILKY WAY GALAXY and one of the few visible to the unaided eye, appearing as a milky blur. About 2 million light-years from Earth, it has a diameter of about 200,000 light-years, which makes it the largest galaxy in the LOCAL GROUP. For centuries astronomers considered it part of the Milky Way; only in the 1920s did EDWIN HUBBLE determine conclusively that it was a separate galaxy.

Andronicus I Comnenus \ˌan-drə-'nī-kəs...käm-'nē-nəs\ (b. 1118, Constantinople—d. Sept. 1185, Constantinople) Byzantine emperor (1183–85), the last of the Comnenus dynasty. A cousin of MANUEL I COMNENUS, he raised an army and seized power in 1182, causing a massacre of Westerners in Constantinople. He was crowned coemperor with Alexius II in 1183; two months later he had Alexius strangled and married his 13-year-old widow. Andronicus reformed the Byzantine government and asserted the independence of the Eastern church, provoking a Sicilian Norman invasion. News of the Normans' approach led to a revolt, in which Andronicus was killed by a mob and ISAAC II ANGELUS was declared emperor.

Andronicus II Palaeologus \ˌpā-lē-'äl-ə-gəs\ (b. c. 1260, Constantinople—d. Feb. 13, 1332, Constantinople) Byzantine emperor (1282–1328). The son of MICHAEL VIII PALAEOLOGUS, he was an intellectual and theologian rather than a soldier and statesman, and during his reign the BYZANTINE EMPIRE declined to the status of a minor state. Ottoman Turks controlled Anatolia by 1300, and Serbs dominated the Balkans. By siding with Genoa in the war between Genoa and Venice, Andronicus provoked an attack by the Venetian navy. Despite the rising political disorder, he promoted Byzantine art and the independence of the Eastern Orthodox church. Deposed by his grandson ANDRONICUS III PALAEOLOGUS, he entered a monastery.

Andronicus III Palaeologus (b. March 25, 1297, Constantinople—d. June 15, 1341, Constantinople) Byzantine emperor (1328–41). He forced his grandfather ANDRONICUS II PALAEOLOGUS to make him coemperor (1325) and then to abdicate (1328). He relied on JOHN VI CANTACUZENUS to reform the courts and rebuild the imperial navy. He ceded control of Macedonia to Serbia (1334) and lost land to the Ottoman Turks in Anatolia, but he regained some Aegean islands from the Genoese and reasserted control of Epirus and Thessaly.

Andropov \än-'drō-ˌpȯf**, Yury (Vladimirovich)** (b. June 15, 1914, Nagutskoye, Russia—d. Feb 9, 1984, Moscow, Russia, U.S.S.R.) Soviet leader. He joined the Communist Party in 1939 and rose rapidly in the party hierarchy. His tenure as head of the KGB (1967–82) was noted for its suppression of political dissidents. In 1982 he succeeded LEONID BREZHNEV as general secretary of the party's Central Committee, but ill health quickly overtook him, and he accomplished little else before his death 15 months later.

Andros \ˌan-drəs\ Island (pop., 2000: 7,686), The Bahamas. The Bahamas' largest island, it extends about 100 mi (160 km) north to south and about 45 mi (72 km) east to west; its area is 2,300 sq mi (6,000 sq km). Just off its eastern coast is the third largest barrier reef in the world.

Andros \'an-drəs**, Sir Edmund** (b. Dec. 6, 1637, London, Eng.—d. Feb. 24, 1714, London) English colonial administrator in North America. Appointed governor of New York and New Jersey in 1674, he was recalled in 1681 following complaints from colonists. He returned in 1686 as governor of the Dominion of New England, a kind of supercolony imposed by Britain. His interference in local government aroused sharp resentment among the colonists, and in 1688 they revolted and imprisoned him. Andros was recalled to England but returned as governor of Virginia (1692) and Maryland (1693–94).

anemia Condition in which ERYTHROCYTES are reduced in number or volume or are deficient in HEMOGLOBIN. The patient is usually noticeably pale. Close to 100 varieties exist (including APLASTIC ANEMIA, PERNICIOUS ANEMIA, and SICKLE-CELL ANEMIA), distinguished by cause; erythrocyte size, shape, and hemoglobin content; and symptoms. Anemia may result from blood loss; increased destruction, reduced production, or inhibited formation of red cells; or hormone deficiency. Treatment may involve nutrition, toxin removal, drugs, surgery, or transfusion. See also FOLIC-ACID-DEFICIENCY ANEMIA, IRON-DEFICIENCY ANEMIA.

anemometer \ˌan-ə-'mä-mə-tər\ Instrument for measuring the speed of airflow. The most familiar instruments for measuring wind speeds are the revolving cups that drive an electric generator (useful range approximately 5–100 knots). For very low airspeeds, a unit in which revolving vanes operate a counter measures the airspeed. For strong, steady wind speeds (in wind tunnels and aboard aircraft in flight), a PITOT-TUBE anemometer is often used; the pressure difference between the interior of the tube and the surrounding air can be measured and converted to airspeed.

anemone \ə-'ne-mə-nē\ Any of about 120 species of perennial plants that make up the genus *Anemone*, in the BUTTERCUP family, many of which are cultivated for their colourful flowers. Though found throughout the world, anemones are most common in woodlands and meadows of the northern temperate zone. Many varieties of the tuberous poppylike anemone *A. coronaria* are grown for the garden and florist trade. Popular spring-flowering species include *A. apennina*, *A. blanda*, and *A. pavonina*. Other species, such as the Japanese anemone (*A. hupehensis*), are favourite border plants for autumn flowering. The European wood anemone, *A. nemorosa*, causes blistering of the skin and was once used as an ingredient in medicines. Anemones are also known colloquially as pasqueflowers or windflowers.

anesthesiology \ˌa-nəs-ˌthē-zē-'äl-ə-jē\ Medical specialty dealing with anesthesia and related matters, including resuscitation and pain. Originally concerned only with general anesthesia in the operating room, anesthesiology now includes epidural anesthesia (injection of local ANESTHETICS into the spinal fluid, cutting off feeling below the point of injection); artificial respiratory support during operations requiring paralyzing drugs that render patients unable to breathe; clinical management of all unconscious patients; management of pain relief and cardiac and respiratory resuscitation problems; respiratory therapy; and treatment of fluid, electrolyte, and metabolic disturbances. Progress in anesthesiology has made possible more complex operations and surgery for more critically ill patients. The anesthesiologist's role has become increasingly important and complex.

anesthetic \ˌan-es-'thet-ik\ Agent that produces a local or general loss of sensation, including pain, and therefore is useful in SURGERY and DENTISTRY. General anesthesia induces loss of consciousness, most often using HYDROCARBONS (e.g., cyclopropane, ethylene); halogenated (see HALOGEN) hydrocarbons (e.g., CHLOROFORM, ethyl chloride, trichloroethylene); ETHERS (e.g., ethyl ether or vinyl ether); or other compounds, such as tribromoethanol, NITROUS OXIDE, or BARBITURATES. Local anesthesia induces loss of sensation in one area of the body by blocking nerve conduction (see NERVOUS SYSTEM, NEURON), usually with ALKALOIDS such as COCAINE or synthetic substitutes (e.g., lidocaine). See also ANESTHESIOLOGY.

aneuploidy See PLOIDY

aneurysm \'an-yə-ˌriz-əm\ Blood-filled protrusion in the wall of a blood vessel (usually an ARTERY, and particularly the AORTA). Disease or injury weakens the wall so that normal BLOOD PRESSURE makes it balloon out. Typically, the two inner layers rupture and the outer layer bulges. In a false aneurysm, all three layers rupture and surrounding tissues hold the blood in place. Symptoms vary with size and location. Aneurysms tend to enlarge over time, and blood-vessel walls weaken with age. Many aneurysms eventually burst, causing serious, even massive, internal bleed-

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ing; aortic aneurysm rupture causes severe pain and immediate collapse. Rupture of an aneurysm in the brain is a major cause of STROKES. Treatment can consist of simply tying off a small vessel; more serious aneurysms require surgery to replace the diseased section of artery with a plastic graft.

Angara \ən-ˌgə-ˈrä\ **River** River, southeast-central Russia. The outlet for Lake BAIKAL, it is a major tributary of the YENISEY RIVER, which it joins near Yeniseysk. It is about 1,105 mi (1,779 km) long, and with its many rapids, it provides great potential for hydroelectric power. Some existing dams and power stations provide power in the IRKUTSK industrial area.

angel Primarily in Western religions, any of numerous benevolent spiritual beings who mediate between heaven and earth. They often serve as messengers or servants of God or as guardians of an individual or nation. In ZOROASTRIANISM the AMESHA SPENTA are arranged in a hierarchy of seven. JUDAISM and CHRISTIANITY base their notion of angels on references in the Hebrew scriptures to divine servants and to the heavenly hosts. Two archangels (MICHAEL and GABRIEL) are mentioned in the OLD TESTAMENT and two others (RAPHAEL and Uriel) in the APOCRYPHA. Angels are mentioned throughout the Christian scriptures, and Christian tradition identifies nine orders of angels. ISLAM's hierarchy of angels descends from the four throne bearers of God to the cherubim who praise God, the four archangels, and lesser angels such as the *ḥafaẓah* (guardian angels). See also CHERUB; SERAPH.

Angel Falls Waterfall, southeastern Venezuela. It lies on the Churún River, a tributary of the Caroní, southeast of Ciudad Bolívar. The highest waterfall in the world, the cataract drops 3,212 ft (979 m) and is 500 ft (150 m) wide at its base. It was named for James Angel, an American who crash-landed his plane nearby in 1937.

Angel Falls (Salto Ángel), La Gran Sabana region of Bolívar state, Venezuela.
G. DE STEINHEIL/SHOSTAL ASSOCIATES

angelfish Any of various fishes of the order Perciformes. The best-known angelfishes are freshwater CICHLIDS (genus *Pterophyllum*) popular in home aquariums. These are thin and deep-bodied fishes that usually are silver with vertical dark markings but may be solid or partially black; they may grow to 6 in. (15 cm) in length. Brightly coloured marine angelfishes are in the family Pomacanthidae. They are found among tropical reefs in the Atlantic and the Indo-Pacific, where they eat algae and marine invertebrates and reach a maximum length of 18 in. (46 cm).

An aquarium angelfish (*Pterophyllum*)
JANE BURTON—BRUCE COLEMAN LTD.

Angelico \an-ˈjel-i-kō**, Fra** *orig.* **Guido di Pietro** (b. c. 1400, Vicchio, Florence [Italy]—d. Feb. 18, 1455, Rome) Italian painter and Dominican friar active in Florence. He entered the convent of San Domenico at Fiesole sometime between 1417 and 1425 and began his artistic career by painting illuminated manuscripts and altarpieces. He was influenced by MASACCIO's use of architectural perspective. Among his earliest masterpieces is a large triptych, the *Linaiuoli Altarpiece* (1433–36), executed for the linen merchants' guild; it is enclosed in a marble shrine designed by LORENZO GHIBERTI. His most notable works are frescoes at the convent of San Marco, Florence (c. 1440–45), and in the chapel of Pope Nicholas V in the Vatican (c. 1448–49). One of the outstanding fresco painters of the 15th century, he influenced such masters as FRA FILIPPO LIPPI; BENOZZO GOZZOLI was among his students.

Angelou \ˈan-jə-ˌlō**, Maya** *orig.* **Marguerite Johnson** (b. April 4, 1928, St. Louis, Mo., U.S.) U.S. poet. She was raped at age eight and went through a period of muteness. Her autobiographical works, which explore themes of economic, racial, and sexual oppression, include *I Know Why the Caged Bird Sings* (1970), *The Heart of a Woman* (1981), and *All God's Children Need Traveling Shoes* (1986). Her poetry collections include *Just Give Me a Cool Drink of Water 'fore I Diiie* (1971), *And Still I Rise* (1978), and *I Shall Not Be Moved* (1990). Her recitation of a poem she wrote for BILL CLINTON's first inauguration (1993) brought her widespread fame. In 2002 she published her sixth volume of memoirs, *A Song Flung Up to Heaven*.

Angevin \ˈan-jə-vən\ **dynasty** Descendants of a 10th-century count of ANJOU (the source of the adjective Angevin). The Angevin dynasty overlaps with the house of PLANTAGENET but is usually said to consist of only the English kings HENRY II, RICHARD I, and JOHN. Henry established the Angevin empire in the 1150s when he took control of Normandy, Anjou, Maine, and, through his marriage to ELEANOR, Aquitaine. When he became the king of England in 1154, Henry extended the Angevin holdings from Scotland to the Pyrenees. English claims to French territory led to the HUNDRED YEARS' WAR; by 1558 the English had lost all their former French lands.

Angilbert \ˈaŋ-gəl-ˌbərt**, Saint** (b. c. 740, Aachen, kingdom of the Franks—d. Feb. 18, 814, Centula, Picardy) Frankish poet and prelate at the court of CHARLEMAGNE. Of a noble family, he was educated at the palace school at Aachen and was a student of ALCUIN. In 800 he accompanied Charlemagne to Rome. He was made lay abbot of Centula (St.-Riquier), Picardy, in 794. His graceful and sophisticated Latin poems offer a picture of life in the imperial circle. Charlemagne's daughter Bertha and Angilbert were the parents of the historian Nithard.

angina pectoris \an-ˈjī-nə-ˈpek-tə-rəs\ Spasm of chest pain, caused when the heart's oxygen demand temporarily outpaces its blood supply, usually because of CORONARY HEART DISEASE. A deep, viselike pain in the heart and stomach area commonly spreads to the left arm. Exertion or emotional stress can bring on angina, obliging the victim to rest until the pain subsides. If rest does not help, drugs can dilate the blood vessels. As heart disease worsens, angina recurs with less exertion.

angiocardiography \ˌan-jē-ō-ˌkär-dē-ˈäg-rə-fē\ Method of DIAGNOSTIC IMAGING that shows the flow of blood through the HEART and great vessels. It is used to evaluate patients for surgery on the cardiovascular system. A CONTRAST MEDIUM is introduced through a catheter into a heart chamber. A series of X-ray images shows where the flow narrows, signaling blockage of a blood vessel by ATHEROSCLEROSIS.

angiography \ˌan-jē-ˈäg-rə-fē\ *or* **arteriography** \är-ˌtir-ē-ˈäg-rə-fē\ X-RAY examination of arteries and veins with a CONTRAST MEDIUM to differentiate them from surrounding organs. The contrast medium is introduced through a catheter to show the blood vessels and the structures they supply, including organs. Angiography of diseased leg, brain, or heart arteries is necessary before corrective surgery. See also ANGIOCARDIOGRAPHY.

Angiolini \ˌan-jə-ˈlē-nē**, Gasparo** *or* **Angelo Gasparini** (b. Feb. 9, 1731, Florence—d. Feb. 6, 1803, Milan) Italian choreographer. In 1757 he became ballet master of the Vienna court opera house; in 1761 he collaborated with the composer CHRISTOPH WILLIBALD GLUCK to produce *Don Juan*, and he later choreographed other ballets to Gluck's music. In 1765 Angiolini became ballet master of the Imperial Theatre in St. Petersburg. He was among the first to integrate dance, music, and plot in dramatic ballets, developing the form known as *ballet d'action*. He maintained a rivalry with JEAN-GEORGES NOVERRE and disagreed with his interpretation of the *ballet d'action*.

angioplasty \ˈan-jē-ə-ˌplas-tē\ Therapeutic opening of a blocked blood vessel. Usually a balloon is inflated near the end of a catheter (see CATHETERIZATION) to flatten plaques (see ATHEROSCLEROSIS) against an artery's wall. Performed on a coronary artery, angioplasty is a less invasive alternative to CORONARY BYPASS surgery in the treatment of CORONARY HEART DISEASE. Complications, including EMBOLISMS and tearing, are rare and results are excellent, but plaques tend to build up again after the procedure. Angioplasty is also used to expand a severely obstructed heart valve.

angiosperm See FLOWERING PLANT

Angkor Archaeological site, northwestern Cambodia. Located 4 mi (6 km) north of the modern town of Siem Reap, it was the capital of the KHMER (Cambodian) empire from the 9th to the 15th century. Its most imposing monuments are ANGKOR WAT, a temple complex built in the 12th century by King SURYAVARMAN II, and Angkor Thom, a temple complex

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built c. 1200 by King Jayavarman VII. During the period of great construction that lasted more than 300 years, there were many changes in architecture as the religious focus changed from Hindu to Buddhist cults. After the Siamese conquest of the Khmer in the 15th century, the ruined city and its temples were buried in the jungle. When the French colonial regime was established in 1863, the entire site became the focus of scholarly interest. During Cambodia's political upheavals of the late 20th century there was some war damage, but the major problem was one of neglect. Angkor was added to the World Heritage site list in 1992.

Angkor Wat \'aŋ-kȯr-'wät\ Temple complex in Angkor (now in northwestern Cambodia), the crowning work of Khmer architecture. About 1,700 yards (1,550 m) long by 1,500 yards (1,400 m) wide, it is the world's largest religious structure. Dedicated to Vishnu, it was built in the 12th century by Suryavarman II. The Wat, an artificial mountain originally surrounded by a vast external wall and moat, rises in three enclosures toward a flat summit. The five remaining towers (shrines) at the summit are composed of the repetitive diminishing tiers typical of Asian architecture.

Angle Any member of a Germanic people who, with the Jutes and Saxons, invaded England in the 5th century AD. According to Bede, their homeland was Angulus, traditionally identified as the Angeln district in Schleswig. They abandoned this area when they invaded Britain, where they settled in the kingdoms of Mercia, Northumbria, East Anglia, and Middle Anglia. Their language was known, even then, as Englisc, and they gave their name to England.

angle In geometry, a pair of rays (see line) sharing a common endpoint (the vertex). An angle may be thought of as the rotation of a single ray from an initial to a terminal position. Clockwise rotation is considered negative and counterclockwise rotation positive. Either may be measured in degrees (one full rotation = 360°) or radians (one full rotation = 2π rad). A 90° angle is called a right angle. Any angle less than 90° is an acute angle. Any angle more than 90° but less than 180° is an obtuse angle.

anglerfish Any of about 210 species of marine fishes (order Lophiiformes) named for their method of "fishing" for prey. The foremost spine of the dorsal fin is located on the head and is modified into a "fishing rod" tipped with a fleshy "bait." Prey fishes attracted to this lure stray close enough for the anglerfish to swallow them. Often bizarre in form, anglerfishes are also characterized by small gill openings and by limblike pectoral and (in some species) pelvic fins. Most species inhabit the sea bottom. In some species the small male bites into the larger female's body, his mouth fuses with the skin, and the bloodstreams of the two become permanently connected.

Anglesey \'aŋ-gəl-sē**, Isle of** *ancient* **Mona** County (pop., 2001: 66,828), Wales. It encompasses Anglesey island, the largest island in England and Wales (276 sq mi [715 sq km]), and Holy Island. Anglesey island is known for its ancient history and its prehistoric and Celtic remains. By 100 BC the Celts had colonized the island, which became a famous Druid centre and later a stronghold of resistance to the Romans. It finally fell to Agricola in AD 78. It was ruled by the princes of Wales in the 7th–13th centuries, until it was taken by Edward I. Tourism is now an important part of the county's economy.

Anglia See England

Anglican Communion See Church of England

Anglo-Afghan Wars See Afghan wars

Anglo-Burmese Wars (1824–26, 1852, 1885) Conflicts between the British and the Burmans (Burmese) in present-day Myanmar. King Bodawpaya's conquest of Arakan, which bordered on British-controlled territory in India, led to border conflicts between Arakan freedom fighters and the Burmans. When the Burmans crossed the border into Bengal, the British responded in force, taking Rangoon (now Yangôn). The resulting two-year conflict ended with a treaty that gave Britain Arakan and Assam and required the Burmans to pay an indemnity. Another war erupted 25 years later when a British naval officer seized a ship that belonged to the Burman king; the British advanced into and soon occupied all of Lower Burma. A third war was sparked by threats to the British teak monopolies in Lower Burma and Burman overtures to the French; as a result, the British annexed Upper Burma (formalized in 1886), thus ending Burman independence.

Anglo-Dutch Wars *or* **Dutch Wars** Four naval conflicts between England and the Dutch Republic in the 17th–18th century. The First (1652–54), Second (1665–67), and Third (1672–74) Anglo-Dutch Wars all arose from commercial rivalry between the two nations, and victories by England established its naval might. The two countries had been allied for a century when the Fourth Anglo-Dutch War (1780–84) broke out over Dutch interference in the American Revolution. By 1784 the Dutch Republic had declined dramatically in power and prestige.

Anglo-French Entente See Entente Cordiale

Anglo-French War See Opium Wars

Anglo-German Naval Agreement (1935) Bilateral concord between Britain and Germany countenancing a German navy but limiting it to 35% of the size of the British navy. Part of the process of appeasement before World War II, the agreement allowed Germany to violate restrictions imposed by the Treaty of Versailles, prompting international criticism and driving a wedge between the French and the British.

Anglo-Japanese Alliance (1902–23) Alliance between Britain and Japan to protect their respective interests in China and Korea. Directed against Russian expansionism, the alliance helped Japan in the Russo-Japanese War by discouraging France from entering the war on the Russian side. The alliance later prompted Japan to enter World War I on the side of the Allies. Britain allowed the alliance to lapse after the war, when it no longer feared Russian encroachment in China.

Anglo-Russian Entente \än-'tänt\ (1907) Pact in which Britain and Russia settled their colonial disputes in Persia, Afghanistan, and Tibet. It delineated spheres of influence in Persia, stipulated that neither country would interfere in Tibet's internal affairs, and recognized Britain's influence over Afghanistan. The agreement led to the formation of the Triple Entente.

Anglo-Saxon See Old English

Anglo-Saxon art Painting, sculpture, and architecture produced in Britain from the late 5th century to the Norman Conquest. Before the 9th century, manuscript illumination was the predominant art form, with two schools: Canterbury produced works in the Classical tradition brought by Roman missionaries; a more influential school in Northumbria produced works inspired by the revival of learning encouraged by Irish missionaries. The curvilinear forms, spirals, and interlaced patterns of the Celtic tradition brought by Irish monks were integrated with the abstract ornamentation and bright colors of the Anglo-Saxon metalwork tradition. After the destructive effects of the 9th-century Danish invasions, the monasteries were revived and interest in architecture developed. Building activity consisted of small churches influenced by continental types, notably from Norman France (e.g., the original Westminster Abbey, c. 1045–50, rebuilt 1245). The monastic revival resulted in the production of many books and the formation of the Winchester school of illumination (late 10th century). See also Hiberno-Saxon style.

Anglo-Saxon law Body of legal principles that prevailed in England from the 6th century until the Norman Conquest (1066). It was directly influenced by early Scandinavian law as a result of the Viking invasions of the 8th and 9th centuries and indirectly influenced (primarily through the church) by Roman law. Anglo-Saxon law had three components: laws promulgated by the king, customary practices such as those regulating kinship relations, and private compilations. The primary emphasis was on criminal law, though certain material dealt with problems of public administration, public order, and ecclesiastical matters.

Anglo-Saxon literature Literature written in Old English c. 650–c. 1100. Anglo-Saxon poetry survives almost entirely in four manuscripts. Beowulf is the oldest surviving Germanic epic and the longest Old English poem; other great works include *The Wanderer*, *The Seafarer*, *The Battle of Maldon*, and the *Dream of the Rood*. The poetry is alliterative; one of its features is the kenning, a metaphorical phrase used in place of a common noun (e.g., "swan road" for "sea"). Notable prose includes the *Anglo-Saxon Chronicle*, a historical record begun about the time of King Alfred's reign (871–899) and continuing for more than three centuries. See also Caedmon; Cynewulf.

Angola *officially* **Republic of Angola** *formerly* **Portuguese West Africa** Country, southern Africa. Its northernmost section of coastland, the Cabinda exclave, is separated from Angola proper by a narrow corridor of Congo territory. Area: 481,354 sq mi (1,246,700 sq km). Population (2005 est.): 11,827,000. Capital: Luanda. The population is made up of mostly Bantu-speaking peoples; the main ethnic groups are

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the Ovimbundu and the Mbundu, while the Khoisan-speaking San (Bushmen) inhabit southeastern Angola. Languages: Portuguese (official), indigenous languages. Religions: Christianity (mostly Roman Catholic; also Protestant); also traditional beliefs. Currency: kwanza. The country contains several plateau regions, which separate it into three distinct drainage systems. One in the northeast drains into the Congo River basin, and another in the southeastern sector drains into the Zambezi system; the remaining drainage, westward into the Atlantic, provides most of Angola's hydroelectric power. About half of the land area is forest; less than 10% is arable. Despite substantial petroleum reserves, Angola's economy has been unable to take advantage of its resources, because of the devastation caused by protracted civil war. Angola is nominally a republic with one legislative house; its head of state and government is the president. An influx of Bantu-speaking peoples in the 1st millennium AD led to their dominance in the area by c. 1500. The most important Bantu kingdom was the Kongo; south of the Kongo was the Ndongo kingdom of the Mbundu people. Portuguese explorers arrived in the early 1480s and over time gradually extended their rule. Angola's frontiers were largely determined by other European powers in the 19th century but not without strong resistance by the indigenous peoples. Resistance to colonial rule led to the outbreak of fighting in 1961, which led ultimately to independence in 1975. Rival factions continued fighting after independence. Although a peace accord was reached in 1994, forces led by Jonas M. Savimbi continued to resist government control until his death in 2002, after which a peace accord was signed.

Angora See Ankara

Angora cat See Turkish Angora cat

Angora goat Breed of domestic goat that originated in ancient times in the district of Angora in Asia Minor. Its silky coat yields commercial mohair. Angora goats are generally smaller than other domestic goats and sheep and have long, drooping ears. Both sexes are horned. The Western mohair industry developed after the animal was established in South Africa in the mid-19th century. Importation to the U.S. followed shortly, and breeding there has centred in the Southwest. The coat, with its strong elastic fibres, differs from wool primarily in its smoothness and lustre.

Angora goat
GRANT HEILMAN PHOTOGRAPHY, INC.

Angoulême \ˌäⁿ-gü-ˈlām\ City (pop., 1999: 43,171), southwestern France, on the Charente River. Clovis captured the town from the Visigoths in 507, and from the 9th century it was the centre of a countship. Fought over by the French and English in the Hundred Years' War, it was ceded to England in 1360 but restored to France in 1373. It passed to the house of Orléans in 1394. The city is noted for papermaking and is the site of the 12th-century cathedral of Saint-Pierre.

Angry Young Men Group of mid-20th-century young British writers. Their works express the bitterness of the lower classes toward the established sociopolitical system and the mediocrity and hypocrisy of the middle and upper classes. The label came from a press agent's description of John Osborne, whose play *Look Back in Anger* (1956) is the movement's representative work. The group includes John Wain (1925–1994), Kingsley Amis, Alan Sillitoe, and Bernard Kops (b. 1926). A dominant literary force in the 1950s, the movement had faded by the early 1960s.

Ångström \ˈäŋ-strœm**, Anders Jonas** (b. Aug. 13, 1814, Lögdö, Swed.—d. June 21, 1874, Uppsala) Swedish physicist. From 1839 he taught at the University of Uppsala. He devised a method of measuring thermal conductivity, showing it to be proportional to electrical conductivity, and deduced that an incandescent gas emits rays of the same refrangibility as those it can absorb. A founder of spectroscopy, he discovered that hydrogen is present in the Sun's atmosphere, published a map of the normal solar spectrum, and was the first to examine the spectrum of the aurora borealis and to detect and measure the characteristic bright line in its yellow-green region. The angstrom (10^{-10} m), a unit of length, was named in his honour.

Anguilla \aŋ-ˈgwi-lə\ Island (pop., 2001: 11,300), Leeward Islands, West Indies. A dependent territory of the United Kingdom, it is the most northerly of the Leeward Islands and covers about 35 sq mi (90 sq km). Its territory includes nearby Scrub, Seal, Dog, and Sombrero islands and Prickly Pear Cays. Most of its people are descendants of African slaves. The official language is English, and most of the population is Protestant. First colonized in 1650 by settlers from Saint Kitts, it was administered by the British. From 1825 it was closely associated with Saint Kitts, a situation Anguilla protested. It was united with Saint Kitts and Nevis in 1882. When a nation consisting of the three was formed in 1967, Anguilla proclaimed its independence. The British intervened, and Anguilla was separated in 1980; while retaining some autonomy, it consented to remain under British rule.

angular momentum Property that describes the rotary inertia of a system in motion about an axis. It is a vector quantity, having both magnitude and direction. The magnitude of the angular momentum of an object is the product of its linear momentum (mass $m \times$ velocity v) and the perpendicular distance r from the centre of rotation, or mvr. The direction is that of the axis of rotation. The angular momentum of an isolated system is constant. This means that a rigid spinning object continues to spin at a constant rate unless acted upon by an external torque. A spinning gyroscope in an airplane remains fixed in its orientation, independent of the airplane's motion, because of the conservation of direction as well as magnitude.

Angus Breed of black, hornless beef cattle. Formerly known as Aberdeen Angus, it originated in northeastern Scotland, but its ancestry is obscure. Angus have a compact and low-set body. The fine quality of the flesh and the high dressing percentage make it a beef breed of the highest rank. Introduced into the U.S. in 1873, its influence there and in other countries spread widely thereafter.

Anhalt \ˈän-ˌhält\ Former German state in what is now central Germany. The area around the upper Elbe River from which Anhalt was constituted was, in the 11th century, still part of the duchy of Saxony. It achieved separate territorial status in 1212. Subdivided and reunited frequently, it was finally reconstituted as the duchy of Anhalt by Leopold IV in 1863. It became part of the German Empire in 1871. Reconstituted after World War II as Saxony-Anhalt, it subsequently became part of East Germany and, in 1990, part of reunified Germany.

Anheuser \ˈän-hȯi-zər\ **-Busch Co., Inc.** One of the largest producers of beer in the world. Headquarters are in St. Louis, Mo., U.S. Its origins can be traced to a small brewery founded in 1852 and bought in 1860 by soap manufacturer Eberhard Anheuser. In 1861 his daughter married

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Adolphus Busch, a brewery supplier. Busch pioneered the use of refrigerated railcars and of PASTEURIZATION in the brewing industry. In 1876 the company introduced a light-coloured beer called Budweiser; under August Anheuser Busch, Jr. (president 1946–75), and August A. Busch III (1975–2002), it became the best-selling U.S. beer brand. The company also produces the Michelob brand. Among its other holdings are beverage-container manufacturing and recycling plants, media and advertising groups, and amusement parks, including the SeaWorld theme parks and Busch Gardens (Tampa, Fla.).

anhinga *or* **snakebird** Any fish-eating bird of the family Anhingidae (order Pelecaniformes), sometimes considered a single species (*Anhinga anhinga*) with geographical variants. Anhingas are about 35 in. (90 cm) long, slender, and long-necked. They are mostly black, with silvery wing markings. Males, glossed with green, develop pale head plumes and a dark "mane" in breeding season. Anhingas live in small colonies along lakes and rivers in tropical to warm temperate regions except in Europe. They swim nearly submerged; the head and neck show above water, darting snakelike from side to side.

Anhui *or* **An-hui** *conventional* **Anhwei** \'än-'hwā\ Province (pop., 2002 est.: 63,380,000), east-central China. It is bounded by JIANGSU, ZHEJIANG, JIANGXI, HUBEI, SHANDONG, and HENAN provinces. With an area of 54,000 sq mi (139,900 sq km), it is one of China's smallest provinces; its capital is HEFEI. Anhui was the first part of southern China to be settled by the HAN DYNASTY, from c. 205 BC. Well-watered by the Huai and YANGTZE (Chang) rivers, it was the empire's major agricultural area for several centuries. Anhui was ruled by the MING DYNASTY in the 14th–17th centuries. It was occupied by the Japanese in World War II; after the war the Nationalists held it briefly before the communists took over. It remains a notable agricultural producer.

anhydride \ˌan-'hī-ˌdrīd\ Any chemical COMPOUND obtained, either in practice or in principle, by eliminating WATER (H_2O) from another compound. Examples of inorganic anhydrides are sulfur trioxide, SO_3, which is derived from sulfuric acid, H_2SO_4, and calcium oxide, CaO, which is derived from calcium hydroxide $Ca(OH)_2$. The most important organic anhydride is acetic anhydride, $(CH_3CO)_2O$, a raw material for making cellulose acetate (used for films, fibres, and plastic goods) and ASPIRIN. It can be thought of as ACETIC ACID minus water. Organic anhydrides are very important starting materials for organic synthesis, as they can give rise to CARBOXYLIC ACIDS, ESTERS, or AMIDES under the proper conditions.

anhydrite Rock-forming mineral, anhydrous calcium sulfate ($CaSO_4$), which differs chemically from gypsum (to which it changes in humid conditions) by having no water of crystallization. Anhydrite occurs most often with salt deposits in association with gypsum, as in the cap rock of the Texas-Louisiana salt domes. Anhydrite is one of the major minerals in EVAPORITE deposits; it is also present in dolomites and limestones, and in ore veins. It is used in plasters and cement as a drying agent.

Aniakchak \ˌan-ē-'ak-chak\ **National Monument and Preserve** Park, southern shore of the ALASKA PENINSULA, U.S. Situated in the volcanically active Aleutian Range, it consists primarily of a great dry caldera, which last erupted in 1931. The crater has an average diameter of 6 mi (10 km). Declared a national monument in 1978, it covers 942 sq mi (2,440 sq km).

Aniene River \än-'yā-nā\ River, central Italy. It rises in the Simbruini Mountains southeast of Rome and meanders 67 mi (108 km) to join the TIBER RIVER north of Rome. NERO created a group of artificial lakes in its upper course and built a villa there, the remains of which survive.

aniline \'a-nə-ˌlīn\ One of the most important organic BASES, parent substance for many dyes and drugs. Pure aniline is a highly poisonous, oily, colourless liquid with a distinctive odour. First obtained (1826) from INDIGO, it is now prepared synthetically. It is a weakly basic primary aromatic AMINE and participates in many reactions with other compounds. It is used to make chemicals used in producing rubber, dyes and intermediates, photographic chemicals, urethane foams, pharmaceuticals, explosives, herbicides, and fungicides as well as to make chemicals used in petroleum refining.

animal Any member of the kingdom Animalia (see TAXONOMY), a group of many-celled organisms that differ from members of the two other many-celled kingdoms, the PLANTS and the fungi (see FUNGUS), in several ways. Animals have developed muscles, making them capable of spontaneous movement (see LOCOMOTION), more elaborate sensory and nervous systems, and greater levels of general complexity. Unlike plants, animals cannot manufacture their own food, and thus are adapted for securing and digesting food. In animals, the cell wall is either absent or composed of material different from that of the plant cell wall. Animals account for about three-quarters of living species. Some one-celled organisms display both plant and animal characteristics. See also ALGAE, ARTHROPOD, BACTERIA, CHORDATE, INVERTEBRATE, PROTIST, PROTOZOAN, VERTEBRATE.

animal communication Transmission of information from one animal to another by means of sound, visible sign or behaviour, taste or odour, electrical impulse, touch, or a combination of these. Most animal communication uses sound (e.g., birds calling, crickets chirping). Visual communication usually indicates an animal's identity (species, sex, age, etc.) or other information through specific characteristics (e.g., horns, patches of colour) or behaviour (e.g., the bee's "dance" describing a source of food). Chemical communication involves pheromones (chemical signals) produced by the animal's endocrine system. EELS and some other fishes use electrical impulses to communicate.

animal husbandry Controlled cultivation, management, and production of domestic animals, including improvement of the qualities considered desirable by humans by means of BREEDING. Animals are bred and raised for utility (e.g., food, fur), sport, pleasure, and research. See also BEEKEEPING, DAIRY FARMING.

animal rights rights, primarily against being killed and being treated cruelly, that are thought to be possessed by higher nonhuman animals (e.g., chimpanzees) and many lower ones by virtue of their sentience. Respect for the welfare of animals is a precept of some ancient Eastern religions, including JAINISM, which enjoins *ahimsa* ("noninjury") toward all living things, and BUDDHISM, which forbids the needless killing of animals, especially (in India) of cows. In the West, traditional JUDAISM and CHRISTIANITY taught that animals were created by God for human use, including as food, and many Christian thinkers argued that humans had no moral duties of any kind to animals, even the duty not to treat them cruelly, because they lacked rationality or because they were not, like Man, made in the image of God. This view prevailed until the late 18th century, when ethical philosophers such as JEREMY BENTHAM applied the principles of UTILITARIANISM to infer a moral duty not to inflict needless suffering on animals. In the latter half of the 20th century, the ethical philosopher Peter Singer and others attempted to show that a duty not to harm animals follows straightforwardly from simple and widely accepted moral principles, such as "It is wrong to cause unnecessary suffering." They also argued that there is no "morally relevant difference" between humans and animals that would justify raising animals, but not humans, for food on "FACTORY FARMS" or using them in scientific experiments or for product testing (e.g., of cosmetics). An opposing view held that humans have no moral duties to animals because animals are incapable of entering into a hypothetical "moral contract" to respect the interests of other rational beings. The modern animal-rights movement was inspired in part by Singer's work. At the end of the 20th century, it had spawned a large number of groups dedicated to a variety of related causes, including protecting endangered species, protesting against painful or brutal methods of trapping and killing animals (e.g., for furs), preventing the use of animals in laboratory research, and promoting what adherents considered the health benefits and moral virtues of VEGETARIANISM.

animals, cruelty to Willful or wanton infliction of pain, suffering, or death upon an animal or the intentional or malicious neglect of an animal. Perhaps the world's first anticruelty law, which addressed the treatment of domesticated animals, was included in the legal code of the Massachusetts Bay Colony (1641); similar legislation was passed in Britain in 1822. The world's first animal welfare society, the Society for the Protection of Animals, was established in England in 1824; the American Society for the Prevention of Cruelty to Animals was chartered in 1866. In varying degrees, cruelty to animals is illegal in most countries, and interest in ENDANGERED SPECIES gave further impetus to the anticruelty movement in the late 20th century. Reflecting such interest, many laws have been passed, though they are seldom enforced unless public pressure is brought to bear. Acts targeted by the movement have ranged from the mistreatment of domesticated animals to BULLFIGHTING and VIVISECTION. FACTORY FARMING, which involves various evidently cruel practices, has remained largely exempt from legal scrutiny. See also ANIMAL RIGHTS.

animals, master of the Supernatural figure regarded as the protector of game animals in the traditions of hunting peoples. In some tradi-

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tions he is the ruler of the forest and guardian of all species; in others, he is the guardian of a single species—usually a large and valuable animal—and may have both human and animal characteristics. He requires that hunters treat slain animals with respect; if they fail to do so, he may withhold game until he is placated through a ceremony or by a SHAMAN.

animation Process of giving the illusion of movement to drawings, models, or inanimate objects. From the mid-1850s, such optical devices as the zoetrope produced the illusion of animation. Stop-action photography enabled the production of cartoon films. The innovative design and assembly techniques of WALT DISNEY soon moved him to the forefront of the animation industry, and he produced a series of classic animated films, beginning with *Snow White and the Seven Dwarfs* (1937). The FLEISCHER brothers and the animators at Warner Brothers offered more irreverent cartoons that often appealed to adult audiences. In Europe new animation alternatives to line drawing were developed, including animation using puppets (sometimes made from clay). In the late 20th century computer animation, as seen in the first fully computer-generated animated feature, *Toy Story* (1995), moved the art to a new level.

animé Style of animation popular in Japanese films. *Animé* films are meant primarily for the Japanese market and, as such, employ many cultural references unique to Japan. For example, the large eyes of *animé* characters are commonly perceived in Japan as multifaceted "windows to the soul." Much of the genre is aimed at the children's market, but *animé* films are sometimes marked by adult themes and subject matter. Modern *animé* began in 1956 and found lasting success in 1961 with the establishment of Mushi Productions by Osamu Tezuka, a leading figure in modern *manga* (Japanese comics). Such *animé* as *Akira* (1988), *Princess Mononoke* (1997), and the *Pokémon* series of films have attained international popularity.

animism Belief in the existence of spirits separable from bodies. Such beliefs are traditionally identified with small-scale ("primitive") societies, though they also occur in major world religions. They were first competently surveyed by EDWARD BURNETT TYLOR in *Primitive Culture* (1871). Classic animism, according to Tylor, consists of attributing conscious life to natural objects or phenomena, a practice that eventually gave rise to the notion of a SOUL. See also SHAMAN.

anion \'a-ˌnī-ən\ Atom or group of atoms carrying a negative ELECTRIC CHARGE, indicated by a superscript minus sign after the chemical symbol. Anions in a liquid subjected to an electric field migrate toward the positive electrode (ANODE). Examples include hydroxyl ($—OH^-$; see HYDROXIDE), CARBONATE ($—CO_3^{2-}$), and PHOSPHATE ($—PO_4^{3-}$). See also ION; compare CATION.

anise Annual herb (*Pimpinella anisum*) of the PARSLEY family, cultivated chiefly for its fruit, called aniseed, which tastes like LICORICE. Native to Egypt and the eastern Mediterranean region, anise is cultivated throughout the world. Aniseed is used as a flavouring and as a soothing herbal tea. Star anise is the dried fruit of the EVERGREEN tree *Illicium verum* (MAGNOLIA family), native to southeastern China and Vietnam. Its flavour and uses are similar to those of anise.

Anjou \'an-jü\ Historical region, lower LOIRE valley, northwestern France. Organized in the Gallo-Roman period as the Civitas Andegavensis, it later became the countship, and from 1360 the duchy, of Anjou. Its capital was Angers. Under the CAROLINGIAN DYNASTY, it was nominally administered by a count representing the French king. The area came under the English king HENRY II when he married ELEANOR OF AQUITAINE in 1152, thus founding the Anglo-Angevin empire of the PLANTAGENET dynasty. The French recovered Anjou in 1259, and it was united with France in 1487. It ceased to exist as a department in 1790.

Anjou, House of See House of PLANTAGENET

Ankara \'äŋ-kə-rə\ *formerly* **Angora** City (pop., 1997: 2,984,099), capital of TURKEY. Located about 125 mi (200 km) south of the BLACK SEA, it has been inhabited at least since the Stone Age. Conquered by ALEXANDER THE GREAT in 334 BC, it was incorporated into the Roman Empire by AUGUSTUS. As a city of the Byzantine Empire, Ankara fell to the Turks in 1073, but the Crusader RAYMOND IV of Toulouse drove them out in 1101. In 1403 it came under the rule of the OTTOMAN EMPIRE. After World War I (1914–18) MUSTAFA KEMAL ATATÜRK made Ankara the centre of resistance to both the Ottomans and the invading Greeks, and it became the capital of the Republic of Turkey in 1923. The modern city is the country's chief industrial centre after ISTANBUL. Its history is displayed in its Roman, Byzantine, and Ottoman architecture and ruins and in its important historical museums.

The Atatürk Mausoleum, Ankara, Turkey.
ROBERT HARDING PICTURE LIBRARY

ankh \'äŋk\ Ancient Egyptian HIEROGLYPH signifying life, consisting of a cross surmounted by a loop. In tomb inscriptions, gods and pharaohs are often pictured holding the ankh, which forms part of the hieroglyph for concepts such as health and happiness. It is used as a cross in the COPTIC ORTHODOX CHURCH.

Ankobra River River, southern Ghana. It rises northeast of Wiawso and flows about 130 mi (209 km) south to the Gulf of GUINEA, just west of Axim. Its chief tributaries are the Mansi and Bonsa rivers; much of its basin is shared with the Tano River to the west.

Ann, Cape Cape northeast of Boston, Mass., U.S. Sheltering Ipswich Bay, it includes Annisquam Harbor on the north and Gloucester Harbor on the south. The rocky, picturesque promontory, named for Queen Anne (wife of JAMES I), is noted for its old fishing villages and artists' colonies. Gloucester and Rockport are its main towns.

Ann Arbor City (pop., 2000: 114,024), southeastern Michigan, U.S. Founded in 1824, it became an agricultural centre with the coming of the railroad in 1839. The University of MICHIGAN, which moved there from DETROIT in 1837, has played a major role in Ann Arbor's growth. Private industrial research and the university's institutes of science and technology make the city a major Midwest centre for space and nuclear research.

Anna (Ivanovna) (b. Jan. 28, 1693, Moscow, Russia—d. Oct. 17, 1740, St. Petersburg) Empress of Russia (1730–40). After the death of PETER II, the Supreme Privy Council, Russia's actual ruling body, offered Anna the throne (as the daughter of IVAN V) if she agreed to conditions placing the real power in the council's hands. She initially agreed but later tore up the conditions, abolished the council, and reestablished the autocracy, countenancing a severely repressive regime. She occupied herself primarily with extravagant amusements and relied on her lover, Ernst Johann Biron (1690–1772), and a group of German advisers to manage the state. Shortly before her death, Anna named as her successor her grand-nephew Ivan (later IVAN VI).

Anna Comnena \käm-'nē-nə\ (b. Dec. 2, 1083—d. c. 1153) Byzantine historian. Daughter of the emperor ALEXIUS I COMNENUS, she conspired with her mother against her brother JOHN II COMNENUS; when the plot was discovered, she was forced to enter a convent. There she wrote the *Alexiad*, a biography of her father and a pro-Byzantine account of the early CRUSADES.

Annaba \ä-'nä-bə\ *formerly* **Bône** \'bōn\ Seaport (pop., 2004 est.: 410,700), northeastern ALGERIA. Identified with the port of ancient Hippo (or Hippo Regius), it was a rich city of Roman Africa. It was home to St. AUGUSTINE 396–430. Severely damaged by the VANDALS in 431, it passed to the BYZANTINE EMPIRE in 533 before being overrun by the Arabs in the 7th century and named Bona. It was occupied by the French in 1832 when they conquered Algeria. Modern Annaba is Algeria's chief exporter of minerals; it also serves as a trading port and port of call.

Annales \ä-'näl\ **school** School of history. Established by Lucien Febvre (1878–1956) and MARC BLOCH (1886–1944), its roots were in the journal *Annales: économies, sociétés, civilisations*, Febvre's reconstituted version of a journal he had earlier formed with Marc Bloch. Under FERNAND BRAUDEL's direction the Annales school promoted a new form of history, replacing the study of leaders with the lives of ordinary people and replacing examination of politics, diplomacy, and wars with inquiries into climate, demography, agriculture, commerce, technology, transportation, and communication, as well as social groups and mentalities. While aiming at a "total history," it also yielded dazzling microstudies of villages and regions. Its international influence on historiography has been enormous.

Annam \a-'nam\ Historic kingdom, central VIETNAM. The area was conquered c. 200 BC by the Chinese, who gave it its name (which has never

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been used by the indigenous inhabitants). It became independent in the 15th century AD, opening the way for steady Vietnamese movement toward the MEKONG RIVER delta. When Vietnam was united in 1802, the city of HUE became the capital, and the area was ruled by the emperor of Annam. Central Vietnam gradually came under French control in the 19th century; it became a protectorate in 1883–85, leaving the court at Hue with only nominal power. The area was partitioned between North and South Vietnam in 1954; Annam's last emperor had abdicated in 1945 but served as Vietnam's chief of state from 1949 until shortly after partition.

Annan \ä-'nan**, Kofi (Atta)** (b. April 8, 1938, Kumasi, Gold Coast) Seventh secretary-general of the UNITED NATIONS (from 1997), who shared, with the UN, the 2001 Nobel Prize for Peace. He was the son of a provincial governor and hereditary paramount chief of the FANTE people. He did graduate work at Geneva's Institute for Advanced International Studies and at MIT. He has spent almost his entire career within the UN, beginning at the WORLD HEALTH ORGANIZATION (1962). As undersecretary-general for peacekeeping (from 1993), he transferred peacekeeping operations in Bosnia from the UN to NATO. Elected in December1996, he became the first UN secretary-general from sub-Saharan Africa, and he enjoyed a mandate to reform the UN bureaucracy. He criticized the UN's failure to prevent or minimize genocide in Rwanda (1994) and unsettled many by declaring that the UN should address human-rights violations perpetrated by governments against their own people. His priorities included reforming the UN, restoring public confidence in the organization, and strengthening the UN's activities for peace and development. Annan was appointed to a second term in 2001.

Annapolis \ə-'na-pə-ləs\ City (pop., 2000: 35,838), capital of Maryland, U.S. It lies along the Severn River on CHESAPEAKE BAY. Settled in 1649 as Providence by Virginia Puritans, it was later known as Town Land at Proctor's and Ann Arundel Town. It became the colonial capital in 1694 and was later renamed to honour Princess (later Queen) ANNE. Its economy is tied to government services, and it is home to the U.S. NAVAL ACADEMY.

Annapolis Convention (September 1786) Meeting in Annapolis, Md., U.S., that caused the convening of the CONSTITUTIONAL CONVENTION. Delegates from five states gathered to discuss problems in maritime commerce but found they could not solve them without making changes to the ARTICLES OF CONFEDERATION. They issued a call to all states to meet in Philadelphia in 1787 to resolve the difficulties.

Annapurna Mountain range, Nepal. It forms a ridge 30 mi (48 km) long and contains four main summits. Annapurna I (26,545 ft, or 8,091 m) was first scaled in 1950 by a French expedition; it was the first peak of more than 26,000 ft (8,000 m) to be ascended to the summit. In 1970 an all-woman Japanese team climbed Annapurna III (24,786 ft, or 7,555 m).

Anne (b. Feb. 6, 1665, London, Eng.—d. Aug. 1, 1714, London) Queen of Great Britain (1702–14) and the last STUART monarch. Second daughter of JAMES II, who was overthrown by WILLIAM III in 1688, Anne became queen on William's death (1702). Though she wished to rule independently, her intellectual limitations and poor health led her to rely on advisers, including the duke of MARLBOROUGH. Her reign was marked by the Act of UNION with Scotland (1707) and by bitter rivalries between Whigs and Tories. Because she never gave birth to a successor, the regency passed to the Hanoverian descendants of James I.

Anne Boleyn \bù-'lin\ (b. 1507?—d. May 19, 1536, London, Eng.) British royal consort. After spending part of her childhood in France, Anne lived at the court of HENRY VIII, who soon fell in love with her and began secret proceedings to rid himself of his first wife, CATHERINE OF ARAGON. For six years Pope CLEMENT VII refused to grant an annulment. In 1533 Henry and Anne were secretly married, and Henry had the archbishop of Canterbury, Thomas CRANMER, annul his previous marriage. Anne gave birth to the future ELIZABETH I but failed to produce the male heir Henry wanted. He lost interest in her, and in 1536 he had her imprisoned on questionable charges of adultery and incest. She was convicted and beheaded.

Anne of Austria (b. Sept. 22, 1601, Valladolid, Spain—d. Jan. 20, 1666, Paris, France) Queen consort (1615–43) of LOUIS XIII of France and regent (1643–51) for her son LOUIS XIV. Daughter of PHILIP III of Spain and Margaret of Austria, Anne married the 14-year-old Louis XIII in 1615. He treated her coolly, and the powerful cardinal de RICHELIEU attempted to limit her influence over her husband. After Louis XIII died and she was declared sole regent, she strove to ensure that her son would succeed to the absolute power Richelieu had won for Louis XIII. Together with her first minister, Cardinal MAZARIN, she faced the series of revolts known as the FRONDE. Her regency ended in 1651, when Louis XIV was proclaimed of age to rule.

Anne of Austria, detail of a portrait by Peter Paul Rubens; in the Rijksmuseum, Amsterdam.
ART MEDIA/HERITAGE-IMAGES

Anne of Brittany (b. Jan. 25, 1477, Nantes, France—d. Jan. 9, 1514, Blois) Duchess of Brittany and twice queen consort of France. After succeeding to her father's duchy in 1488, Anne allied herself with MAXIMILIAN I of Austria. She was then forced to break with him and in 1491 marry CHARLES VIII of France, thus beginning the process of the union of Brittany with the French crown. After Charles's death (1498), she married his successor, LOUIS XII. Throughout her life Anne devoted herself to safeguarding Brittany's autonomy within the kingdom.

Anne of Cleves (b. Sept. 22, 1515—d. July 16, 1557, London, Eng.) Fourth wife of HENRY VIII of England. Henry married Anne, whom he found homely, to form an alliance with her brother William, duke of Cleves, a leader of the Protestants of western Germany. The alliance, arranged by THOMAS CROMWELL, seemed necessary because it appeared that the major Roman Catholic powers, France and the Holy Roman Empire, intended to attack Protestant England. When that threat dissipated, the marriage became a political embarrassment and was annulled by an Anglican convocation in 1540.

annealing Treatment of a METAL, ALLOY, or other material by heating to a predetermined temperature, holding for a certain time, and then cooling to room temperature, done to improve DUCTILITY and reduce brittleness. Process annealing is carried out intermittently during the working of a piece of metal to restore ductility lost through repeated hammering or other working, if several cold-forming operations are required but the metal is so hardened after the first operation that further cold working would cause cracking (see HARDENING). Full annealing is done to give workability to such parts as forged blanks destined for use in the machine-tool industry. Annealing is also done for relief of internal stresses in metal and glass. Annealing temperatures and times differ for different materials and with properties desired; steel is usually held for several hours at about 1,260°F (680°C) and then cooled for several hours. See also HEAT TREATING, SOLID SOLUTION.

annelid \'a-nə-ˌlid\ Any member of a phylum (Annelida) of INVERTEBRATE animals that possess a body cavity (coelom), movable bristles (setae), and a body divided into segments by crosswise rings. Known as segmented WORMS, annelids are divided into three classes: marine worms (Polychaeta; see POLYCHAETE), EARTHWORMS (Oligochaeta), and LEECHES (Hirudinea). See illustration on following page.

Anne's War, Queen See QUEEN ANNE'S WAR

annihilation In physics, a reaction in which a particle and its antiparticle (see ANTIMATTER) collide and disappear. The annihilation releases energy equal to the original mass m multiplied by the square of the speed of light c, or $E = mc^2$, in accordance with ALBERT EINSTEIN's special theory of RELATIVITY. The energy can appear directly as GAMMA RAYS or can convert back to particles and antiparticles (see PAIR PRODUCTION).

annual Any plant that completes its life cycle in a single GROWING SEASON. The dormant SEED is the only part of an annual that survives from one growing season to the next. Annuals include many WEEDS, WILDFLOWERS, garden flowers, and VEGETABLES. See also BIENNIAL, PERENNIAL.

annual ring See GROWTH RING

annuity Payment made at a fixed interval. A common example is the payment received by retirees from their PENSION plan. There are two main classes of annuities: annuities certain and contingent annuities. Under an annuity certain, a specified number of payments are made, after which the annuity stops. With a contingent annuity, each payment depends on the continuance of a given status; for example, a life annuity continues only

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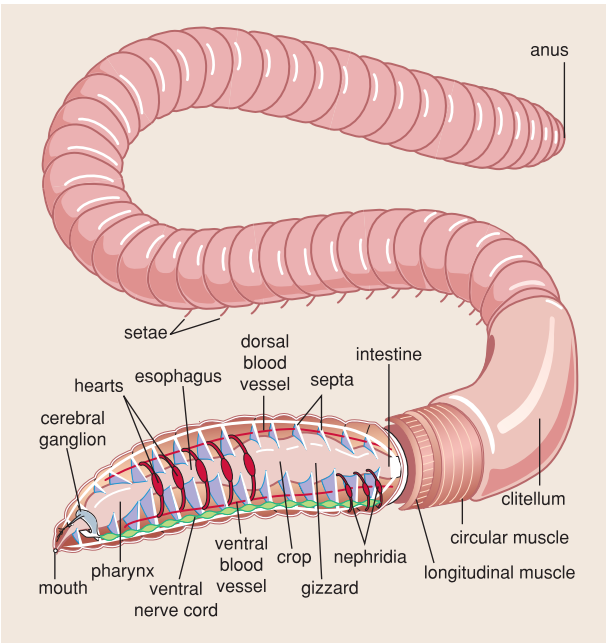

Body plan of an earthworm. Partitions (septa) divide the body cavity (coelom) into more than 100 segments. The circular and longitudinal muscles work with the setae to move the worm forward. Soil is pulled into the mouth by the sucking action of the pharynx; the crop releases food slowly into the gizzard, where the soil is ground to release and break up any organic matter. The cerebral ganglion, or "brain," controls all body functions and movement via a ventral nerve cord. Contraction of the hearts (aortic arches) and ventral blood vessel forces blood through the body; blood returns via the dorsal blood vessel. Nitrogenous waste is eliminated through the tubules of the nephridia, while digested soil is pushed through the intestine and out the anus. The clitellum secretes mucus for mating and a cocoon in which eggs are deposited.

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as long as the recipient survives. Contingent annuities such as pension plans or LIFE INSURANCE depend on shared risk. Everyone pays in a fixed amount until the annuity begins; some will not live long enough to receive back all the money they have paid, while others will live long enough to collect more than they have paid.

annulment Legal invalidation of a MARRIAGE. It announces the invalidity of a marriage that was void from its inception. It is to be distinguished from dissolution or DIVORCE. To justify annulment, the marriage contract must have a defect (e.g., incompetence of one party because of age, insanity, or a preexisting marriage). Continued absence of one party may also justify annulment. Generally, annulment is easier if the marriage is unconsummated. Both secular law and Christian CANON LAW have annulment procedures.

anode Terminal or ELECTRODE from which ELECTRONS leave a system. In a BATTERY or other source of DIRECT CURRENT, the anode is the negative terminal. In a passive load it is the positive terminal. In an electron tube, electrons from the CATHODE travel across the tube toward the anode; in an electroplating cell, negative ions are deposited at the anode.

anodizing Method of coating metal for corrosion resistance, electrical insulation, thermal control, abrasion resistance, sealing, improving paint adhesion, and decorative finishing. Anodizing consists of electrically depositing an OXIDE film from aqueous solution onto the surface of a metal, often ALUMINUM, which serves as the ANODE in an electrolytic cell. In the most common type of anodizing, which uses a 15% sulfuric acid bath, dyes can be introduced into the oxidation process to achieve a coloured surface. Aluminum thus anodized and coloured is used widely in giftware, home appliances, and architectural decoration.

anomie \'a-nə-mē\ In the social sciences, a condition of social instability or personal unrest resulting from a breakdown of standards and values or from a lack of purpose or ideals. The term was introduced in 1897 by ÉMILE DURKHEIM, who believed that one type of SUICIDE (anomic) resulted from the breakdown of social standards that people need and use to regulate their behavior. ROBERT K. MERTON studied the causes of anomie in the U.S., finding it severest in persons who lack acceptable means of achieving their cultural goals. Delinquency, crime, and suicide are often reactions to anomie. See also ALIENATION.

anorexia nervosa \ˌa-nə-'rek-sē-ə-nər-'vō-sə\ Eating disorder, mostly in young women, characterized by a failure to maintain body weight at a normal level because of an intense desire to be thin, a fear of gaining weight, or a disturbance in body image. Anorexia nervosa typically begins in late adolescence. In women a usual symptom is AMENORRHEA. A person with anorexia nervosa will often go to great lengths to resist eating in order to lose weight, and medical complications can be life-threatening. Treatment can include psychological and social therapy.

anorthite FELDSPAR mineral, calcium aluminosilicate ($CaAl_2Si_2O_8$), that occurs as white or grayish, brittle, glassy crystals. Primarily a rock-forming mineral, it is used in the manufacture of glass and ceramics. Anorthite occurs in basic igneous rocks (see ACID AND BASIC ROCKS).

anorthosite Type of IGNEOUS ROCK composed predominantly of calcium-rich FELDSPAR. It is considerably less abundant than either basalt or granite, but the complexes in which it occurs are often immense. All anorthosites found on the earth consist of coarse crystals, but some from the moon are finely crystalline.

Anouilh \ä-'nüy**, Jean (-Marie-Lucien-Pierre)** (b. June 23, 1910, Bordeaux, France—d. Oct. 3, 1987, Lausanne, Switz.) French playwright. After studying law, he wrote his first play, *The Ermine* (1932), followed by the successful *Traveler Without Luggage* (1937). He is best remembered for *Antigone* (1944), *The Lark* (1953), and *Becket* (1959), in which he used techniques such as the play within the play, flashbacks and flash-forwards, and the exchange of roles. A skillful exponent of the WELL-MADE PLAY, he rejected naturalism and realism in favour of a return to THEATRICALISM.

Anṣār *Arabic* **"Helper"** Term originally applied to some of the COMPANIONS OF THE PROPHET. When MUHAMMAD left Mecca for MEDINA, the Anṣār were the Medinese who aided him and who became his devoted followers, serving in his army. The term was revived in the 19th century to refer to the followers of the Sudanese al-MAHDI, al-Mahdi's successor, or his descendants.

Anschluss \'än-ˌshlůs\ (German: "union") Political union of Austria with Germany, which occurred when ADOLF HITLER annexed Austria. In 1938 the Austrian chancellor KURT VON SCHUSCHNIGG was bullied into canceling a plebiscite on union with Germany, which he expected Austrians to oppose. He resigned his office and ordered the Austrian army not to resist the Germans. The Germans invaded on March 12, and the enthusiasm shown by Austrians persuaded Hitler to annex Austria outright the next day. Though France and Britain protested Hitler's methods, they and other countries accepted the fait accompli.

Anselm of Canterbury, Saint (b. 1033/34, Aosta, Lombardy—d. April 21, 1109, possibly at Canterbury, Kent, Eng.; feast day April 21) Founder of SCHOLASTICISM. Anselm entered the Benedictine monastery at Bec (in Normandy) in 1057 and became abbot in 1078. In 1077 he wrote the *Monologium* to demonstrate God's existence and attributes by reason alone. He then wrote *Proslogium*, which established the ONTOLOGICAL ARGUMENT for the existence of God. In 1093, he became archbishop of Canterbury and soon became involved in disputes with WILLIAM II over the independence of the church and the right to appeal to the pope, arguments that led to Anselm's exile. Although invited back by HENRY I, Anselm again argued with the king over lay investiture (see INVESTITURE CONTROVERSY). In 1099 he completed *Cur Deus homo?* ("Why Did God Become Man?"), which provided a new understanding of Jesus' redemption of humankind and revealed the increasing focus on the humanity of Jesus. Anselm was declared a Doctor of the Church in 1720.

Ansgar \'ans-ˌgär**, Saint** (b. probably 801, near Corbie, Austrasia—d. Feb. 3, 865, Bremen, Saxony; feast day February 3) Missionary, first archbishop of Hamburg, and patron saint of Scandinavia. He was sent by LOUIS I (the Pious) to help King Harald Christianize Denmark and King Bjorn Christianize Sweden. He initiated a mission to all Scandinavians and Slavs and was appointed archbishop of Hamburg (832). But Sweden and Denmark returned to paganism by 845, and Ansgar had to repeat all his work. He thwarted another pagan rebellion and was recognized as a saint soon after his death.

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Anshan \'an-ˌshan\ City and territory of ancient ELAM, north of modern SHĪRĀZ, Iran. Anshan came to prominence c. 2350 BC, but its greatest period was in the 13th–12th centuries BC, when, as kings of Anshan and Susa, Elamite rulers periodically raided the cities of BABYLONIA. The area apparently came under the control of the Persians c. 675 BC. Its ruins have yielded major finds, including examples of early Elamite writing.

Anshan \'än-'shän\ *or* **An-shan** City (pop., 1999 est.: 1,285,849), LIAONING province, northeastern China. Established as a post station in 1387, it was fortified in 1587 as part of the defenses set up by the MING DYNASTY against the rising power of the MANCHUS. It was destroyed by fire during the BOXER REBELLION and badly damaged during the RUSSO-JAPANESE WAR (1904–05). In the 1930s the Japanese occupied Anshan and made it a steelmaking centre. The city was bombed by U.S. aircraft in 1944 and looted by the Soviets following World War II. The Chinese later redeveloped it into an industrial centre that produces steel, cement, and chemicals.

ant Any member of approximately 8,000 species of the social insect family Formicidae. Ants are found worldwide but are especially common in hot climates. They range from 0.1 to 1 in. (2–25 mm) long and are usually yellow, brown, red, or black. Ants eat both plant and animal substances; some even "farm" fungi for food, cultivating them in their nests, or "milk" APHIDS. Ant colonies consist of three castes (queens, males, and workers, including soldiers) interacting in a highly complex society paralleling that of the HONEYBEES. Well-known ant species are the carpenter ants of North America, the voracious army ants of tropical America, and the stinging FIRE ANT.

Carpenter ant (*Camponotus*)
GRACE THOMPSON FROM THE NATIONAL AUBUDON SOCIETY COLLECTION—PHOTO RESEARCHERS/EB INC.

antacid Any substance, such as sodium bicarbonate, magnesium hydroxide, or aluminum hydroxide, used to relieve the discomfort caused by indigestion, gastritis, and several forms of ulcers. Antacids counteract or neutralize gastric acidity for up to three hours after a single dose. Antacids should be taken when gastric acidity is most likely to be increasing—namely, between one and three hours after each meal and at bedtime.

Antakya See ANTIOCH

Antananarivo \ˌän-tä-ˌnä-nä-'rē-vō\ *formerly* **Tananarive** \tä-ˌnä-nä-'rēv\ City (pop., 2001 est.: 1,403,449), capital of Madagascar. Located in central Madagascar Island, and rising to an elevation of 4,694 ft (1,431 m), the city was founded in the 17th century and was controlled by the Merina from the early 1790s until the end of the 19th century. The French made it the capital of their colony when they took control of the region at the end of the 19th century and renamed it Tananarive. The name became Antananarivo after the 1972 revolution. The University of Madagascar (1961) is located there, as are tobacco- and food-processing plants. A railway connects it with Toamasina, the island's chief port.

Antarctic Circle Parallel of latitude approximately 66.5° south of the Equator that circumscribes the southern frigid zone. It marks the northern limit of the area within which, for one day or more each year, the sun does not set or rise. The length of continuous day or night increases southward from the Antarctic Circle, mounting to six months at the SOUTH POLE.

Antarctic regions ANTARCTICA and the southern portions of the Pacific, Atlantic, and Indian oceans. The waters around Antarctica are sometimes called the Southern Ocean; however, the term "Antarctic Ocean" is sometimes also used, inappropriately. Much of the area is characterized by subpolar conditions, and ice shelves and sea ice extend well beyond the borders of the continent. Water cooled by the coastal ice masses of the Antarctic continent sinks and flows northward along the ocean bottom and is replaced at the surface by warmer water flowing south from the Indian, Pacific, and Atlantic oceans. The meeting point of these currents is the Antarctic Convergence, an area rich in phytoplankton and krill, which are important to various species of fish as well as to penguins and seabirds.

Antarctica Fifth largest continent on Earth. Antarctica lies concentrically about the SOUTH POLE, its landmass almost wholly covered by a vast ice sheet averaging 6,500 ft (2,000 m) thick. It is divided into two subcontinents: East Antarctica, consisting mainly of a high, ice-covered plateau, and West Antarctica, consisting largely of an archipelago of

mountainous islands covered with ice. Its land area is about 5.5 million sq mi (14.2 million sq km). The southern portions of the Atlantic, Pacific, and Indian oceans surround it (see ANTARCTIC REGIONS). Antarctica would be circular except for the outflaring Antarctic Peninsula and two principal bays, the Ross Sea and the Weddell Sea. East and West Antarctica are separated by the long chain (1,900 mi [3,000 km]) of the Transantarctic Mountains. The ice sheet overlaying the continent represents about 90% of the world's glacial ice. By far the coldest continent, it has the world's lowest recorded temperature, –128.6 °F (–89.2 °C), measured in 1983. The climate supports only a small community of land plants, but the rich offshore food supply sustains penguins and immense seabird rookeries. There are no permanent human inhabitants. The Russian F.G. von Bellingshausen (b. 1778—d. 1852), the Englishman Edward Bransfield (b. 1795?—d. 1852), and the American Nathaniel Palmer (b. 1799—d. 1877) all claimed first sightings of the continent in 1820. The period to c. 1900 was dominated by the exploration of Antarctic and sub-Antarctic seas. The early 20th century, the "heroic era" of Antarctic exploration, produced expeditions deep into the interior by ROBERT FALCON SCOTT and later ERNEST SHACKLETON. The South Pole was reached by ROALD AMUNDSEN in December 1911 and by Scott in January 1912. The first half of the 20th century was also Antarctica's colonial period. Seven nations claimed sectors of the continent, while many other nations carried out explorations. In the International Geophysical Year of 1957–58, 12 nations established over 50 stations on the continent for cooperative study. In 1961 the Antarctic Treaty, reserving Antarctica for free and nonpolitical scientific study, entered into full force. A 1991 agreement imposed a ban on mineral exploitation for 50 years.

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anteater Any of four species of toothless, insect-eating placental mammals. Found in tropical savannas and forests from Mexico to northern Argentina and Uruguay, anteaters have a long tail, dense fur, a long skull, and a tubular muzzle. Their mouth opening is small, and the tongue is long and wormlike. They live alone or in pairs and feed mainly on ants and termites, which they obtain by inserting their sticky tongue into a nest torn open by the long, sharp, curved claws of their forefeet. The species range in length from 15 in. (37 cm) to 6 ft (1.8 m). Once grouped together, anteaters are now considered as separate from ECHIDNAS and PANGOLINS.

Antelami \ˌän-te-ˈlä-mē**, Benedetto** (b. c. 1150, probably Lombardy—d. c. 1230, Parma) Italian sculptor and architect. He probably belonged to the Magistri Antelami, a civic builders' guild in the Lake Como region. An early signed marble relief by him, *The Descent from the Cross* (1178), is in Parma Cathedral; his extensive cycle of sculpture on the baptistery at Parma was begun in 1196. He is credited with the sculptural decorations of Fidenza Cathedral and Ferrara Cathedral. His last work is believed to have been the decoration and (at least in part) the construction of the church of Sant'Andrea at Vercelli, the architecture of which successfully combined Tuscan Romesque with Gothic characteristics (such as flying buttresses, rose windows, and ribbed vaulting) and won him lasting renown.

antelope Any of numerous species of Old World grazing or browsing BOVIDS that typically are swift, slender, and graceful plains dwellers. The North American PRONGHORN is also sometimes referred to as an antelope. Most antelope are African; the others, except for the pronghorn, are Eurasian. They range in shoulder height from 10 to 70 in. (25–175 cm). The male, and sometimes the female, bears distinctive, backwardly curved horns. See also BONGO, DIK-DIK, DUIKER, ELAND, GAZELLE, GNU, HARTEBEEST, IMPALA, KUDU, NYALA, ORYX, SPRINGBOK, WATERBUCK.

antenna *or* **aerial** Component of RADIO, TELEVISION, and RADAR systems that directs incoming and outgoing radio waves. Usually of metal, antennas range in shape and size from the mastlike devices used for radio and television broadcasting to the large parabolic reflectors used to focus satellite signals and the radio waves generated by distant astronomical objects and reflect them toward the centrally located receiver. Antennas were invented in the 1880s by HEINRICH HERTZ; GUGLIELMO MARCONI made many improvements.

antenna In zoology, one of a pair of slender, segmented sensory organs on the head of INSECTS, myriapods (e.g, CENTIPEDES, MILLIPEDES), and CRUSTACEANS. Antennae of insects, which are movable, are believed to serve as both tactual and smell receptors; in some species, the development of elaborate antennal plumes and brushlike terminations has led to the suggestion that they also serve for hearing. Evidence supports this idea only for the MOSQUITO, whose antennae are attached to specialized structures stimulated by vibrations of the antennal shaft. In social insects (e.g., ANTS), antennae movements may serve as communication.

Antenor \an-ˈtē-nȯr\ (fl. c. 530–510 BC) Greek sculptor active in Athens. In antiquity he was famous for his bronze group of the *Tyrannicides* (c. 510 BC) made for the Athenian AGORA; the statues no longer exist. There were elements of motion and accurate anatomical detail in the work that mark the transition between the Archaic and Classical eras. A large marble KORE (c. 520 BC) from the Acropolis, found in 1886, is also attributed to him and is considered one of the finest examples of late Archaic sculpture.

anthem Choral composition with English words used in church services. It developed in the mid-16th century as the Anglican version of the Catholic Latin MOTET. The full anthem is for unaccompanied chorus throughout; the verse anthem employs one or more soloists and, generally, instrumental accompaniment. Both types often employ antiphonal singing, the alternation of two half-choirs (*anthem* derives from *antiphon*). WILLIAM BYRD, THOMAS TALLIS, HENRY PURCELL, and GEORGE FRIDERIC HANDEL wrote well-known anthems.

Anthesteria \ˌan-thə-ˈstir-ē-ə\ Athenian festival in honor of DIONYSUS, held during the month of Anthesterion (Feb.–Mar.) to celebrate the beginning of spring and the maturing of the wine stored at the previous vintage. It lasted three days and included libations to the god from newly opened casks, popular merrymaking, a secret ceremony of marriage between Dionysus and the wife of the king, and underworld rites.

Anthony, Susan B(rownell) (b. Feb. 15, 1820, Adams, Mass., U.S.—d. March 13, 1906, Rochester, N.Y.) U.S. pioneer in the WOMEN'S SUFFRAGE MOVEMENT. A precocious child, she learned to read and write at the age of three. After attending a boarding school in Philadelphia, she took a teaching position in a Quaker seminary in upstate New York. She taught at a female academy (1846–49) and then settled in her family home near Rochester, N.Y. There she met many leading abolitionists, including FREDERICK DOUGLASS and WILLIAM LLOYD GARRISON. The rebuff of her attempt to speak at a temperance meeting in Albany in 1852 prompted her to join ELIZABETH CADY STANTON in organizing the Woman's State Temperance Society of New York. From this time she was a tireless campaigner for abolition and women's rights. During the early phase of the Civil War she helped organize the Women's National Loyal League, which urged the case for emancipation. After the war, she campaigned unsuccessfully to have the language of the Fourteenth Amendment altered to allow for woman as well as "Negro" suffrage. In 1868 she represented the Working Women's Association of New York, which she had recently organized, at the National Labor Union convention. In January 1869 she organized a woman suffrage convention in Washington, D.C., and in May she and Stanton formed the National Woman Suffrage Association (NWSA). As a test of the legality of the suffrage provision of the Fourteenth Amendment, she cast a vote in the 1872 presidential election in Rochester. She was arrested, convicted (the judge's directed verdict of guilty had been written before the trial began), and fined; though she refused to pay the fine, the case was carried no further. She served as president of the National American Woman Suffrage Association (1892–1900) and lectured throughout the country for a federal women's-suffrage amendment.

Susan B. Anthony.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Anthony of Egypt, Saint (b. 251, Koma, near al-Minyā, Heptanomis, Egypt—d. Jan. 17?, 356, Dayr Mārī Antonios hermitage, near the Red Sea; feast day January 17) Egyptian hermit considered the founder of organized Christian MONASTICISM. He began his practice of asceticism at age 20 and lived in solitude on Mount Pispir from 286 to 305. He emerged from his retreat to organize the monastic life of the hermits who had settled nearby. When the Edict of Milan (313) ended the persecution of Christians, Anthony moved to the desert between the Nile and the Red Sea. His monastic rule was compiled from writings and discourses attributed to him in Athanasius's *Life of St. Anthony* and the *Apophthegmata patrum* and was still observed in the 20th century by Coptic and Armenian monks. The hellish temptations he endured as a hermit became a popular subject for artists.

Anthony of Padua, Saint (b. 1195, Lisbon, Port.—d. June 13, 1231, Arcella, Verona; canonized 1232; feast day June 13) FRANCISCAN friar, Doctor of the Church, and patron saint of Portugal. He joined the AUGUSTINIAN order in 1210 and was probably ordained a priest. He joined the Franciscans in 1220 with the goal of seeking martyrdom among the Muslims but instead became a teacher of theology in Bologna, Italy, and in southern France. The most beloved of the followers of St. FRANCIS, he was known as a great preacher and miracle worker. He was buried in Padua, Italy, and he is the patron of that city. He is also invoked for the return of lost property.

anthophyllite \ˌan-thə-ˈfi-līt\ AMPHIBOLE mineral, a magnesium and iron silicate that occurs in altered rocks, such as the crystalline schists of Kongsberg, Norway; southern Greenland; and Pennsylvania. Anthophyllite is commonly produced by regional METAMORPHISM of ultrabasic rocks (see ACID AND BASIC ROCKS).

anthracite *or* **hard coal** Coal containing more fixed carbon than any other form of COAL and the lowest amount of volatile (quickly evaporating) material, giving it the greatest heat value. The most valuable of the coals, it is also the least plentiful, making up less than 2% of all coal reserves in the U.S., with most of the known deposits occurring in the East. Anthracites are black and have a brilliant, almost metallic lustre. Hard and brittle, they can be polished and used for decorative purposes. They are difficult to ignite but burn with a pale-blue flame and require little attention to sustain combustion. In the past they were used for

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domestic heating, but today they have given way to other sources of energy (e.g., natural gas and electricity).

anthracnose \an-'thrak-ˌnōs\ Plant disease of warm humid areas, caused by a FUNGUS (usually *Colletotrichum* or *Gloeosporium*). It infects various plants, from trees to grasses. Symptoms include sunken spots of various colours in leaves, stems, fruits, or flowers, often leading to wilting and dying of tissues. Dogwood anthracnose, caused by the fungus *Discula destructiva*, thrives in cool climates; in the U.S. it has caused severe losses to natural stands of DOGWOODS in mountainous regions. It is controlled by destroying diseased tree tissue, using disease-free seed and disease-resistant varieties, applying FUNGICIDES, and controlling insects and mites that spread anthracnose fungi from plant to plant.

anthrax \'an-ˌthraks\ Infectious disease of warm-blooded animals, caused by *Bacillus anthracis*, a bacterium that, in spore form, can retain its virulence in contaminated soil or other material for many years. A disease chiefly of herbivores, the infection may be acquired by persons handling the wool, hair, hides, bones, or carcasses of affected animals. Infection may lead to death from respiratory or cardiac complications (within 1–2 days if acute), or the animal may recover. In humans, anthrax occurs as a cutaneous, pulmonary, or intestinal infection. The most common type, which occurs as an infection of the skin, may lead to fatal septicemia (blood poisoning). The pulmonary form of the disease is usually fatal. Sanitary working environments for susceptible workers are critical to preventing anthrax; early diagnosis and treatment are also of great importance. In recent decades, various countries have attempted to develop anthrax as a weapon of BIOLOGICAL WARFARE; many factors, including its extreme potency (vastly greater than any chemical-warfare agent), make it the preferred biological-warfare agent. Concerns about anthrax mounted in 2001 after it was found in letters mailed to members of the U.S. government and news agencies.

anthropology The "study of humanity." Anthropologists study human beings in aspects ranging from the biology and evolutionary history of *Homo sapiens* to the features of society and culture that decisively distinguish humans from other animal species. Because of the diverse subject matter it encompasses, anthropology has become, especially since the middle of the 20th century, a collection of more specialized fields. PHYSICAL ANTHROPOLOGY is the branch that concentrates on the biology and evolution of humanity. The branches that study the social and cultural constructions of human groups are variously recognized as belonging to CULTURAL ANTHROPOLOGY (or ethnology), social anthropology, linguistic anthropology, and psychological anthropology. ARCHAEOLOGY, as the method of investigation of prehistoric cultures, has been an integral part of anthropology since it became a self-conscious discipline in the latter half of the 19th century.

anthroposophy \ˌan-thrə-'pä-sə-fə\ Philosophy based on the view that the human intellect has the ability to contact spiritual worlds. It was formulated in the early 20th century by RUDOLF STEINER and was influenced by THEOSOPHY. Steiner wanted to develop a faculty for spiritual perception independent of the senses, which he believed was latent in all human beings, and to this end he founded the Anthroposophical Society in 1912. Now based in Dornach, Switzerland, the society has branches worldwide.

anthurium \an-'thůr-ē-əm\ Any plant of the genus *Anthurium*, comprising about 600 tropical herbaceous species in the ARUM FAMILY, many of which are popular foliage plants. A few species are widely grown for the florist trade for their showy, long-lasting blossoms; these include the flamingo lily (*A. andraeanum*), which boasts a salmon-red flower, and the flamingo flower, or pigtail plant (*A. scherzeranum*), which has a scarlet flower.

Anti-Comintern Pact Agreement concluded first between Germany and Japan (Nov. 25, 1936) and later between Italy, Germany, and Japan (Nov. 6, 1937). The pact, sought by ADOLF HITLER, was ostensibly directed against the COMINTERN but was specifically directed against the Soviet Union. It was one of a series of agreements leading to the formation of the AXIS POWERS. Japan renounced the pact in 1939 but later acceded to the Tripartite Pact of 1940, which pledged Germany, Japan, and Italy to mutual assistance.

Anti-Corn Law League British organization founded in 1839, devoted to fighting England's CORN LAWS, regulations governing the import and export of grain. It was led by RICHARD COBDEN, who saw the laws as both morally wrong and economically damaging. The league mobilized the industrial middle classes against the landlords, and Cobden won over the prime minister, SIR ROBERT PEEL. The Corn Laws were repealed in 1846.

Anti-Federalists U.S. leaders who opposed the strong central government envisioned in the CONSTITUTION OF THE UNITED STATES of 1787. Their agitation led to the creation of the BILL OF RIGHTS. While admitting the need for changes in the ARTICLES OF CONFEDERATION, they feared that a strong federal government would infringe on STATES' RIGHTS. The group's adherents, including GEORGE MASON, PATRICK HENRY, THOMAS PAINE, SAMUEL ADAMS, and GEORGE CLINTON, were as numerous as the members of the FEDERALIST PARTY, but their influence was weak in urban areas, and only Rhode Island and North Carolina voted against ratification of the Constitution. Anti-Federalists were powerful during the presidency of THOMAS JEFFERSON, when they formed the nucleus of what later became the DEMOCRATIC PARTY.

Anti-Lebanon Mountains Mountain range along the border of Syria and Lebanon. Running parallel to the LEBANON MOUNTAINS, the range averages 6,500 ft (2,000 m) in elevation. Because of its poor soil and steep slopes, it is sparsely populated.

Anti-Masonic Movement Popular movement in the U.S. in the 1830s opposed to FREEMASONRY. The movement was ignited in 1826 by the disappearance and presumed murder of a New York bricklayer and former Mason, who had supposedly intended to reveal the order's secrets. Reaction against the Masons swept through the northeastern U.S. In 1831 the Anti-Masonic Party became the first U.S. third party and the first party to hold a national convention. It condemned Freemasonry for its secrecy and undemocratic character. Its candidate won Vermont in the 1832 election. By the late 1830s the Anti-Masonic movement had been absorbed into the WHIG PARTY.

anti-Semitism Hostility toward or discrimination against Jews as a religious group or "race." Although the term *anti-Semitism* has wide currency, it is regarded by some as a misnomer, implying discrimination against all Semites, including Arabs and other peoples who are not the targets of anti-Semitism as it is usually understood. In antiquity, hostility to the Jews emerged because of religious differences, a situation worsened as a result of the competition with Christianity. By the 4th century, Christians tended to see Jews as an alien people whose repudiation of Christ had condemned them to perpetual migration. Jews were denied citizenship and its rights in much of Europe in the Middle Ages (though some societies were more tolerant) or were forced to wear distinctive clothing, and there were forced expulsions of Jews from several regions in that period. Developed during the Middle Ages were many of the stereotypes of Jews (e.g., the blood libel, alleged greed, conspiracy against humankind) that have persisted into the modern era. The Enlightenment and the French Revolution brought a new religious freedom to Europe in the 18th century but did not reduce anti-Semitism, because Jews continued to be regarded as outsiders. In the 19th century violent discrimination intensified (see POGROM), and so-called "scientific racism" emerged, which based hostility to the Jews on their supposed biological characteristics and replaced religion as the primary basis for anti-Semitism. In the 20th century the economic and political dislocations caused by World War I intensified anti-Semitism, and racist anti-Semitism flourished in Nazi Germany. Nazi persecution of the Jews led to the HOLOCAUST, in which an estimated six million Jews were exterminated. Despite the defeat of the Nazis in World War II, anti-Semitism remained a problem in many parts of the world into the 21st century.

Anti-Slavery Society, American See AMERICAN ANTI-SLAVERY SOCIETY

antiaircraft gun ARTILLERY piece fired from the ground or shipboard in defense against aerial attack. They were first used in combat in World War I, when field artillery were converted to antiaircraft use by mountings that enabled them to fire nearly vertically. RANGE FINDERS and searchlights, developed in the 1920s and '30s, increased their effectiveness. Advances in World War II included rapid-firing and automatic weapons, RADAR for target tracking, and radio-operated fuses. British and U.S. forces used a 40-mm gun that fired ammunition to a height of 2 mi (3.2 km). Heavier GUNS, up to 120 mm, were used against high-flying bombers. For most of the war, the most effective was the German 88-mm *Fliegerabwehrkanone*; its abbreviated name, flak, became a universal term for antiaircraft fire. With the introduction of GUIDED MISSILES in the 1950s and '60s, heavy antiaircraft guns were phased out, though lighter radar-guided automatic guns remained effective against low-flying aircraft and helicopters.

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antiballistic missile (ABM) Weapon designed to intercept and destroy ballistic MISSILES. Effective ABM systems have been sought since the Cold War, when the nuclear arms race raised the spectre of complete destruction by unstoppable ballistic missiles. In the late 1960s both the U.S. and the Soviet Union developed nuclear-armed ABM systems that combined a high-altitude interceptor missile (the U.S. Spartan and Soviet Galosh) with a terminal-phase interceptor (the U.S. Sprint and Soviet Gazelle). Both sides were limited by the 1972 Treaty on Antiballistic Missile Systems to one ABM location each; the U.S. dismantled its system, while the Soviet Union deployed one around Moscow. During the 1980s the U.S. began research on an ambitious STRATEGIC DEFENSE INITIATIVE against an all-out Soviet attack, but this effort proved expensive and technically difficult, and it lost urgency with the collapse of the Soviet Union. Attention shifted to "theatre" systems such as the U.S. Patriot missile, which was used with limited effect against conventionally armed Iraqi Scud missiles during the Persian Gulf War (1990–91). In 2002 the U.S. formally withdrew from the ABM treaty in order to develop a defense against limited missile attack by smaller powers or "rogue" states.

Antibes \ä^{n}-'tēb\ *ancient* **Antipolis** Seaport (pop., 1999: 72,412), southeastern France. Located on the Mediterranean coast southwest of NICE, it was a Greek trading post established by Phocaeans c. 340 BC. It became a Roman town and eventually a fief of the Grimaldi family (see MONACO) from 1384 to 1608. It is noted as a winter resort and for its Roman ruins.

antibiotic Chemical substance that in dilute solutions can inhibit the growth of microorganisms or destroy them with little or no harm to the infected host. Early antibiotics were natural microbial products, but chemists have modified the structures of many to produce semisynthetic and even wholly synthetic ones. Since the discovery of penicillin (1928), antibiotics have revolutionized the treatment of BACTERIAL, FUNGAL, and some other diseases. They are produced by many ACTINOMYCETES (e.g., STREPTOMYCIN, TETRACYCLINE) and other BACTERIA (e.g., polypeptides such as bacitracin) and by fungi (e.g., PENICILLIN). Antibiotics may be broad-spectrum (active against a wide range of pathogens) or specific (active against one, or one class). Drawbacks include activity against beneficial microorganisms, often causing DIARRHEA; ALLERGIES; and development of drug-resistant strains of the targeted microorganisms.

antibody Molecule in the IMMUNE SYSTEM that circulates in blood and LYMPH in response to invasion by an ANTIGEN. Antibodies are GLOBULINS formed in LYMPHOID TISSUES by B CELLS, whose receptors are specialized to bind to a specific antigen. These receptors are copied as antibodies that attack the target antigens by binding to them, either neutralizing them or triggering a COMPLEMENT reaction. Antibodies have widely varying binding sites, providing protection from a wide range of infectious agents and toxic substances. Antibodies derived from the blood serum of infected people or animals are often given in an antiserum for quick immunization against fast-acting toxins or microbes. In 1975 CÉSAR MILSTEIN and colleagues developed a process for producing specific antibodies in virtually limitless amounts; these monoclonal antibodies can deliver radiation or drugs directly to specific antigens. See also ANTITOXIN; RETICULOENDOTHELIAL SYSTEM.

Antichrist Chief enemy of Christ who would reign at the end of time, first mentioned in the epistles of St. JOHN. The idea of a mighty ruler who will appear at the end of time to fight against the forces of good was adapted from Judaism; the Jewish concept in turn had been influenced by Iranian and Babylonian myths of the battle of God and the DEVIL at the end of time. In the Book of DANIEL the evil one is a military leader modeled on ANTIOCHUS IV EPIPHANES, who persecuted the Jews. In several books of the New Testament, the Antichrist is a tempter who works by signs and wonders and seeks divine honors. It was a potent concept in medieval Christianity that received the attention of many commentators including Adso of Montier-en-Der, whose work became the basic medieval treatise on the Antichrist. During the Middle Ages, popes and emperors struggling for power often denounced each other as the Antichrist, and during the Reformation, MARTIN LUTHER and other Protestant leaders identified the papacy itself as the Antichrist.

anticoagulant Substance that prevents blood from clotting by suppressing the synthesis or function of various clotting factors (see COAGULATION). Anticoagulants are given to prevent THROMBOSIS and used in drawing and storing blood. There are two main types of anticoagulants: HEPARIN and vitamin K antagonists (e.g., WARFARIN). The latter have longer-lasting effects, interfering in the liver's metabolism of VITAMIN K to cause production of defective clotting factors. Anticoagulant therapy carries a high risk of uncontrollable HEMORRHAGE.

Anticosti Island Island, Gulf of ST. LAWRENCE. Lying at the mouth of the ST. LAWRENCE RIVER in southeastern Quebec, it is 140 mi (225 km) long; its greatest width is 35 mi (56 km). Visited by JACQUES CARTIER in 1534, it became part of Quebec province in 1774. Port-Menier is its present-day—and only—settlement. It is now primarily a recreation area.

antidepressant Any drug used to treat DEPRESSION. The three main types inhibit the metabolism of SEROTONIN and NOREPINEPHRINE in the brain. The aim is to keep these monoamine NEUROTRANSMITTERS from dropping to levels associated with depression. The drugs may take a few weeks to show any effect. Tricyclic antidepressants, which inhibit inactivation of norepinephrine and serotonin, help more than 70% of patients. Monoamine oxidase (MAO) inhibitors apparently block the action of MAO, an enzyme that helps break down norepinephrine, serotonin, and DOPAMINE in neurons. They have unpredictable side effects and are usually given only when tricyclic drugs do not help. Selective serotonin reuptake inhibitors (SSRIs) apparently block reabsorption only of serotonin, allowing its levels to build up in the brain. SSRIs, which include fluoxetine (trade name Prozac), often help with depression unrelieved by tricyclics or MAO inhibitors and have milder side effects.

antidote Remedy to counteract the effects of a POISON or TOXIN. Administered by mouth, intravenously, or sometimes on the skin, it may work by directly neutralizing the poison; causing an opposite effect in the body; binding to the poison to prevent its absorption, inactivate it, or keep it from fitting a receptor at its site of action; or binding to a receptor to prevent the poison's binding there, blocking its action. Some poisons are not active until converted to a different form in the body; their antidotes interrupt that conversion.

Antietam \an-'tē-təm**, Battle of** (Sept. 17, 1862) Decisive and bloody battle of the AMERICAN CIVIL WAR that halted the Confederate advance on Maryland. Following victory in the Second Battle of BULL RUN, Gen. ROBERT E. LEE moved his troops into Maryland with an eye to capturing Washington, D.C. They were stopped by Union troops under GEORGE B. MCCLELLAN at Antietam Creek, Md. Confederate casualties numbered some 13,700, and Union losses were about 12,400. McClellan was criticized for allowing Lee's forces to retreat to Virginia, but the victory encouraged Pres. ABRAHAM LINCOLN to issue a preliminary EMANCIPATION PROCLAMATION.

antifreeze Any substance that lowers the FREEZING POINT of WATER, protecting a system from the ill effects of ice formation. Antifreezes such as ETHYLENE GLYCOL or propylene glycol commonly added to water in automobile cooling systems prevent damage to radiators. Additives to prevent freezing of water in gasoline (e.g., Drygas) usually contain METHANOL or isopropanol. Organisms that must survive freezing temperatures use various chemicals to inhibit ice crystal formation in their cells and tissues: GLYCEROL or DIMETHYL SULFOXIDE in insects, glycerol or trehalose in other invertebrates (NEMATODES, ROTIFERS), and PROTEINS in Antarctic fishes.

antigen \'an-ti-jən\ Foreign substance in the body that induces an immune response. The antigen stimulates LYMPHOCYTES to produce antibodies or to attack the antigen directly (see ANTIBODY;IMMUNITY). Virtually any large foreign molecule can act as an antigen, including those of bacteria, viruses, parasites, foods, venoms, blood components, and cells and tissues of various species, including other humans. Sites on the antigen's surface fit and bind to receptor molecules on the lymphocytes' surface, stimulating the latter to multiply and initiate an immune response that neutralizes or destroys the antigen.

Antigone \an-'ti-gə-nē\ In Greek legend, the daughter born of the incestuous relationship between OEDIPUS and his mother, Jocasta. After Oedipus had blinded himself in self-punishment, Antigone and her sister Ismene served as his guides, following him into exile. When he died, Antigone returned to THEBES, where her brothers Eteocles and Polyneices were at war. Both were killed, and Creon, the new king, declared that because Polyneices was a traitor, his corpse should remain unburied. Unwilling to let the body be defiled, Antigone buried him; when Creon condemned her to death, she hanged herself. Her story was dramatized by SOPHOCLES and EURIPIDES (in Euripides' version she escapes and joins her beloved, Haemon).

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Antigonid dynasty (306–168) Ruling house of ancient Macedonia. ANTIGONUS I was proclaimed king in 306 BC after his son Demetrius conquered Cyprus, thus giving his father control of the Aegean, the eastern Mediterranean, and most of the Middle East. Under Demetrius II (r. 239–229 BC), Macedonia was weakened by war with the Greek ACHAEAN and AETOLIAN leagues. Antigonus III (d. 221) reestablished the Hellenic Alliance, restoring Macedonia to a strong position in Greece. Under PHILIP V, Macedonia first clashed with Rome, in 215. Philip's defeat upset the old balance of power, and Rome became the decisive force in the eastern Mediterranean. The defeat of his successor, PERSEUS, at Pydna in 168 BC marked the end of the dynasty.

Antigonus I Monophthalmus \an-'tig-ə-nəs...-ˌmän-əf-'thal-məs\ *or* **Antigonus I Cyclops** *Latin* **"One-Eyed"** (b. 382—d. 301 BC, Phrygia, Asia Minor) Founder of the Macedonian dynasty of the ANTIGONIDS. He served as a general under ALEXANDER THE GREAT. From the plots, alliances, and wars among Alexander's successors, he emerged in control of Asia Minor and Syria, though he soon relinquished the lands east of the Euphrates to SELEUCUS I NICATOR. In 307 his son DEMETRIUS I ousted the governor of Athens and conquered Cyprus, giving Antigonus control of the eastern Mediterranean, the Aegean, and Asia Minor. In 306 he was proclaimed king of the empire by the assembled army. In 302 he and his son renewed the Panhellenic League (consisting of all the Hellenic states except Sparta, Messenia, and Thessaly), in order to ensure peace in Hellas and protect Antigonus. His dreams of taking Macedonia itself and Alexander's entire former empire died with him at the Battle of IPSUS (301), the only battle he ever lost.

Antigonus II Gonatas \'gän-ət-əs\ (b. c. 320—d. 239 BC) King of Macedonia (276–239 BC). The son of DEMETRIUS I POLIORCETES, he defeated the Gauls in Greece (279) and in Asia Minor (277), occupied key cities, and made alliances. He defeated PYRRHUS of Epirus in Greece (272) to solidify his control in Macedonia. In the Chremonidean War (267–261), he achieved lasting victory over Egypt, Sparta, and Athens. He allied with the AETOLIAN LEAGUE and local tyrants to stave off incursions of the ACHAEAN LEAGUE. His defeat of the Egyptian fleet at Andros (244?) assured Macedonian hegemony in the Aegean.

Antigua and Barbuda \an-'tə-gə...bär-'byü-də\ Island country, Lesser ANTILLES, Caribbean Sea. It consists of three islands: Antigua, Barbuda, and Redonda. Area: 171 sq mi (442 sq km). Population (2005 est.): 77,800. Capital: ST. JOHN'S (on Antigua). The majority of the population are descendants of African slaves brought in during colonial times. Language: English (official). Religion: Christianity (mostly Protestant; also Roman Catholic). Currency: Eastern Caribbean dollar. The largest of the islands is Antigua (108 sq mi [280 sq km]), which lacks forests, mountains, and rivers and is subject to droughts. The main anchorage is the deepwater harbour of St. John's. Barbuda—25 mi (40 km) north of Antigua, 62 sq mi (161 sq km) in area, and mostly uninhabited—is home to a large bird sanctuary; its only human settlement is Codrington, on the western coast. Redonda, an uninhabited rock (0.5 sq mi [1.3 sq km]), lies southwest of Antigua. Tourism is the mainstay of the country's economy; offshore banking is growing. CHRISTOPHER COLUMBUS visited Antigua in 1493 and named it after a church in SEVILLA, Spain. It was colonized by English settlers in 1632, who imported African slaves to grow tobacco and sugarcane. Barbuda was colonized by the English in 1678. In 1834 the islands' slaves were emancipated. Antigua (with Barbuda) was part of the British colony of the Leeward Islands from 1871 until that colony was defederated in 1956. The islands achieved full independence in 1981. See map opposite.

antihistamine \ˌan-ti-'his-tə-ˌmēn, ˌan-ti-'his-tə-mən\ Synthetic drug that counteracts the effects of released HISTAMINE in the body. Antihistamines compete with histamine at one of the three types of histamine receptors, preventing allergic attacks (see ALLERGY) or INFLAMMATION. Some antihistamines also prevent MOTION SICKNESS and VERTIGO. Drowsiness is a frequent side effect. H_2 antihistamines, which bind to the second receptor type, are used to control gastric-acid secretion (see STOMACH) and treat PEPTIC ULCERS.

Antilles \an-'til-ēz**, Greater and Lesser** Two groups of islands in the WEST INDIES, bounding the Caribbean Sea on the north and east, respectively. The Greater Antilles include the largest islands (Cuba, Jamaica, Hispaniola, and Puerto Rico), the Lesser Antilles all being much smaller. The name Antilia originally referred to semimythical lands located somewhere west of Europe across the Atlantic. After CHRISTOPHER COLUMBUS's discoveries, the Spanish name Antillas was commonly assigned to the new lands; "Sea of the Antilles" in various European languages is used as an alternative name for the Caribbean Sea.

antimatter Substance composed of elementary particles having the MASS and ELECTRIC CHARGE of ordinary matter (such as ELECTRONS and PROTONS) but for which the charge and related magnetic properties are opposite in sign. The existence of antimatter was posited by the electron theory of P.A.M. DIRAC. In 1932 the POSITRON (antielectron) was detected in COSMIC RAYS, followed by the antiproton and the antineutron detected through the use of PARTICLE ACCELERATORS. Positrons, antiprotons, and antineutrons, collectively called antiparticles, are the antiparticles of electrons, protons, and neutrons, respectively. When matter and antimatter are in close proximity, ANNIHILATION occurs within a fraction of a second, releasing large amounts of ENERGY.

antimetabolite \ˌan-ti-mə-'ta-bə-ˌlīt\ Substance that competes with, replaces, or inhibits a specific compound within a CELL, whose functioning is thereby disrupted. Because its structure resembles the compound's, it is taken up by the cell, but it does not react in the same way with the ENZYME that acts on the usual compound. It may inhibit the enzyme or be converted into an aberrant chemical. Many antimetabolites are useful in treating disease, including SULFA DRUGS, which disrupt bacterial but not human METABOLISM for bacterial diseases, and others (e.g., methotrexate, 5-fluorouracil) for various cancers.

antimony \'an-tə-ˌmō-nē\ Semimetallic to metallic chemical ELEMENT (see METAL), chemical symbol Sb, atomic number 51. Of its various ALLOTROPES, the most common is a lustrous, bluish, brittle, flaky solid. In nature

antimony occurs chiefly as the gray SULFIDE MINERAL STIBNITE, Sb_2S_3. Pure antimony metal has no important uses, but its ALLOYS and compounds are extremely useful. Some antimony alloys have the rare quality of expanding on solidifying; these are used for castings and for type metal. Alloys with lead are used in car BATTERIES, bullets, and cable sheaths. Antifriction alloys with tin and lead (babbitt metals) are used as components of machine bearings. Antimony COMPOUNDS (VALENCES 3, 4, and 5) are widely used as flame retardants in paints, plastics, rubber, and textiles; others are used as paint pigments.

antinovel Type of avant-garde novel that departs from traditional novelistic conventions by ignoring such elements as plot, dialogue, and human interest. Seeking to overcome readers' habits and challenge their expectations, antinovelists deliberately avoid any intrusion of authorial personality, preferences, or values. Though the term was coined by JEAN-PAUL SARTRE in 1948, the approach is at least as old as the works of the

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18th-century writer Laurence Sterne. Writers of such works include Nathalie Sarraute, Claude Simon, Alain Robbe-Grillet, Uwe Johnson, and Rayner Heppenstall.

Antioch \'an-tē-ˌäk\ *Turkish* **Antakya** \ˌän-tä-'kyä\ City (pop., 1997: 139,046), southern Turkey. Founded in 300 BC by the Seleucid dynasty, Antioch was the centre of the Seleucid power until 64 BC, when it became the capital of the province of Syria under the Roman Republic and Empire. An early centre of Christianity, the city was the headquarters of St. Paul c. AD 47–55. Despite being briefly occupied by the Persians in the 6th century, it remained part of the Byzantine Empire until the Arab invasion of the 7th century. Thereafter it returned to Byzantine rule (969) and was seized by the Turkish Seljūq dynasty (1084) before being captured by the Crusaders in 1098. (See Crusades.) From 1268 it was ruled by the Mamlūk dynasty, and it was absorbed by the Ottoman Empire in 1517. The city remained under their control until World War I (1914–18), when it was transferred to Syria. It was made part of the Republic of Turkey in 1939. The economy of the modern town is based on agriculture and light manufacturing.

Antiochus I Soter \an-'tī-ə-kəs...'sō-ter\ (b. c. 324—d. 261 BC) King of Seleucid Syria in the east (292?–281 BC) and later overall (281–261). Son of Seleucus I, he consolidated the Seleucid kingdom, founded numerous cities, and expanded trade routes. In 281 he contended with revolts in Syria and northern Anatolia and fought a war with Antigonus II Gonatas. With the defeat of the Gauls in Greece (279), he and Antigonus signed a pact of nonintervention. The Gauls in Asia Minor were not defeated until 275, after which he was hailed as Soter ("Saviour") by appreciative Ionians. He settled Greeks in Asia Minor and Persia to counter invasions, and he worked to revive Babylonian culture. Though he won Phoenicia and the coast of Asia Minor from Egypt, he soon lost them, and in 261 he lost much of northern Asia Minor to Pergamum.

Antiochus III *known as* **Antiochus the Great** (b. 242—d. 187 BC, near Susa, Iran) Seleucid king of the Syrian empire (223–187 BC). After quelling a rebellion by Achaeus, his governor in Asia Minor (213), Antiochus marched east to India (212–205). He forged a peaceful alliance with Armenia and forcible ones with Parthia and Bactria, stilling resistance to his campaign. After the death of Ptolemy IV, Antiochus and Philip V of Macedonia divided most of his empire, Antiochus taking the southern and eastern lands, including Palestine (c. 202). He then marched against Egypt, concluding a peace in 195, through which he acquired southern Syria and Ptolemy's territories in Asia Minor. Rome grew angry with Antiochus after he admitted Hannibal of Carthage to his court; when Antiochus took a force to defend the Aetolians against Rome, Rome struck against him, eventually defeating him at Magnesia (189). He gave up lands in Europe and western Asia Minor but kept Syria, Mesopotamia, and western Iran. He was murdered while exacting much-needed tribute near Susa.

Antiochus III, coin, late 3rd–early 2nd century BC; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Antiochus IV Epiphanes \i-'pif-ə-ˌnēz\ (b. c. 215—d. 164 BC, Tabae, Iran) Seleucid king of the Hellenistic Syrian kingdom (175–164 BC). Son of Antiochus III, he was taken hostage in Rome (189–175), where he learned about Roman institutions. On his release, he ousted a usurper to take over Syria. He conquered Egypt except Alexandria (169) and ruled Egypt as regent for his nephew Ptolemy VI. The Roman defeat of his Macedonian allies neutralized his victories in Cyprus and Egypt (168), and he was forced to leave both, though he kept southern Syria. He took Jerusalem (167) and enforced its Hellenization; Jewish rites were forbidden on pain of death. In 164 Judas Maccabaeus and the anti-Greek Jews conquered Judaea except for the Acra in Jerusalem (164), tore down the altar of Zeus, and reconsecrated the Temple. Antiochus then turned to defending his empire against the Parthians in the east, regained Armenia, and went on to the Arabian coast before dying in Persis.

antioxidant Any of various compounds added to certain foods, natural and synthetic rubbers, gasolines, and other products to retard autoxidation (combination with oxygen in the air at room temperature) and its effects. Aromatic compounds such as aromatic amines, phenols, and aminophenols delay loss of elasticity in rubber and gummy deposits in gasoline. Preservatives such as tocopherol (vitamin E), propyl gallate, butylated hydroxytoluene (BHT), and butylated hydroxyanisole (BHA) prevent rancidity in fats, oils, and fatty foods. In the body, antioxidants such as vitamins C and E and selenium may reduce oxidation caused by free radicals.

Antipater \an-'tip-ə-tər\ (d. 43 BC) Founder of the Herodian dynasty in Palestine. Born in Idumaea, a region of southern Judaea, he gained power by helping the Romans, and in return, Julius Caesar appointed him procurator of Judaea in 47 BC. He was assassinated by a rival four years later, but his son, Herod the Great, was made king of Judaea.

Antiphon \'an-ti-ˌfän\ (fl. c. 480–411 BC) Orator and statesman. The first Athenian known to practice rhetoric professionally, he wrote speeches for others to give in court but was reluctant to appear in public debate. He may have instigated the revolution of the oligarchic Council of the Four Hundred, an attempt to seize the Athenian government in the midst of war. When the oligarchy fell, he defended his role in the overthrow in a speech called by Thucydides the greatest defense ever made, but he was nonetheless executed for treason.

antipope In Roman Catholicism, a person who tries to take the place of the legitimately elected pope. Some antipopes were elected by factions in doctrinal disagreements, and others were chosen in double elections arbitrated by secular authorities or picked as third candidates in an effort to resolve such disputes. The earliest of the antipopes appeared in the 3rd century. During the Investiture Controversy, Henry IV appointed an antipope, and several more antipopes claimed the papal office over the next 200 years as a result of disputed elections or further struggles with secular rulers. The principal age of the antipope came after the papal court was moved from Rome to Avignon in the 14th century (see Avignon papacy), an event that led to the Western Schism of 1378–1417. During this era, the popes now considered canonical were elected in Rome, and the antipopes were elected in Avignon.

Antirent War (1839–46) Civil protest by leaseholding farmers in upper New York state. Protesting outdated laws based on semifeudal leaseholding practices of the early Dutch estate owners, the leaseholders of Albany county in 1839 refused to pay back rent. The governor called out the militia to quell the violence. Sporadic acts of resistance against rent and tax collection spread across the state, and in 1845 the governor declared martial law. In 1846 a new state constitution abolished the leasehold system.

antiseptic Any of a variety of agents applied to living tissue to destroy or inhibit growth of infectious microorganisms. An antiseptic's efficiency depends on concentration, time, and temperature. It is most valuable in the disinfection of contaminated wounds or skin surfaces when a wide margin exists between the concentration at which it is germicidal and that at which it is toxic to the body's cells. Many antiseptics destroy specific types or forms of microorganisms (e.g., bacteria but not spores). Among the major families of antiseptics are alcohols, phenols, chlorine and iodine compounds, mercury-based tinctures, certain acridine dyes, and some essential oils. Antiseptics are distinguished from disinfectants, which are germicidal agents used to destroy microorganisms on inanimate surfaces. See also antibiotic.

antitank weapon Any of several guns, missiles, and mines intended for use against tanks. Land mines, ordinary artillery, and other projectiles were used to destroy tanks in World War I. By World War II antitank guns had been developed; they frequently fired special ammunition such as the hollow charge shell, which exploded on impact with great penetrating force. Various antitank missiles and launching devices, including the bazooka, were also used in the war.

antitoxin Antibody formed in the body in reaction to a bacterial toxin, which it can neutralize. People who have recovered from bacterial diseases often develop specific antitoxins that give them immunity against recurrence. Injecting an animal (usually a horse) with increasing doses of toxin produces a high concentration of antitoxin in the blood. The resulting highly concentrated preparation of antitoxins is called an antiserum. The first antitoxin developed (1890) was specific to diphtheria; today, antitoxins are also used to treat botulism, dysentery, gas gangrene, and tetanus.

antitrust law Any law restricting business practices that are considered unfair or monopolistic. Among U.S. laws, the best known is the Sherman Antitrust Act of 1890, which declared illegal "every contract,

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combination…or conspiracy in restraint of trade or commerce." The Clayton Antitrust Act of 1914, as amended in 1936 by the Robinson-Patman Act, prohibits discrimination among customers through prices or other means; it also prohibits mergers or acquisitions whenever the effect may be "to substantially lessen competition." Labour unions are also subject to antitrust laws.

antlion Insect (family Myrmeleontidae) known in its larval stage for its aggressive capture of prey. The antlion LARVA digs a funnel-shaped sandy pit by using its oval, bristled abdomen, then buries itself in the pit with only its powerful jaws uncovered. Any small insect that ventures over the pit's edge slips to the bottom and is seized by the antlion, which sucks the contents of its victim and throws out the empty skin. The adult antlion does not feed. The best known of the 65 described species occurs in North America and Europe.

Antlion
WILLIAM E. FERGUSON

Antofagasta \ˌän-tō-fä-'gäs-tä\ Seaport (pop., 1999: est.: 243,038), capital of Antofagasta region, northern Chile. Located on Moreno Bay, it was a Bolivian city until it was taken by Chile in 1879 (see War of the PACIFIC). Its early growth resulted from the nitrate boom that began in 1866 and from the Caracoles silver discovery in 1870. The largest city of northern Chile, it remains a supply source for the mines and is a communications centre on the PAN-AMERICAN HIGHWAY.

Antonello da Messina \ˌan-tō-'nel-ō-dä-mā-'sē-nə\ (b. c. 1430, Messina, Sicily—d. c. Feb. 19, 1479, Messina) Italian painter. Trained in Naples, then a cosmopolitan art centre, he studied the Flemish artists, notably JAN VAN EYCK. Based on these experiences, when he returned to Venice he introduced oil painting and Flemish pictorial techniques into mid-15th-century Venetian art. His major works were altarpieces and portraits. In Venice he executed the San Cassiano altarpiece, of which three fragments remain. His portrait busts in three-quarter view, combining Flemish detail with Italian grandeur, became fashionable. Antonello's practice of building form with colour rather than line and shade greatly influenced the subsequent development of Venetian painting. See also VENETIAN SCHOOL.

"Portrait of a Man," panel painting by Antonello da Messina, c. 1472; in the National Gallery, London.
COURTESY OF THE TRUSTEES OF THE NATIONAL GALLERY, LONDON

Antonescu \ˌan-tə-'nes-kü**, Ion** (b. June 15, 1882, Piteşti, Rom.—d. June 1, 1946, near Jilava) Romanian marshal. He served in World War I and later became chief of staff (1934) and minister of defense (1937). Appointed prime minister in 1940, he established a fascist dictatorship and openly supported the Axis Powers. Initially he won broad support for his domestic reforms and declaration of war against the Soviet Union (1941), but that support eroded. His regime was overthrown in 1944, and he was later executed as a war criminal.

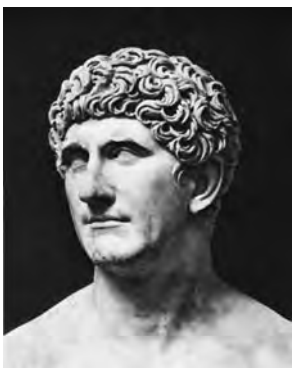
Antonine Wall Roman frontier barrier in Britain. It ran 37 mi (59 km) across Scotland between the River Clyde and the Firth of Forth. Ordered by ANTONINUS PIUS and built in AD 142 by the governor of Britain, it was about 15 ft (5 m) wide and 10 ft (3 m) high; a ditch 40 ft (12 m) wide and 12 ft (4 m) deep ran in front of it and a road behind. It was controlled by 19 forts spaced at intervals of 2 mi (3 km). Its construction moved the northern boundary of Roman Britain into Scotland, providing defense against the northern tribes beyond HADRIAN'S WALL, which lay to the south. The wall was abandoned by 196, but traces remain.

Antoninus Pius \ˌan-tə-'nī-nəs-'pī-əs\ *in full* **Caesar Titus Aelius Hadrianus Antoninus Augustus Pius** (b. Sept. 19, 86, Lanuvium, Latium—d. March 7, 161, Lorium, Etruria) Roman emperor (AD 138–161). Of Gallic origins, he served as consul (120) before being assigned judicial administrative duties in Italy. He later governed the province of Asia (c. 134). He became an adviser to HADRIAN and in 138 was made Hadrian's heir. On accession he had the deceased emperor declared a god; for such dutiful acts he was named Pius ("Pious"). He quelled rebellions in Britain and other provinces and built the ANTONINE WALL.

Antoninus Pius, marble bust; in the British Museum.
REPRODUCED BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Antonioni \ˌan-ˌtō-nē-'ō-nē**, Michelangelo** (b. Sept. 29, 1912, Ferrara, Italy) Italian film director and producer. He wrote film reviews and studied filmmaking before directing his short film *The People of the Po Valley* (1947). His first major film, *The Girl Friends* (1955), was followed by the international successes *L'avventura* (1960), *Eclipse* (1962), and *Blow-up* (1966). His other films include *The Red Desert* (1964), *Zabriskie Point* (1970), and *The Passenger* (1974). In Antonioni's films, plot and dialogue are subordinated to the visual image, which becomes a metaphor of human existence rather than a record of it.

Antony, Mark *Latin* **Marcus Antonius** (b. c. 83—d. August, 30 BC) Roman general. After military service (57–54), he joined the staff of his relative Julius CAESAR. He helped Caesar drive POMPEY from Italy in 49 and in 44 was made co-consul. After Caesar's assassination, Octavian (later Caesar AUGUSTUS) initially opposed Antony but later formed the Second TRIUMVIRATE with Antony and Lepidus. Antony helped defeat republican forces at PHILIPPI and took control of Rome's eastern provinces. On a mission to Egypt to question CLEOPATRA about her loyalty, he became her lover (41–40). He returned to Italy in 40 to settle differences with Octavian, whereupon he received command of the eastern provinces. To strengthen his position, he agreed to marry Octavian's sister Octavia. When relations with Octavian again collapsed, he headed for Syria and sent for Cleopatra for aid. Octavian sent Octavia to him, and, when Antony ordered her back to Rome, a fatal breach opened. The Triumvirate ended in 32, leaving Antony little support in Rome. He divorced Octavia, and Octavian declared war on Cleopatra. Antony lost the Battle of ACTIUM, and he and Cleopatra fled to Egypt, pursued by Octavian. When resistance became futile, they committed suicide.



Mark Antony, detail of a marble bust; in the Vatican Museum.
ALINARI/ART RESOURCE

Antrim Town and district (pop., 2001: 48,366), Northern Ireland. It is also the name of a former Northern Irish county. The town borders Lough NEAGH. In 1798 it was the scene of a battle in which several thousand nationalist insurgents led by Henry J. McCracken were defeated by the British. A busy market centre, Antrim town was formerly an important locale for the linen industry. The area has evidence of human inhabitation dating to c. 6000 BC. Anglo-Norman adventurers arrived in the 12th century AD, and the area became part of the earldom of Ulster. The invasion by Edward Bruce from Scotland in 1315 caused the decline of British power. In the 1973 administrative reorganization of Northern Ireland, the county was divided into several districts.

Antwerp *French* **Anvers** \ä^{n}-'ver\ *Flemish* **Antwerpen** \'änt-ˌver-pən\ City (pop., 2000 est.: 446,500), capital of Antwerp province, Belgium. One of the world's major seaports, it is located 55 mi (88 km) southeast of the North Sea. Because it lies in the Flemish-speaking part of Belgium, it plays the role of unofficial capital of FLANDERS. It

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received municipal rights in 1291 and became a member of the Hanseatic League by 1315. As a distribution centre for Spanish and Portuguese trade, it became the commercial and financial capital of Europe in the 16th century. Following destructive invasions it went into decline but began to revive after Napoleon's improvement of the harbour c. 1803. It was part of the Kingdom of the Netherlands (1815–30), then was ceded to Belgian nationalists. Its current economic life centres around shipping, port-related activities, and major manufacturing.

antyesti \ant-'yes-tē\ Hindu funeral rites. They generally involve cremation followed by disposal of the ashes in a sacred river. As soon as possible after death, the body is removed to the cremation grounds, usually on the riverbank. The eldest son of the deceased and a priest perform the final rites. For 10 days, the mourners are considered impure as they perform rites intended to provide the soul of the deceased with a new spiritual body for the next life. At a prescribed date, the bones are collected and buried or immersed in a river.

Anu \'ä-ˌnü\ Mesopotamian sky god. He belonged to a triad that included Bel and Ea. Though he was the highest god, his role in mythology, hymns, and cult was small. The father of all gods, evil spirits, and demons, and the god of kings and the calendar, he was depicted with headdress and horns signifying strength. His Sumerian counterpart, An, was originally envisaged as a great bull; he probably began as a god of herders.

Anu \'ä-ˌnü**, Chao** (b. 1767—d. 1835, Bangkok, Siam) Ruler of the central Lao kingdom of Vientiane (r. 1804–29). In his youth Anu fought with the Siamese against the Burmans (Burmese) and won Siamese respect for his military prowess. Chosen by them to be king of Vientiane, he undertook major public works and cultivated good relations with Vietnam. He had the Siamese appoint his son ruler of the southern Lao principality of Champassak and began to plot a rebellion for Lao independence. His armies nearly reached Bangkok, but the revolt was quelled and Vientiane was sacked and later razed. Anu fled to the forests but was captured, punished, and killed.

Anubis \ə-'nü-bəs\ Ancient Egyptian god of the dead, represented as a jackal or as a man with the head of a jackal. In the Early Dynastic period and the Old Kingdom he was preeminent as lord of the dead, but he was later overshadowed by Osiris. Anubis was associated with the care of the dead and was credited with the invention of embalming, an art he first practiced on the corpse of Osiris. Later assigned the role of conducting souls into the underworld, he was sometimes identified in the Greco-Roman world with Hermes.

Anuradhapura \ə-'nür-ə-də-ˌpür-ə\ (c. 3rd century BC–10th century AD) Sinhalese kingdom centred at Anuradhapura in Sri Lanka. Though plagued by invasions from southern India (which took actual control of the kingdom several times) and internal strife among warring clans, the kingdom of Anuradhapura developed a high degree of culture. Its complex irrigation system is often considered its major achievement. The modern city of Anuradhapura (pop. 2001 prelim.: 56,632) contains vast Buddhist ruins and a bo tree grown from a slip of the tree under which the historical Buddha is said to have reached Enlightenment.

Anvers See Antwerp

anvil Iron block on which metal is placed for shaping, originally by hand with a hammer. The blacksmith's anvil is usually of wrought iron (sometimes of cast iron), with a smooth working surface of hardened steel. A projecting conical beak, or horn, at one end is used for hammering curved pieces of metal. When power hammers are used, the anvil is supported on a heavy block, which in turn rests on a strong foundation of timber and masonry or concrete. See also smithing.

anxiety In psychology, a feeling of dread, fear, or apprehension, often with no clear justification. Anxiety differs from true fear in that it is typically the product of subjective, internal emotional states rather than a response to a clear and actual danger. It is marked by physiological signs such as sweating, tension, and increased pulse, by doubt concerning the reality and nature of the perceived threat, and by self-doubt about one's capacity to cope with it. Some anxiety inevitably arises in the course of daily life and is normal; but persistent, intense, chronic, or recurring anxiety not justified by real-life stresses is usually regarded as a sign of an emotional disorder. See also stress.

Anzio \'änt-sē-ˌō\ Seaport and resort town (pop., 2001 prelim.: 36,468) southeast of Rome, Italy. It was founded, according to legend, by Anteias, son of Odysseus and Circe. It was a stronghold of the Volsci in the 5th century BC. Conquered by Rome in 338 BC, Antium (as it was then known) became a resort for wealthy Romans. Nero and Caligula were born there. Destroyed by the Saracens in the 9th–10th centuries, it remained virtually deserted until 1698, when Pope Innocent XII built a new port nearby. In 1944 it was the scene of a bloody but successful amphibious landing by Allied forces during World War II.

ANZUS Pact *officially* **Pacific Security Treaty** Security pact for the South Pacific, signed in 1951 by Australia, New Zealand, and the U.S. (hence its acronym). The U.S. first suggested a pact to Australia in the wake of the U.S.-Japan Security Treaty and fears of Japanese rearmament. The signatories agreed to maintain a consultative relationship for their collective security. In the 1980s New Zealand refused to let ships carrying nuclear weapons dock at its ports; the U.S., refusing to identify its nuclear-armed ships, suspended its treaty obligations to New Zealand in 1986, and the treaty has since been nonoperative with reference to New Zealand.

aorta Artery that carries blood from the heart to all the organs and structures of the body. Where the left ventricle opens into the aorta, a valve prevents backflow of blood into the heart. The aorta ascends from the heart, arches over it to the left, then descends into the trunk. Arteries branch off along its length until it divides at hip level into arteries that go to the legs.

aorta, coarctation of the Congenital disorder involving narrowing of a short section of the aorta's arch over the heart. It causes a characteristic murmur, abnormally high blood pressure in the arms, and reduced blood flow to the abdomen, pelvis, and legs. It increases the workload of the left ventricle, which usually becomes enlarged. Surgical reconstruction or replacement (depending on the person's age) of the narrowed area is most effective in the young.

Aosta \ä-'ȯs-tä\ City (pop., 2001: 33,926), capital of Valle d'Aosta region, northwestern Italy. Located at the juncture of the Great and Little St. Bernard Pass roads through the Alps, it was a stronghold of the Salassi, a Celtic tribe subdued by the Romans in 25 BC. A Roman town was founded there by Augustus in 24 BC, and many Roman structures survive, including the walls, two gates, and a triumphal arch in honour of Augustus. Aosta was the birthplace of St. Anselm.

Ruins of Roman theatre, Aosta, Italy.
MARZARI—SCALA FROM ART RESOURCE

AP See Associated Press

Apache North American Indians of the southwestern U.S. Their name is a Zuni word meaning "enemy." Most Apaches live on five reservations in Arizona and New Mexico, U.S. Culturally, the Apache are divided into Eastern Apache, which include the Mescalero, Jicarilla, Chiricahua, and

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Lipan, and Western Apache, which include the Cibecue. The Eastern Apache were predominantly HUNTING AND GATHERING SOCIETIES, while their Western counterparts relied more on farming. Their ancestors had come down from the north, as is evident from their languages; Apachean languages are distantly related to other Athabascan languages spoken in Canada. They settled the Plains, but with the introduction of the horse they were pressed south and west by the COMANCHE and UTE. They attempted to befriend the Spanish, the Mexicans, and later the U.S. In 1861, however, there began a quarter-century confrontation between U.S. military forces and the Apache and NAVAJO. The Apache wars were among the fiercest fought on the frontier. The last ended in 1886 with the surrender of GERONIMO. The Chiricahua Apache were evacuated from the West and held successively in Florida, Alabama, and Oklahoma. In the 2000 U.S. census some 57,000 people claimed sole Apache descent. See also COCHISE.

Apamea Cibotus \ˌa-pə-'mē-ə-si-'bō-təs\ City of Hellenistic PHRYGIA, near modern Dinar, Turkey. The city was built by ANTIOCHUS I (Antiochus Soter) in the 3rd century BC on the Maeander (MENDERES) River. Superseding the fortress city of Celaenae, it was placed in a commanding position on the great east-west trade route of the SELEUCID DYNASTY. In the 2nd century BC Apamea passed to the rule of the ROMAN REPUBLIC AND EMPIRE and became an important centre for Italian and Jewish traders. Declining after the 3rd century AD, it was captured by Turkish invaders in 1070 and thereafter was destroyed by an earthquake.

apartheid \ə-'pär-ˌtāt\ (Afrikaans: "apartness" or "separateness") Policy of RACIAL SEGREGATION and political and economic discrimination against non-European groups in South Africa. The term was first used as the name of the official policy of the NATIONAL PARTY in 1948, though racial segregation, sanctioned by law, was already widely practiced. The Group Areas Act of 1950 established residential and business sectors in urban areas for each "race" and strengthened the existing "pass" laws, which required nonwhites to carry identification papers. Other laws forbade most social contacts between those of European descent and others, authorized segregated public facilities, established separate educational standards, restricted each group to certain types of jobs, curtailed nonwhite labour unions, denied nonwhite participation in the national government, and established various black African "homelands," partly self-governing units that were nevertheless politically and economically dependent on South Africa. These so-called homelands were not recognized by international governments. Apartheid was always subject to internal criticism and led to many violent protests, strikes, and acts of sabotage; it also received international censure. In 1990–91 most apartheid legislation was repealed, but segregation continued on a de facto basis. In 1993 a new constitution enfranchised blacks and other racial groups, and all-race national elections in 1994 produced a coalition government with a black majority. These developments marked the end of legislated apartheid, though not of its entrenched social and economic effects. See also AFRICAN NATIONAL CONGRESS; RACISM.

apatite A member of the PHOSPHATE group of minerals, the world's major source of phosphorus, found as variously coloured, glassy crystals, masses, or nodules. Much of it has a chemical composition approximating $Ca_5(PO_4)_3(F,Cl,OH)$. If not for its softness, apatite would be a popular gemstone; some of the material found is clear, but it is fragile and difficult to cut and polish.

Apatosaurus \ə-ˌpa-tə-'sȯr-əs\ Genus of giant herbivorous dinosaur, one of the largest land animals of all time. *Apatosaurus* lived between 147 million and 137 million years ago during the Late Jurassic and Early Cretaceous Periods in North America and Europe. It weighed as much as 30 tons and was as long as 70 ft (21 m), including the very long neck and tail. Formerly known as *Brontosaurus* because of incomplete fossil evidence, its head was depicted until 1978 as massive and snub-nosed, with spoonlike teeth; scientists now know the animal had a slender, elongated skull and long, peglike teeth. Skeletal evidence indicates that, despite their great bulk, apatosaurs were primarily land animals.

ape Any of the tailless PRIMATES known as the lesser apes (GIBBONS and siamangs; family Hylobatidae) or the great apes (CHIMPANZEES, BONOBOS, ORANGUTANS, and GORILLAS; family Hominidae). Apes are found in the tropical forests of western and central Africa and South Asia. They are distinguished from monkeys by having no tail, having an appendix, and having a more complex brain. Apes typically move about by swinging or knuckle-walking, though they are capable of standing erect and occasionally walk on two feet. Highly intelligent animals, apes are very closely related to humans, who are also categorized by zoologists as members of Hominidae. As a result of habitat destruction and hunting, all the apes are now regarded as endangered.

APEC *in full* **Asia-Pacific Economic Cooperation** Trade group established in 1989 in response to the growing interdependence of Asia-Pacific economies and the advent of regional economic blocs (such as the European Union and the North American Free Trade Area) in other parts of the world. APEC works to raise living standards and education levels through sustainable economic growth and to foster a sense of community and an appreciation of shared interests among Asia-Pacific countries. At the end of the 1990s APEC's membership included its 12 founding members—Australia, Brunei, Canada, Indonesia, Japan, South Korea, Malaysia, New Zealand, the Philippines, Singapore, Thailand, and the United States—as well as Chile, China, Hong Kong, Mexico, Papua New Guinea, Peru, Russia, Taiwan, and Vietnam. The Pacific Economic Cooperation Council, the South Pacific Forum, and the secretariat of the Association of Southeast Asian Nations maintain observer status. The APEC group represents about 40% of the world's population, 40% of global trade, and 50% of the world's gross national product. See also NAFTA; TRADE AGREEMENT; WORLD TRADE ORGANIZATION.

apella \ə-'pe-lə\ Ancient Spartan assembly, similar to the ECCLESIA of other Greek states. The *apella*, whose monthly meetings were open to citizens over age 30, did not initiate proposals. It could only consider matters submitted by the EPHORS or the GEROUSIA. Voting was by shouts. Its business included treaties, wars, and succession; it named commanders, elected elders and ephors, and voted on changes in the laws.

Apelles \ə-'pe-ˌlēz\ (fl. late 4th century–early 3rd century BC) Greek painter. He studied under Pamphilus and was court painter to PHILIP II of Macedonia and his son, ALEXANDER THE GREAT. Notable works included a portrait of Alexander, an allegorical picture of Calumny, and a painting of Aphrodite rising from the sea. A master of composition and chiaroscuro, he was noted for his technical improvements; he used a dark glaze to preserve his paintings and soften their colour. Though no copies of his works survive, in antiquity he was considered the greatest of Greek painters.

Apennines \'a-pə-ˌnīnz\ Mountain range, central Italy. It stretches some 840 mi (1,350 km) from near Savona in the northwest to REGGIO DI CALABRIA in the south, its width varying from 25 to 80 mi (40–130 km). Monte Corno is its highest peak, at 9,560 ft (2,915 m). The range is the source of most of Italy's rivers, including the ARNO, TIBER, Volturno, and Garigliano. It is famous for its hill towns, including FLORENCE, Arezzo, L'AQUILA, and Benevento.

Apgar Score System Rating procedure to identify newborns needing life-sustaining medical assistance. It was developed in 1952 by Virginia Apgar (1909–1974). Five signs, keyed to Apgar's name—Appearance (color), Pulse, Grimace (reflex irritability), Activity (muscle tone), and Respiration—measure adaptation to leaving the uterus. The maximum score is 10. If the total score at one and then five minutes after birth is less than 7, the infant is reevaluated every five minutes for 20 minutes or until two consecutive scores of 7 or more are obtained.

aphasia \ə-'fā-zhə\ *or* **dysphasia** \dis-'fā-zhə\ Defect in the expression and comprehension of words, caused by damage to the frontal and temporal lobes of the brain. It can result from head trauma, tumour, stroke, or infection. Symptoms vary with the brain area involved, and the ability to put words in a meaningful order may be lost. Speech therapy may be useful. In some cases, improvement may be due to assumption of some language functions by other areas of the brain.

aphid \'ā-fəd', a-fəd\ Any of several species of sapsucking, soft-bodied INSECTS (order Homoptera) that are about the size of a pinhead, with tube-like projections on the abdomen. Serious plant pests, they stunt plant growth, produce plant GALLS, transmit plant viral diseases, and deform leaves, buds, and flowers. ANTS may take care of aphids, protecting them from weather and natural enemies and transferring them from wilted to healthy plants. The ants in turn obtain honeydew, a sweet product excreted by aphids, which the ants retrieve by "milking" the aphids (stroking their abdomens).

aphorism Terse formulation of any generally accepted truth or sentiment conveyed in a pithy, memorable statement. The term was first used in the *Aphorisms* of HIPPOCRATES, a long series of propositions concerning disease and the art of healing. Aphorisms were used especially in dealing

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with subjects for which principles and methodology developed relatively late, including art, agriculture, medicine, jurisprudence, and politics, but in the modern era they have usually been vehicles of wit and pithy wisdom. Celebrated modern aphorists include Friedrich Nietzsche and Oscar Wilde.

aphrodisiac \ˌa-frə-ˈdē-zē-ˌak\ Any of various forms of stimulation thought to arouse sexual excitement. They may be psychophysiological (arousing the senses of sight, touch, smell, or hearing) or internal (e.g., foods, alcoholic drinks, drugs, love potions, medicinal preparations). Most foods traditionally believed to be aphrodisiacs have no chemical components that would have such an effect. In some cases, their reputation may be based on a supposed resemblance to genitalia (e.g., ginseng root, rhinoceros horn). Drugs such as alcohol or marijuana may lead to sexual excitation by lessening the user's inhibitions. Few medical studies have been conducted; the only substances medically recognized as aphrodisiacs are extremely hazardous to the health.

Aphrodite \ˌa-frə-ˈdī-tē\ Greek goddess of sexual love and beauty. She is also associated with the sea and, according to legend, was born of sea foam arising from the genitals of Uranus. Sparta, Thebes, and Cyprus honored her as a goddess of war. Many scholars believe that her cult is Semitic rather than Greek in origin. According to Homer, she was the daughter of Zeus and his consort Dione, and she married Hephaestus but betrayed him with Ares. She had many mortal lovers. Her main centres of worship were on the islands of Cyprus and Cythera and at Corinth. As a fertility goddess, she is associated with Eros, the Graces, and the Horae (seasons). Venus is her Roman counterpart.

Apia \ä-ˈpē-ä\ Seaport town (pop., 2001: 38,836) and capital, Samoa. It lies on the northern coast of Upolu Island. Its economy centres on the export of goods to American Samoa. Robert Louis Stevenson is buried at nearby Mount Vaea; Vailima, his former home, is now the residence of the head of state.

apiculture See beekeeping

Apis \ˈā-pəs\ In ancient Egyptian religion, a sacred bull deity worshiped at Memphis. The cult originated at least as early as the 1st dynasty (c. 2925–c. 2775 BC). Apis was probably at first a fertility god but became associated with Ptah and also with Osiris and Sokaris, gods of the dead. When an Apis bull died, it was buried with great pomp, and the calf that was to be its successor was installed at Memphis. Apis's priests drew omens from the bull's behaviour, and his oracle had a wide reputation. The worship of Serapis (a combination of Osiris and Apis) probably arose at Memphis in the 3rd century BC and became one of the most widespread Oriental cults in the Roman Empire.

Apis, bull deity, painted on the bottom of a wooden coffin, *c.* 700 BC; in the Roemer und Pelizaeus Museum, Hildesheim, Ger.
BAVARIA VERLAG

aplastic \ā-ˈplas-tik\ **anemia** *or* **anemia of bone-marrow failure** Inadequate blood-cell formation by bone marrow. Pancytopenia is the lack of all blood-cell types (erythrocytes, leukocytes, and platelets), but any combination may be missing. Drug, chemical, or radiation exposure most often causes the disease, but about half of all cases have no known cause. It may occur at any age. Acute disease may be quickly severe, even fatal; chronic disease has symptoms including weakness, shortness of breath, headache, fever, and pounding heart. There is usually a waxy pallor. Hemorrhages occur in mucous membranes, skin, and other organs. Lack of white blood cells lowers resistance to infection and becomes the major cause of death. Very low platelet count may lead to severe bleeding. The treatment of choice is bone-marrow transplantation. Otherwise treatment involves avoiding any known toxic agent and giving fluids, glucose, and proteins (often intravenously) as well as blood components and antibiotics.

aplite *or* **haplite** Any igneous rock of simple composition, such as granite composed only of alkali feldspar, muscovite mica, and quartz; in a more restricted sense, uniformly fine-grained (less than 0.08 in., or 2 mm), light-coloured igneous rocks that have a characteristic granular texture. Unlike pegmatite, which is similar but much coarser-grained, aplite occurs in small bodies that rarely contain zones of different minerals. The two rocks may occur together and are assumed to have formed at the same time from similar magmas.

Apo \ˈä-pō**, Mt.** Active volcano, Mindanao, Philippines. Located west of Davao City, it is the highest point in the Philippines, at 9,690 ft (2,954 m). In 1939 its slopes and immediate vicinity were incorporated into Mount Apo National Park, which includes numerous peaks and valleys as well as Malasita Falls and Sibulao Lake.

apocalypse \ə-ˈpä-kə-ˌlips\ In many Western religious traditions, the period of catastrophic upheaval expected to occur just before the end of the world, when God will come to sit in judgment on humankind. The belief that the world will come to a violent and cataclysmic end exists in Judaism and Christianity as well as in Zoroastrianism. Several of the prophetic works of the Hebrew Scriptures, notably the book of Daniel, include visions of the apocalypse. The book of Revelation (or Apocalypse) gives a dark and dramatic picture of the end of time, when the wicked will be punished and the good will triumph through God's intervention. The approach of the Last Days is expected to be marked by famines, wars, earthquakes, plagues, and other natural disasters, along with signs in the heavens. Today apocalyptic themes are emphasized by various religious groups (e.g., fundamentalist Christians) and have also been taken up by science-fiction writers. See also eschatology; millennialism.

Apocrypha \ə-ˈpä-krə-fə\ In biblical literature, works outside an accepted canon of scripture. In modern usage the Apocrypha refers to ancient Jewish books that are not part of the Hebrew Bible but are considered canonical in Roman Catholicism and Eastern Orthodoxy. Among the various books included are Tobit, Judith, Baruch, and the Maccabees as well as Ecclesiasticus and the Wisdom of Solomon. Protestant churches follow Jewish tradition in judging these works apocryphal or noncanonical. The term deuterocanonical is used to refer to works accepted in one canon but not all. Pseudepigrapha are spurious works for which biblical authorship is claimed.

Apollinaire \ȧ-pȯ-lē-ˈner**, Guillaume** *orig.* **Guillelmus (or Wilhelm) Apollinaris de Kostrowitzky** (b. Aug. 26, 1880, Rome?, Italy—d. Nov. 9, 1918, Paris, Fr.) French poet of Polish-Italian birth. Arriving in Paris at age 20, Apollinaire always kept his early years obscure. In his short life he took part in all the avant-garde movements that flourished at the beginning of the 20th century. His poetry was characterized by daring, even outrageous, technical experiments. Because of his efforts to create an effect of surprise by means of unusual verbal associations and word patterns, he is often considered the herald of Surrealism. His poetic masterpiece was *Alcools* (1913). His death resulted from a head wound received in World War I.

Apollinaire, drawing by Pablo Picasso from the frontispiece to *Calligrammes*, 1918
H. ROGER-VIOLLET

Apollo Most widely revered of the Greek gods. He communicated the will of his father Zeus, made humans aware of their guilt and purified them of it, presided over religious and civil law, and foretold the future. His bow symbolized distance, death, terror, and awe; his lyre symbolized music, poetry, and dance. As a patron of the arts, he was often associated with the Muses. He was also a god of crops and herds. He became associated with the sun, and was even identified with Helios, the sun god. Also associated with healing, he was the father of Asclepius. By tradition, Apollo and his twin, Artemis, were born at Delos to Leto. Apollo's oracle was established at Delphi; the Pythian Games commemorated his killing (while still an infant) of the serpent Python to take the shrine. His many lovers fared poorly: the fleeing Daphne became a laurel tree; the unfaithful Coronis was shot by Artemis, and Cassandra, who rejected him, was doomed to utter true prophecies no one would believe. See photograph opposite page.

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Apollo NASA manned Moon-landing project of the 1960s and '70s. The Apollo spacecraft, supplied with their own low-powered rockets, could brake on approach to the Moon and go into lunar orbit. They also could release part of the spacecraft, the lunar module, with its own rocket power, to land astronauts on the Moon and bring them back to the lunar orbiter. In July 1969 Apollo 11 made the first lunar landing (see Edwin Aldrin; Neil Armstrong). In 1970 Apollo 13 was damaged by an explosion in an oxygen tank but returned safely to Earth. Later Apollo missions explored the lunar surface extensively, collecting samples of Moon rocks and installing instruments for research. Apollo 17, the program's final lunar flight, took place in 1972. In total, 12 American astronauts walked on the Moon during six successful lunar-landing missions.

Apollo asteroid See Earth-crossing asteroid

Apollo Theatre During and after the Harlem Renaissance, a centre of African-American popular music on 125th Street in New York City's Harlem district. Built in 1914, it hosted musical performers such as Bill Robinson, Billie Holiday, Bessie Smith, Ethel Waters, Duke Ellington, and others in the 1930s and '40s; stars such as Ella Fitzgerald, Sarah Vaughan, and James Brown were discovered on Wednesday amateur nights. In the 1960s the Apollo featured soul artists such as the Supremes, Stevie Wonder, and Marvin Gaye. Converted into a movie theatre in 1975, it was reopened as a performance venue in 1983.

Apollonius Dyscolos \ˌap-ə-ˈlō-nē-əs-ˈdis-kə-ləs\ (fl. 2nd century AD) Greek grammarian. Apollonius is considered the founder of the systematic study of grammar. Priscian based his work on the writings of Apollonius. Four of Apollonius's works survive: *On Syntax* and the shorter treatises *On Pronouns*, *On Conjunctions*, and *On Adverbs*.

Apollonius of Perga (b. c. 240 BC, Perga, Anatolia—d. c. 190 BC, Alexandria, Egypt) Mathematician known as "The Great Geometer." His *Conics* was one of the greatest scientific treatises of the ancient world. In it he introduced the terms *parabola*, *ellipse*, and *hyperbola*. Because *Conics* was fundamental to later advances in optics and astronomy in the Islamic world, a 9th-century Arabic translation survived to fill in for some of the missing Greek original. Generally, his other writings survive only as titles.

Apollonius of Rhodes (b. c. 295 BC) Greek poet and grammarian. He served as librarian of the famous Library of Alexandria. His *Argonautica*, a romantic epic in four books about the Argonauts, is derived from Homer and is noted for its suggestive similes, vivid descriptions of nature, and fresh handling of old episodes.

apologetics Branch of Christian theology devoted to the intellectual defense of faith. In Protestantism, apologetics is distinguished from polemics, the defense of a particular sect. In Roman Catholicism, apologetics refers to the defense of the whole of Catholic teaching. Apologetics has traditionally argued positively to quell believers' doubts and negatively against opposing beliefs to remove obstacles to conversion. It attempts to take objections to Christianity seriously without giving ground to skepticism. Biblical apologetics defended Christianity as the culmination of Judaism, with Jesus as the Messiah. In the 2nd and 3rd centuries a number of Christian writers defended the faith against the criticisms of Greco-Roman culture, and in the 5th century St. Augustine wrote his monumental *City of God* as a response to further criticisms of Christianity following the sack of Rome in 410. John Calvin's "natural theology" attempted to establish religious truths by rational argument. The late 18th-century argument that a universe exhibiting design must have a designer continues to be used; apologists have also dealt with the challenges of Darwinism, Marxism, and psychoanalysis. See also Apologist.

Apollo Belvedere, restored Roman copy of the Greek original attributed to Leochares, 4th century BC; in the Vatican Museum, Rome
ALINARI—ART RESOURCE/EB INC.

Apologist Any of the Christian writers, primarily in the 2nd century, who attempted to provide a defense of Christianity against Greco-Roman culture. Many of their writings were addressed to Roman emperors and were submitted to government secretaries in order to defend Christian beliefs and practices. The Apologists tried to prove the antiquity of Christianity as the fulfillment of Old Testament prophecy, and they argued that the worshipers of the mythological gods were truly godless. They also insisted on the philosophical nature of their faith and its high ethical standards. Greek Apologists include Justin Martyr and Clement of Alexandria. Latin Apologists of the 2nd century include Tertullian. See also apologetics.

apology In literature, an autobiographical form in which a defense is the framework for discussion of the author's personal beliefs. Examples include Plato's *Apology* (4th century BC), in which Socrates answers his accusers by giving a history of his life and moral commitment, and John Henry Newman's *Apologia pro Vita Sua* (1864), an examination of the principles that inspired his conversion to Roman Catholicism.

apomixis \ˌa-pə-ˈmik-səs\ Reproduction by special tissues without fertilization. Examples include parthenogenesis in animals (in which a new individual develops from an unfertilized egg) and apogamy in plants (in which the generating tissue may be either the gametophyte or the sporophyte). Apomixis provides for the preservation of traits favourable to individual survival, but it eliminates the longer-term evolutionary advantage of genetic contribution from two parents.

apoptosis \ˌa-pəp-ˈtō-səs\ *or* **programmed cell death** Mechanism that allows cells to self-destruct when stimulated by the appropriate trigger. It may be initiated when a cell is no longer needed, when a cell becomes a threat to the organism's health, or for other reasons. The aberrant inhibition or initiation of apoptosis contributes to many disease processes, including cancer. Though embryologists had long been familiar with the process of programmed cell death, not until 1972 was the mechanism's broader significance recognized. Apoptosis is distinguished from necrosis, a form of cell death that results from injury.

Apostle Any of the 12 disciples chosen by Jesus. They were Peter, James and John (sons of Zebedee), Andrew, Philip, Bartholomew, Matthew, Thomas, James (son of Alphaeus), Thaddaeus or Judas (son of James), Simon the Cananaean or Zealot, and Judas Iscariot. The 12 were privileged to attend Jesus continually and receive his teaching. Peter, James, and John formed an inner circle and were allowed to witness such events as the Transfiguration and the agony of Jesus at Gethsemane. After the defection and death of Judas Iscariot, Matthias was elected an Apostle. Paul also claimed the title on the ground that he had seen the Lord and been commissioned by him.

Apostolic succession \ˌa-pə-ˈstä-lik\ In Christianity, the doctrine that bishops represent an uninterrupted line of descent from the Apostles of Jesus. This succession gives bishops special powers, including the right to confirm church members, ordain priests, consecrate bishops, and rule over the clergy and church members of a diocese. Clement, bishop of Rome, stated the doctrine as early as AD 95, and it is accepted by Roman Catholic, Eastern Orthodox, Old Catholic, and several other churches. Some Protestant churches maintain that succession is spiritual and doctrinal rather than ritual and historical.

apotheosis \ə-ˌpä-thē-ˈō-səs\ Elevation to the status of a god. The term recognizes that some individuals cross the dividing line between human and divine. Ancient Greek religion was disposed to belief in heroes and demigods, and historical figures were sometimes worshiped as gods. Until the end of the republic the Romans accepted only one apotheosis, identifying the god Quirinus with Romulus. The emperor Augustus ordered Julius Caesar recognized as a god and thus began a tradition of deifying emperors.

apotropaic eye \ˌa-pə-trō-ˈpā-ik\ Painting of a large eye or eyes used to ward off evil. The symbol appears most commonly on Greek drinking vessels from the 6th century BC and was perhaps thought to keep dangerous spirits from entering the mouth with the wine. It is also used in Turkish and Egyptian art.

Appalachian Geosyncline Great downbuckle in the Earth's crust in the region of the present Appalachian Mountains. It was in the Appalachians that James Hall first worked out the geosynclinal theory of mountain building (see geosyncline).

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Appalachian Mountains Mountain system, eastern North America. The Appalachians, among the oldest mountains on Earth, extend almost 2,000 mi (3,200 km) from the Canadian province of Newfoundland and Labrador in the northeast southwestward to Alabama in the U.S. They include the White Mountains in New Hampshire, the Green Mountains in Vermont, the Catskill Mountains in New York, the Allegheny Mountains primarily in Pennsylvania, the Blue Ridge Mountains in Virginia and North Carolina, the Great Smoky Mountains in North Carolina and Tennessee, and the Cumberland Plateau extending from West Virginia to Alabama. Their highest peak is Mount Mitchell in North Carolina. See also Appalachian Geosyncline; Appalachian National Scenic Trail.

Appalachian National Scenic Trail Footpath, Appalachian Mountains, U.S. Extending over 2,000 mi (3,200 km) from Mount Katahdin, Maine, to Springer Mountain, Georgia, along the crest of the mountains, the trail passes through 14 states, 8 national forests, and 2 national parks. Hikers and volunteers maintain the shelters and campsites. The trail's highest point is Clingmans Dome (6,643 ft [2,025 m]) in the Great Smoky Mountains. With its first section opened in 1923, the trail was completed in 1937 and became part of the National Trail System established by the U.S. Congress in 1968.

Appalachian orogenic \ˌȯr-ə-ˈje-nik\ **belt** Mountain range that extends more than 1,860 mi (3,000 km) along the eastern margin of North America, from Alabama to Newfoundland. It was formed by the progressive eastward addition of material to the continental margin of North America. The earliest Appalachian sediments were deposited near the start of the Cambrian Period.

Appalachian Revolution See Alleghenian orogeny

Appaloosa Colour breed of horse popular in the U.S. It is said to have descended in the Nez Percé Indian territory of North America from wild mustangs, which in turn descended from the horses of Spanish explorers. Appaloosas have several distinctive colour patterns and all the regular coat colours of horses. They stand 14–16 hands (about 56–64 in. [142–163 cm]) tall and weigh 1,000–1,100 lbs (450–500 kg). Though light, they are also sturdy.

Appaloosa
SALLY ANNE THOMPSON

appanage \ˈa-pə-nij\ In France, primarily from the 13th to the 16th century, the giving of lands or pensions to children of the royal family. Established to provide for the younger brothers and sisters of the king, appanages also helped develop royal administration within the lands concerned. The Ordinance of Moulins (1566) made royal lands inalienable, so all appanages would eventually revert to the crown. They were abolished during the French Revolution but were briefly reestablished between 1810 and 1832.

appeal Resort to a higher court to review the decision of a lower court, or to any court to review the order of an administrative agency. Its scope is usually limited. In the U.S., the higher court reviews only matters in the record of the original trial; no new evidence can be presented. The Supreme Court of the United States hears appellate cases that it regards as having important implications; otherwise, appeals generally stop with the United States Courts of Appeals. See also certiorari.

appeasement Foreign policy of pacifying an aggrieved nation through negotiation in order to prevent war. The prime example is Britain's policy toward Fascist Italy and Nazi Germany in the 1930s. Neville Chamberlain sought to accommodate Italy's invasion of Ethiopia in 1935 and took no action when Germany absorbed Austria in 1938. When Adolf Hitler prepared to annex ethnically German portions of Czechoslovakia, Chamberlain negotiated the notorious Munich Agreement.

Appel \ˈä-pel**, Karel** (b. April 25, 1921, Amsterdam, Neth.) Dutch painter, sculptor, and graphic artist. He attended Amsterdam's Royal Academy of Fine Arts (1940–43) and was cofounder of the COBRA group of northern European Expressionists. In 1950 he moved to Paris; by the 1960s he had settled in New York City. An exponent of expressive abstraction, he developed a painting style characterized by thick layering of pigment, violent colour and brushwork, and crude, reductive figures. His figurative sculptures are executed in metal and wood. He painted portraits of jazz musicians and a number of public works, including a mural in the Paris UNESCO building.

appendix *in full* **vermiform appendix** Vestigial hollow tube attached to the cecum of the large intestine. The human appendix, usually 3–4 in. (8–10 cm) long and less than 0.5 in. (1.3 cm) wide, has no digestive function. Its muscular walls expel their own mucous secretions or any intestinal contents that enter it. Blockage of the opening may prevent expulsion and cause appendicitis: fluids collect, bacteria propagate, and the appendix becomes distended and inflamed; tissue in the appendix begins to die, and the organ may burst, causing peritonitis. Its symptoms may begin with moderate pain in the upper abdomen, about the navel, or all over the abdomen. Nausea and vomiting may then develop. The pain may shift to the right lower abdomen. Fever is usually present but is seldom high in the early phases. Differentiating acute appendicitis from other causes of abdominal pain requires careful examination. Treatment is removal of the appendix (appendectomy).

Appian Way \ˈa-pē-ən\ *Latin* **Via Appia.** First and most famous of the ancient Roman roads, running from Rome to Campania and southern Italy. Begun in 312 BC by the censor Appius Claudius Caecus, the road originally ran 132 mi (212 km) to ancient Capua; by 244 BC it extended 230 mi (370 km) to the port of Brundisium (Brindisi) in Italy's heel. Built of smoothly fitted blocks of lava on a heavy stone foundation, the road provided a long-lasting surface for transporting merchandise to these seaports (and thence by ship to Greece and the eastern Mediterranean). Remains can be seen today outside Rome.

apple Fruit of the genus *Malus*, in the rose family, the most widely cultivated tree fruit. *Malus* species are native to the temperate zones of both hemispheres. They require a considerable period of dormancy, well-drained soil, careful pruning in early years of growth, and a rigorous pest-management program for mature trees. The apple is one of the pome (fleshy) fruits. Apples at harvest vary widely in size, shape, colour, and acidity, but most are fairly round and some shade of red or yellow. The thousands of varieties fall into three broad classes: cider, cooking, and dessert varieties. Varieties that ripen in late summer generally do not store well, but those that ripen in late autumn may be stored for as long as a year. The largest producers of apples are the U.S., China, France, Italy, and Turkey. Eaten fresh or cooked in various ways, apples provide vitamins A and C, carbohydrates, and fibre.

Apple Computer, Inc. Microcomputer design and manufacturing company, the first successful personal-computer company. It was founded in 1976 by Steven P. Jobs and Stephen G. Wozniak, whose first computer was manufactured in the Jobs family's garage. The Apple II (1977), with its plastic case and colour graphics, launched the company to success, earning Apple over $100 million by 1980, the year the company first offered stock to the public. The 1981 introduction of IBM's PC, running a Microsoft Corp. operating system, marked the beginning of long-term competition for Apple in the personal-computer market. The Macintosh, introduced in 1984, was the first personal computer to use a graphical user interface and a mouse. The "Mac" initially sold poorly, and Jobs left the company in 1985, but eventually it found its niche in the desktop publishing market. Meanwhile, Microsoft's Windows operating system eroded Apple's market share. Apple recalled Jobs in 1997. He returned the company to profitability by introducing more innovative products, such as the iMac. Apple introduced iTunes, software for playing music that has been converted to the MP3 format, and the iPod portable MP3 music player in 2001; in 2003 the company began selling downloadable copies of major record company songs in MP3 format over the Internet.

apple scab Disease of apple trees caused by the fungus *Venturia inaequalis*, producing dark blotches or lesions on the leaves, fruit, and sometimes young twigs. Affected plants may drop their fruit prematurely, resulting in potentially high crop losses. Apple scab is found wherever apples are grown but is most severe where spring and summer are cool and moist. All apple species are affected. Regular spraying with fungicides is the most effective method of controlling the disease.

Appleseed, Johnny *orig.* **John Chapman** (b. Sept. 26, 1774, Leominster, Mass.—d. March 18?, 1845, near Ft. Wayne, Ind., U.S.) U.S. pioneer and folk hero. He was trained as a nurseryman and began c. 1800 collecting apple seeds from cider presses in Pennsylvania. He then traveled west to the Ohio River valley, planting apple seeds along the way. He tended 1,200 acres of his own orchards and was responsible for hun-

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dreds of square miles of others, having sold or given away thousands of apple seedlings to pioneers. His kind and generous nature, devout spirituality, affinity for the Indians and the wilderness, and eccentric appearance (including bare feet, a coffee-sack shirt, and a mush pan for a hat) helped make him a figure of legend.

applied psychology Branch of PSYCHOLOGY concerned with solving practical problems of human behaviour by using the findings and methods of psychological science. INTELLIGENCE testing, legal problems, industrial efficiency, MOTIVATION, and delinquency were among the first areas of application in the early 20th century. World Wars I and II fostered work on vocational testing, teaching methods, evaluation of attitudes and morale, performance under stress, PROPAGANDA and PSYCHOLOGICAL WARFARE, and rehabilitation. The aviation and aerospace industries were important for the development of engineering psychology, the study of human-machine relationships. Other areas include CONSUMER PSYCHOLOGY, SCHOOL PSYCHOLOGY, and community psychology. See also INDUSTRIAL-ORGANIZATIONAL PSYCHOLOGY; PSYCHOMETRICS.

appliqué See QUILTING

Appomattox \ˌa-pə-ˈma-təks\ **Court House** Former town, southern central Virginia, U.S., site of the surrender of ROBERT E. LEE to ULYSSES S. GRANT on April 9, 1865, effectively ending the AMERICAN CIVIL WAR. It was virtually deserted after the removal of the county seat to the new town of Appomattox in 1892. It became a national historical monument in 1940 and a national historical park in 1954.

apprenticeship Training in an art, trade, or craft under a legal agreement defining the relationship between master and learner and the duration and conditions of their relationship. Known from antiquity, apprenticeship became prominent in medieval Europe with the emergence of the craft GUILDS. The standard apprenticeship lasted seven years. During the INDUSTRIAL REVOLUTION a new kind of apprenticeship developed in which the employer was the factory owner and the apprentice, after a period of training, became a factory worker. The increasing need for semiskilled workers led to the development of vocational and technical schools in Europe and the U.S., especially after World War II. Some industries in the U.S., such as construction, continue to employ workers in an apprenticeship arrangement.

approximation, linear See LINEAR APPROXIMATION

APRA \ˈä-prä\ *in full* **Alianza Popular Revolucionaria Americana** Party founded by Víctor Raúl HAYA DE LA TORRE (1924), which dominated Peruvian politics for decades. Largely synonymous with the so-called Aprista movement, it was dedicated to Latin American unity, the nationalization of foreign-owned enterprises, and an end to the exploitation of Indians. Supported by workers and middle-class liberals, the party wielded significant power, but conservative forces took extraordinary measures to prevent Haya de la Torre from ever gaining the presidency. An APRA candidate, Alan García, finally became president in 1985. See also INDIGENISMO.

apraxia \ā-ˈprak-sē-ə\ Disturbance in carrying out skilled acts, caused by a lesion in the CEREBRAL CORTEX; motor power and mental capacity remain intact. Motor apraxia is the inability to perform fine motor acts. Ideational apraxia is loss of the ability to plan even a simple action. In ideokinetic apraxia, there is no coordination between formation of ideas and motor activity; affected persons can do certain things automatically but not deliberately. Constructional apraxia is the inability to put together elements to form a meaningful whole.

apricot Fruit of the tree *Prunus armeniaca*, in the ROSE family, cultivated generally throughout the temperate regions of the world and used fresh, cooked in pastries, or preserved by canning or drying. Apricot trees are large and spreading, with heart-shaped, dark green leaves. Flowers are white. The fruit is nearly smooth and generally similar to the PEACH in shape but with little to no hairiness when ripe. Apricots are a good source of vitamin A and are high in natural sugars. Dried apricots are an excellent source of iron.

April Fools' Day *or* **All Fools' Day** First day of April, named for the custom of playing practical jokes on that date. Though it has been observed for centuries in several countries, including France and Britain, its origin is unknown. It resembles the Hilaria festival of ancient Rome (March 25) and the HOLI festival of India (ending March 31). The custom of playing April Fools' jokes was brought to America by the British.

April Theses Program developed by VLADIMIR ILICH LENIN during the RUSSIAN REVOLUTION OF 1917, calling for Soviet control of state power. In the theses, published in April 1917, Lenin advocated seizing power from the Provisional Government, withdrawing from World War I, and distributing land among the peasantry. The theses contributed to the JULY DAYS uprising and the Bolshevik coup d'état in October.

apse Semicircular or polygonal termination to the choir, chancel (see CATHEDRAL), or aisle of a public building, first used in pre-Christian Roman architecture. Originally a large niche to hold the statue of a deity in a temple, the apse also appeared in ancient baths and BASILICAS. The domed apse became a standard part of the Christian church plan.

Apse, basilica of S. Vitale, Ravenna, 526–547
ALINARI—ART RESOURCE

Apuleius \ˌa-pə-ˈlā-əs**, Lucius** (b. c. AD 124, Madauros, Numidia—d. after 170?) Roman Platonic philosopher, rhetorician, and author. His *The Golden Ass*, a prose narrative of the ribald adventures of a young man who is changed into an ass, was long influential. This novel, considered a revelation of ancient manners, is valuable for its description of the ancient religious mysteries. Apuleius's philosophical treatises include three books on PLATO, two of which survive.

Apulia See PUGLIA

Apure \ä-ˈpü-rā\ **River** River, western Venezuela. The major navigable tributary of the ORINOCO RIVER, the Apure rises in the Cordillera de Mérida and flows about 510 mi (820 km) northeast and east through the heart of Venezuela's Llanos (plains), the country's principal cattle-raising area.

Apurímac \ˌä-půr-ˈē-ˌmäk\ **River** River, southern Peru. Arising in the ANDES MOUNTAINS in Peru, it is the most distant source of the AMAZON RIVER. It flows northwest to join the URUBAMBA RIVER and form the UCAYALI RIVER. For most of its 430-mi (700-km) length, it flows through narrow canyons, and its course is interrupted by falls and rapids. Short stretches of its lower course are also called the Ene River and the Tambo River.

Āqā Khān See AGA KHAN

Aqaba \ˈä-kə-bə**, Gulf of** Northeastern arm of the RED SEA, between Saudi Arabia and the SINAI PENINSULA. It varies in width from 12 to 17 miles (19 to 27 km) and is 100 miles (160 km) long. Its head touches Egypt, Israel, Jordan, and Saudi Arabia. Its only sheltered harbour is Dhahab (Dahab), Egypt; Jordan and Israel created the ports of Al-ʿAqabah and Elat, respectively, as outlets to the Red Sea and the INDIAN OCEAN.

Aqhat Epic \ˈä-kät\ Ancient West Semitic legend explaining the earth's barrenness during the dry summer months, known only in fragmentary form from three tablets excavated in northern Syria and dating to about the 14th century BC. It records the birth of a prince, Aqhat, in response to prayers. As a youth, Aqhat comes into possession of a bow intended for the goddess ANATH and is killed by her when he refuses to part with it. His death brings famine, and his father and sister set out to avenge him, but there the text ends.

Aqmola See ASTANA

aquaculture *or* **fish farming** *or* **mariculture** \ˈmar-ə-ˌkəl-chər\ Rearing of fish, shellfish, and some aquatic plants to supplement the natural supply. Fish are reared in controlled conditions worldwide. Though most aquaculture supplies the commercial food market, many governmental agencies engage in it to stock lakes and rivers for sport fishing. It also supplies goldfish and other decorative fish for home aquariums and bait fish for sport and commercial fishing. CARP, TROUT, CATFISH, TILAPIA, SCALLOPS, MUSSELS, LOBSTERS, and OYSTERS are well-known species raised through aquaculture.

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aquamarine Pale greenish blue or bluish green variety of BERYL that is valued as a gemstone. The most common variety of gem beryl, it occurs in PEGMATITES, in which it forms much larger and clearer crystals than EMERALD, the dark green variety of beryl. Aquamarine occurs in Brazil, which is the chief source, and in such other sites as the Ural Mountains, Madagascar, Sri Lanka, India, and Maine, New Hampshire, Connecticut, North Carolina, and Colorado in the U.S. Heat treatment is commonly used to improve the colour of gem beryls.

aquarium Receptacle for maintaining aquatic organisms, either freshwater or marine, or a facility in which a collection of aquatic organisms is displayed or studied. The first display aquarium opened in Regent's Park, England, in 1853. Many of the world's principal cities now have public aquariums as well as commercial ones; other aquarium facilities serve chiefly as research institutions. Regardless of size—whether a small one-gallon jar or a huge million-gallon tank—aquariums must be constructed with care; many substances, especially plastics and adhesives, that are nontoxic to humans are toxic to water-breathing animals. The primary requirement for maintaining aquatic organisms is water quality.

Aquarius (Latin: "Water carrier") In astronomy, the constellation lying between Capricorn and Pisces; in ASTROLOGY, the 11th sign of the ZODIAC, governing approximately the period January 20–February 18. It is usually represented as a man pouring a stream of water out of a jug, probably because in ancient times the rising of Aquarius coincided in the Middle East with the annual arrival of floods or rainfall. In the astrological concept called the Great Year—the 25,000-year period it takes the earth to pass through the influence of the entire zodiac—the early 19th century was the beginning of the Age of Aquarius.

aquatint Method of ETCHING that produces finely granulated tonal areas rather than lines, so that finished prints often resemble WATERCOLOUR or wash drawings. A copper plate is exposed to acid through a layer of granulated resin or sugar, which yields a finely speckled gray tone when the plate is inked and printed. The texture and depth of tone are controlled by the strength of the acid baths and the length of time the plate is exposed to them. Aquatint became the most popular method of producing toned prints in the late 18th century; its most notable practitioner was FRANCISCO GOYA. In the 19th century EDGAR DEGAS and CAMILLE PISSARRO experimented with it, and in the 20th century the sugar aquatint was employed by PABLO PICASSO, GEORGES ROUAULT, and ANDRÉ MASSON.

aquavit \'ä-kwə-ˌvēt\ (from Latin *aqua vitae*, "water of life") Scandinavian clear DISTILLED LIQUOR flavoured with caraway seeds. Distilled from a fermented potato or grain mash, filtered with charcoal, and usually bottled without aging, aquavit has an alcohol content of 42–45% by volume. Most aquavits are sweet and spicy. It is usually served chilled and unmixed, in small glasses.

aqueduct Conduit built to carry water from its source to a main distribution point. Ancient Rome's aqueduct system, an extraordinary feat of engineering, brought water to the city from as far as 57 mi (92 km) away. Only a portion of the Roman aqueducts utilized the familiar stone arch; most were underground conduits made of stone or terra-cotta pipe. Modern aqueduct systems employ cast iron or steel. See also WATER-SUPPLY SYSTEM.

aquifer \'ä-kwə-fər\ In hydrology, a rock layer or sequence that contains water and releases it in appreciable amounts. The rocks contain water-filled pores that, when connected, allow water to flow through their matrix. A confined aquifer is overlain by a rock layer that does not transmit water in any appreciable amount or that is impermeable. There probably are few truly confined aquifers. In an unconfined aquifer the upper surface (water table) is open to the atmosphere through permeable overlying material. An aquifer also may be called a water-bearing stratum, lens, or zone.

Aquinas \ə-'kwī-nəs**, Saint Thomas** (b. 1224/25, Roccasecca, near Aquino, Terra di Lavoro, Kingdom of Sicily—d. March 7, 1274, Fossanova, near Terracina, Latium, Papal States; canonized July 18, 1323; feast day January 28, formerly March 7) Foremost philosopher and theologian of the Roman Catholic church. Born of noble parents, he studied at the University of Naples, joined the DOMINICANS, and taught at a Dominican school at the University of Paris. His time in Paris coincided with the arrival of Aristotelian science, newly discovered in Arabic translation; his great achievement was to integrate into Christian thought the rigours of ARISTOTLE's philosophy, just as the early Church Fathers had integrated PLATO's thought in the early Christian era. He held that reason is capable of operating within faith; while the philosopher relies solely on reason, the theologian accepts faith as his starting point and then proceeds to conclusion through the use of reason. This point of view was controversial, as was his belief in the religious value of nature, for which he argued that to detract from the perfection of creation was to detract from the creator. He was opposed by St. BONAVENTURE. In 1277, after his death, the masters of Paris condemned 219 propositions, 12 of them Thomas's. He was nevertheless named a Doctor of the Church in 1567 and declared the champion of orthodoxy during the modernist crisis at the end of the 19th century. A prolific writer, he produced more than 80 works, including *Summa contra Gentiles* (1261–64) and *Summa theologica* (1265–73). See also THOMISM.

Aquino \ə-'kē-nō**, (Maria) Corazon** *orig.* **Maria Corazon Cojuangco** (b. Jan. 25, 1933, Manila, Phil.) President of the Philippines (1986–92). Born into a politically prominent family, she married Benigno Simeon Aquino, Jr. (1932–83), who became the most prominent opponent of Pres. FERDINAND MARCOS. Benigno was assassinated in 1983 on his return from exile, and Corazon became the opposition candidate for president in 1986. Though Marcos was officially reported the winner, there were widespread allegations of voting fraud; high officials in the military supported Aquino, and Marcos fled. As president, Aquino introduced a hugely popular constitution. Over time her popularity declined amid charges of corruption and economic injustice.

Aquitaine Historical region, southwestern France. It was roughly equivalent to Aquitania, the Roman division of southwestern Gaul, which consisted of the area between the PYRENEES Mountains and the GARONNE RIVER. Conquered by CLOVIS in AD 507, it was later made a subkingdom by CHARLEMAGNE in the 8th century. After the Carolingian decline, it became a powerful duchy, which by the 10th century controlled much of France south of the LOIRE. It passed to the Capetian line when ELEANOR OF AQUITAINE married LOUIS VII (1137); on her second marriage, to HENRY II of England (1152), it passed to the English Plantagenets. The name GUYENNE, a corruption of Aquitaine, came into use in the 10th century, and the subsequent history of Aquitaine is merged with that of GASCONY and Guyenne.

AR-15 See M16 RIFLE

Ara Pacis \'ä-rä-'pā-sis\ **(Augustae)** *Latin* **"Augustan Altar of Peace"** State monument built by Caesar AUGUSTUS in Rome's Campus Martius (13–9 BC) to commemorate his victorious return from Spain and Gaul. It consists of an altar on a podium enclosed by walls. Its lavish sculptural decoration is among the finest examples of Roman art; reliefs representing the ceremonial procession at the altar's dedication are the first in Western art that can strictly be called documentary, showing identifiable individuals in a contemporary event.

Arab Any member of the ARABIC-speaking peoples native to the Middle East and North Africa. Before the spread of Islam in the 630s, the term referred to the largely nomadic Semitic peoples of the ARABIAN PENINSULA; it came to apply to Arabic-speaking peoples from Africa's Mauritanian and Moroccan coasts east to Iraq and the Arabian Peninsula and south to The Sudan after their acceptance of Islam. Traditionally, some Arabs are desert-dwelling pastoral nomads (see BEDOUIN), whereas others live by oases and in small, isolated farming villages. While most Arabs are Muslims, some are Christian. The term has also been used in a political sense by Arab nationalists to describe a greater sociolinguistic or ethnic ideal ("the Arab nation"). See also PAN-ARABISM.

Arab-Israeli wars Series of military conflicts fought between various Arab countries and Israel (1948–49, 1956, 1967, 1969–70, 1973, and 1982). The first war (1948–49) began when Israel declared itself an independent state following the United Nations' partition of PALESTINE. Protesting this move, five Arab countries—Egypt, Iraq, Jordan, Lebanon, and Syria—attacked Israel. The conflict ended with Israel gaining considerable territory. The 1956 SUEZ CRISIS began after Egypt nationalized the SUEZ CANAL. A French, British, and Israeli coalition attacked Egypt and occupied the canal zone but soon withdrew under international pressure. In the SIX-DAY WAR of 1967, Israel attacked Egypt, Jordan, and Syria. The war ended with the Israel occupying substantial amounts of Arab territory. An undeclared war of attrition (1969–70) was fought between Egypt and Israel along the Suez Canal and ended with the help of international diplomacy. Egypt and Syria attacked Israel in 1973 (the Yom Kippur War), but, despite early Arab success, the conflict ended inconclusively. In 1979 Egypt made peace with Israel. In 1982 Israel invaded Lebanon in order to expel Palestinian guerrillas based there. Israel withdrew from most of Lebanon by 1985 but maintained a narrow buffer zone inside that coun-

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try until 2000. See also Yāsir ʿArafāt; Ḥāfiẓ al-Assad; Menachem Begin; David Ben-Gurion; Camp David Accords; Moshe Dayan; Hezbollah; Gamal Abdel Nasser; Yitzhak Rabin; Sabra and Shatila massacres; Anwar el-Sādāt.

Arab League *or* **League of Arab States** Regional organization formed in 1945 and based in Cairo. It initially comprised Egypt, Syria, Lebanon, Iraq, Transjordan (now Jordan), Saudi Arabia, and Yemen; joining later were Libya, Sudan, Tunisia, Morocco, Kuwait, Algeria, Bahrain, Oman, Qatar, the United Arab Emirates, Mauritania, Somalia, the Palestine Liberation Organization, Djibouti, and Comoros. The league's original aims were to strengthen and coordinate political, cultural, economic, and social programs and to mediate disputes; a later aim was to coordinate military defense. Members have often split on political issues; Egypt was suspended for 10 years (1979–89) following its peace with Israel, and the Persian Gulf War (1990–91) also caused deep rifts. See also Pan-Arabism.

arabesque Style of decoration characterized by interlacing plant forms and abstract curvilinear motifs. It is typical of Islamic ornamentation from c. 1000. The word was first used in the 15th or 16th century when Europeans became interested in the Islamic arts, but the motif itself was derived from Hellenistic craftsmen in Asia Minor. Arabesques were also applied to the decoration of illuminated manuscripts, walls, furniture, metalwork, pottery, stonework, majolica, and tapestry from the Renaissance to the 19th century.

Arabesque decoration on the dome of the Madar-i-Shāh *madrasah* ("school") built by Ḥusayn I, early 18th century, at Eṣfahān, Iran
RAY MANLEY—SHOSTAL ASSOC./EB INC.

Arabia See Arabian Peninsula

Arabian Desert Desert region, Arabian Peninsula. It covers about 900,000 sq mi (2,330,000 sq km), occupying nearly the entire peninsula. It lies largely within Saudi Arabia but large portions extend into Jordan, Iraq, Kuwait, Qatar, the United Arab Emirates, Oman, and Yemen. Its relief is broken by a number of mountain ranges, with elevations reaching as high as 12,000 ft (3,700 m), and it is bounded on three sides by high escarpments. At least one-third of the desert is covered by sand, including the Rubʿ al-Khali, considered to have one of the most inhospitable climates on Earth. There are no perennial bodies of water, though the Tigris-Euphrates river system lies to the northeast and the Wadi Ḥajr is located to the south, in Yemen. Humans have inhabited the area since Pleistocene times.

Arabian horse Earliest improved breed of horse, valued for its speed, stamina, beauty, intelligence, and gentleness. Its long history has been obscured by legend, but it was developed in Arabia by the 7th century AD. It has contributed its qualities to most modern breeds of light horses. It is compact and relatively small, with a small head, protruding eyes, wide nostrils, marked withers, and a short back. Its average height is about 15 hands (60 in. [152 cm]), its average weight 800–1,000 lbs (360–450 kg). Though many colours are possible, gray is the most common.

Arabian Nights' Entertainment See The Thousand and One Nights

Arabian Peninsula *or* **Arabia** Peninsular region, southwest Asia. With its offshore islands, it covers about 1 million sq mi (2.6 million sq km). Constituent countries are Bahrain, Kuwait, Oman, Qatar, United Arab Emirates, Yemen, and, the largest, Saudi Arabia. It is generally arid and is covered almost entirely by the Arabian Desert. The modern economy is dominated by the production of petroleum and natural gas. The world's largest proven reserves of those minerals are in the Arabian Peninsula. Its political consolidation was begun by the Prophet Muhammad, and it was the centre of the orthodox caliphate until 661, when that office passed to the Umayyad dynasty in Damascus. After 1517 much of the region was dominated by the Ottoman Empire, though the peninsula's people, who had remained largely tribal and nomadic, revolted repeatedly until the World War I (1914–18), when the Ottoman Empire dissolved. Thereafter, individual nation-states followed their own histories, though many maintained close ties with European powers such as the United Kingdom.

Arabian religions, ancient Polytheistic religions of Arabia prior to the rise of Islam. Most of the deities of the Arab tribes were sky gods, associated with heavenly bodies such as the Sun and Moon, and they had the power to ensure fecundity, protection, or revenge. At the head of the southern Arabian pantheon was ʿAthtar, a god of thunderstorms and rain. Each kingdom also had a national deity, of whom the nation called itself the progeny. Sanctuaries were carved in rock on high places and held a baetyl ("raised stone") or statue of the god in an open-air enclosure, accessible only to ritually clean persons. In northern Arabia they included a walled enclosure with a covered or enclosed altar, similar to the Muslim Kaʿbah. Libations, animal sacrifices, and other offerings were made to the gods, and priests interpreted oracles and performed divination. Worshipers made yearly pilgrimages to important shrines, participating in rites that included purification, the wearing of ritual clothing, sexual abstinence, abstention from shedding blood, and circuits performed around the sacred object.

Arabian Sea Northwestern part of the Indian Ocean, lying between India and the Arabian Peninsula. It has an area of about 1,491,000 sq miles (3,862,000 sq km) and an average depth of 8,970 feet (2,734 m). The Gulf of Oman connects it with the Persian Gulf via the Strait of Hormuz, while the Gulf of Aden connects it with the Red Sea via the Strait of Mandeb. The Indus is the principal river draining into the Arabian Sea. Socotra, Lakshadweep, and other islands lie within it. Chief ports are Mumbai (Bombay), India; Karachi, Pak.; and Aden, Yemen. The sea has been part of the principal trade route between Europe and India for centuries.

Arabic alphabet Script used to write Arabic and a number of other languages whose speakers have been influenced by Arab and Islamic culture. The 28-character Arabic alphabet developed from a script used to write Nabataean Aramaic. Because Arabic had different consonants than Aramaic, diacritical dots came to be used to eliminate ambiguous readings of some letters, and these remain a feature of the script. Arabic is written from right to left. The letters denote only consonants, though the symbols for *w*, *y*, and (historically) the glottal stop do double duty as vowel letters for long *u*, *i*, and *a*. Additional diacritics, representing short vowels (or the lack thereof), case endings, and geminate (duplicate) consonants, are normally employed only for the text of the Qur'ān, for primers, or in instances where the reading might otherwise be ambiguous. Because Arabic script is fundamentally cursive, most letters have slightly different forms depending on whether they occur in the beginning, middle, or end of a word. Non-Semitic languages for which some version of the Arabic alphabet has been or is used include Persian, Kurdish, Pashto, Urdu, some Turkic languages, Malay, Swahili, and Hausa. The Maltese language is the only form of Arabic to be written in the Latin alphabet.

Arabic language Ancient Semitic language whose dialects are spoken throughout the Middle East and North Africa. Though Arabic words and proper names are found in Aramaic inscriptions, abundant documentation of the language begins only with the rise of Islam, whose main texts are written in Arabic. Grammarians from the 8th century on codified it into the form known as Classical Arabic, a literary and scribal argot that differed markedly from the spoken vernacular. In the 19th–20th centuries, expansion of Classical Arabic's stylistic range and vocabulary led to the creation of Modern Standard Arabic, which serves as a lingua franca among contemporary Arabs. However, Arabic speakers, who number roughly 200 million, use an enormous range of dialects, which at their furthest extremes are mutually unintelligible. Classical Arabic remains an important cultural and religious artifact among the non-Arab Islamic community. See also Arabic alphabet.

Arabic literary renaissance (19th-century) Movement to develop a modern Arabic literature. Inspired by contacts with the West and a renewed interest in classical Arabic literature, it began in Egypt with Syrian and Lebanese writers who sought the freer environment there, and it spread to other Arab countries as a result of the dismemberment of the Ottoman Empire after World War I and the coming of independence after World War II. Its success in altering the direction of Arabic literature is related to the spread and modernization of education and the emergence of an Arabic press.

Arabic philosophy *or* **Islamic philosophy** Doctrines of the Arabic philosophers of the 9th–12th century who influenced medieval Scholasticism in Europe. The Arabic tradition combines Aristotelianism and Neoplatonism with other ideas introduced through Islam. Influential thinkers include the Persians al-Kindi, al-Farabi, and Avicenna, as well as the

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Spaniard Averroës, whose interpretations of Aristotle were taken up by both Jewish and Christian thinkers. Muslims, Christians, and Jews participated in the Arabic tradition and separated themselves according to philosophic rather than religious doctrines. When the Arabs dominated Spain, the Arabic philosophic literature was translated into Hebrew and Latin; this contributed to the development of modern European philosophy. In Egypt around the same time, the Arabic tradition was developed by Moses Maimonides and Ibn Khaldun.

Arachne \ə-'rak-nē\ In Greek mythology, the daughter of the dyer Idmon of Colophon. She was a weaver who acquired such skill that she ventured to challenge Athena to a contest. Athena wove a tapestry showing the gods in majesty, while Arachne depicted them in their amorous adventures. Enraged at the perfection of her rival's work, Athena tore it to shreds, whereupon Arachne hanged herself. Out of pity Athena loosened the rope, which became a cobweb, and Arachne was changed into a spider.

arachnid \ə-'rak-nid\ Any member of the class Arachnida, primarily carnivorous arthropods having a well-developed head, a hard external skeleton, and four pairs of walking legs. Spiders and scorpions have a segmented body, but daddy longlegs, ticks, and mites do not. Arachnids range in size from tiny mites (0.003 in. [0.08 mm] long) to the 8-in. (21-cm) black scorpion of Africa. As arachnids grow, they molt several times (see molting). Most are unable to digest food internally; instead, they inject their prey with digestive fluids and suck the liquefied remains. Arachnids are found worldwide in nearly every habitat. Most groups are free-living, but some mites and ticks are parasitic and can carry serious diseases of animals and humans. Venomous spiders and scorpions also may pose a danger to humans. However, most arachnids are harmless and prey on insect pests.

Arachosia \ˌar-ə-'kō-zhə\ Ancient province, eastern Persian empire. The province encompassed much of what is now southern Afghanistan in the area of the city of Kandahār. It was conquered by Alexander the Great c. 330 BC.

ʿArafāt \ˌar-ə-'fat**, Yāsir** *orig.* **Muḥammad ʿAbd al-Raʾūf al-Qudwah al-Ḥusaynī** (b. August 1929—d. Nov. 11, 2004, Paris, France) Palestinian leader. The date and place of his birth are disputed. A birth certificate registered in Cairo, Egypt, gives Aug. 24, 1929, but some sources support his claim to have been born in Jerusalem on Aug. 4, 1929. He graduated from the University of Cairo as a civil engineer and served in the Egyptian army during the 1956 Suez Crisis. That year, working as an engineer in Kuwait, he cofounded the guerrilla organization Fatah, which became the leading military component of the Palestine Liberation Organization (PLO), which he led from 1969. In 1974 the PLO was formally recognized by the UN, and ʿArafāt became the first leader of a nongovernmental organization to address the UN. In 1988 he acknowledged Israel's right to exist, and in 1993 he formally recognized Israel during direct talks regarding land controlled by Israel since the Six-Day War. In 1994 he shared the Nobel Prize for Peace with Israelis Yitzhak Rabin and Shimon Peres. In 1996 he became president of the new Palestinian Authority.

Aragon \'ar-ə-ˌgän\ *Spanish* **Aragón** Autonomous community (pop., 2001: 1,204,215), northeastern Spain. Roughly coextensive with the historical kingdom of Aragon, it occupies an area of 18,425 sq mi (47,720 sq km). Its capital is Zaragoza (Saragossa). Mountains, including the Pyrenees, dominate the relief north and south of the Ebro River, which bisects Aragon. Established in 1035 by Ramiro I, the historical kingdom grew as land was retaken from the Moors: Zaragoza, the capital of the Almoravid kingdom, fell to Alfonso I of Aragon in 1118, and the reconquest of present-day Aragon was completed by the late 12th century. In the 13th–15th centuries it came to rule Sicily, Sardinia, Naples, and Navarra. In the 15th century Ferdinand married Isabella of Castile, uniting the kingdoms of Aragon and Castile and forming the nucleus of modern Spain. The old kingdom of Aragon survived as an administrative unit until 1833, when it was divided into provinces. Agriculture, mining, and industry, the latter concentrated at Zaragoza, are economically important.

Aragon \à-rà-'gōⁿ**, Louis** *orig.* **Louis Andrieux** (b. Oct. 3, 1897, Paris, Fr.—d. Dec. 24, 1982, Paris) French poet, novelist, and essayist. He was introduced by André Breton into avant-garde circles, and the two cofounded the Surrealist review *Littérature* in 1919. From 1927 he was increasingly a political activist and spokesman for communism, which resulted in a break with the Surrealists. Among his works are the novel tetralogy *Le Monde réel*, 4 vol. (1933–44), describing the class struggle of the proletariat; the huge novel *Les Communistes*, 6 vol. (1949–51); novels of veiled autobiography; and volumes of poems expressing patriotism and love for his wife. He was editor of the communist weekly of arts and literature, *Les Lettres françaises*, 1953–72.

aragonite \ə-'rag-ə-ˌnīt\ A carbonate mineral, the stable form of calcium carbonate ($CaCO_3$) at high pressures. It is somewhat harder and has a slightly higher specific gravity than calcite. Aragonite is found in recent deposits formed at low temperatures near the surface of the earth, as in caves as stalactites, with ore minerals, in serpentine and other basic (see acid and basic rocks) rocks, and in sediments. Aragonite is the mineral normally found in pearls, and it occurs in some animal shells. It is polymorphous (same chemical formula but different crystal structure) with calcite and vaterite, and, with geologic time, changes to calcite even under normal conditions.

Araguaia \ˌar-ə-'gwī-ə\ **River** River, central Brazil. Rising in the Brazilian highlands, it flows north some 1,600 mi (2,600 km) to join the Tocantins River at São João do Araguaia. In midcourse it divides into channels on either side of Bananal Island, which is about 200 mi (320 km) long and the site of the National Park of Araguaia. Though the river drains a vast area of interior Brazil, it offers poor transportation because of its many falls.

arahant See arhat

Arai Hakuseki \à-rī-hà-kù-'sā-kē\ (b. March 24, 1657, Edo [Tokyo], Japan—d. June 29, 1725, Edo) Japanese scholar of Confucianism and government official of the mid-Tokugawa period. Arai was tutor and later adviser to Tokugawa Ienobu, the sixth Tokugawa shogun. He wrote on such subjects as Japanese geography, philosophy, and legal institutions and is considered one of Japan's greatest historians. Among his best-known works are *Tokushi yoron*, a history of Japan, and *Koshitsū*, a study of early document sources. See also Genroku period; Edo culture.

Arakcheyev \à-rək-'chā-yif**, Aleksey (Andreyevich), Count** (b. Oct. 4, 1769, Novgorod province, Russia—d. May 3, 1834, Gruzino, Novgorod province) Russian soldier and statesman. Appointed inspector general of artillery in 1803, he reorganized that branch of the army, then served as minister of war (1808–10). In the Russo-Swedish War of 1808–09, he personally compelled the reluctant Russian forces to cross the frozen Gulf of Finland to attack the Åland Islands, which ultimately resulted in Sweden's cession of Finland to Russia. He was Alexander I's chief military adviser in the Napoleonic Wars. After the wars, he supervised the management of Russia's domestic matters with brutal and ruthless efficiency, which caused the period (1815–25) to be known as Arakcheyevshchina, but also took part in the emancipation of serfs in the Baltic provinces and created a system of military-agricultural colonies.

Araks River See Aras River

Aral Sea Large salt lake between Kazakhstan and Uzbekistan. It once covered some 26,300 sq mi (68,000 sq km) and was the fourth largest inland body of water in the world, but diversion of the waters of the Syr Darya and Amu Darya rivers for irrigation has led to an overall reduction of its surface area by more than half since 1960. Its volume has been reduced drastically, which has led to an increase in salinity. The soil of the dried-up lake bed has been found to contain salts and other toxic substances.

Aram \'ar-əm\ Ancient country, Middle East, southwestern Asia. It extended eastward from the Anti-Lebanon Mountains to beyond the Euphrates River. It was named for the Aramaeans, who emerged from the Syrian desert to invade Syria and Upper Mesopotamia (c. 11th century BC) and who built numerous city-kingdoms, including Damascus. It lends its name to the Aramaic language.

Aramaean \ˌar-ə-'mē-ən\ A member of any people belonging to a confederacy of tribes that migrated from the Arabian Peninsula to the Fertile Crescent c. 1500–1200 BC. Among them were the biblical matriarchs Leah and Rachel, wives of Jacob. The Aramaic language and culture spread through international trade. They reached a cultural peak during the 9th–8th centuries BC. By 500 BC, Aramaic had become the universal language of commerce, culture, and government throughout the Fertile Crescent and remained so through the time of Jesus and into the 7th century in some areas.

Aramaic \ˌar-ə-'mā-ik\ **language** Semitic language originally spoken by the ancient Aramaeans. The earliest Aramaic texts are inscriptions in

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an alphabet of Phoenician origin found in the northern Levant dating from c. 850 to 600 BC. The period 600–200 BC saw a dramatic expansion of Aramaic, leading to the development of a standard form known as Imperial Aramaic. In later centuries, as "Standard Literary Aramaic," it became a linguistic model. Late (or Classical) Aramaic (c. AD 200–1200) has an abundant literature, both in Syriac and in Mandaic (see MANDAEANISM). With the rise of Islam, Arabic rapidly supplanted Aramaic as a vernacular in South Asia. Modern Aramaic (Neo-Aramaic) comprises West Neo-Aramaic, spoken in three villages northeast of Damascus, Syria, and East Neo-Aramaic, a group of languages spoken in scattered settlements of Jews and Christians in southeastern Turkey, northern Iraq, and northwestern Iran, and by modern Mandaeans in the SHAṬṬ AL-ʿARAB. Since c. 1900 persecution has forced most contemporary East Neo-Aramaic-speakers, who number several hundred thousand, into diaspora communities around the world.

Aramco \ə-'ram-kō\ *in full* **Arabian American Oil Company** Oil company founded by the Standard Oil Co. of California (Chevron) in 1933, when the government of SAUDI ARABIA granted it a concession. Other U.S. companies joined after oil was found near Dhahran in 1938. In 1950 Aramco opened a pipeline from Saudi Arabia to the Mediterranean Sea port of Sidon, Leb. It was closed in 1983 except to supply a refinery in Jordan. A more successful pipeline, with a destination on the Persian Gulf, was finished in 1981. In 1951 Aramco found the first offshore oil field in the Middle East. In the 1970s and '80s, control gradually passed to the Saudi Arabian government, which eventually took over Aramco and renamed it Saudi Aramco in 1988.

Aran Islands \'ar-ən\ Islands (pop., 2001: 543), Galway Bay, western Ireland. The group of small islands, totaling about 18 sq mi (47 sq km), includes Inishmore (or Aranmore), Inishmaan, and Inisheer. Their main town is Kilronan on Inishmore. The islands contain impressive prehistoric and early Christian forts. Novelist LIAM O'FLAHERTY was born on Inishmore.

Arany \ȯr-'ȯnʸ\ **János** (b. March 2, 1817, Nagyszalonta, Hung.—d. Oct. 22, 1882, Budapest) Hungarian epic poet. His main work is the trilogy of *Toldi* (1847), *Toldi szerelme* (1848–79), and *Toldi estéje* (1854). Recounting the adventures of a 14th-century youth of great physical strength, it was received with enthusiasm by a public craving a national literature of quality in a language all could grasp. Other notable works include a fragment of an epic poem, *Bolond Istók* (1850), and *The Death of King Buda* (1864), the first part of a projected Hun trilogy. The *Oszikék*, written just before his death, poignantly reflects his sense of unfulfillment and isolation. He is considered Hungary's greatest epic poet.

arap Moi, Daniel See Daniel arap MOI

Arapaho \ə-'ra-pə-ˌhō\ North American PLAINS INDIAN peoples living mostly in Oklahoma and Wyoming, U.S. They are believed to have once lived in permanent villages in the eastern woodlands. Their language is of ALGONQUIAN STOCK. Like other Plains groups, the Arapaho were nomadic, living in TEPEES and depending on the buffalo for subsistence. They split into northern and southern groups after 1830. They were highly religious and practiced the SUN DANCE. Their social organization included age-graded military societies as well as men's shamanistic societies. They traded with the MANDAN and Arikara and were often at war with the SHOSHONE, UTE, and PAWNEE. A southern branch was long allied with the CHEYENNE and fought with them against Col. GEORGE CUSTER at LITTLE BIGHORN in 1876. In the 2000 U.S. census some 7,000 people claimed sole Arapahoe descent.

Ararat \'ar-ə-ˌrat**, Mount** *Turkish* **Ağrı Dağı** Extinct volcanic massif, eastern Turkey. Located in Ağrı province, near the Iranian border, Ararat has two peaks, Great Ararat, at 16,853 ft (5,137 m) the highest point of elevation in Turkey, and Little Ararat, almost 13,000 ft (4,000 m). Ararat is traditionally associated with the mountain where Noah's ark came to rest at the end of the biblical Deluge. A village on its slopes at the site where NOAH is said to have built an altar was destroyed in an earthquake in 1840.

Aras \ä-'räs\ **River** *or* **Araks** \ä-'räks\ **River** River in Turkey, Armenia, Azerbaijan, and Iran. It rises in the mountains south of Erzurum, Turkey, and flows east to join the KURA RIVER in Azerbaijan about 75 mi (120 km) from its mouth. Since a flood in 1897, a separate distributary of the Aras has also emptied into the CASPIAN SEA. Some 665 mi (1,070 km) long, it forms the boundary between Armenia and Azerbaijan (north) and Turkey and Iran (south). Located on an island from 180 BC to AD 50 was Armenia's capital, Artaxata.

Aratus of Sicyon \ə-'rā-təs...'sis-ē-ˌän\ (b. 271—d. 213 BC) Hellenistic Greek statesman, diplomat, and soldier. He democratized SICYON (251) and, as leader of the ACHAEAN LEAGUE (in alternate years from 245), set up democracies in league cities and helped free Athens from Macedonia (229). Under him, the league opposed Sparta; with Macedonian help, it defeated Aetolia (217). Aratus nevertheless defied the anti-Roman policy of PHILIP V of Macedonia; his death, popularly linked to Philip, was more likely caused by tuberculosis.

Araucanian \ə-ˌraù-'kā-nē-ənz\ South American Indian people who are now concentrated in the valleys and basins between the Bío Bío and Toltén rivers in south-central Chile. When the Spanish CONQUISTADORES arrived in Chile, they encountered three Araucanian populations: the Picunche, who were accustomed to INCA control; the Huilliche, who were too few and scattered to resist the conquistadores; and the MAPUCHE, successful farmers and artisans. The first two were soon assimilated, but the Mapuche managed to resist Spanish and Chilean control for some 350 years. They were subdued in the late 19th century and were settled on reservations; they now live independently.

araucaria \ˌar-ȯ-'kar-ē-ə\ Any pinelike coniferous plant (see CONIFER) of the genus *Araucaria* (family Araucariaceae). Found in South America, the PHOENIX ISLANDS, and Australia, araucaria trees are magnificent EVERGREENS, with whorled branches and stiff, flattened, pointed leaves. Common species are the MONKEY PUZZLE TREE and the NORFOLK ISLAND PINE, often grown as a houseplant. Several species are cultivated on the Pacific coast of the U.S. and in southern Florida. See also PINE.

Arawak \'ar-ə-ˌwäk\ American Indians of the Greater Antilles and South America. The TAINO, an Arawak subgroup, were the first native peoples encountered by CHRISTOPHER COLUMBUS on Hispaniola. The island Arawak were wiped out by disease, but some mainland South American Arawak, who inhabited northern and western areas of the Amazon River basin, survived conquest. At the turn of the 21st century, the Arawak lived mainly in Guyana, where they represented about one-third of the Indian population. Smaller numbers live in Suriname, French Guiana, and Venezuela.

Arawakan \ˌar-ə-'wä-kən\ **languages** *or* **Maipuran** \mī-'pü-rən\ **languages** Largest family of American Indian languages. The family comprises an estimated 65 known languages, of which at least 30 are now extinct. They stretch from the Caribbean coast of Central America to the GRAN CHACO and southern Brazil, and from western Peru to the Guianas and central Brazil. Taino, a now-extinct Arawakan language of the Antilles, was the first American Indian language encountered by Europeans. Arawakan languages that are still viable include Goajiro in Colombia and Venezuela; Amuesha, Machiguenga, and the Campa languages in Peru; and Terena in Brazil.

Arbenz \'är-bāns\ **(Guzmán), Jacobo** (b. Sept. 14, 1913, Quezaltenango, Guat.—d. Jan. 27, 1971, Mexico City, Mex.) Soldier and president of Guatemala (1951–54). The son of a Swiss emigré, Arbenz joined the leftist army officers who overthrew the dictator Jorge Ubico (1878–1946) in 1944. Elected president in 1951, he made LAND REFORM his central project. His efforts to expropriate idle land owned by the UNITED FRUIT CO. and his alleged communist links led to an invasion sponsored by the U.S. CENTRAL INTELLIGENCE AGENCY. When the army refused to defend Arbenz against what appeared to be a superior force, he resigned and went into exile, and the CIA installed the leader of the proxy army, Col. Carlos Castillo Armas (1914–57), as president.

Arber, Werner (b. June 3, 1929, Gränichen, Switz.) Swiss microbiologist. He has taught chiefly at the University of Basel. He shared a 1978 Nobel Prize with DANIEL NATHANS and HAMILTON O. SMITH for the discovery and use of restriction enzymes that break the giant molecules of DNA into pieces small enough to be separated for individual study but large enough to retain meaningful amounts of the genetic information of the original substance. He also observed that bacteriophages cause mutation in their bacterial hosts and undergo hereditary mutations themselves.

Arbiter, Gaius Petronius See Gaius PETRONIUS ARBITER

arbitrage \'är-bə-ˌträzh\ Business operation involving the purchase of foreign CURRENCY, gold, financial securities, or commodities in one market and their almost simultaneous sale in another market, in order to profit

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from price differentials existing between the markets. In the 1980s a form of speculation called risk arbitrage arose, in which speculators tried to identify companies targeted for takeover and buy blocks of their STOCK, to be resold at a profit when the takeover was announced and the company's stock rose in value. See also INSIDER TRADING; SECURITY.

arbitration Process of resolving a dispute or a grievance outside a court system by presenting it for decision to an impartial third party. Both sides in the dispute usually must agree in advance to the choice of arbitrator and certify that they will abide by the arbitrator's decision. In medieval Europe arbitration was used to settle disputes between merchants; it is now commonly used in commercial, labour-management, and international disputes. The procedures differ from those used in the courts, especially regarding burden of proof and presentation of evidence. Arbitration avoids costly litigation and offers a relatively speedy resolution as well as privacy for the disputants. The main disadvantage is that setting guidelines is difficult; therefore the outcome is often less predictable than a court decision. See also MEDIATION.

arbor Garden shelter providing privacy and partial protection from the weather, most commonly a lightweight, latticed framework (trellis) of wood or metal with interlaced branches of vines or climbing shrubs trained over it. If there is a distinction between an arbor and a bower, it is that the bower is an entirely natural recess whereas an arbor is only partially natural.

arboretum \ˌär-bə-ˈrē-təm\ Place where trees, shrubs, and sometimes herbaceous plants are cultivated for scientific and educational purposes. An arboretum may be a collection in its own right or a part of a BOTANICAL GARDEN. Important U.S. arboretums include the Arnold Arboretum of Harvard University (Jamaica Plain, Mass.) and the U.S. National Arboretum in Washington, D.C.

arboriculture \ˈär-bər-ə-ˌkəl-chər\ Cultivation of trees, shrubs, and woody plants for shading and decorating. Arboriculture includes all aspects of growing, maintaining, and identifying plants, arranging plantings for their ornamental values, and removing trees. The well-being of individual plants is the major concern of arboriculture, in contrast to such related fields as FORESTRY and AGRICULTURE, in which the major concern is the welfare of a large group of plants as a whole.

arborvitae \ˌär-bər-ˈvī-tē\ (Latin: "tree of life") Any of six species (genus *Thuja*) of resinous, EVERGREEN ornamental and timber CONIFERS of the CYPRESS family, native to North America and eastern Asia. Arborvitae trees or shrubs have thin, scaling outer bark and fibrous inner bark; horizontal or ascending branches; and flattened, spraylike branchlets with scalelike leaves. The Oriental, or Chinese, arborvitae (*T. orientalis*), a popular ornamental native to Asia, is a gracefully symmetrical shrub. Arborvitae wood is soft and lightweight but very durable, fragrant, and easily worked. The giant arborvitae (*T. plicata*) is the most important timber-producing species, but the wood of the American arborvitae (*T. occidentalis*) is also frequently used. False arborvitae (*Thujopsis dolabrata*) is closely related.

arbovirus \ˌär-bə-ˈvī-rəs\ Any of a large group of viruses that develop in arthropods (chiefly mosquitoes and ticks). The name derives from "*ar*thropod-*bo*rne *virus*." The spheroidal virus particle is encased in a fatty membrane and contains RNA; it causes no apparent harm to the arthropod host. Arboviruses are transmitted by bites to vertebrate hosts, in which they establish infections and complete their growth cycle; they include the agents responsible for YELLOW FEVER and equine ENCEPHALITIS. See also TOGAVIRUS.

Arbus, Diane *orig.* **Diane Nemerov** (b. March 14, 1923, New York, N.Y., U.S.—d. July 26, 1971, New York City) U.S. photographer. The sister of the poet and critic HOWARD NEMEROV, she worked as a fashion photographer in the 1950s. From about 1955 to 1957 she studied with documentary photographer Lisette Model. She published her first photoessay, for *Esquire*, in 1960. In the 1960s she began to explore the subjects that would occupy her for much of her career: individuals living on the outskirts of society and "normalcy," such as nudists, transvestites, dwarfs, and the mentally or physically handicapped. Her own evident intimacy with the subjects of her photos resulted in images that engage the sympathy and collusion of the viewer and elicit a strong response. During this period she mastered her technique of using a square format and flash lighting, which gives her work a sense of theatricality and surrealism. In 1971 Arbus committed suicide.

Arbuthnot \ˈär-ˈbəth-nət**, John** (b. April 1667, Inverbervie, Scot.—d. Feb. 27, 1735, London, Eng.) Scottish mathematician, physician, and satirist. His satirical writings include a political allegory, *The History of John Bull* (1712), that established John Bull as a personification of England. He was a founding member of the famous Scriblerus Club, which aimed to ridicule bad literature and false learning. He was also chief contributor to and guiding spirit of the *Memoirs of Martinus Scriblerus* (written 1713–14), a mocking exposure of pedantry that was written by club members.

Arbuthnot, detail of an oil painting by W. Robinson; in the Scottish National Portrait Gallery, Edinburgh.
COURTESY OF THE SCOTTISH NATIONAL PORTRAIT GALLERY, EDINBURGH

arbutus \ˈär-ˈbyü-təs\ Any of about 14 species (genus *Arbutus*) of broad-leaved EVERGREEN shrubs or trees, in the HEATH FAMILY. Native to southern Europe and western North America, they are characterized by loosely clustered white or pink flowers and red or orange berries. *A. menziesii* (variously known as the madrona, Pacific madrona, laurelwood, and Oregon laurel) and *A. unedo* (the strawberry tree) are cultivated as ornamentals. The TRAILING ARBUTUS belongs to the genus *Epigaea*.

Arc de Triomphe \ˈärk-də-trī-ˈōⁿf\ Largest TRIUMPHAL ARCH in the world. A masterpiece of Romantic Classicism, it is one of the best-known monuments of Paris. It stands at the centre of the Place Charles de Gaulle, at the western terminus of the CHAMPS-ÉLYSÉES. Initiated by NAPOLEON, designed by JEAN-FRANÇOIS-THÉRÈSE CHALGRIN, and constructed in 1806–36, the monument is 164 ft (50 m) high and 148 ft (45 m) wide. Decorative relief sculptures celebrating Napoleon's victorious military campaigns were executed on the arch by FRANÇOIS RUDE, Jean-Pierre Cortot, and Antoine Etex.

arc furnace Type of ELECTRIC FURNACE in which heat is generated by an arc between carbon ELECTRODES above the surface of the material (commonly a metal) being heated. WILLIAM SIEMENS first demonstrated the arc furnace in 1879 at the Paris Exposition by melting iron in crucibles; horizontally placed carbon electrodes produced an electric arc above the container of metal. The first commercial arc furnace in the U.S. (1906) had a capacity of four tons (3.6 metric tons) and was equipped with two electrodes. Modern furnaces range in heat size from a few tons up to 400 tons (360 metric tons), and the arcs strike directly into the metal bath from vertically positioned, graphite electrodes to remelt scrap steel or refine briquettes of direct-reduced iron ore.

arcade Series of arches, supported by columns or piers, joined together end to end in a row. When supporting a roof, an arcade may function as a passageway adjacent to a solid wall, a covered walkway that provides access to adjacent shops, or a transitional element surrounding an open internal court. See also COLONNADE.

Arcadia Ancient country, central PELOPONNESE, Greece. Mountainous and landlocked, it was not overrun by the DORIANS during their occupation of Greece (1100–1000 BC). Its isolation and its pastoral character partly explain why it was represented as a paradise in Greek and Roman bucolic poetry. It was the scene of conflict during the War of GREEK INDEPENDENCE (1821–29). The modern Greek department of Arkadhía is nearly coextensive with the ancient country.

Arcadian League Confederation of ancient Greek city-states of Arcadia. Arcadian towns had been forced to ally with SPARTA by 550 BC, and most Arcadians remained faithful to Sparta during the PELOPONNESIAN WAR (431–404 BC). In an effort to contain Sparta, EPAMINONDAS of Thebes founded the city-state of MEGALOPOLIS in 371–368 BC as the seat of the Arcadian League. The League united the Arcadians for a few decades until internal discord crippled their confederation.

Arcaro, Eddie *orig.* **George Edward Arcaro** (b. Feb. 19, 1916, Cincinnati, Ohio, U.S.—d. Nov. 14, 1997, Miami, Fla.) U.S. jockey. He became the first jockey to ride five KENTUCKY DERBY winners (1938, 1941, 1945, 1948, 1952) and the first to ride two TRIPLE CROWN champions (Whirl-

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away, 1941; CITATION, 1948). In 31 years of riding Thoroughbreds (1931–61), he won 549 stakes events, a total of 4,779 races, and more than $30 million in purses.

arch Curved structure that spans the opening between two piers or columns and supports loads from above. The masonry arch provides the stepping stone from the POST-AND-BEAM SYSTEM to the evolution of the VAULT, and was first widely used by the Romans. Its construction depends on a series of wedge-shaped blocks (voussoirs) set side by side in a semicircular curve or along two intersecting arcs (as in a pointed arch). The central voussoir is called the keystone, and the two points where the arch rests on its supports are known as the spring points. An arch can carry a much greater load than a horizontal beam of the same size and material, because downward pressure forces the voussoirs together instead of apart. The resulting outward thrust must be resisted by the arch's supports. Present-day lightweight monolithic (one-piece) arches of steel, concrete, or laminated wood are highly rigid, and thereby minimize horizontal thrust. See illustration opposite.

archaebacteria \ˌär-kē-ˌbak-ˈtir-ē-ə\ Group of BACTERIA whose members differ from the EUBACTERIA in certain physical, physiological, and genetic features (e.g., cell-wall components). Archaebacteria are aquatic or terrestrial microorganisms that exhibit a diversity of shapes, including spherical, rod-shaped, and spiral forms. They survive in various extreme environments, including very hot or salty ones. Some require oxygen; some do not. Some produce methane as an end product; others depend on sulfur for their metabolism.

archaeology Scientific study of material remains of past human life and activities. These include human artifacts from the very earliest stone tools to the man-made objects that are buried or thrown away in the present day. Archaeological investigations are a principal source of modern knowledge of prehistoric, ancient, and extinct cultures. The field emerged as an academic discipline in the late 19th century, following centuries of haphazard antiquarian collecting. Among the archaeologist's principal activities are the location, surveying, and mapping of sites and the EXCAVATION, classification, DATING, and interpretation of materials to place them in historical context. Major subfields include classical archaeology, the study of ancient Mediterranean and Middle Eastern civilizations; prehistoric archaeology, or general archaeology; and historical archaeology, the study of historic-period remains to augment the written record. See also ANTHROPOLOGY; COIN COLLECTING; STONE-TOOL INDUSTRY.

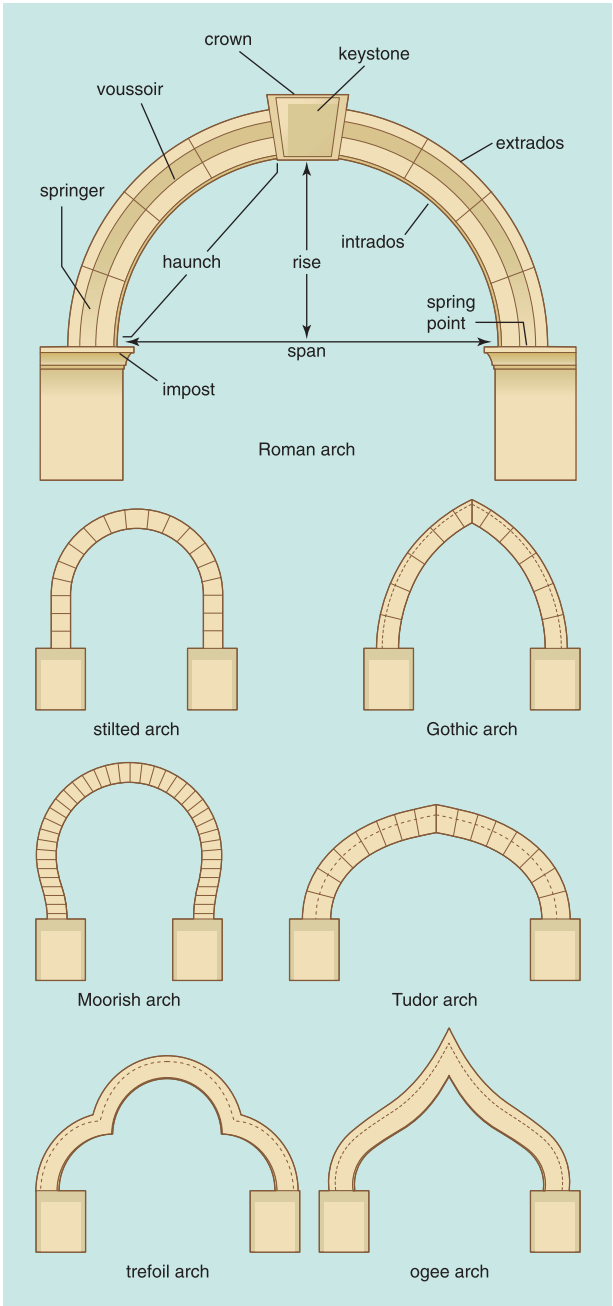
archaeopteryx \ar-kē-ˈäp-tə-riks\ Oldest known fossil animal that is generally accepted as a bird (classified as genus *Archaeopteryx*). It flourished during the Late JURASSIC PERIOD (159–144 million years ago). Fossil specimens indicate that archaeopteryx ranged in size from as small as a blue jay to as large as a chicken. Archaeopteryx shared anatomical characteristics with both birds (well-developed wings and birdlike skull) and THEROPOD dinosaurs (well-developed teeth and a long tail).

Archangel See ARKHANGELSK

archbishop In Christianity, a BISHOP who has jurisdiction, but not superiority, over the other bishops in a province as well as episcopal authority in his own diocese. Introduced as an honorary title in the Eastern churches in the 4th century, the office did not become common in Western churches until the 9th century. It is now most widely used in the Roman Catholic and Eastern Orthodox churches. It is more rarely used in Protestant denominations, though the Church of England has archbishops of Canterbury and York, and the Lutheran churches of both Sweden and Finland have an archbishop.

Archean \är-ˈkē-ən\ **Eon** *or* **Archaean Eon** *or* **Archeozoic Eon** Older of the two divisions of PRECAMBRIAN TIME. The Archean begins with the formation of the Earth's CRUST c. 3.8 billion years ago and extends to c. 2.5 billion years ago, up to the start of the Proterozoic Eon, the second division of the Precambrian Period. The earliest and most primitive forms of life (BACTERIA and CYANOBACTERIA) originated c. 3.5 billion years ago in the middle of the Archean Eon (the Archean's alternative name, Archeozoic, means "ancient life").

archer fish Any of five species (family Toxotidae) of Indo-Pacific fishes noted for their ability to knock their insect prey off overhanging vegetation by shooting it with drops of water expelled from their mouth. Archer fishes are elongated and have a relatively deep body that is almost flat from the dorsal fin forward. The head is pointed, the mouth is large, and the dorsal



The arch supports a vertical load primarily by axial compression of its wedge-shaped voussoirs. As shown on the Roman arch, the first voussoir, or springer, rests on the impost, at the top of the abutment or pier. The haunch, rising from the impost to the crown (highest point), is defined by the inner curve, or intrados, and outer curve, or extrados. The Roman arch, with its semicircular intrados, has a rise exactly half the width of the span. Below it are shown examples of the curved arch (left) and the pointed arch (right). The stilted arch has vertical sides. A Moorish arch widens above the spring points. The trefoil arch's intrados has three indentations, or foils. A Gothic arch is a pointed arch usually having two haunches of equal radii of curvature. A Tudor arch has greater curvature near the springers than near the point. Each haunch of the ogee arch consists of a double curve.

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and anal fins are placed toward the back of the body. Different species are spotted or vertically banded with black. Archer fishes live in both fresh and salt water, usually remaining near the surface. One well-known species (*Toxotes jaculator*, or *jaculatrix*) grows to about 7 in. (18 cm) long.

archery Sport of shooting with BOW AND ARROW. As the bow began to be replaced by the gun as the principal weapon of warfare and the hunt beginning in the 16th century, it increasingly became a sporting device. By the mid-19th century, many archery clubs had sprung up in England and the U.S. Competitions including target-shooting were held at the Olympic Games in the early 20th century, but were then suspended until 1972. Other varieties of archery include field archery, or roving (a simulation of hunting), and flight shooting (a distance event).

Arches National Park Preserve, eastern Utah, U.S. Located on the COLORADO RIVER north of Moab, the preserve was established as a national monument in 1929 and as a national park in 1971. Its area is about 120 sq mi (310 sq km). The park's sandstone has been eroded into unusual shapes, including Courthouse Towers, Fiery Furnace, and Devils Garden, the site of Landscape Arch, at 306 ft (93 m) the longest freestanding natural rock bridge in the world.

archetype \'är-ki-ˌtīp\ Primordial image, character, or pattern of circumstances that recurs throughout literature and thought consistently enough to be considered universal. Literary critics adopted the term from Carl Gustav JUNG's theory of the collective UNCONSCIOUS. Because archetypes originate in pre-logical thought, they are held to evoke startlingly similar feelings in reader and author. Examples of archetypal symbols include the snake, whale, eagle, and vulture. An archetypal theme is the passage from innocence to experience; archetypal characters include the blood brother, rebel, wise grandparent, and prostitute with a heart of gold.

Archimedean screw \ˌär-kə-'mēd-ē-ən\ *or* **Archimedes' screw** Machine for raising water, said to have been invented by ARCHIMEDES for removing water from the hold of a large ship. One form consists of a circular pipe enclosing a helix and inclined at an angle of about 45°, with its lower end dipped in the water; rotation of the device lifts the water in the pipe. Other forms consist of a helix revolving in a fixed cylinder or a helical tube wound around a shaft.

Archimedes \ˌär-kə-'mē-ˌdēz\ (b. c. 290–280 BC, Syracuse, Sicily—d. 212/211 BC, Syracuse) Legendary Greek inventor and mathematician. His principal discoveries were the Archimedes screw, an ingenious device for raising water, and the hydrostatic principle, or ARCHIMEDES' PRINCIPLE. His main interests were optics, mechanics, pure mathematics, and astronomy. Archimedes' mathematical proofs show both boldly original thought and a rigour meeting the highest standards of contemporary geometry. His approximation of π was not improved on until after the Middle Ages, and translations of his works were important influences on 9th-century Arab and 16th- and 17th-century European mathematicians. In his native city, Syracuse, he was known as a genius at devising siege and countersiege weapons. He was killed by a Roman soldier during the storming of the city.

Archimedes' principle Law of buoyancy, discovered by ARCHIMEDES, which states that any object that is completely or partially submerged in a fluid at rest is acted on by an upward, or buoyant, force. The magnitude of this force is equal to the weight of the fluid displaced by the object. The volume of fluid displaced is equal to the volume of the portion of the object submerged.

Archipenko \ˌär-kə-'peŋ-kō**, Alexander** (b. May 30, 1887, Kiev, Ukr.—d. Feb. 25, 1964, New York, N.Y., U.S.) Ukrainian-U.S. sculptor. In 1908 he moved to Paris to study at the École des Beaux-Arts, and he soon became active in radical circles such as the CUBIST movement. He began to explore the interplay between interlocking voids and solids and between convex and concave surfaces, forming a sculptural equivalent to Cubist paintings' overlapping planes and, in the process, revolutionizing modern sculpture. About 1912 he introduced the concept of collage in sculpture, and he went on to further defy tradition in his "sculptopaintings," works in which he introduced painted colour to the intersecting planes of his sculpture. In 1923 he moved to New York City, where he worked and taught for most of his life.

architecture Art and technique of designing and building, as distinguished from the skills associated with construction. The practice of architecture emphasizes spatial relationships, ORIENTATION, the support of activities to be carried out within a designed environment, and the arrangement and visual rhythm of structural elements, as opposed to the design of structural systems themselves (see CIVIL ENGINEERING). Appropriateness, uniqueness, a sensitive and innovative response to functional requirements, and a sense of place within its surrounding physical and social context distinguish a built environment as representative of a culture's architecture. See also BUILDING CONSTRUCTION.

archives Repository for an organized body of records. Archives are produced or received by a public, semipublic, institutional, or business entity in the transaction of its affairs and are preserved by it or its successors. The modern institution of archives and archival administration dates from the late 18th century, when national and departmental archives were established in France. In the U.S. the National Archives was established in 1934 to house the retired records of the national government; the Federal Records Act of 1950 authorized regional records repositories. Each U.S. state has its own archival agency. Archivists in the 20th century increasingly handled records involving new technologies, such as computer-kept records and motion pictures, as well as the records of businesses, institutions, and individuals.

archon In ancient Greece, the chief magistrate or magistrates in a city-state, from the Archaic period onward. In ATHENS, nine archons divided state duties: the *archon eponymous* headed the BOULE and ECCLESIA, the polemarch commanded troops and presided over legal cases involving foreigners, the *archon basileus* headed state religion and the AREOPAGUS, and the six remaining archons handled various judicial matters. At first only elected aristocrats could serve, and their term was for life; later, terms were limited to a year. Archons were chosen by a combination of election and lot. In the 5th century BC the authority of the archons declined as elected generals assumed most of their powers.

Archon \'är-ˌkän\ In GNOSTICISM, any of various world-governing powers created with the material world by the DEMIURGE. Because the Gnostics regarded the material world as evil or as the product of error, Archons were considered forces of evil. Seven or 12 in number, they were identified with the seven planets of antiquity or the 12 signs of the ZODIAC. They were thought to have imprisoned the divine spark of human souls in material creation. The gnosis sent from the realms of divine light through Jesus enabled Gnostic initiates to pass through the spheres of the Archons into the realms of light.

archosaur \'är-kə-ˌsȯr\ Any of the various advanced REPTILES in the subclass Archosauria ("ruling reptiles"), including all thecodonts, PTEROSAURS, DINOSAURS, birds, and crocodilians. The first known archosaurs appeared 242–227 million years ago during the TRIASSIC PERIOD. All early archosaurs possessed an ankle specialization that aided in upright posture, and most had long hindlegs and short forelimbs. Unlike the teeth of earlier reptiles, which were set in a shallow groove, the teeth of archosaurs were (and are) set in sockets.

Archytas \är-'kī-təs\ (fl. 400–350 BC, Tarentum, Magna Graecia) Greek scientist, philosopher, and Pythagorean mathematician. Archytas is sometimes called the founder of mathematical mechanics. PLATO, a close friend, made use of his work in mathematics, and there is evidence that EUCLID borrowed from Archytas for Book VIII of the *Elements*. An influential public figure, he served seven years as commander in chief of his city, Tarentum (now Taranto, Italy).

Arcimboldo \ˌär-chēm-'bōl-dō**, Giuseppe** (b. c. 1527, Milan—d. 1593, Milan) Italian painter. He began his career as a painter and designer of stained-glass windows for Milan Cathedral. In 1562 he moved to Prague and became court painter to the emperors Ferdinand I and Rudolf II. He also painted scenery for the court theatre and became skillful at illusionistic imagery containing allegorical meanings, puns, and jokes. He is known for his eccentric and grotesque MANNERIST compositions of fruits, vegetables, animals, landscapes, and implements arranged to resemble human forms. The style was regarded as being in poor taste until the SURREALISTS revived the art of visual punning in the 1920s. See photograph on opposite page.

Arctic Archipelago Group of Canadian islands, Arctic Ocean. They lie north of the Canadian mainland and have an area of about 550,000 sq mi (1,424,500 sq km). The southeastern islands are an extension of the Canadian Shield; the balance consists of the Arctic lowlands to the south and the Innuitian Mountains to the north. The archipelago includes the large islands of BAFFIN, ELLESMERE, VICTORIA, BANKS, and Prince of Wales.

Arctic Circle Parallel of latitude approximately 66.5° north of the Equator that circumscribes the northern frigid zone. It marks the southern limit

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of the area within which, for one day or more each year, the sun does not set or rise. The length of continuous day or night increases northward from the Arctic Circle, mounting to six months at the North Pole.

Arctic fox Northern fox (*Alopex lagopus*) found throughout the Arctic, usually on tundra or mountains near the sea. Its short, rounded ears and short muzzle reduce its body area exposed to heat loss, and it has fur-covered soles. It is 20–24 in. (50–60 cm) long (excluding the 12-in., or 30-cm, tail) and weighs 7–17 lbs (3–8 kg). It has two colour phases. Individuals in the white phase are grayish brown in summer and white in winter; those in the blue phase (blue foxes of the fur trade) are grayish in summer and gray-blue in winter. The Arctic fox dwells in burrows and feeds on any available animal or vegetable material.

Arctic National Park, Gates of the See Gates of the Arctic National Park

Arctic Ocean Ocean centring approximately on the North Pole. Smallest of the world's oceans, it is almost completely surrounded by the landmasses of Eurasia and North America, and it is distinguished by a cover of ice. Lands in it and adjacent to it include Point Barrow in Alaska, the Arctic Archipelago, Greenland, Svalbard, Franz Josef Land, and northern Siberia. The ocean covers about 5,440,000 sq mi (14,090,000 sq km) and reaches a maximum depth of about 18,000 ft (5,500 m). Its marginal seas include the Barents, Beaufort, Chukchi, East Siberian, Greenland, Kara, Laptev, and White seas. Areas within the Arctic Circle were first explored beginning in the 9th century by the Norse. In the 16th–17th centuries explorers searching for the Northwest Passage reached the area; Martin Frobisher discovered the southern part of Baffin Island (1576–78), and Henry Hudson navigated the eastern coast of Hudson Bay (1610–11). Later explorers included Roald Amundsen, Fridtjof Nansen, Robert E. Peary, and Richard E. Byrd. Development of the area's natural resources was spurred by the discovery of oil in Alaska in the 1960s. Virtually all of the Arctic has now been mapped. See map opposite.

Arctic tern Tern species (*Sterna paradisaea*) that makes the longest annual migration of any bird. It breeds in the southerly reaches of the Arctic and winters in the Antarctic, making its migration a round-trip of nearly 22,000 mi (over 35,000 km). Its appearance—white with a black cap and grayish wings—is similar to that of the common tern (*S. hirundo*), its frequent companion.

Ardea \'är-dē-ə\ Ancient town, Italy. Located south of Rome, Ardea was ruled by the Rutuli people and was an important center for the cult of Juno. In 444 BC the town signed a treaty with the Romans, who colonized it as a barrier against the Volsci. It declined in the Roman civil wars of the 1st century BC.

Arden, Elizabeth *orig.* **Florence Nightingale Graham** (b. Dec. 31, 1884, Woodbridge, Ont., Can.—d. Oct. 18, 1966, New York, N.Y., U.S.) Canadian-U.S. businesswoman who founded a chain of women's salons. Graham moved to New York c. 1908, where she opened a beauty salon under the name Elizabeth Arden. She was instrumental in making cosmetics acceptable for respectable women. In 1915 she began to market her cosmetics products internationally. At her death there were over 100 Elizabeth Arden salons throughout the world.

"Summer," painting on canvas by Giuseppe Arcimboldo, 1563; in the Kunsthistorisches Museum, Vienna
BY COURTESY OF THE KUNSTHISTORISCHES MUSEUM, VIENNA; PHOTOGRAPH, ERWIN MEYER

Arden, John (b. Oct. 26, 1930, Barnsley, Yorkshire, Eng.) British playwright. He studied architecture at Cambridge and the Edinburgh College of Art. His plays mix poetry and songs with colloquial speech in a boldly theatrical manner and involve strong conflicts purposely left unresolved. Arden's works include *All Fall Down* (1955), *Serjeant Musgrave's Dance* (1959), *The Workhouse Donkey* (1963), *Vandaleur's Folly* (1978), and the radio series *Whose Is the Kingdom?* (1988).

Ardennes \är-'den\ *or* **Forest of Ardennes** Wooded plateau region, northwestern Europe. It covers over 3,860 sq mi (10,000 sq km) and includes parts of Belgium, Luxembourg, and the Meuse River valley of France; its average height is about 1,600 ft (488 m). Though half of it is covered with forests, the soil is generally unfertile and supports only heath. It is located in the middle of the heavily populated triangle of Paris, Brussels, and Cologne. During World Wars I and II, the area was the scene of severe fighting in 1914, 1918, and 1944 (see Battle of the Bulge).

Ardhanarisvara \ˌär-də-nä-'rēsh-və-rə\ Composite male-female figure of the Hindu god Shiva and his consort Parvati. In many Indian and S.East Asian sculptures, the right half is male and the left female. The figure symbolizes the inseparability of male and female principles.

Ards District (pop., 2001: 73,244), Northern Ireland. Formerly part of County Down, Ards was established as a district in 1973. Much of its land is devoted to crops and pasture. Newtownards, settled c. 1608 by Scots, is its administrative seat and manufacturing centre. Donaghadee is a popular resort town.

area See length, area, and volume

Arecibo \ˌar-ə-'sē-bō\ **Observatory** Astronomical observatory near Arecibo, P.R., site of the world's largest single-unit radio telescope (as opposed to multiple telescope interferometers such as the Very Large Array). The telescope dish, 1,000 ft (300 m) across, is built into a valley; celestial sources are tracked across the sky by moving secondary structures suspended about 500 ft (150 m) above the dish. The observatory has produced detailed radar maps of the surface of Venus and near-Earth asteroids (see Earth-crossing asteroid), made detailed studies of Earth's ionosphere, and made major contributions to studies of pulsars and hydrogen gas in galaxies.

arena stage See theater-in-the-round

Arendt \ä-'rent**, Hannah** (b. Oct. 14, 1906, Hannover, Ger.—d. Dec. 4, 1975, New York, N.Y., U.S.) German-born U.S. political philosopher.

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She studied philosophy at the Universities of Marburg, Freiburg, and Heidelberg, receiving a doctorate from the latter in 1928. While at Marburg she began a romantic relationship with her teacher MARTIN HEIDEGGER. Following the Nazi takeover of Germany in 1933, Arendt, who was Jewish, fled to Paris, where she became a social worker, and then to New York City in 1941. Her major work, *Origins of Totalitarianism* (1951), traced TOTALITARIANISM to 19th-century ANTI-SEMITISM, IMPERIALISM, and the disintegration of the traditional nation-state. Her highly controversial book *Eichmann in Jerusalem* (1963) argued that the Nazi war criminal ADOLF EICHMANN was not inwardly wicked or depraved but merely "thoughtless"; his role in the extermination of the Jews thus epitomized the fearsome "banality of evil" that had swept across Europe at the time. Resuming contact with Heidegger in 1950, she claimed that his involvement with the Nazis had been the "mistake" of a great philosopher. She taught at the University of Chicago (1963–67) and thereafter at the New School for Social Research in New York City.

Areopagus \ˌar-ē-'ä-pə-gəs\ Supreme tribunal of ancient ATHENS. It was named for the Areopagus ("Ares' Hill"), where it met. It began as the king's council; by DRACO's code of law (c. 621 BC) it consisted of former ARCHONS, but SOLON (594) opened candidacy to any citizen. It had broad judicial powers. Its prestige fluctuated from the mid 6th to the mid 4th century BC, after which its power revived and continued under Roman domination, when it reacquired extensive administrative duties.

Arequipa \ˌä-rā-'kē-pä\ City (pop., 1998 est.: 710,103), southern Peru. Located in the Andes Mountains at an elevation of 7,557 ft (2,303 m) at the foot of MISTI VOLCANO (19,098 ft [5,821 m]), it has been subject to earthquakes, usually associated with volcanic activity, and was largely destroyed by an earthquake in 1868. In the INCA empire, Arequipa was an important point on the route from CUZCO to the seacoast. Modern Arequipa is the commercial centre of southern Peru.

Ares \'ar-ēz\ Greek god of war. Unlike his Roman counterpart, MARS, his worship was not extensive. From the time of HOMER, he was one of the Olympian deities, the son of ZEUS and HERA, but disliked by the other gods. His worship occurred largely in northern Greece. He was associated from early times with APHRODITE, occasionally portrayed as his legitimate wife and at other times his lover. He was accompanied in battle by his sister Eris (strife) and by two of his children by Aphrodite, Phobos and Deimos (Panic and Rout).

Ares, classical sculpture; in the National Roman Museum, Rome
ANDERSON—ALINARI FROM ART RESOURCE

Aretino \ˌä-rā-'tē-nō**, Pietro** (b. April 20, 1492, Arezzo, Republic of Florence [Italy]—d. Oct. 21, 1556, Venice) Italian poet, prose writer, and dramatist. He was celebrated throughout Europe in his time for his bold and insolent literary attacks on the powerful. His fiery letters and dialogues are of great biographical and topical interest. His dramas, which are relatively free of venomous assaults, include five comedies and a tragedy, *Orazia* (1546), perhaps the best Italian tragedy of the 16th century.

Arévalo \ˌä-rā-'bä-lō\ **(Bermejo), Juan José** (b. Sept. 10, 1904, Taxisco, Guat.—d. Oct. 6, 1990, Guatemala City) President of Guatemala (1945–51). Soon after earning his doctorate, he went to Argentina, where he held various academic positions. After the overthrow of the Guatemalan dictator Jorge Ubico, he was elected president, receiving 85 percent of the vote. He established freedom of speech and of the press, and his administration inaugurated a social security system, a labour code, and important education and health programs. His policies favoured urban and agricultural workers and the indigenous population. He stepped down voluntarily at the end of his term. A military coup prevented him from running again in 1963.

Argentina *officially* **Argentine Republic** Country, southern South America. Area: 1,073,400 sq mi (2,780,092 sq km). Population (2005 est.): 38,592,000. Capital: BUENOS AIRES. The people are mostly of Euro-

pean ancestry, especially Spanish, with smaller mestizo, Indian, and Arab populations. Language: Spanish (official). Religions: Christianity (predominantly Roman Catholic [official]; also Protestant); also Islam, Judaism. Currency: Argentine peso. Argentina can be divided into four general regions: the North, the PAMPAS, PATAGONIA, and the ANDES MOUNTAINS. The subtropical plains in the northeast are divided by the PARANÁ RIVER into Mesopotamia to the east and GRAN CHACO to the west and north. The Pampas, south and west of the Paraná, is one of the world's most productive agricultural areas and the country's most populous region. Patagonia lies south of the COLORADO RIVER. The Argentine Andes include the continent's highest peak, Mount ACONCAGUA. Argentina's hydrology is dominated by rivers that include the Paraná, URUGUAY, and PILCOMAYO, which drain into the Río de la PLATA. Argentina has a developing economy based largely on manufacturing and agriculture; it is Latin America's largest exporter of beef and beef products. It is a republic with two legislative houses; the head of state and government is the president. Little is known of the indigenous population before the Europeans' arrival. The area was explored for Spain by SEBASTIAN CABOT beginning in 1526; by 1580 ASUNCIÓN, Santa Fe, and Buenos Aires had been settled. Early in the 17th century it was attached to the Viceroyalty of PERU, but in 1776 it was included with regions of modern Uruguay, Paraguay, and Bolivia in the Viceroyalty of the RÍO DE LA PLATA, whose capital was Buenos Aires. With the establishment of the United Provinces of the Río de la Plata in 1816, Argentina achieved its independence from Spain, but its boundaries were not set until the early 20th century. In 1943 the government was overthrown by the military; Col. JUAN PERÓN took control in 1946. He in turn was overthrown in 1955. He returned in 1973 after two decades of turmoil. His third wife, Isabel,

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became president on his death in 1974 but lost power after another military coup in 1976. The military government tried to take the Falkland Islands (Islas Malvinas) in 1982 but was defeated by the British in the Falkland Islands War, with the result that the government returned to civilian rule in 1983. The government of Raúl Alfonsín worked to end the human rights abuses that had characterized the former regimes. Hyperinflation, however, led to public riots and Alfonsín's party's electoral defeat in 1989; his Peronist successor, Carlos Menem, instituted laissez-faire economic policies. In 1999 Fernando de la Rúa of the Alliance coalition was elected president, and his administration struggled with rising unemployment, heavy foreign debt, and government corruption.

Argerich \'är-ger-ich**, Martha** (b. June 5, 1941, Buenos Aires, Arg.) Argentine pianist. A prodigy, she began concertizing before she was 10. In 1955 she went to Europe, where her teachers included Arturo Benedetti Michelangeli (1920–95). She won two prestigious competitions at age 16 and the Chopin competition in 1965. Her exceptionally brilliant technique, emotional depth, and élan won her an enthusiastic international following.

arginine \'är-jə-ˌnēn\ One of the essential amino acids, particularly abundant in histones and other proteins associated with nucleic acids. It plays an important metabolic role in the synthesis of urea, the principal form in which mammals excrete nitrogen compounds. Arginine is used in medicine and biochemical research, in pharmaceuticals, and as a dietary supplement.

argon Chemical element, chemical symbol Ar, atomic number 18. Colourless, odourless, and tasteless, it is the most abundant of the noble gases on Earth and the one most used in industry. It constitutes about 1% of air and is obtained by distillation of liquid air. Argon provides an inert gas shield in welding and brazing, in lightbulbs and lasers, in Geiger counters, and in the production and fabrication of certain metals. Because a radioactive form of argon is produced by decay of a naturally occurring radioactive potassium isotope, it can be used to date rocks and samples more than 100,000 years old.

argon-argon dating See potassium-argon dating

Argonauts In Greek legend, a band of 50 heroes who went with Jason in the ship *Argo* to retrieve the Golden Fleece from the grove of Ares at Colchis. They had many adventures before arriving at Colchis, from which they were eventually forced to flee, pursued by Medea's father, Aeëtes. The *Argo* eventually returned to Jason's home kingdom (Iolcus) and was placed in a grove sacred to Poseidon; Jason died when its prow toppled as he was resting in its shadow.

The Argonauts, detail of a painting by Lorenzo Costa in the Civic Museum, Padua, Italy
SCALA/ART RESOURCE, NEW YORK

Árgos Ancient city-state, northeastern Peloponnese, Greece. Under the Argive king Pheidon, it was the dominant city-state in the Peloponnese in the 7th century BC until the rise of Sparta. After suffering incursions from Macedonia, Árgos joined the Achaean League in 229 BC. Later it came under Roman rule. The city flourished in Byzantine times but ultimately fell to the Ottoman Empire in the 16th century. During the War of Greek Independence (1821–29), the first free Greek Parliament was convened at Árgos. The modern town (pop., 1991: 22,429) is an agricultural centre.

argument from design *or* **teleological argument** Argument for the existence of God. According to one version, the universe as a whole is like a machine; machines have intelligent designers; like effects have like causes; therefore, the universe as a whole has an intelligent designer, which is God. The argument was propounded by medieval Christian thinkers, especially St. Thomas Aquinas, and was developed in great detail in the 17th and 18th centuries by writers such as Samuel Clarke (1675–1729) and William Paley. It was powerfully criticized by David Hume in his *Dialogues Concerning Natural Religion*. Immanuel Kant also rejected the argument. In the late 20th century the argument was revived as the doctrine of intelligent design. See also creationism.

Argun \'är-'gün\ **River** *Chinese* **Ergun He** *or* **O-erh-ku-na** \'ō-'är-'gü-'nä\ **Ho** River, northeastern Asia. Rising in the Da Hinggan (Greater Khingan) Range, it runs about 1,000 mi (1,600 km), forming part of the boundary between northeastern China and Russia and uniting with the Shilka River to form the Amur River. In its upper course it is called the Hailar.

arhat \'är-hət\ *or* **arahant** \'a-rə-hant\ In Buddhism, one who has gained insight into the true nature of existence, has achieved nirvana, and will not be reborn. Theravada Buddhism regards becoming an arhat as the goal of spiritual progress. It holds that a seeker must pass through three earlier stages before being reborn in a heaven as an arhat. Mahayana Buddhism criticizes the goal of becoming an arhat as selfish and considers the bodhisattva to be a higher goal because the bodhisattva remains in the cycle of rebirths to work for the good of others. This divergence of opinion is one of the fundamental differences between Theravada and Mahayana Buddhism.

Århus *or* **Aarhus** \'ȯr-ˌhüs\ Seaport (pop., 2001: 286,688), eastern Jutland, Denmark. It lies along Århus Bay and has an extensive harbour. Its origins are unknown, but it became a bishopric in AD 948 and, with its many religious institutions, prospered during the Middle Ages. In modern times, industrialization and harbour expansion have made it Denmark's second largest city.

aria Solo song with instrumental accompaniment in opera, cantata, or oratorio. The strophic or stanzaic aria, in which each new stanza might represent a melodic variation on the first, appeared in opera in Claudio Monteverdi's *Orfeo* (1607) and was widely used for decades. The standard aria form c. 1650–1775 was the da capo aria, in which the opening melody and text are repeated after an intervening melody-text section (often in a different key, tempo, and metre); the return of the first section was often virtuosically embellished by the singer. Comic operas never limited themselves to da capo form. Even in serious opera, from c. 1750 a variety of forms were used; Gioacchino Rossini and others often expanded the aria into a complete musical scene in which two or more conflicting emotions were expressed. Richard Wagner's operas largely abandoned the aria in favour of a continuous musical texture, but arias have never ceased to be written.

Ariadne \ˌar-ē-'ad-nē\ In Greek mythology, the daughter of Pasiphaë and King Minos of Crete. She fell in love with Theseus, who had promised to slay the Minotaur confined in Minos's Labyrinth. She gave Theseus a ball of thread or glittering jewels that enabled him to mark his path and thus to escape the Labyrinth after killing the monster. Endings to the legend vary. In one, Theseus abandons Ariadne and she hangs herself; in others, he carries her to Naxos, where she either dies or marries the god Dionysus. See also Phaedra.

Arianism Christian heresy that declared that Christ is not truly divine but a created being. According to the Alexandrian presbyter Arius (4th century), God alone is immutable and self-existent, and the Son is not God but a creature with a beginning. The Council of Nicaea (AD 325) condemned Arius and declared the Son to be "of one substance with the father." Arianism had numerous defenders for the next 50 years but eventually collapsed when the Christian emperors of Rome Gratian and Theodosius assumed power. The First Council of Constantinople (381) approved the Nicene Creed and proscribed Arianism. The heresy continued among the Germanic tribes through the 7th century, and similar beliefs are held in the present day by the Jehovah's Witnesses and by some adherents of Unitarianism.

Arias Sánchez \'är-ē-ˌäs-'sän-chās**, Oscar** (b. Sept. 13, 1941, Heredia, Costa Rica) President of Costa Rica (1986–90). A moderate socialist born to wealth, Arias worked for the National Liberation Party from the 1960s. He became president at a time when much of Central America was torn by civil war. His 1987 Central American peace plan, signed by the leaders of El Salvador, Guatemala, Honduras, and Nicaragua, included provisions for cease-fires, free elections, and amnesty for political prisoners. He was awarded the 1987 Nobel Peace Prize.

Aries (Latin: "Ram") In astronomy, the constellation lying between Pisces and Taurus; in astrology, the first sign of the zodiac, governing approximately the period March 21–April 19. It is represented by a ram, which is sometimes identified with the Egyptian god Amon. In Greek

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mythology Aries was identified with the ram that carried the prince Phrixus out of Thessaly to Colchis. Phrixus sacrificed the ram to Zeus, who placed it in the heavens as a constellation. Its golden fleece was later recovered by JASON.

Arīḥā See JERICHO

aril \'ar-il\ Special covering of certain seeds that commonly develops from the seed stalk. It is often a bright-coloured fleshy envelope, as in such woody plants as the YEWS and NUTMEG and in members of the ARROWROOT family, OXALIS, and the CASTOR-OIL PLANT. Animals are attracted to arils and eat the seeds, dispersing them in their wastes. The aril of nutmeg is the source of the spice known as mace.

Arion \ə-'rī-ən\ Semilegendary Greek poet and musician. He lived at Methymna on the island of LESBOS and is identified as the inventor of the DITHYRAMB. He was sailing homeward after a performing tour when the sailors decided to kill him and steal his wealth. After singing a dirge for himself, he jumped overboard, but a dolphin charmed by his music carried him to shore. He reached CORINTH before the ship; when the sailors arrived, the ruler Periander forced them to confess and punished them. Arion's lyre and the dolphin were placed in the heavens as the constellations Lyra and Delphinus.

Ariosto \ˌär-ē-'ō-stō**, Ludovico** (b. Sept. 8, 1474, Reggio Emilia, duchy of Modena [Italy]—d. July 6, 1533, Ferrara) Italian poet. His epic poem *Orlando Furioso* (1516) is regarded as the finest literary expression of the Italian Renaissance. It enjoyed immediate popularity throughout Europe and was highly influential. He also wrote five comedies based on Latin classics but inspired by contemporary life; though minor in themselves, they are among the first of the imitations of Latin comedy in the vernacular that would long characterize European comedy. He also composed seven satires (1517–25) modeled after those of HORACE .

Ariosto, woodcut after a drawing by Titian from the third edition of *Orlando furioso,* 1532.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Aristagoras \ˌar-ə-'stag-ə-rəs\ (d. 497) Tyrant of MILETUS. He assumed his regency from his father-in-law, Histiaeus (d. 494 BC), who had lost the trust of the Persian emperor, DARIUS I. Possibly incited by Histiaeus, and with support from Athens and Eretria, Aristagoras raised the IONIAN REVOLT against Persia. Defeated, he left Miletus to found a colony in Thrace, where he was killed by Thracians.

Aristarchus \ˌar-ə-'stär-kəs\ **of Samos** (b. c. 310 BC—d. c. 230 BC) Greek astronomer. His advanced ideas on the movement of the Earth (which he asserted revolved around the Sun) are known from ARCHIMEDES and PLUTARCH. His only surviving work is the short treatise "On the Sizes and Distances of the Sun and Moon"; though the values he obtained are inaccurate, he showed that the Sun and stars are at immense distances. A peak in the centre of a lunar crater named for him is the brightest formation on the Moon.

Aristide \ˌar-i-'stēd**, Jean-Bertrand** (b. July 15, 1953, Port Salut, Haiti) First president of Haiti (1991, 1994–96, 2001–04) to be elected in free democratic elections. A priest in the Roman Catholic Salesian order, he aligned himself with the poor and opposed the harsh regime of Jean-Claude Duvalier, son of FRANÇOIS DUVALIER, often putting himself at odds with the church hierarchy and the military. Expelled by the Salesians in 1988, he formally requested that he be relieved of his priestly duties in 1994. In 1990 progressive-centre forces united behind Aristide and swept him into power. He initiated dramatic reforms but was ousted in a military coup after only seven months in office. Though restored to office in 1994 with the help of U.S. occupying troops, he received little aid with which to address his country's endemic ills. Constitutionally prohibited from seeking a consecutive term, he stepped down in 1996 but remained Haiti's most potent political figure. In 2000 he was reelected president amid charges of electoral fraud. A coup against Aristide failed in 2001, but unrest with his rule increased until a full-scale rebellion in 2004 forced him to flee the country.

Aristides \ˌar-ə-'stī-dēz\ (2nd century AD) Athenian philosopher, one of the earliest Christian APOLOGISTS. His *Apology for the Christian Faith* discussed the harmony in creation and the nature of the divine being and stated that barbarians, Greeks, and Jews were all inadequate in their conception of the deity and their religious practices. Long considered lost, the *Apology* was reconstructed in the late 19th century.

Aristides the Just (fl. 5th century BC) Athenian statesman and general. He was ostracized in 482 BC, probably for opposing THEMISTOCLES but was recalled in 480 and helped defeat the Persians at the battles of SALAMIS and PLATAEA. In 478 he helped Sparta's eastern allies form the DELIAN LEAGUE; allied with Athens and based on Athenian naval power and the trust Aristides inspired, the league effectively became the Athenian empire.

aristocracy \ˌar-ə-'stä-krə-sē\ Originally, leadership by a small privileged class or a minority thought to be best qualified to lead. PLATO and ARISTOTLE considered aristocrats to be those who are morally and intellectually superior, and therefore fit to govern in the interests of the people. The term has come to mean the upper layer of a stratified group. Most aristocracies have been hereditary, and many European societies stratified their aristocratic classes by formally titling their members, thereby making the term roughly synonymous with nobility. See also OLIGARCHY.

Aristophanes \ˌar-ə-'stä-fə-ˌnēz\ (b. c. 450—d. c. 388 BC) Greek playwright. An Athenian, he began his career as a comic dramatist in 427. He wrote approximately 40 plays, of which 11 survive, including *The Clouds* (423), *The Wasps* (422), *The Birds* (414), *Lysistrata* (411), and *The Frogs* (405). Most of the plays typify the Old Comedy (of which they are the only extant representatives), in which mime, chorus, and burlesque were important features. His satire, wit, and merciless topical commentary made him the greatest comic dramatist of ancient Greece.

Aristotle (b. 384, Stagira—d. 322 BC, Chalcis) Greek philosopher and scientist whose thought determined the course of Western intellectual history for two millenia. He was the son of the court physician to Amyntas III, grandfather of ALEXANDER THE GREAT. In 367 he became a student at the Academy of PLATO in Athens; he remained there for 20 years. After Plato's death in 348/347, he returned to Macedonia, where he became tutor to the young Alexander. In 335 he founded his own school in Athens, the Lyceum. His intellectual range was vast, covering most of the sciences and many of the arts. He worked in physics, chemistry, biology, zoology, and botany; in psychology, political theory, and ethics; in logic and metaphysics; and in history, literary theory, and rhetoric. He invented the study of formal logic, devising for it a finished system, known as SYLLOGISTIC, that was considered the sum of the discipline until the 19th century; his work in zoology, both observational and theoretical, also was not surpassed until the 19th century. His ethical and political theory, especially his conception of the ethical virtues and of human flourishing ("happiness"), continue to exert great influence in philosophical debate. He wrote prolifically; his major surviving works include the *Organon*, *De Anima* ("On the Soul"), *Physics*, *Metaphysics*, *Nicomachean Ethics*, *Eudemian Ethics*, *Magna Moralia*, *Politics*, *Rhetoric*, and *Poetics,* as well as other works on natural history and science. See also TELEOLOGY.

arithmetic Branch of mathematics that deals with the properties of NUMBERS and ways of combining them through addition, subtraction, multiplication, and division. Initially it dealt only with the counting numbers, but its definition has broadened to include all REAL NUMBERS. The most important arithmetic properties (where a and b are real numbers) are the COMMUTATIVE LAWS of addition and multiplication, $a + b = b + a$ and $ab = ba$; the ASSOCIATIVE LAWS of addition and multiplication, $a + (b + c) = (a + b) + c$ and $a(bc) = (ab)c$; and the DISTRIBUTIVE LAW, which connects addition and multiplication, $a(b + c) = ab + ac$. These properties include subtraction (addition of a negative number) and division (multiplication by a FRACTION).

Arius \'ar-ē-əs\ (b. c. 250, Libya—d. 336, Constantinople, Byzantine Empire) Christian priest and heretic whose teachings gave rise to the doctrine of ARIANISM. He was leader of a Christian community near Alexandria, Egypt, where he preached doctrines that combined NEOPLATONISM with a literal, rationalist interpretation of biblical texts. By asserting the absolute oneness and immutability of God, he called into question the divinity of Christ. His views were publicized through his major work, *Thalia*

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(c. 323). In 325 the Council of Nicaea declared him a heretic. He was striving to compromise his views and win readmission to the church when he died suddenly in Constantinople. The Arian heresy posed a threat to Christian orthodoxy for several centuries.

Arizona State (pop., 2000: 5,130,632), southwestern U.S. Bordered by Mexico and the U.S. states of Utah, New Mexico, California, and Nevada, it covers 113,999 sq mi (295,256 sq km). Its capital is Phoenix. Its highest point is Humphreys Peak, at 12,633 ft (3,850 m). The site of Grand Canyon and Petrified Forest national parks, Arizona also contains much of America's Indian tribal lands. Humans settled the area more than 25,000 years ago. Nomadic Apache and Navajo Indians arrived after the collapse of the Anasazi and Hohokam civilizations. They were followed in the 16th century by Spanish treasure seekers from Mexico, including Francisco Vázquez de Coronado, establishing Mexico's claim to the area. In 1776 the Mexican army built a presidio at Tucson. After the Mexican War, Arizona was ceded to the U.S. as part of New Mexico in 1848; the Gadsden Purchase added to it in 1853. Organized as a territory in 1863, Arizona became the 48th state in 1912. Though still lightly populated, it has grown rapidly in population in recent decades, largely because of its climate. About one-fifth of the population is Spanish-speaking, while about 5% is American Indian, including Navajo, Hopi, Apache, Papago, and Pima. Its diverse economy includes agriculture, mining, aerospace, electronics, and tourism.

Arjan \'ər-jən\ (b. 1581—d. 1606) Fifth Guru of the Sikhs (1581–1606) and its first martyr. He compiled the volume of Sikh scripture on which the Ādi Granth is based, and he completed the Golden Temple at Amritsar, India. The first Guru to serve as both temporal and spiritual head of Sikhism, he built up Amritsar as a commercial centre and enlarged missionary efforts. He was also a prolific poet and writer of hymns. He prospered under the tolerant Mughal emperor Akbar but was tortured to death by Akbar's successor for not altering the *Ādi Granth* to remove passages that gave offense to Hinduism or Islam.

Arjuna \'ər-jù-nə\ One of the five brothers who are the heroes of the *Mahabharata*. His reluctance to go into battle prompts Krishna, manifested as his friend and charioteer, to deliver the discourse on duty that constitutes the *Bhagavadgita*. An exemplar of skill, duty, and compassion as well as a seeker of true knowledge, Arjuna is a central figure in Hindu myth and theology.

Ark of the Covenant In Judaism and Christianity, the ornate, gold-plated wooden chest that in biblical times housed the two tablets of the Law given to Moses by God. The Levites carried the Ark during the Hebrews' wandering in the wilderness. Following the conquest of Canaan, it was kept at Shiloh but was sometimes carried into battle by the Israelites. David took it to Jerusalem, and Solomon placed it in the Temple of Jerusalem, where it rested in the Holy of Holies and was seen only by the high priest on Yom Kippur. It is believed to have been captured when Jerusalem fell to the Babylonians in 586 BC, and its subsequent fate is unknown.

Arkansas State (pop., 2000: 2,673,400), south-central U.S. Bordered by Missouri, Tennessee, Mississippi, Louisiana, Texas, and Oklahoma, it covers 53,178 sq mi (137,730 sq km). Its capital is Little Rock, and its highest point is Mount Magazine, at 2,753 ft (839 m). The earliest inhabitants were Indian bluff dwellers along the Mississippi River c. AD 500. Mound-building cultures later left burial mounds along the river. Spanish and French explorers traversed the region in the 16th–17th centuries; the first permanent European settlement was founded at Arkansas Post in 1686. Acquired by the U.S. as part of the Louisiana Purchase, Arkansas Territory was established in 1819; the state's current boundaries were fixed in 1828. Arkansas became the 25th state in 1836. It seceded in 1861 to join the Confederacy in the American Civil War; it was readmitted to the Union in 1868. Following Reconstruction, a rigid policy of segregation lasted until 1957, when court-ordered desegregation of the schools was implemented. Once dominated by agriculture, the state's economy now also includes mining and manufacturing. Tourism is promoted, especially by the mineral springs at Hot Springs National Park and resorts in the Ozark Mountains.

Arkansas River River, rising in central Colorado, U.S. At 1,450 mi (2,333 km) long, it flows east through southern Kansas and southeast across northeastern Oklahoma and bisects Arkansas, where it empties into the Mississippi River. Navigable for 650 mi (1,046 km), its largest tributaries are the Canadian and Cimarron rivers. It is believed to have been crossed by Francisco Vazquez de Coronado in 1541 near the site of Dodge City, Kan., and by Zebulon Pike in 1806.

Arkhangelsk \ˌär-ˈkän-gilsk\ *or* **Archangel** City (pop., 2002: 355,500), northwestern Russia. Located near the mouth of Northern Dvina River, it has a large harbour kept open in winter by icebreakers. The area was settled by Norsemen in the 10th century AD. In 1553 it was visited by the English who were looking for the Northeast Passage. Founded in 1584 as a monastery of Michael the archangel, it became a trading station of the Muscovy Co. It was opened to European trade by Tsar Boris Godunov and flourished as the sole Russian seaport until St. Petersburg was built in 1703. Arkhangelsk was the scene of British, French, and U.S. support of the northern Russian government against the Bolsheviks in 1918–20. During World War II it received convoys of lend-lease goods from Britain and the U.S. (1941–45). It is a major timber-exporting port and has extensive shipbuilding facilities.

Arkona W. Slavic citadel-temple of the war-god Svantovit, built in the 9th–10th century AD and destroyed in 1168/69 by Christian Danes when they stormed the island of Rügen in the southwestern Baltic. According to Saxo Grammaticus, it was a log structure with red roof, surrounded by a yard and fence, carved and painted with symbols. The inner sanctum contained a statue of Svantovit with four heads and throats facing in opposite directions. Excavations in 1921 proved the temple's actual existence.

arkose \'är-ˌkōs, 'är-ˌkōz\ Coarse sandstone that has formed by the disintegration of granite without appreciable decomposition. It thus consists primarily of quartz and feldspar grains. In the absence of stratification, arkose may bear superficial resemblance to granite, and it sometimes has been described as reconstituted granite, or granite wash. Like the granite from which it was formed, arkose is pink or gray.

Arkwright, Sir Richard (b. Dec. 23, 1732, Preston, Lancashire, Eng.—d. Aug. 3, 1792, Cromford, Derbyshire) British textile industrialist and inventor. His first spinning machine was patented in 1769 (see Lewis Paul). His water frame (so-called because it operated by waterpower) produced a cotton yarn suitable for warp (see weaving), stronger than thread made on the spinning jenny, which proved suitable only for weft. He introduced all-cotton calico in 1773. He opened several factories equipped with machinery for carrying out the phases of textile manufacturing from carding through spinning (see drawing).

Arledge, Roone (b. July 8, 1931, Forest Hills, N.Y., U.S.—d. Dec. 5, 2002, New York City) U.S. television executive. He began work at ABC-TV in 1960 as a sports producer. He later became president of ABC Sports and group president of ABC News and Sports (1985–90). He created sports programs such as *Wide World of Sports* (from 1961) and *Monday Night Football* (from 1968) and produced television coverage of 10 Olympic games, making many technical and editorial innovations in sports coverage. As president of ABC News he developed several successful news shows such as *Nightline* (from 1980) and *PrimeTime Live* (from 1989).

Arlen, Harold *orig.* **Hyman Arluck** (b. Feb. 15, 1905, Buffalo, N.Y., U.S.—d. April 23, 1986, New York, N.Y.) U.S. songwriter. After working as a performer and arranger, in 1929 he began a collaboration with lyricist Ted Koehler (1894–1973) with the song "Get Happy"; until the mid-1930s they wrote many songs that were featured in shows at Harlem's Cotton Club. Arlen's scores for Broadway musicals include *Bloomer Girl* (1944) and *St. Louis Woman* (1946). For Hollywood films Arlen wrote the songs "It's Only a Paper Moon," "Let's Fall in Love," and "That Old Black Magic." His most famous song is perhaps "Over the Rainbow" (lyrics by E.Y. Harburg) from *The Wizard of Oz* (1939).

Arles \'ärl, 'ärlz\ City (pop., 1999: 50,453), southeastern France. Occupied and built up by the Romans in the 1st century BC, Arles became, through commerce, a leading city of the Roman Empire. In the 10th century AD it became the capital of Burgundy, known also as the kingdom of Arles. Portions of the Roman wall around the old town remain, and a Roman arena of the 1st century BC is still used for bullfights and plays. The city was home to Vincent van Gogh during one of his most productive periods. Arles is still a river port, but its economy is based largely on tourism and agriculture.

Arlington Unincorporated settlement (pop., 2000: 189,453), northern Virginia, U.S. Lying across the Potomac River from Washington, D.C., it is the capital of Arlington county, which was part of Washington, D.C., from 1801 to 1847, when it was returned to Virginia. It is the site of

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Arlington National Cemetery (located on the former estate of Robert E. Lee), Ronald Reagan Washington National Airport, and numerous federal buildings, including the Pentagon.

arm Upper limb of a biped, particularly a primate. Primate arms have one long bone, the humerus, in the upper arm above the elbow, and two thinner bones, the radius and ulna, in the forearm. The triceps muscle straightens the forearm at the elbow joint; the brachialis and biceps muscles bend it. Forearm and small muscles in the hand move the hand and fingers. The term may also denote the limb or the locomotive or prehensile organ of an invertebrate (e.g., the ray of a starfish or the tentacle of an octopus).

Armada, Spanish Great fleet sent by Philip II of Spain in 1588 to invade England in conjunction with a Spanish army from Flanders. Philip was motivated by a desire to restore the Roman Catholic faith in England and by English piracies against Spanish trade and possessions. The Armada, commanded by the duke of Medina-Sidonia, consisted of about 130 ships. In the weeklong battle, the Spanish suffered defeat after the English launched fire ships into the Spanish fleet, breaking the ships' formation and making them susceptible to the English ships' heavy guns. Many Spanish ships were also lost during the long voyage home, and a total of perhaps 15,000 Spaniards died. The defeat of the Armada, in which Francis Drake played a principal role, saved England and the Netherlands from possible absorption into the Spanish empire.

armadillo Any of 20 species of armoured mammals (family Dasypodidae) related to sloths and anteaters. Armadillos are stout and short-legged, with strong, curved claws and a protective covering of pinkish to brown armour composed of bony plates covered with tough scales. The plates are separated by flexible bands of tissue. One species lives in the U.S., the others in tropical and subtropical regions to the south, primarily in South America. Most inhabit open areas, but some can be found in forests. Species range in size from about 6 in. (16 cm) to 5 ft (1.5 m) long. They live alone, in pairs, or in small groups and feed on termites or other insects, vegetation, small animals, and carrion.

Nine-banded armadillo (*Dasypus novemcinctus*).
APPEL COLOR PHOTOGRAPHY

Armageddon \ˌär-mə-'ged-ən\ In the New Testament, the place where the kings of the earth under demonic leadership will wage war on the forces of God at the end of history. Armageddon is mentioned only in the Revelation to John. The name may mean "Mountain of Megiddo," a reference to the city of Megiddo, which held strategic importance in Palestine. Other biblical references suggest Jerusalem as the battle site.

Armagh \'är-ˌmä\ District (pop., 2001: 54,263), Northern Ireland. Formerly part of County Armagh, the district was established in 1973. It lies south of Lough Neagh. The northern part of the district is the island's main fruit-growing region; the southern part, along the Irish border, was a hotbed of sectarian violence through the late 20th century. The district seat is Armagh town. According to tradition, St. Patrick established his principal Irish church here in the 5th century. The area was the leading intellectual centre of the Western world in the 5th–9th centuries. Taken by English Protestant forces in the 16th century, Armagh became a prosperous centre for Protestant clergy and gentry, a circumstance reflected in its many Georgian monuments and buildings.

Armagnac \ˌär-mä-'nyäk\ Small territory in historical Gascony, southwestern France. A portion was part of the Roman province of Aquitania (see Aquitaine). From c. 960 it was the separate countship of Armagnac, and it grew to occupy a buffer zone between lands controlled by the French kings (Toulouse) and those controlled by the English (Guyenne). It led the resistance to the English king Henry V's invasion of France but suffered a setback at the Battle of Agincourt. It was first annexed to France in 1497, became a countship again, but finally, by descent through the rulers of Navarra, returned to the French crown in 1607. Again a countship from 1645, it was dissolved in 1789. The region produces the famous Armagnac brandy.

Armani \är-'mä-nē**, Giorgio** (b. July 11, 1934, Piacenza, Italy) Italian fashion designer. He abandoned medical school and worked as a buyer for a department store (1957–64) before training as a fashion designer. In 1974–75 he introduced his own label of ready-to-wear apparel for men and women. In 1980–81 he founded Giorgio Armani USA, Emporio Armani, and Armani Jeans, and in 1989 he opened shops in London. He was a leader in the move toward a pared-down, unstructured silhouette in menswear and was responsible for the wide-shouldered look for executive women. His designs, often characterized by understated glamour and luxurious fabrics, introduced ease and streamlined modernity into late 20th-century dressing.

Armed Islamic Group *French* **Groupe Islamique Armée (GIA)** Algerian militant group. It was formed in 1992 after the government nullified the likely victory of the Islamic Salvation Front in 1991 legislative elections and was fueled by the repatriation of numerous Algerian Islamists who had fought in the Afghan War (1978–92). The GIA began a series of violent, armed attacks against the government and against foreigners in Algeria and has been accused of civilian massacres—although it has been alleged that many such atrocities were committed by security-service infiltrators and special military units. It has also engaged in attacks abroad (particularly in France) and purportedly maintained links with militant Islamic groups throughout the world. Estimates of GIA strength have varied from hundreds to several thousand guerrillas.

Armenia *officially* **Republic of Armenia** Country, Transcaucasia, western Asia. Area: 11,484 sq mi (29,743 sq km). Population (2005 est.): 2,983,000. Capital: Yerevan. Armenians constitute nine-tenths of the population; there are also small numbers of Azerbaijanians, Kurds, Russians, and Ukrainians. Languages: Armenian (official), Russian. Religions: Christianity (predominantly Armenian Apostolic; also Roman Catholic); also Islam. Currency: dram. Armenia is a mountainous country with an average elevation of 5,900 ft (1,800 m). The Lesser Caucasus ranges stretch across its northern portion, and Lake Sevan lies in the east-central part. Armenia has a dry and continental climate that changes dramatically with elevation. Though the country has become highly industrialized (as a result of the development of hydroelectric power during Soviet rule) and increasingly urbanized, agriculture is still important. The Republic of Armenia is a successor state to a historical region in Caucasia. Historical Armenia's boundaries have varied considerably, but old Armenia extended over what are now northeastern Turkey and the Republic of Armenia. The area was equivalent to the ancient kingdom of Urartu, which ruled c. 1270–850 BC. It was later conquered by the Medes (see Media) and Macedonia and still later allied with Rome. Armenia adopted Christianity as its national religion c. AD 300. For cen-

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turies the scene of strife among Arabs, Seljūqs, Byzantines, and Mongols, it came under the rule of the Ottoman Empire in 1514–16. Over the next centuries, as parts were ceded to other rulers, nationalism arose among the scattered Armenians; by the late 19th century it had caused widespread disruption. Fighting between Ottomans and Russians escalated when part of Armenia was ceded to Russia in 1828, and it continued through World War I (1914–18), leading to genocide against Armenians (see ARMENIAN MASSACRES). With the Ottoman defeat, the Russian portion became part of a Soviet republic in 1922. Armenia was established as a constituent republic of the U.S.S.R. in 1936. The U.S.S.R. began to dissolve in the late 1980s, and Armenia declared its independence in 1991. In the years that followed, it fought Azerbaijan for control of NAGORNO-KARABAKH, a conflict that continued despite attempts to settle it. Large numbers of Armenians left the country in the 1990s following an economic downturn, and many stayed away even after the economy began to improve.

Armenia, Little See LITTLE ARMENIA

Armenian *Armenian* **Hay** *plural* **Hayk or Hayq** Member of an Indo-European people first recognized in the early 7th century BC when they moved into areas of Transcaucasia, Anatolia, and the Middle East that came to be known as ARMENIA. Armenian history has been one of nearly constant struggles for independence from foreign domination, first from the Medes and Persians, the SELEUCID DYNASTY, and the ROMAN REPUBLIC AND EMPIRE and later from the BYZANTINE EMPIRE, the SELJŪQ DYNASTY, the OTTOMAN EMPIRE, the Ṣafavid dynasty, and tsarist Russia. At the beginning of the 20th century most Armenians were driven from Anatolia or killed by Ottoman forces during the ARMENIAN MASSACRES. The Republic of Armenia was declared in 1990 after being part of the Soviet Union since 1922. More than 3.5 million Armenians live there, and there is an appreciable diaspora in other countries of Transcaucasia, in parts of the Middle East, and in the West. Armenian culture reached an apex in the 14th century, producing highly regarded sculpture, architecture, and fine art. Until the 20th century, Armenians were primarily agricultural; now they are highly urbanized. Traditionally they are either Orthodox or Roman Catholic Christians; Armenia was considered the first Christian state.

Armenian language INDO-EUROPEAN LANGUAGE of the ARMENIANS. It is spoken by perhaps five to six million people worldwide. Armenian has undergone phonetic and grammatical changes that make it completely distinct from other branches of Indo-European; its closest affinity may be with Greek, though this hypothesis has been vigorously disputed. Its long history of contact with IRANIAN LANGUAGES has resulted in the adoption of many PERSIAN loanwords. According to tradition, the unique Armenian alphabet was created by the cleric Mesrop Mashtots in AD 406 or 407. Armenian of the 5th–9th centuries (Grabar, or Classical Armenian) was employed as the literary language into modern times. A 19th-century cultural revival led to the formation of two new literary languages: West Armenian, based on the speech of Istanbul Armenians, and East Armenian, based on the speech of Transcaucasian Armenians. Because of a long tradition of emigration and the massacres and expulsions during the last decades of Ottoman rule, most speakers of West Armenian live outside Anatolia. East Armenian is the language of the present-day Republic of Armenia.

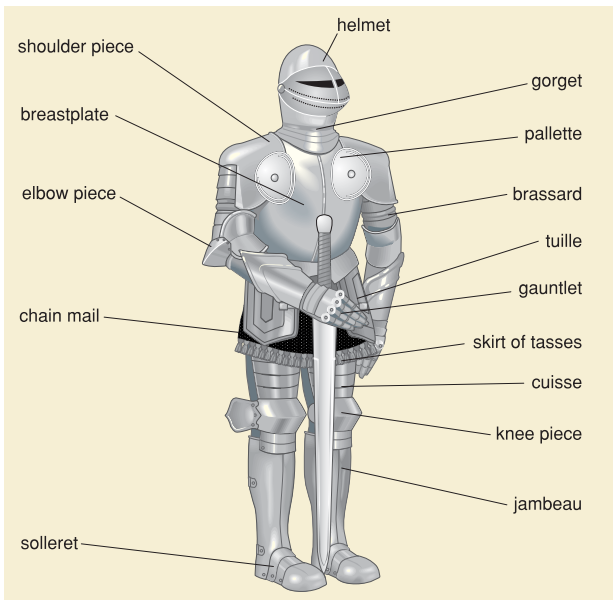
Armenian massacres Murder and expulsion of Turkish Armenians by the OTTOMAN EMPIRE under ABDÜLHAMID II in 1894–96 and by the YOUNG TURK government in 1915–16. In 1894, when the Armenians began agitating for territorial autonomy and protesting against high taxes, Ottoman troops and Kurdish tribesmen killed thousands. In 1896, hoping to call attention to their plight, Armenian revolutionaries seized the Ottoman Bank in Istanbul. Mobs of Muslim Turks, abetted by elements of the government, killed more than 50,000 Armenians in response. Sporadic killings occurred over the next two decades. In response to Russia's use of Armenian troops against the Ottomans in World War I (1914–18), the government deported 1.75 million Armenians south to Syria and Mesopotamia, in the course of which some 600,000 Armenians were killed or died of starvation.

Armenian Secret Army to Liberate Armenia See ASALA

Armistice (Nov. 11, 1918) Agreement between Germany and the Allies ending WORLD WAR I. Allied representatives met with a German delegation in a railway carriage at Rethondes, France, to discuss terms. The agreement was signed on Nov. 11, 1918, and the war ended at 11:00 AM that day ("the 11th hour of the 11th day of the 11th month"). The principal term was that Germany would evacuate Belgium, France, and Alsace-Lorraine. Negotiations formalizing the armistice were conducted at the PARIS PEACE CONFERENCE. Later a "stab in the back" legend developed in Germany, asserting that the German military situation had not been hopeless and that traitorous politicians had done the Allies' bidding by signing the Armistice.

Armory Show *formally* **International Exhibition of Modern Art** Exhibition of painting and sculpture held in 1913 at the 69th Regiment Armory in New York City. Conceived by its organizers, the Association of American Painters and Sculptors, as a selection of works exclusively by U.S. artists, it evolved into a comprehensive look at current European art movements, due in part to the advanced vision of association president Arthur B. Davies. Of the 1,300 works assembled, one-third were European, tracing the evolution of modern art from FRANCISCO DE GOYA to MARCEL DUCHAMP and VASILY KANDINSKY, with works representative of IMPRESSIONISM, SYMBOLISM, POST-IMPRESSIONISM, FAUVISM, and CUBISM. Perhaps the most controversial work was Duchamp's nearly abstract *Nude Descending a Staircase, No. 2* (1912). The U.S. artists featured were mainly members of the ASH CAN SCHOOL and The EIGHT. The show exposed the American public for the first time to advanced European art; American art suffered by contrast. The exhibition traveled to Chicago and Boston, establishing itself as a decisive event in the development of U.S. art and art collecting.

armour *or* **body armour** Protective clothing that can shield the wearer from weapons and projectiles. By extension, armour is also protective covering for animals, vehicles, and so on. Prehistoric warriors used leather hides and helmets. Chinese warriors used rhinoceros skin in the 11th century BC, and Greek infantry wore thick, multilayered metal-and-linen cuirasses (armour covering the body from neck to waist) in the 5th century BC. Shirts of CHAIN MAIL were worn throughout the Roman Empire, and mail was the chief armour of western Europe until the 14th century. Ancient Greeks and Romans used armour made of rigid metal plates, which reappeared in Europe around the 13th century. Plate armour dominated European design until the 17th century, when firearms began to make it obsolete. It began to disappear in the 18th century, but the helmet reappeared in World War I and became standard equipment. Modern body armour (the bulletproof vest) covers the chest and sometimes the groin; it is a flexible garment reinforced with steel plates, fibreglass, boron carbide, or multiple layers of synthetic fabric such as KEVLAR.



Suit of 15th-century European plate armour.
© MERRIAM-WEBSTER INC.

Armour, Philip Danforth (b. May 16, 1832, Stockbridge, N.Y., U.S.—d. Jan. 6, 1901, Chicago, Ill.) U.S. entrepreneur and innovator. Armour's first entrepreneurial success was in California mining endeavours. He vastly expanded his family's Midwestern grain and meatpack-

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ing business in 1875, originating the use of byproducts and the sale of canned meat. When railcar refrigeration was introduced in the 1880s (see GUSTAVUS FRANKLIN SWIFT), he established distributing plants in eastern states and began exporting Armour meat products to Europe. His Armour & Co. enterprises helped make Chicago the meatpacking capital of the world.

armoured vehicle Motor vehicle with plating for protection against bullets, shells, or other projectiles that moves on wheels or tracks. The TANK is the chief armoured vehicle for larger military forces. Other military types include infantry fighting vehicles, amphibious landing vehicles, and mobile weapons platforms such as self-propelled artillery and ANTI-AIRCRAFT GUNS. Infantry fighting vehicles, descended from the armoured personnel carriers of World War II and the Vietnam War, are armoured, tracked vehicles that transport infantry into battle but also serve as platforms from which soldiers can fight without dismounting. Armoured cars are wheeled civilian vehicles, ranging from commercial trucks to luxury sedans, that generally are equipped with armour and other amenities for securely transporting valuables and individuals over paved roads.

armoury practice Production system for the assembly of finished products, in this case arms. With the adoption of the Model 1842 musket, the U.S. military achieved the large-scale assembly of weapons from uniform, INTERCHANGEABLE PARTS. By the mid-1850s arms makers around the world were beginning to copy this AMERICAN SYSTEM OF MANUFACTURE, which contributed to the creation of the modern military small arm, especially after the introduction of percussion ignition and rifled barrels.

arms control Limitation of the development, testing, production, deployment, proliferation, or use of weapons through international agreements. Arms control did not arise in international diplomacy until the first HAGUE CONVENTION (1899). The WASHINGTON CONFERENCE (1921–22) and the KELLOGG-BRIAND PACT (1928) were broken without much fear of sanction. U.S.-Soviet treaties to control nuclear weapons during the COLD WAR were taken more seriously. In 1968 the two superpowers and Britain sponsored the NUCLEAR NON-PROLIFERATION TREATY (signed also by 59 other countries), which committed signatory countries not to promote the spread, or proliferation, of nuclear weapons to countries that did not already possess them. See also NUCLEAR TEST-BAN TREATY; STRATEGIC ARMS LIMITATION TALKS; STRATEGIC ARMS REDUCTION TALKS.

Armstrong, Edwin H(oward) (b. Dec. 18, 1890, New York, N.Y., U.S.—d. Jan. 31/Feb. 1, 1954, New York City) U.S. inventor. He studied at Columbia University, where he devised a feedback circuit that brought in signals with a thousandfold amplification (1912). At its highest amplification, the circuit shifted from being a receiver to being a primary generator of radio waves, and as such it is at the heart of all radio and television broadcasting. It earned him the Franklin Medal, the highest U.S. scientific honour. His 1933 invention of circuits that produced the carrier waves for frequency modulation (FM) made high-fidelity broadcasting possible.

Armstrong, Gillian (b. Dec. 18, 1950, Melbourne, Austl.) Australian film director. She first garnered international acclaim as the director of *My Brilliant Career* (1979), a feminist film about a young woman aspiring to be a writer in Victorian-era Australia. Her subsequent works include Australian films such as *The Last Days of Chez Nous* (1993) and *Oscar and Lucinda* (1997), as well as U.S. films such as *Mrs. Soffel* (1984), *Little Women* (1994), and *Charlotte Gray* (2001).

Armstrong, Lance (b. Sept. 18, 1971, Plano, Texas, U.S.) American cyclist and the first rider to win seven TOUR DE FRANCE titles (1999–2005). Armstrong began his professional CYCLING career in 1992 when he joined the Motorola team. He won stages of the Tour de France in 1993 and 1995 but withdrew from three of four Tours he attempted from 1993 to 1996. After the 1996 Tour, Armstrong fell ill, suffering from testicular cancer that had spread to his lungs and brain. Months of treatments followed before he could attempt his comeback. In 1998 he won the Tour of Luxembourg, and on July 25, 1999, he became the second American to win the Tour de France and the first to win it for an American team (three-time winner Greg LeMond had raced with European teams). In 2003 Armstrong won his fifth consecutive Tour de France, tying a record set by Miguel Indurain, and the following year he broke the record with his sixth consecutive win. After winning his seventh Tour in 2005, Armstrong announced his retirement.

Armstrong, Louis (b. Aug. 4, 1901, New Orleans, La., U.S.—d. July 6, 1971, New York, N.Y.) U.S. jazz trumpeter and singer. As a youth in New Orleans, he participated in marching, riverboat, and cabaret bands. A childhood nickname, Satchelmouth, was shortened to Satchmo and used throughout his life. In 1922 he moved to Chicago to join KING OLIVER's Creole Jazz Band (see DIXIELAND). In 1924 he joined the FLETCHER HENDERSON Orchestra in New York City; the following year he switched from cornet to trumpet and began recording under his own name with his Hot Five and Hot Seven ensembles. In these recordings the prevailing emphasis on collective improvisation gives way to his developing strength as soloist and vocalist. By the time of his "West End Blues" (1928), Armstrong had established the preeminence of the virtuoso soloist in jazz. His vibrant melodic phrasing, inventive harmonic improvisation, and swinging rhythmic conception established the vernacular of jazz music. His powerful tone, great range, and dazzling velocity set a new technical standard. He also was one of the first scat singers, improvising nonsense syllables in the manner of a horn. He became something more than a jazz musician: solo attraction, bandleader, film actor, and international star.

Louis Armstrong.
AP/WIDE WORLD PHOTOS

Armstrong, Neil (Alden) (b. Aug. 5, 1930, Wapakoneta, Ohio, U.S.) U.S. astronaut. He became a pilot at 16, studied aeronautical engineering, and won three Air Medals in the Korean War. In 1955 he became a civilian research pilot for the forerunner of NASA. He joined the space program in 1962 with the second group of astronauts. In 1966, as command pilot of GEMINI 8, he and David Scott completed the first manual space docking maneuver, with an unmanned Agena rocket. On July 20, 1969, as part of the APOLLO 11 mission, he became the first person to step onto the Moon, proclaiming "That's one small step for [a] man, one giant leap for mankind."

Neil Armstrong, 1969.
NASA

army Large, organized force armed and trained for war, especially on land. The term may be applied to a large unit organized for independent action or to a nation's or ruler's overall military organization for land warfare. The character and organization of armies have varied through history. At various times armies have been built around INFANTRY soldiers or mounted warriors (e.g., CAVALRY) or men in machines, and have been made up of professionals or amateurs, of MERCENARIES fighting for pay or for plunder, or of patriots fighting for a cause. See also AIR FORCE, CONSCRIPTION, GUERRILLA, MILITARY UNIT, MILITIA, U.S. ARMY.

Arndt, Ernst Moritz (b. Dec. 26, 1769, Schoritz bei Gartz, Swed.—d. Jan. 29, 1860, Bonn, Ger.) Swedish-born German prose writer, poet, and patriot. He rejected the Lutheran ministry at age 28 and eventually became a professor of history at Greifswald and Bonn. Among his important works is the huge *Spirit of the Times*, 4 vol. (1806–18), a bold call for political reforms that expressed German national awakening during the Napoleonic era. Not all of Arndt's poems were inspired by political ideas; *Gedichte* (1804–18) contains many religious poems of great beauty.

Arne, Thomas Augustine (b. March 12, 1710, London, Eng.—d. March 5, 1778, London) British composer. Son of a London upholsterer, he secretly taught himself instrumental skills and composition with the help of an opera musician. Smitten by the opera, he had an early success with his own first opera, *Rosamond* (1733), and thereafter concentrated almost exclusively on the theatre. As composer to Drury Lane Theatre and London's great pleasure gardens, he became Britain's leading theatrical composer and, after GEORGE FRIDERIC HANDEL, possibly the finest British composer of the century. Of his approximately 90 theatrical works, the best known are *Comus* (1738), *The Judgment of Paris* (1740), and *Artaxerxes* (1762). His song "Rule, Britannia" became an unofficial national anthem. His sister Susannah (1714–66) was the famous singer and actress known as Mrs. Cibber.

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Arnhem \'är-nəm\ **Land** Region, northeastern Northern Territory, Australia. It extends south from Van Diemen Gulf to the Gulf of Carpentaria and Groote Eylandt. Never fully explored, it has a total area of about 37,000 sq mi (96,000 sq km) and contains important bauxite and uranium mines. Occupied by Australian Aboriginals since the late Pleistocene, it was visited in 1623 by the Dutch explorer Jan Carstensz, who named it for his ship. The name now primarily refers to its large Aboriginal reserve.

Arnim, Bettina von *orig.* **Elisabeth Katharina Ludovica Magdalena Brentano** (b. April 4, 1785, Frankfurt am Main [Germany]—d. Jan. 20, 1859, Berlin) German writer. Her best-known works are reworked records of her correspondence with Johann Wolfgang von Goethe, Karoline von Günderode, and her brother Clemens Brentano, much of it fictitious but written in a brilliantly vivid, uninhibited style.

Bettina von Arnim, engraving after Armgass von Arnim's copy of a miniature by an unknown artist.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Arno River River, central Italy. It is 150 mi (240 km) long, flowing west from the Apennines through Florence and into the Ligurian Sea below Pisa. Near Arezzo it is connected with the Tiber River by its canalized tributary, the Chiani. Subject to disastrous floods, in 1966 it inundated Florence and caused extensive damage.

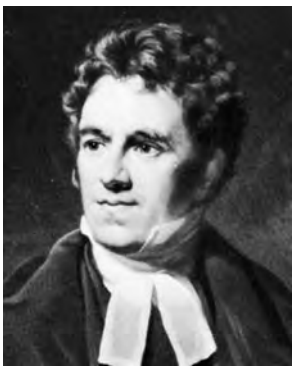
Arnold, Benedict (b. Jan. 14, 1741, Norwich, Conn.—d. June 14, 1801, London, Eng.) American army officer and traitor. He joined the American Revolutionary army in 1775 and contributed to American victories at the Battle of Ticonderoga, at Fort Stanwix, N.Y., and at the Battle of Saratoga, where he was seriously wounded. He was made a major general and placed in command of Philadelphia, where he lived extravagantly and socialized with wealthy loyalist sympathizers, one of whom he married in 1779. Reprimanded for fiscal irregularities in his command, he began secret overtures to the British. After receiving command of the fort at West Point, N.Y. (1780), he offered to surrender it to the British for £20,000. The plot was uncovered after his British contact, John André, was captured. Arnold escaped on a British ship to England, where he died penniless.

Benedict Arnold, engraving by H.B. Hall, 1865.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Arnold, Henry (Harley) *known as* **Hap Arnold** (b. June 25, 1886, Gladwyne, Pa., U.S.—d. Jan. 15, 1950, Sonoma, Calif.) U.S. air force officer. He attended West Point and initially served in the infantry. Volunteering as a flyer, he received instruction from Orville Wright. After World War I, with Billy Mitchell he became an eloquent advocate of an expanded air force. He rose through the ranks of the U.S. Army Air Corps to become its commander in 1938, and he commanded the Army Air Forces worldwide during World War II, overseeing a massive buildup and greatly influencing air bombardment strategy. He was named general of the army in 1944 and, after the National Defense Act of 1947 created an independent Air Force, general of the Air Force.

Arnold, Matthew (b. Dec. 24, 1822, Laleham, Middlesex, Eng.—d. April 15, 1888, Liverpool) English poet and literary and social critic. Son of the educator Thomas Arnold, he attended Oxford and then worked as an inspector of schools for the rest of his life. His verse includes "Dover Beach," his most celebrated work; "Sohrab and Rustum," a romantic epic; and "The Scholar Gipsy" and "Thyrsis." *Culture and Anarchy* (1869), his central work of criticism, is a masterpiece of ridicule as well as a searching analysis of Victorian society. In a later essay, "The Study of Poetry," he argued that, in an age of crumbling creeds, poetry would replace religion and that therefore readers would have to understand how to distinguish the best poetry from the inferior.

Arnold, Thomas *known as* **Doctor Arnold** (b. June 13, 1795, East Cowes, Isle of Wight, Eng.—d. June 12, 1842, Rugby, Warwickshire) British educator. A classical scholar, he became headmaster in 1828 of Rugby School, which was in a state of decline. He revived Rugby by reforming its curriculum, athletics program, and social structure (in the prefect system he introduced, older boys served as house monitors to keep discipline among younger boys), becoming in the process the preeminent figure in British education. In 1841 he was named Regius Professor of Modern History at Oxford. In addition to several volumes of sermons, he wrote a three-volume *History of Rome* (1838–43). He was the father of Matthew Arnold and grandfather of the novelist Mrs. Humphry Ward (1851–1920).



Thomas Arnold, detail of an engraving by H. Cousins, 1840, after an oil painting by Thomas Philips.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Arnolfo di Cambio (b. c. 1245, Colle di Val d'Elsa—d. 1301/10, Florence) Italian sculptor and architect active in Florence. He studied under Nicola Pisano and assisted him on the pulpit for Siena Cathedral (1265–68). In 1277 he went to Rome, where he worked for Charles of Anjou, king of Sicily. He also designed and constructed monuments, including the tomb of Cardinal de Braye in San Domenico, Orvieto. In 1296 Arnolfo returned to Florence to undertake his most important commission, the design of the Duomo (the cathedral of Florence) and the carving of statues for its facade. Other buildings in Florence attributed to him include the Palazzo Vecchio and the church of Santa Croce. The structural and decorative elements of Santa Croce and the Duomo have a unity, balance, and a lightness of movement that demonstrate Arnolfo's complete mastery of the late 13th-century Gothic architectural vocabulary. His works embody the transition between the late Gothic and Renaissance architectural sensibilities.

Arnulf (d. Dec. 8, 899) King of Germany. Originally duke of Carinthia, he was elected king of the eastern Franks in 887, deposing his uncle, Charles the Fat. The western Franks, Burgundy, and Italy refused to recognize Arnulf, thus dividing the Carolingian empire. He defeated the Vikings (891), ending their raids up the Rhine River, and maintained control of Lotharingia (now Lorraine). He invaded Italy at the urging of Pope Formosus, captured Rome (895), and was crowned emperor in 896. Illness forced him to return to Germany, however, and the previous emperor continued to rule. Arnulf's last years saw invasions by Magyars and Slavs and the collapse of his power.

aromatherapy Therapy using essential oils and water-based colloids extracted from plant materials to promote physical, emotional, and spiritual health and balance. Single or combined extracts may be diffused into inhaled air, used in massage oil, or added to bathwater. Inhaled molecules of these extracts stimulate the olfactory nerve, sending messages to the brain's limbic system (the seat of memory, learning, and emotion) that are said to trigger physiological responses (e.g., eucalyptus relieves congestion, lavender promotes relaxation). Mainstream medical practitioners question the claim of independent physiological effects; they consider many of the benefits more likely due to the conditioned responses that odors can reinforce or help create. The oils and solutions used have been shown to have certain effects but are not standardized. The few risks involved include allergic reactions.

aromatic compound Any of a large class of organic compounds whose molecular structure includes one or more planar rings of atoms, usually but not always six carbon atoms. The ring's carbon-carbon bonds (see bonding) are neither single nor double but a type characteristic of these compounds, in which electrons are shared equally with all the atoms around the ring in an electron cloud. The term was first applied c. 1860

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to a class of HYDROCARBONS isolated from coal tar and distinguished by odours much stronger than those of other classes of hydrocarbons. In modern chemistry, aromaticity denotes the chemical behaviour, especially the low reactivity, of this class of molecules related to their bonding. The parent compound of this class is BENZENE (C_6H_6). See also HYDROGENATION.

Aron \är-'ō^{n}**, Raymond (-Claude-Ferdinand)** (b. 1905—d. 1983) French sociologist and historian. After receiving his doctorate from the École Normale Supérieure (1930), he taught at the University of Toulouse until 1939. During World War II he joined the FREE FRENCH and edited their newspaper (1940–44). He later taught at the École Nationale d'Administration, the Sorbonne, and the Collège de France. He was also a columnist for *Le Figaro* (1947–77) and *L'Express* (1977–83). Aron upheld a rationalist humanism that was often contrasted with the Marxist existentialism of his great contemporary and former classmate JEAN-PAUL SARTRE. A continuing theme in his writings was the subject of violence and war.

Aroostook \ə-'rü-stůk\ **War** (1838–39) Bloodless conflict over the disputed boundary between the U.S. state of Maine and the British Canadian province of New Brunswick. As settlers from both countries moved into the disputed Aroostook area, officials and bands of men from both sides made arrests and took prisoners of "trespassers." In 1839 U.S. and Canadian troops were ordered to the area. A truce allowed joint occupancy of the territory until 1842, when a satisfactory settlement was reached.

Arp, Jean *known as* **Hans Arp** (b. Sept. 16, 1887, Strassburg, Ger.—d. June 7, 1966, Basel, Switz.) French painter, sculptor, and poet. After studying in Weimar, Ger., and at the Académie Julian in Paris, he became involved in the most important movements of early 20th-century art: DER BLAUE REITER in Munich (1912), CUBISM in Paris (1914), DADA in Zurich during World War I, SURREALISM (1925), and Abstraction-Création (1931). During these years he produced polychrome relief carvings in wood, cut-paper compositions, and, in the 1930s, his most distinctive sculptural works: abstract forms that suggest animals and plants. He also wrote poetry.

Arrabal \ˌär-rä-'bäl**, Fernando** (b. Aug. 11, 1932, Melilla, Spanish Morocco) Spanish French Absurdist playwright, novelist, and filmmaker. He turned to writing in the 1950s, and in 1955 he began studying drama in Paris, where he remained. His early plays, in particular *Picnic on the Battlefield*, brought him to the attention of the French avant-garde. After the mid 1960s his plays evolved into what he termed Théâtre Panique ("Panic Theater"); typical of this period is *And They Put Handcuffs on the Flowers*. His dramatic and fictional world is often violent, cruel, and pornographic.

arrastra \ə-'ras-trə\ Drag-stone mill for pulverizing ORES to isolate SILVER by the PATIO PROCESS, apparently used in pre-Columbian America. The silver ore was crushed and ground by mule power in the arrastras (shallow circular pits paved with stone). Large blocks of stone attached by beams to a central rotating post were dragged around the arrastra, reducing the ore to a fine mud. Further steps resulted in the isolating of the silver.

arrest Restraint and seizure of a person by someone (e.g., a police officer) acting under legal authority. An officer may arrest a person who is committing or attempting to commit a crime in the officer's presence. Arrest is also permitted if the officer reasonably believes that a crime has been committed and that the person arrested is the guilty party. A court or judicial officer may issue an arrest warrant on a showing of probable cause. Most states restrict or prohibit arrest in civil (noncriminal) cases; an example of occasionally permitted civil arrest is the taking into custody of a debtor who might otherwise abscond. In the U.S., suspects must be warned of their rights when they are arrested (see *MIRANDA V. ARIZONA*). An unlawful arrest is regarded as false imprisonment and usually invalidates any evidence collected in connection with it. See also rights of the ACCUSED; GRAND JURY; INDICTMENT.

Arrhenius \är-'ā-nē-əs**, Svante (August)** (b. Feb. 19, 1859, Vik, Swed.—d. Oct. 2, 1927, Stockholm) Swedish physical chemist. His theories on DISSOCIATION of substances in solution into ELECTROLYTES or IONS, first published in 1884 as his Ph.D. thesis, were initially met with skepticism, but increasing recognition abroad gradually won over the opposition in Sweden. He also did important work on REACTION RATES; the equation describing the dependence of reaction rates on temperature is often called the Arrhenius law, and he was the first to recognize the GREENHOUSE EFFECT. After receiving the Royal Society of London's Davy Medal (1902), he became in 1903 the third recipient of the Nobel Prize for Chemistry. He is regarded as one of the founders of the field of physical chemistry.

Svante Arrhenius, 1918.
BY COURTESY OF THE KUNGLIGA BIBLIOTEKET, STOCKHOLM

arrhythmia \ā-'rith-mē-ə\ Variation from the heartbeat's normal rate or rhythm, caused by problems in the HEART'S PACEMAKER or in nerves conducting its signals. Occasional arrhythmias are normal. TACHYCARDIA is a fast regular rhythm; bradycardia is a slow rhythm. Premature atrial or ventricular beats are extra contractions in normal rhythm. Ongoing arrhythmia in some heart diseases can reduce the heart's ability to supply the body with blood and can lead to heart failure. Severe arrhythmias can trigger ATRIAL FIBRILLATION or VENTRICULAR FIBRILLATION. Arrhythmias are detected by ELECTROCARDIOGRAPHY and treated by electric shock (often with an implanted pacemaker) or by drugs such as quinidine and DIGITALIS.

arrow See BOW AND ARROW

Arrow, Kenneth J(oseph) (b. Aug. 23, 1921, New York, N.Y., U.S.) U.S. economist. He received his Ph.D. from Columbia University and taught principally at Stanford and Harvard. Arrow's books include *Social Choices and Individual Values* (1951). His most striking claim was that, under certain conditions of rationality and equality, a ranking of societal preferences will not necessarily correspond to the rankings of individual preferences, given more than two individuals and alternative choices. In 1972 he shared the Nobel Prize with JOHN R. HICKS.

Arrow War See OPIUM WARS

arrowroot Any of several plant species of the genus *Maranta* (family Marantaceae), whose RHIZOMES yield an edible starch. Chief among these is the herbaceous perennial *M. arundinacea*, the source of genuine, or West Indies, arrowroot. The powder obtained from the harvested roots is almost pure starch; it is used in cookery as a thickener. Arrowroot is easily digested and is used in diets requiring bland, low-salt, and low-protein foods. Its name is sometimes applied to starches obtained from other plants and used as substitutes for true arrowroot. Brazilian arrowroot, from the CASSAVA plant, is the source of tapioca.

Ars Antiqua \'ärs-an-'tē-kwə\ *Latin* **"Ancient Art"** Musical style of 13th-century France. The term was derived retrospectively to distinguish 13th-century music from that of the 14th century (ARS NOVA). It is partly characterized by use of the six rhythmic MODES, each being a rhythmic pattern that would recur throughout a piece, such as long-short (first mode) or short-long (second). Akin to the "feet" of poetry (see PROSODY), the relative lengths of long and short depended on the mode. The system broke down as composers began to use subdivisions of the short note. The musical genres of the Ars Antiqua included ORGANUM and the early MOTET.

Ars Nova \'ärs-'nō-və\ *Latin* **"New Art"** Musical style of 14th-century Europe, particularly France. As composers began to use ever shorter notes in their music, the old system of rhythmic MODES (see ARS ANTIQUA) ceased to be adequate to describe it. In his treatise *Ars nova* (1323), Philippe de Vitry (1291–1361) proposed a way of relating longer and shorter notes by a metrical scheme—the ancestor of time signatures—whereby each note value could be subdivided into either two or three of the next-shorter note. Though seemingly abstract, this innovation had a marked effect on the sound of music because composers were better able to control the relative motion of several voices, and 14th-century music consequently sounds much less "medieval" to modern ears. De Vitry and GUILLAUME DE MACHAUT are the principal composers of the Ars Nova. The term is sometimes extended to describe all 14th-century music, including that of Italy. See also FORMES FIXES.

Arsacid \är-'sas-id\ **dynasty** (247 BC–AD 224) Persian dynasty. It was founded by Arsaces (r. c. 250–211? BC) of the Parni tribe, which originally dwelt east of the Caspian Sea and entered PARTHIA after the death of ALEXANDER THE GREAT (323 BC), gradually extending control southward. Arsacid power reached its peak under Mithradates I (r. 171–138 BC). The

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government was influenced by that of the SELEUCID DYNASTY and tolerated the formation of vassal kingdoms. The dynasty legitimized its rule over former ACHAEMENIAN territories by claiming descent from the Achaemenian king Artaxerxes II. It controlled trade routes between Asia and the Greco-Roman world and used its resultant wealth to erect many buildings. The dynasty was overthrown in 224 by the SĀSĀNIAN DYNASTY.

arsenic Nonmetallic to semimetallic chemical ELEMENT, chemical symbol As, atomic number 33. It exists uncombined in two stable (and several unstable) ALLOTROPES, one gray and one yellow, but is more often found in nature as the sulfide or OXIDE. The elemental form is used to form ALLOYS of METALS (especially lead), and certain SEMICONDUCTORS are made from crystals of gallium arsenide (GaAs). Arsenious oxide (arsenic trioxide or white arsenic, As_2O_3) is used in pesticides, as a pigment, and as a preservative of hides and wood; this is the poisonous "arsenic" (see ARSENIC POISONING) in detective stories. Arsenic pentoxide (As_2O_5) is also used in insecticides, herbicides, metal adhesives, and pigments.

Arsenic (gray) with realgar (red) and orpiment (yellow)
BY COURTESY OF THE JOSEPH AND HELEN GUETTERMAN COLLECTION; PHOTOGRAPH, JOHN H. GERARD

arsenic poisoning Harmful effects of ARSENIC compounds (in pesticides, chemotherapy drugs, paints, etc.), most often from INSECTICIDE exposure. Susceptibility varies. Arsenic is believed to combine with certain enzymes, interfering with cellular metabolism. Symptoms of acute arsenic poisoning include nausea and abdominal pain followed by circulatory collapse. Acute exposure to the gas arsine causes destruction of red blood cells and kidney damage; chronic exposure causes weakness, skin disorders, anemia, and nervous-system disorders. Arsenic in urine and hair or nails is the key to diagnosis. Treatment involves washing out the stomach and promptly administering the antidote dimercaprol.

Arsinoe \är-'sin-ō-ē\ **II** (b. c. 316—d. July 270 BC) Queen of THRACE (300–281) and Egypt (277–270). Daughter of PTOLEMY I SOTER, she married the king of Thrace (300) and tried to have her son made heir instead of Agathocles, the king's son by an earlier marriage. Agathocles sought help from SELEUCIDS, causing a war in which Arsinoe's husband was killed in battle. Her half brother, who took power in Thrace and Macedonia, cajoled her into marrying him and then promptly killed her two younger sons. She fled to Alexandria, ousted the wife of her brother PTOLEMY II, and married him (c. 277); like the pharaohs, the two were called "Philadelphoi" ("Sibling-Loving"). She wielded great power and shared many honours with Ptolemy, including deification while alive.

Arsinoe II, coin, 270–250 BC; in the British Museum
BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

arson Crime commonly defined by statute as the unlawful damage or destruction of property by means of fire or explosion. In nearly all countries (except Great Britain) an arsonist is guilty of murder if someone dies as a result of his action, even if he did not intend to kill. Germany and some U.S. states also impose serious penalties for arson when it is committed to conceal or destroy evidence of another crime. Although fire caused by accident or ordinary carelessness is not arson, a person may be guilty of arson if he causes a fire in reckless disregard of the consequences of his actions.

art *also called* **visual art** A visual object or experience consciously created through an expression of skill or imagination. The term *art* encompasses diverse media such as painting, sculpture, printmaking, drawing, decorative arts, photography, and installation. The various visual arts exist within a continuum that ranges from purely aesthetic purposes at one end to purely utilitarian purposes at the other. This should by no means be taken as a rigid scheme, however, particularly in cultures in which everyday objects are painstakingly constructed and imbued with meaning. Particularly in the 20th century, debates arose over the definition of *art*. Figures such as DADA artist MARCEL DUCHAMP implied that it is enough for an artist to deem something "art" and put it in a publicly accepted venue. Such intellectual experimentation continued throughout the 20th century in movements such as CONCEPTUAL ART and MINIMALISM. By the turn of the 21st century, a variety of new media (e.g., video art) further challenged traditional definitions of art. See AESTHETICS; ART CONSERVATION AND RESTORATION; DRAWING; PAINTING; PRINTMAKING; SCULPTURE; PHOTOGRAPHY; DECORATIVE ARTS.

art brut \ˌärt-'brüt, ˌär-'brüt\ *French* **"raw art"** Art produced by people outside the established art world, particularly crude, inexperienced, or obscene works created by the untrained or the mentally ill. The term was coined by JEAN DUBUFFET, who regarded such works as the purest form of expression. See also NAIVE ART.

art collection Works of art accumulated by an individual or institution. Such collections were made in the earliest civilizations; precious objects were stored in temples, tombs, sanctuaries, and palaces. A taste for collecting per se developed in Greece (4th–1st century BC). The great art collections of the world grew out of private collections formed by royalty, aristocracy, and the wealthy. By the 18th century, collectors were donating their holdings to the public and constructing buildings to house them (e.g., the LOUVRE MUSEUM, UFFIZI GALLERY). Wealthy industrialists in the U.S. played a prominent role in the 19th–20th century, and an unprecedented flow of masterpieces from Europe soon filled U.S. museums.

art conservation and restoration Maintenance and preservation of works of art, their protection from future damage, deterioration, or neglect, and the repair or renovation of works that have deteriorated or been damaged. Research in art history has relied heavily on 20th- and 21st-century technical and scientific advances in art restoration. Modern conservation practice adheres to the principle of reversibility, which dictates that treatments should not cause permanent alteration to the object.

art criticism Description, interpretation, and evaluation of works of art, manifested in journal reviews, books, and patronage. Art criticism encompasses a wide variety of approaches, from critical commentary to more subjective emotional reactions inspired by viewing works of art. Art criticism as a distinct discipline developed parallel to Western aesthetic theory, beginning with antecedents in ancient Greece and fully taking form in the 18th and 19th centuries. In the 20th century perceptive critics became champions of new artistic movements. Beginning in the 20th and continuing into the 21st century, many critics used social and linguistic, rather than aesthetic, theoretical models. Prominent art critics include ROGER FRY, CLIVE BELL, CLEMENT GREENBERG, Harold Rosenblum, Lawrence Alloway, Rosalind Krauss, and Donald Kuspit. See also AESTHETICS.

Art Deco \ˌärt-'de-kō, ˌär-dā-'kō\ *or* **Style Moderne** \'stēl-mȯ-'dern\ Movement in design, interior decoration, and architecture in the 1920s and '30s in Europe and the U.S. The name derives from the Exposition Internationale des Arts Décoratifs et Industriels Modernes in Paris in 1925. Its products included both individually crafted luxury items and mass-produced wares, but, in either case, the intention was to create a sleek and antitraditional elegance that symbolized wealth and sophistication. Influenced by Art Nouveau, Bauhaus, Cubist, Native American, and Egyptian sources, the distinguishing features of the style are simple, clean shapes, often with a "streamlined" look; ornament that is geometric or stylized from representational forms; and unusually varied, often expensive materials, which frequently include man-made substances (plastics, especially bakelite; vita-glass; and ferroconcrete) in addition to natural ones (jade, silver, ivory, obsidian, chrome, and rock crystal). Typical motifs included stylized animals, foliage, nude female figures, and sun rays. New York City's ROCKEFELLER CENTER (especially its interiors supervised by Donald Deskey), the CHRYSLER BUILDING by William Van Alen, and the EMPIRE STATE BUILDING by Shreve, Lamb & Harmon are the most monumental embodiments of Art Deco.

Art Ensemble of Chicago U.S. jazz ensemble. The group evolved from the Association for the Advancement of Creative Musicians (AACM), an experimental collective. Saxophonists Roscoe Mitchell and Joseph Jarman, trumpeter Lester Bowie, bassist Malachi Favors, and drummer Don Moye formed the group in 1969, combining freely changing tempos, dynamics, and textures with an often comic theatricality of presentation. Their diversity of inspiration is expressed by their motto, "Great Black Music: Ancient to the Future."

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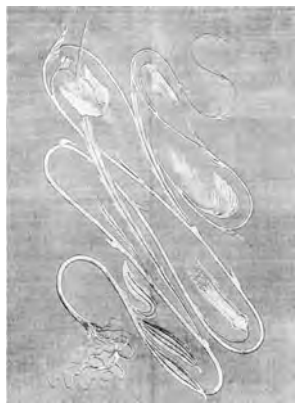
art history Historical study of the visual arts for the purpose of identifying, describing, evaluating, interpreting, and understanding art objects and artistic traditions. Art-historical research involves discovering and collecting biographical data on artists to establish attribution; determining at what stage in a culture's or artist's development an object was made; weighing the influence the object or artist had on the historical past; and documenting an object's previous whereabouts or ownership (provenance). The analysis of symbols, themes, and subject matter is often of primary concern. In the 20th and 21st centuries art historians became increasingly concerned with the social and cultural context of artists and their work.

Art Institute of Chicago Museum in Chicago that houses European, American, Asian, African, and pre-Columbian art. It was established in 1866 as the Chicago Academy of Design and took its current name in 1882. In 1893 it moved to its present building, designed by the architectural firm of Shepley, Rutan, and Coolidge for the World's Columbian Exposition, on Michigan Avenue. The Art Institute, which comprises both a museum and a school, is noted for its extensive collections of 19th-century French painting (Impressionist works and the work of Claude Monet in particular) and 20th-century European and American painting. Among its best-known works are Georges Seurat's *A Sunday Afternoon on La Grand Jatte—1884* (1884–86), Grant Wood's *American Gothic* (1930), and Edward Hopper's *Nighthawks* (1942).

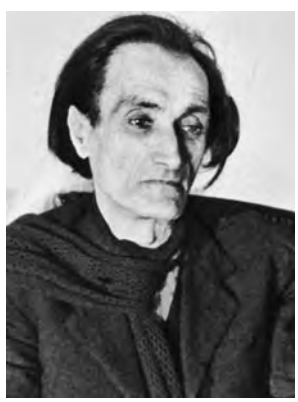
Art Nouveau \ˌärt-nü-ˈvō, ˌär-nü-ˈvō\ Decorative style that flourished in western Europe and the U.S. c. 1890–1910. The term was derived in 1895 from a gallery in Paris called L'Art Nouveau. Characterized by sinuous, asymmetrical lines based on plant forms, the style was used in architecture, interior design, graphic art and design, jewelry, and glass. It was international in scope, with celebrated exponents in England (Aubrey Beardsley), Paris (Alphonse Mucha), the U.S. (Louis Comfort Tiffany), Scotland (Charles Rennie Mackintosh), Spain (Antonio Gaudí), and Belgium (Victor Horta). The style did not significantly survive the outbreak of World War I. See also Arts and Crafts Movement; Jugendstil.



"The Whiplash," Art Nouveau tapestry by Hermann Obrist, silk embroidered on wool, 1895; in the Münchner Stadtmuseum, Munich.
COURTESY OF THE MUNCHNER STADTMUSEUM, MUNICH

Arta, Gulf of Inlet of the Ionian Sea, western Greece. It is 25 mi (40 km) long and 4–10 mi (6–16 km) wide. On its shores are the ruins of several cities important in ancient Greece. The seaport of Preveza, founded 290 BC, is to the north; the Battle of Actium took place near the gulf's entrance.

Artaud \ȧr-ˈtō**, Antonin** (b. Sept. 4, 1896, Marseille, France—d. March 4, 1948, Ivry-sur-Seine) French poet, actor, and drama theorist. He wrote Surrealist poetry from 1925 and made his acting debut in Surrealist productions in Paris. He described his theory of drama in the *Manifesto of the Theatre of Cruelty* (1932; see Theatre of Cruelty) and *The Theatre and Its Double* (1938). His own plays (including *Les Cenci*, 1935) were failures, but his theories exerted great influence on playwrights of the Theatre of the Absurd. Lifelong mental illness confined him periodically to asylums from 1936.



Artaud, 1948.
DENISE COLOMB-J.P. ZIOLO

Artemis \ˈär-tə-məs\ In Greek religion, the goddess of wild animals, the hunt, vegetation, chastity, and childbirth. Artemis was the daughter of Zeus and Leto and the twin sister of Apollo. Accompanied by nymphs, she danced in mountains and forests. She both killed game and, as Mistress of Animals (see Master of the Animals), protected it. Stories of her nymphs' love affairs may originally have been told of the goddess herself, but poets after Homer stressed her chastity. She was known for her unpitying wrath when offended. Artemis may have developed out of Ishtar in the East. Her Roman counterpart was Diana.

Artemis as a huntress, classical sculpture; in the Louvre.
ALINARI/ART RESOURCE

artemisia \ˌär-tə-ˈmi-zhə\ Any of a genus (*Artemisia*) of aromatic herbs and shrubs in the composite family. Examples include wormwood, sagebrush, and tarragon. Many species are valued as ornamentals for their attractive silvery gray foliage, which is frequently used in horticultural plantings to create contrast or to smooth the transition between intense colors. The leaves of common wormwood (*A. absinthium*) have been used in medicines and beverages such as absinthe and vermouth. An extract from the Eurasian *A. annua* is used to treat quinine-resistant malaria.

Artemisia \ˌärt-ə-ˈmiz-ē-ə\ **I** (fl. 5th century BC) Queen of Halicarnassus and of the island of Cos c. 480 BC. She ruled under the Persian king Xerxes and helped him invade Greece (480–479). She commanded five ships in the Battle of Salamis; according to Herodotus, she advised Xerxes to retreat from Greece rather than risk another engagement.

Artemisia II (d. c. 350 BC) Sister and wife of King Mausolus (r. 377–353 BC) of Caria, southwestern Anatolia, and sole ruler for about three years after his death. She built his tomb, the Mausoleum, considered one of the Seven Wonders of the World.

Artemisia II, statue by an unknown artist; in the National Archeological Museum, Naples.
ANDERSON—ALINARI FROM ART RESOURCE

arteriography See angiography

arteritis \ˌär-tə-ˈrī-təs\ Inflammation of the arteries. It occurs in diseases including syphilis, tuberculosis, and lupus erythematosus. Varieties not closely associated with systemic disease or disease of an organ outside the cardiovascular system have been described as temporal arteritis, polymyalgia rheumatica, and polyarteritis nodosa.

artery Vessel that carries blood from the heart to other parts of the body (see cardiovascular system). Arterial blood carries oxygen and nourishment to tissues; the one exception is the pulmonary artery, which conveys oxygen-depleted blood from the heart to the lungs for oxygenation and removal of excess carbon dioxide. Arteries are muscular, elastic tubes that transport blood under the pressure of the heart's pumping action, which can be felt as the pulse. Large arteries branch off from the aorta and give rise to smaller arteries, down to the threadlike arterioles, which branch into capillaries. An artery wall's inner layer (tunica intima) consists of an endothelial (cellular) lining, a fine connective tissue network, and a layer of elastic fibres. The middle layer (tunica media) is mostly smooth muscle cells. The outer layer (tunica externa) contains supportive collagen fibres. See also capillary; vein.

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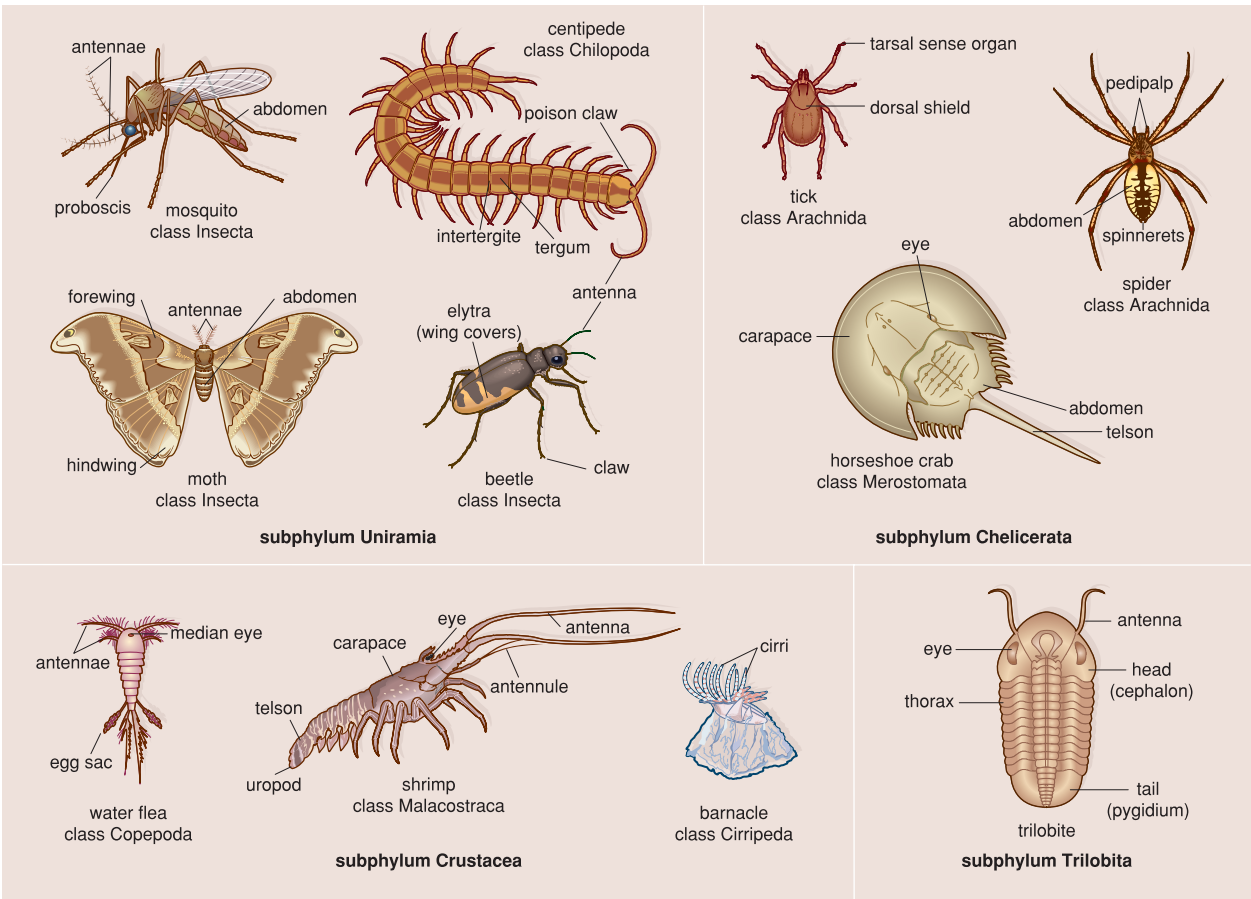

Representative arthropods. Uniramia, the largest of the arthropod subphyla, contains mostly terrestrial insects and myriapods (including centipedes and millipedes). The insects, the largest arthropod class, differ from other arthropods in that they are usually winged and have only three pairs of legs. Members of the Crustacea subphylum are mostly marine-dwelling and include the shrimps, lobsters, crabs, and barnacles. The microscopic water fleas are chiefly found in fresh water and, along with other minute members of this subphylum, are part of the zooplankton. Most members of the Chelicerata subphylum are arachnids, including the spiders, scorpions, ticks, and mites. The trilobites (members of the Trilobita subphylum) are extinct marine arthropods that flourished during the Cambrian Period. Fossilized remains show a body having three longitudinal lobes divided into three regions—head, thorax, and tail.

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arthritis \är-'thrī-təs\ INFLAMMATION of the JOINTS and its effects. Acute arthritis is marked by pain, redness, and swelling. The principal forms are OSTEOARTHRITIS, RHEUMATOID ARTHRITIS, and SEPTIC ARTHRITIS. Several forms of arthritis are part of the symptom complexes of AUTOIMMUNE DISEASES.

arthropod Any member of the largest phylum, Arthropoda, in the ANIMAL kingdom. Arthropoda consists of more than one million known INVERTEBRATE species in four subphyla: Uniramia (five classes, including INSECTS), Chelicerata (three classes, including ARACHNIDS and HORSESHOE CRABS), Crustacea (CRUSTACEANS), and Trilobita (TRILOBITES). All arthropods are bilaterally symmetrical and possess a segmented body covered by an exoskeleton containing CHITIN, which serves as both armour and a surface for muscle attachment. Each body segment may bear a pair of jointed appendages. The phylum includes CARNIVORES, HERBIVORES, OMNIVORES, detritus feeders, filter feeders, and parasites (see PARASITISM) in nearly all environments, both aquatic and terrestrial. See illustration above.

Arthur, Chester A(lan) (b. Oct. 5, 1829, North Fairfield, Vt., U.S.—d. Nov. 18, 1886, New York, N.Y) 21st president of the U.S. (1881–85). He practiced law in New York City from 1854, later becoming a close associate of Sen. ROSCOE CONKLING, the Republican boss of New York. With Conkling's backing, he was appointed customs collector for the port of New York (1871–78), an office long known for its use of the SPOILS SYSTEM. He conducted the business of the office with integrity but continued to pad its payroll with Conkling loyalists. At the Republican national convention in 1880, Arthur was the compromise choice for vice president on a ticket with JAMES GARFIELD; he became president on Garfield's assassination. As president, Arthur displayed unexpected independence by vetoing measures that rewarded political patronage. He also signed the PENDLETON CIVIL SERVICE ACT, which created a civil-service system based on merit. He and his navy secretary recommended appropriations that later helped transform the U.S. Navy into one of the world's great fleets. He failed to win his party's nomination for a second term.

Arthurian legend Body of stories and medieval romances centring on the legendary English king Arthur. The stories chronicle Arthur's life, the adventures of his knights, and the adulterous love between his knight Sir LANCELOT and his queen, Guinevere. The legend was popular in Wales before the 11th century, was brought into literature by GEOFFREY OF MONMOUTH, and was adapted by other medieval writers, including CHRÉTIEN DE TROYES, WACE, LAYAMON, and SIR THOMAS MALORY, becoming entwined with legends of the HOLY GRAIL. From Victorian times, when interest in the legend revived, it has figured in major works by ALFRED TENNYSON (*Idylls of the King*) and T.H. WHITE (*The Once and Future King*). It is uncertain whether Arthur was a historical figure. Medieval sources say he was a 6th-century warrior and champion of Christianity who united the British tribes against the Saxon invaders, died in battle at Camlann c. 539, and was buried at Glastonbury. See also GALAHAD; MERLIN; TRISTAN AND ISOLDE.

Arthur's Pass *or* **Arthur Pass** Mountain pass, SOUTHERN ALPS, New Zealand. It lies at an elevation of 3,020 ft (920 m) at the northern end of the mountain range and provides the main railway and highway passage,

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with the rail line passing through the Otira Tunnel (5.3 mi [8.6 km]). Arthur's Pass National Park was created in 1929.

Artibonite River \ˌär-tē-bō-ˈnēt\ River, Hispaniola Island. Rising in the Cordillera Central of the Dominican Republic, it flows along the Haitian border and then west and northwest into and through Haiti's Artibonite Plain to enter the Gulf of Gonaïves after a course of some 150 mi (240 km). It is the island's longest river.

artichoke Large, coarse, herbaceous, thistlelike perennial plant (*Cynara scolymus*) of the COMPOSITE FAMILY. The thick edible scales and bottom part (heart) of the immature flower heads are a culinary delicacy. The artichoke is native to the Mediterranean and is cultivated extensively in other regions with rich soil and a mild, humid climate. The JERUSALEM ARTICHOKE is a TUBER and does not resemble the artichoke.

Articles of Confederation Early U.S. constitution (1781–89) under the government by the CONTINENTAL CONGRESS, replaced in 1787 by the U.S. CONSTITUTION. It provided for a confederation of sovereign states and gave the Congress power to regulate foreign affairs, war, and the postal service, to control Indian affairs, and to borrow money. Under the Articles, Congress settled state claims to western lands and established the NORTHWEST ORDINANCES. But Congress had no power to enforce its requests to the states for money or troops, and by late 1786 the government had ceased to be effective, as was demonstrated by SHAYS'S REBELLION (1786–87) against courts that had been enforcing seizures of property for debt. Delegates to the ANNAPOLIS CONVENTION called a meeting of all the states to amend the Articles.

articulation In PHONETICS, the shaping of the vocal tract (LARYNX, PHARYNX, and oral and nasal cavities) by positioning mobile organs (such as the tongue) relative to other parts that may be rigid (such as the hard palate) and thus modifying the airstream to produce SPEECH sounds. Articulators include the tongue, lips, teeth and upper gum ridge, hard and soft palate, uvula, pharyngeal wall, and glottis. Primary articulation refers either to where or how the vocal tract is narrowed or blocked to produce a CONSONANT, or to the tongue contour, lip shape, and larynx height that determine the sound of a vowel. Other articulators may be used to produce a secondary articulation such as palatalization (the front of the tongue approaching the hard palate), glottalization (complete or partial closure of the vocal cords), or nasalization (simultaneous passage of air through the nasal and oral tracts).

artificial heart Machine or mechanical pump that maintains blood circulation in the human body. The heart-lung machine, a mechanical pump, can maintain circulation for a few hours while the heart is stopped for surgery. It shunts blood away from the heart, oxygenates it, and returns it to the body. No device has yet been developed for total, long-term replacement of the heart; existing artificial hearts reduce the heart's workload by pumping between beats or acting as an auxiliary ventricle and are suitable only as temporary replacements in patients awaiting transplant. See also PACEMAKER.

artificial insemination Introduction of semen into a female's vagina or cervix by means other than sexual intercourse. First developed for animal breeding in the early 20th century in Russia, it is now also used to induce pregnancy in women whose partners cannot impregnate them. The partner's (or other donor's) semen is inserted with a syringe. Though reasonably successful, artificial insemination in humans raises moral issues that are not yet fully resolved. In livestock, deep-frozen semen from a male animal can be stored for long periods without losing its fertility, thus allowing a single bull to sire as many as 10,000 calves a year.

artificial intelligence (AI) Ability of a machine to perform tasks thought to require human intelligence. Typical applications include game playing, language translation, EXPERT SYSTEMS, and ROBOTICS. Although pseudo-intelligent machinery dates back to antiquity, the first glimmerings of true intelligence awaited the development of DIGITAL COMPUTERS in the 1940s. AI, or at least the semblance of intelligence, has developed in parallel with computer processing power, which appears to be the main limiting factor. Early AI projects, such as playing chess and solving mathematical problems, are now seen as trivial compared to visual PATTERN RECOGNITION, complex decision making, and the use of natural language. See also TURING TEST.

artificial respiration Breathing induced by any of several techniques in a person who has stopped or is having difficulty breathing. It consists chiefly of keeping the air passage open and inducing inhalation and exhalation. It does not include chest compressions to maintain circulation (see CARDIOPULMONARY RESUSCITATION). The primary method is mouth-to-mouth breathing, in which the rescuer breathes into the victim's mouth, with pauses to allow exhalation.

Artigas \är-ˈtē-gȧs**, José Gervasio** (b. June 19, 1764, probably Montevideo [Uru.]—d. Sept. 23, 1850, Ibiray, near Asunción, Para.) Soldier and revolutionary leader regarded as the father of Uruguayan independence. In his youth Artigas was a GAUCHO in what is now Uruguay. Allied with the Buenos Aires junta, he fought for independence from Spain and won a brilliant victory at Las Piedras. His insistence on federalism against the efforts of Buenos Aires to assert control over the entire region led to civil war. He ruled over a portion of what is now Uruguay and central Argentina until a Portuguese invasion forced him into exile in 1820. Uruguay achieved independence in 1828.

artillery In modern military science, big GUNS such as CANNONS, howitzers, or MORTARS operated by crews and of a calibre greater than 15 mm. The earliest artillery, introduced in the 14th century, were cannons and mortars of bronze, brass, or iron mounted on two-wheeled carriages. Modern artillery dates from the second half of the 19th century, when advances included steel gun barrels, more powerful gunpowders, and piston mountings that held artillery carriages steady during recoil. Both powder and projectile were encased in a SHELL, which allowed for faster loading. Since World War II, artillery has been ranked as light (up to 105 mm, for support of ground troops), medium (106–155 mm, for bombardment), and heavy (over 155 mm, for attacking rear installations). See also ANTIAIRCRAFT GUN.

Arts and Crafts movement English social and aesthetic movement of the second half of the 19th century, dedicated to reestablishing the importance of craftsmanship in an era of mechanization and mass production. The name derives from the Arts and Crafts Exhibition Society (1888). Inspired by JOHN RUSKIN and other writers who deplored the effects of industrialization, WILLIAM MORRIS founded a firm of interior designers and manufacturers to produce handcrafted textiles, printed books, WALLPAPER, furniture, jewelry, and metalwork. The movement was criticized as elitist and impractical in an industrial society, but in the 1890s its appeal widened and spread to other countries, including the U.S. See also ART NOUVEAU.

An English room decorated by William Morris in the Arts and Crafts style.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON, PHOTOGRAPH, JOHN WEBB

Aru \ˈä-ˌrü\ **Islands** Island group, eastern INDONESIA. The easternmost island group of the MOLUCCAS, located off southwestern NEW GUINEA, it stretches north-south about 110 mi (180 km) and extends some 50 mi (80 km) east-west. The group consists of six main islands (Warilau, Kola, Wokam, Kobroor, Maikoor, and Trangan), which are separated by narrow channels, and dozens of smaller islands. Dobo, on Wamar Island, is the principal harbour. The islands became part of Indonesia in 1949.

Aruba Island (pop., 2005 est.: 97,400), Lesser ANTILLES, off northwestern Venezuela. Aruba is an internally self-governing part of The Netherlands. It has an area of 75 sq mi (193 sq km). Its capital is ORANJESTAD.

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The majority of the present-day population is a combination of mostly American Indian, Spanish, and Dutch ancestry. Dutch is the official language; Papiamento, a Creole language, is used for daily affairs. The principal religion is Roman Catholicism. The currency is the Aruban florin. Aruba's lack of water severely limits agriculture. The large petroleum-refining complex there, once the island's main employer, reopened after closing in the mid-1980s, but tourism has become the island's economic mainstay. The earliest inhabitants were Arawak Indians, whose cave drawings can still be seen. Though the Dutch took possession of Aruba in 1636, they did not begin to develop it aggressively until 1816. The Netherlands controls Aruba's defense and foreign affairs, but internal affairs are handled by an island government directing its own judiciary and currency. In 1986 Aruba seceded from the Federation of the Netherlands Antilles in an initial step toward independence.

arugula \ə-'rü-gə-lə\ *or* **rocket** Yellowish-flowered European herbaceous plant (*Eruca vesicaria sativa*), of the mustard family, cultivated for its foliage, which is used especially in salads. The leaves taste sharp and peppery when young and succulent but become bitter with age. A medicinal oil is extracted from the seeds.

arum \'ar-əm\ **family** Family Araceae, containing about 2,000 species, many of which are popular ornamentals and foliage plants. Native primarily to the tropics and subtropics, a few species grow in temperate zones. The genera *Philodendron* and *Monstera* are grown for their vine-like habit and large green leaves. Other arums grown ornamentally include the florist's calla lily and the water arum (*Calla palustris*). Jack-in-the-pulpit (*Arisaema triphyllum*) is well known in woodlands, and the foul-smelling eastern skunk cabbage (*Symplocarpus foetidus*) in marshes. The genus *Arum* contains about 15 perennial species noted for funnel-shaped bracts and glossy, arrow-shaped leaves. Sap in *Arum* species can be poisonous.

Arunachal Pradesh \'är-ù-ˌnä-chəl-prə-'desh\ State (pop., 2001: 1,097,968), extreme northeastern India. Bordered by Bhutan, Tibet (China), and Myanmar and Nagaland and Assam states, it occupies 32,333 sq mi (83,743 sq km); its capital is Itanagar. A portion of the region was annexed by the Ahom rulers of Assam in the 16th century. By 1826 the British had made Assam part of British India. Later called the North East Frontier Agency, the region became Arunachal Pradesh union territory in 1972 and was granted statehood in 1987. It incorporates major ranges of the Himalaya foothills and has a rugged terrain. The population consists of many ethnic groups who speak dialects of the Tibeto-Burman linguistic family.

arupa-loka \ä-ˌrü-pə-'lō-kə\ In Buddhism, the "world of immaterial form," the highest of the three spheres of existence in which rebirth takes place. The others are the "fine-material world" (*rupa-loka*) and the "world of feeling" (*kama-loka*). In the *arupa-loka*, existence depends on the stage of concentration attained in the previous life, of which there are four levels: the infinity of space, the infinity of thought, the infinity of nonbeing, and the infinity of neither consciousness nor nonconsciousness. Beings in the *arupa-loka* do not have a material body.

Arusha National Park Preserve, northern Tanzania. Established in 1960, the park contains a rich variety of flora and fauna. It is the site of Mount Meru (14,978 ft [4,565 m]) and Ngurdoto Crater, an extinct volcano. Nearby are Mount Kilimanjaro, Olduvai Gorge, and Ngorongoro Crater, whose surrounding area teems with wildlife.

Arya Samaj \'är-yə-sä-'mäj\ Reform sect of Hinduism, founded in 1875 by Dayananda Sarasvati, in order to reestablish the Vedas as revealed and infallible truth. The Arya Samaj opposes idolatry, ancestor worship, animal sacrifice, a caste system based on birth rather than merit, untouchability (see untouchable), child marriage, pilgrimages, and temple offerings. It upholds the sanctity of the cow, samskaras, oblations to fire, and social reform, including the education of women. Strongest in western and northern India, it is governed by representatives elected to *samajas* ("societies") at the local, provincial, and national levels, and it played an important role in the growth of Indian nationalism.

Aryabhata I (b. 476, possibly Ashmaka or Kusumapura, India) Astronomer and the earliest Indian mathematician whose work survives. He composed at least two works, *Aryabhatiya* (c. 499) and the now lost *Aryabhatasiddhanta*, which circulated mainly in the northwest of India and influenced the development of Islamic astronomy. Written in verse couplets, *Aryabhatiya* deals with mathematics and astronomy. Topics include prediction of solar and lunar eclipses and an explicit statement that the apparent westward motion of the stars is due to the spherical Earth's rotation about its axis. Aryabhata also correctly ascribed the luminosity of the Moon and planets to reflected sunlight. The Indian government named its first satellite Aryabhata (launched 1975) in his honour.

Aryan \'ar-ē-ən\ Prehistoric people who settled in Iran and northern India. From their language, also called Aryan, the Indo-European languages of South Asia are descended. In the 19th century there arose a notion, propagated by the count de Gobineau and later by his disciple Houston Stewart Chamberlain, of an "Aryan race": people who spoke Indo-European, especially Germanic, languages and lived in northern Europe. The "Aryan race" was considered to be superior to all other peoples. Although this notion was repudiated by numerous scholars, including Franz Boas, the notion was seized on by Adolf Hitler and made the basis of the Nazi policy of exterminating Jews, Gypsies (Roma), and other "non-Aryans." See also racism.

Asad, Ḥāfiẓ al- See Ḥāfiẓ al-Assad

ASALA *acronym for* **Armenian Secret Army to Liberate Armenia** Marxist-Leninist group formed in 1975 to force the Turkish government to acknowledge the Armenian massacres of 1915 and pay reparations. Its activities, which have included acts of terrorism, have been directed against Turkish government officials and institutions. Its founder, Hagop Hagopian, was killed in 1988; thereafter the group's activities diminished.

Asam \'äz-äm**, Cosmas Damian and Egid Quirin** (respectively b. Sept. 29, 1686, Benediktbeuren, Bavaria—d. May 10, 1739, Munich; b. Sept. 1, 1692, Tegernsee, Bavaria—d. April 29, 1750, Mannheim, Palatinate) Bavarian architects and decorators. After studying in Rome (1711–13), Cosmas Damian became a prolific fresco painter, and his brother, Egid Quirin, became a sculptor and stuccoist. They developed the effects of dramatic lighting and illusionism originated by Gian Lorenzo Bernini and Andrea Pozzo. Working as a team, they produced magnificent illusionistic decoration in ecclesiastical buildings, combining dramatic lighting and colour. Their works are notable for their profound and dramatic intensity of religious feeling. The brothers became the principal late Baroque exponents of illusionist decoration in religious architecture. Their most notable collaboration is the church of St. John Nepomuk in Munich (1733–46)—known as the Asamkirche in honour of the brothers.

Asante *or* **Ashanti** People of southern Ghana and adjacent areas of Togo and Côte d'Ivoire. The largest segment of the Akan peoples, they speak Twi, a language of the Kwa group of Niger-Congo languages; all together the Akan peoples make up about half the population of Ghana. Though some Asante now live and work in urban centres, most live in villages and engage in agriculture. The symbol of Asante unity is the Golden Stool, held to be so sacred that not even kings were allowed to sit on it. The Asante supplied slaves to British and Dutch traders in exchange for firearms, which they used to build up a large empire in the 18th and 19th centuries. They fought several wars against the British (1824, 1863, 1869, 1874), finally losing their capital, Kumasi, in 1896. Thereafter what remained of the empire went into decline. Asante goldwork and *kente* cloth remain prominent items of trade. See also Fante.

asbestos Any of several minerals that separate readily into long, flexible fibres. Chrysotile accounts for about 95% of all asbestos still in commercial use. The other types all belong to the amphibole group and include the highly fibrous forms of anthophyllite, amosite, crocidolite, tremolite, and actinolite. Asbestos fibre was used in brake linings, insulation, roofing shingles, floor and ceiling tiles, cement pipes, and other building materials. Asbestos fabrics were used for safety apparel and theatre curtains. In the 1970s it was found that prolonged inhalation of the tiny asbestos fibres can cause asbestosis, lung cancer, and/or mesothelioma, all serious lung diseases. The incidence of mesothelioma is most commonly associated with extensive inhalation of amphibole asbestos. In 1989 the U.S. government instituted a gradual ban on the manufacture, use, and export of most products made with asbestos.

asbestos, amphibole See amphibole asbestos

asbestosis \ˌas-ˌbes-'tō-səs\ Lung disease caused by long-term inhalation of asbestos fibres. A pneumoconiosis found primarily in asbestos workers, asbestosis is also seen in people living near asbestos industries. Fibres remain in the lungs and many years later cause extensive scarring and fibrosis. Shortness of breath and inadequate oxygenation result; advanced cases include a dry cough. There is no effective treatment. The associated increased cardiac effort may induce heart disease. Cigarette smoking

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greatly exacerbates its symptoms. LUNG CANCER and malignant mesothelioma are more common with asbestos inhalation and asbestosis.

Ascalon See ASHQELON

Ascanius \as-'kā-nē-əs\ In Roman legend, the son of AENEAS and founder of Alba Longa (probably the site of modern Castel Gandolfo) near Rome. In LIVY's account, his mother was Lavinia, and he was born after Aeneas founded Lavinium. Ascanius was also called Iulus, and he was considered the founder of the line that included Julius CAESAR.

Ascension In Christian belief, the ascent of JESUS into heaven 40 days after the Resurrection. The Book of Acts relates that, after several appearances to the APOSTLES over a period of 40 days, Jesus was taken up in their presence and hidden behind a cloud, a symbol of God's presence. The event is thought to indicate a new relationship between Jesus and God and between Jesus and his followers. The feast of the Ascension is universally observed by Christians, and its celebration emphasizes the kingship of Christ. Since the 4th century, it has been celebrated 40 days after EASTER and 10 days before PENTECOST.

asceticism \ə-'set-ə-ˌsiz-əm\ Practice of the denial of physical or psychological desires in order to attain a spiritual ideal or goal. Most religions have some features of asceticism. The desire for ritual purity in order to come in contact with the divine, the need for atonement, and the wish to earn merit or gain access to supernatural powers all are reasons for ascetic practice. Christian hermits and monks, wandering Hindu ascetics, and Buddhist monks all reject worldly goods and practice various forms of self-denial, including celibacy, abstinence, and fasting. Members of the Digambara sect of JAINISM practice an extreme form of asceticism that includes the rejection of wearing clothes. Though MONASTICISM is rejected in the Qur'ān, ascetic movements such as ZUHD have arisen in Islam. ZOROASTRIANISM forbids fasting and mortification.

Asch \'äsh**, Sholem** (b. Nov. 1, 1880, Kutno, Pol., Russian Empire—d. July 10, 1957, London, Eng.) Polish-born U.S. novelist and playwright. Much of his writing concerns the experience of Jews in eastern European villages or as immigrants in the U.S. (to which he himself immigrated in 1914). It includes the play *The God of Vengeance* (1907) and the novels *Mottke the Thief* (1916), *Uncle Moses* (1918), *Judge Not* (1926), and *Chaim Lederer's Return* (1927). In later, more controversial works, he explored the common heritage of Judaism and Christianity. His career was outstanding for both output and impact, and he is one of the best-known writers in modern Yiddish literature.

Ascham \'as-kəm**, Roger** (b. 1515, Kirby Wiske, near York, Eng.—d. Dec. 30, 1568, London) English humanist, scholar, and writer. He entered Cambridge University at age 14 and studied Greek. He became the future Queen ELIZABETH I's tutor in Greek and Latin (1548–50) and continued to serve her after she took the throne. His best-known book is the posthumous *The Scholemaster* (1570), which deals with the psychology of learning, the education of the whole person, and the ideal moral and intellectual personality that education should mold. He is notable also for his lucid prose style and his promotion of the vernacular.

ASCII \'as-ˌkē\ *in full* **American Standard Code for Information Interchange.** Data-transmission code used to represent both text (letters, numbers, punctuation marks) and noninput device commands (control characters) for electronic exchange and storage. Standard ASCII uses a string of 7 BITS (binary digits) for each symbol and can thus represent $2^7 = 128$ characters. Extended ASCII uses an 8-bit encoding system and can thus represent $2^8 = 256$ characters. While ASCII is still found in legacy data, UNICODE, with 8-, 16-, and 32-bit versions, has become standard for modern OPERATING SYSTEMS and BROWSERS. In particular, the 32-bit version now supports all of the characters in every major language.

Asclepius \as-'klē-pē-əs\ *Latin* **Aesculapius** \ˌes-kyə-'lā-pē-əs\ Greco-Roman god of medicine. He was the son of APOLLO and the nymph Coronis. He learned the art of healing from the Centaur CHIRON. Fearful that Asclepius would make humans immortal, ZEUS slew him with a thunderbolt. His cult originated in Thessaly and spread throughout Greece. Because he was said to cure the sick in dreams, the practice of sleeping in his temples became common. Asclepius was often represented holding a staff with a serpent coiled around it. See photograph opposite.

ascorbic acid See VITAMIN C

ASEAN *in full* **Association of Southeast Asian Nations** International organization established by the governments of Indonesia, Malaysia, the Philippines, Singapore, and Thailand in 1967 to accelerate regional economic growth, social progress, and cultural development and to promote peace and security in the region. Brunei became a member in 1984, Vietnam in 1995, Laos and Myanmar (Burma) in 1997, and Cambodia in 1999. ASEAN became a leading voice on regional trade and security issues in the 1990s; in 1992 member nations created the ASEAN Free Trade Area.

Asgard \'as-ˌgärd\ In Norse mythology, the dwelling place of the gods. It consisted of 12 or more realms, including VALHALLA, home of ODIN; Thrudheim, home of THOR; and Breidablick, home of BALDER. Each Norse god had his own palace in Asgard. This heavenly region could only be reached from earth via the rainbow bridge called Bifrost.

ash Any tree of the genus *Fraxinus*, in the OLIVE family. The genus includes about 70 species of trees and shrubs found mostly in the Northern Hemisphere. The U.S. boasts 18 species of ash, 5 of which furnish most of the ash cut as lumber. Most important are the white ash (*F. americana*) and the green ash (*F. pennsylvanica*), which yield wood that is stiff, strong, and resilient, yet lightweight. This "white ash" is used for baseball bats, hockey sticks, paddles and oars, tennis and other racket frames, and the handles of agricultural tools. Black ash (*F. nigra*), blue ash (*F. quadrangulata*), and Oregon ash (*F. latifolia*) produce wood of comparable quality that is used for many more purposes, including furniture, interior paneling, and barrels.

Ash Can school Group of U.S. realist painters, active in New York City c. 1908–18, who specialized in scenes of everyday urban life. Inspired by ROBERT HENRI, the core group included WILLIAM GLACKENS, George Luks (1867–1933), Everett Shinn (1876–1953), and JOHN SLOAN. As artist-reporters on the *Philadelphia Press* before moving to New York, they had developed a quick eye and a memory for detail. Though they often depicted slums and outcasts of the city, they were more interested in the picturesque aspects of these subjects than in the social issues they raised. GEORGE WESLEY BELLOWS and EDWARD HOPPER were also associated with the group. See also The EIGHT.

ash cone See CINDER CONE

Ash Wednesday See LENT

Ashanti See ASANTE

Asclepius, from an ivory diptych, 5th century AD; in the Liverpool City Museum, England
THE BRIDGEMAN ART LIBRARY/ART RESOURCE

Ash'arī \'ä-shä-rē**, Abū al-Ḥasan al-** (b. 873/874, Basra, Iraq—d. 935/936, Baghdad) Muslim Arab theologian. He probably belonged to the family of Abū Mūsā al-Ash'arī, one of the COMPANIONS OF THE PROPHET. He joined the MU'TAZILAH school and compiled scholarly opinions in his *Maqālāt al-Islāmīyīn* ("Theological Opinions of the Muslims"). At about age 40 he concluded that his method had led to sterile concepts of God and humanity, and he turned to more orthodox theology. He expanded his *Maqālāt* and authored *Kitāb al-Luma'* ("The Luminous Book"). Reflecting on the ideas of al-MUḤĀSIBĪ and others, he created his own school, which became known as the Khorāsān, or Ash'arite, school. See also ASH'ARIYYAH.

Ash'ariyyah School of Muslim theology founded by Abū al-Ḥasan al-ASH'ARĪ in the 10th century. It supported the use of reason and speculative theology (KALĀM) to defend the faith but was not as extreme in its rationalism as the MU'TAZILAH school. Followers attempted to demonstrate the existence and nature of God through rational argument, while affirming the eternal, uncreated nature of the QUR'ĀN. They were

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accused by the Muʿtazilah of believing in predestination because they claimed the human capacity for action was only acquired at the very moment of action.

Ashbery, John (Lawrence) (b. July 28, 1927, Rochester, N.Y., U.S.) U.S. poet. He earned degrees from Harvard and Columbia universities and subsequently became known as an art critic. His poems, noted for their elegance, originality, and obscurity, are characterized by arresting images, exquisite rhythms, intricate form, and sudden shifts in tone and subject. His collections include *The Double Dream of Spring* (1970), *Self-Portrait in a Convex Mirror* (1975, Pulitzer Prize, National Book Award), *A Wave* (1984), *Flow Chart* (1991), and *Wakefulness* (1998).

Ashcroft, Dame Peggy *orig.* **Edith Margaret Emily Ashcroft** (b. Dec. 22, 1907, Croydon, London, Eng.—d. June 14, 1991, London) British actress. She made her debut in 1927 and appeared from 1932 with the Old Vic company, winning acclaim in *Romeo and Juliet* (1935). She starred in more than 100 stage productions, playing comedy and tragedy with equal success. One of the great actresses of the British stage, she was a founding member of the Royal Shakespeare Co. (1961) and later a director. She acted in films such as *The Thirty-nine Steps* (1935) and *A Passage to India* (1984, Academy Award) and in the television series *The Jewel in the Crown* (1984).

Ashe, Arthur (Robert), Jr. (b. July 10, 1943, Richmond, Va., U.S.—d. Feb. 6, 1993, New York, N.Y.) U.S. tennis player. He won his first grand-slam singles title (the 1968 U.S. Open) as an amateur. The first African American member of the U.S. Davis Cup team, he helped win five championships (1963, 1968, 1969, 1970, 1978). In 1975 he won the Wimbledon singles title and received World Championship Tennis top ranking. He retired in 1980 and became captain of the U.S. Davis Cup team (to 1985). Off the court he was a critic of racial injustice, including South Africa's apartheid policy. In 1992 he revealed that he had been infected with HIV by a transfusion following surgery, and he thereafter devoted time to increasing public awareness of AIDS. The U.S. Open is now played at Arthur Ashe Stadium, which opened at the National Tennis Center in Flushing, N.Y., in 1997.

Ashford, Evelyn (b. April 15, 1957, Shreveport, La., U.S.) U.S. sprinter. She attended UCLA, where she won four national collegiate championships and competed in the 1976 Olympics in Montreal. She went on to win world championships (100- and 200-m sprints) in 1979 and 1981 and was named Woman Athlete of the Year both years. She won two gold medals in the 1984 Olympics (100-m dash, 4 × 100-m relay) and a silver and a gold medal in the 1988 Olympics (in the same events). At the 1992 games, her fifth Olympics, she became the oldest woman (at 35) to win a gold medal in track and field (4 × 100-m relay).

Ashgabat \'äsh-gä-ˌbät\ *formerly* **Ashkhabad** \'ash-kə-ˌbad\ City (pop., 1999 est.: 605,000), capital of Turkmenistan. It lies in an oasis at the northern foot of the Kopet-Dag Range near the Iranian border. Founded in 1881 as a Russian military fort, it was the capital of Turkmenistan S.S.R. (1924–90). A violent earthquake destroyed the city in 1948; it was rebuilt on the same plan. It is now an industrial, transportation, and cultural centre.

Ashikaga \ˌä-shē-'kä-gä\ **family** Japanese warrior family that established the Ashikaga shogunate in 1338. The founder, Ashikaga Takauji (1305–58), supported the emperor Go-Daigo's attempt to wrest control of the country from the Hōjō family, but then turned on him and set up an emperor from another branch of the imperial family, who granted Takauji the title of shogun. Takauji's grandson Yoshimitsu (1358–1408), the third Ashikaga shogun, ended the dual imperial courts that had resulted from his grandfather's actions, took an active role in the court bureaucracy, and reorganized civil government. Yoshimitsu reopened formal trade with China and is remembered as a sponsor of the arts; he commissioned the famous Golden Pavilion (Kinkaku-ji) in Kyōto. Ashikaga Yoshimasa (1436–90), the eighth Ashikaga shogun, was also a great patron of the arts and a devotee of the tea ceremony. He commissioned the Silver Pavilion (Ginkaku-ji), whose understated elegance contrasts with the opulence of the Golden Pavilion. Politically, Yoshimasa's tenure as shogun coincided with increasing loss of control over the countryside as Japan headed toward a century of civil war. See also Muromachi period; daimyo; Ōnin War; samurai.

Ashkenazi \ˌäsh-kə-'nä-zē\ Any of the historically Yiddish-speaking European Jews who settled in central and northern Europe, or their descendants. They lived originally in the Rhineland valley, and their name is derived from the Hebrew word *Ashkenaz* ("Germany"). After the start of the Crusades in the late 11th century, many migrated east to Poland, Lithuania, and Russia to escape persecution. In later centuries Jews who adopted the German-rite synagogue ritual were called Ashkenazim to differentiate them from the Sephardic, or Spanish-rite, Jews (see Sephardi), from whom they differ in cultural traditions, pronunciation of Hebrew, and synagogue chanting as well as in the use of the Yiddish language (until the 20th century). Today they constitute more than 80% of the world's Jews.

Ashley, William Henry (b. c. 1778, Powhatan, Va., U.S.—d. March 26, 1838, Cooper county, Mo.) U.S. fur trader. Arriving in Missouri about 1802, he prospered in mining and land speculation. In 1820 he became the state's first lieutenant governor. With Andrew Henry (1771–1833), he organized the Rocky Mountain Fur Co. in 1822 and established a trading post at the mouth of the Yellowstone River. Forced to abandon the post by Indians, he instituted the annual rendezvous (1825), where trappers would trade their furs to him for supplies for the next year. By 1827 he had made a fortune and retired. Elected to the U.S. House of Representatives (1831–37), he championed Western interests.

Ashoka \ə-'shō-kə\ *or* **Asoka** \ə-'sō-kə\ (b. c. 304—d. c. 232 BC) Last major emperor (c. 269–232 BC) of the Mauryan empire in India and a patron of Buddhism. After his bloody conquest of Kalinga in the eighth year of his reign, Ashoka renounced military aggression and resolved to live according to the dharma. He spoke of Buddhism only to fellow Buddhists and adopted a policy of toleration for other religions. He spread Buddhist teachings through inscriptions known as the Rock Edicts and Pillar Edicts. He enjoined officials to be aware of the needs of common people and to dispense justice impartially; dharma ministers were appointed to relieve suffering and look to the special needs of other religions, women, outlying regions, and neighbouring peoples. He erected stupas and monasteries, developed a course of study for adherents, and sent missionaries to Sri Lanka. He is remembered as the ideal Buddhist ruler.

Ashqelon \'ash-kə-ˌlän\ *formerly* **Ascalon** Town (pop., 2000 est.: 98,937) and archaeological site, Israel. The historic coastal city-state of Ascalon was traditionally the key to the conquest of southwestern Palestine. Its name appears in Egyptian texts as early as c. 1800 BC. It was conquered by several ancient empires, including that of Alexander the Great (332 BC). Conquered by the Arabs in AD 636, it was taken by Crusaders in 1153 and became one of their principal ports (see Crusades). It was retaken by the Ayyūbid sultan Saladin in 1187 and destroyed by the Mamlūk sultan Baybars I in 1270. Modern Ashqelon, originally an Arab town, was resettled by Israelis after 1949 and is now a resort and industrial centre.

ashram \'äsh-rəm, 'ash-ˌram\ *or* **ashrama** \'äsh-rə-mə\ In Hinduism, any of the four stages of life through which a "twice-born" (see upanayana) Hindu ideally will pass. These stages are: the student, who is devoted and obedient to his teacher; the householder, who supports his family and the priests and fulfills duties to the gods and ancestors; the hermit, who withdraws from society to pursue ascetic and yogic practices; and the homeless mendicant, who renounces all possessions and wanders from place to place begging for food. In English the word has come to mean a place for the pursuit of spiritual or religious disciplines, often under a guru.

Ashtart See Astarte

Ashton, Sir Frederick (William Mallandaine) (b. Sept. 17, 1904, Guayaquil, Ecua.—d. Aug. 18, 1988, Sussex, Eng.) Principal choreographer and director of England's Royal Ballet. After creating ballets from 1925 for the Ballet Club (later Ballet Rambert), he joined the Vic-Wells Ballet (later Royal Ballet) in 1933, becoming principal choreographer, assistant director (1953–63), and director (1963–70). At least 30 of his works remain in its repertoire, including *Façade* (1931), *Symphonic Variations* (1946), and *Birthday Offering* (1956). He also choreographed for companies such as the Royal Danish Ballet (*Romeo and Juliet*, 1955) and the New York City Ballet (*Illuminations*, 1950).

Ashur Ancient religious capital of Assyria. It is located on the Tigris River, 60 mi (97 km) south of Mosul, Iraq. The name Ashur was applied to the city, to Assyria itself, and to Assyria's principal god. The capital's site was originally occupied c. 2500 BC and later became part of Akkad. By the late 12th century BC it was under Assyrian control. Its religious sanc-

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tity ensured its continuous upkeep until 614 BC, when it was destroyed by BABYLONIA. The archaeological site has yielded fortifications, temples, and palaces.

Ashurbanipal \ˌä-sər-ˈbä-ni-ˌpäl\ (fl. 7th century BC) Last great Assyrian king (r. 668–627 BC). He was appointed crown prince of Assyria in 672 BC; his half-brother was appointed crown prince of Babylonia. On his father's death, Ashurbanipal assumed full power without incident. He quelled a rebellion in Egypt and successfully besieged Tyre. His half brother, who served him in Babylonia peacefully for 16 years, joined a coalition of peoples from outlying areas of the Assyrian empire and plotted rebellion, but Ashurbanipal discovered the plots and, after a three-year siege, took Babylon. By 639 BC he had the whole known world under his control. A person of religious zeal, he rebuilt or adorned most of the major shrines of Assyria and Babylonia. His principal intellectual accomplishment was the creation in Nineveh of the first systematically organized library in the Middle East; the clay tablets collected there preserved omen texts, Mesopotamian epics, prayers and incantations, scientific texts, lexicographical texts, and folktales.

Ashurbanipal carrying a basket in the rebuilding of the temple, stone bas-relief from the Esagila, Babylon, 650 BC; in the British Museum

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Asia Largest continent on Earth. It is bounded by the Arctic, Pacific, and Indian oceans. The western boundary, with Europe, runs roughly north-south along the eastern URAL MOUNTAINS; the Caspian, Black, Aegean, and Mediterranean seas; the Suez Canal; and the Red Sea. The islands of Sri Lanka and Taiwan and the archipelagoes of Indonesia (excluding New Guinea), the Philippines, and Japan also form part of Asia. Area: 17,226,000 sq mi (44,614,000 sq km). Population (2004 est.): 3,879,659,000. Mountains and plateaus predominate on the continent, with the highest mountains located in Central Asia and north of the Indian subcontinent. Terrain features include Earth's highest peak, Mount EVEREST, at 29,035 ft (8,850 m), and the lowest natural point, the DEAD SEA, at 1,312 ft (400 m) below sea level. The largest of Asia's many arid regions are the THAR and GOBI deserts. It has some of the longest rivers in the world, including the EUPHRATES, TIGRIS, INDUS, GANGES (Ganga), YANGTZE (Chang; the longest river in Asia), HUANG HE (Yellow), OB, YENISEY, and LENA. The CASPIAN, ARAL, and Dead seas are major saltwater lakes. About one-fifth of Asia's landmass is arable. Its principal language groups include SINO-TIBETAN, INDO-ARYAN, AUSTRONESIAN, AUSTROASIATIC, and SEMITIC; important singular languages include JAPANESE and KOREAN. East Asia contains three main ethnic groups: Chinese, Japanese, and Korean. The Indian subcontinent is home to a vast diversity of peoples, most of whom speak languages from the Indo-Aryan subgroup of the INDO-EUROPEAN family. Because of the influence of China and the former Soviet Union, the Mandarin Chinese dialect and the Russian language are used widely. Asia is the birthplace of all the world's major religions and hundreds of minor ones. HINDUISM is the oldest major religion to have originated in southern Asia; JAINISM and BUDDHISM emerged in the 6th and 5th centuries BC, respectively. Southwest Asia was the cradle of the so-called Abrahamic religions: JUDAISM, CHRISTIANITY, and ISLAM. DAOISM and CONFUCIANISM, both of which originated in the 6th or 5th century BC, have profoundly influenced Chinese culture and the cultures of surrounding peoples. Asia is marked by great disparities in wealth. A few countries, notably Japan, Singapore, and the oil-rich countries of the Arabian Peninsula, have attained high standards of living; others, such as Bangladesh and Myanmar, are among the poorest. Between these two extremes lie Russia, China, and India. Asia is a land of great cultural diversity, but there are five main cultural influences: Chinese, Indian, Islamic, European, and Central Asian. China has had great influence in East Asia as the source of Confucianism, artistic styles, and the Chinese writing system. Indian influence has been expressed through Hinduism and Buddhism, affecting Tibet, Indonesia, Cambodia, and Central Asia. Islam spread from its original Arabian home to become important in the Middle East, South Asia, Central Asia, and elsewhere. Members of the earlier human species *Homo erectus* migrated from Africa to East Asia at least one million years ago. One of the earliest civilizations to use writing developed in the Tigris and Euphrates river valleys c. 3000 BC (see MESOPOTAMIA). Civilization in the Indus River valley and in northern Syria followed c. mid-3rd millennium BC. Chinese urban civilization began with the SHANG DYNASTY (c. 1600–1046 BC) and continued under the ZHOU DYNASTY (1046–256 BC). Indo-European-speaking peoples (ARYANS) began to invade India from the west c. 2000–1500 BC and developed the VEDIC RELIGION. A succession of empires and charismatic rulers, including the Macedonian ALEXANDER THE GREAT, spread their political control as far as military power could carry them. In the 13th century AD GENGHIS Khan and his MONGOL successors united much of Asia under their rule. In the 14th century the Turkic warlord TIMUR conquered much of Central Asia. Muslim Turks destroyed the remnants of the Byzantine Empire in the 15th century. In the 19th century European imperialism began to replace Asian imperialism. Tsarist Russia pushed its political control across Asia to the Pacific Ocean, the British gained control of India and Burma (Myanmar), the French dominated eastern Southeast Asia (see FRENCH INDOCHINA), the Dutch occupied the East Indies (Indonesia), and the Spanish and later the U.S. ruled the Philippines. After World War II (1939–45), European imperialism steadily disappeared as former colonies gained independence in the second half of the 20th century. See map on opposite page.

Asia Minor See ANATOLIA

Asimov \ˈa-zi-ˌmȯf**, Isaac** (b. Jan. 2, 1920, Petrovichi, Russia—d. April 6, 1992, New York, N.Y., U.S.) Russian-born U.S. author and biochemist. He arrived in the U.S. at age 3, earned a doctorate from Columbia University, and subsequently taught for many years at Boston University. Before embarking on graduate study, he had already begun publishing his stories. "Nightfall" (1941) is often called the finest science-fiction short story ever written. His *I, Robot* (1950) greatly influenced how later writers treated intelligent machines. A trilogy of novels—*Foundation*, *Foundation and Empire*, and *Second Foundation* (1951–53)—is widely considered a classic. Asimov's nonfiction science books for lay readers are noted for their lucidity and humour. Immensely prolific, he published more than 300 volumes in all.

Askja \ˈäs-kyä\ Caldera, Iceland. The largest crater in the Dyngjufjöl volcanic massif, Askja lies 20 mi (32 km) north of Vatnajökull, Iceland's largest ice field. Its rugged peaks, up to 4,954 ft (1,510 m), encircle a lake of 4.25 sq mi (11 sq km) that occupies the caldera. The volcano erupted in 1875 and again in 1961.

Asmara \ˈäs-mȧ-rȧ\ City (pop., 2002 est.: 500,600), capital of Eritrea. It lies on the northern tip of the Ethiopian Plateau at an elevation of 7,628 ft (2,325 m). Its Red Sea port, Massawa, is 40 mi (65 km) northeast. Formerly a hamlet of the TIGRE people, Asmara became the capital of the Italian colony of Eritrea in 1900. It was under British control from 1941 until Eritrea's federation with Ethiopia in 1952 and became the capital of independent Eritrea in 1993. It is an agricultural marketplace.

Aso \ˈä-sō**, Mount** *Japanese* **Aso-san** Volcanic mountain, central KYUSHU island, Japan. The highest of its five peaks is about 5,223 ft (1,592 m) tall. It has one of the largest active craters in the world, measuring 71 mi (114 km) in circumference; its caldera marks the original crater and contains an active volcano and hot springs. The crater is inhabited; its pastures are used for cattle raising and dairy farming. The volcano is at the centre of Aso-Kuju National Park.

Asoka See ASHOKA

asp Anglicized form of *aspis*, the name used in classical antiquity for a venomous snake, probably the Egyptian COBRA (*Naja haje*). The asp was the symbol of royalty in Egypt, and its bite was used for the execution of criminals in Greco-Roman times. CLEOPATRA is said to have killed herself with an asp.

asparagine \ə-ˈspar-ə-jēn\ One of the nonessential AMINO ACIDS, widely distributed in plant PROTEINS and closely related to ASPARTIC ACID. First isolated in 1806 from asparagus, it is used in medicine and biochemical research.

asparagus Any plant of the genus *Asparagus* (LILY FAMILY), which contains about 300 species native from Siberia to southern Africa. The best-

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known and economically most important species is the garden asparagus (*A. officinalis*), cultivated as a green VEGETABLE for its succulent spring stalks. Several African species are grown as ornamental plants. The poisonous species prized for their delicate and graceful foliage are *A. plumosus* (the feathery asparagus fern, or florists' fern—not a true FERN), *A. sprengeri*, and *A. asparagoides*.

aspartame \'as-pər-ˌtām\ Synthetic organic compound (a dipeptide) of PHENYLALANINE and ASPARTIC ACID. It is 150–200 times as sweet as cane SUGAR and is used as a nonnutritive tabletop sweetener and in low-calorie prepared foods (brand names NutraSweet, Equal) but is not suitable for baking. Because of its phenylalanine content, persons with PHENYLKETONURIA must avoid it. Though it is approved by the U.S. FOOD AND DRUG ADMINISTRATION and other regulatory authorities around the world, its safety even for those without the disease remains controversial. See also SACCHARIN.

aspartic acid One of the nonessential AMINO ACIDS, found in many PROTEINS and closely related to ASPARAGINE. It is used in medical and biochemical research, as an organic intermediate, and in various industrial applications. It is one of the two components of ASPARTAME.

Aspasia \as-'pā-shə\ (fl. 5th century BC) Mistress of PERICLES and a vivid figure in Athenian society. Originally from Miletus, she lived with Pericles from c. 445 BC until his death in 429. Because she was not a citizen, their son was initially denied civic rights. Though an intellectual admired by SOCRATES, she endured public attacks, especially in comic theatre, for her private life and her supposed influence on Pericles' foreign policy.

Aspen City (pop., 2000: 5,914), western central Colorado, U.S. It is located on the Roaring Fork River at the edge of the White River National Forest, at an altitude of 7,907 ft (2,410 m). Founded by prospectors c. 1878, it was a booming silver-mining town by 1887 but declined rapidly after silver prices collapsed in the early 1890s. Its revival as a ski resort began in the late 1930s, and it is now a popular tourist town; it is also known for its cultural festivals, notably the Aspen Music Festival.

aspen Any of three tree species of the genus *Populus*, of the WILLOW family: *P. tremula* (the common European aspen), *P. tremuloides* (the American quaking, or trembling, aspen), and *P. grandidentata* (the American big-tooth aspen). Native to the Northern Hemisphere, aspens are known for the fluttering of their leaves in the slightest breeze. Aspens grow farther north and higher up the mountains than other *Populus* species. All aspens have a smooth, gray-green bark, random branching, rich green leaves that turn brilliant yellow in fall, and CATKINS that appear before the leaves in spring.

Aspendus \as-'pen-dəs\ Ancient city, Pamphylia (now southwestern Turkey). It was a wealthy city by the 5th century BC. Occupied by ALEXANDER THE GREAT in 333 BC, it was taken by the Romans in 133 BC. It is noted for its Roman ruins, including a huge theatre designed by the architect Zeno in honour of the emperor MARCUS AURELIUS.

Aspergillus \ˌas-pər-'jil-əs\ Any FUNGUS of the genus *Aspergillus* of the Fungi Imperfecti (form-class Deuteromycetes). Species for which the sexual phase is known are placed in the order Eurotiales. *A. niger* causes black mold on some foods; *A. niger*, *A. flavus*, and *A. fumigatus* cause aspergillosis in humans. *A. oryzae* is used to ferment SAKE, and *A. wentii* to process soybeans.

asphalt Black or brown petroleum-like material that has a consistency varying from viscous liquid to glassy solid. It is obtained either as a residue from the distillation of petroleum or from natural deposits. Asphalt consists of compounds of hydrogen and carbon with minor proportions of nitrogen, sulfur, and oxygen. It softens when heated and is elastic under certain conditions. Used principally in road surfacing, asphalt is also used for roofs, coatings, floor tilings, and waterproofing, and in industrial products.

asphodel \'as-fə-ˌdel\ Any of several flowering plants belonging to the LILY FAMILY. This common name is variously applied and thus much misunderstood. The asphodel of the poets is often a NARCISSUS; that of the ancients is either of two genera, *Asphodeline* or *Asphodelus*. Asphodels are hardy herbaceous perennials with narrow leaves and an elongated stem bearing a handsome spike of white, pink, or yellow flowers. Bog asphodel (*Narthecium ossifragum*) is a small herbaceous plant that grows in boggy places in Britain.

asphyxia \as-'fik-sē-ə\ Lack of exchange of oxygen and carbon dioxide due to respiratory failure or disturbance, resulting in insufficient brain oxygen, which leads to unconsciousness or death. Causes include strangulation, drowning, and carbon monoxide poisoning. Breathing in food or fluid can cause obstruction of the airway and pulmonary collapse. Emergency resuscitation usually includes CARDIOPULMONARY RESUSCITATION.

aspidistra \ˌas-pə-'dis-trə\ Any plant of the genus *Aspidistra* (LILY FAMILY), native to eastern Asia and known for ornamental foliage. The only cultivated species is a HOUSEPLANT commonly known as cast-iron plant (*A. elatior*, or *A. lurida*), which has long, stiff, pointed EVERGREEN leaves that are capable of withstanding temperature extremes, dust, smoke, and other harsh conditions. The solitary, bell-shaped flowers, which are usually lilac in colour but sometimes brown or green, are borne at the base of the plant. The fruits are small berries.

aspirin Common name of acetylsalicylic acid, an organic compound introduced in 1899. The ESTER of SALICYLIC ACID and ACETIC ACID, it inhibits production of PROSTAGLANDINS in the body. Its ANALGESIC, fever-reducing, and anti-inflammatory effects make it useful in treating headaches, muscle and joint aches, ARTHRITIS pain, and the symptoms of mild fevers and infections. It also has ANTICOAGULANT activity and is taken in low doses by CORONARY HEART DISEASE patients to prevent HEART ATTACK. Prolonged use may cause stomach bleeding and PEPTIC ULCER, and its use in children with fever has been linked to REYE SYNDROME. See also ACETAMINOPHEN; IBUPROFEN; NSAID.

Aspiring, Mt. See MOUNT ASPIRING NATIONAL PARK

Asplund, (Erik) Gunnar (b. Sept. 22, 1885, Stockholm, Swed.—d. Oct. 20, 1940, Stockholm) Swedish architect. His work shows the historically important transition from Neoclassical architecture to Modernism. By 1928, influenced by LE CORBUSIER, he had turned from a retrospective style to a new vision for architecture. He planned the Stockholm Exposition of 1930, a place of futuristic, glassy pavilions that had a significant influence on subsequent exhibition architecture. His Woodland Crematorium, Stockholm (1935–40), with its spare Neoclassical colonnade surrounded by meadows, is admired by Classicists and Modernists alike.

Asquith, H(erbert) H(enry), 1st earl of Oxford and Asquith (b. Sept. 12, 1852, Morley, Yorkshire, Eng.—d. Feb. 15, 1928, Sutton Courtenay, Berkshire) British politician and prime minister (1908–16). Elected to the House of Commons in 1886, he served as home secretary (1892–95). A leader of the Liberal Party, he became prime minister in 1908. His plan to limit the powers of the House of Lords was enacted by the PARLIAMENT ACT OF 1911. He led Britain in the early years of World War I, but domestic crises combined with British losses in the war led to widespread dissatisfaction. He resigned in 1916 but remained leader of his party until 1926.

ass *or* **wild ass** Either of two species of small, sturdy EQUINES. Asses are 3–5 ft (90–150 cm) high at the shoulder. The African wild ass, or true ass (*Equus asinus*) is bluish gray to fawn; the Asiatic wild ass, or half-ass (*E. hemionus*) is reddish to yellow-gray. The half-ass differs from the true ass in that it has extremely long, slender legs, shorter ears, and larger hooves. The true ass has the alternating "hee-haw" bray. Desert dwellers, wild asses often inhabit regions that cannot support other large mammals. They are very swift runners. See also DONKEY.

Assad \'ä-säd**, Ḥāfiẓ al-** (b. Oct. 6, 1930, Qardāḥa, Syria—d. June 10, 2000, Damascus) President of SYRIA (1971–2000). He joined the BAʿTH PARTY in 1946 and in 1955 became an air force pilot. He became air force commander (1963) after helping the Baʿthists gain power. After participating in a military coup in 1966, he became minister of defense. He led a coup in 1970 to replace his political mentor, Ṣalāḥ al-Jadīd, as Syria's leader. He joined Egypt in a surprise attack on Israel (1973) but nearly 20 years later (1991) participated in peace negotiations with Israel in an effort to regain the GOLAN HEIGHTS, taken by Israel in the SIX-DAY WAR of 1967. A longtime foe of Iraqi leader ṢADDĀM ḤUSSEIN, he supported the Western alliance against Iraq in the PERSIAN GULF WAR (1990–91). He was succeeded by his son Bashshār.

Assal \ä-'säl**, Lake** Saline lake, central Djibouti. Situated at 515 ft (157 m) below sea level, it is the lowest point in Africa. It has been used for quarrying salt.

Assam \a-'sam\ State (pop., 2001 prelim.: 26,638,407), northeastern India. With an area of 30,285 sq mi (78,438 sq km), Assam borders BHUTAN and BANGLADESH and ARUNACHAL PRADESH, NAGALAND, MANIPUR, MIZORAM, MEGHALAYA, and WEST BENGAL states; its capital is DISPUR. A strong inde-

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pendent kingdom was founded there in the 13th century by invaders from Myanmar (Burma) and China; it reached its zenith in the early 18th century. The British took control in the early 19th century. In the division of India (1947), Assam lost some territory to Pakistan. Beginning in the 1960s, four new states—Nagaland, Meghalaya, Mizoram, and Arunachal Pradesh—were created from land within Assam. The Brahmaputra River valley is its dominant physical feature. The population consists of Indo-Iranian and Asian peoples; the most widely spoken language is Assamese.

Assassin *properly* **Nizāriyyah** Byname for any member of a subsect of Ismāʿīlī Shīʿite Muslims who operated in parts of Iran and Syria from the 11th to the 13th century. The order takes its name from the purported use of hashish to induce ecstatic visions of paradise among its devotees (*hashshāshūn*, "hashish smokers"—whence is derived the English term) before they set out to face martyrdom. The Assassins operated out of series of mountain fortresses and, seeing assassination as a religious duty, engaged in a long campaign of murder against members of the Sunnite community, including numerous officials of the ʿAbbāsid and Seljūq dynasties, and others. The Assassins' power was finally broken by the Mongols, who captured the great Assassin stronghold of ʿAlamūt in Iran in 1256. The Syrian branch was destroyed by the Mamlūk Baybars I in 1271–73. Leadership of the Nizārī order continued until modern times in the line of the Aga Khans, a family prominent worldwide as philanthropists and public servants.

assassin bug Any of about 4,000 insect species (family Reduviidae) characterized by a thin, necklike structure connecting the narrow head to the body. Many species are common to North and South America. Ranging in size from 0.5 to 1 in. (13–25 mm), assassin bugs use their short, three-segmented beak to suck body fluids from their victims. Most assassin bugs prey on other insects; some, however, suck blood from vertebrates, including humans, and transmit diseases. One species, the large assassin bug, defends itself by accurately "spitting" saliva toxic enough to blind a human.

assassin fly See robber fly

assault and battery Related but distinct crimes. Battery is the unlawful application of physical force to another; assault is an attempt to commit battery or an act that may reasonably cause fear of imminent battery. With manslaughter and murder (see homicide), these concepts are articulated to protect against rude and undesired physical contact or the threat of it. Battery requires no minimum degree of force, nor does it need to be applied directly; administering poison and transmitting a disease may both be battery. Accidents and ordinary negligence are not, nor is reasonable force used in the performance of duty (e.g., by a police officer). See also rape.

assault rifle Military firearm that is chambered for ammunition of reduced size or propellant charge and has the capacity to switch between semiautomatic and fully automatic fire. Light and portable, yet able to deliver a high volume of fire with reasonable accuracy at modern combat ranges of 1,000–1,600 ft (300–500 m), assault rifles have become the standard infantry weapon of modern armies. Their ease of handling makes them ideal for mobile assault troops crowded into personnel carriers or helicopters, as well as for guerrilla fighters engaged in jungle or urban warfare. Widely used assault rifles are the U.S. M16, the Soviet Kalashnikov (the AK-47 and modernized versions), the Belgian FAL and FNC, and the German G3.

assaying \'a-sā-iŋ\ In chemical analysis, the process of determining proportions of metal, particularly precious metal, in ores and metallurgical products. The most important assaying technique grew largely out of the experiments of the ancient alchemists and goldsmiths. Precious metals tend to occur as scattered particles randomly distributed, so a large sample of ore is required. Such large samples (typically containing gold, silver, and lead) are still most economically assayed by this ancient method, which involves several steps of heating and cooling. More sophisticated recent methods, such as spectrochemical analysis, are not suited to assaying precious metal ores because the samples of the inhomogeneous ore that must be used are larger than the instruments can handle. See also parting.

assemblage \ˌa-säm-'bläzh\ Three-dimensional construction made from household materials such as rope and newspapers or from any found materials. The term, coined by Jean Dubuffet in the 1950s, has been applied to collage, photomontage, and sculptural assemblage. The Dadaists and Surrealists produced ready-made assemblages and elevated them to art by simply exhibiting them. Later artists who have worked with the technique include Louise Nevelson and Robert Rauschenberg.

Assemblies of God Largest Pentecostal denomination in the U.S. It was formed in 1914 in Hot Springs, Ark., by the union of several small Pentecostal groups. The Assemblies of God emphasize the centrality of the Bible in Christian faith and worship. Instead of sacraments, the Assemblies have two ordinances, baptism by total immersion and the Lord's Supper. Personal sanctification is believed to happen gradually rather than instantaneously, and millennial doctrines dealing with Christ's Second Coming and the establishment of the Kingdom of God are of great importance. The Assemblies of God have been very active in mission work in the U.S. and overseas. See also millennialism, Pentecostalism.

assembly language Type of low-level computer programming language consisting mostly of symbolic equivalents of a particular computer's machine language. Computers produced by different manufacturers have different machine languages and require different assemblers and assembly languages. Some assembly languages can be used to convert the code that programmers write (source code) into machine language (readable by the computer), and have functions to facilitate programming (e.g., by combining a sequence of several instructions into one entity). Programming in assembly languages requires extensive knowledge of computer architecture.

assembly line Industrial arrangement of machines, equipment, and workers for continuous flow of workpieces in mass-production operations. An assembly line is designed by determining the sequences of operations for manufacture of each component as well as the final product. Each movement of material is made as simple and short as possible, with no cross flow or backtracking. Work assignments, numbers of machines, and production rates are programmed so that all operations performed along the line are compatible. Automated assembly lines (see automation) consist entirely of machines run by other machines and are used in such continuous-process industries as petroleum refining and chemical manufacture and in many modern automobile-engine plants. See also Henry Ford, interchangeable parts, Taylorism.

assessment Process of setting a value on real or personal property, usually for the purpose of taxation. It is carried out either by central government agencies or by local officials. Property may be assessed on the basis of its annual rental value, as in Britain, or its capital value, as in the U.S. Various methods are used to determine capital value, including analysis of market data to estimate the property's current market price, estimation of the cost of reproducing the property minus accrued depreciation, and capitalization of the property's earnings.

assessor One with special knowledge of a subject who is appointed or elected to assist a judge or magistrate in deciding a legal matter. In the U.S., the term also designates an official who evaluates property for the purposes of taxation. Assessors were appointed in the late 19th century throughout Europe to try to limit the influence of the jury system, which had been introduced in the wake of the French Revolution. Assessors thus represented a return to the civil-law traditions of Europe. In Britain and the U.S., assessors came to be used in labour and maritime courts as well as in some other civil jurisdictions.

assimilation See culture contact

Assiniboia \ə-ˌsin-ə-'bȯi-ə\ Early region, western Canada. Named for the Assiniboin Indians, it was an area with indefinite boundaries, controlled by the Hudson's Bay Co. c. 1811–70. It included present-day southern Manitoba and, until 1818, the Red River Valley in present-day North Dakota and Minnesota. It was incorporated into Manitoba in 1870. In 1882 the Canadian government created another district of Assiniboia as part of the old Northwest Territories. In 1905 this district was divided between Alberta and Saskatchewan.

Assiniboin \ə-ˌsin-ə-'bȯi-ən\ *or* **Nakota** North American Plains Indian people living mostly on reservations in Montana, U.S., and Saskatchewan and Alberta, Can. They speak a Siouan language. Their name is an Ojibwa word meaning "those who cook with stones." They were divided into bands, each with its own chief and council, and were generally friendly with whites. The bands moved their camps frequently in pursuit of migrating buffalo. Prowess in war consisted of taking scalps and horses and of touching the enemy ("counting coups") during battle. Their numbers were severely reduced by smallpox in the 1820s and '30s, after which most

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were placed on reservations. Some 3,900 people claimed sole Assiniboin descent in the 2000 U.S. census. There are somewhat fewer in Canada.

Assiniboine River \ə-'sin-ə-ˌbȯin\ River, southern Canada. Rising in Saskatchewan, it flows southeast across Manitoba into the Red River of the North at Winnipeg. It is about 665 mi (1,070 km) long and has two tributaries, the Qu'Appelle and the Souris. Explored by Pierre La Verendrye in 1736, it later served as a route to the plains by colonists from Red River Settlement.

Assiniboin, placating the spirit of a slain eagle, photograph by Edward S. Curtis, 1908; from *The North American Indian*
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Assis, Joaquim Maria Machado de See Joaquim M. Machado de Assis

assistance, writ of General search warrant used by the British in the American colonies. The warrants authorized customhouse officers, with the assistance of a sheriff, to search any house or ship for smuggled goods, without requiring them to specify the place or the goods. The legality of the writs was challenged by the colonists in the 1760s, and they became a major grievance in the years leading up to the American Revolution. See also James Otis.

assize \ə-'sīz\ In law, a session, or sitting, of a court. It originally referred to a judicial inquest in which a panel of men conducted an investigation. It was later applied to special sessions of high courts in England and France. Assize courts were abolished in most countries in the 20th century, but in France they are still the courts of first instance in the handling of serious crimes.

Associated Press (AP) Cooperative news agency, the oldest and largest in the U.S. and long the largest in the world. Its beginnings trace to 1848, when six New York City newspapers pooled their efforts to finance a telegraphic relay of foreign news brought by ships to Boston. In 1892 the modern AP was set up under the laws of Illinois; several years later it moved to New York. Its restrictive controls on new memberships were ended with federal antitrust prosecution in the 1940s. AP was the first agency to devote a news wire to sports coverage (1946), and it distributes business news through a partnership with Dow Jones & Co., Inc. More than 15,000 organizations worldwide obtain news, photographs, and illustrations from the agency. The *AP Stylebook* has become a standard in many journalistic organizations.

association In psychology, the process of forming mental connections or bonds between sensations, ideas, or memories. Though discussed by the ancient Greeks (in terms of similarities, contrasts, and contiguities), the "association of ideas" was first proposed by John Locke and subsequently examined by David Hume, John Stuart Mill, Herbert Spencer, and William James. Ivan Pavlov used objective methods to study the phenomenon, resulting in his identification of the conditioned reflex (see conditioning). Within psychoanalysis, the therapist encourages "free association" in order to help identify latent conflicts. Practitioners of Gestalt psychology and others have criticized associationist theories as too all-embracing, while some theorists of cognitive psychology have made it central to their theory of memory.

association football See football

Association of Caribbean States (ACS) Trading bloc composed of 25 countries of the Caribbean basin. Responding to a proposal by Pres. Bill Clinton for a Free Trade Area of the Americas (FTAA), existing Caribbean-area trading blocs joined forces in 1995 to strengthen their economic position and ease future integration into the FTAA. Prominent in the ACS are the Caricom countries (13 English-speaking countries and Suriname), which have been struggling toward a single market and economy along the lines of the European Union. The ACS has addressed such issues as unifying responses to natural disasters, ending the U.S. embargo of Cuba, and ending shipments of nuclear materials through the Panama Canal.

Association of Southeast Asian Nations See ASEAN

associative law Two closely related laws of number operations. In symbols, they are stated: $a + (b + c) = (a + b) + c$, and $a(bc) = (ab)c$. Stated in words: The terms or factors may be associated in any way desired and the result will be the same. This holds for the numbers generally encountered: positive and negative, integral and fractional, rational and irrational, real and imaginary. Exceptions occur (e.g., in nonassociative algebras and divergent infinite series). See also commutative law, distributive law.

Assos See Assus

assumpsit \ə-'səmp-sit\ (Latin: "he has undertaken") In common law, an action to recover damages for breach of contract, especially an implied or quasi contract. It developed in early English law as a form of recovery for the negligent performance of an undertaking (e.g., failing to protect from damage another's goods in one's care). Eventually, it came to cover broader claims regarding failure to keep a promise. It remains available as a contractual remedy in some U.S. jurisdictions.

Assus *or* **Assos** Ancient Greek city, southern Troas (now northwestern Turkey). It was founded in the 1st millennium BC on the Gulf of Edremit, opposite the island of Lesbos. It was long an important city and port. Aristotle taught there 348–345 BC, and it was the birthplace of the philosopher Cleanthes (331?–232? BC).

Assyria Ancient empire, southwestern Asia. It grew from a small region around Ashur (in modern northern Iraq) to encompass an area stretching from Egypt to Anatolia. Assyria may have originated in the 2nd millennium BC, but it came to power gradually. Its greatest period began in the 9th century BC, when its conquests reached the Mediterranean Sea under Ashurnasirpal II (883–859), and again c. 746–609 BC, during the Neo-Assyrian empire, when it conquered much of the Middle East. Its greatest rulers during the latter period were Tiglath-pileser III, Sargon II, Sennacherib, and Ashurbanipal. Famous for their cruelty and fighting prowess, the Assyrians were also monumental builders, as shown by archaeological finds at Nineveh, Ashur, and Calah. The opulence of Ashurbanipal's court at Nineveh became legendary. Artistically, the Assyrians were particularly noted for their stone bas-reliefs. The kingdom was finally vanquished in 612–609 BC by a coalition of Media and Babylonia (Chaldea).

Assyro-Babylonian language See Akkadian language

Astaire, Fred *orig.* **Frederick Austerlitz** (b. May 10, 1899, Omaha, Neb., U.S.—d. June 22, 1987, Los Angeles, Calif.) U.S. dancer and singer of stage and movies. At age seven he began his popular vaudeville dance act with his sister Adele, and they made their Broadway debut in 1917; they continued dancing in stage hits until Adele retired in 1932. Astaire's successful film appearances with Ginger Rogers began with *Flying Down to Rio* (1933) and continued until 1939. In the 1940s and 1950s he danced on-screen with Eleanor Powell, Cyd Charisse, and Judy Garland. His singing, though untrained, was admired by the finest songwriters of his time. He retired in 1971 but occasionally appeared in films and on television. His combination of sophisticated, seemingly effortless grace and technical virtuosity revolutionized popular-dance performance.

Astaire in *Top Hat,* 1935
CORBIS-BETTMANN

Astana *formerly (1992–98)* **Aqmola** *or* **Akmola** \åk-'mō-lə\ *or(1961–92)* **Tselinograd** \'tsi-'lē-nə-ˌgrät\ City (pop., 1999: 319,318), capital of Kazakhstan. Situated on the banks of the Ishim River in north-central Kazakhstan, it was founded in 1824 as a Russian military outpost. The city's importance was enhanced by its location at the junction of the Trans-Kazakhstan and South Siberian railways. It is in the centre of a mineral-rich steppe region. In 1994 the Kazakh government began to transfer the national capital from Almaty to Astana, changing the city's name in 1998.

Astarte \a-'stär-tē\ *or* **Ashtart** \'ash-ˌtärt\ Goddess of the ancient Middle East and chief deity of the Mediterranean seaports of Tyre, Sidon,

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and Elath. Astarte shared many qualities, and perhaps a common origin, with her sister ANATH. The goddess of love and war, Astarte was worshiped in Egypt and in Canaan, as well as among the Hittites. Her Akkadian counterpart was ISHTAR. She is often mentioned in the Bible under the name Ashtaroth; SOLOMON is said to have worshipped the goddess, and JOSIAH destroyed the shrines dedicated to her. In Egypt she was assimilated with ISIS and HATHOR; in the Greco-Roman world she was assimilated with APHRODITE, ARTEMIS, and JUNO.

aster Any of various chiefly fall-blooming, leafy-stemmed herbaceous plants (*Aster* and closely related genera) in the COMPOSITE FAMILY, often with showy flowers. Included among the asters are many perennial WILDFLOWERS and hundreds of garden varieties.

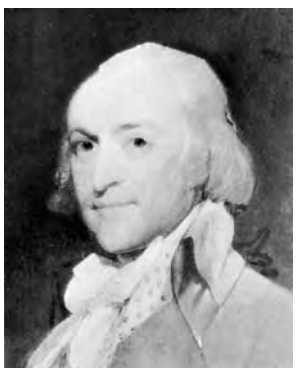
asteroid Any of the many small rocky objects found mainly in a flat ring, or belt, between the orbits of Mars and Jupiter. It is thought that the gravitational influence of what became Jupiter kept the asteroids from aggregating into a single planet while the SOLAR SYSTEM was forming. Also called minor PLANETS, asteroids are smaller than any of the nine major planets; only about 30 are more than 125 mi (200 km) across. CERES is the largest known asteroid. Millions of boulder-sized asteroidal fragments are thought to exist in the solar system. Asteroids or their fragments regularly strike Earth, plunging through the atmosphere as METEORS to reach its surface (see METEORITE). Asteroids appear to be composed of carbonaceous, stony, and metallic (mainly iron) materials. See also EARTH-CROSSING ASTEROID; TROJAN ASTEROIDS.

asthenosphere \as-'the-nə-ˌsfir\ Zone of the Earth's MANTLE lying beneath the LITHOSPHERE, believed to be much hotter and more fluid than the lithosphere. The asthenosphere is thought to extend from about 60 mi (100 km) to about 450 mi (700 km) below the Earth's surface.

asthma \'az-mə\ Chronic disease with attacks of shortness of breath, wheezing, and coughing from constriction and mucous-membrane swelling in the bronchi (air passageways in the lungs). It is caused primarily by ALLERGY or respiratory infection. Secondhand smoke can cause asthma in children. Asthma is common and runs in families; predisposition may be hereditary. In established asthmatics, exercise, stress, and sudden changes in temperature or humidity can bring on attacks. Attacks usually last from a half hour to several hours; severe attacks can be fatal. Corticosteroids can control asthma; injections of EPINEPHRINE can relieve acute attacks. Prevention involves avoiding exposure to allergens.

astigmatism \ə-'stig-mə-ˌti-zəm\ Lack of symmetry in the curvature of the cornea or, rarely, the lens of the EYE. The unequal curvatures spread light rays, preventing them from being sharply focused at a point on the RETINA, causing blurring of part of the image. The effect of astigmatism can also be produced by misalignment of the lens. Astigmatic vision is corrected by means of lenses (see CONTACT LENS, EYEGLASSES) that refract the light rays to the proper degree in the opposite direction of that produced by the defects in curvature.

Astor, John Jacob *orig.* **Johann Jakob Astor** (b. July 17, 1763, Waldorf, Ger.—d. March 29, 1848, New York, N.Y., U.S.) German-born U.S. fur magnate and financier. After emigrating from Germany at age17, he opened a fur-goods shop in New York c. 1786. By 1800 he was a leader in the fur trade, and he established the AMERICAN FUR CO. He controlled the fur trade with China (1800–17) and in the Mississippi and Missouri valleys (in the 1820s) before selling his interests in 1834. His investment in New York City real estate became the foundation of the family fortune. At his death, Astor was the wealthiest person in the U.S.; he willed $400,000 to found what became the NEW YORK PUBLIC LIBRARY. His son, William B. Astor (1792–1875), greatly expanded the family real-estate holdings, building more than 700 stores and dwellings in the city.



John Jacob Astor, detail of an oil painting by Gilbert Stuart, 1794; in the Brook Club, New York.
COURTESY OF THE FRICK ART REFERENCE LIBRARY

Astrakhan \'as-trə-ˌkan\ City (pop., 2002: 506,400), southwestern RUSSIA. It is situated on several islands in the delta of the VOLGA RIVER. It was the capital of a TATAR khanate that became independent of the GOLDEN HORDE in the 13th century, and its location on caravan and water routes made it a trading centre. IVAN IV (the Terrible) conquered Astrakhan in 1556, giving Russia control of the Volga. The Turks burned the city in 1569. It served as the base for the campaign of PETER I (the Great) against Persia and later was given special trade privileges. Sites of interest include a fortress and a cathedral.

astrolabe Type of early scientific instrument used for reckoning time and for observational purposes. Astrolabes can be traced to the 6th century AD; they came into wide use in Europe and the Islamic world in the early Middle Ages and were adopted by mariners by the mid-15th century. One widely used variety, the planispheric astrolabe, can be regarded as a rudimentary analog computer. It enabled astronomers to calculate the positions of the Sun and prominent stars with respect to both the horizon and the meridian.

Astrolabe, 11th century.
OXFORD SCIENCE ARCHIVE/HERITAGE-IMAGES

astrology DIVINATION that consists of interpreting the influence of stars and planets on earthly affairs and human destinies. In ancient times it was inseparable from ASTRONOMY. It originated in Mesopotamia (c. 3rd millennium BC) and spread to India, but it developed its Western form in Greek civilization during the Hellenistic period. Astrology entered Islamic culture as part of the Greek tradition and was returned to European culture through Arabic learning during the Middle Ages. According to the Greek tradition, the heavens are divided according to the 12 constellations of the ZODIAC, and the bright stars that rise at intervals cast a spiritual influence over human affairs. Astrology was also important in ancient China, and in imperial times it became standard practice to have a HOROSCOPE cast for each newborn child and at all decisive junctures of life. Though the COPERNICAN SYSTEM shattered the geocentric worldview that astrology requires, interest in astrology has continued into modern times and astrological signs are still widely believed to influence personality.

astronaut Person trained to pilot a SPACECRAFT, operate any of its systems, or conduct research aboard it during spaceflights. The term commonly refers to those participating in U.S. space missions; cosmonaut is the Russian equivalent. Extensive training, including classroom study of technical subjects as well as practice in computer-controlled simulators and full-sized mock-ups of spacecraft to experience FREE FALL, prepares astronauts physically and psychologically for space missions. Astronauts also learn to use the control, communication, and life-support systems of any given spacecraft and conduct difficult flight operations. See also EDWIN ALDRIN; NEIL ARMSTRONG; GUION S. BLUFORD, JR.; YURY A. GAGARIN; JOHN H. GLENN, JR.; MAE JEMISON; SALLY RIDE; ALAN B. SHEPARD, JR.; VALENTINA TERESHKOVA.

astronomical unit (AU) Length of the semimajor axis of Earth's orbit around the Sun, 92,955,808 mi (149,597,870 km), often defined simply as the average distance from Earth to the Sun. Direct measurement through the PARALLAX method cannot be used for accurate determinations, because the Sun's glare blots out the light of the background stars necessary to make the measurement. The most precise values have been obtained by measuring the distance from Earth to other objects orbiting the Sun. This indirect method requires an accurate proportional mathematical model of the solar system; once the distance to one planet or other object is determined, then the distance to the Sun can be calculated.

astronomy Science dealing with the origin, evolution, composition, distance, and motion of all bodies and scattered matter in the UNIVERSE. The most ancient of the sciences, it has existed since the dawn of recorded civilization. Much of the earliest knowledge of celestial bodies is often credited to the Babylonians. The ancient Greeks introduced influential cosmological ideas, including theories about the Earth in relation to the rest of the universe. PTOLEMY's model of an Earth-centred universe (2nd

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century AD) influenced astronomical thought for over 1,300 years. In the 16th century, NICOLAUS COPERNICUS assigned the central position to the Sun (see COPERNICAN SYSTEM), ushering in the age of modern astronomy. The 17th century saw several momentous developments: JOHANNES KEPLER's discovery of the principles of planetary motion, GALILEO's application of the TELESCOPE to astronomical observation, and ISAAC NEWTON's formulation of the laws of motion and gravitation. In the 19th century, SPECTROSCOPY and photography made it possible to study the physical properties of planets, stars, and nebulae, leading to the development of ASTROPHYSICS. In 1927 EDWIN HUBBLE discovered that the universe, hitherto thought static, was expanding (see EXPANDING UNIVERSE). In 1937 the first RADIO TELESCOPE was built. The first artificial SATELLITE, SPUTNIK, was launched in 1957, inaugurating the age of SPACE EXPLORATION; SPACECRAFT that could escape Earth's gravitational pull and return data about the solar system were launched beginning in 1959 (see LUNA; PIONEER). See also BIG BANG; COSMOLOGY; GAMMA-RAY ASTRONOMY; INFRARED ASTRONOMY; RADIO AND RADAR ASTRONOMY; ULTRAVIOLET ASTRONOMY; X-RAY ASTRONOMY.

astrophysics Branch of ASTRONOMY concerned mainly with the properties and structures of cosmic objects, including the universe as a whole. Starting in the 19th century, SPECTROSCOPY and photography were applied to astronomical research, making it possible to study the brightness, temperature, and chemical composition of cosmic objects. It was soon realized that the properties of these bodies could be fully understood only in terms of the physics of their atmospheres and interiors. X-RAY ASTRONOMY, GAMMA-RAY ASTRONOMY, INFRARED ASTRONOMY, ULTRAVIOLET ASTRONOMY, and RADIO AND RADAR ASTRONOMY are all basically concerned with extending electromagnetic coverage beyond the visible spectrum to constrain the physical characteristics of astronomical objects.

Astruc \as-trʉ̄k\ **of Lunel** *orig.* **Abba Mari ben Moses ben Joseph** (b. 1250?, Lunel, near Montpellier, France—d. after 1306) French Jewish scholar. He revered MAIMONIDES but argued that Maimonides' followers undermined faith by reading the Bible allegorically. Through letters he persuaded the powerful rabbi Solomon ben Abraham Adret (1235–1310) of Barcelona, Spain, to forbid the study or teaching of science and philosophy by those under 25 (1305). The resulting controversy almost split the Jewish communities of France and Spain. A schism was prevented when PHILIP IV of France expelled the Jews from France in 1306, and Astruc settled in Majorca.

Asturias \ȧs-'tu̇r-ē-əs\ Autonomous community (pop., 2001: 1,062,998) and province, on the Bay of BISCAY, northwestern Spain. It occupies an area of 4,094 sq mi (10,604 sq km); its capital is OVIEDO. Coextensive with the historical principality of Asturias, it is largely covered by mountains that isolate it from other Spanish provinces. Its population and industries are concentrated in the Nalón River valley, whose extensive coalfields make the province Spain's mining centre. Conquered by the Romans under AUGUSTUS in 25 BC, it was later ruled by the VISIGOTHS. It became part of the kingdom of LEÓN on the accession of Alfonso III in 866. It was made a principality in 1388, a province in 1838, and an autonomous community in 1981.

Asturias \ȧs-'tu̇r-ē-əs**, Miguel Ángel** (b. Oct. 19, 1899, Guatemala City, Guat.—d. June 9, 1974, Madrid, Spain) Guatemalan poet, novelist, and diplomat. He moved to Paris in 1923 and became a Surrealist under the influence of ANDRÉ BRETON. His first major works appeared in the 1930s. He began his diplomatic career in 1946; it culminated in his serving as ambassador to France 1966–70. Asturias's writings combine a Mayan mysticism with an epic impulse toward social protest, especially against U.S. and oligarchic power. In *Men of Maize* (1949), often considered his masterpiece, he depicts the seemingly irreversible wretchedness of the Indian peasant. Other major novels, some of which employ the style of magic realism, are *El Señor Presidente* (1946), a fictional denunciation of Guatemala's dictator; *The Cyclone* (1950); *The Green Pope* (1954); and *The Eyes of the Interred* (1960). He won the Nobel Prize for Literature in 1967.

Miguel Ángel Asturias.
CAMERA PRESS

Asunción \ä-ˌsün-'syōn\ *in full* **Nuestra Señora de la Asunción** City (pop., 2002 prelim.: 513,339), capital of Paraguay. It lies on the PARAGUAY RIVER near its confluence with the PILCOMAYO RIVER. Founded in 1537 by Spanish CONQUISTADORES, it replaced BUENOS AIRES as the headquarters of Spanish colonial activities in eastern South America during the period of the latter's depopulation (1541–80). In 1731 Asunción was the site of one of the first major rebellions against Spanish rule. The city declared independence from both Spain and Argentina in 1811. Today it dominates social, cultural, and economic trends in Paraguay.

Asvaghosa \ˌäsh-və'-gō-shə\ (b. AD 80?, Ayodhya, India—d. 150?, Peshawar) Indian philosopher and poet considered the father of Sanskrit drama. Born a BRAHMAN, he opposed BUDDHISM until a debate with a Buddhist scholar led to his conversion. Asvaghosa became known as a brilliant orator, and he spoke on MAHAYANA at the fourth BUDDHIST COUNCIL. He is considered India's greatest poet before KALIDASA. Works attributed to him include the *Buddhacarita* ("Life of the Buddha") and the *Mahalankara* ("Book of Glory").

asvamedha \ˌäsh-və-'mā-də\ Rite of the VEDIC RELIGION in ancient India, performed by a king to celebrate his supremacy. A stallion was selected and allowed to roam freely for a year under the protection of a royal guard. It was said to symbolize the progress of the sun and the power of the king. If it was not captured during the year, it was brought back to the capital along with the rulers of lands it had entered. It was then sacrificed at a public ceremony, and the king assumed the title of universal monarch. The BUDDHA condemned the practice, but it was revived in the 2nd century BC and may have continued as late as the 11th century AD.

Aswān City (pop., 1996 est.: 219,017), southeastern Egypt. It lies on the NILE RIVER just north of Lake NASSER. In ancient times it was the southern frontier of pharaonic Egypt. Later known as Syene, it served as a frontier garrison post for the Romans, Ottomans, and British. Modern Aswān is located near the old Aswān Dam (completed 1902) and the ASWĀN HIGH DAM.

Aswan High Dam Dam across the NILE RIVER, north of ASWAN, Egypt. Built 4 mi (6 km) upstream from the earlier Aswan Dam (1902), it is 364 ft (111 m) high and 12,562 ft (3,830 m) long. Differences with GAMAL ABDEL NASSER led the U.S. and Britain to withdraw their financial support of the project in 1956, whereupon Nasser turned to the Soviet Union for assistance. The dam, completed in 1970, impounds the reservoir Lake NASSER and controls the annual Nile flood, releasing floodwaters when needed for irrigation; it also enables the production of great amounts of electric power. Its construction necessitated the relocation of the ancient ABU SIMBEL ruins.

asylum Protection from arrest and extradition given to political refugees by a country or by an embassy that has diplomatic immunity. No one has a legal right to asylum, and the sheltering state, which has the legal right to grant asylum, is under no obligation to give it. It is thus a right of the state, not the individual. Its traditional use has been to protect those accused of political offenses such as TREASON, desertion, SEDITION, and ESPIONAGE. Beginning in the 20th century, asylum also was granted to those who could demonstrate a significant risk of politically motivated persecution if they returned to their home countries.

asymmetric synthesis CHEMICAL REACTION by which unequal amounts of two product ISOMERS are formed. It is normally not possible to synthesize from materials that do not have OPTICAL ACTIVITY (i.e., are not chiral) one stereoisomer of a chiral compound without the other, but use of a chiral auxiliary, such as an ENZYME or other catalyst, a SOLVENT, or an intermediate, can force the reaction to produce predominantly or only one isomer. Asymmetric syntheses are often called stereoselective; if one product forms exclusively, it is stereospecific.

asymptote \'a-səm-ˌtōt\ In mathematics, a line or curve that acts as the LIMIT of another line or curve. For example, a descending curve that approaches but does not reach the horizontal axis is said to be asymptotic to that axis, which is the asymptote of the curve.

AT&T Inc. *formerly* **American Telephone and Telegraph Co.** U.S. telecommunications corporation. It was established as a subsidiary of Bell Telephone Co. (founded by ALEXANDER GRAHAM BELL in 1877) to build long-distance telephone lines and later became the parent company of the Bell System. In the early 20th century it gained a virtual monopoly over the U.S. telecommunications industry, and by 1970 it was the world's largest corporation. It developed transoceanic radiotelephone links and

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telephone cable systems and created the Telstar satellite communications system. Years of federal antitrust litigation resulted in 1984 in the divestment by AT&T (nicknamed "Ma Bell") of its 22 regional telephone companies, which were combined to form seven "Baby Bells": Nynex, Bell Atlantic, Ameritech, BellSouth, Southwestern Bell Corp. (renamed SBC Corp. in 1995), US West, and Pacific Telesis Group. Although several Baby Bells merged following the Telecommunications Act of 1996, AT&T proceeded to divide its operations into three separate companies: AT&T Corp., Lucent Technologies Inc. (composed of the former operations of Western Electric and Bell Laboratories), and the NCR Corp. In 2005 AT&T was acquired by SBC Corp., which then changed its name to AT&T Inc. Its diversified telecommunications businesses included local and long-distance telephone service, wireless voice and data networks, broadband DSL (Digital Subscriber Line), and Internet communication and Web management services.

Atacama \ˌä-tä-'kä-mä\ **Desert** Cool, arid area, north-central Chile. Extending north from the city of Copiapó, the area runs from north to south for a distance of some 600 to 700 mi (1,000 to 1,100 km) and covers most of the Antofagasta region and the northern part of the Atacama region. Because of its location between low coastal mountains and a higher inland range, the region is meteorologically anomalous. Despite its low latitude, summer temperatures average only about 65 °F (18 °C), and, though heavy fogs are common, the desert is one of the driest regions in the world. Some areas receive heavy rain only two to four times a century. For much of the 19th century, the desert was the object of conflicts between Chile, Bolivia, and Peru; after the War of the Pacific (1879–83), Chile emerged with permanent ownership of sectors previously controlled by Peru and Bolivia. For years before the development of synthetic methods of fixing nitrogen, the desert was a chief source of the world's nitrates.

Atahuallpa \ˌä-tä-'wäl-pä\ (b. c. 1502—d. Aug. 29, 1533, Cajamarca, Inca empire) Last free-reigning emperor of the Incas. He became ruler after defeating his half brother in what may have been the greatest military engagement in Inca history. The conquistador Francisco Pizarro met Atahuallpa just before the emperor's triumphal entry into Cuzco and invited him to a feast in his honour. When Atahuallpa and his unarmed retainers arrived, Pizarro ambushed them on horseback with cannons and guns, slaughtered thousands, and took Atahuallpa prisoner. Pizarro accepted Atahuallpa's offer of a ransom of a roomful of gold; then, having received 24 tons of gold and silver, he ordered Atahuallpa burned at the stake. The sentence was changed to death by garrote when Atahuallpa agreed to convert to Christianity.

Atalanta \ˌa-tᵊl-'an-tə\ In Greek mythology, a swift-footed huntress. Born in Boeotia or Arcadia, she was left to die at birth but was suckled by a bear. As an adult she took part in the famous Calydonian boar hunt and drew first blood. She offered to marry any man who could outrun her in a race, but the losers were required to pay with their lives. One contestant, Hippomenes (or Milanion), obtained three golden apples from Aphrodite to carry in the race. As he dropped them, Atalanta stooped to pick them up, and thus lost the race. The two were later turned into lions after they desecrated a shrine to Cybele or Zeus.

Atalanta, Greek marble statue; in the Louvre.
GIRAUDON-ART RESOURCE

Atanasoff \ə-'tan-ə-ˌsȯf**, John V(incent)** (b. Oct. 4, 1903, Hamilton, N.Y., U.S.—d. June 15, 1995, Frederick, Md.) U.S. physicist. He received his Ph.D. from the University of Wisconsin. With Clifford Berry, he developed the Atanasoff-Berry Computer (1937–42), a machine capable of solving differential equations using binary arithmetic. In 1941 he joined the Naval Ordnance Laboratory; he participated in the atomic bomb tests at Bikini Atoll (1946). In 1952 he established the Ordnance Engineering Co., which he later sold to Aerojet Engineering Corp. In 1973, after a judge voided a patent owned by Sperry Rand Corp. on ENIAC, the Atanasoff-Berry Computer was credited as the first electronic digital computer.

Atargatis \ə-'tär-gə-tis\ Goddess of northern Syria who was worshiped at Hierapolis, northeast of Aleppo, along with her consort, Hadad. Primarily a goddess of fertility, she was also mistress of the city and its people. She was often depicted wearing a crown and carrying a sheaf of grain, and her throne was supported by lions, suggesting her power over nature. Considered a combination of Anath and Astarte, she also showed kinship with the Anatolian Cybele (Great Mother of the Gods). Merchants and mercenaries carried her cult throughout the Greek world, where she was considered a form of Aphrodite.

Atatürk \'at-ə-ˌtərk**, Mustafa Kemal** *orig.* **Mustafa Kemal** (b. 1881, Salonika, Greece, Ottoman Empire—d. Nov. 10, 1938, Istanbul, Tur.) Founder of modern Turkey. Dedicated by his father to military service, he graduated near the top of his class in military school. As a young officer, he was critical of the government of the Ottoman Empire and became involved with the Turkish nationalist Committee of Union and Progress. He nevertheless fought for the government during World War I (1914–18), achieving great success against Allied forces during the Dardanelles Campaign. The eventual Allied victory brought British, French, and Italian troops to Anatolia; appointed to restore order there, he used the opportunity to incite the people against the Allied occupation. Greece and Armenia, territorial beneficiaries of the Ottoman defeat, opposed the Turkish nationalists, but Mustafa Kemal overcame all opposition, and the Republic of Turkey was established in 1923. He was given the name Atatürk ("Father of the Turks") in 1934. He pursued a policy of Westernization and secularization, in which Western styles of dress and appellation were made mandatory, seclusion of women was abolished, and the legal and educational system was overhauled. See also Enver Pasha; Young Turks.

ataxia \ā-'tak-sē-ə\ Inability to coordinate voluntary muscular movements. In common usage, the term describes an unsteady gait. Hereditary ataxias are usually caused by degeneration of the spinal cord, cerebellum, or other parts of the nervous system. The most common is Friedreich ataxia, which begins at ages 3–5, progressing slowly to almost complete incapacity by age 20. There is no specific therapy. Metabolic disorders, brain injuries, and toxins can cause ataxia.

Atbara \'at-bə-rə\ **River** River, North Africa. Rising in the Ethiopian highlands, it flows about 500 mi (800 km) northwest through eastern Sudan to join the Nile River at Atbara in The Sudan. It is the Nile's northernmost tributary.

Atchafalaya \ə-ˌcha-fə-'lī-ə\ **Bay** Inlet of the Gulf of Mexico on the Louisiana coast, U.S. Together with Four League Bay, it extends about 21 mi (34 km). The Atchafalaya River links the bay with Morgan City on the Gulf Intracoastal Waterway. The area includes many natural gas and oil fields.

Atchafalaya River River, southern Louisiana, U.S. A distributary of the Red and Mississippi rivers, it branches southwest from the Red River in east-central Louisiana and flows south about 140 mi (225 km) to Atchafalaya Bay. Its name is Choctaw for "Long River."

Atchison, Topeka and Santa Fe Railroad Co. Former railway. Chartered in Kansas in 1860 by Cyrus K. Holliday, the founder of Topeka, as the Atchison and Topeka Railroad Co., it was built along the Santa Fe Trail and became known as the Santa Fe Railway. Its main line, completed in 1872, extended to the Colorado state border. Further expansion west in the 1880s and early 1890s reached about 9,000 mi (14,500 km) of track. It reached its greatest extent in 1941, with more than 13,000 mi (21,000 km) of track, but gradually shrank thereafter. In 1971 its famously luxurious passenger service was sold to Amtrak. In the 1990s it merged with Burlington Northern to become Burlington Northern Santa Fe Railway.

atelectasis \ˌat-ᵊl-'ek-tə-səs\ *or* **lung collapse** Lack of expansion of pulmonary alveoli (see pulmonary alveolus). With a large-enough collapsed area, the victim stops breathing. In adhesive atelectasis, obstruction or lack of surface tension keeps a newborn's alveoli from expanding. Compression atelectasis is caused by external pressure. Obstructive atelectasis may be caused by blockage of a major airway or when pain from abdominal surgery keeps breathing too shallow to clear bronchial secretions; treatment involves removal of obstruction or fluids, control of infection, and lung reinflation.

Aten See Aton

Atget \ȧt-'zhe**, (Jean-) Eugène (-Auguste)** (b. Feb. 12, 1857, Libourne, near Bordeaux, France—d. Aug. 4, 1927, Paris) French pho-

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tographer. He began his adult life as an itinerant actor. Around age 30 he settled in Paris and became a photographer. The rest of Atget's life was spent recording everything he could that he considered picturesque or artistic in and around Paris. With an eye for strange and unsettling images, he made several series of photographs of iron grillwork, fountains, statues, and trees. He also photographed shop fronts, store windows, and poor tradespeople. His main clients were museums and historical societies that bought his photographs of historic buildings and monuments. After World War I he received a commission to document the brothels of Paris. MAN RAY published four of Atget's photographs in *La révolution surréaliste* (1926), the only recognition he received in his lifetime. After his death, Ray, BERENICE ABBOTT, and the art dealer Julien Lévy bought his remaining collection, which is now in the Museum of Modern Art.

Athabasca, Lake Lake, western central Canada. It extends 208 mi (335 km), crossing the Alberta-Saskatchewan boundary. On the southwest it receives the ATHABASCA RIVER, and on the northwest it discharges into the SLAVE RIVER. It is important for its commercial fishing.

Athabasca River River, west-central Canada. A tributary of the MACKENZIE RIVER in Alberta, it rises in the Rocky Mountains in JASPER NATIONAL PARK and flows northeast and north 765 mi (1,231 km) into Lake ATHABASCA. Its chief tributaries are the Pembina, Lesser Slave, McLeod, and Clearwater rivers. Extensive petroleum deposits lie in oil-impregnated sands (Athabasca Tar Sands) along a 70-mi (113-km) stretch of the river.

Athabaskan languages *or* **Athapaskan languages** Family of North American Indian languages. There are perhaps 200,000 speakers of Athabaskan. Northern Athabaskan includes more than 20 languages scattered across an immense region of subarctic North America from western Alaska to Hudson Bay and south to southern Alberta and British Columbia. Pacific Coast Athabaskan consisted of four to eight languages, all now extinct or nearing extinction. Apachean consists of eight closely related languages spoken in the southwestern U.S. and northern Mexico, including Navajo and the various subdivisions of Apache. In 1990 Navajo had some 150,000 speakers, far more than any other indigenous language of the U.S. or Canada. In 1915 EDWARD SAPIR placed the Athabaskan family together with Tlingit and Haida (languages of Alaska and British Columbia, respectively) in a larger grouping called Na-Dene; this hypothetical relationship continues to be controversial.

Athanasius \ˌa-thə-ˈnā-zhəs**, Saint** (b. 293, Alexandria, Egypt—d. May 2, 373, Alexandria; feast day May 2) Early Christian theologian and staunch opponent of ARIANISM. He studied philosophy and theology at Alexandria, Egypt, and in 325 he attended the Council of NICAEA, which condemned the Arian heresy. He welcomed the council's teaching that the Son is "consubstantial with the Father" and defended that teaching throughout his career. In 328 he was appointed patriarch of Alexandria, but theological disputes led to the first of several banishments in 336. He returned from exile repeatedly and resumed his office, but Arian opposition continued. After being banished by Constantius II in 356, Athanasius lived in a remote desert in Upper Egypt and wrote theological treatises, including his *Four Orations Against the Arians*. The emperor's death in 361 gave Athanasius a brief respite under the toleration proclaimed by JULIAN, but a controversy with Julian's heathen subjects forced him to flee into the Theban desert. At the time of his death he again possessed the see at Alexandria.

atheism \ˈā-thē-ˌiz-əm\ Critique and denial of metaphysical beliefs in God or divine beings. Unlike AGNOSTICISM, which leaves open the question of whether there is a God, atheism is a positive denial. It is rooted in an array of philosophical systems. Ancient Greek philosophers such as DEMOCRITUS and EPICURUS argued for it in the context of MATERIALISM. In the 18th century DAVID HUME and IMMANUEL KANT, though not atheists, argued against traditional proofs for God's existence, making belief a matter of faith alone. Atheists such as LUDWIG FEUERBACH held that God was a projection of human ideals and that recognizing this fiction made self-realization possible. MARXISM exemplified modern MATERIALISM. Beginning with FRIEDRICH NIETZSCHE, existentialist atheism proclaimed the death of God and the human freedom to determine value and meaning. Logical POSITIVISM holds that propositions concerning the existence or nonexistence of God are nonsensical or meaningless.

Athena \ə-ˈthē-nə\ *or* **Athene** \ə-ˈthē-nē\ In ancient GREEK RELIGION, the goddess of war, handicraft, and wisdom and the patroness of Athens. Her Roman counterpart was MINERVA. HESIOD told how Athena sprang in full armour from ZEUS's forehead. In the *Iliad* she fought alongside the Greek heroes, and she represented the virtues of justice and skill in warfare as opposed to the blood lust of ARES. She was associated with birds (especially the owl) and the snake, and she was usually represented as a virgin goddess. Her birth and contest with POSEIDON for suzerainty of Athens were depicted on the PARTHENON. Her birthday festival was the PANATHENAEA.

The *Varvakeion*, a Roman marble copy (c. AD 130) of the colossal gold and ivory statue of the Athena Parthenos by Phidias (438 BC); in the National Archaeological Museum, Athens.
ALINARI/ART RESOURCE, NEW YORK

Athens *Greek* **Athínai** \ä-ˈthē-ne\ City (pop., 2001: 745,514), capital of Greece. It is located inland near its port, PIRAEUS, on the SARONIC GULF in eastern Greece. The source of many of the West's intellectual and artistic conceptions, including that of democracy, Athens is generally considered the birthplace of Western civilization. An ancient CITY-STATE, it had by the 6th century BC begun to assert its influence. It was destroyed by XERXES in 480 BC, but rebuilding began immediately. By 450 BC, led by PERICLES, it was at the height of its commercial prosperity and cultural and political dominance, and over the next 40 years many major building projects, including the Acropolis and PARTHENON, were completed. Athens's "Golden Age" saw the works of the philosophers SOCRATES, PLATO, and ARISTOTLE; the dramatists SOPHOCLES, ARISTOPHANES, and EURIPIDES; the historians HERODOTUS, THUCYDIDES, and XENOPHON; and the sculptors PRAXITELES and PHIDIAS. The PELOPONNESIAN WARS with SPARTA ended in Athens's defeat in 404, but it quickly recovered its independence and prosperity. After 338 BC Athens came under MACEDONIA's hegemony, which was lifted with the aid of Rome in 197 BC in a battle at Cynoscephalae. It became subject to Rome in 146 BC. In the 13th century Athens was taken by the Crusaders. It was conquered in 1456 by the Ottoman Turks, who held it until 1833, when it was declared the capital of independent Greece. Athens is Greece's principal centre for business and foreign trade. The city's ruins and many museums make it a major tourist destination. It was selected to host the 2004 Olympic Games.

atherosclerosis *or* **hardening of the arteries** Chronic disease characterized by abnormal thickening of the walls of the arteries due to fatty deposits (atheromas) of CHOLESTEROL on the arterial inner walls (see ARTERY). These thicken, forming plaques that narrow the vessel channel (lumen) and impede blood flow. Scarring and calcification make the walls less elastic, raising blood pressure. Eventually plaques may completely block a lumen, or a blood clot (thrombus) may obstruct a narrowed channel. Atherosclerosis of one or more coronary arteries (also called CORONARY HEART DISEASE) can decrease the heart muscle's blood supply, causing ANGINA PECTORIS. Complete blockage causes HEART ATTACK. In the brain, atherosclerosis may result in STROKE. Treatments include drugs that reduce the level of cholesterol and fat in the blood, anticoagulants and other drugs that prevent the formation of blood clots, CORONARY BYPASS, and balloon ANGIOPLASTY.

athlete's foot Form of RINGWORM that affects the feet. In the inflammatory type, the infection may lie inactive much of the time, with occasional acute episodes in which blisters develop, mostly between the toes. The dry type is a chronic condition marked by slight redness of the skin and dry scaling that may involve the sole and sides of the foot and the toenails, which become thick and brittle.

athletics See TRACK AND FIELD

Athos \ˈä-ˌthȯs**, Mount** Mountain, northern Greece. Reaching a height of 6,670 ft (2,033 m), it occupies Aktí, a promontory of the Chalcidice Peninsula. It is the site of a semiautonomous republic of 20 monasteries and dependencies (skítes). Organized monastic life began there in 963, when St. ATHANASIUS the Athonite founded the first monastery. By 1400

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there were 40 monasteries. Long regarded as the holy mountain of the Greek Orthodox Church, it was declared a theocratic republic in 1927. Its churches and libraries house a rich collection of Byzantine art and ancient and medieval manuscripts.

Athyr See Hathor

Atitlán \,ä-tē-'tlän**, Lake** Lake, southwestern Guatemala. It lies at an elevation of about 5,100 ft (1,560 m) in the central highlands. Occupying a crater some 1,000 ft (300 m) deep, the lake is 12 mi (19 km) long and 6 mi (10 km) wide. On its borders are three volcanoes: Atitlán, Tolimán, and San Pedro. Many of the towns along the lake, including Atitlán and San Lucas, are popular tourist destinations.

Atkins, Chet *orig.* **Chester Burton Atkins** (b. June 20, 1924, Luttrell, Tenn., U.S.—d. June 30, 2001, Nashville, Tenn.) U.S. guitarist and record company executive. Atkins began his musical career as a fiddler in the early 1940s, but it was his signature style of playing guitar (bass rhythm played with thumb, melody picked with three fingers) that brought him worldwide acclaim. In the early 1950s he began playing electric guitar, pioneering its use in country music. As an RCA Records executive, he produced hit recordings for Elvis Presley, Jim Reeves, and Waylon Jennings.

Atlanta City (pop., 2000: 416,474; metro. area pop.: 4,112,198), capital of Georgia, U.S. Lying in the foothills of the Blue Ridge Mountains, Atlanta is Georgia's largest city. In 1837 a spot was selected there for a railroad terminus that would serve the southeastern U.S. First named Terminus and later Marthasville, it was given the name Atlanta in 1845. An important supply depot during the American Civil War, it was burned by Union forces under William T. Sherman. Atlanta became the state capital in 1868. As it recovered from the war's destruction, it began to epitomize the spirit of the "New South" in seeking reconciliation with the North. It was the home of Martin Luther King, Jr., and the first major Southern city to elect a black mayor (1970). It is the principal trade and transportation centre of the southeastern U.S.

Atlanta Campaign Important series of battles in the American Civil War in Georgia (May–September 1864). Though most of the battles ended in draws, they eventually cut off the main Confederate supply centre, Atlanta. Union troops under William T. Sherman forced the evacuation of the city (August 31–September 1) and then burned it. His victory assured the reelection of Pres. Abraham Lincoln later that year.

Atlanta Compromise Classic statement on race relations by Booker T. Washington, made in a speech at the Atlanta Exposition (1895). He asserted that vocational education, which gave blacks a chance for economic security, was more valuable than social equality or political office. Many African Americans feared that such a limited goal would doom them to indefinite subservience to whites; that fear led to the Niagara Movement and later to the founding of the NAACP.

Atlanta Journal-Constitution Daily morning newspaper published in Atlanta, Ga., based largely on the former *Atlanta Constitution*. Generally regarded as the "voice of the New South," the *Constitution* counted among the great newspapers of the U.S. It became a leader among Southern papers soon after its founding in 1868, and a succession of outstanding editors contributed to its distinction: Henry W. Grady (1850–89), in the late 1870s and 1880s; Clark Howell (1897–1938); and Ralph McGill, who served as both editor (1942–60) and publisher (1960–69). In 1950 it was bought by James M. Cox, who already owned the evening *Atlanta Journal* (founded 1883); for many years a merged paper, the *Atlanta Journal-Constitution*, was published on weekends until the two papers were fully merged in 2001.

Atlantic Charter Joint declaration issued on Aug. 14, 1941, during World War II, by Winston Churchill and Franklin D. Roosevelt. Among the statements made in this propaganda manifesto, signed when the U.S. had not yet entered the war, were that neither the U.S. nor Britain sought aggrandizement and that both advocated the restoration of self-government to peoples forcibly deprived of it. The charter was incorporated by reference in the Declaration of the UN (1942).

Atlantic City City (pop., 2000: 40,517) and resort, southeastern New Jersey, U.S. Lying on narrow Absecon Island, the resort began to be developed in the mid-19th century. Amusement piers were constructed, and the first beachfront boardwalk was built there in 1870. The Miss America Pageant was established in Atlantic City in 1921. After World War II the city began to decline. In 1976 the state approved legalized gambling, and extensive development in Atlantic City provided a huge influx of money to the resort, but much of the surrounding area remained impoverished.

Atlantic Intracoastal Waterway Navigable route, coastal eastern U.S. Authorized by Congress in 1919 to provide sheltered passage for both commercial shipping and pleasure craft, and constructed by the Army Corps of Engineers, it was originally planned to form a continuous channel from New York City to Brownsville, Texas. Because the link through Florida was never completed, it remains in two separate sections (see Gulf Intracoastal Waterway). The Atlantic portion consists of rivers, bays, and canals from Cape Cod to Florida Bay, including the Cape Cod Canal and the Chesapeake and Delaware Canal.

Atlantic languages *formerly* **West Atlantic languages** Branch of the Niger-Congo language family. Atlantic comprises some 45 languages spoken by some 30 million people living mainly in Senegal, The Gambia, Guinea, Guinea-Bissau, Sierra Leone, and Liberia. About half of these people speak Fula, the language of the Fulani. The languages of the Wolof of Senegal and The Gambia and the Temne of northwest Sierra Leone are spoken by more than 1 million people.

Atlantic Monthly, The Monthly journal of literature and opinion, one of the oldest and most respected of U.S. reviews. Published in Boston, it was founded in 1857 by Moses Dresser Phillips. It soon became noted for the quality of its fiction and general articles, contributed by distinguished editors and authors such as James Russell Lowell, Ralph Waldo Emerson, Henry W. Longfellow, and Oliver Wendell Holmes. In the early 1920s it expanded its scope to political affairs, featuring articles by figures such as Theodore Roosevelt, Woodrow Wilson, and Booker T. Washington. In the 1970s increasing costs nearly shut down the magazine; it was purchased in 1980 by Mortimer B. Zuckerman and was sold to the National Journal Group in 1999.

Atlantic Ocean Ocean separating North and South America from Europe and Africa. The second largest of the world's oceans, the Atlantic has an area of 31,830,000 sq mi (82,440,000 sq km). With its marginal seas, including the Baltic, North, Black, and Mediterranean to the east, and Baffin Bay, Hudson Bay, the Gulf of St. Lawrence, Gulf of Mexico, and Caribbean Sea to the west, it covers some 41,100,000 sq mi (106,450,000 sq km). Including these latter bodies of water, its average depth is 10,925 ft (3,330 m); its maximum depth is 27,493 feet (8,380 m) in the Puerto Rico Trench. Its most powerful current is the Gulf Stream.

Atlantic salmon Oceanic trout species (*Salmo salar*), a highly prized game fish. It averages about 12 lbs (5.5 kg) and is marked with round or cross-shaped spots. Found on both sides of the Atlantic Ocean, it enters streams in the fall to spawn. The young enter the sea in about two years and mature in about four. Adults may return to the sea and, after a year or two, spawn again. The ouananiche of rivers and the sebago, or lake, salmon are landlocked subspecies that are also prized for sport. The Atlantic salmon has been successfully introduced into the U.S. Great Lakes.

Atlantic, Battle of the Contest in World War II between Britain (and later the U.S.) and Germany for the control of Atlantic sea routes. Initially the Anglo-French coalition drove German merchant shipping from the Atlantic, but with the fall of France in 1940, Britain was deprived of French naval support. The U.S. then assisted Britain with the lend-lease program. Early in 1942, the Axis began a large-scale submarine offensive against coastal shipping in U.S. waters, and German U-boats also operated in force along the South Atlantic ship lanes to India and the Middle East. Allied shipping losses were severe, but the Allies succeeded in tightening their blockade of Axis Europe and combating the Axis war on shipping. By mid-1943 the Allies had recovered control of the sea routes.

Atlantis Legendary sunken island in the Atlantic Ocean west of Gibraltar. The main sources for the legend are two of Plato's dialogues, *Timaeus* and *Critias*. According to Plato, Atlantis had a rich civilization, and its princes made many conquests in the Mediterranean before earthquakes destroyed the island and it was swallowed up by the sea. Plato also supplied a history of its ideal commonwealth, and Atlantis is sometimes imagined as a utopia. The legend may have originated with the eruption c. 1500 BC of a volcano on Thíra, which was so powerful that it gave rise to earthquakes and tidal waves.

atlas Collection of maps or charts, usually bound together. The name derives from a custom—initiated by Gerardus Mercator in the 16th century—of using the figure of the Titan Atlas, holding the globe on his

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shoulders, as a frontispiece for books of maps. Abraham Ortelius's *Epitome of the Theater of the World* (1570) is generally thought to be the first modern atlas. Atlases often contain pictures, tabular data, facts about areas, and indexes of place-names keyed to coordinates of latitude and longitude or to a locational grid with numbers and letters along the sides of maps.

atlas Male figure used as a column to support an ENTABLATURE, balcony, or other projection, originating in Classical architecture. Such figures are posed as if supporting great weights, like ATLAS bearing the world. The related telamon of Roman architecture, the male counterpart of the CARYATID, is also a weight-bearing figure but does not usually appear in an atlas pose.

Atlas In GREEK MYTHOLOGY, the strong man who supported the weight of the heavens on his shoulders. He was the son of the TITAN Iapetus and the nymph Clymene (or Asia) and the brother of PROMETHEUS. According to HESIOD, Atlas was one of the Titans who waged war against Zeus, and as punishment he was condemned to hold aloft the heavens.

Atlas, Charles *orig.* **Angelo Siciliano** (b. Oct. 30, 1893, Acri, Italy—d. Dec. 24, 1972, Long Beach, N.Y., U.S.) Italian-born U.S. bodybuilder. Atlas immigrated to the U.S. at age 10. In 1929 he and the advertiser Charles P. Roman launched a course involving isotonic exercises and nutritional maintenance. Their mail-order bodybuilding course became legendary through advertisements in three generations of pulp comic books, the standard ad depicting scenes in which a skinny boy loses his girlfriend to a well-built lifeguard (who kicks sand in his face) and regains her after taking the Atlas course.

Atlas Mountains Mountain system, northwestern Africa. It extends some 1,200 mi (2,000 km) from the Moroccan port of Agadir in the southwest to the Tunisian capital of Tunis in the northeast. It comprises several ranges, rising to various elevations, including the High Atlas in Morocco; the Tell, or Maritime, Atlas, which runs along the coast from Morocco to Tunisia; and the Saharan Atlas in Algeria, located farther inland and running adjacent to the SAHARA. Among these ranges are situated numerous plateaus and plains that support diverse ecologies. The system's highest peak is Morocco's Mount Toubkal, elevation 13,665 ft (4,165 m).

Atlas rocket Any of a series of U.S. expendable space launch vehicles. The Atlas was originally designed as a liquid-fueled ICBM and first tested in an operational version in 1959. Early versions launched most of the MERCURY manned missions and, coupled with upper-stage rockets, a number of RANGER, SURVEYOR, MARINER, and PIONEER probes on lunar and planetary missions. Later generations have become workhorses of the U.S. space program and carry a wide variety of scientific, military, and commercial spacecraft.

atman \'ät-mən\ (Sanskrit: "breath" or "self") Basic concept in Hindu philosophy, describing that eternal core of the personality that survives death and transmigrates to a new life or is released from the bonds of existence. Atman became a central philosophical concept in the UPANISHADS. It underlies all aspects of personality, as BRAHMAN underlies the working of the universe. The schools of SAMKHYA, YOGA, and VEDANTA are particularly concerned with atman. See also SOUL.

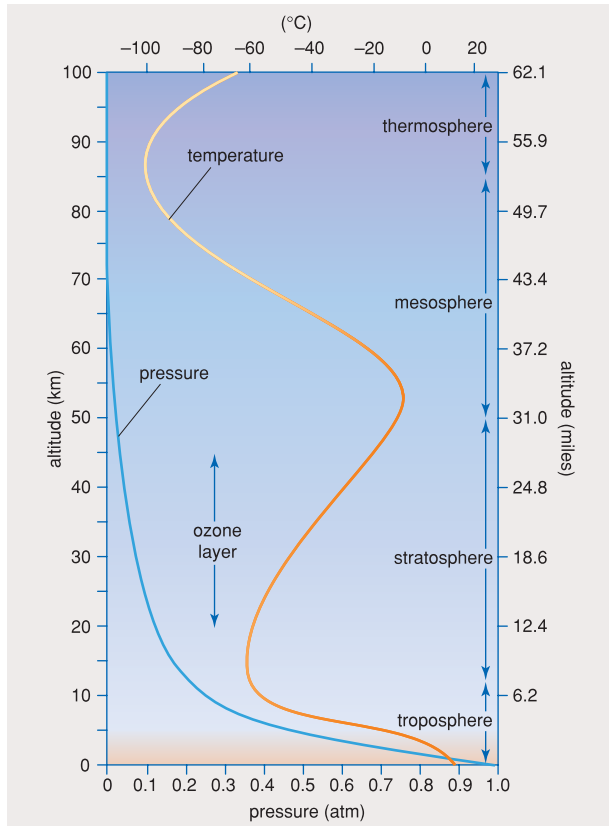
atmosphere Gaseous envelope that surrounds the Earth. Near the surface it has a well-defined chemical composition (see AIR). In addition to gases, the atmosphere contains solid and liquid particles in suspension. Scientists divide the atmosphere into five main layers: in ascending order, the TROPOSPHERE (surface to 6–8 mi, or 10–13 km); the STRATOSPHERE (4–11 mi, or 6–17 km, to about 30 mi, or 50 km); the mesosphere (31–50 mi, or 50–80 km); the thermosphere (50–300 mi, or 80–480 km); and the exosphere (from 300 mi and gradually dissipating). Most of the atmosphere consists of neutral atoms and molecules, but in the IONOSPHERE a significant fraction is electrically charged. The ionosphere begins near the top of the stratosphere but is most distinct in the thermosphere. See also OZONE LAYER. See illustration opposite.

atmospheric pressure *or* **barometric pressure** Force per unit area exerted by the air above the surface of the Earth. Standard sea-level pressure, by definition, equals 1 atmosphere (atm), or 29.92 in. (760 mm) of mercury, 14.70 lbs per square in., or 101.35 kilopascals, but pressure varies with elevation and temperature. It is usually measured with a mercury barometer (hence the term barometric pressure), which indicates the height of a column of mercury that exactly balances the weight of the column of atmosphere above it. It may also be measured using an aneroid barometer, in which the action of atmospheric pressure in bending a metallic surface is made to move a pointer.

atoll \'a-ˌtȯl\ Coral reef enclosing a LAGOON. Atolls consist of ribbons of reef that may not be circular but that are closed shapes, sometimes miles across, around a lagoon that may be 160 ft (50 m) deep or more. Most of the reef itself is usually below the water surface; around the rim along the top are usually low, flat islands or more continuous strips of low, flat land.

atom Smallest unit into which matter can be divided and still retain the characteristic properties of an element. The word derives from the Greek *atomos* ("indivisible"), and the atom was believed to be indivisible until the early 20th century, when ELECTRONS and the NUCLEUS were discovered. It is now known that an atom has a positively charged nucleus that makes up more than 99.9% of the atom's MASS but only about 1/100,000 of its volume. The nucleus is composed of positively charged PROTONS and electrically neutral NEUTRONS, each about 2,000 times as massive as an electron. Most of the atom's volume consists of a cloud of electrons that have very small mass and negative charge. The electron cloud is bound to the nucleus by the attraction of opposite charges. In a neutral atom, the protons in the nucleus are balanced by the electrons. An atom that has gained or lost electrons becomes negatively or positively charged and is called an ION. See illustration on opposite page.

atomic bomb Weapon whose great explosive power results from the sudden release of energy upon the splitting, or fission, of the nuclei of heavy elements such as plutonium or uranium (see NUCLEAR FISSION). With



In Earth's atmosphere, the limits of the atmospheric layers are approximate and variable, especially with latitude. Most weather occurs within the troposphere. The ozone layer, which absorbs most incoming ultraviolet radiation, forms part of the stratosphere. The thermosphere extends hundreds of miles above Earth's surface and is bounded by outer space. Atmospheric pressure drops off steadily with altitude, but temperature rises and falls through successive layers in a more complex manner.

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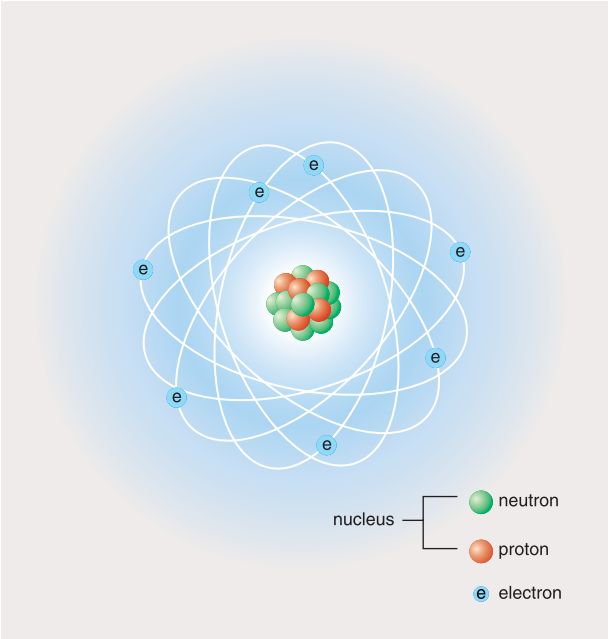

The classical "planetary" model of an atom. The protons and neutrons in the nucleus are circled by electrons in "orbit" around the nucleus. The number of protons determines which element is represented, the number of electrons determines its charge, and the number of neutrons determines which isotope of the element is represented.
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only 11–33 lb (5–15 kg) of highly enriched uranium, a modern atomic bomb could generate a 15-kiloton explosion, creating a huge fireball, a large shock wave, and lethal radioactive FALLOUT. The first atomic bomb, developed by the MANHATTAN PROJECT during World War II, was set off on July 16, 1945, in the New Mexico desert. The only atomic bombs used in war were dropped by the U.S. on HIROSHIMA on Aug. 6, 1945, and on NAGASAKI three days later. In 1949 the Soviet Union tested its first atomic bomb, followed by Britain (1952), France (1960), China (1964), India (1974), and Pakistan (1998). Israel and South Africa were suspected of testing atomic weapons in 1979. See also HYDROGEN BOMB; NUCLEAR NONPROLIFERATION TREATY; NUCLEAR WEAPON.

First atomic bomb test, near Alamogordo, New Mexico, July 16, 1945.
COURTESY OF LOS ALAMOS NATIONAL LABORATORY, NEW MEXICO

atomic number Number of a chemical ELEMENT in the systematic, ordered sequence shown in the PERIODIC TABLE. The elements are arranged in order of increasing number of PROTONS in the NUCLEUS of the ATOM (the same as the number of ELECTRONS in the neutral atom), and that number for each element is its atomic number.

atomic physics Scientific study of the structure of the ATOM, its energy states, and its interaction with other particles and fields. The modern understanding of the atom is that it consists of a heavy NUCLEUS of positive charge surrounded by a cloud of light, negatively charged ELECTRONS. The physical properties of atoms are largely determined by the laws of QUANTUM MECHANICS and QUANTUM ELECTRODYNAMICS. The primary tools for the study of these properties are SPECTROSCOPY, particle collisions (see PARTICLE ACCELERATOR), and statistical models that simulate complex, many-body interactions (such as gas dynamics). A broad field, atomic physics has applications in the study of condensed matter, gases, chemical-reaction mechanisms, atmospheric science, lasers, NUCLEAR PHYSICS, and the arrangement of elements in the periodic table.

atomic weapon See NUCLEAR WEAPON

atomic weight Ratio of the average MASS of a chemical ELEMENT's atoms to 1/12 the mass of an atom of the carbon-12 ISOTOPE. The original standard of atomic weight, established in the 19th century, was hydrogen, with a value of 1. From c. 1900 until 1961, the reference standard was oxygen, with a value of 16, and the unit of atomic mass was defined as 1/16 the mass of an oxygen atom. Oxygen, however, contains small amounts of two isotopes that are heavier than the most abundant one, and 16 is actually a weighted average of the masses of the three isotopes of oxygen. Therefore, the standard was changed to one based on carbon-12. The new scale required only minimal changes to the values that had been used for chemical atomic weights.

atomism Philosophical doctrine that material objects are aggregates of simpler parts known as atoms. Atomism in the strict sense is characterized by three points: the atoms are absolutely indivisible, qualitatively identical apart from shape, size, and motion, and combinable with each other only by juxtaposition. Atomism is usually associated with REALISM and MECHANISM; it is mechanistic because it maintains that all observable changes can be reduced to changes in the configuration of the atoms that constitute matter. It is opposed to HOLISM because it holds that the properties of any whole can be explained in terms of those of its parts.

Aton *or* **Aten** \'ä-tən, 'a-tən\ In ancient Egyptian religion, a sun god, depicted as the solar disk emitting rays terminating in human hands. The pharaoh AKHENATON (r. 1353–36 BC) declared Aton to be the only god, and in opposition to the Amon-Re priesthood of Thebes, built the city of Akhetaton as the center for Aton's worship, but Aton's religion is poorly understood. After Akhenaton's death, the old religion was restored.

King Akhenaton (left) with his wife, Queen Nefertiti, and three of their daughters under the rays of the sun god Aton, altar relief, mid-14th century BC; in the State Museums at Berlin
FOTO MARBURG—ART RESOURCE

atonality \ˌā-tō-'na-lə-tē\ In music, the absence of functional harmony as a primary structural element. Probably originally a pejorative term applied to music of extreme CHROMATICISM, it has become the most widely used descriptive term for 20th-century music whose connection with TONALITY is difficult to hear. ARNOLD SCHOENBERG and his students ALBAN BERG and ANTON WEBERN are regarded as the seminal atonal composers; the SERIALISM of their later work is often distinguished from their earlier "free atonality."

atonement Religious concept in which obstacles to reconciliation with God are removed, usually through sacrifice. Most religions have rituals of purification and expiation by which the relation of the individual to the divine is strengthened. In Christianity, atonement is achieved through the death and resurrection of JESUS. In Roman Catholicism, Eastern Orthodoxy, and some Protestant churches, penance is a sacrament that allows for per-

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sonal atonement (see CONFESSION). In Judaism the annual Day of Atonement, YOM KIPPUR, is the culmination of 10 days centered on repentance.

Atonement, Day of See YOM KIPPUR

ATP *in full* **adenosine triphosphate** \ə-'de-nə-ˌsēn-trī-'fäs-ˌfāt\ Organic compound, substrate in many enzyme-catalyzed reactions (see CATALYSIS) in the CELLS of animals, plants, and microorganisms. ATP's chemical bonds (see BONDING) store a large amount of chemical energy. ATP therefore functions as the carrier of chemical energy from energy-yielding oxidation (see OXIDATION-REDUCTION) of food to energy-demanding cellular processes. Three such processes of METABOLISM are sources of ATP and stored energy: FERMENTATION, the TRICARBOXYLIC ACID CYCLE, and cellular respiration (also called oxidative phosphorylation). All form ATP from adenosine monophosphate (AMP) or adenosine diphosphate (ADP) and inorganic PHOSPHATE. When the reaction goes in the other direction, ATP is broken down to ADP or AMP and phosphate, and the released energy is used to perform chemical, electrical, or osmotic work for the cell.

atresia and stenosis \ə-'trē-zhə...ste-'nō-səs\ Absence (atresia), usually congenital, or narrowing (stenosis) of almost any normal body cavity or passage. The more important include atresia of the anus, esophagus, aortic arch, heart valves, and urinary passages; and stenosis of the intestine, urinary passages, pyloric valve (stomach outlet), and heart valves. Most must be surgically corrected soon after birth.

Atreus \'ā-trē-əs\ In Greek legend, the son of PELOPS. Atreus became king of Mycenae and drove out his brother Thyestes. Plagued by a curse on the house of Pelops, Atreus murdered his own son Pleisthenes and was eventually killed by the nephew he had raised as a son. Two more sons, AGAMEMNON and MENELAUS, fought in the Trojan War.

atrial \'ā-trē-əl\ **fibrillation** Irregular rhythm (arrhythmia) of contraction of the atria (upper heart chambers). The most common major ARRHYTHMIA, it may result as a consequence of increased fibrous tissue in the aging heart, of heart disease, or in association with severe infection. If it continues, it can permit formation of blood clots, which can block blood flow to essential organs. Emergency treatment consists of drugs such as BETA-BLOCKERS or DIGITALIS, which slow the heart's action, and anticoagulants. In addition, atrial fibrillation can be interrupted by administering electric shocks (defibrillation). See also VENTRICULAR FIBRILLATION.

atrium \'ā-trē-əm\ In an ancient Roman house, an open central court that contained the impluvium, a basin where rainwater collected. It originally contained the hearth and functioned as the center of family life. The term later came to be used for the open front courtyard of a Christian BASILICA, where congregants collected before services. The atrium was revived in the 20th century in the form of glass-covered, greenery-filled multistory spaces sometimes found in shopping centers, office buildings, and large hotels.

Atrium of the basilica of S. Ambrogio, Milan, 1088–1128
ALINARI—ART RESOURCE

atrophy \'a-trə-fē\ Decrease from previous normal size of the body or a part, cell, organ, or tissue. An organ or body part's cells may be reduced in number, size or both. Atrophy of some cells and organs is normal at certain points in the life cycle. Other causes include malnutrition, disease, disuse, injury, and hormone over- or underproduction.

atropine \'a-trə-ˌpēn\ Anticholinergic drug. A poisonous, crystalline alkaloid derived from certain NIGHTSHADE plants, especially Egyptian henbane, atropine is used chiefly to dry up bodily secretions, to dilate the bronchi, to prevent excessive cardiac slowing during anesthesia, and in ophthalmology to dilate the pupil of the eye. It works by suppressing the parasympathetic NERVOUS SYSTEM. Atropine is also used as an ANTIDOTE for nerve gas poisoning.

Atsumi Kiyoshi (b. March 10, 1928, Tokyo, Japan—d. Aug. 4, 1996, Tokyo) Japanese comic actor. Atsumi grew up in an impoverished section of Tokyo and took odd jobs in the theatre before first portraying the role of Tora-san for a television film in 1968. He went on to play the character until 1996 in the 48-film series *Otoko wa tsurai yo* ("It's Tough Being a Man"), the longest-running series in which the same actor portrayed the central character. Tora-san, a middle-aged peddler, is a charmingly irresponsible rogue who sells trinkets to passersby and unsuccessfully courts pretty women. Atsumi infused the role with witty wordplay and a folksy sincerity.

attainder In English law, the extinction of civil and political rights after a sentence of death or outlawry, usually after a conviction of TREASON. A legislative act attainting a person without trial was known as a bill of attainder. The most important consequences of attainder were forfeiture of property and "corruption of blood," meaning that the attainted person was disqualified from inheriting or transmitting property, thus disinheriting his descendants. All forms of attainder except forfeiture following indictment for treason were abolished in the 19th century. As a result of the English experience, the U.S. Constitution provided that "no Attainder of Treason shall work Corruption of Blood, or Forfeiture except during the Life of the Person attainted." The U.S. Supreme Court has also struck down as bills of attainder such things as the test oaths passed after the Civil War to disqualify Confederate sympathizers from certain professions.

Attalus I Soter \'at-ə-ləs...'sōt-ər\ (b. 269—d. 197 BC) Ruler of PERGAMUM (241–197). He crushed an attack by the Galatians (c. 230) and won most of Anatolia (228) through victory over the SELEUCID king, though by 222 the Seleucids had won most of it back. With Rome Attalus fought the First and Second MACEDONIAN WARS, but he died shortly before PHILIP V's defeat. He was celebrated as a patron of the arts.

Attenborough, Sir David (Frederick) (b. May 8, 1926, London, Eng.) British television writer. For the BBC, which he joined in 1952, he originated the series *Zoo Quest* (1954–64). As controller of BBC-2 (1965–68) and director of programs (1968–72), he helped produce *The Forsyte Saga*, *The Ascent of Man*, and *Civilisation*. As an independent producer, he made innovative educational programs such as *Life on Earth* (1979) and *The Living Planet* (1984). He was knighted in 1985.

attention In PSYCHOLOGY, the act or state of applying the mind to an object of sense or thought. WILHELM WUNDT was perhaps the first psychologist to study attention, distinguishing between broad and restricted fields of awareness. He was followed by WILLIAM JAMES, who emphasized active selection of stimuli, and IVAN PAVLOV, who noted the role attention plays in activating conditioned reflexes. JOHN B. WATSON sought to define attention not as an "inner" process but rather as a behavioral response to specific stimuli. Psychologists today consider attention against a background of "orienting reflexes" or "preattentive processes," whose physical correlates include changes in the voltage potential of the CEREBRAL CORTEX and in the electrical activity of the skin, increased cerebral blood flow, pupil dilation, and muscular tightening. See also ATTENTION DEFICIT DISORDER.

attention deficit (hyperactivity) disorder (ADD or ADHD) *formerly* **hyperactivity** Behavioral syndrome in children, whose major symptoms are inattention and distractibility, restlessness, inability to sit still, and difficulty concentrating on one thing for any period of time. It occurs in about 5% of all schoolchildren, and it is three times more common in boys than in girls. It can adversely affect learning, though many children with ADD can learn to control their behaviour sufficiently to perform satisfactorily in school. It appears to be caused by a combination of genetic and environmental factors. Certain aspects of the syndrome may persist into ADULTHOOD. Treatment usually entails counseling and close parental supervision, and it may also include prescription medication.

atthakatha \ˌä-tə-'kä-tə\ Commentaries on the Pali Buddhist canon from ancient India and Ceylon. Pali commentaries had reached Ceylon by the 3rd century BC and been translated into Sinhalese by the 1st century AD. The scholar Buddhaghosa (5th century) reworked in Pali much of the early material plus Dravidian commentaries and Sinhalese traditions. The earlier atthakatha have disappeared, but the works of Buddhaghosa and his successors provide information on the development of life and thought in the THERAVADA Buddhist community and contain much secular and legendary material as well.

attic Floor of a dwelling contained within the eaves of the roof structure. The word originally denoted any portion of a wall above the main cornice (see ENTABLATURE). Used by the ancient Romans principally for decorative purposes and inscriptions, as in TRIUMPHAL ARCHES, it became an important part of the Renaissance facade, often enclosing an additional story. See photograph on opposite page.

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Inscribed attic surmounting the main cornice of the Arch of Titus, Rome, AD 81
A.F. KERSTING

Attica *Greek* **Attiki** \ˌä-tē-'kē\ Ancient district, eastern central Greece. It was bordered by the AEGEAN SEA on the south and east and included the island of Salamis; its chief cities were ATHENS, PIRAEUS, and ELEUSIS. Its coastal settlements were enriched by maritime trade. Originally inhabited by Pelasgians, it was a center of MYCENAEAN culture in the 2nd millennium BC; the IONIAN Greeks invaded it c. 1300 BC. The territory was unified under Athens by 700 BC, traditionally through the efforts of King THESEUS.

Attila \'a-tᵊl-ə, ə-'ti-lə\ (d. 453) King of the HUNS (434–53, ruling jointly with his elder brother until c. 445). He was one of the greatest of the barbarian rulers who assailed the ROMAN EMPIRE. He and his brother Bleda inherited an empire that stretched from the Alps and the Baltic nearly to the Caspian Sea. The failure of the Romans to pay promised tributes prompted Attila to launch assaults along the Danube in 441 and 443. He murdered his brother in 445 and two years later invaded the Balkan provinces and Greece, a campaign later ended by another peace treaty that exacted heavy damages from the Eastern Romans. He invaded Gaul (451) but was defeated by an alliance of the Roman general Aetius and the Visigoths. His invasion of Italy (452) was ended by famine and plague. His depredations, which seemed to some like divine punishment, earned him the epithet Flagellum Dei ("Scourge of God"). Attila died on his wedding night, possibly murdered by his bride. His sons took control of his empire, which collapsed shortly after Attila's death.

Attis Mythical consort of the GREAT MOTHER OF THE GODS and vegetation god worshiped in Phrygia and Asia Minor. His worship later spread to the Roman empire, where he became a solar deity in the 2nd century AD. The worship of Attis and the Great Mother included the celebration of mysteries at the beginning of spring.

attitude In PSYCHOLOGY, a mental position with regard to a fact or state. Attitudes reflect a tendency to classify objects and events and to react to them with some consistency. Attitudes are not directly observable but rather are inferred from the objective, evaluative responses a person makes. Thus, investigators depend heavily on behavioral indicators of attitudes—what people say, how they respond to questionnaires, or such physiological signs as changes in heart rate. Attitude research is employed by social psychologists, advertising professionals, and political scientists, among others. Public-opinion researchers often attempt to distinguish attitudes from related concepts such as values, opinions, and knowledge.

Attlee, Clement (Richard), 1st Earl Attlee of Walthamstow (b. Jan. 3, 1883, Putney, London, Eng.—d. Oct. 8, 1967, Westminster, London) British Labour Party leader (1935–55) and prime minister (1945–51). Committed to social reform, he lived for much of the years (1907–22) in a settlement house in London's impoverished East End. Elected to Parliament in 1922, he served in several Labour governments and in the wartime coalition government of WINSTON CHURCHILL, whom he succeeded as prime minister in 1945. Attlee presided over the establishment of the WELFARE STATE in Britain, the nationalization of major British industries, and the granting of independence to India, an important step in the conversion of the BRITISH EMPIRE into the COMMONWEALTH of Nations. He resigned when the Conservatives narrowly won the election in 1951.

Clement Attlee, photograph by Yousuf Karsh.
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attorney See LAWYER

attorney, power of Authorization to act as agent or attorney for another. Many of the general powers of attorney important in civil-law countries come under the powers of TRUST in common-law countries (see CIVIL LAW, COMMON LAW). Durable power of attorney becomes effective when the principal becomes unable to manage his or her affairs; general power of attorney authorizes the agent to carry on business for the principal; special power of attorney authorizes the agent to carry out a particular business transaction.

attorney general Chief law-enforcement officer of a state and legal adviser to the chief executive. The office dates to the Middle Ages but did not assume its modern form until the 16th century. In the U.S., the position dates to the Judiciary Act of 1789. Head of the Department of Justice and a member of the CABINET, the attorney general oversees all the government's law business and acts as the president's legal adviser. Every U.S. state also has an attorney general.

Attucks \'at-əks**, Crispus** (b. 1723?—d. March 5, 1770, Boston, Mass.) American patriot and martyr of the BOSTON MASSACRE. His early life is unclear, but he was probably a runaway slave of African and Natick Indian ancestry, and he may have served on whaling ships. He is the only one of the massacre's five victims who is widely remembered. In 1888 the Crispus Attucks monument was unveiled in the Boston Common.

Atwood, Margaret (Eleanor) (b. Nov. 18, 1939, Ottawa, Ont., Can.) Canadian poet, novelist, and critic. Atwood attended the University of Toronto and Harvard University. In the poetry collection *The Circle Game* (1964; Governor General's Award), she celebrates the natural world and condemns materialism. Her novels, several of which have become best-sellers, include *Lady Oracle* (1976), *Bodily Harm* (1981), *The Handmaid's Tale* (1985; Governor General's Award), *The Robber Bride* (1993), *Alias Grace* (1996), and *The Blind Assassin* (2000). She is noted for her feminism and Canadian nationalism.

Aubusson \ˌō-bə-'sōⁿ\ **carpet** Floor covering produced at the village of Aubusson in central France. A centre for the production of tapestries and furniture coverings since the 16th century, Aubusson was granted the title of Royal Manufactory in 1665. In 1743 workshops were established to manufacture pile carpets for the nobility, and soon thereafter carpets were being produced in the flat-woven tapestry technique in floral and chinoiserie patterns. In the 19th–20th centuries the name Aubusson became synonymous with a flat-woven French carpet.

Auckland City (pop., 2001: 377,382; metro. area pop.: 1,158,891), North Island, New Zealand. Located on WAITEMATA and Manukau harbours, it is the country's principal port and largest city. Founded in 1840 as New Zealand's capital and named for George Eden, earl of Auckland, it remained the capital until superseded by WELLINGTON in 1865. It is a major manufacturing and shipping centre. A bridge links it with the growing northern shore suburbs and with Devonport, New Zealand's chief naval base.

auction Buying and selling of property through open public bidding. Typically, potential purchasers make a succession of increasing bids or offers until the highest (and final) bid is accepted by the auctioneer. At a so-called Dutch auction, by contrast, the seller offers property at successively lower prices until one of his offers is accepted or until the price drops so low as to force the withdrawal of the offered property. Prospective buyers are usually allowed to examine auction items beforehand, and sellers may set a minimum price below which the property will not be sold. Auctions are important in the agricultural markets of many countries, permitting the rapid sale of perishable goods. Other items often sold at auction include artwork and antiques, secondhand goods, and farms and buildings repossessed by banks or the government. Auctions can be structured in many ways (e.g., bids submitted in person, via telephone, or over the Internet). Auction selling is also employed on stock and commodity exchanges.

Auden, W(ystan) H(ugh) (b. Feb. 21, 1907, York, Yorkshire, Eng.—d. Sept. 29, 1973, Vienna, Austria) British-born U.S. poet and man of letters. He attended Oxford University, where he exerted a strong influence on C. DAY-LEWIS, LOUIS MACNEICE, and STEPHEN SPENDER. Auden's varied works throughout his life dealt with intellectual and moral issues of public concern as well as with the inner world of fantasy and dream. In the 1930s he became a hero of the left, pointing up the evils of capitalism while also warning against those of totalitarianism. He collaborated with CHRISTOPHER ISHERWOOD on three verse dramas. Auden's later writing

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reflects changes in his life (he became a U.S. citizen) and in his religious and intellectual perspective (he embraced Christianity and became disillusioned with the left) and occasionally his homosexuality. His poetic works include *The Age of Anxiety* (1947, Pulitzer Prize) and the collections *Another Time* (1940) and *Homage to Clio* (1960). With his longtime companion Chester Kallman, he wrote opera librettos, notably *The Rake's Progress* (1951) for Igor Stravinsky.

Auden, 1965.
HORST TAPPE

audio card See SOUND CARD

Audion Elementary radio tube developed by Lee De Forest (patented 1907). It was the first triode VACUUM TUBE, incorporating a control grid as well as a cathode and an anode. It was capable of more sensitive reception of wireless signals than were the electrolytic and Carborundum detectors then in use. The Audion made possible live radio broadcasting and became the key component of all radio, telephone, radar, television, and computer systems before the invention of the TRANSISTOR.

audit Examination of the records and reports of an enterprise by accounting specialists other than those responsible for their preparation. Public auditing by independent accountants is common in large firms. The auditor performs tests to determine whether the firm's statements were prepared in accordance with acceptable accounting principles and that they fairly present its financial position and operating results. Personal tax audits are carried out to determine whether people have accurately reported their financial circumstances when filing their taxes. Failing such an audit may result in a fine, or, in cases of extensive and deliberate deception, criminal prosecution. See also Internal Revenue Service.

auditorium Portion of a theater or hall where an audience sits, as distinct from the stage. The auditorium originated in the theaters of ancient Greece, as a semicircular seating area cut into a hillside. Floor levels in a large auditorium may include stalls, private boxes, dress circle, balcony or upper circle, and GALLERY. A sloping floor and converging walls allow for a clear view of the stage and improve acoustics. The walls and ceilings of contemporary auditoriums usually conceal light, sound, and air-conditioning equipment.

Audubon, John James *orig.* **Fougère Rabin** *or* **Jean Rabin** *later* **Jean-Jacques Fougère Audubon** (b. April 26, 1785, Les Cayes, Saint-Domingue, West Indies —d. Jan. 27, 1851, New York, N.Y., U.S.) U.S. ornithologist, artist, and naturalist known for his drawings and paintings of North American birds. Born to a French merchant in Haiti, he returned with his father to France, where he briefly studied painting with Jacques-Louis David before moving to the U.S. at age 18. From his father's Pennsylvania estate, he made the first American bird-banding experiments. After failing in business ventures, he concentrated on drawing and studying birds, which took him from Florida to Labrador. His extraordinary four-volume *Birds of America* was published in London in 1827–38. He simultaneously published the extensive accompanying text *Ornithological Biography* (5 vol., 1831–39). His multivolume *Viviparous Quadrupeds of North America* (1842–54) was completed by his sons. Though his bird poses are sometimes unrealistic (the result of painting dead birds wired into position) and some details are inaccurate, few argue with the excellence of his illustrations as art, and his studies were fundamental to New World ornithology.

Audubon Society, National U.S. organization dedicated to conserving and restoring natural ecosystems. Founded in 1905 and named for John James Audubon, the society has 600,000 members and maintains more than 100 wildlife sanctuaries and nature centres throughout the U.S. Its high-priority campaigns include preserving wetlands and endangered forests, protecting corridors for migratory birds, and conserving marine wildlife. Its 300-member staff includes scientists, educators, sanctuary managers, and government-affairs specialists.

Auerstedt, Battle of See Battles of Jena and Auerstedt

auger Tool (or bit) used with a carpenter's brace for drilling holes, usually in wood. It looks like a corkscrew and produces extremely clean holes, almost regardless of how large the bit is. Expansive auger bits have adjustable blades with cutting edges and spurs that can be extended radially to cut large holes. Large augers are used to bore holes in soil for fence posts and telephone poles, or in ice for ice fishing. Horizontal augers as much as 8 ft (2.5 m) in diameter are used in coal mining.

augite \'ȯ-jīt\ Most common PYROXENE mineral, occurring chiefly as blocky crystals in basalts, gabbros, andesites, and various other dark igneous rocks. It also is a common constituent of lunar basalts and meteorites and may be found in certain metamorphic rocks, such as pyroxenites. Because the diopside-hedenbergite series and augite are nearly indistinguishable, the term augite is sometimes used to designate any dark green to black pyroxene with monoclinic symmetry (three unequal crystallographic axes with one oblique intersection).

Augsburg \'aůks-ˌbůrk\ City (pop., 2002 est.: 257,800), Bavaria, southern Germany. Founded as a Roman colony by Augustus c. 14 BC, it was the seat of a bishopric by AD 739. It became an imperial free city in 1276 and joined the Swabian League in 1331. The Fugger and Welser families made the city a major banking and commercial centre in the 15th–16th centuries. The Augsburg Confession was read at the Diet of 1530; the Peace of Augsburg was concluded in 1555; and the League of Augsburg was formed in 1686. The city became part of Bavaria in 1806. It was heavily bombed during World War II. Sites of interest include the Fuggerei (1519), the world's oldest housing settlement for the poor.

Augsburg \'ȯgz-bərg**, League of** Coalition formed in 1686 by Emperor Leopold I, the kings of Sweden and Spain, and the electors of Bavaria, Saxony, and the Palatinate. The league was formed to oppose the expansionist plans of Louis XIV of France prior to the War of the Grand Alliance. It proved ineffective because of the reluctance of some princes to oppose France and the absence of provisions for combined military action.

Augsburg, Peace of Convention promulgated in 1555 by the Diet of the Holy Roman Empire, which provided the first permanent legal basis for the existence of Lutheranism in addition to Catholicism in Germany. The Diet determined that no member of the empire would make war against another on religious grounds. It recognized just two denominations, the Roman Catholics and the Lutherans, and it stipulated that in each territory of the empire, only one denomination was allowed. However, people were allowed to move to states where their faith was adopted. Despite numerous shortcomings, the accord saved the empire from serious internal conflicts for over 50 years. See also Reformation.

Augsburg \'aůks-ˌbůrk\ **Confession** Basic doctrinal statement of Lutheranism. Its principal author was Philipp Melanchthon, and it was presented to Emperor Charles V at the Diet of Augsburg on June 25, 1530. Its purpose was to defend the Lutherans against misrepresentations of their teachings and to provide a statement of theology that Roman Catholics might accept. It consisted of 28 articles that outlined Lutheran doctrine and listed abuses that had crept into Western Christendom over the centuries. The unaltered document has remained authoritative for Lutherans, and a heavily revised version by Melanchthon is accepted by some Reformed churches. Translated into English in 1536, it had a major influence on the Anglican Church's Thirty-nine Articles and the Methodists' Twenty-five Articles of Religion.

Augusta City (pop., 2000: 18,560), capital of Maine, U.S. It was established in 1628 by traders from Plymouth colony as a post at the head of navigation on the Kennebec River. Fort Western was built there in 1754 (restored 1922), attracting settlers. Incorporated in 1797, the town was renamed the next year for the daughter of an American Revolutionary general. It became the state capital in 1832. It is one of Maine's leading vacation centres.

Augustan Age (c. 43 BC–AD 18) Illustrious period in Latin literary history. Along with the preceding period, which was dominated by Cicero, it forms the Golden Age of Latin literature. Marked by civil peace and prosperity, the age reached its highest expression in poetry, with polished, sophisticated verse on themes of patriotism, love, and nature, generally addressed to a patron or to the emperor Augustus. Writers active in the period include Virgil, Horace, Livy, and Ovid. The term is also applied to "classical" periods in the literature of other nations, especially to late 17th- and 18th-century England.

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Augustine (of Hippo), Saint (b. Nov. 13, 354, Tagaste, Numidia—d. Aug. 28, 430, Hippo Regius; feast day August 28) Christian theologian and one of the Latin Fathers of the Church. Born in Roman North Africa, he adopted MANICHAEISM, taught rhetoric in Carthage, and fathered a son. After moving to Milan he converted to Christianity under the influence of St. AMBROSE, who baptized him in 387. He returned to Africa to pursue a contemplative life, and in 396 he became bishop of Hippo (now Annaba, Alg.), a post he held until his death while the city was under siege by a Vandal army. His best-known works include the *Confessions*, an autobiographical meditation on God's grace, and *The City of God*, on the nature of human society and the place of Christianity in history. His theological works *On Christian Doctrine* and *On the Trinity* are also widely read. His sermons and letters show the influence of Neoplatonism and carry on debates with the proponents of Manichaeism, DONATISM, and PELAGIANISM. His views on predestination influenced later theologians, notably JOHN CALVIN. He was declared a Doctor of the Church in the early Middle Ages.

Augustine \ȯ-'gəs-tən\ **of Canterbury, Saint** (b. Rome?—d. May 26, 604/605, Canterbury, Kent, Eng.; feast day May 26 in England and Wales, May 28 elsewhere) First archbishop of Canterbury. A Benedictine prior in Rome, he was chosen by Pope GREGORY I to lead 40 monks as missionaries to England. They arrived in 597 and were welcomed by King ETHELBERT of Kent, at the behest of his queen, and he gave them a church in Canterbury. Augustine converted the king and thousands of his subjects and was made bishop of the English. On the pope's instructions he purified pagan temples and consecrated 12 other bishops. He founded Christ Church, Canterbury, as his cathedral and made Canterbury the primary see in England. He tried unsuccessfully to unify his churches with the Celtic churches of northern Wales.

Augustinian In the Roman Catholic church, a member of any of the religious orders and congregations whose constitutions are based on the Rule of St. AUGUSTINE, including the Hospitallers (KNIGHTS OF MALTA) and the DOMINICANS. The two main branches of the Augustinians, however, are the Augustinian Hermits and the Augustinian Canons. The former was one of the four great mendicant orders of the Middle Ages, and its members (including MARTIN LUTHER) were active in European university life and ecclesiastical affairs. The latter became in the 11th century the first Roman Catholic order to combine clerical status with full common life. The order declined after the REFORMATION, but it continues missionary, educational, and hospital work. Other notable orders are the Augustinian Recollects (founded in the 16th century) and the Second Order of St. Augustine (1264) for nuns, both still active today.

Augustus, Caesar *or* **Octavian** *orig.* **Gaius Octavius** *later* **Gaius Julius Caesar Octavianus** (b. Sept. 23, 63 BC—d. Aug. 19, AD 14, Nola, near Naples) First Roman emperor. Born to a wealthy family, at age 18 he was named adoptive son and heir of his great-uncle Julius CAESAR. After Caesar's assassination (44 BC) a power struggle ensued, and several battles later Octavian formed the Second TRIUMVIRATE with his chief rivals, LEPIDUS and Mark ANTONY. Octavian disposed of Lepidus in 32 and Antony (then allied with CLEOPATRA) at the Battle of ACTIUM in 31 to become sole ruler. He was anointed PRINCEPS; the Roman Empire is said to begin with his accession. At first he ruled as CONSUL, maintaining republican administration, but in 27 he accepted the title Augustus and in 23 he received imperial power. His rule (31 BC–AD 14) brought changes to every aspect of Roman life and lasting peace and prosperity to the Greco-Roman world. He secured outlying imperial provinces, built roads and public works, established the PAX ROMANA, and fostered the arts. He took steps to rectify Roman morality, even exiling his daughter JULIA for adultery. When he died, the empire stretched from Iberia to Cappadocia and from Gaul to Egypt. He was deified after his death.

Augustus II *Polish* **August Fryderyk** (b. May 12, 1670, Dresden, Saxony—d. Feb. 1, 1733, Warsaw) King of Poland and elector of Saxony (as Frederick Augustus I). He ascended to the Polish throne in 1697, having converted to Catholicism to better his chances. Also called Augustus the Strong, he invaded Livonia in 1700, beginning the Second NORTHERN WAR. Charles XII of Sweden defeated Augustus's army and forced him to abdicate in 1706, but he was restored as king in 1710. Poland declined during Augustus's reign from a major European power to a protectorate of Russia.

Augustus III *Polish* **August Fryderyk** (b. Oct. 17, 1696, Dresden, Saxony—d. Oct. 5, 1763, Dresden) King of Poland and elector of Saxony (as Frederick Augustus II), whose reign (1733–63) marked a great period of disorder within Poland. He cared more for pleasure than affairs of state and left the administration of Saxony and Poland to his chief adviser, Heinrich von Brühl (1700–1763), and the powerful CZARTORYSKI FAMILY. He gave Saxon support to Austria in the War of the AUSTRIAN SUCCESSION and the SEVEN YEARS' WAR.

auk In general, any of 22 species of diving birds (family Alcidae), especially the little auk and the razorbill, or razor-billed auk. Auks are 6–16 in. (15–40 cm) long, with short wings and legs and webbed feet. They occur only in Arctic, subarctic, and temperate regions (with a few species south to Baja California). Auks nest colonially on cliff ledges or in rock crevices or burrows near the sea; many spend the winter far from land. They feed on fish, crustaceans, mollusks, and plankton. True auks are black and white and stand erect on land. See also GREAT AUK.

aulos \'ȯ-lōs\ Single- or double-reed pipe usually played in pairs, particularly in ancient Greece. During the Classical period the pipes were of equal length, each with three or four finger holes. The principal wind instrument of most ancient Middle Eastern peoples, it existed in Europe up to the early Middle Ages, often as a single pipe with more finger holes. Its quavering sound, described by PLATO, was classically associated with the rites of DIONYSUS.

Auloi player with *phorbeia* and dancer with *krotala*, detail from a *kylix* found at Vulci, Italy, signed by Epictetus, c. 520–510 BC; in the British Museum, London.

COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM, LONDON

AUM Shinrikyo \'aům-shin-'rik-yō\ *Japanese* **"AUM Supreme Truth"** Japanese new religious movement founded by Asahara Shoko (b. 1955 as Matsumoto Chizuo) in 1987. It contained elements of Hinduism and Buddhism and was founded on the millenarian expectation of a series of disasters that would bring an end to this world and inaugurate a new cosmic cycle. In 1995 its members released nerve gas into the Tokyo subway system, killing 12 people and injuring some 5,500. The group has been linked with other nerve-gas incidents and violent crimes. It claimed some 50,000 members, mostly in Russia, at the time of the gas attack. Membership collapsed in the wake of the attack, but it had grown to more than 1,500 members by the early 21st century. The group changed its name to Aleph in 2000. More than 10 AUM members were sentenced to death for their involvement in the gassing incident, including Asahara, who in 2004 was found guilty of masterminding the attack.

Aung San \'ȯŋ-'san\ (b. 1914?, Natmauk, Burma—d. July 19, 1947, Rangoon) Nationalist leader of Burma (Myanmar). He led a student strike in 1936 and became secretary-general of a nationalist group in 1939. He accepted Japanese aid in raising a military force in Burma that helped the Japanese in their 1942 invasion. However, he came to doubt that the Japanese would ever allow Burma to become independent and grew displeased with their treatment of Burmese forces, and in 1945 he switched to the Allied cause. After the war, he effectively became prime minister and negotiated Burma's independence, which was agreed on in 1947; he was assassinated before independence was achieved in 1948.

Aung San Suu Kyi \'ȯŋ-'san-'sü-'chē\ (b. June 19, 1945, Rangoon, Burma) Opposition leader in Burma (Myanmar). Daughter of nationalist leader AUNG SAN, she studied in Burma and India and at the University of Oxford. She lived quietly in Britain until, returning to Myanmar in 1988, she was moved by the brutality of U NE WIN's military regime to begin a nonviolent struggle for democracy and human rights. The 1990 electoral victory of her National League for Democracy was ignored by Ne Win's government, and she was held under house arrest from 1989 to 1995. She subsequently continued her opposition activities and was subject to varying degrees of government harrassment, including another period of house arrest in 2000–02. She was awarded the 1991 Nobel Prize for Peace.

Aurangzeb \ˌaů-rəŋ-'zeb\ *orig.* **Muḥī al-Dīn Muḥammad** (b. Nov. 3, 1618, Dhod, Malwa, India—d. March 3, 1707) Last of the great Mughal emperors of India (r. 1658–1707). He was the third son of the emperor SHAH JAHĀN and Mumtāz Maḥal, for whom the TAJ MAHAL was built. After distin-

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guishing himself early in life with his military and administrative ability, he fought his eldest brother for the right of succession and had several other rival relatives (including a son) executed. During the first half of his reign, he proved to be a capable Muslim monarch of a mixed Hindu-Muslim empire; he was disliked for his ruthlessness but respected. From c. 1680 his devout religious side came to dominate; he excluded Hindus from public office and destroyed their temples and schools, became embroiled in fruitless warfare with the Marathas in South India, and executed the Sikh Guru Tegh Bahadur (r. 1664–75), starting a Sikh-Muslim feud that has continued to the present.

Aurangzeb, Mughal miniature, 17th century; in the Metropolitan Museum of Art, New York City

BY COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK, BEQUEST OF GEORGE D. PRATT, 1945

Aurelian \ó-'rā-lē-ən\ *Latin* **Lucius Domitius Aurelianus** (b. c. 215—d. 275, near Byzantium) Roman emperor AD 270–75. Probably from the Balkans, he became emperor after Claudius II's death and the brief reign of Claudius's brother. He reunited the empire and restored Roman power in Europe, turning back invaders and quelling revolts, securing provinces in the east and defeating the Germans to the north, for which he took the title *restitutor orbis* ("restorer of the world"). He built a new wall around Rome and increased food distribution to the poor, but his monetary and religious reforms failed. While marching to Persia, he was slain by a group of officers who mistakenly believed they had been marked for execution.

Aurelius, Marcus See MARCUS AURELIUS

Aurgelmir \'aůr-gəl-ˌmir\ *or* **Ymir** \'i-mir\ In Norse mythology, the first being, a giant created from the drops of water that formed when the ice of Niflheim met the heat of Muspelheim. He was the father of all giants; a male and female grew under his arm and his legs produced a six-headed son, whom the cow Audumla nursed. Audumla licked salty frost from stones, which she shaped into the man Buri, grandfather of ODIN and his brothers. The gods killed Aurgelmir and put his body into the void, where his flesh became the earth, his blood the seas, his bones mountains, his teeth stones, his skull the sky, and his brains the clouds. His eyelashes (or eyebrows) became the fence around MIDGARD, home of mankind.

Aurignacian culture \ˌȯr-ēn-'yā-shən\ STONE-TOOL INDUSTRY and artistic tradition of Upper PALEOLITHIC Europe, named after the village of Aurignac in southern France where the tradition was first identified. The Aurignacian period dates to 35,000–15,000 BC. Its tools included scrapers, burins (which made the engraving possible), and blades. Points and awls were fashioned from bones and antlers. Aurignacian art represents the first complete artistic tradition, moving from simple engravings of animal forms on small rocks to finer pieces of carved bone and ivory to highly stylized clay figurines of pregnant women (the so-called "Venus figures," presumably fertility figures). By the end of the Aurignacian, hundreds of engravings, reliefs, and paintings had been executed on the walls and ceilings of limestone caves in western Europe, most famously LASCAUX GROTTO.

Cave painting of a bull and horse; in Lascaux Grotto, near Montignac, France.

HANS HINZ, BASEL

aurochs \'aůr-ˌäks\ *or* **auroch** Extinct wild OX (*Bos primigenius*) of Europe, the species from which CATTLE are probably descended. The aurochs survived in central Poland until 1627. It was black, stood 6 ft (1.8 m) high at the shoulder, and had spreading, forward-curving horns. Some German breeders claim to have re-created this race since 1945, but their animals are smaller and probably lack the aurochs's genetic constitution. The name has sometimes been wrongly applied to the European BISON.

Aurora Roman goddess of dawn. Her Greek counterpart was Eos. HESIOD described her as the daughter of the TITANS Hyperion and Theia. She was the sister of HELIOS, the sun, and SELENE, the moon. By the Titan Astraeus, she became the mother of the winds and of the evening star. In Greek mythology she was also represented as the lover of the hunters Cephalus and ORION.

aurora Luminous phenomenon of the upper atmosphere that occurs primarily at high latitudes. Auroras in the Northern Hemisphere are called aurora borealis, or northern lights; in the Southern Hemisphere they are called aurora australis, or southern lights. Auroras are caused by the interaction of energetic particles (electrons and protons) from outside the atmosphere with atoms of the upper atmosphere. Such interaction occurs in zones surrounding the Earth's magnetic poles. During periods of intense solar activity, auroras occasionally extend to the middle latitudes.

Aurora City (pop., 2000: 276,393), north-central Colorado, U.S. It was founded near DENVER as Fletcher during the silver boom of 1891 and renamed in 1907. Though mainly residential, it is also the site of Buckley Air National Guard Base.

Auschwitz \'aůsh-ˌvits\ *or* **Auschwitz-Birkenau** Nazi Germany's largest CONCENTRATION CAMP and extermination camp, located in southern Poland (modern Oświęcim). It consisted of three camps (prison, extermination, and forced labour), established in 1940, 1941 (Birkenau), and 1942. Able-bodied Jewish prisoners were sent to a slave-labour camp, while the aged, the weak, and children and their mothers were killed. Some prisoners were also subjected to medical experiments, conducted by JOSEF MENGELE. The camp was gradually abandoned in 1944–45 as Soviet troops advanced. The total number who died at Auschwitz is estimated at between 1.1 million and 1.5 million, 90% of which were Jews; also among the dead were some 19,000 Roma (Gypsies), who were killed in July 1944, and some 83,000 Poles. Much of the camp was later converted into a museum and memorial. It was designated a UNESCO World Heritage site in 1979. See also HOLOCAUST.

auscultation \ˌȯ-skəl-'tā-shən\ Procedure for detecting certain defects or conditions by listening for normal and abnormal heart, breath, bowel, fetal, and other sounds in the body. The invention of the stethoscope in 1819 improved and expanded this practice, still very useful despite the great technological advances in other means of diagnosis.

Ausgleich See COMPROMISE OF 1867

Austen, Jane (b. Dec. 16, 1775, Steventon, Hampshire, Eng.—d. July 18, 1817, Winchester, Hampshire) English novelist. The daughter of a rector, she lived in the circumscribed world of minor landed gentry and country clergy that she was to use in her writing; her closest companion was her sister, Cassandra. Her earliest known writings are mainly parodies, notably of sentimental fiction. In her six full-length novels—*Sense and Sensibility* (1811), *Pride and Prejudice* (1813), *Mansfield Park* (1814), *Emma* (1815), *Persuasion* (1817), and *Northanger Abbey* (published 1817 but written before the others)—she created the COMEDY OF MANNERS of middle-class English life in her time. Her writing is noted for its wit, realism, shrewd sympathy, and brilliant prose style. Through her treatment of ordinary people in everyday life, she was the first to give the novel its distinctly modern character. She published her novels anonymously; two appeared only after her death, which probably resulted from Addison disease.

Jane Austen, pencil and watercolour by Cassandra Austen, c. 1810; in the National Portrait Gallery, London.

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

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Austerlitz, Battle of (Dec. 2, 1805) First engagement of the War of the Third Coalition and one of NAPOLEON's greatest victories. In the battle, fought near Austerlitz in Moravia (now Slavkov u Brna, Czech Rep.), Napoleon's 68,000 troops defeated almost 90,000 Russians and Austrians under Russia's ALEXANDER I and MIKHAIL KUTUZOV. Also called the Battle of the Three Emperors, Napoleon's resounding victory forced Austria's FRANCIS I to conclude the Treaty of Pressburg, ceding Venetia to the French kingdom in Italy and temporarily ending the anti-French alliance. See also NAPOLEONIC WARS.

Austin City (pop., 2000: 656,600), capital of Texas, U.S. It was founded in 1835 as the village of Waterloo on the COLORADO RIVER in south-central Texas. In 1839 it was made capital of the Republic of Texas and renamed to honour STEPHEN AUSTIN; when Texas became a state in 1845, Austin was its capital. As the home of the University of TEXAS, it has expanded as a research and development centre for defense, high-technology, and consumer industries. The LYNDON B. JOHNSON Library is on the university campus.

Austin, J(ohn) L(angshaw) (b. March 28, 1911, Lancaster, Lancashire, Eng.—d. Feb. 8, 1960, Oxford) British philosopher. He taught at Oxford from 1945 until his death. He was a leading member of the "ordinary language," or "Oxford," movement of analytic philosophy, which was characterized by its belief that philosophical problems frequently arise through inattention to or misunderstandings of ordinary uses of language; accordingly, such problems can be resolved through consideration of the ordinary uses of the terms by which the relevant philosophical concepts are expressed. Ordinary-language analyses by Austin and his followers frequently took the form of asking "what one would say" in various concrete situations. Austin was also the inventor of SPEECH ACT THEORY, through which he attempted to account for the various "performative" aspects of conveyed linguistic meaning. Several of his essays and lectures were published posthumously in *Philosophical Papers* (1961), *Sense and Sensibilia* (1962), and *How to Do Things with Words* (1962). See also ANALYTIC PHILOSOPHY.

Austin, John (b. March 3, 1790, Creeting Mill, Suffolk, Eng.—d. Dec. 1859, Weybridge, Surrey) British jurist. Although initially unsuccessful in his law practice (1818–25), his analytical mind and intellectual honesty impressed colleagues, and he was named the first professor of JURISPRUDENCE at University College, London (1826). Distinguished men attended his lectures, but he failed to attract students, and he resigned his chair in 1832. His writings, especially *The Province of Jurisprudence Determined* (1832), sought to distinguish law from morality. He also helped to define jurisprudence as the analysis of fundamental legal concepts, as distinct from the criticism of legal institutions, which he called the "science of legislation." His work, largely unrecognized in his lifetime, influenced later jurists, including OLIVER WENDELL HOLMES, JR.

Austin, Stephen (Fuller) (b. Nov. 3, 1793, Austinville, Va., U.S.—d. Dec. 27, 1836, Austin, Texas) U.S. founder of the first legal colony of English-speaking people in Texas when it was still part of Mexico. He was raised in the Missouri Territory and served in its legislature (1814–19). The economic panic in 1819 led his father to conceive a plan to colonize Texas on land obtained from the Mexican government. Austin continued the project after his father died (1821) and founded a colony of several hundred families on the Brazos River in 1822. He maintained good relations with the Mexican government. He tried to induce the Mexican government to make Texas a separate state in the Mexican confederation; when this attempt failed, he recommended in 1833 the organization of a state without waiting for the consent of the Mexican congress, and he was imprisoned. Released in 1835, he traveled to the U.S. to secure help when the Texas revolution broke out in October of that year. He is considered one of the state's founders. The city of AUSTIN is named for him.

Austral Islands Group of islands (pop., 2002: 6,386), southern FRENCH POLYNESIA. The southernmost part of French Polynesia (*austral* is Latin for "south"), the islands form a chain about 800 mi (1,300 km) long. They were sighted by Capt. JAMES COOK in 1769 and 1777. They were taken over by the French in the late 19th century. The inhabited islands are Rimatara, Rurutu, Tubuai, Raevavae, and Rapa.

Australia *officially* **Commonwealth of Australia** Smallest continent and sixth largest country (in area) on Earth, lying between the Pacific and Indian oceans. Area: 2,969,978 sq mi (7,692,208 sq km). Population (2005 est.): 20,345,000. Capital: CANBERRA. Most Australians are descendants of Europeans. The largest nonwhite minority is the AUSTRALIAN ABORIGINE population. The Asian portion of the population has grown as a result of relaxed immigration policy. Language: English (official). Religions: Christianity (mostly Protestant; also Roman Catholic, Eastern Orthodox, other Christians), Buddhism, Islam. Currency: Australian dollar. Australia has three major physiographic regions. More than half of its land area is on the Western Australian plateau, which includes the outcrops of Arnhem Land and the Kimberleys in the northwest and the MACDONNELL RANGES in the east. A second region, the Interior Lowlands, lies east of the plateau. The Eastern Uplands, which include the GREAT DIVIDING RANGE, are a series of high ridges, plateaus, and basins. The country's highest point is Mount KOSCIUSKO in the AUSTRALIAN ALPS, and the lowest is Lake EYRE. Major rivers include the MURRAY-DARLING system, the FLINDERS and SWAN rivers, and COOPER CREEK. There are many islands and reefs along the coast, including the GREAT BARRIER REEF, MELVILLE ISLAND, KANGAROO ISLAND, and TASMANIA. Australia is rich in mineral resources, including coal, petroleum, and uranium. A vast diamond deposit was found in WESTERN AUSTRALIA in 1979. The country's economy is basically free enterprise; its largest components include finance, manufacturing, and trade. Formally a constitutional monarchy, its chief of state is the British monarch, represented by the governor-general. In reality it is a parliamentary state with two legislative houses; its head of government is the prime minister. Australia has long been inhabited by Aborigines, who began arriving at least 50,000 years ago. Estimates of the population at the time of European settlement in 1788 range from 300,000 to 1,000,000. Widespread European knowledge of Australia began with 17th-century explorations. The Dutch landed in 1616 and the British in 1688, but the first large-scale expedition was that of JAMES COOK in 1770, which established Britain's claim to Australia. The first British settlement, at Port Jackson (1788), consisted mainly of convicts and seamen; convicts were to make up a large proportion of the incoming settlers. By 1859 the colonial nuclei of all Australia's states had been formed, but with devastating effects on the indigenous peoples, whose populations declined sharply with the introduction of European diseases. Britain granted its colonies limited self-government in the mid-19th century, and an act federating the colonies into a commonwealth went into effect in 1901. Australia fought alongside the British in World War I, notably at GALLIPOLI, and again in World War II, preventing Australia's occupation by the Japanese. It joined the U.S. in the KOREAN and VIETNAM wars. Since the 1960s the government has sought to deal more fairly with the Aborigines, and a loosening of immigration restrictions has led to a more heterogeneous population. Constitutional links allowing British interference in government were formally abolished in 1968, and Australia has assumed a major role in Asian and Pacific affairs. During the 1990s there were several debates about giving up its British ties and becoming a republic. See map on following page.

Australian Aboriginal languages Group of perhaps as many as 500 languages spoken by the 300,000 to 1,000,000 native inhabitants of Australia before the beginning of European conquest in 1788. More than half are now extinct; of the remainder, only about 20, mostly in the North Territory and northern Western Australia, remain in active use by both adults and children. Most Australian languages belong to a single superfamily, Pama-Nyungan, and the remainder, a very diverse group of languages spoken in the Kimberley region of Western Australia and parts of the North Territory, may be remotely akin to Pama-Nyungan.

Australian Aborigine \a-bə-'ri-jə-ˌnē\ Any of the indigenous peoples of Australia. The first Australians are estimated to have reached the continent at least 50,000 years ago. At one time there may have been as many as 500 language-named, territorially anchored groups of indigenous Australians. They subsisted as hunters and gatherers. Groups (bands) were formed along the male line (patrilineal descent) and consisted of two or more families. Their lives were centred around a specific site settled by the group's ancestors. The men were custodians of the mythology, ritual, sites, and symbols evoked in the DREAMING. Australian Aborigines are believed to have numbered 300,000–1,000,000 when European colonization began in the late 18th century, but they were devastated by introduced diseases and by the bloody 19th-century policy of "pacification by force." In the early 21st century they were estimated to number more than 400,000. Most aspects of their traditional culture have been severely modified. All Aboriginal peoples have had some contact with modern Australian society, and all are now Australian citizens. At the turn of the 21st century Aboriginal interest in cultural revival was strong.

Australian Alps Mountain range, southeastern Australia. The mountains form the southern end of the GREAT DIVIDING RANGE and the watershed

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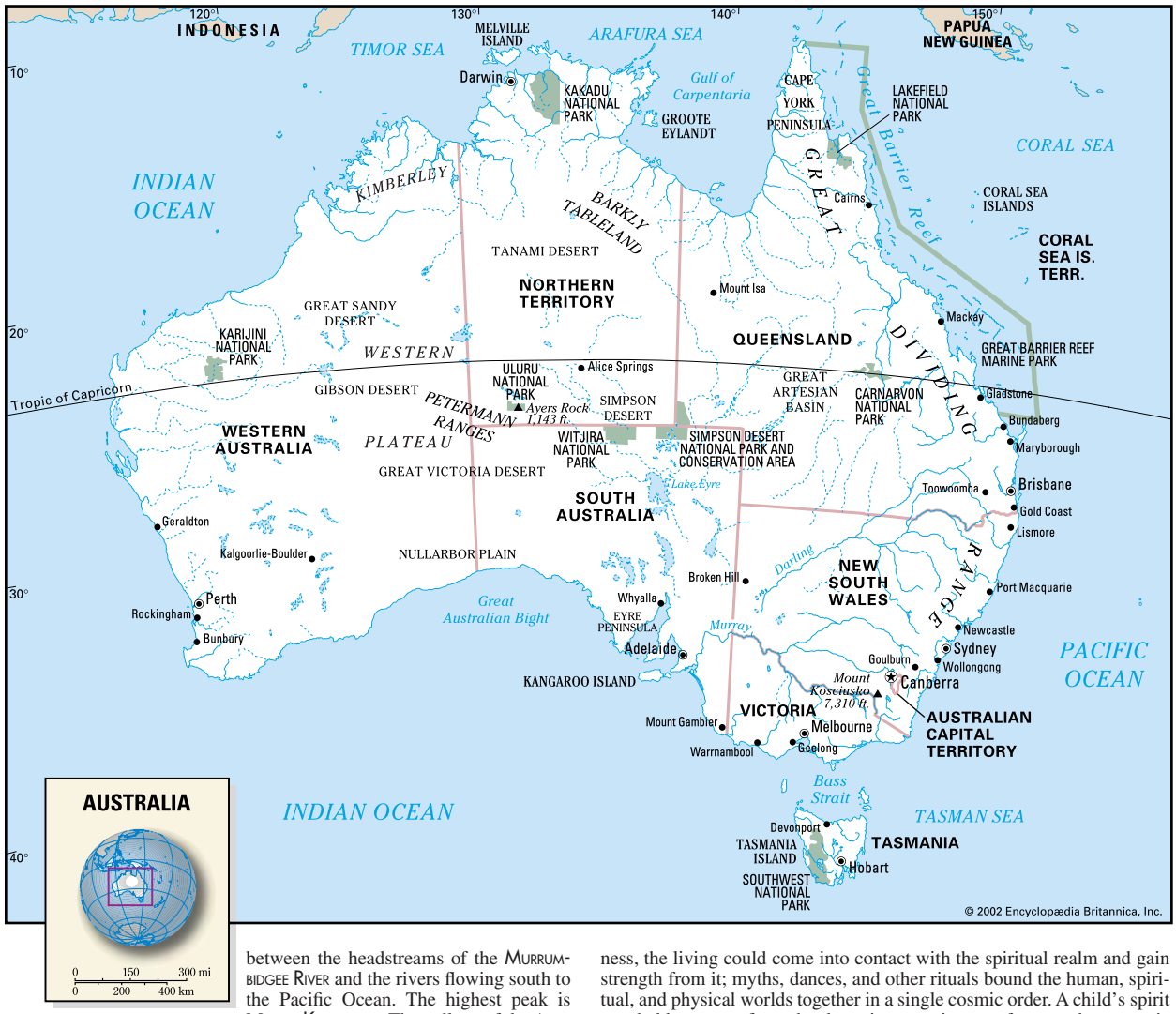

between the headstreams of the Murrumbidgee River and the rivers flowing south to the Pacific Ocean. The highest peak is Mount Kosciusko. The valleys of the Australian Alps have been used for grazing, while the highlands have seen scattered mining ventures.

Australian Ballet Leading ballet company of Australia. It was sponsored in 1962 by art patrons interested in promoting a national ballet. Peggy van Praagh was the first artistic director (1962–74). Since 1965 the company has toured Europe and North America.

Australian Capital Territory Political entity (pop., 2001: 321,680), southeastern Australia. A capital territory was mandated by the 1901 Australian constitution; the site was chosen in 1908. It lies within New South Wales and consists of Canberra and the area around Jervis Bay. Parliament moved there from Melbourne in 1927. In 1989 the Territory received responsibility for self-government similar to that held by Australian states.

Australian National University Public university in Canberra, Australian Capital Territory. Founded in 1946, it originally offered only graduate programs. Undergraduates were first admitted in 1960, and today the university offers a wide range of graduate and undergraduate programs. Affiliated with the university are research schools of medicine, physical and biological sciences, social sciences, and Pacific studies.

Australian religion Religion of Australia's Aborigines, based in the Dreaming. Religion involved living in agreement with the way of life ordained in the Dreaming, through the performance of rituals and obedience to the law. Through dreams and other states of altered consciousness, the living could come into contact with the spiritual realm and gain strength from it; myths, dances, and other rituals bound the human, spiritual, and physical worlds together in a single cosmic order. A child's spirit was held to come from the dreaming to animate a fetus, and a person's spiritual heritage was more important than the bond between a physical parent and child. Sacred art included tjurunga, sand and cave paintings, and paintings on bark.

Australian Rules football Variety of football played between two teams of 18 players. The field is oval, 148–202 yd (135–185 m) long, with four goalposts at each end. A six-point goal is scored when the oval ball is kicked through the two central goalposts. A one-point "behind" is scored when the ball is kicked over the behind line extending between the central and outer goalposts. The game's finest spectacle is the "mark" in which competing players leap, sometimes riding on the back of an opponent, in order to catch the ball directly from the kick of another player. The player making such a catch is awarded a mark, an unhindered kick from behind the spot of the catch. The sport, Australia's foremost, was developed in Melbourne. The Victorian Football League was established in 1896 as the first professional league. It was renamed the Australian Football League in 1990 to reflect the addition of franchises outside of Victoria state.

Australopithecus \ȯ-ˌstrā-lō-'pi-thə-kəs\ *Latin* **"southern ape"** Genus of extinct hominins that may be ancestral to human beings (*Homo sapiens*). The name *Australopithecus* refers to the first fossils, which were discovered in South Africa. *Australopithecus* lived in much of Africa during the Pliocene Epoch (c. 5.3–1.8 million years ago [mya]). These hominins were distinguished from apes by their upright posture and bipedal

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gait, and their teeth were more humanlike than apelike, but their brains were small and not very different from those of living apes. Five species are recognized: *A. anamensis* (4.2–3.9 mya), *A. afarensis* (3.8–2.9 mya), *A. bahrelghazali* (3.5–3.0 mya), *A. africanus* (3–2.4 mya), and *A. garhi* (2.5 mya). Three "robust" species are now instead classified as *Paranthropus* (2.7–1.3 mya): *P. aethiopicus*, *P. robustus*, and *P. boisei*. *Paranthropus* eventually became extinct, leaving no evolutionary successors. See also HADAR REMAINS; HUMAN EVOLUTION; LAETOLI FOOTPRINTS; LUCY; OLDUVAI GORGE; STERKFONTEIN.

Lateral view of an *Australopithecus africanus* skull found at Sterkfontein, S.Af.
COURTESY OF THE TRANSVAAL MUSEUM, PRETORIA, S.AF.

Austrasia \ò-'strā-zhə\ *or* **Ostrasia** \ä-'strā-zhə\ Early medieval European kingdom. During the MEROVINGIAN DYNASTY (6th–8th centuries AD), it was the eastern Frankish kingdom and NEUSTRIA was the western kingdom. Austrasia covered present-day northeastern France and areas of western and central Germany; its capital was at METZ. The region was the power base of the early Carolingian mayors of the palace, one of whom, PIPPIN III, deposed the last Merovingian king in 751 and founded the CAROLINGIAN DYNASTY. The dynasty's heartland, Austrasia, was an important region in the empire established by CHARLEMAGNE.

Austria *officially* **Republic of Austria** Country, south-central Europe. Area: 32,383 sq mi (83,871 sq km). Population (2005 est.): 8,168,000. Capital: VIENNA. The population is predominantly Austrian.

Language: German (official). Religions: Christianity (predominantly Roman Catholic; also Protestant); also Islam. Currency: euro. Much of Austria is covered by Alpine regions, including the eastern Alps, where the country's highest point, the GROSSGLOCKNER, is found. The Bohemian Forest, a highland region, extends north into the Czech Republic. The lowland region, including the Vienna Basin, lies in the east; it supports mainly agricultural activities. The DANUBE RIVER and its tributaries drain nearly the entire country. Austria has a developed mixed free-market and government-operated economy based on manufacture and commerce; tourism is also important. Austria is a republic with two legislative houses. The chief of state is the president, and the head of government is the chancellor. Austria's greatest cultural contribution has been in music (see JOSEPH HAYDN; WOLFGANG AMADEUS MOZART; FRANZ SCHUBERT; ALBAN BERG; ANTON WEBERN). Major cultural figures in other fields include OSKAR KOKOSCHKA in art, SIGMUND FREUD in psychoanalysis, and LUDWIG WITTGENSTEIN in philosophy. Settlement in Austria goes back some 3,000 years, when Illyrians were probably the main inhabitants. The CELTS invaded c. 400 BC and established the kingdom of NORICUM. The Romans arrived after 200 BC and established the provinces of RAETIA, Noricum, and PANNONIA; prosperity followed, and the population became Romanized. With the fall of Rome in the 5th century AD, many tribes invaded, including the SLAVS; they were eventually subdued by CHARLEMAGNE, and the area became ethnically Germanic. The distinct political entity that would become Austria emerged in 976 with Leopold I of Babenberg as margrave. In 1278 Rudolf IV of HABSBURG (later RUDOLF I as the king of Germany) conquered the area; Habsburg rule lasted until 1918. While in power, the Habsburgs created a kingdom centred on Austria, Bohemia, and Hungary. The Napoleonic Wars brought about the end of the Holy Roman Empire (1806) and the emergence of the Austrian Empire. The prince von METTERNICH tried to assure Austrian supremacy among Germanic states, but war with Prussia led Austria to divide the empire into the Dual Monarchy of AUSTRIA-HUNGARY. Nationalist sentiment plagued the kingdom, and the assassination of FRANCIS FERDINAND by a Bosnian Serb nationalist in 1914 triggered WORLD WAR I, which destroyed the Austro-Hungarian Empire. In the postwar carving up of Austria-Hungary, Austria became an independent republic. It was annexed by Nazi Germany in 1938 (see ANSCHLUSS) and joined the Axis powers in World War II. The republic was restored in 1955 after 10 years of Allied occupation. Austria became a full member of the EUROPEAN UNION (EU) in 1995. After a half-century of military neutrality, Austria was one of the few members of the EU that was not a member of NATO at the outset of the 21st century.

Austria-Hungary *or* **Austro-Hungarian Empire** Former monarchy, central Europe. Austria-Hungary at one time included Austria and Hungary, Bohemia, Moravia, Bukovina, Transylvania, Carniola, Küstenland, Dalmatia, Croatia, Fiume, and Galicia. The so-called Dual Monarchy, formed by the COMPROMISE OF 1867, created a king of Hungary in addition to the existing Austrian emperor; though these were the same person, Hungary was granted its own parliament and considerable autonomy. FRANCIS JOSEPH held both titles from Austria-Hungary's inception until his death in 1916. Up to 1914, the monarchy maintained a precarious balance among its many minorities; that year saw the balance toppled with the assassination of the Austro-Hungarian FRANCIS FERDINAND by a Serbian nationalist that precipitated WORLD WAR I. With its defeat in that war and revolutions by the Czechs, Yugoslavs, and Hungarians, the monarchy collapsed in 1918.

Austrian Netherlands (1713–95) Provinces located in the southern part of the Low Countries, roughly comprising modern Belgium and Luxembourg. In 1713, the Peace of UTRECHT gave Emperor CHARLES VI control of what had been called the SPANISH NETHERLANDS. Administration of the region continued under the Habsburg rulers MARIA THERESA and later JOSEPH II, until the Austrian Netherlands was annexed to France in 1795.

Austrian school of economics Body of economic theory developed by several late 19th-century Austrian economists. Carl Menger (1840–1921) published a paper on their new theory of value in 1871. The concept of value was subjective, the source of a product's value being its ability to satisfy human wants. The actual value depended on the utility derived by the consumer from the product in its least important use (MARGINAL UTILITY). The theory was also applied to production and pricing. Other founders of the school included Friedrich von Wieser (1851–1926) and Eugen von Böhm-Bawerk (1851–1914). See also OPPORTUNITY COST; PRODUCTIVITY.

Austrian Succession, War of the (1740–48) Group of related wars that took place after the death (1740) of Emperor CHARLES VI. At issue was the right of Charles's daughter MARIA THERESA to inherit the Habsburg lands. The war began when FREDERICK II of Prussia invaded SILESIA in 1740. His victory suggested that the Habsburg dominions were incapable of defending themselves, prompting other countries to enter the fray. The conflict was ended by the Treaty of AIX-LA-CHAPELLE.

Austro-German Alliance *or* **Dual Alliance** (1879) Pact between Austria-Hungary and the German Reich in which the two powers promised each other support in case of attack by Russia, and neutrality in case of aggression by any other power. Germany's OTTO VON BISMARCK saw the alliance as a way to prevent the isolation of Germany and to preserve peace, as Russia would not wage war against both empires. The addition

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of Italy in 1882 made it the Triple Alliance. The agreement remained an important element of both German and Austro-Hungarian foreign policy until 1918.

Austro-Hungarian Empire See Austria-Hungary

Austro-Prussian War See Seven Weeks' War

Austroasiatic languages Superfamily of about 150 languages spoken by close to 90 million physically and culturally very diverse people in South and Southeast Asia. Today most scholars believe that it is subdivided into two families, Munda and Mon-Khmer. The present fragmented distribution of Austroasiatic languages is most likely the result of relatively recent incursions by Indo-Aryan, Sino-Tibetan, Tai, and Austronesian-speaking peoples. In prehistoric times Austroasiatic languages most likely extended over a much broader and more continuous area, including much of what is now southeastern China. Other than Vietnamese and Khmer, no Austroasiatic language is an official national language.

Austronesian languages *formerly* **Malayo-Polynesian languages** Family of about 1,200 languages spoken by more than 200 million people in Indonesia, the Philippines, Madagascar, the central and southern Pacific island groups (except most of New Guinea; see Papuan languages), and parts of mainland Southeast Asia and Taiwan. Before European colonial expansion, it had the widest territorial extent of any language family. A primary genetic division in the family separates the Austronesian languages of Taiwan from the remaining languages, which are divided into Western and Central-Eastern Malayo-Polynesian. Western Malayo-Polynesian includes Javanese, which is spoken by about 76 million people—more than a third of all Austronesian-speakers. Eastern Malayo-Polynesian includes Oceanic, the best-defined subgroup of Austronesian, comprising nearly all the languages of Polynesia, Micronesia, and Melanesia. Typological generalizations about Austronesian languages are difficult because of their enormous number and diversity, though content words tend to be disyllabic, and vowel and consonant inventories tend to be limited, especially in Polynesian. Written records in scripts of Southeast Asian provenance (see Indic writing system) survive for several languages, including Old Javanese and Cham, the language of the kingdom of Champa.

auteur \ō-'tœr\ **theory** Theory that holds that a film's director is its "author" (French, *auteur*). It originated in France in the 1950s and was promoted by François Truffaut and Jean-Luc Godard and the journal *Cahiers du Cinéma*. The director oversees and "writes" the film's audio and visual scenario and therefore is considered more responsible for its content than the screenwriter. Supporters maintain that the most successful films bear the distinctive imprint of their director.

authoritarianism Principle of unqualified submission to authority, as opposed to individual freedom of thought and action. As a political system, authoritarianism is antidemocratic in that political power is concentrated in a leader or small elite not constitutionally responsible to those governed. It differs from totalitarianism in that authoritarian governments usually lack a guiding ideology, tolerate some pluralism in social organization, lack the power to mobilize the whole population in pursuit of national goals, and exercise their power within relatively predictable limits. See also absolutism, dictatorship.

autism Neurobiological disorder that affects physical, social, and language skills. First described by Leo Kanner and Hans Asperger in the 1940s, the syndrome usually appears before 2½ years of age. Autistic infants appear indifferent or averse to affection and physical contact. They may be slow in learning to speak and suffer episodes of rage or panic; they may also appear deaf and display an almost hypnotized fascination with certain objects. Autism is often characterized by rhythmic body movements such as rocking or hand-clapping and by an obsessive desire to prevent change in daily routines. Autistic individuals may be hypersensitive to some stimuli (e.g., high-pitched sounds) and abnormally slow to react to others (e.g., physical pain). The disorder is three to four times more common in males. Though postnatal factors such as lack of parental attention were once blamed, it is now known that autism is the result of abnormalities in the brain structure. About 15–20% of autistic adults live and work independently; "high-functioning" autistic people may have special abilities based on their unusual ability for visual thinking. See also savant syndrome.

auto sacramental \'aù-tō-ˌsä-krä-men-'täl\ *Spanish* **"sacramental act"** Spanish dramatic genre of short plays on sacred or biblical subjects. Performed outdoors as part of Corpus Christi feast-day celebrations, they were verse allegories dealing with some aspect of the mystery of the Holy Eucharist. The form first appeared in the 16th century and reached its height in plays by Pedro Calderón de la Barca, who covered a wide range of nonsacramental subjects. Their performance was prohibited by royal decree in 1765 on the ground of irreverence.

autobiography Biography of oneself narrated by oneself. Little autobiographical literature exists from antiquity and the Middle Ages; with a handful of exceptions, the form begins to appear only in the 15th century. Autobiographical works take many forms, from intimate writings made during life that are not necessarily intended for publication (including letters, diaries, journals, memoirs, and reminiscences) to the formal autobiography. Outstanding examples of the genre extend from St. Augustine's *Confessions* (c. AD 400) to Vladimir Nabokov's *Speak, Memory* (1951).

autoclave Vessel, usually of steel, able to withstand high temperatures and pressures. The chemical industry uses various types of autoclaves in manufacturing dyes and in other chemical reactions requiring high pressures. In bacteriology and medicine, instruments, equipment, supplies, and culture media are sterilized by superheated steam in an autoclave. In 1679 Denis Papin (1647–c. 1712) invented a prototype known as a steam digester; still used in cooking, it is now called a pressure cooker.

autograph Any manuscript handwritten by its author; in common usage, a handwritten signature. Aside from its value as a collector's item, an early or corrected draft of a work may show its stages of composition or "correct" final version. The earliest autograph signature of a famous person is probably the Cid's, dated 1096. There exist autographs of most of the great Renaissance figures, including Leonardo da Vinci, Michelangelo, and Ludovico Ariosto. Since the 18th century, autograph material of notable people in the arts, sciences, or public life has been more abundant.

autoimmune disease Any disease caused by an immune response (see immunity) against antigens in the tissues of one's own body. The immune system has two known ways to prevent such a response: destruction of lymphocytes in the thymus before they leave to attack one's own tissues and loss of ability to react to their target antigens by any such cells that do leave the thymus. Autoimmune diseases arise when these mechanisms fail and lymphocytes destroy host tissues; examples include type 1 diabetes mellitus, systemic lupus erythematosus, pernicious anemia, and rheumatoid arthritis. Treatment may replace the function of the affected tissue (e.g., insulin therapy for diabetes) or suppress the immune system (see immunosuppression). Allergy is another type of autoimmune reaction.

automata \ò-'tä-mə-tə\ **theory** Body of physical and logical principles underlying the operation of any electromechanical device (an automaton) that converts information input in one form into another, or into some action, according to an algorithm. Norbert Wiener and Alan M. Turing are regarded as pioneers in the field. In computer science, automata theory is concerned with the construction of robots (see robotics) from basic building blocks of automatons. The best example of a general automaton is an electronic digital computer. Networks of automata may be designed to mimic human behaviour. See also artificial intelligence; Turing machine.

automation Term coined about 1946 by a Ford Motor Co. engineer, used to describe a wide variety of systems in which there is a significant substitution of mechanical, electrical, or computerized action for human effort and intelligence. In general usage, automation can be defined as a technology concerned with performing a process by means of programmed commands combined with automatic feedback control (see control system) to ensure proper execution of the instructions. The resulting system is capable of operating without human intervention.

automatism \ò-'tä-mə-ˌtiz-əm\ Method of painting or drawing in which conscious control over the movement of the hand is suppressed so that the subconscious mind may take over. For some Abstract Expressionists, such as Jackson Pollock, the automatic process encompassed the entire process of composition. The Surrealists, having once achieved an interesting image or form by automatic or chance means, exploited the technique with fully conscious purpose. See also Abstract Expressionism, action painting, Surrealism.

automaton \ò-'tä-mə-tən\ Mechanical object, either functional (such as a clock) or decorative (such as a miniature singing bird), that is self-operating. Devices set in motion by water, falling weights, and steam were in use in the 1st century. Decorative mechanical objects were made for

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ecclesiastical use and table ornaments in the Middle Ages and Renaissance. Spectacular fountains and waterworks can be seen in 16th-century Italian gardens; elaborate mechanical devices (such as the chess-playing Turk) were popular in the 18th–19th century. Except for some works by Carl Fabergé, the production of expensive automatons virtually ceased by the 20th century.

automobile Four-wheeled automotive vehicle designed for passenger transportation, commonly propelled by an internal combustion engine using a volatile fuel. The modern automobile consists of about 14,000 parts, divided into several structural and mechanical systems. These include the steel body, containing the passenger and storage space, which sits on the chassis or steel frame; the internal combustion gasoline engine, which powers the car by means of a transmission; the steering and braking systems, which control the car's motion; and the electrical system, which includes a battery, alternator, and other devices. Subsystems involve fuel, exhaust, lubrication, cooling, suspension, and tires. Though experimental vehicles were built in the 18th and mid-19th century, not until the 1880s did Gottlieb Daimler and Karl Benz in Germany begin separately to manufacture cars commercially. In the U.S., James and William Packard and Ransom Olds were among the first auto manufacturers, and by 1898 there were 50 U.S. manufacturers. Some early cars operated by steam engine, such as those made from c. 1902 by Francis E. and Freelan O. Stanley. The internal combustion engine was used by Henry Ford when he introduced the Model T in 1908; Ford would soon revolutionize the industry with his use of the assembly line. In the 1930s European manufacturers began to make small, affordable cars such as the Volkswagen. In the 1950s and '60s, U.S. automakers produced larger, more luxurious cars with more automatic features. In the 1970s and '80s Japanese manufacturers exported their small, reliable, fuel-efficient cars worldwide, and their increasing popularity spurred U.S. automakers to produce similar models. See also axle, brake, bus, carburetor, electric automobile, fuel injection, motorcycle, truck.

automobile racing Sport practiced in a variety of forms on roads, tracks, or closed circuits. It includes Grand Prix racing, speedway racing (including the Indianapolis 500), stock-car racing, sports-car racing, drag racing, midget-car racing, and karting, as well as hill climbs and rally driving. The International Motor Sports Hall of Fame is located in Talladega, Ala., U.S. There is no central governing body for automobile racing in the U.S. as there is in most other countries.

autonomic \ˌȯt-ə-'näm-ik\ **nervous system** Part of the nervous system that is not under conscious control and that regulates the internal organs. It includes the sympathetic, parasympathetic, and enteric nervous systems. The first, which connects the internal organs to the brain via spinal nerves, responds to stress by increasing heart rate and blood flow to the muscles and decreasing blood flow to the skin. The second comprises the cranial nerves and the lower spinal nerves, which increase digestive secretions and slow the heartbeat. Both have sensory fibres that send feedback on the condition of internal organs to the central nervous system, information that helps maintain homeostasis. The third division, embedded in the walls of the stomach and intestines, controls digestive movement and secretions. See illustration opposite.

autopsy \'ȯ-ˌtäp-sē\ *or* **necropsy** *or* **postmortem** Dissection and examination of a dead body to determine cause of death and learn about disease processes in ways that are not possible with the living. Autopsies have contributed to the development of medicine since at least the Middle Ages. Beyond revealing causes of individual deaths, autopsy is crucial to the accuracy of disease and death statistics, the education of medical students, the understanding of new and changing diseases, and the advancement of medical science.

Autry, (Orvon) Gene (b. Sept. 29, 1907, Tioga, Texas, U.S.—d. Oct. 2, 1998, North Hollywood, Calif.) U.S. actor and singer. He made his debut on a local radio show in 1928, hosting his own radio program from 1931. His first film, *In Old Santa Fe* (1934), launched his career as a cowboy actor. Known as "the Singing Cowboy," he starred in 18 movies, ending with *Alias Jesse James* (1959). His recordings, including "Rudolph the Red-Nosed Reindeer" (1949), sold millions of copies. The televised *Gene Autry Show* ran from 1950 to 1954.

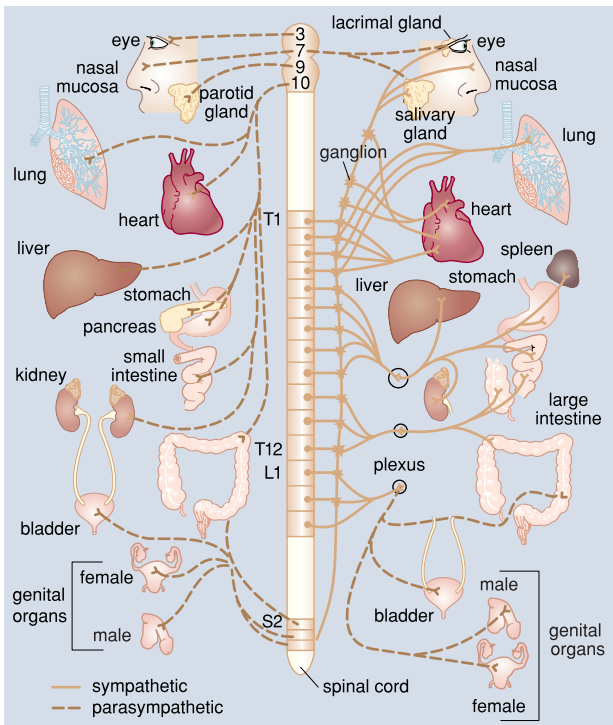
autumn crocus Any plant of the genus *Colchicum* (lily family), sometimes called meadow saffron, comprising about 30 species of herbaceous plants native to Eurasia. The stemless, crocuslike flowers bloom in autumn. Several species are cultivated as ornamentals for their pink, white, or bluish-purple tubelike flowers, especially *C. autumnale*, *C. bornmuelleri*, and *C. speciosum*. The swollen underground stem of *C. autumnale* contains colchicine, a substance used to relieve the pain of gout.

Auvergne \ō-'vern'\ Region (pop., 1999: 1,308,878), south-central France. It was once inhabited by the Arverni, a Gallic people led by Vercingetorix and defeated by Julius Caesar. It was yielded to the Visigoths in AD 475 and conquered by the Franks under Clovis I in 507. It became part of Aquitaine, and in the 8th century it was made a countship. It passed to the Bourbons in 1416 and to France c. 1530.

auxiliary In grammar, a verb that is subordinate to the main lexical verb in a clause. Auxiliaries can convey distinctions of tense, aspect, mood, person, and number. In Germanic languages such as English and Romance languages such as French, an auxiliary verb occurs with the main verb in the form of an infinitive or participle.

auxin Any of a group of hormones that regulate plant growth, particularly by stimulating cell elongation in stems and inhibiting it in roots. Auxins influence the growth of stems toward light (phototropism) and against the force of gravity (geotropism). Auxins also play a role in cell division and differentiation, fruit development, the formation of roots from cuttings, the inhibition of lateral branching, and leaf fall. The most important naturally occurring auxin is beta-indolylacetic acid.

Ava \'ä-vä\ Ruined city, Myanmar. The city, located on the Irrawaddy River southwest of Mandalay, was founded in the 14th century by the Shans, who made it their capital. It was destroyed in 1527, but again became the capital in 1634 under the Toungoo dynasty. When Alaung-



Pathways of the autonomic nervous system. Nerve impulses begin in motor neurons in the brain or spinal cord. Each motor neuron connects with a second motor neuron outside the central nervous system to carry the impulse to the glands and smooth muscles. In the sympathetic nervous system, these second motor neurons are found in ganglia (masses of neurons) along either side of the spinal cord. In the parasympathetic nervous system, ganglia are located closer to, or sometimes within, the target organs. Some ganglia form large clusters called plexuses. Preganglionic fibres of the sympathetic system emerge along the thoracic (T) and first three lumbar (L) segments of the spinal cord. Fibres of the parasympathetic system originating in the brainstem arise from the third, seventh, ninth, and tenth cranial nerves; other parasympathetic fibres emerge from the second, third, and fourth sacral (S) segments of the spinal cord.

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paya founded the Konbaung dynasty in the 18th century, Ava served as its capital for a time, and even after the dynasty built Amarapura and Mandalay, its seat was often referred to as the "Court of Ava."

avalanche Large mass of material, such as snow or rock debris, that moves rapidly down a mountain slope, sweeping everything in its path. Avalanches begin when a mass of material overcomes the frictional resistance of the sloping surface, often after the material's foundation has been weakened by rains or the snow has been partially melted by a warm, dry wind. Other weather conditions that can lead to avalanches are heavy snowfall and high winds. A common method of avalanche control consists of detonating explosives in the upper reaches of avalanche zones, which intentionally causes the snow to slide before accumulations have become very great.

Avalokitesvara \ˌə-və-ˌlō-ki-ˈtāsh-və-rə\ *Chinese* **Guanyin** \ˈgwän-ˈyin\ *Japanese* **Kannon** \ˈkän-ˈnōn\ Bodhisattva of infinite compassion and mercy, the most popular of Mahayana Buddhist deities. He is the earthly manifestation of Amitabha, guarding the world between the departure of the historical Buddha, Gautama, and the appearance of the future Buddha, Maitreya. He is the creator of the fourth world, the actual living universe. In China and Japan his gender became ambiguous; he is sometimes called a goddess. For Pure Land Buddhists, he forms a ruling triad with Amitabha and the bodhisattva Mahasthamaprapta. In Tibetan Buddhism, he is thought to be reincarnated in each Dalai Lama in order to preserve buddha-teaching.

Avalokiteśvara, bronze figure from Kurkihār, Bihār, 9th century; in Patna Museum, Patna, Bihār
BY COURTESY OF PATNA MUSEUM, PATNA (BIHAR); PHOTOGRAPH, ROYAL ACADEMY OF ARTS, LONDON

Avalon Island to which Britain's legendary King Arthur was taken after he was mortally wounded in his last battle. First described by Geoffrey of Monmouth, it was said to be ruled by Morgan le Fay and her eight sisters, all of whom were skilled in the healing arts. Legend held that when Arthur was healed he would return to rule Britain. The tale may have originated in Celtic myths of an elysium for fallen heros. Avalon has sometimes been identified with Glastonbury in Somerset.

Avanti Historic kingdom, north-central India. Located on the overland trade routes between northern and southern India, it lay within present-day Madhya Pradesh. Its capital was at Ujjayini (near present-day Ujjain). It flourished in the 6th–4th centuries BC as one of the great powers of northern India. In the 4th century BC it was conquered and annexed by Candra Gupta Maurya of Magadha. Ujjayini, one of the seven holy cities of Hinduism, was renowned for its beauty and wealth; it also became a centre of early Buddhism and Jainism.

Avar \ˈä-vär\ Any member of a people of undetermined origin who built an empire in eastern Europe between the Adriatic and Baltic seas and the Elbe and Dnieper rivers in the 6th–9th centuries. Mounted nomads, possibly from Central Asia, they made the Hungarian plain the centre of their empire, from which they intervened in Germanic tribal wars, helped the Lombards overthrow allies of Byzantium, and nearly succeeded in occupying Constantinople in 626. They also fought the Merovingians and helped push the Serbs and Croats southward. Avar decline began in the late 7th century and culminated in the destruction of their capital by Charlemagne in 796. In the early 9th century the Avars were fully incorporated in the Carolingian empire.

Avatamsaka-sutra \ˌə-və-ˈtəm-sə-kə-ˈsü-trə\ *or* **Garland Sutra** Mahayana Buddhist sutra that explores the teachings of the Buddha Gautama. It speaks of the deeds of the Buddha and the resulting merits that blossom like a garland of flowers. It begins with the Buddha's Enlightenment attended by a chorus of bodhisattvas and divine beings. It describes an assembly in the palace of Indra, where the Buddha teaches that all beings have the Buddha nature. Around AD 400 a Chinese translation appeared, *Huayan jing*, which gave rise in the 6th century to the Huayan sect, which became in Japan the Kegon school. See also Vairocana.

avatar \ˈa-və-ˌtär\ In Hinduism, the incarnation of a deity in human or animal form to counteract an evil in the world. It usually refers to 10 appearances of Vishnu, including an incarnation as the Buddha Gautama and Kalkin (the incarnation yet to come). The doctrine appears in the *Bhagavadgita* in the words of Lord Krishna to Arjuna: "Whenever there is a decline of righteousness and rise of unrighteousness then I send forth Myself."

Avebury \ˈāv-bə-rē\ Village, Wiltshire, England, lying partly within one of the largest prehistoric sites in Europe. The site occupies 28.5 acres (11.5 hectares) and contains vast megalithic remains, including chalk blocks and sandstone pillars placed in circles. Its date and origin are uncertain. Kennet Avenue, a route into the interior of the great circle, linked Avebury with a temple 1 mi (1.6 km) away.

Avedon \ˈa-və-ˌdän**, Richard** (b. May 15, 1923, New York, N.Y., U.S.—d. Oct. 1, 2004, San Antonio, Texas) U.S. photographer. He began studying photography in the U.S. merchant marine. In 1945 he became a regular contributor to *Harper's Bazaar*; he later was closely associated with *Vogue*. Avedon's fashion photographs are characterized by a strong black-and-white contrast that creates an effect of austere sophistication. In his portraits of celebrities and other sitters, he created a sense of drama by often using a stark, white background and eliciting a frontal, confrontational pose. Many collections of his photographs have been published.

avens \ˈa-venz\ Any of the low-growing, perennial flowering plants (approximately 50 species) of the genus *Geum*, in the rose family. Most occur in the northern or southern temperate zones or in the Arctic. Several species are cultivated for their solitary or clustered white, red, orange, or yellow flowers. The plants grow no more than 2 ft (60 cm) tall. Most of the compound, deeply lobed or cut leaves arise from the base of the stem.

average See mean, median, and mode

Avernus \ə-ˈvər-nəs**, Lake** *ancient* **Lacus Avernus.** Lake, southern Italy. It lies west of Naples in the crater of an extinct volcano. Because of its sulfurous vapors, it was considered an entrance to the underworld by the ancient Romans, including Virgil. According to legend, the grove of Hecate and the grotto of the Cumaean Sibyl lay nearby. In the 1st century BC it was transformed into a naval base, Portus Iulius, by Agrippa and linked to the sea. Its impressive Roman ruins include baths, temples, and villas.

Averroës \ə-ˈver-ə-ˌwēz\ *Arabic* **Ibn Rushd** \ˌib-ən-ˈrůsht\ *in full* **Abū al-Walīd Muḥammad ibn Aḥmad ibn Muḥammad ibn Rushd** (b. 1126, Córdoba—d. 1198, Marrakech, Almohad empire) Spanish Arabic philosopher. Trained in law, medicine, and philosophy, he rose to be chief judge of Córdoba, an office also once held by his grandfather. His series of commentaries on most of the works of Aristotle, written between 1169 and 1195, exerted considerable influence on both Jewish and Christian scholars in later centuries. While mostly faithful to Aristotle's thought, he endowed the Aristotelian "prime mover" with the characteristics of the Plotinian (see Plotinus) and Islamic transcendent God, the universal First Cause. In his *Commentary on Plato's Republic* he attempted to apply Platonic doctrines to the contemporary Almoravid and Almohad states. See also Arabic philosophy.

Avery, Oswald (Theodore) (b. Oct. 21, 1877, Halifax, N.S., Can.—d. Feb. 20, 1955, Nashville, Tenn., U.S.) Canadian-born U.S. bacteriologist. He studied at Colgate University before taking a post at New York's Rockefeller Institute Hospital. There he discovered transformation, a process by which a change could be introduced into bacteria and passed on to later generations of transformed cells. He and his coworkers reported in 1944 that the substance that caused the transformation was DNA, the cell's genetic material. The discovery thus opened the door to deciphering the genetic code.

Avesta \ə-ˈves-tə\ *or* **Zend-Avesta** Sacred book of Zoroastrianism. It contains hymns, prayers, and appeals to righteousness ascribed to Zoroaster. The present text was assembled in the 3rd–7th century AD from the remains of a larger body of scripture that was destroyed when Alexander the Great conquered Persia. It has five parts: the *Gathas*, hymns in what are thought to be Zoroaster's own words; *Visp-rat*, containing homages

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to spiritual leaders; *Vendidad*, the main source for Zoroastrian law; the *Yasht*s, 21 hymns to angels and ancient heroes; and the *Khurda avesta*, composed of minor texts.

Avestan \ə-'ves-tən\ **language** Eastern IRANIAN LANGUAGE of the AVESTA, the sacred book of ZOROASTRIANISM. The oldest portion of the Avesta, the Gathas, are now commonly thought to date from around the end of the 2nd millennium BC and are thus contemporary with Vedic SANSKRIT. Not until the mid-SASANIAN period (5th–6th century AD) was the Avesta committed to writing, in an alphabetic script invented for the purpose on the basis of existing Middle Persian scripts. The oldest manuscripts date only from the 13th century.

aviary Structure for keeping captive birds, usually spacious enough for the aviculturist to enter. Aviaries range from small enclosures to large flight cages 100 ft (30 m) or more long and up to 50 ft (15 m) high. Enclosures for birds that fly only little or weakly (e.g., RAILS, PHEASANTS) may be only about 3 ft (1 m) high. In cold climates the aviary is usually enclosed and heated. Most aviculturists prefer to place birds in natural, planted surroundings. Many aviaries are maintained for pleasure by private aviculturists; others, especially large ones, are found in ZOOS or research institutions.

aviation Development and operation of aircraft. In 1783 the BALLOON became the first aircraft to carry humans. Production of a successful GLIDER in 1891 and refinement of the INTERNAL-COMBUSTION ENGINE led to the first successful engine-powered AIRPLANE flight by WILBUR AND ORVILLE WRIGHT in 1903. World War I accelerated the expansion of aviation, and in the 1920s the first small airlines began carrying mail and passengers. World War II was another period of innovation in aircraft size, speed, and range. In the late 1940s the JET ENGINE made possible the subsequent development of commercial airlines throughout the world. See also AIRSHIP; HELICOPTER; SEAPLANE.

Avicenna \ˌa-və-'se-nə\ *Arabic* **Ibn Sīnā** \'ib-ən-'sē-nä\ *in full* **Abū ʾAlī al-Ḥusayn ibn ʿAbd Allāh ibn Sīnā** (b. 980, Bukhara, Iran—d. 1037, Hamadan) Islamic philosopher and scientist. He became physician to several sultans and also twice served as vizier. His *Canon of Medicine* was long a standard work in the field. He is known for his great encyclopaedia of philosophy, *The Book of Healing*. His other writings include *The Book of Salvation* and *The Book of Directives and Remarks*. His interpretations of ARISTOTLE influenced European SCHOLASTICISM. His system rests on a conception of God as the necessary existent: only in God do essence (what God is) and existence (that God is) coincide.

Avignon \ˌá-vē-'nyōⁿ\ *ancient* **Avennio** City (pop., 2004 prelim.: 89,400), southeastern France. Founded by the Gallic tribe of Cavares, it later fell under Roman rule and was a much-fought-over prize in its early days. Its status grew tremendously as the capital of the papacy (1309–77) and seat of the Avignonese popes during the Western SCHISM. France annexed the city in 1791. Landmarks include a Romanesque cathedral, the papal palace, and Saint-Bénézet bridge, made famous by the song "Sur le pont d'Avignon." The city's historic centre was designated a World Heritage site in 1995.

Avignon papacy Roman Catholic papacy during the period 1309–77, when the popes resided at AVIGNON, France. Elected pope through the machinations of Philip IV of France, CLEMENT V moved the papal capital to Avignon four years later primarily for political reasons. All seven popes of this period were French, as were most of the cardinals, which aroused English and German animosity. During the Avignon papacy the cardinals began to play a stronger role in church government, church and clergy were reformed, missionary efforts were expanded, and popes tried to settle royal rivalries and establish peace. The heavy French influence damaged the prestige of the papacy, however, and in 1377 Gregory XI returned to Rome. The cardinals elected a new pope who took the Avignon seat, becoming the first of a line of ANTIPOPES and beginning the Western SCHISM.

Avignon school School of late Gothic painting associated with the city of Avignon, Fr., during the AVIGNON PAPACY, when many Italian artists worked there. This "school" represents a body of late Gothic painting and not necessarily a single stylistic evolution. Under the direction of SIMONE MARTINI, the papal palace of Avignon and secular buildings in nearby towns were decorated with frescoes. The city was one of the channels by which Italian 14th-century art reached France. By the early 15th century Flemish influences had reached the city, consolidating the Italian and northern styles. The Avignon Pietà (c. 1460), attributed to Enguerrand Charonton, is the masterpiece of the school. The artistic activity at Avignon greatly influenced French painting in the late 15th and 16th centuries. See also GOTHIC ART.

Avilés, Pedro Menéndez de See Pedro MENENDEZ DE AVILES

avocado Fruit of *Persea americana*, of the LAUREL FAMILY, a tree native to the Western Hemisphere from Mexico south to the Andean regions. Avocados are extremely variable in shape, size, and colour (green to dark purple). The outer skin may be thin, or coarse and woody. The greenish or yellowish flesh has a buttery consistency and a rich, nutty flavour. In some varieties the flesh contains as much as 25% unsaturated oil. Avocados are the principal ingredient of the Mexican sauce guacamole. They provide thiamine, riboflavin, and vitamin A.

Avocado (*Persea americana*).
S.A. SCIBOR—SHOSTAL

avocet \'a-və-ˌset\ Any of several large shorebirds (genus *Recurvirostra*) with boldly contrasting plumage, long bluish legs, and a long black bill upturned at the tip. Avocets inhabit fresh and salt marshes that have areas of open shallow water and mudflats, and feed by sweeping the partly open bill in the shallows. They often wade together to corral minnows and crustaceans. Four avocet species are found in temperate and tropical regions worldwide. The American avocet is about 18 in. (45 cm) long, including the bill.

American avocet (*Recurvirostra americana*)
MILDRED GLUECK FROM ROOT RESOURCES—EB INC.

Avogadro's law \ˌä-və-'gä-drōz\ Statement that, under the same conditions of TEMPERATURE and PRESSURE, equal volumes of different GASES contain an equal number of molecules (see AVOGADRO'S NUMBER). First proposed by the Italian scientist Amedeo Avogadro (1776–1856) in 1811, it became accepted c. 1860. From the law, it follows that the volume occupied by one MOLE of gas (at standard conditions of 32 °F [0 °C] and 1 atmosphere of pressure) is the same for all gases (0.791 cubic feet [22.4 litres]).

Avogadro's number Number of units in one MOLE of any substance (defined as its MOLECULAR WEIGHT in grams), equal to 6.0221367×10^{23}. The units may be ELECTRONS, ATOMS, IONS, or MOLECULES, depending on the nature of the substance and the character of the reaction (if any). See also AVOGADRO'S LAW; law of MASS ACTION; STOICHIOMETRY.

avoidance, zone of Region of apparent absence of GALAXIES near the plane of the MILKY WAY GALAXY. Millions of external galaxies are in this region of the sky but are obscured by interstellar dust within the Milky Way. The zone's obscuration can be penetrated at the infrared portion of the ELECTROMAGNETIC SPECTRUM. See also INFRARED ASTRONOMY.

avoidance behaviour Type of activity, exhibited by animals exposed to adverse stimuli, in which the tendency to flee or to act defensively is stronger than the tendency to attack. Vision is the sense that most often produces avoidance behaviour (e.g., small birds react to the sight of an owl), but sound (e.g., a warning cry) may do so as well.

Avon, River *or* **Lower Avon** River, southwestern England. Rising in GLOUCESTERSHIRE, it flows 75 mi (121 km) southwest through BRISTOL and into the BRISTOL CHANNEL at Avonmouth, Bristol's port. Below Bristol it has cut through a limestone ridge to form Clifton Gorge, noted for its suspension bridge.

Avon, River *or* **Upper Avon** River, central England. Rising in NORTHAMPTONSHIRE, it flows 96 mi (154 km) southwest into the River SEVERN at Tewkesbury. It is known for its scenic beauty, notably in the Vale of Evesham. Important towns along it include STRATFORD, where WILLIAM SHAKESPEARE was born.

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AWACS \'ā-waks\ **(Airborne Warning and Control System)** Mobile, long-range RADAR surveillance-and-control centre for air defense. Used by the U.S. Air Force since 1977, AWACS is mounted in a specially modified Boeing 707 aircraft, with its main radar antenna affixed to a rotating dome. It can detect, track, and identify low-flying aircraft at a distance of 200 nautical mi (370 km) and high-level targets at much greater distances. It can also track maritime traffic and operate in any weather. The computer system can assess enemy action and track the location and availability of any aircraft within range. Operators of its secure communications system can guide friendly aircraft against enemy planes.

Awakening, Great See GREAT AWAKENING

Awolowo \ä-'wü-lō-ˌwō**, Obafemi** (b. March 6, 1909, Ikenne, Colony and Protectorate of Southern Nigeria—d. May 9, 1987, Ikenne) Nigerian nationalist politician and leader of the YORUBA ethnic group. While studying law in London, he wrote the influential *Path to Nigerian Freedom* (1947) and laid the basis for the first Yoruba political party, the Action Group. As premier of Nigeria's Western Region (1954–59), he worked to improve education, social services, and agriculture. He remained a major figure in national politics but never won high elective office.

ax Hand tool used for chopping, splitting, chipping, and piercing. Stone Age hand axes originated in simple stone implements that acquired wooden hafts, or handles, about 30,000 BC. Copper-bladed axes appeared in Egypt about 4000 BC and were followed by axes with blades of BRONZE and eventually iron. The development of the iron-bladed felling ax in the Middle Ages made possible the vast forest clearances of Europe, North and South America, and elsewhere. Though the ax has lost much of its historic role to powered saws and other machinery, it remains a widely used tool with many uses.

axiology *or* **value theory** Philosophical theory of value. Axiology is the study of value, or goodness, in its widest sense. The distinction is commonly made between intrinsic and extrinsic value—i.e., between that which is valuable for its own sake and that which is valuable only as a means to something else, which itself may be extrinsically or intrinsically valuable. Many different answers have been given to the question "What is intrinsically valuable?" For hedonists, it is pleasure; for pragmatists, it is satisfaction, growth, or adjustment; for Kantians, it is a good will. Pluralists such as G.E. MOORE and WILLIAM DAVID ROSS assert that there are any number of intrinsically valuable things. According to subjective theories of value, things are valuable only insofar as they are desired; objective theories hold that there are at least some things that are valuable independently of people's interest in or desire for them. Cognitive theories of value assert that ascriptions of value function logically as statements of fact, whereas noncognitive theories assert that they are merely expressions of feeling (see EMOTIVISM) or prescriptions or commendations (see PRESCRIPTIVISM). According to naturalists, expressions such as "intrinsically good" can be analyzed as referring to natural, or non-ethical, properties, such as being pleasant. Moore famously denied this, holding that "good" refers to a simple (unanalyzable) non-natural property. See also FACT-VALUE DISTINCTION; NATURALISTIC FALLACY.

axiom In mathematics or logic, an unprovable rule or first principle accepted as true because it is self-evident or particularly useful (e.g., "Nothing can both be and not be at the same time and in the same respect"). The term is often used interchangeably with *postulate*, though the latter term is sometimes reserved for mathematical applications (such as the postulates of EUCLIDEAN GEOMETRY). It should be contrasted with a THEOREM, which requires a rigorous proof.

axiomatic method In LOGIC, the procedure by which an entire science or system of theorems is deduced in accordance with specified rules by logical deduction from certain basic propositions (AXIOMS), which in turn are constructed from a few terms taken as primitive. These terms may be either arbitrarily defined or conceived according to a model in which some intuitive warrant for their truth is felt to exist. The oldest examples of axiomatized systems are Aristotle's SYLLOGISTIC and EUCLIDEAN GEOMETRY. Early in the 20th century, BERTRAND RUSSELL and ALFRED NORTH WHITEHEAD attempted to formalize all of mathematics in an axiomatic manner. Scholars have even subjected the empirical sciences to this method, as in J. H. Woodger's *The Axiomatic Method in Biology* (1937) and Clark Hull's *Principles of Behavior* (1943).

Axis Powers Coalition headed by Germany, Italy, and Japan that opposed the ALLIED POWERS in World War II. The alliance originated in a series of agreements between Germany and Italy, followed in 1936 by the Rome-Berlin Axis declaration and the German-Japanese ANTI-COMINTERN PACT. The connection was strengthened by the formal Pact of Steel (1939) between Germany and Italy and by the Tripartite Pact signed by all three powers in 1940. Several other countries, including Hungary, Romania, Bulgaria, Croatia, and Slovakia, later allied themselves with the original Axis Powers.

axle Pin or shaft on or with which wheels revolve; with fixed wheels, one of the basic simple MACHINES for amplifying FORCE. Combined with the WHEEL, in its earliest form it was probably used for raising weights or water buckets from wells. Its principle of operation can be illustrated in the attachment of large and small GEARS to the same shaft; the tendency of a force applied at the radius on the large gear to turn the shaft is sufficient to overcome a larger force at the radius on the small gear. The MECHANICAL ADVANTAGE is equal to the ratio of the two forces and also equal to the ratio of the radii of the two gears.

Axminster carpet Floor covering produced in a factory founded at Axminster, England, in 1755 by the cloth weaver Thomas Whitty. The carpets were knotted in wool on woolen warps, with wefts of flax or hemp, and featured Renaissance architectural or floral patterns. The factory closed in 1835 with the advent of industrial weaving machines. The name survives as a generic term for all machine-made carpets with pile similar to velvet or chenille.

Axum See AKSUM

ayatollah \ˌī-ə-'tō-lə\ In the SHIITE branch of Islam, a high-ranking religious authority regarded by his followers as the most learned person of his age. The ayatollah's authority rests on the infallible IMAM. His legal decisions are accepted as binding by his personal followers and (in the present day) by the wider community.

Ayckbourn \'āk-ˌbȯrn**, Sir Alan** (b. April 12, 1939, London, Eng.) British playwright. He began acting with the Stephen Joseph Co. in Scarborough, Yorkshire, where he also wrote his earliest plays under the pseudonym Roland Allen (1959–61). Most of his plays premiered at the company's theatre, where he was artistic director beginning in 1970. He has written over 50 plays, mostly farces and comedies that deal with marital and class conflicts, including *Relatively Speaking* (1967), *Absurd Person Singular* (1972), the trilogy *The Norman Conquests* (1973), *Intimate Exchanges* (1982), and *Communicating Doors* (1995).

Aydid \ī-'dēd**, Muhammad Farah** *orig.* **Muhammad Farah Hassan** (b. c. 1930, Beledweyne, Italian Somaliland—d. Aug. 1, 1996, Mogadishu, Somalia) Somali faction leader. He received military training in Italy and the U.S.S.R. and served in posts under MOHAMED SIAD BARRE (1978–89) before overthrowing him in 1991. He became the dominant clan leader at the centre of the Somalian civil war. Losing the interim presidency to another factional leader, Aydid continued warring on rival clans. When UN and U.S. troops arrived in Somalia (1992), Aydid ambushed a UN contingent and was declared an outlaw. The attempt to capture him led to many deaths, and foreign troops were withdrawn. He then intensified his campaign against his rivals, but he reportedly died of a heart attack after being wounded in battle.

Ayer \'a(ə)r, 'e(ə)r**, Sir A(lfred) J(ules)** (b. Oct. 29, 1910, London, Eng.—d. June 27, 1989, London) British philosopher. He taught at University College London (1946–59) and later at Oxford (1959–78). He gained international notice in 1936 with the publication of his first book, *Language, Truth and Logic*, a manifesto of LOGICAL POSITIVISM that drew on the ideas of the VIENNA CIRCLE and the tradition of British EMPIRICISM as represented by DAVID HUME and BERTRAND RUSSELL. He is also remembered for his contributions to EPISTEMOLOGY and his writings on the history of Anglo-American philosophy (see also ANALYTIC PHILOSOPHY). His other works include *The Foundations of Empirical Knowledge* (1940), *The Problem of Knowledge* (1956), *The Origins of Pragmatism* (1968), *Russell and Moore* (1971), *The Central Questions of Philosophy* (1973), and *Wittgenstein* (1985).

Ayers \'arz\ **Rock** Rock outcrop, southwestern Northern Territory, Australia. Called Uluru by the AUSTRALIAN ABORIGINES and located in Uluru-Kata Tjuta National Park, it is 1,100 ft (335 m) high and may be the world's largest monolith. Its arkosic sandstone changes colour according to the height of the sun. Shallow caves at the base of the rock are sacred to several Aboriginal tribes and contain carvings and paintings. In 1985 ownership of Ayers Rock was officially returned to the Aborigines.

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Aying *or* **A Ying** \'ä-'yiŋ\ *orig.* **Qian Xingcun** (b. Feb. 6, 1900—d. June 17, 1977) Chinese critic and historian of modern Chinese literature. A member of the Communist Party and of the standing committee of the League of Left-Wing Writers, he began c. 1930 to gather and study materials on the literature of modern times and of the Ming and Qing dynasties. His published works, including *Women Writers in Modern China* (1933) and *Two Talks on the Novel* (1958), contributed greatly to the record of modern culture in China.

Aylesbury \'ālz-bə-rē\ Town (pop., 1995 est.: 61,000), south-central England. The county seat of BUCKINGHAMSHIRE, it lies northwest of London in the THAMES valley known as the Vale of Aylesbury, noted for its rich clay. Once an important market town, it is now an industrial centre. Its historic buildings include an 18th-century county hall and a 15th-century inn.

Aymara \ˌī-mə-'rä\ Large South American Indian group living on the Titicaca plateau of the central Andes Mountains in present-day Peru and Bolivia. The Aymara were conquered by the INCA and the Spanish, though they rebelled against both. Traditional Aymara now live in an area of poor soil and harsh climate, where they herd llamas and alpacas, grow crops, and fish using boats made of large reeds. Poverty rates within the group are among the highest in the hemisphere.

Aymé \e-'mā**, Marcel** (b. March 29, 1902, Joigny, Fr.—d. Oct. 14, 1967, Paris) French novelist, essayist, and playwright. His novels include *The Hollow Field* (1929), *The Fable and the Flesh* (1943), and *The Transient Hour* (1946). He delighted a vast public with witty tales of talking farm animals (reflecting his own farm upbringing), some of which were published in English as *The Wonderful Farm* (1951). Though his extravagant creations mingling fantasy and reality were long dismissed as minor, he was belatedly recognized as a master of light irony and storytelling.

Ayodhya \ə-'yōd-yə\ *or* **Oudh** Town (pop., 2001: 49,417), UTTAR PRADESH state, northern India. Lying on the banks of the GHAGHARA RIVER just east of Faizabad, of which it is now a suburb, Ayodhya in ancient times was one of India's greatest cities; today, it is one of the seven holy cities of HINDUISM. It was the capital of KOSALA, as described in the *RAMAYANA*. It became an important Buddhist centre in BUDDHISM's early years (6th–4th century BC), and the BUDDHA is said to have lived there. In the 16th century the Mughal emperor BABUR built a mosque on a site traditionally associated with an ancient Hindu temple marking the birthplace of the god RAMA. The storming of the mosque by Hindus in 1990, amid religious tensions, was followed by riots, and the ensuing crisis brought down the government. In 1992 the mosque was demolished by Hindu fundamentalists, and hundreds of people died in the rioting that subsequently swept through India.

Ayrshire \'er-ˌshir\ Breed of hardy dairy CATTLE (see DAIRY FARMING) that originated in the county of Ayr, Scotland, in the late 18th century. It is considered the only special dairy breed to have originated in the British Isles. Its body colour varies from almost pure white to nearly all cherry red or brown. Exported widely to other countries, it is especially common in Great Britain, the U.S., and Canada.

Ayub Khan \ā-'üb-'kän**, Mohammad** (b. May 14, 1907, Hazara, India—d. April 19, 1974, near Islamabad, Pak.) President of Pakistan (1958–69). After studies at Aligarh Muslim University and at the British Royal Military College, he became an officer in the Indian army (1928). He fought in Burma (Myanmar) in World War II, and afterward he rose through the ranks in the military in newly independent Pakistan. In 1958 Pakistan's Pres. Iskander Mirza abrogated the country's constitution, and Ayub became chief martial-law administrator. He declared himself president the same year, exiling Mirza. He established close ties with China and in 1965 went to war with India over control of the KASHMIR region. The failure to take Kashmir, combined with unrest over suffrage restrictions, led to riots, and Ayub resigned in 1969.

Ayurveda \'ä-yər-ˌvā-də\ *or* **Ayurvedic medicine** Traditional system of Indian medicine. It is attributed to Dhanvantari, the physician to the gods in Hindu mythology, who received it from BRAHMA. Its earliest concepts were set out in the portion of the VEDAS known as the Atharvaveda (c. 2nd millennium BC). The most important Ayurvedic texts are the *Caraka samhita* and *Susruta samhita* (1st–4th century AD). These texts analyze the human body in terms of earth, water, fire, air, and ether as well as the three bodily humours (wind, bile, and phlegm). To prevent illness, Ayurvedic medicine emphasizes hygiene, exercise, herbal preparations, and yoga. To cure ailments, it relies on herbal medicines, physiotherapy, and diet. Ayurvedic medicine is still a popular form of health care in India, where it is taught in roughly 100 colleges, and it has gained currency in the West as a form of alternative medicine.

Ayutthaya \ˌä-yü-'tī-ə\ *in full* **Phra Nakhon Si Ayutthaya.** Town (pop., 2000 prelim.: 75,898), former capital city of the Thai kingdom of Ayutthaya. It is located northeast of present-day Bangkok. Modern-day Thailand (then called Siam) is said to date from its founding (between 1347 and 1351). The kingdom of Ayutthaya was once one of the most powerful in Southeast Asia, and its capital city flourished for more than 400 years. Much of the ancient city's architecture, art, and literature was destroyed in 1767 when it was sacked by Hsinbyushin of the ALAUNGPAYA DYNASTY. The modern town of Ayutthaya is set among the ruins of the ancient city. There is some manufacturing, and tourism is important. The area was designated a UNESCO WORLD HERITAGE SITE in 1991.

Ayyūbid \ä-'yü-bid\ **dynasty** (1173–1250) Kurdish dynasty founded by SALADIN that ruled over Egypt, most of Syria, upper Iraq, and Yemen. After overthrowing the FĀṬIMID DYNASTY, Saladin defended Palestine during the CRUSADES and made Egypt the most powerful Muslim state in the world. After Saladin's death the Ayyūbid regime became decentralized. In 1250 a group of *mamlūk*s (military slaves) exploited a lapse in Ayyūbid succession to take over the government in Egypt and to found the MAMLŪK DYNASTY. Minor Ayyūbid princes continued to rule in parts of the Syria for some years afterward.

azalea Any plant of certain species of the genus *Rhododendron* (HEATH FAMILY), formerly given the generic name *Azalea*. Though some gardeners consider azaleas distinct from RHODODENDRONS, distinguishing characteristics of the two groups are not consistent enough to separate them into two genera. Azaleas typically are deciduous (see DECIDUOUS TREE), with flowers that are funnel-shaped, somewhat two-lipped, and often fragrant. Cultivated varieties have been bred from species native to the hilly regions of Asia and North America. Well-known North American kinds include the smooth, or sweet, azalea (*R. arborescens*); the flame azalea (*R. calendulaceum*); and the pinxter flower (*R. periclymenoides*).

Azalī \ä-zä-'lē\ Any member of the Bābī movement who remained faithful to the teachings of the BĀB and his chosen successor, Mīrzā Yahya, known as Ṣobḥ-e Azal, after the movement split in 1863. For 13 years after the Bāb's execution, followers recognized Ṣobḥ-e Azal as their leader. Then Ṣobḥ-e Azal's half-brother, BAHĀʾ ULLĀH, privately declared himself to be the prophet whose coming the Bāb had foretold. The Azalīs rejected him, but most Bābīs followed him, establishing the BAHĀʾĪ faith in 1867. Now located almost exclusively in Iran, the Azalīs probably number no more than a few thousand.

Azaña \ə-'thän-yə\ **(y Díaz), Manuel** (b. Jan. 10, 1880, Alcalá de Henares, Spain—d. Nov. 4, 1940, Montauban, France) Spanish prime minister and president. As prime minister from 1931 to 1933, he attempted to fashion a moderately liberal government. Elected president in May 1936, he was able to accomplish little before the SPANISH CIVIL WAR broke out in July. He lost control of policy and remained in office as only a figurehead until 1939, when he went into exile following the victory of the Nationalist forces of FRANCISCO FRANCO.

Azande See ZANDE

Azerbaijan \ˌa-zər-bī-'jän\ *officially* **Republic of Azerbaijan** Country, Transcaucasia, western Asia. Area: 33,400 sq mi (86,600 sq km). Population (2005 est.): 8,381,000. Capital: BAKU. Most residents are of Turkic origin, dating from the 11th century AD. Later migrations during the SELJŪQ period brought further groups, including some speaking Persian; Russians are a decreasing minority. Languages: Azerbaijanian (official), Russian. Religion: Islam (mostly Shīʿite). Currency: manat. Azerbaijan is characterized by a variety of landscapes. More than two-fifths of its territory is lowlands, while areas above 5,000 ft (1,500 m) occupy some one-tenth of the total area. The central part of the country is a plain through which flows the KURA RIVER and its tributaries, including the Aras, whose upper course forms part of the boundary with Iran. The CASPIAN SEA serves Baku as a trade outlet. Agriculture, petroleum refining, and light manufacturing are economically important. Azerbaijan is a republic with one legislative body; its head of state and government is the president, assisted by the prime minister. Azerbaijan adjoins the Iranian region of the same name, and the origin of their respective inhabitants is the same. By the 9th century AD it had come under Turkish influence, and in ensuing centuries it was fought over by Arabs, Mongols,

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Turks, and Iranians. Russia acquired what is now independent Azerbaijan in the early 19th century. After the Russian Revolution of 1917, Azerbaijan declared its independence; it was subdued by the Red Army in 1920 and was incorporated into the Soviet Union. It declared independence from the collapsing Soviet Union in 1991. Azerbaijan has two geographic peculiarities. The exclave Naxçivan (Nakhichevan) is separated from the rest of Azerbaijan by Armenian territory. Nagorno-Karabakh, which lies within Azerbaijan and is administered by it, has a Christian Armenian majority. Azerbaijan and Armenia went to war over both territories in the 1990s, causing many deaths and great economic disruption. Though attempts at mediation were made, the political situation remained unresolved.

Azhar \'äz-ˌhär\ **University, al-** Chief school of Islamic and Arabic learning in the world, centred on the al-Azhar Mosque in the medieval quarter of Cairo. It was founded by the Fāṭimid dynasty in 970. The basic program has always focused on Islamic law, theology, and the Arabic language. Philosophy and medical studies were added during the Middle Ages but were eventually dropped from the curriculum. Philosophy was restored at the end of the 19th century, and social sciences were added at a branch campus in the early 1960s. Women were first admitted in 1962.

Azikiwe \ə-'zik-wā**, Nnamdi** (b. Nov. 16, 1904, Zungeru, Nigeria—d. May 11, 1996, Enugu) First president (1963–66) of independent Nigeria. Azikiwe's National Council party won the important 1959 federal elections and helped stimulate Nigerian independence. In the conflict over Biafra (1967–70), Azikiwe first backed his fellow Igbo but then threw his support to the federal government. Thereafter he was a leading opponent of the ruling party.

azimuth See altitude and azimuth

azo \'ā-zō\ **dye** Any of a large class of synthetic organic compounds, dyes containing two nitrogen atoms joined by a double bond (see bonding, covalent bond) in the form —N═N— as part of their molecular structure. More than half the dyes in commercial use are azo dyes. They are usually classed according to the fibres for which they are useful or the methods by which they are applied; direct dyes are absorbed from solution by the fibres, but others require a second solution (a mordant) or a second step before the colour is fast.

Azores \ə-'zōrz\ *Portuguese* **Açores** \ə-'sō-rish\ Archipelago (pop., 2001: 242,073), northern Atlantic Ocean, constituting an autonomous region of Portugal. Its islands are Flores, Corvo, Terceira, São Jorge, Pico, Faial, Graciosa, São Miguel, and Santa Maria; the capital is Ponta Delgada (on São Miguel). It covers an area of 901 sq mi (2,333 sq km). Subject to earthquakes and volcanic eruptions, the islands lie some 1,000 mi (1,600 km) west of mainland Europe. The uninhabited Azores were reputedly discovered c. 1427 by Portuguese pilot Diogo de Sevilha. Settlement began c. 1432; by the end of the 15th century, all the islands were inhabited and trade with Portugal was well established. They were subject to Spain in 1580–1640, and a famous sea battle between the British and Spanish occurred off Flores in 1591. The Portuguese installed a governor and captain general for the whole group in 1766; the islands were given limited autonomy in 1895. Important air and naval bases were set up there during World War II; in 1951 the U.S. established a NATO base on Lajes.

Azov \ə-'zȯf, 'ā-ˌzȯf**, Sea of** Inland sea in Europe between Ukraine and Russia. It is connected to the Black Sea by Kerch Strait. About 210 mi (340 km) long and 85 mi (135 km) wide, it occupies an area of 14,500 sq mi (37,600 sq km). With a maximum depth of only about 46 ft (14 m), it is the world's shallowest sea. It is fed by the Don and Kuban rivers, and at their entrance in the Taganrog Gulf, its depth is 3 ft (1 m) or less. In the west lies the Arabat Spit, a 70-mi- (113–km-) long sandbar that separates the Sea of Azov from the Syvash, a system of marshy inlets dividing the Crimean Peninsula from the Ukrainian mainland.

AZT *in full* **azidothymidine** *also known as* **zidovudine** Drug that has had success in delaying the development of AIDS in patients with HIV. Since its introduction in the mid 1980s, it has prolonged the lives of millions of patients. It is particularly effective in preventing transmission of HIV from infected pregnant women to their fetuses. Since it has a greater effect on the replication of viruses than of body cells, it has fewer side effects than most other AIDS drugs, though many patients nevertheless cannot tolerate it. Because HIV rapidly becomes resistant to any single antiretroviral drug, AZT is usually given in combination with other drugs.

Aztec Nahuatl-speaking people who in the 15th and early 16th centuries ruled a large empire in what is now central and southern Mexico. They may have originated on the northern Mexican plateau before migrating to their later location. Their migration may have been linked to the collapse of the Toltec civilization. The Aztec empire, which at its height comprised roughly five to six million people spread over some 80,000 sq mi (200,000 sq km), was made possible by their successful agricultural methods, including intensive cultivation, irrigation, and reclamation of wetlands. The Aztec state was despotic, militaristic, and sharply stratified according to class and caste. Aztec religion was syncretic, drawing especially on the beliefs of the Maya. The Aztec practiced human sacrifice, an activity that sometimes reached mass proportions. The empire came to an end when the Spanish conquistador Hernán Cortés took the emperor Montezuma II prisoner and conquered the great city Tenochtitlán (modern Mexico City). See also Nahua.

Aztec Ruins National Monument Archaeological site, northwestern New Mexico, U.S. Located on the Animas River just north of the town of Aztec, it was established in 1923 and has an area of 0.5 sq mi (1.3 sq km). Mistakenly named by early settlers, the site actually contains the excavated ruins of a 12th-century Pueblo town. It was designated a World Heritage site in 1987.

azulejo \ˌä-zü-'lā-hō\ Spanish and Portuguese glazed, polychromed tile produced from the 14th century. Introduced into Spain by the Arabs during the Moorish occupation, azulejos were used in Islamic architecture for facing walls and paving floors. Early designs were geometric and 5–6 in. (13–15 cm) square. In the 15th–16th centuries Portugal imported the tiles from Spain for use in religious and private buildings. The Portuguese exported them in the 17th century to the Azores, Madeira, and Brazil, and the Spaniards introduced them to their American colonies. In the 18th century, interiors and exteriors in Puebla, Mex., were covered with azulejos in brilliant colours on a scale unequaled elsewhere.

Azulejos from Seville, late 16th century; in the Museum Boymans-van Beuningen, Rotterdam

BY COURTESY OF MUSEUM BOYMANS-VAN BEUNINGEN, ROTTERDAM

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B-17 *or* **Flying Fortress** U.S. heavy BOMBER used in World War II. Designed by the Boeing Aircraft Co. in 1934, it cruised at 35,000 ft (10,700 m) at a maximum speed of 287 mph (462 kph). It was called the Flying Fortress because of the .50-caliber MACHINE GUNS, 13 in all, at every corner. It could carry 3 tons (2.7 metric tons) of bombs in its bays and more on racks under its wings. More than 12,000 B-17s were produced during World War II, and most were used for high-level bombing over Europe.

B-52 *or* **Stratofortress** U.S. long-range heavy BOMBER, designed in 1948 by the Boeing Company and first flown in 1952. Originally intended as an atomic-bomb carrier capable of reaching the Soviet Union, it has proved highly adaptable and has remained in service as a conventional bomber, cruise-missile carrier, and maritime reconnaissance platform. It has a wingspan of 185 ft (56 m) and a length of more than 160 ft (49 m). Powered by eight JET ENGINES, its maximum speed at 55,000 ft (17,000 m) is 595 mph (960 kph).

B

B cell One of the two types of LYMPHOCYTES (the others being T CELLS). All lymphocytes begin their development in the BONE MARROW. B cells are involved in so-called humoral IMMUNITY; on encountering a foreign substance (ANTIGEN), the B lymphocyte differentiates into a plasma cell, which secretes immunoglobulin (see ANTIBODY).

Baader-Meinhof Gang \'bä-dər-'mīn-ˌhōf\ *or* **Red Army Faction** West German leftist terrorist group formed in 1968 and popularly named after two of its early leaders, Andreas Baader (1943–1977) and Ulrike Meinhof (1934–1976). The members initially supported themselves by bank robberies and engaged in terrorist bombings and arson, especially of West German and U.S. targets in West Germany. Baader, Meinhof, and 18 others were arrested in 1972; Meinhof eventually hanged herself, and Baader apparently also died a suicide. By the mid-1970s the group had turned to international terrorism; two members took part in the 1976 Palestinian airplane hijacking in the ENTEBBE INCIDENT. After the collapse of communism in East Germany (1989–90), it was discovered that East Germany's secret police had provided training and supplies to the gang. The group announced an end to its terrorist campaign in 1992.

Baal \'bāl\ God worshiped in many ancient Middle Eastern communities, especially among Canaanites, for whom he was a fertility deity. In the mythology of CANAAN, he was locked in combat with Mot, the god of death and sterility; depending on the outcome of their struggles, seven-year cycles of fertility or famine would ensue. Baal was also king of gods, having seized the kingship from the sea god, Yamm. Baal worship was popular in Egypt from the later New Kingdom to its end (1400–1075 BC). The ARAMAEANS used the Babylonian pronunciation BEL; Bel became the Greek Belos, identified with ZEUS. The OLD TESTAMENT often refers to a specific local Baal or multiple Baalim.

ba'al shem \bäl-'shām\ In JUDAISM, a title bestowed on men who worked wonders and cures through secret knowledge of the names of God. The practice dates to the 11th century, long before the term was applied to certain rabbis and Kabbalists. They were numerous in 17th- and 18th-century eastern Europe, where they exorcised demons, inscribed amulets, and performed cures using herbs, folk remedies, and the TETRAGRAMMATON. Because they combined faith healing with use of the KABBALA, they clashed with physicians, rabbis, and followers of the HASKALA. See also BA'AL SHEM TOV.

Ba'al Shem Ṭov \'bāl-'shem-'tȯv\ *orig.* **Israel ben Eliezer** (b. c. 1700, probably Tluste, Podolia, Pol.—d. 1760, Medzhibozh) Charismatic founder of HASIDISM (c. 1750). An orphan, he worked in synagogues and yeshivas, and when he retired to the Carpathian Mountains to engage in mystical speculation he gained a reputation as a BA'AL SHEM, or healer. From c. 1736 he lived in the village of Medzhibozh and devoted himself to spiritual pursuits. He was widely known as the Besht, an acronym of Ba'al Shem Ṭov. He rejected the asceticism of older rabbis and focused on communion with God, service of God in everyday tasks, and rescue of the sparks of divinity that, according to the KABBALA, are trapped in the material world. His discourses during Sabbath meals have been preserved; he left no writings of his own. He made a point of conversing with simple working people. Hasidism brought about a social and religious upheaval in Judaism, establishing a mode of worship marked by new rituals and religious ecstasy.

Baalbeck \'bā-əl-ˌbek, 'bäl-ˌbek\ *or* **Baalbek** *Arabic* **Ba'labakk** Large archaeological complex, eastern LEBANON. In ancient times it was a great city built on the lower western slope of the ANTI-LEBANON MOUNTAINS. Its identification with the worship of BAAL, a Semitic sun-god, gave rise to its Greek name, Heliopolis. It was made a Roman colony by the emperor Augustus Caesar. In AD 637 it came under Arab control and was administered by Muslim rulers from Syria until the 20th century. After World War I (1914–18) the French mandatory authorities made it part of Lebanon. The area in and around the city is noted for its extensive ruins, including temples of Jupiter, Bacchus, and Venus, town walls, Roman mosaics, a mosque, and Arab fortifications. The complex was designated a UNESCO WORLD HERITAGE SITE in 1984. The modern town (pop. 2002 est.: 29,200) is a regional urban centre.

Baath Party See BA'TH PARTY

Báb \'bäb**, the** *orig.* **Mīrzā 'Alī Muḥammad of Shīrāz** (b. Oct. 20, 1819, or Oct. 8, 1820, Shīrāz, Iran—d. July 9, 1850, Tabriz) Iranian religious leader who founded the Bābī religion and was one of the central figures of BAHĀ'Ī. The son of a merchant, he was influenced by the Shaykhī school of SHI'ITE Islam. In 1844 he wrote a commentary on the SŪRAH of JOSEPH in the Qur'ān and declared himself the Báb (Arabic: "Gateway") to the hidden IMAM. Later he would claim to be the imam himself, and finally a divine manifestation. The same year he assembled 18 disciples, who spread the new faith in the various Persian provinces. He had popular support but was opposed by members of the religious class, and he was arrested near Tehrān in 1847 and imprisoned. Meeting at Badasht in 1848, his followers, the AZALĪ, formally broke with Islam. The Báb was executed by a firing squad at Tabriz in 1850.

Bab el-Mandeb See MANDEB, STRAIT OF

Babbage \'bab-ij**, Charles** (b. Dec. 26, 1791, London, Eng.—d. Oct. 18, 1871, London) British mathematician and inventor. Educated at Cambridge University, he devoted himself from about 1812 to devising machines capable of calculating mathematical tables. His first small calculator could perform certain computations to eight decimals. In 1823 he obtained government support for the design of a projected machine with a 20-decimal capacity. In the 1830s he developed plans for the so-called Analytical Engine, capable of performing any arithmetical operation on the basis of instructions from punched cards, a memory unit in which to store numbers, sequential control, and most of the other basic elements of the present-day computer. The forerunner of the modern DIGITAL COMPUTER, the Analytical Engine was never completed. In 1991 British scientists built Difference Engine No. 2 (accurate to 31 digits) to Babbage's specifications. His other contributions included establishing the modern postal system in England, compiling the first reliable actuarial tables, and inventing the locomotive cowcatcher.

Charles Babbage, detail of an oil painting by Samuel Lawrence, 1845; in the National Portrait Gallery, London.

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Babbitt, Milton (Byron) (b. May 10, 1916, Philadelphia, Pa., U.S.) U.S. composer. At Princeton University he studied with composer ROGER SESSIONS and later joined the faculty. He became one of the first U.S. 12-tone composers, and he was (with his *Three Compositions for Piano*, 1947) perhaps the first composer to write totally serialized music based on ordered structures not only of pitch but of elements such as rhythm and dynamics. The first composer to work with RCA's Mark II synthesizer, he

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became one of the first Americans to write electronically synthesized music. He wrote various pieces combining live performers and tape.

Babel \'bä-bᵊl**, Isaak (Emmanuilovich)** (b. July 13, 1894, Odessa, Ukraine, Russian Empire—d. March 17, 1941, Siberia, Russia, U.S.S.R.) Russian short-story writer. Born Jewish in Ukraine, Babel grew up in an atmosphere of persecution that is reflected in his stories. Maksim Gorky encouraged him to travel abroad to expand his horizons. Out of his experience as a soldier in the war with Poland came the stories in *Red Cavalry* (1926). His *Odessa Tales* (1931) include realistic and humorous sketches of the Jewish ghetto outside Odessa. Initially well regarded in the Soviet Union, in the late 1930s Babel's writing was found incompatible with official literary doctrine. He was arrested in 1939 and died in a Siberian prison camp. He is one of Russia's greatest writers of short stories.

Babel \'bā-bəl, 'ba-bəl**, Tower of** In the Hebrew scriptures, a high tower built in Shinar (Babylonia). According to Genesis 11:1–9, the Babylonians wanted to build a tower "with its top in the heavens." Angry at their presumption, God disrupted the enterprise by confusing the languages of the workers so that they could no longer understand each other. The tower was left unfinished and the people dispersed over the face of the earth. The myth may have been inspired by a tower temple located north of the Marduk temple and known as Bab-ilu ("Gate of God").

"The Tower of Babel," oil painting by Pieter Bruegel the Elder, 1563; in the Kunsthistorisches Museum, Vienna
COURTESY OF THE KUNSTHISTORISCHES MUSEUM, VIENNA

Babenberg \'bä-bən-ˌberk**, House of** Austrian ruling house in the 10th–13th century. Leopold I of Babenberg became margrave of Austria in 976. The Babenbergs' power was modest until the 12th century, when they came to dominate the Austrian nobility. With the death of Duke Frederick II in 1246, the male line ended, and the family's power declined rapidly.

Babeuf \ba-'bəf**, François-Noël** (b. Nov. 23, 1760, Saint-Quentin, France—d. May 27, 1797, Vendôme) French political journalist and agitator. During the era of the French Revolution he advocated an equal distribution of land and income. For his part in a conspiracy to overthrow the Directory and institute a return to the Constitution of 1793, he was guillotined. His tactical strategies provided a model for left-wing movements of the 19th and 20th centuries.

Babeuf, engraving by an unknown artist, 18th century
COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS

Babington, Anthony (b. October 1561, Dethick, Derbyshire, Eng.—d. Sept. 20, 1586, London) English conspirator. Raised secretly as a Catholic, Babington was joined by the priest John Ballard in the unsuccessful "Babington Plot" to assassinate Queen Elizabeth I and install her prisoner, Mary, Queen of Scots, on the English throne. The conspiracy included many Roman Catholics, and Philip II of Spain promised to provide immediate assistance after the assassination. Babington was imprisoned and executed after the interception of an exchange of letters with Mary explaining his plans. The letters were also used as evidence supporting the execution of Mary the following year.

Bābism \'bab-ˌiz-əm\ Religion that developed in Iran around Mīrzā ʿAlī Muḥammad's claim (1844) to be the Bāb. Its beliefs are set forth in the *Bayān*, a holy book written by the Bāb, which proclaims a universal law in place of all existing religious legal codes. Bābism originated as a messianic movement in Shiʿite Islam. In 1867 the movement split, with the Azalīs remaining faithful to the original teachings of the Bāb and those of his successor Ṣobḥ-e Azal. Most Bābīs accepted the leadership of Ṣobḥ-e Azal's half-brother Bahāʾ Ullāh, and under him the Bahāʾī faith was developed.

baboon Any of five species of robust monkeys (genus *Papio*) of Arabia and sub-Saharan Africa. Baboons have a large head, cheek pouches, and a long, doglike muzzle. They walk on all fours, carrying the tail in a characteristic arch. They weigh 30–90 lbs (14–40 kg) and are about 20–45 in. (50–115 cm) long, excluding the tail (18–28 in., or 45–70 cm, long). Found mainly in drier savanna and rocky areas, they feed on a variety of plants and animals. Highly social and intelligent, they travel in large noisy troops, communicating by calls. They may destroy crops, and their enormous canine teeth and powerful limbs make them dangerous opponents.

Anubis, or olive, baboon (*Papio anubis*).
NORMAN MYERS/PHOTO RESEARCHERS

Bābur \'bä-bər\ *orig.* **Ẓahīr al-Dīn Muḥammad** (b. Feb. 15, 1483, principality of Fergana—d. Dec. 26, 1530, Agra, India) Emperor (1526–30) and founder of the Mughal dynasty of India. A descendant of Genghis Khan and Timur, he came from a tribe of Mongol origin but was Turkish in language and upbringing. In his youth he tried for 10 years (1494–1504) to gain control of Samarkand, Timur's old capital. Those efforts ended in his losing his own principality in Fergana (modern Uzbekistan), but he consoled himself by seizing and holding Kabul (1504). After four failed attempts, he successfully occupied Delhi (1525). Surrounded by enemy states, Bābur (the name means "Tiger") persuaded his homesick troops to stand their ground, and over the next four years he defeated his foes. His grandson Akbar consolidated the new empire. Bābur was also a gifted poet and a lover of nature who constructed gardens wherever he went. The *Bābur-nāmeh*, his prose memoirs, has become a world classic of autobiography.

Babuyan \ˌbä-bü-'yän\ **Islands** Island group, northern Philippines. Lying north of Luzon, it consists of about 24 islands with a total area of 225 sq mi (583 sq km). The chief islands are Babuyan, Camiguin, Calayan, Fuga, and Dalupiri. Calayan is the largest town and only port.

baby boom In the U.S., increase in the birth rate between 1946 and 1964; also, the generation born in the U.S. during that period. The hardships and uncertainties of the Great Depression and World War II led many unmarried couples to delay marriage and many married couples to delay having children. The war's end, followed by a sustained period of economic prosperity (the 1950s and early 1960s), was accompanied by a surge in population. The sheer size of the baby-boom generation (some 75 million) magnified its impact on society: the growth of families led to a migration from cities to suburbs in the postwar years, prompting a building boom in housing, schools, and shopping malls. As the "boomers" reached young adulthood in the 1960s and '70s, their tastes in music and their hair and dress styles strongly influenced the national culture, and the political activism of some contributed to the unpopularity of the Vietnam War. As they aged and prospered in the 1980s and '90s, their buying habits determined the course of many consumer industries, including automobiles. The needs of baby boomers during their retirement years were expected to strain public resources.

Baby Yar \ˌbä-bē-'yär\ Large ravine near Kiev, Ukraine, the site of a mass grave of some 100,000 people killed by German Nazi SS squads between 1941 and 1943. Most of the victims were Jews, but some were

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communist officials and Russian prisoners of war. After the initial massacre of Jews, Baby Yar remained in use as an execution site for Soviet prisoners of war and for Roma (Gypsies) as well as for Jews. It became the symbol of the first stage of killing during the HOLOCAUST and of the massacres by the *Einsatzgruppen* (German: "deployment groups")—the mobile killing units. The site came to world attention after the 1961 publication of YEVGENY YEVTUSHENKO's poem *Baby Yar*. Though a small obelisk and memorial were erected in the 1960s and '70s, not until 1991 was the identity of the Jewish victims recorded on the monument by the newly independent Ukrainian government.

Babylon Ancient Middle Eastern city. The city's ruins are located about 55 mi (89 km) south of Baghdad, near the modern city of Al-Ḥillah, Iraq. Babylon was one of the most famous cities in antiquity. Probably first settled in the 3rd millennium BC, it came under the rule of the Amorite kings around 2000 BC. It became the capital of BABYLONIA and was the chief commercial city of the TIGRIS and EUPHRATES river system. Destroyed by SENNACHERIB in 689 BC, it was later rebuilt. It attained its greatest glory as capital of the Neo-Babylonian empire under NEBUCHADREZZAR II (r. 605–c. 561 BC). ALEXANDER THE GREAT, who took the city in 331 BC, died there. Evidence of its topography comes from excavations, cuneiform texts, and descriptions by the Greek historian HERODOTUS. Most of the ruins are from the city built by Nebuchadrezzar. The largest city in the world at the time, it contained many temples, including the great temple of MARDUK with its associated ZIGGURAT, which was apparently the basis for the story of the Tower of BABEL. The Hanging Gardens, a simulated hill of vegetation-clad terracing, was one of the SEVEN WONDERS OF THE WORLD.

Babylonia Ancient cultural region of the TIGRIS and EUPHRATES river system. The area was divided into SUMER (southeast) and AKKAD (northwest) when the first Babylonian line of Amorite kings took power after 2000 BC. Largely because of the efforts of HAMMURABI (r. c. 1792–50 BC), Babylonia gained regional hegemony but declined after his death; the Kassites from the east eventually assumed power (c. 1595) and established a dynasty that lasted some four centuries. After ELAM conquered Babylonia (c. 1157 BC), a series of wars established a new Babylonian dynasty whose outstanding member was Nebuchadrezzar I (r. c. 1124–1103 BC). Following his rule, a three-way struggle developed for control of Babylonia among ASSYRIA, Aram (see ARAMAEANS), and CHALDEA, in which the Assyrians ruled the area most frequently (9th–7th century BC). In the 7th–6th centuries BC the Chaldean NEBUCHADREZZAR II (605–562 BC) instituted the last and greatest period of Babylonian supremacy, conquering SYRIA and PALESTINE and rebuilding BABYLON, the capital city. It was conquered in 539 BC by the Persian ACHAEMENIAN DYNASTY under CYRUS II and in 331 BC by ALEXANDER THE GREAT, after which the capital city was gradually abandoned.

Babylonian Exile *or* **Babylonian Captivity** Forced detention of Jews in Babylonia following Babylonian conquest of Judah in 598/597 and 587/586 BC. The first deportation may have occurred after King Jehoiachin was deposed in 597 BC or after NEBUCHADREZZAR destroyed JERUSALEM in 586. In 538 BC the Persian CYRUS II conquered Babylonia and allowed the Jews to return to Palestine. Some Jews chose to remain in Babylonia, initiating the Jewish DIASPORA. During the Babylonian Exile the Jews maintained their national spirit and religious identity despite cultural pressures in a foreign land, with EZEKIEL and other prophets keeping hope alive. PETRARCH and other writers designated the AVIGNON PAPACY as the Babylonian Captivity in the 14th century, and MARTIN LUTHER used the term in the title of one of his works attacking the PAPACY and the Roman Catholic church in the 16th century.

baby's breath Either of two species of herbaceous plants of the genus *Gypsophila* (PINK FAMILY), having profuse small blossoms. Both *G. elegans*, an annual, and *G. paniculata*, a perennial, are cultivated for their fine misty effect in rock gardens and flower borders and in floral arrangements. They are native to Eurasia.

Bacall, Lauren *orig.* **Betty Joan Perske** (b. Sept. 6, 1924, New York, N.Y., U.S.) U.S. actress. She worked as a model while seeking Broadway roles; her photograph on a magazine cover led to her casting in the film *To Have and Have Not* (1944) with HUMPHREY BOGART, whom she soon married. An instant success, she made three more films with Bogart: *The Big Sleep* (1946), *Dark Passage* (1947), and *Key Largo* (1948). She also appeared in such memorable films as *How to Marry a Millionaire* (1953) and *Murder on the Orient Express* (1974). On Broadway she won Tony Awards for her performances in *Applause* (1970), and *Woman of the Year* (1981).

baccarat Casino card game that resembles a simpler version of blackjack. In basic baccarat the house is the bank. In CHEMIN DE FER (a more advanced baccarat) the bank passes from player to player. In *punto banco*, it appears to pass from player to player but is actually held by the house. Casino play involves three or six 52-card decks shuffled together and dealt from a shoe (a box designed to hold several decks of playing cards). Counting spot-cards at face value and face-cards and 10s as 0, the bettor's aim is to receive cards that are closer to totaling 9 than those of the banker. For the purpose of totaling these cards, 10 or more counts only as its last digit (for instance, 17 is counted as 7). The banker deals two cards to the bettor and to himself.

Baccarat glass Glassware manufactured since 1765 in Baccarat, France. The firm originally produced soda glass for windows and industrial use. In 1816 it was acquired by a Belgian manufacturer of lead crystal; since then it has specialized in this type of glass, especially paperweights. Baccarat exhibited works in the important 1925 Exposition des Arts Décoratifs et Industriels Modernes in Paris. Today the company produces tableware in both historical and modern designs.

Bacchanalia \ˌba-kə-ˈnāl-yə\ *or* **Dionysia** In Greco-Roman religion, any of the festivals of the wine god Bacchus (DIONYSUS), which probably originated as fertility rites. The most famous Greek festivals included the Greater Dionysia, with its dramatic performances; the ANTHESTERIA; and the Lesser Dionysia, characterized by simple rites. Bacchanalia were introduced from lower Italy into Rome, where they were at first secret, open only to women, and held three times a year. They later admitted men and became as frequent as five times a month. In 186 BC their reputation as orgies led the Senate to prohibit them throughout Italy, except in special cases.

bacchantes See MAENADS AND BACCHANTES

Bacchus See DIONYSUS

Bach, Alexander, baron von (b. Jan. 4, 1813—d. 1893) Austrian politician noted for instituting a system of centralized control. He served as minister of the interior (1849–59); after the death of Felix, prince zu SCHWARZENBERG in 1852, he largely dictated policy in the regime. Bach centralized administrative authority for the Austrian Empire, but he also endorsed reactionary policies that reduced freedom of the press and abandoned public trials.

Bach, Carl Philipp Emanuel (b. March 8, 1714, Weimar, Saxe-Weimar—d. Dec. 14, 1788, Hamburg) German composer. Second son of JOHANN SEBASTIAN BACH, he received a superb musical education from his father. In 1740 he became harpsichordist at the court of FREDERICK II the Great, where he remained for 28 years, after which he moved to Hamburg to take the city's leading musical position. He was a leader of the *Empfindsamkeit* ("sensitivity") movement, which emphasized rhapsodic freedom and sentiment. A founder of the Classical style, he is one of the first composers in whose works SONATA FORM becomes clearly evident. He wrote some 200 works for harpsichord, clavichord, and piano (including dozens of sonatas), some 50 keyboard concertos, many symphonies, and several oratorios and Passions. His *Essay on the True Manner of Playing Keyboard Instruments* (1753) was a highly important practical music treatise.

C.P.E. Bach, engraving by A. Stöttrup
COURTESY OF HAAGS GEMENTEMUSEUM, THE HAGUE

Bach, Johann Christian (b. Sept. 5, 1735, Leipzig—d. Jan. 1, 1782, London, Eng.) German-born British composer. Youngest son of JOHANN SEBASTIAN BACH, he studied with his brother CARL PHILIPP EMANUEL BACH in Berlin before moving to Italy. In 1762 he became composer to the King's Theatre in London, where he would remain the rest of his life, becoming music teacher to the queen, and later the impresario (with Karl Friedrich Abel) of an important series of concerts (1765–81). He wrote some 50 symphonies, some 35 keyboard concertos, and much chamber music. His music, melodious and well formed but far from profound and with no

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trace of his father's influence, became an important prototype of the Classical style and influenced Wolfgang Amadeus Mozart.

Bach, Johann Sebastian (b. March 21, 1685, Eisenach, Thuringia, Ernestine Saxon Duchies—d. July 28, 1750, Leipzig) German composer. Born to a musical family, he became a superbly well-rounded musician; from 1700 he held positions as singer, violinist, and organist. His first major appointment, in 1708, was as organist at the ducal court at Weimar. This was followed by a six-year stay (1717–23) as kapellmeister at the princely court of Köthen, which was in turn followed by his appointment as cantor at the great church of St. Thomas in Leipzig, where he would remain for the rest of his life. Imbued with the northern German contrapuntal style (see counterpoint) from early childhood, he encountered the lively Italian style, especially in the works of Antonio Vivaldi, about 1710, and much of his music embodies an immensely convincing melding of the two styles. At St. Thomas he wrote more than 200 church cantatas. His orchestral works include the six *Brandenburg Concertos*, four orchestral suites, and many harpsichord concertos, a genre he invented. His solo keyboard works include the great didactic set *The Well-Tempered Clavier* (1722 and 1742), the superb *Goldberg Variations* (1742), the massive but unfinished *Art of the Fugue* (1749), numerous suites, and many organ preludes and fugues. His surviving choral works include (in addition to the sacred cantatas) more than 30 secular cantatas, two monumental Passions, and the *Mass in B Minor*. His works, never widely known in his lifetime, went into near-total eclipse after his death, and only in the early 19th century were they revived, to enormous acclaim. He was perhaps the most accomplished organist and harpsichordist of his time. Today Bach is regarded as the greatest composer of the Baroque era, and, by many, as the greatest composer of all time.

Bach, Wilhelm Friedemann (b. Nov. 22, 1710, Weimar, Saxe-Weimar—d. July 1, 1784, Berlin) German composer and organist. Eldest son of Johann Sebastian Bach, he was trained by his father. One of the finest organists of his time, he held important organist posts in Dresden (1723–46) and Halle (1746–64) but thereafter lived an unsettled life and drifted into drinking and poverty. Though he was a highly gifted composer, his compositions veered confusingly between the old contrapuntal style and the new pre-Classical styles. He wrote more than 30 church cantatas, several keyboard concertos, and many solo keyboard works.

Bacharach \'bak-ə-ˌrak**, Burt** (b. May 12, 1928, Kansas City, Mo., U.S.) U.S. songwriter and pianist. He studied under Darius Milhaud, Bohuslav Martinů, and Henry Cowell. In the 1950s he wrote arrangements for Steve Lawrence and Vic Damone and later toured with Marlene Dietrich. In the late 1950s he began his long association with lyricist Hal David (b. 1921), which would produce many hits especially for singer Dionne Warwick (b. 1940), including "Walk On By," "I Say a Little Prayer," and "Do You Know the Way to San Jose?" He and David wrote the successful musical *Promises, Promises* (1968) and the score for the film *Butch Cassidy and the Sundance Kid* (1969, Academy Award). Bacharach collaborated with singer-songwriter Elvis Costello (b. 1954) on the album *Painted from Memory* (1998).

Bachchan, Amitabh (b. Oct. 11, 1942, Allahabad, India) Indian film actor. Bachchan's first film success was *Zanjeer* (1973); by the end of the 1970s he was something of a cultural phenonemon in India and was regarded as the most popular star in the history of Indian films. He is often compared to such American action stars as Clint Eastwood, although Bachchan's talents also extend to singing, dancing, and comedy. After a brief stint in politics in the mid 1980s, Bachchan gained a new generation of fans in the next decade as host of the television game show *Kaun banega crorepati*, the Indian version of the U.S. and U.K. hit *Who Wants to Be a Millionaire?*

bachelor's button *or* **cornflower** Herbaceous, hardy annual plant (*Centaurea cyanus*) of the composite family, having flower heads with blue, pink, or white rays. It is native to the Mediterranean region and widely cultivated in North America. A common garden plant, it often also appears as a weed.

bacillus \bə-'si-ləs\ Any of the rod-shaped, gram-positive bacteria (see gram stain) that make up the genus *Bacillus*, widely found in soil and water. The term is sometimes applied to all rodlike bacteria. Bacilli frequently occur in chains and can form spores under unfavourable environmental conditions. Resistant to heat, chemicals, and sunlight, these spores may remain capable of growing and developing for long periods of time. One type sometimes causes spoilage in canned foods. Another, widespread bacillus contaminates laboratory cultures and is often found on human skin. Most strains do not cause disease in humans, infecting them only incidentally in their role as soil organisms; a notable exception is *B. anthracis*, which causes anthrax. Some bacilli produce antibiotics.

backbone See vertebral column

backgammon Two-person game played by moving counters (called stones) on a board or table, the movement of the counters being controlled by the throw of two dice. The board has four sections (called tables), each marked with six narrow wedges (points) in two alternating colors. Representing the two opposing sides are 15 white and 15 black stones. Stones are moved from point to point in opposite directions according to the number of points shown on the dice. On getting all 15 of his stones into his own home (inner) table, a player may begin "bearing off"—moving his stones to an imaginary point beyond the edge of the board. The player who first bears off all 15 stones wins the game. Backgammon is one of the most ancient board games, dating from 3000 BC.

backpacking Sport of hiking while carrying clothing, food, and camping equipment in a pack on the back. In the early 20th century backpacking was primarily a means of getting to wilderness areas inaccessible by car or by day hike. It subsequently became associated with general touring by foot in urban as well as wilderness settings. Types of packs range from the frameless rucksack to the contour frame pack, with a frame of aluminum tubing and often a waistband that transfers most of the pack's weight to the hips.

Backus, John W(arner) (b. Dec. 3, 1924, Philadelphia, Pa., U.S.) U.S. mathematician. He received his bachelor's and master's degrees from Columbia University. He was head of a small group that in 1957 developed the computer language FORTRAN for numerical analysis. He contributed to the development of ALGOL and developed a notation known as the Backus Normal, or Backus-Naur, Form for defining the syntax of a programmable language (1959). He received the Turing Award in 1977.

Bacolod \bə-'kō-ˌlȯd\ City (pop., 2000: 429,076), south-central Philippines. It lies on the Guimaras Strait in the north of the island of Negros, opposite Guimaras Island. It is regarded as the Philippine sugar capital. Its port, to the south, is important for fishing.

Bacon, Francis (b. Oct. 28, 1909, Dublin, Ire.—d. April 28, 1992, Madrid, Spain) Irish-British painter. He lived in Berlin and Paris before settling in London (1929) to begin a career as an interior decorator. With no formal art training, he started painting, drawing, and participating in gallery exhibitions, with little success. In 1944 he achieved instant notoriety with a series of controversial paintings, *Three Studies for Figures at the Base of a Crucifixion*. His mature style emerged completely with the series of works known as "The Screaming Popes" (1949–mid-1950s), in which he converted Diego Velázquez's famous *Portrait of Pope Innocent X* into a nightmarish icon of hysterical terror. Most of Bacon's paintings depict isolated figures, often framed by geometric constructions, and rendered in smeared, violent colours. His imagery typically suggests anger, horror, and degradation.

Bacon, Francis, Viscount St. Albans (b. Jan. 22, 1561, London, Eng.—d. April 9, 1626, London) British statesman and philosopher, father of modern scientific method. He studied at Cambridge and at Gray's Inn. A supporter of the Earl of Essex, Bacon turned against him when Essex was tried for treason. Under James I he rose steadily, becoming successively solicitor general (1607), attorney general (1613), and lord chancellor (1618). Convicted of accepting bribes from those being tried in his court, he was briefly imprisoned and permanently lost his public offices; he died deeply in debt. He attempted to put natural science on a firm empirical foundation in the *Novum Organum* (1620), which sets forth his scientific method. His elaborate classification of the sciences inspired the 18th-century French Encyclopedists (see Encyclopédie), and his empiricism inspired 19th-century British philosophers of science. His other works include *The Advancement of Learning* (1605), *History of Henry VII* (1622), and several important legal and constitutional works.

Bacon, Nathaniel (b. Jan. 2, 1647, Suffolk, Eng.—d. October 1676, Virginia Colony) British-born American colonial planter, leader of Bacon's Rebellion. He emigrated from England in 1673 and acquired land in Virginia, where he was appointed to the council of William Berkeley, the British governor. After a dispute over Indian policy, he defied Berkeley's orders and organized an expedition against the Indians in 1676. He then

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turned his forces against Berkeley, captured Jamestown, and briefly controlled most of Virginia. His death at age 29 of influenza, at the height of his power, ended the rebellion.

Nathaniel Bacon, detail of an engraving
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Bacon, Roger (b. c. 1220, Ilchester, Somerset, or Bisley, Gloucester?, Eng.—d. 1292, Oxford) English scientist and philosopher. He was educated at Oxford and the University of Paris and joined the Franciscan order in 1247. He displayed a prodigious energy and zeal in the pursuit of experimental science; his studies eventually won him a place in popular literature as a worker of wonders. He was the first European to describe in detail the process of making gunpowder, and he proposed flying machines and motorized ships and carriages. He therefore represents a historically precocious expression of the empirical spirit of experimental science, even though his actual practice of it seems to have been exaggerated. His philosophical thought was essentially Aristotelian, though he was critical of the methods of theologians such as Albertus Magnus and Thomas Aquinas, arguing that a more accurate experimental knowledge of nature would be of great value in confirming the Christian faith. He also wrote on mathematics and logic. He was condemned to prison c. 1277 by his fellow Franciscans because of "suspected novelties" in his teaching.

bacteremia \ˌbak-tē-ˈrē-mē-ə\ Presence of bacteria in the blood. Short-term bacteremia follows dental or surgical procedures, especially if local infection or very high-risk surgery releases bacteria from isolated sites. In some cases, prior antibiotic therapy can prevent this. It causes little problem to a healthy immune system but can be serious for those with prostheses (where infection can center) or high susceptibility to bacterial invasion. Extensive bacteremia can release toxins into the blood (septicemia), leading to shock and vascular collapse. Antibiotic-resistant bacteria have increased the rate of severe bacteremia.

bacteria Group of microscopic, single-celled organisms that are prokaryotes. They may have spherical, rodlike, or spiral shapes. They inhabit virtually all environments, including soil, water, organic matter, and the bodies of multicellular animals. Different types are distinguished in part by the structure of their cell walls, which is determined by Gram stain. Many bacteria swim by means of flagella (see flagellum). The DNA of most bacteria is found in a single circular chromosome and is distributed throughout the cytoplasm rather than contained within a membrane-enclosed nucleus. Though some bacteria can cause food poisoning and infectious diseases in humans, most are harmless and many are beneficial. They are used in various industrial processes, especially in the food industry (e.g., the production of yogurt, cheeses, and pickles). Bacteria are divided into eubacteria and archaebacteria. See also budding bacteria, coliform bacteria, cyanobacteria, denitrifying bacteria, nitrifying bacteria, sheathed bacteria, sulfur bacteria.

bacterial diseases Diseases caused by bacteria. The most common infectious diseases, they range from minor skin infections to bubonic plague and tuberculosis. Until the mid-20th century, bacterial pneumonia was probably the leading cause of death among the elderly. Improved sanitation, vaccines, and antibiotics have all decreased the mortality rates from bacterial infections, though antibiotic-resistant strains have caused a resurgence in some illnesses. Bacteria cause disease by secreting or excreting toxins (as in botulism), by producing toxins internally, which are released when the bacteria disintegrate (as in typhoid), or by inducing sensitivity to their antigenic properties (as in tuberculosis). Other serious bacterial diseases include cholera, diphtheria, bacterial meningitis, and syphilis.

bacteriology Study of bacteria. Modern understanding of bacterial forms dates from Ferdinand Cohn's classifications. Other researchers, such as Louis Pasteur, established the connection between bacteria and fermentation and disease. The modern methods of bacteriological technique began in the late 19th century with the use of stains and the development of methods of cultivating organisms on plates of nutrients. Important discoveries came when Pasteur succeeded in immunizing animals against two bacterial diseases, which led to the development of immunology. See also microbiology.

bacteriophage \bak-ˈtir-ē-ə-ˌfāj\ *or* **phage** Any of a group of usually complex viruses that infect bacteria. Discovered in the early 20th century, bacteriophages were used to treat human bacterial diseases such as bubonic plague and cholera but were not successful; they were abandoned with the advent of antibiotics in the 1940s. The rise of drug-resistant bacteria in the 1990s focused renewed attention on the therapeutic potential of bacteriophages. Thousands of varieties exist, each of which may infect only one or a few types of bacteria. The core of a bacteriophage's genetic material may be either DNA or RNA. On infecting a host cell, bacteriophages known as lytic or virulent phages release replicated viral particles by lysing (bursting) the host cell. Other types, known as lysogenic or temperate, integrate their nucleic acid into the host's chromosome to be replicated during cell division. During this time they are not virulent. The viral genome may later become active, initiating production of viral particles and destruction of the host cell. A.D. Hershey and Martha Chase used a bacteriophage in a famous 1952 experiment that supported the theory that DNA is the genetic material. Because bacteriophage genomes are small and because large quantities can be prepared in the laboratory, they are a favourite research tool of molecular biologists. Studies of phages have helped illuminate genetic recombination, nucleic acid replication, and protein synthesis.

Bactria Ancient country, Central Asia. It was situated between the Hindu Kush and the Amu Darya in parts of modern Afghanistan, Uzbekistan, and Tajikistan. Its capital was the city of Bactra. From the 6th century BC it was controlled by the Achaemenian dynasty; conquered by Alexander the Great, the area was ruled after his death (323 BC) by the Seleucid dynasty and for a time (c. 250 BC) formed an independent kingdom. It was long important as a crossroads for overland trade and as a meeting place for various religious and artistic traditions. The area ultimately came under Muslim control in the 7th century AD.

Baden \ˈbäd-ᵊn\ Former German state, southern Germany. The name (meaning "baths") refers to the warm mineral springs, particularly in the town of Baden-Baden, valued since Roman times. Baden first became a political unit in 1112. Split up many times, the territory was finally reunited under Charles Frederick in 1771. A centre of 19th-century liberalism, it was active in the revolutions of 1848–50. It joined the German Empire in 1871 and became part of the Weimar Republic in 1919. After World War II, Baden was incorporated into West Germany as part of Baden-Württemberg state.

Baden and Rastatt, Treaties of See Treaties of Rastatt and Baden

Baden-Powell \ˈbā-dᵊn-ˈpō-əl\ **(of Gilwell), Robert Stephenson Smyth, 1st Baron** (b. Feb. 22, 1857, London, Eng.—d. Jan. 8, 1941, Nyeri, Kenya) British army officer and founder of the Boy Scouts and Girl Guides (later Girl Scouts; see scouting). He was noted for his use of observation balloons in warfare in Africa (1884–85). In the South African War, he became a national hero in the Siege of Mafikeng. Having learned that his military textbook *Aids to Scouting* (1899) was being used to train boys in woodcraft, he wrote *Scouting for Boys* (1908) and that same year established the Boy Scout movement. In 1910, with his sister Agnes and his wife, Olave, he founded the Girl Guides.

badger Any of eight species of stout-bodied carnivores (family Mustelidae) that possess an anal scent gland, powerful jaws, and large, heavy claws on their forefeet. Most species are brown, black, or gray, with markings on the face or body, and are found in South Asia. Badgers dig to find food and to construct burrows and escape routes. The American badger (*Taxidea taxus*), the only New World species, lives in the open, dry country of western North America. Badgers feed mostly on small animals, especially rodents. Species may be 9–12 in. (23–30 cm) high and 13–32 in. (33–81 cm) long, excluding the 2- to 10-in. (5– to 23-cm) tail, and may weigh 2–48 lbs (1–22 kg). Badgers can be savage fighters.

Badlands Barren region covering some 2,000 sq mi (5,200 sq km) of southwestern South Dakota, U.S. It has an extremely rugged landscape almost devoid of vegetation. It was created by cloudbursts that cut deep gullies in poorly cemented bedrock; its extensive fossil deposits have yielded the remains of such animals as the three-toed horse, camel, saber-toothed tiger, and rhinoceros. Badlands National Park (379 sq mi [982 sq

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km]), lying mostly between the Cheyenne and White rivers, was established as a national monument in 1939 and a national park in 1978.

badminton Court or lawn game played with light long-handled rackets and a shuttlecock volleyed over a net. The game is named after the residence of Britain's duke of Beaufort, where it supposedly originated c. 1873. Officially sanctioned badminton matches are played indoors to protect the shuttlecock from winds. Play consists entirely of hitting the shuttlecock back and forth without letting it touch the floor or ground. The best-known match is the All-England Championships. Badminton became a full-medal sport at the 1992 Olympics. The world governing body is the International Federation of Badminton in Cheltenham, Gloucestershire, Eng.

Badoglio \bə-'dōl-yō**, Pietro** (b. Sept. 28, 1871, Grazzano Monferrato, Italy—d. Nov. 1, 1956, Grazzano Badoglio) Italian general and politician. An army officer, he served as chief of the general staff in 1919–21 and again in 1925–28 and was made a field marshal in 1926. He governed Libya (1928–34) and commanded the Italian forces in Ethiopia (1935–36). In 1940 he resigned as chief of staff in disagreement with Benito Mussolini, and in 1943 he helped organize Mussolini's downfall. As prime minister (1943–44), Badoglio extricated Italy from World War II by arranging for an armistice with the Allies.

BAE Systems British manufacturer of aircraft, missiles, avionics, naval vessels, and other aerospace and defense products. BAE Systems was formed (1999) from the merger of British Aerospace (BAe) with Marconi Electronic Systems. BAe, in turn, dates to the merger (1977, with two other firms) of British Aircraft Corporation (BAC) and Hawker Siddeley Aviation, both having been nationalized a year earlier owing to unprofitable financial situations. Through its BAe antecedents, BAE Systems carries the legacy of some 20 British aircraft firms (e.g., Bristol, Avro, Gloster, De Havilland, Supermarine), several dating to the first decades of flight. In the 1960s and early '70s, BAC and Hawker Siddeley each produced significant aircraft. BAC built the Vickers-Armstrongs VC10 and BAC One-Eleven jetliners and, in partnership with Aerospatiale of France, the Concorde supersonic transport. Hawker Siddeley developed the HS 121 Trident jetliner, Vulcan bomber, and Harrier vertical/short-takeoff-and-landing (V/STOL) fighter. In 1979 British Aerospace joined the Airbus Industrie jetliner-manufacturing consortium, and during the early 1980s it became privatized. In the 1990s it became a partner with firms in Germany, Italy, and Spain in the Eurofighter Typhoon program. It also joined a venture led by Lockheed Martin to develop the Joint Strike Fighter.

Baeck \'bek**, Leo** (b. May 23, 1873, Lissa, Posen, Prussia—d. Nov. 2, 1956, London, Eng.) Prussian-Polish rabbi, spiritual leader of German Jewry during the Nazi period. After earning his Ph.D. in philosophy at the University of Berlin, he served as a rabbi in Silesia, Düsseldorf, and Berlin, becoming the leading liberal Jewish religious thinker of his time. He synthesized Neo-Kantianism and rabbinic ethics in *The Essence of Judaism* (1905) and considered the Christian gospels as rabbinic literature in *The Gospel as a Document of Jewish Religious History* (1938). He negotiated with the Nazis to buy time for the German Jews; finally arrested, he was sent to the Theresienstadt concentration camp, where he wrote and lectured on Plato and Immanuel Kant. Liberated in 1945 on the day before he was to be executed, he settled in England.

Karl Baedeker, oil painting by an unknown artist
POPPERFOTO

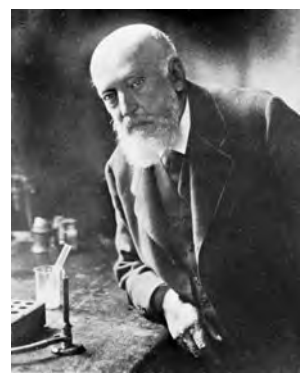
Baedeker \'bed-ə-kər**, Karl** (b. Nov. 3, 1801, Essen, Duchy of Oldenburg—d. Oct. 4, 1859, Koblenz, Prussia) German publisher. The son of a printer and bookseller, Baedeker started a firm at Koblenz in 1827 that became known for its guidebooks. His aim was to give travelers the practical information necessary to enable them to dispense with paid guides. A notable feature of the books was the use of "stars" to indicate objects and views of special interest and to designate reliable hotels. By the time of his death much of Europe had been covered by his guidebooks. Under the ownership of his sons the firm expanded to include French and English editions.

Baekeland \'bə-kə-ˌlänt,\ *English* \'bāk-lənd**, Leo (Hendrik)** (b. Nov. 14, 1863, Ghent, Belg.—d. Feb. 23, 1944, Beacon, N.Y., U.S.) Belgian-born U.S. industrial chemist. A teacher of chemistry in Belgium, he immigrated to the U.S. in 1889. He invented Velox, the first commercially successful photographic paper, which could be developed under artificial light, and sold the rights to George Eastman for $1 million in 1899. His search for a substitute for shellac led to the discovery in 1909 of a method of forming a hard thermosetting plastic, which he named Bakelite, produced from formaldehyde and phenol. His discovery helped found the modern plastics industry.

Baer \'ber**, Karl Ernst, knight von** (b. Feb. 29, 1792, Piep, Est., Russian Empire—d. Nov. 28, 1876, Dorpat, Est.) Prussian-born Estonian embryologist. Studying chick development with Christian Pander (1794–1865), Baer expanded Pander's concept of germ layer formation to all vertebrates, thereby laying the foundation for comparative embryology. He emphasized that embryos of one species could resemble embryos (but not adults) of another and that the younger the embryo, the greater the resemblance, a concept in line with his belief that development proceeds from simple to complex, from like to different. He also discovered the mammalian ovum. His *On the Development of Animals* (2 vol., 1828–37) surveyed all existing knowledge on vertebrate development and established embryology as a distinct subject of research.

baetylus *or* **baetulus** \'bē-tə-ləs, 'bē-tyə-ləs\ In Greek religion, a sacred stone or pillar. In antiquity there were numerous holy stones, most associated with a deity. The most famous example is the holy stone known as the Omphalos in the temple of Apollo at Delphi. Sometimes the stones were formed into pillars or into groups of three pillars.

Baeyer \'bā-ər**, (Johann Friedrich Wilhelm) Adolf von** (b. Oct. 31, 1835, Berlin, Prussia—d. Aug. 20, 1917, Starnberg, near Munich, Ger.) German research chemist. He synthesized indigo and formulated its structure, discovered the phthalein dyes, and investigated such chemical families as the polyacetylenes, oxonium salts, and uric-acid derivatives (discovering barbituric acid, parent compound of the barbiturates). He also made contributions to theoretical chemistry. He received the Nobel Prize in 1905.



Baeyer, 1905
HISTORIA-PHOTO

Baez \'bī-ez**, Joan (Chandos)** (b. Jan. 9, 1941, Staten Island, New York, N.Y., U.S.) U.S. folksinger and activist. She moved often as a child, receiving little musical training, but she became influential in the 1960s folk-song revival. Singing in a soprano voice, usually accompanied by her own guitar arrangements, she popularized traditional songs through her performances and best-selling record albums. An active participant in the protest movements of the 1960s and '70s, Baez made free concert appearances at civil-rights and anti-Vietnam War rallies. Her recordings include *Diamonds and Rust* (1975) and *Gone from Danger* (1997).

Baffin Bay Large inlet, Atlantic Ocean, between western Greenland and eastern Baffin Island. With an area of 266,000 sq mi (689,000 sq km), it extends 900 mi (1,450 km) southward from the Arctic and is connected to the Atlantic by Davis Strait. It was visited by the English captain Robert Bylot in 1615 and named for his lieutenant, William Baffin. Its climate is severe, and icebergs are dense even in August.

Baffin Island Largest island in Canada and fifth largest island in the world (183,810 sq mi [476,068 sq km]), lying between Greenland and the Canadian mainland. Located west of Baffin Bay and the Davis Strait, it is administered as part of Nunavut territory. It was probably visited by Norse explorers in the 11th century. It was sighted by Martin Frobisher during his search for a Northwest Passage (1576–78). It is uninhabited except for a few coastal settlements. The world's northernmost mines are at Nanisvik. In 1972 Auyuittuq National Park was created on the eastern coast.

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Baganda See GANDA

bagasse \bə-'gas\ Fibre remaining after the extraction of the sugar-bearing juice from SUGARCANE. The term was once applied more generally to various waste residues from processing plant materials. Bagasse may be used as fuel in the sugarcane mill or as a source of CELLULOSE for manufacturing animal FEEDS. Paper is produced from bagasse in several Latin American countries, in the Middle East, and in all sugar-producing countries that are deficient in forest resources. It is the essential ingredient for the production of pressed building board, acoustic tile, and other construction materials.

Bagehot \'baj-ət**, Walter** (b. Feb. 3, 1826, Langport, Somerset, Eng.—d. March 24, 1877, Langport) English economist, political analyst, and journalist. While working in his uncle's bank, Bagehot wrote literary essays and economic articles that led to his involvement with *The* ECONOMIST. As its editor from 1860, he helped make it one of the leading business and political journals in the world. His classic *The English Constitution* (1867) describes how the British system of government really operates behind its facade. His other works include *Physics and Politics* (1872), one of the earliest attempts to apply the concept of evolution to societies, and *Lombard Street* (1873), a study of banking methods. His literary essays have been continually republished.

Walter Bagehot, mezzotint by Norman Hirst, after a photograph.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Baggara \bä-'gär-ə\ *or* **Baqqarah** \bä-'kär-ə\ Nomadic Arab people. They number about 600,000 and are probably descended from the Arabs who migrated west out of Egypt in the Middle Ages. Today they live in a region of The Sudan extending from Lake Chad east to the Nile, migrating with their cattle herds south to the river lands in the dry season and north to the grasslands during the rains. They also raise sorghum and millet. Association with the FULANI and others have given them a distinct dialect of Arabic.

Baghdad *or* **Bagdad** City (pop., 2003 est.: metro. area, 5,750,000), capital of IRAQ. Located on the TIGRIS RIVER, the site has been settled from ancient times. It rose to importance after being chosen in AD 762 by Caliph al-Manṣūr (r. 754–775) as the capital of the 'ABBĀSID DYNASTY. Under HĀRŪN AL-RASHĪD it achieved its greatest glory—reflected in the many tales from *THE THOUSAND AND ONE NIGHTS* that were set there—as one of the world's largest and wealthiest cities. A centre of Islamic civilization, it was second only to the Byzantine capital, Constantinople (modern ISTANBUL), in trade and culture. The capital was moved briefly to Sāmarrā' in 836, after which the city was prone to bouts of political instability. It was sacked by the Mongols under Hülegü in 1258, taken by TIMUR in 1401, and captured by the Persian ṢAFAVID DYNASTY in 1508. Under the sultan SÜLEYMAN I, the city became part of the OTTOMAN EMPIRE in 1534 and remained so—save for a brief period (1623–38) when it returned to Ṣafavid rule—until the end of World War I (1914–18). It became capital of the kingdom (1920) and then the republic (1958) of Iraq. During the 20th century the city grew greatly in size and population. It was severely damaged during the First and Second PERSIAN GULF WARS (1990–91 and 2003, respectively), and from 2003 it was occupied by a U.S.-led coalition force.

bagpipe Wind instrument consisting of two or more single- or double-reed pipes, the reeds being vibrated by wind fed by arm pressure on a skin or cloth bag. The pipes are held in wooden sockets tied into the bag, which is inflated either by the mouth or by bellows strapped to the body. Melodies are played on the fingerholes of the melody pipe, or chanter, while the remaining pipes, or drones, sound single notes. Bagpipes existed by about AD 100. The early bag was an animal bladder or a nearly whole sheepskin or goatskin. Bagpipes have always been folk instruments, but after the 15th century some were used for court music, and others have survived as military instruments. An important related instrument is the Irish union (or uilleann) pipe.

Baguirmi *or* **Bagirmi** \bä-gēr-'mē\ Former sultanate, now part of southwestern Chad. Located southeast of Lake CHAD, it was probably established in the 16th century. The king ruled from the capital city of Massenya. Though the 17th century brought prosperity as a result of the slave trade, Baguirmi became a pawn in conflicts between rival empires to the east and west. It was repeatedly sacked in the 19th century and ultimately came under French control in the late 19th century.

bagworm moth Any insect of the MOTH family Psychidae, found worldwide, named for the baglike cases the larvae (see LARVA) carry with them. The bag, which ranges in size from 0.25 to 6 in. (6–150 mm), is constructed from silk and bits of leaves, twigs, and other debris. The strong-bodied male has broad, fringed wings with a wingspread averaging 1 in. (25 mm). The wormlike female lacks wings. Bagworm larvae often damage trees, especially evergreens.

Bagyidaw \'bäg-yi-ˌdaù\ (d. October 1846) Seventh monarch of the ALAUNGPAYA DYNASTY (r. 1819–37) of Myanmar. Bagyidaw was an ineffectual king, but his general, Maha Bandula, convinced him to pursue a policy of expansion in northeastern India. His conquest of Assam and Manipur angered the British, who launched the first of the ANGLO-BURMESE WARS. Bagyidaw spent the rest of his reign trying to mitigate the harsh terms of the Treaty of Yandabo (1826), which concluded that conflict.

Bahā' Ullāh \bä-'hä-ùl-'lä\ *orig.* **Mīrzā Ḥoseyn 'Ali Nūrī** (b. Nov. 12, 1817, Tehrān, Iran—d. May 29, 1872, Acre, Palestine) Iranian religious leader, founder of the BAHĀ'Ī faith. A Shī'ite Muslim who allied himself with the BĀB, he joined his half brother Mīrzā Yaḥyā (known as Ṣobḥ-e Azal) in leading the Bābī movement after the Bāb's execution. Sunnite Muslims exiled him to Baghdad, Kurdistan, and finally Constantinople, where in 1867 he declared himself the imam-mahdi foretold by the Bāb and sent by God. This pronouncement split BĀBISM into two factions, with a small group (the AZALĪ) adhering to its original beliefs and a larger group following him into what became the Bahā'ī faith. The Ottoman government banished him to Acre where, as Bahā' Ullāh, he developed Bahā'ī into a teaching that advocated the unity of all religions and universal human brotherhood.

Baha'i \bä-'hä-ē\ Religion founded in Iran in the mid-19th century by BAHĀ' ULLĀH. It emerged from BĀBISM when in 1863 Bahā' Ullāh asserted that he was the messenger of God predicted by the Bāb. Before his death in 1892, he appointed his son 'Abd ol-Bahā to lead the community. The writings of the Bāb, Bahā' Ullāh, and 'Abd ol-Bahā form the sacred literature. Worship consists of readings from scriptures of all religions. Bahā'ī faith proclaims the essential unity of all religions and the unity of humanity. It is concerned with social ethics and has no priesthood or sacraments. Because of its 19 initial disciples, it considers the number 19 sacred, and the calendar consists of 19 months of 19 days (with four additional days). Adherents are expected to pray daily, fast 19 days a year, and keep to a strict ethical code. Bahā'ī has experienced major growth since the 1960s but has been persecuted in Iran since the fundamentalist revolution of 1979.

Bahamas, The *officially* **Commonwealth of The Bahamas** Archipelago and state, northwestern edge of the WEST INDIES, lying southeast of Florida and north of Cuba. It consists of about 700 islands and numerous cays. Area: 5,382 sq mi (13,939 sq km). Population (2005 est.): 323,000. Capital: NASSAU (on New Providence Island). The people are of African and European ancestry, a legacy of the slave trade. Language: English (official). Religion: Christianity (mostly Protestant; also Roman Catholic, other Christians). Currency: Bahamian dollar. Chief among the islands, from north to south, are Grand Bahama, Abaco, Eleuthera, New Providence, Andros, Cat, and Inagua; New Providence has most of the population. All are composed of coralline limestone and lie mostly only a few feet above sea level; the highest point is Mount Alvernia (206 ft [63 m]) on Cat Island. There are no rivers. The country's market economy is heavily dependent on tourism, for which gambling is a particular attraction, and on international financial services. Most foodstuffs are imported from the U.S.; fish and rum are significant exports. The Bahamas is a constitutional monarchy with two legislative houses; its chief of state is the British monarch, represented by a governor-general, and the head of government is the prime minister. The islands were inhabited by Arawak Indians when CHRISTOPHER COLUMBUS sighted them on Oct. 12, 1492. Many scholars believe Columbus landed on San Salvador (Watling) Island, though others contend his first landfall was on Samana Cay (Cat Island). The Spaniards made no attempt to settle but carried out slave raids that depopulated the islands; when English settlers arrived in 1648 from Bermuda, the islands were uninhabited. They became a haunt of pirates and

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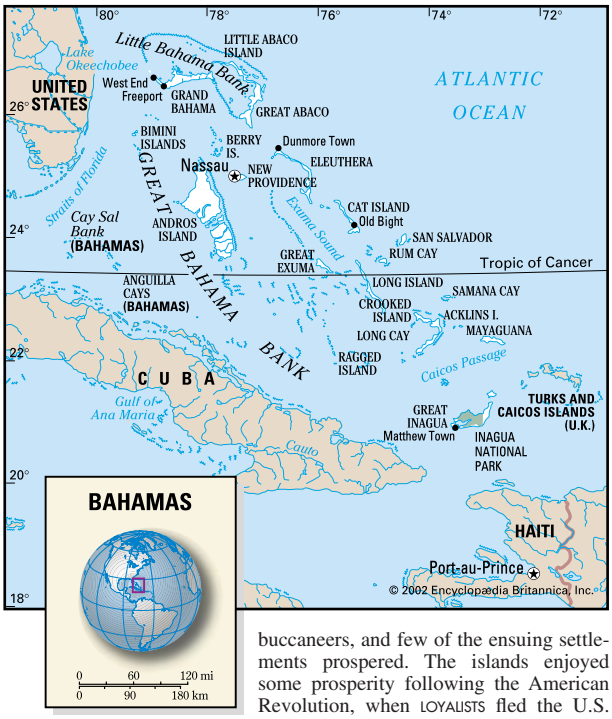


buccaneers, and few of the ensuing settlements prospered. The islands enjoyed some prosperity following the American Revolution, when LOYALISTS fled the U.S. and established cotton plantations there. The islands were a centre for blockade runners during the American Civil War. Not until the development of tourism after World War II did permanent economic prosperity arrive. The Bahamas was granted internal self-government in 1964 and became independent in 1973.

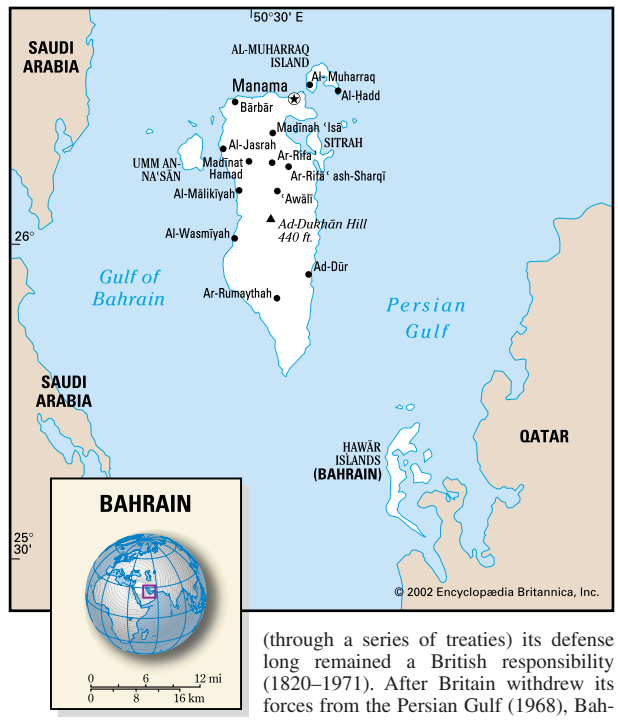
Bahia \bä-'ē-ä\ State (pop., 2003 est.: 13,435,612), eastern Brazil. It covers an area of 218,029 sq mi (564,693 sq km), and its capital is SALVADOR. The major river is the SÃO FRANCISCO. The Portuguese first entered the region in 1501, through the bay where Salvador is now located. Colonization began in the coastal region; the discovery of gold and gems in the Diamantina Upland attracted more settlers in the 18th century. A state since 1889, Bahia is rich in mineral resources, including petroleum, natural gas, lead, copper, chromium, and tin. Its heavy industries include petroleum refining and ironworks. It is also an important agricultural producer.

Bahia See SALVADOR

Baḥr al-Ghazāl See GHAZĀL RIVER

Baḥr al-Jabal See JABAL RIVER

Bahrain \bä-'rān\ *officially* **Kingdom of Bahrain** Country, Middle East, southwestern Asia. Area: 278 sq mi (720 sq km). Population (2005 est.): 715,000. It occupies an archipelago consisting of Bahrain Island and about 30 smaller islands lying along the ARABIAN PENINSULA in the PERSIAN GULF. Saudi Arabia lies to the west across the Gulf of Bahrain, and the Qatar peninsula lies to the east. The capital is MANAMA. Most of the population is Arab. Language: Arabic (official). Religion: Islam (official). Currency: Bahraini dinar. Bahrain Island, which is about 30 mi (50 km) long and 10 mi (16 km) wide, accounts for seven-eighths of the country's total area and, with the islands of Al-Muḥarraq and Sitrah off its northeastern coast, constitutes the population and economic centre of the country. Since 1986 the main island has been connected to Saudi Arabia by a 15-mi (24-km) causeway. The highest point of elevation is Al-Dukhān Hill (440 ft [134 m]). Bahrain has a developing mixed (state and private enterprise) economy based largely on natural gas and petroleum production and refining. Bahrain is a constitutional monarchy. The chief of state is the king, and the head of government is the prime minister. The area has long been an important trading centre and is mentioned in Persian, Greek, and Roman references. It was ruled by various Arab groups from the 7th century AD but was then occupied by the Portuguese (1521–1602). Since 1783 it has been ruled by a family group known as the Āl Khalīfah, though



(through a series of treaties) its defense long remained a British responsibility (1820–1971). After Britain withdrew its forces from the Persian Gulf (1968), Bahrain declared its independence (1971). It served as a centre for the allies in the First PERSIAN GULF WAR (1990–91). Since 1994 it has experienced periods of political unrest, mainly among its large Shī'ite population. Constitutional revisions, ratified in 2002, made Bahrain a constitutional monarchy and enfranchised women; parliamentary elections (the first since 1975) were held in October 2002.

Bai River See YONGDING RIVER

Baibars I See BAYBARS I

Baikal, Lake *Russian* **Ozero Baykal** \bī-'käl\ Lake, southern SIBERIA, Russia, in Asia. With a length of 395 mi (636 km) long and an area of some 12,200 sq mi (31,500 sq km), it is the largest freshwater basin in Eurasia. It is also the deepest continental body of water on Earth (5,315 ft [1,620 m]), containing one-fifth of the fresh water on Earth's surface. More than 330 rivers and streams flow into it; on its east it receives the Barguzin and SELENGA rivers, and most of its outflow is through the ANGARA at the northern end. The island of Olkhon is in its centre. Plant and animal life are rich and various; at least 1,500 species are unique to the lake. Growing industrialization along its shores has produced threatening pollution. In 1996 the Lake Baikal Coastal Protection Zone was designated a UNESCO WORLD HERITAGE SITE.

bail Temporary release of a prisoner in exchange for security given to guarantee the prisoner's appearance at a later hearing. It also refers to the actual security given (e.g., cash). Its main use today is to secure the freedom, pending trial, of someone arrested and charged with a criminal offense. Its use in civil (noncriminal) cases is far less common, as most do not involve imprisonment. The amount of bail is generally set in relation to the gravity of the offense, though other factors, such as the strength of the evidence, the character of the accused, and the accused's ability to secure bail may also be considered. See also BOND, RECOGNIZANCE.

Bailey, Pearl (Mae) (b. March 29, 1918, Newport News, Va., U.S.—d. Aug. 17, 1990, Philadelphia, Pa.) U.S. singer and entertainer. She began her career at age 15, appearing in nightclubs and theatres and with jazz bands, including the COUNT BASIE band. Her first Broadway musical was *St. Louis Woman* in 1946; her first film was *Variety Girl* in 1947. She became known for her lively and earthy style. In 1952 she married the drummer and bandleader Louis Bellson, with whom she later often appeared. The most memorable of her Broadway roles, which included Carmen Jones (1954), was as Dolly Levi in an all-black production of *Hello, Dolly!* (1967–69).

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bailiff Officer of some U.S. courts whose duties include keeping order in the courtroom and guarding prisoners or jurors in deliberation. In medieval Europe, it was a title of some dignity and power, denoting a manorial superintendent or royal agent who collected fines and rent, served writs, assembled juries, made arrests, and executed the monarch's orders. The bailiff's authority was gradually eroded by the increasing need to use administrators with legal or other specialized training.

Bailly \bä-'yē**, Jean-Sylvain** (b. Sept. 15, 1736, Paris, France—d. Nov. 12, 1793, Paris) French astronomer and politician. Noted for his computation of an orbit for Halley's Comet in 1759, he turned to politics with the outbreak of the French Revolution. He was chosen president of the Third Estate in May 1789 and was proclaimed the first mayor of Paris in July. He later lost popularity, particularly after his order to disperse a riotous crowd led to the massacre of the Champ de Mars (1791). He retired but was subsequently arrested, taken before the revolutionary tribunal, and guillotined.

Baily's beads Arc of bright spots seen during a total eclipse of the Sun, named for Francis Baily (1774–1844), the English astronomer who first called attention to them. Just before the Moon's disk completely covers the Sun, the narrow crescent of sunlight may be broken in several places by mountains and valleys on the edge of the Moon's disk; the resulting spots resemble a string of beads. The "diamond-ring effect" occurs when the very last rays of the Sun to be obscured look like a bright diamond on the solar corona.

Baird, Bil and Cora (respectively b. Aug. 15, 1904, Grand Island, Neb., U.S.—d. March 18, 1987, New York, N.Y.; b. Jan. 26, 1912, New York City—d. Dec. 6, 1967, New York City) U.S. puppeteers. Bil Baird (originally William Britton Baird) worked under the puppeteer Tony Sarg for five years then produced his own puppet shows from the mid 1930s. He and Cora Eisenberg married in 1937 and began to create original puppets, scenery, and music for their shows. They produced a series of television shows in the 1950s and opened their own marionette theatre in New York in 1966. Bil wrote *The Art of the Puppet* (1965) and trained puppeteers such as Jim Henson.

Baird, John L(ogie) (b. Aug. 13, 1888, Helensburgh, Dunbarton, Scot.—d. June 14, 1946, Bexhill-on-Sea, Sussex, Eng.) Scottish engineer. Plagued by ill health, he gave up his job as an electric-power engineer in 1922 and devoted himself to television research. He produced televised objects in outline in 1924 and recognizable human faces in 1925, and in 1926 became the first person to televise pictures of objects in motion. He demonstrated colour television in 1928. The German post office gave him facilities to develop a television service in 1929. When the BBC television service began (1936), his system competed with that of Marconi Electric and Musical Industries; the BBC adopted the latter exclusively in 1937. Baird was reported to have completed research on stereoscopic television at the time of his death.

Bairiki \'bī-ˌrē-kē\ Islet (pop., 2000: urban agglomeration, 36,717) and administrative centre, Kiribati. It is located on Tarawa Atoll, northern Gilbert Islands. It has port facilities as well as an extension centre of the University of the South Pacific.

Baja \'bä-ˌhä\ **California** *Spanish* **"Lower California"** Peninsula, northwestern Mexico. Bounded by the U.S. to the north, the Pacific Ocean to the west, and the Gulf of California to the east, it is about 760 mi (1,220 km) long and has an area of 55,366 sq mi (143,396 sq km). Politically, it is divided into the states of Baja California and Baja California Sur. It has more than 2,000 mi (3,200 km) of coastline, with sheltered harbours on both the western and gulf coasts. The area had been inhabited for some 9,000 years when the Spanish arrived in 1533. Jesuit missionaries established permanent settlements in the late 17th century, but the native Indians were practically exterminated in epidemics introduced by the Spanish. The area was separated from what is now the U.S. state of California by treaty in 1848 following the Mexican War.

Baja California *formerly* **Baja California Norte** State (pop., 2000: 2,487,367), northern Baja California peninsula, northwestern Mexico. It covers an area of 27,071 sq mi (70,114 sq km), and its capital is Mexicali. Although long inhabited, it remained sparsely populated until the 1950s, when it experienced phenomenal growth. This was partly because of its proximity to the U.S. border; numerous foreign companies have established assembly oriented factories (maquiladoras) in the region, a trend accelerated by the establishment of NAFTA in 1994.

Baja California Sur State (pop., 2000: 423,516), southern Baja California peninsula, northwestern Mexico. It occupies an area of 28,369 sq mi (73, 475 sq km), and its capital is La Paz. It became a state in 1974. It is sparsely populated and remains relatively underdeveloped. Much new acreage of cotton has been planted near La Paz, but subsistence agriculture is most common. An increase in tourism and improved communications have begun to alleviate the state's isolation.

Baker, Chet *orig.* **Chesney Henry Baker** (b. Dec. 23, 1929, Yale, Okla., U.S.—d. May 13, 1988, Amsterdam, Neth.) U.S. trumpeter and singer. After playing in army bands he attracted attention during engagements with Charlie Parker and Gerry Mulligan in 1952 and 1953. His subdued tone and gentle phrasing made him the epitome of the cool jazz (see bebop) of the 1950s. With recordings such as "My Funny Valentine" he established his plaintive, fragile approach as a vocalist, which mirrored his trumpet style. Much of his later career, interrupted several times by legal problems stemming from drug addiction, was spent in Europe.

Baker, Josephine *orig.* **Freda Josephine McDonald** (b. June 3, 1906, St. Louis, Mo., U.S.—d. April 12, 1975, Paris, France) U.S.-born French entertainer. She joined a dance troupe at age 16 and soon moved to New York City, where she performed in Harlem nightclubs and on Broadway in *Chocolate Dandies* (1924). She went to Paris in 1925 to dance in *La Revue nègre*. To French audiences she personified the exoticism and vitality of African American culture, and she became Paris's most popular music-hall entertainer, receiving star billing at the Folies Bergère. In World War II she worked with the Red Cross and entertained Free French troops. From 1950 she adopted numerous orphans of all nationalities as "an experiment in brotherhood." She returned periodically to the U.S. to advance the cause of civil rights.

Josephine Baker.
H. ROGER-VIOLLET

Baker, Newton D(iehl) (b. Dec. 3, 1871, Martinsburg, W.Va., U.S.—d. Dec. 25, 1937, Cleveland, Ohio) U.S. secretary of war. He practiced law in Martinsburg from 1897. After moving to Cleveland, he was elected mayor (1912–16). He helped obtain the 1912 Democratic presidential nomination for Woodrow Wilson, who appointed him secretary of war (1916–21). Although he was a pacifist, Baker developed a plan for the military draft and oversaw the mobilization of more than four million men during World War I. In 1928 he was appointed to the International Court of Arbitration at The Hague.

Baker, Philip John Noel- See Philip Noel-Baker

Baker, Russell (Wayne) (b. Aug. 14, 1925, Loudoun county, Va., U.S.) U.S. newspaper columnist. Baker joined the *Baltimore Sun* in 1947. In 1954 he moved to the Washington bureau of the *New York Times*, and in the early 1960s he began his syndicated "Observer" column. Initially concentrating on political satire, he later found other subjects to skewer as well. In 1979 he won the Pulitzer Prize for commentary. His books include the autobiographies *Growing Up* (1982, Pulitzer Prize) and *The Good Times* (1989). In 1993 he became host of the television program *Masterpiece Theatre*.

Baker, Sara Josephine (b. Nov. 15, 1873, Poughkeepsie, N.Y., U.S.—d. Feb. 22, 1945, New York, N.Y.) U.S. physician. She became the first American woman to receive a doctorate in public health. As the first director of New York City's Division of Child Hygiene (the first public agency devoted to child health), she helped make New York's infant-mortality rates the lowest of any major American city. She helped found the American Child Hygiene Association and organized what became the Children's Welfare Federation of New York. She published five books on child hygiene.

Baker v. Carr (1962) U.S. Supreme Court case that forced the Tennessee legislature to reapportion itself on the basis of population. The case ended the traditional overrepresentation of rural areas in the legislature and established that the court may intervene in apportionment cases. The court ruled that every citizen's vote should carry equal weight, regardless

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of the voter's place of residence. Its ruling in *Reynolds* v. *Sims* (1964) built on *Baker* by requiring virtually every state legislature to be reapportioned, ultimately causing political power in most states to shift from rural to urban areas.

Bakersfield City (pop., 2000: city, 247,057; metro. area, 661,645), southern California, U.S. Situated on the Kern River in the San Joaquin Valley, it was founded in 1869 by Thomas Baker. It was an agricultural area when the discovery of the Kern River oil fields in 1899 sparked a petroleum boom. The city was quickly rebuilt after a major earthquake in 1952. Nearby vineyards produce about a quarter of the wine made in California.

Bakewell, Robert (b. 1725, Dishley, Leicestershire, Eng.—d. Oct. 1, 1795, Dishley) English agriculturist. He revolutionized English sheep and cattle breeding by methodical selection, inbreeding, and culling. He was one of the first to breed sheep and cattle for meat and the first to establish on a large scale the practice of letting animals for stud. His farm became famous as a model of scientific management.

Bakewell, detail of an engraving.
THE MANSELL COLLECTION

Bakhtin \bək-'tēn**, Mikhail (Mikhailovich)** (b. Nov. 17, 1895, Orel, Russia—d. March 7, 1975, Moscow, U.S.S.R.) Russian literary theorist and philosopher of language. His works frequently offended the Soviet authorities, and in 1929 he was exiled from Vitsyebsk to Kazakhstan. He is especially known for *Problems of Dostoevsky's Poetics* (1929), which advanced theories that he further developed in *The Dialogic Imagination* (1975). His wide-ranging ideas significantly influenced Western thinking in cultural history, linguistics, literary theory, and aesthetics.

Bakhtyārī *or* **Bakhtiyārī** *or* **Bakhtiārī** \bäk-'tē-ə-rē\ Any member of a community of nomadic pastoral tent dwellers of western Iran. They speak a dialect of Luri (a language related to Modern Persian) and are mostly Shīʿite Muslims. Their two tribal groups are the Chahār Lang and Haft Lang; the position of leader of all the Bakhtyārī alternates every two years between the chiefs of the two tribal groups. Many chiefs have been influential in national public affairs and have held office. Bakhtyārī women are normally better-educated and freer than other Muslim women in Iran.

baking Process of cooking by dry heat, especially in an oven. Baked products include BREAD, cookies, pies, and pastries. Ingredients used in baking include FLOUR, water, leavening agents (baker's yeast, baking soda, baking powder), shortening (fats, oils), eggs, milk, and sugars. These are mixed together to create dough or batter, which is then transferred to a pan or sheet and heated. Leavening agents produce gas that becomes trapped in the dough, causing it to rise. Shortening makes doughs more easily workable and the final product more tender. Egg whites are used to produce a light, airy texture, and yolks contribute colour, flavour, and texture. Milk is used for moistening and flavouring and sugars for sweetening and aiding FERMENTATION.

baking soda See BICARBONATE OF SODA

Bakke \'ba-kē\ **decision** *formally* **Regents of the University of California v. Bakke** (1978) Decision of the SUPREME COURT OF THE UNITED STATES that ruled unconstitutional the use of fixed quotas for minority applicants at professional schools. At issue was a state medical school's AFFIRMATIVE ACTION program that, because it required a certain number of minority admissions, twice denied entrance to an otherwise qualified white candidate (Allan Bakke). Though the court outlawed quota programs on the grounds that they violated the EQUAL-PROTECTION clause of the CONSTITUTION OF THE UNITED STATES, it allowed colleges to use race as a factor in making college admissions decisions.

Bakongo See KONGO

Bakst \'bȧkst**, Léon** *orig.* **Lev Samuilovich Rosenberg** (b. Jan. 27, 1866, St. Petersburg, Russia—d. Dec. 28, 1924, Paris, France) Russian painter and stage designer. He attended the Imperial Academy of Arts at St. Petersburg and studied in Paris. In 1898 he cofounded the journal *Mir Iskusstva* ("World of Art") with SERGEY DIAGHILEV. He began designing scenery for the imperial theatres in 1900. In Paris he designed sets and costumes for Diaghilev's new BALLETS RUSSES. His bold designs and sumptuous colours, conveying an exotic "Orientalism," won him international fame. His designs for a London production of Pyotr Ilyich Tchaikovsky's *Sleeping Beauty* in 1921 are regarded as his greatest work.

Baku \bä-'kü\ City (pop., 2003 est.: 1,828,800), capital of AZERBAIJAN. Located on the western shore of the CASPIAN SEA at the sea's best harbour, Baku has long been inhabited. By the 11th century AD it was in the possession of the Shirvan shahs, who made it their capital in the 12th century. In 1723 PETER I (the Great) took Baku, but it was returned to Persia in 1735; Russia recaptured it in 1806. It was the capital of the short-lived independent state of Azerbaijan (1918–20) and in 1920 became the capital of the new Soviet republic of Azerbaijan. The basis of Baku's economy is petroleum. The city's historic centre was designated a UNESCO WORLD HERITAGE SITE in 2000.

bakufu \bä-'kü-fü\ *Japanese* **"tent government"** Military rule of the country by a hereditary SHOGUN, as opposed to rule by the imperial court and the emperor. There have been three periods of *bakufu* government in Japanese history: MINAMOTO YORITOMO established the Kamakura *bakufu* (see KAMAKURA PERIOD) at the end of the 12th century, Ashikaga Takauji established the Muromachi *bakufu* (see MUROMACHI PERIOD) in the early 14th century, and TOKUGAWA IEYASU established the Edo *bakufu* (see TOKUGAWA PERIOD) at the beginning of the 17th century. The Edo *bakufu* was the most successful, a time of peace and prosperity that lasted over 250 years. See also DAIMYO; HŌJŌ FAMILY; JITŌ.

Bakunin \bə-'kün-yən**, Mikhail (Aleksandrovich)** (b. May 30, 1814, Premukhino, Russia—d. July 1, 1876, Bern, Switz.) Russian anarchist and political writer. He traveled in western Europe and was active in the REVOLUTIONS OF 1848. After attending the Slav congress in Prague, he wrote the manifesto "An Appeal to Slavs" (1848). Arrested for revolutionary intrigues in Germany (1849), he was sent to Russia and exiled to Siberia. He escaped in 1861 and returned to western Europe, where he continued his militant anarchist teachings. At the FIRST INTERNATIONAL (1872) he engaged in a famous quarrel with KARL MARX, which split the European revolutionary movement.

Baʿlabakk See BAALBEK

Balaguer \ˌbä-lä-'ger\ **(y Ricardo), Joaquín (Vidella)** (b. Sept. 1, 1907, Villa Bisonó, Dom. Rep.—d. July 14, 2002, Santo Domingo) President of the Dominican Republic (1960–62, 1966–78, 1986–96). He held numerous government posts during Gen. RAFAEL TRUJILLO's 30-year dictatorship. Balaguer was vice president under Trujillo's brother Hector and became president when Hector resigned, but Trujillo continued to wield actual power until assassinated in 1961. Balaguer's subsequent attempts at liberalization caused his overthrow by the military. Elected president in 1966 after the U.S. military intervention in 1965, he achieved steady economic growth and modest social reforms. He was reelected repeatedly, but his last term was shortened by two years amid political violence and charges of electoral fraud and corruption.

Balakirev \bə-'lä-kyi-ryif**, Mily (Alekseyevich)** (b. Jan. 2, 1837, Nizhny Novgorod, Russia—d. May 29, 1910, St. Petersburg) Russian composer. As a youth he met and was influenced by the nationalist composer MIKHAIL GLINKA. Balakirev himself later became the mentor of César Cui (1835–1918) and MODEST MUSSORGSKY; in 1861–62 their group expanded to become THE FIVE. In 1862 Balakirev cofounded the Free School of Music. His works include two symphonies, the piano fantasy *Islamey* (1869), music for *King Lear* (1858–61), and a piano concerto. With his colourful imagination and use of folk themes, he was perhaps the most influential proponent of Russian nationalism. After a nervous breakdown in 1871, he adopted a fervent and bigoted form of Orthodoxy and was thereafter involved in musical life only sporadically.

Balaklava \bə-lə-'klä-və**, Battle of** (Oct. 25, 1854) Indecisive military engagement of the CRIMEAN WAR. The Russians sought to capture the Black Sea supply port of Balaklava, which was controlled by the British, French, and Turks. The Russians occupied positions on the heights above a nearby valley. To disrupt the Russian troop movements, BARON RAGLAN gave an ambiguous order for Lord CARDIGAN's Light Brigade to attack. Instead of leading his cavalry against the Russian guns on the heights,

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Cardigan swept down the valley after the retreating Russian cavalry. The battle ended with the loss of 40% of the Light Brigade and inspired the 1855 poem "Charge of the Light Brigade" by Alfred, Lord TENNYSON.

balalaika \ˌba-lə-ˈlī-kə\ Russian stringed instrument with a triangular body, three strings, and movable frets on its fingerboard. It comes in six sizes, from piccolo to double bass. It developed in the 18th century from the dombra. It has been primarily a solo folk instrument for accompanying song and dance, but is also played in large balalaika orchestras.

Russian tenor balalaika, 20th century; in the Metropolitan Museum of Art, New York City

COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, THE CROSBY BROWN COLLECTION OF MUSICAL INSTRUMENTS, 1889

balance Instrument for comparing the weights of two bodies, usually for scientific purposes, to determine the difference in MASS. The equal-arm balance dates back to the ancient Egyptians, possibly as early as 5000 BC. By the early 20th century, it had been developed into an exquisitely precise measuring device. Electronic balances today depend on electrical compensation rather than mechanical deflection. The ultramicrobalance is any weighing device that serves to determine the weight of even smaller samples than can be weighed with the microbalance (which can weigh samples as small as a few milligrams), that is, total amounts as small as a few micrograms.

balance of payments Systematic record of all economic transactions during a given period between residents (including the government) of one country and residents (including the governments) of other countries. The transactions are presented in the form of double-entry bookkeeping. The U.S. balance of payments, for example, records the various ways in which dollars are made available to foreigners through U.S. imports, U.S. tourist spending abroad, foreign lending, and so on. These expenditures are shown on the debit side of the balance. The credit side shows the various uses to which foreigners put their dollars, including paying for U.S. exports, servicing debts to the U.S., and the like. Foreign countries may acquire more dollars than they need to spend on U.S. goods and services and may hold the surplus or purchase gold or securities; or they may have fewer dollars than they need to purchase U.S. goods and services, and may acquire additional dollars by transferring gold, selling holdings in the U.S., and so on. Certain forms of transferring funds (e.g., large outflows of gold) are less desirable as a way of settling foreign debts than others (e.g., transfers of currency acquired through international trade). The INTERNATIONAL MONETARY FUND helps address problems relating to balance of payments. See also BALANCE OF TRADE.

balance of power In international relations, an equilibrium of power sufficient to discourage or prevent one nation or party from imposing its will on or interfering with the interests of another. The term came into use at the end of the Napoleonic Wars to denote the power relationships in the European state system. Until World War I, Britain played the role of balancer in a number of shifting alliances. After World War II, a Northern Hemisphere balance of power pitted the U.S. and its allies (see NATO) against the Soviet Union and its satellites (see WARSAW PACT) in a bipolar balance of power backed by the threat of nuclear war. China's defection from the Soviet camp to a nonaligned but covertly anti-Soviet stance produced a third node of power. With the Soviet Union's collapse (1991), the U.S. and its NATO allies were recognized universally as the world's paramount military power.

balance of trade Difference in value over a period of time between a nation's imports and exports of goods and services. The balance of trade is part of a larger economic unit, the BALANCE OF PAYMENTS, which includes all economic transactions between residents of one country and those of other countries. If a nation's exports exceed its imports, the nation has a favourable balance of trade, or a trade surplus. If imports exceed exports, an unfavourable balance of trade, or a trade deficit, exists. Under MERCANTILISM a favourable balance of trade was an absolute necessity, but in CLASSICAL ECONOMICS it was more important for a nation to utilize its economic resources fully than to build a trade surplus. The idea of the undesirability of trade deficits persisted, however, and arguments against deficits are often advanced by advocates of PROTECTIONISM.

balance sheet Financial statement that describes the resources under a company's control on a specified date and indicates where they have come from. It consists of three major sections: assets (valuable rights owned by the company), liabilities (funds provided by outside lenders and other creditors), and the owners' EQUITY. On the balance sheet, total assets must always equal total liabilities plus total owners' equity.

Balanchine \ˌbä-läⁿ-ˈshēn**, George** *orig.* **Georgy Melitonovich Balanchivadze** (b. Jan. 22, 1904, St. Petersburg, Russia—d. April 30, 1983, New York, N.Y., U.S.) Russian-born U.S. choreographer. After studying at the Imperial Ballet School, he left the Soviet Union in 1925 to join the BALLETS RUSSES, where his choreography of *Apollo* (1928) exemplified the spare neoclassical style that became his trademark. His work impressed the impresario LINCOLN KIRSTEIN, who in 1933 invited "Mr. B." to form the School of American Ballet and its performing group, the American Ballet. The group became the Metropolitan Opera's resident company (1935–38) but disbanded in 1941. In 1946 Kirstein and Balanchine founded the Ballet Society, from which emerged the NEW YORK CITY BALLET in 1948. Balanchine created more than 150 works for the company, including *The Nutcracker* (1954), *Don Quixote* (1965), and *Jewels* (1967), and he also choreographed musicals and operas. He collaborated closely with the composer IGOR STRAVINSKY, setting more than 30 works to his music. Balanchine's work remains in the repertoires of many companies worldwide, and he is widely considered the greatest choreographer of the 20th century.

George Balanchine.

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Balaton \ˈbȯ-lȯ-ˌtōn**, Lake** Lake, Hungary. Southwest of Budapest, it is the largest lake in central Europe, covering 231 sq mi (598 sq km), with a maximum depth of about 37 ft (11 m). It contains two wildlife reserves. While agriculture remains important in the area, the tourist industry has become significant, and resorts, including Siófok and Balatonfüred, have been developed.

Balbo, Italo (b. June 6, 1896, near Ferrara, Italy—d. June 28, 1940, Tobruk, Libya) Italian aviator and politician. He led the fascist BLACKSHIRTS in the March on ROME (1922) and served under BENITO MUSSOLINI as general of militia (1923) and air minister (1929–33). Balbo developed Italian military and commercial aviation and became famous for promoting mass international flights to demonstrate Italy's air power. He was appointed governor of Libya in 1933 and died when his plane was accidentally shot down by Italian guns over Tobruk.

Balboa, Vasco Núñez de (b. 1475, Badajoz, Extremadura province, Castile—d. Jan. 12, 1519, Acla, near Darién, Pan.) Spanish conquistador and explorer. In 1500 he explored the coast of modern Colombia, then settled in Hispaniola. Forced to flee creditors, he joined an expedition to assist a colony in Colombia. He persuaded the settlers to move across the Gulf of Urabá to Darién, where in 1511 they founded the first stable settlement on the South American continent. In 1513 he became the first European to see the Pacific Ocean and took possession of the Mar del Sur (South Sea) and adjacent lands for Spain. He became governor of the Mar del Sur and of the provinces of Panamá and Coiba but remained subject to a rival, Pedro Arias Dávila, or Pedrarias (1440?–1531). Fearing Balboa's influence, Pedrarias had him seized and charged with rebellion, treason, and other misdeeds. After a farcical trial, Balboa was beheaded.

Balch \ˈbȯlch**, Emily Greene** (b. Jan. 8, 1867, Jamaica Plain, Mass., U.S.—d. Jan. 9, 1961, Cambridge, Mass.) U.S. sociologist and peace

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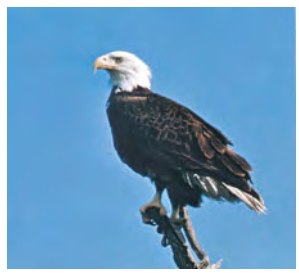
activist. She studied at Bryn Mawr College and taught at Wellesley College from 1896. She founded a settlement house in Boston and served on state commissions on industrial relations (1908–09) and immigration (1913–14). She lost her professorship in 1918 because of her opposition to U.S. entry into World War I. In 1919 she helped found, with JANE ADDAMS, the Women's International League for Peace and Freedom. In 1946 she shared the Nobel Prize for Peace with John R. Mott (1865–1955).

bald cypress Either of two large SWAMP trees (*Taxodium distichum* and *T. ascendens*; family Taxodiaceae) of the southern U.S. that are related to the sequoias. The hard red wood of cypress is often used for roofing shingles. The so-called deciduous cypress family (see DECIDUOUS TREE) comprises 10 genera with 15 species of ornamental and timber EVERGREEN trees, native to eastern Asia, Tasmania, and North America. The leaves on a single tree may be scalelike, needlelike, or a mixture of both. Both male and female CONEs are borne on the same tree. The Tasmanian cedar (*Athrotaxis*), Japanese cedar (*Cryptomeria japonica*), China fir (*Cunninghamia lanceolata*), umbrella pine (*Sciadopitys verticillata*), BIG TREE, REDWOOD, DAWN REDWOOD, and bald cypress are economically important timber trees in this family.

bald eagle Species of SEA EAGLE (*Haliaeetus leucocephalus*) that occurs inland along rivers and large lakes. Strikingly handsome, it is the only EAGLE native solely to North America, and it has been the U.S. national bird since 1782. The adult, about 40 in. (1 m) long with a wingspan of 6.5 ft (2 m), is dark brown with white head and tail and yellow beak, eyes, and feet. Bald eagles snatch fish at the water surface, rob OSPREY of fish, and eat carrion. They nest in lone trees, often on river islands. Though still protected in the U.S., the bald eagle is no longer considered an endangered species.



Bald eagle (*Haliaeetus leucocephalus*).
ALEXANDER SPRUNT, IV

baldachin \'bȯl-də-kən\ Freestanding canopy of stone, wood, or metal over an altar or tomb. The Italian term *baldacchino* originally referred to brocaded material from Baghdad hung as a canopy over an altar or throne. The characteristic architectural form consists of four columns supporting ENTABLATURES, which carry miniature COLONNADES topped by a pyramidal or gabled roof. GIAN LORENZO BERNINI's famous bronze baldachin (1624–33) stands at ST. PETER'S BASILICA in Rome.

Baldachin, St. Peter's, Vatican City, by Gian Lorenzo Bernini, 1624–33
SCALA—ART RESOURCE/EB INC.

Balder \'bȯl-dər, 'bäl-dər\ In Norse mythology, the just and beautiful son of ODIN and FRIGG. He could be harmed by nothing except mistletoe. Knowing he was invulnerable, the gods amused themselves by throwing things at him. Deceived by LOKI, the blind god Höd hurled mistletoe at Balder and killed him. The giantess Thökk, probably Loki in disguise, refused to weep the tears that would have released Balder from the underworld.

baldness *or* **alopecia** \ˌal-ə-'pē-shə\ Lack or loss of HAIR, either permanent (from destruction of hair follicles) or temporary (from short-term follicle damage). Male pattern baldness is inherited and affects up to 40% of men; treatments are transplanting of follicles from areas where hair still grows and application of drugs (e.g., minoxidil) to the scalp. Other causes of permanent baldness are skin diseases and injuries, inborn lack of hair development, and severe follicle injury. Temporary hair loss may follow high fever or come from X rays, drugs, malnutrition, or endocrine disorders. Alopecia areata, with sharply outlined patches of sudden complete baldness, is also usually temporary.

Baldovinetti \ˌbäl-dō-vē-'nät-tē**, Alesso** (b. Oct. 14, 1425?, Florence—d. Aug. 29, 1499, Florence) Italian artist active in Florence. Little is known of his early training, but his style shows the influence of Fra ANGELICO and DOMENICO VENEZIANO. Both his masterpiece, *The Nativity* (1460–62), a fresco in the church of the Santissima Annunziata, Florence, and his *Madonna and Child* (1460s) in the Louvre depict views of the Arno River valley in the background; they are among the earliest European paintings of landscapes. His work, though seldom innovative, exemplified the careful modeling of form and the accurate depiction of light characteristic of the most progressive style of Florentine painting during the last half of the 15th century. He also designed the mosaic decoration over LORENZO GHIBERTI's doors on the Baptistery in Florence (1453–55) and produced designs for stained glass and intarsia.

"Madonna and Child," oil on canvas by Alesso Baldovinetti, *c.* 1465; in the Louvre, Paris
GIRAUDON—ART RESOURCE/EB INC.

Baldung \'bäl-důŋ**, Hans** *or* **Hans Baldung Grien** \'grēn\ (b. c. 1484, Schwäbisch Gmünd, Württemberg—d. 1545, Imperial Free City of Strasbourg) German painter and graphic artist. He was assistant to ALBRECHT DÜRER in Nürnberg and was active in Strasbourg as official painter to the episcopate. He is best known for the high altar of the cathedral at Freiburg, where he lived in 1512–17. His output was varied and extensive, encompassing religious paintings, allegories, mythologies, portraits, designs for stained glass, tapestry, and book illustration. His paintings are equaled in importance by his drawings, engravings, and woodcuts, frequently depicting the themes of the "dance of death" and "death and the maiden." In his taste for the gruesome, Baldung is close in style and spirit to MATTHIAS GRÜNEWALD.

Baldwin I (b. 1172, Valenciennes—d. 1205) First Latin emperor of Constantinople (1204–05). Count of Flanders and Hainaut, he was a leader of the Fourth CRUSADE, which was directed against the Byzantine Empire. He helped install a pro-Latin emperor (1203). When the Crusaders in Constantinople seized power, he was elected emperor (1204) and recognized by the pope. He created a government on the western European model, granting Greek lands to his knights, but was defeated, taken prisoner, and executed by invading Bulgars.

Baldwin I *known as* **Baldwin of Boulogne** \bü-'lȯn-yə\ (b. 1058?—d. April 2, 1118, Al-Arish, Egypt) King of Jerusalem (1100–18). The son of a French count, he joined the First CRUSADE and created the first Crusader state when he gained control of Edessa (now in Turkey) in 1098. In 1100 his brother Godfrey died in Jerusalem, and Baldwin was summoned by the nobles to succeed him as king of the Crusader state and defender of the Holy Sepulchre. He expanded the kingdom by conquering coastal cities such as Arsuf and Caesarea, built the important castle Krak de Montréal, and established an administration that served for 200 years as the basis for Frankish rule in Syria and Palestine.

Baldwin II *known as* **Baldwin of Bourg** \'bürk\ (d. August 1131, Jerusalem) King of Jerusalem (1118–31). A French nobleman, he joined the First CRUSADE and was made count of Edessa by his cousin BALDWIN I in 1100. Captured by Seljuq Turks in 1104, he was ransomed four years later and reclaimed Edessa from the regent by force. He became king of Jerusalem in 1118 on the death of Baldwin I. He was held hostage by the Turks 1123–24. He later expanded his kingdom and attacked Damascus with the aid of the KNIGHTS OF MALTA and the TEMPLARS. He arranged the marriage of his daughter Melisend to Fulk V of Anjou and made them his successors.

Baldwin II Porphyrogenitus \ˌpōr-fə-rō-'jen-ət-əs\ (b. 1217, Constantinople—d. Oct. 1273, Foggia, Kingdom of Sicily) Fifth and last Latin emperor of Constantinople (1228–61). The son of the third Latin emperor (Porphyrogenitus means "born to the purple," thus "of royal birth"), Baldwin inherited the throne on the death of his brother. Inva-

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sions by Greeks and Bulgars reduced the empire to the area around Constantinople, and Baldwin's empty treasury obliged him to travel twice to western Europe to ask for aid. He sold sacred relics to Louis IX of France and broke up parts of the imperial palace for firewood. He lost the throne in 1261 when Michael VIII Palaeologus captured Constantinople and restored Greek rule. Baldwin fled to Europe and later died in Sicily.

Baldwin IV *known as* **Baldwin the Leper** (b. 1161—d. March 1185, Jerusalem) King of Jerusalem (1174–85). He was crowned at age 13 on the death of his father, but the kingdom was ruled by a series of regents. Baldwin was afflicted with leprosy throughout his short life, which contributed to power struggles among the nobility. His defeat of Saladin in 1177 led to a two-year truce, but in 1183 Saladin captured Aleppo and completed the encirclement of Jerusalem. Baldwin crowned his nephew king in 1183.

Baldwin, James (Arthur) (b. Aug. 2, 1924, New York, N.Y., U.S.—d. Dec. 1, 1987, Saint-Paul, France) U.S. essayist, novelist, and playwright. He grew up in poverty in the New York City district of Harlem and became a preacher while in his teens. After 1948 he lived alternately in France and the U.S. His semiautobiographical first novel, *Go Tell It on the Mountain* (1953), regarded as his finest, was followed by the essay collections *Notes of a Native Son* (1955) and *Nobody Knows My Name* (1961); the novels *Giovanni's Room* (1956), a story of homosexual life, and *Another Country* (1962); the long polemical essay *The Fire Next Time* (1963), prophesying widespread racial violence; and the play *Blues for Mister Charlie* (produced 1964). His eloquence and passion on the subject of race made him for years perhaps the country's most prominent black writer.

James Baldwin
UPI

Baldwin, Robert (b. May 12, 1804, York, Upper Canada—d. Dec. 9, 1858, Toronto) Canadian politician. Called to the bar in 1825, Baldwin began his political career as a member of the Legislative Assembly of Upper Canada for York (1829–30). In 1842–43 he and Louis Hippolyte LaFontaine formed the first Liberal Party administration; when the Liberals returned to power in 1848, they were able to establish responsible, or cabinet, government. He resigned in 1851.

Baldwin, Roger (Nash) (b. Jan. 21, 1884, Wellesley, Mass., U.S.—d. Aug. 26, 1981, Ridgewood, N.J.) U.S. civil-rights leader. Born into an aristocratic Massachusetts family, Baldwin attended Harvard University and taught sociology at Washington University (1906–09) in St. Louis, where he also was chief probation officer of the city's juvenile court and secretary of its Civic League. When the U.S. entered World War I, he became director of the pacifist American Union Against Militarism, the predecessor of the American Civil Liberties Union (ACLU). As the ACLU's director (1920–50) and national chairman (1950–55), he made civil rights, once a predominantly leftist cause, a universal one.

Stanley Baldwin, 1st Earl Baldwin of Bewdley, 1932.
BASSANO AND VANDYK

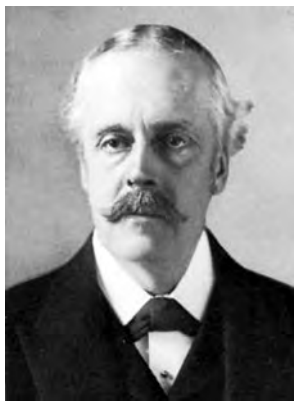
Baldwin (of Bewdley), Stanley Baldwin, 1st Earl (b. Aug. 3, 1867, Bewdley, Worcestershire, Eng.—d. Dec. 14, 1947, Astley Hall, near Stourport-on-Severn, Worcestershire) British politician. After managing his family's large industrial holdings, he became a Conservative member of the House of Commons (1908–37). He served as financial secretary of the treasury (1917–21) and president of the Board of Trade (1921–22), then was appointed prime minister (1923–24, 1924–29, 1935–37). He proclaimed a state of emergency in the general strike of 1926 and later secured passage of the antiunion Trade Disputes Act. As prime minister after 1935, he began to strengthen the British military while showing little public concern about the aggressive policies of Germany and Italy. He was criticized for not protesting the Italian conquest of Ethiopia. In 1936 he satisfied public opinion by procuring the abdication of Edward VIII, whose desire to marry divorcée Wallis Simpson, Baldwin believed, threatened the prestige of the monarchy.

Balearic \ˌba-lē-ˈar-ik\ **Islands** *Spanish* **Islas Baleares** Archipelago (pop., 2001: 841,669), western Mediterranean Sea, constituting an autonomous community and province of Spain. It occupies an area of 1,927 sq mi (4,992 sq km); its capital is Palma. The most important islands are Majorca, Minorca, Ibiza, Formentera, and Cabrera. Long inhabited, the islands were ruled by Carthage in the 6th century BC, by Rome from c. 120 BC, and by the Byzantine Empire from AD 534. Raided by the Arabs, the area was conquered in the 10th century by the Umayyad dynasty at Córdoba. It was reconquered by the Spanish and united with the kingdom of Aragon in 1349. After territorial challenges in the 18th century by the British, the islands came under Spanish rule in 1802. The present-day economy is fueled by tourism.

baleen whale \bə-ˈlēn, ˈba-ˌlēn\ Any of about 13 species of cetaceans in the suborder Mysticeti. They are distinguished by a specialized feeding structure, the baleen, which strains plankton and small crustaceans from the water. It consists of two horny plates attached to the roof of the mouth. Each plate (as long as 12 ft, or 3.6 m, in the right whale) is composed of parallel slats with fringes that mat together to form a sieve. Other baleen whales are the blue, fin, gray, humpback, and sei whales and the rorqual. Baleen was once used for corset stays and is still used in some industrial brushes.

Balenciaga \bäl-en-ˈthyäg-ə**, Cristóbal** (b. Jan. 21, 1895, Guetaria, Spain—d. March 23, 1972, Valencia) Spanish-French fashion designer. He studied dressmaking as a child and was inspired to become a couturier by a visit to Paris. By age 20 he had his own firm in San Sebastián. Over the next 15 years Balenciaga became the leading couturier of Spain. In 1937, when the Spanish Civil War disrupted his business, he moved to Paris. For the next 30 years his collections featured sumptuously elegant dresses and suits. Balenciaga helped popularize the trend toward capes and flowing clothes without waistlines in the late 1950s as well as the use of plastic for rainwear in the mid 1960s. He retired in 1968.

Balfour (of Whittingehame), Arthur James, 1st Earl (b. July 25, 1848, Whittinghame, East Lothian, Scot.—d. March 19, 1930, Woking, Surrey, Eng.) British statesman. The nephew of the marquess of Salisbury, Balfour served in Parliament (1874–1911) and in his uncle's government as secretary for Ireland (1887–91). From 1891 he was the Conservative Party's leader in Parliament and succeeded his uncle as prime minister (1902–05). He helped form the Entente Cordiale (1904). His most famous action came in 1917 when, as foreign secretary (1916–19), he wrote the so-called Balfour Declaration, which expressed official British approval of Zionism. He served as lord president of the council (1919–22, 1925–29) and drafted the Balfour Report (1926), which defined relations between Britain and the dominions expressed in the Statute of Westminster.



Arthur James Balfour, c. 1900.
BASSANO AND VANDYK

Balfour Declaration (Nov. 2, 1917) Statement issued by the British foreign secretary, Arthur James Balfour, in a letter to Lionel Walter Rothschild, a leader of British Jewry, as urged by the Russian Jewish Zionist leaders Chaim Weizmann and Nahum Sokolow. The declaration promised the establishment of a homeland for the Jewish people in Palestine that would not disturb the non-Jewish groups already residing there. The Brit-

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ish anticipated gaining a mandate over Palestine after World War I (1914–18) and hoped to win over Jewish public opinion to the side of the Allies. They also hoped that pro-British settlers would help protect the approaches to the Suez Canal, a vital link to Britain's South Asian possessions.

Bali \'bä-lē, 'ba-lē\ Island (pop., 2000 prelim.: 3,151,162), Indonesia. Located in the Lesser Sunda Islands, off the eastern coast of Java, it constitutes, with minor adjacent islands, a province of Indonesia. The main towns are Singaraja and Denpasar, the provincial capital. The island is mountainous; its highest peak is Mount Agung (10,308 ft [3,142 m]). Colonized by India in early times and supplemented by émigrés from Java in the 16th century, Bali is the remaining stronghold of Hinduism in the Indonesian archipelago. Visited by the Dutch in the late 16th century, it came under Dutch rule only in the late 19th century. It was occupied by the Japanese in World War II and became part of Indonesia in 1950. Tourism is now one of the mainstays of its economy.

Balinese People of the island of Bali, Indon. They differ from other Indonesians in adhering to Hinduism, though their culture has been heavily influenced by the Javanese. In Balinese villages each family lives in its own compound, surrounded by earthen or stone walls; all villages have temples and an assembly hall. Balinese religion fuses Hindu Shaivism with Buddhism, ancestor cults (see ancestor worship), and belief in spirits and magic. Marriage is often limited to members of the same kinship organization, and family relationships are reckoned through the male line.

Balkan League \'bȯl-kən\ (1912–13) Alliance of Bulgaria, Serbia, Greece, and Montenegro, which fought the first Balkan War against the Ottoman empire. Ostensibly created to limit Austrian power in the Balkans, the league was actually formed at the instigation of Russia to expel the Turks from the Balkans. The league disintegrated when its members quarreled over the division of territorial spoils after their victory in the first Balkan War.

Balkan Mountains *Bulgarian* **Stara Planina** \'stä-rä-ˌplä-nē-'nä\ Mountain range, southeastern Europe. It extends east to west across central Bulgaria from the Black Sea to the Serbian border; the highest point is Botev Peak, at 7,795 ft (2,376 m). The range forms the major divide between the Danube River in the north and the Maritsa River in the south. It is crossed by about 20 passes (notably Shipka Pass), several railway lines, and the Iskur River.

Balkan Wars (1912–13) Two military conflicts that deprived the Ottoman Empire of almost all its remaining territory in Europe. In the First Balkan War, the Balkan League defeated the Ottoman Empire, which, under the terms of the peace treaty (1913), lost Macedonia and Albania. The Second Balkan War broke out after Serbia, Greece, and Romania quarreled with Bulgaria over the division of their joint conquests in Macedonia. Bulgaria was defeated, and Greece and Serbia divided up most of Macedonia between themselves. The wars heightened tensions in the Balkans and helped spark World War I.

Balkans *or* **Balkan Peninsula** Peninsula, southeastern Europe. Located between the Adriatic Sea, the Mediterranean Sea, and the Aegean and Black seas, it contains many countries, including Slovenia, Croatia, Bosnia and Herzegovina, Macedonia, Serbia and Montenegro, Moldova, Romania, and Bulgaria. From 168 BC to AD 107, part of the area was incorporated into Roman provinces, including Epirus, Moesia, Pannonia, Thrace, and Dacia. It was subsequently settled by Slavic invaders, Serbs, Croats, Slovenes, and Slavonized Bulgars, the last of whom were pushed into the Balkan region in the 6th century. It was gradually organized into kingdoms, many of which were overrun by the Ottoman Empire in the 14th–15th century. The factional strife that occurred there from the early 20th century, provoking the continual breakups and regroupings of different states, introduced the word *balkanize* into English.

Balkhash, Lake *or* **Lake Balqash** \'bäl-'käsh\ Lake, southeastern Kazakhstan. It is about 375 mi (600 km) long, with a maximum depth of roughly 85 ft (25 m). Its chief feeder is the Ili River, which enters at the west in a wide delta. Harsh climate affects its size greatly; its area has varied from about 6,000 sq mi (15,500 sq km) to 7,300 sq mi (19,000 sq km), depending on seasonal precipitation. It is frozen from November to early April. Since the mid-20th century, industrial pollution has caused severe ecological damage.

Ball, Lucille (Désirée) (b. Aug. 6, 1911, Celoron, near Jamestown, N.Y., U.S.—d. April 26, 1989, Los Angeles, Calif.) U.S. actress and television star. She performed in films from 1933 and starred in a comedy radio series from 1947. With her bandleader husband, Desi Arnaz, she created the very successful television comedy series *I Love Lucy* (1951–57) and later the *Lucy-Desi Comedy Hour* (1957–60). After their divorce in 1960, Ball appeared in *The Lucy Show* (1962–68) and *Here's Lucy* (1968–74). With her red hair and rasping voice and a comic persona alternately brassy and feminine, she was the preeminent female star of the early decades of television.

Lucille Ball and Desi Arnaz.
PHOTOFEST

ball bearing One of the two types of rolling, or antifriction, bearings (the other is the roller bearing). Its function is to connect two machine members that move relative to one another so that the frictional resistance to motion is minimal. In many applications, one of the members is a rotating shaft and the other a fixed housing. Each ball bearing has three main parts: two grooved, ringlike races and a number of balls. The balls fill the space between the two races and roll with negligible friction in the grooves. The balls may be loosely restrained and separated by means of a retainer or cage.

ballad Form of short narrative folk song. Its distinctive style crystallized in Europe in the late Middle Ages as part of the oral tradition, and it has been preserved as a musical and literary form. The oral form has persisted as the folk ballad, and the written, literary ballad evolved from the oral tradition. The folk ballad typically tells a compact tale with deliberate starkness, using devices such as repetition to heighten effects. The modern literary ballad (e.g., those by W.H. Auden, Bertolt Brecht, and Elizabeth Bishop) recalls in its rhythmic and narrative elements the traditions of folk balladry.

ballad opera English 18th-century comic opera in which songs and musical interludes, usually consisting of existing popular tunes or opera melodies with new words, are interspersed with spoken dialogue. The first ballad opera, *The Beggar's Opera* (1728), by John Gay and J.C. Pepusch (1667–1752), was a sharply satirical work that became wildly popular and led to numerous similar works. Ballad opera led directly to the German singspiel and can be seen as the source of the modern musical.

ballade \bä-'läd\ One of several formes fixes in French lyric poetry and song, cultivated particularly in the 14th–15th centuries. It consists of three main stanzas having the same rhyme scheme plus a shortened final dedicatory stanza; all four stanzas have identical final refrain lines. The texts were often solemn and formal, containing elaborate symbolism and classical references. Though present in the poetry of many ages and regions, the ballade in its purest form was found only in France and England. Its precursors can be found in the songs of the troubadours and trouvères.

Ballard \'bal-ərd**, J(ames) G(raham)** (b. Nov. 15, 1930, Shanghai, China) British writer. Ballard spent four years of his childhood in a Japanese prison camp, an experience he described in *Empire of the Sun* (1984; film, 1987). His science fiction is often set in ecologically unbalanced landscapes caused by decadent technological excess. His apocalyptic novels, often shockingly violent, include *Crash* (1973; film, 1996), *Concrete Island* (1974), and *High Rise* (1975). His later works include the short-story collection *War Fever* (1990) and the novels *The Kindness of Women* (1991) and *Cocaine Nights* (1998).

Ballard \'ba-lərd**, Robert D(uane)** (b. 1942, Wichita, Kan., U.S.) U.S. oceanographer and marine geologist. He grew up near San Diego, Calif. As a marine scientist at the Woods Hole (Mass.) Oceanographic Research Institution, he pioneered the use of deep-diving submersibles, participated in the first manned exploration of the Mid-Atlantic Ridge, and discovered warm water springs and their unusual animal communities in the Galápagos Rift. He is best known for his dramatic discovery of the wreck of the *Titanic* in 1985. Since then he has gone on to discover ships lost in battle during World War II.

Ballesteros \ˌbal-əs-'ter-ōs**, Seve(riano)** (b. April 9, 1957, Pedreña, Spain) Spanish golfer. One of four professional golfing brothers, he fre-

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quently won the British Open (1979, 1984, 1988) and the Masters (1980, 1983) and captained the 1997 European Ryder Cup team to victory. Known for his flamboyant and imaginative style of play, by the late 1990s he had accumulated more than 70 wins in international tournaments.

ballet Theatrical dance in which a formal academic technique (the *danse d'école*) is combined with music, costume, and stage scenery. Developed from court productions of the Renaissance, ballet was renewed under Louis XIV, who in 1661 established France's Académie Royale de Danse, where Pierre Beauchamp developed the five BALLET POSITIONS. Early ballets were often accompanied by singing and incorporated into opera-ballets by composers such as JEAN-BAPTISTE LULLY. In the 18th century JEAN-GEORGES NOVERRE and GASPARO ANGIOLINI separately developed the dramatic ballet (*ballet d'action*) to tell a story through dance steps and mime, a reform echoed in CHRISTOPH WILLIBALD GLUCK's music. Significant developments in the early 19th century included pointe work (balance on the extreme tip of the toe) and the emergence of the prima ballerina, exemplified by MARIE TAGLIONI and FANNY ELSSLER. In the late 19th and early 20th centuries, Russia became the centre of ballet production and performance, through the work of innovators such as SERGEY DIAGHILEV, ANNA PAVLOVA, VASLAV NIJINSKY, MARIUS PETIPA, and MICHEL FOKINE; great ballets were composed by PYOTR TCHAIKOVSKY and IGOR STRAVINSKY. Since then, ballet schools in Great Britain and the U.S. have elevated ballet in those countries to Russia's level and greatly increased its audience. See also AMERICAN BALLET THEATRE; BALLET RUSSE DE MONTE CARLO; BALLETS RUSSES; BOLSHOI BALLET; NEW YORK CITY BALLET; ROYAL BALLET.

ballet position Any of the five positions of the feet fundamental to all classical BALLET. First codified by Pierre Beauchamp (1636–1705) in 1680, the positions form the base from which a dancer achieves stability or aplomb, the basic law of ballet. Fundamental to all the positions is the turnout, or rotation of the dancer's legs out from the hips, which creates a firm basis for movement in any direction. Various positions of the arms and hands (*port de bras*) complete the figures.

Arabesque executed by Natalya Bessmertnova, with Nikolay Fadeychev, of the Bolshoi Ballet; *Swan Lake*
NOVOSTI—SOVFOTO

Ballet Russe de Monte Carlo \bå-lā-'rüs-də-mō[n]-tā-'kär-lō\ Ballet company formed in Monte Carlo in 1932. The name derived from SERGEY DIAGHILEV's BALLETS RUSSES, which dissolved after his death in 1929. Under René Blum and Col. W. de Basil, the company presented works by LÉONIDE MASSINE and GEORGE BALANCHINE and featured ALEXANDRA DANILOVA, ANDRÉ EGLEVSKY, and David Lichine. In 1938 clashes split the company into two groups: the Original Ballet Russe (led by de Basil), which toured internationally before dissolving in 1948; and the Ballet Russe de Monte Carlo (led by Massine), which toured mainly in the U.S. with Danilova, ALICIA MARKOVA, and MARIA TALLCHIEF until 1963.

Ballets Russes \bå-lā-'rüs\ Ballet company founded in Paris in 1909 by SERGEY DIAGHILEV. Considered the source of modern ballet, the company employed the most outstanding creative talent of the period. Its choreographers included MICHEL FOKINE, LÉONIDE MASSINE, BRONISLAVA NIJINSKA, and GEORGE BALANCHINE, and among its dancers were YEKATERINA GELTZER, TAMARA KARSAVINA, and VASLAV NIJINSKY. Music was commissioned from composers such as IGOR STRAVINSKY, MAURICE RAVEL, DARIUS MILHAUD, SERGEY PROKOFIEV, and CLAUDE DEBUSSY, and ballets featured stage designs by artists ALEXANDRE BENOIS, PABLO PICASSO, GEORGES ROUAULT, HENRI MATISSE, and ANDRÉ DERAIN.

Ballinger \'bal-in-jər\, Richard A(chilles) (b. July 9, 1858, Boonesboro, Iowa, U.S.—d. June 6, 1922, Seattle, Wash.) U.S. secretary of the interior (1909–11). As the reform mayor of Seattle, Wash. (1904–06), he attracted national attention. In 1907 he was appointed commissioner of the General Land Office, and in 1909 he became secretary of the interior. During his two years in that post he sought to make public resources more available for private exploitation. Implicated in a fraudulent Alaskan land-claims scheme, he was cleared after a congressional investigation but resigned in 1911. The episode split the Republicans between conservatives led by Pres. WILLIAM H. TAFT and progressives loyal to THEODORE ROOSEVELT.

Balliol, John de See JOHN (SCOTLAND)

ballista \bə-'lis-tə\ Ancient missile launcher designed to hurl long arrows or heavy balls. The Greek version was basically a huge CROSSBOW fastened to a mount. The Roman ballista was powered by torsion derived from two thick skeins of twisted cords through which were thrust two separate arms joined at their ends by the cord that propelled the missile. The largest could accurately hurl 60-lb (27-kg) weights up to about 500 yards (450 m).

ballistics Science of propulsion, flight, and impact of projectiles. Internal ballistics deals with propulsion of projectiles, such as within the barrel of a gun or at a rocket launch. Guns and rocket engines convert CHEMICAL ENERGY of propellants into KINETIC ENERGY of projectiles. External ballistics deals with projectile flight. The trajectory, or path, of a projectile is subject to the forces of gravity (see GRAVITATION), DRAG, and LIFT. Terminal ballistics deals with the impact of projectiles on a target. Wound ballistics deals with the mechanisms and medical implications of trauma caused by bullets and explosively driven fragments, such as shrapnel.

balloon Large airtight bag filled with hot air or a lighter-than-air gas such as HELIUM or HYDROGEN that can rise and float in the atmosphere. Experimental attempts may have begun by 1709, but not until 1783 did J.-M. and J.-É. MONTGOLFIER develop a fabric-bag balloon that would rise when filled with hot air. Balloons provided military aerial observation sites in the 19th century and were used in the 20th century by scientists such as AUGUSTE PICCARD to gather high-altitude data. The first round-the-world balloon flight was achieved in 1999 by Bertrand Piccard and Brian Jones. See also AIRSHIP.

ballooning Flying in a BALLOON in competition or for recreation. Sport ballooning began in the early 20th century and became popular in the 1960s. The balloons used are of lightweight synthetic materials (e.g., polyester coated in aluminized mylar) and are filled with hot air or lighter-than-air gas. Balloon races often involve tasks such as changing elevations or landing on or near a target. Competitions are regulated by the Fédération Aéronautique Internationale. The first transatlantic, transcontinental, and transpacific balloon flights were achieved in 1978, 1980, and 1981, respectively. In 1997–98 international teams began competing to become the first to balloon nonstop around the world. This feat was finally accomplished in 1999 by the Swiss psychiatrist Bertrand Piccard (grandson of famed physicist and balloonist Auguste Piccard) and his British copilot Brian Jones, who spent 19 days in the air.

Ballot Act (1872) British law that introduced the secret ballot for all parliamentary and municipal elections. The secret ballot was also called the Australian ballot, because it was first used in Australian elections (1856). The British law, which was designed to protect voters from bribery and coercion, was one of the important achievements of WILLIAM E. GLADSTONE's first administration.

ballot initiative See REFERENDUM AND INITIATIVE

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ballroom dance European and American social dancing performed by couples. It includes standard dances such as the fox-trot, WALTZ, POLKA, TANGO, CHARLESTON, JITTERBUG, and MERENGUE. Ballroom dance was popularized by VERNON AND IRENE CASTLE and FRED ASTAIRE and, later, by Arthur Murray (1895–1991), who established ballroom dance studios throughout the U.S. Ballroom dance contests, especially popular in Europe, feature both amateur and professional dancers.

Ballycastle Town (pop., 1991: 4,005), district seat of MOYLE, Northern Ireland. It is situated along Ballycastle Bay, opposite an island where Scotland's King ROBERT I is said to have hidden from enemies in a cave. It is a market centre, fishing harbour, and resort.

Ballymena \ˌba-lē-ˈmē-nə\ District (pop., 2001: 58,610), Northern Ireland. Established in 1973, it is an agricultural area. The Antrim Mountains, which reach a height of 1,430 ft (435 m), traverse the eastern part of the district, sloping toward the valley of the River MAIN. Ballymena town, the district seat, is a marketing centre for the surrounding area; it has long been known for its linen and woolen production.

Ballymoney \ˌba-lē-ˈmə-nē\ District (pop., 2001: 26,894), Northern Ireland. Established in 1973, it is an agricultural area intersected by the Antrim Mountains. The town of Ballymoney is the district seat.

balm Any of several fragrant herbs of the MINT family, particularly *Melissa officinalis* (balm gentle, or lemon balm), cultivated in temperate climates for its fragrant leaves, which are used as a scent in perfumes and as a flavouring. The name is also applied to *Melittis melissophyllum* (bastard balm), *Monarda didyma* (BERGAMOT, or BEE BALM), *Collinsonia canadensis* (horse balm), *Glecoma hederacea* and *Satureja (Calamintha) nepeta* (field balm), and *Molucella laevis* (Molucca balm, or bells of Ireland), as well as to aromatic substances from species of *Commiphora* (trees and shrubs of the incense-tree family).

Balmain \bȧl-ˈmaⁿ**, Pierre (-Alexandre-Claudius)** (b. May 18, 1914, Saint-Jean-de-Maurienne, Fr.—d. June 29, 1982, Paris) French fashion designer. He gave up architectural studies to become a designer in 1934. He worked briefly with CHRISTIAN DIOR, who became his rival after World War II. Balmain's designs, particularly for evening wear, were characterized by superb quality and a combination of femininity and imposing elegance; his clients included film stars and royalty. He later opened branches in New York City and Caracas and expanded into perfume and accessories.

Balochi \bə-ˈlō-chē\ *or* **Baluchi** \bə-ˈlü-chē\ Any member of a group of tribes speaking the Balochi language and inhabiting the province of BALOCHISTAN in Pakistan and neighbouring areas of Iran, Afghanistan, Bahrain, and the Punjab (India). Some 70% of the total Balochi population live in Pakistan, where they are divided into two groups, the Sulaimani and the Makrani. Mentioned in 10th-century Arabic chronicles, they probably came originally from the Iranian plateau. Traditional Balochis are nomads, but settled agricultural existence is becoming more common. They raise camels and other livestock and engage in carpet making and embroidery.

Balochistan \bə-ˌlō-chi-ˈstän\ *or* **Baluchistan** \bə-ˌlü-chi-ˈstän\ Province (pop., 1998: 6,511,000), southwestern Pakistan. Its capital is Quetta (pop., 1998: 560,307). Its landscape includes mountains, notably the SULAIMAN and Kithar ranges; barren, flat plains; arid desert; and marshy swamps. In ancient times, it was part of GEDROSIA. ALEXANDER THE GREAT traversed it in 325 BC. It was included in the Bactrian kingdom, then was ruled by Arabs from the 7th to the 10th century AD. It was ruled by Persia for centuries, with the exception of a period when it belonged to the Mughal Empire (1594–1638). It became a British dependency in 1876 and a British province of India in 1887. It was made part of Pakistan in 1947–48 and was designated a separate province in 1970. Wheat, sorghum, and rice are staple crops; manufactures include cotton and woolen goods.

Balqash, Lake See Lake BALKHASH

balsa Tree (*Ochroma pyramidale*, or *O. lagopus*) of the bombax family (Bombacaceae), native to tropical South America and noted for its extremely light wood, which resembles clear white pine or BASSWOOD. Because of its buoyancy (about twice that of cork), balsa has long been used for making floats for lifelines and life preservers. Its resilience makes it an excellent shock-absorbing packing material. Its insulating properties make it a good lining material for incubators, refrigerators, and cold-storage rooms. Because it combines lightness and high insulating power, it is a valuable construction material for transportation containers for dry ice (solidified carbon dioxide). It is also used in the construction of airplane passenger compartments and in model airplanes and boats.

balsam Aromatic resinous substance that flows from a plant, either spontaneously or from an incision, and is used chiefly in medicinal preparations. Some of the more aromatic varieties are used in incense. Balsam of Peru, a fragrant, thick, deep brown or black fluid used in perfumes, is a true balsam, from a lofty leguminous tree, *Myroxylon pereirae*, native to and introduced into Sri Lanka. Balsam of Tolu (Colombia) is used in perfumes and in cough syrups and lozenges; it hardens with age. Canada balsam and Mecca balsam are not true balsams.

balsam poplar North American POPLAR (*Populus balsamifera*), native from Labrador to Alaska and across the extreme northern U.S. Often cultivated as a shade tree, it has buds thickly coated with an aromatic resin that is used to make cough syrups. It grows best in northwestern Canada.

Balthus \bȧl-ˈtüs\ *orig.* **Balthazar Klossowski** (b. Feb. 29, 1908, Paris, Fr.—d. Feb. 18, 2001, La Rossinière, Switz.) French painter. Born in Paris to Polish parents, he was considered a child prodigy and was encouraged by family friends including PIERRE BONNARD, ANDRÉ DERAIN, and RAINER MARIA RILKE. Without formal training, he supported himself through commissions for stage sets and portraits. He had his first one-man show in 1934. In the midst of 20th-century avant-gardism, he explored the traditional categories of European painting: the landscape, the still life, the subject painting, and the portrait. He presented ordinary moments of contemporary life on a grand scale and utilized traditional, Old Master painting techniques. Balthus is best known for his controversial depictions of adolescent girls. His disturbing and erotic images and his carefully cultivated persona made him an international cult figure. From 1961 to 1977 he served as director of the French Academy in Rome.

Baltic languages Branch of the INDO-EUROPEAN LANGUAGE FAMILY that includes three attested languages, LITHUANIAN, LATVIAN, and Old Prussian. They were or are spoken along the eastern and southeastern shore and hinterlands of the Baltic Sea. Medieval chronicles report four other Baltic-speaking peoples in the region, though by the 16th century these peoples had been completely assimilated. Baltic has certain striking features in common with SLAVIC LANGUAGES, though the deep divisions within Baltic itself, among other factors, make the hypothesis of a common Balto-Slavic protolanguage difficult to defend.

Baltic religion Ancient beliefs and practices of the Balts of Eastern Europe. They are believed to give evidence of a common source with VEDIC and IRANIAN RELIGION. The most important Baltic divinities were sky gods: DIEVS (the sky), Perkons (the thunderer), SAULE (sun goddess), and Meness (moon god). A forest divinity, the Mother of the Forest, was common to all Baltic peoples and was differentiated into goddesses that personified various aspects of nature. Destiny or luck was personified as the goddess Laima, who determined a person's fate at the moment of birth. The dead were thought to revisit the world as good or evil spirits; evil was also done by the devil, Velns, and by a werewolf-like creature known as Vilkacis or Vilkatas. The structure of the world, with the WORLD TREE at its center, and the enmity between Saule and Meness are important themes. Festivals marked the summer solstice, the harvest, marriages, and funerals. Worship was conducted at holy groves and small hills; excavations have also revealed circular wooden temples.

Baltic Sea Sea, northern Europe. An arm of the Atlantic Ocean, connecting with the North Sea, it is about 1,000 mi (1,600 km) long, covers an area of about 149,000 sq mi (386,000 sq km), and has a maximum depth of about 1,500 ft (450 m). It receives the VISTULA and ODER rivers and many other rivers. It is enclosed by Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany, and Russia. It has two large arms, the Gulf of BOTHNIA and the Gulf of FINLAND. The modifying effect of the North Atlantic Current is scarcely felt; its waters contain only about one-fourth as much salt as the oceans, and it freezes readily.

Baltic States Republics of Lithuania, Latvia, and Estonia, situated on the eastern shore of the BALTIC SEA. The name has sometimes been used to include Finland and Poland. They were created as independent states in 1917 from the Baltic provinces of Russia, the city of Kovno, and part of the Polish department of Wilno (later Lithuania). With the aid of German and Allied forces, the Baltic states repelled a BOLSHEVIK invasion in 1919. In 1940 they were forcibly occupied by the Soviet Union and incorpo-

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rated as constituent republics. In 1944 Soviet troops recovered the territory overrun by German forces in 1941. The Baltic states gained independence on the breakup of the Soviet Union in 1991.

Baltimore, David (b. March 7, 1938, New York, N.Y., U.S.) U.S. virologist. He received his doctorate from the Rockefeller Institute. He and Howard Temin (1934–94), working independently, discovered an enzyme that synthesizes DNA from RNA, the reverse of the usual process. This enzyme, reverse transcriptase, has become an invaluable tool in recombinant DNA technology. The research of Baltimore, Temin, and RENATO DULBECCO helped illuminate the role of viruses in cancer; the three men shared a Nobel Prize in 1975. In 1990 Baltimore became president of Rockefeller University; in 1997 he became president of the California Institute of Technology.

Baltimore (of Baltimore), George Calvert, 1st Baron (b. 1578/79, Kipling, Yorkshire, Eng.—d. April 15, 1632) English colonialist. He served in the House of Commons from 1621; charged with communicating the policy of JAMES I, he was distrusted by Parliament. After declaring himself a Roman Catholic (1625), he gave up his office and was created Baron Baltimore, receiving land grants in Ireland. To assure the prosperity of his New World holdings, he took his family to his Newfoundland colony in 1628. Because of conflict over his Catholicism and the severe climate, he petitioned CHARLES I for a land grant in the Chesapeake Bay area. He died before the charter was granted, and his son Cecil became proprietor of the colony of Maryland.

Baltimore City (pop., 2000: 651,154), north-central Maryland, U.S. Located at the head of the Patapsco River estuary, 15 mi (24 km) above CHESAPEAKE BAY, it is Maryland's largest city and economic hub. Established in 1729, it was named after the Irish barony of Baltimore (seat of the Calvert family, proprietors of the colony of Maryland). It became the first U.S. Roman Catholic diocese in 1789. In 1827 the nation's first railroad began operations there. In World War I, Baltimore began to develop industrially, and it has since become a major seaport.

Baltimore and Ohio Railroad (B&O) First steam-operated railway in the U.S. to be chartered as a common carrier of freight and passengers (1827). The B&O was established by Baltimore merchants to foster trade with the West. By 1852 the railroad extended to Wheeling, Va. (now W.V.), and in the next two decades it reached Chicago, Ill., and St. Louis, Mo. The B&O's long-distance passenger trains were discontinued in 1971 after AMTRAK was established. Many of B&O's operations were assumed by the CSX Corp. in 1980.

Baltimore Sun Daily newspaper published in Baltimore, Md., U.S. It was begun as a four-page penny tabloid in 1837 by Arunah Shepherdson Abell, a journeyman printer from Rhode Island. Known through much of its history for its coverage of national and international news, the paper was run by Abell's family until 1910, when control passed to a group of Baltimore businessmen, including H. Crawford Black. Members of Black's family were chairmen of the board until 1984. In 1986 the *Sun* was acquired by the Times Mirror Company, which in turn was acquired by the Tribune Company in 2000. Author H.L. MENCKEN was for years prominently associated with the *Sun*.

Baluba See LUBA

Baluchistan See BALOCHISTAN

Balzac \bäl-'zak**, Honoré de** *orig.* **Honoré Balssa** (b. May 20, 1799, Tours, France—d. Aug. 18, 1850, Paris) French writer. Balzac began working as a clerk in Paris at about age 16. An early attempt at a business career left him with huge debts, and for decades he toiled incessantly to improve his worsening financial condition. In 1829 his novels and stories began to achieve some success, and his early masterpieces soon followed. In a vast series he collectively called *The Human Comedy*, eventually numbering some 90 novels and novellas, he sought to produce a comprehensive picture of contemporary society by presenting all the varieties of human nature. Among his masterpieces are *Eugénie Grandet* (1833), *Père Goriot* (1835), *Lost Illusions* (1837–43), *A Harlot High and Low* (1843–47), and *Cousin Bette* (1846). His novels are notable for their great narrative drive, their large casts of vital and diverse characters, and their obsessive interest in and examination of virtually all spheres of life. His best-known story collection is his *Droll Stories*, 3 vol. (1832–37). His tumultuous life was one of mounting debts and almost incessant toil, with frequent bouts of writing feverishly for 15 hours at a stretch (his death has been attributed to overwork and excessive coffee consumption). He is generally considered the major early influence on REALISM, or NATURALISM, in the novel and one of the greatest fiction writers of all time.

Honoré de Balzac, daguerreotype, 1848.
J.E. BULLOZ

Bamako \'bä-mä-ˌkō\ City pop., 1996: metro area, 809,552), capital of Mali. Located in southwestern Mali on the NIGER RIVER, it was a settlement of a few hundred inhabitants when it was occupied by the French in 1880. It became the capital of the former colony of French Sudan in 1908. Now spanning both sides of the river, it has several colleges and most of Mali's industrial enterprises. The city more than tripled in size in the 1960s, largely because of rural migration from drought-stricken areas of the countryside.

Bambara \bam-'bär-ə\ People of the upper Niger region of Mali who speak a MANDE LANGUAGE of the NIGER-CONGO family. Numbering 3.4 million, the Bambara use the distinctive N'ko alphabet, which reads from right to left, and they are noted for their wood and metal sculptures. In the 17th–18th centuries the Bambara developed two separate empires, one based in Ségou (and including TIMBUKTU) and the other in Kaarta.

bambocciati \ˌbäm-bȯ-'chät-ē\ (Italian: "childishnesses") Small, anecdotal paintings of everyday life made in Rome in the mid-17th century. The genre's originator and most noteworthy exponent was the Dutch painter Pieter van Laer (1599–1642); the word derives from his nickname, Il Bamboccio ("Little Clumsy One," reflecting his physical deformity). Van Laer arrived in Rome from Haarlem c. 1625 and influenced various other northern European painters active in Rome. Their images depicting the lower classes in humorous or grotesque ways were condemned by the leading critics and painters. The *bambocciantì* (painters of *bambocciati*) influenced the Dutch genre painters ADRIAEN BROUWER and ADRIAEN VAN OSTADE.

bamboo Any of the tall, treelike GRASSES, found in tropical and subtropical to mild temperate regions, that make up the subfamily Bambusoideae, family Poaceae (or Gramineae). Bamboos are giant, fast-growing grasses with woody stems. A few species of the genus *Arundinaria* are native to the southern U.S., where they form dense canebrakes along riverbanks and in marshy areas. The woody, hollow aerial stems grow in branching clusters from a thick RHIZOME, often forming a dense undergrowth that excludes other plants. All parts of the bamboo are used, for purposes including food, livestock fodder, fine-quality paper, construction materials, and medicines. Bamboos also have ornamental use in landscape gardens.

Bambuti \bä-em-'bü-tē\ *or* **Mbuti** A number of PYGMY peoples of the Ituri Forest of eastern Congo (Kinshasa). Bambuti is a collective name for four populations of Ituri Pygmies—the Sua (Asua), Aka, Efe, and Mbuti—each of which has formed a loose economic and cultural interdependency with an agricultural group. They average under 4 ft 6 in. (137 cm) in height. Probably the earliest inhabitants of the region, they are nomadic hunters and gatherers living in small groups of from 10 to 100. They have no chiefs or formal councils of elders and believe in a benevolent forest deity. Their music, complex in rhythm and harmony, is often accompanied by dance or mime. Today they number in the tens of thousands.

banana Fruit of the genus *Musa* (family Musaceae), a gigantic herbaceous plant spread by RHIZOMES, and one of the most important food crops of the world. The banana is consumed extensively throughout the tropics, where it is grown, and is also valued in the temperate zone for its flavour, nutritional value, and constant availability. Hundreds of varieties are cultivated. Perhaps the most important species is the common banana, *M. sapientum*. The ripe fruit is high in carbohydrates (mainly sugar), potassium, and vitamins C and A, and it is low in protein and fat. Though usually eaten fresh, bananas may also be cooked. The U.S. imports more bananas than does any other country. See also PLANTAIN.

Banbridge District (pop., 2001: 41,392), Northern Ireland, established in 1973. The area includes the Legananny Hills, which reach an altitude of 1,745 ft (532 m) in eastern Banbridge district and slope southwestward to lowlands that are bisected by the River BANN. Located on the Bann is

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the town of Banbridge, established in 1712; it is the district seat and the main agricultural and population centre of the region.

Banco, Nanni di See NANNI DI BANCO

Bancroft, George (b. Oct. 3, 1800, Worcester, Mass., U.S.—d. Jan. 17, 1891, Washington, D.C.) U.S. historian. Bancroft was educated at Harvard and several German universities. He was minister to England (1846–49), Prussia (1867–71), and the German empire (1871–74). He was the first scholar to plan a comprehensive study of the U.S. from the colonial days through the end of the Revolutionary War. His 10-volume *History of the United States* (1834–40, 1852–74) reflected his belief that the U.S. represented humanity's closest approximation yet to the perfect state and earned him his reputation as the "father of U.S. history."

George Bancroft, photograph by Mathew Brady
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

band Type of human social organization consisting of a small number of nuclear families (see FAMILY) or related subgroups who are loosely organized for purposes of subsistence or security. Bands may be integrated into a larger community or TRIBE. They generally exist in sparsely populated areas and possess relatively simple technologies; their habitats range from the desert (AUSTRALIAN ABORIGINALS) to the African rainforest (BAMBUTI) to the North American tundra (Kaska). Bands may occasionally coalesce for broader community ceremonies, hunting, or warfare. See also HUNTING AND GATHERING SOCIETY; SOCIOCULTURAL EVOLUTION.

band Musical ensemble that generally excludes STRINGED INSTRUMENTS. Ensembles of WOODWIND, BRASS, and PERCUSSION instruments originated in 15th-century Germany, taking on a particularly military role; these spread to France, Britain, and eventually the New World. In the 15th–18th centuries, many European towns had town musicians, or waits, who performed especially for ceremonial occasions in wind bands often consisting primarily of SHAWMS and sackbuts (trombones). In the 18th–19th centuries, the English amateur brass band, largely consisting of the many newly developed brass instruments, took on the important nonmilitary function of representing organizations of all kinds. In the U.S., PATRICK GILMORE's virtuoso band became famous in the mid-19th century; his greatest successor, JOHN PHILIP SOUSA, bequeathed a repertory of marches that has remained very popular. The "big band," under leaders such as DUKE ELLINGTON and COUNT BASIE, was central to American popular music in the 1930s and '40s. In the rock band, unlike most other bands, stringed instruments (electric guitars and electric bass) are paramount.

band theory In chemistry and physics, a theoretical model describing the states of ELECTRONS in solid materials, which can have energy values only within certain specific ranges, called bands. Ranges of energy between two allowed bands are called forbidden bands. As electrons in an atom move from one energy level to another, so can electrons in a solid move from an energy level in one band to another in the same band or in another band. The band theory accounts for many of the electrical and thermal properties of solids and forms the basis of the technology of devices such as SEMICONDUCTORS, heating elements, and capacitors (see CAPACITANCE).

Banda, Hastings (Kamuzu) (b. c. 1898, near Kasungu [Malawi]—d. Nov. 25, 1997, Johannesburg, S.Af.) First president of Malawi (1963–94). Educated as a physician in the U.S., Banda moved to Scotland and practiced medicine there. He became involved in politics when white settlers demanded the federation of Nyasaland (later Malawi) and the Rhodesias in 1949. In the 1950s he toured the country making antifederation speeches, for which he was imprisoned by British colonial officials. In 1963, when the federation was dissolved, he became prime minister. He concentrated on building his country's infrastructure and increasing agricultural productivity. Declared president for life in 1971, his rule became increasingly autocratic and austere. He was voted out of office in 1994.

Bandama \bän-'dä-mä\ **River** River, central Côte d'Ivoire. The longest and commercially most important river in Côte d'Ivoire, it and its tributaries drain half the country's surface area. It rises in the highlands and flows southward 497 mi (800 km) to enter the Gulf of GUINEA and the Taga Lagoon. A major hydroelectric plant is sited at Kossou.

Bandar Seri Begawan \'bän-där-'ser-ē-be-'gä-wän\ *formerly* **Brunei Town** City (pop., 2001: city, 27,285; 2002 est.: metro. area, 74,700), capital of BRUNEI. Lying along the Brunei River near its mouth on Brunei Bay, it is a trade centre and river port. Heavily damaged during World War II, it was largely rebuilt; newer buildings include the largest mosque in eastern Asia.

Bandaranaike \ˌbən-də-rə-'nī-kə**, S(olomon) W(est) R(idgeway) D(ias)** (b. Jan. 9, 1899, Colombo, Ceylon—d. Sept. 26, 1959, Colombo) Statesman and prime minister (1956–59) of Ceylon (Sri Lanka). Educated at the University of Oxford, he became a prominent member of Ceylon's Western-oriented United National Party. In 1952 he founded the nationalist Sri Lanka Freedom Party, becoming the opposition leader in the legislature. He later formed an alliance of four nationalist-socialist parties that swept elections in 1956 and made him prime minister. Under Bandaranaike, Sinhalese replaced English as the country's official language, Buddhism (the majority religion) was given a prominent place in the affairs of state, and Ceylon established diplomatic relations with communist states. He was assassinated in 1959. His widow, Sirimavo Ratwatte Dias Bandaranaike (1916–2000), became the world's first woman prime minister in 1960, serving until 1965; she was prime minister twice more (1970–77 and 1994–2000). During her second term a new constitution was adopted that proclaimed a republic (1972) and changed the country's name to Sri Lanka. She was appointed to a third term when her daughter, Chandrika Bandaranaike Kumaratunga (b. 1945), became president in 1994.

S.W.R.D. Bandaranaike
CAMERA PRESS

bandeira \bän-'der-ə\ Series of 17th-century Portuguese slave-hunting expeditions into the interior of Brazil. Bandeiras consisted of anywhere from 50 to several thousand men (known as *bandeirantes*), usually from São Paulo, who were organized and controlled by wealthy entrepreneurs. The *bandeirantes* penetrated unmapped regions and expanded Portuguese claims to the South American interior. Along the way they built roads, established settlements, and laid the basis for ranching and agriculture in the interior while reaping large profits and inflicting untold hardship on local Indian tribes.

Bandelier \ˌban-də-'lir\ **National Monument** Archaeological area, north-central New Mexico, U.S. Lying along the RIO GRANDE 20 mi (32 km) northwest of SANTA FE, it was established in 1916. It occupies an area of 51 sq mi (132 sq km) and was named for Adolph Bandelier, a Swiss-American archaeologist. The monument contains many cliff and open-pueblo ruins of pre-Columbian Indians (mostly 13th-century) in Frijoles Canyon. Stone sculptures and man-made caves have also been unearthed.

bandicoot Any of about 22 species of MARSUPIALS (family Peramelidae) found in Australia, Tasmania, New Guinea, and nearby islands. Bandicoots are 12–30 in. (30–80 cm) long, including the 4- to 12-in. (10– to 30-cm) sparsely haired tail. They have a stout, coarse-haired body, a tapered muzzle, and hindlimbs longer than their forelimbs. Unlike other marsupials, bandicoots have a placenta. They are terrestrial, solitary animals that dig pits to search for insect and plant food. Farmers consider them pests. All species have declined, and some are now endangered.

Long-nosed bandicoot (*Perameles nasuta*).
WARREN GARST—TOM STACK AND ASSOCIATES

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Bandinelli, Baccio (b. Nov. 12, 1493?, Florence—d. Feb. 7, 1560, Florence) Italian sculptor and painter active in Florence. Though trained as a goldsmith by his father, he soon became one of the principal sculptors at the Medici court. He often failed to complete his commissions and was accused of jealousy and incompetence by Benvenuto Cellini and Giorgio Vasari. He is remembered more for accounts of his unattractive character than for the quality of his work, although surviving works prove him to have been a more distinguished sculptor than his contemporaries allowed. His most famous sculpture is *Hercules and Cacus* (1534), in the Piazza della Signoria.

Bandung \'bän-dùŋ\ City (pop., 1996 est.: 2,429,000), Indonesia. The capital of West Java province, it was founded by the Dutch in 1810 in the interior of Java on a 2,400-ft (730-km) plateau. It is surrounded by beautiful scenery. It is the centre of cultural life for the Sundanese, who compose most of West Java's population and differ in customs and language from their Javanese neighbours. It is a centre for the study and preservation of Sundanese culture and an educational centre.

bandwidth Measurement of the capacity of a communications signal. For digital signals, the bandwidth is the data speed or rate, measured in bits per second (bps). For analog signals, it is the difference between the highest and lowest frequency components, measured in hertz (cycles per second). For example, a modem with a bandwidth of 56 kilobits per second (Kbps) can transmit a maximum of about 56,000 bits of digital data in one second. The human voice, which produces analog sound waves, has a typical bandwidth of three kilohertz between the highest and lowest frequency sounds it can generate.

Banerjea \'bə-nər-jē**, Sir Surendranath** (b. Nov. 10, 1848, Calcutta, India—d. Aug. 6, 1925, Barrackpore, near Calcutta) Indian statesman, one of the founders of modern India. As a young man, he attempted unsuccessfully to serve in the Indian Civil Service, at the time virtually closed to ethnic Indians. He then became a teacher and founded a college in Calcutta (now Kolkata), which was later named for him. Banerjea attempted to bring Hindus and Muslims together for political action, and for 40 years he put forward a nationalist viewpoint in his newspaper, *The Bengalee*. Twice elected president of the Indian National Congress, he advocated for an Indian constitution on the Canadian model. He was elected in 1913 to two legislative councils and later was knighted (1921); in 1924 he was defeated by an independence candidate, whereupon he retired to write his autobiography, *A Nation in the Making* (1925).

Banff National Park Park, southwestern Alberta, Canada. Established as a natural reserve in 1885 and as Canada's first national park in 1887, it lies on the eastern slopes of the Rocky Mountains and includes mineral springs, ice fields, and glacial lakes, including Lake Louise. It has been greatly expanded to its present area of 2,564 sq mi (6,641 sq km). Banff is famed for its spectacular beauty, and visitors are so numerous that it is now more a recreation than a conservation area. In 1984 it was designated part of the Canadian Rocky Mountain Parks UNESCO World Heritage site.

Bangalore \'baŋ-gə-ˌlōr\ City (pop., 2001: city, 4,301,326; metro. area, 5,701,446), capital of Karnataka state, southern India. It is a cultural meeting place for speakers of the Kannada, Telugu, and Tamil languages. Founded in the 16th century, it became a fief of the Indian ruler Hyder Ali c. 1760 but was later taken by the British. It was the headquarters of the British administration 1831–81, when it was restored to the raja of Mysore (now Karnataka). Today, it is one of India's largest cities and an industrial and educational centre.

Banghāzī \bän-'gä-zē\ *or* **Benghazi** \ben-'gä-zē\ Coastal city (pop., 1995 est.: 650,000), northeastern Libya. Located on the Gulf of Sidra, it is Libya's second largest city and was once its capital. Founded by Greeks as Hesperides, it received from Ptolemy III the additional name Berenice in honour of his wife. After the 3rd century AD it superseded Cyrene and Barce as the chief city of the region. After its importance waned, it remained a small town until it was extensively developed during the Italian occupation of Libya (1912–42). In World War II it suffered considerable damage before being captured by the British in 1942. It is now an administrative and commercial centre and the site of one of the world's largest desalinization plants.

Bangka *or* **Banka** Island, Bangka-Belitung province, west-central Indonesia. Located off the eastern coast of Sumatra across the Bangka Strait, it is separated from Billiton (Belitung) island by Gaspar Strait. Its area is 4,375 sq mi (11,330 sq km); the chief town is Pangkalpinang. The sultan of Palembang ceded Bangka to the British in 1812; they in turn exchanged it with the Dutch in 1814 for property in India. Occupied by Japan during World War II, it became part of Indonesia in 1949. Bangka is one of the world's chief tin-producing centres.

Bangkok *Thai* **Krung Thep** \'krùŋ-'tep\ City (pop., 2000: metro. area, 6,355,144), capital of Thailand. Lying 25 mi (40 km) above the mouth of the Chao Phraya River, it is the country's major port and also its cultural, financial, and educational centre. It was established as the capital of Siam (Thailand) in 1782 by King Rama I. Seized by the Japanese in World War II, it subsequently suffered heavy Allied bombing. In 1971–72 it incorporated several outlying districts to form a single province-level metropolis and has since experienced phenomenal growth. Throughout the city, walled Buddhist temples and monasteries serve as focal points for its religious life.

Bangladesh *officially* **People's Republic of Bangladesh** Country, south-central Asia. Area: 56,977 sq mi (147,570 sq km). Population (2002 est.): 133,377,000. Capital: Dhaka. The vast majority of the

population are Bengali. Language: Bengali (official). Religions: Islam (official; mainly Sunni); also Hinduism. Currency: taka. Bangladesh is generally flat, its highest point reaching over 1,000 ft (305 m) above sea level. The landscape is characterized by alluvial plains dissected by numerous connecting rivers. The southern part consists of the eastern sector of the Ganges-Brahmaputra delta. The chief rivers are the Ganges (there known as the Padma) and the Brahmaputra (or Jamuna), which unite as the Padma. Though primarily agricultural, the country often is not self-sufficient in food production. The monsoonal rains that occur from May to October produce extreme flooding over much of Bangladesh, often causing severe crop damage and great loss of life. Cyclones in 1970 and 1991 killed some 300,000 and 140,000 Bengalis, respectively. Bangladesh is a republic with one legislative house; its chief of state is the president and its head of government the prime minister. In its early years Bangladesh was known as Bengal. When the British left the subcontinent in 1947, the area that was East Bengal became the part of Pakistan called East Pakistan. Bengali nationalist sentiment increased after the creation of an independent Pakistan. In 1971 violence erupted; some one million Bengalis were killed, and millions more fled to India, which finally entered the war on the side of the Bengalis, ensuring West Pakistan's defeat. East Pakistan became the independent country of Bangladesh. Little of the devastation caused by the war has been repaired, and political instability, including the assassination of two presidents, has continued.

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Bangor Town (pop., 1991: 52,437), seat of North Down district, Northern Ireland. It lies on the southern shore of Belfast Lough, 12 mi (19 km) northeast of Belfast. St. Comgall founded a monastery at Bangor c. 555, which became a celebrated seat of learning. The town was sacked by the Danes in the 9th century; it was partially rebuilt by St. Malachy in the 12th century. It is now a seaside resort.

Bangui \'bäŋ-gē\ City (pop., 1995: 553,000), capital of the Central African Republic. A major port on the Ubangi River, it is connected by an extended 1,100-mi (1,800-km) river and rail transport system with the Congolese cities of Pointe-Noire and Brazzaville. Chiefly a commercial and administrative centre, Bangui is also the site of a university and research institutes.

Bangweulu \ˌbäŋ-gwā-'ü-lü**, Lake** Lake, northern Zambia. Located southeast of Lake Mweru and southwest of Lake Tanganyika at an elevation of 3,740 ft (1,140 m), it is about 45 mi (72 km) long and, with its adjacent swamps, covers an area of 3,800 sq mi (9,840 sq km). Its outlet is the Luapula, a headstream of the Congo. It has three inhabited islands. David Livingstone, the first European to visit the lake, died there in 1873.

Banja Luka \'bän-yä-'lü-kä\ City (pop., 1997 est.: 160,000), northeastern Bosnia and Herzegovina. It was an important military centre under the Turks and the seat (1583–1639) of the Bosnian territory governed by a pasha. A battlefield between the Austrians and Turks in the 16th–18th centuries, it played an important part in the 19th-century Bosnian uprisings against Turkey as well as in the revolts of the Serbs. It was a hub of resistance in the Axis-dominated country of Croatia during World War II. In 1992 it became the capital of the autonomous Serbian Republic of Bosnia and Herzegovina. It was the site of much fighting during the Bosnian conflict.

banjo Plucked stringed musical instrument of African origin. It has a tambourine-like body, four or five strings, and a long fretted neck. The fifth string (if present) is pegged at the fifth fret and acts primarily as a drone plucked by the thumb. In its original form, the banjo had only four strings and lacked frets. Slaves introduced the instrument to the U.S., where it was popularized in 19th-century minstrel shows and thence exported to Europe. It has been an important American folk instrument, especially in bluegrass, and it was used in early jazz.

Banjul \'bän-ˌjül\ *formerly (1816–1973)* **Bathurst** Seaport (pop., 1993: urban agglomeration, 270,540), capital of The Gambia. Located on the Island of St. Mary in the Gambia River, it is the country's largest city. Founded by the British in 1816 to suppress the slave trade, it subsequently became the capital of the British colony of Gambia. With The Gambia's independence in 1965, it became the national capital. Tourism is of increasing importance, and Banjul serves as a transportation centre with connections to the interior and to Senegal.

bank Institution that deals in money and its substitutes and provides other financial services. Banks accept deposits and make loans and derive a profit from the difference in the interest paid to lenders (depositors) and charged to borrowers, respectively. They also profit from fees charged for services. The three major classes of banks are commercial banks, investment banks, and central banks. Banking depends entirely on public confidence in the system's soundness; no bank could pay all its depositors should they simultaneously demand cash, as may happen in a panic. See also credit union; Federal Reserve System; savings and loan association; savings bank.

Bank of Canada Canada's central bank, established under the Bank of Canada Act (1934). It was founded during the Great Depression to regulate credit and currency. The Bank acts as the Canadian government's fiscal agent and has the sole right to issue paper money. It is directed by the Canadian Ministry of Finance; all profits go to the Receiver General of Canada.

Bank of England Central bank of Britain, headquartered in London. Incorporated by act of Parliament in 1694, it soon became the largest and most prestigious financial institution in England. It did not assume the responsibilities of a central bank until the 19th century, and it was privately owned until 1946, when it was nationalized.

Bank of the United States Bank chartered in 1791 by the U.S. Congress. It was conceived by Alexander Hamilton to pay off the country's debts from the American Revolution and to provide a stable currency. Its establishment, opposed by Thomas Jefferson, was marked by extended debate over its constitutionality and contributed significantly to the evolution of pro- and anti-bank factions into the first U.S. political parties, the Federalist Party and the Democratic-Republican Party. The national bank played the unexpected but beneficial role of preventing private state banks from overextending credit, a restriction that some nevertheless considered an affront to states' rights. Meanwhile, agrarian populists regarded the bank as an institution of privilege and wealth and the enemy of democracy and the interests of the common people. Antagonism over the bank issue grew so heated that its charter could not be renewed in 1811. Criticism of the bank reached its height during the administration of Pres. Andrew Jackson, who led anti-bank forces in the long struggle known as the Bank War. The bank's charter expired in 1836. Its reorganization as the Bank of the United States of Pennsylvania ended its regulation of private banks.

bank rate See discount rate

Bank War Controversy in the 1830s over the existence of the Bank of the United States, at that time the only national banking institution. The first Bank of the United States, chartered in 1791 over the objections of Thomas Jefferson, ceased in 1811 when Jeffersonian (Democratic) Republicans refused to pass a new federal charter. In 1816 the second Bank of the United States was created, with a 20-year federal charter. In 1829 and again in 1830 Pres. Andrew Jackson made clear his constitutional objections to and personal antagonism toward the bank. He believed it concentrated too much economic power in the hands of a small moneyed elite beyond the public's control. Its president, Nicholas Biddle, with the support of Henry Clay and Daniel Webster, applied for a new charter in 1832, four years before the old charter was due to expire, thus ensuring that the bank would be an issue in the 1832 presidential election. Jackson vetoed the recharter bill and won the ensuing election, interpreting his victory as a mandate to destroy the bank. He forbade the deposit in the bank of government funds; Biddle retaliated by calling in loans, which precipitated a credit crisis. Denied renewal of its federal charter, the bank secured a Pennsylvania charter in 1836. Faulty investment decisions forced it to close in 1841.

Banka See Bangka

Bankhead, Tallulah (Brockman) (b. Jan. 31, 1902, Huntsville, Ala., U.S.—d. Dec. 12, 1968, New York, N.Y.) U.S. film and stage actress. Born to a prestigious family (her father became a prominent congressman), she made her Broadway debut in 1918 and achieved fame on the London stage in *The Dancer* (1923). Her vivid presence and throaty voice contributed to her singular performances in the hit plays *The Little Foxes* (1939), *The Skin of Our Teeth* (1942), and *Private Lives* (1946). She made films such as *A Woman's Law* (1928) and Alfred Hitchcock's *Lifeboat* (1944) but remained primarily a stage performer. Her final stage appearance was in *The Milk Train Doesn't Stop Here Anymore* (1964).

bankruptcy Status of a debtor who has been declared by judicial process to be unable to pay his or her debts. It also refers to the legal process involved: the administration of an insolvent debtor's property by the court for the benefit of the debtor's creditors. Filing by a debtor is called voluntary bankruptcy; involuntary bankruptcy is declared by the court upon petition by a creditor. The U.S. Bankruptcy Code makes four types of relief available to bankrupt individuals or corporations: liquidation (under Chapter 7), reorganization (Chapter 11), debt adjustment for a family farmer (Chapter 12), and debt adjustment for an individual with a regular income (Chapter 13). Municipalities may file under Chapter 9. Generally, not all debts are paid in a bankruptcy. The court determines which debts are to be repaid, and the debtor is typically granted a discharge of the rest. See also insolvency.

Banks Island Island, Northwest Territories, Canada. The westernmost island in the Canadian Arctic Archipelago, it lies northwest of Victoria Island and is separated from the mainland by Amundsen Gulf. About 250 mi (400 km) long, it has an area of 27,038 sq mi (70,028 sq km). First sighted by Sir William Parry's expedition in 1820, it was named for the naturalist Joseph Banks.

Banks Peninsula Peninsula, South Island, New Zealand, extending about 35 mi (55 km) into the Pacific Ocean. Originally an island formed by two contiguous volcanic cones, the peninsula was visited in 1770 by Capt. James Cook, who named it for Joseph Banks. Christchurch is situated at its base.

Banks, Ernie *in full* **Ernest Banks** (b. Jan. 31, 1931, Dallas, Tex., U.S.) American baseball player. In 1950 Banks was signed by the Kan-

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sas City Monarchs, one of the top teams in the Negro leagues. After one season with the Monarchs, Banks spent two years in the U.S. Army. He spent only a short time in the Negro leagues after his discharge from the service, as he was signed by the Chicago Cubs in 1953. Banks soon established himself as one of the National League's leading power hitters, his career batting totals were 512 home runs and 1,636 runs batted in, with more than 40 home runs in each of five seasons. He was elected to the Baseball Hall of Fame in 1977, his first year of eligibility.

Banks, Russell (b. March 28, 1940, Newton, Mass., U.S.) U.S. novelist. Banks was associated in the 1960s with Lillabulero Press and has taught at various colleges and universities. He attracted wide attention with *Continental Drift* (1985), inspired by a stint in Jamaica; his later novels, which, like his earlier works, often portray characters trapped by economic and social forces they do not understand, include *Affliction* (1989; film, 1998), *The Sweet Hereafter* (1991; film, 1997), and *Cloudsplitter* (1998), a historical novel about the abolitionist John Brown.

Banks, Sir Joseph (b. Feb. 13, 1743, London, Eng.—d. June 19, 1820, Isleworth, London) British explorer and naturalist. After studying at Oxford, Banks inherited a fortune that allowed him to travel extensively, collecting plant and natural history specimens. He outfitted and accompanied James Cook's voyage around the world (1768–71). Particularly interested in economic plants and their introduction from one country to another, he was the first to suggest the identity of the wheat rust and barberry fungus (1805); he was also the first to show that marsupial mammals are more primitive than placental mammals. He served as president of the Royal Society from 1778 to 1820, and, as unofficial director of Kew Gardens, he transformed it into a major botanical institution. His herbarium, one of the most important in existence, and his library, a major collection of works on natural history, are now at the British Museum.

Bann, River River, Northern Ireland. The Upper Bann flows northwest 25 mi (40 km) into Lough Neagh, while the Lower Bann flows north out of the lake 33 mi (53 km) into the Atlantic Ocean.

Bannā', Ḥasan al- (b. 1906, Egypt—d. February 1949, Cairo) Egyptian political and religious leader. He began teaching Arabic at a primary school in Ismailia in 1927. In 1928 he established the Muslim Brotherhood, which aimed at rejuvenating Islam and Egyptian society and expelling the British from Egypt. By 1940 it was attracting students, civil servants, and urban labourers to its ranks. He tried to maintain an alliance with the Egyptian government, but many members saw the government as betraying Egyptian nationalism, and after the war, members were implicated in several political assassinations, including that of Prime Minister al-Nuqrāshī in 1948. Ḥasan al-Bannā' was assassinated with government involvement the next year.

Banneker, Benjamin (b. Nov. 9, 1731, Ellicott's Mills, Md.—d. Oct. 25, 1806, Baltimore, Md., U.S.) American astronomer, compiler of almanacs, and inventor. A free black who owned a farm near Baltimore, Banneker was largely self-educated in astronomy and mathematics. In 1761 he attracted attention by building a wooden clock that kept precise time. He began astronomical calculations about 1773, accurately predicted a solar eclipse in 1789, and published annually from 1791 to 1802 the *Pennsylvania, Delaware, Maryland, and Virginia Almanac and Ephemeris*. (He sent an early copy of the almanac to Thomas Jefferson to counter a contention that blacks were intellectually inferior.) In 1790 he was appointed to the commission that surveyed the site for Washington, D.C. He also wrote essays denouncing slavery and war.

Banner system Military organization used by the Manchu tribes of Manchuria (now northeastern China) to conquer and control China in the 17th century. The system was developed by the Manchu leader Nurhachi, who in 1601 organized his warriors into four companies, each known for its banner of a distinguishing colour. More Banners (as the companies were known) were soon established, and, as the Manchus began to conquer their Chinese and Mongol neighbours, they organized their captives into similar companies. With these troops the Manchus conquered China and established the Qing dynasty in 1644. Over time, the Banners' fighting qualities deteriorated, until by the end of the 19th century the system had become largely ineffective.

Bannister, Sir Roger (Gilbert) (b. March 23, 1929, Harrow, Middlesex, Eng.) British runner. He attended the University of Oxford before earning a medical degree. In 1954 he became the first person to run a mile in less than four minutes (3 minutes 59.4 seconds). Many authorities had previously regarded the four-minute mile "barrier" as unbreakable. A neurologist, he wrote papers on the physiology of exercise, and he is said to have achieved his speed through scientific training methods.

Bannockburn, Battle of (June 23–24, 1314) Decisive battle in Scottish history, at which the Scots under Robert the Bruce (later Robert I) defeated the English under Edward II. The Scots were outnumbered three to one by the English soldiers, but they triumphed through masterly use of terrain, forcing the English onto a cramped, marshy battlefield with little room to maneuver. The English forces were put to flight, and many were slaughtered by the pursuing Scots. The victory cleared the last English troops from Scotland and secured Scottish independence, confirming Robert as king of the Scots.

Banpo \'bän-'pō\ *or* **Pan-p'o** Site of a Neolithic village located on the Wei River in China, dating to the earlier part of the Yangshao culture, 5000–4000 BC. A huge number of artifacts have been uncovered, including 8,000 stone and bone tools, pottery fragments, and clay figurines. The main cultivated crop was foxtail millet; the diet was supplemented through hunting and gathering. Pigs and dogs were domesticated, and evidence of hemp and silkworm cultivation point to textile manufacture. Some 250 graves have been excavated. See also Neolithic Period.

Banque de France \'bäⁿk-də-'fräⁿs\ National bank of France, created in 1800 to restore confidence in the French banking system after the financial upheavals of the revolutionary period. Napoleon was one of its founding shareholders. The bank has primary responsibility for formulating and implementing credit and monetary policies in France and for the orderly functioning of the banking system. It also has the exclusive privilege of issuing currency. See also central bank.

Bantam Former city and sultanate, Java. It was located at the western end of Java between the Java Sea and the Indian Ocean. In the early 16th century it became a powerful Muslim sultanate, which extended its control over parts of Sumatra and Borneo. Invaded by the Dutch, Portuguese, and British, it ultimately recognized Dutch sovereignty in 1684. The city was Java's most important port for the European spice trade until its harbour silted up in the late 18th century. It suffered severely from the eruption of Krakatoa in 1883.

Banting, Sir Frederick Grant (b. Nov. 14, 1891, Alliston, Ont., Can.—d. Feb. 21, 1941, Nfd.) Canadian physician. He taught at the University of Toronto from 1923. With Charles Best, he was the first to obtain a pancreatic extract of insulin (1921), which, in the laboratory of J.J.R. Macleod, they isolated in a form effective against diabetes. Banting and Macleod received a 1923 Nobel Prize for the discovery of insulin; Banting voluntarily shared his portion of the prize with Best.

Bantu languages Group of some 500 languages belonging to the Benue-Congo language branch of the Niger-Congo language family. They are spoken by more than 200 million people in a very large area, including most of Africa from southern Cameroon eastward to Kenya and southward to the southernmost tip of the continent. Twelve Bantu languages, including Rundi (Kirundi), Rwanda (Kinyarwanda), Shona, Zulu, and Xhosa, are spoken by more than 5 million people.

Bantu peoples Speakers of the close to 500 distinct Bantu languages, numbering more than 200 million and occupying almost the entire southern projection of Africa. The classification is primarily linguistic, for the cultural patterns of Bantu speakers are extremely diverse. Included in the group are the Bemba, Bena, Chaga, Chewa, Embu, Fang, Ganda, Gusii, Hehe, Herero, Hutu, Kagwe, Kikuyu, Luba, Luhya, Lunda, Makonde, Meru, Nayamwezi, Ndebele, Nkole, Nyakyusa, Nyoro, Pedi, Shona, Sotho, Swazi, Tsonga, Tswana, Tutsi, Venda, Xhosa, Yao, Zaramo, and Zulu.

banyan Unusually shaped tree (*Ficus benghalensis*, or *F. indica*) of the fig genus in the mulberry family, native to tropical Asia. Aerial roots that develop from its branches descend and take root in the soil to become new trunks. The banyan reaches a height of up to 100 ft (30 m) and spreads laterally indefinitely. One tree may in time assume the appearance of a very dense thicket as a result of the tangle of roots and trunks.

Bánzer Suárez \'bän-ser-'swä-res**, Hugo** (b. July 10, 1926, Santa Cruz, Bol.—d. May 5, 2002, Santa Cruz) Soldier and president of Bolivia (1971–78, 1997–2001). After an education in Bolivian and U.S. Army training schools, Bánzer served in various government posts. He became president after participating in the overthrow of two Bolivian governments in 1970 and 1971. A conservative, he encouraged foreign investment and

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severely repressed all opposition. His restrictions of union activities and constitutional liberties led to opposition by labour, the clergy, peasants, and students. A 1978 coup d'état overthrew him, but he was democratically elected in 1997. He resigned in 2001.

Bao Dai \'baù-'dī\ *orig.* **Nguyen Vinh Thuy** (b. Oct. 22, 1913, Vietnam—d. Aug. 1, 1997, Paris, France) Last reigning emperor of Vietnam (r. 1926–45, 1949–55). He was educated in France and in 1926 succeeded to a throne that was dominated by the French. Retained as a powerless ruler under the Japanese during World War II, he fled the country after the Viet Minh drove the Japanese out. In 1949 the French, having agreed to the principle of an independent Vietnam, invited him to return as sovereign. He did, but he accomplished little and retired to France in 1955 when a national referendum called for the country to become a republic.

baobab \'baù-ˌbab\ Tree (*Adansonia digitata*) of the bombax family (Bombacaceae), native to Africa. The barrel-like trunk may reach a diameter of 30 ft (9 m) and a height of 60 ft (18 m). The large, gourdlike, woody fruit contains a tasty pulp. A strong fibre from the bark is used locally for rope and cloth. The trunks are often excavated to serve as water reserves or temporary shelters. For its extraordinary shape the baobab is grown as a curiosity in areas of warm climate, such as Florida. A related species, *A. gregorii*, occurs in Australia, where it is also called a bottle tree.

baojia \'baù-'jē-ə\ *or* **pao-chia** Chinese village militia system created by Wang Anshi as part of his reforms of 1069–76. Units of 10 families were regularly trained and supplied with arms, thereby reducing the government's dependence on mercenaries. Members were mutually responsible for each other. The system was resurrected in the 19th century to help put down the Taiping Rebellion and was imitated by both the Nationalist Party and the Chinese Communist Party in the 20th century.

baptism In Christianity, the sacrament of admission to the church, symbolized by the pouring or sprinkling of water on the head or by immersion in water. The ceremony is usually accompanied by the words "I baptize you in the name of the Father, and of the Son, and of the Holy Spirit." Indeed, Christians believe that after his resurrection, Jesus appeared to his disciples and commanded them to baptize in the name of the Father, Son, and Holy Spirit. In the teaching of St. Paul, it signifies the wiping away of past sins and the rebirth of the individual into a new life. Judaism practiced ritual purification by immersion, and the Gospels report that John the Baptist baptized Jesus. Baptism was an important ritual in the early church by the 1st century, and infant baptism appeared by the 3rd century. Roman Catholic, Orthodox, and most Protestant churches practice infant baptism. The Anabaptist reformers insisted on adult baptism after a confession of faith; modern Baptists and the Disciples of Christ also practice adult baptism.

Baptist Member of a group of Protestant Christians who hold that only adult believers should be baptized and that it must be done by immersion. During the 17th century two groups of Baptists emerged in England: General Baptists, who held that Christ's atonement applied to all persons, and Particular Baptists, who believed it was only for the elect. Baptist origins in the American colonies can be traced to Roger Williams, who established a Baptist church in Providence, R.I., in 1639. Baptist growth in the U.S. was spurred by the Great Awakening in the mid-18th century. The 1814 General Convention showed divisions among U.S. Baptists over slavery; a formal split occurred when the Southern Baptist Convention was organized in 1845 and was confirmed when the Northern (American) Baptist Convention was organized in 1907. African-American Baptist churches provided leadership in the 1960s civil rights movement, notably through the work of Martin Luther King. Baptist belief emphasizes the authority of local congregations in matters of faith and practice; worship is characterized by extemporaneous prayer and hymn-singing as well as by the exposition of scripture in sermons.

baptistery *or* **baptistry** Domed hall or chapel, adjacent to or part of a church, for the administration of baptism. By the 4th century, the baptistery had assumed an eight-sided shape (eight in Christian numerology being the symbol for a new life), as had the baptismal font within. The font itself was set beneath a dome-shaped baldachin and encircled by columns and an ambulatory (aisle), features first used by the Byzantines. See photograph opposite.

Baqqarah See Baggara

bar association Group of lawyers organized primarily to deal with issues affecting the legal profession. In general, they are concerned with furthering the interests of lawyers through advocating reforms in the legal system, sponsoring research projects, and regulating professional standards. Bar associations sometimes administer the examinations required for admission to practice law. The largest U.S. bar association is the American Bar Assn.

bar code Printed series of parallel bars of varying width used for entering data into a computer system, typically for identifying the object on which the code appears. The width and spacing of the bars represent binary information that can be read by an optical (laser) scanner that is part of a computer system. The coding is used in many different areas of manufacturing and marketing, including inventory control and tracking systems. The bar codes printed on supermarket and other retail merchandise are those of the Universal Product Code (UPC).

bar graph See histogram

Bar Kokhba \ˌbär-'kȯk̲-bä\ *orig.* **Simeon bar Kosba** (d. AD 135) Leader of an unsuccessful Jewish revolt against Roman rule in Palestine. In 131 Hadrian forbade circumcision and built a temple to Jupiter on the ruins of the Temple of Jerusalem. The Jews rebelled in 132, led by Simeon bar Kosba, who, according to one story, was hailed as a messiah by Akiba ben Joseph. He was called Bar Kokhba ("Son of the Star"), a messianic allusion drawn from the book of Numbers. His army captured Aelia and inflicted heavy casualties, but Hadrian visited the battlefield and summoned reinforcements, and the Romans retook Jerusalem. Bar Kokhba was killed at Betar in 135, and the remnant of the Jewish army was soon crushed, with total Jewish losses, according to the 3rd-century Roman historian Dio Cassius, numbering 580,000. Surviving Jews were exiled and barred from Jerusalem.

Bar Mitzvah \ˌbär-'mits-və\ Jewish ritual celebrating a boy's 13th birthday and his entry into the community of Judaism. It usually takes place during a Sabbath service, when the boy reads from the Torah and may give a discourse on the text. The service is often followed by a festive Kiddush and a family dinner on the same day or next day. Reform Judaism substituted confirmation of boys and girls for the Bar Mitzvah celebration after 1810, but many congregations restored the Bar Mitzvah in the 20th century. A separate ceremony for girls, Bat Mitzvah, has been instituted in Reform and Conservative Judaism.

Bara \'bar-ə**, Theda** *orig.* **Theodosia Goodman** (b. July 20, 1885?, Cincinnati, Ohio, U.S.—d. April 7, 1955, Los Angeles, Calif.) U.S. film actress. She had a brief stage career before going to Hollywood. Her first major picture, *A Fool There Was* (1915), was accompanied by a publicity campaign, billing her as the daughter of a Middle Eastern potentate, that made her an instant success. Establishing a sultry, exotic persona, she became the prototype of the screen "vamp." She made more than 40 films within a few years, but her popularity soon declined, and she retired in the 1920s.

Barabbas \bə-'ra-bəs\ In the New Testament, a prisoner or criminal freed to please the mob before the crucifixion of Jesus. Described as a thief or an insurrectionist, Barabbas is mentioned in all four Gospels. Following the custom of setting free one prisoner chosen by popular demand before Passover, Pontius Pilate suggested pardoning Jesus, but the crowd protested and demanded the release of Barabbas. Pilate gave in and sent Jesus to his death.

Battistero (baptistery) San. Giovanni, Florence, begun 7th century
ALINARI-ART RESOURCE

Barada \'bär-ə-də\ **River** *ancient* **Chrysorrhoas** River, western Syria. It flows about 45 mi (72 km) from the Anti-Lebanon Mountains past Damascus. Throughout history, channels have been cut at different levels parallel to the main branch of the river to divert its flow. The channels (of Nabataean, Aramaean, and, especially, Roman origin) fan out as they reach Damascus, irrigating a large area. This system created the site of Damascus, an artificial oasis of extreme fertility.

Barak River See Surma River

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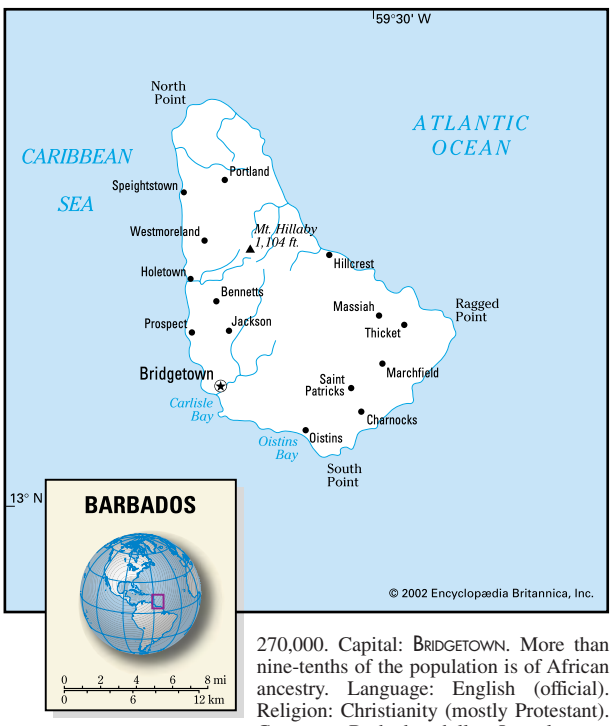
Baraka \bä-'rä-kə**, (Imamu) Amiri** *orig.* **(Everett) LeRoi Jones** (b. Oct. 7, 1934, Newark, N.J., U.S.) U.S. playwright, poet, and activist. After graduating from Howard University and serving in the U.S. Air Force, he joined the BEAT MOVEMENT and in 1961 published his first major poetry collection. His play *Dutchman* (1964), produced off-Broadway, explored the suppressed hostility of U.S. blacks toward the dominant white culture. After the assassination of MALCOLM X in 1965, Baraka became involved in black nationalism and founded the Black Arts Repertory Theatre in Harlem. In 1974 he adopted a Marxist-Leninist philosophy. He was appointed Poet Laureate of New Jersey in 2002.

barangay \ˌbar-ən-'gī\ Type of early Filipino settlement. The term was derived from *balangay*, the sailboats that brought Malay settlers to the Philippines from Borneo. Each boat carried a family group that established a village. These villages, which sometimes grew to include 30–100 families, remained isolated from one another; the fact that no larger political grouping emerged (except on Mindanao) facilitated the 16th-century Spanish conquest. The Spanish retained the barangay as a unit of local administration.

Barataria \ˌbar-ə-'tar-ē-ə\ **Bay** Inlet of the Gulf of Mexico, southeastern Louisiana, U.S. The bay is about 15 mi (24 km) long and 12 mi (19 km) wide, and its entrance is a narrow channel, navigable through connecting waterways into the GULF INTRACOASTAL WATERWAY system. The area is noted for its shrimp industry and natural-gas and oil wells. JEAN LAFFITE and his brother organized a colony of pirates around its coast in 1810–14, and it is sometimes called Laffite Country.

Barbados \bar-'bā-dəs\ Island country, WEST INDIES. The most easterly of the Caribbean islands, it lies about 100 mi (160 km) east of Saint Vincent and the Grenadines. Area: 166 sq mi (430 sq km). Population (2005 est.):



270,000. Capital: BRIDGETOWN. More than nine-tenths of the population is of African ancestry. Language: English (official). Religion: Christianity (mostly Protestant). Currency: Barbados dollar. Largely covered by a layer of coral, Barbados is low and flat except in its north-central part; its highest point is Mount Hillaby, at 1,115 ft (340 m). There is little surface water. The island is almost encircled by coral reefs. Bridgetown is its only seaport. The economy is based on tourism and sugar, while the offshore financial sector is growing. Barbados is a constitutional monarchy with two legislative houses; its chief of state is the British monarch, represented by a governor-general, and the head of government is the prime minister. The island was probably inhabited originally by ARAWAK and later by Carib Indians. Spaniards may have landed by 1518, and by 1536 they had apparently wiped out the Indian population. Barbados was settled by the English in the 1620s. Slaves were brought in to work the sugar plantations, which were especially prosperous in the 17th–18th century. The British Empire abolished slavery in 1834, and all the Barbados slaves were freed by 1838. In 1958 Barbados joined the West Indies Federation. When the latter dissolved in 1962, Barbados sought independence from Britain, which it gained in 1966.

Barbara, Saint (d. 200; feast day December 4) Early Christian martyr and patroness of artillerymen. She was the daughter of a pagan, Dioscorus, who kept her guarded to protect her beauty and virginity. When she converted to Christianity he became enraged and took her to the Roman prefect, who ordered her to be tortured and beheaded. Her father performed the execution himself, and on the way home he was struck by lightning and reduced to ashes. Barbara was a popular saint during the Middle Ages and was invoked for aid in thunderstorms. She was dropped from the church calendar in 1969.

Barbarossa \ˌbär-bə-'rä-sə\ *orig.* **Khiḍr** *later* **Khayr al-Dīn** (d. 1546) Greek Turkish pirate and admiral in the service of the OTTOMAN EMPIRE. He and his brother ʿArūj, sons of a Turk from Lesbos, hated the Spanish and Portuguese for their attacks on North Africa and took up piracy on the BARBARY COAST in hopes of seizing an African domain for themselves. When ʿArūj was killed in 1518, Khiḍr took the title Khayr al-Dīn. He offered allegiance to the Ottoman sultan and in return received military aid that enabled him to capture Algiers in 1529. Appointed admiral in chief of the Ottoman Empire (1533), he conquered all of Tunisia. Emperor CHARLES V captured Tunis in 1535, but Khayr al-Dīn defeated his fleet at the Battle of Preveza (1538), securing the eastern Mediterranean for the Turks for 33 years. His red beard was the source of the epithet Barbarossa, used by Europeans.

Barbary Coast Mediterranean coastal region, North Africa. It extends from Egypt to the Atlantic Ocean. Once part of ROMAN AFRICA, the region was overrun by VANDALS in the 5th century AD. Reconquered by the Eastern Roman Empire (BYZANTINE EMPIRE) c. AD 533, it was overcome by Arabs during the 7th century and was eventually broken up into the independent Muslim polities known collectively as the Barbary states (MOROCCO, ALGERIA [Algiers], TUNISIA [Tunis], and LIBYA [Tripoli]). For centuries the coast was notorious as a haven for pirates, who ravaged shipping and collected tribute from European states. After the U.S. war with Tripoli (see TRIPOLITAN WAR), the U.S. expedition to Algiers (1815), and the bombardment of Algiers by the British (1816), the pirates ceased exacting tribute.

Barbary macaque Tailless, terrestrial monkey (*Macaca sylvana*) found in groups in Algeria and Morocco and on the Rock of Gibraltar. It is about 24 in. (60 cm) long and has yellowish brown fur and a bald, pale pink face. Lacking a tail, this MACAQUE has often been incorrectly called an ape. It is the only wild monkey in Europe and may have arrived in medieval times, taken westward during the Muslim Arab territorial expansion. According to legend, British dominion over Gibraltar will end when the Barbary macaque departs.

Barbary macaque (*Macaca sylvana*).
TOM MCHUGH/PHOTO RESEARCHERS

Barber, Red *orig.* **Walter Lanier Barber** (b. Feb. 17, 1908, Columbus, Miss., U.S.—d. Oct. 22, 1992, Tallahassee, Fla.) U.S. sports broadcaster. He became the radio and television announcer for the baseball games of the Cincinnati Reds (1934–39), Brooklyn Dodgers (1939–53), and New York Yankees (1954–66). He combined technical expertise with homespun comments; his signature exclamation was "Oh-ho, Doctor!" He provided weekly commentary on National Public Radio from 1981 and wrote two books on baseball and an autobiography.

Barber, Samuel (b. March 9, 1910, West Chester, Pa., U.S.—d. Jan. 23, 1981, New York, N.Y.) U.S. composer. He studied piano, voice, conducting, and composition at the Curtis Institute. After graduation in 1934, he devoted himself to composition. Barber's style, frequently lyrical and neo-Romantic, proved highly attractive to the public. His works include the popular *Adagio for Strings* (1936), two *Essays for Orchestra* (1937, 1942), the opera *Vanessa* (1957, Pulitzer Prize), and a *Piano Concerto* (1962, Pulitzer Prize).

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barberry Any of the almost 500 species of thorny EVERGREEN or deciduous shrubs constituting the genus *Berberis*. The genus is the largest and most important group in the family Berberidaceae, of the buttercup order. Most barberries are native to the northern temperate zone, particularly Asia. Barberry bushes have yellow wood and yellow flowers. The fruit of several species is made into jellies. Other members of the same family include heavenly bamboo (*Nandina domestica*), an indoor potted plant; mayapple (*Podophyllum peltatum*), a woodland wildflower; *Epimedium*, a ground cover; and Oregon grape (*Mahonia*), a genus of broad-leaved evergreen shrubs.

American barberry (*Berberis canadensis*).
WALTER CHANDOHA

barbershop quartet Popular vocal ensemble consisting of four unaccompanied male voices. The voice parts are tenor, lead, baritone, and bass, with the lead normally singing the melody and the tenor harmonizing above. The emphasis is on close harmony, synchronization of word sounds, and variation of tempo, volume, diction, and phrasing. Barbershop apparently originated in the U.S. in the late 19th century, when American barbershops formed social and musical centres for neighbourhood men, though the term may derive from "barber's music," the British term for an extemporized performance by patrons waiting to be shaved and referring to a barber's traditional role as a musician.

barbet \'bär-bət\ Any of about 75 species of tropical birds (family Capitonidae) named for the bristles at the base of their stout, sharp bill. They are big-headed and short-tailed, 3.5–12 in. (9–30 cm) long, and greenish or brownish with splashes of bright colours or white. Barbets are found throughout Central America and in northern South America, in sub-Saharan Africa, and in South Asia. They all fly weakly, and they sit in treetops when not feeding on insects, lizards, birds' eggs, fruits, and berries. They call loudly while jerking the head or tail. Maddeningly vocal or repetitious species are sometimes called brain-fever birds.

Crimson-headed barbet (*Capito bourcieri*).
C. LAUBSCHER-BRUCE COLEMAN INC./EB INC.

Barbie *in full* **Barbara Millicent Roberts** A plastic doll, 11.5 in. (29 cm) tall, with the figure of an adult woman that was introduced in 1959 by Mattel, Inc., a southern California toy company. Ruth Handler, who cofounded Mattel with her husband, Elliot, spearheaded the introduction of the doll. Since the 1970s, Barbie has been criticized for materialism (amassing cars, houses, and clothes) and unrealistic body proportions. Yet many women who had played with the doll as girls credit Barbie with providing an alternative to restrictive 1950s gender roles. Today the doll has come to symbolize consumer capitalism and is a global brand, with key markets in Europe, Latin America, and Japan. Barbie never caught on in the Muslim world, however. In 1995 Saudi Arabia stopped its sale because it violated the Islamic dress code. Similar dolls, complete with *ḥijāb*s (head coverings), were eventually marketed to Muslim girls.

Barbie, Klaus (b. Oct. 25, 1913, Bad Godesberg, Ger.—d. Sept. 25, 1991, Lyon, France) Nazi leader. As head of the Gestapo in Lyon, France (1942–44), he pursued members of the French RESISTANCE and promoted the torture and execution of thousands of prisoners. After World War II he was seized by U.S. authorities in Germany, who recruited him for counterintelligence work (1947–51) and then moved him and his family to Bolivia. He lived there as a businessman from 1951 until he was extradited to France in 1983 to stand trial. Throughout his trial "the Butcher of Lyon" remained unrepentant and proud of his service to the Nazis. Held responsible for the death of some 4,000 persons and the deportation of some 7,500 others, he was sentenced to life imprisonment.

barbiturate \bär-'bi-chə-rət\ Any of a class of HETEROCYCLIC COMPOUNDS based on the parent structure, uric acid, and used in medicine. They depress the central NERVOUS SYSTEM, acting particularly on certain parts of the BRAIN, though they tend to depress the functioning of all the body's tissues. Long-acting barbiturates (e.g., barbital and phenobarbital) are used to treat EPILEPSY. Intermediate ones (e.g., amobarbital) are used to treat INSOMNIA, short-acting ones (e.g., pentobarbital) to overcome difficulty in falling asleep (one aspect of insomnia), and ultra-short-acting ones (e.g., thiopental sodium) to induce unconsciousness in surgical patients before administration of other ANESTHETICS. Prolonged use of barbiturates may lead to addiction. Sudden withdrawal can be fatal; addicts must be weaned from the drug under medical supervision. Overdoses can result in coma and even death; barbiturates are particularly dangerous, even at normal doses, when combined with alcoholic beverages.

Barbizon \ˌbär-bə-'zōn\ **school** Group of 19th-century French landscape painters. They were part of a larger European movement toward NATURALISM that made a significant contribution to REALISM in French landscape painting. Led by THEODORE ROUSSEAU and JEAN-FRANÇOIS MILLET, they attracted a large following of painters who came to live at Barbizon, a village near Paris; most notable of this group were CHARLES-FRANÇOIS DAUBIGNY, Narcisse-Virgile Díaz de la Peña, Jules Dupré, Charles-Émile Jacque, and Constant Troyon. Each had his own style, but all emphasized painting out-of-doors directly from nature, using a limited palette, and creating atmosphere or mood in their landscapes.

Barbosa \bär-'bō-sə**, Ruy** (b. Nov. 5, 1849, Salvador, Bahia, Brazil—d. March 1, 1923, Petrópolis) Brazilian orator, statesman, and jurist. Barbosa, an eloquent liberal, wrote the constitution for Brazil's newly formed republic in 1890 and held various posts, including minister of finance, in the provisional government that launched the republic. He became a senator in 1895, and in 1907 he led a delegation to the second of the HAGUE CONVENTIONS, where he gained international renown for his oratory and for his defense of the legal equality of rich and poor nations. He ran for president in 1910 on an antimilitary platform, and again in 1919, but lost both times.

Barbuda See ANTIGUA AND BARBUDA

Barca, Pedro Calderón de la See Pedro CALDERON DE LA BARCA

Barcelona \bär-sə-'lō-nə\ Seaport city (pop., 2005 est.: 1,593,075), capital of CATALONIA autonomous region, northeastern Spain. Spain's largest port and second largest city, it is the country's principal industrial and commercial centre, as well as a major cultural and educational centre. It is said to have been founded in the 3rd century BC by the Carthaginians or the Phoenicians, and it was later ruled by the Romans and Visigoths. It was captured by the Moors c. AD 715, but it was retaken by the Franks under CHARLEMAGNE in 801 and made the capital of the Spanish March (Catalonia). After Catalonia united with ARAGON in 1137, Barcelona became a flourishing commercial centre and the rival of Italian ports. In the 19th century it was a cauldron for radical social movements and Catalan separatism. It was the loyalist capital in 1937–39 during the SPANISH CIVIL WAR; its capture by FRANCISCO FRANCO brought the collapse of Catalan resistance and Catalonia's reintegration into Spain. Modern Barcelona is known for its handsome architecture, including buildings by ANTONI GAUDÍ. It hosted the 1992 Summer Olympic Games.

Barclay de Tolly \bär-'klī-də-'tò-lē**, Mikhail (Bogdanovich), Prince** (b. Dec. 13, 1761, Pamuskis, Poland-Lithuania—d. May 14, 1818, Insterburg, East Prussia) Russian field marshal prominent in the NAPOLEONIC WARS. A member of a Scottish family that had settled in Livonia, Barclay entered the Russian army in 1786. In 1812 he took command of one of two Russian armies operating against NAPOLEON. His strategy of avoiding decisive action and retreating into Russia proved unpopular, and he was forced to resign his command. He took part in the invasion of France in 1814, and in 1815 he was commander in chief of the Russian army that invaded France after Napoleon's return from Elba.

Barcoo River See COOPER CREEK

bard Celtic tribal poet-singer gifted in composing and reciting verses of eulogy and satire or of heroes and their deeds. The institution died out in Gaul but survived in Ireland, where bards have preserved a tradition of chanting poetic eulogy, and in Wales, where the bardic order was codified into distinct grades in the 10th century. Despite a decline in the late Middle Ages, the Welsh tradition is celebrated in the annual National EISTEDDFOD.

Bard College Private liberal arts college founded in 1860 in Annandale-on-Hudson, New York, U.S. It was founded by John Bard and

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Episcopal church leaders as St. Stevens, an Episcopal college for men. The name was changed to Bard College in 1934. Between 1928 and 1944 it served as Columbia University's undergraduate school. It became coeducational in 1944. Its undergraduate curriculum includes courses in the social sciences, languages and literature, arts, and natural sciences and mathematics.

Bardeen, John (b. May 23, 1908, Madison, Wis., U.S.—d. Jan. 30, 1991, Boston, Mass.) U.S. physicist. He earned a Ph.D. in mathematical physics from Princeton University. He worked for the U.S. Naval Ordnance Laboratory during World War II, after which he worked for Bell Telephone Laboratories. His work there led to his sharing a 1956 Nobel Prize with William B. Shockley and Walter H. Brattain for the invention of the transistor. In 1972 he again shared a Nobel Prize, this time with Leon Cooper and J. Robert Schrieffer for developing the theory of superconductivity (1957); this theory (called the BCS theory, for Bardeen-Cooper-Schrieffer) is the basis for all later theoretical work in superconductivity. Bardeen was also the author of a theory explaining certain properties of semiconductors.

Bardesanes \ˌbär-də-ˈsā-nēz\ *or* **Bardaisan** \ˌbär-dī-ˈsän\ (b. July 11, 154, Edessa, Syria—d. c. 222, Edessa) Syrian Gnostic Christian and speculative thinker. He converted to Christianity in 179 and became a missionary. He attacked the fatalism of the Greek philosophers and, showing the influence of Gnosticism, ascribed the creation of the world, the Devil, and evil to a hierarchy of gods rather than to the supreme God. His chief written work, *The Dialogue of Destiny*, is the oldest known example of Syriac literature. He is also remembered for his Syriac hymns.

Bardot \bär-ˈdō**, Brigitte** (b. Sept. 28, 1934, Paris, France) French film actress. She was discovered by Roger Vadim when she appeared on a magazine cover at 15 and made her film debut in 1952. Vadim crafted her "sex kitten" image for his films *And God Created Woman* (1956) and *The Night Heaven Fell* (1958), which set box-office records and made her an international star. She displayed her acting ability in such films as *The Truth* (1960), *Contempt* (1963), and *Viva Maria!* (1965). An animal rights activist, she established an animal welfare organization in 1987.

Barenboim \ˈbar-ən-ˌbȯim**, Daniel** (b. Nov. 15, 1942, Buenos Aires, Arg.) Argentine-born Israeli pianist and conductor. A prodigy, he made his debut at age eight. His family moved to Israel in 1952, and he first performed in the U.S. at Carnegie Hall in 1957. As a pianist he became known for his colourful interpretations of Classical and Romantic composers. He started conducting professionally in 1962 and led the English Chamber Orchestra (1964–75) and the Orchestre de Paris (1975–89). He became principal conductor of the Chicago Symphony Orchestra in 1991 and was appointed music director of the Berlin State Opera in 1992. He has been a prominent advocate for peace in the Middle East.

Barents Sea Outlying portion of the Arctic Ocean. Named for the Dutch explorer Willem Barents, it is bounded by the Norwegian and northwestern Russian mainland (south), the Norwegian Sea and Svalbard (west), Franz Josef Land (north), and the Kara Sea and Novaya Zemlya (east). It is 800 mi (1,300 km) long and 650 mi (1,050 km) wide and covers 542,000 sq mi (1,405,000 sq km). Its average depth is 750 ft (229 m), with a maximum depth of 2,000 ft (600 m) in the major Bear Island Trench.

bargello \bär-ˈje-lō\ *or* **Florentine canvas work** Type of 17th-century embroidery, named for the upholstery of a set of Italian chairs at Florence's Bargello Museum. It consists of a wavy zigzag pattern of flat vertical stitches laid parallel with the canvas weave, rather than crossing the intersections diagonally as in most canvas stitches, in gradating tones of the same colour or in contrasting colours. The characteristic stitch is called Florentine, cushion, Hungarian, or flame stitch (an allusion to the flamelike gradation of colour).

Bari \ˈbä-rē\ *ancient* **Barium** Seaport city (pop., 2001 prelim.: 332,143), capital of Puglia, southeastern Italy. Evidence shows that the site may have been inhabited since 1500 BC. Under the Romans it became an important port. In the 9th century AD it was a Moorish stronghold, but it was taken by the Byzantines in 885. Peter the Hermit preached the First Crusade there in 1096. Razed by the Sicilians in 1156, it acquired new greatness in the 13th century under Frederick II. It became an independent duchy in the 14th century, passed to the Kingdom of Naples in 1558, and became part of the Kingdom of Italy in 1861.

barite \ˈbar-ˌīt\ *or* **barytes** \bə-ˈrī-tēz\ *or* **heavy spar** Most common barium mineral, barium sulfate ($BaSO_4$). It commonly forms as platy crystals (known as crested barite). Barite is abundant in parts of Spain, Germany, and the U.S. Commercially, ground barite is used in oil well and gas well drilling muds; in the preparation of barium compounds; as a filler for paper, cloth, and phonograph records; as a white pigment; and as an inert material in coloured paints.

Sample of crested barite from Missouri
JOSEPH AND HELEN GUETTERMAN COLLECTION; PHOTOGRAPH, JOHN H. GERARD

baritone In vocal music, the most common category of male voice, between the bass and the tenor. Its range is approximately from the second A below middle C to the F above middle C. The term *baritonus* was first employed in 15th-century five- and six-voice part music; when four-part settings became standard, the baritone part was dropped, and natural baritones were forced to develop either their bass or tenor register. Instruments that play principally in the baritone register include the baritone saxophone and the baritone horn.

barium \ˈbar-ē-əm\ Chemical element, one of the alkaline earth metals, chemical symbol Ba, atomic number 56. It is very reactive and in compounds always has valence 2. In nature it is found chiefly as the minerals barite (barium sulfate) and witherite (barium carbonate). The element is used in metallurgy, and its compounds are used in fireworks, petroleum mining, and radiology and as pigments and reagents. All soluble barium compounds are toxic. Barium sulfate, one of the most insoluble salts known, is given in a "barium meal" as a contrast medium for X-ray examination of the gastrointestinal tract.

bark In woody plants, tissues outside of the vascular cambium. The term is also used more popularly to refer to all tissues outside the wood. The inner soft bark is produced by the vascular cambium; it consists of secondary phloem (food-conducting) tissue whose innermost layer transports food from the leaves to the rest of the plant. The layered outer bark contains cork and old, dead phloem. The bark is usually thinner than the woody part of the stem or root.

Bark beetle (*Dendroctonus valens*)
WILLIAM E. FERGUSON

bark beetle Any member of the beetle family Scolytidae, many of which severely damage trees. Bark beetles are cylindrical, brown or black, and usually less than 0.25 in. (6 mm) long. A male and females (as many as 60 females with each male) bore into a tree and form a chamber where each female deposits her eggs. The emerging larvae bore away from the chamber, forming a characteristic series of tunnels. Different species attack particular trees, damaging roots, stems, seeds, or fruits. Some species transmit disease (e.g., elm bark beetles carry spores of the fungal Dutch elm disease).

bark painting Abstract and figurative designs applied to nonwoven fabric made from bark. Also called tapa, the pieces are made by scratching or painting the designs. The most popular material is the inner bark of the paper mulberry tree. The bark is stripped off, soaked, and beaten until it is thin. Today hand-painted bark cloth is made in northern Australia, New Guinea, and parts of Melanesia. Styles and imagery vary by location,

Tapa wall drapery painted with animal clan emblems, from the Teluk Jos Sudarso (Humboldt Bay) area, Irian Jaya (West New Guinea), Indonesia, in the Rijksmuseum voor Volkenkunde Justinus van Nassau, Breda, Neth.
HOLLE BILDARCHIV, BADEN-BADEN, GER.

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from naturalistic and stylized representations of human and animal forms to mythical beings, spirals, circles, and abstract motifs.

Barker, Harley Granville- See Harley GRANVILLE-BARKER

barking deer See MUNTJAC

Barkley, Alben W(illiam) (b. Nov. 24, 1877, Graves county, Ky., U.S.—d. April 30, 1956, Lexington, Va.) U.S. politician. After graduating from college, he studied law and was admitted to the Kentucky bar in 1901. He was elected as a Democrat to the U.S. House of Representatives (1913–27) and the Senate (1927–49), where he served as majority leader (1937–47). He was a prominent spokesman for the domestic and international policies of Pres. FRANKLIN D. ROOSEVELT. He served as vice president under Pres. HARRY S. TRUMAN (1949–53). He later returned to the Senate (1954–56).

Barkley, Charles (Wade) (b. Feb. 20, 1963, Leeds, Ala., U.S.) U.S. basketball player. He spent his collegiate career as a forward at Auburn University. He played for the Philadelphia 76ers (1984–91), the Phoenix Suns (1992–95), and the Houston Rockets (1996–99). He is known for his bruising play on the court and for his outspokenness off it.

Barlach \'bär-läk̲**, Ernst** (b. Jan. 2, 1870, Wedel, Ger.—d. Oct. 24, 1938, Güstrow) German sculptor, graphic artist, and writer. After studying in Hamburg, Dresden, and Paris, he became the outstanding sculptor of the Expressionist movement, achieving a rough-hewn quality by preferring wood, the material used in late Gothic sculpture. Even when he worked with other, more contemporary materials, he often emulated the raw quality of wood sculpture to achieve a more brutal effect. He achieved fame in the 1920s and '30s with the execution of several war memorials for the Weimar Republic. Barlach also wrote Expressionist plays, which he illustrated with woodcuts and lithographs. His studio at Güstrow was opened posthumously as a museum.

barley CEREAL plant of the genus *Hordeum*, in the family Poaceae (or Gramineae), and its edible grain. The three cultivated species are *H. vulgare*, *H. distichum*, and *H. irregulare*. Barley is adaptable to a greater range of climate than any other cereal. About half of the world's crop is used as livestock feed, the rest for human food and for malting. Most BEER is made from malted barley, which is also used in distilled beverages (see MALT). Barley has a nutlike flavour and is high in carbohydrates, with moderate quantities of protein, calcium, and phosphorus. Barley flour is used to make unleavened bread and porridge. Pearl barley, the most popular form in many parts of the world, is often added to soups.

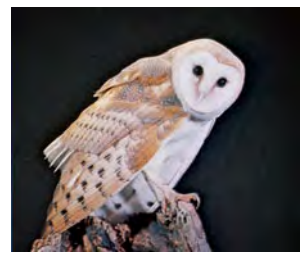
Barlow, Joel (b. March 24, 1754, Redding, Connecticut Colony [U.S.]—d. Dec. 24, 1812, Żarnowiec, Pol.) U.S. writer and poet. He was a member of the group of young writers known as the Hartford (or Connecticut) Wits, whose patriotism led them to attempt to create a national literature. He became famous for his *Vision of Columbus* (1787), a poetic paean to America, but is remembered primarily for *The Hasty Pudding* (1796), a mock-heroic epic poem inspired by homesickness for New England.

Barmakid \'bär-mə-ˌkid\ *or* **Barmecide** \'bär-mə-ˌsīd\ Any member of the priestly family of Persian origin that achieved prominence in the 8th century as scribes and VIZIERS to the caliphs of the ʿABBĀSID DYNASTY. They supported the arts and sciences, tolerated explorations of religion and philosophy, and promoted public works. The first notable Barmakid, Khālid ibn Barmak (d. 781/782), helped establish the ʿAbbāsid caliphate; he became governor of Ṭabaristān and later Fars. His son Yaḥyā (d. 805) and grandsons al-Faḍl (d. 808) and Jaʿfar (d. 803) held power as viziers but died in prison or were executed in a reversal of fortune, largely because their excessive power, wealth, and liberalism led the caliphs to see them as threats.

Barmen, Synod of Meeting of German Protestant leaders at Barmen in May 1934 to organize Protestant resistance to Nazism. Representatives came from Lutheran, Reformed, and United churches. Some church leaders had already chosen to limit their efforts to passive resistance, and others had been co-opted by the Nazi regime. The Pastors' Emergency League, headed by MARTIN NIEMÖLLER, was the backbone of active resistance. The Synod was of major importance in the founding of the CONFESSING CHURCH by KARL BARTH and others.

barn Farm building used for sheltering animals, their feed and other supplies, farm machinery, and farm products. Barns are named according to their purpose (e.g., hog barns, dairy barns, tobacco barns, and tractor barns). The principal type in the U.S. is the general-purpose barn, used for housing LIVESTOCK and for storing HAY and grain. Most North American and European farms have one or more barns. They usually consist of two stories, though one-story barns gained in popularity in the late 20th century.

barn owl Any of several species of nocturnal BIRDS OF PREY (genus *Tyto*), sometimes called monkey-faced owls because of their heart-shaped facial disk and absence of ear tufts. Barn owls are about 12–16 in. (30–40 cm) long, white to gray or yellowish to brownish orange. Their dark eyes are smaller than those of other OWLS. They hunt mainly small rodents, often on cultivated land, and nest in hollow trees, buildings, towers, and old hawk nests. The common barn owl is found worldwide except in Antarctica and Micronesia. Other species occur only in the Old World.



Common barn owl (*Tyto alba*).
KARL MASLOWSKI/PHOTO RESEARCHERS

Barnabas \'bär-nə-bəs**, Saint** *orig.* **Joseph the Levite** (fl. 1st century; feast day June 11) Apostolic Father and early Christian missionary. Born in Cyprus, he was a Hellenized Jew who joined the church in Jerusalem shortly after its founding. According to the Acts of the Apostles, he helped found the church in Antioch, calling on St. PAUL to assist him. A conflict eventually separated them, and Barnabas returned to the island of his birth. One legend holds that he was martyred in Cyprus. His reputed tomb is near the Monastery of St. Barnabas at Salamis, whose Christian community Paul and Barnabas founded.

barnacle Any of a majority of the 1,000 species of the subclass Cirripedia of marine CRUSTACEANS that, as adults, are covered with a shell made of hard calcium-containing plates and are permanently cemented, head down, to rocks, pilings, ships' hulls, driftwood, or seaweed or to the bodies of larger sea creatures, from clams to whales. Barnacles trap tiny particles of food with their cirri, feathery retractable organs that emerge from openings between the shell plates. Adult barnacles commonly are hermaphrodites.

Barnacle
ANTHONY MERCIECA, FROM ROOT RESOURCES—EB INC.

barnacle goose Species (*Branta leucopsis*) of waterbird that resembles a small CANADA GOOSE, with dark back, white face, and black neck and bib. It winters in the northern British Isles and on the coasts of Denmark, Germany, and the Netherlands. In the Middle Ages, it was thought to hatch from BARNACLES, and thus was considered "fish" and could be eaten on Fridays.

Barnard \'bär-nərd**, Christiaan (Neethling)** (b. Nov. 8, 1922, Beaufort West, S.Af.—d. Sept. 2, 2001, Paphos, Cyprus) South African surgeon. He showed that intestinal atresia is caused by deficient fetal blood supply, which led to development of a surgical procedure to correct the formerly fatal defect. He introduced open-heart surgery to South Africa, designed a new artificial heart valve, and did animal heart transplant experiments. In 1967 Barnard's team performed the first human heart transplant, replacing the heart of Louis Washkansky with one from an accident victim. The transplant was successful, but Washkansky, given immunosuppressant drugs to prevent rejection of the heart, died 18 days later from pneumonia.

Barnard, Henry (b. Jan. 24, 1811, Hartford, Conn., U.S.—d. July 5, 1900, Hartford) U.S. educator. He studied law and entered the state legislature, where he helped create a state board of education and the first teachers' institute (1839). With HORACE MANN, he undertook to reform the country's common schools; he was an innovator in instituting school

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inspections, textbook reviews, and parent-teacher organizations. As Rhode Island's first commissioner of education (from 1845) he worked to raise teachers' wages, repair buildings, and obtain higher-education appropriations. In 1855 he helped found the *American Journal of Education*. He was chancellor of the University of Wisconsin (1858–61). In 1867 he became the first U.S. commissioner of education, in which post he established a federal agency to collect national educational data.

Henry Barnard, detail of a portrait by an unknown artist; in the University of Wisconsin collection, Madison
COURTESY OF THE UNIVERSITY OF WISCONSIN, MADISON

Barnard's \'bär-nərdz\ **star** Star about six light-years away from the Sun, next nearest the Sun after the Alpha Centauri system, in the constellation Ophiuchus. Named for Edward Emerson Barnard (b. 1857—d. 1923), who discovered it in 1916, it has the largest proper motion of any known star. It is gradually nearing the solar system. The star attracted astronomers' attention in the 1960s when its proper motion was claimed to show periodic deviations attributed to the gravitational pull of two planets (see planets of other stars). The deviations were later proved to be artifacts of measurement.

Barnburners See Hunkers and Barnburners

Barnes, Albert C(oombs) (b. Jan. 2, 1872, Philadelphia, Pa., U.S.—d. July 24, 1951, Chester county, Pa.) Pharmaceutical manufacturer and art collector. He obtained a medical degree and later studied in Germany. In 1902 he made a fortune with his invention of the antiseptic Argyrol. After building a mansion in Merion, Pa., in 1905, he began to collect art seriously, amassing some 180 paintings by Pierre-Auguste Renoir, 66 by Paul Cézanne, 35 by Pablo Picasso, and an extraordinary collection of 65 works by Henri Matisse. The Barnes Foundation, housed in quarters next to his Merion home, was chartered on Dec. 4, 1922, and opened in 1925. The 22-room structure displayed his collection in a highly personal manner that eschewed standard museum practice. The foundation also was intended to promote art education by providing art classes and by establishing a publishing program. (Barnes himself wrote and coauthored a number of books on art.) In 1961, after extensive litigation, his galleries were opened to the public.

Barnes, Djuna (b. June 12, 1892, Cornwall-on-Hudson, N.Y., U.S.—d. June 18?, 1982, New York, N.Y.) U.S. writer. Barnes worked as an artist and journalist in her youth. She went to Paris in 1920, where she became a well-known figure in the literary scene. She wrote plays, short stories, and poems; her masterpiece, the novel *Nightwood* (1936), tells of the homosexual and heterosexual loves of five extraordinary people. After returning to New York in 1940, she wrote little and lived reclusively.

Barnet \bär-'net**, Charlie** *orig.* **Charles Daly Barnet** (b. Oct. 26, 1913, New York, N.Y., U.S.—d. Sept., 4, 1991, San Diego, Calif.) U.S. saxophonist and big-band leader of the swing era. Born to a wealthy family, Barnet took up the saxophone as a child and eventually performed on tenor, alto, and soprano. His was among the first of the big bands to be racially integrated, and his unabashed admiration for Duke Ellington and Count Basie resulted in an effective synthesis of their styles. His best-known recording was "Cherokee" (1939).

Barnett, Ida B. Wells- See Ida B. Wells

Barnsley Town and metropolitan borough (pop., 2001: 218,062), northern England. Located on the River Dearne, the town lies in the ceremonial county of South Yorkshire. Its major growth came in the 19th century as a coal-mining town in the heart of the Yorkshire coalfield. Local coal production has declined since the early 20th century, and light industries have been promoted.

Barnum, P(hineas) T(aylor) (b. July 5, 1810, Bethel, Conn., U.S.—d. April 7, 1891, Bridgeport, Conn.) U.S. showman. In 1841 he bought the American Museum, a collection of conventional exhibits in New York City, and transformed it into a carnival of live freaks and dramatic curiosities, which he promoted with sensational publicity. He exhibited the midget Tom Thumb with great international success and brought Jenny Lind (billed as the "Swedish Nightingale") to the U.S. for a profitable concert tour in 1850. By the time his museum closed in 1868 after several fires, he had enticed 82 million visitors there. In 1871 he started a circus and in 1881 joined a rival, James A. Bailey (1847–1906), to form the three-ring Barnum and Bailey's Circus, which featured the elephant Jumbo as part of the "Greatest Show on Earth."

Barocci \bä-'rȯt-chē**, Federico** (b. c.1526, Urbino, Duchy of Urbino, Papal States—d. 1612, Urbino) Italian painter. Except for two visits to Rome (mid 1550s, 1560–63), where he painted frescoes for Pope Pius IV's casino in the Vatican Gardens, he seems to have spent his whole life in and near Urbino. He executed altarpieces and devotional paintings in a style characterized by subtle colour harmonies and warmth of feeling. His patrons included the duke of Urbino and Emperor Rudolf II (1552–1612), and he received commissions from the cathedrals of Genoa and Perugia. His famous works include the *Deposition* (1567–69) and the *Madonna del Popolo* (1579). A prolific draftsman, he was one of the first artists to use coloured chalks. He enjoyed a long and productive career, becoming one of the leading painters in central Italy.

Baroda See Vadodara

Baroja \bä-'rō-hä\ **(y Nessi), Pío** (b. Dec. 28, 1872, San Sebastián, Spain—d. Oct. 30, 1956, Madrid) Basque writer. He wrote 11 trilogies dealing with contemporary social problems, the best known of which is *The Struggle for Life* (1904). His most ambitious project was a long cycle of works about a 19th-century insurgent and his era. He wrote almost 100 novels, including *Zalacaín el aventurero* (1909). Because of his anti-Christian views, stubborn insistence on nonconformity, and somewhat pessimistic tone, he never achieved great popularity. He is considered the foremost Spanish novelist of his time.

barometer Device used to measure atmospheric pressure. Because atmospheric pressure changes with distance above or below sea level, a barometer can also be used to measure altitude. In the mercury barometer, atmospheric pressure balances a column of mercury, the height of which can be precisely measured. Normal atmospheric pressure is about 14.7 lb per square inch, equivalent to 30 in. (760 mm) of mercury. Other liquids can be used in barometers, but mercury is the most common because of its great density. An aneroid barometer indicates pressure on a dial using a needle that is mechanically linked to a partially evacuated chamber, which responds to pressure changes.

barometric pressure See atmospheric pressure

baron Title of nobility, ranking in modern times immediately below a viscount or a count (in countries without viscounts). The wife of a baron is a baroness. Originally, in the early Middle Ages, the term designated a tenant of whatever rank who held a tenure of barony direct from the king. Gradually, it came to mean a powerful personage, and therefore a magnate. The rights and title may be conferred for military or other honorable service.

baronet British hereditary rank of honor, first created by James I in 1611 to raise money, ostensibly for support of troops in Ulster. The baronetage is not part of the peerage, nor is it an order of knighthood. A baronet ranks below a baron but above all knights except a Knight of the Garter (see Order of the Garter). The baronetcy is inherited by the male heirs of a baronet.

Baroque, Late See Rococo style

Baroque \bə-'rōk\ **architecture** Architectural style originating in late 16th-century Italy and lasting in some regions, notably Germany and colonial South America, until the 18th century. It had its origins in the Counter-Reformation, when the Catholic Church launched an overtly emotional and sensory appeal to the faithful through art and architecture. Complex architectural plan shapes, often based on the oval, and the dynamic opposition and interpenetration of spaces were favoured to heighten the feeling of motion and sensuality. Other characteristic qualities include grandeur, drama and contrast (especially in lighting), curvaceousness, and an often dizzying array of rich surface treatments, twisting elements, and gilded statuary. Architects unabashedly applied bright colours and illusory, vividly painted ceilings. Outstanding practitioners in Italy included Gian Lorenzo Bernini, Carlo Maderno (1556–1629), Francesco Borromini, and Guarino Guarini (1624–83). Classical elements

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subdued Baroque architecture in France. In central Europe, the Baroque arrived late but flourished in the works of such architects as the Austrian Johann Bernhard Fischer von Erlach (1656–1723). Its impact in Britain can be seen in the works of Christopher Wren. The late Baroque style is often referred to as Rococo or, in Spain and Spanish America, as Churrigueresque.

Baroque period (17th–18th century) Era in the arts that originated in Italy in the 17th century and flourished elsewhere well into the 18th century. It embraced painting, sculpture, architecture, decorative arts, and music. The word, derived from a Portuguese term for an irregularly shaped pearl and originally used derogatorily, has long been employed to describe a variety of characteristics, from dramatic to bizarre to overdecorated. The style was embraced by countries absorbed in the Counter-Reformation; artworks commissioned by the Roman Catholic church were overtly emotional and sensory. The period's most notable practitioners were Annibale Carracci (see Carracci family), Caravaggio, and Gian Lorenzo Bernini. A spectacular example of the Baroque arts is the Palace of Versailles. In music, the Baroque era is usually considered to extend from c. 1600 to c. 1750, when such significant new vocal and instrumental genres as opera, oratorio, cantata, sonata, and concerto were introduced and such towering composers as Claudio Monteverdi, J.S. Bach, and George Frideric Handel flourished.

Barotse See Lozi

Barquisimeto \ˌbär-kē-sē-ˈmā-tō\ City (pop., 2000 est.: 875,790), northwestern Venezuela. The capital of Lara state, it is located at the northern end of the Cordillera Mérida, at an elevation of 1,800 ft (500 m). Founded in 1552 as Nueva Segovia, it is one of the country's oldest cities. It was almost destroyed by an earthquake in 1812 and was further damaged in 19th-century civil wars. It is a hub of transport and commerce and the centre of an agricultural region.

barracuda Any of about 20 species of predaceous marine fishes (family Sphyraenidae) found in all warm and tropical regions and in some more temperate areas. Swift and powerful, barracudas are slender and have small scales, a jutting lower jaw, and a large mouth with many large, sharp teeth. They vary in size from relatively small to 4–6 ft (1.2–1.8 m) long. They are primarily fish eaters. They are popular sport fishes and are caught for food, though in certain seas they may become contaminated with a toxic substance. Bold and inquisitive, they are potentially dangerous to humans when large.

Barracuda (*Sphyraena*)
C. LEROY FRENCH/TOM STACK & ASSOCIATES

Barranquilla \ˌbä-rän-ˈkē-yä\ City (pop., 1999: 1,226,292), northern Colombia. Founded in 1629 about 10 mi (16 km) from the mouth of the Magdalena River, it remained unimportant until the 1930s, when the clearing of sandbars made it an important port on the Caribbean Sea. It has since been rivaled by the Pacific Ocean port of Buenaventura, but it still handles goods from the interior and is the terminus of natural-gas pipelines from northern Colombia.

Barraqué \bä-rä-ˈkā**, Jean** (b. Jan. 17, 1928, Puteaux, France—d. Aug. 17, 1973, Paris) French composer. He studied at the Paris Conservatoire with Jean Langlais (1907–91) and Olivier Messiaen. His major work, employing a radically nonrepetitive style, was a planned five-part reflection on Hermann Broch's novel *The Death of Virgil*, of which he completed three parts— . . . *au-delà du hasard* (1959), *Chant après chant* (1966), and *Le Temps restitué* (1968)—before his early death. He also composed a long piano sonata (1952) and a clarinet concerto (1968).

Barras \bä-ˈräs**, Paul-François-Jean-Nicolas, viscount de** (b. June 30, 1755, Fox-Amphoux, France—d. Jan. 29, 1829, Chaillot) French revolutionary. A Provençal nobleman, Barras became disenchanted with the royal regime and welcomed the French Revolution. Elected to the National Convention (1792), he played a key role in the overthrow of Maximilien Robespierre and emerged as the commander of the army of the interior and the police. In 1795 he and Napoleon defended the regime against a royalist insurrection and established the Directory, with Barras as chief among the five directors. The Coup of 18 Fructidor brought him greater power, but he was overthrown in 1799 and exiled from Paris on suspicion of conspiracy to restore the monarchy.

Barrault \bä-ˈrō**, Jean-Louis** (b. Sept. 8, 1910, Le Vésinet, France—d. Jan. 22, 1994, Paris) French actor and director. He made his acting debut in Paris (1931) and joined the Comédie-Française (1940–46) as an actor and director. He and his wife, Madeleine Renaud, formed their own company (1946–58) at the Théâtre Marigny. There they performed a mixture of French and foreign classics and modern plays that helped revive French theatre after World War II. He was appointed director of the Théâtre de France (1959–68) and later directed at several other Paris theatres (1972–81). He appeared in more than 20 films and was best known for his role in *The Children of Paradise* (1945).

Barre, Mohamed Siad See Mohamed Siad Barre

Barrès \bä-ˈres**, (Auguste-) Maurice** (b. Aug. 19, 1862, Charmes-sur-Moselle, France—d. Dec. 5, 1923, Paris) French writer and politician. He served in the Chamber of Deputies (1889–93) and became a strong nationalist. With Charles Maurras, he expounded the doctrines of the French Nationalist Party in two newspapers, and in his novels he expressed an individualism that included a deep-rooted attachment to one's native region. His series of novels titled *Les Bastions de l'Est* earned success as French propaganda during World War I.

Barrès, 1906.
H. ROGER-VIOLLET

Barrie, Sir James (Matthew) (b. May 9, 1860, Kirriemuir, Angus, Scot.—d. June 19, 1937, London, Eng.) Scottish playwright and novelist. After moving to London, he wrote *Auld Licht Idylls* (1888), a book about his native Scotland. His best-selling novel *The Little Minister* (1891) was made into a play in 1897. His plays *Quality Street* (1901) and *The Admirable Crichton* (1902) ran successfully in London. After creating the stories of Peter Pan for a friend's sons, he won great success with his classic children's play *Peter Pan, the Boy Who Wouldn't Grow Up* (1904). His other plays include *The Twelve-Pound Look* (1910) and *Dear Brutus* (1917).

barrier penetration See tunneling

barrister \ˈbar-ə-stər\ One of two types of practicing lawyers in Britain (the other is the solicitor). Barristers engage in advocacy (trial work), and only they may argue cases before a high court. A barrister must be a member of one of the four Inns of Court. In Canada, all lawyers are both barristers and solicitors, though individual lawyers may describe themselves as one or the other. In Scotland trial lawyers are called advocates.

Barrow, Clyde See Bonnie and Clyde

Barry \dūē-bä-ˈrē**, (Marie-) Jeanne Bécu, countess du** *known as* **Madame du Barry** (b. Aug. 19, 1743, Vaucouleurs, France—d. Dec. 8, 1793, Paris) French mistress of Louis XV. A Paris shop assistant, she became the mistress of Jean du Barry, who introduced her into Parisian high society. Admired for her beauty, she joined Louis XV's court in 1769 after a nominal marriage to Jean's brother, a nobleman, qualified her as Louis's official royal mistress. Though she exercised little political influence, her unpopularity contributed to the decline of the prestige of the crown in the early 1770s. After Louis's death (1774), she was ban-

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ished from court. In the French Revolution she was condemned as a counterrevolutionary and guillotined.

Barry, John (b. 1745, County Wexford, Ire.—d. Sept. 13, 1803, Philadelphia, Pa., U.S.) Irish-born American naval officer. He immigrated to America in 1760 and was a merchant shipmaster out of Philadelphia at age 21. He outfitted the first American fleet in 1776, and as captain of a frigate he captured several British ships. He fought the last battle of the American Revolution in March 1783 in the Straits of Florida, where he defeated three British ships. After the war he was recalled to active service as senior captain of the new U.S. Navy. He was often called the "Father of the Navy" because he trained many future naval officers.

Barrymore family U.S. theatrical family. Maurice Barrymore (orig. Herbert Blythe; 1847–1905) made his stage debut in London before moving to New York City (1875), where he adopted Barrymore as his stage name. He joined Augustin Daly's company and in 1876 married Georgiana Drew, of the theatrical DREW FAMILY. Their eldest child, Lionel Barrymore (orig. Lionel Blythe; 1878–1954), became a leading Broadway actor in plays such as *Peter Ibbetson* (1917) and *The Copperhead* (1918), then moved to Hollywood in 1926, where he appeared in films such as *A Free Soul* (1931, Academy Award) and *Grand Hotel* (1932). Famous as a character actor, he made some 200 films, including 15 Dr. Kildare pictures. His sister Ethel Barrymore (orig. Ethel Blythe; 1879–1959) appeared in London in *Peter the Great* (1898) and on Broadway in *Captain Jinks of the Horse Marines* (1901). She opened the New York theatre named for her in 1928 in *The Kingdom of God* and later starred in *The Corn Is Green* (1940). She appeared in more than 30 films, including *None but the Lonely Heart* (1944, Academy Award) and *The Spiral Staircase* (1946). Their brother John Barrymore (orig. John Blythe; 1882–1942) was acclaimed in plays such as *Justice* (1916), *Richard III* (1920), and especially *Hamlet* (1922). His films include *Dr. Jekyll and Mr. Hyde* (1920) and *Dinner at Eight* (1933). An alcoholic, he was known for his flamboyant behaviour. John's granddaughter Drew Barrymore (b. 1975) first won notice at age seven in the film *E.T.* (1982).

barter Direct exchange of goods or services without the use of money or any other intervening medium of exchange. Barter is conducted either according to established rates of exchange or by bargaining. Barter is common among preliterate societies, particularly in those communities with some developed form of market. Goods may be bartered within a group as well as between groups, although GIFT EXCHANGE probably accounts for most intragroup trade, particularly in small and relatively simple societies. See also CURRENCY.

Barth, John *orig.* **John Simmons Barth, Jr.** (b. May 27, 1930, Cambridge, Md., U.S.) U.S. writer. Barth grew up on Maryland's eastern shore, the locale of much of his writing, and from 1953 he taught principally at Johns Hopkins University. Apart from the experimental pieces in *Lost in the Funhouse* (1968), his best-known works are the novels *The Floating Opera* (1956), *The End of the Road* (1958), *The Sot-Weed Factor* (1960), *Giles Goat-Boy* (1966), and *The Tidewater Tales* (1987), most of which play with and parody traditional narrative forms, combining philosophical depth with biting satire and boisterous, often bawdy humour. In 2001 he published the experimental novel *Coming Soon!!!: A Narrative*, which was not well received.

Barth \'bärt**, Karl** (b. May 10, 1886, Basel, Switz.—d. Dec. 9/10, 1968, Basel) Swiss theologian. He studied at the Universities of Berlin, Tübingen, and Marburg, and in 1911–21 he was a pastor at Safenwil, Switz. The tragedy of World War I made him question the liberal theology of his teachers, rooted in post-Enlightenment ideas. With *The Epistle to the Romans* (1919) he inaugurated a radical turnaround in PROTESTANT thought, initiating a trend toward neoorthodoxy. The work led to his appointment as professor at Göttingen (1921), Münster (1925), and Bonn (1930). He was a founder of the CONFESSING CHURCH, which opposed the Nazi regime; when his refusal to take the oath of allegiance to ADOLF HITLER cost him his chair at Bonn, he returned to Basel. He spoke at the opening of the World Council of Churches in 1948 and visited Rome following the Second VATICAN COUNCIL.

Barthelme \'bärt-əl-mē**, Donald** (b. April 7, 1931, Philadelphia, Pa., U.S.—d. July 23, 1989, Houston, Texas) U.S. writer. Barthelme worked as a journalist, journal editor, and museum director before his fiction began to be published. He is known for modernist "collages" marked by technical experimentation and melancholy gaiety. His story collections include *Come Back, Dr. Caligari* (1964), *City Life* (1970), *Sixty Stories* (1981), and *Overnight to Many Distant Cities* (1983); his novels include *Snow White* (1967), *The Dead Father* (1975), *Paradise* (1986), and *The King* (1990). His brother Frederick (b. 1943) is also a novelist (*Second Marriage*, 1984) and short-story writer (*Moon Deluxe*, 1983).

Barthes \'bärt**, Roland (Gérard)** (b. Nov. 12, 1915, Cherbourg, France—d. March 25, 1980, Paris) French social and literary critic. His early books examined the arbitrariness of the constructs of language and applied similar analyses to popular-culture phenomena. He analyzed mass culture in *Mythologies* (1957). *On Racine* (1963) set off a literary furor, pitting him against more traditional French literary scholars. His later contributions to SEMIOTICS included the even more radical *S/Z* (1970); *The Empire of Signs* (1970), his study of Japan; and other significant works that brought his theories wide (if belated) attention in the 1970s and helped establish STRUCTURALISM as one of the leading intellectual movements of the 20th century. In 1976 he became the first person to hold the chair of literary semiology at the Collège de France.

Bartholdi \bär-'tōl-dē**, Frédéric-Auguste** (b. April 2, 1834, Colmar, Alsace, Fr.—d. Oct. 4, 1904, Paris) French sculptor. He studied sculpture and painting in Paris. In 1865 he and several others conceived the idea for a monument to the Franco-American alliance of 1778. Beginning work in 1870, Bartholdi designed the huge statue that would come to be known as the "STATUE OF LIBERTY" (1875–86) and was able to see its construction through using funds he raised in both France and the U.S. While not as famous, his masterpiece is the *Lion of Belfort* (1871–80), carved out of the red sandstone of a hill overlooking Belfort in eastern France.

Bartholomaeus \bär-ˌtōl-ə-'mā-əs\ **(Anglicus)** *or* **Bartholomew the Englishman** (fl. c. 1220–40) Franciscan encyclopedist. Though primarily interested in scripture and theology, in his 19-volume encyclopedia *On the Properties of Things* he covered all customary knowledge of his time and was the first to make readily available the views of Greek, Jewish, and Arabic scholars on medical and scientific subjects. The encyclopedia was printed in English translation c. 1495.

Bartholomew, Saint (fl. 1st century AD—d. traditionally Albanopolis, Armenia; Western feast day August 24; date varies in Eastern churches) One of the Twelve APOSTLES of JESUS. He is mentioned only briefly in the Gospels, and his Hebrew name may have been Nathanael bar Tolmai. By tradition he was a missionary to Ethiopia, Mesopotamia, Parthia (in modern Iran), Lycaonia (in modern Turkey), and Armenia. He was supposedly martyred at the command of the Armenian king Astyages, who had him flayed and beheaded.

Barthou \bär-'tü**, (Jean-) Louis** (b. Aug. 25, 1862, Oloron-Sainte-Marie, France—d. Oct. 9, 1934, Marseille) French politician. Elected to the Chamber of Deputies in 1889, he served in various conservative governments. He was appointed premier (1913) and secured the passage of a bill requiring three years' compulsive military service. He represented France at the Conference of GENOA, entered the Senate, and became chairman of the reparations commission. Named foreign minister in 1934, he was assassinated with King ALEXANDER of Yugoslavia during the latter's visit to France.

Bartlett, Sir Frederic C(harles) (b. Oct. 20, 1886, Stow-on-the-Wold, Gloucestershire, Eng.—d. Sept. 30, 1969, Cambridge, Cambridgeshire) British psychologist best known for his studies of memory. The first professor of experimental psychology at the University of Cambridge (1931–52), he also directed the university's psychological laboratory. His major work, *Remembering* (1932), described memories not as direct recollections but rather as mental reconstructions coloured by cultural attitudes and personal habits.

John Bartlett
COURTESY OF LITTLE, BROWN AND CO.

Bartlett, John (b. June 14, 1820, Plymouth, Mass., U.S.—d. Dec. 3, 1905, Cambridge, Mass.) U.S. bookseller and editor. Bartlett was an employee and then owner of the Harvard University Bookstore. In 1855

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he published the work for which he is best known, *Familiar Quotations*, based largely on a notebook he kept for his customers. It was greatly expanded in later editions; the 17th edition appeared in 2002. He also wrote a complete concordance to Shakespeare's dramatic works and poems (1894), outstanding for the number and fullness of its citations.

Bartók \'bär-tȯk**, Béla** (b. March 25, 1881, Nagyszentmiklós, Hung., Austria-Hungary—d. Sept. 26, 1945, New York, N.Y., U.S.) Hungarian composer, pianist, and ethnomusicologist. He developed a superb piano technique at an early age. In 1904 he set about researching Hungarian folk music, having discovered that the folk-music repertory generally accepted as Hungarian was in fact largely urban Roma (Gypsy) music (see ROM). His fieldwork with the composer ZOLTÁN KODÁLY formed the basis for all later research in the field, and he published major studies of Hungarian, Romanian, and Slovakian folk music. He worked folk themes and rhythms into his own music, achieving a style that was at once nationalistic and deeply personal. He also toured widely as a virtuoso pianist. In 1940 he immigrated to the U.S., where he was inadequately recognized. His works include the opera *Bluebeard's Castle* (1911), six celebrated string quartets (1908–39), the didactic piano set *Mikrokosmos* (1926–39), *Sonata for Two Pianos and Percussion* (1937), *Concerto for Orchestra* (1943), and three piano concertos (1926, 1931, 1945).

Bartolomé de Cárdenas See Bartolome BERMEJO

Bartolomeo \ˌbär-tō-lō-'mā-ō**, Fra** *orig.* **Baccio della Porta** (b. March 28, 1472, Florence—d. Oct. 31, 1517, Florence) Italian painter active in Florence. His early works, such as the *Annunciation* (1497) in Volterra Cathedral, were influenced by PERUGINO and LEONARDO DA VINCI. In 1500 he joined the Dominican order. He painted religious subjects, primarily the Madonna and Child in various settings, with monumental figures grouped in balanced compositions. He became a prominent exponent of the High Renaissance style and was the leading painter in Florence, rivaled only by ANDREA DEL SARTO.

Barton, Clara *orig.* **Clarissa Harlowe** (b. Dec. 25, 1821, Oxford, Mass., U.S.—d. April 12, 1912, Glen Echo, Md.) U.S. nurse, founder of the American RED CROSS. She attended the Liberal Institute at Clinton, N.Y. (1850–51). In 1852 she established a free school in Bordentown, N.J., that soon became so large that the townsmen would no longer allow a woman to run it. After resigning her post, she was employed by the U.S. Patent Office in Washington, D.C. (1854–57, 1860). During the American Civil War she organized the distribution of medicine and supplies for soldiers wounded in the first Battle of Bull Run. She gained permission to pass through battle lines to distribute supplies, search for the missing, and nurse the wounded, becoming known as the "angel of the battlefield." In 1865, at the request of Pres. Abraham Lincoln, she set up a bureau of records to aid in the search for missing men. While in Europe for a rest, she helped with relief work for victims of the Franco-Prussian War (1870–71) and became associated with the International Red Cross. In 1881 she founded the American Red Cross. She lobbied Congress to sign the Geneva Convention (see GENEVA CONVENTIONS), which provided for the treatment of the sick and wounded in battle and the proper handling of prisoners of war. She wrote the U.S. amendment to the constitution of the Red Cross, which provides for the distribution of relief not only in war but also during natural disasters. She served as president of the American Red Cross until 1904.

Barton, Sir Derek H(arold) R(ichard) (b. Sept. 8, 1918, Gravesend, Kent, Eng.—d. March 16, 1998, College Station, Texas, U.S.) British chemist. Unsatisfied in his father's carpentry business, he entered London's Imperial College and received his doctorate in 1942. His studies revealed that organic molecules have a preferred three-dimensional form from which their chemical properties can be inferred. This research earned him the 1969 Nobel Prize for Chemistry, shared with Odd Hassel of Norway.

Bartram \'bär-trəm**, John** (b. March 23, 1699, Marple, Pa., U.S.—d. Sept. 22, 1777, Kingsessing, Pa.) naturalist and explorer, considered the "father of American botany." Largely self-educated, he was a friend of BENJAMIN FRANKLIN and the botanist for the American colonies to GEORGE III. He was the first North American experimenter to hybridize flowering plants, and he established near Philadelphia a botanical garden that became internationally famous. He explored the Alleghenies and the Carolinas and in 1743 was commissioned by the British crown to explore the wilderness north to Lake Ontario in Canada. In 1765–66 he explored extensively in Florida with his son WILLIAM BARTRAM.

Bartram, William (b. April 9, 1739, Kingsessing, Pa., U.S.—d. July 22, 1823, Kingsessing) U.S. naturalist, botanist, and artist. the son of JOHN BARTRAM, he described the abundant river swamps of the southeastern U.S. in their primeval condition in his *Travels through North and South Carolina, Georgia, East and West Florida* (1791). The book was influential among the English and French Romantics (see ROMANTICISM). Bartram was also noted for his renderings of plants and animals.

Baruch \bə-'rük**, Bernard (Mannes)** (b. Aug. 19, 1870, Camden, S.C., U.S.—d. June 20, 1965, New York, N.Y.) U.S. financier and adviser to presidents. After graduating from the College of the City of New York in 1889, he went to work in Wall Street brokerage houses, where he amassed a fortune as a speculator. During World War I he was appointed chairman of the War Industries Board by Pres. WOODROW WILSON. In 1919 he was a member of the Supreme Economic Council at the Paris Peace Conference at Versailles and one of Wilson's advisers on the terms of peace. During World War II he served as an unofficial adviser on economic mobilization to Pres. FRANKLIN D. ROOSEVELT. Later he was instrumental in setting UN policy on the international control of atomic energy.

Barye \bȧ-'rē**, Antoine-Louis** (b. Sept. 24, 1796, Paris, Fr.—d. June 29, 1875, Paris) French sculptor. The son of a goldsmith, he was apprenticed at 13 to an engraver. He studied at the École des Beaux-Arts (1818–23) and began to sculpt animal forms c. 1819. Influenced by THÉODORE GÉRICAULT, he had a unique talent for rendering dynamic tension and exact anatomical detail. His most famous works depict wild animals devouring their prey; he also rendered groups of domestic animals. His notable bronzes include *Lion Devouring a Gavial Crocodile* (1831) and an equestrian statue of Napoleon at Ajaccio, Corsica (1860–65).

baryon \'bar-ē-ˌän\ Any member of one of two classes of HADRONS. Baryons are heavy SUBATOMIC PARTICLES made up of three QUARKS. They are characterized by a baryon number, *B*, of 1, and have half-integer spin values. Their antiparticles (see ANTIMATTER), called antibaryons, have a baryon number of −1. Both PROTONS and NEUTRONS are baryons.

Baryshnikov \bə-'rish-nə-ˌkȯf**, Mikhail (Nikolayevich)** (b. Jan. 28, 1948, Riga, Latvia, U.S.S.R.) Latvian-born U.S. dancer. After entering the Kirov Ballet's training school in St. Petersburg in 1963, he joined the company as a soloist in 1966. There he quickly became popular with Soviet audiences, dancing leading roles created for him in ballets such as *Gorianka* (1968) and *Vestris* (1969). He defected while on tour in Canada in 1974. He danced with AMERICAN BALLET THEATRE until 1978, winning enormous acclaim, and he served as its artistic director from 1980 to 1989. He danced and acted in several movies and on television.

barytes See BARITE

barzakh \'bär-ˌzäk̲**, al-** *Arabic* **"obstacle" or "barrier"** Term that appears in the QUR'ĀN on three separate occasions and has been interpreted in various ways by Muslim commentators. In one *sūrah* (chapter), it refers to the barrier that prevents the dead from returning to earth to accomplish the good they left undone in life. It has been understood as a physical barrier between heaven and hell and as a moral prohibition by God. The term is used elsewhere in the Qur'ān to describe a barrier between two seas, one saltier than the other, whose waters meet but do not mix. In SUFISM, *barzakh* is understood as the barrier between the material world and the world of God and the angels.

basalt \bə-'sȯlt\ Dark IGNEOUS ROCK that is low in silica content and comparatively rich in iron and magnesium. Some basalts are glassy (have no visible crystals), and many are very fine-grained and compact. Basaltic lavas may be spongy or pumice-like. Olivine and augite are the most common minerals in basalts; PLAGIOCLASE is also present. Basalts may be broadly classified into two main groups. Calc-alkali basalts predominate among the lavas of mountain belts; the active volcanoes of Mauna Loa and Kilauea in Hawaii erupt calc-alkali lavas. Alkali basalts predominate among the lavas of the ocean basins and are also common in mountain belts.

base In chemistry, any substance that in water solution is slippery to the touch, tastes bitter, changes the colour of acid-base indicators (e.g., LITMUS paper), reacts with ACIDS to form SALTS, and promotes certain chemical reactions (e.g., base CATALYSIS). Examples of bases are the HYDROXIDES of the ALKALI METALS and alkaline earth metals (SODIUM, CALCIUM, etc.; see CAUSTIC SODA) and the water solutions of AMMONIA or its derivatives (AMINES). Such substances produce hydroxide IONS (OH^-) in water solutions. Broader

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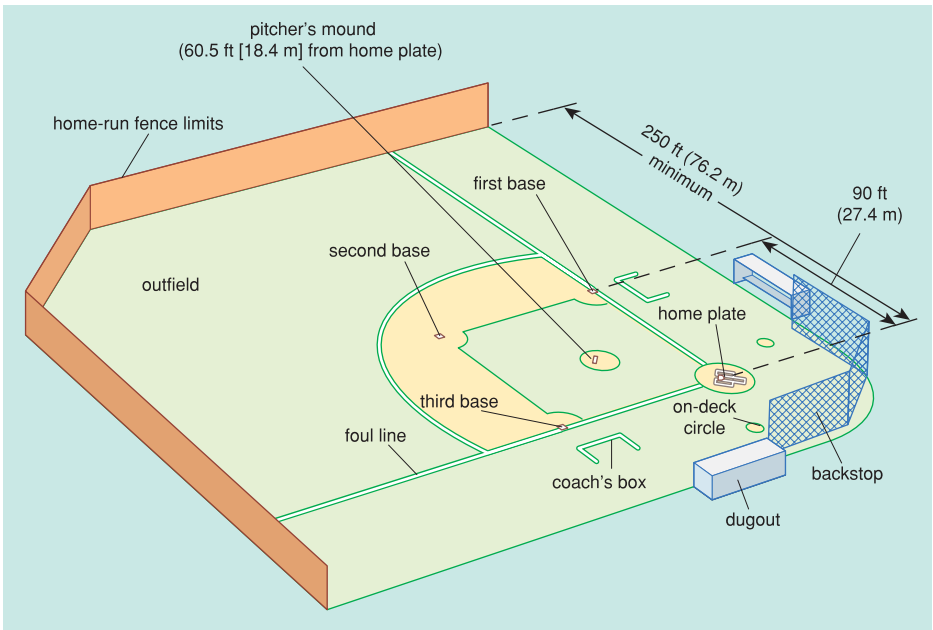
definitions of bases cover situations in which water is not present. See also ACID-BASE THEORY; ALKALI; NUCLEOPHILE.

baseball Game played with a bat and ball between two teams of nine players (or 10, if a designated hitter bats and runs for the pitcher). Baseball is played on a large field that has four bases laid out in a square, positioned like a diamond, whose outlines mark the course a runner must take to score. Teams alternate positions as batters and fielders, exchanging places when three members of the batting team are put out. Batters try to hit a pitched ball out of reach of the fielding team and complete a circuit around the bases in order to score a "run." The team that scores the most runs in nine innings (times at bat) wins the game. If a game is tied, extra innings are played until the tie is broken. Baseball is traditionally considered the national pastime of the United States. It was once thought to have been invented in 1839 by Abner Doubleday in Cooperstown, N.Y., but it is more likely that baseball developed from an 18th-century English game called rounders that was modified by Alexander Cartwright. The first professional association was formed in 1871; in 1876 it became the National League. Its rival, the American League, was founded in 1900, and since 1903 (except in 1904 and 1994) the winning teams of each league have played a postseason championship known as the World Series. The Baseball Hall of Fame is located in Cooperstown. Professional baseball leagues also exist in several Latin American countries. The champions of leagues in the Dominican Republic, Mexico, Puerto Rico, and Venezuela compete in the Caribbean Series each February. In Asia there are professional baseball leagues in Japan, South Korea, and Taiwan. Japan has two major leagues, the Central and the Pacific, that face off in the Japan Series every October.



A typical college or professional baseball field. The batter stands at home plate, the pitcher at the pitcher's mound. When a hit falls outside the foul lines, the batter may not run. Any ball over the fence represents a home run for the batter. Coaches at first and third base tell runners when to run. In the dugout, players wait to bat. Home-run fence distances and configurations vary from field to field. Softball is played on a similar field, but with bases closer together (typically 60 ft apart) and the pitcher's mound closer to the plate (40 ft for women, 46 ft for men), and the home-run fence may be as close as 200 ft.
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Basel \'bä-zəl\ *or* **Basle** \'bäl\ *French* **Bâle** \'bȧl\ City (2000: city, 166,558; metro. area, 402,387), northwestern Switzerland. It straddles the RHINE at the point where France, Germany, and Switzerland meet. It was originally a settlement of the Celtic Rauraci tribe. Its university, the first in Switzerland, was founded by Pope Pius II while attending the Council of BASEL (1431–49). In 1501 Basel was admitted into the Swiss Confederation. When DESIDERIUS ERASMUS taught at the university (1521–29), the city became a centre of humanism and of the REFORMATION. Primarily German-speaking and Protestant, it is an important trading and industrial city and river port.

Basel, Council of (1431–49) Council of the Roman Catholic church held in Basel, Switz. It addressed the question of ultimate authority in the church and the problem of the HUSSITE heresy. Its members renewed the decree *Sacrosancta* (issued by the Council of CONSTANCE), which declared the council's authority to be greater than the pope's, and voted to receive most Hussites back into the church on terms opposed by the pope. In 1437 Pope Eugenius IV transferred the council to Ferrara to negotiate reunion with the Orthodox church more effectively, but several members remained in Basel as a rump council and declared Eugenius deposed. They then elected a new pope, Felix V, and the renewed schism cost the council its prestige and popular support. On the death of Eugenius, his successor, NICHOLAS V, obliged the antipope Felix to abdicate, ended the rump council, and brought the CONCILIAR MOVEMENT to a close.

basenji \bə-'sen-jē\ Ancient breed of HOUND native to central Africa, where it is used to point and retrieve and to drive quarry into a net. Known as the barkless dog, it produces a variety of sounds other than barks. Its finely wrinkled forehead, erect ears, and tightly curled tail give it a characteristic alert expression. It has a short, silky reddish brown, black, or black-and-tan coat and white feet, chest, and tail tip. It stands 16–17 in. (41–43 cm) high and weighs 22–24 lbs (10–11 kg). It is clean and gentle.

Basenji
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BASF AG German chemical and plastics manufacturing company. Founded in 1865, BASF (the full German name means "Baden Aniline and Soda Factory") was part of the chemical cartel IG FARBEN from 1925 until 1945, when the latter was dissolved by the Allies. Refounded in 1952, BASF expanded operations globally to become one of the world's largest chemical companies. Its products have included oil and natural gas, fertilizers, synthetic fibers, dyes and pigments, inks and printing accessories. BASF sold its pharmaceutical company, Knoll, in 2001 to focus on its chemical businesses. Its headquarters are in Ludwigshafen am Rhein.

Bashan \'bā-shən\ Ancient polity, eastern PALESTINE. Frequently cited in the Old Testament and later important in the ROMAN REPUBLIC AND EMPIRE, it was located in what is now Syria. In New Testament times, Bashan ranked as one of the great granaries of Rome. One of its towns, BOSTRA (Buṣra al-Shām), was important to both Nabataea and Rome. AUGUSTUS made HEROD THE GREAT ruler of Bashan, and in AD 106 TRAJAN brought the whole Nabataean kingdom under the empire in creating the province of Arabia, with Bostra as its capital. The country went into decline in the 7th century.

Bashō \ˌbäsh-'ō\ *or* **Matsuo** \mä-'tsü-ō\ **Bashō** *orig.* **Matsuo Munefusa** (b. 1644, Ueno, Iga province, Japan—d. Nov. 28, 1694, Ōsaka) Japanese HAIKU poet, the greatest practitioner of the form. Following the Zen philosophy he studied, he attempted to compress the meaning of the world into the simple pattern of his poetry, disclosing hidden hopes in small things and showing the interdependence of all objects. His

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The Narrow Road to the Deep North (1694), a poetic prose travelogue, is one of the loveliest works of Japanese literature.

BASIC *in full* **Beginner's All-purpose Symbolic Instruction Code** Computer PROGRAMMING LANGUAGE developed by JOHN G. KEMENY and Thomas E. Kurtz (b. 1928) at Dartmouth College in the mid 1960s. One of the simplest high-level languages, with commands similar to English, it can be learned with relative ease even by schoolchildren and novice programmers. Since c. 1980, BASIC has been popular for use on PERSONAL COMPUTERS.

basic Bessemer process Modification of the BESSEMER PROCESS for converting pig iron into steel. The original Bessemer converter was not effective in removing the PHOSPHORUS from iron made from the high-phosphorus ores common in Britain and Europe. The invention of the basic process in England by Sidney G. Thomas (1850–1885) and PERCY GILCHRIST overcame this problem; the Thomas-Gilchrist converter was lined with a basic material such as burned limestone rather than an acid siliceous material. The introduction of the basic Bessemer process in 1879 made it possible for the first time for such high-phosphorus ore to be used for making STEEL.

Basic Input/Output System See BIOS

basic oxygen process Steelmaking method in which pure OXYGEN is blown through a long, movable lance into a bath of molten BLAST-FURNACE IRON and scrap, in a steel furnace with a REFRACTORY lining called a converter. The oxygen initiates a series of heat-releasing reactions, including the oxidation of such impurities as silicon, carbon, phosphorus, and manganese; carbon dioxide is released, and the oxidation products of the other impurities form molten slag that floats on the molten STEEL. The advantages of using pure oxygen instead of air in refining iron into steel were recognized as early as the 1850s (see BESSEMER PROCESS), but the process could not be commercialized until the late 1940s, when cheap, high-purity oxygen became available. Within 40 years it had replaced the OPEN-HEARTH PROCESS and was producing more than half of all steel worldwide. Commercial advantages include high production rates, less labour, and steel with a low nitrogen content.

basic rocks See ACID AND BASIC ROCKS

basidiomycete \bə-ˌsi-dē-ō-ˈmī-ˌsēt\ Any of a large and diverse class of fungi (division Mycota), including jelly and shelf, or bracket, fungi; MUSHROOMS, PUFFBALLS, and stinkhorns; and the rusts and SMUTS. The club-shaped, SPORE-bearing organ (basidium) is borne on a usually large and conspicuous fruiting body. Basidiomycetes include bird's-nest fungi, whose hollow fruiting bodies resemble nests containing eggs. The 15 species of the order Exobasidiales are parasitic on higher plants, particularly AZALEAS and RHODODENDRONS. Jelly fungi are so called because they have jellylike, often colourful fruiting bodies. See also FUNGUS.

Basie \ˈbā-sē**, Count** *orig.* **William Allen Basie** (b. Aug. 21, 1904, Red Bank, N.J., U.S.—d. April 26, 1984, Hollywood, Fla.) U.S. jazz pianist and bandleader. Basie was influenced by the Harlem pianists JAMES P. JOHNSON and FATS WALLER. In Kansas City in 1936 he formed his own band, which became known as the most refined exponent of SWING. Its rhythm section was noted for its lightness, precision, and relaxation; on this foundation, the brass and reed sections developed a vocabulary of riffs and motifs. Their hit recordings included "One O'Clock Jump" and "Jumpin' at the Woodside." Basie's piano style became increasingly spare and economical. His soloists included singer JIMMY RUSHING, trumpeters Buck Clayton and Harry ("Sweets") Edison, and saxophonist LESTER YOUNG. Basie's reorganized band of the 1950s placed greater emphasis on ensemble work and developed a more powerful style built from the riffs and buoyant rhythm of the earlier group. The band achieved renewed popularity for recordings featuring vocalist JOE WILLIAMS.

Count Basie, 1969.
RON JOY/GLOBE PHOTOS

basil Herb consisting of the dried leaves of *Ocimum basilicum*, an annual herb of the MINT family, native to India and Iran. The dried large-leaf varieties have a fragrant aroma faintly reminiscent of ANISE, with a warm, sweet, aromatic, mildly pungent flavour. The dried leaves of common basil are less fragrant and more pungent. Basil is widely grown as a kitchen herb. TEA made from basil leaves is a stimulant. The heart-shaped basil leaf is a symbol of love in Italy.

Basil \ˈba-zəl\ **I** *known as* **Basil the Macedonian** (b. 826/835, Thrace—d. Aug. 29, 886) Byzantine emperor (867–86) and founder of the Macedonian dynasty. Born into a peasant family in Macedonia, he won employment in official circles in Constantinople and was made chamberlain by the reigning emperor, Michael III. He became coemperor with Michael in 866 and murdered him the next year. Basil won victories against Muslim forces along the eastern borders of Asia Minor and asserted control over Slavs in the Balkans. He gained ground in southern Italy but lost Syracuse (878) and other key cities in Sicily to the Muslims. He also formulated the Greek legal code known as the Basilica. In later life Basil showed signs of madness.

Basil II *known as* **Basil Bulgaroctonus** \ˌbül-gə-ˈräk-tə-nəs\ **("Slayer of the Bulgars")** (b. 957/958—d. Dec. 15, 1025) Byzantine emperor (976–1025). Crowned coemperor with his brother in 960, he had to exile the grand chamberlain (985) and defeat rival generals (989) in order to gain the authority to rule. Basil became one of the strongest Byzantine emperors, winning territory in the Balkans, Mesopotamia, Armenia, and Georgia. He was noted for his victory (1014) in the war with Bulgaria, which ended with his blinding all the soldiers in the defeated Bulgarian army. He increased his domestic authority by attacking the landed interests of the military aristocracy and of the church. Because Basil left no able successor, the gains of his rule were soon undone.

Basil the Great, Saint (b. AD 329, Caesarea Mazaca, Cappadocia—d. Jan. 1, 379, Caesarea; Western feast day January 2; Eastern feast day January 1) Early church father. Born into a Christian family in Cappadocia, he studied at Caesarea, Constantinople, and Athens and later established a monastic settlement on the family estate at Annesi. He opposed ARIANISM, which was supported by the emperor VALENS and his own bishop Dianius, and organized resistance to it after 365. He succeeded EUSEBIUS as bishop of Caesarea in 370. He died shortly after Valens, whose death in battle opened the way for the victory of Basil's cause. More than 300 of his letters survive; several of his *Canonical Epistles* have become part of canon law in EASTERN ORTHODOXY.

St. Basil, detail of a mosaic, 12th century; in the Palatine Chapel, Palermo, Sicily, Italy.
ALINARI—ART RESOURCE

basilica Originally a secular public building in ancient Rome, typically a large rectangular structure with an open hall and a raised platform at one or both ends. In one type, the central hall was flanked by side aisles set off by COLONNADES, and the raised platform was enclosed by an APSE. The early Christians adopted this type for their churches. In the typical early Christian basilica, the columns separating the NAVE from the lower side aisles carried either arches or ENTABLATURES, above which rose CLERESTORY walls that supported the roof. The long nave came to be crossed just before the apse by a shorter TRANSEPT, creating the cross-shaped plan that remains a standard church form to the present. "Basilica" is also a title of honor given to a Roman Catholic or Greek Orthodox church distinguished by its antiquity or its role as an international center of worship. See also CATHEDRAL.

Basilicata \bä-ˌzē-lē-ˈkä-tä\ Autonomous region (pop., 2001 prelim.: 595,727), southern Italy. Roughly divided into a western mountainous region and an eastern section of low hills and wide valleys, its capital is POTENZA. Known in ancient times as Lucania, the area was under LOMBARD LEAGUE rule in the early Middle Ages. Until the fall of the Swabian HOHENSTAUFENS (1254), it played a significant part in the affairs of southern Italy;

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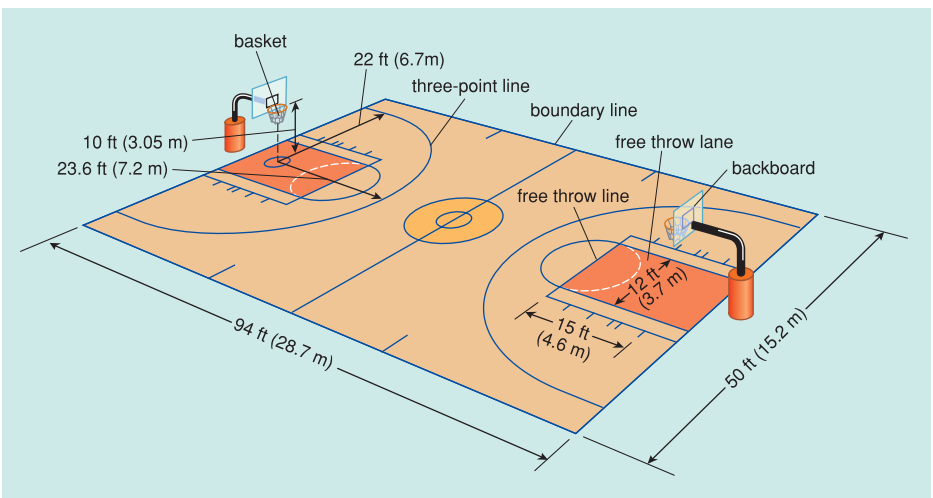
later it followed the variable fortunes of the Kingdom of Naples until united with the Kingdom of Italy in 1861. The region suffered severe damage in a disastrous earthquake in 1980. Agriculture is an economic mainstay.

Basilides \,ba-sə-'lī-dēz\ (fl. 2nd century AD, Alexandria) Founder of the Basilidian school of Gnosticism. According to Clement of Alexandria, Basilides claimed to base his teaching on a secret tradition of Peter the Apostle. He wrote psalms, odes, commentaries on the Gospels, and his own gospel. Fragments of these writings and varying accounts by Clement, St. Irenaeus, and others suggest that his system of belief included elements from Neoplatonism as well as the New Testament. The school survived in Egypt until the 4th century.

Baskerville, John (b. Jan. 28, 1706, Wolverly, Worcestershire, Eng.—d. Jan. 8, 1775, Birmingham, Warwickshire) British typographer. In 1757 he set up a printing house and published his first work, an edition of Virgil. His editions of the Latin classics, John Milton's poems (1758), and a folio Bible (1763) are characterized by clear and careful presswork rather than ornament; they are among the finest examples of the art of printing. He served as printer to Cambridge University (1758–68), and he created the widely used Baskerville typeface, which is still used and prized for its clarity and balance.

Baskerville, detail of a portrait after James Millar, 1774; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

basketball Court game between two teams of five players. They score by tossing, or "shooting," an inflated ball through a raised hoop, or "basket," located in their opponent's end of the court. A goal is worth two points, three if shot from outside a specified limit. A player who is fouled (through unwarranted physical contact) by another is awarded one to three free-throw attempts (depending on the circumstances of the foul). A successful free throw is worth one point. Invented in 1891 by James A. Naismith at the YMCA Training School in Springfield, Mass., basketball quickly became popular throughout the U.S., with games organized at the high school and collegiate level for both sexes. (For the first game, Naismith used as goals two half-bushel peach baskets, which gave the sport its name.) Women first played the game under a markedly different set of rules. The game developed internationally at a slower pace. The first Olympic basketball contest was held in 1936, and the Fédération Internationale de Basketball Amateur (FIBA) introduced world championships for men and women in 1950 and 1953, respectively. In the U.S., high school and collegiate championship tournaments are traditionally held in March and generate considerable excitement. A men's professional league was organized in 1898 but did not gain much of a following until 1949, when it was reconstituted as the National Basketball Association (NBA). The first women's professional leagues in the U.S. emerged during the 1970s but failed after a year or two. The current Women's National Basketball Association (WNBA), owned by the NBA, was organized in 1997. Club and professional basketball outside the U.S. developed rapidly in the latter part of the 20th century. The Basketball Hall of Fame is located in Springfield.



The U.S. professional court is shown. The U.S. college court has similar dimensions but has a shallower (19-ft 9-in) three-point line. International courts are slightly smaller and have 20-ft 6-in three-point lines and trapezoidal free-throw lanes that are wider at the boundary line than at the free-throw line. The basket height is 10 ft on all courts.
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basketry Art and craft of making containers and other objects from interwoven flexible fibres such as grasses, twigs, bamboo, and rushes. It is primarily a functional rather than a decorative art. The type of basketry in a given geographic region is determined by the type of vegetation available there. Numerous Asian, African, Oceanic, and Native American cultures have excelled in basketry.

Baskin, Leonard (b. Aug. 15, 1922, New Brunswick, N.J., U.S.—d. June 3, 2000, Northampton, Mass.) U.S. sculptor and graphic artist. After studying in Europe and the U.S., in 1939 he had his first one-man exhibition in New York City, and he later taught for many years at Smith College. He is known for his bleak portrayals of the human figure. His sculptures in bronze, limestone, and wood are dominated by themes of death, vulnerability, and spiritual decay. In his woodcuts he developed a distinctive linear style, depicting figures resembling those in anatomical charts. Baskin was particularly noted for his memorials, including the Holocaust Memorial (dedicated 1994) in Ann Arbor, Mich.

basking shark Huge, sluggish shark (family Cetorhinidae) named for its habit of floating or slowly swimming at the surface. Possibly comprising more than one distinct species, it inhabits northern and temperate regions of the Atlantic, Pacific, and Indian oceans. It may grow as large as 46 ft (14 m); among fishes, only the whale shark grows larger. Despite its size, the basking shark feeds on plankton. It is gray-brown or blackish, with tiny teeth and very long gill slits. It is generally harmless and is hunted sporadically for fish meal and liver oil.

Basle See Basel

Basque \'bask\ *Spanish* **Vasco** Member of a people of unknown origin living in Spain and France along the Bay of Biscay and in the western Pyrenees mountains in the region of the Basque Country. About 850,000 true Basques live in Spain and another 130,000 in France. Physically the Basques are similar to other Western European peoples; the Basque language, however, is not Indo-European. The Basques have sought autonomy from Spain since the 19th century. A national government was proclaimed in the Spanish Civil War, which saw the brutal bombing of Guernica (1937). After the war, the government and many Basques went into exile as Francisco Franco abolished their special privileges. The Basque separatist movement was rekindled after Franco's death and the establishment of a liberal Spanish monarchy in 1975. Despite the granting of limited autonomy in 1978, the more militant separatists, including the terrorist ETA (Basque Homeland and Liberty), continued a campaign for complete independence.

Basque Country *Spanish* **País Vasco** \'pīs-'bäs-kō\ *Euskera* **Euskadi** Autonomous community (pop., 2005 est.: 2,124,846) and his-

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torical region, northern Spain. Bounded by the Bay of Biscay, it consists of the modern provinces of Vizcaya (Biscay), Álava, and Guipúzcoa and has an area of 2,793 sq mi (7,234 sq km); its capital is Vitoria-Gasteiz. The Pyrenees Mountains separate it from the Basque Country of France. The Basques who inhabit the region have long sought autonomy. A separatist movement succeeded in regaining Basque autonomy in 1936 under the short-lived Republican government, but autonomy was withdrawn by Francisco Franco in 1937. Though limited autonomy was granted in 1979, a campaign of terrorism against the Spanish government continued. Álava is an agricultural region, while metallurgical industry is concentrated around Bilbao.

Basque Country *French* **Pays Basque** \pe-'ē-'bäsk\ Cultural region, extreme southwestern France. It extends from the Anie Peak of the Pyrenees to the coast around Biarritz on the Bay of Biscay. The region has been largely spared the problems associated with Basque separatism in Spain's Basque Country. Fishing and tourism are economic mainstays.

Basque language Language spoken by an estimated 1,000,000 Basque people living in the Basque Country of north-central Spain and southwestern France. About 200,000 Basques live in other parts of the world. The only remnant of the languages spoken in western Europe before incursions by Indo-European-speaking peoples, Basque has no known linguistic relatives; linguists call it a language isolate. Its grammar is markedly distinct from that of all other western European languages. Basque is sparsely attested before the 16th century, when the first book in the language was printed (1545), though it has maintained a continuous literary tradition since then.

Baṣrah, Al- *or* **Basra** Port and city (pop., 2003 est.: 1,400,000), southeastern Iraq. It lies at the head of the Shatt al-Arab, about 70 mi (110 km) upstream from the Persian Gulf. Founded in AD 638, it became famous under the ʿAbbāsid dynasty; in *The Thousand and One Nights* it was the city from which Sindbad the Sailor set sail. In the 17th–18th centuries it became a trading centre. Occupied by the British in World War I (1914–18), the town and port underwent many improvements and grew in importance. After World War II (1939–45), the growth of Iraq's petroleum industry turned Al-Baṣrah into a major refining centre. It suffered heavy damage in the Iran-Iraq War (1980–90) and the First Persian Gulf War (1990–91) and was the scene of fighting between Iraqi and coalition forces in the Second Persian Gulf War (2003).

bas-relief \ˌbä-ri-'lēf\ *or* **low relief** Sculptural form in which figures are carved in a flat surface and project only slightly from the background rather than standing freely. Depending on the degree of projection, reliefs may also be classified as high or medium relief.

bass \'bas\ In zoology, any of numerous fish species, many valued for food or sport. Most are placed in three families (all in the order Perciformes): 400 species of sea bass and grouper; the family Moronidae, which contains about 12 species, including striped and European basses; and sunfishes, including the black and largemouth basses, prized by fishermen. Many other species are also known as bass, including the channel bass (a drum) and the calico bass (a crappie).

bass \'bās\ Lowest musical voice or register. In vocal music, its range is approximately from the second E below middle C to middle C itself. A basso profundo emphasizes a lower register, a basso cantante a somewhat higher one. Outside of Russia, the solo bass voice has generally been relegated to certain standard operatic character roles. The lowest-pitched member of most instrumental families is usually called the bass (bass clarinet, double bass, etc.). In Western tonal music, the bass part is usually second in importance only to the melody, being the chief determiner of harmonic movement, a tendency that became particularly notable after the appearance of the basso continuo c. 1600.

Bass Strait \'bas\ Strait separating Australia from Tasmania. It is 150 mi (240 km) wide at its widest point and 185 mi (298 km) long. It was named in 1798 for the British surgeon-explorer George Bass. Development of its offshore petroleum resources began in the 1960s.

Bassano \bä-'sä-nō**, Jacopo** *orig.* **Jacopo da Ponte** (b. c. 1517, Bassano, republic of Venice—d. Feb. 13, 1592, Bassano) Italian painter. He was the most celebrated member of a family of artists from the small town of Bassano, near Venice, where he worked for most of his life. He trained with Bonifacio de' Pitati in Venice and was influenced by other Venetian painters. He became known for his late Renaissance-style works depicting biblical themes, lush landscapes, and rustic scenes. Four painter sons continued the Bassano workshop tradition: Francesco (1549–92) and Leandro (1557–1622), both of whom were part of the workshop's Venetian branch, Giovanni Battista (1553–1613), and Gerolamo (1566–1621). Many products of the workshop were collaborative efforts.

basset hound Centuries-old breed of dog developed in France and maintained, chiefly in France and Belgium, as a hunting dog of the aristocracy. Originally used to trail hares, rabbits, and deer, it has also been used for hunting birds, foxes, and other game. It is a slow, deliberate hunter, with a deep voice and a nose exceeded in keenness only by the bloodhound's. Short-legged and heavy-boned, the basset hound has long, dangling ears and a short coat in any combination of black, tan, and white. It stands 12–15 in. (30–38 cm) high and weighs 40–60 lbs (18–27 kg).

Basset hound
SALLY ANNE THOMPSON/EB INC.

Basseterre \bäs-'ter\ Seaport (pop., 1994 est.: 12,605), Saint Kitts Island. Chief town of Saint Kitts and capital of the federated state of Saint Kitts and Nevis, it lies on the southwestern coast, west of St. John's, Antigua. Founded in 1627, it serves as a depot distributing merchandise to neighbouring islands.

Bassi \'bäs-ē**, Agostino** (b. Sept. 25, 1773, near Lodi, Lombardy, Habsburg crown land—d. Feb. 8, 1856, Lodi) Italian bacteriologist. He attended Pavia University. In 1807 he began an investigation of the silkworm disease muscardine, which was causing serious economic losses in Italy and France. After 25 years of research, he demonstrated that the disease was contagious and was caused by a microscopic parasitic fungus spread among the silkworms by contact and infected food. He announced his discoveries in 1835 and theorized that many plant, animal, and human diseases are caused by animal or vegetable parasites, thus preceding both Louis Pasteur and Robert Koch in formulating a germ theory of disease.

basso continuo See continuo

bassoon Principal tenor and bass instrument of the orchestral woodwind family. Its mouthpiece has a double reed attached to a curved metal crook, which leads to a narrow conical bore that doubles back on itself (to keep its length manageable). It developed from the older curtal (or dulzian) in the 17th century. An agile instrument with a mild tone, it has a range of 3½ octaves, starting at B-flat two octaves below middle C. The contrabassoon, a large metal instrument whose tubing doubles back four times, has a range an octave lower.

basswood Any of certain species of linden common to North America. The name refers especially to *Tilia americana*, found in a vast area of eastern North America but centred in the Great Lakes region, and to *T. caroliniana* and *T. georgiana*, found in the southeastern U.S.

bast See phloem

Bastet \'bas-ˌtet\ *or* **Bast** *or* **Ubasti** In Egyptian religion, a goddess worshiped first as a lioness and later as a cat. Her nature changed after the domestication of the cat c. 1500 BC. She had cults at Bubastis in the Nile delta and at Memphis. In the Late and Ptolemaic periods, large cemeteries of mummified cats were created at both sites, and thousands of bronze statuettes of the goddess were deposited as votive offerings. Bastet is represented as a lioness or a woman with a cat's head, usually holding a bag, a breastplate, and a sistrum (wire rattle). The Romans carried her cult to Italy.

Bastille \bas-'tēl\ Medieval fortress in Paris that became a symbol of despotism. In the 17th–18th centuries, the Bastille was used as a French state prison and a place of detention for important persons. On July 14, 1789, at the beginning of the French Revolution, an armed mob of Parisians captured the fortress and released its prisoners, a dramatic action that came to symbolize the end of the ancien régime. The Bastille was subsequently demolished by the Revolutionary government. Bastille Day (July 14) has been a French national holiday since 1880.

Basutoland See Lesotho

bat Any member of about 900 species (order Chiroptera) of the only mammals to have evolved true flight. Their wings are evolutionary modi-

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fication of the forelimbs, with greatly elongated fingers joined by a membrane that extends down the side of the body. Most bats use ECHOLOCATION to orient themselves and find prey. Found worldwide, they are particularly abundant in the tropics. Wingspreads vary among species from 6 in. (15 cm) to 5 ft (1.5 m). Nearly all species roost during the day (in caves, crevices, burrows, building, or trees) and feed at night. Most are INSECTIVORES, consuming enough insects to affect the balance of insect populations. Others feed on fruit, pollen, nectar, or blood (VAMPIRE BATS). Some may live more than 20 years. The GUANO of bats has long been used for agricultural fertilizer. See also FREE-TAILED BAT, FRUIT BAT.

Bat Mitzvah See BAR MITZVAH

Bataan Death March \bə-'tan\ (April 1942) Forced march of 70,000 U.S. and Filipino prisoners of war (World War II) captured by the Japanese in the Philippines. From the southern end of the Bataan Peninsula, the starving and ill-treated prisoners were force-marched 63 mi (101 km) to a prison camp. Only 54,000 prisoners lived to reach the camp; up to 10,000 died on the way and others escaped in the jungle. In 1946 the Japanese commander of the march was convicted by a U.S. military commission and executed.

Bataille \bä-'täy**, Georges** (b. Sept. 10, 1897, Billom, France—d. July 9, 1962, Paris) French librarian and writer. He trained as an archivist and worked at the Bibliothèque Nationale and at the Orléans library. He wrote a number of novels under pseudonyms before publishing *Le Coupable* (1944; *Guilty*) under his own name. His novels, essays, and poetry show a fascination with eroticism, mysticism, violence, and an ideal of excess and waste. In 1946 he founded the influential literary review *Critique*, which he edited until his death.

Batak \bə-'täk\ Any member of any of several closely related ethnic groups of central Sumatra, Indon. The Batak are descendants of a powerful Proto-Malayan people who until 1825 lived in relative isolation in the highlands surrounding Lake Toba in Sumatra. They have their own written language. In their traditional religion, ancestors, plants, animals, and inanimate objects are considered to possess souls or spirits; today about a third of the 3.1 million Batak adhere to traditional beliefs, while the rest profess Christianity or Islam.

Batavian Republic Republic of the Netherlands after it was conquered by France in 1795. Its government, set up in 1798, was bound to France by alliance. In 1805 NAPOLEON renamed it the Batavian Commonwealth and placed executive power in the hands of a dictator. In 1806 it was replaced by the Kingdom of Holland under the rule of Louis BONAPARTE; it was incorporated into the French empire in 1810.

bat-eared fox Species (*Otocyon megalotis*) of large-eared FOX found in open, arid areas of eastern and southern Africa. It has 48 teeth (six more than any other CANINE) and, except for its unusually large ears, looks like the RED FOX. It grows to a length of about 32 in. (80 cm), including a 12-in. (30-cm) tail, and weighs 7–10 lbs (3–4.5 kg). It lives alone or in small groups and feeds primarily on insects, especially termites.

Bat-eared fox (*Otocyon megalotis*)
MARK BOULTON FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS—EB INC.

Bateman, Hester *orig.* **Hester Needham** (b. 1709, London, Eng.—d. 1794, London) British silversmith. In 1760, after the death of her husband, John Bateman, she took over the family business. Until 1774 she generally executed designs commissioned by other silversmiths. After that time her shop became well known for its tableware, such as spoons, sugar bowls, saltcellars, and teapots. Bateman's designs were restrained and graceful, characterized by beaded edges. In addition to domestic silver, she produced large presentation pieces. See photograph opposite.

Bateson, Gregory (b. May 9, 1904, Grantchester, Eng.—d. July 4, 1980, San Francisco, Calif., U.S.) British-born U.S. anthropologist. Son of British biologist William Bateson, he studied anthropology at Cambridge University but soon thereafter moved to the U.S. His most important book, *Naven* (1936), was a groundbreaking study of cultural symbolism and ritual based on fieldwork in New Guinea. From 1936 to 1950 he was married to MARGARET MEAD, with whom he studied the connection between culture and personality, publishing *Balinese Character* in 1942. His interests broadened to include problems of learning and communication among schizophrenics. His last book, *Mind and Nature* (1978), synthesized many of his ideas.

Bateson, William (b. Aug. 8, 1861, Whitby, Yorkshire, Eng.—d. Feb. 8, 1926, London) British biologist. In 1900, while studying inheritance of traits, he was drawn to the research of GREGOR MENDEL, which explained perfectly the results of his own plant experiments. He was the first to translate Mendel's major work into English. With REGINALD CRUNDALL PUNNETT, he published the results of a series of breeding experiments that not only extended Mendel's principles to animals but also showed that, contrary to Mendel, certain features were consistently inherited together, a phenomenon that came to be termed linkage (see LINKAGE GROUP). In 1908 he became Britain's first professor of genetics, and in 1909 he introduced the term *genetics*. He opposed THOMAS HUNT MORGAN's theory of CHROMOSOMES. GREGORY BATESON was his son. See also CARL ERICH CORRENS; HUGO DE VRIES; ERICH TSCHERMAK VON SEYSENEGG.

William Bateson, drawing by Sir William Rothenstein, 1917; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Bath City (pop., 1995 est.: 84,000), southwestern England. Situated on the River AVON, it was founded as Aquae Sulis by the Romans, who were attracted to its hot mineral springs. The Anglo-Saxons arrived in the 6th century AD, followed by the Normans c. 1100. In the Middle Ages it was a prosperous centre for the cloth trade. When the Roman baths were rediscovered in 1755, Bath had already revived as a spa; its popularity is reflected in the works of JANE AUSTEN, RICHARD BRINSLEY SHERIDAN, and TOBIAS SMOLLETT. It was rebuilt and extended in the Palladian style during the 18th century. Bath today retains many of its 18th-century structures.

Ba'th \'bäth\ **Party** *or* **Baath Party** Arab political party that advocates formation of a single Arab socialist state. It was founded in Damascus, Syria, by MICHEL ʿAFLAQ and Salāḥ al-Dīn al-Bīṭār in 1943 and in 1953 merged with the Syrian Socialist Party to form the Arab Socialist Baʿth Party. It espoused nonalignment and opposition to imperialism and colonialism. It gained control of Syria in 1963 after the failure of a short-lived union with Egypt and of Iraq in 1968 after a series of coups there; the Iraqi branch of the party was toppled as a result of the Second PERSIAN GULF WAR (2003). The party also has branches in other Middle Eastern countries. See also PAN-ARABISM; ḤĀFIẒ AL-ASSAD; ṢADDĀM ḤUSSEIN.

Silver coffee pot by Hester Bateman, 1773–74; in the Victoria and Albert Museum, London.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

batholith Large body of IGNEOUS ROCK formed beneath the Earth's surface by the intrusion and solidification of MAGMA. Batholiths are usually composed of coarse-grained rocks (e.g., granite or quartz diorite) and often have an irregular shape, with side walls that incline steeply. They may have a surface exposure of 40 sq mi (100 sq km) or more and may be 6–9 mi (10–15 km) thick. A well-known batholith is located in the Sierra Nevada range of California.

Báthory, Stephen See STEPHEN BÁTHORY

Bathurst See BANJUL

Bathurst Island Island, Nunavut, Canada. Located in the Arctic Ocean between Cornwallis and MELVILLE ISLANDS, it is 160 mi (260 km) long and 50–100 mi (80–160 km) wide.

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The coastline is fringed with islets, and several islands stretch from its western tip. Discovered in 1819 by Sir William Parry, it was named for Henry Bathurst, 3rd Earl Bathurst.

bathypelagic zone \ˌbath-i-pə-ˈla-jik\ Worldwide zone of deep ocean waters, about 3,000–13,000 ft (1,000–4,000 m) below the surface. It is inhabited by a wide variety of marine forms, including eels, fishes, molusks, and others.

bathyscaphe \ˈba-thi-ˌskaf\ Navigable diving vessel developed by Auguste Piccard (assisted by his son Jacques), designed to reach great depths in the ocean. The first bathyscaphe, the *FNRS 2*, was built in 1946–48 in Belgium. A later version, the *Trieste*, was acquired by the U.S. Navy; in 1960 it dived to a record 35,810 ft (10,916 m) in the Mariana Trench. The bathyscaphe consists of two main components: a steel cabin, heavier than water and resistant to sea pressure, to accommodate the observers; and a light container called a float, filled with gasoline, which, being lighter than water, provides the necessary lifting power (replacing cables, which had previously been used to support descending chambers but had proven unreliable at great depths).

batik \bə-ˈtēk\ Method of dyeing textiles, principally cottons, in which patterned areas are covered with wax so that they will not receive colour. Multicoloured effects are achieved by repeating the dyeing process several times, the initial pattern of wax being boiled off and another design applied before redyeing. Wax was applied with bamboo strips in Indonesia, where the technique originated. A small copper pot with a handle and narrow applicator spout for applying the wax came into use in Java by the mid 18th century; a wood-block wax applicator was developed in the 19th century. Dutch traders imported the cloth and the technique to Europe. Today machines for applying wax in traditional Javanese patterns reproduce the same effects as the hand-dyeing process.

Bāṭiniyyah \ˌbä-ti-ˈnē-yə\ School of Islamic thought that interpreted religious texts exclusively on the basis of hidden rather than literal meanings. Such interpretation gained currency around the 8th century among esoteric Shīʿite sects, especially the schismatic Ismāʿīlīyyah, who believed that beneath every obvious meaning lay a hidden, true meaning, which the imam was empowered to interpret. While influenced by speculative philosophy and theology, the Bāṭiniyyah remained proponents of esoteric knowledge. Sunnite Muslims condemned the Bāṭiniyyah as enemies of Islam for rejecting literal truth and producing confusion and controversy through their multiple textual readings.

Batista \bä-ˈtēs-tä\ **(y Zaldívar), Fulgencio** (b. Jan. 16, 1901, Banes, Cuba—d. Aug. 6, 1973, Guadalmina, near Marbella, Spain) Soldier, president, and dictator who twice ruled Cuba (1933–44, 1952–59). Batista worked his way up through the army and came to power as a strongman, ruling first through associates, then as president himself from 1940. During his first term he cultivated the support of the U.S., the army, organized labour, and the civil service, and he achieved gains in the educational system, public works, and the economy as a whole while enriching himself and his associates. He lost the 1944 election but returned by way of an army revolt in 1952. His second rule was a corrupt and brutal dictatorship that set the stage for his overthrow by Fidel Castro on Jan. 1, 1959.

Batlle y Ordóñez \ˈbät-yā-ē-ȯr-ˈthōn-yās**, José** (b. May 21, 1856, Montevideo, Uru.—d. Oct. 20, 1929, Montevideo) President of Uruguay (1903–07, 1911–15). The son of a former president of Uruguay, he was involved in politics from the 1880s. His narrow victory in the 1903 presidential election led to a brief civil war, but when he held new elections in 1905 he won again. He stepped down at the end of his term and was reelected in 1911. He inaugurated labour reforms, limited the profits of foreign-owned businesses, encouraged migration, nationalized and developed public works, ended the death penalty, and protected children born out of wedlock. He is credited with transforming Uruguay into a stable, democratic welfare state.

Baton Rouge \ˈbat-ᵊn-ˈrüzh\ City (pop., 2000: 227,818), capital of Louisiana, U.S. Located on the Mississippi River, it is the state's second-largest city. Settled by the French in 1719, it was named for a red cypress pole that marked a boundary between Indian tribes. The area was ceded to Britain in 1763, then taken by the Spanish in the American Revolution. Spain ceded Louisiana to France in 1800 but tried to retain Baton Rouge at the time of the Louisiana Purchase (1803). In 1810 the city was annexed to the U.S., and it became the state capital in 1849. The capital was transferred to other towns when Baton Rouge was occupied by Federal troops during the American Civil War; in 1882 it regained its capital status. It has deepwater port facilities and is an important petroleum refining centre.

battalion Tactical military organization composed of a headquarters and two or more companies, batteries, or similar units and usually commanded by a field-grade officer such as a lieutenant colonel. The term has been used in nearly every Western army for centuries and has had many meanings. In the 16th–17th century, it denoted a unit of infantry used in a line of battle and was loosely applied to any large body of men. During the Napoleonic Wars, battalions were fighting units of the French army under the administrative unit of the regiment. In the armies of the British Commonwealth nations, infantry battalions are tactical units within regiments. The typical U.S. Army battalion is a unit of 800–900 soldiers, divided into a headquarters company and three rifle companies; two to five battalions form the combat elements of a tactical brigade. See also military unit.

Battenberg family *or* **Mountbatten family** Family that rose to international prominence in the 19th–20th centuries. The first Battenbergs were a family of German counts that died out c. 1314; the title was revived in 1851. In 1917 the family members who lived in England renounced the German title of prince of Battenberg and adopted Mountbatten as a surname ("mount" being a translation of "Berg"). Prominent members of the family included Philip, duke of Edinburgh, and Louis Mountbatten.

battered woman syndrome Psychological and behavioral pattern displayed by female victims of domestic violence. Explanations that have evolved since the late 1970s include learned helplessness, a "cycle of violence" theory, and a form of post-traumatic stress disorder. The term is a legal concept rather than a psychiatric diagnosis and lacks clearly defined criteria. It has been used to support legal arguments of self-defense, diminished responsibility, or insanity when a woman is accused of murdering or assaulting her batterer, committing a crime under his coercion, or provoking the behaviour the batterer is on trial for. Critics say the term creates a stereotyped image inadequate to describe individual experiences.

battering ram Medieval weapon consisting of a heavy timber with a metal knob or point at the front. Rams were used to beat down the gates or walls of a besieged city or castle. Usually suspended by ropes from the roof of a movable shed, the timber was swung back and forth by its operators so that it banged against the structure under siege. The shed's roof was covered with animal skins to protect the operators inside it from bombardment with stones or fiery materials.

Battersea enamelware Painted enamelware made by Stephen Theodore Janssen at York House in London's Battersea district from 1753 to 1756. The ware is composed of soft white enamel over a copper ground. The designs were applied by hand painting or by transfer printing: an impression from an engraved metal plate brushed with enamel colours was made on paper, and the design was then transferred to the object to be decorated. Most of the objects (e.g., snuffboxes, watch cases) were decorated with mottoes, portraits, landscapes, or flowers. The transfer printing technique was first used for large-scale production at Battersea.

battery Any of a class of devices, consisting of a group of electrochemical cells (see electrochemistry), that convert chemical energy into electrical energy; the term is also commonly applied to a single cell of this kind. A wet cell (e.g., a car battery) contains free liquid electrolyte; in a dry cell (e.g., a flashlight battery) the electrolyte is held in an absorbent material. Chemicals are arranged so that electrons released from the battery's negative electrode flow (see electric current) through a circuit outside the battery (in the device powered by it) to the battery's positive electrode. The battery's voltage depends on the chemicals used and the number of cells (in series); the current depends on the resistance in the total circuit (including the battery—and thus on electrode size). Multiple batteries may be connected in series (the positive electrode of one to the negative electrode of the next), which increases total voltage, or in parallel (positive to positive and negative to negative), which increases total current. Batteries that are not rechargeable include standard dry cells used in flashlights and certain wet cells for marine, mine, highway, and military use. Car batteries, many kinds of dry cells used in cordless appliances, and batteries for certain military and aerospace uses may be recharged repeatedly. See illustration on opposite page.

battery See assault and battery

battlement Parapet (portion above the roof) of the exterior wall of a fortification, consisting of alternating low portions (crenels) and high por-

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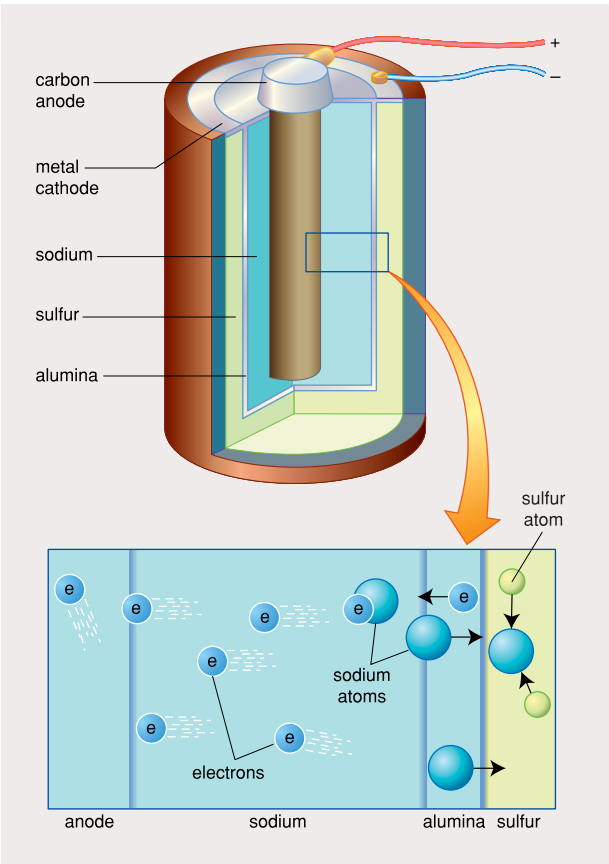
tions (merlons). Rooftop defenders would shoot from behind the merlons during times of siege. Medieval battlements were often bracketed out (see CORBEL) to form a machicolation (overhang) with holes in its floor through which objects could be dropped on encroachers below.

battleship Capital ship of the world's navies from c. 1860, when it began to replace the wooden-hulled SHIP OF THE LINE, until World War II, when it was superseded by the AIRCRAFT CARRIER. It combined large size, powerful guns, and heavy armour with fairly high speed and great cruising radius. The most powerful could hit targets at a range of more than 20 mi (30 km) and absorb heavy damage while remaining afloat and continuing to fight. It originated in early IRONCLAD vessels with mixed sail and steam propulsion, such as the French armoured frigate *Gloire* (1859). In 1906 HMS *DREADNOUGHT* revolutionized battleship design by introducing steam-turbine propulsion and an array of ten 12-in. (305-mm) guns. In World War II (1939–45) battleships were used mainly for specialized tasks such as bombarding enemy coastal defenses in AMPHIBIOUS WARFARE. After the Persian Gulf War (1990–91), the U.S. decommissioned its last two active battleships.

Batu \'bä-tü\ (d. c. 1255, Russia) Grandson of GENGHIS KHAN and founder of the GOLDEN HORDE. In 1235 Batu was elected commander in chief of the western part of the Mongol empire and given responsibility for the invasion of Europe. His troops burned and sacked Kiev in 1240, and by the end of 1241 he had conquered Russia, Poland, Bohemia, Hungary, and the Danube valley. Only the death of ÖGÖDEI prevented him from invading western Europe. Batu established the state of the Golden Horde in southern Russia, which was ruled by his successors for the next 200 years.



The sodium-sulfur (NaS) battery, patented in 1965 by the Ford Motor Company, has been used in some electric cars. During discharge, the sodium reacts with the ceramic alumina electrolyte, losing electrons, which travel out the anode to the circuit the battery is powering. The ionic sodium then combines with sulfur, which has acquired electrons from the cathode. The reaction is reversible, so the battery can be recharged. The advantage of this battery over other rechargeables (e.g., lead-acid, nickel-cadmium, or nickel-metal hydride batteries) is that it can provide the same amount of power with a smaller, lighter battery. However, since the chemicals must be heated to a molten state (about 325 °C, or 617 °F) and pure sodium is very reactive, failure of the battery casing or ceramic electrolyte is potentially dangerous.

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Baudelaire \bōd-'ler**, Charles (-Pierre)** (b. April 9, 1821, Paris, France—d. Aug. 31, 1867, Paris) French poet. While a law student he became addicted to opium and hashish and contracted syphilis. His early reckless spending on fine clothes and furnishings led to a life dogged by debt. In 1844 he formed an association with Jeanne Duval, a woman of mixed black and white ancestry who inspired some of his finest poetry. He published a single novel, *La fanfarlo*, in 1847. His discovery of the works of EDGAR ALLAN POE in 1852 led to years of work on Poe, which produced many masterly translations and critical articles. His reputation rests primarily on the extraordinary poetry collection *Les fleurs du mal* (1857; *The Flowers of Evil*), which dealt with erotic, aesthetic, and social themes in ways that appalled many of his middle-class readers, and he was accused of obscenity and blasphemy. Though the title became a byword for depravity, the book became perhaps the most influential collection of lyrics published in Europe in the 19th century. His *Petits poèmes en prose* (1868) was an important and innovative experiment in prose poetry. He also wrote provocative essays in art criticism. Baudelaire's later years were darkened by disillusionment, despair, and mounting debt; his death at 46 resulted from syphilis. He is regarded as the earliest and finest poet of modernism in French.

Baudelaire, photograph by Étienne Carjat, 1863.
COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS

Baudot \bō-'dō**, (Jean Maurice) Émile** (b. 1845, Magneux, France—d. March 28, 1903, Sceaux) French engineer. In 1874 he patented a telegraph code that by the mid 20th century had supplanted Morse code as the standard telegraphic alphabet. In Baudot's code, each letter is represented by a five-unit combination of current-on or current-off signals of equal duration, providing 32 permutations (sufficient for the Roman alphabet, punctuation, and control of the machine's mechanical functions). Baudot also invented (1894) a distributor system for multiplex (simultaneous) transmission of several messages on the same telegraphic circuit or channel. The baud, a unit of data transmission speed, is named for him.

Baudouin \bōd-'waü\ **I** (b. Sept. 7, 1930, Stuyvenberg Castle, near Brussels, Belg.—d. July 31, 1993, Motril, Spain) King of the Belgians (1951–93). The son of King LEOPOLD III, Baudouin lived with his family under house arrest in German-occupied Belgium during World War II. After postwar exile in Switzerland, Baudouin became king on his father's abdication (1951). He helped restore confidence in the monarchy after the stormy reign of his father and became a unifying force in a country divided between Flemish- (Dutch-) and French-speaking factions. Because Baudouin and his wife, Fabiola, were childless, he was succeeded by his brother, Albert II.

Baudrillard \bō-drē-'yär**, Jean** (b. 1929, Riems, France) French sociologist, philosopher, and social critic. He taught sociology at the University of Paris from 1966 to 1987. He is known for his theories of consumer culture and of the influence of contemporary electronic media, especially television. In a series of works in the 1970s, he applied ideas from SEMIOTICS to argue that consumer culture and especially advertising constitute a "code" of images and ideals in terms of which individuals construct their social identities. In works published during the 1980s and '90s, he argued that the exchange of words, images, and other symbols through increasingly pervasive electronic media created a new kind of reality, the "hyper-real," in which symbols become partly constitutive of the reality they serve to represent. An example, according to Baudrillard, is the tele-

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vision news, which reports about important events in the world but at the same time makes events important by reporting about them. In *The Gulf War Did Not Take Place* (1991), he contended that the mass-media portrayal of the 1991 war in the Persian Gulf had made that event "unreal." See also POSTMODERNISM.

Baugh \'bò**, Sammy** *in full* **Samuel Adrian Baugh** (b. March 17, 1914, Temple, Texas, U.S.) First outstanding quarterback of U.S. professional football. He led the NFL in forward passing in 6 of 16 seasons (1937–52) with the Washington Redskins. He also excelled as a punter and as a defensive halfback.

Bauhaus \'baù-ˌhaùs\ *German* **"House of Building"** (1919–33) Influential, forward-looking German school of architecture and applied arts. It was founded by WALTER GROPIUS with the ideal of integrating art, craftsmanship, and technology. Realizing that mass production had to be the precondition of successful design in the machine age, its members rejected the ARTS AND CRAFTS MOVEMENT's emphasis on individually executed luxury objects. The Bauhaus is often associated with a severe but elegant geometric style carried out with great economy of means, though in fact the works produced by its members were richly diverse. Its faculty included JOSEF ALBERS, LÁSZLÓ MOHOLY-NAGY, LYONEL FEININGER, PAUL KLEE, VASILY KANDINSKY, and MARCEL BREUER. The school was based in Weimar until 1925, Dessau through 1932, and Berlin in its final months, when its last director, Ludwig MIES VAN DER ROHE, closed the school in anticipation of the Nazis' doing so. See also INTERNATIONAL STYLE.

Baum \'bäm**, L(yman) Frank** (b. May 15, 1856, Chittenango, N.Y., U.S.—d. May 6, 1919, Hollywood, Calif.) U.S. writer of children's books. Baum achieved commercial success with his first book, *Father Goose* (1899), and followed it the next year with the even more popular *Wonderful Wizard of Oz*. He wrote 13 more Oz books, which acquired a huge readership. The series was continued by Ruth Plumly Thompson after his death.

bauxite Most important ALUMINUM ore, of varying compositions in which aluminum hydroxide or aluminum oxide predominate (named for Les Baux in southern France, where the ore was identified in 1821). The other constituents are largely iron oxide, silica, and titania. Bauxite has been found in all the continents except Antarctica. Known deposits can supply the world with aluminum for hundreds of years at present production levels.

Bavaria *German* **Bayern** \'bī-ərn\ State (pop., 2002 est.: 12,330,000), southern Germany. Conquered by the Romans in the 1st century BC (see NORICUM; RAETIA), the area was taken by CHARLEMAGNE and incorporated into his empire in 788. It became one of the great duchies of the HOLY ROMAN EMPIRE. Under MAXIMILIAN I, Bavaria led the CATHOLIC LEAGUE in the THIRTY YEARS' WAR. It was overrun repeatedly in the context of larger wars in the 18th century. It joined the German Empire in 1871, while remaining a kingdom. The king was overthrown in 1918; after a brief period of instability, Bavaria joined the WEIMAR REPUBLIC in 1919. ADOLF HITLER had his first power base in Bavaria in the 1920s. It adopted a new constitution in 1946 and became a state of the Federal Republic of Germany in 1949. It has long been Germany's most Roman Catholic area. Its largest cities are MUNICH (its capital), AUGSBURG, and NÜRNBERG. Notable regions include the Bavarian ALPS, the BLACK FOREST, and the BOHEMIAN FOREST. Bavaria is famous for the beauty of its rolling landscape and the charm of its villages.

Bavarian Succession, War of the (1778–79) Conflict in which FREDERICK II of Prussia prevented JOSEPH II of Austria from acquiring Bavaria. After the death of the Bavarian elector Maximilian Joseph (1727–77), his successor, Charles Theodore (1724–99), ceded Lower Bavaria to Austria. Frederick II responded by declaring war (1778). There was little fighting because each force was concerned with cutting its opponent's communications and denying it supplies. Short on supplies, soldiers foraged for potatoes; hence, the conflict was nicknamed the "potato war." In 1779 Austria and Prussia signed a treaty giving Austria a fraction of the territory originally occupied.

Bax, Sir Arnold (Edward Trevor) (b. Nov. 8, 1883, London, Eng.—d. Oct. 3, 1953, Cork, County Cork, Ire.) British composer. Born into a wealthy family, he was free to compose throughout his life and consequently wrote prolifically. His early works, influenced by the poetry of WILLIAM BUTLER YEATS, frequently evoke Celtic legend. His compositions include seven symphonies, the orchestral works *Spring Fire* (1913), *November Woods* (1917), and *Tintagel* (1919), piano sonatas, string quartets, and numerous vocal works.

bay In architecture, any division of a building between vertical lines or planes, especially the entire space included between the centerlines of two adjacent vertical supports. The space between two columns or PILASTERS, or from PIER to pier in a church, including that part of the vaulting (see VAULT) or ceiling between them, is thus called a bay.

bay Any of several small trees with aromatic leaves, especially the sweet bay, or bay laurel (*Laurus nobilis*), source of the bay leaf used in cooking. The California laurel (*Umbellularia californica*) is an ornamental tree also called the bay tree. The bay rum tree, or simply bay (*Pimenta racemosa*), has leaves and twigs that yield, when distilled, oil of bay, which is used in perfumery and in the preparation of bay rum, a fragrant cosmetic and medicinal liquid.

bay Semicircular or nearly circular concavity, similar to a GULF but usually smaller. Bays may range from a few hundred yards to several hundred miles from side to side. They are usually located where easily eroded rocks, such as clays and sandstones, are bounded by harder, more erosion-resistant formations of igneous rocks, such as granite, or hard calcareous rocks, such as massive limestones. Some bays form excellent harbours.

Bay \'bī**, Laguna de** Lake, central LUZON, Philippine Islands. Located southeast of MANILA, the lake, about 32 mi (52 km) long, is the largest in the Philippines. Its outlet is the Pasig River. It is dotted with islands, the largest being densely settled Talim.

Bay of Pigs invasion (April 17, 1961) Abortive invasion of Cuba directed by the U.S. CENTRAL INTELLIGENCE AGENCY and carried out by Cuban exiles. The invasion was intended to spark a rebellion that would topple FIDEL CASTRO, whose communist regime was considered a threat to U.S. interests in the region. The invasion began with the bombing of Cuban military bases; two days later a force of about 1,500 landed at several sites along the coast, including the Bay of Pigs. The rebellion never materialized, the invasion force was quickly defeated, and more than 1,100 men were imprisoned. The result was a huge propaganda victory for Castro and a severe embarrassment for the administration of U.S. president JOHN F. KENNEDY.

Bayamón \ˌbī-ä-'mōn\ Municipality (pop., 2000: 224,044), northeastern Puerto Rico, part of the metropolitan area of SAN JUAN. Puerto Rico's first settlement, Caparra, was founded nearby in 1508 by Spanish explorer Juan PONCE DE LEÓN. Established as a town in 1772, it is now a manufacturing centre for clothing, furniture, automotive parts, and metal products. Educational institutions include Bayamón Central University.

Bayard \'bā-ərd**, Thomas Francis** (b. Oct. 29, 1828, Wilmington, Del., U.S.—d. Sept. 28, 1898, Dedham, Mass.) U.S. statesman, diplomat, and lawyer. Born into a prominent political family, he succeeded his father as U.S. senator from Delaware (1869–85). He served as secretary of state (1885–89) and as ambassador to Britain (1893–97), the first U.S. representative to Great Britain to hold that rank. A champion of arbitration, he was critical of the aggressive position of Pres. GROVER CLEVELAND in the dispute with Britain over the Venezuelan boundary (1895).

Baybars I *or* **Baibars** \'bī-bärs\ (b. c. 1223, north of the Black Sea—d. July 1, 1277, Damascus, Syria) Most eminent sultan of the MAMLŪK DYNASTY. A Kipchak Turk, he was sold as a slave (*mamlūk*) after a Mongol invasion in the 1240s. He ended up in the service of the sultan of Egypt's AYYŪBID DYNASTY, who gave him military training. In 1250 his army captured the Crusader king LOUIS IX, and he and other *mamlūk* officers murdered the last Ayyūbid sultan, establishing the Mamlūk dynasty. He distinguished himself against an invading Mongol force at the Battle of ʿAyn Jālūt (1260) and soon thereafter took the throne, when he murdered the third Mamlūk sultan. As sultan, he rebuilt the Syrian fortresses that had been destroyed by the Mongols and built up the sultanate's armaments. He seized territory from the Crusaders that they were never to recover. He harried the Mongols in Persia, attacking their allies (the Christian Armenians) and forging an alliance with the Mongols of the GOLDEN HORDE against them. He sent military expeditions into Nubia and Libya. He had diplomatic relations with James I of Aragon, Alfonso X of León and Castile, and Charles of Anjou, as well as with the Byzantine emperor. At home he built canals and the great mosque in Cairo that bears his name and established efficient postal service between Cairo and Damascus. The *Sīrat Baybars*, a folk account purporting to be his life story, is still popular in the Arabic-speaking world.

bayberry Any of several aromatic shrubs and small trees of the genus *Myrica* in the bayberry family (Myricaceae), but especially *M. pennsyl-*

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vanica, also called candleberry, which has grayish waxy berries that, upon boiling, yield the wax used in bayberry candles. The California bayberry, or California wax myrtle (*M. californica*), is used as an ornamental on sandy soils in warm climates.

Bayer AG German chemical and pharmaceutical company. Founded in 1863 by Friedrich Bayer (1825–1880), it now operates plants in more than 30 countries. Bayer has originated scores of pharmaceuticals, chemicals, and synthetic materials; it was the first developer and marketer of ASPIRIN (1899); of Prontosil, the first SULFA DRUG (1935); and of polyurethane (1937). Bayer was part of the chemical cartel IG FARBEN from 1925 to 1945, when the latter was dissolved by the Allies; it was reestablished as an independent company in 1951. Its most noteworthy drug of the 1990s was the antibiotic Cipro. Its headquarters are in Leverkusen.

Bayeux \bä-'yœ\ **Tapestry** Medieval embroidered TAPESTRY depicting the NORMAN CONQUEST. Woven in woolen threads of eight colours on coarse linen, it is about 231 ft (70 m) long by about 20 in. (50 cm) wide. It consists of 79 consecutive scenes, with Latin inscriptions and decorative borders. Stylistically it resembles English illuminated manuscripts. It was probably woven c. 1066, within a few years of the conquest, and was possibly commissioned by Odo, bishop of Bayeux, brother of WILLIAM I (the Conqueror). The most famous of all pieces of needlework, it hung for centuries in the cathedral in Bayeux (Normandy) and now hangs in the tapestry museum there.

English axman in combat with Norman cavalry during the Battle of Hastings, detail from the 11th-century Bayeux Tapestry, Bayeux, France.
GIRAUDON/ART RESOURCE, NEW YORK

Bayezid \bī-ə-'zēd\ **I** (b. c. 1360—d. March 1403?, Akşehir, Anatolia) Sultan of the OTTOMAN EMPIRE (1389–1402). After succeeding his father, Murad II (d. 1389), Bayezid expanded Ottoman control of the shrinking BYZANTINE EMPIRE by conquering vast tracts of territory in the Balkans, thus securing his rule south of the Danube. From 1391 to 1398 he blockaded Constantinople (modern ISTANBUL), and he crushed the Hungarian Crusaders at the Battle of NICOPOLIS in 1396. He then sought to widen Ottoman control over Anatolia. Defeated by TIMUR at the Battle of Ankara in 1402, Bayezid died in captivity. He was succeeded by his son, Mehmed I, after an interregnum of some 10 years.

Bayezid \ˌbī-ə-'zēd\ **II** (b. December 1447/January 1448?, Demotika, Thrace, Ottoman Empire—d. May 26, 1512, Demotika) Sultan who consolidated control of the OTTOMAN EMPIRE begun by his father, MEHMED II. After taking the throne in 1481, he reversed his father's policies of expropriating Muslim religious properties and rejected his pro-European orientation but continued the policy of territorial conquest. Under him, Herzegovina came under direct Ottoman control, and the Ottoman hold over the Crimea and Anatolia was strengthened. He fought the ṢAFAVID DYNASTY in the east, the MAMLŪK DYNASTY in the south, and the Venetians in the west. At home he built mosques, colleges, hospitals, and bridges and supported jurists, scholars, and poets. He abdicated in favour of his son, Selim I, a month before his death.

Baykal, Lake See Lake BAIKAL

Bayle \'bel**, Pierre** (b. Nov. 18, 1647, Carla-le-Comte, France—d. Dec. 28, 1706, Rotterdam, Neth.) French philosopher. Educated at a Jesuit school, he converted to Roman Catholicism but later reverted to his original Calvinist faith. His religious views led to his losing professorships first at Sedan and later at Rotterdam. He was convinced that philosophical reasoning led to universal SKEPTICISM, but that nature compelled mankind to adopt beliefs on the basis of blind faith. The bulk of his *Historical and Critical Dictionary* (1697) consists of quotations, anecdotes, commentaries, and erudite annotations that cleverly undo whatever orthodox Christian beliefs the articles express; and it was condemned by religious authorities. Bayle's oblique method of subversive criticism was later adopted by the contributors to the *ENCYCLOPÉDIE* of DENIS DIDEROT.

Baylis, Lilian (Mary) (b. May 9, 1874, London, Eng.—d. Nov. 25, 1937, London) British theatrical manager and founder of the OLD VIC. She assisted her aunt, Emma Cons, in the operation of the Royal Victoria Hall and Coffee Tavern, and on Cons's death in 1912 she converted the hall into the Old Vic, which became famous for its Shakespearean productions. Between 1914 and 1923 the theatre staged all of WILLIAM SHAKESPEARE's plays, a feat no other playhouse had attempted. In 1931 she took over the derelict Sadler's Wells Theatre and made it a centre of opera and ballet.

Bayliss, Sir William Maddock (b. May 2, 1860, Wolverhampton, Staffordshire, Eng.—d. Aug. 27, 1924, London) British physiologist. He and ERNEST H. STARLING studied nerve-controlled blood-vessel contraction and dilation and discovered the peristaltic wave. In 1902 they showed that dilute hydrochloric acid mixed with partly digested food activates a chemical in the duodenum that they called secretin, because it stimulates secretion of pancreatic juice. This marked the discovery of hormones, a term the men coined. Bayliss also showed how the enzyme trypsin was formed from inactive trypsinogen and measured precisely the time it took to digest protein. His recommendation of gum-saline injections for wound shock saved many lives in World War I.

Baylor, Elgin (b. Sept. 16, 1934, Washington, D.C., U.S.) U.S. basketball player. At 6 ft 5 in. (1.96 m) Baylor played for the Minneapolis (later Los Angeles) Lakers of the NBA from 1958 to 1971. A high-scoring and acrobatic forward, Baylor averaged 27.4 points for his career, placing him in the top five of all time.

bayonet Short, sharp-edged, sometimes pointed weapon, designed for attachment to the muzzle of a firearm. According to tradition, it was developed in Bayonne, France, early in the 17th century and soon spread throughout Europe. The earliest design, the plug bayonet, was inserted into the muzzle of a musket, thus preventing the musket from being fired until the bayonet was removed. Later designs, including the socket bayonet invented by SEBASTIEN LE PRESTRE DE VAUBAN (1688), slipped it over the muzzle. Repeating firearms greatly reduced its combat value. By World War I it had become an all-purpose knife.

bayou \'bī-ü\ Still or slow-moving section of marshy water, usually a creek, secondary watercourse, or minor river that is a tributary of another river or channel. It may occur in the form of an OXBOW LAKE. Bayous are typical of Louisiana's Mississippi River DELTA.

Bayreuth \bī-'rȯit\ City (pop., 2001 est.: 74,500), east-central Germany. It is situated northeast of NÜRNBERG. Founded in 1194 under Bishop Otto II of Bamberg, it came under the burgrave of Nürnberg in 1248–1398 and the margraves of Brandenburg-Kulmbach in 1603–1769. The margraves patronized the arts and commissioned many Baroque buildings that still exist. It was ceded to Prussia in 1791, captured by NAPOLEON in 1806, and passed to BAVARIA in 1810. Composer RICHARD WAGNER settled there in 1872 and designed the Festspielhaus, where Wagner festivals have been held since its opening in 1876. Manufactures include machinery, textiles, chemicals, pianos, porcelain, and glassware.

Bazin \bà-'za^{n}**, Henri-Émile** (b. Jan. 10, 1829, Nancy, France—d. Feb. 7, 1917, Dijon) French engineer. As an assistant to H.-P.-G. Darcy (1803–1858), he completed his program of tests on resistance to water flow in channels after Darcy's death, producing the classic study of the subject. He later studied the problem of wave propagation (see WAVE) and the contraction of fluid flowing through an orifice. In 1854 he enlarged the Canal de Bourgogne and made it profitable for commercial navigation. In 1867 he suggested the use of pumps for dredging rivers, leading to the construction of the first suction dredgers.

bazooka Shoulder-type rocket launcher adopted by the U.S. Army in World War II. It consisted of a smoothbore steel tube, originally about 5

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ft (1.5 m) long, open at both ends and equipped with a hand grip, shoulder rest, trigger mechanism, and sights. Officially named the M9A1 Rocket Launcher, it was called bazooka after the crude horn of that name used by a popular radio comedian. It was developed chiefly for attacking tanks and fortified positions at short range. The U.S. Army abandoned it during the Vietnam War in favour of lighter-weight ANTITANK WEAPONS.

BBC *in full* **British Broadcasting Corp.** Publicly financed broadcasting system in Britain. A private company at its founding in 1922, it was replaced by a public corporation under royal charter in 1927. The BBC World Service began in 1932, and by the 1990s was broadcasting programs in 38 languages to 120 million people worldwide. BBC television service, which kept its monopoly on television service until a commercial channel began broadcasting in 1954, introduced regular color broadcasts in Europe in 1967. The BBC radio monopoly ended in 1972. The BBC today offers five radio networks and two national television channels.

BBS See BULLETIN-BOARD SYSTEM

BCS theory Comprehensive theory that explains the behaviour of superconducting materials. It was developed in 1957 by JOHN BARDEEN, LEON COOPER, and J. Robert Schrieffer (b. 1931), whose surname initials provide its name. Cooper discovered that ELECTRONS in a superconductor are grouped in pairs (Cooper pairs) and that the motions of all the pairs within a single superconductor constitute a system that functions as a single entity. An electric voltage applied to the superconductor causes all Cooper pairs to move, forming an ELECTRIC CURRENT. When the voltage is removed, the current continues to flow because the pairs encounter no opposition. See also SUPERCONDUCTIVITY.

beach Sediments that accumulate along sea or lake shores. One type of beach occurs as a sediment strip bordering a rocky or cliffy coast. A second type is the outer margin of a marine plain. The third type consists of narrow sediment barriers stretching for dozens or even hundreds of miles parallel to the general direction of the coast. These barriers separate LAGOONS from the open sea and generally are dissected by tidal inlets. Certain sediment forelands, such as spits, points, and tombolos (which connect an island with a mainland), occasionally are called beaches.

Beach, Amy Marcy *orig.* **Amy Marcy Cheney** *known as* **Mrs. H.H.A. Beach** (b. Sept. 5, 1867, Henniker, N.H., U.S.—d. Dec. 27, 1944, New York, N.Y.) U.S. composer and pianist. A precociously brilliant musician, she performed as soloist with major orchestras in the U.S. and Europe. As a composer she was devoted to German Romanticism rather than American themes or sources. Her best-loved works were her songs. Her *Gaelic Symphony* (1894) was the first symphony by an American woman. Other works include a piano concerto (1899), the choral pieces *The Chambered Nautilus* (1907) and *Canticle of the Sun* (1928), the opera *Cabildo* (1932), and a piano quintet (1907).

Beach Boys U.S. rock group. The band was formed in California in 1961 by brothers Brian Wilson (b. 1942) on keyboards and bass, Dennis Wilson (1944–83) on drums, and Carl Wilson (1946–98) on guitar; their cousin Mike Love (b. 1941) on drums; and Alan Jardine (b. 1942) on guitar. Within a year they launched a string of surfing-oriented hits marked by close vocal harmony, including "Surfin' Safari" and "California Girls." By 1966 they had released more than 10 albums, including *Pet Sounds* (1966), considered their best. Despite Brian Wilson's reclusiveness due to stress- and drug-related breakdowns, the band continued to make recordings into the 1980s and toured into the 1990s.

beach flea See SAND FLEA

bead Small object, usually pierced for stringing. It may be made of virtually any material—wood, shell, bone, seed, nut, metal, stone, glass, or plastic—and is worn or affixed to another object for decorative or, in some cultures, magical purposes. The earliest Egyptian beads (c. 4000 BC) were made of stone, feldspar, lapis lazuli, carnelian, turquoise, hematite, or amethyst and were variously shaped (sphere, cone, shell, animal head). By 3000–2000 BC, gold beads in tubular shapes were in use. From the Middle Ages to the 18th century, trade in beads was enormous. Today the richness of BEADWORK varies with fashion.

Beadle, George Wells (b. Oct. 22, 1903, Wahoo, Neb., U.S.—d. June 9, 1989, Pomona, Calif.) U.S. geneticist. He earned his Ph.D. from Cornell University. While studying *Drosophila*, he realized that genes must influence heredity chemically and designed a complex technique to determine the nature of those effects, showing that something as apparently simple as eye colour results from a long series of chemical reactions, which are affected by genes. With EDWARD L. TATUM, he found that the total environment of a bread mold could be varied so that researchers could locate and identify mutations relatively easily, concluding that each gene determines the structure of a specific enzyme, which in turn allows a single chemical reaction to proceed. For the "one gene, one enzyme" concept, they shared a 1958 Nobel Prize with JOSHUA LEDERBERG. Beadle later served as president of the University of Chicago (1960–68).

beadwork Ornamental work in beads. In the Middle Ages beads were used to embellish embroidery work. In Renaissance and Elizabethan England, clothing, purses, fancy boxes, and small pictures were adorned with beads. In the 19th–20th century beadwork proliferated in dress decoration. Beads are used as ornamentation on a variety of objects (clothing, masks, weapons, dolls) in many cultures, including the Native American, African, and Oceanic.

beagle Breed of small HOUND, popular as both a pet and a hunter. It looks like a small FOXHOUND, with large brown eyes, hanging ears, and a short coat that is usually a combination of black, tan, and white. Beagles are solidly built and heavy for their height. Two sizes are recognized: those standing less than 13 in. (33 cm) and weighing about 18 lbs (8 kg), and those standing about 15 in. (38 cm) and weighing about 30 lbs (13.5 kg). Beagles generally excel as rabbit hunters and are typically alert and affectionate.

Beagle
SALLY ANNE THOMPSON/EB INC.

Beagle Channel Channel, extreme southern South America. Separating the main islands of TIERRA DEL FUEGO from smaller islands in the archipelago, it is about 150 mi (240 km) long and 3–8 mi (5–13 km) wide. The eastern portion forms part of the Chile-Argentina border, while the western portion lies entirely within Chile. It was named for the British ship HMS *Beagle*, in which CHARLES DARWIN explored the area.

beak *or* **bill** Stiff, projecting oral structure of birds and turtles (both of which lack teeth) and certain other animals (e.g., CEPHALOPODS and some insects, fishes, and mammals). The term *bill* is preferred for the beak of a bird, which is composed of upper and lower jaws covered by a horny sheath of skin, with the nostrils on top, usually at the base. The shapes and sizes of bills are adapted for obtaining food, preening, building nests, and other functions; they range from the long, slim bills of nectar-sipping hummingbirds to the sturdy, curved, nut-cracking bills of parrots.

Beaker culture Late NEOLITHIC and early BRONZE AGE culture of northern and western Europe. The people are known for a group of distinctive bell-shaped earthenware beakers decorated with toothed stamps, probably used in rituals of consumption. The Beaker people buried their dead in simple graves but also in megalithic tombs in western Europe. They used the bow and arrow as well as copper daggers and spearheads. As they searched for gold and copper, they spread metallurgy into other parts of Europe. They eventually mixed with the Battle-Ax culture and spread from central Europe to eastern England.

beam In building construction, a horizontal member spanning an opening and carrying a load. The load may be a wall above the opening (see POST-AND-BEAM SYSTEM) or it may be a floor or roof. Beams may be of wood, steel or other metals, reinforced or prestressed concrete, plastic, or even brick with steel reinforcement. For weight reduction, metal beams are I-shaped, having a thin vertical web and thicker horizontal flanges where greater stress occurs. A joist is any of a series of small parallel beams supporting a floor or roof. See also GIRDER, SPANDREL.

bean SEED or pod of certain leguminous plants (see LEGUME). The mature seeds of the principal food beans, except SOYBEANS, are similar in composition, though they differ widely in eating quality. Rich in protein and providing moderate amounts of iron and vitamins B_1 and B_2, fresh or dried beans are used worldwide for cooking. Varieties differ greatly in size, shape, colour, and tenderness of the immature pods. The common string, snap, or green bean (*Phaseolus vulgaris*) of Central and South American origin is the dominant edible-podded bean in the U.S., second to the soy-

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bean in importance. Third in importance is the broad, or fava, bean (*Vicia faba*), the principal bean of Europe. The lima bean (*P. limensis*), of Central American origin, is commercially important in few countries outside the Americas. The scarlet runner bean (*P. coccineus*) is native to the New World tropics and is grown in Europe for its attractive flowers and fleshy immature pods. The mung bean, or green gram (*P. aureus*), is native to India and grown extensively in the Orient for food.

Bean, Roy (b. 1825?, Mason county, Ky., U.S.—d. March 16, 1903, Langtry, Texas) U.S. justice of the peace and saloonkeeper. He left Kentucky in 1847 and moved from town to town, killing at least two men in duels, before settling in Texas. During the American Civil War he first served with Confederate regulars and then was a blockade runner in Texas, becoming so prosperous that he was able to live at ease in San Antonio for some 16 years. In 1882 he moved to a site on the lower Pecos River that he named for Lillie Langtry, opened a saloon, and dispensed hard, commonsensical, and prankish rulings as an unofficial magistrate, styling himself the "law west of the Pecos."

bear Generally massive, short-legged mammals constituting the family Ursidae. Bears are the most recently evolved carnivore, found in Europe, Asia, and the Americas. Closely related to the dog and the raccoon, most bears climb with ease and are strong swimmers. As a family, they are omnivores, but dietary preferences vary among species (the POLAR BEAR feeds mainly on seals, the SPECTACLED BEAR on vegetation, etc.). Though they do not truly hibernate, bears often sleep fitfully through much of the winter. They live 15–30 years in the wild but much longer in captivity. They have been hunted as trophies, for hides, and for food. See also BLACK BEAR; BROWN BEAR; SUN BEAR.

bear cat See lesser PANDA

Bear Flag Revolt Short-lived rebellion in 1846 by American settlers in California against Mexican authorities. In June a small group captured Sonoma, a settlement north of San Francisco, and declared independence, raising a flag that featured a grizzly bear. Capt. John C. Frémont soon arrived to give his support and was elected to head the "republic." In July U.S. forces occupied San Francisco and Sonoma and claimed California for the U.S. The bear flag later became the state flag.

bear grass Either of two species of North American plants that make up the genus *Xerophyllum*, in the LILY FAMILY. The western species, *X. tenax*, also known as elk grass, squaw grass, and fire lily, is a smooth, light-green mountain perennial with a stout, unbranched stem and grasslike, rough-edged leaves at the bottom. It flowers at five to seven years, bearing a large cluster of small, creamy white flowers at the top of the stem. The turkey beard (*X. asphodeloides*) of southern North America is a similar plant that grows in dry pine barrens. In the southern and southwestern U.S., the name bear grass is given to various kinds of YUCCA and to the camas (*Camassia scilloides*) and the aloelike *Dasylirion texanum*.

bear market In securities and commodities trading, a declining market. A bear is an investor who expects prices to decline and, on this assumption, sells a borrowed SECURITY or commodity in the hope of buying it back later at a lower price, a speculative transaction called short-selling. See also BULL MARKET.

bearberry Flowering, prostrate, EVERGREEN shrub (*Arctostaphylos uva-ursi*) of the HEATH FAMILY, growing widely throughout North America in rocky and sandy woods and open areas. It has woody stems that are often 5–6 ft (1.5–1.8 m) long. Roots develop from stem joints, and the plant spreads, forming a broad, massive ground cover. The foliage turns bronzy in winter. The white, pink, or pink-tipped flowers are shaped like a narrow-mouthed bell. The berries are red.

Beard, Charles A(ustin) (b. Nov. 27, 1874, near Knightstown, Ind., U.S.—d. Sept. 1, 1948, New Haven, Conn.) U.S. historian. Beard taught at Columbia University (1904–17) and cofounded New York's New School for Social Research (1919). He is best known for iconoclastic studies of the development of U.S. political institutions, emphasizing the dynamics of socioeconomic conflict and change and analyzing motivational factors in the founding of institutions. His works include *An Economic Interpretation of the Constitution of the United States* (1913), claiming that the Constitution was formulated to serve the economic interests of the founders; *The Economic Origins of Jeffersonian Democracy* (1915); and, with his wife, Mary R. Beard (1876–1958), *The Rise of American Civilization* (1927).

Beard, James (b. May 5, 1903, Portland, Ore., U.S.—d. Jan. 23, 1985, New York, N.Y.) U.S. culinary expert and cookbook author. In 1945 he became the first chef to demonstrate cooking on network television. Through his Greenwich Village cooking school he influenced such future chefs as Julia Child and Craig Claiborne (b. 1920—d. 2000). He championed simple American and English dishes and wrote one of the first serious books on outdoor cooking. His more than 20 cookbooks include *James Beard's American Cookery* (1972) and *Beard on Bread* (1973).

Bearden, Romare (Howard) (b. Sept. 2, 1914, Charlotte, N.C., U.S.—d. March 11, 1988, New York, N.Y.) U.S. painter. He studied with George Grosz at the Art Students League and Columbia University. After military service in World War II, he attended the Sorbonne and traveled in Europe. During this time he achieved recognition for his complex, semiabstract collages of photographs and painted paper on canvas. The narrative structure of his work is clear; aspects of African American culture, including ritual, music, and family, were his predominant themes. By the 1960s Bearden was recognized as the preeminent collagist in the U.S. He is regarded as one of the most important African American artists of the 20th century.

Beardsley, Aubrey (Vincent) (b. Aug. 21, 1872, Brighton, Sussex, Eng.—d. March 16, 1898, Menton, Fr.) British illustrator. His only formal training was a few months of evening classes at the Westminster School of Art. His style was based on the work of Edward Burne-Jones and Japanese woodcuts, and he quickly became a master of the curvilinear black-and-white ornamental illustration popularized by the Art Nouveau movement. In 1893 he illustrated an edition of Sir Thomas Malory's *Le Morte Darthur*, and in 1894 he achieved notoriety with his erotic illustrations for the English version of Oscar Wilde's *Salome*. He became art editor and illustrator of the new quarterly *The Yellow Book* that same year. He died at age 25 of tuberculosis.

bearing In machine construction, a connector (usually a support) that permits the connected members to rotate or to move in a straight line relative to one another. Often one of the members is fixed, and the bearing acts as a support for the moving member. Most bearings support rotating shafts against either transverse (radial) or thrust (axial) loads. To minimize FRICTION, the contacting surfaces in a bearing may be separated by a film of oil or gas; these are sliding bearings (see OIL SEAL). In BALL BEARINGS and ROLLER BEARINGS, the surfaces are separated by balls or rollers.

bearing wall *or* **load-bearing wall** Wall that carries the load of floors and roof above in addition to its own weight. The traditional masonry bearing wall is thickened in proportion to the forces it has to resist: its own weight, the dead load of floors and roof, the live load of people, as well as the lateral forces of ARCHES, VAULTS, and wind. Such walls may be much thicker toward the base, where maximum loads accumulate. Bearing walls may also be framed and sheathed or constructed of reinforced concrete.

Béarn \bā-'ärn\ Historical region and former province, southwestern France. It was bounded by Gascony and the Pyrenees; its capital was Pau. It formed part of Aquitania under the Romans; it was later devastated by the Vandals and Visigoths. Held as the countship of Béarn by the future Henry IV, it became a holding of the French crown when he became king in 1589. In the 16th century Pau was an important cultural centre under the patronage of Margaret of Angoulême.

Beas River \'bē-ˌäs\ *ancient* **Hyphasis** River, northwestern India. One of the "five rivers" that give the Punjab its name, it rises in the Himalayas in central Himachal Pradesh state and flows south and southwest for some 290 mi (470 km) to the Sutlej River in western Punjab state. It was the approximate limit of Alexander the Great's invasion of India in 326 BC.

beat In physics, the pulsation resulting from a combination of two waves of slightly different FREQUENCY. Beat frequency is the difference between the frequencies of the combining waves. When the interfering frequencies are in the audible range, the beats are heard as alternating soft and loud pulses. The human ear can detect beats with frequencies up to 10 hertz, or 10 beats per second. Piano tuners listen for beats when comparing the pitch of a tuning fork to that of a vibrating string; when no beats are heard, the fork and string are at the same frequency. Ultrasonic or inaudible frequencies can be superimposed to produce audible beats, allowing the detection of vocal sounds produced by bats or dolphins.

Beat movement American social and literary movement of the 1950s and '60s. It is associated with artists' communities in San Francisco, Los

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Angeles, and New York. Its adherents expressed alienation from conventional society and advocated personal release and illumination through heightened sensory awareness and altered states of consciousness. Beat poets, including Lawrence Ferlinghetti, Allen Ginsberg, Gregory Corso (1930–2001), and Gary Snyder, sought to liberate poetry from academic refinement, creating verse that was vernacular, sometimes sprinkled with obscenities, but often powerful and moving. Jack Kerouac and William S. Burroughs developed an unstructured, spontaneous, sometimes hallucinatory approach to prose writing that was designed to convey the immediacy of experience. The Beat movement had faded by c. 1970, though its influence continued to be felt decades later.

Beatles British rock group that came to personify the counterculture of the 1960s. Its principal members, all born in Liverpool, Eng., were Paul McCartney, John Lennon, George Harrison, and Ringo Starr. The group began with the pairing of McCartney and Lennon in 1956; Harrison joined in 1957, and Stu Sutcliffe and Pete Best later. In 1960 they adopted the name the Beatles. In 1962 they signed a recording contract and replaced Best with Starr (Sutcliffe had left the group in 1961). The release in 1962–63 of such songs as "Please Please Me" and "I Want to Hold Your Hand" made them England's most popular rock group, and in 1964 "Beatlemania" struck the U.S. Originally inspired by Chuck Berry, Elvis Presley, Little Richard, and Buddy Holly, among others, their direct, energetic songs kept them at the top of the pop charts. Their long hair and tastes in dress were influential throughout the world, as were their experimentation with hallucinogenic drugs and Indian mysticism and their involvement with the politics of peace. From 1965 to 1967 the Beatles' music rapidly evolved, becoming increasingly subtle, sophisticated, and varied—ranging from ballads such as "Yesterday" to the psychedelic hard rock of "Tomorrow Never Knows." Their public performances ended in 1966. Albums such as *Rubber Soul* (1965), *Revolver* (1966), and *The Beatles* ("White Album," 1968) set new trends in rock. In 1967 they produced *Sgt. Pepper's Lonely Hearts Club Band*, an album novel for its conception as a dramatic whole, use of electronic music, and character as a studio work not reproducible onstage. They appeared in the films *A Hard Day's Night* (1964) and *Help!* (1965). The group dissolved in 1970. In 1988 the Beatles were inducted into the Rock and Roll Hall of Fame, and Lennon (1994), McCartney (1999), and Harrison (2004) were also inducted as solo performers.

Beaton, Sir Cecil (Walter Hardy) (b. Jan. 14, 1904, London, Eng.—d. Jan. 18, 1980, Broadchalke, Salisbury, Wiltshire) British photographer and designer. When he received his first camera at age 11, he began making portraits of his sisters. In the 1920s he became staff photographer at *Vanity Fair* and *Vogue*. In Beaton's exotic and bizarre portraits, the sitter is only one element of an overall decorative composition dominated by flamboyant backgrounds. His photographs of the siege of Britain were published in *Winged Squadrons* (1942). After the war he designed costumes and stage sets, including those for the movies *Gigi* (1958) and *My Fair Lady* (1964).

Beatrix \bā-ȧ-'trēks\ **(Wilhelmina Armgard)** (b. Jan. 31, 1938, Soestdijk, Neth.) Queen of The Netherlands. Beatrix went into exile with her family when the Germans invaded The Netherlands in World War II, and she spent the war years in Britain and Canada. In 1965 her betrothal to a German diplomat sparked controversy because of his past membership in the Hitler Youth and the German army. They were married in 1966, and the hostility waned with the births of the first male heirs in the house of Orange since 1890. Beatrix became queen in 1980 after the abdication of her mother, Juliana.

Beatrix of The Netherlands.
COURTESY OF THE ROYAL NETHERLANDS EMBASSY; PHOTOGRAPH, MAX KOOT

Beatty \'bāt-ē**, (Henry) Warren** *orig.* **Henry Warren Beaty** (b. March 30, 1937, Richmond, Va., U.S.) U.S. film actor, producer, director, and screenwriter. He studied acting with famed coach Stella Adler in New York and made his film debut in *Splendor in the Grass* (1961). He later starred in and produced the influential film *Bonnie and Clyde* (1967). Often cowriting, directing, or producing his own films, he later starred in *Shampoo* (1975), *Heaven Can Wait* (1978), *Reds* (1981, Academy Award for direction), and *Bulworth* (1998).

Beaubourg Center See Pompidou Center

Beaufort Sea \'bō-fərt\ Part of the Arctic Ocean northeast of Alaska, northwest of Canada, and west of Banks Island in the Arctic Archipelago. Its surface area is about 184,000 sq mi (476,000 sq km), its average depth is 3,239 ft (1,004 m), and its greatest depth is 15,360 ft (4,680 m). It is frozen over almost year-round; only in August and September does the ice break up. The Mackenzie River flows into the sea; the chief settlement is Prudhoe Bay, Alaska.

Beauharnais \bō-är-'ne**, Alexandre, viscount de** (b. May 28, 1760, Martinique—d. June 23, 1794, Paris, France) French politician and general, first husband of Joséphine. A liberal noble, he became a prominent figure during the French Revolution. He presided over the Constituent Assembly in 1791, served with gallantry in the army, and was named general in chief of the Army of the Rhine in 1793. He was guillotined during the Reign of Terror, largely because he was a noble. He was the father of Eugène and Hortense de Beauharnais and the grandfather of Napoleon III.

Beauharnais, Eugène de (b. Sept. 3, 1781, Paris, France—d. Feb. 21, 1824, Munich, Bavaria) French administrator and general. Son of Joséphine and Alexandre, viscount de Beauharnais, he became a useful military aide to his stepfather, Napoleon. In 1804 he received the title of prince and was appointed archchancellor of state. He was named Napoleon's viceroy in Italy (1805), where he reorganized public finances, built roads, and introduced the French legal system. As commander of the Italian army, he fought admirably in various conflicts. In 1814 he held out in Italy against the Austrians and the Neapolitans but was forced to conclude an armistice. He retired to the Bavarian court of his wife's family.

Beauharnais, (Eugénie-) Hortense de (b. April 10, 1783, Paris, France—d. Oct. 5, 1837, Arenenberg, Switz.) French-born queen of Holland (1806–10). Daughter of Joséphine and Alexandre, viscount de Beauharnais, and stepdaughter of Napoleon, Hortense married Napoleon's brother, Louis Bonaparte. When he became king of Holland, she was named queen. The marriage was unhappy but produced three children, including the future Napoleon III. When Napoleon was exiled in 1814, Hortense became the centre of Bonapartist intrigue, and her support of Napoleon during his return led to her banishment from France in 1815, after which she settled in Switzerland.

Beaujolais \ˌbō-zhō-'lā\ Region in northern Rhône and northeastern Loire departments, east-central France. It is located east of the Massif Central and west of the Sâone River. The region is wooded and supports local forestry; its highest point is Mount Saint-Rigaud, elevation 3,310 ft (1,009 m). East of the mountain are the limestone escarpments of the Côte Beaujolaise, which support a world-famous red wine industry.

Beaujoyeulx \bōzh-wȧ-'yœ**, Balthazar de** *orig.* **Baltazarini di Belgioioso** (b. 16th century, Piedmont region—d. 1587, Paris, Fr.) Italian-born French composer and choreographer. In 1555 he left Italy for Paris and joined the court of Catherine de Médicis as a violinist. There he organized unofficial court fetes and became valet de chambre to the royal family. In 1581 he staged the lavish *Ballet comique de la reine*; considered the first ballet, it was emulated by other European courts and was the precursor of developments in ballet for the next century.

Beaumarchais \ˌbō-mär-'shā**, Pierre-Augustin Caron de** (b. Jan. 24, 1732, Paris, France—d. May 18, 1799, Paris) French playwright. Son of a watchmaker, he invented a clockwork mechanism and became embroiled in lawsuits over its patent; a series of witty pamphlets he wrote in his defense established his reputation as a writer. His comedy *The Barber of Seville* (1772) was kept off the stage for three years because it criticized the aristocracy. His *Marriage of Figaro* (1784) similarly censured the nobility and it, too, was initially banned. The plays became famous operas by Gioacchino Rossini and Wolfgang Amadeus Mozart, respectively. He founded the Société des Auteurs (1777) to enable playwrights to obtain royalty payments. His wealth led, ironically, to his temporary imprisonment during the French Revolution, an event his plays were sometimes said to have sparked.

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Beaumont \'bō-ˌmänt\ City (pop., 2000: 113,866), southeastern Texas, U.S. Lying at the head of navigation on the Neches River, it is connected to the Gulf of Mexico by the Sabine-Neches Canal and is a major port of entry. It was founded in 1835. When Spindletop, the first major oil field in Texas, was discovered in 1901, the city grew rapidly. With Port Arthur and Orange, it forms the "Golden Triangle" petrochemical and industrial complex.

Beaumont \'bō-ˌmänt**, Francis** (b. c. 1585, Grace-Dieu, Leicestershire, Eng.—d. March 6, 1616, London) British playwright. He is known chiefly for the 10 very popular plays on which he collaborated with John Fletcher (1579–1625) c. 1606–13. These included the tragicomedies *The Maides Tragedy*, *Phylaster*, and *A King and No King*. Forty other plays attributed to them were later found to have been written by others. Their independent work includes Beaumont's poetry and his parody *The Knight of the Burning Pestle* (1607) and Fletcher's pastoral *The Faithful Shepherdess* (1608). After Beaumont retired in 1613, Fletcher collaborated with other playwrights, possibly including William Shakespeare, with whom he may have written *King Henry the Eighth* and *The Two Noble Kinsmen*.

Beaumont, William (b. Nov. 21, 1785, Lebanon, Conn., U.S.—d. April 25, 1853, St. Louis, Mo.) U.S. surgeon. He served many years as an army surgeon. When treating a trapper whose abdomen had been perforated by a shotgun blast, Beaumont collected gastric juice for analysis and showed that it contained hydrochloric acid, which supported his belief that digestion was a chemical process. He also reported on the effects of different foods on the stomach and established alcohol as a cause of gastritis.

Beauregard \'bō-rə-ˌgärd**, P(ierre) G(ustave) T(outant)** (b. May 28, 1818, near New Orleans, La., U.S.—d. Feb. 20, 1893, New Orleans) U.S. military leader. He graduated from West Point in 1838 and served in the Mexican War. After Louisiana seceded in 1861, he resigned his commission and became a general in the Confederate army. He commanded the forces that bombarded Fort Sumter, S.C., was on the field at the First Battle of Bull Run (1861), and assumed command at the Battle of Shiloh after the death of Gen. Albert Sidney Johnston (1862). He conducted the defenses of Charleston, S.C., and Richmond, Va. Though a capable commander, his penchant for questioning orders sometimes bordered on insubordination. After the war he quarreled with other generals' accounts of his role.

Beauvoir \'bō-ˌvwär**, Simone (Lucie-Ernestine-Marie-Bertrand) de** (b. Jan. 9, 1908, Paris, France—d. April 14, 1986, Paris) French writer and feminist. As a student at the Sorbonne, she met Jean-Paul Sartre, with whom she formed a lifelong intellectual and romantic bond. She is known primarily for her treatise *The Second Sex* (1949), a scholarly and passionate plea for the abolition of what she called the myth of the "eternal feminine"; the book became a classic of feminist literature. She also wrote four admired volumes of autobiography (1958–72), philosophical works that explore themes of existentialism, and fiction, notably *The Mandarins* (1954, Prix Goncourt). *The Coming of Age* (1970) is a bitter reflection on society's indifference to the elderly.

Beaux-Arts \bō-'zär\ **style** *or* **Second Empire style** *or* **Second Empire Baroque** Architectural style developed at the École des Beaux-Arts in Paris. It enjoyed international dominance in the late 19th century (see Second Empire) and rapidly became an official style for many of the new public buildings demanded by expanding cities and their national governments. Beaux-Arts buildings are typically massive and have a symmetrical plan with rooms arranged axially, profuse Classicist detail, and pavilions that extend forward at the ends and centre. Among the most admired Beaux-Arts structures is the Paris Opéra.

beaver Either species of the aquatic rodent family Castoridae (genus *Castor*), both of which are well known for building dams. Beavers are heavyset and have short legs and large, webbed hind feet. They grow as large as 4 ft (1.3 m) long, including the 1-ft (30-cm) tail, and as heavy as 66 lb (30 kg). Beavers build their dams of sticks, stones, and mud in small rivers, streams, and lakes, often producing sizable ponds. With their powerful jaws and large teeth, they can fell medium-size trees, whose branches they use in their dams and whose tender bark and buds they eat. One or more family groups share a dome-shaped stick-and-mud lodge built in the water, with tunnel entrances below water level. American beavers (*C. canadensis*) range from northern Mexico to the Arctic. Their prized pelts stimulated the exploration of western North America, and by 1900 beavers were trapped to near extinction. Eurasian beavers (*C. fiber*) are now found in only a few locations, including the Elbe and Rhône drainages of Europe. The mountain beaver of the Pacific Northwest is unrelated.

Beaver (*Castor canadensis*).
KARL MASLOWSKI

Beaverbrook (of Beaverbrook and of Cherkley), Maxwell Aitken, 1st Baron *orig.* **William Maxwell Aitken** *known as* **Lord Beaverbrook** (b. May 25, 1879, Maple, Ont., Can.—d. June 9, 1964, near Leatherhead, Surrey, Eng.) Canadian-British politician and newspaper proprietor. After making a fortune in Montreal as a financier, he moved to England and became active in politics as a Conservative. Beginning in 1916, he took over or founded newspapers, including the London *Daily Express*, *Sunday Express*, and *Evening Standard*. Idiosyncratic and very successful, he became a "press lord" and a champion of individual enterprise and British imperial interests. He held various high government appointments, including positions in the British Cabinet during both World Wars, but he never fully achieved the political power he sought.

Bebel \'bā-bəl**, August** (b. Feb. 22, 1840, Deutz, near Cologne, Ger.—d. Aug. 13, 1913, Passugg, Switz.) German socialist and writer. A turner by trade, Bebel joined the Leipzig Workers' Educational Association (1861) and became its chairman (1865). Influenced by the ideas of Wilhelm Liebknecht, in 1869 he helped found the Social Democratic Labour Party (later the Social Democratic Party) and became its most influential and popular leader for more than 40 years. He served in the Reichstag in 1867, 1871–81, and 1883–1913. He spent a total of nearly five years in prison on such charges as "libel of Bismarck." He wrote a number of works, including *Woman and Socialism* (1883), a powerful piece of Social Democratic propaganda.

Bebey, Francis (b. July 15, 1929, Douala, Camer.—d. May 28, 2001, Paris, France) Cameroonian-born French writer and singer-songwriter. After studying in Paris and New York City, he settled in Paris in 1960. He worked for radio stations and then for UNESCO, researching and documenting traditional African music. Meanwhile, he also composed and recorded his own highly experimental music that often incorporated Latin American, Western, and African elements. Because of this, he is sometimes considered "the father of world music." He also wrote two books about African music and several works of fiction.

bebop *or* **bop** Jazz characterized by harmonic complexity, convoluted melodic lines, and frequent shifting of rhythmic accent. In the mid-1940s, a group of musicians, including Dizzy Gillespie, Thelonious Monk, and Charlie Parker, rejected the conventions of swing to pioneer a self-consciously artistic extension of improvised jazz, which set new technical standards of velocity and harmonic subtlety. Two genres grew out of bebop in the 1950s: the delicate, dry, understated approach that came to be known as cool jazz, and the aggressive, blues-tinged earthiness of hard bop.

The Birth of the Virgin, panel painting by Domenico Beccafumi, c. 1543; in the Pinacoteca Nazionale, Siena, Italy.
SCALA-ART RESOURCE/EB INC.

Beccafumi \ˌbek-ə-'fü-mē**, Domenico** *orig.* **Domenico di Giacomo di Pace** *known as* **Mecherino** \ˌmāk-kā-'rē-nō\ (b. c. 1484, Cortina, Republic of Venice—d. May 1551, Siena, Republic of Siena) Italian painter and sculptor active in Siena. He adopted the name of his patron, Lorenzo Beccafumi. In 1510 he went to Rome to study the work of Raphael and Michelangelo. In 1512 he returned to Siena, where most of his best work can be found. He is noted for his sense of fantasy and creation of striking light effects, as in *The Birth of the Virgin* (c. 1543). He

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painted decorations for the Siena town hall (1529–35) and executed designs for the marble pavement of Siena Cathedral. He is considered the outstanding Sienese painter of the Mannerist style.

Beccaria \,bäk-kä-'rē-ə**, Cesare** (b. March 15, 1738, Milan—d. Nov. 28, 1794, Milan) Italian criminologist and economist. He became an international celebrity in 1764 with the publication of *Crime and Punishment*, the first systematic statement of principles governing criminal punishment, in which he argued that the effectiveness of criminal justice depended more on the certainty of punishment than on its severity. The book greatly influenced criminal-law reform in western Europe. In later years, Beccaria lectured at Milan's Palatine School and served as a public official, dealing with such issues as monetary reform, labour relations, and public education.

Bechet \bə-'shā**, Sidney** (b. May 14, 1897, New Orleans, La., U.S.—d. May 14, 1959, Paris, France) U.S. saxophonist. He took up the clarinet at age six, later switching to the more powerful soprano saxophone. His emergence as a soloist from the New Orleans tradition of collective improvisation (see Dixieland) established his reputation in the mid-1920s. He produced a large, warm tone with a wide and rapid vibrato. His mastery of drama and his use of critically timed deviations in pitch ("note bending") had a long-lasting influence, because they were absorbed by his disciple Johnny Hodges. From the late 1940s he was based in Paris.

Bechtel \'bek-tᵊl**, Stephen D(avison)** (b. Sept. 24, 1900, Aurora, Ind., U.S.—d. March 14, 1989, San Francisco, Calif.) U.S. construction engineer and president (1936–60) of W.A. Bechtel Co. and its successor, Bechtel Corp. He became a vice president in the San Francisco-based family firm of W.A. Bechtel Co. in 1925. In 1937 he and John McCone formed Bechtel-McCone Corp., a builder of refineries and chemical plants. The companies built ships and made aircraft parts during World War II. After the war, the newly formed Bechtel Corp. became one of the world's largest construction and engineering firms, building pipelines in Canada, the Middle East, and elsewhere and constructing power plants all over the world. The Bechtel companies helped construct the Hoover Dam, the Alaska oil pipeline, and the city of Al-Jubayl in Saudi Arabia. Bechtel retired as its president in 1960 but remained senior director of what became known as the Bechtel Group.

Bechuanaland See Botswana

Beck, Ludwig (b. June 29, 1880, Biebrich, Ger.—d. July 20, 1944, Berlin) German general. After serving with the army general staff in World War I, he was later chief of the general staff (1935–38). He opposed Adolf Hitler's occupation of the Rhineland and resigned to protest the decision to conquer Czechoslovakia. He helped plan the unsuccessful July Plot to assassinate Hitler; when it failed, Beck committed suicide.

Beckenbauer, Franz (b. Sept. 11, 1945, Munich, Ger.) German football (soccer) player. He is credited with inventing the modern attacking sweeper position. Nicknamed "Der Kaiser," Beckenbauer is the only man to both captain and manage World Cup-winning teams (1974 and 1990, respectively). He spent most of his career with Bayern Munich (1958–77), leading the team to three European Cup championships (1974–76) and four national titles. He was named European Footballer of the Year in 1972 and 1976. After brief stints in New York and Hamburg, he retired in 1984 and turned to managing.

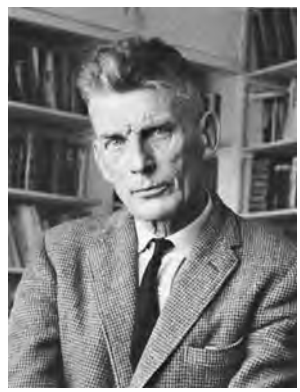
Becker, Boris (Franz) (b. Nov. 22, 1967, Leimen, W.Ger.) German tennis player. He left school in the 10th grade to concentrate on tennis. In 1985 he became the youngest winner (at 17) of the Wimbledon's men's singles title and the youngest ever to win a men's grand-slam tournament, as well as the only unseeded player and the first German ever to win the title. He was victorious at Wimbledon again in 1986 and 1989 and also won singles titles at the 1989 U.S. Open and the 1991 and 1996 Australian Open.

Becker, Gary S(tanley) (b. Dec. 2, 1930, Pottsville, Pa., U.S.) U.S. economist. He studied at Princeton University and the University of Chicago. As a professor at Columbia University and the University of Chicago, he applied the methods of economics to aspects of human behaviour previously considered the domain of sociology and demography. In *Human Capital* (1964) and *A Treatise on the Family* (1981), he advanced the theory that rational economic choices, based on self-interest, govern most human activities, even apparently noneconomic activities such as the formation of families. He won the Nobel Prize in 1992.

Becket, Saint Thomas *or* **Thomas à Becket** (b. c. 1118, Cheapside, London, Eng.—d. Dec. 29, 1170, Canterbury, Kent; canonized 1173; feast day December 29) Archbishop of Canterbury (1162–70). The son of a Norman merchant, he served as chancellor of England (1155–62) under Henry II, whose entire trust he won. A brilliant administrator, diplomat, and military strategist, he aided the king in increasing the royal power. Resistant to the Gregorian reform movement that asserted the autonomy of the church, Henry hoped to reinforce royal control of the church by appointing Becket archbishop of Canterbury in 1162. Becket, however, embraced his new duties devoutly and opposed royal power in the church, especially proclaiming the right of offending clerics to be tried in ecclesiastical courts. The king issued the Constitutions of Clarendon (1164) listing royal rights over the church, and he summoned the archbishop to trial. Becket fled to France and remained in exile until 1170, when he returned to Canterbury and was murdered in the cathedral by four of Henry's knights, traditionally said to be acting in response to the king's angry words. Becket's tomb, which was visited by Henry in an act of penance, became a site of pilgrimage.

Martyrdom of Thomas Becket, illustration from an English psalter, c. 1220; in the British Library.
© THE BRITISH LIBRARY/HERITAGE-IMAGES

Beckett, Samuel (Barclay) (b. April 13?, 1906, Foxrock, Co. Dublin, Ire.—d. Dec. 22, 1989, Paris, France) Irish playwright. After studying in Ireland and traveling, he settled in Paris in 1937. During World War II he supported himself as a farmworker and joined the underground resistance. In the postwar years he wrote, in French, the narrative trilogy *Molloy* (1951), *Malone Dies* (1951), and *The Unnamable* (1953). His play *Waiting for Godot* (1952) was an immediate success in Paris and gained worldwide acclaim when he translated it into English. Marked by minimal plot and action, existentialist ideas, and humour, it typifies the Theatre of the Absurd. His later plays, also sparsely staged, abstract works that deal with the mystery and despair of human existence, include *Endgame* (1957), *Krapp's Last Tape* (1958), and *Happy Days* (1961). In 1969 he was awarded the Nobel Prize.



Samuel Beckett, 1965.
© GISÈLE FREUND

Beckford, William (b. Sept. 29, 1760, London, Eng.—d. May 2, 1844, Bath, Somerset) English dilettante, novelist, and eccentric. He is remembered for his gothic novel *Vathek* (1786), about an impious voluptuary who builds a tower so high that he challenges Muhammad in heaven and so brings about his own fall to the kingdom of the prince of darkness; though unevenly written, the story is full of invention and bizarre detail. Beckford and his family were forced to leave England for 10 years by a scandal involving a youth. On his return he built Fonthill Abbey, the most sensational building of the English Gothic Revival, whose own 270-ft (82-m) tower collapsed several times.

Beckmann \'bek-,män**, Max** (b. Feb. 12, 1884, Leipzig, Ger.—d. Dec. 27, 1950, New York, N.Y., U.S.) German Expressionist painter and graphic artist. After training at the conservative Weimar Academy, in 1903 he moved to Berlin and joined the Berlin Sezession. His experience as a medical orderly in World War I changed his outlook, and his work became full of horrifying imagery, with deliberately repulsive colours and erratic forms. He considered his work to be a combination of brutal realism and

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social commentary. In 1933 the Nazis declared his art "degenerate" and forced him to resign his professorship at the Städel School of Art in Frankfurt. In 1937 he fled to Amsterdam, and in 1947 he moved to the U.S., where he taught in St. Louis, Mo., and New York City.

Becknell \'bek-nəl**, William** (b. 1796?, Amherst county, Va., U.S.—d. April 30, 1865, Texas) U.S. trader. After settling in Missouri, he became involved in trade with the Southwest. When the Spanish prohibition on trade with New Mexico was lifted in 1821, he followed the customary route through the Colorado Rocky Mountains south to Santa Fe, where he sold his goods at great profit. The next year he pioneered a new route through the mountains of northeastern New Mexico that became known as the SANTA FE TRAIL. In the mid-1830s he moved to Texas, where he fought for Texas's independence.

Beckwourth, Jim *orig.* **James Pierson Beckwith** (b. April 26, 1798, Virginia, U.S.—d. 1867?, Denver, Colo.) U.S. mountain man. Born a slave, the son of a white man and a slave woman, he was taken by his father to St. Louis and set free. In 1823–24 he was hired by trading expeditions in the Rocky Mountains. He married a series of Indian women and lived among the Crow for about six years. During the California gold rush (1848) he established a route through the Sierra Nevada. In California he met Thomas D. Bonner, who in 1856 published many of Beckwourth's stories and recollections.

Becquerel \be-'krel**, (Antoine-) Henri** (b. Dec. 15, 1852, Paris, France—d. Aug. 25, 1908, Le Croisic) French physicist. His grandfather, Antoine-César (1788–1878), was one of the founders of the field of electrochemistry, and his father, Alexandre-Edmond (1820–91), made important studies of light phenomena. Henri likewise studied phosphorescent materials as well as uranium compounds and employed photography in his experiments. He is remembered for his discovery of RADIOACTIVITY, which occurred when he found that the element uranium (in a sample of pitchblende) emitted invisible rays that could darken a photographic plate. His 1901 report of a burn caused by a sample of MARIE CURIE's radium that he carried in his vest pocket led to investigations by physicians and ultimately the medical use of radioactive substances. In 1903 he shared a Nobel Prize for Physics with the Curies. The unit of radioactivity, the becquerel (Bq), is named for him.

bed Piece of furniture on which a person may recline or sleep. Beds of simple construction appear in medieval manuscripts, as do more decorative beds with carving and inlay, embroidered coverlets, and elaborate hangings. The canopy, or tester, was introduced in the 15th century. In the 1820s the development of coiled springs fitted into mattresses revolutionized the bed. In the Middle East beds consisted of rugs piled up on the floor. In China raised and canopied beds were used 2,000 years ago. The traditional Japanese bed (futon) consists of quilted padding and a coverlet arranged on the floor.

Great Bed of Ware, carved, inlaid, and painted wood, English, late 16th century; in the Victoria and Albert Museum, London.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON, CROWN COPYRIGHT RESERVED

bedbug Any member of approximately 75 species of nocturnal insects (family Cimicidae) that feed by sucking the blood of humans and other warm-blooded animals. The reddish brown adult is broad and flat and less than 0.2 in. (4–5 mm) long. Among the most cosmopolitan of human parasites, they are found in every kind of dwelling. They digest meals slowly; adults have lived for at least a year without food. Though the bite is irritating, it is not known to transmit diseases to humans.

Bedbug (*Cimex lectularius*) magnified 5 ×
WILLIAM E. FERGUSON

bedding plant Plant that is grown, usually in quantity, in pots or flats in a GREENHOUSE or similar structure, and that is intended to be transplanted to a flower garden, hanging basket, window box, or other outdoor planter. Most bedding plants are annuals. They are transplanted outdoors after all danger of frost has passed. Some important bedding plants are IMPATIENS, MARIGOLDS, and PETUNIAS.

Bede, Saint *known as* **the Venerable Bede** (b. 672/673, traditionally Monkton in Jarrow, Northumbria [Eng.]—d. May 25, 735, Jarrow; feast day May 25) Anglo-Saxon theologian, historian, and chronologist. Raised in a monastery, he was ordained a priest at age 30. He is best known for his *Ecclesiastical History of the English People* (732?), tracing Britain's history from 55 BC to AD 597, a source vital to the history of the conversion to Christianity of the Anglo-Saxon tribes in Britain. His method of dating events from the time of Christ's birth (AD) came into general use through the popularity of the *Historia ecclesiastica* and two works on chronology.

Bedford City (pop., 1995 est.: 81,000), southeast-central England. The administrative seat of BEDFORDSHIRE, it lies on the River OUSE northwest of London. It was a Roman fording station and a Saxon town. It was recaptured by the Anglo-Saxons from the Danes in 914. JOHN BUNYAN is thought to have written *A Pilgrim's Progress* while imprisoned there in the 17th century.

Bedfordshire \'bed-fərd-ˌshir\ Administrative (pop., 2001: 381,571), geographic, and historic county, southeast-central England. Much of the county is occupied by the River OUSE valley; its capital is BEDFORD. Settled c. 1800 BC by the BEAKER CULTURE, the valley was resettled by the Romans in the 1st–5th centuries AD. First mentioned as a political unit in 1010, the county has survived virtually unchanged within its present boundaries. Its architectural masterpiece is Woburn Abbey, seat of the dukes of Bedford.

Bedlington terrier Breed of dog. It was developed in the 19th century in Northumberland, Eng., and named for Bedlingtonshire, a mining district in the area. Initially established as a fighting dog and hunter of vermin, the breed later became a popular pet. Lamblike in appearance, it has an arched back, a topknot, and a thick, curly coat that is blue-gray, deep reddish brown, or pale sandy, often with tan markings. The breed stands 15–16 in. (38–40 cm) tall and weighs 22–24 lbs. (10–11 kg).

Bedlington terrier
SALLY ANNE THOMPSON/EB INC.

Bedouin \'bed-win\ Any member of a community of Arabic-speaking desert nomads of the Middle East. Ethnically, the Bedouin are identical to other ARABS. Bedouin traditionally have made their living by animal husbandry, and social rank among them is determined by the animals that they herd: camel nomads enjoy the greatest status, followed by sheep and goat herders and, finally, cattle nomads. Traditionally, Bedouin would migrate into the desert during the rainy season and return to cultivated areas during the dry season, but since World War II (1939–45) the governments of many countries have nationalized their range lands, and conflicts over land use have arisen. Many Bedouin have since adopted sedentary ways of life; most, however, retain pride in their nomadic heritage.

Bedouin with a young goat in central Qatar
M. ERICSON/OSTMAN AGENCY

bedstraw Any low perennial herbaceous plant of the genus *Galium*, in the MADDER FAMILY, found in damp woods and swamps and along stream banks and shores. Bedstraws bear finely toothed, often needle-shaped leaves in whorls of four to eight; clusters of small green, yellow, or white flowers; and fruit composed of two rounded NUTs joined together. Northern bedstraw (*G. boreale*), marsh bedstraw (*G. palustre*), and goosegrass (*G. aparine*) are common throughout Europe and have become naturalized in parts of North America. Sweet

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woodruff (*G. odoratum*) smells like freshly mown HAY; its dried shoots are used in perfumes, sachets, and beverages. The roots of several species yield a red dye.

bee Any of some 20,000 INSECT species belonging to the superfamily Apoidea (order Hymenoptera), including the familiar BUMBLEBEE. Adults range in size from about 0.08 to 1.6 in. (2 mm–4 cm). Bees are related to WASPS, but, unlike wasps, which can eat other insects, most bees are entirely dependent on flowers for their food. Male bees are usually short-lived and never collect pollen; female bees make and provision the nest and usually have special anatomical structures for carrying pollen. Most species are solitary. The so-called killer bee, an Africanized subspecies of *Apis mellifera* (see HONEYBEE), reached the U.S. from Mexico c. 1990; killer bees react quickly and attack in number. See also KARL VON FRISCH.

Leaf-cutting bee (*Anthidium*)
M.W.F. TWEEDIE FROM THE NATURAL HISTORY PHOTOGRAPHIC AGENCY—EB INC.

bee balm Any of 12 North American annual or perennial plants in the genus *Monarda*, variously known as BERGAMOT, horsemint, and bee balm. They belong to the MINT family and have showy flowers. Wild bergamot (*M. fistulosa*) has a minty aroma. The more sharply scented Oswego tea (*M. didyma*; a bergamot variety) is native to eastern North America but is widely cultivated elsewhere.

beech Any of several different types of trees, especially about 10 species of deciduous ornamental and timber trees constituting the genus *Fagus* (family Fagaceae), native to temperate and subtropical regions of the Northern Hemisphere. About 40 species of superficially similar trees, known as false beech (genus *Nothofagus*), are native to cooler regions of the Southern Hemisphere. A beech of the family Fagaceae is tall, round-headed, and wide-spreading, with smooth, steel-gray bark and toothed, shiny green leaves. The American beech (*F. grandifolia*), native to eastern North America, and the European beech (*F. sylvatica*), found throughout England and Eurasia, are the most widely known species. Both are economically important timber trees, often planted as ornamentals. Beech wood is durable under water and is valued for indoor use, tool handles, and shipping containers. The nuts provide forage for game animals, are used in fattening poultry, and yield an edible oil. Beeches are slow-growing and may live 400 years or more.

Beecham, Sir Thomas (b. April 29, 1879, St. Helens, Lancashire, Eng.—d. March 8, 1961, London) British conductor. He was born to an aristocratic family and was self-taught as a conductor. Devoted to broadening British musical tastes, he created the Beecham Symphony Orchestra in 1909. In 1932 he founded the London Philharmonic Orchestra and in 1947 the Royal Philharmonic Orchestra; he also founded opera companies. Though he had significant gaps in his technique, he was an incomparable interpreter of the music he loved, especially that of WOLFGANG AMADEUS MOZART; of his contemporaries, he particularly championed RICHARD STRAUSS and FREDERICK DELIUS.

Beecher, Catharine (Esther) (b. Sept. 6, 1800, East Hampton, N.Y., U.S.—d. May 12, 1878, Elmira, N.Y.) U.S. educator who popularized and shaped a conservative movement to both elevate and entrench woman's role in the domestic sphere. Daughter of the minister and temperance activist Lyman Beecher and sister of HARRIET BEECHER STOWE and HENRY WARD BEECHER, she helped found the Hartford Female Seminary (1823) and other organizations devoted to women's education. Her popular *Treatise on Domestic Economy* (1841) helped standardize domestic practices while reinforcing the belief that a woman's proper place was in the home.

Beecher, Henry Ward (b. June 24, 1813, Litchfield, Conn., U.S.—d. March 8, 1887, Brooklyn, N.Y.) U.S. Congregational clergyman. The son of a minister, he was the brother of HARRIET BEECHER STOWE and CATHARINE ESTHER BEECHER. After graduating from Amherst College and later studying at Lane Theological Seminary, he served as pastor to congregations in Indiana. In 1847 he was called to Plymouth Church in Brooklyn. A famous orator and one of the most influential preachers of his time, he opposed slavery and supported women's suffrage, CHARLES DARWIN's theory of evolution, and scientific biblical criticism. He gained unfavourable publicity in 1874 when he was put on trial for adultery, but he was acquitted and returned to his church.

Henry Beecher, photographed by Napoleon Sarony
THE GRANGER COLLECTION

bee-eater Any of about 25 species of brightly coloured birds (family Meropidae) that feed on bees, wasps, and other insects. They are found throughout tropical and subtropical Eurasia, Africa, and Australasia (one species occasionally reaches the British Isles). Bee-eaters range in length from 6 to 14 in. (15–35 cm). Their bill is moderately long, slightly downcurved, and pointed. Their brilliant plumage is usually predominantly green, but many species are partially coloured with red, yellow, blue, or purple.

Bee-eater (*Merops apiaster*).
S.C. PORTER—BRUCE COLEMAN LTD.

beef Flesh of mature CATTLE, as distinguished from VEAL, the flesh of calves. The best beef is obtained from steers (castrated males) and heifers (female COWS that have not calved). Tenderness and flavour are improved by aging; in one common method, the carcass is hung for about two weeks at approximately 36 °F (2 °C). The world's primary beef producers and consumers are the U.S., the European Union, Brazil, China, Argentina, and Australia. Grading standards are relatively uniform; in the U.S., grades range from prime and choice to utility and canner. Beef provides protein and B vitamins; it also contains saturated fat, an excess of which can contribute to heart disease and other health problems. Beef is not eaten by Hindus because of the sacred status of the cow.

beehive tomb *or* **tholos** \'thō-ˌläs\ Large, beehive-shaped ceremonial tomb, sometimes built into the side of a hill. The Treasury of Atreus, a surviving tholos (c. 1300–1250 BC) of the Mycenaean civilization, is a pointed dome built up of stepped blocks of conglomerate masonry cut and polished to give the impression of a true VAULT. A small side chamber contained the burials, while the main chamber was probably reserved for ritual use.

beekeeping *or* **apiculture** \'ā-pə-ˌkəl-chər\ Care and manipulation of HONEYBEES to enable them to produce and store more honey than they need so that the excess can be collected. Beekeeping is one of the oldest forms of animal husbandry. Early efforts at collecting the honey required destroying the hive; modern beekeepers use an extractor that empties the cells of the honeycomb without damaging them. To collect honey, beekeepers need a veiled helmet for protection, a tool for cutting comb, and a smoker for tranquilizing the bees. Maintaining the hive includes protecting the colony against diseases, parasites, and predators.

beer ALCOHOLIC BEVERAGE made usually from malted BARLEY, flavoured with HOPS, and brewed by slow FERMENTATION. Known from ancient times, beer was especially common in northern climates not conducive to grape cultivation for WINE. It is produced by employing either a bottom-fermenting YEAST, which falls to the bottom of the container when fermentation is completed, or a top-fermenting yeast, which rises to the surface. Lager beers (from *lagern*, "to store"), of German origin, are bottom-fermented and stored at a low temperature for several months; most are light in colour, with high carbonation, medium hop flavor, and alcohol content of 3–5% by volume. Top-fermented beers, popular in Britain, include ALE, stout, and porter; they are characterized by a prominent head of released carbon dioxide, a sharper and more strongly hopped flavour than lagers, and an alcohol content of 4–6.5% by volume. See also MALT.

Beer Hall Putsch *or* **Munich Putsch** \'půch\ (Nov. 8–9, 1923) Unsuccessful attempt by ADOLF HITLER to start an insurrection in Germany against the WEIMAR REPUBLIC. On Nov. 8, 1923, Hitler and his men pushed

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their way into a right-wing political meeting in a Munich beer hall and obtained agreement that the leaders there should join in carrying the "revolution" to Berlin. The next day, some 3,000 Nazis marched toward the Marienplatz but were met by police gunfire. Hitler was subsequently sentenced to five years in prison for treason; he served only eight months, time he spent writing *Mein Kampf*.

Beerbohm, Sir (Henry) Max(imilian) (b. Aug. 24, 1872, London, Eng.—d. May 20, 1956, Rapallo, Italy) English caricaturist, writer, and dandy. His sophisticated drawings and parodies were unique in capturing, usually without malice, whatever was pretentious, affected, or absurd in his famous and fashionable contemporaries. His first literary collection, *The Works of Max Beerbohm* (1896), and his first book of drawings, *Caricatures of Twenty-five Gentlemen* (1896), were followed by the charming fable *The Happy Hypocrite* (1897) and his only novel, *Zuleika Dobson* (1911), a burlesque of Oxford life. His story collection *Seven Men* (1919) is considered a masterpiece.

Beersheba City (pop., 1999 est.: 163,700), southern Israel. Historically it marked the extreme southern limit of Palestine, hence the biblical phrase "from Dan to Beersheba" (Dan is in far northern Israel). It fell to the Arabs in the 7th century and to the Ottoman Empire in the 16th century. It was long a watering place for the nomadic Bedouin tribes of the Negev desert. Held by the British from 1917, it became part of Israel in 1948. It has since developed as the administrative, cultural, and industrial centre of the Negev.

Beery, Wallace (Fitzgerald) (b. April 1, 1885, Kansas City, Mo., U.S.—d. April 15, 1949, Los Angeles, Calif.) U.S. film and stage actor. He initially worked in the circus and later in the choruses of New York City theatrical productions. After playing the lead in *The Yankee Tourist*, he spent several years as a dramatic actor in touring and stock companies. He started his film career in 1913, first as a comedian in Mack Sennett's Keystone comedies. He is best known for his performances as dim-witted, but endearing, toughs in such films as *The Champ* (1931, Academy Award), *Min and Bill* (1931), and *Tugboat Annie* (1933).

beeswax Commercially useful wax secreted by worker honeybees to make the cell walls of the honeycomb. A bee consumes an estimated 6–10 lbs (3–4.5 kg) of honey for each pound of the wax it secretes in small flakes from glands on the underside of its abdomen. After honey removal, the comb is melted to produce the beeswax, which ranges from yellow to almost black. It is used for candles (often for churches), artificial fruit and flowers, modeling wax, and as an ingredient of furniture and floor waxes, leather dressings, waxed paper, lithographic inks, cosmetics, and ointments.

beet Cultivated form of the plant *Beta vulgaris* of the goosefoot family (Chenopodiaceae), one of the most important vegetables. Four distinct types are cultivated: the garden beet, as a garden vegetable; the sugar beet, a major source of sugar and commercially the most important type; the mangel-wurzel, a succulent feed for livestock; and the leaf beet, or Swiss chard, for its edible leaves. Beet greens are a source of riboflavin, iron, and vitamins A and C. Beets are grown most extensively in temperate to cool regions or during the cooler seasons.

Beet (*Beta*).
GRANT HEILMAN

Beethoven \'bā-ˌtō-vən**, Ludwig van** (baptized Dec. 17, 1770, Bonn, archbishopric of Cologne—d. March 26, 1827, Vienna, Austria) German composer. Born to a musical family, he was a precociously gifted pianist and violist. After nine years as a court musician in Bonn, he moved to Vienna to study with Joseph Haydn and remained there for the rest of his life. He was soon well known as both a virtuoso and a composer, and he became the first important composer to earn a successful living while forsaking employment in the church or court. He uniquely straddled the Classical and Romantic eras. Rooted in the traditions of Haydn and Mozart, his art also encompassed the new spirit of humanism expressed in the works of German Romantic writers as well as in the ideals of the French Revolution, with its passionate concern for the freedom and dignity of the individual. His astonishing *Third* (*Eroica*) *Symphony* (1803) was the thunderclap that announced the Romantic century, and it embodies the titanic but rigorously controlled energy that was the hallmark of his style. He began to lose his hearing from c. 1795; by c. 1819 he was totally deaf. For his last 15 years he was unrivaled as the world's most famous composer. In musical form he was a considerable innovator, widening the scope of sonata, symphony, concerto, and string quartet. His greatest achievement was to raise instrumental music, hitherto considered inferior to vocal, to the highest plane of art. His works include the celebrated 9 symphonies; 16 string quartets; 32 piano sonatas; the opera *Fidelio* (1805, rev. 1814);2 masses, including the *Missa Solemnis* (1823); 5 piano concertos; a violin concerto (1806); 6 piano trios; 10 violin sonatas; 5 cello sonatas; and several concert overtures.

beetle Any of at least 250,000 species of insects constituting the order Coleoptera (the largest order in the animal kingdom), characterized by special forewings, called elytra, which are modified into hardened covers over a second pair of functional wings. Beetles occur in almost all environments except Antarctica and the peaks of the highest mountains. Temperate zones have fewer beetle species than the tropics but in greater numbers. The smallest species are less than 0.04 in. (1 mm) long; the largest can exceed 8 in. (20 cm). Most beetles eat either other animals or plants; some eat decaying matter. Some species destroy crops, timber, and textiles and spread parasitic worms and diseases. Others are valuable predators of insect pests. Some beetles are known by other common names (e.g., borer, chafer, curculio, firefly, weevil). Beetles are preyed on by other insects and by bats, swifts, and frogs.

Begin \be-'gēn,\ *English* \'bā-gin**, Menachem (Wolfovitch)** (b. Aug. 16, 1913, Brest-Litovsk, Russia—d. March 9, 1992, Tel Aviv, Israel) Prime minister of Israel (1977–83). He earned a law degree from the University of Warsaw, Pol. During World War II (1939–45) the Soviet authorities sent him to Siberia, but he was soon released to join the Polish army in exile. He escaped to Palestine, where he became leader in 1943 of the Irgun Zvai Leumi (a right-wing underground movement in favour of a Jewish state). From 1948 to 1977 he led the opposition in the Israeli Knesset, except for three years when he sat in the Government of National Unity (1967–70). As head of the Likud party coalition, he became prime minister in 1977. He shared the 1978 Nobel Prize for Peace with Anwar el-Sādāt for negotiations that resulted in the 1979 Israel-Egypt peace treaty. His 1982 invasion of Lebanon turned world opinion against Israel, and he resigned in 1983. See also Arab-Israeli wars; Vladimir Jabotinsky.

Menachem Begin, 1987.
RALPH CRANE/CAMERA PRESS FROM GLOBE PHOTOS

begonia \bi-'gōn-yə\ Any of about 1,000 species (genus *Begonia*) of mostly succulent, tropical or subtropical plants, many with colourful flowers or leaves and used as potted plants indoors or as garden plants. Begonias come in a bewildering array of cultivated varieties. The wax begonia (*B. semperflorens*) is the most popular for use as a summer bedding plant; angelwing begonias are characterized by their tall stems; hairy begonias have feltlike leaves. Most begonias are tender and intolerant of dry conditions; they require protection from strong sunlight.

Behan \'bē-ən**, Brendan (Francis)** (b. Feb. 9, 1923, Dublin, Ire.—d. March 20, 1964, Dublin) Irish author. An alcoholic from age eight and an anti-English rebel, he was repeatedly arrested. *Borstal Boy* (1958) is an account of his detention in an English reform school, which combines earthy satire and powerful political commentary. His first play, *The Quare Fellow* (1954), is an explosive statement on capital punishment and prison life. His second, *The Hostage* (produced 1958), is considered his masterwork. He also wrote poetry, short stories, radio scripts, anecdotes, memoirs, and a novel.

behaviour genetics Study of the influence of an organism's genetic composition on its behaviour and of the interaction of heredity and envi-

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ronment ("nature" and "nurture") in determining behaviour. The first scientist to explore the area was Sir Francis Galton, who sought to show that mental powers run in families. His work was followed by huge numbers of studies seeking to establish a link between IQ and genetics, none of them conclusive. Other human characteristics or behaviours studied for their possible hereditary nature include schizophrenia, alcoholism, depression, introvert and extravert behaviour, and general activity level (including sleep disorders). Many such studies are based on long-term observation of identical (monozygotic) twins raised in different environments. In animal studies, which examine topics such as learning, sexual activity, and aggressive behaviour, selective breeding is used to produce groups of genetically similar individuals that may be compared with other, dissimilar individuals or groups. See also human nature.

behaviour therapy *or* **behaviour modification** Application of experimentally derived principles of learning to the treatment of psychological disorders and the control of behaviour. The concept, which has its roots in the work of Edward L. Thorndike, was popularized in the U.S. by theorists of behaviourism, including B.F. Skinner. Behaviour-therapy techniques are based on the principle of operant conditioning, in which desired behaviours are rewarded. There is little or no concern for conscious experience or unconscious processes. Such techniques have been applied with some success to disturbances such as enuresis, tics, phobias, stuttering, obsessive-compulsive disorder, and various neuroses. Behaviour modification more generally refers to the application of reinforcement techniques for shaping individual behaviour toward some desired end or for controlling behaviour in classrooms or institutional situations. See also psychotherapy.

behaviourism Highly influential academic school of psychology that dominated psychological theory in the U.S. between World War I and World War II. Classical behaviourism concerned itself exclusively with the objective evidence of behaviour (measured responses to stimuli) and excluded ideas, emotions, and inner mental experience (see conditioning). It emerged in the 1920s from the work of John B. Watson (who borrowed from Ivan Pavlov) and was developed in subsequent decades by Clark L. Hull and B.F. Skinner. Through the work of Edward C. Tolman, strict behaviourist doctrines began to be supplemented or replaced by those admitting such variables as reported mental states and differences in perception. A natural outgrowth of behaviourist theory was behaviour therapy.

Behn \'bān**, Aphra** (b. July 1640, Harbledown?, Kent, Eng.—d. April 16, 1689, London) English dramatist, novelist, and poet, the first Englishwoman known to earn her living by writing. Her early life is obscure (as is her original surname), but she spent most of it in South America. She married a merchant named Behn in 1658; he died in the mid 1660s. Her novel *Oroonoko* (1688), the story of an enslaved African prince whom Behn knew in South America, influenced the development of the English novel. Her first play, *The Forc'd Marriage*, was produced in 1671; her later witty comedies, such as the two-part *The Rover* (1677, 1681), were highly successful, and toward the end of her life she wrote many popular novels.

Behrens \'bā-rens**, Peter** (b. April 14, 1868, Hamburg—d. Feb. 27, 1940, Berlin, Ger.) German architect and designer. He became director of Düsseldorf's arts and crafts school in 1903. The large electrical company AEG hired him in 1907 as its artistic adviser, a comprehensive job that led him to design the hexagonal trademark of the AEG, its catalogs, its office stationery, products such as electric fans and street lamps, and retail shops and factories. His AEG Works turbine factory in Berlin (1909–12), with its sweeping glass curtain wall, became the most significant building in Germany at that time. He was an influential pioneer of Modernism; Walter Gropius, Le Corbusier, and Ludwig Mies van der Rohe all worked in his office.

Behrens, painting by Max Liebermann.
ARCHIV FUR KUNST UND GESCHICHTE, BERLIN

Behrman \'ber-mən**, S(amuel) N(athaniel)** (b. June 9, 1893, Worcester, Mass., U.S.—d. Sept. 9, 1973, New York, N.Y.) U.S. playwright. He contributed to New York newspapers and magazines and studied drama at Harvard University. His successful first play, the light comedy *The Second Man* (1927), was followed by the popular *Meteor* (1929), *Brief Moment* (1931), and *Biography* (1932). His more serious plays include *Rain from Heaven* (1934) and *No Time for Comedy* (1939). Noted for addressing complex social and moral issues, he wrote over 25 comedies in his 40-year career, and nearly every one was a hit.

Beiderbecke \'bī-dər-ˌbek**, (Leon) Bix** (b. March 10, 1903, Davenport, Iowa, U.S.—d. Aug. 6, 1931, Long Island, N.Y.) U.S. jazz cornetist and composer. Beiderbecke developed a style independent of the influence of Louis Armstrong and became the leading player of the Chicago style of jazz in the 1920s. He was noted for his gentle, clear tone and introspective approach. His interest in the harmonies of composers such as Claude Debussy was reflected in both his playing and his compositions. With saxophonist Frankie Trumbauer, Beiderbecke worked in the bands of Jean Goldkette and Paul Whiteman. His alcoholism and early death contributed to his status as one of the early romantic legends of jazz.

Bix Beiderbecke.
BROWN BROTHERS

Beijing \'bā-'jiŋ\ *or* **Pei-ching** *conventional* **Peking** \'pē-'kiŋ\ *formerly (1928–49)* **Beiping** \'bā-'piŋ\ City, municipality with provincial status (pop., 2003 est.: city, 7,699,300; 2002 est.: municipality, 14,230,000), and capital of China. The municipality is bordered by Hebei province and Tianjin municipality and has an area of 6,500 sq mi (16,800 sq km). Lying on a broad plain in northeastern China, the city has been settled since ancient times and has been known by various names. It became the royal residence of Kublai Khan, who in 1272 named it Dadu. It was chosen as the capital of the Ming dynasty (1368–1644) in 1421, which it remained during the Qing dynasty (1644–1911/12). It suffered heavy damage when it was occupied by European forces in 1860 and 1900 (see Boxer Rebellion). In 1928 the capital was moved to Nanjing, and the name Beiping (Pei-p'ing) was given to the former capital. Nearby, in 1937, the Marco Polo Bridge Incident took place. Beijing's capital status and its former name were restored following the communist victory in 1949. It is China's cultural and educational centre. The old Forbidden City contains the former imperial palace, designated a UNESCO World Heritage site in 1987. Abutting it is Tiananmen Square, one of the world's largest public squares. Beijing's 15th-century walls were partly demolished in the Cultural Revolution. In 2001 the city was selected as the site for the 2008 Summer Olympic Games.

Beijing University See Peking University

Beilstein \'bīl-ˌshtīn**, Friedrich Konrad** (b. Feb. 17, 1838, St. Petersburg, Russia—d. Oct. 18, 1906, St. Petersburg) Russian chemist. From 1866 to his retirement he taught at St. Petersburg's Technical Institute. His *Handbuch der organischen Chemie* ("Handbook of Organic Chemistry"; 1st ed., 1880–83) fully described 15,000 organic compounds. The fourth edition (27 vol., 1937) is periodically supplemented, and remains indispensable for workers in organic chemistry.

Beira \'bā-rə\ Coastal city (pop., 1997: 412,588), central Mozambique. Situated on the Mozambique Channel at the mouths of the Púngoè and Búzi rivers, it is the chief port for central Mozambique and for landlocked Zimbabwe and Malawi. Founded in 1891 as a trading company's headquarters, it passed to Portuguese administration in 1942 and then to independent Mozambique in 1975. It is the terminus of railways from South Africa, Zimbabwe, Congo (Kinshasa), Zambia, and Malawi.

Beirut \bā-'rüt\ City (pop., 1998 est.: metro. area, 1,500,000), capital of Lebanon. The country's chief port and largest city, it lies at the foot of the Lebanon Mountains. Initially settled by the Phoenicians, it gained prominence under Roman rule in the 1st century BC. It was captured by the Arabs in AD 635. Christian Crusaders held Beirut (1110–1291), after which it was dominated by the Mamlūk dynasty. In 1517 it fell under the control of the Ottoman Empire. Under a French mandate, it became the capital of the new state of Lebanon in 1920 and capital of an independent Lebanon

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in 1943. It went on to flourish as the chief banking hub and a major cultural centre of the Middle East. It was severely damaged during the Lebanese Civil War (1975–91) and during fighting between Israeli forces and those of the Palestine Liberation Organization in 1982. The city slowly began to rebuild after the end of the civil war.

Béjart \bā-'zhär**, Maurice** *orig.* **Maurice Jean Berger** (b. Jan. 1, 1927, Marseille, Fr.) French-born Belgian dancer, choreographer, and opera director. He studied in Paris, then toured with various companies before founding his own, Les Ballets de l'Étoile (later Ballet Théâtre de Maurice Béjart), in Paris in 1954. In 1959 it moved to Brussels; renamed the Ballet of the 20th Century, it became one of the world's foremost troupes. His productions have been noted for reworking tradition in unusual and often controversial ways. Since 1961 he has also worked in opera, staging *Tales of Hoffmann* and Berlioz's *Damnation of Faust*, among other works. In 1987 the company moved to Switzerland and took the new name Béjart Ballet Lausanne.

Béjart \bā-'zhär\ **family** Seventeenth-century French theatrical family. Brothers Joseph (c. 1617–59) and Louis (1630–78) and their sisters Madeleine (1618–72) and Geneviève (c. 1622–75) were members of a traveling company directed by Madeleine. They joined Molière's first company, the Illustre Théâtre, in 1643 and created many parts in his plays. Madeleine's sister, or possibly daughter, Armande Béjart (1642–1700), joined the company in 1653. She married Molière in 1662 and played most of his heroines. After his death, she led the company until it merged with another troupe to become the Comédie-Française in 1680.

Békésy \'bā-ˌkā-shē**, Georg von** (b. June 3, 1899, Budapest, Hung.—d. June 13, 1972, Honolulu, Hawaii, U.S.) Hungarian-born U.S. physicist and physiologist. He immigrated to the U.S. in 1947 and taught at Harvard University in 1947–66. He discovered that sound vibrations travel along a membrane in the cochlea in waves, peaking at different places, where nerve receptors determine pitch and loudness. His research resulted in greatly expanded understanding of the hearing process, partly through instrumentation Békésy had helped design, and the differentiation of forms of deafness, which permitted the selection of proper treatment. He received a 1961 Nobel Prize for Physiology or Medicine.

Bekhterev \'byā̱k-tir-yif**, Vladimir (Mikhaylovich)** (b. Feb. 1, 1857, Sorali, Vyatka, Russia—d. Dec. 24, 1927, Moscow, Russia, U.S.S.R.) Russian neurophysiologist and psychiatrist. A competitor of Ivan Pavlov, Bekhterev independently developed a theory of conditioned reflexes. His most lasting work was in brain structure research and descriptions of nervous symptoms and illnesses. He discovered the superior vestibular nucleus (Bekhterev nucleus) and other brain formations and described spinal numbness (spondylitis deformans, or Bekhterev disease) and other diseases. He founded the first Russian journal on nervous diseases. His approach to the study of behaviour influenced the growing movement toward behaviourism in the U.S.

Bel Akkadian god of the atmosphere and member of a triad including Anu (An) and Ea (Enki). His Sumerian counterpart was Enlil. His breath brought both severe storms and gentle spring winds. He was the god of agriculture and as such was more important than the high god Anu. As Bel he was known as the god of order and destiny. As Enlil, he was banished to the underworld for raping his consort Ninlil (Belit), in a myth that explains the cycle of the seasons.

Bel See Marduk

Belafonte \ˌbel-ə-'fän-tā**, Harry** *orig.* **Harold George Belafonte, Jr.** (b. March 1, 1927, New York, N.Y., U.S.) U.S. singer, actor, and producer. He was born to immigrants from Martinique and Jamaica, and he lived with his mother in Jamaica from 1935 to 1940. In the early 1950s he initiated a fad for calypso music with songs such as "Day-O (Banana Boat Song)" and "Jamaica Farewell." He starred in the films *Carmen Jones* (1954) and *Island in the Sun* (1957) and later became the first black television producer. In the 1960s and '70s he was a prominent civil-rights activist. From the 1970s onward his singing career was a secondary occupation, and he acted in films such as *Uptown Saturday Night* (1974) and *Kansas City* (1996).

Belarus Country, eastern Europe. Area: 80,200 sq mi (207,600 sq km). Population (2005 est.): 9,776,000. Capital: Minsk. The population is mainly Belarusian, with Russian and Ukrainian minorities. Languages: Belarusian, Russian (both official). Religion: Christianity (predominantly Eastern Orthodox; also Roman Catholic). Currency: rubel. The northern

part of the country is crossed by the Western Dvina (Dzvina) River; the Dnieper (Dnyapro) flows through eastern Belarus; the south has extensive marshy areas along the Pripet (Prypyats') River; the upper course of the Neman (Nyoman) flows in the west; and the Bug (Buh) forms part of the boundary with Poland in the southwest. The chief cities, in addition to Minsk, are Homyel, Mahilyow, and Vitsyebsk. Agriculture, once the linchpin of the Belarusian economy, has diminished in importance, while manufacturing and the service sector have grown. Belarus is a republic with two legislative houses; its president is head of state and government. Although Belarusians share a distinct identity and language, they never previously enjoyed political sovereignty. The territory that is now Belarus underwent partition and changed hands often; as a result, its history is entwined with its neighbours'. In medieval times the region was ruled by Lithuanians and Poles. Following the Third Partition of Poland, Belarus was ruled by Russia. After World War I the western part was assigned to Poland, and the eastern part became Soviet territory. After World War II the Soviets expanded what had been the Belorussian S.S.R. by annexing more of Poland. Much of the area suffered radioactive contamination from the Chernobyl accident in 1986, which forced many to evacuate. Belarus declared its independence in 1991 and later joined the Commonwealth of Independent States. Amid increasing political turmoil in the 1990s, it moved toward closer union with Russia but continued to struggle economically and politically at the start of the 21st century.

Belarusian \ˌbyā-lə-'rü-se-ən\ **language** *or* **Belarusan** \ˌbyā-lə-'rüs-ən\ **language** East Slavic language of Belarus, spoken by some 10.2 million people worldwide. Belarusian features begin to appear in Church Slavonic manuscripts from the 14th century (see Old Church Slavonic language). The chancery language of the grand duchy of Lithuania, used in the 15th–16th centuries, contains a substantial Belarusian element, mixed with Church Slavonic, Ukrainian, and Polish. Belarusian was not fully elaborated as a modern literary language until the early 20th century, when orthographic norms for writing it in Cyrillic were established. It has long struggled to maintain itself against Russian, particularly in Belarusian urban centres, where there is a high degree of Russification and Belarusian-Russian bilingualism.

Belasco \bə-'las-kō**, David** (b. July 25, 1853, San Francisco, Calif., U.S.—d. May 14, 1931, New York, N.Y.) U.S. theatrical producer and playwright. He acted with traveling companies before becoming a theatre manager, first in San Francisco and later in New York City (from 1880). An independent producer from 1890, he built his own theatre in 1906; there he introduced changes in stage lighting, used realistic scenery, and demanded high production standards. He successfully fought against the

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monopolistic Theatrical Syndicate. He wrote or collaborated on numerous plays, including *Madame Butterfly* (1900) and *The Girl of the Golden West* (1905), which were made into operas by the Italian composer Giacomo Puccini.

Belau See Palau

Belém \be-'lem\ City (pop., 2000 prelim.: metro. area , 1,271,615), northern Brazil. The capital of Pará state, the port of Belém lies on the Pará River in the vast Amazon River delta 90 mi (145 km) from the Atlantic Ocean. It began in 1616 as a fortified settlement; as it gradually became established, it helped consolidate Portuguese supremacy in northern Brazil. It was made the state capital in 1772. It enjoyed prosperity in the late 19th century as the main exporting centre of the Amazon rubber industry. After the rubber era ended in 1912, it continued to be northern Brazil's commercial centre and a main port for Amazon River craft.

belemnoid \'bel-əm-ˌnȯid\ *or* **belemnite** Member of an extinct group of cephalopods, possessing a large internal shell, that first appeared c. 345 million years ago, in the Early Carboniferous Period, and became extinct during the Eocene Epoch, which ended c. 36.6 million years ago. The internal shell of most species is straight, but that of some species is loosely coiled. The shell served for support and muscle attachment and enabled the animal to compensate for depth and its own body weight. See also ammonoid.

Reconstruction of squidlike belemnoid cephalopods from the Cretaceous System, southern Tennessee

COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK

Belfast District, seaport, and capital (pop., 1999 est.: 297,200) of Northern Ireland. On the River Lagan, the site was occupied in the Stone and Bronze ages, and the remains of Iron Age forts can still be seen. Belfast's modern history began in the early 17th century when Sir Arthur Chichester developed a plan for colonizing the area with English and Scottish settlers. Having survived the Irish insurrection of 1641, the town grew in economic importance, especially after a large immigration of French Huguenots arrived after the rescinding of the Edict of Nantes (1685) and strengthened the linen trade. It became a centre of Irish Protestantism, setting the stage for sectarian conflict in the 19th–20th centuries. Fighting was renewed in the 1960s and did not subside until a peace agreement was reached in 1998. The city is Northern Ireland's educational and commercial hub.

belfry Bell tower, either freestanding or attached to another structure. More particularly it refers to the room, usually at the top of such a tower, where the bells and their supporting timberwork are hung. The belfry is a prominent feature of Belgian Gothic architecture, especially in Flanders. The Halles (Market Hall) and belfry in Brugge (late 13th century) is a typical example. The term derives from the medieval siege tower (*berfrei*), a tall wooden structure that could be rolled up to a fortification wall so that the warriors hidden inside could storm the battlements.

Belgae \'bel-ˌgī\ Inhabitants of Gaul north of the Sequana (Seine) and Matrona (Marne) rivers. The term was apparently first applied by Julius Caesar, whose Gallic victories (54–51 BC) sent many Belgae into Britain, where they formed kingdoms, the most important of which were at Camulodunum (Colchester), Verulamium (St. Albans), and Calleva Atrebatum (Silchester).

Belgian Congo See Democratic Republic of the Congo

Belgica \'bel-ji-kə\ Ancient country, northeastern Gallia (Gaul). One of the administrative areas into which Augustus divided Gaul, it stretched from the Seine River to the Rhine and included the Low Countries. Its capital was Durocortorum Remorum (now Reims). Part of the area became Germania Inferior and Germania Superior under Domitian, and later, under Diocletian, the remainder was divided into Belgica Prima and Belgica Secunda. In the 5th century AD, Belgica was absorbed by the Franks. See also Belgium.

Belgium *officially* **Kingdom of Belgium** Country, northwestern Europe. Area: 11,787 sq mi (30,528 sq km). Population (2005 est.): 10,432,000. Capital: Brussels. The population consists mostly of Flemings and Walloons. The Flemings, more than half of the population, speak

Flemish (Dutch) and live in the northern half of the country; the Walloons, about one-third of the population, speak French and inhabit the southern half. Languages: Dutch, French, German (all official). Religions: Christianity (predominantly Roman Catholic); also Islam. Currency: euro. Belgium can be divided into several geographic regions. The southeast consists of the forested Ardennes highland, which extends south of the Meuse River valley and includes Belgium's highest point, Mount Botrange (2,277 ft [694 m]). Middle Belgium is a fertile region crossed by tributaries of the Schelde River. Lower Belgium comprises the flat plains of Flanders in the northwest with their many canals. Maritime Flanders borders the North Sea and is agriculturally prosperous; the chief North Sea port is Ostende, but Antwerp, near the mouth of the Schelde, handles more trade. Belgium has minimal natural resources, so the manufacture of goods from imported raw materials plays a major role in the economy, and the country is highly industrialized. It is a monarchy with a parliament composed of two legislative houses; the chief of state is the monarch, and the head of government is the prime minister. Inhabited in ancient times by the Belgae, a Celtic people, the area was conquered by Julius Caesar in 57 BC; under Augustus it became the Roman province of Belgica. Conquered by the Franks, it later broke up into semi-independent territories, including Brabant and Luxembourg. By the late 15th century the territories of the Netherlands, of which the future Belgium was a part, gradually united and passed to the Habsburgs. In the 16th century it was a centre for European commerce. The basis of modern Belgium was laid in the southern Catholic provinces that split from the northern provinces after the Union of Utrecht in 1579 (see The Netherlands). Overrun by the French and incorporated into France in 1801, the area was reunited with Holland and with it became the independent Kingdom of The Netherlands in 1815. After the revolt of its citizens in 1830, it became the independent Kingdom of Belgium. Under Leopold II it acquired vast lands in Africa. Overrun by the Germans in World Wars I and II, it was the scene of the Battle of the Bulge (1944–45). Internal discord led to legislation in the 1970s and '80s that created three nearly autonomous regions in accordance with language distribution: Flemish Flanders, French Wallonia, and bilingual Brussels. In 1993 Belgium became a federation comprising the three regions, which gained greater autonomy at the outset of the 21st century. It is a member of the European Union.

Belgrade *Serbian* **Beograd** \bā-'ō-ˌgräd\ City (pop., 2002: 1,120,092), capital of the republic of Serbia and administrative centre of Serbia and Montenegro. Lying at the juncture of the Danube and Sava rivers, it is one of the Balkans' most important commercial and transportation centres. Inhabited by Celts in the 4th century BC, it was later taken by the Romans and named Singidunum. It was destroyed by Huns in the

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5th century. In the 11th century it became a frontier town of Byzantium and in the 13th century came under the rule of Serbia. The Ottoman Empire besieged the city in the 15th century, and the forces of Süleyman I finally took it in 1521; it was held almost continuously by the Turks into the 19th century. It became the capital of the kingdom of Serbia in 1867 and, after World War I, of the new Kingdom of Serbs, Croats, and Slovenes (renamed Yugoslavia in 1929). It suffered severely under Nazi occupation (1941–44). It was damaged by NATO bombers in the Kosovo conflict (1999). Yugoslavia underwent many border changes in the 20th century and was renamed Serbia and Montenegro in 2003.

Belgrade, Peace of (1739) Either of two peace settlements that ended the Ottoman empire's four-year war with Russia and its two-year war with Austria. In 1735 Russia had attempted to establish itself on the northern Black Sea. Austria entered the war as Russia's ally in 1737, but military failures prompted it to make a separate peace in September 1739, ceding northern Serbia (including Belgrade) and Little Walachia to the Ottomans. With Austria's defection, the Russians had to make a disappointing peace that same month. Under its terms, Russia could not have warships on the Black Sea and had to depend on Ottoman shipping for its Black Sea commerce.

Belhadj \bel-'häj**, Ali** *also spelled* **'Alī Bel Ḥajj** (b. c. 1956, Tunisia) Deputy leader of the Islamic Salvation Front (FIS), an Algerian political party. Born to Algerian parents, he became a high-school teacher and an imam. He and the more moderate Abbasi al-Madani registered FIS as a political party in 1989. In 1990 FIS won a majority of votes in local elections; in 1991 the Algerian government announced martial law and imprisoned Belhadj and al-Madani. In 1994 Belhadj was transferred to house arrest.

Belidor \bā-lē-'dȯr**, Bernard Forest de** (b. 1698, Catalonia, Spain—d. Sept. 8, 1761, Paris, France) French military and civil engineer. After serving in the French army, he worked on measuring an arc of the Earth. As professor of artillery at a French military school, he wrote notable books on engineering, artillery, ballistics, and fortifications, but his fame rests primarily on his classic *Architecture hydraulique* (4 vol., 1737–53), covering engineering mechanics, mills and waterwheels, pumps, harbours, and sea works.

Belinsky \byəl-'yēn-skē**, Vissarion (Grigoryevich)** (b. May 30, 1811, Sveaborg, Fin., Russian Empire—d. May 26, 1848, St. Petersburg, Russia) Russian literary critic. Expelled from the University of Moscow in 1832, he worked as a journalist, making his reputation with critical articles that expounded nationalist doctrine. His argument that literature should express political and social ideas had a major impact on Soviet literary criticism, and he was often called the father of the Russian radical intelligentsia.

Belisarius (b. c. 505, Germania, Illyria?—d. March 565) Byzantine general. While serving in the bodyguard of Emperor Justinian I, he was appointed (c. 525) to command in the eastern armies, and he defeated the Persians in the Battle of Dara (530). In 532 Belisarius further gained Justinian's confidence by commanding the troops that ended the Nika Insurrection that nearly toppled the emperor. He led expeditions to overthrow the Vandals in North Africa (533) and regain Sicily and southern Italy from the Ostrogoths (535–537), defending Rome (537–538). He was offered a kingship by the Goths, which caused Justinian to recall him in disfavour. He was sent again to Rome (544–548) but with inadequate forces, and he was replaced by Narses in 548. Still loyal to Justinian, he was recalled in 559 to repel Hun invaders.

Belit \'bā-lit\ Akkadian goddess of destiny, consort of Bel, and mother of the moon god, Sin. Her Sumerian counterpart was Ninlil. Assyrians sometimes identified her with Ishtar. Ninlil was a grain goddess, and the story of her rape by Enlil, the Lord of the Wind, reflects the seasonal cycle of pollination, ripening, and withering.

Belitung See Billiton

Beliveau \'bel-i-vō**, Jean (Marc A.)** (b. Aug. 31, 1931, Trois-Rivières, Que., Can.) Canadian ice-hockey centre. He played for the Montreal Canadiens from 1953 to 1971. His career record of 79 goals and 176 points made during play-off games, including 17 Stanley Cup championships, stood until 1987.

Belize \bə-'lēz\ *formerly (1840–1973)* **British Honduras** Country, Central America. Area: 8,867 sq mi (22,965 sq km). Population (2005 est.): 291,000. Capital: Belmopan. Most Belizeans are of mixed ancestry (Indian-European, African-European), with smaller groups of Maya Indians and Garifuna. Languages: English (official), Creole, Spanish. Religion: Christianity (Roman Catholic, Protestant). Currency: Belize dollar. The country is bounded to the north by Mexico, to the east by the Caribbean Sea, and to the west and south by Guatemala. Belize is a land of mountains, swamps, and tropical jungles. The northern half consists of swampy lowlands drained by the Belize and Hondo rivers; the latter forms the boundary with Mexico. The southern half is more mountainous and contains the country's highest point, Victoria Peak (3,681 ft [1,122 m]). Off the coast lies Belize Barrier Reef, the world's second largest barrier reef. Belize is relatively prosperous and has a developing free-market economy with some government participation. It is a constitutional monarchy with two legislative houses; its head of state is the British monarch represented by a governor-general, and the head of government is the prime minister. The area was inhabited by the Maya (c. 300 BC–AD 900); the ruins of their ceremonial centres, including Caracol and Xunantunich, can still be seen. The Spanish claimed sovereignty from the 16th century but never tried to settle Belize, though they regarded the British who did as interlopers. British loggers arrived in the mid-17th century; Spanish opposition was finally overcome in 1798. When settlers began to penetrate the interior, they met with Indian resistance. In 1871 British Honduras became a crown colony, but an unfulfilled provision of an 1859 British-Guatemalan treaty led Guatemala to claim the territory. The situation had not been resolved when Belize was granted its independence in 1981. Although Guatemala officially recognized the territory's independence in 1991, a British force, stationed there to ensure the new country's security, was not withdrawn until 1994.

Belize City City (pop., 2000: 49,050), Belize. The chief seaport and former capital of Belize, it lies at the mouth of the Belize River, which was until the 10th century a heavily populated trade artery of the Maya empire. The British settled the area in the 17th century. The city, built on ground only slightly above sea level, has been ravaged by hurricanes, so the capital was moved inland to Belmopan in 1970.

bell Hollow vessel, usually of metal, that produces a ringing sound when struck by an interior clapper or a mallet. In the West, open bells have acquired a standard "tulip" shape. Though the vibrational patterns of such open bells are basically nonharmonic, they can be tuned so that the lower overtones produce a recognizable chord. Forged bells have existed for many thousands of years. Bells were first cast, or founded, in the Bronze Age; the Chinese were the first master founders. Bells have carried a wide range of cultural meanings. They are particularly important in religious

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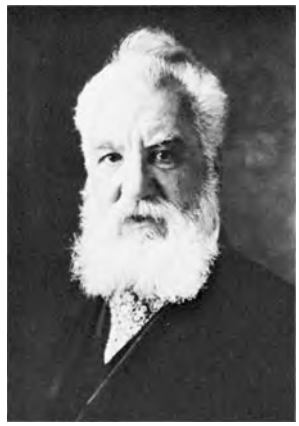
ritual in East and South Asia. In Christianity, especially Russian Orthodoxy, bells have also been used ritually. They have tolled the hours from monastery and church steeples, originally to govern monastic routine and later also to fill a similar role for the secular world.

Bell, Alexander Graham (b. March 3, 1847, Edinburgh, Scot.—d. Aug. 2, 1922, Beinn Bhreagh, Nova Scotia, Can.) Scottish-born U.S. audiologist and inventor. He moved to the U.S. in 1871 to teach the visible-speech system developed by his father, Alexander Melville Bell (1819–1905). He opened his own school in Boston for training teachers of the deaf (1872) and was influential in disseminating these methods. In 1876 he became the first person to transmit intelligible words through electric wire ("Watson, come here, I want you," spoken to his assistant Thomas Watson). He patented the telephone the same year, and in 1877 he cofounded Bell Telephone Co. With the proceeds from France's Volta Prize, he founded Volta Laboratory in Washington, D.C., in 1880. His experiments there led to the invention of the photophone (which transmitted speech by light rays), the audiometer (which measured acuteness of hearing), the Graphophone (an early practical sound recorder), and working wax recording media, both flat and cylindrical, for the Graphophone. He was chiefly responsible for founding the journal *Science*, founded the American Association to Promote Teaching of Speech to the Deaf (1890), and continued his significant research on deafness throughout his life.



Alexander Graham Bell.
CULVER PICTURES

Bell, (Arthur) Clive (Heward) (b. Sept. 16, 1881, East Shefford, Berkshire, Eng.—d. Sept. 17, 1964, London) British art critic. He studied at Cambridge University and in Paris. In 1907 he married Vanessa Stephen, sister of VIRGINIA WOOLF; with Virginia's husband, Leonard Woolf, and ROGER FRY, they formed the core of the BLOOMSBURY GROUP. Bell's most important aesthetic ideas were published in *Art* (1914) and *Since Cézanne* (1922), in which he promoted his theory of "significant form" (the quality that distinguishes works of art from all other objects). His assertion that art appreciation involves an emotional response to purely formal qualities, independent of subject matter, was influential for several decades.

Bell, Cool Papa *orig.* **James Thomas Bell** (b. May 17, 1903, Starkville, Miss., U.S.—d. March 7, 1991, St. Louis, Mo.) U.S. baseball player. Bell was a switch-hitting outfielder for most of his career. Playing primarily in the NEGRO LEAGUES, he is said to have stolen 175 bases in a 200-game season and is reputed to have been the fastest base runner of all time. Also a fine hitter, he once batted .391 over a five-year period. He was inducted into the Baseball Hall of Fame in 1972.

Bell, Gertrude (b. July 14, 1868, Washington Hall, Durham, Eng.—d. July 12, 1926, Baghdad, Iraq) British traveler, writer, and colonial administrator. After graduating from Oxford, she journeyed throughout the Middle East. After World War I she wrote a well-received report on the administration of Mesopotamia between the end of the war (1918) and the Iraqi rebellion of 1920 and later helped determine postwar boundaries. In 1921 she helped place a son of the sharif of Mecca, FAYṢAL I, on the Iraqi throne. In helping create the National Museum of Iraq, she promoted the idea that excavated antiquities should stay in their country of origin.

Bell, John (b. Feb. 15, 1797, near Nashville, Tenn., U.S.—d. Sept. 10, 1869, Dover, Tenn.) U.S. politician. He represented Tennessee in the U.S. House of Representatives (1827–41) and Senate (1847–59). Although a large slaveholder, he opposed efforts to expand slavery to U.S. territories and voted against admitting Kansas as a slave state. His defense of the Union brought him the 1860 nomination for president on the Constitutional Union ticket, but he carried only three states. He later supported the South in the American Civil War.

Bell Burnell, (Susan) Jocelyn *orig.* **Susan Jocelyn Bell** (b. July 15, 1943, Belfast, N.Ire.) British astronomer. As a research assistant at the University of Cambridge, she assisted in constructing a large radio telescope and discovered PULSARS, cosmic sources of peculiar radio pulses, providing the first direct evidence for the existence of rapidly spinning NEUTRON STARS. The 1974 Nobel Prize for Physics was awarded for the discovery of pulsars to ANTONY HEWISH (her adviser) and MARTIN RYLE, sparking a controversy over the omission of Bell Burnell. She subsequently became a professor at Open University and vice president of the Royal Astronomical Society.

bell curve See NORMAL DISTRIBUTION

Bell Laboratories U.S. research and development company (founded 1925) that develops telecommunications equipment and carries out defense-related research. Formerly part of AT&T, it now belongs to Lucent Technologies, Inc., which spun off from AT&T in 1996. Bell Labs has produced thousands of inventions, including the first synchronous-sound MOTION-PICTURE system, the electrical-relay DIGITAL COMPUTER, the LASER, the SOLAR CELL, UNIX, and the C and C++ programming languages. Several Bell researchers have won Nobel Prizes: Clinton Davisson, for demonstrating the wave nature of matter; JOHN BARDEEN, WALTER H. BRATTAIN, and WILLIAM B. SHOCKLEY, for inventing the TRANSISTOR; and ARNO PENZIAS and ROBERT W. WILSON, for discovering cosmic microwave background radiation. It operates today in some 20 countries.

Bell palsy See PARALYSIS

bell ringing See CHANGE RINGING

Bella, Ahmed Ben See Ahmed BEN BELLA

belladonna Tall, bushy, herbaceous plant, the deadly nightshade (*Atropa belladonna*), of the NIGHTSHADE FAMILY; also, the crude drug consisting of its dried leaves or roots. The plant is a native of wooded or waste areas in central and southern Eurasia. It has dull green leaves, violet or greenish flowers, shiny black berries about the size of cherries, and a large, tapering root. Belladonna is highly poisonous and is cultivated for medicinal substances (ALKALOIDS) that are derived from the crude drug and used in sedatives, stimulants, and antispasmodics. Because of toxicity and undesirable side effects, however, these substances are being replaced by synthetic drugs.

Bellamy \'bel-ə-mē**, Edward** (b. March 26, 1850, Chicopee Falls, Mass., U.S.—d. May 22, 1898, Chicopee Falls) U.S. writer. Bellamy first became aware of the plight of the urban poor at age 18 while studying in Germany. He engaged throughout his life in progressive causes and wrote several books reflecting his concerns, but he is known chiefly for his utopian novel *Looking Backward* (1888), which describes the U.S. in the year 2000 as an ideal socialist state featuring cooperation, brotherhood, and industry geared to human need. It sold more than a million copies; a sequel, *Equality* (1897), was less successful.

Bellamy
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Bellarmine \'bel-ˌär-mən**, Saint Robert** *Italian* **Roberto Francesco Romolo Bellarmino** (b. Oct. 4, 1542, Monrepulciano, Tuscany—d. Sept. 17, 1621, Rome; canonized 1930; feast day September 17) Italian cardinal and theologian. He joined the JESUITS in 1560, and after ordination in the Spanish Netherlands (1570) he began to teach theology. He was made a cardinal in 1599 and an archbishop in 1602. He took a prominent part in the first examination of GALILEO's writings; though somewhat sympathetic to Galileo, he thought it best to have the COPERNICAN SYSTEM declared "false and erroneous," which was done in 1616. He gave impartial attention to Protestant works and was regarded as an enlightened theologian. He died a pauper, having given all his funds to the poor. In 1931 he was named a Doctor of the Church.

Belle Isle, Strait of Channel, eastern Canada. The northern entrance from the Atlantic Ocean to the Gulf of ST. LAWRENCE, it is 90 mi (145 km) long and 10–20 mi (16–32 km) wide. It flows between the northern tip

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of Newfoundland and southeastern Labrador and is the most direct route from the Saint Lawrence Seaway and Great Lakes ports to Europe. The cold Labrador Current flows through the strait, extending the period of ice cover and limiting shipping to between June and late November.

Bellerophon \bə-'ler-ə-fən\ Legendary Greek hero. The son of Glaucus and grandson of Sisyphus, as a youth in Corinth he tamed and rode the winged horse Pegasus. The wife of King Proteus of Argos fell in love with him, and when he rejected her, she falsely accused him of attempted rape. Proteus sent him to the king of Lycia with a message asking that he be killed. The king instead ordered him to kill the monster Chimera, and with the aid of Pegasus he succeeded. He married the king's daughter but later lost the favour of the gods and became an unhappy wanderer. Another version of the legend holds that he tried to fly up to heaven and was thrown from Pegasus and lamed.

bellflower Any of about 300 annual, perennial, and biennial herbaceous plants of the genus *Campanula* (family Campanulaceae) that bear bell-shaped, usually blue flowers. They are native mainly to northern temperate regions in both hemispheres, Mediterranean areas, and tropical mountains. Distribution and habitat may be quite diverse. Species native to northern Eurasia and eastern North America but also grown in gardens are the bluebell (*C. rotundifolia*) and the tall bellflower (*C. americana*). The creeping bellflower (*C. rapunculoides*) is a notorious garden weed. Among the few food plants in the bellflower family, which includes a total of 40 genera and 700 species, are the rampion (*C. rapunculus*), eaten as a vegetable in parts of Europe, and some robust members—especially *Canarina*, *Clermontia*, and *Centropogon*—that produce edible berries.

Bellflower (*Campanula*)
W.H. HODGE

Bellini, Vincenzo (b. Nov. 3, 1801, Catania, Sicily—d. Sept. 23, 1835, Puteaux, France) Italian composer. Born into a musical family, he was educated at the Naples Conservatory. He wrote his first opera at age 24 and went on to complete nine more before his death at age 33. The most famous are *The Pirate* (1827), *The Capulets and the Montagues* (1830), *The Sleepwalker* (1831), *Norma* (1831), and *The Puritans* (1835). His works, which rely strongly on beautiful vocal melody (*bel canto*), rivaled those of his contemporaries Gioacchino Rossini and Gaetano Donizetti in popularity.

Bellini \bāl-'lē-nē\ **family** Family of Italian artists. Jacopo Bellini (c. 1400–70/71) was trained under Gentile da Fabriano, and by c. 1440 he had a thriving studio in Venice. More important than his paintings are his two surviving sketchbooks, which contain nearly 300 drawings. He was the father-in-law of Andrea Mantegna. His son Gentile Bellini (c. 1429–1507) inherited his father's sketchbooks and took over as head of the studio. His most important extant works are two huge canvases, *Procession of the Relic of the True Cross* (1496) and *Miracle at the Bridge of San Lorenzo* (1500), depicting scenes of contemporary Venetian life. Gentile's brother Giovanni Bellini (called Giambellino, c. 1430–1516) was the greatest and most prolific artist of the family. He transformed Venice into a Renaissance centre rivaling Florence and Rome. Giovanni was an early master of oil painting. Primarily a religious painter, he also excelled at portraits, of which *Doge Leonardo Loredan* (c. 1501) is his best known. Titian and Giorgione were probably trained in his workshop. See also Venetian school.

Belloc \'bel-ˌäk**, (Joseph-Pierre) Hilaire** (b. July 27, 1870, La Celle-Saint-Cloud, France—d. July 16, 1953, Guildford, Surrey, Eng.) French-born British poet, historian, Catholic apologist, and essayist. A highly versatile writer, he is best remembered for his light verse, particularly for children, and for his lucid and graceful essays. His works include *Verses and Sonnets* (1895), *The Bad Child's Book of Beasts* (1896), *The Modern Traveller* (1898), *Mr. Burden* (1904), and *Cautionary Tales* (1907). He also wrote several historical works, including a four-volume *History of England* (1925–31).

Bellotto \bel-'lȯt-tō**, Bernardo** *known as* **Canaletto** (b. Jan. 30, 1720, Venice—d. Oct. 17, 1780, Warsaw, Pol.) Italian painter of topographical views, known as *vedute* ("view paintings"). He was the nephew of Canaletto and was himself known by that name when painting outside Italy. In 1747 he left Italy to spend the rest of his life working at various European courts, most notably at Dresden for Frederick Augustus II (1747–66) and at Warsaw for Stanisław II (1767–80). His detailed views of the Polish capital were used as guides to reconstruct the historic sections of the city after their destruction in World War II. Bellotto's style is distinguishable from his uncle's by its Dutch characteristics (e.g., cast shadows, massed clouds, sombre tone and colour).

Bellow, Saul (b. June 10, 1915, Lachine, near Montreal, Que., Can.—d. April 5, 2005, Brookline, Mass., U.S.) Canadian-born U.S. novelist. Born to an immigrant Russian Jewish family, he was fluent in Yiddish from childhood. His family moved to Chicago when he was nine; he grew up and attended college there and, after some years in New York, returned to teach in Chicago. His works, which make him representative of the Jewish American writers whose works became central to American literature after World War II, deal with the modern urban dweller, disaffected by society but not destroyed in spirit; his originality lay partly in his combination of cultural sophistication and street wisdom. His works include *The Adventures of Augie March* (1953, National Book Award), *Seize the Day* (1956), *Henderson the Rain King* (1959), *Herzog* (1964, National Book Award), *Mr. Sammler's Planet* (1970, National Book Award), *Humboldt's Gift* (1975, Pulitzer Prize), *The Dean's December* (1982), and *Ravelstein* (2000). He won the Nobel Prize for Literature in 1976.

bellows Mechanical contrivance for creating a jet of air, consisting usually of a hinged box with flexible sides, which expands to draw in air through an inward opening valve and contracts to expel the air through a nozzle. Invented in medieval Europe, the bellows was commonly used to speed combustion, as in a blacksmith's or ironworker's forge, or to operate reed or pipe organs.

Bellows, George Wesley (b. Aug. 12, 1882, Columbus, Ohio, U.S.—d. Jan. 8, 1925, New York, N.Y.) U.S. painter and lithographer. He studied with Robert Henri at the New York School of Art and became associated with the artists of the Ash Can school. Best known for his boxing scenes, he achieved notoriety with his painting *Stag at Sharkey's* (1909), which depicts an illegal boxing match. He was one of the organizers of the Armory Show. From 1916 until his death he produced a series of some 200 lithographs, including the well-known *Dempsey and Firpo* (1924).

Stag at Sharkey's, oil on canvas by George Bellows, 1909; in the Cleveland Museum of Art, Ohio, U.S.
COURTESY OF THE CLEVELAND MUSEUM OF ART, OHIO, HINMAN B. HURLBUT COLLECTION

Belmondo \bel-mōⁿ-'dō**, Jean-Paul** (b. April 9, 1933, Neuilly-sur-Seine, near Paris, France) French film actor. After studying in Paris and performing with provincial stage companies, he appeared in minor film roles before achieving international fame in Jean-Luc Godard's *Breathless* (1960). Though not conventionally handsome, he became the leading antihero of New Wave cinema, acting in 25 films by 1963, then went on to appear in such acclaimed films as *Pierrot le Fou* (1965), *Mississippi Mermaid* (1969), and *Les Misérables* (1995).

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Belmont family U.S. family prominent in banking and finance, politics, and patronage of the arts. Its founder in the U.S. was August Belmont (1816–90), a Prussian-born Jewish banker and diplomat. Belmont entered the Rothschilds' Frankfurt, Ger., banking house at age 14. In 1837 he moved to New York, where he acted as the Rothschilds' agent and laid the foundation for his own banking house, which became one of the largest in the country. He took an active interest in politics. Strongly opposed to slavery, he influenced merchants and financiers in England and France in favour of the Union during the Civil War. He introduced Thoroughbred horse racing into the U.S. (see Belmont Stakes). He married the daughter of Commodore Matthew Perry. His son Perry (1850–1947) became a U.S. Congressman and wrote books on U.S. history and politics. Another son, August Belmont, Jr. (1853–1924), took over the banking house and financed the building of New York's subway, while his wife, Eleanor, supported the Metropolitan Opera.

Belmont Stakes Oldest of the three U.S. horse races that constitute the Triple Crown. The Belmont originated in 1867 and is named after August Belmont (see Belmont family). The stakes is held in early June at Belmont Park, near Garden City, Long Island; the course is 1.5 mi (2,400 m).

Belmopan \ˌbel-mȯ-ˈpän\ City (pop., 2000: 8,130), capital of Belize. It lies in the Belize River valley, 50 mi (80 km) inland from the former capital, Belize City. After a hurricane did extensive damage to low-lying Belize City, the new capital site was chosen far enough inland to avoid flooding. Construction began in 1966, and Belmopan became the capital in 1970.

Belo Horizonte \ˈbā-lō-rē-ˈzōⁿn-tē\ City (pop., 2003 est.: city, 2,305,800; metro. area, 5,100,359), southeastern Brazil. Capital of Minas Gerais state, it lies on the western slope of the Serra do Espinhaço at an elevation of 2,720 ft (830 m). The site was chosen in the late 19th century to accommodate expansions that the former capital could not. Brazil's first planned city, it was laid out on a grid following the models of Washington, D.C., and La Plata, Arg. It is the hub of a large agricultural region and the area's commercial and industrial centre.

Belorussia See Belarus

Belorussian language See Belarusian language

Belsen See Bergen-Belsen

Belshazzar \bel-ˈsha-zər\ (d. c. 539 BC) Coregent of Babylon. Though he is referred to in the book of Daniel as the son of Nebuchadrezzar, Babylonian inscriptions suggest that he was the eldest son of King Nabonidus. When the king went into exile in 550 BC, the kingdom and most of its army were entrusted to Belshazzar. In the biblical story Belshazzar holds a last great feast at which he sees a hand writing on a wall the Aramaic words "*mene*, *mene*, *tekel*, *upharsin*," which Daniel interprets as a judgment from God foretelling the fall of Babylon. Belshazzar died after Babylon fell to the Persians in 539 BC.

belt drive Pair of pulleys attached to usually parallel shafts and connected by an encircling flexible belt (band) that can serve to transmit and modify rotary motion from one shaft to the other. Most belt drives consist of flat leather, rubber, or fabric belts running on cylindrical pulleys or of belts with a V-shaped cross section running on grooved pulleys. Another type of belt, used on some internal-combustion engines for connecting the crankshaft and camshafts, is the toothed (or timing) belt, a flat belt with evenly spaced transverse teeth that fit in matching grooves on the periphery of the pulley.

Beltane \ˈbel-tān, ˈbel-tin\ *or* **Beltine** \ˈbel-tin\ *or* **Cétsamain** \ˈket-ˌsaù-in\ In Celtic religion, a festival held on the first day of May, celebrating the beginning of summer and open pasturing. Beltane was one of two turning points in the year, the other being November 1 (Samhain), the start of winter. At both, the bounds between the human and supernatural worlds were erased. On May Eve, witches and fairies roamed freely, and measures had to be taken against their enchantments. As late as the 19th century in Ireland, cattle were driven between two bonfires on Beltane as a magical means of protecting them from disease. See also Halloween.

Belter, John Henry *orig.* **Johann Heinrich Belter** (b. 1804, Germany—d. 1863, New York, N.Y., U.S.) German-born U.S. cabinetmaker and designer. Trained in Germany, he settled in New York City in 1833. He opened a fashionable shop specializing in rosewood, walnut, and mahogany furniture. In 1854 he patented his invention of processing rosewood in many layers to achieve thin panels that, once shaped in molds through steam heating, could be finely carved. He opened a large factory in 1858, but soon competitive French imports and economic troubles associated with the American Civil War impaired his business, and the firm closed in 1867.

beluga \bə-ˈlü-gə\ *or* **hausen** \ˈhaù-zᵊn\ Large species of sturgeon (*Huso huso*, or *Acipenser huso*) that inhabits the Caspian and Black seas and the Sea of Azov. It reaches a length of 25 ft (7.5 m) and a weight of 2,900 lbs (1,300 kg), but its flesh and caviar are less valuable than those of smaller species.

beluga *or* **white whale** Species (*Delphinapterus leucas*) of whale found in the Arctic Ocean and adjacent seas, in both deep offshore and coastal waters. It may also enter rivers that empty into far northern seas. A toothed whale with a rounded forehead and no dorsal fin, the beluga is about 13 ft (4 m) long. Born dark blue-gray or blackish, it fades to white or cream at 4–5 years of age. It feeds on fish, cephalopods, and crustaceans and usually lives in groups of five to 10. It has been hunted commercially for its oil, hide, and flesh, and is used in the Arctic as food for humans and dogs.

Beluga, or white whale (*Delphinapterus leucas*).
E.R. DEGGINGER

belvedere Roofed architectural structure, freestanding or attached, and open on one or more sides. It is built in an elevated position to provide a view and capture daylight and fresh air. Used in Italy since the Renaissance, it often assumes the form of a loggia. The term is often used for a gazebo on top of a building, especially the glazed viewing room of a Victorian dwelling.

Belvedere Torso Hellenistic marble torso of a male figure 5 ft 3 in. (1.6 m) high seated on a rock. It is named after the Belvedere court in Vatican City, where it once stood; it is now in the Vatican Museum. It is signed by the Greek sculptor Apollonius and possibly dates from the 1st century BC. Well known by 1500, it had a profound influence on Michelangelo and other Renaissance artists.

bema \ˈbē-mə\ (Greek: "step") Raised stone platform originally used in Athens as a tribunal where orators addressed the citizens and courts of law. In modern times it is usually a rectangular wooden platform. The bema became a standard fixture in Eastern Orthodox churches, functioning as a stage for the altar and clergy. In synagogues, the bema (or *bimah*) is a raised platform with a reading desk from which the Torah and passages from the Prophets are read.

Bembo \ˈbem-ˌbō**, Pietro** (b. May 20, 1470, Venice—d. Jan. 18, 1547, Rome) Italian prelate and linguist. Born into an aristocratic family, he became librarian of St. Mark's Cathedral and was created a cardinal in 1539. After writing lyric poetry in Latin, he turned to the vernacular, producing Italian poems in imitation of Petrarch and an Italian history of Venice. His *Discussions of the Vernacular Language* (1525) was one of the earliest books to codify Italian spelling and grammar, and it helped establish the Italian literary language. Bembo successfully advocated the adoption of 14th-century Tuscan as a model for literary Italian.

Ben Ali \ben-ˈä-lē**, Zine el-Abidine** (b. Sept. 3, 1938, near Sousse, Tun.) President of Tunisia (from 1987). Trained as a soldier, he headed the defense ministry's military intelligence section for 10 years (1964–

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74) before entering the foreign service. He served as ambassador to Poland before returning home to hold several domestic government posts, which culminated in a dual appointment as prime minister and interior minister. In 1987 he replaced President Habib Bourguiba, who had been declared medically unfit. He was returned to office in elections in 1989, 1994, 1999, and 2004.

Ben Bella, Ahmed (b. Dec. 25, 1918?, Maghnia, Alg.) First elected president of Algeria. After a French education, he entered the French army and was decorated during World War II (1939–45). After the war he took up arms to fight French rule. In 1954 he helped found the National Liberation Front (FLN) and became its political leader. He was imprisoned (1956–62) while the FLN fought for Algerian independence. He took control of the FLN's Political Bureau after his release and was elected president in 1963. He was deposed in a coup in 1965 and imprisoned until 1980. Thereafter he spent 10 years in exile, returning to Algeria in 1990. See also Mohamed Boudiaf; Houari Boumedienne.

Ben-Gurion \ben-'gůr-ē-ən**, David** *orig.* **David Gruen** (b. Oct. 16, 1886, Płońsk, Pol., Russian Empire—d. Dec. 1, 1973, Tel Aviv–Yafo, Israel) First prime minister of Israel (1948–53, 1955–63). Introduced to Zionism by his father, Ben-Gurion immigrated to Palestine, then part of the Ottoman Empire, in 1906, hoping to fulfill the Zionist aspiration of building a Jewish state in historic Israel. Expelled by the Ottomans at the outbreak of World War I (1914–18), he traveled to New York, where he married. Following the issuance of the Balfour Declaration, he joined the British army's Jewish Legion and returned to the Middle East. In the 1920s and '30s he led several political organizations, including the Jewish Agency, world Zionism's highest directing body. As Britain became more sympathetic to the interests of the Palestinian Arabs, thereafter restricting Jewish immigration to Palestine, he called on the Jewish community to rise against Britain. However, he again called for Jews to support the Allies during World War II (1939–45), while continuing the clandestine immigration of Jews to Palestine. On the establishment of the State of Israel (1948), he became prime minister and minister of defense. He succeeded in fusing the underground Jewish militias that had fought the British into a national army, which he used successfully to defend against Arab attacks. Unpopular with Britain and the U.S., he found an ally in France—then embroiled in its own war in the Arab world—which helped arm Israel in the period leading to the Suez Crisis (1956). He retired from the premiership in 1963 and from the Knesset (parliament) in 1970. See also Arab-Israeli wars.

Ben Nevis Highest mountain, British Isles. It is located in the Scottish Highlands; its summit, which reaches 4,406 ft (1,343 m), is a plateau of about 100 acres (40 hectares). Snow lies in some parts all year. It consists of a superstructure of volcanic rocks surmounting the ancient schists of the Highlands.

Benares See Varanasi

Benavente y Martínez \ˌbe-nə-'ven-tē-ē-mär-'tē-nəs**, Jacinto** (b. Aug. 12, 1866, Madrid, Spain—d. July 14, 1954, Madrid) Spanish dramatist. His most celebrated work, *The Bonds of Interest* (1907), was based on the Italian commedia dell'arte; his 1913 tragedy *La malquerida* was also popular. During the Spanish Civil War he was detained by the authorities for a time, but he reestablished himself in official favour with *Lo increíble* (1941). One of the foremost Spanish dramatists of the 20th century, he continued to write until the end of his life, producing more than 150 plays. He received the Nobel Prize for Literature in 1922.

Bench, Johnny (Lee) (b. December 7, 1947, Oklahoma City, Okla., U.S.) U.S. baseball player. Bench joined the Cincinnati Reds in 1967. During his 17 seasons catching for them (1967–83), he helped lead the team (with Pete Rose and Joe Morgan) to four National League pennants (1970, 1972, 1975, 1976) and two World Series victories (1975, 1976). Batting right-handed, he led the National League in runs batted in three times (1970, 1972, 1974) and twice in home runs (1970, 1972). He is regarded as one of the greatest defensive catchers ever to play the game.

Benchley, Robert (Charles) (b. Sept. 15, 1889, Worcester, Mass., U.S.—d. Nov. 21, 1945, New York, N.Y., U.S.) U.S. drama critic, actor, and humorist. Benchley graduated from Harvard University and joined the staff of *Life* magazine in 1920. A regular member of the Algonquin Round Table, he was drama critic for *The New Yorker* 1929–40, for which he also wrote "The Wayward Press" column under the pseudonym Guy Fawkes. He had bit parts in many feature films, but he is best known for more than 40 short subjects, including *How to Sleep* (1934, Academy Award). His writing was warmly humorous, his satire sharp but not cruel.

bends See decompression sickness

Bene-Israel \'ben-ē-ˌiz-rä-'el\ (Hebrew: "Sons of Israel") one of three groups of Jews in India. The origins of the Bene-Israel are uncertain, but because of their observance of certain traditions and lack of observance of others, they are believed to have escaped persecution in Galilee before the 2nd century BCE and to have shipwrecked on the coast of India. Seven couples are believed to have survived, without the benefit of a material culture. Isolated from other Jews, they largely assimilated into India's caste system, though they practiced Jewish dietary laws, circumcised male children on the eighth day, and did not work on Saturday. Present-day Bene-Israel bear a physical resemblance to the Marathi people and speak Marathi and English. Many have emigrated to Israel.

Benedetto da Maiano \bā-nā-'dät-tō-dä-mä-'yä-nō\ (b. 1442, Majano, Republic of Venice—d. May 24, 1497, Florence) Italian sculptor active in Florence. He was influenced by Bernardo Rossellino; his marble tomb designs are variants on Rossellino's patterns. His masterpiece is a pulpit in Santa Croce in Florence (completed 1485) consisting of five narrative reliefs. He often worked with his brothers, Giovanni and Giuliano, in the design and execution of architectural features such as pilasters, capitals, friezes, and niches. He was also a master of naturalistic portrait busts.

Benedict, Ruth *orig.* **Ruth Fulton** (b. June 5, 1887, New York, N.Y., U.S.—d. Sept. 17, 1948, New York City) U.S. anthropologist. She received a Ph.D. under Franz Boas at Columbia University and taught at Columbia from 1924 until her death. In *Patterns of Culture* (1934), her most famous work, she emphasized how small a part of the range of possible human behaviour is elaborated or emphasized in any one society. She described how these forms of behaviour are integrated into patterns or configurations, and she supported cultural relativism, or the judging of cultural phenomena in the context of the culture in which they occur. In *The Chrysanthemum and the Sword* (1946), she applied her methods to Japanese culture. Her theories had a profound influence on cultural anthropology.

Ruth Benedict.
COURTESY OF COLUMBIA UNIVERSITY, NEW YORK

Benedict of Nursia, Saint (b. c. 480, Nursia, Kingdom of the Lombards—d. c. 547) Founder of the Benedictine monastery at Monte Cassino, Italy, and father of Western monasticism. Born into a prominent family at Nursia in central Italy, he rejected the immoral and profligate life of the rich and became a hermit outside Rome, where he attracted disciples. At his monastery at Cassino he formulated the Benedictine Rule, which became standard in monasteries throughout Europe. The Rule includes a probationary year prior to the vow of obedience and lifelong residence at one monastery, a ban on personal property, an abbot elected for life who appoints all other officers, and a precisely ordered day that includes five to six hours of liturgy and prayer, five hours of manual work, and four hours of scriptural and spiritual reading.

Benedict XII *orig.* **Jacques Fournier** (b. Saverdun, near Toulouse, France—d. April 25, 1342, Avignon, Provence) Pope (1334–42). A French cardinal and theologian, he became the third pontiff to reign at Avignon (see Avignon papacy), succeeding John XXII. The bishop of Pamiers and Mirepoix and a zealous inquisitor before his elevation to the papacy, Benedict devoted himself to the reform of the church and its religious orders; he also tried unsuccessfully to prevent the outbreak of the conflict between England and France that became the Hundred Years' War. His bull *Benedictus Deus* (1336) set forth the doctrine of the beatific vision as a vision of God granted to the souls of the just immediately after death.

Benedict XIII *orig.* **Pedro de Luna** (b. c. 1328, Illueca, Kingdom of Aragon—d. 1423, Peñíscola, in Valencia) Antipope (1394–1423). A French

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professor of canon law, he was named a cardinal in 1375. When the Western Schism began in 1378, he supported the antipope Clement VII. Elected pope at Avignon (see Avignon papacy), he refused French pressure to abdicate and was besieged in the papal palace (1398). Benedict escaped to Provence in 1403 and won back the obedience of France. He refused to yield when deposed by the Councils of Pisa (1409) and Constance (1417).

Benedict XIV *orig.* **Prospero Lambertini** (b. March 31, 1675, Bologna, Papal States—d. May 3, 1758, Rome) Pope in 1740–58. Nobly born, he received a doctorate in theology and law. Typical of his pontificate were his promotion of scientific learning and his admonition to those drawing up the *Index Librorum Prohibitorum* (*Index of Forbidden Books*) to act with restraint. In the Papal States he reduced taxation, encouraged agriculture, and supported free trade. He maintained conciliatory relations with neighbouring kingdoms. A lifelong active scholar, he founded several learned societies and laid the groundwork for the present Vatican Museum. Bernard Garnier, a French cleric who was counter-antipope (1425–33) while Martin V was pope and Clement VIII was antipope, was also called Benedict XIV.

Benedict XV *orig.* **Giacomo Della Chiesa** (b. Nov. 21, 1854, Pegli, Kingdom of Sardinia—d. Jan. 22, 1922, Rome, Italy) Pope (1914–22). Ordained a priest in 1878, he entered the papal diplomatic service. He was made archbishop of Bologna in 1907 and cardinal in 1914. Elected pope a month after the outbreak of World War I, he tried to follow a policy of strict neutrality and concentrated the church's efforts on relief. He later made positive efforts toward reestablishing peace, though his principal attempt in 1917 to mediate the war was unsuccessful.

Benedict XV, 1921
UPI

Benedict XVI *orig.* **Joseph Alois Ratzinger** (b. April 16, 1927, Marktl am Inn, Ger.) Pope from 2005. He was ordained in 1951 and received a doctorate in theology at the University of Munich in 1953. Thereafter he pursued a career as a theologian and teacher at various universities. During the Second Vatican Council (1962–65) he served as an expert adviser and an advocate of reform. In 1977 he was appointed archbishop of Munich; three months later he was made a cardinal. As prefect of the Congregation for the Doctrine of the Faith from 1981 to 2005, he enforced doctrinal uniformity in the church and served as a close adviser of Pope John Paul II. He was faced with numerous challenges when he became pope, including a decline in church attendance and in the number of new priests, deep divisions over the direction of the church, and the lingering effects of a sexual-abuse scandal involving priests in various parts of the world.

Benedict XVI, 2005.
VINCENZO PINTO—AFP/GETTY IMAGES

Benedictine Member of the Order of St. Benedict, the confederated autonomous congregations of monks and lay brothers who follow the Benedictine Rule, created by St. Benedict of Nursia in the 6th century. The Rule spread slowly in Italy and Gaul. By the 9th century it was nearly universal in northern and western Europe, where Benedictine monasteries became repositories of learning, literature, and wealth. The order declined during the 12th–15th century, when it was revived with reforms that limited abbots to fixed terms and required monks to make their vows to the congregation rather than a particular house. The Reformation virtually eliminated Benedictines from northern Europe, and they declined elsewhere. In the 19th century another revival strengthened the order in Europe, especially in France and Germany, and led to the establishment of new congregations worldwide.

benefice \'be-nə-fəs\ System of land tenure first used by the Franks during the 8th century. A Frankish lord leased an estate to a freeman *in beneficium* (Latin: "for the benefit (of the tenant)"), normally until the death of the lord or tenant, though tenants often succeeded in turning benefices into hereditary holdings. By the 12th century benefice was dying out as a term for land tenure; instead it referred to a church office that carried with it the right of receiving income. A lord or bishop chose a priest, who was granted the benefice in return for the performance of spiritual duties.

beneficiary \ˌbe-nə-'fi-shē-ˌer-ē, ˌbe-nə-'fi-shə-rē\ Person or entity (e.g., a charity or estate) that receives a benefit from something (e.g., a trust, life-insurance policy, or contract). A primary beneficiary receives proceeds from a trust or insurance policy before any other. A contingent beneficiary receives proceeds upon the occurrence of a specified event, such as the death of the primary beneficiary. A direct beneficiary is a third party whom contracting individuals intend to benefit from a contract; an incidental beneficiary benefits without that being the contracting individuals' intention.

beneficiation \ˌbe-nə-ˌfi-shē-'ā-shən\ Treatment of raw material (such as pulverized ore) to improve physical or chemical properties in preparation for further processing. Beneficiation techniques include washing, sizing of particulates, and concentration (which involves the separation of valuable minerals from the other raw materials received from a grinding mill). In large-scale operations, various distinguishing properties of the minerals to be separated (e.g., magnetism, wettability, density) are exploited to concentrate the desirable components. Beneficiation also is used in the ceramics and clay industries. See also flotation; mining; mineral processing.

Benelux Economic Union \'be-nə-ˌləks\ Economic union of Belgium, the Netherlands, and Luxembourg. The three countries formed a customs union in 1948, and in 1958 they signed the Treaty of the Benelux Economic Union, which became operative in 1960. Benelux became the first completely free international labor market and contributed to the establishment of the European Economic Community.

Beneš \'be-ˌnesh**, Edvard** (b. May 28, 1884, Kozlany, Bohemia, Austria-Hungary—d. Sept. 3, 1948, Sezimovo Ústí, Czech.) Czechoslovakian statesman. A disciple of Tomáš Masaryk, Beneš was a founder of modern Czechoslovakia. He served as its first foreign minister (1918–35) and its president (1935–38). Forced to capitulate to Adolf Hitler's demands over the Sudetenland, he resigned. He headed the Czech government-in-exile in England (1940–45), then reestablished a government on his native soil in 1945. Recognizing the need to cooperate with the Soviet Union, he nevertheless refused to sign a new communist constitution and resigned in 1948 shortly before his death.

Benét \bə-'nā**, Stephen Vincent** (b. July 22, 1898, Bethlehem, Pa., U.S.—d. March 13, 1943, New York, N.Y.) U.S. poet, novelist, and short-story writer. Benét is best known for *John Brown's Body* (1928, Pulitzer Prize), a long narrative poem on the American Civil War. *A Book of Americans* (1933), poems written with his wife, the former Rosemary Carr, brought many historical characters to life for American schoolchildren. His story "The Devil and Daniel Webster" (1937) was the basis for a play by Archibald MacLeish, an opera by Douglas Moore (first performed 1939), and two films (1941, 2001).

Bengal \ben-'gȯl\ Former province, northeastern British India. Generally corresponding to the area inhabited by speakers of the Bengali language, it is now divided between eastern India and Bangladesh. Bengal formed part of most of the early empires that controlled northern India. From the 8th to the 12th century it was under a Buddhist dynasty, and from 1576 it belonged to the Mughal Empire. In the 18th century it was dominated by the nawabs of Bengal; they came into conflict with the British, who had established themselves at Calcutta (now Kolkata) in 1690. By 1764 the British had taken possession, and Bengal became the base for British expansion in India. Bengal was partitioned in 1905, and with the end of British rule in 1947, the western portion formed the Indian states of West Bengal, Bihar, and Orissa. East Bengal went to Pakistan; in 1971 it became Bangladesh. Jharkhand state was created from southern Bihar in 2000.

Bengal, Bay of Part of the Indian Ocean. Occupying about 839,000 sq mi (2,172,000 sq km), it is bordered by Sri Lanka, India, Bangladesh, Myanmar, and the northern Malay Peninsula. It is about 1,000 mi (1,600

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km) wide, with an average depth of more than 8,500 ft (2,600 m). Many large rivers, including the Godavari, Krishna, Kaveri, Ganges, and Brahmaputra, flow into it. The Andaman and Nicobar Islands, the bay's only islands, separate it from the Andaman Sea. It has long been crossed by Indian and Malaysian traders; Chinese maritime trading dates from the 12th century. Vasco da Gama led the first European voyage into the bay in 1498.

Bengal, Partition of (1905) Division of Bengal carried out by Lord Curzon, the British viceroy in India. The British province of Bengal, which also included Bihar and Orissa, had by the beginning of the 20th century grown too large to handle under a single administration. Curzon chose to unite eastern Bengal with Assam, leaving western Bengal with Bihar and Orissa. The partition went through despite widespread protests, unrest, and boycotts, but in 1911 eastern and western Bengal were reunited. Assam resumed its old status, and Bihar and Orissa were separated to form a new province.

Bengali \ben-'gä-lē\ **language** Indo-Aryan language spoken principally in Bangladesh and the Indian state of West Bengal. Bengali has more speakers—some 190 million—than all but a handful of other languages of the world. Like other Modern Indo-Aryan languages, Bengali has drastically reduced the complex inflectional system of Old Indo-Aryan (see Sanskrit language). It has virtually dropped grammatical gender and fixed stress on the initial syllable of a word or phrase. Bengali was the first of the Indian languages to adopt Western secular literary styles, such as fiction and drama.

Benghazi See Banghāzī

Beni \'bā-nē\ **River** River, Bolivia. Rising in the eastern cordillera of the Andes Mountains, it flows north and unites with the Mamoré River to form the Madeira River at Villa Bella. Near its mouth it receives the Madre de Dios River. It is 994 mi (1,599 km) long.

Benin \bə-'nēn\ *officially* **Republic of Benin** *formerly* **Dahomey** Country, western Africa. Area: 43,484 sq mi (112,622 sq km). Population (2005 est.): 7,649,000. Capital: Porto-Novo (official), Cotonou (de facto). The Fon people and related groups constitute two-fifths of the population; minorities include the Yoruba, Fulani, and Adjara. Languages: French (official), Fon. Currency: CFA franc. Religions: traditional religions, Islam, Christianity. Extending about 420 mi (675 km) inland from the Gulf of Guinea, Benin includes a hilly region in the northwest, where the maximum elevation is 2,103 ft (641 m). There are plains in the east and north and a marshy region in the south, where the coastline extends about 75 mi (120 km). Benin's longest river, the Ouémé, flows into the Porto-Novo Lagoon and is navigable for 125 mi (200 km) of its 280-mi (450-km) length. Benin has a developing mixed economy based largely on agriculture and operates an offshore oil field. It is a republic with one legislative house; the head of state and government is the president, assisted by the prime minister. In southern Benin the Fon established the Abomey kingdom in the early 17th century. In the 18th century the kingdom expanded to include Allada and Ouidah, where French forts had been established in the 17th century. By 1882 the French were firmly reestablished in the area, and conflict between the French and Africans ensued. In 1894 Dahomey became a French protectorate; it was incorporated into the federation of French West Africa in 1904. It achieved independence in 1960. Dahomey was renamed Benin in 1975. Its chronically weak economy created problems for the country into the 21st century.

Benin, Bight of Bay, northern section of Gulf of Guinea. It extends along the West African coast about 400 mi (640 km) from Cape St. Paul, Ghana, past Togo and Benin to an outlet of the Niger River in Nigeria. Major ports include Lomé, Cotonou, and Lagos. It was the scene of extensive slave trading during the 16th–19th century, and the region of coastal lagoons west of the Niger delta became known as the Slave Coast. By the 1830s trade in palm oil had become the major economic activity. Petroleum was discovered in the Niger delta in the 1950s.

Benin, kingdom of One of the principal historic kingdoms (12th–19th century) of the western African forest region. Founded by the Edo people, the kingdom was centred on present-day Benin City in southern Nigeria.With the accession of Ewuare the Great in the mid 15th century, the Benin kingdom was vastly expanded, including the founding of the city of Lagos. The Portuguese first visited Benin in the late 15th century, and, for a time, Benin traded ivory, palm oil, pepper, and slaves with Portuguese and Dutch traders. Benin stopped trading slaves with Europeans in the 18th century and focused attention on dependent regions around it. Succession struggles in the 18th and 19th centuries put a series of weaker kings on the throne. After the British attacked and burned Benin City in 1897, the kingdom was incorporated into British Nigeria.

Benjamin, Judah P(hilip) (b. Aug. 6, 1811, St. Croix, Virgin Islands—d. May 6, 1884, Paris, France) Prominent lawyer in the U.S. and Britain and member of the Confederate cabinet. He moved with his parents from St. Croix to South Carolina in his early youth. In 1832 he began building a successful law practice in New Orleans. He was the first Jew elected to the U.S. Senate (1853–61), where he was noted for his proslavery speeches. After the South seceded, Jefferson Davis appointed him attorney general (1861), secretary of war (1861–62), and secretary of state (1862–65). Late in the war he enraged many white Southerners by urging that slaves be recruited into the Confederate army and emancipated after their term of service. At the end of the war he escaped to England, where he was called to the bar (1866) and served as queen's counsel (1872).

Judah Benjamin
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Benjamin \'ben-yä-ˌmēn,\ *English* \'ben-jə-mən**, Walter** (b. July 15, 1892, Berlin, Ger.—d. Sept. 26, 1940, near Port-Bou, Spain) German literary critic. Born into a prosperous Jewish family, Benjamin studied philosophy and worked as a literary critic and translator in Berlin from 1920 until 1933, when he fled to France to avoid persecution. The Nazi takeover of France led him to flee again in 1940; he committed suicide at the Spanish border on hearing that he would be turned over to the Gestapo. Posthumous publication of his essays has won him a reputation as the leading German literary critic of the first half of the 20th century; he was also one of the first serious writers about film and photography. His independence and originality are evident in the essays collected in *Illuminations* (1961) and *Reflections* (1979). His writings on art reflect his reading of Karl Marx and his friendships with Bertolt Brecht and Theodor Adorno.

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Benn, Gottfried (b. May 2, 1886, Mansfeld, Ger.—d. July 7, 1956, Berlin) German poet and essayist. He received military medical training and was made medical supervisor of jail inmates and prostitutes in occupied Brussels during World War I. His early poems, including those in *Fleisch* (1917; "Flesh"), contain allusions to degeneracy and medical aspects of decay. Because of his Expressionism and despite his right-wing views, he was penalized during the Nazi era. He regained literary attention with *Statische Gedichte* (1948; "Static Poems") and the reappearance of his old poems. A broad selection of his poetry and prose was published in English as *Primal Vision* (1961).

Bennett, Alan (b. May 9, 1934, Leeds, Yorkshire, Eng.) British dramatist, screenwriter, and actor. He first gained success with the brilliant satirical revue *Beyond the Fringe* (1960), which he cowrote and performed with Dudley Moore, Peter Cook, and JONATHAN MILLER. His first stage play, *Forty Years On* (1968), was followed by plays such as *Getting On* (1971) and *Enjoy* (1980). He later wrote works for television, including *An Englishman Abroad* (1982) and *Talking Heads* (1988), which were marked by his characteristic mixture of wry comedy and sadness. His screenplays include *Prick Up Your Ears* (1987). His successful play *The Madness of King George* (1991) was made into an acclaimed film in 1994.

Bennett, (Enoch) Arnold (b. May 27, 1867, Hanley, Staffordshire, Eng.—d. March 27, 1931, London) English novelist, playwright, critic, and essayist. His major works, inspired by GUSTAVE FLAUBERT and HONORÉ DE BALZAC, form an important link between the English novel and the mainstream of European realism. He is best known for his highly detailed novels of the "Five Towns"—the Potteries in his native Staffordshire—which are the setting of *Anna of the Five Towns* (1902), *The Old Wives' Tale* (1908), and the three novels that make up *The Clayhanger Family* (1925). He was also a well-known critic.

Bennett, James Gordon (b. Sept. 1, 1795, Newmill, Banffshire, Scot.—d. June 1, 1872, New York, N.Y., U.S.) Scottish-born U.S. editor. He immigrated to the U.S. in 1819 and was employed on various newspapers until 1835, when he started *The New York Herald*. The paper became very successful and introduced many of the methods of modern news reporting. Among other innovations, Bennett published the first Wall Street financial article (1835), established the first correspondents in Europe (1838), maintained a staff of 63 war correspondents during the Civil War, was a leader in using illustrations, introduced a society department, and published the first account in U.S. journalism of a love-nest murder (1836).

Bennett, Michael *orig.* **Michael Bennett Difiglia** (b. April 8, 1943, Buffalo, N.Y., U.S.—d. July 2, 1987, Tucson, Ariz.) U.S. dancer, choreographer, and stage musical director. He began dancing at age three and left high school to tour in a production of *West Side Story*. His major contribution to dance was as choreographer-director of Broadway musicals such as *Promises, Promises* (1968), *Company* (1970), *Follies* (1971), and *Dreamgirls* (1981). His most remarkable musical was *A Chorus Line* (1975, Pulitzer Prize), which he conceived, directed, and choreographed. Bennett personally received eight Tony awards during his career.

Bennett (of Mickleham and of Calgary and Hopewell), Richard Bedford Bennett, Viscount (b. July 3, 1870, Hopewell, N.B., Can.—d. June 27, 1947, Mickleham, Surrey, Eng.) Canadian prime minister (1930–35). Bennett was admitted to the bar in 1893 and practiced in New Brunswick. He then moved west and served in the legislatures of the Northwest Territories and Alberta and in the Canadian House of Commons (1911). He was named director general of national service (1916) and later minister of justice (1921). He became head of the Conservative Party in 1927 and, promising relief from the Great Depression, prime minister in 1930. But he underestimated the severity of the crisis, and his measures were ineffective. He was defeated by the Liberals under W.L. MACKENZIE KING. In 1939 he retired to England, where he was made a viscount in 1941.

Bennett, Tony *orig.* **Anthony (Dominick) Benedetto** (b. Aug. 3, 1926, Astoria, Queens, N.Y., U.S.) U.S. popular singer. His first job was as a singing waiter, and he later sang under the name Joe Bari. In 1949 Pearl Bailey asked him to join her nightclub revue, and in 1950 BOB HOPE suggested his new name. He had many hits in the 1950s, but "I Left My Heart in San Francisco" (1962) became his signature song. His style grew increasingly jazz-oriented over the years, and in the mid-1990s a special appearance on MTV heralded his comeback.

Benny, Jack *orig.* **Benjamin Kubelsky** (b. Feb. 14, 1894, Chicago, Ill., U.S.—d. Dec. 27, 1974, Beverly Hills, Calif.) U.S. comedian. He took up the violin as a boy and played it in vaudeville from 1912. After discovering a talent for comedy while in the navy, he returned to vaudeville as a comedian. He made his film debut in 1927 and appeared in 18 films in the years 1930–45. His weekly *Jack Benny Program* on radio (1932–55) and television (1950–65) won loyal audiences, and he became famous for a unique comic style characterized by subtle verbal inflection, meaningful pauses, seriocomic violin playing, and the stage image of a vain, stingy man.

Benois \'byi-nȯi**, Alexandre (Nikolayevich)** (b. May 4, 1870, St. Petersburg, Russia—d. Feb. 9, 1960, Paris, Fr.) Russian theatre art director, painter, and influential ballet set designer. With SERGEY DIAGHILEV he cofounded the avant-garde art magazine *Mir Iskusstva* ("World of Art") in 1899. He began his scenic-design career in 1901 and designed many of the innovative BALLETS RUSSES decors from 1909 to 1929. He designed sets for numerous other ballet companies in the 1940s and 1950s.

Bénoué River See BENUE RIVER

bent grass Any of the annual or perennial GRASSES that make up the genus *Agrostis*, in the family Poaceae (or Gramineae), found in temperate and cool regions and at high altitudes in subtropical and tropical areas. At least 40 species are found in the U.S.; some are weeds, others FORAGE and TURF plants. They have slender stems and flat blades. Many spread by creeping STOLONS. Redtop (*A. gigantea*) is a HAY and pasture grass. Creeping bent (*A. stolonifera* variety *palustris*) and colonial bent (*A. tenuis*) are popular lawn grasses; the many strains of both species are planted in golf courses and bowling greens, where they are closely cut to develop a fine, spongy, firm turf.

Creeping bent (*Agrostis stolonifera* variety *palustris*)
R.G. DOORD—THE NATURAL HISTORY PHOTOGRAPHIC AGENCY/EB INC.

Bentham \'ben-thəm**, Jeremy** (b. Feb. 15, 1748, London, Eng.—d. June 6, 1832, London) British moral philosopher and legal theorist, the earliest expounder of UTILITARIANISM. A precocious student, he graduated from Oxford at age 15. In his *An Introduction to the Principles of Morals and Legislation*, he argued that mankind was governed by two sovereign motives, pain and pleasure. The object of all legislation, therefore, must be the "greatest happiness of the greatest number"; and since all punishment involves pain and is therefore evil, it ought only to be used "so far as it promises to exclude some greater evil." His work inspired much reform legislation, especially regarding prisons. He was also an exponent of the new laissez-faire economics of ADAM SMITH and DAVID RICARDO. Though a vocal advocate of democracy, he rejected the notions of the SOCIAL CONTRACT, NATURAL LAW, and natural rights as fictional and counterproductive ("Rights is the child of law; from real law come real rights; but from imaginary laws, from 'law of nature,' come imaginary rights"). He helped found the radical *Westminster Review* (1823). In accordance with his will, his clothed skeleton is permanently exhibited at University College, London.

Jeremy Bentham, detail of an oil painting by H.W. Pickersgill, 1829; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Bentham, Sir Samuel (b. Jan. 11, 1757, England—d. May 31, 1831, London) British engineer, naval architect, and navy official. He was the

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brother of Jeremy Bentham and father of the botanist George Bentham (1800–84). An early advocate of explosive-shell weapons for warships, Bentham led Russian vessels fitted with shell guns to victory over a larger Turkish force in 1788. In England he developed the Arrow class of sloops used against France. He served as commissioner of the navy (1807–12).

Bentinck, William (Henry Cavendish), Lord (b. Sept. 14, 1774, Bulstrode, Buckinghamshire, Eng.—d. June 17, 1839, Paris, France) British colonial administrator. Born to wealth and rank, he was appointed governor of Madras in 1803. Recalled in 1807 after a mutiny of Indian troops at Vellore, he pressed for the next 20 years for a chance to vindicate his name. In 1828 he was named governor-general of Bengal (in effect, of all India), and he served until 1835. He reformed the country's finances, opened up administrative and judicial posts to Indians, suppressed bands of assassins known as thugs, and abolished suttee. His policies helped pave the way to independence more than a century later.

Bentley, Eric (Russell) (b. Sept. 14, 1916, Bolton, Lancashire, Eng.) British-born U.S. drama critic and translator. He was a stage director in several European cities (1948–51); in Munich, after working with Bertolt Brecht on a production of the playwright's *Mother Courage*, he translated Brecht's plays into English. His reporting on European theatre for several magazines helped introduce many European playwrights to the U.S. He wrote numerous critical works, including *Life of the Drama* (1964), and taught at Columbia University (1953–69) and elsewhere.

Bentley, Richard (b. Jan. 27, 1662, Oulton, Yorkshire, Eng.—d. July 14, 1742, Cambridge, Cambridgeshire) English clergyman and classical scholar. He was appointed Boyle lecturer at Oxford in 1692, became keeper of the Royal Library in 1694, and was named master of Trinity College, Cambridge, in 1700. He displayed his skill in textual emendation and his knowledge of ancient metre in *Epistola ad Joannem Millium* (1691). In *Dissertation on the Epistles of Phalaris* (1699), he proved the epistles to be spurious; his dispute with Charles Boyle over their authenticity was satirized by Jonathan Swift in *The Battle of the Books* (1704). He also published critical texts of classical authors, including Horace, and made linguistic contributions to the study of ancient Greek.

Benton, Thomas Hart (b. March 14, 1782, near Hillsborough, N.C., U.S.—d. April 10, 1858, Washington, D.C.) U.S. politician. After moving to St. Louis, Mo. (1815), he became editor of the *St. Louis Enquirer*. Appealing to agrarian and commercial interests, he won election to the U.S. Senate in 1820. He became a crusader for the distribution of public lands to settlers and was soon acknowledged as the chief spokesman in the Senate of the early Democratic Party. His opposition to the extension of slavery into the West cost him his Senate seat in 1851, though he later served in the House of Representatives (1853–55). His grandnephew was the artist Thomas Hart Benton.

Thomas Hart Benton, c. 1845–50.
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Benton, Thomas Hart (b. April 15, 1889, Neosho, Mo., U.S.—d. Jan. 19, 1975, Kansas City, Mo.) U.S. painter and muralist. He studied at the Art Institute of Chicago and at the Académie Julian in Paris, where he came into contact with Synchromism and Cubism. In 1912 he returned to the U.S. and settled in New York City. Failing in his attempts at Modernism, he set out to travel through the rural heartland, sketching people and places. In the 1930s he painted several notable murals, including *America Today* (1930–31) at the New School for Social Research. He often transposed biblical and classical stories to rural American settings, as in *Susanna and the Elders* (1938). His style, which quickly became influential, is characterized by undulating forms, cartoonlike figures, and brilliant colour. He taught at the Art Students League in New York, where Jackson Pollock was his best-known student.

Benton, William (Burnett) (b. April 1, 1900, Minneapolis, Minn., U.S.—d. March 18, 1973, New York, N.Y.) U.S. publisher, advertising executive, and government official. A descendant of missionaries and educators, he founded, with Chester Bowles, the successful New York advertising agency of Benton & Bowles. He later became a vice president of the University of Chicago; through his efforts, the university acquired *Encyclopaedia Britannica*, which he managed and later purchased. In 1945 he became assistant secretary of state, and he later briefly served in the U.S. Senate (1949–52). Thereafter he devoted sustained attention to the encyclopaedia; he died shortly before the publication of its 15th edition.

bentwood furniture Type of furniture made of wooden rods bent into shape after being heated with steam. The method was used on the 18th-century Windsor chair, but its principal exponent was Michael Thonet, who exploited its possibilities in the 1840s. His bentwood chairs are among the most successful examples of early mass-produced furniture. Bentwood is light, comfortable, and inexpensive, as well as strong and graceful.

Bent beechwood armchair by the Thonet brothers, Austria, c. 1870; in the Museum of Modern Art, New York City
COURTESY OF THE MUSEUM OF MODERN ART, NEW YORK, GIFT OF THONET INDUSTRIES

Benue-Congo \'bā-nwā\ **languages** Largest branch of the Niger-Congo language family, both in numbers of languages (900) and speakers (at least 500 million). Its major divisions are Defoid, including Yoruba, with more than 20 million speakers; Edoid, including Edo (see kingdom of Benin); Nupoid, including Nupe, Ebira, and Gbagyi; Idomoid, including Idoma; Igboid, including the many dialects of the approximately 19 million Igbo people; Kainji, with 40 languages; Platoid, a congeries of 50 languages; Cross River, a group of more than 55 languages; and Bantoid. The largest branch, Bantoid, comprises a Northern and a Southern group and includes more than 500 languages, 47 of which are spoken by more than 1 million people. The Bantu languages make up the largest subgroup of Southern Bantoid.

Benue \'bā-nwā\ **River** *or* **Bénoué** \bā-'nwā\ **River** River, western Africa. Rising in northern Cameroon (as the Bénoué), the river flows west across east-central Nigeria (as the Benue). About 870 mi (1,400 km) long, it is the chief tributary of the Niger River and transports a considerable volume of trade.

Benz \'bents**, Karl (Friedrich)** (b. Nov. 25, 1844, Karlsruhe, Baden—d. April 4, 1929, Ladenburg, Ger.) German mechanical engineer who designed and built the first practical automobile powered by an internal-combustion engine. The original car, his three-wheeled *Motorwagen*, first ran in 1885. Benz's company produced its first four-wheeled car in 1893 and the first of its series of racing cars in 1899. Benz left the company in 1906 to form another group with his sons. In 1926 the Benz company merged with the company started by Gottlieb Daimler.

benzene Simplest aromatic hydrocarbon (see aromatic compound), parent substance of a large class of chemical compounds. It was discovered in 1825 by Michael Faraday. The chemical formula is C_6H_6; August Kekule von Stradonitz in 1865 was the first to propose the correct structure, a six-membered ring of carbon atoms, each with one hydrogen atom bonded to it (see bonding). Although benzene is often represented with alternating single and double bonds between carbon atoms, the electrons in the bonds are shared or delocalized in such a way as to make all carbon-carbon bonds alike. Benzene is a colourless, mobile liquid with a characteristic odour. An excellent solvent, it is also widely used as a starting material for many plastics, dyes, detergents, insecticides, and other industrial chemicals. Benzene is highly toxic, and long exposure may cause leukemia.

Benzer, Seymour (b. Oct. 15, 1921, New York, N.Y., U.S.) U.S. molecular biologist. He received his Ph.D. from Purdue University. He developed a method for determining the detailed structure of viral genes and coined the term *cistron* to denote functional subunits of genes. He did much to explain the nature of genetic oddities, called nonsense mutations, in terms of the nucleotide sequence of DNA, and he discovered a reversal, or suppression, of these mutations in certain bacteria.

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Beowulf \'bā-ə-ˌwůlf\ Heroic poem considered the highest achievement of Old English literature and the earliest European vernacular EPIC. It deals with events of the early 6th century and was probably composed c. 700–750. It tells the story of the Scandinavian hero Beowulf, who gains fame as a young man by vanquishing the monster Grendel and Grendel's mother; later, as an aging king, he kills a dragon but dies soon after, honoured and lamented. *Beowulf* belongs metrically, stylistically, and thematically to the Germanic heroic tradition but shows a distinct Christian influence.

Berain \bā-'ra^{n}**, Jean, the Elder** (b. Oct. 28, 1637, Saint-Mihiel, Fr.—d. Jan. 24, 1711, Paris) French decorator and designer. Trained under CHARLES LE BRUN, he was appointed chief designer to the court of LOUIS XIV in 1674. He was skilled in designing tapestries, accessories, furniture, costumes, and elaborate stage settings for operas and extravagant theatrical productions; these were typically filled with fantastic iconography. He satisfied the king's appetite for splendour and inspired other cabinetmakers such as ANDRÉ-CHARLES BOULLE.

Berar \bā-'rär\ Historical region, west-central INDIA. Located in what is now northern MAHARASHTRA state, Berar emerged as a distinct political entity after the incursions of Muslim armies in the 13th century AD. It formed part of several Muslim kingdoms until, on the breakup of the Mughal Empire, it fell to the ruler of Hyderabad. Coming under British control in 1853, it was subsequently assigned to various provinces; it has been part of Maharashtra state since 1960. The region includes a rich cotton-growing area in the Purna River basin.

Berber Any member of a community native to the MAGHRIB who speaks one of various Berber languages, including Tamazight, Tashahit, and Tarifit. Berber-speakers were the original inhabitants of North Africa, though many regions succumbed to colonization by the ROMAN REPUBLIC AND EMPIRE and later (from the 7th century AD) to conquest by the ARABS. Berbers gradually accepted Islam, and many switched to Arabic or became bilingual. Berber languages are still spoken in some rural and mountain areas of Morocco and Algeria and by some inhabitants of Tunisia and Libya. Since the 1990s Berber intellectuals have sought to revive interest in the language. The Berber-speaking ALMORAVID and ALMOHAD dynasties built empires in North Africa and Spain in the 11th–13th centuries. See also ABD EL-KRIM; KABYLE; RIF.

Berbice \bər-'bēs\ **River** River, eastern Guyana. Rising in Guyana's highlands, it flows northward 370 mi (595 km) through dense forests to the Atlantic Ocean. Its basin is restricted by the proximity of the larger ESSEQUIBO and COURANTYNE rivers. Its name derives from a Dutch colony that became part of British Guiana (now Guyana) in 1831.

Berchtesgaden \'berk-təs-ˌgäd-ᵊn\ Town (pop., 1992 est.: 8,000), southern Germany. Located in the Bavarian Alps south of SALZBURG, it is surrounded on three sides by Austrian territory. Once part of Austria, it passed to BAVARIA in the early 19th century. It was the site of ADOLF HITLER's villa retreat before and during World War II. In 1938 he met there with NEVILLE CHAMBERLAIN. Destroyed by bombing in 1945, the villa was leveled in 1952. Mountain climbing and skiing make the area a popular destination.

Berchtold \'berk̲-ˌtōlt**, Leopold, count von** (b. April 18, 1863, Vienna, Austria—d. Nov. 21, 1942, near Csepreg, Hung.) Austro-Hungarian politician. One of the richest men in Austria-Hungary, he entered the diplomatic service in 1893 and became foreign minister in 1912. After the assassination of Archduke FRANCIS FERDINAND in 1914, Berchtold delivered an ultimatum to Serbia that led to the outbreak of WORLD WAR I. He was forced to resign in 1915.

Berengar of Tours \'ber-ən-ˌgär...'tůr\ (b. c. 999, Tours, Touraine—d. Jan. 10, 1088, priory of Saint-Cosme, near Tours) French theologian. He became canon of Tours Cathedral and archdeacon of Angers (c. 1040). He rejected the prevailing eucharistic theology and argued against any material change to the bread and wine. He was opposed by numerous theologians, most notably LANFRANC, and may have been excommunicated (1050) by Pope LEO IX. He was condemned by the Council of Vercelli (1050) and the Synod at Paris (1051). After a compromise, he was again condemned in 1076, 1078, 1079, and 1080 and spent the rest of his life in ascetic solitude.

Berenson \'ber-ən-sən**, Bernard** (b. June 26, 1865, Vilnius, Lithuania, Russian Empire—d. Oct. 6, 1959, Settignano, Italy) Lithuanian-born U.S. art historian, critic, and connoisseur. He grew up in Boston and attended Harvard University, but for most of his life he lived in Italy, where he built a reputation as an authority on Italian Renaissance painting. He was adviser to the art dealer Joseph Duveen (1869–1939) and to Isabella Stewart Gardner (1840–1924), founder of Boston's Gardner Museum. Berenson bequeathed his villa, I Tatti (near Florence), with its art collection and outstanding library, to Harvard to be administered as the Harvard Center for Italian Renaissance Studies. His books include *The Drawings of the Florentine Painters* (1903, 1938, 1961) and *Italian Painters of the Renaissance* (1952).

Berezina River \bə-'rāz-ᵊn-ə\ River, Belarus. It is 365 mi (587 km) long and flows southeast into the DNIEPER RIVER. During NAPOLEON's retreat from Moscow in 1812, a bitter engagement was fought on the Berezina at the crossroads of the river near Baryslaw, and Russian forces inflicted enormous losses on Napoleon's army. In 1941 it was the scene of fierce fighting during the German advance on SMOLENSK.

Berg \'berk̲\ Former duchy, HOLY ROMAN EMPIRE. Located on the RHINE RIVER, the area now lies in the districts of DÜSSELDORF and COLOGNE, Germany. In the 11th century the counts of Berg acquired Westphalian lands east of Cologne; these were incorporated into a duchy in 1380. Berg became a leading iron and textile manufacturing centre in the 17th–18th centuries. In 1806 NAPOLEON made it a grand duchy in his CONFEDERATION OF THE RHINE. Following the Congress of VIENNA in 1814–15, it became part of PRUSSIA.

Berg \'berk̲**, Alban (Maria Johannes)** (b. Feb. 9, 1885, Vienna, Austria-Hungary—d. Dec. 24, 1935, Vienna, Austria) Austrian composer. He was largely self-taught musically until he met ARNOLD SCHOENBERG at age 19. This would prove to be the decisive event in his life, and Schoenberg would remain his teacher for eight years. Under his influence, Berg's early late-Romantic tonal works gave way to increasing ATONALITY and finally (1925) to 12-tone composition. His Expressionist opera *Wozzeck* (1922) would become the most universally acclaimed post-Romantic opera. His second opera, *Lulu*, on which he worked for six years, remained unfinished at his death. Berg's other works include two string quartets, including the *Lyric Suite* (1926); *Three Pieces for Orchestra* (1915); and a violin concerto (1935).

Berg, Paul (b. June 30, 1926, New York, N.Y., U.S.) U.S. biochemist. He received his Ph.D. from Western Reserve University. While studying the actions of isolated genes, he devised methods for splitting DNA molecules at selected sites and attaching the resulting segments to the DNA of a virus or plasmid, which could then enter bacterial or animal cells. The foreign DNA was incorporated into the host and caused the synthesis of proteins not ordinarily found there. One of the earliest practical results of this research was the development of a strain of bacteria that contained the gene for producing insulin. In 1980 Berg shared a Nobel Prize with Walter Gilbert (b. 1932) and FREDERICK SANGER.

bergamot \'bər-gə-ˌmät\ Any of several North American perennial plants of the MINT family, also known as BEE BALM, fragrant balm, and Indian's plume. The leaves are used as an herb to flavour tea, punches, lemonade, and other cold drinks. *Monarda didyma*, native to the U.S., is made into Oswego tea, a beverage used by the American Indian Oswego tribe and said to be the drink adopted by the 18th-century colonists during their boycott of British tea. The pear-shaped fruit of the bergamot orange (*Citrus bergamia*), found chiefly in Calabria, Italy, is valued by the flavouring and perfume industries for the ESSENTIAL OIL extracted from its peel. The bergamot pear, a popular winter pear cultivated in Britain, is a large, round fruit with yellowish green skin.

Bergen City (pop., 2000 est.: municipality, 229,496), southwestern Norway. It is Norway's second largest city and most important port. Founded in 1070 by King Olaf III, it was Norway's capital in the 12th–13th centuries. In the 14th century, German HANSEATIC LEAGUE merchants acquired control over its trade; their influence in a weakened Norway lasted into the 16th century. Repeatedly destroyed by fire (most notably in 1702 and 1916), Bergen has been resurrected each time. Its economy is based largely on fishing and shipbuilding. It was the birthplace of EDVARD GRIEG and the violinist OLE BULL.

Bergen, Edgar *orig.* **Edgar John Bergren** (b. Feb. 16, 1903, Chicago, Ill., U.S.—d. Sept. 30, 1978, Las Vegas, Nev.) U.S. comedian and ventriloquist. As a boy he developed the skill in VENTRILOQUISM that he later used to earn his tuition at Northwestern University. After stints in vaudeville and nightclubs, he took his act to radio, where the *Edgar Bergen–*

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Charlie McCarthy Show (with his caustic and irrepressible dummy Charlie McCarthy) was one of the most popular programs for 20 years (1937–57). His daughter, Candice (b. 1946), was a successful screen and television actress.

Bergen-Belsen *or* **Belsen** Nazi CONCENTRATION CAMP near Bergen and Belsen, villages in what was then Prussian Hannover, Germany. Established in 1943 partly as a prisoner-of-war camp and partly as a Jewish transit camp, it was designed for 10,000 prisoners but eventually held about 60,000, most of whom lacked any food or shelter. It contained no gas chambers, but some 35,000 prisoners died there, including ANNE FRANK, between January and mid-April 1945. As the first such camp to be liberated by the Western Allies (April 15, 1945), it received instant notoriety. Some 28,000 prisoners died of diseases and other causes in the weeks after their liberation by British troops.

Berger, Victor (Louis) (b. Feb. 28, 1860, Nieder-Rehbach, Austria-Hungary—d. Aug. 7, 1929, Milwaukee, Wis., U.S.) Cofounder of the U.S. Socialist Party. He immigrated to the U.S. from Austria-Hungary in 1878, founded a German-language newspaper in 1892, and edited the *Social Democratic Herald* (later *Milwaukee Leader*) from 1898 to 1929. With EUGENE V. DEBS he founded the Social Democratic Party, which became the Socialist Party in 1901. He served in the U.S. House of Representatives (1911–13) as the first Socialist ever elected to Congress. Elected again in 1918, he was denied his seat after being convicted under the Espionage Act for opposing U.S. participation in World War I. His conviction was overturned, and he again served in the House (1923–29) and succeeded Debs as Socialist Party chairman (1927–29).

Bergerac, Savinien Cyrano de See Savinien CYRANO DE BERGERAC

Bergey \'bər-gē**, David Hendricks** (b. Dec. 27, 1860, Skippack, Pa., U.S.—d. Sept. 5, 1937, Philadelphia, Pa.) U.S. bacteriologist. He taught school before attending the University of Pennsylvania, where he earned a doctorate in public health. He subsequently became director of biological research for the National Drug Company in Philadelphia. He is best remembered as the primary author of *Bergey's Manual of Determinative Bacteriology*, a reference for classification of bacteria, and he researched such varied topics as tuberculosis, food preservatives, phagocytosis (engulfment of particles by cells), and allergic reactions.

Bergman, (Ernst) Ingmar (b. July 14, 1918, Uppsala, Swed.) Swedish film writer-director. The rebellious son of a Lutheran pastor, he worked in the theatre before directing his first film, *Crisis* (1945). He won international acclaim for his films *The Seventh Seal* (1956) and *Wild Strawberries* (1957). He assembled a group of actors, including MAX VON SYDOW and LIV ULLMANN, and a cinematographer, SVEN NYKVIST, with whom he made powerful films often marked by bleak depictions of human loneliness, including *Through a Glass Darkly* (1961), *Cries and Whispers* (1972), *Autumn Sonata* (1978), and *Fanny and Alexander* (1982). He later wrote screenplays for *The Best Intentions* (1992) and *Private Confessions* (1996). Throughout his career Bergman continued to direct stage productions, usually at Stockholm's Royal Dramatic Theatre.

Bergman, Ingrid (b. Aug. 29, 1915, Stockholm, Swed.—d. Aug. 29, 1982, London, Eng.) Swedish film and stage actress. After appearing in *Intermezzo* in Sweden, she went to the U.S. to act in the English-language version (1939). Her radiance and unaffected charm made her a star in films such as *Casablanca* (1942), *Gaslight* (1944, Academy Award), and ALFRED HITCHCOCK's *Spellbound* (1945) and *Notorious* (1946). The scandal caused by her love affair with ROBERTO ROSSELLINI (1949) kept her off the U.S. screen for seven years, and she made films in Europe before being welcomed back to Hollywood in *Anastasia* (1956, Academy Award). Her later films include *Indiscreet* (1958) and *Murder on the Orient Express* (1974, Academy Award).

Bergson \berk-'sōⁿ**, Henri (-Louis)** (b. Oct. 15, 1859, Paris, France—d. Jan. 4, 1941, Paris) French philosopher. In *Creative Evolution* (1907), he argued that evolution, which he accepted as scientific fact, is not mechanistic but driven by an *élan vital* ("vital impulse"). He was the first to elaborate a PROCESS PHILOSOPHY, rejecting static values and embracing dynamic values such as motion, change, and evolution. His writing style has been widely admired for its grace and lucidity; he won the Nobel Prize for Literature in 1927. Very popular in his time, he remains influential in France. See photograph opposite.

Beria \'ber-ē-ə**, Lavrenty (Pavlovich)** (b. March 29, 1899, Merkheuli, Russia—d. Dec. 23, 1953, Moscow, Russia, U.S.S.R.) Soviet politician and director of the Soviet secret police. He worked in intelligence and counterintelligence activities from 1921. As Communist Party head of the Transcaucasian republics (1932–38), he personally oversaw the political purges initiated by JOSEPH STALIN (see PURGE TRIALS). He was head of the Soviet secret police (1938–53), and after Stalin's death he became one of four deputy prime ministers and the head of the Ministry of Internal Affairs. After attempting to succeed Stalin as sole dictator, he was arrested and executed.

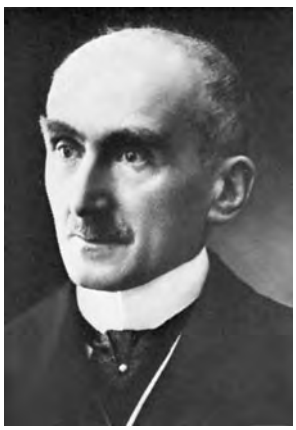
beriberi \ˌber-ē-'ber-ē\ *or* **vitamin B_1 deficiency** Nutritional disorder, with nerve and heart impairment, caused by THIAMIN deficiency. Its name is from the Sinhalese word for "extreme weakness." Symptoms include fatigue, digestive problems, and limb numbness and weakness. Dry beriberi involves gradual long-nerve degeneration, with muscle atrophy and loss of reflexes. Wet beriberi is more acute, with EDEMA from cardiac failure and poor circulation. Thiamin occurs widely in food but is lost in processing; a well-balanced diet high in unprocessed foods can prevent beriberi. In Western countries, chronic alcoholism is the most common cause.

Bering, Vitus (Jonassen) (b. 1681, Horsens, Den.—d. Dec. 19, 1741, Bering Island, near the Kamchatka Peninsula) Danish-born Russian navigator. He joined the fleet of the Russian tsar PETER I and in 1724 was appointed leader of an expedition to determine whether Asia and North America were connected by land. In 1728 he set sail from the Kamchatka Peninsula of Siberia and passed through what would later be named the Bering Strait. His plan for a second expedition was expanded into Russia's Great Northern Expedition (1733–43), which mapped much of the Arctic coast of Siberia. After exploring the Alaskan coast, he fell ill from scurvy and died after his ship was wrecked. His exploration paved the way for a Russian foothold in North America.

Bering Sea Marginal sea, North PACIFIC OCEAN. Enclosed by Alaska, the ALEUTIAN ISLANDS, the KAMCHATKA Peninsula, and eastern SIBERIA, it covers some 890,000 sq mi (2,304,000 sq km). It has numerous islands, including Karagin and Nunivak, as well as the St. Lawrence, Aleutian, and Komandor archipelagos. It is crossed diagonally by the INTERNATIONAL DATE LINE. The sea is connected to the ARCTIC OCEAN by the Bering Strait, which separates Asia from North America and is believed to have been a land bridge during the Ice Age that enabled migration from Asia to North America. VITUS BERING's exploration of the sea and strait in 1728 and 1741 formed a basis for Russian claims to Alaska.

Bering Sea Dispute Dispute between the U.S. and Britain (and Canada) over the international status of the BERING SEA. In an attempt to control seal hunting off the Alaskan coast, the U.S. in 1881 claimed authority over the Bering Sea and the right to seize sealing vessels. When several Canadian ships were seized in the late 1880s, Britain protested the U.S. claim. An agreement in 1891 permitted both countries to police the area. In 1893 an international tribunal determined that the area was part of the high seas and that no nation had jurisdiction over it.

Berio, Luciano (b. Oct. 24, 1925, Oneglia, Italy—d. May 27, 2003, Rome) Italian composer. He was an important innovator in electronic music, the combining of live and taped music, aleatory music, graphic notation, musical "collage" using borrowed material, and (perhaps most significantly) in musical "performance pieces." His wife, the singer Cathy Berberian (1925–83), was his principal collaborator. His best-known works include *Omaggio a Joyce* (1958), *Visage* (1961), *Sinfonia* (1968), *Opera* (1970), and his series of *Sequenze* (1958–2002).



Henri Bergson, 1928.
ARCHIV FUR KUNST UND GESCHICHTE, WEST BERLIN

Berkeley City (pop., 2000: 102,743), west-central California, U.S. Located on San Francisco Bay, the city was founded as Ocean View in 1853 and selected as a campus site by the College (later University) of California. The campus, named for the philosopher GEORGE BERKELEY, opened in 1873. See also University of CALIFORNIA.

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Berkeley, Busby *orig.* **William Berkeley Enos** (b. Nov. 29, 1895, Los Angeles, Calif., U.S.—d. March 14, 1976, Palm Springs, Calif.) U.S. film director and choreographer. The son of itinerant actors, he acted and danced in comedies from age five. After choreographing over 20 Broadway musicals, he was summoned to Hollywood to direct dance numbers for *Whoopee* (1930). His elaborate production numbers, innovative camera techniques, and opulent sets in such films as *Gold Diggers of 1933* and *Footlight Parade* (1933) revolutionized the musical and offered escapist fare for moviegoers during the Great Depression. When rising production costs made such extravaganzas unfeasible, he directed less innovative but still popular films such as *The Gang's All Here* (1943).

Berkeley \'bärk-lē**, George** *known as* **Bishop Berkeley** (b. March 12, 1685, near Dysert Castle, near Thomastown?, County Kilkenny, Ire.—d. Jan. 14, 1753, Oxford, Eng.) Irish bishop, philosopher, and social activist. He worked principally at Trinity College, Dublin (to 1713), and as bishop of Cloyne (1734–52). He is best known for his contention that, for material objects, to be is to be perceived ("Esse est percipi"). His religious calling may have prompted his qualification that, even if no human perceives an object, God does, thereby ensuring the continued existence of the physical world when not perceived by any finite being. With John Locke and David Hume, he was one of the founders of modern empiricism. Unlike Locke, he did not believe that there exists any material substance external to the mind, but rather that objects exist only as collections of sensible ideas. His works include *An Essay Towards a New Theory of Vision* (1709), *Treatise Concerning the Principles of Human Knowledge* (1710), and *Three Dialogues Between Hylas and Philonous* (1713). He spent part of his career in America, where he advocated educating Native Americans and blacks. The city of Berkeley, Calif., U.S., is named for him.

Berkeley, Sir William (b. 1606, Somerset, Eng.—d. July 9, 1677, Twickenham, Middlesex) British colonial governor of Virginia. Appointed governor in 1641, he introduced crop diversification, encouraged manufacturing, and promoted peace with the Indians. A strong monarchist, he was forced to retire to his Virginia plantation during the Commonwealth period in England (1652–59). Reappointed in 1660, he faced crop failures and Indian attacks on the frontier. In 1676 Nathaniel Bacon mounted an expedition against the Indians in defiance of Berkeley's policy of fostering trade. Berkeley fought Bacon for control of the colony, which he eventually regained.

Berkshire \'bərk-shər\ Geographic county, southern England. It occupies the river valleys of the middle Thames and its tributary, the Kennet, immediately west of London. Settlement of the area dates from the Iron Age, and the Belgic site at Silchester later became a Roman route centre. With the Norman Conquest the Thames valley's strategic importance was recognized, and the first Windsor Castle was built. Windsor and Eton, on Berkshire's eastern boundary, contain the county's most noted structures. With its seat at Reading, it was an administrative county from 1974 to 1998.

Berkshire Hills Segment of the Appalachian Mtns., western Massachusetts. Many of its summits exceed 2,000 ft (600 m), including Mount Greylock (3,491 ft, or 1,064 m), the highest point in the state. The wooded hills are a continuation of the Green Mtns. of Vermont; they include the Hoosac and Taconic ranges. Crossed by the Appalachian National Scenic Trail, the Berkshires contain state parks and forests and are the home of the Tanglewood summer music festival (in Lenox).

Berlage \'ber-läk-ə**, Hendrik Petrus** (b. Feb. 21, 1856, Amsterdam, Neth.—d. Aug. 12, 1934, The Hague) Dutch architect. After studies in Zürich, he began his practice in Amsterdam (1889). His best-known work is the Amsterdam Stock Exchange (1897–1903), notable for its forthright use of structural steel and traditional Dutch brickwork. While visiting the U.S. (1911), he was exposed to the work of Louis H. Sullivan and Frank Lloyd Wright and later introduced their methods and ideas to Europe. His work was characterized by the honest use of materials based on their fundamental properties and the avoidance of meaningless ornamentation.

Berle \'bərl**, Milton** *orig.* **Milton Berlinger** (b. July 12, 1908, New York, N.Y., U.S.—d. March 27, 2002, Los Angeles, Calif.) U.S. comedian. He appeared in vaudeville from age 10 and later acted in more than 50 silent films. He worked chiefly as a nightclub comedian (1939–49) while vainly seeking a radio audience. His slapstick routines and facial contortions, however, were more suited to a visual medium, and between 1937 and 1968 he appeared in 19 movies. His greatest success came with the television variety show *Texaco Star Theater* (1948–54), a show so popular that many people are said to have bought television sets just to watch "Uncle Miltie."

Berlin City and state (pop., 2002 est: city, 3,388,000; metro. area, 4,101,000), capital of Germany. Founded in the early 13th century, it was a member of the Hanseatic League in the 14th century. It became the residence of the Hohenzollerns and the capital of Brandenburg. It was successively the capital of Prussia (from 1701), the German Empire (1871–1918), the Weimar Republic (1919–32), and the Third Reich (1933–45). In World War II much of the city was destroyed by Allied bombing. In 1945 it was divided into four occupation zones: U.S., British, French, and Soviet. The three Western powers integrated their sectors into one economic entity in 1948; the Soviets responded with the Berlin blockade. When independent governments were established in eastern and western Germany in 1949, East Berlin was made the capital of East Germany, and West Berlin, though surrounded by East Germany, became part of West Germany. Continuing immigration from East to West Berlin through the 1950s prompted the 1961 erection of the Berlin Wall. The area immediately became the most vivid focal point of the Cold War. The dramatic dismantling of the wall in 1989 marked the international upheaval that accompanied the end of the Soviet Union. Berlin became reunified as Germany's official capital in 1991; the transfer of government from Bonn was completed in 1999. It is the site of the University of Berlin, Charlottenburg Palace, Brandenburg Gate, and Berlin Zoo and is home to the Berlin Opera and Berlin Philharmonic Orchestra.

Berlin, Congress of (June 13–July 13, 1878) Diplomatic meeting of the major European powers at which the Treaty of Berlin replaced the Treaty of San Stefano. Dominated by Otto von Bismarck, the congress solved an international crisis by revising the peace settlement to satisfy the interests of Britain and Austria-Hungary. By humiliating Russia and failing to acknowledge adequately the aspirations of the Balkan peoples, it laid the foundation for future Balkan crises.

Berlin, Irving *orig.* **Israel Baline** (b. May 11, 1888, Mogilyov, Russia—d. Sept. 22, 1989, New York, N.Y., U.S.) U.S. songwriter. The son of a Russian Jewish cantor, he and his family immigrated to New York City in 1893. He worked as a street singer and singing waiter, then began writing songs. His first published song, "Marie from Sunny Italy," appeared in 1907; a printer's error named him Irving Berlin. In 1911 he wrote the great hit of Tin Pan Alley's ragtime vogue, "Alexander's Ragtime Band." He may have written more than 1,500 songs. Some of his songs include "Cheek to Cheek" and "God Bless America." He scored many successful films; his score for *Holiday Inn* (1942) introduced "White Christmas," one of the best-selling songs of all time. Altogether Berlin wrote the scores for 19 Broadway shows (including *Annie Get Your Gun*, 1946) and 18 films.

Berlin, Sir Isaiah (b. June 9, 1909, Riga, Latvia—d. Nov. 5, 1997, Oxford, Eng.) Latvian-born British political philosopher and historian of ideas. His family immigrated to Britain in 1920. Educated at the University of Oxford, Berlin taught there from 1950 to 1967, serving as president of Wolfson College from 1966 to 1975 and thereafter teaching at All Souls College. His writings on political philosophy are chiefly concerned with the problem of free will in increasingly totalitarian and mechanistic societies. His most important works include *Karl Marx* (1939), *The Hedgehog and the Fox* (1953), *Historical Inevitability* (1955), *The Age of Enlightenment* (1956), and *Four Essays on Liberty* (1969).

Berlin, University of *or* **Humboldt University of Berlin** Public university in Berlin, Germany. It was founded (as Friedrich Wilhelm University) in 1809–10 by Wilhelm, baron von Humboldt. By the mid 1800s it had attained world renown for its modern curriculum and its scientific research institutes. Among its faculty were G.W.F. Hegel, Johann Gottlieb Fichte, Arthur Schopenhauer, Leopold von Ranke, Hermann von Helmholtz, Friedrich Schleiermacher, and Jacob and Wilhelm Grimm. In the 1930s it was Nazified, and many of its faculty fled abroad. Under the German Democratic Republic after World War II, it was renamed Humboldt University and given a Marxist-Leninist orientation. It was reorganized after East and West Germany reunified in 1990.

Berlin blockade and airlift (1948–49) International crises that arose from an attempt by the Soviet Union to force the Allied powers (U.S., Britain, and France) to abandon their postwar jurisdictions in West Berlin. The Soviets, regarding the economic consolidation of the three Allied occupation zones in Germany in 1948 as a threat to the East German

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economy, blockaded all transportation routes between Berlin and West Germany. The U.S. and Britain responded by supplying the city with food and other supplies by military air transport and airlifting out West Berlin exports. An Allied embargo on exports from the Eastern bloc forced the Soviets to lift the blockade after 11 months.

Berlin Painter (fl. 500–460 BC, Athens, Greece) Greek vase painter, the outstanding vase painter of the late Archaic period. He is best known as the decorator of an amphora now in Berlin. Whereas it had been customary to frame the groups of figures on each side of the vase with pattern bands, the Berlin Painter eliminated the frame, allowing the figures to dominate and stand out sharply against the black background. Nearly 300 vases are attributed to him.

Berlin Wall Barrier surrounding West BERLIN that closed off East Germans access to West Berlin from 1961 to 1989 and served as a symbol of the COLD WAR's division of East and West Germany. The barrier was built in response to the flight of about 2.5 million East Germans to West Germany in the years 1949–61. First erected on the night of Aug. 12–13, 1961, it developed into a system of concrete walls topped with barbed wire and guarded with watchtowers, gun emplacements, and mines. It was opened in the 1989 democratization that swept through eastern Europe and has been largely torn down.

Berlin West Africa Conference (1884–85) Series of negotiations at Berlin in which the major European nations met to determine the future of Central Africa. The participants declared the Congo River basin region to be neutral, guaranteed freedom of trade and shipping for all colonial powers, forbade slave trading, and rejected Portugal's claims to the region.

Berlinguer \ˌber-lin-'gwer**, Enrico** (b. May 25, 1922, Sassari, Sardinia, Italy—d. June 11, 1984, Padua) Italian politician. Born into a middle-class Sardinian family, he joined the Communist Party in 1943 and held a series of party posts before becoming secretary-general in 1972, a post he would keep until his death. He became a leading advocate of "national communism," seeking independence from Moscow and favouring the adaptation of MARXISM to local requirements. His proposal for a coalition government of Christian Democrats and communists was never realized.

Berlioz \'ber-lē-ˌōz**, (Louis-) Hector** (b. Dec. 11, 1803, La Côte-Saint-André, France—d. March 8, 1869, Paris) French composer. He studied guitar in his early years and later studied music at the Paris Conservatoire, against his parents' wishes. His first great score was the stormy *Symphonie fantastique* (1830), which became a landmark of the Romantic era. Impulsive and passionate, he was a contentious critic and gadfly constantly at war with the musical establishment. Though he was the most compelling French musical figure of his time, his idiosyncratic compositional style kept almost all his music out of the repertory until the mid-20th century. His works include the operas *Benvenuto Cellini* (1837) and *Les Troyens* (1858); the program symphonies *Harold in Italy* (1834) and *Romeo and Juliet* (1839); and the choral dramas *La Damnation de Faust* (1846) and *L'Enfance du Christ* (1854). He was also known as a brilliant conductor with an unsurpassed knowledge of the orchestra; his orchestration treatise (1843) is the most influential such work ever written.

Berlusconi, Silvio (b. Sept. 29, 1936, Milan, Italy) Italian media tycoon and prime minister in 1994 and again from 2001. After graduating from the University of Milan, he became a real estate developer, amassing a considerable fortune by the 1970s. By the 1990s he owned more than 150 businesses, including three television networks and Italy's largest publishing house. In 1994 he founded Forza Italia, a conservative political party, and was elected prime minister. Faced with conflict of interest and other charges, he resigned in December 1994. He was later convicted of fraud and corruption, though he was acquitted of tax evasion. Despite the convictions and criticism of his control of much of the Italian media, he remained the leader of Forza Italia and again became prime minister in 2001.

Bermejo \ber-'mā-hō**, Bartolomé** *or* **Bartolomé de Cárdenas** \'kär-dā-näs\ (b. c. 1440, Córdoba, Spain—d. 1495, Barcelona) Spanish painter. He was active in Valencia (1468), Aragon (1474–85), and Barcelona (from 1486). Bermejo's earliest masterpiece is the panel painting *Santo Domingo de Silos* (1474). His *Pietà* (1490) in Barcelona Cathedral is considered a masterpiece of early Spanish oil painting; the influence of ROGIER VAN DER WEYDEN can be seen in the rich detail and colour. Bermejo cultivated the Flemish style and was considered the most outstanding painter in Spain before EL GRECO.

Bermejo \ber-'mā-hō\ **River** River, northern Argentina. Rising on the Bolivian frontier, it flows southeast 650 mi (1,045 km) into the PARAGUAY RIVER on the border of Paraguay and Argentina. The abundant silt it carries in suspension is the source of its name (*bermejo*, "reddish"). It is navigable for small craft along its central course, known as the Teuco River.

Bermuda British overseas territory (pop., 2005 est.: 65,400), western Atlantic Ocean. Comprising 7 main islands and about 170 additional (named) islets and rocks, it lies about 570 mi (920 km) southeast of Cape HATTERAS, N.C., U.S. The archipelago has a total land area of about 20.5 sq mi (53 sq km). The capital is HAMILTON on Main Island. Bermuda was named for Juan de Bermúdez, who may have visited the islands in 1503. Colonized by the English in 1612, Bermuda became a crown colony in 1684, and its status changed to an overseas territory in 2002. Its economy is based on tourism and international finance; its gross national product per capita is among the world's highest.

Bermuda Triangle Triangular section of the North Atlantic Ocean whose boundaries are usually said to be BERMUDA, the southern U.S. coast, and the Greater ANTILLES. The region attracted international attention after numerous planes and ships were said to have mysteriously disappeared there. Reports of unnatural occurrences were popularized, but by the late 20th century much of the myth surrounding the Bermuda Triangle had been dispelled.

Bern City (pop., 2000 est: city, 128,600; metro. area, 317,300), capital of Switzerland. Lying along a loop of the AARE RIVER, it was founded as a military post in 1191 by Berthold V, duke of Zähringen. It became a free imperial city in 1218. Gradually extending its power, it became an independent state, and in 1353 it entered the Swiss Confederation. It was a scene of disputation in 1528 between Roman Catholics and reformers, which led to its subsequent championing of Protestant doctrines. It became a member of the Helvetic Republic and in 1848 was made the capital of Switzerland. It is headquarters of the international postal, railway, and copyright unions.

Bern Convention *officially* **International Convention for the Protection of Literary and Artistic Works** International agreement adopted in Bern, Switz., in 1886 to protect COPYRIGHTS on an international basis. It was modified several times throughout the 20th century. Its signatories constitute the Bern Copyright Union. Each member country grants the authors of other member countries the same rights that its laws grant its own nationals. Protected works include every kind of literary, scientific, and artistic production, regardless of mode of expression, including paintings, sculptures, architectural plans, and musical arrangements. Copyright is now protected for 70 years after the creator's death.

Bernadette of Lourdes, Saint *orig.* **Marie-Bernarde Soubirous** (b. Jan. 7, 1844, Lourdes, France—d. April 16, 1879, Nevers; canonized Dec. 8, 1933; feast day April 16, but sometimes February 18 in France) French visionary. The daughter of a miller, she had a poverty-stricken childhood and was often ill. In 1858 she had a series of visions of Mary; she defended their authenticity against the doubts of her parents, the clergy, and civil authorities. She joined the Sisters of Charity at Nevers (1866) and remained in seclusion until her death at 35. The grotto at LOURDES became a pilgrimage site; its waters are reputed to have healing powers.

Bernadotte \ber-nȧ-'dȯt\ **(af Wisborg), Folke, Count** (b. Jan. 2, 1895, Stockholm, Swed.—d. Sept. 17, 1948, Jerusalem) Swedish soldier, humanitarian, and diplomat. A nephew of King GUSTAV V, Bernadotte headed the Swedish Red Cross in World War II and was credited with saving some 20,000 concentration-camp inmates. In 1948 he was appointed mediator in Palestine by the UN Security Council and secured a cease-fire between Israel and the Arab states. He made enemies by proposing that Arab refugees be allowed to return to their homes in what had become Israel and was assassinated by Jewish extremists.

Bernanos \ber-nȧ-'nōs**, Georges** (b. Feb. 20, 1888, Paris, France—d. July 5, 1948, Neuilly-sur-Seine) French novelist and polemical writer. One of the most original and independent Roman Catholic writers of his time and a man of humour and humanity, he abhorred materialism and compromise with evil. His masterpiece, *The Diary of a Country Priest* (1936), is

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the story of a young priest's war against sin. *Dialogues of the Carmelites* (1949), a screenplay about 16 nuns martyred during the French Revolution, was the basis for an opera by Francis Poulenc (1957).

Bernard \ber-'närd**, Claude** (b. July 12, 1813, Saint-Julien, France—d. Feb. 10, 1878, Paris) French physiologist. He taught at several major French institutions and was named a senator in 1869. He discovered the role of the pancreas in digestion, the glycogenic function of the liver in carbohydrate metabolism, and blood-supply regulation by the vasomotor nerves. He helped establish the principles of experimentation in the life sciences, including the need for a hypothesis. His concept of the internal environment of the organism led to the present understanding of homeostasis. Bernard also studied the effects of such poisons as carbon monoxide and curare. He was awarded the grand prize in physiology three times by the Académie des Sciences.

Bernard de Clairvaux \kler-'vō**, Saint** (b. 1090, probably Fontaine-les-Dijons, near Dijon, Burgundy—d. Aug. 20, 1153, Clairvaux, Champagne; canonized 1174; feast day August 20) French Cistercian monk, mystic, and doctor of the church. Born into an aristocratic family near Dijon, he turned away from a literary education for the monastic life, entering the austere religious community at Cîteaux in 1112. As abbot of the Cistercian monastery at Clairvaux, Champagne, which he founded in 1115, he helped establish the widespread popularity of the order. Between 1130 and 1145 he mediated civil and ecclesiastical councils and theological debates, and his support for Pope Innocent II helped secure the papacy during the schism with Anacletus. Bernard was the confidant of five popes and became perhaps the most renowned religious figure in Europe. He actively preached the Second Crusade and wrote a number of sermons on the Song of Solomon. He opposed the teachings of Peter Abelard and Henry of Lausanne and defended devotion to the Virgin Mary.

Bernardine See Cistercian

Bernardine \'bər-nər-dēn\ **of Siena, Saint** (b. Sept. 8, 1380, Massa Marittima, Siena—d. May 20, 1444, L'Aquila, Kingdom of the Two Sicilies; canonized 1450; feast day May 20) Franciscan priest and theologian. Born into a noble family but orphaned early, he entered the Observants (1402), a strict branch of the Franciscan order that he later helped to spread throughout Europe. In 1417 he began preaching tours in Italy, seeking to combat the lawlessness, strife, and immorality resulting from the Western Schism. Through the Council of Florence he worked to unite the Greek and Roman churches. Numerous miracles are said to have occurred at his tomb.

Bernays, Edward L. (b. Nov. 22, 1891, Vienna, Austria—d. March 9, 1995, Cambridge, Mass., U.S.) U.S. publicist, the "father of public relations." A nephew of Sigmund Freud, he was born in Austria but was brought up in New York. In organizing endorsements for a play on the taboo subject of venereal disease, he found his calling as a publicist. His early clients included the U.S. War Department and the Lithuanian government. He edited *The Engineering of Consent* (1955), whose title is his often-quoted definition of public relations. He died at the age of 103.

Berners-Lee, Tim (b. June 8, 1955, London, Eng.) British physicist. The son of computer scientists, he graduated from Oxford University and in 1980 accepted a fellowship at CERN in Geneva. In 1989 he suggested a global hypertext project. He and his CERN colleagues created a communications protocol called HyperText Transfer Protocol (HTTP) that standardized communication between computer servers and clients. Their text-based Web browser was released to the public in 1991, marking the beginnings of the World Wide Web and general public use of the Internet. He declined all opportunities to profit from his immensely valuable innovation. In 1994 he joined MIT's Laboratory for Computer Science as director of the World Wide Web Consortium.

Bernese Alps *German* **Berner Oberland** \ˌbər-nər-'ō-bər-ˌländ\ Segment of the Alps, Switzerland. It lies north of the Rhône River and south of Brienzer and Thuner lakes and extends east from Martigny-Ville to Grimsel Pass and the valley of the upper Aare River. Many peaks, including the Finsteraarhorn, Jungfrau, and Aletschhorn, rise more than 12,000 ft (3,660 m). The Bernese Alps are crossed by the Lötschen, Gemmi, and Pillon passes and the Lötschberg railway tunnel. Many resorts, including Interlaken, Grindelwald, and Gstaad, dot the area.

Bernese mountain dog Breed of Swiss working dog brought to Switzerland over 2,000 years ago by invading Romans. The hardy breed was widely used to pull carts and to drive cattle to and from their pastures. It has a broad chest, hanging V-shaped ears, and a long, silky, black coat. Markings include brown spots on the chest and forelegs and over the eyes, and sometimes white on the chest, nose, feet, and tail tip. The breed stands 21–28 in. (53–70 cm) high and weighs about 90 lbs (40 kg).

Bernhard \'bern-ˌhärt\ (b. June 29, 1911, Jena, Ger.—d. Dec. 1, 2004, Utrecht, Neth.) Prince of The Netherlands. The son of Prince Bernhard Casimir of Lippe-Biesterfeld, Bernhard married the Dutch crown princess Juliana in 1937 and took Dutch citizenship. He opposed Germany's invasion of The Netherlands and took his family to Britain after the Dutch surrender (1940). In World War II he served as the Dutch liaison with the British armed forces, flew with the Royal Air Force (1942–44), and led Dutch troops in the Allied offensive in The Netherlands (1945). After the war and Juliana's accession as queen (1948–80), he became The Netherlands' goodwill ambassador. He was active in conservation efforts and in 1961 helped found the World Wildlife Fund. In 1976 he was implicated in a bribery scandal that temporarily tarnished the monarchy.

Bernhardi \'bern-ˌhär-dē**, Friedrich von** (b. 1849, Estonia, Russian Empire—d. 1930) German soldier and military writer. He fought in the Franco-Prussian War and became commander of the Seventh Army corps in 1909. In 1911 he published *Germany and the Next War*, arguing that Germany had a right and responsibility to wage war to gain the power it deserved. The Allies later considered his book a contributing cause of World War I, in which Bernhardi served as a corps commander.

Bernhardt \ber-'närˌ\ *English* \'bərn-ˌhärt**, Sarah** *orig.* **Henriette-Rosine Bernard** (b. Oct. 22/23, 1844, Paris, France—d. March 26, 1923, Paris) French actress. The illegitimate child of a courtesan, she was encouraged to pursue a theatrical career by one of her mother's lovers, the duke de Morny. After a brief appearance at the Comédie-Française (1862–63), she joined the Odéon theatre (1866–72), where she acted in *Kean* by Alexandre Dumas *père* and *Ruy Blas* by Victor Hugo, charming audiences with her "golden voice." Returning to the Comédie-Française (1872–80), she starred in *Phèdre* to great acclaim in Paris and London. She formed her own company in 1880 and toured the world in *The Lady of the Camellias* by Alexandre Dumas *fils*, *Adrienne Lecouvreur* by Eugène Scribe, four plays written for her by Victorien Sardou, and *The Eaglet* by Edmond Rostand. After an injury to her leg forced its amputation (1915), she strapped on a wooden leg and chose roles she could play largely seated. One of the best-known figures in the history of the stage, she was made a member of France's Legion of Honour in 1914.

Sarah Bernhardt, photograph by Napoleon Sarony, 1880.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Bernicia \ber-'ni-shə\ Ancient northern Anglo-Saxon kingdom. It stretched northward from perhaps as far south as the River Tees, ultimately reaching the Firth of Forth. By the end of the 7th century AD it had united with its neighbour Deira to form the kingdom of Northumbria. It had a royal residence at coastal Bamburgh. The first recorded king, Ida, was crowned there in 547; his grandson Aethelfrith (r. 593–616) united Bernicia and Deira.

Bernini, Gian Lorenzo (b. Dec. 7, 1598, Naples, Kingdom of Naples—d. Nov. 28, 1680, Rome, Papal States) Italian architect and artist credited with creating the Baroque style of sculpture. He began his career working for his father, a sculptor. Among his early sculptures are *Apollo and Daphne* (1622–24) and an active *David* (1623–24). Under the patronage of Urban VIII, the first of eight popes he was to serve, he created the baldachin over the tomb of St. Peter in Rome. Bernini's architectural duties increased after 1629, when he was appointed architect of St. Peter's Basilica and the Palazzo Barberini. His works often represent a fusion of architecture and sculpture, as in the Cornaro Chapel, in Santa Maria della Vittoria, Rome, with its celebrated theatrical sculpture, *The Ecstasy of St. Teresa* (1645–52). His greatest architectural achievement is the colonnade enclosing the piazza before St. Peter's. Among his many

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other contributions to Rome are his Triton Fountain and Fountain of the Four Rivers, noted for their architectural composition and detail.

Apollo and Daphne, marble sculpture by Gian Lorenzo Bernini, 1622–24; in the Borghese Gallery, Rome.
SCALA/ART RESOURCE, NEW YORK

Bernoulli \ber-'nů-lē\ **family** Two generations of distinguished Swiss mathematicians. Jakob (1655–1705) and Johann (1667–1748) were the sons of a pharmacist who wanted one boy to study theology and the other medicine. Over his objections, both pursued careers in mathematics, making important discoveries in CALCULUS, the calculus of variations, and DIFFERENTIAL EQUATIONS. They sometimes worked together, but not without friction. Johann's son Daniel (1700–82) made important contributions to fluid dynamics (see BERNOULLI'S PRINCIPLE) and PROBABILITY THEORY. Widely admired throughout Europe, he also studied and lectured on medicine, physics, astronomy, and botany.

Bernoulli's principle *or* **Bernoulli's theorem** Principle that relates PRESSURE, VELOCITY, and height for a nonviscous fluid with steady flow. A consequence is that, for horizontal flow, as the speed of a fluid increases, the pressure it exerts decreases. Derived by Daniel Bernoulli (see BERNOULLI FAMILY), the principle explains the LIFT of an airplane in motion. As the speed of the plane increases, air flows faster over the curved top of the wing than underneath. The upward pressure exerted by the air under the wing is thus greater than the pressure exerted downward above the wing, resulting in a net upward force, or lift. Race cars use the principle to keep their wheels pressed to the ground as they accelerate. A race car's spoiler—shaped like an upside-down wing, with the curved surface at the bottom—produces a net downward force.

Bernstein \'bern-shtīn**, Eduard** (b. Jan. 6, 1850, Berlin, Prussia—d. Dec. 18, 1932, Berlin, Germany) German politician and writer. He joined the German SOCIAL DEMOCRATIC PARTY in 1872, then spent years in exile as an editor of socialist journals. In London he met FRIEDRICH ENGELS and was influenced by the FABIAN SOCIETY. Returning to Germany in 1901, Bernstein became the political theorist of the revisionists and was one of the first socialists to modify such Marxist tenets as the imminent collapse of capitalism. He envisaged a type of social democracy that combined private initiative with social reform. As a member of the Reichstag (1902–06, 1912–16, 1920–28), he inspired much of the reformist programs of the Social Democrats.

Bernstein, Leonard (b. Aug. 25, 1918, Lawrence, Mass., U.S.—d. Oct. 14, 1990, New York, N.Y.) U.S. conductor, composer, and writer. He resolved on a music career only after graduating from Harvard University. He studied conducting at the Curtis Institute of Music with FRITZ REINER and then at Tanglewood (in Lenox, Mass.), where he met AARON COPLAND and became SERGE KOUSSEVITZKY's assistant. Fame came abruptly in 1943 when he substituted on short notice for the conductor of the New York Philharmonic orchestra and was praised for his technical self-assurance and interpretive excellence. In 1944 he triumphed with his music for JEROME ROBBINS's ballet *Fancy Free* and the Broadway show *On the Town*. As a composer he made use of diverse elements ranging from biblical themes to jazz rhythms. His best-known composition was the score for the hit musical *West Side Story* (1957); other works include the musicals *Wonderful Town* (1952) and *Candide* (1956), three symphonies, the *Chichester Psalms* (1965), and the theatrical *Mass* (1971). Well known as a television lecturer, he was also a prominent political activist.

Leonard Bernstein.
LAUTERWASSER, COURTESY DEUTSCHE GRAMMOPHON

Bernstorff \'bern-shtôrf**, Johann-Heinrich, count von** (b. Nov. 14, 1862, London, Eng.—d. Oct. 6, 1939, Geneva, Switz.) German diplomat. After entering the diplomatic service (1899), he represented Germany in London and Cairo before serving as ambassador to the U.S. (1908–17). During World War I he worked to facilitate mediation of the conflict with WOODROW WILSON but did not receive the support he expected from authorities in Berlin. He served as chairman of the German League of Nations Union until 1933, when he went into exile in Geneva.

Berra \'ber-ə**, Yogi** *orig.* **Lawrence Peter Berra** (b. May 12, 1925, St. Louis, Mo., U.S.) U.S. baseball player, manager, and coach. Berra joined the New York Yankees in 1946 and served as the team's regular catcher from 1949 until his retirement in 1963. He was named the AMERICAN LEAGUE's Most Valuable Player in 1951, 1954, and 1955. He caught in more World Series games (75) than any other catcher and hit 20 or more home runs a season through 1958. He managed the Yankees in 1964 but was fired and became a coach and manager (1965–75) with the New York Mets. He returned to the Yankees as a coach (1976–82) and later manager (1983–85). He was known for idiosyncratic remarks such as "It ain't over till it's over" and "It's déjà vu all over again." The American cartoon character Yogi Bear was named for him.

Berrigan, Daniel (Joseph) and Philip (Francis) (respectively b. May 9, 1921, Virginia, Minn., U.S.(b. Oct. 5, 1923, Two Harbors, Minn., U.S.) —d. Dec. 6, 2002, Baltimore, Md.) U.S. priests and political activists. After joining the Catholic priesthood (Daniel became a Jesuit, Philip a Josephite), the brothers became involved in nonviolent political activism, carrying out campaigns of civil disobedience to oppose racism, the nuclear arms race, and the Vietnam War. They were best known for their Vietnam-era raid of draft-board files in Catonsville, Md., which they destroyed with chicken blood and napalm. They were also known for the persistence of their activism. Philip later left the priesthood. Both authored numerous books on their work and beliefs; Daniel also wrote poetry and plays.

Berruguete, Alonso (b. c. 1488, Paredes de Nava, Castile—d. 1561, Toledo, Castile) Spanish sculptor and painter. His father, PEDRO BERRUGUETE, was a great Renaissance painter. Alonso worked in Florence and Rome c. 1508–16. In 1516 he returned to Spain, and in 1518 he became court painter to Charles V. He succeeded primarily as a sculptor, however, and became known for his intensely emotional MANNERIST sculptures of figures portrayed in spiritual torment or in transports of religious ecstasy. His best-known work is a set of wooden reliefs with highly expressive figures for choir stalls in Toledo Cathedral (1539–43). Berruguete's use of a rather rich and extravagant but delicate ornamentation in his church decorations is typical of Spain's PLATERESQUE style. He is considered the greatest Spanish sculptor of the 16th century.

Berruguete \ˌber-ü-'gā-tā**, Pedro** *or* **Pedro Español** *or* **Pietro Spagnuolo** \ˌspän-yə-'wō-lō\ (b. c. 1450, Paredes de Nava, Castile—d. Jan. 6, 1504, Avila, Castile) Spanish painter. After a sojourn in Italy, he returned to Spain, where he painted numerous altarpieces and also worked as a fresco painter in Toledo Cathedral (1483–99). The influence of Flemish and Italian art is evident in his panel paintings, which are characterized by luxurious ornament and gold decoration. He was the first great Renaissance painter in Spain. His son ALONSO BERRUGUETE was a sculptor and painter.

Berry \be-'rē\ Historical region and former province, central France. It was originally inhabited by the Bituriges Cubi, who opposed VERCINGETORIX. Under Roman rule it was part of Aquitania Prima. A countship in the Carolingian period, it fell to the French crown in the 12th century. When AQUITAINE was acquired by HENRY II of England, Berry became a matter of dispute between England and France. As a duchy, at one time it came under Jean de France, duke de Berry, an important patron of the arts. It returned to France in 1601 and remained a province until 1790.

berry Simple, fleshy FRUIT that usually has many seeds (e.g., the BANANA, TOMATO, or CRANBERRY). The middle and inner layers of the fruit wall often are not distinct from each other. Any small, fleshy fruit is popularly called a berry, especially if it is edible. RASPBERRIES, BLACKBERRIES, and STRAWBERRIES are not true berries, but rather aggregate fruits—fruits that consist of multiple smaller fruits. The DATE is a one-seeded berry whose stone is hard nutritive tissue.

Berry, Chuck *orig.* **Charles Edward Anderson Berry** (b. Oct. 18, 1926, St. Louis, Mo., U.S.) U.S. singer-songwriter. Though first

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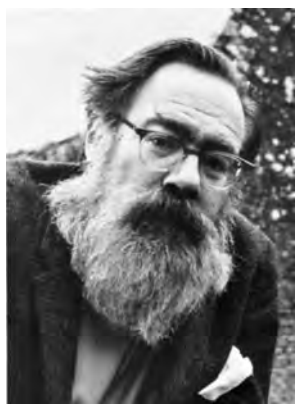
interested in country music, in the early 1950s Berry led a BLUES trio that played in black nightclubs around St. Louis. In 1955 he traveled to Chicago and made his first hit record, "Maybellene," which was soon followed by "Sweet Little Sixteen," "Johnny B. Goode," "Rock and Roll Music," and "Roll Over, Beethoven." He was one of the first to shape big-beat blues into what came to be called rock and roll (see ROCK MUSIC) and to achieve widespread popularity with white audiences. After two trials tainted by racist overtones, in 1959 he began a five-year prison sentence for immoral behaviour. In 1972 he achieved his first number one hit, "My Ding-A-Ling." He continued to perform into the 1990s. The BEATLES and the ROLLING STONES were among the many rock bands greatly influenced by Berry.

Berry, Jean de France, duke de (b. Nov. 30, 1340, Vincennes, France—d. June 15, 1416, Paris) French nobleman and patron of the arts. He was the son of King JOHN II. As duke de Berry and Auvergne, he controlled at least one-third of France during the middle period of the HUNDRED YEARS' WAR. Berry shared in the administration of France and worked for peace with England and within France, acting as diplomat and mediator. He invested fortunes in the art treasures that became his monument—paintings, tapestries, jewelry, and illuminated manuscripts that included the famous *Très Riches Heures du duc de Berry*.

Berry \be-'rē**, Jean de France, duke de** *orig.* **Charles-Ferdinand de Bourbon** (b. Jan. 24, 1778, Versailles, France—d. Feb. 14, 1820, Paris) French nobleman. Son of the future CHARLES X, he left France at the outbreak of the French Revolution and lived abroad until 1815. His assassination by a Bonapartist fanatic marked a turning point in the BOURBON RESTORATION, hastening the downfall of the moderate Decazes government and the polarization into liberal and royalist groups.

Berryman, John (b. Oct. 25, 1914, McAlester, Okla., U.S.—d. Jan. 7, 1972, Minneapolis, Minn.) U.S. poet. Berryman attended Columbia University and the University of Cambridge and later taught at various universities. *Homage to Mistress Bradstreet* (1956), one of his first experimental poems, assured his importance. His technical daring was also evident in *77 Dream Songs* (1964, Pulitzer Prize), augmented to form a sequence of 385 "Dream Songs" in *His Toy, His Dream, His Rest* (1968). Later works include the deceptively offhand *Love & Fame* (1970) and *Recovery* (1973), an account of his struggle against alcoholism. He is noted for his confessional poetry laced with humour. Subject to deep depression, he committed suicide by jumping from a bridge.



Berryman
COURTESY OF THE UNIVERSITY OF MINNESOTA

berserker (from Old Norse *beserkr*, "bearskin") In premedieval and medieval Norse and Germanic history and folklore, any member of unruly warrior gangs that worshiped ODIN and attached themselves to royal and noble courts as bodyguards and shock troops. They raped and murdered at will in their host communities, and their savagery in battle and animal-skin attire (they are also said to have fought naked) contributed to the development of the WEREWOLF legend in Europe.

Bert \'ber**, Paul** (b. Oct. 17, 1833, Auxerre, Yonne, France—d. Nov. 11, 1886, Hanoi) French physiologist, founder of modern AEROSPACE MEDICINE. He taught for many years at the Sorbonne and served as a deputy in the government from 1872–86. His research on the effects of air pressure on the body helped make possible the exploration of space and the ocean depths. Bert found the main cause of altitude sickness to be low atmospheric oxygen content and showed decompression sickness to be due to nitrogen bubbles formed in the blood during rapid drops in external pressure.

Bertelsmann AG German media company. Beginning as a religious printer and publisher in 1835, the company grew steadily over the next century. Though virtually destroyed by Allied bombing in 1945, it recovered quickly after World War II. By 1998 Bertelsmann AG had grown to include more than 300 media companies, with more than half its employees in countries other than Germany. Its worldwide acquisitions have included the U.S. publishers Bantam Doubleday Dell and RANDOM HOUSE. By the early 21st century the company was among the world's largest media conglomerates.

Berthelot \ber-tə-'lō**, (Pierre-Eugène-) Marcellin** (b. Oct. 27, 1827, Paris, France—d. March 18, 1907, Paris) French chemist. The first professor of organic chemistry at the Collège de France (from 1865), he later also held high government offices, including that of foreign minister (1895–96). He did research in ALCOHOLS and CARBOXYLIC ACIDS, the synthesis of HYDROCARBONS, and REACTION RATES, studied the mechanism of explosion, discovered many coal-tar derivatives, and wrote on the history of early chemistry. He was a pioneer in the use of chemical analysis as a tool of archaeology. His work helped break down the traditional division between organic and inorganic compounds. He opposed the then-current idea that a "vital force" is responsible for synthesis and was one of the first to prove that all chemical phenomena depend on physical forces that can be measured.

Berthoud \ber-'tü**, Ferdinand** (b. March 19, 1727, Plancemont, Switz.—d. June 20, 1807, Groslay, France) Swiss-French clockmaker and writer on timekeeping. Working in Paris from 1748, his inventiveness and many publications soon made him influential. His interest in the problem of determining longitude at sea (see LATITUDE AND LONGITUDE) led to his major achievement, an improved, less expensive marine CHRONOMETER. Berthoud's improvements were retained in modern instruments. See also JOHN HARRISON.

Bertoia \bər-'tȯi-ə**, Harry** (b. March 10, 1915, San Lorenzo, Italy—d. Nov. 6, 1978, Barto, Pa., U.S.) Italian-born U.S. sculptor and designer. He attended the Cranbrook Academy of Art and later taught there (1937–43). He worked in California with designer CHARLES EAMES before joining Knoll Associates in New York City in 1950. His achievements there included the Diamond Chair (commonly known as the Bertoia chair), made of polished steel wire and covered with elastic Naugahyde upholstery. He also produced "sound sculptures" that were activated by the wind and numerous works for corporations and public spaces.

The Diamond chair designed by Harry Bertoia, 1952
COURTESY OF THE KNOLL GROUP

Bertolucci \,ber-tə-'lü-chē**, Bernardo** (b. March 16, 1940, Parma, Italy) Italian film director. After writing poetry and an award-winning book, he entered filmmaking as an assistant to PIER PAOLO PASOLINI in 1961. His first films as a director, *The Grim Reaper* (1962) and *Before the Revolution* (1964), were followed by the well-received *The Conformist* (1970). The erotic *Last Tango in Paris* (1972) made him an international and commercial sensation. He later directed such films as *1900* (1976), *The Last Emperor* (1987, Academy Awards for direction and best film), and *Stealing Beauty* (1996).

beryl \'ber-əl\ Mineral composed of beryllium aluminum silicate, $Be_3Al_2(SiO_3)_6$, a commercial source of BERYLLIUM. Several varieties are valued as gemstones: AQUAMARINE (pale blue-green); EMERALD (deep green); heliodor (golden yellow); and morganite (pink). Before 1925 beryl was used only as a gemstone, but since then many important uses have been found for beryllium (e.g., in nuclear reactors, space vehicles, and X-ray tubes). No large deposits have been found, and most production is a by-product of the mining of feldspar and mica. Brazil is a major producer; others include Zimbabwe, South Africa, Namibia, and the U.S.

beryllium \bə-'ril-ē-əm\ Chemical ELEMENT, lightest of the ALKALINE EARTH METALS, chemical symbol Be, atomic number 4. It does not occur uncombined in nature but is found chiefly as the mineral BERYL (of which emerald and aquamarine are gemstone varieties). Beryllium METAL, particularly in ALLOYS, has many structural and thermal applications; it is used in nuclear reactors. Beryllium has VALENCE 2 in all its compounds, which are generally colourless and taste distinctly sweet. All soluble beryllium compounds are toxic. Beryllium oxide is used in specialized ceramics for nuclear devices, and beryllium chloride is a CATALYST for organic reactions.

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Berzelius \ber-'sā-lē-əs**, Jöns Jacob, Baron** (b. Aug. 20, 1779, near Linköping, Swed.—d. Aug. 7, 1848, Stockholm) Swedish chemist. As a professor in Stockholm (1807–32) he achieved an immensely important series of innovations and discoveries. He is especially noted for his introduction of basic laboratory equipment that remains in use today; his determination of ATOMIC WEIGHTS; his creation of the modern system of CHEMICAL SYMBOLS; his theory of ELECTROCHEMISTRY; his discovery of the elements CERIUM, SELENIUM, and thorium and his isolation of SILICON, ZIRCONIUM, and TITANIUM; his contribution to the classical techniques of ANALYSIS; and his investigations of ISOMERISM and CATALYSIS, both of which he named. He published more than 250 original research papers. He is regarded as one of the founders of modern chemistry.

Jöns Jacob Berzelius, detail of an oil painting by Olof Johan Södermark, 1843; in the Royal Swedish Academy of Sciences, Stockholm.
COURTESY OF SVENSKA PORTRATTARKIVET, STOCKHOLM

Bes Minor Egyptian god with a grotesque appearance. His figure was intended to inspire joy or drive away pain and sorrow, and his ugliness was probably thought to frighten off evil spirits. He was associated with music and childbirth. The name Bes is now used to designate a group of deities of similar appearance with various ancient names.

Bes represented as a dwarf, statue; in the Louvre
GIRAUDON-ART RESOURCE

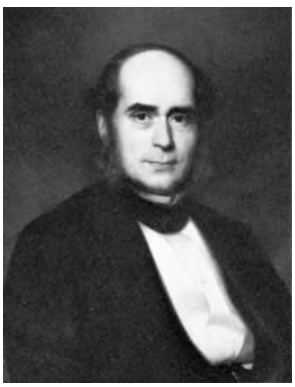
Besant \'be-sᵊnt**, Annie** *orig.* **Annie Wood** (b. Oct. 1, 1847, London, Eng.—d. Sept. 20, 1933, Adyar, Madras) British social reformer. She was a prominent Fabian socialist in the 1880s before becoming an adherent of THEOSOPHY in 1889. She served as international president of the Theosophical Society from 1907 until her death, and her writings are still considered some of the best expositions of theosophical belief. After immigrating to India, she became an Indian independence leader and established the Indian Home Rule League in 1916.

Bessarabia \ˌbe-sə-'rā-bē-ə\ Region, eastern Europe. It is bounded by the Prut and DNIESTER rivers, the BLACK SEA, and the DANUBE RIVER delta. Greek colonies were founded on its Black Sea coast in the 7th century BC, and it was probably part of DACIA in the 2nd century AD. It became part of MOLDAVIA in the 15th century; the Turks later annexed the southern portion into the Ottoman empire. The remainder fell to them in the 16th century when Moldavia submitted to the Turks; Bessarabia remained under Turkish control until the 19th century. Russia acquired it and half of Moldavia in 1812 and retained control until World War I. A nationalist movement developed, and after the RUSSIAN REVOLUTION OF 1917 Bessarabia declared its independence and voted to unite with Romania. The Soviet Union never recognized Romania's right to the province and in 1940 demanded that it cede Bessarabia; when Romania complied, the U.S.S.R. set up the Moldavian Soviet Socialist Republic (see MOLDOVA), and incorporated the northern region into the Ukrainian S.S.R. Bessarabia remained divided after Ukraine and Moldavia declared independence in 1991.

Bessel \'be-səl**, Friedrich Wilhelm** (b. July 22, 1784, Minden, Brandenburg—d. March 17, 1846, Königsberg, Prussia) German astronomer. He was the first to measure (by means of PARALLAX) the distance to a star other than the Sun. One of his major discoveries was that the bright stars SIRIUS and Procyon make tiny motions explainable only by the existence of invisible companions disturbing their motions. His observation of tiny irregularities in the orbit of Uranus, which he concluded were caused by an unknown planet beyond, led to the discovery of Neptune. His mathematical functions for studying planetary motions became widely used in solving a wide range of differential equations.

Bessel, engraving by E. Mandel after a painting by Franz Wolf
THE BETTMANN ARCHIVE

Bessemer, Sir Henry (b. Jan. 19, 1813, Charlton, Hertfordshire, Eng.—d. March 15, 1898, London) British inventor and engineer. Son of a metallurgist, he set up his own casting business at 17. At that time the only iron-based construction materials were CAST IRON and WROUGHT IRON. So-called steel was made by adding CARBON to pure forms of wrought iron (see WOOTZ); the resulting material was used almost entirely for cutting tools. During the Crimean War Bessemer worked to devise a stronger cast iron for cannon. The result was a process for the inexpensive production of large, slag-free ingots of steel as workable as any wrought iron. He eventually also discovered how to remove excess oxygen from the iron. The BESSEMER PROCESS (1856) led to the development of the Bessemer converter. See also BASIC BESSEMER PROCESS; R.F. MUSHET; PUDDLING PROCESS.



Bessemer, detail of an oil painting by Rudolf Lehmann; in the Iron and Steel Institute, London
COURTESY OF THE IRON AND STEEL INSTITUTE, LONDON; PHOTOGRAPH, THE SCIENCE MUSEUM, LONDON

Bessemer process Technique for converting pig iron to steel invented by HENRY BESSEMER in England in 1856 and brought by him into commercial production in 1860. Air blown through liquid pig iron in a refractory-lined converter oxidizes the carbon and silicon in the iron. Heat released by the oxidation keeps the metal molten. R.F. MUSHET contributed the technique for deoxidizing the converted metal that made the process a success. WILLIAM KELLY conducted experiments with an air-blown converter between 1856 and 1860 in Kentucky and Pennsylvania, but failed to make steel. Alexander L. Holley built the first successful Bessemer steel plant in the U.S. in 1865. High-volume production of low-cost steel in Britain and the U.S. by the Bessemer process soon revolutionized building construction and provided steel to replace iron in railroad rails and many other uses. The Bessemer process was eventually superseded by the OPEN-HEARTH PROCESS. See also BASIC BESSEMER PROCESS.

Bessey, Charles E(dwin) (b. May 21, 1845, near Milton, Ohio, U.S.—d. Feb. 25, 1915, Lincoln, Neb.) U.S. botanist. He taught at Iowa State Agricultural College (1870–84) before joining the faculty of the University of Nebraska. By then he had so developed the experimental study of plant morphology that the recently founded university immediately became one of the nation's outstanding centres for botanical research. He wrote widely popular textbooks that dominated U.S. botanical instruction for more than 50 years.

Bessey, c. 1910
COURTESY OF HUNT INSTITUTE FOR BOTANICAL DOCUMENTATION, CARNEGIE MELLON UNIVERSITY, PITTSBURGH, PA.

Besson \bes-'ōⁿ**, Jacques** (b. 1540, Grenoble, France—d. 1576, Orléans) French engineer. His improvements in the LATHE were of great importance in the development of the MACHINE-TOOL industry and of

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scientific instrumentation. His designs were illustrated in great detail in his *Theatrum instrumentorum et machinarum* (1569). Among many innovations, Besson introduced CAMS and templates (patterns used to guide the form of a piece being made) to the screw-cutting lathe, thus increasing the operator's control of tool and workpiece and permitting production of more accurate and intricate work in metal.

Best, Charles H(erbert) (b. Feb. 27, 1899, West Pembroke, Maine, U.S.—d. March 31, 1978, Toronto, Ont., Can.) U.S.-born Canadian physiologist. He was a professor and administrator at the University of Toronto 1929–67. With FREDERICK BANTING, he was the first to obtain a pancreatic extract of INSULIN in a form useful for controlling DIABETES MELLITUS (1921). He did not receive the 1923 Nobel Prize for Physiology or Medicine with Banting and J. J. R. MACLEOD because he did not yet have his medical degree, although Banting voluntarily shared his portion of the prize with Best. Best also discovered the vitamin choline and the enzyme histaminase and was one of the first to introduce anticoagulants to treat thrombosis.

bestiary Medieval European work in verse or prose, often illustrated, consisting of a collection of stories, each based on a description of certain qualities of the subject, usually an animal or a plant. The stories were allegories, used for moral and religious instruction and admonition. They ultimately were derived from the Greek *Physiologus*, a text compiled by an unknown author before the mid 2nd century AD. Many traditional attributes of real or mythical creatures derive from bestiaries, such as the phoenix's burning itself to be born again and the parental love of the pelican, which, believed to feed its young by gashing its own breast, became a symbol of Christ.

beta \'bā-tə\ **-blocker** *in full* **beta-adrenergic blocking agent** Any of a class of synthetic drugs used to treat a wide range of diseases and conditions of the sympathetic NERVOUS SYSTEM (see AUTONOMIC NERVOUS SYSTEM). Stimulation by EPINEPHRINE of beta-adrenergic receptors, which are predominately found in the HEART but are also present in vascular and other smooth MUSCLE, results in excitation of the sympathetic nervous system. By preventing that excitation, beta-blockers are useful in controlling ANXIETY, HYPERTENSION, and a variety of heart conditions (see HEART DISEASE). They reduce the risk of a second HEART ATTACK.

beta decay Any of three processes of radioactive disintegration in which a beta particle is spontaneously emitted by an unstable atomic NUCLEUS in order to dissipate excess energy. Beta particles are either ELECTRONS or POSITRONS. The three beta-decay processes are electron emission, positron emission, and electron capture. The process of beta decay increases or decreases the positive charge of the original nucleus by one unit without changing the mass number. Though beta decay is in general a slower process than GAMMA or ALPHA decay, beta particles can penetrate hundreds of times farther than alpha particles. Beta decay HALF-LIVES are a few milliseconds or more. See also RADIOACTIVITY.

Betancourt \ˌbe-ˌtän-ˈkůr**, Rómulo** (b. Feb. 22, 1908, Guatiré, Miranda, Venez.—d. Sept. 28, 1981, New York, N.Y., U.S.) President of Venezuela (1945–48, 1959–64). As a youth he was active against the dictatorial regime of Juan Vincente Gómez (1857/64–1935). After a brief period in the Communist Party, he turned against it and helped found the left-wing anticommunist party Acción Democrática, which came to power in 1945 after a coup. As provisional president, he pursued a policy of moderate social reform before resigning to permit election of a successor. Elected to a second term in 1959, he steered a middle course between pro-Cuban communists and frightened conservatives, initiating an ambitious public-works program and fostering industrial development, mostly financed by Venezuela's vast oil exports. He retired in 1964.

betel \'bē-tᵊl\ Either of two different plants that are widely used in combination for chewing purposes in southern Asia and the East Indies. The betel nut is the seed of the areca, or betel, PALM (*Areca catechu*), family Palmae; the betel leaf is from the betel pepper, or pan plant (*Piper betle*), family Piperaceae. For chewing, a small piece of the areca palm's fruit is wrapped in a leaf of the betel pepper, along with a pellet of lime to cause salivation and release the stimulating ALKALOIDS. Chewing results in a heavy flow of brick-red saliva, which may temporarily dye the mouth, lips, and gums orange-brown. Betel nuts yield an alkaloid that veterinarians use as a worming agent.

The betel nut, seed of the areca palm (*Areca catechu*)
WAYNE LUKAS–GROUP IV—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Betelgeuse \'bē-tᵊl-ˌjüs\ (from Arabic *bat al-dshauza*, "the giant's shoulder") Brightest STAR in the constellation Orion, marking the hunter's eastern shoulder. About 430 light-years from Earth, Betelgeuse is easily identifiable by its brightness, its position in brilliant Orion, and its deep reddish colour. It is a red SUPERGIANT STAR, one of the largest known; its diameter is roughly 500 times that of the Sun.

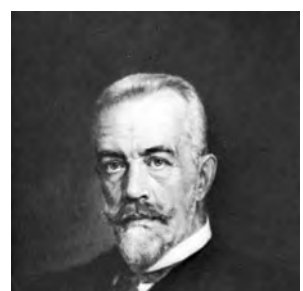
Bethe \'bā-tə**, Hans (Albrecht)** (b. July 2, 1906, Strassburg, Ger.—d. March 6, 2005, Ithaca, N.Y., U.S.) German-born U.S. theoretical physicist. His work helped shape QUANTUM MECHANICS and increased understanding of the forces governing the structures of atomic nuclei. Bethe fled Germany in 1933 and taught at Cornell University (1935–75). He showed how the electric field surrounding an atom in a crystal affects the atom's energy states. He was the first to propose the carbon cycle as a source of energy production in stars (1939). He headed the Theoretical Physics Division of the MANHATTAN PROJECT, but in the postwar era he worked to publicize the threat of nuclear warfare. He was awarded the Max Planck Medal (1955) and the Enrico Fermi Award (1961) and received the 1967 Nobel Prize for Physics.

Bethel City, ancient PALESTINE. It is located near the modern town of Baytīn in the West Bank and lies about 10 mi (16 km) north of Jerusalem. Important in Old Testament times, it was associated with ABRAHAM and JACOB. After the division of Israel, Bethel was made the chief sanctuary of the northern kingdom (Israel) and was later the centre for the prophetic ministry of AMOS.

Bethlehem *Arabic* **Bayt Laḥm** Town (pop., 2005 prelim.: 29,000), WEST BANK, south of JERUSALEM. An ancient town of JUDAEA, it was the early home of King DAVID. A Roman garrison was stationed there during the Second Jewish Revolt (AD 135). Christians regard it as the birthplace of JESUS, and in the early 4th century the Church of the Nativity, located on what is believed to be the site of Jesus' birth, was built there. Bethlehem was included in the British mandate of Palestine (1923–48); in 1950, following the first ARAB-ISRAELI WAR (1948–49), it was annexed by Jordan. After the SIX-DAY WAR (1967), it became part of the WEST BANK territory under Israeli administration. Under an agreement reached in 1995, Israel ceded rule of the town to a Palestinian Authority. Long an important pilgrim and tourist centre, it is also an agricultural market closely linked to Jerusalem.

Bethlehem City (pop., 2000: metro area, 71,329), eastern Pennsylvania, U.S. With ALLENTOWN and Easton it forms an urban industrial complex. Founded in 1741 by MORAVIAN missionaries, it was the site of a hospital for Continental soldiers during the AMERICAN REVOLUTION. Industrialization began with the opening of the Lehigh Canal (1829) and the founding of the forerunner of the BETHLEHEM STEEL CORP. (1857); the city became a major steel-producing centre. Its economy has since diversified to include textiles, metal products, furniture, and chemicals.

Bethlehem Steel Corp. U.S. corporation created in 1904 to consolidate Bethlehem Steel Co., the Union Iron Works, and a few smaller companies. Its principal founder was CHARLES M. SCHWAB. In its early decades Bethlehem Steel (based in Bethlehem, Pa.) produced primarily coal, iron ore, and steel; it supplied the steel for the GOLDEN GATE BRIDGE. In later decades it diversified into plastics, chemicals, and nonferrous ores. By the late 20th century it had become one of the largest steel producers in the U.S., with operations in Pennsylvania, Indiana, Maryland, and New York. The company's high labour costs, aging infrastructure, and inability to compete globally led to its liquidation in 2003.



Theobald von Bethmann Hollweg, detail from a portrait by Brant, 1909.
ARCHIV FUR KUNST UND GESCHICHTE, BERLIN

Bethmann Hollweg \'bāt-ˌmän-ˈhȯl-ˌvek**, Theobald von** (b. Nov. 29, 1856, Hohenfinow, Prussia—d. Jan. 1, 1921, Hohenfinow, Germany)

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German politician and chancellor (1909–17). A member of the civil service, he was appointed Prussian minister of the interior in 1905 and became German chancellor in 1909. Before World War I, he allowed the militarist factions to dominate the government; in 1914 he supported a "blank check" to Austria-Hungary for measures against Serbia. In 1916 he tried to secure the mediation of the U.S. to end the war, but he also failed to restrict submarine warfare. In 1917 he angered conservatives by promises of electoral reforms in Prussia and was forced to resign.

Bethune \be-'thün**, Louise Blanchard** *orig.* **Jennie Louise Blanchard** (b. July 21, 1856, Waterloo, N.Y., U.S.—d. Dec. 18, 1913, Buffalo, N.Y.) First professional woman architect in the U.S. She opened an independent office in Buffalo in 1881. Her firm designed several hundred buildings throughout New York state, many of them in the Romanesque revival style popular in the late 19th century. In 1888 she became the first woman elected to the American Institute of Architects.

Bethune \bā-'th(y)ün**, Mary (Jane) McLeod** *orig.* **Mary Jane McLeod** (b. July 10, 1875, Mayesville, S.C., U.S.—d. May 18, 1955, Daytona Beach, Fla.) U.S. educator. Born to former slaves, she made her way through college and in 1904 founded a school that later became part of Bethune-Cookman College in Daytona Beach, Fla. She was president of the college in 1923–42 and 1946–47, also serving as a special adviser to Pres. Franklin Roosevelt. Prominent in African-American organizations, particularly women's groups, she directed the Division of Negro Affairs of the National Youth Administration (1936–44).

Bethune \bə-'thün**, (Henry) Norman** (b. March 3, 1890, Gravenhurst, Ont., Can.—d. Nov. 12, 1939, Huang Shikou, Hebei, China) Canadian surgeon and political activist. He began his medical career in 1917, serving with Canadian forces in World War I. During the Spanish Civil War he was a surgeon with the loyalist forces, setting up the first mobile blood-transfusion service. After a trip to the Soviet Union in 1935, he joined the Communist Party of Canada. In 1938 he left Canada to serve as a surgeon with the Chinese army in its war with Japan, organizing field hospitals and setting up medical schools. He became a national hero of China.

Betjeman \'bech-ə-mən**, Sir John** (b. Aug. 28, 1906, London, Eng.—d. May 19, 1984, Trebetherick, Cornwall) English poet. His poetry volumes include *Mount Zion* (1933), *High and Low* (1966), and *A Nip in the Air* (1974), and his prose works include guidebooks to English counties and essays on places and buildings. His nostalgia for the near past, his exact sense of place, and his precise rendering of social nuance made him widely read at a time when much of what he wrote about was vanishing. From 1972 until his death he served as poet laureate of England.

Bettelheim \'be-təl-ˌhīm**, Bruno** (b. Aug. 28, 1903, Vienna, Austria—d. March 13, 1990, Silver Spring, Md., U.S.) Austrian-U.S. psychologist. Trained in Vienna, he was arrested by the Nazis and interned in concentration camps (1938–39). He immigrated to the U.S., where from 1944 he directed the University of Chicago's Orthogenic School, a laboratory school for disturbed children, and became known especially for his work with autistic children. He applied psychoanalytic principles to social problems, especially in child rearing. His works include an influential paper on adaptation to extreme stress (1943), "Love Is Not Enough" (1950), as well as *The Informed Heart* (1960), *The Empty Fortress* (1967), *Children of the Dream* (1967), and *The Uses of Enchantment* (1976). Depressed after the death of his wife and after suffering a stroke, he took his own life. His reputation was later clouded by revelations that he had invented his academic credentials and had abused and misdiagnosed children at his school.

Better Business Bureau Any of several U.S., Puerto Rican, and Canadian organizations formed to protect communities from unfair, misleading, or fraudulent advertising and selling practices. Organized at the local level, Better Business Bureaus investigate and set standards for business practices, receive complaints of improper practices, and conduct educational campaigns alerting the public to methods of deceit and fraud in advertising and selling.

Betti \'bāt-tē**, Ugo** (b. Feb. 4, 1892, Camerino, Italy—d. June 9, 1953, Rome) Italian playwright. He pursued a legal career, serving as a judge and as librarian of the Ministry of Justice in Rome. He wrote three volumes of poetry, three collections of short stories, and 26 plays. His first play, *The Landlady* (1927), drew mixed reviews, but later works were more successful. Several were translated into French and English and performed in Paris, London, and New York City, including *Landslide* (1933), *Corruption in the Palace of Justice* (1949), *The Queen and the Rebels* (1951), and *The Fugitive* (1953).

Betwa River \'bā-twä\ River, northern India. Rising in western Madhya Pradesh state, it flows northeast 380 mi (610 km) through Uttar Pradesh state into the Yamuna River near Hamirpur. Nearly half its course is unnavigable. The Matatila Dam, a joint venture between the two states, is near Jhansi.

Beust \'bȯist**, Friedrich Ferdinand, count von** (b. Jan. 13, 1809, Dresden, Saxony—d. Oct. 24, 1886, Schloss Altenberg, near Vienna, Austria-Hungary) German statesman. A career diplomat in Saxony from 1830, he served as its foreign minister (1849–53) and its interior minister (1853–66). Often opposed to Otto von Bismarck, Beust was forced to resign in 1866. Saxony's ally, the Habsburg emperor Francis Joseph, then appointed him Austrian minister for foreign affairs (1866) and imperial chancellor (1867–71). As chancellor, Beust negotiated the Compromise of 1867 and helped restore the Habsburgs' international position. He later served as ambassador to England (1871–78) and France (1878–82).

Beuve, Charles-Augustin Sainte- See C.-A. Sainte-Beuve

Beuys \'bȯis**, Joseph** (b. May 12, 1921, Krefeld, Ger.—d. Jan. 23, 1986, Düsseldorf, W.Ger.) German avant-garde sculptor and performance artist. He served in the German air force in World War II and later studied art in Düsseldorf (1947–51); in 1961 he was appointed professor of sculpture at its art academy. In the 1960s he worked with the international group Fluxus, whose emphasis was not on what an artist makes but on his or her personality, actions, and opinions. Beuys's most famous and controversial performance was *How to Explain Pictures to a Dead Hare* (1965), in which he walked around an art gallery with his face covered in honey and gold leaf, talking to a dead hare about human and animal consciousness. He also became known for sculptural works that utilized fat and layers of felt. He succeeded in creating a popular personal mythology and was one of the most influential artists and teachers of the later 20th century.

Bevan \'bev-ən**, Aneurin** (b. Nov. 15, 1897, Tredegar, Monmouthshire, Eng.—d. July 6, 1960, Chesham, Buckinghamshire) British politician. As a young man, he entered Labour Party politics and was elected to the House of Commons in 1929. He overcame a speech impediment to become a brilliant orator. As minister of health in Clement Attlee's government (1945–51), "Nye" Bevan established the National Health Service. He was minister of labour (1951) but resigned in protest against rearmament expenditures that reduced spending on social programs. A controversial figure in the Labour Party, he headed its left-wing (Bevanite) group and was the party's leader until 1955.

Beveridge \'bev-ˌrij**, Albert J(eremiah)** (b. Oct. 6, 1862, Highland county, Ohio, U.S.—d. April 27, 1927, Indianapolis, Ind.) U.S. senator and historian. He was admitted to the Indiana bar in 1887 and began the practice of law in Indianapolis. Elected as a Republican to the U.S. Senate (1900–12), he supported the progressive legislation proposed by Pres. Theodore Roosevelt. In 1912 he broke with the conservative wing of the Republican Party to serve as chairman of the convention that organized the Progressive Party and nominated Roosevelt for president. He subsequently retired from public life to write several historical works, including the four-volume *Life of John Marshall* (1916–19), which won a Pulitzer Prize.

Beveridge (of Tuggal), William Henry, 1st Baron (b. March 5, 1879, Rangpur, India—d. March 16, 1963, Oxford, Oxfordshire, Eng.) British economist. He took a lifelong interest in the problem of unemployment and served as director of labour exchanges (1909–16). He directed the London School of Economics (1919–37), then became master of University College, Oxford (1937–45). Invited by the government to become the architect of the new British welfare state, he helped shape Britain's social policies and institutions through the Beveridge Report (1942). His books included *Insurance for All* (1924), *Full Employment in a Free Society* (1944), and *Pillars of Security* (1948).

Beverly Hills City (pop., 2000: 33,784), southwestern California, U.S. It is surrounded by the city of Los Angeles and adjoining Hollywood. It was established in 1906 as a residential area called Beverly. The Beverly Hills Hotel was built in 1912. Movie stars Mary Pickford and Douglas Fairbanks lived there in 1919, beginning the fashion among Hollywood celebrities of building lavish homes in Beverly Hills. Occupying an area

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of 5.7 sq mi (14.8 sq km), the city is crossed by the famous streets of Sunset Boulevard, Santa Monica Boulevard, and Rodeo Drive.

Bevin, Ernest (b. March 9, 1881, Winsford, Somerset, Eng.—d. April 14, 1951, London) British labour leader and statesman. Active in labour organizations from 1905, he became head of the Dockers' Union. In 1921 he merged several unions into the Transport and General Workers' Union, which became the world's largest trade union, and served as its general secretary until 1940. He was a forceful minister of labour and national service in Winston Churchill's wartime coalition government (1940–45). As foreign secretary in Clement Attlee's Labour government (1945–51), he negotiated the Brussels Treaty and helped establish NATO.

Bewick, Thomas (b. Aug. 12, 1753, Cherryburn, Eng.—d. Nov. 8, 1828, Gateshead) British wood engraver. At age 14 he was apprenticed to a metal engraver, with whom he later went into partnership in Newcastle; Bewick remained there most of his life. He rediscovered the technique of wood engraving, which had declined into a reproductive technique, and brought to it brilliant innovations, such as the use of parallel lines instead of cross-hatching to achieve a wide range of tones and textures. He also developed a method of printing gray backgrounds to heighten the effect of atmosphere and space. Some of his finest works are illustrations for books on natural history. He established a school of engraving in Newcastle.

The Tawny Owl, wood engraving by Thomas Bewick, from his *History of British Birds,* 1797–1804.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Bezos \'bā-zōs**, Jeff(rey P.)** (b. Jan. 12, 1964, Albuquerque, N.M., U.S.) U.S. Internet entrepreneur. Educated at Princeton University, he worked in banking and investment at Bankers Trust and D.E. Shaw & Co. before founding Amazon.com, Inc., in 1995. The Internet company began as a bookseller and later expanded into recorded music, videos, electronic equipment, tools, and other areas, including on-line auctions. Amazon.com became famous for the extraordinary rise in its stock-market valuation despite continued annual losses—a reflection of investor confidence in the future of on-line retailing that marked the late 1990s. The company posted its first quarterly profit in January 2002.

Bhadracarya-pranidhana \ˌbäd-rə-chär-'yä-ˌprä-nē-də-'nä\ Mahayana Buddhist text that is also important to Tibetan Buddhism. It is related to the Avatamsaka-sutra and is considered by some to be its final section. It presents ten vows of the bodhisattva Samantabhadra. These became daily lessons in Chinese monasteries. By keeping the vows, including inexhaustible service to all buddhas and the embracing of all universes, the faithful can realize the universe of interdependent phenomena manifested in the Buddha and enter into the Pure Land of Amitabha.

Bhagavadgita \'bä-gə-ˌväd-'gē-tə\ (Sanskrit: "Song of God") One of the greatest of the Hindu scriptures, constituting part of the *Mahabharata.* It is written in the form of a dialogue between the warrior Prince Arjuna and the charioteer Krishna, an incarnation of Vishnu. It was probably composed in the 1st or 2nd century AD, later than much of the epic. Concerned over the suffering the impending battle will cause, Arjuna hesitates, but Krishna explains that the higher way is the dispassionate discharge of duty without concern for personal triumph. The *Bhagavadgita* considers the nature of God and ultimate reality and offers three disciplines for transcending the limitations of this world: *jnana* (knowledge or wisdom), karma (dispassionate action), and bhakti (love of God). It has inspired numerous commentaries over the centuries, including those by Ramanuja and Mohandas K. Gandhi.

Bhagavata \'bä-gə-ˌvə-tə\ Member of the earliest recorded Hindu sect, representing the beginnings of theistic, devotional worship and modern Vaishnavism. The Bhagavata sect originated in the Mathura region c. 3rd–2nd century BC and spread through western, northern, and southern India. The faith centers on devotion to a personal god, variously called Vishnu, Krishna, Hari, or Narayana. The Bhagavadgita (1st–2nd century AD) is the earliest exposition of the Bhagavata system, but its central scripture is the Bhagavata Purana. The sect was prominent within Vaishnavism until the 11th century, when bhakti (devotional worship) was revitalized by Ramanuja.

bhakti \'bək-tē\ Southern Asian devotional movement, particularly in Hinduism, emphasizing the love of a devotee for his or her personal god. In contrast to Advaita, bhakti assumes a dualistic relationship between devotee and deity. Though Vishnu, Shiva, and Shakti (see shakti) all have cults, bhakti characteristically developed around Vishnu's incarnations as Rama and Krishna. Practices include reciting the god's name, singing hymns, wearing his emblem, and making pilgrimages. The fervour of South Indian hymnists in the 7th–10th centuries spread bhakti and inspired much poetry and art. Poets such as Mirabai conceived of the relationship between the worshiper and the god in familiar human terms (e.g., the lover and beloved), while more abstract poets such as Kabir and his disciple Nanak, the first Sikh Guru and founder of Sikhism, portrayed the divinity as singular and ineffable.

bharata natya \'bä-rə-tə-'nät-yə\ Principal classical dance style of India, indigenous to Tamil Nadu and prevalent in South India. It expresses Hindu religious themes, and its techniques and terminology are found in the treatise *Natya-shastra*, written by the sage Bharata (3rd century AD). One dancer performs the entire two-hour program, accompanied by drums, drone, and singer. Originally performed only by female temple dancers, the art fell into disrepute as temple dancing became associated with prostitution, but it was revived in its original purity in the late 19th century. It was not brought to the stage until the 1930s.

Bharatiya Janata Party (BJP) *English* **Indian People's Party** Pro-Hindu political party of India. The BJP traces its roots to the the Bharatiya Jana Sangh (founded in 1951), which advocated the rebuilding of India in accordance with Hindu culture. The BJP was formally established in 1980. It achieved its first significant electoral success in 1989, though in 1992 the destruction of the Babri Mosjid (Mosque of Bābur) in Ayodhya caused a backlash against it. In 1996 the BJP formed a short-lived government. Two years later the party and its allies formed a majority government with Atal Bihari Vajpayee as prime minister. Vajpayee again became prime minister in 1998 as head of a coalition of the BJP and other parties. In 2004, however, the coalition was defeated in parliamentary elections, and Vajpayee resigned from office.

Bharatpur \'bə-rət-ˌpůr\ *or* **Bhurtpore** \'bərt-ˌpōr\ City (pop., 2001 prelim.: 204,456), Rajasthan state, northwestern India. Located west of Agra, it was founded c. 1733 and was the capital of the princely state of Bharatpur. It was so strongly fortified that it successfully resisted the British siege in 1805, and it was not taken by them until 1826. The city is renowned for the superb bird sanctuary at nearby Keoladeo National Park.

Bharhut \'bä-rət\ **sculpture** Indian sculpture from the mid 2nd century BC that decorated the great stupa, or relic mound, of Bharhut, in Madhya Pradesh, India. It is now mostly destroyed; the railings and gateways that remain are in Kolkata's (Calcutta's) Indian Museum. The ornamental medallions depicting legends of the Buddha's previous births and events in his life are labeled and so are indispensable for an understanding of Buddhist iconography. The Bharhut style marked the beginning of a tradition of Buddhist narrative relief and decoration of sacred buildings that continued for several centuries.

Bhartrhari \'bä-trə-rē\ (b. 570?, Ujjain, Malwa, India—d. 651?, Ujjain) Indian Hindu philosopher, poet, and grammarian. He was of noble birth; according to legend, he made seven attempts to renounce the world for monastic life before eventually becoming a yogi and moving into a cave near Ujjain. *Vakyapadiya* is his major work on the philosophy of language. Also ascribed to him are three collections of poetry, each containing 100 verses: *Shrngara-shataka* (on love), *Niti-shataka* (on ethics and polity), and *Vairagya-shataka* (on dispassion). His poem *Bhatti kavya* demonstrates the subtleties of Sanskrit.

Bhasa \'bä-sə\ (b. 3rd century AD) Indian dramatist. The earliest known dramatist in Sanskrit, he was known only by the allusions of other Sanskrit dramatists until the texts of 13 of his dramas were discovered and published in 1912. Most of his works are adaptations of themes of heroism and romantic love borrowed from two epics, the *Ramayana* and the *Mahabharata.* He diverged from the conventions of the time by portraying battles and killings on the stage. His influence is seen in the works of the 5th-century dramatist Kalidasa.

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Bhaskara I (fl. c. 629, possibly Valabhi, India) Indian astronomer and mathematician. His fame rests on three treatises he composed on the works of Aryabhata I (b. 476). Two of these, known today as *Mahabhaskariya* ("Great Book of Bhaskara") and *Laghubhaskariya* ("Small Book of Bhaskara"), are astronomical works in verse, while *Aryabhatiyabhashya* (629) is a prose commentary on the *Aryabhatiya* of Aryabhata. Bhaskara stressed the importance of proving mathematical rules rather than just relying on tradition or expediency.

Bhaskara II (b. 1114, Biddur, India—d. c. 1185, probably Ujjain) The leading mathematician of the 12th century. He was the lineal successor of BRAHMAGUPTA as head of an astronomical observatory at Ujjain, the leading mathematical centre of ancient India. His mathematical works were the first to make full and systematic use of the decimal system. He evidently was the first to gain some understanding of the meaning of division by zero. He used letters to represent unknown quantities, much as in modern algebra, and solved indeterminate equations of 1st and 2nd degrees. He wrote on his astronomical observations of planetary positions, conjunctions, eclipses, cosmography, geography, and the mathematical techniques and astronomical equipment used in these studies. He was also a noted astrologer.

bhiksu \'bik-shü\ *Pali* **bhikku** \'bik-ü\ In BUDDHISM, a member of the SANGHA, the ordained order of men established by the Buddha. (Female orders exist in some Mahayana Buddhist traditions). Originally they were mendicant followers of the Buddha who taught Buddhist ways in return for food. Today children may enter monastic life as novices, but candidates for ordination must be 21 years old. There are some 200 rules; sexual relations, taking of life, stealing, or boasting of spiritual attainment will lead to expulsion. A bhiksu shaves his head and face, owns a few essential items, and begs daily for his food. THERAVADA Buddhism forbids monks to handle money and perform labour. Chan (ZEN) Buddhism requires monks to work. See also VINAYA PITAKA.

Bhima River \'bē-mə\ River, southwestern India. Rising in MAHARASHTRA state in the Western Ghats east of MUMBAI (Bombay), it flows southeast 450 mi (725 km) through southern Maharashtra, northern KARNATAKA, and central ANDHRA PRADESH to join the KRISHNA RIVER. The Bhima's banks are heavily populated. Its water level rises sharply during the monsoons, and receding floodwaters form fertile farming belts.

Bhopal \bō-'päl\ City (pop., 2001: 1,437,354), capital of MADHYA PRADESH state, India. Situated northwest of NAGPUR, it is primarily an industrial city and a major rail junction. It is the site of India's largest mosque and home to several colleges. In 1984 Bhopal became the site of one of the worst industrial accidents in history when tons of toxic gas escaped from a Union Carbide insecticide plant and spread over a densely populated area; the final death toll was estimated to be between 15,000 and 20,000, with some half-million survivors suffering various ailments.

Bhopal Former princely state, central INDIA. It is crossed by the Vindhya Mountains; the NARMADA RIVER is its southern boundary. It was founded in 1723 by an Afghan adventurer. In its struggles with the Marathas, Bhopal was itself friendly to the British and concluded a treaty with them in 1817. It was a major component of the Bhopal Agency and the second largest Muslim principality of the British Empire. At India's independence, Bhopal remained a separate Indian province. When it was incorporated into MADHYA PRADESH in 1956, BHOPAL city became the state's capital.

Bhubaneshwar \ˌbü-bə-'nesh-wər\ City (pop., 2001 prelim.: 647,302), capital of ORISSA, eastern India. Its history from the 3rd century BC is represented in nearby archaeological remains. From the 5th to the 10th century AD it was the provincial capital of many Hindu dynasties. Its many temples, displaying every phase of Orissan architecture, were built from the 7th to the 16th century. It became the state capital in 1950.

Bhumibol Adulyadej *or* **Phumiphon Adunlayadet** \'pü-mē-ˌpòn-ä-'dùn-lə-ˌdāt\ *or* **Rama IX** (b. Dec. 5, 1927, Cambridge, Mass., U.S.) Ninth king of the CHAKRI DYNASTY and Thailand's longest-ruling monarch. A grandson of King CHULALONGKORN, he succeeded to the throne in 1946 after the death of his older brother, King Ananda Mahidol (r. 1935–46). His role as head of state is largely ceremonial, but he moderates between extreme parties in Thai politics and serves as a focus of national unity.

Bhurtpore See BHARATPUR

Bhutan \bü-'tän\ *officially* **Kingdom of Bhutan** Kingdom, HIMALAYAS, south-central Asia. Area: 14,824 sq mi (38,394 sq km). Population (2005 est.): 776,000. Capital: THIMPHU. There are three main ethnic groups:

the Buddhist Sharchops (Assamese) in the east; the Tibetan Buddhist Bhutia, about half of the population, in the northern, central, and western areas; and the Hindu Nepalese in the southwest. Languages: Dzongkha (official), Tibetan dialects. Religions: Mahayana Buddhism (official); also Hinduism. Currency: ngultrum. The northern part of the country lies in the Great Himalayas, with peaks surpassing 24,000 ft (7,300 m) and high valleys lying at 12,000–18,000 ft (3,700–5,500 m). Spurs radiate southward, forming the Lesser Himalayan ranges. Several fertile valleys there, at elevations of 5,000–9,000 ft (1,500–2,700 m), are fairly well populated and cultivated. South of these mountains lies the Duars Plain, controlling access to the strategic mountain passes; much of it is hot and steamy and covered with dense forest. The Bhutanese economy is mainly agricultural; nearly all exports go to India. Bhutan is a monarchy with one legislative house; the head of state is the monarch, and the head of government is the prime minister. Bhutan's mountains and forests long made it inaccessible to the outside world, and its feudal rulers banned foreigners until well into the 20th century. It nevertheless became the object of foreign invasions; in 1865 it came under British influence, and in 1910 it agreed to be guided by Britain in its foreign affairs. It later became oriented toward British-ruled India, though much of its trade continued to be with Tibet. India took over Britain's role in 1949, and the Chinese army's presence in neighbouring Tibet since 1950 further strengthened Bhutan's ties with India. The apparent Chinese threat made its rulers aware of the need to modernize, and it has embarked on a program to build roads and hospitals and to create a system of secular education.

Bhutto \'bü-tō**, Benazir** (b. June 21, 1953, Karachi, Pak.) Pakistani politician, the first woman leader of a Muslim nation in modern history. After receiving an education at Harvard and Oxford, she led the political opposition to Pres. ZIA-UL-HAQ after the execution of her father, ZULFIKAR ALI BHUTTO in 1979. She subsequently endured frequent house arrest (1979–84) and was exiled (1984–86). When Zia died in a plane crash in 1988, she became prime minister of a coalition government. She was unable to do much to combat Pakistan's widespread poverty, governmental corruption, and increasing crime, and her government was dismissed in 1990 on charges of corruption and other malfeasance. A second stint as prime minister (1993–96) ended similarly. In 1999 she was convicted of taking kickbacks from a Swiss company and sentenced in absentia to five years in prison.

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Bhutto, Zulfikar Ali (b. Jan. 5, 1928, near Larkana, Sindh, India—d. April 4, 1979, Rawalpindi, Pak.) President (1971–73) and prime minister (1973–77) of Pakistan. Son of a prominent politician, he was educated in India, the U.S., and Britain. He served eight years in the government of Mohammad Ayub Khan (1907–74) then resigned to form the Pakistan People's Party (1967). After the overthrow of the Ayub Khan regime and the Pakistani civil war, Bhutto became president (1971). He nationalized several key industries and taxed landed families. He became prime minister in 1973, and his government, retaining martial law, began a process of Islamization. Bhutto's party won elections in 1977, but the opposition accused him of electoral fraud. Gen. ZIA-UL-HAQ seized power and had Bhutto imprisoned and later executed. BENAZIR BHUTTO is his daughter.

Biafra \bē-'äf-rə\ Former secessionist state, West Africa. It constituted the former Eastern Region of Nigeria, inhabited principally by the IGBO. In a period of political and economic instability in the 1960s, the resentment of the HAUSA in the north toward the more prosperous and educated Igbo exploded in fighting and massacres, which led to the secession of the Eastern Region as the state of Biafra in 1967. A costly civil war and the death by starvation of an estimated one million civilians ended in Biafra's collapse and reincorporation into Nigeria in 1970.

Biafra, Bight of Inlet of the Atlantic Ocean, West Africa. The innermost bay of the Gulf of GUINEA, it is bounded by Nigeria, Cameroon, Equatorial Guinea, and Gabon, and receives portions of the NIGER and OGOOUÉ rivers. It includes several islands, including BIOKO. Its ports include MALABO, CALABAR, and DOUALA. In the 16th–19th century the bay was the scene of extensive slave dealing. By the 1830s palm-oil trading had surpassed slave trading. Today petroleum is a major economic resource.

Białystok \byä-'wi-stȯk\ City (pop., 2000 est: 285,500), northeastern Poland. Founded in the 14th century, it was annexed to Prussia in 1795–1807. It passed to Russia, was captured by Germany in 1915, and was restored to Poland in 1919. During World War II it was overrun by Germans in 1941, then retaken by Soviet troops in 1944. Returned to Poland in 1945, it is now an important rail junction; it has been a major textile producer since 1863.

Biarritz \byä-'rēts\ Town (pop., 1999: 30,005), southwestern France. It lies on the Gulf of Gascogne (Bay of BISCAY) near Bayonne, 11 mi (18 km) from Spain. Once a small fishing village, Biarritz became a fashionable summer resort after 1854 with the visits of NAPOLEON III; visited also by British royalty, it grew additionally as a winter residence. Its mild climate and variety of beaches, and the folklore and traditions of the local BASQUES, continue to draw an international clientele.

biathlon Winter sports event combining CROSS-COUNTRY SKIING with rifle sharpshooting. It originated in Scandinavian hunting. It was first included in the Winter Olympics program in 1960. Competitors cover a course, carrying a single-shot rifle and ammunition and stopping at four points to fire five shots at small targets. Events are either 10 or 20 km long, and there are a variety of race types, including relay, sprint, and pursuit.

Bibiena family See GALLI BIBIENA FAMILY

Bible Sacred scriptures of JUDAISM and CHRISTIANITY. The Jewish scriptures consist of the TORAH (or Pentateuch), the Neviim ("Prophets"), and the Ketuvim ("Writings"), which together constitute what Christians call the OLD TESTAMENT. The Pentateuch and Joshua relate how Israel became a nation and came to possess the Promised Land. The Prophets describe the establishment and development of the monarchy and relate the prophets' messages. The Writings include poetry, speculation on good and evil, and history. The Roman Catholic and Eastern Orthodox Bible includes additional Jewish writings called the APOCRYPHA. The NEW TESTAMENT consists of early Christian literature. The GOSPELS tell of the life, person, and teachings of Jesus. The Acts of the Apostles relates the earliest history of Christianity. The Epistles (Letters) are correspondence of early church leaders (chiefly St. PAUL) and address the needs of early congregations. REVELATION is the only canonical representative of a large genre of early Christian apocalyptic literature. See also BIBLICAL SOURCE, BIBLICAL TRANSLATION. See table opposite.

Old Testament: Jewish Scripture

Genesis	Isaiah	Nahum	Song of Songs
Exodus	Jeremiah	Habakkuk	Ruth
Leviticus	Ezekiel	Zephaniah	Lamentations
Numbers	Hosea	Haggai	Ecclesiastes
Deuteronomy	Joel	Zechariah	Esther
Joshua	Amos	Malachi	Daniel
Judges	Obadiah	Psalms	Ezra
1 & 2 Samuel	Jonah	Proverbs	Nehemiah
1 & 2 Kings	Micah	Job	1 & 2 Chronicles

Old Testament: Roman Catholic and Protestant Canons

Catholic	Protestant	Catholic	Protestant
Genesis	Genesis	Wisdom	
Exodus	Exodus	Sirach	
Leviticus	Leviticus	Isaiah	Isaiah
Numbers	Numbers	Jeremiah	Jeremiah
Deuteronomy	Deuteronomy	Lamentations	Lamentations
Joshua	Joshua	Baruch	
Judges	Judges	Ezekiel	Ezekiel
Ruth	Ruth	Daniel	Daniel
1 & 2 Samuel	1 & 2 Samuel	Hosea	Hosea
1 & 2 Kings	1 & 2 Kings	Joel	Joel
1 & 2 Chronicles	1 & 2 Chronicles	Amos	Amos
Ezra	Ezra	Obadiah	Obadiah
Nehemiah	Nehemiah	Jonah	Jonah
Tobit		Micah	Micah
Judith		Nahum	Nahum
Esther	Esther	Habakkuk	Habakkuk
Job	Job	Zephaniah	Zephaniah
Psalms	Psalms	Haggai	Haggai
Proverbs	Proverbs	Zechariah	Zechariah
Ecclesiastes	Ecclesiastes	Malachi	Malachi
Song of Songs	Song of Solomon	1 & 2 Maccabees	

Old Testament: Protestant Apocrypha

1 & 2 Esdras	Additions to Esther	Baruch	Bel and the Dragon
Tobit	Wisdom of Solomon	Prayer of Azariah	Prayer of Manasses
Judith	Ecclesiasticus	Susanna	1 & 2 Maccabees

New Testament

Matthew	Romans	Colossians	Hebrews
Mark	1 & 2 Corinthians	1 & 2 Thessalonians	James
Luke	Galatians	1 & 2 Timothy	1 & 2 Peter
John	Ephesians	Titus	1, 2, 3 John
Acts of the Apostles	Philippians	Philemon	Jude
			Revelation

biblical source Any of the original oral or written materials compiled as the BIBLE. While authorship of many biblical books is anonymous or pseudonymous, scholars have used internal evidence and the tools of biblical criticism to identify sources and arrange them in chronological order of composition. There are four sources for the Pentateuch: J (sources in which God is called YHWH, German JHVH), eastern (sources in which God is called Elohim), D (sources in the style of Deuteronomy), and P (for sources with priestly style and content). Parts of lost books have also been identified in the OLD TESTAMENT. NEW TESTAMENT sources include original writings and ORAL TRADITIONS. The first three (synoptic) GOSPELS have a common source, Matthew and Luke being based on Mark and a lost source called Q; John conveys an independent tradition. Biblical sources are studied to uncover the history of the scriptures and to restore texts as closely as possible to their original content. Scholars may also analyze biblical sources in an effort to reconstruct the oral tradition behind them.

biblical translation Art and practice of translating the BIBLE. The OLD TESTAMENT was originally written in Hebrew, with scattered passages of Aramaic. It was first translated in its entirety into Aramaic and then, in the 3rd century AD, into Greek (the SEPTUAGINT). Hebrew scholars created the authoritative Masoretic text (6th–10th century) from Aramaic TARGUMS, the original Hebrew scrolls having been lost. The NEW TESTAMENT was originally in Greek or Aramaic. Christians translated both Testaments into Coptic, Ethiopian, Gothic, and Latin. St. JEROME's Latin Vulgate (405) was the standard Christian translation for 1,000 years. New learning in the 15th–16th century generated new translations. MARTIN LUTHER translated the

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entire Bible into German (1522–34). The first complete English translation, credited to John Wycliffe, appeared in 1382, but it was the King James version (1611) that became the standard for more than three centuries. By the late 20th century the entire Bible had been translated into 250 languages and portions of it into more than 1,300.

bibliography Broadly, the systematic study and description of books. The word can refer to the listing of books according to some system (called descriptive, or enumerative, bibliography), to the study of books as tangible objects (called critical, or analytical, bibliography), or to the product of those activities. The purpose of bibliography is to organize information about materials on a given subject so that students of the subject may have access to it. A descriptive bibliography may take the form of information about a particular author's works or about works on a given subject or on a particular nation or period. Critical bibliography, which emerged in the early 20th century, involves meticulous descriptions of the physical features of books, including the paper, binding, printing, typography, and production processes used, to help establish such facts as printing dates and authenticity.

Bibliothèque Nationale de France \ˌbib-lē-ō-ˈtek-ˌnȧ-sē-ȯ-ˈnȧl-də-ˈfrä^{n}s\ Most important library in France and one of the oldest in the world. The nation's first royal library, the Bibliothèque du Roi ("King's Library"), was established under Charles V (r. 1364–80) but later dispersed; another was established under Louis XI (r. 1461–83). From 1537 the library received a copy of every French publication. It was moved from Fontainebleau to Paris in the late 16th century and opened to the public in 1692. It acquired its current name in 1795, and its collection was expanded through Revolutionary appropriations and Napoleon's acquisitions. In 1995 it moved to a new facility with a controversial design; this facility now houses all its books (more than 12 million), periodicals, and magazines.

bicameral system System of government in which the legislature comprises two houses. It originated in Britain (see Parliament), where eventually it served to represent the interests of both the common people and the elite and to ensure deliberation over legislation. In the U.S. the bicameral system is a compromise between the claims for equal representation among the states (each state is represented by two members of the Senate) and for equal representation among citizens (each member of the House of Representatives represents roughly the same number of people). Each house has powers not held by the other, and measures need the approval of both houses to become law. Many contemporary federal systems of government have bicameral legislatures. All U.S. states except Nebraska have bicameral legislatures. See also Canadian Parliament; Congress of the United States; Diet.

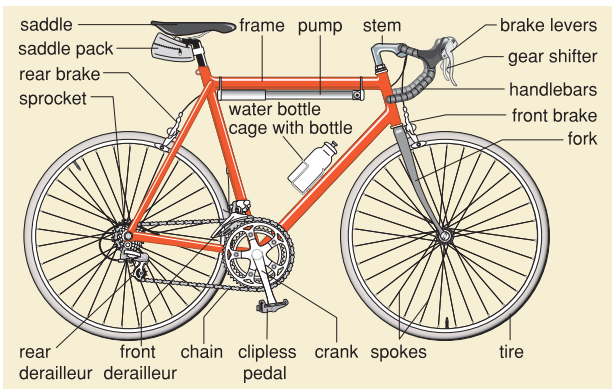
bicarbonate of soda *or* **sodium bicarbonate** *or* **baking soda** Inorganic compound, white, crystalline salt of sodium, chemical formula $NaHCO_3$. It is a weak base and dissociates into water and carbon dioxide gas as it dissolves in the presence of hydrogen ions. In addition to household uses as an antacid, cleaner, and deodorizer, it is used in manufacturing effervescent salts and beverages and baking powder. Industrial uses include production of other sodium salts, treatment of wool and silk, and use in pharmaceuticals, sponge rubber, fire extinguishers, cleaners, lab reagents, mouthwash, and gold and platinum plating.

Bichat \bē-ˈshȧ**, (Marie-François-) Xavier** (b. Nov. 11/14, 1771, Thoirette, Fra.—d. July 22, 1802, Lyon) French anatomist and physiologist. In addition to bedside observations of patients, he conducted autopsies to study the changes disease causes in various organs. With no knowledge of the cell as the functional unit of living things, Bichat was among the first to see the organs of the body as being formed through the specialization of simple, functional units (tissues). Without using a microscope, he distinguished 21 kinds of tissues that, in different combinations, form the organs of the body. His systematic study of human tissues helped create the science of histology.

bichon frise \bē-ˌshō^{n}-frē-ˈzā\ Breed of small dog noted for its fluffy coat and cheerful disposition. Descended from the water spaniel, it stands about 9–12 in. (23–30.5 cm) tall and has a short, blunt muzzle; silky, drooping ears; a puffy, silky, curled coat; and an undercoat. It is mostly white, but may have shadings of cream, gray, or apricot on the head. It originated in the Mediterranean region.

Bicol \ˈbē-ˌkōl\ **Peninsula** Peninsula, southeastern Luzon, Philippines. It has a lengthy coastline with large subpeninsulas. Its area is about 4,660 sq mi (12,070 sq km). It includes the Bicol Plain, a large lowland area important in rice production. It is densely populated though largely rural. It is the homeland of the Bicol, the country's fifth largest ethnolinguistic group, and it has been a stronghold of Philippine communists.

bicycle Lightweight, two-wheeled, steerable machine that is propelled by the rider. The wheels are mounted in a metal frame, and the front wheel is held in a movable fork. The rider sits on a saddle and steers with handlebars attached to the fork, propelling the bicycle with two pedals attached to cranks that turn a chainwheel. An endless chain transmits power from the chainwheel to a sprocket on the back wheel. A heavy, pedalless form built in 1818 was propelled simply by the rider paddling his feet against the ground. In the early 1840s Scottish blacksmith Kirkpatrick Macmillan (1813–78) built bicycles propelled by pedals, cranks, and drive rods; he is widely credited with having invented the bicycle. Important innovations were introduced by Pierre and Ernest Michaux in France in the early 1860s, and by 1865 their company was manufacturing 400 *vélocipèdes* a year. A lighter version produced in England in 1870 (nicknamed the "penny-farthing") featured a large front wheel and small back wheel. By the 1890s the standard bicycle design was established, and, with the smooth ride enabled by the new pneumatic tires, its popularity exploded. The so-called mountain bike became the standard design by the early 1990s. The bicycle is used worldwide as a basic means of transportation.



Components of a modern touring bicycle.
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Bidault \bē-ˈdō**, Georges (-Augustin)** (b. Oct. 5, 1899, Moulins, France—d. Jan. 27, 1983, Cambo-les-Bains, near Bayonne) French statesman and Resistance leader in World War II. After being imprisoned in Germany (1940), he returned to France (1941) and worked with the National Council of Resistance, which he headed in 1943. He helped found the Popular Republican Movement (1944) and supported Charles de Gaulle's wartime government. After the war he briefly served twice as prime minister and three times as minister of foreign affairs. In 1958 he broke with de Gaulle and opposed Algerian independence. He advocated terrorism to prevent independence, went underground, and was forced into exile (1962–68).

Biddle, James (b. Feb. 18, 1783, Philadelphia, Pa., U.S.—d. Oct. 1, 1848, Philadelphia) U.S. naval officer. He entered the navy in 1800. During the War of 1812, he served on the USS *Wasp* when it captured the British ship *Frolic*, and he commanded the USS *Hornet* in its victory over the *Penguin*. In 1817 he was sent to the Columbia River to claim the Oregon Territory for the U.S. As commodore of U.S. ships in East Asia, he negotiated the first treaty, a trade agreement, between the U.S. and China.

Biddle, John (b. 1615, Wotton-under-Edge, Gloucestershire, Eng.—d. Sept. 22, 1662, London) Father of English Unitarianism. He studied at the University of Oxford and became master of a free school in Gloucester. In 1644 he wrote *Twelve Arguments Drawn Out of Scripture*, denying the deity of the Holy Spirit. When the manuscript reached church authorities, he was arrested and imprisoned for two years. After its publication in 1647 he was again detained, and copies of the book were burned. His later writings attacked the doctrine of the Holy Trinity. Freed from a third imprisonment in 1652, he began to meet for worship with his adherents, who came to be called Unitarians. After Biddle published his *Two-Fold Catechism* (1654),

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Oliver Cromwell prevented his execution by exiling him to the Scilly Isles. He returned in 1658; in 1662 he was again put in prison, where he died.

Biddle, Nicholas (b. Jan. 8, 1786, Philadelphia, Pa., U.S.—d. Feb. 27, 1844, Philadelphia) U.S. author, financier, and lawyer. He served as secretary to Pres. James Monroe (1806–07), then minister to England, and, afterward, while practicing law in the U.S., he wrote *History of the Expedition of Captains Lewis and Clark* (1814) from the explorers' notes. In 1823 Monroe appointed him president of the Second Bank of the United States. He developed the bank into the first effective U.S. central bank, sponsoring policies that curbed credit, regulated the money supply, and safeguarded government deposits. In 1832 the bank came under attack from Pres. Andrew Jackson, who managed to terminate its national charter in 1836. Biddle later became president of the bank under a Pennsylvania state charter. The Federal Reserve System was later established as the country's central bank.

Nicholas Biddle
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Bidwell, John (b. Aug. 5, 1819, Chautauqua county, N.Y., U.S.—d. April 4, 1900, near Sacramento, Calif.) U.S. political leader. He was a member of the first group to travel by wagon train to California from Independence, Mo. Reluctant to join the Bear Flag revolt of Americans in California against Mexico, he nonetheless helped draw up the Bear Flag Republic's resolution of independence in July 1846. He fought under John C. Frémont in the Mexican War and assisted in the recapture of Los Angeles in 1847. At the end of the war he returned to Sutter's Fort, where he was the first to find gold on the Feather River. Later he became a leading agriculturalist and played a prominent role in state politics. He was elected to the House of Representatives in 1864 and later ran for governor three times, though he was never elected. In 1892 he became the presidential candidate of the Prohibition Party.

Biedermeier \'bē-dər-ˌmī-ər\ **style** Style of German and Austrian art, furniture, and decoration that developed c. 1815 to 1848. Gottlieb ("Papa") Biedermeier was a fictional cartoon character, the comic symbol of middle-class comfort, with an emphasis on family life and the pursuit of hobbies. The subject matter of Biedermeier paintings, which were either genre or historical, was treated sentimentally; Carl Spitzweg (1808–85) is the best-known of the Biedermeier painters. The simplicity and functionality of Biedermeier furniture were derived from the Empire and Directoire styles, but the furniture was characterized by more restrained geometric shapes. The style was revived in the 1960s.

Biel \'bēl**, Gabriel** (b. c. 1420, Speyer [Germany]—d. Dec. 7, 1495, Tübingen, Württemberg) German philosopher, economist, and Scholastic theologian. He became professor at the University of Tübingen (1484). His *Collectorium circa IV libros sententiarum* presented the teachings of William of Ockham; the work influenced followers known as Gabrielistae. His economic theories favoured fair taxation and price control. See also Scholasticism.

Bielefeld \'bē-lə-ˌfelt\ City (pop., 2002 est: city, 323,400; metro. area, 579,000), northwestern Germany. Founded in 1214, the town arose from a religious settlement around St. Mary's Church in the late 13th century. It joined the Hanseatic League in the 14th century and passed to Brandenburg in 1647. The first mechanized textile mills in Germany were established there in 1851. Heavily damaged in World War II, the city has since been rebuilt. It is the centre of a linen industry; it also has silk and plush weaving mills.

biennial Any plant that completes its life cycle in two growing seasons. During the first growing season biennials produce roots, stems, and leaves; during the second they produce flowers, fruits, and seeds, and then die. Sugar beets and carrots are examples of biennials. See also annual, perennial.

Bienville \bya"-'vēl**, Jean-Baptiste Le Moyne de** (baptized Feb. 23, 1680, Montreal, New France—d. March 7, 1767, Paris, France) French explorer, colonial governor of Louisiana, and founder of New Orleans. He served with the French navy in King William's War. He accompanied his brother Pierre Iberville on expeditions to the mouth of the Mississippi River. They founded a settlement in 1699, and he later commanded the colony of Louisiana (1701–12, 1717–23). He founded New Orleans in 1718 and made it the colony's capital in 1722. Recalled to France in 1723, he returned to serve as governor of Louisiana (1733–43).

Bierce, Ambrose (Gwinnett) (b. June 24, 1842, Meigs county, Ohio, U.S.—d. 1914, Mexico?) U.S. newspaperman, satirist, and short-story writer. Not long after serving in the Civil War, he became a newspaper columnist and editor in San Francisco, specializing in attacks on frauds of all sorts. Among his books are *Tales of Soldiers and Civilians* (1891; revised as *In the Midst of Life*), which includes "An Occurrence at Owl Creek Bridge"; *Can Such Things Be?* (1893); and *The Devil's Dictionary* (1906), a volume of ironic definitions. Tired of American life, he went in 1913 to Mexico, then in the middle of a revolution, and mysteriously disappeared, possibly killed in the 1914 siege of Ojinaga.

Bierstadt \'bēr-ˌshtät**, Albert** (b. Jan. 7, 1830, near Düsseldorf, Westphalia—d. Feb. 19, 1902, New York, N.Y., U.S.) German-born U.S. painter of the Hudson River school. His parents immigrated to the U.S. when he was an infant. As a young man he traveled and sketched throughout Europe before returning to the U.S. to join a westward-bound expedition in 1859. Specializing in grandiose pictures of vast mountain scenery, he achieved great popularity in his lifetime with panoramic and often fanciful scenes of the American West, including *The Rocky Mountains* (1863) and *Mount Corcoran* (c. 1875–77). His huge paintings were actually executed in his New York City studio.

big bang Model of the origin of the universe, which holds that it emerged from a state of extremely high temperature and density in an explosive expansion 10 billion–15 billion years ago. Its two basic assumptions—that Albert Einstein's general theory of relativity correctly describes the gravitational interaction of all matter and that an observer's view of the universe does not depend on direction of observation or on location—make it possible to calculate physical conditions in the universe back to a very early time called the Planck time (after Max Planck). According to the model proposed by George Gamow in the 1940s, the universe expanded rapidly from a highly compressed early state, with a steady decrease in density and temperature. Within seconds, matter predominated over antimatter and certain nuclei formed. It took another million years before atoms could form and electromagnetic radiation could travel through space unimpeded. The abundances of hydrogen, helium, and lithium and the discovery of cosmic background radiation support the model, which also explains the redshifts of the light from distant galaxies as resulting from the expansion of space.

Big Ben Clock housed in the tower at the eastern end of Britain's Houses of Parliament. Designed by Sir Edmund Beckett (1816–1905), Big Ben is famous for its accuracy and its 13-ton bell. The name (for Sir Benjamin Hall, commissioner of works at the time of its installation in 1859) originally applied only to the bell but eventually came to include the clock itself.

Big Ben, London.
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Big Bend National Park Preserve, southwestern Texas, U.S. It lies 250 mi (400 km) southeast of El Paso and occupies 1,252 sq mi (3,243 sq km). It was established in 1944 and named for the wide bend in the Rio Grande that skirts its southern edge. The park has magnificent mountain and desert scenery; it is home to more than 1,000 species of plants, and its wildlife includes coyotes, pumas, and roadrunners.

Big Bertha Either of two different sets of long-range artillery produced by the Krupp works (see Thyssen Krupp Stahl) in Germany during World War I. The first were 420-mm (16.5-in.) howitzers used by German forces advancing through Belgium in 1914. The second were cannons specially built to bombard Paris in 1918. About 112 ft (34 m) long, they weighed

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200 tons (181 metric tons) and were 210 mm (8 in.) or more in calibre. The Paris guns were moved on railway tracks; they bombarded the city for 140 days. Their unprecedented range of 75 mi (121 km) was achieved by sending the shells on a trajectory 12 mi (19 km) into the stratosphere. They were nicknamed for the Krupp matriarch Bertha von Bohlen.

Big Cypress Swamp Swamp region whose eastern half is a national preserve, southern Florida, U.S. Covering 2,400 sq mi (6,200 sq km), the region merges with the swampy EVERGLADES on the east and south. It is dominated by cypress trees, and wildlife is abundant. The SEMINOLE Indians have reservations in the area.

Big Stick Policy Policy named by Pres. THEODORE ROOSEVELT to describe the assertion of U.S. dominance as a moral imperative. It was taken from an African proverb, "Speak softly and carry a big stick; you will go far." Roosevelt first used it when he asked Congress for money to increase U.S. naval preparedness to support his diplomatic objectives. The press used the phrase to describe Roosevelt's Latin America policy and his domestic policy of regulating monopolies.

Big Sur Scenic region along the Pacific coast of California, U.S. It comprises a ruggedly beautiful stretch of seacoast 100 mi (160 km) long. Popular with tourists and naturalists, it extends southward from Carmel to the Hearst Castle at San Simeon. A narrow, mountainous coastal road affords views of the Pacific Ocean and the wilderness areas of the Los Padres National Forest. The Pfeiffer–Big Sur State Park contains the town of Big Sur and borders the Big Sur River. The home of ROBINSON JEFFERS is a local landmark.

big tree *or* **giant sequoia** *or* **Sierra redwood** Coniferous EVERGREEN (*Sequoiadendron giganteum*; see CONIFER) found in scattered groves on the western slopes of the Sierra Nevada range of California, U.S. The largest of all trees in bulk, the big tree is distinguished from the coastal REDWOOD (*Sequoia sempervirens*) by having uniformly scalelike, or awl-shaped, leaves that lie close against the branches, scaleless winter buds, and cones requiring two seasons to mature. The pyramidal tree shape, reddish brown furrowed bark, and drooping branches are common to both genera. The largest specimen (in total bulk) is the General Sherman tree in SEQUOIA NATIONAL PARK—101.5 ft (31 m) in circumference at its base, 272.4 ft (83 m) tall, and weighing an estimated 6,167 tons (5,593 metric tons). Because big-tree lumber is more brittle than redwood lumber and thus less desirable, the big tree has been easier to preserve; though some groves have been cut, most of the 70 remaining groves are now protected by state or national forests or parks.

Bigfoot *or* **Sasquatch** Large, hairy, humanlike creature that reportedly lives in isolated areas of the northwestern U.S. and western Canada. Descriptions of Bigfoot are similar to those of the ABOMINABLE SNOWMAN of the Himalayas. It is said to be a primate 6–15 ft (2–4.5 m) in height, walking upright and either moving silently or emitting a high-pitched cry. Supposed footprints (some are hoaxes) have measured up to 24 in. (60 cm) in length. Despite many reported sightings, there is still no solid evidence that Bigfoot exists.

bighorn *or* **mountain sheep** Stocky, climbing hoofed mammal (*Ovis canadensis*) of western North America. Both sexes have horns that in the male may curve in a spiral more than 39 in. (1 m) long. Their fur is usually brown with a whitish rump patch. The related thinhorn, or Dall's sheep (*O. dalli*), of Alaska and Canada is similar to the bighorn. Both species are about 39 in. (1 m) tall at the shoulder, but the bighorn is heavier, weighing up to 300 lb (136 kg). They live in small groups among remote crags and cliffs of mountainous areas and feed mainly on grasses. Bighorn rams compete for females by launching themselves at each other from a few yards' distance and clashing horns.

Canadian bighorn sheep (*Ovis canadensis*)
HARRY ENGELS—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Bighorn Mountains Mountain range, southern Montana and northern Wyoming, U.S. It is a range of the northern ROCKY MOUNTAINS extending 120 mi (193 km), rising abruptly 4,000–5,000 ft (1,200–1,500 m) above the GREAT PLAINS and Bighorn Basin. The highest summit is Wyoming's Cloud Peak, at 13,165 ft (4,013 m). Bighorn National Forest covers part of the range. On Medicine Mountain is the Medicine Wheel, a prehistoric stone-spoked circle 70 ft (20 m) in diameter.

Bighorn River River, Wyoming and Montana, U.S. Formed by the confluence of the Popo Agie and Wind rivers in west-central Wyoming, it flows north 336 mi (541 km) into the YELLOWSTONE RIVER in southeastern Montana. The Little Bighorn joins the main stream at Hardin, Mont. The Bighorn Canyon National Recreation Area stretches along the Montana-Wyoming border. See also Battle of the LITTLE BIGHORN.

Bihar \bi-'här\ State (pop., 2001: 82,998,509), northeastern INDIA. Bordered by NEPAL and WEST BENGAL, JHARKHAND, and UTTAR PRADESH states, it occupies 38,301 sq mi (99,200 sq km); its capital is PATNA. Its limits are nearly the same as those of the ancient kingdoms of Videha and Magadha. In the 4th century AD the area came under the GUPTA empire, whose capital was at Pataliputra (Patna). Overcome by the Muslims c. 1200, Bihar was annexed to DELHI in 1497. Taken by the British in 1765, it was made part of BENGAL. The area was the scene of revolts against the British in the mid-19th century and of MOHANDAS K. GANDHI's nonviolent movement in the early 20th century. Bihar was made a province of British India in 1936; in 1950 it became a state in independent India. It is one of India's least urbanized states, and most of its population engages in agriculture. In 2000 the state of Jharkhand was created from Bihar's southern districts.

Bikini Atoll, western MARSHALL ISLANDS, central PACIFIC OCEAN. It consists of a ring of 20 small coral islands. Administered by the U.S. from 1947 as part of a UN-sanctioned U.S. Trust Territory of the Pacific Islands, it was used for U.S. nuclear-weapons testing in 1946–58. The 166 inhabitants were removed before the tests began and returned in 1969, but they were evacuated again in 1978 because of high radiation levels. Cleanup there continued, and in the late 1990s Bikini was again deemed safe for habitation. The atoll became part of the Republic of the Marshall Islands in 1979.

Biko \'bē-kō**, Stephen** (b. Dec. 18, 1946, King William's Town, S.Af.—d. Sept. 12, 1977, Pretoria) South African political activist. A former medical student, in 1968 he founded the Black Consciousness movement, designed to raise black awareness of APARTHEID oppression. He was officially "banned" by the South African government in 1973 and was arrested several times in 1976–77. His death from head injuries suffered in police custody made him an international martyr for South African black nationalism. The initial inquest absolved the police of wrongdoing, but in 1997 five former officers confessed to Biko's murder.

Bilbao \bil-'bä-,ō, bil-'baů\ Port city (pop., 2001: city, 349,972; metro. area, 947,334), northern Spain. It is located 7 mi (11 km) inland from the Bay of BISCAY. The largest city in the BASQUE COUNTRY, it originated as a settlement of mariners and ironworkers and was chartered in 1300. In the 18th century it prospered through trade with Spain's New World colonies. The city was sacked by French troops in the PENINSULAR WAR (1808) and besieged during the Carlist Wars (see CARLISM). It is a chief port in Spain and a centre of the metallurgical industries, shipbuilding, and banking. Landmarks include the 14th-century Cathedral of Santiago and the 20th-century Guggenheim Museum Bilbao.

bilberry Low-growing deciduous shrub (*Vaccinium myrtillus*) of the HEATH FAMILY, found in woods and on heaths, chiefly in hilly districts of Britain, northern Europe, and Asia. The stiff stems bear small egg-shaped leaves and small rosy flowers tinged with green. The dark blue, waxy berries are an important food of the GROUSE and are used for tarts and preserves. They are borne singly, unlike those of the much more productive cultivated BLUEBERRIES of the U.S. (*V. australe*), which are borne in long clusters.

bildungsroman \'bil-,důŋz-rō-,män\ *German* **"novel of character development"** Class of novel in German and other literature that deals with the formative years of the main character, whose moral and psychological development is depicted. It ends on a positive note, with the hero's foolish mistakes and painful disappointments behind him and a life of usefulness ahead. It grew out of folklore tales in which a dunce goes out into the world seeking adventure. The first novelistic development of the theme, JOHANN W. VON GOETHE's *Wilhelm Meister's Apprenticeship* (1795–96), remains a classic example.

bile Greenish-yellow liver secretion passed to the GALLBLADDER for concentration, storage, or transport into the duodenum for fat digestion. Bile

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contains bile acids and salts, cholesterol, and electrolyte chemicals that keep it slightly acidic. In the intestine, products of the acids and salts emulsify fat and reduce its surface tension to prepare it for the action of pancreatic and intestinal fat-splitting enzymes.

bilingualism Ability to speak two languages. It may be acquired early by children in regions where most adults speak two languages (e.g., French and dialectal German in Alsace). Children may also become bilingual by learning languages in two different social settings; for example, British children in British India learned an Indian language from their nurses and family servants. A second language can also be acquired in school. *Bilingualism* can also refer to the use of two languages in teaching, especially to foster learning in students trying to learn a new language. Advocates of bilingual education in the U.S. argue that it speeds learning in all subjects for children who speak a foreign language at home and prevents them from being marginalized in English-language schools. Detractors counter that it hinders such children from mastering the language of the larger society and limits their opportunities for employment and higher education.

bill See BEAK

Bill, Max (b. Dec. 22, 1908, Winterthur, Switz.—d. Dec. 9, 1994, Berlin, Ger.) Swiss painter, sculptor, graphic artist, and industrial designer. He studied architecture, metalwork, stage design, and painting at the Bauhaus. In 1930 he opened his own studio in Zürich, where he spent most of his life and earned a living designing advertisements. In the 1940s he designed chairs featuring geometric forms. He cofounded and directed the College of Design in Ulm, Ger. (1951–55), and also designed its buildings. He is best known for his advertising designs.

bill of exchange Short-term negotiable financial instrument consisting of a written order addressed by the seller of goods to the buyer requiring the latter to pay a certain sum of money on demand or at a future time. Bills of exchange are often used in international transactions, and the holder of such a bill may redeem it in cash immediately by selling it to a bank at a discount. Bills of exchange used in domestic transactions are sometimes called drafts. See also PROMISSORY NOTE.

Bill of Rights (1689) British law, one of the basic instruments of the British constitution. It incorporated the provisions of the Declaration of Rights, which WILLIAM III and MARY II accepted upon taking the throne. Its main purpose was to declare illegal various practices of JAMES II, such as the royal prerogative of dispensing with the law in certain cases. The result of a long struggle between the STUART kings and the English people and PARLIAMENT, it made the monarchy clearly conditional on the will of Parliament and provided freedom from arbitrary government. It also dealt with the succession to the throne.

Bill of Rights First 10 amendments to the CONSTITUTION OF THE UNITED STATES, adopted as a group in 1791. They are a collection of guarantees of individual rights and of limitations on federal and state governments that derived from popular dissatisfaction with the limited guarantees of the Constitution. The first Congress submitted 12 amendments (drafted by JAMES MADISON) to the states, 10 of which were ratified. The 1st Amendment guarantees freedom of religion, speech, and the press and grants the right to petition for redress and to assemble peacefully. The 2nd Amendment guarantees the right of the people to keep and bear arms. The 3rd prohibits the quartering of soldiers in private dwellings in peacetime. The 4th protects against unreasonable SEARCH AND SEIZURE. The 5th establishes grand-jury indictment for serious offenses, protects against DOUBLE JEOPARDY in criminal cases, and prohibits compelling testimony by a person against himself. The 6th establishes the rights of the ACCUSED to a speedy trial and an impartial jury and guarantees the right to legal counsel and to the obtaining of witnesses in his favour. The 7th preserves the right to trial by jury in serious civil suits and prohibits double jeopardy in civil cases. The 8th prohibits excessive bail and cruel and unusual punishment. The 9th states that enumeration of certain rights in the Constitution does not mean the abrogation of rights not mentioned. The 10th reserves to the states and people any powers not delegated to the federal government.

billfish Any of several long-jawed fishes, especially those in the family Istiophoridae, including MARLINS, spearfishes, and SAILFISHES. The name is also applied to the GAR, NEEDLEFISH, and sauries (family Scomberesocidae), as well as to the SWORDFISH (family Xiphiidae).

billiards Any of various games played on a cloth-topped, cushion-railed rectangular table by driving small, hard balls against one another or into pockets with a long stick called a cue. Carom, or French billiards, is played with three balls, two white and one red, on a table without pockets. The object is to stroke the white cue ball so that it hits the two object balls in succession, scoring a carom (one point). English billiards is also played with three balls but on a pocketed table; it is scored in various ways. SNOOKER is another popular British billiards game. The principal billiards game in North America is pocket billiards, or POOL. The Billiard Congress of America controls U.S. tournament play, including the U.S. Open Pockets Billiard Championship, regarded as the world championship.

Billings City (pop., 2000: 89,847), south-central Montana, U.S. Originally settled on the YELLOWSTONE RIVER in 1877 as Coulson, Billings was renamed in 1882 in honour of Frederick Billings, president of the Northern Pacific Railway Company. It is now a trading and shipping point for wool, livestock, and agriculture. Nearby Pictograph Cave State Monument has prehistoric artifacts.

Billings, John Shaw (b. April 12, 1838, Switzerland county, Ind., U.S.—d. March 11, 1913, New York, N.Y.) U.S. surgeon and librarian. He worked for the U.S. Army 1861–95. He fostered the growth of the surgeon general's library in Washington, D.C., developing what would become the National Library of Medicine, the world's largest medical reference centre. He founded the monthly *Index Medicus* (1879), still one of the primary U.S. medical bibliographies, and published the first *Index Catalogue* (1880–95). He also designed Johns Hopkins Hospital and was its medical adviser, ran national vital statistics programs, led the U.S. effort to end yellow fever, and was the first director of the New York Public Library. His organization of U.S. medical institutions was central to modernization of hospital care and maintenance of public health.

Billings, William (b. Oct. 7, 1746, Boston, Mass.—d. Sept. 26, 1800, Boston, Mass., U.S.) American hymn composer, sometimes called the first American composer. A tanner by trade, he was largely self-taught in music. His robust and primitive style, lacking instrumental parts, has seemed to embody the distinctive virtues of early America. His *New England Psalm-Singer* (1770) was the first published collection of American music; his other works include *The Singing Master's Assistant* (1778) and *The Continental Harmony* (1794).

Billiton \bē-'lē-ˌtōn\ *or* **Belitung** \bā-'lē-ˌtůŋ\ Island, Bangka-Belitung province, west-central Indonesia. Lying on the Karimata Strait between the islands of BANGKA (west) and BORNEO (northeast), it is situated between the South CHINA SEA (north) and JAVA SEA (south). It is some 55 mi (90 km) long and 45 mi (70 km) wide, with an area of about 1,850 sq mi (4,800 sq km). The main town and port is Tanjungpandan. Billiton was ceded to the British in 1812 by the sultan of Palembang, SUMATRA, but Britain recognized the Dutch claim in 1824. The island became part of Indonesia after World War II. It is important for its tin mines, discovered in 1851.

Billroth \'bil-rōt**, (Christian Albert) Theodor** (b. April 26, 1829, Bergen auf Rügen, Prussia—d. Feb. 6, 1894, Abbazia, Austria-Hungary) Austrian surgeon. He pioneered the study of bacterial causes of wound fever and adopted early the antiseptic techniques that eradicated the threat of fatal surgical infections. The founder of modern surgery of the abdominal cavity, he altered and removed organs previously considered inaccessible. In 1872 he was the first to remove part of an esophagus, joining the ends together; later he performed the first complete larynx removal. In 1881, when he had made intestinal surgery almost commonplace, he successfully removed a cancerous pylorus (lower end of the stomach).

Billy the Kid *orig.* **William H. Bonney, Jr.,** *or* **Henry McCarty** (b. Nov. 23, 1859/60, New York, N.Y., U.S.—d. July 14, 1881, Fort Sumner, N.M.) U.S. criminal. As a child he migrated with his family to Kansas, then lived in New Mexico from c. 1868. His career of lawlessness throughout the Southwest began early; by the time he was captured by Sheriff Pat Garrett in 1880 he had allegedly killed 27 men. Convicted in New Mexico in 1881 and sentenced to hang, he escaped from jail, killing two deputies, and remained at large until Garrett tracked him down and killed him.

Biloxi \bi-'lək-sē, bi-'läk-sē\ Coastal city (pop., 2000: 50,644), southeastern Mississippi, U.S. Located east of Gulfport on the Gulf of Mexico, it was first settled as Fort Louis (established 1719); a nearby earlier fort, Fort Maurepas, was the lower Mississippi valley's first permanent European settlement (1699). Biloxi has been under the flags of France, Spain, Britain, the West Florida Republic, and the Confederacy. By the late 20th

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century, casino gambling had become its chief industry, augmented by fishing and seafood processing. Beauvoir, Jefferson Davis's last home, is nearby. Biloxi has been subject to periodic devastating tropical cyclones, notably Hurricanes Camille (1969) and Katrina (2005).

Bilqīs See Queen of Sheba

bimetallism Monetary standard or system based on the use of two metals, traditionally gold and silver, rather than one (monometallism). In the 19th century, a bimetallic system defined a nation's monetary unit by law in terms of fixed quantities of gold and silver (thus automatically establishing a rate of exchange between the two metals). The system provided a free and unlimited market for the two metals, imposed no restrictions on the use and coinage of either metal, and made all other money in circulation redeemable in either gold or silver. Because each nation independently set its own rate of exchange between the two metals, the resulting rates of exchange often differed widely from country to country. When the ratio of the official prices proved different from the ratio of prices in the open market, Gresham's law operated in such a way that coins of only one metal remained in circulation. A monometallic system using the gold standard proved more responsive to changes in supply and demand and was widely adopted after 1867. See also exchange rate; silver standard.

bin Laden, Osama (b. 1957, Riyadh, Saud.Ar.) Leader of a broad-based Islamic extremist movement implicated in numerous acts of terrorism against the U.S. and other Western countries. The son of a wealthy Saudi family, he joined the Muslim resistance in Afghanistan after the 1979 Soviet invasion of that country. Following his homecoming, he became enraged at the presence of U.S. troops in Saudi Arabia during the Persian Gulf War (1990–91) and, through a network of like-minded Islamic militants known as al-Qaeda, launched a series of terrorist attacks. These acts included the bombings of the World Trade Center in New York City in 1993, the U.S. embassies in Kenya and Tanzania in 1998, and the U.S. warship *Cole* in Aden, Yemen, in 2000. A self-styled Islamic scholar, bin Laden issued several legal opinions calling on Muslims to take up jihad (holy war) against the U.S., and in 2001 a group of militants under his direction launched the September 11 attacks, which led to the deaths of some 3,000 people. The U.S. thereafter demanded bin Laden's extradition from Afghanistan, where he was sheltered by that country's Taliban militia, and launched attacks on Taliban and al-Qaeda forces when that ultimatum was not met. With the collapse of the Taliban, bin Laden and his associates went into hiding.

binary code Code used in digital computers, based on a binary number system in which there are only two possible states, off and on, usually symbolized by 0 and 1. Whereas in a decimal system, which employs 10 digits, each digit position represents a power of 10 (100, 1,000, etc.), in a binary system each digit position represents a power of 2 (4, 8, 16, etc.). A binary code signal is a series of electrical pulses that represent numbers, characters, and operations to be performed. A device called a clock sends out regular pulses, and components such as transistors switch on (1) or off (0) to pass or block the pulses. In binary code, each decimal number (0–9) is represented by a set of four binary digits, or bits. The four fundamental arithmetic operations (addition, subtraction, multiplication, and division) can all be reduced to combinations of fundamental Boolean algebraic operations (see Boolean algebra) on binary numbers.

binary star Pair of stars in orbit around a common centre of gravity. Their relative sizes and brightnesses and the distance between them vary widely. Perhaps half of all stars in the Milky Way Galaxy are binaries or members of more complex multiple systems. Some binaries form a class of variable stars (see eclipsing variable star). Stars can be identified as binaries in various ways—visually by telescope, through spectroscopic observation, by changes in apparent brightness (when the dimmer star eclipses its companion), or by changes in the proper motion of the visible member (owing to the gravitational pull of the invisible companion).

binding energy Energy required to separate a particle from a system of particles or to disperse all the particles of a system. Nuclear binding energy is the energy required to separate an atomic nucleus into its constituent protons and neutrons. It is also the energy that would be released by combining individual protons and neutrons into a single nucleus. Electron binding energy, or ionization potential, is the energy required to remove an electron from an atom, molecule, or ion, and also the energy released when an electron joins an atom, molecule, or ion. The binding energy of a single proton or neutron in a nucleus is about a million times greater than that of a single electron in an atom.

bindweed Any plant of the closely related genera *Convolvulus* and *Calystegia*, mostly twining, often weedy, and producing funnel-shaped flowers. Bellbine, or greater bindweed (*Calystegia sepium*), native in Eurasia and North America, is a twining perennial that grows from creeping, underground stems and is common in hedges and woods and along roadsides. Sea bindweed (*C. soldanella*) creeps along European seaside sand and gravel. Several *Convolvulus* species are widespread or conspicuous. The weedy perennial field bindweed (*C. arvensis*), European but widely naturalized in North America, twines around crop plants and along roadsides. Scammony, a purgative, is derived from the rhizomes of *C. scammonia*, a trailing perennial native to western Asia. Rosewood oil comes from certain species of *Convolvulus*.

Binet \bi-'nā**, Alfred** (b. July 8, 1857, Nice, France—d. Oct. 18, 1911, Paris) French psychologist. His interest in Jean-Martin Charcot's work on hypnosis prompted him to abandon a law career and study medicine at the Salpêtrière Hospital in Paris (1878–91). He served as director of a research laboratory at the Sorbonne (1895–1911). A major figure in the development of experimental psychology in France, he founded *L'Année Psychologique*, the first French journal on psychology, in 1895. He developed experimental techniques to measure reasoning ability; between 1905 and 1911 he and Theodore Simon developed influential scales for the measurement of intelligence of children. His works include *Experimental Study of Intelligence* (1903) and *A Method of Measuring the Development of the Intelligence of Young Children* (1915).

Binford, Lewis R(oberts) (b. Nov. 21, 1930, Norfolk, Va., U.S.) U.S. archaeologist. Binford taught principally at the University of New Mexico. In the mid 1960s he initiated what came to be known as the "New Archaeology," which champions the use of quantitative methods and the practice of archaeology as a rigorous science. He applied the new methodology in an influential study of Mousterian artifacts and later extended it to a study of the hunting activities of a living people, the Nunamiut, trying to draw analogies to prehistoric contexts.

Bing, Sir Rudolf (b. Jan. 9, 1902, Vienna, Austria-Hungary—d. Sept. 2, 1997, New York, N.Y., U.S.) Austrian-born British opera impresario. After holding positions in German opera houses, he assumed the position of general manager at the Glyndebourne Opera in England (1935–49). In 1946 he helped found the Edinburgh Festival. From 1950 until 1972 he served as general manager of the Metropolitan Opera, where, wielding autocratic power, he raised the institution's performance standards, extended its season, encouraged innovations in design and production, ended the exclusion of black singers, and oversaw the company's move to Lincoln Center in 1966.

Bingham, George Caleb (b. March 20, 1811, Augusta county, Va., U.S.—d. July 7, 1879, Kansas City, Mo.) U.S. painter and frontier politician. He studied briefly at the Pennsylvania Academy of the Fine Arts,

Fur Traders Descending the Missouri, oil on canvas by George Caleb Bingham, 1845; in the Metropolitan Museum of Art, New York City.
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK, MORRIS K. JESUP FUND, 1933

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but he was largely self-taught. He entered politics in Missouri and worked as an itinerant portrait painter before turning to the lively routines of frontier life for inspiration. Bingham is known for his incisive characterizations, clear, golden light, and talent for organizing large, dense compositions. His best-known works include *Fur Traders Descending the Missouri* (1845) and *Jolly Flatboatmen* (1846).

bingo Game of chance played with cards having a grid of numbered squares corresponding to numbered balls drawn at random. When a number on the card is drawn, the players cover that number (should they have it); the game is won by covering a certain number of squares in a row (vertically, horizontally, or diagonally). Cards are purchased and proceeds are placed into a common "pot"; winning cards are awarded a portion of the pot. Wildly popular in the mid 20th century, bingo has in recent decades suffered a decline in America but has increased in popularity in other parts of the world. The earliest name for bingo—lotto—was recorded in Britain in 1776; the game is sometimes called keno in the U.S.

Binh Dinh Vuong See LE LOI

binoculars Optical instrument for providing a magnified view of distant objects, consisting of two similar TELESCOPES, one for each eye, mounted on a single frame. In most binoculars, each telescope has two PRISMS, which reinvert the inverted image provided by the eyepiece of each telescope. Light rays travel along a folded path inside the telescopes, so the instrument has a shorter overall length. The prisms also provide better depth perception at greater distances, by allowing the two objectives (object LENSES) to be set farther apart than the eyepieces. Binocular eyepieces are often fitted to microscopes or other optical instruments.

binomial nomenclature System of naming organisms in which each organism is indicated by two words, the GENUS (capitalized) and SPECIES (lowercase) names, both written in italics. For example, the tea rose is *Rosa odorata*; the common horse is *Equus caballus*. The system was developed by CAROLUS LINNAEUS in the mid 18th century. The number of binomial names proliferated as new species were established and more categories were formed, and by the late 19th century the nomenclature of many groups of organisms was confused. International committees in the fields of zoology, botany, bacteriology, and virology have since established rules to clarify the situation. See also TAXONOMY.

binomial theorem In algebra, a formula for expansion of the binomial $(x + y)$ raised to any positive integer power. A simple case is the expansion of $(x + y)^2$, which is $x^2 + 2xy + y^2$. In general, the expression $(x + y)^n$ expands to the sum of $(n + 1)$terms in which the power of x decreases from n to 0 while the power of y increases from 0 to n in successive terms. The terms can be represented in factorial notation by the expression $[n!/((n - r)!r!)]x^{n-r}y^r$ in which r takes on integer values from 0 to n.

Bío-Bío \ˌbē-ō-ˈbē-ō\ **River** River, south-central Chile. Rising in the ANDES MOUNTAINS, it flows northwestward 240 mi (380 km) to enter the Pacific Ocean near CONCEPCIÓN. Though it is one of Chile's longest rivers, it is shallow and navigable only by flat-bottomed boats.

biochemistry Field of science concerned with chemical substances and processes that occur in plants, animals, and microorganisms. It involves the quantitative determination and structural ANALYSIS of the organic compounds that make up CELLS (PROTEINS, CARBOHYDRATES, and LIPIDS) and of those that play key roles in CHEMICAL REACTIONS vital to life (e.g., NUCLEIC ACIDS, VITAMINS, and HORMONES). Biochemists study cells' many complex and interrelated chemical changes. Examples include the chemical reactions by which proteins and all their precursors are synthesized, food is converted to ENERGY (see METABOLISM), hereditary characteristics are transmitted (see HEREDITY), energy is stored and released, and all biological chemical reactions are catalyzed (see CATALYSIS, ENZYME). Biochemistry straddles the biological and physical sciences and uses many techniques common in medicine and physiology as well as those of organic, analytical, and PHYSICAL CHEMISTRY.

biochip Small-scale device, analogous to an INTEGRATED CIRCUIT, constructed of or used to analyze organic molecules associated with living organisms. One type of theoretical biochip is a small device constructed of large organic molecules, such as proteins, and capable of performing the functions (data storage, processing) of an electronic computer. The other type of biochip is a small device capable of performing rapid, small-scale biochemical reactions for the purpose of identifying gene sequences, environmental pollutants, airborne toxins, or other biochemical constituents.

biodegradability Capacity of a material to decompose by biological action. The term usually refers to the environmental breakdown of waste by microorganisms. Generally, plant and animal products are biodegradable, whereas mineral substances (e.g., metals, glass, plastics) are not. Local conditions, especially the presence or absence of oxygen, affect biodegradability. Disposal of nonbiodegradable waste is a primary source of pollution. Surgical materials made to be absorbed by the body are also called biodegradable.

biodiversity Quantity of plant and animal species found in a given environment. Sometimes habitat diversity (the variety of places where organisms live) and genetic diversity (the variety of traits expressed within a species) are also considered types of biodiversity. The estimated 3–30 million species on Earth are divided unequally among the world's habitats, with 50–90% of the world's species living in tropical regions. The more diverse a habitat, the better chance it has of surviving a change or threat to it, because it is more likely to be able to make a balancing adjustment. Habitats with little biodiversity (e.g., Arctic tundra) are more vulnerable to change. The 1992 EARTH SUMMIT resulted in a treaty for the preservation of biodiversity.

bioengineering Application of ENGINEERING principles and equipment to BIOLOGY and MEDICINE. It includes the development and fabrication of life-support systems for underwater and SPACE EXPLORATION, devices for medical treatment (see DIALYSIS, PROSTHESIS), and instruments for monitoring biological processes. Development has been particularly rapid in the area of artificial organs, which culminated in the implantation of an ARTIFICIAL HEART into a human being in 1982. Bioengineers also develop equipment that enables humans to maintain body functions in hostile environments, such as the space suits worn by astronauts during extravehicular maneuvers.

biofeedback Information supplied instantaneously about an individual's own physiological processes. Data concerning cardiovascular activity (BLOOD PRESSURE and heart rate), temperature, brain waves, or muscle tension is monitored electronically and returned or "fed back" to the individual through a gauge on a meter, a light, or a sound. The goal is for the patient to use that biological data to learn to voluntarily control the body's reactions to stressful external events. A type of BEHAVIOUR THERAPY, biofeedback training is sometimes used in combination with PSYCHOTHERAPY to help patients understand and change their habitual reactions to stress. Complaints treated through biofeedback include MIGRAINE HEADACHES, gastrointestinal problems, high blood pressure, and epileptic seizures.

biography Form of nonfictional literature whose subject is the life of an individual. The earliest biographical writings probably were funeral speeches and inscriptions. The origins of modern biography lie with PLUTARCH's moralizing lives of prominent Greeks and Romans and SUETONIUS's gossipy lives of the Caesars. Few biographies of common individuals were written until the 16th century. The major developments of English biography came in the 18th century, with such works as JAMES BOSWELL's *Life of Johnson*. In modern times impatience with Victorian reticence and the development of psychoanalysis have sometimes led to a more penetrating and comprehensive understanding of biographical subjects. See also AUTOBIOGRAPHY.

Bioko \bē-ˈō-kō\ *formerly* **Fernando Pó** \fer-ˈnän-dō-ˈpō\ Island (pop., 1987 est.: 67,920), Bight of BIAFRA, West Africa. It lies 100 mi (160 km) northwest of continental EQUATORIAL GUINEA, of which it is a part. Bioko became the official name in 1979. Volcanic in origin, with an area of 779 sq mi (2,018 sq km), it rises sharply from the sea; its highest point is Santa Isabel Peak, at 9,869 ft (3,008 m). MALABO, the country's capital, is located on Bioko. The island was visited by the Portuguese explorer Fernão Pó, probably in 1472. Though the island was claimed by Spain after 1778, the first attempt at firm Spanish control came only in 1858. The original inhabitants, the Bubi, are descendants of Bantu-speaking migrants from the mainland. Many FANG have flocked to the island from the continent.

biological rhythm Periodic biological fluctuation in an organism corresponding to and in response to periodic environmental change, such as day and night or high and low tide. The internal mechanism that maintains this rhythm even without the apparent environmental stimulus is a "biological clock." When the rhythm is interrupted, the clock's adjustment is delayed, accounting for such phenomena as JET LAG when traveling across time zones. Rhythms may have 24-hour (CIRCADIAN RHYTHM), monthly, or annual cycles. See also PHOTOPERIODISM.

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biological warfare *or* **germ warfare** Military use of disease-producing or poisonous agents, and the means for defending against such agents. Biological warfare agents include many bacteria, such as those which cause ANTHRAX, BRUCELLOSIS, and TYPHUS; viruses that cause diseases such as equine ENCEPHALITIS; fungi such as rice blast, cereal rust, wheat SMUT, and potato BLIGHT; and toxins such as botulinum and ricin that are extracted from living organisms. Biological warfare dates from ancient times when warring groups would try to poison enemy soldiers with rotting or diseased corpses, infect cattle and horses, or spread contagion through civilian populations. Following the horrors of World War I, a 1925 Geneva Protocol prohibited the use of biological agents in warfare; however, this did not prevent Japan from using them in China during World War II. During the Cold War the Soviet Union as well as the U.S. and its allies built huge stockpiles of biological agents. Both sides signed the 1972 Biological Weapons Convention, which prohibits the production, stockpiling, or development of biological weapons and requires the destruction of existing stockpiles, but the Soviets conducted a clandestine program until the 1990s. Biological weapons programs can be concealed easily, and the 1972 convention contains no provisions for inspection and reporting. As a result, many states have been suspected of developing biological warfare agents, and some modern armed forces have prepared defensive measures. These include battlefield sensors, protective garments and masks, sterilizing agents, and vaccines.

biology Study of living things and their vital processes. An extremely broad subject, biology is divided into branches. The current approach is based on the levels of biological organization involved (e.g., molecules, cells, individuals, populations) and on the specific topic under investigation (e.g., structure and function, growth and development). According to this scheme, biology's main subdivisions include MORPHOLOGY, PHYSIOLOGY, TAXONOMY, EMBRYOLOGY, GENETICS, and ECOLOGY, each of which can be further subdivided. Alternatively, biology can be divided into fields especially concerned with one type of living thing; for example, BOTANY (plants), ZOOLOGY (animals), ORNITHOLOGY (birds), ENTOMOLOGY (insects), MYCOLOGY (fungi), MICROBIOLOGY (microorganisms), and BACTERIOLOGY (bacteria). See also BIOCHEMISTRY; MOLECULAR BIOLOGY.

biology, philosophy of Philosophical investigation of the concepts, problems, and methods of the biological sciences. Many of the topics considered in contemporary philosophy of biology have arisen from reflection on aspects of the theory of EVOLUTION. They include the question of whether evolution is ultimately falsifiable, a conventional requirement of all scientific theories; whether the thesis of NATURAL SELECTION has empirical content or is merely a TAUTOLOGY; whether selection operates at the level of the individual, the species, or the gene; and whether selection is guided by certain constraints controlling development at the molecular level. Other more general issues concern the possible reduction of biological theories to theories of the physical sciences, the role of teleological language in biology (see TELEOLOGY), and the nature of species as a biological category. See also CREATIONISM; SOCIOBIOLOGY.

bioluminescence \ˌbī-ō-ˌlü-mə-ˈne-sᵊns\ Emission of light by an organism or biochemical system (e.g., the glow of BACTERIA on decaying meat or fish, the phosphorescence of PROTOZOANS in tropical seas, the flickering signals of fireflies). It occurs in a wide range of protists and animals, including bacteria and fungi, insects, marine invertebrates, and fish. It is not known to exist naturally in true plants or in amphibians, reptiles, birds, or mammals. It results from a chemical reaction that produces radiant energy very efficiently, giving off very little heat. The essential light-emitting components are usually the organic molecule luciferin and the ENZYME luciferase, which are specific for different organisms. In higher organisms, light production is used to frighten predators and to help members of a species recognize each other. Its functional role in lower organisms such as bacteria, dinoflagellates, and fungi is uncertain. Luminous species are widely scattered taxonomically, with no clear-cut pattern, though most are marine.

biomass Weight or total quantity of living organisms of one animal or plant species (species biomass) or of all the species in the community (community biomass), commonly referred to as a unit area or volume of the habitat. The biomass in an area at a given moment is the standing crop.

biome \ˈbī-ˌōm\ Largest geographic biotic unit, a major community of plants and animals with similar requirements of environmental conditions. It includes various communities and developmental stages of communities and is named for the dominant type of vegetation, such as grassland or coniferous forest. Several similar biomes constitute a biome type; for example, the temperate deciduous forest biome type includes the deciduous forest biomes of Asia, Europe, and North America. The standard European term for biome is "major life zone."

Biondi \bē-ˈän-dē**, Matt** (b. Oct. 15, 1965, Palo Alto, Calif., U.S.) U.S. swimmer. Biondi, 6 ft 7 in. (2 m) tall, won 11 medals, including eight gold medals, in three consecutive OLYMPIC GAMES (1984, 1988, and 1992). Along with MARK SPITZ, he is the most successful U.S. swimmer in Olympic history.

biophysics Discipline concerned with applications of the principles and methods of the physical sciences to biological problems. Biophysics deals with biological functions that depend on physical agents such as electricity or mechanical force, with the interaction of living organisms with physical agents such as light, sound, or ionizing radiation, and with interactions between living things and their environment as in locomotion, navigation, and communication. Its subjects include bone, nerve impulses, muscle, and vision as well as organic molecules, using such tools as PAPER CHROMATOGRAPHY and X-ray CRYSTALLOGRAPHY.

biopsy \ˈbī-ˌäp-sē\ Procedure in which cells or tissues are removed from a patient and examined. The sample may be obtained from any organ, by any of several methods, including suction through a needle, swabbing, scraping, ENDOSCOPY, and cutting out the entire structure or part of it to be tested. Biopsy is a standard step in distinguishing malignant from benign tumours and can provide other information for diagnosis, particularly concerning such organs as the liver or pancreas. Slides of the tissue are prepared and examined by microscope.

BIOS \ˈbī-ˌōs\ *in full* **Basic Input/Output System** Computer PROGRAM that is typically stored in EPROM and used by the CPU to perform start-up procedures when the computer is turned on. Its two major procedures are determining what peripheral devices (keyboard, mouse, disk drives, printers, video cards, etc.) are available and loading the operating system (OS) into main memory. After start-up, the BIOS program manages data flow between the OS and the peripherals, so neither the OS nor the application programs need to know the details of the peripherals (such as hardware addresses).

biosolids Sewage sludge, the residues remaining from the treatment of sewage. For use as a FERTILIZER in agricultural applications, biosolids must first be stabilized through processing, such as digestion or the addition of lime, to reduce concentrations of heavy metals and harmful organisms (certain BACTERIA, VIRUSES, and other pathogens). This processing also reduces the volume of material and stabilizes the organic matter in it, thus reducing the potential for odours. Use of biosolids in agriculture has become controversial, critics claiming that even treated sewage may harbour harmful bacteria, viruses, and heavy metals.

biosphere Relatively thin life-supporting stratum of the earth's surface, extending from a few miles into the atmosphere to the deep-sea vents of the oceans. The biosphere is a global ECOSYSTEM that can be broken down into regional or local ecosystems, or BIOMES. Organisms in the biosphere are classified into trophic levels (see FOOD CHAIN) and communities.

biotechnology Application to industry of advances made in the biological sciences. The growth of the field is linked to the development in the 1970s of GENETIC ENGINEERING and to the 1980 U.S. Supreme Court decision that "a live human-made microorganism is a patentable matter," which resulted in the establishment of numerous commercial biotechnology firms that manufacture genetically engineered substances for a variety of mostly medical, agricultural, and ecological uses.

biotin \ˈbī-ə-tən\ Organic compound, part of the VITAMIN B COMPLEX, essential for growth and well-being in animals and some microorganisms. A CARBOXYLIC ACID with two rings in its structure, it includes nitrogen and sulfur atoms as well as carbon, hydrogen, and oxygen. It functions in the formation and metabolism of fats and carbohydrates. It is widely distributed in nature and is especially abundant in egg yolk, beef liver, and yeast. A biotin deficiency can be induced by consuming large amounts of raw egg white, which contains a protein (avidin) that combines with biotin and makes it unavailable. Biotin is needed to synthesize FATTY ACIDS and convert AMINO ACIDS to GLUCOSE in the body.

biotite *or* **black mica** SILICATE MINERAL in the common MICA group. It is abundant in metamorphic rocks, in pegmatites, and in granites and other

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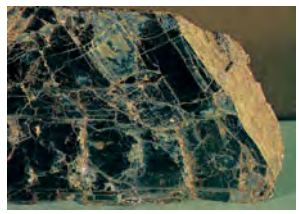
igneous rocks. Biotite is a layer silicate structure in which aluminum and silicon occur in infinitely extending Si-Al-O sheets that alternate with potassium-rich and magnesium- (and iron-) containing sheets.



Biotite mica from the district of Juchitán, Oaxaca, Mex.
COURTESY OF THE FIELD MUSEUM OF NATURAL HISTORY, CHICAGO; PHOTOGRAPH, JOHN H. GERARD-EB INC.

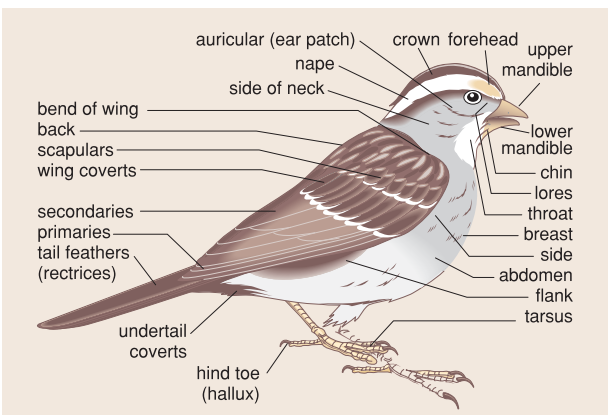
Bioy Casares \bē-'ȯi-kä-'sä-rās**, Adolfo** (b. Sept. 15, 1914, Buenos Aires, Arg.—d. March 8, 1999, Buenos Aires) Argentine writer and editor. He is known for his use of MAGIC REALISM both in his own works and in collaborations with JORGE LUIS BORGES. Among his novels are *The Invention of Morel* (1940), *The Dream of Heroes* (1954), and *Diary of the War of the Pig* (1969). In 1990 he received the Cervantes Prize, the highest honour in Hispanic letters.

bipolar disorder *or* **manic-depressive psychosis** Mental illness characterized by the alternation of manic and depressive states. DEPRESSION is the more common symptom, and many patients experience only a brief period of overoptimism and mild euphoria during the manic phase. The condition, which seems to be inheritable, probably arises from malregulation of the amines NOREPINEPHRINE, DOPAMINE, and 5-hydroxytryptamine. It is most commonly treated with LITHIUM carbonate.

Biqāʿ \be-'kä**, Al-** *or* **Bekaa** \be-'kä\ **Valley** *ancient* **Coele-Syria** Broad valley region of central Lebanon. Located between the LEBANON and ANTI-LEBANON mountain ranges, it is about 75 mi (120 km) long and 10 mi (15 km) wide. Traversed by the upper ORONTES and Litani rivers, the valley is an agricultural area. The ruins of the ancient city of BAALBECK are located there. The majority of the inhabitants are Shīʿite Muslims. The region was the scene of some factional fighting during the Lebanese Civil War (1975–90), and during that time Israel intermittently fought there against forces of the PALESTINE LIBERATION ORGANIZATION and the Syrian army. Since the 1980s the region has been a stronghold of the Shīʿite militant organization HEZBOLLAH.

birch Any of about 40 species of short-lived ornamental and timber trees and shrubs of the genus *Betula*, the largest genus of the family Betulaceae, which also contains ALDERS, FILBERTS, *Carpinus* (hornbeam), and the genera *Ostrya* and *Ostryopsis*. Birches are found throughout cool regions of the Northern Hemisphere; other members of the family Betulaceae are found in temperate and subarctic areas of the Northern Hemisphere, in tropical mountains, and in South America through the Andes as far south as Argentina. Leaves are simple, serrate, and alternate; male and female flowers (CATKINS) are borne on the same plant. The fruit is a small NUT or short-winged samara (dry, winged fruit). Birches produce economically important timber. Oil obtained from birch twigs smells and tastes like wintergreen and is used in tanning Russian leather (see TANNING).

bird Any of the warm-blooded, beaked VERTEBRATES of the class Aves, including more than 9,600 living species. A covering of FEATHERS distinguishes birds from all other animals. Birds have a four-chambered heart (like MAMMALS), forelimbs modified into WINGS, and keen vision, and their eggs have calcium-rich eggshells. Their sense of smell is not highly developed. Birds are found almost worldwide in diverse habitats on both land and water. Dietary preferences and NEST structure vary widely. Almost all species incubate their eggs. Flying birds have evolved skeletons in which part of the bone is replaced by air spaces, an adaptation for reducing weight. The crop, an enlarged part of the esophagus used for temporary food storage, enables birds to feed while in flight. Humans use wild and domesticated birds and their eggs for food, hunt wild birds for sport, and use feathers for decoration and insulation. More than 1,000 extinct species of bird have been identified from fossil remains; the earliest fossil bird known is *ARCHAEOPTERYX*.



Principal features of a songbird.
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Bird, Larry (Joe) (b. Dec. 7, 1956, West Baden, Ind., U.S.) U.S. basketball player. Bird spent most of his collegiate career at Indiana State University, before being drafted by the Boston Celtics of the National Basketball Association (NBA). Playing forward and standing 6 ft 9 in. (2.06 m) tall, he was a great shooter and ball handler and one of the most formidable playmakers in the game. He helped lead Boston to NBA championships in 1981, 1984, and 1986 and was named the NBA's most valuable player for three consecutive years (1984–86). He retired in 1992 and was head coach of the Indiana Pacers for the 1997–98 season.

bird flu *or* **avian influenza** viral respiratory disease, mainly of birds including poultry and waterbirds but also transmissible to humans. Symptoms in humans include fever, sore throat, cough, headache, and muscle aches. Severe infections can result in life-threatening complications such as pneumonia and acute respiratory illness. The first known human cases occurred in Hong Kong in 1997, resulting in six deaths. Deadly outbreaks among poultry in several countries in eastern and central Asia between 2003 and mid-2005 were accompanied by more than 100 human cases, about half of them fatal. The causative agents are VIRUS subtypes related to the human INFLUENZA type A viruses, the most virulent and contagious being the H5N1 subtype. A specific protective VACCINE for this virus remains to be developed. Studies suggest that some antiviral drugs that work against human influenza may be effective in treating bird flu in humans.

bird-of-paradise Any of about 40 species (family Paradisaeidae) of small to medium-size forest birds that are rivaled by only a few pheasants and hummingbirds in colour and in the bizarre shape of the males' plumage. Courting males perform mating rituals for hours on a perch or in a cleared space on the forest floor. Birds-of-paradise are found in the highlands of New Guinea and on nearby islands; some species are also found in Australia. Among the most notable species are the plumebirds, which are 12–18 in. (30–46 cm) long and have central tail feathers elongated as wires or twisted ribbons.

bird-of-paradise *or* **crane flower** Ornamental plant (*Strelitzia reginae*) of the family Strelitziaceae. All five species of the genus *Strelitzia* are native to southern Africa. The large, showy *Strelitzia* flower has two erect, pointed petals and five stamens. One main BRACT, shaped like a boat, is green with red borders. It holds many long-stemmed orange and bright blue flowers, each resembling the crest and beak of a crane, giving the plant its common names.

bird of prey Any member of the order Falconiformes (EAGLES, FALCONS, HAWKS, and VULTURES) or Strigiformes (OWLS). Falconiforms are also called RAPTORS. They are active during the day, whereas owls are nocturnal. CONDORS and eagles are among the largest and strongest of flying birds. All birds of prey have a hook-tipped beak and sharp curved claws called talons. (Nonpredatory vultures have less-developed talons.) Despite the similarities between owls and raptors, many authorities believe they are not closely related but developed similar features because of their similar predatory lives.

bird stone Abstract stone carving by the prehistoric cultures of North America. They resemble birds and are about 6 in. (15 cm) long. Many were carved from black, brown, or dark green slate and polished with sand or other abrasive materials. All feature a pair of conical holes running diagonally through the base. They may have been used as weights or handles on a short rod (known as an atlatl) used to hurl spears or arrows.

bird-watching *or* **birding** Observation or identification of wild birds in their natural habitat. Basic equipment includes binoculars, a field guide to aid identification, and a notebook for recording time and place of sight-

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ings. The lists of bird observations compiled by members of local bird-watching societies are often useful to scientists in determining dispersal, habitat, and migration patterns of the various species. Bird-watching is primarily a 20th-century phenomenon; before 1900 most students of birds had to shoot them in order to identify them. Its popularity grew through the publication of journals and books, in particular the field guides (beginning in 1934) of ROGER TORY PETERSON.

bird's-foot trefoil Perennial, spreading, herbaceous LEGUME (*Lotus corniculatus*) native to Europe and Asia but introduced to other regions. The stem grows to about 2 ft (60 cm) long. Its leaves consist of three oval leaflets, broadest near the tip. The yellow flowers (sometimes tinged with red) grow in clusters of 5 to 10. Often used as FORAGE for cattle, it is occasionally a troublesome weed.

Birdseye, Clarence (b. Dec. 9, 1886, New York, N.Y., U.S.—d. Oct. 7, 1956, New York) U.S. businessman and inventor. He developed a highly efficient process for FREEZING foods in small packages suitable for retailing. He achieved rapid freezing by placing packaged food, including fish, fruits, and vegetables, between two refrigerated metal plates. Though his were not the first frozen foods, his process largely preserved the original taste of the food. In 1929 his company was bought by Postum, Inc., which later became GENERAL FOODS CORP. Birdseye served as a corporate executive until 1938.

birdsong Certain vocalizations of birds, characteristic of males during the breeding season, for the attraction of a mate and for territorial defense. Birdsong also reinforces pair bonds, and some species have a flight song. Birdsongs are usually more complex and longer than birdcalls, which are used for communication within a species. Birdsong may be hereditary or learned; a newly hatched male CHAFFINCH, for example, can sing a "subsong" but must learn to sing the true song by listening to and imitating adult males.

birefringence See DOUBLE REFRACTION

Biringuccio \bē-rēŋ-'güt-chō**, Vannoccio** (b. Oct. 20, 1480, Siena—d. August 1537, Rome) Italian metallurgist and armaments maker. He is chiefly known for the first clear, comprehensive work on METALLURGY, *De la pirotechnia* (published posthumously in 1540). His book, which contrasts strikingly with the obscure alchemical writings of the time, is replete with lavish woodcuts illustrating equipment and processes and includes clear, practical instructions for MINING, SMELTING, and metalworking. It became a standard reference and remains a valuable resource on 15th- and 16th-century technology.

Birkenau See AUSCHWITZ

Birkenhead, Frederick Edwin Smith, 1st earl of (b. July 12, 1872, Birkenhead, Cheshire, Eng.—d. Sept. 30, 1930, London) British politician. Elected to the House of Commons in 1906, he became noted as an orator and soon became a leader of the Conservative Party. As attorney general (1915–18), he successfully prosecuted ROGER CASEMENT. As lord chancellor (1919–22), he secured passage of the Law of Property Act (1922) and subsequent real-property statutes (1925) that replaced a convoluted system of land law. He also helped negotiate the Anglo-Irish Treaty of 1921.

Birmingham \'bər-miŋ-ˌham\ City (pop., 2000: 249,459), north-central Alabama, U.S. It is Alabama's largest city. Founded in 1871 by a land company backed by railroad officials, it was named for the English city. It developed as the South's iron and steel centre. From nearby Port Birmingham a barge canal leads south to MOBILE. Birmingham was the scene of civil rights drives by MARTIN LUTHER KING, JR., in the early 1960s, and in 1963 four black girls were killed there in a church bombing; this incident gave major impetus to the CIVIL RIGHTS MOVEMENT.

Birmingham \'bər-miŋ-əm\ City and metropolitan borough (pop., 2001: 977,091), central England. Birmingham lies 100 mi (160 km) northwest of London. Its first charter was granted in 1166. It was a small manufacturing town until the 18th century, when it became a centre of the INDUSTRIAL REVOLUTION, counting among its citizens JAMES WATT, JOSEPH PRIESTLEY, and JOHN BASKERVILLE. It suffered heavy bombing during World War II but was subsequently rebuilt. It remains the chief centre of Britain's light and medium industry, and it is also the cultural centre for a wide area. Birmingham is the site of two universities and of a grammar school founded by King Edward VI in 1552.

Birney, (Alfred) Earle (b. May 13, 1904, Calgary, Alta., Northwest Territories [Canada]—d. Sept. 3, 1995, Toronto, Ont.) Canadian poet and educator. Birney received a Ph.D. from the University of Toronto and brought out his first collection of poetry, *David* (1942, Governor General's Award), during his time there. After serving in World War II, he published *Now Is Time* (1946, Governor General's Award) and other collections and held a number of teaching and editorial positions. His love of language led him to experiment with sound poems and to explore concrete poetry; he also wrote two novels, a drama in verse, and several radio plays.

Birney, James G(illespie) (b. Feb. 4, 1792, Danville, Ky., U.S.—d. Nov. 25, 1857, Eagleswood, N.J.) U.S. politician and antislavery leader. He practiced law in Danville, Ky., before moving to Alabama, where he was elected to the state legislature in 1819. He became active in the abolition movement and in 1837 was elected secretary of the AMERICAN ANTI-SLAVERY SOCIETY. After the group split, he helped lead the faction that became the LIBERTY PARTY; he was the party's presidential candidate in 1840 and 1844.

birth See PARTURITION

birth control Voluntary limiting of human reproduction, using such means as CONTRACEPTION, sexual abstinence, surgical STERILIZATION, and induced ABORTION. The term was coined in 1914–15 by MARGARET SANGER. Medically, birth control is often advised when childbirth might endanger the mother's health or substantial risk exists of bearing a severely disabled child. Socially and economically, limitation of reproduction frequently reflects a desire to maintain or improve family living standards. Most religious leaders now generally agree that some form of fertility regulation is desirable, though the means are strongly debated. See also FAMILY PLANNING.

birth defect Genetic or trauma-induced abnormality present at birth. A more restrictive term than CONGENITAL DISORDER, it covers abnormalities that arise during the formation of an EMBRYO's organs and tissues and does not include those caused by diseases (e.g., SYPHILIS) that damage structures after they are formed.

birthmark Unusual mark or blemish on the skin at birth. Most birthmarks are either HEMANGIOMAS or MOLES. They are usually harmless and many fade in childhood; those that do not can sometimes be removed by laser surgery or abrasion.

birthstone Gemstone associated with the month of one's birth. Wearing one was popularly supposed to bring good luck or health. The ancient belief that supernatural powers could be attributed to gemstones is still held by some people today. The list of genuine stones (e.g., diamond, emerald, sapphire, ruby) was supplemented in the 20th century by a series of synthetic stones for use as less costly substitutes.

Birtwistle, Sir Harrison (Paul) (b. July 15, 1934, Accrington, Lancashire, Eng.) British composer. He began as a clarinetist, shifting to composition in his 20s. He cofounded the Pierrot Players with Peter Maxwell DAVIES (1967) but felt limited by the group's size. He concentrated on exploring large-scale time structures; his music's form is controlled by complex cyclical principles that he declined to discuss. His works include the theatre pieces *Punch and Judy* (1966–67), *The Mask of Orpheus* (1973–86), and *Gawain* (1991), and the orchestral works *The Triumph of Time* (1972), *Silbury Air* (1977), and *Secret Theatre* (1984).

Bīrūnī \bē-'rü-nē**, al-** (b. September 973, Khwārezm, Khorāsān—d. Dec. 13, 1048, Ghazna, Ghaznavid Afg.) Persian scientist and scholar. Sometime after 1017, he went to India, a land of which he wrote an encyclopaedic account. Later he settled at Ghazna in Afghanistan, where he enjoyed the support of the renowned MAḤMŪD OF GHAZNA and other rulers of the GHAZNAVID DYNASTY. Conversant with many languages, he wrote in Arabic, producing works on mathematics, astronomy, astrology, geography, physics, medicine, history, and chronology. His scientific achievements included accurate calculations of latitude and longitude and explanations of natural springs by the laws of hydrostatics. His best-known works are *A History of India* and *Chronology of Ancient Nations*.

Biscay, Bay of *or* **Gulf of Gascony** *French* **Golfe de Gascogne** \ˌgȯlf-də-gȧ-'skȯnʸ\ *Spanish* **Golfo de Vizcaya** \'gōl-fō-ˌthā-bēth-'kä-yä\ Inlet of the Atlantic Ocean, bounded by southwestern France and northwestern Spain. It has an area of about 86,000 sq mi (223,000 sq km) and a maximum depth of 15,525 ft (4,735 m). It is known for its rough

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seas. Rivers flowing into the bay include the Loire, Adour, and Garonne. Its ports include (in France) Brest, Nantes, and Bordeaux, and (in Spain) Bilbao, Santander, and Avilés; none can accommodate large vessels. French coastal resorts include La Baule, Biarritz, and Saint-Jean-de–Luz.

Biscayne Bay Inlet of the Atlantic Ocean, southeastern U.S. Located along southeastern Florida, it is about 40 mi (64 km) long and 2–10 mi (3–16 km) wide; it forms part of the Atlantic Intracoastal Waterway. It is bordered by Miami on the northwest and the Florida Keys on the east. The bay was named for the early explorer El Biscaino, of Viscaya (Biscaya) province, Spain. See also Biscayne National Park.

Biscayne National Park Preserve, southeastern Florida, U.S. Located 20 mi (32 km) south of Miami, with an area of 172,925 acres (70,035 hectares), it consists mostly of coral reef and water containing some 33 keys that form a north-to-south chain separating Biscayne Bay from the Atlantic Ocean. It is noted for a wide variety of sea life. Authorized as Biscayne National Monument in 1968, it became a national park in 1980.

Bischof \'bi-shōf**, Werner** (b. April 26, 1916, Zürich, Switz.—found dead May 16, 1954, Peruvian Andes) Swiss photojournalist. He studied at the Zürich Arts and Crafts School (1932–36). In 1942 he began working for the picture magazine *Du*, for which he photographed war-torn France, Germany, and The Netherlands. In 1949 he joined the cooperative photographers' agency Magnum Photos. He died in a car accident while working in Peru. Collections of his photographs were published in the books *Japan* (1954), *Incas to Indians* (1956), and *The World of Werner Bischof* (1959).

Bishkek \bish-'kek\ *or* **Pishpek** \pish-'pek\ *formerly (1926–91)* **Frunze** \'frün-zi\ City (pop., 1999 est.: 619,000), capital of Kyrgyzstan. It lies on the Chu River near the Kyrgyz Mountains on the Kazakhstan border. In 1825 the Uzbek khanate of Kokand (see Qo'qon) established a fortress on the site, which in 1862 was captured by the Russians. The Russians mistakenly called it Pishpek. When the Kirgiz (Kyrgyz) Autonomous Soviet Socialist Republic was set up in 1926, the city became its capital and was renamed Frunze for a Red Army leader who was born there. It developed as an industrial city, especially in World War II (1939–45) when heavy industries from western Russia were moved there.

bishop In some Christian churches, the chief pastor and overseer of a diocese, an area containing several congregations. From the 4th century AD until the Reformation, bishops held broad secular and religious powers, including the settling of disputes, ordination of clergy, and confirmation of church members. Some Christian churches (notably the Anglican, Roman Catholic, and Eastern Orthodox churches) continue the bishop's office and the doctrine of Apostolic succession. Others, including some Lutheran and Methodist churches, retain bishops but not the principle of apostolic succession; still others have abolished the office altogether. Popes, cardinals, archbishops, patriarchs, and metropolitans are gradations of bishops. In Roman Catholicism, the pope selects the bishop; in Anglicanism, the dean and chapter of the cathedral of the diocese elect the bishop; in Methodism a synod chooses the bishop. See also episcopacy.

Bishop, Elizabeth (b. Feb. 8, 1911, Worcester, Mass., U.S.—d. Oct. 6, 1979, Boston, Mass.) U.S. poet. Bishop was reared by relatives in Nova Scotia, Can., after her father died and her mother was institutionalized. In the 1950s and '60s she lived principally in Brazil with the Brazilian woman she loved. Her first book of poems (1946) contrasts her New England origins and her love of hot climates; reprinted with additions as *North & South: A Cold Spring* (1955), it received the Pulitzer Prize. Her works are celebrated for their formal brilliance and their close observations of everyday reality. They have elicited much admiration from other poets. Posthumous publications include *The Collected Prose* (1984) and *One Art* (1994), a collection of her letters.

Bishop, J(ohn) Michael (b. Feb. 22, 1936, York, Pa., U.S.) U.S. virologist. He graduated from Harvard Medical School. In 1970 he and Harold Varmus tested the theory that healthy body cells contain oncogenes (cancer-causing genes). Further research showed that such genes can cause cancer even without viral involvement. By 1989, the year Bishop and Varmus shared a Nobel Prize for their research, scientists had identified more than 40 oncogenes in animals.

Bishop, William Avery *known as* **Billy Bishop** (b. Feb. 8, 1894, Owen Sound, Ont., Can.—d. Sept. 11, 1956, West Palm Beach, Fla., U.S.) Canadian World War I fighter ace. Educated at the Royal Military College, he transferred from the cavalry to the Royal Flying Corps in 1915. While serving in France in 1917, he shot down 72 enemy aircraft, including 25 in one 10-day period. He was appointed to the staff of the British Air Ministry and helped form the Royal Canadian Air Force as a separate brigade. After the war he became a businessman and writer.

Bishop's University Privately endowed university in Lennoxville, Quebec, Canada, founded in 1843. It offers undergraduate and graduate programs in the humanities, social sciences, natural sciences, business, and education.

Bīsitūn \ˌbē-si-'tün\ *ancient* **Behestūn** Town and historic site, western Iran. On a limestone cliff above the present village is a bas-relief and series of inscriptions purportedly commissioned by the Achaemenian king Darius the Great (r. 522–486 BC); inscriptions in Old Persian, Babylonian, and Elamite record how Darius killed a usurper, defeated rebel forces, and assumed the throne. The inscriptions were first copied (1837–47) by Sir Henry Rawlinson (1810–95), an officer of the East India Company The deciphering of the Old Persian was a major advance in the study of cuneiform writing.

bisj \'bis-ē\ **pole** Carved wooden pole used in the religious rites of the South Pacific islands. The poles, 12–26 ft (4–8 m) tall, resemble an upended canoe with an exaggerated prow; they consist of carved figures placed one atop the other (thought to represent deceased ancestors) and terminate in a flat projection of ornate, openwork ornament. They are intended to harbour the souls of the dead, keeping them away from the village, and are also used to transmit magical powers. See also totem pole.

Bismarck \'biz-ˌmärk\ City (pop., 2000: 55,532), capital of North Dakota, U.S. It was settled as a Missouri River port in the 1830s. In 1872 a military post was established to protect railway workers, and in 1873 it was named for Otto von Bismarck in the hope of attracting German investment. With the discovery of gold in the nearby Black Hills, it became a prospecting centre. In 1883 it was made the capital of Dakota Territory; when the territory was divided into two states in 1889, Bismarck became the capital of the northern state. Today it is the region's business, cultural, and financial centre.

Bismarck German battleship of World War II. The formidable 52,600-ton (47,700-metric-ton) vessel was launched in 1939. British reconnaissance aircraft sighted it off Bergen, Norway, in May 1941, and almost the entire British home fleet was sent to intercept it. Two cruisers engaged it near Iceland, and the *Bismarck* destroyed the *Hood* before escaping to the open sea. Sighted 30 hours later, it was torpedoed and then bombarded by battleships throughout the night. The *King George V* and the *Rodney* crippled it in an hour-long attack, and it was finally sunk by torpedoes from the cruiser *Dorsetshire*.

Bismarck, Otto (Eduard Leopold), prince von (b. April 1, 1815, Schönhausen, Altmark, Prussia—d. July 30, 1898, Friedrichsruh, near Hamburg) Prussian statesman who founded the German Empire in 1871 and served as its chancellor for 19 years. Born into the Prussian landowning elite, Bismarck studied law and was elected to the Prussian Diet in 1849. In 1851 he was appointed Prussian representative to the federal Diet in Frankfurt. After serving as ambassador to Russia (1859–62) and France (1862), he became prime minister and foreign minister of Prussia (1862–71). When he took office, Prussia was widely considered the weakest of the five European powers, but under his leadership Prussia won a war against Denmark in 1864 (see Schleswig-Holstein Question), the Seven Weeks' War (1866), and the Franco-Prussian War (1870–71). Through these wars he achieved his goal of political unification of a Prussian-dominated German Empire. Once the empire was established, he became its chancellor. The "Iron Chancellor" skillfully preserved the peace in Europe through alliances against France (see Three Emperors' League; Reinsurance Treaty; Triple Alliance). Domestically, he introduced administrative and economic reforms but sought to preserve the status quo, opposing the Social Democratic Party and the Catholic church (see Kulturkampf). When Bismarck left office in 1890, the map of Europe had been changed immeasurably. However, the German Empire, his greatest achievement, survived him by only 20 years because he had failed to create an internally unified people.

Bismarck Archipelago Island group, western Pacific Ocean. Lying northwest of New Guinea, it forms part of Papua New Guinea. It has a total area of 19,173 sq mi (49,658 sq km); its largest components include New Britain, New Ireland, the Admiralty Islands, and New Hanover (Lavongai).

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Annexed by Germany in 1884, it was named for Otto von Bismarck. Occupied by Australia in 1914, it was made a mandated territory of Australia in 1920. The group became part of the UN Trust Territory of New Guinea after World War II and part of Papua New Guinea when it attained independence in 1975.

bismuth \'biz-məth\ Semimetallic to metallic chemical element, chemical symbol Bi, atomic number 83. Hard, brittle, and lustrous, it has a distinctive gray-white colour with a reddish tinge. It is often found free in nature and also occurs in compounds and in mixed ores. Bismuth alloys are used (because of their low melting points) in making metal castings, special solders, automatic sprinkler heads, fuses, and many fire-detection devices. Bismuth phosphomolybdate is a catalyst in the production of acrylonitrile, an important raw material for fibres and plastics. Salts of bismuth are used in making soothing agents for digestive disorders (especially bismuth subsalicylate), in treating skin infections and injuries, and in lipstick, nail polish, and eye shadow, to which they impart a pearlescent quality.

bison \'bī-sᵊn, 'bī-zᵊn\ Either species (genus *Bison*) of oxlike bovid with a convex forehead and a pronounced shoulder hump. Its dark brown, coarse hair is especially long on the head, which is held low, and on the neck and shoulders. Both sexes bear heavy, curved horns. A mature bull stands about 6.5 ft (2 m) at the shoulder and weighs more than 1,980 lb (900 kg). Bison live in herds. The American bison (*B. bison*), commonly called buffalo, was abundant over most of North America when Europeans arrived. Uncontrolled hunting drove it nearly to extinction by 1900, but it has since recovered. The European bison (*B. bonasus*) is similar and survives only in a few managed herds.

American bison, or plains buffalo (*Bison bison*).
ALAN G. NELSON/ROOT RESOURCES

Bissau \bis-'aù\ Seaport (pop., 1999 est.: 274,000), capital of Guinea-Bissau. Lying on an estuary of the Gêba River where it flows into the Atlantic Ocean, the port originated in 1687 as a Portuguese fortified post. In 1941 it replaced Bolama as the country's capital and has since developed as an excellent roadstead for large vessels.

bit *in full* **binary digit** In communication and information theory, a unit of information equivalent to the result of a choice between only two possible alternatives, such as 1 and 0 in the binary code generally used in digital computers. It is also applied to a unit of memory corresponding to the ability to store the result of a choice between two alternatives. A byte consists of a string of eight consecutive bits and makes up the basic information processing unit of a computer. Because a byte includes only an amount of information equivalent to one letter or one symbol (e.g., a comma), the processing and storage capacities of computer hardware are usually given in kilobytes (1,024 bytes), megabytes (1,048,576 bytes), and even gigabytes (about 1 billion bytes) and terabytes (1 trillion bytes).

bit-map Method by which a display space (such as a graphics image file) is defined, including the colour of each of its pixels (or bits). In effect, a bit-map is an array of binary data representing the values of pixels in an image or display. A GIF is an example of a graphics image file that has a bit-map. When the GIF is displayed on a computer monitor, the computer reads the bit-map to determine which colours to use to "paint" the screen. In a bit-mapped font, each character is defined as a pattern of dots in a bit-map.

Bithynia \bə-'thin-ē-ə\ Ancient country, northwestern Anatolia. Bounded by the Sea of Marmara, the Bosporus, and the Black Sea, it was settled by Thracians in the late 2nd millennium BC. They never submitted to Alexander the Great, and by the 3rd century BC a powerful Hellenistic kingship had been established in the area. There followed a century of inept leadership and rapid decline. Bithynia's last king, Nicomedes IV, bequeathed his kingdom to the Romans in 74 BC.

bittern Any of 12 species of solitary marsh birds (family Ardeidae), related to herons but having a shorter neck and a stouter body. Most bitterns bear a camouflage pattern (streaks of variegated brown and buff) that enables them to hide by standing upright with bill pointed upward, imitating the reeds and grasses of their habitat. They feed on fish, frogs, crayfish, and other small swamp and marsh animals, which they spear with their sharp-pointed bills. Bitterns are found almost worldwide. The largest species grow to 30 in. (75 cm), the smallest to about 12–16 in. (30–40 cm).

Bitterroot Range Segment of the northern Rocky Mountains, U.S. Extending north-south 300 mi (480 km) along the Idaho-Montana border, its peaks average about 9,000 ft (2,700 m); Idaho's Scott Peak is the highest, at 11,393 ft (3,473 m). Owing to the mountains' inaccessibility from the east, the Lewis and Clark Expedition (1805) had to travel north more than 100 mi (160 km) to find a route through the range. Bitterroot National Forest extends across the centre of the range.

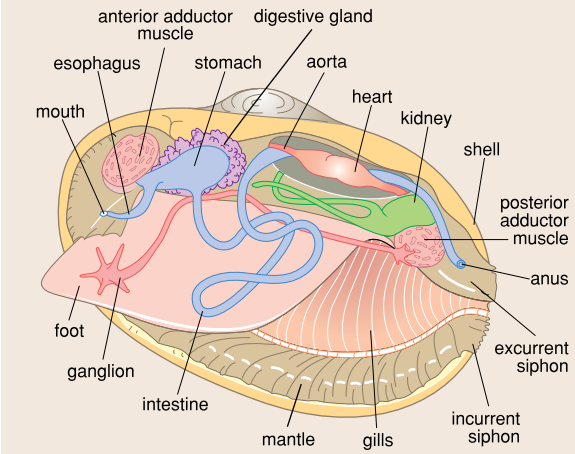
bittersweet Any of several vines with colourful fruit. The genus *Celastrus* (family Celastraceae) includes American bittersweet, or staff vine (*C. scandens*), and Oriental bittersweet (*C. orbiculatus*), woody vines grown as ornamentals. Oriental bittersweet is a more vigorous climber than the American species. Both types climb by twining around supports. Another bittersweet, *Solanum dulcamara*, belongs to the nightshade family.

bitumen \bə-'tyü-mən\ Mixture of tarlike hydrocarbons derived from petroleum. Black or brown, it varies from viscous to solid; the solid form is usually called asphalt. Bitumen occurs in nearly every part of the world and in nearly the whole range of geologic strata. The term may also refer to synthetic hydrocarbon compounds.

bituminous \bə-'tyü-mə-nəs\ **coal** *or* **soft coal** Most abundant form of coal. It is dark brown to black and has a relatively high heat value. Widely abundant and with the broadest range of commercial uses, it has long been used for steam generation in electric power plants and industrial boiler plants. Certain varieties are also used to make coke, a hard substance of almost pure carbon that is important for smelting iron ore. One major problem is that burning large quantities of bituminous coal that has a medium to high sulfur content contributes to air pollution and produces acid rain. See also subbituminous coal.

bituminous sand See tar sand

bivalve Any member of the mollusk class Bivalvia, or Pelecypoda, characterized by having a two-halved (valved) shell. Clams, cockles, mussels, oysters, scallops, and shipworms are bivalves. Most are completely enclosed by the shell, the two valves of which are joined by an elastic ligament,



Internal structure of a clam. A ligament hinges the shell's two halves (valves) open, and the beating motion of cilia on the gills causes water to enter through the incurrent siphon. As water moves over the gills, oxygen diffuses into the blood, and food particles become trapped in mucus and are moved to the mouth. A pair of adductor muscles can hold the shell tightly closed. A fold of tissue (mantle) encloses the body's organs and releases the material that forms the shell. A large muscular foot allows the clam to creep and burrow. The circulatory system consists of a heart and blood vessels, and kidneys remove wastes from the blood. Deoxygenated blood and wastes are removed in the water that exits through the excurrent siphon.
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and by two sheets of tissue called the mantle. Bivalves have no head. They feed on PHYTOPLANKTON by pumping water across the gills and trapping food particles that are then moved to the mouth. Bivalves are found in most parts of the ocean from the intertidal zone to abyssal depths.

Biwa \'bē-wä**, Lake** Lake, west-central HONSHU, Japan. It is Japan's largest lake, measuring 40 mi (64 km) long and up to 12 mi (19 km) wide, with an area of 259 sq mi (670 sq km). Its name refers to the musical instrument (see PIPA) that the lake resembles in shape. Its sole outlet, the Yodo River, flows from its southern tip to Ōsaka Bay. Lake Biwa is noted for its pearl culture industry. Its great scenic beauty, long a subject of Japanese poetry, makes it one of Japan's major tourist attractions.

Bizet \bē-'zā**, Georges** *orig.* **Alexandre-César-Léopold Bizet** (b. Oct. 25, 1838, Paris, France—d. June 3, 1875, Bougival) French composer. Son of a music teacher, he gained admission to the Paris Conservatoire at age 9, and at age 17 he wrote the precocious *Symphony in C Major* (1855). Intent on success on the operatic stage, he produced *The Pearl Fishers* (1863), *La Jolie Fille de Perth* (1866), and *Djamileh* (1871). Disgusted with the frivolity of French light opera, he determined to reform the genre of *opéra comique*. In 1875 his masterpiece, *Carmen*, reached the stage. Though its harsh realism repelled many, *Carmen* quickly won international enthusiasm and was recognized as the supreme example of *opéra comique*. Bizet's death soon after its premiere cut short a remarkable career.

Björling \'byœr-liŋ**, Jussi** *orig.* **Johan Jonaton Björling** (b. Feb. 2, 1911, Stora Tuna, Swed.—d. Sept. 9, 1960, Siarö) Swedish tenor. He began to sing in public as a child and toured Europe and the U.S. with his family. Recruited by the Royal Swedish Opera in 1928, he was soon a star performer. He made his Metropolitan Opera debut in 1938 as Rodolfo in *La Bohème*. He remained in Sweden during World War II but returned to the Met for several seasons afterward. He became a favourite on stage and in recordings for the sheer beauty and musicality of his singing.

Bjørnson \'byœrn-sȯn**, Bjørnstjerne (Martinius)** (b. Dec. 8, 1832, Kvikne, Nor.—d. April 26, 1910, Paris, France) Norwegian writer, editor, and theatre director. He worked to stimulate national pride by linking Norwegian history and legend to modern ideals. Together with HENRIK IBSEN, Alexander Kielland, and JONAS LIE, he is known as one of "the four great ones" of 19th-century Norwegian literature. He won the Nobel Prize for Literature in 1903. His poem "Yes, We Love This Land Forever" is the Norwegian national anthem.

Black, Hugo (La Fayette) (b. Feb. 27, 1886, Clay county, Ala., U.S.—d. Sept. 25, 1971, Bethesda, Md.) U.S. Supreme Court justice (1937–71). After practicing law in Alabama from 1906, he served in the U.S. Senate (1927–37), where he was a strong supporter of the NEW DEAL. Pres. FRANKLIN ROOSEVELT appointed him to the SUPREME COURT OF THE UNITED STATES, where he helped reverse earlier court decisions against New Deal legislation. In the 1960s he was prominent in the liberal majority that struck down mandatory school prayer and guaranteed the availability of legal counsel to suspected criminals. He became best known for his absolutist belief in the BILL OF RIGHTS as a guarantee of civil liberties. His last major opinion supported the right of the *New York Times* to publish the PENTAGON PAPERS (1971).

Black, Sir James (Whyte) (b. June 14, 1924, Uddingston, Scot.) Scottish pharmacologist. Through studying interactions between receptors on cells and chemicals in the bloodstream that attach to them, Black developed the first of the beta-blocking drugs, to relieve angina pectoris. He used a similar approach to develop drugs for stomach and duodenal ulcers. He shared a 1988 Nobel Prize for Physiology or Medicine with GEORGE H. HITCHINGS and GERTRUDE ELION.

Black Aesthetic movement *or* **Black Arts movement** Period of artistic and literary development among black Americans in the 1960s and early '70s. Based on the cultural politics of black nationalism, the movement sought to create art forms capable of expressing the varieties of black experience in the U.S. Leading theorists included AMIRI BARAKA, Houston Baker (b. 1943), and HENRY LOUIS GATES. Don L. Lee (b. 1942), known as Haki R. Madhubuti after 1973, was one of its most popular writers; other notable writers included TONI MORRISON, ALICE WALKER, and Ntozake Shange (b. 1948). The movement also produced such autobiographical works as *The Autobiography of Malcolm X* (1965; with ALEX HALEY), Eldridge Cleaver's *Soul on Ice* (1968), and *Angela Davis: An Autobiography* (1974).

Black and Tan Member of a British auxiliary force employed in Ireland against the republicans (1920–21). When Irish nationalist agitation intensified after World War I, many Irish police resigned and were replaced by these temporary English recruits, who dressed in a mixed "black and tan" outfit because of a shortage of uniforms. In their efforts to thwart the terrorism of the IRISH REPUBLICAN ARMY, the Black and Tans themselves engaged in brutal reprisals.

black bass Any of about six species (genus *Micropterus*) of slender freshwater fishes of the SUNFISH family; found in eastern North America. Two, the largemouth and smallmouth black basses, have been introduced into other countries and are prized as hard-fighting game fishes. Black basses are larger and longer-bodied than sunfishes and more predatory. The largemouth bass may grow to 32 in. (80 cm) long and weigh 22 lbs (10 kg); it lives in quiet weedy lakes and streams. The smallmouth bass, which usually grows to 5–6 lbs (2–3 kg), inhabits clear, cool lakes and running streams.

black bear Forest-dwelling BEAR (*Ursus americanus*) that, despite reductions in population and range, is still the most common North American bear. The adult ranges from 5 to 6 ft (150–180 cm) in length and weighs 200–600 lbs (90–270 kg). It has various colour morphs but always a brown face and usually a white chest mark. It eats animals and vegetation, including pinecones, berries, and roots. It frequently raids campsites and seizes anything edible. Though it may be tamed and taught tricks, it often becomes dangerous when mature.

American black bear (*Ursus americanus*)
LEONARD LEE RUE III

Black Canyon of the Gunnison National Park Park, western Colorado, U.S. Comprising a narrow, deep gorge of the Gunnison River, the preserve, established as a national monument in 1933 and elevated to a national park in 1999, occupies an area of 51 sq mi (133 sq km). The canyon derives its name from its black-stained, lichen-covered walls, which accentuate the gloom of the chasm.

black codes Laws, enacted in the former Confederate states after the AMERICAN CIVIL WAR, that restricted the freedom of former slaves and were designed to assure white supremacy. They originated in the slave codes, which defined slaves as property. In some states these codes included vagrancy laws that targeted unemployed blacks, apprentice laws that made black orphans and dependents available for hire to whites, and commercial laws that excluded blacks from certain trades and businesses and restricted their ownership of property. Northern reaction to the laws helped produce Radical RECONSTRUCTION and passage of the 14th and 15th amendments to the Constitution, as well as creation of the FREEDMEN'S BUREAU. Many provisions of the black codes were reenacted in the JIM CROW LAWS and remained in force until the 1964 CIVIL RIGHTS ACT.

Black Death Fierce and widespread outbreak of PLAGUE, probably bubonic and pneumonic, that ravaged Europe during the 14th century. The epidemic originated in Asia and was transmitted to Europeans in 1347 when a Turkic army besieging a Genoese trading post in the Crimea catapulted plague-infested corpses into the town. It spread from the Mediterranean ports and ravaged all of Europe between 1347 and 1351. Renewed outbreaks occurred in 1361–63, 1369–71, 1374–75, 1390, and 1400. Towns and cities were more heavily hit than the countryside, and whole communities were sometimes destroyed. Much of Europe's economy was devastated. About one-third of the European population, or a total of 25 million people, died in the Black Death.

black-eyed pea See COWPEA

black-eyed Susan Either of two North American CONEFLOWERS (*Rudbeckia hirta* and *R. serotina*) having flower heads with deep yellow to orange petals and dark conical centers. The stems are rough and hairy; the leaves are large and ovate at the base of the plant and narrow at the top.

black-figure pottery Type of GREEK POTTERY that originated in Corinth c. 700 BC. The figures were painted in black pigment on the natural red clay ground. Finishing details were then incised into the black pigment,

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revealing the red ground. The great Attic painters (mid 6th century BC), most notably EXEKIAS, developed narrative scene decoration and perfected the style. It continued to be popular until the advent of RED-FIGURE POTTERY (c. 530 BC).

Dionysus and satyrs, amphora painted in the black-figure style by the Amasis Painter, c. 540 BC; in the Antikenmuseum, Basel, Switz.
COURTESY OF THE ANTIKENMUSEUM, BASEL, SWITZ.; PHOTOGRAPH, COLORPHOTO HANS HINZ

Black Forest *German* **Schwarzwald** \'shfärts-ˌvält\ Mountain region, Baden-Württemberg, southwestern Germany. It extends in a fairly narrow strip about 100 mi (160 km) along the eastern bank of the upper RHINE RIVER, from the NECKAR RIVER to the Swiss border. Its highest peak is Feldberg, at 4,897 ft (1,493 m). Its name comes from its dark interior, the higher parts being thickly forested with fir and pine. It is the source of the Neckar and DANUBE rivers. The setting of many of the GRIMM brothers' fairy tales, it is famed for the beauty and charm of its villages and rolling hills. Winter sports are prominent in the area, which also has many mineral springs and watering places, including the spa town of Baden-Baden.

Black Friday Day (Sept. 24, 1869) when plunging gold prices precipitated a U.S. stock-market PANIC. An attempt by JAY GOULD and JAMES FISK to corner the market in gold and drive up its price depended on preventing the sale of government gold, an arrangement assured through the two men's political influence. When Pres. ULYSSES S. GRANT heard of the scheme, he ordered the government to sell $4 million in gold, which caused the price to drop and produced a panic selling of other stocks.

black gum *or* **sour gum** Most widely distributed TUPELO, *Nyssa sylvatica*, also known as black tupelo or pepperidge tree. It is found in moist areas of the eastern U.S. from Maine south to the Gulf Coast and westward to Oklahoma. Its wood is light and soft but tough. The black gum is sometimes grown as an ornamental and is prized for its brilliant scarlet autumnal foliage.

Black Hand Secret Serbian society formed in 1911 primarily by army officers, which used terrorist methods to promote the liberation of Serbs outside Serbia from Habsburg or Ottoman rule. It conducted propaganda campaigns, organized armed bands in Macedonia, and established revolutionary cells throughout Bosnia. Within Serbia it dominated the army and wielded tremendous influence over the government. It gained its greatest notoriety with the assassination of Archduke FRANCIS FERDINAND in 1914. After a trial in 1917, three leaders were executed and more than 200 were imprisoned. The name also referred to several extortion rackets run by immigrant Sicilian and Italian gangsters in the Italian communities of many large U.S. cities c. 1890–1920. Local merchants and wealthy individuals would receive threatening notes printed with black hands, daggers, or other menacing symbols that demanded money on pain of death or destruction of property. It declined with the beginning of Prohibition and large-scale bootlegging.

Black Hawk, oil painting by George Catlin, 1832; in the National Museum of American Art, Smithsonian Institution, Washington, D.C.
COURTESY OF NATIONAL MUSEUM OF AMERICAN ART, SMITHSONIAN INSTITUTION, WASHINGTON, D.C.

Black Hawk (b. 1767, Sauk Sautenuk, Va.—d. Oct. 3, 1838, village on the Des Moines River, Iowa, U.S.) SAUK Indian leader. Long antagonistic to whites, Black Hawk was driven into Iowa from Illinois in 1831. Defying the government orders to vacate villages along the Rock River in Illinois, he led a faction of Sauk and Fox Indians back across the Mississippi River the following year. This act led to the brief but tragic Black Hawk War of 1832. He himself survived the final battle, a massacre. The ruthlessness of the war so affected neighbouring Indian groups that by 1837 most had fled far west, leaving most of the Northwest Territory to white settlers.

Black Hills Group of mountains in western South Dakota and northeastern Wyoming, U.S. Occupying about 6,000 sq mi (15,540 sq km), they lie between the CHEYENNE and Belle Fourche rivers and rise to a maximum elevation of 7,242 ft (2,207 m) at Harney Peak. Their name refers to the dark appearance that their rounded hilltops and well-forested slopes present at a distance. The SIOUX Indians were guaranteed treaty rights to the region in 1868; however, the discovery of gold in 1874 led to an influx of white miners and to the Black Hills War (1876), including the Battle of the LITTLE BIGHORN. Tourist attractions include the mining town of Deadwood, Mount RUSHMORE and JEWEL CAVE NATIONAL MONUMENTS, WIND CAVE NATIONAL PARK, and Custer State Park, all in South Dakota, and DEVILS TOWER NATIONAL MONUMENT in Wyoming.

black hole Cosmic body with gravity (see GRAVITATION) so intense that nothing, not even LIGHT, can escape. It is suspected to form in the death and collapse of a STAR that has retained at least three times the Sun's mass. Stars with less mass evolve into WHITE DWARF STARS or NEUTRON STARS. Details of a black hole's structure are calculated from ALBERT EINSTEIN's general theory of RELATIVITY: a "singularity" of zero volume and infinite density pulls in all matter and energy that comes within an EVENT HORIZON, defined by the SCHWARZSCHILD RADIUS, around it. Black holes cannot be observed directly because they are small and emit no light. However, their enormous gravitational fields affect nearby matter, which is drawn in and emits X rays as it collides at high speed outside the event horizon. Some black holes may have nonstellar origins. Astronomers speculate that supermassive black holes at the centres of QUASARS and many galaxies are the source of energetic activity that is observed. STEPHEN W. HAWKING theorized the creation of numerous tiny black holes, possibly no more massive than an asteroid, during the BIG BANG. These primordial "mini black holes" lose mass over time and disappear as a result of HAWKING RADIATION. Although black holes remain theoretical, the case for their existence is supported by many observations of phenomena that match their predicted effects.

black humour Humour marked by the use of morbid, ironic, or grotesquely comic episodes that ridicule human folly. The term came into common use in the 1960s to describe the work of novelists such as JOSEPH HELLER, whose *Catch-22* (1961) is an outstanding example; KURT VONNEGUT, particularly in *Slaughterhouse Five* (1969); and THOMAS PYNCHON, in *V* (1963) and *Gravity's Rainbow* (1973). A film exemplar is STANLEY KUBRICK's *Dr. Strangelove* (1963). The term *black comedy* has been applied to some playwrights in the THEATRE OF THE ABSURD, especially EUGÈNE IONESCO.

black lead See GRAPHITE

Black Legend Stories from the Spanish colonies in the Americas that led to the general belief, eagerly endorsed by such rivals as Britain and Holland, that Spain exceeded other nations in cruelty to its subject populations. The 16th-century historians BARTOLOMÉ DE LAS CASAS and GARCILASO DE LA VEGA documented the treatment of the Indians in New Spain (Mexico and Guatemala) and Peru, respectively, and laid the foundation for the legend. Though Spain may not actually have surpassed other colonial powers in cruelty, the Spanish conquest clearly reduced the numbers of indigenous peoples rapidly and caused them great suffering.

black letter *or* **Gothic script** *or* **Old English script** Style of alphabet used in handwriting throughout Europe in the Middle Ages. It features uniform vertical strokes that end on the baseline, angular lines instead of smooth curves and circles, and the overlapping of convex forms. Black letter and roman were the dominant letter shapes of medieval typography. The only extant work known to have been printed by JOHANNES GUTENBERG, the 42-line Bible (1450s), was set in black-letter type. Roman type largely superseded it in the Renaissance, though black letter persisted in Germany well into the 20th century. Today black letter is often used for diplomas, Christmas cards, and liturgical writings.

black market Trading in violation of publicly imposed regulations such as rationing laws, laws against the sale of certain goods, and official rates of exchange among currencies. Black-market activity is common in wartime, when scarce goods and services are often strictly rationed (see RATIONING). Black-market foreign-exchange transactions flourish in countries where convertible foreign currency is scarce and foreign exchange is tightly controlled.

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Black Muslims See Nation of Islam

black nationalism U.S. political and social movement aimed at developing economic power and community and ethnic pride among African Americans. It was proclaimed by Marcus Garvey in the early 20th century, when many U.S. black nationalists hoped for the eventual creation of a separate black nation in Africa. In the 1960s and '70s, Elijah Muhammad and Malcolm X preached the ideal of black nationalism as an alternative to assimilation into the predominantly white culture of the U.S.

Black Panther Party (for Self-Defense) U.S. African American revolutionary party founded in 1966 by Huey Newton and Bobby Seale (b. 1936) in Oakland, Calif. Its original purpose was to protect African Americans from acts of police brutality. Eventually the Panthers developed into a Marxist revolutionary group that called for the arming of African Americans, their exemption from the draft, the release of all African American prisoners, and payment of compensation to African Americans for centuries of exploitation by white Americans. By the late 1960s it had more than 2,000 members, with chapters in several major cities; an early spokesman was Eldridge Cleaver (1935–98). Conflicts with police in the late 1960s and early '70s led to shoot-outs in California, New York, and Chicago, one of which resulted in Newton's imprisonment for the murder of a police officer. Though some members of the party were guilty of criminal acts, the entire group was subjected to violent attacks by police and harassment by other government agencies, including the Federal Bureau of Investigation. Police activities in dealing with the Panthers were later the subject of congressional investigations. By the mid-1970s, having lost many members and having fallen out of favour with African American leaders, the party turned to providing social services in African American neighbourhoods. By the early 1980s it had effectively disbanded.

black pepper *or* **pepper** Perennial, woody climbing vine (*Piper nigrum*) of the family Piperaceae, native to India; also, the hotly pungent spice made from its berries. One of the earliest spices known, pepper is probably the most widely used spice in the world today. It early became an important article of overland trade between India and Europe. The plant is cultivated throughout Indonesia and has been introduced into tropical areas elsewhere. It has broad, shiny leaves and dense, slender spikes of small flowers. The small berrylike fruits are called peppercorns. See also pepper.

black sand Accumulation of fragments of durable, usually dark, heavy minerals (those with a density greater than that of quartz). These accumulations are found in streambeds or on beaches where stream flow and wave energy are sufficient to carry away low-density material but not the heavy minerals. Thus, heavy minerals resistant to weathering and abrasion concentrate in these areas, though they may be only minor constituents of inland rocks. Placer mining of such deposits yields magnetite, cassiterite, and zircon, as well as gold, platinum, and other rare metals.

Black Sea Sea between Europe and Asia. Bordered by Ukraine, Russia, Georgia, Turkey, Bulgaria, and Romania, it has a maximum depth of 7,250 ft (2,210 m). The Black Sea proper has an area of 163,000 sq mi (422,000 sq km). It is connected with the Aegean Sea through the Bosporus, the Sea of Marmara, and the Dardanelles, and with the Sea of Azov by Kerch Strait. It receives many rivers, including the Danube, Dniester, Bug, Dnieper, Kuban, Kizil, and Sakarya. The Crimean Peninsula (see Crimea) extends into it from the north. Created when structural upheavals in Asia Minor split off the Caspian basin from the Mediterranean Sea, the Black Sea gradually became isolated; salinity is now less than half that of the world's oceans. Though long popular for its resorts, it has suffered severe pollution in recent decades.

black snake Any of several species of all-black or nearly all-black snakes. Australian black snakes are in the elapid genus *Pseudeschis*. The black snake of Australian wetlands (*P. porphyriacus*) grows to an average length of 5 ft (1.5 m). If annoyed, it expands its neck, cobra fashion. Its venom is rarely fatal. Other Australian black snakes are the mulga snake (*P. australis*) and the spotted black snake (*P. guttatus*). North American black snakes include two species in the family Colubridae: the black racer and the pilot black snake (*Elaphe obsoleta*).

Black Sox scandal U.S. baseball scandal, centring on the charge that eight members of the Chicago White Sox had been bribed to lose the 1919 World Series to the Cincinnati Reds. Five of those accused admitted to a grand jury that they had thrown the series, but their signed confessions later disappeared. Although all eight players were acquitted in 1921, commissioner Kenesaw Mountain Landis banned them from playing for life.

Black Stone of Mecca Muslim object of veneration, built into the eastern wall of the Kaaba and probably predating Islam. It consists of three large pieces of stone and some fragments, surrounded by a stone ring and held together with a silver band. According to legend, the stone was given to Adam on his fall from paradise and was originally white but has been made black by the sins of the thousands of pilgrims who have touched and kissed it.

black theatre In the U.S., a dramatic movement encompassing plays written by, for, and about blacks. The first known play by an American black was James Brown's *King Shotaway* (1823). After the Civil War, blacks began to perform in minstrel shows, and musicals written, produced, and acted entirely by blacks appeared by c. 1900. The first real success of a black dramatist was Angelina W. Grimké's *Rachel* (1916). Theatre flourished during the Harlem Renaissance of the 1920s and '30s, and by 1940 the American Negro Theater and the Negro Playwrights' Co. were firmly established. After World War II black theatre grew more progressive and militant, seeking to establish its own mythology, abolish racial stereotypes, and integrate black playwrights into the mainstream. Its strongest proponent, Amiri Baraka, established the Black Arts Repertory Theatre in 1965. In the 1980s and '90s the African American playwrights Charles Fuller and August Wilson won Pulitzer Prizes.

Black Warrior River Navigable river, western Alabama, U.S. Formed by the confluence of the Locust and Mulberry forks in Jefferson county, it flows southwest through coalfields to join the Tombigbee River near Demopolis. The river is 178 mi (286 km) long and furnishes waterpower above Tuscaloosa.

black widow Any of several black spiders in the genus *Latrodectus* with a venomous bite that is rarely fatal to humans. Black widow species are found worldwide, with three living in North America. In Australia it is called the redback. The females are shiny black, usually with a reddish hourglass-shaped design on the underside of the spherical abdomen and with a body about 1 in. (2.5 cm) long. The black widow preys on insects. The male, about one-fourth the female's size, is often killed and eaten by the female after mating (the source of its name).

Blackbeard *orig.* **Edward Teach** (b. Bristol?, Eng.—d. Nov. 22, 1718, Ocracoke Island, North Carolina) English pirate. He was probably a privateer in the West Indies until 1716. With his 40-gun warship, he preyed on shipping off the Virginia and Carolina coasts, sharing his prizes with the governor of the North Carolina colony in return for protection. He was eventually killed by a British naval force, and his head, with its great black beard, was affixed to the end of his bowsprit. According to legend, he left a great buried treasure; it has never been found and probably never existed.

blackberry Usually prickly, fruit-bearing bush of the genus *Rubus*, in the rose family, native chiefly to northern temperate regions. The blackberry is abundant in eastern North America and on the Pacific coast; in Europe it is common in thickets and hedges. Its usually biennial, prickly, and erect, semierect, or trailing stems bear leaves with usually three or five oval, coarsely toothed, stalked leaflets; white, pink, or red flowers in terminal clusters; and black or red-purple aggregate fruits. The several trailing species are commonly called dewberries. Blackberries are a fairly good source of iron and vitamin C.

Blackberry (*Rubus*).
DEREK FELL

blackbird In the New World, any of several species of songbirds in the family Icteridae, collectively called icterids; also, an Old World thrush (*Turdus merula*, family Turdidae). The best known icterid is the red-winged blackbird (*Agelaius phoeniceus*), which ranges from Canada to the West Indies and Central America. It is 8 in. (20 cm) long, and the male's black plumage is set off by red shoulder patches. The Old World blackbird, 10 in. (25 cm) long, is common in woods and gardens throughout temperate Eurasia as well as in Australia and New Zealand. See also grackle.

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blackbody Theoretical surface that absorbs all radiant energy that falls on it, and radiates electromagnetic energy at all frequencies, from RADIO WAVES to GAMMA RAYS, with an intensity distribution dependent on its temperature. Because all visible light falling on such a surface is absorbed without reflection, the surface will appear black as long as its temperature is such that its emission peak is not in the visible portion of the SPECTRUM. See also ABSORPTION.

blackcap Common WARBLER (*Sylvia atricapilla*, family Sylviidae) from Europe and North Africa to central Asia. It is about 6 in. (14 cm) long and has brownish upper parts, gray underparts and face, and a black (male) or reddish brown (female) crown. Common in woodland borders and rough hedges, it has a rich song.

Male (bottom) and female blackcaps (*Sylvia atricapilla*).
HANS REINHARD-BRUCE COLEMAN LTD.

Blackett \'blak-ət\ **(of Chelsea), Patrick M(aynard) S(tuart), Baron** (b. Nov. 18, 1897, London, Eng.—d. July 13, 1974, London) British physicist. He graduated from the University of Cambridge in 1921 and spent 10 years at the Cavendish Laboratory, where he developed the Wilson CLOUD CHAMBER into an instrument for the study of cosmic radiation. He was awarded a 1948 Nobel Prize for his discoveries and was made a life peer in 1969.

blackfly Any member of the insect family Simuliidae, comprising 300 species of small, humpbacked DIPTERANS found worldwide. Usually black or dark gray, the blackfly has short mouthparts adapted for sucking blood. The females bite and are sometimes abundant enough to kill chickens and even cattle. Some species carry worms capable of causing human disease, including RIVER BLINDNESS. In subarctic regions blackflies may be so numerous that human habitation is impossible.

Black fly (Simuliidae)
E.S. ROSS

Blackfoot *or* **Blackfeet** Group of ALGONQUIAN-speaking Indian peoples in Alberta, Can., and Montana, U.S., comprising the Piegan (Pikuni or Blackfeet), the North Piegan Pikuni, the Blood (Kainai), and the Blackfoot proper (Siksika). Together they are referred to as Siksika, or Blackfoot, a name thought to have derived from the discoloration of moccasins with ashes. They were among the first Algonquians to move westward from timberland to open grassland and, later, among the first to acquire horses and firearms. They were known as the strongest and most aggressive military power on the northwestern plains. At the height of their power, in the first half of the 19th century, they held a vast territory extending from northern Saskatchewan to southwestern Montana. Each group was subdivided into hunting bands led by one or more chiefs. These bands wintered separately but came together in summer to celebrate the SUN DANCE. For three decades beginning in 1806, the Blackfoot prevented white men from settling in their territory. They signed their first treaty with the U.S. in 1855, after which they were forced into farming and cattle raising. Some 10,000 Blackfoot live in Canada, and more than 27,000 claimed sole Blackfoot descent in the 2000 U.S. census, although only 15,000 U.S. Blackfoot are enrolled members. See photograph opposite.

blackjack *or* **twenty-one** Card game whose object is to be dealt cards having a higher count than those of the dealer, up to but not exceeding 21. The dealer may use a single deck of 52 cards or two or more decks from a holder called a shoe. Aces count as 1 or 11, and face cards as 10. Depending on the rules used, bets may be placed before the deal, after each player has been dealt one card facedown, or after each player has received two cards facedown and the dealer has exposed one of his cards.

blackmail See EXTORTION

Blackmun, Harry (b. Nov. 12, 1908, Nashville, Ill., U.S.—d. March 4, 1999, Arlington, Va.) U.S. jurist. He received his law degree from Harvard (1932) and taught law at the St. Paul College of Law (1935–41) while advancing to general partner in a Minnesota law firm. After serving as resident counsel to the Mayo Clinic (1950–59), he was appointed to the Eighth U.S. Circuit Court of Appeals. In 1970 Pres. Richard Nixon named him to the SUPREME COURT OF THE UNITED STATES, where he served until 1994. Perceived as a conservative when he began his Supreme Court service, Blackmun became increasingly liberal over the years. He wrote the majority decision in *ROE V. WADE* (1973).

blackpoll warbler Species (*Dendroica striata*) of WOOD WARBLER. Like all wood warblers, it is a small, active bird that feeds on insects and has a short thin bill. A common species, it is less striking than many other wood warblers, which are known for their brightly coloured plumage.

Blackshirts *Italian* **Camicie Nere** Armed squads of Italian Fascists under BENITO MUSSOLINI who wore black shirts as part of their uniform. The squads, first organized in 1919, targeted socialists, communists, republicans, and others. Hundreds of people were killed as the squads grew in number. In 1922 Blackshirts from all over Italy participated in the March on Rome (see ROME, MARCH ON). In 1923 the private Blackshirts were officially transformed into a national militia. With Mussolini's fall in 1943, the Blackshirts fell into disgrace.

Blackstone, Sir William (b. July 10, 1723, London, Eng.—d. Feb. 14, 1780, Wallingford, Oxfordshire) British jurist. Orphaned at age 12, he was educated at public school and later at Pembroke College, Oxford, at the expense of his uncle, a London surgeon. He was elected a fellow of All Souls College in 1744, and in 1746 he became a BARRISTER. Having taken a doctorate in civil law in 1750, he abandoned his legal practice in 1753 to concentrate on teaching and legal work around Oxford. He gave the first university lectures on English COMMON LAW, publishing a synopsis for students in 1756. He was elected to the first chair in common law, the Vinerian professorship at Oxford, in 1758. His classic *Commentaries on the Laws of England* (1765–69) is the best-known description of the doctrines of English law; it became the basis of university legal education in England and North America. He also served as a member of Parliament (1761–70), as solicitor general to the queen (from 1763), and as judge of the Court of COMMON PLEAS (1770–80).

Blackstone River River, central Massachusetts and Rhode Island, U.S. It flows about 50 mi (80 km) past WORCESTER and across northeastern Rhode Island to Pawtucket, where it becomes the Seekonk River. It furnishes power to a highly industrialized area.

Blackwell, Elizabeth (b. Feb. 3, 1821, Counterslip, Bristol, Gloucestershire, Eng.—d. May 31, 1910, Hastings, Sussex) British-born U.S. physician. Her family immigrated to the U.S. in 1832. She began her medical education by reading medical books and hiring private instructors. Medical schools rejected her applications until she was accepted at

In a Piegan lodge, photograph by Edward S. Curtis, 1910; from *The North American Indian*
COURTESY OF THE EDWARD E. AYER COLLECTION, THE NEWBERRY LIBRARY, CHICAGO

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the Geneva Medical (later Hobart) College in 1847. Though ostracized, she graduated at the head of her class in 1849, becoming the first woman doctor in modern times and the first to gain her degree from a U.S. medical school. In 1857, despite much opposition, she established the New York Infirmary, staffed entirely by women, and she later added a full course of medical education for women. She was also a founder of the London School of Medicine for Women. Her sister Emily (1826–1910) ran the infirmary for many years and served as dean and professor at the associated medical college.

Blackwell's Island See Roosevelt Island

bladder cancer Malignant tumour of the bladder. The most significant risk factor associated with bladder cancer is smoking. Exposure to chemicals called arylamines, which are used in the leather, rubber, printing, and textiles industries, is another risk factor. Most bladder cancers are diagnosed after the age of 60; men are affected more than women. Symptoms include blood in the urine, difficulty urinating, excessive urination, or, more rarely, painful urination. Bladder cancer can be treated with surgery, radiation therapy, or chemotherapy.

bladderwort Any of about 120 widespread species of terrestrial and aquatic carnivorous plants of the genus *Utricularia* (family Lentibulariaceae). They are characterized by small hollow sacs (bladders) that actively capture and digest tiny animals that touch them, including insect larvae, aquatic worms, water fleas, and other small swimmers. Closely related to the bladderworts are the butterworts (*Pinguicula*), 35 species of land plants that capture insects by means of sticky glands on the leaf surfaces.

Blaine, James G(illespie) (b. Jan. 31, 1830, West Brownsville, Pa., U.S.—d. Jan. 27, 1893, Washington, D.C.) U.S. politician and diplomat. He moved to Maine in 1854 to become editor of the *Kennebec Journal*, a crusading Republican newspaper. He served in the U.S. House of Representatives (1863–76), becoming speaker in 1868. An advocate of moderation in the Republican Party, he opposed the Radical Republicans led by Roscoe Conkling. Elected to the U.S. Senate in 1876, he resigned his seat in 1881 to become secretary of state. In this office he took the first steps toward securing U.S. control of the eventual route of the Panama Canal. As the Republican presidential candidate in 1884 he narrowly lost to Grover Cleveland. As secretary of state for a second time in 1889–92, he chaired the first Pan-American Conference.

Blair, Henry William (b. Dec. 6, 1834, Campton, N.H., U.S.—d. March 14, 1920, Washington, D.C.) U.S. politician. He practiced law from 1859 and served in the New Hampshire state legislature before being elected to the U.S. House of Representatives (1875–79) and Senate (1879–91). In 1876 he sought to give revenues from the sale of public lands to the nation's schools, and in 1881 he proposed to "vitalize" the schools with a $120-million grant to the states; neither effort succeeded. He also advocated women's rights and racial justice.

Blair, Tony *orig.* **Anthony Charles Lynton** (b. May 6, 1953, Edinburgh, Scot.) British politician who in 1997 became the country's youngest prime minister since 1812. Blair was a lawyer before winning election to the House of Commons in 1983. Entering the shadow cabinet of the Labour Party in 1988 at age 35, Blair urged the party to move to the political centre and deemphasize its traditional advocacy of state control and public ownership of certain sectors of the economy. He assumed leadership of Labour in 1994 and revamped its platform. He led the party to victories in the 1997, 2001, and 2005 elections. His government brokered a peace agreement between unionists and republicans in Northern Ireland, introduced devolved assemblies in Wales and Scotland, and carried out reforms of Parliament. After the September 11 attacks on the U.S. in 2001, Blair allied the United Kingdom with the U.S. and its president, George W. Bush, in a global war against terrorism. In late 2002 Blair and Bush accused the Iraqi government of Saddām Hussein of continuing to possess and develop biological, chemical, and nuclear weapons in violation of UN mandates. Despite deep divisions within his own party and strong public opposition to a war with Iraq, Blair, with Bush, led an attack on Iraq that toppled Ḥussein's regime in March–April 2003.

Blais \'ble**, Marie-Claire** (b. Oct. 5, 1939, Quebec, Que., Can.) French-Canadian novelist and poet. In two early, dreamlike novels, *Mad Shadows* (1959) and *Tête blanche* (1960), she staked out her territory, working-class people doomed to unrelieved sorrow and grinding poverty. *A Season in the Life of Emmanuel* (1965) received the Prix Médicis and was widely translated and discussed. Later works include *The Manuscripts of Pauline Archange* (1968, Governor General's Award) and *Deaf to the City* (1979, Governor General's Award). She received the Governor General's Award again in 1996 for *Soifs* (1995). She has also published poetry collections and several plays.

Blake, Edward (b. Oct. 13, 1833, Adelaide, Upper Canada—d. March 1, 1912, Toronto, Ont., Can.) Canadian politician. Blake was called to the bar in 1856 and created a queen's counsel in 1864. In 1867 he was elected to the Canadian House of Commons. He served as premier of Ontario (1871–72) and minister of justice (1875–77) in Alexander Mackenzie's cabinet, helping draft the constitution. He was leader of the Liberal Party (1880–87). In 1890 he withdrew from Canadian politics and moved to Ireland, where he served in the British House of Commons (1892–1907).

Blake, Eubie *orig.* **James Hubert Blake** (b. Feb. 7, 1883, Baltimore, Md., U.S.—d. Feb. 12, 1983, Brooklyn, N.Y.) U.S. songwriter and pianist. He played piano in cafés and brothels as a teenager, and in 1899 he composed his first ragtime song, "Sounds of Africa." He and his partner, lyricist and vocalist Noble Sissle (1889–1975), were among the first African American performers to appear onstage without minstrel makeup. Their show *Shuffle Along* (1921), which introduced Paul Robeson and Josephine Baker, was among the first musicals written, produced, and directed by African Americans. In 1925 Blake cowrote the score to *Blackbirds of 1930.* He achieved his greatest fame when the musical *Eubie* opened on Broadway (1978). He gave his last concert in 1982.

Blake, William (b. Nov. 28, 1757, London, Eng.—d. Aug. 12, 1827, London) English poet, painter, engraver, and visionary. Though he did not attend school, he was trained as an engraver at the Royal Academy and opened a print shop in London in 1784. He developed an innovative technique for producing coloured engravings and began producing his own illustrated books of poetry with his "illuminated printing," including *Songs of Innocence* (1789), *The Marriage of Heaven and Hell* (1793), and *Songs of Experience* (1794). *Jerusalem* (1804–20), his third major epic treating the fall and redemption of humanity, is his most richly decorated book. His other major works include *The Four Zoas* (1795–1804) and *Milton* (1804–08). A late series of 22 watercolours inspired by the Book of Job includes some of his best-known pictures. He was called mad because he was single-minded and unworldly; he lived on the edge of poverty and died in neglect. His books form one of the most strikingly original and independent bodies of work in the Western cultural tradition. Ignored by the public of his day, he is now regarded as one of the earliest and greatest figures of Romanticism.

William Blake, watercolour portrait by John Linnell; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Blakelock, Ralph (b. Oct. 15, 1847, New York, N.Y., U.S.—d. Aug. 9, 1919, near Elizabethtown, N.Y.) U.S. painter. A self-taught artist, he developed a highly original and subjective style of landscape painting, characterized by luminous impasto images of moonlit scenes with nocturnal lighting and strangely dappled trees and foliage. Neglected by the public and constantly under the strain of poverty, he suffered a breakdown in 1899, ceased to paint, and spent the rest of his life in an asylum. During his confinement he achieved some fame, and forgeries of his work became common as his popularity rose.

Blakeslee, Albert Francis (b. Nov. 9, 1874, Geneseo, N.Y., U.S.—d. Nov. 16, 1954, Northampton, Mass.) U.S. botanist and geneticist. He received his Ph.D. from Harvard University. In his dissertation he became the first person to describe sexuality in the lower fungi. His later experimental work focused on higher plants. After a long tenure with the Carnegie Institution's Cold Spring Harbor Laboratory (1915–41), he joined the faculty of Smith College, where he published a series of papers on the genetics and cell biology of jimsonweed. He used the alkaloid colchicine

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to achieve an increase in the number of chromosomes and thus opened up a new field of artificially produced polyploids.

Blakey, Art *later* **Abdullah Ibn Buhaina** (b. Oct. 11, 1919, Pittsburgh, Pa., U.S.—d. Oct. 16, 1990, New York, N.Y.) U.S. jazz drummer and bandleader. He worked with FLETCHER HENDERSON's big band before joining BILLY ECKSTINE's forward-looking ensemble (1944–47). Blakey's prodigious technique and thunderous attack assured his role as one of the principal drum stylists in modern jazz. With HORACE SILVER, Blakey formed the Jazz Messengers in 1954, and the group, with its aggressive blues-inflected approach, became the archetypal hard-bop unit (see BEBOP).

Blalock \'blā-ˌläk**, Alfred** (b. April 5, 1899, Culloden, Ga., U.S.—d. Sept. 15, 1964, Baltimore, Md.) U.S. surgeon. He received an M.D. from Johns Hopkins University. His research, showing that traumatic and hemorrhagic shock resulted from loss of blood volume, led to volume-replacement treatment, which saved countless lives during World War II. He is remembered for his development, with HELEN BROOKE TAUSSIG, of a surgical treatment for heart malformations in newborns. In 1944 he performed the first subclavian-pulmonary artery anastomosis operation, which corrected the birth defect.

Blanc \'blä^{n}**, (Jean-Joseph-Charles-) Louis** (b. Oct. 29, 1811, Madrid, Spain—d. Dec. 6, 1882, Cannes, France) French utopian socialist and journalist. In 1839 he founded the socialist newspaper *Revue du Progrès* and serially published his *The Organization of Labour*, which described his theory of worker-controlled "social workshops" that would gradually take over production until a socialist society came into being. He was a member of the provisional government of the SECOND REPUBLIC (1848) but was forced to flee to England after workers unsuccessfully revolted. In exile (1848–70), he wrote a history of the French Revolution and other political works.

Louis Blanc.
H. ROGER-VIOLLET

Blanc \'blaŋk**, Mel(vin Jerome)** (b. May 30, 1908, San Francisco, Calif., U.S.—d. July 10, 1989, Los Angeles, Calif.) U.S. entertainer. He began his career as a musician on NBC radio, and in 1933 he joined a daily radio program, for which he created several voices to augment the cast. In 1937 he joined the cartoon department of WARNER BROTHERS, and he took part in the development of *Looney Tunes* and *Merrie Melodies*, providing the voices of Porky Pig, Daffy Duck, Woody Woodpecker, and Bugs Bunny. In his 50-year career he supplied the voices for about 3,000 animated cartoons, including 90% of the Warner Brothers cartoons.

Blanc \'blä^{n}**, Mont** *Italian* **Monte Bianco** Mountain massif, Europe. Located in the ALPS on the borders of France, Italy, and Switzerland, it is Europe's highest peak, at 15,771 ft (4,807 m). It was first climbed in 1786 by Michel-Gabriel Paccard and Jacques Balmat. Mont Blanc Tunnel, 7.3 mi (11.7 km) long and one of the longest vehicular tunnels in the world, connects France with Italy. The region has become a major tourist and winter sports centre.

Blanchard \blä^{n}-'shärd**, Jean-Pierre-François** (b. July 4, 1753, Les Andelys, France—d. March 7, 1809, Paris) French balloonist. In 1785 he made the first aerial crossing of the English Channel, accompanied by John Jeffries, a U.S. doctor. He invented a parachute in 1785. His balloon flights in other European countries and in the U.S. in 1793 spurred an interest in ballooning. He and his wife performed many exhibitions in Europe; they died in separate balloon accidents.

J.-P.-F. Blanchard, engraving by James Newton, 1785, after an oil painting by Richard Livesay.
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Blanchard \'blan-chərd**, Thomas** (b. June 24, 1788, Sutton, Mass., U.S.—d. April 16, 1864, Boston, Mass.) U.S. inventor. In 1818 he invented a LATHE capable of turning irregular shapes, such as a gunstock. It duplicated the form of a pattern object by transmitting to the cutting tool the motion of a friction wheel rolling over the pattern. His invention was an essential step in the development of MASS PRODUCTION techniques. He produced several successful designs of shallow-draft steamboats, and in 1849 he invented machinery for bending wood into complex shapes such as plow handles and ship's frames.

Blanda, George (Frederick) (b. Sept. 17, 1927, Youngwood, Pa., U.S.) U.S. football player. He played for the University of Kentucky. As a professional quarterback and kicker, he played for the Chicago Bears (1949–58), Houston Oilers (1960–66), and Oakland Raiders (1967–76), setting still-standing records for most seasons played (26), most games played (340), and most points after touchdowns (943). His record for most field goals (335) was broken in 1983.

blank verse Unrhymed verse, specifically unrhymed iambic pentameter, the preeminent dramatic and narrative verse form in English. It is also the standard form for dramatic verse in Italian and German. Adapted from Greek and Latin sources, it was introduced in Italy, then in England, where in the 16th century WILLIAM SHAKESPEARE transformed blank verse into a vehicle for the greatest English dramatic poetry, and its potential for grandeur was confirmed with JOHN MILTON's *Paradise Lost* (1667).

Blanqui \blä^{n}-'kē**, (Louis–) Auguste** (b. Feb. 1, 1805, Puget-Théniers, France—d. Jan. 1, 1881, Paris) French socialist and revolutionary. A legendary martyr-figure of French radicalism, Blanqui believed that there could be no socialist transformation of society without a temporary dictatorship that would eradicate the old order. His activities, including the formation of various secret societies, caused him to be imprisoned various times for a total of more than 33 years. His disciples, the Blanquists, played an important role in the history of the workers' movement even after his death.

blanquillo See TILEFISH

Blanton, Jimmy *orig.* **James Blanton** (b. October 1918, Chattanooga, Tenn., U.S.—d. July 30, 1942, Monrovia, Calif.) U.S. jazz musician. He joined DUKE ELLINGTON's orchestra as a string bass player in 1939. Blanton's buoyant rhythmic approach and harmonic subtlety provided a supple, relaxed sense of swing for the band. His unprecedented dexterity, tone, and intonation enabled him to execute a melodic conception of the role of the bass in jazz, demonstrated on recordings made with Ellington such as "Jack the Bear" and "Pitter Panther Patter." His revolutionary technique changed jazz bass playing and became the major influence on subsequent bassists. He died of tuberculosis.

Blantyre \blan-'tīr\ City (pop., 2003 est.: 646,235), southern Malawi. It is the largest city in Malawi and the seat of the country's judiciary. Blantyre was founded in 1876 as a Church of Scotland mission station and named after explorer DAVID LIVINGSTONE's Scottish birthplace. It became a British consular post in 1883 and attained municipal status in 1895; it is Malawi's oldest municipality. Its colonial trade laid the foundation for its present importance as Malawi's chief commercial centre. In 1956 Blantyre was united with nearby Limbe.

Blarney Village (pop., 2002: 2,146), County Cork, Ireland. Situated northwest of the city of CORK, it is famous as the site of Blarney Castle (c. 1446). Below the battlements on the southern castle wall is the Blarney Stone, which in local legend is said to confer eloquence on anyone who kisses it.

Blasco Ibáñez \'bläs-kō-ē-'bän-yāth**, Vicente** (b. Jan. 29, 1867, Valencia, Spain—d. Jan. 28, 1928, Menton, France) Spanish writer and politician. An ardent republican, he was elected to the Cortes (parliament) but later settled on the French Riviera because of his opposition to the military dictatorship of MIGUEL PRIMO DE RIVERA. His early novels are primarily intense depictions of life in Valencia. He achieved world renown for his novels dealing with World War I, especially *The Four Horsemen of the Apocalypse* (1916).

Blasis \'blä-sēs**, Carlo** (b. Nov. 4, 1803, Naples, Kingdom of Naples—d. Jan. 15, 1878, Cernobbio, Italy) Italian ballet teacher and

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writer on the technique, history, and theory of dance. He danced briefly at the Paris Opéra before being appointed director of the ballet school at Milan's La Scala in 1837, where he would train many of the most brilliant dancers of the 19th century. Among his many innovations, Blasis discovered the technique of spotting (focusing on one spot and snapping one's head around faster than one's body) to prevent dizziness when turning. Many of his teachings still form the basis of classical ballet.

Blass, Bill (b. June 22, 1922, Ft. Wayne, Ind., U.S.—d. June 12, 2002, New Preston, Conn.) U.S. fashion designer. Blass left home at age 17 to attend the Parsons School of Design in New York City. After serving in the U.S. Army during World War II, he returned to New York, where in 1959 he became the head designer of Maurice Rentner, Ltd. Building upon the innovations of European designers such as Coco Chanel, Blass made clothes that allowed women a chic, modern sense of ease and comfort. His work became popular among New York high-society women. In 1970 Blass became owner of Rentner, which he renamed after himself. He was a pioneer in employing the business strategy of licensing his designs and name to a huge array of fashion accessories. In 1999 he sold his company, which continued as Bill Blass Ltd., and he retired the following year.

blast furnace Vertical shaft furnace that produces liquid metals by the reaction of air introduced under pressure into the bottom of the furnace with a mixture of metallic ore, fuel, and flux fed into the top. Blast furnaces are used to produce pig iron from iron ore for subsequent processing into steel; they are also employed in processing lead, copper, and other metals. The current of pressurized air maintains rapid combustion. Blast furnaces were used in China as early as 200 BC, and appeared in Europe in the 13th century, replacing the bloomery process. Modern blast furnaces are 70–120 ft (20–35 m) high, have 20–45-ft (6–14-m) hearth diameters, use coke fuel, and can produce 1,000–10,000 tons (900–9,000 metric tons) of pig iron daily. See also metallurgy, smelting.

Blaue Reiter \ˌblau̇-ə-ˈrī-tər**, Der** *German* **"The Blue Rider"** Organization of Expressionist artists formed in Munich in 1911 by Vasily Kandinsky and Franz Marc. The name derived from a volume of essays and illustrations they published. Other members included Paul Klee and August Macke (1887–1914). Influenced by Jugendstil, Cubism, and Futurism but lacking a specific program or philosophy, they exhibited with an international group, including Georges Braque, André Derain, and Pablo Picasso. The group disintegrated at the outbreak of World War I.

Blavatsky \blə-ˈvat-skē**, Helena (Petrovna)** *orig.* **Helena Petrovna Hahn** *known as* **Madame Blavatsky** (b. Aug. 12, 1831, Yekaterinoslav, Ukraine, Russian Empire—d. May 8, 1891, London, Eng.) Russian spiritualist and writer. After a brief marriage, she studied occultism and spiritualism and traveled through Europe, Asia, and the U.S. In 1873 in New York City she became a close companion of Henry Olcott (1832–1907); they and others founded the Theosophical Society (1875; see theosophy). In 1879 Blavatsky and Olcott went to India and established headquarters at Adyar. The society thrived, and she edited its journal, *The Theosophist*. She claimed psychic powers, but the London Society for Psychical Research in 1885 labeled her a fraud. In poor health, she returned to live in Europe. Her most important work, *The Secret Doctrine* (1888), was an overview of theosophical teachings.

bleach Solid or liquid chemical compound used to whiten or remove the natural colour of fibres, yarns, paper, and textile fabrics. Sunlight was the chief bleaching agent up to the discovery of chlorine in 1774 by Karl Wilhelm Scheele (b. 1742—d. 1786) and the demonstration of its bleaching properties in 1785 by Claude-Louis Berthollet (b. 1748—d. 1822). In textile finishing, the bleaching process is used to produce white cloth, to prepare fabrics for other finishes, or to remove discoloration. Chlorine, sodium hypochlorite, calcium hypochlorite, and hydrogen peroxide are commonly used as bleaches.

bleeding heart Any of several species of *Dicentra*, a genus of herbaceous flowering plants of the fumitory family (Fumariaceae). The old garden favourite is the Japanese *D. spectabilis*, which has small rosy-red and white, heart-shaped flowers dangling from arching stems. The eastern, or wild, bleeding heart (*D. eximia*) produces sprays of small pink flowers from April to September in the Allegheny Mountains region of the U.S. The Pacific, or western, bleeding heart (*D. formosa*), ranging from California to British Columbia, has several varieties of garden interest.

Bleeding heart (*Dicentra spectabilis*)
GRANT HEILMAN

Bleeding Kansas Term applied to a period of civil unrest (1854–59) between proslavery and antislavery advocates for control of the new Kansas Territory. Under the doctrine of popular sovereignty, antislavery emigrants from the North clashed with armed proslavery groups from Missouri. In 1856 a proslavery raid and burning of a hotel and newspaper in Lawrence were followed by several murders instigated by antislavery radicals under John Brown. Sporadic battles continued until Kansas was admitted to the Union as a free state in 1861.

blende See sphalerite

Blenheim \ˈble-nim**, Battle of** (Aug. 13, 1704) Famous victory of the duke of Marlborough and Eugene of Savoy against the French in the War of the Spanish Succession, fought at Blenheim (now Blindheim) on the Danube River in Bavaria. English and Austrian troops led by Marlborough and Eugene surprised the unprepared French and Bavarian forces, broke through their centre, and captured 13,000 of their troops; another 18,000 were killed, wounded, or drowned. The French army suffered its first major defeat in more than50 years, and Bavaria was removed from the war.

Blenheim \ˈble-nim\ **Palace** English residence near Woodstock, Oxfordshire, designed by John Vanbrugh and built (1705–24) by the British Parliament as a gift to John Churchill, duke of Marlborough. It is regarded as the finest example of Baroque architecture in Britain. In the early 18th century Queen Anne's gardener, Henry Wise, designed its grounds in the formal style of the Palace of Versailles; Capability Brown later redesigned them in his pastoral style, using natural-looking woods, lawns, and waterways.

blenny Any of numerous and diverse fishes (suborder Blenniodei, order Perciformes) that are mostly small, marine species found from tropical to cold seas. Blennies are slim, ranging from moderately elongated to very long and eel-like. Their habitats range from rocky pools to sandy beaches, reefs, and beds of kelp. Many live in shallow water, but some range to depths of about 1,500 ft (450 m). Some are mainly herbivores; others are partial or complete carnivores. They are generally unobtrusive and of little economic importance.

Shanny (*Blennius pholis*), a common European blenny
JANE BURTON—BRUCE COLEMAN LTD.

Blériot, Louis (b. July 1, 1872, Cambrai, France—d. Aug. 2, 1936, Paris) French aviator who made the first airplane flight across the English Channel between continental Europe and Great Britain. A successful manufacturer of automotive accessories, Blériot also built and tested a variety of powered aircraft. On July 25, 1909, he piloted his Blériot XI, a monoplane with a 28-horsepower engine, from Calais, France, to Dover, Eng., winning a prize of £1,000 and demonstrating the power of airplanes to overcome geographic barriers. Blériot remained a leader of the aviation industry through World War I and in the immediate postwar decade.

Blessing Way Central ritual in the complex system of ceremonies performed by the Navajo to restore equilibrium to the cosmos. Of the major categories of Navajo rituals, the largest group is the Chant Ways, which are concerned with curing. The Chant Ways include a subgroup of chants called the Holy Ways, which are further divided into the Blessing Way and the Wind Ways (used to cure illness). Lasting for two days, the Blessing Way is a simple chant performed for the well-being of the community rather than for a specific curative purpose.

Bleuler \ˈblȯi-lər**, Eugen** (b. April 30, 1857, Zollikon, Switz.—d. July 15, 1939, Zollikon) Swiss psychiatrist. He is best known for his studies of schizophrenia and for introducing (1908) the term for the disorder previously called dementia praecox. Bleuler argued (against accepted wisdom) that schizophrenia was more than one disease, was not always incurable, and did not always progress to full dementia. He described the basic symptoms—disordered mental associations and splitting or frag-

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mentation of the personality—but believed that many cases were not apparent. He insisted that psychosis did not need to result from organic brain damage and could have psychological causes instead. His *Textbook of Psychiatry* (1916) became a standard text.

Bligh, William (b. Sept. 9, 1754, county of Cornwall, Eng.—d. Dec. 7, 1817, London) English admiral. He went to sea at the age of seven and joined the Royal Navy in 1770. After serving as the sailing master on Capt. James Cook's final voyage (1776–80), he was named to command the HMS *Bounty* in 1787. While en route from Tahiti to Jamaica, the ship was seized by Fletcher Christian, the master's mate, and Bligh and loyal crew members were set adrift; some two months later, they reached Timor. The mutiny made little difference to Bligh's career, though he had two more encounters with mutineers, including one while he was governor of New South Wales, Australia (1805–08). Described as overbearing, he was unpopular as a commander but was also courageous and a greatly skilled navigator.

blight Any of various plant diseases whose symptoms include sudden and severe yellowing, browning, spotting, withering, or dying of leaves, flowers, fruit, stems, or the entire plant. Usually the shoots and other young, rapidly growing tissues of a plant are attacked. Most blights are caused by bacteria or fungi (see fungus); some result from drought. Fungal and bacterial blights are most likely under cool, moist conditions. Most economically important plants are susceptible to one or more blights. Measures taken to fight blight include destroying the infected plant parts; using disease-free seed or stock and resistant varieties; rotating crops (see crop rotation); pruning and spacing plants for better air circulation; controlling pests that carry the fungus from plant to plant; avoiding overhead watering and working among wet plants; and, where needed, applying fungicides or antibiotics. Maintaining sanitary conditions is the most important measure for stopping the spread of the infestation. See also chestnut blight.

blind fish Any of various species of sightless fishes, among them several unrelated cave-dwelling species. Blind cave fishes are pale and small, growing to about 4 in. (10 cm) long, and are found in dark limestone caves of the U.S. All have small but nonfunctional eyes and tactile organs that are sensitive to touch, allowing the fish to feel what it cannot see. Other cave-dwelling fishes tending toward blindness are found in Cuba, Mexico's Yucatán, South America, and Africa.

blindness Inability to see with one or both eyes. Transient blindness (blackout) can result from vertical acceleration causing high gravitational forces, glomerulonephritis (a kidney disease), or a clot in a blood vessel of the eye. Continuing blindness may arise from injuries or diseases of the eye (e.g., cataract, glaucoma), including the retina, the optic nerve, or the brain's visual centres. Many infectious, noninfectious, and parasitic systemic diseases can cause blindness. Sexually transmitted diseases and rubella in pregnant women can cause blindness in their infants. See also macular degeneration; visual-field defect.

Bliss, Sir Arthur (Edward Drummond) (b. Aug. 2, 1891, London, Eng.—d. March 27, 1975, London) British composer. He studied with Ralph Vaughan Williams and Gustav Holst. Though he was compositionally adventurous at first, he later adopted a conservative, Romantic style. His works include *A Colour Symphony* (1922), *Pastoral* (1928), the choral symphony *Morning Heroes* (1930), *Music for Strings* (1936), and the ballets *Checkmate* (1937) and *Miracle in the Gorbals* (1944).

Bliss, Tasker (Howard) (b. Dec. 31, 1853, Lewisburg, Pa., U.S.—d. Nov. 9, 1930, Washington, D.C.) U.S. general. After attending West Point (1875), he served in various military assignments, including that of instructor at West Point and military attaché at the U.S. legation in Madrid. In the Spanish-American War, he was chief of staff under Gen. James H. Wilson in Puerto Rico; he later served in the Philippines (1905–09). As army chief of staff in 1917, he made the U.S. Army battle-ready for World War I and resisted attempts to divide the force among the various Allied commands. He was a delegate to the Paris Peace Conference and an ardent supporter of U.S. participation in the League of Nations.

Bliss, William D(wight) P(orter) (b. Aug. 20, 1856, Constantinople, Tur.—d. Oct. 8, 1926, New York, N.Y., U.S.) U.S. social reformer. The son of U.S. missionaries, he graduated from Hartford Theological Seminary and held Congregationalist and Episcopalian pastorates. An advocate of Christian socialism, he organized the first such group in the U.S. in 1889. He lectured widely on labour and social reform and compiled many books, including the *Encyclopedia of Social Reform* (1897).

blister Rounded skin elevation in which fluid fills a separation between layers of epidermis or between the epidermis and the dermis. The fluid is usually clear; yellowish fluid contains pus, and red fluid contains blood. Blisters often occur on the palms or soles when pressure and friction cause an upper skin layer to move back and forth over the one under it. A small gap opens between them and becomes filled with fluid. This type generally heals spontaneously, sometimes leaving a thickened callus. Blisters that occur as symptoms of contact dermatitis, viral infection, or autoimmune disease can appear anywhere on the body and may leave scars.

blister beetle Any of approximately 2,000 species of beetles (family Meloidae) that secrete an irritating substance, cantharidin, which is used medically as a topical skin irritant to remove warts. In the past, cantharidin was often used to induce blisters, a common remedy for many ailments, and the dried remains of Spanish fly (*Lytta vesicatoria*) were a major ingredient in so-called love potions. Adult blister beetles, which are often brightly coloured, range between 0.1 and 0.8 in. (3–20 mm) in length. Blister beetles are both helpful and harmful to humans; the larvae eat grasshopper eggs, but the adults destroy crops.

Blister beetle (*Lytta magister*).
PHOTO RESEARCH INTERNATIONAL

blister rust Any of several diseases of pines, caused by rust fungi (see fungus) of the genus *Cronartium*. Blister rust affects sapwood (see wood) and inner bark and produces external blisters from which additional spores of the fungus are released and resin oozes, forming characteristic hardened masses on the trunk. It affects pines of all ages and sizes, retarding growth and weakening stems as it spreads along the trunk, sometimes killing the tree; young trees are killed more quickly than older ones. Measures taken to fight blister rust include growing resistant varieties, destroying nearby alternative host plants, observing strict sanitation measures, and spraying with fungicides.

blitzkrieg \'blits-ˌkrēg\ (German: "lightning war") Military tactic used by Germany in World War II, designed to create psychological shock and resultant disorganization in enemy forces through the use of surprise, speed, and superiority in matériel or firepower. The Germans tested the blitzkrieg during the Spanish Civil War in 1938 and against Poland in 1939, and used it in the successful invasions of Belgium, the Netherlands, and France in 1940. The German blitzkrieg coordinated land and air attacks—using tanks, dive-bombers, and motorized artillery—to paralyze the enemy principally by disabling its communications and coordination capacities.

Blitzstein \'blit-ˌstīn**, Marc** (b. March 2, 1905, Philadelphia, Pa., U.S.—d. Jan. 22, 1964, Fort-de-France, Martinique) U.S. composer. He studied at the Curtis Institute, then with the conductor Nadia Boulanger in Paris and the composer Arnold Schoenberg in Berlin. His best-known works were for the theatre: *The Cradle Will Rock* (1937), the circumstances of whose production by Orson Welles and John Houseman became legendary; the opera *Regina* (1949); and his English adaptation of Bertolt Brecht and Kurt Weill's *The Threepenny Opera* (1952), which became a Broadway hit. He was working on a Metropolitan Opera commission for an opera about the Sacco-Vanzetti case when he was murdered.

Blobel, Günter (b. May 21, 1936, Waltersdorf, Silesia, Ger.) U.S. cellular and molecular biologist. He earned his M.D. from Eberhard-Karl University and his Ph.D. from the University of Wisconsin. Working in collaboration with other research groups, Blobel showed that each protein carries a signal sequence that directs it to the proper location inside the cell. He also concluded that proteins enter organelles through a pore-like channel that opens in the organelle's outer membrane when the correct protein arrives at the organelle. For his work, Blobel was awarded a Nobel Prize in 1999. His research shed light on such hereditary diseases as cystic fibrosis and provided the basis for bioengineered drugs, including insulin.

Bloc National \'blȯk-nȧs-yō-'nȧl\ Right-wing coalition that controlled the French government from 1919 to 1924. On a wave of nationalist sentiment at the end of World War I, the Bloc gained about 75% of the seats in the French Chamber of Deputies in the 1919 elections. The government tried to ensure French security against Germany through a strict enforcement of the Treaty of Versailles. Its leaders, including Raymond Poincare,

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supported the Ruhr occupation (1923) to force Germany to pay reparations. It gradually lost public support, and it was defeated in the 1924 elections.

Bloch \'blȯk**, Ernest** (b. July 24, 1880, Geneva, Switz.—d. July 15, 1959, Portland, Ore., U.S.) Swiss-born U.S. composer. He conducted and lectured at the Geneva Conservatory before moving in 1916 to the U.S., where he served as director of the San Francisco Conservatory (1925–30) and taught at the University of California, Berkeley (1942–52). He worked in tonal, atonal, and serialist idioms (see also tonality; atonality; serialism); his works, many of them inspired by Jewish themes, include the opera *Macbeth* (1910), *Schelomo* for cello and orchestra (1916), the large choral works *America* (1926) and *Avodath hakodesh* (1933), and a violin concerto (1938).

Bloch \'bläk**, Felix** (b. Oct. 23, 1905, Zürich, Switz.—d. Sept. 10, 1983, Zürich) Swiss-born U.S. physicist. He emigrated to the U.S. in 1933 and taught at Stanford University (1934–71). He worked on atomic energy at Los Alamos and on radar countermeasures at Harvard University during World War II. In 1954 he became the first director general of CERN. For developing the nuclear magnetic resonance method of measuring the magnetic fields of atomic nuclei, he shared with Edward Purcell (1912–97) the 1952 Nobel Prize for Physics.

Bloch \'blȯk**, Marc (Léopold Benjamin)** (b. July 6, 1886, Lyon, France—d. June 16, 1944, near Lyon) French historian. He served in the French infantry in World War I. From 1919 he taught medieval history at the University of Strasbourg, where he cofounded the important periodical *Annales d'histoire économique et sociale*. He taught economic history at the Sorbonne from 1936. During World War II he joined the French Resistance and was captured and killed by the Germans. Among his major works are *The Royal Touch* (1924), *French Rural History* (1931), and *Feudal Society* (1939). As the founder of the Annales school of historiography, with its wide-ranging, interdisciplinary approach, Bloch exerted a huge influence on the study of history.

block and tackle Combination of pulleys with a rope or cable, commonly used to augment pulling force. Two or more of the pulleys are attached to a fixed block, and the remaining pulleys are free to move as well as rotate. A block and tackle can be used to lift heavy weights or to exert large forces in any direction. Higher force ratios may be obtained by the use of more pulleys, but this advantage may be offset by increased friction.

Block Island Island, Rhode Island, U.S. It lies at the eastern entrance to Long Island Sound, 9 mi (15 km) southwest of Point Judith, R.I. It has an area of about 11 sq mi (29 sq km) and is coextensive with the town of New Shoreham (pop., 2000: 1,010). Called Manisses by its original Indian inhabitants, Block Island (named for the Dutch explorer Adriaen Block) received its first European settlers in 1661 and was admitted to the colony of Rhode Island in 1664. Once dependent on fishing and farming, it is now primarily a resort.

block mill Earliest mechanized factory for mass production. It was conceived by Samuel Bentham, with machinery designed by Marc Brunel and built by Henry Maudslay, and built at England's Portsmouth naval dockyard. By 1805 it was producing 130,000 pulley blocks per year. It remained in production for over 100 years. See also American System of manufacture.

blockade Act of war whereby one party blocks entry to or departure from an enemy area, often a coast. Blockades are regulated by international law and custom, which require advance warning to neutral states and impartial application. Penalties for breach of blockade are seizure of ship and cargo and their possible condemnation as lawful prizes. Neutral ships may not be destroyed for blockade running.

Bloemfontein \'blüm-ˌfän-ˌtān\ City (pop., 2005 est.: 379,000), judicial capital of the Republic of South Africa. It is also the capital of Free State province. Founded in 1846 as a fort, it became the seat of the British-administered Orange River Sovereignty (1848–54) and later that of Orange Free State, an independent Boer republic formed in 1854. The failure of the Bloemfontein Conference (1899) resulted in the outbreak of the South African War. In the 20th century the city became a geographical transportation hub. Bloemfontein became part of the Mangaung Local Municipality in 2000. See also Pretoria; Cape Town.

Blok, Aleksandr (Aleksandrovich) (b. Nov. 28, 1880, St. Petersburg, Russia—d. Aug. 7, 1921, Petrograd [St. Petersburg]) Russian poet and dramatist. He was the principal representative of Russian Symbolism (see Symbolist movement). He later rejected what he termed their sterile bourgeois intellectualism and embraced the Bolshevik movement as essential for the redemption of the Russian people. Influenced by early 19th-century Romantic poetry, he wrote musical verse in which sound was paramount. His preeminent work of impressionistic verse was the enigmatic ballad *The Twelve* (1918), which united the Russian Revolution and Christianity in an apocalyptic vision. In the era of postrevolutionary hardship he declined into mental and physical illness, possibly brought on by venereal disease, and died at 40.

Blondin \blōⁿ-'daⁿ,\ *English* \'blän-dēn\ *orig.* **Jean-François Gravelet** (b. Feb. 28, 1824 , Hesdin, Fr.—d. Feb. 22, 1897, Little Ealing, near London, Eng.) French tightrope walker. After training as an acrobat, he achieved fame, first in 1859, with his many crossings of Niagara Falls on a tightrope 1,100 ft (335 m) long, 160 ft (48 m) above the water. Each time he used a different theatrical variation: blindfolded, in a sack, trundling a wheelbarrow, on stilts, carrying a man on his back, and sitting down midway to cook an omelette. He gave his last performance in 1896.

blood Circulatory fluid (see circulation) in multicellular animals. In many species it also carries hormones and disease-fighting substances. Blood picks up oxygen from the lungs and nutrients from the gastrointestinal tract and carries them to cells throughout the body for metabolism. It picks up carbon dioxide and other wastes from those cells and transports them to the lungs and excretory organs. Blood composition varies among species. Mammalian blood consists of plasma, red and white cells (erythrocytes and leukocytes), and platelets (thrombocytes). Blood disorders include polycythemia (abnormal increase in the number of circulating red blood cells), anemia, leukemia, and hemophilia. See also ABO blood-group system; blood analysis; blood bank; blood pressure; blood transfusion; blood typing; Rh blood-group system.

blood analysis Laboratory examination of the physical and chemical properties and components of a sample of blood. Analysis includes number of red and white blood cells (erythrocytes and leukocytes); red cell volume, sedimentation (settling) rate, and hemoglobin concentration; blood typing; cell shape and structure; hemoglobin and other protein structure; enzyme activity; and chemistry. Special tests detect substances characteristic of specific infections.

blood bank Organization that collects, stores, processes, and supplies blood. Most blood donations are separated into components, which can be frozen and stored longer than whole blood and used by multiple patients. In hemapheresis, large amounts of one component can be separated from a single donor's blood and the rest returned to the donor. Before World War I, a physician had to find a compatible donor and give an immediate blood transfusion. Safe storage of blood and its components made possible innovations such as heart-lung machines.

blood poisoning See septicemia

blood pressure Force originating when the heart's pumping pushes the blood against the walls of the blood vessels. Their stretching and contraction help maintain blood flow. Usually measured over an arm or leg artery in humans, blood pressure is expressed as two numbers; normal adult blood pressure is about 120/80 mm of mercury. The higher number (systolic) is measured when the heart's ventricles contract and the lower (diastolic) when they relax. See also hypertension, hypotension.

blood transfusion Transfer of blood taken from one person into the circulation of another to restore blood volume, increase hemoglobin levels, or combat shock. Once the blood-group antigens and antibodies (see ABO blood-group system, Rh blood-group system) were discovered, blood typing of donors and recipients rendered transfusion safe. In exchange transfusion, all or most of the blood is removed and replaced with another's blood. Undesirable reactions to transfusion are not uncommon.

blood typing Classification of blood by inherited antigens associated with erythrocytes (red blood cells). The ABO blood-group system and Rh blood-group system are among those most commonly considered. Without identification of these factors, blood transfusion from an incompatible donor may result in destruction of red cells or coagulation. Blood typing also helps identify disorders such as erythroblastosis fetalis.

bloodhound Breed of dog superior to any other in scenting ability, the foundation breed of most scent-hunting hound breeds. They were known, although not in the present form, in the Mediterranean area in pre-Christian times. Calm and affectionate, they are often used to track ani-

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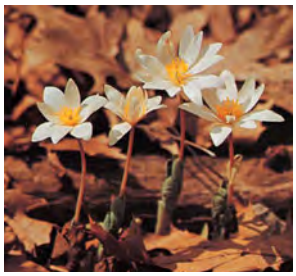
mals and trail persons. A large, strong dog, the bloodhound stands 23–27 in. (58–69 cm) and weighs 80–110 lb (35–50 kg). It has short hair and long ears, with loose skin that falls into folds and wrinkles around the head and neck. The coat is black-and-tan, red-brown and tan, or tawny.

Bloodless Revolution See GLORIOUS REVOLUTION

bloodroot Plant (*Sanguinaria canadensis*) of the POPPY FAMILY, native throughout eastern and midwestern North America, growing mainly in deciduous woodlands and blooming in early spring. The white, cup-shaped flower with bright yellow stamens in the centre is borne on a reddish stalk. Large, veiny, half-opened leaves on red stalks enfold the flower stem and, after the flower has bloomed, open into multilobed, round, blue-green leaves. The orange-red sap, once used by American Indians for dye, is found in the RHIZOMES, as is the medical ALKALOID sanguinarine. The species, particularly the variety *S. canadensis* 'Multiplex,' which has showy double flowers, is an interesting plant for the wild garden.



Bloodroot (*Sanguinaria canadensis*)
WALTER CHANDOHA

Bloody Sunday (1905) Massacre of peaceful demonstrators in Saint Petersburg, marking the beginning of the RUSSIAN REVOLUTION OF 1905. The priest Georgy Gapon (1870–1906), hoping to present workers' request for reforms directly to NICHOLAS II, arranged a peaceful march toward the Winter Palace. Police fired on the demonstrators, killing more than 100 and wounding several hundred more. The massacre was followed by strikes in other cities, peasant uprisings, and mutinies in the armed forces. The term "Bloody Sunday" was also used to describe the murder in Dublin, Ireland (Nov. 21, 1920), of 11 Englishmen suspected of being intelligence agents, by the IRISH REPUBLICAN ARMY; the BLACK AND TANS took revenge and attacked spectators at a football (soccer) match, killing 12 and wounding 60. The term was used again in Londonderry (Derry) when on Jan. 30, 1972, 3 participants in a civil rights march were killed by British soldiers, who allegedly had been fired on by the marchers.

Bloom, Harold (b. July 11, 1930, New York, N.Y., U.S.) U.S. literary critic. Bloom studied at Cornell and Yale universities and taught at Yale from 1955. In *The Anxiety of Influence* (1973) and *A Map of Misreading* (1975) he suggested that poetry results from poets deliberately misreading the works that both influence and threaten them. In *The Book of J* (1990) he speculated that the earliest known biblical texts were written by a woman with principally literary intentions. His best-selling *The Western Canon* (1994) identifies 26 canonical Western writers and argues against the politicization of literary study.

Bloomer, Amelia *orig.* **Amelia Jenks** (b. May 27, 1818, Homer, N.Y., U.S.—d. Dec. 30, 1894, Council Bluffs, Iowa) U.S. reformer. In 1840 she married Dexter Bloomer, a Quaker newspaper editor. She wrote articles on education, unjust marriage laws, and women's suffrage and published the biweekly *Lily* (1849–54). Among her interests was dress reform, and the full trousers that she wore came to be known as bloomers. Her costume generated considerable publicity and helped to attract large crowds to her lectures in New York City, where she often shared the platform with SUSAN B. ANTHONY and the Rev. Antoinette L. Brown.

bloomery process Process for IRON SMELTING. In ancient times, smelting involved creating a bed of red-hot CHARCOAL in a furnace to which iron ORE mixed with more charcoal was added. The ore was chemically reduced (see OXIDATION-REDUCTION), but, because primitive furnaces could not reach the melting temperature of iron, the product was a spongy mass of pasty globules of metal intermingled with a semiliquid SLAG. This hardly usable product, known as a bloom, may have weighed up to 10 lbs (5 kg). Repeated reheating and hot hammering eliminated much of the slag, creating WROUGHT IRON, a much better product. By the 15th century, many bloomeries used low shaft furnaces with waterpower to drive the bellows, and the bloom, which might weigh over 200 lbs (100 kg), was extracted through the top of the shaft. The final version of this kind of bloomery hearth survived in Spain until the 19th century. Another design, the high bloomery furnace, had a taller shaft and evolved into the Stückofen, which produced blooms so large they had to be removed through a front opening.

Bloomfield, Leonard (b. April 1, 1887, Chicago, Ill., U.S.—d. April 18, 1949, New Haven, Conn.) U.S. linguist. He began his career as a philologist trained in INDO-EUROPEAN, especially GERMANIC LANGUAGES. He taught Germanic philology at the University of Chicago (1927–40) and linguistics at Yale (1940–49). In *Language* (1933), one of the clearest 20th-century presentations of linguistics, he advocated the study of linguistic phenomena in isolation from their nonlinguistic environment and emphasized the need for empirical description. His thinking was influenced by his work on non-Indo-European languages, particularly the ALGONQUIAN family; *The Menomini Language* (1962) is a paragon of linguistic description and American Indian linguistic scholarship.

Bloomsbury group A coterie of English writers, philosophers, and artists. The name was a reference to the Bloomsbury district of London, where between about 1907 and 1930 the group frequently met to discuss aesthetic and philosophical questions. Among the group were E.M. FORSTER, LYTTON STRACHEY, CLIVE BELL, the painters Vanessa Bell (1879–1961) and Duncan Grant (1885–1978), JOHN MAYNARD KEYNES, the Fabian writer Leonard Woolf (1880–1969), and VIRGINIA WOOLF.

Blount \'blənt**, William** (b. March 26, 1749, Bertie county, N.C.—d. March 21, 1800, Knoxville, Tenn., U.S.) U.S. politician. He served in the American Revolution before being elected to six terms in the North Carolina legislature. He was a delegate to the CONSTITUTIONAL CONVENTION. As the first governor of lands ceded to the U.S. by North Carolina, he worked to secure statehood for what would become Tennessee. In 1796 he became one of Tennessee's first two senators, but he was expelled from the Senate in 1797 on charges of plotting to help the British gain control of Spanish Florida and Louisiana.

Blow, John (baptized Feb. 23, 1649, Newark-on-Trent, Nottinghamshire, Eng.—d. Oct. 1, 1708, Westminster, London) British composer, organist, and teacher. He was appointed organist at Westminster Abbey in 1668; in 1774 he became master of the children at the Chapel Royal, and he later held various equally prominent posts, in which he influenced many students, including composer HENRY PURCELL. Of the many religious and secular ceremonial works he wrote in his official capacities, about 12 services and more than 100 anthems survive. His court masque *Venus and Adonis* (1685) represents a landmark in the development of English opera.

blowfish See PUFFER

blowfly Any member of the DIPTERAN family Calliphoridae, including the SCREWWORM and the bluebottle, greenbottle, and cluster flies. Metallic blue, green, or bronze, and noisy in flight, blowflies resemble the HOUSEFLY in size and habits. The larvae usually feed on decaying flesh and sometimes infest open wounds. They may help prevent infection by cleaning away dead flesh, but may also destroy healthy tissue. Blowflies were once used to treat gangrene and a human bone disease and were used in World War I to clean soldiers' wounds. Some species seriously hurt or kill livestock by massive infestation or by carrying diseases such as ANTHRAX, DYSENTERY, and JAUNDICE.

blowgun Long, narrow pipe through which darts or other projectiles are blown. Primarily a hunting weapon, it is rarely used in warfare. It has been used by aboriginal peoples in Malaysia and elsewhere in South Asia, southern India and Sri Lanka, Madagascar, northwestern South America, and Central America. Blowguns vary in length from 18 in. to more than 23 ft (45 cm to 7 m) and are often made of cane or bamboo. Darts are usually made of palm-leaf midribs or wood or bamboo splinters 1.5–40 in. (4–100 cm). The dart must fit the tube snugly, so that a puff of human breath will cause it to fly from the tube. To be effective against quarry larger than small birds, blowgun darts require poison.

blowing engine Machine for pumping air into a furnace. Bellows driven by a waterwheel were the earliest form of blowing engine, later replaced by reciprocating pumps driven by steam or gas engines and by turbo-blowers. A modern blast furnace requires an enormous blowing engine.

Blücher \'blü-kər**, Gebhard Leberecht von, prince von Wahlstatt** \'väl-ˌshtät\ (b. Dec. 16, 1742, Rostock, Mecklenburg—d. Sept. 12, 1819, Krieblowitz, near Kanth, Silesia, Prussia) Prussian military leader. He joined the Prussian army in 1760 and commanded troops against the French (1793–94) and in the NAPOLEONIC WARS. In 1813 he came out of retirement to command Prussian troops against the French, defeating them at Wahlstatt and assisting in the allied victory at the Battle of LEIPZIG. In 1815 he again commanded Prussian forces in the Battle of

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Waterloo, coordinating his army with the allied forces under the duke of Wellington to bring about Napoleon's defeat.

blue (butterfly) Any member of the widely occurring lepidopteran family Lycaenidae. Adults, sometimes known as gossamer-winged butterflies, are small and delicate, with a wingspan of 0.75–1.5 in. (18–38 mm). Blues are rapid fliers, and most species have iridescent wings. Larvae are short, broad, and sluglike. Some species secrete honeydew, a sweet by-product of digestion that attracts ants, which stroke the larvae with their legs to stimulate honeydew secretion.

blue asbestos See crocidolite

blue crab Any member of a genus (*Callinectes*) of decapods, particularly *C. sapidus* and *C. hastatus*, common edible crabs of the western Atlantic coast prized as delicacies. Their usual habitats are muddy shores, bays, and estuaries. The blue crab shell, greenish on top and dingy white below, is about 3 in. (15–18 cm) long. The legs are bluish. The chelae, or pincers, are large and somewhat unequal in size, and the fifth pair of legs is flattened for swimming. Blue crabs are scavengers.

Blue crab (*Callinectes sapidus*)
JOHN H. GERARD FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHES—EB INC.

blue-green algae See cyanobacteria

blue ground See kimberlite

blue law U.S. statute regulating work, commerce, and amusements on Sundays. The name is said to derive from a list of Sabbath regulations published (on blue paper or in blue wrappers) in New Haven, Conn., in 1781. Throughout colonial New England such laws regulated morals and conduct. Most lapsed after the American Revolution, but some, such as prohibitions against the Sunday sale of alcoholic beverages, remain on the books in some areas.

Blue Mountains Plateau region, part of the Great Dividing Range, southeastern Australia. Located in New South Wales, the region rises to about 3,600 ft (1,100 m). Once used as a retreat by wealthy Sydney residents, it is now accessible by good roads and is a popular tourist area; the Blue Mountains area was designated a UNESCO World Heritage site in 2000. The city of Blue Mountains (pop., 2004 est.: 77,011) was incorporated in 1947.

Blue Mountains Mountain range, eastern Jamaica. It extends from north of Kingston eastward 30 mi (50 km) to the Caribbean Sea. Its highest point is Blue Mountain Peak, at 7,388 ft (2,252 m). It experiences heavy rain and widely divergent temperatures. Blue Mountain coffee is famous for its excellent quality.

Blue Nile See Nile River

Blue Ridge *or* **Blue Ridge Mountains** Section of the Appalachian Mountains, eastern U.S. The range extends southward from Carlisle, Pa., through parts of Maryland, Virginia, North Carolina, and South Carolina to Mt. Oglethorpe in Georgia. The highest peaks are in the Black Mountains of North Carolina; the average elevation is 2,000–4,000 ft (600–1,200 m). The scenic Blue Ridge Parkway, established in 1936 and administered by the National Park Service, runs 469 mi (755 km) along the crest.

blue whale Mottled, blue-gray baleen whale (*Balaenoptera musculus*), also called sulfur-bottom whale because of the yellowish diatoms on some individuals. The largest of all animals, the blue whale reaches a maximum length of about 100 ft (30 m) and a maximum weight of 150 tons (136,000 kg). It is found alone or in small groups in all oceans. In summer it feeds on krill in polar waters, and in winter it moves toward the equator to breed. It was once the most important of the commercially hunted baleen whales, and its populations were greatly reduced. Listed as an endangered species, it is now protected.

Bluebeard *or* **Gilles de Rais** \zhēl-də-'rā\ *or* **Gilles de Retz** (b. Sept./Oct. 1404, Champtocé, Fr.—d. Oct. 26, 1440, Nantes) Baron and marshal of France renowned for his cruelty. His name was later connected with the story "Bluebeard" by Charles Perrault. He fought several battles at the side of St. Joan of Arc and was made marshal of France (1429). Back in Brittany he led a dissipated life and eventually turned to alchemy and satanism. Accused of abducting and murdering more than 140 children, he was tried by ecclesiastical and civil courts. Condemned for heresy, he confessed, repented, and died bravely at the gallows; his body was burned. Skeptics have noted irregularities in the trials and the interest of others in his ruin. The fairy-tale Bluebeard takes a wife, who, curious about the one room of the castle to which he denies her the key, discovers there the skeletons of her predecessors.

Bluebeard, illustration by Gustave Doré
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO., LTD.

bluebell Any plant of the genus *Endymion*, in the lily family, native to Eurasia. Bluebell, or wild hyacinth (*E. nonscriptus*), and Spanish bluebell (*E. hispanicus*), bearing clusters of bell-shaped blue flowers, are cultivated as garden ornamentals; some authorities place them in the related genus *Scilla* of the same family. Many other plants are commonly known as bluebells, including species of the genera *Campanula*, *Eustoma*, *Polemonium*, and *Clematis*. In the U.S. the name bluebell is usually reserved for *Mertensia virginica*.

Wild hyacinth (*Endymion nonscriptus*)
M.T. TANTON—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

blueberry Any of several shrubs, native to North America, of the genus *Vaccinium* in the heath family. They are prized for their sweet edible fruits, a source of vitamin C and iron. Blueberries grow only in highly acidic and well-drained but moist soils. The highbush blueberry (*V. corymbosum*), economically and ornamentally the most important species, is in the U.S. cultivated primarily in Maine, New Jersey, southwestern Michigan, and eastern North Carolina.

Blueberry.
GRANT HEILMAN—EB INC.

bluebird Any of three North American bird species (songbird genus *Sialia*) of the chat-thrush group. The eastern bluebird (*S. sialis*), which is 5.5 in. (14 cm) long, and the western bluebird (*S. mexicana*) are red-breasted forms found east and west of the Rockies, respectively. The mountain bluebird (*S. currucoides*), also found in the West, is all blue. Bluebirds arrive from the south in earliest spring. They live in open country and woodlands and nest in holes in trees or in fence posts and bird boxes.

Western bluebird (*Sialia mexicana*)
HERBERT CLARKE

bluebonnet Any of several flowering plants, including the Texas bluebonnet (*Lupinus subcarnosus*), a North American annual legume native to the plains of Texas. About 1 ft (0.3 m) tall, it bears silky-haired compound leaves and clusters of purplish blue flowers marked in the centre with white or yellow. In the spring it covers immense areas in southern and western Texas like a blue carpet. It is one of the most popular wildflowers of Texas. In Scotland the name is given to the bluebottle (*Centaurea cyanus*) and to the blue scabious, or devil's bit (*Succisa pratensis*).

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bluefish Swift-moving food and game fish (*Pomatomus saltatrix*) found throughout warm and tropical regions of the Atlantic and Indian oceans. It lives in schools and is a voracious predator of smaller animals, especially other fishes. It is slender and has a forked tail and a large mouth with strong, pointed teeth. It is blue or greenish and grows to a length of about 4 ft (1.2 m) and a weight of 25 lbs (11.5 kg).

bluegill Popular game fish (*Lepomis macrochirus*) and one of the best-known SUNFISHES throughout its original range, the freshwater habitats of the central and southern U.S. It has been introduced throughout the western U.S. and in other parts of the world. Bluegills are usually bluish or greenish and have a characteristic dark flap at the rear of the gill cover. Among the smallest of the food and game fishes, they normally are only 6–9 in. (15–23 cm) long and weigh less than 0.5 lbs (0.25 kg). Bluegills are known as highly spirited fighters on the end of a fishing line.

bluegrass Any of many slender annual and perennial lawn, pasture, and forage GRASSES of the genus *Poa*, in the family Poaceae, or Gramineae. About 250 species are found in temperate and cool climates, more than 50 in the U.S. Most have small spikelets lacking bristles and arranged in open clusters. The narrow leaf blades have boat-shaped tips. With its blue-green leaves, Kentucky bluegrass (*P. pratensis*), the best-known U.S. species, is a popular lawn and pasture grass in the northern states and is common in open areas and along roadsides. Texas bluegrass (*P. arachnifera*), mutton grass (*P. fendleriana*), and plains bluegrass (*P. arida*) are important western forage grasses. Annual bluegrass (*P. annua*), a small, light green species, is considered a pest in lawns.

bluegrass In music, a COUNTRY-MUSIC style that emerged after World War II. It is a direct descendant of the string-band music played by groups such as the CARTER FAMILY. Bluegrass is distinguished from its predecessors by its more syncopated rhythm, its high-pitched tenor (lead) vocals, its tight harmonies, its driving rhythms, and a strong influence of JAZZ and BLUES. A very prominent place is given to the banjo, always played in the unique three-finger style developed by Earl Scruggs (see LESTER FLATT). Mandolin and fiddle are generally featured, and traditional square-dance tunes, religious songs, and ballads furnish much of the repertory. Bluegrass was originated by and got its name from BILL MONROE and his Blue Grass Boys. From the late 1940s on, it continued to grow in popularity; from the 1970s an influx of younger musicians brought some influence from rock music.

Bluegrass region Area of central Kentucky, U.S. The region contains Kentucky's best agricultural land and thus became the first area to be settled. It became known for its abundant BLUEGRASS and became famous for breeding fine horses; the calcium-rich soil imparts its minerals to the grass and thence into the horses' bones.

blues Secular musical form incorporating a repeating harmonic structure with melodic emphasis on the flatted or "blue" third and seventh notes of the scale. The specific origins of the blues are not known, but elements of the music of former slaves include the call-and-response pattern and syncopated rhythms of SPIRITUALS and work songs. The codification of the structure of the blues occurred in the early 20th century, most commonly as a 12-bar phrase using the chords of the first, fourth, and fifth degrees of the major scale. Its origins as a primarily vocal form induced instrumental performers to imitate the human voice with "bent" notes. Lyric stanzas are usually in three lines, the words of the second generally repeating those of the first. The elaboration of the rural blues from Texas and the Mississippi delta established both lyric and instrumental traditions, often featuring speech-like inflection and guitar accompaniment. The bandleader W.C. HANDY's compositions brought blues elements to the popular music of the first decades of the century. The first blues recordings, in the early 1920s, featured singers such as Ma RAINEY and BESSIE SMITH using jazz accompanists; their style would become known as classic blues. The highly personal interpretations and improvisation of the blues, combined with elements of its structure and inflection, served as the foundation for JAZZ, RHYTHM AND BLUES, and ROCK MUSIC.

Bluestocking In mid-18th-century England, any of a group of women who met to discuss literature. Attempting to replace the playing of cards and such social activities with more intellectual pursuits, they held "conversations" to which they invited men of letters and members of the aristocracy with literary interests. The term probably originated when Mrs. Elizabeth Vesey invited the learned Benjamin Stillingfleet to one of her parties; he declined, saying he lacked appropriate dress, until she told him to come "in his blue stockings"—the ordinary worsted stockings he was wearing at the time. The word *bluestocking* came to be applied derisively to a woman who affects literary or learned interests.

Bluford \'blü-fərd**, Guion S(tewart), Jr.** (b. Nov. 22, 1942, Philadelphia, Pa., U.S.) U.S. astronaut. He flew 144 combat missions in the Vietnam War; on his return, he received a Ph.D. in aerospace engineering from the Air Force Institute of Technology. He joined NASA's astronaut program in 1978 and flew on numerous SPACE-SHUTTLE missions; his first was *Challenger*'s third flight (1983), the first to be launched and land at night. He was the first African American to fly in space.

Blum \'blüm**, Léon** (b. April 9, 1872, Paris, France—d. March 30, 1950, Jouy-en-Josas) French politician and writer. He made a name as a brilliant literary and drama critic, then entered politics in the FRENCH SOCIALIST PARTY. As a member of the Chamber of Deputies (1919–28, 1929–40), he became a leader of the Socialists from 1921. The chief architect of an electoral alliance of the left, he became the first Socialist (and the first Jewish) premier of France as head of the POPULAR FRONT government (1936–37). He introduced such reforms as the 40-hour workweek and collective bargaining and nationalized the chief war industries and the Bank of France. Arrested by the Vichy government in 1940, he was imprisoned until 1945. In the postwar years he was one of France's leading veteran statesmen.

Blumberg \'bləm-bərg**, Baruch S(amuel)** (b. July 28, 1925, New York, N.Y., U.S.) U.S. research physician. He received his M.D. from Columbia University. His discovery of an ANTIGEN that he later proved to be part of the hepatitis B virus, and which causes the body to produce antibodies to the virus, led to blood-donor screening and a vaccine. He shared a 1976 Nobel Prize in Physiology or Medicine with D. Carleton GAJDUSEK.

Blunt, Anthony (Frederick) (b. Sept. 26, 1907, Bournemouth, Hampshire, Eng.—d. March 26, 1983, London) British art historian and spy. He began his espionage for the Soviet Union after meeting GUY BURGESS at the University of Cambridge in the 1930s. From 1937 Blunt had a brilliant career as an art historian, publishing scores of scholarly works that largely established art history in Britain. In World War II he served in British military intelligence and also gave secret information to the Soviets. In 1945 he was appointed surveyor of the king's (later queen's) pictures, and in 1947 he became director of the prestigious Courtauld Institute. He ceased active intelligence work but in 1951 arranged for the escape of Burgess and Donald Maclean (1913–1983) from Britain. In 1964, after the defection of KIM PHILBY, Blunt was confronted by British authorities and secretly confessed his Soviet connections. When his past as the "fourth man" in the spy ring was made public in 1979, he was stripped of the knighthood awarded him in 1956.

Bly, Nellie *orig.* **Elizabeth Cochrane** (b. May 5, 1867?, Cochran's Mills, Pa., U.S.—d. Jan. 27, 1922, New York, N.Y.) U.S. newspaper writer. Bly started writing for *The Pittsburgh Dispatch* at age 18, producing feature articles on such subjects as divorce and slum life. After joining the *New York World*, she feigned insanity to get into an asylum and wrote an exposé that brought about needed reforms. Beginning in 1889, in an attempt to beat the fictional record in JULES VERNE's *Around the World in Eighty Days*, she circled the globe in about 72 days, 6 hours. The much-publicized trip made her byname a celebrated synonym for a female star reporter.

Bly, Robert (Elwood) (b. Dec. 23, 1926, Madison, Minn., U.S.) U.S. poet and translator. Bly attended Harvard University and the University of Iowa. In 1958 he founded the magazine *The Fifties* (later *The Sixties*), which published the works of young poets. He helped found American Writers Against the Vietnam War, and he donated his 1968 National Book Award prize money (received for *The Light Around the Body*) to a draft resisters' organization. His best-selling *Iron John* (1990) probed the male psyche, and Bly became the best-known leader of the "men's movement." In 2001 he published *The Night Abraham Called to the Stars*, poems utilizing the Arabic ghazal form. He is also known for his translations of a wide range of poetry.

Blyton \'blī-tᵊn**, Enid (Mary)** (b. Aug. 11, 1897, London, Eng.—d. Nov. 28, 1968, London) English children's writer. Trained as a schoolteacher, she published her first book, *Child Whispers*, in 1922. She went on to produce more than 600 children's books and numerous magazine articles. She is probably best known for several book series, including those featuring Noddy, the Famous Five, and the Secret Seven. Though

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often criticized for their stereotyped characters, simple writing style, and didactic moralism, her books were widely translated and remained internationally popular long after her death.

BMW *in full* **Bayerische Motoren Werke** \'bī-er-ish-ə-mō-'tōr-ən-'ver-kə\ **AG** German automaker. Founded as an aircraft engine manufacturer in 1916, the company assumed the name Bayerische Motoren Werke and became known for its high-speed motorcycles in the 1920s. During World War II, BMW built the world's first jet airplane engines for the Luftwaffe. It suffered financially in the postwar period but recovered after 1959 with a new line of conventionally designed high-performance cars. The company's turnaround was also credited to German entrepreneur Herbert Quandt, who purchased a controlling share of BMW's stock in 1959. In the 21st century the firm's brands included BMW cars and motorcycles, MINI automobiles, and ROLLS-ROYCE. Members of the Quandt family continued to hold a significant stake in the company.

B'nai B'rith \bə-'nā-'brith\ (Hebrew: "Sons of the Covenant") Oldest and largest Jewish service organization. Founded in New York City in 1843, it now has men's lodges, women's chapters, and youth organizations around the world. Its goals include defending human rights, aiding Jewish college students (mainly through the Hillel Foundation), sponsoring educational programs for adult and youth groups, helping victims of natural disasters, supporting hospitals and philanthropic institutions, and promoting the welfare of Israel. In 1913 it established the Anti-Defamation League to combat ANTI-SEMITISM.

Bo Hai \'bō-'hī\ *or* **Po Hai** *conventional* **Gulf of Chihli** \'jə-'lē\ Arm of the YELLOW SEA off the northern China coast. With the Gulf of Liaodong (generally considered part of the Bo Hai), its maximum dimensions are 300 mi (480 km) northeast-southwest and 190 mi (306 km) east-west. The LIAO RIVER and HUANG HE (Yellow River) empty into it.

Bo Juyi \'bwȯ-'jüē-'ē\ *or* **Po Chü-i** (b. 772, Xinzheng, China—d. 846, Luoyang) Chinese poet of the TANG DYNASTY. He began composing poetry at age 5, and at age 28 he passed the examinations for the Chinese civil service. He rose steadily in official life and became the informal leader of a group of poets who rejected the courtly style of the time, believing that poetry should have a moral and social purpose. His satirical ballads and poems of social protest often took the form of free verse based on old folk ballads. He was revered in both China and Japan, where his poems, notably the "Song of Everlasting Sorrow," became material for other literary works.

bo tree See BODHI TREE

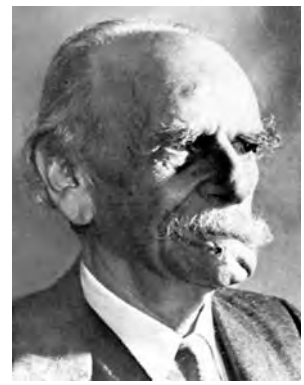
boa Any of about 60 species of stout-bodied snakes (subfamily Boinae, family Boidae) found in both the Old and New Worlds, mostly in warm regions. Species vary in length from about 8 in. (20 cm) to more than 25 ft (7.5 m). Most are terrestrial or semiaquatic; some live in trees. Most species have blotches and diamonds on their brown, green, or yellowish body. Boas bite their prey, then kill by wrapping their body around the prey and crushing it. Several species have heat-sensitive lip pits for detecting warm-blooded prey, and most bear live young. Contrary to folklore, boas are not dangerous to humans.

Boadicea See BOUDICCA

boar *or* **wild boar** *or* **wild pig** Any wild member of the PIG species *Sus scrofa*; the ancestor of domestic pigs. It is native to forests ranging from western and northern Europe and North Africa to India, the Andaman Islands, and China and has been introduced to New Zealand and the U.S. It has a bristly, blackish or brown coat and stands up to 35 in. (90 cm) tall at the shoulder. Except for old, solitary males, boars live in groups. They are omnivores and are good swimmers. They have sharp tusks and, though normally not aggressive, can be dangerous. Because of its strength, speed, and ferocity, the boar has long been a prized game animal.

Board of Trade See Board of TRADE

Boas \'bō-ˌaz**, Franz** (b. July 9, 1858, Minden, Westphalia [Germany]—d. Dec. 22, 1942, New York, N.Y., U.S.) German-born U.S. anthropologist. Trained in physics and geography (Ph.D., 1881), Boas was part of an early scientific expedition to Baffin Island (1883–84), where he turned to studying ESKIMO culture. He later studied native peoples of British Columbia, including the KWAKIUTL. From 1896 to 1905 he directed the Jesup North Pacific Expedition, which investigated the relationships between the aboriginal peoples of Siberia and North America. Teaching at Columbia University from 1896 until his death, he was a leading organizer of the profession in the U.S. and the mentor of Ruth Benedict, Alfred L. Kroeber, Margaret Mead, and Edward Sapir. He is largely credited with establishing anthropology as an academic discipline in the U.S. His achievements in anthropology are virtually unrivaled. Before Boas, most anthropologists adhered to a relatively crude theory of SOCIOCULTURAL EVOLUTION, arguing that some peoples are inherently more civilized or developed than others. Boas argued that such views are ethnocentric and that all human groups have actually evolved equally but in different ways. It is largely because of Boas that anthropologists now attribute human differences to historic "cultural," rather than genetic, factors. His books include *The Mind of Primitive Man* (1911), *Primitive Art* (1927), and *Race, Language, and Culture* (1940).



Boas, 1941
AP/WIDE WORLD PHOTOS

boat people Refugees fleeing by boat. The term originally referred to the thousands of Vietnamese who fled their country by sea following the collapse of the South Vietnamese government in 1975. Crowded into small vessels, they were prey to pirates, and many suffered dehydration, starvation, and death by drowning. The term was later applied to waves of refugees who attempted to reach the U.S. by boat from Cuba and Haiti and also to Afghan and other refugees seeking asylum in Australia.

Bob and Ray *in full* **Robert Brackett Elliott** *and* **Raymond Walter Goulding** (respectively b. March 26, 1923, Boston, Mass., U.S.(b. March 20, 1922, Lowell, Mass.) —d. March 24, 1990, Manhasset, N.Y.) U.S. comedy team. They met while working at a Boston radio station and soon established their comic style in a program of parodies and satire (1946–51). *The Bob and Ray Show* was nationally syndicated (1951–53), and their comedy sketches were popular in the 1950s and '60s on several networks. They also performed in the theatre and starred in the Broadway show *The Two and Only* (1970).

bobbin Elongated spool of thread, used in the TEXTILE industry. In modern processes, the spun fibres are wound on bobbins; the weft filling in WEAVING comes off bobbins. Bobbins are essential to the manufacture of bobbin LACE (see LACEMAKING). The first bobbin lace probably originated in Flanders in the early 16th century. Early bobbin lace consisted of rows of deep acute-angled points worked from a narrow band, and the patterns were usually similar to those of the needle laces. It was much used for ruffs and collars in the 16th–17th centuries. See also TAPESTRY.

bobcat Bobtailed, long-legged North American cat (*Lynx rufus*) found in forests and deserts from southern Canada to southern Mexico. It is a close relative of the LYNX and CARACAL. Bobcats have large paws and tufted ears; are 24–40 in. (60–100 cm) long, excluding the 4–8-in. (10–20-cm) tail; stand 20–24 in. (50–60 cm) at the shoulder; and weigh 15–33 lb (7–15 kg). The fur is pale brown to reddish with black spots. Bobcats are nocturnal and generally solitary. They feed on small mammals and some birds and are important for controlling rodent and rabbit populations. They are sometimes found in suburban areas. See photograph on opposite page.

bobolink \'bäb-ə-ˌliŋk\ Songbird (*Dolichonyx oryzivorus*) that breeds in northern North America and winters chiefly in central South America. Migrating flocks may raid rice fields, and the fat "ricebirds" were formerly shot as a table delicacy. In the breeding season the 7-in (18-cm) male bobolink (named for his bubbling song) has a black underside, yellow hindneck, white back and rump, and white patches on the wings; in winter he resembles the brown female.

bobsledding Sport of sliding down a winding ice-covered run on a large metal sled (bobsled). The sled is equipped with two pairs of runners, a long seat for two or more (usually four) people, a steering wheel or steering ropes, and a hand brake. Bobsledding originated in Switzerland in the 1890s and was included in the first Olympic Winter Games in 1924. Championship competitions are held each year. Bob runs are typically about 4,920 ft (1,500 m) long, with 15–20 banked turns. Four-person sleds attain speeds approaching 100 mph (160 kph).

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bobwhite North American QUAIL species (*Colinus virginianus*) that exists in about 20 subspecies from southern Canada to Guatemala. It is reddish brown and has a gray tail. Its name is suggestive of its two-note call. A popular game bird of the southern and central U.S., it is found in brush, open pinelands, and abandoned fields.

Boccaccio \bōk-'käch-chō**, Giovanni** (b. 1313, Paris, France—d. Dec. 21, 1375, Certaldo, Tuscany) Italian poet and scholar. His life was full of difficulties and occasional bouts of poverty. His early works include *The Love Afflicted* (c. 1336), a prose work in five books, and *The Book of Theseus* (c. 1340), an ambitious epic of 12 cantos. He is best known for his *Decameron*, a masterpiece of classical Italian prose that had an enormous influence on literature throughout Europe. A group of 100 earthy tales united by a frame story, it was probably composed 1348–53. After this period he turned to humanist scholarship in Latin. With PETRARCH, he laid the foundations for Renaissance humanism, and through his writings in Italian he helped raise vernacular literature to the level of the classics of antiquity.

Boccaccio, detail of a fresco by Andrea del Castagno; in the Cenacolo di Sant'Apollonia, Florence.
ALINARI/ART RESOURCE

Boccherini \ˌbä-kə-'rē-nē**, Luigi (Rodolfo)** (b. Feb. 19, 1743, Lucca—d. May 28, 1805, Madrid, Spain) Italian composer. Son of a musician, he received excellent early training and toured widely in Europe as a cellist. He held positions at the courts of Madrid and Prussia. His vast CHAMBER MUSIC output includes some 125 string quintets (more than any other composer), some 90 string quartets, and many string trios. He also wrote symphonies and cello concertos. The elegance and charm of his music has ensured its continuing popularity.

boccie *or* **bocci** *or* **bocce** \'bä-chē\ (from Italian *bocce*, "balls") Game of Italian origin, similar to BOWLS. It is played on a long, narrow, packed-clay court enclosed with boarded ends and sides. Each player or team in turn rolls four balls (made of wood, metal, or composition material) toward a smaller target ball. The object is to bring the ball to rest nearest the target ball (for which points are awarded at the end of a round), to protect a well-placed ball, or to knock aside an opponent's ball. The game usually proceeds until one side has 12 points.

Boccioni \bōt-'chō-nē**, Umberto** (b. Oct. 19, 1882, Reggio di Calabria, Italy—d. Aug. 16, 1916, Verona) Italian painter, sculptor, and theorist. He was trained in the studio of Giacomo Balla (1871–1958) in Rome. The most energetic member of the Futurist group (see also FUTURISM), Boccioni helped publish *Technical Manifesto of the Futurist Painters* (1910), promoting the representation of modern technology, power, time, motion, and speed. These ideas are best shown in his masterpiece of early modern sculpture, *Unique Forms of Continuity in Space* (1913). His painting *The City Rises* (1910) is a dynamic composition of swirling human figures in a fragmented crowd scene.

Bobcat (*Felis rufa*)
JOE VAN WORMER/PHOTO RESEARCHERS

Bochco \'bäch-kō**, Steven (Ronald)** (b. Dec. 16, 1943, New York, N.Y., U.S.) U.S. television writer, director, and producer. He worked as a scriptwriter and producer for Universal Studios (1966–78) and MTM Enterprises (1978–85) before forming his own production company in 1987. He cowrote and produced such successful television dramas as *Hill Street Blues* (1981–86), *L.A. Law* (1986–94), and *NYPD Blue* (from 1993), winning numerous Emmy Awards for his scripts.

Böcklin \'bœk-lēn**, Arnold** (b. Oct. 16, 1827, Basel, Switz.—d. Jan. 16, 1901, Fiesole, Italy) Swiss-born Italian painter. After studies and work in northern Europe and Paris, he won the patronage of the king of Bavaria with his mural *Pan in the Bulrushes* (1856–58). From 1858 to 1861 he taught at the Weimar Art School and executed mythological frescoes for the Public Art Collection in his native Basel. He settled in Italy, painting nymphs, satyrs, tritons, moody landscapes, and sinister allegories that presaged SYMBOLISM and SURREALISM. His later style was sombre, mystical, and morbid, as in his five versions of *The Isle of the Dead* (1880–86). Though most of his time was spent in Italy, he was the most influential artist in the German-speaking world in the late 19th century.

"Self-Portrait with Death as a Fiddler," oil on canvas by Arnold Böcklin, 1872; in the Nationalgalerie, Berlin.
COURTESY OF THE STAATLICHE MUSEEN PREUSSISCHER KULTURBESITZ, NATIONALGALERIE, BERLIN; PHOTOGRAPH, WALTER STEINKOPF

Bodawpaya \ˌbō-dȯ-'pī-ə\ (b. 1740/41—d. 1819, Amarapura, Myanmar) King of Myanmar (Burma) (r. 1782–1819). He was a son of Alaungpaya and the sixth monarch of the ALAUNGPAYA DYNASTY. Bodawpaya deposed his grandnephew to become king. In 1784 he invaded the kingdom of Arakan and deported more than 20,000 of its people as slaves; in 1785 he attempted to conquer Siam. His oppressive rule in Arakan led to rebellion; his pursuit of rebel leaders across the border into British-controlled Bengal nearly brought him into open conflict with the British. His campaigns in Assam heightened tensions. A fervent Buddhist, he proclaimed himself Arimittya, the messianic Buddha destined to conquer the world.

Bodensee See Lake CONSTANCE

Bode's law Rule giving the approximate distances of PLANETS from the SUN. First announced in 1766 by the German Johann Daniel Titius (b. 1729—d. 1796), it was popularized, from 1772, by his countryman Johann Elert Bode (b. 1747—d. 1826). It may be given as follows: To each number in the sequence 0, 3, 6, 12, 24, and so on, add 4 and divide the result by 10. The answers closely approximate the distances from the Sun, in ASTRONOMICAL UNITS, of the first seven planets. Bode's law also suggested that a planet should be found between Mars and Jupiter, where the ASTEROID belt was later discovered. Once thought to have some significance regarding the formation of the solar system, it is now regarded as a numerological curiosity.

bodhi \'bō-dē\ (Sanskrit and Pali: "awakening" or "enlightenment") In BUDDHISM, the final enlightenment that ends the cycle of death and rebirth and leads to NIRVANA. This awakening transformed Siddhartha Gautama into the historical BUDDHA. Bodhi is achieved by ridding oneself of false beliefs and the hindrance of passions through the discipline of the EIGHTFOLD PATH. Though not supported in canonical texts, commentaries give a threefold classification of bodhi: that of a perfectly enlightened one, or a Buddha; that of an independently enlightened one; and that of an ARHAT.

bodhi tree *or* **bo tree** In BUDDHISM, the fig tree under which the BUDDHA sat when he attained enlightenment (BODHI) at Bodh Gaya (near Gaya,

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India). The tree growing on the site now is believed to be a descendant of the original, planted from a cutting of a tree in Sri Lanka that had been propagated from the original; both trees are sites of pilgrimage for Buddhists. The bo tree or a representation of its leaf has often been used as a symbol of the Buddha.

Bodhidharma \ˌbō-di-ˈdər-mə\ *Chinese* **Damo** *Japanese* **Daruma** (fl. 6th century AD) Legendary Indian monk credited with the establishment of the Chan (Sŏn, or ZEN) school of BUDDHISM. Considered the 28th Indian successor in a direct line from the BUDDHA Gautama, he is recognized by the Chan school as its first patriarch. Legend states that he traveled from India to Guang (now Guangzhou), China, where he was granted an interview with the emperor Wudi, who was famous for his good works. He told the emperor that meditation, not good deeds, led to enlightenment. He himself was said to have meditated sitting motionless for nine years.

bodhisattva \ˌbō-di-ˈsət-və\ Term for the historical BUDDHA Gautama prior to his enlightenment as well as for other individuals destined to become buddhas. In MAHAYANA Buddhism the bodhisattva postpones attainment of NIRVANA in order to alleviate the suffering of others. The ideal supplanted the THERAVADA Buddhist ideals of the ARHAT and the self-enlightened buddha, which Mahayana deemed selfish. The number of bodhisattvas is theoretically limitless, and the title has been applied to great scholars, teachers, and Buddhist kings. Celestial bodhisattvas (e.g., AVALOKITESVARA) are considered manifestations of the eternal Buddha and serve as savior figures and objects of personal devotion, especially in East Asia.

Bodin \bō-ˈdaⁿ**, Jean** (b. 1530, Angers, Fr.—d. June 1596, Laon) French political philosopher. He studied at the University of Toulouse and later taught law there (1551–61). In 1571 he entered the household of the king's brother, François, duke d'Alençon. He favoured negotiation with the Huguenots, with whom the government was engaged in a civil war, and opposed the sale of royal domains. His *The Six Bookes of a Commonweale* (1576) won him immediate fame. In it he suggested that the key to securing order and authority lay in recognition of the state's SOVEREIGNTY, which he believed derived from divine right and not from the consent of the subject. He distinguished three types of government: MONARCHY (which he favoured), ARISTOCRACY, and DEMOCRACY.

Bodleian \bȯd-ˈlē-ən\ **Library** Library of the University of Oxford and one of the oldest and most important nonlending reference libraries in Britain. The Bodleian is particularly rich in Asian manuscripts and collections of English literature, local history, and early printing. Though it was established earlier, it was not secured by the university until 1410. After a period of decline, it was restored by Sir Thomas Bodley (1545–1613), a collector of medieval manuscripts, and reopened in 1602. Under provisions established in 1610 and 1662, it is a legal deposit library entitled to free copies of all books printed in Britain.

Bodmer \ˈbōd-mər**, Johann Georg** (b. Dec. 6, 1786, Zürich, Switz.—d. May 30, 1864, Zürich) Swiss inventor of MACHINE TOOLS and textile-making machinery. In 1824 he established a small factory in England to make textile machinery, and by 1833 he had a shop equipped with his own machine tools. Between 1839 and 1841 he patented more than 40 specialized machine tools that he then set up in an ingenious factory-type arrangement. A gear-making machine that cut teeth of predetermined pitch, form, and depth in a metal blank was especially noteworthy. Bodmer also patented various STEAM-ENGINE devices and is credited with inventing the cylinder with opposed pistons.

Bodoni \bō-ˈdō-nē**, Giambattista** (b. Feb. 16, 1740, Saluzzo, Piedmont—d. Nov. 29, 1813, Parma, French Empire) Italian typographer. Son of a printer, he served an apprenticeship at the press of the Roman Catholic Church in Rome. In 1768 he assumed management of the Royal Press of the duke of Parma. By the 1780s he was designing his own typefaces; the Bodoni typeface appeared in 1790 and is still in use today. He became internationally known and collectors sought his books. His many important works include fine editions of HORACE (1791), VIRGIL (1793), and HOMER's *Iliad* (1808).

Bodrum See HALICARNASSUS

body louse See human LOUSE

body modification and mutilation Intentional modification of the human body for religious, aesthetic, or social reasons. It is frequently performed for magical or pseudo-medical purposes, but cosmetic motives are equally common. The variability of the results in different cultures reflects varying ideals of beauty or morality. Modifications include head flattening, insertion of a lip plug, TATTOOS, scarification, and piercing of the ear and other parts of the body. Mutilations include male and female circumcision, foot binding, and amputation.

bodybuilding Developing of the physique through exercise and diet, often for competitive exhibition. Bodybuilding aims at displaying pronounced muscle tone and exaggerated muscle mass and definition for overall aesthetic effect. WEIGHT TRAINING is the principal form of exercise used; high-protein foods and vitamin and mineral supplements contribute to the diet. Bodybuilding competition grew largely out of 19th-century European strongman theatrical and circus acts. The first important international competition was the Mr. Universe contest, founded in 1947. It was followed in 1965 by the even more prestigious Mr. Olympia contest. Competition for women began in the 1970s. In 1998 bodybuilding was granted provisional status by the International Olympic Committee. The use of STEROIDS to enhance performance, though generally forbidden, has long been common among bodybuilders.

Boehm \ˈbœm**, Theobald** (b. April 9, 1794, Munich, Bavaria—d. Nov. 25, 1881, Munich, German Empire) German flutist and FLUTE designer. Son of a goldsmith, he was a self-taught virtuoso flutist. Realizing that the craft he learned from his father could be put to use to improve the instrument, he created a new kind of key mechanism in 1832. He later studied acoustics, and by 1847 he had completely redesigned the flute, giving it a different internal shape, moving the holes, and extending the use of the keys. His work achieved a stronger and more uniform tone than that of earlier instruments and formed the basis for the modern flute.

Boeing Co. Major U.S. firm that is the world's largest aerospace company and foremost maker of commercial jet transports. It was founded by William E. Boeing (1881–1956) in 1916 (as Aero Products Company). In the late 1920s it became part of United Aircraft and Transport Corp., but it reemerged as an independent entity in 1934 when that company was broken up to comply with antitrust legislation. Boeing pioneered the development of single-wing planes in the 1930s; its B-17 Flying Fortress (first flown 1935) and B-29 Superfortress (1942) played prominent roles in World War II. After the war the company developed the B-52 jet bomber, long a mainstay of U.S. strategic forces. It produced the first U.S. jetliner, the Boeing 707 (in service 1958), and went on to develop a highly successful series of commercial jet transports. By the start of the 21st century these formed seven families—the narrow-body 737 and 757; wide-body 747, 767, and 777; 717 (formerly McDonnell Douglas MD-95); and MD-11. In the 1960s Boeing built the Lunar Orbiters, Lunar Roving Vehicles, and the first stage of the Saturn V rockets (see SATURN) for the U.S. APOLLO program. Beginning in 1993, it served as NASA's prime contractor for the INTERNATIONAL SPACE STATION. In 1996 it purchased the aerospace and defense units of Rockwell International Corp., and a year later it bought MCDONNELL DOUGLAS CORP. It acquired the satellite business of Hughes Electronics in 2000. See also LOCKHEED MARTIN CORP.

Boeotia \bē-ˈō-shə\ District and ancient republic, eastern central Greece. Bounded by ATTICA and the Gulf of Corinth, its chief cities were ORCHOMENUS and THEBES. Inhabited by Boeotians, an Aetolian people from Thessaly, it became politically significant after the Boeotian League was formed under Theban leadership c. 600–550 BC. Hostile to ATHENS, the League revolted against it c. 447 BC. In the PELOPONNESIAN WAR, Boeotia defeated Athens at Delium in 424 BC. Led by Thebes, it dominated Greece until Thebes was destroyed by ALEXANDER THE GREAT c. 335 BC.

Boer See AFRIKANER

Boerhaave \ˈbür-ˌhȧ-və**, Hermann** (b. Dec. 31, 1668, Voorhout, Neth.—d. Sept. 23, 1738, Leiden) Dutch physician. As a professor at the University of Leiden, he was renowned as a teacher, and he is often credited with founding the modern system of teaching medical students at the patient's bedside. His reputation as one of the greatest physicians of the 18th century lay partly in his attempts to organize the mass of medical information known at the time, in a series of major texts and encyclopedic works.

Boethius \bō-ˈē-thē-əs\ *in full* **Anicius Manlius Severinus Boethius** (b. AD 470–475?, Rome—d. 524, Pavia?) Roman scholar, Christian philosopher, and statesman. Born to a patrician family, he became consul in 510 and subsequently chief minister to the Ostrogothic king THEODORIC.

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Accused of treason and condemned to death, he wrote his Neoplatonic *The Consolation of Philosophy* while in prison awaiting execution. The work was extremely popular and influential through the Middle Ages and later. He is also known for his translations of works of Greek logic and mathematics, including those of Porphyry and ARISTOTLE. His translations and commentaries were among the basic texts of medieval SCHOLASTICISM.

bog body Any of an informal collection of some 700 variously preserved human remains found over the past 200 years in natural peat bogs, mostly in western Europe. The bodies, including the soft tissues and the stomach contents, remain preserved because of the anaerobic fluid conditions in the bogs. They range chronologically from c. 8000 BC to early medieval times. That they have been variously found with cut throats, severed limbs, ropes around the neck, and so on suggests the possibility of ritual killings, murders, and ignominious burial (since none was found within a proper grave).

bog iron ore Iron ore consisting of hydrated iron oxide minerals such as limonite and goethite formed by precipitation of groundwater flowing into wetlands. Bacterial action contributes to formation of the ore. Economically useful deposits can regrow within 20 years after harvesting. Bog iron was widely used as a source of iron in the past.

Bogarde \'bō-ˌgärd**, Sir Dirk** *orig.* **Derek Niven van den Bogaerde** (b. March 28, 1921, London, Eng.—d. May 8, 1999, London) British actor. The son of a Dutch-born art critic, he made his stage debut in 1939 and won a film contract from the Rank studios after World War II. After appearing for a decade mainly in light comedies such as *Doctor in the House* (1953), he began demonstrating his acting range in serious films such as *The Doctor's Dilemma* (1958), *The Servant* (1963), *Darling* (1965), and *Providence* (1977).

Bogart, Humphrey (DeForest) (b. Dec. 25, 1899, New York, N.Y., U.S.—d. Jan. 14, 1957, Hollywood, Calif.) U.S. actor. He had minor roles on the stage and in Hollywood before winning success on Broadway as the murderer Duke Mantee in *The Petrified Forest* (1935), a role he reprised in the film version (1936). He appeared in many low-budget films, usually as a gangster, before achieving stardom in *High Sierra* (1941) and *The Maltese Falcon* (1941). Often playing a sardonic loner who proves capable of love, he appeared in films such as *Casablanca* (1942), *Treasure of the Sierra Madre* (1948), and *The African Queen* (1951, Academy Award). He acted in four films with his fourth wife, LAUREN BACALL.

Humphrey Bogart in *Sahara* (1943).
THE BETTMANN ARCHIVE

Boğazköy \bō-'ä-kœi\ *or* **Boğazkale** \bō-'äz-kä-le\ Village, north-central TURKEY. Located about 90 mi (145 km) east of ANKARA, it is on the ruins of the ancient HITTITE capital of Hattusas (Hattusha). The site contains archaeological remains, including temples, city gates, and walls, associated with the powerful Hattic dynasty (c. 16th–12th century BC) and was later described by HERODOTUS. Excavations conducted during the 20th century uncovered hundreds of CUNEIFORM tablets attesting to the ancient city's importance. Hattusas was designated a UNESCO WORLD HERITAGE SITE in 1986.

Bogd Gegeen Khan \'bȯg-əd-gə-'gen\ (fl. 1911–24, Urga [Ulaanbaatar]) "Living Buddha" of the Yellow Hat (DGE-LUGS-PA) sect. In 1911 he proclaimed Mongolia independent of China, though true independence was not achieved until 1921. He remained head of state until 1924.

Bogomil \'bä-gə-ˌmil\ Any member of a religious sect that flourished in the Balkans during the 10th–15th centuries. Founded by a 10th-century Bulgarian priest traditionally known as Bogomil, the sect's beliefs arose from the possible fusion of dualistic doctrines imported mainly from the Paulicians (a sect of Armenia and Asia Minor) and a local Slavonic movement aimed at reforming the new Bulgarian Orthodox church. Its central teaching was that the visible, material world was created by the Devil. The Bogomils taught a Docetist Christology instead of the traditional doctrine of the Incarnation, rejected the Christian conception of matter as a vehicle of grace, and repudiated the whole organization of the Orthodox church. They were active missionaries who lived rigorously ascetic lives. During the 11th–12th centuries Bogomilism spread over many European and Asian provinces of the Byzantine Empire; it also spread into western Europe, where it contributed to the formation of the CATHAR heresy. In Bulgaria it remained a powerful force until the late 14th century. With the Ottoman conquest of southeastern Europe in the 15th century, its influence declined. See also DUALISM.

Bogotá \ˌbō-gō-'tä\ *in full* **Capital District of Santafé de Bogotá** City (pop., 1999: 6,276,428), capital of Colombia. It lies on a plateau east of the ANDES MOUNTAINS. European settlement began in 1538 when Spanish conquistadores overran Bacatá, the main seat of the CHIBCHA Indians; the name was soon corrupted to Bogotá. It became the capital of the Viceroyalty of NEW GRANADA and a centre of Spanish colonial power in South America. It was the scene of revolt against Spanish rule (1810–11), and the revolutionary leader SIMÓN BOLÍVAR took the city in 1819. It became the capital of the confederation of GRAN COLOMBIA; when that entity was dissolved in 1830, it remained the capital but of New Granada and later the Republic of Colombia. Today Bogotá is an industrial, commercial, educational, and cultural centre.

Bogusławski \ˌbó-gü-'slȧf-skē**, Wojciech** (b. April 9, 1757, Glinna, Pol.—d. July 23, 1829, Warsaw) Polish actor, director, and playwright. He joined the Polish National Theatre in Warsaw as an actor in 1778 and later became its director (1783–1814). Considered the father of Polish theatre, he wrote over 80 plays, including numerous comedies adapted from western European writers as well as the popular original play *Krakovians and Highlanders* (1794). He helped develop theatre companies in Vilna (1785) and Lwów (1794) and toured with the Lwów company, performing in foreign and Polish plays. In 1787 he played Hamlet in his own translation of Shakespeare's play.

Bohai See PARHAE

Bohemia Former kingdom, central Europe. Settled in the 5th century AD by the Czechs, it became tributary to CHARLEMAGNE's empire. It was part of the kingdom of MORAVIA in 870; on the dissolution of Moravia, it became a duchy with an important center at PRAGUE. In the 10th century it expanded to include parts of SILESIA, Slovakia, and KRAKÓW. From the election of FERDINAND I as king in 1526, it remained under HABSBURG rule until 1918. Following World War I, Bohemia declared independence along with Moravia and Slovakia. It was invaded by Germany in 1939 on the pretext that much of the population was German. After World War II it became a province of Czechoslovakia (later the Czech Socialist Republic). On the breakup of the eastern European bloc, it became part of the independent Czech Republic in 1993.

Bohemian Forest *German* **Böhmer Wald** \'bœ̄-mər-ˌvält\ Mountain range, central Europe. It lies along the boundary between BAVARIA (Germany) and BOHEMIA (Czech Republic), extending northwest-southeast from the Ohre River to the DANUBE RIVER valley in Austria. Its highest point, the Arber, rises 4,780 ft (1,457 m). It is the source of the VLTAVA (MOLDAU) RIVER.

Bohemian glass Decorative glass made in Bohemia from the 13th century. In the early 17th century, Caspar Lehmann, gem cutter to Rudolf II in Prague, perfected the technique of gem engraving on glass. By 1700, a heavy, high-lustre, richly ornamented potash-lime glass (Bohemian crystal) had become popular. In the late 18th century, black glass with chinoiserie designs was introduced. Ruby glass and an opaque glass with white overlay, both carved and enameled, were introduced in the 19th century.

Bohemian glass goblet, relief cut and decorated with intaglio-engraved Baroque flowers, from the workshop of Friedrich Winter in Silesia, about 1710–20; in the Museum of Decorative Arts, Prague
MUSEUM OF DECORATIVE ARTS, PRAGUE

Bohemian language See CZECH LANGUAGE

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Bohemian school School of visual arts that flourished in and around Prague in the later 14th century. Charles IV attracted artists and scholars to Prague from all over Europe. French and Italian manuscripts inspired a local school of book illumination. Though most of the painters are anonymous, their achievements in panel painting and fresco had an important influence on German Gothic art. A vital Bohemian tradition in architecture provided the impetus for the great German Gothic architecture of the 15th century.

Resurrection, panel painting by the Master of Wittingau, c. 1380–90; in the National Gallery, Prague.
GIRAUDON/ART RESOURCE, NEW YORK

Bohemond \'bō-ə-mənd\ **I** *orig.* **Marc** (b. 1050–58—d. March 5 or 7, 1109, probably Bari) Prince of Otranto (1089–1109) and of Antioch (1098–1101, 1103–4). The son of a duke who held sway in southeastern Italy, he was nicknamed after a legendary giant. He joined his father's army and contested with Alexius I Comnenus for territory in the Byzantine Empire. In 1095 he joined the First Crusade, reconquering Byzantine lands from the Turks and capturing Antioch (1098). Rather than taking part in the battle to gain Jerusalem, Bohemond remained in Antioch, which he ruled as a principality. His efforts to muster French and Italian support against Alexius and the Byzantine Empire were ultimately unsuccessful.

Böhm \'bœm**, Karl** (b. Aug. 28, 1894, Graz, Austria—d. Aug. 14, 1981, Salzburg) Austrian conductor. Having risen from rehearsal pianist to chief conductor at the Graz Opera House, he was invited to conduct at the Munich Opera in 1921. As director of the Dresden State Opera (1934–42), he conducted numerous premieres. He had a long association with the Salzburg Festival (from 1938) and was especially admired for his interpretations of the works of Wolfgang Amadeus Mozart. His recordings and performances elicited admirable qualities of warmth, subtlety, and lyricism.

Böhme \'bœ-mə**, Jakob** (b. 1575, Altseidenberg, Saxony—d. Nov. 21, 1624, Görlitz) German philosophical mystic. Originally a cobbler, Böhme had a religious experience in 1600 that he felt gave him insight into how the tensions of his age could be resolved. He expounded this insight in his work *Aurora* (1612). The writings of Paracelsus inspired his interest in nature mysticism. In *The Great Mystery* (1623), he explained the Genesis account of creation in terms of Paracelsian principles. In *On the Election of Grace*, he expounded the free will problem, made acute at the time by the spread of Calvinism and its doctrine of predestination. He profoundly influenced later intellectual movements such as idealism and Romanticism, and he is regarded as the father of theosophy.

Bohol \bō-'hȯl\ Island (pop., 2000: 1,137,268), Philippines. Located in the Visayan group north of Mindanao, it has an area of 1,492 sq mi (3,864 sq km). Visited by the Spanish in 1565, it remained under their rule until the late 19th century. Its character is essentially rural and its economy agricultural. The chief settlements, including Loon and Talibon, are on the coast.

Bohr \'bōr**, Niels (Henrik David)** (b. Oct. 7, 1885, Copenhagen, Den.—d. Nov. 18, 1962, Copenhagen) Danish physicist. He studied the structure of the atom with J.J. Thomson and Ernest Rutherford at the universities of Cambridge and Manchester. He was among the first to see the importance of an element's atomic number and postulated that any atom could exist only in a discrete set of states characterized by definite values of energy. He became the first to apply the quantum theory to atomic and molecular structure, and his concept of the atomic nucleus was a key step in understanding such processes as nuclear fission. From 1920 to 1962 he directed the newly created Institute for Theoretical Physics in Copenhagen. His work on atomic theory won him a Nobel Prize for Physics in 1922. He was president of the Royal Danish Academy from 1939 until his death. Though he contributed to atomic bomb research in the U.S. during World War II, he later dedicated himself to the cause of arms control. He received the first U.S. Atoms for Peace Award in 1957. Element 107, bohrium, is named in his honour. His son Aage Niels Bohr (b. 1922) shared the 1975 Nobel Prize for Physics with Ben Mottelson (b. 1926) and James Rainwater (1917–86) for their work on atomic nuclei.

Boieldieu \bȯ-yel-'dyœ**, (François-) Adrien** (b. Dec. 16, 1775, Rouen, France—d. Oct. 8, 1834, Jarsy) French composer. Well known as a concert pianist, he taught piano at the Paris Conservatoire from 1798. His early *opéras comiques* won popularity in Paris, and he wrote several more operas as director of the French Opera in St. Petersburg (1804–10). Of his approximately 40 operas (including many one-act works), the most popular were *Le Calife de Bagdad* (1800), *Le Petit Chaperon rouge* (1818), and *La Dame blanche* (1825). He was France's leading opera composer of the early 19th century, but his achievements were increasingly overshadowed by those of Gioacchino Rossini.

Boigny, Félix Houphouët- See Felix Houphouet-Boigny

boil *or* **furuncle** \'fyůr-ˌəŋ-kəl\ *or* **furunculosis** Inflamed pus-filled swelling due to staphylococcus skin infection at a hair follicle. It is painful and feels hard. Boils usually occur in hairy areas exposed to friction and maceration. Scratching an existing skin disorder may introduce staphylococci on the skin into hair follicles and cause a boil to arise. A carbuncle occurs when several adjoining boils merge. Healing requires discharging the pus. Treatment involves antibiotics.

Boileau \bwȧ-'lō\ **(-Despréaux), Nicolas** (b. Nov. 1, 1636, Paris, France—d. March 13, 1711, Paris) French poet and literary critic. His *L'Art poétique* (1674), a didactic treatise in verse setting out rules of composition of poetry in the classical tradition, provides valuable insight into the literary controversies of the period. He also translated the classical treatise *On the Sublime*, attributed to Longinus, which ironically became a key source of the aesthetics of Romanticism. His works upheld classical standards in both French and English literature.

boiler Apparatus for converting a liquid to vapour. A boiler consists of a furnace in which fuel is burned, surfaces to transmit heat from the combustion products to the water (or other liquid), and a space where steam (or vapour) can form and collect. A conventional boiler burns a fossil fuel or waste fuel; a nuclear reactor may instead supply the heat. There are two types of conventional steam boiler. In a fire-tube boiler, the water surrounds the steel tubes through which hot gases from the furnace flow; easy to install and operate, fire-tube boilers are widely used to heat buildings and to provide power for factory processes, as well as in steam locomotives. In a water-tube boiler, the water is inside tubes, with the hot furnace gases circulating outside the tubes; water-tube boilers, which produce more and hotter steam, are used in ships and factories. The largest are found in the central-station power plants of public utilities; other large units are used in steel mills, paper mills, oil refineries, and chemical plants. See also steam engine.

boiling Cooking of food by immersion in water, stock, or other liquid heated to its boiling point. Boiling is used to cook meats, vegetables, and some grain foods (pasta, for example). Scalding, accomplished by heating to about 185 °F (85 °C), is commonly used to prepare milk to be used as an ingredient in various dishes. At just above the scalding temperature, fish and eggs may be poached. At the simmering point, just below that of boiling, soups, stews, and pot roasts may be prepared. Many foods, especially vegetables, are steamed in a rack placed above boiling water.

boiling point Temperature at which a liquid is converted to vapour when heated. At the boiling point, addition of heat results in the transformation of the liquid into its vapour without an increase in temperature. A liquid's boiling point varies according to the liquid's characteristics and the applied pressure. Water at standard atmospheric pressure, or sea level, boils at 212 °F (100 °C), while ethanol boils at about 172 °F (78 °C). At higher altitudes, boiling points are lower and foods can take longer to cook; pressure cookers can be used to increase the pressure so that the boiling point is raised.

Bois, W.E.B. Du See W.E.B. Du Bois

Boise \'bȯi-zē\ City (pop., 2000: 185,787), capital of Idaho, U.S. The largest city in the state, it lies on the Boise River. Following the 1862 gold rush to the river basin, Fort Boise was established in 1863, and a community developed to provide services for the mines. It became the capital of Idaho Territory in 1864, and of the state in 1890. Agricultural expansion and the growth of the lumber industry contributed to its rapid growth. Boise is the headquarters of the Boise National Forest.

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Boito \'bō-ē-tō**, Arrigo** *orig.* **Enrico Giuseppe Giovanni Boito** (b. Feb. 24, 1842, Padua, Lombardy-Venetia—d. June 10, 1918, Milan, Italy) Italian composer and librettist. As a composer, he is remembered for his opera *Mefistofele* (1868). He wrote the text for Giuseppe Verdi's *Inno delle nazioni* (1862) and revised the libretto for his *Simon Boccanegra* (1881), tasks that led to his writing the celebrated texts for Verdi's masterworks *Otello* (1887) and *Falstaff* (1893). He was also the librettist of Amilcare Ponchielli's *La Gioconda* (1876). His own opera *Nerone* was left unfinished at his death.

Bojador \ˌbò-jə-'dȯr**, Cape** Cape, West Africa. It extends into the Atlantic Ocean off Western Sahara south of the Canary Islands. After 1434 the Portuguese began exploiting the region, particularly for slaves. Later the area was disputed by Spain and Portugal; Spain finally gained control in 1860 and annexed it in 1884. After Spain's withdrawal from Western Sahara in 1976, Morocco claimed the cape, garrisoned troops there, and made the area a province.

Bojangles See Bill Robinson

Bok, Edward (William) (b. Oct. 9, 1863, Den Helder, Neth.—d. Jan. 9, 1930, Lake Wales, Fla., U.S.) Dutch-born U.S. editor. Raised in a poor immigrant family in Brooklyn, N.Y., Bok pursued a career in book and magazine publishing. As editor of the *Ladies' Home Journal* (1889–1919) he devised departments to inform women on diverse subjects and led campaigns for public health and beautification. His decision to stop accepting patent-medicine advertising helped bring about the Pure Food and Drug Act (1906). He also broke the taboo against the printed mention of venereal disease. His last years were devoted to working for civic improvement and world peace. He wrote a notable autobiography, *The Americanization of Edward Bok* (1920, Pulitzer Prize).

Edward Bok, photograph by Pirie MacDonald, 1909.
Library of Congress, Washington, D.C.

bok choy *or* **Chinese mustard** *Brassica chinensis*, one of two types of Chinese cabbage. It has glossy dark green leaves and thick, crisp white stalks in a loose head. Its yellow-flowering centre is especially prized. See also brassica; mustard family.

Bokassa \bō-'kas-ə**, Jean-Bédel** *or* **Bokassa I** (b. Feb. 22, 1921, Bobangui [Central African Republic]—d. Nov. 3, 1996, Bangui, Central African Republic) President of the Central African Republic (1966–77) and self-proclaimed emperor of the Central African Empire (1977–79). Son of a village chief, Bokassa joined the French army in 1939 and later received the Croix de Guerre for his service in Indochina. In 1961 he returned to head the army of the newly independent Central African Republic; five years later he overthrew the president, his cousin David Dacko. In 1977 he had himself crowned emperor. When he was found to have participated in the massacre of 100 schoolchildren and was accused of cannibalism, French paratroops removed him in a coup and reestablished the republic. Bokassa settled in Côte d'Ivoire. He was sentenced to death in absentia in 1980, but his death sentence was later commuted.

Bokhara See Bukhara

Bokn Fjord \'bük-ᵊn-'fyȯrd\ Inlet of the North Sea, southwestern Norway. It is about 28 mi (45 km) long and 12 mi (20 km) wide. Its branches include other fjords, and it is dotted by many islands and islets. The major settlement along the fjord is Stavanger, a centre for offshore oil drilling.

Boleyn, Anne See Anne Boleyn

Bolingbroke \'bä-liŋ-ˌbrük**, Henry Saint John, 1st Viscount** (b. Sept. 16, 1678, probably Wiltshire, Eng.—d. Dec. 12, 1751, Battersea, near London) British politician. After entering Parliament in 1701, he became a prominent Tory in the reign of Queen Anne, serving as secretary of war (1704–08) and of state (1710–15). He was dismissed from office by George I and, fearing impeachment because of his intrigues with the Jacobites, he fled to France in 1715. He returned to England in 1725 and became the centre of a literary circle that included Jonathan Swift, Alexander Pope, and John Gay. He waged an influential propaganda campaign in opposition to the Whigs and their leader, Robert Walpole, and also wrote several historical and philosophical works, including *The Idea of a Patriot King* (published secretly by Pope in 1744 and as a corrected version in 1749).

Bolívar \bō-'lē-vär**, Simón** *known as* **The Liberator** (b. July 24, 1783, Caracas, New Granada—d. Dec. 17, 1830, near Santa Maria, Colombia) South American soldier and statesman who led the revolutions against Spanish rule in New Granada (now Colombia, Venezuela, and Ecuador), Peru, and Upper Peru (now Bolivia). The son of a Venezuelan aristocrat, Bolívar received a European education. Influenced by European rationalism, he joined Venezuela's independence movement and became a prominent political and military leader. The revolutionaries expelled Venezuela's Spanish governor (1810) and declared the nation's independence in 1811. The young republic was defeated by the Spanish in 1814, and Bolívar went into exile. In 1819 he undertook a daring attack on New Granada, leading some 2,500 men over routes considered impassable. Taking the Spanish by surprise, he defeated them quickly. With the help of Antonio Sucre, he secured the independence of Ecuador in 1822. He completed José de San Martín's revolutionary work in Peru, freeing that country in 1824. On Bolívar's orders, Sucre liberated Upper Peru (1825). As president of both Colombia (1821–30) and Peru (1823–29), Bolívar oversaw the creation in 1826 of a league of Hispanic American states, but the new states soon began warring among themselves. Less successful at ruling countries than at liberating them, Bolívar exiled himself and died on his way to Europe.

Simón Bolívar, detail of an engraving by C.G. Childs.
Library of Congress, Washington, D.C.

Bolívar \bō-'lē-vär\ **Peak** *or* **Pico Bolívar** *or* **La Columna** Mountain, Venezuela. It is located in Sierra Nevada National Park. Rising 16,427 ft (5,007 m), it is the highest mountain in the Cordillera de Mérida (a northeastern spur of the Andes Mountains) and in Venezuela.

Bolivia *officially* **Republic of Bolivia** Country, west-central South America. Area: 424,164 sq mi (1,098,581 sq km). Population (2005 est.): 8,858,000. Capitals: La Paz (administrative), Sucre (judicial). The population consists of three principal groups: Indians, largely Aymara and Quechua; mestizos; and descendants of Europeans. Languages: Spanish, Aymara, Quechua (all official). Religions: Christianity (predominantly Roman Catholic [official]; also Protestant); also vestiges of pre-Columbian religion. Currency: boliviano. Bolivia may be divided into three major regions. The southwestern highlands, or Altiplano, where Lake Titicaca is located, extends through southwestern Bolivia. It is enclosed by the second region, the western and eastern branches of the Andes Mountains. Much of the eastern branch is heavily forested terrain, with many deep river valleys; the western branch is a high plateau bordered by volcanoes, including the country's highest peak, Mount Sajama, which rises to 21,463 ft (6,542 m). The third region is a lowland area that comprises the northern and eastern two-thirds of the country; its rivers include the Guaporé, Mamoré, Beni, and upper Pilcomayo. Bolivia has a developing mixed economy based on the production of natural gas and agricultural foodstuffs. It is a republic with two legislative houses; its head of state and government is the president. The Bolivian highlands were the location of the advanced Tiwanaku culture in the 7th–11th centuries and, with its passing, became the home of the Aymara, an Indian group conquered by the Inca in the 15th century. The Inca were overrun by the invading Spanish conquistadores under Francisco Pizarro in the 1530s. By 1600 Spain had established the cities of Charcas (now Sucre), La Paz, Santa Cruz, and what would become Cochabamba and had begun to exploit the silver wealth of Potosí. Bolivia flourished in the 17th century, and for a time Potosí was the largest city in the Americas. By the end of the century, the mineral wealth had been depleted. Talk of independence began as early as 1809, but not until 1825 were Spanish forces finally defeated. Bolivia shrank in size when it lost Atacama province to Chile in 1884 at the end of the War of the Pacific and again when it lost most of Gran Chaco to Paraguay in 1938 as a result of the Chaco War. One of South

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America's poorest countries, Bolivia was plagued by governmental instability for much of the 20th century. Social and economic tension continued in the early 21st century, fueled by resistance to government efforts to eradicate the growth of coca (from which the narcotic cocaine is derived), by unrest among Bolivia's Indians, and by disagreements over how to exploit the country's vast natural gas reserves.

Böll \'bœl\, Heinrich (Theodor) (b. Dec. 21, 1917, Cologne, Ger.—d. July 16, 1985, near Bonn, W.Ger.) German writer. As a soldier in World War II he fought on several fronts, a central experience in the development of his antiwar, nonconformist views. His ironic novels on the travails of German life during and after the war captured the changing psychology of the German nation. He became a leading voice of the German left. Among his works are *Acquainted with the Night* (1953), *Billiards at Half-Past Nine* (1959), *The Clown* (1963), *Group Portrait with Lady* (1971), and *The Lost Honor of Katharina Blum* (1974). He won the Nobel Prize for Literature in 1972.

boll weevil \'bōl-'wē-vəl\ Small BEETLE (*Anthonomus grandis*) found almost everywhere cotton is cultivated. It is the most serious cotton pest in North America. Adults vary in size according to how much food they received as larvae, but they average about 0.25 in. (6 mm) long, including the long, curved snout. In the spring adults deposit eggs in cotton buds or fruit. After hatching, the larvae live within the cotton boll, destroying the seeds and surrounding fibres. Because the larvae and pupae remain inside the cotton bolls, they cannot be killed with insecticides. The boll weevil destroys an estimated three to five million bales of cotton annually.

Boll weevil (*Anthonomus grandis*)
HARRY ROGERS

bollworm \'bōl-ˌwərm\ Any LARVA of various MOTH species, including the pink bollworm (family Gelechiidae) and some *Heliothis* species (family Noctuidae; see CORN EARWORM). Bollworms attack corn, tomatoes, cotton, peas, alfalfa, beans, soybeans, flax, peanuts, and other commercial crops. They can be controlled by natural parasites, early crop planting, trap crops, and insecticides.

Bollywood Indian moviemaking industry that began in Bombay (now Mumbai) in the 1930s and developed into an enormous film empire. Bombay Talkies, launched in 1934 by Himansu Rai, spearheaded the growth of Indian cinema. Throughout the years, several classic genres emerged from Bollywood: the historical epic, notably *Mughal-e-azam* (1960; "The Great Mughal"); the curry western, such as *Sholay* (1975; "The Embers"); the courtesan film, such as *Pakeezah* (1972; "Pure Heart"), which highlights stunning cinematography and sensual dance choreography; and the mythological movie, represented by *Jai Santoshi Maa* (1975; "Hail Santoshi Maa"). Star actors, rather than the films themselves, have accounted for most box-office success. Standard features of Bollywood films include formulaic story lines, expertly choreographed fight scenes, spectacular song-and-dance routines, emotion-charged melodrama, and larger-than-life heroes. At the beginning of the 21st century, Bollywood produced as many as 1,000 feature films annually, and international audiences began to develop among Asians in the U.K. and the U.S.

Bologna \bō-'lō-nyə\ City (pop., 2004 est.: 373,539), capital of EMILIA-ROMAGNA region, northern Italy. Located north of FLORENCE, it lies at the northern foot of the APENNINES. Originally the Etruscan town of Felsina, it became a Roman military colony c. 190 BC. It was subject to the Byzantine exarchate of RAVENNA from the 6th century AD. It became a free commune in the 12th century. Incorporated into the PAPAL STATES in 1506, it was the scene of the crowning of CHARLES V in 1530. After a brief period of French occupation, it was restored to the Papal States in 1815, and in 1860 it was united to the Kingdom of Italy. The University of BOLOGNA is among Europe's oldest. The city is a road and rail centre for traffic between northern and southern Italy. It is the site of excellent medieval and Renaissance architecture and is famous for its cuisine. Locally, it was governed by leftists in the second half of the 20th century.

Bologna, Giovanni da See GIAMBOLOGNA

Bologna, University of Oldest university in Europe, founded in Bologna, Italy, in 1088. It became in the 12th–13th centuries the principal centre for studies in civil and canon law, and it served as a model for the organization of universities throughout Europe. Its faculties of medicine and philosophy were formed c. 1200. The faculty of science was developed in the 17th century. In the 18th century women were admitted as students and teachers. The modern university includes faculties of law, political science, economics, letters and philosophy, natural sciences, agriculture, medicine, and engineering.

Bolognese school \ˌbō-lə-'nēz, ˌbō-lə-'nyēz\ Works produced and theories expounded by the Academy of the Progressives, founded in Bologna c. 1582 by Lodovico, Agostino, and Annibale CARRACCI. In reaction against MANNERISM, they advocated drawing directly from life. Among their leading students were DOMENICHINO and GUIDO RENI. Their clear, simple pictures accorded well with the artistic demands of the COUNTER-REFORMATION, which wanted works of art to be immediately comprehensible. What began as a regional movement became one of the most influential forces in 17th-century art.

Bolshevik \'bōl-shə-ˌvik\ (Russian: "member of the majority") Member of the wing of the RUSSIAN SOCIAL-DEMOCRATIC WORKERS' PARTY led by VLADIMIR ILICH LENIN that seized control in the RUSSIAN REVOLUTION OF 1917. The group arose in 1903 when Lenin's followers insisted that party membership be restricted to professional or full-time revolutionaries. Though they joined with their rivals, the MENSHEVIKS ("members of the minority"), in the RUSSIAN REVOLUTION OF 1905, the two groups later split, and in 1912 Lenin formed his own party. Its appeal grew among urban workers and soldiers during World War I. The Bolshevik consolidation of power after 1917 became one prototype of TOTALITARIANISM; the other was FASCISM of BENITO MUSSOLINI and ADOLF HITLER. See also COMMUNIST PARTY, LENINISM.

Bolshoi Theatre complex in Moscow where concerts, opera, ballet, and dramatic works are presented. The institution (whose name means "Large") dates back to 1776, when CATHERINE II licensed a company to give all theatrical performances in Moscow; its scope soon expanded to include opera and dance as well as drama. The original complex was built in 1825; it was rebuilt after a fire in 1853. The performing companies have changed over time, but the institution and the rebuilt edifice have survived.

Bolshoi Ballet \bōl-'shȯi\ Leading ballet company of Russia, noted for elaborate productions of 19th-century classical ballets. The company was formed in 1776 and took the name of its home, Moscow's BOLSHOI Theatre, in 1825. Its influential choreographers included MARIUS PETIPA, CARLO BLASIS, and ALEKSANDR GORSKY. Yuri Grigorovich was artistic director from 1964 to 1995. Its many successful tours have introduced its outstanding

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dancers, including Yekaterina Geltzer, Vasily Tikhomirov, Galina Ulanova, and Maya Plisetskaya, to audiences worldwide.

bolt Mechanical fastener, usually used with a nut, for connecting two or more parts. Bolted joints can be readily disassembled and reassembled; hence bolts or screw fasteners are used more than other types of mechanical fastener. A bolt consists of a head and a cylindrical body with screw threads along a portion of its length. Nuts have internal (or female) threads to match those of the bolt. Washers are often used to prevent loosening and crushing.

bolt action Type of breech mechanism that was key to developing an effective repeating rifle. It combines the firing pin, a spring, and an extractor, all housed in or attached to the bolt. A projecting handle with a round knob moves the bolt back and forth. As the bolt is thrust forward, it pushes a cartridge into the chamber and cocks the piece. The trigger releases the spring-driven firing pin inside the bolt. After firing, the extractor on the head of the bolt removes the spent cartridge and ejects it. The bolt then moves a new cartridge from the magazine.

Bolton, Guy (Reginald) (b. Nov. 23, 1884, Broxbourne, Hertfordshire, Eng.—d. Sept. 5, 1979, London) British-born U.S. playwright and librettist. The son of American parents, Bolton studied architecture before he began writing plays. His first play appeared on Broadway in 1911, but it was not until he began contributing to Broadway musicals that his fame spread. In collaboration with P.G. Wodehouse and others, he wrote dozens of scripts scored by composers such as Jerome Kern (*Oh, Boy!*, 1917), George Gershwin (*Lady, Be Good!*, 1924; *Girl Crazy*, 1930), and Cole Porter (*Anything Goes*, 1934).

Boltzmann \'bōlts-ˌmän\, Ludwig (Eduard) (b. Feb. 20, 1844, Vienna, Austria—d. Sept. 5, 1906, Duino, Italy) Austrian physicist. He obtained his doctorate from the University of Vienna and thereafter taught at several German and Austrian universities. He was one of the first European scientists to recognize the importance of James Clerk Maxwell's electromagnetic theory. He explained the second law of thermodynamics by applying the laws of mechanics and the theory of probability to the motions of atoms, and he is remembered as the developer of statistical mechanics. His work was widely attacked and misunderstood; subject to depression after 1900, he eventually committed suicide. Shortly after his death, his conclusions were finally supported by discoveries in atomic physics and by recognition that phenomena such as Brownian motion could be explained only by statistical mechanics.

Boltzmann constant Ratio of the universal gas constant (see gas laws) to Avogadro's number. It has a value of 1.380662×10^{-23} joules per kelvin. Named after Ludwig Boltzmann, it is a fundamental constant of physics, occurring in nearly every statistical formulation of both classical and quantum physics.

bomb In volcanology, any unconsolidated volcanic material that has a diameter greater than 1.25 in. (32 mm). Bombs form from clots of wholly or partly liquid lava ejected during a volcanic explosion; they solidify and become rounded during flight. The final shape is determined by the initial size, viscosity, and flight velocity of the magma.

Bombay See Mumbai

bomber Military aircraft designed to drop bombs on surface targets. Aerial bombardment can be traced to the Italo-Turkish War (1911), in which an Italian pilot dropped grenades on two Turkish targets. In World War I zeppelins and large two- to four-engined biplanes were used as strategic bombers. In the 1930s small dive bombers were developed; they caused great destruction and panic in the Spanish Civil War and early in World War II. The latter conflict saw further development of heavy strategic bombers, which were used to destroy targets in the enemy's home territory; meanwhile, smaller fighter-bombers supported ground troops on the battlefield. After the war, jet-propelled long-range bombers carrying nuclear bombs were important to Cold War strategy, and they also dropped conventional bombs during the Vietnam War, the Persian Gulf War, and the Afghan conflicts. Efforts to evade increasingly sophisticated electronic early-warning systems have culminated in the development of U.S. stealth bombers, but cheaper and smaller jet fighter-bombers, equipped with electronic sensors and guided "smart" bombs, have proved effective in conflicts ranging from the Balkans to the Middle East.

Bombon, Lake See Lake Taal

Bomu River \'bō-mü\ River, central Africa. Flowing west, it forms the boundary between northern Congo and southern Central African Republic (where it is called the Mbomou). It flows in a wide 500-mi (800-km) curve through savannas to join the Uele River and form the Ubangi.

Bon \'pā^{n}\ Indigenous religion of Tibet. It was originally concerned with magical propitiation of demonic forces, and its practices included blood sacrifices. It later developed a cult of divine kingship (with kings regarded as manifestations of the sky divinity), reformulated in Tibetan Buddhism as the reincarnation of lamas. Bon's order of oracular priests had their counterpart in Buddhist soothsayers, and its gods of air, earth, and underworld in the lesser Tibetan Buddhist deities. Though its religious supremacy ended in the 8th century, Bon survives in many aspects of Tibetan Buddhism and as a living religion on Tibet's northern and eastern frontiers.

Bon \'bȯn\ Popular annual festival in Japan, usually observed July 13–15, in honor of the spirits of deceased family members and of all the dead. As at the New Year festival, the dead are believed to return to their birthplaces. Memorial stones are cleaned, dances performed, and paper lanterns and fires are lit to welcome the dead and to bid them farewell when their visit ends.

Bon, Gustave Le See Gustave Le Bon

Bon Marché \bō^{n}-mȧr-'shā\ *French* **"Good Buy"** Paris department store. It was founded as a small shop in the early 19th century, and by c. 1865 it had become the world's first true department store. Its 1876 building was designed by Alexandre-Gustave Eiffel (1832–1923). It is unrelated to the Bon Marché chain of department stores in the northwestern U.S.

Bona Dea \ˌbō-nə-'dā-ə\ In Roman religion, the deity of fruitfulness, both in the earth and in women. The dedication day of her temple on the Aventine was May 1. Her temple was cared for and attended only by women, though inscriptions show that there was a public side to her worship in which men could participate.

Bonaparte, (Marie-Annonciade-) Caroline (b. March 25, 1782, Ajaccio, Corsica—d. May 18, 1839, Florence) Queen of Naples (1808–15). The youngest sister of Napoleon, she married Joachim Murat in 1800. Her ambitious nature was partially responsible for her husband's becoming king of Naples, among other achievements. Her relations with Napoleon became strained as she associated herself with Murat's shifting allegiances in 1814–15, which led to his execution. Caroline then took refuge in Trieste and became countess de Lipona.

Bonaparte, Jérôme (b. Nov. 15, 1784, Ajaccio, Corsica—d. June 24, 1860, Villegenis, France) French nobleman. He was the youngest brother of Napoleon, from whom he became estranged after marrying a U.S. resident (1803) without Napoleon's consent; he later allowed his marriage to be annulled. Napoleon then married Jérôme to Princess Catherine of Württemberg and made him king of Westphalia (1807–13). He served in the Russian campaign of 1812 and at the Battle of Waterloo. After Napoleon's fall, he lived in Florence; after the rise of his nephew, Napoleon III, he returned to France to become a marshal of France and president of the Senate.

Bonaparte, Joseph (b. Jan. 7, 1768, Corte, Corsica—d. July 28, 1844, Florence, Tuscany, Italy) French lawyer, diplomat, and soldier. Elder brother of Napoleon, he served during Napoleon's reign as king of Naples (1806–08), where he abolished feudalism, reformed the monastic orders, and reorganized the judicial, financial, and educational systems. He was named king of Spain in 1808, but his attempts at reform there were less successful. In 1813 he abdicated and returned to France. After Napoleon's defeat at Waterloo, Joseph lived in the U.S. (1815–32) and later settled in Italy.

Bonaparte, Louis (b. Sept. 2, 1778, Ajaccio, Corsica—d. July 25, 1846, Livorno, Italy) French nobleman and soldier. A brother of Napoleon, he accompanied Napoleon on the Italian campaign of 1796–97 and was his aide-de-camp in Egypt (1798–99). At Napoleon's insistence, he married Hortense de Beauharnais in 1802, but the union proved unhappy and did not last. Proclaimed king of Holland in 1806, he was criticized by Napoleon for being too easy on his subjects. His unwillingness to join the Continental System led him into conflict with Napoleon, and in 1810 he fled his kingdom and eventually settled in Italy. Napoleon III was his son.

Bonaparte, Lucien (b. May 21, 1775, Ajaccio, Corsica—d. June 29, 1840, Viterbo, Italy) French nobleman and politician. A brother of Napoleon, he became president of the Council of Five Hundred, and he helped Napoleon seize power in the Coup of 18–19 Brumaire. Lucien's belief that Napoleon's ambition jeopardized the cause of democracy led to strained

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relations between the brothers. However, he offered Napoleon help during the Hundred Days and was the last to defend Napoleon's prerogatives at the time of his second abdication, after which he lived in Italy.

Bonaparte, (Marie-) Pauline (b. Oct. 20, 1780, Ajaccio, Corsica—d. June 9, 1825, Florence) French noblewoman. A sister of Napoleon, in 1797 she married one of his staff officers, Gen. C.V.E. Leclerc (1772–1802). After Leclerc's death, she married Prince Camillo F.L. Borghese (1803) and went with him to Rome. She soon tired of him and returned to Paris, where her behaviour caused some scandal. In 1806 she received the title of duchess of Guastalla. She died of cancer in Florence.

Bonaventure \,bä-nə-'ven-chər**, Saint** (b. 1217, Bagnoregio, Papal States—d. July 15, 1274, Lyon; canonized April 14, 1482; feast day July 15) Italian medieval theologian, cardinal, and minister general of the Franciscans. The son of a physician from near Viterbo, he recovered from a near-fatal childhood illness through the intercession of St. Francis of Assisi. After study at the University of Paris, he entered the Franciscan order in 1244. In 1254 he assumed control of the Franciscan school in Paris. He defended the mendicants against the charge that they defamed the Gospels by begging for alms. Elected Franciscan minister-general in 1257, he healed an incipient rift between those who favoured a rigorous approach to poverty and those favouring a looser regimen, and he wrote a new life of St. Francis. His theological works include a commentary on the *Sentences* of Peter Lombard and *Journey of the Mind to God* (1259). Pope Gregory X appointed him cardinal of Albano (Italy) in 1273, and at the Second Council of Lyon he reconciled parish clergy with the mendicant orders.

bond In construction, the systematic arrangement of bricks or other building units (e.g., concrete blocks, glass blocks, or clay tiles) to ensure stability. Units laid with their ends toward the face of a wall are called headers; units with their lengths parallel to the wall are called stretchers. Common types are the English bond (courses of stretchers and headers alternate), the Flemish or Dutch bond (headers and stretchers are laid alternately within each course, each header being centered over the stretcher below it), and the American bond (every fifth or sixth course consists of headers, the rest being stretchers). See also masonry.

bond In finance, loan contract issued by local, state, and national governments and by private corporations, specifying an obligation to return borrowed funds. The issuer promises to pay interest on the debt when due (usually semiannually) at a stipulated percentage of the face value and to redeem the face value of the bond at maturity in legal tender. Bonds usually indicate a debt of substantial size and are issued in more formal fashion than promissory notes, ordinarily under seal. Government bonds may be backed by taxes, or they may be revenue bonds, backed only by revenue from the specific project (toll roads, airports, etc.) to which they are committed. Bonds are rated based on the issuer's creditworthiness. The ratings, assigned by independent rating agencies, generally run from AAA to D; bonds with ratings from AAA to BBB are regarded as suitable for investment. See also junk bond.

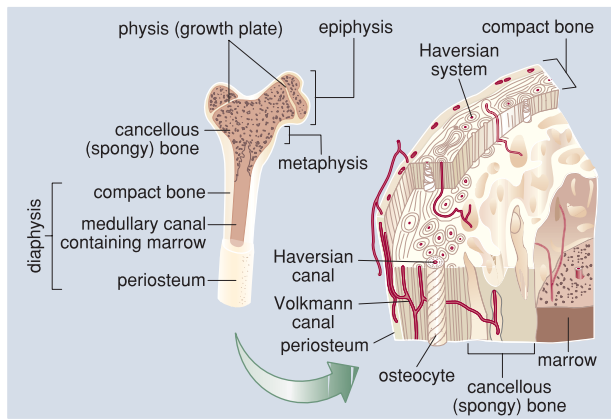
bond In law, a formal written agreement by which a person undertakes to perform a certain act (e.g., appearing in court or fulfilling the obligations of a contract). Failure to perform the act obligates the person to pay a sum of money or to forfeit money on deposit. A bond is an incentive to fulfill an obligation; it also provides reassurance that compensation is available if the duty is not fulfilled. A surety usually is involved, and the bond makes the surety responsible for the consequences of the obligated person's behaviour. See also bail.

Bond, (Horace) Julian (b. Jan. 14, 1940, Nashville, Tenn., U.S.) U.S. politician and civil-rights leader. The son of prominent educators, Bond graduated from Morehouse College. In 1960 he helped create the Student Nonviolent Coordinating Committee (SNCC). In 1965 he was elected to the Georgia legislature, but his support of a SNCC statement accusing the U.S. of violating international law in the Vietnam War caused the legislature to deny him his seat. He was twice reelected and was twice more refused entry. The U.S. Supreme Court ruled his exclusion unconstitutional in December 1966, and he assumed his seat in January 1967. He later served in the state senate (1975–87). In 1998 he became chairman of the NAACP.

bonding Any of the interactions that account for the association of atoms into molecules, ions, crystals, metals, and other stable species. When atoms' nuclei and electrons interact, they tend to distribute themselves so that the total energy is lowest; if the energy of a group arrangement is lower than the sum of the components' energies, they bond. The physics and mathematics of bonding were developed as part of quantum mechanics. The number of bonds an atom can form—its valence—equals the number of electrons it contributes or receives. Covalent bonds form molecules; atoms bond to specific other atoms by sharing an electron pair between them. If the sharing is even, the molecule is not polar; if it is uneven, the molecule is an electric dipole. Ionic bonds are the extreme of uneven sharing; certain atoms give up electrons, becoming cations. Other atoms take up the electrons and become anions. All the ions are held together in a crystal by electrostatic forces. In crystalline metals, a diffuse electron sharing bonds the atoms (metallic bonding). Other types include hydrogen bonding; bonds in aromatic compounds; coordinate covalent bonds; multicentre bonds, exemplified by boranes (boron hydrides), in which more than two atoms share electron pairs; and the bonds in coordination complexes (see transition element), still poorly understood. See also van der Waals forces.

Bonds, Barry *in full* **Barry Lamar Bonds** (b. July 24, 1964, Riverside, Calif.) U.S. baseball player. Bonds was a college All-American at Arizona State University. A left-handed power hitter and a superb base stealer, he played outfield for the Pittsburgh Pirates (1985–92) and the San Francisco Giants (from 1993). By the early 21st century, he had earned eight Gold Glove awards for fielding and had been named Most Valuable Player six times. In 2001 he hit 73 home runs, breaking Mark McGwire's single-season record of 70; that year he also had 177 walks to top Babe Ruth's record (170). His father, Bobby Bonds (1946–2003), was also an outstanding professional baseball player.

bone Rigid connective tissue of vertebrates, consisting of cells embedded in a hard matrix. Bones serve as the body's supporting framework, provide muscle-attachment points for movement, protect the internal organs, house the blood-cell formation system (red bone marrow), and hold about 99% of the calcium vital to many body processes. Bone consists of a matrix of crystals of calcium, chiefly the phosphate and carbonate, embedded among collagen fibres, providing strength and elasticity, and bone cells (less than 5% of its volume). An external layer of compact bone surrounds a central area of spongy bone, except at the marrow cavity. Bone does not grow by cell division; instead, different types of bone cells generate bone matrix, break it down, and maintain it. Bone is remodeled by this process, which strengthens it in areas under greatest stress, permits healing of fractures, and helps regulate calcium levels in body fluid (see



Internal structure of a human long bone, with a magnified cross section of the interior. The central tubular region of the bone, called the diaphysis, flares outward near the end to form the metaphysis, which contains a largely cancellous, or spongy, interior. At the end of the bone is the epiphysis, which in young people is separated from the metaphysis by the physis, or growth plate. The periosteum is a connective sheath covering the outer surface of the bone. The Haversian system, consisting of inorganic substances arranged in concentric rings around the Haversian canals, provides compact bone with structural support and allows for metabolism of bone cells. Osteocytes (mature bone cells) are found in tiny cavities between the concentric rings. The canals contain capillaries that bring in oxygen and nutrients and remove wastes. Transverse branches are known as Volkmann canals.
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calcium deficiency). The process also causes underutilized bone, as in an immobilized limb, to atrophy. Bone disorders include rheumatoid arthritis, osteoarthritis, rickets, osteoporosis, and tumours. Bone can fracture suddenly or over time, as in stress fractures.

Bône See Annaba

bone china Hard-paste porcelain containing bone ash. It was developed by Josiah Spode (1754–1827) in England c. 1800. The addition of bone ash to china stone and china clay (i.e., hard china) made bone china easier to manufacture; it is stronger, does not chip easily, and has an ivory-white colour that lends itself to decoration. Other factories (Minton, Derby, Worcester, Wedgwood, Rockingham) adopted the formula in the early 19th century. Bone china remains popular for tableware in Britain and the U.S. See also stoneware.

Wedgwood bone china plate, Staffordshire, 1815–20; in the Victoria and Albert Museum, London.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, EB INC.

bone marrow *or* **myeloid tissue** Soft, gelatinous tissue that fills bone cavities. Red bone marrow contains stem cells, progenitor cells, percursor cells, and functional blood cells (see reticuloendothelial system). Lymphocytes mature in the lymphoid organs (see lymphoid tissue). All other blood-cell formation occurs in red marrow, which also takes part in destruction of old erythrocytes (red blood cells). Yellow bone marrow mainly stores fats. Because the leukocytes (white blood cells) produced in bone marrow are involved in immune defenses, marrow transplants can treat some types of immunodeficiency. Radiation and some anticancer drugs can damage marrow and impair immunity. Bone-marrow examination helps diagnose diseases related to blood and blood-forming organs.

bonefish Marine game fish (*Albula vulpes*) that inhabits coastal and island waters in tropical seas and is admired by anglers for its speed and strength. Its maximum length is about 30 in. (76 cm), and its maximum weight is 14 lbs (6.4 kg). The bonefish has a deeply notched caudal fin (near the tail) and a small mouth beneath a pointed, piglike snout. It grubs on the bottom for worms and other food.

bongo Large, brightly coloured antelope (*Boocercus*, or *Taurotragus*, *eurycerus*) found in dense forests of central Africa. Shy, swift, and elusive, the bongo lives in small groups or in pairs. It stands about 51 in. (1.3 m) at the shoulder and has an erect mane running the length of the back. Both sexes bear heavy, spirally twisted horns. The male is reddish brown to dark mahogany with black underparts, black-and-white legs, white head markings, and narrow, vertical white stripes on the body. The female is similarly marked but usually a brighter reddish brown.

Bongo (*Boocercus euryceros*).
TOM MCHUGH/PHOTO RESEARCHERS

Bonheur \bä-'nər**, Rosa** (b. March 16, 1822, Bordeaux, France—d. May 25, 1899, Melun) French animal painter. She was trained by her father, an art teacher, and began exhibiting regularly at the Paris Salon in 1841. Her unsentimental paintings of lions, tigers, horses, and other animals became very popular; *The Horse Fair* (1853) gained her an international reputation. A colourful personality, she dressed as a man to study horses at the actual Horse Fair in Paris, receiving formal permission from the police to do so. In 1865 she became the first woman to receive the Grand Cross of the Legion of Honour.

Bonhoeffer \'bön-ˌhœ-fər**, Dietrich** (b. Feb. 4, 1906, Breslau, Ger.—d. April 9, 1945, Flossenbürg) German Lutheran pastor and theologian. He attended the Universities of Berlin and Tübingen, and from 1931 he lectured in theology at the University of Berlin. He became a leading spokesman for the Confessing Church and was active in the resistance movement under the guise of employment in military intelligence. He was arrested and imprisoned in 1943. The discovery of documents connecting him with the 1944 attempt on Adolf Hitler's life led to his execution a month before the end of World War II. One of the most insightful theologians of the 20th century, he argued for a new vision of Christianity that would abolish the division between the sacred and profane and abandon the traditional privileges of the church in favour of active involvement in the world's problems. His best-known works include *The Cost of Discipleship* (1937), *Ethics* (1949), and *Letters and Papers from Prison* (1951).

Boniface \'bä-nə-fəs**, Saint** (b. 675, Wessex, Eng.—d. June 5, 754, Dokkum, Frisia; feast day June 5) English missionary and reformer. Originally named Wynfrith, he became a Benedictine monk and then a priest. He made two attempts to convert the Frisian Saxons; in 718 he journeyed to Rome, where Pope Gregory II entrusted him with a mission to the pagans east of the Rhine and gave him the name Boniface. In 722 at Hesse he founded the first of many Benedictine monasteries. He was active for 10 years (725–735) in Thuringia. He established four bishoprics in Bavaria, paving the way for its incorporation into the Carolingian empire. He convened five synods (740–745) to reform the Frankish clergy and Christian missionaries and a council (747) to reform the entire Frankish kingdom. He was killed by a band of Frisians while reading the Bible to recent converts.

Boniface of Querfurt, Saint See Saint Bruno of Querfurt

Boniface VIII *orig.* **Benedict Caetani** (b. c. 1235, Anagni, Papal States—d. Oct. 11, 1303, Rome) Pope (1294–1303). Born into an influential Roman family, Caetani studied law in Bologna and rose through the papal government to become cardinal-deacon (1281) and pope. In 1296 his attempt to end hostilities between Edward I of England and Philip IV of France became embroiled in the issue of taxation of clergy without papal consent. When Boniface issued a bull forbidding such taxation, Philip fought back with economic measures. They clashed again in 1301 over control of the clergy when Philip had a French bishop tried and imprisoned. Eventually, hearing that Boniface planned to excommunicate Philip, Philip's supporters captured the pope; though rescued two days later, he died shortly thereafter.

Bonifácio, José See Jose Bonifacio de Andrada e Silva

Bonin \'bō-nin\ **Islands** *Japanese* **Ogasawara-shotō** \ō-ˌgä-sä-'wär-ä-'shō-tō\ Island group, western Pacific Ocean. Administratively part of Japan and located about 600 mi (950 km) south of Tokyo, the group consists of islands with a total area of about 40 sq mi (100 sq km). The Bonins include some 30 mountainous islands such as Chichi (the largest), Haha, Muko, and Yome. They were colonized in 1830 by a group of Europeans and Hawaiians. The islands were formally annexed by Japan in 1876; they were administered by the U.S. in 1945–68.

Bonington \'bä-niŋ-tən**, Richard Parkes** (b. Oct. 25, 1801, Arnold, Eng.—d. Sept. 23, 1828, London) British painter active in France. In 1818 he went to Paris to study with Antoine-Jean Gros. His skill in watercolour, a novelty in Paris, attracted many imitators. He exhibited at the famous "English" Salon of 1824 and won a gold medal. With John Constable and J.M.W. Turner, he popularized the oil sketch, a rapidly executed record of the transitory effects of nature. He became influential in England and France as a master of the Romantic movement and a technical innovator. His death at age 26 cut short a brilliant career.

bonito \bə-'nē-tō\ Swift, predaceous schooling fishes (genus *Sarda*) of the mackerel family (Scombridae). Bonitos, found worldwide, have a striped back and silvery belly and grow to about 30 in. (75 cm) long. Like tunas, they are streamlined, with a narrow tail base, a forked tail, and a row of small finlets behind the dorsal and anal fins. Bonitos have both commercial and sporting value. The three generally recognized species are found in the Atlantic and Mediterranean, the Indo-Pacific, and the Pacific.

Bonn City (pop., 2002 est: city, 306,000; metro. area, 878,700), Germany. Located on the Rhine River south of Cologne, it was, until 1990, the capital of West Germany. An old settlement that predated the coming of the Romans, its name was continued in Castra Bonnensia, a 1st-century Roman fortress. By the 9th century it had become the Frankish town of Bonnburg. It grew from the 13th century, becoming capital of the Electorate of Cologne. In 1815 Bonn was awarded to Prussia by the Congress of Vienna, and by the late 19th century it was a fashionable residential town. It was bombed heavily in World War II; its postwar redevelopment was accelerated when in 1949 it was chosen as West Germany's capital.

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With Germany's reunification in 1990, the national capital was moved to Berlin. Bonn was the birthplace of Ludwig van Beethoven.

Bonnard \bȯ-'närˈ**, Pierre** (b. Oct. 3, 1867, Fontenay-aux-Roses, Fr.—d. Jan. 23, 1947, Le Cannet) French painter and printmaker. He studied at the Académie Julian and the École des Beaux-Arts (1888–89). In the 1890s he became a leading member of the Nabis group and came under the influence of Art Nouveau and Japanese prints. With his friend Édouard Vuillard, he developed the intimate domestic interior scene, a genre known as Intimism, depicting fashionable Parisian life in the years before World War I. He also produced still lifes, self-portraits, seascapes, and large-scale decorative paintings. In 1910 he discovered the south of France and began a series of luminous landscapes of the Mediterranean region. He was fascinated by perspective, which he employed in paintings such as *The Dining Room* (1913). From the 1920s he specialized in landscapes, interiors, views of gardens, and bathing nudes. He produced illustrations for the celebrated journal *Revue blanche* and decorative pages for Paul Verlaine's book of poetry *Parallèlement* (1900). Bonnard was one of the greatest colourists of modern art.

Bonnefoy, Yves (b. June 24, 1923, Tours, France) French poet. A student of mathematics, Bonnefoy moved to Paris and came under the influence of the Surrealists. His poetry describes a thought universe brought to life by an intuition of the "real world." Among his poetry collections are *In the Shadow's Light* (1987), *The Beginning and End of Snow* (1991), and *New and Selected Poems* (1995). Bonnefoy, also a scholar, compiled *Mythologies* (1981), a dictionary of mythologies and religions. He held the chair in comparative poetics at the Collège de France from 1981 to 1994.

Bonnet \bȯ-'nāˈ**, Georges-Étienne** (b. July 23, 1889, Bassillac, France—d. June 18, 1973, Paris) French politician. Elected to the Chamber of Deputies (1924–40), he became a leader of the Radical-Socialist Party. He served as finance minister (1937–38) and foreign minister (1938–39) and was a prominent supporter of appeasement of Nazi Germany. He also supported the Vichy regime. After the liberation, proceedings against him were started but dropped. He was expelled from the Radical Party in 1944, readmitted in 1952, and again expelled in 1955. He later served in the Chamber of Deputies (1956–68).

bonnet monkey Agile Indian macaque (*Macaca radiata*) named for the thatch of long hair forming a cap, or "bonnet," on the crown. It is grayish brown and has a hairless pink face. It is 14–24 in. (35–60 cm) long, excluding its 20–28-in. (50–70-cm) tail, and weighs 7–20 lbs (3–9 kg). It sometimes raids gardens or stores of food.

Bonnet monkey (*Macaca radiata*).
WARREN GARST/TOM STACK & ASSOCIATES

Bonnie and Clyde *in full* **Bonnie Parker and Clyde Barrow** (respectively b. March 24, 1909, Telico, Texas, U.S.—d. May 23, 1934, near Gibsland, La.; b. Oct. 1, 1910, Rowena, Texas, U.S.—d. May 23, 1934, near Gibsland, La.) U.S. criminals. After Barrow spent time in prison (1930–32), he and Parker began a 21-month crime spree, robbing gas stations, restaurants, and small-town banks in Texas, Oklahoma, New Mexico, and Missouri and murdering a number of people. Their exploits received wide coverage in the press. Betrayed by a friend, they were ambushed by police officers along a highway in Gibsland, La.; as they attempted to flee, police opened fire, killing them. Their exploits inspired numerous books and films.

Bonnie Prince Charlie See Charles Edward, the Young Pretender

bonobo \bə-'nō-bōˈ\ Species (*Pan paniscus*) of great ape. It was once considered a subspecies of the chimpanzee, which it closely resembles in size, appearance, and way of life. Its range, the lowland rainforests of central Congo (Kinshasa), is more restricted than that of the chimpanzee, and it has longer, more slender arms, a more slender body, and a less protruding face. Bonobos eat mainly fruits but also leaves, seeds, grass, and small animals. They form communities of 50–120 individuals. A striking feature of their social lives is that they engage in sexual activity with great frequency, often as a means of settling quarrels, and with little regard for gender or age. Populations are shrinking, largely because of hunting and habitat destruction, and bonobos are an endangered species.

Bononcini \ˌbō-nōn-'chē-nēˈ**, Giovanni** (b. July 18, 1670, Modena, Duchy of Modena—d. July 9, 1747, Vienna) Italian composer. His father was Giovanni Maria Bononcini (1642–78), *maestro di cappella* of Modena Cathedral and the composer of numerous church and chamber sonatas. Giovanni himself served as *maestro di cappella* at San Giovanni in Monte; he later held desirable positions in various European capitals. In London in the 1720s he had a celebrated operatic rivalry with George Frideric Handel. He wrote more than 30 operas, some 20 oratorios, and nearly 300 cantatas (most for solo voice and continuo), but they are rarely heard today. His brother Antonio Maria Bononcini (1677–1726) was also a composer.

bonsai (Japanese: "tray planting") Living dwarf tree or trees; also, the art of training and growing them in containers. Bonsai specimens are ordinary trees and shrubs, not hereditary dwarfs; they are dwarfed by a system of pruning roots and branches and training branches by tying them with wire. The art originated in China but has been pursued and developed primarily by the Japanese. The direct inspiration for bonsai is found in nature, in trees that grow in harsh, rocky places and are dwarfed and gnarled throughout their existence. Prized characteristics are an aged-looking trunk and branches and weathered-looking exposed upper roots. Bonsai may live for a century or more and are handed down from one generation to another as valued family possessions. Bonsai pots, usually earthenware and of variable shape, are carefully chosen to harmonize in colour and proportion with the tree. A sizable bonsai industry exists as part of the nursery industry in Japan; California is home to a small-scale bonsai industry.

Bonsai pine.
JUDITH GROFFMAN

Bontemps \bän-'täm**, Arna(ud) (Wendell)** (b. Oct. 13, 1902, Alexandria, La., U.S.—d. June 4, 1973, Nashville, Tenn.) U.S. writer of the Harlem Renaissance. At age three Bontemps moved with his family to California. His poetry began appearing in the black magazines *Crisis* and *Opportunity* in the 1920s. With Countee Cullen he turned his first novel, *God Sends Sundays* (1931), into the play *St. Louis Woman*. Two later novels dealt with slave revolts. He edited anthologies with Langston Hughes and wrote prolifically for children, mostly nonfiction works on African Americans and African American history. He worked at Fisk University for most of his adult life.

Bonus Army World War I veterans who gathered in Washington, D.C., in summer 1932 to demand payment of their promised bonuses. More than 12,000 veterans and their families camped near the U.S. Capitol, urging support for a bill to force early payment of bonuses already voted by Congress. When the bill was defeated, most of the crowd returned home, but some angry protests caused local authorities to ask Pres. Herbert Hoover for federal assistance. Army troops led by Gen. Douglas MacArthur drove out the protesters and burned their camps. The resulting public outcry was a factor in Hoover's defeat in the 1932 election. Another group of veterans gathered in 1933, but Congress again rejected bonus legislation. In 1936 Congress finally enacted a bill that paid nearly $2 billion in veterans' benefits.

bony fish Any member of the vertebrate class Osteichthyes, including the great majority of living fishes and all the world's sport and commercial fishes. Also called Pisces, the class excludes jawless fishes (hagfishes and lampreys) and cartilaginous fishes (sharks, skates, and rays). There are more than 20,000 species worldwide, all with a skeleton at least partly composed of true bone. Other features include, in most species, a swim bladder (an air-filled sac to give buoyancy), gill covers over the gill chamber, bony platelike scales, a skull with sutures, and external fertilization of eggs. Bony fishes occur in all freshwater and ocean environments.

booby Any of six or seven species of large tropical seabirds (family Sulidae), named for their presumed lack of intelligence. Two common species are wide-ranging in the Atlantic, Pacific, and Indian oceans;

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another is found in the Pacific from southern California to northern Peru and on the Galápagos Islands. The booby has a long bill, cigar-shaped body, and long, narrow, angular wings. It flies high above the ocean looking for schools of fish and squid, which it snatches in a vertical dive. Boobies vary in length from 25 to 35 in. (65–85 cm). They nest in colonies but are territorial.

book Written (or printed) message of considerable length, meant for circulation and recorded on any of various materials that are durable and light enough to be easily portable. The PAPYRUS roll of ancient Egypt is more nearly the direct ancestor of the modern book than is the clay tablet; examples of both date to c. 3000 BC. Somewhat later, the Chinese independently created an extensive scholarship based on books, many made of wood or bamboo strips bound with cords. Lampblack ink was introduced in China c. AD 400 and printing from wooden blocks in the 6th century. The Greeks adopted the papyrus roll and passed it on to the Romans. The PARCHMENT or vellum CODEX superseded the papyrus roll by AD 400. Medieval parchment or vellum leaves were prepared from the skins of animals. By the 15th century, paper manuscripts were common. Printing spread rapidly in the late 15th century. Subsequent technical achievements, such as the development of offset printing, improved many aspects of book culture. In the late 1990s, downloadable electronic books became available over the Internet.

book club Marketing service that offers books to subscribers through the mail, often at reduced prices. The first U.S. book club, the Book-of-the-Month Club, was founded in 1926; the rival Literary Guild appeared a year later. By the 1980s nearly 100 book clubs existed in the U.S., most of them specialized (e.g., for history books, mysteries, etc.). A common incentive for attracting new members is the offer of several free or heavily discounted books; long-standing members often receive bonuses.

Book of Common Prayer Liturgical book used by the churches of the Anglican Communion. First authorized for the Church of England in 1549, it went through several versions; the 1662 revision has remained the standard (with minor changes) throughout the Commonwealth of Nations. The Church of ENGLAND and the Protestant EPISCOPAL CHURCH in the U.S. adopted a liturgy in contemporary language in the 1970s.

Book of Kells ILLUMINATED MANUSCRIPT version of the four Gospels, c. late 8th–early 9th century. A masterpiece of the ornate HIBERNO-SAXON STYLE, it features geometric design (rather than naturalistic representation), flat areas of colour, and complex interlaced patterns. The illumination was probably begun at the Irish monastery on the Scottish island of Iona; the book was apparently taken to the monastery of Kells in County Meath, Ire., after a Viking raid and may have been completed there. See also LINDISFARNE GOSPELS.

Book of the Dead Ancient Egyptian collection of mortuary texts made up of spells and charms and placed in tombs to aid the deceased in the next world. It was probably compiled and reedited during the 16th century BC. Later compilations included hymns to RE. Scribes produced and sold copies, often colorfully illustrated, for burial use. Of the many extant copies, none contains all of the approximately 200 known chapters.

bookbinding Joining together of leaves of paper, parchment, or vellum within covers to form a BOOK or CODEX. Bookbinding developed when the codex replaced the roll. Early bindings were often splendidly decorated, but the typical artistic bookbinding is of decorated leather and was first produced in the monasteries of Egypt's Coptic Church. Rare books, historical documents, and manuscripts may be bound by hand. The cover (case) of the typical book is now affixed to the leaves by machine.

bookcase Piece of furniture fitted with shelves, formerly often enclosed by doors. In early times the ambry, or wall cupboard, was used to hold books. Bookcases were included in the medieval fittings of college libraries in Britain. The earliest dated domestic examples were made of oak in 1666 for the diarist SAMUEL PEPYS.

Booker Prize *in full* **(2002–) Man Booker Prize** Prestigious British award given annually to a full-length novel. It was established in 1968 by the multinational company Booker McConnell as a counterpart to the French Prix Goncourt. The Booker Prize Foundation administers the prize, aided by an advisory committee. Entries, which are nominated by publishers, must be written by an English-language author from the United Kingdom, the Commonwealth countries, Ireland, or South Africa. Its winners have included KINGSLEY AMIS, A.S. BYATT, RUTH PRAWER JHABVALA, and SALMAN RUSHDIE. In 1992 a Booker Russian Novel Prize was introduced.

bookkeeping Recording of the money values of business transactions. Bookkeeping provides the information from which accounts are prepared but is distinct from ACCOUNTING. Bookkeeping offers information on both the current value, or EQUITY, of an enterprise and on its change in value (due to profit or loss) over a given time period. Managers require such information to examine the results of operations and budget for the future; investors need it to make decisions about buying or selling securities; and credit grantors use it to determine whether to grant a loan. Financial records were kept in Babylon and in ancient Greece and Rome. The double-entry method of bookkeeping began with the development of the Italian commercial republics of the 15th century. The Industrial Revolution stimulated the spread of bookkeeping, and 20th-century taxation and government regulations made it a necessity. Two types of records continue to be used in bookkeeping—journals and ledgers. They can be recorded by hand or entered into a computer. The journal contains daily transactions (sales, purchases, etc.), while the ledger contains the record of individual accounts. Each month an income statement and a BALANCE SHEET are posted in the ledger.

bookmaking Gambling practice of determining odds and receiving and paying off bets on the outcome of sporting events and other competitions. Horse racing is perhaps most closely associated with bookmaking, but boxing, baseball, football, basketball, and other sports have also long been of interest to bookmakers ("bookies") and gamblers. Morning-line odds, established by legal bookmakers, are printed in the sports sections of newspapers throughout the U.S. Illegal bookmaking operations have often been linked to ORGANIZED CRIME. See also HANDICAP.

bookplate Label with a printed design pasted inside the front cover of a book to identify its owner. It probably originated in Germany in the mid-15th century; the earliest extant dated bookplate (1516) is German. The earliest American example is dated 1749. Bookplate designs include portraits, views of libraries, and landscapes, as well as symbols of the owner's interests or occupation (e.g., military trophies, palettes), and, toward the end of the 19th century, nude figures.

Jane Patterson's bookplate designed by Robert Anning Bell, English, 1890s
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

Boole, George (b. Nov. 2, 1815, Lincoln, Eng.—d. Dec. 8, 1864, Ballintemple, Ire.) British mathematician. Though basically self-taught and lacking a university degree, in 1849 he was appointed professor of mathematics at Queen's College in Ireland. His original and remarkable general symbolic method of logical inference is fully stated in *Laws of Thought* (1854). Boole argued persuasively that logic should be allied with mathematics rather than with philosophy, and his two-valued algebra of logic, now called BOOLEAN ALGEBRA, is used in telephone switching and by electronic digital computers.

George Boole, engraving.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Boolean algebra Symbolic system used for designing logic circuits and networks for DIGITAL COMPUTERS. Its chief utility is in representing the truth value of statements, rather than the numeric quantities handled by ordinary algebra. It lends itself to use in the binary system employed by digital computers, since the only possible truth values, true and false, can be represented by the binary digits 1 and 0. A circuit in computer memory can be open or closed, depending on the value assigned to it, and it is the integrated work of such circuits that

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give computers their computing ability. The fundamental operations of Boolean logic, often called Boolean operators, are "and," "or," and "not"; combinations of these make up 13 other Boolean operators.

boomerang Curved throwing stick used chiefly by the aborigines of Australia for hunting and warfare. About 12–30 in. (30–75 cm) in length, the returning boomerang varies in shape from a deep curve to almost straight sides of an angle. The ends are twisted or skewed in opposite directions. It is held at one end, above and behind the thrower's shoulder, and swung forward rapidly. Just before release, the thrower adds spin by flicking the wrist so that the stick will loop around and return to him. Returning boomerangs were used only in eastern and western Australia as playthings, in tournament competition, and by hunters to imitate hawks for driving flocks of game birds into nets. The longer, straighter, and heavier nonreturning boomerang can kill animals and even humans.

boomslang Venomous snake (*Dispholidus typus*) of the savannas of sub-Saharan Africa, the only species of its family that is decidedly dangerous to humans. When hunting, it lies in wait in a bush or tree for chameleons and birds; the forepart of the body often extends motionless into the air. The boomslang's body and eye colours are extremely variable and provide excellent camouflage. In defense it inflates its neck, showing the dark skin between the scales, and then may strike. Its venom causes hemorrhages and can be fatal to humans in small amounts.

Boomslang (*Dispholidus typus*)
DADE THORNTON FROM THE NATIONAL AUDUBON SOCIETY COLLECTION—PHOTO RESEARCHERS/EB INC.

Boone, Daniel (b. c. Nov. 2, 1734, Berks county, Pa.—d. c. Sept. 26, 1820, St. Charles, Mo., U.S.) U.S. frontiersman and legendary hero. He lived on the North Carolina frontier as a hunter and trapper. He made several trips through the Cumberland Gap into eastern Kentucky (1767, 1769–71) and in 1775 was employed to blaze a permanent trail, called the Wilderness Road. He established the settlements of Boonesboro and Harrodsburg. As a militia captain he defended Boonesboro against the Indians; he was captured by the Shawnee in 1778 but escaped after five months to warn Boonesboro of an impending attack. After losing his Kentucky land claims in the late 1780s, he moved to the Missouri Territory. His exploits were featured in a widely read history of Kentucky and in Lord Byron's epic poem *Don Juan*.

Boorman, John (b. Jan. 18, 1933, Shepperton, Middlesex, Eng.) British film director. As head of the BBC's documentary film unit in Bristol (1962–64) he produced the acclaimed *Citizen 63* series. After directing his first feature film in 1965, Boorman directed *Point Blank* (1967) and *Hell in the Pacific* (1968) in the U.S. His successful *Deliverance* (1972) was a harrowing tale of endurance and survival. Later films include *Excalibur* (1981) and *Hope and Glory* (1987).

Booth, Edwin (Thomas) (b. Nov. 13, 1833, near Belair, Md., U.S.—d. June 7, 1893, New York, N.Y.) U.S. actor. Born into a noted theatrical family, he played his first starring roles in Boston and New York City in 1857. He became famous as Hamlet, appearing in the role for 100 consecutive nights in 1864–65. When his brother John Wilkes Booth assassinated Pres. Abraham Lincoln, Edwin withdrew from the stage until 1866. In 1869 he opened his own theatre, but mismanagement forced him to sell it in 1873. His interpretations of Hamlet, Iago, and King Lear won great acclaim in England and Germany. He founded the Players' Club in New York in 1888.

Edwin Booth, photograph by Bradley and Rulofson
COURTESY OF THE THEATRE COLLECTION, THE NEW YORK PUBLIC LIBRARY AT LINCOLN CENTER, ASTOR, LENOX AND TILDEN FOUNDATIONS

Booth, John Wilkes (b. May 10, 1838, near Bel Air, Md., U.S.—d. April 26, 1865, near Port Royal, Va.) U.S. actor and assassin of Pres. Abraham Lincoln. Born into a family of famous actors, he achieved success in Shakespearean roles but resented the greater acclaim enjoyed by his brother, Edwin Booth. A fanatical believer in slavery and the Southern cause, he made plans with co-conspirators to abduct Lincoln; after several failed attempts, he vowed to destroy the president and his cabinet. On April 14, 1865, he shot Lincoln during a performance at Ford's Theatre. Though he broke his leg jumping from the president's box, he was able to escape on horseback to a Virginia farm. Tracked down, he refused to surrender and was shot, either by a soldier or by himself.

Booth, William (b. April 10, 1829, Nottingham, Nottinghamshire, Eng.—d. Aug. 20, 1912, London) British religious leader, founder and general (1878–1912) of the Salvation Army. At age 15 he underwent a religious conversion and became a revivalist preacher. In 1849 he went to London, where he became a regular preacher of the Methodist New Connection (1852–61) and then an independent revivalist. Aided by his wife, Catherine Mumford Booth (1829–90), a fellow preacher and social worker, he founded the Christian Mission in 1865, which in 1878 became the Salvation Army. He traveled worldwide to lecture and organize branches of the Army. His proposals for remedying social ills received widespread acceptance and the encouragement of Edward VII.

Boothia Peninsula Peninsula, Nunavut, Canada. Almost an island, it is the northernmost point of the North American mainland, reaching 71°58' N, and was formerly the location of the north magnetic pole. With an area of 12,483 sq mi (32,330 sq km), it extends into the Arctic Ocean and is separated from Baffin Island by the Gulf of Boothia and from Prince of Wales Island by the Franklin Strait. It was discovered in 1829 by James Clark Ross, who named it Boothia Felix for Sir Felix Booth, the expedition's financier. It is sparsely populated.

bootlegging Illegal traffic in liquor in the U.S. The term was probably first used to describe the practice of concealing flasks of illicit liquor in boot tops when going to trade with Indians. It became widely used in the 1920s when the 18th Amendment to the Constitution and the Volstead Act of 1919 effected the prohibition of liquor manufacturing and sales. Early bootleggers smuggled foreign-made liquor into the U.S. from Canada and Mexico and from ships anchored in international waters. Later sources included medicinal whiskey, denatured alcohol, and the manufacture of corn liquor. Bootlegging led to the rise of organized-crime syndicates that controlled operations from the manufacture of liquor to its distribution in restaurants and speakeasies. In 1933 Prohibition was repealed by the 21st Amendment. Some counties and municipalities continue to ban liquor, and bootlegging is still practiced.

bop See bebop

Bophuthatswana \ˌbō-pü-tä-'tswä-nä\ Former political entity, South Africa. Consisting of a group of noncontiguous black enclaves, it was established by South African authorities as a "homeland" for the Tswana people and granted its independence in 1977, with its capital at Mmabatho. It was never internationally recognized as independent. Under the 1993 South African constitution, Bophuthatswana was dissolved and the area was reincorporated into South Africa. Its various enclaves, with a population of more than 2,500,000, became parts of Orange Free State (now Free State) and the newly created North-West and Eastern Transvaal (now Mpumalanga) provinces.

Bopp \'bȯp**, Franz** (b. Sept. 14, 1791, Mainz, archbishopric of Mainz—d. Oct. 23, 1867, Berlin, Prussia) German linguist. He published the first lengthy comparative analysis of Indo-European languages, his voluminous *Comparative Grammar of Sanskrit, Zend, Latin, Lithuanian, Old Slavic, Gothic, and German* (1833–52). Though the relation of Sanskrit to European languages was known at the time, Bopp was a pioneer in isolating common elements in the verbal and nominal morphology of Sanskrit and other older Indo-European languages. Most of his career was spent at the University of Berlin.

borage Large hairy annual herb (*Borago officinalis*), an ornamental species with large, rough, oblong leaves and loose, drooping clusters of starlike blue flowers. It is a member of the family Boraginaceae, which contains mostly herbs but also some trees and shrubs, all found in tropical, subtropical, and temperate areas and most concentrated in the Mediterranean region. Several other ornamental species are grown in gardens, including the Virginia bluebell (*Mertensia virginica*), forget-me-nots,

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HELIOTROPES, and lungworts (*Pulmonaria*). Borage is also used as an herbal and bee plant and eaten as a vegetable.

Borage (*Borago officinalis*).
A TO Z BOTANNICAL COLLECTION/EB INC.

Borah, William E(dgar) (b. June 29, 1865, Fairfield, Ill., U.S.—d. Jan. 19, 1940, Washington, D.C.) U.S. senator (1907–40). He practiced law in Boise, Idaho, and in 1892 became the state's Republican Party chairman. In the Senate he wielded great power as chairman of the foreign relations committee from 1924. A champion of ISOLATIONISM in foreign policy, he was best known for his role in preventing the U.S. from joining the LEAGUE OF NATIONS; he also opposed efforts to aid the Allies before the U.S. entered World War II. A maverick Republican, he supported many of the NEW DEAL programs to relieve economic hardship and sponsored bills establishing the Department of Labor as well as the federal Children's Bureau.

borax *or* **tincal** \'tiŋ-kəl\ Sodium tetraborate decahydrate ($Na_2B_4O_7 \cdot 10H_2O$), a soft, light, colourless crystalline mineral used as a component of glass and pottery glazes in the ceramics industry, as a solvent for metal-oxide slags in metallurgy, as a flux in welding and soldering, and as a fertilizer additive, a soap supplement, a disinfectant, a mouthwash, and a water softener. About 50% of the world's supply comes from southern California deserts, including DEATH VALLEY.

Borch, Gerard ter See Gerard TERBORCH

Bordeaux \bȯr-'dō\ City (pop., 1999: city, 215,363; metro. area, 753,931), southwestern France. Lying on the GARONNE RIVER above its junction with the DORDOGNE, Bordeaux has long been noted for its wine production. As Burdigala, it was the chief town of the Bituriges Vivisci, a Celtic people. Under Roman rule it was capital of Aquitania province. As part of the inheritance of ELEANOR OF AQUITAINE, Bordeaux became English in 1154 on her husband's accession to the English throne as HENRY II. It enjoyed great prosperity through a thriving trade with the English until it was united with France on the English defeat in the HUNDRED YEARS' WAR (1453). As a GIRONDIN centre, it suffered severely in the FRENCH REVOLUTION. In 1870, during the FRANCO-PRUSSIAN WAR, the French government was transferred to Bordeaux, as it was again in 1914 at the outbreak of World War I. Its university, founded in 1441, educated such figures as MONTESQUIEU. The economy focuses on the service sector.

Borden, Sir Frederick (William) (b. May 14, 1847, Cornwallis, Nova Scotia—d. Jan. 6, 1917, Canning, Nova Scotia, Can.) Canadian politician. After studying at Harvard University, he returned to Nova Scotia to practice medicine. In 1874 he was elected as a Liberal Party member to the House of Commons, where he served almost continuously until 1911. As minister of militia and defense (1896–1911), he improved the training of the armed services and helped create a Canadian navy.

Borden, Lizzie (Andrew) (b. July 19, 1860, Fall River, Mass., U.S.—d. June 1, 1927, Fall River) U.S. murder suspect. The daughter of a businessman, she lived with her wealthy but parsimonious father and stepmother. On Aug. 4, 1892, Lizzie (according to her testimony) discovered her father and his wife dead in their home, brutally mutilated with a sharp instrument. Lizzie and the maid admitted to being in the house at the time of the murders. Lizzie was arrested and tried for both crimes, the maid being suspected as an accomplice. Evidence against Lizzie included her attempt to buy prussic acid (a poison) the day before the murders took place. An ax, which some suspected was the murder weapon, was found in the basement. Acquitted because of the circumstantial nature of the evidence, she remained in Fall River until her death, largely ostracized by the community.

Borden, Sir Robert (Laird) (b. June 26, 1854, Grand Pré, Nova Scotia—d. June 10, 1937, Ottawa, Ont., Can.) Prime minister of Canada (1911–20). He practiced law in Halifax, Nova Scotia, from 1874 and later founded one of the largest law firms in the Maritime Provinces. In 1896 he was elected to the Canadian House of Commons; he became leader of the Conservative Party in 1901. As prime minister, he implemented conscription in World War I and represented Canada in Britain's imperial war cabinet. He insisted on separate Canadian membership in the League of Nations, which helped transform Canada from a colony to an independent country.

border collie Breed of long-haired SHEEPDOG that has been used along the English-Scottish border for about 300 years. Usually black and white, it stands about 20 in. (50 cm) and weighs 30–50 lbs (14–23 kg). It is the most popular working sheepdog in the British Isles.

Bordet \bȯr-'dā**, Jules (-Jean-Baptiste-Vincent)** (b. June 13, 1870, Soignies, Belg.—d. April 6, 1961, Brussels) Belgian bacteriologist and immunologist. In 1895 he found that two blood serum components cause bacteriolysis (bacterial cell-wall rupture), one a heat-stable antibody in animals immune to the bacterium and the other a heat-sensitive complement in all animals. In 1898 he discovered hemolysis (rupture of foreign erythrocytes), a similar process that also requires complement. This research was vital to the foundation of serology, the study of immune reactions in body fluids. His work with Octave Gengou led to serological tests for many diseases, including typhoid, tuberculosis, and syphilis (the Wassermann test). In 1906 they discovered *Bordetella pertussis*, which causes whooping cough. In 1919 Bordet received a Nobel Prize.

Borduas \bȯr-dūe-'äs**, Paul-Émile** (b. Nov. 1, 1905, Saint-Hilaire, Que., Can.—d. Feb. 22, 1960, Paris, France) Canadian painter. He was trained in Montreal as a church decorator and later studied in Paris. In the early 1940s, influenced by SURREALISM, he began to produce "automatic" paintings and with JEAN-PAUL RIOPELLE founded the radical abstract group known as Les Automatistes (c. 1946–51). His later works are reminiscent of those of JACKSON POLLOCK, but the only U.S. influence he acknowledged was that of FRANZ KLINE. See also AUTOMATISM.

boreal forest See TAIGA

Borg, Björn (Rune) (b. June 6, 1956, Södertälje, Swed.) Swedish tennis player. Turning professional at age 14, Borg was noted for his powerful serve and two-handed backhand. He became the first man to win the Wimbledon singles championship five successive times (1976–80) since Laurie Doherty (1902–6) and the first to win the French Open four times in a row and six times in all (1974–75, 1978–81). By the time he finally lost at Wimbledon to JOHN MCENROE (1981), he had won a record 41 straight Wimbledon singles matches. He won a lifetime total of 11 grand-slam titles. He retired in 1983.

Borge \'bȯr-gə**, Victor** *orig.* **Borge Rosenbaum** (b. Jan. 3, 1909, Copenhagen, Den.—d. Dec. 23, 2000, Greenwich, Conn., U.S.) Danish-born U.S. comedian and pianist. He studied at the Copenhagen Music Conservatory and later in Vienna and Berlin. Initially performing as a concert musician, he soon developed a style that combined comedy with classical music, and he toured throughout Europe. In 1940 he immigrated to the U.S., where he achieved fame appearing in various venues, including radio, films, concert halls, Broadway, and television. Though he performed as soloist and guest conductor with many of the world's leading orchestras, his significant pianistic talent was often overshadowed by his highly popular humour.

Borges \'bȯr-hās**, Jorge Luis** (b. Aug. 24, 1899, Buenos Aires, Arg.—d. June 14, 1986, Geneva, Switz.) Argentine poet, essayist, and short-story writer. Educated in Switzerland, Borges recognized early that he would have a literary career. From the 1920s on he was afflicted by a growing hereditary blindness. In 1938 a severe head wound seemed to free his deepest creative forces. His blindness was total by the mid 1950s and forced him to abandon the writing of long texts and begin dictating his works. From 1955 he held the honorary post of director of Argentina's national library. Much of his work is rich in fantasy and metaphorical allegory, including the story collections *Ficciones* (1944), which won him an international following, and *The Aleph* (1949). *Dreamtigers* (1960) and *The Book of Imaginary*

Jorge Luis Borges.
COURTESY OF WELLESLEY COLLEGE, WELLESLEY, MASSACHUSETTS

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Beings (1967) almost erase the distinctions between prose and poetry. Though he later repudiated it, he is credited with establishing in South America the modernist Ultraist movement, a rebellion against the decadence of the established writers of the Generation of '98.

Borghese family \bōr-'gā-sā\ Noble Italian family, originally from Siena, who first gained fame in the 13th century as magistrates, ambassadors, and other public officials. They moved to Rome in the 16th century and there, after Camillo Borghese was elected (1605) as Pope Paul V, the family rose in wealth and fame. Prominent family members included the adopted Scipione Caffarelli (later Borghese) (1576–1633), a cardinal and patron of the arts, and Camillo F. L. Borghese (1775–1832), who married PAULINE BONAPARTE and played an important role in Franco-Italian relations.

Borgia \'bȯr-jä**, Cesare** *later* **duc de Valentinois** \vä-lä^{n}-tēn-'wä\ (b. c. 1475/76, probably Rome—d. 1507, near Viana, Spain) Italian military leader, illegitimate son of Pope Alexander VI, and brother of LUCREZIA BORGIA. He was made archbishop of Valencia (1492) and cardinal (1493). After his brother's murder (1497), he took command of the papal armies. In 1498 he resigned his ecclesiastical offices and married the sister of the king of Navarre, a move calculated to win French support for a campaign to regain control of the Papal States. Acting in concert with his father, Cesare won a series of military successes in the Papal States (1499–1503), gaining a reputation for ruthlessness and assassination; his political astuteness led NICCOLÒ MACHIAVELLI to cite him as an example of the new "Prince." Cesare's gains proved fruitless, however, when his father died (1503) and the new pope, JULIUS II, demanded that he give up his lands. He escaped from prison in Spain and died fighting for Navarre.

Borgia, Lucrezia (b. April 18, 1480, Rome—d. June 24, 1519, Ferrara, Papal States) Italian noblewoman. The daughter of the future pope ALEXANDER VI and sister of CESARE BORGIA, she was probably more an instrument for their ambitious projects than, as has been suggested, an active participant in their many crimes. Her three marriages into prominent families helped augment the political and territorial power of the Borgias. Her child may have been the issue of an incestuous relationship with her father. After her father's death (1503), she ceased to play a political role and increasingly turned to religion. She died at age 39.

Lucrezia Borgia, detail from the fresco the "Dispute of St. Catherine," by Pinturicchio, 1492–94; in the Vatican.
ALINARI/ART RESOURCE, NEW YORK

Borglum \'bȯr-gləm**, (John) Gutzon (de la Mothe)** (b. March 25, 1867, St. Charles, Idaho, U.S.—d. March 6, 1941, Chicago, Ill.) U.S. sculptor. Born to Danish immigrant parents, he studied art in Paris. In 1901 he opened a studio in New York City. His bronze group *The Mares of Diomedes* was the first U.S. sculpture purchased by the Metropolitan Museum of Art. He carved the head of ABRAHAM LINCOLN in the U.S. Capitol rotunda. In 1916 he was commissioned to sculpt a memorial to the Confederacy on Stone Mountain, Ga., but disputes with his patrons caused him to abandon the project in 1924; it was completed by others. His most notable project was the MOUNT RUSHMORE National Memorial (completed 1941).

Gutzon Borglum.
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

boring machine MACHINE TOOL for producing smooth and accurate holes in a workpiece by enlarging existing holes with a cutting tool, which may bear a single tip of steel, cemented carbide, or diamond or may be a small grinding wheel. The hole's diameter is controlled by adjusting the boring head. Bored holes are more accurate in roundness, concentricity, and parallelism than drilled holes. Boring machines used in toolmaking shops have a vertical spindle and a work-holding table that moves horizontally in two perpendicular directions so that holes can be accurately spaced. In mass-production plants, boring machines with multiple spindles are common. See also DRILL; DRILL PRESS; LATHE.

Boris I *orig.* **Mikhail** (d. May 2, 907, Preslave, Bulg.) Khan of Bulgaria (852–89). He resolved to use Christianity to unite his ethnically divided country, and an unsuccessful war with the Byzantines led to his baptism in the Orthodox faith (864). Boris's attempt to enforce mass baptism set off a pagan rebellion, which he quelled, and he helped establish the Bulgarian church. He sponsored missionaries to foster Slavic learning and the use of the OLD CHURCH SLAVIC LANGUAGE. He abdicated in 889 to become a monk but returned to drive his reactionary son Vladimir from the throne. After installing another son, SIMEON I, as khan, Boris went back to his monastery. He was later made an Orthodox saint.

Boris Godunov See Boris GODUNOV

Borlaug \'bȯr-ˌlȯg**, Norman (Ernest)** (b. March 25, 1914, Cresco, Iowa, U.S.) U.S. agricultural scientist and plant pathologist. He earned his Ph.D. at the University of Minnesota. As a researcher with the Rockefeller Foundation in Mexico (1944–60), he developed strains of grain that tripled Mexican WHEAT production. Later his dwarf wheats raised harvests in Pakistan and India by 60%, ending the food shortages that had plagued the subcontinent in the 1960s. For helping lay the groundwork of the GREEN REVOLUTION, he was awarded the Nobel Prize for Peace in 1970. Afterward he worked on improving crop yields in Africa and taught at Texas A&M University.

Bormann \'bȯr-ˌmän**, Martin** (b. June 17, 1900, Halberstadt, German Empire—d. May 1945, Berlin, Ger.) German Nazi leader. He joined the Nazi party in 1925 and served as RUDOLF HESS's chief of staff (1933–41). He was appointed head of the party chancellery in 1941 and became one of ADOLF HITLER's closest lieutenants. A shadowy but extremely powerful presence, Bormann controlled all legislation, party promotions and appointments, and the personal access of others to Hitler. He disappeared shortly after Hitler's death. Though some reports allege that he escaped to South America, German authorities officially declared him dead after exhuming his presumed remains.

Born, Max (b. Dec. 11, 1882, Breslau, Ger.—d. Jan. 5, 1970, Göttingen, W.Ger.) German physicist. He taught theoretical physics at the University of Göttingen from 1921 to 1933, when he fled to Britain. There he taught principally at the University of Edinburgh (1936–53). In 1921 he gave a very precise definition of quantity of heat, the most satisfactory mathematical statement of the first law of thermodynamics. In 1926 he collaborated with his student WERNER HEISENBERG to develop the mathematical formulation that would adequately describe Heisenberg's first laws of a new quantum theory. He later showed, in the work for which he is perhaps best known, that the solution of the SCHRÖDINGER EQUATION has a statistical meaning of physical significance. His later work concerned the scattering of atomic particles and calculations dealing with the electronic structures of molecules. In 1954 he shared a Nobel Prize for Physics with Walther Bothe (1891–1957).

Max Born
COURTESY OF GODFREY ARGENT; PHOTOGRAPH, WALTER STONEMAN

Borneo Island, MALAY ARCHIPELAGO. Bounded by the South CHINA SEA, the Sulu and CELEBES seas, the MAKASSAR STRAIT, and the JAVA SEA, it is the third largest island in the world, measuring 290,320 sq mi (751,929 sq km). The northern part includes the Malaysian states of Sabah and Sarawak and the sultanate of Brunei; the southern section forms part of Indonesia. Borneo is mountainous and largely covered in dense rainforest; its highest point is Mount Kinabalu, at 13,455 ft (4,101 m). Much of it is drained

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by navigable rivers, including the Rajang, which are the principal lifelines of trade and commerce. It is mentioned in Ptolemy's *Guide to Geography* (c. AD 150); Roman trade beads give evidence of an earlier civilization. Brahman and Buddhist images in the Gupta style indicate the influence of Indians who apparently arrived in the 5th century. With the arrival of Islam in the 16th century, various Muslim kingdoms were founded, some of which owed allegiance to Java. Around the same time, the Portuguese, followed by the Spanish, set up trading stations. In the early 17th century the Dutch broke the Portuguese-Spanish monopoly, but they in turn had to deal with newly established British interests. After World War II, Sarawak and North Borneo (later Sabah) became British crown colonies. Strong nationalist sentiment emerged in Dutch Borneo, and sovereignty passed to Indonesia in 1949. The British relinquished Sabah and Sarawak to the Malaysian federation in 1963, while Brunei became independent in 1984.

Bornholm Island (pop., 2001: 44,126), Denmark. Lying in the Baltic Sea south of Sweden, it has an area of 227 sq mi (588 sq km). Its seat is at Rønne. Once a Viking stronghold, it was seized by the Hanseatic League in 1510. Until 1660 it was held for varying periods by Sweden and Denmark, but it has since been Danish. It is now a popular tourist resort.

bornite Common copper-ore mineral, copper and iron sulfide (Cu_5FeS_4). Typical occurrences are found in Mount Lyell, Tasmania; Chile; Peru; and Butte, Mont. Bornite may form isometric crystals but occurs most commonly as irregular masses. Under appropriate geologic conditions, it alters to chalcocite and other copper minerals.

Bornu Historical region, northeastern Nigeria. Prominent physical features include a vast plain, a volcanic plateau, and swamps south of Lake Chad. Now inhabited chiefly by the Kanuri people, it constituted a Muslim kingdom from about the 11th century. Together with Kanem it later formed an empire (see Kanem-Bornu), which reached the height of its power c. 1570–1600. In 1902 it became part of Nigeria, which was then under British rule. The region is largely contained in Nigeria's present-day state of Borno.

Borobudur \ˌbō-rō-bü-'dür\ Buddhist monument in central Java, built c. 778–850 under the Shailendra dynasty. Constructed with about 2 million cu ft (57,000 cu m) of gray volcanic stone, it resembles a stepped pyramid. Its base and first five terraces are square; the highest three terraces are circular. Reliefs on its terrace walls represent the ascending stages of enlightenment. The simple and spacious upper circular terraces carry 72 bell-shaped stupas, each containing a statue of the Buddha.

Borobuḍur, Java, Indonesia.
ROBERT HARDING PICTURE LIBRARY/PHOTOBANK BKK

Borodin \ˌbȯr-ə-'dēn**, Aleksandr (Porfiryevich)** (b. Nov. 12, 1833, St. Petersburg, Russia—d. Feb. 27, 1887, St. Petersburg) Russian composer. From 1862 he took lessons from Mily Balakirev; fired by nationalist sentiment, the two men became the core of the group of Russian composers known as The Five. A professor of chemistry for much of his life, he left a small compositional output, which includes the orchestral suite *In the Steppes of Central Asia* (1880), two string quartets, and three symphonies, the second of which has remained highly popular. His opera *Prince Igor*—which contains the often-heard "Polovtsian Dances"—was left unfinished after 18 years of intermittent work.

Borodin \bə-rə-'dyēn,\ *English* \ˌbȯr-ə-'dēn**, Mikhail (Markovich)** *orig.* **Mikhail Gruzenberg** (b. July 9, 1884, Yanovichi, Russia—d. May 29, 1951, Siberia) Russian diplomat. He joined the Bolshevik faction in 1903, was arrested (1906), and lived in exile in the U.S. He returned to Russia in 1917 and in 1923 was sent to China as an adviser to Sun Yat-sen. There he built the loosely structured Nationalist Party (Guomindang) into a highly centralized Leninist-style organization and helped the Chinese Nationalists develop their army. After leaving China (1927), he served as deputy director of the Tass news agency and editor of the *Moscow Daily News* (1932–49). He was arrested in a Stalinist purge of Jewish intellectuals and died in a Siberian labour camp.

Borodino, Battle of (Sept. 7, 1812) Bloody battle of the Napoleonic Wars, fought during Napoleon's invasion of Russia, near the town of Borodino, about 70 miles (110 km) west of Moscow. Napoleon's 130,000 troops won a narrow victory over 120,000 Russians under Mikhail Kutuzov. The Russians suffered about 45,000 dead and wounded, while the French lost about 30,000 men. The victory allowed Napoleon to occupy Moscow.

boron Semimetallic chemical element, chemical symbol B, atomic number 5. Pure crystalline boron is a black, lustrous, very hard but brittle semiconductor that does not occur naturally. Boron compounds are found widely dispersed as various minerals, including borax and the gemstone tourmaline. The element is used to harden certain steels, among other metallurgical uses, and is also used in semiconductor devices. Its borate compounds, in which it has valence 3, are essential to plant growth and have many uses in soaps, mild antiseptics, and eye ointments. Industrially, they are used as herbicides, fire retardants in fabrics, and catalysts in numerous organic chemical reactions. They are also used in electroplating and glass and ceramic formulations. The exceptional hardness and inertness of certain boron compounds, including boron carbide, aluminum boride, and boron nitride (which has an electronic structure resembling that of diamond), make them useful as abrasives and reinforcing agents, particularly for high-temperature applications.

Borromeo \ˌbōr-rō-'mā-ō**, Saint Charles** (b. Oct. 1538, Arona, duchy of Milan—d. Nov. 3, 1584, Milan; canonized 1610; feast day November 4) Archbishop of Milan and leading figure in the Counter-Reformation. He earned a doctorate in canon and civil law at the University of Pavia in 1559. His uncle, Pope Pius IV, appointed him cardinal and archbishop of Milan in 1560. He was active in directing the Council of Trent, and he later helped execute its decrees and draw up the Roman catechism in 1566. He established seminaries and colleges in Milan and nearby cities and gained renown for his heroic behaviour during the plague of 1576–78.

Borromini, Francesco *orig.* **Francesco Castelli** (b. Sept. 25, 1599, Bissone, Duchy of Lombardy—d. Aug. 2, 1667, Rome) Italian Baroque architect. Though he worked with Gian Lorenzo Bernini on the design of the famous baldachin in St. Peter's Basilica, the two later became bitter rivals. Borromini's first independent commission was the Roman church and monastery of San Carlo alle Quattro Fontane (1638–41), the dome of which appears to float because its spring points (see arch) and light sources are concealed below. His works, composed of flowing concave and convex forms, contain spaces that are irregular ovals and polygons, as at Sant'Ivo della Sapienza (1642–60). His fortunes declined in later years, and in 1667 he committed suicide. His influence was felt in northern Italy and central Europe in the next century.

Interior of the dome of the church of S. Ivo della Sapienza, Rome, by Francesco Borromini, 1642–60.
GEKS

Borsippa \bȯr-'si-pə\ Ancient city, Babylonia. Located southwest of Babylon (near modern Al-Ḥillah, Iraq), its proximity to that capital helped it become an important religious centre. Hammurabi built or rebuilt the temple at Borsippa, dedicating it to the deity Marduk. During the reign of Nebuchadrezzar II, the city reached its greatest prosperity. Borsippa was destroyed by Xerxes I in the early 5th century BC and never fully recovered.

borzoi \'bȯr-ˌzȯi\ Breed of hound developed in Russia. It is descended from the Arabian greyhound and a collielike Russian sheepdog. Formerly known as the Russian wolfhound, it was originally bred to hunt wolves and hares. It is graceful, strong, and swift, attaining a height of about 26–31 in. (66–79 cm) and a weight of 55–105 lbs (25–48 kg). It has a long, narrow head; small ears; a deep but narrow chest; long, muscular hindquarters; and a long, curved tail. Its silky coat is flat or slightly curled and usually is white with darker markings. It is noted for its elegant appearance.

Borzoi
SALLY ANNE THOMPSON/EB INC.

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Bosanquet \'bō-zən-ˌket**, Bernard** (b. June 14, 1848, Alnwick, Northumberland, Eng.—d. Feb. 8, 1923, London) British philosopher. He helped revive in Britain the absolute IDEALISM of G.W.F. HEGEL and sought to apply its principles to social and political problems. His debt to Hegel is most evident in his works on ethics, aesthetics, and metaphysics. His *Some Suggestions in Ethics* (1918) presents a view of reality as a synthesis in which traditional oppositions such as pleasure/duty and egoism/altruism are reconciled. His other works include *Knowledge and Reality* (1885), *Logic* (1888), and *History of Aesthetic* (1892). His idealism was attacked by G.E. MOORE and BERTRAND RUSSELL.

Bosch \'bòsh**, Hiëronymus** *orig.* **Jeroen van Aken** *or* **Jerome van Aken** (b. c. 1450s, 's Hertogenbosch, Brabant—d. Aug. 9, 1516, 's Hertogenbosch) Netherlandish painter. He was the son and grandson of accomplished painters; his name comes from his native town of 's Hertogenbosch. He enjoyed a successful career and was widely imitated. Of the numerous works attributed to him, none can be dated precisely. His paintings blend fantasy and reality in apocalyptic scenes of chaos with half-human, half-animal creatures, devils, and demons interacting with human figures in imaginary architecture and landscapes. Among his best-known works is *The Garden of Earthly Delights*, depicting the dreams that afflict people who live in a pleasure-seeking world. One of the most original northern European artists of the late Middle Ages, he was an outstanding draftsman and one of the first to make drawings as independent works. He also produced decorative works, altarpieces, and stained-glass designs.

Bosch (Gaviño) \'bòsh**, Juan** (b. June 30, 1909, La Vega, Dom. Rep.—d. Nov. 1, 2001, Santo Domingo) Scholar, poet, and president of the Dominican Republic (1963). Bosch was raised in a lower-middle-class family. Dismayed by the brutality of the dictator RAFAEL TRUJILLO, he spent 24 years in exile but returned after Trujillo's death to build a leftist anti-communist movement. After winning the first free presidential election in 38 years, he instituted liberal constitutional changes, many of which benefited the country's poor. His reforms, however, alienated landholders and industrialists, and after only seven months in office Bosch was ousted in a military coup. When his supporters revolted against the ruling junta in 1965, U.S. Pres. Lyndon B. Johnson, claiming that Bosch's followers were communists, sent troops to suppress the rebellion. Over the subsequent three decades, Bosch ran repeatedly but unsuccessfully for president.

Bose \'bōs**, Subhas Chandra** (b. Jan. 23, 1897, Cuttack, Orissa, India—d. Aug. 18, 1945, Taipei, Taiwan?) Indian revolutionary. Preparing in Britain for a career in the Indian civil service, he resigned his candidacy on hearing of nationalist turmoil back home. Sent by MOHANDAS K. GANDHI to organize in Bengal, he was deported and imprisoned several times. He favoured industrialization, which put him at odds with Gandhi's economic thought, and though he was elected president of the INDIAN NATIONAL CONGRESS in 1938 and 1939, without Gandhi's support he felt bound to resign. He slipped out of India in 1941 and carried on his struggle against the British from Nazi Germany and later from Southeast Asia. In 1944 he invaded India from Burma (Myanmar) with a small army of Indian nationals and Japanese, but his army was soon forced to retreat. He fled Southeast Asia after the Japanese surrender in 1945 and died of burns suffered in a plane crash.

Bose-Einstein statistics One of two possible ways (the other is FERMI-DIRAC STATISTICS) in which a collection of indistinguishable particles may occupy a set of available discrete energy states. The gathering of particles in the same state, which is characteristic of particles that obey Bose-Einstein statistics, accounts for the cohesive streaming of LASER light and the frictionless creeping of superfluid helium (see SUPERFLUIDITY). The theory of this behaviour was developed in 1924–25 by Satyendra Nath Bose (1894–1974) and ALBERT EINSTEIN. Bose-Einstein statistics apply only to those particles, called BOSONS, which have integer values of SPIN and so do not obey the PAULI EXCLUSION PRINCIPLE.

Bosna \'bòs-nä\ **River** River, Bosnia and Herzegovina. Rising at the foot of Mount Igman, it flows northward 168 mi (271 km) before entering the SAVA RIVER. Major cities along the Bosna include Zenica and Doboj.

Bosnia and Herzegovina \'bäz-nē-ə...ˌher-tsə-gō-'vē-nə\ Country, BALKAN PENINSULA, southeastern Europe. It is bounded by Serbia and Montenegro and by Croatia. Area: 19,772 sq mi (51,209 sq km). Population (2005 est.): 3,853,000. Capital: SARAJEVO. Major ethnic groups include Bosniacs (Bosnian Muslims; about two-fifths of the population), Serbs

(about one-third), and Croats (about one-fifth). Languages: Bosnian, Serbian, Croatian (all official). Religions: Christianity (mostly Eastern Orthodox; also Roman Catholic), Islam. Currency: marka. The country's relief is largely mountainous, and elevations of more than 6,000 ft (1,800 m) are common. The land, drained by the SAVA, DRINA, and Neretva rivers and their tributaries, drops abruptly southward toward the ADRIATIC SEA. Agriculture is a mainstay of the economy; though the area possesses a variety of minerals, it remains one of the poorest regions of the former YUGOSLAVIA. Bosnia and Herzegovina is a republic with two legislative houses; its chief of state is the chairman of the tripartite presidency, and the head of government is the chairman of the Council of Ministers. Habitation long predates the era of Roman rule, during which much of the country was included in the province of DALMATIA. Slav settlement began in the 6th century AD. For the next several centuries, parts of the region fell under the rule of Serbs, Croats, Hungarians, Venetians, and Byzantines. The Ottoman Turks invaded Bosnia in the 14th century, and after many battles it became a Turkish province in 1463. Herzegovina, then known as Hum, was taken in 1482. In the 16th and 17th centuries the area was an important Turkish outpost, constantly at war with the HABSBURGS and VENICE. During this period much of the population converted to Islam. At the Congress of BERLIN after the RUSSO-TURKISH WAR of 1877–78, Bosnia and Herzegovina were assigned to AUSTRIA-HUNGARY, and they were annexed in 1908. Growing Serbian nationalism resulted in the 1914 assassination of the Austrian archduke FRANCIS FERDINAND at Sarajevo by a Bosnian Serb, an event that precipitated World War I. After the war the area became part of the Kingdom of Serbs, Croats, and Slovenes. Following World War II, the twin territories became a republic of communist Yugoslavia. With the collapse of communist regimes in eastern Europe, Bosnia and Herzegovina declared its independence in 1992; its Serbian population objected, and conflict ensued among Serbs, Croats, and Muslims (see BOSNIAN CONFLICT). A peace accord in 1995 established a loosely federated government roughly divided between the Muslim-Croat Federation of Bosnia and Herzegovina and the Serb Republic. In 1996 a NATO peacekeeping force was installed there.

Bosnian conflict (1992–98) Ethnically rooted war in BOSNIA AND HERZEGOVINA, a republic of Yugoslavia with a multiethnic population—44% Bosniac (formerly known as Muslim), 33% Serb, and 17% Croat. Unrest began with Yugoslavia's breakup in 1990; after a 1992 referendum, the European Community (now European Union) recognized Bosnia's independence. Bosnia's Serbs responded violently, seized 70% of Bosnian territory, besieged Sarajevo, and terrorized Bosniacs and Croats in what came to be known as "ethnic cleansing." After bitter fighting between the Bosnian Croats and the Bosnian government, international pressure forced

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the two factions to sign a cease-fire and an agreement for a federation. Both then concentrated on their common enemy, the Serbs. After rejected peace plans and continued warring, Western nations, with NATO backing, imposed a final cease-fire negotiated at Dayton, Ohio, in 1995. Bosnia and Herzegovina became a single state composed of two distinct entities. Today Bosnia and Herzegovina has three de facto monoethnic entities, three separate armies and police forces, and a very weak national government. See also RADOVAN KARADZIC, FRANJO TUDJMAN.

Bosnian crisis (1908) International crisis caused by Austria-Hungary's annexation of the Balkan provinces of Bosnia and Herzegovina. Russia supported Serbia, which protested the annexation and demanded that Austria cede part of the territory to Serbia, but Austria-Hungary, supported by Germany, threatened to invade Serbia if it persisted in its demands. Since Russia could not risk war against both Germany and Austria-Hungary, it was forced to accept the annexation. Though the crisis was resolved without immediate warfare, it contributed to the outbreak of WORLD WAR I.

boson \'bō-ˌzän\ SUBATOMIC PARTICLE with integral SPIN that is governed by BOSE-EINSTEIN STATISTICS. Bosons include MESONS, nuclei of even mass number, and the particles required to embody the fields of QUANTUM FIELD THEORY. Unlike FERMIONS, there is no limit to the number of bosons that can occupy the same quantum state, a behaviour that gives rise to the SUPERFLUIDITY of helium-4.

Bosporus \'bäs-pə-rəs\ *Turkish* **Karadeniz Bogazi** \ˌkä-rä-de-'nēz-ˌbō-ä-'zi\ Strait separating European Turkey from Asian Turkey. Connecting the Sea of MARMARA with the BLACK SEA, it is 19 mi (31 km) long and 2.8 mi (4.4 km) at its widest. Bosporus literally means "ox ford"; it is traditionally connected with the legendary figure of Io, who in the form of a heifer crossed the Thracian Bosporus in her wanderings. Because of its strategic importance for the defense of Constantinople (modern ISTANBUL), which straddled its southern end, the Byzantine emperors and later the Ottoman sultans constructed fortifications along its shores. With the growing influence of the European powers in the 19th century, rules were codified governing the transit of vessels through the strait. An international commission assumed control of it after World War I; Turkey resumed control in 1936. Two of the world's longest bridges, completed in 1973 and 1988, span the strait.

Bosporus, Kingdom of the *or* **Cimmerian Bosporus** Ancient Greek kingdom, in modern southern Ukraine. It was first settled by Milesians (6th century BC) at Panticapaeum, which later became the capital. Gradually the kingdom grew to include all of the CRIMEA. It maintained close ties with Athens in the 5th–3rd century BC, reaching the peak of its power in the 4th century BC. It came under the rule of the kings of Pontus after 110 BC. For 300 years it belonged to the Roman Empire, and after AD 342 it was alternately under barbarian and Byzantine control.

Bosra See BOSTRA

Bossuet \bȯ-'swā**, Jacques-Bénigne** (b. Sept. 25, 1627, Dijon, France—d. April 12, 1704, Paris) French bishop. Ordained a priest in 1652, he gained a reputation as a great orator and popular preacher. In 1681 he became bishop of Meaux. He was the most eloquent and influential spokesman for the rights of the French church against papal authority in the 17th century. He is now chiefly remembered for his literary works, including funeral panegyrics.

Boston Seaport city (pop., 2000: 589,141), capital of Massachusetts, U.S. Located on Massachusetts Bay, an arm of the Atlantic Ocean, it is the state's largest city. Settled in 1630 by Puritan Englishmen of the Massachusetts Bay Company, Boston became the hub of the self-governing MASSACHUSETTS BAY COLONY under the leadership of Gov. JOHN WINTHROP. At the forefront of the opposition to British trade restrictions on its American colonies, Boston was a locus of events leading to the AMERICAN REVOLUTION: it was the scene of the BOSTON MASSACRE (1770) and BOSTON TEA PARTY (1773). It was the centre for the antislavery movement (1830–65). As the INDUSTRIAL REVOLUTION took hold in the U.S., Boston grew as an important manufacturing and textile centre. Today financial and high-technology industries are basic to the economy of the Boston area. Numerous institutions of higher education are located there, including Boston University. See also CAMBRIDGE.

Boston Globe, The Daily newspaper published in Boston, one of the more influential newspapers in the U.S. Founded in 1872, it was purchased in 1877 by Charles H. Taylor. Under his leadership, it began publishing morning and evening editions, increased local and regional coverage, and introduced big headlines, especially on sensational stories. In the 20th century, still headed by the Taylor family, the paper began providing more national and international news while maintaining a generally liberal editorial stance. The NEW YORK TIMES Co. acquired the *Globe* in 1993.

Boston Massacre Skirmish on March 5, 1770, between British troops and a crowd in Boston. After provocation by the colonists, British soldiers fired on the mob and killed five men, including CRISPUS ATTUCKS. The incident was widely publicized by SAMUEL ADAMS, PAUL REVERE, and others as a battle for American liberty, and it contributed to the unpopularity of the British in the years before the AMERICAN REVOLUTION.

Boston Police Strike Strike in 1919 by most of Boston's police force to protest the police commissioner's decision to deny them the right to unionize. The mayor called in the city militia to restore order and break the strike; Gov. CALVIN COOLIDGE later sent in the state militia, which gave him a reputation as a strong supporter of law and order and led to his nomination as vice president on the 1920 Republican ticket.

Boston Strangler American serial killer who murdered at least 11 and as many as 13 women in the Boston area between 1962 and 1964. The killer's first victim, a 55-year-old woman, was sexually assaulted and strangled in her apartment on June 14, 1962. During the following months, several other elderly women were murdered in similar circumstances, though subsequent victims included young women. In 1965 Albert DeSalvo, an inmate at a state mental hospital, confessed to the murders. Although never charged with the killings because no physical evidence tied him to the murder scenes, he was convicted on separate counts of sexual assault and sentenced to life imprisonment. DeSalvo's guilt remains controversial, in part because his confessions demonstrated ignorance of many aspects of the crimes. DNA tests in 2001 confirmed that it was all but impossible that DeSalvo was guilty of the last of the murders, though it was one of the crimes to which he had confessed.

Boston Tea Party Incident on Dec. 16, 1773, in which American patriots dressed as Indians threw 342 chests of tea from three British ships into Boston Harbour. Their leader was SAMUEL ADAMS. The action was taken to prevent the payment of a British-imposed tax on tea and to protest the British monopoly of the colonial tea trade authorized by the TEA ACT. In retaliation, Parliament passed the punitive INTOLERABLE ACTS, which further united the colonies in their opposition to the British.

Boston terrier Breed of dog developed in the late 19th century in Boston. Bred from the English BULLDOG and a white English TERRIER, the Boston terrier is one of the few breeds to have originated in the U.S. It has a terrier-like build, dark eyes, a short muzzle, and a short, fine coat of black or brindle, with white on the face, chest, neck, and legs. It stands 14–17 in. (36–43 cm) high and ranges in weight from 15 to 25 lbs (7–11 kg). The breed is characteristically gentle and affectionate.

Bostra *modern* **Buṣra** \'bůs-rə\ **al-Shām** Ruined city, southwestern Syria. Lying south of DAMASCUS, it was first a Nabataean city and was later conquered by the Romans (see ROMAN REPUBLIC AND EMPIRE) under TRAJAN. It was the capital of the Roman province of Arabia and served as a fortress east of the JORDAN RIVER. It became the see of a bishop early in the 4th century AD but fell to the Muslims in the 7th century. Crusaders captured the city in the 12th century but failed to hold it, and it quickly fell into decline. It is the site of monumental remains of temples, triumphal arches, aqueducts, churches, and mosques.

Boswell, detail of an oil painting from the studio of Sir Joshua Reynolds, 1786; in the National Portrait Gallery, London

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Boswell, James (b. Oct. 29, 1740, Edinburgh, Scot.—d. May 19, 1795, London, Eng.) Scottish friend and biographer of SAMUEL JOHNSON. Boswell, a lawyer, met Johnson in 1763 and visited him often (1772–84), making a superlatively detailed record in his journals of Johnson's conversations. His two-volume *Life of Samuel Johnson, LL.D.* (1791) is

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regarded as one of the greatest English biographies. His *Journal of a Tour to the Hebrides* (1785) is mainly an account of Johnson's responses to their 1773 trip to Scotland. The 20th-century publication of Boswell's journals showed him to have been also one of the world's greatest diarists.

Bosworth Field, Battle of (Aug. 22, 1485) Final battle in the English Wars of the Roses. It was fought between the forces of King Richard III of York and the contender for the crown, Henry Tudor (later Henry VII) of Lancaster. The battle occurred when Henry returned from exile, landing with an army at Milford Haven and meeting Richard's forces 12 mi (19 km) west of Leicester. The king's men were defeated and put to flight, and Richard was unhorsed and killed in a bog (a scene depicted in William Shakespeare's *Richard III*). The battle established the Tudor dynasty on the English throne.

botanical garden *or* **botanic garden** Originally, a collection of living plants designed to illustrate relationships within plant groups. Most modern botanical gardens are concerned primarily with exhibiting ornamental plants in a scheme that emphasizes natural relationships. A display garden of mostly woody plants (shrubs and trees) is often called an arboretum. The botanical garden as an institution can be traced to ancient China and many Mediterranean countries, where such gardens were often centers for raising plants used for food and medicines. Botanical gardens are also reservoirs of valuable heritable characteristics, potentially important in the breeding of new varieties of plants. Still another function is the training of gardeners. The world's most famous botanical garden is Kew Gardens.

botany Branch of biology that deals with plants, including the study of the structure, properties, and biochemical processes of all forms of plant life, as well as plant classification, plant diseases, and the interactions of plants with their physical environment. The science of botany traces back to the ancient Greco-Roman world but received its modern impetus in Europe in the 16th century, mainly through the work of physicians and herbalists, who began to observe plants seriously to identify those useful in medicine. Today the principal branches of botanical study are morphology, physiology, ecology, and systematics (the identification and ranking of all plants). Subdisciplines include bryology (the study of mosses and liverworts), pteridology (the study of ferns and their relatives), paleobotany (the study of fossil plants), and palynology (the study of modern and fossil pollen and spores). See also forestry, horticulture.

Botany Bay Inlet of the South Pacific Ocean, southeastern Australia. Lying south of Sydney off Port Jackson, it is about 6 mi (10 km) at its widest. It was the scene of the first Australian landing by Capt. James Cook in 1770; he named the bay for its great variety of plants. It was selected in 1787 as the site for a penal settlement, but the settlement was soon transferred inland. Its shores are now ringed by Sydney's suburbs.

Botero, Fernando (b. April 19, 1932, Medellín, Colom.) Colombian painter and sculptor. He began painting as a teenager. By the time he moved to New York City in 1960, he had developed his trademark style: the depiction of round, corpulent humans and animals. In these works, his use of flat, bright colour and boldly outlined forms reflected the influence of Latin American folk art, while his strong compositions often emulated the Old Masters. In 1973 Botero moved to Paris and began creating sculptures that again focused on rotund subjects. Successful outdoor exhibitions of his monumental bronze figures were staged around the world at the end of the 20th century.

botfly Any member of several dipteran families with beelike adults and larvae that are parasitic on mammals. Some species are serious pests of horses, cattle, deer, sheep, rabbits, and squirrels, and one species (the human botfly) attacks humans. Adults of several species lay many eggs (nits) on the host's body, and the emerging larvae penetrate its skin. The larvae reemerge through the skin, then mature into egg-laying adults. In the New World tropics, the botfly's infestation of cattle has led to loss of beef and hides. See also warble fly.

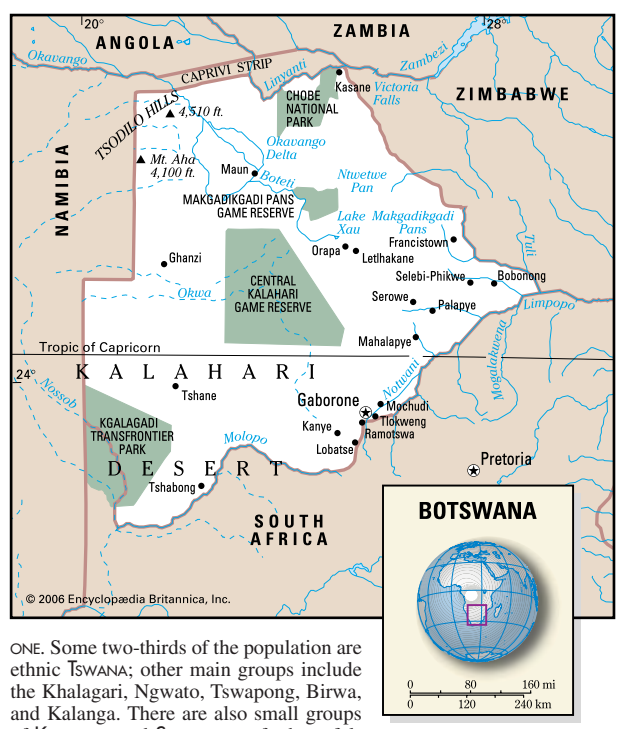
Botha \'bō-tə**, Louis** (b. Sept. 27, 1862, near Greytown, Natal [South Africa]—d. Aug. 27, 1919, Pretoria, Transvaal) First prime minister (1910–19) of the Union of South Africa. Botha was elected to the South African Republic's parliament in 1897, where he sided with moderates against Pres. Paul Kruger's hostile policy toward Uitlanders (non-Boer, mostly English, settlers). In the South African War he commanded southern forces besieging Ladysmith and then tried unsuccessfully to defend the Transvaal. As prime minister he sought earnestly to appease the English-speaking population and was bitterly attacked by Afrikaner nationalists. In World War I he acceded to British requests to conquer German South West Africa (Namibia).

Botha, P(ieter) W(illem) (b. Jan. 12, 1916, Paul Roux, S.Af.) Prime minister (1978–84) and first state president (1984–89) of South Africa. Elected to parliament as a National Party candidate in 1948, Botha served in several subsequent posts before replacing John Vorster as prime minister in 1978. His government faced serious difficulties, including the coming to power of black governments in Mozambique, Angola, and Zimbabwe, an insurgency in South West Africa (Namibia), and domestic unrest among black students and labour unions. Botha responded by backing antigovernment troops in the bordering states and suppressing rebellion at home. A target of criticism from within and outside his party, he fell ill and resigned in 1989.

Bothnia, Gulf of Northern arm of the Baltic Sea. Extending between Sweden and Finland, it covers about 45,200 sq mi (117,000 sq km). It is 450 mi (725 km) long and 50–150 mi (80–240 km) wide, with an average depth of 200 ft (60 m). Because many rivers drain into it, its salinity is very low; annual ice cover consequently lasts up to five months.

Botox Trademark for botulinum toxin type A, a drug produced by the bacterium *Clostridium botulinum*. It contains the same toxin that causes severe food poisoning (botulism). When locally injected, Botox blocks the release of the neurotransmitter acetylcholine, interfering with the ability of the muscle to contract. It is used to treat severe muscle spasm or severe, uncontrollable sweating. Botox can also be used for cosmetic purposes to treat facial wrinkles.

Botswana *officially* **Republic of Botswana** *formerly* **Bechuanaland** \ˌbech-ˈwä-nə-ˌland\ Country, southern Africa. Area: 224,848 sq mi (582,356 sq km). Population (2005 est.): 1,765,000. Capital: Gaborone. Some two-thirds of the population are ethnic Tswana; other main groups include the Khalagari, Ngwato, Tswapong, Birwa, and Kalanga. There are also small groups of Khoekhoe and San, some of whom follow a traditional nomadic way of life. Languages: English (official), Tswana. Religions: Christianity (mostly independent and unaffiliated Christians; also Protestant), traditional beliefs. Currency: pula. Botswana is essentially a sand-filled basin, with a mean elevation of about 3,300 ft (1,000 m). Part of the Kalahari Desert is in the southwest and west, while the Okavango Swamp is in the north. The only sources of permanent surface water are the Chobe River, which marks the Namibian boundary; the Okavango River, in the far northwest; and the Limpopo River, which marks



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the South African boundary in the southeast. The economy traditionally depends on livestock raising; the development of diamond mining has increased the country's wealth. Botswana is a republic with one legislative body; its head of state and government is the president. The region's earliest inhabitants were the Khoekhoe and San. Sites were settled as early as AD 190 during the southerly migration of Bantu-speaking farmers. Tswana dynasties, which developed in the western TRANSVAAL in the 13th–14th centuries, moved into Botswana in the 18th century and established several powerful states. European missionaries arrived in the early 19th century, but it was the discovery of gold in 1867 that excited European interest. In 1885 the area became the British Bechuanaland Protectorate, remaining so until the 1960s. In 1966 the Republic of Bechuanaland was proclaimed as an independent member of the British COMMONWEALTH, and later that year its name was changed to Botswana. Independent Botswana tried to maintain a delicate balance between its economic dependence on South Africa and its relations with the surrounding black countries; the independence of Namibia in 1990 and South Africa's rejection of apartheid eased tensions.

Botticelli \ˌbät-ə-ˈchel-ē\, **Sandro** *orig.* **Alessandro di Mariano Filipepi** (b. 1445, Florence—d. May 17, 1510, Florence [Italy]) Italian Renaissance painter. As a youth he may have been apprenticed to a goldsmith, and he later trained with FRA FILIPPO LIPPI in Florence. By 1470 he had developed a distinctive style and was established as a master. In 1481 he was among a team of Florentine and Umbrian artists called to Rome to decorate the SISTINE CHAPEL; three of his finest religious frescoes (completed 1482) can be seen there. Though prolific as a painter of religious images, his mythological paintings are his best-known works. His outstanding portraits show the influence of contemporary Flemish art in the placement of the figure in front of a landscape. Among his greatest works are the *Primavera*, *Pallas and the Centaur*, *Venus and Mars*, and *The Birth of Venus*, all painted c. 1477–90. About 75 of his paintings survive, many of them in the Uffizi Gallery in Florence. Interest in his work revived in the 19th century, and today he is one of the most esteemed painters of the Italian Renaissance.

The Birth of Venus, oil on canvas by Sandro Botticelli, c. 1485; in the Uffizi, Florence.
ART MEDIA/HERITAGE-IMAGES

bottlenose dolphin *or* **bottle-nosed dolphin** Widely recognized species (*Tursiops truncatus*) of MAMMAL belonging to the DOLPHIN family, found worldwide in warm and temperate seas. Bottlenose dolphins reach an average length of 8–10 ft (2.5–3 m) and weight of 300–650 lb (135–300 kg). Males are generally larger than females. A familiar performer at marine shows, the species is characterized by a "built-in smile" formed by the curvature of its mouth. It has also become the subject of scientific studies because of its intelligence and its ability to communicate with its kind through sounds and ultrasonic pulses.

bottom water Lowermost layer of ocean water that can be distinguished by its characteristic low temperature, high density, and low oxygen content compared with surface waters. Most bottom waters are formed near Antarctica during the southern winter. The partial freezing of seawater over the Antarctic continental shelf produces salt-free ice and residual brine with a high density, which causes it to sink; it then flows northward along the seafloor. The Arctic Ocean is less important as a source of bottom water because it is isolated by barriers such as the Bering Sill and submarine ridges and banks between Greenland and the British Isles.

botulism \ˈbä-chə-ˌli-zəm\ Poisoning by botulinum toxin, one of the most potent TOXINS known, produced by *Clostridium botulinum* bacteria. It usually results from improperly sterilized canned (mostly home-canned) foods. Heat-resistant spores of these anaerobic bacteria in fresh food may survive canning. The bacteria multiply and secrete toxin, which remains potent if the food is not well heated before it is eaten. Botulism can also result from wound infection. Botulinum toxin blocks nerve-impulse transmission. If botulism is recognized in time, administered ANTITOXINS can neutralize it. The first symptoms of botulism are nausea and vomiting, which usually appear six hours or less after the contaminated food is eaten. Fatigue, blurry vision, and general weakness follow. Respiratory paralysis can cause death if not treated with emergency tracheotomy and respiratory aid. Most victims recover completely if they survive paralysis. The bacteria's intense toxicity makes it a potentially deadly biological warfare agent.

Bouaké \bwä-ˈkā\ City (pop., 1995 est.: 330,000), central Côte d'Ivoire. It was established as a French military post in 1899 on the road and railroad line from ABIDJAN to BURKINA FASO (then Upper Volta). Bouaké is among the nation's largest cities and is the commercial and transportation hub of the interior.

Boucher \bü-ˈshā\, **François** (b. Sept. 29, 1703, Paris, Fr.—d. May 30, 1770, Paris) French painter, engraver, and designer. He was probably trained by his father, a minor painter. In 1723 he won the Prix de Rome, but he was unable to travel to Italy until 1728. For his first major commission he produced 125 engravings of drawings by ANTOINE WATTEAU. He executed important decorative commissions for Madame de POMPADOUR at Versailles. His playful style and frivolous subject matter exemplify the ROCOCO STYLE and embody the elegant superficiality of French court life in the mid 18th century. He became a member of the Royal Academy in 1734, a principal designer for the royal porcelain factories, and director of the Gobelins tapestry factory. In 1765 he was appointed director of the Royal Academy and first painter to LOUIS XV. One of the great painters and draftsmen of the 18th century, he mastered every branch of decorative and illustrative painting.

Boucher \ˈbaù-chər\, **Jonathan** (b. March 12, 1738, Cumberland, Eng.—d. April 27, 1804, Epsom, Surrey) English-American clergyman. He went to Virginia in 1759 as a private tutor. As rector of Annapolis, Md., he tutored GEORGE WASHINGTON's stepson and became a family friend. His royalist views cost him his position and he was forced to return to England in 1775. In his retirement he wrote *A View of the Causes and Consequences of the American Revolution* (1779); his glossary of "archaic and provincial words" was later used for NOAH WEBSTER's dictionary.

Boucicault \ˈbü-si-ˌkō\, **Dion** *orig.* **Dionysius Lardner Boursiquot** (b. Dec. 26, 1820/22, Dublin, Ire.—d. Sept. 18, 1890, New York, N.Y., U.S.) Irish-born U.S. playwright. He began acting in 1837 and wrote the successful comedy *London Assurance* (1841) and *The Corsican Brothers* (1852). In 1853 he moved to New York City, where he was instrumental in obtaining the first copyright law for drama in the U.S. His successful play *The Poor of New York* (1857) was presented elsewhere—as, for example, *The Poor of London*. Concerned with social themes, he wrote a veiled attack on slavery in *The Octoroon* (1859). He also wrote a series of popular Irish plays, including *The Colleen Bawn* (1860) and *The Shaughraun* (1874).

Boudiaf \bü-ˈdyäf\, **Mohamed** (b. June 23, 1919, M'Sila, Alg.—d. June 29, 1992, Annaba) Algerian political leader. With AHMED BEN BELLA, he cofounded the Algerian NATIONAL LIBERATION FRONT (FLN), which led the fight for Algerian independence from France (1954–62). He was imprisoned by the French from 1956 until Algerian independence in 1962, whereupon he became deputy premier under Ben Bella in the new government. His opposition to Ben Bella's autocratic style led to a 27-year exile. In 1992 he was invited back to head the government and to deal with rising religious influence in political affairs. He was assassinated by a bodyguard shortly thereafter. See also ISLAMIC SALVATION FRONT.

Boudicca \bü-ˈdik-ə\ *or* **Boadicea** \ˌbō-əd-ə-ˈsē-ə\ (d. AD 60) Ancient British queen. When her husband, a Roman client king of the Iceni, died in AD 60, he left his estate to his daughters and the emperor NERO, hoping for protection. Instead the Romans annexed his kingdom and mistreated his family and tribesmen. Boudicca raised a rebellion in East Anglia, burning

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Camulodunum (Colchester), Verulamium (St. Albans), and part of Londinium (London) and military posts; according to TACITUS, her forces massacred up to 70,000 Romans and pro-Roman Britons and destroyed the Roman 9th Legion. She is thought to have taken poison or died of shock when the Roman governor rallied his troops and destroyed her huge army.

Boudin \bü-'dan\, **Eugène** (b. July 12, 1824, Honfleur, Fr.—d. Aug. 8, 1898, Deauville) French landscape painter. Encouraged at an early age by JEAN-FRANÇOIS MILLET, Boudin became a strong advocate of painting directly from nature. In 1874 he exhibited with the Impressionists, but, unlike those painters, he was not an innovator, and from 1863 to 1897 he exhibited regularly in the official Salon. His favourite subjects were beach scenes and seascapes, which show remarkable sensitivity to effects of atmosphere; on the backs of his paintings he recorded the weather, light, and time of day. His works link the careful naturalism of the mid 19th century and the brilliant colours and fluid brushwork of IMPRESSIONISM.

boudinage \ˌbüd-ᵊn-'äzh\ Cylinder-like structures making up a layer of deformed rock. They commonly lie adjacent to each other and are joined by short necks, giving the appearance of a string of sausages (*boudin* is French for "sausage"). The necks may be filled with recrystallized minerals such as quartz, feldspar, or calcite. Boudinage occurs in a variety of rock types and is one of the more common structures found in folded rocks.

Boudinot \'büd-ᵊn-ō\, **Elias** (b. May 2, 1740, Philadelphia, Pa.—d. Oct. 24, 1821, Burlington, N.J., U.S.) U.S. public official. He became a lawyer in 1760. Though a conservative Whig, he supported the AMERICAN REVOLUTION. He was president of the CONTINENTAL CONGRESS in 1782–83 and later served in the U.S. House of Representatives (1789–95) and as director of the U.S. Mint at Philadelphia (1795–1805).

Bougainville \'bü-gən-ˌvil\ Island (pop., 2000: 175,160), PAPUA NEW GUINEA. The largest of the Solomon Islands, near the northern end of that chain, it has a land area of about 3,600 sq mi (8,500 sq km). The Emperor Range, with its highest peak at Balbi (9,000 ft [2,743 m]), occupies the northern half of the island, while the Crown Prince Range occupies the southern half. It was visited by Louis-Antoine de BOUGAINVILLE in 1768, and it came under German control in the late 19th century. After World War I it was included in an Australian mandate. Following World War II it was made part of the UN Trust Territory of New Guinea, and it passed to Papua New Guinea when that country became independent in 1975. A treaty signed in 2001 promised the island autonomy, which was attained in 2005.

Bougainville \bü-gan-'vēl\, **Louis-Antoine de** (b. Nov. 11, 1729, Paris, France—d. Aug. 3, 1811, Paris) French navigator. In 1764 he established a colony for France in the Falkland Islands. Commissioned by the government to circle the Earth in a voyage of exploration, he put to sea in 1766; after touching Samoa and the New Hebrides he continued west into waters not previously navigated by any European. He turned north on the fringes of the Great Barrier Reef and did not sight Australia. He stopped in the Moluccas and in Java before returning to Brittany in 1769. His widely read *Voyage Round the World* (1771) helped popularize a belief in the moral worth of people in their natural state. He was secretary to LOUIS XV (1772), led the French fleet in support of the American Revolution, and was named to the Legion of Honour by NAPOLEON. The plant genus *Bougainvillea* is named for him.

bougainvillea \ˌbü-gən-'vil-yə, ˌbü-gən-'vē-ə\ Any plant of the genus *Bougainvillea*, comprising about 14 species of shrubs, vines, or small trees (family Nyctaginaceae) native to South America and hardy in warm climates. Many species are spiny. Only the woody vines are widely popular; showy cultivated varieties of several species are often grown indoors. The inconspicuous flowers are surrounded by brightly coloured papery BRACTS, for which one species, *B. glabra*, is called paperflower. The bracts of various species range from purple to lemon-yellow.

Bouguereau \bü-gə-'rō\, **William (-Adolphe)** (b. Nov. 30, 1825, La Rochelle, Fr.—d. Aug. 19, 1905, La Rochelle) French painter. He entered the École des Beaux-Arts in 1846 and was awarded the Prix de Rome in 1850. On his return from Italy in 1854, he became a successful proponent of academic painting and was instrumental in the exclusion of the radical IMPRESSIONISTS from the official Salon. Working in a smooth, highly finished style, he painted sentimental religious works, coyly erotic nudes, allegorical scenes, and realistic portraits. In 1876 he was elected to the Academy of Fine Arts. His influence was felt widely, particularly in the U.S.

Bouillaud \bü-'yō\, **Jean-Baptiste** (b. Sept. 16, 1796, Garat, Fr.—d. Oct. 29, 1881, Paris) French physician and researcher. He established the speech centre's location in the brain and differentiated between speech loss because of inability to create and remember word forms and inability to control speech movements. In cardiology, he established the connection between carditis and acute articular rheumatism. He helped explain normal heart sounds and described many abnormal ones, and he was the first to name and accurately describe the endocardial membrane and endocarditis. He published important books on heart diseases and on rheumatism and the heart.

Boukhara See BUKHARA

Boukharouba, Mohammed ben Brahim See HOUARI BOUMÉDIENNE

Boulanger \bü-lan-'zhā\, **Georges (-Ernest-Jean-Marie)** (b. April 29, 1837, Rennes, France—d. Sept. 30, 1891, Brussels, Belg.) French general and politician. He entered the army in 1856, helped suppress the PARIS COMMUNE (1871), and rose in rank to brigadier general (1880) and director of infantry (1882). Named minister of war in 1886, he introduced various military reforms and was seen as the man destined to avenge France's defeat in the Franco-Prussian War. In 1888 he led a short-lived but influential authoritarian movement that threatened to topple the THIRD REPUBLIC. In 1889 the government decided to prosecute him, prompting him to flee Paris. He was convicted in absentia for treason, and in 1891 he committed suicide.

Georges Boulanger
H. ROGER-VIOLLET

Boulanger \bü-lan-'zhā\, **Nadia (-Juliette)** (b. Sept. 16, 1887, Paris, France—d. Oct. 22, 1979, Paris) French music teacher and conductor. Having studied composition with Charles-Marie Widor (1844–1937) and GABRIEL FAURÉ, she stopped composing in her twenties (after the death of her sister, Lili, who was also a composer) and devoted the rest of her life to conducting, playing the organ, and teaching at the École Normale (1920–39), Paris Conservatoire (from 1946), and especially the American Conservatory at Fontainebleau (from 1921). She became the most celebrated composition teacher of the 20th century; her many students included AARON COPLAND, ROY HARRIS, DARIUS MILHAUD, VIRGIL THOMSON, ELLIOTT CARTER, LEONARD BERNSTEIN, and PHILIP GLASS. Her sister, Lili Boulanger (1893–1918), wrote a remarkable amount of vocal and other music and was the first woman composer to win the Prix de Rome (1913).

Boulder City (pop., 2000: 94,673), north-central Colorado, U.S. Located at the base of the ROCKY MOUNTAINS northwest of DENVER, it was settled by miners in 1858 and grew with the arrival of two railroads in 1873. An extensive government-industrial-educational complex has developed since the 1950s. It is the site of the University of Colorado.

Boulder Dam See HOOVER DAM

boule \'bü-lē\ Deliberative council in the city-states of ancient Greece. It existed in almost all constitutional city-states, especially from the late 6th century BC. In ATHENS the boule was created as an aristocratic body by SOLON in 594 BC; later, under CLEISTHENES, 500 members were elected to represent the 10 TRIBES (50 each). A certain number, in rough proportion to size, were allotted to each DEME. Complementing the work of the ECCLESIA and AREOPAGUS, the boule controlled finances, managed the fleet and cavalry, evaluated officials, received foreign ambassadors, and advised the STRATEGUS. The boule model largely influenced the organization of councils of other cities in the Hellenic period.

boules \'bülz\ French ball game, similar to BOWLS and BOCCIE. Players take turns throwing or rolling a steel ball as close as possible to a small target ball; an opponent's ball may be knocked away if necessary. The playing field is called a pitch.

boulevard Broad landscaped avenue that typically permits several lanes of vehicular traffic as well as pedestrian walkways. The earliest

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boulevards originally followed the city walls (the word originally meant "bulwark") and were built in the ancient Middle East, especially at Antioch. In Paris, straight and geometrically precise boulevards were incorporated into design principles taught at the École des Beaux-Arts, and they form a prominent feature of the city. Similar boulevards are found in other cities such as Washington, D.C. Formal curving boulevards are a feature of such cities as Vienna and Prague.

Boulez \bü-'lez**, Pierre** (b. March 26, 1925, Montbrison, France) French composer and conductor. Originally a student of mathematics, he later studied with the composer and organist Olivier Messiaen at the Paris Conservatoire. Inspired by the works of Anton Webern, in the 1950s he began to experiment with total serialism; his serialist music is marked by a sensitivity to the nuances of instrumental texture and colour. In 1954 he founded a series of avant-garde concerts, the Domaine Musicale. His important works include *Le Soleil des eaux* (1948), *Structures I* and *II* (1952, 1961), *Le Marteau sans maître* (1957), *Pli selon pli* (1962), and three piano sonatas. By the 1960s he had gained an international reputation not only as a composer but also as a conductor, particularly of the 20th-century repertoire. He was chief conductor of the BBC Symphony Orchestra (1971–74) and conductor of the New York Philharmonic (1971–78). In 1974 he founded the French national experimental studio IRCAM. With his greatly varied activities, including his often iconoclastic writings, he was the principal figure of the postwar international musical avant-garde.

Boulle \'bül**, André-Charles** *or* **André-Charles Boule** (b. Nov. 11, 1642, Paris, Fr.—d. Feb. 29, 1732, Paris) French cabinetmaker. After studying drawing, painting, and sculpture, he achieved fame as the most skillful furniture designer in Paris. In 1672 Louis XIV appointed him royal cabinetmaker at Versailles; his other patrons included Philip V of Spain and the duke of Bourbon. Boulle stretched the technique of marquetry to new heights, and his incorporation of elaborate brasswork and the inlaying of exotic woods (called boulle or buhl work, since his last name sometimes appeared as Buhl) was heavily imitated in the 18th–19th centuries.

Boullée \bü-'lā**, Étienne-Louis** (b. Feb. 12, 1728, Paris, Fr.—d. Feb. 6, 1799, Paris) French architect, theorist, and teacher. He studied architecture and opened his own studio by age 19. Through his investigation of the properties of geometric forms, to which he attributed innate symbolic qualities, Boullée achieved a pure, modern Classicism. His greatest influence was as a teacher and theorist. In a series of theoretical plans for public monuments, culminating in the design (1784) for an immense sphere that would serve as a cenotaph honouring Isaac Newton, he gave imaginary form to his theories.

Boulogne, Jean See Giambologna

Boulsover \'bōl-ˌzō-vər**, Thomas** (b. 1706, Elkington, Derbyshire, Eng.—d. September 1788, Sheffield) British inventor of fused plating ("old Sheffield plate"). As a craftsman of the Cutlers Co. in 1743, while repairing a copper-and-silver knife handle, he discovered that the two metals could be fused and that when the fused metals were rolled in a rolling mill they behaved like a single metal. His invention opened the way to economical production of a great variety of plated objects, from buttons and snuffboxes, which he himself made, to hollowware (e.g., tea sets) and utensils, which were soon manufactured in large quantity by other Sheffield workers.

Boulton \'bōlt-ᵊn**, Matthew** (b. Sept. 3, 1728, Birmingham, Warwickshire, Eng.—d. Aug. 17, 1809, Birmingham) British manufacturer and engineer. With James Watt and William Murdock (1754–1839), he established the steam-engine industry by installing pumping engines to drain the Cornish tin mines. Foreseeing great industrial demand for steam power, he urged Watt to make various design improvements. Applying steam power to coining machinery, he made large quantities of coins for the British East India Co. and also supplied machinery to the Royal Mint. By 1800, almost 500 steam engines had been installed in the British Isles and abroad.

Boumédienne \bü-mād-'yen**, Houari** *orig.* **Mohammed ben Brahim Boukharouba** (b. Aug. 23, 1927, near Guelma, Alg.—d. Dec. 27, 1978, Algiers) Algerian political leader and president (1965–78). During Algeria's fight for independence, he helped raise an Algerian army in the safety of Morocco and Tunisia. He deposed President Ahmed Ben Bella in 1965. His policies in the 1970s created tensions with Morocco and France, but he also negotiated important industrial contracts with Western nations and cultivated close relations with the Soviet bloc, becoming a leading figure in the nonaligned movement.

boundary layer In fluid mechanics, a thin layer of flowing gas or liquid in contact with a surface (e.g., of an airplane wing or the inside of a pipe). The fluid in the boundary layer is subjected to shear forces. A range of velocities is established across the boundary layer, from zero (provided the fluid is in contact with the surface) to maximum. Flow in boundary layers is more easily described mathematically than is flow in the free stream. Boundary layers are thinner at the leading edge of an aircraft wing and thicker toward the trailing edge; such boundary layers generally have laminar flow in the leading (upstream) portion and turbulent flow in the trailing (downstream) portion. See also drag.

Bounty, HMS British armed transport ship remembered for the mutiny of its crew on April 28, 1789. Commanded by Capt. William Bligh, it had sailed to Tahiti, taken on a cargo of breadfruit trees, and traveled as far as the Friendly Islands (Tonga) on the voyage to Jamaica when it was seized by the master's mate, Fletcher Christian. The causes have been much debated; Bligh's opponents charged him with tyranny, while Bligh argued that the mutineers had become attached to Tahiti and its women. Bligh and 18 loyal crew members were set adrift in a longboat; after a voyage of more than two months and some 3,600 mi (5,800 km), they reached Timor. Christian and eight others took the *Bounty* to Pitcairn Island, where the small colony they founded remained undiscovered until 1808 and where their descendants still live. Of the mutineers who later went to Tahiti, three were taken to Britain and hanged.

bourbon See whiskey

Bourbon, Charles-Ferdinand de See duc de Berry

Bourbon \bür-'bōⁿ,\ *English* \'bůr-bən**, House of** One of the most important ruling houses of Europe. Its members were descended from Louis I, duc de Bourbon from 1327 to 1342, grandson of the French king Louis IX. Bourbons subsequently ruled in France (1589–1792, 1814–48); in Spain (1700–1868, 1870–73, 1874–1931, and since 1975); and in Naples and Sicily (1735–1861). Among its prominent members were Henry IV, Louis XIII, Louis XIV, Louis XV, Louis XVI, and Philip V.

Bourbon Restoration (1814–30) In France, the period that began when Napoleon abdicated and the Bourbon monarchs were restored to the throne. The First Restoration occurred when Napoleon fell from power and Louis XVIII became king. Louis's reign was interrupted by Napoleon's return to France (see Hundred Days), but Napoleon was forced to abdicate again, leading to the Second Restoration. The period was marked by a constitutional monarchy of moderate rule (1816–20), followed by a return of the ultras during the reign of Louis's brother, Charles X (1824–30). Reactionary policies revived the opposition liberals and moderates and led to the July Revolution, Charles's abdication, and the end of the Bourbon Restoration.

Bourbonnais \ˌbür-bȯ-'ne\ Historical region, central France. In Roman times it was part of Celtic Gaul under Julius Caesar and later part of Aquitania under Augustus. It gradually began a separate existence in the 10th century under a lord of Bourbon. It eventually passed to Louis, created duke de Bourbon in 1327, the ancestor of the Bourbon dynasty. Bourbonnais became part of the royal domain in 1527.

Bourdieu \bür-'dyœ**, Pierre** (b. Aug. 1, 1930, Denguin, France—d. Jan. 23, 2002, Paris) French sociologist and public intellectual. Bourdieu introduced the concept of cultural capital, wealth based on social status and education, noting that success in school and society depends largely on the individual's ability to absorb the cultural ethos, or what he termed *habitus*, of the dominant class. Influenced by structuralism, he suggested that habitus is similar to yet more fundamental than a language. His works include *The Algerians* (1962), *Outline of a Theory of Practice* (1977), *Distinction* (1984), and *Acts of Resistance: Against the Tyranny of the Market* (1998).

Bourgeois \bür-'zhwȧ**, Léon (-Victor-Auguste)** (b. May 21, 1851, Paris, France—d. Sept. 29, 1925, Château d'Oger, near Épernay) French politician. He entered the civil service in 1876 and was elected to the National Assembly in 1888. He served in several ministerial posts and was briefly premier (1895–96). He was a member of the Senate in 1905–23 and its president from 1920. An advocate of international cooperation, he was appointed to the International Court of Justice in 1903. In 1919 he was France's representative to the League of Nations, emerging as its champion. For this, in 1920 he was awarded the Nobel Prize for Peace.

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Bourgeois \bür-'zhwä**, Louise** (b. Dec. 25, 1911, Paris, Fr.) French-born U.S. sculptor. She studied briefly with FERNAND LÉGER and initially worked as a painter and engraver. In the late 1940s, after moving to New York City with her American husband, she turned to sculpture. She achieved recognition in the 1950s with wooden constructions painted uniformly black or white. She also worked in marble, plaster, latex, and glass. Though her works are abstract, they are suggestive of the human figure and express themes of betrayal, anxiety, and loneliness.

bourgeoisie \ˌbůrzh-ˌwä-'zē\ In social and political theory, the social order dominated by the property-owning class. The term arose in medieval France, where it denoted the inhabitant of a walled town. The concept of the bourgeoisie is most closely associated with KARL MARX and those who were influenced by him. According to Marx, the bourgeoisie plays a heroic role in history by revolutionizing industry and modernizing society; however, it also seeks to monopolize the benefits of modernization and exploit the property-less PROLETARIAT, thereby creating revolutionary tensions. The end result will be a final revolution in which the property of the bourgeoisie is expropriated and class conflict, exploitation, and the state are abolished. Much employed by 19th-century social reformers, the term had nearly disappeared from the vocabulary of political writers and politicians by the mid 20th century. In popular speech, it connotes philistinism, materialism, and a striving concern for "respectability." See also social CLASS.

Bourges, Pragmatic Sanction of See PRAGMATIC SANCTION OF BOURGES

Bourguiba \bůr-'gē-bə**, Habib (ibn Ali)** (b. Aug. 3, 1903, Al-Munastīr, Tun.—d. April 6, 2000, Al-Munastīr) President of Tunisia (1957–87). He studied at the Sorbonne, where he met independence-minded Algerians and Moroccans. He founded a nationalist newspaper in 1932. In 1934 he founded the Neo-Destour Party and became central to the Tunisian liberation movement. His efforts led the French to imprison him for three years, but he negotiated Tunisia's independence from that country in 1956. The Tunisian monarchy was abolished in 1957, and Bourguiba became president. During his 30 years in office he kept the army small and devoted much of the budget to improving education and health. Made president for life in 1975, he was removed from in 1987 because of ill health. He was succeeded by ZINE EL-ABIDINE BEN ALI.

Bourke-White \ˌbərk-'hwīt**, Margaret** (b. June 14, 1906, New York, N.Y., U.S.—d. Aug. 27, 1971, Stamford, Conn.) U.S. photographer. She began her professional career as an industrial and architectural photographer in 1927. She gained a reputation for originality and in 1929 was hired by HENRY R. LUCE for his magazine *Fortune*. She covered World War II for *Life* magazine as the first woman photographer to serve with the U.S. armed forces. Several collections of her photographs have been published, including *You Have Seen Their Faces* (1937), about sharecroppers of the American South.

Bournemouth \'bōrn-məth\ Seaside resort and unitary authority (pop., 2001: 163,441), DORSET, southern England, on the ENGLISH CHANNEL. It dates from 1810 but did not grow rapidly until after the coming of the railway in 1870. Predominantly a resort and residential town, it is one of England's main convention centres and is popular with retirees.

Bournonville \'bōr-nōn-ˌvē-lə**, August** (b. Aug. 21, 1805, Copenhagen, Den.—d. Nov. 30, 1879, Copenhagen) Danish dancer, choreographer, and director of the Royal Danish Ballet for almost 50 years. After studying and performing in Paris and Copenhagen, in 1830 he became director and choreographer of the Royal Danish Ballet, where he continued to dance until 1848. He established the Danish style, characterized by bravura dancing and expressive mime. Many of his ballets were based on observations he made while on tour; *Napoli* (1842), for example, was inspired by a trip to Italy.

Boutros-Ghali \'bü-trōs-'gä-lē**, Boutros** (b. Nov. 14, 1922, Cairo, Egypt) Sixth secretary-general of the UNITED NATIONS (1992–96), the first Arab and first African to hold the office. A descendant of a distinguished Egyptian Coptic family, he was educated at Cairo University and the University of Paris. After teaching at universities around the world, he joined Egypt's foreign ministry in 1977. As foreign minister, he accompanied Pres. ANWAR EL-SĀDĀT to Jerusalem. He became Egypt's deputy prime minister in 1991 and was appointed UN secretary-general in 1992. During his single term he oversaw peacekeeping operations in Bosnia, Somalia, and Rwanda and led the UN in its 50th-anniversary celebration. In 1996 the U.S. blocked his bid for a second term.

Bouts \'baůts**, Dirck** (b. c. 1415, Haarlem, Holland—d. May 6, 1475, Louvain, Brabant) Netherlandish painter. He was active in Louvain, where he was influenced by ROGIER VAN DER WEYDEN. His best-known works are a triptych altarpiece (1464) for the church of St. Peter in Louvain, its panels representing the Last Supper and four Old Testament scenes, and two huge panels representing a scene of secular justice (1470–75) for the city hall, intended as examples of justice for the Louvain town council. His treatment of the human figure ranges from strong emotion expressed through symbolic gesture to great severity and restraint.

Bouvines \bü-'vēn**, Battle of** (July 27, 1214) Decisive victory won by the French king PHILIP II over an international coalition that included Emperor OTTO IV, King JOHN of England, and several powerful French vassals. Fought in the marshy plain between Bouvines and Tournai in Flanders, the battle was furiously contested but ended in a clear French victory. It confirmed Philip's possession of French lands formerly held by the English and added to the power and prestige of the French monarchy. John's defeat increased the opposition of his barons.

bouzouki \bů-'zü-kē\ Long-necked lute used in Greek popular music. Developed from a Turkish instrument early in the 20th century, it has a pear-shaped body and a fretted fingerboard. The modern instrument usually has four courses of strings, which are plucked with a plectrum, typically in a vigorous and agile style.

Boveri \bō-'vā-rē**, Theodor Heinrich** (b. Oct. 12, 1862, Bamberg, Bavaria—d. Oct. 15, 1915, Würzburg) German cell biologist. Working with roundworm eggs, Boveri proved that chromosomes are separate units within the nucleus of a cell. With WALTER S. SUTTON, he was the first to propose that genes were located on chromosomes. Boveri proved Edouard von Beneden's theory that the ovum (egg) and sperm cell contribute equal numbers of chromosomes to the new cell created during fertilization. He later introduced the term *centrosome* and demonstrated that this structure is the division centre for a dividing egg cell.

bovid \'bō-vid\ Any RUMINANT of the family Bovidae. Bovids have hollow, unbranched, permanently attached horns; they are grazing or browsing animals found in both the Eastern and Western Hemispheres, most often in grasslands, scrublands, or deserts. Most species live in large herds. Species range in shoulder height from a 10-in. (25-cm) ANTELOPE to the 6.5-ft (2-m) BISON. Some of the 138 species (including domestic CATTLE, SHEEP, GOATS) are of economic value to humans. Others (including BIGHORN and some antelope) are hunted for food, sport, horns, or hides. See also BUFFALO, RUMINANT.

Bow \'bō**, Clara** (b. July 29, 1905, Brooklyn, N.Y., U.S.—d. Sept. 27, 1965, Los Angeles, Calif.) U.S. film actress. At age 16 she won a magazine contest that gave her a bit part in a film. Hired by Paramount Pictures in 1925, she played larger roles in silent films such as *Mantrap* (1926) and *Kid Boots* (1926). After her starring role as a flapper in the popular film *It* (1927), Bow became known as "the It girl," with "It" being understood as the appeal of a liberated young woman. She starred in 20 more films (1927–30), but scandals and nervous breakdowns undermined her career.

Clara Bow.
BROWN BROTHERS

bow and arrow Weapon consisting of a strip of wood or other flexible material, bent and held in tension by a string. The arrow, a long wooden shaft with a pointed tip, is stabilized in flight by a feathered tail. The arrow is fitted to the string by a notch in the end of the shaft and is drawn back to produce tension in the bow, which propels the arrow when the string is released. Bow construction ranges from wood, bone, and metal to plastic and fiberglass; arrowheads have been made from stone, bone, and metal. The origins of the bow and arrow are prehistoric. The bow was a primary military weapon from Egyptian times through the Middle Ages in the Mediterra-

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nean world and Europe and even longer in China and Japan. The Huns, Turks, Mongols, and other peoples of the Eurasian steppes excelled in warfare as mounted archers; horse archers were the most deadly weapon system of pre-gunpowder warfare. The CROSSBOW, the compound bow, and the English LONGBOW made the arrow a formidable battlefield missile. The powerful Turkish bow had a great impact on warfare in the late Middle Ages. In many cultures, the bow's importance in warfare has been secondary to its value as a hunting weapon. It is still sometimes used for recreational hunting. See also ARCHERY.

Bow porcelain \'bō\ English soft-paste PORCELAIN made at a factory in Stratford-le-Bow, Essex, c. 1744–76. From 1750 bone ash was used in its production by Thomas Frye, an Irish engraver, who invented the process. Bow varies in appearance and quality, but at its best has a soft, creamy-white tone with a smooth glaze. Bow tablewares were among the first English porcelain to be ornamented with transfer-printed decorations (see BATTERSEA ENAMELWARE). Bow also produced great quantities of figurines (e.g., statesmen, actors, birds, animals) in the ROCOCO STYLE.

Bow \'bō\ River River, Alberta, Canada. Rising in BANFF NATIONAL PARK on the eastern slopes of the ROCKY MOUNTAINS, it flows 315 mi (507 km) southeast through the park and east past CALGARY to unite with the Old-man River and form the SASKATCHEWAN RIVER. It is important for hydroelectric power and irrigation. Bow Valley Provincial Park is 50 mi (80 km) west of Calgary.

Bowditch \'baůd-ich\, Nathaniel (b. March 26, 1773, Salem, Mass., U.S.—d. March 16, 1838, Boston, Mass.) U.S. mathematician and astronomer. He was largely self-educated. After investigating the accuracy of J.H. Moore's *The Practical Navigator*, he produced a revised edition in 1799. In 1802 he published *The New American Practical Navigator*; adopted by the U.S. Department of the Navy, it was recognized as the best navigation text of its time. He translated and updated four volumes of PIERRE-SIMON LAPLACE's *Celestial Mechanics* (1829–39). He discovered the Bowditch curves (describing the motion of a pendulum), which have important applications in astronomy and physics. He refused professorships at several universities and instead worked for insurance companies.

Bowdler, Thomas (b. July 11, 1754, Ashley, near Bath, Somerset, Eng.—d. Feb. 24, 1825, Rhydding, near Swansea, Glamorganshire, Wales) English physician, philanthropist, and man of letters. He is known for his *Family Shakspeare* (1818), in which, by expurgation and paraphrase, he aimed to provide an edition of the plays suitable for a father to read aloud to his family without fear of offending their susceptibilities or corrupting their minds. The first edition (1807) contained a selection of 20 plays that probably were expurgated by Bowdler's sister, Harriet.

Bowdoin \'bō-dᵊn\ College Private liberal arts college in Brunswick, Maine. Founded in 1794 as a men's college, it was named for James Bowdoin (1726–90), first president of the American Academy of Arts and Sciences. It became coeducational in 1971. It offers bachelor's degrees in the arts, humanities, natural sciences, and social sciences. Academic facilities include a marine research station and an arctic museum. Its historic buildings include the Walker Art Building, designed by CHARLES F. MCKIM and STANFORD WHITE. Notable alumni include NATHANIEL HAWTHORNE and U.S. Pres. FRANKLIN PIERCE.

bowel movement See DEFECATION

Bowen \'bō-ən\, Elizabeth (Dorothea Cole) (b. June 7, 1899, Dublin, Ire.—d. Feb. 22, 1973, London, Eng.) Irish-born British novelist and short-story writer. Among her novels are *The House in Paris* (1935), *The Death of the Heart* (1938), and *The Heat of the Day* (1949). Her short-story collections include *The Demon Lover* (1945). Her finely wrought prose style frequently details uneasy and unfulfilling relationships among the upper middle class. Her essays appear in *Collected Impressions* (1950) and *Afterthought* (1962).

Bowen, Norman L(evi) (b. June 21, 1887, Kingston, Ont., Can.—d. Sept. 11, 1956, Washington, D.C., U.S.) Canadian geologist. He worked on and off for more than 35 years for the Geophysical Laboratory in Washington, D.C., where he researched silicate systems. During World War I he made a brief foray into optics, but after the war he returned to his studies of silicate systems. In 1928 he published *The Evolution of the Igneous Rocks*, which had a profound influence on petrologic thought. At the University of Chicago (1937–47) he developed a school of experimental PETROLOGY. His achievements won him honours both in the U.S. and Europe.

bowerbird \'baů(-ə)r-ˌbərd\ Any of 17 bird species constituting the PASSERINE family Ptilonorhynchidae, of Australia, New Guinea, and nearby islands. The male builds an elaborate structure (the bower) on the ground, decorates it with bright and shiny objects, and displays and sings loudly above it; females visit him and then lay their eggs in simple nests nearby. The mat, or platform, type of bower is a thick pad of plant material. The maypole type is a hut (sometimes as large as a child's playhouse) of twigs erected around one or more saplings in a cleared court. The avenue type consists of two close-set parallel walls of sticks on a circular mat of twigs. See also CATBIRD.

Bowes, Edward *known as* **Major Bowes** (b. June 14, 1874, San Francisco, Calif., U.S.—d. June 14, 1946, Rumson, N.J.) U.S. radio personality. He promoted attendance at New York City's Capitol Theatre by starting a variety show, the *Major Bowes Capitol Family*, which became the radio program *Original Amateur Hour* (1935–46). The show (later revived for television as *The Ted Mack Original Amateur Hour* [1948–60]) gave aspiring singers and comedians, including FRANK SINATRA and BOB HOPE, a chance to perform before a national radio audience.

bowfin \'bō-ˌfin\ Voracious freshwater fish (*Amia calva*) that is the only living representative of the family Amiidae, which dates back to the JURASSIC PERIOD (206–144 million years ago). It is found in sluggish North American waters from the Great Lakes southward to the Gulf of Mexico. Mottled green and brown, it has a long dorsal fin and strong conical teeth. The female, which is larger than the male, reaches a length of 30 in. (75 cm). The bowfin spawns in spring, when the male constructs a crude nest and guards both the fertilized eggs and the newly hatched young. It is sometimes called a dogfish.

Bowie \'bō-ē\, David *orig.* **David Robert Jones** (b. Jan. 8, 1947, London, Eng.) British rock singer. In the mid-1960s Bowie sang in a number of bands in his native London. He changed his name in 1966 to avoid confusion with the lead singer of the Monkees. His first hit recording, "Space Oddity" (1969), and albums such as *The Rise and Fall of Ziggy Stardust and the Spiders From Mars* (1972) ushered in the glam rock trend, marked by theatricality and androgyny. His style varied widely, from the disco romanticism of *Young Americans* (1975) to the avant-garde austerities of *Low* (1977) to the mainstream pop of *Let's Dance* (1983). Bowie also acted in stage plays and in films such as *The Man Who Fell to Earth* (1976). He continued to record and perform into the 21st century.

Bowie \'bü-ē\, Jim *orig.* **James Bowie** (b. 1796?, Logan county, Ky., U.S.—d. March 6, 1836, San Antonio, Texas) U.S. soldier. Bowie migrated with his parents to Missouri (1800) and then to Louisiana (1802), where later he owned a sugar plantation and served in the state legislature. In 1828 he settled in Texas, assumed Mexican citizenship, acquired land grants, and married the vice-governor's daughter. In opposition to Mexican legislation to curb the immigration of U.S. settlers, he joined the Texas revolutionary movement and became a colonel in the Texas army. He is remembered for his gallant role in the defense of the ALAMO. He invented the knife that bears his name. He became a legendary hero through Western song and ballad.

Bowles \'bōlz\, Chester (Bliss) (b. April 5, 1901, Springfield, Mass., U.S.—d. May 25, 1986, Sussex, Conn.) U.S. advertising executive and diplomat. A graduate of Yale University, he and WILLIAM BENTON established the Benton and Bowles advertising company (1929), which became one of the largest in the world. After selling his interest in 1941, Bowles served as director of the Federal Price Administration (1943–46). Elected governor of Connecticut in 1948, he was defeated in 1950 because of his liberal stand on civil rights. He was ambassador to India (1951–53), served in the U.S. House of Representatives (1953–61), and returned to India as ambassador (1963–69).

Bowles, Paul (Frederic) (b. Dec. 30, 1910, New York, N.Y., U.S.—d. Nov. 18, 1999, Tangier, Mor.) U.S.-Moroccan composer, writer, and translator. Bowles studied musical composition with AARON COPLAND and wrote music for more than 30 plays and films. He moved to Morocco in the 1940s. He set his best-known novel, *The Sheltering Sky* (1948; film, 1990), in Tangier. His protagonists, in that novel and other works, are often Westerners maimed by their contact with traditional cultures that bewilder them, and violent events and psychological collapse are recounted in a detached and elegant style. His wife, Jane Bowles (1917–73), is known for the novel *Two Serious Ladies* (1943) and the play *In the Summer House* (1953).

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bowling Game in which a heavy ball is rolled down a long, narrow lane to knock down a group of 10 wooden objects (called pins). Versions of the game have existed since ancient times. Ninepin bowling was brought to the U.S. in the 17th century by Dutch settlers; it became so popular and so associated with gambling that it was outlawed in several states. The game grew to enormous popularity in the 20th century, both as a recreational activity and (since 1958) as a professional sport. If all the pins are knocked down with the first ball, a strike is recorded (10 points). If pins remain standing but the second ball knocks them down, the player is awarded a spare (10 points). If a strike is thrown in a frame (turn), the number of pins knocked down by the next two balls bowled count in that frame. After a spare, the score of the next ball counts in the spare's frame. Thus, the maximum point total for a single frame is 30. Each game is divided into 10 frames, and each player is allowed to deliver up to two balls per frame (except in the final frame, in which two additional deliveries are permitted following a strike [one additional following a spare]. A perfect score is 300, or 12 strikes in a row. Versions of the game include candlepins, duckpins, and SKITTLES.

bowls *or* **lawn bowls** *or* **lawn bowling** Bowling game similar to the Italian BOCCIE and the French BOULES played on a green with wooden balls (called bowls) that are rolled at a target ball (the jack). The object is to roll one's bowls so that they come to rest nearer to the jack than those of an opponent, sometimes achieved by knocking aside an opponent's bowl or jack. One point is awarded for each winning bowl. Depending on the game, players use four, three, or two bowls, and games end at 18 or 21 points.

Bowman \'bō-mən**, Sir William** (b. July 20, 1816, Nantwich, Cheshire, Eng.—d. March 29, 1892, near Dorking, Surrey) English surgeon and histologist. His studies of organ tissues with his teacher Robert Todd led to major papers on the structure and function of voluntary muscle and of the kidneys and on the detailed anatomy of the liver. In the kidneys, he found that the capsule (Bowman capsule) surrounding each glomerulus (ball of capillaries) in the nephrons is a continuous part of the renal duct. This was of prime importance to his filtration theory of urine formation, key to understanding kidney function. Bowman and Todd published *The Physiological Anatomy and Physiology of Man* (2 vol., 1845–56), a pioneering work in both physiology and histology. Turning to the eye, Bowman became one of the world's foremost ophthalmic research scientists, London's outstanding eye surgeon, and the first to describe several eye structures and their functions.

box In botany, an EVERGREEN shrub or small tree (genus *Buxus*) of the box family (Buxaceae), best known for the ornamental and useful boxwoods. The family comprises seven genera of trees, shrubs, and herbaceous plants, native to North America, Europe, North Africa, and Asia. The plants bear male and female flowers, without petals, on separate plants. The leathery, evergreen leaves are simple and alternate. Fruits are one- or two-seeded CAPSULES or drupes. Three species of the genus *Buxus* provide the widely grown boxwood: the common, or English, box (*B. sempervirens*), used for hedges, borders, and TOPIARY figures; the Japanese box (*B. microphylla*); and the tall boxwood tree (*B. balearica*).

box elder Hardy and fast-growing tree (*Acer negundo*), also called ash-leaved maple, of the MAPLE FAMILY, native to the central and eastern U.S. Its compound leaves (rare among maples) consist of three, five, or seven coarsely toothed leaflets. The single seed is borne in a samara (dry, winged fruit). Because of its rapid growth and its drought resistance, it was widely planted for shade by early settlers in the prairie regions of the U.S. Maple syrup and sugar are sometimes obtained from the box elder. Its wood is used for crates, furniture, paper pulp, and charcoal.

box turtle Any of several species of terrestrial TURTLE (genus *Terrapene*) found in the U.S. and Mexico. Box turtles have a high, rounded upper shell (carapace) that grows to a maximum length of about 7 in. (18 cm). The lower shell (plastron) is hinged across the center and can be drawn very tightly against the carapace to form a protective "box" that completely encloses the turtle's soft parts. They feed on earthworms, insects, mushrooms, and berries. Box turtles are often kept as pets.

Box turtle (*Terrapene carolina*)
JOHN H. GERARD—EB INC.

boxer Smooth-haired breed of working dog named for its manner of "boxing" with its sturdy front paws when beginning to fight. Developed in Germany, it includes strains of BULLDOG and TERRIER in its heritage. Because of its reputation for courage, aggressiveness, and intelligence, it has been used in police work; it is also valued as a watchdog and companion. Trim and squarely built, it has a short, square muzzle; a black mask on its face; and a shiny, shorthaired coat of reddish brown or brindle. It stands 21–24 in. (53–61 cm) high and weighs 60–70 lbs (27–32 kg).

Boxer
SALLY ANNE THOMPSON/EB INC.

Boxer Rebellion Officially supported peasant uprising in 1900 in China that attempted to drive all foreigners from the country. "Boxer" was the English name given to a Chinese secret society that practiced boxing and calisthenic rituals in the belief that it would make its members impervious to bullets. Support for them grew in northern China during the late 19th century, when China's people were suffering from growing economic impoverishment and the country was forced to grant humiliating concessions to Western powers. In June 1900, after Boxers had killed Chinese Christians and Westerners, an international relief force was dispatched to quell the attacks. The empress dowager, CIXI, ordered imperial forces to block its advance; the conflict escalated, hundereds of people were killed, and the matter was not resolved until August, when Beijing was captured and sacked. Hostilities were ended with a protocol (1901) requiring China to pay a large indemnity to 11 countries. Britain and the U.S. later returned much of their reparations, the U.S. using its portion to further Chinese higher education. See also U.S. OPEN DOOR POLICY.

boxing Sport involving attack and defense with the fists. In the modern sport, boxers wear padded gloves and fight bouts of up to 12 three-minute rounds in a roped-off square known as the ring. In ancient Greece fighters used leather thongs on their hands and forearms, while in Rome GLADIATORS used metal-studded leather hand coverings (cesti) and usually fought to the death. Not until implementation of the London Prize Ring rules in 1839 were kicking, gouging, butting, biting, and blows below the belt eliminated from the boxer's standard repertoire. In 1867 the QUEENSBERRY RULES called for the wearing of gloves, though bare-knuckle boxing continued into the late 1880s. The last of the great bare-knuckle fighters was JOHN L. SULLIVAN. From Sullivan on, the U.S. became the premier boxing venue, partly because immigrants supplied a constantly renewed pool of boxers. Boxing has been included among the Olympic Games since 1904. Today there are 17 primary weight classes in professional boxing: strawweight, to 105 lbs (48 kg); junior flyweight, to 108 lbs (49 kg); flyweight, to 112 lbs (51 kg); junior bantamweight, to 115 lbs (52 kg); bantamweight, to 118 lbs (53.5 kg); junior featherweight, to 122 lbs (55 kg); featherweight, to 126 lbs (57 kg); junior lightweight, to 130 lbs (59 kg); lightweight, to 135 lbs (61 kg); junior welterweight, 140 lbs (63.5 kg); welterweight, to 147 lbs (67 kg); junior middleweight, 154 lbs (70 kg); middleweight, to 160 lbs (72.5 kg); super middleweight, 168 lbs (76 kg); light heavyweight, to 175 lbs (79 kg); cruiserweight, 190 lbs (86 kg); and heavyweight, over 190 lbs. A bout can be won either by knocking out or felling one's opponent for a count of 10 (a KO) or by delivering the most solid blows and thus amassing the most points. The referee can also stop the fight when one boxer is being badly beaten (a technical knockout, or TKO) or he can disqualify a fighter for rules violations and award the fight to his opponent.

Boy Scouts See SCOUTING

boyar \bō-'yär\ Any male member of the upper class of medieval Russian society and state administration. In KIEVAN RUS (10th–12th centuries) the boyars belonged to the prince's retinue, holding posts in the army and civil administration and advising the prince in matters of state through a boyar council, or duma. In the 13th–14th centuries the boyars constituted a privileged class of rich landowners in northeastern Russia. In the 15th–17th centuries the boyars of Muscovy ruled the country along with the grand prince (later the CZAR) and legislated through the boyar council. Their importance declined in the 17th century, and the title was abolished by PETER I in the early 18th century.

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boycott Collective and organized ostracism applied in labour, economic, political, or social relations to protest and punish practices considered unfair. The tactic was popularized by Charles Stewart Parnell to protest high rents and land evictions in Ireland in 1880 by the estate manager Charles C. Boycott (b. 1832—d. 1897). Boycotts are principally used by labour organizations to win improved wages and working conditions or by consumers to pressure companies to change their hiring, labour, environmental, or investment practices. U.S. law distinguishes between primary boycotts, which consist of the refusal by employees to purchase the goods or services of their employers, and secondary boycotts, which involve attempts to induce third parties to refuse to patronize the employer. The latter type of boycott is illegal in most states. Boycotts were used as a tactic in the U.S. civil rights movement of the 1950s and '60s and also have been applied to influence the conduct of multinational corporations.

Boyer \bwä-'yā**, Charles** (b. Aug. 28, 1897, Figeac, France—d. Aug. 26, 1978, Phoenix, Ariz., U.S.) French-U.S. actor. After earning a philosophy degree from the Sorbonne, he made his stage debut in Paris in 1920. He became a popular romantic leading man in French theatre and film, and his rich, accented voice and suave manner made him an international star. His first successful U.S. film, *Private Worlds* (1935), was followed by such films as *Algiers* (1938) and *Gaslight* (1944).

Boyle, Kay (b. Feb. 19, 1902, St. Paul, Minn., U.S.—d. Dec. 27, 1992, Mill Valley, Calif.) U.S. writer. Boyle lived in Europe during the 1920s and '30s. Later she served as a European correspondent for *The New Yorker* (1946–53). Her writing is noted for its elegant style and consistently leftist stance. Her novels, which include *Plagued by the Nightingale* (1931) and *Generation Without Farewell* (1960), are less highly regarded than her short stories, which include "The White Horses of Vienna," "Keep Your Pity," and "Defeat."

Boyle, Robert (b. Jan. 25, 1627, Lismore Castle, County Waterford, Ire.—d. Dec. 31, 1691, London, Eng.) Irish-born English chemist and natural philosopher. The son of Richard Boyle, the "Great Earl of Cork" (1566–1643), he settled at Oxford in 1654 and, with his assistant Robert Hooke, began his pioneering experiments on the properties of gases, including those expressed in Boyle's law (see gas laws). He demonstrated the physical characteristics of air, showing that it is necessary in combustion, respiration, and sound transmission. In *The Sceptical Chymist* (1661) he attacked Aristotle's theory of the four elements (earth, air, fire, and water), espousing a corpuscular view of matter that presaged the modern theory of chemical elements. A founding member of the Royal Society of London, he achieved great renown in his lifetime. His brother Roger Boyle, earl of Orrery (1621–79), was a general under Oliver Cromwell but eventually helped secure Ireland for Charles II.

Boyne, Battle of the (July 1690) Victory in Ireland for William III of England, a Protestant, over the former king James II, a Roman Catholic. James was attempting, with the help of the French and the Irish, to regain his throne. In this battle, fought on the banks of the River Boyne, some 35,000 men under William defeated about 21,000 of James's troops, forcing James to flee the country. The battle is celebrated in Northern Ireland as a victory for the Protestant cause.

boysenberry Very large bramble fruit, usually considered, along with the loganberry and the youngberry, a variety of blackberry (*Rubus ursinus*). The dark, reddish-black fruit is especially valued for canning and preserving. It is grown chiefly in the southern and southwestern U.S. and on the Pacific Coast from southern California into Oregon. It was developed in the early 1920s by Rudolph Boysen (1895–1950) of Napa, Cal.

BP PLC *formerly* **Anglo-Persian Oil Co., Ltd.,British Petroleum Co. PLC,** *and* **BP Amoco** British petrochemical corporation. Formed in 1909 as the Anglo-Persian Oil Co., Ltd., to finance an oil-field concession granted by the Iranian government to William Knox D'Arcy, it became one of the largest oil companies in the world, with oil fields and refineries in Alaska and the North Sea. The British government was for many years BP's largest single stockholder, but by the late 1980s it had turned over the company to private ownership. In 1987 BP consolidated its U.S. interests by acquiring the Standard Oil Co. In 1998 it merged with Amoco (formerly Standard Oil of Indiana) to form BP-Amoco. In addition to oil and natural gas, it produces chemicals, plastics, and synthetic fibres. Its headquarters are in London.

Brabant \'brä-bänt\ Old duchy, northwestern Europe. Located in what is now the southern part of The Netherlands and central and northern Belgium, the region in the 9th century AD was part of the kingdom of Lotharingia. In the late 12th century it became independent; it finally passed to the house of Burgundy in 1430. Inherited by the Habsburgs in 1477, it became a centre of culture and commerce (see Antwerp; Brussels). The northern section of Brabant took part in a revolt from Spain, and in 1609 it was awarded to the United Provinces, while the southern section remained part of Spanish (later Austrian) Netherlands. The northern section now forms the Dutch province of North Brabant. The southern section eventually became part of Belgium and is divided between the provinces of Flemish Brabant and Walloon Brabant.

Bracciolini, Gian Francesco Poggio See Gian Francesco Poggio Bracciolini

bracken *or* **brake** fern of the genus *Pteridium*, represented by a single species (*P. aquilinum*). Twelve varieties are found throughout the world in temperate and tropical regions. It is a noxious weed, with a perennial black rootstock that creeps extensively underground. At intervals along the rootstock, the plant sends up fronds that may reach a height of 15 ft (5 m) or more. Though they die in autumn, the fronds often remain standing throughout winter, affording cover for wildlife in some areas. The fronds are used for thatching and as fodder.

bracket fungus *or* **shelf fungus** Basidiomycete that forms shelflike sporophores (spore-producing organs). Bracket fungi are commonly found growing on trees or fallen logs in damp woodlands. They can severely damage cut lumber and stands of timber. Specimens 16 in. (40 cm) or more in diameter are not uncommon.

bract Modified, usually small, leaflike structure often positioned beneath a flower or inflorescence. What are often taken to be the petals of flowers are sometimes bracts—for example, the large, colourful bracts of poinsettias or the showy white or pink bracts of dogwood blossoms.

Bradbury, Ray (Douglas) (b. Aug. 22, 1920, Waukegan, Ill., U.S.) U.S. author. Bradbury is best known for highly imaginative science-fiction stories and novels that blend social criticism with an awareness of the hazards of runaway technology. *The Martian Chronicles* (1950; television miniseries, 1980) is considered a science-fiction classic. His other short-story collections include *The Illustrated Man* (1951; film, 1969), *The October Country* (1955), *I Sing the Body Electric!* (1969; teleplay, 1981), and *Quicker Than the Eye* (1996); his novels include *Fahrenheit 451* (1953; film, 1966), *Dandelion Wine* (1957; film, 1997), and *Death Is a Lonely Business* (1985).

Braddock, Edward (b. 1695, Perthshire, Scot.—d. July 13, 1755, Great Meadows, Pa.) British army commander in the French and Indian War. After service in Europe, he arrived in Virginia in 1755 to command British forces in North America against the French. He undertook an expedition to attack the French-held Fort Duquesne (now Pittsburgh, Pa.); his force, which included British regulars and provincial militiamen such as George Washington, cut the first road across the Allegheny Mountains and reached a point on the Monongahela River near the fort. There his army of over 1,400 men was ambushed and defeated by a group of 254 French and 600 Indians, and he was mortally wounded in the ensuing rout.

Bradford City and metropolitan borough (pop., 2001: 467,668), West Yorkshire, northern England. The manufacture of wool products was important to its economy as early as 1311; the fine worsted trade began in the late 17th century. By 1900 it emerged as the main wool-buying centre for Yorkshire. The city remains a centre of the textile industry and is the site of the University of Bradford.

Bradford, William (b. March 1590, Austerfield, Yorkshire, Eng.—d. May 9, 1657, Plymouth, Mass.) Governor of the Plymouth Colony in America for 30 years. A member of the Separatist movement within Puritanism, in 1609 he left England and went to Holland seeking religious freedom. Finding a lack of economic opportunity there, in 1620 he helped organize an expedition of about 100 Pilgrims to the New World. He helped draft the Mayflower Compact aboard the group's ship, and he served as governor of the Plymouth Colony for all but five years from 1621 to 1656. He helped establish and foster the principles of self-government and religious freedom that characterized later American colonial government. His descriptive journal provides a unique source of information on both the voyage of the *Mayflower* and the challenges faced by the settlers.

Bradlee, Benjamin C(rowninshield) (b. Aug. 26, 1921, Boston, Mass., U.S.) U.S. newspaper editor. Bradlee was a reporter for *The Wash-*

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ington Post before joining *Newsweek* in Paris and then in Washington. Returning to the *Post*, he served as its executive editor 1968–91. During his tenure the *Post* published the PENTAGON PAPERS, broke much of the story surrounding the WATERGATE SCANDAL, and was recognized as one of the most important and influential newspapers in the U.S. Bradlee's books include *Conversations with Kennedy* (1975) and the memoir *A Good Life* (1995).

Bradley, Bill *in full* **William Warren Bradley** (b. July 28, 1943, Crystal City, Mo., U.S.) U.S. basketball player and politician. Bradley attended Princeton University (1961–65), where, as a playmaker and high-scoring forward 6 ft 5 in. (196 cm) tall, he was named College Player of the Year in 1964–65. In a semifinal game he scored 58 points, an NCAA tournament record. In 1964 he helped the U.S. team win the Olympic gold medal. He studied at the University of Oxford as a Rhodes scholar, then returned to play with the New York Knicks until 1977, helping them win two NBA championships (1970, 1973). As a prominent U.S. senator from New Jersey (1979–97), he sought to raise public awareness of race relations and poverty and was a critic of campaign-financing practices. In 1999–2000 he was an unsuccessful candidate for the Democratic presidential nomination.

Bradley, F(rancis) H(erbert) (b. Jan. 30, 1846, Clapham, Surrey, Eng.—d. Sept. 18, 1924, Oxford) British idealist philosopher. Influenced by G.W.F. HEGEL, he considered mind to be more fundamental than matter. In *Ethical Studies* (1876), he sought to expose confusions in UTILITARIANISM. In *The Principles of Logic* (1883), he denounced the psychology of the empiricists. His most ambitious work, *Appearance and Reality* (1893), maintained that, though reality is spiritual, the thesis cannot be demonstrated because of the fatally abstract nature of human thought. Instead of ideas, which could not properly contain reality, he recommended feeling, the immediacy of which could embrace the harmonious nature of reality. He was the first English philosopher to be awarded the Order of Merit. His brother was the eminent poetry critic A.C. Bradley (1851–1935).

Bradley, Omar N(elson) (b. Feb. 12, 1893, Clark, Mo., U.S.—d. April 8, 1981, New York, N.Y.) U.S. army commander. After graduating from West Point, he directed the army's infantry school at the start of World War II. In 1943 he commanded U.S. forces in the NORTH AFRICA CAMPAIGN and contributed directly to the fall of Tunisia to the Allies; he then led the successful invasion of Sicily. As commander of the 1st Army, he helped plan the invasion of France and took part in the NORMANDY CAMPAIGN and the liberation of Paris. As commander of the 12th Army, the largest U.S. force ever placed under one general, he oversaw European operations until the German surrender. After the war he was appointed head of veterans' affairs (1945–47) and chief of staff of the army (1948–49). Admired by both officers and men, he was chosen the first chairman of the Joint Chiefs of Staff (1949–53) and promoted to General of the Army (1950).

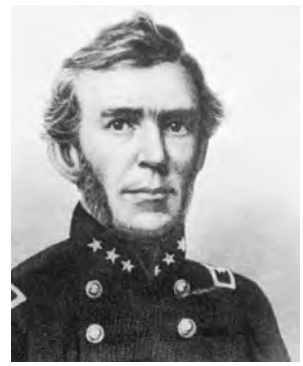
Bradley, Thomas (b. Dec. 29, 1917, Calvert, Texas, U.S.—d. Sept. 29, 1998, Los Angeles, Calif.) Mayor of Los Angeles (1973–93). The son of a sharecropper, he moved with his family to Los Angeles when he was seven and endured poverty after his father abandoned the family. In 1940 he began a 22-year tenure with the city's police department, during which he earned a law degree (1956) by attending night school. In 1963 he became the city's first African American council member, and in 1973 he was elected one of the country's first two African American mayors of a major city (with COLEMAN YOUNG of Detroit). During five terms as mayor, he helped transform Los Angeles into a bustling business and trading centre, overseeing massive growth and hosting the 1984 Olympic Games. He retired in 1992 after the city was consumed by riots following the acquittal of police officers in the beating of African American motorist Rodney King.

Bradman, Don (b. Aug. 27, 1908, Cootamundra, N.S.W., Austl.—d. Feb. 25, 2001, Adelaide, S.Aus.) Australian cricketer. One of the greatest run scorers in the history of the game, in test (international) matches Bradman scored 6,996 runs for Australia and set a record with his average of 99.94 runs per match. In 1948 he was captain of the Australian team that was victorious in England, four matches to none. He retired from first-class cricket in 1949 and was knighted in the same year. Bradman is often judged the greatest cricket player of the 20th century.

Bradstreet, Anne *orig.* **Anne Dudley** (b. c. 1612, Northampton, Northhamptonshire?, Eng.—d. Sept. 16, 1672, Andover, Massachusetts Bay Colony) English-born American poet, one of the first poets of the American colonies. At age 18 she sailed from England with her husband, her parents, and other Puritans to settle on Massachusetts Bay. She wrote many of her poems while rearing eight children. Without her knowledge, her brother-in-law took her poems to England, where they were published in 1650. She won critical acceptance in the 20th century, particularly for "Contemplations," a sequence of religious poems first published in the mid 19th century. Her prose works include "Meditations," a collection of aphorisms.

Brady, Mathew B. (b. c. 1823, near Lake George, N.Y., U.S.—d. Jan. 15, 1896, New York, N.Y.) U.S. photographer. He learned to make daguerreotypes from SAMUEL F.B. MORSE. In 1844 he opened the first of two studios in New York City and began photographing famous people (including DANIEL WEBSTER, EDGAR ALLAN POE, and HENRY CLAY). In 1847 Brady opened a studio in Washington, D.C., and there created, copied, and collected portraits of U.S. presidents. He achieved international fame with *A Gallery of Illustrious Americans* (1850). In 1861 he set out to make a complete record of the American Civil War with a staff of more than 20 photographers, including TIMOTHY H. O'SULLIVAN and ALEXANDER GARDNER. He probably photographed the battles of BULL RUN, ANTIETAM, and GETTYSBURG himself.

Bragg, Braxton (b. March 22, 1817, Warrenton, N.C., U.S.—d. Sept. 27, 1876, Galveston, Texas) U.S. and Confederate army officer. He graduated from West Point and served in the SEMINOLE WARS and the MEXICAN WAR. When North Carolina seceded, he joined the Confederate army and fought in the AMERICAN CIVIL WAR. He was promoted to general in 1862 at the BATTLE OF SHILOH. As commander of the Army of Tennessee, he led his troops to victory at the BATTLE OF CHICKAMAUGA. His forces besieged the Union troops at Chattanooga but were eventually routed. He was relieved of his command but appointed military adviser to Confederate Pres. JEFFERSON DAVIS.



Braxton Bragg, engraving by George E. Perine
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Bragg law Relation between the spacing of atomic planes in crystals and the angles of incidence at which the planes produce the most intense reflections of ELECTROMAGNETIC RADIATION and particle waves. The law, first formulated by Lawrence Bragg, is useful for measuring WAVELENGTHS and for determining the lattice spacings of crystals (see CRYSTAL LATTICE), and is the principal way to make precise energy measurements of X RAYS and low-energy GAMMA RAYS. See also WILLIAM BRAGG.

Bragg, Sir William (Henry) (b. July 2, 1862, Wigton, Cumberland, Eng.—d. March 12, 1942, London) British scientist, a pioneer in solid-state physics. With his son (William) Lawrence Bragg (1890–1971), he shared a 1915 Nobel Prize for research on the determination of CRYSTAL structures and Lawrence's discovery (1912) of the BRAGG LAW of X-RAY DIFFRACTION. The Bragg ionization spectrometer William designed and built is the prototype of all modern X-ray and neutron diffractometers; the two men used it to make the first exact measurements of X-ray wavelengths and crystal data.

Tycho Brahe, engraving by Hendrik Goltzius of a drawing by an unknown artist, c. 1586.
COURTESY OF DET NATIONALHISTORISKE MUSEUM PÅ FREDERIKSBORG, DEN.

Brahe \'brä, 'brä-hē**, Tycho** (b. Dec. 14, 1546, Knudstrup, Scania, Den.—d. Oct. 24, 1601, Prague) Danish astronomer. Kidnapped by his wealthy but childless uncle, he was raised at his uncle's castle and educated at the Universities of Copenhagen and Leipzig. He traveled through Europe (1565–70),

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acquiring mathematical and astronomical instruments, and, on inheriting his father's and uncle's estates, he built a small observatory. In 1573 he reported his discovery of a new star (later recognized as a SUPERNOVA), news that shook faith in the immutable heavens. With the aid of Denmark's King Frederick II, he built a new, larger observatory (Uraniborg), which became northern Europe's centre of astronomical study and discovery. There he undertook a comprehensive study of the solar system and accurately charted the positions of more than 777 fixed stars. The observational data left at his death was used by his pupil and assistant Johannes Kepler to lay the groundwork for ISAAC NEWTON's work.

Brahma One of three major gods in late Vedic HINDUISM, c. 500 BC–c. AD 500. He was gradually eclipsed by the other two, VISHNU and SHIVA. In classical times the doctrine of TRIMURTI identified the three as aspects of a supreme deity. Brahma was associated with the creator god PRAJAPATI, whose identity he came to assume. All temples of Shiva or Vishnu contain an image of Brahma, but today there is no sect or cult devoted exclusively to him.

brahma-loka \'brä-mə-'lō-kə\ In HINDUISM and BUDDHISM, the realm of pious celestial spirits. In THERAVADA, it includes the 20 uppermost planes of existence. The lower 16 of these are the *rupa-brahma-loka*, material realms inhabited by progressively radiant gods. The highest four realms, the *arupa-brahma-loka*, are devoid of substance. Rebirth into these realms is the reward for great virtue and meditation; the level attained is determined by faithfulness to the BUDDHA, the DHARMA and the SANGHA. See also ARUPA-LOKA, RUPA-LOKA.

Brahmagupta \ˌbrə-mə-'güp-tə\ (b. 598—d. c. 665, possibly Bhillamala, Rajasthan, India) Indian mathematician and astronomer. His principal work, the *Brahma-sphuta-siddhanta* ("The Opening of the Universe"), most of which deals with planetary motion, also contains important proofs of various geometrical theorems on QUADRATIC EQUATIONS, the geometry of right triangles, and the properties of geometric solids.

Brahman In the UPANISHADS, the eternal, infinite, and omnipresent spiritual source of the finite and changing universe. The schools of VEDANTA differ in interpreting Brahman. The ADVAITA school defines Brahman as categorically different from any phenomenon, conceiving it as an absolute reality onto which human perceptions of differentiation are projected. The Bhedabheda school maintains that Brahman is not different from the world it produces. The VISISTADVAITA school holds that phenomenality is a glorious manifestation of Brahman. The Dvaita school maintains that both soul and matter are separate from and dependent on Brahman.

Brahman \'brā-mən\ *or* **zebu** \'zē-ˌbü\ Any of several varieties of CATTLE that originated in India and were crossbred in the U.S. with improved beef breeds to produce the hardy beef animal known as the SANTA GERTRUDIS. Similar blending in Latin America resulted in the breed known as Indo-Brazil. The Brahman is characterized by a pronounced hump over the shoulder and neck, horns that usually curve up and back, and drooping ears. Gray is the prevalent colour, with deep shading in the fore and rear quarters of the bull. A red strain has also been developed.

Brahman *or* **Brahmin** Any member of the highest of the four VARNAS, or social classes, in Hindu India. Their existence as a priestly CASTE dates to the late Vedic period, and they have long been considered to be of greater ritual purity than members of other castes and alone to be capable of performing certain religious tasks, including preservation of the collections of Vedic hymns. Because of their high prestige and tradition of education, they dominated Indian scholarship for centuries. As the spiritual and intellectual elite, they advised the politically powerful warrior caste, and after Indian independence they supplied many heads of state. They still retain traditional privileges, though these are no longer legally sanctioned. Ritual purity is maintained through taboos, vegetarianism, and abstention from certain occupations.

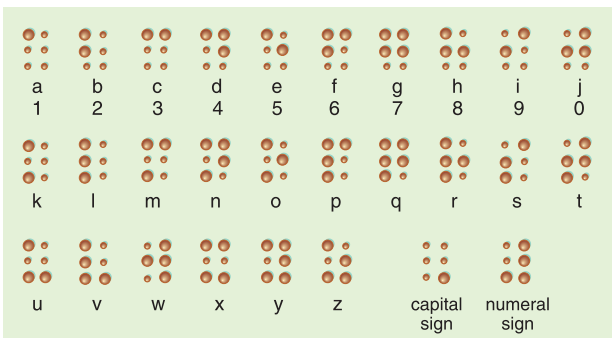
Brahmana \'brä-mə-nə\ Any of a number of discourses on the VEDAS that explain their use in ritual sacrifices and the symbolism of the priests' actions. Dating to 900–600 BC, they constitute the oldest historical sources for Indian ritual. The *Aitareya* and *Kausitaki Brahmana*, compiled by followers of the *Rig Veda*, include discussions of daily sacrifices, the sacrificial fire, new- and full-moon rites, and the rites for installation of kings. The *Pancavimsa*, *Sadvimsa*, and *Jaiminiya Brahmana* discuss the "going of the cows," SOMA ceremonies, and atonements for mistakes in ritual. The *Satapatha Brahmana* introduces elements of domestic ritual, and the *Gopatha Brahmana* treats the priests' supervision of sacrifices.

Brahmaputra \ˌbrä-mə-'pü-trə\ **River** River, Central and South Asia. From its headsprings in Tibet (as the Zangbo River), it flows across southern Tibet to break through the HIMALAYAS in great gorges (where it is known as the Dihang). It flows southwest through the ASSAM Valley and south through Bangladesh (where it is known as the Jamuna). There it merges with the GANGES (Ganga) to form the Ganges-Brahmaputra delta. About 1,800 mi (2,900 km) long, the river is an important source for irrigation and transportation. Its upper course was long unknown, and its identity with the Zangbo was only established by exploration in 1884–86.

Brahmo Samaj \'brä-mō-sə-'mäj\ Monotheistic movement within HINDUISM, founded in Calcutta (now Kolkata) in 1828 by RAM MOHUN ROY. It rejected the authority of the VEDAS and the doctrine of AVATARS, did not insist on belief in KARMA or rebirth, denounced POLYTHEISM and the CASTE system, and adopted some Christian practices. Roy's intention was to reform Hinduism from within, but his successor, DEBENDRANATH TAGORE, rejected Vedic authority. In 1866 Keshab Chunder Sen organized the more radical Brahmo Samaj of India, which campaigned for the education of women and against child marriages. After Keshab nonetheless arranged a marriage for his underage daughter, a third group, Sadharan Brahmo Samaj, was formed in 1878. It gradually reverted to the teaching of the UPANISHADS but continued the work of social reform. The movement, always an elite group without significant popular following, lost force in the 20th century.

Brahms, Johannes (b. May 7, 1833, Hamburg—d. April 3, 1897, Vienna, Austria-Hungary) German composer. The son of a musician, he became a piano prodigy. In 1853 he met the composer ROBERT SCHUMANN and his pianist wife, Clara (see CLARA SCHUMANN); Robert immediately proclaimed him a genius, and Clara became the lifelong object of his affections. In 1863 Brahms moved to Vienna, which would remain his principal home until his death. He took several positions as choral and orchestral conductor and performed as a soloist. The success of his *German Requiem* (1868) gave him an international reputation; his first symphony (1876) brought him even greater fame, and his violin concerto (1879) and second piano concerto (1882) led many to acclaim him the greatest living composer. His music complemented and counteracted the rapid growth of Romantic individualism in the second half of the 19th century. He was a traditionalist in the sense that he greatly revered the subtlety and power of movement displayed by the Classical composers Haydn, Mozart, and Beethoven. His orchestral works include four symphonies (1876, 1877, 1883, 1885), two piano concertos (1858, 1881), a violin concerto (1878), and a double concerto for violin and cello (1887). His chamber music includes four string quartets, two string sextets, two string quintets, three piano quartets, three piano trios, and violin, cello, piano, and clarinet sonatas. He also wrote choral music and more than 250 lieder (see LIED).

Braille \'brāl\ Universal system of writing and printing for the blind. The Frenchman LOUIS BRAILLE invented the system in 1824. Characters embossed on paper are read by passing the fingers lightly over the manuscript. The system is based on a matrix of six dots arranged in two columns of three. The 63 combinations possible in this framework stand for letters, numbers, punctuation marks, and common words such as *and* and *the*. A Braille code for English was not adopted until 1932. Modifications



The alphabet and the digits 0–9 in the modern Braille system. Each letter or digit consists of six "cells" that are either embossed or left blank to form a unique pattern. Large dots indicate raised cells; smaller dots indicate cells that are left blank.
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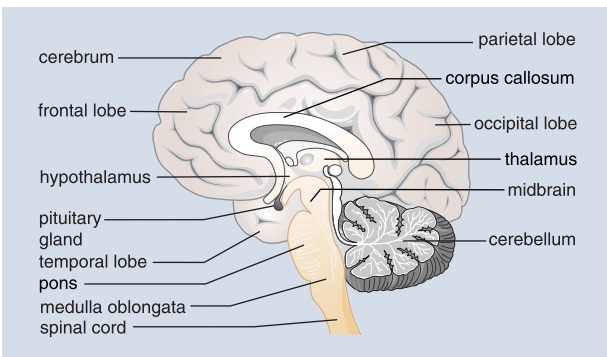
also exist for other languages, for mathematical and technical material, and for musical notation. Braille may be handwritten—from right to left—using a stylus to press dots into a piece of paper between hinged metal plates; when the sheet is turned over, the dots face up and are read from left to right. Braille typewriters and electric embossing machines are also used.

Braille \'bräy**, Louis** (b. Jan. 4, 1809, Coupvray, near Paris, France—d. Jan. 6, 1852, Paris) French educator who developed the BRAILLE system of printing and writing for the blind. Himself blinded at the age of three in an accident, he went to Paris in 1819 to attend the National Institute for Blind Children, and from 1826 he taught there. Braille adapted a method created by Charles Barbier to develop his own simplified system.

Louis Braille, portrait bust by an unknown artist.
ARCHIV FÜR KUNST UND GESCHICHTE, BERLIN

brain Concentration of nerve tissue in the front or upper end of an animal's body. It handles sensory information, controls motion, is vital to instinctive acts, and in higher vertebrates is the centre of learning. Vertebrate brains consist of the hindbrain (rhombencephalon), midbrain (mesencephalon), and forebrain (prosencephalon). The hindbrain comprises the medulla oblongata and the pons, which connects the SPINAL CORD with higher brain levels and transfers information from the CEREBRAL CORTEX to the CEREBELLUM. The midbrain, a major sensory integration centre in other vertebrates, serves primarily to link the hindbrain and forebrain in mammals. Large nerve bundles connect the cerebellum to the medulla, pons, and midbrain. In the forebrain the two cerebral hemispheres are connected by a thick bundle of nerve fibres (corpus callosum) and are divided by two deep grooves into four lobes (frontal, parietal, temporal, and occipital). The cerebrum, the largest part of the human brain, is involved with its more complex functions. Motor and sensory nerve fibres from each hemisphere cross over in the medulla to control the opposite side of the body.



Side view of the brain showing its major structures. The large cerebrum is divided into two halves, or hemispheres, connected by the corpus callosum, a band of nerve fibres. Two grooves divide the hemispheres into four lobes: frontal, temporal, parietal, and occipital. Many nerve cells are found in the convoluted cerebrum's outer surface, or cerebral cortex, which controls sensory and motor activities. The thalamus relays incoming sensory impulses from the spinal cord to the cortex. The hypothalamus's many functions include control of breathing, blood flow, temperature regulation, and emotions. The pituitary gland is attached to and regulated by the hypothalamus. The midbrain relays signals between the forebrain and hindbrain. The cerebellum, along with the cerebrum, plays a role in voluntary movement as well as balance. The pons serves as a relay point linking the medulla oblongata, midbrain, cerebellum, and cerebrum. The medulla, lying between the pons and the spinal cord and continuous with both, plays a role in essential involuntary regulatory and reflexive responses (including breathing, swallowing, and heartbeat) and relays signals between the spinal cord and other brain regions.
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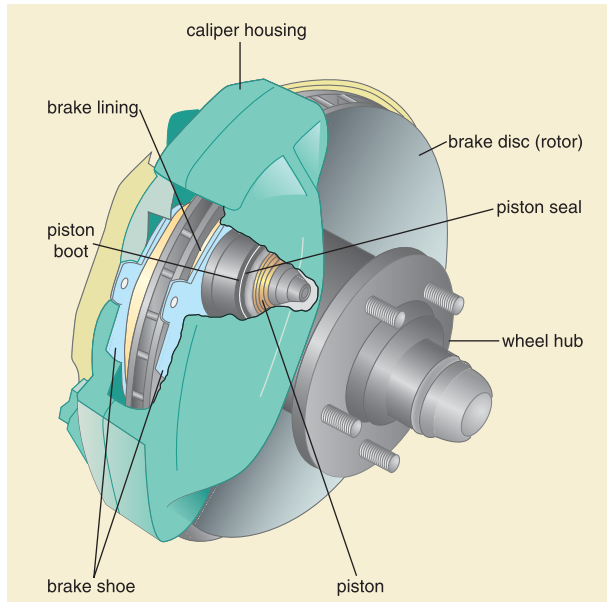
brain death State of irreversible destruction of the brain. Before the invention of life-support systems, brain death always led quickly to death of the body. Ethical considerations are crucial to defining criteria for brain death, which in most countries must be met before efforts to extend life may be ended. Such criteria include deep coma with a known cause, absence of any brainstem functions (e.g., spontaneous respiration, pupil reactions, gag and cough reflexes), and exclusion of hypothermia, drugs, and poison as causes. ELECTROENCEPHALOGRAPHY is useful but not essential in determining brain death. Organ donors must be declared brain-dead before their organs may be removed for transplant. The question of when life support can legally be ended has been the subject of numerous court cases.

brain laterality See LATERALITY

Brain Trust Group of advisers to FRANKLIN ROOSEVELT in his 1932 presidential campaign. Its principal members were the Columbia University professors RAYMOND MOLEY, REXFORD TUGWELL, and Adolf A. Berle, Jr. (1895–1971). They presented Roosevelt with analyses of national social and economic problems and helped him devise public-policy solutions. The group did not meet after Roosevelt became president, but members served in government posts. See also NEW DEAL.

brainwashing Systematic effort to destroy an individual's former loyalties and beliefs and to substitute loyalty to a new ideology or power. It has been used by religious CULTS as well as by radical political groups such as the Chinese Communists in 1949. The techniques of brainwashing usually involve isolation from former associates and sources of information; an exacting regimen calling for absolute obedience and humility; strong social pressures and rewards for cooperation; physical and psychological punishments for noncooperation, including social ostracism and criticism, deprivation of food, sleep, and social contacts, bondage, and torture; and constant reinforcement. Its effects are sometimes reversed through deprogramming, which combines confrontation and intensive psychotherapy.

brake Device for decreasing the speed of a body or stopping its motion. Most brakes act on rotating mechanical elements and absorb KINETIC ENERGY mechanically, hydrodynamically, or electrically. Mechanical brakes are the most common; they dissipate the kinetic energy as heat generated by mechanical FRICTION between a rotating drum or disk and a stationary friction element. A hydrodynamic (fluid) brake has a rotor (rotating element) and a stator (stationary element). Resistance to rotation is created by fluid



A disc brake assembly. Wheel rotation is slowed by friction when the hydraulic pistons squeeze the caliper, pressing the brake pads (shoe and lining assemblies) against the spinning disc (rotor), which is bolted to the wheel hub.
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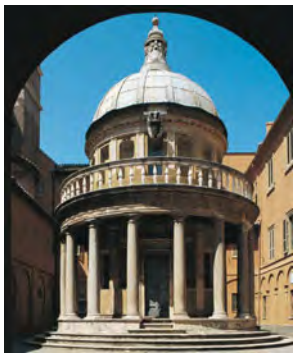
friction and circulation of the liquid (usually water) from a series of pockets in the rotor to a series of complementary pockets in the stator. See also AIR BRAKE.

brake See BRACKEN

Bramah, Joseph (b. April 13, 1748, Stainborough, Yorkshire, Eng.—d. Dec. 9, 1814, London) British engineer and inventor. Originally a cabinetmaker, Bramah in 1784 devised a pick-proof lock, which defied all efforts for 67 years. Since the success of his locks depended on their complexity, they could be produced in quantity only after the creation of a set of well-designed and precisely engineered machine tools, for which he hired a brilliant young blacksmith, HENRY MAUDSLAY. Their prototype machines were essential to the founding of the MACHINE-TOOL industry. Bramah's hydraulic press found many industrial uses and led to the development of hydraulic machinery.

Bramante \brä-'män-tā**, Donato** (b. 1444, probably at Monte Asdruvaldo, Duchy of Urbino—d. April 11, 1514, Rome) Italian architect and perspectivist painter. The son of a farmer, he was working as a painter by 1477. His early architectural works included the church of Santa Maria presso San Satiro (c. 1480), in which the choir is painted in perspective to give an illusion of a much larger space. In 1499 he went to Rome, where he spent the rest of his life. His TEMPIETTO was the first masterpiece of the High Renaissance. Under the patronage of Pope JULIUS II, he drew up plans for the immense Belvedere courtyard in the Vatican (begun c. 1505) and the new ST. PETER'S BASILICA (begun 1506), his greatest work. These ambitious projects were far from complete at the time of his death. Despite the grandiose scale of the St. Peter's undertaking, Bramante continued to work on other projects and played an important role in Julius II's plans for rebuilding Rome.



Tempietto, San Pietro in Montorio, Rome, designed by Donato Bramante, 1502.
G. BERENGO GARDIN—© DEA PICTURE LIBRARY

bramble Any plant of the genus *Rubus* (rose family), consisting of usually prickly shrubs, including RASPBERRIES and BLACKBERRIES. Brambles grow wild throughout North America, as well as in Europe and Asia, and are widely cultivated for their fruits.

Brampton City (pop., 2001: 325,428), southeastern Ontario, Canada. Located west of TORONTO, it was founded c. 1830. It was incorporated as a town in 1873 and as a city in 1976. Its industries include flower growing, tanning, lumbering, and the manufacture of automobiles, shoes, stationery, furniture, and optical equipment.

Brân \'bran\ In CELTIC RELIGION, a gigantic deity described in the *MABINOGION* as king of Britain. He was so large that he and his court lived in a tent rather than a house. When Brân was mortally wounded, he asked his companions to cut off his head and keep it with them, telling them it would provide entertainment and allow them to forget their sorrows. His companions passed 80 joyous years, eventually following his instructions and burying the head on the White Mount in London, where it protected England from invaders until it was finally unearthed.

bran Edible broken seed coat, or protective outer layer, of WHEAT, RYE, or other CEREAL grain, separated from the kernel. In flour processing, it is normally removed from the ground kernels by sifting them in a rotating, meshed, cylindrical frame; whole-grain flours retain the bran. Wheat bran, the most widely processed, contains 16% protein, 11% natural fibre, and 50% carbohydrate. Most bran is coarsely ground for stock feed. In a more refined form, it is used in breakfast cereal, breads, and muffins for its value to the human digestive system as roughage.

Branch Davidians Religious sect that believes in the imminent return of Jesus Christ. It was founded in 1935 near Waco, Texas, by Victor Houteff as a breakaway group from the Seventh-Day Adventists. Under the leadership of Vernon Howell, a charismatic and apocalyptic preacher who would take the name David Koresh (1959–1993), it stockpiled weapons at its compound, where some 130 followers were living by 1993. That year, after a shoot-out in which four federal agents were killed, federal law-enforcement agencies besieged the compound for 51 days. The standoff ended, at the orders of Attorney General Janet Reno, in a conflagration in which some 80 members died, including several children and Koresh himself. Intense controversy about the precise circumstances and the necessity of the final assault led to a Congressional investigation, which in 2000 exonerated federal agents.

Brancusi, Constantin (b. Feb. 21, 1876, Hobiţa, Rom.—d. March 16, 1957, Paris, Fr.) Romanian-born French sculptor. He became adept at carving wooden farm implements as a child and later studied in Bucharest and Munich and at the École des Beaux-Arts in Paris, having walked most of the way from Munich. He first exhibited in Paris in 1906. In 1908 he executed *Sleeping Muse*, influenced by AUGUSTE RODIN, and *The Kiss*, his first truly original work. He developed a geometric style that became his hallmark, reducing natural forms to an abstract simplicity. He exhibited five works, including *Mademoiselle Pogany*, in the 1913 ARMORY SHOW. One of his favourite themes was a bird in flight; his most famous treatment was the celebrated polished-bronze *Bird in Space* (1919). Through numerous exhibitions in the U.S. and Europe, he achieved great fame and success, and he is regarded as a pioneer of modern abstract sculpture.

Brandeis \'bran-ˌdīs**, Louis (Dembitz)** (b. Nov. 13, 1856, Louisville, Ky., U.S.—d. Oct. 5, 1941, Washington, D.C.) U.S. jurist. The son of Bohemian Jewish immigrants, he attended schools in Kentucky and Germany before obtaining his law degree from Harvard (1877). As a lawyer in Boston (1877–1916), he was known as "the people's attorney" for his defense of the constitutionality of several state hours-and-wages laws, his devising of a savings-bank life-insurance plan for working people, and his efforts to strengthen the government's anti-trust power. His work influenced passage in 1914 of the Clayton Anti-Trust Act and the Federal Trade Commission Act. He also developed what came to be called the "Brandeis brief," in which economic and sociological data, historical material, and expert opinion are marshaled to support a legal argument. Appointed to the SUPREME COURT OF THE UNITED STATES (1916), he was noted for his devotion to FREEDOM OF SPEECH. Many of his minority opinions, in which he was often aligned with OLIVER WENDELL HOLMES, JR., later were accepted by the court in the New Deal era. His appointment as the first Jewish justice was vigorously opposed by some business interests and anti-Semitic groups. He served until 1939. Brandeis University is named for him.

Louis Brandeis.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Brandenburg Historical region and province of PRUSSIA. The earliest Germanic inhabitants were replaced by Slavic Wends, who in turn were overcome in the 12th century by Albert the Bear, margrave of Brandenburg. It became one of the seven electorates of the HOLY ROMAN EMPIRE in 1356. Under the elector FREDERICK WILLIAM (1640–88), Brandenburg-Prussia grew to be a leading power. It became a province of Prussia in 1815 and remained such after the unification of Germany (1871) and until the end of World War II. After the war, the eastern portion became part of Poland and the western portion part of East Germany. After Germany's reunification in 1990, the western part became a German state. Brandenburg city, or Brandenburg an der Havel (pop., 2002 est.: 76,400), was formerly the residence of Prussia's reigning family.

Brandenburg Gate The only remaining town gate of Berlin, it is located at the western end of the avenue Unter den Linden. Carl G. Langhans (1732–1808), who built the gate (1789–93), modeled it after the PROPYLAEUM of the Athenian Acropolis. On top was the "Quadriga of Victory," a statue of a chariot drawn by four horses. Heavily damaged in World War II, the gate was restored in 1957–58. From 1961 to 1989 the Berlin Wall shut off access to it for both eastern and western Germans; the gate was reopened in 1989 with the reunification of East and West Berlin.

Brandes \'bran-dəs**, Georg (Morris Cohen)** (b. Feb. 4, 1842, Copenhagen, Den.—d. Feb. 19, 1927, Copenhagen) Danish critic and

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scholar. His published lectures at the University of Copenhagen, *Main Currents in 19th-Century Thought*, 6 vol. (1872–90), catalyzed the breakthrough from Romanticism to realism in Danish literature. His calls for writers to work in the service of progressive ideas and the reform of modern society, along with his championing of such writers as Henrik Ibsen and August Strindberg, earned strong conservative opposition but exerted enormous influence throughout Scandinavia. His other critical works include *Men of the Modern Breakthrough* (1883) and *Danish Poets* (1877).

Brando, Marlon, (Jr.) (b. April 3, 1924, Omaha, Neb., U.S.—d. July 1, 2004, Los Angeles, Calif.) U.S. actor. He gained stardom on Broadway as Stanley Kowalski in *A Streetcar Named Desire* (1947). An early member of the Actors Studio, he brought its method acting style to his first film, *The Men* (1950). His slurred, mumbling delivery marked his rejection of classical dramatic training, and his true and passionate performances proved him one of the great actors of his generation. After starring in the screen version of *Streetcar* (1951), he appeared in films such as *The Wild One* (1954), *On the Waterfront* (1954, Academy Award), *The Godfather* (1972, Academy Award), *Last Tango in Paris* (1972), and *Apocalypse Now* (1979).

Brandt, Bill *orig.* **Hermann Wilhelm Brandt** (b. May 1904, Hamburg, Ger.—d. Dec. 20, 1983, London, Eng.) German-born British photographer. In 1929 he worked in the studio of Man Ray in Paris. He returned to England in 1931 and took up photojournalism, documenting English industrial workers in the 1930s and covering the home front during World War II. His work reveals the influence of Eugène Atget, Brassaï, and Henri Cartier-Bresson. He is best known for his photographs of British life and especially for his unconventional nudes; he placed his wide-angle camera at close range to the human body, causing a distorted effect that transformed the human body into a series of abstract designs.

Brandt, Willy *orig.* **Herbert Ernst Karl Frahm** (b. Dec. 18, 1913, Lübeck, Ger.—d. Oct. 8/9, 1992, Unkel, near Bonn) German statesman. As a young Social Democrat, he fled to Norway to avoid arrest after the rise of the Nazis in the 1930s. There he assumed the name Willy Brandt and worked as a journalist. Returning to Germany after World War II, he was elected to parliament in 1949 and became mayor of West Berlin (1957–66), a post in which he achieved world fame. He led a coalition government as chancellor of the Federal Republic of Germany (1969–74). As chancellor, he improved relations with East Germany, other communist nations in eastern Europe, and the Soviet Union and helped strengthen the European Economic Community. For these efforts he received the Nobel Prize for Peace in 1971. He remained the leader of the Social Democratic Party until 1987.

Willy Brandt.
AUTHENTICATED NEWS INTERNATIONAL

brandy Alcoholic beverage distilled from wine or a fermented fruit mash. The name comes from the Dutch *brandewijn*, "distilled wine." Most brandies are aged and contain about 50% alcohol by volume. Some are darkened with caramel. They are usually served alone as after-dinner drinks but are sometimes used in mixed drinks or dessert dishes or as fuel in flamed dishes such as crêpes suzettes and cherries jubilee. They are also used as the base of various liqueurs. The finest brandy is usually thought to be French cognac.

Brandywine, Battle of the (Sept. 11, 1777) Battle in the American Revolution. British Gen. William Howe attempted to remove Pennsylvania from the war by engaging troops under Gen. George Washington on Brandywine Creek, 25 mi (40 km) from the revolutionary capital of Philadelphia. In the end, the British troops occupied the battlefield but failed to destroy Washington's army or cut it off from Philadelphia. This failure contributed to the later British defeat at the Battle of Saratoga.

Brant, Joseph (b. 1742, banks of the Ohio River—d. Nov. 24, 1807, near Brantford, Ont., Can.) Mohawk Indian chief and Christian missionary. Brant was converted to the Anglican church while attending a school for Indians in Connecticut. He fought for the British in the last French and Indian War (1754–63). He led four of the six Iroquois nations on the British side in the American Revolution, winning several notable battles. After the war Brant was granted land along the Grand River in Ontario, Can., where he ruled peacefully and continued his missionary work.

Joseph Brant, portrait by Charles Willson Peale, 1797; in Independence National Historical Park, Philadelphia
COURTESY OF THE INDEPENDENCE NATIONAL HISTORICAL PARK COLLECTION, PHILADELPHIA

Brant, Sebastian (b. 1458?, Strassburg—d. May 10, 1521, Strassburg) German poet. He taught law and later was appointed imperial councillor and court palatine by Maximilian I. His varied writings include works on law, religion, politics, and especially morals. His best-known work is *The Ship of Fools* (1494), an allegory telling of fools on a ship bound for a "fool's paradise." The most famous German literary work of the 15th century, it ridicules the vices of the age and gave rise to a whole school of fool's literature.

Braque \'bräk**, Georges** (b. May 13, 1882, Argenteuil, France—d. Aug. 31, 1963, Paris) French painter. He studied painting in Le Havre, then in Paris at a private academy and briefly at the École des Beaux-Arts. Though his earliest works were influenced by Impressionism, his first important paintings (1905–07) were in the style of Fauvism pioneered by André Derain and Henri Matisse; in 1907 he exhibited and sold six of these paintings at the Salon des Indépendants. Abandoning Fauvism in 1907, he invented with Pablo Picasso the revolutionary new style known as Cubism. He painted mostly still lifes featuring geometric shapes and low-key colour harmonies. In 1912 he introduced the collage, or *papier collé* (pasted-paper picture), by attaching three pieces of wallpaper to the drawing *Fruit Dish and Glass*. By the 1920s he was a prosperous, well-established modern master. In 1923 and 1925 he designed stage sets for Sergey Diaghilev's Ballets Russes. He enjoyed a long and prestigious career; in his later years he was honoured with important exhibitions throughout the world. In 1961 he became the first living artist to have his works exhibited in the Louvre.

Bras d'Or \brä-'dȯr\ **Lake** Salt lake, Nova Scotia, Canada. Located on Cape Breton Island, it is about 50 mi (80 km) long and has an area of 360 sq mi (932 sq km). Its extension, Little Bras d'Or, connects it to the Atlantic Ocean on the north, while a man-made canal connects it to the Atlantic on the south. The lake is a popular summer resort area.

Brasília City (pop., 2000: 2,043,169), capital of Brazil. It lies on the Paraná River. Though the idea of having the country's capital located in the interior was proposed as early as 1789, Brasília's construction began only in 1956. It was designed by the Brazilian architects Lúcio Costa and Oscar Niemeyer. In 1960 the government began its move from Rio de Janeiro. The city is a governmental rather than an industrial centre, although many Brazilian companies have headquarters there. Brasília National Park is nearby.

Brasov *or* **Brashov** \brä-'shōv\ *German* **Kronstadt** \'krōn-ˌshtät\ City (pop., 2002: 588,366), Romania. It lies in the foothills of the Transylvanian Alps north of Bucharest. Founded by Teutonic Knights in 1211, it became the centre of a Saxon colony trading in cloth and metalwork throughout much of Walachia and Moldavia. The substantial autonomy of its German inhabitants ended in 1876 with the abolition of their separate national status. Brasov is today a centre for heavy manufacturing.

brass Alloy of copper and zinc, important for its hardness and workability. Brass was first used c. 1200 BC in the Near East, then extensively in China after 220 BC, and soon thereafter by the Romans. In ancient documents, including the Bible, the term brass is often used to denote bronze (copper/tin alloy). The malleability of brass depends on its zinc content; brasses with more than 45% zinc are not workable. Alpha brasses contain less than 40% zinc; beta brasses (40–45% zinc) are less ductile than alpha brasses but stronger. A third group includes brasses with additional elements. Among these are lead brasses, which are more easily machined;

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naval and admiralty brasses, in which a small amount of tin improves resistance to corrosion by seawater; and aluminum brasses, which provide strength and corrosion resistance where the naval brasses may fail.

brass instrument Musical wind instrument, usually made of brass or other metal, in which the vibration of the player's lips against a cup- or funnel-shaped mouthpiece causes the initial vibration of an air column. The TRUMPET, TROMBONE, FRENCH HORN, TUBA, EUPHONIUM, SOUSAPHONE, CORNET, FLÜGELHORN, and BUGLE, as well as historical instruments such as the ophicleide, cornett, and serpent, are considered brass instruments (though the last two were made of wood); the saxophones, though made of brass, are REED INSTRUMENTS classified as WOODWIND INSTRUMENTS.

Brassaï \brä-ˈsī\ *orig.* **Gyula Halász** (b. Sept. 9, 1899, Brassó, Transylvania, Austria-Hungary—d. July 8, 1984, Eze, France) Hungarian-born French photographer, poet, and sculptor. His pseudonym derives from his native city. In 1924 he settled in Paris, where he became acquainted with PABLO PICASSO, JOAN MIRÓ, and SALVADOR DALÍ. He earned his living as a journalist and found it necessary to use a camera for his assignments. In the 1930s he became known for his dramatic photographs of Paris nightlife. Books of his photographs, including *Paris After Dark* (1933) and *Pleasures of Paris* (1935), brought him international fame.

"'Bijoux' in Place Pigalle Bar," by Brassaï, 1932.
BRASSAI—RAPHO/PHOTO RESEARCHERS

brassica Any plant of the large genus *Brassica*, in the MUSTARD FAMILY, containing about 40 Old World species and including the CABBAGES, mustards, and RAPES. *B. oleracea* has many edible varieties, such as BROCCOLI, BRUSSELS SPROUTS, cabbage, CAULIFLOWER, KALE, and KOHLRABI. Also included in this genus are the TURNIP (*B. rapa*), the RUTABAGA (*B. napobrassica*), and the CHINESE CABBAGES (*B. pekinensis* and *B. chinensis*).

Bratislava \ˌbrä-ti-ˈslä-və\ *German* **Pressburg** \ˈpres-ˌbůrk\ *Hungarian* **Pozsony** \ˈpō-ˌzhōnʸ\ City (pop., 2001 prelim.: 428,672), capital of Slovakia. Settled first by Celts and Romans, it was ultimately inhabited by Slavs in the 8th century. As Pressburg, it developed as a trade centre and became a free royal town in 1291. The first university in what was then Hungary was founded there in 1467. The city served as the Hungarian capital (1541–1784) and was the seat of the Diet until 1848. The Treaty of Pressburg (1805) was signed here by NAPOLEON and FRANCIS II following the Battle of AUSTERLITZ. After World War I, on the formation of Czechoslovakia, it became capital of the province of Slovakia, and it became the national capital on Slovakia's independence in 1992.

Brattain \ˈbra-tᵊn**, Walter H(ouser)** (b. Feb. 10, 1902, Amoy, China—d. Oct. 13, 1987, Seattle, Wash., U.S.) U.S. scientist. His American parents brought him to the U.S. soon after his birth. After earning a Ph.D. from the University of Minnesota, he became a researcher at Bell Laboratories in 1929. With JOHN BARDEEN and WILLIAM B. SHOCKLEY, he shared the 1956 Nobel Prize for Physics for the development of the TRANSISTOR and for investigation of the properties of SEMICONDUCTORS.

Brauchitsch \ˈbraů-ˌkich**, (Heinrich Alfred) Walther von** (b. Oct. 4, 1881, Berlin, Ger.—d. Oct. 18, 1948, Hamburg) German army officer. A member of the general staff in World War I, he rose to become field marshal and army commander in chief (1938). In World War II, he successfully directed Germany's ground war until ADOLF HITLER forced his resignation after suffering major losses in Russia in 1941. He survived the war but died shortly before his scheduled trial as a war criminal.

Braudel \brō-ˈdel**, (Paul Achille) Fernand** (b. Aug. 24, 1902, Luméville, France—d. Nov. 28, 1985, Haute-Savoie) French historian and educator. While a prisoner of the Germans during World War II, Braudel wrote from memory his thesis on the history of the Mediterranean region in the 16th century, later published as *The Mediterranean and the Mediterranean World in the Age of Phillip II* (1949). With MARC BLOCH and Lucien Febvre, he became an influential leader of the ANNALES SCHOOL, which emphasized the effects of factors such as climate, geography, and demographics on history. His second major work was *Civilization and Capitalism, 15th–18th Century* (1967, 1979).

Braun \ˈbraůn**, Eva** (b. Feb. 6, 1912, Munich, Ger.—d. April 30, 1945, Berlin) Mistress of ADOLF HITLER. A saleswoman in the shop of Hitler's photographer, she became Hitler's mistress in the 1930s, living first in a house he provided in Munich, then at his chalet in Berchtesgaden. He never allowed her to be seen in public with him, and she had no influence on his political life. In April 1945 she joined him in Berlin, against his orders, as the Allied Powers were closing in on the capital. In recognition of her loyalty, he married her in a civil ceremony in the Chancellery bunker on April 29. The next day Eva Hitler ended her life by taking poison; her husband shot himself. In accordance with his instructions, their bodies were burned.

Eva Braun, 1944
HEINRICH HOFFMANN, MUNICH

Braun \ˈbraůn**, Wernher von** (b. March 23, 1912, Wirsitz, Ger.—d. June 16, 1977, Alexandria, Va., U.S.) German-born U.S. ROCKET engineer. Born into an aristocratic family, he received his doctorate from the University of Berlin. In 1936 he became technical director of the new military development facility at Peenemünde, an essential centre for the rearmament of Nazi Germany, forbidden by the Versailles accords. Liquid-fueled rocket aircraft and jet-assisted takeoffs were successfully demonstrated there, and the V-2 long-range ballistic missile and the Wasserfall supersonic antiaircraft missile were developed. By 1944 the sophistication of the rockets and missiles being tested at Peenemünde was many years ahead of that of any other country. After World War II he and his team surrendered to the U.S.; they were immediately set to work on guided missiles by the U.S. Army, and in 1952 he became technical director (later chief) of the Army's ballistic weapon program. Under his leadership, the Redstone, Jupiter-C, Juno, and Pershing missiles were developed. In 1958 he and his group launched the first U.S. satellite, EXPLORER 1. After NASA was formed, von Braun led the development of some of the large SATURN space launch vehicles; the engineering success of each of the Saturn class of space boosters remains unmatched in rocket history.

Braunschweig \ˈbraůn-ˌshfīk\ *English* **Brunswick** Administrative district, Lower Saxony, Germany. A possession of the Welf family, the duchy of Braunschweig (Brunswick-Lüneberg) was created by Emperor Frederick II in 1235 and included the lands surrounding the town of Braunschweig. The electorate of Hanover was included in 1692; its rulers established the English royal house of HANOVER. The duchy became part of the German Empire in 1871 and a German state after 1919. After World War II the region was incorporated into the state of Lower Saxony. The city of Braunschweig (Brunswick; pop., 2003 est.: 245,076) is today an important industrial centre.

Brazil *officially* **Federative Republic of Brazil** Country, east-central South America. Area: 3,287,612 sq mi (8,514,877 sq km). Population (2005 est.): 184,016,000. Capital: BRASÍLIA. Most Brazilians are of European or mixed (Indian-European, European-African) ancestry. Brazil's ethnic groups have intermixed since the earliest days of its colonial history; Indian peoples who have experienced no mixing with immigrants are restricted to the most remote parts of the AMAZON RIVER basin. Language: Portuguese (official). Religions: Christianity (predominantly Roman Catholic; also Protestant); also traditional beliefs. Currency: real. Brazil may be divided into many regions, but the Amazon lowlands and the Brazilian Highlands (often called the Central Highlands or Central Plateau) dominate the landscape. The highlands, a plateau with an average elevation of 3,300 ft (1,000 m), are primarily in the southeast, while the Amazon lowlands, with elevations below 800 ft (250 m), are in the north. The AMAZON RIVER basin, with its more than 1,000 known tributaries, occupies nearly half of the country's total area. Brazil's other rivers include the São Francisco, Parnaíba, PARAGUAY, Alto Paraná, and URUGUAY. Except for the islands of Marajó and Caviana at the mouth of the Amazon and Maracá to the north, there are no large islands along the roughly 4,600 mi (7,400 km) of Brazil's Atlantic Ocean coast. There are good

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harbours at Belém, Salvador, Rio de Janeiro, Santos, and Pôrto Alegre. The country's immense forests are a source of many products, while its savannas support cattle raising. Agriculture is important, and mineral reserves are large. Brazil has a developing market economy based mainly on manufacturing, financial services, and trade. It is a federal republic with two legislative houses; its chief of state and government is the president. Little is known about Brazil's early indigenous inhabitants. Though the area was theoretically allotted to Portugal by the 1494 Treaty of Tordesillas, it was not formally claimed by discovery until Portuguese navigator Pedro Álvares Cabral accidentally touched land in 1500. It was first settled by the Portuguese in the early 1530s on the northeastern coast and at São Vicente (near modern São Paulo); the French and Dutch created small settlements over the next century. A viceroyalty was established in 1640, and Rio de Janeiro became the capital in 1763. In 1808 Brazil became the refuge and seat of the government of John VI of Portugal when Napoleon I invaded Portugal; ultimately the Kingdom of Portugal, Brazil, and Algarve was proclaimed, and John ruled from Brazil (1815–21). On John's return to Portugal, Pedro I proclaimed Brazilian independence. In 1889 his successor, Pedro II, was deposed, and a constitution mandating a federal republic was adopted. Beginning in the 20th century, immigration increased and manufacturing grew, and there were frequent military coups and suspensions of civil liberties. Construction of a new capital at Brasília, intended to spur development of the country's interior, worsened the inflation rate. After 1979 the military government began a gradual return to democratic practices, and in 1989 the first popular presidential election in 29 years was held. A severe economic crisis began in the late 1990s.

Brazil nut Edible seed of a large South American tree, *Bertholletia excelsa* (family Lecythidaceae), and one of the major commercially traded nuts in the world. The hard-walled fruit, resembling a large coconut, contains 8–24 nuts (seeds) arranged in it like sections of an orange. Each nut has a very hard shell and is three-sided in shape. Brazil nuts are high in fat and protein and taste somewhat like almond or coconut. The tree grows wild in stands in the Amazon River basin, reaching heights of 150 ft (45 m) or more.

brazing Process for joining two pieces of metal by applying heat and adding a filler metal. The filler, which has a lower melting point than the metals to be joined, is either pre-placed or fed into the joint as the parts are heated. In brazing parts with small clearances, the filler is able to flow into the joint by capillarity. The temperature of the molten filler in brazing exceeds 800°F (430°C). In soldering, a related process, the filler metal remains below that temperature. Brazed joints are usually stronger than soldered joints. Most metals can be brazed, and the range of available brazing alloys has increased as new alloys and new service requirements are introduced. Brazed joints are highly reliable and are used extensively on rockets, jet engines, and aircraft parts. See also welding.

Brazos \'bra-zəs\ **River** River, central Texas, U.S. Formed in eastern New Mexico, it flows southeast 1,280 mi (2,060 km) into the Gulf of Mexico. The city of Waco is one of the largest on the river. Near its mouth it connects with the Gulf Intracoastal Waterway. The lower river valley was a major site of early Anglo-American settlement in Texas; one of the first English-speaking colonies there was founded by Stephen Austin at San Felipe de Austin in 1822. The river's original name was Brazos de Dios ("Arms of God").

Brazza \brä-'zä**, Pierre (-Paul-François-Camille) Savorgnan de** (b. Jan. 26, 1852, near Rome [Italy]—d. Sept. 14, 1905, Dakar, Seneg., French West Africa) French explorer and colonial administrator. Born to Italian nobility in Brazil, he joined the French navy. In 1875–78 he explored the Ogooué River (in present-day Gabon). Racing his British-U.S. counterpart, Henry Morton Stanley, Brazza was sent to explore the Congo River region. There he founded the French (Middle) Congo, explored Gabon, and founded the city of Brazzaville (1883), adding some 200,000 sq mi (500,000 sq km) to the French colonial empire. From 1886 to 1897 he governed a colony there.

Brazzaville \'brä-zə-ˌvil\ River port (pop., 1992 est.: 937,579), capital of Republic of the Congo. Lying on the north bank of the Congo River across from Kinshasa, it was founded in 1883 by Pierre Savorgnan de Brazza. Developed as a European administrative and residential center, it was used as a base for later claims of France to lands to the northeast; it became the capital of French Equatorial Africa. The river port forms the terminus of the Congo-ocean transport system, with steamer service to the Congo's upper reaches and a railroad to Pointe-Noire 245 mi (394 km) west.

bread Baked food product. It is made of flour or meal that is moistened into a dough, kneaded, and usually leavened with yeast. A major food since prehistoric times, bread has been made worldwide in various forms using a variety of ingredients and methods. Flat, unleavened bread, the earliest

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form, is still eaten in the Middle East, Asia, and Africa. The principal grains used in such breads are WHEAT, BARLEY, MILLET, BUCKWHEAT, RYE, and CORN. Raised bread, common in Europe and the U.S., is usually made of wheat or rye. Both contain the elastic protein substance gluten, which traps gas produced by FERMENTATION during leavening, helping the bread to rise. While the simplest breads contain only flour, water, and yeast, other common ingredients are milk, shortening (fats, butter, oils), salt, eggs, and sugar. Bread is a source of complex CARBOHYDRATES and B vitamins (see VITAMIN B COMPLEX); whole-wheat bread contains more protein, vitamins, minerals, and fibre than white-flour bread. See also BAKING.

breadfruit Fruit of either of two closely related trees belonging to the MULBERRY FAMILY. *Artocarpus communis* (also called *A. incisa* or *A. altilis*) provides a staple food of the South Pacific. Its greenish to brownish-green, round fruits have a white, fibrous pulp. *Treculia africana*, native to tropical Africa, is less important as a food crop. Cultivated in the Malay Archipelago (where it is thought to be indigenous) since remote antiquity, the breadfruit was spread throughout the tropical South Pacific in prehistoric times. It is high in starch and is seldom eaten raw. Unable to tolerate frost, the tree has not been successfully grown in the U.S., even in southernmost Florida. In the South Seas, cloth is made from the inner bark, the wood is used for canoes and furniture, and glue and caulking material are obtained from the milky juice.

bream European food and game fish (*Abramis brama*) of the CARP family (Cyprinidae). Found in lakes and slow rivers, the bream lives in schools and eats worms, mollusks, and other small animals. Deep-bodied, with flat sides and a small head, it is silvery with a bluish or brown back. It is usually about 12–20 in. (30–50 cm) long and weighs up to 13 lbs (6 kg). Other species called bream include the silver bream (*Blicca bjoorkna*), the golden SHINER, and the sea breams (family Sparidae).

Bream (*Abramis brama*)
W.S. PITT—ERIC HOSKING

breast cancer Malignant TUMOUR in a breast, usually in women after menopause. Risk factors include family history of breast cancer, prolonged menstruation, late first pregnancy (after age 30), obesity, alcohol use, and some benign tumours. Most breast cancers are adenocarcinomas. Any lump in the breast needs investigation because it may be cancer. Treatment may begin with radical or modified MASTECTOMY or lumpectomy (in which only the tumour is removed), followed by radiation therapy, chemotherapy, or removal of the ovaries or adrenal glands.

breathing See RESPIRATION

Brébeuf \brā-'bœf**, Saint Jean de** (b. March 25, 1593, Condé-sur-Vire, Normandy—d. March 16, 1649, Saint-Ignace, New France; canonized 1930; feast day October 19) French Jesuit missionary to NEW FRANCE. Ordained in 1623, he arrived in New France in 1625 to work as a missionary among the HURON. Forced out by the English in 1629, he returned to "Huronia" in 1634. In 1648 the Iroquois began their war against the Huron, and in 1649 they captured Brébeuf and tortured him to death. His writings include historical narratives and a Huron grammar. He is regarded as the patron saint of Canada.

breccia \'bre-chə\ Coarse sedimentary rock consisting of angular or nearly angular fragments larger than 0.08 in. (2 mm). Breccia commonly results from processes such as landslides or geologic faulting, in which rocks are fractured. It can also be of igneous explosive origin (e.g., a volcanic breccia).

Brecht \'brekt**, Bertolt** *orig.* **Eugen Berthold Friedrich Brecht** (b. Feb. 10, 1898, Augsburg, Ger.—d. Aug. 14, 1956, East Berlin, E.Ger.) German playwright and poet. He studied medicine at Munich (1917–21) before writing his first plays, including *Baal* (1922). Other plays followed, including *A Man's a Man* (1926), as well as a considerable body of poetry. With the composer KURT WEILL he wrote the satirical musicals *The Threepenny Opera* (1928; film, 1931), which gained him a wide audience, and *The Rise and Fall of the City of Mahagonny* (1930). In these years he became a Marxist and developed his theory of EPIC THEATRE. With the rise of the Nazis he went into exile, first in Scandinavia (1933–41), then in the U.S., where he wrote his major essays and the plays *Mother Courage and Her Children* (1941), *The Life of Galileo* (1943), *The Good Woman of Sichuan* (1943), and *The Caucasian Chalk Circle* (1948). Harassed for his politics, in 1949 he returned to East Germany, where he established the Berliner Ensemble theatre troupe and staged his own plays, including *The Resistible Rise of Arturo Ui* (1957). He outlined his theory of drama in *A Little Organum for the Theatre* (1949).

Bertolt Brecht, 1931
ULLSTEIN BILDERDIENST

Breckinridge, John C(abell) (b. Jan. 21, 1821, near Lexington, Ky., U.S.—d. May 17, 1875, Lexington) U.S. politician, vice president (1857–61), and Confederate army officer. He practiced law and later served in the U.S. House of Representatives (1851–55). In 1856 he was elected vice president under JAMES BUCHANAN. In 1860 the Democratic Party split into factions over the slavery issue, and Breckinridge became the Southern wing's nominee for president. Defeated by ABRAHAM LINCOLN, he worked for compromise; but after the firing on Fort Sumter he urged Kentucky to secede. He became a general in the Confederate army and took part in the Vicksburg, Wilderness, and Shenandoah Valley campaigns. He served as Confederate secretary of war in 1865. After the war he fled to England for three years before returning to Kentucky to resume his law practice.

Breda \brā-'dä**, Declaration of** (1660) Document issued by the exiled King CHARLES II in Breda, the Netherlands, making certain promises in return for his restoration to the English throne. It expressed his desire for a general amnesty, liberty of conscience, an equitable settlement of land disputes, and full payment of arrears to the army. He left the specifics to the Convention Parliament. See also RESTORATION.

breeding Application of genetic principles in animal husbandry, agriculture, and horticulture to improve desirable qualities. Ancient agriculturists improved many plants through selective cultivation. Modern plant breeding centers on pollination; pollen from the chosen male plant, and no other pollen, must be transferred to the female plant. Animal breeding consists of choosing the ideal trait (e.g., fine wool, high milk production), selecting the breeding stock, and determining the mating system (e.g., whether mating animals are unrelated, mildly related, or highly inbred).

Breisgau \'brīs-ˌgaù\ Historic region, southwestern Germany. Located between the RHINE RIVER and the BLACK FOREST, it was once part of the Roman empire. From the 3rd century AD it was occupied by the Germanic Alemanni. It became a countship in the early Middle Ages, and in 1120 the town of Freiburg im Breisgau was founded. In the 14th century the HABSBURGS incorporated most of it into their domains. Breisgau was subjected to destructive sieges during the THIRTY YEARS' WAR, and for a time was held by the Swedes. It now forms part of the state of Baden-Württemberg.

Brel, Jacques (b. April 8, 1929, Brussels, Belg.—d. Oct. 9, 1978, Bobigny, near Paris, France) Belgian singer and songwriter. He began his career singing in French cafés. His songs, frequently sharply satirical and often implicitly religious, became hugely popular in Europe. He acted in and directed a number of films from 1967 to 1973. His U.S. reputation was made by the revue *Jacques Brel Is Alive and Well and Living in Paris* (1968).

Bremen City (pop., 2002 est.: city, 540,950; metro. area, 849,800), northwestern Germany. Located on the WESER RIVER, it was established as a diocese in 787 by CHARLEMAGNE and was the seat of an archbishopric from 845. In the 10th century it became an economic centre of northern Germany, especially after entering the HANSEATIC LEAGUE in 1358. It joined the GERMAN CONFEDERATION in 1815 and the reconstituted German Empire in 1871. It suffered extensive damage in World War II; after the war Bremen, with nearby Bremerhaven (pop., 2002 est.: 195,863), became a state of West Germany. Today the state, covering 156 sq mi (404 sq km), forms an integral part of the German economy and serves as headquarters for many industries.

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Bremen \'brā-mən\ Former duchy, Germany. Lying between the lower Weser and lower Elbe rivers and northwest of the former duchy of Brunswick-Lüneburg, it covered an area of about 2,000 sq mi (5,200 sq km). It was made an archbishopric in the 13th century, and in 1648 became a duchy under the supremacy of Sweden. In 1715 it became part of the electorate of Hanover.

bremsstrahlung \'brem-ˌshträl-əŋ\ *German* **"braking radiation"** Electromagnetic radiation produced by a sudden slowing down or deflection of charged particles, especially electrons, passing through matter in the vicinity of the strong electric fields of atomic nuclei. It occurs as cosmic rays pass through the Earth's atmosphere and accounts for continuous X-ray spectra.

Brendan, Saint (b. 484/486, Tralee, Ire.—d. 578, Annaghdown, County Galway; feast day May 16) Celtic saint and hero of legendary Atlantic voyages. Educated by St. Ita at her school in southwestern Ireland, he became a monk and priest and was put in charge of the abbey at Ardfert. He later founded monasteries in Ireland and Scotland, notably Clonfert (561). A famous traveler, he voyaged to the Hebrides and perhaps to Wales and Brittany. He was immortalized in *Voyage of Brendan*, an Irish epic translated into Latin in the 10th century that told of his journey to a "Promised Land of Saints," and St. Brendan's Island was long sought by explorers.

Brennan, William J(oseph), Jr. (b. April 25, 1906, Newark, N.J., U.S.—d. July 24, 1997, Arlington, Va.) U.S. jurist. He studied under Felix Frankfurter at Harvard Law School, receiving his degree in 1931. He practiced labour law in New Jersey until 1949, when he was appointed to the state Superior Court. He rose through the ranks of the New Jersey courts, where he was noted for his administrative skill. Although a Democrat, he was named to the Supreme Court of the United States by Republican Pres. Dwight D. Eisenhower in 1956. He came to be regarded as one of the most influential jurists in its history. A liberal constructionist and an articulate defender of the Bill of Rights, he is perhaps best remembered for his role in a series of obscenity cases, beginning with *Roth* v. *United States* (1957), many of which broadened the protection accorded to publishers while seeking to balance individual freedoms with the interests of the community. In *New York Times* v. *Sullivan* (1964), he wrote that even false statements about public officials are protected under the 1st and 14th Amendments unless "actual malice" can be demonstrated. He also wrote the majority opinion in *Baker* v. *Carr* (1962). He opposed capital punishment and supported abortion rights, affirmative action, and school desegregation. He served until 1990; his decisions numbered more than 1,350.

Brent, Margaret (b. c. 1600, Gloucestershire, Eng.—d. 1669/71, Westmoreland county, Va.) British colonial landowner in North America. She arrived in Maryland in 1638 and obtained a patent for 70 acres, becoming the first woman in the colony to hold land in her own right. By 1657 she was among the colony's largest landowners. In a border dispute with Virginia in 1646, she organized a group of armed volunteers to support the Maryland colony's governor, Leonard Calvert. On his death in 1647, she became executor of his estate and settled a dispute over back pay for his soldiers that had nearly led to civil war.

Brentano \bren-'tä-nō**, Clemens** (b. Sept. 9, 1778, Ehrenbreitstein, near Koblenz—d. July 28, 1842, Aschaffenburg, Bavaria) German poet, novelist, and dramatist. He was one of the founders of the Heidelberg Romantic school, which emphasized German folklore and history. With his brother-in-law Achim von Arnim (1781–1831), he published *Des Knaben Wunderhorn* (1805–08; *The Youth's Magic Horn*), a collection of German folk lyrics (including successful imitations of folk style) that became an important inspiration to lyric poets and composers such as Gustav Mahler. Among his most successful works are his fairy tales, particularly *Gockel, Hinkel and Gackeleia* (1838).

Brentano \bren-'tä-nō**, Franz (Clemens)** (b. Jan. 16, 1838, Marienberg, Hesse-Nassau—d. March 17, 1917, Zürich, Switz.) German philosopher. Nephew of Clemens Brentano, he was ordained a priest in 1864 and taught at the University of Würzburg (1866–73). Religious doubts led to his resignation from the priesthood in 1873. To present a systematic psychology that would serve as a science of the soul, he wrote the influential *Psychology from an Empirical Standpoint* (1874). He became the founder of act psychology, or intentionalism, which concerns itself with the mind's "acts" or processes (e.g., perception, judgment, loving, and hating) rather than its contents. He later taught at the University of Vienna (1874–80, 1881–95) and published works such as *Inquiry into Sense Psychology* (1907) and *The Classification of Psychological Phenomena* (1911).

Brescia \'brā-shä, 'bre-shə\ *ancient* **Brixia** City (pop., 2001 prelim.: 187,865), Lombardy region, northern Italy. Originally a Celtic stronghold, it was occupied by the Romans c. 200 BC and became the seat of a Roman colony in 27 BC. It was devastated by the Goths (AD 412) and plundered by Attila (452). It was a free city from 936 to 1426. It passed to Venice, France, and Austria before being united with Italy in 1860. Historic structures include Roman ruins and 11th- and 17th-century cathedrals. The art treasures in its numerous churches include works by painters of the 15th- and 16th-century Brescia school.

Breshkovsky, Catherine (b. 1844—d. Sept. 12, 1934, near Prague, Czech.) Russian revolutionary. After becoming involved with the Narodnik (or Populist) revolutionary group in the 1870s, she was arrested and exiled to Siberia for the years 1874–96. In 1901 she helped organize the Socialist Revolutionary Party, and her involvement again led to her arrest and exile to Siberia (1910–17). Though she became known as the "little grandmother of the Revolution," she opposed the Bolsheviks after their 1917 victory and emigrated to Prague.

Breslau See Wrocław

Breslin, Jimmy *orig.* **James Earl Breslin** (b. Oct. 17, 1929, Jamaica, N.Y., U.S.) U.S. columnist and novelist. During his long newspaper career Breslin became known as a tough-talking voice of his native Queens, a working-class New York City borough. He started as a copyboy, then established himself as a sportswriter; later, as a syndicated columnist and contributor to numerous publications, he wrote with passion and personal involvement on politics and social issues, often focusing on injustice and corruption. He won a 1986 Pulitzer Prize for newspaper columns championing ordinary citizens. Among his books are the novel *The Gang That Couldn't Shoot Straight* (1969).

Bresson, Henri Cartier- See Henri Cartier-Bresson

Bresson \brə-'sōⁿ**, Robert** (b. Sept. 25, 1901, Bromont-Lamonthe, Puy-de Dôme, France—d. Dec. 18, 1999) French film director. He worked as a painter and photographer before making his first film in 1934. His feature-length *Les Anges du péché* (1943) established his austere, intellectual style. Noted for intense psychological probing and the subordination of plot to visual imagery, he also directed *The Diary of a Country Priest* (1950), *A Man Escaped* (1956), *Pickpocket* (1959), *Balthazar* (1966), *Lancelot of the Lake* (1974), and *L'Argent* (1983).

Brest-Litovsk \'brest-li-'tȯfsk**, Treaty of** (March 3, 1918) Peace treaty signed at Brest-Litovsk (now in Belarus) by the Central Powers with Soviet Russia, concluding hostilities between those countries in World War I. Russia lost the Ukraine, its Polish and Baltic territories, and Finland by signing the treaty, which was later annulled by the Armistice.

Brétigny \brā-tēn-'yē**, Treaty of** (1360) Treaty between England and France that ended the first phase of the Hundred Years' War. Marking a serious setback for the French, the treaty was signed after Edward the Black Prince defeated and captured John II of France at the Battle of Poitiers (1356). The French ceded extensive territories in northwestern France to England and agreed to ransom John at a cost of three million gold crowns, while King Edward III renounced his claim to the French throne. The treaty failed to establish a lasting peace, and the war began again in 1369.

Breton \brə-'tōü**, André** (b. Feb. 18, 1896, Tinchebray, France—d. Sept. 28, 1966, Paris) French writer, critic, and editor. In 1919 he helped found the Dada magazine *Littérature*. Influenced by psychiatry and the Symbolist movement, he wrote poetry using the automatic-writing technique. In 1924 his *Manifeste du surréalisme* provided a definition of Surrealism, of which he was the chief promoter. In the 1930s he joined and then broke with the Communist Party; in 1938 he founded the Fédération de l'Art Revolutionnaire Indépendant with Leon Trotsky in Mexico. He spent World War II in the U.S. and returned to France in 1946. His *Poèmes* appeared in 1948. He also wrote essays, works of criticism, and novels, including *Nadja* (1928).

Breton \'bre-tᵊn\ **language** Celtic language spoken in Brittany in France. It was introduced in the 5th–6th centuries by immigrants from southern Britain. Breton is attested in glosses in Latin manuscripts of the 8th–10th centuries, but no continuous text is known before the 15th century. The modern language is divided into four groups of very diverse

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dialects; this disunity has hindered efforts to form orthographic and literary standards. Though Breton may have half a million speakers, use of the language is generally thought to be in sharp decline among younger people despite a resurgence of regional particularism in western Europe.

Bretton Woods Conference *officially* **United Nations Monetary and Financial Conference** (July 1–22, 1944) Meeting held at Bretton Woods, N.H., to make financial arrangements for the postwar era after the expected defeat of Germany and Japan. Representatives of 44 countries, including the Soviet Union, agreed to create the INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT (WORLD BANK) and the INTERNATIONAL MONETARY FUND. See also JOHN MAYNARD KEYNES.

bretwalda \bret-'wäl-də\ *or* **brytenwalda** \ˌbri-tən-'wäl-də\ Any of several Anglo-Saxon kings with lordship over kingdoms beyond their own. Used in the Anglo-Saxon Chronicle, the title probably means "ruler of the Britons." It was given to Egbert (died 839) of Wessex and to seven earlier kings: Aelle of Sussex (fl. late 5th century), Ceawlin of Wessex (died 593), Aethelberht of Kent (died 616), Raedwald of East Anglia (died 616/27), Edwin of Northumbria (died 632), Oswald of Northumbria (died 641), and Oswiu of Northumbria (died 670).

Breuer \'brȯi-ər**, Marcel (Lajos)** (b. May 21, 1902, Pécs, Hung.—d. July 1, 1981, New York, N.Y., U.S.) Hungarian-U.S. architect and furniture designer. He studied and then taught at the BAUHAUS (1920–28), where in 1925 he invented the famous tubular steel chair. He moved to Cambridge, Mass., in 1937 to teach at Harvard University and practice with WALTER GROPIUS. Their synthesis of Bauhaus internationalism with New England regional wood-frame building greatly influenced domestic architecture throughout the U.S. He was one of the most influential exponents of the INTERNATIONAL STYLE. His major architectural commissions include UNESCO's Paris headquarters (1953–58) and the Whitney Museum of American Art (1966).

Brewer, David J(osiah) (b. June 20, 1837, Smyrna, Ottoman Empire—d. March 28, 1910, Washington, D.C., U.S.) U.S. jurist. Born to U.S. missionaries, he grew up in Connecticut and practiced law in Kansas from 1858. He served in local judgeships (1861–70), on the state supreme court (1870–84), and on the federal circuit court. Appointed by Pres. BENJAMIN HARRISON to the SUPREME COURT OF THE UNITED STATES in 1889, he generally joined conservatives in resisting the trend toward increased federal power and responsibility. In 1895–97 he led the panel that settled the boundary dispute between Venezuela and British Guiana.

Brewster, William (b. 1567, England—d. April, 1644, Plymouth, Mass.) Anglo-American PURITAN leader of Plymouth Colony in Massachusetts. He studied briefly at the University of Cambridge and became leader of a small Puritan congregation at Scrooby. Government persecution forced Brewster and his followers to emigrate to Holland in 1608, and he printed religious books in Leiden. In 1620 he joined the first group of Pilgrims aboard the *Mayflower* on the voyage to North America. When the colonists landed at Plymouth, Brewster became the senior elder of the colony, serving as its religious leader and as an adviser to Gov. WILLIAM BRADFORD.

Breyer \'brī-ər**, Stephen (Gerald)** (b. Aug. 15, 1938, San Francisco, Calif., U.S.) U.S. jurist. He received his law degree from Harvard Law School in 1964. After clerking for ARTHUR GOLDBERG (1964–65), he taught at Harvard (1967–81). He served as special counsel (1974–75) and chief counsel (1979–81) of the U.S. Senate Judiciary Committee before being appointed to the First U.S. Circuit Court of Appeals (1980); he became its chief judge in 1990. From 1985 to 1989 he served on the commission that devised guidelines for federal sentencing. He was nominated to the SUPREME COURT OF THE UNITED STATES in 1994 by Pres. BILL CLINTON. He was known as a pragmatic moderate acceptable to both Republicans and Democrats.

Brezhnev \'brezh-ˌnef**, Leonid (Ilich)** (b. Dec. 19, 1906, Kamenskoye, Ukraine, Russian Empire—d. Nov. 10, 1982, Moscow, Russia, U.S.S.R.) Soviet leader. He worked as an engineer and director of a technical school in Ukraine and held local posts in the Communist Party, becoming regional party secretary in 1939. In World War II he was a political commissar in the Red Army and rose to major general (1943). In the 1950s he supported NIKITA KHRUSHCHEV and became a member of the Politburo, though in 1964 he was the leader of a coalition that ousted Khrushchev, and soon he emerged as general secretary of the party (1966–82). He developed the Brezhnev Doctrine, which asserted the right of Soviet intervention in such WARSAW PACT countries as Czechoslovakia (1968). In the 1970s he attempted to normalize relations with the West and to promote DÉTENTE with the U.S. He was made marshal of the Soviet Union in 1976 and chairman of the Presidium of the Supreme Soviet in 1977, becoming the first to hold the leadership of both the party and the state. He greatly expanded the Soviet Union's military-industrial complex, but in so doing he deprived the rest of the Soviet economy. Despite frail health, he retained his hold on power to the end.

Brian Boru \'brēn-bə-'rü\ (b. 941, near Killaloe, Ire.—d. April 23, 1014, Clontarf, near Dublin) High king of Ireland (1002–14). He became king of Munster in 976, won control of the southern half of Ireland from the high king Maelsechlainn in 997, and replaced him in 1002. Leinster and the Norsemen of Dublin united against him in 1013 with help from abroad; at the Battle of Clontarf, won by his son Murchad, Brian was killed in his tent by fleeing Norsemen (see VIKINGS). A line of princes, the O'Briens, descended from him.

Briand \brē-'äⁿ**, Aristide** (b. March 28, 1862, Nantes, France—d. March 7, 1932, Paris) French statesman. He became secretary-general of the FRENCH SOCIALIST PARTY in 1901 and served in the Chamber of Deputies (1902–32). Between 1909 and 1929 he served 11 times as premier of France, and he held 26 ministerial posts between 1906 and 1932. His achievements included the Pact of LOCARNO and the KELLOGG-BRIAND PACT. For his efforts for international cooperation, the LEAGUE OF NATIONS, and world peace, he shared the 1926 Nobel Prize for Peace with GUSTAV STRESEMANN.

bribery Crime of giving a benefit (e.g., money) in order to influence the judgment or conduct of a person in a position of trust (e.g., an official or witness). Accepting a bribe also constitutes a crime. Bribery is typically punishable as a felony (see FELONY AND MISDEMEANOUR). In any charge of bribery, some element of "corrupt purpose" must be implied or proved. Thus, in the absence of a complete statutory prohibition on the granting of favours to a public official, a gift is not a bribe unless it is given with some intent to influence the recipient's official behaviour. See also EXTORTION.

Brice, Fanny *orig.* **Fannie Borach** (b. Oct. 29, 1891, New York, N.Y., U.S.—d. May 29, 1951, Los Angeles, Calif.) U.S. comedian and singer. She played in vaudeville and burlesque shows, where the producer FLORENZ ZIEGFELD discovered her in 1910. She became a headliner in his *Follies* with her musical numbers and comedy routines, including satiric sketches of ballet dancers and fan dancers as well as affecting torch songs such as "My Man." The character of Baby Snooks, an incorrigible little girl, which she created to amuse her friends, became a *Follies* favourite, and in that character Brice was featured on radio from 1936 until her death. The Broadway musical *Funny Girl* (1964; film, 1968) was based on her life.

Fanny Brice as Baby Snooks.
CULVER PICTURES

brick Small building unit in the form of a rectangular block, first produced in a sun-dried form at least 6,000 years ago. Clay, the basic ingredient, is mined from open pits, formed, and then fired in a kiln to produce strength, hardness, and heat resistance. Brick was the chief building material in the ancient Near East. Its versatility was expanded in ancient Rome by improvements in manufacture and by new techniques of bonding. Brick came to be widely used in Western Europe for the protection it offered against fire. See also MASONRY, MORTAR.

Bricker, John W(illiam) (b. Sept. 6, 1893, Madison county, Ohio, U.S.—d. March 22, 1986, Columbus, Ohio) U.S. politician, governor of Ohio (1939–45) and U.S. senator (1947–59). He graduated from Ohio State University (1916), then practiced law and later served as the state's attorney general (1933–37). Elected governor, he became the first Republican to win three consecutive terms. He was THOMAS DEWEY's running mate in the 1944 presidential race. As a U.S. senator, he led efforts to curb the president's power in foreign affairs. In 1953 he sponsored a constitutional amendment to limit U.S. participation in international treaties; opposed by JOHN FOSTER DULLES, it was narrowly defeated.

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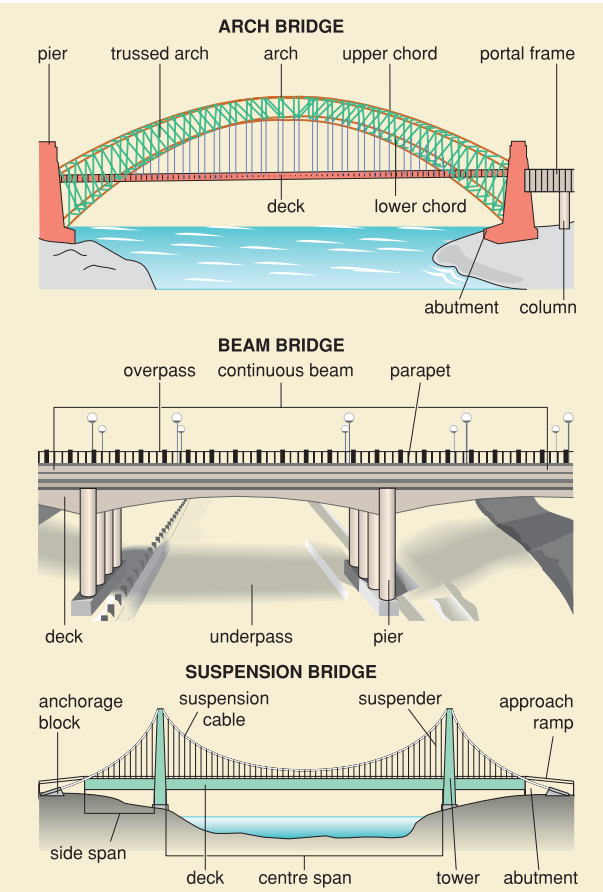
bridewealth Payment made by the groom or his kin to the kin of the wife in order to ratify the marriage. The practice is common in most parts of the globe in one form or another, but it is perhaps most prevalent in Africa. It is most often a matter of social and symbolic as well as economic reciprocity, being part of a long series of exchanges between the two intermarrying families. It represents a pledge that the wife will be well treated and serves as compensation for her family's loss. Payment may consist of goods or, less frequently, services, and it may be paid in one sum or regularly over a long period of time. See also DOWRY.

bridge Structure that spans horizontally to allow pedestrians and vehicles to cross a void. Bridge construction has always presented civil engineering with its greatest challenges. The simplest bridge is the beam (or girder) bridge, consisting of straight, rigid beams of steel or concrete placed across a span. Ancient Roman bridges are famous for their rounded arch form, which permitted spans much longer than those of stone beams and were more durable than wood. A modern version of the arch bridge might have a trussed arch anchored to the abutments and a deck hanging from the arch by vertical cables. Suspension bridges (e.g., BROOKLYN BRIDGE, GOLDEN GATE BRIDGE) are capable of spanning great distances; their main support members are cables composed of thousands of strands of wire supported by two towers and anchored at each end, and the deck is suspended by vertical cables hung from the main cables. In cable-stayed bridges, cables fan out and down from a central tower to various points on the deck; variations of this design have resulted in bridges of striking design and very long span. Other bridges include the truss bridge, popular (e.g., for railroad bridges) because it uses a relatively small amount of material to carry large loads, and the cantilever bridge, typically made with three spans, with the outer spans anchored down at the shore and the central span resting on the cantilevered arms.



Three common types of bridge design.
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bridge Card game similar to WHIST. Bridge is any one of several games, including games such as auction bridge and contract bridge, which retain the essential features of whist: Four players participate, two against two in partnership. They play with a 52-card pack, all cards of which are dealt face downward one at a time, clockwise. When play begins, the object is to win tricks, consisting of one card from each player in rotation. The players must, if able, contribute a card of the suit led, and the trick is won by the highest card. All tricks taken in excess of the first six tricks are known as odd tricks. Before play begins, a suit may be designated the trump suit, in which case any card in it beats any card of the other suits. In all types of bridge a certain number points are needed to win a game, and two games won by the same team allows them to win the rubber.

Bridgeport City (pop., 2000: 139,529), southwestern Connecticut, U.S. Located on LONG ISLAND SOUND at the mouth of the Pequonnock River, it was settled in 1639. Its earlier names included Newfield and Stratfield; Bridgeport was chosen in 1800. P.T. BARNUM was once its mayor, and his star attraction "Tom Thumb" was born there. The city evolved into an industrial centre following the arrival of the railroad in 1840. In the late 20th century, its industrial base eroded, causing financial problems for the city.

Bridger, Jim *orig.* **James Bridger** (b. March 17, 1804, Richmond, Va., U.S.—d. July 17, 1881, near Kansas City, Mo.) U.S. frontiersman. From 1822 he led fur-trapping expeditions to Utah and Idaho. He was apparently the first white man to visit the Great Salt Lake (1824) and among the first to explore Wyoming's Yellowstone River region. In 1843 he established Fort Bridger, Wyo., as a fur-trading post on the OREGON TRAIL. After the 1850s he worked as a government scout. He became legendary for his knowledge of the territory and its Indian inhabitants.

Bridges, Calvin Blackman (b. Jan. 11, 1889, Schuyler Falls, N.Y., U.S.—d. Dec. 27, 1938, Los Angeles, Calif.) U.S. geneticist. He entered Columbia University in 1909 and assisted THOMAS HUNT MORGAN in designing experiments using *Drosophila* that showed that variations in the insect could be traced to observable changes in its genes. These experiments led to the construction of gene maps and proved the chromosome theory of heredity. In 1928 Bridges and Morgan moved to California Institute of Technology, where Bridges continued gene mapping and later discovered an important class of drosophila mutants caused by gene duplications.

Bridges, Harry *orig.* **Alfred Bryant Renton** (b. July 28, 1901, Kensington, near Melbourne, Vic., Austl.—d. March 30, 1990, San Francisco, Calif., U.S.) Australian-born U.S. labour leader. He arrived in the U.S. as a seaman in 1920, and he soon settled in San Francisco and became active in the local branch of the International Longshoremen's Association (ILA). In 1937 he led the Pacific Coast division out of the ILA and reconstituted it as the International Longshoremen's and Warehousemen's Union (ILWU), affiliated with the CIO (see AFL-CIO). His aggressive labour tactics and Communist Party connections led the CIO to expel the ILWU in 1950 during a purge of allegedly communist-dominated unions, and opponents tried unsuccessfully to have Bridges deported. He retired as president of the ILWU in 1977.

Bridges, Robert (Seymour) (b. Oct. 23, 1844, Walmer, Kent, Eng.—d. April 21, 1930, Boar's Hill, Oxford) English poet. He published several long poems and poetic dramas, but his reputation rests on the lyrics collected in *Shorter Poems* (1890, 1894), which reveal his mastery of prosody. His 1916 edition of the poetry of his friend GERARD MANLEY HOPKINS rescued it from obscurity. He was poet laureate of England from 1913 until his death.

Robert Bridges, gold-point drawing by W. Strang; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Bridget, Saint (b. c. 1303, Swed.—d. July 23, 1373, Rome; canonized Oct. 8, 1391; feast day July 23) Mystic and patron saint of Sweden. She had religious visions from an early age but married and had eight children, including St. Catherine of Sweden. On the death of her husband (1344), she retired to

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a life of prayer. She lived in Rome after 1350, striving to bring the pope back from Avignon. In response to a revelation, she founded a new religious order in 1370, the Brigittines. In 1372, inspired by another vision, she journeyed to the Holy Land and died soon after her return to Rome.

Bridgetown Capital (pop., 1990: 6,070) of Barbados, West Indies. Located on Carlisle Bay at the southwestern end of Barbados, it is the island's only port of entry. Founded in 1628, it was originally called Indian Bridge. The name St. Michael's Town came into favor c. 1660 and remained in use into the 19th century. The town was ravaged repeatedly by fires, and in 1854 a cholera epidemic killed some 20,000 people. Landmarks include St. Michael's Anglican Cathedral, built of coral rock. Economic mainstays include sugar refining, rum distilling, and tourism.

brier *also spelled* **briar** term generally applied to any plant with a woody and thorny or prickly stem, such as those of the genera *Rosa*, *Rubus*, *Smilax*, and *Erica*. White, or tree, heath (*E. arborea*) is found in southern France and the Mediterranean region. Its roots and knotted stems are used for making briarwood tobacco pipes. Its leaves are needlelike and its flowers almost white.

brig Two-masted sailing ship with square rigging on both masts. Brigs were both naval and mercantile vessels. As merchantmen, they often followed coastal trading routes, but ocean voyages were not uncommon, and some were even used for whaling and sealing. Naval brigs carried 10–20 guns on a single deck. In the 18th–19th century, they served as couriers for battle fleets and as training vessels for cadets. Brigs of the early U.S. Navy won distinction on the Great Lakes in the War of 1812. Because square rigging required a large crew, merchant brigs became uneconomical, and in the 19th century they began to give way to vessels such as the schooner and the bark.

brigade \bri-'gād\ Military unit commanded by a brigadier general or a colonel and composed of two or more subordinate units, such as regiments or battalions. Two or more brigades make up a division.

Brigham \,brig-əm\ Young University Private university in Provo, Utah, U.S. Founded in 1875 by the Mormon church president Brigham Young, it continues to be supported by the Mormon church. It comprises nine colleges as well as schools of management and law. Important research facilities include laboratories for nuclear, plasma, and solid-state physics, aquatic ecology, and veterinary pathology and institutes for the study of food and agriculture and of computer-aided manufacturing.

Bright, John (b. Nov. 16, 1811, Rochdale, Lancashire, Eng.—d. March 27, 1889, Rochdale) British reform politician and orator. He entered Parliament in 1843 and served three times as a member of William E. Gladstone's cabinet. He was active in campaigns for free trade, lower grain prices, and parliamentary reform. His Quaker beliefs shaped his politics, which consisted mainly of demands for an end to inequalities between individuals and between peoples. He denounced the Crimean War, supported the Reform Bill of 1867, and was a cofounder (with Richard Cobden) of the Anti-Corn Law League.

Bright disease Type of nephritis without pus formation or edema. It may or may not recur. The acute stage involves severe inflammation and back pain, deficient kidney function, swelling, and hypertension. In the subacute stage the kidney enlarges, blood does not reach its surface and red blood cells are damaged (leading to anemia), and its tissue breaks down, releasing excess blood protein into urine. In the chronic stage a small, shriveled, scarred kidney cannot filter nitrogen compounds from the blood, causing uremia. Treatment focuses on symptom relief.

Brighton Town (pop., 1995 est.: 143,000), southern England. Lying on the English Channel south of London, it was for several centuries a small fishing village, but it gained popularity in the late 18th century when the prince of Wales (later George IV) made the first of his many visits. His powerful patronage stamped the town with the distinguished character still seen in its Regency-style squares. Victorian Brighton grew rapidly with the opening of the railway connecting it to London (1841).

Brigit \'bri-jət\ In Celtic religion, the goddess of poetry, crafts, prophecy, and divination. She was equivalent to the Roman Minerva and the Greek Athena and substantially the same as the northern British goddess Brigantia. In Ireland she was worshiped by the *filid*, a poetic and priestly class. She was one of three daughters of Dagda, all named Brigit, the others being associated with healing and the craft of the smith. Some of the lore surrounding Brigit was transferred to the 5th-century Irish abbess St. Brigid. Her feast day, February 1, is the date of the pagan festival Imbolc, when the ewes came into milk. Her great monastery at Kildare was probably founded on a pagan sanctuary, and many holy wells in the British Isles are dedicated to her.

Brillat-Savarin \brē-yä-sä-vä-'ra^{n}**, (Jean-) Anthelme** (b. April 1, 1755, Belley, Fra.—d. Feb. 2, 1826, Paris) French lawyer and gastronome. Mayor of the town of Belley, he fled France during the Reign of Terror but returned to sit on France's highest court, where he remained the rest of his life. His celebrated *Physiologie du goût* ("Physiology of Taste"; Eng. trans. *A Handbook of Gastronomy*), published in 1825, is less a treatise on cuisine than a witty compendium of anecdotes and observations intended to enhance the pleasures of the table; only the occasional recipe is included.

brine shrimp Any of several small crustaceans (genus *Artemia*) inhabiting brine pools and other highly salty inland waters throughout the world. *A. salina*, which occurs in vast numbers in Great Salt Lake, Utah, is commercially important. Young brine shrimp hatched there from dried eggs are used widely as food for fish and other small animals in aquariums. Up to 0.6 in. (15 mm) long, the brine shrimp's body has a distinguishable head and a slender abdomen. It normally swims upside down, and it feeds primarily on green algae, which it filters from the water with its legs.

Brine shrimp (*Artemia salina*)
DOUGLAS P. WILSON

Brinkman, Johannes Andreas (b. March 22, 1902, Rotterdam, Neth.—d. May 6, 1949, Rotterdam) Dutch architect. After graduating from the Delft Technical University, he helped design the van Nelle tobacco factory (1928–30) in Rotterdam, one of the most architecturally important industrial buildings of the 1920s. An outstanding example of Modernist architecture, its unbroken expanses of glass convey a strong feeling of lightness and transparency.

Brisbane \'briz-,bān\ City (pop., 2004 est.: urban agglom. 1,774,890), southeastern Queensland, Australia. Lying on the northern bank of the Brisbane River above its mouth at Moreton Bay, the site was first explored by the English in 1823. It was founded as a penal colony in 1824 and was declared a town in 1834 when it was named in honour of Sir Thomas Brisbane, former governor of New South Wales. Made the capital of Queensland in 1859, it was joined with South Brisbane in the 1920s to form Greater Brisbane. The city, connected by bridges and ferries, is Australia's third largest; it is the hub of rail lines and highways and a busy port. It is the site of the Queensland Cultural Centre and a university.

Brisbane, Albert (b. Aug. 22, 1809, Batavia, N.Y., U.S.—d. May 1, 1890, Richmond, Va.) U.S. social reformer. The son of wealthy landowners, he went to Europe in 1828 to study social reform with great thinkers of his age. Disappointed with François Guizot in Paris and G.W.F. Hegel in Berlin, he later discovered the works of Charles Fourier, under whom he studied for two years. In 1834 he returned to the U.S. and later established a Fourier community in New Jersey. His book *Social Destiny of Man* (1840) attracted widespread attention. In his newspaper column in the *New York Tribune* he explained the Fourier system of self-sustaining communities, which he called Associationism. His son Arthur (1864–1936) was editor of the *New York Evening Journal* (1897–1921) and the *Chicago Herald and Examiner* (from 1918).

brise-soleil \,brēz-sō-'lā\ (French: "breaks the sun") Sun baffle of vertical or horizontal louvers outside the windows or extending over the entire surface of a building's facade, especially precast concrete grids of the type developed by Le Corbusier. Many traditional methods exist for reducing the effects of the sun's glare, such as the projecting upper-story window of latticework (*mashrabiyah* or *mushrabiyah*) used in Islamic architecture, pierced screens as used at the Taj Mahal, or blinds of split bamboo (*sudare*) as used in Japan.

brisling See sprat

Brissot \brē-'sō\ **(de Warville), Jacques-Pierre** (b. Jan. 15, 1754, Chartres, France—d. Oct. 31, 1793, Paris) French revolutionary politician. He founded the popular newspaper *Le Patriote Français* and became a leader of the Girondins (often called Brissotins) in the French Revolution. Elected to the Legislative Assembly in 1791, he advocated war against

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Austria, arguing that war would consolidate the Revolution. Along with other Girondins, he was arrested and guillotined during the Reign of Terror.

Bristol City and unitary authority (pop., 2001: 380,615), southwestern England. Lying at the confluence of the Rivers Avon and Frome, the city received its first charter in 1155. Long a centre of commerce, it was the point of departure in 1497 of John Cabot in his search for a route to Asia. During the 17th–18th centuries it prospered in the triangular trade (rum, molasses, and slaves) between West Africa and the West Indian and American plantation colonies. Though Bristol suffered a decline in trade in the early 19th century, it soon rebounded with the coming of the railway. It suffered severe damage from bombing in World War II but was rebuilt. Today it is an important shipping centre, especially for oil and food products.

Bristol Channel Inlet of the Atlantic Ocean, southwestern England. It extends about 85 mi (135 km) between southern Wales and southwestern England, ranging from 5 to 43 mi (8–69 km) wide. Lundy Island, once a pirate stronghold, lies in the centre of the channel; it is maintained as a trust preserve. Ships using the English port of Bristol and the Welsh ports of Swansea and Cardiff pass through the channel.

Britain Name historically applied to the island of Great Britain. Britain is used especially when referring to its pre-Roman and Roman periods and to its early Anglo-Saxon period. It is the Anglicized form of Latin *Britannia*. See also United Kingdom.

Britain, Battle of (June 1940–April 1941) Series of intense raids directed against Britain by the German air force in World War II. The air attacks, intended to prepare the way for a German invasion, were directed against British ports and RAF bases. In September 1940 the attacks turned to London and other cities in a "blitz" of bombings for 57 consecutive nights, which was followed by intermittent raids until April 1941. The RAF was outnumbered but succeeded in blocking the German air force through superior tactics, advanced air defenses, and the penetration of German secret codes.

British Airways *in full* **British Airways PLC** International passenger airline based in London. In 1936 British Airways Ltd. was founded through the merger of three smaller airlines. A merger with Imperial Airways in 1939 created British Overseas Airways Corporation (BOAC). The British Airways name returned in 1974 with the government-mandated merger of BOAC and British European Airways (BEA). The airline was privatized in 1987. It merged with British Caledonian later that year. British Airways is one of Europe's largest air carriers.

British American Tobacco PLC *formerly* **British-American Tobacco Company Ltd. (1902–76)** *and* **B.A.T Industries PLC (1976–98)** British conglomerate that is one of the world's largest manufacturers of tobacco products. The company's international headquarters are in London, while its chief American subsidiary, Brown & Williamson Tobacco Corporation, is headquartered in Louisville, Ky. Its acquisitions have included the American Tobacco Company (1994), which represents such cigarette brands as Pall Mall and Lucky Strike; Rothmans International (1999), known for its Dunhill and Rothmans brands; and Canada's largest cigarette company, Imperial Tobacco (2000).

British Broadcasting Corp. See BBC

British Columbia Province (pop., 2003 est.: 4,146,600), western Canada. It is bounded by Yukon Territory, Northwest Territories, Alberta, the Pacific Ocean, and the U.S. (including Alaska). The province has an area of 364,764 sq mi (944,735 sq km), and its capital is Victoria. The area was inhabited by indigenous peoples, including Coast Salish, Nootka, Kwakiutl, and Haida. It was visited in 1578 by Sir Francis Drake and in 1778 by Capt. James Cook, who was searching for the Northwest Passage. Capt. George Vancouver surveyed the coast (1792–94), and overland expeditions were made by several explorers, including Alexander Mackenzie and Simon Fraser. The British and Americans contended over Vancouver Island for years, until it was recognized as British and made a crown colony in 1849. The mainland became the colony of British Columbia in 1858; with the colony of Vancouver Island, it joined Canada in 1871 as the province of British Columbia. The province now has a prosperous economy based on diverse sources, including logging, mining, agriculture, and shipping.

British Columbia, University of Canadian public university in Vancouver. It is one of the largest universities in Canada and the oldest in the province (founded 1908). It comprises faculties of agricultural sciences, applied science, arts, commerce and business administration, dentistry, education, forestry, graduate studies, law, medicine, pharmacy, theology, and science. Plant research is conducted at the UBC Botanical Garden, which is open to the public. The university has extensive study-abroad and continuing-education programs.

British Commonwealth See Commonwealth

British East Africa Territory under former British control, Africa. British penetration of the area began at Zanzibar in the late 19th century. In 1888 the British East Africa Co. established claims to territory in what is now Kenya. British protectorates were subsequently established over the sultanate of Zanzibar and the kingdom of Buganda (see Uganda). In 1919 Britain was awarded the former German territory of Tanganyika as a League of Nations mandate. All these territories achieved political independence in the 1960s.

British Empire Worldwide system of dependencies—colonies, protectorates, and other territories—that over a span of three centuries came under the British government. Territorial acquisition began in the early 17th century with a group of settlements in North America and West Indian, South Asian, and African trading posts founded by private individuals and trading companies. In the 18th century the British took Gibraltar, established colonies along the Atlantic seacoast of North America and in the Caribbean Sea, and began to add territory in India. With its victory in the French and Indian War (1763), the empire secured Canada and the eastern Mississippi Valley and gained supremacy in India. From the late 18th century it began to build power in Malaya and acquired the Cape of Good Hope, Ceylon (see Sri Lanka), and Malta. The British settled Australia in 1788 and subsequently New Zealand. Aden was secured in 1839, and Hong Kong in 1841. Britain went on to control the Suez Canal (1875–1956). In the 19th-century European partition of Africa, Britain acquired Nigeria, Egypt, the territories that would become British East Africa, and part of what would become the Union (later Republic) of South Africa. After World War I, Britain secured mandates to German East Africa, part of the Cameroons, part of Togo, German South-West Africa, Mesopotamia, Palestine, and part of the German Pacific islands. Britain gradually evolved a system of self-government for some colonies after the U.S. gained independence, as set forth in Lord Durham's report of 1839. Dominion status was given to Canada (1867), Australia (1901), New Zealand (1907), the Union of South Africa (1910), and the Irish Free State (1921). Britain declared war on Germany in 1914 on behalf of the entire empire; after World War I the dominions signed the peace treaties themselves and joined the League of Nations as independent states. In 1931 the Statute of Westminster recognized them as independent countries "within the British Empire," referring to the "British Commonwealth of Nations," and from 1949, the Commonwealth of Nations. The British Empire, therefore, developed into the Commonwealth in the mid-20th century, as former British dependencies obtained sovereignty but retained ties to the United Kingdom.

British Expeditionary Force (BEF) Home-based regular British army forces sent to northern France at the start of World Wars I and II to support the French armies. Britain wished to help France in case of a German attack, and the BEF was created in 1908 to ensure that British forces would be trained and ready to respond quickly. It consisted of six infantry divisions and one cavalry division. Five divisions sent to France at the outbreak of World War I sustained heavy losses and were succeeded by vast British armies. Divisions sent to France early in World War II (1939) returned to England when France fell the next year.

British Guiana See Guyana

British Honduras See Belize

British Invasion Musical movement. In the mid 1960s the popularity of a number of British rock-and-roll ("beat") groups spread rapidly to the U.S., beginning with the triumphant arrival of Liverpool's Beatles in New York in 1964 and continuing with the Rolling Stones, the Animals, and others. Building on 1950s U.S. models, these groups incorporated such local musical traditions as skiffle (acoustic drummerless ensembles), dancehall, and Celtic folk.

British Library National library of Great Britain, formed by the British Library Act (1972) and organized July 1, 1973. It consists of the former British Museum library, the National Central Library, the National Lending Library for Science and Technology, and the British National Bibliography. The British Museum library, founded in 1753 based on earlier col-

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lections and later increased by the addition of royal libraries, had the right to a free copy of all books published in the United Kingdom. Its collection included a rich series of charters (including those of the Anglo-Saxon kings), codices, psalters, and other papers ranging from the 3rd century BC to modern times. The present-day British Library receives a copy of every publication produced in the United Kingdom and Ireland.

British Museum Britain's national museum of archaeology and antiquities, established in London in 1753 when the government purchased three large private collections consisting of books, manuscripts, prints, drawings, paintings, medals, coins, seals, cameos, and natural curiosities. In 1881 the natural-history collections were transferred to another building to form the Natural History Museum, and in 1973 the library collections were consolidated to form the BRITISH LIBRARY. Among the museum's most famous holdings are the ELGIN MARBLES, the ROSETTA STONE, the PORTLAND VASE, and Chinese ceramics. In 1808 the department of prints and drawings opened with over 2,000 drawings. It is now one of the world's largest and most comprehensive collections.

British North America Act (1867) Act of the British Parliament by which three British colonies—Nova Scotia, New Brunswick, and Canada—were united as "one Dominion under the name of Canada." The act also divided the province of Canada into the provinces of Quebec and Ontario. It served as Canada's "constitution" until 1982, when it became the basis of the CANADA ACT.

British Somaliland Former British protectorate, southern shore of the Gulf of ADEN, eastern Africa. In the Middle Ages it was a powerful Arab sultanate; it was broken up in the 17th century. Its coast came under British influence in the early 19th century, but formal control was not acquired until it was taken from Egypt in 1884. It fell under Italian control in World War II. In 1960 it was united with the former ITALIAN SOMALILAND to form Somalia. In 1991 a government opposition group declared the region comprising the former British Somaliland to be an independent state; however, it was not internationally recognized. See also SOMALILAND.

British Virgin Islands See British VIRGIN ISLANDS

Brittany *French* **Bretagne** \'brə-'tän^{y}\ Peninsula that forms a historical and governmental region, northwestern France. Known in ancient times as Armorica, it comprised the coastal area between the SEINE and LOIRE rivers. Inhabited by Celts, it was conquered by JULIUS CAESAR and organized as a Roman province. Invaded in the 5th century AD by Britons (Celtic people from Britain), the extreme northwestern part was thereafter called Brittany. Subdued by CLOVIS I, it was never effectively part of the MEROVINGIAN or CAROLINGIAN kingdom. France claimed Brittany in the 13th century, but it remained a separate state until the 15th century. It was formally incorporated into France in 1532 and had province status until the FRENCH REVOLUTION. Roughly coextensive with but smaller than the historical region, the current administrative *région* of Brittany (pop., 2004 est.: 3,011,000) covers 10,505 sq mi (27,209 sq km). Its capital is Rennes. It is an important agricultural region.

Britten of Aldeburgh, (Edward) Benjamin Britten, Baron (b. Nov. 22, 1913, Lowestoft, Suffolk, Eng.—d. Dec. 4, 1976, Aldeburgh, Suffolk) British composer. He studied at the Royal College of Music, where he met the tenor Peter Pears (1910–86), who would become his lifelong companion. His auspicious *Variations on a Theme of Frank Bridge* (1937), for string orchestra, won him international acclaim. In 1945 his opera *Peter Grimes* established him as a leading opera composer. In 1948 he cofounded the Aldeburgh Festival, which became one of the most important English music festivals and the centre of Britten's musical activities. His operas include *The Rape of Lucretia* (1946), *The Turn of the Screw* (1954), and *Death in Venice* (1973); they are admired for their skillful setting of English words and their orchestral interludes, as well as for their dramatic aptness and depth of psychological characterization. His large choral work *War Requiem* (1961) was greatly acclaimed. His best-known orchestral piece is *The Young Person's Guide to the Orchestra* (1946). In 1976 he became the first British composer in history to be ennobled.

Britten, 1960
CAMERA PRESS

Brno \'bər-nō\ *German* **Brünn** \'brün\ City (pop., 2001 prelim.: 379,185), southeastern Czech Republic. Located southeast of PRAGUE, it lies in an area that shows evidence of prehistoric inhabitance and traces of Celtic and Slavic settlements in the 5th–6th centuries AD. German colonization in the 13th century stimulated its growth; it received city status in 1243. In various wars in the 15th–19th centuries, it was besieged by the Swedes, Prussians, and French. Before World War I it was the capital of the Austrian crown land of MORAVIA. The inhabitants, predominantly German before World War II, are now mainly Czech. GREGOR MENDEL worked on his theory of heredity (1865) in the monastery at Brno.

broaching machine MACHINE TOOL, usually hydraulically operated, for finishing surfaces by drawing or pushing a cutter called a broach entirely over and past the surface. A broach has a series of cutting teeth arranged in a row or rows, graduated in height from the teeth that cut first to those that cut last. Each tooth removes only a few thousandths of an inch, and the total depth of cut is distributed over all the teeth. Broaching is particularly suitable for internal surfaces such as holes and internal GEARS, but it can also shape external gears and flat surfaces.

broad jump See LONG JUMP

broadband Term describing the RADIATION from a source that produces a broad, continuous SPECTRUM of FREQUENCIES (contrasted with a LASER, which produces a single frequency or very narrow range of frequencies). A typical broadband-light source that can be used for either emission or absorption SPECTROSCOPY is a metal filament heated to a high temperature, such as a tungsten lightbulb. Sunlight is also broadband radiation. See also BROADBAND TECHNOLOGY.

broadband technology Telecommunications devices, lines, or technologies that allow communication over a wide band of frequencies, and especially over a range of frequencies divided into multiple independent channels for the simultaneous transmission of different signals. Broadband systems allow voice, data, and video to be broadcast over the same medium at the same time. They may also allow multiple data channels to be broadcast simultaneously.

broadcasting Transmission of sound or images by radio or television. After GUGLIELMO MARCONI's discovery of wireless broadcasting in 1901, radio broadcasting was undertaken by amateurs. The first U.S. commercial radio station, KDKA of Pittsburgh, began operation in 1920. The number of stations increased rapidly, as did the formation of national radio networks. To avoid radio monopolies, Congress passed the Radio Act of 1927, which created the Federal Communications Commission to oversee broadcast operations. In the 1930s and '40s, the "golden age of radio," innovations in broadcast techniques and programming made radio the most popular entertainment medium. Television broadcasting began in Germany and Britain in the 1930s. After World War II, the U.S. took the lead, and television stations soon overshadowed radio networks. Color television broadcasts began in 1954 and became widespread in the 1960s. By the 1980s, satellite transmission of live television further expanded the field of broadcasting. See also ABC, BBC, CBS, CNN, NBC, PBS.

Broadway Theatre district in New York City. It is named for the avenue that runs through the Times Square area in central Manhattan, where most of the larger theatres are located. Broadway attracted theatre producers and impresarios from the mid-19th century. The number and size of the theatres grew with New York's increasing prosperity, and by the 1890s the brightly lit street was called "the Great White Way." By 1925, the height of theatrical activity in New York, about 80 theatres were located on or near Broadway; by 1980 only about 40 remained. In the 1990s the revitalization of the seedy Times Square neighbourhood attracted larger audiences, though high production costs limited the viability of serious plays in Broadway theatres, which often chose to mount big musicals and other crowd-pleasing commercial ventures. See also OFF-BROADWAY.

Broca \'brō-kə**, Paul** (b. June 28, 1824, Sainte-Foy-la-Grande, Fr.—d. July 9, 1880, Paris) French surgeon. His study of brain lesions contributed significantly to understanding of the origins of aphasia. Much of Broca's research concerned the comparative study of the skulls of the races of humankind, work that aided the development of modern physical anthropology. He originated methods to study the brain's form, structure, and surface features and sections of prehistoric skulls. His discovery

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(1861) of the brain's speech centre (convolution of Broca) was the first anatomical proof of localization of brain function.

brocade Woven fabric having a raised floral or figured design that is introduced during the weaving process. The design, appearing only on the fabric face, is usually made in a SATIN or TWILL weave (see WEAVING). The background may be twill, satin, or plain weave. The rich, fairly heavy fabric is frequently used for evening dresses, draperies, and upholstery.

Detail of handwoven Italian silk brocaded on silk with floral motif, c. 1730–50.
COURTESY OF SCALAMANDRE, NEW YORK CITY

broccoli Plant (*Brassica oleracea*, Botrytis group) closely related to CABBAGE in the MUSTARD FAMILY. A fast-growing, upright, branched, annual plant, it bears dense green clusters of edible flower buds. Native to the eastern Mediterranean and Asia Minor, it was introduced to the U.S. probably in colonial times. Broccoli thrives in moderate to cool climates. Its flavour resembles that of cabbage but is somewhat milder. It is one of the most broadly nutritious of all common vegetables.

Broccoli (*Brassica oleracea* variety *italica*).
G.R. ROBERTS

Broch \'brȯk**, Hermann** (b. Nov. 1, 1886, Vienna—d. May 30, 1951, New Haven, Conn., U.S.) German writer. A student of physics, mathematics, and philosophy, Broch published his first major work, *The Sleepwalkers* (1931–32), when he was in his 40s. A trilogy tracing the disintegration of European society between 1888 and 1918, it exemplifies his innovative multidimensional novels in its use of many different narrative forms to present a wide range of experiences. His other novels include *The Death of Virgil* (1945), which presents the last 18 hours of VIRGIL's life, and *The Spell* (1953), a portrayal of a Hitlerian stranger's domination of a village. He also wrote essays, letters, and reviews.

Brocken Highest point in the HARZ MOUNTAINS, central Germany. Its granite peak reaches 3,747 ft (1,142 m). When the sun is low, shadows from the peak become magnified, casting gigantic silhouettes on the upper surfaces of low-lying clouds or fog below the mountain. This effect, known as the Brocken bow or Brocken spectre, has mystical significance in the mountain's folklore. Traditional rites enacted there on WALPURGIS NIGHT became connected with the legend of FAUST.

Brodsky, Joseph *orig.* **Iosip Aleksandrovich Brodsky** (b. May 24, 1940, Leningrad, Russia, U.S.S.R.—d. Jan. 28, 1996, New York, N.Y., U.S.) Russian-born U.S. poet. In the Soviet Union his independent spirit and irregular work record led to a five-year sentence to hard labour. Exiled in 1972, he settled in New York. He was poet laureate of the U.S. from 1991 to 1992. His lyric and elegiac poems ponder the universal concerns of life, death, and the meaning of existence. Brodsky's poetry collections include *A Part of Speech* (1980), *History of the Twentieth Century* (1986), and *To Urania* (1988). He was awarded the Nobel Prize for Literature in 1987.

Broglie \'brȯi\ **family** French noble family, descended from a Piedmontese family of the 17th century, that produced many high-ranking soldiers, politicians, and diplomats. Prominent members included François-Marie, 1st duke de Broglie (1671–1745), general and marshal of France; Victor-François, 2nd duke de Broglie (1718–1814), a soldier and marshal of France; Victor, 3rd duke de Broglie (1785–1870), a prime minister who campaigned against reactionary forces; and Albert, 4th duke de Broglie (1821–1901), who served as premier in the early years of the French Third Republic. The family also included the physicist Louis-Victor, 7th duke de BROGLIE.

Broglie \'brȯi**, Louis-Victor (-Pierre–Raymond), duke de** (b. Aug. 15, 1892, Dieppe, France—d. March 19, 1987, Paris) French physicist. A descendant of the de BROGLIE FAMILY of diplomats and politicians, he was inspired to study atomic physics by the work of MAX PLANCK and ALBERT EINSTEIN. In his doctoral thesis he described his theory of electron waves, then extended the WAVE-PARTICLE DUALITY theory of light to matter. He is noted both for his discovery of the wave nature of electrons and for his research on quantum theory. Einstein built on de Broglie's idea of "matter-waves"; based on this work, ERWIN SCHRÖDINGER constructed the system of wave mechanics. De Broglie remained at the Sorbonne after 1924 and taught theoretical physics at the Henri Poincaré Institute (1928–62). He was awarded a Nobel Prize for Physics in 1929 and UNESCO's Kalinga Prize in 1952.

bromegrass Any of about 100 annual and perennial species of weeds and forage GRASSES that make up the genus *Bromus*, in the family Poaceae (Gramineae). Found in temperate and cool climates, bromegrasses have flat, thin leaves and open, spreading, erect or drooping flower clusters. More than 40 species are found in the U.S.; about half are native grasses. Rescue grass (*B. catharticus*), a forage and pasture grass, and smooth brome (*B. inermis*), a forage plant and soil binder, are the economically important species. Downy brome or cheatgrass (*B. tectorum*), ripgut grass (*B. diandrus*), and foxtail brome (*B. rubens*) are dangerous to grazing animals; their spines can puncture the animals' eyes, mouths, and intestines, leading to infection and possible death.

bromeliad \brō-'mē-lē-ˌad\ Any of the flowering plants of the order Bromeliales, containing a single family, Bromeliaceae, with almost 2,600 species. All but 1 species are native to the tropical New World and the West Indies. Bromeliad flowers have three parts, like lilies, but with contrasting sepals and petals. Many bromeliads are short-stemmed EPIPHYTES. Many species bear flowers in a long spike, with coloured BRACTS below or along the spike. Most have fleshy fruit, but some produce dry pods. SPANISH MOSS and the edible fruit of the PINEAPPLE are the major economic products of the family. The leaves of some species contain fibres that are made into rope, fabric, and netting. The largest known bromeliad is the giant *Puya raimondii* of Peru and Bolivia, which may grow to more than 30 ft (9 m). Some species are cultivated indoors as ornamentals for their colourful flowers and foliage.

bromine \'brō-ˌmēn\ Nonmetallic chemical ELEMENT, chemical symbol Br, atomic number 35. One of the HALOGENS, it is a deep red, fuming liquid at ordinary temperatures (freezing point 19 °F [–7.2 °C]; boiling point 138 °F [59 °C]) that contains diatomic molecules (Br_2), and it does not occur free in nature. It is obtained from seawater and brines or salt beds. Extremely irritating and toxic, bromine is a strong oxidizing agent (see OXIDATION-REDUCTION). Its compounds, in which it may have VALENCE 1, 3, 5, or 7, have many uses, including as petroleum additives (ethylene dibromide), in photographic EMULSIONS (silver bromide), as sedatives, and in flour (potassium bromate).

bronchiectasis \ˌbräŋ-kē-'ek-tə-səs\ Abnormal expansion of bronchi in the LUNGS. It usually results when preexisting lung disease causes bronchial INFLAMMATION and obstruction. Bronchial wall fibres degenerate, and bronchi become dilated or paralyzed, preventing removal of secretions, which stagnate. Infection spreads and intensifies. Evidence of the disease includes presence of infective agents, excess mucous secretions, and, in children, fatigue and growth retardation. Complications include recurrent PNEUMONIA, lung abscesses, spitting up blood, and, in chronic cases, toe and finger clubbing. Treatment involves frequent, long-term drainage or (if the disease is on one side only) surgical removal of affected lung segments and antibiotics.

bronchitis \bräŋ-'kī-təs\ INFLAMMATION in the bronchi of the LUNGS. Microbes and foreign matter that have entered the airways cause inflammation of the bronchi and stimulate excess secretion of mucus. Symptoms include a productive cough and a sensation of chest congestion. Long-term repetitive injury, as from smoking, may lead to chronic bronchitis, in which severe, irreversible damage leaves the lungs open to infection and fibrosis. Smoking-related chronic bronchitis often occurs in association with EMPHYSEMA (together called chronic obstructive pulmonary disease). Treatment includes drugs to dilate the bronchi and promote coughing, antibiotics, and lifestyle adaptations (e.g., quitting smoking).

Brontë \'brän-tē\ **sisters** Family of English writers. The daughters of an Anglican clergyman, they were brought up in Haworth on the Yorkshire moors. Their mother died early. Charlotte Brontë (April 21, 1816–March 31, 1855) attended the Clergy Daughter's School with her sister Emily and subsequently taught school and served as a governess. She and Emily made an unsuccessful attempt to open a school. Her novel *Jane Eyre* (1847), an immediate success, was a powerful narrative of a woman in conflict with her natural desires and social situation that gave a new

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truthfulness to Victorian fiction. It was followed by the novels *Shirley* (1849) and *Villette* (1853). In 1854 she married her father's curate, and she died soon after at age 38. Emily (Jane) Brontë (July 30, 1818–Dec. 19, 1848) was perhaps the greatest writer of the three. *Poems by Currer, Ellis and Acton Bell* (1846), published jointly by the sisters (who assumed pseudonyms to avoid the special treatment that they believed reviewers accorded to women), contained 21 of her poems. Many critics believe that her verse alone reveals poetic genius. Her one novel, *Wuthering Heights* (1847), is a highly imaginative story of passion and hatred set on the Yorkshire moors. Though not a success when published, it later came to be considered one of the finest novels in English. Soon after its publication, her health began to fail, and she died of tuberculosis at 30. Anne Brontë (Jan. 17, 1820–May 28, 1849) contributed 21 poems to *Poems by Currer, Ellis and Acton Bell*; she wrote two novels, *Agnes Grey* (1847) and *The Tenant of Wildfell Hall* (1848). Anne died of tuberculosis at 29.

Brontosaurus See APATOSAURUS

Bronx Borough (pop., 2000: 1,332,650), NEW YORK, New York, U.S. One of New York City's five boroughs, it is the only mainland borough, and it is connected to MANHATTAN by a dozen bridges and railroad tunnels and to QUEENS by the Triborough, Bronx-Whitestone, and Throgs Neck bridges. The site was called Keskesbeck by the Indians who sold it in 1639 to the Dutch West India Company. The borough was a part of Westchester county until 1898, when it was incorporated into the city of New York. Though primarily residential, much of its more than 80 mi (130 km) of waterfront is used for shipping, warehouses, and industry. It is home to baseball's Yankee Stadium. It has an extensive park system and includes the BRONX ZOO and the New York Botanical Gardens.

Bronx Zoo *formally* **New York Zoological Park** ZOO in New York City. It opened in 1899 on 265 acres (107 hectares) in the northwestern area of the Bronx. In 1941 it added the 4-acre (1.6-hectare) African Plains, which features large groups of animals in natural surroundings. The zoo also includes the World of Darkness (the world's first major exhibit of nocturnal animals, added in the 1960s), the World of Birds (a huge, indoor free-flight exhibit), the Rare Animal Range (near-extinct species in natural settings), a Children's Zoo, Wild Asia (Asian mammals and birds), and the Congo Gorilla Forest. Managed by the New York Zoological Society and financed by the society and the city, it supports much research and oversees the Wildlife Survival Center on St. Catherine's Island, Georgia.

bronze ALLOY traditionally composed of COPPER and TIN. Bronze was first made before 3000 BC (see BRONZE AGE) and is still widely used, though iron often replaced bronze in tools and weapons after about 1000 BC because of iron's abundance compared to copper and tin. Bronze is harder than copper, more readily melted, and easier to cast. It is also harder than iron and far more resistant to corrosion. Bell metal (which produces pleasing sounds when struck) is bronze with 20–25% tin content. Statuary bronze, with less than 10% tin and an admixture of zinc and lead, is technically a BRASS. The addition of less than 1% phosphorus improves the hardness and strength of bronze; that formulation is used for pump plungers, valves, and bushings. Also useful in mechanical engineering are manganese bronzes, with little or no tin but considerable amounts of zinc and up to 4.5% manganese. Aluminum bronzes, containing up to 16% aluminum and small amounts of other metals such as iron or nickel, are especially strong and corrosion-resistant; they are cast or wrought into pipe fittings, pumps, gears, ship propellers, and turbine blades. Most "copper" coins are actually bronze, typically with about 4% tin and 1% zinc, or copper plating over base metal.

Bronze Age Third phase in the development of material culture among the ancient peoples of Europe, Asia, and the Middle East, following the PALEOLITHIC and NEOLITHIC periods and preceding the IRON AGE. The term also denotes the first period in which metal was used. The date at which the age began varied by region; in Greece and China it began before 3000 BC, in Britain not until c. 1900 BC. The beginning of the period is sometimes called the Chalcolithic (Copper-Stone) Age, referring to the initial use of pure copper (along with its predecessor, stone). By 3000 BC the use of copper was well known in the Middle East, had extended westward into the Mediterranean area, and was beginning to infiltrate Europe. Only in the 2nd millennium BC did true BRONZE come to be widely used. The age was marked by increased specialization and the invention of the wheel and the ox-drawn plow. From c. 1000 BC the ability to heat and forge iron brought the Bronze Age to an end.

Bronzino \brȯn-ˈdzē-nō\, **Il** *orig.* **Agnolo di Cosimo** (b. Nov. 17, 1503, Monticelli, duchy of Milan—d. Nov. 23, 1572, Florence) Italian painter active in Florence. He was the student and adopted son of Jacopo da PONTORMO. He excelled as a portraitist and was court painter to COSIMO I for most of his career. His portraits were emotionally inexpressive, but in their elegance and decorative qualities they embodied the courtly ideal under the Medici dukes. His work influenced European court portraiture for the next century, while his polished, sophisticated religious and mythological paintings epitomized the Mannerist style of his time (see MANNERISM). In 1563 he became a founding member of the Accademia del Disegno.

"Portrait of a Young Man" (possibly Guidobaldo II, duke of Urbino), oil painting by Il Bronzino; in the Metropolitan Museum of Art, New York City.

THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, BEQUEST OF MRS. H.O. HAVEMEYER, 1929, THE H.O. HAVEMEYER COLLECTION (29.100.16), COPYRIGHT 1981 BY THE METROPOLITAN MUSEUM OF ART

brooch Ornamental pin with a clasp to attach it to a garment. Brooches developed from the Greek and Roman fibula, which resembled a decorative safety pin and was used as a fastening for cloaks and tunics. Brooches have been made in a wide variety of shapes throughout history, the ornamentation and design varying from region to region. In the 19th century, with the expansion of wealth and the creation of a market for inexpensive jewelry, the brooch became a popular form of personal decoration.

Brook, Sir Peter (Stephen Paul) (b. March 21, 1925, London, Eng.) British director and producer. After directing plays in Stratford-upon-Avon, he became director of the Royal Opera House, COVENT GARDEN (1947–50). He directed several innovative Shakespearean productions that aroused controversy. Appointed codirector of the ROYAL SHAKESPEARE CO. in 1962, he directed critically acclaimed productions of *King Lear* (1962) and *A Midsummer Night's Dream* (1970). He won international fame with his avant-garde direction of PETER WEISS's play *Marat/Sade* (1964). His films include *Lord of the Flies* (1962), *King Lear* (1969), and the six-hour *Mahabharata* (1989). In 1970 he cofounded, with JEAN-LOUIS BARRAULT, the International Centre for Theatre Research.

Brook Farm (Institute of Agriculture and Education) Short-lived utopian experiment in communal living (1841–47) in West Roxbury, Mass. (near Boston), founded by GEORGE RIPLEY. The best known of the many utopian communities organized in the U.S. in the mid-19th century, Brook Farm was to combine the thinker and the worker, to guarantee the greatest mental freedom, and to prepare a society of liberal, cultivated persons whose lives would be more wholesome and simpler than they could be amid the pressure of competitive institutions. It is remembered for the distinguished literary figures and intellectual leaders associated with it, including CHARLES A. DANA, NATHANIEL HAWTHORNE, MARGARET FULLER, HORACE GREELEY, JAMES RUSSELL LOWELL, JOHN GREENLEAF WHITTIER, and RALPH WALDO EMERSON (though not all of them were actual members). It was also noted for the modern educational theory of its excellent school. See also ONEIDA COMMUNITY.

brook trout *or* **speckled trout** Popular freshwater game fish (*Salvelinus fontinalis*), a variety of CHAR, that is valued for its flavour and its fighting qualities when hooked. The brook trout is a native of the northeastern U.S. and Canada and has been transplanted to many parts of the world. It lives in cold, clean waters and carries dark, wormlike markings on the back and red and whitish spots on the body. The brook trout may weigh up to 6 lbs (3 kg). Some individuals migrate to large lakes or the sea and grow much larger and more silvery.

Brooke Raj (1841–1946) Dynasty of British rajas that ruled Sarawak (now a state in Malaysia) for a century. Sir James Brooke (1803–68) served with the British EAST INDIA COMPANY and fought in the first ANGLO-BURMESE WAR (1824–26) before using his family fortune to outfit a schooner and sail for the Indies (1838). He was awarded the title of raja of Sarawak by the sultan of Brunei for helping suppress a rebellion. Brooke established a secure government on Sarawak and was succeeded by his

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nephew, Sir Charles Anthony Johnson Brooke (1829–1917), who had spent much of his life on Sarawak, knew the local language, and respected local beliefs and customs. Under him, social and economic changes were limited. His eldest son, Sir Charles Vyner de Windt Brooke (1874–1963), succeeded him and began a modernization program after World War I. He terminated Brooke rule in 1946, ceding Sarawak to Britain.

Brooke, Rupert (b. Aug. 3, 1887, Rugby, Warwickshire, Eng.—d. April 23, 1915, Skyros, Greece) English poet. His best-known work, the sonnet sequence *1914* (1915), which includes the popular poem "The Soldier," expresses an idealism in the face of death that is in strong contrast to later poetry of trench warfare. His death at age 27 in World War I contributed to his idealized image in the interwar period.

Rupert Brooke, posthumous portrait drawing by J.H. Thomas; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Brooklyn Borough (pop., 2000: 2,465,326), New York, New York, U.S. Separated from Manhattan by the East River, it is bordered to the south by the Atlantic Ocean. Brooklyn is connected to Manhattan by bridges (including the Brooklyn Bridge), a vehicular tunnel, and rapid transit services. The first settlement in the area by Dutch farmers in 1636 was soon followed by other villages, including Breuckelen (1645). The Battle of Long Island was fought in Brooklyn in 1776. It became a borough of New York City in 1898. Brooklyn is both residential and industrial and also handles considerable oceangoing traffic. Among its educational institutions is Pratt Institute. Coney Island is located there.

Brooklyn Bridge Suspension bridge built (1869–83) over the East River to link Brooklyn to Manhattan island. It was designed by the cable manufacturer John A. Roebling and his son Washington. A brilliant feat of 19th-century engineering, the bridge was the first to use steel for cable wire and the first in which explosives were used inside a pneumatic caisson during construction. In 1869 John was killed in one of at least 27 fatal construction accidents; his son saw the project to completion. The bridge's main span of 1,595 ft (486 m) was the longest in the world to date. It opened to such fanfare that within 24 hours an estimated quarter-million people crossed over it, using an elevated walkway designed to give pedestrians a dramatic view of the city.

Brooks Islands See Midway

Brooks Range Mountain range, northern Alaska, U.S. It extends about 600 mi (1,000 km) from Kotzebue Sound to the Canadian border. Its highest peak is Mount Isto, at 9,060 ft (2,760 m). Forming the northwestern end of the Rocky Mountains, it lies within Gates of the Arctic National Park. Huge reserves of oil were discovered at Prudhoe Bay, and the range is crossed at Atigun Pass by the Trans-Alaska Pipeline.

Brooks, Gwendolyn (Elizabeth) (b. June 7, 1917, Topeka, Kan., U.S.—d. Dec. 3, 2000, Chicago, Ill.) U.S. poet. Reared in the Chicago slums, Brooks published her first poem at age 13. With *Annie Allen* (1949), a loosely connected series of poems about growing up in Chicago, she became the first black poet to win the Pulitzer Prize. *The Bean Eaters* (1960) contains some of her best verse. Among her other books are *In the Mecca* (1968), the autobiographical *Report from Part One* (1972), *Primer for Blacks* (1980), *Young Poets' Primer* (1981), and *Children Coming Home* (1991).

Brooks, James L. (b. May 9, 1940, Brooklyn, N.Y., U.S.) U.S. screenwriter, director, and producer. He worked in television from 1964. He cocreated and produced the hit *Mary Tyler Moore Show* (1970–77) and several other TV programs and series, including *The Tracey Ullman Show* (1986–90) and *The Simpsons* (from 1989). As writer, producer, and director of the film *Terms of Endearment* (1983), he won three Academy Awards; he also wrote, directed, and produced *Broadcast News* (1987) and *As Good As It Gets* (1997).

Brooks, Louise (b. Nov. 14, 1906, Cherryvale, Kan., U.S.—d. Aug. 8, 1985, Rochester, N.Y.) U.S. film actress. She danced in Florenz Ziegfeld's *Follies* (1925) and soon gained a Hollywood contract. Noted for her magnetic screen presence and dark bobbed hair, she personified the 1920s flapper in the silent films *A Girl in Every Port* (1928) and *Beggars of Life* (1928). In Germany she gave legendary performances in G.W. Pabst's *Pandora's Box* (1928) and *Diary of a Lost Girl* (1929). Back in Hollywood (1930), however, she was offered only minor roles, and she retired in 1938 with little fame and no fortune. Her films were rediscovered in the 1950s, and her book *Lulu in Hollywood* (1982) won critical praise.

Brooks, Mel *orig.* **Melvin Kaminsky** (b. June 28, 1926, Brooklyn, N.Y., U.S.) U.S. director, producer, and actor. He wrote comedy routines for Sid Caesar's television shows (1949–59) and cocreated the TV series *Get Smart* (1965). He wrote and directed his first feature film, *The Producers* (1968, Academy Award for writing), which was later transformed into a hit Broadway musical. He directed, produced, and cowrote (and sometimes acted in) film comedies such as *Blazing Saddles* (1974), *Young Frankenstein* (1974), and *Spaceballs* (1987).

Brooks, Rodney Allen (b. Dec. 30, 1954, Adelaide, S.Aus., Austl.) Australian computer scientist. By the time he finished his doctorate (1981) at Stanford University, Calif., Brooks was disillusioned by the traditional "model-based" approach to artificial intelligence (AI). After moving to the Mobile Robotics Laboratory at MIT in 1984, he built simple robots that could perform "insectlike" actions on the premise that practical learning comes from interacting with the real world. In 1997 Brooks became director of the MIT AI Research Laboratory.

Brooks, Romaine Goddard *orig.* **Beatrice Romaine Goddard** (b. May 1, 1874, Rome, Italy—d. Dec. 7, 1970, Nice, Fr.) U.S. painter. Born to wealthy American parents, she studied painting in Italy. After a brief marriage, in 1905 she moved to Paris where she established herself in literary, artistic, and homosexual circles. Her reputation reached its height in 1925 with several important exhibitions. Her gray-shaded portraits, touched by occasional colour, distilled their subjects' personalities to a disturbing degree. *The Amazon* (c. 1920), Brooks's portrait of her longtime lover Natalie Clifford Barney (1876–1972), is among her finest works.

Brooks, Van Wyck (b. Feb. 16, 1886, Plainfield, N.J., U.S.—d. May 2, 1963, Bridgewater, Conn.) U.S. critic, biographer, and literary historian. Brooks attended Harvard University. His Finders and Makers series, tracing American literary history in rich biographical detail from 1800 to 1915, includes *The Flowering of New England, 1815–1865* (1936, Pulitzer Prize); *New England: Indian Summer, 1865–1915* (1940); *The World of Washington Irving* (1944); *The Times of Melville and Whitman* (1947); and *The Confident Years: 1885–1915* (1952).

broom In botany, any of several leguminous shrubs or small trees of the genus *Cytisus*, native to temperate regions of Europe and western Asia. They are cultivated widely, chiefly for their attractive flowers. The compound leaves have three leaflets. The solitary or clustered yellow, purple, or white flowers resemble pea flowers. The fruit is a flat pod. A common, almost leafless species is *C. scoparius*, a shrub with bright yellow flowers often grown for erosion control in warm climates. Butcher's broom (*Ruscus aculeatus*) is a shrub of the lily family with small whitish flowers and red berries.

Broom (*Cytisus beanii*)
VALERIE FINNIS

Brouwer \'braù-ər**, Adriaen** (b. 1605/06, Oudenaarde, Flanders—d. January 1638, Antwerp) Flemish painter. After studying with Frans Hals in Haarlem c. 1623, he returned to Flanders and by 1631 had settled in Antwerp. His pictures, mostly small and painted on panels, typically depict peasants drinking and brawling in taverns. The coarseness of his subjects was in direct contrast to his delicate technique; his virtuoso brushwork and sparkling tonal values were unsurpassed. Brouwer popularized genre painting in Flanders and Holland. Adriaen van Ostade and David Teniers were among his many followers.

Browder, Earl (Russell) (b. May 20, 1891, Wichita, Kan., U.S.—d. June 27, 1973, Princeton, N.J.) U.S. Communist Party leader (1930–44). He was imprisoned in 1919–20 for his opposition to U.S. participation in

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World War I. In 1921 he joined the U.S. Communist Party; he served as the party's general secretary from 1930 to 1944 and was its presidential candidate in 1936 and 1940. In 1944 he was removed from his position for declaring that capitalism and socialism could coexist, and in 1946 he was expelled from the party.

Brown, Capability *orig.* **Lancelot Brown** (b. 1715, Kirkharle, Northumberland, Eng.—d. Feb. 6, 1783, London) British master of naturalistic garden design. He worked for years at Stowe, Buckinghamshire, one of the most talked-of gardens of the day, under William Kent (1685–1748). By 1753 he was the leading "improver of grounds" in England. At Blenheim Palace he created masterly lakes and almost totally erased the earlier formal scheme. His landscapes consisted of expanses of grass, irregularly shaped bodies of water, and trees placed singly and in clumps. His style is often thought of as the antithesis of that of André Le Nôtre, designer of the formal Versailles gardens. Brown's nickname arose from his habit of saying that a place had "capabilities."

Brown, Charles Brockden (b. Jan. 17, 1771, Philadelphia, Pa., U.S.—d. Feb. 22, 1810, Philadelphia) U.S. writer. Brown left his law studies to devote himself to writing. His gothic novels in American settings were the first in a tradition later adapted by Edgar Allan Poe and Nathaniel Hawthorne. *Wieland* (1798), his best-known work, shows the ease with which mental balance is lost when common sense is confronted with the uncanny. His writings reflect a thoughtful liberalism while exploiting horror and terror. He has been called the "father of the American novel."

Brown, Clifford (b. Oct. 30, 1930, Wilmington, Del., U.S.—d. June 26, 1956, Pennsylvania) U.S. jazz trumpeter. He became the most influential trumpeter of his generation, inspired by Fats Navarro to combine technical brilliance with lyrical grace in his playing. He was a principal figure in the hard-bop idiom (see bebop). After touring with Lionel Hampton's big band in 1953, he worked with Art Blakey; in 1954 he and drummer Max Roach formed a quintet that became one of the outstanding groups in modern jazz. He died in a car crash at age 25.

Brown, Ford Madox (b. April 16, 1821, Calais, Fr.—d. Oct. 6, 1893, London, Eng.) British painter. He studied in Bruges, Antwerp, Paris, and Rome. In Italy (1845) he met Peter von Cornelius, a member of the Nazarenes, who influenced his palette and style. His use of brilliant colour, meticulous handling, and taste for literary subjects had a strong effect on the Pre-Raphaelites, most notably Dante Gabriel Rossetti. His most famous paintings are *The Last of England* (1852–55), a poignant tribute to emigration, and *Work* (1852–63), a Victorian social commentary. In 1861 he became a founding member of William Morris's company, for which he designed stained glass and furniture.

Brown, George (b. Nov. 29, 1818, Edinburgh, Scot.—d. May. 9, 1880, Toronto, Ont., Can.) Canadian journalist and politician. He immigrated to New York in 1837 and in 1843 moved to Toronto, where he founded *The Globe* (1844), a reformist political newspaper. As a member of the Canadian assembly (1857–65), he advocated proportional representation, the confederation of British North America, acquisition of the Northwest Territories, and separation of church and state. He later became a leader of the Clear Grits movement. In 1873 he was appointed to the Canadian Senate, though he continued to manage his influential and popular newspaper (later *The Globe and Mail*).

Brown, James (b. May 3, 1933, Barnwell, S.C., U.S.) U.S. singer and songwriter. Growing up in Georgia during the Depression, Brown first sang and danced on street corners for money. He later formed a trio, appearing at small clubs throughout the South. He gradually evolved a highly personal style, combining blues and gospel music elements with his own emotionally charged and highly rhythmic delivery, accented by a strong sense of showmanship. His first hit, "Please, Please, Please" (1956), was followed by other million-selling singles, including "Papa's Got a Brand New Bag"; his style, marked by strong dance-oriented rhythms and heavy syncopation, became known as funk. His checkered personal life was highlighted in 1988 when he received a three-year jail sentence on a variety of charges.

Brown, Jim *orig.* **James Nathaniel Brown** (b. Feb. 17, 1936, St. Simons, Ga., U.S.) U.S. football player, often considered the greatest running back of all time. He was an All-American in football and lacrosse at Syracuse University. In his nine seasons with the Cleveland Browns (1957–65), he set NFL overall rushing and combined yardage records that stood until 1984. Averaging a record 5.22 yards per carry in his career, Brown led the NFL in rushing in eight of the nine years he played. After retiring from football, he became a movie actor.

Brown, John (b. 1735, Buncle, Berwickshire, Scot.—d. Oct. 17, 1788, London, Eng.) British physician. He propounded the "excitability" theory published in *Elementa medicinae* (1780), which classified diseases as over- or understimulating and held that internal and external "exciting powers," or stimuli, operate on living tissues. Brown viewed diseases as states of decreased excitability, requiring stimulants, or increased excitability, requiring sedatives. Hermann von Helmholtz discredited the theory.

Brown, John (b. May 9, 1800, Torrington, Conn., U.S.—d. Dec. 2, 1859, Charles Town, Va.) U.S. abolitionist. He grew up in Ohio, where his mother died insane when he was eight. He moved around the country working in various trades and raised a large family of 20 children. Though he was white, he settled in 1849 with his family in a black community founded at North Elba, N.Y. An ardent advocate of overt action to end slavery, he traveled to Kansas in 1855 with five of his sons to retaliate against proslavery actions in Lawrence. He and his group murdered five proslavery settlers (see Bleeding Kansas). In 1858 he proposed to establish a mountain stronghold in Maryland for escaping slaves, to be financed by abolitionists. He hoped that taking the federal arsenal at Harpers Ferry, W.Va., would inspire slaves to join his "army of emancipation." In 1859 his small force overpowered the arsenal's guard; after two days it was in turn overpowered by federal forces led by Col. Robert E. Lee. Brown was tried for treason, convicted, and hanged. His raid made him a martyr to northern abolitionists and increased the sectional animosities that led to the American Civil War.

Brown, Joseph Rogers (b. Jan. 26, 1810, Warren, R.I., U.S.—d. July 23, 1876, Isles of Shoals, N.H.) U.S. inventor and manufacturer. He perfected and produced a highly accurate linear dividing engine in 1850, and then developed a vernier caliper and also applied vernier methods to the protractor. With Lucian Sharpe he founded the Brown and Sharpe Manufacturing Co. His micrometre caliper appeared in 1867. He invented a precision gear cutter to produce clock gears, a universal milling machine, and (perhaps his finest innovation) a universal grinding machine, in which articles were hardened first and then ground, thereby increasing accuracy and eliminating waste.

Brown, Molly *orig.* **Margaret Tobin** (b. July 18, 1867, Hannibal, Mo, U.S.—d. Oct. 26, 1932, New York, N.Y.) U.S. philanthropist, social reformer, and socialite. The daughter of Irish immigrants, she attended a grammar school and later worked at a tobacco factory. She followed her brother c. 1884 to Colorado, where she met and married James Brown, a miner. After he found gold in 1894, they moved to Denver, where they were welcomed into society. She became a founding member of the Denver Woman's Club, part of a national network of women's clubs dedicated to improving the conditions of women and children. After her husband left her, she traveled to New York and Newport, where she enjoyed social success. As a passenger on the disastrous maiden voyage of the *Titanic* (1912), she helped command a lifeboat and was celebrated by the U.S. press as "the Unsinkable Mrs. Brown." Her life, in the semilegendary form she herself recounted it, was popularized in a stage musical and movie.

Brown, Robert (b. Dec. 21, 1773, Montrose, Angus, Scot.—d. June 10, 1858, London, Eng.) Scottish botanist. The son of a clergyman, he studied medicine in Aberdeen and Edinburgh before entering the British army as an ensign and assistant surgeon (1795). He obtained the post of naturalist aboard a ship bound to survey the coasts of Australia (1801), and on the journey he gathered some 3,900 plant species. He published some of the results of his trip in 1810 in his classic *Prodromus Florae Novae Hollandiae…*, laying the foundations of Australian botany and refining prevailing plant classification systems. In 1827 he transferred Joseph Banks's botanical collection to the British Museum and became keeper of the museum's newly formed botanical department. The following year he published his observation of the phenomenon that came to be called Brownian motion. In 1831 he noted the existence in plant cells of what he called the nucleus. He was the first to recognize the distinction between gymnosperms and angiosperms (flowering plants).

Brown, William Wells (b. 1814?, near Lexington, Ky., U.S.—d. Nov. 6, 1884, Chelsea, Mass.) U.S. writer. Born into slavery, Brown escaped and educated himself, settling in the Boston area. He wrote a popular autobiography, *Narrative of William W. Brown, A Fugitive Slave* (1847),

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and lectured on abolitionism and temperance reform. *Clotel* (1853), his only novel, concerning the descendants of Thomas Jefferson and a slave, was the first novel ever published by an African American. His only play, *The Escape* (1858), is about two slaves who secretly marry.

brown bear Shaggy-haired, characteristically brown species (*Ursus arctos*) of bear with numerous races native to Eurasia and to northwestern North America. North American brown bears are usually called grizzly bears. Eurasian brown bears are generally solitary animals, able to run and swim well, and usually 48–84 in. (120–210 cm) long and 300–550 lbs (135–250 kg). They feed on mammals, fish, vegetable materials, and honey. The exceptionally large Siberian brown bear is similar in size to the grizzly.

brown dwarf Astronomical object intermediate in mass between a planet and a star. Sometimes described as failed stars, brown dwarfs are believed to form in the same way as stars, from fragments of an interstellar cloud that contract into gravitationally bound objects. However, they do not have enough mass to produce the internal heat that in stars ignites hydrogen and establishes nuclear fusion. Though they generate some heat and light, they also cool rapidly and shrink; they may differ from high-mass planets only in how they form.

brown recluse spider Venomous species (*Loxosceles reclusa*) of brown spider, most common in the western and southern U.S. The brown recluse is light-coloured, generally with a dark violin-shaped design on its back, for which it is sometimes called the violin spider. About 0.25 in. (7 mm) long, it has a leg span of about 1 in. (2.5 cm). It has extended its range into parts of the northern U.S. and is often found under stones or in dark corners inside buildings. The venom of the brown recluse destroys the walls of blood vessels near the site of the bite, sometimes causing a slow-healing skin ulcer. Bites are occasionally fatal.

brown trout Prized and wary European game fish (*Salmo trutta,* family Salmonidae) that is favoured for food. The species includes several varieties (e.g., the Loch Leven trout of Britain). The brown trout is recognized by the light-ringed black spots on its brown body. It has been transplanted to many areas of the world because it can thrive in warmer waters than most other trout. It grows to about 8 lbs (3.6 kg). Oceangoing individuals, called sea trout, are larger than freshwater forms and provide good sport, as do those that enter large lakes.

Brown trout (*Salmo trutta*)
TREAT DAVIDSON—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Brown University Private university in Providence, Rhode Island, U.S., a traditional member of the Ivy League. It was founded in 1764 as Rhode Island College and renamed in 1804 for a benefactor, Nicholas Brown. It became coeducational in 1971 when it merged with Pembroke, a women's college founded in 1891. Today it offers undergraduate and graduate degrees in all major academic fields; its school of medicine awards the M.D. Research facilities include centres for geological, astronomical, and educational research.

Brown v. Board of Education (of Topeka) (1954) U.S. Supreme Court case in which the court ruled unanimously that racial segregation in public schools violated the 14th Amendment to the U.S. Constitution. The amendment says that no state may deny equal protection of the laws to any person within its jurisdiction. The court declared separate educational facilities to be inherently unequal, thus reversing its 1896 ruling in Plessy v. Ferguson. The *Brown* ruling was limited to public schools, but it was believed to imply that segregation is not permissible in other public facilities. Guidelines for ending segregation were presented and school boards were advised to proceed "with all deliberate speed." See also Thurgood Marshall.

Browne, Sir Thomas (b. Oct. 19, 1605, London, Eng.—d. Oct. 19, 1682, Norwich, Norfolk) British physician and author. While practicing medicine, he began a parallel career as a writer. His best-known work, *Religio Medici* (1642), is a journal of reflections on the mysteries of God, nature, and man. A larger work commonly known as *Browne's Vulgar Errors* (1646) attempted to correct popular beliefs and superstitions. He also wrote treatises on antiquarian subjects and the beautiful and subtle *A Letter to a Friend* (1690).

Brownian motion Any of various physical phenomena in which some quantity is constantly undergoing small, random fluctuations. It was named for Robert Brown, who was investigating the fertilization process of flowers in 1827 when he noticed a "rapid oscillatory motion" of microscopic particles within pollen grains suspended in water. He later discovered that similar motions could be seen in smoke or dust particles suspended in air and other fluids. The idea that molecules of a fluid are constantly in motion is a key part of the kinetic theory of gases, developed by James Clerk Maxwell, Ludwig Boltzmann, and Rudolf Clausius (1822–88) to explain heat phenomena.

Browning, Elizabeth Barrett *orig.* **Elizabeth Barrett** (b. March 6, 1806, near Durham, Durham, Eng.—d. June 29, 1861, Florence) British poet. Though she was an invalid who was afraid to meet strangers, her poetry became well known in literary circles with the publication of volumes of verse in 1838 and 1844. She met Robert Browning in 1845 and, after a courtship kept secret from her despotic father, they married and settled in Florence. Her reputation rests chiefly on the love poems written during their courtship, *Sonnets from the Portuguese* (1850). Her most ambitious work, the blank-verse novel *Aurora Leigh* (1857), was a huge popular success.

Elizabeth Barrett Browning, detail of an oil painting by Michele Gordigiani, 1858; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Browning, Robert (b. May 7, 1812, London, Eng.—d. Dec. 12, 1889, Venice, Italy) British poet. His early works include verse dramas, notably *Pippa Passes* (1841), and long poems, including *Sordello* (1840). In the years of his marriage (1846–61) to Elizabeth Barrett Browning, spent in Italy, he produced little other than *Men and Women* (1855), which contains dramatic lyrics such as "Love Among the Ruins" and the great monologues "Fra Lippo Lippi" and "Bishop Blougram's Apology." *Dramatis Personae* (1864), including "Rabbi Ben Ezra" and "Caliban upon Setebos," finally won him popular recognition. *The Ring and the Book* (1868–69), a book-length poem, is based on a 1698 murder trial in Rome. Browning influenced many modern poets through his development of the dramatic monologue (with its emphasis on individual psychology) and through his success in writing about the variety of modern life in language his contemporaries found often difficult as well as original.

Browning, Tod *orig.* **Charles Albert Browning** (b. July 12, 1880, Louisville, Ky., U.S.—d. Oct. 6, 1962, Malibu, Calif.) U.S. film director. He was a circus performer and vaudeville comic before joining the Biograph film studio in 1915. He wrote several screenplays, then directed melodramas and adventure films (1917–25). He directed the macabre film *The Unholy Three* (1925), starring Lon Chaney, followed by *Dracula* (1931) and *Freaks* (1932), which established his reputation for films of horror and the grotesque.

Brownshirts See SA

Brownsville Affair Racial incident in 1906 in Brownsville, Texas, involving white citizens of Brownsville and African American soldiers stationed at nearby Fort Brown. On the evening of August 13–14, rifle shots on a street in Brownsville killed one white man and wounded another. The mayor and other whites accused African American soldiers of the crime. Though their white officers stated that the soldiers were in their barracks, investigators accepted the mayor's version, and Pres. Theodore Roosevelt ordered dishonourable discharges for 167 African American soldiers for their alleged conspiracy of silence. In 1972 a congressional investigation cleared the soldiers of guilt.

browser Software that allows a computer user to find and view information on the Internet. The first text-based browser for the World Wide Web became available in 1991; Web use expanded rapidly after the release in 1993 of a browser called Mosaic, which used "point-and-click" graphical manipulations. Such Web browsers interpret the HTML tags in downloaded documents and format the displayed data according to a set of

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standard style rules. Netscape Navigator became the dominant Web browser soon after its release in 1994; Microsoft's Internet Explorer was introduced a year later and has become widespread.

Brubeck, Dave *orig.* **David Warren Brubeck** (b. Dec. 6, 1920, Concord, Calif., U.S.) U.S. jazz pianist and composer. Brubeck studied composition with DARIUS MILHAUD before working as a jazz pianist. He formed a quartet with saxophonist Paul Desmond in 1951. His use of unconventional metres contributed to his immense appeal: the recording of Desmond's "Take Five" became the first jazz instrumental to sell more than a million copies. This exposure brought many new listeners to jazz, particularly on college campuses during the 1950s and '60s.

Bruce, Blanche K(elso) (b. March 1, 1841, Prince Edward county, Va., U.S.—d. March 17, 1898, Washington, D.C.) U.S. senator from Mississippi during RECONSTRUCTION. Born to a slave mother and a white father, he was educated by his father. He moved to Mississippi, where he became a significant figure in state politics and purchased a plantation. In the U.S. Senate (1875–81), he advocated just treatment of African Americans and Indians and opposed the policy of excluding Chinese immigrants. He later served as register of the U.S. treasury (1881–85, 1895–98), District of Columbia recorder of deeds (1889–95), and trustee of Howard University.

Bruce, Lenny *orig.* **Leonard Alfred Schneider** (b. Oct. 13, 1925, Mineola, N.Y., U.S.—d. Aug. 3, 1966, Hollywood, Calif.) U.S. stand-up comedian. He studied acting and began performing stand-up routines in nightclubs in the 1950s, soon developing a style marked by black humour and punctuated with obscenity. As he gained notoriety, he focused his material on criticisms of the social and legal establishments, organized religion, and other controversial subjects. His reputation acquired iconic status as a daring performer and an activist for free speech after his death from a drug overdose.

brucellosis \ˌbrü-sə-ˈlō-səs\ *or* **Malta fever** *or* **Mediterranean fever** *or* **undulant fever** Infectious disease of humans and domestic animals. It is characterized by gradual onset of fever, chills, sweats, weakness, and aches, and it usually ends within six months. It is named after the British physician David Bruce (b. 1855—d. 1931), who first identified (1887) the causative bacteria. Three main species in the genus *Brucella* commonly cause the disease in humans, who contract it from infected animals (goats, sheep, pigs, cattle). Brucellosis is rarely transmitted between humans but spreads rapidly in animals, causing severe economic losses. Drug therapy is not practical for animal brucellosis, but vaccination of young animals is useful. Infected animals must be removed from herds. ANTIBIOTICS are effective against acute disease in humans, in whom it can cause liver and heart problems if untreated.

Bruch \ˈbrük**, Max (Karl August)** (b. Jan. 6, 1838, Cologne, Prussia—d. Oct. 2, 1920, Friedensau, near Berlin, Ger.) German composer. Bruch held many conducting positions and taught for 20 years at the Berlin Academy. He was known in his lifetime principally for his many sacred and secular choral pieces, including *Odysseus* (1872) and *Das Lied von der Glocke* (1879). Today he is remembered especially for his first violin concerto (1868); he also wrote two further violin concertos, the cello variations *Kol Nidrei* (1881), and operas and symphonies.

Brücke \ˈbrʉ̄-kə**, Die** *German* **"The Bridge"** Organization of German EXPRESSIONIST artists. It was founded in 1905 by four architectural students at the Dresden Technical School, including ERNST LUDWIG KIRCHNER and KARL SCHMIDT-ROTTLUFF, who were soon joined by other German and European artists. Its name reflects their hope that their work would be a bridge to the art of the future. Strongly influenced by primitive art, German Gothic woodcuts, and the prints of EDVARD MUNCH, they produced figure paintings and portraits depicting human suffering and anxiety, as well as still lifes and landscapes characterized by harshly distorted shapes and violent colours. They contributed to the 20th-century revival of the woodcut. The group disbanded in 1913. See photograph opposite.

Bruckner \ˈbrůk-nər**, (Josef) Anton** (b. Sept. 4, 1824, Ansfelden, Austria—d. Oct. 11, 1896, Vienna) Austrian composer. Son of a rural schoolmaster who died in Anton's youth, he was taken into a monastery as a choirboy and there learned to play the organ. Greatly gifted, he became organist at Linz Cathedral in 1855; throughout his composing career, his orchestrations would be compared to organ sonorities. In 1865 he heard *Tristan und Isolde* in Munich and thereafter idolized RICHARD WAGNER, though his own works remained indebted to LUDWIG VAN BEETHOVEN. In 1868 he was appointed professor at the Vienna Conservatory and settled in Vienna for the rest of his life. He was 60 before he achieved fame with his *Symphony No. 7 in E Major* (1884). He was socially awkward and eccentric, and he remained a deeply devout Christian to his death. His reputation rests on his nine mature symphonies (1866–96), his three masses, and his *Te Deum* (1884).

Bruegel \ˈbrȯi-gəl**, Jan, the Elder** (b. 1568, Brussels—d. Jan. 13, 1625, Antwerp) Flemish painter and draftsman, second son of PIETER BRUEGEL. Early in his career he went to Italy, where he painted under the patronage of Cardinal Federigo Borromeo. After returning to Antwerp in 1596, he enjoyed a highly successful and prestigious career. In 1608 he was appointed court painter to the archdukes of Habsburg, regents of the southern Netherlands. He is known for his small-scale landscapes and exquisite flower paintings, all painted in a miniaturistic style on copper or panel. His skill at depicting delicate textures earned him the nickname "Velvet." He often collaborated with other artists, including his friend PETER PAUL RUBENS. His sons, Jan the Younger and Ambrosius, were also painters.

Bruegel \ˈbrȯi-gəl**, Pieter, the Elder** (b. c. 1525, probably Breda, duchy of Brabant—d. Sept. 5/9, 1569, Brussels) Greatest Netherlandish painter of the 16th century. Not much is known of his early life, but in 1551 he set off for Italy, where he produced his earliest signed painting, *Landscape with Christ and the Apostles at the Sea of Tiberias* (c. 1553). Returning to Flanders in 1555, he achieved some fame with a series of satirical, moralizing prints in the style of HIËRONYMUS BOSCH, commissioned by an Antwerp engraver. He is best known for his paintings of Netherlandish proverbs, seasonal landscapes, and realistic views of peasant life and folklore, but he also took a novel approach to religious subject matter, portraying biblical events in panoramic scenes, often viewed from above. He had many important patrons; most of his paintings were commissioned by collectors. In addition to many drawings and engravings, about 40 authenticated paintings from his enormous output have survived. His sons, Peter Brueghel the Younger and JAN, THE ELDER BRUEGHEL (both of whom restored to the name the *h* their father had abandoned), and later imitators carried his style into the 18th century.

Brugge \ˈbrʉ̄-kə,\ *English* \ˈbrů-gə\ *or* **Bruges** \ˈbrʉ̄zh\ City (pop., 2000 est.: 116,200), northwestern Belgium. First mentioned in 7th-century records, it was the site of a castle built in the 9th century by the first counts of FLANDERS against Norman invaders. It joined the HANSEATIC LEAGUE and was a major marketplace in the 13th century. As the centre of the Flemish cloth industry, it was the commercial hub of northern Europe. In the 15th century it was home to Jan van EYCK and other painters of the Flemish school (see FLEMISH ART). It declined as a port and textile centre but later revived with the construction of canals linking it with the North Sea. Shipbuilding, food processing, chemicals, electronics, and tourism are the main industries.

"Dodo and Her Brother," oil painting by Die Brücke artist Ernst Ludwig Kirchner, c. 1908; in the Smith College Museum of Art, Northampton, Mass.
COURTESY OF THE SMITH COLLEGE MUSEUM OF ART, NORTHAMPTON, MASS.

Brugghen, Hendrik ter See Hendrik TERBRUGGHEN

Brugmann \ˈbrůg-ˌmän**, (Friedrich) Karl** (b. March 16, 1849, Wiesbaden, Nassau—d. June 29, 1919, Leipzig, Ger.) German linguist. A professor of Sanskrit and comparative linguistics, he belonged to the Neogrammarian school, which asserted the inviolability of phonetic laws and adhered to strict research methodology. Among the best known of his 400 publications are the two volumes on sounds and forms that he contributed to the *Outline of the Comparative Grammar of the Indo-Germanic Languages* (1886–93).

Bruhn \ˈbrün**, Erik** *orig.* **Belton Evers** (b. Oct. 3, 1928, Copenhagen, Den.—d. April 1, 1986, Toronto, Ont., Can.) Danish ballet

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dancer. From 1937 he studied at the Royal Danish Ballet training school, and in 1947 he joined the company. He performed as guest soloist with many other companies, including American Ballet Theatre in the 1950s and '60s, dancing leading roles in such ballets as *La Sylphide*, *Swan Lake*, and *Carmen*. He was admired for his classical technique. He later served as director of the Royal Swedish Opera House (1967–72) and assistant director (1973–81) and director (1983–86) of Canada's National Ballet.

Bruhn as Romeo, 1967
FRED FEHL

bruise *or* **contusion** Visible bluish or purplish mark beneath the surface of unbroken skin, indicating burst blood vessels in deeper tissue layers. Bruises are usually caused by a blow or pressure, but they may occur spontaneously in elderly persons. The yellowish hue that becomes visible as a bruise heals comes from the disintegration and gradual absorption of blood.

Brumaire \brü-'mer**, Coup of 18–19** (1799) French coup d'état that overthrew the DIRECTORY and substituted the CONSULATE, making way for the despotism of NAPOLEON. Planned by EMMANUEL JOSEPH SIEYES and CHARLES MAURICE DE TALLEYRAND with the aid of Napoleon, the coup took place on November 9–10 (18–19 Brumaire in the French republican calendar). It is often considered the effective end of the FRENCH REVOLUTION.

Brummell, Beau *orig.* **George Bryan** (b. June 7, 1778, London, Eng.—d. March 30, 1840, Caen, France) English dandy. The son of Lord NORTH's private secretary, he attended Oxford and became famous for his dress and wit as well as for his friendship with George, prince of Wales (later King GEORGE IV). The leader of English fashion of his time, he had by 1816 exhausted his inherited fortune on gambling and extravagance, and his sharp tongue had alienated his patron. He fled to Calais, France to avoid his creditors and struggled for 14 years before becoming British consul at Caen (1830–32). In 1835 his friends rescued him from debtor's prison, but he soon lost all interest in his personal appearance, and he spent his final years in a charitable asylum.

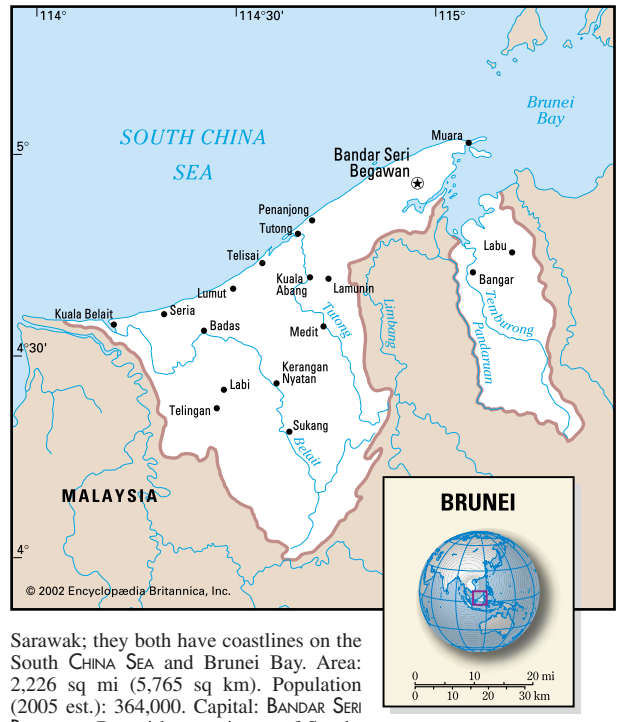
Beau Brummell, engraving by John Cooke after a portrait miniature, 1844.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Brun, Charles Le See Charles LE BRUN

Brundage, Avery (b. Sept. 28, 1887, Detroit, Mich., U.S.—d. May 8, 1975, Garmisch-Partenkirchen, W.Ger.) U.S. sports administrator. He competed in the decathlon at the 1912 OLYMPIC GAMES. He served as president of the U.S. Olympic Association and Committee 1929–53 and as vice president (1945–52) and president (1952–72) of the International Olympic Committee. Controversial and domineering, he demanded strict adherence to the rules of amateur competition, and he often dismissed political events as unrelated to Olympic competition, most notably the 1972 murder of Israeli athletes by terrorists.

Brundtland \'brünt-land**, Gro Harlem** *orig.* **Gro Harlem** (b. April 20, 1939, Oslo, Nor.) Norwegian politician, first woman prime minister of Norway (1981, 1986–89, 1990–96). Trained as a physician, she worked with various government health services, then served as minister of the environment (1974–79). She served in the Norwegian parliament (1977–97). As leader of the Labour Party group, she served as premier three times. In 1987 she chaired the UN World Commission on Environment and Development, and in 1998 she was elected director-general of the World Health Organization.

Brunei \brü-'nī\ *officially* **State of Brunei, Abode of Peace** Independent sultanate, northern BORNEO, western Pacific Ocean. The country is divided into two parts, each surrounded by the Malaysian state of



Sarawak; they both have coastlines on the South CHINA SEA and Brunei Bay. Area: 2,226 sq mi (5,765 sq km). Population (2005 est.): 364,000. Capital: BANDAR SERI BEGAWAN. Brunei has a mixture of Southeast Asian ethnic groups: about two-thirds are Malay, one-tenth Chinese, and the remainder indigenous peoples and Indians. Languages: Malay (official), English (widely understood). Religions: Islam (official; predominantly Sunni); also traditional beliefs, Buddhism, Christianity. Currency: Brunei dollar, ringgit. The narrow northern coastal plain gives way to rugged hills in the south. Brunei's western enclave consists of the valleys of the Belait, Tutong, and Brunei rivers and is mainly hilly. The eastern enclave contains the Pandaruan and Temburong river basins and the country's highest point, Pagon Peak (6,070 ft [1,850 m]). Much of Brunei is covered by dense tropical rainforest; very little land is arable. Its economy is dominated by production from major oil and natural gas fields. It has one of the highest per capita incomes in Asia. Brunei is a monarchy; the head of state and government is the sultan. Brunei traded with China in the 6th century AD. Through allegiance to the Javanese MAJAPAHIT kingdom (13th–15th century), it came under Hindu influence. In the early 15th century, with the decline of the Majapahit kingdom, many converted to Islam, and Brunei became an independent sultanate. When FERDINAND MAGELLAN's ships visited in 1521, the sultan of Brunei controlled almost all of Borneo and its neighbouring islands. In the late 16th century Brunei lost power because of the Portuguese and Dutch activities in the region; they were soon joined by the British. By the 19th century the sultanate of Brunei included Sarawak (including present-day Brunei) and part of North Borneo (now part of Sabah). In 1841 a revolt took place against the sultan, and a British soldier, James Brooke, helped put it down; he was later proclaimed governor (see BROOKE RAJ). In 1847 the sultanate entered into a treaty with Great Britain, and by 1906 it had yielded all administration to a British resident. Brunei rejected membership in the Federation of Malaysia in 1963, negotiated a new treaty with Britain in 1979, and achieved independence in 1984, with membership in the COMMONWEALTH. Brunei has pursued ways to diversify the economy, notably by encouraging tourism.

Brunei See BANDAR SERI BEGAWAN

Brunel \brü-'nel**, Isambard Kingdom** (b. April 9, 1806, Portsmouth, Hampshire, Eng.—d. Sept. 15, 1859, London) British civil and mechanical engineer. He was the son of MARC BRUNEL. His introduction of the broad-gauge railway, with rails 7 ft (2 m) apart, made possible high

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speeds and provided a great stimulus to railroad progress. He was responsible for building more than 1,000 mi (1,600 km) of railway in Britain and also oversaw construction of railway lines in Italy, Australia, and India. His use of a compressed-air CAISSON to sink bridge pier foundations helped gain acceptance of compressed-air techniques in underwater and underground construction. Brunel made outstanding contributions to marine engineering with three steamships—the *Great Western,* the *Great Britain*, and the *Great Eastern*—each the largest in the world at date of launching. The *Great Western* instituted the first regular transatlantic service, and *Great Eastern* laid the first successful transatlantic cable.

Brunel, Sir Marc (Isambard) (b. April 25, 1769, Hacqueville, France—d. Dec. 12, 1849, London, Eng.) French-born British engineer and inventor. He perfected a method for making ships' blocks (PULLEYS) by mechanical means rather than by hand; the system of 43 machines, run by 10 men, produced blocks superior in quality and consistency to those previously handmade by more than 100 men. This installation was an early example of completely mechanized production (see MECHANIZATION). In 1818 he patented the tunneling shield, a device that made safe tunneling through water-bearing strata possible. In 1825 operations began for building the Brunel-designed tunnel under the RIVER THAMES, an unprecedented feat completed in 1842. He was the father of I.K. BRUNEL.

Brunelleschi \ˌbrü-nᵊl-'es-kē**, Filippo** (b. 1377, Florence [Italy]—d. April 15, 1446, Florence) Florentine architect and engineer. Trained as a sculptor and goldsmith, he turned his attention to architecture after failing to win a competition for the bronze doors of the Baptistery of Florence, having tied with LORENZO GHIBERTI. He worked out the laws of linear perspective (later codified by LEON BATTISTA ALBERTI). By the early 1420s Brunelleschi was Florence's most prominent architect. His major work, the octagonal dome of the cathedral (1420–36), was constructed with the aid of machines of his own invention. The Medici family commissioned him to design the (old) sacristy and basilica of San Lorenzo (begun 1421), considered keystones of the early Renaissance; he adhered to the conventional format while adding his own interpretation of antique designs for capitals, friezes, pilasters, and columns. His later monumental works foreshadowed the strong profiles and massive grandeur of the work of Alberti and DONATO BRAMANTE.

Interior of Santo Spirito, Florence, designed by Filippo Brunelleschi, begun 1436
ALINARI-ART RESOURCE/EB INC.

Brunhild \'brün-ˌhild\ (b. c. 534—d. 613, Renève, Burgundy) Queen of the Frankish kingdom of AUSTRASIA. Daughter of a king of the VISIGOTHS, she married the Austrasian king SIGEBERT I in 567. One of the most forceful monarchs of the MEROVINGIANS, she urged Sigebert to reclaim her murdered sister's lands from CHILPERIC I. When her husband was assassinated in 575, Brunhild was imprisoned at Rouen. She later took refuge at Metz, where her son Childebert II had been proclaimed king, and she struggled to establish her authority over her son and the reluctant Austrasian magnates. After Childebert's death she continued to influence affairs and impose her will on her grandsons. After a long career she fell into the hands of her enemies, including the founders of the CAROLINGIAN family; she was tortured and then dragged to death by a horse.

Brunhild *or* **Brunhilda** *or* **Brynhild** Beautiful Amazon-like heroine of ancient Germanic literature. She is known from Old Norse sources, notably the EDDA poems and the VOLSUNGA SAGA, and from the German NIBELUNGENLIED. She also appears in the operas of RICHARD WAGNER's *Ring* cycle. She vowed to wed only a man of the most outstanding qualities who could surpass her in strength. She was successfully wooed by King Gunther, who defeated her in a contest in which the deeds were actually performed by SIEGFRIED in cloak of invisibility. When she later discovered that she had been deceived, she exacted vengeance, and Siegfried was killed. Siegfried's widow in turn sought revenge and brought about the destruction of Gunther's people, the Burgundians. In some Norse sources, Brunhild has supernatural qualities and is described as a VALKYRIE.

Brüning \'brü̇-niŋ**, Heinrich** (b. Nov. 26, 1885, Münster, Ger.—d. March 30, 1970, Norwich, Vt., U.S.) German politician. Elected to the Reichstag in 1924, he became noted as a financial expert. Leader of the Catholic Centre Party from 1929, he became chancellor of Germany in 1930. In response to the GREAT DEPRESSION, he instituted harsh austerity measures that paralyzed the German economy. He ignored the Reichstag and governed by presidential decree, which hastened the drift toward rightist dictatorship and ADOLF HITLER's rise to power. Forced to resign in 1932, he left Germany in 1934 and eventually moved to the U.S., where he taught at Harvard University (1937–52).

Brünn See BRNO

Brunner \'brün-ər**, (Heinrich) Emil** (b. Dec. 23, 1889, Winterthur, Switz.—d. April 6, 1966, Zürich) Swiss Reformed theologian. After serving as a pastor at Obstalden (1916–24), he taught for many years at the University of Zürich (1924–53); he lectured widely during this time and was a delegate to the founding session of the World Council of Churches in 1948. His theology was influenced by MARTIN BUBER's view of the relationship between God and man. Like KARL BARTH, he rejected 19th-century liberal theology in favour of reaffirming the central tenets of the REFORMATION, but his assertion that God was revealed in creation led to a dispute with Barth. His works include *The Theology of Crisis* (1929), *Man in Revolt* (1937), and *Justice and the Social Order* (1945).

Bruno of Querfurt \'kfer-ˌfürt**, Saint** *or* **Saint Boniface of Querfurt** (b. c. 974, Querfurt, Saxony—d. March 14, 1009, near Braunsberg, Prussia; feast day June 19) Missionary and martyr. A member of a noble family, he was attached to the clerical household of the emperor OTTO III. After the martyrdom of St. ADALBERT (997), Bruno entered a monastery, taking the name Boniface, and continued Adalbert's work in Christianizing the pagan Prussians. The members of a mission he sent to Poland, including Saints Benedict and John, were killed en route; Bruno wrote biographies of both saints, as well as an acclaimed biography of Adalbert. As archbishop, Bruno visited the rulers of Germany, Hungary, and Ukraine, seeking aid. He temporarily converted the pagan Pechenegs. He was killed on his way to his Prussian mission.

Bruno, Giordano *orig.* **Filippo Bruno** (b. 1548, Nola, near Naples—d. Feb. 17, 1600, Rome) Italian philosopher, astronomer, mathematician, and occultist. He entered a Dominican convent in 1565 and was ordained a priest in 1572. He abandoned the order in 1576 after being accused of heresy. He moved to Geneva in 1578 and thereafter traveled Europe as a lecturer and teacher. Rejecting the traditional geocentric astronomy for a theory even more radical than that of COPERNICUS, he hypothesized an infinite universe and multiple worlds. His cosmological theories, which anticipated fundamental aspects of the modern conception of the universe, led to his excommunication by the Roman Catholic, Calvinist, and Lutheran churches. In 1592 he was arrested and tried by the Venetian Inquisition, which extradited him to the Roman Inquisition in the following year. After a seven-year trial, he was burned at the stake. His ethical ideas have appealed to modern humanists, and his ideal of religious and philosophical tolerance has influenced liberal thinkers. His most important works are *On the Infinite Universe and Worlds* (1584) and *The Expulsion of the Triumphant Beast* (1584).

Brusa See BURSA

Brusilov \brü-'syē-lȯf**, Aleksey (Alekseyevich)** (b. Aug. 31, 1853, Tiflis, Russia—d. March 17, 1926, Moscow, Russia, U.S.S.R.) Russian general. He distinguished himself in the Russo-Turkish War (1877–78) and was promoted to general in 1906. In World War I he led the Russian campaign in Galicia (1914) and was most famous as commander of the "Brusilov breakthrough" on the Eastern Front against Austria-Hungary (1916), inflicting losses that forced Germany to divert troops from the Battle of VERDUN against France on the Western Front. He later served in the Bolshevik government as a military consultant (1920–24).

Brussels *French* **Bruxelles** \brə̄-'sel, brə̄k-'sel\ *Flemish* **Brussel** \'brə̄-səl\ City (pop., 2000 est.: 133,900), capital of Belgium. Part of the Brussels Capital Region (pop., 2000 est.: 959,300), one of the three regions into which Belgium is divided, it lies on the Senne River, a tributary of the SCHELDE. The village began on an island in the Senne and ultimately became a holding of the dukes of BRABANT. In 1530 it became the capital of the Netherlands, which was then under HABSBURG control. Part of the Kingdom of the Netherlands from 1815, it became a centre of Bel-

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gian rebellion in 1830 and then the capital of Belgium. An important industrial and commercial city, it is the headquarters of both NATO and the European Union.

Brussels sprout Small cabbage-related plant (*Brassica oleracea*, Gemmifera group). A member of the mustard family, Brussels sprouts are widely grown in Europe and the U.S. In early stages of growth, the plant closely resembles the common cabbage, but the main stem grows to a height of 2–3 ft (60–90 cm) and the axillary buds along the stem develop into small heads (sprouts) similar to heads of cabbage but measuring only 1–1.6 in. (25–40 mm) in diameter. The plant requires a mild, cool climate and is harmed by hot weather. Highly nutritious, Brussels sprouts are a particularly good source of vitamins A and C.

Brussels Treaty (1948) Agreement signed by Britain, France, Belgium, the Netherlands, and Luxembourg, creating a collective-defense alliance. It led to the formation of NATO and the Western European Union. A goal of the treaty was to show that Western European states could cooperate, thus encouraging the U.S. to play a role in the security of Western Europe.

Brutalism *or* **New Brutalism** Term coined (1953) to describe Le Corbusier's use of monumental, sculptural shapes and raw, unfinished molded concrete, an approach that represented a departure from International Style. New Brutalist architects displayed a willful avoidance of polish and elegance in their buildings, exposing such structural elements as steel beams and precast concrete slabs to convey a stark, austere rectilinearity. See also Louis Kahn, James Stirling.

Brutus, Marcus Junius *or* **Quintus Caepio Brutus** (b. 85—d. 42 BC, near Philippi, Macedonia) Roman politician, leader of the conspirators who assassinated Julius Caesar in 44 BC. He joined Pompey's army against Caesar in the civil war (49) but was pardoned by Caesar after Pompey's death. He joined the plot to murder Caesar out of his desire to restore the Roman republic. After Caesar's death, he and Gaius Cassius formed an army in Macedonia; Brutus defeated the Caesarians under Octavian (Augustus) in the first engagement of the Battle of Philippi, but Mark Antony and Octavian crushed his army in a second encounter. Realizing the republican cause was lost, Brutus committed suicide.

Marcus Brutus, marble bust; in the Capitoline Museum, Rome
ALINARI-ART RESOURCE

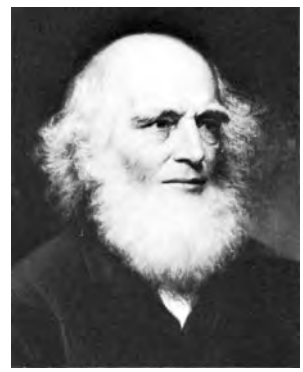
Bruyère, Jean de La See Jean de La Bruyere

Bryan, William Jennings (b. March 19, 1860, Salem, Ill., U.S.—d. July 26, 1925, Dayton, Tenn.) U.S. politician and orator. He practiced law at Jacksonville, Ill. (1883–87), before moving to Lincoln, Neb., where he was elected to the U.S. Congress in 1890. In the U.S. House of Representatives (1891–95), he became the national leader of the Free Silver Movement; he advocated its aims in his "Cross of Gold" speech, which won him the Democratic Party nomination for president in 1896. He was the party's nominee again in 1900 and 1908. In 1901 he founded a newspaper, *The Commoner*, and thereafter lectured widely to admiring audiences; he was called "the Great Commoner." He helped secure the presidential nomination for Woodrow Wilson in 1912 and served as his secretary of state (1913–15), contributing to world law by espousing arbitration to prevent war. A believer in a literal interpretation of the Bible, he was a prosecuting attorney in the Scopes trial (1925), in which he debated Clarence Darrow on the issue of evolution; the trial took a heavy toll on his health, and he died soon after it ended.

William Jennings Bryan, c. 1908.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Bryant, Bear *orig.* **Paul William Bryant** (b. Sept. 11, 1913, Kingsland, Ark., U.S.—d. Jan. 26, 1983, Tuscaloosa, Ala.) U.S. collegiate football coach. He was an all-state tackle in high school and went on to play blocking end at the University of Alabama (1932–36). As head coach at the University of Kentucky (1946–53), his team won 60 games, lost 23, and tied 5. After coaching at Texas A&M University (1954–57), he returned to Alabama (1957–82). His Alabama coaching record of 323 wins, 85 losses, and 17 ties broke Amos Alonzo Stagg's long-standing coaching record for games won; in 1985 it was broken by Eddie Robinson of Grambling State. In all, he took Alabama to 28 bowl games and six national championships.

Bryant, William Cullen (b. Nov. 3, 1794, Cummington, Mass., U.S.—d. June 12, 1878, New York, N.Y.) U.S. poet. At age 17 Bryant wrote "Thanatopsis," a meditation on nature and death that remains his best-known poem; influenced by deism, it in turn influenced Ralph Waldo Emerson and Henry David Thoreau. Admitted to the bar at age 21, he spent nearly 10 years as an attorney, a profession he hated. His *Poems* (1821), including "To a Waterfowl," secured his reputation. In 1825 he moved to New York City, where for almost 50 years (1829–78) he was editor in chief of the *Evening Post*, which he transformed into an organ of progressive thought.



William Cullen Bryant, detail of an oil painting by Daniel Huntington, 1866; in the Brooklyn Museum collection.
COURTESY OF THE BROOKLYN MUSEUM, NEW YORK

Bryce Canyon National Park Park, southern Utah, U.S. It is not a true canyon but rather a series of natural amphitheatres below which stands an array of limestone and sandstone columns. Its geology is related to that of Grand Canyon and Zion national parks, since the stone of all three was formed while the entire region was under a shallow sea. The park, established in 1928, covers 35,835 acres (14,513 hectares).

Bryn Mawr \'brin-'mȯr\ **College** Private women's liberal arts college in Bryn Mawr, Pa., near Philadelphia. Though founded in 1885 by a group of Quakers, it has long operated on a nondenominational basis. It offers a range of undergraduate and graduate programs in the arts and sciences, social research, and social work. It enjoys an academic exchange with nearby Haverford and Swarthmore colleges and the University of Pennsylvania.

Brynhild See Brunhild

bryophyte \'brī-ə-ˌfīt\ Any of the green, seedless land plants that make up the division Bryophyta, numbering at least 18,000 species and divided into three classes: mosses, liverworts, and hornworts. They are distinguished from vascular plants and seed plants by the production of only one spore-containing organ in their spore-producing stage. Most bryophytes are 0.8–2 in. (2–5 cm) tall or, if reclining, generally less than 12 in. (30 cm) long. Found throughout the world, from polar regions to the tropics, they are most abundant in humid environments, though none is marine. Bryophytes are extremely tolerant of dry and freezing conditions. Peat moss is economically important to humans in horticulture and as an energy source. Some bryophytes are used ornamentally, as in moss gardens. In nature, bryophytes initiate soil formation on barren terrain and maintain soil moisture, and they recycle nutrients in forest ecosystems. They are found on rocks, logs, and forest litter.

bryozoan \ˌbrī-ə-'zō-ən\ Aquatic invertebrate of the phylum Bryozoa ("moss animals"), members (called zooids) of which form colonies. Each zooid is a complete and fully organized animal. Species range in size from a one-zooid "colony" small enough (less than 0.04 in., or 1 mm, long) to live between sand particles to colonies that hang in clumps or chains as much as a 1.6 ft (0.5 m) across. The texture of colonies varies from soft

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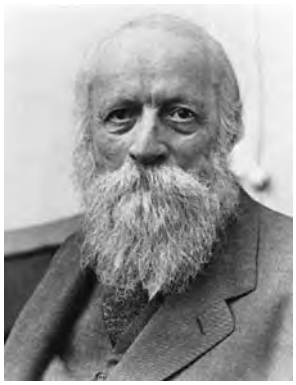
and gelatinous to hard with calcium-containing skeletons. Freshwater bryozoans attach primarily to leaves, stems, and tree roots in shallow water. Marine bryozoans have a wide range of habitats, from coastal areas to great ocean depths, but are most common just below the tidemarks. Bryozoans feed by capturing plankton with their tentacles.

brytenwalda See BRETWALDA

BSE See MAD COW DISEASE

bubble chamber SUBATOMIC-PARTICLE detector that uses a superheated liquid which boils into tiny bubbles of vapour along the tracks of the particles. As charged particles move through the liquid, they knock electrons from the atoms of the liquid, creating ions. If the liquid is close to its boiling point, the first bubbles form around these ions. The observable tracks can be photographed and analyzed to measure the behaviour of the charged particles. Developed in 1952 by DONALD GLASER, the bubble chamber proved very useful in the 1960s and '70s for the study of high-energy nuclear and particle physics.

Buber \'bü-bər**, Martin** (b. Feb. 8, 1878, Vienna, Austria-Hungary—d. June 13, 1965, Jerusalem) German Jewish religious philosopher and biblical translator. Brought up in Lemberg (now Lviv, Ukraine), he studied in Vienna, Berlin, Leipzig, and Zürich. FRIEDRICH NIETZSCHE's heroic nihilism led Buber, a nonobservant Jew, to Zionism. He advocated Jewish-Arab cooperation in Palestine and saw HASIDISM as a healing power for the malaise of modern Judaism. Under Nazi pressure, he emigrated to Palestine in 1938, and he taught at Hebrew University until 1951. *I and Thou* (1923) expresses Buber's belief that the human (I) encounters God (Thou) as a distinct being, rather than merging in mystical union. The Bible was for Buber derived from the encounter between God and his people, but he rejected many of the TALMUD's laws as emerging from a relationship in which God was objectified rather than truly addressed.



Martin Buber.
CONSULATE GENERAL OF ISRAEL IN NEW YORK

Bubka \'bu̇b-kə**, Sergey** (b. Dec. 14, 1963, Voroshilovgrad, Ukr., U.S.S.R.) Ukrainian pole-vaulter. He first cleared 6 m (19 ft 8 in.), long considered impossible, in Paris in 1985. In 1991 he cleared 6.1 m (20 ft), and he remains the only pole-vaulter to have done so. He won an Olympic gold medal in 1988 but failed to place at the 1992 Olympic Games. In 1994, at Sestriere, Italy, he vaulted a record 6.14 m (20 ft 1.75 in.) for his 17th outdoor record and his 35th overall.

buccaneer Any of the British, French, or Dutch sea adventurers who chiefly haunted the Caribbean and the Pacific seaboard of South America during the latter part of the 17th century, preying on Spanish settlements and shipping. Though inspired by such PRIVATEERS as Englishman FRANCIS DRAKE, the buccaneers were not legitimate privateers (the commissions they held were seldom valid), but neither were they the outlawed pirates who flourished in the 18th century. Usually escaped servants, former soldiers, or loggers, they ran their ships democratically, divided plunder equitably, and even provided a form of accident insurance. They influenced the founding of the South Sea Co., and stories of their adventures inspired more serious voyages of exploration as well as the tales of writers JONATHAN SWIFT, DANIEL DEFOE, and ROBERT LOUIS STEVENSON.

Buchanan \byü-'ka-nən**, George** (b. February 1506, Killearn, Stirlingshire, Scot.—d. Sept. 29, 1582, Edinburgh) Scottish humanist, scholar, and educator. As a teacher of Latin in Paris, Buchanan wrote bitter attacks on the Franciscans that landed him in jail for heresy. He escaped and became a teacher in Bordeaux, where MICHEL DE MONTAIGNE was one of his pupils. There he translated two of EURIPIDES' plays into Latin and wrote original dramas. His paraphrase of the Psalms was long used for Latin instruction. At first a supporter of MARY, QUEEN OF SCOTS, he later helped prepare the case that led to her execution. In *De jure regni apud Scotos* (1579), he argued for limited monarchy; *Rerum Scotiacarum historia* (1582) traces Scotland's history.

Buchanan \byü-'ka-nən**, James** (b. April 23, 1791, near Mercersburg, Pa., U.S.—d. June 1, 1868, near Lancaster) 15th president of the U.S. (1857–61). He was admitted to the bar in 1812 and soon established a successful law practice. He was elected to the Pennsylvania legislature in 1814 and later served in the U.S. House of Representatives (1821–31), as minister to Russia (1832–34), and in the U.S. Senate (1834–45). He was secretary of state in the cabinet of Pres. JAMES K. POLK (1845–49). As minister to Britain (1853–56), he helped draft the OSTEND MANIFESTO. In 1856 he was elected president as a Democrat, defeating JOHN C. FRÉMONT. Although experienced in government and law, he lacked the courage to deal effectively with the slavery crisis, and he equivocated on the question of Kansas's status as a slaveholding state. The ensuing split within his party allowed ABRAHAM LINCOLN to win the election of 1860. He denounced the secession of South Carolina following the election and sent reinforcements to Fort Sumter but failed to respond further to the mounting crisis. He was the only president never to have married.

James Buchanan, photograph by Mathew Brady.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Bucharest \'bü-kə-ˌrest\ *Romanian* **București** \ˌbü-kü-'reshtʸ\ City (pop., 1997: 2,057,512), capital of Romania. Excavations have revealed evidence of prehistoric settlement. The site gained importance when the rulers of WALACHIA moved there in the 14th century. VLAD III built a fortress there in the 15th century to ward off invading Turks; they eventually took it and made it their Ottoman Walachian capital in 1659. In the 19th century civic unrest helped force the union of Walachia and MOLDAVIA, and Bucharest became the capital of the new Romanian state in 1862. Occupied by the Soviet army after World War II, it came under communist control. During the 1980s it was the scene of political demonstrations against the government of NICOLAE CEAUȘESCU that resulted in his overthrow and execution.

Bucharest, Treaty of (May 7, 1918) Settlement forced on Romania after it had been defeated by the CENTRAL POWERS in World War I. Romania was required to return southern Dobruja to Bulgaria, give Austria-Hungary control of the passes in the Carpathian Mtns., and lease its oil wells to Germany for 90 years. When the Central Powers collapsed in November 1918, the treaty was nullified.

Buchenwald \'bü-k̲ən-ˌvält\ One of the first and biggest of the German Nazi concentration camps, established in 1937 near Weimar. In World War II it held about 20,000 prisoners, most of whom worked as slave laborers in nearby factories. Though there were no gas chambers, many perished through disease, malnutrition, exhaustion, beatings, and executions. Inmates were used to test the effects of viral infections and vaccines. The commandant's wife was the infamously sadistic Ilsa Koch (1906?–1967), the "Witch of Buchenwald." See also HOLOCAUST.

Büchner \'bʊ̈k̲-nər**, Georg** (b. Oct. 17, 1813, Goddelau, Hesse-Darmstadt—d. Feb. 19, 1837, Zürich, Switz.) German dramatist. As a medical student, he became involved in revolutionary politics and was forced to flee to Zürich. There he wrote plays marked by vivid imagination and unconventional structure, combining extreme naturalism with visionary power; he is regarded as a forerunner of the Expressionist movement. His first play, *Danton's Death* (1835), a drama of the French Revolution, was followed by *Leonce and Lena* (1836), a satire on the illusions of Romanticism. His last play, *Woyzeck* (1836), anticipated the social drama of the 1890s with its compassion for the poor and oppressed; it became the basis of a famous opera by ALBAN BERG.

Buchner \'bʊ̈k̲-nər**, Hans** (b. Dec. 16, 1850, Munich, Bavaria—d. April 5, 1902, Munich, Ger.) German bacteriologist. He served as a physician in the Bavarian army in the 1870s and taught at the University of Munich from 1880 until his death. Buchner was one of the first to note that a substance in blood serum could destroy bacteria. He named the substance alexin; now known as complement, it consists of proteins called gamma globulins and is of great importance in immunology.

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Buchwald \'bük-ˌwȯld**, Art(hur)** (b. Oct. 20, 1925, Mt. Vernon, N.Y., U.S.) U.S. humour writer and columnist. Buchwald moved to Paris in 1948. His popular original column—reviews of the city's nightlife for the *International Herald Tribune*—increasingly included offbeat spoofs and candid comments from celebrities. After moving in 1961 to Washington, D.C., he began poking fun at issues in the news, soon becoming established as one of the sharpest satirists of American politics and modern life. His widely syndicated work won a Pulitzer Prize in 1982. His books include numerous collections of columns and the memoir *I'll Always Have Paris* (1996).

Buck, Pearl *orig.* **Pearl Sydenstricker** (b. June 26, 1892, Hillsboro, W.Va., U.S.—d. March 6, 1973, Danby, Vt.) U.S. author. Buck was reared in China by her missionary parents and later taught in a Chinese university. Her first book to reach a wide audience was *The Good Earth* (1931, Pulitzer Prize), describing the struggles of a Chinese peasant and his slave wife. *Sons* (1932) and *A House Divided* (1935) followed; the trilogy was published as *The House of Earth* (1935). Among her later works are short stories, novels (including five under the pseudonym John Sedges), and an autobiography. She received the Nobel Prize for Literature in 1938.

buckeye Any of about 13 trees and shrubs of the genus *Aesculus* (family Hippocastanaceae), native to North America, southeastern Europe, and eastern Asia. The name refers to the resemblance of the nut, which has a pale patch on a shiny red ground, to the eye of a deer. Buckeyes are valued as ornamental trees for their handsome candelabra-like flower clusters. Both the young foliage and the nuts are poisonous. Among the most notable is the Ohio buckeye (*A. glabra*), also called fetid buckeye and American horse chestnut, with twigs and leaves that yield an unpleasant odour when crushed. The sweet, or yellow, buckeye (*A. flava*, or *A. octandra*) is the largest buckeye, up to 89 ft (27 m) tall, and is naturally abundant in Great Smoky Mountains National Park, U.S.

Buckingham Palace London residence of the British sovereign. It takes its name from the house built there early in the 18th century for the dukes of Buckingham. Victoria was the first sovereign to live there. John Nash began the reconstruction of Buckingham House as a Neoclassical palace in 1821, but was not allowed to finish. His garden front remains virtually unchanged, but the Mall front was redesigned in 1913 by Sir Aston Webb (1849–1930) as a background for the Queen Victoria Memorial statue.

Buckingham \'bək-iŋ-əm**, 1st duke of** *orig.* **George Villiers** (b. Aug. 28, 1592, Brooksby, Leicestershire, Eng.—d. Aug. 23, 1628, Portsmouth, Hampshire) English courtier and politician. Charming and handsome, he quickly became a royal favourite of James I and the future Charles I. He became lord high admiral in 1619 and was created a duke in 1623, but his arrogance and abuse of power made him highly unpopular. His erratic foreign policy led to a series of disasters, including failed military expeditions to Spain and France. A bill to impeach him was introduced in Parliament in 1626, prompting Charles to dissolve Parliament. When Buckingham was assassinated by a naval lieutenant, Londoners rejoiced.

Buckingham, 2nd duke of *orig.* **George Villiers** (b. Jan. 30, 1628, London, Eng.—d. April 16, 1687, Kirkby Moorside, Yorkshire) English politician. Born eight months before the assassination of his father, the 1st duke of Buckingham, he was brought up with the family of Charles I. He fought for Charles II in the English Civil Wars, and after the Restoration in 1660 Buckingham became a leading member of the king's inner circle of ministers, known as the Cabal. Parliament had him dismissed from his posts for alleged Catholic sympathies in 1674.

Buckinghamshire \'bə-kiŋ-əm-ˌshir\ Administrative (pop., 2001: 479,028), geographic, and historic county, southern England. It is bordered by the River Thames, London, and the River Ouse valley in the north; its county seat is at Aylesbury. It was affected by each phase of English settlement, from the Neolithic to the Saxon. Under Saxon rule, as part of the kingdom of Mercia, it resisted Danish invasion and became prosperous. Before the 20th century it was a rural area, but the modern growth of London and the expansion of transportation links with it have brought population growth.

Buckley, William F(rank), Jr. (b. Nov. 24, 1925, New York, N.Y., U.S.) U.S. writer and editor. He attended Yale University, where he was chairman of the *Yale Daily News*. In 1955 founded the *National Review*; as editor in chief, he used the journal as a forum for his conservative views. His column "On the Right" was syndicated in 1962 and eventually appeared in more than 200 newspapers. From 1966 he hosted *Firing Line*, a weekly television interview program in which he often employed his wit and debating skills against ideological opponents. His books include *God and Man at Yale* (1951), *Rumbles Left and Right* (1963), and a series of spy novels.

buckling Mode of failure under compression of a structural component that is thin (see shell structure) or much longer than wide (e.g., post, column, leg bone). Leonhard Euler first worked out in 1757 the theory of why such members buckle. The definition by Thomas Young of the elastic modulus significantly propelled building construction science forward. The elastic theory formed the basis of structural analysis until World War II, when the behaviour of bomb-damaged buildings forced the modification of some of the theory's underlying assumptions. See also post-and-beam system.

buckminsterfullerene See fullerene

Buckner, Simon Bolivar (b. April 1, 1823, near Munfordville, Ky., U.S.—d. Jan. 8, 1914, near Munfordville) U.S. and Confederate military leader. He graduated from West Point and served in the Mexican War. In the American Civil War he established the Kentucky militia and became a Confederate general. Ordered to reinforce Fort Donelson, Tenn. (1862), he found the situation hopeless and unconditionally surrendered to Ulysses S. Grant. After his release in a prisoner exchange, he served the Confederacy in many capacities. He was later governor of Kentucky (1887–91).

buckwheat Either of two species (*Fagopyrum esculentum*, or *sagittatum*, and *F. tataricum*) of herbaceous plants and their edible, triangular seeds, used as a cereal grain though the plant is not a cereal grass. It is less productive than other grain crops on good soils but is particularly adapted to arid, hilly land and cool climates. Because it matures quickly, it can be grown as a late-season crop. It improves conditions for the cultivation of other crops by smothering weeds and may be planted as a green-manure crop. Buckwheat is often used as a feed for poultry and other livestock. It is high in carbohydrates and is about 11% protein and 2% fat. The hulled kernels, or groats, can be cooked and served much like rice. Buckwheat flour is unsatisfactory for bread but is used to make pancakes ("buckwheat cakes").

buckyball See fullerene

bud Small lateral or terminal protuberance on the stem of a vascular plant that may develop into a flower, leaf, or shoot. Buds arise from meristem tissue. In temperate climates, trees form resting buds that are resistant to frost in preparation for winter. Flower buds are modified leaves.

Budapest \'bü-də-ˌpest\ City (pop., 2001: 1,775,203), capital of Hungary. Situated on the Danube River, it acquired its name in 1873 when the towns of Buda and Óbuda on the river's right bank and the town of Pest on its left bank amalgamated. Inhabited from Neolithic times, Buda was the site of a Roman camp in the 2nd century AD. By the 13th century both Buda and Pest had German inhabitants. Buda was fortified by Matthias I Corvinus in the 15th century and became the capital of Hungary. It was taken and held by the Turks (1541–1686), then retaken by Charles V, duke of Lorraine. In 1848–49 both towns experienced nationalistic revolt, and Pest became the capital of Kossuth Lajos's revolutionary government. It became the centre of revolt for Hungarian independence in 1918. After World War II, it came under communist control. It was the base of an unsuccessful anticommunist uprising in 1956 (see Hungarian Revolution). Anticommunist unrest there in the 1980s led to the declaration of the Hungarian republic in 1989. Budapest is a vital Hungarian transport centre; its economy includes heavy industry and manufactures from telecommunications and electronics.

Buddha \'bü-də\ *orig.* **Siddhartha Gautama** (fl. c. 6th–4th century, b. Kapilavastu, Shakya republic, Kosala kingdom—d. Kusinara, Malla republic, Magadha kingdom) Indian spiritual leader and founder of Buddhism. The term *buddha* (Sanskrit: "enlightened one") is a title rather than a name, and Buddhists believe that there are an infinite number of past and future buddhas. The historical Buddha, referred to as the Buddha Gautama or simply as the Buddha, was born a prince of the Shakyas, on the India-Nepal border. He is said to have lived a sheltered life of luxury that was interrupted when he left the palace and encountered an old man, a sick man, and a corpse. Renouncing his princely life, he spent seven years seeking out teachers and trying various ascetic practices, including fasting, to gain enlightenment. Unsatisfied with the

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results, he meditated beneath the BODHI TREE, where, after temptations by MARA, he realized the FOUR NOBLE TRUTHS and achieved enlightenment. At Sarnath he preached his first sermon to his companions, outlining the EIGHTFOLD PATH, which offered a middle way between self-indulgence and self-mortification and led to the liberation of NIRVANA. The five ascetics who heard this sermon became his first disciples and were admitted as BHIKSUS (monks) into the SANGHA, or Buddhist order. His mission fulfilled, the Buddha died after eating poisonous mushrooms served him by accident and escaped the cycle of rebirth; his body was cremated, and STUPAS were built over his relics.

Buddhism Major world religion and philosophy founded in northeastern India in the 5th century BCE. Based on the teachings of Siddhartha Gautama, called the BUDDHA, Buddhism takes as its goal the escape from suffering and from the cycle of rebirth: the attainment of NIRVANA. It emphasizes MEDITATION and the observance of certain moral precepts. The Buddha's teachings were transmitted orally by his disciples; during his lifetime he established the Buddhist monastic order (SANGHA). He adopted some ideas from the HINDUISM of his time, notably the doctrine of KARMA, but also rejected many of its doctrines and all of its gods. In India, the emperor ASHOKA promoted Buddhism during the 3rd century BC, but it declined in succeeding centuries and was nearly extinct there by the 13th century. It spread south and flourished in Sri Lanka and Southeast Asia, and it moved through Central Asia and Tibet (see TIBETAN BUDDHISM) to China, Korea, and Japan (see PURE LAND BUDDHISM; ZEN). In the 19th century, Buddhism spread to Europe and the United States, and it became increasingly popular in the West in the second half of the 20th century. Buddhism's main teachings are summarized in the FOUR NOBLE TRUTHS, of which the fourth is the EIGHTFOLD PATH. Buddhism's two major branches, MAHAYANA and THERAVADA, have developed distinctive practices and unique collections of canonical texts. In the early 21st century, the various traditions of Buddhism together had more than 375 million followers.

Buddhist councils In most Buddhist traditions, two early councils on doctrine and practice. The first, which most modern scholars do not accept as historical, was reputedly held at Rajagrha (modern Rajgir), India, during the first rainy season after the BUDDHA's death, to compile his remembered words, including the SUTRAS and monastic rules. The second, which is accepted as historical, met more than a century later at Vaisali, India, to resolve disputes within the monastic community. Theravada Buddhism recognizes subsequent councils: a third, called by ASHOKA c. AD 247, at which the doctrinal disputes were resolved in its favor, and others continuing up to the mid-20th century. Other Buddhist traditions recognize other important councils at which their respective canons were established or edited.

budding bacteria Group of bacteria that reproduce by budding. Each bacterium divides following unequal cell growth; the mother cell is retained, and a new daughter cell forms. In budding, the cell wall grows from one point on the cell rather than throughout the cell; this type of growth permits the development of more complex structures and processes. Most budding bacteria are aquatic and can attach to surfaces by their stalks; some are free-floating.

buddleia \'bəd-lē-ə\ *or* **butterfly bush** Any of more than 100 species of plants constituting the genus *Buddleia*, native to tropical and subtropical areas of the world. The genus was formerly included in the family Loganiaceae (order Gentianales) but is now placed in the family Buddlejaceae (order Scrophulariales), which includes about 10 genera and more than 150 species. Most species of *Buddleia* have hairy or scaly leaves and clusters of purple, white, yellow, or orange flowers. Several species are cultivated as garden ornamentals.

Budenny \bü-'dyò-nē**, Semyon (Mikhaylovich)** (b. April 13, 1883, Kozyurin, near Rostov-na-Donu, Russia—d. Oct. 17, 1973, Moscow, Russia, U.S.S.R.) Russian army officer. In 1919 he joined the Communist Party and, as commander of the 1st Cavalry Army in the RUSSIAN CIVIL WAR, he played a crucial role in defeating the White (anti-Bolshevik) generals ANTON DENIKIN and PYOTR WRANGEL and in fighting the Poles (1920). He later became a marshal of the Soviet Union and was commander of Moscow's military district.

Budge, (John) Don(ald) (b. June 13, 1915, Oakland, Calif., U.S.—d. Jan. 26, 2000, Scranton, Pa.) U.S. tennis player. He won his very first tournament, the California Boys State Singles title (1930). In 1936 he became the first lawn-tennis player to win the grand-slam (the Australian, French, British, and U.S. singles championships). At Wimbledon in both 1937 and 1938, he won not only the singles but also the men's doubles and mixed doubles. Representing the U.S. four times in the DAVIS CUP competition (1935–38), he won 25 of 29 matches. He turned professional in 1939. He is noted for having developed the backhand into an offensive stroke.

Buell \'byül**, Don Carlos** (b. March 23, 1818, near Marietta, Ohio, U.S.—d. Nov. 19, 1898, Rockport, Ky.) U.S. general. A graduate of West Point, he was appointed general of volunteers at the start of the American Civil War, and he helped organize the Union's Army of the Potomac. He was sent to Kentucky to succeed WILLIAM T. SHERMAN and to organize the Army of the Ohio. In 1862 he was Union commander in the Kentucky campaign against Confederate forces under BRAXTON BRAGG. Following the Battle of Perryville, he was removed from his command for alleged tardiness in his pursuit of Confederate forces.

Buena Vista \ˌbwā-nä-'vēs-tä**, Battle of** Battle fought in 1847 near Monterrey, Mexico, in the MEXICAN WAR. A U.S. force of 5,000 commanded by Gen. ZACHARY TAYLOR and assisted by JEFFERSON DAVIS invaded northern Mexico and engaged a Mexican force of 14,000 under Gen. ANTONIO SANTA ANNA. The U.S. forces repulsed the Mexican attack, and the Mexicans retreated with 1,500 casualties. Taylor's victory helped him win the 1848 U.S. presidential election.

Buenos Aires \ˌbwā-nəs-'ar-ēz,\ *Spanish* \ˌbwā-nōs-'ī-rās\ City (pop., 2001: city, 2,776,138; metro. area, 12,046,799), capital of Argentina. Located on an estuary of the Río de la PLATA in east-central Argentina, about 150 mi (240 km) from the Atlantic Ocean, it is nevertheless a major port. First colonized by the Spanish in 1536, it was not permanently settled until 1580. It became the seat of the Viceroyalty of the Río de la PLATA in 1776. In 1853 the city and the surrounding area that made up the province of Buenos Aires refused to recognize a new constitution approved by the country's other provinces and began fighting with them intermittently over control of the Argentine government. After being made a federal district and Argentina's capital, it settled its wars with the other provinces (1880) and by World War I (1914–18) had become a thriving port. The country's largest and most influential city, it is an important industrial and transportation centre.

buffalo Any member of several BOVID species, including the massive WATER BUFFALO and CAPE BUFFALO. The name is often applied to the American BISON. The anoa (*Anoa depressicornis*) is a tiny, dark-brown buffalo of the dense, mature forests of Sulawesi. A shy animal, it stands 2.5–3 ft (0.75–1 m) at the shoulder and has straight, sharp-tipped horns. It is hunted for food, hides, and horns. A slightly larger species, the tamarau (*A. mindorensis*), inhabits the Philippine island of Mindoro. Exceedingly shy and wild, its numbers have been greatly reduced.

Cape, or African, buffalo (*Syncerus caffer*).
MARK BOULTON—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Buffalo City (pop., 2000: 292,648), western New York, U.S. Located at the northeastern point of Lake ERIE on the NIAGARA RIVER, it is the terminus of the New York State Barge Canal. Settled by American Indians in 1780, the site was laid out as a town at the beginning of the 19th century. It was a military post in the WAR OF 1812 and was burned by the British. Rebuilt

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in 1814–15, it became the western terminus of the Erie Canal, which brought an economic boom to the community. A major port on the St. Lawrence Seaway and the main U.S. gateway to Ontario's Toronto-Hamilton industrial region, it processes much of U.S.-Canadian trade. It is also an educational and medical research centre.

Buffalo Bill See William F. Cody

buffalo soldier Nickname given to members of African American cavalry regiments of the U.S. Army who served in the western U.S. (1867–96). An 1866 law authorized the army to form cavalry and infantry regiments of African American men under the command of white officers; the result was the 9th and 10th cavalries and the 38th through 41st infantries. The primary mission of the cavalry regiments was to control Indians on the western frontier (the nickname "buffalo" was given by the Indians). The soldiers took part in almost 200 engagements. Noted for their courage and discipline, they had the army's lowest desertion and court-martial rates. One of the 10th Cavalry's officers was John Pershing, whose nickname "Black Jack" reflected his advocacy on behalf of African American troops.

buffer Solution usually containing a weak acid and its conjugate weak base, or a salt, of such a composition that the pH is held constant within a certain range. An example is a solution containing acetic acid (CH_3COOH) and the acetate ion (CH_3COO^-). The pH depends on their relative concentration and can be found with a simple formula involving their ratio. Relatively small additions of acid or base will change the concentration of the two species, but their ratio, and hence the pH, will not change much. Different buffers are useful in different pH ranges; they include phosphoric acid, citric acid, and boric acid, each with their salts. Biological fluids such as blood, tears, and semen have natural buffers to maintain them at the pH required for their proper function. See also law of mass action.

Buffett, Warren (b. Aug. 30, 1930, Omaha, Neb., U.S.) U.S. businessman and investor. He attended the University of Nebraska (B.S., 1950) and Columbia University (M.S., 1951), where he was influenced by professor Benjamin Graham's approach toward value investing—that is, purchasing shares of companies whose stocks are priced below their intrinsic value. Returning to his native Omaha, he turned $105,000 of initial investment in his Buffett Partnership (1956–69) into $105 million by the time of its dissolution. He then began investing in businesses, bought under the umbrella of the textile manufacturer Berkshire Hathaway. He is said to be the first person to have made $1 billion in the stock market. His financial reports are read eagerly by stock-market novices and experts alike for their pithy wisdom.

Buffon \bǖ-'fōⁿ**, G(eorges)-L(ouis) Leclerc, comte de** (b. Sept. 7, 1707, Montbard, Fr.—d. April 16, 1788, Paris) French naturalist. He studied mathematics, medicine, and botany until a duel forced him to cut short his studies. He settled on his family's estate, where he researched the calculus of probability, the physical sciences, and forest management. Appointed keeper of the royal botanical garden (Jardin du Roi) in 1739, he was also assigned the cataloging of the royal natural history collections, an undertaking that grew into his comprehensive work *Histoire naturelle, générale et particulière* (1749–1804), an attempt to account for all known flora and fauna, of which he published 36 of the proposed 50 volumes before his death. He was ennobled in 1773.

bug Coding error in a computer program that prevents it from functioning as designed. Most software companies have a quality-assurance department which is charged with finding program bugs while the program is in development (debugging); bugs are also often detected by means of beta testing (testing of a product, often by potential consumers, before it is placed on the market). The term originated in a computer context in 1945 when a moth flew into and jammed an electrical relay of the Harvard Mark II computer; it was extracted and taped into the log book with the inscription "First actual case of bug being found" (the term having previously been used for other kinds of mechanical defects).

bug Commonly, any insect; scientifically, any member of the insect order Heteroptera. In scientific usage, when the word "bug" is part of the common name for a member of the order Heteroptera, it is a separate word (e.g., "chinch bug"); when used as part of the common name for an organism that is not a heteropteran, it is not separated (e.g., the ladybug, in the order Coleoptera). In common usage, there are many exceptions to this convention (e.g., bedbugs are heteropterans).

Bug \'büg\ **River** *or* **Western Bug River** River, eastern Europe. Rising in western Ukraine, it flows north along the Poland-Ukraine and Poland-Belarus borders to Brest, and turns west into Poland to the Vistula River north of Warsaw, running a total of 516 mi (830 km). It is navigable below Brest. In World War I several battles were fought along its course in 1915. About 200 mi (322 km) of its central course formed part of the Curzon Line, a demarcation line between Poland and Soviet Russia for much of the 20th century.

bugaku \bü-'gä-kü\ Repertoire of stylized dances of the Japanese imperial court, derived from the traditional dance forms of China, Korea, India, and Southeast Asia. The dances are divided into two basic forms: "dances of the left" (*saho no mai*), accompanied by music derived from China, with dancers wearing red costumes; and "dances of the right" (*uho samai no mai*), accompanied by music introduced from Korea, with dancers wearing costumes of blue or green. The dancers wear elaborate masks of painted wood to portray fictional characters.

Buganda \bü-'gän-də\ Precolonial kingdom, East Africa. Located along the northern shore of Lake Victoria in present-day Uganda, the kingdom was founded in the late 14th century by the Ganda people. Ruled by the *kabaka*, or king, by the 19th century Buganda was the most powerful kingdom in the area. In 1900 it became a British protectorate. The Ganda subsequently played a major role in assisting British administration in East Africa. When Uganda became independent in 1962, Buganda was accorded special federal status within the new country. Ensuing tensions with the central government led in 1967 to the kingdom's abolition and the area's integration into Uganda. Buganda was restored in 1993.

Bugatti \bü-'gät-tē**, Ettore (Arco Isidoro)** (b. Sept. 15, 1881, Milan, Italy—d. Aug. 21, 1947, Paris, France) Italian builder of racing and luxury automobiles. His factory at Mosheim, Alsace (founded 1909), produced a highly successful low-powered racer for Le Mans. His luxurious Type 41 ("Golden Bugatti" or "La Royale"), produced in the 1920s, was probably the most meticulously built of all cars; no more than eight were constructed. His firm did not survive long after his death.

Buginese \ˌbəg-ə-'nēz\ Culturally dominant ethnic group of Celebes (Sulawesi), Indonesia. Their trading-port city Macassar (modern Ujung Pandang) fell to the Dutch in 1667, and they emigrated to other parts of the Malay Peninsula, establishing Buginese states in Selangor and Riau. They continued to harry the Dutch and also fought with the Malays. Their conflicts with the latter cost them their supremacy in the region by 1800. Early converts to Buddhism, the Buginese were converted to Islam in the 17th century. Today they number about 3.3 million. Their village economy is based on rice cultivation and some trade between islands.

bugle Soprano brass instrument historically used for hunting and military signaling. It developed from an 18th-century semicircular German hunting horn with widely expanding bore. In the 19th century the semicircle was reshaped into an oblong double loop. Natural bugles use only harmonics 2–6 (producing tones of the C triad) in their calls ("Reveille," "Taps," etc.). The keyed bugle, patented in 1810, has six sideholes and keys which give it a complete chromatic scale. In the 1820s valves were added to produce the flügelhorn and, in lower ranges, the baritone, euphonium, and saxhorns.

building code Systematic statement of a body of rules that govern and constrain the design, construction, alteration, and repair of buildings. Such codes are based on requirements for the safety, health, and quality of life of building users and neighbors, and vary from city to city. Model codes developed by states, professional societies, and trade associations—including the BOCA (Building Officials and Code Administrators) coda, National Building Code, Uniform Building Code, and Standard Building Code—are typically adopted by local communities, with amendments. New York City's code is the oldest (1916) and, because of the city's population density and such concerns as fire prevention, adequate light, and ventilation, the most stringent.

building construction Techniques and industry involved in the assembly and erection of structures. Early humans built primarily for shelter, using simple methods. Building materials came from the land, and fabrication was dictated by the limits of the materials and the builder's hands. The erection sequence involved, as now, first placing a foundation (or using the ground). The builder erected the structural system; the structural material (masonry, mud, or logs) served as both skeleton and enclosure. Traditional bearing-wall and post-and-beam systems eventually gave

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way to FRAMED STRUCTURES, and builders became adept at sealing and FIREPROOFING with a variety of claddings (exterior coverings) and finishes. Steel-framed buildings are usually enclosed by CURTAIN WALLS. In modern-day construction, sheathing the skeleton of the building is only the beginning; specialists then begin the bulk of the work inside, installing PLUMBING, electrical wiring, HVAC (HEATING, VENTILATING, and AIR-CONDITIONING), WINDOWS, FLOOR COVERINGS, plasterwork, MOLDINGS, ceramic TILE, cabinets, and other features. See also ARCHITECTURE.

building stone See building STONE

Bujumbura \ˌbü-jəm-ˈbůr-ə\ *formerly* **Usumbura** City (pop., 2001: 346,000), capital of Burundi. Lying on the northern end of Lake TANGANYIKA, it is the country's chief port and largest urban centre. Known as Usumbura in the 1890s when German troops occupied the area and incorporated it into GERMAN EAST AFRICA, it was included in a TUTSI kingdom. When Burundi achieved independence in 1962, the city's name was changed to Bujumbura. Its industry specializes in textiles and agricultural products; most of Burundi's foreign trade is shipped between the capital and Kigoma, Tanzania.

Bukhara *or* **Bokhara** *or* **Buxoro** \bò-ˈk̲ä-rä, bü-ˈkär-ə\ City (pop., 1999 est.: 237,900), west-central UZBEKISTAN. Lying east of the AMU DARYA, it was founded in the 1st century AD and was a major trade centre when the Arabs captured it c. 710. Built up by the Sāmānid dynasty, it became the capital of their realm, which at its height encompassed much of southern Central Asia. After falling to GENGHIS Khan in 1220 and to TIMUR in 1370, it was taken by the Uzbeks, who in the 16th century made it the capital of the khanate of Bukhara. In 1868 the khanate was made a Russian protectorate and in 1920 a Soviet republic. Bukhara was the capital until the republic was absorbed into the Uzbek S.S.R. in 1924. It became part of Uzbekistan on that country's independence in 1991. Historic buildings in the central city were designated a UNESCO WORLD HERITAGE SITE in 1993.

Bukhārī \bü-ˈk̲är-ē**, (Abū ʿAbd Allāh Muḥammad ibn Ismāʿīl) al-** (b. July 19, 810, Bukhara, Central Asia—d. Aug. 31, 870, Khartank, near Samarkand) Muslim compiler and scholar of ḤADĪTH. He began his study as a child in Central Asia and traveled as far as Mecca and Cairo to learn about MUHAMMAD and his utterances. Of the 600,000 traditions he collected, he deemed 7,275 authentic and included them in *Kitāb al-jāmiʿ al-ṣaḥīḥ* ("Entirety of the Genuine"). His *Kitāb al-taʾrīkh al-kabīr* ("The Great History") contains biographies of those who passed on the oral traditions from the days of the Prophet to Bukhārī's own era.

Bukharin \bü-ˈk̲är-ən**, Nikolay (Ivanovich)** (b. Oct. 9, 1888, Moscow, Russia—d. March 14, 1938, Moscow) Russian communist leader and economist. After the Bolsheviks seized power, he became the editor of the party newspaper *Pravda* (1917–29). A member of the Politburo and a prominent leader of the Comintern, he also wrote several theoretical economic works. In 1938 he was a defendant in the last of the public PURGE TRIALS. Falsely accused of counterrevolutionary activities and espionage, he was found guilty and executed.

Bukovina \ˌbü-kō-ˈvē-nä\ Region, eastern central Europe. It consists of part of the northeastern CARPATHIAN MTNS. and the adjoining plain. Settled by both Ukrainians and Romanians, it became an integral part of MOLDAVIA in the 14th century. It acquired its own name in 1775, when it was ceded to Austria by the Turks. Romania occupied it when AUSTRIA-HUNGARY collapsed in 1918, and was granted it through treaty in 1919. In 1944 the Soviet Union took the northern region, which became part of the Ukrainian S.S.R. (now Ukraine), while the rest became part of the Romanian People's Republic (now Romania).

Bukowski, Charles (b. Aug. 16, 1920, Andernach, Ger.—d. March 9, 1994, San Pedro, Calif., U.S.) German-born U.S. poet, short-story writer, and novelist. His family immigrated to Los Angeles in 1922. He began publishing short stories in the mid 1940s. His first poetry collection, *Flower, Fist and Bestial Wail*, appeared in 1959, and the poetry volumes he published regularly for the next few years earned a devoted cult following. His novels include *Post Office* (1971) and *Factotum* (1975); he also wrote the screenplay for the film *Barfly* (1987), a semiautobiographical comedy about alcoholic lovers. The novel *Hollywood* (1989) dealt with its filming. His writing, often scurrilous but humorous, frequently reflected his perpetually down-and-out mode of existence.

Bulawayo \ˌbü-lä-ˈwä-yō\ City (pop., 1998 est.: 790,000), southwestern Zimbabwe. One of the country's largest cities, it lies 4,400 ft (1,340 m) above sea level. Originally the headquarters of the king of the NDEBELE, it was occupied in 1893 by the British. It is Zimbabwe's principal industrial centre and, as headquarters for the country's railroads, its main transshipment point for goods to and from South Africa.

bulb In botany, the resting stage of certain SEED PLANTS, particularly PERENNIAL monocotyledons (see COTYLEDON), consisting of a relatively large, usually globe-shaped, underground BUD with membranous or fleshy overlapping leaves arising from a short stem. The fleshy leaves function as food reserves that enable a plant to lie dormant when water is unavailable (during winter or drought) and to resume active growth when favourable conditions again prevail. There are two main types of bulbs. One, typified by the ONION, has a thin papery covering protecting its fleshy leaves. The other, the scaly bulb, as seen in true lilies, has naked storage leaves, with no papery covering, making the bulb appear to consist of angular scales. Bulbs enable many common ornamentals, such as the NARCISSUS, TULIP, and HYACINTH, to flower rapidly in early spring when growing conditions are favourable. Other bulb-producing plants bloom in the summer (e.g., lilies) or fall (e.g., the AUTUMN CROCUS). The solid CORMS of the CROCUS and GLADIOLUS and the elongated RHIZOMES of some irises are not bulbs.

Bulfinch, Charles (b. Aug. 8, 1763, Boston, Massachusetts Bay Colony—d. April 4, 1844, Boston, Mass., U.S.) First professional U.S. architect. He studied at Harvard University and then toured Europe, visiting major architectural sites in France and Italy. Most of his works incorporate Classical orders and show a mastery of proportion. Chiefly a designer of government buildings, he served as architect of the U.S. CAPITOL in 1817–30. He used the plans of his immediate predecessor, BENJAMIN H. LATROBE, for the wings but prepared a new design for the ROTUNDA. His son Thomas Bulfinch (1796–1867) wrote the famous *Bulfinch's Mythology*.

Bulgakov \bůl-ˈgä-kəf**, Mikhail (Afanasyevich)** (b. May 15, 1891, Kiev, Ukraine, Russian Empire—d. March 10, 1940, Moscow, Russian S.F.S.R., U.S.S.R.) Russian playwright, novelist, and short-story writer. He wrote and staged many popular plays in the years 1925–29, including dramatizations of his own novels, but by 1930 his trenchant criticism of Soviet mores had caused him to be effectively prohibited from publishing. His works, known for their scathing humour, include the novella *The Heart of a Dog* (written 1925), a satire on pseudoscience that did not appear openly in the Soviet Union until 1987, and the dazzling fantasy *The Master and Margarita*, not published in unexpurgated form until 1973.

Bulganin \bůl-ˈgä-nyin**, Nikolay (Aleksandrovich)** (b. June 11, 1895, Nizhy Novgorod, Russia—d. Feb. 24, 1975, Moscow, Russia, U.S.S.R.) Soviet statesman and industrial and economic administrator. After supporting NIKITA KHRUSHCHEV in the latter's power struggle with GEORGY MALENKOV, Bulganin was made premier of the Soviet Union (1955–58). Though closely identified with Khrushchev, he joined an "anti-party group" that tried to oust Khruschev in 1957, a move that led to his own downfall.

Bulgaria *officially* **Republic of Bulgaria** Country, southeastern Europe. Area: 42,858 sq mi (111,002 sq km). Population (2005 est.): 7,740,000. Capital: SOFIA. Bulgarians make up the great majority of the population; smaller ethnic groups include Turks, Roma (Gypsies), and Macedonians. Languages: Bulgarian (official), regional dialects. Religions: Christianity (predominantly Eastern Orthodox; also other Christians); also Islam. Currency: lev. Three major regions define the landscape. The northernmost is the Danubian Plain, a fertile area occupying one-third of the country. Immediately south lie the BALKAN MOUNTAINS (Stara Planina). In the southwest and south lie the Rhodope Mountains, with the country's highest point, Musala Peak, rising 9,596 ft (2,925 m). Smaller than the three major regions, Bulgaria's Black Sea coast is a popular eastern European resort area. Major drainage systems include the BLACK and AEGEAN seas. Bulgaria had a planned economy modeled on the Soviet system (1946–89). Since 1991 the noncommunist government has been moving to privatize some sectors of the economy, including agriculture. Bulgaria is a republic with one legislative body; its chief of state is the president, and its head of government is the prime minister. Evidence of human habitation dates from prehistoric times. Thracians were the first recorded inhabitants, dating from c. 3500 BC, and their first state dates from about the 5th century BC. The area was subdued by the Romans, who divided it into the provinces of MOESIA and THRACE. In the 7th century AD the Bulgars took the region south of the Danube

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River. The Byzantine Empire in 681 formally recognized Bulgar control over the area between the Balkans and the Danube, though it would again dominate Bulgaria from the early 11th century to the late 12th century. Late in the 14th century Bulgaria fell to the Ottoman Turks and again lost its independence. At the end of the Russo-Turkish War (1877–78), Bulgaria rebelled. The ensuing Treaty of San Stefano was unacceptable to the great powers, and the Congress of Berlin (1878) resulted. In 1908 the Bulgarian ruler, Ferdinand, declared Bulgaria's independence. After its involvement in the Balkan Wars (1912–13), Bulgaria lost territory. It sided with the Central Powers in World War I and with Germany in World War II. A communist coalition seized power in 1944, and in 1946 a people's republic was declared. With other eastern European countries in the late 1980s, Bulgaria experienced political unrest; its communist leader resigned in 1989. A new constitution that proclaimed a republic was implemented in 1991. Economic turmoil followed Bulgaria into the 21st century as it sought political stability and joined NATO in 2004.

Bulgarian Horrors Atrocities committed by the Ottoman empire in subduing the Bulgarian rebellion of 1876. The name was used by William E. Gladstone in his pamphlet publicizing the incident. About 15,000 persons were reportedly massacred at Philippopolis (now Plovdiv), and villages and monasteries were destroyed. Despite widespread public indignation, the European powers did little in response. The crisis ended with the Congress of Berlin, which created a small, autonomous principality of Bulgaria.

Bulgarian language South Slavic language spoken by about nine million people in Bulgaria and enclaves in Romania, Moldova, Ukraine, and Turkey. Closely related is Macedonian, spoken by two to three million people in Macedonia, adjacent parts of Albania and Greece, and enclaves elsewhere. Both languages differ from other major Slavic languages in several features. Both are direct descendants of Old Church Slavonic. Under Ottoman rule, literary production was solely in Church Slavonic. The Bulgarian vernacular became a literary language only in the mid-19th century; it was codified on the basis of northeastern Bulgarian dialects in 1899. Though efforts to create a literary Macedonian were underway before the Balkan Wars (1912–13), it was not formally recognized as a distinct language until the declaration of a Macedonian Republic within nascent communist Yugoslavia (1944).

Bulge, Battle of the (Dec. 16, 1944–Jan. 16, 1945) In World War II, the last German offensive on the Western Front, an unsuccessful attempt to divide the Allied forces and prevent an invasion of Germany. The "bulge" refers to the wedge that the Germans drove into the Allied lines. In December 1944, Allied forces were caught unprepared by a German counterthrust in the wooded Ardennes region of southern Belgium. The German drive, led by Gerd von Rundstedt's panzer army, was initially successful but was halted by Allied resistance and reinforcements led by George Patton. The Germans withdrew in January 1945, but both sides suffered heavy losses.

Buli style \'bü-lē\ African wood sculpture made by the Luba people in the village of Buli, Congo (Zaire). The most typical examples are statues of ancestor figures and stools with seats supported on the heads and fingertips of figures. Because the carvings are almost identical and differ from other Luba carvings, they were once thought to be the work of a single artist, known as the Master of Buli, but it was later determined that they were actually produced in a workshop.

bulimia nervosa \bü-'lē-mē-ə-nər-'vō-sə\ Eating disorder, mostly in women, in which excessive concern with weight and body shape leads to binge eating followed by compensatory behaviour such as self-induced vomiting or the excessive use of laxatives or diuretics. The disorder typically begins in adolescence or early adulthood and is associated with depression, anxiety, and low self-esteem. Bulimia can have serious medical complications such as dental decay and dehydration. Treatment may include psychotherapy. Unlike persons with anorexia nervosa, most bulimics remain close to their proper weight.

bulk modulus \'mä-jə-ləs\ Numerical constant that describes the elastic properties of a solid or fluid under pressure from all sides. It is the ratio of the tensile strength or compressive force per unit surface area to the change in volume per unit volume of the solid or fluid and thus is a measure of a substance's ability to resist deformation. Its units are newtons per square metre (N/m^2). Matter that is difficult to compress has a large bulk modulus; for example, steel has a bulk modulus of 1.6×10^{11} N/m^2, three times that of glass (i.e., glass is three times more compressible than steel).

Bull, John (b. 1562/63, Radnorshire, Wales?—d. March 12/13, 1628, Antwerp, Spanish Netherlands) British composer. He became organist of Hereford Cathedral in 1582, then organist at the Chapel Royal in 1591. In 1613 he departed for the continent to escape punishment for adultery; he held important organist positions in Brussels and Antwerp until his death. He wrote many verse anthems but is remembered for his keyboard works. In an era of remarkable English music for the virginal (a small harpsichord), he produced works that, with their resourceful keyboard figurations, reflect his own brilliant technique.

Bull \'bül\, Ole (Bornemann) (b. Feb. 5, 1810, Bergen, Nor.—d. Aug. 17, 1880, Lysøen, near Bergen) Norwegian violinist. After training in his native Bergen, he freelanced in Christiania (now Oslo) in 1828–31. His Paris concerts, which featured Norwegian songs played on a folk violin, won much attention, and he toured Europe and the U.S. for two decades. A longtime nationalist, he was brought back home by the revolution of 1848. He helped found the Norwegian Theatre in Bergen, and in 1852–53 he established the socialist colony Oleona in Pennsylvania; debts from the failed experiment kept him touring the rest of his life. Much of the music he composed is lost.

bull market In securities and commodities trading, a rising market. A bull is an investor who expects prices to rise and, on this assumption, buys a security or commodity in hopes of reselling it later for a profit. A bullish market is one in which prices are expected to rise. See also bear market.

Bull Moose Party U.S. dissident political party that nominated former president Theodore Roosevelt for the presidency in 1912. Formed by Sen. Robert La Follette in 1911 as the National Republican Progressive League, it opposed the conservatism of the Republican Party controlled by Pres. William H. Taft. The party derived its name from the characteristics of strength and vigour that Roosevelt attributed to himself. In 1912 Roosevelt won 25% of the popular vote; thus split, the Republicans lost the election to the Democratic candidate, Woodrow Wilson. The party gradually dissolved, and the Republicans were reunited in 1916. See also Progressive Party.

bull-roarer Flat piece of wood, several inches to a foot in length, fastened at one end to a string, by which it is swung around in the air to produce a whirring or howling sound likened to those of animals or spirits. It has been observed in Australia, the Americas, and other areas where indigenous societies survive. It may symbolize totemic ancestors, or it

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may be believed to cause or cure sickness, warn women and children away from men's sacred ceremonies, control the weather, or promote fertility in animals and crops.

Bull Run, Battles of Two engagements of the American Civil War fought at a stream near Manassas, Va. The first battle (also called First Manassas) was fought on July 21, 1861, between 37,000 Union troops under Gen. Irvin McDowell (1818–85) and 35,000 Confederate troops under P.G.T. Beauregard and Joseph Johnston. In this first major encounter of the war, the Union assault was beaten back and the army retreated to Washington, D.C. The second battle took place on Aug. 29–30, 1862, between a Confederate force of more than 56,000 under Robert E. Lee and a Union army of more than 70,000 under John Pope. To prevent the Union army from being joined by the Army of the Potomac, Lee sent troops under Stonewall Jackson to march around Pope's right flank. Lee's attack forced the Union troops to withdraw as far as Washington, D.C. Casualties numbered 15,000 for the North and 9,000 for the South. Both battles strengthened the South's resolve and caused the North to review its military leadership and strategy.

bull terrier Breed of dog developed in 19th-century England from the bulldog and the now-extinct white English terrier. The Spanish pointer was later bred into the line to increase its size. The bull terrier was developed as a courageous fighting dog but not an aggressive fight provoker, and it is generally friendly. A muscular dog, it is considered, for its weight, the strongest of all dogs. It has a short coat, tapering tail, erect ears, and deep-set eyes. It stands 19–22 in. (48–56 cm) high and weighs 50–60 lbs (23–27 kg). There are two varieties, coloured and white.

bulldog *or* **English bulldog** Centuries-old breed of dog developed in Britain to fight bulls. Powerful and courageous, often vicious, and largely unaware of pain, the bulldog nearly disappeared when dogfighting was outlawed in 1835. Fanciers of the breed saved it and bred out its ferocity. It is now considered gentle and reliable. It has a large head, folded ears, a short muzzle, a protruding lower jaw, and loose skin that forms wrinkles on the head and face. Its short, fine coat is tan, white, reddish brown, brindle, or piebald. It stands 13–15 in. (34–38 cm) high and weighs 40–50 lbs (18–23 kg).

Buller River River, South Island, New Zealand. It was named for Charles Buller, founder of the New Zealand Co. It is the major river of the island's west coast. Rising in the central highlands, it flows west 110 mi (177 km) into the Tasman Sea. Its gorge, which is most scenic at Inangahua Junction, is an important tourist attraction.

bulletin-board system (BBS) Computerized system used to exchange public messages or files. A BBS is typically reached by using a dial-up modem. Most are dedicated to a special interest, which may be an extremely narrow topic. Any user may "post" his or her own message (so that they appear on the site for all to read). Bulletin boards produce "conversations" between interested participants, who may download or print out messages they desire to keep or pass on to others. BBS sites today number in the tens of thousands. See also newsgroup.

bullfighting *Spanish* **corrida de toros** Spectacle, popular in Spain, Portugal, and Latin America, in which matadors ceremonially taunt, and usually kill, bulls in an arena. Spectacles with bulls were common in ancient Crete, Thessaly, and Rome. In the modern era, Roman amphitheatres were rebuilt and embellished for use as bullrings. The largest are in Madrid, Barcelona, and Mexico City. The corrida, which usually involves six individual fights, begins with a procession of matadors and their entourages. At the beginning of each fight an assistant (banderillero) performs a preliminary maneuver to allow the matador to assess the animal's behaviour. The matador then performs his capework, drawing the bull as close to him as possible without being gored. This is followed by the entrance of the picadors, horsemen who jab the bull with lances to weaken its neck and shoulder muscles. The matador then ritually slays the bull using a sword. In the Portuguese version of the ritual, the bull is fought from horseback and is not killed in the arena. Bullfighting has been banned in many countries.

Manolete executing a natural pass, a close pase with his left hand.
BARNABY CONRAD

bullfinch Any of several species of stocky, stout-billed songbird (family Fringillidae). Eurasia has six species of the genus *Pyrrhula*, all boldly marked. The common bullfinch (*P. pyrrhula*), 6 in. (15 cm) long, is black and white; the male has a pinkish orange underside. It has a soft warbling call and is a popular cage bird. Usually found in evergreen groves and hedgerows, it is notorious for eating the buds of fruit trees. The trumpeter bullfinch (*Rhodopechys githaginea*), of arid localities from the Canary Islands to India, is a pale bird with a blaring buzzy note.

Common bullfinch (*Pyrrhula pyrrhula*)
H.M. BARNFATHER/BRUCE COLEMAN LTD.

bullfrog Solitary aquatic frog (*Rana catesbeiana*) named for its loud call. The largest U.S. frog, native to the eastern states, the bullfrog has been introduced into the western states and into other countries. The bullfrog is green or brown with a white to yellowish belly and dark-barred legs. Its body is about 8 in. (20 cm) long, and its hindlegs may be 10 in. (25 cm) long. Large adults weigh 1 lb (0.5 kg) or more. Bullfrogs usually live in or near a body of still water. They are used for food and as laboratory animals. The name is sometimes applied to other large frogs.

Bullfrog (*Rana catesbeiana*)
RICHARD PARKER

bullhead Any of several species of North American freshwater catfish in the genus *Ictalurus*, valued as food and sport fishes. Bullheads are related to the channel catfish (*I. punctatus*) and other large North American species, but their tail is squared, rather than forked, and they are generally less than 12 in. (30 cm) long. The black bullhead (*I. melas*) is found in the Mississippi Valley, the yellow and brown bullheads (*I. natalis* and *I. nebulosus*) east of the Rocky Mtns., and the flat bullhead (*I. platycephalus*) in coastal streams between North Carolina and Florida. The name is sometimes applied to sculpins.

bullionism Monetary policy of mercantilism, which called for national regulation of transactions in foreign currency and precious metals (bullion) in order to maintain a favourable balance in the home country. Bullionism is most closely associated with 16th- and 17th-century Spain, which was thought to owe its prosperity and military might to the gold and silver of its New World colonies. This view gave rise to the theory that a favourable balance of trade would increase the nation's supply of precious metals. Spain's abundant treasure led it to buy goods and services abroad at the neglect of domestic industry, causing it to experience an economic decline.

Bullock, Wynn (b. April 18, 1902, Chicago, Ill., U.S.—d. Nov. 16, 1975, Monterey, Calif.) U.S. photographer. He was strongly influenced in his early work—mainly "solarizations," in which the image is partly negative and partly positive—by the avant-garde experiments of László Moholy-Nagy. In 1948 Edward Weston persuaded him to focus on realism and tonal beauty, and Bullock followed his advice so closely that his images often resembled Weston's. He is best known for realistic images that are meant to be viewed as "equivalents," or visual metaphors (e.g., the passing of time, the inevitability of death).

Bülow \'bü̇-lō**, Bernhard (Heinrich Martin Karl), prince von** (b. May 3, 1849, Klein-Flottbek, near Altona, Ger.—d. Oct. 28, 1929, Rome, Italy) German imperial chancellor and Prussian prime minister (1900–09). After holding a number of diplomatic posts, he was appointed state secretary for the foreign department in 1897. He quickly became a potent force and succeeded to the chancellorship in 1900. In cooperation with William II, he pursued a policy of German aggrandizement in the years preceding World War I. He was unable to prevent the formation of the

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English-French-Russian alliance against Germany (see Entente Cordiale; Triple Entente) and increased international tension with the first of the Moroccan crises.

Bülow \'bü̅-lō**, Hans (Guido), baron von** (b. Jan. 8, 1830, Dresden, Saxony—d. Feb. 12, 1894, Cairo, Egypt) German conductor and pianist. He studied piano with Clara Schumann's father. His meetings with the composers Franz Liszt (1849) and Richard Wagner (1850) led to his decision to give up law for music, and with their help he launched a renowned career as conductor and pianist, studying with Liszt from 1851 and marrying his daughter Cosima in 1857. He was appointed court conductor to Louis II and later director of the Munich Conservatory. He conducted the premieres of Wagner's operas *Tristan und Isolde* (1859) and *Die Meistersinger* (1868). Cosima abandoned von Bülow for Wagner, whom she married in 1870; nonetheless, von Bülow continued to promote Wagner's music. He was one of the first conductors to conduct from memory; his interpretations were noted for their integrity and emotional power.

bulrush Any of the annual or perennial grasslike plants constituting the genus *Scirpus*, especially *S. lacustris*, in the sedge family, that bear solitary or much-clustered spikelets. Bulrushes grow in wet locations, including ponds, marshes, and lakes. Their stems are often used to weave strong mats, baskets, and chair seats. Bulrushes may act as a filter, absorbing poisonous metals and toxic microorganisms, thus helping to reduce water pollution. In Britain, the term bulrush refers to either of two cattails (*Typha latifolia* and *T. angustifolia*).

Bultmann \'bu̇lt-ˌmän**, Rudolf (Karl)** (b. Aug. 20, 1884, Wiefelstede, Ger.—d. July 30, 1976, Marburg, W.Ger.) German Protestant theologian and New Testament scholar. The son of a Lutheran pastor, he studied at the University of Tübingen and later taught many years at Marburg (1921–51). He established his reputation with his analysis of the Gospels in *History of the Synoptic Tradition* (1921). Influenced by his colleague Martin Heidegger, he held that Christian faith should focus less on the historical Jesus and more on the transcendent Christ, and he examined the New Testament in mythical terms. During the Nazi era he supported the anti-Nazi Confessing Church. His postwar books included *Kerygma and Myth* (1953), *History and Eschatology* (1957), and *Jesus Christ and Mythology* (1960).

Bulwer, Sir (William) Henry Lytton (Earle) *later* **Baron Dalling and Bulwer of Dalling** (b. Feb. 13, 1801, London, Eng.—d. May 23, 1872, Naples, Italy) British diplomat. In the diplomatic service from 1829, he negotiated the Ponsonby Treaty (1838), which was advantageous to British trade with the Ottoman Empire. As ambassador to the U.S. (1849–52), he negotiated the controversial Clayton-Bulwer Treaty, which was intended to resolve (but in fact aggravated) Anglo-American disputes in Latin America. In 1856 he played a major part in the negotiations following the Crimean War. His brother was the novelist Edward Bulwer-Lytton.

Bulwer-Lytton, Edward (George Earl) *later* **1st Baron Lytton (of Knebworth)** (b. May 25, 1803, London, Eng.—d. Jan. 18, 1873, Torquay, Devonshire) British politician, novelist, and poet. His first novel, *Pelham*, was published in 1828. He entered Parliament as a Liberal in 1831, retired in 1841, and returned in 1852 as a Tory. In the interim he wrote his long historical novels, including *The Last Days of Pompeii*, 3 vol. (1834), and *Harold, the Last of the Saxon Kings* (1848). He was created a peer in 1866. The opening to his 1830 novel *Paul Clifford* ("It was a dark and stormy night…") led to an annual Bulwer-Lytton Fiction Prize, in which entrants vie to create the most overwritten first sentence to a hypothetical novel.

bumblebee Any member of two genera constituting the insect tribe Bombini (family Apidae, order Hymenoptera), found almost worldwide but most common in temperate climates. Bumblebees are robust and hairy, average about 0.6–1 in. (1.5–2.5 cm) in length, and are usually black with broad yellow or orange bands. *Bombus* species are nest builders, often nesting in the ground, commonly in deserted bird or mouse nests. They live in organized groups, with a queen, drones, and workers (see caste). *Psithyrus* species are social parasites (see parasitism); they lay their eggs in *Bombus* nests, where the eggs and larvae are cared for by *Bombus* workers.

Bunau-Varilla \bü̅-nō-vä-rē-'yä**, Philippe (-Jean)** (b. July 26, 1859, Paris, France—d. May 18, 1940, Paris) French engineer. He worked for the French Panama Canal Co. (1884–89) until the project failed. He helped to instigate the revolution that resulted in Panamanian independence and was appointed by the provisional government to negotiate a treaty with the U.S. for the construction of a canal. In 1903 he signed a treaty with U.S. Secretary of State John Hay assuring the construction of the Panama Canal under U.S. control.

bunchberry Creeping perennial herbaceous plant (*Cornus canadensis*), also called dwarf cornel, of the dogwood family. The small and inconspicuous yellowish flowers, grouped in heads surrounded by four large and showy white (rarely pink) petal-like bracts, give rise to clusters of red fruits. Bunchberry is found in acid soils, bogs, and upland slopes in Asia and from Greenland to Alaska, and south as far as Maryland, New Mexico, and California.

Bunche \'bənch**, Ralph (Johnson)** (b. Aug. 7, 1904, Detroit, Mich., U.S.—d. Dec. 9, 1971, New York, N.Y.) U.S. diplomat. He earned graduate degrees at Harvard University and taught at Howard University from 1928. After studying colonial policy in Africa, he collaborated with Gunnar Myrdal in *An American Dilemma* (1944), a study of U.S. race relations. He worked in the U.S. war and state departments during World War II. In 1947 he became director of the trusteeship department of the UN Secretariat. His work in forging a truce between Palestinian Arabs and Jews earned him the 1950 Nobel Prize for Peace. As UN undersecretary for political affairs, he oversaw UN peacekeeping forces around the Suez Canal (1956), in the Congo (1960), and in Cyprus (1964). He also served on the board of the NAACP for 22 years.

Bunche.
H. ROGER-VIOLLET

Bundelkhand \'bu̇n-dəl-ˌkənd\ Historic region, central India. Long inhabited by various dynasties, it was finally settled by the Bundela Rajputs in the 14th century. For centuries afterward they engaged in warfare with the Muslim power of Delhi. After a period of Mughal rule, the Marathas extended their influence, but by 1817 the British government had acquired all territorial rights over the region. After Indian independence was achieved, Bundelkhand in 1948 merged into Vindhya Pradesh, which in turn merged with Madhya Pradesh in 1956.

Bundestag \'bu̇n-dəs-ˌtäk\ Lower house of the German bicameral legislature. It represents the nation as a whole and is elected by universal suffrage under a system of mixed direct and proportional representation. Members serve four-year terms. The Bundestag in turn elects the chancellor. The term was formerly used to refer to the federal Diet of the German Confederation (1815–66), known as the Reichstag under the Weimar Republic (1919–34). Its building burned down in 1933 (see Reichstag fire), and its members were not allowed to meet again for the duration of the Nazi regime (1933–45). The Reichstag was reconstituted as the Bundestag in the governmental reorganization of 1949. Its membership was again reorganized after German unification in 1990.

bundle theory Theory advanced by David Hume to the effect that the mind is merely a bundle of perceptions without deeper unity or cohesion, related only by resemblance, succession, and causation. Hume's well-argued denial of a substantial or unified self precipitated a philosophical crisis from which Immanuel Kant sought to rescue Western philosophy.

Bundy, McGeorge (b. March 30, 1919, Boston, Mass., U.S.—d. Sept. 16, 1996, Boston) U.S. public official and educator. He served in World War II as an intelligence officer. He joined the faculty of Harvard University in 1949 and became dean of arts and sciences in 1953. As special assistant for national security to presidents John F. Kennedy and Lyndon B. Johnson, he was a forceful advocate of expanding U.S. involvement in the Vietnam War. He resigned to become president of the Ford Foundation (1966–79) and later taught at New York University (1979–89).

bungee jumping \'bən-jē\ Sport in which the jumper falls from a high place with a rubber ("bungee") cord attached both to his or her feet and to the jump site, and, after a period of headfirst free fall, is bounced part-

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way back when the cord rebounds from its maximum stretch. It traces its roots to the "land diving" practiced on Pentecost Island, Vanuatu, in which divers jump off a high tower, their feet connected to it by a vine whose length is calculated to allow the jumper to fall until his hair just brushes the ground below. The Oxford Dangerous Sports Club, inspired by reports of the Pentecost Island divers, made the first Western bungee jumps, and bungee jumping was first offered commercially to the public in New Zealand in 1988.

Bunin \'bü-nʸin**, Ivan (Alekseyevich)** (b. Oct. 10, 1870, Voronezh, Russia—d. Nov. 8, 1953, Paris, France) Russian poet and novelist. He worked as a journalist and clerk while writing and translating poetry, but he made his name as a short-story writer, with such masterpieces as the title story of *The Gentleman from San Francisco* (1916). His other works include the novel *Mitya's Love* (1925), the story collection *Dark Avenues* (1943), fictional autobiography, memoirs, and books on Leo Tolstoy and Anton Chekhov. The first Russian awarded the Nobel Prize for Literature (1933), he is among the best stylists in the language.

Bunker Hill, Battle of *also known as* **Battle of Breed's Hill** (June 17, 1775) First major battle of the American Revolution. Within two months after the Battles of Lexington and Concord, more than 15,000 colonial troops assembled near Boston to prevent the British army from occupying several hills around the city, including Bunker and Breed's hills. The colonists fortified Breed's Hill in Charlestown, across the Charles River from Boston. They withstood a cannonade from British ships in Boston Harbor and fought off assaults by 2,300 British troops but were eventually forced to retreat. Although the British won the battle, it was a Pyrrhic victory that lent considerable encouragement to the revolutionary cause. British casualties (about 1,000) and the colonists' fierce resistance convinced the British that subduing the rebels would be difficult.

bunraku \'bůn-rä-ků\ Japanese traditional puppet theatre, in which nearly life-size dolls act out a chanted dramatic narrative, called *jōruri*, to the accompaniment of a small samisen. Puppet theatre reached its height in the 18th century with the plays of Chikamatsu Monzaemon and declined later because of a lack of good *jōruri* writers.

Bunsen, Robert (Wilhelm) (b. March 31, 1811, Göttingen, Westphalia—d. Aug. 16, 1899, Heidelberg, Baden) German chemist. With Gustav Robert Kirchhoff, he observed (c. 1859) that each element emits light of a characteristic wavelength, opening the field of spectrochemical analysis. They discovered several new elements (including helium, cesium, and rubidium) by spectroscopy. His only book discussed methods of measuring volumes of gases. He invented the carbon-zinc battery, grease-spot photometer (see photometry), filter pump, ice calorimeter, and vapour calorimeter. Though often credited with inventing the Bunsen burner, he seems to have made only a minor contribution to its development.

bunting Common name for any of about 37 Old World species (genus *Emberiza*) of finch, as well as certain similar species found in the New World. All belong to the family Fringillidae, and many are recognizable by strongly patterned heads or bright colours. *Emberiza* species are seed eaters that commonly breed in temperate Eurasia and from northern Africa to India. The snow bunting (*Plectrophenax nivalis*) breeds in the far north, and the lark bunting (*Calamospiza melanocorys*) inhabits the U.S. Great Plains. U.S. species include the indigo bunting (*Passerina cyanea*) and the painted bunting (*P. ciris*). The male painted bunting, with red, green, and blue feathers, is the most colourful bird that breeds in the U.S.

Painted bunting (*Passerina ciris*)
DONALD D. BURGESS FROM E.R. DEGGINGER—EB INC.

Buñuel \,bůn-yů-'wel**, Luis** (b. Feb. 22, 1900, Calanda, Spain—d. July 29, 1983, Mexico City, Mex.) Spanish film director. As a student at the University of Madrid he met Salvador Dalí, with whom he later made the Surrealist film *Un chien andalou* (1928). Buñuel then directed the anticlerical *L'Âge d'or* (1930) and the documentary *Land Without Bread* (1932). After working as a commercial producer in Spain and a technical adviser in Hollywood, he moved to Mexico, where he directed *Los olvidados* (1950) and *Nazarín* (1958). He returned to Spain to make *Viridiana* (1961), which was suppressed in Spain as anticlerical but internationally acclaimed. He attacked conventional morality in such later films as *Belle de jour* (1967), *Tristana* (1970), *The Discreet Charm of the Bourgeoisie* (1972), and *That Obscure Object of Desire* (1977).

Buñuel.
CAMERA PRESS

Bunyan, John (b. November 1628, Elstow, Bedfordshire, Eng.—d. Aug. 31, 1688, London) English minister and author. Bunyan encountered the seething religious life of various left-wing sects while serving in Oliver Cromwell's army in the English Civil Wars. He underwent a period of spiritual crisis, converted to Puritanism, and became a preacher. After the Restoration, he was jailed as a Nonconformist for 12 years, during which he wrote his spiritual autobiography, *Grace Abounding* (1666). He is best known for *The Pilgrim's Progress* (1678–84), a religious allegory expressing the Puritan religious outlook. A symbolic vision of the character Christian's pilgrimage through life, it was at one time second only to the Bible in popularity among ordinary readers. Despite his ministerial responsibilities, he published numerous works in his last 10 years.

John Bunyan, pencil drawing on vellum by Robert White; in the British Museum
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Bunyan, Paul Legendary giant lumberjack of the U.S. frontier. A symbol of strength and vitality, he is accompanied by a giant blue ox, Babe. He was credited with creating Puget Sound, digging the Grand Canyon, and building the Black Hills, and was known for his prodigious appetite, eating hotcakes off a griddle so large it was greased by men using sides of bacon as skates. Tales of his exploits probably originated in lumber camps, and were first published by James MacGillivray in "The Round River Drive" (1910), which soon led to a national myth.

Bunyoro See Nyoro

Buonarroti, Michelangelo See Michelangelo

buoyancy See Archimedes' principle

burakumin \bù-'rä-kù-min\ *Japanese* **"hamlet people"** Japanese minority group that suffers discrimination based on its historical outcaste status. In the late 16th century, when Toyotomi Hideyoshi divided the populace into four social classes, one group remained outside and beneath the system: those whose occupation involved the taking of life (such as butchers or executioners) or handling flesh or dead bodies (such as leatherworkers or gravediggers). Buddhist and Shintō beliefs in the polluting nature of these occupations have long stigmatized those who held them. Though their outcaste status was removed by law in 1871, prejudice remains, and *burakumin* heritage often stands in the way of marriages and employment opportunities. *Burakumin* are estimated to number 1–3 million.

Burbage \'bər-bij**, Richard** (b. c. 1567, London, Eng.—d. March 9/13, 1619, London) British actor. A popular actor by age 20, he was a member of the Earl of Leicester's company and the Chamberlain's (later King's) Men. Closely associated with William Shakespeare, he was the first to play roles such as Richard III, Romeo, Henry V, Hamlet, Macbeth, Othello, and King Lear. He also performed in plays by Thomas Kyd, Ben Jonson, and John Webster. He was a major shareholder of the Globe Theatre and the Blackfriars Theatre.

Burbank, Luther (b. March 7, 1849, Lancaster, Mass., U.S.—d. April 11, 1926, Santa Rosa, Cal.) U.S. plant breeder. He was reared on a farm and never obtained a college education. Influenced by Charles Darwin's writings on domesticated plants, he began a plant-breeding career at age 21. On the proceeds of his rapid development of the hugely successful Burbank potato, he set up a nursery garden, greenhouse, and experimen-

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tal farms in Santa Rosa, Cal. There he developed more than 800 new and useful strains and varieties of fruits, flowers, vegetables, grains, and grasses, many of which are still commercially important. His laboratory became world-famous, and he helped make plant breeding a modern science. He published two multivolume works and a series of descriptive catalogs.

Burbank
COURTESY OF HUNT INSTITUTE FOR BOTANICAL DOCUMENTATION, CARNEGIE MELLON UNIVERSITY, PITTSBURGH, PA.

Burbidge, (Eleanor) Margaret *orig.* **Eleanor Margaret Peachey** (b. Aug. 12, 1919, Davenport, Cheshire, Eng.) English astronomer. She served as acting director (1950–51) of the Observatory of the University of London. In 1955 her husband, Geoffrey Burbidge (b. 1925), became a researcher at the Mount Wilson Observatory, and she accepted a research post at Caltech. She later joined the faculty at UC–San Diego, briefly serving as director of the Royal Greenwich Observatory (1972–73). Jointly with her husband, she made notable contributions to the theory of QUASARS and to the understanding of how the elements are formed in the depths of stars through NUCLEAR FUSION (NUCLEOSYNTHESIS).

burbot \'bər-bət\ Elongated fish (*Lota lota*), the only freshwater member of the COD family. It lives in cold rivers and lakes of Europe, Asia, and North America. A mottled, greenish or brown bottom-dweller, it descends as deep as 700 ft (200 m). It may grow about 3.6 ft (1.1 m) long. It has very small, embedded scales, a long anal fin, and two dorsal fins. The burbot is valued as food in some areas.

Burchfield, Charles (Ephraim) (b. April 9, 1893, Ashtabula Harbor, Ohio, U.S.—d. Jan. 10, 1967, Gardenville, N.Y.) U.S. painter. He attended the Cleveland School of Art and, after service in World War I, worked as a wallpaper designer in Buffalo, N.Y. In the 1920s and '30s he was one of the leading painters of American life; his work was associated with EDWARD HOPPER's in its portrayal of the loneliness and bleakness of small-town life (e.g., *November Evening*, 1934). In the 1940s he abandoned realism for a more personal interpretation of nature, emphasizing its mystery, movement, and colour from season to season (e.g., *The Sphinx and the Milky Way*, 1946).

Burckhardt \'bůrk-ˌhärt**, Jacob (Christopher)** (b. May 25, 1818, Basel, Switz.—d. Aug. 8, 1897, Basel) Swiss historian of art and culture. After abandoning his study of theology, Burckhardt studied art history, then a new field, at the University of Berlin (1839–43). As he matured he became a cultural conservative, alienated from the contemporary world and preoccupied with reclaiming the past. From 1843 he taught primarily at the University of Basel; from 1886 until his retirement in 1893 he taught art history exclusively. He is famous for *The Civilization of the Renaissance in Italy* (1860), which examines daily life in the Renaissance in terms of such phenomena as the development of individuality and the modern sense of humour; it became a model for cultural historians. He died while working on a four-volume survey of Greek civilization.

burdock Any plant of the genus *Arctium*, in the COMPOSITE FAMILY, bearing globular flower heads with prickly BRACTS. Native to Europe and Asia, burdock species have been naturalized throughout North America. Regarded as weeds in the U.S., they are cultivated for their edible root in Asia. Their fruits are round burrs that stick to clothing and fur.

Bureau of Standards *since 1988* **U.S. National Institute of Standards and Technology (NIST)** Agency of the U.S. Department of Commerce responsible for the standardization of weights and measures, timekeeping, and navigation. Active since at least the mid-19th century, the agency works closely with the U.S. Naval Observatory and the Bureau International de l'Heure in Paris to ensure global standardized time.

bureaucracy Professional corps of officials organized in a pyramidal hierarchy and functioning under impersonal, uniform rules and procedures. Its characteristics were first formulated systematically by MAX WEBER, who saw in the bureaucratic organization a highly developed DIVISION OF LABOUR, authority based on administrative rules rather than personal allegiance or social custom, and a "rational" and impersonal institution whose members function more as "offices" than as individuals. For Weber, bureaucracy was a form of legalistic "domination" inevitable under CAPITALISM. Later writers saw in bureaucracy a tendency to concentrate power at the top and become dictatorial, as occurred in the SOVIET UNION. ROBERT K. MERTON emphasized its red tape and inefficiency due to blind conformity to procedures. More recent theories have stressed the role of managerial cliques, occupational interest groups, or individual power-seekers in creating politicized organizations characterized by internal conflict.

Burgas \bůr-'gäs\ City (pop., 2001: 802,932), eastern Bulgaria. Located on an inlet of the BLACK SEA, it is one of Bulgaria's chief ports. It was founded in the 17th century; its development received impetus with the coming of the railroad in the late 19th century. It claims much of Bulgaria's Black Sea trade and handles most of its fish catch. With several neighbouring towns, Burgas is part of the developing Black Sea Riviera.

Bürger \'bu̇r-gər**, Gottfried August** (b. Dec. 31, 1747, Molmerswende bei Halberstadt, Brandenburg—d. June 8, 1794, Göttingen, Hanover) German poet. He was associated with the Göttinger Hain, a circle of STURM UND DRANG poets who reawakened interest in folk and nature themes. His bizarre ballad "Lenore" (1773) had a profound effect on the subsequent development of literary Romanticism throughout Europe, and he is remembered as a founder of German Romantic BALLAD literature. He is also noted for his Petrarchan sonnets and translations from English, especially Thomas Percy's *Reliques of Ancient English Poetry*.

Burger, Warren E(arl) (b. Sept. 17, 1907, St. Paul, Minn., U.S.—d. June 25, 1995, Washington, D.C.) U.S. jurist. He graduated with honours from St. Paul (now William Mitchell) College of Law in 1931, after which he joined a prominent law firm and became active in the Republican Party. He was appointed an assistant U.S. attorney general (1953) and named to the U.S. Court of Appeals for the District of Columbia (1955), where his conservative approach commended him to Pres. Richard Nixon, who nominated him for chief justice of the SUPREME COURT OF THE UNITED STATES in 1969. Contrary to the expectations of some, he did not try to reverse the liberal decisions on civil-rights issues and criminal law made during the tenure of his predecessor, EARL WARREN. Under his leadership, the court upheld the 1966 *MIRANDA V. ARIZONA* decision, permitted busing as a means of ending racial segregation in public schools, and endorsed the use of racial quotas in the awarding of federal grants and contracts. Burger voted with the majority in *ROE V. WADE* (1973). Keenly interested in judicial administration, he became deeply involved in efforts to improve the judiciary's efficiency. He retired in 1986 and was awarded the Presidential Medal of Freedom in 1988.

Burgess \'bər-jəs**, Anthony** *orig.* **John Anthony Burgess Wilson** (b. Feb. 25, 1917, Manchester, Eng.—d. Nov. 22, 1993, London) English novelist, critic, and composer. His experiences in Southeast Asia produced the novel trilogy *The Long Day Wanes* (1956–59). *A Clockwork Orange* (1962; film, 1971), his most original work, is a satire on extreme political systems. His other novels, which combine mordant wit, moral seriousness, verbal dexterity, and the bizarre, include *The Wanting Seed* (1962), *Inside Mr. Enderby* (1963), and *Earthly Powers* (1980). In addition to his extensive literary criticism, biographies, and works on linguistics and music, he composed more than 65 musical works.

Burgess \'bər-jəs**, Guy (Francis de Moncy)** (b. 1911, Devonport, Devon, Eng.—d. Aug. 30, 1963, Moscow, Russia, U.S.S.R.) British diplomat and Soviet spy. At the University of Cambridge in the 1930s, he became part of a group of young men, including Donald Maclean (1913–83), who shared a disdain for capitalist democracy. They were recruited by Soviet intelligence operatives and supplied information from their positions, mainly in the British foreign office (Maclean from 1934, Burgess from 1944). Maclean's post with the British embassy in Washington, D.C., enabled him to pass secret information about NATO to the Soviets; Burgess also served in Washington. In 1951 both men were warned by their colleague KIM PHILBY that an investigation was closing in on Maclean. With the aid of ANTHONY BLUNT, they fled England and vanished, then surfaced in Moscow in 1956.

Burgess \'bər-jəs**, Thornton W(aldo)** (b. Jan. 14, 1874, Sandwich, Mass., U.S.—d. June 5, 1965, Hampden, Mass.) U.S. children's author and naturalist. He loved nature as a child. His first book, *Old Mother West*

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Wind (1910), introduced the animal characters that were to populate his subsequent stories, which were published in many languages. He promoted conservationism through his "Wildlife Protection Program," his "Radio Nature League," and other organizations. He wrote more than 170 books and 15,000 stories for newspaper columns.

Burgess \'bər-jəs\ **Shale** Fossil formation containing remarkably detailed traces of soft-bodied marine organisms of the middle of the Cambrian Epoch (520–512 million years ago). Collected from a fossil bed in the Burgess Pass of the Canadian Rockies, the Burgess Shale is one of the best preserved and most important fossil formations in the world. Since it was discovered in 1909, over 60,000 specimens have been retrieved from the bed.

Burgesses \'bər-jəs-əz**, House of** Representative assembly in colonial Virginia, the first elective governing body in a British colony. It was one division of the legislature established in 1619 by the colonial governor at Jamestown; the other included the governor himself and a council, all appointed by the colonial proprietor (the Virginia Company). Each Virginia settlement was entitled to elect two delegates, or burgesses (citizens of a borough in England). See also LONDON CO.

Burghley, Baron See William CECIL

burglary Crime of breaking into and entering a structure with the intent to commit a felony within (see FELONY AND MISDEMEANOUR). It is one of several crimes in the general category of theft. Some state statutes specify degrees of burglary based on when and where the crime occurs, whether anyone is present in the structure when it is broken into, and whether a deadly weapon is used.

Burgoyne \bər-'gȯin**, John** (b. 1722, Sutton, Bedfordshire, Eng.—d. June 4, 1792, London) British general. After serving in the Seven Years' War he was elected to the British House of Commons in 1761 and 1768. Assigned to Canada in 1776, he began a campaign to join British forces from the north, south, and west to isolate the rebellious New England colonies. In 1777 his army captured Fort TICONDEROGA, N.Y., but was stopped at the Hudson River by a larger army of colonists under HORATIO GATES and BENEDICT ARNOLD. After several months of fighting, he surrendered to Gates at Saratoga Springs, N.Y.; he returned to England to face criticism for his defeat.

Burgundian school Group of 15th-century French composers, most of whom were associated with courts of various dukes of BURGUNDY. They are best known for their three-part CHANSONS in rondeau form (see FORMES FIXES), usually with text only in the highest part—perhaps implying a solo voice accompanied by instruments, written in full triadic harmony. The most important Burgundian composers were GUILLAUME DUFAY, Gilles Binchois (c. 1400–60), and Antoine Busnois (c. 1430–92).

Burgundy *French* **Bourgogne** \bür-'gôn^{y}\ Historical and governmental region, France. The name was originally applied to a kingdom in the RHÔNE valley and western Switzerland founded by the Burgundians, a Germanic people who fled Germany in the 5th century. Conquered by the MEROVINGIANS c. 534, it was incorporated into the Frankish empire. By the 843 Treaty of VERDUN, which divided the empire of Charlemagne, it was included in the Middle Kingdom of LOTHAR I. It was later divided into Cisjurane (Lower) Burgundy, or PROVENCE (founded 879), and Transjurane (Upper) Burgundy (founded 888); they united in 933 to form the kingdom of Burgundy. After the 13th century, it was known as the kingdom of ARLES; the name Burgundy was applied to the duchy of Burgundy, formed in the 9th century from lands in the northwestern part of the original kingdom. On the death of Burgundy's duke in 1361, the duchy reverted to the French crown. Given to PHILIP II, by 1477 its lands extended into the LOW COUNTRIES. It was seized by LOUIS XI, annexed to the French crown, and was a province until the FRENCH REVOLUTION. Roughly coextensive with the pre-Revolutionary province, the current administrative *région* of Burgundy (1999: 1,610,067) covers 12,194 sq mi (31,582 sq km). Its capital is DIJON. Wine making is an important part of the economy.

burial Ritual disposal of human remains. The practice is often intended to facilitate the deceased's entry into the afterworld. Grave burial dates back at least 125,000 years. Types of graves range from trenches to large burial mounds to great stone tombs such as PYRAMIDS. Caves have also long been used for the dead—e.g., in ancient Hebrew burials, the sepulchral caves (rock temples) of western India and Sri Lanka, and the Dogon cliff burial sites. Water burial, such as occurred among the Vikings, has also been common. Cremation and the scattering of ashes on water is widely practiced, especially in Asia; in India the remains of the deceased are thrown into the sacred GANGES RIVER. Some peoples (American Indian groups, Parsis, etc.) employ exposure to the elements to dispose of their dead. Among many peoples, the first burial is followed by a second, after an interval that often coincides with the duration of bodily decomposition. This reflects a concept of death as slow passage from the society of the living to that of the dead. Jewish custom requires speedy burial; a prayer known as the Kaddish is recited at the graveside, and a gravestone is normally erected a year after burial. Christian burials are often preceded by a wake, a "watch" held over the deceased's body and sometimes accompanied by festivity. Bodies of Muslims are laid on their right side and facing Mecca.

Buridan \bǖ-rē-'dä^{n},\ *English* \'byůr-əd-^{ə}n**, Jean** (b. 1300, Béthune?, France—d. 1358) French philosopher, logician, and scientific theorist. He studied under WILLIAM OF OCKHAM at the University of Paris and later taught there. According to his modified version of DETERMINISM, though one must choose what presents itself as the greater good, the will is free to delay reason's judgment by suggesting a more thorough inquiry into the worth of one's motives. The dilemma of a particular kind of moral choice, between two evidently identical alternatives, is illustrated by the celebrated allegory of "Buridan's ass." Among his achievements in mechanics was a revision of ARISTOTLE's theory of motion; he developed a theory of impetus by which the mover imparts to the moved a power, proportional to the former's speed and mass, which keeps it moving. His studies of optical images prefigured modern developments in cinematics. In logic he explicated the doctrines of Aristotle and Peter of Spain (c. 1210–77). His works include *Summula de dialecta* (1487) and *Consequentie* (1493).

Burke, Edmund (b. January 12?, 1729, Dublin, Ire.—d. July 9, 1797, Beaconsfield, Buckinghamshire, Eng.) British parliamentarian, orator, and political philosopher. The son of a lawyer, he began legal studies but lost interest, became estranged from his father, and spent some time wandering about England and France. Essays he published in 1757–58 gained the attention of DENIS DIDEROT, IMMANUEL KANT, and GOTTHOLD LESSING, and he was hired to edit a yearly survey of world affairs (1758–88). He entered politics (1765) as secretary to a Whig leader and soon became involved in the controversy over whether Parliament or the monarch controlled the executive. He argued (1770) that GEORGE III's efforts to reassert a more active role for the crown violated the constitution's spirit. Elected to Parliament (1774–80), he contended that its members should exercise judgment rather than merely follow their constituents' desires. Although a strong constitutionalist, he was not a supporter of pure democracy; although a conservative, he eloquently championed the cause of the American colonists, whom he regarded as badly governed, and he supported the abolition of the international slave trade. He tried unsuccessfully to legislate relief for Ireland and to reform the governance of India. He disapproved of the French Revolution for its leaders' precipitous actions and its antiaristocratic bloodshed. He is often regarded as the founder of modern CONSERVATISM.

Burkina Faso \bůr-'kē-nə-'fä-sō\ *formerly* **Upper Volta** Country, West Africa. A landlocked country, it lies south of the SAHARA Desert. Area: 103,456 sq mi (267,950 sq km). Population (2005 est.): 13,492,000. Capital: OUAGADOUGOU. Ethnic groups are the MOSSI, HAUSA, FULANI, Mande, Bobo, and Senufo. Languages: French (official), Mossi, Dyula, Fula. Religions: Islam, traditional beliefs, Christianity. Currency: CFA franc. Burkina Faso consists of an extensive plateau characterized by a savanna, grassy in the north and sparsely forested in the south. The plateau is notched by the valleys of the Mouhoun (Black Volta), Nazinon (Red Volta), and Nakanbe rivers, which flow south into Ghana. The economy is largely agricultural. Burkina Faso is a republic with one legislative body; its chief of state is the president and its head of government the prime minister. Probably in the 14th century, the Mossi and Gurma peoples established themselves in eastern and central areas. The Mossi kingdoms of Yatenga and Ouagadougou existed into the early 20th century. A French protectorate was established over the region (1895–97), and its southern boundary was demarcated through an Anglo-French agreement. It was part of the Upper Senegal–Niger (see MALI) colony, then became a separate colony in 1919. It was constituted an overseas territory within the FRENCH UNION in 1947, became an autonomous republic within the FRENCH COMMUNITY in 1958, and achieved total independence in 1960. Since then it has been ruled primarily by the military and has experienced several coups; the country received its present name in 1984. A

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new constitution, adopted in 1991, restored multiparty rule; elected government returned in the 1990s. Economic problems plagued the country at the beginning of the 21st century.

Burkitt, Denis P(arsons) (b. Feb. 28, 1911, Enniskillen, N.Ire.—d. March 23, 1993, England) British surgeon and medical researcher. He discovered Burkitt LYMPHOMA, a lethal cancer of the lymphatic system with a high incidence among children. He showed that it was common in equatorial African regions where malaria and yellow fever are endemic and linked it to Epstein-Barr virus in children with immune systems depressed by chronic malaria. He later helped develop an effective chemotherapy treatment. Burkitt was also known for his theory that a high-fibre diet protects against colon cancer, publicized in his book *Don't Forget Fibre in Your Diet* (1979).

burlesque In literature, comic imitation of a serious literary or artistic form that relies on an extravagant incongruity between a subject and its treatment. It is closely related to PARODY, though burlesque is generally broader and coarser. Early examples include the comedies of ARISTOPHANES. English burlesque is chiefly drama. JOHN GAY's *The Beggar's Opera* (1728), HENRY FIELDING's *Tom Thumb* (1730), and RICHARD BRINSLEY SHERIDAN's *The Critic* (1779) are parodies of popular dramatic forms of the period. Victorian burlesque, usually light entertainment with music, was eclipsed by other popular forms by the late 19th century, and burlesque eventually came to incorporate and be identified with striptease acts (see BURLESQUE SHOW).

burlesque show Stage entertainment composed of slapstick sketches, bawdy humour, chorus numbers, and solo dances. Introduced in the U.S. in 1868 by a company of English chorus girls, it developed as a version of the MINSTREL SHOW, divided into three parts: (1) a series of coarse humorous songs, slapstick sketches, and comic monologues; (2) the olio, or mixture of variety acts (e.g., acrobats, magicians, singers); and (3) chorus numbers and occasionally a takeoff, or burlesque, on politics or a current play. The show ended with an exotic dancer or a boxing match. In the early 20th century, many performers, including FANNY BRICE, AL JOLSON, and W.C. FIELDS, began their careers in burlesque. The addition of the striptease in the 1920s made a star of GYPSY ROSE LEE, but censorship and competition from motion pictures soon led to burlesque's decline.

Burlingame, Anson (b. Nov. 14, 1820, New Berlin, N.Y., U.S.—d. Feb. 23, 1870, St. Petersburg, Russia) U.S. diplomat. He served in the U.S. House of Representatives (1855–61) and helped found the REPUBLICAN PARTY. As U.S. minister to China (1861–67), he implemented a policy of cooperation between China and the Western powers. He so impressed the Chinese government that in 1867 he was appointed imperial envoy to conduct China's international relations. He concluded the Burlingame Treaty, which established reciprocal rights of Chinese and U.S. citizens.

Burlingame, detail of an engraving by Perine & Giles, late 19th century.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Burlington City (pop., 2000: 38,889), northwestern Vermont, U.S. Lying on a hillside sloping toward Lake CHAMPLAIN, it is the largest city in the state and a port of entry. Chartered by Gov. Benning Wentworth of New Hampshire in 1763, it was named for the Burling family, who were pioneer landowners. Settlement began in 1773. Later it was a military post; in the WAR OF 1812 it saw several engagements between land batteries and British warships on the lake. It was the home of ETHAN ALLEN. It is the seat of the University of Vermont. Shelburne Museum, a reconstruction of early American life, is nearby.

Burma See MYANMAR

Burma Road Highway, South Asia. It runs 717 mi (1,154 km) from Lashio (in eastern Burma, now MYANMAR) northeast to Kunming (in YUNNAN, China). An extension runs east through China from Kunming, then north to CHONGQING. Completed in 1939, it functioned as a supply route to the interior of China, carrying war goods. It was seized by the Japanese in 1942 and reopened when it was connected to the STILWELL ROAD from India. Its importance diminished after World War II, but it has remained a link in a 2,100-mi (3,400-km) road system from YANGÔN, Myanmar, to Chongqing.

Burmese cat Breed of DOMESTIC CAT, presumably of Asian origin. Compactly built, it has a small, rounded head and wide-set, round, yellow eyes. The short, finely textured, glossy coat darkens as it matures from milk-chocolate to a rich sable brown and is paler on the underside; the ears, face, legs, and tail may be darker. The tapered tail may be kinked near the tip.

burn Damage caused to the body by contact with flames, hot substances, some chemicals, radiation (including sunlight), or electricity. Burns are classified by depth of SKIN damage and by percentage of skin damaged. First-degree burns injure only the epidermis (top layer), with redness, pain, and minimal EDEMA. In a second-degree burn, damage extends into the dermis (inner layer), with redness and blisters. Third-degree burns destroy the entire thickness of the skin. There is no pain, because the skin's pain receptors are destroyed. Burns deeper than the skin can release toxic materials into the bloodstream and may require amputation. Secondary SHOCK follows severe burns, caused by loss of fluid both in the destroyed tissue and in leaks from the damaged area. Treatment depends on severity; first-degree burns need only first aid; third-degree burns require long-term hospitalization. Depending on the type, extent, and site of the burn, it may be left exposed, covered with a bandage, or excised to remove dead tissue in preparation for skin grafts. Complications of burns include respiratory problems, infection, ULCERS in the stomach or duodenum, and, especially in brown skin, thick scarring. Seizures and hypertension after burns occur almost entirely in children. Survivors usually require plastic surgery, long-term physical therapy, and psychotherapy.

Burnaby District municipality (pop., 2001: 193,954), southwestern British Columbia, Canada. The settlement developed along with VANCOUVER in the late 19th century and is now an eastern suburb of that city. It is one of the province's chief commercial and industrial centres, with important trucking, warehousing, and petroleum-distribution facilities.

Burne-Jones \'bərn-'jōnz**, Sir Edward (Coley)** (b. Aug. 28, 1833, Birmingham, Eng.—d. June 17, 1898, London) British painter, illustrator, and designer. At Oxford he met his future collaborator, WILLIAM MORRIS. In 1856 he became apprenticed to DANTE GABRIEL ROSSETTI. His paintings portray the romantic medieval imagery favoured by the PRE-RAPHAELITES, and he drew inspiration from the elongated, melancholy figures of FRA FILIPPO LIPPI and SANDRO BOTTICELLI. He first achieved great success in 1877

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with an exhibition of paintings including *The Beguiling of Merlin* (1873–77). He was a founding member of Morris & Co. (1861), notably as a designer of stained glass and tapestries, and he executed 87 designs for the Kelmscott Press edition of Geoffrey Chaucer (1896), considered one the world's finest printed books. His work had great influence on the French Symbolist movement, and his revival of the ideal of the artist-craftsman influenced the development of 20th-century industrial design.

Burnet \bər-'net**, Sir (Frank) Macfarlane** (b. Sept. 3, 1899, Traralgon, Vic., Austl.—d. Aug. 31, 1985, Melbourne, Vic.) Australian physician and virologist. Burnet received his medical degree from the University of Melbourne. He later discovered a method for identifying bacteria by the viruses (bacteriophages) that attack them, and he shared a 1960 Nobel Prize with Peter Medawar for the discovery of acquired immunological tolerance to tissue transplants. He was knighted in 1951.

Burnett, Carol (b. April 26, 1933, San Antonio, Texas, U.S.) U.S. comedian and actress. She made her Broadway debut in *Once upon a Mattress* (1959), then appeared regularly on television in *The Garry Moore Show* (1959–62). Her gift for parody and her knock-kneed comic grace gained her a wide following. The weekly *Carol Burnett Show* (1966–77) became one of television's most popular programs and won her five Emmy Awards. She acted in several films, including *Pete 'n' Tillie* (1972) and *Annie* (1982), and returned to Broadway in *Moon over Buffalo* (1995).

Burnett, Frances (Eliza) Hodgson (b. Nov. 24, 1849, Manchester, Eng.—d. Oct. 29, 1924, Plandome, N.Y., U.S.) British-U.S. playwright and author. She is best remembered for the popular children's novel *Little Lord Fauntleroy* (1886), about an American boy who inherits an English earldom. *The Secret Garden* (1911), considered her best work, is a classic of children's literature. Other works include the novel *Through One Administration* (1883), about corruption in Washington, D.C., and the play *A Lady of Quality* (1896).

Burney, Charles (b. April 7, 1726, Shrewsbury, Shropshire, Eng.—d. April 12, 1814, Chelsea, Middlesex) British music historian. After being apprenticed to Thomas Arne, he taught music and played the organ. In 1770 he set off on European travels, undertaken to research his seminal *General History of Music*, 4 vol. (1776–89). His accounts of the many famous musicians and others he met, including Christoph Willibald Gluck and Carl Philipp Emanuel Bach, provide an entertaining and invaluable account of 18th-century European musical life and of intellectual life in general. The novelist Fanny Burney was his daughter.

Burney (d'Arblay), Fanny *orig.* **Frances Burney** (b. June 13, 1752, King's Lynn, Norfolk, Eng.—d. Jan. 6, 1840, London) English novelist. The self-educated daughter of Charles Burney, she wrote lively accounts of his social musical evenings. Her habit of recording observations of society led to *Evelina* (1778), an epistolary novel about an unsure young girl's social development; a landmark in the evolution of the novel of manners, it pointed the way to Jane Austen's novels. Her later novels include *Cecilia* (1782) and the potboiler *Camilla* (1796).

Fanny Burney, detail of an oil painting by her brother, E.F. Burney; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Burnham, Daniel H(udson) (b. Sept. 4, 1846, Henderson, N.Y., U.S.—d. June 1, 1912, Heidelberg, Ger.) U.S. architect and city planner. He pioneered the development of Chicago commercial architecture with his partner, John Wellborn Root (1850–91). Three of the firm's Chicago buildings were designated landmarks in 1962: the Rookery (1886), the Reliance Building (1890), and the Monadnock Building (1891), the last and tallest (16-story) U.S. masonry skyscraper. As chief consulting architect for Chicago's World's Columbian Exposition (1893), Burnham chose firms working in academic eclecticism, the antithesis of the Chicago School. The exposition's resulting "White City," with its boulevards, gardens, and Classical facades, influenced subsequent planning in the U.S. Burnham's plan for Chicago (1907–09), which the city used for many years, is a classic example of U.S. city planning.

Burns, George *orig.* **Nathan Birnbaum** (b. Jan. 20, 1896, New York, N.Y., U.S.—d. March 9, 1996, Beverly Hills, Calif.) U.S. comedian best known for his collaboration with Gracie Allen (1902–64). Burns and Allen formed a comedy team in 1925 and were married in 1926. They performed on radio in *The George Burns and Gracie Allen Show* (1932–50), with Burns playing the straight man to Allen's malaprop-prone chatterbox, before their show moved to television (1950–58). They made 13 films together, including *The Big Broadcast* films of 1932, 1936, and 1937. Burns returned to the screen in films such as *The Sunshine Boys* (1975, Academy Award) and *Oh, God!* (1977) and its sequels. Famous for his wry humour and his cigars, he continued performing into his late 90s.

Burns, Ken(neth Lauren) (b. July 27, 1953, Brooklyn, N.Y., U.S.) U.S. documentary filmmaker. He founded his own production company in 1975 and made such documentary films as *Brooklyn Bridge* (1981), *The Shakers* (1984), *The Statue of Liberty* (1985), and *The Congress* (1988). His acclaimed series *The Civil War* (1990), televised on PBS, won numerous filmmaking and history awards. His later television documentaries include *Baseball* (1994), *Lewis and Clark* (1997), *Frank Lloyd Wright* (1998), and *Jazz* (2001).

Burns, Robert (b. Jan. 25, 1759, Alloway, Ayrshire, Scot.—d. July 21, 1796, Dumfries, Dumfriesshire) National poet of Scotland. The son of a poor farmer, he early became familiar with orally transmitted folk song and tales. His father's farm failed, and a farm he started himself quickly went bankrupt. Handsome and high-spirited, he engaged in a series of love affairs, some of which produced children, and celebrated his lovers in his poems. His *Poems, Chiefly in the Scottish Dialect* (1786) brought acclaim but no financial security, and he eventually took a job as an exciseman. He later began collecting and editing hundreds of traditional airs for James Johnson's *Scots Musical Museum* (1787–1803) and George Thomson's *Select Collection of Original Scotish Airs* (1793–1818); he substantially wrote many of these songs, though he did not claim them or receive payment for them. Among his best-known songs are "Auld Lang Syne," "Green Grow the Rashes, O," "John Anderson My Jo," "A Red, Red Rose," and "Ye Banks and Braes o' Bonnie Doon." He freely proclaimed his radical opinions, his sympathies with the common people, and his rebellion against orthodox religion and morality.

Robert Burns, detail of an oil painting by Alexander Nasmyth; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Burnside, Ambrose (Everett) (b. May 23, 1824, Liberty, Ind., U.S.—d. Sept. 13, 1881, Bristol, R.I.) Union general in the American Civil War. A graduate of West Point, he was promoted to major general in 1862 and replaced George B. McClellan as commander of the Army of the Potomac; he was himself replaced after the Union loss at the Battle of Fredericksburg. He resigned in 1864 after the "Burnside mine" fiasco in the Petersburg Campaign, when a mine explosion intended to damage Confederate troops resulted in heavy Union losses. He was governor of Rhode Island (1866–69) and a U.S. senator (1875–81). He originated the fashion of side whiskers, later known as "sideburns."

Burnt Njáll See Njáls saga

Burr, Aaron (b. Feb. 6, 1756, Newark, N.J.—d. Sept. 14, 1836, Port Richmond, N.Y., U.S.) U.S. politician, third vice president of the U.S. (1801–05). He served in the American Revolution on George Washington's staff until 1779. He had a successful law practice in New York from 1782 and served as state attorney general (1789–91) and in the U.S. Senate (1791–97). In 1800 he won the vice presidential nomination on the Jeffersonian Republican ticket. In the election, he and Thomas Jefferson received the same number of electoral college votes; under procedures then prevailing, the electors had cast their votes for both Jefferson and Burr without indicating which should be president and which vice president. The election went to the House of Representatives, which became

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deadlocked. Jefferson eventually was chosen president after Alexander Hamilton endorsed him; Burr became vice president. Burr resented Hamilton's action and his later effort to block Burr's nomination for governor of New York in 1804. Following some remarks by Hamilton about Burr's character, Burr challenged him to a duel, in which Hamilton was mortally wounded. Burr fled to Philadelphia, where with Gen. James Wilkinson he planned an invasion of Mexico. He was tried for treason in 1807 before John Marshall, whose narrow interpretation of the constitutional charge led to acquittal. Under a cloud, Burr left for Europe, where he tried in vain to interest English and French authorities in his scheme to conquer Florida. In 1812 he returned to New York to resume his law practice.

burro See donkey

Burroughs, Edgar Rice (b. Sept. 1, 1875, Chicago, Ill., U.S.—d. March 19, 1950, Encino, Calif.) U.S. novelist. Burroughs worked as an advertising copywriter before trying fiction. His jungle adventure novel *Tarzan of the Apes* (1914) became the first of 25 books featuring Tarzan, the son of an English nobleman abandoned in Africa and raised by apes. He wrote 43 other novels.

Burroughs, John (b. April 3, 1837, near Roxbury, N.Y., U.S.—d. March 29, 1921, en route from California to New York) U.S. essayist and naturalist. In his early years he worked as a teacher, farmer, and U.S. Treasury Department clerk. In 1873 he moved to a farm in the Hudson River valley. Traveling extensively, he hiked and camped with John Muir and Theodore Roosevelt, among other friends, and accompanied an expedition to Alaska. His many books helped establish the genre of the nature essay; they include *Wake-Robin* (1871), *Birds and Poets* (1877), *Locusts and Wild Honey* (1879), *Ways of Nature* (1905), and *Field and Study* (1919).

Burroughs, William S(eward) (b. Jan. 28, 1855, Auburn, N.Y., U.S.—d. Sept. 15, 1898, Citronelle, Ala.) U.S. inventor. He was self-supporting from age 15. In 1885 he constructed his first calculating machine; though it proved commercially impractical, he patented a practical model in 1892. This machine was a commercial success, but he died before he could earn much money from it. A year before his death he received the Franklin Institute's John Scott Medal. In 1905 the Burroughs Adding Machine Co. was organized as successor to the company he had started. William S. Burroughs was his grandson.

Burroughs, William S(eward) (b. Feb. 5, 1914, St. Louis, Mo., U.S.—d. Aug. 2, 1997, Lawrence, Kan.) U.S. novelist. The grandson of the inventor William S. Burroughs, he attended Harvard University and later became a member of the central group of the Beat movement. His experimental novels evoke, in deliberately erratic prose, a nightmarish, sometimes wildly humorous world. His early *Junkie* (1953) frankly describes his experiences as a heroin addict. *The Naked Lunch* (1959; film, 1991), his best-known work, is preoccupied with homosexuality and police persecution and vividly satirizes the grotesque world of the addict. (Burroughs accidentally killed his second wife while executing a drunken prank.) In his later novels, including *The Soft Machine* (1961), *Nova Express* (1964), *The Wild Boys* (1971), *Cities of the Red Night* (1981), and *The Western Lands* (1987), he further experimented with dystopian visions and radical technical devices.

Bursa *formerly* **Brusa** *ancient* **Prusa** City (pop., 1997: 1,066,559), northwestern Turkey. It was founded in the 3rd century BC, at the foot of the Mysian Mount Olympus near the southeastern shore of the Sea of Marmara, as the seat of the kings of Bithynia. It flourished under the Romans (see Roman Republic and Empire) and later under the Byzantine Empire. After Crusaders conquered Constantinople (modern Istanbul) in 1204, it was a seat of Byzantine resistance. The Ottoman Empire took it in the early 14th century and made it their first great capital. Conquered by Timur in the early 15th century, it was later recovered by the Ottomans. Though the Ottoman capital was later moved to Constantinople, Bursa continued to prosper. Under the Republic of Turkey, it is a centre for agriculture and is noted for its carpets and many 15th-century mosques.

Burschenschaft \'bůr-shən-ˌshäft\ (German: "youth association") German student organization that started as an expression of the nationalism prevalent in post-Napoleonic Europe. First appearing in 1815, the early groups were liberal and egalitarian and favored the political unification of Germany. The groups were suppressed under the Carlsbad Decrees and went underground until 1848, when they participated in the German revolution (see Revolutions of 1848). After German unification, they adopted a new and aggressive nationalism.

bursitis \bər-'sī-təs\ Inflammation of the lubricating sac (bursa) over a joint or extension of a joint, or between tendons and muscles or bones, caused by infection, injury, arthritis or gout, calcium deposits along a tendon or joint, or repetitive minor irritation. Common types are "housemaid's knee," "soldier's heel," "tennis elbow," and "weaver's bottom." Bursitis in the shoulder is the most common form. Usually occurring in people unaccustomed to physical labour, it may be so painful that the affected part cannot be used. Treatment includes rest, heat, mild exercise, and medication to relieve inflammation and remove calcium deposits.

Burt, Sir Cyril (Lodowic) (b. March 3, 1883, Stratford-upon-Avon, Warwickshire, Eng.—d. Oct. 10, 1971, London) British psychologist. He taught at the University of London (1924–50), becoming known for his pioneering work in educational psychology, especially mental testing and statistical analysis. His studies of human intelligence convinced him that intelligence was primarily inherited. Subsequent examination indicated that he had fabricated some of the data, though some of his earlier work remained unaffected by this revelation. His books, which were very popular in England and went through many editions, include *The Factors of the Mind* (1940), *The Backward Child* (1961), *The Young Delinquent* (1965), and *The Gifted Child* (1975).

Burton, Richard *orig.* **Richard Walter Jenkins, Jr.** (b. Nov. 10, 1925, Pontrhydyfen, Wales—d. Aug. 5, 1984, Geneva, Switz.) British-U.S. actor. He first won success on the stage in *The Lady's Not for Burning* in London (1949) and on Broadway (1950). His first Hollywood film role was in *My Cousin Rachel* (1952). During the filming of *Cleopatra* (1963) he had a highly publicized love affair with Elizabeth Taylor, whom he later twice married. Known for his resonant voice and his Welsh mournfulness, he starred again on Broadway in *Camelot* (1960) and an acclaimed *Hamlet* (1964). Among his other films are *The Spy Who Came in from the Cold* (1965), *Who's Afraid of Virginia Woolf?* (1966), and *Equus* (1977).

Burton, Robert (1577–1640) British scholar and writer. He spent most of his life as a vicar at Oxford. His great *Anatomy of Melancholy* (1621) describes the kinds, causes, symptoms, and cures of melancholy in a lively, elegant, and sometimes humorous style; a mine of classical erudition and curious information, it is an index to the philosophical and psychological ideas of its time. His Latin comedy *Philosophaster* (1606) is a vivacious exposure of charlatanism.

Burton, Sir Richard (Francis) (b. March 19, 1821, Torquay, Devonshire, Eng.—d. Oct. 20, 1890, Trieste, Austria-Hungary) English scholar-explorer and Orientalist. Expelled from Oxford in 1842, Burton went to India as a subaltern officer. There he disguised himself as a Muslim and wrote detailed reports of merchant bazaars and urban brothels. He then traveled to Arabia, again disguised as a Muslim, and became the first non-Muslim European to penetrate the forbidden holy cities; he recounted his adventures in *Pilgrimage to El-Medinah and Mecca* (1855–56), a classic account of Muslim life. In 1857–58 he led an expedition with John Hanning Speke in search of the source of the Nile River; stricken with malaria, he turned back after becoming the first European to reach Lake Tanganyika. His travels resulted in a total of 43 accounts of such subjects as Mormons, West African peoples, the Brazilian highlands, Iceland, and Etruscan Bologna. He learned 25 languages and numerous dialects; among his 30 volumes of translations were ancient Eastern manuals on the art of love, and he larded his famous *Arabian Nights* translation with ethnological footnotes and daring essays that won him many enemies in Victorian society. After his death his wife, Isabel, who was a devout Catholic, burned his 40 years of diaries and journals.

Buru *Dutch* **Boeroe** \'bü-rü\ Island, Indonesia. Located west of Ceram in the western Moluccas, it measures 90 mi (145 km) long by 50 mi (81 km) wide. Namlea, the chief town, lies on the narrow coastal plain. It was taken by the Dutch in the mid-17th century. It became part of Indonesia after World War II. Indonesia used Buru for a prison camp following the 1965 attempted coup; most of the prisoners had been freed by 1981.

Burundi \bů-'rün-dē\ *officially* **Republic of Burundi** Country, east-central Africa. Area: 10,740 sq mi (27,816 sq km). Population (2005 est.): 7,795,000. Capital: Bujumbura. The population is divided primarily between the approximately four-fifths who are Hutu and the approximately one-fifth who are Tutsi. The first inhabitants, the Twa Pygmies, make up about 1% of the population. Languages: Rundi (Kirundi), French (both official), Swahili. Religions: Christianity (mostly Roman Catholic; also Protestant, other Christians); also traditional beliefs. Currency: Burundi franc. Burundi occupies a high plateau straddling the divide of

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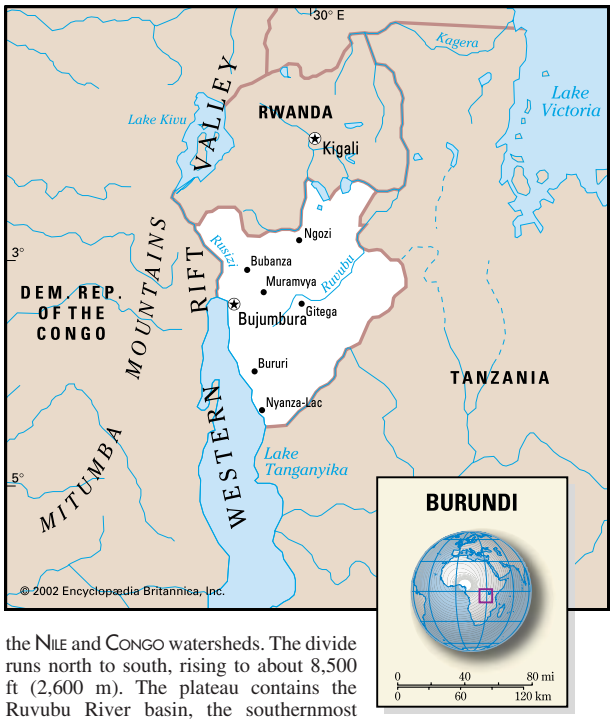

the Nile and Congo watersheds. The divide runs north to south, rising to about 8,500 ft (2,600 m). The plateau contains the Ruvubu River basin, the southernmost extension of the Nile basin. In the west the Rusizi River connects Lake Kivu in the north with Lake Tanganyika to the south. Burundi has a developing economy based primarily on agriculture. It is governed by a military regime. It has one legislative house, and its head of state and government is the president assisted by a vice president. Original settlement by the Twa was followed by Hutu settlement, which occurred gradually and was completed by the 11th century. The Tutsi arrived 300–400 years later; though a minority, they established the kingdom of Burundi in the 16th century. In the 19th century the area came within the German sphere of influence, but the Tutsi remained in power. Following World War I, the Belgians took control of the area; their administration was replaced by a UN trusteeship after World War II. Colonial conditions had intensified Hutu-Tutsi ethnic animosities, and, as independence neared, hostilities flared. Independence was granted in 1962 in the form of a kingdom ruled by the Tutsi. In 1965 the Hutu rebelled but were brutally repressed. The two groups clashed violently throughout the rest of the 20th century, although the number of deaths did not approach the nearly one million people killed in Rwanda. The unstable government that existed in these surroundings was overthrown by the military in 1996. In 2001 a transitional government took power, but political instability continued in the region.

bus Device on a computer's motherboard that provides a data path between the CPU and attached devices (keyboard, mouse, disk drives, video cards, etc.). Like a vehicular bus that stops at designated stations to pick up or drop off riders, a computer bus receives a data signal from the CPU and drops it off at the appropriate device (for example, the contents of a file in RAM are sent, via the bus, to a disk drive to be stored permanently). Conversely, data signals from devices are sent back to the CPU. On a network, a bus provides the data path between the various computers and devices. See also USB.

bus Large motor vehicle designed to carry passengers usually along a fixed route according to a schedule. The first gasoline-powered bus was built in Germany in 1895 and carried eight passengers. The first integral-frame bus was constructed in the early 1920s in the U.S. In the 1930s DIESEL ENGINES were introduced, providing greater power and fuel efficiency to larger buses. With the development of highway systems, transcontinental bus lines became common in North America. Double-decked buses are used in some European cities; articulated buses pull trailers with flexible joints. Trolley buses, whose electric motors draw power from overhead wires, are now used mostly in European cities.

Bush, George (Herbert Walker) (b. June 12, 1924, Milton, Mass., U.S.) 41st president of the U.S. (1989–93). Bush was the son of Prescott Bush, an investment banker and U.S. senator from Connecticut. He served in World War II as a torpedo bomber pilot on aircraft carriers in the Pacific, flying some 58 combat missions; he was shot down by the Japanese in 1944. After graduating from Yale University in 1948, he started an oil business in Texas. He was elected to a Republican seat in the U.S. House of Representatives (1966–70) and later served as ambassador to the UN (1971–72), chief of liaison to China (1974–76), and head of the CIA (1976–77). In 1980 he lost the Republican Party nomination for president to RONALD REAGAN. Bush served as vice president under Reagan (1981–89), whom he succeeded as president, defeating Michael Dukakis. He made no dramatic departures from Reagan's policies. In 1989 he ordered a brief military invasion of Panama, which toppled that country's leader, Gen. MANUEL NORIEGA. He helped impose a UN-approved embargo against Iraq in 1990 to force its withdrawal from Kuwait. When Iraq refused, he authorized a U.S.-led air offensive that began the PERSIAN GULF WAR. Despite general approval of his foreign policy, an economic recession led to his defeat by BILL CLINTON in 1992. His son GEORGE W. BUSH was elected governor of Texas in 1994 and president of the U.S. in 2000. Another son, Jeb Bush, was elected governor of Florida in 1998.

Bush, George W(alker) (b. July 6, 1946, New Haven, Conn., U.S.) Governor of Texas (1995–2000) and 43rd president of the U.S. (from 2001). The eldest child of GEORGE BUSH, the 41st president of the U.S. (1989–93), George W. Bush attended Yale University and Harvard Business School. After spending a decade in the oil business with mixed success, he served as managing general partner of the Texas Rangers professional baseball franchise. In 1994 he was elected governor of Texas and won reelection by a landslide in 1998. In 2000 Bush captured the Republican Party presidential nomination. Despite losing the national popular vote to AL GORE by more than 500,000 votes, he gained the presidency when the U.S. Supreme Court reversed a recount order by the Florida Supreme Court, enabling him to secure a narrow majority in the ELECTORAL COLLEGE (271–266). In June 2001 Bush signed into law a $1.35 trillion tax-cut bill. In foreign affairs, his administration refused to abide by the Kyoto Protocol on reducing the emission of gases responsible for the GREENHOUSE EFFECT, withdrew from the Treaty on the Limitation of Anti-Ballistic Missile Systems, and attempted to remove U.S. citizens from the jurisdiction of the new INTERNATIONAL CRIMINAL COURT. Following the terrorist attacks on the WORLD TRADE CENTER in NEW YORK CITY and the PENTAGON building near Washington, D.C., in September 2001 (see SEPTEMBER 11 ATTACKS), the Bush administration's main priorities shifted to domestic security and counterterrorism. Bush identified Osama BIN LADEN and his AL-QAEDA network as responsible for the attacks. In October he launched a military campaign against Afghanistan's TALIBAN government, which harboured bin Laden; the invasion of the country routed al-Qaeda and forced the Taliban from power. In late 2002 Bush and British Prime Minister TONY BLAIR accused the Iraqi government of ṢADDĀM ḤUSSEIN of continuing to possess and develop biological, chemical, and nuclear weapons in violation of UN mandates. After failing to persuade France, Russia, and other UN Security Council members that those weapons would not be uncovered by UN weapons inspections, which had resumed in November, Bush and Blair led an attack on Iraq that toppled Ṣaddām's regime in 2003. Though no such weapons were found, fighting continued and escalated, as the United States helped Iraq pave the way for democratic elections. Bush faced a strong challenge for the presidency in 2004 by Democratic Senator John Kerry but defeated him in a close contest.

George W. Bush.
ERIC DRAPER/WHITE HOUSE PHOTO

Bush, Vannevar (b. March 11, 1890, Everett, Mass., U.S.—d. June 28, 1974, Belmont, Mass.) U.S. electrical engineer and administrator. He taught principally at MIT (1919–38, 1955–71). In the late 1920s and '30s, Bush and his students built several electronic ANALOG COMPUTERS to solve

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DIFFERENTIAL EQUATIONS. He helped found Raytheon Co., and he served as president of the Carnegie Institute (1939–55). In 1941 he became director of the U.S. Office of Scientific Research and Development, in which capacity he helped organize the MANHATTAN PROJECT. By providing government support for university-based scientific research, the agency paved the way for postwar federal support of basic scientific research. As adviser to Pres. FRANKLIN ROOSEVELT, he laid the groundwork for the establishment of the National Science Foundation (1950). An information retrieval and annotation system he described became the theoretical prototype of HYPERTEXT, the basis of the WORLD WIDE WEB.

bushidō \'bù-shi-dō\ *Japanese* **"way of the warrior"** Code of conduct of the SAMURAI class of Japan, first formulated in the 17th century. Its precise content varied over time, taking on overtones of ZEN Buddhism and CONFUCIANISM. Along with self-discipline, honour, and austerity, one constant feature was the samurai's obligation to his lord, which superseded even familial ties. This obligation of loyalty and sacrifice was transferred to the emperor with the MEIJI RESTORATION and was a salient feature of the Japanese national mindset until the end of World War II (1945).

bushmaster Species (*Lachesis muta*) of PIT VIPER, found in scrublands and forests from Costa Rica south to the Amazon River basin. It is normally about 6 ft (1.8 m) long but reportedly may grow to twice this length. It is pinkish or tan, marked with large, dark, diamond-shaped blotches. Though seldom encountered, the bushmaster is potentially lethal.

Bushmen See SAN

business cycle Periodic fluctuation in the rate of economic activity, as measured by levels of employment, prices, and production. Economists have long debated why periods of prosperity are eventually followed by economic crises (stock-market crashes, bankruptcies, unemployment, etc.). Some have identified recurring 8-to-10-year cycles in market economies; longer cycles have also been proposed, notably by NIKOLAY KONDRATEV. Apart from random shocks to the economy, such as wars and technological changes, the main influences on the level of economic activity are INVESTMENT and CONSUMPTION. An increase in investment, as when a factory is built, leads to consumption because the workers employed to build the factory have wages to spend. Conversely, increases in consumer demand cause new factories to be built to satisfy the demand. Eventually the economy reaches its full capacity, and, with little free capital and no new demand, the process reverses itself and contraction ensues. Natural fluctuations in agricultural markets, psychological factors such as a bandwagon mentality, and changes in the MONEY SUPPLY have all been proposed as explanations for initial changes in investment and consumption. After World War II many governments used MONETARY POLICY to moderate the business cycle, aiming to prevent the extremes of INFLATION and DEPRESSION by stimulating the national economy in slack times and restraining it during expansions. See also PRODUCTIVITY.

business finance Raising and managing of funds by business organizations. Such activities are usually the concern of senior managers, who must use financial forecasting to develop a long-term plan for the firm. Shorter-term budgets are then devised to meet the plan's goals. When a company plans to expand, it may rely on cash reserves, expected increases in sales, or bank loans and trade credits extended by suppliers. Managers may also decide to raise long-term capital in the form of either DEBT (BONDS) or EQUITY (STOCK). The value of the company's stock is a constant concern, and managers must decide whether to reinvest PROFITS or to pay DIVIDENDS. Other duties of financial managers include managing ACCOUNTS RECEIVABLE and fixing the optimum level of inventories. When deciding how to deploy corporate assets to increase growth, financial managers must also consider the benefits of mergers and acquisitions, analyzing economies of scale and the ability of businesses to complement each other. See also CORPORATE FINANCE; INVENTORY.

business law *or* **commercial law** *or* **mercantile law** Legal rules and principles bearing on business organizations and commercial matters. It regulates various forms of legal business entities, including sole proprietors, partnerships, registered companies with limited liability, agents, and multinational corporations. Nearly all statutory rules governing business organizations are intended to protect creditors or investors. In addition, specific bodies of law regulate commercial transactions, including the sale and carriage of goods (terms and conditions, specific performance, breach of contract, insurance, bills of lading), consumer credit agreements (letters of credit, loans, security, bankruptcy), and relations between employers and employees (wages, conditions of work, health and safety, fringe benefits, and trade unions). It is a broad and continually evolving field. See also AGENCY; CORPORATION; DEBTOR AND CREDITOR; INTELLECTUAL PROPERTY; LABOUR LAW.

Busoni \bü-'sō-nē**, Ferruccio (Dante Michelangiolo Benvenuto)** (b. April 1, 1866, Empoli, Tuscany—d. July 27, 1924, Berlin, Ger.) Italian-born German composer and pianist. He first performed in public at age 7, and at 12 he conducted his own *Stabat Mater*. He taught in Helsinki, Moscow, and Boston before settling permanently in Berlin in 1894. He won fame as a virtuoso pianist and gave premieres of the works of major composers. His most celebrated work in his lifetime, the opera *Die Brautwahl* (1910), was followed by the operas *Arlecchino* (1916) and *Turandot* (1917), but the unfinished and posthumously produced *Doktor Faust* is regarded as his masterpiece. Of his orchestral works, his piano concerto (1904) is most widely performed. His many piano pieces include the *Fantasia contrappuntistica* (1910), six sonatinas (1910–20), and arrangements of organ works by JOHANN SEBASTIAN BACH.

bustard Any of about 23 species of medium-sized to large game birds in the family Otididae, related to the CRANES and RAILS in the order Gruiformes. Bustards are found in Africa, southern Europe, Asia, Australia, and New Guinea. A tall running bird, they have long legs, a compact body carried in a horizontal position, and an erect neck placed forward of the legs. The best-known species is the great bustard (*Otis tarda*), the largest European land bird. Males of this species weigh as much as 31 lbs (14 kg) and reach lengths of 4 ft (1.2 m), with 8-ft (2.4-m) wingspreads.

Bute, John Stuart, 3rd earl of *orig.* **John Stuart** (b. May 25, 1713, Edinburgh, Scot.—d. March 10, 1792, London, Eng.) Scottish-born British statesman. He was the tutor and constant companion of the future GEORGE III; when the latter ascended to the throne, he named Bute secretary of state (1761). As prime minister (1762–63), Bute negotiated the peace ending the SEVEN YEARS' WAR, but, having failed to create a stable administration, he resigned in 1763.

Buthelezi \ˌbüt-ᵊl-'ā-zē**, Mangosuthu G(atsha)** (b. Aug. 27, 1928, Mahlabatini, Natal, S.Af.) ZULU chief and leader of the INKATHA FREEDOM PARTY. Descended from CETSHWAYO, he assumed leadership of the Buthelezi clan in 1953. He was elected head of the nonindependent black state of KwaZulu in 1972 and revived Inkatha in 1975 after breaking with the AFRICAN NATIONAL CONGRESS (ANC). Rejecting full independence for KwaZulu, he worked within the white establishment to end APARTHEID. In 1990–94 he engaged in a fierce struggle for leadership with the ANC; thousands were killed in Inkatha-ANC clashes. Following the 1994 national elections, he was appointed minister of home affairs by NELSON MANDELA; he held the post until 2004.

Butkus \'bət-kəs**, Dick** *in full* **Richard J. Butkus** (b. Dec. 9, 1942, Chicago, Ill., U.S.) U.S. football player. He played for the University of Illinois before joining the Chicago Bears (1965–73). He became known for his aggression and toughness on the field as much as for his playmaking ability. His career was shortened by injuries; after retirement he became active in television and sports promotion. Butkus is considered among the best middle linebackers of all time.

Butler, Benjamin F(ranklin) (b. Nov. 5, 1818, Deerfield, N.H., U.S.—d. Jan. 11, 1893, Washington, D.C.) U.S. army officer. A prominent attorney in Lowell, Mass., Butler served two terms in the state legislature (1853, 1859). In the AMERICAN CIVIL WAR he commanded Fort Monroe, Va., where he refused to return fugitive slaves to the Confederacy, calling them "contraband of war," an interpretation later upheld by the government. He oversaw the occupation of New Orleans in 1862 but was recalled because of his harsh rule. He led the Union army in Virginia, but after several defeats he was relieved of his command in 1865. In the U.S. House of Representatives (1867–75, 1877–79), he was a RADICAL REPUBLICAN prominent in the impeachment trial of Pres. ANDREW JOHNSON. He switched parties in 1878 to support the GREENBACK MOVEMENT and later served as governor of Massachusetts (1882–84).

Butler, Joseph (b. May 18, 1692, Wantage, Berkshire, Eng.—d. June 16, 1752, Bath, Somerset) British bishop and moral philosopher. He became dean of St. Paul's Cathedral in 1740 and bishop of Durham in 1750. His works defended revealed religion against the rationalist thinkers of his time. His *The Analogy of Religion, Natural and Revealed, to the Constitution and Course of Nature* (1736) attacked the doctrine of DEISM, according to which knowledge of God is acquired through reason rather than revelation. His *Of the Nature of Virtue,* appended to the *Anal-*

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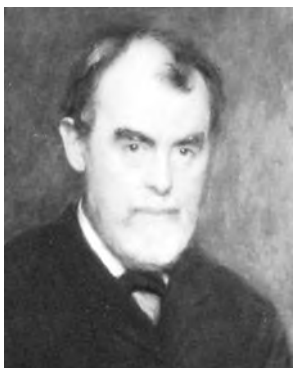
ogy, presented a refutation of hedonism and of the notion that self-interest is the ultimate principle of good conduct.

Butler, Nicholas M(urray) (b. April 2, 1862, Elizabeth, N.J., U.S.—d. Dec. 7, 1947, New York, N.Y.) U.S. educator. He received his Ph.D. from Columbia University. He was the founding president of what is today Columbia's Teachers College (1886–91). As president of Columbia University itself (1901–45), he led the institution to world renown. Early in his career he criticized prevailing pedagogical methods, but later he turned on pedagogical reform itself, decrying vocationalism in education and behaviorism in psychology. A champion of international understanding, he helped establish the Carnegie Endowment for International Peace in 1910 and served as its president (1925–45). In 1931 he shared the Nobel Peace Prize with JANE ADDAMS.

Butler, R(ichard) A(usten), baron of Saffron Walden (b. Dec. 9, 1902, Attock Serai, India—d. March 8, 1982, Great Yeldham, Essex, Eng.) British politician. Known as "Rab" Butler, he was elected to Parliament in 1929 and served in various Conservative governments in the 1930s. As minister of education, he was responsible for the 1944 Education Act, which established free secondary education. After the Tories' electoral losses in 1945, he helped remold the Conservative Party, serving as its leader (1955–61). He served as chancellor of the exchequer (1951–55), home secretary (1957–62), and foreign secretary (1963–64).

Butler, Samuel (b. Feb. 8, 1612, Strensham, Worcestershire, Eng.—d. Sept. 25, 1680, London) British poet and satirist. He held several clerical positions, where he could observe cranks and scoundrels like those whose antics he targeted. He is famous for *Hudibras* (1663–78), a mock-heroic poem skewering the fanaticism, pretentiousness, pedantry, and hypocrisy he saw in militant PURITANISM. It is the most memorable BURLESQUE poem in English and the first English satire that successfully attacked ideas rather than personalities.

Butler, Samuel (b. Dec. 4, 1835, Langar Rectory, Nottinghamshire, Eng.—d. June 18, 1902, London) British novelist, essayist, and critic. Descended from distinguished clergymen, he grappled for many years with Christianity and evolution, first embracing, then rejecting, CHARLES DARWIN's theories in his writings. He is best known for *The Way of All Flesh* (1903), his autobiographical novel that tells, with ruthless wit and lack of sentiment, the story of his escape from the suffocating moral atmosphere of his home circle. In his lifetime his reputation rested on the utopian satire *Erewhon* (1872), which foreshadowed the end of the Victorian illusion of eternal progress.



Samuel Butler, detail of an oil painting by Charles Gogin, 1896; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Buto \'byü-tō\ In ancient EGYPTIAN RELIGION, the cobra goddess who was tutelary goddess of Lower Egypt and, with the vulture-goddess Nekhbet of Upper Egypt, protector of the king. She was nurse to the infant god HORUS and helped his mother, ISIS, protect him from his uncle SETH. She was later identified with LETO. She is depicted as a cobra twined around a papyrus stem.

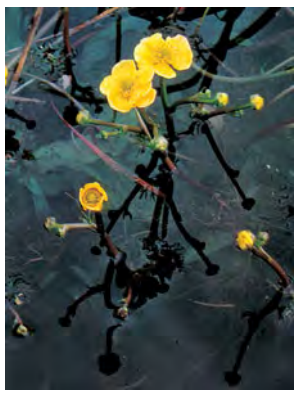
Buton \'bü-ˌtȯn\ *or* **Butung** \'bü-ˌtůŋ\ Island, east-central Indonesia. Lying off the southeast coast of CELEBES (Sulawesi), it is about 100 mi (160 km) long and has an area of about 2,000 sq mi (5,200 sq km). Its chief town is Baubau, on the southwestern coast. The coastal people are chiefly trading sailors and fishermen.

butte \'byüt\ (French: "hillock" or "rising ground") Flat-topped hill surrounded by a steep cliff, from the bottom of which a slope descends to the plain. The term is sometimes used for an elevation higher than a hill but not high enough to be a mountain. Buttes topped by horizontal platforms of hard rock are characteristic of the arid plateau region of the western U.S. A butte is similar to a MESA but generally smaller; both are created by erosional processes.

butter Solid emulsion of FAT globules and water made by churning CREAM, used as a food. Presumably known since the advent of animal husbandry, butter has long been used as a cooking fat and as a spread. It was traditionally a farm product, but with the advent of the cream separator in the late 19th century it began to be mass-produced. It is a high-energy food, containing about 715 calories per 100 grams. It is high in butterfat (80–85%) and low in protein. Colouring is sometimes added to enhance its natural yellow colour (from CAROTENE), and salt is often added.

butter-and-eggs *or* **toadflax** Common perennial herbaceous plant (*Linaria vulgaris*) of the SNAPDRAGON FAMILY, native to Eurasia and widely naturalized in North America. The plant bears flaxlike leaves and showy yellow and orange flowers that are two-lipped and spurred like snapdragons.

buttercup Any of about 250 species of herbaceous flowering plants constituting the genus *Ranunculus* of the family Ranunculaceae. Buttercups are especially common in the woods and fields of the northern temperate zone. The turban, or Persian buttercup (*R. asiaticus*), is the florist's ranunculus. Among the many wild species are the tall meadow buttercup (*R. acris*) and common water crowfoot (*R. aquatilis*). Other members of the family Ranunculaceae are widely distributed in all temperate and subtropical regions. In the tropics they occur mostly at high elevations. Their leaves are usually alternate and stalkless and may be simple or much divided. The flowers may be radially symmetrical or irregular. The family includes such flowers as ANEMONE, LARKSPUR, MARSH MARIGOLD, CLEMATIS, and hepatica (genus *Hepatica*).



Aquatic buttercup (*Ranunculus flabellaris*).
FRANCES V. DAVIS

butterfly Any of more than 17,000 LEPIDOPTERAN species found worldwide. Unlike MOTHS, butterflies are active during the day and are usually brightly coloured or strikingly patterned. Distinctive features are club-tipped antennae and a habit of holding the wings vertically over the back when at rest. With few exceptions the larvae and adults eat plants. Butterflies are classified into five or six families. The metalmarks of the family Lycaenidae are found chiefly in the New World tropics; some members of the family Nymphalidae are called snout butterflies. Other species (with their families) include the WHITE and SULPHUR butterflies (Pieridae), the SWALLOWTAIL BUTTERFLY (Papilionidae), the BLUE, COPPER, and HAIRSTREAK butterflies (Lycaenidae), and the ADMIRAL, MONARCH, and PAINTED LADY (Nymphalidae).

butterfly bush See BUDDLEIA

butterfly effect See CHAOTIC BEHAVIOR

butterfly weed North American plant (*Asclepias tuberosa*) of the MILKWEED FAMILY, a stout, rough-haired perennial with long horizontal roots. The leafy, erect, somewhat branching stem is about 1–3 ft (0.3–0.9 m) tall. In midsummer it bears numerous clusters of bright orange flowers. Unlike most milkweeds, it has a scanty milky juice. It is native to dry fields and is often planted in wild gardens or grown as a border plant.

butternut Deciduous NUT-producing tree (*Juglans cinerea*) of the WALNUT family, native to eastern North America. A mature tree has gray, deeply furrowed bark. Each leaf has 11–17 yellowish green leaflets that are hairy underneath. Chocolate-coloured partitions divide the pith of the twig into many chambers. The egg-shaped fruit has a sticky, greenish brown husk. The hard, woody nut bears many ridges and contains a sweet, oily seed. The tree is economically important for its edible nuts and for a yellow or orange dye obtained from the fruit husks. Some substances in the inner bark of the roots are used in medicines.

button Small disk or knob used as a fastener or ornament. It usually has holes or a shank through which it is sewn to one side of a garment. It is used to fasten or close the garment when it is passed through a loop or hole in the other side. The ancient Greeks fastened their tunics with buttons and loops. In medieval Europe, garments were laced or fastened together with brooches or clasps until the buttonhole was reinvented in the 13th century. Throughout history, buttons have been made in a range of sizes and materials, some elaborated into miniature works of art.

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buttress Exterior support, usually of masonry, projecting from the face of a wall and serving to strengthen it or resist outward thrust from an arch or roof. Buttresses also have a decorative function. Though used since ancient times (Mesopotamian temples featured decorative buttresses, as did Roman and Byzantine structures), they are especially associated with GOTHIC ARCHITECTURE. See also FLYING BUTTRESS.

Butung See BUTON

Buwayhid dynasty See BŪYID DYNASTY

Buxtehude \ˌbůk-stə-ˈhü-də\ **, Dietrich** (b. 1637, probably in Oldesloe, Holstein—d. May 9, 1707, Lübeck) Danish organist and composer. He held two organist positions before being appointed organist at the important Marienkirche in Lübeck (now in Germany), where he remained for almost 40 years. There he reinstated the tradition of the *Abendmusik*, an annual series of church concerts. His reputation was such that in 1705 JOHANN SEBASTIAN BACH traveled 200 miles there to hear him play and ended up staying three months. Buxtehude's approximately 130 surviving vocal works, usually called cantatas, can instead be classified as concertos, chorale settings, and arias. All are imbued with a devout simplicity that contrasts strongly with the elaborations of their Bachian successors. He also composed almost 100 works for organ, some 20 keyboard suites, and more than 20 chamber sonatas.

Būyid \ˈbü-yid\ **dynasty** *or* **Buwayhid** \bü-ˈwī-hid\ **dynasty** (945–1055) Muslim Shīʿite dynasty founded by three sons of Būyeh, a Daylamite (north Persian) fisherman. They captured Baghdad in 945, and each brother took a portion of territory. After they died, one Būyid leader, ʿAḍūd al-Dawlah, consolidated control (977) and enlarged the Būyid domain. From 983 the territories were split among family members. The dynasty ended when the Turkic SELJŪQ DYNASTY took Baghdad in 1055. Būyid art maintained its influence throughout the Seljūq reign; Būyid silverwork is notable.

buzkashi *Persian* **"goat dragging"** An equestrian game in which riders compete to gain control of a goat or calf carcass that has been decapitated and dehoofed. Buzkashi likely originated as an entertaining variant of ordinary herding or raiding. It is popular predominantly among Turkic peoples in Afghanistan but can be found in the Muslim republics of Central Asia and in parts of northwestern China. Buzkashi has two main forms. The traditional version, *tudabaray*, has no formal teams and is not played within clearly defined boundaries. Games often involve hundreds of riders, and the objective is to gain sole possession of the carcass and ride it free and clear of all other riders. The modern government-sponsored *qarajay* style involves two teams of 10–12 riders that contend on a defined field with goals. Beginning in the early 1950s, the Kabul-based Afghan government hosted national tournaments.

buzz bomb See V-1 MISSILE

buzzard Chiefly British term for any of several BIRDS OF PREY of the HAWK genus *Buteo* (family Accipitridae) and, in North America, various New World VULTURES, especially the TURKEY VULTURE. In Australia, a large hawk of the genus *Hamirostra* is called a black-breasted buzzard. The buteos, also called buzzard hawks, can usually be distinguished when soaring by their broad wings and expansive rounded tail. The plumage of most species is dark brown above and white or mottled brown below; the tail and underside of the wings are usually barred. Buteos customarily prey on insects, small mammals, and occasionally birds. They nest in trees or on cliffs. Species range over much of the New World, Eurasia, and Africa. The red-tailed hawk, the most common North American buteo, is about 2 ft (60 cm) long.

Buzzards Bay Inlet of the Atlantic Ocean, southeastern Massachusetts, U.S. Connected to Cape Cod Bay by the Cape Cod Canal on the northeast and bordered on the southeast by the Elizabeth Islands, it is 30 mi (48 km) long and 5–10 mi (8–16 km) wide. Its coastline is dotted with fishing villages and summer resorts. Buzzards Bay town (pop., 2000: 3,549) is the site of Massachusetts Maritime Academy.

Byatt, A(ntonia) S(usan) *orig.* **Antonia Susan Drabble** (b. Aug. 24, 1936, Sheffield, Eng.) British novelist and scholar. Sister of MARGARET DRABBLE, she was educated at Cambridge and taught at University College, London. Her third novel, *The Virgin in the Garden* (1978), won high acclaim; the sequel *Still Life* (1985) followed. *Possession* (1990), a virtuoso double narrative, won the 1990 Booker Prize, and both it and *Angels and Insects* (1991) were adapted for film. Her story collections include *The Djinn in the Nightingale's Eye* (1995) and *Elementals* (1998). *Degrees of Freedom* (1965) was the first major study of IRIS MURDOCH. In 2002 Byatt published the novel *A Whistling Woman*, the last of a series of four novels—beginning with *The Virgin in the Garden*—featuring the character Frederica Potter.

Byblos \ˈbi-bləs\ *modern* **Jbail** *or* **Jubayl** \jù-ˈbāl\ Ancient coastal city, eastern Mediterranean Sea. Located north of BEIRUT, Leb., the site was occupied by at least the NEOLITHIC PERIOD (New Stone Age); extensive settlement developed during the 4th millennium BC. As the chief harbour for the export of cedar to Egypt, it was a great trading centre. Papyrus, an early writing surface produced in Egypt, received its original Greek name, *byblos*, from its export to the Aegean through the city; the English word Bible means essentially "the (papyrus) book." Almost all known early Phoenician inscriptions, most from the 10th century BC, come from Byblos. By that time TYRE had become the preeminent city in Phoenicia, and, though Byblos continued to flourish into Roman times, it never recovered its former supremacy.

Bydgoszcz \ˈbid-ˌgôshch\ City (pop., 2000 est.: 384,500), northern Poland. Originally a commercial city of the TEUTONIC ORDER, it received town rights in 1346. It prospered as a grain and timber centre until it was devastated in the 17th-century Swedish wars. In the 18th century the Bydgoszcz Canal, which linked the basins of the VISTULA and ODER rivers, made the city a major inland port. It fell under Prussian rule in 1772–1919. The Germans held it throughout World War II, but it was noted for its staunch resistance to the Nazi invasion of 1939. It remains important as a water transport route, connecting Upper Silesia with the Baltic ports.

Byelarus See BELARUS

Byelorussian language See BELARUSIAN LANGUAGE

bypass surgery See CORONARY BYPASS

Byrd, Richard E(velyn) (b. Oct. 25, 1888, Winchester, Va., U.S.—d. March 11, 1957, Boston, Mass.) U.S. naval officer, aviator, and polar explorer. After serving in World War I, he worked developing navigational aids for aircraft. In 1926 he and Floyd Bennett claimed to have reached the North Pole by airplane, becoming the first to do so. In 1928 Byrd began his explorations of Antarctica with the first expedition to his "Little America" base, which was followed in 1929 by a flight with three companions over the South Pole, again the first such flight. He led subsequent expeditions that discovered and mapped large areas of Antarctica. His several books include *Discovery* (1935) and *Alone* (1938), which chronicled his months spent alone in a camp near the South Pole. His brother Harry F. Byrd (1887–1966) served as a U.S. senator from Virginia (1933–65).

Byrd, William (b. 1543, Lincoln, Lincolnshire?, Eng.—d. July 4, 1623, Stondon Massey, Essex) British composer. He studied under THOMAS TALLIS and was appointed organist of Lincoln Cathedral at age 20. In 1572 he became organist of the Chapel Royal, sharing the post with Tallis. In 1575 the two men received from ELIZABETH I the exclusive license for the printing and selling of music in Britain. Though repeatedly prosecuted as a Roman Catholic, Byrd remained in favour with the queen. He is renowned as Britain's finest composer of sacred choral works, as well as for his keyboard music and songs. His works include three masses (for three, four, and five voices), some 220 Latin motets, four important Anglican services, and some 60 anthems, as well as some 100 virginal pieces (many preserved in the collections *Parthenia* and *The Fitzwilliam Virginal Book*).

Byrne, David (b. May 14, 1952, Dumbarton, Dunbartonshire, Scot.) Scottish-born U.S. singer and songwriter. At the Rhode Island School of Design in the mid-1970s, he cofounded the rock group Talking Heads as singer and guitarist. Identified with the new wave movement (see PUNK), the band's debut album *Talking Heads '77* (1977) was followed by releases that reflected Byrne's interest in experimental pop and African rhythms, including *Speaking in Tongues* (1983), *Stop Making Sense* (soundtrack for film of the same name; 1984), and solo albums such as *Rei Momo* (1989). An ethnomusicologist and producer, Byrne also wrote the score for choreographer TWYLA THARP's *The Catherine Wheel* (1980) and directed the film *True Stories* (1986).

Byron, George (Gordon) Byron, 6th Baron *known as* **Lord Byron** (b. Jan. 22, 1788, London, Eng.—d. April 19, 1824, Missolonghi, Greece) British Romantic poet and satirist. Born with a clubfoot and extremely sensitive about it, he was 10 when he unexpectedly inherited

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his title and estates. Educated at Cambridge, he gained recognition with *English Bards and Scotch Reviewers* (1809), a satire responding to a critical review of his first published volume, *Hours of Idleness* (1807). *Childe Harold's Pilgrimage* (1812–18), a poetic travelogue expressing melancholy and disillusionment, brought him fame, while his complex personality, dashing good looks, and many scandalous love affairs, with women and with boys, captured the imagination of Europe. Settling near Geneva, he wrote the verse tale *The Prisoner of Chillon* (1816), a hymn to liberty and an indictment of tyranny, and *Manfred* (1817), a poetic drama whose hero reflected Byron's own guilt and frustration. His greatest poem, *Don Juan* (1819–24), is an unfinished epic picaresque satire in OTTAVA RIMA. Among his numerous other works are verse tales and poetic dramas. He died of fever in Greece while aiding the struggle for independence, making him a Greek national hero.

byssinosis \ˌbi-sə-ˈnō-səs\ *or* **brown lung disease** Respiratory disorder caused by dust from cotton and other fibres, common among textile workers. In addition, the dust stimulates HISTAMINE release; air passages constrict, making breathing difficult. Over time the dust accumulates in the lung, producing a typical brown discoloration. Byssinosis today is seen in most cotton-producing regions of the world. Several years of exposure to cotton dust are needed before byssinosis develops. In advanced stages, it causes chronic, irreversible obstructive lung disease. Though cotton is by far the most common cause, flax, hemp, and other organic fibres can also produce byssinosis. There is evidence that a bacterial product found in the fibres is the cause of the disease.

byte See BIT

Byzantine architecture \ˈbi-zən-ˌtēn\ Building style of Constantinople (now Istanbul, formerly ancient Byzantium) after AD 330. Byzantine architects were eclectic, at first drawing heavily on Roman temple features. Their combination of the BASILICA and symmetrical central-plan (circular or polygonal) religious structures resulted in the characteristic Byzantine Greek-cross-plan church, with a square central mass and four arms of equal length. The most distinctive feature was the domed roof. To allow a dome to rest above a square base, either of two devices was used: the squinch (an arch in each of the corners of a square base that transforms it into an octagon) or the PENDENTIVE. Byzantine structures featured soaring spaces and sumptuous decoration: marble columns and inlay, mosaics on the vaults, inlaid-stone pavements, and sometimes gold coffered ceilings. The architecture of Constantinople extended throughout the Christian East and in some places, notably Russia, remained in use after the fall of Constantinople (1453). See also HAGIA SOPHIA.

Byzantine art Art associated with the BYZANTINE EMPIRE. Its characteristic styles were first codified in the 6th century and persisted with remarkable homogeneity until the capture of Constantinople by the Turks in 1453. Concerned almost exclusively with religious expression, it tends to reflect an intensely hierarchical view of the universe. It relies on vigour of line and brilliance of colour; individual features are absent, forms are flattened, and perspective is absent. Walls, vaults, and domes were covered in mosaic and fresco decoration in a total fusion of architectural and pictorial expression. Byzantine sculpture was largely limited to small ivory reliefs. The importance of Byzantine art to European religious art was immense; the style was spread by trade and expansion to the Mediterranean basin, eastern European centres, and especially Russia. See also BYZANTINE ARCHITECTURE.

Byzantine chant Unison liturgical chant of the GREEK ORTHODOX CHURCH from the era of the BYZANTINE EMPIRE to the 16th century. It probably derived principally from Hebrew and Syrian Christian liturgies. A system of eight MODES, very similar to the eight Greek modes, was used for psalms and hymns, each mode (or *echos*) consisting primarily of a few melodic formulas. The principal hymn genres were the *troparion* (one or more stanzas of poetic prose), the *kontakion* (a metrical sermon), and the *kanon* (a complexly ordered set of hymn types). See also GREGORIAN CHANT.

Byzantine Empire Empire, southeastern and southern Europe and western Asia. It began as the city of Byzantium, which had grown from an ancient Greek colony founded on the European side of the BOSPORUS. The city was taken in AD 330 by CONSTANTINE I, who refounded it as CONSTANTINOPLE. The area at this time was generally termed the Eastern Roman Empire. The fall of Rome in 476 ended the western half of the Roman Empire; the eastern half continued as the Byzantine Empire, with Constantinople as its capital. The eastern realm differed from the west in many respects: heir to the civilization of the HELLENISTIC era, it was more commercial and more urban. Its greatest emperor, JUSTINIAN (r. 527–565), reconquered some of western Europe, built the HAGIA SOPHIA, and issued the basic codification of Roman law. After his death the empire weakened. Though its rulers continued to style themselves "Roman" long after Justinian's death, "Byzantine" more accurately describes the medieval empire. The long controversy over ICONOCLASM within the eastern church prepared it for the break with the Roman church (see SCHISM OF 1054). During the controversy, Arabs and Seljuq Turks increased their power in the area. In the late 11th century, ALEXIUS I COMNENUS sought help from Venice and the pope; these allies turned the ensuing CRUSADES into plundering expeditions. In the Fourth Crusade the Venetians took over Constantinople and established a line of Latin emperors. Recaptured by Byzantine exiles in 1261, the empire was now little more than a large city-state. In the 14th century the Ottoman Turks began to encroach; their extended siege of Constantinople ended in 1453, when the last emperor died fighting on the city walls and the area came under Ottoman control.

Byzantium See ISTANBUL

Byzantine Emperors

Zeno	474–491
Anastasius I	491–518
Justin I	518–527
Justinian I	527–565
Justin II	565–578
Tiberius II Constantine	578–582
Maurice Tiberius	582–602
Phocas	602–610
Heraclius	610–641
Heraclius Constantine	641
Heraclonas (or Heraclius)	641
Constans II (Constantine Pogonatus)	641–668
Constantine IV	668–685
Justinian II Rhinotmetus	685–695
Leontius	695–698
Tiberius III	698–705
Justinian II Rhinotmetus (*restored*)	705–711
Philippicus	711–713
Anastasius II	713–715
Theodosius III	715–717
Leo III	717–741
Constantine V Copronymus	741–775
Leo IV	775–780
Constantine VI	780–797
Irene (*empress*)	797–802
Nicephorus I	802–811
Stauracius	811
Michael I Rhangabe	811–813
Leo V	813–820
Michael II Balbus	820–829
Theophilus	829–842
Michael III	842–867
Basil I	867–886
Leo VI	886–912
Alexander	912–913
Constantine VII Porphyrogenitus	913–959
Romanus I Lecapenus	920–944
Romanus II	959–963
Nicephorus II Phocas	963–969
John I Tzimisces	969–976
Basil II Bulgaroctonus	976–1025
Constantine VIII	1025–28
Romanus III Argyrus	1028–34
Michael IV	1034–41
Michael V Calaphates	1041–42
Zoe (*empress*)	1042–50
Constantine IX Monomachus	1042–55
Theodora (*empress*)	1055–56
Michael VI Stratioticus	1056–57
Isaac I Comnenus	1057–59
Constantine X Ducas	1059–67
Romanus IV Diogenes	1067–71
Michael VII Ducas	1071–78
Nicephorus III Botaniates	1078–81
Alexius I Comnenus	1081–1118
John II Comnenus	1118–43
Manuel I Comnenus	1143–80
Alexius II Comnenus	1180–83
Andronicus I Comnenus	1183–85
Isaac II Angelus	1185–95
Alexius III Angelus	1195–1203
Isaac II Angelus (*restored*) & Alexius IV Angelus	1203–4
Alexius V Ducas Murtzuphlus	1204
Latin emperors	
Baldwin I	1204–5
Henry	1206–16
Peter	1217
Yolande (*empress*)	1217–19
Robert	1221–28
Baldwin II	1228–61
John	1231–37
Nicaean emperors	
Constantine (XI)	1204–5?
Theodore I Lascaris	1205?–22
John III Ducas Vatatzes	1222–54
Theodore II Lascaris	1254–58
John IV Lascaris	1258–61
Greek emperors restored	
Michael VIII Palaeologus	1261–82
Andronicus II Palaeologus	1282–1328
Andronicus III Palaeologus	1328–41
John V Palaeologus	1341–76
John VI Cantacuzenus	1347–54
Andronicus IV Palaeologus	1376–79
John V Palaeologus (*restored*)	1379–90
John VII Palaeologus	1390
John V Palaeologus (*restored*)	1390–91
Manuel II Palaeologus	1391–1425
John VIII Palaeologus	1421–48
Constantine XI Palaeologus	1449–53

*For emperors of the Eastern Roman Empire (at Constantinople) before the fall of Rome, see ROMAN REPUBLIC AND EMPIRE.

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C High-level procedural computer PROGRAMMING LANGUAGE with many low-level features, including the ability to handle memory addresses and bits. It is highly portable among platforms and therefore widely used in industry and among computer professionals. C was developed by Dennis M. Ritchie (born 1941) of Bell Laboratories in 1972. The OPERATING SYSTEM UNIX was written almost exclusively in C, and C has been standardized as part of POSIX (Portable Operating System Interface for UNIX).

C++ \'sē-'pləs-'pləs\ High-level computer PROGRAMMING LANGUAGE. Developed by Bjarne Stroustrup of Bell Laboratories in the early 1980s, it is traditional C language with added OBJECT-ORIENTED PROGRAMMING capabilities. C++, along with JAVA, has become popular for developing commercial software packages that incorporate multiple interrelated applications.

C-section See CESAREAN SECTION

Cabala See KABBALA

Caballero, Francisco Largo See Francisco LARGO CABALLERO

cabaret \ˌka-bə-'rā\ Restaurant that serves liquor and offers light musical entertainment. The cabaret probably originated in France in the 1880s as a small club that presented amateur acts and satiric skits lampooning bourgeois conventions. The first German *Kabarett* was opened in Berlin c. 1900 by Baron Ernst von Wolzogen and accompanied its musical acts with biting political satire. By the 1920s it had become the centre for underground political and literary expression and a showcase for the works of social critics such as BERTOLT BRECHT and KURT WEILL; this decadent but fertile artistic milieu was later portrayed in the musical *Cabaret* (1966; film, 1972). The English cabaret derived from concerts given in city taverns in the 18th–19th centuries and evolved into the MUSIC HALL. In the U.S. the cabaret developed into the nightclub, where comedians, singers, or musicians performed. Small jazz and folk clubs and, later, comedy clubs evolved from the original cabaret.

cabbage Leafy garden plant (*Brassica oleracea*, Capitata group) of European origin, with a short stem and a globular head of usually green leaves. A member of the MUSTARD FAMILY, it is a major table VEGETABLE in most countries of the temperate zone. The term *cabbage* also refers more generally to a vegetable and fodder plant of various horticultural forms developed by long cultivation from the wild, or sea, cabbage (*B. oleracea*) found near the seacoast in England and continental Europe. The common forms may be classified by the plant parts used for food: leaves (e.g., KALE, COLLARD, common cabbage, BRUSSELS SPROUT); flowers and flower stalks (e.g., BROCCOLI, CAULIFLOWER); and stems (e.g., KOHLRABI). Cabbages grow best in mild to cool climates and tolerate frost. Edible portions are low in caloric value and are an excellent source of vitamin C, minerals, and dietary fibre. See also CHINESE CABBAGE.

cabbage looper Distinctive green, white-lined LARVA, or CATERPILLAR (*Trichoplusia ni*), of the owlet MOTH family (Noctuidae). Like other LOOPERS, it moves in an "inching" motion. It is an economic pest of cabbages and associated crops, particularly in the U.S. and Europe. The adults, known as Ni moths, migrate considerable distances. They are mottled brown with a pale Y-shaped mark on each forewing. The typical adult wingspan is about 1 in. (25 mm).

cabbage palmetto See PALMETTO

cabbage white *or* **cabbage butterfly** European cabbage BUTTERFLY (*Pieris rapae*). Its LARVA is a major economic pest, attacking cabbage and related plants. Introduced into North America c. 1860, the cabbage white is today one of the most common North American WHITE BUTTERFLY species.

Cabbala See KABBALA

Cabeiri *or* **Cabiri** \kə-'bī-ˌrī\ Important group of deities, probably of Phrygian origin, worshiped in Asia Minor and in Macedonia and northern and central Greece. In classical times there were two males, Axiocersus and his son Cadmilus, and two females, Axierus and Axiocersa. They were promoters of fertility and protectors of seafarers. The male pair, the more important, was often confused with the DIOSCURI. The Cabeiri were also identified with the Great Gods of Samothrace, and their cult reached its height in the 4th century BC.

Cabell \'kab-əl**, James Branch** (b. April 14, 1879, Richmond, Va., U.S.—d. May 5, 1958, Richmond) U.S. writer. Cabell attacked American orthodoxies and institutions in his best-known novel, *Jurgen* (1919), a story replete with sexual symbolism. His other works, many of them allegories set in an imaginary medieval province, include *The Cream of the Jest* (1917) and *The High Place* (1923). Though much praised in the 1920s, his mannered style and skeptical view of human experience soon lost favour.

Cabeza de Vaca \kə-'bā-zə-də-'vä-kə**, Álvar Núñez** (b. c. 1490, Extremadura, Castile—d. c. 1560, Sevilla, Spain) Spanish explorer. He took part in an expedition that reached what is now Tampa Bay, Fla., U.S., in 1528. One of only four members of the expedition to survive, he spent eight years in the Gulf region of modern Texas. His accounts of the legendary Seven Cities of CÍBOLA probably inspired the extensive explorations of North America by Hernando de SOTO and Francisco Vázquez de CORONADO.

Cabezón \ˌkä-bā-'thōn**, Antonio de** (b. c. 1510, Castrillo de Matajudíos, near Burgos, Spain—d. March 26, 1566, Madrid) Spanish composer and organist. Of noble birth, he was blind from early childhood. In 1526 he became organist to Isabella, wife of CHARLES V. He remained a royal favourite, especially to Philip II, whom he accompanied on his travels. His works, which influenced the English virginalists and J.P. SWEELINCK, are almost entirely for keyboard; they include numerous *tientos* (*ricercar*s or fantasias) and *diferencias* (variations), a genre of which he was one of the first masters.

cabildo *Spanish* **"municipal council"** Fundamental unit of local government in colonial Latin America. It was responsible for all ordinary aspects of municipal government, including policing, sanitation, taxation, price and wage regulation, and the administration of justice. Its jurisdiction extended beyond the city to the surrounding hamlets and countryside. By the mid-16th century appointments to *cabildos* were usually made by the Spanish crown and could be sold or inherited. *Cabildos* were often corrupt, but *cabildos abiertos* (open town meetings) were important to the Latin American independence movement of the early 19th century.

cabinet Body of senior ministers or, in the U.S., advisers to a chief executive, whose members also serve as the heads of government departments. The cabinet has become an integral part of parliamentary government in many countries, though its form varies. It developed from the British PRIVY COUNCIL, when King CHARLES II and Queen ANNE regularly consulted the council's leading members to reach decisions before meeting with the unwieldy full council. The modern British cabinet consists of departmental ministers, drawn from the members of Parliament and appointed by the prime minister. In the U.S., the cabinet serves as an advisory group to the PRESIDENT without the sanction of law. Members' appointments are subject to Senate approval, and the U.S. Constitution sets cabinet members' order of succession to the presidency. The cabinet includes the secretaries of State, Treasury, Defense, Interior, Agriculture, Commerce, Labor, Health and Human Services, Housing and Urban Development, Transportation, Education, Energy, and Veterans Affairs and the attorney general.

cable car See STREETCAR

cable modem MODEM used to convert analog data signals to digital form and vise versa, for transmission or receipt over cable television lines, especially for connecting to the INTERNET. A cable modem modulates and demodulates signals like a telephone modem, but is a much more complex device. Data can be transferred over cable lines much more quickly than over traditional phone lines. Transmission rates are typically around 1.5 megabits per second. Faster transmission is actually possible, but speed is usually restricted by the cable company's (typically slower) connection to the Internet. Cable Internet access is regarded as a replacement for slower dial-up and ISDN services, and is competitive with other broadband modes of delivery (e.g., DSL connections). See also BROADBAND TECHNOLOGY.

Cable News Network See CNN

cable structure Form of long-span structure that is subject to tension and uses suspension cables for support. Highly efficient, cable structures

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include the suspension bridge, the cable-stayed roof, and the bicycle-wheel roof. The graceful curve of the huge main cables of a suspension bridge is almost a catenary, the shape assumed by any string or cable suspended freely between two points. The cable-stayed roof is supported from above by steel cables radiating downward from masts that rise above roof level. The bicycle-wheel roof involves two layers of tension cables radiating from an inner tension ring and an outer compression ring, which in turn is supported by columns.

cable television System that distributes TELEVISION signals by means of COAXIAL or FIBRE-OPTIC cables. Cable television systems originated in the U.S. in the early 1950s to improve reception in remote and hilly areas, where broadcast signals were weak. In the 1960s they were introduced in large metropolitan areas where reception is sometimes degraded by reflection of signals from tall buildings. Since the mid-1970s there has been a proliferation of cable systems that offer special services and which generally charge a monthly fee. Besides providing high-quality signals, some systems can deliver hundreds of channels. Another feature increasingly offered by cable operators is two-way, interactive communication by which viewers can, for example, participate in public-opinion polls as well as connect to the INTERNET. Cable operators are also involved in the development of video compression, digital transmission, and HIGH-DEFINITION TELEVISION.

Cabot, George (b. Jan. 16, 1752, Salem, Mass.—d. April 18, 1823, Boston, Mass., U.S.) U.S. FEDERALIST PARTY leader. After studying at Harvard University, he went to sea; he became a shipowner and successful merchant, retiring from business in 1794. Elected to the U.S. Senate (1791–96), he supported the fiscal policies of ALEXANDER HAMILTON. In 1793 he was appointed a director of the BANK OF THE UNITED STATES. A member of the Federalist ESSEX JUNTO, he presided at the HARTFORD CONVENTION in 1814.

Cabot, John *orig.* **Giovanni Caboto** (b. c. 1450, Genoa?—d. c. 1499) Italian navigator and explorer. In the 1470s he became a skilled navigator in travels to the eastern Mediterranean for a Venetian mercantile firm. In the 1490s he moved to Bristol, Eng., and, with support from city merchants, he led an expedition in 1497 to find trade routes to Asia. After landing somewhere in North America, possibly southern Labrador or Cape Breton Island, he took possession of the land for HENRY VII and conducted explorations along the coastline. On a second expedition in 1498, he may have reached America but probably was lost at sea. His two voyages for England helped lay the groundwork for the later British claim to Canada. SEBASTIAN CABOT was his son.

Cabot, Sebastian (b. c. 1476, Bristol, Gloucestershire, Eng., or Venice—d. 1557, London) English navigator, explorer, and cartographer. The son of JOHN CABOT, he served at various times both the English and Spanish crowns. In 1525 he took charge of a Spanish expedition, abandoning the original goal of developing trade with the Orient and instead embarking on a fruitless expedition to South America. Later he served in England as governor of the Merchant Adventurers, organizing an expedition to search for a northeast passage from Europe to the Orient.

Cabral \kə-'bräl**, Amílcar** (b. 1921, Bafata, Portuguese Guinea—d. Jan. 20, 1973, Conakry, Guinea) Guinean nationalist politician. In 1956 he founded the Partido Africano da Independência da Guiné e Cabo Verde, which in 1962 began a war of liberation against Portuguese forces. By the late 1960s Cabral controlled much of Portuguese Guinea. He was assassinated in 1973. His half-brother, Luís de Almeida Cabral, became the first president of independent Guinea-Bissau in 1974.

Cabral, Pedro Álvares (b. 1467/68, Belmonte, Port.—d. 1520, Santarém?) Portuguese navigator credited with the discovery of Brazil. A nobleman, Cabral long enjoyed the favour of MANUEL I of Portugal, who in 1500 sent him and 13 ships on the second Portuguese voyage to India, following the route taken by VASCO DA GAMA, to strengthen commercial ties and further Portugal's conquests. Cabral sailed southwest on a route that took him close to lands that had previously been sighted and claimed by the Portuguese. On April 22, 1500, he landed on the coast of what is now Brazil and formally took possession of the country for Portugal. The rest of his journey to India and back was beset by misfortune; only four ships returned to Portugal.

Cabrillo \kə-'bri-lō**, Juan Rodríguez** (d. Jan. 3, 1543?, off the coast of northern California) Explorer in the service of Spain and discoverer of California. Little is known of his early life, though he may have been born in Portugal. In 1520 he accompanied Spanish explorers to Mexico. He was one of the conquerors of present-day Guatemala, where he may have served as governor. In 1542 he left Mexico and sailed along the California coast, entering San Diego and Monterey bays. He landed on several islands off the coast; he apparently died of complications from a broken leg suffered on one such landing.

Cabrini, Saint Frances Xavier *known as* **Mother Cabrini** (b. July 15, 1850, Sant'Angelo Lodigiano, Lombardy, Austria—d. Dec. 22, 1917, Chicago, Ill., U.S.; canonized July 7, 1946; feast day December 22) Italian-born U.S. missionary, the first U.S. citizen to be canonized by the Roman Catholic church. She was determined from childhood to become a missionary, and she took her vows in 1877. She founded the Missionary Sisters of the Sacred Heart in 1880, and in 1889 Pope LEO XIII sent her to the U.S. to work among Italian immigrants. She lived in New York City and Chicago but traveled in the Americas and Europe to found 67 houses of her order.

cacao \kə-'kaù\ Tropical New World tree (*Theobroma cacao*) of the chocolate family (Sterculiaceae, or Byttneriaceae). Its seeds, after fermentation and roasting, yield cocoa and CHOCOLATE. Cocoa butter is extracted from the seed. The tree is grown throughout the wet lowland tropics, often in the shade of taller trees. Its thick trunk supports a canopy of large, leathery, oblong leaves. The small, foul-smelling, pinkish flowers are borne directly on the branches and trunk; they are followed by the fruit, or pods, each yielding 20–40 seeds, or cocoa beans.

Caccini \kät-'chē-nē**, Giulio** *or* **Giulio Romano** (b. c. 1550, Rome, Papal States—buried Dec. 10, 1618, Florence) Italian composer and singer. He accompanied his patron, COSIMO I, to Florence in the 1570s; there he became associated with the Camerata, an academy that dedicated much attention to producing a revival of ancient Greek drama. His *Euridice* (1600), embodying the Camerata's ideals, was the first opera to be published and was one of the first two surviving operas; the other, also titled *Euridice*, is largely by Jacopo Peri (1561–1633), whose lost *Dafne* (1598) was the first opera of all. Caccini's *Le nuove musiche* (1602), a collection of songs with basso continuo, was of landmark importance in establishing the new monodic style.

cachalot See SPERM WHALE

cache \'kash\ Temporary computer storage used for quick retrieval of data in order to increase processing speed. The cached data can be stored in a reserved area of RAM, a special cache chip (separate from the CPU) that provides faster access than RAM, or on the disk drive. By keeping frequently accessed data in a rapidly accessible place, the computer can respond quickly to requests for those data without having to perform time-consuming searches of RAM or hard drives. Since a "stale" cache will contain data that have been superseded by later information, the cached data must be refreshed periodically.

cachet, lettre de See LETTRE DE CACHET

cactus Any of the flowering plants that make up the family Cactaceae, containing about 1,650 species, native through most of North and South America, with the greatest number and variety in Mexico. Cacti are SUCCULENT perennials. Most live in and are well adapted to dry regions. Cacti generally have thick herbaceous or woody stems containing chlorophyll. Leaves usually are absent or greatly reduced, minimizing the surface area from which water can be lost; the stem is the site of photosynthesis. The generally thin, fibrous, shallow root systems range widely in area to absorb superficial moisture. Cacti vary greatly in size and appearance, from buttonlike PEYOTE and low clumps of PRICKLY PEAR and hedgehog cactus (*Echinocereus*) to the upright columns of barrel cacti (*Ferocactus* and *Echinocactus*) and the imposing SAGUARO. Cacti can be distinguished from other succulent

Golden rainbow cactus (*Echinocereus dasyacanthus*), a hedgehog cactus, growing in the desert of southwestern Texas.
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plants by the presence of small cushionlike structures (areoles) from which, in almost all species, spines arise, as do flowers, branches, and leaves (when present). Flowers, often large and colourful, are usually solitary. Cacti are widely cultivated as ornamentals. Various species, notably prickly pears and CHOLLAS, are cultivated as food. Barrel cacti are an emergency source of water for people.

Cacus and Caca \'kā-kəs...'kā-kə\ In ROMAN RELIGION, brother and sister fire deities of the early Roman settlement on the Palatine Hill. VIRGIL described Cacus as the son of VULCAN and as a fire-breathing brigand who terrorized the countryside. He stole some of the giant Geryon's cattle from Hercules (see HERACLES) and hid them in his lair, but Hercules discovered Cacus's hiding place and killed him. The story is traditionally connected with the establishment of Hercules's oldest Roman place of worship, the Ara Maxima, in the Forum Boarium (cattle market).

CAD/CAM \'kad-ˌkam, ˌkad-'kam\ *in full* **computer-aided design/computer-aided manufacturing.** Integration of design and manufacturing into a system under direct control of DIGITAL COMPUTERS. CAD systems use a computer with terminals featuring video monitors and interactive graphics-input devices to design such things as machine parts, patterns for clothing, or INTEGRATED CIRCUITS. CAM systems use numerically controlled (see NUMERICAL CONTROL) machine tools and high-performance programmable industrial ROBOTS. Drawings developed during the design process are converted directly into instructions for the production machines, thus optimizing consistency between design and finished product, and providing flexibility in altering machine operations. These two processes are sometimes grouped as CAE (computer-aided engineering).

Cadbury, George (b. Sept. 19, 1839, Birmingham, Warwickshire, Eng.—d. Oct. 24, 1922, Birmingham) British businessman and social reformer. In 1861 he and his brother Richard took over their father's failing business and built it into the highly prosperous Cadbury Brothers cocoa- and chocolate-manufacturing firm. They improved working conditions and introduced a private social security program for employees. George was also noted for his successful experiments in housing and town planning in Bournville, where he built affordable working-class homes with large gardens.

caddis fly Any member of about 7,000 species of mothlike aquatic insects (order Trichoptera) found worldwide, usually in freshwater habitats but sometimes in brackish and tidal waters. Generally dull brownish, caddis flies have long antennae and hairy wings that fold rooflike over the abdomen. They feed primarily on plant juices and flower nectar, though a few are predaceous. Many caddis-fly larvae construct a portable case from grains of sand, bits of shells, and plant debris glued together by a sticky substance they secrete. This case surrounds the larva's abdomen while it matures. Caddis flies are important to freshwater ecosystems because they clean the water by consuming plant and animal debris and serve, as larvae and adults, as an important food for fish, particularly TROUT.

Caddo One of a group of North American Indian people living mostly in western Oklahoma, U.S. Their language is of the Caddoan language family. Their name derives from a French truncation of *kadohadacho*, meaning "real chief" in Caddo. From ancient times they occupied the lower Red River area in Louisiana and Arkansas, and many striking examples of prehistoric pottery and basketry have been found. They were a semisedentary agricultural people who lived in conical pole-and-thatch dwellings. In the 18th century pressures from white settlers pushed many Caddo off their lands, a process that intensified with the LOUISIANA PURCHASE in 1803. By 1835 the Caddo had ceded all their land to the U.S., and by 1859 most were living on reservations in Oklahoma. Some 2,700 Caddo claimed sole Caddo descent in the 2000 U.S. census.

Incised redware cat effigy bowl, Caddoan from Louisiana; in the Museum of the American Indian, Heye Foundation, New York City

COURTESY OF THE NATIONAL MUSEUM OF THE AMERICAN INDIAN, NEW YORK CITY

Cade's Rebellion (1450) Uprising against the government of HENRY VI of England. Jack Cade, an Irishman of uncertain occupation living in Kent, organized a rebellion among local small property holders angered by high taxes and prices. He took the name John Mortimer, identifying himself with the family of Henry's rival, the duke of York. Cade and his followers defeated a royal army in Kent and entered London, where they executed the lord treasurer. They were soon driven out of the city; Cade's followers dispersed on being offered a pardon, and Cade was mortally wounded in Sussex. His rebellion contributed to the breakdown of royal authority that led to the Wars of the ROSES.

Cádiz \kə-'diz,\ *Spanish* \'kä-thēs\ City (pop., 2001: city, 133,363; metro. area, 400,157), southwestern Spain. Located on a peninsula in the Bay of CÁDIZ northwest of GIBRALTAR, it is the main seaport of Cádiz province in ANDALUSIA. Founded as Gadir by PHOENICIANS from TYRE c. 1100 BC, it was later ruled by CARTHAGE, Rome (as Gades), and the VISIGOTHS. It was held by the MOORS beginning in AD 711. In 1262 Cádiz was captured by Alfonso X of CASTILE-LEÓN. The city enjoyed great prosperity as a centre for Spanish trade with the American colonies in the 16th–18th centuries (see SEVILLA). It now has naval and mercantile shipbuilding yards.

Cádiz, Bay of Inlet of the Gulf of Cádiz, southwestern Spain. An inlet indenting the coast of Cádiz province, it receives the Guadalete River and is partially protected by the Isle of Léon, on which the port of CÁDIZ is located. The Spanish-U.S. air and naval base at Rota is situated on the bay.

cadmium Metallic chemical ELEMENT, chemical symbol Cd, atomic number 48. It normally occurs along with other metals, especially ZINC, in ORES. A silvery white METAL capable of taking a high polish, cadmium does not corrode under alkaline (see ALKALI) conditions; one of its major uses is in ELECTROPLATING other metals and ALLOYS to protect them. Because it absorbs NEUTRONS effectively, it is used in control rods in some nuclear reactors. Its compounds, in which it has VALENCE 2, are very toxic. They are used as pigments, as phosphors in TELEVISION and computer monitor screens, as pesticides, and in photographic applications and analytical chemistry.

Cadmus In GREEK MYTHOLOGY, the son of the king of Phoenicia, brother of EUROPA, and founder of THEBES. When ZEUS carried off Europa, Cadmus was sent to find her. The Delphic ORACLE ordered him to end his search, follow a cow, and build a town where it lay down. That town became Thebes. He built the citadel of Thebes with the help of fierce armed men who sprang up where he sowed the teeth of a dragon he had slain. He married Harmonia, daughter of ARES and APHRODITE, and their five children included SEMELE. Cadmus was said to have brought the alphabet to Greece.

Cadogan \kə-'dəg-ən**, William, 1st Earl** (b. 1672, Liscarton, County Meath, Ire.—d. July 17, 1726, Kensington, near London, Eng.) British soldier. He served as a trusted colleague with the duke of MARLBOROUGH in the War of the SPANISH SUCCESSION. Later he became involved in intrigues to secure the succession for the Hanoverian GEORGE I (1714). He crushed a JACOBITE rebellion in 1716, was granted an earldom in 1718, and was promoted to commander in chief in 1722.

caduceus \kə-'dü-sē-əs\ Staff carried by HERMES as a symbol of peace. It served as a badge of protection for ancient Greek and Roman heralds and ambassadors. It was originally depicted as a rod or olive branch ending in two shoots and decorated with garlands or ribbons; in later iconography the garlands became two snakes and a pair of wings was attached to the staff to represent Hermes' speed. The caduceus was adopted as a symbol of physicians because of its similarity to the staff of ASCLEPIUS.

caecilian \si-'sil-yən\ Any of 155 species of wormlike AMPHIBIANS found in humid regions from Mexico to northern Argentina and in Africa, Southeast Asia, and the Seychelles. The elongate, ringed, limbless body is 4–60 in. (10–150 cm) long. Colour ranges from blackish to pinkish tan. The tiny eyes are covered by skin and often by bone. A chemosensory projection lies between the eye and nostril. Some species lay eggs, which are guarded by the female and hatch into free-living larvae; other species bear live young. Caecilians spend their lives underground and eat worms and insects.

Caecus, Appius Claudius See Appius CLAUDIUS CAECUS

Caedmon \'kad-mən\ (fl. 658–680) Earliest known Old English Christian poet. According to BEDE, he was a herdsman who received a divine call in a dream to sing of "the beginning of things" and began to utter "verses which he had never heard." He entered a monastery, where he produced vernacular poetry on sacred themes expounded to him by more learned brethren. Only the nine-line original dream hymn can be confidently attributed to him, but it set the pattern for almost all of Anglo-Saxon religious verse.

Caen \'kä^{n}\ City (pop., 1999: 113,987), northwestern France. Situated on the ORNE RIVER, it was the capital of lower NORMANDY in the 11th cen-

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tury. The English took it in 1346 and 1417 and held it until 1450. It suffered in the Wars of Religion and fell to the Protestants in 1562. During the French Revolution it was a centre for the Girondin movement. The city was severely damaged in the Allied Normandy Campaign (1944), but it was rebuilt. Notable structures include the 11th-century abbey and the university. Caen is a transportation centre and manufactures automobiles and electrical equipment.

Caere \'kī-rā\ Ancient city, Etruria. Located northwest of Rome near the modern city of Ceveteri, it was an important trading centre. Brought under Roman control in 253 BC, it prospered as part of the empire but declined in later centuries. The derived Latin word *caeremonium* (source of English *ceremony*) reflects the Etruscan fascination with divination and prophecy. Tomb chambers have yielded gold and silver objects, which show an Orientalizing tendency in the Etruscan art of the 7th century BC.

Gold fibula from the Regolini-Galassi tomb, Caere, 7th century BC; in the Vatican Museum.
SCALA/ART RESOURCE, NEW YORK

Caernarfon \kīr-'när-vȯn,kär-'närvȯn\ Town (pop., 2001: 9,611), administrative centre of Gwynedd county and county seat of the historic county of Caernarvonshire, Wales. Located near the west end of the Menai Strait, it was the site of a Roman fort, Segontium, built c. AD 75. After the Roman withdrawal (c. 380–390), it was the seat of local chieftains. The township was completely transformed by Edward I after his conquest of Wales in 1282–83. The imposing castle he built (birthplace of his son Edward II) has been preserved, and since 1911 it has been the site of the investiture of the prince of Wales.

Caesar, Irving *orig.* **Isidor Caesar** (b. July 4, 1895, New York, N.Y., U.S.—d. Dec. 18, 1996, New York City) U.S. lyricist. Caesar worked with Henry Ford during World War I before turning to songwriting. Working with various collaborators, he provided the lyrics for such standards as "Swanee," "Sometimes I'm Happy," "Crazy Rhythm," and "Tea for Two," one of the most frequently recorded tunes ever written.

Caesar, (Gaius) Julius (b. July 12/13, 100, Rome—d. March 15, 44 BC, Rome) Celebrated Roman general, statesman, and dictator. A patrician by birth, he held the prominent posts of quaestor and praetor before becoming governor of Farther Spain in 61–60. He formed the First Triumvirate with Pompey and Marcus Licinius Crassus in 60 and was elected consul in 59 and proconsul in Gaul and Illyria in 58. After conducting the Gallic Wars, during which he invaded Britain (55, 54) and crossed the Rhine (55, 53), he was instructed by the Senate to lay down his command, Senate conservatives having grown wary of his increasing power, as had a suspicious Pompey. When the Senate would not command Pompey to give up his command simultaneously, Caesar, against regulations, led his forces across the Rubicon River (49) between Gaul and Italy, precipitating the Roman Civil War. Pompey fled from Italy but was pursued and defeated by Caesar in 48; he then fled to Egypt, where he was murdered. Having followed Pompey to Egypt, Caesar became lover to Cleopatra and supported her militarily. He defeated Pompey's last supporters in 46–45. He was named dictator for life by the Romans. He was offered the crown (44) but refused it, knowing the Romans' dislike for kings. He was in the midst of launching a series of political and social reforms when he was assassinated in the Senate House on the ides of March by conspirators led by Cassius and Brutus. His writings on the Gallic and Civil wars are considered models of classical historiography.

Caesar, Sid (b. Sept. 8, 1922, Yonkers, N.Y., U.S.) U.S. comedian. He began his career as a band musician but switched to comedy. Noted for his pantomime skills and his ability to mimic foreign languages at high speed, he performed comic routines in live television shows and costarred with Imogene Coca (1908–2001) and Carl Reiner in the popular comedy variety program *Your Show of Shows* (1950–54). He created his own *Caesar's Hour* (1954–57) and later appeared in television specials.

Caesar Augustus See Caesar Augustus

Caesarea \ˌsē-zə-'rē-ə\ *modern* **Ḥorbat Qesari** \'ḵȯr-bȧt-'kā-sȧ-rē\ Ancient seaport, Palestine. Located on the coast of present-day Israel south of the city of Haifa, it was originally a Phoenician settlement. Taken by the Romans and rebuilt in the 1st century BC by Herod the Great, it was renamed for his patron Augustus. The capital of the Roman province of Judaea in AD 6, it was the site of an early Christian church and was often visited by St. Paul. It later declined under Byzantine and Arab rule and was destroyed by the Mamlūk sultan Baybars I in the 13th century.

caesaropapism \ˌsē-zə-rō-'pā-ˌpi-zəm\ Political system in which the head of the state is also the head of the church and supreme judge in religious matters. It is often associated with the Byzantine Empire, where emperors presided over church councils and appointed patriarchs. The term has also been applied to other historical eras, including the rule of Tsar Peter I, who made the Russian Orthodox Church a department of the state, and the reign of Henry VIII in England.

caffeine Heterocyclic compound that, like other alkaloids, has marked physiological effects. It occurs in coffee beans, tea leaves, kola nuts, cacao, maté, and guarana and in the products made from them. Its stimulating effect on the central nervous system, heart, cardiovascular system, and kidneys makes it medically useful in treating respiratory depression caused by overdose of barbiturates, morphine, or heroin. Its positive effects can include improved motor performance, decreased fatigue, increased alertness, and enhanced sensory activity. Excessive caffeine can produce irritability, anxiety, insomnia, and potentially serious symptoms such as heart irregularities and delirium. Much of the caffeine included in many over-the-counter stimulants, cold remedies, and painkillers has been extracted during production of decaffeinated coffee and tea.

Cagayan de Oro \ˌkä-gä-'yän-dā-'ō-rō\ City (pop., 2000: 461,877), northern Mindanao, Philippines. Located along the Cagayan River near the head of Macajalar Bay, it was established as a mission station in the 17th century and fortified by the Spaniards. Chartered as a city in 1950, it has become northern Mindanao's transportation and commercial hub.

Cagayan River *or* **Río Grande de Cagayan** River, northeastern Luzon, Philippines. Flowing north 220 mi (354 km) to the port of Aparri on the Babuyan Channel, it is the longest river in Luzon and is navigable for much of its course. Its chief tributary is the Chico. Its valley, 50 mi (80 km) wide, is agriculturally important.

Cage, John *in full* **John Milton Cage, Jr.** (b. Sept. 5, 1912, Los Angeles, Calif., U.S.—d. Aug. 12, 1992, New York, N.Y.) U.S. avant-garde composer and writer. The son of an inventor, Cage studied music with Arnold Schoenberg and Henry Cowell. From the early 1940s he was closely associated with the choreographer Merce Cunningham. Though he began as a 12-tone composer (see serialism), by 1943 his sonic experiments had marked him as notably original. He soon turned to Zen Buddhism and concluded that all activities that make up music are part of a single natural process and that all sounds are potentially musical; thenceforth he advocated indeterminism and endeavoured to ensure randomness in his works, using increasingly inventive notation and often relying on the Confucian classic *Yijing*. By the 1960s he had expanded into the realm of multimedia. His disparate works include *Bacchanale* for prepared piano (1938), *Imaginary Landscape No. 4* for 12 radios (1951), *Fontana Mix* for tape (1958), *HPSCHD* for seven harpsichords, 51 tapes, and nonmusical media (1969), and *Roaratorio* (1979). His widely read books include *Silence* (1961), *A Year from Monday* (1967), *Notations* (1969), and *M* (1973). His international influence was far greater than that of any previous American composer.

Cagliari \'käl-yä-rē\ *ancient* **Caralis** City (pop., 2001 prelim.: 158,351), capital of Sardinia, Italy. Located on the southern coast of the island of Sardinia, Cagliari was founded by the Phoenicians. Held successively by Rome, the Saracens, Pisa, Spain, and Austria, it passed with the rest of Sardinia to the house of Savoy in 1718. Long the military headquarters of the island, Cagliari was bombed heavily in World War II. The rebuilt harbour is Sardinia's principal port.

Cagney, James (b. July 17, 1899, New York, N.Y., U.S.—d. March 30, 1986, Stanfordville, N.Y.) U.S. actor. He toured in vaudeville as a song-and-dance man before starring in the successful Broadway musical *Penny Arcade* (1929). He played the first in a series of pugnacious criminal roles in the film *Public Enemy* (1931), followed by *Angels with Dirty Faces* (1938) and *White Heat* (1949). As George M. Cohan in *Yankee*

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Doodle Dandy (1942, Academy Award) he showed off his dance skills and streetwise charm. Later films include *Mister Roberts* (1955) and *Ragtime* (1981).

Cahn, Sammy *orig.* **Samuel Cohen** (b. June 18, 1913, New York, N.Y., U.S.—d. Jan. 15, 1993, Los Angeles, Calif.) U.S. song lyricist. He became a professional songwriter while still a teenager and later formed a songwriting team with Saul Chaplin; their first hit was "Rhythm Is Our Business" (1935). With Jule Styne he collaborated on songs for many films and musicals, including "Three Coins in the Fountain" (1954, Academy Award). In 1955 Cahn and Jimmy Van Heusen formed a partnership and went on to write dozens of songs for Frank Sinatra, whose recordings won them Academy Awards for "All the Way," "High Hopes," and "Call Me Irresponsible."

Caicos Islands See Turks and Caicos Islands

Caillaux \kä-'yō**, Joseph (-Marie-Auguste)** (b. March 30, 1863, Le Mans, France—d. Nov. 22, 1944, Mamers) French politician. Serving several times as minister of finance, he was an early but unsuccessful advocate of a national income tax. He was named premier in 1911 but was forced to resign after negotiating a controversial treaty with Germany over the second of the Moroccan crises. Later his opposition to World War I and friendship with German agents led to conviction on charges of corresponding with the enemy. Granted amnesty in 1924, he was later elected to the Senate and became head of the Commission of Finance (1927–40).

Caillebotte \kä-yə-'bôt**, Gustave** (b. Aug. 19, 1848, Paris, Fr.—d. Feb. 21, 1894, Gennevilliers) French painter and art collector. Born to a wealthy family, he was a naval architect by profession. He pursued his interest in painting at the École des Beaux-Arts and became a prolific painter of contemporary subjects, town and country views, still lifes, and boating scenes. In Caillebotte's masterpiece, *Paris Street; Rainy Day* (1877), he used bold perspective to create a monumental portrait of a Paris intersection. In addition to his own painting, Caillebotte was the chief organizer, promoter, and financial backer of the Impressionist exhibitions, and he purchased works by Édouard Manet, Edgar Degas, Claude Monet, Paul Cézanne, and others. He bequeathed his collection to the state, and in 1897 it formed the basis of the first Impressionist exhibition in a French museum. See Impressionism.

caiman \'kā-mən\ Any member of several species of Central and South American reptiles of the alligator family. Like the rest of the crocodile order, caimans are amphibious, lizardlike carnivores. They live along the edges of rivers and other bodies of water, and reproduce by laying hard-shelled eggs in nests built and guarded by the female. The largest species is the black caiman (*Melanosuchus niger*), a potentially dangerous animal with a maximum length of about 15 ft (4.5 m). Average lengths for the other species (genera *Caiman* and *Paleosuchus*) are 4–7 ft (1.2–2.1 m).

Cain and Abel In the Hebrew scriptures, the sons of Adam and Eve. According to Genesis, Cain, the firstborn, was a farmer, and his brother Abel was a shepherd. Cain was enraged when God preferred his brother's sacrifice of sheep to his own offering of grain, and he murdered Abel. When God asked where Abel was, Cain pretended ignorance, saying, "Am I my brother's keeper?" God punished Cain by sending him into exile but marked him with a sign as a warning to others, promising that he would be avenged if he were killed.

cairn terrier Breed of terrier developed in Scotland to rout animals that prey on game. The modern breed's characteristics are carefully patterned on those of the dog's ancestor, a 17th-century terrier of the Isle of Skye. This short-legged dog has a short, broad face. Its coarse coat is usually bluish gray, tan, or pale yellowish brown. Generally active, hardy, alert, and spirited, it is valued as a pet and watchdog. It stands 9–10 in. (23–25.5 cm) high and weighs about 13–14 lbs (6–6.5 kg).

Cairngorm Mountains \'karn-ˌgȯrm\ Mountain range, northeastern Scotland. It is located in the Highlands between the Spey and Dee river valleys; its highest peak is Ben Macdui, at 4,296 ft (1,309 m) the second-highest (after Ben Nevis) in the British Isles. Since World War II winter sports have developed in the area. It is a chief source of the cairngorm variety of quartz.

Cairo \'kī-rō\ *Arabic* **Al-Qāhirah** \ȧl-'kä-hē-rə\ City (pop., 1996: city, 6,789,479; 1999 est.: metro. area, 10,345,000), capital of Egypt. Located on the banks of the Nile River near the site of a Roman city captured by the Arabs in 641, Old Cairo (Al-Fusṭāṭ) was then built by the Arabs as a military camp. Cairo's newer section (Al-Qāhirah) was built by the Fatimid dynasty (c. 968) and was made the capital in 973. From the 13th century, as the capital of the Mamlūk dynasty, it reached its greatest prosperity as a trade and cultural centre. Occupied by French forces under Napoleon I in 1798, it was held by the French for three years. In World War II (1939–45) it was a base of operations for British and U.S. forces and was also the site of two conferences by the Allied Powers (see Cairo conferences). The ancient metropolis is a blend of old and new, East and West. It is the centre of the largest urban agglomeration in the Middle East and Africa, and it is the chief cultural centre of the Arab world. Its most noteworthy landmark is the pyramid complex of Giza, located at the southwestern edge of the city. A manufacturing centre, it is also the site of several important universities and colleges.

Cairo conferences (November–December 1943) Two meetings held in Cairo during World War II. At the first, Winston Churchill and Franklin Roosevelt discussed plans for the Normandy Invasion (see Normandy Campaign). With Chiang Kai-shek, they announced their goal of stripping Japan of all the territories it had seized since 1914 and of restoring Korea to independence. At the second conference, Churchill and Roosevelt tried unsuccessfully to persuade Turkey's Pres. Ismet Inönü to bring his country into the war on the side of the Allies.

Caishen *or* **Ts'ai-shen** \'tsī-'shən\ Chinese god of wealth, believed to bestow on his devotees the riches carried about by his attendants. A Ming-dynasty novel relates that a hermit, Zhao Gongming, employed magic to support the collapsing Shang dynasty. He was killed by Jiang Ziya, a supporter of the Zhou dynasty. Rebuked for causing the death of a virtuous man, Jiang apologized in a temple, extolled Zhao's virtues, and canonized him as the god of wealth. During Chinese New Year, incense is burned in Caishen's temple and the greeting "May you become rich" is exchanged.

caisson \'kā-ˌsän\ In engineering, a type of foundation most commonly used underwater for a bridge, but sometimes used in building construction. It is a large hollow structure that is sunk down through the earth by workers excavating from inside it; ultimately it becomes a permanent part of the pier. There are three types: the open caisson, open at both top and bottom; the box caisson, closed at the bottom; and the pneumatic caisson, with an airtight chamber to accommodate submerged workers. Caisson columns, typically 2 ft (0.6 m) or more in diameter, may be used as an alternative to bearing piles. A round hole is dug or bored to a stable layer of earth and temporarily supported by a steel shell, then filled with concrete poured around a cage of reinforcing bars.

caisson disease See decompression sickness

Caitanya \kī-'tän-yə**, Sri Krishna** *orig.* **Vishvambhara Mishra** (b. 1485, Navadvipa, Bengal, India—d. 1533, Puri, Orissa) Indian Hindu mystic. Born into a Brahman family, he became a teacher. While on a pilgrimage to perform his father's death-anniversary ceremony, he had a profound religious experience, and he returned home indifferent to worldly matters. Disciples joined him in worship that consisted of choral singing of the name of God, often accompanied by dance movements and ending in trance states. He took his new name on initiation as an ascetic in 1510. In his lifetime his following came to constitute a major sect of Vaishnavism (see Caitanya movement). According to tradition, he died when he walked into the ocean while lost in a devotional trance.

Caitanya movement Emotional form of Hinduism that developed in the 16th century, inspired by the mode of worship originated by Caitanya. Centred in Bengal, the movement was organized by Caitanya's followers Nityananda and Advaita. Bhakti (devotion) is central and takes the form of singing for hours, with accompaniment, hymns that repeat God's name. Caitanya himself came to be worshiped as an incarnation of both Krishna and his beloved, Radha. Caitanya, Nityananda, and Advaita are regarded as the movement's three masters. A group of six of Caitanya's disciples developed its theology and devotional literature. Its present leaders are mostly lineal descendants of the early disciples. See also Hare Krishna movement.

Cajun Any descendant of French Canadians who in the 18th century were driven by the British from the captured French colony of Acadia (now Nova Scotia and adjacent areas) and settled in the fertile bayou lands of southern Louisiana, U.S. Many Cajuns speak a dialect of North American French. U.S. census figures for Cajuns are deceptive; although in 2000

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only some 85,000 people reported themselves to be Acadian/Cajun, the census form also included a French Canadian category, which may have confused the issue. Experts suggest that there are some 100,000 Cajuns in Texas and from 500,000 to 700,000 Cajuns in Louisiana. In recent decades Cajun cuisine, noted for its use of spicy seasonings, and ZYDECO music have become popular among non-Cajuns.

cakravartin See CHAKRAVARTIN

Calabar \'ka-lə-ˌbar\ City (pop., 1991.: 310,839), southeastern Nigeria. Lying along the Calabar River above its confluence with the CROSS RIVER, it was settled in the 17th century by the Efik and became an important trading centre for Europeans arriving on the African coast. After accepting British protection in 1884, it served as capital of a British protectorate until British administrative headquarters were moved to LAGOS in 1906. With its natural harbour, it remains an important port.

calabash Tree (*Crescentia cujete*) of the trumpet-creeper family (Bignoniaceae) that grows in Central and South America, the West Indies, and extreme southern Florida. It is often grown as an ornamental. It produces large spherical fruits, the hard shells of which are useful as bowls, cups, and other water containers when hollowed out. The fruit's shell encloses a whitish pulp and thin, dark brown seeds. The tree bears funnel-shaped, light green and purple-streaked flowers and evergreen leaves. Fruits of the unrelated bottle gourd (*Lagenaria siceraria*) are also known as calabashes.

Calabria \kä-'lä-brē-ä\ Region (pop., 2001 prelim.: 1,993,274), southern Italy. Forming the "toe" of the Italian "boot," it is a peninsula that separates the TYRRHENIAN and Ionian seas. A mountainous area covering 5,823 sq mi (15,080 sq km), it has been subject to earthquakes. Its capital is CATANZARO. Founded as a Greek colony and known in ancient times as Bruttium, it was taken by the Romans in the 3rd century BC and gradually went into decline. It eventually passed to the Byzantines, who renamed it Calabria. Conquered by the Normans, it was united with the Kingdom of NAPLES in the 11th century AD. A stronghold of Italian republicanism until the RISORGIMENTO, it became part of Italy after the 1860 expedition of Giuseppe de GARIBALDI. Long a poor area dependent on farming, it underwent a land-reform system in the mid-20th century that promoted more diverse profitable crops.

caladium \kə-'lā-dē-əm\ Any of the tropical New World tuberous herbaceous plants that make up the genus *Caladium*, in the ARUM FAMILY, widely cultivated for their showy, fragile-looking, variably coloured leaves. Caladiums are nonhardy BULBS used as potted plants indoors and in summer outdoor plantings. They keep surprisingly well if protected from chills and wintry drafts.

Calah \'kā-lə\ *modern* **Nimrūd** \'nim-ˌrüd\ Ancient city, ASSYRIA. Lying south of modern MOSUL, Iraq, it was founded in the 13th century BC by Shalmaneser I. It remained unimportant until the 9th century BC, when Ashurnasirpal II made it the capital of Assyria. It was the site of a religious building founded in 798 BC by Queen Sammu-remat (Semiramis of Greek legend). Excavations there have yielded thousands of carved ivories from the 9th–8th centuries BC.

Winged bull of alabaster, guardian of a gate of the palace of Ashurnasirpal II at Nimrud; in the Metropolitan Museum of Art, New York City.
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK, GIFT OF JOHN D. ROCKEFELLER, JR., 1932

Calais \kà-'le, ka-'lā\ Seaport (pop., 1999: 77,333) on the Strait of Dover, northern France. Originally a fishing village built on an island, it was improved by the count of Flanders in 997 and fortified by the count of Boulogne in 1224. Calais was taken in 1347 by EDWARD III of England, and after 1450 it was the only remaining English possession in France. The 2nd duke de GUISE took Calais from the English in 1558. In WORLD WAR II it was a main objective in the German drive to the sea in 1940. It is an important passenger port and is near the French terminus of the CHANNEL TUNNEL. The city is famous for its lace and embroideries.

Calamity Jane *orig.* **Martha Jane Cannary** (b. May 1, 1852?, near Princeton, Mo.?, U.S.—d. Aug. 1, 1903, Terry, near Deadwood, S.D.) U.S. frontierswoman. She grew up in Montana and worked in mining camps, where she acquired riding and shooting skills. In 1876 she settled in Deadwood, S.D., site of new gold strikes; her pursuits there included hauling goods and machinery to the outlying camps and working as a cook and a dance-hall girl. There she probably first met WILD BILL HICKOK, who would become her companion. In 1891 she married Charley Burke, and from 1895 she toured with Wild West shows in the Midwest. Facts about her life were embellished by contemporary feature-magazine writers.

Calamity Jane
THE BETTMANN ARCHIVE

Calatrava \ˌkä-lä-'trä-vä**, Order of** Oldest military and religious order in Spain. It was founded in 1158 by two Cistercian monks who proclaimed a holy Crusade to defend the city of Calatrava against the MOORS. By the 15th century the order had 200,000 members and became increasingly involved in Castilian domestic politics. In 1489 it was incorporated into the crown by FERDINAND V and ISABELLA I, who deemed that all private armies had outserved their usefulness. It remained an honorary association of Spanish nobles until its dissolution in the 19th century.

calcedony See CHALCEDONY

calcite \'kal-ˌsīt\ Most common form of natural calcium carbonate ($CaCO_3$), a widely distributed mineral known for the beautiful development and great variety of its crystals. It occurs in stalagmites and stalactites and forms the structure of coral reefs. Calcite is the most important mineral in limestones and marbles used in the building, steel, chemical, and glass industries. Transparent crystals are called Iceland spar.

calcium Chemical ELEMENT, one of the ALKALINE EARTH METALS, chemical symbol Ca, atomic number 20. The most abundant metallic element in the human body, it is an essential part of BONES and teeth and has many physiological functions (see CALCIUM DEFICIENCY; TOOTH). It is the fifth most abundant element in Earth's crust but does not occur naturally in the free state. In its compounds calcium has VALENCE 2. It occurs in LIMESTONE, CHALK, MARBLE, DOLOMITE, eggshells, pearls, coral, and many marine shells as calcium carbonate, or CALCITE; in APATITE as calcium phosphate; in GYPSUM as calcium sulfate; and in many other minerals. It is used as an alloying agent and in other metallurgical applications; its ALLOY with lead is used in cable sheathing and grids for BATTERIES. Calcite is used as a lime source, a filler, a neutralizer, and an extender; in pure form it is used in baking powder and as an antacid and calcium supplement. Calcium oxide (lime) and its product after water addition, calcium hydroxide (slaked lime), are important industrially. Other significant compounds are calcium chloride (a drying agent), calcium hypochlorite (a BLEACH), calcium sulfate (gypsum and PLASTER OF PARIS), and calcium phosphate (a plant food and stabilizer for plastics).

calcium deficiency Inadequate supply or METABOLISM of CALCIUM, the main structural element of bones and teeth. Its metabolism is regulated by VITAMIN D, PHOSPHORUS, and HORMONES (see PARATHYROID GLAND). Calcium in the blood has roles in muscle contraction, nerve-impulse transmission, blood clotting, milk production, hormone secretion, and enzyme function, for which calcium is pulled from the bones if deficiency develops. Chronic deficiency may be a factor in the development of OSTEOPOROSIS or osteomalacia (softening of bone) and may contribute to HYPERTENSION and colon cancer. Severe calcium deficiency (hypocalcemia), usually the result of a metabolic problem rather than a dietary deficiency, causes numbness, tingling, and painful muscle aches and spasms.

calcium oxide See LIME

calculator Machine for performing arithmetic operations and certain mathematical functions automatically. BLAISE PASCAL devised a digital arithmetic machine in 1642. By the late 19th century, such machines had become smaller and easier to use, and desktop machines appeared in the early 20th century. Electronic DATA-PROCESSING systems in the mid-1950s led to the obsolescence of mechanical calculators. Miniature SOLID-STATE

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DEVICES ushered in calculators that could perform mathematical functions in addition to basic arithmetic, and also store data and instructions in memory registers, providing programming capabilities similar to those of small computers.

calculus Field of mathematics that analyzes aspects of change in processes or systems that can be modeled by FUNCTIONS. Through its two primary tools—the DERIVATIVE and the INTEGRAL—it allows precise calculation of rates of change and of the total amount of change in such a system. The derivative and the integral grew out of the idea of a LIMIT, the logical extension of the concept of a function over smaller and smaller intervals. The relationship between DIFFERENTIAL CALCULUS and INTEGRAL CALCULUS, known as the FUNDAMENTAL THEOREM OF CALCULUS, was discovered in the late 17th century independently by ISAAC NEWTON and GOTTFRIED WILHELM LEIBNIZ. Calculus was one of the major scientific breakthroughs of the modern era.

Calcutta See KOLKATA

Caldecott \'kȯl-də-kət**, Randolph** (b. March 22, 1846, Chester, Cheshire, Eng.—d. Feb. 12, 1886, St. Augustine, Fla., U.S.) British graphic artist and watercolourist. While working as a bank clerk, he began drawing for periodicals such as *London Society*, and, after he moved to London, *Punch* and *Graphic*. He developed a gently satirical style and achieved success with illustrations for WASHINGTON IRVING's books *The Sketch Book* (1875) and *Bracebridge Hall* (1876). Caldecott is best known as an illustrator of children's books, including WILLIAM COWPER's *John Gilpin* (1878) and OLIVER GOLDSMITH's *Elegy on a Mad Dog* (1879). Always frail in health, he died at age 39 in Florida, where he had gone to improve his condition. Since 1938 the Caldecott Medal has been awarded annually to the illustrator of the most distinguished U.S. picture book for children.

Calder \'kȯl-dər**, Alexander (Stirling)** (b. July 22, 1898, Lawnton, Pa., U.S.—d. Nov. 11, 1976, New York, N.Y.) U.S. sculptor. He was the son and grandson of sculptors, and his mother was a painter. He studied mechanical engineering, and in 1923 attended the Art Students League, where he was influenced by artists of the ASH CAN SCHOOL. In 1924 he contributed illustrations to the *National Police Gazette*. In 1926 he moved to Paris and began making toylike animals and circus figures of wood and wire; from these he developed his famous miniature circus. In the 1930s he became well known in Paris and the U.S. for his wire sculptures, as well as for portraits, continuous-line drawings, and abstract, motor-driven constructions. He is best known as the inventor of the MOBILE, a forerunner of KINETIC SCULPTURE. He also constructed nonmovable sculptural works known as stabiles. Although Calder's early mobiles and stabiles were relatively small, he increasingly moved toward monumentality in his later works. His art was recognized with many large-scale exhibitions.

Calder, photograph by Yousuf Karsh, 1966.
©KARSH/WOODFIN CAMP AND ASSOCIATES

caldera \kal-'der-ə\ Large, bowl-shaped volcanic depression that forms when the top of a volcanic cone collapses into the space left after MAGMA is ejected during a violent volcanic eruption. The term is Spanish for "caldron." Subsequent minor eruptions may build small cones on the floor of the caldera which may still later fill up with water; an example is Crater Lake in Oregon.

Calderón de la Barca \ˌkäl-də-'rōn-dā-lə-'bär-kə**, Pedro** (b. Jan. 17, 1600, Madrid, Spain—d. May 25, 1681, Madrid) Spanish playwright. He abandoned religious studies in 1623 to write plays for the court of PHILIP IV of Spain. His secular plays included *The Surgeon of His Honour* (1635), *Life Is a Dream* (1638), and his masterpiece, *The Daughter of the Air* (1653). His many plays on religious themes include *The Constant Prince* (1629) and *The Wonder-Working Magician* (1637). He also created 76 one-act religious dramas, notably *The Great Theatre of the World* (c. 1635) and *The Faithful Shepherd* (1678). Considered the successor to LOPE DE VEGA as the greatest playwright of the Spanish Golden Age, he was noted for his well-constructed plots and his preoccupation with the vanity of human existence.

Caldwell, Erskine (b. Dec. 17, 1903, Coweta county, Ga., U.S.—d. April 11, 1987, Paradise Valley, Ariz.) U.S. author. Caldwell became familiar with poor sharecroppers through his father's missionary work. Fame arrived with *Tobacco Road* (1932), a controversial novel whose title became a byword for rural squalor; adapted as a play, it ran more than seven years on Broadway. *God's Little Acre* (1933), also a best-seller, featured a cast of hopelessly poor degenerates. Like his other novels and stories about the rural Southern poor, they mix violence and sex in grotesque tragicomedy. He also wrote the text for documentary books with photographs by MARGARET BOURKE-WHITE, whom he married.

Caledonian orogenic \ˌkal-ə-'dō-nē-ən-ˌōr-ə-'je-nik\ **belt** Range of mountains in northwestern Europe, extending in a southwest-northeast direction from Ireland, Wales, and northern England through Norway. The mountains developed in the period from the start of the CAMBRIAN PERIOD (543 million years ago) to the end of the SILURIAN PERIOD (c. 417 million years ago). Remnants also exist in eastern Greenland.

calendar System for dividing time over extended periods, such as DAYS, months, or years, and arranging these divisions in a definite order. A calendar is essential for the study of chronology, which reckons time by regular divisions, or periods, and uses these to date events. It is also vital for any civilization that needs to measure periods for agricultural, business, domestic, or other reasons. The lunation, or period in which the moon completes a cycle of its phases (29½ days), is the basis for the month; most ancient calendars were collections of months. Days and SEASONS, which are a solar phenomena, do not have periods that evenly divide, so ancient calendars employed various means, such as the periodic insertion of an intercalary month, to reconcile the months with the seasons. The GREGORIAN CALENDAR used almost universally today is a modification of the Julian calendar adopted by Julius Caesar, which used a 365¼–day year with 12 months that came to have the number of days we know today. See also CALENDAR, JEWISH; CALENDAR, MUSLIM; SIDEREAL PERIOD.

calendar, French republican See FRENCH REPUBLICAN CALENDAR

calendar, Jewish *or* **Hebrew calendar** Religious and civil dating system based on both lunar and solar cycles. In the calendar used today, a day is counted from sunset to sunset, a week comprises 7 days, a month has 29 or 30 days, and a year has 12 lunar months plus approximately 11 days (or 353, 354, or 355 days). In order to bring the calendar in line with the annual solar cycle, a 13th month of 30 days is added in the 3rd, 6th, 8th, 11th, 14th, 17th, and 19th years of a 19-year cycle. Therefore, a leap year may have from 383 to 385 days. The Jewish calendar in use today was popularly accepted around the 4th century AD and is based on Biblical calculations placing the creation in 3761 BC.

Month	Days	Month	Days
Tishri (Sept.–Oct.)	30	Nisan (Mar.–Apr.)	30
Heshvan (Oct.–Nov.)	29 or 30	Iyar (Apr.–May)	29
Kislev (Nov.–Dec.)	29 or 30	Sivan (May–June)	30
Tebet (Dec.–Jan.)	29	Tammuz (June–July)	29
Shebat (Jan.–Feb.)	30	Ab (July–Aug.)	30
Adar (Feb.–Mar.)	29 or 30	Elul (Aug.–Sept.)	29

calendar, Muslim *or* **Islamic calendar** Dating system used in the Muslim world and based on a year of 12 months, each month beginning approximately at the time of the new moon. The months are alternately 30 and 29 days long except for the 12th, Dhu al-Hijjah, the length of which is varied in a 30-year cycle intended to keep the calendar in step with the true phases of the moon. In 11 years of this cycle, Dhu al-Hijjah has 30 days, and in the other 19 years it has 29. Thus the year has either 354 or 355 days. No months are added as in leap years, so the named months

Month	Days	Month	Days
Muharram	30	Rajab	30
Safar	29	Shaban	29
Rabi I	30	Ramadan	30
Rabi II	29	Shawwal	29
Jumada I	30	Dhu al-Qadah	30
Jumada II	29	Dhu al-Hijjah	29
		in leap years	30

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do not remain in the same seasons but retrogress through the entire solar, or seasonal, year (of about 365¼ days) every 32½ solar years.

calendering Process of smoothing and compressing a material (notably PAPER) during production by passing a continuous sheet through a number of pairs of heated rolls. The rolls in combination are called calenders; they are made of hardened steel or steel covered with fiber. In paper production, they typically exert a pressure of 500 lbs per linear in. (89 kg per cm). Coated papers are calendered to obtain a smooth, glossy finish. Calendering is also widely used in the manufacture of TEXTILES, coated fabrics, and plastic sheeting.

calendula \kə-'len-jə-lə\ Any herbaceous plant of the small genus *Calendula*, in the COMPOSITE FAMILY, found in temperate regions. Calendulas produce yellow-rayed flowers. The pot marigold (*C. officinalis*) is grown especially for ornamental purposes.

Calgary \'kal-gə-rē\ City (pop., 2001: city, 878,866; metro. area, 951,395), southern Alberta, Canada. It was founded in 1875 as a fort on the BOW RIVER for the Northwest Mounted Police. The arrival of the Canadian Pacific Railway in 1883 aided its growth, as did the discovery of nearby oil and gas fields in 1914 and 1947. Its major industries are petroleum refining, meatpacking, and lumbering. The annual Calgary Stampede, founded in 1912, is a world-famous rodeo and celebration of the Old West.

Calgary, University of Public university in Calgary, Alberta, Canada. It was founded in 1945 as part of the University of ALBERTA and gained full autonomy in 1966. It has faculties of education, engineering, environmental design, fine arts, graduate studies, humanities, law, management, medicine, nursing, physical education, science, social sciences, and social work. It has special programs devoted to space research, international development, gifted education, and world tourism.

Calhoun \kal-'hün**, John C(aldwell)** (b. March 18, 1782, Abbeville district, S.C., U.S.—d. March 31, 1850, Washington, D.C.) U.S. politician. A graduate of Yale University, he became an ardent Jeffersonian Republican and was elected to the U.S. House of Representatives (1811–17). As a leader of the WAR HAWKS, he introduced the declaration of war against Britain in June 1812 (see WAR OF 1812). From 1817 to 1825 he served as U.S. secretary of war. He was elected vice president in 1824 (under JOHN QUINCY ADAMS) and again in 1828 (under ANDREW JACKSON). In the 1830s he became an extreme advocate of strict construction of the U.S. Constitution, a champion of STATES' RIGHTS, a defender of slavery, and a supporter of NULLIFICATION. In 1832 he resigned the vice presidency and was elected to the U.S. Senate, where he served until 1850; he was briefly secretary of state in 1844–45. His exuberant defense of slavery as a "positive good" aroused strong anti-Southern feeling in the free states.

John Calhoun, detail of a daguerreotype by Mathew Brady, c. 1849.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Cali \'kä-lē\ City (pop., 1999 est.: 2,077,386), western Colombia. Lying on both sides of the Cali River, it was founded in 1536. Located far from the coast, it did not develop economically until the 20th century, when the upper CAUCA RIVER was harnessed to generate electrical power and prevent flooding. It is a major service centre for area products and rivals BOGOTÁ, BARRANQUILLA, and MEDELLÍN as an industrial centre. Beginning in the late 20th century, Cali became notorious for its trade in illegal narcotics.

calico cat In North America, a blotched or spotted DOMESTIC CAT, usually predominantly white with red and black patches (a pattern also called tortoiseshell-and-white). Because genetic determination of some coat colours in cats is linked to the sex chromosome, calicoes are almost always female.

California State (pop., 2000: 33,871,648), western U.S. Lying on the Pacific Ocean, it is bordered by Mexico and the U.S. states of Oregon, Nevada, and Arizona. California is the largest state in population and the third largest in area (158,647 sq mi [410,895 sq km]), extending about 800 mi (1,300 km) north to south and 250 mi (400 km) east to west. Its capital is SACRAMENTO. Within 85 mi (137 km) of each other lie Mount WHITNEY and DEATH VALLEY, the highest and lowest points in the 48 contiguous states. It was inhabited originally by American Indians. The first European coastal expansion took place in 1542–43 when JUAN CABRILLO established a Spanish claim to the area. The first mission was established by JUNIPERO SERRA at SAN DIEGO in 1769. The region remained under Spanish and, after the 1820s, Mexican control until it was taken by U.S. forces in the MEXICAN WAR and ceded to the U.S. by the Treaty of GUADALUPE HIDALGO in 1848. Though settlement had begun by the U.S. in 1841, it was greatly accelerated by the 1848 GOLD RUSH. California was admitted to the Union in 1850 as a nonslavery state under the COMPROMISE OF 1850. Its already expanding population grew immensely in the 20th century. It has the largest economy of any U.S. state. It has suffered severe earthquakes, most destructively those of SAN FRANCISCO in 1906 and 1989 and LOS ANGELES in 1994.

California, Gulf of *or* **Sea of Cortés** Gulf separating BAJA CALIFORNIA from the rest of Mexico. Its area is about 59,000 sq mi (153,000 sq km). Its waters were coloured by red plankton when 16th-century Spanish explorers named it Mar Bermejo ("Vermilion Sea"). Some geologists hold that the gulf is structurally part of the Pacific Ocean; others claim Baja California is pulling away from the continent as it moves north along the SAN ANDREAS FAULT, allowing the gulf to form.

California, Lower See BAJA CALIFORNIA

California, University of U.S. public university with campuses at Berkeley (main campus), Davis, Irvine, Los Angeles, Merced, Riverside, San Diego (La Jolla), San Francisco, Santa Barbara, and Santa Cruz. Established in 1868 in Oakland, it has become one of the largest university systems in the U.S. The Berkeley campus, which replaced the Oakland campus in 1873, remains a leader in scientific fields as well as in many other academic areas. In the 1930s researchers there produced the first CYCLOTRON, isolated the human POLIO virus, and discovered several new chemical elements. The San Francisco campus, originally a medical college, joined the University of California in 1873 and remains a centre for medical research and education. The San Diego campus, founded as a marine station, became part of the university in 1912; it includes the Scripps Institution of Oceanography. The Los Angeles branch (UCLA), founded in 1919, includes schools of law, medicine, and engineering. The Santa Barbara campus, originally founded as a teachers college, joined the university system in 1944. The Davis and Riverside campuses grew out of agricultural institutes and were added in 1959. To answer a growing need for broad-based education and research, the university opened campuses at Santa Cruz and Irvine in 1965 and added the Merced campus in 2005. The University of California operates nuclear research centres at Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, and LOS ALAMOS National Laboratory.

California Institute of Technology *known as* **Caltech** U.S.-based, highly select, private university and research institute in Pasadena. Established in 1891, it offers graduate and undergraduate instruction and research in pure and applied science and engineering. It is considered one of the world's premier scientific research centres. In 1958 its Jet Propulsion Laboratory, in conjunction with NASA, launched Explorer I, the first U.S. satellite. Caltech operates astronomical observatories at such locations as Palomar Mountain, Owens Valley, and Big Bear Lake, Calif., and Mauna Kea, Hawaii. Other facilities include a seismology laboratory, a marine biology laboratory, and a centre for the study of radio astronomy.

California Institute of the Arts *known as* **CalArts** U.S. private institution of higher learning in Valencia. Created in 1961 through the merger of two other art institutes, it was the first in the U.S. to specialize in degree programs for the visual and performing arts. It consists of five schools—art, dance, film and video, music, and theatre—and a division of critical studies. All schools award B.F.A. and M.F.A. degrees. A community arts program sponsors work with young students in disadvantaged areas of Los Angeles.

California poppy Annual garden plant (*Eschscholzia californica*) in the POPPY FAMILY, native to the western coast of North America and naturalized in parts of southern Europe, Asia, and Australia. The flowers are usually pale yellow, orange, or cream in the wild, but whites and shades of red and pink have been developed in cultivation. The foliage is gray-

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green and feathery. The flowers open only in sunlight. They blossom all summer in northern climates and into the winter in areas with mild winters.

California poppy (*Eschscholzia californica*).
GRANT HEILMAN PHOTOGRAPHY

Californian Indian Any member of the various North American Indian peoples living in and around present-day California, U.S. Of the many Californian groups, most were composed of independent territorial and political units that were smaller than the average groupings of other North American Indians. Food varied with the region inhabited (coastal peoples fished, desert peoples hunted and practiced marginal agriculture, etc.), as did style of housing. The peoples of California were politically stable, sedentary, and conservative and less in conflict with one another than was usually the case in other areas of North America; neighbouring groups often developed elaborate systems of economic exchange of goods and services. The Californian Indians reached peaks of cultural attainment rarely seen among peoples depending almost wholly for subsistence on hunting, fishing, and the gathering of wild plant foods. Californian Indians had a renowned oral literature, and Californian basketwork is considered exquisite. See also Modoc; Northwest Coast Indian; Pomo; Yuman.

Caligula \kə-'li-gyə-lə\ *officially* **Gaius Caesar (Germanicus)** (b. Aug. 31, AD 12, Antium, Latium—d. Jan. 24, 41, Rome) Roman emperor (37–41). Known by his childhood nickname, Caligula ("Little Boot") was declared heir to the throne by Tiberius following the suspicious deaths of Caligula's parents and brothers and probably connived in Tiberius's death. Caligula suffered a severe illness seven months into his rule and began displaying mental instability, engaging in despotic caprice and cruelty. Restoring treason trials (38), he executed former supporters and extorted money from the citizens. He plundered Gaul in 40 and began planning to invade Britain. He made pretensions to divinity and declared his sister Drusilla a goddess on her death. Weary of his tyranny, a group of conspirators assassinated him.

caliper Instrument that consists of two adjustable legs or jaws for measuring the dimensions of material parts. Spring calipers have an adjusting screw and nut; firm-joint calipers use friction at the joint to hold the legs unmoving. Outside calipers measure thicknesses and outside diameters of objects; inside calipers measure hole diameters and distances between surfaces. Hermaphrodite calipers, which have one leg bent inward and one straight leg ending in a sharp point, are used for scribing lines at a specified distance from a flat or curved surface. See also micrometer.

caliph \'kā-ləf, 'ka-ləf\ *Arabic* **khalīfah ("deputy" or "successor")** Title given to those who succeeded the Prophet Muhammad as real or nominal ruler of the Muslim world, ostensibly with all his powers except that of prophecy. Controversy over the selection of the fourth caliph, ʿAlī, eventually split Islam into the Sunnite and Shiʿite branches. ʿAlī's rival, Muʿāwiyah I, established the Umayyad dynasty of caliphs, which produced 14 caliphs (661–750). The ʿAbbāsid dynasty (750–1258), the most widely observed caliphate, associated with 38 caliphs, moved the capital from Damascus to Baghdad. The Mongol conquest of Baghdad in 1258 effectively ended the dynasty. Other Muslim leaders created caliphates with limited success. The Fāṭimid dynasty proclaimed a new caliphate in 920; ʿAbd al-Raḥmān III announced one in opposition to both the ʿAbbāsids and the Fāṭimids in 928. A scion of the ʿAbbasid line was set up by the Mamlūk dynasty as a sort of puppet caliph after 1258. This caliphate exercised no power whatsoever, and, from 1517 until it was abolished by the Republic of Turkey in 1924, it resided in Istanbul under the control of the Ottoman Empire. Modern Muslim militants consider the abolition of the caliphate a catastrophic event, and its return has been a central pillar of their political program.

calisthenics Systematic rhythmic bodily exercises (e.g., jumping jacks, push-ups), usually performed without apparatus. Calisthenics promote strength, endurance, flexibility, and general well-being by placing regular demands on the cardiovascular system. The exercises, initially conceived as primarily for women, arose in the 19th century in Germany and Sweden. Catharine Esther Beecher in the U.S. advocated women's calisthenics. As their health benefits became known, they became an activity for both sexes.

Calixtus \kə-'lik-stəs\ **II** *orig.* **Guido of Burgundy** (d. Dec. 13/14, 1124, Rome) Pope (1119–24). As archbishop of Vienne in Lower Burgundy, he became known as an advocate of reform and an opponent of Holy Roman emperor Henry V. Elected pope in 1119, he condemned lay investiture and excommunicated Henry. They were later reconciled, and the Concordat of Worms (1122) ended the Investiture Controversy. Calixtus called the first Lateran Council (1123), which secured peace between church and empire for the next 35 years. His bull *Etsi Judaeis* (1120) protected Roman Jews.

calla Either of two distinct kinds of plants of the arum family. *Calla palustris* is known as the arum lily, water arum, or wild calla. The common name calla is also generally given to several species of *Zantedeschia*, often called calla lilies. The handsome *C. palustris* occurs widely in wet places in cool, northern temperate and subarctic regions. It has heart-shaped leaves, showy white floral leaves, and clusters of brilliant red berries. Its juice is violently poisonous. The most important of the calla lilies, all native to South Africa, is the common florist's calla (*Z. aethiopica*), a stout herb with a fragrant white spathe and arrow-shaped leaves; a popular indoor plant, it is grown commercially for cut flowers.

Arum lily (*Calla palustris*)
INGMAR HOLMASEN

Callaghan \'ka-lə-ˌhan\ **(of Cardiff), (Leonard) James Callaghan, Baron** (b. March 27, 1912, Portsmouth, Hampshire, Eng.—d. March 26, 2005, Ringmer, East Sussex) British politician. A trade union official, he entered the House of Commons as a Labour Party member in 1945. He served in Labour governments as chancellor of the Exchequer (1964–67), home secretary (1967–70), and foreign secretary (1974–76) before becoming prime minister (1976–79). A moderate within his party, he tried to stem the vociferous demands of the trade unions. After a series of paralyzing labour strikes in 1978–79 (the "Winter of Discontent"), his government was brought down by a parliamentary vote of no confidence. He was created a life peer in the House of Lords in 1987.

Callaghan \'ka-lə-ˌhan**, Morley (Edward)** (b. Sept. 22, 1903, Toronto, Ont., Can.—d. Aug. 25, 1990, Toronto) Canadian novelist and short-story writer. Callaghan received a law degree in 1928 but never practiced. He won acclaim for the short-story collection *A Native Argosy* (1929). His first novel, *Strange Fugitive* (1928), describes the destruction of a social misfit, a type that recurs in his fiction. Subsequent novels, including *They Shall Inherit the Earth* (1935) and *The Loved and the Lost* (1951, Governor General's Award), emphasize Christian love as an answer to social injustice. *That Summer in Paris* (1963) describes Callaghan's friendship with F. Scott Fitzgerald and Ernest Hemingway. Later works include *A Fine and Private Place* (1975) and *A Time for Judas* (1983).

Callahan, Harry (Morey) (b. Oct. 22, 1912, Detroit, Mich., U.S.—d. March 15, 1999, Atlanta, Ga.) U.S. photographer. He had no formal training in photography and first developed an interest in it in 1938. In 1941 Ansel Adams's photographs inspired him to develop his own style. His subjects included landscapes, cityscapes, and unconventional portraits of his wife and daughter. He was best known as a teacher; he was head of the photography department at the Chicago Institute of Design (1949–61) and developed the photography department at the Rhode Island School of Design (1961–76). In 1980 two collections of his works were published, *Water's Edge* and *Harry Callahan: Color, 1945–1980*.

Callao \kä-'yä-ō\ City (pop., 1996 est.: 407,904), chief seaport, Peru. It was founded in 1537 by Francisco Pizarro on Callao Bay west of Lima. As the leading shipping point for gold and silver taken by Spanish conquistadores from the Incas, it was frequently assaulted by pirates and by Spain's European rivals. It was destroyed by a tidal wave in 1746, then rebuilt near its original site. It withstood several sieges by Spanish forces during the wars for independence. The revolutionary leader Simón Bolí-

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VAR landed here in 1823, and three years later it was the scene of the final Spanish surrender to rebel forces. It suffered heavy earthquake damage in 1940 but has since expanded and modernized.

Callas \'ka-ləs**, Maria** *orig.* **Cecilia Sophia Anna Maria Kalogeropoulos** (b. Dec. 2, 1923, New York, N.Y., U.S.—d. Sept. 16, 1977, Paris, France) U.S. soprano of Greek descent. In 1937 she moved to Greece with her mother and made her debut there in 1939. She gained an international reputation for her performance in *La Gioconda* at the 1947 Verona Festival. She continued to sing heavy dramatic roles, including GIACOMO PUCCINI's *Turandot* and RICHARD WAGNER's *Kundry*, until the conductor Tullio Serafin (1878–1968) convinced her to shift to the bel canto repertoire, for which she became famous. Her signature role was VINCENZO BELLINI's Norma. Though her voice was imperfect, her extraordinary range, dramatic stage presence, and mastery of difficult roles made her the most famous opera star of her day. Her fiery temperament and her flamboyant and demanding personality made her an international celebrity; she was the consummate diva.

calligraphy \kə-'lig-rə-fē\ Art of beautiful, stylized, or elegant handwriting or lettering with pen or brush and ink. It involves the correct formation of characters, the ordering of the various parts, and the harmony of proportions. In the Islamic and Chinese cultures, calligraphy is as highly revered as painting. In Europe in the 14th–16th century, two scripts developed that influenced all subsequent handwriting and printing: the roman and italic styles. With the invention of modern printing (1450), calligraphy became increasingly bold and ornamental.

Callimachus (fl. late 5th century BC) Greek sculptor. Though little is known of his life, he reputedly invented the ornate Corinthian CAPITAL (see ORDER) after seeing leaves growing around a basket placed on a girl's tomb. He was noted for the elaborate carving and detailed draperies of his sculptures, which survive only as Roman copies.

Callimachus \kə-'lim-ə-kəs\ (b. c. 305, Cyrene, North Africa—d. c. 240 BC) Greek poet and scholar. He migrated to Egypt, where he worked at the Library of ALEXANDRIA. Of his voluminous writings, only fragments survive. His best-known poetical work is the *Causes* (c. 270 BC), a medley of obscure tales explaining the origins of customs, festivals, and names. He is the most representative poet of the erudite and sophisticated Alexandrian school. His most famous prose work is the *Pinakes* ("Tablets") in 120 books, a catalog of the authors whose works were held in the library.

Calliope *or* **Kalliope** \kə-'lī-ə-pē\ In GREEK MYTHOLOGY, the foremost of the nine MUSES and the patron of epic poetry. She and King Oeagrus of Thrace were the parents of ORPHEUS. She also bore Apollo two sons, HYMEN and Ialemus. Other versions of the myth say she was the mother of Rhesus, king of Thrace, or the mother of Linus, inventor of melody and rhythm.

Callipolis See GALLIPOLI

Callisto \kə-'lis-tō\ In GREEK MYTHOLOGY, a nymph and a hunting companion of ARTEMIS. Though she vowed never to wed, she was seduced by ZEUS, who turned her into a she-bear to conceal his infidelity from the jealous HERA. She was then killed by Artemis during a hunt. Other versions hold that it was Artemis or Hera, enraged at her unchastity, who turned her into a bear. After her death Zeus placed her in the heavens as the constellation Ursa Major (Great Bear).

Callot \ka-'lō**, Jacques** (b. 1592/93, Nancy, Fr.—d. March 24, 1635, Nancy) French etcher, engraver, and draftsman. He learned the technique of engraving in Rome. In 1612, at the court of the MEDICI FAMILY in Florence, he was employed to make pictorial records of pageants and feasts. He had a genius for caricature and the grotesque; his series of etchings *The Miseries of War* (1633), documenting the atrocities of the Thirty Years' War, was used as a source by FRANCISCO DE GOYA. His output was prodigious; more than 1,400 etchings and 2,000 drawings survive. One of the greatest of all etchers, he was also one of the first major artists to practice the graphic arts exclusively.

Calloway, Cab *orig.* **Cabell Calloway III** (b. Dec. 25, 1907, Rochester, N.Y., U.S.—d. Nov. 18, 1994, Hockessin, Del.) U.S. singer and big-band leader. He fronted his first group in 1928; it became the house band at Harlem's COTTON CLUB in 1931. An accomplished scat singer who combined audacious showmanship with prodigious vocal range and imagination, he became most identified with his hit "Minnie the Moocher" (1931). Exposure with his band launched the careers of many important jazz soloists. The composer GEORGE GERSHWIN modeled the character Sportin' Life in his musical *Porgy and Bess* (1935) on Calloway, who later performed the role himself.

Cab Calloway.
SCHOMBURG CENTER FOR RESEARCH IN BLACK CULTURE; THE NEW YORK PUBLIC LIBRARY; ASTOR, LENOX AND TILDEN FOUNDATIONS

callus In botany, soft tissue that forms over a wounded or cut plant surface, leading to healing. A callus arises from cells of the CAMBIUM. When a callus forms, some of its cells may organize into growing points, some of which in turn give rise to roots while others produce stems and leaves. Thus a callus may be capable of regenerating an entire plant.

Calmette \kal-'met**, Albert (Léon Charles)** (b. July 12, 1863, Nice, Fr.—d. Oct. 29, 1933, Paris) French bacteriologist. In the 1890s he founded the Pasteur bacteriological institutes in Saigon and later Lille. He discovered in 1908 that tuberculosis bacteria from cattle were weakened when cultured with bile, producing a strain of bacteria that provoked a protective immune reaction without causing disease. That discovery led him to develop, with Camille Guérin, a tuberculosis vaccine. He also described a test (Calmette reaction) for tuberculosis and discovered an antivenin for snakebite.

Calmette
HARLINGUE-H. ROGER-VIOLLET

Calonne \kà-'lȯn**, Charles-Alexandre de** (b. Jan. 20, 1734, Douai, France—d. Oct. 29, 1802, Paris) French politician. He served as intendant of Metz (1768) and Lille (1774), and his financial genius led to his appointment as controller general of finance (1783). He soon discovered that major reforms were necessary to save France from bankruptcy. His efforts precipitated the governmental crisis that led to the FRENCH REVOLUTION. After the Revolution began, he devoted himself to the cause of counterrevolution from his exile in England.

calorie Unit of ENERGY or HEAT. Various precise definitions are used for different purposes (physical chemistry measurements, engineering steam tables, and thermochemistry), but in all cases the calorie is about 4.2 joules, the amount of heat needed to raise the temperature of 1 g of water by 1 °C (1.8 °F) at normal atmospheric pressure. The calorie used by dietitians and food scientists and found on food labels is actually the kilocalorie (also called Calorie and abbreviated kcal or Cal), or 1,000 calories. It is a measure of the amount of heat energy or metabolic energy contained in the chemical bonds (see BONDING) of a food.

calorimeter \ˌka-lə-'ri-mə-tər\ Device for measuring heat produced during a mechanical, electrical, or chemical reaction and for calculating the HEAT CAPACITY of materials. A common design, known as a bomb calorimeter, consists of a reaction chamber surrounded by a liquid that absorbs the heat produced by the reaction. The amount of heat can be determined from the increase in temperature, taking into account the properties of the container and the liquid.

Caltech See CALIFORNIA INSTITUTE OF TECHNOLOGY

Calukya \'kä-lək-yə\ **dynasty** *or* **Chalukya dynasty** Either of two ancient Indian dynasties. The Western Calukyas ruled as emperors in the Deccan (peninsular India) from AD 543 to 757 and again from c. 975 to c. 1189. The Eastern Calukyas ruled in Vengi (present-day eastern Andhra Pradesh) from c. 624 to c. 1070. The most significant ruling family of the Deccan in the 5th and 6th centuries, they controlled both coasts and the major river valleys.

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calumet \'kal-yə-ˌmet\ *or* **sacred pipe** *or* **peace pipe** One of the central ceremonial objects of many American Indian groups. It was considered a microcosm, its parts and its decorative colours and motifs corresponding to the essential parts of the universe. It was smoked in personal prayer as well as at collective rites. Because of the narcotic effect of the tobacco and the symbolism of the indrawn and ascending smoke, the calumet was employed as a means of communication between the spirit world and humans.

Calvary *or* **Golgotha** Hill in JERUSALEM. The purported site of JESUS' Crucifixion, the hill was outside the Old City walls of Jerusalem and near the sepulchre where Jesus was said to have been afterward interred. Its exact location is uncertain, but most scholars prefer either the spot now covered by the Church of the Holy Sepulchre or a hillock called Gordon's Calvary north of the Damascus Gate.

Calvert, George See George Calvert, 1st Baron BALTIMORE

Calvert, Leonard (b. c. 1606, England—d. June 9, 1647, St. Mary's, Md.) First governor of the Maryland colony. He was the younger brother of Cecil Calvert, the colony's proprietor. In 1633 he was sent from England to establish a settlement at St. Mary's. He gradually allowed limited legislative initiative in the colony's assembly. He lost a land conflict with WILLIAM CLAIBORNE and was forced to leave Maryland (1644–46); aided by colonists, including MARGARET BRENT, he returned to reinstate his proprietorial rule.

Calvin, John *French* **Jean Cauvin** \kō-'va^{n}\ (b. July 10, 1509, Noyon, Picardy, France—d. May 27, 1564, Geneva, Switz.) French Protestant theologian and major figure of the REFORMATION. He studied religion at the University of Paris and law in Orléans and Bourges. When he returned to Paris in 1531 he studied the Bible and became part of a movement that emphasized salvation by grace rather than by works. Government intolerance prompted him to move to Basel, Switz., where he wrote the first edition of *Institutes of the Christian Religion* (1536). Gaining a reputation among Protestant leaders, he went to Geneva to help establish Protestantism in that city. He was expelled by city fathers in 1538 but returned in 1541, when the town council instituted the church order outlined in his *Ecclesiastical Ordinances*, including enforcement of sexual morality and abolition of Catholic "superstition." He approved the arrest and conviction for heresy of MICHAEL SERVETUS. By 1555 Calvin had succeeded in establishing a theocracy in Geneva, where he served as pastor and head of the Genevan Academy and wrote the sermons, biblical commentaries, and letters that form the basis of CALVINISM.

Calvin, Melvin (b. April 8, 1911, St. Paul, Minn., U.S.—d. Jan. 8, 1997, Berkeley, Calif.) U.S. biochemist. He received his Ph.D. from the University of Minnesota. He developed a system of using the radioactive isotope carbon-14 as a tracer element in his studies of the green alga chlorella. By halting the plant's metabolism at various stages and measuring tiny amounts of radioactive compounds present, Calvin was able to identify most of the reactions involved in the intermediate steps of photosynthesis, for which he was awarded a 1961 Nobel Prize. His research also included work in radiation chemistry and the processes leading to the origin of life.

Calvinism In PROTESTANTISM, the theology developed and advanced by JOHN CALVIN. It was further developed by his followers and became the foundation of the REFORMED CHURCH and PRESBYTERIANISM. As shaped by Calvin's successor at Geneva, Theodore Beza (1519–1605), Calvinism emphasizes the doctrine of PREDESTINATION, holding that God extends GRACE and grants SALVATION only to the chosen, or elect. It stresses the literal truth of the Bible, and it views the church as a Christian community in which Christ is head and all members are equal under him. It therefore rejects the episcopal form of church government in favor of an organization in which church officers are elected. Calvinism was the basis of theocracies in Geneva and Puritan New England (see PURITANISM), and it strongly influenced the Presbyterian church in Scotland.

Calvino \käl-'vē-nō**, Italo** (b. Oct. 15, 1923, Santiago de las Vegas, Cuba—d. Sept. 19, 1985, Siena, Italy) Cuban-born Italian writer. After early works inspired by his involvement with the Italian Resistance in World War II, he turned decisively to fantasy and allegory in the 1950s. *Cosmicomics* (1965) is a collection of whimsical narratives about the creation and evolution of the universe. The novels *Invisible Cities* (1972), *The Castle of Crossed Destinies* (1973), and *If on a Winter's Night a Traveler* (1979) use playfully innovative structures and shifting viewpoints. *The Uses of Literature* (1980) is a collection of essays he wrote for a left-wing journal he edited from 1959 to 1966.

calypso \kə-'lip-sō\ Musical style best known as a type of folk song. Calypso originated in Trinidad but is common throughout the Caribbean. The calypso tradition dates to the early 19th century. The subject of a calypso text, usually witty and satiric, is an event of political or social import. The lyric often incorporates Spanish, Creole, and African phrases, employing newly invented expressions such as *bobol* (graft) and *pakoti* (unfaithfulness). The exaggeration of local speech patterns is matched by an offbeat rhythm. Favourite accompanying instruments are the shak-shak (maraca), cuatro (a string instrument), and tamboo-bamboo (bamboo poles of various lengths struck on the ground). Shaped and tuned oil drums, played together in orchestras called steel bands, have also been popular.

cam Machine component that either rotates or reciprocates (moves back and forth) to create a prescribed motion in a contacting element (the follower). Since the shape of the contacting surface of the cam is determined by the prescribed motion and the profile of the follower, cams take various forms. Cam-follower mechanisms are particularly useful when a simple motion of one part of a machine is to be converted to a more complicated prescribed motion of another part, one that must be accurately timed with respect to the simple motion and may include periods of rest (dwells). Cams are essential elements in automatic MACHINE TOOLS, PRINTING machines, SEWING MACHINES, and TEXTILE machinery.

Cam Ranh \'käm-'rän\ **Bay** *Vietnamese* **Vinh Cam Ranh** Inlet of the South CHINA SEA, south-central Vietnam. Located between Phan Rang and Nha Trang, it was a French colonial naval base. It was used by the Japanese in World War II. From 1965 it was a major U.S. base in the VIETNAM WAR. It later was a major Soviet naval base, and Russia maintained a presence there after the dissolution of the U.S.S.R.

Camagüey \ˌkä-mä-'gwā\ City (pop., 1994 est.: 293,961), capital of Camagüey province, Cuba. Founded at the site of the present-day port of Nuevitas, it was moved inland in 1528. Because of the province's great production of livestock and agricultural products, it is now Cuba's largest interior city and an important communications, trading, and industrial centre.

Camargo \kä-mär-'gō**, Marie (-Anne de Cupis de)** (b. April 15, 1710, Brussels, Spanish Netherlands—d. April 20, 1770, Paris, Fr.) French ballerina. She made her Paris Opéra debut in 1726 and went on to dance in 78 ballets and operas before her retirement in 1751. Admired for her speed and agility, she executed jumping steps previously performed only by male dancers, shortening her skirts and removing the heels from her slippers to enable her do so. Her name was adopted in 1930 by a British ballet group, the Camargo Society.

Camargue \kä-'märg\ Marshy island in the delta of the RHÔNE RIVER, southern France. Occupying an area of 300 sq mi (780 sq km), it is sparsely populated). The region was once entirely wild, with free-roaming herds of cattle and wild horses; such herds can still be found in the regional park. Vineyards, forage crops, and grains were planted beginning in the late 19th century; rice growing developed after 1945. A nature reserve at the Vaccarès Lagoon protects waterbirds such as flamingos and egrets.

Cambay, Gulf of See Gulf of KHAMBHAT

Cambio, Arnolfo di See ARNOLFO DI CAMBIO

cambium In plants, a layer of actively dividing cells between XYLEM (fluid-conducting) and PHLOEM (food-conducting) tissues that is responsible for the secondary growth of stems and roots, resulting in an increase in thickness. A cambium may also form within CALLUS tissues. See also BARK, WOOD.

Cambodia *officially* **Kingdom of Cambodia** Country, Southeast Asia. Area: 69,898 sq mi (181,035 sq km). Population (2005 est.): 13,327,000. Capital: PHNOM PENH. The vast majority of the population belongs to the Khmer ethnic group. Language: Khmer (official). Religions: Buddhism (official); also traditional beliefs. Currency: riel. The landscape is dominated by large central plains; the Dangrek Mountains rise along the northern border. Cambodia lies largely in the basin of the MEKONG RIVER; the large lake TONLE SAP is in its western part. Much of the country is tropical forest. It is one of the world's poorest countries. Agriculture employs about three-fourths of the workforce. Cambodia is a constitutional monarchy with two legislative houses; its chief of state is the

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king, and its head of government is the prime minister. In the early centuries AD the area was under Hindu and, to a lesser extent, Buddhist influence. The KHMER state gradually spread in the early 8th century and reached its height under Jayavarman II and his successors in the 9th–12th centuries, when it ruled the Mekong valley and neighbouring states and built ANGKOR. Buddhism was widely adopted in the 13th century. From the 13th century the state was attacked by ANNAM and Tai (Siamese) city-states and was subject largely to Tai and Vietnamese hegemony. It became a French protectorate in 1863. It was occupied by the Japanese in World War II and became independent in 1954. Its borders were the scene of fighting in the VIETNAM WAR from 1961, and in 1970 its northeastern and eastern areas were occupied by the North Vietnamese and penetrated by U.S. and South Vietnamese forces. A bombing campaign in Cambodia by U.S. warplanes alienated much of the population, enabling the communist KHMER ROUGE under POL POT to seize power in 1975. Their regime of terror resulted in the deaths of at least 1.5 million Cambodians. Vietnam invaded in 1978 and drove the Khmer Rouge into the western hinterlands, but Cambodian infighting continued. A peace accord was reached by most Cambodian factions under UN auspices in 1991. Elections were held in 1993, and NORODOM SIHANOUK was restored to the monarchy. A civilian government slowly emerged under UN tutelage until 1997, when a coup by Hun Sen consolidated his position as prime minister. Hun Sen's party won legislative elections in 1998; also that year, Cambodia became part of ASEAN.

Cambodian See KHMER

Cambodian language See KHMER LANGUAGE

Cambon \kä^{n}-'bō^{n}**, (Pierre-) Paul** (b. Jan. 20, 1843, Paris, France—d. May 29, 1924, Paris) French diplomat. He worked in the civil service (1870–82) before entering the diplomatic service, in which he served as ambassador to Spain and Turkey. Appointed ambassador to Britain (1898–1920), he spent his first years in smoothing over Anglo-French relations. His efforts were crowned by the signing of the ENTENTE CORDIALE in 1904. During World War I he continued to play a vital role in cooperation between the two allies.

Cambrai \kam-'brā**, League of** (1508–10) Alliance of Pope JULIUS II, Emperor MAXIMILIAN I, King LOUIS XII, and King FERDINAND V, formed in 1508. Ostensibly directed against the Turks, its actual aim was to attack the Republic of Venice and divide its possessions among the allies. The allies were unable to act together because of their individual ambitions, and the league collapsed in 1510, when the pope joined with Venice, while Ferdinand became neutral.

Cambrai \kam-'brā**, Treaty of** *or* **Paix des Dames** \'pe-dā-'däm\ (French: "Peace of the Ladies") (August 3, 1529) Agreement ending one phase of the wars between FRANCIS I of France and Emperor CHARLES V, temporarily confirming Spanish (Habsburg) control in Italy. It was called the Paix des Dames because it was negotiated by Louise of Savoy (1476–1531), mother of King Francis and regent in his absence, and MARGARET OF AUSTRIA, aunt of Charles and regent of the Netherlands. See also Treaty of CATEAU-CAMBRÉSIS.

Cambrian Period Oldest time division of the PALEOZOIC ERA. During the Cambrian, 543–490 million years ago, there were widespread seas and several scattered landmasses. The largest continent was GONDWANA. The average climate was probably warmer than today, with less variation between regions. There were no land plants or animals, but there were marine organisms with either shells or skeletons. Because the dominant animals were TRILOBITES, the Cambrian is sometimes referred to as the Age of Trilobites.

Cambridge City and administrative district (pop., 2001: 108,878), eastern England. It is the county seat of CAMBRIDGESHIRE. Cambridge lies on the River Cam, a tributary of the OUSE, north of London. Originally a fording site, Cambridge possesses earthworks and Roman remains. Two monastic foundations date from the 11th–12th centuries. Cambridge received its first charter in 1207. It is best known as the site of the University of CAMBRIDGE, noted for its educational excellence and outstanding architecture. The city's economy is linked to the university and its research and development services.

Corpus Christi College, University of Cambridge, Cambridge.
SHOSTAL

Cambridge City (pop., 2000: 101,355), northeastern Massachusetts, U.S. Adjacent to Boston, it was founded in 1630 as one of the MASSACHUSETTS BAY COLONY settlements. The first American institution of higher learning, Harvard College (see HARVARD UNIVERSITY), was founded here in 1636. GEORGE WASHINGTON took command of the Continental Forces at what is now Cambridge Common in 1775. In the 19th century it was the home of such literary leaders as HENRY WADSWORTH LONGFELLOW, JAMES RUSSELL LOWELL, and OLIVER WENDELL HOLMES. The MASSACHUSETTS INSTITUTE OF TECHNOLOGY moved to Cambridge from Boston in 1916.

Cambridge, University of Autonomous institution of higher learning in Cambridge, Cambridgeshire, England. Its beginnings lie in an exodus of scholars from the University of OXFORD in 1209. Its first college was built in 1284, and the university was officially recognized by the pope in 1318. From 1511 DESIDERIUS ERASMUS did much to inculcate the new learning of the Renaissance at Cambridge. In 1546 Henry VIII founded Trinity College, which remains the largest of Cambridge's 31 colleges. From 1669 ISAAC NEWTON taught mathematics, giving this field a unique position there. In 1871 JAMES CLERK MAXWELL accepted the chair of experimental physics, beginning a leadership in physics that would continue into the next century. A host of world-renowned scholars in other fields have also taught at Cambridge, including JOHN MAYNARD KEYNES in economics and STEPHEN W. HAWKING in applied mathematics and theoretical physics. Many of the university's buildings, including the famous King's College Chapel and two chapels designed by CHRISTOPHER WREN, are rich in history and tradition. The library houses numerous important collections, and the Fitzwilliam Museum contains noteworthy collections of antiquities.

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Cambridge Agreement Pledge made in Cambridge, England, in 1629 by Puritan stockholders of the Massachusetts Bay Co. to emigrate to New England if the colony's government could be transferred there. The company agreed and shifted control of the corporation to the signers of the agreement. John Winthrop was elected governor, and he set sail in 1630 with a large group of Puritan followers to settle in the Boston area (see Massachusetts Bay Colony).

Cambridge Platonists \ˈplā-tᵊn-ists\ Group of 17th-century British philosophic and religious thinkers. Led by Benjamin Whichcote (1609–1683), it included Ralph Cudworth and Henry More (1614–1687) at Cambridge and Joseph Glanvill (1636–1680) at Oxford. Educated as Puritans, they reacted against the Calvinist emphasis on the arbitrariness of divine sovereignty. In their eyes, Thomas Hobbes and the Calvinists erred in making the voluntarist assumption (see voluntarism) that morality consists in obeying the will of a sovereign. Morality, they asserted, is essentially rational, and the good person's virtue is grounded in an understanding of the eternal and immutable nature of goodness, which not even God can alter through sovereign power.

Cambridgeshire \ˈkām-brij-ˌshir\ Administrative (pop., 2001: 552,655), geographic, and historic county, eastern England. Greatly enlarged in the government reorganization in 1974, Cambridgeshire now includes part of the former county of Huntingdonshire and the Isle of Ely; the county seat is Cambridge. Prehistoric tracks ring the fens; drainage was begun by the Romans. Major structures include Ely Cathedral and the buildings of the University of Cambridge. Cambridgeshire is crossed by two major rivers, the Nen and the Ouse, with its tributary the Cam.

Camden Town Group Group of English painters formed in 1911. The artists met weekly in the studio of Walter Sickert (1860–1942), the group's prime inspiration, in a working-class area of London. The Camden Town artists utilized an Impressionist technique but were also open to the influence of Post-Impressionism. Their subject matter was derived from the everyday life of an English industrial town. Despite a somewhat expressive use of colour, their paintings remained representational and realistic, reflecting an interpretation of a modern aesthetic different from the more formally daring developments emerging in Paris at the same time. The Camden Town Group was absorbed in 1913 by the London Group, a combination of several smaller groups of contemporary English artists.

camel Either of two species of large, hump-backed ruminants of the family Camelidae. Camels are used as draft and saddle animals in desert regions of Africa, Arabia, and Asia. Adaptations to windblown deserts include double rows of eyelashes, the ability to close the nostrils, and wide-spreading soft feet. They also can tolerate dehydration and high body temperatures. They are thus able to go several days without drinking water. Though docile when properly trained, camels can be dangerous. The Bactrian camel (*Camelus bactrianus*) is about 7 ft (2 m) tall at the top of the two humps; the Arabian camel (*C. dromedarius*), or dromedary, has one hump and is 7 ft (2 m) high at the shoulder. When food is available, camels store fat in their humps to be used later for sustenance; water is produced as a by-product of fat metabolism. The feral camels of Australia were introduced to that continent in the 1800s.

Bactrian camel (*Camelus bactrianus*)
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camel racing Sport of running camels at speed, with a rider astride, over a predetermined course. The sport is generally limited to running the dromedary—whose name is derived from the Greek verb *dramein*, "to run"—rather than the Bactrian camel. Camel racing on the Arabian Peninsula can be traced to at least the 7th century. Although traditionally overshadowed by horse racing in that region, the racing of camels was long a folk sport practiced at social gatherings and festivals. In the late 20th century it was organized into a formal sport, similar to Thoroughbred horse racing. The sport is popular in India, Australia, parts of East Africa, and especially the Arab countries of the Middle East. A race typically has 25 to 30 entries and covers distances ranging from 2.5 to 6 mi (4 to 10 km).

camellia \kə-ˈmēl-yə\ Any of the East Asian evergreen shrubs and trees that make up the genus *Camellia* in the tea family (Theaceae), most notable for three ornamental flowering species and for *C. sinensis* (sometimes called *Thea sinensis*), the source of tea. The common camellia (*C. japonica*) is the best-known, particularly for its double (many-petaled) cultivated varieties. The tea plant (*C. sinensis*), reaching 30 ft (9 m) in the wild but in cultivation kept to a low, mounded shrub, bears fragrant white, yellow-centred flowers.

Camelot In Arthurian legend, the seat of King Arthur's court. It has been variously identified with Caerleon in Wales, Queen Camel in Somerset, Camelford in Cornwall, Winchester in Hampshire, and Cadbury Castle in Somerset. Camelot has come to symbolize a short-lived golden era under a beloved leader.

cameo Hard or precious stone, glass, ceramic, or shell carved in relief above the surface. It is the opposite of intaglio. Surviving cameos date from the early Sumerian period (c. 3100 BC) to the decline of Roman civilization, and from the Renaissance to the Neoclassical period of the 18th century. They were carved with mythological scenes and portraits, and many commemorated specific persons. In the 18th–19th century, cameos adorned diadems, belts, brooches, and bracelets.

"The Rape of Europa," cameo in gold and enamel frame, 16th–17th century; in the Kunsthistorisches Museum, Vienna
COURTESY OF THE KUNSTHISTORISCHES MUSEUM, VIENNA

cameo glass Glassware decorated with figures and forms in coloured glass carved in relief against a glass background of a contrasting colour. It is produced by blowing two layers of glass together. When the glass has cooled, an outline of the design is drawn on the surface and covered with wax. The glass is then etched down to the inner layer, leaving the design outline in relief. Fine cameo glass was produced by the Romans in the 1st century AD. The art was revived by John Northwood in England and Émile Gallé in France in the late 19th century.

camera Device for recording an image of an object on a light-sensitive surface (see photography). It is essentially a light-tight box with an opening (aperture) to admit light focused onto a sensitized film or plate. All cameras have included five crucial components: (1) the camera box, which holds and protects the sensitive film from all light except that entering through the lens; (2) film, on which the image is recorded; (3) the light control, consisting of an aperture or diaphragm and a shutter, both often adjustable; (4) the lens, which focuses the light rays from the subject onto the film, creating the image; and (5) the viewing system, which may be separate from the lens system (usually above it) or may operate through it by means of a mirror. The camera was inspired by the camera obscura—a dark enclosure with an aperture (usually provided with a lens) through which light enters to form an image of outside objects on the opposite surface—and was developed by Nicephore Niepce and L.-J.-M. Daguerre in the early 19th century. See also digital camera.

Camerarius \ˌkam-ə-ˈrar-ē-əs**, Rudolph (Jacob)** *German* **Rudolph Camerer** (b. Feb. 17, 1665, Tübingen, Ger.—d. Sept. 11, 1721, Tübingen) German botanist. One of the first to perform experiments in heredity, he demonstrated sexuality in plants by identifying and defining the male and female reproductive parts of the plant and by describing their function in fertilization, showing that pollen is required for the process.

Cameron, Julia Margaret (b. June 11, 1815, Calcutta, India—d. Jan. 26, 1879, Kalutara, Ceylon) British portrait photographer. In 1864, after receiving a camera as a gift, she set up a studio and darkroom and began taking portraits. Her sitters were friends such as Alfred Tennyson, Henry Wadsworth Longfellow, and Charles Darwin. Her sensitive portraits of women, such as that of Ellen Terry, are especially noteworthy. Like many Victorian photographers, she made allegorical photographs in imitation of the Pre-Raphaelite paintings of the day. Her technical ability was criticized, but she was more interested in spiritual depth than in technical perfection; her portraits are considered exceptionally fine.

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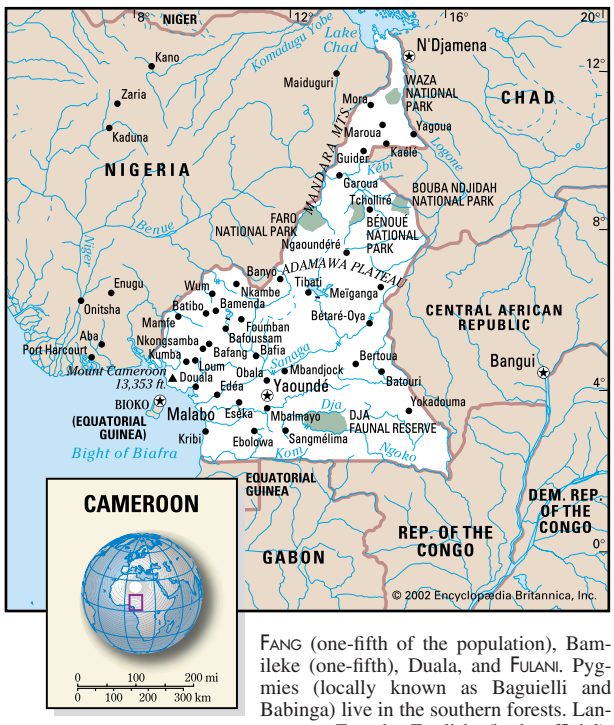
Cameron, Simon (b. March 8, 1799, Maytown, Pa., U.S.—d. June 26, 1889, Donegal Springs, Pa.) U.S. politician. He was successful in several businesses before entering the U.S. Senate (1845–49, 1857–61, and 1867–77). As leader of Pennsylvania's Republican Party, he helped secure the nomination of Abraham Lincoln in 1860. Appointed secretary of war in 1861, he was soon dismissed for showing favouritism in awarding army contracts.

Cameroon *officially* **Republic of Cameroon** Country, West Africa. Area: 183,569 sq mi (475,442 sq km). Population (2005 est.): 16,988,000. Capital: Yaoundé. The country has numerous ethnic groups, including the



Fang (one-fifth of the population), Bamileke (one-fifth), Duala, and Fulani. Pygmies (locally known as Baguielli and Babinga) live in the southern forests. Languages: French, English (both official), Fula, Bamileke, Duala. Religions: Christianity (mostly Roman Catholic; also Protestant), traditional beliefs, Islam (mainly in the north). Currency: CFA franc. Cameroon has four geographic regions. The southern area consists of coastal plains and a densely forested plateau. The central region rises progressively to the north and includes the Adamawa Plateau. In the north a savanna plain slopes downward toward the Lake Chad basin. To the west and north along the Nigerian border the relief is mountainous and includes Mount Cameroon. Of the main rivers, the Sanaga drains into the Atlantic Ocean, and the Benue flows westward into the Niger River basin in Nigeria. Cameroon has a developing market economy based largely on agriculture but with a growing services sector. It is a republic with one legislative house; its chief of state is the president and its head of government the prime minister. Long inhabited before European colonization, Cameroon was peopled by Bantu-language speakers coming from equatorial Africa to settle in the south. They were followed by Muslim Fulani from the Niger River basin, who settled in the north. Portuguese explorers visited in the late 15th century, and the Dutch were also active there. In 1884 the Germans took control and extended their protectorate over Cameroon. In World War I joint French-British action forced the Germans to retreat, and after the war the region was divided into French and British administrative zones. After World War II the two areas became UN trusteeships. In 1960 the French trust territory became an independent republic. In 1961 the southern part of the British trust territory voted for union with the new Republic of Cameroon, and the northern part voted for union with Nigeria. The independent country has faced chronic economic problems, which have produced unrest in the country.

Cameroon, Mount Volcanic massif, Cameroon. Rising to 13,435 ft (4,095 m), it is the highest peak in West Africa. Extending 14 mi (23 km) inland from the Gulf of Guinea, it is the westernmost extension of a series of mountains that form a natural boundary between Cameroon and Nigeria. Richard Burton climbed its summit in 1861. The volcano last erupted in 2000.

Camilla In Roman mythology, a legendary warrior maiden and favourite of Diana. According to Virgil, her father dedicated her to Diana and trained her as a hunter and warrior, and she led a band of warriors that included women. She fought against Aeneas and was killed as she chased a retreating soldier.

Camillus \kə-'mil-əs**, Marcus Furius** (d. 365 BC) Roman soldier and statesman. He allegedly defeated the Gauls after their sack of Rome (c. 390), for which he was honoured as the city's second founder. Awarded four triumphs and made dictator five times, he enjoyed his greatest victory in 396, over the Etruscans at Veii. Though a patrician, he adopted reforms beneficial to the army and the plebeians (367).

Camisards \'kam-ə-ˌzärdz\ Protestant militants in southern France who opposed Louis XIV's persecution of Protestantism. The armed insurrection, which began in 1702, came in response to Louis's revocation of the Edict of Nantes, ending religious toleration. The well-organized Camisards, so named for their white shirts (in French dialect, *camisa*), fought successfully and even held royal armies in check. In response, the government burned hundreds of villages and massacred their populations. By 1705, with many of the Camisard leaders captured and executed, the revolt had lost its force.

Camões \kə-'mōi^{n}sh**, Luís (Vaz) de** (b. c. 1524/25, Lisbon—d. June 10, 1580, Lisbon) Portuguese poet. A member of the impoverished aristocracy, he may have spent about 17 years in India. His masterpiece, the epic *The Lusiads* (1572), extols glorious deeds in Portuguese history as it recounts Vasco da Gama's discovery of the sea route to India. His numerous lyric pieces (together with many apocryphal poems) appeared posthumously in editions of the poetry collection *Rimas* (from 1595). He also wrote dramatic works, including *Filodemo* (1587), in which he developed the *auto*, a kind of morality play, and the comedy *The Two Amphitryons* (1587). He had an unparalleled impact on Portuguese and Brazilian literature and is regarded as Portugal's national poet.

camouflage \'ka-mə-ˌfläzh\ Art and practice of concealment and visual deception in war. Its goal is to prevent enemy observation of installations, personnel, equipment, and activities. Camouflage came into wide use in World War I in response to air warfare. Aerial reconnaissance (and later aerial bombardment) required concealment of troops and equipment. By World War II, long-range bombing threatened warring countries in their entirety, and almost everything of military significance was hidden to some degree, using mottled, dull-coloured paint patterns (green, gray, or brown), cloth garnishing, netting, and natural foliage. Dummies and decoys, including fake vehicles and airfields, tricked enemy planes into bombing harmless targets. It remained an important technique after World War II, used with notable success by communist guerrilla units in the Vietnam War.

Camp David Rural retreat of U.S. presidents, northern Maryland. The scenic mountainous area (200 acres, or 81 hectares) was established as "Shangri-La" in 1942 by Pres. Franklin Roosevelt and made an official presidential retreat by Harry Truman in 1945. In 1953 Dwight D. Eisenhower renamed it Camp David for his grandson. It has been the scene of a number of high-level presidential conferences with foreign heads of state. See also Camp David Accords.

Camp David Accords (1978) Two agreements reached between Menachem Begin of Israel and Anwar el-Sādāt of Egypt with the help of U.S. President Jimmy Carter at Camp David, Md., U.S. One agreement created a framework for negotiations to arrive at a peace treaty between Egypt and Israel, formally ending some 30 years of being in a state of war. This treaty, normalizing relations, was signed in 1979 and led to the return of the Sinai Peninsula, occupied by Israel in the Six-Day War (1967), to Egypt. The other agreement created a framework for a broader peace in the region that included a plan for Palestinian self-rule in the West Bank and Gaza Strip. The latter provisions were not implemented. See also Moshe Dayan.

Campania \käm-'pä-nyä\ Region (pop., 2001 prelim.: 5,652,492), southern Italy. It is located on the Tyrrhenian Sea and occupies 5,249 sq mi (13,595 sq km). Its capital is Naples. Occupied successively by Greeks, Etruscans, and Samnites, Campania became an ally of Rome c. 350 BC. It was a favourite resort of the Romans, and it is noted for its natural beauty and famous old towns, including Cumae, Pompeii, Capua, Salernum, and

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Neapolis (Naples). After the fall of Rome, Campania was ruled by Gaul, Byzantium, and the Normans; it became part of the Kingdom of Naples in 1282. It was united with Italy in 1861. Its economy is bolstered by agriculture, the industrial area around Naples, and tourism.

campanile \ˌkam-pə-ˈnē-lē\ Italian belltower, originally built beside or attached to a church. The earliest campaniles (7th–10th century) were plain round towers with a few small arched openings near the top; the LEANING TOWER OF PISA is an elaborate version of this type. The Venetian form of campanile consisted of a tall, square, slim shaft, frequently tapered, with a BELFRY at the top, above which rose the SPIRE, sometimes square as in the famous campanile of ST. MARK'S BASILICA (10th–12th century, belfry story 1510). After falling out of favor during the Renaissance, the Venetian type was revived in the 19th century, often in connection with factories, housing, or collegiate buildings.

campanula See BELLFLOWER

Campbell, John Archibald (b. June 24, 1811, Washington, Ga., U.S.—d. March 12, 1889, Baltimore, Md.) U.S. jurist. After being admitted to the bar at age 18, he moved to Alabama, where he gained a large private practice and served in the state legislature. Appointed to the SUPREME COURT OF THE UNITED STATES in 1853, he became known as a strict constructionist; his tenure was notable for his concurrence in the DRED SCOTT DECISION. Although he opposed secession as imprudent, he resigned from the Supreme Court in 1861 and cast his lot with the South in the American Civil War, serving as assistant secretary of war for the Confederacy. After the South's surrender he was imprisoned for four months on false charges. Upon his release he moved to New Orleans, where he established a law practice.

Campbell, Joseph (b. March 26, 1904, New York, N.Y., U.S.—d. Oct. 31, 1987, Honolulu, Hawaii) U.S. author of works on comparative mythology. He studied English literature and taught at Sarah Lawrence College. He explored the common functions of myths in human cultures, examining mythic archetypes in folklore and literature from around the world. His views, strongly influenced by CARL GUSTAV JUNG, were popularized through a public-television series in the 1980s. His books include *The Hero with a Thousand Faces* (1949) and *The Masks of God* (4 vol., 1959–67).

Campbell, Kim *orig.* **Avril Phaedra Campbell** (b. March 10, 1947, Port Alberni, B.C., Can.) Prime minister of Canada (1993). She taught political science at the University of British Columbia and practiced law for two years before turning to politics. In 1988 she was elected to the federal parliament as a Progressive Conservative. Under Prime Minister BRIAN MULRONEY, she became minister for Indian affairs (1989), attorney general (1990), and defense minister (1993). Upon Mulroney's retirement in June 1993, she became Canada's first female prime minister and the first prime minister from the West Coast. Her tenure was brief; in November her party suffered a heavy defeat, and she resigned as party leader.

Campbell, Mrs. Patrick *orig.* **Beatrice Stella Tanner** (b. Feb. 9, 1865, London, Eng.—d. April 9, 1940, Pau, France) British actress. She married at age 19 and made her stage debut in 1888, winning fame as Paula in *The Second Mrs. Tanqueray* in 1893. She originated the role of Eliza Doolittle in GEORGE BERNARD SHAW's *Pygmalion* (1914), and she and Shaw conducted a famous correspondence for many years. She also achieved great success in MAURICE MAETERLINCK's *Pelléas and Mélisande*, HENRIK IBSEN's *Ghosts*, and SOPHOCLES' *Electra*. She made her film debut in *Riptide* (1933) at age 68 and later appeared in several more films.

Campbell family \ˈkam-bəl\ *or* **Campbells of Argyll** \är-ˈgīl\ Scottish noble family. The Campbells of Lochow gained prominence in the later Middle Ages. In 1457 Colin Campbell, Baron Campbell (died 1493), was created 1st earl of Argyll. Archibald (died 1558), 4th earl, was a leading Protestant. Archibald (1532?–1573), 5th earl, was also a Protestant but supported the Catholic MARY, QUEEN OF SCOTS. Archibald (1607?–1661), 8th earl, was the leader of Scotland's anti-Royalist party in the ENGLISH CIVIL WARS. His son Archibald (1629–1685), 9th earl, was a Protestant leader executed for his opposition to the Roman Catholic king JAMES II. Archibald (1651?–1703), 10th earl, regained the family estates and was created 1st duke of Argyll; he organized the massacre of the Macdonalds of Glencoe. John Campbell (1678–1743), 2nd duke, supported union with England and was commander of the British forces in the JACOBITE rebellion of 1715. Archibald (1682–1761), 3rd duke, was a prominent politician during the early Hanoverian period in Britain. After he died without a legitimate heir, the succession passed to the Campbells of Mamore.

Campbell-Bannerman, Sir Henry *orig.* **Henry Campbell** (b. Sept. 7, 1836, Glasgow, Scot.—d. April 22, 1908, London, Eng.) British politician. A member of the House of Commons from 1868, he was elected leader of the Liberal Party in 1899 and served as prime minister (1905–08). His popularity unified his badly divided party. Though much of his legislative program was nullified by the House of Lords, he obtained approval of the Trades Disputes Act of 1906. He took the lead in granting self-government to the Transvaal and the Orange River Colony, thereby securing the Boers' loyalty to the British Empire.

Campeche \käm-ˈpā-chā\ State (pop., 2000: 690,689), southeastern Mexico. Covering 19,619 sq mi (50,812 sq km), its capital is CAMPECHE. Located on the YUCATÁN PENINSULA, it is bounded by the Gulf of MEXICO. Named for the ancient Mayan province of Kimpech (Campech), it comprises much of the western part of the peninsula. Rivers in the southern part drain into Términos Lagoon, at whose gulf entrance is the area's chief depot, Ciudad del Carmen. Forest products and commercial fishing are important to the economy.

Campeche City (pop., 2000: 190,813), capital of CAMPECHE state, Mexico. The Spanish town was founded in 1540 on the site of a MAYAN village, the remains of which are still visible. It became the capital of the newly created Campeche state in 1863. It is a service centre for offshore oil drilling facilities.

Campeche, Bay of Inlet of the Gulf of MEXICO. Bounded by the YUCATÁN PENINSULA, the Isthmus of Tehuantepec, and the southern part of the state of VERACRUZ, it covers about 6,000 sq mi (15,500 sq km). Major offshore oil fields were developed in the bay in the 1970s, and it became Mexico's principal oil-producing region. In 1979 an accident at an oil well there released some 3 million barrels of crude oil into the gulf; the government spent more than $100 million to bring the spill under control.

camphor Organic compound of the ISOPRENOID family. A white, waxy solid with a penetrating, somewhat musty aroma, it is obtained from the wood of the camphor laurel (see LAUREL FAMILY), *Cinnamomum camphora* (found in Asia), or produced synthetically from oil of TURPENTINE. It has long been used in incense and as a medicinal. Modern applications include use as a plasticizer for cellulose nitrate, as a moth repellent, as a flavouring, in embalming, and in fireworks. Camphorated oil is 20% camphor in olive oil.

Campin \ˈkäm-pin**, Robert** (b. c. 1378, Tournai, Fr.—d. April 26, 1444, Tournai) Flemish painter. He is identified with the Master of Flémalle on stylistic grounds. Documents show that Campin was a master painter in Tournai in 1406; two students are listed as entering his studio in 1427: ROGIER VAN DER WEYDEN and Jacques Daret. Campin's principal surviving works are two large panels of an altarpiece once believed to have come from a nonexistent Abbey of Flémalle. The famous Mérode Altarpiece, a triptych of the Annunciation formerly regarded as his masterpiece, is now thought to be by a member of his workshop or circle. Characterized by a naturalistic conception of form and a poetic representation of the objects of daily life, Campin's work marks the break with the prevailing International Gothic style and prefigures the achievements of the painters of the Northern Renaissance. Despite much uncertainty about his life and work, he was one of the most important and influential Flemish artists of the 15th century.

camping Recreational activity in which participants live outdoors, often in the wilderness, usually using tents, trailers, or motor homes, but sometimes only a sleeping bag, for shelter. Modern camping originated near the end of the 19th century in the U.S. as a rough, back-to-nature pastime for hardy lovers of nature. Canoes were the original vehicle; bicycle camping soon followed. Camping was a major part of the programs of the Boy Scouts and Girl Guides (see SCOUTING). It gained greatly in popularity after World War II. As the number of campgrounds with greater amenities grew, it became the standard holiday for many ordinary families. Recent decades have seen its continued growth, to the point of placing a serious strain on the resources of state and federal outdoor-recreation areas. See also BACKPACKING.

campion Any of the ornamental rock-garden or border plants that make up the genus *Silene*, of the PINK FAMILY, consisting of about 500 species of herbaceous plants found throughout the world. The name is also applied

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to members of the genus *Lychnis* of the same family. Some species of *Silene* stand erect; others are spreading plants. The stems often are covered with a sticky material. Some species have solitary flowers; others have branched clusters of red, white, or pink flowers. The fruit is a CAPSULE.

Bladder campion (*Silene vulgaris*). JEWEL CRAIG—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Campion, Jane (b. April 30, 1954, Wellington, N.Z.) New Zealand film director. After training as a painter in Australia, she studied filmmaking and made several notable short films. Her first feature, *Sweetie* (1989), was followed by the successful *An Angel at My Table* (1990). She wrote and directed the internationally acclaimed *The Piano* (1993) and directed *The Portrait of a Lady* (1996) and *Holy Smoke* (1999).

Campo Formio \ˌkäm-pō-'fôr-mē-ō**, Treaty of** (Oct. 17, 1797) Peace settlement between France and Austria, signed at Campo Formio (now Campoformido, Italy) following Austria's defeat in NAPOLEON's first Italian campaign. The treaty preserved most of the French conquests and completed Napoleon's victory over the First Coalition, the group of European nations opposing him. See also FRENCH REVOLUTIONARY WARS.

Campobasso \ˌkäm-pō-'bä-sō\ City (pop., 2001 prelim.: 46,860), Italy. Located northeast of NAPLES, it is the capital of MOLISE autonomous region. The old hill town was abandoned in 1732 when its inhabitants built a new town on a lower fertile plain. The old town still has a medieval castle and Romanesque churches; the new town has an archaeological museum.

Campylobacter \'kam-pi-lō-ˌbak-tər\ Genus of gram-negative spiral-shaped BACTERIA infecting mammals. Many species, especially *C. fetus*, cause miscarriage in sheep and cattle. *C. jejuni* is a common cause of FOOD POISONING. Sources include meats (particularly chicken) and unpasteurized milk. Infection causes acute GASTROENTERITIS, fever, headache, and joint and muscle pain; nerve damage and death may occur in severe cases.

Camus \kà-'mü**, Albert** (b. Nov. 7, 1913, Mondovi, Alg.—d. Jan. 4, 1960, near Sens, France) Algerian-French novelist, essayist, and playwright. Born into a working-class family, Camus graduated from the university in Algiers and then worked with a theatrical company, becoming associated with leftist causes. He spent the war years in Paris, and the French Resistance brought him into the circle of JEAN-PAUL SARTRE and EXISTENTIALISM. He became a leading literary figure with his enigmatic first novel, *The Stranger* (1942), a study of 20th-century alienation, and the philosophical essay "The Myth of Sisyphus" (1942), an analysis of contemporary nihilism and the concept of the absurd. *The Plague* (1947), his allegorical second novel, and "The Rebel" (1951), another long essay, developed related issues. Other major works include the short-story collection *Exile and the Kingdom* (1957) and the posthumous autobiographical novel *The First Man* (1994). His plays include *Le Malentendu* (1944) and *Caligula* (1944). Camus won the Nobel Prize for Literature in 1957. He died in a car accident.

Canaan \'kā-nən\ Ancient name for an area of shifting boundaries but centred on PALESTINE. Coastal Canaanite civilization dates to the Paleolithic Period; towns developed in Neolithic times (c. 7000–4000 BC). The name appears in writings from the 15th century BC. Invaded by the Hebrews (c. 1200 BC), who settled in southern areas, it was later invaded by the PHILISTINES. In the 10th century BC the Israelites, under King DAVID, broke Philistine power, and Canaan became thereafter the Land of Israel, the "Promised Land" of the biblical book of EXODUS.

Canada Country, North America. Area: 3,855,103 sq mi (9,984,670 sq km). Population (2005 est.): 32,227,000. Capital: OTTAWA. People of British and French descent constitute more than half the population; there are significant minorities of Chinese, South Asian, German, Italian, American Indian, and Inuit (ESKIMO) origin. Languages: English, French (both official). Religions: Christianity (mostly Roman Catholic; also Protestant, other Christians, Eastern Orthodox); also Islam, Judaism, Hinduism, Buddhism. Currency: Canadian dollar. Canada may be divided into several physiographic regions. A large interior basin centred on HUDSON BAY and covering nearly four-fifths of the country is composed of the CANADIAN SHIELD, the interior plains, and the Great Lakes–St. Lawrence lowlands. Rimming the basin are highland regions, including the ARCTIC ARCHIPELAGO. Mountain ranges include the ROCKY, Coast, and Laurentian mountains. Canada's highest peak is Mount LOGAN (19,551 ft [5,959 m]) in YUKON TERRITORY. Five of Canada's rivers—the ST. LAWRENCE, MACKENZIE, YUKON, FRASER, and NELSON—rank among the world's 40 longest. In addition to Lakes SUPERIOR and HURON, both shared with the U.S., Canada's GREAT BEAR and GREAT SLAVE lakes are among the world's 11 largest lakes in area. The country also includes several major islands, including BAFFIN, ELLESMERE, VICTORIA, NEWFOUNDLAND, and MELVILLE, and many small ones. Its border with the U.S., the longest border in the world not patrolled by military forces, extends 5,525 mi (8,890 km). With a developed market economy that is export-directed and closely linked with that of the U.S., Canada is one of the world's most prosperous countries. It is a parliamentary state with two legislative houses; its chief of state is the British monarch, whose representative is Canada's governor-general, and the head of government is the prime minister. Originally inhabited by American Indians and Inuit, Canada was visited c. AD 1000 by Scandinavian explorers, whose settlement is confirmed by archaeological evidence from Newfoundland. Fishing expeditions off Newfoundland by the English, French, Spanish, and Portuguese began as early as 1500. The French claim to Canada was made in 1534 when JACQUES CARTIER entered the Gulf of ST. LAWRENCE. A small settlement was made in NOVA SCOTIA (Acadia) in 1604, and by 1608 SAMUEL DE CHAMPLAIN had reached Quebec. Fur trading was the impetus behind the early colonizing efforts. In response to French activity, the English in 1670 formed the HUDSON'S BAY COMPANY. The British-French rivalry for the interior of upper North America lasted almost a century. The first French loss occurred in 1713 at the conclusion of QUEEN ANNE'S WAR (War of the SPANISH SUCCESSION), when Nova Scotia and Newfoundland were ceded to the British. The SEVEN YEARS' WAR (FRENCH AND INDIAN WAR) resulted in France's expulsion from continental North America in 1763. After the AMERICAN REVOLUTION Canada's population was augmented by LOYALISTS fleeing the United States, and the increasing number arriving in Quebec led the British to divide the colony into Upper and Lower Canada in 1791. The British reunited the two provinces in 1841. Canadian expansionism resulted in the confederation movement of the mid-19th century, and in 1867 the Dominion of Canada, comprising Nova Scotia, New Brunswick, Quebec, and Ontario, came into existence. After confederation, Canada entered a period of westward expansion. The prosperity that accompanied Canada into the 20th century was marred by continuing conflict between the English and French communities. Through the Statute of WESTMINSTER (1931), Canada was recognized as an equal partner of Great Britain. With the CANADA ACT of 1982, the British gave Canada total control over its constitution and severed the remaining legal connections between the two countries. French Canadian unrest continued to be a major concern, with a movement growing for Quebec separatism in the late 20th century. Referendums for more political autonomy for Quebec were rejected in 1992 and 1995, but the issue remained unresolved. In 1999 Canada formed the new territory of NUNAVUT. See map on following page.

Canadian Prime Ministers

John A. Macdonald	1867–73	W. L. Mackenzie King	1935–48
Alexander Mackenzie	1873–78	Louis St. Laurent	1948–57
John A. Macdonald	1878–91	John G. Diefenbaker	1957–63
John Abbott	1891–92	Lester B. Pearson	1963–68
John Thompson	1892–94	Pierre Elliott Trudeau	1968–79
Mackenzie Bowell	1894–96	Joseph Clark	1979–80
Charles Tupper	1896	Pierre Elliott Trudeau	1980–84
Wilfred Laurier	1896–1911	John N. Turner	1984
Robert Laird Borden	1911–20	Brian Mulroney	1984–93
Arthur Meighen	1920–21	Kim Campbell	1993
W. L. Mackenzie King	1921–26	Jean Chrétien	1993–2003
Arthur Meighen	1926	Paul Martin	2003–06
W. L. Mackenzie King	1926–30	Stephen Harper	2006–
Richard Bedford Bennett	1930–35		

Canada Act *or* **Constitution Act** Measure formally ending British power to legislate for Canada, approved by the British Parliament on March 25, 1982, and proclaimed by Queen ELIZABETH II on April 17, 1982. The document contains the BRITISH NORTH AMERICA ACT and was approved by all the Canadian provinces except Quebec, which was denied its claim of a constitutional veto by Canada's Supreme Court.

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Canada Bill See CONSTITUTIONAL ACT (1791)

Canada Company Organization instrumental in colonizing much of the western part of Upper Canada (now Ontario). The company was formed in 1824 to bring settlers to the region. It was directed until 1829 by John Galt (1779–1839), founder of Guelph and father of ALEXANDER GALT. Though the company, chartered with 2.5 million acres, was criticized as a monopoly, it continued to exist until the 1950s.

Canada Day *formerly* **Dominion Day** Annual Canadian holiday. Observed on July 1, it commemorates the formation of the Dominion of Canada on July 1, 1867. With the 1982 passage of the CANADA ACT, its name was officially changed to Canada Day. It is celebrated with parades, fireworks, flag display, and the singing of the national anthem, "O Canada."

Canada East *or* **Lower Canada** Region of Canada now known as QUEBEC. In 1791–1841 it was known as Lower Canada and in 1841–67 as Canada East. Populated mainly by French settlers who wanted to preserve their distinctive identity and cultural traditions, it was reluctant to join the proposed confederation with CANADA WEST. It finally agreed to confederation in 1867, providing that it would remain a territorial and governmental unit in which French Canadians would have an electoral majority.

Canada goose Brown-backed, light-breasted GOOSE (*Branta canadensis*) with a black head and neck and white cheeks. Subspecies vary in size, from the 4.4-lb (2-kg) cackling goose to the 14.3-lb (6.5-kg) giant Canada goose, which has a wingspread of up to 6.6 ft (2 m). Canada geese breed across Canada and Alaska and winter mainly in the southern U.S. and Mexico; they have been introduced into England and other countries. They are an important game bird. Their almost incessant honking draws attention to their V-formations during migration. In recent years their population in North America has increased, making them pests in some inhabited areas.

Canada goose (*Branta canadensis*). LEONARD LEE RUE III

Canada West *or* **Upper Canada** Region of Canada now known as ONTARIO. In 1791–1841 it was known as Upper Canada and in 1841–67 as Canada West. Settled primarily by English-speaking immigrants, it sought confederation with CANADA EAST in order to secure the unified government needed for effective administration and the construction of intercolonial railways. The unified Dominion of Canada was made official by the BRITISH NORTH AMERICA ACT of 1867.

Canadian Alliance *French* **Alliance Canadienne** Former conservative Canadian political party. It was created in 2000 from the merger of the Reform Party of Canada with other conservative groups in an effort to mount a united challenge to the ruling LIBERAL PARTY OF CANADA. By 1997 the Reform Party, whose support had been concentrated in the western Canadian provinces, held 60 seats in the Canadian House of Commons and was the official opposition party. The new Canadian Alliance gained 66 seats in the 2000 election and became the official opposition, though it was unable to make significant inroads in eastern Canada. In 2003 the party merged with the PROGRESSIVE CONSERVATIVE PARTY to form the Conservative Party of Canada. The party's platform generally favoured a reduction in the size of government, lower taxes, and conservative positions on social issues.

Canadian Broadcasting Corp. (CBC) Canadian public broadcasting service, created in 1936 to promote Canadian culture and serve as an instrument of national unity. It offers French- and English-language programs over AM and FM radio networks, television networks, cable television channels, and shortwave radio. Noted for its news and public affairs programs, the CBC also presents documentaries, dramas, classical music, entertainment, and educational programs as well as sports programs.

Canadian Football League (CFL) Major Canadian professional gridiron FOOTBALL organization, formed in 1958. The league's Western Conference includes teams from Edmonton, Calgary, British Columbia, Saskatchewan, and Winnipeg; its Eastern Conference comprises teams from Hamilton, Montreal, Ottawa, and Toronto. The conference winners compete for the Grey Cup. The CFL plays a gridiron style of football.

Canadian Labour Congress (CLC) Nationwide association of labour unions in Canada. The CLC was formed in 1956 by the merger of the Canadian counterparts to the American Federation of Labor and the Congress of Industrial Organizations, which merged in the same year (see AFL-CIO). It represents roughly 3 million unionized workers across Canada.

Canadian National Railway Co. Corporation created by the Canadian government in 1918 to operate a number of nationalized railroads (including the old Grand Trunk lines, Intercolonial Railway, National Transcontinental Railway, and Canadian Northern Railway) as one of Canada's two transcontinental railroad systems. Its passenger services were taken over by VIA Rail Canada in 1978, and the company was privatized in 1995. The Canadian National Railway stretches across Canada from Nova Scotia to Vancouver. It bought the Illinois Central Corp. in 1999, thus acquiring a railroad network that links Canada to the Gulf of Mexico.

Canadian Pacific Railway Ltd. (CPR) Privately owned company that operates one of Canada's two transcontinental railroad systems. The company was created in 1881 to complete a railroad from Montreal to Port Moody in British Columbia. Its passenger services were taken over by VIA Rail Canada in 1978. After its former parent company, Canadian Pacific Ltd., reorganized in 2001, CPR became a publicly owned operator of freight rail lines across Canada and in parts of the U.S.

Canadian River River, southwestern U.S. Flowing across northeastern New Mexico, it cuts a gorge nearly 1,500 ft (450 m) deep before turning eastward to continue across northwestern Texas and through central Oklahoma to the ARKANSAS RIVER in Oklahoma. It is 906 mi (1,458 km) long. Its course is punctuated by flood-control and irrigation units.

Canadian Shield One of the world's largest geologic CONTINENTAL SHIELDS, centred on Hudson Bay and extending for 3 million sq mi (8 million sq km) over Canada from the Great Lakes to the Canadian Arctic and into Greenland, with small extensions into northern Minnesota, Wisconsin, Michigan, and New York. It is the largest mass of exposed PRECAMBRIAN rock on earth. The region as a whole is composed of ancient crystalline rocks whose complex structure attests to a long history of uplift and depression, mountain building, and erosion.

canal Artificial waterway built for transportation, irrigation, water supply, or drainage. The early Middle Eastern civilizations probably first built canals to supply drinking and irrigation water. The most ambitious navigation canal was a 200-mi (320-km) construction in what is now Iraq. Roman canal systems for military transport extended throughout northern Europe and Britain. The most significant canal innovation was the pound lock, developed by the Dutch c. 1373. The closed chamber, or pound, of a lock is flooded or drained of water so that a vessel within it is raised or lowered in order to pass between bodies of water at different elevations. Canals were extremely important before the coming of the railroad in the mid-19th century. Among the significant waterways in the U.S. were the ERIE CANAL, several canals linking the Great Lakes, and one connecting the Great Lakes to the Mississippi River. Modern waterway engineering enables larger vessels to travel faster by reducing delays at locks. See also GRAND CANAL, PANAMA CANAL, SUEZ CANAL. See illustration on following page.

Canal Zone *or* **Panama Canal Zone** Strip of territory, a historic administrative entity in Panama over which the U.S. formerly exercised jurisdictional rights (1903–79). The zone came into being in 1904 when Panama granted the U.S., in return for annual payments, sole right to operate and control the PANAMA CANAL, including a strip of land 10 mi (16 km) wide along the canal extending from the Atlantic to the Pacific Ocean and bisecting the Isthmus of Panama. The zone was abolished by treaty in 1979, and civil control of the territory was returned to Panama. By the same treaty a commission under joint U.S.-Panamanian ownership was established to operate the canal until the year 2000, when Panama assumed full control.

Canaletto \ˌka-nᵊl-'e-tō\ *orig.* **Giovanni Antonio Canal** (b. Oct. 18, 1697, Venice, Republic of Venice—d. April 20, 1768, Venice) Italian painter and etcher. He was trained in the studio of his father, a theatrical scene painter. From 1719 to 1720 he worked in Rome, painting scenes for operas, until he turned to painting topographical images. After his return

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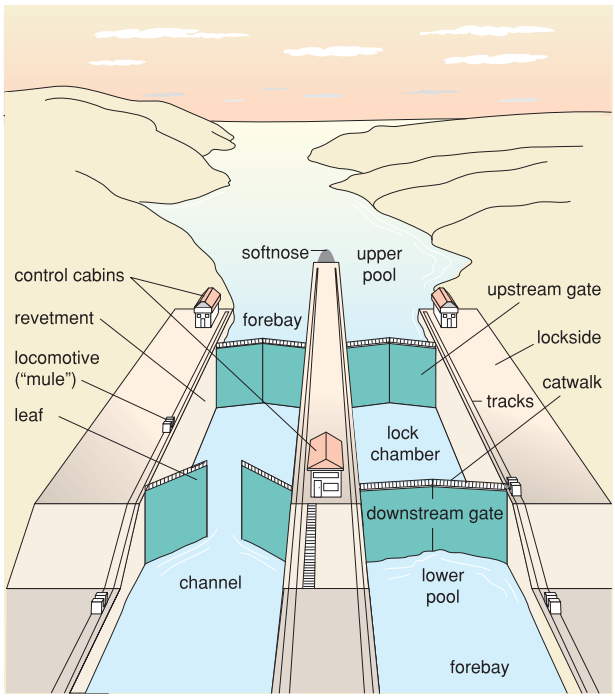

Canal with a basic lock arrangement. Boats traveling upstream pass from the lower to the upper pool through the chamber (or pound) on the left; downstream traffic uses the pound on the right.
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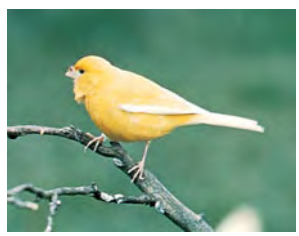
to Venice, he produced the picturesque views (*vedute*) that would bring him international fame. His pictures provide dramatic views of Venetian architecture and demonstrate skill in rendering sunlight and shadow. In the 1730s he was kept busy meeting foreign visitors' demand for souvenir views of Venice. When the War of the Austrian Succession made foreign visitors scarce, he expanded his output to include imaginative views of Roman ruins, and in 1746 he went to England to paint views of London and the great English country houses. In 1763 he was elected to the Venetian Academy. The most famous topographical painter of the 18th century, he influenced succeeding generations of landscape artists. He is not to be confused with his nephew Bernardo Bellotto, also known as Canaletto.

Canaris \kä-'nä-rəs**, Wilhelm (Franz)** (b. Jan. 1, 1887, Aplerbeck, Westphalia, Ger.—d. April 9, 1945, Flossenbürg concentration camp, Bavaria) German naval officer. Under Adolf Hitler, Canaris became head of military intelligence (Abwehr) in 1935. Believing that the Nazi regime would destroy traditional conservative values and that its foreign ambitions were dangerous to Germany, he enlisted some of the anti-Hitler conspirators into the Abwehr and shielded their activities. After the abortive July Plot against Hitler in 1944, Canaris was arrested and executed.

canary Popular cage bird (*Serinus canaria*; in the goldfinch family, Carduelidae) that owes its coloration and sustained vocal powers to 400 years of selective breeding. Varieties called rollers trill almost continuously; choppers have a loud trill of distinct notes. Well-known breeds include Hartz Mountain, Norwich, and Yorkshire. The average life span of a caged canary is 10–15 years. The canary is native to the Canary, Azores, and Madeira islands. The wild form is streak-backed and mostly greenish brown.



Canary (*Serinus canaria*).
ERIC HOSKING

Canary Islands *Spanish* **Islas Canarias** Island group and autonomous community (pop., 2005 est.: 1,968,280) of Spain located in the Atlantic Ocean 67 mi (108 km) off the northwestern coast of Africa. The islands comprise two provinces, Santa Cruz de Tenerife and Las Palmas, with an area of 2,876 sq mi (7,447 sq km). The capital is Santa Cruz de Tenerife. Known in ancient times as the "Fortunate Islands," they were written about by both Plutarch and Pliny the Elder. Believed to be the western limit of the world, they were visited in the Middle Ages by Arabs, Genoese, Majorcans, Portuguese, and French. They were taken by Castile (see Castile-León) in 1404, and their indigenous inhabitants, the Guanche and Canario, were gradually conquered during the 15th century. The islands became a stop on the usual route for Spanish trading vessels with the New World. Today agriculture is an economic mainstay, as is an expanding tourist trade.

canasta \kə-'nas-tə\ Form of rummy, using two full decks, in which players or partnerships try to meld groups of three or more cards of the same rank and score bonuses for seven-card melds. Eleven cards are dealt to each player, the undealt portion of the pack is placed on the table, and the top card is turned up to start the discard pile. Each player in turn must draw, may meld, and must discard one card. A hand ends when a player melds his last card (goes out). Canasta originated in Uruguay in the late 1940s; its name (meaning "basket") is probably a reference to the tray for holding discards.

Canaveral \kə-'na-və-rəl**, Cape** Cape, eastern Florida, U.S. It is the location of NASA's John F. Kennedy Space Center and the launch site of U.S. spaceflights, which included the first U.S. manned spaceflight (1961), the first lunar-landing flight (1969), and flights of the space shuttle *Challenger*, which exploded shortly after liftoff in 1986. After the death of Pres. John F. Kennedy in 1963, it was renamed Cape Kennedy; it reverted to its original name in 1973.

Canberra \'kan-ber-ə\ City (pop., 2004 est.: metro. area, 377,074), capital of Australia. Located in the Australian Capital Territory, on the Molonglo River, it was chosen in 1909 as the site of the capital. An international competition held in 1911 chose the U.S. architect Walter Burley Griffin (b. 1876—d. 1937) to design the city, and construction began in 1913. The transfer of Parliament from Melbourne took place in 1927. The city continues to expand, with residential development taking place in satellite towns. There is light industry and a growing tourist trade, though government functions dominate.

A statue by Henry Moore sits on the grounds of the National Library of Australia in Canberra.
ROBIN SMITH PHOTOGRAPHY, NEW SOUTH WALES

cancer Uncontrolled multiplication of abnormal cells. Cancerous cells and tissues have abnormal growth rates, shapes, sizes, and functioning. Cancer may progress in stages from a localized tumour (confined to the site of origin) to direct extension (spread into nearby tissue or lymph nodes) and metastasis (spread to more distant sites via the blood or lymphatic system). This malignant growth pattern distinguishes cancerous tumours from benign ones. Cancer is also classified by grade, the extent to which cell characteristics remain specific to their tissue of origin. Both stage and grade affect the chances of survival. Genetic factors and immune status affect sus-

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ceptibility. Triggers include hormones, viruses, smoking, diet, and radiation. Cancer can begin in almost any tissue, including blood (see LEUKEMIA) and lymph (see LYMPHOMA). When it metastasizes, it remains a cancer of its tissue of origin. Early diagnosis and treatment increase the chance of cure. Treatment may include CHEMOTHERAPY, surgery, and RADIATION THERAPY. See also BLADDER CANCER; BREAST CANCER; CARCINOGEN; COLORECTAL CANCER; KAPOSI SARCOMA; LARYNGEAL CANCER; LUNG CANCER; OVARIAN CANCER; PANCREATIC CANCER; PROSTATE CANCER; SKIN CANCER; STOMACH CANCER; UTERINE CANCER.

Cancer (Latin: "Crab") In astronomy, the constellation lying between Leo and Gemini; in ASTROLOGY, the fourth sign of the ZODIAC, governing approximately the period June 22–July 22. It is represented as a crab (or crayfish), a reference to the crab in Greek mythology that pinched HERACLES while he was fighting the Lernaean hydra. Heracles crushed the crab, but his enemy Hera rewarded it by placing it in the sky as a constellation.

Cancer, Tropic of See TROPIC OF CANCER

Cancún \kan-'kün\ City (pop., 2000: 397,191) and island resort, southeastern Mexico. The city, on the northeastern coast of the YUCATÁN PENINSULA, is a service town for the resort on Cancún Island (13 mi [21 km] long), which is connected by a causeway to the city. Originally settled by MAYA Indians, the area was first described by JOHN LLOYD STEPHENS and Frederick Catherwood in their *Incidents of Travel in Yucatán* (1843). Cancún remained a fishing village until 1970, when the area was selected as a suitable site for a resort. The plan proved hugely successful; today Cancún is one of Mexico's busiest resorts.

Candela \kän-'dā-lə**, Felix** (b. Jan. 27, 1910, Madrid, Spain—d. Dec. 7, 1997, Durham, N.C., U.S.) Spanish Mexican engineer and architect. He immigrated to Mexico in 1939 and began to design and construct buildings there. His ferroconcrete structures are distinguished by thin, curved shells that are extremely strong and economical; his imaginative use of paraboloid barrel-vaulting helped dispel mistaken notions of the limits of this material. Notable works include the expressionistic church of Nuestra Señora de los Milagros in Mexico City (1955), with a hyperbolic paraboloid roof of ferroconcrete only 1.5 in. (3.8 cm) thick.

candida \'kan-də-də\ Any of the parasitic imperfect fungi (see FUNGUS) that make up the genus *Candida*, which resemble YEASTS and occur especially in the mouth, vagina, and intestinal tract. Though usually benign, candidas can become pathogenic, causing diseases including candidiasis and thrush.

Candlemas (February 2) In the Christian church, the celebration of the presentation of the infant JESUS and the post-childbirth purification of MARY in the Temple, in accordance with Jewish law. The Greek church calls it Hypapante ("Meeting") in reference to Jesus' meeting there with Simeon, to whom it had been revealed that he would not die before meeting the MESSIAH. The festival is first documented in Jerusalem in the late 4th century; the custom of observing it with lighted candles (the source of its name) dates to at least the mid-5th century. The popular nonreligious holiday GROUNDHOG DAY developed, in part, from the medieval tradition that certain animals interrupted their hibernation on this day.

Candolle \kän-'dōl**, Augustin (Pyrame de)** (b. Feb. 4, 1778, Geneva, Switz.—d. Sept. 9, 1841, Geneva) Swiss botanist. In Paris (from 1796) he became an assistant to GEORGES CUVIER and worked with LAMARCK on revising his botanical works. He carried out a government-commissioned botanical and agricultural survey of France (1806–12). In 1813 he published his most important work, *Théorie élémentaire de la botanique*, in which he contended that plant ANATOMY, not PHYSIOLOGY, must be the basis of classification, for which he coined the term TAXONOMY. He introduced the concept of homologous parts for plants (following Cuvier's work on animals). From 1817 until his death he taught at the University of Geneva. He outlined systematic laws of botanical nomenclature (1818–21); his taxonomy suffered from certain weaknesses, but he achieved extensive subdivision of FLOWERING PLANTS, describing 161 families of dicotyledons, and his system supplanted that of CAROLUS LINNAEUS. He completed seven volumes of a descriptive classification of all known seed plants (from 1824).

Candomblé \ˌkan-dōm-'blā\ Variant of Macumba, a syncretic Afro-Brazilian religion most prominent in the Brazilian state of Bahia. Incorporating elements of Roman Catholicism, Candomblé is the most African of the Afro-Brazilian sects. Its deities, called *orixás*, have distinct personalities (often capricious) and are associated with occupations, colours, days of the week, and natural phenomena. Rituals include animal sacrifice, spirit offerings, and dances. See also MACUMBA; VODUN.

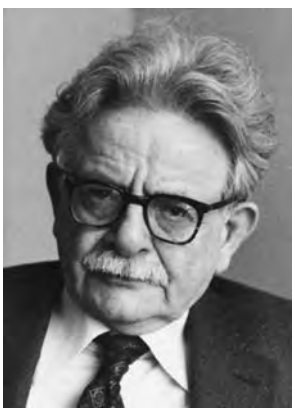
Candra Gupta See CHANDRAGUPTA MAURYA

Candra Gupta II See CHANDRA GUPTA II

candy Sweet SUGAR- or chocolate-based confection. The Egyptians made candy from HONEY (combined with figs, dates, nuts, and spices), sugar being unknown. With the spread of SUGARCANE cultivation in the 15th century, the industry began to grow. In the late 18th century the first candy-manufacturing machinery was produced. The main ingredients are cane and beet sugars combined with other carbohydrate foods such as CORN SYRUP, cornstarch, honey, molasses, and maple sugar. To the sweet base are added CHOCOLATE, fruits, nuts, peanuts, eggs, milk, flavours, and colours. Common varieties include hard candies (crystallized sugar), caramels and toffees, nougats, jellies, fondants, marshmallows, marzipans, truffles, cotton candies, licorices, and chewing gums.

cane Hollow or pithy and usually slender and flexible jointed stem (as of a REED). Also, any of various slender woody stems, especially an elongated flowering or fruiting stem (as of a rose) usually arising directly from the ground. The term is also applied to any of various tall woody GRASSES or reeds, including the coarse grasses of the genus *Arundinaria* (see BAMBOO), SUGARCANE, and SORGHUM.

Canetti, Elias (b. July 25, 1905, Ruse, Bulg.—d. Aug. 14, 1994, Zürich, Switz.) Bulgarian-born British novelist and playwright. Canetti was from a Spanish-speaking Jewish family. His best-known work, the novel *Auto-da-Fé* (1935), deals with the dangers in believing that detached intellectualism can prevail over evil and chaos. He settled in Britain in 1938. Later works that reflect his interest in the psychopathology of power include *Crowds and Power* (1960); the plays *The Wedding* (1932), *Comedy of Vanity* (1950), and *Life-Terms* (1964); and his series of autobiographies beginning with *The Tongue Set Free* (1977). He was awarded the Nobel Prize for Literature in 1981.


Canetti
HORST TAPPE/CAMERA PRESS/GLOBE PHOTOS

Cange \'käⁿzh**, Charles du Fresne, Lord du** (b. Dec. 18, 1610, Amiens, France—d. Oct. 23, 1688, , Paris) French scholar. Du Cange's most important works, *A Glossary for Writers of Middle and Low Latin* (1678) and *A Glossary for Writers of Middle and Low Greek* (1688), made use of his encyclopaedic knowledge not only of languages but of history, law, archaeology, and geography. His historical approach and effort to distinguish medieval vocabularies from their classical counterparts inspired later scholars to examine the development of language from a historical perspective. Frequently reedited, his dictionaries retained their usefulness through the 20th century.

canine *or* **canid** \'ka-nəd, 'kā-nəd\ Any domestic or wild DOG or doglike mammal (e.g., WOLF, JACKAL, FOX) in the family Canidae, found throughout the world except in Antarctica and on most ocean islands. Canines tend to be slender and long-legged, with a long muzzle, bushy tail, erect pointed ears, and well-developed canine and cheek teeth. They prey on all types of animals; some also eat carrion and vegetable matter. They probably were the first animals to be domesticated. Though helpful in controlling rodent and rabbit populations, canines have been hunted for their pelts and slaughtered to prevent their reputed (and sometimes real) destruction of livestock and large game.

cankerworm See LOOPER

canna Any of the tropical herbaceous plants that make up the family Cannaceae, of the GINGER order (Zingiberales), containing a single genus with about 55 species, found from southeastern North America through South America. Cannas have RHIZOMES with erect stems growing to 10 ft (3 m) high. The green or bronze leaves are spirally arranged. The flowers are asymmetrical. Spotted variations of the scarlet, red-orange, or yel-

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low flowers sometimes occur. The genus *Canna* is widely grown for ornamental use. *C. edulis*, from Peru, has edible, starchy rhizomes.

cannabis \'ka-nə-bəs\ Any plant of the genus *Cannabis*, which contains a single species, *C. sativa*. It is widely cultivated throughout the northern temperate zone. HEMP fiber is obtained from a tall, canelike variety, while MARIJUANA is obtained from the female plant of a smaller variety.

Cannae \'ka-nē**, Battle of** (216 BC) Major battle near the ancient village of Cannae, in Apulia, southeastern Italy, during the Second PUNIC WAR. The Romans, with 80,000 men, met the 50,000 Carthaginian and allied African, Gallic, and Spanish troops under Hannibal's command and were crushed by them. Hannibal's troops gradually surrounded their foes and annihilated them in a classic example of the "double envelopment" maneuver. Roman losses exceeded 65,000 men, while the Carthaginians lost only about 6,000.

Cannes \'kän\ City (pop., 1999: 67,304), southeastern France. Located on the Mediterranean Sea southwest of NICE, it is an international resort. Probably settled by Ligurians, it was occupied successively by Phocaeans, Celts, and Romans. In the 10th century the monks of Lérins built fortifications to guard against Muslim sea raiders. NAPOLEON, on his return from ELBA in 1815, camped nearby. A resort since the 19th century, the city is home to the CANNES FILM FESTIVAL.

Cannes Film Festival \'kän\ Film festival held annually in Cannes, France. First held in 1946 for the recognition of artistic achievement, the festival came to provide a rendezvous for those interested in the art and influence of the movies. Like other film festivals, it became an international marketplace where producers and distributors could exchange ideas, view films, and sign contracts. The phenomenon of international coproduction arose at Cannes in the late 1940s. The festival was at times the site of artistic contention as well, as in 1958–59, when advocates and opponents of the French NEW WAVE exchanged diatribes and manifestos.

cannibalism The usually ritualistic eating of human flesh by humans. The term derives from the Spanish name (Caríbales or Caníbales) for the Carib people, first encountered by Christopher Columbus. Reliable firsthand accounts of the practice are comparatively rare, causing some to question whether full-blown cannibalism has ever existed. Most agree that the consumption of particular portions or organs was a ritual means by which certain qualities of the person eaten might be obtained or by which powers of WITCHCRAFT AND SORCERY might be exercised. In some cases, a small portion of the dead person was ritually eaten by relatives. Headhunters (see HEADHUNTING) sometimes consumed bits of the bodies or heads of deceased enemies. The AZTECS apparently practiced cannibalism on a large scale as part of the ritual of HUMAN SACRIFICE.

cannibalism In zoology, the eating of any animal by another member of the same species. Certain ANTS regularly consume injured immatures and, when food is scarce, eat healthy immatures; this practice allows the adults to survive the food shortage and live to breed again. Male LIONS taking over a pride may kill and eat the existing young. After losing her cubs the mother will become impregnated by the new dominant male, thereby ensuring his genetic contribution. Aquarium GUPPIES sometimes regulate their population size by eating most of their young.

canning Method of preserving food from spoilage by storing it in containers that are hermetically sealed and then sterilized by heat. The process was invented in 1809 by Nicolas Appert (b. c. 1750—d. 1841) of France, who used glass bottles. In the 19th century tin-coated iron cans with soldered tops, bottoms, and seams were used, but in the early 20th century these were replaced by tin-plated steel containers with interlocking seams and polymer seals. In the later 20th century seamless aluminum cans (punched out from a single sheet) capped with a steel or aluminum lid became common, particularly in the beverage industry. In modern canning, food is passed under hot water or steam, transferred to a sterile container, sealed inside, and subjected to heat sufficient to kill any remaining microorganisms, cooking the food. The process preserves most nutrients but often affects consistency and taste.

Canning, George (b. April 11, 1770, London, Eng.—d. Aug. 8, 1827, Chiswick, near London) British politician. As a young man, he came under the influence of WILLIAM PITT, who helped him win a seat in Parliament (1793) and a post as undersecretary for foreign affairs (1796–99). Canning served twice as foreign secretary (1807–09, 1822–27); his policies included cutting England adrift from the HOLY ALLIANCE and recognizing the independence of the Spanish American colonies. He became prime minister in 1827 but died a few months later. He helped the Tory Party take a more liberal view on many questions of domestic, colonial, and foreign policy.

George Canning, painting by Sir Thomas Lawrence and Richard Evans; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Canning, Stratford, Viscount Stratford (of Redcliffe) (b. Nov. 4, 1786, London, Eng.—d. Aug. 14, 1880, Frant, Sussex) British diplomat. A cousin of GEORGE CANNING, he served as minister to Switzerland (1814–18) and later to the U.S. (1820–23). As ambassador to Constantinople intermittently for almost 20 years, he exerted a strong influence on Turkish policy. He was involved with the movement for Greek independence from Turkey. He later became friends with the Ottoman sultan and encouraged the TANZIMAT program of reforms. He supported Turkish resistance to Russian attempts to influence Ottoman affairs and tried in vain to prevent the CRIMEAN WAR. He retired after leaving Turkey in 1858.

cannon Long-range artillery piece, as distinguished from other big GUNS such as the howitzer or MORTAR. Early cannons, appearing in Europe in the 15th century, were smooth-bored and forged of iron, weighed 6,000–8,000 lbs (2,800–3,600 kg) and were loaded through the muzzle. They were mounted on wheeled carriages, which were thrown backward when the cannon was fired. Rifled bores and breechloading were adopted in the later 19th century, and new mechanisms such as the hydraulic buffer absorbed the recoil. Before 1850 ammunition was either cannister, grapeshot, or round, solid cannonballs and black powder, but rifled bores made possible the use of elongated projectiles, which had a longer range. The SHRAPNEL shell was widely used in the 19th–20th century. Modern cannons, of high-grade steel, are towed on split-trail carriages or are mounted on tracked vehicles; a common calibre is 155 mm (6 in.). Many helicopters, airplanes, and naval vessels are equipped with multibarreled, Gatling-type rotary cannons firing 20-mm exploding shells.

Cannon, Joseph (Gurney) (b. May 7, 1836, Guilford county, N.C., U.S.—d. Nov. 12, 1926, Danville, Ill.) U.S. politician. He began practicing law in Illinois in 1859. Elected to the U.S. House of Representatives in 1872, he served 46 years (1873–91, 1893–1913, 1915–23). A staunchly conservative Republican, he used his power as speaker (1903–11) in a partisan manner. In 1910 a coalition of Democrats and insurgent Republicans passed a resolution that made the speaker ineligible for membership on the rules committee, the main source of his power. Personally well liked, he was popularly known as "Uncle Joe."

Cannon, Walter B(radford) (b. Oct. 19, 1871, Prairie du Chien, Wis., U.S.—d. Oct. 1, 1945, Franklin, N.H.) U.S. neurologist and physiologist. He was the first to use X rays in physiological studies. He also investigated hemorrhagic and traumatic SHOCK during World War I and worked on methods of blood storage. He researched the emergency functions of the sympathetic nervous system and homeostasis and sympathin, an epinephrine-like substance released by certain neurons. With Philip Bard he developed the Cannon-Bard theory, which proposed that emotional and physiological responses to external situations arise simultaneously and that both prepare the body to deal with the situation.

Cano \'kä-nō**, Alonso** (b. March 19, 1601, Granada, Spain—d. Sept. 3, 1667, Granada) Spanish painter, sculptor, and architect. He studied in Sevilla with Francisco Pacheco and was active as court painter in Madrid (1638–44). Despite a violent temperament, Cano produced serene and elegant religious paintings and sculpture. He worked for much of his career in Granada, where he designed the facade of the Granada Cathedral (1667), one of the masterpieces of Spanish Baroque architecture. He is often called the Spanish MICHELANGELO for the diversity of his talents.

canoe Lightweight boat pointed at both ends and propelled by one or more paddles. The earliest canoes had light frames of wood covered by tightly stretched tree bark. The birchbark canoe was first used by the

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Algonquian Indians in what is now the northeastern U.S. and Canada, and its use passed westward. Canoes were often about 20 ft (6 m) in length, though war canoes might be as long as 100 ft (30 m). The dugout canoe, made from a hollowed-out log, was used by Indians in what is now the southeastern U.S. and along the Pacific coast as far north as Canada, as well as by peoples in Africa and New Zealand. Modern canoes are made of wood, canvas over wood frames, aluminum, and molded plastic or fibreglass. Most are open from end to end, but the KAYAK is also considered a canoe. See also CANOEING.

canoeing Use of a CANOE or KAYAK for recreation or competition. Both types of boat are used in water touring, in speed competitions, and in white-water sport, or navigation through rapids (which includes, in the case of kayaks, ocean surf). The Scottish philanthropist John MacGregor (1825–1892) is traditionally credited with establishing the modern outdoor activity of canoeing in the 1860s. Canoeing events became part of the Olympic Games in 1936 (1948 for women). In addition to various singles, pairs, and team still-water events for distance and speed, there are white-water racing competitions and, for kayaks, slalom events involving the use of gates similar to those of slalom skiing.

canon Musical form and compositional technique. Canons are characterized by having a melody that is imitated at a specified time interval by one or more parts, either at the same pitch or at some other pitch. Imitation may occur in the same note values, in augmentation (longer notes), or in diminution (shorter notes); in retrograde order (beginning at its end), mirror inversion (each ascending melodic interval becoming a descending interval, and vice versa), or retrograde mirror inversion; and so on. Canons range from folk rounds such as "Three Blind Mice" and "Frère Jacques" to the massively complex canons of JOHANN SEBASTIAN BACH.

canon law Body of laws established within Roman Catholicism, Eastern Orthodoxy, independent churches of Eastern Christianity, and the Anglican Communion for church governance. Canon law concerns the constitution of the church, relations between it and other bodies, and matters of internal discipline. The ecclesiastical lawyer and teacher Gratian published the first definitive collection of Roman Catholic canon law c. 1140; the *Decretum Gratiani* drew on older local collections, councils, Roman law, and church fathers. The enlarged *Corpus juris canonici* ("Body of Canon Law") was published in 1500. A commission of cardinals issued the new *Codex juris canonici* ("Code of Canon Law") in 1917, and a revised version was commissioned after the SECOND VATICAN COUNCIL and published in 1983. Following the Schism of 1054, the Eastern Orthodox church developed its own canon law under the patriarch of Constantinople. The Anglican, Coptic, and Ethiopian Orthodox churches also formulated their own collections.

canonization Official act of a Christian church declaring a deceased member worthy of veneration and entering his or her name in the canon (authorized list) of SAINTS. The cult of local martyrs was widespread in the early church, and by the 10th century church authorities were considering the need for formal recognition of saints by Rome, a change that was formalized by GREGORY IX in the 13th century. Responsibility for beatification (declaring a person worthy of limited veneration) was assigned to the ROMAN CURIA under SIXTUS V (r. 1585–90). A candidate's writings, miracles, and reputation for sanctity are investigated: one official gathers evidence in favor of beatification; another (the "devil's advocate") is charged with seeing that the entire truth is made known about the candidate. Canonization requires proof of two miracles subsequent to beatification. The process in the Eastern Orthodox Church is less formal; popular devotion by the faithful serving as the usual basis for sainthood.

canopic jar In ancient Egyptian funerary ritual, a covered vessel of wood, stone, pottery, or faience containing the embalmed viscera removed from a body during mummification. First used during the Old Kingdom (c. 2575–c. 2130 BC), the jars became more elaborate during the Middle Kingdom (c. 1938–c. 1600 BC), when their lids were decorated with sculpted human heads (probably representations of the deceased). From the 19th dynasty until the end of the New Kingdom (1539–1075 BC), the heads represented the four sons of HORUS. During the 20th dynasty (1190–1075 BC), the practice began of returning the viscera to the body, and the art of canopic jars declined.

Canova, Antonio (b. Nov. 1, 1757, Possagno, Republic of Venice—d. Oct. 13, 1822, Venice) Italian sculptor. Apprenticed to a sculptor at an early age, he opened his own studio in Venice by 1775. In 1778–79 he produced his first important sculpture, *Daedalus and Icarus*; the figures were so realistic that he was accused of making plaster casts from live models. He settled in Rome in 1779 and became strongly influenced by Classical antiquity. Among his most important commissions were the tombs of two popes, Clement XIII and Clement XIV. In 1802 he became court sculptor to NAPOLEON I in Paris. In 1816 Pope Pius VII awarded him the title of marquis of Ischia for arranging the return of Italian art looted by the French. Canova also painted portraits and re-creations of paintings discovered at POMPEII and HERCULANEUM. He dominated European sculpture around the turn of the century and was of primary importance in the development of the Neoclassical style in sculpture (see CLASSICISM AND NEOCLASSICISM).

Canso, Strait of *or* **Canso Gut** Channel, NOVA SCOTIA, Canada. Separating mainland Nova Scotia and CAPE BRETON ISLAND, it is 4.5 mi (23 km) long and 1 mi (2 km) wide, with depths of 200 ft (60 m). Since 1955 the 7,000-ft (2,100-m) Canso Causeway has linked Cape Breton with the mainland. A navigation lock can handle most oceangoing vessels.

Cantabria \kän-'tä-brē-ə\ Historical region, autonomous community (pop., 2001: 535,131), and province, northern Spain. It borders the Bay of BISCAY and covers an area of 2,054 sq mi (5,321 sq km); its coastal hills rise gradually into the CANTABRIAN MOUNTAINS. Its capital is SANTANDER. The Cantabri, an Iberian tribe, dominated the region until 19 BC, when they were subdued by the Romans. Because of its isolation, the area was little affected by the Iberian Moorish invasions (c. 8th–11th centuries). In the Middle Ages, Cantabria came under Castilian influence. The region itself was formerly known as Santander, and much of its population is centred on the city of the same name. Mining is an important part of the economy.

Cantabrian Mountains \kan-'tā-brē-ən\ Mountain range, northern Spain. The mountains, which extend about 180 mi (300 km), are geologically of similar origin to the PYRENEES, though classified as a separate formation. They include many tall peaks, the highest being Torre de Cerredo (8,787 ft, or 2,678 m), and thus form a more formidable barrier than the Pyrenees. The region is economically important for its coal and iron.

cantata Work for voice or voices and instruments of the Baroque era. From its beginnings in early 17th-century Italy, both secular and religious cantatas were written. The earliest cantatas were generally for solo voice and minimal instrumental accompaniment. Cantatas soon developed a dramatic character and alternating sections of RECITATIVE and ARIA, paralleling the simultaneous development of OPERA, and they came to resemble unstaged operatic scenes or acts. In Germany the Lutheran cantata developed more directly out of the expanding choral MOTET, and almost always involved a chorus. A single chorale (HYMN) often served as the basis for an entire cantata, which might have up to 10 diverse numbers, including duets, recitatives, and choral fugues. The most celebrated are the approximately 200 written by JOHANN SEBASTIAN BACH. After c. 1750 the cantata gradually declined.

Canterbury Historic city and administrative district (pop., 2001: 135,287), southeastern England. Located on the River Great STOUR, the site has been occupied since pre-Roman times; the Roman town of Durovernum Cantiacorum was established after CLAUDIUS invaded Britain in AD 43. It has been an ecclesiastical metropolis of England since St. AUGUSTINE OF CANTERBURY founded a monastery there in 602 and later established a cathedral. The cathedral was the scene of the murder of Archbishop St. Thomas BECKET in 1170. After his canonization in 1172, it became a pilgrimage shrine; it is the destination of the pilgrims in GEOFFREY CHAUCER's *Canterbury Tales*. Canterbury was heavily bombed in World War II, but the cathedral largely escaped damage. The cathedral and other historic buildings were designated a UNESCO WORLD HERITAGE SITE in 1988.

cantilever \'kan-tə-ˌlē-vər\ Projecting beam or other horizontal member supported at one or more points but not at both ends. Some engineers distinguish between a cantilever, supported at only one fixed end, and an overhanging beam that projects beyond one of its end supports. The free, unsupported end is capable of supporting a weight or surface, such as a concrete slab. Any beam built into a wall with a projecting free end forms a cantilever, which may carry a balcony, canopy, roof, or part of a building above. Cantilevering can be used for constructions as simple as bookshelves or as complicated as bridges.

canton Political subdivision of Switzerland, France, and some other European countries. Each of Switzerland's 26 cantons and half-cantons has its own constitution, legislature, executive, and judiciary. Five pre-

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serve the ancient democratic assembly, in which all citizens meet; the remaining 21 have a cantonal legislature with elective representatives and usually proportional representation. In France, the canton is a territorial and administrative subdivision of an arrondissement but not an actual unit of local government.

Canton See GUANGZHOU

Canton system System of trade that developed between Chinese and foreign merchants in the southern China city of GUANGZHOU (Canton). From 1759 to 1842, all foreign trade coming into China was confined to Guangzhou and had to be conducted with authorized Chinese merchants. Foreign merchants were confined to a small area outside the city wall and were subject to Chinese law and other restrictions. British merchants' complaints grew during the early 19th century, and, with Britain's victory in the first OPIUM WAR (1839–42), China was forced to abolish the system. See also British EAST INDIA CO.; Treaty of NANJING.

cantor In Judaism and Christianity, an official in charge of music or chants. In Judaism the *ḥazzan* (cantor) leads liturgical prayer and chanting. In medieval Christianity the cantor had charge of a cathedral's music—specifically, of supervising the choir's singing. The term also designated the head of a college of church music.

Cantor, Eddie *orig.* **Edward Israel Iskowitz** (b. Jan. 31, 1892, New York, N.Y., U.S.—d. Oct. 10, 1964, Hollywood, Los Angeles, Calif.) U.S. comedian and singer. As a child, Cantor clowned and sang for coins on street corners in his native New York City. He dropped out of elementary school, could not keep a job because of his irrepressible clowning, and soon went into VAUDEVILLE as a blackface song-and-dance man. He toured with FLORENZ ZIEGFELD's *Follies* and the Shuberts. He appeared in several Broadway reviews, and from 1923 to 1926 he was a star in *Kid Boots*. From 1931 Cantor performed for 18 years on *The Chase and Sanborn Hour* as a standup comedian. His films include *Roman Scandals* (1933) and *Strike Me Pink* (1936). In the 1950s he hosted a television show.

Cantor \'kän-tōr**, Georg** (b. March 3, 1845, St. Petersburg, Russia—d. Jan. 6, 1918, Halle, Ger.) German mathematician, founder of SET THEORY. He was the first to examine number systems, such as the RATIONAL NUMBERS and the REAL NUMBERS, systematically as complete entities, or sets. This led him to the surprising discovery that not all infinite sets are the same size. In particular, he showed that the rational numbers could be put in a one-to-one correspondence with the counting numbers; hence the set is countable. He also showed that no such correspondence is possible for the much larger set of IRRATIONAL NUMBERS; hence they are known as an uncountable set. His investigations led him to the classification of transfinite numbers, which are, informally speaking, degrees of INFINITY.

cantus firmus *Latin* **"fixed chant"** Preexistent melody, such as a plainchant (see GREGORIAN CHANT) excerpt, underlying a polyphonic musical composition (one consisting of several independent voices or parts). In the 11th- and 12th-century ORGANUM, the tones of the plainchant melody for such words as "alleluia" and "amen" were held by one voice (the tenor), while another, more active, improvised line was added. Developments introduced by the NOTRE-DAME SCHOOL of the late 12th and early 13th centuries included rhythmic patterning of the added voice and the addition of two or three voices. The composition of nonliturgical words for the added voice or voices in the 13th century resulted in the independent MOTET. Cantus firmus technique remained the basis of most composition of the 14th–15th centuries (though the "chant" was now often a secular melody) and remained important in the 16th-century MASS. It was later codified in the pedagogical method called species COUNTERPOINT.

Canute \kə-'nüt\ **the Great** *Danish* **Knut** (d. Nov. 12, 1035) Danish king of England (1016–35), Denmark (1019–35), and Norway (1028–35). He helped his father, SWEYN I, invade England in 1013. Sweyn was accepted as king of England after exiling King ETHELRED II but died in 1014; Canute returned and defeated Ethelred's son to win the English throne in 1016. At first he ruled ruthlessly, killing English opponents and appointing Danes in their places, but within a few years he had married Ethelred's widow and was granting earldoms to Englishmen. Canute proved an effective ruler who brought peace and prosperity to England, issued an important law code, and became a strong supporter of the church. With English help he secured the throne of Denmark on his brother's death. His early death and that of his sons led to the restoration of Ethelred's dynasty.

canvas Stout cloth. Canvas (probably named for cannabis, or HEMP), has been made from hemp and FLAX fibres since ancient times to produce cloth for sails. More recently it has also been made from tow, JUTE, COTTON, and mixtures of such fibres. Flax canvas is essentially of double warp (see WEAVING), being invariably intended to withstand pressure or rough usage. Articles made from canvas include camera and golf bags, running shoes, tents, and mailbags. Tarred canvas is used for tarpaulins to cover goods. Artists' canvas for painting is much lighter than sail canvas; those of the best quality are made of cream or bleached flax fibre.

canvasback DIVING DUCK (*Aythya valisineria*), one of the most popular game birds. The male weighs about 3 lb (1.4 kg). During the breeding season he has a red head and neck and a black breast, with a white back and sides finely lined in gray. In eclipse (nonbreeding) plumage, he resembles the female, with a tan head and gray-brown back. Canvasbacks breed in northwestern North America and winter along the coasts from British Columbia and Massachusetts south to central Mexico. They prefer the roots of wild celery (eelgrass) but will eat many other plants and even some small animals.

canyon Very narrow, deep valley cut by a river through resistant rock and having steep, almost vertical sides. Canyons occur most often in arid or semiarid regions. Some canyons (e.g., the GRAND CANYON) are spectacular natural features. See also SUBMARINE CANYON.

Canyon de Chelly \də-'shā\ **National Monument** Preserve, northeastern Arizona, U.S. Located on the NAVAJO Indian reservation immediately east of Chinle, the preserve was established in 1931 and occupies 131 sq mi (339 sq km). It includes several hundred pre-Columbian cliff dwellings, some of them built in caves on the canyon walls. They represent a broader time span than any other ruins in the Southwest, with many dating from the 11th century. Modern Navajo homes and farms occupy the canyon floor.

Canyonlands National Park Park, southeastern Utah, U.S. The park, established in 1964, occupies a wilderness of water-eroded sandstone spires, canyons, and mesas extending over 527 sq mi (1,366 sq km). Some of its rock walls display Indian petroglyphs. The Needles section in its southern part contains the Angel and Druid arches, gigantic balanced rock formations.

Cao Cao \'tsaù-'tsaù\ *or* **Ts'ao Ts'ao** (b. AD 155, Boxian, China—d. 220, Luoyang) Chinese general who, at the end of the HAN DYNASTY, assumed imperial prerogatives. Cao Cao rose to prominence when he suppressed the YELLOW TURBAN rebellion in the last years of the Han. Though the rebellion was suppressed, the dynasty was irreparably weakened, and in the ensuing chaos Cao Cao occupied the strategic northern section of China around the capital of Luoyang. His domain was known as the kingdom of Wei (see THREE KINGDOMS). Confucian historians and popular legends alike describe him as the archetypal unscrupulous villain; he is portrayed as such in the famous 14th-century novel *Sanguozhi yanyi* ("Romance of the Three Kingdoms"). His son, Cao Pei, founded the Wei dynasty (220–265/266).

Cao Dai \'kaù-'dī\ Syncretist modern Vietnamese religious movement with a strongly nationalist political character. Cao Dai draws on ethical precepts from CONFUCIANISM, occult practices from DAOISM, theories of karma and rebirth from BUDDHISM, and hierarchical organization (including a pope) from ROMAN CATHOLICISM. It was formally established in 1926 by Ngo Van Chieu (1878–1926?), a colonial administrator in French Indochina who professed to have had a communication from the supreme deity. The movement met with resistance from the Vietnamese government both before and after the communist takeover in 1975. It was reported to have some three million adherents in Vietnam and abroad in the early 21st century.

Cao Zhan \'tsaù-'jän\ *or* **Ts'ao Chan** (b. 1715?, Jiangning, Jiangsu province, China—d. Feb. 12, 1763, Beijing) Chinese novelist. He is the author of *Dream of the Red Chamber* (1791), generally considered China's greatest novel. A partly autobiographical work written in the vernacular, it describes in lingering detail the decline of a powerful family and an ill-fated love between cousins. Cao finished at least 80 of its 120 chapters; it was completed after his death, probably by Gao E, about whom little is known.

Capa, Robert *orig.* **Andrei Friedmann** (b. 1913, Budapest, Hung.—d. May 25, 1954, Thai Binh, Viet.) Hungarian-born U.S. photojournalist. In Paris he presented his photographs as the work of a fictitious rich American, Robert Capa; the deception was soon discovered but he kept the name. He first achieved fame as a war correspondent in the

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Spanish Civil War (1936). In World War II he covered the fighting in Africa, Sicily, and Italy for *Life* magazine; images of the Normandy invasion are among his most memorable works. In 1947 he founded Magnum Photos with Henri Cartier-Bresson and David Seymour. He was killed by a land mine while photographing the French Indochina war for *Life*.

Capablanca, José (Raúl) (b. Nov. 19, 1888, Havana, Cuba—d. March 8, 1942, New York, N.Y., U.S.) Cuban chess master. He learned chess from his father at age 4 and beat Cuba's best player at 12. He defeated Emanuel Lasker to become world champion in 1921; in 1927 he was defeated by Alexander Alekhine (1892–1946). From 1916 to 1924, while playing in many tournaments, he did not lose a game. In 1921 he published an instruction manual, *Chess Fundamentals*.

capacitance \kə-'pa-sə-təns\ Property of a pair of electric conductors separated by a nonconducting material (such as air) that permits storage of electric energy by the separation of electric charge, and that is measured by the amount of separated charge that can be stored per unit of electric potential between the conductors. If electric charge is transferred between two initially uncharged conductors, they become equally (but oppositely) charged. A potential difference is set up between them and some of the electricity can be stored. Capacitance C is the ratio of the amount of charge q on one of the conductors to the potential difference V between the conductors, or $C = q/V$. The unit of capacitance is coulombs per volt (C/V), or farads (F).

Cape Agulhas See Cape Agulhas

Cape Ann See Cape Ann

Cape Bojador See Cape Bojador

Cape Bon Peninsula See Sharīk Peninsula

Cape Breton \'bret-ᵊn\ **Island** Island, (pop., 2001: 109,330), eastern part of Nova Scotia, Canada. Separated from the mainland by the Strait of Canso, it is 110 mi (175 km) long and up to 75 mi (120 km) wide, with an area of 3,981 sq mi (10,311 sq km). It contains the Bras d'Or salt lakes. Originally called Île Royale as a French colony, it later took the name of its eastern cape, probably the first land visited by John Cabot on his 1497–98 voyage and probably named by Basque fishermen from Cap Breton, France. It was ceded to the British by the 1763 Treaty of Paris and joined to Nova Scotia. In 1784 it became a separate British crown colony, but it was rejoined to Nova Scotia in 1820. In 1955 the island was linked to the mainland by a causeway. Cape Breton Highlands National Park was established in 1936. Tourism is an important industry on the island.

Cape buffalo Massive, black, horned buffalo (*Syncerus caffer*), formerly found throughout sub-Saharan Africa but now greatly reduced in number by disease and hunting. It is a gregarious animal of open or scrub-covered plains and open forests. When wounded, it is regarded as one of the most dangerous animals. It stands up to 5 ft (1.5 m) tall at the shoulder, and bulls can weigh almost a ton (about 900 kg). Its heavy horns typically curve downward, then up and inward. A smaller subspecies is found in dense West African forests.

Cape Canaveral See Canaveral, Cape

Cape Cod Peninsula, eastern Massachusetts, U.S. Some 65 mi (105 km) long and 1–20 mi (2–32 km) wide, it touches Buzzards Bay and extends into the Atlantic Ocean in a wide curve, enclosing Cape Cod Bay. The Cape Cod Canal, cutting across the base of the peninsula, forms part of the Atlantic Intracoastal Waterway. Named by an English explorer who visited its shores in 1602 and took aboard a "great store of codfish," Cape Cod was the site, near Provincetown, of the Pilgrims' landing in 1620. Extending into the warm Gulf Stream, it has coastal towns and villages that become densely populated resorts in summer. In the 19th century Provincetown was an active whaling port. The cape's northern hook was designated the Cape Cod National Seashore in 1961.

Cape Colony See Cape Province

Cape Dezhnev See Cape Dezhnev

Cape Fear River River, central and southeastern North Carolina, U.S. Formed by the confluence of the Deep and Haw rivers, it flows southeast about 200 mi (320 km) to enter the Atlantic Ocean near Southport at Cape Fear. The southern estuary forms part of the Atlantic Intracoastal Waterway. A series of locks and dams makes the river navigable from Wilmington to Fayetteville.

Cape Hatteras \'ha-tə-rəs\ **National Seashore** Scenic coastal area situated on Bodie, Hatteras, and Ocracoke islands along the Outer Banks, eastern North Carolina, U.S. The park, the country's first national seashore, was authorized in 1937 and established in 1953. It has a total area of 47 sq mi (122 sq km). It includes the tallest (208 ft [63 m]) masonry lighthouse in the country, located at Cape Hatteras.

Cape Horn See Cape Horn

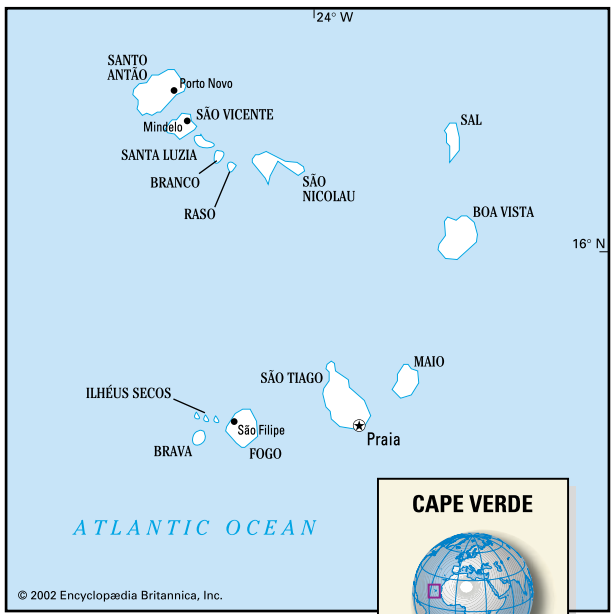
Cape Krusenstern \'krü-zən-ˌstern\ **National Monument** National preserve, northwestern Alaska, U.S., on the coast of the Chukchi Sea. Established in 1978, it was enlarged in 1980 to 1,031 sq mi (2,670 sq km). Its remarkable archaeological sites illustrate the cultural evolution of the Arctic peoples over some 4,000 years.

Cape of Good Hope See Cape of Good Hope

Cape Province *or* **Cape of Good Hope** *formerly (1826–1910)* **Cape Colony** Former province, South Africa. Occupying the southern extremity of the African continent, it comprised the southern and western portions of South Africa; its capital was Cape Town. The black state of Ciskei and parts of two others, Transkei and Bophuthatswana, lay within its boundaries. Its name refers to the Cape of Good Hope, 30 mi (50 km) south of Cape Town. The original inhabitants included Bantu, San, and Khoekhoe peoples. Bartolomeu Dias, en route to India in 1488, became the first European to visit the area. A colony was founded by the Dutch at Table Bay in 1652; it was ceded to the British in 1814. It joined the Union of South Africa in 1910 and the Republic of South Africa in 1961. The province ceased to exist in 1994, when it was split roughly into Eastern Cape, Northern Cape, and Western Cape provinces.

Cape Town *Afrikaans* **Kaapstad** \'käp-ˌstät\ City (pop., 2005 est., urban agglom.: 3,103,000), legislative capital of the Republic of South Africa. It is also the capital of Western Cape province. Located on Table Bay, Cape Town has long been an important regional port. The first settlement at Table Bay, it was founded in the 17th century by the Dutch navigator Jan van Riebeeck for the Dutch East India Company, and it soon served as a stopover for ships plying the Europe-to-India route. It was under Dutch rule intermittently until it was taken by the British in 1806. Today it is a commercial and cultural centre. See also Pretoria; Bloemfontein.

Cape Verde \'vərd\ *officially* **Republic of Cape Verde** Island country, east-central Atlantic Ocean. Lying 385 mi (620 km) off the west-



ern coast of Senegal, it consists of 10 islands and 5 islets. Area: 1,557 sq mi (4,033 sq km). Population (2005 est.): 476,000. Capital: Praia. More than two-thirds of its population are Creole (mixed origin); the remainder are Euro-

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pean and black African. Languages: Portuguese (official), Crioulo (a Portuguese dialect). Religions: Christianity (predominantly Roman Catholic); also Islam. Currency: Cape Verde escudo. The mountainous windward islands are craggy and furrowed by erosion; the flat leeward islands are largely plains and lowlands. The archipelago is volcanic in origin. Fogo Island has an active volcano that erupted in 1951; it is also the location of the highest peak, which rises 9,281 ft (2,829 m). The other main islands are Santo Antão, Boa Vista, and São Tiago. Cape Verde has a developing mixed economy based largely on agriculture, though tourism has been promoted. It is a republic with one legislative house; its chief of state is the president and its head of government the prime minister. The islands were uninhabited when Diogo Gomes sighted and named Maio and São Tiago in 1460; in 1462 the first settlers landed on São Tiago, founding the city of Ribeira Grande. The city's importance grew with the development of the slave trade, and its wealth attracted attacks so often that it was abandoned in 1712. The prosperity of the Portuguese-controlled islands vanished with the decline of the slave trade in the 19th century, when they were made a coaling and submarine cable station. In 1951 the colony became an overseas province of Portugal. Many islanders preferred outright independence, which was granted in 1975. Once associated politically with Guinea-Bissau, Cape Verde split from it in 1981.

Čapek \'chä-pek**, Karel** (b. Jan. 9, 1890, Malé Svatoňovice, Bohemia, Austria-Hungary—d. Dec. 25, 1938, Prague, Czech.) Czech novelist, short-story writer, and playwright. Čapek's "black utopias," works showing the dangers of technological progress, include the cautionary play *R.U.R.: Rossum's Universal Robots* (1920), a depiction of a society dependent on mechanical workers called *robots* (a term he coined from a Czech word for forced labour). The comic fantasy *The Insect Play* (1921; with his brother Josef) satirizes human greed. *The Makropoulos Affair* (1922) was made into an opera by Leoš Janáček. Čapek explored aspects of knowledge in the novel trilogy *Hordubal* (1933), *Meteor* (1934), and *An Ordinary Life* (1934).

caper Any of the low prickly shrubs that make up the genus *Capparis* (family Capparaceae), of the Mediterranean region. The European caperbush (*C. spinosa*) is known for its flower buds, which are pickled in vinegar and used as a spicy condiment. The term caper also refers to one of the pickled flower buds or young berries. Buds of *C. decidua* are eaten as potherbs, and curries are prepared from seeds and fruits of *C. zeylandica*.

Capernaum \kə-'pər-nā-əm\ Ancient city, Palestine. Located on the northwestern shore of the Lake Tiberias (Sea of Galilee), it was the home of Jesus for much of his ministry. His disciples Peter, Andrew, and Matthew were from Capernaum, and he was said to have performed many of his miracles there. Excavations begun in 1905 indicated that the cite of the ancient city is likely near modern Kefer Naḥum, Israel. Among the remains discovered was a synagogue dating from the 2nd–3rd century AD.

Capet, Hugh See Hugh Capet

Capetians \kə-'pē-shəns\ *or* **Capets** \'kā-pəts\ Ruling house of France (987–1328), who laid the foundation of the French state. Descended from Robert the Strong (died 866), they included Hugh Capet (r. 987–96), the first Capetian king; Philip II Augustus (r.1180–1223); and Louis IX (r.1226–70). Capetians also ruled as dukes of Burgundy and Brittany, emperors of Constantinople, counts of Artois and Provence, kings and queens of Naples, and kings of Hungary and Navarre.

capillarity \ˌka-pə-'lar-ə-tē\ Rise or fall of liquid in a small passage or tube. When a glass tube of small internal diameter is inserted into water, the surface water molecules are attracted to the glass and the water level in the tube rises. The narrower the tube, the higher the water rises. The water is said to "wet" the tube. Water will also be drawn into the fibres of a towel, even if the towel is in a horizontal position. Conversely, if a glass tube is inserted into mercury, the level of the liquid in the tube falls. The mercury does not wet the tube. Capillarity is caused by the difference in attraction of the liquid molecules to each other and the attraction of the liquid molecules to those of the tube.

capillary \'ka-pə-ˌler-ē\ Any of the minute blood vessels that form networks where the arterial and venous circulation (see artery, vein) meet for exchange of oxygen, nutrients, and wastes with body tissues. Capillaries are just large enough for red blood cells to pass through in single file. Their thin walls are semipermeable, allowing small molecules to pass through in both directions. The smallest lymphatic vessels and minute bile channels in the liver are also called capillaries.

capital In architecture, the crowning member of a column, pier, pilaster, or other vertical form, providing a structural support and transition for the horizontal member (entablature) or arch above. In Classical styles, the capital is the architectural member that most readily identifies the order. Simple stone capitals have been found in the earliest known pyramids of ancient Egypt (c. 2890–2686 BC), at Saqqarah.

capital In economics, the stock of resources that are used to produce other goods now and in the future. In classical economics the three factors of production are capital, labour, and land. Capital embodies the man-made resources, which include the buildings, plant, equipment, and inventories created by all three factors. In this sense, capital goods may be contrasted with consumer goods. The creation of capital goods means that consumption is forgone, resulting in saving. The flow of saving becomes a flow of investment. Expenditures on education and training are often referred to as investment in human capital (see Gary S. Becker). Financial capital is the term given to the stocks and bonds issued in order to finance the acquisition of capital goods.

capital gains tax Tax levied on gains realized from the sale or exchange of capital assets. Though capital gains have been taxed in the U.S. since the advent of the federal income tax, certain capital gains are taxed less heavily than regular income, while others are exempted from taxation. This preferential treatment is intended to encourage investment and thereby stimulate economic growth. In theory the tax break encourages investors to risk their capital in new ventures. Critics argue that preferential treatment results in distorted patterns of investment because regular income is converted into capital gains in order to avoid paying income tax. See also corporate income tax.

capital goods See producer goods

capital levy Direct tax assessed simultaneously on the capital resources of all persons possessing taxable wealth in excess of a minimum value and paid at least partly out of capital resources. It aims at capturing a substantial portion of the taxpayers' wealth to enable the government to cope with a major emergency or to redistribute wealth. Capital levies were adopted in many European nations after World Wars I and II.

capital punishment *or* **death penalty** Execution of an offender sentenced to death after conviction by a court of law of a criminal offense. Capital punishment for murder, treason, arson, and rape was widely employed in ancient Greece, and the Romans also used it for a wide range of offenses. It also has been sanctioned at one time or another by most of the world's major religions. In 1794 the U.S. state of Pennsylvania became the first jurisdiction to restrict the death penalty to first-degree murder, and in 1846 Michigan abolished capital punishment for all murders and other common crimes. In 1863 Venezuela became the first country to abolish capital punishment for all crimes. Portugal was the first European country to abolish the death penalty (1867). By the mid-1960s some 25 countries had abolished the death penalty for murder. During the last third of the 20th century, the number of abolitionist countries increased more than threefold. Despite the movement toward abolition, many countries have retained capital punishment, and some have extended its scope. In the U.S., three-fourths of the states and the federal government retain the death penalty, and death sentences are regularly carried out in China, Saudi Arabia, Singapore, and Iran. Supporters of the death penalty claim that life imprisonment is not an effective deterrent to criminal behaviour. Opponents maintain that the death penalty has never been an effective deterrent, that errors sometimes lead to the execution of innocent persons, and that capital punishment is imposed inequitably, mostly on the poor and on racial minorities.

capitalism *or* **free-market economy** *or* **free-enterprise system** Economic system in which most of the means of production are privately owned, and production is guided and income distributed largely through the operation of markets. Capitalism has been dominant in the Western world since the end of mercantilism. It was fostered by the Reformation, which sanctioned hard work and frugality, and by the rise of industry during the Industrial Revolution, especially the English textile industry (16th–18th centuries). Unlike earlier systems, capitalism used the excess of production over consumption to enlarge productive capacity rather than investing it in economically unproductive enterprises such as palaces or cathedrals. The strong national states of the mercantilist era

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provided the social conditions, such as uniform monetary systems and legal codes, necessary for the rise of capitalism. The ideology of classical capitalism was expressed in Adam Smith's *Wealth of Nations* (1776), and Smith's free-market theories were widely adopted in the 19th century. In the 20th century the Great Depression effectively ended laissez-faire economics in most countries, but the demise of the state-run command economies of eastern Europe and the former Soviet Union (see communism) and the adoption of some free-market principles in China left capitalism unrivaled (if not untroubled) by the beginning of the 21st century.

Capitol, United States Meeting place of the U.S. Congress. In 1792 a competition for its design was won by William Thornton (1759–1828); his revised Federal-style design of 1795 was executed as the exterior of the wings adjacent to the central rotunda. Benjamin H. Latrobe, as Surveyor of Public Buildings (1803), followed Thornton's conception of the exterior but used his own interior designs; perhaps his best-known contribution was his invention of tobacco-leaf and corn-cob capitals. After the British set fire to the Capitol in 1814, Latrobe began its reconstruction, but resigned in 1817. By 1827 his successor, Charles Bulfinch, had joined the two wings and built the first dome and the rotunda. In 1850 Thomas Ustick Walter (1804–1887) won a competition to expand the wings; he also designed the 287–ft- (87–m-) high cast-iron dome (1855–66), which was based on Michelangelo's dome for St. Peter's Basilica. The marble and sandstone building contains about 540 rooms and stands in a 131-acre (53-hectare) park.

Capitol Reef National Park Park, south-central Utah, U.S. Occupying 378 sq mi (979 sq km), it comprises great buttressed cliffs of coloured Navajo sandstone extending for 100 mi (160 km) along the western edge of the Waterpocket Fold. Established as a national monument in 1937, it became a national park in 1971. It is so named because its rock towers reminded geologists of coral reefs, while its dome-shaped formations suggest capitol architecture. The cliff walls are covered with pre-Columbian petroglyphs.

Capone, Al(phonse) (b. Jan. 17, 1899, Brooklyn, N.Y., U.S.—d. Jan. 25, 1947, Palm Island, Fla.) U.S. gangster. Quitting school after the sixth grade, he joined the James Street Boys gang, led by Johnny Torrio. In a youthful fight in a brothel-saloon he was slashed across the left cheek, prompting the later nickname "Scarface." In 1919 he joined Torrio in Chicago to help run prostitution there. When Torrio retired (1925), Capone became the city's crime czar, running gambling, prostitution, and bootlegging rackets. He expanded his territory by killing his rivals, most famously in the St. Valentine's Day Massacre, in which members of the Bugs Moran gang were machine-gunned in a garage on Feb. 14, 1929. In 1931 Capone was convicted for income-tax evasion and sentenced to 11 years in prison; eventually he served time in the new Alcatraz prison (see Alcatraz Island). Granted an early release from prison in 1939, in part because he suffered from an advanced stage of syphilis, he died a powerless recluse at his Florida estate.

Caporetto, Battle of (Oct. 24, 1917) Italian military disaster in World War I in which Italian troops retreated before an Austro-German offensive near Trieste on the Isonzo front (see Battles of the Isonzo). More than 600,000 Italian soldiers either deserted or surrendered. The defeat prompted Italy's allies, France and Britain, to send reinforcements and eventually to establish the Supreme War Council to unify the Allied war effort.

Capote \kə-'pō-tē**, Truman** *orig.* **Truman Streckfus Persons** (b. Sept. 30, 1924, New Orleans, La., U.S.—d. Aug. 25, 1984, Los Angeles, Calif.) U.S. novelist, short-story writer, and playwright. Capote spent much of his youth in small towns in Louisiana and Alabama. His early works, in the Southern Gothic tradition, include the novels *Other Voices, Other Rooms* (1948) and *The Grass Harp* (1951) and the story collection *A Tree of Night* (1949). His later journalistic style was exemplified in the highly successful "nonfiction novel" *In Cold Blood* (1966), an account of a multiple murder. Other works include the novella *Breakfast at Tiffany's* (1958; film, 1961), the musical *House of Flowers* (1954; with Harold Arlen), and the collections *The Dogs Bark* (1973) and *Music for Chameleons* (1980).

Capp, Al *orig.* **Alfred Gerald Caplin** (b. Sept. 28, 1909, New Haven, Conn., U.S.—d. Nov. 5, 1979, New Haven, Conn.) U.S. cartoonist. He studied landscape architecture before turning to cartooning. His comic strip *Li'l Abner* first appeared in the *New York Mirror* in 1934 and was soon being syndicated throughout the country. Set in the backwoods community of Dogpatch, U.S.A., it featured Li'l Abner, a shy, awkward woodsman; Daisy Mae, a persistent maiden who succeeded in catching Abner after a 17-year pursuit; and a host of colourful characters.

Cappadocia \ˌka-pə-'dō-shə\ Ancient district, eastern Anatolia. It is a mountainous area located in present-day Turkey; its earliest records date from the 6th century BC, when it was a Persian satrapy. A period of semi-autonomy followed Alexander the Great's conquest of the Persian empire (330 BC). Important as a Roman ally and client, it was annexed by the emperor Tiberius in AD 17 and made a Roman province. With its command over strategic passes in the Taurus Mountains, the area was a bulwark of the Byzantine Empire until the 11th century. Part of the district was designated a UNESCO World Heritage site in 1985.

Capra, Frank (b. May 18, 1897, near Palermo, Sicily, Italy—d. Sept. 3, 1991, La Quinta, Calif., U.S.) U.S. film director. At age six he immigrated with his family to the U.S. After holding various jobs in the film industry, he emerged as a major director with *That Certain Thing* (1928) and *Platinum Blonde* (1931). He won Academy Awards for *It Happened One Night* (1934) and *Mr. Deeds Goes to Town* (1936), stories that portray naive idealists who triumph over more worldly types. He chose the same theme for his next film, *Mr. Smith Goes to Washington* (1939) but departed from his usual style in *Lost Horizon* (1937) and *Meet John Doe* (1941). Capra also won a third Academy Award for *You Can't Take It with You* (1938). He made the documentary series *Why We Fight* during World War II and the Christmas classic *It's a Wonderful Life* (1946).

Capri \'kä-prē, kə-'prē\ Island, southern Italy. Located at the southern entrance to the Bay of Naples, it has an area of 4 sq mi (10 sq km). Cliffs rise in the west to a height of 1,932 ft (589 m). It was a colony of ancient Greece; later it became a favourite resort of Roman emperors. In the Middle Ages it belonged to the abbey of Montecassino and to the republic of Amalfi before passing to the kingdom of Naples. Its rocky shores abound with caves, notably the famous Blue Grotto. Capri is one of Italy's most popular resorts.

Capricorn *or* **Capricornus** (Latin: "Goat horn") In astronomy, the constellation lying between Aquarius and Sagittarius; in astrology, the tenth sign of the zodiac, governing approximately the period December 22–January 19. It is represented as a goat with what appears to be a fish-tail. One explanation for this odd depiction is that it derives from the Greek myth of Pan. To avoid the monster Typhon, Pan jumped into the water just as he was changing into animal shape. The half of his body above water became a goat, while the submerged half took the shape of a fish. Another relates the form to the Mesopotamian deity Enki (see Ea).

Capricorn, Tropic of See Tropic of Capricorn

Caprivi \kä-'prē-vē**, (Georg) Leo, count von** (b. Feb. 24, 1831, Berlin-Charlottenburg, Prussia—d. Feb. 6, 1899, near Crossen-an-der-Oder, Ger.) German soldier and politician. A distinguished soldier, he served as chief of the admiralty (1883–88). He succeeded Otto von Bismarck as Germany's imperial chancellor (1890–94) and Prussian minister president (1890–92). His achievements included an Anglo-German agreement concerning spheres of influence in Africa, commercial treaties with Austria, Romania, and other states, and the reorganization of the German army.

capsicum See pepper

capstan Mechanical device used chiefly on board ships or in shipyards for moving heavy weights by means of ropes, cables, or chains. A capstan consists of a drum, driven either manually or by steam or electricity, that rotates about a vertical axis to wind in a line wrapped around it. The grip between the line and the drum depends on friction and on the number of times the line is wrapped around the drum. A notched track (ratchet) on the base plate and pawls attached to the drum prevent backward rotation.

capsule In botany, a dry fruit that opens when ripe. It splits from top to bottom into separate segments known as valves, as in the iris, or forms pores at the top (e.g., poppy), or splits around the circumference, with the top falling off (e.g., pigweed and plantain). The spore-forming organ (see sporophyte) of liverworts and mosses is also called a capsule.

Capuchin \'ka-pyə-shən\ Member of the Order of Friars Minor Capuchin, an autonomous branch of the Franciscans. It began in 1525 as a reform movement led by Matteo da Bascio (c. 1495–1552), who wanted the Franciscans to return to strict observance of the Rule of St. Francis.

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He and his followers wore robes with pointed hoods (Italian, *cappuccino*), went barefoot, and lived in extreme poverty. Other Franciscans harassed them, and the pope forbade them to extend their membership outside Italy. The new order was nearly ruined by the defection of their vicar-general, Bernardino Ochino, to Protestantism in 1542, but it later grew quickly, reaching a membership of 17,000 by 1571. It was active in the Counter-Reformation in keeping the common people loyal to Catholicism. An independent order since 1619, they are known for their missionary and social work.

capuchin (monkey) \'ka-pyə-shən, kə-'pyü-shən\ Any of four species of tropical monkeys (genus *Cebus*) found from Nicaragua to Paraguay. Considered among the most intelligent New World monkeys, capuchins are named for their cap of crown hair, which resembles the cowl of Capuchin monks. These stocky, round-headed monkeys are 12–22 in. (30–55 cm) long, with a hairy, prehensile tail of about the same length, and are brown or black, sometimes with white markings. Capuchins live in troops, often in the treetops. They eat fruit and small animals and sometimes raid plantations for oranges and other food. Easily trained, they are valued as gentle pets.

capybara \ka-pi-'bar-ə\ Semiaquatic rodent (*Hydrochoerus hyrdrochaeris*) of Central and South America. Classified as the only species in its family, it is related to the cavy and the guinea pig. Capybaras are the largest living rodents, growing as large as 50 in. (1.25 m) long and weighing 110 lbs (50 kg) or more. They are sparsely haired and brownish, with a blunt snout, short legs, small ears, and almost no tail. Capybaras are shy and associate in groups along the banks of lakes and rivers. Herbivorous, they can become pests when they eat cultivated melons, grain, and squash. They swim and dive readily and commonly enter water to elude predators.

caracal \'kar-ə-ˌkal\ Short-tailed cat (*Caracal caracal*) found in hills, deserts, and plains of Africa, the Middle East, and Central and South Asia. It is sleek and short-haired, with a reddish brown coat and long tufts of black hairs on its pointed ears. Long-legged and short-tailed, it stands 16–18 in. (40–45 cm) tall and is 26–30 in. (66–76 cm) long, excluding its tail. Generally solitary and nocturnal, it preys on birds and mammals, including peafowl, gazelles, and hares. In Asia, where it has become rare, it has been trained as a hunting animal.

Caracalla \ˌkar-ə-'ka-lə\ *officially* **Marcus Aurelius Severus Antoninus Augustus** *orig.* **Septimius Bassianus** (b. April 4, AD188, Lugdunum [Lyon], Gaul—d. April 8, 217, near Carrhae, Mesopotamia) Roman emperor (198–217). He was nicknamed Caracalla for a Gallic cloak he allegedly designed. Until 211 he ruled with his father, Septimius Severus, a North African who became emperor in 193. To assure his undisputed rule, Caracalla killed his brother Geta and many of his friends. He built colossal baths in Rome, which still stand. He gave Roman citizenship to all free inhabitants of the empire (212) but showed extreme cruelty toward all who opposed him, and he massacred Germans, Parthians, and Alexandrians. He was murdered by the praetorian prefect. He is regarded as one of Rome's most bloodthirsty tyrants, and his reign contributed to the empire's decay.

Caracas \kä-'rä-käs, kə-'ra-kəs\ City (pop. 2001: 1,836,000), capital of Venezuela. Its Caribbean Sea port is La Guaira. Lying at an elevation of about 3,000 ft (900 m), Caracas is one of the most developed cities in Latin America. It was founded in 1567 by Diego de Losada. It is the birthplace of Simón Bolívar (1783), under whose leadership it became the first colony to revolt against Spain (c. 1810). Caracas has become the country's primary centre of industry, commerce, education, and culture.

Caramanlis, Constantine See Konstantinos Karamanlis

Caravaggio \ˌkar-ə-'vä-jō\ *orig.* **Michelangelo Merisi** (b. 1571?, Milan?—d. July 18, 1610, Port'Ercole, Tuscany) Italian painter. He was orphaned at 11. After an apprenticeship in Milan, he went to Rome in 1590, where he won the patronage of a cardinal. A series of large paintings (1599–1603) on the life of St. Matthew established him as the most renowned and controversial painter in Rome of his era. Breaking with conventional formulas used in depicting saints, he used ordinary people as models and painted them with unforgiving realism; his inclination against tradition gave new meaning to the interpretation of traditional themes in religious painting. His use of tenebrism—dramatic, selective illumination of form out of deep shadow to heighten the emotional tension, focus the details, and isolate the figures—became the most outstanding feature of his style and a hallmark of the Baroque period. After c. 1600 he received many commissions, including the monumental *The Deposition of Christ* (1602–04) and *Death of the Virgin* (1605–06), which was refused by the Carmelites because of the Virgin's plebeian features, bared legs, and swollen belly. His reputation and income increased despite harsh criticism and a turbulent lifestyle. He had an enormous impact on painting throughout Europe.

The Deposition of Christ, oil on canvas by Caravaggio, 1602–04; in the Vatican Museum.
SCALA/ART RESOURCE, NEW YORK

caravan Group of merchants, pilgrims, or travelers journeying together, usually for mutual protection, in deserts or other hostile regions. The camel was the most common means of transport. Caravans have been described since the beginning of recorded history, and they were a major factor in the growth of settlements along their routes. One caravan trail developed into the Silk Road. During the height of caravan travel, which lasted until the 19th century, a single caravan of Muslim pilgrims journeying from Cairo and Damascus to Mecca might employ as many as 10,000 camels.

caravansary \ˌkar-ə-'van-sə-rē\ *or* **caravanserai** \ˌkar-ə-'van-sə-ˌrī\ Public building used for sheltering caravans and other travelers in the Middle East. The structure is quadrangular in form and enclosed by a massive wall that has small windows near the top and a few narrow air holes near the bottom. The central court, surrounded by an arcade and storerooms, is usually large enough to contain 300–400 camels. It is open to the sky and has a well with a fountain basin in its center. There are rooms upstairs for lodging.

caraway Dried fruit, commonly called the seed, of *Carum carvi*, a biennial herb of the parsley family. Native to Europe and western Asia, it has been cultivated since ancient times. It has a distinctive aroma and a warm, slightly sharp taste. It is used as a seasoning, and the oil is used to flavor alcoholic beverages and as a medicine.

carbamide See urea

carbide Inorganic compound, any of a class of chemical compounds in which carbon is combined with a metal or semimetallic element. The nature of the second element (its position in the periodic table) determines the carbide's type of bonding and its properties. Calcium carbide is useful as a source of acetylene. Carbides of tungsten, silicon (see Carborundum), and boron, called refractory carbides, are extremely hard, remain stable when heated, and have a high melting point and chemical resistance. They are used as abrasives and in cutting tools, as furnace linings, and in other high-temperature applications. Iron carbide (cementite) is an important constituent of steel and cast iron.

carbine Light, short-barreled rifle. The first carbines, from the muzzle-loading muskets of the 18th century to the lever-action repeaters of the 19th, were chiefly cavalry weapons or saddle firearms for mounted frontiersmen. During World War II carbine versions of standard bolt-action or semiautomatic infantry rifles were carried by some officers, artillerymen, and other specialists. Carbine versions of modern assault rifles (such as the Russian AK-47 or the U.S. M16 rifle) are intended for close-quarter fighting, partly replacing the submachine gun. Carbine versions of hunting and target rifles are also made.

carbohydrate Any member of a very abundant and widespread class of natural organic compounds that includes sugars, starch, and cellulose. They are commonly classified as monosaccharides (simple sugars; e.g., glucose, fructose), disaccharides (2-unit sugars; e.g., sucrose, lactose), oligosaccharides (3–10 or so sugars), and polysaccharides (large molecules with up to 10,000 monosaccharide units, including cellulose, starch, and glycogen). Green plants produce carbohydrates by photosynthesis. In most animals, carbohydrates are the quickly accessible reservoir of energy, and oxidation (see oxidation-reduction) of glucose in tissues supplies energy for metabolism. Many (but by no means all) carbohydrates have the gen-

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eral chemical formula $C_n(H_2O)_n$. The carbon (C) atoms are bonded to hydrogen atoms (—H), hydroxyl groups (—OH; see FUNCTIONAL GROUP), and carbonyl groups (—C═O), whose combinations, order, and geometric arrangement lead to a large number of ISOMERS with the same chemical formula but different properties. The class is further enlarged because each isomer has various derivatives: uronic acids, sugars with an oxidized group; sugar alcohols, sugars with a reduced group; GLYCOSIDES, compounds of sugars with other molecules containing a hydroxyl group; and amino sugars, sugars with an amino group (see AMINO ACID).

carbolic acid \kär-'bä-lik\ *or* **phenol** \'fē-ˌnōl, 'fē-ˌnȯl\ Organic compound, simplest member of the class of PHENOLS. A colourless liquid with a bland, sweetish odour, it is toxic and caustic. It is a high-volume industrial chemical used chiefly in the manufacture of phenol-formaldehyde RESINS (see FORMALDEHYDE; PLASTICS), EPOXY resins, nylon, herbicides, biocides, other synthetic chemicals and pharmaceuticals, and DYES. It is also a SOLVENT and general disinfectant. The phenol coefficient is a number that expresses the germicidal action of a chemical compared with that of phenol.

carbon Nonmetallic chemical ELEMENT, chemical symbol C, atomic number 6. The usual stable ISOTOPE is carbon-12; carbon-13, another stable isotope, makes up 1% of natural carbon. Carbon-14 is the most stable and best known of five radioactive isotopes (see RADIOACTIVITY); its HALF-LIFE of approximately 5,730 years makes it useful in CARBON-14 DATING and radiolabeling of research compounds. Carbon occurs in four known ALLOTROPES: DIAMOND, GRAPHITE, carbon black (amorphous carbon including COAL, COKE, and CHARCOAL), and hollow cage molecules called FULLERENES. Carbon forms more compounds than all other elements combined; several million carbon compounds are known. Each carbon atom forms four bonds (four single bonds, two single and one double bond, two double bonds, or one single and one triple bond) with up to four other atoms. Multitudes of chain, branched, ring, and three-dimensional structures can occur. The study of these carbon compounds and their properties and reactions is organic chemistry (see ORGANIC COMPOUND). With hydrogen, oxygen, nitrogen, and a few other elements whose small amounts belie their important roles, carbon forms the compounds that make up all living things: PROTEINS, CARBOHYDRATES, LIPIDS, and NUCLEIC ACIDS. BIOCHEMISTRY is the study of how those compounds are synthesized and broken down and how they associate with each other in living organisms. Organisms consume carbon and return it to the environment in the CARBON CYCLE. CARBON DIOXIDE, produced when carbon is burned and from biological processes, makes up about 0.03% of the air, and carbon occurs in Earth's crust as CARBONATE rocks and the HYDROCARBONS in coal, PETROLEUM, and NATURAL GAS. The oceans contain large amounts of dissolved carbon dioxide and carbonates.

carbon cycle Circulation through nature of CARBON in the form of the simple ELEMENT and its compounds. The source of carbon in living things is CARBON DIOXIDE (CO_2) from air or dissolved in water. ALGAE and green PLANTS (producers) use CO_2 in PHOTOSYNTHESIS to make CARBOHYDRATES, which in turn are used in the processes of METABOLISM to make all other compounds in their tissues and those of animals that consume them. The carbon may pass through several levels of HERBIVORES and CARNIVORES (consumers). Animals and, at night, plants return the CO_2 to the atmosphere as a by-product of RESPIRATION. The carbon in animal wastes and in the bodies of organisms is released as CO_2 in a series of steps by decay organisms (decomposers), chiefly BACTERIA and fungi (see FUNGUS). Some organic carbon (the remains of organisms) has accumulated in Earth's crust in FOSSIL FUELS, LIMESTONE, and CORAL. The carbon of fossil fuels, removed from the cycle in prehistoric times, is being returned in vast quantities as CO_2 via industrial and agricultural processes, some accumulating in the oceans as dissolved CARBONATES and some staying in the atmosphere (see GREENHOUSE EFFECT).

carbon dioxide Inorganic compound, a colourless gas with a faint, sharp odour and a sour taste when dissolved in water, chemical formula CO_2. Constituting about 0.03% of air by volume, it is produced when carbon-containing materials burn completely, and it is a product of FERMENTATION and animal RESPIRATION. Plants use CO_2 in PHOTOSYNTHESIS to make CARBOHYDRATES. CO_2 in Earth's atmosphere keeps some of the Sun's energy from radiating back into space (see GREENHOUSE EFFECT). In water, CO_2 forms a solution of a weak ACID, carbonic acid (H_2CO_3). The reaction of CO_2 and AMMONIA is the first step in synthesizing UREA. An important industrial material, CO_2 is recovered from sources including flue gases, limekilns, and the process that prepares HYDROGEN for synthesis of ammonia. It is used as a refrigerant, a chemical intermediate, and an inert atmosphere; in fire extinguishers, foam rubber and plastics, carbonated beverages (see CARBONATION), and aerosol sprays; in water treatment, welding, and cloud seeding; and for promoting plant growth in greenhouses. Under pressure it becomes a liquid, the form most often used in industry. If the liquid is allowed to expand, it cools and partially freezes to the solid form, DRY ICE.

carbon-14 dating *or* **radiocarbon dating** Method of determining the age of once-living material, developed by U.S. physicist WILLARD LIBBY in 1947. It depends on the decay of the radioactive isotope carbon-14 (radiocarbon) to nitrogen. All living plants and animals continually take in carbon: green plants absorb it in the form of carbon dioxide from the atmosphere, and it is passed to animals through the food chain. Some of this carbon is radioactive carbon-14, which slowly decays to the stable isotope nitrogen-14. When an organism dies it stops taking in carbon, so the amount of carbon-14 in its tissues steadily decreases. Because carbon-14 decays at a constant rate, the time since an organism died can be estimated by measuring the amount of radiocarbon in its remains. The method is a useful technique for dating fossils and archaeological specimens from 500 to 50,000 years old and is widely used by geologists, anthropologists, and archaeologists.

carbon monoxide Inorganic compound, a highly toxic, colourless, odourless, flammable gas, chemical formula CO. It is produced when CARBON (including COAL and COKE) or carbon-containing fuel (including PETROLEUM HYDROCARBONS; e.g., GASOLINE, fuel oil) does not burn completely to CARBON DIOXIDE, because of insufficient OXYGEN. CO is present in the exhaust gases of internal combustion engines and furnaces. It is toxic because it binds to HEMOGLOBIN in blood much more strongly than does oxygen and thus interferes with transport of oxygen from lungs to tissues (see HYPOXIA; RESPIRATION). Symptoms of CO poisoning range from headache, nausea, and syncope to coma, weak pulse, respiratory failure, and death. CO is used industrially as a fuel and in synthesis of numerous organic compounds, including methanol, ethylene, and aldehydes.

carbon steel ALLOY of IRON and CARBON in which the carbon content may range from less than 0.015% to slightly more than 2%. Adding this tiny amount of carbon produces a material that exhibits great strength, hardness, and other valuable mechanical properties. Carbon steels account for about 90% of the world's STEEL production. They are used extensively for automobile bodies, appliances, machinery, ships, containers, and the structures of buildings. Carbon steel, formerly made by the BESSEMER, CRUCIBLE, or OPEN-HEARTH PROCESS, is now made by the BASIC OXYGEN PROCESS, or by an ARC FURNACE.

Carbonari \ˌkär-bə-'nä-rē\ (Italian dialect: "Charcoal Burners") Members of a secret society (the Carbonaria) in early-19th-century Italy. Advocating liberal and patriotic ideas, the Carbonari favored constitutional and representative government and aimed to protect Italian interests against foreigners. They helped lead the unsuccessful revolts of 1820 and 1831 and were gradually absorbed into the YOUNG ITALY movement. Their influence prepared the way for the RISORGIMENTO.

carbonate Any member of two classes of chemical compounds—one inorganic and the other organic—that are derived from CARBON DIOXIDE (CO_2) or its water solution, carbonic acid (H_2CO_3). Inorganic carbonates (MCO_3 or M_2CO_3, where M is a METAL atom of, e.g., CALCIUM or SODIUM) are SALTS of carbonic acid. The shells and other hard parts of shellfish are calcium carbonate, as is the LIMESTONE they turn into. Many other minerals, including CALCITE, DOLOMITE, and ARAGONITE, consist of or contain carbonates. Sodium carbonate is one of the world's most important basic chemical commodities. Organic carbonates are ESTERS of carbonic acid and various ALCOHOL groups (methyl, ethyl, or phenyl). These are liquids used as SOLVENTS and to synthesize plastics and other compounds.

carbonate mineral Any member of a family of minerals that contains the carbonate ion, CO_3^{2-}, as the basic structural unit. The carbonates are among the most widely distributed minerals in the earth's CRUST; the most common are CALCITE, DOLOMITE, and ARAGONITE. Dolomite replaces calcite in limestones; when this replacement is extensive, the rock is called dolomite. Other relatively common carbonate minerals are SIDERITE, RHODOCHROSITE, strontianite (strontium-rich); smithsonite (zinc-rich); witherite (barium-rich); and cerussite (lead-rich).

carbonation Addition of CARBON DIOXIDE gas to a beverage, imparting sparkle and a tangy taste and preventing spoilage. The liquid is chilled and cascaded down in an enclosure containing carbon dioxide (either as DRY ICE or a liquid) under pressure. Increasing pressure and lowering temperature maximize gas absorption. Carbonated beverages do not require PASTEURIZATION.

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Carboniferous Period Interval of geologic time 354–290 million years ago, marked by great changes in world geography. All the landmasses drew closer together as a result of tectonic plate movements. The supercontinent GONDWANA occupied much of the Southern Hemisphere. By the end of the period, present-day North America, Greenland, and northern Europe were also part of Gondwana. Siberia and China (including Southeast Asia) remained individual continents located at high latitudes in the Northern Hemisphere. During this period, swamp forests became widespread, and enormous coal deposits formed. Plants made great advances in the complex forests, and vertebrates were undergoing extensive evolution. Amphibians became widespread and diverse, and reptiles appeared for the first time and rapidly adapted to many habitats.

carbonyl chloride See PHOSGENE

Carborundum \ˌkär-bə-'rən-dəm\ Trademark name of silicon CARBIDE, an inorganic compound discovered in the 1880s by E.G. ACHESON. Carborundum has a crystal structure like that of DIAMOND and is almost as hard. It is used as an abrasive for cutting, grinding, and polishing, as an antislip additive, and as a REFRACTORY.

carboxylic acid \ˌkär-bäk-'si-lik\ Any organic compound with the general chemical formula —COOH in which a carbon (C) atom is bonded to an oxygen (O) atom by a double bond to make a carbonyl group (—C═O; see FUNCTIONAL GROUP) and to a hydroxyl group (—OH) by a single bond (see BONDING). The fourth bond on the carbon links it to a hydrogen (H) atom (for FORMIC ACID), a methyl ($—CH_3$) group (for ACETIC ACID), or another natural or synthetic monovalent group. Carboxylic acids occur widely in nature. In FATTY ACIDS, the fourth group is a HYDROCARBON chain. In aromatic acids (see AROMATIC COMPOUND), it is a ring-structured hydrocarbon. In AMINO ACIDS, it contains a nitrogen atom. Carboxylic acids participate in chemical reactions as ACIDS, usually fairly weak. Many carboxylic acids (acetic acid, CITRIC ACID, LACTIC ACID) are intermediates in METABOLISM and can be found in natural products; others (e.g., SALICYLIC ACID) are used as SOLVENTS and to prepare many chemical compounds. Important carboxylic-acid derivatives include ESTERS, ANHYDRIDES, AMIDES, halides (see HALOGEN), and SALTS (see SOAP).

carburetor \'kär-bə-ˌrā-tər\ Device for supplying a spark-ignition ENGINE with a mixture of fuel and air. Carburetors are used in small GASOLINE ENGINES, such as lawn mowers and chainsaws. Once an essential component in all gasoline engines, automobile carburetors were displaced by electronic FUEL INJECTION systems from the late 1970s through 1990. Carburetors for automobile engines usually contained a storage chamber for liquid fuel, a choke, an idling jet, a main jet, an airflow restriction, and an accelerator pump. The quantity of fuel in the storage chamber was controlled by a valve actuated by a float. The choke, a butterfly VALVE, reduced the intake of air so that a fuel-rich charge was drawn into the cylinders when a cold engine was started. As the engine warmed up, the choke was gradually opened. Reduced pressure near the partially closed throttle valve caused the fuel to flow from the idling jet into the intake air. Further opening the throttle valve activated the main fuel jet. Then the venturi-shaped airflow restriction created reduced pressure, drawing fuel from the main jet into the airstream at a rate related to the airflow so that a nearly constant fuel-air ratio was obtained. The accelerator pump injected fuel into the inlet air when the throttle was opened suddenly. See also GASOLINE ENGINE; VENTURI TUBE.

carburizing Oldest method for surface-hardening STEEL, by heat or mechanical means to increase the hardness of the outer surface while leaving the core relatively soft. The combination of hard surface and soft interior withstands very high STRESS and FATIGUE, and also offers low cost and superior flexibility in manufacturing. To carburize, the steel parts are placed in a carbonaceous environment (with charcoal, coke, and carbonates, or with carbon dioxide, carbon monoxide, methane, or propane) at a high temperature for several hours. The CARBON diffuses into the surface of the steel, altering the crystal structure of the metal. Gears, ball and roller bearings, and piston pins are often carburized.

Carcassonne \ˌkär-kä-'sȯn\ *ancient* **Carcaso** City (pop., 1999: 43,950), southwestern France. Situated on the Aude River, it was occupied by the IBERIANS in the 5th century BC and later by Gallo-Romans. Muslims took it in AD 728. The French soldier Simon de MONTFORT captured it c. 1209, and in 1247 it was united with the French crown. It was burned by EDWARD THE BLACK PRINCE in 1355 when he failed to take the citadel. A 13th-century church and cathedral survive, as do remains of medieval fortifications, the last of which were designated a World Heritage site in 1997. The city's main economic activities are tourism and retailing.

Carchemish \'kär-kə-ˌmish\ Ancient city-state, western bank of the EUPHRATES RIVER. Its remains lay southeast of GAZIANTEP, Tur., near the Syrian border. It was a city of the MITANNI kingdom in the 2nd millennium BC and later a chief HITTITE city. Probably subjugated by SEA PEOPLES after c. 1200 BC, it gradually came under Assyrian rule, finally capitulating in 717 BC. In a battle at Carchemish in 605 BC, Babylonian king NEBUCHADREZZAR II expelled the Egyptians from Syria. The ruins were excavated in 1911–20.

carcinogen \kär-'si-nə-jən\ Agent that can cause CANCER. Exposure to one or more carcinogens, including certain chemicals, radiation, and certain viruses, can initiate cancer under conditions not completely understood. Some people have a genetic tendency to develop cancer when exposed to a specific carcinogen or combination of carcinogens. Repeated local injury or irritation to a part of the body can be carcinogenic. Identifying and eliminating carcinogens in time can reduce the incidence of cancer.

cardamom \'kär-də-məm\ Spice consisting of whole or ground dried fruit, or seeds, of *Elettaria cardamomum*, a perennial herb of the GINGER family. The flavour is warm, slightly pungent, and highly aromatic. Cardamom is a popular seasoning. Native to moist forests of southern India, the fruit may be collected from wild plants, but most is cultivated. The whole fruit is a green, three-sided oval CAPSULE containing 15–20 dark, hard, angular seeds.

Cárdenas, Bartolomé de See Bartolome BERMEJO

Cárdenas \'kär-dᵊn-ˌäs\ **(del Río), Lázaro** (b. May 21, 1895, Jiquilpan, Mex.—d. Oct. 19, 1970, Mexico City) President of Mexico (1934–40). Of Indian descent, he joined the armed struggle against the dictatorial VICTORIANO HUERTA, rising through the ranks of the revolutionary forces. His faction triumphed, and Cárdenas was made a general in the Mexican army in 1920. In 1928 he became governor of Michoacán, and in 1934 he became president. Noted for his efforts to carry out the social and economic aims of the revolution, he distributed a record amount of land to peasants, made loans available to them, organized workers' and peasants' confederations, and nationalized the oil industry, the principal railways, and other foreign-owned industries. He opposed U.S. influence in Mexico and later supported FIDEL CASTRO. For many Mexicans he remains the foremost symbol of the political left. His son Cuauhtémoc, a prominent leader of the opposition to Mexico's ruling party, is widely believed to have been denied victory in the 1988 presidential elections by fraud; he has since served as mayor of Mexico City. See also INDIGENISMO.

Cardiff City and county (pop., 2001: 305,340), capital of Wales. It is located on the BRISTOL CHANNEL in southeastern Wales. The Romans built a fort there c. AD 75. The town itself was established with the arrival of the Normans in the 11th century. Its population was small into the early 19th century, but by the early 20th century Cardiff had become the largest coal-exporting port in the world. The coal trade ceased in the 1960s, but Cardiff remains the largest city and the principal commercial centre of Wales.

Cardigan, James Thomas Brudenell, 7th earl of (b. Oct. 16, 1797, Hambleden, Buckinghamshire, Eng.—d. March 27/28, 1868, Deene Park, Northamptonshire) British general. After entering the army (1824), he purchased promotions to become a lieutenant colonel (1832) and gained a reputation as a martinet. He spent his inherited wealth to make his regiment the best-dressed in the service (introducing the later-named cardigan jacket). At the outbreak of the CRIMEAN WAR (1853), he was appointed commander of the Light Brigade of British cavalry, which he led in the ill-fated charge at the Battle of BALAKLAVA. Despite the disaster, Cardigan was lionized on his return to England and appointed inspector general of cavalry.

Cardigan Bay Bay, western WALES. A widemouthed inlet of ST. GEORGE'S CHANNEL, it is about 65 mi (105 km) long. Two national parks, Snowdonia and Pembrokeshire Coast, incorporate substantial stretches of shoreline. Many resort towns line the bay, including ABERYSTWYTH and Fishguard, a base for ferry service between Wales and Ireland.

Cardin \kär-'daⁿ**, Pierre** (b. July 7, 1922, Venice, Italy) French fashion designer. At age 17 he went to Vichy to become a tailor at a men's shop. After World War II he joined the Parisian fashion house of Paquin

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and designed the costumes for Jean Cocteau's film *Beauty and the Beast* (1945). In 1959 he created the first ready-to-wear collection for women ever presented by a top designer and in 1960 introduced the first designer ready-to-wear collection for men. He showed himself a master of the bias cut, soft semifitted lines, and lavish colour. In the late 1960s his stark, short tunics, and his use of vinyl, helmets, and goggles launched the Space Age look. His men's clothing influenced other designers, including Bill Blass.

cardinal Member of the Sacred College of Cardinals. The cardinals' duties include electing the pope, acting as his principal counselors, and aiding in the governance of the Roman Catholic Church. Cardinals serve as officers of the Roman Curia, bishops of major dioceses, and papal envoys. Since 769 only cardinals have been eligible to become pope, and since 1059 the pope has been elected only by cardinals. The first cardinals were the deacons of the seven regions of Rome. Their present-day successors are known as cardinal deacons. Cardinal bishops are the successors of the bishops of the sees just outside Rome and of the patriarchal sees of the Eastern Catholic Church. Cardinal priests are the bishops of important sees around the world and constitute the most numerous order of cardinals. The number of cardinals was limited to 70 for nearly 400 years until 1958, when John XXIII (1958–63) eliminated the restriction. Under Paul VI (1963–78) there were 145 cardinals, and under John Paul II (1978–2005) there were 182. With the increase in the size of the cardinalate came new restrictions imposed by the popes. Paul VI directed that cardinals who do not resign by age 75 relinquish the right to vote for a pope when they reach 80. He also limited the number of voting cardinals to 120, a restriction confirmed during the pontificate of John Paul II. A red biretta and ring are symbolic of the office.

cardinal *or* **redbird** Songbird (*Cardinalis cardinalis*, family Fringillidae or Emberizidae) of North America, primarily east of the Rocky Mountains. It is 8 in. (20 cm) long and has a pointed crest. The male is bright red, the female a duller red or olive-brown. Pairs of cardinals utter loud, clear whistling notes year-round in gardens and open woodlands. They feed on insects, wild seeds, and fruits. Cardinals are especially abundant in the southeastern U.S. and have been introduced into Hawaii, southern California, and Bermuda. Related species also called cardinals live in South America.

Male northern cardinal (*Cardinalis cardinalis*).
STEPHEN COLLINS

cardinal flower Any of several closely related species of the genus *Lobelia*, perennial plants of the lobelia family, native to North and Central America. All bear spikes of scarlet, lipped flowers on leafy stems up to 5 ft (1.5 m) tall. *L. cardinalis* and *L. splendens*, considered to be one species by some authorities, are taller than *L. fulgens*, the Central American parent species of the garden cardinal flower. The blue cardinal (*L. siphilitica*) is smaller than the others and has blue or whitish flowers.

carding In yarn production, a process of separating individual fibres, causing many of them to lie parallel and removing most of the remaining impurities. Cotton, wool, waste silk, and man-made staple are subjected to carding. Carding produces a thin sheet of uniform thickness that is then condensed to form a thick, continuous, untwisted strand called sliver. When very fine yarns are desired, carding is followed by combing, a process that removes short fibres, leaving a sliver composed entirely of long fibres, all laid parallel and smoother and more lustrous than uncombed types. Carded and combed sliver is then spun.

carding machine Machine for carding textile fibres. In the 18th century, hand carding was laborious and constituted a bottleneck in the newly mechanized production of textiles. Several inventors worked to develop machines to perform the task, notably John Kay, Oliver Evans, Lewis Paul, R. Arkwright, and Johann Bodmer.

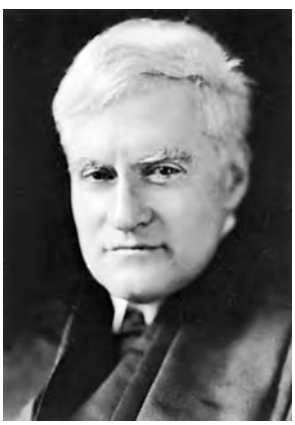
cardiology Medical specialty dealing with heart diseases and disorders. It began with the 1749 publication by Jean Baptiste de Sénac of contemporary knowledge of the heart. Diagnostic methods improved in the 19th century, and in 1905 the electrocardiograph was invented. The 20th century saw many surgical advances in cardiology, including heart transplants and the use of artificial hearts. Current diagnostic methods include chest percussion (tapping) and auscultation, electrocardiography, and echocardiography (see ultrasound). Cardiologists provide continuing care of heart patients, doing basic heart-function studies, supervising therapy, including drug therapy, and working closely with heart surgeons.

cardiopulmonary resuscitation (CPR) Emergency procedure to restore breathing and circulation in an unconscious person. A trained rescuer opens the airway and confirms the absence of breathing and pulse. Resuscitation itself consists of alternating mouth-to-mouth breathing (see artificial respiration) and repeated pressure on the chest to circulate the blood.

cardiovascular system System of vessels that convey blood to and from tissues throughout the body, bringing nutrients and oxygen and removing wastes and carbon dioxide. It is essentially a long, closed tube through which blood moves in a double circuit—one through the lungs (pulmonary circulation) and one through the rest of the body (systemic circulation). The heart pumps blood through the arteries, which branch into smaller arterioles, which feed into microscopic capillaries (see artery; capillary). These converge to form small venules, which join to become larger veins, generally following the same path as the arteries back to the heart. Cardiovascular diseases include atherosclerosis, congenital and rheumatic heart disease, and vascular inflammation.

Cardoso, Fernando Henrique (b. June 18, 1931, Rio de Janeiro, Braz.) President of Brazil (1995–2003). Born into a wealthy military family, he taught sociology at the University of São Paulo and was a prominent member of the left-wing intellectual opposition when Brazil was under military rule, though he turned more centrist after civilian rule was restored. In 1993 he became finance minister and supervised the creation of the Real Plan, an effective anti-inflation package that helped him gain the presidency in 1994. He worked for privatization of state-owned companies and increased foreign investment. In 1998 he became the first president in Brazilian history to be reelected. A foreign-exchange crisis in 1999 damaged Brazil's growth prospects.

Cardozo, Benjamin (Nathan) (b. May 24, 1870, New York, N.Y., U.S.—d. July 9, 1938, Port Chester) U.S. jurist. Born into a distinguished Jewish family, he was admitted to the New York bar in 1891 and became a successful courtroom lawyer. Elected to the state Supreme Court as a reform candidate (1913), he was quickly promoted to the Court of Appeals. During his tenure many thought the quality of the appellate bench exceeded that of the U.S. Supreme Court. He influenced the trend in U.S. appellate judging toward greater involvement in public policy and consequent modernization of legal principles. He was both a creative common-law judge and a notable legal essayist. Appointed to the Supreme Court of the United States in 1932, he usually voted with liberals Louis Brandeis and Harlan Fiske Stone. He wrote the majority opinion upholding the constitutionality of the Social Security Act (1937). In a 1937 case on double jeopardy, he held that the states were not required to implement all the provisions of the Bill of Rights, a position that became known as "selective incorporation." He served on the Supreme Court until 1938. The law school at Yeshiva University is named for him.



Benjamin Cardozo.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

cards, playing See playing cards

Carducci \kär-'dü-chē**, Giosuè** (b. July 27, 1835, Val di Castello, near Lucca, Tuscany—d. Feb. 16, 1907, Bologna, Italy) Italian poet. He taught literary history in Bologna for 40 years and in later years served as a senator. He opposed the prevailing Romanticism and advocated a return to classical models of prosody, but his rhetorical tirades provoked resistance to reform. His best volumes of verse, *The New Lyrics* and *The Barbarian Odes* (1887), contain evocations of landscape, memories of childhood, and representations of the glory of ancient Rome. Regarded in his time as Italy's national poet, he won the Nobel Prize for Literature in 1906.

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Carême \kä-'rem**, Marie-Antoine** (b. June 8, 1784, Paris, Fr.—d. Jan. 12, 1833, Paris) French chef. Born into a poor family, he attained employment in a pastry shop frequented by Charles-Maurice de Talleyrand. He served as Talleyrand's chef for 12 years and subsequently created grandiose dishes and elaborately sculpted confections for the most splendid households of Europe, including those of the young George IV, Tsar Alexander I, and the baron de Rothschild. He wrote several classics of *grande cuisine*.

Carew, Rod *in full* **Rodney Cline Carew** (b. Oct. 1, 1945, Gatún, Pan.) Panamanian-born U.S. baseball player. Carew moved from Panama to New York City in 1962, where he learned sandlot ball. Playing for the Minnesota Twins (1967–78), he became one of the great hitters of the modern era and led the American League in batting seven times between 1969 and 1978. His highest average was .388, in 1977. He was traded in 1979 to the California (later Anaheim) Angels and retired in 1986 with a lifetime batting average of .328.

Carey, Peter (Philip) (b. May 7, 1943, Bacchus Marsh, Vic., Austl.) Australian writer. He worked as an advertising copywriter and at other odd jobs until 1988, when he became a full-time writer. His short-story collection *The Fat Man in History* (1974) contains macabre elements. His novels, more realistic but laced with black humour, include *Bliss* (1981), *Illywhacker* (1985), *Oscar and Lucinda* (1988, Booker Prize), *The Unusual Life of Tristan Smith* (1994), *Jack Maggs* (1997), and *True History of the Kelly Gang* (2000; Booker Prize, 2001).

cargo cult Any religious movement based on the observation by local residents of the delivery of supplies by ship and aircraft to colonial officials. Cargo cults were observed chiefly in Melanesia in the late 19th and early 20th centuries. They were characterized by the expectation of a new age of blessing and prosperity to be initiated by the arrival of a special "cargo" of goods from supernatural sources. Such beliefs may have expressed traditional millennial ideas, often revived by the teaching of Christian missions.

Caria \'kar-ē-ə\ Ancient district, southern Anatolia. It was one of the most thoroughly Hellenized districts in ancient Anatolia; its territory included Greek cities along the shore of the Aegean Sea and a mountainous interior bounded by Lydia, Phrygia, and Lycia. Absorbed first by Lydia, it later was annexed (4th century BC) by the Persian Achaemenian Empire, one of whose governors, Mausolus, transferred its capital from Mylasa to Halicarnassus. Taken from Persia in 334 BC by Alexander the Great, it was incorporated into the Roman province of Asia in 129 BC.

Carib \'kar-əb\ American Indian people who inhabited the Lesser Antilles and parts of the South American coast at the time of the Spanish conquest. The Island Carib (now extinct) were a warlike, individualistic people who reportedly practiced cannibalism (the term derives from their name). Carib groups on the mainland, some of whom still survive, lived in the Guianas and as far south as the Amazon River; they subsisted by hunting and growing crops and were less aggressive than their island relatives.

Cariban \'kar-e-bən\ **languages** Large family of South American Indian languages. It has an estimated 43 members; nearly half are now extinct, and most of the remainder have very few speakers. Most Cariban languages are spoken in southern Venezuela, the Guianas, and Brazil north of the Amazon, though several have strayed far from this area. Cariban incursions into the mainly Arawakan-speaking Antilles at the time of Columbus provided European languages with the words *Carib* (hence, *Caribbean*) and *cannibal*, both perhaps from a proto-Cariban form meaning "Indian, person."

Caribbean Sea Arm of the Atlantic Ocean. It covers about 1,049,500 sq mi (2,718,200 sq km) and washes the northern coast of South America, eastern Central America, and eastern Mexico. It reaches its greatest known depth, about 25,000 ft (7,500 m), in Cayman Trench, between Cuba and Jamaica. Its generally tropical climate varies, depending on mountain elevations, water currents, and trade winds. The economies of its island countries, including Saint Kitts and Nevis, Dominica, Saint Lucia, and Barbados, are greatly dependent on tourism; the region is one of the world's principal winter resort areas. See map on opposite page.

caribe See piranha

caribou \'kar-ə-ˌbü\ Arctic deer (*Rangifer tarandus*) of the tundra, taiga, and forests, native to North America and northern Eurasia from Scandinavia to eastern Siberia. Both sexes have antlers. Caribou stand 2.3–4.6 ft (0.7–1.4 m) tall at the shoulder and weigh up to 660 lbs (300 kg); domesticated races are about the size of donkeys. They are usually grayish or brownish with lighter underparts but may be whitish or nearly black. Their herds are famous for their seasonal migration between summer and winter ranges. Their staple winter food is a lichen, popularly called reindeer moss, which they reach by scraping the snow away with their feet. In summer they also eat grasses and saplings. See also reindeer.

caricature \'kar-i-kə-ˌchůr\ Comically distorted drawing or likeness intended to satirize or ridicule its subject. The word, derived from the Italian *caricare* ("to load or charge"), was probably coined by the Carracci family, who defended the practice as a counterpart to idealization. In the 18th century the caricature became connected with journalism and was put to virulent use by political commentators. In the 1880s photo-process engraving made it possible to produce and illustrate daily newpapers cheaply, bringing caricatures to the general public. In the 20th century caricature increasingly moved into the editorial, sports, and theatrical sections of newspapers. Important caricaturists include Jacques Callot, George Cruikshank, Honoré Daumier, Gustave Doré, and Al Hirschfeld.

caries \'kar-ēz\ *or* **tooth decay** Localized disease that causes decay and cavities in teeth. It begins at the tooth's surface and may penetrate the dentin and the pulp cavity. Microorganisms in the mouth are believed to consume sugars and produce acids that eat away at tooth enamel. The dentin's protein structure is then destroyed by enzymes. Diet, general health, structural tooth defects, and heredity affect the risk of having caries. Prevention involves avoiding excessive sweets, brushing and flossing the teeth, and having regular dental care. Treatment includes restoration of teeth with cavities. Fluoridation of water can reduce the occurrence of caries by as much as 65%.

carillon \'kar-ə-ˌlän\ Musical instrument consisting of at least 23 cast bronze bells tuned in chromatic order. Usually located in a tower, it is played from a keyboard. Most carillons encompass three to four octaves. The carillon originated in Flanders c. 1480, and the art of carillon building reached its height in the Netherlands in the 17th century, when the tuning of the bells became highly refined.

Carillon clavier
GILLETT & JOHNSTON (CROYDON) LIMITED

Carinthia See Kärnten

Carissimi \kä-'rēs-sē-mē**, Giacomo** (baptized April 18, 1605, Marino, near Rome—d. Jan. 12, 1674, Rome) Italian composer. He worked as *maestro di cappella* at the Collegio Germanico in Rome, a musically important post at a notable Jesuit institution, from 1629 until

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his death. His approximately 15 oratorios (performed in place of operas during Lent), including *Baltazar*, *Ezechia*, *Jephte*, *Jonas*, and *Judicium extremum* made him the principal oratorio composer of the mid-17th century. He also wrote some 150 cantatas and nearly 100 motets.

Carl XVI Gustaf *Swedish* **Carl Gustaf Folke Hubertus** (b. April 30, 1946, Stockholm, Swed.) King of Sweden from 1973. Grandson of King Gustav VI Adolf (1882–1973), he became crown prince in 1950, his father having died in 1947. After studying at military schools, he became a naval officer. His accession occurred at a time when the role of the Swedish monarchy was being radically altered; the new constitutional laws of 1973 left the king with a solely symbolic function rather than a formal role in the country's administration.

Carleton, Guy See Guy Carleton, 1st Baron Dorchester

Carleton \'kär-əl-tən\ **College** Private liberal arts college in Northfield, Minn., founded in 1866. It offers a variety of undergraduate majors. Small classes and opportunities to participate in faculty research projects attract a select student body, most from out of state. The academic year is based on three 10-week trimesters, with each student typically enrolling in three courses per trimester.

Carlisle \kär-'līl\ City, administrative district (pop., 2001: 100,734), and seat of the administrative county of Cumbria, northwestern England. It was founded as Luguvallium by the Romans on the River Eden opposite a fortified camp on the line of Hadrian's Wall. Destroyed by Norse invaders c. 875, it was restored when claimed from the Scots by William II in 1092. Mary, Queen of Scots, was imprisoned there in 1568. It was besieged during the English Civil Wars, and its Royalist defenders eventually surrendered to Parliamentary forces in 1645. Its cotton textile industry grew in the 18th–19th centuries, and it has remained the centre of northern England's cotton industry.

Carlism Spanish political movement of traditionalist character that originated in the 1820s. Carlists supported the claims of Ferdinand VII's brother Don Carlos (1788–1855) and his descendants to the throne, rejecting the succession of Ferdinand's daughter Isabella II by invoking the Salic Law (introduced into Spain in 1713), which excluded females from the royal succession. The disputed succession led to several unsuccessful civil rebellions, known as the Carlist Wars (1833–39, 1872–76). Later adherents of Carlism formed the Traditionalist Party (1918), which merged with the Falange in 1937.

Carlowitz \'kär-lə-ˌvits**, Treaty of** (1699) Peace settlement that ended hostilities (1683–99) between the Ottoman Empire and the Holy League (Austria, Poland, Venice, and Russia). Signed at Carlowitz (now Sremski Karlovci), near Belgrade, it significantly diminished Turkish influence in eastern Europe and made Austria the dominant power there. Austria received most of Hungary, Transylvania, Croatia, and Slovenia. Venice acquired most of Dalmatia, and Poland regained Podolia and part of Ukraine. The Russians concluded a two-year armistice at Carlowitz, signing a treaty in 1700 that gave Azov to Russia, though the Turks regained Azov in 1711.

Carlsbad See Karlovy Vary

Carlsbad Caverns National Park Preserve, southeastern New Mexico, U.S. Established as a national monument in 1923 and as a national park in 1930, it covers 73 sq mi (189 sq km). Beneath the surface winds a maze of underground chambers; one of the largest caverns ever discovered, the Big Room, is about 2,000 ft (600 m) long and 1,100 ft (330 m) wide, and its ceiling arches 255 ft (78 m) above the floor. In the summer a colony of bats inhabits a part of the caverns known as Bat Cave.

Carlsbad Decrees (Aug. 6–31, 1819) Resolutions issued by German leaders to suppress liberal and nationalistic tendencies. Meeting at Carlsbad, Bohemia (now Karlovy Vary, Cz.Rep.), the conference of ministers

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from the major German states agreed to Prince von Metternich's proposals advocating censorship, the disbanding of the Burschenschaft groups, and the creation of a commission to ferret out conspiratorial organizations. In the long run, the repressive decrees failed to stifle German nationalism or liberal developments.

Carlsson, Arvid (b. Jan. 25, 1923, Uppsala, Swed.) Swedish pharmacologist. He received his M.D. from the University of Lund. Carlsson established that dopamine is an important neurotransmitter, showing that high levels of dopamine are found in areas of the brain that control walking and other voluntary movements. He determined that levodopa, a substance that the brain uses to make dopamine, could be employed as a treatment for parkinsonism. His work also contributed to an understanding of the relationship between neurotransmitters and mental states such as clinical depression, which led to new antidepressant drugs, including Prozac. Along with Eric Kandel and Paul Greengard, Carlsson was awarded the Nobel Prize in 2000.

Carlton, Steve *in full* **Steven Norman Carlton** (b. Dec. 22, 1944, Miami, Fla., U.S.) U.S. baseball pitcher. Carlton pitched in junior college before signing with the St. Louis Cardinals in 1965. A left-handed pitcher, he won 20 or more games in a single season six times and was a four-time Cy Young Award winner for best pitcher. He played for the Cardinals (1966–70), the Philadelphia Phillies (1971–83), and several other teams. His career total of 4,136 strikeouts is second only to that of Nolan Ryan.

Carlyle, Thomas (b. Dec. 4, 1795, Ecclefechan, Dumfriesshire, Scot.—d. Feb. 5, 1881, London, Eng.) Scottish historian and essayist. The son of a mason, Carlyle was reared in a strict Calvinist household and educated at the University of Edinburgh. He moved to London in 1834. An energetic, irritable, fiercely independent idealist, he became a leading moral force in Victorian literature. His humorous essay "Sartor Resartus" (1836) is a fantastic hodgepodge of autobiography and German philosophy. *The French Revolution*, 3 vol. (1837), perhaps his greatest achievement, contains outstanding set pieces and character studies. *On Heroes, Hero-Worship, and the Heroic in History* (1841) showed his reverence for strength, particularly when combined with the conviction of a God-given mission. He later published a study of Oliver Cromwell (1845) and a huge biography of Frederick the Great, 6 vol. (1858–65).

Carlyle, detail of an oil painting by G.F. Watts, 1877; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Carmarthen \kər-'mär-thən\ Town (pop., 2001: 13,130), administrative centre of the county of Carmarthenshire, southern Wales. It lies on the Afon Tywi above the mouth of the Bristol Channel. Both the Romans and Normans built strongholds there. An Augustinian priory dating from the Norman period once housed the *Black Book of Carmarthen* (c. 1250), which is the oldest Welsh manuscript extant.

Carmelite Mendicant order of the Roman Catholic church. It originated c. 1155 on Mount Carmel in Palestine, where a number of former pilgrims and crusaders began to live as hermits. Their rule was written by St. Albert, Latin patriarch of Jerusalem, and approved by Pope Honorius III in 1226. As Muslim incursions made Palestine increasingly unsafe, the Carmelites scattered to Cyprus, Sicily, France, and England. In England and Western Europe the order transformed itself from a group of hermits into one of mendicant friars. The first institution of Carmelite nuns was founded in 1452. St. Teresa of Ávila and St. John of the Cross reemphasized the strictness and austerity of Carmelite traditions, establishing Discalced (barefoot) Carmelite orders in 1562 and 1569, which gave rise to an independent order in 1593. Both the reformed and the original orders suffered greatly during the French Revolution and the Napoleonic era, but they were later restored in most of Western Europe as well as in the Middle East, Latin America, and the U.S.

Carmichael, Hoagy *orig.* **Hoagland Howard Carmichael** (b. Nov. 22, 1899, Bloomington, Ind., U.S.—d. Dec. 27, 1981, Rancho Mirage, Calif.) U.S. songwriter. While studying law in Indiana, he met many jazz musicians, including Bix Beiderbecke, who recorded Carmichael's first composition, "Riverboat Shuffle" (1924). The relaxed tunefulness of later songs such as "Georgia (Georgia on My Mind)," "Rockin' Chair," and "Lazy River" gave them a universal appeal. For Hollywood films he wrote "Thanks for the Memory," "Two Sleepy People," "Heart and Soul," and "In the Cool, Cool, Cool of the Evening" (1951, Academy Award). His "Stardust" is reputedly the most recorded popular song of all time. He acted in several films, including *To Have and Have Not* (1944) and *Young Man with a Horn* (1950), and wrote the memoirs *The Stardust Road* (1946) and *Sometimes I Wonder* (1965).

Carmona \kär-'mō-nə**, António Oscar de Fragoso** (b. Nov. 24, 1869, Lisbon, Port.—d. April 18, 1951, Lisbon) Portuguese general and politician. A career officer, he rose to the rank of general by 1922. He took part in the army coup of May 1926 and became premier later that year. He ruled as a virtual dictator before calling for a plebiscite; elected president, he served from 1928 to 1951, acting as a symbol of political continuity after he named António de Oliveira Salazar premier in 1932.

Carnap, Rudolf (b. May 18, 1891, Ronsdorf, Ger.—d. Sept. 14, 1970, Santa Monica, Calif., U.S.) German-born U.S. philosopher. He earned a doctorate in physics at the University of Jena in 1921. In 1926 he was invited to join the faculty of the University of Vienna, where he soon became an influential member of a group of philosophers, mathematicians, and scientists known as the Vienna Circle. Out of their discussions developed the basic ideas of logical positivism. Carnap immigrated to the U.S. in 1935 and taught at the University of Chicago (1936–52). After two years at the Institute for Advanced Study at Princeton (1952–54), he joined the faculty of the University of California at Los Angeles, where he remained until his death. Carnap sought to give the basic thesis of empiricism—that all concepts and beliefs about the world ultimately derive from immediate experience—a precise interpretation, construing it as a logical thesis about the evidential grounding of empirical knowledge. For Carnap, empiricism is the doctrine that the terms and sentences that express assertions about the world are "reducible" in a clearly specifiable sense to terms and sentences describing the immediate data of experience. His major works include *The Logical Structure of the World* (1928), *The Logical Syntax of Language* (1934), *Introduction to Semantics* (1942), *Meaning and Necessity* (1947), and *The Logical Foundations of Probability* (1950).

carnation Herbaceous plant (*Dianthus caryophyllus*) of the pink family, native to the Mediterranean, widely cultivated for its fringe-petaled, often spicy-smelling flowers. Border, or garden, carnations include a range of varieties and hybrids. The perpetual flowering carnation, taller and stouter, produces larger flowers and blooms almost continuously in the greenhouse; miniature (baby) and spray varieties are also grown for the florist trade. Carnations are among the most popular cut flowers, used in floral arrangements, corsages, and boutonnieres.

carnauba wax Very hard wax obtained from fronds of the carnauba tree, *Copernicia cerifera*, a fan palm of Brazil. During the regular dry seasons in Brazil, where it is called the tree of life, the carnauba palm protects its fanlike fronds from loss of moisture by secreting a coat of carnauba wax. Carnauba has been used in high-gloss polishes, phonograph records, and explosives. Synthetics have replaced it for many applications.

Carné \kär-'nā**, Marcel** (b. Aug. 18, 1906, Paris, France—d. Oct. 31, 1996, Clamart) French film director. He worked as an assistant director before directing his first feature, *Jenny* (1936). This success was followed by *Bizarre, Bizarre* (1937), *Port of Shadows* (1938), and *Daybreak* (1939), works of poetic realism that were the fruit of his collaboration with screenwriter Jacques Prévert. During the Nazi occupation he made *The Devil's Envoys* (1942) and later his masterpiece, *The Children of Paradise* (1945), which chronicled life in the theatre and celebrated the French spirit. His work declined after his breakup with Prévert in 1948.

Carnegie Hall Concert hall in New York, N.Y., U.S. It was endowed by the industrialist Andrew Carnegie at the insistence of the conductor Walter Damrosch (1862–1950). Designed in a Neo-Italian Renaissance style by William Burnet Tuthill, it opened in 1891, with Pyotr Tchaikovsky as guest of honour. Threatened by destruction in the late 1950s, it was saved by a public outcry and purchased by the city. It was extensively renovated in 1982–86. Admired for its beauty and its superb acoustics, it seats almost 2,800 people and has long been the most famous concert hall in the U.S.

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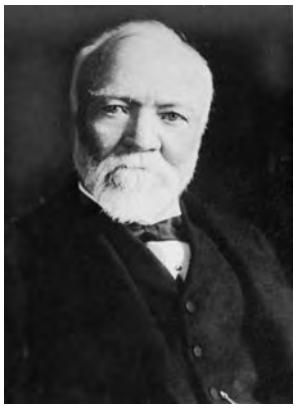
Carnegie Mellon University Private university in Pittsburgh, Pennsylvania, U.S. It was formed in 1967 through the merger of the Carnegie Institute of Technology (created in 1900 through a gift from Andrew Carnegie) and the Mellon Institute of Industrial Research (founded in 1913 through a gift from Andrew W. Mellon). It comprises schools of technology, science, computer science, humanities and social sciences, fine arts, public policy, and industrial administration. It has built a reputation as an arts centre, operating three galleries, two concert halls, and two theatres.

Carnegie \kär-'ne-gē, 'kär-nə-gē**, Andrew** (b. Nov. 25, 1835, Dunfermline, Fife, Scot.—d. Aug. 11, 1919, Lenox, Mass., U.S.) U.S. industrialist and philanthropist. The son of a Scottish weaver, he emigrated to the U.S. with his family in 1848. A job in a telegraph office led to his early career with the Pennsylvania Railroad Co., and his canny investments made him wealthy by age 30. In 1872–73 he founded the steelworks near Pittsburgh, Pa., that evolved into the Carnegie Steel Co. in 1889. By adopting technological innovations such as the open-hearth furnace and by increasing efficiency through vertical integration, Carnegie built a vast enterprise that dominated the U.S. steel industry. In 1901 he sold his company to J.P. Morgan, and it became part of U.S. Steel. Believing that the affluent were obliged to use their surplus wealth for the improvement of mankind, Carnegie retired to devote himself to philanthropy, giving hundreds of millions of dollars to libraries and universities, including Carnegie Mellon University, and endowing such organizations as the Carnegie Institute of Pittsburgh and the Carnegie Corp. of New York, the largest of all his foundations.



Andrew Carnegie
BROWN BROTHERS

Carnegie, Dale *orig.* **Dale Carnegey** (b. Nov. 24, 1888, Maryville, Mo., U.S.—d. Nov. 1, 1955, Forest Hills, N.Y.) U.S. lecturer and author. Born into poverty, he worked as a traveling salesman and an actor before he began teaching public speaking at a YMCA in New York City in 1912. His classes were extremely successful, and he was soon lecturing to packed houses. To standardize his teaching methods he began publishing pamphlets, which he collected into book form as *Public Speaking: A Practical Course for Business Men* (1926). His hugely popular *How To Win Friends and Influence People* (1936) won him a national following; like most of his books, it reveals little that was unknown about human psychology but stresses that an individual's attitude is crucial. The Dale Carnegie Institute subsequently established hundreds of chapters throughout the country.

carnelian \kär-'nē-lē-ən\ *or* **cornelian** Translucent, semiprecious variety of the silica mineral chalcedony that owes its red to reddish brown colour to the incorporation of small amounts of iron oxide. A closely related variety of chalcedony, sard, differs only in the shade of red. Carnelian was highly valued and used in rings and signets by the Greeks and Romans, some of whose intaglios have retained their high polish better than those made from harder stones. Carnelian is mined principally in India, Brazil, and Australia. Its physical properties are those of quartz.

Carniola Region, western Slovenia. It is located northeast of the head of the Adriatic Sea and includes a mountainous area. Its chief town is Ljubljana. It was part of the Roman province of Pannonia in ancient times and was occupied by the Slovenes in the 6th century AD. In the 13th century it became part of the Holy Roman Empire. In 1335 it became a possession of the Austrian Habsburgs, who held it as a duchy until 1849, when it was recognized as an Austrian crown land (1849–1918). After World War I it was divided between Italy and the new Kingdom of Serbs, Croats, and Slovenes (later Yugoslavia); it was incorporated entirely into Yugoslavia by a 1947 treaty. When Yugoslavia was fragmented in the 1990s, Carniola was included in Slovenia.

carnival Final celebration before the fasting and austerity of Lent in some Roman Catholic regions. The most famous and probably most exuberant carnival is that of Rio de Janeiro, which is celebrated with masked balls, costumes, and parades; the best-known U.S. celebration is Mardi Gras in New Orleans. The first day of carnival season varies with local traditions, but carnival usually ends on Shrove Tuesday, the day before the start of Lent.

carnivore Any meat-eating animal, but especially any member of the order Carnivora, consisting of 12 families of primarily predatory mammals: Canidae (e.g., dogs), Ursidae (bears), Procyonidae (raccoons), Mustelidae (weasels), Mephitidae (skunks), Viverridae (civets), Herpestidae (mongooses), Hyaenidae (hyenas), Felidae (cats), Otariidae and Phocidae (seals), and Odobenidae (the walrus). Though most carnivores eat only meat, some rely heavily on vegetation (e.g., the panda). Most have a complex tooth structure and a lower jaw that can move only vertically but can exert great power. The earliest carnivores, which probably evolved from an insectivorous ancestor, appeared during the Paleocene Epoch (about 65–55 million years ago). Carnivores are highly intelligent.

carnivorous plant Any of about 400 diverse species of plants specially adapted for capturing insects and other tiny animals by ingenious pitfalls and traps and for digesting the nitrogen-rich animal proteins to obtain nutrients. These adaptations are thought to enable such plants to survive under otherwise marginal or hostile environmental conditions. The conspicuous trapping mechanism (a leaf modification) draws the prey's attention to the plant. More than half the species belong to the family Lentibulariaceae, most being bladderworts. The remainder belong to several families composed of the pitcher plants, sundews, and flytraps (see Venus's-flytrap). Most are found in damp heaths, bogs, swamps, and muddy or sandy shores where water is abundant and where nitrogenous materials are often scarce or unavailable because of acid or other unfavourable soil conditions. The smallest *Drosera* species are often hidden among the moss of a sphagnum bog; most carnivorous plants are small herbaceous perennials. Some become large shrubby vines.

carnosaur Any of the large carnivorous dinosaurs, a branch of theropod dinosaurs that evolved into predators of large herbivorous dinosaurs. Carnosaurs were massive animals with short necks, large skulls, and wide, gaping mouths equipped with formidable teeth. They walked on two legs. Tyrannosaurs were the largest of all carnosaurs. The carnosaurs became extinct at the end of the Cretaceous period (65 million years ago).

Carnot \kär-'nō**, Lazare (-Nicolas-Marguerite)** (b. May 13, 1753, Nolay, Burgundy, France—d. Aug. 2, 1823, Magdeburg, Prussian Saxony) French statesman and administrator in successive governments of the French Revolution. He entered the army as an engineer (1773) and was elected to the Legislative Assembly in 1791. As a leading member of the Committee of Public Safety and the Directory, he helped mobilize the Revolutionary armed forces and matériel, and he was lauded as the "Organizer of Victory." During the Coup of 18 Fructidor he fled France to escape arrest. He returned after Napoleon rose to power and served him in various offices, including minister of the interior during the Hundred Days.

Carnot \kär-'nō**, (Nicolas-Léonard-) Sadi** (b. June 1, 1796, Paris, France—d. Aug. 24, 1832, Paris) French scientist, known for describing the Carnot cycle. Son of Lazare Carnot, he was an army officer most of his life. Convinced that Britain's advanced steam engines and France's inadequate use of steam were factors in Napoleon's downfall, he wrote a nontechnical essay on steam engines (1824). He subsequently developed a theory of heat engines, predicting that efficiency depends only on the temperature of the hottest and coldest parts and not on the substance (steam or any other fluid) that drives the mechanism. Though adopted slowly, his theory was eventually incorporated into the general theory of thermodynamics.

Carnot, (Marie-François-) Sadi (b. Aug. 11, 1837, Limoges, France—d. June 24, 1894, Lyon) French politician. Grandson of Lazare Carnot and son of Sadi Carnot, he worked as a government engineer before turning to politics. After serving as minister of public works (1880–81) and finance (1885–87), he was elected in 1887 as fourth president of the Third Republic. He competently handled the plots by Georges Boulanger, anarchist agitation, and the Panama Canal scandals, and retained his popularity through 10 different governments but was assassinated in 1894 by an Italian anarchist.

Carnot cycle In heat engines, the ideal cycle of changes of pressures and temperatures of a working fluid, such as steam or ammonia, conceived by Sadi Carnot. It is the standard of performance of all heat engines operating between a high and a low temperature. In the cycle, the working

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fluid undergoes four successive changes: (1) the fluid receives HEAT, expanding at high temperature; (2) it delivers WORK during the reversible adiabatic expansion (it changes in volume or pressure without losing or gaining heat); (3) it rejects heat (to the heat sink) during compression at low temperature; and (4) it receives work during the reversible adiabatic compression. The EFFICIENCY is determined by the difference between the temperatures of the heat source and the heat sink divided by the temperature of the heat source. See also RANKINE CYCLE.

Carnuntum Ancient town, Roman Empire. Located in northern PANNONIA on the DANUBE RIVER, it was an important Roman post from the time of Tiberius. It was used as a base by MARCUS AURELIUS in his campaign against the Marcomanni (AD 172–174); there he wrote the second book of his *Meditations*. The camp was finally destroyed by the Germans in the 4th century.

carob Leguminous EVERGREEN tree (*Ceratonia siliqua*) native to the eastern Mediterranean region and cultivated elsewhere. It is sometimes known as locust, or St. John's bread, in the belief that the "locusts" on which JOHN THE BAPTIST fed were carob pods. The tree, about 50 ft (15 m) tall, bears compound, glossy leaves with thick leaflets. Its red flowers are followed by flat, leathery pods that contain 5–15 hard brown seeds embedded in a sweet, edible pulp that tastes similar to chocolate.

carol Popular song, usually of religious joy, associated with a season, especially Christmas. It typically alternates verses with a repeated refrain or chorus. The carol originated in medieval England, with texts in English or Latin or both, and it was often associated with dancing and processions. The French *noël*, the German *Weihnachtslied*, and the Spanish *villancico* can also be regarded as carols.

Carol I \'kä-rȯl,\ *English* \'kar-əl\ *orig.* **Karl Eitel Friedrich, prince von Hohenzollern-Sigmaringen** (b. April 20, 1839, Sigmaringen, Hohenzollern-Sigmaringen—d. Oct. 10 1914, Sinaia, Rom.) King of Romania (1881–1914). Originally a German prince, he became prince of Romania in 1866, and when Romania gained full independence from the Ottoman Empire he was crowned its first king. He brought notable military and economic development along Western lines, but his neglect of festering rural problems led to the bloody peasant rebellion of 1907.

Carol II (b. Oct. 15, 1893, Sinaia, Rom.—d. April 4, 1953, Estoril, Port.) King of Romania (1930–40). He became crown prince on the death of his great uncle, CAROL I, in 1914. Because of his scandalous affair with Magda Lupescu (1896?–1977), he was obliged to renounce his rights to the throne and go into exile in 1925, but he returned in 1930 and became king. He gradually undermined Romanian democracy and in 1938 proclaimed a corporatist dictatorship, but in 1940 he was forced to abdicate in favour of his son MICHAEL.

Caroline Islands Archipelago, western PACIFIC OCEAN. Lying south of the Philippines, the islands cover a land area of about 460 sq mi (1,190 sq km). Formerly part of the U.S.-administered Trust Territory of the Pacific Islands, the group consists of several larger islands, including Yap, Pohnpei, Chuuk (Truk), Kosrae, and Babelthuap, as well as many small coral islets and reefs. Though explored by the Spanish in the 16th century, they were rarely visited until Germany took them in 1899. Granted as a mandate to Japan after World War I, they were placed under U.S. trusteeship in 1947. The islands became the Federated States of Micronesia in 1986, with the exception of PALAU (Babelthuap and associated islands), which became independent in 1994.

Ivory book cover from the Lorsch Gospels, early 9th century; in the Victoria and Albert Museum, London.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON, CROWN COPYRIGHT

Carolingian \ˌkar-ə-'lin-jən\ **art** Art produced in Europe during the reign of CHARLEMAGNE and his successors until c. 900. The outstanding characteristic of the period was a revival of interest in Roman antiquity. Works of BYZANTINE ART and architecture served as models. Illuminated manuscripts and relief scenes in ivory and metalwork reflected Classical motifs; mosaics and murals were also produced, but few have survived.

Carolingian dynasty Family of Frankish aristocrats that ruled nearly all or part of western Europe in 751–987. Pippin I (d. 640), the dynasty's founder, came to power in the office of mayor of the palace under the MEROVINGIAN king Chlotar II, with authority over AUSTRASIA. From this post, his descendants, including CHARLES MARTEL, continued to usurp authority from the Merovingians, who remained on the throne as figureheads until 751, when Charles's son PIPPIN III, with papal support, deposed Childeric III and formally took the title of King of the Franks. Under Pippin's son CHARLEMAGNE (Carolus Magnus—the source of the dynasty's name), the Carolingian realm was extended into Germany and Italy, where he conquered the Lombards and continued the alliance with Rome. Charlemagne also promoted religious reform and cultural growth and was crowned emperor by Pope Leo III on Dec. 25, 800. On his death, Charlemagne was succeeded by his son Louis the Pious, whose three sons divided the realm in 843. Despite internal strife and foreign invasion, the dynasty survived until 911 in the eastern part of the realm, where German rulers would revive Carolingian political ideals later in the century, and in the western realm until 987.

Carondelet \kə-ˌrän-də-'let**, (Francisco Luis) Hector, baron de** (b. c. 1748, Noyelles, Flanders—d. Aug. 10, 1807, Quito, Viceroyalty of New Granada) Spanish governor of the territory of Louisiana and western Florida (1791–97). When he arrived in New Orleans, he formed alliances with local Indian tribes to defend disputed territory north of the 31st parallel of latitude against U.S. settlers. He negotiated with Gen. JAMES WILKINSON to effect the secession of the trans-Appalachian territories from the U.S. and to secure their alliance with Spain. These efforts were terminated in 1795 with the signing of Pinckney's Treaty (see THOMAS PINCKNEY). Carondelet was recalled in 1797 and went to South America to become governor-general of Quito.

carotene \'kar-ə-ˌtēn\ Any of several organic compounds widely distributed in plants and animals. They are PIGMENTS that give orange, yellow, or sometimes red colours to, for example, dandelions, apricots, carrots, sweet potatoes, butter, egg yolks, canary feathers, and lobster shells. Carotenes are converted in the body into VITAMIN A, but, unlike the vitamin, they are not toxic even at high doses. Carotene has an ANTIOXIDANT effect and is therefore used in pharmaceuticals and as a food and feed additive, as well as to colour margarine and butter.

Carothers \kə-'rəth-ərz**, W(allace) H(ume)** (b. April 27, 1896, Burlington, Iowa, U.S.—d. April 29, 1937, Philadelphia, Pa.) U.S. chemist. He became director of organic chemical research at DUPONT in 1928. There he first worked on polymerization of acetylene and derivatives, leading to the development of NEOPRENE. His outstanding achievement involved the theory of linear polymerization; he tested it by synthesizing polymers structurally resembling cellulose and silk, culminating in the production of NYLON. The first synthetic POLYMER fibre to be produced commercially (1938), it laid the foundation of the synthetic fibre industry.

carp Hardy, greenish brown fish (*Cyprinus carpio*, family Cyprinidae) native to Asia but introduced into Europe, North America, and elsewhere. Large-scaled, with two barbels (fleshy, whiskerlike feelers) on each side of its upper jaw, the carp lives alone or in small schools in quiet, weedy, mud-bottomed ponds, lakes, and rivers. An omnivore, it often stirs up sediment while rooting about for food, adversely affecting many plants and animals. Carp grow to an average length of about 14 in. (35 cm); some grow to 40 in. (100 cm) and 49 lbs (22 kg). In captivity they may live more than 40 years.

Carpaccio \kär-'pät-chō**, Vittore** (b. c. 1460, Venice—d. 1525/26, Venice) Italian painter active in Venice. Little is known of his early life, but the dominant influences on his work were the BELLINI FAMILY and ANTONELLO DA MESSINA. In the 1490s he began the first of four cycles of paintings that are his greatest achievement: scenes from the life of St. Ursula, now in the Accademia, Venice; scenes from the lives of St. George, St. Jerome, and St. Tryphon (1502–07) for the Scuola di San Giorgio degli Schiavoni, Venice; and scenes from the life of the Virgin (c. 1500–10) and the life of St. Stephen (1511–20). He was one of the greatest early Renaissance narrative painters of the VENETIAN SCHOOL.

carpal tunnel syndrome (CTS) \'kär-pəl\ Painful condition caused by repetitive stress to the wrist over time. The median nerve and the TENDONS that bend the fingers pass through the carpal tunnel on the inner side

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of the wrist, between the wrist (carpal) bones on three sides and a ligament on the fourth. Repetitive finger and wrist movements rub the tendons against the walls of the carpal tunnel and may make the tendons swell, squeezing the nerve. Numbness, tingling, and pain in the wrist and hand may progress to loss of muscle control. CTS is most common in assembly-line workers and computer keyboard users. Treatment may include avoidance of the causative activity, ergonomic workplace design, anti-inflammatory drugs, brace or splint use, and surgery.

Carpathian Mountains \kär-'pā-thē-ən\ Mountain system, eastern Europe. It extends along the Slovakia-Poland border and southward through Ukraine and eastern Romania about 900 mi (1,450 km). Its highest peak, Gerlachovka (in Slovakia), rises 8,711 ft (2,655 m). The Little Carpathians and White Carpathians are its southwestern extensions; the Transylvanian Alps are sometimes called the South Carpathians. The mountains are the source for the Vistula, Dniester, and Tisza rivers. Agriculture, forestry, and tourism are economically important.

carpel One of the leaflike, seed-bearing structures that constitute the innermost whorl of a flower. One or more carpels make up the pistil. Fertilization of an egg within a carpel by a pollen grain from another flower results in seed development within the carpel.

Carpentaria \ˌkär-pen-'tär-ē-ə**, Gulf of** Gulf, northeastern Australia. An inlet of the Arafura Sea, it is bordered by the Northern Territory and by Cape York Peninsula and extends north-south about 375 mi (600 km) and east-west 310 mi (500 km). It was explored by the Dutch 1605–28; its western coasts were discovered by Abel Janszoon Tasman in 1644. Neglected for centuries, it became economically significant from the late 20th century for its bauxite and manganese deposits and for its prawn-rich waters.

Carpenter Gothic U.S. domestic architecture style of the 19th century. The houses executed in this phase of the Gothic Revival style display little awareness of the original Gothic approach, but rather an eclectic and naive use of superficial Gothic decorative motifs. Turrets, spires, and pointed arches were liberally applied, as was much decorative gingerbread, made possible by the invention of the scroll saw. Carpenter Gothic houses were built throughout the U.S., but surviving structures are found chiefly in the Northeast and Midwest.

Carpentier, Alejo (b. Dec. 26, 1904, Lausanne, Switz.—d. April 24, 1980, Paris, France) Latin American novelist, essayist, and playwright, a leading literary figure. Born to a French father and a Russian mother, Carpentier spoke French before he learned Spanish, although he was taken to Havana, Cuba, as an infant. Educated in Havana, he helped found the Afro-Cuban movement that sought to incorporate African forms into the arts. He initiated the use of magic realism in his story collection *Guerra del tiempo* (1958; *War of Time*). His best-known novel, *Los pasos perdidos* (1953; *The Lost Steps*), portrays a character who travels to the Orinoco jungle in search of the origins of time. Carpentier fled Cuba in 1928 and settled in Paris. In 1945 he went to Venezuela, but in 1959 he returned to Cuba and became a diplomat in Fidel Castro's regime.

carpet See rug and carpet

carpetbagger Epithet used during the Reconstruction period (1865–77) to describe a Northerner in the South seeking private gain. The word referred to an unwelcome outsider arriving with nothing more than his belongings packed in a satchel or carpetbag. Many carpetbaggers were involved in corrupt financial schemes, but others helped rebuild the economy in the South and participated in educational and social reform.

Carpocratian \ˌkär-pə-'krā-shən\ Follower of the 2nd-century Christian Gnostic Carpocrates, whose sect flourished in Alexandria. Carpocratians revered Jesus as an ordinary man whose soul had not forgotten that its origin and true home was within the sphere of the unknown perfect God. They rejected the created world, claimed superiority due to their ability to communicate with demons, and subverted biblical law as the work of the evil angels who created the world. Their goal of transcendent freedom required having every possible experience, which required several lifetimes. The first sect known to have used pictures of Christ, they also made images of Plato, Pythagoras, and Aristotle. See also Gnosticism.

Carracci \kä-'rät-chē\ **family** Family of Italian painters. Annibale Carracci (1560–1609) was prominent in Bologna and Rome in the movement against Mannerism. In the 1580s, with his brother and cousin, he founded a teaching academy in Bologna, the Accademia degli Incamminati ("Academy of the Progressives"). He specialized in fresco painting and monumental religious altarpieces but was also a pioneer in the development of ideal landscapes, genre subjects, and caricature. The fresco decoration of the Gallery of the Farnese Palace in Rome (1597–1601), comprising scenes from the loves of the gods, remains his masterpiece; it was indispensable as a source of figure design and technical procedure for young painters into the 18th century. His elder brother, Agostino Carracci (1557–1602), assisted him in decorating the Farnese Gallery but was known primarily as a teacher and engraver; his anatomical studies were used as teaching aids for nearly two centuries. His cousin Lodovico (or Ludovico) Carracci (1555–1619) collaborated with them on various fresco commissions. He directed the academy in Bologna after his cousins had gone to Rome, produced works of a passionate and poetic quality, and trained some of the major Bolognese artists of the next generation, including Domenichino, Guido Reni, and Alessandro Algardi. See also Bolognese school.

Carranza \kär-'rän-sä**, Venustiano** (b. Dec. 29, 1859, Cuatro Ciénegas, Mex.—d. May 20/21, 1920, Tlaxcalantongo) First president of the post-Porfirio Díaz Mexican Republic (1917–20). The son of a landowner, he was active in politics from 1877. In 1910 he joined the struggle of Francisco Madero against Díaz. A moderate and a nationalist, he favoured political but not social reform. Because he did little to implement the far-reaching reforms called for in the constitution of 1917, his presidency was plagued by social unrest and clashes with the more radical leaders Pancho Villa and Emiliano Zapata as well as by serious financial problems. His nationalism led him to oppose U.S. intervention in Mexican affairs, even when he stood to benefit from it. He is held responsible for Zapata's assassination and was himself murdered while fleeing an armed rebellion. See also Mexican Revolution.

Venustiano Carranza, c. 1910
ARCHIVO CASASOLA

Carré, John Le See John Le Carre

Carrel \kə-'rel**, Alexis** (b. June 28, 1873, Sainte-Foy-lès-Lyon, Fra.—d. Nov. 5, 1944, Paris) French surgeon, sociologist, and biologist. He received a 1912 Nobel Prize for developing a way to suture (stitch) blood vessels and laid the groundwork for further studies of blood-vessel and organ transplantation. He also researched preservation of tissues outside the body and the application of the process to surgery, and he helped develop the Carrel-Dakin method of flushing wounds with an antiseptic. His writings include *Man, the Unknown* (1935), *The Culture of Organs* (with Charles A. Lindbergh, 1938), and *Reflections on Life* (1952).

Carrhae \'kar-ē**, Battle of** (53 BC) Battle that stopped the Roman invasion of Parthian Mesopotamia (see Parthia). The Romans were led by Crassus, who wanted a victory to balance those of his fellow triumvirs Pompey and Julius Caesar. With seven legions (about 44,000 men) but little cavalry, he was defeated in the desert by 10,000 mounted Parthian archers and was killed while trying to negotiate. His defeat damaged Roman prestige, and his death gave impetus to Caesar's quest for power.

carriage Four-wheeled, horse-drawn vehicle, mainly for private passenger use. It was the final refinement of the horse-drawn passenger conveyance, having developed from the wagon, chariot, and coach. Light carriages with enhanced suspension for added comfort had been developed by the 17th century. A variety of carriages were common in the 19th century, including the brougham and the buggy. Carriage manufacturers provided the very similar early designs for automobile bodies.

Carrickfergus \ˌkar-ik-'fər-gəs\ District (pop., 2001: 37,659), northeastern Northern Ireland. Established in 1974, it lies on Belfast Lough. The name, meaning "rock of Fergus," commemorates King Fergus, shipwrecked off the coast c. AD 320. Carrickfergus town (pop., 1991: 22,786) is the district seat. Carrickfergus Castle, a relic of the Norman period, sits on a crag above the town; it was a refuge for the Protestants of Antrim in the English Civil Wars.

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Carrier, Willis Haviland (b. Nov. 26, 1876, Angola, N.Y., U.S.—d. Oct. 7, 1950, New York, N.Y.) U.S. inventor and industrialist. Carrier designed the first system to control temperature and humidity in 1902. His "Rational Psychrometric Formulae," introduced in 1911, initiated scientific AIR-CONDITIONING design. In 1915 he cofounded the Carrier Engineering Company, which became the world's largest manufacturer of air-conditioning equipment. Carrier was purchased by United Technologies Corporation in 1979.

Carriera \,kä-rē-'ā-rə**, Rosalba (Giovanna)** (b. Oct. 7, 1675, Venice—d. April 15, 1757, Venice) Venetian pastel portraitist and miniaturist. She became known for her miniature portraits on snuffboxes and was the first artist to use ivory rather than vellum as a support for miniatures. An originator of the ROCOCO STYLE, she achieved spectacular success throughout Europe with her fashionable pastel portraits of notables. On a trip to Paris (1720–21) she received commissions for numerous portraits, including one of LOUIS XV as a child. In 1721 she was elected to the French Royal Academy.

Carroll, Charles (b. Sept. 19, 1737, Annapolis, Md.—d. Nov. 14, 1832, Baltimore, Md., U.S.) American patriot leader. He attended Jesuit colleges in Maryland and studied law in France and England. He served on COMMITTEES OF CORRESPONDENCE, signed the DECLARATION OF INDEPENDENCE, and served in the CONTINENTAL CONGRESS (1776–78). He was a U.S. senator (1789–92).

Carroll, Lewis *orig.* **Charles Lutwidge Dodgson** (b. Jan. 27, 1832, Daresbury, Cheshire, Eng.—d. Jan. 14, 1898, Guildford, Surrey) British logician, mathematician, and novelist. An unmarried deacon and a lecturer in mathematics at the University of Oxford, he enjoyed the company of young girls. His novel *Alice's Adventures in Wonderland* (1865; illustrated by JOHN TENNIEL) is based on stories he told to amuse young friends, especially Alice Liddell. Its sequel, *Through the Looking-Glass* (1871), describes Alice's further adventures. The two books, full of whimsy but also of sophisticated wit and puzzles, became among the most famous and admired children's books in the world. Carroll's other works include the narrative nonsense poem *The Hunting of the Snark* (1876) and the children's novels *Sylvie and Bruno* (1889) and *Sylvie and Bruno Concluded* (1893). He was also an important early portrait photographer.

carrot Herbaceous, generally biennial plant (*Daucus carota*) of the PARSLEY family, that produces an edible globular or long TAPROOT in the first growing season. Native to Afghanistan and neighbouring lands, it is grown extensively in temperate zones. It is a rich source of carotene. An erect rosette of feathery leaves develops above ground in the first season; the edible carrot is below. After a rest period at temperatures near freezing, large flower stalks arise, bearing large compound umbels.

Carrot (*Daucus carota*).
KENNETH AND BRENDA FORMANEK/EB INC.

Carson (of Duncairn), Edward Henry, Baron (b. Feb. 9, 1854, Dublin, Ire.—d. Oct. 22, 1935, Minster, Kent, Eng.) Irish lawyer and politician. In 1892 he was elected to the British House of Commons and was appointed Irish solicitor general. He served as British solicitor general (1900–05), attorney general (1915), first lord of the Admiralty (1916–17), and lord of appeal (1921–29). Known as the "uncrowned king of Ulster," he successfully led Northern Irish resistance to the British government's attempts to introduce HOME RULE for all of Ireland.

Carson, Johnny *in full* **John William Carson** (b. Oct. 23, 1925, Corning, Iowa, U.S.—d. Jan. 23, 2005, Los Angeles, Calif.) U.S. television personality. He worked as a radio announcer and television comedy writer before hosting several television quiz shows (1955–62). As the long-standing host of *The Tonight Show* (1962–92), he was noted for his wry monologues, comedy sketches, and genial banter, and the program became a staple for a large and faithful late-night audience.

Carson, Kit *orig.* **Christopher Carson** (b. Dec. 24, 1809, Madison county, Ky., U.S.—d. May 23, 1868, Fort Lyon, Colo.) U.S. frontiersman, scout, and Indian agent. Raised in Missouri, he ran away from home at age 15 to become a trapper and trader in the Southwest. In the early 1840s he served as a guide to JOHN C. FRÉMONT's explorations of the West. He guided Gen. STEPHEN KEARNY's expedition to California during the Mexican War, often carrying dispatches to Washington, D.C. In 1854 he was appointed Indian agent (an official representative of the U.S. government to Indian tribes) at Taos, N.M. During the American Civil War he commanded the 1st New Mexico Volunteers. In 1868 he was appointed superintendent of Indian affairs for the Colorado Territory. His contributions to westward expansion made him a folk hero.

Kit Carson
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Carson, Rachel (Louise) (b. May 27, 1907, Springdale, Pa., U.S.—d. April 14, 1964, Silver Spring, Md.) U.S. biologist and science writer. Carson trained as a marine biologist and had a long career at the U.S. Fish and Wildlife Service. *The Sea Around Us* (1951) won a National Book Award. Her prophetic *Silent Spring* (1962), about the dangers of pesticides in the food chain, is regarded as the seminal work in the history of the environmental movement, which in some respects can be seen to date from its publication.

Carson City City (pop., 2000: 52,457), capital of Nevada, U.S. Located east of Lake TAHOE and south of RENO, it was settled in 1858 and named for KIT CARSON. The discovery of silver in 1859 in the nearby Virginia City area stimulated Carson City's economy. The federal government established a mint at Carson City, which later became the Nevada State Museum. Carson City became the state capital in 1864 when Nevada gained statehood.

State Capitol, Carson City, Nev.
DONALD DONDERO

cart Two-wheeled vehicle drawn by a draft animal, used throughout recorded history for transporting freight and people. The simplest of vehicles, its frame consists merely of crossed wooden stakes or a box with shafts as an extension of the frame. Carts are known to have been used by the Greeks and Assyrians by 1800 BC, though earlier use (c. 3500 BC) can be assumed.

Cartagena \,kär-tä-'hā-nä\ City (pop., 2003 est.: 902,688), Colombia. Located on the northern coast, it has a good harbour and is Colombia's principal port for oil exports. Founded in 1533, it became one of Spanish America's chief cities. It was strongly fortified and often attacked, notably by British forces under Francis Drake (c. 1585–86) and Edward Vernon (c. 1741–42). It remained under Spanish control until the province of Cartagena, which included the city, declared independence in 1811. After reverting back to Spanish control in 1815, the city was recaptured by patriot forces in 1821. It declined in the 19th century but regained prominence in the 20th century as an oil-processing centre.

Cartagena Port city (pop., 2001: 184,686), southeastern Spain. Founded by the Carthaginians under Hasdrubal in 227 BC, it was captured by SCIPIO AFRICANUS THE ELDER in 209 BC and made a Roman colony. It was sacked by the GOTHS in AD 425. It was held by the MOORS from 711 until it was taken by JAMES I of Aragon in 1269. In the 16th century PHILIP II made it a great naval port; it remains Spain's chief Mediterranean naval base as well as a commercial port.

cartel \,kär-'tel\ Organization of a few independent producers for the purpose of improving the profitability of the firms involved (see OLIGOPOLY). This usually involves some restriction of output, control of price, and allocation of market shares. Members of a cartel generally maintain

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their separate identities and financial independence while engaging in cooperative policies. Cartels can either be domestic (e.g., the historical example of the German IG Farben) or international (e.g., OPEC). Because cartels restrict competition and result in higher prices for consumers, they are outlawed in some countries. The only industry operating in the U.S. with a blanket exemption from the antitrust laws is major league baseball, but several U.S. firms have been given permission to participate in international cartels.

Cartel des Gauches \kär-'tel-dā-'gōsh\ (French: "Coalition of the Left") In the French Third Republic, a coalition of left-wing parties (the Socialists and the Radicals) in the Chamber of Deputies. They formed the Cartel in opposition to the right-wing Bloc National, which they defeated in the elections of 1924. Led by Edouard Herriot and later Aristide Briand, the Cartel was defeated in 1926 by a financial crisis brought about by continuing inflation.

Carter, Benny *orig.* **Bennett Lester Carter** (b. Aug. 8, 1907, New York, N.Y., U.S.—d. July 12, 2003, Los Angeles, Calif.) U.S. jazz musician. Known as one of the primary stylists of the alto saxophone, he was also an accomplished arranger, composer, clarinetist, trumpeter, and bandleader. He played in the big bands of Chick Webb and Fletcher Henderson before assuming leadership of McKinney's Cotton Pickers (1931–32). Carter worked in Europe (1935–38) and moved to California in 1945 to write music for film and television. His best-known composition is "When Lights Are Low." He was awarded the National Medal of Arts in 2000.

Carter, Elliott (Cook, Jr.) (b. Dec. 11, 1908, New York, N.Y., U.S.) U.S. composer. Born to a wealthy family, he studied English and music at Harvard University and later studied in Paris with Nadia Boulanger. He taught at many institutions, after 1972 primarily at the Juilliard School. He absorbed a range of influences, including Igor Stravinsky and Charles Ives. His style evolved into a densely contrapuntal, dissonant, and rhythmically complex texture in which the various instrumental parts frequently suggest conversation and combat. His principal works include a sonata for flute, oboe, cello, and harpsichord (1952), *Variations for Orchestra* (1955), a double concerto for piano and harpsichord (1961), a piano concerto (1965), *Concerto for Orchestra* (1969), *A Symphony of Three Orchestras* (1977), *Night Fantasies* for piano (1980), and four string quartets (1951, 1959, 1971, 1986), two of which received the Pulitzer Prize. He is often called the greatest American composer of the late 20th century.

Carter, Jimmy *orig.* **James Earl Carter** (b. Oct. 1, 1924, Plains, Ga., U.S.) 39th president of the U.S. (1977–81). He graduated from Annapolis and served in the U.S. Navy until 1953, when he left to manage the family peanut business. He served in the state senate from 1962 to 1966. He ran unsuccessfully for governor in 1966; depressed by this experience, he found solace in evangelical Christianity, becoming a born-again Baptist. In 1970 he ran again and won. As governor (1971–75), he opened Georgia's government offices to African Americans and women and introduced stricter budgeting procedures for state agencies. In 1976, though lacking a national political base or major backing, he won the Democratic nomination and the presidency, defeating the Republican incumbent, Gerald Ford. As president, Carter helped negotiate a peace treaty between Egypt and Israel, signed a treaty with Panama to make the Panama Canal a neutral zone after 1999, and established full diplomatic relations with China. In 1979–80 the Iran hostage crisis became a major political liability. He responded forcefully to the Soviet Union's invasion of Afghanistan in 1979, embargoing the shipment of U.S. grain to the Soviet Union and pressing for a U.S. boycott of the 1980 Summer Olympics in Moscow. The poor state of the economy, which was plagued by high inflation and high unemployment, contributed to Carter's electoral defeat by Ronald Reagan in 1980. He subsequently became involved in numerous international diplomatic negotiations and helped to oversee elections in countries with insecure democratic traditions; he also became the first sitting or former American president to visit Fidel Castro's Cuba. He was awarded the Nobel Prize for Peace in 2002.

Jimmy Carter.
COURTESY JIMMY CARTER LIBRARY

Carter Family U.S. singing group. It consisted of Alvin Pleasant Carter (1891–1960), his wife Sara (1898–1979), and his sister-in-law Maybelle (1909–78). Natives of Virginia, they began their recording career in 1927. Over 16 years, with various combinations of Carter daughters, they recorded more than 300 songs from the 19th and early 20th centuries, including "Wabash Cannonball," "I'm Thinking Tonight of My Blue Eyes," "Wildwood Flower," and "Keep on the Sunny Side." They helped popularize Appalachian folk songs. After the original group broke up in 1943, its members continued to perform. "Mother" Maybelle Carter formed a successful act with her daughters and later performed with her son-in-law Johnny Cash. In the 1950s the Carter Family re-formed and appeared intermittently, with a changing lineup. The original Carter Family was the first group admitted (1970) to the Country Music Hall of Fame.

Carteret \'kärt-ə-ˌret**, Sir George** (b. c. 1610, probably Jersey, Channel Islands, Eng.—d. January 1680, New Jersey) British politician and colonial proprietor. His naval exploits and service as lieutenant governor of the Channel Island of Jersey won him a knighthood (1644) and baronetcy (1645). After the 1660 Restoration he became a powerful administrator and legislator. In 1663 he became one of eight original proprietors granted the area of Carolina; in 1664 he received half of New Jersey, named for his birthplace. The other owner sold out to the Quakers in 1674. With the Quakers, Carteret agreed to divide the colony. After Carteret's death, his heirs sold the remaining portion to the Quakers.

Cartesian \ˌkär-'tē-zhən\ **circle** Allegedly circular reasoning used by René Descartes to show that whatever he perceives "clearly and distinctly" is true. Descartes argues that clear and distinct perception is a guarantor of truth because God, who is not a deceiver, would not allow Descartes to be mistaken about that which he clearly and distinctly perceives. The argument relies on Descartes's earlier proof of the existence of God. But Descartes cannot know that this proof does not contain an error unless he assumes that his clear and distinct perception of the steps of his reasoning guarantees that the proof is correct. Thus the criterion of clear and distinct perception depends on the assumption that God exists, which in turn depends on the criterion of clear and distinct perception. See also cogito, ergo sum.

Cartesianism Philosophical tradition derived from the philosophy of René Descartes. A form of rationalism, Cartesianism upholds a metaphysical dualism of two finite substances, mind and matter. The essence of mind is thinking; the essence of matter is extension in three dimensions. God is a third, infinite substance, whose essence is necessary existence. God unites minds with bodies to create a fourth, compound substance, man. Mind-body dualism generates problems concerning the possibility of causal interaction between mind and body and knowledge of the external world (see mind-body problem), and various lines of Cartesianism developed from different proposed solutions to these problems. A historically important Cartesian theory holds that animals are essentially machines, lacking even the ability to feel pain. See also Arnold Geulincx; Nicolas de Malebranche; occasionalism.

Carthage Ancient city and state, northern Africa. Located near modern Tunis, Tun., it was built around a citadel called the Byrsa. Founded by colonists from Tyre, probably in the 8th century BC, its people undertook conquests in western Africa, Sicily, and Sardinia in the 6th century BC. Under the descendants of Hamilcar, it came to dominate the western Mediterranean Sea. In the 3rd century BC it fought the first of the three Punic Wars with Rome. Destroyed by a Roman army led by Scipio Africanus the Younger (146 BC), it became the site of a colony founded by Julius Caesar in 44 BC; in 29 BC Augustus made it the administrative centre of the province of Africa. Among the Christian bishops who served there were Tertullian and St. Cyprian. Captured by the Vandals in 439 and the Byzantine Empire in the 6th century, it was taken by the Arabs in the 7th century and was eclipsed by their emphasis on Tunis.

Carthaginian Wars See Punic Wars

Carthusian \kär-'thü-zhən\ Member of a Roman Catholic monastic order founded by St. Bruno of Cologne (c. 1030–1101) in 1084 in the Chartreuse valley of southeastern France. Members of the Order of Carthusians pray, study, eat, and sleep alone but gather in church for morning mass, vespers, and the night office. They dine together on Sundays and major holidays and walk together once a week. They wear hair shirts, abstain from eating meat, and consume only bread and water on Fridays and fast days. At the motherhouse, or Grande Chartreuse (today

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in Voiron, Isère), the monks distill the liqueur that bears the house's name. Carthusian nuns are also strictly cloistered and contemplative.

Cartier \kär-'tyā**, Jacques** (b. 1491, Saint-Malo, Brittany, France—d. Sept. 1, 1557, near Saint-Malo) French sailor and explorer. He was commissioned by Francis I to explore North America in the hope of discovering gold, spices, and a passage to Asia. Cartier's explorations of the North American coast and the St. Lawrence River (1534, 1535, 1541–42) did not produce the desired results, but they did lay the basis for later French claims to Canada.

Cartier \kär-'tyā**, Sir George Étienne, Baronet** (b. Sept. 6, 1814, St. Antoine, Lower Canada—d. May 20, 1873, London, Eng.) Canadian prime minister jointly with John Macdonald (1858–62). He was elected as a Liberal to the Canadian legislative assembly (1848) and was later appointed provincial secretary (1855) and attorney general for Canada East (1857). In 1858 Cartier represented Canada East in the alliance with Macdonald and promoted the improvement of Anglo-French relations in Canada. He was a proponent of the Grand Trunk Railway. In 1867, despite great opposition, he carried his native province into confederation. He then served as minister of militia and defense in Macdonald's first Confederation cabinet (1867–72).

Cartier-Bresson \kȧr-tyā-brə-'sō^{n}**, Henri** (b. Aug. 22, 1908, Chanteloup, Fr.—d. Aug. 3, 2004, Céreste) French photographer. He studied art in Paris and literature and painting at the University of Cambridge. His interest in photography developed c. 1930 when he encountered the works of Eugène Atget and Man Ray. He is known for spontaneous, sequential images in still photography, a technique inspired by his enthusiasm for filmmaking. He helped establish photojournalism as an art form and with Robert Capa, David Seymour, and others founded the cooperative Magnum Photos (1947). The best known of his many collections is *The Decisive Moment* (1952).

cartilage \'kär-t^{ə}l-ij\ Connective tissue in parts of the human skeleton. A network of collagen fibres in a firm, gelatinous base, it contains no blood vessels or nerves. Different types of cartilage are found at the ends of some bones and in nasal and respiratory structures; in the spinal disks; and in the ear and epiglottis (back of the throat). Most of the skeleton of an embryo is made of cartilage, which is later replaced by bone.

Cartland, Dame (Mary) Barbara (Hamilton) (b. July 9, 1901, Edgbaston, Birmingham, Eng.—d. May 21, 2000, Hatfield, Hertfordshire) English author. Her first novel, *Jigsaw* (1925), was a popular success. She wrote two more novels and a play during the 1920s; thereafter her output grew steadily, and by the 1970s she was averaging 23 books a year, all of which she dictated. Her approximately 600 books, mostly formulaic romance novels, have sold more than 600 million copies. Cartland's nonfiction includes autobiographies and books on health food, vitamins, and beauty. She was the step-grandmother of Diana, Princess of Wales.

cartography \kär-'tä-grə-fē\ *or* **mapmaking** Art and science of representing a geographic area graphically, usually by means of a map or chart. Political, cultural, or other nongeographic features may be superimposed. Ptolemy's eight-volume *Geography* showed a flat, disc-shaped projection of part of the Earth. Medieval European maps followed Ptolemy's guide but placed east at the top of the map. In the 14th century more-accurate maps were developed for use in navigation. The first surviving globe dates from 1492. Discovery of the New World led to new techniques in cartography, notably projection of a curved surface onto a flat surface. In particular, Gerardus Mercator projected landmasses onto a cylinder wrapped around the Earth's Equator. Such cylindrical projections maintain proper directions or bearings, though they cause distortions in distances at high latitudes. Contour maps show relief by connecting points of equal elevation with lines, mean sea level being the reference point. Modern cartography uses aerial photography and satellite radar for a degree of accuracy previously unattainable. Satellites have also made possible the mapping of features of the Moon and of several planets and their moons. See also geographic information system; global positioning system.

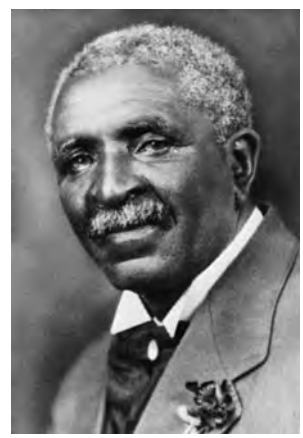
cartoon Originally, a full-size drawing used for transferring a design to a painting, tapestry, or other large work. Cartoons were used from the 15th century by fresco painters and stained-glass artists. In the 19th century the term acquired its popular meaning of a humorous drawing or parody. Cartoons in that sense are used today to convey political commentary, editorial opinion, and social comedy in newspapers and magazines. The greatest early figure is William Hogarth, in 18th-century Britain. In 19th-century France, Honoré Daumier introduced accompanying text that conveyed his characters' unspoken thoughts. Britain's *Punch* became the foremost 19th-century venue for cartoons; in the 20th century *The New Yorker* set the American standard. A Pulitzer Prize for editorial cartooning was established in 1922. See also caricature; comic strip.

Cartwright, Alexander (Joy) (b. April 17, 1820, New York, N.Y., U.S.—d. July 12, 1892, Honolulu, Hawaii) U.S. surveyor and baseball enthusiast. Cartwright was a founder of the amateur New York Knickerbocker Base Ball Club and chaired the commission that established baseball's official rules. These included the requirement of tagging out a base runner rather than hitting him with a thrown ball and fixing the distance between bases at 90 ft (27.4 m). The first game under the newly codified rules was apparently played in Hoboken, N.J., in 1846. See also Abner Doubleday.

Cartwright, Edmund (b. April 24, 1743, Marnham, Nottinghamshire, Eng.—d. Oct. 30, 1823, Hastings, Sussex) British inventor. On visiting Richard Arkwright's cotton-spinning mills, he was inspired to construct a power-driven machine for weaving. He invented a power loom and set up a weaving and spinning factory in Yorkshire. In 1789 he patented a wool-combing machine. In 1809 the House of Commons voted to reward him for the benefits his loom had conferred on the nation. His other inventions included a cordelier (machine for making rope) and a steam engine that used alcohol instead of water.

Caruso \kə-'rü-sō**, Enrico** *orig.* **Errico Caruso** (b. Feb. 27, 1873, Naples, Italy—d. Aug. 2, 1921, Naples) Italian tenor. Apprenticed to a mechanical engineer at age 10, at 18 he began to sing in public in his free time. He attracted the notice of a teacher and made his professional debut in 1894. He sang his best-known role, Canio in Ruggero Leoncavallo's *Pagliacci*, for the first time in 1896. He recovered from a disastrous La Scala debut in 1900 and within two years had gained the high notes that made him an international star and a legend. He sang at the Metropolitan Opera (1903–20) in almost 60 roles, becoming the most famous male opera star of his time. His warm, appealing tenor voice of great emotive power made his recordings (which include some of the first vocal recordings ever made) best-sellers for decades after his death.

Carver, George Washington (b. 1861?, near Diamond Grove, Mo., U.S.—d. Jan. 5, 1943, Tuskegee, Ala.) U.S. agricultural chemist and agronomist. Born a slave, Carver lived until age 10 or 12 on his former owner's plantation, then left and worked at a variety of menial jobs. He did not obtain a high school education until his late twenties; he then obtained bachelor's and master's degrees from Iowa State Agricultural College. In 1896 he joined Booker T. Washington at the Tuskegee Institute (now Tuskegee University) in Alabama, where he became director of agricultural research. He was soon promoting the planting of peanuts and soybeans, legumes that he knew would help restore the fertility of soil depleted by cotton cropping. To make them profitable, he worked intensively with the sweet potato and the peanut (then not even recognized as a crop), ultimately developing 118 derivative products from sweet potatoes and 300 from peanuts. His efforts helped liberate the South from its untenable cotton dependency; by 1940 the peanut was the South's second largest cash crop. During World War II he devised 500 dyes to replace those no longer available from Europe. Despite international acclaim and extraordinary job offers, he remained at Tuskegee throughout his life, donating his life's savings in 1940 to establish the Carver Research Foundation at Tuskegee.



George Washington Carver
COURTESY OF THE TUSKEGEE INSTITUTE, ALABAMA; PHOTOGRAPH, P.H. POLK

Carver, Jonathan (b. April 13, 1710, Weymouth, Mass.—d. Jan. 31, 1780, London, Eng.) American explorer. He served in the French and Indian War. In 1766 he was sent by Maj. Robert Rogers to explore an area west of northern Michigan. He traveled through the Great Lakes and up

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the Mississippi River, wintering in a Sioux village. Though his travel journal (published 1778) was a huge success, he died penniless.

Cary, (Arthur) Joyce (Lunel) (b. Dec. 7, 1888, Londonderry, Ire.—d. March 29, 1957, Oxford, Oxfordshire, Eng.) British novelist. Cary studied art in Edinburgh and Paris before graduating from the University of Oxford. After serving in West Africa in World War I, he began publishing short stories, then novels, some set in Africa, including *An American Visitor* (1933) and *Mister Johnson* (1939). *The Horse's Mouth* (1944), his best-known novel, was the third in a trilogy in which each volume is narrated by one of three protagonists. Other works include a second trilogy, *A Prisoner of Grace* (1952), *Except the Lord* (1953), and *Not Honour More* (1955).

caryatid \ˌkar-ē-ˈa-təd\ Supporting column sculpted in the form of a draped female figure. Caryatids first appeared in three small buildings (treasuries) at Delphi (550–530 BC). The most celebrated example is the caryatid porch of the Erechtheum (421–406 BC), with six figures, on the Acropolis (see ACROPOLIS) of Athens. Caryatids are sometimes called *korai* ("maidens"). Their male counterpart is the ATLAS.

Casa Grande \ˈkä-sə-ˈgrän-dā\ **Ruins National Monument** Archaeological site, southern Arizona, U.S. Designated a national monument in 1918, it occupies 448 acres (181 hectares). The site's pre-Columbian ruins are dominated by the Casa Grande ("Big House"), a multistory building built by Salado Indians in the 14th century; it is the only surviving building of its type. Nearby are partially excavated village sites established much earlier by Hohokam Indians (see HOHOKAM CULTURE).

Casablanca Coastal city (pop., 1994: 2,940,623), western Morocco. It occupies the site of the ancient city of Anfa, destroyed by the Portuguese in 1468. The Portuguese returned in 1515 and built a new town, Casa Branca ("White House"). Abandoned after an earthquake, it was occupied by a Moroccan sultan in 1757. European traders, including the French, began to settle there. In 1907, after French citizens were murdered there, French forces occupied the town. During the subsequent French protectorate, it became Morocco's chief port. Since then, its growth and development have been continuous. In World War II (1939–45) it surrendered to the Allied Powers in 1942, and in 1943 the CASABLANCA CONFERENCE was held there.

Casablanca Conference (Jan. 12–23, 1943) Meeting during WORLD WAR II at Casablanca, Morocco, between FRANKLIN ROOSEVELT and WINSTON CHURCHILL. They planned future global military strategy for the Western allies, reaching agreement on such issues as the invasion of Sicily, operations in the Pacific theatre, and the concentrated bombing of Germany. Most importantly, they issued a demand for an "unconditional surrender" from Germany, Italy, and Japan.

Casals \kə-ˈsälz**, Pablo (Carlos Salvador Defilló)** *orig.* **Pau Casals** (b. Dec. 29, 1876, Vendrell, Spain—d. Oct. 22, 1973, Río Piedras, P.R.) Spanish (Catalan)-born U.S. cellist and conductor. He received early instruction from his organist father and took up the cello and composition in his teens. A romantic who eschewed the drier, literal interpretations of modernism, Casals established an innovative technique employing more flexible fingering positions and freer bowing. He performed internationally as soloist, in a trio with Alfred Cortot (1877–1962) and Jacques Thibaud (1880–1953), and from the 1920s as a conductor. Refusing to return to Spain after FRANCISCO FRANCO took power, he ultimately made his home in Puerto Rico.

Casamance \ˌkä-zä-ˈmäⁿs\ **River** River, Senegal. Rising in southern Senegal, it flows west between The Gambia and Guinea-Bissau and empties into the Atlantic Ocean after a course of about 200 mi (322 km). Only some 80 mi (130 km) of the river are navigable.

Casanova \ˌka-sə-ˈnō-və**, Giovanni Giacomo** (b. April 2, 1725, Venice—d. June 4, 1798, Dux, Bohemia) Italian ecclesiastic, writer, soldier, spy, and diplomatist. Expelled from a seminary for scandalous conduct, he launched a dissolute career that took him throughout Europe. In Venice in 1755 he was denounced as a magician and imprisoned; he escaped and fled to Paris, where he mingled with the aristocracy. Fleeing from creditors, he took the name Chevalier de Seingalt and traveled again before returning to Venice in 1774 to become a spy for the Venetian inquisitors of state. He spent his late years (1785–98) as librarian to the Count von Waldstein in Bohemia. His huge autobiography, first published in 12 volumes in 1825–38, gives a splendid picture of 18th-century Europe; it established his reputation as an extraordinary seducer of women.

Casas, Bartolomé de las See Bartolome de LAS CASAS

Cascade Range Mountain range, western U.S. A continuation of the SIERRA NEVADA, it extends north from Mount LASSEN in northeastern California across Oregon and Washington for 700 mi (1,100 km). Its highest elevation is Mount RAINIER. Some of the summits, including Mount ST. HELENS, have erupted in the recent past. The LEWIS AND CLARK EXPEDITION passed through the range in the Columbia River Gorge. Its northern continuation in British Columbia is known as the Coast Mountains. See also NORTH CASCADES NATIONAL PARK.

CASE *in full* **computer-aided software engineering** Use of computers in designing sophisticated tools to aid the SOFTWARE engineer and to automate the software development process as much as possible. It is particularly useful where major software products are designed by teams of engineers who may not share the same physical space. CASE tools can be used for simple operations such as routine coding from an appropriately detailed design in a specific PROGRAMMING LANGUAGE, or for more complex tasks such as incorporating an EXPERT SYSTEM to enforce design rules and eliminate software defects and redundancies before the coding phase.

Case, Steve *orig.* **Stephen McConnell Case** (b. Aug. 21, 1958, Honolulu, Hawaii, U.S.) U.S. businessman. In 1985 he cofounded Quantum Computer Services, which was renamed America Online, Inc. (AOL), in 1991. As chairman and CEO of the company, he developed it into the world's foremost INTERNET SERVICE PROVIDER and helped turn the Internet into a mass medium. In 2001 he became the CEO of the newly formed AOL Time Warner Inc. (later TIME WARNER INC.) but resigned the post in 2003.

Casement, Sir Roger (David) (b. Sept. 1, 1864, Kingstown, County Dublin, Ire.—d. Aug. 3, 1916, London, Eng.) British civil servant and Irish rebel. As British consul in Africa (1895–1904) and Brazil (1906–11), he became famous for his reports revealing white traders' cruel exploitation of native labour in the Congo and in the Putumayo River region of Peru. Ill health forced his retirement to Ireland (1912), where he joined the Irish nationalists and helped form the Irish National Volunteers. After World War I broke out, he sought German support for the Irish independence movement. For his additional intrigue in the EASTER RISING, he was convicted of treason and hanged. His execution made him an Irish martyr in the revolt against British rule in Ireland.

cash flow Financial and accounting concept. Cash flow results from three major groups of activities: operating activities, investing activities, and financing activities. A cash-flow statement differs from an income statement in reflecting actual cash on hand rather than money owed (accounts receivable). Its purpose is to throw light on management's use of its available financial resources and to help in evaluating a company's liquidity.

Cash, Johnny *orig.* **J.R. Cash** (b. Feb. 26, 1932, Kingsland, Ark., U.S.—d. Sept. 12, 2003, Nashville, Tenn.) U.S. singer and songwriter. He learned guitar and began writing songs during military service in the early 1950s. Settling in Memphis, he earned regular appearances on *Louisiana Hayride* and the GRAND OLE OPRY with hits such as "Hey, Porter," "Folsom Prison Blues," and "I Walk the Line." By 1957 Cash was acknowledged the top COUNTRY MUSIC artist. His popularity waned for a time because of health and drug addiction problems, but his album *Johnny Cash at Folsom Prison* (1968) led to his rediscovery by a wider audience. In 1968 he married June Carter of the CARTER FAMILY, with whom he had worked since 1961. In 1994 he released *American Recordings*, which was a critical and popular success and won him a new generation of fans. His later albums include *American IV: The Man Comes Around* (2002). Cash was inducted into the Country Music Hall of Fame in 1980 and the Rock and Roll Hall of Fame in 1992. His autobiographies *Man in Black* and *Cash* (cowritten with Patrick Carr) were published in 1975 and 1997, respectively.

cashew Edible seed or NUT of *Anacardium occidentale*, a tropical and subtropical evergreen shrub or tree in the SUMAC family, native to tropical Central and South America. Important chiefly for its nuts, the tree

Cashew apples (hypocarp) and nuts of the domesticated cashew tree (*Anacardium occidentale*).
W.H. HODGE

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also produces wood used for shipping crates, boats, and charcoal, and a GUM similar to gum arabic. Related to POISON IVY and POISON SUMAC, it must be handled with care. The two-shelled nut is shaped like a large, thick bean. A brown oil between the two shells blisters human skin and is used as a lubricant and an insecticide and in the production of plastics. The nut is rich and distinctively flavoured.

cashmere Animal-hair fibre forming the downy undercoat of the Kashmir GOAT. The fibre became known for its use in beautiful shawls and other handmade items produced in Kashmir, India. The fibres have diameters finer than those of the best WOOLS. Natural colour is usually gray or tan but ranges from white to black. Cashmere fabric is warm and comfortable and has excellent draping qualities and soft texture; it is used mainly for fine coat, dress, and suit fabrics and for high-quality knitwear and hosiery. A sweater requires the fleece of 4–6 goats; an overcoat uses that of 30–40. Because world production is small and gathering and processing are costly, cashmere is a luxury fibre.

Casimir \'kä-zə-ˌmir\ **III** *known as* **Casimir the Great** *Polish* **Kazimierz Weilki** (b. April 30, 1310, Kujavia, Pol.—d. Nov. 5, 1370) King of Poland (1333–70). He was the son of Władysław I, who revived the Polish kingship, and he continued his father's quest to make Poland a power in central Europe. He crafted treaties with Hungary, Bohemia, and the TEUTONIC ORDER and acquired Red Russia and Masovia by diplomacy. Casimir also arranged a series of dynastic alliances that tied Poland to many royal European families. He codified Teutonic law, gave new towns self-government under the Magdeburg Law, and founded the University of Kraków.

Casimir IV *known as* **Casimir Jagiellonian** \yäg-yel-'lō-nē-ən\ *Polish* **Kazimierz Jagiellończyk** (b. Nov. 30, 1427—d. June 7, 1492) Grand duke of Lithuania (1440–92) and king of Poland (1447–92). He became ruler of Lithuania by will of the boyars and king of Poland on his brother's death. He sought to preserve the political union between Poland and Lithuania and to recover the lost lands of old Poland. Through his own marriage to Elizabeth of Habsburg and the marriages of his children, he formed alliances with various European royal houses and built the JAGIELLON DYNASTY. The great triumph of his reign was the effective destruction of the TEUTONIC ORDER (1466), which brought Prussia under Polish rule.

casino Building or room used for GAMBLING. The term originally referred to a public hall for music and dancing, but by the late 19th century it had come to denote a gaming house, particularly one in which card and dice games were played. Today casinos are places where gamblers can risk their money against a common gambler (called the banker or house), and they have an almost uniform character throughout the world. One of the oldest and best-known casinos is that at Monte Carlo (Monaco), founded in 1861. Others include those at Cannes and Nice (France), Corfu (Greece), Baden-Baden (Germany), Rio de Janeiro (Brazil), and Las Vegas and Reno (Nevada, U.S.). Casinos in Havana (Cuba) were confiscated by the Castro government after the 1959 revolution, spelling the end of a flourishing gambling scene that rivaled Las Vegas. Nevada has long had casino gambling, but other U.S. states prohibited it; that ban was ended when a casino opened in Atlantic City, N.J., in 1978. From the 1980s casinos began appearing on American Indian reservations, which are not subject to state antigambling statutes, and casino gambling expanded vastly in the U.S. as gambling became legal in more states, particularly as a riverboat operation. In the late 1990s Internet gambling sites permitted players to play casino games such as roulette and blackjack. These virtual casinos usually offered the option of playing against other players or only against the house.

Casper City (pop., 2000: 49,644), east-central Wyoming, U.S., on the NORTH PLATTE RIVER. Founded in 1888, it was located on the OREGON TRAIL and the PONY EXPRESS route. The discovery of oil in the 1890s began an oil boom, and the oil fields of the TEAPOT DOME SCANDAL were nearby. Casper's economy is based on the production of oil and natural gas and the manufacture of oil-field equipment. Mining (uranium, coal, bentonite) and cattle and sheep raising also are important.

Caspersson \käs-'per-ˌsōn**, Torbörn Oskar** (b. Oct. 15, 1910, Motala, Swed.) Swedish cell biologist and geneticist. After receiving his medical degree from the University of Stockholm in 1936, he initiated the use of the ultraviolet microscope to determine the nucleic acid content of cellular structures such as the nucleus and nucleolus. He theorized that nucleic acids must be present for protein synthesis to occur. He was the first to perform cellular chemical studies on the giant chromosomes found in insect larvae. He also investigated the role of the nucleolus in protein synthesis.

Caspian Sea Inland salt lake between Europe and Asia, bordering Azerbaijan, Russia, Kazakhstan, and Iran. With a basin 750 mi (1,200 km) long and up to 200 mi (320 km) wide and an area of 149,200 sq mi (386,400 sq km), it is the largest inland body of water in the world. Though it receives many rivers, including the VOLGA, URAL, and KURA, the sea itself has no outlet. It was important as a commercial route in the premodern era, when it formed part of the Mongol-Baltic trade route for goods from Asia. It is now a major source of petroleum. Its numerous ports include BAKU in Azerbaijan and Bandar-e Anzalī and Bandar-e Torkaman in Iran.

Cass, Lewis (b. Oct. 9, 1782, Exeter, N.H., U.S.—d. June 17, 1866, Detroit, Mich.) U.S. politician. He fought in the War of 1812 and served as governor of Michigan Territory (1813–31). As secretary of war (1831–36) under Pres. ANDREW JACKSON, he directed the conduct of the Black Hawk and Seminole wars. He served as U.S. minister to France (1836–42). In the U.S. Senate (1845–48, 1849–57), he supported westward expansion and the COMPROMISE OF 1850. He was the Democratic nominee in the presidential election of 1848, which he lost to ZACHARY TAYLOR. He later served as secretary of state (1857–60) but resigned when Pres. JAMES BUCHANAN took no action to counter the secession of the Southern states.

Cassandra In GREEK MYTHOLOGY, the daughter of King PRIAM of Troy. APOLLO promised her the gift of prophecy if she would grant his desires; she accepted the gift but rebuffed the god, who took his revenge by ordaining that her prophecies should never be believed. She predicted the fall of Troy and the death of Agamemnon, but her warnings went unheeded. Given as part of the war spoils to Agamemnon, she was murdered with him.

Cassatt \kə-'sat**, Mary** (b. May 22, 1844, Allegheny City, Pa., U.S.—d. June 14, 1926, Château de Beaufresne, near Paris, France) U.S. painter and printmaker, active in Paris. She spent her early years traveling in Europe with her wealthy family. After attending the Pennsylvania Academy of the Fine Arts (1860–65) she later studied in Paris, copying Old Masters. In 1874 Cassatt chose Paris as her permanent residence and established her studio there. She shared with the Impressionists an interest in experiment and in the use of bright colours inspired by the out-of-doors. EDGAR DEGAS became her friend, and at his request she exhibited with the Impressionists. She portrayed scenes of everyday life, particularly images of mothers and children, and was skilled at drawing and printmaking. Some of her best works were executed in pastel. Through her social contacts with wealthy private collectors, she promoted IMPRESSIONISM in the U.S. and exerted a lasting influence on U.S. taste.

cassava \kə-'sä-və\ *or* **manioc** *or* **yuca** Tuberous edible perennial plant (*Manihot esculenta*) of the SPURGE family, from the New World tropics. It is cultivated for its tuberous roots, from which cassava flour, breads, tapioca, a laundry starch, and an alcoholic beverage are derived. It has conspicuous, almost palmate (fan-shaped) leaves and fleshy roots. Different varieties range from low herbs through many-branched shrubs to slender, unbranched trees adapted to diverse habitats.

Cassavetes \ˌka-sə-'ve-tēz**, John** (b. Dec. 9, 1929, New York, N.Y., U.S.—d. Feb. 3, 1989, Los Angeles, Calif.) U.S. film director and actor. He acted in films and in television dramas before making his directorial debut with the critically praised *Shadows* (1961), a low-budget independent film in the CINÉMA VÉRITÉ style. He played featured roles in such films as *The Dirty Dozen* (1967) and *Rosemary's Baby* (1968) and returned to directing independent films, including *Faces* (1968), *Husbands* (1970), and *A Woman Under the Influence* (1974), which dramatized marital problems.

cassia \'ka-shə\ Spice, also called Chinese cinnamon, consisting of the aromatic bark of the *Cinnamomum cassia* plant, of the LAUREL FAMILY. Similar to true CINNAMON bark, cassia bark has a more pungent, less delicate flavor and is thicker. It is used as a flavoring in cooking. Whole buds, the dried, unripe fruits of *C. cassia* and *C. loureirii*, taste like the bark and are added to foods for flavoring. Confusion sometimes arises with another group of plants because *Cassia* is the name of an extensive genus of legumes, the source of various medicinal products and of SENNA leaves.

Cassidy, Butch *orig.* **Robert Leroy Parker** (b. April 13, 1866, Beaver, Utah, U.S.—d. 1909?, Concordia Tin Mines, near San Vicente,

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Bol.?) U.S. outlaw. Taking his name from an older outlaw mentor, Cassidy was a cattle rustler and a robber from the mid-1880s. In 1900 he became the criminal partner of Harry Longabaugh, the "Sundance Kid" (1870–1909?), whose nickname derived from a town where he had once been imprisoned. They became the foremost members of the Wild Bunch, a group of bank and train robbers. The two eluded Pinkerton detectives by escaping to South America in 1901. They bought a ranch in Argentina but returned to a life of outlawry in 1906. In 1909, trapped by soldiers in Bolivia, Sundance was mortally wounded, and Cassidy shot himself. The time, place, and circumstances of their deaths vary widely in different accounts.

Cassini, Gian Domenico (b. June 8, 1625, Perinaldo, Republic of Genoa—d. Sept. 14, 1712, Paris, France) Italian-born French astronomer. His early studies were mainly observations of the Sun, but, after obtaining more powerful telescopes, he turned his attention to the planets. He calculated Jupiter's and Mars's rotational periods and compiled a table of the positions of Jupiter's satellites. His observations of the Moon (1671–79) led to his compiling a large map. In 1683, after a study of the ZODIACAL LIGHT, he concluded it was of cosmic origin. He discovered four of Saturn's moons: Iapetus (1671), Rhea (1672), Tethys (1684), and Dione (1684). The dark gap between two of Saturn's main rings (Cassini's division) is named for him.

Cassiodorus \ˌka-sē-ə-ˈdōr-əs\ *in full* **Flavius Magnus Aurelius Cassiodorus** (b. 490, Scylletium, Bruttium, kingdom of the Ostrogoths—d. c. 585, Vivarium Monastery, near Scylletium) Historian, statesman, and monk who helped preserve Roman culture after the collapse of the Roman Empire. He was secretary to THEODORIC and later held other high imperial offices. Soon after 540 he founded a monastery to perpetuate the culture of Rome. He collected pagan and Christian manuscripts and had the monks copy them, establishing a practice continued in later centuries. His own works included the *Chronicon*, a history of mankind to 519; *De anima*, on the soul after death; and *Institutiones divinarum et saecularium litterarum*, on the study of scripture and the seven liberal arts.

Cassirer \kä-ˈsir-ər**, Ernst** (b. July 28, 1874, Breslau, Silesia, Ger.—d. April 13, 1945, New York, N.Y., U.S.) German philosopher and educator. He taught at the University of Berlin (1905–19) and the University of Hamburg (1919–33) before the rise of Nazism forced him to flee to Sweden and the U.S. Cassirer's philosophy, based primarily on the work of IMMANUEL KANT, expanded that philosopher's doctrines concerning the ways in which human experience is structured by innately existing concepts. After examining various forms of cultural expression, Cassirer concluded that man is uniquely characterized by his ability to use the "symbolic forms" of myth, language, and science to structure his experience and thereby to understand both himself and the natural world. His most important original work is *The Philosophy of Symbolic Forms* (1923–29); he also wrote works on Kant, G.W. LEIBNIZ, Renaissance cosmology, and the Cambridge Platonists.

Cassius \ˈkash-əs\ **(Longinus), Gaius** (d. 42 BC, near Philippi, Macedonia) Roman general and administrator. He fought alongside POMPEY THE GREAT against JULIUS CAESAR but was reconciled with Caesar after Pompey's defeat. Motivated by jealousy and bitterness, he joined BRUTUS in the successful conspiracy to assassinate Caesar (44 BC). Forced to leave Rome after the assassination, he went to Syria, and there he ousted the Roman governor (43). With Brutus he raised an army in Macedonia to challenge the Second TRIUMVIRATE. Defeated at the Battle of PHILIPPI by MARK ANTONY, he had his freedmen slay him. He was lamented by Brutus as "the last of the Romans."

cassone \kə-ˈsō-nā\ *or* **marriage chest** Chest, usually of wood, intended to contain a bride's dowry or to be given as a wedding present. It was the most elaborately decorated piece of furniture in Renaissance Italy. In the 15th century, wealthy Florentine families employed artists such as SANDRO BOTTICELLI and PAOLO UCCELLO to decorate *cassoni* with paintings. They were often made in pairs, bearing the respective coats of arms of the bride and groom. Though *cassoni* were made in many countries, the finest come from Italy.

cassowary \ˈka-sə-ˌwer-ē\ Any of several species of RATITE (family Casuariidae) of the Australo-Papuan region. Related to the EMU, it has been known to kill humans with slashing blows of its feet, which have long, daggerlike claws on the innermost toe. It has a featherless blue head protected by a bony crest and has a black body (immature birds are brownish). It moves rapidly along narrow tracks in the bush. Cassowaries eat fruit and small animals. The largest species is the common, or southern, cassowary (*Casuarius casuarius*), which stands almost 5 ft (1.5 m) tall.

Common, or southern, cassowary (*Casuarius casuarius*).
ANTHONY MERCIECA FROM ROOT RESOURCES

cast iron ALLOY of IRON that contains 2–4% CARBON, along with SILICON, MANGANESE, and impurities. It is made by reducing iron ORE in a BLAST FURNACE (cast iron is chemically the same as blast-furnace iron) and CASTING the liquid iron into INGOTS called pigs. PIG IRON is remelted, along with scrap and alloying elements, in cupola furnaces and recast into molds for a variety of products. In the 18th–19th centuries, cast iron was a cheaper engineering material than WROUGHT IRON (not requiring intensive refining and hammering). It is more brittle and lacks tensile strength. Its compressive (load-bearing) strength made it the first important structural metal. In the 20th century, STEEL replaced it as a construction material, but cast iron still has industrial applications in automobile engine blocks, agricultural and machine parts, pipes, hollowware, stoves, and furnaces. Most cast iron is either so-called gray iron or white iron, the colours shown by fracture; gray iron contains more silicon and is less hard and more machinable than white iron. Both are brittle, but malleable cast iron (produced by prolonged HEAT-TREATING), first made in 18th-century France, was developed into an industrial product in the U.S. Cast iron that is ductile as cast was invented in 1948. The latter now constitutes a major family of metals, widely used for gears, dies, automobile crankshafts, and many other machine parts.

Castagno \kä-ˈstä-nyō**, Andrea del** *orig.* **Andrea di Bartolo** (b. c. 1421, San Martino a Corella, Republic of Florence—d. Aug. 19, 1457, Florence) Italian painter active in Florence. Little is known of his early life, and many of his paintings have been lost. His earliest dated works are frescoes in the church of San Zaccaria in Venice (1442). In 1447 he began his greatest work, a series of monumental frescoes depicting the Last Supper and other scenes of Christ's Passion for the convent of Sant' Apollonia in Florence (now a museum). His use of pictorial illusionism and scientific perspective, as well as the powerful, sculptural form of his figures, established him as one of the most influential Renaissance painters of the 15th century.

caste Any of the ranked, hereditary, endogamous (see EXOGAMY AND ENDOGAMY) occupational groups that constitute traditional societies in certain regions of the world, particularly among Hindus in India. There caste is rooted in antiquity and specifies the rules and restrictions governing social intercourse and activity. Each caste has its own customs that restrict the occupations and dietary habits of its members and their social contact with other castes. There are about 3,000 castes, or *jati*s (broadly, "form of existence fixed by birth"), and more than 25,000 subcastes in India. They are traditionally grouped into four major classes, or *varna*s ("colours"). At the top are the BRAHMANS, followed by the KSHATRIYAS, VAISHYAS, and SHUDRAS. Those with the most defiling jobs (such as those who dispose of body emissions and dead animals) are ranked beneath the Shudras. Considered untouchable, they were simply dubbed as "the fifth" (*panchama*) category. Although a great many spheres of life in modern India are little influenced by caste, most marriages are nevertheless arranged within the caste. This is in part because most people live in rural communities and because the arrangement of marriages is a family activity carried out through existing networks of kinship and caste.

caste \ˈkast\ In biology, a subset of individuals within a colony of social animals (chiefly ANTS, BEES, TERMITES, and WASPS) that has a specialized function and is distinguished from other subsets by morphological and anatomical differences. Typical insect castes are the queen (the female responsible for reproduction), workers (the usually sterile female caretakers of the queen, eggs, and larvae), soldiers (defenders of the colony; also sterile females), and sometimes drones (short-lived males). The dif-

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ferentiation of larvae into various castes is often determined by diet, though hormonal and environmental factors can also play a role.

Castelo Branco \kȧsh-'tel-ü-'brä^{n}ŋ-kü**, Camilo, viscount of Correia Botelho** (b. March 16, 1825, Lisbon, Port.—d. June 1, 1890, Seide) Portuguese novelist. An orphan from a family with a tendency to insanity, he studied medicine and theology before beginning to write. While imprisoned for eloping with another man's wife, he wrote his best-known work, *Amor de perdição* (1862; "Fatal Love"), about a thwarted love that leads to crime and exile. His 58 novels, many mirroring his passionate life, range from Romantic melodrama to realism. His best works include *O romance d'um homem rico* (1861; "The Love Story of a Rich Man") and *O retrato de Ricardina* (1868; "Portrait of Ricardina"). Ennobled in 1885, he committed suicide five years later.

Castiglione \ˌkäs-tēl-'yō-nā**, Baldassare** (b. Dec. 6, 1478, Casatico, near Mantua—d. Feb. 2, 1529, Toledo) Italian diplomat, courtier, and writer. Born into a noble family, he was attached to the courts of Mantua and Urbino and later entered papal service. He is remembered for *The Courtier* (1528). Written in the form of a philosophical dialogue, it describes the conduct of the perfect courtier, the qualities of a noble lady, and the ideal relationships between the courtier and his prince. Immediately successful in Italy and beyond, it became a manual for those aspiring to aristocratic manners during the Renaissance.

Baldassare Castiglione, detail of a portrait by Raphael, 1516; in the Louvre, Paris
GIRAUDON-ART RESOURCE/EB INC.

Castile \ka-'stēl\ *Spanish* **Castilla** \kä-'stē-lyä\ Traditional region, peninsular Spain. Comprising several modern provinces, its northern part is called Old Castile and its southern part New Castile. Castilian territory was united under León by Fernán González in the 10th century. Though it separated from León in the 12th century, it was reunited with it by Ferdinand III in 1230. The Spanish part of the kingdom of Navarra was annexed by Castile in 1512, thus completing the formation of modern Spain. Castile remains Spain's centre of political and administrative power. See also Castile-León; Castile–La Mancha.

Castile–La Mancha *Spanish* **Castilla La Mancha** Autonomous community (pop., 2005 est.: 1,894,667) and historic region, central Spain. Established in 1982, it encompasses the provinces of Toledo, Ciudad Real, Cuenca, Guadalajara, and Albacete and covers an area of 30,681 sq mi (79,463 sq km). Its capital is Toledo. The watershed of the low-lying Toledo Mountains bisects the region; land to the north is drained by the Tagus River, and the plains of La Mancha to the south are drained by the Guadiana. In the 20th century, emigration to Madrid depleted the population. Agriculture dominates the economy. See Castile; Miguel de Cervantes.

Castile-León *Spanish* **Castilla y León** Autonomous community (pop., 2001: 2,456,474) and historic region, northern Spain. Established in 1983, it encompasses the provinces of Valladolid, Burgos, León, Salamanca, Zamora, Polencia, and Segovia and covers an area of 36,380 sq mi (94,224 sq km). Its capital is Valladolid. It occupies the elevated Central Plateau and is drained by the Douro River, which bisects the region. The Cantabrian Mountains rise to the north. The area's population experienced periods of decline in the 20th century, with notable emigration from the countryside to the provincial capitals. Its economy is largely agricultural. See also Castile.

Castilho \kȧsh-'tel-yü**, António Feliciano de** (b. Jan. 28, 1800, Lisbon—d. June 18, 1875, Lisbon) Portuguese poet. Though blind from childhood, he became a classical scholar and by age 16 was publishing poems, translations, and pedagogical works. With his *Obras completas* (1837; "Complete Works"), he became a literary figure in Lisbon. As director of the important journal *O panorama* and later of the major cultural review *Revista universal Lisbonense*, he became a central figure in the Portuguese Romantic movement. After 1850 he gradually returned to a genteel traditionalism. His lifeless style so dominated literary taste that it provoked a rebellion by younger writers, and he was dethroned as literary arbiter.

Castillo de San Marcos \ka-'stē-yō-dā-san-'mär-kōs\ **National Monument** Historic site, northeastern Florida, U.S. Established in 1924, it is the 25-acre (10-hectare) site of the oldest masonry fort in the U.S., built by the Spanish (1672–95) to protect St. Augustine. The fort played an important role in the Spanish-English struggle for the Southeast (c. 1670–1763). In the 19th century it served as a U.S. military prison.

casting Pouring of molten metal into a mold, where it solidifies into the shape of the mold. The process was well established in the Bronze Age, when it was used to form bronze pieces now found in museums. It is particularly valuable for the economical production of complex shapes, ranging from mass-produced parts for automobiles to one-of-a–kind production of statues, jewelry, or massive machinery. Most steel and iron castings (see cast iron) are poured into silica sand. For metals of lower melting point, such as aluminum or zinc, molds can be made of another metal or of sand. See also die casting, founding, investment casting, lost-wax casting, patternmaking.

castle Medieval European stronghold, generally the fortified dwelling of the king or lord of the territory in which it stood. The castle developed rapidly in western Europe from the 9th century. In form it was somewhat sprawling compared to later fortified buildings. The castle's *enceinte* (outer wall) was surrounded by one or more moats, which were crossed by drawbridges that could be raised from the inner side. The gateway itself was heavily protected and often defended by a barbican, or watchtower. One or more baileys, or walled courtyards, surrounded the donjon. The age of the medieval castle came to an end with the increasing use of firearms in the 15th–16th centuries.

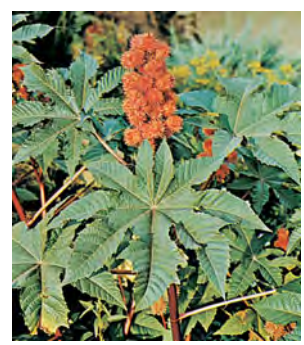
Castle, Vernon and Irene *orig.* **Vernon Blythe and Irene Foote** (respectively b. May 2, 1887, Norwich, Norfolk, Eng.—d. Feb. 15, 1918, Fort Worth, Texas, U.S.; b. 1893, New Rochelle, N.Y., U.S.—d. Jan. 25, 1969, Eureka Springs, Ark.) U.S. husband-and-wife ballroom dance team. Vernon moved to the U.S. in 1906 and married Irene in 1911. They gained worldwide popularity for their graceful style, and they introduced such dances as the one-step, fox-trot, turkey trot, castle polka, castle walk, and hesitation waltz and popularized several others. Irene is credited with creating the fashion for bobbed hair. Following Vernon's death in an airplane crash, Irene retired from dancing.

Castlereagh \'ka-səl-ˌrā\ District (pop., 2001: 66,488), Northern Ireland. Located southeast of Belfast, it was established in 1973. The area was settled in the 14th century by the O'Neill clan of Ulster, from whose main stronghold, Grey Castle (no longer extant), it takes its name. It is closely linked to eastern Belfast, the district seat, where many of its residents are employed.

Castlereagh, Robert Stewart, Viscount (b. June 18, 1769, Dublin, Ire.—d. Aug. 12, 1822, London, Eng.) British politician. He was elected to the Irish Parliament in 1790 and later served in the British Parliament (1794–1805, 1806–22). As chief secretary for Ireland (1798–1801), Castlereagh singlehandedly forced the Act of Union through the Irish Parliament in 1800. He served as Britain's secretary for war (1805–06, 1807–09) and as secretary for foreign affairs and leader of the House of Commons (1812–22). Considered one of the most distinguished foreign secretaries in British history, he played a leading role in bringing together the Grand Alliance that overthrew Napoleon and in deciding the form of the peace settlements at the Congress of Vienna. Beset with paranoia and believing that he was being blackmailed, he eventually committed suicide.

Castor and Pollux See Dioscuri

castor-oil plant Large plant (*Ricinus communis*) of the spurge family, probably native to Africa and naturalized throughout the tropics. It is grown commercially for the pharmaceutical and industrial uses of its oil and for use in landscape gardening because of its handsome, giant, fanlike leaves. The bristly, spined, bronze-to-red clusters of fruits are attractive but are often removed before they mature because of the poison concentrated in their mottled,



Castor-oil plant (*Ricinus communis*).
KENNETH AND BRENDA FORMANEK/EB INC.

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beanlike seeds. There are hundreds of natural forms and many horticultural varieties of this species.

castration *or* **neutering** Removal of the TESTES. The procedure stops most production of the hormone TESTOSTERONE. If done before PUBERTY, it prevents the development of functioning adult sex organs. Castration after sexual maturity makes the sex organs shrink and stop functioning, ending sperm formation and sexual interest and behaviour. Livestock and pets are castrated to keep them from reproducing (see STERILIZATION) or to create a more docile animal. In humans, castration has been used for both cultural (see EUNUCH, CASTRATO) and medical (e.g., for testicular cancer) reasons.

castrato \ka-'strä-ˌtō\ Male soprano or alto voice produced as a result of CASTRATION before puberty. The castrato voice was introduced in the Vatican's Sistine Chapel in the 16th century, when women were still banned from church choirs as well as the stage. It reached its greatest prominence in 17th- and 18th-century opera. The illegal and inhumane practice of castration, largely practiced in Italy, could produce a treble voice of extraordinary power, attributable to the lung capacity and physical bulk of the adult male. The unique tone quality and the ability of intensively trained singers to execute virtuosic passagework made castrati the rage among opera audiences and contributed to the spread of Italian opera. Most male singers in 18th-century opera were castrati; the most famous bore the stage names Senesino (Francesco Bernardi; died c. 1750), Caffarelli (Gaetano Majorano; 1710–1783), and FARINELLI. Castrati sang in the Sistine Chapel choir until 1903.

Castries \kȧ-'strē, 'käs-ˌtrē\ Seaport (pop., 1997 est.: 16,187), capital of SAINT LUCIA. Located on the island's northwestern coast, its fine harbour is Saint Lucia's chief port. A fortress on Mount Fortune (852 ft [260 m]) overlooks the town. Castries is a gateway for tourists visiting the island.

Castro (Ruz), Fidel (b. Aug. 13, 1926/27, near Birán, Cuba) Political leader of Cuba (from 1959). Son of a prosperous sugar planter, he became a lawyer and worked on behalf of the poor in Havana. He was a candidate for Cuba's legislature when Gen. FULGENCIO BATISTA overthrew the government in 1952. He organized a rebellion against Batista in 1953, but it failed; captured, he served time in prison and then went to Mexico, where he and others, including CHE GUEVARA, continued to plot Batista's overthrow. Castro led an armed expedition back to Cuba in 1956; most of his men were killed, but a dozen survivors took refuge in the mountains, where they gradually managed to organize guerrillas throughout the island. In 1959 Batista was forced to flee the country. Castro nationalized private commerce and industry and expropriated U.S.-owned land and businesses, vastly expanded health services and eliminated illiteracy, and ruthlessly suppressed opposition, outlawing all political groups but the Communist Party. The U.S. attempted to bring about his overthrow and failed (see BAY OF PIGS INVASION), precipitating the CUBAN MISSILE CRISIS. Castro exercised total control of the government and economy, which was increasingly dependent on subsidies from the Soviet Union. The Soviet Union's collapse (1991) devastated Cuba's economy, and Castro has attempted to replace its former revenues by encouraging tourism.

Castro y Bellvís \'käs-trō-ē-belʸ-'vēs**, Guillén de** (b. 1569, Valencia, Spain—d. 1631, Madrid) Spanish playwright. Of his approximately 50 plays, the best-remembered is *The Youth of the Cid* (c. 1599), on which PIERRE CORNEILLE based his *Le Cid* (1637). Castro's play is notable for its naturalistic dialogue. He was one of the earliest playwrights to deal with the difficulties of marriage, as in *The Unhappy Marriages of Valencia*. He drew heavily on traditional Castilian ballads and based three of his plays on novels by MIGUEL DE CERVANTES.

casualty insurance Provision against loss to persons and property, covering legal hazards as well as those of accident and sickness. Major classes include LIABILITY, theft, aviation, WORKERS' COMPENSATION, CREDIT, and title. Liability insurance contracts may cover liability arising from use of an automobile, operation of a business, professional negligence (MALPRACTICE insurance), or property ownership. Credit insurance may cover the risk of bad debts from insolvency, death, and disability, the risk of loss of savings from bank failure, and the risk of loss of export credit due to commercial or political changes.

casuarina \ˌkazh-yə-'rē-nə\ Any of the chiefly Australian trees that make up the genus *Casuarina* (family Casuarinaceae), which have whorls of scalelike leaves and segmented stems resembling HORSETAILS. Several species, especially *C. equisetifolia*, are valued for their hard, dense, yellowish to reddish brown wood, which is strong and reputed to be resistant to termite attack. Beefwood and ironwood are common names that reflect the wood's colour and hardness.

cat *or* **feline** Any member of the family Felidae, the most highly specialized group of mammalian CARNIVORES. Modern-type cats appeared in the fossil record about 10 million years ago. Cats in the genus *Panthera* (LEOPARD, JAGUAR, TIGER, and LION) roar but cannot purr, and their pupils are round. Other cats, including the SNOW LEOPARD and COUGAR, can purr but do not roar; the pupil is usually vertical. Cats have sharp, retractable (except in the CHEETAH) claws, and their teeth are adapted for stabbing, anchoring, and cutting. They almost always land on their feet when they fall from a height. Most species are nocturnal, and their eyes are adapted for seeing in low light. Cats are known for their habit of grooming themselves with their rasplike tongue. Small cats have been domesticated for some 3,500 years (see DOMESTIC CAT). Other cat species include the BOBCAT, CARACAL, LYNX, OCELOT, SERVAL, and WILDCAT.

CAT See COMPUTED AXIAL TOMOGRAPHY

cat bear See lesser PANDA

catacomb Subterranean cemetery of galleries with recesses for tombs. The term was probably first applied to the cemetery under St. Sebastian's Basilica that was a temporary resting place for the bodies of Sts. PETER and PAUL in the late 3rd century AD, but it came to refer to all the subterranean cemeteries around Rome. In addition to serving as burial sites, catacombs in early Christian Rome were the sites of funeral feasts celebrated in family vaults on the day of burial and on anniversaries. They were used as hiding places during times of persecution; Pope Sixtus II was supposedly captured and killed (AD 258) while hiding in the St. Sebastian's catacomb during VALERIAN's persecution. Catacombs are also found in Sicily and other parts of Italy, in Egypt, and in Lebanon.

Arched niche of a tomb with early Christian paintings of scenes from the Old and New Testaments, in the catacomb on Via Latina, Rome
PONT. COMM. DI ARCH. SACRA/M. GRIMOLDI

Catalan \'ka-tə-ˌlan\ **language** ROMANCE LANGUAGE spoken in eastern and northeastern Spain, chiefly Catalonia and Valencia, and in Andorra, the Balearic Isles, and the Roussillon region of France. Its literary tradition dates from the 12th century, when it was the official language of the kingdom of Aragon. As Catalonia achieved greater autonomy in the late 20th century, Catalan revived as the language of politics and education there. Its dialects, divided into an Occidental and an Oriental group, remain mutually intelligible. Catalan is related to the OCCITAN LANGUAGE of southern France and to SPANISH.

Çatalhüyük \chä-ˌtäl-hüē-'yükˌ\ *English* \chä-ˌtäl-hü-'yük\ Neolithic site, Anatolia. Located near KONYA in southern Turkey, it was the centre of an advanced Neolithic culture. The earliest period of settlement is tentatively dated to c. 6700 BC and the latest to c. 5650 BC. Excavation of the religious quarter produced a series of shrines; the wall paintings have been linked with Upper Paleolithic art.

Catalonia *Catalan* **Catalunya** *Spanish* **Cataluña** Autonomous community (pop., 2001: 6,343,110) and historic region, northeastern

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Spain. It encompasses the provinces of Girona, Barcelona, Tarragona, and Lleida and covers an area of 12,399 sq mi (32,113 sq km). Its capital is Barcelona. The Pyrenees separate Catalonia from France; the Mediterranean Sea lies to the east. Its principal rivers, the Ter, Llobrégat, and Ebro, all run into the Mediterranean. Catalonia was one of Rome's first Spanish possessions. Occupied in the 5th century AD by the Goths, it was taken by the Moors in 712 and by Charlemagne in 795. After the unification of Spain (1469), Catalonia lost its centrality in Spanish affairs, and by the 17th century its conflict of interest with Castile-León led to the first of a series of separatist movements. Catalan nationalism became a serious force after 1876. In 1932 a compromise with the central government granted Catalonia autonomy; this was revoked with the 1939 Nationalist victory in the Spanish Civil War, and Francisco Franco's government adopted a repressive policy toward Catalan nationalism. The reestablishment of democratic rule after Franco's death again led to autonomy in 1979. Today it is the richest and most industrialized part of Spain.

catalpa \kə-'ta-lpə\ Any of 11 species of trees in the genus *Catalpa* (family Bignoniaceae), native to eastern Asia, eastern North America, and the West Indies. Catalpas have large, attractive leaves and showy white, yellowish, or purplish flowers. The catalpa fruit is a long cylindrical pod bearing numerous seeds with white tufts of hair at each end. The common catalpa, *C. bignonioides*, yields a durable timber and is one of the most widely planted ornamental species.

catalysis \kə-'ta-lə-səs\ Modification (usually acceleration) of a chemical reaction rate by addition of a catalyst, which combines with the reactants but is ultimately regenerated so that its amount remains unchanged and the chemical equilibrium of the conditions of the reaction is not altered. Catalysts reduce the activation energy barrier between reactants and products. When more than one reaction is possible, a catalyst that accelerates only one reaction pathway selectively enhances the creation of its product. Catalysis is inhibited if the reactant or the catalyst is removed or altered by any of several types of agents (inhibitors). Catalysis in a single phase (e.g., the catalyst is dispersed in a liquid solution or gaseous mixture with the reactants) is homogeneous; that in more than one phase (e.g., the reactants are liquids and the catalyst a solid) is heterogeneous. Chemisorption, a type of heterogeneous catalysis, often involves bonding between the catalyst's solid surface and the reactant, changing the nature of the chemisorbed molecules. To make the accessible surface area as large as possible, such catalysts are finely powdered or highly porous solids. Catalysis is essential to the modern chemical industry. See also enzyme.

catalyst \'ka-tᵊl-əst\ Any substance of which a small proportion notably affects the reaction rate of a chemical reaction without itself being changed or consumed (see catalysis). One molecule may transform several million reactant molecules a minute. Catalysts may be gaseous, liquid, or solid; they may be inorganic compounds, organic compounds, or complex combinations. They tend to be highly specific, reacting with only one substance or a small set of substances. Substances that reduce the effectiveness of catalysts by altering them or blocking reactants' access to them are called catalyst inhibitors or catalyst poisons. Catalysts are essential to virtually all industrial chemical reactions, especially in petroleum refining and synthetic organic chemical manufacturing. Most solid catalysts are transition elements (metals) or their oxides in finely divided or porous form. In a car's catalytic converter, the platinum catalyst converts unburned hydrocarbons and nitrogen compounds to products less harmful to the environment. Water, especially saltwater, catalyzes oxidation (see oxidation-reduction) and corrosion. Enzymes are among the most active and selective catalysts known.

catalytic converter In automobiles, a component of emission control systems used to reduce the discharge of noxious gases from the internal-combustion engine. The catalytic converter consists of an insulated chamber containing pellets of catalyst through which the exhaust gases are passed. The exhaust's hydrocarbons and carbon monoxide are converted to water vapour and carbon dioxide.

catamaran \'ka-tə-mə-ˌran\ Twin-hulled sailing and engine-powered boat. Its design was based on a raft of two logs bridged by planks used by peoples in the Indonesian archipelago, Polynesia, and Micronesia. Up to 70 ft (21 m) long, early catamarans were paddled by many men and used for travel, in war, and in recreation. Especially after the sail was added, voyages as long as 2,000 mi (3,700 km) were made. In the 1870s they sailed so successfully against monohulled boats that they were barred from racing. The modern catamaran, which averages about 40 ft (12 m) in length, has been produced since 1950. They are very fast craft, achieving speeds of 20 mph (32 kph).

Catania \kä-'tä-nyä\ City (pop., 2001 prelim.: 306,464), Sicily, Italy. It was founded by Greeks in 729 BC at the foot of Mount Etna on the Gulf of Catania. Taken by the Romans in the First Punic War (263 BC), Catania was made a Roman colony by Octavian (later Augustus). Catanian Christians suffered under the emperors Decius and Diocletian; their martyrs included St. Agatha, patron saint of the city. Catania fell successively to the Byzantines, Arabs, and Normans, and it suffered devastation by earthquakes especially in 1169 and 1693. In World War II the city was severely damaged by bombing. Rebuilt, it is Sicily's second largest city and is an industrial and transportation centre.

Catanzaro \ˌkä-tänd-'zä-rō\ City (pop., 2001 prelim.: 93,540), capital of Calabria, southern Italy. Catanzaro lies near the Gulf of Squillace. It was probably founded in the 10th century by Byzantines. It was taken in 1059 by the Normans under Robert Guiscard. It played an important part in the Napoleonic Wars and in the movement for Italian unity. Catanzaro suffered severely from earthquakes in 1905 and 1907 and from bombing in World War II. It is an agricultural centre.

catapult Mechanism for forcefully propelling stones, spears, or other projectiles, in use since ancient times. Nearly all catapults employed in ancient and medieval artillery operated by a sudden release of tension on wooden beams or twisted cords of horsehair, gut, sinew, or other fibres. An exception was the medieval trebuchet, powered by a counterweight. Modern mechanisms using steam, hydraulic pressure, tension, or other force to launch gliders, aircraft, or missiles are also called catapults.

cataract Opacity of the eye's crystalline lens. Cataracts causing central visual-field defects are most likely to affect vision. Cataracts may occur in newborns and infants. Diabetes mellitus, prolonged exposure to ultraviolet rays, or trauma can cause them in adults, but they most often occur with age, resulting from gradual loss of transparency of the lens. Treatment is a surgical procedure to replace the lens with an artificial one.

catastrophe theory Branch of mathematics (considered a branch of geometry) that explores how gradual changes to a system produce sudden, drastic results (though usually not as dire as the name suggests). A simple example is how a plastic coffee stirrer subjected to gradually increasing pressure from both ends will suddenly buckle in one direction or another. Other "catastrophes" include optical phenomena such as reflection or refraction of light through moving water. More speculatively, ideas from catastrophe theory have been applied by social scientists to such situations as the sudden eruption of mob violence.

Catatumbo \ˌkä-tä-'tüm-bō\ **River** River, northern South America. Rising in northern Colombia, it flows northeast across the Venezuelan border and the oil-rich Maracaibo lowland to empty into Lake Maracaibo after a course of 210 mi (338 km).

Catawba \kə-'tȯ-bə\ North American Indian people of South Carolina, U.S. The meaning of the name Catawba, which seems to have been applied after European contact to several small bands of peoples in the region of the Catawba River, is unknown. The peoples first encountered by Hernando de Soto subsisted principally by farming, harvesting corn, beans, squash, and gourds. Fish and birds were also staples of their diet. They traded bowls, baskets, and mats to other native groups and, later, to colonists. Each village was governed by a council presided over by a chief. After contact with European settlers, disease and other factors diminished their numbers rapidly. In the 2000 U.S. census some 1,700 people identified themselves as of sole Catawba descent.

Catawba River River, southeastern U.S. Rising in North Carolina's Blue Ridge, it flows south into South Carolina, where it becomes the Wateree River. It is 220 mi (350 km) long. With the Wateree, it forms an important source of hydroelectric power for South Carolina.

catbird Any of several passerine species (family Mimidae) named for their mewing calls, which they use in addition to song. The North American catbird (*Dumetella carolinensis*) is 9 in. (23 cm) long and gray with a black cap. It is found in gardens and thickets. The black catbird (*Melanoptila glabrirostris*) is found in coastal Yucatán. Three species of the bowerbird family are also called catbirds; they are found in Australia, New Guinea, and nearby islands and do not build bowers but hold territories in the forest by loud singing.

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catch English round, or simple perpetual CANON, for three or more unaccompanied voices. Catches were sung by men as a popular pastime in the 16th–19th centuries. Catch texts were often humorous or ribald, and in some instances a pause in the melody in one voice was filled in by the notes and text of another, creating a pun or change of meaning, especially in the late-17th-century RESTORATION period.

Cateau-Cambrésis \ka-tō-kän-brā-'zē**, Treaty of** (April 3, 1559) Agreement marking the end of the 65-year struggle (1494–1559) between France and Spain for the control of Italy. France gave up its claims to Italian territory, leaving Habsburg Spain the dominant power there. France returned Savoy and Piedmont to Spain's ally Emmanuel-Philibert of Savoy (1528–80) and restored Corsica to Genoa. Elsewhere, France retained Calais, which it had seized from England in 1558, and the bishoprics of Toul, Metz, and Verdun, taken from Emperor CHARLES V.

catechesis See KERYGMA AND CATECHESIS

catechism Manual of religious instruction usually arranged in the form of questions and answers and used to instruct the young, win converts, and testify to the faith. The medieval catechism concentrated on the meaning of faith, hope, and charity. Later catechisms added other subjects and became more important following the REFORMATION and the invention of the printing press. MARTIN LUTHER's Small Catechism (1529) added discussions of baptism and the EUCHARIST. JOHN CALVIN published a children's catechism in 1542. The Anglican catechism is included in the *Book of* COMMON PRAYER. The Baltimore Catechism (1885) is the Catholic catechism best known in the U.S. In 1992 the Vatican issued a new universal *Catechism of the Catholic Church*.

catecholamine \ˌka-tə-'kō-lə-ˌmēn\ Any naturally occurring AMINE functioning as a NEUROTRANSMITTER or HORMONE, including DOPAMINE, NOREPINEPHRINE, and EPINEPHRINE. All are derived from TYROSINE and have a catechol group (BENZENE ring with two hydroxyl groups) with an attached amine group. Neurons in the brain, in the adrenal gland, and in some sympathetic nerve fibres produce different catecholamines.

categorical imperative In IMMANUEL KANT's moral philosophy, an imperative that presents an action as unconditionally necessary (e.g., "Thou shalt not kill"), as opposed to an imperative that presents an action as necessary only on condition that the agent wills something else (e.g., "Pay your debts on time, if you want to be able to obtain a mortgage"). Kant held that there was only one formally categorical imperative, from which all specific moral imperatives could be derived. In one famous formulation, it is: "Act only according to that maxim by which you can at the same time will that it should become a universal law." See also DEONTOLOGICAL ETHICS.

categorical proposition In SYLLOGISTIC, a proposition in which the predicate is affirmed or denied of all or part of the subject. Thus, categorical propositions are of four basic forms: "Every S is P," "No S is P," "Some S is P," and "Some S is not P." These are designated by the letters A, E, I, and O, respectively; thus, "Every man is mortal" is an A-proposition. Categorical propositions are to be distinguished from compound and complex propositions, into which they can enter as integral terms. In particular, they contrast especially with hypothetical propositions, such as "If every man is mortal, then Socrates is mortal."

caterpillar LARVA of a BUTTERFLY or MOTH. Caterpillars have a cylindrical body consisting of 13 segments, with three pairs of legs on the thorax and "prolegs" on the abdomen. The head has six eyes on each side, short antennae, and strong jaws. Though not true WORMS, many caterpillars are called worms (e.g., the inchworm, or LOOPER, and the CUTWORM). Caterpillar-like larvae are also found in other insect groups (e.g., SAWFLIES and scorpionflies).

catfish Any of about 2,500 species of scale-less, mostly freshwater, fishes (order Siluriformes) related to CARP and MINNOWS and named for their whiskerlike barbels (fleshy feelers). All species have at least one pair of barbels on the upper jaw, and some have a pair on the snout and additional pairs on the chin. Many species possess spines that may be associated with venom glands. Found almost worldwide, they are generally bottom-dwelling scavengers that feed on almost any kind of plant or animal matter. Species vary from 1.5 in. to 15 ft (4 cm–4.5 m) long and may weigh up to 660 lbs (300 kg). Many small species are popular aquarium fishes; many large species are used for food.

Cathari \'ka-thə-ˌrī\ *or* **Albigensians** \al-bə-'jen-sē-ənz\ Heretical Christian sect that flourished in Western Europe in the 12th–13th century. The Cathari adhered to the dualist belief that the material world is evil and that humans must renounce the world to free their spirits, which are good and long for communion with God. Jesus was seen as an angel whose human suffering and death were an illusion. Followers divided themselves into the "perfect," who had to maintain the highest moral standards, and ordinary "believers," of whom less was expected. By 1200 they had established 11 bishoprics in France and Italy. In an effort to stamp out their HERESY, Pope INNOCENT III declared the ALBIGENSIAN CRUSADE, in which the populace in Cathar regions was indiscriminately massacred. Persecution through the INQUISITION, sanctioned by St. LOUIS IX, was even more effective, and when the Cathar stronghold of Montségur fell in 1244, most Cathari fled to Italy. The movement disappeared in the 15th century.

catharsis \kə-'thär-səs\ Purging or purification of emotions through art. The term is derived from the Greek *katharsis* ("purgation," "cleansing"), a medical term used by ARISTOTLE as a metaphor to describe the effects of dramatic TRAGEDY on the spectator: by arousing vicarious pity and terror, tragedy directs the spectator's own anxieties outward and, through sympathetic identification with the tragic protagonist, purges them.

Cathay \ka-'thā\ Former name for China, especially northern China. The word is derived from Khitay, the name of a seminomadic people who dominated northern China in the 10th–12th century. By the time of GENGHIS KHAN, the MONGOLS had begun referring to northern China as Kitai (still the Russian word for China). The name may have been introduced to Europe by returning Franciscan friars c. 1254, but it was MARCO POLO's *Travels* 50 years later that put Cathay's image before the European public.

cathedral Church, often large and magnificent, in which a residential bishop has his official seat. Cathedrals are usually embellished versions of early Christian BASILICAS; their construction, on an ever-larger scale, was a major preoccupation throughout Europe in the Middle Ages. Masonry vaulting replaced the earlier timber roofs, and the basilican plan grew more complex. Above the arches of the NAVE, and below the CLERESTORY, was the triforium, an arcaded upper story that often contained vaulted tribune GALLERIES open to the nave. The portion containing seats for the choir, usually east of the TRANSEPT, was called the chancel. Between the chancel and the sanctuary (high altar) was the presbytery, a raised area occupied only by clergy. The chapter house, a popular feature of English cathedrals, was a chamber, typically octagonal, in which business was transacted. Small chapels, including the founder's chantry and the Lady Chapel (dedicated to the Virgin Mary) were often added. Many cathedrals of the Île-de-France region were remodeled to embody a chevet, or arc of radiating chapels, on the eastern wall, a feature reflected in England in WESTMINSTER ABBEY and Canterbury Cathedral.

Cather \'ka-thər**, Willa** *orig.* **Wilella Sibert Cather** (b. Dec. 7, 1873, near Winchester, Va., U.S.—d. April 24, 1947, New York, N.Y.) U.S. novelist. Cather moved with her family to Nebraska at age 9; she returned east 12 years later, eventually settling in New York. *The Troll Garden* (1905), her first short-story collection, contains some of her best-known work. The novels *O Pioneers!* (1913) and *My Ántonia* (1918), often judged her finest achievement, celebrate frontier spirit and courage. *Song of the Lark* (1915), *Youth and the Bright Medusa* (1920), and other works reflect the struggle of a talent to emerge from small-town provincialism. *One of Ours* (1922, Pulitzer Prize) and *A Lost Lady* (1923) mourn the loss of the pioneer spirit. Pioneers of earlier eras also inspired *Death Comes for the Archbishop* (1927) and *Shadows on the Rock* (1931).

Catherine I *Russian* **Yekaterina Alekseyevna** *orig.* **Marta Skowronska** (b. April 15, 1684—d. May 17, 1727, St. Petersburg, Russia) Second wife of PETER I and empress of Russia (1725–27). A peasant woman of Baltic origin, she became Peter's mistress in 1702. In 1703, after the birth of their first child, she was received into the Russian Orthodox church and rechristened. She married Peter in 1712 and in 1724 was crowned empress-consort. After Peter's death (1725), she served two years as empress of Russia.

Catherine II *Russian* **Yekaterina Alekseyevna** *orig.* **Sophie Friederike Auguste, princess von Anhalt-Zerbst** *known as* **Catherine the Great** (b. May 2, 1729, Stettin, Prussia—d. Nov. 17, 1796, Tsarskoye Selo, near St. Petersburg, Russia) German-born empress of Russia (1762–96). The daughter of an obscure German prince, she was chosen at age 14 to be the wife of the future PETER III. The marriage was a complete failure. Because her neurotic husband was incapable of ruling, the ambitious Catherine saw the possibility of eliminating him and governing Russia herself. After Peter became emperor in 1762, she con-

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spired with her lover, Grigory G., Count Orlov, to force Peter to abdicate (he was murdered soon after) and have herself proclaimed empress. In her 34-year reign she led Russia into full participation in European political and cultural life. With her ministers she reorganized the administration and law of the Russian Empire and extended Russian territory, adding the Crimea and much of Poland. Though she had once intended to emancipate the serfs, she instead strengthened the system she had once condemned as inhuman. She had great energy and wide interests, and her personal life was notable for her many lovers, including Grigory Potemkin.

Catherine de Médicis \kà-trēn-də-mā-dē-ˈsēs\ *orig.* **Caterina de' Medici** (b. April 13, 1519, Florence—d. Jan. 5, 1589, Blois, France) Queen consort of Henry II (1547–59), mother of Francis II, Charles IX, and Henry III, and regent of France (1560–74). A member of the Medici family, she married Henry in 1533 and bore him 10 children. She became queen when Henry inherited the crown in 1547, and she greatly mourned his accidental death in 1559. After their son Francis became king, she began a long struggle with members of the Guise family, extremists who sought to dominate the crown. After Francis's premature death in 1560, she became regent for Charles IX until 1563 and dominated the rest of his reign until 1574. She attempted to settle the Wars of Religion between Catholics and Huguenots. She has traditionally been blamed for the Massacre of Saint Bartholomew's Day, but, though she authorized the assassination of Gaspard II de Coligny and his principal followers, it appears that she did not authorize the massacre that followed.

Catherine Howard (b. c. 1520—d. Feb. 13, 1542, London, Eng.) Fifth wife of Henry VIII of England. The granddaughter of the 2nd duke of Norfolk, she became a maid of honour to Anne of Cleves, Henry's fourth wife. After Henry had his marriage to Anne annulled, he married Catherine (1540). In 1541 he learned that Catherine had had several affairs before their marriage and that she also had probably committed adultery. Incensed, he had Parliament pass a bill in 1542 declaring it treason for an unchaste woman to marry the king. Catherine was beheaded two days later in the Tower of London.

Catherine of Alexandria, Saint (d. c. early 4th century, Alexandria, Egypt; feast day November 25) Early Christian martyr. According to tradition, she was a learned girl of noble birth who protested the persecution of Christians during the reign of the Roman emperor Maxentius. She converted the emperor's wife and defeated in debate the best scholars he sent to oppose her. She was sentenced to be killed with a spiked wheel (the Catherine wheel), but, when it broke, she was beheaded instead. Her body was transported by angels to the top of Mount Sinai. One of the most popular saints of the Middle Ages, she was patron of philosophers and scholars. Her historicity is doubtful.

Catherine of Aragon (b. Dec. 16, 1485, Alcalá de Henares, Spain—d. Jan. 7, 1536, Kimbolton, Huntingdon, Eng.) First wife of Henry VIII. The daughter of Ferdinand II and Isabella I, she married Henry in 1509. She gave birth to six children, but only one daughter (later Mary I) survived infancy. Henry's desire for a legitimate male heir prompted him in 1527 to appeal to Rome for an annulment, but Pope Clement VII refused, triggering the break between Henry and Rome and leading to the English Reformation. In 1533 Henry had his own archbishop of Canterbury, Thomas Cranmer, annul the marriage, and Catherine spent her last years isolated from public life.

Catherine of Aragon.
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Catherine of Braganza (b. Nov. 25, 1638, Vila Viçosa, Port.—d. Dec. 31, 1705, Lisbon) Portuguese wife of Charles II of England. She was married to Charles in 1662 as part of an alliance between England and Portugal, bringing England trading privileges and the port cities of Tangier and Bombay (now Mumbai). She produced no heir. Though not a faithful husband, Charles defended her against accusations of scheming to poison him. She helped convert him to Catholicism shortly before his death. In 1692 she returned to Portugal, and in 1704 she governed the country as regent for her ailing brother, Pedro II.

Catherine of Siena, Saint *orig.* **Caterina Benincasa** (b. March 25, 1347, Siena, Tuscany—d. April 29, 1389, Rome; canonized 1461; feast day April 29) Dominican mystic and patron saint of Italy. She joined the Dominican third order in Siena in 1363 and soon became known for her holiness and severe asceticism. Catherine called for a Crusade against the Muslims as a means of calming domestic conflict in Italy. She also played a major role in returning the papacy from Avignon to Rome (see Avignon papacy). Her writings include four treatises on religious mysticism known as *The Dialogue of St. Catherine*.

Catherine Parr (b. 1512—d. Sept. 7, 1548) Sixth and last wife of King Henry VIII of England. The daughter of an official in the royal household, she had been widowed twice by the time she married Henry in 1543. She exerted a beneficial influence on the increasingly paranoid king and developed close friendships with his children by previous marriages. After Henry's death in 1547, she married Baron Thomas Seymour but died shortly after giving birth to a daughter.

catheterization \ˌka-thə-tə-rə-ˈzā-shən\ Threading of a flexible tube (catheter) through a channel in the body to inject drugs or a contrast medium, measure and record flow and pressures, inspect structures, take samples, diagnose disorders, or clear blockages. A cardiac catheter, passed into the heart through an artery or vein (the incision is often in the groin), can also carry pacemaker electrodes. A bladder catheter goes through the urethra into the bladder.

cathode Terminal or electrode at which electrons enter a system, such as an electrolytic cell or an electron tube. In a battery or other source of direct current, the cathode is the positive terminal. In a passive load it is the negative terminal. In an electron tube, such as a cathode-ray tube, electrons stream off the cathode and travel through the tube toward the anode.

cathode ray Stream of electrons leaving the negative electrode, or cathode, in an evacuated or gas-filled discharge tube or emitted by a heated filament in certain electron tubes. Cathode rays cause fluorescent materials to luminesce and are utilized in cathode-ray oscilloscopes and television tubes (see cathode-ray tube).

cathode-ray tube (CRT) Vacuum tube that produces images when its phosphorescent surface is struck by electron beams. CRTs can be monochrome (using one electron gun) or colour (typically using three electron guns to produce red, green, and blue images that, when combined, render a multicolour image). They come in a variety of display modes, including CGA (Color Graphics Adapter), VGA (Video Graphics Array), XGA (Extended Graphics Array), and the high-definition SVGA (Super Video Graphics Array). See illustration on opposite page.

Catholic church, Old See Old Catholic church

Catholic Emancipation Freedom from discrimination and civil disabilities granted to the Roman Catholics of Britain and Ireland in the late 18th and early 19th century. After the Reformation, Roman Catholics in Britain could not purchase land, hold offices or seats in Parliament, inherit property, or practice their religion without incurring civil penalties. Irish Catholics faced similar limitations. By the late 18th century, Catholicism no longer seemed so great a social and political danger, and a series of laws, culminating in the Emancipation Act of 1829, eased the restrictions. A major figure in the struggle for full emancipation was Daniel O'Connell.

Catholic League (1609–35) Military alliance of the Catholic powers of Germany, led by Maximilian I, duke of Bavaria, and designed to stem the growth of Protestantism in Germany. Plans for a league had long been discussed, but the formation of the Protestant Union in 1608 finally caused the Catholics to unite. In alliance with the Habsburg emperors, the League's forces, led by Graf von Tilly, played a key role in the Thirty Years' War. The league was abolished by the Peace of Prague (1635).

Catholic Reformation See Counter-Reformation

Catiline \ˈkat-ᵊl-ˌīn\ *orig.* **Lucius Sergius Catilina** (b. c. 108—d. 62 BC, Pistoria, Etruria [Italy]) Roman aristocrat turned demagogue who sought to overthrow the republic. He was first suspected of conspiracy in 65, after which he sought to be elected consul. Failing twice, he planned a coup, known as Catiline's conspiracy (63), assembling an army outside Rome from his supporters among the alienated and discontented elements

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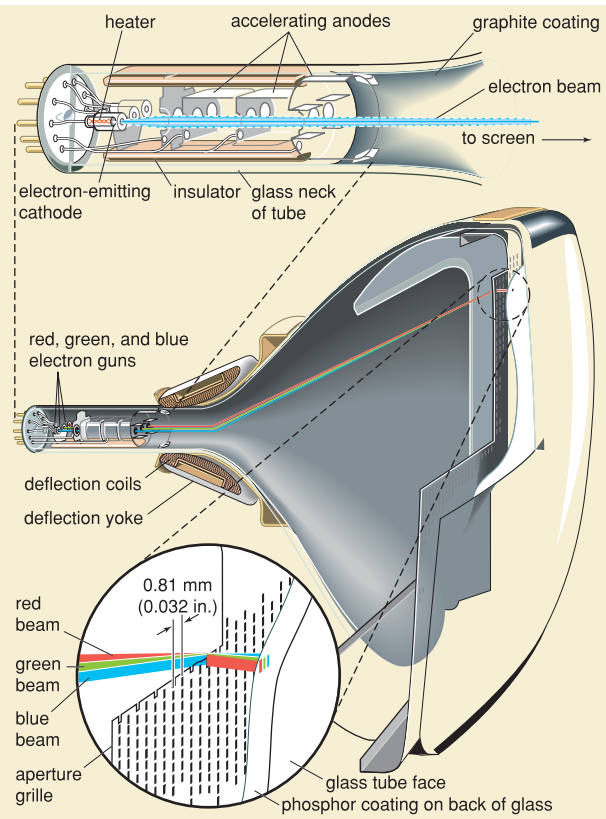
of society. CICERO, then consul, learned of the conspiracy; with Senate approval, he caught and executed a group of the plotters in Rome, and later sent the army to defeat and kill Catiline in northern Italy (62).

cation \'kat-ˌī-ən\ ATOM or group of atoms carrying a positive ELECTRIC CHARGE, indicated by a superscript plus sign after the chemical symbol. Cations in a liquid subjected to an ELECTRIC FIELD collect at the negative pole (CATHODE). Examples include SODIUM (Na^+), CALCIUM (Ca^{2+}), and ammonium (NH_4^+; SEE AMMONIA). See also ION; compare ANION.

catkin Elongated cluster of single-sex flowers bearing scaly BRACTS and usually lacking petals. Many trees bear catkins, including WILLOWS, BIRCHES, and OAKS. Wind carries pollen from male to female catkins or from male catkins to female flowers that take a different form (e.g., in spikes).

Catlett, Elizabeth (b. April 15, 1919, Washington, D.C., U.S.) Expatriate U.S. sculptor and printmaker. Catlett was born into a middle-class family. After studying sculpture, she went to Mexico City in 1946 to work at the Taller de Gráfica Popular, an artists' collective, where she created prints depicting Mexican life. About 1962 she took Mexican citizenship. In her sculptures and prints, Catlett focused on mother-child pairings, famous subjects such as Harriet Tubman and Malcolm X, and anonymous workers—notably strong, solitary black women.

Catlin, George (b. July 26, 1796, Wilkes-Barre, Pa., U.S.—d. Dec. 23, 1872, Jersey City, N.J.) U.S. painter and author. He practiced law briefly before becoming a self-taught portrait painter in Philadelphia (1823). Long interested in Native American life, in 1830 he began a series of visits to various tribes on the Great Plains. He produced some 500 paintings and sketches based on his travels and exhibited them in the U.S. and Europe. In 1854–57 he traveled to Central and South America; in 1858–70 he lived in Europe. He published several illustrated books on Native American life. Most of his collection was acquired by the Smithsonian Institution for its ethnographic and historical interest.



In a colour-television tube, three electron guns (one each for red, green, and blue) fire electrons toward the phosphor-coated screen. The electrons are directed to a specific spot (pixel) on the screen by magnetic fields, induced by the deflection coils. To prevent "spillage" to adjacent pixels, a grille or shadow mask is used. When the electrons strike the phosphor screen, the pixel glows. Every pixel is scanned about 30 times per second.
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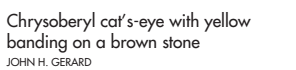
catnip *or* **catmint** Aromatic herb (*Nepeta cataria*) of the MINT family. Catnip has spikes of small, purple-dotted flowers. It has been used as a seasoning and as a medicinal tea for colds and fever. Because its mintlike flavour and aroma are particularly exciting to domestic cats, it is often used as a stuffing for cat toys.

Catnip (*Nepeta cataria*).
WALTER CHANDOHA

Cato \'kā-tō**, Marcus Porcius** *known as* **Cato the Censor** *or* **Cato the Elder** (b. 234, Tusculum, Latium—d. 149 BC) Roman statesman and orator, the first important Latin prose writer. Born of plebeian stock, he fought in the Second PUNIC WAR. His oratorical skills paved the way for his political career. He held conservative anti-Hellenic views and opposed the pro-Hellenic Scipio family, whose power he broke. Elected censor (magistrate in charge of censuses, taxes, and the public good) in 184, he tried to restore the *mos majorum* ("ancestral custom") and combat Greek influence, which he believed undermined Roman morality. He crafted laws against luxury and the financial freedom of women and never ceased to demand the destruction of Carthage. His writings include works on history, medicine, law, military science, and agriculture. His great-grandson Cato the Younger (b. 95—d. 46 BC) was a leading Optimate (see OPTIMATES AND POPULARES) who sought to preserve the republic against Julius CAESAR.

Cats \'käts**, Jacob(us)** *known as* **Father Cats** (b. Nov. 10, 1577, Brouwershaven, Zeeland, Spanish Netherlands—d. Sept. 12, 1660, Zorgvliet, near The Hague) Dutch poet. A magistrate and high official, he was enormously popular as a writer of emblem books, consisting of woodcuts or engravings with verses possessing a moral. His *Mirror of Old and New Times* (1632) contains many quotations that have become household sayings in the Netherlands, and he used it to express the ethical concerns of Dutch Calvinists, especially about love and marriage.

cat's-eye Any of several gemstones that display a luminous band reminiscent of the eye of a cat. Grayish green or greenish quartz cat's-eye is the most common type; although it comes from the Orient, it is often called occidental cat's-eye to differentiate it from the rarer, and more valuable, precious or oriental cat's-eye, which is a greenish variety of chrysoberyl. Crocidolite cat's-eye (African cat's-eye) is more commonly known as TIGEREYE. Corundum cat's-eye is an imperfect star sapphire or ruby in which the star is reduced to a luminous zone.


Chrysoberyl cat's-eye with yellow banding on a brown stone
JOHN H. GERARD

Catskill Mountains Mountain group of the APPALACHIAN mountain system, southeastern New York, U.S. It is bounded by the MOHAWK and HUDSON rivers. Many of its peaks reach 3,000 ft (900 m); the highest, Slide Mountain, reaches 4,204 ft (1,281 m). The area has many resorts, and its lakes supply New York City with water. The mountains were made famous through WASHINGTON IRVING's stories of Rip Van Winkle, who supposedly took his long nap near the town of Catskill.

Catt, Carrie Chapman *orig.* **Carrie Lane** (b. Jan. 9, 1859, Ripon, Wis., U.S.—d. March 9, 1947, New Rochelle, N.Y.) U.S. advocate of woman suffrage. A graduate of Iowa State College (1880), she became a high-school principal in Mason City, Iowa, in 1881 and superintendent of schools two years later; she was one of the first U.S. women to hold such a post. She married Leo Chapman in 1884. After his untimely death in

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built, the impala stands 30–40 in. (75–100 cm) high at the shoulder. It has a golden to reddish brown coat, white underparts, a vertical black stripe on each thigh, and a black tuft behind each hind hoof. The male has long, lyre-shaped horns.

impatiens \im-'pā-shənz\ Any of about 900 species of herbaceous plants in the genus *Impatiens* (BALSAM family), so named because the seed-pod bursts when slightly touched. Garden balsam (*I. balsamina*), native to the tropics of Asia, is a favourite showy annual in U.S. gardens; its flowers are irregular, single or clustered, and of almost every colour but blue. Familiar related weeds in eastern North America are spotted jewelweed (*I. biflora* or *I. capensis*) and pale TOUCH-ME-NOT. Most impatiens have weak, hollow stems and require high moisture. Close relatives are GERANIUMS and NASTURTIUMS.

impeachment Criminal proceeding instituted against a public official by a legislative body. In the U.S. the president, vice president, and other federal officers, including judges, may be impeached by the U.S. House of Representatives. The House draws up articles of impeachment that itemize the charges and their factual bases. Once approved by a majority of House members, the articles are submitted to the Senate, which holds a trial. At its conclusion, each member votes for or against conviction on each article; conviction requires a two-thirds majority. A convicted official can be removed from office. The CONSTITUTION OF THE UNITED STATES specifies that an officer is to be impeached for "high crimes and misdemeanors"; experts agree that impeachment is permitted for noncriminal misconduct (e.g., violation of the Constitution). Two U.S. presidents, ANDREW JOHNSON and BILL CLINTON, were impeached; both were acquitted. In 1974, articles of impeachment were drawn up against Pres. RICHARD NIXON, who resigned before formal proceedings could begin. In Britain, where the House of COMMONS prosecutes and the House of LORDS judges impeachment proceedings, impeachment was formerly a means by which Parliament could get rid of unpopular ministers, usually court favourites protected by the monarch. The procedure fell into disuse in the early 19th century, when cabinet ministers became responsible to Parliament rather than to the sovereign.

Imperial Chemical Industries PLC (ICI) Major British chemical corporation. It was founded in 1926 as Imperial Chemical Industries Ltd. to amalgamate four major British chemical companies. Between World Wars I and II, ICI was a major competitor of IG FARBEN. Today it produces industrial chemicals, paints, and explosives; its drug, pesticide, and specialty chemical concerns were split off into a new corporation, Zeneca Group PLC, in 1993. ICI's headquarters are in London.

Imperial Conferences Periodic meetings held between 1907 and 1937 by the dominions within the British Empire and later the COMMONWEALTH. Convened to discuss mutual defense and economic issues, they passed nonbinding resolutions. However, the Statute of WESTMINSTER implemented decisions made at the 1926 and 1930 conferences that described the self-governing dominions (Canada, Australia, New Zealand, South Africa, Ireland, and Newfoundland) as "autonomous communities within the British empire." After World War II, meetings between the countries' prime ministers replaced the conferences.

Imperial Valley Valley extending from southeastern California, U.S., to Mexico. It forms part of the Colorado Desert. Intensive irrigation began in 1901 with the opening of the Imperial Canal, which diverted water from the COLORADO RIVER. Floodwaters in 1905–07 destroyed the irrigation channels and created the SALTON SEA. The valley is now watered by the HOOVER DAM and the All-American Canal. With 3,000 mi (4,800 km) of irrigation canals, it contains 500,000 acres (200,000 hectares) of cultivated land.

imperialism State policy, practice, or advocacy of extending power and dominion, especially by direct territorial acquisition or by gaining political and economic control of other areas. Because imperialism always involves the use of power, often in the form of military force, it is widely considered morally objectionable, and the term accordingly has been used by states to denounce and discredit the foreign policies of their opponents. Imperialism in ancient times is clear in the unending succession of empires in China, western Asia, and the Mediterranean. Between the 15th century and the middle of the 18th, England, France, the Netherlands, Portugal, and Spain built empires in the Americas, India, and the East Indies. Russia, Italy, Germany, the United States, and Japan became imperial powers in the period from the middle of the 19th century to World War I. The imperial designs of Japan, fascist Italy, and Nazi Germany in the 1930s culminated in the outbreak of World War II. After the war the Soviet Union consolidated its military and political control of the states of eastern Europe (see IRON CURTAIN). From the early 20th century the U.S. was accused of imperialism for intervening in the affairs of developing countries in order to protect the interests of U.S.-owned international corporations (see UNITED FRUIT CO.). Economists and political theorists have debated whether imperialism benefits the states that practice it and whether such benefits or other reasons ever justify a state in pursuing imperialist polices. Some theorists, such as NICCOLÒ MACHIAVELLI, have argued that imperialism is the justified result of the natural struggle for survival among peoples. Others have asserted that it is necessary in order to ensure national security. A third justification for imperialism, offered only infrequently after World War II, is that it is a means of liberating peoples from tyrannical rule or bringing them the blessings of a superior way of life. See also COLONIALISM; SPHERE OF INFLUENCE.

impetigo \im-pə-'tī-ˌgō, im-pə-'tē-ˌgō\ Bacterial inflammatory skin disease, the most common skin infection in children. Initial blisters rupture, drying to a crust. Caused by STAPHYLOCOCCUS or STREPTOCOCCUS, it is very contagious in newborns, becoming less so with age. Poor hygiene, crowding, and humid, hot weather may promote its spread. A broad-spectrum antibiotic applied to the blisters can treat simple impetigo; more extensive cases, especially in infants, may require a systemic antibiotic.

Imphal \'imp-ˌhəl\ City (pop., 2001 prelim.: 217,275), capital of MANIPUR state, northeastern India. Located east-northeast of KOLKATA (Calcutta), it lies in the Manipur River valley at an elevation of 2,500 feet (760 meters). It was the seat of the kings of Manipur before the region came under British rule. In 1944 it was the site of a victory for the Anglo-Indian forces over the Japanese on the Burmese front. Imphal is a major trade centre, noted for its weaving, brass ware, and bronze ware.

implication In LOGIC, a relation that holds between two propositions when they are linked as antecedent and consequent of a true conditional proposition. Logicians distinguish two main types of implication, material and strict. Proposition p materially implies proposition q if and only if the material conditional $p \supset q$ (read "if p then q") is true. A proposition of the form $p \supset q$ is false whenever p is true and q is false; it is true in the other three possible cases (i.e., p true and q true; p false and q true; p false and q false). It follows that whenever p is false, $p \supset q$ is automatically true: this is a peculiarity that makes the material conditional inadequate as an interpretation of the meaning of conditional sentences in ordinary English. On the other hand, proposition p strictly implies proposition q if and only if it is *impossible* for p to be true without q also being true (i.e., if the conjunction of p and not-q is impossible).

impotence \'im-pə-təns\ Inability to achieve or maintain erection of the PENIS; hence, inability to participate fully in SEXUAL INTERCOURSE. Erectile impotence (failure to achieve erection) may have either physical causes (e.g., alcoholism, endocrine disease) or psychological ones (e.g., anxiety, hostility toward the partner). Ejaculatory impotence (inability to reach orgasm, sometimes with an erection maintained for a long time) nearly always has an emotional cause. See also VIAGRA.

Impressionism Movement in art that developed in France in the late 19th century. In painting it included works produced c. 1867–86 by a group of artists who shared approaches, techniques, and discontent with academic teaching, originally including CLAUDE MONET, PIERRE-AUGUSTE RENOIR, CAMILLE PISSARRO, ALFRED SISLEY, and BERTHE MORISOT. Later ÉDOUARD MANET, whose earlier style had strongly influenced several of them, MARY CASSATT, EDGAR DEGAS, PAUL CÉZANNE and others joined them. The identifying feature of their work was an attempt to record a scene accurately and objectively, capturing the transient effects of light on colour and texture. To this end they abandoned the traditional muted browns, grays, and greens in favour of a lighter, more brilliant palette; stopped using grays and blacks for shadows; built up forms out of discrete flecks and dabs of colour; and often painted out of doors, rather than in the studio. They abandoned traditional formal compositions in favour of a more casual and less contrived disposition of objects within the picture frame, and their subject matter included landscapes, trees, houses, and even urban street scenes and railroad stations. After the French Academy's SALON consistently rejected most of their works, they held their own exhibition in 1874; seven others followed. A critic described them derisively as "impressionists," and they adopted the name as an accurate description of their intent. Before dissolving in the late 1880s, the group had revolutionized Western painting. See also POST-IMPRESSIONISM; SALON DES INDÉPENDANTS.

Impressionism In music, a style initiated by French composer CLAUDE DEBUSSY at the end of the 19th century. The term, which is somewhat vague in reference to music, was introduced by analogy with contemporaneous

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French painting; it was disliked by Debussy himself. Elements often termed *impressionistic* include static harmony, emphasis on instrumental timbres that creates a shimmering interplay of "colours," melodies that lack directed motion, surface ornamentation that obscures or substitutes for melody, and an avoidance of traditional musical form. Impressionism can be seen as a reaction against the rhetoric of ROMANTICISM, disrupting the forward motion of standard harmonic progressions. The other composer most often associated with Impressionism is MAURICE RAVEL. Impressionistic passages are common in earlier music by FRÉDÉRIC CHOPIN, FRANZ LISZT, and RICHARD WAGNER, and in music by later composers such as CHARLES IVES, BÉLA BARTÓK, and GEORGE GERSHWIN.

impressment Enforcement of military or naval service on unwilling men. Until the early 19th century, it flourished in port towns everywhere, as "recruiters" searched through waterfront boardinghouses, brothels, and taverns. They often chose vagabonds or prisoners. Impressed men were forced into service through violence or coercion and were held to their duty by brutal discipline. In the early 19th century, ROYAL NAVY ships halting U.S. vessels to search for British deserters frequently impressed naturalized U.S. citizens, one cause of the WAR OF 1812. Impressment declined in the 19th century as states adopted more systematic recruiting methods. See also CONSCRIPTION.

imprinting Form of learning wherein a very young animal fixes its attention on the first object with which it has visual, auditory, or tactile experience and thereafter follows that object. In nature, the object is almost always a parent; in experiments, other animals and inanimate objects have been used. Imprinting has been studied extensively only in birds, but a comparable form of learning apparently takes place among many mammals and some fishes and insects. Ducklings and chicks, which can imprint in a few hours, lose receptivity to imprinting stimuli within 30 hours of hatching.

improvisation Creation of music in real time. Improvisation usually involves some preparation beforehand, particularly when there is more than one performer. Despite the central place of notated music in the Western tradition, improvisation has often played a role, from the earliest ORGANUM through the use of CONTINUO (partially improvised accompaniment played on a bass line) in the 17th and 18th centuries. It has taken forms such as creation of a melody over a bass line for dancing, elaborate ORNAMENTATION added to a repeated section in an aria, keyboard variations on popular songs, concerto cadenzas, and free solo FANTASIAS. Perhaps at its lowest ebb in the 19th century, improvisation returned to concert music in "experimental" compositions and in "authentic" performances of older music. Its most important contemporary Western form is JAZZ. It is also a defining feature of the RAGA.

in vitro fertilization (IVF) \in-'vē-trō\ *or* **test-tube conception** Procedure, used to overcome INFERTILITY, in which EGGS are removed from a woman, fertilized with SPERM outside the body, and inserted into the UTERUS of the same or another woman. The first child thus conceived was born in 1978. IVF includes extraction of eggs, collection of sperm, fertilization in culture, and introduction into the uterus at the eight-cell stage. In a successful procedure, the embryo is implanted in the uterine wall, and pregnancy begins. The most common problem is failed implantation. IVF has been a source of moral, ethical, and religious controversy since its development.

Inari, wood figurine, Tokugawa period (1603–1867); in the Musée Guimet, Paris
COURTESY OF THE MUSEE GUIMET, PARIS

Inari \ē-'nä-rē\ In Japanese mythology, the patron god of rice cultivation and prosperity. He was worshiped especially by merchants and tradesmen, and he also served as patron deity of swordsmiths, brothels, and entertainers. Inari was variously depicted as a bearded old man riding a fox or as a woman with long hair, carrying sheaves of rice. The fox is sometimes identified as his messenger. The god's most popular shrine is the Fushimi Inari Shrine near Kyōto.

inbreeding Mating of closely related individuals. The opposite is outbreeding, the mating of unrelated organisms. Inbreeding is useful in keeping desirable characteristics or eliminating undesirable ones, but it often results in decreased vigour, size, and fertility of the offspring because of the combined effect of harmful GENES that were recessive in both parents (see RECESSIVENESS). The closest type of inbreeding is SELF-FERTILIZATION. In linebreeding, mates are selected on the basis of their relationships to a certain superior ancestor. The backcross (crossing a first-generation hybrid with one of the parental types) is a common method of inbreeding.

Inca Group of South American Indians who ruled an empire that extended along the Pacific coast and ANDES MOUNTAINS from what is now northern Ecuador to central Chile. According to tradition (the Inca left no written records), the founder of the Incan dynasty led the tribe to Cuzco, which became their capital. Under the fourth emperor, they began to expand, and under the eighth they began a program of permanent conquest by establishing garrisons among the conquered peoples. Under Topa Inca Yupanqui and his successor, the empire reached its southernmost and northernmost extent. By the early 16th century the Inca controlled an empire of some 12 million subjects. They constructed a vast network of roads, their architecture was highly developed, and the remains of their irrigation systems, palaces, temples, and fortifications are still in evidence throughout the Andes. Incan society was highly stratified and featured an aristocratic bureaucracy. Their pantheon, worshiped in a highly organized state religion, included a sun god, a creator god, and a rain god. The Incan empire was overthrown in 1532 by the Spanish CONQUISTADORES, who made great use of the Incan road system during their conquests. The Inca's descendants are the Quechua-speaking peasants of the Andes (see QUECHUA). In Peru nearly half the population is of Incan descent. They are primarily farmers and herders living in close-knit communities. Their Roman Catholicism is infused with belief in pagan spirits and divinities. See also ANDEAN CIVILIZATION; ATAHUALLPA; AYMARA; CHIMÚ; FRANCISCO PIZARRO.

incandescent lamp Any of various devices that produce light by heating a suitable material to a high temperature. In an electric incandescent lamp, or lightbulb, a filament is enclosed in a glass shell that is either evacuated or filled with an inert gas. The filament gives off light when heated by an electric current. The first practical electric incandescent lamps were independently produced in the late 1870s by JOSEPH SWAN and THOMAS ALVA EDISON. Edison has received the major credit because of his development of the power lines and other equipment needed for a lighting system. Inefficient in comparison with FLUORESCENT LAMPS and ELECTRIC DISCHARGE LAMPS, incandescent lighting is today reserved mainly for domestic use. See also HALOGEN LAMP.

Incarnation Central Christian doctrine that God became man in the form of JESUS, the son of God and the second person of the Holy TRINITY. In Jesus the divine and human nature are joined but neither is changed or diminished. This difficult doctrine gave rise to a variety of HERESIES, some denying Jesus's divine nature, others his human nature. For orthodox believers the conflict was settled at the Councils of NICAEA (AD 325) and CHALCEDON (AD 451).

incense Grains of RESINS (sometimes mixed with spices) that burn with a fragrant odor, widely used as religious offerings. Historically, the chief substances used as incense have been resins such as FRANKINCENSE and myrrh, along with fragrant wood and bark, seeds, roots, and flowers.

incest Sexual relations between persons who, because of the nature of their KINSHIP ties, are prohibited by law or custom from intermarrying. The incest taboo is generally universal, although it is imposed differently in different societies. Usually, the closer the genetic relationship between two people, the stronger and more highly charged is the TABOO prohibiting or discouraging sexual relations. Some sociobiologists consider that inbred populations have diminished reproductive success and become gene pools for hereditary disorders. Some cultural anthropologists argue instead that the incest prohibition, with the corresponding rules of EXOGAMY, acts to require males to seek sexual and marital partners outside the group, thereby establishing useful alliances. Other theories emphasize the need to control sexual jealousies within the family or to prepare children to function with restraint in adult society. No single explanation seems satisfactory, causing some to question whether incest should be treated as a unitary subject. Most cases of incest that come before criminal courts concern sexual intercourse between fathers and relatively young daughters (see CHILD ABUSE).

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inch Unit of measure equal to 1/36 YARD and since 1959 defined officially as 2.54 cm (see METRE). DAVID I of Scotland (c. 1150) defined the inch as the breadth of a man's thumb at the base of the nail; usually the thumb breadths of three men—one small, one medium, and one large—were added and then divided by three. During the reign of England's EDWARD II, the inch was defined as "three grains of barley, dry and round, placed end to end lengthwise." At various times it has also been defined as the combined lengths of 12 poppy seeds. See also FOOT; INTERNATIONAL SYSTEM OF UNITS; MEASUREMENT; METRIC SYSTEM.

In'chŏn \'in-ˌchän\ *or* **Incheon** *formerly* **Jinsen** \'jin-ˌsen\ *or* **Chemulpo** \jə-'mùl-pō\ Seaport city (pop., 2002 est.: 2,596,102), South Korea, near SEOUL. A fishing port since the 14th century, it was a Korean treaty port in 1883 and developed as an international commercial port before the Japanese occupation (1910–45). During the KOREAN WAR it was the site of a successful UN troop landing in 1950. It now has metropolitan city (provincial) status. Its industries produce iron and steel, glass, chemicals, and lumber.

inchworm See LOOPER

incidental music Music composed to accompany a play. The practice dates back to ritualistic Greek drama, and it is thus connected to the use of music in other kinds of ritual. Sometimes limited to the role of introduction or interlude (setting a mood or a historical period, for example), it may also accompany spoken dialogue (see MELODRAMA). Film and television music is sometimes considered incidental music.

Inclán, Ramón María del Valle- See Ramón María del VALLE-INCLÁN

income statement In accounting, the activity-oriented financial statement issued by businesses. Covering a specified time, such as three months or one year, the income statement is a summary of revenues and expenses. It also lists gains and losses from other transactions, such as the sale of assets or the repayment of debt. Standard accounting rules govern the procedures for recording each item.

income tax Levy imposed by public authority on the incomes of persons or corporations within its jurisdiction. In nations with an advanced system of private enterprise, income taxes represent the chief source of government revenue. Income tax levied on individuals or family units is known as personal income tax. In 1799 Britain enacted a general income tax to finance the Napoleonic Wars. In the U.S. an income tax was first tried during the Civil War; the Supreme Court held it to be constitutional in 1881 but declared another income tax unconstitutional in 1894. In 1913 the 16th Amendment to the Constitution made the personal income tax permanent. The fairness of personal income taxation is based on the premise that one's income is the best single index of one's ability to contribute to the support of the government; most personal income taxes are conceived on the theory that when people's financial circumstances differ, their tax liabilities should also differ. Thus U.S. income taxes are PROGRESSIVE TAXes, falling more heavily on those who earn more money, and individual income tax deductions are allowed for items such as interest paid on home MORTGAGE debt, unusual medical expenses, philanthropic contributions, and state and local income and property taxes. Enforcement has been facilitated by withholding the tax from wages and salaries. See also CAPITAL GAINS TAX; CAPITAL LEVY; CORPORATE INCOME TAX; REGRESSIVE TAX; SALES TAX; VALUE-ADDED TAX.

incomes policy Collective governmental effort to control the incomes of LABOUR and CAPITAL, usually by limiting increases in wages and PRICES. The term often refers to policies directed at the control of INFLATION, but it may also indicate efforts to alter the distribution of income among workers, industries, locations, or occupational groups. See also WAGE-PRICE CONTROL.

incontinence Inability to control EXCRETION. Starting and stopping URINATION relies on normal function in pelvic and abdominal muscles, diaphragm, and control nerves. Babies' nervous systems are too immature for urinary control. Later incontinence may reflect disorders (e.g., NEURAL TUBE DEFECT causing "neurogenic bladder"), paralysis of URINARY SYSTEM muscles, long-term bladder distension, or certain urogenital malformations. Weak pelvic muscles can allow small urine losses on coughing or sneezing ("stress incontinence"). Uncontrolled DEFECATION can result from spinal or bodily injuries, old age, extreme fear, or severe DIARRHEA. See also ENURESIS.

incubus and succubus Demons (male and female, respectively) who seek to have sexual intercourse with sleeping humans. In medieval Europe some believed that union with an incubus resulted in the birth of witches, demons, and deformed human offspring. MERLIN was said to have been fathered by an incubus.

incunabulum \ˌin-kyə-'nab-yə-ləm\ Book printed before 1501. The date, though convenient, is arbitrary and unconnected to any development in the printing art. The term was probably first applied to early printing in general c. 1650. The total number of editions produced by 15th-century European presses is generally estimated at above 35,000, excluding ephemeral literature (e.g., single sheets, ballads, and devotional tracts) that is now lost or exists only in fragments in places such as binding linings.

Indépendants, Salon des See SALON DES INDÉPENDANTS

Independence City (pop., 2000: 113,288), western Missouri, U.S. Settled in 1827, it served as the starting point for the SANTA FE TRAIL and the OREGON TRAIL and was a rendezvous for wagon trains during the California GOLD RUSH. Home of a MORMON colony (1831–33), it is now the world headquarters of the Community of Christ (formerly Reorganized Church of Jesus Christ of Latter Day Saints). It was occupied by Union troops during the AMERICAN CIVIL WAR and was the scene of two skirmishes with Confederates. The hometown of Pres. HARRY TRUMAN, it is the site of the Harry S. Truman Library and Museum.

Independence, Declaration of See DECLARATION OF INDEPENDENCE

Independence Day *or* **Fourth of July** Anniversary of the adoption of the U.S. DECLARATION OF INDEPENDENCE by the Second CONTINENTAL CONGRESS (July 4, 1776). It is the greatest secular holiday in the country. Celebrating the day became common only after the War of 1812. Thereafter, civic-minded groups worked to link the ideals of democracy and citizenship to the patriotic spirit of the day.

independent counsel *formerly* **special prosecutor** Official appointed by the court at the request of the U.S. attorney general to investigate and prosecute criminal violations by high government officials, members of Congress, or directors of a presidential election campaign after an investigation by the attorney general finds evidence that a crime may have been committed. The counsel is intended to ensure an impartial investigation in situations in which the attorney general would face a conflict of interest. The law establishing the office was passed after the firing of Archibald Cox by Pres. RICHARD NIXON during the WATERGATE SCANDAL. Independent counsels played a prominent role in the IRAN-CONTRA AFFAIR in the 1980s. In 1999, in the wake of controversy over perceived abuses of the office during the Whitewater investigation of Pres. BILL CLINTON, Congress declined to renew the independent counsel law.

independent school See PUBLIC SCHOOL (BRITISH)

Independent States, Commonwealth of See COMMONWEALTH OF INDEPENDENT STATES

indeterminacy principle See UNCERTAINTY PRINCIPLE

Index librorum prohibitorum \'in-deks-lī-'brō-rəm-prō-ˌhi-bə-'tō-rəm\ *Latin* **Index of Forbidden Books** List of books considered dangerous to the faith or morals of Catholics. Compiled by official Roman Catholic censors, the *Index* was never a complete catalog of forbidden reading; it contained only works that the ecclesiastical authority was asked to act on. Though the church's concern over books is much older, the first catalog of banned books to be called an index was published in 1559. Publication of the list ceased in 1966, and it was relegated to the status of a historic document.

indexation Comparison of PRICE levels over time. In FISCAL POLICY, indexation is used as a means of offsetting the effect of INFLATION or DEFLATION on SOCIAL SECURITY payments and taxes by measuring the real value of money from a fixed point of reference, usually a PRICE INDEX. Without indexing, recipients of social security benefits, for example, would suffer during times of inflation if their benefits remained at a fixed rate. Indexation is used in some countries to offset "bracket creep," which occurs in any PROGRESSIVE TAX system when inflation pushes taxpayers into higher tax brackets. Indexation may also refer to the linking of wage rates and financial instruments to a price index.

India *officially* **Republic of India** Country, South Asia. It fronts the Bay of BENGAL on the southeast and the ARABIAN SEA on the southwest. Area: 1,222,559 sq mi (3,166,414 sq km). Population (2005 est.): 1,103,371,000. Capital: NEW DELHI. The peoples of India comprise widely

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varying mixtures of ethnic strains drawn from peoples settled in the subcontinent before the dawn of history or from invaders. Languages: Hindi, English (both official), and other Indo-European languages, including Bengali, Kashmiri, Marathi, and Urdu; DRAVIDIAN LANGUAGES; hundreds from several other language families. Religions: Hinduism; also Islam, Christianity, Sikhism, Buddhism, Jainism. Currency: rupee. India has three major geographic regions: the HIMALAYAS, along its northern border; the INDO-GANGETIC PLAIN, formed by the alluvial deposits of three great river systems, including the GANGES (Ganga); and the southern region, noted for the DECCAN plateau. Agricultural products include rice, wheat, cotton, sugarcane, coconut, spices, jute, tobacco, tea, coffee, and rubber. The manufacturing sector is highly diversified and includes both heavy and high-technology industries. India is a republic with two legislative houses; its chief of state is the president, and the head of government is the prime minister. India has been inhabited for thousands of years. Agriculture in India dates to the 7th millennium BC, and an urban civilization, that of the INDUS valley, was established by 2600 BC. BUDDHISM and JAINISM arose in the 6th century BC in reaction to the caste-based society created by the VEDIC RELIGION and its successor, Hinduism. Muslim invasions began c. AD 1000, establishing the long-lived DELHI SULTANATE in 1206 and the MUGHAL DYNASTY in 1526. VASCO DA GAMA's voyage to India in 1498 initiated several centuries of commercial rivalry between the Portuguese, Dutch, English, and French. British conquests in the 18th and 19th centuries led to the rule of the British EAST INDIA CO., and direct administration by the BRITISH EMPIRE began in 1858. After MOHANDAS K. GANDHI helped end British rule in 1947, JAWAHARLAL NEHRU became India's first prime minister, and Nehru, his daughter INDIRA GANDHI, and his grandson RAJIV GANDHI guided the nation's destiny for all but a few years until 1991. The subcontinent was partitioned into two countries—India, with a Hindu majority, and PAKISTAN, with a Muslim majority—in 1947. A later clash with Pakistan resulted in the creation of BANGLADESH in 1971. In the 1980s and '90s, Sikhs sought to establish an independent state in PUNJAB, and ethnic and religious conflicts took place in other parts of the country as well. The KASHMIR region in the northwest has been a source of constant tension.

India rubber plant See RUBBER PLANT

Indian buffalo See WATER BUFFALO

Indian law Legal practices and institutions of India. Indian law draws on a number of sources, beginning with the customs of the ancient VEDAS and later accretions of Hindu law, which largely concern social matters such as marriage and succession. After the Arab invasions of the 8th century, Islamic law (see SHARĪʿAH) was introduced in some areas, particularly in the north. English COMMON LAW became the residual law in jurisdictions under British colonial control, while the Portuguese and French used their own laws in their colonies. Since independence (1947), India has aimed at developing a unified civil code and updating its criminal code.

Indian licorice See ROSARY PEA

Indian Mutiny *or* **Sepoy Mutiny** (1857–58) Widespread rebellion against British rule in India begun by Indian troops (sepoys) in the service of the English EAST INDIA COMPANY. The mutiny began when sepoys refused to use new rifle cartridges (which were thought to be lubricated with grease containing a mixture of pigs' and cows' lard and thus religiously impure). They were shackled and imprisoned, but their outraged comrades shot their British officers and marched on Delhi. The ensuing fighting was ferocious on both sides and ended in defeat for the mutineers. Its immediate result was that the East India Company was abolished in favour of direct rule of India by the British government; in addition, the British government began a policy of consultation with Indians. British-imposed social measures that had antagonized Hindu society (e.g., a proposed bill that would remove legal obstacles to the remarriage of Hindu women) were also halted.

Indian National Congress *or* **Congress Party** Broadly based political party of India, founded in 1885. The Congress Party was a moderate reform party until 1917, when it was taken over by its "extremist" Home Rule wing (see BAL GANGADHAR TILAK). In the 1920s and '30s, under MOHANDAS K. GANDHI, it promoted noncooperation to protest the feebleness of the constitutional reforms of 1919. During World War II, the party announced that India would not support the war until granted complete independence. In 1947 an Indian independence bill became law, and in 1950 the constitution took effect. JAWAHARLAL NEHRU dominated the party from 1951 to 1964. The Indian National Congress formed most of India's governments from 1947 to 1996, but at the end of the 20th century, its support plummeted. After several years out of power, it returned to government in 2004.

Indian Ocean Body of salt water stretching between Africa in the west, Australia in the east, Asia in the north, and Antarctica in the south. With an area of 28,360,000 sq mi (73,440,000 sq km), it covers approximately

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one-seventh of the Earth's surface, and it is the smallest of the world's three major oceans (see ATLANTIC OCEAN; PACIFIC OCEAN). Its greatest depth (24,442 ft [7,450 m]) is in the Java Trench. Its chief marginal seas include the RED SEA, ARABIAN SEA, PERSIAN GULF, ANDAMAN SEA, Bay of BENGAL, and the GREAT AUSTRALIAN BIGHT. Its major islands and island groups include MADAGASCAR, SRI LANKA, and the Mascarenes.

Indian paintbrush *or* **paintbrush** Any plant of the genus *Castilleja* (SNAPDRAGON FAMILY), which contains about 200 species of partially or wholly parasitic wildflowers that obtain nourishment from the roots of other plants. The small, tubular, two-lipped flowers are surrounded by brightly coloured upper leaves, giving the plant the appearance of having been dipped in a pot of red, orange, yellow, pink, or white paint.

Indian philosophy Any of the numerous philosophical systems developed on the Indian subcontinent, including both orthodox (*astika*) systems, namely, the NYAYA, VAISHESHIKA, SAMKHYA, YOGA, MIMAMSA, and VEDANTA schools of philosophy, and unorthodox (*nastika*) systems, such as BUDDHISM and JAINISM. The history of Indian philosophy may be divided into three periods: the prelogical (to the beginning of the Christian era), the logical (1st–11th century), and the ultralogical (11th–18th century). What Dasgupta calls the prelogical stage covers the pre-Mauryan and the Mauryan periods (c. 321–185 BC) in Indian history. The logical period begins roughly with the Kusanas (1st–2nd century AD) and was developed most fully in the Gupta era (3rd–5th century) and in the age of imperial Kanauj (7th century). In the 19th century, newly founded universities introduced Indian intellectuals to Western thought, particularly British EMPIRICISM and UTILITARIANISM. Indian philosophy in the early 20th century was influenced by German IDEALISM. Later Indian philosophers made significant contributions to ANALYTIC PHILOSOPHY.

Indian pipe Nongreen herbaceous plant (*Monotropa uniflora*) that is saprophytic (living on the remains of dead plants). Clusters grow in moist, shady, wooded areas of North America and Asia. The entire plant is white or grayish, occasionally pink, and turns black as it dries out. A single odourless, cup-shaped flower droops from the tip of a stalk 6–10 in. (15–25 cm) tall. The leaves, which lack CHLOROPHYLL and do not perform PHOTOSYNTHESIS, are small scales. The name reflects the resemblance of this plant to a miniature Indian peace pipe with its stem stuck in the ground.

Indian Removal Act (May 28, 1830) First major legislation that reversed the U.S. policy of respecting the rights of American Indians. The act granted tribes unsettled western prairie land in exchange for their territories within state borders, mainly in the Southeast. Some tribes refused to trade their land, and U.S. troops forced tribes such as the CHEROKEE to march westward in what became known as the TRAIL OF TEARS (1838–39). In Florida the SEMINOLES fought resettlement in the SEMINOLE WARS (1835–42).

Indian Reorganization Act (June 18, 1934) Measure enacted by the U.S. Congress to decrease federal control of American Indians and to increase tribal self-government. The act sought to strengthen tribal structure by encouraging written constitutions and to undo the damage caused by the DAWES GENERAL ALLOTMENT ACT by returning surplus lands to the tribes rather than homesteaders. It gave Indians the power to manage their internal affairs and established a revolving credit fund for tribal land purchases and educational assistance. It remains the basic legislation concerning Indian affairs.

Indian Territory Former territory, U.S. West, including most of modern Oklahoma. The CHOCTAW, CREEK, SEMINOLE, CHEROKEE, and CHICKASAW tribes were forcibly moved to this area between 1830 and 1843, and an 1834 act set aside the land as Indian country. In 1866 its western half was ceded to the U.S.; this portion was opened to white settlers in 1889 and became the Territory of Oklahoma in 1890. The two territories were united and admitted to the Union as the state of Oklahoma in 1907.

Indiana State (pop., 2000: 6,080,485), midwestern U.S. Bordered by Michigan, Ohio, Kentucky, and Illinois, it covers 36,420 sq mi (94,328 sq km). Its capital is INDIANAPOLIS. The WABASH RIVER and the OHIO RIVER define its southwestern and southern borders, respectively; Lake Michigan lies to the northwest. Indiana was originally inhabited by Indians speaking ALGONQUIAN LANGUAGES, including the MIAMI, Potawatomi, and DELAWARE peoples. The French explorer LA SALLE explored the region in 1679 and claimed it for France. It passed to Britain in 1763 and then to the U.S. in 1783, and it became a territory in 1800. In 1811 U.S. forces won a final victory over the Indians at the Battle of TIPPECANOE. After it was admitted to the Union as the 19th state in 1816, its population began to grow. From 1850 its agriculture expanded, as did industrialization after the AMERICAN CIVIL WAR. For much of the 20th century, steelmaking (see GARY) was important economically.

Indiana, Robert *orig.* **Robert Clark** (b. Sept. 13, 1928, New Castle, Ind., U.S.) U.S. painter, sculptor, and graphic artist. After studies at the Art Institute of Chicago, he settled in New York City and became a leading exponent of POP ART. He achieved wide recognition for paintings and prints featuring geometric shapes emblazoned with lettering and vivid colours. In 1964 he collaborated with ANDY WARHOL on the film *Eat* and was commissioned to produce an *EAT* sign for the New York pavilion at the New York World's Fair. His most famous image, *LOVE*, first lettered on canvas in 1965, became a universal symbol for the hippie generation.

Indiana Dunes State park and national lakeshore, southern shore of Lake MICHIGAN, northern Indiana, U.S. The state park (founded 1925) comprises 2,182 acres (883 hectares) of shoreline, marshland, dunes, and forests. At the Big Blowout in the eastern end of the park, lake winds drift sands over a wooded area, creating a "graveyard of trees"; the dunes may reach heights of 200 ft (60 m). The national lakeshore (founded 1966) encloses the state park on three sides. Now covering more than 12,857 acres (5,205 hectares), it includes beaches and wooded ravines.

Indianapolis City (pop., 2000: 791,926) and capital of Indiana, U.S. Located on the White River near the centre of the state, it was founded in 1821 and made the state capital in 1825. It is a hub of road, rail, and air transportation. It is a leading grain market and an industrial centre, with manufactures including pharmaceuticals, machinery, and transportation and electrical equipment. The annual INDIANAPOLIS 500 automobile race is an international event; the Speedway Hall of Fame Museum is located there. Indianapolis is the site of several colleges and universities.

Indianapolis 500 U.S. automobile race. It has been held annually since 1911 at the Indianapolis Motor Speedway, a 2.5-mi (4-km) asphalt oval with banked quarter-mile turns. The "Indy 500" is a 500-mi (805-km) race for top international competitors using specially designed Formula One cars (open-wheel, open-cockpit, rear-engine vehicles). Traditionally held on or near Memorial Day, the race is one of the most prestigious on the international racing circuit, drawing large crowds (about 300,000) and offering substantial prizes (more than $1.5 million).

Indic writing systems Set of several dozen scripts used now or in the past to write many South and Southeast Asian languages. Aside from the Kharoshthi (Kharosthi) script, used c. 4th century BC–3rd century AD, all extant writing of the region descends from the Brahmi script, first attested in the Middle Indo-Aryan rock inscriptions of ASHOKA (3rd century BC). In the first six centuries after Ashoka, Brahmi appears to have diversified into northern and southern variants. The northern types gave rise to the so-called Gupta scripts (4th–5th centuries), which are ultimately the progenitors of the Devanagari script (now used to write SANSKRIT, HINDI, Marathi, and Nepali), the BENGALI and Oriya scripts, and Gurmukhi, the script of the SIKH scriptures, used also for modern Punjabi in India. The southern types gave rise to the Sinhalese, TELUGU, and Kannada scripts on the one hand, and to the Pallava script on the other. The latter formed the basis of numerous other scripts, including those of the TAMIL and MALAYALAM languages, a host of Southeast Asian scripts (e.g., those used to write Mon, Burmese, KHMER, Thai, and Lao), and a number of AUSTRONESIAN LANGUAGES.

indicator, economic See ECONOMIC INDICATOR

indictment In criminal law, a formal written accusation of a crime affirmed by a GRAND JURY and handed up to the court for trial of the accused. In the U.S., the indictment is one of three principal methods of charging offenses, the others being the information (a written accusation resembling an indictment, prepared and presented to the court by a prosecuting official) and, for petty offenses, a complaint by the aggrieved party or by a police officer. An indictment may contain several counts.

Indies, Laws of the Entire body of law promulgated by the Spanish crown in the 16th–18th centuries for the governance of its colonies. It consists of a compendium of decrees on church government and education, upper and lower courts, political and military administration, Indians, finance, navigation, and commerce. A summary promulgated in 1681 contained 6,377 laws; though criticized for its inconsistencies, for excessive attention to unenforceable details, and for depriving colonists of a responsible role in government, it was the most comprehensive law code

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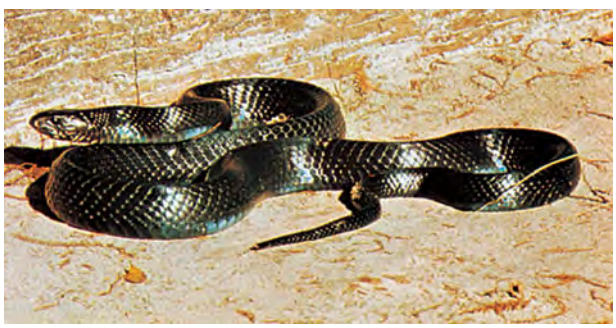
ever instituted for a colonial empire, and it set forth humane (if often ignored) principles for treatment of Indians.

Indigenismo \ēn-ˌdē-hā-ˈnēs-mō\ Latin American movement pressing for a dominant social and political role for Indians in countries where they constitute a majority. Its adherents draw a sharp distinction between Indians and people of European ancestry, who have dominated the Indian majorities since the 16th-century Spanish and Portuguese conquest. The movement became influential in Mexico with the revolution of 1910–20; it was particularly strong during the presidency of Lázaro Cárdenas (1934–40), who made serious efforts to reconstitute the country in accordance with its Indian heritage. In Peru it is associated with the APRA movement.

indigo \ˈin-di-ˌgō\ Blue vat dye, obtained until about 1900 entirely from some species of the indigo plant. Extraction of the dye was important to the economy of colonial America and remained so in India until the early 20th century. Synthetic indigo has replaced the natural dye; it is reduced chemically to the soluble yellow compound leucoindigo, in which form it is applied to textile fibres and reoxidized to indigo (see oxidation-reduction).

indigo plant Any shrub or herb in the genus *Indigofera* of the pea family (see legume). Most occur in warm climates and are silky or hairy. The leaves are usually divided into smaller leaflets. Small rose, purple, or white flowers are borne in spikes or clusters. The fruit is a pod. Some species, particularly *I. sumatrana* and *I. arrecta*, were once an important source of indigo dye, a deep navy blue.

indigo snake Nonvenomous snake (*Drymarchon corais*, family Colubridae) found from the southeastern U.S. to Brazil. The largest snake in the U.S., it has a record length of 9.2 ft (2.8 m). In the U.S. it is blue-black; southward it may have brown forepart, and in the tropics it is often called brown snake. It kills small vertebrates, including venomous snakes, by crushing with its jaws and the weight of its coils, but is not a constrictor. In defense it hisses and vibrates its tail but rarely strikes. It may share a burrow with a gopher tortoise, for which it is often called gopher snake. It has been listed as an endangered species since the 1970s.



Indigo snake (*Drymarchon corais*)
LEONARD LEE RUE III

indiscernibles, identity of See identity of indiscernibles

indium Metallic chemical element, chemical symbol In, atomic number 49. Of a brilliant, silvery-white lustre, it is so soft that it can be scratched with a fingernail. Its most common isotope, indium-115, is very weakly radioactive, with a half-life measured in billions of years. Like tin, the pure metal emits a high-pitched "cry" when bent, and, like gallium, molten indium wets glass and other surfaces, which makes it valuable for producing seals between glass, metals, quartz, ceramics, and marble. The metal is used in coating high-performance engine bearings and is an ingredient in low-melting-point alloys for sprinkler heads, fire-door links, and fusible plugs. In various combinations with elements such as gallium, phosphorus, and arsenic, it forms compounds having semiconductor properties useful in electronics, including solid-state light-emitting devices. Transparent electrodes made from an oxide of indium and tin are widely employed in liquid crystal displays.

individualism Political and social philosophy that emphasizes individual freedom. Modern individualism emerged in Britain with the ideas of Adam Smith and Jeremy Bentham, and the concept was described by Alexis de Tocqueville as fundamental to the American temper. Individualism encompasses a value system, a theory of human nature, and a belief in certain political, economic, social, and religious arrangements. According to the individualist, all values are human-centred, the individual is of supreme importance, and all individuals are morally equal. Individualism places great value on self-reliance, on privacy, and on mutual respect. Negatively, it embraces opposition to authority and to all manner of controls over the individual, especially when exercised by the state. As a theory of human nature, individualism holds that the interests of the normal adult are best served by allowing him maximum freedom and responsibility for choosing his objectives and the means for obtaining them. The institutional embodiment of individualism follows from these principles. All individualists believe that government should keep its interference in the lives of individuals at a minimum, confining itself largely to maintaining law and order, preventing individuals from interfering with others, and enforcing agreements (contracts) voluntarily arrived at. Individualism also implies a property system according to which each person or family enjoys the maximum of opportunity to acquire property and to manage and dispose of it as he or they see fit. Although economic individualism and political individualism in the form of democracy advanced together for a while, in the course of the 19th century they eventually proved incompatible, as newly enfranchised voters came to demand governmental intervention in the economic process. Individualistic ideas lost ground in the later 19th and early 20th century with the rise of large-scale social organization and the emergence of political theories opposed to individualism, particularly communism and fascism. They reemerged in the latter half of the 20th century with the defeat of fascism, the fall of communism in the Soviet Union and eastern Europe, and the worldwide spread of representative democracy. See also libertarianism.

individuation Determination that an individual identified in one way is numerically identical with or distinct from an individual identified in another way (e.g., Venus, known as "the morning star" in the morning and "the evening star" in the evening). Since the concept of an individual seems to require that it be recognizable as such in several possible situations, the problem of individuation is of great importance in ontology and logic. The problem of identifying an individual existing at two different times (transtemporal identity) is one of many forms that the problem of individuation can take: What makes that caterpillar identical with this butterfly? What makes the person you are now identical with the person you were a decade ago? In modal logic, the problem of transworld individuation (or transworld identity) is of importance because the standard model of theoretic semantics for systems of modal logic assumes that it makes sense to speak of the same individual existing in more than one possible world.

Indo-Aryan languages *or* **Indic languages** Major subgroup of the Indo-Iranian branch of the Indo-European language family. Indo-Aryan languages are spoken by more than 800 million people, principally in India, Nepal, Pakistan, Bangladesh, and Sri Lanka. The Old Indo-Aryan period is represented by Sanskrit. Middle Indo-Aryan (c. 600 BC–AD 1000) consists principally of the Prakrit dialects, including Pali. Modern Indo-Aryan speech is largely a single dialect continuum spread over an undivided geographical space, so demarcations between languages and dialects are somewhat artificial. Complicating the situation are competing distinctions between languages with an old literary tradition, local language identification by native speakers (as in censuses), supraregional languages such as Modern Standard Hindi and Urdu, and labels introduced by linguists, particularly those of George Abraham Grierson. In the centre of the Indo-Aryan speech area (the "Hindi zone"), covering northern India and extending south as far as Madhya Pradesh, the most common language of administration and education is Modern Standard Hindi. Important regional languages in the northern Indian plain are Haryanvi, Kauravi, Braj, Awadhi, Chhattisgarhi, Bhojpuri, Magahi, and Maithili. Regional languages in Rajasthan include Marwari, Dhundhari, Harauti, and Malvi. In the Himalayan foothills of Himachal Pradesh are Grierson's Pahari languages. Surrounding the Hindi zone, the most significant languages are, moving clockwise, Nepali (East Pahari), Assamese, Bengali, Oriya, Marathi, Gujarati, Sindhi, the speech of southern, northwestern, and northern Punjab province in Pakistan (called West Punjabi or Lahnda by Grierson), Punjabi, and Dogri. In Jammu and Kashmir and the far north of Pakistan are the Dardic languages; the most important are Kashmiri, Kohistani, Shina, and Khowar. The Nuristani languages of northwestern Afghanistan are sometimes considered a separate branch of Indo-Iranian. Sinhalese (spoken in Sri Lanka), Divehi (spoken in the Maldive Islands), and Romany are also Indo-Aryan languages.

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Indo-European languages Family of languages with the greatest number of speakers, spoken in most of Europe and areas of European settlement and in much of southwestern and southern Asia. They are descended from a single unrecorded language believed to have been spoken more than 5,000 years ago in the steppe regions north of the Black Sea and to have split into a number of dialects by 3000 BC. Carried by migrating tribes to Europe and Asia, these developed over time into separate languages. The main branches are ANATOLIAN, Indo-Iranian (including INDO-ARYAN and IRANIAN), GREEK, ITALIC, GERMANIC, ARMENIAN, CELTIC, ALBANIAN, the extinct TOCHARIAN LANGUAGES, BALTIC, and SLAVIC. The study of Indo-European began in 1786 with Sir WILLIAM JONES's proposal that Greek, Latin, Sanskrit, Germanic, and Celtic were all derived from a "common source." In the 19th century linguists added other languages to the Indo-European family, and scholars such as RASMUS RASK established a system of sound correspondences. Proto-Indo-European has since been partially reconstructed via identification of roots common to its descendants and analysis of shared grammatical patterns.

Indo-Gangetic Plain See GANGETIC PLAIN

Indochina *or* **Indochinese Peninsula** Region of mainland SOUTHEAST ASIA. The term, now largely superseded by the name Southeast Asia, was used mainly by Westerners to describe the intermingling of Indian and Chinese cultural influences in the region. Indochinese Peninsula typically referred to Cambodia, Laos, and Vietnam (see FRENCH INDOCHINA), though it was sometimes expanded to include Myanmar (Burma), Thailand, and the mainland portion of Malaysia.

Indochina wars 20th-century conflicts in Vietnam, Laos, and Cambodia. The first conflict (1946–54; often called the French Indochina War) involved France, which had ruled Vietnam as its colony (FRENCH INDOCHINA), and the newly independent Democratic Republic of Vietnam under HO CHI MINH; the war ended in Vietnamese victory in 1954. Vietnam was then divided into the communist-dominated north and the U.S.-supported south; war soon broke out between the two. North Vietnam won the war (the VIETNAM WAR) despite heavy U.S. involvement, and the country was reunited in 1976. Cambodia experienced its own civil war between communists and noncommunists during that period, which was won by the communist KHMER ROUGE in 1975. After several years of horrifying atrocities under POL POT, the Vietnamese invaded in 1979 and installed a puppet government. Fighting between the Khmer Rouge and the Vietnamese continued throughout the 1980s; Vietnam withdrew its troops by 1989. In 1993 UN-mediated elections established an interim government, and Cambodia's monarchy was reestablished. In Laos, North Vietnam's victory over South Vietnam brought the communist Pathet Lao into complete control in Laos.

Indonesia *officially* **Republic of Indonesia** *formerly* **Netherlands East Indies** Archipelago country, located off the coast of mainland SOUTHEAST ASIA. It comprises some 17,500 islands, of which about 6,000 are uninhabited. Area: 730,024 square miles (1,890,754 square km). Population (2005 est.): 222,781,000. Capital: JAKARTA (on JAVA). Indonesia has more than 300 ethnic groups, which in the western islands fall into three broad divisions: the inland rice-growing peoples of Java and neighbouring islands; the Muslim coastal peoples, including the MALAYS of Sumatra; and the DAYAK and other tribal groups. In the east the distinction is between coastal and interior peoples. Languages: Bahasa Indonesia (official), some 250 languages from different ethnic groups. Religions: Islam; also Christianity, Hinduism, traditional beliefs. Currency: rupiah. The Indonesian archipelago stretches 3,200 miles (5,100 km) from west to east. Major islands include SUMATRA, JAVA (with more than half of Indonesia's population), BALI, LOMBOK, SUMBAWA, about three-fourths of BORNEO (Kalimantan), CELEBES (Sulawesi), the MOLUCCAS, and the western portions of TIMOR and NEW GUINEA. The islands are characterized by rugged volcanic mountains and tropical rainforests. Geologically unstable, Indonesia has frequent earthquakes and 220 active volcanoes, including KRAKATOA (Krakatau). Roughly one-fifth of its land is arable, and rice is the staple crop. Petroleum, natural gas, timber products, garments, and rubber are major exports. Indonesia is a republic with two legislative houses; its head of state and government is the president.

Austronesian-speaking peoples began migrating to Indonesia about the 3rd millennium BC. Commercial relations were established with Africa about the 1st century AD, and Hindu and Buddhist cultural influences from India began to take hold. Indian traders also brought Islam to the islands, and by the 13th century it was spreading throughout the islands—except BALI, which retained its Hindu religion and culture. Indonesia now has the largest Muslim population of any country. European influence began in the 16th century, and the Dutch gradually established control of Indonesia from the late 17th century until 1942, when the Japanese invaded. SUKARNO declared Indonesia's independence in 1945, which the Dutch granted, with nominal union to The Netherlands, in 1949; Indonesia dissolved this union in 1954. The suppression of an alleged coup attempt in 1965 resulted in the deaths of hundreds of thousands of people the government claimed to be communists, and by 1968 Gen. SUHARTO had taken power. His government forcibly incorporated EAST TIMOR into Indonesia in 1975–76, with much loss of life. In the 1990s the country was beset by political, economic, and environmental problems, and Suharto was deposed in 1998. Muslim leader Abdurrahman Wahid was elected president in 1999 but was replaced in 2001 by his vice president, Megawati Sukarnoputri, the eldest daughter of Sukarno. In 2004 she was succeeded by Susilo Bambang Yudhoyono. In 1999 the people of EAST TIMOR voted for independence from Indonesia, which was granted; after a period under UN supervision, it achieved full sovereignty in 2002. In 2004 a large tsunami generated by an earthquake off the western coast of Sumatra caused widespread death and destruction. See map on following page.

Indonesian language See MALAY LANGUAGE

Indore \in-'dōr\ City (pop., 2001 prelim.: metro. area, 1,639,044), western MADHYA PRADESH state, central India. Located northeast of MUMBAI (Bombay), it was founded in 1715 as a trade market by local landowners, who erected Indreshwar Temple, from which the city's name is derived. It became the capital of the princely state of Indore belonging to the Maratha Holkars. Under the British, it served as the headquarters of the British Central India Agency. The largest city in the state, it is an important commercial and industrial centre.

Indra In the ancient VEDIC RELIGION of India, chief of the gods and patron of warriors. Armed with lightning and thunderbolts and strengthened by drinking the elixir SOMA, he vanquished demonic enemies and killed the dragon that kept the monsoon rains from breaking. In later Hinduism Indra was demoted to a rain god and regent of the heavens. He was father to ARJUNA, hero of the *MAHABHARATA*. Indra also appears in Buddhist and Jain mythologies.

Indre River \'a^{n}dr^{ə}\ River, central France. It is a tributary of the LOIRE RIVER. Rising on the northern flanks of the plateau region known as the MASSIF CENTRAL, it flows northwest through agricultural lands and joins the Loire after a total course of 165 mi (265 km).

inductance Property of a CONDUCTOR, sometimes in the shape of a coil, that is measured by the size of the ELECTROMOTIVE FORCE (emf), or voltage, induced in it, compared with the rate of change of the ELECTRIC CURRENT that produces the voltage. A steadily changing electric current produces a varying MAGNETIC FIELD, which induces an emf in a conductor that is present in the field. The magnitude of this voltage is proportional to the rate of change of the current. The inductance is the proportionality factor. The unit of inductance is the henry, named after JOSEPH HENRY; one henry is equivalent to one volt divided by one ampere per second.

induction In LOGIC, a type of nonvalid inference or argument in which the premises provide some reason for believing that the conclusion is true. Typical forms of inductive argument include reasoning from a part to a whole, from the particular to the general, and from a sample to an entire population. Induction is traditionally contrasted with DEDUCTION. Many of the problems of inductive logic, including what is known as the problem of INDUCTION, have been treated in studies of the methodology of the natural sciences. See also JOHN STUART MILL; philosophy of SCIENCE; SCIENTIFIC METHOD.

induction See ELECTROMAGNETIC INDUCTION, ELECTROSTATIC INDUCTION

induction, problem of Problem of justifying the inductive inference from the observed to the unobserved. It was given its classic formulation by DAVID HUME, who noted that such inferences typically rely on the assumption that the future will resemble the past, or on the assumption that events of a certain type are necessarily connected, via a relation of causation, to events of another type. (1) If we were asked why we believe that the sun will rise tomorrow, we would say that in the past the Earth turned on its axis every 24 hours (more or less), and that there is a uniformity in nature that guarantees that such events always happen in the same way. But how do we know that nature is uniform in this sense? We might answer that, in the past, nature has always exhibited this kind of uniformity, and so it will continue to be uniform in the future. But this

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inference is justified only if we assume that the future must resemble the past. How do we justify this assumption? We might say that in the past, the future turned out to resemble the past, and so in the future, the future will again turn out to resemble the past. The inference is obviously circular: it succeeds only by tacitly assuming what it sets out to prove, namely that the future will resemble the past. (2) If we are asked why we believe we will feel heat when we approach a fire, we would say that fire causes heat—i.e., there is a "necessary connection" between fire and heat, such that whenever one occurs, the other must follow. But, Hume asks, what is this "necessary connection"? Do we observe it when we see the fire or feel the heat? If not, what evidence do we have that it exists? All we have is our observation, in the past, of a "constant conjunction" of instances of fire being followed by instances of heat. This observation does not show that, in the future, instances of fire will continue to be followed by instances of heat; to say that it does is to assume that the future must resemble the past. But if our observation is consistent with the possibility that fire may not be followed by heat in the future, then it cannot show that there is a necessary connection between the two that makes heat follow fire whenever fire occurs. Thus we are not justified in believing that (1) the sun will rise tomorrow or that (2) we will feel heat when we approach a fire. It is important to note that Hume did not deny that he or anyone else formed beliefs about the future on the basis of induction; he denied only that we could know with certainty that these beliefs are true. Philosophers have responded to the problem of induction in a variety of ways, though none has gained wide acceptance.

induction heating Method of raising the temperature of an electrically conductive material by subjecting it to an alternating ELECTROMAGNETIC FIELD. Energy in the ELECTRIC CURRENTS induced in the object is dissipated as HEAT. Induction heating is used in metalworking to heat METALS for soldering, tempering, and annealing, and in induction furnaces for melting and processing metals. The principle of the induction-heating process resembles that of the transformer. A water-cooled coil (inductor), acting as the primary winding of a transformer, surrounds the material to be heated (the workpiece), which acts as the secondary winding. Alternating current flowing in the primary coil induces eddy currents in the workpiece, causing it to become heated. The depth to which the eddy currents penetrate, and therefore the distribution of heat within the object, depend on the frequency of the primary alternating current and the magnetic permeability, as well as the resistivity, of the material.

indulgence In ROMAN CATHOLICISM, the remission of temporal punishment for a SIN after the sin has been forgiven through the SACRAMENT of penance. The theology of indulgences is based on the concept that, even though the sin and its eternal punishment are forgiven through penance, divine justice demands that the sinner pay for the crime either in this life or in PURGATORY. The first indulgences were intended to shorten times of penance by substituting periods of FASTING, private prayers, almsgiving, and monetary payments that were to be used for religious purposes. Pope URBAN II granted the first plenary, or absolute, indulgence to participants in the First CRUSADE, and subsequent popes offered indulgences on the occasion of the later Crusades. After the 12th century they were more widely used, and abuses became common as indulgences were put up for sale to earn money for the church or to enrich unscrupulous clerics. JAN HUS opposed them, and MARTIN LUTHER's NINETY-FIVE THESES (1517) were in part a protest against indulgences. In 1562 the Council of TRENT put an end to the abuses but not to the doctrine itself.

Indus civilization (c. 2500–c. 1700 BC) Earliest known urban culture of the Indian subcontinent and the most extensive of the world's three earliest civilizations. It stretched from near the present-day Iran-Pakistan border on the Arabian Sea in the west to near Delhi in the east, and 500 mi (800 km) to the south and 1,000 mi (1,600 km) to the northeast. It is known to have included two large cities, Harappa and MOHENJO DARO (in what is now Pakistan), whose large size suggests centralization in two large states or one state with two capitals. Alternatively, Harappa may have succeeded Mohenjo Daro. It was a literate civilization; the language has been tentatively identified as Dravidian. Wheat and barley were grown, many animals (including cats, dogs, and cattle) were domesticated, and cotton was cultivated. The best-known artifacts are seals depicting real and imaginary animals. How and when the civilization came to an end is unclear; Mohenjo Daro was attacked and destroyed in the mid-2nd millennium BC, but in the south there was continuity between the Indus civilization and the COPPER AGE civilizations of central and western India.

Indus River Trans-Himalayan river of southern Asia. It is one of the world's longest rivers, with a length of 1,800 mi (2,900 km). Its annual flow of 272 billion cu yd (207 billion cu m) is twice that of the NILE. It rises in southwestern Tibet and flows northwest through valleys of the

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Himalayas. After crossing into the Kashmir region, it continues northwestward through the Indian- and Pakistani-administered areas and then turns south into Pakistan. Swelled by tributaries from the Punjab region, including the Jhelum, Chenab, Ravi, Beas, and Sutlej rivers, it widens and flows more slowly. It has supplied water for irrigation on the plains of Pakistan since early times.

industrial and organizational relations *or* **organizational relations** Study of human behaviour in the workplace, focusing especially on the influence such relations have on an organization's productivity. Classical economics viewed workers as instruments of production, subject to the laws of supply and demand. Industrial relations did not become the subject of scholarly attention until the late 1920s, when Elton Mayo (1880–1949) studied productivity at Western Electric Co.'s Hawthorne Works. Concluding that merely being chosen to participate in the study improved workers' productivity (the "Hawthorne effect"), Mayo became the first scholar to show workers responding to psychosocial stimuli. Other aspects of industrial and organizational relations include human resources management, which involves the development of job descriptions and organizational structures; recruiting, training, and general oversight of employees; negotiating terms of employment, planning for the future, and the study of managerial styles.

industrial design Design of products made by large-scale industry for mass distribution. Among the considerations for such products are structure, operation, appearance, and conformance to production, distribution, and selling procedures; appearance is the principal consideration in industrial design. The International Council of Societies of Industrial Design was founded in London in 1957 and within 25 years had members in more than 40 countries. Two significant trends have persisted: streamlining, a design principle pioneered by Raymond Loewy and others in the 1930s; and planned obsolescence, design changes that tempt owners to replace goods with new purchases more frequently than would normally be necessary.

industrial ecology Discipline that traces the flow of energy and materials from their natural resources through manufacture, the use of products, and their final recycling or disposal. Research in industrial ecology began in the early 1990s. Life-cycle analysis traces the flow of materials; design for the environment works to minimize energy use, pollution, and waste. Industrial ecologists aim to create industries in which every waste is a raw material for another product.

industrial engineering Application of engineering principles and techniques of scientific management to the maintenance of high levels of productivity at optimum cost in industrial enterprises. Frederick W. Taylor pioneered in the scientific measurement of work, and Frank (1868–1924) and Lillian (1878–1972) Gilbreth refined it with time-and-motion studies. As a result, production processes were simplified, enabling workers to increase production. The industrial engineer selects tools and materials for production that are most efficient and least costly to the company. The engineer may also determine the sequence of production and the design of plant facilities or factories. See also ergonomics.

industrial espionage Acquisition of trade secrets from business competitors. Industrial spying is a reaction to the efforts of many businesses to keep secret their designs, formulas, manufacturing processes, research, and future plans. Trade secrets may find their way into the open market through disloyal employees or through various other means. Penalties against those found guilty range from an injunction against further use of the knowledge to substantial damages. See also patent.

industrial medicine *or* **occupational medicine** Branch of medicine dealing with workers' health and the prevention and treatment of diseases and injuries in the workplace. Workplace hazards include exposure to dangerous materials including asbestos and coal dust, radiation exposure, and machinery capable of causing injuries ranging from minor to life-threatening. Industrial medical programs mandate protective devices around machines' moving parts, proper ventilation of work areas, use of less toxic materials, containment of production processes, and protective equipment and clothing. Good industrial medical programs improve labour-management relations, increase workers' overall health and productivity, and reduce insurance costs.

industrial melanism \'me-lə-ˌni-zəm\ Darkness of the skin, feathers, or fur developed by a population of animals living in an industrial region where the environment is soot-darkened. The melanization of a population increases the probability that its members will survive and reproduce because it offers protection in the form of camouflage; it takes place over the course of many generations as the result of natural selection of the lighter, more conspicuous animals by predators.

industrial-organizational psychology *or* **I-O psychology** Application of the concepts and methods of experimental, clinical, and social psychology to the workplace. I-O psychologists are concerned with such matters as personnel evaluation and placement, job analysis, worker-management relations (including morale and job satisfaction), workforce training and development (including leadership training), and productivity improvement. They may work closely with business managers, industrial engineers, and human-resources professionals.

Industrial Revolution Process of change from an agrarian, handicraft economy to one dominated by industry and machine manufacture. It began in England in the 18th century. Technological changes included the use of iron and steel, new energy sources, the invention of new machines that increased production (including the steam engine and the spinning jenny), the development of the factory system, and important developments in transportation and communication (including the railroad and the telegraph). The Industrial Revolution was largely confined to Britain from 1760 to 1830 and then spread to Belgium and France. Other nations lagged behind, but, once Germany, the U.S., and Japan achieved industrial power, they outstripped Britain's initial successes. Eastern European countries lagged into the 20th century, and not until the mid-20th century did the Industrial Revolution spread to such countries as China and India. Industrialization effected changes in economic, political, and social organization. These included a wider distribution of wealth and increased international trade; political changes resulting from the shift in economic power; sweeping social changes that included the rise of working-class movements, the development of managerial hierarchies to oversee the division of labour, and the emergence of new patterns of authority; and struggles against externalities such as industrial pollution and urban crowding.

Industrial Workers of the World (IWW) *known as* **the Wobblies** Radical labour organization founded in Chicago in 1905. The founders, who opposed the moderate policies of the AFL (see AFL-CIO), included William Haywood of the Western Federation of Miners, Daniel De Leon of the Socialist Labor Party, and Eugene V. Debs. In 1908 the IWW split, and a militant group led by Haywood prevailed. To reach its goal of worker control of the means of production, it advocated general strikes, boycotts, and sabotage. Its tactics led to arrests and adverse publicity, though it made gains through strikes in the mining and lumber industries. It opposed U.S. participation in World War I, and some of its leaders were prosecuted. By the 1920s membership had dwindled greatly.

industrialization Process of converting to a socioeconomic order in which industry is dominant. The changes that took place in Britain during the Industrial Revolution of the late 18th and 19th century led the way for the early industrializing nations of western Europe and North America. Industrialization entailed both technology and profound social developments. The freeing of labourers from feudal and customary obligations created a free market in labour, with a pivotal role for the entrepreneur. Cities attracted large numbers of people, massing workers in new industrial towns and factories. Later industrializers attempted to manipulate some of the elements: the Soviet Union eliminated the entrepreneur; Japan stimulated and sustained the entrepreneur's role; Denmark and New Zealand industrialized primarily by commercializing and mechanizing agriculture.

industry Group of productive organizations that produce or supply goods, services, or sources of income. In economics, industries are customarily classified as primary, secondary, and tertiary; secondary industries are further classified as heavy and light. Primary industry includes agriculture, forestry, fishing, mining, quarrying, and extracting minerals. Secondary or manufacturing industry processes the raw materials supplied by primary industries into consumer goods, or further processes goods from other secondary industries, or builds capital goods used to manufacture consumer and nonconsumer goods; secondary industry also includes energy-producing industries and the construction industry. Tertiary or service industry includes banking, finance, insurance, investment, and real estate services; wholesale, retail, and resale trade; transportation, information, and communications services; professional, consulting, legal, and personal services; tourism, hotels, restaurants, and entertainment; repair

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and maintenance services; education and teaching; and health, social welfare, administrative, police, security, and defense services.

Indy \aⁿ-ˈdē**, (Paul-Marie-Theodore-) Vincent d'** (b. March 27, 1851, Paris, France—d. Dec. 1, 1931, Paris) French composer and teacher. Trained in organ and composition, he rejected the prevailing French style as frivolous by comparison with the German musical tradition. He wrote several important stage works, including *Fervaal* (1895) and *The Legend of Saint Christopher* (1915), but orchestral works such as *Symphony on a French Mountain Air* (1886), *Summer Day in the Mountains* (1905), and *Istar* (1896) remain better known. In 1894 he cofounded the music academy called the Schola Cantorum in Paris, where many of France's foremost composers and musicians would be trained.

inequality In mathematics, a statement of an order relationship—greater than, greater than or equal to, less than, or less than or equal to—between two numbers or algebraic expressions. Inequalities can be posed either as questions, much like EQUATIONS, and solved by similar techniques, or as statements of fact in the form of THEOREMS. For example, the triangle inequality states that the sum of the lengths of any two sides of a triangle is greater than or equal to the length of the remaining side. Mathematical ANALYSIS relies on many such inequalities (e.g., the CAUCHY-SCHWARZ INEQUALITY) in the proofs of its most important theorems.

inert gas See NOBLE GAS

inertia \i-ˈnər-shə\ Inherent property of a body that makes it oppose any force that would cause a change in its motion. A body at rest and a body in motion both oppose forces that might cause ACCELERATION. The inertia of a body can be measured by its MASS, which governs its resistance to the action of a force, or by its moment of inertia about a specified axis, which measures its resistance to the action of a TORQUE about the same axis.

inertia, moment of Quantitative measure of the rotational INERTIA of a body. As a rotating body spins about an external or internal axis (either fixed or unfixed), it opposes any change in the body's speed of rotation that may be caused by a TORQUE. It is defined as the sum of the products obtained by multiplying the mass of each particle of matter in a given body by the square of its distance from the axis of rotation.

inertial guidance system An electronic system that continuously monitors the position, velocity, and acceleration of a vehicle, usually a submarine, missile, or airplane, and thus provides navigational data or control. The basic components of an inertial guidance system are GYROSCOPES, ACCELEROMETERS, and a computer.

infancy In humans, the period of life between birth and the acquisition of language usually one to two years later. The average newborn infant weighs 7.5 lbs (3.4 kg) and is about 20 in (51 cm) long. At birth, infants display a set of inherited reflexes involving such acts as sucking, blinking, and grasping. They are sensitive to light-dark visual contrasts and movements and show a noticeable preference for gazing at the human face; they also begin to recognize the human voice. By 4 months of age most babies are able to sit up, and most begin crawling in 7–10 months; by 12 months most are able to start walking. Virtually all infants begin to comprehend some words several months before they themselves speak their first meaningful words.

infanticide Killing of the newborn. Infanticide has often been interpreted as a primitive method of BIRTH CONTROL and a means of ridding a group of its weak or undesirable children; but most societies actively welcome children and put them to death (or allow them to die) only under exceptional circumstances—e.g., when there is little or no likelihood of being able to provide support. As late as the 18th century in European countries unwanted infants were disposed of by abandonment and exposure. Firstborn SACRIFICE, or the offering of one's most precious possession to the deities, is known from the Bible and from the histories of Egypt, Greece, Rome, and India.

infantile paralysis See POLIOMYELITIS

infantry Troops who fight on foot. The term applies both to soldiers armed with hand weapons such as the spear and sword in ancient times and to troops armed with automatic rifles and rocket launchers in modern times. Their objective has always been to seize and hold ground and, when necessary, to occupy enemy territory. Apart from the temporary dominance of CAVALRY in the feudal period, it has been the largest single element in Western armies since ancient times.

infection Invasion of the body by various agents—including BACTERIA, fungi (see FUNGUS), PROTOZOANS, VIRUSES, and WORMS—and its reaction to them or their TOXINS. Infections are called subclinical until they perceptibly affect health, when they become infectious diseases. Infection can be local (e.g., an ABSCESS), confined to one body system (e.g., PNEUMONIA in the lungs), or generalized (e.g., SEPTICEMIA). Infectious agents can enter the body by inhalation, ingestion, sexual transmission, passage to a fetus during pregnancy or birth, wound contamination, or animal or insect bites. The body responds with an attack on the invader by LEUKOCYTES, production of ANTIBODIES or ANTITOXINS, and often a rise in temperature. The antibodies may result in short-term or lifelong IMMUNITY. Despite significant progress in preventing and treating infectious diseases, they remain a major cause of illness and death, particularly in regions of poor sanitation, poor nutrition, and crowding.

inferiority complex Acute sense of personal inferiority, often resulting in either timidity or (through overcompensation) exaggerated aggressiveness. Though once a standard psychological concept, particularly among followers of ALFRED ADLER, it has lost much of its usefulness through imprecise popular misuse.

infertility Inability of a couple to conceive and reproduce. It is defined as failure to conceive after one year of regular intercourse without CONTRACEPTION. Inability to conceive when desired can result from a defect at any of the stages required for FERTILITY (see REPRODUCTIVE SYSTEM). About one in every eight couples is infertile. Most cases involve the female partner, 30–40% involve the male, and 10% are caused by unknown factors. In women, causes include ovulation or hormone problems, fallopian-tube disorders, and a chemical balance that is hostile to SPERM; in men, causes include IMPOTENCE, low sperm count, and sperm abnormalities. Either partner can have a blockage of the pathways the sperm must travel, often treatable by surgery. Emotional factors may contribute; return of normal fertility may require only counseling. Fertility drugs can stimulate the release of EGGS (often more than one, leading to MULTIPLE BIRTHS). Low sperm count may be overcome by limiting intercourse to the time of ovulation, the most fertile period. If these methods are unsuccessful, couples may try ARTIFICIAL INSEMINATION, IN VITRO FERTILIZATION, or SURROGATE MOTHERHOOD, or they may choose ADOPTION instead.

infinite series In mathematics, the sum of infinitely many numbers, whose relationship can typically be expressed as a formula or a FUNCTION. An infinite series that results in a finite sum is said to converge (see CONVERGENCE). One that does not, diverges. Mathematical ANALYSIS is largely taken up with studying the conditions under which a given function will result in a convergent infinite series. Such series (e.g., the FOURIER SERIES) are particularly useful in solving DIFFERENTIAL EQUATIONS.

infinity In mathematics, the useful concept of a process with no end. As represented by the symbol ∞, it is often mistakenly thought to be the largest number or a place on the real number line. Instead, it is the idea of a limit, as in the expression $x \to \infty$, which suggests that the variable x increases without bound. For example, the function $f(x) = 1/x$, or the reciprocal of x, tends toward 0 as x approaches infinity as a limit. This process of approaching is crucial to the definition of the DERIVATIVE and the INTEGRAL in calculus, as well as to many other concepts of mathematical ANALYSIS.

inflammation Local reaction of living tissues to injury or illness, including burns, pneumonia, leprosy, tuberculosis, and rheumatoid arthritis. Its major signs are heat, redness, swelling, and pain. The process begins with brief contraction of nearby arterioles (see ARTERIES). Dilation follows, flushing the CAPILLARIES with blood, from which fluid, PLASMA proteins, and LEUKOCYTES pass into the injured tissues, causing swelling as they attack the cause of injury. Initial acute inflammation can have any of four outcomes: resolution (return to normal), organization (new tissue buildup; see SCAR), suppuration (pus formation; see ABSCESS), or chronic inflammation. Sometimes treatment—including ANTIBIOTICS for bacteria, or surgical removal of an irritating foreign body—can eliminate the cause. If not, anti-inflammatory drugs (e.g., CORTISONE or ASPIRIN) may be given, or simple remedies (e.g., hot or cold compresses) may be applied.

inflation In COSMOLOGY, a hypothesized period of exponential expansion of the universe, shortly after the BIG BANG, which may account for some of the universe's observed properties, such as the distribution of energy and matter. GRAND UNIFIED THEORIES of the forces of nature suggest that inflation could have occurred during the first 10^{-32} second after the universe began, when the STRONG FORCE was decoupling from the WEAK and ELECTROMAGNETIC forces. During this time, the universe would have expanded by

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more than 100 orders of magnitude. Interpreted in the context of general RELATIVITY, inflation occurred while the universe existed in a state of nonzero energy density (false vacuum).

inflation In economics, increases in the level of PRICES. Inflation is generally thought of as an inordinate rise in the general level of prices. Four theories are commonly used to explain inflation. The first and oldest, the quantity theory, promoted in the 18th century by DAVID HUME, assumes that prices will rise as the supply of money increases. MILTON FRIEDMAN refined the quantity theory in the mid-20th century, arguing that the prescription for stable prices is to increase the money supply at a rate equal to that at which the economy is expanding. A second approach is JOHN MAYNARD KEYNES's theory of income determination, which assumes that inflation occurs when the demand for goods and services is greater than the supply. It calls for the government to control inflation by adjusting levels of spending and taxation and by raising or lowering interest rates. A third approach is the cost-push theory. It traces inflation to a phenomenon known as the price-wage spiral, in which workers' demands for wage increases lead employers to increase prices to reflect their higher costs, thereby sowing the seeds of a further round of wage demands. A fourth approach is the structural theory, which emphasizes structural maladjustments in the economy, as when in developing countries imports tend to increase faster than exports, pushing down the international value of the developing country's currency and causing prices to rise internally. See also DEFLATION, PRICE INDEX.

inflorescence \ˌin-flə-ˈre-sᵊns\ Cluster of flowers on one or a series of branches, which together make a large showy blossom. Categories depend on the arrangement of flowers on an elongated main axis (peduncle) or on sub-branches from the main axis, and on the timing and position of flowering. In determinate inflorescences, the youngest flowers are at the bottom or outside (e.g., ONION flowers). In indeterminate inflorescences, the youngest flowers are at the top or in the center (e.g., SNAPDRAGON, LILY OF THE VALLEY, and *Astilbe* flowers). Other indeterminate inflorescences are the dangling male and female CATKINS of OAK trees, the spike of BARLEY, and the flat head (capitulum) of the DANDELION.

influenza *or* **flu** *or* **grippe** Acute viral INFECTION of the upper or lower respiratory tract. Influenza VIRUSES A (the most common), B, and C produce similar symptoms, but infection with or vaccination against one does not give immunity against the others. Chills, fatigue, and muscle aches begin abruptly. The temperature soon reaches 38–40 °C (101–104 °F). Head, muscle, abdominal, and joint aches may be accompanied by sore throat. Recovery starts in three to four days, and respiratory symptoms become more prominent. Bed rest, high fluid intake, and aspirin or other antifever drugs are standard treatment. Influenza A tends to occur in wavelike annual pandemics. Mortality is usually low, but in rare outbreaks (see INFLUENZA EPIDEMIC OF 1918–19) it reaches immense proportions. Most deaths result from PNEUMONIA or BRONCHITIS.

influenza epidemic of 1918–19 *or* **Spanish influenza epidemic** Most severe INFLUENZA outbreak of the 20th century. It apparently started as a fairly mild strain in a U.S. army camp in early March 1918. Troops sent to fight in World War I spread the virus to western Europe. Outbreaks occurred in nearly every inhabited part of the world, spreading from ports to cities along transportation routes. PNEUMONIA often developed quickly and killed within two days. Among the most deadly epidemics in history, it left an estimated 25 million dead; unusually, half the deaths were among 20- to 40-year-olds.

information processing Acquisition, recording, organization, retrieval, display, and dissemination of information. Today the term usually refers to computer-based operations. Information processing consists of locating and capturing information, using software to manipulate it into a desired form, and outputting the data. An Internet SEARCH ENGINE is an example of an information-processing tool, as is any sophisticated INFORMATION-RETRIEVAL system. See also DATA PROCESSING.

information retrieval Recovery of information, especially in a DATABASE stored in a computer. Two main approaches are matching words in the query against the database index (keyword searching) and traversing the database using HYPERTEXT or hypermedia links. Keyword searching has been the dominant approach to text retrieval since the early 1960s; hypertext has so far been confined largely to personal or corporate information-retrieval applications. Evolving information-retrieval techniques, exemplified by developments with modern Internet SEARCH ENGINES, combine natural language, hyperlinks, and keyword searching. Other techniques that seek higher levels of retrieval precision are studied by researchers involved with ARTIFICIAL INTELLIGENCE.

information science Discipline that deals with the processes of storing and transferring information. It attempts to bring together concepts and methods from such varied disciplines as library science, computer science and engineering, linguistics, and psychology to develop techniques and devices to aid in the handling of information. In its early stages in the 1960s, information science was concerned primarily with applying the then-new computer technology to the processing and managing of documents. The applied computer technologies and theoretical studies of information science have since permeated many other disciplines. Computer science and engineering still tend to absorb its theory- and technology-oriented subjects, and management science tends to absorb information-systems subjects.

information theory See COMMUNICATION THEORY

infrared \ˌin-frə-ˈred\ **astronomy** Study of astronomical objects by observing the INFRARED RADIATION they emit. Its techniques enable examination of many celestial objects that give off energy at wavelengths in the infrared region of the ELECTROMAGNETIC SPECTRUM but that cannot otherwise be seen from Earth because they do not emit much visible light or because that light is blocked by dust clouds, which infrared radiation can penetrate. Infrared astronomy originated in the early 19th century with the work of William Herschel (see HERSCHEL FAMILY), who discovered infrared radiation while studying sunlight. The first systematic infrared observations of other stars were made in the 1920s; modern techniques, such as the use of interference filters for ground-based telescopes, were introduced in the early 1960s. Because atmospheric water vapour absorbs many infrared wavelengths, observations are carried out with telescopes sited on high mountaintops and from airborne and space-based observatories. Infrared astronomy allows studies of the dust-obscured core of the MILKY WAY GALAXY and the hearts of star-forming regions and has led to many discoveries including BROWN DWARF candidates and disks of matter around certain stars.

infrared radiation Portion of the ELECTROMAGNETIC SPECTRUM that extends from the MICROWAVE range to the red end of the visible light range. Its wavelengths vary from about 0.7 to 1,000 micrometres. Most of the radiation emitted by a moderately heated surface is infrared, and it forms a continuous spectrum. Molecular excitation produces extensive infrared radiation but in a discrete spectrum of lines or bands. Infrared wavelengths are useful for night-vision equipment, heat-seeking missiles, molecular SPECTROSCOPY, and INFRARED ASTRONOMY, among other things. The trapping of infrared radiation by atmospheric gases is also the basis of the GREENHOUSE EFFECT.

Inge \ˈinj**, William (Motter)** (b. May 3, 1913, Independence, Kan., U.S.—d. June 10, 1973, Hollywood Hills, Calif.) U.S. playwright and screenwriter. He worked as a schoolteacher (1937–49) and moonlighted as drama editor of the *St. Louis Star-Times* (1943–46). His first play, *Farther Off from Heaven* (1947), was revised for Broadway as *The Dark at the Top of the Stairs* (1957; film, 1960). He is best known for his plays *Come Back, Little Sheba* (1950; film, 1952), *Picnic* (1953, Pulitzer Prize; film, 1956), and *Bus Stop* (1955; film, 1956), and for his original screenplay for *Splendor in the Grass* (1961, Academy Award). He was one of the first dramatists to explore small-town life in the Midwest.

Inglewood City (pop., 2000: 112,580), southwestern California, U.S., situated southwest of LOS ANGELES. Settled by Daniel Freeman in 1873, it was laid out by the Centinela-Inglewood Land Co. in 1887 and incorporated in 1908. It developed along with the Los Angeles metropolitan area and is the site of Hollywood Park racetrack.

ingot \ˈiŋ-gət\ Mass of METAL cast into a size and shape such as a bar, plate, or sheet convenient to store, transport, and work into a semifinished or finished product. The term also refers to a MOLD in which metal is so cast. Steel ingots range in size from small rectangular blocks weighing a few pounds (or kilograms) to huge, tapered, octagonal masses weighing more than 500 tons (450 metric tons).

Ingres \ˈaⁿgrᵊ**, Jean-Auguste-Dominique** (b. Aug. 29, 1780, Montauban, France—d. Jan. 14, 1867, Paris) French painter. He studied with JACQUES-LOUIS DAVID in Paris before attending the École des Beaux-Arts (1799–1801), where he won a Prix de Rome scholarship. Critics condemned one of his first public works, the awe-inspiring portrait *Napoleon on His Imperial Throne* (1806), as stiff and archaic, but its style was one he developed intentionally. In Italy (1806–24) he prospered with portraits and history paintings. His small-scale portrait drawings are meticu-

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lously rendered. Back in Paris he received critical acclaim at last and won admission to the academy with *The Vow of Louis XIII* (1824). He succeeded David as the leader of French NEOCLASSICAL painting, a style that was the antithesis of the lush ROMANTICISM of contemporary artists such as EUGÈNE DELACROIX, Ingres's chief rival. In 1825 he opened a teaching studio, which became one of the largest in Paris. By the mid 1840s he was France's most sought-after society portraitist. Some of his most notable later works are female nudes, which are often notable for their elongated distortion. None of his many students attained distinction, but his influence is seen in the work of EDGAR DEGAS, PIERRE-AUGUSTE RENOIR, and PABLO PICASSO.

Valpinçon Bather, oil painting by Jean-Auguste-Dominique Ingres, 1808; in the Louvre, Paris.
GIRAUDON/ART RESOURCE

inheritance Devolution of property on an heir or heirs upon the death of its owner. In civil law jurisdictions it is called succession. The concept depends on a common acceptance of the notion of private ownership of goods and property. Under some systems, land is considered communal property and rights to it are redistributed, rather than bequeathed, on the death of a community member. In many countries, a minimum portion of the decedent's estate must be assigned to the surviving spouse and often to the progeny as well. Intestacy laws, which govern the inheritance of estates whose distribution is not directed by a WILL, universally view kinship between the decedent and the beneficiary as a primary consideration. Inheritance usually entails payment of an inheritance tax. See also INHERITANCE TAX; INTESTATE SUCCESSION; PROBATE.

inheritance tax Levy on the property accruing to each beneficiary of the estate of a deceased person. Inheritance tax may be more difficult to administer than ESTATE TAX because the value passing to each beneficiary must be fixed, and this often requires complex actuarial calculations. Inheritance taxes date back to the Roman Empire. In the U.S. inheritance taxes have always been collected by the individual states, while the federal government has imposed an estate tax. The first state inheritance tax was imposed by Pennsylvania in 1826.

inhibition In enzymology, a phenomenon in which a compound (an inhibitor), usually similar in structure to the substance on which an ENZYME acts (substrate), interacts with the enzyme so that the resulting complex cannot undergo the usual reaction or cannot form the usual product. The inhibitor may function by combining with the enzyme at the site at which the reaction usually occurs (competitive inhibition) or at another site (noncompetitive inhibition). See also ALLOSTERIC CONTROL, FEEDBACK INHIBITION, REPRESSION.

inhibition In psychology, the conscious or unconscious suppression of free or spontaneous thought or behaviour through the operation of psychological impediments, including internalized social controls. Inhibition serves useful social functions such as protecting oneself and others from harm and enabling the delay of gratification from pleasurable activities. Both extreme lack of inhibition and excessive inhibition can be personally destructive. Inhibition also plays an important role in LEARNING, since an organism must learn to restrain certain instinctual behaviours or previously learned patterns in order to master new patterns. In PHYSIOLOGICAL PSYCHOLOGY, inhibition refers to the suppression of neural electrical activity.

initiation See rite of PASSAGE, SECRET SOCIETY

injunction In civil proceedings, a court order compelling a party to do or to refrain from doing a specified act. It is an equitable remedy for harm for which no adequate remedy exists in law. Thus it is used to prevent a future harmful action (e.g., disclosing confidential information, instituting a national labour strike, or violating a group's civil rights) rather than to compensate for an injury that has already occurred. It also provides relief from harm for which an award of money damages is not a satisfactory solution. A defendant who violates an injunction may be cited for contempt. See also EQUITY.

ink Fluid or paste of various colours (usually black or dark blue) used for writing and PRINTING, composed of a PIGMENT or DYE in a liquid "vehicle." Early inks used lampblack (a form of CARBON) or coloured juices, extracts, or suspensions of plant, animal, and mineral substances. Modern writing inks usually contain ferrous sulfate (see IRON) with a small amount of an acid; on paper, they darken and bond, becoming permanent. Coloured and washable inks usually contain soluble synthetic dyes. Printing inks are formulated for various requirements (including colour, opacity, fade resistance, pliability, odourlessness, drying behaviour, and health and environmental safety) for uses in OFFSET, LETTERPRESS, screen, ink-jet, laser, and other printing.

Inkatha \in-'kä-tə\ **Freedom Party** Political party in South Africa consisting largely of the ZULU. It originated in 1924 as a cultural movement under King Dinizulu. His grandson, MANGOSUTHU G. BUTHELEZI, revived it in 1974 as a political party after breaking with the AFRICAN NATIONAL CONGRESS (ANC). Under Buthelezi, Inkatha advocated a struggle against APARTHEID but a willingness to accept power-sharing arrangements short of majority rule. From the late 1980s Inkatha and ANC followers were regularly involved in bloody clashes with strong ethnic (Zulu v. non-Zulu) overtones. In 1991 the white South African government admitted that it had secretly subsidized Inkatha.

Inland Passage See INSIDE PASSAGE

Inn River Major tributary of the DANUBE RIVER. It rises in Switzerland and flows 317 mi (510 km) northeast across western Austria and southern Germany. Its Swiss section is called the Engadin. In Austria it travels past INNSBRUCK and along the Bavarian ALPS, entering Germany in BAVARIA, where it flows northeast. It forms part of the Austro-German border as it joins the Danube at Passau.

inner ear *or* **labyrinth of the ear** Part of the EAR containing organs of HEARING and equilibrium. The bony labyrinth has three sections (semicircular canals, vestibule, and cochlea); within each structure is a corresponding part of the membranous labyrinth (semicircular ducts, two saclike structures in the vestibule, and cochlear duct). Sound vibrations are transmitted from the middle ear through the membrane-covered oval window to fluid in the snail-shell-shaped cochlea, whose motion stimulates hair cells in the cochlea. The hair cells trigger nerve impulses that travel to the brain, which interprets them as sound. The vestibule and semicircular canals also have organs with hair cells. Those in the vestibule indicate the head's position with respect to the rest of the body (see PROPRIOCEPTION). The three semicircular canals, at right angles to each other, signal motion of the head in three-dimensional space. Continued stimulation after motion stops causes a mismatch with visual input, experienced as dizziness or MOTION SICKNESS.

Inner Mongolia *Chinese* **Nei Mongol** \'nā-'mùŋ-'gôl\ *or* **Neimeng-ku** \'nā-'məŋ-'gü\ Autonomous region (pop., 2002 est.: 23,790,000), China. Stretching some 1,800 mi (2,900 km) across northnortheastern China, it has an area of 454,600 sq mi (1,177,500 sq km); its capital is HOHHOT. Mongols and Chinese make up the bulk of the population, most of which is concentrated in the agricultural belt near the HUANG HE (Yellow River). Inner Mongolia is an inland plateau lying at an elevation of about 3,300 ft (1,000 m); it is fringed by mountains and valleys. Its northern portion lies within the GOBI DESERT, and its southern border is partly marked by the GREAT WALL. Inner Mongolia was separated from MONGOLIA (Outer Mongolia) in 1912 and was established as an autonomous region in 1947. Its harsh climate restricts intensive agriculture; some industrial development has occurred there.

inner product space In mathematics, a VECTOR SPACE or function space in which an operation for combining two vectors or FUNCTIONS (whose result is called an inner product) is defined and has certain properties. Such spaces, an essential tool of FUNCTIONAL ANALYSIS and vector theory, allow analysis of classes of functions rather than individual functions. In mathematical ANALYSIS, an inner product space of particular importance is a Hilbert space, a generalization of ordinary space to an infinite number of dimensions. A point in a Hilbert space can be represented as an infinite sequence of coordinates or as a vector with infinitely many components. The inner product of two such vectors is the sum of the products of corresponding coordinates. When such an inner product is zero, the vectors are said to be orthogonal (see ORTHOGONALITY). Hilbert spaces are an essential tool of MATHEMATICAL PHYSICS. See also DAVID HILBERT.

Innes, Michael See J.I.M. STEWART

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Inness, George (b. May 1, 1825, Newburgh, N.Y., U.S.—d. Aug. 3, 1894, Bridge of Allen, Stirling, Scot.) U.S. landscape painter. He was largely self-taught. His early paintings were influenced by the HUDSON RIVER SCHOOL. He spent much time in Europe studying the works of the BARBIZON SCHOOL, and from c. 1855 to 1874 he developed the luminous, atmospheric quality for which his landscapes are known. The influence of CAMILLE COROT is evident in his intimately rendered images of far-reaching expanses. His later works are marked by the ascendancy of colour over form. His sense of mysticism intensified over time, and the pictures tended to dissolve into shimmering colour with no outlines or formal construction. See also LUMINISM.

Inniskilling See ENNISKILLEN

Innocent III *orig.* **Lothar of Segni** (b. 1160/61, Gavignano Castle, Campagna di Roma, Papal States—d. July 16, 1216, Perugia) Pope (1198–1216). Innocent, who was trained in both theology and law, brought the medieval papacy to the height of its prestige and power. He crowned OTTO IV as Holy Roman emperor, but Otto's determination to unite Germany and Sicily angered him, and in 1212 he gave his support to the Hohenstaufen candidate, FREDERICK II. After Innocent excommunicated King JOHN of England for refusing to recognize STEPHEN LANGTON as archbishop of Canterbury, John was obliged to submit and to declare England a fief of the Holy See (1213). Innocent launched the Fourth CRUSADE, which captured Constantinople, and the ALBIGENSIAN CRUSADE, which attempted to suppress heresy in southern France. He approved the Mendicant orders founded by ST. DOMINIC and ST. FRANCIS OF ASSISI, and he convoked the fourth LATERAN COUNCIL, which promulgated the doctrine of TRANSUBSTANTIATION and endorsed annual confession for all Christians.

Innocent IV *orig.* **Sinibaldo Fieschi** (b. 12th century, Genoa—d. Dec. 7, 1254, Naples) Pope (1243–54). His clash with Holy Roman Emperor FREDERICK II formed an important chapter in the conflict between papacy and empire. Frederick wanted the newly elected pope to lift his excommunication, but Innocent interrupted the negotiations and fled Rome for France (1244); he later condemned Frederick and urged the election of a new emperor. Concerned with the evangelization of the East, he persuaded LOUIS IX to lead a Crusade and sent a mission to the Mongols. He returned to Rome in 1253 and gave the Sicilian throne to Edmund, son of HENRY III of England, but the papal army was defeated by MANFRED, Frederick's son, in 1254.

innovation In TECHNOLOGY, an improvement to something already existing. Distinguishing an element of novelty in an invention remains a concern of PATENT law. The Renaissance was a period of unusual innovation: Leonardo da Vinci produced ingenious designs for submarines, airplanes, and helicopters and drawings of elaborate trains of gears and of the patterns of flow in liquids. Technology provided science with instruments that greatly enhanced its powers, such as Galileo's telescope. New sciences have also contributed to technology, as in the theoretical preparation for the invention of the steam engine. In the 20th century, innovations in semiconductor technology increased the performance and decreased the cost of electronic materials and devices by a factor of a million, an achievement unparalleled in the history of any technology.

Inns of Court Four societies of British students and practitioners of law that have the exclusive right to admit people to practice. The four are Lincoln's Inn, Gray's Inn, Inner Temple, and Middle Temple. All are located in London and trace their origins to the Middle Ages. Until the 17th century, when the Inn of Chancery developed (for training in the framing of writs and other legal documents used in the courts of chancery, or EQUITY courts), the Inns of Court had a monopoly over legal education. By the 19th century, modern law schools had emerged.

Innsbruck City (pop., 2001: 113,392), on the INN RIVER in western Austria, southwest of SALZBURG. A small market town in the 12th century, it was located beside a bridge (*Brücke*) over the Inn. It was chartered in 1239, passed to the HABSBURGS in 1363, and in 1420 became the capital of TIROL. Napoleon gave the city to BAVARIA in 1806, and in 1809 it was the site of an uprising of Tirolian patriots against the Bavarians and the French. The old town has narrow streets lined with medieval houses and arcades. A winter sports centre, Innsbruck was the site of the Winter OLYMPIC GAMES in 1964 and 1976.

İnönü \i-nœ-'nü**, İsmet** (b. Sept. 24, 1884, Smyrna, Ottoman Empire—d. Dec. 25, 1973, Ankara, Tur.) Turkish army officer and statesman. On the surrender of the OTTOMAN EMPIRE in World War I (1918), he was undersecretary of war. He became prime minister in 1923, and president and permanent chairman of the Republican People's Party in 1938 on MUSTAFA KEMAL ATATÜRK's death. In 1950 he was replaced as president by Celâl Bayar and led the opposition, assuming the role of defender of democracy. Following a 1960 coup d'état, he formed three coalition governments, but in the 1965 and 1969 elections his party suffered overwhelming defeats.

inorganic compound Any substance in which two or more chemical ELEMENTS other than CARBON are combined, nearly always in definite proportions (see BONDING), as well as some COMPOUNDS containing carbon but lacking carbon-carbon bonds (e.g., CARBONATES, CYANIDES). Inorganic compounds may be classified by the elements or groups they contain (e.g., oxides, SULFATES). The major classes of inorganic POLYMERS are SILICONES, SILANES, silicates, and borates. Coordination compounds (or complexes), an important subclass of inorganic compounds, consist of molecules with a central METAL atom (usually a TRANSITION ELEMENT) bonded to one or more nonmetallic LIGANDS (inorganic, organic, or both) and are often intensely coloured. See also ORGANIC COMPOUND.

inosilicate \ˌin-ō-'si-lə-kət, ˌī-nō-'si-lə-kət\ *or* **chain silicate** Any of a class of inorganic compounds that have structures characterized by silicate tetrahedrons (a central silicon atom surrounded by four oxygen atoms at the corners of a tetrahedron) arranged in chains. Two of the oxygen atoms of each tetrahedron are shared with other tetrahedrons, forming a chain that is potentially infinite in length. Mineral examples include the PYROXENES and the AMPHIBOLES.

Inoue Enryō \ē-'nō-ü-e-'en-'ryō\ (b. March 18, 1858, Echigo province, Japan—d. June 6, 1919, Dairen, Manchuria) Japanese philosopher. After studying at the main temple of PURE LAND Buddhism in Japan, he earned a degree in philosophy at Tokyo Imperial University. He opposed the Westernization of Japan and the conversion of officials to Christianity. He founded the Philosophical Institute in 1887 to promote the study of BUDDHISM. As part of his campaign to rid Japan of superstitions associated with folklore and mythology, he established the Ghost Lore Institute in Tokyo.

input-output analysis Economic analysis developed by WASSILY LEONTIEF, in which the interdependence of an economy's various productive sectors is observed by viewing the product of each industry both as a commodity for CONSUMPTION and as a factor in the production of itself and other goods. For example, input-output analysis will break down a nation's total production of trucks, showing that some trucks are used in the production of more trucks, some in farming, some in the production of houses, and so on. An input-output analysis is usually summarized in a gridlike table showing what various industries buy from and sell to one another.

Inquisition In the MIDDLE AGES, a judicial procedure that was used to combat HERESY; in early modern times, a formal Roman Catholic judicial institution. *Inquisito*, a Latin term meaning investigation or inquest, was a legal procedure that involved the assemblage of evidence and the prosecution of a criminal trial. Use of the procedure against the heresies of the CATHARI and WALDENSES was approved by Pope GREGORY IX in 1231. Suspected heretics were arrested, interrogated, and tried; the use of torture was approved by INNOCENT IV in 1252. Penalties ranged from prayer and fasting to imprisonment; convicted heretics who refused to recant could be executed by lay authorities. Medieval inquisitors functioned widely in northern Italy and southern France. The Spanish Inquisition was authorized by SIXTUS IV in 1478; the pope later tried to limit its powers but was opposed by the Spanish crown. The auto-da-fé, the public ceremony at which sentences were pronounced, was an elaborate celebration, and the grand inquisitor TOMÁS DE TORQUEMADA was responsible for burning about 2,000 heretics at the stake. The Spanish Inquisition was also introduced into Mexico, Peru, Sicily (1517), and the Netherlands (1522), and it was not entirely suppressed in Spain until the early 19th century.

insanity In criminal law, a disease, defect, or condition of the mind that renders one unable to understand the nature of a criminal act or the fact that it is wrong. Tests of insanity are not intended as medical diagnoses but rather only as determinations of whether a person may be held criminally responsible for his or her actions. The most enduring definition of insanity in Anglo-American law was that proposed by ALEXANDER COCKBURN (1843). Many U.S. states and several courts have adopted a standard under which the accused must lack "substantial capacity either to appreciate the criminality of his conduct or to conform his conduct to the requirements of the law." Some states have abolished the insanity plea, and others allow a finding of "guilty but mentally ill." See also DIMINISHED RESPONSIBILITY.

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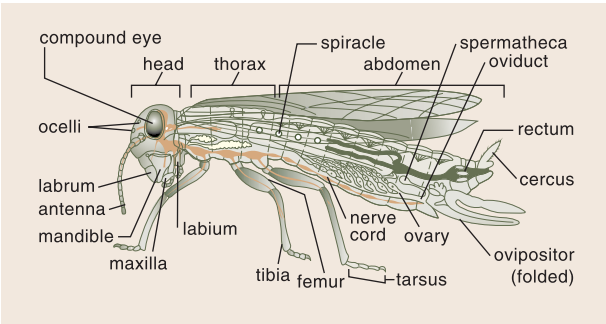
insect Any member of the class Insecta, the largest ARTHROPOD class, including nearly 1 million known species (about three-fourths of all animals) and an estimated 5–10 million undescribed species. Insect bodies have three segments: head, thorax (which bears three pairs of legs and usually two pairs of wings), and many-segmented abdomen. Many species undergo complete METAMORPHOSIS. There are two subclasses: Apterygota (primitive, wingless forms, including SILVERFISH and bristletails) and Pterygota (more advanced, winged or secondarily wingless forms). The approximately 27 orders of Pterygota are generally classified by wing form: e.g., Coleoptera (BEETLES), Diptera (DIPTERANS), Heteroptera (BUGS). Insects are found in almost all terrestrial and freshwater and some marine habitats.



Body plan of a generalized insect. The body is usually divided into a head, thorax, and abdomen. The head bears appendages modified into mouthparts and antennae bearing sense organs. Mouthparts include the toothed mandibles and bladelike maxillae found behind the "upper lip," or labrum. A second pair of maxillae, partly fused, form the "lower lip," or labium. An adult usually has both simple eyes (ocelli) and more-complex faceted compound eyes, as well as a pair of wings on the thorax. The tarsal segment of the jointed leg often has claws with adhesive pads, enabling the insect to hold onto smooth surfaces. In some insects (including crickets and cockroaches), a pair of feelers (cerci) bearing sense organs are located at the rear of the abdomen. Tiny openings (spiracles) on the thorax and abdomen allow passage of oxygen to and release of carbon dioxide from internal air-filled tubules or tracheae. Sperm from the male is stored in the female's spermatheca until an egg released from the ovary passes through the oviduct. The female may have an ovipositor for depositing eggs.

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insecticide Any of a large group of substances used to kill INSECTS. Such substances are mainly used to control pests that infest cultivated plants and crops or to eliminate disease-carrying insects in specific areas. Inorganic insecticides include ARSENIC, LEAD, and COPPER compounds. Some organic insecticides are natural, such as rotenone, pyrethrins, and NICOTINE (see TOXIN). Others are synthetic, such as chlorinated HYDROCARBONS (e.g., DDT, dieldrin, lindane); carbamates, related to UREA (e.g., carbaryl, carbofuran); and parathions, organic PHOSPHORUS ESTERS. Insect HORMONES may be included as a class. Insecticides may affect the NERVOUS SYSTEM, inhibit essential ENZYMES, or prevent LARVAE from maturing (e.g., juvenile hormone). Some are stomach POISONS, some inhalation poisons, and others contact poisons. Agents such as inert oils act mechanically, simply blocking the breathing pores. Insecticides vary widely not only in effectiveness against target insects (which may develop resistance) but also in toxicity to nontarget species (including humans) and environmental effects; many of the worst (e.g., DDT) have been banned or their use curtailed.

insectivore \in-'sek-tə-ˌvōr\ Any member of the mammalian order (Insectivora) that includes the HEDGEHOGS, MOLES, and sometimes SHREWS (some of which are considered PRIMATES by some authorities), or, more generally, any animal that eats mainly insects. The mammalian insectivores are generally small, active, and nocturnal. They are found in most parts of the world except Antarctica, Australia, and South America. Most species are solitary (except during the breeding season) and short-lived.

insei *Japanese* **"cloistered government"** Rule by retired emperors who have taken Buddhist vows and retired to cloisters. During the late 11th and the 12th century, governmental control of Japan passed from the FUJIWARA FAMILY, which had maintained power through marriages to the imperial family, to cloistered emperors. By abdicating, these emperors escaped the control of Fujiwara regents and chancellors; once inside a temple or monastary, they surrounded themselves with capable non-Fujiwara aristocrats. It was the edicts of the cloistered emperor, not the reigning one, that were obeyed, insofar as any orders were obeyed in a period of increasing collapse of central authority. The practice came to an end with the reign of the emperor GO-DAIGO (1318–39). See also SHOEN.

inside contracting System of manufacturing intermediate between the putting-out system and full factory production. A factory proprietor supplies to an artisan who then hires the workers needed to make a particular part under a contract with the proprietor. Inside contracting was used extensively in the U.S. in the 19th century.

Inside Passage *or* **Inland Passage** Natural sheltered sea route along the U.S.-Canadian coast from SEATTLE, Wash., to Skagway, Alaska. Extending northwest for more than 1,000 mi (1,600 km), it comprises channels and straits between the mainland and islands (including VANCOUVER ISLAND) that protect it from Pacific storms. It is the favoured route for coastal shipping to Alaska. Ports in British Columbia include VICTORIA, VANCOUVER, and Prince Rupert; those in Alaska include Ketchikan, Wrangell, and JUNEAU.

insider trading Illegal use of insider information for profit in financial trading. Since 1934, the SECURITIES AND EXCHANGE COMMISSION has prohibited trading while in possession of material nonpublic information. See also ARBITRAGE, MICHAEL R. MILKEN.

insolvency Condition in which liabilities exceed assets so that creditors cannot be paid. It is a financial condition that often precedes BANKRUPTCY. In the context of equity, insolvency is the inability to pay debts as they become due; insolvency under the balance-sheet approach means that total liabilities exceed total assets.

insomnia Inability to sleep adequately. The causes may include poor sleeping conditions, circulatory or brain disorders, breathing disorders (e.g., sleep apnea), mental distress (e.g., tension or depression), or physical discomfort. Mild insomnia may be treated by improving sleeping conditions or through traditional remedies such as warm baths, milk, or systematic relaxation. Apnea and its associated insomnia may be treated surgically or mechanically with breathing apparatus. Severe or chronic insomnia may necessitate the temporary use of barbiturates or tranquilizers, but such drugs are often addictive and may be decreasingly effective as the body builds up tolerance. Other methods of treatment include PSYCHOTHERAPY and HYPNOSIS.

instinct Involuntary response by an animal, resulting in a predictable and relatively fixed behaviour pattern. Instinctive behaviour is an inherited mechanism that serves to promote the survival of an animal or species. It is most apparent in fighting and sexual activity. The simplest form is the REFLEX. All animals have instinct, but, in general, the higher the animal form, the more flexible the behaviour. Among mammals, learned behaviour often prevails over instinctive behaviour.

Institut Canadien \aⁿ-stē-'tüē-ka-nad-'yaⁿ\ Literary and scientific society that came into conflict with the Catholic Church in 19th-century French Canada. It was founded in Montreal in 1844 as a discussion forum and free library, and it established branches throughout French-speaking Canada. It criticized the institutionalism of the church in Quebec and displayed books considered undesirable. Church leaders, including Ignace Bourget, bishop of Montreal (1840–76), attacked the institute, which appealed to Rome for support. In 1869 the church condemned the movement, and most members withdrew.

institutional economics School of economics that flourished in the U.S. in the 1920s and '30s, which viewed the evolution of economic institutions as part of the broader process of cultural development. THORSTEIN VEBLEN laid the foundation for institutionalism with his criticism of traditional economic theory. He tried to replace the concept of people as the makers of economic decisions with a more realistic image of people as influenced by changing customs and institutions. JOHN R. COMMONS emphasized the collective action of various groups in the economy, viewed within a system of continually evolving institutions and laws. Other U.S. institutional economists include REXFORD TUGWELL and WESLEY C. MITCHELL. See also CLASSICAL ECONOMICS, GERMAN HISTORICAL SCHOOL OF ECONOMICS.

Institutional Revolutionary Party (PRI) Political party that dominated Mexico's political life for most of the time since its founding in 1929. It was established as a result of a shift of power from political-military chieftains to state party units following the MEXICAN REVOLUTION (1910–20). Until the late 1990s, nomination to public office by the PRI virtually guaranteed election, but in 1997 Mexico City elected its first non-PRI mayor. At

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the national level, the president, as leader of the party, typically selected the party's next presidential candidate—thus effectively choosing his own successor. Pres. Ernesto Zedillo broke from that tradition in 1999, and the following year opposition candidate Vicente Fox won the presidency, although the PRI maintained control of several state governments.

instrumentalism *or* **experimentalism** Philosophy advanced by John Dewey holding that what is most important in a thing or idea is its value as an instrument of action and that the truth of an idea lies in its usefulness. Dewey favored these terms over the term pragmatism to label the philosophy on which his views of education rested. His school claimed that cognition has evolved not for speculative or metaphysical purposes but for the practical purpose of successful adjustment. Ideas are conceived as instruments for transforming the uneasiness arising from facing a problem into the satisfaction of solving it.

instrumentation In technology, the development and use of precise measuring, analysis, and control equipment. Among the oldest known instruments of measurement was the armillary sphere, an astronomical instrument used in ancient China and Greece. The compass was a striking advance in navigational instrumentation made about the 11th century. Theodolites made accurate determination of locations possible in the 18th century. Instrumentation developed rapidly in the Industrial Revolution. Manufacturing required precision instruments, such as the screw micrometer, which could measure 0.0001 in. (0.0025 mm). The industrial application of electricity required instruments to measure current, voltage, and resistance. Today most manufacturing processes rely on instrumentation for monitoring chemical, physical, and environmental properties. Instruments used in medicine and biomedical research are just as varied as those in industry. See also analysis.

insulator Substance that blocks or retards the flow of electric current or heat. An insulator is a poor conductor because it has a high resistance to such flow. Electrical insulators are commonly used to hold conductors in place, separating them from one another and from surrounding structures to form a barrier between energized parts of an electric circuit and confine the flow of current to wires or other conducting paths. Electrical insulators include rubber, plastic, porcelain, and mica. Thermal insulators. which break up the heat-flow path by absorbing radiant heat, include fiberglass, cork, and rock wool.

insulin Polypeptide hormone (see peptide) that regulates blood glucose levels. Secreted by the islets of Langerhans (see Langerhans, islets of) in the pancreas when blood glucose rises, as after a meal, it helps transfer the glucose into the body's cells to be oxidized (see oxidation-reduction) for energy or converted and stored as fatty acids or glycogen. When blood glucose falls, insulin secretion stops and the liver releases more glucose into the blood. Insulin has various related functions in the liver, muscles, and other tissues, controlling the balance of glucose with related compounds. Insulin-related disorders include diabetes mellitus and hypoglycemia. Frederick Banting and J.J.R. Macleod won a Nobel Prize in 1923 for discovering insulin, and Frederick Sanger won one in 1958 for determining its amino acid sequence.

Insull \'in-səl**, Samuel** (b. Nov. 11, 1859, London, Eng.—d. July 19, 1938, Paris, France) British-born U.S. public-utilities magnate. He moved to the U.S. in 1881 to become the private secretary of Thomas Alva Edison and rose to become president of the Chicago Edison Co. in 1892. By 1907 he had taken control of Chicago's transit system. By 1912 his vast electric-power system, enlarged by various mergers, was operating several hundred power plants. He vigorously promoted the stock of his holding companies. When they collapsed in 1932, he fled to Europe; extradited in 1934, he was tried three times for fraud, violation of bankruptcy laws, and embezzlement but was acquitted each time.

insurance Contract that, by redistributing risk among a large number of people, reduces losses from accidents incurred by an individual. In return for a specified payment (premium), the insurer undertakes to pay the insured or his beneficiary a specified amount of money in the event that the insured suffers loss through the occurrence of an event covered by the insurance contract (policy). By pooling both the financial contributions and the risks of a large number of policyholders, the insurer is able to absorb losses much more easily than is the uninsured individual. Insurers may offer insurance to any individual able to pay, or they may contract with members of a group (e.g., employees of a firm) to offer special rates for group insurance. Marine insurance, covering ships and voyages, is the oldest form of insurance; it originated in ancient times with loans to shipowners that were repayable only on safe completion of a voyage, and it was formalized in medieval Europe. Fire insurance arose in the 17th century, and other forms of property insurance became common with the spread of industrialization in the 19th century. It is now possible to insure almost any kind of property, including homes, businesses, motor vehicles, and goods in transit. See also casualty insurance; health insurance; liability insurance; life insurance.

intaglio \in-'tal-yō\ Engraved or incised work on gemstones, glass, ceramics, stone, or similar material in which the design is sunk beneath the surface, the opposite of cameo and relief. It is the most ancient form of gem engraving; the earliest known Babylonian cylinder seals date from c. 4000 BC. The term intaglio is also used to describe printmaking processes in which the design is cut, scratched, or etched into a printing surface of copper, zinc, or aluminum; ink is then rubbed into the incisions or grooves, the surface is wiped clean, and the paper is embossed into the incised lines with pressure from a roller press. Intaglio processes are the most versatile of printmaking methods, as they can produce a wide range of effects.

intarsia \in-'tär-sē-ə\ Form of wood inlay. Italian intarsia, or inlaid mosaic of wood, which probably derived from East Asian ivory and wood inlay, found its richest expression during the Renaissance in Italy (c. 1400–1600). It was often used in panels over the backs of choir stalls and in private studies and chapels of princes.

integer Whole-valued positive or negative number or 0. The integers are generated from the set of counting numbers 1, 2, 3, . . . and the operation of subtraction. When a counting number is subtracted from itself, the result is zero. When a larger number is subtracted from a smaller number, the result is a negative whole number. In this way, every integer can be derived from the counting numbers, resulting in a set of numbers closed under the operation of subtraction (see group theory).

integral Fundamental concept of calculus related to areas and other quantities modeled by functions. A definite integral gives the area between the graph of a function and the horizontal axis between vertical lines at the endpoints of an interval. It also calculates the net change in a system over an interval, thus leading to formulas for the work done by a varying force or the distance traveled by an object moving at varying speeds. When only the function is given, with no interval, it is known as an indefinite integral. The process of solving either a definite or an indefinite integral is called integration. According to the fundamental theorem of calculus, a definite integral can be calculated by using its antiderivative (a function whose rate of change, or derivative, equals the function being integrated). Integrals extend to higher dimensions through multiple integrals. See also line integral; surface integral.

integral, line See line integral

integral, surface See surface integral

integral calculus Branch of calculus concerned with the theory and applications of integrals. While differential calculus focuses on rates of change, such as slopes of tangent lines and velocities, integral calculus deals with total size or value, such as lengths, areas, and volumes. The two branches are connected by the fundamental theorem of calculus, which shows how a definite integral is calculated by using its antiderivative (a function whose rate of change, or derivative, equals the function being integrated). For example, integrating a velocity function yields a distance function, which enables the distance traveled by an object over an interval of time to be calculated. As a result, much of integral calculus deals with the derivation of formulas for finding antiderivatives. The great utility of the subject emanates from its use in solving differential equations.

integral equation In mathematics, an equation with an unknown function within an integral. An example is

$$f(x) = \int_{-\infty}^{\infty} \cos(xt)\,\varphi(t)\,dt$$

where $f(x)$ is known and $\varphi(t)$ is to be found, given certain conditions on f. Such equations are useful in solving differential equations.

integral transform In mathematics, a function that results when a given function is multiplied by a so-called kernel function, and the product is integrated (see integration) between suitable limits. Its value lies in its ability to simplify intractable differential equations (subject to particular

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boundary conditions) by transforming the DERIVATIVES and boundary conditions into terms of an ALGEBRAIC EQUATION that may easily be solved. The solution yielded must be converted to the final solution using an inverse transformation. Several integral transforms are named for the mathematicians who introduced them (FOURIER TRANSFORM, LAPLACE TRANSFORM).

integrated circuit (IC) *or* **microcircuit** *or* **chip** *or* **microchip** Assembly of microscopic electronic components (TRANSISTORS, DIODES, capacitors, and resistors) and their interconnections fabricated as a single unit on a wafer of semiconducting material, especially silicon. Early ICs of the late 1950s consisted of about 10 components on a chip 0.12 in. (3 mm) square. Very large-scale integration (VLSI) vastly increased circuit density, giving rise to the MICROPROCESSOR. The first commercially successful IC chip (Intel, 1974) had 4,800 transistors; Intel's Pentium (1993) had 3.2 million, and more than a billion are now achievable.

integrated pest management Technique for agricultural disease- and PEST-control in which as many pest-control methods as possible are used in an ecologically harmonious manner to keep infestation within manageable limits. Integrated pest management addresses the serious ecological problems created by the extensive use of powerful chemical PESTICIDES. It minimizes their use and combines them with biological methods of pest control, including the breeding of pest-resistant crop varieties, the development of crop culture methods that inhibit pest proliferation, the release of predators or parasites of the pest species, and the placement of traps baited with the pest's own sex attractants (PHEROMONES). Chemical insecticides generally are applied only as a last resort.

Integrated Services Digital Network See ISDN

integration In CALCULUS, the process of finding a FUNCTION whose DERIVATIVE is a given function. The term, sometimes used interchangeably with "antidifferentiation," is indicated symbolically with the integral sign $\int$. (The DIFFERENTIAL dx usually follows to indicate x as the VARIABLE.) The basic rules of integration are: (1) $\int(f + g)dx = \int f dx + \int g dx$ (where f and g are functions of the variable x), (2) $\int kf dx = k\int f dx$ (k is a constant), and (3)

$$\int x^n dx = \left(\frac{1}{n+1}\right)x^{n+1} + C$$

(C is a constant). Note that any constant value may be added onto an indefinite integral without changing its derivative. Thus, the indefinite integral of $2x$ is $x^2 + C$, where C can be any real number. A definite integral is an indefinite integral evaluated over an interval. The result is not affected by the choice for the value of C. See also DIFFERENTIATION.

integument \in-'teg-yù-mənt\ Covering of the body, which protects it from the outside world and from drying out. In humans and other mammals it consists of the SKIN (including outer epidermis and inner dermis) and its related structures, including HAIR, NAILS, and SEBACEOUS and SWEAT glands.

Intel Corp. U.S. manufacturer of semiconductor computer circuits. Intel was founded in 1968 as NM Electronics by ROBERT NOYCE and Gordon Moore, inventors of the integrated circuit, to manufacture large-scale integrated (LSI) circuits. In the early 1970s it introduced the most powerful semiconductor chips then known, which soon replaced the magnetic cores previously used in computer memories. IBM chose to use Intel's 8088 MICROPROCESSOR (introduced 1978) in its first PERSONAL COMPUTER (the IBM PC), and Intel microprocessors became standard for all PC-type machines. Although other manufacturers eventually developed Intel-compatible microprocessors, Intel continued to power more than 75% of PCs at the beginning of the 21st century.

intellectual property Property that derives from the work of an individual's mind or intellect. Early COPYRIGHT law aimed to protect the economic interests of book publishers rather than the intellectual rights of authors. Modern copyright law protects the labour of elaborating an idea, but not the idea itself. The concept of discovery also plays a role in intellectual property rights: a PATENT is awarded to one who can demonstrate that he or she has invented something not previously known. The WORLD TRADE ORGANIZATION requires members to establish and enforce minimum levels of copyright, patent, and TRADEMARK protection within their jurisdictions. The World Intellectual Property Organization, which began operations in 1970, promotes the worldwide protection of both industrial property (inventions, trademarks, and designs) and copyrighted materials (literary, musical, photographic, and other artistic works).

intelligence In education, the ability to learn or understand or to deal with new or challenging situations. In psychology, the term may more specifically denote the ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria (such as the IQ test). Intelligence is usually thought of as deriving from a combination of inherited characteristics and environmental (developmental and social) factors. The subject remains hotly debated, and many have tried to show that either biology (especially genes) or environment (especially conditions reflecting socioeconomic class) are more or less exclusively responsible for producing differences in intelligence. Particularly contested have been studies purporting to show links between ethnic heritage and intelligence, most of which have not been accepted in the scientific community. General intelligence is often said to comprise various specific abilities (verbal ability, ability to apply logic in solving problems, etc.), but critics contend that such compartments fail to reflect the nature of cognition and that other models, perhaps based on INFORMATION PROCESSING, are needed. High intelligence (as measured by tests) is sometimes shown to correlate with social achievement, but most experts believe other factors are important and that intelligence is no guarantor of success (and its lack is no guarantor of failure). See also ARTIFICIAL INTELLIGENCE; CREATIVITY.

intelligence In government and military operations, evaluated information concerning the strength, activities, and probable courses of action of international actors that are usually, though not always, enemies or opponents. The term also refers to the collection, analysis, and distribution of such information and to the secret intervention in the political or economic affairs of other countries, an activity commonly known as "covert action." Intelligence is an important component of national power and a fundamental element in decision making regarding national security, defense, and foreign policies. It is conducted on three levels: strategic, tactical, and counterintelligence. Despite the public image of intelligence operatives as cloak-and-dagger secret agents, much intelligence work involves an undramatic search of "open" sources, such as radio broadcasts and various publications. Among covert sources of intelligence are imagery intelligence, which includes aerial and space reconnaissance, signals intelligence, which includes electronic eavesdropping and CODE breaking, and human intelligence, which involves the secret agent working at the classic spy trade. Leading national intelligence organizations are the CENTRAL INTELLIGENCE AGENCY (CIA) in the U.S.; the Federal Security Service in Russia; MI5 and MI6 in Britain; and the MOSSAD in Israel.

intelligence quotient See IQ

intelligent design Argument intended to demonstrate that living organisms were created in more or less their present forms by an "intelligent designer." Intelligent design was formulated in the 1990s, primarily in the United States, as an explicit refutation of the Darwinian theory of biological EVOLUTION. Building on a version of the ARGUMENT FROM DESIGN for the existence of God, proponents of intelligent design observed that the functional parts and systems of living organisms are "irreducibly complex" in the sense that none of their component parts can be removed without causing the whole system to cease functioning. From this premise they inferred that no such system could have come about through the gradual alteration of functioning precursor systems by means of random mutation and NATURAL SELECTION, as the standard evolutionary account maintains; therefore, living organisms must have been created all at once by an intelligent designer. Proponents of intelligent design generally avoided identifying the designer with the God of Christianity or other monotheistic religions, in part because they wished the doctrine to be taught as a legitimate scientific alternative to evolution in public schools in the United States, where the government is constitutionally prohibited from promoting religion. Critics of intelligent design argued that it rests on a fundamental misunderstanding of natural selection, that it ignores the existence of precursor systems in the evolutionary history of numerous organisms, and that it is ultimately untestable and therefore not scientific. See also CREATIONISM.

intensive care unit *or* **critical care unit** Hospital facility for care of critically ill patients at a more intensive level than is needed by other patients. Staffed by specialized personnel, the intensive care unit contains a complex assortment of monitors and life-support equipment that can sustain life in once-fatal situations, including adult RESPIRATORY DISTRESS SYNDROME, KIDNEY FAILURE, multiple organ failure, and sepsis (see SEPTICEMIA).

intention In Scholastic logic and psychology, a concept used to describe a mode of being or relation between a mind and an object. In knowing, the mind is said to "intend" or "tend toward" its object, and a thing as

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known, or in the knowing mind, has "intentional being," as with squaring the circle, which, though impossible, can be an object of intention. In action theory, intention is taken in a different but related sense, as in acting with the intention of accomplishing a specific purpose. An important question in action theory is that of the relation between having a specific intention in doing something and doing the same thing intentionally. Is an intention necessary for intentional action and, if so, is it a cause of such action or some other kind of ground of it?

intentionality Property of being directed toward an object. Intentionality is exhibited in various mental phenomena. Thus, if a person experiences an emotion toward an object, he has an intentional attitude toward it. Other examples of intentional attitudes toward an object are, looking for, believing in, and thinking about. Intentional attitudes also include PROPOSITIONAL ATTITUDES. One characteristic of intentionality is "inexistence": A person may be intentionally related to an object that does not exist. Thus, what a person looks for (and intentionally seeks) may not exist, and an event he believes to occur may not occur at all. Another characteristic is referential opacity: A sentence truly ascribing an intentional state to a person may become false when some alternative description of the object of that state is substituted for it. Suppose that his pen is the millionth pen produced this year, so that "his pen" and "the millionth pen produced this year" have the same reference. It may be true to say that he is in the intentional state of searching for his pen but false to say that he is in the intentional state of searching for the millionth pen produced this year; similarly, he may believe that this is his pen and yet not believe this is the millionth pen produced this year.

interaction, fundamental See FUNDAMENTAL INTERACTION

interactionism In sociology, a theoretical perspective that derives social processes (such as conflict, cooperation, identity formation) from human interaction. It was GEORG SIMMEL who first stated that "society is merely the name for a number of individuals connected by interaction." In the U.S., JOHN DEWEY, Charles H. Cooley, and especially GEORGE HERBERT MEAD developed symbolic interactionism, the theory that mind and self are not part of the innate human equipment but arise through social interaction—i.e., communication with others using SYMBOLS. For symbolic interactionists, the individual is always engaged in socialization or the modification of one's mind, role, and behaviour through contact with others. Other theorists, such as ALFRED SCHUTZ, drew on PHENOMENOLOGY to extend interactionism, an effort that led to the creation of fields such as SOCIOLINGUISTICS and ethnomethodology, the study of people's sense-making activities. See also ERVING GOFFMAN.

interactionism In philosophy of MIND, a species of mind-body DUALISM that holds that mind and body, though separate and distinct substances, causally interact. Interactionists assert that a mental event (as when a person forms the intention to put his hand in a fire) can be the cause of a physical action. Conversely, the physical event (his hand coming into contact with the fire) can be the cause of a mental event (his feeling an intense pain). The classical formulation of interactionism is due to RENÉ DESCARTES, who could not satisfactorily explain how the interaction takes place, apart from the speculation that it occurs in the pineal gland. This problem led some philosophers to deny that mind and body really interact and to explain appearances to the contrary by appealing to divine intervention to create mental or physical effects for physical or mental causes (see OCCASIONALISM) or to a divinely ordained "preestablished harmony" between the courses of mental and physical events. BENEDICT DE SPINOZA argued for a monistic theory on which mind and body were both attributes of a single underlying substance. See also DUALISM; MIND-BODY PROBLEM.

Inter-American Development Bank (IDB) international organization founded in 1959 by 20 governments in North and South America to finance economic and social development in the Western Hemisphere. The largest charter subscribers were Argentina, Brazil, Mexico, Venezuela, and the U.S. Subscribers now include nearly 30 countries in North and South America and more than 15 countries in Europe, as well as Japan and Israel. The IDB group also includes the Inter-American Investment Corp. and the Multilateral Investment Fund. It is headquartered in Washington, D.C.

interchangeable parts Identical components that can substitute one for another, particularly important in MANUFACTURING. MASS PRODUCTION, which transformed the organization of work, came about by the development of the MACHINE-TOOL industry by a series of 19th-century innovators. With precision equipment, large numbers of identical parts could be produced at low cost and with a small workforce. See also AMERICAN SYSTEM OF MANUFACTURE; ARMOURY PRACTICE; AUTOMOBILE industry; FACTORY; HENRY FORD; HENRY LELAND.

intercolumniation In architecture, the space between columns that support an ARCH or ENTABLATURE. Classical, Renaissance, and Baroque architecture used a system codified by VITRUVIUS in which the measurement is expressed in terms of the columns' diameters (e.g., two columns might be described as being three diameters apart). The system conveniently expressed the measurement of a unit of space whose size varied from building to building according to the Classical ORDER used.

intercontinental ballistic missile See ICBM

interest Price paid for the use of CREDIT or MONEY. It is usually figured as a percentage of the money borrowed and is computed annually. Interest is charged by the lender as payment for the loss of his or her money for a period of time. The interest rate reflects the risk of lending and is higher for loans that are considered higher-risk, a relationship known as the risk/return tradeoff. Like the prices of goods and services, interest rates are responsive to SUPPLY AND DEMAND. Theories explaining the need for interest include the time-preference theory, according to which interest is the inducement to engage in time-consuming but more productive activities, and the LIQUIDITY-PREFERENCE theory of JOHN MAYNARD KEYNES, according to which interest is the inducement to sacrifice a desired degree of liquidity for a nonliquid contractual obligation. Interest rates may also be used as a tool for implementing MONETARY POLICY (see DISCOUNT RATE). High interest rates may dampen the economy by making it difficult for consumers, businesses, and home buyers to secure loans, while lower rates tend to stimulate the economy and encourage both INVESTMENT and CONSUMPTION.

interference In physics, the net effect of combining two or more WAVE trains moving on intersecting or coincident paths. Constructive interference occurs if two components have the same FREQUENCY and PHASE; the wave amplitudes are reinforced. Destructive interference occurs when the two waves are out of phase by one-half period (see PERIODIC MOTION); if the waves are of equal amplitude, they cancel each other. Two waves moving in the same direction but having slightly different frequencies interfere constructively at regular intervals, resulting in a pulsating frequency called a BEAT. Two waves traveling in opposite directions but having equal frequencies interfere constructively in some places and destructively in others, resulting in a standing wave.

interferon \ˌin-tər-'fir-ˌän\ Any of several related PROTEINS produced by all VERTEBRATES and possibly some invertebrates. They play an important role in resistance to infection. The body's most rapidly produced and important defense against VIRUSES, they can also combat BACTERIA and parasites (see PARASITISM), inhibit cell division, and promote or impede cell differentiation. Interferon's effect is indirect—it reacts with susceptible cells, which then resist virus multiplication—in contrast to ANTIBODIES, which act by combining directly with a specific virus. Various types of interferons are distinguished by their characteristics as proteins and by which cells produce them. Some are now produced by GENETIC ENGINEERING. Initial hopes that interferon would be a wonder drug for a wide variety of diseases were deflated by its serious side effects, but a few rare conditions respond to it.

interior design Design of interior spaces, closely related to architecture and sometimes including interior decoration. The designer's goal is to produce a coordinated and harmonious whole in which the architecture, site, function, and visual aspects of the interior are unified, pleasing to mind and body, and appropriate to the activities to be pursued there. Design criteria include harmony of colour, texture, lighting, scale, and proportion. Furnishings must be in proportion to the space they occupy and to the needs and lifestyles of the residents. The design of such nonresidential spaces as offices, hospitals, stores, and schools places clear organization of functions ahead of purely aesthetic concerns.

interleukin \ˌin-tər-'lü-kən\ Any of a class of naturally occurring PROTEINS important in regulation of LYMPHOCYTE function. Several known types are recognized as crucial constituents of the body's immune system (see IMMUNITY). ANTIGENS and microbes stimulate production of interleukins, which induce production of various types of lymphocytes in a complex series of reactions that ensure a plentiful supply of T CELLS that fight specific infectious agents.

intermediate goods See PRODUCER GOODS

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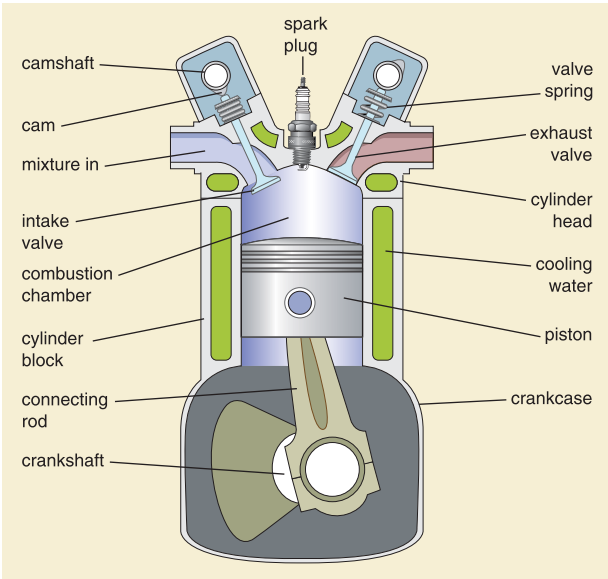
intermediate-range nuclear weapons Class of NUCLEAR WEAPONS with a range of 620–3,400 mi (1,000–5,500 km). Some multiple warheads developed by the Soviet Union could strike several targets anywhere in Western Europe in less than 10 minutes. The U.S. could send a single nuclear warhead from central Europe to Moscow in less than 10 minutes. Both were regarded as offensive, first-strike weapons. U.S.-Soviet arms-control negotiations (1980–87) led to the intermediate nuclear forces (INF) treaty, signed by MIKHAIL GORBACHEV and RONALD REAGAN, to completely remove and dismantle these and shorter-range weapons.

internal-combustion engine Any ENGINE in which a fuel-air mixture is burned in the engine proper so that the hot gaseous products of combustion act directly on the surfaces of its moving parts, such as those of pistons (see PISTON AND CYLINDER) or TURBINE rotor blades. Internal-combustion engines include GASOLINE ENGINES, DIESEL ENGINES, gas turbine engines, pure JET ENGINES, and ROCKET engines and motors, and are one class of heat engines. They are commonly divided into continuous-combustion engines and intermittent-combustion engines. In the first type (e.g., jet engines) fuel and air flow steadily into the engine, where a stable flame is maintained for continuous combustion. In the second (e.g., gasoline–reciprocating-piston engines), discrete quantities of fuel and air are periodically ignited. See also AUTOMOBILE industry, MACHINE, STEAM ENGINE.



Cross section showing one cylinder of a four-stroke internal-combustion engine. In the first stroke (shown), a cam (left) compresses a valve spring, opening the intake valve to admit the fuel-air mixture to the cylinder. Both valves then close, the mixture is compressed by the piston, and current is sent to the spark plug. Ignited by the spark plug, the burning mixture forces the piston down, producing power to turn the crankshaft and run the car. Another cam (right) opens the exhaust valve and the burned exhaust gases exit.

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internal medicine Medical specialty dealing with the entire patient rather than a particular organ system, covering DIAGNOSIS and medical (rather than surgical) treatment in adults. Its development began in the 17th century with THOMAS SYDENHAM's concept of disease, but until disease-specific therapies were developed in the 20th century, internists could do little to treat diseases. As more specific treatments became available, medical knowledge increased, and subspecialties in specific organ systems were defined, internal medicine became recognized as a specialty.

internal reflection, total See TOTAL INTERNAL REFLECTION

Internal Revenue Service (IRS) Agency of the U.S. Department of the Treasury charged with administering and enforcing federal tax laws, except those relating to alcohol, tobacco, firearms, and explosives. It issues rulings and regulations to supplement the provisions of the Internal Revenue Code; determines, assesses, and collects internal revenue taxes; and determines exempt organization status.

International, Communist See FIRST INTERNATIONAL, SECOND INTERNATIONAL, COMINTERN

international agreement Instrument by which nation-states and international organizations regulate matters of concern. They are governed by INTERNATIONAL LAW, and their purposes include the development and codification of international law, the creation of international bodies, and the resolution of actual and potential international conflict. The most comprehensive agreement is a TREATY; others, including conventions (e.g., the GENEVA CONVENTIONS), charters (e.g., the UN charter), and pacts (e.g., the KELLOGG-BRIAND PACT), are less formal and rely primarily on goodwill. Agreements may be negotiated between states, between an organization and a state, between organizations, or between any of those and a NONGOVERNMENTAL ORGANIZATION.

International Atomic Energy Agency (IAEA) International organization officially founded in 1957 to promote the peaceful use of NUCLEAR ENERGY. Based in Vienna, its activities include research on the applicability of nuclear energy to medicine, agriculture, water resources, and industry; provision of technical assistance; development of radiation safeguards; and public relations programs. Following the FIRST PERSIAN GULF WAR, IAEA inspectors were called on to certify that Iraq was not manufacturing nuclear weapons. The IAEA and its director general, Mohamed ElBaradei, were awarded the Nobel Prize for Peace in 2005.

International Bank for Economic Cooperation (IBEC) International bank instituted by an agreement signed by Bulgaria, Hungary, East Germany, Mongolia, Poland, Romania, Czechoslovakia, and the Soviet Union in 1963 to facilitate economic cooperation among member countries and promote their development. Cuba and Vietnam joined later. Its functions included making multilateral settlements in transferable rubles, advancing credit to members with temporary trade imbalances, accepting deposits in transferable rubles and in gold and convertible currencies, and conducting ARBITRAGE and other financial operations. After the fall of the Soviet Union it became a Russian bank with a new charter.

International Bank for Reconstruction and Development (IBRD) Main component organization of the WORLD BANK. The IBRD lends money to middle-income and creditworthy poorer countries. Most of its funds come from sales of bonds in international capital markets. More than 180 countries are members of the IBRD. Each member's voting power is linked to its capital subscription; the U.S., with some one-sixth of the shares in the IBRD, has veto power over any proposed changes to the bank. See also INTERNATIONAL MONETARY FUND; UNITED NATIONS DEVELOPMENT PROGRAMME.

International Brigades Groups of foreign volunteers who fought on the Republican side against the Nationalist forces in the SPANISH CIVIL WAR (1936–39). So-called because their members initially came from some 50 countries, the International Brigades were recruited, organized, and directed by the COMINTERN, with headquarters in Paris. The U.S. contingent called itself the Abraham Lincoln Batallion. Many of the mostly young recruits were communists before they became involved in the conflict; more joined the party during the course of the war. The total number of volunteers reached about 60,000. The brigades were formally withdrawn from Spain late in 1938.

"The Internationals—United with the Spaniards We Fight the Invader," poster by Parrilla, published by the International Brigades, 1936–37.

COURTESY OF THE ABRAHAM LINCOLN BRIGADE ARCHIVES, BRANDEIS UNIVERSITY LIBRARY

International Court of Justice (ICJ) *or* **World Court** Principal judicial body of the UNITED NATIONS, located at The Hague. Its predecessor organization was the Permanent Court of International Justice, the judicial body of the LEAGUE OF NATIONS. Its first session was held in 1946. Its jurisdiction is limited to disputes between states willing to accept its authority on matters of INTERNATIONAL LAW. Its decisions are binding, but it has no enforcement power; appeals must be made to the UN Security

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Council. Its 15-member body of judges, each of whom serves a nine-year term, is elected by countries party to the court's founding statute. No two judges may come from the same country. See also European Court of Justice.

International Criminal Court (ICC) Permanent judicial body established by the Rome Statute of the International Criminal Court (1998) to prosecute individuals accused of genocide, war crimes, and crimes against humanity. The court commenced operations on July 1, 2002, after the requisite number of countries (60) ratified the Rome Statute (some 140 countries signed the agreement). The ICC was established as a court of last resort to prosecute the most heinous offenses in cases where national courts fail to act. It is headquartered in The Hague. By 2002 China, Russia, and the U.S. had declined to participate in the ICC, and the U.S. had campaigned actively to have its citizens exempted from the court's jurisdiction.

International Date Line Imaginary line from the North Pole to the South Pole that arbitrarily separates each calendar day from the next. It corresponds along most of its length to the 180th meridian of longitude but deviates to the east through the Bering Strait to avoid dividing Siberia and then deviates to the west to include the Aleutian Islands with Alaska. South of the Equator, another eastward deviation allows certain island groups to have the same day as New Zealand. The date line is a consequence of the worldwide use of timekeeping systems arranged so that local noon corresponds approximately to the time at which the Sun crosses the local meridian of longitude. See also standard time.

international exchange See foreign exchange

International Harvester Co. See Navistar International Corp.

International Herald Tribune Daily newspaper published in Paris. It has long been the staple source of English-language news for American expatriates, tourists, and businesspeople in Europe. Its roots are in the *Paris Herald* (established 1887); a merger in 1924 between its parent, the *New York Herald*, and the *New York Tribune* created the *New York Herald-Tribune* and the *Paris Herald Tribune*. The Paris edition, which was faring well at the time of its parent's demise in 1966, was renamed when it was rescued by a joint venture of the *New York Times*, the *Washington Post*, and Whitney Communications. The New York Times Co. and the Washington Post Co. became half-owners of the paper in 1991. The New York Times Co. became the full owner in 2003.

International Labour Organization (ILO) Specialized agency of the United Nations system dedicated to improving labour conditions and living standards throughout the world. Established in 1919 through the Treaty of Versailles as an agency of the League of Nations, the ILO became the first specialized agency affiliated with the UN in 1946. Its activities include compiling labour statistics, protecting international migrants, and safeguarding trade-union rights. Its delegates come from member governments (50%), labour (25%), and employers (25%). About 175 countries are represented in the ILO. It received the Nobel Prize for Peace in 1969.

International Ladies' Garment Workers' Union (ILGWU) Former industrial union in the U.S. and Canada that represented workers in the women's clothing industry. When it was formed in 1900, most of its members were Jewish immigrants working in sweatshops. Successful ILGWU strikes in New York in 1909–10 secured higher wages and shorter hours. Under the leadership of David Dubinsky (president 1932–66), the union grew from 45,000 members to almost half a million. Active in the effort to organize mass-production industries, it was expelled from the AFL in 1937 but returned in 1940. From the 1970s, membership shrank as U.S. firms moved garment production overseas, and in 1995 the ILGWU merged with the Amalgamated Clothing and Textile Workers' Union to form the Union of Needletrades, Industrial and Textile Employees. See also AFL-CIO.

international law Body of legal rules, norms, and standards that apply between sovereign states and other entities that are legally recognized as international actors. The term was coined by the English philosopher Jeremy Bentham. Important elements of international law include sovereignty, recognition (which allows a country to honour the claims of another), consent (which allows for modifications in international agreements to fit the customs of a country), freedom of the high seas, self-defense (which ensures that measures may be taken against illegal acts committed against a sovereign country), freedom of commerce, and protection of nationals abroad. International courts, such as the International Court of Justice, resolve disputes on these and other matters, including war crimes. See also asylum; immunity.

International Monetary Fund (IMF) Specialized agency of the United Nations system. It was conceived at the Bretton Woods Conference (1944) and officially founded in 1945 as a voluntary cooperative institution to help ensure the smooth international buying and selling of currency. More than 180 countries are members of the IMF. Its principal functions are stabilizing currency-exchange rates, financing the short-term balance-of-payments deficits of member countries, and providing advice and technical assistance to borrowing countries. Members contribute operating funds and receive voting rights according to their volume of international trade, national income, and international reserve holdings; the U.S. holds in excess of one-sixth of the voting rights, more than twice the percentage of any other member. The IMF has no coercive power over members, but it can refuse to lend money to members that do not agree to adhere to its policies; as a last resort it can ask members to withdraw from the organization. Critics of the IMF contend that the austerity and privatization measures it requires of borrowing countries reduce economic growth, deepen and prolong financial crises, and create severe hardships for the world's poorest people. See also International Bank for Reconstruction and Development; World Bank.

international organization Institution drawing membership from at least three states, having activities in several states, and whose members are held together by a formal agreement. Only a few existed before 1850; several thousand were active in the early 21st century. Some are intergovernmental (e.g., the United Nations), and some are nongovernmental (e.g., Amnesty International). Some have multiple worldwide or regional purposes (e.g., the European Union), and some have single purposes (e.g., the World Intellectual Property Organization). One effect of their proliferation is a stronger sense of interdependence among states, which in turn has stimulated recognition of the need for cooperation to address international and global problems.

International Organization for Standardization (ISO) Organization for determining standards in most technical and nontechnical fields. Founded in Geneva in 1947, its membership includes more than 100 countries. An appropriate national body represents each country; for example, the U.S. member is the American National Standards Institute (ANSI). Standardization affects units of measurement, alphabetization and transliteration, and specifications for parts, materials, surfaces, processes, tools, methods of testing, and machines. The ISO publishes the results of its work as "International Standards" (IS). ISO standards are optimally reviewed every five years.

international payment Payment made between countries, whether in settlement of a trade debt, as a unilateral transfer of funds, for capital investment, or for some other purpose. The reasons for such payments and the methods of making them and accounting for them are matters of concern to economists and national governments. International debts are settled either from accumulated balances of foreign currency or claims on foreign currency, or by loans from creditor to debtor, or by drawing on the International Monetary Fund, or by movements of gold. How a country balances its international accounts is one of the most important decisions for its balance of payments.

International Phonetic Alphabet (IPA) Set of symbols intended as a universal system for transcribing speech sounds. The promulgation and updating of the IPA has been a principal aim of the International Phonetic Association (Association Phonétique Internationale), founded in Paris in 1886. The first IPA chart was published in 1888. IPA symbols are based on an extended version of the Latin alphabet, with modifications of some letters and the use of additional symbols, some of which had been used in earlier phonetic alphabets. Diacritics are used primarily to show various kinds of secondary articulation.

International Refugee Organization (IRO) Temporary specialized agency of the United Nations system (1946–52). The IRO assisted refugees and displaced persons in Europe and Asia who could not or would not return home after World War II. Taking over the work of its principal predecessor, the United Nations Relief and Rehabilitation Administration, it also assumed responsibility for the legal protection and resettlement of refugees previously carried out by the Intergovernmental Committee on Refugees. It was succeeded by the Office of the United Nations High Commissioner for Refugees.

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international relations Study of the relations of states with each other and with international organizations and certain subnational entities (e.g., bureaucracies and political parties). It is related to a number of other academic disciplines, including political science, geography, history, economics, law, sociology, psychology, and philosophy. The field emerged at the beginning of the 20th century largely in the West and particularly in the U.S. as that country grew in power and influence. The study of international relations has always been heavily influenced by normative considerations, such as the goal of reducing armed conflict and increasing international cooperation. At the beginning of the 21st century, research focused on issues such as TERRORISM, religious and ethnic conflict, the emergence of substate and nonstate entities, the spread of weapons of mass destruction and efforts to counter nuclear proliferation, and the development of international institutions.

International Space Station (ISS) Space station assembled from modules in Earth orbit largely by the U.S. and Russia, with assistance and components from a multinational consortium. The project, which began as a U.S. effort, was long delayed by funding and technical problems. Originally called Freedom in the 1980s, it was redesigned in the 1990s to reduce costs and expand international involvement, at which time it was renamed. In-orbit construction started in late 1998 with the launches of a Russian control module and a U.S.-built connecting node, which were linked in orbit by SPACE SHUTTLE astronauts. In mid 2000 a habitat and control-centre module was added, and later in the year the ISS received its first resident crew, comprising two Russians and an American. Other elements were subsequently joined to the station, with the overall plan calling for a complex of laboratories and habitats crossed by a long truss supporting four large solar power arrays. Station construction involved at least 16 countries, including Canada, Japan, Brazil, and 11 members of the EUROPEAN SPACE AGENCY. Much of the early work aboard the ISS would focus on long-term life-sciences and material-sciences research in the weightless environment. It was expected to serve as the basis for human operations in Earth orbit for at least the first quarter of the 21st century.

International Standard Book Number (ISBN) Ten-digit number assigned before publication to a book or edition thereof. The ISBN identifies various elements of the work, grouping it within a national, geographic, language, or other convenient category and revealing its publisher, title, edition, and volume number. The ISBN is part of the International Standard Bibliographic Description (ISBD), which was prescribed by the International Organization for Standardization; delegates adopted the numbering system in 1969. The numbers are assigned by publishers and administered by designated national standard book numbering agencies such as the R.R. Bowker Co. in the U.S. and the Standard Book Numbering Agency Ltd. in Britain.

International Style Architectural style that developed in Europe and the U.S. in the 1920s and '30s and dominated Western architecture in the mid 20th century. The term was first used in 1932 by Henry-Russell Hitchcock and PHILIP JOHNSON in their essay "The International Style: Architecture Since 1922." The style's most common characteristics are rectilinear forms, open interior spaces, large expanses of glass, steel, and REINFORCED-CONCRETE construction, and light, taut plane surfaces devoid of applied ornamentation. WALTER GROPIUS, Ludwig MIES VAN DER ROHE, and LE CORBUSIER are among the architects most clearly associated with the style. See also BAUHAUS.

Savoye House, Poissy, Fr., an International Style residence by Le Corbusier, 1929–30

PIERRE BELZEAUX—RAPHO/PHOTO RESEARCHERS

International System of Units *or* **Système International d'Unités** \sēs-'tem-aⁿ-ter-nȧ-syȯ-'nȧl-dīē-nē-'tā\ *or* **SI system** International decimal system of weights and measures derived from and extending the METRIC SYSTEM of units. Adopted by the 11th General Conference on Weights and Measures in 1960, it was developed to eliminate overlapping but different systems of units of measures fostered by rapid advances in science and technology in the 19th–20th centuries. Its fundamental units include the metre (m) for length, the kilogram (kg) for mass, and the second (sec) for time. Derived units include those for force (newton, N), energy (joule, J), and power (watt, W). See table on opposite page.

International Telecommunication Union (ITU) UNITED NATIONS agency headquartered in Geneva. Its roots can be traced to 1865, when the International Telegraph Union was established to coordinate international development of the telegraph. It acquired its present name in 1934 and became a UN specialized agency in 1947. Its activities include regulating allocation of radio frequencies, setting standards on technical and operational matters, and assisting countries in developing their own telecommunications systems.

International Telephone and Telegraph Corp. (ITT) Former U.S. telecommunications company. It was founded in 1920 by Sosthenes and Hernand Behn as a HOLDING COMPANY for their Caribbean-based telephone and telegraph companies. It expanded into the European market and became a major telecommunications manufacturer. In the 1960s and '70s ITT became a conglomerate, acquiring firms including the Sheraton Corp. and the Hartford Fire Insurance Co. It divested its telecommunications businesses in 1987, and in 1995 it split into three companies: ITT Hartford Group Inc. (insurance); ITT Industries Inc. (defense electronics and auto parts); and a "new" ITT Corp., which merged with Starwood Lodgings in 1997.

international unit Any of several precision standards used in measuring physical quantities, such as mass, length, and time (see INTERNATIONAL SYSTEM OF UNITS), and also lighting systems, radiation processes, and pharmacology. The luminous intensity or candlepower of a light is expressed in candelas. The second is based on the frequency of radiation emitted by cesium-133 atoms. In radioactive decay, the international unit is the number of disintegrations per second in a sample. In pharmacology, the international unit is the quantity of a substance (vitamin, hormone, or toxin) that produces a specified effect when tested according to an internationally accepted procedure.

International Whaling Commission (IWC) An intergovernmental organization created in 1946 to control the rapid escalation of whaling. The original purpose of the IWC was to preserve whale stocks for commercial whalers. Whale populations, however, continued to decline, and in 1986 the IWC instituted a moratorium on commercial whaling that remains in effect. At the beginning of the 21st century, 40 countries belonged to the commission, but membership has fluctuated over the years. The commission's success has been limited by governments leaving the IWC, ignoring its policies, or breaching regulations.

Internet Publicly accessible computer NETWORK connecting many smaller networks from around the world. It grew out of a U.S. Defense Department program called ARPANET (Advanced Research Projects Agency Network), established in 1969 with connections between computers at the University of California at Los Angeles, Stanford Research Institute, the University of California-Santa Barbara, and the University of Utah. ARPANET's purpose was to conduct research into computer networking in order to provide a secure and survivable communications system in case of war. As the network quickly expanded, academics and researchers in other fields began to use it as well. In 1971 the first program for sending E-MAIL over a distributed network was developed; by 1973, the year international connections to ARPANET were made (from Britain and Norway), e-mail represented most of the traffic on ARPANET. The 1970s also saw the development of mailing lists, NEWSGROUPS and BULLETIN-BOARD SYSTEMS, and the TCP/IP communications PROTOCOLS, which were adopted as standard protocols for ARPANET in 1982–83, leading to the widespread use of the term Internet. In 1984 the DOMAIN NAME addressing system was introduced. In 1986 the National Science Foundation established the NSFNET, a distributed network of networks capable of handling far greater traffic, and within a year more than 10,000 hosts were connected to the Internet. In 1988 real-

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International System of Units*
(Basic Units)

LENGTH

Unit	*Abbreviation*	*Number of Meters*	*Approximate U.S. Equivalent*
kilometer	km	1,000	0.62 mile
hectometer	hm	100	328.08 feet
dekameter	dam	10	32.81 feet
meter	m	1	39.37 inches
decimeter	dm	0.1	3.94 inches
centimeter	cm	0.01	0.39 inch
millimeter	mm	0.001	0.039 inch
micrometer	μm	0.000001	0.000039 inch

AREA

Unit	*Abbreviation*	*Number of Square Meters*	*Approximate U.S. Equivalent*
square kilometer	sq km *or* km^2	1,000,000	0.3861 square miles
hectare	ha	10,000	2.47 acres
are	a	100	119.60 square yards
square centimeter	sq cm *or* cm^2	0.0001	0.155 square inch

VOLUME

Unit	*Abbreviation*	*Number of Cubic Meters*	*Approximate U.S. Equivalent*
cubic meter	m^3	1	1.307 cubic yards
cubic decimeter	dm^3	0.001	61.023 cubic inches
cubic centimeter	cu cm *or* cm^3 *also* cc	0.000001	0.061 cubic inch

CAPACITY

Unit	*Abbreviation*	*Number of Liters*	*Approximate U.S. Equivalent*		
			cubic	*dry*	*liquid*
kiloliter	kl	1,000	1.31 cubic yards		
hectoliter	hl	100	3.53 cubic feet	2.84 bushels	
dekaliter	dal	10	0.35 cubic foot	1.14 pecks	2.64 gallons
liter	l	1	61.02 cubic inches	0.908 quart	1.057 quarts
cubic decimeter	dm^3	1	61.02 cubic inches	0.908 quart	1.057 quarts
deciliter	dl	0.10	6.1 cubic inches	0.18 pint	0.21 pint
centiliter	cl	0.01	0.61 cubic inch		0.338 fluid ounce
milliliter	ml	0.001	0.061 cubic inch		0.27 fluid dram
microliter	μl	0.000001	0.000061 cubic inch		0.00027 fluid dram

MASS AND WEIGHT

Unit	*Abbreviation*	*Number of Grams*	*Approximate U.S. Equivalent*
metric ton	t	1,000,000	1.102 short tons
kilogram	kg	1,000	2.2046 pounds
hectogram	hg	100	3.527 ounces
dekagram	dag	10	0.353 ounce
gram	g	1	0.035 ounce
decigram	dg	0.10	1.543 grains
centigram	cg	0.01	0.154 grain
milligram	mg	0.001	0.015 grain
microgram	μg	0.000001	0.000015 grain

*For metric equivalents of U.S. units, see Weights and Measurements table

time conversation over the network became possible with the development of Internet Relay Chat protocols (see CHAT). In 1990 ARPANET ceased to exist, leaving behind the NSFNET, and the first commercial dial-up access to the Internet became available. In 1991 the WORLD WIDE WEB was released to the public (via FTP). The Mosaic BROWSER was released in 1993, and its popularity led to the proliferation of World Wide Web sites and users. In 1995 the NSFNET reverted to the role of a research network, leaving Internet traffic to be routed through network providers rather than NSF supercomputers. That year the Web became the most popular part of the Internet, surpassing the FTP protocols in traffic volume. By 1997 there were more than 10 million hosts on the Internet and more than 1 million registered domain names. Internet access can now be gained via radio signals, cable-television lines, satellites, and fibre-optic connections, though most traffic still uses a part of the public telecommunications (telephone) network. The Internet is widely regarded as a development of vast significance that will affect nearly every aspect of human culture and commerce in ways still only dimly discernible.

Internet Protocol address See IP ADDRESS

Internet service provider (ISP) Company that provides INTERNET connections and services to individuals and organizations. For a monthly fee, ISPs provide computer users with a connection to their site (see DATA TRANSMISSION), as well as a log-in name and password. They may also provide software packages (such as BROWSERS), E-MAIL accounts, and a personal WEB SITE or home page. ISPs can host Web sites for businesses and can also build the Web sites themselves. ISPs are all connected to each other through network access points, public network facilities on the Internet backbone.

Interpol *officially* **International Criminal Police Organization** International organization whose purpose is to fight international crime. Interpol promotes the widest possible mutual assistance between the criminal police authorities of affiliated countries and seeks to establish and develop all institutions likely to contribute effectively to the prevention and suppression of ordinary crime. The organization traces its

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history to 1914, when a congress of international criminal police, attended by delegates from 14 countries, was held in Monaco. Interpol was formally founded in Austria in 1923 with 20 member countries; after World War II its headquarters moved to Paris and, in 1989, to Lyon, France. By the early 21st century, its membership exceeded 180 countries. Interpol pursues criminals who operate in more than one country (e.g., smugglers), those who stay in one country but whose crimes affect other countries (e.g., counterfeiters of foreign currency), and those who commit a crime in one country and flee to another.

interpolation In mathematics, ESTIMATION of a value between two known data points. A simple example is calculating the mean (see MEAN, MEDIAN, AND MODE) of two population counts made 10 years apart to estimate the population in the fifth year. Estimating outside the data points (e.g., predicting the population five years after the second population count) is called extrapolation. If more than two data points are available, a curve may fit the data better than a line. The simplest curve that fits is a POLYNOMIAL curve. Exactly one polynomial of any given degree—an interpolating polynomial—passes through any number of data points.

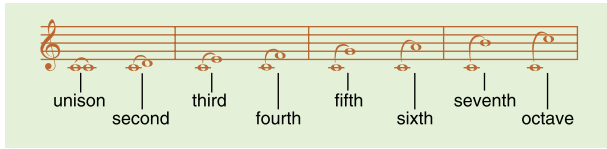
interrogation In CRIMINAL LAW, process of formally and systematically questioning a suspect in order to elicit incriminating responses. The process is largely outside the governance of law, though in the U.S. relatively elaborate safeguards have been placed on police interrogatory powers in order to protect the rights of the ACCUSED.

interstate commerce In the U.S., any commercial transaction or traffic that crosses state boundaries or that involves more than one state. Government regulation of interstate commerce is founded on the commerce clause of the Constitution (Article I, section 8), which authorizes Congress "To regulate Commerce with foreign Nations, and among the several States, and with Indian Tribes." The INTERSTATE COMMERCE COMMISSION, established in 1887, was originally intended to regulate the railroad industry; its jurisdiction was later expanded to include trucks, ships, freight forwarders, and other interstate carriers. The Sherman Act (1890), followed by the Clayton Act (1914), made illegal any act that tended to interfere with free competition between and among industries, businesses, and any interstate commercial venture. The Federal Trade Commission (FTC) was established by the Federal Trade Commission Act of 1914, which gave the FTC powers—judicial, legislative, and executive—to administer the Sherman and Clayton acts. The Federal Communications Commission (FCC) was created to protect the right of the public to the airwaves through licensing and oversight of the practices of broadcasters in radio and television. In the 20th century, court decisions tended to interpret interstate commerce broadly, thus allowing Congress to regulate a wide variety of activities by which interstate commerce could be affected, even if they took place within the borders of a single state. One such decision was *Heart of Atlanta Motel* v. *U.S.* (1964), in which the Supreme Court upheld the prohibition of discrimination in public accommodations contained in the 1964 Civil Rights Act on the ground that the discriminatory practices of a business operating in only one state could affect interstate commerce.

Interstate Commerce Commission (ICC) (1887–1995) First REGULATORY AGENCY established in the U.S. and a prototype for independent government regulatory bodies. An agency of the U.S. Department of Transportation, it was responsible for the economic regulation of interstate surface transportation, including railroads, trucking companies, and buslines. It certified carriers, regulated rates, oversaw mergers, and approved railroad construction. The ICC was dissolved in 1995.

interstellar medium Content of the region between the stars, including vast, diffuse clouds of gases and minute solid particles. Such tenuous matter in the MILKY WAY GALAXY accounts for about 5% of its total mass. By no means a complete vacuum, the interstellar medium contains mainly hydrogen gas, with a smaller amount of helium and sizable quantities of dust particles of uncertain composition. Primary COSMIC RAYS also travel through interstellar space, and magnetic fields extend across much of it. Most interstellar matter occurs in cloudlike concentrations, which can condense to form STARS. Stars, in turn, continually lose mass through stellar winds (see SOLAR WIND). SUPERNOVAS and PLANETARY NEBULAE also feed mass back to the interstellar medium, where it mixes with matter that has not yet formed stars (see POPULATIONS I AND II).

interval In music, the inclusive distance between one tone and another, whether sounded successively (melodic interval) or simultaneously (harmonic interval). In Western music, intervals are generally named according to the number of scale-steps within a given KEY that they embrace; thus, the ascent from C to G (C–D–E–F–G) is called a fifth because the interval embraces five scale degrees. There are four perfect intervals: prime, or unison; octave; fourth; and fifth. The other intervals (seconds, thirds, sixths, sevenths) have major and minor forms that differ in size by a half step (semitone). Both perfect and major intervals may be augmented, or enlarged by a half tone. Perfect and minor intervals may be diminished, or narrowed by a half tone.



Examples of simple musical intervals.
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intestate succession In the law of INHERITANCE, transmission of property or property interests of a decedent as provided by statute, as distinguished from transfer according to the decedent's WILL. Modern laws of intestacy, though they vary widely, share the common principle that the estate should devolve upon persons standing in some kinship relation with the decedent; modern practice tends to favour the rights of the surviving spouse.

intestinal gas Volatile material (mostly swallowed air, partly digestive by-products) in the digestive tract, which normally contains 150–500 cc of gas. Air in the stomach is either belched out or passed to the intestines. Some of its oxygen is absorbed into the blood along the way. Carbon dioxide produced by DIGESTION is added. Nitrogen, the major component, is inert and usually passed on. Obstructions in the small intestine can trap gas in distended pockets, causing severe pain. In the large intestine, bacterial fermentation products are added—mostly hydrogen but also methane, hydrogen sulfide, ammonia, and sulfur-containing mercaptans. Excess gas in the colon is eventually expelled from the body.

intestinal obstruction Blockage of the SMALL INTESTINE or LARGE INTESTINE, resulting from either lack of PERISTALSIS or mechanical obstruction (e.g., by narrowing, foreign objects, or HERNIA). Obstruction near the start of the small intestine often causes VOMITING. Near the end or in the large intestine, backed-up waste and swallowed air cause intestinal distention; the resulting pressure may cause necrosis (death of intestinal wall tissue). Waste products may escape into the bloodstream. Symptoms and treatment depend on the obstruction's nature and location.

intestine See LARGE INTESTINE, SMALL INTESTINE

intifāḍah \ˌin-ti-ˈfä-də\ *Arabic* **"shaking off"** Palestinian revolt (1987–93, 2000–) against the Israeli occupation in the GAZA STRIP and WEST BANK. Initially a spontaneous reaction to 20 years of occupation and worsening economic conditions, it was soon taken over by the PALESTINE LIBERATION ORGANIZATION (PLO). Its tactics included strikes, boycotts, and confrontations with Israeli troops. The International Red Cross estimated that some 800 Palestinians, more than 200 under the age of 16, had been killed by Israeli security forces by 1990. Several dozen Israelis were killed during the same period. *Intifāḍah* pressure is credited with helping make possible the 1993 Israeli-PLO agreement on Palestinian self-rule. A breakdown in further negotiations in late 2000 led to another outburst of violence, which quickly became known as the Aqṣā *intifāḍah*, named for the Aqṣā Mosque in Jerusalem, where the fighting began. See also YĀSIR ʿARAFĀT; FATAH; ḤAMĀS.

Intolerable Acts *or* **Coercive Acts** (1774) Four punitive measures enacted by the British Parliament against the American colonies. Boston's harbour was closed until restitution was made for the tea destroyed in the BOSTON TEA PARTY; the Massachusetts colony's charter was annulled and a military governor installed; British officials charged with capital offenses could go to England for trial; and arrangement for housing British troops in American houses was revived. The QUEBEC ACT added to these oppressive measures. The acts, called "intolerable" by the colonists, led to a convening of the CONTINENTAL CONGRESS.

intonation In PHONETICS, the melodic pattern of an utterance. Intonation is primarily a matter of variation in the pitch level of the voice (see TONE), but in languages such as English, stress and rhythm are also involved. Intonation conveys differences of expressive meaning (e.g., surprise,

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doubtfulness). In many languages, including English, intonation serves a grammatical function, distinguishing one type of phrase or sentence from another. Thus, "it's gone" is an assertion when spoken with a drop in pitch at the end, but a question when spoken with a rise in pitch at the end.

introvert and extravert Basic personality types, according to the theories of Carl Gustav Jung. The introvert, who directs thoughts and feelings inward, is often shy, contemplative, and reserved. The extravert, who directs attention toward other people and the outside world, is usually outgoing, responsive, and aggressive. This typology is now regarded as simplistic because almost no one can be described as wholly introverted or extraverted.

intrusive rock Igneous rock formed from magma forced into older rocks at depths within the Earth's crust, which then slowly solidifies below the Earth's surface, though it may later be exposed by erosion. Igneous intrusions form a variety of rock types. See also extrusive rock.

intuition In philosophy, the power of obtaining knowledge that is not or cannot be acquired either by inference or observation. As such, intuition is thought of as an original, independent source of knowledge, since it is designed to account for just those kinds of knowledge that other sources do not provide. Knowledge of some necessary truths and basic moral principles is sometimes explained in this way. A technical sense of intuition, deriving from Immanuel Kant, refers to immediate acquaintance with individual entities; intuition (*Anschauung*) in this sense may be empirical (e.g., consciousness of sense-data) or pure (e.g., consciousness of space and time a priori as forms of all empirical intuitions). As conceived by Benedict de Spinoza and Henri Bergson, intuition is taken to be concrete knowledge of the world as an interconnected whole, as contrasted with the piecemeal, "abstract" knowledge obtained by science and observation.

intuitionism School of mathematical thought introduced by the Dutch mathematician Luitzen Egbertus Jan Brouwer (1881–1966). In contrast with mathematical Platonism, which holds that mathematical concepts exist independent of any human realization of them, intuitionism holds that only those mathematical concepts that can be demonstrated, or constructed, following a finite number of steps are legitimate. Few mathematicians have been willing to abandon the vast realms of mathematics built with nonconstructive proofs.

intuitionism In metaethics, a form of cognitivism that holds that moral statements can be known to be true or false immediately through a kind of rational intuition. In the 17th and 18th centuries, intuitionism was defended by Ralph Cudworth, Henry More (1614–87), Samuel Clarke (1675–1729), and Richard Price (1723–91); in the 20th century its supporters included H.A Prichard (1871–1947), G.E. Moore, and David Ross. Intuitionists have differed over the kinds of moral truths that are amenable to direct apprehension. For example, whereas Moore thought that it is self-evident that certain things are morally valuable, Ross thought that we know immediately that it is our duty to do acts of a certain type.

Inuit See Eskimo

Invar Trademark name for an alloy of iron (64% iron, 36% nickel) that expands very little when heated. Invar was formerly used for absolute standards of length measurement and is now used for surveying tapes and in watches and various other temperature-sensitive devices. The name expresses the invariability of its dimensions. It was developed by Charles-Édouard Guillaume (1861–1938), winner of the 1920 Nobel Prize for Physics.

inventory In business, any item of property held in stock by a firm, including finished goods held for sale, goods in the process of production, raw materials, and items that will be consumed in the process of producing salable goods. Inventories appear on a company's balance sheet as assets. Inventory turnover, which indicates the rate at which goods are converted into cash, is a key factor in appraising a firm's financial condition. For financial statements, inventories may be priced either at cost or at market value.

Inverness \,in-vər-'nes\ Royal burgh (pop., 2001: 44,084), Highland council area, in the historic county of Inverness-shire, northwestern Scotland. Located on the River Ness and the Caledonian Canal, it has long been the centre of the Scottish Highlands. In the 6th century it was the capital of the Pictish king Brude. By the 12th century it had become a burgh near the castle of Malcolm III Canmore. Inverness is now an educational and tourist centre. Its manufacturing has expanded in conjunction with the growth of offshore oil production.

The 19th-century castle on the River Ness, Inverness, Scotland.
J. ALLEN CASH—EB INC.

inverse function Mathematical function that undoes the effect of another function. For example, the inverse function of the formula that converts Celsius temperature to Fahrenheit temperature is the formula that converts Fahrenheit to Celsius. Applying one formula and then the other yields the original temperature. Inverse procedures are essential to solving equations because they allow mathematical operations to be reversed (e.g. logarithms, the inverses of exponential functions, are used to solve exponential equations). Whenever a mathematical procedure is introduced, one of the most important questions is how to invert it. Thus, for example, the trigonometric functions gave rise to the inverse trigonometric functions.

invertebrate Any animal that lacks a vertebral column, or backbone. They include the protozoans, annelids, cnidarians, echinoderms, flatworms, nematodes, mollusks, and arthropods. More than 90% of living animals are invertebrates. Worldwide in distribution, they range in size from minute protozoans to giant squids. Apart from the absence of a vertebral column, invertebrates have little in common. They are generally soft-bodied and have an external skeleton for muscle attachment and protection. See also vertebrate.

Investiture Controversy Struggle between the papacy and the secular rulers of Europe over the latter's presentation of the symbols of office to churchmen. Pope Gregory VII condemned lay investiture in 1078 as an unjustified assertion of secular authority over the church; the issue was pivotal in his dispute with King Henry IV and in the larger struggle over Henry's refusal to obey papal commands. Henry successfully drove Gregory from Rome and installed an antipope, but it would be Gregory's rejection of lay investiture that would ultimately prevail. Henry I of England renounced lay investiture (1106) in return for the guarantee that homage would be paid to the king before consecration, and the Concordat of Worms (1122) forged a similar compromise between Henry V and Calixtus II.

investment Process of exchanging income for an asset that is expected to produce earnings at a later time. An investor refrains from consumption in the present in hopes of a greater return in the future. Investment may be influenced by rates of interest, with the rate of investment rising as interest rates fall, but other factors more difficult to measure may also be important—for example, the business community's expectations about future demand and profit, technical changes in production methods, and expected relative costs of labour and capital. Investment cannot occur without saving, which provides funding. Because investment increases an economy's capacity to produce, it is a factor contributing to economic growth.

investment bank Firm that originates, underwrites, and distributes new security issues of corporations and government agencies. The Banking

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Act of 1933 required the separation of investment banking and COMMERCIAL BANKing functions. Investment banks operate by purchasing all the new securities issued by a corporation at one price and selling fractions of the new issue to the investing public at prices high enough to yield a profit. The investment bank is responsible for setting the public offering price, which it bases on probable demand and assessments of the economic climate. A syndicate of investment banking firms underwrites and distributes most security issues in order to divide the RISK of the new issue. An initial public offering (IPO) refers to the issuance of the first public shares of a formerly nonpublic company. See also BANK; CENTRAL BANK; SAVINGS BANK; SECURITY.

investment casting Precision CASTING for forming METAL shapes with minutely precise details. Casting BRONZE or precious metals typically involves several steps, including forming a MOLD around the sculptured form; detaching the mold (in two or more sections); coating its inside with WAX; forming a second mold, of heat-resisting clay, around the wax shell, and filling the interior with a clay core; baking the assembly (hardening the clay and melting the wax, which escapes through openings in the outer mold); pouring molten bronze into the space vacated by the wax; and breaking the mold to expose the cast form. In modern foundries, plastics, or occasionally frozen mercury, are used instead of wax. See also LOST-WAX CASTING, DIE CASTING.

investment credit *or* **investment tax credit** Tax incentive that permits companies or individuals to deduct a specified percentage of certain investment costs from their tax liability in addition to the normal allowances for DEPRECIATION. Investment credits are similar to investment allowances, which permit investors or businesses to deduct a specified percentage of certain capital costs from taxable income. Both investment credits and investment allowances differ from accelerated depreciation by offering a percentage deduction at the time an asset is purchased. In effect, the credits are SUBSIDIES for investment. Investment credits and investment allowances were adopted by the U.S. in 1962 in order to protect domestic business from foreign competition but have since been applied toward the support of energy conservation, pollution control, or various forms of desirable economic development.

investment trust *or* **closed-end trust** Financial organization that pools the funds of its shareholders and invests them in a diversified portfolio of SECURITIES. It differs from a MUTUAL FUND, which issues units representing diversified holdings rather than shares in the company itself. Investment trusts have a fixed number of shares for sale; their price depends on the market value of the underlying securities and on the demand for and supply of shares. The first modern investment trusts were formed in England and Scotland as early as 1860. Many early U.S. investment trusts failed with the collapse of the stock market in 1929, but others have since prospered under stricter federal regulation.

Io \'ī-ō\ In GREEK MYTHOLOGY, the daughter of the river god Argos. Io drew HERA's jealousy when ZEUS fell in love with her. Zeus changed her into a white heifer to protect her. Hera sent the many-eyed creature Argus to watch over the heifer, but Zeus sent HERMES to lull Argus to sleep and kill him. Hera then sent a gadfly to pursue Io, who fled across Europe and crossed the bodies of water later named the Ionian Sea and the BOSPORUS ("Ford of the Cow") in her honour. When she arrived in Egypt she resumed her original form. She was later identified with the Egyptian goddess ISIS.

iodine Nonmetallic chemical ELEMENT, chemical symbol I, atomic number 53. The heaviest nonradioactive HALOGEN, it is a nearly black crystalline solid (diatomic molecule I_2) that sublimes (see SUBLIMATION) to a deep violet, irritating vapour. It is never found in nature uncombined. Its sources (mostly in brines and seaweeds) and compounds are usually iodides; iodates (small amounts in saltpeter) and periodates also occur. Dietary iodine is essential for THYROID GLAND function; in areas of the world where food contains insufficient iodine, an iodine compound such as potassium iodide (KI) is added to table salt (SODIUM CHLORIDE) to prevent IODINE DEFICIENCY. Elemental iodine is used in medicine, in synthesizing some organic chemicals, in manufacturing dyes, in analytical chemistry (see ANALYSIS) to measure FAT SATURATION (see HYDROGENATION) and to detect STARCH, and in photography. The radioactive ISOTOPE iodine-131 (see RADIOACTIVITY), with an eight-day HALF-LIFE, is very useful in medicine (see NUCLEAR MEDICINE) and other applications.

iodine deficiency Inadequate intake or metabolism of IODINE. It directly affects THYROID secretions, which influence heart action, nerve response, growth rate, and metabolism. Simple GOITRE, the most frequent result, is most common in areas without access to salt water and is rare along seacoasts. Severe, prolonged deficiency can cause hypothyroidism. Eating seafood regularly or using iodized table salt will prevent iodine deficiency. Some countries have made dietary iodine additives mandatory.

ion ATOM or group of atoms with one or more positive or negative ELECTRIC CHARGES. Positively charged ions are CATIONS, negatively charged ones ANIONS. Ions are formed when ELECTRONS are added to or removed from neutral MOLECULES or other ions, as sodium (Na) and chlorine (Cl) atoms react to form Na^+ and Cl^-; when ions combine with other particles, as hydrogen cations (H^+) and ammonia (NH_3) combine to form ammonium cations (NH_4^+); or when a COVALENT BOND between two atoms is ruptured in such a way that the resulting particles are charged, as water (H_2O) dissociates (see DISSOCIATION) into hydrogen and hydroxide ions (H^+ and OH^-). Many crystalline substances (see CRYSTAL) are composed of ions held in regular geometric patterns by the attraction of oppositely charged particles for each other. Ions migrate to the electrode of opposite charge in an ELECTRIC FIELD and are the conductors of current in electrolytic cells (see ELECTROLYSIS). Compounds that form ions are called ELECTROLYTES. Ions are also formed in gases when heated to very high temperatures or when an electrical discharge passes through them (see PLASMA).

ion-exchange resin Any of a wide variety of synthetic POLYMERS containing positively or negatively charged sites that can interact with or bind to an ION of opposite charge from a surrounding solution. Light, porous solids in granules, beads, or sheets, they absorb the solution and swell as they attract the target ions; when exhausted, they are removed from use and regenerated by an inexpensive brine or carbonate solution. A solid support of styrene-divinylbenzene copolymer to which are attached sulfonic or carboxylic acid groups is often used to attract and exchange CATIONS (e.g., ions of HYDROGEN or METALS). Quaternary ammonium groups on the solid matrix are used to attract ANIONS (e.g., ions of CHLORINE). Industrially, the resins are used to soften HARD WATER, purify SUGAR, and concentrate valuable elements (gold, silver, uranium) from their ORES. In the laboratory they are used to separate and concentrate substances and sometimes as catalysts. ZEOLITES are minerals with ion-exchange properties.

Ionesco \yō-nes-'kō**, Eugène** *orig.* **Eugen Ionescu** (b. Nov. 26, 1909, Slatina, Rom.—d. March 28, 1994, Paris, France) Romanian-born French playwright. He studied in Bucharest and Paris, where he lived from 1945. His first one-act "anti-play," *The Bald Soprano* (1950), inspired a revolution in dramatic techniques and helped inaugurate the THEATRE OF THE ABSURD. He followed it with other one-act plays in which illogical events create an atmosphere both comic and grotesque, including *The Lesson* (1951), *The Chairs* (1952), and *The New Tenant* (1955). His most popular full-length play, *Rhinoceros* (1959), concerns a provincial French town in which all the citizens are metamorphosing into rhinoceroses. Other plays include *Exit the King* (1962) and *A Stroll in the Air* (1963). He was elected to the Académie Française in 1970.

Eugène Ionesco, 1959.
MARK GERSON

Ionia \ī-'ō-nyə\ Ancient region, western coast of ASIA MINOR (modern Turkey) bordering the AEGEAN SEA. It consisted of a coastal strip that extended from the mouth of the Hermus River to the Halicarnassus Peninsula, a distance of 100 mi (160 km). In the 8th century BC there were 12 major Greek cities in the region, including PHOCAEA, ERYTHRAE, COLOPHON, and MILETUS on the mainland, and the islands CHIOS and SAMOS. It was very prosperous, and until 500 BC Ionic philosophy and architecture and the Ionic dialect were highly influential in Greece. In the mid-6th century BC it fell to LYDIA and then to the Persians. After a brief period of independence beginning in 334 BC, it became part of the SELEUCID kingdom. In 133 BC it passed to the Romans and became part of the Roman province of Asia. It was devastated during the Turkish conquest of Asia Minor.

Ionian Any ancient Greek inhabitant of IONIA, from the time of the collapse of Mycenae. Ionian cities colonized southern Italy and opened up the Black Sea from c. 700 BC. Their contributions to Greek culture

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included the epics of HOMER and the earliest elegiac and iambic poetry. They began the study of geography, philosophy, and historiography in the 6th century. After Alexander the Great their literary language was the basis of KOINE, or "common speech," the language of practically all Greek writing to the present day.

Ionian \ī-'ō-nē-ən\ **Islands** *ancient* **Heptanesos** Group of seven Greek islands (pop., 2001: 214,274) in the Ionian Sea. They include CORFU, CEPHALONIA, Zacynthus, Leucas, Ithaca, Cythera, and Paxos and have a combined land area of 891 sq mi (2,307 sq km). Controlled by Venice in the 15th and 16th centuries, they were taken by Russian and Turkish forces in 1799. In 1815 the Treaty of Paris placed them under the control of Britain; the British ceded them to Greece in 1864.

Ionian revolt Uprising (499–494 BC) of some of the Ionian cities of Asia Minor against their Persian overlords. The cities deposed their own tyrants and, with help from Athens, tried unsuccessfully to throw off Persian domination. DARIUS I of Persia used Athens's involvement as a pretext for his invasion of Greece in 490, initiating the PERSIAN WARS, which resulted in a stronger Athenian influence in western Anatolia.

Ionian school School of Greek philosophers of the 6th–5th century BC, including THALES, ANAXIMANDER, ANAXIMENES, HERACLEITUS, ANAXAGORAS, Diogenes of Apollonia, Archelaus, and Hippon. Though IONIA was the original center of their activity, they differed so greatly from one another in their conclusions that they cannot truly be said to represent a specific school of philosophy, but their common concern to explain phenomena in terms of matter or physical forces distinguished them from later thinkers.

Ionian Sea Part of the MEDITERRANEAN SEA lying between Greece, Sicily, and Italy. Though once considered part of the ADRIATIC SEA, to which it connects by the Strait of Otranto, it is now considered a separate body. The Mediterranean reaches its greatest depth (16,000 ft or 4,900 m) in the Ionian south of Greece. Along its eastern shore are the IONIAN ISLANDS.

ionic bond Electrostatic attraction between oppositely charged IONS in a chemical COMPOUND. Such a bond forms when one or more ELECTRONS are transferred from one neutral ATOM (typically a METAL, which becomes a CATION) to another (typically a nonmetallic element or group, which becomes an ANION). The two types of ion are held together by electrostatic forces in a solid that does not comprise neutral MOLECULES as such; rather, each ion has neighbours of the opposite charge in an ordered overall crystalline structure. When, for example, CRYSTALS of common salt (SODIUM CHLORIDE, NaCl) are dissolved in water, they dissociate (see DISSOCIATION) into two kinds of ions in equal numbers, sodium cations (Na^+) and chloride anions (Cl^-). See also BONDING; COVALENT BOND.

ionization Process by which electrically neutral ATOMS or MOLECULES are converted to electrically charged atoms or molecules (IONS) by the removal or addition of negatively charged ELECTRONS. It is one of the principal ways in which RADIATION transfers energy to matter, and hence of detecting radiation. In general, ionization occurs whenever sufficiently energetic charged particles or radiant energy travels through gases, liquids, or solids. A certain minimal level of ionization is present in the earth's atmosphere because of continuous absorption of COSMIC RAYS from space and ULTRAVIOLET RADIATION from the sun.

ionization potential *or* **ionization energy** Amount of ENERGY required to remove an ELECTRON from an isolated ATOM or MOLECULE. There is an ionization potential for each successive electron removed, though that associated with removing the first (most loosely held) electron is most commonly used. The ionization potential of an ELEMENT is a measure of its ability to enter into chemical reactions requiring ION formation or donation of electrons and is related to the nature of the chemical bonding in the compounds formed by elements. See also BINDING ENERGY, IONIZATION.

ionosphere \ī-'än-ə-ˌsfir\ Region of the Earth's atmosphere in which the number of ions, or electrically charged particles, is large enough to affect the propagation of radio waves. The ionosphere begins at an altitude of about 30 mi (50 km) but is most distinct above about 50 mi (80 km). The IONIZATION is caused mainly by solar radiation at X-ray and ultraviolet wavelengths. The ionosphere is responsible for the long-distance propagation, by reflection, of radio signals in the shortwave and broadcast bands.

Iowa State (pop., 2000: 2,926,324), midwestern U.S. Bordered by Minnesota, Wisconsin, Illinois, Missouri, Nebraska, and South Dakota, it covers 56,276 sq mi (145,755 sq km). Its capital is DES MOINES. The DES MOINES RIVER flows across the state from northwest to southeast. The MISSISSIPPI RIVER forms its eastern boundary, while the MISSOURI RIVER and the Big Sioux River define portions of its western boundary. The SAUK, FOX, Iowa, and SIOUX Indians lived in the region when French explorers LOUIS JOLLIET and JACQUES MARQUETTE arrived in 1673. The U.S. acquired Iowa as part of the LOUISIANA PURCHASE in 1803. Following the Black Hawk War and purchase of eastern Iowa from the Sauk and Fox Indians in the 1830s, white settlement advanced rapidly. Iowa became a territory in 1838 and was made the 29th state in 1846. After the Civil War, railroad expansion drew large waves of immigrants from the east and from Europe. After World War I population growth slowed. Its economy is based on agriculture, and Iowa is a leader in the U.S. production of livestock.

IP address *in full* **Internet Protocol address** Number that uniquely identifies each computer on the INTERNET. A computer's IP address may be permanently assigned or supplied each time that it connects to the Internet by an INTERNET SERVICE PROVIDER. In order to accommodate the extraordinary growth in the number of devices connected to the Internet, a 32-bit protocol standard, known as IPv4, began to be replaced by a 128-bit protocol, IPv6, in 2000. See also TCP/IP; DOMAIN NAME; URL.

ipecac \'i-pi-ˌkak\ *or* **ipecacuanha** \ˌi-pi-ˌka-kyə-'wä-nə\ Dried RHIZOME and roots of either of two tropical New World plants (*Cephaelis acuminata* and *C. ipecacuanha*) of the MADDER FAMILY. It has been used since ancient times especially as a source of a drug to treat poisoning by inducing nausea and vomiting. The name also refers to the drug itself.

Iphigeneia \ˌi-fə-jə-'nī-ə\ In GREEK MYTHOLOGY, the eldest daughter of AGAMEMNON and Clytemnestra and sister of ELECTRA and ORESTES. When the Achaean fleet was becalmed at Aulis, Iphigeneia's father sacrificed her to ARTEMIS in order to secure favourable winds to carry the ships to Troy. Her mother later avenged her death by murdering Agamemnon. Iphigeneia's story is treated in plays by AESCHYLUS, SOPHOCLES, and EURIPIDES. According to Euripides, she did not die but was saved by Artemis; she went to the land of Tauris, where she became a priestess, and she saved Orestes from madness and death when he fled there after killing their mother.

Ipoh \'ē-pō\ City (pop., 2000 prelim.: 566,211), western MALAYSIA. Its name comes from a local tree, whose poisonous resin was once used by indigenous people for hunting. The modern city dates from the 1890s, when British tin-mining companies were set up. Immigrant Chinese were brought in to work the tin deposits, and their descendants now dominate the city. It is the country's mining capital.

Ipsus, Battle of (301 BC) Battle marking the defeat at Ipsus, Phrygia, of ANTIGONUS I MONOPHTHALMUS and his son DEMETRIUS I POLIORCETES at the hands of Lysimachus of Thrace, SELEUCUS I NICATOR of Babylon, PTOLEMY I SOTER of Egypt, and Cassander of Macedonia. Antigonus was killed and his Asian territory lost, but Demetrius kept territory in Greece and Macedonia. The battle was part of the struggle for control of territories that made up ALEXANDER THE GREAT's empire.

Ipswich Town and borough (pop., 2001: 117,074), administrative and historic county seat of SUFFOLK, England. Located northeast of LONDON, it was chartered in 1200. It prospered as a port for the export of East Anglian textiles from medieval times to the 17th century. It is now an agricultural market and service centre. Its landmarks include the 16th-century Christchurch mansion and the Great White Horse coaching inn mentioned in CHARLES DICKENS's *The Pickwick Papers*. It was the birthplace of Thomas Cardinal WOLSEY.

IQ *in full* **intelligence quotient** Number intended to represent a measure of relative INTELLIGENCE as determined by the subject's responses to a series of test problems. The IQ was originally computed as the ratio of a person's mental age to his or her chronological (physical) age, multiplied by 100, but use of the concept of mental age has been largely discontinued, and IQ is now generally assessed on the basis of the statistical distribution of scores. The most widely used intelligence tests are the Stanford-Binet test (1916), for children, and the Wechsler test (1939), originally for adults but now also for children. A score above 130 is considered to reflect "giftedness," while a score below 70 is considered to reflect mental impairment or MENTAL RETARDATION. Intelligence tests have provoked great controversy, particularly about what kinds of mental ability constitute intelligence and whether IQ adequately represents these abilities, and about cultural and class bias in test construction and standardization procedures.

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Iqaluit \ē-'kä-lü-it\ *formerly* **Frobisher Bay** Town (pop., 2001: 5,236), capital of Nunavut territory, Canada. Situated on southeastern Baffin Island, it is the largest community in the eastern Canadian Arctic. It was established as a trading post in 1914 and became an air base during World War II. It later was the site of construction camps for the DEW (Distant Early Warning) line of radar stations. It is the site of a meteorological station and a hospital. It became Nunavut's capital in 1999.

Iqbal \'ik-ˌbäl**, Sir Muhammad** (b. Nov. 9, 1877, Si)lkot, Punjab, India—d. April 21, 1938, Lahore, Punjab, Pakistan) Indian poet and philosopher. He first won fame for his poetry, which was written in the classical style for public recitation and became known even among the illiterate. His perspective grew increasingly Pan-Islamic, as revealed in the long poem *The Secrets of the Self* (1915), which he wrote in Persian in order to address a broader Muslim audience. Calling for a revitalization of Islam, he advocated the separate Muslim state that would eventually be realized with the founding of Pakistan in 1947, and he was acclaimed after his death as the father of that country. His poetic masterpiece is "The Song of Eternity" (1932). He is considered the greatest 20th-century poet to write in Urdu.

iqṭāʿ \ik-'tä\ Type of land tenure system practiced in early Islamic societies. Under the *iqṭāʿ* system, which began in the 9th century, political leaders awarded the right of usufruct over land to an individual (usually in exchange for military service) for a limited period. It differed from feudal land tenure practiced in Europe by the fact that land in the Islamic system remained the property of the original owner, not the recipient or granter of the *iqṭāʿ*. The exact implementation of the system varied from region to region and changed over time.

IRA See Irish Republican Army

Iran *officially* **Islamic Republic of Iran** *formerly* **Persia** Country, Middle East, southwestern Asia. Area: 636,374 sq mi (1,648,200 sq km). Population (2005 est.): 69,515,000. Capital: Tehrān. Persians constitute

about one-third of its population; other ethnic groups include Azerbaijanians, Kurds, Lurs, Bakhtyārī, and Balochi. Languages: Persian (Farsi; official), numerous others. Religions: Islam (official; predominantly Shīʿite); also Zoroastrianism. Currency: rial. Iran occupies a high plateau, rising higher than 1,500 ft (460 m) above sea level, and is surrounded largely by mountains. More than half of its surface area consists of salt deserts and other wasteland. About one-tenth of its land is arable, and another one-fourth is suitable for grazing. Iran's rich petroleum reserves account for about one-tenth of world reserves and are the basis of its economy. It is an Islamic republic with one legislative house and several oversight bodies dominated by clergy. The head of state and government is the president, but supreme authority rests with the *rahbar*, a ranking cleric. Human habitation in Iran dates to some 100,000 years ago, but recorded history began with the Elamites c. 3000 BC. The Medes flourished from c. 728 but were overthrown in 550 by the Persians, who were in turn conquered by Alexander the Great in the 4th century BC. The Parthians (see Parthia) created an empire that lasted from 247 BC to AD 226, when control passed to the Sāsānian dynasty. Various Muslim dynasties ruled from the 7th century. In 1501 the Ṣafavid dynasty was established and lasted until 1736. The Qājār dynasty ruled from 1796, but in the 19th century the country was economically controlled by the Russian and British empires. Reza Khan (see Reza Shah Pahlavi) seized power in a coup (1921). His son Mohammad Reza Shah Pahlavi alienated religious leaders with a program of modernization and Westernization and was overthrown in 1979; Shīʿite cleric Ruhollah Khomeini then set up an Islamic republic, and Western influence was suppressed. The destructive Iran-Iraq War of the 1980s ended in a stalemate. Since the 1990s the government has gradually moved to a more liberal conduct of state affairs.

Iran-Contra Affair U.S. political scandal. In 1985 Robert McFarlane, head of the National Security Council (NSC), authorized sales of weapons to Iran in an attempt to secure the release of U.S. hostages held in Lebanon by pro-Iranian terrorist groups. The deal contravened stated policy regarding both dealings with terrorists and military aid to Iran. At the instigation of Oliver North, a NSC staff member, and with the approval of John M. Poindexter, part of the $48 million paid by Iran for the arms was diverted to the Nicaraguan contras, in direct violation of a 1984 law banning such assistance. A Senate investigation resulted in the conviction of North and Poindexter on charges of obstructing justice and related offenses, though their convictions were later overturned on the ground that testimony given at their trials had been influenced by information they had supplied to Congress under a limited grant of immunity. Pres. Ronald Reagan accepted responsibility for the arms-for-hostages deal but denied any knowledge of the diversion.

Iran hostage crisis (1979–81) Political crisis involving Iran's detention of U.S. diplomats. Anti-American sentiment in Iran—fueled in part by close ties between the U.S. and the unpopular leader Mohammad Reza Shah Pahlavi—peaked when Pahlavi fled Iran during the 1979 Iranian revolution. When the monarch entered the U.S. for medical treatment later that year, Islamic militants stormed the U.S. embassy in Tehrān and seized 66 Americans. The hostage-takers, who enjoyed the tacit support of the new Iranian regime of Ruhollah Khomeini, demanded the shah's extradition to Iran, but Pres. Jimmy Carter refused and froze all Iranian assets in the U.S. The Iranians released 13 women and African Americans on Nov. 19–20, 1979, and another hostage was released in July 1980. A rescue attempt in April 1980 failed. Negotiations for the hostages' return began after the shah died in July 1980, but the remaining 52 hostages were kept in captivity until Jan. 20, 1981, when they were released moments after the inauguration of Ronald Reagan. The crisis contributed to Carter's failure to win reelection. See also Iran-Contra Affair.

Iran-Iraq War (1980–90) Protracted and indecisive conflict prompted by Iraq's invasion of its eastern neighbour. Following the 1979 Iranian revolution, the Iraqi leadership sought to exploit Iran's military and political chaos in order to resolve border disputes, gain control of Iran's oil-rich western (largely Arab) province, and achieve hegemony in the Persian Gulf. Iraq was successful early (1980–82) but began to lose ground and sought to negotiate peace. Iran refused, and the war turned into a bloody stalemate that included the first use of chemical warfare since World War I (1914–18). After additional Iraqi advances, Iran agreed to a cease-fire in 1988. Peace was concluded only when Iraq invaded another neighbour, Kuwait, in 1990. See also Ṣaddām Ḥussein; Ruhollah Khomeini.

Iranian languages Major subgroup of the Indo-Iranian branch of the Indo-European language family. Iranian languages are probably spoken by more than 80 million people in southwestern and southern Asia. Only two Old Iranian languages are known, Avestan and Old Persian. A greater number of Middle Iranian languages (c. 300 BC–AD 950) are known; these are divided into a western and an eastern group. Modern Iranian languages fall into four groups. The southwestern group includes Modern Persian (Farsi), Dari (in northern Afghanistan), Tajiki (in Tajikistan and other Central Asian republics); Luri and Bakhtiari (in southwestern Iran); and Tat. The northwestern group includes Kurdish (spoken in Kurdistan) and Baluchi (in southwestern Pakistan, southeastern Iran, and southern Afghanistan). The southeastern group includes Pashto (in Afghanistan and

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northwestern Pakistan) and the 10 or so Pamir languages (in eastern Tajikistan and adjacent parts of Afghanistan and China). The northeastern group includes Ossetic, spoken by the Ossetes in the central Caucasus Mountains, and Yaghnobi, formerly spoken in a single valley of the Pamirs. Nearly all the Modern Iranian languages have been written—if at all—in adaptations of the Arabic alphabet.

Iranian religions Ancient religions of the peoples of the Iranian plateau. The Medes and Persians were dominated by a powerful priestly tribe, the magi. The magi were responsible for chanting accounts of the origin and descent of the gods, and they were probably the source of the dualism that later characterized Zoroastrianism, the best known of the Iranian religions. The chief god of the pre-Zoroastrian pantheon was Ahura Mazda, the creator of the universe and the one who maintains the cosmic and social order. Mithra was the second most important deity and the protector of covenants. Other major deities included Anahita, the war goddess; Rashnu, the god of justice; and astral deities such as Tishtrya, identified with the star Sirius. The ancient Iranians did not build temples or make images of their gods, preferring to worship in the open. The central ritual was the *yazna*, which consisted of a festive meal at which the worshipers made animal sacrifices and invited the deity to attend as a guest. Fire was regarded as a sacred element. The sacred drink *hauma*, which contained a mind-altering drug, was used to inspire worshipers with insight into truth and to stimulate warriors going into battle.

Iraq *officially* **Republic of Iraq** Country, Middle East, southwestern Asia, northwest of the Persian Gulf. Area: 167,618 sq mi (434,128 sq km). Population (2005 est.): 27,818,000. Capital: Baghdad. The population consists mainly of an Arab majority and a Kurdish minority. Language: Arabic (official). Religions: Islam (official; mostly Shīʿite); also Christianity. Currency: dinar. The country can be divided into four major regions: the Tigris-Euphrates alluvial plains in central and southeastern Iraq; Al-Jazīrah, an upland region in the north between the Tigris and Euphrates rivers; deserts in the west and south, covering about two-fifths of the country; and highlands in the northeast. Iraq has the world's second largest proven reserves of petroleum, and it has substantial reserves of natural gas. Agriculture is also a major component of the economy. Iraq has a transitional government with one legislative house; its head of state is the president. Called Mesopotamia in Classical times, the region gave rise to the world's earliest civilizations, including those of Sumer, Akkad, and Babylon. Conquered by Alexander the Great in 331 BC, the area later became a battleground between Romans and Parthians, then between Sāsānians and Byzantines. Arab Muslims conquered it in the 7th century AD, and various Muslim dynasties ruled until the Mongols took over in 1258. The Ottoman Empire took control in the 16th century and ruled until the British occupied the country during World War I (1914–18). The British created the kingdom of Iraq in 1921 and occupied Iraq again during World War II (1939–45). The monarchy was restored following the war, but a revolution caused its downfall in 1958. Following a series of military coups, the socialist Baʿth Party, eventually led by Ṣaddām Ḥussein, took control and established totalitarian rule in 1968. The Iran-Iraq War in the 1980s and the First Persian Gulf War in 1990–91 caused extensive death and destruction. The economy languished under a UN economic embargo imposed on Iraq in the 1990s. The embargo began to erode by the early 21st century, and in 2003, during the Second Persian Gulf War, the Baʿth Party was driven from power.

Irbid Town (pop., 1994: 208,329), northern Jordan. Built on Early Bronze Age settlements, it may have been the biblical city of Beth Arbel and the Arbila of the ancient Decapolis. Modern Irbid is one of Jordan's industrial areas and an agricultural centre. The many springs in the area, in addition to the Yarmūk River, provide water for irrigation. It is the home of Yarmūk University.

Iredell \ˈīr-ˌdel\ **James** (b. Oct. 5, 1751, Lewes, Sussex, Eng.—d. Oct. 20, 1799, Edenton, N.C., U.S.) U.S. jurist. His family immigrated to North Carolina, where he was appointed comptroller of the customhouse at age 17. He helped draft and revise the laws of the new state of North Carolina and served as state attorney general (1779–81). He led the state's Federalists in supporting ratification of the U.S. Constitution, and his letters in its defense (signed "Marcus") are said to have prompted Pres. George Washington to appoint him to the U.S. Supreme Court (1790). He wrote several notable dissents, including those for *Chisholm* v. *Georgia* (1793; affirming the subordination of the states to the federal government) and *Ware* v. *Hylton* (1796; upholding the primacy of U.S. treaties over state statutes). His opinion in *Calder* v. *Bull* (1798) helped establish the principle of judicial review five years before it was actually tested in *Marbury* v. *Madison*.

Ireland Country, western Europe, occupying the greater part of the island of Ireland west of Great Britain. Area: 27,133 sq mi (70,273 sq km). Population (2005 est.): 4,096,000. Capital: Dublin. The northeastern portion of the island is occupied by Northern Ireland. Although Ireland has been invaded and colonized by Celts, Norsemen, Normans, English, and Scots, ethnic distinctions are nonexistent. Languages: Irish, English (both official). Religion: Christianity (predominantly Roman Catholic; also Protestant). Currency: euro. Ireland's topography consists largely of broad lowlands drained by rivers that include the Shannon; its coasts are fringed with mountains. Nearly three-fifths of the population is urban; agriculture

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employs only a small percentage of the workforce. High technology, tourism, and other service industries are pivotal to the Irish economy, while mining, manufacturing, and construction also remain important. Ireland is a republic with two legislative houses; its chief of state is the president, and the head of government is the prime minister. Human settlement in Ireland began c. 6000 BC, and Celtic migration dates from c. 300 BC. ST. PATRICK is credited with having Christianized the country in the 5th century. Norse domination began in 795 and ended in 1014, when the Norse were defeated by BRIAN BORU. Gaelic Ireland's independence ended in 1175 when Roderic O'Connor, Ireland's high king, accepted English King Henry II as his overlord. Beginning in the 16th century, Irish Catholic landowners fled religious persecution by the English and were replaced by English and Scottish Protestant migrants. The United Kingdom of Great Britain and Ireland was established in 1801. The Irish Potato Famine of the 1840s led as many as 1.5 million people to emigrate, and the British government's grudging and ineffective relief measures built momentum for Irish HOME RULE. The EASTER RISING (1916) was followed by virtual civil war (1919–21), during which the Irish Republican Army used guerrilla tactics to force the British government to negotiate. The Catholic majority in southern Ireland favoured complete independence, and the Protestant majority in the north preferred continued union with Britain. Southern Ireland was granted dominion status and became the Irish Free State in 1921, and in 1937 it adopted the name Éire (Ireland) and became a sovereign independent country. It remained neutral during World War II. Britain recognized the status of Ireland in 1949 but declared that cession of the northern six counties (Northern Ireland) could not occur without the consent of the Parliament of Northern Ireland. In 1973 Ireland joined the European Economic Community (later the EUROPEAN COMMUNITY); it is now a member of the EUROPEAN UNION. The last decades of the 20th century were dominated by sectarian hostilities between the island's Catholics and Protestants over the status of Northern Ireland. The Irish government played a pivotal role in negotiating and winning public support for the Belfast Agreement (1998), which gave the country a consultative role in the affairs of Northern Ireland and modified Ireland's constitution to remove its claim to the territory of the entire island.

Ireland, Northern See NORTHERN IRELAND

Irenaeus \ˌī-rə-ˈnē-əs, ˌī-rə-ˈnā-əs**, Saint** (b. c. 120/140, Asia Minor—d. c. 200/203, probably Lyon; Western feast day June 28; Eastern feast day August 23) Bishop and theologian. Born of Greek parents, he was a missionary to Gaul before being named bishop of Lugdunum (modern Lyon, France). All his major works, including *Against Heresies*, were written in opposition to GNOSTICISM. To counteract Gnostic influence, he promoted the development of an authoritative canon of the New Testament. His defense of the belief that the Christian God and the God of the Old Testament were identical led to the development of the Apostles' Creed. His writings against the Gnostics also supported the authority of the bishops, and he claimed that the bishops of various cities were known as far back as the APOSTLES (see APOSTOLIC SUCCESSION). His works have proved a valuable source of information on the Gnostics, because he gave accurate summaries of their beliefs before refuting them.

Ireton \ˈīr-tᵊn**, Henry** (b. 1611, Attenborough, Nottinghamshire, Eng.—d. Nov. 28, 1651, Limerick, County Limerick, Ire.) English politician, leader of the Parliamentary cause in the ENGLISH CIVIL WARS. Joining the Parliamentary army at the outbreak of war, he was involved in many victories. He was elected to Parliament in 1645 and married OLIVER CROMWELL's daughter in 1646. In 1647 he proposed a scheme for a constitutional monarchy; after its rejection by CHARLES I, Ireton provided the ideological foundations for the assault on the monarchy. He helped bring Charles to trial and was one of the signers of his death warrant. As lord deputy of Ireland and commander in chief (1650), he fought against the Roman Catholic rebels and died after the siege of Limerick.

Irgun Zvai Leumi \ir-ˈgün-tsvə-ˈē-lə-ˈū-ˈmē\ *Hebrew* **"National Military Organization"** Jewish right-wing underground movement that advocated using force to establish a Jewish state on both sides of the Jordan River. It opposed the British and the Arabs; its activities included a 1946 attack on the King David Hotel that left 91 dead and a 1947 raid on an Arab village in which all 254 inhabitants were killed. In 1943 MENACHEM BEGIN became the movement's leader. With Israeli independence its units disbanded. Israel's Herut Party was its political incarnation. See also LIKUD; HAGANAH.

Irian See NEW GUINEA

Irian Jaya See PAPUA

iridium \i-ˈri-dē-əm\ Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol Ir, atomic number 77. A very rare, precious, silvery white, hard, brittle METAL that resists most ACIDS, it is one of the densest substances known on Earth. It probably does not occur uncombined in nature but is found in natural ALLOYS with other noble (i.e., chemically inactive or inert) metals. The pure metal is too hard to work with to have any significant uses; alloys with platinum are used in jewelry, pen points, surgical pins and pivots, electrical contacts and sparking points, and extrusion dies. The international prototype kilogram, the primary standard (see WEIGHTS AND MEASURES) for weight, is made of an alloy comprising 90% platinum and 10% iridium. The discovery of abnormally high amounts of iridium in rocks dating to the boundary between the CRETACEOUS and TERTIARY periods led to a much-debated hypothesis that an iridium-containing ASTEROID striking Earth led to a catastrophic chain of events including the extinction of DINOSAURS and many other forms of life.

Irigaray \ē-rē-gȧ-ˈrā,\ *English* \ˈir-i-ˌgar-ē**, Luce** (b. 1932?, Belgium) French feminist psychoanalyst and philosopher. She examined the uses and misuses of language in relation to women in such works as *Speculum of the Other Woman* (1974), which argues that history and culture are written in patriarchal language and centred on men, and that the thinking of SIGMUND FREUD was based in misogyny. Among her other works are *An Ethics of Sexual Differences* (1984) and *Je, tu, nous* (1990).

Irigoyen \ˌir-i-ˈgō-yen**, Hipólito** *or* **Hipólito Yrigoyen** (b. July 12, 1852, Buenos Aires, Arg.—d. July 3, 1933, Buenos Aires) Argentine statesman and president (1916–22, 1928–30). A lawyer, teacher, rancher, and politician, he became leader of the Radical Party in 1896. Working relentlessly for electoral reform, he succeeded in 1912 in securing a secret-ballot vote. When he was elected president in 1916, he passed measures regulating labour conditions but failed to enforce them, and a serious strike was violently broken in 1919. Corruption and the failure to implement democratic reforms cost him support after his return to power in 1928, and he was further weakened by the GREAT DEPRESSION. A nearly bloodless military coup ended his career.

iris family Family Iridaceae, composed of about 1,700 species of perennial herbaceous plants, as well as a few shrubs, in some 80 genera. It is known for ornamentals such as irises (genus *Iris*), gladioli (see GLADIOLUS), CROCUSES, and FREESIAS. Irises have swordlike, smooth leaves and bear showy flowers in a great variety of colours and sizes on a smooth stem. Most abundant and diverse in Africa, they are found nearly worldwide across temperate, subtropical, and tropical zones. The underground stems may be RHIZOMES (e.g., New World *Iris* species), BULBS (e.g., southwestern European *Iris* species), or CORMS (e.g., *Gladiolus*).

Irish elk Any member of a genus (*Megaloceros*) of extinct giant DEER commonly found as fossils in Pleistocene deposits (1.8 million–10,000 years ago) in Europe and Asia. About the size of a modern MOOSE, the Irish elk had the largest antlers of any form of deer known, in some specimens about 13 ft (4 m) across. It may have survived until c. 700–500 BC.

Irish Free State See IRELAND

Irish Home Rule See Irish HOME RULE

Irish language *or* **Gaelic language** CELTIC LANGUAGE of Ireland, written in the LATIN ALPHABET introduced with Christianity in the 5th century. Irish is conventionally divided into three periods: Old Irish (600–c. 950), Middle Irish (c. 950–1200), and Modern Irish (from c. 1200). OGHAM WRITING predates Old Irish. Old and Middle Irish are the vehicles of a rich literature of prose tales and verse. Classical Modern Irish was the exclusive literary medium in Ireland and Scottish Gaeldom into modern times (see SCOTTISH GAELIC LANGUAGE). Literacy in Irish declined under English rule; by 1800 it was all but an unwritten language. The deaths and emigration resulting from the IRISH POTATO FAMINE and a massive shift to English afterward drastically reduced the number of Irish-speakers. Irish was revived as a literary language in the late 19th and early 20th centuries, and with Irish independence (1921) it was made official. Though it is a true community language only for a small number of people on Ireland's western coast in what are called Gaeltachts, hundreds of thousands of Irish citizens and people of Irish descent have some competence in Irish.

Irish literary renaissance Flowering of Irish literary talent in the late 19th and early 20th century. It was closely allied with a strong politi-

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cal nationalism and a revival of interest in Ireland's Gaelic heritage (see Gaelic revival). Other factors in the renaissance were the retelling of ancient heroic legends in books such as Standish O'Grady's *History of Ireland* (1878, 1880) and Douglas Hyde's *A Literary History of Ireland* (1899), and the Gaelic League, formed in 1893 to revive the Irish language and culture. It developed into a vigorous literary force centred on William Butler Yeats; other important figures were Augusta Gregory, John Millington Synge, and Sean O'Casey. See also Abbey Theatre.

Irish Potato Famine (1845–49) Famine that occurred in Ireland when the potato crop failed in successive years. By the early 1840s almost half the Irish population, particularly the rural poor, was depending almost entirely on the potato for nourishment. A reliance on only one or two high-yielding varieties made the crop vulnerable to disease, including the late blight fungus, which ruined the crop. The British government provided minimal relief to the starving Irish, limited to loans and soup kitchens. The famine was a watershed in Ireland's demographic history: more than a million people died from starvation or famine-related diseases, and perhaps as many as 1.5 million emigrated to North America and Britain. Population continued to decline thereafter, and by independence in 1921 the Irish population was barely half of the 8.4 million it had been before the famine.

Irish Rebellion See Easter Rising

Irish Republican Army (IRA) Republican paramilitary organization, founded in 1919, seeking the end of British rule in Northern Ireland and the unification of the province with the republic of Ireland. The IRA used armed force to achieve the same objectives as Sinn Féin, though the two always operated independently. After the establishment of the Irish Free State (1922), the IRA refused to accept a separate Northern Ireland, and the violence continued. The IRA was declared illegal in 1931, and the Irish legislature provided for internment without trial for its members. It gained popular support in the 1960s when Roman Catholics in Northern Ireland began a civil rights campaign against discrimination by the dominant Protestant majority. In 1969 the IRA split into the Marxist Official wing, which eschewed violence, and the Provisionals (Provos), Ulster Catholics committed to the use of terror tactics against Ulster Protestants and the British military, tactics that included the 1979 assassination of Lord Mountbatten and the killing of some 1,800 people by the early 1990s. In 1994 the IRA declared a cease-fire, and its political representatives were included in multiparty talks beginning in 1997. Negotiations produced the Good Friday Agreement (1998), in which the IRA agreed to decommission (disarm). In the ensuing years the IRA destroyed some of its weapons but resisted decommissioning its entire armoury, hampering implementation of the peace agreement. In July 2005, however, the IRA announced that it was ending its armed campaign and instead would pursue only peaceful means to achieve its objectives.

Irish Sea Arm of the North Atlantic Ocean that separates Ireland from Great Britain. Connected with the Atlantic by North Channel and by St. George's Channel, it is about 130 mi (210 km) long and 150 mi (240 km) wide. Its total area is about 40,000 sq mi (100,000 sq km). Its greatest depth measures about 576 ft (175 m). The Isle of Man and Anglesey are its two principal islands.

Irish terrier Breed of terrier developed in Ireland, one of the oldest terrier breeds. It stands 16–18 in. (41.5–46 cm) high, weighs 22–26 lbs (10–12 kg), and has a wiry golden-red to reddish brown coat. Nicknamed the daredevil, it is reputedly adaptable, loyal, spirited, and recklessly courageous. It served as a messenger and sentinel in World War I, and has been used to hunt and to retrieve game.

Irish terrier
SALLY ANNE THOMPSON/EB INC.

Irish wolfhound Tallest of all dog breeds, a keen-sighted hound used in Ireland to hunt wolves and other game and noted for its speed and strength. An ancient breed, first mentioned about the 2nd century AD, it is similar in build to the greyhound but far more powerful. The female, substantially smaller than the male, stands at least 30 in. (76 cm) tall and weighs 105 lb (48 kg) or more. The rough coat is long on the brows and underjaw, and the colours include gray, brindle, red-brown, black, and white. The dog is valued as a gentle, even-tempered companion.

Irkutsk \ir-'kütsk\ City (pop., 2001 est.: 587,200), east-central Russia. Located on the Angara River, it was founded as a wintering camp in 1652. It soon became a commercial centre for the fur trade and a base on the Russian trade route to China and Mongolia. Its importance grew after the opening of the Trans-Siberian Railroad in 1898. An industrial and cultural centre, it is the seat of Irkutsk State University and the Siberian branch of the Academy of Sciences.

iron Metallic chemical element, one of the transition elements, chemical symbol Fe, atomic number 26. Iron is the most used and cheapest metal, the second most abundant metal and fourth most abundant element in Earth's crust. It occurs rarely as a free metal, occasionally in natural alloys (especially in meteorites), and in hundreds of minerals and ores, including hematite, magnetite, limonite, and siderite. The human body contains about one-sixth of an ounce (4.5 g) of iron, mostly in hemoglobin and its precursors; iron in the diet is essential to health. Iron is ferromagnetic (see ferromagnetism) at ordinary temperatures and is the only metal that can be tempered (see tempering). Its uses in steels of various types, as well as in cast and wrought iron (collectively, "ferrous metals"), are numerous. Alteration of its properties by impurities, especially carbon, is the basis of steelmaking. Iron in compounds usually has valence 2 (ferrous) or 3 (ferric). Ferrous and ferric oxides (FeO and Fe_2O_3, respectively) are used as pigments and the latter as jewelers' rouge. Rust is ferric oxide containing water; ferric oxide is widely used as a magnetic recording material in computer data-storage devices and magnetic tapes. Ferrous and ferric sulfates and chlorides are all of industrial importance as mordants, reducing agents, flocculating agents, or raw materials and in inks and fertilizers.

Iron Act (1750) Measure by the British Parliament to restrict the American colonial iron industry. Pig iron and iron bar could be exported to England duty-free to meet British needs. Further development of colonial manufacturing to produce finished iron goods was prohibited, as was the export of iron to other countries.

Iron Age Final technological and cultural stage in the Stone–Bronze–Iron-Age sequence (or Three-Age System) in which iron largely replaced bronze in implements and weapons. The start of the Iron Age varied geographically, beginning in the Middle East and southeastern Europe c. 1200 BC but in China not until c. 600 BC. Though the large-scale production of iron implements brought new patterns of more permanent settlement, use of iron for weapons put arms in the hands of the masses for the first time and set off a series of large-scale movements and conquests that did not end for 2,000 years and that changed the face of Europe and Asia. See also Bronze Age.

Iron Curtain Political, military, and ideological barrier erected by the Soviet Union after World War II to seal off itself and its dependent eastern European allies from open contact with the West and other noncommunist areas. Winston Churchill employed the term in a speech in Fulton, Mo., U.S., about the division of Europe in 1946. The restrictions and the rigidity of the Iron Curtain eased slightly after Joseph Stalin's death in 1953, though the construction of the Berlin Wall in 1961 restored them. The Iron Curtain largely ceased to exist in 1989–90 with the communists' abandonment of one-party rule in eastern Europe.

iron-deficiency anemia Most common type of anemia, which may develop in times of high iron loss and depletion of iron stores (e.g., rapid growth, pregnancy, menstruation) or in settings of low dietary iron intake or inefficient iron uptake (e.g., starvation, intestinal parasites, gastrectomy). Much of the world's population is iron-deficient to some degree. Symptoms include low energy level and sometimes paleness, shortness of breath, cold extremities, sore tongue, or dry skin. In advanced cases, red blood cells are small, pale, and low in hemoglobin, blood iron levels are reduced, and body iron stores are depleted. Treatment with iron usually brings quick improvement.

iron ore, bog See bog iron ore

iron pyrite See pyrite

ironclad Type of warship developed in Europe and the U.S. in the mid-19th century, characterized by the iron armour that protected the hull. In the Crimean War (1853–56) the French and British successfully attacked Russian fortifications with "floating batteries," ironclad barges mounting

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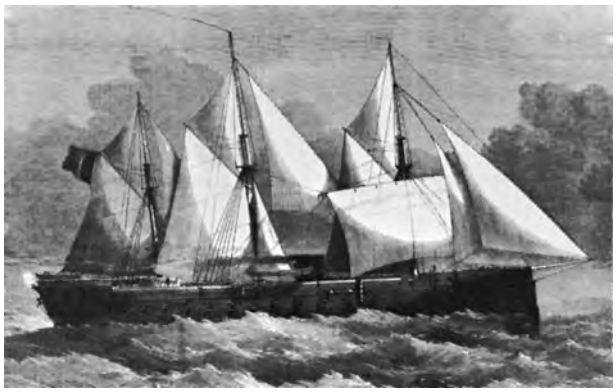
heavy guns. In 1859 the French completed the first iron warship, the *Gloire*; its iron plates, 4.5 in. (11 cm) thick, were backed by heavy timber. Britain and the U.S. soon followed. Union forces launched armored gunboats on the Mississippi at the start of the American Civil War, and a flotilla captured Fort Henry (1862). The first battle between ironclads was the Battle of the *Monitor* and *Merrimack* (1862). Later refinements led to the BATTLESHIP. See also MONITOR.



French ironclad *Gloire,* engraving by Smythe after a painting by A.W. Weedon
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Irons, Jeremy (b. Sept. 19, 1948, Cowes, Isle of Wight, Eng.) British actor. He made his London stage debut in *Godspell* (1973) and appeared on Broadway in *The Real Thing* (1984, Tony Award). After his screen debut in *Nijinsky* (1980), he won notice for *The French Lieutenant's Woman* (1981) and became widely popular in the television series *Brideshead Revisited* (1980–81). His performances were notable for their sensitivity and sophistication, and he offered deliciously wicked turns in *Dead Ringers* (1988) and *Reversal of Fortune* (1990, Academy Award). His later films include *Damage* (1992), *The Lion King* (1994), and *Lolita* (1997).

ironweed Any of about 500 species of perennial plants constituting the genus *Vernonia* (family Asteraceae). Small herbaceous (nonwoody) species are found throughout the world; shrubs and trees are found primarily in tropical regions. Ironweed species have lance-shaped, toothed leaves that alternate along the stem; clusters of flower heads composed only of disk flowers (no ray flowers); and a ring of overlapping BRACTS below the flower heads. Some autumn-blooming species are cultivated as border plants for their attractive white, purple, or pink flower clusters.

Western ironweed (*Vernonia fasciculata*)
DAN MORRILL

ironwood Any of numerous trees and shrubs, found worldwide, that have exceptionally tough or hard wood useful for timber, fence posts, and tool handles. Species include the eastern, or American, hop hornbeam (*Ostrya virginiana*), a small tree of northern Iran (*Parrotia persica*), and Ceylon ironwood (*Mesua ferrea*). Though these trees belong to different plant orders, all have bright yellow to orange and scarlet autumn foliage.

irony Language device in which the real intent is concealed or contradicted by the literal meaning of words or a situation. Verbal irony, either spoken or written, arises from an awareness of contrast between what is and what ought to be. Dramatic irony, an incongruity in a theatrical work between what is expected and what occurs, depends on the structure of a play rather than its use of words, and it is often created by the audience's awareness of a fate in store for the characters that they themselves do not suspect. See also FIGURE OF SPEECH.

Iroquoian \ˈir-ə-ˌkwȯi-ən\ **languages** Family of about 16 North American Indian languages aboriginally spoken around the eastern Great Lakes and in parts of the Middle Atlantic states and the South. Aside from the languages of the IROQUOIS CONFEDERACY (Mohawk, Oneida, Onondaga, Cayuga, and Seneca, all originally spoken in New York, along with Tuscarora, originally spoken in North Carolina) and Cherokee (originally spoken in the southern Appalachians), the Iroquoian languages are extinct, and with the exception of Huron and Wyandot, the extinct languages are poorly documented. Iroquoian languages are remarkable for their grammatical intricacy. Much of a sentence's semantic content is bound around a verbal base, so a single very long word may constitute a fairly complex utterance.

Iroquois \ˈir-ə-ˌkwȯi\ Any of six North American members of the IROQUOIS CONFEDERACY living mostly in southern Ontario and Quebec, Can., and in New York, Wisconsin, Ohio, and Oklahoma, U.S. The name Iroquois is a French derivation of Irinakhoiw, meaning "Rattlesnakes," their Algonquian enemy's epithet. They call themselves Hodenosaunee, meaning "People of the Longhouse." The Iroquois were semisedentary, practiced agriculture, palisaded their villages, and dwelled in LONGHOUSES that lodged many families. Women worked the fields and, when they became clan elders, helped determine the makeup of village councils. Men built houses, hunted, fished, and made war. Iroquoian mythology was largely preoccupied with supernatural aggression and cruelty, sorcery, torture, and cannibalism. Their formal religion consisted of agricultural festivals. Warfare was ingrained in Iroquois society, and war captives were often tortured for days or made permanent slaves. All together the various Iroquois tribes number about 70,000 members, with the MOHAWK making up more than half that figure.

Iroquois Confederacy *or* **League of the Iroquois** Confederation of five (later six) Indian tribes across upper New York that in the 17th–18th century played a strategic role in the struggle between the French and British for supremacy in North America. The five original nations were the MOHAWK, ONEIDA, Onondaga, Cayuga, and SENECA; the Tuscarora, a non-voting member, joined in 1722. According to tradition, the confederacy was founded between 1570 and 1600 by Dekanawidah, born a Huron (see WYANDOT), carrying out the earlier ideas of HIAWATHA, an Onondaga. Cemented mainly by their desire to stand together against invasion, the tribes united in a common council composed of 50 sachems; each original tribe had one vote, and unanimity was the rule. At first the confederacy barely withstood attacks from the Huron and MAHICAN, but by 1628 the Mohawk had defeated the Mahican and established themselves as the region's dominant tribe. When the Iroquois destroyed the Huron in 1648–50, they were attacked by the Huron's French allies. During the AMERICAN REVOLUTION, the Oneida and Tuscarora sided with the American colonists while the rest of the league, led by JOSEPH BRANT, fought for the British. The loyalist Iroquois were defeated in 1779 near Elmira, N.Y., and the confederacy came to an end.

irrational number Among the REAL NUMBERS, any of those that cannot be represented as quotients of integers. In decimal form, irrational numbers are represented by nonterminating, nonrepeating decimals. Examples include square roots of prime numbers and such TRANSCENDENTAL NUMBERS as π and e.

Irrawaddy \ˌir-ä-ˈwä-dē\ **River** River, Myanmar (Burma). It flows 1,350 mi (2,170 km) across the centre of the country and empties into the Bay of BENGAL. The country's most important commercial waterway, it is formed by the confluence of the Nmai and the Mali rivers; in the central dry zone it is joined by its major tributary, the CHINDWIN RIVER. Chief ports are MANDALAY, Chauk, Prome (Pyè), and Henzada.

irrigation Artificial supply of water to land, to maintain or increase yields of food crops, a critical element of modern agriculture. Irrigation can compensate for the naturally variable rate and volume of rain. Water is pumped from natural ponds, lakes, streams, and wells; basin systems and dams hold back larger streams and annual floods. Below the dam, gates to concrete-lined canals are opened, conveying the water over the land through gravity flow. More elaborate, expensive canals flow from huge constructed reservoirs, which hold a year-round water supply. Today portable irrigation systems of lightweight aluminum pipe are in wide use. Drip irrigation, a newer method, uses narrow tubing to supply water directly to the base of each plant. Agricultural irrigation, water towers, and machines invented to lift and distribute water are ancient innovations. Early Egyptians were irrigating with Nile River water by 5000 BC, and

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such other ancient civilizations as Babylon and China seem to have developed largely as a result of irrigation-based agriculture.

irritable bowel syndrome *or* **IBS** Chronic disorder characterized by abdominal pain, intestinal gas, and diarrhea, constipation, or both. Other symptoms may include abdominal pain that is relieved after defecation or a sensation of incomplete rectal evacuation. IBS is caused by a motility disturbance of the intestines that may result from increased intestinal sensitivity to distension. Stress or the consumption of fatty foods, milk products, certain fruits or vegetables (e.g., broccoli and cabbage), alcohol, or caffeine may cause similar symptoms. Treatment includes relaxation, exercise, and avoidance of aggravating foods. Antidiarrheal medications or fibre supplements may help lessen symptoms. Although IBS may cause discomfort and emotional distress, the disorder does not result in any permanent intestinal damage.

Irtysh \ir-'təsh\ **River** *Kazakh* **Ertis** \er-'tis\ River rising in the Altai Mountains in Xinjiang autonomous region, China. It flows west across the Chinese border and then northwest through Kazakhstan into Russian Siberia, where it becomes the largest tributary of the Ob River. It is 2,640 mi (4,248 km) long and is navigable for most of its course. Its main ports include Tobolsk, Tara, Omsk, Pavlodar, Semey, and Öskemen.

Iruña See Pamplona

Irvine Royal burgh and seaport (pop., 1991: 32,988), North Ayrshire council area, on the Atlantic coast of Scotland. The last of Scotland's five new towns, it was designated in 1967 to house overflow population from Glasgow and provide a focus for the economic and industrial rehabilitation of the area. It had declined in the 18th and 19th centuries because of competition from other towns and the silting of the harbour. It became an industrial centre that produces chemicals, engineering, electrical goods, and clothing.

Irving City (pop., 2000: 191,615), northeastern Texas, U.S. Established in 1903 and incorporated in 1914, the city developed into an industrial hub during the 1950s. A suburb of Dallas, it is the site of the University of Dallas and DeVry University as well as of Texas Stadium, home of the Dallas Cowboys professional gridiron football team.

Irving, Sir Henry *orig.* **John Henry Brodribb** (b. Feb. 6, 1838, Keinton Mandeville, Somerset, Eng.—d. Oct. 13, 1905, Bradford, Yorkshire) British actor. He toured for 10 years with a stock company before making his London debut in 1866. With his success in *The Bells* (1871), he became a leading actor in H.L. Bateman's company (1871–77). As actor-manager of the Lyceum Theatre (from 1878), he made it London's most successful theatre. He formed a celebrated acting partnership with Ellen Terry that lasted until the company dissolved in 1902. They were noted for their Shakespearean roles, and their theatrical qualities complemented each other: he the brooding introvert, she the spontaneous charmer.

Irving, John (Winslow) (b. March 2, 1942, Exeter, N.H., U.S.) U.S. novelist. He taught at several universities before beginning to write full-time in the late 1970s. His best-selling *The World According to Garp* (1978; film, 1982) is notable, like his other works, for its engaging story line, colourful characterizations, macabre humour, and examination of contemporary issues. Later novels include *The Hotel New Hampshire* (1981; film, 1984), *The Cider House Rules* (1985; film, 1999), and *A Prayer for Owen Meany* (1989).

Irving, Washington (b. April 3, 1783, New York, N.Y., U.S.—d. Nov. 28, 1859, Tarrytown, N.Y.) U.S. author, called the "first American man of letters." He began his career as a lawyer but soon became a leader of the group that published *Salmagundi* (1807–08), a periodical containing whimsical essays and poems. After his comic *A History of New York...by Diedrich Knickerbocker* (1809), he wrote little until his very successful *The Sketch Book* (1819–20), containing his best-known stories, "The Legend of Sleepy Hollow" and "Rip Van Winkle." It was followed by a sequel, *Bracebridge Hall* (1822). He held diplomatic positions in Madrid, Spain, and writings such as *The Alhambra* (1832) reflect his interest in Spain's past.

Washington Irving, oil painting by J.W. Jarvis, 1809; in the Historic Hudson Valley collection.
COURTESY OF HISTORIC HUDSON VALLEY

Isaac \ē-'zäk**, Heinrich** (b. c. 1450, Brabant—d. 1517, Florence) Flemish composer. He spent much of his career in Italy, especially Florence, but was known as a leading representative of the Netherlandish style. As court composer to Emperor Maximilian I (from 1497), he was allowed to travel. He had many students, including Ludwig Senfl, and his historical importance in Germany is as the main disseminator of the progressive Northern style there. The beauty and quality of his works, which include over 100 masses, dozens of motets, and secular songs, have led some to regard him as second only to Josquin des Prez among his contemporaries.

Isaac II Angelus (b. c. 1135—d. February 1204) Byzantine emperor (1185–95). Proclaimed emperor by the Constantinople mob that murdered his cousin, Andronicus I Comnenus, he drove the Normans out of Greece (1185) but failed to regain Cyprus from rebels. He was forced to help Frederick I Barbarossa in the Third Crusade. He defeated the Serbians (1190), but before he could carry out a planned expedition against the Bulgarians, he was overthrown by his brother, who imprisoned and blinded him (1195). His son Alexius diverted the Fourth Crusade to restore him to power (1203), and father and son briefly ruled as co-emperors before being dethroned and killed in a revolution.

Isaac of Stella (b. c. 1100, England—d. c. 1169, Étoile, near Poitiers, Aquitaine) Monk, philosopher, and theologian. Isaac joined the Cistercians during the reforms carried out by St. Bernard de Clairvaux. His scholarly works make use of logical argumentation and are influenced by the Neoplatonism of St. Augustine. His principal work, *Letter to Alcher on the Soul* (1162), integrates Aristotelian and Neoplatonic psychological theories with Christian mysticism. A leader of humanism in his day, he suggests that the intellect enables humans to grasp eternal ideas in time and that intelligence allows humans to intuit the reality of God.

Isaac the Elder See Isaac ben Solomon Israeli

Isabela Island Island, Galapagos Islands, Ecuador. It is the largest of the Galapagos Islands, located in the eastern Pacific Ocean west of mainland Ecuador. It has an area of 2,249 sq mi (5,825 sq km), and its northern tip, Albemarle, is crossed by the Equator. It has unique species of flightless cormorants and penguins as well as large numbers of iguanas and a flamingo colony.

Isabella I *known as* **Isabella the Catholic** *Spanish* **Isabel la Católica** (b. April 22, 1451, Madrigal de las Altas Torres, Castile—d. Nov. 26, 1504, Medina del Campo, Spain) Queen of Castile (1474–1504) and of Aragon (1479–1504). Daughter of John II of Castile and León, she married Ferdinand V in 1469. Her reign began with civil war over her succession (1474–79), but in 1479 the kingdoms of Castile and Aragon came together in the persons of their rulers, though they remained separately governed. In a long campaign (1482–92), Isabella and Ferdinand succeeded in conquering Granada, the last Muslim stronghold in Spain. In 1492 Isabella approved support of Christopher Columbus's journey to the New World. That same year she was involved in the expulsion of the Jews under the Inquisition. Along with her spiritual advisers, she reformed the Spanish churches.

Isabella I, portrait by an unknown artist; in the Real Academia de la Historia, Madrid, Spain.
ARCHIVO MAS, BARCELONA

Isabella II *Spanish* **Isabel** \ē-sä-'bel\ (b. Oct. 10, 1830, Madrid, Spain—d. April 9, 1904, Paris, France) Queen of Spain (1833–68). She was the daughter of Ferdinand VII, and the issue of her succession to the throne precipitated the First Carlist War (see Carlism). During her minority (1833–43), her mother and Baldomero Espartero acted as regents; in 1843 Espartero was deposed by military officers, and Isabella was declared of age. Liberal opposition to the regime's authoritarianism, scan-

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dalous reports about her private life, and her arbitrary political interference led to the Revolution of 1868, which drove her into exile. She abdicated in favour of her son, Alfonso XII.

Isabella Farnese \fär-'nā-zā\ (b. Oct. 25, 1692, Parma, Duchy of Parma—d. July 11, 1766, Aranjuez, Spain) Queen consort of Philip V of Spain. A member of the ducal Farnese family of Parma, she became Philip's second wife in 1714 and quickly established ascendancy over her weak husband. Because his two sons by his first wife were in line to succeed him, she sought to secure Italian possessions for her own children, including Charles III. This quest embroiled Spain in wars and intrigues for three decades. However, she chose able and devoted ministers, who introduced beneficial internal reforms and improved Spain's economy. After Philip's death in 1746, she ceased to exert any real influence.

Isaiah \ī-'zā-ə\ (fl. 8th century BC, Jerusalem) Prophet of ancient Israel after whom the biblical book of Isaiah is named. He is believed to have written only some of the book's first 39 chapters; the rest are by one or more unknown authors. Isaiah's call to prophesy came c. 742 BC, when Assyria was beginning the westward expansion that later overran Israel. A contemporary of Amos, Isaiah denounced economic and social injustice among the Israelites and urged them to obey the Law or risk cancellation of God's covenant. He correctly predicted the destruction of Samaria, or northern Israel, in 722 BC, and he declared the Assyrians to be the instrument of God's wrath. The Christian Gospels lean more heavily on the book of Isaiah than on any other prophetic text, and its "swords-into-plowshares" passage has universal appeal.

ISBN See International Standard Book Number

Ischia \'is-kē-ə\ Island, southern Italy. Located in the Tyrrhenian Sea between the Gulf of Gaeta and the Bay of Naples, it has a circumference of 21 mi (34 km) and an area of 18 sq mi (47 sq km) and consists almost entirely of volcanic rock. It rises to 2,585 ft (788 m) at Monte Epomeo, an extinct volcano, which gives its name to the island's famous wine. Known for its mild climate and mineral springs, it is a popular resort area. The chief towns, including Ischia, are located in the north.

ISDN *in full* **Integrated Services Digital Network** Digital telecommunications network that operates over standard copper telephone wires or other media. ISDN connections are used to provide a variety of digital services to customers, including digital voice telephone, fax, e-mail, digital video, and access to the Internet. A wide range of data transfer rates are available, with speeds up to about 128 kilobits per second (kbps). ISDN is faster than an ordinary dial-up connection (at about 56 kbps), but much slower than cable modem or DSL connections (which typically exceed one megabit per second).

Ise Shrine *in full* **Grand Shrine of Ise** *Japanese* **Ise-daijingū** Foremost Shintō shrine in Japan, at Ise, in southern Honshu. The Inner Shrine (traditionally founded 4 BC) is dedicated to the sun goddess Amaterasu. The Outer Shrine (5th century), 4 mi (6 km) away, is dedicated to Toyuke Ōkami, god of food, clothing, and housing. At both shrines the main building is a thatched hut built in the ancient Japanese style of unpainted Japanese cypress (*hinoki*). A distinctive feature of Shintō architecture is the *chigi*, a scissor-shaped finial at the front and rear of the roof. Since the 7th century the buildings have been reconstructed every 20 or 21 years.

Entrance to the Outer Shrine of the Grand Shrine of Ise, Japan.
FPG-EB INC.

Iseo \ē-'zā-ō**, Lake** Lake, northern Italy. Situated at the southern foot of the Alps, it is fed by the Oglio River, which enters the northern end near Lovere and leaves the southern end at Sarnico. It is 15.5 mi (25 km) long, with a surface area of 24 sq mi (62 sq km). Monte Isola, a large island in the centre of the lake, is crowned by a chapel.

Isère River \ē-'zer\ River, southwestern France. Originating in the Savoy Alps on the Italian frontier, it flows 180 mi (290 km) southwest to its confluence with the Rhône River above Valence. It is unnavigable but used for hydroelectric power.

Iṣfahān See Eṣfahān

Isherwood, Christopher *orig.* **Christopher William Bradshaw** (b. Aug. 26, 1904, High Lane, Cheshire, Eng.—d. Jan. 4, 1986, Santa Monica, Calif., U.S.) British-born U.S. writer. Educated at Cambridge University, he became close friends with W.H. Auden, with whom he traveled and collaborated on three verse dramas, including *The Ascent of F6* (1936). He lived in Berlin from 1929 to 1933; his two novels about this period, later published together as *The Berlin Stories* (1946), inspired the play *I Am a Camera* (1951; film, 1955) and the musical *Cabaret* (1966; film, 1972). A pacifist, he moved to southern California at the beginning of World War II, where he taught and wrote screenplays. His later fiction and memoirs reflect his homosexuality. A follower of Swami Prabhavananda, he wrote and translated works on Indian Vedanta.

Ishikari \ˌē-shē-'kä-rē\ **River** River, Hokkaido, northern Japan. Rising near the centre of the Kitami Mountains, it flows southwest to empty into Ishikari Bay of the Sea of Japan (East Sea). It is 227 mi (365 km) long, the second longest river in Japan. Its name is derived from the Ainu term *ishikaribetsu* ("greatly meandering river").

Ishim \i-'shim\ **River** *Kazakh* **Esil** \'es-il\ River, north-central Kazakhstan and the Tyumen and Omsk provinces of south-central Russia. A tributary of the Irtysh River, it rises in the Niyaz Hills in the north of the Kazakh Uplands, flowing northwest before entering the Irtysh at Ust-Ishim. It is 1,522 mi (2,450 km) long.

Ishmael ben Elisha \'ish-mā-əl-ˌben-i-'lī-shə\ (fl. 2nd century AD) Jewish scholar. Born into a wealthy priestly family, he was taken captive by the Roman legions that sacked Jerusalem in AD 70, but he was ransomed by his former teacher and was sent back to Palestine to study. Ishmael founded a rabbinic school and wrote commentaries on the Torah, developing 13 rules of exegesis based on the 7 rules of Hillel. Known for his simple, literal approach to biblical scholarship, he sought to relieve hardship for observant Jews in the interpretation of the Law. He is often portrayed in dispute with Akiba ben Joseph for what he saw as the latter's excessive interpretations of superficial biblical words or phrases.

Ishtar In Mesopotamian religion, the goddess of war and sexual love. Known as Ishtar in Akkadia, she was called Astarte by western Semitic peoples and was identified with Inanna in Sumeria. In early Sumeria she was the goddess of the storehouse as well as of rain and thunderstorms. Once a fertility goddess, she evolved into a deity of contradictory qualities, of joy and sorrow, fair play and enmity. In Akkadia she was associated with the planet Venus and was the patroness of prostitutes and alehouses. Her popularity became universal in the ancient Middle East, and she was called Queen of the Universe.

Ishtar, with her cult-animal the lion, and a worshipper, modern impression from a cylinder seal, *c.* 2300 BC; in the Oriental Institute, University of Chicago
COURTESY OF THE ORIENTAL INSTITUTE, UNIVERSITY OF CHICAGO

Ishtar Gate Enormous burnt-brick double entryway built in the ancient city of Babylon c. 575 BC. The gate was more than 38 ft (12 m) high and was decorated with glazed brick reliefs. Through the gatehouse ran the stone- and brick-paved Processional Way. Some 120 brick lions lined the street and some 575 dragons and bulls, in 13 rows, adorned the gate.

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Isidore of Sevilla, Saint (b. c. 560, Cartagena or Sevilla, Spain—d. April 4, 636, Sevilla; canonized 1598; feast day April 4) Spanish prelate and scholar, last of the Western Fathers of the Church. He became archbishop of Sevilla c. 600 and presided over several councils that shaped church policy, including the fourth Council of Toledo (633). He also promoted the conversion of the Visigoths from Arianism to orthodox Christianity. His best-known work was *Etymologies*, an encyclopedia that became a standard reference work in the Middle Ages. He also wrote theological works, biographies, and treatises on natural science, cosmology, and history. He was canonized in 1598 and declared a Doctor of the Church in 1722.

isinglass See muscovite

Isis \'ī-səs\ One of the major goddesses of ancient Egypt, the wife of Osiris. When Osiris was killed by Seth, she gathered up the pieces of his body, mourned for him, and brought him back to life. She hid their son Horus from Seth until Horus was fully grown and could avenge his father. Worshiped as a goddess of protection, she had great magical powers and was invoked to heal the sick or protect the dead. By Greco-Roman times she was dominant among Egyptian goddesses, and her cult reached much of the Roman world as a mystery religion.

ISKCON See Hare Krishna movement

Isla de Pasqua See Easter Island

Islam Major world religion founded by Muhammad in Arabia in the early 7th century AD. The Arabic word *islam* means "submission"—specifically, submission to the will of the one God, called Allah in Arabic. Islam is a strictly monotheistic religion, and its adherents, called Muslims, regard the Prophet Muhammad as the last and most perfect of God's messengers, who include Adam, Abraham, Moses, Jesus, and others. The sacred scripture of Islam is the Qur'ān, which contains God's revelations to Muhammad. The sayings and deeds of the Prophet recounted in the sunna are also an important source of belief and practice in Islam. The religious obligations of all Muslims are summed up in the Five Pillars of Islam, which include belief in God and his Prophet and obligations of prayer, charity, pilgrimage, and fasting. The fundamental concept in Islam is the Sharī'ah, or Law, which embraces the total way of life commanded by God. Observant Muslims pray five times a day and join in community worship on Fridays at the mosque, where worship is led by an imam. Every believer is required to make a pilgrimage to Mecca, the holiest city, at least once in a lifetime, barring poverty or physical incapacity. The month of Ramadan is set aside for fasting. Alcohol and pork are always forbidden, as are gambling, usury, fraud, slander, and the making of images. In addition to celebrating the breaking of the fast of Ramadan, Muslims celebrate Muhammad's birthday (see mawlid) and his ascension into heaven (see mi'rāj). The 'Īd al-Aḍḥā festival inaugurates the season of pilgrimage to Mecca. Muslims are enjoined to defend Islam against unbelievers through jihad. Divisions occurred early in Islam, brought about by disputes over the succession to the caliphate (see caliph). About 90% of Muslims belong to the Sunnite branch. The Shi'ites broke away in the 7th century and later gave rise to other sects, including the Ismā'īlīs. Another significant element in Islam is the mysticism known as Sufism. Since the 19th century the concept of the Islamic community has inspired Muslim peoples to cast off Western colonial rule, and in the late 20th century fundamentalist movements (see Islamic fundamentalism) threatened or toppled a number of secular Middle Eastern governments. In the early 21st century, there were more than 1.2 billion Muslims in the world.

Islam, Nation of See Nation of Islam

Islam, Pillars of Five duties incumbent on every Muslim. The first is the profession of faith in the one God and in Muhammad as his Prophet. The others are prayer five times a day, the giving of alms to the poor, fasting during the month of Ramadan, and the hajj, or pilgrimage to Mecca.

Islamabad \is-'lä-mə-ˌbäd\ Capital (pop., 1998: 524,500) of Pakistan, located northeast of Rawalpindi. Established in 1959 to replace Karachi as the capital, it was designed to blend modern and traditional Islamic architecture. The city itself is small, with an area of 25 sq mi (65 sq km), but the planned capital area is a 350-sq-mi (910-sq-km) expanse of natural terraces and meadows surrounding the city. It is the seat of the University of Islamabad (founded 1965).

Islāmbūlī \ˌis-lam-'bü-lē**, Khālid al-** *or* **Khaled Islambouli** (b. 1958, near Al-Minyā, Egypt—d. April 15, 1982, Egypt) Egyptian radical, assassin of Anwar el-Sādāt. Born into a family of rural notables, he attended Egypt's military academy and was assigned to the artillery corps as a lieutenant. Furious at the arrest of his brother, a leader of the Islamist opposition to Sādāt, he joined the radical Islamic Jihad Group (Jamā'at al-Jihād al-Islāmī), and, along with a group of accomplices, assassinated Sādāt during a parade in 1981. He was executed following a public trial.

Islamic arts Visual, literary, and performing arts of the populations that adopted Islam from the 7th century. Islamic visual arts are decorative, colourful, and, in religious art, nonrepresentational; the characteristic Islamic decoration is the arabesque. From AD 750 to the mid 11th century, ceramics, glass, metalwork, textiles, illuminated manuscripts, and woodwork flourished; lustred glass became the greatest Islamic contribution to ceramics. Manuscript illumination became an important and greatly respected art, and miniature painting flourished in Iran after the Mongol invasions (1220–60). Calligraphy, an essential aspect of written Arabic, developed in manuscripts and architectural decoration. Islamic architecture finds its highest expression in the mosque and related religious buildings. Early Islamic religious architecture drew upon Christian architectural features such as domes, columnar arches, and mosaics, but also included large courtyards for congregational prayer. Religious architecture came into its own in the period of the caliphates with the creation of the hypostyle mosque in Iraq and Egypt. Islamic literature is written in four main languages: Arabic, Persian, Turkish, and Urdu. Arabic is of overwhelming importance as the language of the revelation of Islam and of the Qur'ān. The Persians used the genres, forms, and rules of Arabic poetry in their own language but elaborated on them. They also developed a new genre, the *masnavī*, composed of a series of rhyming couplets, which they employed for epic poetry. Persian literature in turn influenced both Urdu and Turkish literature, especially with regard to vocabulary and metres. In the realm of popular literature, the best-known work is *The Arabian Nights' Entertainment*, a rich collection of fairy tales from different parts of the Muslim world. Islamic music is monophonic, devoid of harmony, and characterized by distinctive systems of rhythms and melodies, extensive ornamentation of the single melodic line, and virtuoso improvisation. It is usually performed by a small ensemble—a singer and several instrumentalists who alternate solo vocal and instrumental passages. While the theatre has not flourished as a major art under Islam—indeed, conservative Muslims have consistently disapproved of the theatre—there are traditions of folk dance, dance as an entertainment spectacle, and dance as an art form in most Islamic countries. One noteworthy form of devotional dance is that of the dervish. Popular traditions such as mime and shadow-puppet shows have also have persisted, and live popular drama has a strong tradition in Persia, where passion plays took root. See also hypostyle hall; Mozarabic art.

Islamic calendar See Muslim calendar

Islamic caste Any one of several units of social stratification among Muslims in India and Pakistan. Their development can be traced to the caste system of Hinduism and the tendency of Muslim converts from Hinduism to maintain social differences. The highest status is reserved for Muslim Arab immigrants, called ashraf. This level is itself divided into subgroups. The highest subgroup claims descent from Muhammad through his daughter, Fatima. The non-ashraf Muslim castes consist of three levels: converts from high Hindu castes, artisan castes, and the untouchables.

Islamic law See Sharia

Islamic philosophy See Arabic philosophy

Islamic Resistance Movement See Ḥamās

Islamic Salvation Front *French* **Front Islamique du Salut (FIS)** Algerian Islamist political party. Known best by its French acronym, the organization was founded in 1989 by Ali Belhadj and Abbasi al-Madani. The party won a majority of the seats contested in local elections in 1990 and most of the seats in the National Assembly in the first round of balloting in 1991. The government canceled the second round, however, and arrested many of the group's leaders. The FIS and more extreme Islamist groups afterward waged a protracted guerrilla war, in which atrocities by both sides were alleged to have occured. The group was blamed for the assassination of Pres. Mohamed Boudiaf, but no clear proof was ever found. See also Armed Islamic Group; Liamine Zeroual.

island Any area of land smaller than a continent and entirely surrounded by water. Islands may occur in oceans, seas, lakes, or rivers. A group of

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islands is called an archipelago. Continental islands are simply unsubmerged parts of a continental mass that are entirely surrounded by water; Greenland, the world's largest island, is of the continental type. Oceanic islands are produced by volcanic activity, when lava accumulates to enormous thickness until it finally protrudes above the ocean surface. The piles of lava that form Hawaii rise as high as 32,000 ft (9,700 m) above the ocean floor.

island arc Long, curved chain of oceanic ISLANDS associated with intense volcanic and seismic activity and mountain-building processes. Examples include the Aleutian-Alaska Arc and the Kuril-Kamchatka Arc. Most island arcs consist of two parallel rows of islands. The inner row is a string of volcanoes, and the outer row is made up of nonvolcanic islands. In the case of single arcs, many of the islands are volcanically active. An island arc typically has a landmass or a partially enclosed, unusually shallow sea on its concave side. Along the convex side there usually exists a long, narrow DEEP-SEA TRENCH.

Islands, Bay of Inlet, South Pacific Ocean, on the northeastern coast of NORTH ISLAND, New Zealand. The bay was formed when the sea flooded an old river valley system. It has a 500-mi (800-km) shoreline and about 150 islands. It opens to the ocean through a passage between Brett Cape and Wiwiki Cape. The first European to enter the bay was Capt. JAMES COOK in 1769. The bay was the site of the 1840 signing of the Treaty of Waitangi between Britain and native MAORI. It is now a popular resort area.

Islas Baleares See BALEARIC ISLANDS

Isle of Man See Isle of MAN

Isle of Wight See Isle of WIGHT

Isle Royale National Park Island national park located in northwestern Lake SUPERIOR, northwestern Michigan, U.S. Established in 1931, it has an area of 571,790 acres (231,575 hectares) and includes Isle Royale, the largest island in Lake Superior, measuring 45 mi (72 km) long and 9 mi (14 km) across. Its forested wilderness, with streams and inland lakes, hosts more than 200 species of birds. Travel is possible only on foot or by canoe, and ferry service is available from mainland Michigan and Minnesota.

islets of Langerhans See islets of LANGERHANS

Ismāʿīl \is-ˈmä-ˌel\ **I** (b. July 17, 1487, Ardabīl, Azer.—d. May 23, 1524, Ardabīl, Ṣafavid Iran) Shah of Iran (1501–24) and founder of the ṢAFAVID DYNASTY. Born into a Shīʿite family with close ties to the Sunnite Sufi tradition, he became head of a Shīʿite military force, the Kizilbash, at age 14. He captured Tabrīz in 1501 and proclaimed himself shah of Iran, bringing the whole country and portions of modern-day Iraq under his control. In 1510 his troops defeated the Sunnite Uzbeks. His proclamation of Shīʿism as the official creed prompted the staunchly Sunnite sultan of the OTTOMAN EMPIRE to order an invasion of Iran in 1514. Ismāʿīl lost the Battle of Chaldiran, but mutiny among the Ottoman troops forced their withdrawal. The conflict between the Ṣafavids and their Sunnite neighbours continued for over a century.

Ismāʿīl Pasha \is-ˈmä-ˌel-pä-ˈshä\ (b. Dec. 31, 1830, Cairo, Egypt—d. March 2, 1895, Constantinople, Ottoman Empire) Viceroy of Egypt (1863–79) under the OTTOMAN EMPIRE. After an education in Paris and diplomatic missions in other parts of Europe, he was appointed viceroy and became involved with work on the SUEZ CANAL (1859–69). His plan to unify the Nile valley by creating a new southern Egyptian province in the Sudan failed. The sultan dismissed him because of his fiscal mismanagement; the enormous debt he brought on the country led the British to occupy Egypt in 1882.

Ismāʿīlī \ˌis-mä-ˈē-lē\ Member of a sect of the SHIʿITE branch of Islam. It came into existence after the death of the sixth IMAM, JAʿFAR IBN MUHAMMAD, in 765. His son Ismāʿīl was accepted as successor only by a minority, who became known as Ismāʿīlites. Their doctrine, formulated in the late 8th and early 9th century, made a distinction between ordinary Muslim believers and the elect, who shared a secret wisdom. The Qarāmitāh subsect was popular in Iraq, Yemen, and Bahrain in the 9th–11th centuries, and the Fāṭimid subsect conquered Egypt in 969 and established the FĀṬIMID DYNASTY. A subgroup of the Fāṭimids was the Nizārīs, who gained control of fortresses in Iran and Syria in the late 11th century and were known as ASSASSINS. The major Nizārī line survived into modern times under the leadership of the AGA KHAN, moving from Iran to India in 1840. The DRUZE separated from the Ismāʿīlīs early in the 11th century and formed a closed society of their own.

Ismay \ˈiz-mā\ **(of Wormington), Hastings Lionel Ismay, Baron** (b. June 21, 1887, Naini Tal, India—d. Dec. 17, 1965, Broadway, Worcestershire, Eng.) British soldier. A career army officer, he served in India and Africa. As WINSTON CHURCHILL's chief of staff (1940–46) and closest military adviser, he participated in most major policy decisions of the Allied powers during World War II, particularly in the decision to make Germany the Allies' first-priority target and in planning for the invasion of France in 1944. After the war he served as secretary-general of NATO (1952–57).

isnād \is-ˈnad\ In Islam, a list of authorities who have transmitted accounts of the teachings or actions of MUHAMMAD, one of the COMPANIONS OF THE PROPHET, or of a later authority. Each of these accounts, known as ḤADĪTH, includes an *isnād* that gives the chain of authorities by which it has been handed down, using the form, "It has been related to me by A on the authority of B on the authority of C on the authority of D that Muhammad said…." See also ʿILM AL-ḤADĪTH.

ISO See INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

isobaric spin See ISOSPIN

Isocrates \ī-ˈsä-krə-ˌtēz\ (b. 436, Athens—d. 338 BC, Athens) Athenian author, rhetorician, and teacher. His school, unlike PLATO's more philosophical Academy, provided an education for the practical needs of society; it was given over almost entirely to RHETORIC. He promoted Greek political unity and cultural superiority based on monarchy and advocated a unified Greek attack on Persia under PHILIP II of Macedonia to secure unity and peace in Greece. When Greece lost its independence after the Battle of CHAERONEA, Isocrates, in despair, starved himself to death.

isolationism National policy of avoiding political or economic entanglements with other countries. Isolationism has been a recurrent theme in U.S. history. It was given expression in the Farewell Address of Pres. GEORGE WASHINGTON and in the early 19th-century MONROE DOCTRINE. The term is most often applied to the political atmosphere in the U.S. in the 1930s. The failure of Pres. WOODROW WILSON's internationalism, liberal opposition to war as an instrument of policy, and the rigours of the GREAT DEPRESSION were among the reasons for Americans' reluctance to concern themselves with the growth of FASCISM in Europe. The Johnson Act (1934) and the Neutrality acts (1935) effectively prevented economic or military aid to any country involved in the European disputes that were to escalate into World War II. U.S. isolationism encouraged the British in their policy of APPEASEMENT and contributed to French paralysis in the face of the growing threat posed by Nazi Germany. See also NEUTRALITY.

Isole Eolie See EOLIE ISLANDS

isoleucine \ˌī-sō-ˈlü-ˌsēn\ One of the essential AMINO ACIDS, present in most common PROTEINS. It was first isolated in 1904 from fibrin, a protein involved in COAGULATION. It is used in medicine and biochemical research and as a nutritional supplement.

isomer \ˈī-sə-mər\ One of two or more substances with identical molecular formulas but different CONFIGURATIONS, differing only in the arrangement of their component atoms. It usually refers to stereoisomers (rather than constitutional isomers or tautomers; see ISOMERISM, TAUTOMERISM), of which there are two types. Optical isomers, or enantiomers (see OPTICAL ACTIVITY), occur in mirror-image pairs. Geometric isomers are often the result of rigidity in the molecular structure; in organic compounds, this is usually due to a double bond (see BONDING) or a ring structure. In the case of a double bond between two carbon atoms, if each has two other groups bonded to it and all are rigidly in the same plane, the corresponding groups can be on the same side (*cis*) of the C═C bond or across the C═C bond (*trans*) from each other. An analogous distinction can be made for ring structures that are all in a plane, between isomers whose substituent groups are on the same side and isomers whose substituent groups are on both sides of the plane. Diastereomers that are not enantiomers also fall into this category. Most *cis-trans* isomers are organic compounds.

isomerism \ī-ˈsä-mə-ˌri-zəm\ Existence of sets of two or more substances with identical molecular formulas (see CHEMICAL FORMULA) but different CONFIGURATIONS and hence different properties. JONS JACOB BERZELIUS was the first to recognize and name it (1830). In constitutional (structural) isomerism, the molecular formula and molecular weight of the substances are the same, but their BONDING differs. For example, C_2H_6O is the molecular formula for both ETHANOL (CH_3CH_2OH) and methyl ETHER (CH_3OCH_3). Constitutional isomers that can be readily converted from one to another

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are called tautomers (see TAUTOMERISM). In stereoisomerism, substances with the same atoms are bonded in the same ways but differ in their three-dimensional configurations. See also ISOMER.

Isonzo \ē-'zōnt-sō**, Battles of the** (1915–17) Twelve battles along the Isonzo River on the eastern sector of the Italian front in WORLD WAR I. The Isonzo River, running just inside Austria, is flanked by rugged peaks that the Austrians had fortified before Italy's entry into the war in 1915. Luigi Cadorna (1850–1928) led all the attacks against Austria, but the Italians could not penetrate the formidable natural barriers. Finally they struck with 51 divisions and dislodged the Austrians, but the Germans sent reinforcements and took the offensive, ending in the Battle of CAPORETTO.

isoprenoid \ˌī-sə-'prē-ˌnȯid\ *or* **terpene** Class of organic compounds made up of two or more structural units derived from isoprene. Isoprene is a five-carbon HYDROCARBON with a branched-chain structure, two double bonds (see BONDING), and the molecular formula C_5H_8. In isoprenoids, isoprene units (with one or neither of their double bonds) are linked into larger molecules having from two to thousands of five-carbon units that can take the form of both linear structures and rings. Many of these molecules play a wide variety of roles in plant and animal physiological processes and as intermediates in the biological synthesis of other important molecules. They contribute greatly to the flavours and fragrances of ESSENTIAL OILS and other plant-derived substances. Geraniol (a contributor to rose perfumes; from geranium oil), menthol (from peppermint oil), citral (from lemongrass oil), limonene (from lemon and orange oils), pinene (from TURPENTINE), and CAMPHOR each have two isoprene units. Examples with more units include phytol, a precursor of CHLOROPHYLL; squalene, the precursor of CHOLESTEROL and other STEROIDS; lycopene, the red pigment in tomatoes and an important phytochemical; and CAROTENE, the pigment in carrots and a precursor of VITAMIN A. Natural RUBBER and the related gutta-percha are polyisoprenes comprising many thousands of isoprene units.

isospin \'ī-sə-ˌspin\ *or* **isobaric spin** *or* **isotopic spin** Property characteristic of families of related SUBATOMIC PARTICLES differing mainly in the values of their ELECTRIC CHARGE. The families are known as isospin multiplets. The components of atomic nuclei, the NEUTRON and the PROTON, form an isospin doublet since they differ only in electric charge and subsidiary properties. They are considered different versions of the same object, called a nucleon. The isospin of a nucleon has a value of ½.

isostasy \ī-'säs-tə-sē\ Theory describing the mass balance in the Earth's CRUST, which treats all large portions of the crust as though they were floating on a denser underlying layer, about 70 mi (110 km) below the surface. In this theory, a mass above sea level is supported below sea level, so high mountains must be regions where the crust is very thick, with deep roots extending into the MANTLE. This is analogous to an iceberg floating on water, in which the greater part of the iceberg is under water.

isotope \'ī-sə-ˌtōp\ One of two or more species of ATOMS of a chemical ELEMENT having nuclei with the same number of PROTONS but different numbers of NEUTRONS. They have the same ATOMIC NUMBER and hence nearly identical chemical behaviour but different atomic MASSES. Most elements found in nature are mixtures of several isotopes; tin, for example, has 10 isotopes. In most cases, only stable isotopes of elements are found in nature. The radioactive forms break down spontaneously into different elements (see RADIOACTIVITY). Isotopes of all elements heavier than bismuth are radioactive; some occur naturally because they have long HALF-LIVES.

Isozaki \ˌē-sō-'zä-kē\ **Arata** (b. July 23, 1931, Ōita, Kyushu, Japan) Japanese avant-garde architect. He studied at the University of Tokyo and opened his own studio in 1963. His first notable building is the Ōita Prefectural Library (1966), which shows the influence of the METABOLIST SCHOOL. In his later works, which often synthesize Eastern and Western elements, he used bold geometric forms and frequently made historical allusions. Among his innovative structures are the Los Angeles Museum of Contemporary Art (1986) and Art Tower (1990) in Mito, Japan.

ISP See INTERNET SERVICE PROVIDER

Israel *officially* **State of Israel** Country, Middle East, at the eastern end of the Mediterranean Sea. Area: 8,367 sq mi (21,671 sq km). Population (2005 est.): 6,681,000 (includes population of GOLAN HEIGHTS and east Jerusalem; excludes population of the WEST BANK). Capital: JERUSALEM. Jews constitute some four-fifths of the population and Arabs about one-fifth. Languages: Hebrew, Arabic (both official). Religions: Judaism; also Islam, Christianity. Currency: new Israeli sheqel (NIS). Israel can be divided into four major regions: the Mediterranean coastal plain in the west; a hill region extending from the northern border into central Israel; the GREAT RIFT VALLEY, containing the JORDAN RIVER, in the east; and the arid NEGEV, occupying nearly the entire southern half of the country. Its major drainage system is the interior basin formed by the Jordan River; Lake TIBERIAS (Sea of Galilee) provides water to much of the country's agricultural land. Israel has a mixed economy based largely on services and manufacturing; exports include machinery and electronics, diamonds, chemicals, citrus fruits, vegetables, and textiles. Its population is nine-tenths urban and is concentrated largely in the Mediterranean coastal plain and around Jerusalem. It is a republic with one legislative house, the KNESSET; its chief of state is the president, and the head of government is the prime minister. The record of human habitation in Israel (see PALESTINE) dates to the Paleolithic Period. Efforts by Jews to establish a national state there began in the late 19th century. Britain supported ZIONISM and in 1923 assumed political responsibility for what was then called Palestine. Migration of Jews to Palestine, which increased during the period of NAZI persecution, led to deteriorating relations with Arabs. In 1947 the UN voted to partition the region into separate Jewish and Arab states. The State of Israel was proclaimed in 1948, and Egypt, Transjordan (later Jordan), Syria, Lebanon, and Iraq immediately declared war on it. Israel won that war (see ARAB-ISRAELI WARS) as well as the 1967 SIX-DAY WAR, in which it occupied the West Bank, GAZA STRIP, Golan Heights, and east Jerusalem. (Subsequent claims of Jerusalem as Israel's capital have not received wide international recognition.) Another war with its Arab neighbours followed in 1973, but the CAMP DAVID ACCORDS led to a peace treaty between Israel and Egypt in 1979. Israel invaded Lebanon in 1982 to expel the PALESTINE LIBERATION ORGANIZATION (PLO) from that country, and in late 1987 an uprising broke out among Palestinians of the occupied territories of the West Bank and Gaza Strip (see INTIFĀḌAH). Peace negotiations between Israel and the Arab states and Palestinians began in 1991. Israel and the PLO agreed in 1993 to a five-year plan to extend self-government to the Palestinians of the occupied territories. Israel signed a peace treaty with Jordan in 1994. Israeli soldiers and a Lebanese militia, HEZBOLLAH, clashed throughout the 1990s. Israeli troops withdrew from Lebanon in 2000, and negotiations between Israel and the Palestinians broke down amid violence that claimed hundreds of lives. In an effort to stem the fighting, Israel in 2005 withdrew its soldiers and settlers from parts of the West Bank and from all of the Gaza Strip, which came under Palestinian control.

Israel, tribes of In the Bible, the 12 clans of the ancient Hebrew people, which were named for the sons of JACOB (Reuben, Simeon, LEVI, Judah, Issachar, Zebulun, Joseph, Benjamin, Gad, Asher, Dan, and Naphtali) and his wives, Leah and Rachel, and concubines, Bilhah and Zilpah. The tribe

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of Levi did not receive land in the settlement of CANAAN but instead was given the priestly office. To maintain the traditional number of 12 tribes, the line of Joseph was divided into the tribes of Ephraim and Manasseh. In Israel's later history, the tribes of Judah and Benjamin formed a southern kingdom called JUDAH with its capital at JERUSALEM, while the 10 northern tribes formed the kingdom of Israel. After being conquered by Assyria in 721 BC, the northern tribes were exiled from the kingdom and were assimilated by other peoples. Disappearing from history, they became known as the 10 lost tribes of Israel and remained part of Jewish folklore and eschatological beliefs. The tribes of Judah and Benjamin survived until NEBUCHADREZZAR's conquest of Judah in 586 BC, when many from the kingdom were exiled to Babylon.

Israel Labour Party Israeli political party founded in 1968 as the union of three socialist-labour parties. The Israel Labour Party and its predecessors led governing coalitions uninterruptedly from 1948 to 1977; since 1977 it has competed with the conservative LIKUD party. Its principal figures have included DAVID BEN-GURION, MOSHE DAYAN, GOLDA MEIR, SHIMON PERES, and YITZHAK RABIN.

Israeli, Isaac ben Solomon *or* **Isaac the Elder** (b. 832/855, Egypt—d. 932/955, Al-Qayrawān, Tun.) Egyptian Jewish physician and philosopher. He began his medical career as an oculist in Cairo and later became court physician to al-Mahdī, founder of the FĀṬIMID DYNASTY in northern Africa. He wrote several medical treatises in Arabic that were later translated into Latin and circulated in Europe. Schooled in Classical learning, he wrote philosophical works, including his *Book of Definitions*, which discusses Aristotle's four types of inquiry and then provides definitions of wisdom, intellect, soul, nature, love, and time. His interpretation of eschatological matters in light of Neoplatonic mysticism was very influential for later Jewish philosophers.

Israeli law Legal practices and institutions of modern Israel. The ancient people of Israel created the law of the TORAH and the MISHNA (the latter was later incorporated into the TALMUD). Contemporary Israeli law reflects a dual legal heritage: it is based on historic Jewish law and the laws of countries in which the Jews had for generations been living. It is derived from Ottoman and British legislation and precedents, religious court opinion, and Israeli parliamentary enactments. Courts are composed of professional judges only; juries are not used. Jewish law as such continues to be applied by the rabbinical courts within their jurisdiction in matters of personal status; it is applied also by the civil courts when called upon to deal with such matters concerning Jews.

Israelite In early Jewish history, a member of the 12 tribes of ISRAEL. After the establishment (930 BC) of two Jewish kingdoms (Israel and Judah) in Palestine, only the ten northern tribes constituting the kingdom of Israel were known as Israelites. When Israel was conquered by the Assyrians (721 BC), its population was absorbed by other peoples, and the term Israelite came to refer to those who were still distinctively Jewish—the descendants of the kingdom of Judah. In liturgical usage, an Israelite is a Jew who is neither a COHEN nor a Levite (see LEVI).

Issus, Battle of (333 BC) Battle on the Issus plain near the Gulf of Iskenderun (in present-day southern Turkey) in which ALEXANDER THE GREAT, on the offensive, defeated Darius III, last king of the ACHAEMENIAN DYNASTY. The Macedonians were said to have lost only 450 men. Darius escaped, but the victory led to Alexander's victories over Phoenicia and Egypt.

Istanbul *formerly* **Constantinople** *ancient* **Byzantium** City and seaport (pop., 2000: 8,803,468), Turkey. Situated on a peninsula at the entrance to the BLACK SEA, Turkey's largest city lies on either side of the BOSPORUS and thus is located in both Europe and Asia. Byzantium was founded as a Greek colony in the 8th century BC. Passing to the Persian Achaemenian dynasty in 512 BC and then to ALEXANDER THE GREAT, it became a free city under the Romans in the 1st century AD. The emperor CONSTANTINE I made the city the seat of the Eastern Roman Empire in 330, later naming it Constantinople. It remained the capital of the subsequent BYZANTINE EMPIRE after the fall of Rome in the late 5th century. In the 6th–13th centuries it was frequently besieged by Persians, Arabs, Bulgars, and Russians. It was captured by the Fourth CRUSADE (1203) and turned over to Latin Christian rule. It was returned to Byzantine rule in 1261. In 1453 it was captured by the OTTOMAN EMPIRE and made the Ottoman capital. When the Republic of Turkey was founded in 1923, the capital was moved to ANKARA, and Constantinople was officially renamed Istanbul in 1930. Many of the city's historic sites are located in the medieval walled city (Stamboul). Among its architectural treasures are the HAGIA SOPHIA, the Mosque of Süleyman, and the Blue Mosque. Its educational institutions include the University of Istanbul (founded 1453), Turkey's oldest university.

The Blue Mosque (Sultan Ahmed Mosque) with its distinctive ensemble of six minarets, Istanbul.
© ROBERT FRERCK—CLICK/CHICAGO

Isthmian Games \'is-mē-ən\ In ancient Greece, a festival of athletic and musical competitions in honor of the sea god POSEIDON. It was held in the spring of the second and fourth years of each Olympiad at Poseidon's legendary sanctuary on the Isthmus of Corinth. It died out when Christianity became dominant in the 4th century AD.

Istria Peninsula, extending into the northeastern Adriatic Sea. It has an area of 1,220 sq mi (3,160 sq km). Its northern portion is part of Slovenia, while the central and southern parts belong to Croatia. A tiny strip of coast in the northwest is the site of TRIESTE and belongs to Italy. Istria's ancient Illyrian inhabitants were overthrown by Romans in 177 BC, and Slavic peoples settled there from the 7th century AD. It passed through the hands of various Mediterranean powers until Austria gained control in 1797 and developed Trieste as a port. Istria was seized by Italy in 1919; Yugoslavia occupied most of the peninsula in 1947. Yugoslavian Istria became part of Croatia and Slovenia at those states' independence in 1991.

Itagaki Taisuke \ē-tä-'gä-kē-'tī-ske\ (b. April 17, 1837, Kōchi, Japan—d. July 11, 1919, Tokyo) Founder of Japan's first political party, the Liberal Party (Jiyūtō). In the 1860s he became military leader of the domain of TOSA, and under his command Tosa's troops participated in the MEIJI RESTORATION. He served sporadically in the new government, but discontent led him to found first a political club and then a national "Society of Patriots" in support of greater democracy. In 1881 he formed the Liberal Party. Though he retired in 1900, he remained its symbolic leader. See also ITŌ HIROBUMI; MEIJI CONSTITUTION; MEIJI PERIOD.

Italian Communist Party See DEMOCRATIC PARTY OF THE LEFT

Italian language ROMANCE LANGUAGE spoken in Italy (including Sicily and Sardinia) and in parts of Switzerland and France (including Corsica). Its 66 million speakers worldwide include many immigrants and their descendants in the Americas. Written Italian dates from the 10th century. The standard literary form is based on the dialect of Florence, but many Italians do not speak it, instead using regional dialects. These include Upper Italian (Gallo-Italian); Venetian in northeastern Italy; Tuscan; the dialects of Marche, Umbria, and Rome; of Abruzzi, Puglia, Naples, Campania, and Lucania; and of Calabria, Otranto, and Sicily. See also ITALIC LANGUAGES.

Italian Liberal Party (PLI) Moderately conservative political party that dominated Italian politics in the decades after unification (1861) and was a minor party after World War II. It was formed as a parliamentary group in 1848 by CAMILLO BENSO, COUNT DI CAVOUR; his followers favoured a centralized government, restricted suffrage, regressive taxation, and free trade. Left Liberals gained control of the party in 1876. Its strength declined after World War I, but beginning in 1944 it was a minor partner in most Christian Democratic coalition governments. Drawing its chief support from small businessmen, it favoured free enterprise; it also backed Italy's involvement in NATO. It was caught up in various corruption scandals after 1992 and was dissolved in the mid 1990s. Most former Liberals joined the centre-right Forza Italia party of SILVIO BERLUSCONI.

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Italian Popular Party (PPI) *formerly (until 1993)* **Christian Democratic Party** Centrist political party whose several factions are united by their Roman Catholicism and anticommunism. They advocate programs ranging from social reform to the defense of free enterprise. The original party was founded in 1919 as the Italian Popular Party and quickly won popularity, but in 1926 the Fascists banned all political parties. After Italy's surrender in World War II, former party leaders, along with Catholic organizations, founded the Christian Democratic Party, which held power in Italy (usually in coalition with other parties) for most of the postwar era. In 1992–93 it was rocked by the involvement of some of its leading members in financial scandals and political corruption. In 1993 the struggling party reverted to its original name, but in the 1994 parliamentary elections it fell from power and was reduced to a minor party. In the late 1990s it participated in elections as part of the La Margherita coalition, which comprised one element of the leftist Olive Tree coalition.

Italian Socialist Party (PSI) *since 1998* **Italian Democratic Socialists (SDI)** Italian political party founded in 1893 by trade unions and socialists. In the early 20th century the left wing of the party clashed with the reformist wing and broke away to form the Italian Communist Party (1921). The PSI formed an alliance with the communists from 1934 until the mid 1950s, when it denounced the Soviet Union after its invasion of Hungary. From 1963 it joined or supported centre-left governments. In 1983 Bettino Craxi became the first Socialist premier, but after political scandals in the 1990s the PSI was reduced to a minor party. The party dissolved itself in 1994, and most of its membership joined a new party, the Italian Socialists. In 1998 the Italian Socialists merged with two other leftist parties to form the Italian Democratic Socialists. In the early 21st century, the party contested elections as part of the Olive Tree coalition.

Italian Somaliland Former Italian colony, eastern Africa. It extended south from Cape Asir to the boundary of Kenya, occupying an area of 178,218 sq mi (461,585 sq km). Italy obtained control of it in 1889 and it was incorporated as a state in Italian East Africa in 1936. Britain invaded in 1941 and retained control until it became a UN trust territory under Italian administration in 1950. In 1960 it was united with British Somaliland to form the independent Republic of Somalia.

Italian Wars (1494–1559) Series of violent wars for control of Italy. Fought largely by France and Spain but involving much of Europe, they resulted in the Spanish Habsburgs dominating Italy and shifted power from Italy to northwestern Europe and its Atlantic world. The wars began with the invasion of Italy by the French king Charles VIII in 1494. He took Naples, but an alliance between Maximilian I, Spain, and the pope drove him out of Italy. In 1499 Louis XII invaded Italy and took Milan, Genoa, and Naples, but he was driven out of Naples in 1503 by Spain under Ferdinand V. Pope Julius II organized the League of Cambrai (1508) to attack Venice, then organized the Holy League (1511) to drive Louis out of Milan. In 1515 Francis I was victorious at the battle of Marignano, and in 1516 a peace was concluded by which France held onto Milan and Spain kept Naples. Fighting began in 1521 between Emperor Charles V and Francis I. Francis was captured and forced to sign the Treaty of Madrid (1526), by which he renounced all claims in Italy, but, once freed, he repudiated the treaty and formed a new alliance with Henry VIII of England, Pope Clement VII, Venice, and Florence. Charles sacked Rome in 1527 and forced the pope to come to terms, and Francis gave up all claims to Italy in the Treaty of Cambrai (1529). By the Treaty of Cateau-Cambrésis (1559), the wars finally ended.

Italic \i-'ta-lik\ **languages** Indo-European languages spoken in the Apennine Peninsula (Italy) during the 1st millennium BC, after which only Latin survived. Traditionally thought to be a subfamily of related languages, these languages include Latin, Faliscan, Osco-Umbrian, South Picene, and Venetic. Latin, the language of Latium and Rome, began to emerge as the predominant language as early as the 3rd century BC. By AD 100 it had replaced all dialects (except Greek) between Sicily and the Alps. Until then, Oscan dialects were most widely spoken; Umbrian, in central Italy, was closely related to Oscan. Venetic was spoken in the region of Venice. These languages were written in various alphabets, including the Greek and Latin alphabets and modified versions of the Etruscan.

Italic War See Social War

Italo-Turkish War (1911–12) War undertaken by Italy to gain colonies in North Africa by conquering the Turkish provinces of Tripolitana and Cyrenaica (modern Libya). The conflict upset the precarious international balance of power just before World War I by revealing the weakness of Turkey and, within Italy, unleashed the nationalist-expansionist sentiment that guided government policy in the following decades. Turkey conceded its rights to the contested provinces in the peace terms.

Italy *officially* **Italian Republic** Country, south-central Europe. It comprises the boot-shaped peninsula extending into the Mediterranean Sea as well as Sicily, Sardinia, and a number of smaller islands. Area: 116,343 sq mi (301,328 sq km). Population (2005 est.): 57,989,000. Capital: Rome. The people are overwhelmingly Italian. Language: Italian (official). Religion: Christianity (predominantly Roman Catholic). Currency: euro.

More than three-fourths of Italy is mountainous or highland country. The Alps stretch from east to west along Italy's northern boundary, and the Apennines stretch southward the length of the peninsula. Most of the country's lowlands lie in the valley of its major river, the Po. Three tectonic plates converge in southern Italy and Sicily, creating intense geologic activity; southern Italy's four active volcanoes include Mount Vesuvius and Mount Etna. The economy is based largely on services and manufacturing; exports include machinery and transport equipment, chemicals, textiles, clothing and shoes, and food products (olive oil, wine, fruit, and tomatoes). Italy is a republic with two legislative houses. The chief of state is the president, and the head of government is the prime minister. Italy has been inhabited since Paleolithic times. The Etruscan civilization arose in the 9th century BC and was overthrown by the Romans in the 4th–3rd centuries BC (see Roman Republic and Empire). Barbarian invasions of the 4th–5th centuries AD destroyed the Western Roman Empire. Italy's political fragmentation lasted for centuries but did not diminish its impact on European culture, notably during the Renaissance. From the 15th to the 18th century, Italian lands were ruled by France, the Holy Roman Empire, Spain, and Austria. When Napoleonic rule ended in 1815, Italy was again a grouping of independent states. The Risorgimento successfully united most of Italy, including Sicily and Sardinia by 1861, and the unification of peninsular Italy was completed by 1870. Italy joined the Allies during World War I, but social unrest in the 1920s brought to power the Fascist movement of Benito Mussolini, and Italy allied itself with Nazi Germany in World War II. Defeated by the Allies in 1943, Italy proclaimed itself a republic in 1946. It was a charter member of NATO (1949) and of the European Community (now embedded in the European Union). It completed the process of setting up regional legislatures with limited autonomy in 1970s. After World War II it experienced rapid changes of government but remained socially stable.

Itami \ē-'tä-mē**, Juzo** *orig.* **Yoshihiro Ikeuchi** (b. May 15, 1933, Kyoto, Japan—d. Dec. 20, 1997, Tokyo) Japanese film director and screenwriter. He had a successful 20-year career as an actor in films such as *55 Days at Peking* (1963) before venturing into directing. His direc-

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torial debut, *The Funeral* (1984), was acclaimed for its satire of social conventions, a novelty in Japanese cinema. He became an international success with his artful and entertaining *Tampopo* (1986) and *A Taxing Woman* (1987). His satire on Japan's crime syndicate, *The Gangster's Moll* (1992), provoked a near-deadly attack on him by gangsters.

Itanagar \ˌē-tə-ˈnə-gər\ Capital (pop. 2001 prelim.: 34,970) of Arunachal Pradesh state, northeastern India, situated west of the Brahmaputra River. The state government has established an industrial estate in the city in order to foster industrial development. It is the home of Arunachal University.

ITAR-TASS *formerly* **TASS** *in full* **Telegrafnoe Agentsvo Sovetskovo Soyuza (Russian: "Telegraph Agency of the Soviet Union")** As TASS, the official news agency of the Soviet Union from 1925 to 1991. It was renamed ITAR-TASS in 1992. The main source of news for all Soviet newspapers and radio and television stations, it was also a major international wire service. After the Soviet Union's 1991 breakup, TASS was reorganized into the Information Telegraph Agency of Russia (ITAR), reporting on news of Russia, and the Telegraph Agency of the Countries of the Commonwealth (TASS), reporting on news of other countries of the Commonwealth of Independent States. ITAR-TASS dispatches on matters of public policy and international affairs reflect the official position of the state.

Itasca \ī-ˈtas-kə**, Lake** Lake, northwestern Minnesota, U.S. Occupying an area of 1.8 sq mi (4.7 sq km), it is located 1,475 ft (450 m) above sea level. Henry Rowe Schoolcraft's theory that Lake Itasca is the source of the Mississippi River has been widely accepted. He is generally credited with originating the name Itasca, but Indian legend mentions I-tesk-ka, the daughter of Hiawatha, whose tears of anguish at being spirited away to the netherworld were the source of the Mississippi.

itching *or* **pruritus** \prü-ˈrīt-əs\ Stimulation of nerve endings in the skin, usually incited by histamine, that evokes a desire to scratch. It is often transient and easily relieved. Pathological itching with skin changes usually signals dermatologic disease. Generalized itching without skin changes can occur in systemic diseases (e.g., metabolic and endocrine conditions, cancer, drug reactions, and kidney, blood, and liver diseases). Dry skin often itches. Treatment depends on cause.

Iténez River See Guaporé River

Ithnā ʿAshariyyah \ˌith-nə-ə-shə-ˈrē-ə\ *or* **Imāmīs** *English* **Twelvers** The largest school of Shiʿite Islam, believing in a succession of 12 imams beginning with ʿAlī ibn Abū Ṭālib, the fourth caliph and the son-in-law of Muhammad. The last of the 12 imams recognized by the school was Muḥammad al-Mahdī al-Ḥujjah, who disappeared in 873 and is thought by believers to be alive and in occultation, ready to return at the Last Judgment. The Ithnā ʿAshariyyah believe that imams are the preservers of the faith and the only interpreters of the esoteric meanings of law and theology. The imams are thought to influence the world's future, and pilgrimages to the tombs of the imams secure special rewards. This school became the state religion of Iran under the Ṣafavid dynasty (1501–1736). The Ithnā ʿAshariyyah also constitute a majority in Iraq and Bahrain, with sizable minorities in other Muslim countries. Compare Ismāʿīliyyah.

Itō Hirobumi \ˈē-tō-hē-ˈrō-bù-mē\ (b. Oct. 14, 1841, Suō province, Japan—d. Oct. 26, 1909, Harbin, Manchuria, China) Japanese statesman, prime minister, and writer of the Meiji Constitution. He played a minor role in the Meiji Restoration, through which he came in contact with Kido Takayoshi and Ōkubo Toshimichi. When Ōkubo was assassinated in 1878, Ito succeeded him as home minister. He persuaded the government to adopt a constitution, then traveled abroad to research constitutions. In 1889 the emperor promulgated the resultant document. Later, as prime minister, Itō negotiated an end to extraterritoriality with Britain; other Western nations followed suit, signaling that the West was beginning to treat Japan as an equal. Frustrated with the ability of the political parties to impede passage of government programs in the Diet, in 1900 Itō founded his own party, the Rikken Seiyūkai. This foray cost him control of the genro (elder statesmen) but made cooperation between high-ranking bureaucrats and party politicians acceptable. In 1906 Ito became resident general in Korea; he was assassinated in 1909 by a Korean nationalist.

Itō Jinsai \ˈē-tō-ˈjēn-ˌsī\ (b. Aug. 30, 1627, Kyōto, Japan—d. April 4, 1795, Kyōto) Japanese Confucian scholar. The son of a lumberman, he devoted himself to scholarship. He opposed the authoritarian Neo-Confucianism of the Tokugawa shogunate (see Tokugawa period) and advocated a return to the authentic teachings of Confucius and Mencius. He helped establish the Kogaku school of Neo-Confucianism and, with his son, founded the Kogi-dō academy in Kyōto, which was run by his descendants until 1904. His writings include *Gōmōjigi* (1683), a commentary on Confucianism that tried to develop a rational basis for morality and the pursuit of happiness.

ITT See International Telephone and Telegraph Corp.

Iturbide \ˌē-tůr-ˈbē-dā**, Agustín de** *or* **Agustín I** (b. Sept. 27, 1783, Valladolid, Viceroyalty of New Spain—d. July 19, 1824, Padilla, Mex.) Leader of the conservative factions in the Mexican independence movement and, briefly, emperor of Mexico (1822–23). An army officer when the independence movement emerged in 1810, he fought for the royalists, but in 1820, in reaction to a liberal coup in Spain, the conservatives did an about-face and advocated immediate independence. Iturbide joined forces with the insurgents and won Mexico's independence in 1821. In 1822 he crowned himself emperor, but his arbitrary and extravagant ways cost him support. His abdication in 1823 did not save him from execution. To Mexico's conservatives he remains the principal hero of Mexican independence.

Ivan Asen \å-ˈsān\ **II** (d. 1241) Tsar of the Second Bulgarian empire (1218–41). He took the throne after overthrowing and blinding his cousin Boril. A good soldier and administrator, Ivan restored order, controlled the boyars, and acquired much of Albania, Serbia, Macedonia, and Epirus (1230). He forged alliances through the marriages of his daughters, but a treaty to make him regent of the Latin empire was repudiated by Latins fearful of Bulgaria's growing power, and he afterward separated the Bulgarian church from Rome.

Ivan \ī-vən\ **III** *known as* **Ivan the Great** (b. Jan. 22, 1440, Moscow—d. Oct. 27, 1505, Moscow) Grand prince of Moscow (1462–1505). Determined to enlarge the territory he inherited from his father, Ivan led successful military campaigns against the Tatars in the south (1458) and east (1467–69). He subdued Novgorod (1478) and gained control of most of the remainder of Great Russia by 1485. He also renounced Moscow's subjection to the khan of the Golden Horde (1480) and won a final victory over the khan's sons in 1502. Stripping the boyars of much of their authority, he laid the administrative foundations of a centralized Russian state. Ivan IV the Terrible was his grandson.

Ivan IV *Russian* **Ivan Vasilyevich** *known as* **Ivan the Terrible** (b. Aug. 25, 1530, Kolomenskoye, near Moscow—d. March 18, 1584, Moscow) Grand prince of Moscow (1533–84) and first tsar of Russia (1547–84). Crowned tsar in 1547 after a long regency (1533–46), he embarked on wide-ranging reforms, including a centralized administration, church councils that systematized the church's affairs, and the first national assembly (1549). He also instituted reforms to limit the powers of the boyars. After conquering Kazan (1552) and Astrakhan (1556), he engaged in an unsuccessful war to control Livonia, fighting against Sweden and Poland (1558–83). After the defeat and the suspected treason of several Russian boyars, Ivan formed an *oprichnina*, a territory separate from the rest of the state and under his personal control. With a large bodyguard, he withdrew into his own entourage and left Russia's management to others. At the same time, he instituted a reign of terror, executing thousands of boyars and ravaging the city of Novgorod. During the 1570s he married five wives in nine years, and, in a fit of rage, he murdered his son Ivan, his only viable heir, in 1581.

Ivan IV, icon, late 16th century; in the National Museum, Copenhagen.
COURTESY OF THE NATIONALMUSEET, COPENHAGEN

Ivan V *Russian* **Ivan Alekseyevich** (b. Sept. 6, 1666, Moscow, Russia—d. Feb. 8, 1696, Moscow) Nominal tsar of Russia (1682–96). When his brother Tsar Fyodor III died, Ivan, a mentally deficient chronic invalid, was proclaimed coruler with his half brother Peter I, with Ivan's sister Sophia as regent. After Sophia's overthrow in 1689, Ivan was allowed to retain his official position, though he never participated in governmental affairs, devoting the bulk of his time to prayer, fasting, and pilgrimages.

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Ivan VI *Russian* **Ivan Antonovich** (b. Aug. 23, 1740, St. Petersburg, Russia—d. July 16, 1764, Shlisselburg Fortress, near St. Petersburg) Infant emperor of Russia (1740–41). The grandnephew of Empress ANNA, Ivan was proclaimed her heir and then emperor, with his mother as regent, when he was only eight weeks old. In 1741 they were deposed by ELIZABETH, daughter of PETER I, and for the next 20 years he remained in solitary confinement in various prisons. In 1764, when an army officer tried to free Ivan to restore him to power and remove CATHERINE II, who had seized the throne in 1762, Ivan was assassinated by his jailers.

Ivanov \i-ˈvä-nəf**, Lev (Ivanovich)** (b. Feb. 18, 1834, Moscow, Russia—d. Dec. 24, 1901, St. Petersburg) Russian dancer and choreographer. He joined the Imperial Ballet in St. Petersburg in 1852 and became lead dancer in 1869. In 1885 he was appointed assistant ballet master under MARIUS PETIPA. He is best known for his choreography of *The Nutcracker* (1892) and parts of *Swan Lake* (1895), which he based closely on the structure and emotional content of the music rather than emphasizing virtuoso technique.

Ivanov \i-ˈvä-nəf**, Vyacheslav Ivanovich** (b. Feb. 28, 1866, Moscow—d. July 16, 1949, Rome) Russian philosopher, scholar, and poet. He studied in Berlin and spent much of his life abroad, especially in Italy, where he converted to Roman Catholicism. His first volume of lyric poetry, *Pilot Stars* (1903), immediately established him as a key figure in the Russian SYMBOLIST MOVEMENT, a position strengthened by later works, including the important *Cor Ardens* (1911). He also produced poetic dramas, essays, criticism, and translations.

Ives, Burl *orig.* **Charles Icle Ivanhoe Ives** (b. June 14, 1909, Jasper county, Ill., U.S.—d. April 14, 1995, Anacortes, Wash.) U.S. singer and actor. Ives began performing at age four and learned Scottish, English, and Irish ballads from his grandmother. He left college to hitchhike around the U.S., collecting songs from hoboes and drifters. Soon after his postwar concert debut in New York City, he was hailed by CARL SANDBURG as "the mightiest ballad singer of this or any other century." He recorded more than 100 albums and had hits with "I Know an Old Lady (Who Swallowed a Fly)," "The Blue Tail Fly," "Big Rock Candy Mountain," "Frosty the Snowman," and "A Little Bitty Tear." He appeared in many films—including *East of Eden* (1955), *Desire Under the Elms* (1958), *Cat on a Hot Tin Roof* (1958), and *The Big Country* (1958, Academy Award)—and on Broadway.

Ives, Charles E(dward) (b. Oct. 20, 1874, Danbury, Conn., U.S.—d. May 19, 1954, New York, N.Y.) U.S. composer. Ives claimed to be the product of training by his father, George, a highly imaginative former Union Army bandmaster. He received a solid classical grounding and began composing and performing at an early age. At Yale University he studied with the academic composer Horatio Parker (1863–1919) and composed his first symphony. Under the influence of TRANSCENDENTALISM, he decided to forgo a music career, and in 1907 he founded a successful insurance firm. With music as a "sideline," he felt free to pursue his unusual interests, though he suffered from his amateur status and a lack of intelligent critiques. A heart attack in 1918 curtailed all activities, and he stopped composing c. 1926. His music is tonal despite much dissonance, atmospheric, and nostalgic, and it runs the gamut from sentimental or quirkily humorous songs to exciting tone poems (*The Fourth of July*, 1913) and weighty meditations (*Concord Sonata*, 1915). He apparently made many remarkable tonal innovations, though questions have been raised about whether he later predated his works to give a misleading impression. His music was rediscovered late in his life; the third of his four symphonies won a Pulitzer Prize in 1947.

IVF See IN VITRO FERTILIZATION

ivory Hard white substance, a variety of dentin, that makes up the tusks of such animals as ELEPHANTS, WALRUSES, and preserved MAMMOTHS. It is prized for its beauty, durability, and suitability for carving. In ancient times it was treasured as highly as gold and precious stones. Most ivory used commercially once came from Africa; sales of ivory declined in the 20th century as the populations of African elephants shrank, and worldwide concern about endangered elephant populations have led to bans on the export and import of ivory. The once-thriving markets of Europe have shifted to South Asia, where skilled artisans, often trading illegally, carve ivory into figurines and other objects.

Ivory, James (Francis) (b. June 7, 1928, Berkeley, Calif., U.S.) U.S. film director. While directing a documentary on India in the 1960s, he met a local producer, Ismail N. Merchant (b. 1936), beginning cinema's longest-lasting partnership. They made several films written by Ivory and RUTH PRAWER JHABVALA before their first international success, *Shakespeare Wallah* (1965). It was followed by a series of well-received adaptations of noted literary works, including *The Europeans* (1979), *The Bostonians* (1984), *A Room with a View* (1986, Academy Award), *Maurice* (1987), *Howards End* (1992), and *The Remains of the Day* (1993). Ivory's films were noted for their attention to period detail and excellent acting.

ivory-billed woodpecker Black-and-white WOODPECKER (*Campephilus principalis*) with a flaring crest (red on the male) and a long whitish bill. The largest North American woodpecker, it was thought to be extinct, though there were unconfirmed sightings of the bird in the southern United States in the late 1990s; a small population on Cuba was last seen in the late 1980s. In 2005, however, researchers announced that it had been sighted in eastern Arkansas. The species' decline coincided with the logging of virgin forest, where it subsisted on deadwood insects. A subspecies, the Cuban ivory-billed woodpecker, is also believed to be extinct. A related species, the imperial woodpecker of Mexico, is critically endangered. All these birds appear to have required large trees and isolation from disturbance.

Ivory-billed woodpeckers (*Campephilus principalis*).
KENNETH W. FINK FROM ROOT RESOURCES

ivory carving Carving of IVORY into decorative or utilitarian objects. It has flourished since prehistoric times. Most Stone Age carvings have been found in southern France, in the forms of small nude female figures and animals. A masterpiece of early Egyptian carving is an ivory statuette of Khufu, builder of the Great Pyramid. In China ivory carvings have been found in the tombs of the Shang dynasty (18th–12th century BC). The major artistic use of ivory in Japan was for netsukes, toggles used as fasteners on men's clothing. The early Inuit (ESKIMOS) produced such utilitarian objects as harpoon shafts and bucket handles out of ivory and often etched them with geometric or curving patterns. See also SCRIMSHAW.

"An Elopement" (sometimes called "Lancelot and Guinevere"), ivory mirror case, French Gothic, 14th century
COURTESY OF THE LIVERPOOL MUSEUM, ENGLAND

Ivory Coast See CÔTE D'IVOIRE

ivy Any of about five species of evergreen woody vines (rarely shrubs) that make up the genus *Hedera* in the GINSENG family, commonly grown as ground covers and on stone walls, especially English ivy (*H. helix*), which climbs by aerial roots with adhering disks that develop on the stems. The tough, dark-green leaves of English ivy have three to five lobes and tend to droop horizontally from the stem. Unrelated plants called ivies include Boston ivy (*Parthenocissus*, or *Ampelopsis, tricuspidata*), a clinging woody vine in the GRAPE family whose leaves turn bright scarlet in autumn, and POISON IVY.

English ivy (*Hedera helix*).
SVEN SAMELIUS

Ivy League Group of eight universities in the northeastern U.S., high in academic and social prestige, that are members of an athletic confer-

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ence for intercollegiate gridiron football dating to the 1870s. It consists of Harvard, Yale, Princeton, Columbia, Brown, and Cornell universities, the University of Pennsylvania, and Dartmouth College.

Iwo Jima Island, the middle of the three Volcano Islands, Japan. Situated in the western Pacific, it is about 5 mi (8 km) long, 800 yards to 2.5 mi (730 m–4 km) wide, and has an area of 8 sq mi (20 sq km). It was under Japanese control until 1945, when it was the scene of one of the severest campaigns of World War II. After extensive bombing by U.S. planes (December 1944–February 1945), it was invaded by U.S. marines and was finally completely taken by mid-March; it became a strategic base for U.S. planes en route to Japan. In 1968 it was returned to Japan.

U.S. Marines raising the American flag over Mount Suribachi, Iwo Jima, in February 1945.
JOE ROSENTHAL—AP/WIDE WORLD

IWW See Industrial Workers of the World

Izabal \ˌē-sä-ˈbäl\, Lake Lake, Guatemala. The country's largest lake, it occupies the lowlands in northeastern Guatemala. Fed by the Polochic River, it drains through the Dulce River into the Caribbean Sea. It lies only 26 ft (8 m) above sea level and has an area of 228 sq mi (590 sq km). The main settlement on its shores is El Estor, which originated as a trading outpost of the United Fruit Company.

Izanagi and Izanami \ē-ˈzä-ˌnä-gē...ē-ˈzä-ˌnä-mē\ Brother and sister gods in the Japanese creation myth. They created the first land mass, and their sexual union produced many islands and deities. In giving birth to the fire god, Izanami was burned to death and went to the land of darkness. Izanagi tried to rescue her, but she had eaten the food of the place and could not leave; in disgust he left her rotting corpse and divorced her. As he bathed to purify himself afterwards, other deities were born from him, including the sun goddess Amaterasu, the moon god Tsukiyomi, and the storm god Susanoo. His bath is the basis for Shinto purification rites.

İzmir \iz-ˈmir\ *formerly* **Smyrna** City (pop., 1997: 2,081,556), western Turkey. On the Aegean seacoast, it is one of Turkey's largest ports and its third largest city. Founded as early as 3000 BC, it was settled by the Greeks before 1000 BC. It was captured by the Lydians c. 600 BC and ceased to exist until it was refounded by Alexander the Great in the 4th century BC. It became one of the principal cities of Anatolia. After being conquered in turn by the Crusaders and by Timur (Tamerlane), it was annexed to the Ottoman Empire c. 1425. It became part of the Republic of Turkey in 1923. It has grown rapidly since 1945 and has a large industrial economy and a growing tourist trade.

ʿIzrāʾīl \ˌiz-rȧ-ˈēl\ In Islam, the angel of death. One of the four archangels (with Jibrāʾīl, Mīkāʾīl, and Isrāfīl), he is of cosmic size, with 4,000 wings and a body formed from innumerable eyes and tongues. He was the only angel brave enough to go down to earth and face Iblīs in order to bring God the materials to create man. For this service he was made the angel of death and given a register of all mankind, which lists the blessed and the damned.

Izu \ˈē-zü\ Peninsula Peninsula, central Honshu, Japan. It extends 37 mi (60 km) into the Pacific Ocean and consists largely of volcanic rock and highly eroded volcanoes. It is part of the Fuji-Hakone-Izu National Park, and its hot springs and warm winter climate are major tourist attractions.

Izumo shrine \ˈē-zù-mȯ,\ *English* \ē-ˈzü-mō\ Oldest Shintō shrine in Japan (the present building is said to date from 1346), located northwest of Izumo on the island of Honshu. The temple complex covers 40 acres (16 hectares) and contains a valuable art collection. Enclosed by hills on three sides, it is approached through an avenue of pines. Most of its present buildings were constructed in the 19th century.

Izvestiya \iz-ˈves-tē-ə\ *formerly in full* **Izvestiya Sovetov Deputatov Trudyashchikhsya SSSR** (Russian: "News of the Councils of Working People's Deputies of the U.S.S.R.") Russian daily newspaper published in Moscow, the official national publication of the Soviet government until 1991. Founded in 1917, it grew rapidly in circulation. Restrictions during World War II and under Joseph Stalin slowed its growth, but it was transformed into a lively, readable daily under the editorship of Alexei Adzhubei, Nikita Khrushchev's son-in-law, while remaining an instrument of the state. Following the Soviet Union's breakup, it became an independent, employee-owned publication whose liberal editorial policy often put it at odds with both unreconstructed communists and Russian nationalists.

Izvolsky \iz-ˈvȯl-skē**, Aleksandr (Petrovich), Count** (b. March 18, 1856, Moscow, Russia—d. Aug. 16, 1919, Paris, France) Russian diplomat. He became minister of foreign affairs in 1906. In 1908 he secured Austria's support for the right of Russian warships to use the Dardanelles strait in return for his reluctant support of Austria's annexation of Bosnia and Herzegovina. While Austria succeeded in its annexation (see Bosnian crisis), Russia failed to gain access to the Dardanelles; Izvolsky's responsibility for Russia's diplomatic defeat increased tensions with Austria-Hungary prior to World War I. Dismissed in 1910, he served as ambassador to France until 1917.

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Jabal al-Shaykh See Mount Hermon

Jabal River *or* **Baḥr al-Jabal** \ˌbär-el-ˈje-bel\ River, south-central Sudan. The river flows northward 594 mi (956 km) over the Fula Rapids, past Juba (the head of navigation), and through a vast swampy region. It receives the Ghazāl River at Lake No and then turns east to join the Sūbāṭ River of western Ethiopia, thereafter forming the White Nile River.

Jabotinsky \ˌyab-ə-ˈtin-skē**, Vladimir** (b. 1880, Odessa, Russian Empire—d. Aug. 3, 1940, near Hunter, N.Y., U.S.) Russian Zionist leader and founder of the Zionist Revisionist movement. He became a popular journalist and editorialist and by 1903 was expounding Zionism. In 1920 he organized and led Hagana, a Jewish militia. A Revisionist Zionist, he passionately advocated a Jewish state in an area both west and east of the Jordan River. See also Irgun Zvai Leumi.

Jabrail See Jibrīl

jacaranda \ˌja-kə-ˈran-də\ Any plant of the genus *Jacaranda* (family Bignoniaceae), especially the two ornamental trees *J. mimosifolia* and *J. cuspidifolia*. Jacarandas are grown widely in warm parts of the world and in greenhouses for their showy blue or violet flowers and attractive, oppositely paired, compound leaves. The genus includes about 50 species native to Central and South America and the West Indies. The name is also applied to several tree species of the genera *Machaerium* and *Dalbergia* in the pea family (see legume), the sources of commercial rosewood.

jack In practical mechanics, portable hand-operated device for raising heavy weights through short distances, exerting great pressures, or holding assembled work firmly in position. The ratio of the load to the amount of force applied to the handle can be made quite high by using a gear or screw to regulate the upward extension. A ratchet allows a heavy weight to be raised in short successive stages. Though limited by the requirements of portability and ease of manual operation, jacks may lift, or exert a force of, several tons. A familiar example is the automobile jack, used to raise one end of a car to change a tire.

jack Any of more than 150 species of fishes (family Carangidae, order Perciformes) found in temperate and tropical portions of the Atlantic, Pacific, and Indian oceans and occasionally in fresh or brackish water. Though body size and shape vary greatly, many species have small scales that create a smooth appearance, a laterally compressed body, rows of large spiky scales along the side near the tail fin, and a deeply forked tail. Many have a bluish green, silvery, or yellowish sheen. Jacks are important commercially and are favoured sport fishes. See also amberjack.

jack-in-the-pulpit North American plant (*Arisaema triphyllum*) of the arum family, noted for the unusual shape of its flower. One of the best-known perennial wildflowers of late spring in the eastern U.S. and Canada, it grows in wet woodlands and thickets from Nova Scotia to Minnesota and south to Florida and Texas. Three-part leaves on each of two long stalks overshadow the flower, which consists of a conspicuous green- and purple-striped structure called a spathe ("pulpit") that rises on a separate stalk. The spathe curves in a hood over a club-shaped spadix ("jack") that, at its base, bears minute flowers. In late summer the plant produces a cluster of brilliant red berries that are poisonous to humans but are eaten by many wild animals.

Jack the Ripper Pseudonymous murderer of at least five women, all prostitutes, in or near London's Whitechapel district, from Aug. 7 to Nov. 10, 1888. The throat of each victim was cut, and usually the body was mutilated in a manner indicating the murderer had considerable knowledge of human anatomy. Authorities received a series of taunting notes from a person calling himself Jack the Ripper and purporting to be the murderer. Although strenuous efforts were made to identify and trap the killer, he remained unknown. The unsolved case retained its hold on the popular imagination, becoming the subject of several motion pictures and more than 100 books, as well as a macabre tourist industry in London.

jackal Any of three canine species of the genus *Canis*. They inhabit open country and live alone, in pairs, or in packs. They hunt at night, feeding on small animals, plant material, or carrion. A pack can bring down larger prey. The golden, or Asiatic, jackal (yellowish) is found from eastern Europe and North Africa to South Asia. The black-backed jackal (rusty red with a black back) and side-striped jackal (grayish with a white-tipped tail and an indistinct stripe on each side) are found in southern and eastern Africa. Jackals are 34–37 in. (85–95 cm) long, including the 12–14-in. (30–35-cm) tail, and weigh 15–24 lbs (7–11 kg).

Black-backed jackal (*Canis mesomelas*).
LEONARD LEE RUE III

jackdaw *or* **daw** Crowlike black bird (*Corvus monedula*) with gray nape and pearly eyes. About 13 in. (33 cm) long, jackdaws breed in colonies in treeholes and on cliffs and tall buildings; their flocks fly in formation around the site. Their cry sounds like their name: "chak." The species ranges from the British Isles to central Asia. See also crow, grackle.

Jackdaw (*Corvus monedula*)
JOHN MARKHAM

jackrabbit Any of several large, common North American species of hares (e.g., *Lepus townsendii*, *L. californicus*). Jackrabbits have very long ears and long hind legs. They are widespread, particularly in the West, but are found most often in prairie and plains environments.

Jackson City (pop., 2000: 184,256), capital of Mississippi, U.S. It lies along the Pearl River in the west-central part of the state. Settled in 1792 by Louis Le Fleur, a French Canadian trader, it was a trading post called Le Fleur's Bluff until settlers began arriving in 1820. It was made the state capital in 1822 and was named for Andrew Jackson. During the American Civil War it was burned by Union forces (1863). The state's largest city, it is a railroad and distribution centre. It is the seat of Jackson State University (1877) and other educational institutions.

Jackson, A(lexander) Y(oung) (b. Oct. 3, 1882, Montreal, Que., Can.—d. April 5, 1974, Kleinburg, Ont.) Canadian landscape painter. He traveled to every region of Canada, including the Arctic; from 1921 on, he returned every spring to a favourite spot on the St. Lawrence River, where he produced sketches that he later executed in paint. Over a long career he became a leading artistic figure in his country. His easy style, featuring rolling rhythms and rich, full colour, exerted a strong influence on Canadian landscape painting.

Jackson, Andrew (b. March 15, 1767, Waxhaws region, S.C.—d. June 8, 1845, the Hermitage, near Nashville, Tenn., U.S.) Seventh president of the U.S. (1829–37). He fought briefly in the American Revolution near his frontier home, where his family was killed in the conflict. In 1788 he was appointed prosecuting attorney for western North Carolina. When the region became the state of Tennessee, he was elected to the U.S. House of Representatives (1796–97) and the Senate (1797–98). He served on the state supreme court (1798–1804) and in 1802 was elected major general of the Tennessee militia. When the War of 1812 began, he offered the U.S. the services of his 50,000-man volunteer militia. Sent to the Mississippi Territory to fight the Creek Indians, who were allied with the British, he defeated them after a short campaign (1813–14) at the Battle of Horseshoe Bend. After capturing Pensacola, Fla., from the

Andrew Jackson, detail of an oil painting by John Wesley Jarvis, *c.* 1819; in the Metropolitan Museum of Art, New York City
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, HARRIS BRISBANE DICK FUND, 1964

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British-allied Spanish, he marched overland to engage the British in Louisiana. A decisive victory at the Battle of New Orleans made him a national hero; he was dubbed "Old Hickory" by the press. After the U.S. acquired Florida, Jackson was named governor of the territory (1821). One of four candidates in the 1824 presidential election, he won an electoral-vote plurality, but the House of Representative instead selected John Quincy Adams as president. Jackson's victory over Adams in the 1828 presidential election is commonly regarded as a turning point in U.S. history. Jackson was the first president from west of the Appalachian Mountains, the first to be born in poverty, and the first to be elected through a direct appeal to the mass of voters rather than through the support of a recognized political organization. The era of his presidency has come to be known as "Jacksonian Democracy." Upon taking office he replaced many federal officials with his political supporters, a practice that became known as the spoils system. His administration acquiesced in the illegal seizure of Cherokee land in Georgia and then forcibly expelled the Indians who refused to leave (see Trail of Tears). When South Carolina claimed a right to nullify a federally imposed tariff, Jackson asked for and received Congressional authority to use the military to enforce federal laws in the state (see nullification). His reelection in 1832 was partially the result of his controversial veto of a bill to recharter the Bank of the United States, which was unpopular with many of his supporters (see Bank War). The intensity of the political struggles during his tenure led to the strengthening of the Democratic Party and to the further development of the two-party system.

Jackson, Charles Thomas (b. June 21, 1805, Plymouth, Mass., U.S.—d. Aug. 28, 1880, Somerville, Mass.) U.S. physician, chemist, geologist, and mineralogist. He graduated from Harvard Medical School in 1829. Known for his contentiousness and litigiousness, he took credit for the first demonstration of surgical anesthesia with ether by a dental surgeon he had advised on it, and he claimed to have told Samuel F.B. Morse the basic principles of the telegraph. He worked many years as a geologist for the U.S. Geological Survey.

Jackson, Glenda (b. May 9, 1936, Birkenhead, Cheshire, Eng.) British stage and film actress. Discovered by Peter Brook, she was cast in his Theatre of Cruelty revue and soon appeared as the mad Charlotte Corday in his celebrated production of Peter Weiss's *Marat/Sade* (1964; film, 1967). She became known for her tense portrayals of complex women, gaining international acclaim in the film *Women in Love* (1969, Academy Award) and later successes such as *Sunday Bloody Sunday* (1971), *A Touch of Class* (1973, Academy Award), and the television series *Elizabeth R*. Her screen career continued until 1992, when she won a seat in the House of Commons.

Jackson, Jesse (Louis) *orig.* **Jesse Louis Burns** (b. Oct. 8, 1941, Greenville, S.C., U.S.) U.S. civil rights leader. He became involved with the civil rights movement as a college student. In 1965 he went to Selma, Ala., to march with Martin Luther King, Jr., and began working for King's Southern Christian Leadership Conference (SCLC). In 1966 he helped found the Chicago branch of Operation Breadbasket, the SCLC's economic arm; he was its national director from 1967 to 1971. Ordained a Baptist minister in 1968, he founded Operation PUSH (People United to Save Humanity) in 1971. In 1983 he led a voter-registration drive in Chicago that helped elect the city's first African American mayor, Harold Washington. In 1984 and 1988 Jackson entered the Democratic presidential primary, becoming the first African American man to make a serious bid for the U.S. presidency; he received 6.7 million votes in 1988. In 1989 he moved to Washington, D.C. and was elected the city's unpaid "statehood senator" to lobby Congress for statehood. From the late 1970s Jackson gained wide attention through his attempts to mediate in various international disputes, including in the Middle East. In the late 1990s he faced allegations of financial misconduct, and in 2001 he admitted fathering a child out of wedlock.

Jesse Jackson, 1988.
© DENNIS BRACK/BLACK STAR

Jackson, Joe *in full* **Joseph Jefferson Jackson** *known as* **Shoeless Joe Jackson** (b. July 16, 1888, Greenville, S.C., U.S.—d. Dec. 6, 1951, Greenville) U.S. baseball player. Jackson started his career in 1908 and became an outfielder with the Chicago White Sox. An outstanding hitter, his career batting average of .356 is the third-highest (after Ty Cobb and Rogers Hornsby) in baseball history. Jackson was involved in the 1919 Black Sox scandal; though acquitted in 1921, he was banned from baseball for life by baseball commissioner Kenesaw Mountain Landis.

Jackson, John Hughlings (b. April 4, 1835, Green Hammerton, Yorkshire, Eng.—d. Oct. 7, 1911, London) British neurologist. He showed that most right-handed persons with aphasia had disease on the left side of the brain, confirming Paul Broca's findings. In 1863 he discovered Jacksonian epilepsy (spasms progressing through the body), tracing it to motor region damage. Electroencephalography has confirmed his 1873 definition of epilepsy as "a sudden, excessive, and rapid discharge" of electricity by brain cells.

Jackson, Mahalia (b. Oct. 26, 1911, New Orleans, La., U.S.—d. Jan. 27, 1972, Evergreen Park, Ill.) U.S. gospel music singer. As a child, Jackson sang in the choir of the New Orleans church where her father preached. She learned sacred songs but was also exposed to blues recordings by Bessie Smith and Ida Cox. In Chicago she worked at odd jobs while singing with a touring gospel quintet, and she opened several small businesses. Her warm, powerful voice first came to wide public attention in the 1930s, when she participated in a cross-country tour singing songs such as "He's Got the Whole World in His Hands." Closely associated with Thomas A. Dorsey, she sang many of his songs. "Move on up a Little Higher" (1948) sold more than a million copies, and she became one of the most popular singers of the 1950s and '60s. She first appeared at Carnegie Hall in 1950. Active in the civil rights movement from 1955, she sang at the epochal 1963 civil rights march on Washington.

Mahalia Jackson, 1961.
THE BETTMANN ARCHIVE

Jackson, Michael (Joseph) (b. Aug. 29, 1958, Gary, Ind., U.S.) U.S. singer and songwriter. The nine-year-old Jackson became the lead singer of The Jackson Five, a family group formed by his father. Their hits on the Motown label included "I Want You Back" and "ABC." Though Michael remained a member of the group until 1984, he began recording under his own name in 1971. His album *Off the Wall* (1979) sold millions; his next solo album, *Thriller* (1982), sold more than 40 million copies, becoming the best-selling album in history. The emerging format of the music video was an important aspect of Jackson's work; his videos for "Beat It" and "Billie Jean" (both 1983) featured his highly influential dancing style (notably his trademark "moonwalk"). He later released the albums *Bad* (1987), *Dangerous* (1991), and *HIStory* (1995). Despite his many efforts to speak out on social issues, Jackson's eccentric, secluded lifestyle stirred controversy in the early 1990s. His reputation was seriously damaged in 1993 when he was accused of child molestation by a 13-year-old boy. Several of his siblings, notably his sister Janet (b. 1966), have also enjoyed solo success.

Jackson, Reggie *in full* **Reginald Martinez Jackson** (b. May 18, 1946, Wyncote, Pa., U.S.) U.S. baseball player. Jackson excelled in track, football, and baseball in high school. In the major leagues, batting and throwing left-handed and playing outfield, he helped three teams (Oakland Athletics, 1968–75; New York Yankees, 1976–81; California Angels, 1982–87) win five World Series, six pennant races, and 10 divisional play-offs. Noted for his home-run hitting, he was nicknamed "Mr. October" for his reliable prowess in play-off and World Series games. He hit a career total of 563 home runs, placing him in the top ten of all-time home-run hitters.

Jackson, Robert H(oughwout) (b. Feb. 13, 1892, Spring Creek, Pa., U.S.—d. Oct. 9, 1954, Washington, D.C.) U.S. jurist. He pleaded his

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first case while still a minor and was a lawyer by age 21. He became corporation counsel for Jamestown, N.Y. As general counsel for the U.S. Bureau of Internal Revenue (1934), he successfully prosecuted Andrew W. Mellon for income-tax evasion. He served as U.S. solicitor general (1938–39) and attorney general (1940–41). In 1941 he was appointed by Pres. Franklin Roosevelt to the U.S. Supreme Court, where he served until 1954. He infused his well-worded opinions with a blend of liberalism and nationalism. In 1945–46 he served as chief U.S. prosecutor in the Nürnberg trials.

Jackson, Shirley (Hardie) (b. Dec. 14, 1919, San Francisco, Calif., U.S.—d. Aug. 8, 1965, North Bennington, Vt.) U.S. novelist and short-story writer. She is best known for her story "The Lottery" (1948), a chilling tale that provoked outrage when first published, and *The Haunting of Hill House* (1959; film, 1963, 1999). These and her other five novels, including *We Have Always Lived in the Castle* (1962), confirmed her reputation as a master of gothic horror and psychological suspense.

Jackson, Stonewall *orig.* **Thomas Jonathan Jackson** (b. Jan. 21, 1824, Clarksburg, Va., U.S.—d. May 10, 1863, Guinea Station, Va.) U.S. and Confederate army officer. Despite little formal education, he secured an appointment to West Point. He served with distinction in the Mexican War. At the start of the American Civil War, he organized Virginia volunteers into an effective brigade. At the first Battle of Bull Run, he stationed his brigade in a strong line and withstood a Union assault, a feat that earned him a promotion to major general and the nickname "Stonewall." In 1862 he won campaigns in the Shenandoah Valley and later in the Seven Days' Battles. Robert E. Lee used Jackson's troops to encircle the Union forces to win the second Battle of Bull Run, and Jackson assisted Lee at Antietam and Fredericksburg. In April 1863, while moving his troops around the flank of the Union army at Chancellorsville, he was accidentally shot and mortally wounded by his own men.

Jackson, William Henry (b. April 4, 1843, Keesville, N.Y., U.S.—d. June 30, 1942, New York, N.Y.) U.S. photographer. As a boy, he worked for a photographic studio in Troy, N.Y. After the American Civil War he went west and opened a studio in Omaha. He was the official photographer for the U.S. Geological and Geographical Survey of the Territories (1870–78), and his photographs were instrumental in the establishment of Yellowstone National Park.

Jacksonville City (pop., 2000: 735,617), northeastern Florida, U.S. It is the site of Florida's first European (French Huguenot) settlement (1564). Named for Andrew Jackson, it was laid out in 1822 and incorporated in 1832. It was largely destroyed by fire in 1901. In 1968 it was consolidated with most of Duval county; it covers 841 sq mi (2,178 sq km), making it one of the largest U.S. cities in terms of land area. A deep-water port with major shipyards, it is Florida's chief transportation and commercial centre. It is the site of Jacksonville University, the University of North Florida, and Jones College.

Jacob Hebrew patriarch, son of Isaac and grandson of Abraham, and the traditional ancestor of the people of Israel. His story is told in the Book of Genesis. The younger twin brother of Esau, he used trickery to gain Isaac's blessing and Esau's birthright. On a journey to Canaan he wrestled all night with an angel, who blessed him and gave him the name Israel. Jacob had 13 children, 10 of whom founded tribes of Israel. His favorite son, Joseph, was sold into slavery in Egypt by his brothers, but the family was later reunited when a famine forced the brothers to go to Egypt to seek grain.

Jacob \zhȧ-'kȯb**, François** (b. June 17, 1920, Nancy, France) French biologist. After receiving his doctorate, he went to work at the Pasteur Institute in Paris. Beginning in 1958, he worked with Jacques Monod studying the regulation of bacterial enzyme synthesis. They discovered regulator genes, so called because they control the activities of other genes. Jacob and Monod also proposed the existence of an RNA messenger, a partial copy of DNA that carries genetic information to other parts of the cell. The two men shared a 1965 Nobel Prize with André Lwoff.

Jacob ben Asher (b. 1269?, Cologne?—d. 1340?, Toledo, Castile) Jewish legal scholar. He emigrated to Spain with his family in 1303, and his father became chief rabbi in Toledo. Jacob is believed to have made his living as a moneylender. He divided Jewish law into categories by subject, producing a codification known as *Tur*, which became a popular Jewish theological work of the 15th century. The basis for many rabbinic decisions, it was considered standard until superseded by the work of Joseph ben Ephraim Karo in the 16th century.

Jacobean \ˌja-kə-'bē-ən\ **age** Period in the visual and literary arts during the reign of James I (Latin Jacobus) of England (r. 1603–25). Jacobean architecture combines motifs from the late Gothic period with Classical details and Tudor pointed arches and interior paneling. Jacobean furniture, made of oak, featured heavy forms and bulbous legs. Inigo Jones, following the theories and works of Andrea Palladio, introduced the Classical style of Renaissance architecture into England. Most Jacobean portraitists and sculptors were foreign-born or foreign-influenced, and their efforts faded when such Flemish painters as Peter Paul Rubens and Anthony Van Dyck worked in England for James's successor, Charles I. See also Jacobean literature.

Jacobean \ˌja-kə-'bē-ən\ **literature** Body of works written during the reign of James I of England (1603–25). The successor to Elizabethan literature, Jacobean literature was often dark in mood, questioning the stability of the social order; some of William Shakespeare's greatest tragedies may date from the beginning of the period, and other dramatists, including John Webster, were often preoccupied with the problem of evil. The era's comedy included the acid satire of Ben Jonson and the varied works of Francis Beaumont and John Fletcher. Jacobean poetry included the graceful verse of Jonson and the Cavalier poets but also the intellectual complexity of the metaphysical poetry of John Donne and others. In prose, writers such as Francis Bacon and Robert Burton showed a new toughness and flexibility of style. The era's monumental prose achievement was the King James Version of the Bible (1611).

Jacobin \'ja-kə-bən\ **Club** *or* **Jacobins** Political group of the French Revolution, identified with extreme radicalism and violence. Formed in 1789 as the Society of the Friends of the Constitution, it was known as the Jacobin Club because it met in a former convent of the Dominicans (known in Paris as Jacobins). It was originally formed by deputies of the National Assembly to protect the Revolution's gains against a possible aristocratic reaction. Although it did not have a direct role in overthrowing the monarchy in 1792, the club later changed its name to Society of the Jacobins, Friends of Liberty and Equality. It admitted leftist Montagnard deputies of the National Convention and agitated for the king's execution and the overthrow of the Girondins. In 1793, with about 8,000 clubs and 500,000 members, the Jacobins became instruments of the Reign of Terror. The Parisian club supported Maximilien Robespierre, but it closed after his fall in 1794. Although officially banned, some local clubs lasted until 1800.

Jacobite In British history, a supporter of the exiled Stuart king James II (in Latin, Jacobus) and his descendants after the Glorious Revolution of 1688. The movement was strong in Scotland, Wales, and Ireland, and it included Catholics and Anglican Tories. The Jacobites, especially under William III and Queen Anne, could offer a feasible alternative title to the crown, and several attempts were made to restore the Stuarts. In 1689 James II landed in Ireland, but his army was defeated at the Battle of the Boyne. In the Fifteen Rebellion (1715), led by John Erskine, 6th earl of Mar (1675–1732), Jacobites tried to seize the crown for James Edward, the Old Pretender. In the Forty-five Rebellion (1745) Charles Edward, the Young Pretender, took Scotland, but the Jacobite army was crushed at the Battle of Culloden (1746).

Jacobs, Helen Hull (1908–1997) U.S. tennis player.Jacobs was the national junior tennis champion in 1924–25. She was first defeated by Helen Wills, who would prove to be her longtime rival, in the 1928 finals at Forest Hills, N.Y. Though Wills was virtually always victorious, Jacobs was a popular favourite. Her only victory over Wills came by default. Though often in Wills's shadow, Jacobs won four U.S. Open singles (1932–35), three doubles (1932 and 1934–35), and mixed doubles (1934) championships. She was ranked in the world's top 10 from 1928 to 1940. In 1933 she became the first woman to break with tradition by wearing man-tailored shorts at Wimbledon. Her autobiography, *Beyond the Game*, appeared in 1936.

Jacobs, Jane *orig.* **Jane Butzner** (b. May 4, 1916, Scranton, Pa., U.S.) U.S.-born Canadian urbanologist. She became active in urban community work while living in New York City with her architect husband. For 10 years she was an editor at *Architectural Forum*. Her highly influential *The Death and Life of Great American Cities* (1961) is a brash, passionate, and highly original reinterpretation of the multiple needs of modern urban places. *The Economy of Cities* (1969) discussed the importance of diversity to a city's prospects. Later works include *Cities and the Wealth of Nations* (1984) and *Edge of Empire* (1996). See also urban planning.

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Jacopo da Pontormo See Jacopo da PONTORMO

Jacopo della Quercia \'yä-kō-pō-dāl-lä-'kwer-chä\ *orig.* **Jacopo di Piero di Angelo** (b. c. 1374, Siena—d. Oct. 20, 1438, Bologna, Papal States) Italian sculptor active in Siena. He was the son of a goldsmith and wood carver. His earliest major work is the tomb of Ilaria del Carretto in Lucca Cathedral (c. 1406–08). His most important commission for Siena was the fountain known as Fonte Gaia (1408–19) in the Piazza del Campo. He worked with DONATELLO and LORENZO GHIBERTI on reliefs for the baptismal font in the Baptistery in Siena (1417–30). His last and greatest work was the sculptural reliefs around the portal of San Petronio in Bologna (1425–30). In 1435 he was appointed supervising architect of Siena Cathedral. He elevated Sienese sculpture to a place of prominence and influenced subsequent Sienese painters. The greatest non-Florentine sculptor of the 15th century, he was a major influence on the young MICHELANGELO.

Jacquard \zha-'kär,\ *English* \'ja-ˌkärd**, Joseph-Marie** (b. July 7, 1752, Lyon, Fr.—d. Aug. 7, 1834, Oullins) French inventor. In 1801 he demonstrated an automatic loom incorporating revolutionary new technology; it was declared public property in 1806, and Jacquard was rewarded with a pension and a royalty on each machine. His loom utilized interchangeable punched cards that controlled the weaving of the cloth so that any desired pattern could be obtained automatically. The JACQUARD LOOM's technology became the basis of the modern automatic loom and a precursor of the modern computer. His punched cards were adapted by CHARLES BABBAGE as an input/output medium for his proposed analytical engine and by HERMAN HOLLERITH to feed data to his census machine, and punched cards were used for inputting data into early digital computers.

Jacquard \'ja-ˌkärd\ **loom** LOOM incorporating a special device to control individual warp YARNS. It enabled production of fabrics with intricate woven patterns such as TAPESTRY, BROCADE, and damask, and has also been adapted to the production of patterned knitted fabrics. Developed in France by J.-M. JACQUARD in 1804–05, it used interchangeable punched cards that controlled the weaving of the cloth so that any desired pattern could be obtained automatically. It aroused bitter hostility among weavers, who feared that its labour-saving capabilities would deprive them of jobs; the weavers of Lyon not only burned the machines but attacked Jacquard as well. Eventually the loom's advantages led to its general acceptance, and by 1812 there were 11,000 in use in France. Use of the loom spread to England in the 1820s and from there virtually worldwide.

Jacuí \zhå-'kwē\ **River** River, southern Brazil. It rises in the hills east of Passo Fundo and flows southward and eastward for 280 mi (450 km). At Pôrto Alegre it receives four other rivers and forms the Guaíba River, a shallow estuary that empties into the Atlantic Ocean. Navigable upstream as far as Cachoeira do Sul, it has one of the most heavily used river barge systems in Brazil.

Dragon among clouds, carved jade medallion or button, Ch'ing dynasty, probably late 18th century (reign of Ch'ien-lung); in the Victoria and Albert Museum, London

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jade Either of two tough, compact, typically green gemstones that take a high polish. Both have been carved into jewelry, ornaments, small sculptures, and utilitarian objects from earliest recorded times. The more highly prized of the two jadestones is JADEITE; the other is NEPHRITE. Both types may be white or colourless, but colours such as red, green, and gray may occur.

jadeite \'jād-ˌīt\ Gem-quality SILICATE MINERAL in the PYROXENE family that is one of the two forms of JADE. Jadeite (imperial jade), sodium aluminum silicate ($NaAlSi_2O_6$), may contain impurities that give it a variety of colours: white, green, red, brown, and blue. The most highly prized variety is emerald green. Jadeite occurs only in metamorphic rocks, most often in those that have been subjected to the high pressures deep below the Earth's surface. The area around the city of Mogaung in northern Myanmar has long been the main source of gem-quality jadeite.

Uncut (left) and cut jadeite

RUNK/SCHOENBERGER—GRANT HEILMAN

jaeger \'yā-gər\ Any of three species (genus *Stercorarius,* family Stercorariidae) of seabirds. They resemble dark GULLS with a forward-set black cap and projecting central tail feathers. Jaegers have two colour phases: all brown or (more commonly) brown above and white below. They nest in the Arctic tundra and then go to sea, many as far as Australia and New Zealand. At sea they catch fish on their own, but, while nesting along coasts, they force TERNS and KITTIWAKES to disgorge their food, destroy the eggs and young of other seabirds, and capture land birds and rodents. The species range from 14 to 20 in. (35 to 50 cm) long. In Great Britain, jaegers are called SKUAS.

Long-tailed jaeger (*Stercorarius longicaudus*).

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Ja'far ibn Muḥammad \'jä-fär-ˌi-bən-mù-'hå-məd\ (b. 699/700, Medina, Arabia—d. 765, Medina) Sixth IMAM of the SHĪʿITE branch of Islam and the last to be recognized by all the Shīʿite sects. He was the great-grandson of ʿALĪ. As a possible claimant to the caliphate, Ja'far was viewed as a threat to both the UMAYYAD and ʿABBĀSID dynasties. He traveled to Baghdad in 762 to prove to the caliph that he was not seeking power, then returned to his native Medina, where his pupils included ABŪ ḤANĪFAH. After his death the Shīʿites began to splinter. One sect, the ISMĀʿĪLIYYAH, became followers of his son, Ismail. Another, the ITHNĀ ʿASHARIYYAH, traced a succession from Ja'far to the Twelfth Imam awaited at the Last Judgment.

Jaffa See TEL AVIV–YAFO

Jagannatha \'jə-gə-ˌnät-ə\ *or* **Jagannath** Form under which KRISHNA is worshiped at Puri, Orissa, a famous religious center of India. His temple at Puri dates from the 12th century. The Rathayatra, or Chariot Festival, is held in his honor each year in June or July. An image of the god is placed on a cart so heavy that it takes thousands of devotees several days to move it to the god's temple outside the city. According to legend, pilgrims sometimes throw themselves under the wagon in hopes of attaining instant salvation, a practice that gave rise to the English word juggernaut.

Jagiello I See WŁADYSŁAW II JAGIEŁŁO

Jagiellon \yäg-'ye-lȯn\ **dynasty** Family of monarchs of Poland-Lithuania, Bohemia, and Hungary that became one of the most powerful in east-central Europe in the 15th–16th centuries. It was founded by Jogaila, grand duke of Lithuania, who became WŁADYSŁAW II JAGIEŁŁO of Poland after marriage to Queen Jadwiga (1373?–99) in 1386. Władysław III Warneńczyk (1424–44) extended the dynasty by also assuming the throne of Hungary (1440). He was succeeded by CASIMIR IV, who placed his son on the thrones of Bohemia (1471) and Hungary. During the reigns of Casimir's sons John Albert (1459–1501) and Alexander (1461–1506), the Jagiellon rulers lost much of their power in Poland to the nobility. When SIGISMUND I succeeded Alexander in 1506, he strengthened the government and saw the TEUTONIC ORDER convert its lands into the secular duchy of Prussia (1525), a Polish fief. In 1526 the death of Louis II ended Jagiellon rule in Bohemia and Hungary. In 1561 SIGISMUND II AUGUSTUS incorporated Livonia into Poland, but when he died, leaving no heirs, the Jagiellon dynasty ended (1572).

jagirdar \jə-'gir-ˌdär\ **system** Form of land tenancy introduced in India by the early sultans of Delhi in the early 13th century. Under the system, land, its revenues, and the power to govern it was assigned to an official of the state. The land reverted to the government on the official's death, but heirs could renew the land assignment by paying a fee. Feudalistic in character, the *jagirdar* system tended to enfeeble the central government by setting up quasi-independent baronies. Periodically abolished, it was always renewed. After Indian independence, measures were taken to abolish absentee landownership.

jaguar Largest New World CAT. Once found in wooded regions from the U.S.-Mexican border south to Patagonia, the jaguar (*Panthera onca*) survives, in reduced numbers, only in remote areas of Central and South

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America; the largest known population is in the Amazon rain forest. The male is 5.5–9 ft (1.7–2.7 m) long, including the 23–35-in. (60–90-cm) tail, and weighs 220–350 lbs (100–160 kg). The coat is typically orange-tan with black spots arranged in rosettes having a black spot in the centre. A solitary predator, the jaguar usually hunts rodents, deer, birds, and fish; it will also take cattle, horses, and dogs.

Jaguaribe \ˌzhä-gwä-ˈrē-bē\ **River** River, northeastern Brazil. Formed by the junction of the Carapateiro and Trici rivers, it flows northeastward for 350 mi (560 km) to enter the Atlantic Ocean at Aracati. Long periods of drought, during which much of the river is dry, are followed by catastrophic floods that inundate the towns along its lower course.

Jahāngīr \jə-ˈhän-gēr\ *or* **Jehangir** (b. Aug. 31, 1569, Fatehpur, Sikri, India—d. Oct. 28, 1627, en route to Lahore) Mughal emperor of India (1605–27). Though designated heir apparent, the impatient Jahāngīr revolted in 1599; his father, AKBAR, nevertheless confirmed him as his successor. Like Akbar, Jahāngīr managed diplomatic relations on the Indian subcontinent adroitly, was tolerant of non-Muslims, and was a great patron of the arts. He encouraged Persian culture in Mughal India. During the middle portion of his reign, politics were dominated by his Persian wife (Nūr Jahān), her father, and Jahāngīr's son Prince Khurram (the future SHAH JAHĀN).

Jahn \ˈyän**, Friedrich Ludwig** (b. Aug. 11, 1778, Lanz, Brandenburg, Prussia—d. Oct. 15, 1852, Freyburg an der Unstrut, Prussian Saxony) German educator who founded the Turnverein (gymnastic club) movement in Germany. As a teacher in Berlin from 1809, he began a program of outdoor exercise for students. He invented the parallel bars, rings, balance beam, horse, and horizontal bar, all of which have become standard equipment for GYMNASTICS. In 1819 he came under suspicion for his fervent nationalism and strong influence on youth. He was arrested and imprisoned for almost a year; his gymnastic club closed, and a national ban was placed on gymnastics (lifted in 1842). He was awarded the Iron Cross for military bravery (1840) and served in the national parliament (1848–49).

jahrzeit See YAHRZEIT

jai alai \ˈhī-ˌlī, ˌhī-ə-ˈlī\ *Basque* **"merry festival"** Court game resembling HANDBALL. Of Basque origin, it developed from pelota and was given its present name when it was imported to Cuba in 1900. It is played between two or four players with a ball and a hurling device consisting of a long, curved wicker basket strapped to the wrist. The use of this hurling device, called a cesta, allows the ball to reach speeds up to 240 km/hr (150 mph). The court, 53.3 m (58.3 yards) long, is three-walled. The object of the game is to bounce the ball off the front wall with such speed and spin that the opponent is unable to return it. PARI-MUTUEL betting on jai alai is permitted in the U.S.

Jaina vrata \ˈjī-nə-ˈvrə-tə\ In JAINISM, any of the vows taken by monks, nuns, and lay members. The first five are the *mahavratas*, or "great vows": nonviolence, truthfulness, not stealing, sexual purity, and renunciation of possessions. These are interpreted more moderately for lay members than for monks; for example, lay members need only remain sexually faithful to their spouses, while monks must practice celibacy. The remaining vows are designed to help in keeping the first five. The final vow is the promise to die in meditation during self-starvation when observance of the other vows is no longer possible.

Jainism \ˈjī-ˌni-zəm\ Religion of India established in the 6th century BCE. It was founded by Vardhamana, who was called MAHAVIRA, as a reaction against the VEDIC RELIGION, which required animal sacrifices. Jainism's core belief is AHIMSA, or noninjury to all living things. Jainism has no belief in a creator god, though there are a number of lesser deities for various aspects of life. Jains believe their religion is eternal and hold that it was revealed in stages by a number of Conquerors, of whom Mahavira was the 24th. Living as an ascetic, Mahavira preached the need for rigorous penance and self-denial as the means of perfecting human nature, escaping the cycle of rebirth, and attaining MOKSHA, or liberation. Jains view KARMA as an invisible material substance that interferes with liberation and can be dissolved only through asceticism. By the end of the 1st century CE the Jains had split into two sects, each of which later developed its own canon of sacred writings: the Digambaras, who held that an adherent should own nothing, not even clothes, and that women must be reborn as men before they can attain moksha; and the more moderate Svetambaras, who retained a few possessions such as a robe, an alms bowl, a whisk broom, and a *mukhavastrika* (a piece of cloth held over the mouth to protect against the ingestion and killing of small insects). In keeping with their principle of reverence for life, Jains are known for their charitable works, including building shelters for animals. Jainism preaches universal tolerance and does not seek to make converts. In the early 21st century Jainism had some 4.5 million followers.

Jaipur \ˈjī-ˌpůr\ Capital (pop., 2001 prelim.: 2,324,319) of RAJASTHAN state, northwestern India. A walled town surrounded by hills (except to the south), it was founded in 1727 by Maharaja Sawai Jai Singh to replace Amber as the capital of the princely state of Jaipur. The city, known for its beauty, is unique in its straight-line planning; its buildings are mostly rose-coloured, and it is sometimes called the "pink city." It is a popular tourist destination; historic structures include the city palace, the Hall of Winds, Ram Bagh palace, and Nahargarh, or Tiger Fort.

Jakarta \jə-ˈkär-tə\ *formerly (1949–72)* **Djakarta** Capital (pop., 1999 est.: 9,604,900) and largest city of Indonesia. Located on the northwestern coast of JAVA, it was founded in 1527 after the sultan of BANTAM defeated the Portuguese on the site. The Dutch took control in 1619, renaming it Batavia and establishing it as the headquarters of the Dutch EAST INDIA COMPANY. In 1949 the city was renamed and made Indonesia's capital. It grew rapidly, soon becoming one of the world's most populous cities. A major trade, industrial, and financial centre, it is also the seat of several universities.

Jakobson \ˈyä-kəb-sən**, Roman (Osipovich)** (b. Oct. 11, 1896, Moscow, Russia—d. July 18, 1982, Boston, Mass., U.S.) Russian-born U.S. linguist. Born and educated in Moscow, Jakobson moved to Prague in 1920; the European political situation forced him to flee to Scandinavia in 1938 and to the U.S. in 1941. He taught at Harvard University (1949–67). His interests ranged from folk epics and the cultural history of the Slavs to general PHONOLOGY, the MORPHOLOGY of the SLAVIC LANGUAGES, and speech acquisition. His preoccupation with contrast and opposition is reflected in his analysis of the Russian case system (1938), a brilliant analysis of the Russian verbal system (1948), and preeminently in his work on distinctive features in phonology.

Jalāl al-Dīn al-Rūmī See RŪMĪ

Jalapa \hä-ˈlä-pä\ *in full* **Jalapa Enríquez** City (pop., 2000: 373,076), capital of VERACRUZ state, east-central Mexico. It is located in the SIERRA MADRE Oriental about 4,700 ft (1,430 m) above sea level. A market city for locally grown coffee and tobacco, it was famous in colonial days for its annual fair, held to dispose of the goods brought from CÁDIZ, Spain, by the returning Spanish silver fleet. The massive Spanish-Moorish architecture of the city is reminiscent of viceregal days.

Jalisco \hä-ˈlēs-kō\ State (pop., 2000: 6,322,002), west-central Mexico. It covers 31,211 sq mi (80,836 sq km), and its capital is GUADALAJARA. The SIERRA MADRE Occidental mountain range traverses the state, separating the Pacific coast from a high plateau region. The Sierra Madre region is largely volcanic, and earthquakes are frequent. The state's many lakes include CHAPALA, Mexico's largest. First invaded by Spaniards in 1526, Jalisco was incorporated into Nueva Galicia. In 1889 its area was much reduced by the separation of the territory of Tepic (now NAYARIT state) from its coastal zone. Its economy is based on agriculture, livestock raising, forest products, and mining.

jam See JELLY AND JAM

Jamaica Island country, West Indies, located south of Cuba. The third largest island in the Caribbean, it is 146 mi (235 km) long and 35 mi (56 km) wide. Area: 4,244 sq mi (10,991 sq km). Population (2005 est.): 2,736,000. Capital: KINGSTON. The population consists mostly of descendents of African slaves. Languages: English (official), Jamaican Creole. Religions: Christianity (mainly Protestant; also Roman Catholic); also RASTAFARIANISM. Currency: Jamaica dollar. Jamaica has three major regions: the coastal lowlands, which encircle the island and are heavily cultivated; a limestone plateau, which covers half of the island; and the interior highlands, with forested mountain ranges, including the BLUE MOUNTAINS. Agriculture employs about one-fifth of the workforce, and the major agricultural export is raw sugar, with molasses and rum as by-products. Industry focuses on the production of bauxite and alumina and on the garment industry. Tourism is very important. Jamaica is a constitutional monarchy with two legislative houses. Its chief of state is the British monarch, represented by the governor-general, and its head of government is the prime minister. The island was settled by Arawak Indians c. AD 600. It was

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sighted by Christopher Columbus in 1494; Spain colonized it in the early 16th century but neglected it because it lacked gold reserves. Britain gained control in 1655, and by the end of the 18th century Jamaica had become a prized colonial possession because of the volume of sugar produced by slave labourers. Slavery was abolished in the late 1830s, and the plantation system collapsed. Jamaica gained full internal self-government in 1959 and became an independent country within the British Commonwealth in 1962. In the late 20th century the government, led by Michael Manley, nationalized many businesses.

Jamaica Bay Inlet of the Atlantic Ocean. It occupies about 20 sq mi (50 sq km) along the southwestern shore of Long Island, in southeastern New York, U.S. Part of the Port of New York, it is sheltered on the south by Rockaway Peninsula and connects with the ocean through Rockaway Inlet. Near the entrance channel is Coney Island. On the northeastern shore, at Idlewild, is the John F. Kennedy International Airport.

Jamāl al-Dīn al-Afghānī \jə-'mäl-ål-'dēn-ål-af-'gå-nē\ (b. 1838, Asadābād, Persia—d. March 9, 1897, Istanbul) Muslim politician and journalist. He is thought to have adopted the name Afghānī to conceal the fact that he was of Persian Shīʿite origin. He lived in Afghanistan from 1866, and a year later he became counselor to the khan. Displaced after a change of rulers, he went to Istanbul and then to Cairo in 1871. After becoming known as a rabble-rouser and heretic, he was deported from Egypt in 1879. By 1883 he was in Paris, where he championed Islamic civilization in the face of European domination. In Russia (1887–89) he seems to have worked as an anti-British agitator. His next stop was Iran, from which he was deported as a heretic in 1892; four years later he avenged himself by instigating the shah's murder. He died in Istanbul after failing to interest the sultan in his pan-Islamic ideas.

James, C(yril) L(ionel) R(obert) (b. Jan. 4, 1901, Tunapuna, Trin.—d. May 31, 1989, London, Eng.) Trinidadian writer and political activist. As a young man he moved to Britain, where his first work, *The Life of Captain Cipriani*, was published in 1929. His study of Toussaint-Louverture, *The Black Jacobins* (1938), was a seminal work. During James's first stay in the U.S. (1938–53), he became friends with Paul Robeson. Eventually deported to Britain because of his Marxism and labour activism, James wrote on cricket for *The Guardian*. His *Beyond the Boundary* (1963) mixes autobiography with commentary on politics and sports. He returned to the U.S. in 1970 but eventually settled permanently in Britain.

James, Harry (Haag) (b. March 15, 1916, Albany, Ga., U.S.—d. July 5, 1983, Las Vegas, Nev.) U.S. trumpeter and leader of one of the most popular big bands of the swing era. He joined Benny Goodman's band in 1937, becoming one of its principal soloists before forming his own group in late 1938. The band achieved commercial success through recordings featuring Frank Sinatra, virtuoso set pieces, and ballads performed with James's trademark wide vibrato. He married actress Betty Grable in 1943 and appeared in several films. An accomplished and technically brilliant improviser, his music from the late 1940s reflected his renewed interest in jazz, and he continued to perform with his band for more than 40 years.

James, Henry (b. April 15, 1843, New York, N.Y., U.S.—d. Feb. 28, 1916, London, Eng.) U.S.-British novelist. Born to a distinguished family, the brother of William James, he was privately educated. He traveled frequently to Europe from childhood on; after 1876 he lived primarily in England. His fundamental theme was to be the innocence and exuberance of the New World in conflict with the corruption and wisdom of the Old. *Daisy Miller* (1879) won him international renown; it was followed by *The Europeans* (1879), *Washington Square* (1880), and *The Portrait of a Lady* (1881). In *The Bostonians* (1886) and *The Princess Casamassima* (1886), his subjects were social reformers and revolutionaries. In *The Spoils of Poynton* (1897), *What Maisie Knew* (1897), and *The Turn of the Screw* (1898), he made use of complex moral and psychological ambiguity. *The Wings of the Dove* (1902), *The Ambassadors* (1903), and *The Golden Bowl* (1904) were his great final novels. His intense concern with the novel as an art form is reflected in the essay "The Art of Fiction" (1884), his prefaces to the volumes of his collected works, and his many literary essays. Perhaps his chief technical innovation was his strong focus on the individual consciousness of his central characters, which reflected his sense of the decline of public and collective values in his time.

Henry James, 1905.
SMITH COLLEGE ARCHIVES/PHOTOGRAPH BY KATHERINE E. MCCLELLAN

James, Jesse and James, Frank *in full* **Jesse Woodson James and Alexander Franklin James** (respectively b. Sept. 5, 1847, near Centerville, Mo., U.S.—d. April 3, 1882, St. Joseph, Mo.; b. Jan. 10, 1843, near Centerville, Mo.—d. Feb. 18, 1915, near Kearney, Mo.) Brothers who were among the most notorious outlaws of the American West. Jesse and Frank both fought as Confederate guerrillas in the American Civil War. In 1866 they and eight other men robbed a bank in Liberty, Mo. Joined by other outlaws in subsequent years, the James gang robbed banks from Iowa to Alabama and Texas. In 1873 the bandits began robbing trains; they also preyed upon stagecoaches, stores, and individuals. In 1876 Jesse led a failed attempt to rob a bank in Northfield, Minn.; though the brothers escaped, the rest of the gang was killed or captured. After assembling a new gang in 1879 the brothers resumed robbing, and in 1881 the governor of Missouri offered a $10,000 reward for the brothers' capture, dead or alive. In 1882 Jesse was shot in the back of the head and killed instantly by Robert Ford, a gang member, who claimed the reward. A few months later, Frank gave himself up. Tried and acquitted three times, he retired to a quiet life on his family's farm. The exploits of the James brothers were romanticized in pulp fiction and in movies.

James, Saint *or* **James the Great** (b. Galilee, Palestine—d. AD 44, Jerusalem; feast day July 25) One of the 12 Apostles of Jesus. He and his brother John (see St. John the Apostle) were fishermen on the Sea of Galilee and were among the first disciples to be called. As a member of the inner circle of disciples, he witnessed the major events in the ministry of Jesus, including the Transfiguration and the Agony in the Garden of Gethsemane. He was beheaded in AD 44 by order of Herod Agrippa. By tradition, his body was taken to Santiago de Compostela, Spain; his shrine there has long been a place of pilgrimage.

James, William (b. Jan. 11, 1842, New York, N.Y., U.S.—d. Aug. 26, 1910, Chocorua, N.H.) U.S. philosopher and psychologist. Son of the philosophical writer Henry James (1811–82) and brother of the novelist Henry James, he studied medicine at Harvard, where he taught from 1872.

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His first major work, *The Principles of Psychology* (1890), treated thinking and knowledge as instruments in the struggle to live. His most famous work is *The Varieties of Religious Experience* (1902). In *Pragmatism* (1907), he generalized the theories of Charles Sanders Peirce to assert that the meaning of any idea must be analyzed in terms of the succession of experiential consequences to which it leads and that truth and error depend solely on these consequences (see pragmatism). He applied this doctrine to the analysis of change and chance, freedom, variety, pluralism, and novelty. His pragmatism was also the basis for his polemic against monism, the idealistic doctrine of internal relations, and all views that presented reality as a static whole. He was also a leader of the psychological movement known as functionalism.

William James
COURTESY OF THE HARVARD UNIVERSITY NEWS SERVICE

James I *Spanish* **Jaime** *known as* **James the Conqueror** (b. Feb. 2, 1208, Montpellier, County of Toulouse—d. July 27, 1276) King of Aragon and Catalonia (1214–76). The most renowned of the medieval kings of Aragon, he was educated by the Knights Templar, and his great-uncle ruled as regent until 1218. James helped to subdue rebellious nobles and took over the government of his kingdoms in 1227. He reconquered the Balearic Islands (1229–35) and Valencia (1233–38) but renounced his claims to lands in southern France. He also helped Alfonso X to suppress a Moorish rebellion in Murcia (1266), and he undertook an unsuccessful Crusade to the Holy Land (1269).

James I (b. June 19, 1566, Edinburgh Castle, Edinburgh, Scot.—d. March 27, 1625, Theobalds, Hertfordshire, Eng.) King of Scotland, as James VI (1567–1625), and first Stuart king of England (1603–25). He was the son of Mary, Queen of Scots, and Lord Darnley, and at age one James succeeded his mother to the Scottish throne. Controlled by a succession of regents, he became the puppet of contending intriguers—Roman Catholics, who sought to bring his mother back to the throne, and Protestants. In 1583 he began to pursue his own policies as king, allying himself with England. On the death of Elizabeth I, he succeeded to the English throne as great-great-grandson of Henry VII. He quickly achieved peace and prosperity by ending England's war with Spain (1604). He presided over the Hampton Court Conference (1604), rejecting most of the Puritans' demands for reform of the Church of England but permitting preparation of a new translation of the Bible, the King James Version. His policies toward Catholics led to the Gunpowder Plot, and his growing belief in royal absolutism and his conflicts with an increasingly self-assertive Parliament led to his dissolution of Parliament from 1611 to 1621. With the death of Robert Cecil, he came under the influence of incompetent favourites.

James I (b. 1394—d. Feb. 20/21, 1437, Perth, Perth, Scot.) King of the Scots (1406–37). The son and heir of Robert III, he was captured by the English in 1406 and held prisoner in London until 1424. During the 13 years in which he truly ruled Scotland (1424–37), he established the first strong monarchy the Scots had known in nearly a century. He weakened the nobility but did not entirely subdue the Highland lords, and he greatly improved the administration of justice for the common people. His murder in a Dominican friary by a group of rival nobles led to a popular uprising in favour of his widow and six-year-old son, who succeeded him as James II.

James II *Spanish* **Jaime** *known as* **James the Just** (b. c. 1264—d. Nov. 3, 1327, Barcelona, Aragon) King of Aragon (1295–1327) and king of Sicily (as James I, 1285–95). He inherited the Sicilian crown on the death of his father (1285); when his brother died (1291) he inherited Aragon. He resigned Sicily (1295) and married the daughter of the king of Naples in order to make peace with the Angevins. Sardinia and Corsica were given to him in compensation for Sicily, but he was able to occupy only Sardinia (1324).

James II (b. Oct. 14, 1633, London, Eng.—d. Sept. 16/17, 1701, Saint-Germain, France) King of Great Britain (1685–88). He was brother and successor to Charles II. In the English Civil Wars he escaped to the Netherlands (1648). After the Restoration (1660) he returned to England and became lord high admiral in the Anglo-Dutch Wars. He converted to Catholicism c. 1668, and he resigned in 1673 rather than take the Test Act oath. By 1678 his Catholicism had created a climate of hysteria about a Popish Plot to assassinate Charles and put James on the throne, and successive Parliaments sought to exclude him from succession. By the time Charles died (1685), James came to the throne with little opposition and strong support from the Anglicans. Rebellions caused him to fill the army and high offices with Roman Catholics and suspend a hostile Parliament. The birth of his son, a possible Catholic heir, brought about the Glorious Revolution in 1688, and he fled to France. In 1689 he landed in Ireland to regain his throne, but his army was defeated at the Battle of the Boyne, and he returned to exile in France.

James II (b. Oct. 16, 1430, Edinburgh, Scot.—d. Aug. 3, 1460, Roxburgh Castle, Roxburgh) King of Scotland (1437–60). He succeeded to the throne on the assassination of his father, James I of Scotland. Because he was so young, the strong central authority his father had established quickly collapsed, and his first adult task was the restoration of monarchical authority. He strove to dominate the powerful Douglas family, and in 1452 he stabbed to death William, earl of Douglas, at Stirling Castle. He established a strong central government and improved the administration of justice. Turning his attention to the English, who had renewed their claims to rule Scotland, he attacked English outposts in Scotland and was killed during a siege of Roxburgh Castle.

James III (b. May 1452—d. June 11, 1488, near Stirling, Stirling, Scot.) King of Scotland (1460–88). He succeeded his father, James II. Unlike the latter, he was unable to restore strong central government after his long minority. A weak monarch, he was confronted with two major rebellions. He evidently offended his nobles by his interest in the arts and by taking artists for his favourites. In 1488 two powerful border families raised a rebellion and won to their cause his son, the future James IV; James III was captured and killed at age 36.

James IV (b. March 17, 1473—d. Sept. 9, 1513, near Branxton, Northumberland, Eng.) King of Scotland (1488–1513). He unified his country, gaining control over all northern and western Scotland by 1493. He fought border skirmishes with England (1495–97) in support of a pretender to the English throne. His marriage (1503) to Margaret Tudor, daughter of Henry VII, helped stabilize relations between the two countries, but in 1512 he allied with France against England. He invaded England in support of the French in 1513; his army was defeated at the Battle of Flodden, and James was killed.

James Bay Extension of Hudson Bay, located between northern Ontario and Quebec, Can. Generally less than 200 ft (60 m) deep, it is 275 mi (443 km) long and 135 mi (217 km) wide. It contains numerous islands, of which the largest is Akimiski Island. The many rivers that empty into the bay, including the Moose, are the cause of its low salinity. Visited by Henry Hudson in 1610, it is named for Capt. Thomas James, who explored it in 1631.

James Edward, the Old Pretender *orig.* **James Francis Edward Stuart** (b. June 10, 1688, London, Eng.—d. Jan. 1, 1766, Rome, Papal States) Claimant to the English and Scottish thrones. Son of the exiled James II of England, he was raised in France as a Catholic. On the death of his father (1701), he was proclaimed king of England by the French king Louis XIV, but the English Parliament passed a bill of attainder against him. He served with the French army in the War of the Spanish Succession. In the Jacobite uprising (1715), James landed in Scotland, but within two months the uprising collapsed and he returned to France. He lived thereafter in Rome under the pope's patronage. He became known as the "Old Pretender" to distinguish him from his son, Charles Edward, the Young Pretender.

James River *or* **Dakota River** River in the U.S. rising in central North Dakota and flowing southeast across South Dakota. It joins the Missouri River about 5 mi (8 km) below Yankton after a course of 710 mi (1,140 km). Major cities along the river include Jamestown, N.D., and Huron, S.D.

James River River, Virginia, U.S. Formed by the junction of the Jackson and Cowpasture rivers, it flows east across the Blue Ridge and past Richmond, then southeast to enter Chesapeake Bay through Hampton Roads after a course of 340 mi (550 km). The historic settlement of Jamestown lies on its lower course.

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James the Conqueror See James I (Aragon)

James the Just See James II (Aragon)

Jameson, Sir Leander Starr (b. Feb. 9, 1853, Edinburgh, Scot.—d. Nov. 26, 1917, London, Eng.) British administrator in southern Africa. As Cecil Rhodes's representative, Jameson successfully negotiated mineral concessions in Matabeleland and Mashonaland (present-day Zimbabwe) before becoming the first administrator of the new colony of Rhodesia in 1893. In 1895 Rhodes and Jameson plotted with Uitlander (British) leaders in the Transvaal to overthrow the Boer government of Paul Kruger; the original plan was postponed, but Jameson carried out his own invasion and was quickly captured with all his men. After imprisonment in England, he returned to participate in South African politics.

Jamestown Colony First permanent English settlement in North America. It was founded in May 1607 on a peninsula in the James River of Virginia. Named after King James I, Jamestown began cultivating tobacco and established the continent's first representative government (1619); the colony, its leader John Smith, and the Indian Pocahontas—who, according to lore, saved Smith's life—have been the subject of numerous novels, dramas, and films, many of them highly fanciful. When nearby Williamsburg replaced it as the capital of colonial Virginia in 1699, it fell into decline. By the mid-19th century, erosion had transformed the peninsula into Jamestown Island. In 1936 the site was incorporated into the Colonial National Historical Park.

Jāmī \'jȯ-ˌmē\ *orig.* **Mawlānā Nūr al-Dīn ʿAbd al-Raḥmān ibn Aḥmad** (b. Nov. 7, 1414, district of Jām—d. Nov. 9, 1492, Herāt, Timurid Afghanistan) Persian scholar, mystic, and poet. Despite offers of patronage by many Islamic rulers, he led a simple life, mostly in Herāt. His prose ranges from Qur'ānic commentaries to treatises on Sufism and music. His poetry expresses ethical and philosophical views in fresh, graceful language. His best known poetry collection is *The Seven Thrones* (or *Ursa Major*). He is often called the last great mystical poet of Iran.

Jamison, Judith (b. May 10, 1943, Philadelphia, Pa., U.S.) U.S. dancer and choreographer. In 1965 she joined Alvin Ailey's American Dance Theater; she became celebrated for her energetic grace and riveting stage presence and inspired many of Ailey's new dances, most notably *Cry* (1971). She left the company in 1980 to star in the Broadway musical *Sophisticated Ladies*. She toured worldwide in the 1980s and choreographed for various companies. In 1988 she founded her own troupe, the Jamison Project, but, after Ailey's death in 1989, she returned to the Ailey troupe as artistic director, becoming the first African American woman to direct a major modern dance company.

Jammu \'jə-mü\ City (pop., 2001 prelim.: 378,431) and winter capital of Jammu and Kashmir state, northwestern India. It lies along the Tawi River, south of Srinagar. Once the capital of the Dogra Rajput dynasty, it became part of Ranjit Singh's domain in the 19th century. It is now a railroad and manufacturing centre. Sites of interest include a fort, a palace of the rajas, and the University of Jammu (founded 1969).

Jammu and Kashmir State (pop., 2001: 10,143,700), northern India. With an area of 39,146 sq mi (101,387 sq km), it occupies the southern portion of the Kashmir region of the northwestern Indian subcontinent and is bordered by the portions of Kashmir administered by Pakistan and China and by the Indian states of Himachal Pradesh and Punjab. The land is predominantly mountainous and includes segments of the Karakoram and Himalaya ranges. Much of Kashmir's Ladakh region is included in the state. There are two major lowland areas: the Jammu plain and the fertile and heavily populated Vale of Kashmir. The majority of the state's people are Muslims, although Hindus predominate in the southeastern Jammu area, and northeastern Ladakh is largely Buddhist. Formerly a princely state created in the 1840s, Jammu and Kashmir became an Indian state in 1947, even as India and Pakistan were fighting for control of the entire Kashmir region. A cease-fire line, established in 1949, has since served as the state's boundary with the Pakistan-administered area. Tension has remained high in the region, and there have been periodic outbreaks of border fighting.

Janáček \'yä-nə-ˌchek**, Leoš (Eugen)** (b. July 3, 1854, Hukvaldy, Moravia, Austrian Empire—d. Aug. 12, 1928, Ostrava, Czech.) Czech (Moravian) composer. Son of a church musician, he worked as a teacher and choral conductor until age 40. When his marriage ended in 1887, he began his first opera and spent the next year collecting folk songs. In 1894 he began his first mature opera, *Jenufa*, in a folk-influenced style; completed nearly a decade later, it had a successful premiere in Brno (1904), and he retired to compose full-time, becoming music's most extraordinary late bloomer. Major works of his last two decades include the *Glagolitic Mass* (1927) and the operas *Kát'a Kabanová* (1921), *The Cunning Little Vixen* (1924), *The Makropulos Affair* (1925), and *From the House of the Dead* (1928). A late love affair inspired the *Kreutzer* and *Intimate Pages* string quartets (1923, 1928).

Leoš Janáček.
EASTFOTO

Jane Seymour (b. 1509?, England—d. Oct. 24, 1537, Hampton Court, London) Third wife of Henry VIII of England. A lady-in-waiting to Henry's wives Catherine of Aragon and Anne Boleyn, she first attracted Henry's attention c. 1535 but refused to be his mistress. This probably hastened Anne Boleyn's downfall and execution (1536), after which Jane and Henry were married privately. She restored Henry's daughter Mary (later Mary I) to his favour and gave birth to his only male heir, the future Edward VI, but she died 12 days later, to Henry's genuine sorrow.

Janissary \'ja-nə-ˌser-ē\ *also spelled* **Janizary** \'ja-nə-ˌzer-ē\ *Turkish* **Yeniçeri ("New Troop")** Elite corps of the Ottoman Empire's army from the late 14th to the early 19th century. Its original soldiers were prisoners of war, but a system soon was developed (the *devşirme*) wherein Christian youths were levied from Balkan vassals, converted to Islam, and—though paid a regular salary—inducted into the ranks of the sultan's slaves. They were, for the most part, infantry troops conscripted to replace the often-unreliable Turkish tribal cavalry (spahi). Strict early rules of behaviour, including celibacy, were later abandoned, and the Janissaries became active in court politics. In 1826 they rebelled rather than accept the reform of the army along European lines. The revolt was violently put down, and most of the Janissaries were killed.

Jansen \'yän-sən,\ *English* \'jan-sən**, Cornelius Otto** (b. Oct. 28, 1585, Acquoi, near Leerdam, Holland—d. May 6, 1638, Ypres, Flanders, Spanish Neth.) Flemish leader of the Roman Catholic reform movement known as Jansenism. He studied at the University of Louvain, where he absorbed the teachings of St. Augustine, especially those concerning original sin and the need for grace. He spent 1611–14 in Bayonne, France, where he directed the episcopal college. After studying theology three more years, he returned to Louvain. He became rector of the university in 1635 and a year later was appointed bishop of Ypres. In 1638 he died of the plague. His major work, the *Augustinus,* was published in 1640; in 1642 Pope Urban VIII forbade the reading of the book.

Jansenism Roman Catholic reform movement inspired by the writings of Cornelius Jansen. Influenced by the works of St. Augustine and especially by Augustine's attacks on Pelagianism and the doctrine of free will, Jansen adopted Augustine's doctrines of predestination and the necessity of God's grace, a stance considered uncomfortably close to Calvinism by Roman Catholic authorities, who banned his book the *Augustinus* in 1642. After Jansen's death in 1638, his followers made their base at the abbey in Port-Royal, France. Blaise Pascal, the most famous Jansenist, defended their teachings in his *Provincial Letters* (1656–57). In 1709 Louis XIV ordered the Port Royal abbey demolished. Followers of Jansen started a Jansenist church in 1723, which endured into the late 20th century.

Jansky, Karl (Guthe) (b. Oct. 22, 1905, Norman, Okla., U.S.—d. Feb. 14, 1950, Red Bank, N.J.) U.S. engineer. He graduated from the University of Wisconsin and went to work for Bell Telephone Laboratories. Assigned to track down sources of static that could interfere with radiotelephone communication, he discovered (1931) the first extraterrestrial source of radio waves, emanating from the constellation Sagittarius in the direction of the Milky Way Galaxy's centre. The discovery proved that celestial bodies could emit radio waves and marked the beginning of radio astronomy.

Janus \'jā-nəs\ Roman god of doorways and archways, after whom the month of January is named. Often depicted as a double-faced head, he was a deity of beginnings. The worship of Janus dated back to the earliest years of Rome, and the city had many freestanding ceremonial gate-

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ways called *jani*, used for symbolically auspicious entrances or exits. The most famous was the Janus Geminus, whose double doors were left open in time of war and closed when Rome was at peace. The festival of Janus, the Agonium, took place on January 9.

The god Janus, beardless, Roman coin; in the Bibliothèque Nationale, Paris
LAROUSSE

Japan Island country, East Asia, western Pacific Ocean. Its four main islands are Hokkaido, Honshu, Shikoku, and Kyushu. It is separated from the Asian mainland by the Sea of Japan (East Sea). Area: 145,903 sq mi (377,887 sq km). Population (2005 est.): 128,085,000. Capital: Tokyo. The Japanese overwhelmingly are a single Asian ethnic group. Language: Japanese (official). Religions: Shintō, Buddhism; also Christianity. Currency: yen. Situated in one of Earth's most geologically active zones, Japan experiences volcanic eruptions and earthquakes. Mountain ranges cover some four-fifths of its land surface; its highest mountain is Mount Fuji. The economy, one of the world's biggest, is based largely on manufacturing and services; exports include electronic and electrical equipment, motor vehicles, chemicals, and iron and steel products. The government's involvement in banking results in unique cooperation between the public and private sectors. Japan is one of the world's principal seagoing nations, with an important marine fishing sector. It is a constitutional monarchy with two legislative houses; its symbol of state is the emperor, and the head of government is the prime minister. Human habitation in Japan is thought to date to at least 30,000 years ago. The Yamato court established the first unified Japanese state in the 4th–5th century AD; during that period, Buddhism arrived in Japan by way of Korea. For centuries Japan borrowed heavily from Chinese culture, but it began to sever its links with the mainland by the 9th century. The Fujiwara family were dominant through the 11th century. In 1192 Minamoto Yoritomo established Japan's first bakufu, or shogunate (see Kamakura period). The Muromachi period (1338–1573) was marked by warfare among powerful families. Unification was achieved in the late 16th and early 17th centuries under the leadership of Oda Nobunaga, Toyotomi Hideyoshi, and Tokugawa Ieyasu. During the Edo (Tokugawa) period (1603–1867), the government imposed a policy of isolation. Under the leadership of the emperor Meiji (1867–1912), it adopted a constitution (1889) and began a program of modernization and Westernization. Japanese imperialism led to war with China (1894–95) and Russia (1904–05) as well as to the annexation of Korea (1910) and Manchuria (1931). During World War II Japan attacked U.S. forces in Hawaii and the Philippines (December 1941) and occupied European colonial possessions in Southeast Asia. In 1945 the U.S. dropped atomic bombs on Hiroshima and Nagasaki, and Japan surrendered to the Allies. A new democratic constitution was drafted (1947) during the U.S. postwar occupation. Japan also began rebuilding its ruined industrial base using new technology. A tremendous economic recovery followed, and Japan became one of the world's wealthiest countries. It was able to maintain a favourable balance of trade despite a long-term economic recession. See map on following page.

Japan, Sea of *or* **East Sea** Branch of the western Pacific Ocean, bounded by Japan, by Sakhalin Island, and by Russia and Korea on the Asian mainland. It has a surface area of about 377,600 sq mi (978,000 sq km), a mean depth of 5,748 ft (1,752 m), and a maximum depth of 12,276 ft (3,742 m). Its relatively warm waters contribute greatly to the mild climate of Japan. The growing trade among East Asian countries has increased its use as a commercial waterway.

Japanese beetle Scarab beetle (Popillia japonica) that is a major pest of plants. Introduced accidentally from Japan into the U.S. in 1916, Japanese beetles are known to feed on more than 200 species of plant. Their larvae feed underground on roots; adults feed on flowers, fruit, and foliage. They range from Maine to South Carolina, and infestations have occurred in other parts of North America. The adult, about 0.4 in. (10 mm) long, is bright metallic green with coppery-brown wing covers. Control efforts include the use of poisonous sprays and a disease-inducing bacterium and introduction of the beetle's natural enemies (certain parasitic wasp and fly species).

Japanese crab See king crab

Japanese language Language spoken by about 125 million people on the islands of Japan, including the Ryukyus. The only other language of the Japanese archipelago is Ainu (see Ainu), now spoken by only a handful of people on Hokkaido, though once much more widespread. Japanese is not closely related to any other language, though a distant genetic kinship to Korean is now thought probable by some scholars, and an even more remote relationship to the Altaic languages is possible. Japanese is first attested in the 8th century AD, when Middle Chinese characters were utilized solely for their phonetic value to write native Japanese words. Japanese retains a huge stock of loanwords from Middle Chinese, long adapted to native phonetics.

Japanese law Law as it has developed in Japan as a consequence of the combination of two cultural and legal traditions, one indigenous Japanese, the other Western. In the 8th century Japan borrowed and adapted the legal system of the Chinese Tang dynasty. With the rise of the warrior class, clan codes governing the behaviour and actions of warrior families were developed. After the Meiji Restoration (1868), Japan began to borrow heavily from European legal systems, particularly the German Civil Code. After World War II, largely as a result of the country's occupation by the U.S. military and later contacts with U.S. legal scholars, Japan incorporated aspects of the U.S. legal system, including various civil procedures and elements of labour and business law. Traditional extralegal dispute-resolution methods remain strong, and litigation plays a less pervasive role than in the U.S.

Japanese philosophy Conceptual expression of Japanese culture since early 6th century AD. Japanese philosophy is not generally indigenous; Japanese thinkers have always skillfully assimilated alien philosophical categories in developing their own systems. One of the two principal schools of Japanese thought arose from Buddhism and was highly tinged with a religious and often somewhat metaphysical character. The second school arose from Confucianism and was essentially a system of moral philosophy. Since the Meiji Restoration (1868), Western philosophy has been abundantly introduced into Japan. At first British and American philosophies predominated, but in the 20th century the influence of German philosophy became increasingly strong; leading Japanese philosophers were especially influenced by German idealism, phenomenology, and existentialism. To distinguish Western philosophy from Buddhist and Chinese thought, the term *tetsugaku* ("wise learning") was coined and has come into common use.

Japanese writing system System of modified Chinese characters used for writing the Japanese language. The Japanese developed a mixed system, partly logographic (based on the Chinese writing system) and partly syllabic. In the 9th or 10th century two sets of syllabic signs evolved: *hiragana*, simplified cursive versions of Chinese characters; and *katakana*, based on elements of Chinese characters. Modern Japanese is written with the two syllabaries and Chinese characters.

Japurá \ˌzhä-pü-ˈrä\ **River** River, northwestern South America. It rises as the Caquetá River in the Cordillera Central of the Andes Mountains in southwestern Colombia. Afterward it flows through southeastern Colombia and is joined by the Apaporis River at the Brazilian border, where it takes the name Japurá and flows eastward to join the Amazon River. Its total length, including the Caquetá, is about 1,750 mi (2,820 km). It has a strong current and is navigable by small boats in Brazil.

Jaques-Dalcroze \ˈzhäk-ˌdal-ˈkrōz**, Émile** (b. July 6, 1865, Vienna, Austria—d. July 1, 1950, Geneva, Switz.) Swiss music educator and composer. He studied composition with Anton Bruckner, Gabriel Fauré, and Léo Delibes, and in 1892 he became professor of harmony at the Geneva Conservatory. In the early 20th century he experimented with new methods of music education, which evolved into eurythmics, a system in which bodily movements are used to represent musical rhythms. In 1914, having left the conservatory, he founded the Institut Jaques-Dalcroze in Geneva to teach and promulgate his new method.

Jari River *or* **Jary** \zhä-ˈrē\ **River** River, northern Brazil. It flows southeast for about 350 mi (560 km) to join the Amazon River at Bôca do Jari. The Jari forms the border between Pará and Amapá states, and its lower course is navigable. Since the late 1960s the river's valley has been the focus of large-scale development for lumber production.

Jarrell \ja-ˈrel**, Randall** (b. May 6, 1914, Nashville, Tenn., U.S.—d. Oct. 14, 1965, Chapel Hill, N.C.) U.S. poet and critic. He taught at the

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University of North Carolina (Greensboro) from 1947 until his death. As a critic, he revitalized the reputations of Robert Frost, Walt Whitman, and William Carlos Williams in the 1950s; his criticism is collected in *Poetry and the Age* (1953), *A Sad Heart at the Supermarket* (1962), and the posthumous *Third Book of Criticism* (1969). His poems appeared in *Little Friend, Little Friend* (1945) and *Losses* (1948), both drawing on his wartime experiences, and such later collections as *The Seven-League Crutches* (1951) and *The Woman at the Washington Zoo* (1960). He was killed when he stepped in front of a moving car.

Jarrett, Keith (b. May 8, 1945, Allentown, Pa., U.S.) U.S. jazz pianist, composer, and bandleader. He played with Art Blakey (1965–66) and with Miles Davis's jazz-rock group (1970–71) before making a series of solo recordings that won him broad popularity. His trio (from 1966) with bassist Charlie Haden (b. 1937) and drummer Paul Motian (b. 1931), later expanded to a quartet (1971–76), was highly regarded. By the 1980s his public performance had turned mainly to classical recitals.

Jarry \zhä-'rē**, Alfred** (b. Sept. 8, 1873, Laval, France—d. Nov. 1, 1907, Paris) French writer. He went to Paris to live on his inheritance at age 18; after exhausting it, he led a life of calculated buffoonery. His farce *Ubu Roi* (1896), considered a forerunner of theatre of the absurd and of Surrealism, featured the grotesque Père Ubu, who becomes king of Poland. Jarry followed it with two sequels, one of which was published posthumously. The brilliant imagery and wit of his stories, novels, and poems usually lapse into incoherence and unintelligible symbolism. A heavy drinker, he died at 34.

Jaruzelski \ˌyär-ü-'zel-skē**, Wojciech (Witold)** (b. July 6, 1923, Kurow, Pol.) Polish army general and chief of state (1981–89) and president (1989–90) of Poland. He rose through the ranks of the army and the Communist Party to be elected premier and first secretary of the party in 1981 as Poland came under increasing pressure from the Solidarity movement. He declared martial law (1981–83), carrying out mass arrests of dissidents. Unable to restore Poland's stagnant economy, he began negotiations in 1988 with Solidarity, culminating in agreements to reform Poland's political system. Elected president in 1989, he resigned his posts in the Communist Party. In 1990 Lech Wałęsa was elected president, and Jaruzelski relinquished the last of communist power in Poland.

jasmine \'jaz-mən\ Any of about 300 tropical and subtropical species of fragrant, flowering, woody, climbing shrubs that make up the genus *Jasminum* of the olive family, native to all continents except North America. The jasmine used in perfumery and aromatherapy comes from the fragrant white flowers of common, or poet's, jasmine (*J. officinale*), native to Iran. The dried flowers of Arabian jasmine (*J. sambac*) make jasmine tea. Many fragrant-flowered plants from other families are also commonly called jasmine.

Winter jasmine (*Jasminum nudiflorum*)
VALERIE FINNIS

Jason In Greek legend, the leader of the Argonauts. He was the son of Aeson, king of Iolcos in Thessaly. Raised by Chiron after his father's half-brother Pelias seized Iolcos, he returned as a young man and was promised his inheritance if he could bring back the Golden Fleece. After an adventurous voyage, he won the fleece with the help of Medea. He married her, and the two returned to Iolcos, where Medea murdered Pelias. Driven out by Pelias's son, they sought refuge with King Creon of Corinth. When Jason deserted Medea for Creon's daughter, Medea killed her own children by Jason.

jasper Opaque, fine-grained or dense variety of the silica mineral chert that exhibits various colours, but chiefly brick red to brownish red. Long used for jewelry and ornamentation, it has a dull lustre but takes a fine polish; its physical properties are those of quartz. Jasper is common and widely distributed, occurring in the Ural Mountains, North Africa, Sicily, Germany, and elsewhere. For thousands of years, black jasper was used to test gold-silver alloys for their gold content. Rubbing the alloys on the stone, called a touchstone, produces a streak the colour of which determines the gold content within 1 part in 100.

Jasper National Park National park, western Alberta, Can. Located on the eastern slopes of the Rocky Mountains, it was established in 1907. It occupies 4,200 sq mi (10,878 sq km), including the Athabasca River valley and the surrounding mountains. It encompasses part of the great Columbia Icefield, the meltwaters of which feed rivers that flow to the Atlantic, Pacific, and Arctic oceans. The park's wildlife includes bear, elk, moose, caribou, and cougar.

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Jaspers \'yäs-pərs**, Karl (Theodor)** (b. Feb. 23, 1883, Oldenburg, Ger.—d. Feb. 26, 1969, Basel, Switz.) German-Swiss philosopher and psychiatrist. As a research psychiatrist, he helped establish psychopathology on a rigorous, scientifically descriptive basis, especially in his *General Psychopathology* (1913). He taught philosophy at the University of Heidelberg from 1921 until 1937, when the Nazi regime forbade him to work. From 1948 he lived in Switzerland, teaching at the University of Basel. In his magnum opus, *Philosophy* (3 vol., 1969), he argued that the aim of philosophy is practical; its purpose is the fulfillment of human existence (*Existenz*). For Jaspers, philosophical illumination is achieved in the experience of limit situations, such as conflict, guilt, and suffering, that define the human condition. In its confrontation with these extremes mankind achieves its existential humanity. He is one of the most important figures of EXISTENTIALISM.

Jassy See IAŞI

Jassy \'yä-sē**, Treaty of** (Jan. 9, 1792) Pact signed at Jassy in Moldavia (modern Iaşi, Rom.), at the conclusion of the RUSSO-TURKISH WARS. The treaty confirmed Russian dominance in the Black Sea by advancing the Russian frontier to the Dniester River. It also restored Bessarabia, Moldavia, and Walachia to the Ottoman Turks.

jaundice Excess BILE pigments (bilirubin) in the bloodstream and tissues, causing a yellow to orange—even greenish—colour in the skin, the whites of the eyes, and the mucous membranes. Bilirubin may be overproduced or inadequately removed by the LIVER or leak into the bloodstream after removal; jaundice may also be due to impaired bile flow. Causes include ANEMIA, PNEUMONIA, and liver disorders (e.g., infection or CIRRHOSIS). While bilirubin excess usually does no harm, retention jaundice signals severe liver malfunction.

Jaurès \zhō-'res**, (Auguste-Marie-Joseph-) Jean** (b. Sept. 3, 1859, Castres, France—d. July 31, 1914, Paris) French socialist leader. He served in the Chamber of Deputies (1885–89, 1893–98, 1902–14) and at first adopted the ideas of ALEXANDRE MILLERAND. After 1899 the socialists split into two groups, and Jaurès headed the FRENCH SOCIALIST PARTY, advocating reconciliation with the state. In the newspaper *L'Humanité*, which he cofounded in 1904, he espoused democratic socialism, but when the SECOND INTERNATIONAL (1904) rejected his position he acquiesced. In 1905 the two French socialist parties united, and his authority continued to grow. On the eve of World War I, he espoused peace through arbitration and championed Franco-German rapprochement, which earned him the hatred of French nationalists, and he was assassinated in 1914 by a young nationalist fanatic. He wrote several books, including the influential *Socialist History of the French Revolution* (1901–07).

Jean Jaurès.
H. ROGER-VIOLLET

Java \'jä-vä\ *Indonesian* **Djawa** Island (pop., 2000 prelim.: 121,352,608), Indonesia. Lying southeast of SUMATRA, it is Indonesia's fourth largest island, and it contains more than half of the country's population. Its area, including offshore Madura Island, is 49,228 sq mi (127,499 sq km). The capital of Java and of Indonesia is JAKARTA. The island's highest point is Mount Semeru, an active volcano measuring 12,060 ft (3,676 m) high. It is inhabited by three major ethnic groups: the Javanese (who constitute 70% of the population), the Sundanese, and the Madurese. The fossilized remains of *HOMO ERECTUS*, or "Java man," indicate that the island was occupied some 800,000 years ago. Indian traders began arriving in the 1st century AD, bringing Hindu influences. The Majapahit dynasty was founded in eastern Java in 1293; it fell early in the 16th century when Muslim kingdoms arose. In 1619 the Dutch EAST INDIA COMPANY took control of Batavia (Jakarta) and extended its influence. Ruled by the Dutch until the 1940s when it was occupied by Japan, it became part of newly independent Indonesia in 1950.

Java Modular OBJECT-ORIENTED PROGRAMMING LANGUAGE developed by Sun Microsystems in 1995 specifically for the INTERNET. Java is based on the idea that the same SOFTWARE should run on many different kinds of computers, consumer gadgets, and other devices; its code is translated according to the needs of the machine on which it is running. The most visible examples of Java software are the interactive programs called "applets" that animate sites on the WORLD WIDE WEB, where Java is a standard creative tool. Java provides an interface to HTML.

Java man Common name of fossilized *HOMO ERECTUS* remains found in 1891 at Trinil, Java. The remains, a skullcap and thighbone, represent the first known fossils of *H. erectus* (though originally assigned to *Pithecanthropus erectus*) and, together with numerous other finds along the Solo River, suggest that *H. erectus* was present in eastern Asia some 1,000,000 years ago and persisted there for at least 500,000 years and possibly as long as 800,000 years. Java man predates the finds at ZHOUKOUDIAN (Peking Man) in China and is considered somewhat more primitive.

Java Sea Part of the western Pacific Ocean between JAVA and BORNEO islands. Measuring 900 mi (1,450 km) long by 260 mi (420 km) wide, it occupies a total area of 167,000 sq mi (433,000 sq km). A shallow sea, it has a mean depth of 151 ft (46 m). It was the scene of a World War II naval battle (1942) that resulted in an Allied defeat and Japan's invasion of Java.

Javanese Any member of the largest ethnic group on the island of JAVA, Indonesia. They speak an AUSTRONESIAN LANGUAGE. The Javanese are Muslim, though relatively few are strictly observant. Traditional Javanese social organization varied in structure from relatively egalitarian villages to the highly stratified society of the cities; these differences find expression in the many Javanese styles of speech still in use. Javanese villages are compact groups of single-family houses, generally built of bamboo, surrounding a central square. Rice is the main food crop. The growth of large cities in Java has produced an urban underclass who live in makeshift huts in enclosed neighbourhoods.

JavaScript Computer PROGRAMMING LANGUAGE developed by Netscape in 1995 for use in HTML pages. JavaScript is a scripting language (or interpreted language), which is not as fast as compiled languages (such as JAVA or C++) but easier to learn and use. It is only loosely related to Java, and is not a true object-oriented language (see OBJECT-ORIENTED PROGRAMMING). JavaScript can be quickly added to a pure HTML page to provide dynamic features, such as automatically calculating the current date or activating an action. The JavaScript code must be interpreted and executed by a BROWSER as it reads the Web page or by a Web server before it delivers the page to the browser.

javelin See PECCARY

javelin throw TRACK-AND-FIELD sport of throwing a wooden or metal spear for distance. It is hurled after a short run and must land point-first. The men's javelin is 8.5 ft (260 cm) long, the women's 7.2 ft (220 cm). Included in the ancient Greek Olympic Games as part of the PENTATHLON, the javelin throw has been part of the modern Olympic program since its inception in 1896. A women's event was added in 1932. See also DECATHLON; HEPTATHLON.

jaw Either of two bones that frame the MOUTH: a movable lower jaw (mandible) and a fixed upper jaw (maxilla). These hold the teeth (see TOOTH) and are used for biting and chewing and in speech. Vertical portions at the back of the lower jaw form hinge joints at the temples. The front of its arch thickens to form the chin. The upper jaw is attached to bones at the bridge of the nose, in the eye sockets and roof of the mouth, and the cheekbones. It contains the large maxillary SINUS.

Jawlān, Al- See GOLAN HEIGHTS

Jawlensky \yəv-'lān-skē**, Alexey** *orig.* **Aleksei Iavlenskii** (b. March 13, 1864, Torzhok, Russia—d. March 15, 1941, Wiesbaden, Ger.) Russian-born German painter. He gave up a military career to study painting, and in 1896 he moved to Munich, where he became affiliated with Der BLAUE REITER. In France in 1905 he worked with HENRI MATISSE. Back in Munich he produced works featuring flat areas of vibrant Fauve colour outlined with simple, thick contours. In Switzerland during World War I he painted a series of "variations" on the view from his window. Their meditative mood culminated in such semiabstract faces as *Looking Within Night* (1923), whose mystical intensity is reminiscent of Russian icon painting. In 1924 he joined VASILY KANDINSKY, PAUL KLEE, and LYONEL FEININGER to form Der Blaue Vier ("The Blue Four"); they exhibited together until arthritis forced Jawlensky to abandon painting.

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Jaxartes River See Syr Darya

jay Any of 35–40 bird species (family Corvidae) that inhabit woodlands and are known for their bold, raucous manner. Most are found in the New World, but several are Eurasian. Jays are nearly omnivores; some steal eggs, and many store seeds and nuts for winter use. They make a twiggy, cuplike nest in trees. The 12-in. (30-cm) blue jay, blue and white with a narrow black neckline, is found in North America east of the Rockies; westward it is replaced by the dark-blue, black-crested Steller's jay. Another abundant species is the scrub jay, found throughout western North America and in Florida.

Blue jay (*Cyanocitta cristata*)
JOHN H. GERARD

Jay, John (b. Dec. 12, 1745, New York, N.Y.—d. May 17, 1829, New Bedford, N.Y., U.S.) U.S. jurist, first chief justice of the Supreme Court of the United States. He practiced law in New York City. Though he initially deplored the growing conflict between Britain and the colonies, he became a staunch supporter of independence once the revolution was launched. He helped assure the approval of the Declaration of Independence (1776) in New York, where he was a member of the provincial Congress. The following year he helped draft New York's first constitution and was elected the state's first chief justice, and in 1778 he was chosen president of the Continental Congress. In 1782 he joined Benjamin Franklin in Paris to negotiate terms of peace with Britain. On his return from abroad, Jay found that Congress had elected him secretary for foreign affairs (1784–90). Convinced of the need for a stronger centralized government, he urged ratification of the U.S. Constitution. Under the pseudonym Publius, he wrote five of the essays that later became known as the Federalist papers (the others were written by James Madison and Alexander Hamilton); published in New York newspapers in 1787–88, the essays were a masterly defense of the Constitution and republican government. As the first chief justice of the Supreme Court (1789–95), he set legal precedent by affirming the subordination of the states to the federal government. In 1794 he was sent to Britain to negotiate a treaty dealing with numerous commercial disputes. The Jay Treaty helped avert war, but critics contended that it was too favourable to Britain. Jay resigned from the court and was elected governor of New York (1795–1801).

Jaya, Mount *Indonesian* **Puncak Jaya** *formerly* **Mount Sukarno** Peak, Papua (Irian Jaya) province, Indonesia. Located on New Guinea, the 16,500-ft (5,030-m) peak is the highest in the South Pacific and the tallest island peak in the world.

Jayavarman \ˌjä-yä-ˈvär-mən\ **VII** (b. c. 1120/25—d. c. 1215/19) King of the Khmer (Cambodian) empire of Angkor (r. 1181–c. 1215). Born into the royal family of Angkor, he settled in the Champa kingdom (present-day central Vietnam) in his young adulthood and engaged in military campaigns. In his late fifties he led his people in a struggle for independence after their subjugation by the Cham. He was crowned king of a reconstituted Khmer empire at 61. He ruled more than 30 years and brought the empire to its zenith in terms both of territorial extent and of royal architecture and construction. Champa, southern Laos, and portions of the Malay Peninsula and Myanmar (Burma) came under his control. He built temples, hospitals, and rest houses, and rebuilt the city of Angkor (now called Angkor Thom). His dedication to both the spiritual and physical needs of the people has made him a national hero to modern Cambodians.

Jayewardene \ˌjä-ye-ˈwär-di-nə**, J(unius) R(ichard)** (b. Sept. 7, 1906, Colombo, Ceylon—d. Nov. 1, 1996, Colombo, Sri Lanka) Prime minister (1977–78) and president (1978–89) of Sri Lanka. The son of a Supreme Court judge, he became minister of finance in 1948, when Ceylon (from 1972, Sri Lanka) became independent. As prime minister, he amended the constitution to give Sri Lanka an executive presidency and became the first elected president in 1978. His administration steered the country away from socialism, revitalizing the private sector and reducing government bureaucracy. When ethnic conflict erupted between the island's Sinhalese Buddhist majority and its Tamil Hindu minority, he was unable to end the violence, which continued after his retirement and death.

Jazā'irī, 'Abd al-Qādir ibn Muḥyī al-Dīn ibn Muṣṭafā al-Ḥasanī al- See Abdelkader

Jazeera, Al- *or* **al-Jazīrah** Arabic-language cable news network founded in Qatar in 1996. It was established by the emir of Qatar and was transmitted from its capital, Doha, and from bureaus around the world. It began continuous programming in 1999. The editorial freedom exercised by its staff was unique in the Middle East, and its broadcasts were occasionally blocked by Arab states. It was the only network to broadcast from Kabul during the 2001 U.S.-led campaign in Afghanistan.

Jazernicki, Yitzhak See Yitzhak Shamir

Jazīrah, Al- See Gezira

jazz Musical form, often improvisational, developed by African Americans and influenced by both European harmonic structure and African rhythms. Though its specific origins are not known, the music developed principally as an amalgam in the late-19th- and early 20th-century musical culture of New Orleans. Elements of the blues and ragtime in particular combined to form harmonic and rhythmic structures upon which to improvise. Social functions of music played a role in this convergence: whether for dancing or marching, celebration or ceremony, music was tailored to suit the occasion. Instrumental technique combined Western tonal values with emulation of the human voice. Emerging from the collective routines of New Orleans jazz (see Dixieland), trumpeter Louis Armstrong became the first great soloist in jazz; the music thereafter became primarily a vehicle for profoundly personal expression through improvisation and composition. Elaboration of the role of the soloist in both small and large ensembles occurred during the swing era (c. 1930–45), the music of pianist and bandleader Duke Ellington in particular demonstrating the combination of composed and improvised elements. In the mid-1940s saxophonist Charlie Parker pioneered the technical complexities of bebop as an outgrowth of the refinement of swing: his extremes of tempo and harmonic sophistication challenged both performer and listener. The trumpeter Miles Davis led groups that established the relaxed aesthetic and lyrical phrasing that came to be known as cool jazz in the 1950s, later incorporating modal and electronic elements. Saxophonist John Coltrane's music explored many of the directions jazz would take in the 1960s, including the extension of bebop's chord progressions and experimental free improvisation.

Jeans, Sir James (Hopwood) (b. Sept. 11, 1877, London, Eng.—d. Sept. 16, 1946, Dorking, Surrey) British physicist and mathematician. After teaching at Cambridge and Princeton, he worked as a research associate at the Mount Wilson Observatory (1923–44). He proposed that matter was continuously created throughout the universe (see steady-state theory). He wrote on a wide variety of phenomena but is perhaps best known as a writer of popular books about astronomy.

Jeddah See Jiddah

jeep Outstanding light vehicle of World War II, developed by the U.S. Army Quartermaster Corps. It weighed 1.25 tons, had a four-cylinder engine, and could climb 60° grades and operate on rough terrain thanks to its four-wheel drive and high clearance. The origin of it name is uncertain; one theory traces it to the military designation "vehicle, GP" (i.e., general-purpose). Since the war the jeep has been adapted for civilian use, though it has been replaced in the U.S. military by the High Mobility Multipurpose Wheeled Vehicle (HMMWV), or Humvee.

Jeffers, (John) Robinson (b. Jan. 10, 1887, Pittsburgh, Penn., U.S.—d. Jan. 20, 1962, Carmel, Calif., U.S.) U.S. poet. Born to a wealthy family, he was educated in literature, medicine, and forestry. His lyrics express contempt for humanity and love of the harsh, eternal beauties of nature, notably the California coast near Carmel, where he moved in 1916. His third book, *Tamar and Other Poems* (1924), cemented his reputation and revealed the unique style and eccentric ideas he later developed in *Cawdor* (1928), *Thurso's Landing* (1932), and *Be Angry at the Sun* (1941).

Jefferson, Thomas (b. April 13, 1743, Shadwell, Va.—d. July 4, 1826, Monticello, Va., U.S.) Third president of the U.S. (1801–09). He was a planter and became a lawyer in 1767. While a member of the House of Burgesses (1769–75), he initiated the Virginia Committee of Correspondence (1773) with Richard Henry Lee and Patrick Henry. In 1774 he wrote the influ-

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ential *A Summary View of the Rights of British America*, stating that the British Parliament had no authority to legislate for the colonies. A delegate to the Second Continental Congress, he was appointed to the committee to draft the Declaration of Independence and became its primary author. He was elected governor of Virginia (1779–81) but was unable to organize effective opposition when British forces invaded the colony (1780–81). Criticized for his conduct, he retired, vowing to remain a private citizen. Again a member of the Continental Congress (1783–85), he drafted the first of the Northwest Ordinances for dividing and settling the Northwest Territory. In 1785 he succeeded Benjamin Franklin as U.S. minister to France. Appointed the first secretary of state (1790–93) by George Washington, he soon became embroiled in a bitter conflict with Alexander Hamilton over the country's foreign policy and their opposing interpretations of the Constitution. Their divisions gave rise to political factions and eventually to political parties. Jefferson served as vice president (1797–1801) under John Adams but opposed Adams's signing of the Alien and Sedition Acts (1798); the Virginia and Kentucky Resolutions, adopted by the legislatures of those states in 1798 and 1799 as a protest against the Acts, were written by Jefferson and James Madison. In the presidential election of 1800 Jefferson and Aaron Burr received the same number of votes in the electoral college; the decision was thrown to the U.S. House of Representatives, which chose Jefferson on the 36th ballot. As president, Jefferson attempted to reduce the powers of the embryonic federal government and to eliminate the national debt; he also dispensed with a great deal of the ceremony and formality that had attended the office of president to that time. In 1803 he oversaw the Louisiana Purchase, which doubled the land area of the country, and he authorized the Lewis and Clark Expedition. In an effort to force Britain and France to cease their molestation of U.S. merchant ships during the Napoleonic Wars, he signed the Embargo Act. In 1809 he retired to his plantation, Monticello, where he pursued his interests in science, philosophy, and architecture. He served as president of the American Philosophical Society (1797–1815), and in 1819 he founded and designed the University of Virginia. In 1812, after a long estrangement, he and Adams were reconciled and began a lengthy correspondence that illuminated their opposing political philosophies. They died within hours of each other on July 4, 1826, the 50th anniversary of the signing of the Declaration of Independence. Though a lifelong slaveholder, Jefferson was an anomaly among the Virginia planter class for his support of gradual emancipation. In January 2000 the Thomas Jefferson Memorial Foundation accepted the conclusion, supported by DNA evidence, that Jefferson had fathered at least one child with Sally Hemings, one of his house slaves.

Jefferson City City (pop., 2000: 39,636), capital of Missouri, U.S. Located on the Missouri River near the centre of the state, it was selected as the site of the state capital in 1821. Named for Thomas Jefferson, it was incorporated as a town in 1825 and as a city in 1839. Loyalties were divided during the American Civil War, but it remained in the Union. The Capitol, completed in 1918, contains murals by Thomas Hart Benton. It is the trading centre for surrounding farmlands and has diversified manufacturing. Lincoln University was founded there by black veterans of the Union army in 1866.

Jeffreys, Sir Harold (b. April 22, 1891, Fatfield, Durham, Eng.—d. March 18, 1989, Cambridge, Cambridgeshire) British astronomer and geophysicist. In astronomy, he established that the four large outer planets (Jupiter, Saturn, Uranus, and Neptune) are very cold, devised models of their planetary structure, and studied the origin of the solar system and the theory of latitude. In geophysics, he investigated the thermal history of the Earth, was coauthor (1940) of the standard tables of travel times for earthquake waves, and was the first to hypothesize that the Earth's core is liquid. He explained the origin of monsoons and sea breezes and showed how cyclones are vital to the general circulation of the atmosphere. Jeffreys also worked on probability theory and on methods of general mathematical physics.

Jehangir See Jahāngīr

Jehovah's Witness Member of an international religious movement founded in Pittsburgh, Pa., by Charles T. Russell in 1872. The movement was originally known as the International Bible Students Association, but its name was changed by Russell's successor, Joseph Franklin Rutherford (1869–1942). The Witnesses are a millennialist group whose beliefs are based primarily on the apocalyptic sections of the Bible, notably Daniel and the Book of Revelation. They refuse to perform military service or salute the flag, actions which have brought them into direct conflict with governments around the world. They are famous for their door-to-door evangelizing and for refusing blood transfusions; they believe there is scriptural justification for all their actions and beliefs. Their goal is the establishment of God's kingdom on earth, and they hold that Jesus—who is believed to be God's first creation rather than one person in a trinity—is God's agent in this plan. Their national headquarters is in Brooklyn, N.Y.; their major publications, the *Watchtower* and *Awake!*, are published in about 80 languages. See also millennialism.

Jekyll, Gertrude (b. Nov. 29, 1843, London, Eng.—d. Dec. 8, 1932, London) British landscape architect. She pursued painting until 1891, when she turned to garden design. She helped the landscape designer William Robinson (1838–1935) in his writings about the natural garden and wrote several successful books on her own, including *Wood and Garden* (1899) and *Home and Garden* (1900). Her taste was for the simplicity and orderly disorder of cottage gardens. She later worked closely with Edwin L. Lutyens, developing a modern, informal style of garden marked by a rhythmic use of colour and form.

Jelinek, Elfriede (b. Oct. 20, 1946, Mürzzuschlag, Austria) Austrian novelist and playwright. At age 17 she suffered an emotional breakdown, and during her recovery she turned to writing as a form of self-expression and introspection. A polemical feminist, Jelinek often wrote about gender oppression and female sexuality. She also rejected the conventions of literary tradition in favour of linguistic and thematic experimentation. Among her notable novels are *Wonderful, Wonderful Times* (1980), *The Piano Teacher* (1983; filmed 2001), and *Lust* (1989). She also wrote a number of plays, including *Clara S.* (1984) and *Bambiland* (2003). In 2004 Jelinek won the Nobel Prize for Literature.

Jellicoe, John Rushworth Jellicoe, 1st Earl (b. Dec. 5, 1859, Southampton, Hampshire, Eng.—d. Nov. 20, 1935, London) British admiral. He entered the Royal Navy in 1872 and rose through the ranks to become commander of the fleet during World War I (1914–16). He won a crucial victory in the Battle of Jutland (1916), after which he was promoted to first sea lord of the Admiralty (1916–17) and admiral of the fleet (1919). He served as governor of New Zealand (1920–24).

Jellinek \'je-li-ˌnek**, Elvin M(orton)** (b. Aug. 15, 1890, New York, N.Y., U.S.—d. Oct. 22, 1963, Palo Alto, Calif.) U.S. physiologist. He studied at the University of Leipzig and worked in Budapest, Sierra Leone, and Honduras before returning to the U.S., where he studied alcoholism. He was an early proponent of the theory that alcoholism should be treated as a disease. He gathered and summarized his and others' research in the authoritative *Alcohol Explored* (1942) and *The Disease Concept of Alcoholism* (1960).

jelly and jam Thick preserves made from fruit and sugar. Jelly is semitransparent, consisting of the strained juice of various fruits (occasionally vegetables), singly or in combination, that is sweetened, slowly simmered, and congealed, often with the aid of pectin or gelatin. Jam differs from jelly in its inclusion of fruit pulp or whole fruit; whole-fruit jam is sometimes called preserve. Fruit jellies and jams are eaten on breakfast breads and in sandwiches and accompany the scones and other baked goods of the British tea meal. Vegetable and herb jellies traditionally complement lamb and other meat dishes.

jellyfish Any of about 200 described species of free-swimming marine cnidarians (in the classes Scyphozoa and Cubozoa), many of which have a bell-shaped body. The term is also frequently applied to other similar cnidarians (e.g., Portuguese man-of-war) and some unrelated forms (e.g., ctenophores and salps). In scyphozoan jellyfish, the free-swimming medusa form is the dominant stage, with the sessile polyp form found only during larval development. Jellyfish live in all oceans and include the familiar disk-shaped animals that are often found drifting along the shoreline. Most species are 1–16 in. (2–40 cm) in diameter; some are 6 ft (1.8 m) in diameter, with tentacles more than 100 feet (30 m) long. Though some jellyfish simply filter-feed, most feed on small animals (e.g., crustaceans) that they catch in their tentacles, whose stinging cells immobilize the prey; contact can be irritating and sometimes dangerous to humans. The cubozoan jellyfish comprise 50 species of box jellies (the rather spherical body is squared off at the edges), which are usually 1–2 in. (2–4 cm) in diameter. See illustration on following page.

Jemison, Mae (Carol) (b. Oct. 17, 1956, Decatur, Ala., U.S.) U.S. physician and astronaut. She received an M.D. from Cornell University and then served in the Peace Corps in Africa. In 1988 she was accepted to NASA's astronaut program and became the first black female astro-

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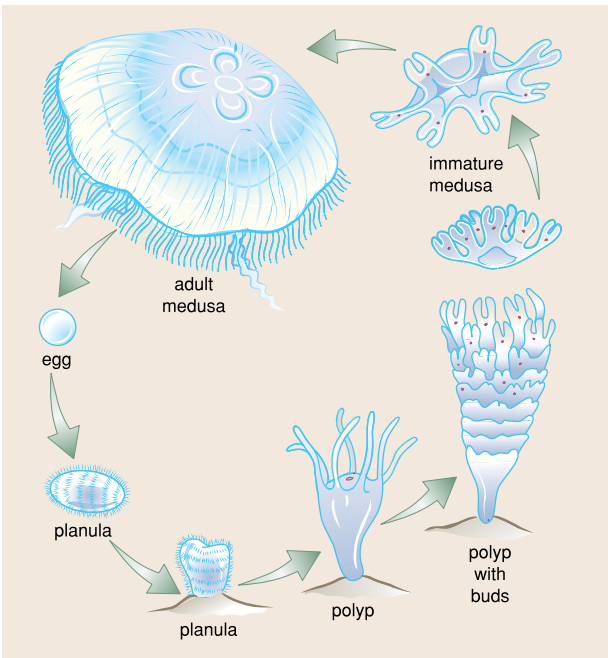

Life cycle of the common jellyfish *Aurelia*. Eggs released by females pass out through the mouth and become lodged in pits on the tentacles. Sperm released from male jellyfish fertilize the eggs, which remain on the tentacles during early development. A fertilized egg develops into a ciliated larva, or planula, which settles on and attaches to a substrate (such as a rock) and develops into a polyp with a mouth and tentacles. The polyp reproduces asexually by budding off saucer-shaped immature medusae, which develop into mature sexually reproducing forms.
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naut. In 1992 she spent more than a week aboard the space shuttle *Endeavour*. After leaving NASA in 1993, she taught environmental studies at Dartmouth College.

jen See REN

Jena and Auerstedt \'yä-nə...'aù-ər-ˌshtet**, Battles of** (1806) Military engagement of the NAPOLEONIC WARS, fought between French troops and Prussians and Saxons. In 1806 FREDERICK WILLIAM III of Prussia signed a secret alliance with Russia and joined the Third Coalition against NAPOLEON. As the Prussian army moved through Saxony to meet its Russian allies, it was forced to face a French attack from the rear. The Prussians split their forces between Auerstedt and Jena, and on October 14 Napoleon swept the Prussian troops off the field at Jena. At the same time, a secondary French force under LOUIS DAVOUT defeated a Prussian army more than twice its size at Auerstedt. Napoleon completed his conquest of Prussia in six weeks.

Jenkins, Fergie *in full* **Ferguson Arthur Jenkins** (b. Dec. 13, 1943, Chatham, Ont., Can.) Canadian-born U.S. baseball pitcher. In high school Jenkins excelled in amateur baseball, basketball, and hockey. He began his major league career with the Philadelphia Phillies in the early 1960s, before playing for the Chicago Cubs, the Texas Rangers, and the Boston Red Sox, winning at least 20 games in each of six consecutive seasons (1967–72) and setting several season records. He was awarded the Cy Young award in 1971 for his 24–13 won-lost record and 2.77 earned run average.

Jenkins (of Hillhead), Roy (Harris) Jenkins, Baron (b. Nov. 11, 1920, Abersychan, Monmouthshire, Eng.—d. Jan. 5, 2003, Oxfordshire) British politician. Elected to Parliament in 1948, he served in Labour Party governments (1964–70, 1974–76). A strong supporter of NATO and the European Community, he was president of the executive branch of the latter (1976–81). He resigned from the Labour Party, and in 1981, with other Labour dissidents, he formed the Social Democratic Party, which he led in 1982–83. After accepting a life peerage (1987), he became leader of the Social and Liberal Democratic Party in the House of Lords. He subsequently became chancellor of the University of Oxford.

Jenkins' Ear, War of War between Britain and Spain that began in 1739 and eventually merged into the War of the AUSTRIAN SUCCESSION. In 1738 Capt. Robert Jenkins appeared before a committee of the House of Commons and exhibited his own amputated ear, which he alleged was cut off by Spanish coast guards who boarded his ship in the West Indies in 1731. Public opinion had already been aroused by other Spanish outrages on British ships, and the incident was exploited by members of Parliament who opposed the government of ROBERT WALPOLE.

Jenner, Edward (b. May 17, 1749, Berkeley, Gloucestershire, Eng.—d. Jan. 26, 1823, Berkeley) English surgeon, discoverer of the smallpox vaccine. He was apprenticed to a surgeon at 13, and at 21 he became the house pupil of JOHN HUNTER, who gave him further training and stressed the need for experimentation and observation. Jenner had noticed as a youth that people who had been sick with the relatively harmless disease cowpox did not contract SMALLPOX. In 1796 he inoculated a young boy with matter taken from a dairymaid's fresh cowpox lesions. The boy caught cowpox and, when subsequently inoculated with smallpox, did not contract it. Despite early difficulties, the procedure spread and the death rate from smallpox fell. Jenner received worldwide recognition (though he was also subject to attacks and slander). He retired from public life in 1815 after the death of his wife.

Edward Jenner, detail of an oil painting by James Northcote, 1803; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Jensen \'yen-sən**, Georg** (b. Aug. 31, 1866, Raadvad, Den.—d. Oct. 2, 1935, Copenhagen) Danish silversmith and designer. At age 14 he was apprenticed to a goldsmith, and in 1904 he opened his own workshop in Copenhagen. Exhibiting his silverware and jewelry at major foreign exhibitions, he quickly built a reputation as an outstanding and original silversmith. He was the first to realize a profit from the manufacture of modern silverware and among the first to fashion steel into handsome, serviceable cutlery. By 1935 his firm had stores all over the world and carried more than 3,000 patterns. After his death the business was continued by his son, Søren Georg Jensen (b. 1917).

Jensen \'yen-sən**, Johannes V(ilhelm)** (b. Jan. 20, 1873, Farsø, Den.—d. Nov. 25, 1950, Copenhagen) Danish novelist, poet, and essayist. He initially studied medicine but later turned to writing. He first made an impression as a writer of tales, including the more than 100 published under the recurring title *Myths*. His early writings also include a historical trilogy, *The Fall of the King* (1900–01), about CHRISTIAN II of Denmark. His best-known work is *The Long Journey* (1908–22), a series of six novels that chronicles humanity's rise from primitive times to the time of CHRISTOPHER COLUMBUS's arrival in the Americas. He received the Nobel Prize for Literature in 1944.

Jephtha \'jef-thə\ One of the judges in ancient Israel. According to the Book of Judges, he was the son of a Gileadite and a prostitute. After being cast out by his father's legitimate sons, he joined a band of brigands. When the Gileadites were oppressed by an Ammonite army, they asked Jephtha to aid them. He led them to victory, having first promised God a sacrifice of whatever he first saw when he left his house; his first sight happened to be his daughter. His significance in the Book of Judges is as an exemplar of Israel's fidelity to God.

Jeremiah (b. probably after 650, Anathoth, Judah—d. c. 570 BC, Egypt) Hebrew PROPHET and reformer, author of the book of Jeremiah. Born into a priestly family in a village near Jerusalem, he began to preach c. 627 BC, charging his fellow citizens with injustice and false worship and calling on them to reform. He accurately predicted the destruction of JUDAH by Babylonia. After Jerusalem fell in 586 and much of its population was carried into exile, he remained behind under the protection of its new governor. When the governor was assassinated, Jeremiah was taken to

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Egypt by Jews who feared reprisals, and he remained there until he died. His most significant prophecy looked to a time when God would make a new covenant with Israel.

Jeremiah, detail from a fresco by Michelangelo in the Sistine Chapel, Rome, *c.* 1512
ALINARI—ART RESOURCE/EB INC.

Jericho *Arabic* **Arīḥā** Town (pop., 1997: 14,674), West Bank territory. Inhabited since c. 9000 BC, it is famous in biblical tradition as the first town attacked by the Israelites under Joshua after they crossed the Jordan River. It was abandoned or destroyed several times and rebuilt in the same area. Captured by the British in 1918, it became part of the British mandate of Palestine. Incorporated into Jordan in 1950, it became the site of two huge camps of Arab refugees following the first Arab-Israeli war (1948). In the Six-Day War (1967), the town was occupied by Israel, and much of the refugee population was dispersed. In 1994 it was turned over to the Palestinian Authority under an Israeli-Palestinian self-rule agreement.

Jerome, Chauncey (b. June 10, 1793, Canaan, Conn., U.S.—d. April 20, 1868, New Haven, Conn.) U.S. inventor and clockmaker. In 1824 he designed a popular bronze looking-glass clock, and he formed a company that soon became the leading U.S. clockmaker. He invented the one-day brass movement, an improvement over the wood clock. Applying mass-production techniques, he flooded the U.S. with low-priced brass clocks, which quickly spread to Europe and so astonished the English that "Yankee ingenuity" became a byword.

Jerome, Saint (b. c. 347, Stridon, Dalmatia—d. 419/420, Bethlehem, Palestine) Church Father and biblical translator. Born into a wealthy Christian family in Dalmatia, he was educated there and in Rome. Baptized c. 366, he spent most of the next 20 years in travel. He lived two years as a hermit in the desert of Chalcis. From 377 to 379 Jerome was in Antioch, where he studied biblical texts and translated the works of Origen and Eusebius. He lived in Rome (382–85), but theological controversy and opposition to his ascetic views led him to depart for the Holy Land, and he settled in Bethlehem, where he lived until his death. Traditionally regarded as the most learned of the Latin Fathers, he wrote numerous biblical commentaries and theological tracts on Pelagianism and other heresies. In 406 he completed his translation of the Bible into Latin, including his own translation of the Old Testament from Hebrew; Jerome's Latin Bible is known as the Vulgate.

Jersey Largest and southernmost of the Channel Islands, in the English Channel. Area: 44.9 sq mi (116.2 sq km). Population (2002 est.): 87,400. Capital: St. Helier (pop., 2001: 28,310). Separated from Normandy in 1204, it kept its Norman law and local customs but was administered for the British king by a warden. It was given legislative authority in 1771. It is now governed by a popularly elected assembly, which is presided over by a royally appointed bailiff. There is also a lieutenant governor, who represents the British monarch. Jersey fabric and Jersey cattle take their names from the island.

Jersey Breed of small, short-horned dairy cattle that originated on Jersey in the English Channel. They are believed to have descended from French cattle. Jerseys are usually fawn- or cream-coulored, but darker shades are common. They were introduced in large numbers into England c. 1811 and into the U.S. in 1850. Adaptable to a wide range of conditions, the Jersey is found worldwide. Its milk is remarkably high in butterfat, and it is an important breed wherever butter is produced (including New Zealand and Denmark).

Jersey City City (pop., 2000: 240,055), northeastern New Jersey, U.S. It lies opposite New York City. First settled by Dutch trappers (1618) and known as Paulus Hook, it was purchased from the Delaware Indians and established as a permanent settlement by 1660. In 1779, during the American Revolution, Henry Lee won a victory there over the British. Renamed Jersey City in 1820, it is a manufacturing centre.

Jerusalem *Hebrew* **Yerushalayim** \ye-ˌrü-shä-ˈlī-im\ *Arabic* **Al-Quds** \ȧl-ˈküts\ City (pop., 2005 est.: 704,900), capital of Israel (see below). Located in the heart of historic Palestine, it is nestled between the West Bank and Israel. The Old City is a typical walled Middle Eastern enclosure; the modern city is an urban agglomeration of high-rises and housing complexes. It is holy to Judaism as the site of the Temple of Jerusalem, to Christianity because of its association with Jesus, and to Islam because of its connection with the Miʿrāj (the Prophet Muhammad's ascension to heaven). Jewish shrines include the Western Wall. Islamic holy places include the Dome of the Rock. In 1000 BC David made it the capital of Israel. Razed by the Babylonians in the 6th century BC, it thereafter enjoyed only brief periods of independence. The Romans devastated it in the 1st and 2nd centuries AD, banishing the Jewish population. From 638 it was ruled by various Muslim dynasties, except for short periods during the Crusades when it was controlled by Christians. Rule by the Ottoman Empire ended in 1917, and the city became the capital of the British mandate of Palestine. It was thereafter the subject of competing Zionist and Palestinian national aspirations. Israel claimed the city as its capital after the Arab-Israeli War in 1948 and took the entire city during the Six-Day War of 1967. Its status as Israel's capital has remained a point of contention: official recognition by the international community has largely been withheld pending final settlement of regional territorial rights.

Jerusalem, Council of Conference of the Christian Apostles at Jerusalem c. AD 50, which decreed that Gentile Christians did not have to observe the Mosaic law of the Jews. It was occasioned by the controversy over whether circumcision was necessary for Gentile converts to Christianity. Led by Sts. Peter the Apostle and James, the council decided the issue in favor of St. Paul and the Gentile Christians, thus helping to separate early Christianity from Judaism.

Jerusalem, Temple of Either of two temples that were at the centre of worship and national identity in ancient Israel. When David captured Jerusalem, he moved the Ark of the Covenant there. As the site for a temple, he selected Mount Moriah, or the Temple Mount, where it was believed that Abraham had built his altar to sacrifice Isaac. The First Temple was constructed under David's son Solomon and was completed in 957 BC. It contained three rooms: a vestibule, the main room for religious services, and the Holy of Holies. From the time of Josiah, it was designated as the only place for sacrifice in Judah. It was destroyed during the Babylonian conquest in 586 BC. When the Jews returned from exile in 538, they built the Second Temple (finished 515). Its desecration by Antiochus IV in 167 BC set off the Maccabees' revolt, after which it was cleansed and rededicated. In 54 BC Marcus Licinius Crassus plundered the Temple. It was rebuilt and enlarged by Herod the Great; construction lasted 46 years. The Jewish rebellion in AD 66 led to its destruction by Roman legions in AD 70. All that remains is part of the Western Wall, a site of pilgrimage. The Temple Mount is now occupied by a Muslim mosque, Al-Aqṣā, and the Dome of the Rock.

Jerusalem artichoke Sunflower (*Helianthus tuberosus*) native to North America and grown for its edible tubers. The aboveground part of the plant is a coarse, usually multibranched, frost-tender perennial, 7–10 ft (2–3 m) tall. The numerous showy flower heads have yellow ray flowers and yellow, brownish, or purplish disk flowers. The underground tubers vary in shape, size, and colour. Jerusalem artichoke is popular as a cooked vegetable in Europe and has long been cultivated in France as livestock feed. In the U.S. it is rarely cultivated.

Jervis Bay Inlet of the Tasman Sea, southeastern New South Wales, Australia. It is about 10 mi (16 km) long and 6 mi (10 km) wide. It was discovered in 1770 and named Long Nose by Capt. James Cook, but in 1791 it was renamed for Adm. John Jervis. In 1915 it was transferred from the jurisdiction of New South Wales to the Australian Commonwealth to provide the Australian Capital Territory with access to the sea. The bay is a resort area and the site of the Royal Australian Naval College (founded 1915).

Jespersen \ˈyes-pər-sən**, (Jens) Otto (Harry)** (b. July 16, 1860, Randers, Den.—d. April 30, 1943, Roskilde) Danish linguist. He led a movement for basing foreign-language teaching on conversational speech rather than textbook study of grammar and vocabulary, helping to revolutionize language teaching in Europe. An authority on English grammar, Jespersen contributed greatly to the advancement of phonetics and linguistic theory. His many published works include *Modern English Gram-*

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mar, 7 vol. (1909–49), *Language: Its Nature, Development, and Origin* (1922), and *The Philosophy of Grammar* (1924). He originated Novial, an international language.

jester See FOOL

Jesuit \'je-zü-ət\ Member of the Roman Catholic order of religious men called the Society of Jesus. First organized by St. Ignatius of LOYOLA in 1534 at the University of Paris, the order was approved by Pope Paul III in 1540. It discontinued many practices of medieval religious life, such as obligatory penances and fasts and a common uniform, and instead focused on military-style mobility and adaptability. Its organization was characterized by centralized authority, probation lasting many years before final vows, and special obedience to the pope. The Jesuits served as a preaching, teaching, and missionary society, actively promoting the COUNTER-REFORMATION, and by the time of Ignatius's death in 1556 their efforts were already worldwide. The success of their enterprise and their championship of the pope earned them much hostility from both religious and political foes. Under pressure from France, Spain, and Portugal, Pope Clement XIV abolished the order in 1773, but it was restored by Pius VII in 1814. The Jesuits have since become the largest male religious order.

Jesuit Estates Controversy Canadian dispute between Protestants and Roman Catholics after reestablishment of the JESUIT order. After the pope suppressed the Jesuits in 1773, their landholdings in Canada were transferred to the British government. The pope restored the order in 1814, and some Jesuits returned to Canada in 1842. Restitution for their land was discussed, and the Jesuits' Estates Act (1888) gave $400,000 in compensation.

Jesus In CHRISTIANITY, the son of God and the second person of the Holy TRINITY. Christian doctrine holds that by his CRUCIFIXION and resurrection he paid for the sins of all mankind. His life and ministry are recounted in the four GOSPELS of the NEW TESTAMENT. He was born a Jew in Bethlehem before the death of HEROD the Great in 4 BC, and he died while Pontius Pilate was Roman governor of Judaea (AD 28–30). His mother, MARY, was married to Joseph, a carpenter of Nazareth (see St. JOSEPH). Of his childhood after the birth narratives in Matthew and Luke, nothing is known, except for one visit to Jerusalem with his parents. He began his ministry about age 30, becoming a preacher, teacher, and healer. He gathered disciples in the region of GALILEE, including the 12 APOSTLES, and preached the imminent arrival of the KINGDOM OF GOD. His moral teachings, outlined in the SERMON ON THE MOUNT, and his reported miracles won him a growing number of followers, who believed that he was the promised MESSIAH. On Passover he entered Jerusalem on a donkey, where he shared the Last Supper with his disciples and was betrayed to the Roman authorities by JUDAS ISCARIOT. Arrested and tried, he was condemned to death as a political agitator and was crucified and buried. Three days later visitors to his tomb found it empty. According to the Gospels, he appeared several times to his disciples before ascending into heaven.

jet engine Any of a class of INTERNAL-COMBUSTION ENGINES that propel aircraft by means of the rearward discharge of a jet of fluid, usually hot exhaust gases generated by burning fuel with air drawn in from the atmosphere. Jets rely on the third of NEWTON'S LAWS OF MOTION (action and reaction are equal and opposite). The first jet-powered airplane was introduced in 1939 in Germany. The jet engine, consisting of a gas-turbine system, significantly simplified propulsion and enabled substantial increases in aircraft speed, size, and operating altitudes. Modern types of jet engines include TURBOJETS, turbofans, TURBOPROPS, turboshafts, and RAMJETS. See AIRPLANE. See also DRAG; GASOLINE ENGINE; LIFT.

jet lag Period of adjustment of BIOLOGICAL RHYTHM after moving from one time zone to another, experienced as fatigue and lowered efficiency. It reflects a delay in the synchronization of changes in the level of blood cortisol, the major STEROID produced by the adrenal cortex (see ADRENAL GLAND), with the local day-night cycle. Duration and severity depend on how much distance is covered in how little time. Travel by jet, after which the phenomenon may persist for some days, first made it noticeable, accounting for the name.

jet stream Any of several long, narrow, high-speed air currents that flow eastward in a generally horizontal zone in the STRATOSPHERE or upper TROPOSPHERE. Jet streams are characterized by wind motions that generate strong vertical shearing action, considered largely responsible for the clear-air turbulence experienced by aircraft. They also have an effect on weather patterns. Jet streams circle the Earth in meandering paths, shifting position as well as speed with the seasons. In the winter they are nearer the Equator and their speeds are higher than in the summer. There are often two, sometimes three, jet-stream systems in each hemisphere.

Jew Any person whose religion is JUDAISM. In a wider sense the term refers to any member of a worldwide ethnic and cultural group descended from the ancient Hebrews who traditionally practiced the Jewish religion. The Hebrew term *Yehudi*, translated as *Judaeus* in Latin and *Jew* in English, originally referred to a member of the tribe of JUDAH. In Jewish tradition, any child born of a Jewish mother is considered a Jew; in REFORM JUDAISM a child is considered a Jew if either parent is Jewish.

Jewel Cave National Monument National monument, southwestern South Dakota, U.S. Established in 1908, it occupies an area of 2 sq mi (5 sq km). It is noted for its limestone caverns, a series of chambers joined by narrow passages. The known length of the caverns is 77 mi (124 km).

jewelry Objects designed for the adornment of the body, usually made of gold, silver, or platinum, often with precious or semiprecious stones and such organic substances as pearls, coral, and amber. Jewelry evolved from shells, animal teeth, and other objects used as adornment in prehistoric times. Over the centuries it came to be a sign of social or religious rank. In Renaissance Italy, jewelry making reached the status of a fine art; many Italian sculptors trained as goldsmiths. From the 17th century the decorative function of jewelry again came to the fore, overshadowing its symbolic significance. By the 19th century, industrialization brought jewelry within the reach of the middle class. Firms opened by jewelers such as CARL FABERGÉ and LOUIS COMFORT TIFFANY achieved great success by making fine jewelry for the wealthy.

Jewett, (Theodora) Sarah Orne (b. Sept. 3, 1849, South Berwick, Maine, U.S.—d. June 24, 1909, South Berwick) U.S. writer. Concerned to capture the folkways of a vanishing culture, she wrote realistic sketches of aging Maine natives, whose manners, idioms, and pithiness she recorded with pungency and humour. Outstanding among her 20 volumes are *Deephaven* (1877), *A White Heron* (1886), and *The Country of the Pointed Firs* (1896).

jewfish Any of several large fishes of the SEA BASS family (Serranidae), especially *Epinephelus itajara*, found on the Atlantic coast of the New World tropics. They may reach a length of 8 ft (2.4 m) and a weight of about 700 lbs (320 kg). The adult is dull olive-brown with faint spots and bands and is usually solitary. The South Pacific jewfish (*E. lanceolatus*) may exceed 12 ft (3.7 m) in length. The Warsaw GROUPER (*E. nigritus*) and giant sea bass (*Stereolepis gigas*) are both occasionally called jewfish, and three Australian species in the genera *Johnius* and *Glaucosoma* are called jewfish.

Jewish calendar See Jewish CALENDAR

Jewish philosophy Any of various kinds of reflective thought engaged in by those identified as being Jews. In the Middle Ages, this meant any methodical and disciplined thought pursued by Jews, whether on specifically Judaic themes or not; in modern times, philosophers who do not discuss Judaism are not ordinarily classified as Jewish philosophers. Philosophy arose in Judaism under Greek influence, though a philosophical approach may be discerned in early Jewish religious works apparently uninfluenced by the Greeks. From the Bible, the books of Job and Ecclesiastes were favourite works of medieval philosophers; the book of Proverbs introduces the concept of Wisdom (*Hokhma*), which was to have primordial significance for Jewish philosophical thought; and the Wisdom of Solomon had considerable influence on Christian theology. Major figures of Jewish philosophy include PHILO JUDAEUS, SAADIA BEN JOSEPH, MOSES MAIMONIDES, and BENEDICT DE SPINOZA.

Jezebel \'je-zə-ˌbel\ (d. c. 843 BC) In the Hebrew scriptures, the wife of King AHAB of Israel. The daughter of the priest-king Ethbaal of Tyre and Sidon, she persuaded Ahab to introduce the worship of the Tyrian god Baal-Melkart into Israel, thus interfering with the exclusive worship of Yahweh. The book of 1 Kings tells how she was opposed by ELIJAH. After Ahab's death Jezebel's son Jehoram became king of Israel, but ELISHA encouraged a general, Jehu, to revolt. Jehoram was killed, and Jezebel was thrown from a window to her death. Dogs consumed most of her body, fulfilling a prophecy by Elijah. In history and literature she became the archetype of the wicked woman.

Jhabvala \'jäb-vä-lə**, Ruth Prawer** *orig.* **Ruth Prawer** (b. May 7, 1927, Cologne, Ger.) German-born British-U.S. novelist and screen-

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writer. Born to a family of Polish Jews, she immigrated to England with her family in 1939. She married an Indian architect and moved to India, where she lived until 1975. Thereafter she lived in New York. Many of her novels, including *Heat and Dust* (1975, Booker Prize), are set in India. She has written original screenplays for such films as *Shakespeare-Wallah* (1965) and film adaptations of such novels as *The Bostonians* (1984), *A Room with a View* (1985), *Howards End* (1992), *The Remains of the Day* (1993), and *The Golden Bowl* (2000).

Jharkhand State (pop., 2001 prelim.: 26,909,428), northeastern India. It is bordered by BIHAR, WEST BENGAL, ORISSA, CHHATTISGARH, and UTTAR PRADESH states and occupies 28,833 sq mi (74,677 sq km); its capital is Ranchi. The state lies mainly on the Chota Nagapur Plateau, a series of plateaus, hills, and valleys. Many aboriginal peoples live there. The area now constituting Jharkhand was a part of Bihar state after Indian independence in 1947 until it was made into a separate state in 2000. It is rich in minerals (notably copper), although most of the population is engaged in agriculture.

Jhelum \ˈjā-ləm\ **River** River, India and Pakistan. The westernmost of the "Five Rivers" of the Punjab region, it rises in the HIMALAYAS in the Indian state of JAMMU AND KASHMIR. It meanders northwest in the Pakistani-administered sector of the KASHMIR region. Bending southward, it joins the CHENAB RIVER, having traveled a course of 450 mi (725 km). It is believed to be the Hydaspes mentioned by Arrian, ALEXANDER THE GREAT's historian, and the Bidaspes mentioned by PTOLEMY.

Jhering \ˈyā-riŋ**, Rudolf von** (b. Aug. 22, 1818, Aurich, Hanover—d. Sept. 17, 1892, Göttingen, Ger.) German legal scholar. He taught Roman law at Giessen (1852–68), at Göttingen (from 1872), and at four other universities (including the University of Vienna) for briefer periods. He examined the relationship between law and social change in *The Spirit of Roman Law* (1852–65) and between individual and social interests in *Law as a Means to an End* (1877–83). He maintained that the purpose of law is to protect individual and societal interests by coordinating them and thus minimizing occasions for conflict. He is sometimes called the father of sociological JURISPRUDENCE.

Jia Xian (fl. c. 1050, China) Mathematician and astronomer active at the beginning of the greatest period of traditional Chinese mathematics. He held a relatively low military office during the reign (1022/23–1063/64) of Emperor Renzong of the SONG DYNASTY. He was a pupil of mathematician and astronomer Chu Yan, who contributed to the revision of the Chongtian calendar in 1023, and he served in the Imperial Astronomical Bureau. Jia's name was mainly quoted in connection with his method of extracting roots (solutions) of polynomials of degree higher than three and with the related Jia Xian triangle, which contains the binomial coefficients for equations up to the sixth degree (see BINOMIAL THEOREM). This diagram is similar to BLAISE PASCAL's triangle, which was discovered independently later in the West.

Jiang Jieshi See CHIANG KAI-SHEK

Jiang Jinguo See CHIANG CHING-KUO

Jiang Qing \jē-ˈäŋ-ˈchiŋ\ *or* **Chiang Ch'ing** *orig.* **Li Jinhai** (b. 1914?, Zhucheng, Shandong, China—d. May 14, 1991, Beijing) Third wife of MAO ZEDONG and member of the radical GANG OF FOUR. Jiang married Mao in the 1930s but entered politics only in the 1960s. As first deputy head of the CULTURAL REVOLUTION, Jiang acquired far-reaching powers over China's cultural life and oversaw the total suppression of a wide variety of traditional cultural activities. Arrested after Mao's death and accused of fomenting the widespread civil unrest that characterized the Cultural Revolution, she refused to confess guilt and received a suspended death sentence that was commuted to life imprisonment. Her death was reported as a suicide.

Jiang Zemin \jē-ˈäŋ-zə-ˈmin\ (b. Aug. 17, 1926, Yangzhou, Jiangsu, China) General secretary of the CHINESE COMMUNIST PARTY (CCP; 1989–2002) and president of China (1993–2003). He started his career in Shanghai as an engineer, received training abroad, and gradually rose through the ranks of the CCP. He was named mayor of Shanghai in 1985 and chairman of China's Central Military Commission in 1989. It is thought that Jiang was a compromise candidate to replace Zhao Ziyang as general secretary in June 1989 following the TIANANMEN SQUARE incident. He combined a commitment to continued free-market reform with a determination to preserve the CCP's monopoly on political power. After serving the maximum two five-year terms as president, Jiang was succeeded by Hu Jintao. He remained in charge of the Central Military Commission until stepping down in favour of Hu in 2004.

Jiangsu \jē-ˈäŋ-ˈsü\ *or* **Chiang-su** *conventional* **Kiangsu** Province (pop., 2000 est.: 74,380,000), eastern China. It lies on the YELLOW SEA and is also bordered by SHANDONG, ANHUI, and ZHEJIANG provinces and SHANGHAI municipality. With an area of 39,600 sq mi (102,600 sq km), it is one of the smallest and most densely populated provinces of China, and it is also one of the wealthiest. Its capital is NANJING (Nanking). It occupies a wide alluvial plain that is divided into two sections by the estuary of the YANGTZE RIVER (Chang Jiang). Once a part of the ancient state of Wu, the region was part of the Nanjing province under the MING DYNASTY (1368–1644). It became a separate province in 1667 and served as the headquarters (1853–64) for the TAIPING REBELLION. It was an important base for China's NATIONALIST PARTY, which made Nanjing the nation's capital from 1928 to 1937 and again from 1946 to 1949. The province was occupied by Japan during the SINO-JAPANESE WAR (1937–45) and came under communist control in 1949. It produces steel, electronics, and agricultural products.

Jiangxi \jē-ˈäŋ-ˈshē\ *or* **Chiang-hsi** *conventional* **Kiangsi** Province (pop., 2000 est.: 41,400,000), south-central China. It is bordered by HUBEI, ANHUI, ZHEJIANG, FUJIAN, GUANGDONG, and HUNAN provinces. It has an area of 63,600 sq mi (164,800 sq km), and its capital is NANCHANG. Located in the drainage basin of the GAN RIVER, it is one of China's richest agricultural provinces, and it is also renowned for its porcelain industry, which dates from the 11th century. The opening of the GRAND CANAL under the TANG DYNASTY (618–907) set it on the main trade route between northern and southern China. During the MONGOL dynasty (1206–1368), it included part of Guangdong; its current boundaries were established in the MING DYNASTY. It was taken in 1926 by CHIANG KAI-SHEK and was fought over by the Nationalists and the communists. It was occupied by the Japanese from 1938 to 1945 and came under communist control in 1949. Agricultural production, as well as a thriving timber industry, contribute to the economy.

Jibrīl \ji-ˈbrēl\ *or* **Jabrail** In Islam, the archangel who acts as intermediary between God and humankind and who bore divine revelations to MUHAMMAD and previous prophets. His biblical counterpart is GABRIEL. Jibrīl aided Muhammad in times of crisis and guided him during his ascent into heaven. Muslim belief holds that Jibrīl appeared to ADAM after his expulsion from Paradise to show him how to write, raise wheat, and work iron and also that Jibrīl aided MOSES in delivering the Israelites from Egypt.

jícama \ˈhē-kə-mə\ Vine (*Pachyrhizus erosus*, or *P. tuberosus*), also called yam bean. A LEGUME native of Mexico and Central and South America, it is grown for its edible root. The irregularly globular, brown-skinned tubers are white-fleshed, crisp, and juicy. There are two varieties, those with clear juice and those with milky juice. Both have a mild flavour and are eaten raw or cooked. Sometimes very young seedpods of the plant are eaten, but the mature seeds are highly toxic.

Jiddah *or* **Jeddah** City (pop., 1992: 2,046,251), western SAUDI ARABIA. Located on the Red Sea, it is a major port and the country's diplomatic capital. It takes its name (which means "ancestress" or "grandmother") from the reputed tomb of Eve, which was located there until it was destroyed by the Saudi government in 1928. Jiddah has long been a point of entry for Muslim pilgrims journeying to the holy cities of MECCA and MEDINA. It belonged to the Ottoman Empire until 1916, when it surrendered to British forces during World War I (1914–18). It was captured by the tribal leader IBN SAʿŪD in 1925 and was incorporated into Saudi Arabia in 1927.

jigs and fixtures Components of MACHINE-TOOL installations, specially designed in each case to position the workpiece, hold it firmly in place, and guide the motion of the power tool (e.g., a PUNCH PRESS). Jigs can also be guides for tools or templates, as in the furniture industry. Special cramping jigs that ensure squareness are set up so that, for example, a wardrobe can be glued up in one operation by power-driven rams. See also ASSEMBLY LINE, INTERCHANGEABLE PARTS, MASS PRODUCTION.

jihad \ji-ˈhäd\ In ISLAM, the central doctrine that calls on believers to combat the enemies of their religion. According to the QUR'ĀN and the ḤADĪTH, jihad is a duty that may be fulfilled in four ways: by the heart, the tongue, the hand, or the sword. The first way (known in SUFISM as the "greater jihad") involves struggling against evil desires. The ways of the tongue and hand call for verbal defense and right actions. The jihad of the sword

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involves waging war against enemies of Islam. Believers contend that those who die in combat become martyrs and are guaranteed a place in paradise. In the 20th and 21st centuries the concept of jihad has sometimes been used as an ideological weapon in the effort to combat Western influences and secular governments and to establish an ideal Islamic society.

Jīlī \jē-'lē**, al-** (b. 1365—d. c. 1424) Islamic mystic. Little is known of his life, though he is believed to have visited India in 1387 and to have studied in Yemen (1393–1403). Influenced by Ibn al-ʿArabī, he developed his doctrine of the "perfect man," which he outlined in his *Studies in Islamic Mysticism*. He asserted that the perfectly moral individual can attain unity with God, a unity already experienced by Muhammad and the other prophets, and then become a channel by which the whole community can enjoy contact with the divine being.

Jilin \'je-'lin\ *or* **Chi-lin** *conventional* **Kirin** \'kē-rin\ Province (pop., 2000 est.: 27,280,000), northeastern China. It is bordered by Russia and North Korea, Heilongjiang and Liaoning provinces, and Inner Mongolia. With an area of 72,200 sq mi (187,000 sq km), it is China's most urbanized province; its capital is Changchun, and its second largest city is Jilin. Its major river is the Sungari River, a tributary of the Amur. It was made a province in 1907. Occupied by the Japanese army in 1931, it became part of the puppet state of Manchukuo (1932–45). Chinese communist forces seized the province from the Nationalists in 1948. Industrialization since the late 20th century has been rapid.

Jim Crow Law Law that enforced racial segregation in the U.S. South between 1877 and the 1950s. The term, taken from a minstrel-show routine, became a derogatory epithet for African Americans. After Reconstruction, Southern legislatures passed laws requiring segregation of whites and "persons of colour" on public transportation. These later extended to schools, restaurants, and other public places. In 1954 the U.S. Supreme Court declared segregation in public schools unconstitutional in *Brown v. Board of Education*; later rulings struck down other Jim Crow laws.

Jiménez \kē-'mā-nās,\ *English* \hē-'mā-nəs**, Juan Ramón** (b. Dec. 24, 1881, Moguer, Spain—d. May 29, 1958, San Juan, P.R.) Spanish poet. His early poetry reflects the influence of Rubén Darío; this highly emotional style gave way to a more austere tone c. 1917. He achieved popularity in America with *Platero and I* (1917), a prose story of a man and his donkey. During the Spanish Civil War (1936–39), he allied himself with Republican forces; after their defeat he moved to Puerto Rico, where he spent most of the rest of his life. His poetic output was immense. He was awarded the Nobel Prize for Literature in 1956.

Jiménez de Quesada \kē-'mā-nās-thā-kā-'sä-thä**, Gonzalo** (b. c. 1495, Córdoba or Granada, Spain—d. Feb. 16, 1579, Mariquita, New Granada) Spanish conquistador. He went to the New World as a colonial chief magistrate, then in 1536 he led an expedition of 900 men up the Magdalena River into the central plain of New Granada (modern Colombia), defeating the Chibcha Indians to win the land for Spain. In 1538 two rival conquistadores challenged his claim of conquest; the case was submitted to the crown in Madrid and was inconclusively settled, but Jiménez became the most influential person in New Granada. In 1569 he set out in search of the mythical El Dorado with 500 men; he returned in 1571 with only 25 of his original company.

Jimmu \'jēm-ˌmü\ Legendary first emperor of Japan and founder of the imperial dynasty. He is credited with establishing his state in 660 BC on the plains of Yamato. (An actual state on the Yamato plains dates from the 3rd century AD.) Jimmu was believed to be a descendant of Ninigi, who was in turn the grandson of the sun goddess Amaterasu.

Jin \'jin\ **dynasty** *or* **Chin dynasty** First of two major Chinese dynasties to bear the name Jin. The dynasty had two distinct phases: the Western Jin (AD 265–317) and the Eastern Jin (AD 317–420). The latter is considered one of the Six Dynasties that ruled China between the fall of the Han (AD 220) and the establishment of the Sui (581). China was reunited under Sima Yan (Ssu-ma Yen), first of the Jin emperors, but after his death the empire rapidly crumbled. The Xiongnu nomads of the north overran the Jin capital of Luoyang and later defeated the Jin again at Chang'an. For the next two centuries China was divided into two societies, northern (plagued by barbarian invasions) and southern. The Eastern Jin, founded by another Sima prince at Nanjing, suffered revolts, court intrigues, and frontier wars, but also saw the flourishing of Buddhism in China and the birth of China's first great painter, Gu Kaizhi (344–406?). See also Juchen dynasty.

Jina See Tirthankara

Jinan \'jē-'nän\ *or* **Chi-nan** *conventional* **Tsinan** City (pop., 2003 est.: 2,345,969), capital of Shandong province, eastern China. It dates to the Zhou dynasty (c. 11th–3rd century BC) and earlier and has been an administrative centre since the 8th century BC. Nearby Mount Tai was one of China's greatest holy mountains; many Buddhist cave temples were built in the hills south of the city in the 4th–7th centuries AD. It was made the capital of Shandong under the Ming dynasty (1368–1644). Opened to foreign commerce in 1904, it developed further after becoming a railroad junction in 1912. It is now a major administrative and industrial centre and Shandong's chief cultural centre, with agricultural, medical, and engineering colleges and a large university (1926).

jingxi *or* **ching-hsi,** *also called* **Beijing opera** *or* **Peking opera** *Chinese* **"opera of the capital"** Traditional Chinese theatre, originally devised in 1790 as part of the Qianlong emperor's birthday celebration. Highly conventionalized and symbolic, it combines orchestral music, speech, song, dance, and acrobatics. The performers enact dramas based on historical epics, legend, and myth. The characters' roles and social ranks are conveyed through elaborate costumes and stylized makeup. The actor Mei Lanfang brought its influence to the West through his tours of Russia and the U.S. in the 1930s. *Jingxi* traditionally employed an all-male cast with female impersonators, but in the late 20th century it expanded its scope to admit female actors.

jinja In the Shintō religion, a place where a god is enshrined or to which it is summoned. Originally rural sites of great natural beauty, *jinja* now include urban shrines. They vary in size from small roadside places of prayer to large building complexes such as the Grand Ise Shrine. There are more than 97,000 such shrines in Japan.

Jinnah, Mohammed Ali (b. Dec. 25, 1876, Karachi, India—d. Sept. 11, 1948, Karachi, Pak.) Indian Muslim politician, founder and first governor-general of Pakistan (1947–48). He was educated in Bombay (now Mumbai) and London, where he became a lawyer at age 19. After returning to India, he practiced law and was elected to India's Imperial Legislative Council in 1910. Committed to home rule for India and to maintaining Hindu-Muslim unity, he joined the Muslim League in 1913 and worked to ensure its collaboration with the Indian National Congress. He was opposed to Mohandas K. Gandhi's noncooperation movement and withdrew from the Congress. In the late 1920s and early '30s, he was seen as too moderate by some Muslims but too Muslim by the Congress Party. From 1937, when the Congress Party refused to form coalition governments with the Muslim League in the provinces, Jinnah began to work for the partitioning of India and on creating a Muslim state. Pakistan emerged as an independent country in 1947, and Jinnah became its first head of state. He died in 1948, revered as the father of the nation.

jinni *or* **genie** *plural* **jinn** In Arabic mythology, any of the supernatural spirits less powerful than angels or devils. Evil spirits of air or fire, they could take animal or human form and could dwell in inanimate objects or under the earth. They had the bodily needs of human beings and could be killed but were otherwise free of physical restraints. Jinn delighted in punishing humans for any harm done to them, but people who knew the proper magical procedure could exploit them to their own advantage. The jinn were popular subjects for folklore, notably in the tale of Aladdin in *The* Thousand and One Nights.

Jinsha River, *or* **Kinsha River**, *or* **Chin-sha River** \'jin-'shä\ River, China. The westernmost major headwater stream of the Yangtze River (Chang Jiang), it rises in western Qinghai province south of the Kunlun Mountains. and flows south to form the western border of Sichuan province for some 250 mi (400 km). It then flows into Yunnan province, and swings northeast to join the Min River at Yibin and form the Yangtze.

jitō \'jē-tō\ In feudal Japan, a land steward appointed by the central military government to each of the estates (*shōen*) into which the countryside was divided. The *jitō* collected taxes and maintained the peace; he was also entitled to a portion of the taxes collected. The position, created by Minamoto Yoritomo in 1184, came to be hereditary. As time went by, the *jitō* came to have closer ties with local leaders than with the central government, which contributed to the weakening of the Kamakura shogunate (see Kamakura period).

jitterbug Dance variation of the two-step in which couples swing, balance, and twirl in standardized patterns to syncopated music in ¼ time. It originated in the U.S. in the mid 1930s and became internationally

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popular in the 1940s. It originally included acrobatic lifts and swings, but it became modified in ballroom versions. Its step patterns varied and could include the lindy hop and the jive.

Jiulong See KOWLOON

jiva \'jē-və\ In JAINISM, the SOUL or living spirit. Jivas are believed to be eternal and infinite in number. Many are bound to earthly existence by KARMA that requires them to move through the cycle of rebirth in successive bodies. Eventually a jiva may obtain release, whereupon a replacement is promoted from the lowest class of jivas, the tiny invisible souls called *nigoda*s that fill the whole space of the world.

Jīzah \ȧl-'jē-zə**, Al-** *or* **Giza** \'gē-zə\ City (pop., 1996: 2,221,868), Upper Egypt. Located on the western bank of the Nile River, it is a suburb of CAIRO. A noted entertainment district, it is also the centre of Egypt's motion-picture industry. Rising 5 mi (8 km) west of the city are the Great Sphinx and the Pyramids of Giza (see PYRAMID), built during Egypt's 4th dynasty (c. 2613–c. 2494 BC).

jizya *or* **jizyah** \'jiz-yə\ Poll tax that early Islamic rulers demanded from their non-Muslim subjects. This tax applied especially to followers of Judaism, Christianity, and Zoroastrianism, who were tolerated in the practice of their religion because they were "peoples of the book." Originally intended to be used for charitable purposes, the revenues from the jizya were paid into the private treasuries of rulers, and the Ottoman sultans used the proceeds to pay military expenses. Many converted to Islam in order to escape the tax.

Joachim \ˌyō-ä-'kēm**, Joseph** (b. June 28, 1831, Kittsee, near Pressburg, Austria-Hungary—d. Aug. 15, 1907, Berlin, German Empire) Austro-Hungarian violinist. A prodigy, he began study as a child in Pest, continuing later in Vienna and Leipzig, where he was associated with FELIX MENDELSSOHN. He was concertmaster at Weimar under FRANZ LISZT (1850–52), but their tastes in music diverged radically. He became close to JOHANNES BRAHMS, who sought Joachim's advice about his violin concerto. Joachim wrote cadenzas that are still used for a number of concertos. As the longtime head of Berlin's Hochschule (1868–1905), he developed it into a first-rank conservatory.

Joachim of Fiore \yō-'ä-kēm...'fyō-rā\ (b. c. 1130/35, Celico, Kingdom of Naples—d. 1201/02, Fiore) Italian mystic, theologian, and philosopher of history. After a pilgrimage to the Holy Land, he became a Cistercian monk, and by 1177 he was abbot at Corazzo, Sicily. He retired into the mountains to follow a contemplative life in 1191, and in 1196 he founded the order of San Giovanni in Fiore. His *Book of Harmony of the New and Old Testaments* outlined a theory of history and traced correspondences in the Old and New Testaments. In his *Exposition of the Apocalypse* he examined the symbols of the ANTICHRIST, and in *Psaltery of Ten Strings* he expounded his doctrine of the HOLY TRINITY. A man of vivid imagination, he was both acclaimed as a prophet and denounced as a heretic.

Joan I *or* **Joanna I** *Italian* **Giovanna** (b. 1326—d. May 22, 1382, Lucania, Kingdom of Naples) Countess of Provence and queen of Naples (1343–82). She belonged to the house of Anjou, and her marriage to the brother of the king of Hungary was intended to reconcile Hungarian and Angevin claims on Naples. Suspected of her husband's murder, she fled to Avignon (1348). She sold Avignon to the papacy in return for being cleared of the crime, then went back to Naples in 1352. She recognized the antipope Clement VII in 1378, and Pope URBAN VI crowned Charles of Durazzo king of Naples in 1381. When Charles captured Naples, he imprisoned Joan and had her killed.

Joan, Pope Legendary female pontiff who supposedly reigned, as Pope John VIII, for about 25 months from 855 to 858. The tale held that she was an Englishwoman who fell in love with a Benedictine monk, disguised herself as a man, and joined his order. After acquiring great learning she moved to Rome, where she became cardinal and then pope. In the earliest version of the story, she was pregnant at the time of her election and gave birth during the procession to the Lateran, whereupon she was dragged out of Rome and stoned to death. The legend, regarded as fact until the 17th century, has since been proved to be apocryphal.

Joan of Arc, Saint *French* **Jeanne d'Arc** \zhän-'dȧrk\ (b. c. 1412, Domrémy, Bar, Fr.—d. May 30, 1431, Rouen; canonized May 16, 1920; feast day May 30) French military heroine. She was a peasant girl who from an early age believed she heard the voices of Sts. Michael, Catherine, and Margaret. When she was about 16, her voices began urging her to aid France's DAUPHIN (crown prince) and save France from the English attempt at conquest in the HUNDRED YEARS' WAR. Dressed in men's clothes, she visited the Dauphin and convinced him, his advisers, and the church authorities to support her. With her inspiring conviction, she rallied the French troops and raised the English siege of Orléans in 1429. She soon defeated the English again at Patay. The Dauphin was crowned king at Reims as CHARLES VII, with Joan beside him. Her siege of Paris was unsuccessful, and in 1430 she was captured by the Burgundians and sold to the English. Abandoned by Charles, she was turned over to the ecclesiastical court at Rouen, controlled by French clerics who supported the English, and tried for witchcraft and heresy (1431). She fiercely defended herself but finally recanted and was sentenced to life imprisonment; when she again asserted that she had been divinely inspired, she was burned at the stake. She was not canonized until 1920.

Job \'jōb\ Central character of the Book of Job in the OLD TESTAMENT, known for his faithfulness to God despite his many afflictions. At the beginning, Job is a wealthy man with a large family. Satan challenges God to allow him to take away Job's blessings as a test of his faith. Soon Job is desolate, covered with boils, his wealth gone and his family dead. Three friends arrive to comfort him; he disputes with them, denying he has done anything to deserve this misery but maintaining his faith in God. At the end, in a confrontation with God, the power and mystery of the deity are memorably reasserted, but the problem of why the innocent suffer is left unresolved. The book dates from the 6th–4th century BC.

Jobim \zhō-'biⁿ**, Antonio Carlos** (b. Jan. 25, 1927, Rio de Janeiro, Braz.—d. Dec. 8, 1994, New York, N.Y., U.S.) Brazilian songwriter and composer. He performed on guitar and piano in Rio de Janeiro clubs before becoming music director of Odeon Records. In 1959 he and Luís Bonfá composed the score for the film *Black Orpheus*, and his worldwide success soon followed. He transformed samba music into bossa nova ("new wrinkle" or "new wave"), a fusion of understated samba pulse (quiet percussion, unamplified guitars playing subtly complex rhythms), gentle singing, and the melodic and sophisticated harmonies of cool jazz; the style found a long-lasting niche in popular music. He collaborated with FRANK SINATRA, STAN GETZ, and Astrud Gilberto, and he also composed classical works and film scores. His more than 400 songs include "One-Note Samba," "Meditation," and "The Girl from Ipanema."

Jobs, Steven Paul (b. Feb. 24, 1955, San Francisco, Cal., U.S.) U.S. businessman. Adopted in infancy, he grew up in Los Altos. He dropped out of Reed College and went to work for Atari Corp. designing video games. In 1976 he cofounded (with STEPHEN WOZNIAK) Apple Computer, Inc. The first Apple computer, created when Jobs was only 21, changed the public's idea of a computer from a huge machine for scientific use to a home appliance that could be used by anyone. Apple's Macintosh computer, which appeared in 1984, introduced a GRAPHICAL USER INTERFACE and MOUSE technology that became the standard for all applications interfaces. In 1980 Apple became a public corporation, and Jobs became the company's chairman. Management conflicts led him to leave Apple in 1985 to form NeXT Computer Inc., but he returned to Apple in 1996 and became CEO in 1997. The striking new iMac computer (1998) revived the company's flagging fortunes.

Jōchō \'jō-ˌchō\ (d. 1057, Japan) Japanese Buddhist sculptor. The son and pupil of a sculptor, he worked primarily for the FUJIWARA FAMILY. He was awarded unprecedented honours for sculptures executed for Kyōto's Hōjō Temple and for the Fujiwara family temple in Nara. He was instrumental in improving the social standing of Buddhist sculptors by organizing a guild, and he perfected the so-called *kiyosehō*, or joined-wood technique. His only extant work is a carved Amida (Buddha) figure (c. 1053) in the Byōdō Temple at Uji.

Joel Second of the 12 Minor Prophets in the Hebrew scriptures, author of the book of Joel. (His prophecy is part of a larger book, The Twelve, in the Jewish canon.) He lived sometime during the period of the Second Temple of JERUSALEM (516 BC–AD 70), but nothing is known of his life. He opens his prophecy by describing a plague of locusts, an allegory of the disasters to come upon a faithless people. His message is simple: salvation will come to Judah only when the people truly turn to Yahweh. The end of the book looks forward to the final days, when all Israel will share in the knowledge of God.

Joffre \'zhȯfrᵊ**, Joseph (-Jacques-Césaire)** (b. Jan. 12, 1852, Rivesaltes, France—d. Jan. 3, 1931, Paris) French commander in chief on the Western Front in World War I. He was responsible for the calamitous

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campaign with which the French army began operations in 1914 against Germany, but he shifted his forces and created a new French army under his direct command that won a great victory in the First Battle of the Marne (1914). As commander in chief (1915–16), he ordered the French armies to burst through the German positions, at ruinous cost. His prestige waned, and, because of the lack of French preparation for the Battle of Verdun (1916), he was stripped of his direct command and resigned. He was created a marshal of France in 1916.

Joffre, detail of a portrait by H. Jacquier, 1915
H. ROGER-VIOLLET

Joffrey, Robert *orig.* **Abdullah Jaffa Bey Khan** (b. Dec. 24, 1930, Seattle, Wash., U.S.—d. March 25, 1988, New York, N.Y.) U.S. dancer and choreographer, founder-director of the Joffrey Ballet. He was the son of an Afghan father and an Italian-born mother. He studied dance in Seattle and later in New York, opened a ballet school in 1953, and in 1954 formed the first of several groups. In 1956 he founded the Robert Joffrey (later simply Joffrey) Ballet with Gerald Arpino (b. 1928). The company gained international fame and toured widely. In 1965 it became affiliated with the New York City Center. Joffrey's ballets include *Persephone* (1952), *Astarte* (1967), *Remembrances* (1973), and *Postcards* (1980). After Joffrey's death, Arpino became director; in 1995 he moved the company to Chicago, renaming it the Joffrey Ballet of Chicago.

Jōgan \'jō-ˌgän\ **style** Japanese sculptural style of the early Heian period, seen primarily but not exclusively in Buddhist sculptures. The massive figures, carved from single blocks of wood, are columnar, erect, and symmetrical and have large round faces, large lips, wide noses, and wide eyes, almost geometrically simplified. The drapery, composed of alternating series of small and large waves, is its most distinguishing feature. The technique was first seen on the drapery of the colossal image of the Buddha at Bāmīān, Afg.; Chinese and Japanese pilgrims brought back holy images and used them as prototypes for their own sacred images.

jogging Aerobic exercise involving running at an easy pace. *Jogging* (1967) by Bill Bowerman and W.E. Harris boosted jogging's popularity for fitness, weight loss, and stress relief. Many medical authorities endorse jogging, but others warn of risks to feet, shins, knees, and backs. Jogging only every other day, warming up properly, and using well-designed shoes and proper technique can reduce risks.

Johanan ben Zakkai \jō-ˈha-nən-ben-ˈza-kā-ˌī\ (fl. 1st century AD) Palestinian Jewish sage. A leading representative of the Pharisees, he helped preserve and develop Judaism in the years after the destruction of the Second Temple of Jerusalem (AD 70). He is said to have been smuggled out of the besieged city in a coffin and to have visited the Roman camp and persuaded the future emperor Vespasian to allow him to set up an academy at Jamnia near the Judaean coast. He established an authoritative rabbinic body there and was revered as a great teacher and scholar.

Johannesburg City (pop., 2001: metro. area, 3,225,810), northeastern South Africa. The capital of Gauteng province and one of the country's largest cities, it bestrides a highland region called the Witwatersrand. It was founded in 1886 after the discovery of gold nearby and was occupied by the British during the South African War in 1900. It was a legally segregated city until 1991; nonwhites were restricted to living in outlying areas called townships, including Soweto. Greater Johannesburg extends more than 600 sq mi (1,600 sq km) and includes more than 500 suburbs and townships. It is a leading industrial and financial centre. Its cultural and educational institutions include the Johannesburg Art Gallery, the Civic Theatre, the University of the Witwatersrand, and the University of Johannesburg.

Johannsen, Wilhelm Ludvig (b. Feb. 3, 1857, Copenhagen, Den.—d. Nov. 11, 1927, Copenhagen) Danish botanist and geneticist. He supported Hugo de Vries's discovery that variation in genotype can occur by mutation; the new character, while independent of natural selection in its initial occurrence, is then subject to natural selection. Johannsen's *Elements of Heredity* (1909) became an influential text, and his terms *phenotype* and *genotype* are now a part of the language of genetics.

Johansson, (Per) Christian (b. May 20, 1817, Stockholm, Swed.—d. 1903, St. Petersburg, Russia) Swedish-born ballet dancer and teacher. Johansson trained under August Bournonville. He was engaged at the Imperial Russian Ballet in 1841. In his prime his innate nobility and grace were unsurpassed. In 1860 he turned his attention to teaching at the Imperial Ballet School. Over the next four decades he brought a new polish to the Russian style, providing it with a firm base in the French method that he had learned from Bournonville.

John *known as* **John Lackland** (b. Dec. 24, 1167, Oxford, Eng.—d. Oct. 18/19, 1216, Newark, Nottinghamshire) King of England (1199–1216). The youngest son of Henry II, he joined his brother Richard (later Richard I) in a rebellion against Henry (1189). John became lord of Ireland, and, when Richard was imprisoned in Germany on his way back from the Third Crusade, he tried to seize control of England (1193). On Richard's return, John was banished (1194), but the two were later reconciled. Crowned king in 1199, John lost Normandy (1204) and most of his other French lands in a war with Philip II (Philip Augustus). After Innocent III excommunicated him for refusing to recognize Stephen Langton as archbishop of Canterbury, John was obliged to declare England a fief of the Holy See (1213). He launched a military campaign against France in 1214 but made no lasting gains. His heavy taxes and aggressive assertion of feudal privileges led to the outbreak of civil war (1215). The barons forced him to sign the Magna Carta, but the civil war continued until his death.

John *or* **John de Balliol** (b. c. 1250—d. April 1313, Château Galliard, Normandy, Fr.) King of Scotland (1292–96). He was one of 13 claimants to the throne but won by primogeniture. John paid homage to Edward I of England but soon refused his request for military aid in Gascony and instead signed a treaty with the French. When Edward invaded Gascony in 1296, the Scots raided northern England. Within months Edward's army had captured strategic castles in Scotland, and John was forced to resign his kingdom to Edward. He was held in the Tower of London until 1299.

John I *Portuguese* **João** *known as* **John of Aviz** \ə-ˈvēzh\ (b. April 11, 1357, Lisbon—d. Aug. 14, 1433, Lisbon) King of Portugal (1385–1433) and founder of the Aviz dynasty. The illegitimate son of Pedro I, he was elected king in 1385 despite the rivalry of Castilian candidates. He fought off a Castilian invasion (1385) and preserved Portugal's independence. He made an alliance with England (1386), but a joint invasion of León was unsuccessful. John signed a 10-year truce with Castile in 1389, but frontier warfare was intermittent until 1411. He and his sons (including the youngest, later Henry the Navigator) captured Ceuta in Morocco in 1415, thus beginning the era of Portuguese expansion.

John II *French* **Jean** *known as* **John the Good** (b. April 16, 1319, near Le Mans, France—d. April 8, 1364, London, Eng.) King of France (1350–64). At odds with England and Navarre, he tried to make peace with the Navarrese king Charles II, then had him imprisoned in 1356. Edward the Black Prince, son of Edward III of England, led an invasion of southern France, defeating and capturing John at the Battle of Poitiers (1356). John was forced to sign the treaties of Brétigny and Calais (1360), which fixed an extravagant ransom and surrendered most of southwestern France to the English. See also Hundred Years' War.

John II Comnenus \käm-ˈnē-nəs\ (b. Sept. 13, 1087—d. April 8, 1143) Byzantine emperor (1118–43). The son of Alexius I Comnenus, he made it his mission to reconquer Byzantine territory lost to the Arabs, Turks, and Crusaders. He cancelled Venetian trading privileges in the empire but was forced to restore them after the Venetians launched a fleet to retaliate against him. John allied himself with the German emperor against Roger II of Sicily (1130). He reconquered Cilicia (1137) and won homage from Antioch, but he failed to defeat the Syrian Turks.

John III Ducas Vatatzes \'dyü-kəs-və-ˈtat-sēz\ (b. c. 1193—d. Nov. 3, 1254, Nymphaion) Emperor of Nicaea (1222–54). He succeeded Theodore I Lascaris and defeated rivals for the imperial throne in 1223. Two years later he triumphed over Latin forces loyal to his rivals and gained control of Asia Minor. He allied with Ivan Asen II against Epirus (1230) and besieged Constantinople (1235), prompting Asen to go to war with him (1235–37). He acquired territory in Bulgaria (1241) and Epirus

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(1242) and supported a cultural revival from his capital at Nicaea, paving the way for the eventual reestablishment of the Byzantine Empire. Venerated by his people, he was canonized in the Eastern church.

John III Sobieski \sȯb-'yā-skē\ *Polish* **Jan Sobieski** (b. Aug. 17, 1629, Olesko, Pol.—d. June 17, 1696, Wilanów) Elective king of Poland (1674–96). Named commander in chief of the Polish army (1668), he distinguished himself by victories over the Cossacks and Turks. His reputation was so great that he was elected king in preference to the Habsburgs' candidate. In 1683 he concluded a treaty with Emperor Leopold I against the Ottoman Turks. When a Turkish army approached Vienna later that year, he rushed there with troops, took command of the entire relief force, and achieved a brilliant victory, briefly restoring the kingdom of Poland-Lithuania to greatness for the last time. He was unsuccessful in a Hungarian campaign (1683–91) to liberate Moldavia and Walachia from Ottoman rule. Later rebellion within his own family, with nobles fighting each other rather than the Turks, led finally to Poland's downfall in the 18th century.

John III Sobieski, engraving by Carel Allardt.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

John V Palaeologus \ˌpā-lē-'ä-lə-gəs\ (b. June 18, 1332, Didymoteichon—d. Feb. 16, 1391, Constantinople) Byzantine emperor (1341–91). The son of Andronicus III Palaeologus, he inherited the throne at age nine; John VI Cantacuzenus served as his regent and coemperor (1347–54). After the Ottoman Turks gained control of Galliopoli and threatened Constantinople, John V appealed to the West for help, proposing to end the schism between the Byzantine and Latin churches. Impoverished by war, he was detained as a debtor when he visited Venice (1369). In 1371 he was forced to recognize Turkish overlords, who later helped him to regain the throne (1379) after he was deposed by his son.

John VI Cantacuzenus \ˌkan-tə-kyü-'zē-nəs\ (b. c. 1292—d. June 15, 1383, Mistra, Byzantine Empire) Byzantine emperor (1347–54). As chief adviser (1328–41) to Andronicus III Palaeologus, he directed both domestic and foreign policy. He fought to serve as regent for the young John V Palaeologus, triumphing over John's mother, Anna of Savoy, only by enlisting Turkish aid. From 1347 he ruled as coemperor with John V, but in 1354 he crowned his own son coemperor. With Venetian aid, John V then forced him to abdicate, and Cantacuzenus retired to a monastery, where he wrote his memoirs.

John VIII Palaeologus \ˌpā-lē-'ä-lə-gəs\ (b. Dec. 17/18, 1392—d. Oct. 31, 1448, Constantinople) Byzantine emperor (1421–48). The son of Manuel II Palaeologus, he was crowned coemperor with his father in 1408 and took effective control of the empire in 1421. He became sole emperor after his father's death in 1425. Of the diminished and fragmented empire, he ruled only Constantinople and the surrounding area. The city was besieged by the Ottoman Turks (1422), and, when Thessaloníki fell to Turkish forces (1430), John appealed to the West for help. He united the Byzantine and Latin churches (1439), but joint efforts against the Turks failed, and the Byzantines refused to submit to the pope. John died amid intrigues over succession.

John XXII *orig.* **Jacques Duèse** (b. Cahors, France—d. Dec. 4, 1334, Avignon) Second Avignon pope (1316–34). The successor to Clement V, he established the papal court at Avignon on a permanent basis (see Avignon papacy). He condemned the Spiritual Franciscans' interpretation of the poverty of Christ and his Apostles and upheld papal authority over imperial elections against the opposition of the emperor, Louis IV. When John excommunicated Louis, the emperor retaliated by declaring him deposed (1328) and sponsoring the election of an antipope. John's views on the beatific vision provoked accusations of heresy (1331–32). He is remembered for centralizing church administration and adding to the body of canon law.

John XXIII *orig.* **Angelo Giuseppe Roncalli** (b. Nov. 25, 1881, Sotto il Monte, Italy—d. June 3, 1963, Rome; beatified Sept. 3, 2000; feast day October 11) Pope (1958–63). He studied theology in Rome, was ordained a priest in 1904, and held a variety of church offices. In 1944 he was named papal nuncio to newly liberated France, where he successfully revived sympathy for the Vatican. Made a cardinal in 1953, he was elected pope after the death of Pius XII (1939–58). Because of his advanced age, he was expected to be little more than a caretaker in the office, but instead he became the major reforming pope of the century. Eager to lead the church into the modern era, he called the Second Vatican Council in 1962, inviting Eastern Orthodox and Protestant observers to join Catholic delegates. He also sought to repair relations with the Jews. The council went on to make major reforms in Catholic liturgy and administration, though John died before its conclusion. An energetic advocate of world peace, he was one of the most popular popes in history. In 2000 he was beatified by John Paul II (1978–2005).

John XXIII, 1963
KEYSTONE

John, Augustus (Edwin) (b. Jan. 4, 1878, Tenby, Pembrokeshire, Wales—d. Oct. 31, 1961, Fordingbridge, Hampshire, Eng.) Welsh painter, portraitist, muralist, and draftsman. By the age of 20 he had won a reputation for his brilliant drawing technique. A colourful personality, he roamed Britain, living with Roma and learning their customs and language; the painting *Encampment on Dartmoor* (1906) is based on these experiences. He is best known for his portraits of leading European personalities, including those of James Joyce and George Bernard Shaw.

John, Sir Elton (Hercules) *orig.* **Reginald Kenneth Dwight** (b. March 25, 1947, Pinner, Middlesex, Eng.) British rock singer, pianist, and songwriter. He played piano by ear as a child, winning a scholarship to the Royal Academy of Music at age 11. In the late 1960s he began a successful partnership with lyricist Bernie Taupin (b. 1950) that would produce hit albums such as *Goodbye Yellow Brick Road* (1973) and songs such as "Rocket Man," "Bennie and the Jets," and "Philadelphia Freedom." The two returned with more hits in the early 1980s, including "I Guess That's Why They Call It the Blues." In 1997 John performed a new version of "Candle in the Wind" (1973) at the funeral of his friend Diana, princess of Wales; his recording immediately became the best-selling single of all time.

John, Saint See Saint John the Apostle

John Birch Society Organization founded in 1958 by Robert H. Welch, Jr. (1899–1985), a retired American candymaker, to combat communism and promote ultraconservative causes. It was named for an American missionary and army intelligence officer killed by Chinese Communists in 1945, considered by the society the first hero of the Cold War. Its membership reached more than 70,000 in the 1960s. Its many publications warned of communist infiltration of the U.S. government and called for the impeachment of officials such as Earl Warren. *The New American* is the organization's biweekly magazine.

John Damascene, Saint See Saint John of Damascus

John Day Fossil Beds National Monument National monument, north-central Oregon, U.S. With an area of 14,014 acres (5,676 hectares), it is located along the John Day River (named after a Virginian scout of the 1811 Astor overland expedition). Fossils more than 30 million years old provide a paleontological record of five epochs of the Cenozoic Era.

John de Balliol See John (Scotland)

John Lackland See John (England)

John Maurice of Nassau *Dutch* **Johan Maurits van Nassau** (b. June 17, 1604, Dillenburg, Nassau—d. Dec. 20, 1679, Cleves, Brandenburg) Dutch colonial governor and military commander. He fought after 1621 in the campaigns of his cousin Frederick Henry, prince of Orange, against Spain. As colonial governor in Brazil, recently conquered from Portugal, he secured control of vast areas for the Dutch West India Company in 1636–44, bringing the Dutch empire in Latin America to the peak of its power. He also sponsored the seizure of Angola (1641) and of several key

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ports on the western African coast to supply slaves for Brazilian plantations, and he led a Dutch army in 1665 in the Anglo-Dutch Wars.

John of Aviz See John I (Portugal)

John of Brienne \brē-'en\ (b. c. 1170—d. March 1237, Constantinople) Count of Brienne (in northeastern France) and later titular king of Jerusalem (1210–25) and Latin emperor of Constantinople (1231–37). The penniless younger son of a French count, he married the queen of the Crusader state of Jerusalem, with the support of Phillip II, and after her death became regent for their infant daughter. He arranged a truce with Egypt (1212) and participated in the unsuccessful Fifth Crusade. In 1228 he became regent and coemperor of Constantinople, and he was crowned emperor three years later. He fended off attacks by Ivan Asen II and John III Ducas Vatatzes.

John of Damascus, Saint *or* **Saint John Damascene** (b. c. 675, Damascus—d. Dec. 4, 749, near Jerusalem; Western feast day December 4) Monk and theological doctor of the Greek and Latin churches. He spent his entire life under Muslim rule. As a writer of hymns and theology, he had great influence in the Eastern and Western churches, especially through *Exposition of the Orthodox Faith*, a summary of the teachings of the Greek Fathers. He also wrote against the Iconoclasts (see iconoclasm).

John of Gaunt, duke of Lancaster (b. March 1340, Ghent—d. Feb. 3, 1399, London, Eng.) English prince, the fourth son of Edward III. John's additional name, "Gaunt" (a corruption of the name of his birthplace, Ghent), was not used after he was three years old; it became the popularly accepted form of his name, however, through its use in William Shakespeare's play *Richard II*. John served as a commander in the Hundred Years' War against France, then returned to become an important influence in his father's last years as king and in the reign of his nephew Richard II. Through his first wife, John acquired the duchy of Lancaster in 1362, and he was the immediate ancestor of the three 15th-century monarchs of the house of Lancaster: Henry IV, Henry V, and Henry VI.

John of Paris *or* **Jean de Paris** \'zhäⁿ-də-pà-'rē\ *or* **John the Deaf** *or* **John Quidort** \kē-'dȯr\ (b. c. 1255, Paris, France—d. Sept. 22, 1306, Bordeaux, Gascony) Dominican monk and disciple of St. Thomas Aquinas. A lecturer at the University of Paris, he wrote on the separation of church and state and the limits of papal authority. His controversial view on the nature of the Eucharist was censured, and he was sentenced to perpetual silence; he died before his appeal could be decided.

John of Salisbury \'sȯlz-ˌber-ē\ (b. 1115/20, Salisbury, Wiltshire, Eng.—d. Oct. 25, 1180, Chartres, France) English prelate and scholar. A noted Latinist who studied with Peter Abelard and other important theologians in Paris, John was a leading figure in the renaissance of the 12th century. He served as secretary to Theobald and St. Thomas Becket, archbishops of Canterbury. He wrote *Historia pontificalis* (c. 1163) and the *Policraticus* and the *Metalogicon* (both 1159) His defense of Becket and of ecclesiastical liberties led Henry II to exile him to France (1163). He returned to England after the reconciliation of Henry and Becket and was in Canterbury Cathedral when Becket was assassinated. He later wrote a hagiography of Becket and promoted the cult of the murdered archbishop. As bishop of Chartres (from 1176), he was active in the third Lateran Council.

John of the Cross, Saint *Spanish* **San Juan de la Cruz** *orig.* **Juan de Yepes y Álvarez** (b. June 24, 1542, Fontiveros, Spain—d. Dec. 14, 1591, Ubeda; canonized 1726; feast day December 14) Spanish mystic, poet, Doctor of the Church, and reformer of monasticism. He became a Carmelite monk at Medina del Campo and was ordained a priest in 1567. Joining St. Teresa of Ávila in her effort to restore the Carmelites to their original austerity, he cofounded the Discalced Carmelite order in 1568. He opened the first Discalced Carmelite monastery at Duruelo a year later, but reform caused friction within the order and led to his imprisonment at Toledo. He escaped in 1578 and later won high office in the order. In his great mystical poetry, including "The Dark Night of the Soul," he traced the steps of the soul's ascent to union with God.

John o'Groat's Village, Scotland. Near Dunnet Head, it was settled in 1793 by John de Groat and his two brothers. It was once considered Britain's most northerly point, giving rise to the expression "from Land's End to John o'Groat's."

John Paul II *orig.* **Karol Wojtyła** (b. May 18, 1920, Wadowice, Pol.—d. April 2, 2005, Vatican City) Pope (1978–2005), the bishop of Rome and head of the Roman Catholic church, the first non-Italian pope in 455 years and the first ever from a Slavic country. He studied for the priesthood at an underground seminary in Kraków during World War II and was ordained in 1946. He earned a doctorate in philosophy in Rome (1948) and returned home to serve in a parish, earning a second doctorate (also 1948), in sacred theology, from the Jagiellonian University. He became archbishop of Kraków in 1964 and cardinal in 1967. Elected pope after the 33-day pontificate of John Paul I (b. 1912—d. 1978), he became known for his energy, charisma, and intellect as well as for his conservative theological views and fervent anticommunism. In 1981 John Paul was shot in St. Peter's Square by a Turkish gunman, but he recovered, resumed his work, and forgave his would-be assassin. His trips abroad attracted some of the largest crowds ever assembled. His nonviolent activism spurred movements that contributed to the peaceful dissolution of the Soviet Union in 1991. He championed economic and political justice in developing nations. In naming 44 cardinals from five continents (February 2001), John Paul reached out to cultures around the world. He also canonized more saints, from more parts of the world, than had any other pope. His ecumenical efforts, including meetings with Jewish, Muslim, and Eastern Orthodox religious leaders, were widely praised, but he often drew criticism for his traditionalist views on issues of gender and sexuality. Although afflicted with Parkinson disease since the early 1990s, John Paul remained active and made a historic trip to Jerusalem in March 2000, during which he sought to improve relations between the Roman Catholic church and Jews.

John Paul II, 1979.
LOCHON-FRANCOLON-SIMON/GAMMA-LIAISON

John the Apostle, Saint *or* **St. John the Evangelist** *or* **St. John the Divine** (fl. 1st century AD) One of the original Twelve Apostles of Jesus, traditionally credited with writing the fourth Gospel and three New Testament epistles. The book of Revelation was also traditionally assigned to him. His father was a Galilean fisherman. John and his brother James (see St. James) were among the first disciples called by Jesus, and John appears to have held a position of authority in the early church after the resurrection. Later accounts of his life are based on legend. He is said to have died in Ephesus, and his tomb became a site of pilgrimage. John's Gospel, unlike the other three, presents a well-developed theological point of view, on a level with the letters of St. Paul. After a prologue in which he identifies God with the Word (Logos), he offers selected episodes from Jesus' life and ministry. His explications of theological issues such as the significance of the Son of God greatly influenced the development of Christian doctrine.

John the Baptist, Saint (b. 1st century AD) Jewish prophet revered in Christianity as the forerunner of Jesus. Sources for his life are the four Gospels, the Acts of the Apostles, and the historian Josephus. His mother, Elizabeth, was perhaps a relative of Mary; his father was the priest Zechariah. As a young man John lived in the Judaean desert, either as a hermit or as part of a Jewish monastic community such as the Essenes. He attracted much public notice c. AD 28 as a prophet in the Jordan Valley. He preached the imminent wrathful judgment of God and called on his hearers to repent and be baptized. Jesus himself came to be baptized by John and shortly afterward began his own mission. John was imprisoned for criticizing the illegal marriage of Herod Antipas and was executed after Herod's stepdaughter, Salome, demanded his head as a reward for dancing for the king's guests.

John the Deaf See John of Paris

John the Good See John II (France)

Johns Hopkins University Private university in Baltimore, Maryland, U.S. It was founded as a graduate school in 1876 through an endowment supplied by the Baltimore merchant Johns Hopkins (1795–1873). It became coeducational after a group of women, in 1893, provided funds for the creation of a medical school. Today its school of medicine and the affiliated Johns Hopkins Hospital constitute one of the nation's leading

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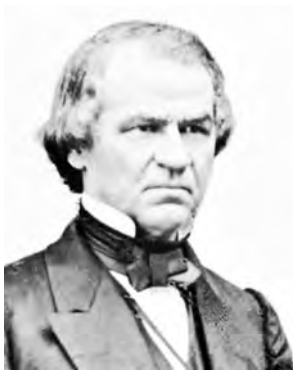
medical research centres. Besides medicine, the university has schools of arts and sciences, engineering, public health, nursing, music, international studies, and continuing education.

Johns, Jasper (b. May 15, 1930, Augusta, Ga., U.S.) U.S. painter, sculptor, and printmaker. He began his career as a commercial artist, producing displays for New York City shop windows. In 1958 he had his first one-man exhibition, a rousing success. The paintings Johns went on to produce depict commonplace, two-dimensional subjects such as flags, targets, maps, numbers, and letters of the alphabet. He was able to raise these objects to the level of icons through his paint handling and manipulation of surface texture, which he obtained through the encaustic technique. In their willful and ironic banality and their rejection of emotional expression, these early works were a radical departure from the then-dominant Abstract Expressionist style. Johns's unabashed depiction of commonplace emblems and objects was emulated by many Pop art artists. From 1961 he began to attach real objects to his canvases. In the 1970s he produced paintings composed of clusters of parallel lines that he called "crosshatchings"; in the 1980s he experimented with figuration.

Johnson, Andrew (b. Dec. 29, 1808, Raleigh, N.C., U.S.—d. July 31, 1875, near Carter Station, Tenn.) 17th president of the U.S. (1865–69). Born in poverty, he never attended school, and he taught himself to read and write. After a short apprenticeship as a tailor, he moved with his family to Greeneville, Tenn., where he opened his own tailor shop. Before he was 21 he organized a workingman's party. Elected to the state legislature (1835–43), he became a spokesman for small farmers. He then served in the U.S. House of Representatives (1843–53) and as governor of Tennessee (1853–57). Elected to the U.S. Senate (1857–62), he opposed antislavery agitation, but, in 1860, after the election of Pres. Abraham Lincoln, he vehemently rejected Southern secession, a position he maintained even after Tennessee seceded in 1861. During the American Civil War he was the only Southern senator who refused to join the Confederacy. In 1862 he was appointed military governor of Tennessee, then under Union control. In 1864 he was selected to run for vice president with President Lincoln; he assumed the presidency after Lincoln's assassination. During Reconstruction he favoured a moderate policy of readmitting former Confederate states to the Union with few provisions for reform or civil rights for freedmen. In 1867, Johnson's vetoes of legislation to establish a Freedmen's Bureau and other civil rights measures angered moderate as well as Radical Republicans; in response, they united to pass the Tenure of Office Act (1867), which forbade the president from removing civil officers without senatorial consent. In 1868, in defiance of the act, Johnson dismissed secretary of war Edwin M. Stanton, an ally of the Radicals. The House then voted to impeach the president—the first such occurrence in U.S. history. In the subsequent Senate trial, the charges proved weak, and the necessary two-thirds vote needed for conviction failed by one vote. Johnson remained in office until 1869, but he had lost the ability to lead. He returned to Tennessee, where he won reelection to the Senate shortly before he died.



Andrew Johnson.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Johnson \'yōn-sȯn**, Eyvind** (b. July 29, 1900, Svartbjörnsbyn, near Boden, Swed.—d. Aug. 25, 1976, Stockholm) Swedish novelist. He endured a grim boyhood of hard labour. His early novels evince feelings of frustration; *Bobinack* (1932) is an exposé of the machinations of modern capitalism, and *Rain at Daybreak* (1933) is an attack on modern office drudgery. *Return to Ithaca* (1946) and *The Days of His Grace* (1960) have been widely translated. Johnson's working-class novels experimented with new forms and techniques; they also introduced new themes to Swedish literature. He shared the 1974 Nobel Prize for Literature with Harry Martinson.

Johnson, Frank (Minis), Jr. (b. Oct. 30, 1918, Halyeville, Ala.—d. July 23, 1999, Montgomery, Ala.) U.S. judge. After graduating at the top of his law-school class at the University of Alabama in 1943, he joined the army, becoming an infantry lieutenant. After the war he returned to Alabama to practice law. Appointed to the federal district court for middle Alabama in 1955, he became widely known for his decisions in support of the civil rights movement. In 1955 he voted with the majority to strike down the bus-segregation law challenged by Rosa Parks, and in 1965 he issued the order that allowed Martin Luther King, Jr., to lead a historic civil rights march from Selma to Montgomery. He also ordered the desegregation of various public facilities in Alabama, and he was the first federal judge to dictate legislative reapportionment. He served on the U.S. District Court of Appeals from 1979 to 1992. In 1995 he received the Presidential Medal of Freedom.

Johnson, Jack *in full* **John Arthur Johnson** (b. Mar. 31, 1878, Galveston, Tex., U.S.—d. June 10, 1946, Raleigh, N.C.) U.S. boxer, the first black to hold the title for the heavyweight championship of the world. Johnson's career was marked from the beginning by racial discrimination; until his match with Tommy Burns, he had a difficult time getting fights. Johnson won the heavyweight crown in 1908 by knocking out Burns and kept it until 1915, when he was knocked out by Jess Willard in 26 rounds. At the height of his career, Johnson was excoriated by the press for having twice married white women, and he further offended white supremacists by knocking out former champion James J. Jeffries, who was induced to come out of retirement as a "Great White Hope." In 1912 Johnson was convicted of violating the Mann Act for transporting his wife-to-be across state lines before their marriage. He was sentenced to a year in prison and was released on bond; he fled to Canada, made his way to Europe, and was a fugitive for seven years. He defended the championship three times in Paris before agreeing to fight Willard in Havana, Cuba. Some observers thought that Johnson, mistakenly believing that the charge against him would be dropped if he yielded the championship to a white man, deliberately lost to Willard. Johnson surrendered to U.S. authorities in 1920 to serve a one-year sentence. From 1897 to 1928, Johnson had 114 bouts, winning 80, 45 by knockouts.

Jack Johnson
UPI COMPIX

Johnson, James P(rice) (b. Feb. 1, 1894, New Brunswick, N.J., U.S.—d. Nov. 17, 1955, New York, N.Y.) U.S. pianist and composer, a chief figure in the transition of ragtime to jazz. Johnson was performing in saloons and at parties in New York City's African American community while still in his teens. He created the stride piano technique, a development of ragtime that used two-beat left-hand rhythms to accompany wide-ranging right-hand lines, in pieces such as "Carolina Shout" and "Harlem Strut." He composed and orchestrated music for stage revues, including *Keep Shufflin'* (1928) with his student Fats Waller. His songs include "The Charleston" (largely responsible for the 1920s dance craze) and "Old Fashioned Love"; his large-scale works include the *Harlem Symphony* (1932).

Johnson, James Weldon (b. June 17, 1871, Jacksonville, Fla., U.S.—d. June 26, 1938, Wiscasset, Maine) U.S. writer. He practiced law in Florida before moving with his brother, the composer J. Rosamond Johnson (1873–1954), to New York; there the two collaborated on some 200 songs for the Broadway stage. Johnson held diplomatic posts in Venezuela and Nicaragua and served as executive secretary of the NAACP (1920–30). From 1930 he taught at Fisk University. His writings include the novel *Autobiography of an Ex-Colored Man* (1912), *Fifty Years and Other Poems* (1917), and his best-known work, *God's Trombones* (1927), a group of dialect sermons in verse. The brothers collaborated on the pioneering anthologies *Book of American Negro Poetry* (1922) and *American Negro Spirituals* (1925, 1926). Their most famous original song, "Lift Every Voice and Sing," became an anthem of the civil rights movement.

Johnson \'jän-sən**, John H(arold)** (b. Jan. 19, 1918, Arkansas City, Ark., U.S.—d. Aug. 8, 2005, Chicago, Ill.) U.S. magazine and book publisher. He moved to Chicago with his family and became a journalist. In 1942 he introduced *Negro Digest*, a periodical for blacks. Three years later he launched *Ebony*, a magazine he modeled on *Life*; by 2004 it had a circulation of some 1.7 million. Through Johnson Publishing Co., he also published black-oriented books and other magazines, and he later moved into radio broadcasting, insurance, and cosmetics manufacturing.

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Johnson, Lyndon B(aines) (b. Aug. 27, 1908, Gillespie county, Texas, U.S.—d. Jan. 22, 1973, San Antonio, Texas) 36th president of the U.S. (1963–69). He taught school in Houston, Texas, before going to Washington, D.C., in 1932 as a congressional aide. In Washington he was befriended by Sam Rayburn, speaker of the House of Representatives, and his political career blossomed. He won a seat in the U.S. House (1937–49) as a supporter of the New Deal, which was under conservative attack. His loyalty impressed Pres. Franklin D. Roosevelt, who made Johnson his protégé. He won election to the U.S. Senate in 1949 in a vicious campaign that involved fraud on both sides. As Democratic whip (1951–55) and majority leader (1955–61), he developed a talent for consensus building through methods both tactful and ruthless. He was largely responsible for passage of the civil rights bills of 1957 and 1960, the first in the 20th century. In 1960 he was elected vice president under John F. Kennedy; he became president after Kennedy's assassination in 1963. In his first few months in office he won passage of the Civil Rights Act of 1964, the most comprehensive and far-reaching legislation of its kind in American history. Later that year he announced his Great Society program of social-welfare and civil rights legislation. His attention to domestic matters, however, was diverted by the country's escalating involvement in the Vietnam War (see Gulf of Tonkin Resolution), which provoked large student demonstrations and other protests, beginning in the late 1960s. Meanwhile, discontent and alienation among the young and racial minorities increased as the promises of the Great Society failed to materialize. By 1967 Johnson's popularity had declined steeply, and in early 1968 he announced that he would not seek reelection. He retired to his Texas ranch.

Johnson, Magic *orig.* **Earvin Johnson, Jr.** (b. Aug. 14, 1959, Lansing, Mich., U.S.) U.S. basketball player. He led Michigan State University to the collegiate championship in 1979 and led the NBA Los Angeles Lakers to five championships in the 1980s. Standing 6 ft 9 in. (2.06 m) tall, he was exceptionally tall for a point guard and was able to use his size to rebound and score inside. However, he was best known for his creative passing and expert floor leadership. He was named Most Valuable Player three times (1987, 1989, 1990). He retired after being diagnosed with HIV in 1991, though he returned to the Lakers for brief stints as a player and as a coach.

Johnson, Michael (Duane) (b. Sept. 13, 1967, Dallas, Texas, U.S.) U.S. sprinter. For much of the 1990s he was virtually unbeaten in the 200-m and 400-m races. He shared an Olympic gold medal in 1992 on the world-record-setting 4 × 400-m relay team, and at the 1996 Olympics he became the first man to win gold medals in both the 200 m and 400 m, setting a world record of 19.32 seconds in the 200 m. In 1999 he set a new world record of 43.18 seconds in the 400 m. In the 2000 Olympics he again won two gold medals.

Johnson, Philip C(ortelyou) (b. July 8, 1906, Cleveland, Ohio, U.S.—d. January 25, 2005, New Canaan, Conn.) U.S. architect and critic. He studied philosophy and architecture at Harvard University. As coauthor of *The International Style: Architecture Since 1922* (1932) and director of the architecture department (1932–34, 1946–54) at the Museum of Modern Art in New York City, he did much to familiarize Americans with modern European architecture. He gained fame with his own Glass House (1949), which struck a balance between the influence of Ludwig Mies van der Rohe (later his collaborator on the Seagram Building) and Classical allusion. His style took a striking turn with the AT&T headquarters, New York (1984), a controversial postmodernist landmark. In 1979 Johnson became the first recipient of the Pritzker Architecture Prize.

Rafer Johnson, putting the shot in the Olympic decathlon, 1960
AP/WIDE WORLD PHOTOS

Johnson, Rafer (Lewis) (b. Aug. 18, 1935, Hillsboro, Texas, U.S.) U.S. decathlete. While a student at UCLA, he won the decathlon gold medal at the 1955 Pan-American Games. At the 1960 Olympic Games he became the first African American athlete to carry the U.S. flag in the Olympic procession, and he captured the decathlon gold medalby narrowly defeating his UCLA teammate, Yang Chuan-kwang of Taiwan.

Johnson, Richard M(entor) (b. 1780, near Louisville, Va., U.S.—d. Nov. 19, 1850, Frankfort, Ky.) U.S. politician. He practiced law in Kentucky before being elected to the U.S. House of Representatives (1807–19, 1829–37). As a colonel in the War of 1812, he was wounded in the Battle of the Thames, where he reputedly killed Tecumseh. He returned to his congressional seat and later was elected to the Senate (1819–29). He was a loyal supporter of Pres. Andrew Jackson, who chose him as Martin Van Buren's running mate in the 1836 election. None of the four vice-presidential candidates won an electoral-vote majority, and the outcome was decided by the Senate, the only such occurrence in U.S. history. Johnson served one term in the office.

Johnson, Robert (b. c. 1911, Hazlehurst, Miss., U.S.—d. Aug. 16, 1938, near Greenwood, Miss.) U.S. blues guitarist, singer, and songwriter. Born to a sharecropping family, he learned harmonica and guitar, probably influenced by personal contact with Delta bluesmen such as Eddie "Son" House and Charley Patton. He traveled widely throughout the South and as far north as Chicago and New York City, playing at house parties, juke joints, and lumber camps. In 1936–37 he recorded songs by House and others, as well as originals such as "Me and the Devil Blues," "Hellhound on My Trail," and "Love in Vain." He is said to have died, at age 27, after drinking strychnine-laced whiskey (possibly the work of a jealous husband) in a juke joint. His eerie falsetto and masterly slide guitar influenced many later blues and rock musicians.

Johnson, Robert Wood (b. Feb. 15, 1845, Carbondale, Pa., U.S.—d. Feb. 7, 1910, New Brunswick, N.J.) U.S. manufacturer. He began his career as a pharmacist and drug broker. In 1885 he founded medical supply company Johnson & Johnson with his brothers, and he served as its president until his death. An early proponent of the teachings of Joseph Lister, Johnson worked to make his products as germ-free as possible, and the firm's high-quality and inexpensive medical supplies, including antiseptic bandages and dressings, proved of great value to surgery. The Robert Wood Johnson Foundation is a major philanthropic institution.

Johnson, Samuel *known as* **Dr. Johnson** (b. Sept. 18, 1709, Lichfield, Staffordshire, Eng.—d. Dec. 13, 1784, London) British man of letters, one of the outstanding figures of 18th-century England. The son of a poor bookseller, he briefly attended Oxford University. He moved to London after the failure of a school he and his wife had started. He wrote for periodicals and was hired to catalog the great library of the earl of Oxford. In 1755, after eight years of labour, he produced his monumental *Dictionary of the English Language* (1755), the first great English dictionary, which brought him fame. He continued to write for such periodicals as *The Gentleman's Magazine* and *The Universal Chronicle*, and he almost single-handedly wrote and edited the biweekly *The Rambler* (1750–52). He also wrote plays, none of which succeeded on the stage. In 1765 he produced a critical edition of William Shakespeare with a famous preface that did much to establish Shakespeare as the centre of the literary canon. His travel writings include *A Journey to the Western Islands of Scotland* (1775). His *Lives of the Most Eminent English Poets*, 10 vol. (1779–81), was a significant critical work. A brilliant conversationalist, he helped found the Literary Club (c. 1763), which became famous for its members of distinction, including David Garrick, Edmund Burke, Oliver Goldsmith, and Joshua Reynolds. His aphorisms helped make him one of the most frequently quoted of English writers. The biography of Johnson written by his contemporary James Boswell is one of the most admired biographies of all time.

Johnson, Virginia See William Masters and Virginia E(shelman) Johnson

Johnson, Walter (Perry) (b. Nov. 6, 1887, Humboldt, Kan., U.S.—d. Dec. 10, 1946, Washington, D.C.) U.S. baseball pitcher. Johnson had perhaps the greatest fastball in the history of the game. A right-handed thrower with a sidearm delivery who batted right as well, Johnson pitched for the Washington Senators of the American League from 1907 through 1927. He holds the all-time record for most shutouts (110), ranks second to Cy Young in wins (416), and established the record for his time for most strikeouts (3,508; broken in 1983). After his playing career, he became a manager with the Senators and later with the Cleveland Indians. See photograph on opposite page.

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Johnson, Sir William, 1st Baronet (b. 1715, Smithtown, County Meath, Ire.—d. July 11, 1774, near Johnstown, N.Y.) British colonial official. In 1737 he emigrated from Ireland and settled in New York's Mohawk Valley. He purchased his first tract of land two years later, thus beginning the acquisitions that eventually made him one of the largest landholders and wealthiest settlers in British America. He fostered friendly relations with the Indians; his ties with them were further cemented when, following the death of his first wife, he married successively two Mohawk women. In 1746 he was appointed colonel of the Iroquois Confederacy. In the French and Indian War he defeated French forces at Lake George, N.Y. (1755), and captured Fort Niagara (1759). He was appointed superintendent of the Six Iroquois Nations (1756–74), helped subdue the Indian uprising called Pontiac's War (1763–64), and negotiated the first Treaty of Fort Stanwix (1768).

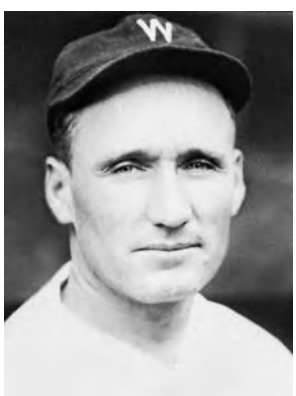
Johnston, Joseph E(ggleston) (b. Feb. 3, 1807, near Farmville, Va., U.S.—d. March 21, 1891, Washington, D.C.) U.S. Army officer. He graduated from West Point and served in the Mexican War. At the start of the American Civil War he resigned his commission to serve the Confederacy. Appointed brigadier general, he won the first Confederate victory at the Battle of Bull Run. He was promoted to general but remained at odds with Confederate Pres. Jefferson Davis. He defended Richmond in the Peninsular Campaign and was badly wounded at the Battle of Fair Oaks (1862). In 1863 he was sent to conduct the Vicksburg Campaign. His order to evacuate the city was countermanded by Davis, but Johnston was blamed for the city's fall. As commander of the Army of the Tennessee, he avoided defeat as the Union advanced toward Atlanta, Ga., but he was removed from command for failing to defeat the invaders. Restored to duty in 1865, he was forced to surrender to William T. Sherman.

Johnstown Flood Disastrous flood (1889) in the town of Johnstown, Pa., U.S. Johnstown lies at the confluence of the Conemaugh River and Stony Creek; at the time of the flood it was a leading U.S. steelmaking centre. At 3:10 PM on May 31, the South Fork Dam, a poorly maintained earthfill dam holding a major upstream reservoir, collapsed after heavy rains, sending a wall of water rushing down the Conemaugh Valley at speeds of 20–40 mph (30–60 kph). A 30-ft (9-m) wall of water smashed into Johnstown at 4:07 PM, killing 2,209 people.

Johore \jə-'hōr\ **Strait** Northern arm of the Singapore Strait between the Republic of Singapore and the southern tip of the Malay Peninsula. It is 30 mi (50 km) long and 0.75–3 mi (1.2–5 km) wide. Its eastern portion has a deepwater access channel to Changi naval base on Singapore's northeastern coast. During World War II it was the scene of heavy fighting in 1942, when the Japanese were driving to conquer Singapore. A causeway now links Singapore to the Malaysian mainland.

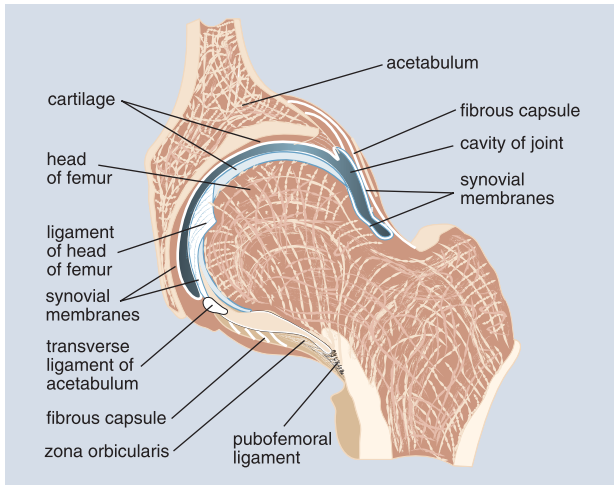
joint In geology, a brittle fracture surface in rocks along which little or no displacement has occurred. Present in nearly all surface rocks, joints extend in various directions, generally more vertical than horizontal. Joints may have smooth, clean surfaces, or they may be scarred by slickensides, or striations. Jointing does not extend very far into the Earth's crust, because at about 7.5 mi (12 km) even rigid rocks tend to flow plastically in response to stress.

joint Structure connecting two or more bones. Most joints, including synovial (fluid-containing) joints and those between vertebrae, which incorporate a disk, can move. Immovable joints include the sutures of the skull (see fontanel). Ligaments connect the bones of a joint, but muscles keep them in place. Joint disorders include various forms of arthritis, injuries (e.g., sprains, fractures, and dislocations), congenital disorders, and vitamin deficiencies. See illustration above.



Walter Johnson.
UPI

joints and joinery In architecture, the connection of construction materials. All joints are carefully detailed by the architect with concern for strength, movement, penetration by the elements, and incompatibilities. The term joinery refers especially to carpentry. Common types of joints include the dovetail, used for interlocking two flat members at right angles, as in the sides of a drawer; the doweled joint, in which doweling is employed for mechanical strength; and the mortise and tenon, in which a projecting piece fits into a groove, used to join a horizontal member with the vertical member of a frame. See illustration on following page.



Section through a hip joint. The hip joint, a synovial joint, is of the ball-and-socket type, the head of the femur articulating with the cup-shaped acetabulum. The joint cavity is enclosed by a fibrous capsule lined with a type of connective tissue (synovial membrane) that produces a fluid (synovial fluid) which lubricates the cartilage-covered opposing surfaces of bone. The fibrous capsule is made up of internal circular fibres (zona orbicularis) and external longitudinal fibres, strengthened by ligaments, and covered by muscles.
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Joinville \zhwaⁿ-'vēl**, Jean, sire de** (b. c. 1224, Joinville, Champagne—d. Dec. 24, 1317, Joinville) French chronicler. A member of the lesser nobility of Champagne, Joinville became friends with Louis IX while taking part in the Seventh Crusade (1248–54). His famous *Histoire de Saint Louis*, completed c. 1309, is a prose chronicle that provides a supreme account of that Crusade, including vivid descriptions of the financial hardships, the dangers of sea voyages, the ravages of disease, the confusion and lack of discipline in the Crusading army, and Muslim customs. On his return he was made seneschal of Champagne and divided his time between the royal court and his fief of Joinville.

Joliba River See Niger River

Joliot-Curie \zhȯl-yō-kyū-'rē**, (Jean-) Frédéric** *orig.* **Jean-Frédéric Joliot** (b. March 19, 1900, Paris, France—d. Aug. 14, 1958, Arcouest) French physical chemist. In 1926 he married Irène Curie (1900–58), daughter of Pierre and Marie Curie; he would eventually append her name to his. In 1932 he first observed production of an electron-positron pair. Frédéric and Irène are remembered for their discovery of new radioactive isotopes prepared artificially, for which they were jointly awarded a 1935 Nobel Prize. Frédéric served in the Resistance during World War II and became a member of the Communist Party; in the postwar years he served as the highest government official in the realm of atomic energy but was dismissed for his political beliefs. From 1946 to 1956 Irène directed the Radium Institute, where she had first worked in 1918; Frédéric succeeded her in the post. Both died of conditions caused by their long exposure to radioactivity.

Jolliet \zhȯl-'yā**, Louis** (b. before Sept. 21, 1645, probably Beaupré, near Quebec—d. after May 1700, Quebec province) French Canadian explorer and cartographer. He led an expedition in the Great Lakes region in 1669. In 1672 he was commissioned by the governor of New France to explore the Mississippi in the company of Jacques Marquette and five others. In 1673 the party set out in birchbark canoes across Lake Michigan, following the Fox and Wisconsin rivers to the Mississippi, then down the Mississippi to its confluence with the Arkansas. They concluded that the river flowed south to the Gulf of Mexico and not, as hoped, into the Pacific Ocean. After their return, Jolliet explored areas of Hudson Bay and the Labrador coast.

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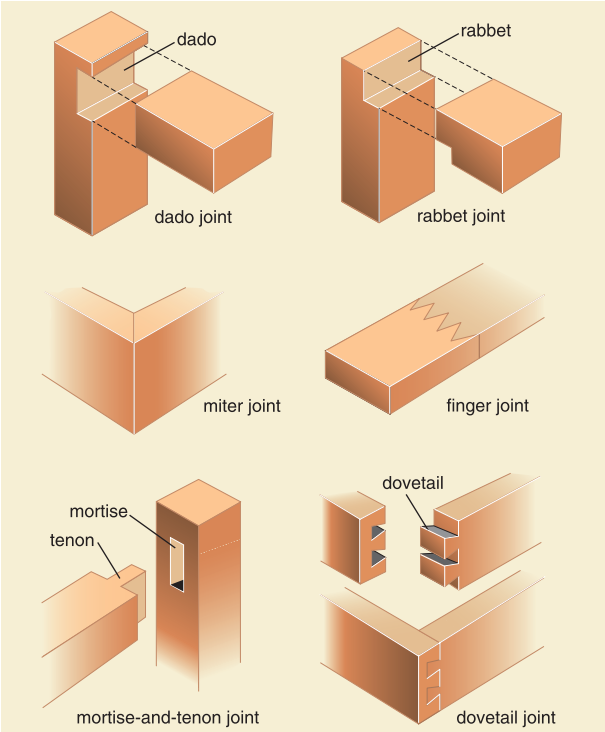

Some common woodworking joints. The dado joint is made by inserting the end of one piece into a rectangular groove (dado) in another. The rabbet joint involves joining pieces along a channel or notch (rabbet) along an edge of one or both members. The miter joint is formed by butting two ends cut at an angle. The finger joint is used to lengthen a board by interlacing fingerlike projections. The mortise-and-tenon joint is made by inserting a projection (tenon) on one piece into a notch or hole (mortise) in the other. The dovetail joint consists of one or more fan-shaped tenons fitting tightly into corresponding mortises.

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Jolson, Al *orig.* **Asa Yoelson** (b. May 26, 1886, Srednike, Russia—d. Oct. 23, 1950, San Francisco, Calif., U.S.) Russian-born U.S. singer, songwriter, and blackface comedian. Jolson's family arrived in the U.S. in 1893 and settled in Washington, D.C., where Jolson made his first stage appearance in 1899, performing in VAUDEVILLE before joining a minstrel troupe (see MINSTREL SHOW) in 1909. In New York City he was featured in musicals such as *La Belle Paree* (1911), *Honeymoon Express* (1913), and *Big Boy* (1925). In *Sinbad* (1918) he transformed the unsuccessful GEORGE GERSHWIN song "Swanee" into his trademark number. In *Bombo* (1921) he introduced "My Mammy," "Toot, Toot, Tootsie," and "California, Here I Come." In 1927 he starred in *The Jazz Singer*, the first feature film with synchronized speech as well as music and sound effects. His later films include *The Singing Fool* (1928), *Mammy* (1930), and *Swanee River* (1940).

Jomini \ˌzhō-mə-'nē**, (Antoine-) Henri, baron de** (b. March 6, 1779, Payerne, Switz.—d. March 24, 1869, Passey, France) Swiss-French general and military theorist. After a volunteer stint with the French army (1798–1800), he wrote his *Treatise on Grand Military Operations*, 5 vol. (1805). He was appointed staff colonel in 1805 by NAPOLEON I, who had read his book. He was created a baron after the Treaties of Tilsit (1807). He rose to the post of chief of staff, but unjust treatment by his superiors prompted him to resign (1813), and thereafter he fought for France's enemy, Russia. Of his numerous later works on military history and strategy, the best known are *Principles of Strategy* (1818) and *Summary of the Art of War* (1838). He was the first to fix divisions between STRATEGY, TACTICS, and LOGISTICS, and his systematic attempt to define the principles of warfare made him a founder of modern military thought.

Jōmon \'jō-ˌmän\ **culture** (c. 7500–c. 250 BC) MESOLITHIC culture characterized by pottery decorated with cord patterns (*jōmon*). Jōmon artifacts have been found from Hokkaido to the Ryukyu Islands. The Jōmon people lived in sunken pit dwellings and subsisted primarily by hunting, fishing, and gathering. They used chipped-stone and later polished-stone tools and made clothing of bark. Though their pottery was technically primitive, it demonstrated diverse forms and imaginative designs and decorations. Many contemporary AINU believe themselves to be descended from the Jōmon people. See also YAYOI CULTURE.

Jonah (fl. c. 785 BC) One of the 12 Minor Prophets in the OLD TESTAMENT, whose story is told in the book of Jonah. (His narrative is part of a larger book, The Twelve, in the Jewish canon, and he is first mentioned in the book of Kings.) God orders Jonah to prophesy against the wickedness of NINEVEH, but Jonah refuses to believe that the people of this hated foreign city deserve salvation, and he sails away on a ship in the opposite direction. When a great storm threatens to destroy the ship, he confesses his fault and asks the crew to throw him overboard. A great fish swallows him, but he prays for deliverance and the fish spews him out on dry ground. He goes on to Nineveh and preaches God's message; its sinful people repent and are saved by God. Jonah is angered over the salvation of the Ninevites and hopes that the city will be destroyed, for which God rebukes him. The book, which opposes the narrow Jewish nationalism of the time, was probably written in the 5th or 4th century BC.

Jonathan In the Hebrew scriptures, the eldest son of King SAUL and friend of DAVID. A warrior in the Israelite army, he is first mentioned as victor over the Philistines at Geba. After David joined Saul's household, he and Jonathan became close friends. Saul became jealous of David's popularity and sought to kill him, but Jonathan prevented him. When the two met for the last time, they planned that David would be the next king of Israel and Jonathan his prime minister, but Saul and Jonathan were killed in battle at Mount Gilboa.

Jones, Bill T. *orig.* **William Tass Jones** (b. Feb. 15, 1952, Bunnell, Fla., U.S.) U.S. dancer and choreographer. He trained in dance and theatre at the State University of New York, Binghamton. In 1982, with his companion, Arnie Zane (1948—88), he cofounded the Bill T. Jones/Arnie Zane Dance Co. All his performances have been in works he has choreographed alone or with a collaborator; they include *Runner Dreams* (1978) and *Open Spaces* (1980). His works often make explicit reference to social issues; his controversial *Still/Here* (1995) deals with the sufferings caused by HIV, with which Jones is infected and which was the cause of Zane's death.

Jones, Bobby *in full* **Robert Tyre Jones, Jr.** (b. March 17, 1902, Atlanta, Ga., U.S.—d. Dec. 18, 1971, Atlanta) U.S. golfer. Jones won 13 major championships between 1923 and 1930, a feat unequaled until 1973. In 1930 he became the first golfer to achieve the grand-slam of his time—the British and U.S. Open and Amateur championships—after which he retired from competitive golf at the age of 28, having never become a professional. Jones helped establish the MASTERS TOURNAMENT, one of the four major tournaments that make up the modern grand-slam of golf (the other three being the British Open, the U.S. Open, and the PGA Championship).

Bobby Jones

UPI/EB INC.

Jones, Chuck *in full* **Charles Martin Jones** (b. Sept. 21, 1912, Spokane, Wash., U.S.—d. Feb. 22, 2002, Corona del Mar, Calif.) U.S. animator. He became a cartoonist for Warner Brothers (1933–62), where he helped develop characters such as Bugs Bunny, Road Runner, and Wile E. Coyote. Three of his cartoon films, noted for their speed and action, won Academy Awards. He was head of animation for MGM in the 1960s, then formed his own company and directed animated features such as *The Phantom Tollbooth* (1971) and specials for television. Jones received an Academy Award for lifetime achievement in 1996.

Jones, Deacon *orig.* **David Jones** (b. Dec. 9, 1939, Eatonville, Fla., U.S.) U.S. football player. He stood 6 ft 5 in. (1.96 m) tall and weighed

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250 lbs (113 kg) and could run the 100-yard dash in 9.7 seconds. He excelled at tackling the quarterback behind the line of scrimmage (for which he coined the term *sack*). As a defensive end for the Los Angeles Rams (1961–71), he was regarded as one of the sport's premier defensemen and was named All-NFL six consecutive times (1965–70). He later played for the San Diego Chargers (1972–73) and Washington Redskins (1974).

Jones, (Alfred) Ernest (b. Jan. 1, 1879, Rhosfelyn, Glamorgan, Wales—d. Feb. 11, 1958, London, Eng.) Welsh psychoanalyst. After he became a member of London's Royal College of Physicians, his interest gradually shifted to psychiatry. With Carl Gustav Jung he organized the first psychoanalytic conference (Salzburg, 1908), where he met Sigmund Freud. Jones was instrumental in introducing psychoanalysis to Britain and North America; in 1919 he founded the British Psycho-Analytical Institute, and in 1920 he founded the *International Journal of Psycho-Analysis*,which he edited until 1939. After the Nazi takeover of Austria, he helped the ailing Freud and his family to escape to London. His biography of Freud, entitled *The Life and Work of Sigmund Freud* (3 vol., 1953–57), was for many years the standard biography.

Jones, George (Glenn) (b. Sept. 12, 1931, Saratoga, Texas, U.S.) U.S. country music singer and songwriter. He was born to an impoverished family, which moved to Beaumont, Texas, when he was 11 years old. He sang on the streets as a youngster, and he began recording in the early 1950s. His first hit, "Why, Baby, Why" (1955), was followed by "She Thinks I Still Care," "He Stopped Loving Her Today," and many others. In 1957 he joined the Grand Ole Opry. He continued to have hits into the 1980s, including many with his former wife Tammy Wynette. His rocky personal life and career only increased his fans' enduring affection.

Jones, Inigo (b. July 15, 1573, Smithfield, London, Eng.—d. June 21, 1652, London) British painter, architect, and designer. The son of a clothworker, he studied painting in Italy and attracted the patronage of the king of Denmark, for whom he apparently designed two palaces before returning to England. Beginning in 1605, he designed the scenes and costumes for masques by Ben Jonson and others. From 1615 to 1642, he was the King's Surveyor of Works. His first important undertaking was the Queen's House at Greenwich (begun 1616), England's first Palladian-style building. His greatest achievement, the Banqueting House at Whitehall (1619–22), consists of one great raised chamber with colonnades set against the walls, which support a flat, beamed ceiling. For his design for Covent Garden (1630), London's first square, Jones is credited with the introduction of town planning in England.

Jones, James Earl (b. Jan. 17, 1931, Arkabutla, Miss., U.S.) U.S. actor. He studied acting in New York City and made his Broadway debut in 1957. He was praised for his performance in *Othello* (1964) and in roles with the New York Shakespeare Festival (1961–73). He starred as the black boxer in *The Great White Hope* (1969, Tony Award; film, 1970). After returning to Broadway in *Paul Robeson* (1978) and *Fences* (1985, Tony Award), he starred in the television series *Paris* (1979–80) and *Gabriel's Fire* (1990–91, Emmy Award). He has appeared in numerous films; his sonorous voice lent gravity to the character of Darth Vader in *Star Wars* (1977) and its sequels and to the Mufasa role in *The Lion King* (1994).

Jones, Jennifer *orig.* **Phyllis Isley** (b. March 2, 1919, Tulsa, Okla., U.S.) U.S. film actress. She played leads in minor films from 1939 before coming to the notice of David O. Selznick, who cast her in *The Song of Bernadette* (1943, Academy Award). Selznick continued to choose her roles, and she starred in such films as *Love Letters* (1945), *Duel in the Sun* (1946), and *Love Is a Many-Splendored Thing* (1955). She married Selznick in 1949 and appeared in films into the 1960s.

Jones, Jim *orig.* **James Warren Jones** (b. May 13, 1931, near Lynn, Ind., U.S.—d. Nov. 18, 1978, Jonestown, Guyana) U.S. leader of a New Religous Movement. He became a preacher in Indianapolis. He established the People's Temple, which was affiliated with the Disciples of Christ and opposed racism and poverty. The group moved to San Francisco in 1971. Accused of defrauding church members, Jones led his group to Guyana in 1977 and set up the agricultural commune of Jonestown, using threats and force to control his followers. In 1978 U.S. Congressman Leo Ryan went to Jonestown to investigate allegations against Jones. Ryan and four others were killed when they reached the airport to return to the U.S. In the aftermath, most of the Jonestown residents, in a mass rite of murder-suicide, were shot or poisoned; Jones died of a gunshot wound. The death toll was 913, including many children.

Jones, John Paul *orig.* **John Paul** (b. July 6, 1747, Kirkbean, Kirkcudbright, Scot.—d. July 18, 1792, Paris, France) American naval hero. He went to sea at age 12 and became a ship's master at age 21. He joined his brother in Virginia in 1775. When the American Revolution began, he joined the new Continental Navy under Esek Hopkins. In 1776 he sailed the *Providence* along the Atlantic coast, capturing eight British ships and sinking eight more. Appointed by Congress to the newly built *Ranger*, he made a spectacular cruise through St. George's Channel and the Irish Sea (1777–78), where he took a number of prizes. In 1779 he commanded the *Bonhomme Richard* and intercepted a merchant fleet. Though outgunned by an escort ship, the *Serapis*, he forced its surrender after a fierce battle, answering its challenge to surrender with "I have not yet begun to fight!" His ship sank soon after, and he sailed two British prizes to the Netherlands. In 1790 he retired, in ill health, to France.

John Paul Jones, portrait by Charles Willson Peale, 1781.
COURTESY OF THE INDEPENDENCE NATIONAL HISTORICAL PARK COLLECTION, PHILADELPHIA

Jones, Mary Harris *orig.* **Mary Harris** *known as* **Mother Jones** (b. May 1, 1830, Cork, Ire.—d. Nov. 30, 1930, Silver Spring, Md., U.S.) Irish-born U.S. labour organizer. She was brought to the U.S. as a child in 1835. In 1867 she lost her children and husband (an ironworker) in a yellow-fever epidemic in Memphis, Tenn.; four years later she lost all her possessions in the great Chicago fire. She turned for assistance to the Knights of Labor, which led to her becoming a highly visible figure in the U.S. labour movement. She traveled across the country, organizing for the United Mine Workers and supporting strikes wherever they were being held. At 93 she was still working among striking coal miners in West Virginia. She actively supported legislation to prohibit child labour. She was a founder of the Social Democratic Party (1898) and the Industrial Workers of the World (1905). Her autobiography was published in 1925. She died at the age of 100 and was buried in the Union Miners' Cemetery in Mount Olive, Ill.

Jones, Quincy *orig.* **Quincy Delight Jones, Jr.** (b. March 14, 1933, Chicago, Ill., U.S.) U.S. composer, bandleader, and producer. Jones joined a combo with his friend Ray Charles in his early teens, and he later studied music in Seattle and Boston. In the early 1950s he played trumpet with Lionel Hampton. He became an arranger for Dizzy Gillespie and others and ultimately formed his own big band and worked with figures such as Count Basie, Sarah Vaughan, and Dinah Washington. In the early 1960s he began writing scores for films, including *Walk Don't Run* (1966), *In Cold Blood* (1967), and *The Color Purple* (1985). Beginning in the mid-1970s he principally worked as a producer, and among his projects were enormously successful albums for Michael Jackson and Frank Sinatra. By the early 21st century, Jones had won more than 25 Grammy Awards. He also founded the music magazine *Vibe* and the record label Qwest.

Jones, Spike *orig.* **Lindley Armstrong Jones** (b. Dec. 14, 1911, Long Beach, Calif., U.S.—d. May 1, 1965, Los Angeles, Calif.) U.S. bandleader known for his novelty recordings. Jones played drums in radio bands in the late 1930s and soon became known for adding anarchically comical sounds such as car horns, cowbells, and anvils to his percussion. In 1942 he formed Spike Jones and His City Slickers, and the band soon had a hit recording with "Der Fuehrer's Face." Jones's comic hits continued into the 1950s, when he also had his own TV show. Later switching from comedy to Dixieland, the band continued to record into the 1960s.

Jones, Sir William (b. Sept. 28, 1746, London, Eng.—d. April 27, 1794, Calcutta) British orientalist, linguist, and jurist. He completed an authoritative *Grammar of the Persian Language* in 1771. For financial reasons he then turned to the study and practice of law. His *Moallakât*, a translation of seven famous Arabic odes, was published in 1782, and the following year he was knighted and sailed for Calcutta (now Kolkata) as judge of the Supreme Court. He founded the Asiatic Society of Bengal

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to encourage Asian studies and published scholarly works on Hindu and Muslim law. His proposition (1786) that there was a common source for languages ranging from Celtic to Sanskrit led to recognition of the INDO-EUROPEAN LANGUAGE family.

jongleur \zhō^{n}-'glœr,\ *English* \'jäŋ-glər\ Professional storyteller or public entertainer in medieval France. His roles included those of musician, juggler, acrobat, and reciter of literary works. Jongleurs performed in marketplaces on public holidays, in abbeys, and in castles of nobles, who sometimes retained them in permanent employment. Jongleurs were most important in the 13th century; in the 14th century, the various facets of their role were taken over by other performers. See also GOLIARD; TROUVÈRE.

jonquil Popular garden flower (*Narcissus jonquilla*), a Mediterranean perennial bulbous herb of the AMARYLLIS FAMILY. Bearing long linear leaves, it is widely cultivated for its yellow or white, fragrant, short-tubed, clustered flowers. An oil from jonquil flowers is used in perfumes. See also NARCISSUS.

Jonson, Ben(jamin) (b. June 11?, 1572, London, Eng.—d. Aug. 6, 1637, London) British playwright, poet, and critic. After learning stagecraft as a strolling player, he wrote plays for PHILIP HENSLOWE's theatres. In 1598 his comedy *Every Man in His Humour* established his reputation. He wrote several MASQUES for the court of James I and created the "antimasque" to precede the masque proper. His classic plays *Volpone* (1605–06), *The Alchemist* (1610), and *Bartholomew Fair* (1614) use satire to expose the follies and vices of his age, attacking greed, charlatanism, and religious hypocrisy as well as mocking the fools who fall victim to them. Regarded as the era's leading dramatist after WILLIAM SHAKESPEARE, Jonson influenced later playwrights, notably in the dramatic characterization of Restoration comedies (see RESTORATION LITERATURE). He was also a lyric poet whose works include two famous elegies for his son and daughter.

Jöntürkler See YOUNG TURKS

Jooss \'yōs**, Kurt** (b. Jan. 12, 1901, Wasseralfingen, Ger.—d. May 22, 1979, Heilbronn, W.Ger.) German dancer, teacher, and choreographer. After studying dance with RUDOLF LABAN (1920–24), he established a school and company. He became ballet master at the Essen Opera House in 1930, where he choreographed his signature ballet, *The Green Table* (1932). He moved his school and company to England in 1934, and his renamed Ballets Jooss toured worldwide until disbanding in 1947. He returned in 1949 to Essen, where he continued to choreograph works that combined ballet and modern dance in an Expressionist style.

Jooss in *The Green Table*, c. 1935
H. ROGER-VIOLLET

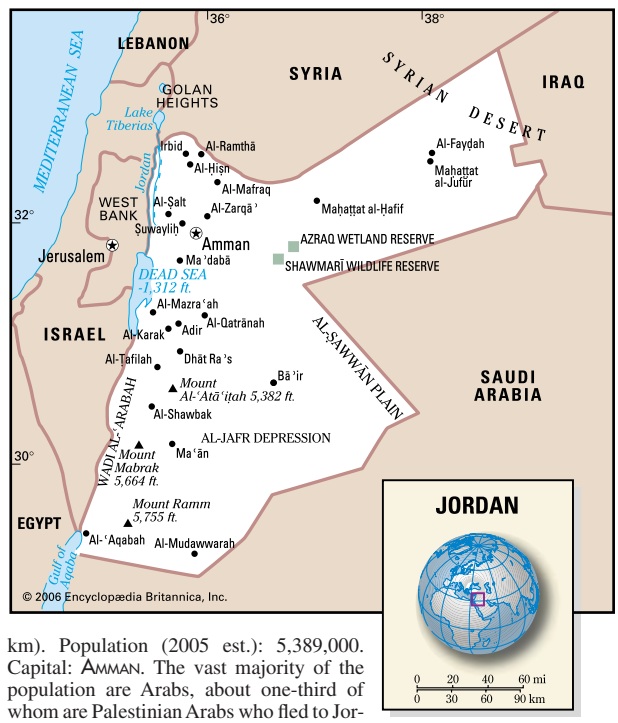
Joplin, Janis (Lyn) (b. Jan. 19, 1943, Port Arthur, Texas, U.S.—d. Oct. 4, 1970, Los Angeles, Calif.) U.S. rock and BLUES singer. Born to a middle-class family, she ran away from home at age 17 and began singing in Austin, Texas, and later in Los Angeles. She joined the band Big Brother and the Holding Company in San Francisco in 1966 and soon became famous for her raw, powerful, emotional blues style. The album *Cheap Thrills* (1968) contains some of her best-known recordings. After leaving the band, she continued to record hit songs, including "Me and Bobby McGee." She died from an overdose of heroin at age 27.

Joplin, Scott (b. Nov. 24, 1868, Bowie county, Texas, U.S.—d. April 1, 1917, New York, N.Y.) U.S. pianist and composer, the outstanding exponent of RAGTIME music. Joplin was a classically trained pianist and composer. His compositions, including "Maple Leaf Rag" (1899), ragtime's first hit, and "The Entertainer" (1902), show an acute logic that transcends the sometimes mechanical dimension of the genre. He also wrote a ballet and two operas, including *Treemonisha* (1911), as well as several didactic works. He suffered a nervous collapse in 1911 and was institutionalized in 1916.

Jordaens \'yȯr-ˌdȧns**, Jacob** (b. May 19, 1593, Antwerp, Spanish Netherlands—d. Oct. 18, 1678, Antwerp) Flemish painter active in Antwerp. He was admitted to the painters' guild in 1615 and by the 1620s had a flourishing studio with many students. After the death of PETER PAUL RUBENS, to whose Baroque style he was indebted, he became the leading painter in Flanders. His paintings, crowded with robust figures, are noted for strong contrasts of light and shade and an air of sensual vitality bordering on coarseness. He also produced religious paintings and portraits. His most important commissions were two enormous murals for the royal residence called the Huis ten Bosch, near The Hague. His later works tend to be mediocre and were frequently executed by assistants.

The King Drinks, oil painting by Jacob Jordaens, 1638; in the Royal Museums of Fine Arts, Brussels.
COURTESY OF THE MUSEES ROYAUX DES BEAUX-ARTS, BRUSSELS; PHOTOGRAPH, PHOTO SASKIA, NORTH AMHERST, MASS.

Jordan *officially* **Hashemite Kingdom of Jordan** Country, MIDDLE EAST, southwestern Asia, lying east of the JORDAN RIVER. Jordan has 16 miles (26 km) of coastline on the Gulf of AQABA. Area: 34,495 sq mi (89,342 sq km). Population (2005 est.): 5,389,000. Capital: AMMAN. The vast majority of the population are Arabs, about one-third of whom are Palestinian Arabs who fled to Jordan from neighbouring Israel and the West Bank as a result of the ARAB-ISRAELI WARS. Language: Arabic (official). Religion: Islam (official; predominantly Sunni). Currency: Jordan dinar. Four-fifths of the country is desert; less than one-tenth of the land is arable. The



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highest point of elevation, Mount Ramm (5,755 ft [1,754 m]), rises in the uplands region on the east bank of the Jordan River. The Jordan Valley region contains the Dead Sea. Jordan's economy is based largely on manufacturing and services (including tourism); exports include phosphate, potash, pharmaceuticals, fruits and vegetables, and fertilizers. Jordan is a constitutional monarchy with two legislative houses; the head of state and government is the king, assisted by the prime minister. Jordan shares much of its history with Israel, since both occupy parts of the area known historically as Palestine. Much of present-day Jordan was once part of the kingdom of Israel under David and Solomon (c. 1000 BC). It fell to the Seleucids in 330 BC and to Muslim Arabs in the 7th century AD. The Crusaders extended the kingdom of Jerusalem east of the Jordan River in 1099. The region became part of the Ottoman Empire during the 16th century. In 1920 the area comprising Jordan (then known as Transjordan) was established within the British mandate of Palestine. Britain recognized Transjordan's partial independence in 1923, although the British mandate did not end until 1948. In 1950, after the end of hostilities with the new State of Israel, Jordan annexed the West Bank and east Jerusalem, administering the territory until Israel gained control of it in the Six-Day War of 1967. In 1970–71 Jordan was wracked by fighting between the government and guerrillas of the Palestine Liberation Organization (PLO), a struggle that ended with the PLO being expelled from Jordan. In 1988 King Hussein renounced all Jordanian claims to the West Bank in favour of the PLO. In 1994 Jordan and Israel signed a full peace agreement.

Jordan, Barbara C(harline) (b. Feb. 21, 1936, Houston, Texas, U.S.—d. Jan. 17, 1996, Austin, Texas) U.S. lawyer and politician. She earned a law degree from Boston University in 1959, served in the Texas state senate (1966–72), and then won election to the U.S. House of Representatives (1973–79), becoming the first African American congresswoman to be elected from the Deep South. She became a national figure in 1974, when she participated in televised hearings of the House Judiciary Committee on the possible impeachment of Pres. Richard Nixon. Her keynote address at the 1976 Democratic National Convention confirmed her reputation as a commanding and articulate public speaker. She retired from the House to teach at the University of Texas.

Jordan, David Starr (b. Jan. 19, 1851, near Gainesville, N.Y., U.S.—d. Sept. 19, 1931, Stanford, Calif.) U.S. educator and ichthyologist. He studied at Cornell University and taught at universities in Indiana until 1885, when he became president of Indiana University. In 1891 he became the first president of Stanford University, and served until 1913. His extensive field trips led to his naming 1,085 genera and more than 2,500 species of fishes. He was coauthor (with B.W. Evermann) of *The Fishes of North and Middle America* (1896–1900) and author of *Manual of the Vertebrates of the Northern United States* (13 editions, 1876–1929). He devoted his later career mainly to the cause of international peace, acting as chief director of the World Peace Foundation.

Jordan, Michael (Jeffrey) (b. Feb. 17, 1963, Brooklyn, N.Y., U.S.) U.S. basketball player. As a freshman in 1982, he helped the University of North Carolina win the collegiate national championship. Drafted by the Chicago Bulls in 1984, he won 10 scoring titles and 5 Most Valuable Player awards while leading the Bulls to six championships (1991–93, 1996–98). He was also part of the 1984 and 1992 U.S. Olympic basketball teams that won gold medals. He retired briefly in 1993, hoping to play professional baseball, but returned to the Bulls in 1995. He retired again in 1999, but, after a stint as an owner and general manager of the Washington Wizards, Jordan returned to play for that team in 2001. Known as "Air Jordan" for his exceptional leaping ability, he combined acrobatic play with a fierce competitive spirit and was considered among the game's greatest players. His success on the court and in the business world made him one of the most popular and recognized athletes of all time.

Jordan River River, Middle East. It rises in Syria, flows through the Lake Tiberias (Sea of Galilee), and then receives its main tributary, the Yarmūk River. It drains into the Dead Sea at 1,312 ft (400 m) below sea level after a total course of 223 mi (360 km). In Christianity it is known as the place where John the Baptist baptized Jesus.

joruri See BUNRAKU

José Bonifácio See Jose Bonifacio de Andrada e Silva

Joseph In the Old Testament, the son of the patriarch Jacob and his wife, Rachel. He was favoured by his father, and his brothers became bitterly jealous when he was given a resplendent "coat of many colors" (literally, coat with flowing sleeves). They sold him into slavery in Egypt, telling Jacob he had been killed by a wild beast. In Egypt Joseph gained favour with the pharaoh and rose to high office, owing to his ability to interpret dreams, and his acquisition of grain supplies enabled Egypt to withstand a famine. When famine forced Jacob to send his sons to Egypt to buy grain, the family was reconciled with Joseph and settled there. The story of Joseph, told in Genesis 37–50, depicts the preservation of Israel and begins the history of the Israelites in Egypt that is continued in Exodus.

Joseph II (b. March 13, 1741, Vienna—d. Feb. 20, 1790, Vienna) Holy Roman emperor (1765–90). He succeeded his father, Francis I, and initially coruled with his mother, Maria Theresa (1765–80). After his mother's death he tried to continue her work of reform. Considered a practicioner of "enlightened despotism," he abolished serfdom, established religious equality before the law, granted freedom of the press, and emancipated the Jews. He came into conflict with the Roman Catholic church by attempting to impose state controls over it, and traditional countries such as the Austrian Netherlands and Hungary resisted his far-reaching reforms. His foreign policies were generally failures; he tried to exchange the Austrian Netherlands for Bavaria but was stopped by Prussia. An alliance with Catherine II of Russia engaged Austrian troops in a war with Turkey, but Joseph had to return home to head off revolutionary unrest in Hungary and the Austrian Netherlands.

Joseph II, Holy Roman emperor, detail of a painting by Pompeo Batoni, 1769; in the Kunsthistorisches Museum, Vienna

COURTESY OF THE KUNSTHISTORISCHES MUSEUM, VIENNA

Joseph, Chief (b. c. 1840, Wallowa Valley, Ore.Terr.—d. Sept. 21, 1904, Colville Reservation, Wash., U.S.) Nez Percé chief. In 1877 the U.S. attempted to force the Nez Percé to move to a reservation in Idaho. Chief Joseph at first agreed but later decided instead to lead his followers on a trek to Canada. During the three-month, 1,000-mile journey, he outmaneuvered and outfought federal troops, and his humane conduct won the admiration of many whites. His group was finally surrounded near the Canadian border and subsequently removed to Indian Territory (Oklahoma). In 1885 they were relocated to a reservation in Washington.

Joseph, Father *orig.* **François-Joseph le Clerc du Tremblay** (b. Nov. 4, 1577, Paris, France—d. Dec. 18, 1638, Rueil) French mystic and religious reformer. He joined the Capuchins in 1599. His fervent ambition to convert European Protestants to Roman Catholicism coincided with cardinal de Richelieu's plans for French domination of Europe, and he became Richelieu's secretary in 1611. He became known as the "Gray Eminence" (for his gray Capuchin cloak), and his close collaboration with Richelieu (the "Red Eminence") gave him powers akin to those of a foreign minister, especially during Richelieu's campaign to finance France's participation in the Thirty Years' War, which Joseph's policies did much to bring about.

Joseph, Saint (fl. 1st century AD, Nazareth, Galilee region of Palestine; principle feast day March 19; Feast of St. Joseph the Worker May 1) In the New Testament, the husband of Mary and the earthly father of Jesus. Descended from the house of David, he was a carpenter in Nazareth. Betrothed to Mary when he found her already pregnant, an angel appeared to him in a vision and told him the expected child was the son of God. He and Mary journeyed to Bethlehem to be counted in the Roman census, and while they were there the child was born. The last mention of Joseph occurs in the Gospel of Luke, when he and Mary take the 12-year-old Jesus to Jerusalem.

Joseph Bonaparte Gulf Inlet of the Timor Sea, northern Australia. It spans 225 mi (360 km) east to west, and it indents the Australian coast for 100 mi (160 km). Entered by a Dutch navigator in 1644, it was visited in 1803 by Nicolas Baudin, a Frenchman who named it after Napoleon's brother Joseph Bonaparte.

Joséphine *orig.* **Marie-Josèphe-Rose Tascher de la Pagerie** (b. June 23, 1763, Trois Ilets, Mart.—d. May 29, 1814, Malmaison,

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France) Consort of Napoleon and empress of the French. She married an army officer, Alexandre, vicomte de Beauharnais, in 1779. He was guillotined during the French Revolution, and Joséphine was imprisoned briefly. A leader of Paris society, she married Napoleon in a civil ceremony in 1796. She was an indifferent and extravagant wife, but during the Consulate she used her social position to advance her husband's political fortunes. After he became emperor (1804), she persuaded him to marry her again, with religious rites. She proved unable to give him a son, and in 1810 he arranged for their marriage to be nullified so that he could make a politically convenient marriage with Marie-Louise.

Joséphine, detail of an oil painting by François Gérard; in the Musée National de Malmaison, Paris.
GIRAUDON/ART RESOURCE, NEW YORK

Josephson, Brian D(avid) (b. Jan. 4, 1940, Cardiff, Wales) British physicist. He received a Ph.D. from the University of Cambridge and began building on earlier work done by Leo Esaki of IBM and Ivar Giaever (b. 1929) of General Electric. For his discovery of what is now called the Josephson effect in superconductivity, he shared a Nobel Prize with Esaki and Giaever in 1973. He was elected a fellow of the Royal Society in 1970 and was named a professor at Cambridge in 1974.

Josephson effect Flow of electric current between two pieces of superconducting material (see superconductivity) separated by a thin layer of insulating material. This flow was predicted by the British physicist Brian Josephson in 1962, based on the BCS theory (see John Bardeen). According to Josephson, pairs of electrons can move from one superconductor to the other across the insulating layer (tunneling). The locus of this action is called a Josephson junction. The Josephson current flows only if no battery is connected across the two conductors. A major application of this discovery is in superfast switching devices used in computers, which can be 100 times faster than ordinary semiconducting circuits.

Josephus \jō-'sē-fəs**, Flavius** *orig.* **Joseph Ben Matthias** (b. AD 37/38, Jerusalem—d. c. 100, Rome) Jewish priest, scholar, and historian. Born of a priestly family, Josephus joined the Pharisees. While on a diplomatic mission he was impressed by the culture and sophistication of Rome, and in the Jewish revolt of AD 66–70 he eventually attached himself to the Roman cause. Favoured in the courts of emperors Vespasian, Titus, and Domitian, he wrote valuable historical works. His *History of the Jewish War* (79) is the principal source on the revolt and includes much on Roman tactics and strategy. *The Antiquities of the Jews* (93), his greatest work, traces Judaism from creation up to the revolt. *Against Apion* defends Judaism against Hellenism.

Joshua Leader of the Israelite tribes after the death of Moses. According to the biblical book of Joshua, Joshua led the people of Israel westward across the Jordan River to invade Canaan. Under his leadership the Israelites conquered the Canaanites and gained control of the Promised Land. The book begins by recounting the battles, including the famous demolition of the walls of Jericho. Joshua then divides Canaan among the 12 tribes of Israel, makes his farewell speech, and dies. The book was compiled much later than the events described, perhaps during the Babylonian Exile in the 6th century BC.

Joshua Tree National Park National park, southeastern California, U.S. Situated on the border between the Mojave and Colorado deserts, it has an area of 1,241 sq mi (3,214 sq km). It was designated a national monument in 1936 and a national park in 1994. It is noted for its variety of desert plant life, including the Joshua tree, creosote bush, and Mojave yucca. Its fauna include coyotes, bobcats, and tarantulas.

Josiah \jō-'sī-ə\ (b. c. 640 BC—d. 609 BC) King of Judah and religious reformer. He became king at age 8 after the assassination of his father, Amon. As the Assyrian empire crumbled, Judah gained a measure of independence, and in 621 BC Josiah began a program of national renewal. He drove out foreign cults, abolished local sanctuaries, and centred the worship of Yahweh in the Temple of Jerusalem. As his reforms were under way, parts of the book of Deuteronomy were discovered in the Temple, giving added impetus to his efforts to revive observance of Mosaic law. Josiah hoped to reunify Judah and Israel, but he was killed in a battle against the Egyptians.

Jospin, Lionel (b. July 12, 1937, Meduon, France) French Socialist Party politician who served as the country's prime minister (1997–2002). He was educated at the elite École Nationale d'Administration. He joined the foreign service and later taught economics at the University Institute of Technology of Paris-Sceaux. He was elected to the National Assembly in 1977 and later was appointed head of the party by Pres. François Mitterrand. He served as minister of education and narrowly lost the presidential election in 1995 to Jacques Chirac. After the Socialists and their allies won a majority in the National Assembly in 1997, he was appointed prime minister by Chirac. He resigned in 2002 after an unsuccessful presidential bid.

Josquin des Prez \zhōs-'ka^{n}-de-'prā\ (b. c. 1445, Condé-sur-l'Escaut?, Burgundian Hainaut—d. Aug. 27, 1521, Condé-sur-l'Escaut) Northern French composer. Perhaps a student of Johannes Ockeghem, he spent his life working as a singer, moving from post to post in Italy, including the Milan Cathedral (1459–72) and the Papal Chapel (1486–94), before returning to Condé in 1504, where he would spend the rest of his life. Josquin was able to balance complexity of imitative counterpoint with an inexhaustible melodic gift. He left over 60 motets (including *Absalon, fili mi*), some 18 complete masses (including *Missa Pange lingua*), and many superb secular songs in the chordal "Italian" style (including "El grillo"). The first music printer, Ottaviano Petrucci, devoted an entire volume to Josquin's works, an honour accorded to no other composer. His posthumous reputation, as attested by Martin Luther and others, was the greatest of any composer up to his time, and his works were closely imitated throughout the 16th century.

Josquin des Prez, drawing by Joris van der Straeten, 16th century.
THE BETTMANN ARCHIVE

Jotunheim \'yō-t^{n}-ˌhām\ **Mountains** Mountain range, south-central Norway. It is the highest range in Scandinavia and extends 80 mi (130 km); its tallest peaks are Glitter Mountain (8,045 ft [2,452 m]) and Galdhø Mountain (8,100 ft [2,470 m]). The mountains are mentioned in early Norse sagas, but they were not fully explored until the early 19th century.

Joule \'jül**, James (Prescott)** (b. Dec. 24, 1818, Salford, Lancashire, Eng.—d. Oct. 11, 1889, Sale, Cheshire) English physicist. After studying under John Dalton, in 1840 he described "Joule's law," which stated that the heat produced in a wire by an electric current is proportional to the product of the resistance of the wire and the square of the current. In 1843 he published his value for the amount of work required to produce a unit of heat, called the mechanical equivalent of heat, and established that heat is a form of energy. He established that the various forms of energy are basically the same and can be changed from one into another, a discovery that formed the basis of the law of conservation of energy, the first law of thermodynamics. In his honour, the value of the mechanical equivalent of heat is usually represented by the letter *J*, and a standard unit of work is called the joule.

journalism Collection, preparation, and distribution of news and related commentary and feature materials through media such as pamphlets, newsletters, newspapers, magazines, radio, film, television, and books. The term was originally applied to the reportage of current events in printed form, specifically newspapers, but in the late 20th century it came to include electronic media as well. It is sometimes used to refer to writing characterized by a direct presentation of facts or description of events without an attempt at interpretation. Colleges and universities confer degrees in journalism and sponsor research in related fields such as media studies and journalism ethics.

jousting Medieval Western European mock battle between two horsemen who charged at each other with leveled lances in an attempt to unseat the other. It probably originated in France in the 11th century, superseding the mêlée, in which mock battles were held between two bodies of armed horsemen, and it flourished in much of Europe in the 12th–15th century.

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Though the lances were blunted, knights were often seriously wounded or killed. Tournaments were mounted only by royalty and nobility; ladies of the court would sponsor individual knights, for whom jousting became a ritual of COURTLY LOVE. Characterized by striking panoply and pageantry, jousting tournaments represented the preeminent display of CHIVALRY.

Jove See JUPITER

Joyce, James (Augustine Aloysius) (b. Feb. 2, 1882, Dublin, Ire.—d. Jan. 13, 1941, Zürich, Switz.) Irish novelist. Educated at a Jesuit school (though he soon rejected Catholicism) and at University College, Dublin, he decided early to become a writer. In 1902 he moved to Paris, which would become his principal home after years spent in Trieste and Zürich. His life was difficult, marked by financial troubles, chronic eye diseases that occasionally left him totally blind, censorship problems, and his daughter Lucia's mental illness. The remarkable story collection *The Dubliners* (1914) and the autobiographical novel *Portrait of the Artist as a Young Man* (1916), his early prose volumes, were powerful examples of his gift for storytelling and his great intelligence. With financial help from friends and supporters, including EZRA POUND, Sylvia Beach (1887–1962), and Harriet Shaw Weaver (1876–1961), he spent seven years writing *Ulysses* (1922), the controversial masterpiece (initially banned in the U.S. and Britain) now widely regarded by many as the greatest English-language novel of the 20th century. It embodies a highly experimental use of language and exploration of such new literary methods as interior monologue and STREAM-OF-CONSCIOUSNESS narrative. He spent 17 years on his final work, the extraordinary *Finnegans Wake* (1939), famous for its complex and demanding linguistic virtuosity.

James Joyce, photograph by Gisèle Freund, 1939.
GISÈLE FREUND

Joyner, Florence Griffith See Florence GRIFFITH JOYNER

Joyner-Kersee, Jackie *orig.* **Jacqueline Joyner** (b. March 3, 1962, East St. Louis, Ill., U.S.) U.S. athlete. She won four consecutive National Junior Heptathlon championships and starred in basketball and track and field at UCLA. In 1986 she became the first HEPTATHLON competitor ever to score 7,000 points. She broke that barrier six times, four times establishing a new world record. She won heptathlon gold medals at the 1988 and 1992 Olympics, becoming the first heptathlete ever to achieve consecutive Olympic wins. Her best events were the long jump (world record, 1987; Olympic gold medal, 1988), 100-m hurdles, 200-m run, and high jump. Many consider her to be the finest female athlete in history.

JPEG \'jā-ˌpeg\ *in full* **Joint Photographic Experts Group** Standard computer file format for storing graphic images in a compressed form for general use. JPEG images are compressed using a mathematical ALGORITHM. A variety of encoding processes can be used, depending on whether the user's goal is the highest quality of image (lossless) or smallest file size (lossy). The JPEG and GIF formats are the most commonly used graphics formats on the Internet for lossy and lossless DATA COMPRESSION, respectively.

JPMorgan Chase & Co. U.S. financial services corporation. Formed in 2000 by the merger of investment bank J.P. Morgan and consumer bank CHASE MANHATTAN CORP., the resulting firm ranked as one of the largest financial services companies in the U.S. The company increased its holdings by purchasing Bank One in 2004.

Juan Carlos I (b. Jan. 5, 1938, Rome, Italy) King of Spain from 1975. The grandson of ALFONSO XIII, he lived in exile until 1947. After FRANCISCO FRANCO abolished the republic and declared Spain a representative monarchy, he prepared Juan Carlos for his future role, paying particular attention to his military education. In 1969 Juan Carlos was designated prince; he acceded to the Spanish throne two days after Franco's death. Although he had sworn loyalty to Franco's National Movement, he proved to be relatively liberal and helped restore parliamentary democracy. In 1981 he deflated a potential military coup and preserved the democracy. He became the first Spanish king to visit the Americas and was the first crowned monarch to make an official visit to China. Throughout his tenure as king, he traveled abroad on many goodwill missions and was very popular at home.

Juan de Austria \ˌhwän-thā-'aùs-trē-ä\ (b. Feb. 24, 1547, Regensburg—d. Oct. 1, 1578, Bouges, near Namur, Spanish Netherlands) Illegitimate son of Emperor CHARLES V and half brother of PHILIP II. After Charles's death, Philip gave him the name Don Juan de Austria (1559). He served as a Spanish military commander, and in 1571 he was appointed head of naval forces of the Holy League against the Ottoman Turks, achieving victory in the Battle of LEPANTO. In 1576 he was appointed governor-general of the Netherlands, then in open revolt against Spanish authority. When his attempts at diplomacy failed, he resumed the war.

Juan de Fuca Strait \ˌhwän-də-'fyü-kə\ Strait, North Pacific Ocean. Located between the Olympic Peninsula of Washington, U.S., and Canada's VANCOUVER ISLAND, it is 11–17 mi (18–27 km) wide and 80–100 mi (130–160 km) long. It is named for a Greek who sailed in the service of Spain and who may have visited the passage in 1592. It is used by ships bound for VANCOUVER and SEATTLE. Settlements along its banks include VICTORIA, B.C., and Port Angeles, Wash.

Juan Fernández Islands Island group, South Pacific Ocean. Located 400 mi (650 km) west of Chile, it consists of two islands and an islet. They were discovered in 1563 by Spanish navigator Juan Fernández. In 1704 Alexander Selkirk, a Scottish seaman, was stranded there alone until 1709; his adventures are believed to have inspired DANIEL DEFOE's *Robinson Crusoe*. Possessions of Chile since the early 19th century, they have often been used as penal settlements.

Juan José \ˌhwän-hō-'sā\ **de Austria** (b. April 7, 1629, Madrid, Spain—d. Sept. 17, 1679, Madrid) Spanish nobleman, the most famous of the illegitimate children of PHILIP IV. He served as a military commander from 1647, and in 1651 he led the royal forces besieging Barcelona. He served as governor of the Netherlands (1656–58). After 1665 he played an active part in the political intrigues surrounding the new king, his half brother CHARLES II, and he served as Charles's chief minister (1677–79).

Juárez *or* **Ciudad Juárez** \ˌsyü-'thäth-'hwär-ˌes\ City (pop., 2000: 1,187,275), northern CHIHUAHUA state, Mexico. Located on the RIO GRANDE opposite EL PASO, Texas, it was formerly known as El Paso del Norte and was renamed in 1888 for Mexico's national hero, BENITO JUÁREZ, who headquartered there in 1865. Today it is an important border city and functions as the marketing centre for a cotton-growing area. The city has grown greatly since the 1970s because of the increase in the number of export-oriented assembly plants (maquiladoras) located there. It contains the Guadalupe mission (1662).

Juárez \'hwär-əs**, Benito (Pablo)** (b. March 21, 1806, San Pablo Guelatao, Oaxaca, Mex.—d. July 18, 1872, Mexico City) National hero and president (1861–72) of Mexico. A ZAPOTEC Indian, Juárez initially studied for the priesthood but later took a law degree and became a legislator, a judge, and a cabinet minister. He led La REFORMA, a liberal political and social revolution in Mexico, and, when liberal forces gained control of the national government in 1855, he was able to implement his ideas. In 1857 he was elected head of the Supreme Court, which, under a new constitution, placed him first in the order of presidential succession. In 1858 a coup by conservative forces sent Mexico's president into exile, but Juárez succeeded him and headed a liberal government that opposed the regime installed by the conservatives. After three years of civil war, the liberals prevailed. Juárez was elected president in 1861 and twice reelected. Early in his first term, the French under NAPOLEON III invaded and occupied Mexico, putting MAXIMILIAN of Austria in power in 1864. When Napoleon later withdrew his troops, Juárez

Benito Juárez.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

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defeated Maximilian's armies and had him executed in 1867. Juárez's final years were marred by a loss of popular support and by personal tragedy. He died in office.

Jubayl See Byblos

Jubba River \'jü-bä\ River, Somalia. Originating in southern Ethiopia, it flows south 545 mi (875 km) to the Indian Ocean just north of Kismaayo, one of Somalia's three main ports. It is the only river in the region that is reliably navigable.

Juchen dynasty \'zhü-'jen\ *or* **Jin dynasty** (1115–1234) Dynasty that ruled an empire formed by the Tungus Juchen tribes of Manchuria. It covered much of Inner Asia and all of northern China. Like the Liao, an earlier Inner Asian dynasty, the Juchen maintained a Chinese-style bureaucracy to rule over the southern part of their conquests and a tribal state to rule in Inner Asia. Very conscious of preserving their ethnic identity, they maintained their language, developed their own script, and banned Chinese clothes and customs from their army.

Judaea *or* **Judea** \jü-'dē-ə\ Southern division of ancient Palestine successively under Persian, Greek, and Roman rule. It was bounded on the north by Samaria and on the west by the Mediterranan Sea. It succeeded the Hebrew kingdom of Judah, which was destroyed by the Babylonians. The revived kingdom of Judaea was established by the Maccabees, who resisted the suppression of Judaism under foreign rule. Family disputes led to Roman intervention in 63 BC. Under Roman control, Herod (the Great) was made king of Judaea in 37 BC. After Herod's death the country was ruled alternately by his descendants (see Herod Antipas; Herod Agrippa I) and by Roman procurators. As a result of the Jewish revolt in AD 66, the city of Jerusalem was destroyed (AD 70). The name Judaea is used by Israelis to describe approximately the same area in the modern West Bank territory.

Judah One of the 12 tribes of Israel, descended from Judah, the fourth son of Jacob. The tribe of Judah entered Canaan with the other Israelites after the escape from Egypt and settled in the region south of Jerusalem. It eventually became the most powerful tribe, producing the kings David and Solomon, and it was prophesied that the messiah would come from among its members. After the 10 northern tribes were dispersed by the Assyrian conquest of 721 BC, the tribes of Judah and Benjamin were left as the sole inheritors of the Mosaic covenant. Judah flourished until 586 BC, when it was overrun by the Babylonians and many of its people were carried into exile. Cyrus II allowed them to return in 538 BC, and the Temple of Jerusalem was rebuilt. The history of Judah from that time forward is the history of the Jews and Judaism. The kingdom of Judah was succeeded by Judaea.

Judah ben Samuel (d. 1217) Jewish mystic and scholar. He was a member of the Kalonymos family, which provided medieval Germany with many Jewish mystics and spiritual leaders. Around 1195 he settled in Regensburg, where he founded a yeshiva and gathered disciples such as Eleazar ben Judah of Worms. He was the founder of 12th-century German Hasidism, an ultrapious movement not directly related to 18th-century Hasidism. *Book of the Pious*, a compilation of the writings of Judah, his father, and Eleazar of Worms, offers a detailed manual of conduct for observant Jews; it is one of the most important documents of medieval Judaism.

Judah ha-Nasi \'jü-də-ˌhä-nä-'sē\ (b. AD 135—d. c. 220) Palestinian Jewish scholar. A descendant of the great sage Hillel, he was patriarch of the Jewish community in Palestine and head of its Sanhedrin, and he became an important figure in early rabbinic Judaism. He spent over 50 years studying the oral law and is said to have compiled it into six sections divided by subject matter, thus creating the Mishna. His exact role in the Mishna's redaction is not known; other scholars such as Meïr and Akiba ben Joseph were probably also involved.

Judaism \'jü-də-ˌi-zəm, 'jü-dē-ˌi-zəm\ Religious beliefs and practices of the Jews. One of the three great monotheistic world religions, Judaism began as the faith of the ancient Hebrews, and its sacred text is the Hebrew Bible, particularly the Torah. Fundamental to Judaism is the belief that the people of Israel are God's chosen people, who must serve as a light for other nations. God made a covenant first with Abraham and then renewed it with Isaac, Jacob, and Moses. The worship of Yahweh (God) was centred in Jerusalem from the time of David. The destruction of the First Temple of Jerusalem by the Babylonians (586 BCE) and the subsequent exile of the Jews led to hopes for national restoration under the leadership of a messiah. The Jews were later allowed to return by the Persians, but an unsuccessful rebellion against Roman rule led to the destruction of the Second Temple in 70 CE and the Jews' dispersal throughout the world in the Jewish Diaspora. Rabbinic Judaism emerged to replace the beliefs and practices associated with the Temple at Jerusalem, as the Jews carried on their culture and religion through a tradition of scholarship and strict observance. The great body of oral law and commentaries were committed to writing in the Talmud and Mishna. The religion was maintained despite severe persecutions by many nations.

Two branches of Judaism emerged in the Middle Ages: the Sephardic, centred in Spain and culturally linked with the Babylonian Jews; and the Ashkenazic, centred in France and Germany and linked with the Jewish culture of Palestine and Rome. Elements of mysticism also appeared, notably the esoteric writings of the Kabbala and, in the 18th century, the movement known as Hasidism. The 18th century was also the time of the Jewish Enlightenment (Haskala). Conservative and Reform Judaism emerged in 19th-century Germany as an effort to modify the strictness of Orthodox Judaism. By the end of the 19th century Zionism had appeared as an outgrowth of reform. European Judaism suffered terribly during the Holocaust, when millions were put to death by the Nazis, and the rising flow of Jewish emigrants to Palestine led to the declaration of the State of Israel in 1948. In the early 21st century there were nearly 15 million Jews worldwide.

Jewish Festivals

Tishri (Sept.–Oct.)	1–2	Rosh Hashanah (New Year)
	3	Fast of Gedaliah
	10	Yom Kippur (Day of Atonement)
	15–21	Sukkot (Tabernacles)
	22	Shemini Atzereth (Eighth Day of Solemn Assembly)
	23	Simhath Torah (Rejoicing of the Law)
Kislev (Nov.–Dec.)	25	Hanukkah (Festival of Lights) begins
Tebet (Dec.–Jan.)	2 or 3	Hanukkah ends
	10	Fast
Shebat (Jan.–Feb.)	15	New Year for Trees
Adar (Feb.–Mar.)	13	Fast of Esther
	14–15	Purim (Feast of Lots)
Second Adar (Adar Sheni) or Veadar (intercalated month); Adar holidays fall in Veadar during leap years.		
Nisan (Mar.–Apr.)	15–22	Pesach (Passover)
Iyar (Apr.–May)	5	Israel Independence Day
	18	Lag b'Omer (33rd Day of the Omer Counting)
Sivan (May–June)	6–7	Shabuoth (Feast of Weeks, or Pentecost)
Tammuz (June–July)	17	Fast
Ab (July–Aug.)	9	Fast

Judas Iscariot (d. c. AD 30) Disciple who betrayed Jesus. He was one of the original 12 disciples. Judas made a deal with the Jewish authorities to betray Jesus into their custody; in return for 30 pieces of silver, he brought the armed guard to the Garden of Gethsemane and identified Jesus with a kiss. He later regretted his deed and committed suicide; according to Matthew 27, he returned the money to the priests before hanging himself. His surname may mean "man of Kerioth," or it may link him to the Sicarii, a band of radical Jewish terrorists.

Judas Maccabaeus \ˌma-kə-'bē-əs\ (d. 161/160 BC) Leader of a Jewish rebellion against the Syrians. The son of an aged priest who took to the mountains in rebellion when Antiochus IV Ephiphanes tried to impose the Greek religion on the Jews, Judas became leader of the rebels on his father's death and won a series of victories over the Syrians in 166–164 BC. In 166 he purified the Temple of Jerusalem, an event celebrated at Hanukkah. On Antiochus's death in 164, the Seleucids offered the Jews freedom of worship, but Judas continued the war, hoping to gain political freedom. He was killed soon thereafter, but his brothers carried on the struggle. The history of the dynasty is told in the two books of Maccabees in the Apocrypha.

Judd, Donald (b. June 3, 1928, Excelsior Springs, Mo., U.S.—d. Feb. 12, 1994, New York, N.Y.) U.S. sculptor. He studied at Columbia University and the Art Students League. He had his first one-man exhibition in 1957. In 1959 he began writing reviews for *Art News* and *Arts Magazine*. In 1960–62 he made the transition from painting to sculpture and became a leading exponent of Minimalism. Much of his work consists of simple cubes or other geometric units that stand on the floor or are cantilevered from the wall, often in stacks or horizontal progressions. His

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materials included painted steel, Plexiglas, iron, wood, and concrete. In the 1970s he began to fill the land around his studio in Marfa, Texas, with large-scale sculptures; this area is now a museum.

Judea See JUDAEA

judge Public official vested with the authority to hear, determine, and preside over legal matters brought in court. In JURY cases, the judge presides over the selection of the panel and instructs it concerning pertinent law. The judge may also rule on motions made before or during a trial. In the U.S., judges are elected or appointed. Most federal judges are appointed for life by the president with the advice and consent of the SENATE. The highest-ranking judge in the U.S. legal system is the CHIEF JUSTICE of the SUPREME COURT. See also JUDGMENT, JUDICIARY, MAGISTRATE'S COURT, MISSOURI PLAN.

judgment In law, a formal decision or determination on a matter or case by a court. Judgments are classified as *in personam*, *in rem*, and *quasi in rem*. A judgment *in personam* determines the rights and liabilities of a particular person. A judgment *in rem* affects the status of a particular thing (e.g., an item of property). The designation *quasi in rem* describes a judgment in which a person's property is subject to court control to satisfy a claim against the person. The court has at its disposal the power to punish for CONTEMPT any party that does not adhere to its orders. See also APPEAL; DECLARATORY JUDGMENT; DEMURRER.

Judgment, Day of In Christianity, the final judgment of God on all people at the end of history. It will occur at the second coming of Christ, when the dead are resurrected. It is especially important in millennialist denominations (see MILLENNIALISM). In Islam, the Day of Judgment is described in the QURAN and the HADITH. Religions that include REINCARNATION (e.g., HINDUISM) lack a Day of Judgment; the determination of how an individual is to be reborn being a particular judgment on the merit of the life just lived (see KARMA).

judgment tale See DILEMMA TALE

judicial review Examination by a country's courts of the actions of the legislative, executive, and administrative branches of government to ensure that those actions conform to the provisions of the constitution. Actions that do not conform are unconstitutional and therefore null and void. The practice is usually considered to have begun with the ruling by the SUPREME COURT OF THE UNITED STATES in *MARBURY* v. *MADISON* (1803). Several constitutions drafted in Europe and Asia after World War II incorporated judicial review. Especially subject to scrutiny in the U.S. have been actions bearing on civil rights (or CIVIL LIBERTY), DUE PROCESS of law, EQUAL PROTECTION under the law, freedom of religion, FREEDOM OF SPEECH, and rights of PRIVACY. See also CHECKS AND BALANCES.

judiciary Branch of government in which judicial power is vested. The principal work of any judiciary is the adjudication of disputes or controversies. Regulations govern what parties are allowed before a judicial assembly, or court, what evidence will be admitted, what trial procedure will be followed, and what types of judgments may be rendered. Typically present in court are the presiding JUDGE, the parties to the matter (sometimes called litigants), the lawyers representing the parties, and other individuals including witnesses, clerks, bailiffs, and jurors when the proceeding involves a JURY. Though the courts' stated function is to administer justice according to rules enacted by the legislative branch, courts also unavoidably make law. In deciding, for example, how legislative provisions are to be applied to specific cases, the courts in effect make law by laying down rules for future cases; this is known as the doctrine of precedent. In some jurisdictions, courts have the power of JUDICIAL REVIEW, enabling them to declare unconstitutional legislation or acts of the executive.

Judith Legendary Jewish heroine, the central character in the Book of Judith in the APOCRYPHA. (The book is excluded from the Hebrew Bible.) A beautiful Jewish widow whose city is besieged by the Assyrians under their general, Holofernes, Judith leaves the city in pretended flight and foretells victory to Holofernes. Invited into his tent, she cuts off his head as he lies in a drunken sleep, and the Jews defeat the leaderless Assyrians. Probably fictional, the story may have been written in the 2nd century BC, after the end of the Maccabean revolt.

judo MARTIAL ART that emphasizes the use of quick movement and leverage to throw an opponent. Its techniques are generally intended to turn an opponent's force to one's own advantage rather than to oppose it directly. The opponent must be thrown cleanly, pinned, or mastered through the application of pressure to arm joints or the neck. Judo is now practiced primarily as sport. It became an Olympic sport in 1964; women's judo was added in 1992. The sport evolved out of JUJITSU in late-19th-century Japan.

juge d'instruction \ˈzhüzh-daⁿ-strük-syōⁿ\ *French* **"judge of inquiry"** In France, a magistrate responsible for conducting the investigative hearing that precedes a criminal trial. In this hearing the major evidence is presented, witnesses are heard, and depositions are taken. If at the end of the hearing the magistrate is not convinced that the evidence of guilt is sufficient to warrant a trial, no trial occurs. This process differs from the GRAND JURY hearing in the Anglo-American system.

Jugendstil \ˈyü-gənt-ˌshtēl\ Artistic style that arose near the end of the 19th century in Germany and Austria. Its name was derived from the Munich magazine *Die Jugend* ("Youth"), founded in 1896, which featured ART NOUVEAU designs. Its early phase, primarily floral in character, was rooted in English Art Nouveau and Japanese prints; a more abstract phase emerged after 1900. Primarily a style in architecture and the decorative arts, it also included the great Austrian painter GUSTAV KLIMT.

juggler Entertainer who keeps several plates, knives, balls, or other objects in the air at once by tossing and catching them. The art of juggling has been practiced since antiquity. Through the 18th century jugglers performed at fairs and marketplaces, and in the 19th century they found larger audiences in CIRCUSES and MUSIC HALLS. In these training grounds the art advanced in technical perfection, producing outstanding performers such as Enrico Rastelli, who could juggle 10 balls. Modern jugglers introduced variations such as performing while blindfolded on horseback, on a high wire, or on a unicycle.

Jugurtha \jù-ˈgər-thə\ (b. c. 160 BC—d. 104, Rome) Ruler of the North African kingdom of NUMIDIA under the Romans (118–105 BC). After the death of his uncle Micipsa, then ruler of Numidia, Jugurtha shared rule with his two cousins. He had one killed and captured the capital city of the other. Rome intervened with troops, which Jugurtha successfully outwitted until he was captured in 105 BC. See also Gaius MARIUS; Lucius Cornelius SULLA Felix.

Juilliard \ˈjü-lē-ˌärd\ **School** Internationally renowned school of the performing arts in New York, New York, U.S. It has its roots in the Institute of Musical Art (founded 1905) and a graduate school (1924) founded through an endowment from the financier Augustus D. Juilliard (1840–1919). It is now the professional educational arm of the LINCOLN CENTER FOR THE PERFORMING ARTS. It offers bachelor's degrees in music, dance, and drama and postgraduate degrees in music. The Juilliard String Quartet (founded 1946) was important to the development of chamber music in the U.S.

jujitsu \jü-ˈjit-sü\ MARTIAL ART that employs holds, throws, and paralyzing blows to subdue or disable an opponent. It evolved among the SAMURAI warrior class in Japan from about the 17th century. A ruthless form of fighting, its techniques included the use of hard or tough parts of the body (e.g., knuckles, fists, elbows, and knees) against an enemy's vulnerable points. Jujitsu declined in the mid-19th century, but many of its concepts and methods were incorporated into JUDO, KARATE, and AIKIDO.

Julia (b. 39 BC—d. AD 14, Rhegium) Only child of AUGUSTUS. She wed MARCELLUS, who died in 23 BC, then AGRIPPA (21), Augustus's chief lieutenant. Their two eldest sons were adopted by Augustus (17) and became his heirs. When Agrippa died (12 BC), Augustus's second wife persuaded him to favour her sons (his stepsons), TIBERIUS and Drusus, as heirs. Augustus forced Tiberius to divorce his wife and marry Julia (11 BC). The unhappy Julia became promiscuous, and Tiberius went into self-imposed exile. When Augustus discovered Julia's behaviour, he banished her to an island off Campania (2 BC), then to Rhegium. On becoming emperor, Tiberius withheld her allowance, and she starved to death.

Julian *or* **Julian the Apostate** *Latin* **Julianus Apostata** *orig.* **Flavius Claudius Julianus** (b. AD 331/332, Constantinople—d. June 26/27, 363, Ctesiphon, Mesopotamia) Roman emperor (361–363), noted scholar and military leader. The nephew of CONSTANTINE I, he was raised a Christian but converted to mystical paganism. As caesar (subemperor) in the west, he restored the Rhine frontier and was proclaimed Augustus (senior emperor) by his armies. Though Constantius II initially objected to Julian as his successor, he accepted him on his deathbed (361). As emperor Julian proclaimed freedom of worship for pagans and Christians in 361; he nevertheless promoted paganism over Christianity, against

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which he committed acts of violence and persecution. He introduced austerity to government, reducing imperial staff and overhauling imperial finances. To reassert Roman power in the east he attacked Persia; the effort failed, and he was killed in a retreat near Baghdad.

Julian the Apostate, detail of a marble statue; in the Louvre, Paris
GIRAUDON/ART RESOURCE, NEW YORK

Julian, George W(ashington) (b. May 5, 1817, Wayne county, Ind., U.S.—d. July 7, 1899, Irvington, Ind.) U.S. politician. He was admitted to the bar in 1840 and practiced law in several Indiana towns. By the mid-1840s he was a Whig member of the Indiana state legislature and a frequent author of antislavery newspaper articles. Elected to the U.S. House of Representatives as a member of the Free Soil Party in 1848, he was that party's vice-presidential candidate in 1852. In 1856 he helped form the Republican Party. Again serving in the House (1861–71), he played an important role in making emancipation a Northern war aim in the American Civil War. In 1867 he helped prepare articles of impeachment against Pres. Andrew Johnson. He later wrote books and articles on reform causes, including women's suffrage.

Julian Alps Range of the eastern Alps. It extends southeast from the Carnic Alps in northeastern Italy to the city of Ljubljana, Slvn. The highest peak is Triglav (9,396 ft [2,864 m]), also the highest point in Slovenia.

Julian of Norwich *or* **Juliana of Norwich** (b. 1342, probably Norwich, Norfolk, Eng.—d. after 1416) English mystic. After being healed of a serious illness (1373), she wrote two accounts of her visions; her *Revelations of Divine Love* is remarkable for its clarity, beauty, and profundity. She spent her later life as a recluse in Norwich.

Juliana (Louise Emma Marie Wilhelmina) (b. April 30, 1909, The Hague, Netherlands—d. March 20, 2004, Baarn) Queen of The Netherlands (1948–80). During World War II she took refuge in Ottawa while her husband, Prince Bernhard, remained with Queen Wilhelmina's government, which had relocated to London. Returning to The Netherlands in 1945, Juliana acted as regent during her mother's illness and became queen when Wilhelmina abdicated. In 1980 she abdicated in favour of her daughter Beatrix.

Julio-Claudian dynasty (AD 14–68) Successors of Augustus, the first Roman emperor: Tiberius, Caligula, Claudius, and Nero. It was a loosely defined set of kin relations rather than a direct bloodline. Tiberius's rule was competent, with notable accomplishments, but it ended in cruel tyranny. The insane Caligula was wild and capricious. Under Claudius, Rome experienced marked development. Under Nero the empire prospered, but he was given to excesses, and his reign ended amid rebellion and civil war.

Julius II *orig.* **Giuliano della Rovere** (b. Dec. 5, 1443, Albisola, republic of Genoa—d. Feb. 21, 1513, Rome) Pope (1503–13). The nephew of Sixtus IV, he fled Rome in 1494 to escape assassination by Alexander VI. Elected pope in 1503, Julius set out to restore the Papal States, subjugating Perugia and Bologna (1508) and defeating Venice (1509) with the aid of the League of Cambrai. His first effort to expel the French from northern Italy failed, but a popular revolt drove them out in 1512, and Parma and Piacenza were added to the Papal States. The greatest art patron of all the popes, Julius was a close friend of Michelangelo, from whom he commissioned the sculpture of Moses and the paintings in the Sistine Chapel. He also commissioned Raphael's Vatican frescoes.

Julius Caesar See Julius Caesar

July Days (1917) Period in the Russian Revolution of 1917 during which Petrograd workers and soldiers staged armed demonstrations against the provisional government that resulted in a temporary decline of Bolshevik influence and in the formation of a new provisional government headed by Aleksandr Kerensky. To undermine Bolshevik popularity, the government produced evidence that Vladimir Ilich Lenin had ties with the German government. The public reacted against the Bolsheviks, Lenin fled to Finland, and Leon Trotsky and other leaders were jailed. The reorganized government was overthrown by the Bolsheviks in October.

July Plot *or* **Rastenburg Assassination Plot** Abortive attempt on July 20, 1944, by German military leaders to assassinate Adolf Hitler, seize control of the government, and seek more favourable peace terms from the Allies. According to plan, Col. Claus von Stauffenberg (1907–44) left a bomb in a briefcase in a conference room at the field headquarters at Rastenburg, East Prussia, where Hitler was meeting with top military aides. But the briefcase was pushed behind a table support, and Hitler survived the blast with minor injuries. Meanwhile, the other conspirators in Berlin failed to act. The chief conspirators, including Stauffenberg, Gen. Ludwig Beck, Gen. Erwin Rommel, and other top officers, were promptly shot or forced to commit suicide. In subsequent days, Hitler's police rounded up about 200 conspirators, who were shot, hanged, or viciously strangled.

July Revolution (1830) Insurrection that brought Louis-Philippe to the throne of France. It was precipitated on July 26 by Charles X's publication of restrictive ordinances contrary to the spirit of the Charter of 1814. Demonstrations were followed by three days of fighting (July 27–29), Charles's abdication, and the proclamation of Louis-Philippe as king. The bourgeoisie secured a political and social ascendancy that was to characterize the subsequent July Monarchy.

jump rope *or* **skip rope** Children's game in which players hold a rope (jump rope) at each end and twirl it in a circle, while one or more players jump over it each time it reaches its lowest point. Dating from the 19th century, it is traditionally a girl's sidewalk or playground game that usually involves the chanting of a counting rhyme (e.g., "One, two, touch my shoe"). There are many types of jumps, including single, double, and backward; in "double Dutch," two ropes are twirled simultaneously in opposite directions. Single-rope jumping, or rope skipping, is popular with boxers to develop the lungs and legs and improve coordination and footwork.

Junayd \jù-'nīd**, Shaykh** (b. 1430, Iranian Azerbaijan?—d. March 4, 1460, near the Kura River) Fourth head of the Ṣafavid order of Sufi mystics. He became head of the order on his father's death in 1447 and set out to turn a society known for piety and learning into a political force. The arming of his followers led to a conflict with Jahān Shāh (died 1467), ruler of Iranian Azerbaijan, and resulted in the expulsion of Junayd and his followers from Ardabīl, the traditional centre of the Ṣafavid order, in 1448. He continued his military adventurism in the lands of present-day Syria and Turkey and was finally killed in battle against a force of Christian Circassians. His policies were carried on by his son, Ḥaydar, and eventually culminated in the founding of the Ṣafavid dynasty under Junayd's grandson, Ismāʿīl I, assuring the dominance of Shīʿite Islam in Iran.

Dark-eyed junco (*Junco hyemalis*)
STEVE AND DAVE MASLOWSKI

junco Any of several species of finchlike birds (genus *Junco*, family Fringillidae), about 6 in. (15 cm) long, of Canada and the U.S. Juncos are usually a shade of gray; they have white outer tail feathers that are flashed in flight to the accompaniment of snapping or twittering calls. They are common winter birds. Their favored habitat is mixed or coniferous forest, though they are often found in fields, thickets, and city parks.

June beetle (*Phyllophaga rugosa*).
HARRY ROGERS

June beetle *or* **May beetle** *or* **June bug** Any insect of the genus *Phyllophaga*, belonging to a widely distributed, plant-feeding scarab beetle subfamily (Melolonthinae). These red-brown beetles commonly appear in the Northern Hemisphere on warm spring evenings and are attracted to lights. Heavy-bodied, they are 0.5–1 in. (1.2–2.5 cm) long and have shiny wing covers. They feed on foliage and flowers at night,

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sometimes causing considerable damage. The larvae live in the soil, and can destroy crops and kill lawns and pastures by severing the grasses from their roots; they are considered excellent fish bait.

June Days (June 23–26, 1848) In French history, a brief and bloody civil uprising in Paris in the early days of the SECOND REPUBLIC. The new government instituted numerous radical reforms, but the new assembly, composed mainly of moderate and conservative candidates, was determined to cut costs and end risky experiments such as public works programs to provide for the unemployed. Thousands of Parisian workers—suddenly cut off from the state payroll—were joined by radical sympathizers and took to the streets in spontaneous protest. The assembly gave Gen. LOUIS-EUGÈNE CAVAIGNAC authority to suppress the uprising, and he brought up artillery against the protesters' barricades. At least 1,500 rebels were killed, 12,000 were arrested, and many were exiled to Algeria. See also REVOLUTIONS OF 1848.

Juneau \'jü-nō\ City (pop., 2000: 30,711), capital of Alaska, U.S. Located in southeastern Alaska, it was settled in 1880 when Joe Juneau and Richard Harris discovered gold nearby. Mining was important until the Alaska-Juneau gold mine closed in 1944. Juneau was made the state capital in 1959. Fishing, forestry, and government activities are important, as is tourism. In 1970 Juneau merged with Douglas, on an island across the channel, to form the largest U.S. city in area (3,108 sq mi [8,050 sq km]).

Jung \'yůŋ**, Carl (Gustav)** (b. July 26, 1875, Kesswil, Switz.—d. June 6, 1961, Küsnacht) Swiss psychiatrist. As a youth he read widely in philosophy and theology. After taking his medical degree (1902), he worked in Zürich with EUGEN BLEULER on studies of mental illness. From this research emerged Jung's notion of the *complex*, or cluster of emotionally charged (and largely unconscious) associations. Between 1907 and 1912 he was SIGMUND FREUD's close collaborator and most likely successor, but he broke with Freud over the latter's insistence on the sexual basis of neuroses. In the succeeding years Jung founded the field of ANALYTIC PSYCHOLOGY, a response to Freud's PSYCHOANALYSIS. Jung advanced the concepts of the introvert and extravert personality, archetypes, and the collective unconscious (the pool of human experience passed from generation to generation). He went on to formulate new psychotherapeutic techniques designed to reacquaint the person with his unique "myth" or place in the collective unconscious, as expressed in dream and imagination. Sometimes dismissed as disguised religion and criticized for its lack of verifiability, Jung's perspective nonetheless remains influential in religion and literature as well as psychiatry. His important works include *The Psychology of the Unconscious* (1912; revised as *Symbols of Transformation*), *Psychological Types* (1921), *Psychology and Religion* (1938), and *Memories, Dreams, Reflections* (1962).

jungle fowl Any of four species of Asian birds (genus *Gallus*) that differ from other species in the PHEASANT family in having, in the male, a fleshy comb, lobed wattles hanging below the bill, and a high-arched tail. The red jungle fowl is the ancestor of the CHICKEN. The cock has shining silky plumage, red on the head and back and green-black elsewhere; the hen is rusty brown with speckled neck and minimal comb.

junior college *or* **community college** Educational institution that provides up to two years of COLLEGE-level academic, technical, and vocational instruction with emphasis on career preparation. Roots of the junior college may be traced to the CHAUTAUQUA MOVEMENT and other adult-education programs created after the American Civil War. The first junior college opened in Joliet, Ill., in 1901. The vast majority of junior colleges are publicly supported; called community colleges, they offer a variety of flexible programs that are often nontraditional in style and content. They have pioneered in offering part-time study, evening sessions, instruction by television, weekend workshops, and other services for members of their communities. Students rarely live on campus. Graduates of junior or community colleges ordinarily earn an associate's degree. They then transfer to a four-year college or enter the workforce. See also CONTINUING EDUCATION.

Juniper berry (*Juniperus communis*)
INGMAR HOLMASEN

juniper Any of about 60–70 species of aromatic evergreen trees or shrubs that make up the genus *Juniperus* of the CYPRESS family, found throughout the Northern Hemisphere. Juvenile leaves are needle-like; mature leaves are awl-shaped, spreading, and arranged in pairs or in whorls of three. Common juniper (*J. communis*) is a sprawling shrub whose fragrant, spicy-smelling berries are used to flavour foods and alcoholic beverages, particularly GIN. The fragrant wood of eastern red cedar (*J. virginiana*) is made into cabinets, fence posts, and pencils. *J. horizontalis* is a popular U.S. ornamental creeping juniper, and wood of the Mediterranean Phoenician juniper (*J. phoenicea*) is burned as incense.

junk Classic Chinese sailing vessel of ancient unknown origin, still in wide use. High-sterned, with a projecting bow, the junk carries up to five masts on which are set square sails consisting of panels of linen or matting flattened by bamboo strips. Each sail can be spread or closed at a pull, like a venetian blind. The massive rudder takes the place of a keel. Chinese junks were sailing to Indonesian and Indian waters by the early Middle Ages.

Modern junk with traditional matting sails and a European-type jib
BBC HULTON PICTURE LIBRARY

junk bond BOND paying a high yield but also presenting greater risk than comparable securities. Junk bonds can be identified through the lower grades assigned by rating services (e.g., BBB instead of AAA for the highest quality bonds). Because the possibility of default is great, junk bonds are usually considered too risky for investment by the large institutional investors (SAVINGS AND LOAN ASSOCIATIONS, PENSION funds, INSURANCE companies, and MUTUAL FUNDS) that provide U.S. corporations with much of their investment capital. Junk bonds are often issued by smaller, newer companies.

Juno In ROMAN RELIGION, the chief goddess and female counterpart of JUPITER. She was identified with the Greek goddess HERA. With Jupiter and MINERVA she was a member of the Capitoline triad of deities traditionally introduced into Rome by the ETRUSCANS. She was connected with all aspects of the lives of women, particularly marriage. Individualized, she became a female guardian spirit; as every man had his GENIUS, so every woman had her juno. Her temple in Rome eventually housed the Roman mint, and she was invoked as the savior of the state. Her sacred bird was the peacock.

Juno, classical sculpture; in the Museo Archeologico Nazionale, Naples
ALINARI-ART RESOURCE

Jupiter *or* **Jove** Chief god of ancient Rome and Italy. Like his Greek counterpart, ZEUS, he was worshiped as a sky god. With JUNO and MINERVA he was a member of the triad of deities traditionally believed to have been introduced into Rome by the ETRUSCANS. Jupiter was associated with treaties, alliances, and oaths; he was the protecting deity of the republic and later of the reigning emperor. His oldest temple was on the Capitoline Hill in Rome. He was worshiped on the summits of hills throughout Italy, and all places struck by lightning became his property. His sacred tree was the oak.

Jupiter Fifth PLANET from the Sun, the largest nonstellar object in the SOLAR SYSTEM. It has 318 times the mass and more than 1,400 times the volume of Earth. Its enormous mass gives it nearly 2.5 times the gravity of Earth (measured at the top of Jupiter's atmosphere), and it exerts strong effects on other members of the solar system. It is responsible for the KIRKWOOD GAPS in the asteroid belt and changes in the orbits of COMETS; it may act as

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a "sweeper," pulling in bodies that might otherwise collide with other planets. Jupiter has more than 60 moons (see GALILEAN SATELLITE) and a diffuse ring system discovered in 1979 by the VOYAGER spacecraft. The planet is a gas giant, composed mainly of hydrogen and helium in proportions near those of the Sun, which it orbits every 11.9 years at an average distance of 483 million mi (778 million km). Its rapid rotation (9 hr 55.5 min) acts on electric currents to give it the largest magnetic field of any of the planets and causes intense storms, including one that has lasted hundreds of years (the GREAT RED SPOT). Little is known of its interior, but it is presumed to have a deep layer of metallic hydrogen and a dense core. Its central temperature is estimated to be 45,000 °F (25,000 °C); it radiates twice as much heat as it receives from the Sun, probably largely heat left over from its formation.

Jupiter Dolichenus \ˌdō-li-ˈkā-nəs\ God of a Roman mystery cult. He was originally a Hittite-Hurrian god of fertility and thunder worshiped at Doliche in Anatolia. He also became identified with the Zoroastrian god AHURA MAZDA as a lord of the universe. Returning legions carried his cult to Rome, where it became popular in the 2nd–3rd century AD. In Roman MYSTERY RELIGION he was believed to control military success and safety. He was usually represented standing on a bull holding a double ax and thunderbolt.

Jura Mountains Mountain range, central Europe. It extends 225 mi (360 km) along the boundary of France and Switzerland. Its highest peak is Mount Neige, some 5,650 ft (1,700 m) high, located in France. Its western slopes are the source of the DOUBS and Ain rivers in France.

Jurassic Period Interval of geologic time, 206–144 million years ago, that is one of the three major divisions of the MESOZOIC ERA, preceded by the TRIASSIC PERIOD and followed by the CRETACEOUS. During the Jurassic, PANGEA began to break up into the present-day continents. Marine invertebrates flourished, and large reptiles dominated many marine habitats. On land, FERNS, MOSSES, CYCADS, and CONIFERS thrived, some developing flowerlike structures in place of cones. The DINOSAURS rose to supremacy on land, and by the end of the Jurassic the largest species had evolved. ARCHAEOPTERYX, the first primitive bird, appeared before the end of the period. Early mammals, tiny shrewlike creatures that appeared near the close of the preceding Triassic, managed to survive and evolve.

Jurchen dynasty See JUCHEN DYNASTY

jurisdiction Authority of a court to hear and determine cases. This authority is constitutionally based. Examples of judicial jurisdiction are: appellate jurisdiction, in which a superior court has power to correct legal errors made in a lower court; concurrent jurisdiction, in which a suit might be brought to any of two or more courts; and federal jurisdiction. A court may also have authority to operate within a certain territory. Summary jurisdiction, in which a magistrate or judge has power to conduct proceedings resulting in a conviction without jury trial, is limited in the U.S. to petty offenses.

jurisprudence Science or philosophy of law. Jurisprudence may be divided into three branches: analytical, sociological, and theoretical. The analytical branch articulates axioms, defines terms, and prescribes the methods that best enable one to view the legal order as an internally consistent, logical system. The sociological branch examines the actual effects of the law within society and the influence of social phenomena on the substantive and procedural aspects of law. The theoretical branch evaluates and criticizes law in terms of the ideals or goals postulated for it.

jury In law, a body of individuals selected and sworn to inquire into a question of fact and to render a verdict according to the evidence. Juries may deal with questions of law in addition to questions of fact, though federal juries in the U.S. are usually limited to dealing with questions of fact. The modern jury can vary in size depending on the proceeding but usually has either 6 or 12 members. By U.S. law, federal grand juries and petit juries must be "selected at random from a fair cross-section of the community in the district or division wherein the court convenes." State jury selection varies somewhat. The SUPREME COURT OF THE UNITED STATES has stated in a series of decisions that a jury is to be composed of "peers and equals" and that systematic exclusion from a jury of a particular class of people (e.g., on the basis of sex, skin colour, or ancestry) violates the EQUAL-PROTECTION clause of the 14th Amendment to the CONSTITUTION OF THE UNITED STATES and the defendant's right to a jury trial. A defendant is not, however, entitled to a jury of any particular composition. See also GRAND JURY; PETIT JURY; VOIR DIRE.

just-in-time manufacturing (JIT) Production-control system, developed by TOYOTA MOTOR CORP. and imported to the West, that has revolutionized MANUFACTURING methods in some industries. By relying on daily deliveries of most supplies, it eliminates waste due to overproduction and lowers warehousing costs. Supplies are closely monitored and quickly altered to meet changing demands, and small and accurate resupply deliveries must be made just as they are needed. Because there are no spares, the components must be free of defects. Plants wholly dedicated to the JIT concept require a logistics staff to schedule production, balancing product demand with plant capacity and availability of inputs. JIT has worked most effectively for large automobile manufacturers, which may have several thousand suppliers feeding parts into 100 factories that assemble components for 20 assembly lines.

just war theory Set of conditions under which a resort to war is morally legitimate (*jus ad bellum*); also, rules for the moral conduct of war (*jus in bello*). Among the proposed conditions for the just resort to war are that the cause be just (e.g., self-defense against an attack or the threat of imminent attack), that the authority undertaking the war be competent, that all peaceful alternatives be exhausted, and that there be a reasonable hope of success. Two of the most important conditions for the just conduct of war are that the force used be "proportional" to the just cause the war is supposed to serve (in the sense that the evil created by the war must not outweigh the good represented by the just cause) and that military personnel be discriminated from innocents (noncombatant civilians), who may not be killed. The concept of just war was developed in the early Christian church; it was discussed by St. AUGUSTINE in the 4th century and was still accepted by HUGO GROTIUS in the 17th century. Interest in the concept thereafter declined, though it was revived in the 20th century in connection with the development of nuclear weapons (the use of which, according to some, would violate the conditions of proportionality and discrimination) and the advent of "humanitarian intervention" to put an end to acts of genocide and other crimes committed within the borders of a single state.

justice In philosophy, the concept of a proper proportion between a person's deserts (what is merited) and the good and bad things that befall or are allotted to him or her. ARISTOTLE's discussion of the virtue of justice has been the starting point for almost all Western accounts. For him, the key element of justice is treating like cases alike, an idea that has set later thinkers the task of working out which similarities (need, desert, talent) are relevant. Aristotle distinguishes between justice in the distribution of wealth or other goods (distributive justice) and justice in reparation, as, for example, in punishing someone for a wrong he has done (retributive justice). The notion of justice is also essential in that of the just state, a central concept in POLITICAL PHILOSOPHY. See also LAW.

justice of the peace In Anglo-American legal systems, a local magistrate empowered chiefly to administer justice in minor cases. In the U.S., justices of the peace are elected or appointed and hear minor civil matters and petty criminal cases. They may also officiate at weddings, issue arrest warrants, deal with traffic offenses, and hold inquests.

justification In Christian theology, the passage of an individual from SIN to a state of GRACE. Some theologians use the term to refer to the act of God in extending grace to the sinner, while others use it to define the change in the condition of a sinner who has received grace. St. PAUL used the term to explain how people moved from sin to grace through the death and resurrection of JESUS and not through any human effort. St. AUGUSTINE saw it as an act of God that makes sinners righteous, while MARTIN LUTHER stressed justification through faith alone.

Justin II (d. Oct. 4, 578) Byzantine emperor (565–78). He tolerated the MONOPHYSITE HERESY until 571, then began to persecute its followers. Despite an alliance with the Franks, Justin lost parts of Italy to the Lombards after 568. He also suffered defeats at the hands of the AVARS, to whom he promised to pay tribute (574), and the Western Turks, who seized lands in the Crimea. He invaded Persia in 572, but the Persians repulsed his army and invaded Byzantine territory, capturing Dara in 573. He became insane, and his general Tiberius (his adopted son) was effective ruler of the empire after 574.

Justin Martyr, Saint (b. c. 100, Flavia Neapolis, Palestine—d. c. 165, Rome; feast day June 1) Early Christian Apologist and theologian. A pagan born in Palestine, he studied philosophy before becoming a Christian in 132, probably at Ephesus. He then spent years as an itinerant preacher and teacher. One of the earliest Christian APOLOGISTS, he was the

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first to blend Greek philosophy and Christian doctrine. He wrote two *Apologies* addressed to Roman emperors, which asserted that Christian faith can be in harmony with human reason and that Christianity is a purer form of the truth glimpsed in pagan philosophy. In his *Dialogue with Trypho* he tried to prove the truth of Christianity to a scholarly Jew named Trypho. While living in Rome, he was denounced as subversive and condemned to death.

Justinian I *orig.* **Petrus Sabbatius** (b. 483, Tauresium, Dardania—d. Nov. 14, 565, Constantinople) Byzantine emperor (527–565). Determined to regain former Roman provinces lost to barbarian invaders, Justinian conquered the Vandals in northern Africa in 534 and enjoyed an initial victory over the Ostrogoths in Italy in 540. War with the Goths, however, lasted another two decades and brought great devastation before Justinian gained control of the whole of Italy in 562 . He was unable to prevent Bulgars, Slavs, Huns, and Avars from carrying out raids along the empire's northern frontier. He also carried on an intermittent war with Persia until 561. He reorganized the imperial government and commissioned the reform and codification of the great body of Roman law known as the Code of Justinian. His efforts to root out corruption triggered a revolt in Constantinople in 532 that nearly toppled his government; his wife, Theodora, helped him put down the revolt. Like all Roman emperors, Justinian was an active builder, and his many public works projects included the reconstruction of cities and the construction of the church of Hagia Sophia, one of the finest and most famous buildings in the world.

Justinian I, detail of a mosaic, 6th century; in the Basilica of San Vitale, Ravenna
ALINARI-GIRAUDON FROM ART RESOURCE

Justinian, Code of Collections of laws and legal interpretations developed under the sponsorship of the Byzantine emperor Justinian I from 529 to 565. Strictly speaking, they did not constitute a new legal code. Rather, Justinian's committees of jurists provided basically two reference works that contained collections of past laws and extracts of the opinions of the great Roman jurists. Also included were an elementary outline of the law and a collection of Justinian's new laws.

jute Either of two herbaceous annuals (*Corchorus capsularis* and *C. olitorius*, in the linden family), or their fibre. The plants grow 10–12 ft (3–4 m) high and have long, serrated, tapered, light green leaves and small yellow flowers. Jute has been grown and processed in the Bengal area of India and Bangladesh since ancient times. Its biggest use is in burlap sacks and bags, which are used to ship and store many agricultural products. High-quality jute cloths are used as backing for tufted carpets and hooked rugs. Coarser jute fibres are made into twines, rough cordage, and doormats.

Jutland *Danish* **Jylland** \'yüt-ˌlən\ Peninsula, northern Europe. Forming the Danish mainland and the German state of Schleswig-Holstein, it is bounded to the west and north by the North Sea. Politically, its name applies only to the mainland of Denmark. It has an area of 11,496 sq mi (29,775 sq km) and is divided into several administrative regions. In World War I, the Battle of Jutland was fought off its coast.

Jutland, Battle of (May 31–June 1, 1916) Only major encounter between the British and German fleets in World War I, fought in the Skagerrak, an arm of the North Sea off the coast of Jutland (Denmark). The battle came to an indecisive end, and both sides claimed victory. Germany destroyed and crippled more ships and men, but Britain retained control of the North Sea. The tactics of the British admiral John R. Jellicoe were criticized at the time, but his strategic victory left the German high-seas fleet ineffective for the rest of the war.

Juvenal \'jü-və-nəl\ *orig.* **Decimus Junius Juvenalis** (b. c. AD 55—d. 130) Roman poet. He is believed to have been born into a wealthy family, to have become an army officer, and to have grown embittered by his failure to receive a promotion. He is chiefly known for his 16 *Satires*, indignant attacks on human brutality and folly, particularly the corruption of Roman society under Domitian and his more humane successors Nerva, Trajan, and Hadrian. Juvenal's verses are technically fine, vivid, and often ruthless, and they have been admired and imitated since the 5th century. Many of his phrases and epigrams ("bread and circuses," "who will guard the guards themselves?" etc.) have entered common parlance.

juvenile court Special court handling problems of delinquent, neglected, or abused children. Two types of cases are processed by a juvenile court: civil matters, often concerning care of an abandoned or impoverished child, and criminal matters, arising from antisocial behaviour by the child. Most statutes provide that all persons under a given age (often 18 years) must first be processed by the juvenile court, which can then, at its discretion, assign the case to an ordinary court. Before the creation of the first juvenile court, in Chicago in 1899, and the subsequent creation of other such courts in the United States and other countries (e.g., Canada in 1908; England in 1908; France in 1912; Russia in 1918; Poland in 1919; Japan in 1922; and Germany in 1923), juveniles were tried in the same courts as adults.

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K2 *or* **Dapsang** \ˌdäp-ˈsäng\ Mountain in the Karakoram Range. The world's second highest peak, it reaches 28,251 ft (8,611 m); it lies partly in China and partly in the Pakistani-administered portion of the Kashmir region. It was discovered and measured in 1856 by Col. T.G. Montgomerie and was given the symbol K2 because it was the second peak measured in the Karakoram Range. In 1954 the Italians Achille Compagnoni and Lino Lacedelli became the first climbers to reach its summit.

Kaʿbah Most sacred Muslim shrine, located near the centre of the Great Mosque in Mecca. All Muslims face toward it in their daily prayers. The cube-shaped structure, made of gray stone and marble, has its corners roughly oriented to the points of the compass; the interior contains only pillars and silver and gold lamps. Pilgrims to Mecca walk around the Kaʿbah seven times and on its eastern side touch the Black Stone of Mecca, which may date from the pre-Islamic religion of the Arabs. Tradition holds that the Kaʿbah was built by Abraham and Ishmael. In 630 Muhammad purged the place of its pagan idols and rededicated it to Islam.

Kabalega National Park \ˌkä-bä-ˈlā-gä\ National park, northwestern Uganda. Established in 1952, it occupies 1,483 sq mi (3,840 sq km) of rolling grassland. Its central feature is the Kabalega Falls on the lower Victoria Nile River. The falls are about 20 ft (6 m) wide and drop 130 ft (40 m) in the first of three cascades.

Kabbala *or* **Cabbala** \kä-ˈbä-lə\ Jewish mysticism as it developed in the 12th century and after. Essentially an oral tradition, it laid claim to secret wisdom of the unwritten Torah communicated by God to Adam and Moses. It provided Jews with a direct approach to God, a notion regarded as heretical and pantheistic by Orthodox Judaism. A major text was the 12th-century *Book of Brightness*, which introduced the doctrine of transmigration of souls to Judaism and provided Kabbala with extensive mythical symbolism. In 13th-century Spain the tradition included the *Book of the Image*, which asserted that each cycle of history had its own Torah, and the *Book of Splendour*, which dealt with the mystery of creation. In the 16th century the centre of Kabbala was Safed, Galilee, where it was based on the esoteric teachings of the greatest of all Kabbalists, Isaac ben Solomon Luria. The doctrines of Lurianic Kabbala, which called for Jews to achieve a cosmic restoration (Hebrew: *tiqqun*) through an intense mystical life and an unceasing struggle against evil, were influential in the development of modern Hasidism.

Kabila \kə-ˈbē-lə**, Laurent (Désiré)** (b. 1939, Jadotville, Belgian Congo—d. Jan. 18?, 2001, en route to Harare, Zimb.) Rebel leader and president (1997–2001) of Congo (Kinshasa). He attended schools abroad, including military school in China, before participating in several Marxist-inspired uprisings in Zaire in the 1960s and '70s. He later became a trader in precious minerals and ivory. In the Rwandan civil war, Kabila collaborated with Paul Kagame in attacking Hutu guerrilla groups in Zaire as well as Zairean government forces. His troops ousted Mobutu Sese Seko in 1997, and Kabila proclaimed himself president and renamed the country. His repressive policies soon led to a new and larger war, in which many African states sent troops and aid to both sides. His assassination was apparently engineered by his own officers; his son Joseph (b. 1971) succeeded him.

Kabir \kə-ˈbir\ (b. 1440, Varanasi, Jaunpur, India—d. 1518, Maghar) Indian mystic and poet. A weaver who lived in Benares, he preached the essential oneness of all religions and was critical of both Hinduism and Islam for meaningless rites and mindless repetition. From Hinduism he accepted the ideas of reincarnation and the law of karma but rejected idolatry, asceticism, and the caste system. From Islam he accepted the idea of one God and the equality of all men. Revered by both Hindus and Muslims, he is also considered a forerunner of Sikhism, and some of his poetry was incorporated into the Adi Granth. His ideas led to the founding of several sects, including the Kabir Panth, which regards Kabir as its principal guru or as a divinity.

kabuki \kä-ˈbü-kē\ Popular Japanese entertainment that combines music, dance, and mime in highly stylized performances. The word is written using three Japanese characters—*ka* ("song"), *bu* ("dance"), and *ki* ("skill"). Kabuki dates from the end of the 16th century, when it developed from the nobility's nō theatre and became the theatre of townspeople. In its early years it had a licentious reputation, its actors often being prostitutes; women and young boys were consequently forbidden to perform, and kabuki is today performed by an adult all-male cast. Its texts, unlike nō texts, are easily understood by its audience. The lyrical but fast-moving and acrobatic plays, noted for their spectacular staging, elaborate costumes, and striking makeup in place of masks, are vehicles in which the actors demonstrate a wide range of skills. Kabuki employs two musical ensembles, one onstage and the other offstage. It shares much of its repertoire with bunraku, a traditional puppet theatre.

Kabul \ˈkä-bəl\ City (pop., 1993 est.: 700,000), capital of Afghanistan. Located on the Kābul River in a valley strategically located between mountain passes, it has existed for some 3,500 years. It became the capital of the Mughal dynasty in the 16th century, and it remained under Mughal rule until 1738, when it was captured by the Iranian conqueror Nādir Shah. Kabul has been the capital of Afghanistan since 1776. When the Soviet Union invaded Afghanistan in 1979, it established a military command in Kabul. After the Soviet withdrawal in 1989, factional fighting among Afghan guerrillas continued intermittently and the city suffered widespread destruction. In 1996 the Taliban captured Kabul and imposed an austere form of Islamic rule. The city began to recover from years of violence only when the Taliban government was overthrown in 2001.

Kābul River River in eastern Afghanistan and northwestern Pakistan. Rising west of the city of Kabul, it flows east into Pakistan and, after a course of 435 mi (700 km), joins the Indus River northwest of Islamabad. The Kābul River valley is a natural route for travel between Afghanistan and Pakistan; Alexander the Great used it to invade India in the 4th century BC. For much of its course, the river is tapped for irrigation.

Kabyle \kə-ˈbīl\ Berber people of northeastern Algeria. Most are Muslim, though a few are Christian. They are predominantly agricultural, growing grains and olives and herding goats. Village government is run by an assembly of adult males. Villages are divided into clans, and the society is organized into classes. The current population is about 2.5 to 3 million.

Kachchh, Rann of *or* **Rann of Kutch** \ˈkəch\ Large salt marsh, west-central India and southern Pakistan. The northern portion, Great Rann, occupies an area of 7,000 sq mi (18,000 sq km) in Gujarat state, India. The eastern section, Little Rann, occupies 2,000 sq mi (5,100 sq km) of Gujarat. Originally an extension of the Arabian Sea, it has been closed off by centuries of silting. A 1965 dispute between India and Pakistan over the boundary line of Great Rann ended when an international tribunal awarded about 10% of the border area to Pakistan and the remainder to India.

Kachin \kä-ˈchin\ Any member of a group of tribal peoples occupying parts of northeastern Myanmar and contiguous areas of India (Arunachal Pradesh and Nagaland) and China (Yunnan). Numbering more than 700,000, they speak a variety of languages of the Tibeto-Burman group of Sino-Tibetan languages. Traditional Kachin society largely subsisted on the shifting cultivation of hill rice, supplemented by the proceeds of banditry and feudal warfare. The traditional Kachin religion is a form of animistic ancestor cult entailing animal sacrifice.

kachina \kə-ˈchē-nə\ Ancestral spirit of the Pueblo Indians. There are more than 500 of these spirits, who

Hopi kachina of *laqán*, or squirrel spirit, *c.* 1950; in the Museum of the American Indian, Heye Foundation, New York City

COURTESY OF THE MUSEUM OF THE AMERICAN INDIAN, HEYE FOUNDATION, NEW YORK CITY

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act as intermediaries between humans and the gods. Each tribe has its own kachinas, which are believed to reside with a tribe for half of each year. They can be seen by the community if men properly perform a ritual while wearing kachina masks. The spirit depicted on the mask is thought to be actually present with the performer, temporarily transforming him. Kachinas are also represented by small wooden dolls, carved and decorated by the men of the tribe.

Kaczynski \kə-'zin-skē**, Theodore** *known as* **the Unabomber** (b. May 22, 1942, Evergreen Park, Ill., U.S.) U.S. criminal. He attended Harvard University and earned a doctorate in mathematics from the University of Michigan. He taught at the University of California-Berkeley (1967–69) then abruptly left for rural Montana, where he lived in a tiny, isolated shack. Over a period of 17 years, he sent mail bombs to people he perceived as enemies of humanity, most of them professors and researchers in science and technology, killing 3 people and injuring 23. His manifesto excoriating industrial society was published widely in 1995. Arrested in 1996 on a tip from his younger brother, he was sentenced to life in prison.

Kádár \'kä-ˌdär\ **János** *orig.* **Czermanik János** (b. May 26, 1912, Fiume, Hung.—d. July 6, 1989, Budapest) Premier of Hungary (1956–58, 1961–65) and first secretary (1956–88) of Hungary's Communist Party. He joined the then-illegal Communist Party in 1931 and entered the Hungarian Politburo in 1945. In 1950 he came into conflict with the Stalinists and was expelled from the party and jailed (1951–53). Rehabilitated in 1954, he joined the short-lived government of Nagy Imre. After Soviet troops took over the country in 1956, Kádár formed a new government with Soviet backing and quelled a popular revolt. He later convinced the Soviet Union to withdraw its troops and allow Hungary a modicum of internal independence.

Kadare, Ismail (b. Jan. 28, 1936, Gjirokastër, Alb.) Albanian novelist and poet. The son of a post-office worker, Kadare became a journalist. Unhappy with the political environment in Albania, he eventually made his home in Paris. Among his better-known works are the novels *The General of the Dead Army* (1963), about post-World War II Albania, and *The Castle* (1970), which explores Albanian nationalism. The stories in *Elegy for Kosovo* (1999) concern a 14th-century battle between Balkan leaders and the Ottoman Empire. He was the only Albanian writer to have an international following in the 20th century.

Kaddish \'kä-dish\ Jewish doxology (hymn of praise to God) that is usually recited in Aramaic at the end of principal sections of all synagogue services. Originally recited in the rabbinical academies, it later became a regular feature of the synagogue service. The prayer expresses, in addition to the praise of God, the plea for the speedy realization of the messianic age. The prayer's association with the arrival of the messiah and the resurrection of the dead led to its becoming the prayer of mourners. There are four other forms of the Kaddish used in worship services.

Kadesh \'kā-ˌdesh\ Ancient city, western Syria. Located just southwest of modern Ḥimṣ, it was seized by the Egyptian king Thutmose III in the 15th century BC. It remained an outpost of Egypt until it came under Hittite rule in the mid-14th century BC. The Egyptian king Seti I captured the city, and in 1275 BC it was the scene of a battle between Ramses II and the Hittite Muwatallis. After invasion by the Sea Peoples c. 1185 BC, Kadesh disappeared from history.

Kadesh-barnea *or* **Kadesh** City of ancient Palestine. Its precise location is unknown, but it was situated in the country of the Amalekites, southwest of the Dead Sea and on the western edge of the wilderness of Zin. It twice served as an encampment for the Israelites.

Kadet See Constitutional Democratic Party

Kaduna River \kä-'dü-nä\ River, central Nigeria. The main tributary of the Niger River, it rises on the Jos Plateau, flowing northwest and then southwest before completing its 340-mi (550-km) course at the Niger in Mureji. The Kaduna (meaning "crocodiles" in the Hausa language) is navigable only part of the year.

Kael \'kāl**, Pauline** (b. June 19, 1919, Petaluma, Calif., U.S.—d. Sept. 3, 2001, Great Barrington, Mass.) U.S. film critic. She managed an art-film theatre (1955–60) in Berkeley, Calif., while writing film reviews for magazines and broadcasting her reviews on network radio. After a collection of her reviews and essays, *I Lost It at the Movies* (1965), gained her national attention, she moved to New York and became film critic for *The New Yorker* (1968–91). Her witty, biting, highly opinionated, and sharply focused reviews (of which five more collections were eventually published) made her arguably the most influential American film critic of her time.

Kafka \'käf-kä**, Franz** (b. July 3, 1883, Prague, Bohemia, Austria-Hungary—d. June 3, 1924, Kierling, near Vienna, Austria) Czech writer who wrote in German. Born into a middle-class Jewish family, he earned a doctorate and then worked successfully but unhappily at a government insurance office from 1907 until he was forced by a case of tuberculosis to retire in 1922. The disease caused his death two years later. Hypersensitive and neurotic, he reluctantly published only a few works in his lifetime, including the symbolic story *The Metamorphosis* (1915), the allegorical fantasy *In the Penal Colony* (1919), and the story collection *A Country Doctor* (1919). His unfinished novels *The Trial* (1925), *The Castle* (1926), and *Amerika* (1927), published posthumously against Kafka's wishes, express the anxieties and alienation of 20th-century humanity. His visionary tales, with their inscrutable mixture of the normal and the fantastic, have provoked a wealth of interpretations. Kafka's posthumous reputation and influence have been enormous, and he is regarded as one of the great European writers of the 20th century.

Kafka
ARCHIV FUR KUNST UND GESCHICHTE, BERLIN

Kafue \kä-'fü-ā\ **National Park** National park, south-central Zambia. Located west of Lusaka, it was established in 1950. It occupies an area of 8,650 sq mi (22,400 sq km) and consists of a vast plateau, situated along the middle reaches of the Kafue River. The park is noted for its lush vegetation and abundant wildlife, including hippopotamuses, zebras, elephants, black rhinoceroses, and lions. Safaris are conducted on foot.

Kafue River River rising on the Democratic Republic of the Congo-Zambia border. It meanders south and eventually flows southeast to join the Zambezi River near Chirundu, Zimbabwe, after a course of 600 mi (960 km). It cuts through the plateau of central Zambia, and its basin contains Kafue National Park. It is one of Zambia's major rivers, and its waters are used for irrigation and hydroelectric power.

Kagame \kä-'gä-mā**, Paul** (b. October 1957, Rwanda) President of Rwanda from 2000. An ethnic Tutsi, Kagame grew up in exile in Uganda, where in 1986 he helped overthrow Milton Obote in favour of Yoweri Museveni. In 1990 he helped direct an unsuccessful coup in Rwanda, and following the 1994 genocide that left almost one million Rwandans dead (most of them Tutsi), he assumed control of the joint Tutsi-Hutu opposition forces that soon controlled all of Rwanda. In July 1994 he was named vice president and minister of defense under Hutu president Pasteur Bizimungu. After Bizimungu resigned in 2000, Kagame was named president. In 1997 he was instrumental in the overthrow of Mobutu Sese Seko in neighbouring Zaire (Congo) and the installation of Laurent Kabila as president.

Kaganovich \kə-gə-'nȯ-vich**, Lazar (Moiseyevich)** (b. Nov. 22, 1893, Kabany, near Kiev, Ukraine, Russian Empire—d. July 25, 1991, Moscow, Russia, U.S.S.R.) Soviet political leader. He joined the Bolsheviks in 1911 and became head of the Soviet government of Tashkent in 1920. As head of the Moscow party organization (1930–35), he brought it firmly under Joseph Stalin's control and with Vyacheslav Molotov formed the core of Stalin's "post-purge" Politburo (see purge trials). Until 1953 he was largely responsible for heavy industry in the Soviet Union. Under Nikita Khrushchev, he held administrative posts, but he opposed de-Stalinization and joined the unsuccessful attempt to depose Khrushchev in 1957, as a result of which he lost all his offices.

Kagera River \kä-'gā-rä\ River, northwestern Tanzania. The most remote headstream of the Nile River and the largest tributary of Lake Victoria, it rises in Burundi near the northern tip of Lake Tanganyika and flows north, constituting the boundary between Tanzania and Rwanda. Turning

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east, it forms the boundary between Tanzania and Uganda before emptying into Lake Victoria. It is about 250 mi (400 km) long.

kagura \'kä-gü-ˌrä\ In Shintō, a traditional style of music and dancing used in religious ceremonies. Kagura dances dedicated to native deities are a reenactment of the propitiatory dance that lured the sun goddess Amaterasu from her cave in ancient myth. Largely unchanged for the past 1,500 years, the dances are performed to the accompaniment of chants, drums, brass gongs, and flutes. The music is of two types: one to praise the spirits or seek their aid, the other to entertain the gods.

Kahlo \'kä-lō\ **(y Calderón de Rivera), (Magdalena Carmen) Frida** (b. July 6, 1907, Coyoacán, Mex.—d. July 13, 1954, Coyoacán) Mexican painter. The daughter of a German Jewish photographer, she had polio as a child and at 18 suffered a serious bus accident. She subsequently underwent some 35 operations; during her recovery, she taught herself to paint. She is noted for her intense self-portraits, many reflecting her physical ordeal. Like many artists working in post-revolutionary Mexico, Kahlo was influenced by Mexican folk art; this is apparent in her use of fantastical elements and bold use of colour, and in her depictions of herself wearing traditional Mexican, rather than European-style, dress. Her marriage to painter Diego Rivera (from 1929) was tumultuous but artistically rewarding. The Surrealists André Breton and Marcel Duchamp helped arrange exhibits of her work in the U.S. and Europe, and though she denied the connection, the dreamlike quality of her work has often led historians to identify her as a Surrealist. She died at 47. Her house in Coyoacán is now the Frida Kahlo Museum.

"Diego and I," oil on masonite, self-portrait (with forehead portrait of Diego Rivera) by Frida Kahlo, 1949; in the gallery of Mary-Anne Martin/Fine Art, New York City
COURTESY MARY-ANNE MARTIN/FINE ART, NEW YORK CITY

Kahn, Albert (b. March 21, 1869, Rhaunen, Westphalia—d. Dec. 8, 1942, Detroit, Mich., U.S.) German-born U.S. industrial architect. In 1904 he received a commission for the Packard Motor Car Co. auto factory; his design, with its reinforced concrete frame, represented an innovative departure from traditional masonry factory construction. Kahn was the principal architect for most of the large American automobile companies for 30 years. His firm designed more than a thousand projects for Ford, among them the fabrication and assembly plant in River Rouge, Mich., which was one of the largest industrial complexes in the world. By 1937 his firm was producing 19% of all architect-designed industrial buildings in the U.S., and he received commissions for factories, foundries, and warehouses from all continents. Kahn's firm designed 521 factories in the U.S.S.R. and trained more than a thousand Soviet engineers during the 1930s.

Kahn, Herman (b. Feb. 15, 1922, Bayonne, N.J., U.S.—d. July 7, 1983, Chappaqua, N.Y.) U.S. physicist and strategist. He studied at the California Institute of Technology and joined the RAND Corp., where he studied the application to military strategy of new analytic techniques such as game theory, operations research, and systems analysis. He won public notice with *On Thermonuclear War* (1960), in which he contended that thermonuclear war differs only in degree from conventional war and ought to be analyzed and planned in the same way. In 1961 he established the Hudson Institute for research into matters of national security and public policy.

Kahn, Louis I(sadore) (b. Feb. 20, 1901, Osel, Estonia, Russian Empire—d. March 17, 1974, New York, N.Y., U.S.) Estonian-born U.S. architect. He came to the U.S. as a child and graduated from the University of Pennsylvania. One of the century's most original architects, Kahn turned from the International Style to a timeless, elegant Brutalism evocative of ancient ruins. His Richards Medical Research Building (1960–65) at the University of Pennsylvania isolated "servant" spaces (stairwells, elevators, vents, and pipes) in four towers distinct from "served" spaces (laboratories and offices). His fortresslike National Assembly Building in Dhaka, Bangl. (1962–74), utilized geometric shapes to admit light to its inner domed mosque. Like R. Buckminster Fuller, Kahn was concerned about wasteful use of natural resources; his urban-planning schemes proposed geodesic skyscrapers and huge car "silos." He taught at Yale University (1947–57) and the University of Pennsylvania (1957–74), where appreciation for his intellect gained him a cult status.

Kahneman, Daniel (b. March 5, 1934, Tel Aviv, Israel) Israeli-born psychologist. He attended Hebrew University (B.A., 1954) in Jerusalem and the University of California, Berkeley (Ph.D., 1961). He later taught at such institutions as Princeton University and was on the editorial board of several academic journals. In the late 1960s he began conducting research to increase understanding of how people make economic decisions. His work with Amos Tversky on decision making under uncertainty resulted in the formulation of a new branch of economics, prospect theory. Using surveys and experiments, Kahneman showed that people were incapable of analyzing complex decision situations when the future consequences were uncertain. Instead, they relied on heuristic, or rule-of-thumb, shortcuts. In 2002 he shared the Nobel Prize for Economics with Vernon L. Smith.

Kaibara Ekiken \'kī-bä-rä-e-'kē-ˌken\ (b. Dec. 17, 1630, Fukuoka, Japan—d. Oct. 5, 1714, Japan) Japanese philosopher, travel writer, and pioneer botanist. Trained as a physician, he left the medical profession in 1657 to study the Neo-Confucian writings of Zhu Xi. He wrote about 100 philosophical works, which stressed the hierarchical nature of society and translated Confucian doctrine into terms understood by Japanese of all social classes. His writings include *The Great Learning for Women*, a tract on obedience long considered the most important ethical text for Japanese women. He is regarded as the father of botany in Japan.

Kaieteur \'kī-ə-ˌtůr\ **Falls** Cataract on the Potaro River, west-central Guyana. After a sheer drop of 741 ft (226 m), the falls pass into a gorge 5 mi (8 km) long, which descends another 81 ft (25 m). The falls are 300 to 350 ft (90 to 105 m) wide at the top and are the central feature of Kaieteur National Park (1930).

Kaifeng \'kī-'fəŋ\ *or* **K'ai-feng** City (pop., 2003 est.: 594,887), northern Henan province, China. In the 4th century BC it became the capital of the state of Wei, and the first of its canals was built. It was destroyed by the Qin dynasty in the late 3rd century BC, and until the 5th century AD it was only a market town. It became an important commercial centre in the 7th century, enriched by traffic along the Grand Canal, and it was the capital of the Five Dynasties and the Song dynasty. Kaifeng was the site of China's only well-documented Jewish community (12th–16th centuries).

Kaikei \'kī-ˌkā\ (fl. 1183–1236, Japan) Japanese sculptor who helped establish the traditional pattern of Buddhist sculpture. His technique, known as the Anami style, is noted for its gentleness and grace. Together with his teacher, Kokei, and his colleague Unkei, he made statues for the temples of Kōfuku and Tōdai in Nara, Japan's ancient capital. He later became a monk and assumed the name Anami Butsu.

Kairouan \ker-'wän\ *or* **Al-Qayrawān** City (pop., 1994: 102,600), northeastern Tunisia. A religious centre of Islam, it was founded in 670 by the Arab general Sīdī ʿUqbah and became the first Arab city in the Maghrib. It was chosen as the Maghrib capital by the Aghlabid dynasty c. 800. It served as an administrative, commercial, religious, and intellectual centre under the Fāṭimid and Zīrid dynasties. The rise of Tunis, the new capital, led to Kairouan's decline and its devastation by Bedouin in the 11th century. It is the site of the 9th-century Great Mosque of the Qayrawān, one of the city's 150 mosques.

Kaiser \'kī-zər**, Henry J(ohn)** (b. May 9, 1882, Sprout Brook, N.Y., U.S.—d. Aug. 24, 1967, Honolulu, Hawaii) U.S. industrialist and founder of more than 100 companies, including Kaiser Aluminum, Kaiser Steel, and Kaiser Cement and Gypsum. He undertook his first public-works projects beginning in 1914, eventually building dams in California, levees on the Mississippi River, and highways in Cuba. Between 1931 and 1945 he organized combinations of construction companies to build the Hoover, Bonneville, and Grand Coulee dams and other large public projects. During World War II he ran seven shipyards, making steel in an integrated steel mill and using assembly-line production to build ships in less than five days. He established the first health maintenance organization, the Kaiser plan, for his shipyard employees; it served more than a million people and became a model for later federal programs. In the postwar era he dealt profitably in aluminum, steel, and automobiles.

Kakinomoto Hitomaro \'kä-kē-nō-ˌmō-tō- 'hē-tō-ˌmä-rō\ *known as* **Hitomaro** (d. 708, Japan) Japanese poet. He entered the service of the

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imperial court and later became a provincial official. Japan's first great literary figure, he lived when Japan was moving from a preliterate to a literate, civilized society. His writings, on a wide range of subjects, balance the homely qualities of primitive song with sophisticated interests and literary techniques. All 77 poems accepted as indisputably his, and many others attributed to him, appear in the *Man'yoshu*, the first and largest of Japan's anthologies of native poetry.

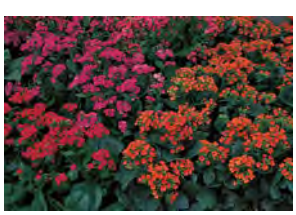
Kalacuri \ˌkä-lə-ˈkü-rē\ **dynasty** *or* **Kalachuri dynasty** Any of several dynasties in Indian history. Apart from the dynastic name and perhaps a belief in common ancestry, there is little in known sources to connect them. The earliest known Kalacuri family ruled c. 550–620 in central and western India; its power ended with the rise of one branch of the CALUKYAS. The rise of another Kalacuri dynasty (1156–81), centred in Karnataka, coincided with the rise of the LINGAYAT, or Virashaiva, Hindu sect. The best-known Kalacuri family ruled in central India with its base at the ancient city of Tripuri (modern Tewar); it originated in the 8th century, expanded significantly in the 11th century, and declined in the 12th–13th centuries.

Kalahari Desert \ˌkä-lä-ˈhä-rē\ Desert region, southern Africa. It covers an area of 360,000 sq mi (930,000 sq km) and lies mostly in Botswana but also occupies portions of Namibia and South Africa. It was crossed by the British explorers DAVID LIVINGSTONE and William C. Oswell in 1849. Although the region has no permanent surface water apart from the Boteti River, it supports trees, low scrub, and grasses as well as abundant wildlife. It includes the KALAHARI GEMSBOK NATIONAL PARK and the Gemsbok National Park.

kalām \kə-ˈläm\ Islamic speculative theology. It arose during the UMAYYAD DYNASTY over varying interpretations of the QUR'ĀN and over questions the Qur'ān provoked, including those on predestination, free will, and the nature of God. The most prominent early school was the 8th-century MUʿTAZILAH, which asserted the supremacy of reason, championed free will, and rejected an anthropomorphic characterization of God. The 10th-century school of ASHʿARIYYAH moved *kalām* back toward traditional faith, accepting, for example, the eternal, uncreated nature of the Qur'ān and its literal truth. The school also represented the successful adaptation of Hellenistic philosophical reasoning to Muslim orthodox theology.

Kalamukha See KAPALIKA AND KALAMUKHA

kalanchoe \ˌka-lən-ˈkō-ē\ Any of several species of SUCCULENT plants that make up the genus *Kalanchoe* in the stonecrop family (Crassulaceae), popular for their easy indoor culture. Potted *K. blossfeldiana* plants are marketed widely for their winter-blooming bright red and orange flowers, which may remain fresh for as long as eight weeks. As succulents, kalanchoes require little care, needing only considerable direct sunlight (or at least bright indirect light) and occasional watering. On some species, young plants grow in notches on the leaves of parent plants, then drop to the soil below and begin root growth.



Kalanchoe blossfeldiana.
© SYDNEY KARP: PHOTO/NATS

Kalaupapa \kä-ˌlä-ü-ˈpä-pä\ **Peninsula** Peninsula on the northern shore of Molokai island, Hawaii, U.S. Occupying a 5-sq-mi (13-sq-km) plateau, it is isolated from the rest of the island by 2,000-ft (600-m) cliffs. Kalawao village, now abandoned, was the site of the original leper colony (see LEPROSY) established by King Kamehameha V in 1866; Father DAMIEN ministered to the lepers there 1873–89. The entire peninsula was occupied by the state leprosarium until 1969, when Hawaii's isolation laws were abolished.

Kalb \kälp,\ *English* \ˈkalb**, Johann** (b. June 29, 1721, Hüttendorf, near Erlangen—d. Aug. 19, 1780, Camden, S.C., U.S.) German army officer who fought in the AMERICAN REVOLUTION. He served in a German regiment of the French infantry from 1743. In 1768 the French sent him on a secret mission to the American colonies to determine their attitude toward Britain. In 1776 he obtained a commission in the Continental Army. He reached Philadelphia in July 1777 and was eventually appointed a major general by the Continental Congress. He became a strong admirer of Gen. GEORGE WASHINGTON and served with him at Valley Forge. In 1780 he joined Gen. HORATIO GATES at Camden, S.C., in an abortive attack on British forces. After Gates was driven from the field, Kalb fought on and was mortally wounded.

kale Loose-leafed, edible plant (*Brassica oleracea*, Acephala group) derived from the CABBAGE, in the MUSTARD FAMILY. Common (or Scotch) and Buda kale have stems up to 2 ft (60 cm) long that carry a rosette of elongated, dark bluish green, wavy or frilled leaves. Grown mainly for autumn and winter harvest because cold weather improves the quality of this hardy vegetable, kale is usually served cooked. It is highly nutritious. See also COLLARD.

Kale (*Brassica oleracea*, Acephala group).
G.R. ROBERTS

kaleidoscope Optical device consisting of mirrors that reflect images of bits of coloured glass or other objects in a symmetrical geometric design through a viewer. The design may be changed endlessly by rotating the section containing the loose fragments. A simple kaleidoscope consists of two thin, wedge-shaped mirror strips touching along a common edge. The mirrors are enclosed in a tube with a viewing eyehole at one end. At the other end is a thin, flat box that can be rotated; it is made from two glass disks, the outer one ground to act as a diffusing screen. In this box are pieces of coloured glass, beads, etc. When the box is turned, the objects inside tumble into an arbitrary grouping, and when the diffusing screen is illuminated, the sixfold or eightfold multiplication creates a striking symmetrical pattern. The kaleidoscope was invented by Sir David Brewster c. 1816.

Kalevala \ˈkä-lā-ˌvä-lä\ Finnish national epic. It was compiled by ELIAS LONNROT from the songs and ballads of Finland's oral tradition and published in complete form in 1849. Kalevala, the dwelling place for the poem's chief characters, is also a poetic name for Finland, meaning "land of heroes." The epic contains a creation story and adventures of legendary heroes. The main character is Väinämöinen, a musician and seer of supernatural origins. Other characters include Ilmarinen, a smith who forged the lids of heaven; Lemminkäinen, a warrior-adventurer and charmer of women; and Louhi, the female ruler of a land in the north. Though the *Kalevala* depicts conditions during the pre-Christian era, it also seems to foretell the decline of the old religions.

Kalf \ˈkälf**, Willem** *or* **Willem Kalff** (b. Nov. 3, 1619, Rotterdam, Neth.—d. July 31, 1693, Amsterdam) Dutch painter. He is among the best-known Dutch painters of still lifes. His early works depict kitchen interiors, with such elements as gourds and pots strewn on the floor. His later paintings feature luxurious, expensive objects such as Venetian glass and Chinese porcelain, painted with restraint and richness of texture. Though his still lifes followed an established formula, Kalf greatly enriched the genre with his use of simple composition, dark background, and acutely perceived highlights. In restraint and richness of texture, Kalf's still lifes were seldom, if ever, matched. Works such as *Still Life with a Nautilus Cup* (c. 1660) were popular among Amsterdam's wealthy.

Kali, sandstone relief from Bheraghat, near Jabalpur, Madhya Pradesh state, India, 10th century AD.
PRAMOD CHANDRA

Kali Destructive and devouring Hindu goddess. She is a terrifying aspect of DEVI, who in other forms appears as peaceful and benevolent. Kali is commonly associated with

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death, violence, sexuality, and, paradoxically, with motherly love. Noted for killing the demon Raktavija, she is usually depicted as a hideous, black-faced hag smeared with blood. In her four hands she holds, variously, a sword, a shield, the severed head of a giant, or a noose for strangling. Nearly naked, she wears a garland of skulls and a girdle of severed hands. She is often shown standing or dancing on her husband, SHIVA. Until the 19th century the thugs of India worshiped Kali and offered their victims to her. In the late 20th century she became a symbol of feminine empowerment in some circles.

Kalidasa \ˌkä-lē-ˈdä-sä\ (fl. c. 5th century) Indian poet and dramatist. Little is known about him; his poems suggest that he was a Brahman (priest). Many works are traditionally ascribed to him, but scholars have identified only six as genuine and one more as likely. The Sanskrit drama *The Recognition of Shakuntala*, his most famous creation, is traditionally judged the major Indian literary effort of any period, and Kalidasa is regarded as perhaps the greatest of all Indian writers.

Kalinga Ancient kingdom, northeastern India. It corresponds to the area of modern northern ANDHRA PRADESH, most of ORISSA, and a portion of CHHATTISGARH. It was conquered by Mahapadma, the founder of the NANDA DYNASTY, in the 4th century BC. Beginning in the mid-11th century AD, the Eastern GANGA DYNASTY assumed control. The temple of the sun-god at Konarak was built in the 13th century by Narasimha I. The dynasty collapsed when the sultan of Delhi invaded Kalinga from the south in 1324.

Kalinin \kə-ˈlē-nyən**, Mikhail (Ivanovich)** (b. Nov. 19, 1875, Verkhnyaya Troitsa, Russia—d. June 3, 1946, Moscow, Russia, U.S.S.R.) Russian communist leader and statesman. An early supporter of the BOLSHEVIKS, he participated in the RUSSIAN REVOLUTION OF 1905 and cofounded *PRAVDA*. After the RUSSIAN REVOLUTION OF 1917 he served as mayor of Petrograd (St. Petersburg). In 1919 he became chair of the central executive committee of the All-Russian Congress of Soviets, and thus titular head of the Soviet state, a position he kept until his death. From 1925 he was a member of the Politburo and supported JOSEPH STALIN in crucial votes, thus retaining his high party office.

Kaliningrad \kə-ˈlē-nin-ˌgrät\ *formerly* **Königsberg** \ˈkœ-niks-ˌberk\ City (pop., 1999 est.: 427,200), western Russia, situated on the Pregolya River. Founded in 1255 as Königsberg, it was the capital of the dukes of Prussia and later the capital of East Prussia. In 1724 it absorbed the nearby cities of Löbenicht and Kneiphof. Virtually destroyed by Soviet forces during World War II, it came under the sovereignty of the U.S.S.R. and was rebuilt in 1946 as Kaliningrad. It is the seat of the University of Kaliningrad and the birthplace of IMMANUEL KANT.

Kalliope See CALLIOPE

Kalmar \ˈkäl-ˌmär\ **Union** (1397–1523) Scandinavian union that joined the kingdoms of Norway, Sweden, and Denmark under the rule of a single monarch. Margaret I had become regent of the three kingdoms by 1388; she chose her grandnephew Erik of Pomerania to become their king, and he was crowned at Kalmar, Swed., in 1397. Each country kept its own laws, customs, and administration. Sweden rebelled and claimed independence under GUSTAV I VASA in 1523, and Norway became a Danish province in 1536.

Kaloyan \ˈkä-lȯ-yän\ *or* **Kalojan** (d. Oct. 1207, near Thessaloníki) Tsar of Bulgaria (1197–1207). The younger brother of the founders of the Second Bulgarian Empire, Kaloyan sought to maintain Bulgarian independence. Although he recognized papal authority and was crowned by papal legates in 1204, Kaloyan reverted to Orthodoxy not long after his coronation. He proposed an alliance with the armies of the Fourth CRUSADE but then led a Bulgarian-Greek uprising in the Balkan Peninsula that defeated the Crusaders at Adrianople (1205) and resulted in the capture of BALDWIN I, the Latin emperor. Kaloyan's success against the Crusaders contributed to the ultimate demise of the Latin empire of Constantinople. He died besieging Thessaloníki during his continuing struggle to expanded the empire.

Kama In Indian mythology, the god of love. In the Vedic age he personified cosmic desire or the creative impulse, and he was called the firstborn of primeval chaos. He was later often depicted as a handsome youth attended by heavenly nymphs, who shot love-producing flower arrows from a sugarcane bow. He was once killed by SHIVA, who was enraged when Kama disturbed his meditation on a mountaintop, but the great god later relented and brought Kama back to life.

Kama River River, west-central Russia. The largest tributary of the VOLGA RIVER, it rises in Udmurtiya and flows for 1,122 mi (1,805 km) until it enters the Volga below Kazan. Navigation is possible for about 955 mi (1,535 km). It is one of the most important rivers of Russia, historically as the route to the Urals and Siberia and economically as part of the vast Volga system of waterways.

Kamakura \ˌkä-mä-ˈkůr-ä\ **period** (1192–1333) Period of Japanese history marked by the country's first era of military government. The Kamakura shogunate was established by MINAMOTO YORITOMO after his 1185 defeat of a rival warrior family, the Taira (see TAIRA KIYOMORI); its headquarters was in Kamakura. To assert his authority, Yoritomo had *JITŌ* (stewards) assigned to all the estates (*SHŌEN*) in the land to collect taxes, and *shugo* (protectors) assigned to one or more provinces to lead them in times of war. This system was improved by the HŌJŌ FAMILY, which took control of the shogunate on Yoritomo's death. The creation of the Kamakura shogunate marks the start of Japan's medieval or feudal period, characterized by a warrior ethic of duty, loyalty, and stoicism. Many elements of Japanese culture that Westerners now associate with the country—including ZEN Buddhism, SAMURAI (warriors), SEPPUKU (ritual disembowelment), and the TEA CEREMONY—date from this period. The True Pure Land and NICHIREN sects of Buddhism, which emphasized salvation through faith alone, provided solace to the masses, while tales of warrior exploits provided them with entertainment. See also *BUSHIDŌ*.

Kamchatka \kəm-ˈchät-kə\ **Peninsula** Peninsula, eastern Russia. It lies between the Sea of Okhotsk on the west and the Pacific Ocean and BERING SEA on the east. It is 750 mi (1,200 km) long and 300 mi (480 km) across at its widest point, and it has an area of 140,000 sq mi (370,000 sq km). Mountain ranges extend along it; of its 127 volcanoes, 22 are active, including Klyuchevskaya Volcano (15,584 ft [4,750 m]), the highest peak in SIBERIA.

Kamehameha \kä-ˈmā-hä-ˈmā-hä\ **I** *orig.* **Paiea** *known as* **Kamehameha the Great** (b. November 1758?, Kohala district, Hawaii island—d. May 8, 1819, Kailua) Hawaiian conqueror and king who united all the Hawaiian Islands. His birth came soon after the return of Halley's Comet (1758), whose appearance led seers to prophesy the coming of a great conqueror. As a young man, he fought his cousin over control of the island of Hawaii; by 1795 he had defeated his cousin and conquered all but two of the Hawaiian Islands, and in 1810 the remaining islands were ceded to him. He retained the harsh traditional legal system but protected the common people from the brutality of powerful chiefs and outlawed human sacrifice. He enriched his kingdom through a government monopoly on the sandalwood trade and through port duties imposed on visiting ships and maintained its independence throughout the difficult period of European discovery and exploration of the islands. He founded the most enduring and best-documented line of rulers of HAWAII.

Kamehameha I, detail of a coloured lithograph by D. Veelward, 1822, after an engraving by Louis Choris, 1816
BERNICE PAUAHI BISHOP MUSEUM, HONOLULU

Kamehameha IV, c. 1862–1863.
BERNICE PAUAHI BISHOP MUSEUM, HONOLULU; PHOTOGRAPH H.L. CHASE

Kamehameha IV *orig.* **Alexander Liholiho** (b. Feb. 9, 1834, Ewa, Oahu, Hawaiian Islands—d. Nov. 30, 1863, Honolulu, Oahu) Hawaiian ruler (1855–63). Adopted as a child by his uncle, Kamehameha III (1813–54), he was educated by Protestant missionaries. As king, he sought to curb the power of the U.S. missionaries. He expanded trade with other countries and, to offset U.S. influence, invited the Church of England to establish itself in the

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islands. A popular and benevolent ruler, he improved harbours to accommodate Hawaii's growing whaling industry and provided free medical care for Hawaiians. He resolutely opposed the annexation of Hawaii by the U.S.

Kamenev \'kä-myə-ˌnyef**, Lev (Borisovich)** *orig.* **Lev Borisovich Rosenfeld** (b. July 18, 1883, Moscow, Russia—d. Aug. 24, 1936, Moscow, Russia, U.S.S.R.) Russian political leader. A member of the Bolsheviks from 1903, he worked with Vladimir Ilich Lenin in Europe (1909–14), then returned to Russia, where he was arrested and sent to Siberia. After the Russian Revolution of 1917, he served as head of the Moscow soviet (1919–25). When Lenin became seriously ill in 1922, Kamenev joined Joseph Stalin and Grigory Y. Zinovyev to form the ruling triumvirate, attacking Leon Trotsky. In 1925 Stalin shifted his attack to Kamenev and Zinovyev, removng Kamenev as Moscow party head. In 1926 Kamenev was expelled from the party after conspiring with Zinovyev and Trotsky against Stalin. In 1936 he was tried in the first of the purge trials and confessed to fabricated charges, hoping to save his family. He was executed, and his wife, Trotsky's sister, perished in the Gulag.

Kamerlingh Onnes \ˌkä-mər-liŋ-'ò-nəs**, Heike** (b. Sept. 21, 1853, Groningen, Neth.—d. Feb. 21, 1926, Leiden) Dutch physicist. He taught at the University of Leiden (1882–1923), and in 1884 he founded the Cryogenic Laboratory (now known by his name) that established Leiden as the world's principal research centre for low-temperature physics. He was the first to produce liquid helium (1908), and he discovered superconductivity. He also investigated the equations describing the states of matter and the general thermodynamic properties of fluids over a wide range of temperatures and pressures. He was awarded the 1913 Nobel Prize for Physics.

kamikaze \ˌkä-mi-'kä-zē\ Any of the Japanese pilots in World War II who made deliberate suicidal crashes into enemy targets, usually ships. The word means "divine wind," a reference to a typhoon that dispersed a Mongol invasion fleet threatening Japan from the west in 1281. The practice was most prevalent in the final year of the war. Most kamikaze planes were ordinary fighter aircraft or light bombers, usually loaded with bombs or extra gasoline tanks before their suicidal dive. Such attacks sank 34 ships and damaged hundreds of others; at Okinawa they inflicted the greatest losses ever suffered by the U.S. Navy in a single battle, killing almost 5,000 men. See also Zero.

Kammu \'kä-mů\ (b. 737, Nara, Japan—d. April 9, 806, Heian-kyō [Kyōto]) Emperor of Japan (781–806). To curb the power of the Buddhist temples located in Nara, he moved the capital from Heijō-kyō (Nara) to Nagaoka in 784 and then to the city of Heian-kyō in 794. The establishment of the capital in Heian-kyō marked the start of the Heian period.

Kamo Chomei \'kä-mō-'chō-mā\ (b. 1155, Japan—d. July 24, 1216, Kyōto) Japanese poet and critic. He is best known for *An Account of My Hut* (1212), a poetic diary describing his life in seclusion written after he left a court office to take Buddhist orders and become a hermit. His poetry is representative of the best of an age that produced many poets of the first rank. His *Nameless Notes* (1208/09) is an extremely valuable collection of critical comments, anecdotes, and poetic lore.

Kampala \käm-'pä-lä\ City (pop., 1998: 1,154,000), capital of Uganda. The country's largest city, it is in southern Uganda, north of Lake Victoria. It was selected in 1890 by Capt. Frederick Lugard as the headquarters of the British East Africa Company. Lugard's fort on Old Kampala Hill remained the Ugandan colonial administrative headquarters until 1905. In 1962 Kampala became the capital of independent Uganda. It is the site of the headquarters of most of Uganda's large firms and of Makerere University (1922) and the Uganda Museum.

Kampuchea See Cambodia

Kampuchean See Khmer

Kan River See Gan River

Kanarese language See Kannada language

Kanawa, Kiri Te See Kiri Te Kanawa

Kanawha \kə-'nȯ-wə\ **River** River, West Virginia, U.S. Formed by the confluence of the New and Gauley rivers, it flows northwest for 97 mi (156 km), entering the Ohio River at Point Pleasant. It has dams and locks and is navigable to Kanawha Falls, located 30 mi (48 km) above Charleston, W.Va. The Kanawha River valley has extensive deposits of salt brines and natural gas and oil wells.

Kanchenjunga \ˌkən-chən-'jəŋ-gə\ Peak in the Himalayas. The world's third highest mountain, it reaches 28,169 ft (8,586 m). It is located on the border between Nepal and Sikkim state, India, northwest of Darjiling. Rinzin Namgyal, a 19th-century explorer, made the first map of the peak. In 1955 a British expedition led by Charles Evans made the first successful climb.

Kandel, Eric (b. Nov. 7, 1929, Vienna, Austria) Austrian-born U.S. neurobiologist. He received his M.D. from New York University. Kandel's research revealed the role of synaptic transmission in learning and memory. He showed that weak stimuli give rise to certain chemical changes in synapses, forming the basis for short-term memory, and that stronger stimuli cause different synaptic changes, which result in a form of long-term memory. Along with Paul Greengard and Arvid Carlsson, Kandel was awarded a Nobel Prize in 2000. The findings of the three men resulted in the development of new drugs for parkinsonism and other disorders.

Kander, John (b. March 18, 1927, Kansas City, Mo., U.S.) U.S. songwriter. He studied music at Oberlin College and Columbia University and later wrote arrangements for plays. With lyricist Fred Ebb, a native New Yorker who also studied at Columbia and wrote lyrics for revues, he wrote the scores for some of Broadway's most successful musicals, including *Cabaret* (1966; film, 1972), *Zorba* (1968), *Chicago* (1975; film, 2002), and *Kiss of the Spider Woman* (1992), and for films such as *Funny Lady* (1975) and *New York, New York* (1977).

Kandinsky \kan-'din-skē**, Vasily (Vasilievich)** (b. Dec. 4, 1866, Moscow, Russia—d. Dec. 13, 1944, Neuilly-sur-Seine, France) Russian painter, a pioneer of pure abstraction in modern painting. Trained in the law and offered a law professorship, he chose painting instead and set out for Germany. After art studies in Munich, by 1909 he began his lifelong pursuit: a kind of painting in which colours, lines, and shapes, freed from the distracting business of depicting recognizable objects, might evolve into a visual "language" capable of expressing general ideas and evoking deep emotions. In his book *Concerning the Spiritual in Art* (1912) he set forth these ideas, comparing the expressiveness of forms and colour to qualities in music. In 1911 he and Franz Marc founded an informally organized group of like-minded artists called Der Blaue Reiter ("The Blue Rider"). From 1921 to 1933 he taught at the influential Bauhaus in Weimar; during this period Kandinsky continued to evolve in the general direction of geometric abstraction, but with a dynamism and a taste for detail. When the Nazis closed the Bauhaus, he immigrated to Paris. During this final period his painting became a synthesis of the organic manner of the Munich period and the geometric manner of the Bauhaus period. The visual language that he had been aiming at since at least 1910 turned into collections of signs that look like almost-decipherable messages written in pictographs and hieroglyphs. His influence on 20th-century art and abstract art in general was profound.

Kändler \'ken-dler**, Johann Joachim** (b. 1706, Fischbach, Saxony—d. May 18, 1775, Meissen) German Baroque sculptor. In 1731 he was engaged to reorganize the modeling department of the porcelain factory at Meissen; he held the position of chief modeler there from 1733 until his death. It was largely through Kändler's genius that Meissen porcelain gained world renown. Among his best-known works are his commedia dell'arte figurines, largely done between 1736 and 1744.

Harlequin, Meissen hard-paste porcelain figure from the commedia dell'arte modeled by Johann Joachim Kändler, c. 1738; in the Victoria and Albert Museum, London.

COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, EB INC.

Kandy Important independent monarchy in Ceylon (Sri Lanka) at the end of the 15th century and the last Sinhalese kingdom to be subjugated by a colonial power. Kandy survived the predations of the Portuguese by allying with the Dutch and survived the Dutch by seeking British aid; when the British took over Ceylon in 1796, Kandy was left on its own. The first British attack on

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Kandy in 1803 failed; in 1815 Kandyan chiefs invited the British to overthrow a tyrannical king, and in 1818 those chiefs' rebellion against the British was suppressed.

Kane, Paul (b. Sept. 3, 1810, Mallow, Ire.—d. Feb. 20, 1871, Toronto, Ont., Can.) Irish-born Canadian painter. His family immigrated to Canada in 1819. He worked mainly in Toronto but traveled as far as the Pacific coast depicting landscapes, Native American subjects, fur traders, and missionaries; he published an account of his adventures in *Wanderings of an Artist* (1859). Half of his paintings are portraits, works of great historical value in which he recorded the dress and ornaments of his subjects in accurate detail. He excelled at composing large figurative groups in a style similar to contemporary European genre painting.

Kanem-Bornu \'kä-ˌnem-'bōr-nü\ Former African empire around Lake Chad. It was ruled by the Sef dynasty in the 9th–19th century. Its territory at various times included what is now southern Chad, northern Cameroon, northeastern Nigeria, eastern Niger, and southern Libya. Probably founded in the mid-9th century, it became an Islamic state at the end of the 11th century. Its location made it a trading hub between North Africa, the Nile Valley, and the sub-Saharan region. From the 16th century Kanem-Bornu, sometimes called simply Bornu, was extended and consolidated. The Sef dynasty died out in 1846.

Kang \'käŋ-'yō-'wā\ **Youwei** *or* **K'ang Yu-wei** (b. March 19, 1858, Guangdong province, China—d. March 31, 1927, Qingdao, Shandong) Chinese scholar, a key figure in the intellectual development of modern China. In 1895 Kang led hundreds of provincial graduates to protest the humiliating terms of China's treaty with Japan after the Sino-Japanese War and to petition for reforms to strengthen the nation. In 1898 the Qing emperor launched a reform program that included streamlining the government, strengthening the armed services, promoting local self-government, and opening Beijing University. The empress Cixi annulled the reforms and had six reform leaders executed, and Kang had to flee the country. In exile, he opposed revolution; instead, he favoured rebuilding China through science, technology, and industry. He returned in 1914 and participated in an abortive restoration of the emperor. His fears of a divided country led him to oppose the government of Sun Yat-sen in southern China. Kang is also known for his reappraisal of Confucius, whom he saw as a reformer.

kangaroo Most specifically, any of six large Australasian marsupials of the family Macropodidae. The term is also used to refer to any of the family's 54 species. Most kangaroos graze on the Australian plains, but tree kangaroos are arboreal; they climb trees and leap from branch to branch. Kangaroos generally have long, powerful hind legs and feet and a long tail, thickened at the base. The hind legs enable their spectacular leaps and are also useful for self-defense; the tail is used for balance. The head is small, the ears large and rounded, and the fur soft and woolly. Females have one young (called a joey) annually; it is suckled in its mother's pouch for six months and often returns to be carried in the pouch later as well. The gray kangaroo, the best-known and second-largest species, can leap more than 30 ft (9 m). The red kangaroo is the largest species; the male may stand 6 ft (1.8 m) tall and weigh 200 lbs (90 kg). Millions are killed annually for their meat and hides and because they compete with livestock for forage. See also wallaby; wallaroo.

Western gray kangaroo (*Macropus fuliginosus*).
WARREN GARST/TOM STACK AND ASSOCIATES

Kangaroo Island Island (pop., 1996: 4,118), South Australia. Located at the entrance to the Gulf St. Vincent, southwest of Adelaide, Kangaroo Island is 90 mi (145 km) long with an area of 1,680 sq mi (4,350 sq km). Visited in 1802 by the English explorer Matthew Flinders, it was named for its many kangaroos. Nepean Bay was the site of the state's first settlement in 1836.

kangaroo rat Any of about 25 species (genus *Dipodomys*, family Heteromyidae) of rodents that leap about on their hind legs; found in dry regions of North America. They have large heads, large eyes, short forelimbs, long hind limbs, and fur-lined external cheek pouches that open alongside the mouth. They are 4–6.5 in. (10–16 cm) long without the long tail, which usually ends in a furry tuft. They are pale buff to brown above and white below, with a white stripe on each hip. They forage by night for seeds, leaves, and other vegetation, carrying food in their cheek pouches to store in their burrows, but seldom drink water.

Kangaroo rat (*Dipodomys*).
ANTHONY MERCIECA FROM ROOT RESOURCES

KaNgwane \käŋ-'gwä-nā\ Former black enclave, eastern Transvaal, South Africa. It was created under the apartheid system in 1977 as a homeland for those Swazi people not residing in Swaziland. The 1994 constitution of South Africa abolished the black enclaves created under the apartheid system, and it is now part of Mpumalanga province.

Kangxi \'käŋ-'shē\ **emperor** *or* **K'ang-hsi emperor** (b. May 4, 1654, Beijing, China—d. Dec. 20, 1722, Beijing) Second emperor of the Qing dynasty. His personal name was Xuanye. One of China's most capable rulers, Kangxi (r. 1661–1722) laid the foundation for a long period of political stability and prosperity. Under his reign, the Treaty of Nerchinsk was signed with Russia, parts of Outer Mongolia were added to China's territory, and control was extended over Tibet. Domestically, Kangxi's reign was a time of large-scale public works, such as repairing the Grand Canal to permit transportation of rice to feed the northern population, and dredging and banking the Huang He (Yellow River) to prevent destructive flooding. Kangxi reduced taxes many times and opened four ports to foreign ships for trade. Though an ardent proponent of Neo-Confucianism, he also welcomed Jesuit missionaries, whose accomplishments led him to permit the propagation of Roman Catholicism in China. He commissioned many books, including the Kangxi dictionary and a history of the Ming dynasty. See also Dga'l-dan; Manchu; Qianlong emperor.

Kaniṣka \kə-'nish-kə\ *or* **Kanishka** (fl. 1st century AD) Greatest king of the Kushān dynasty that ruled over the northern part of the Indian subcontinent, Afghanistan, and possibly regions north of Kashmir in Central Asia. He is thought to have taken the throne between AD 78 and 144 and to have ruled for 23 years. Kaniṣka is noted for having convened a Buddhist council that marked the beginnings of Mahayana Buddhism. He was a tolerant king who honoured the Zoroastrian, Greek, and Brahmanic deities as well as Buddha. During his reign, trade with the Roman Empire increased significantly, and contact between him and the Chinese in Central Asia may have inspired the transmission of Buddhism to China.

Kannada \'kä-nə-də\ **language** *formerly* **Kanarese** \ˌka-nə-'rēz\ **language** Dravidian language, the official language of the Indian state of Karnataka. It is spoken by more than 33 million people in Karnataka; an additional 11 million Indians may speak it as a second language. The earliest inscriptional records in Kannada are from the 6th century. Kannada script is closely akin to Telugu script in origin. Like other major Dravidian languages, Kannada has a number of regional and social dialects and marked distinctions between formal and informal usage.

Kannon See Avalokitesvara

Kano \'kä-nō\ City (pop., 1991: 2,166,554), northern Nigeria. Its traditional founder was Kano, a blacksmith of the Gaya people who in ancient times came to Dalla Hill in search of iron. It became the capital of the Hausa state of Kano in the early 12th century. It was the capital of an emirate in the 19th century before being captured by the British in 1903. Modern Kano is a major commercial and industrial centre. The old city is enclosed by a massive city wall dating from the 15th century; the central mosque there is Nigeria's largest.

Kanō school Japanese painting style of the 15th–19th centuries. It was practiced by a family of artists that served the Ashikaga shoguns of the Muromachi period and also Oda Nobunaga, Toyotomi Hideyoshi, and the shoguns of the Tokugawa period. Bold, large-scale designs were executed on the folding screens and sliding panels that acted as space dividers in

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the castles of the day. Chinese-style ink painting was blended with polychromatic Yamato-e ("Japanese painting"); some artists used a background of gold leaf for even more striking effects.

Kanphata Yogi Member of an order of religious ascetics that venerate the Hindu god Shiva. They are followers of Gorakhnath, a master yogi of the 12th century or earlier. Their ideology incorporates elements of magic, mysticism, and alchemy absorbed from both Hindu and Buddhist esoteric systems. Members focus on acquiring supernatural powers rather than following the more orthodox practices of meditation and devotion. They are distinguished by large earrings worn in the hollow of the ear.

Kanpur \'kän-ˌpůr\ *or* **Cawnpore** City (pop., 2001 prelim.: 2,532,138), Uttar Pradesh, northern India. The British acquired it in 1801 and made it one of their frontier stations. In 1857, during the Indian Mutiny, it was the site of the massacre of British troops and civilians by native forces. One of the largest cities in India, it is a hub of road and rail transportation and a major commercial and industrial centre. Its educational institutions include a university and the Indian Institute of Technology.

Kansas State (pop., 2000: 2,688,418), central U.S. Bordered by Nebraska, Missouri, Oklahoma, and Colorado, it covers 82,282 sq mi (213,110 sq km); its capital is Topeka. It is located on the Great Plains, rising more than 3,000 ft (915 m) from its eastern prairies to the high plains of the west. The region was occupied by the Kansa, Osage, Pawnee, and Wichita Indians before European settlement. The first European explorer was Francisco Vázquez de Coronado, who came from Mexico in 1541 in search of gold. La Salle claimed the region for France in 1682. Kansas was acquired by the U.S. as part of the Louisiana Purchase in 1803. In the early 19th century the federal government relocated displaced eastern Indians to Kansas. The Kansas-Nebraska Act of 1854 created the Kansas Territory and opened it to white settlement. It was the site of conflicts over slavery, including one spurred by John Brown (see Bleeding Kansas). It entered the Union as the 34th state in 1861. After the Civil War, the coming of the railroads promoted the growth of cow towns; Texas cattlemen drove herds to Wichita and Abilene to reach the railheads. Agriculture became important as farmers worked on the Great Plains. During and following World War II, airplane production expanded, and farm products remained strong.

Kansas, Bleeding See Bleeding Kansas

Kansas City City (pop., 2000: 441,545), western Missouri, U.S., on the Missouri River. The city is contiguous with Kansas City, Kan. First settled by French fur traders in 1821, it was known as Westport, prospering as a river port and as the terminus for the Santa Fe Trail and the Oregon Trail. Chartered in 1850 as the town of Kansas and as a city in 1853, it was renamed Kansas City in 1889 to distinguish it from the territory. The state's largest city, it is an important marketing and shipping centre for a vast agricultural region and has extensive grain-storage and food-processing facilities. It is the seat of the University of Missouri at Kansas City and the world headquarters for the Church of the Nazarene.

Kansas-Nebraska Act (1854) Legislation that organized the territories of Kansas and Nebraska according to the doctrine of popular sovereignty. Introduced by Sen. Stephen A. Douglas to stop the sectional division over slavery, the act was criticized by antislavery groups as a capitulation to proslavery advocates. Groups on both sides rushed to settle Kansas Territory with their adherents, leading to the chaotic Bleeding Kansas period. Passage of the act led to the formation of the Republican Party as a political organization opposed to the expansion of slavery to any U.S. territory.

Kansas River *or* **Kaw River** River, northeastern Kansas, U.S. It flows east and empties into the Missouri River at Kansas City. It is 169 mi (272 km) long, and it drains an area of 61,300 sq mi (158,770 sq km), including northern Kansas and parts of southern Nebraska and eastern Colorado.

Kansu See Gansu

Kant \'känt**, Immanuel** (b. April 22, 1724, Königsberg, Prussia—d. Feb. 12, 1804, Königsberg) German philosopher, one of the foremost thinkers of the Enlightenment. The son of a saddler, he studied at the university in Königsberg and taught there as privatdocent (1755–70) and later as professor of logic and metaphysics (1770–97). His life was uneventful. His *Critique of Pure Reason* (1781) discusses the nature of knowledge in mathematics and physics and demonstrates the impossibility of knowledge in metaphysics as it was traditionally conceived. Kant argued that the propositions of mathematics and physics, but not those of metaphysics, are "synthetic a priori," in the sense that they are about objects of possible experience (synthetic) but at the same time knowable prior to, or independently of, experience (a priori), thus making them also necessarily true, rather than merely contingently true (see necessity). Mathematics is synthetic and a priori because it deals with space and time, both of which are forms of human sensibility that condition whatever is apprehended through the senses. Similarly, physics is synthetic and a priori because in its ordering of experience it uses concepts ("categories") whose function is to prescribe the general form that sensible experience must take. Metaphysics in the traditional sense, understood as knowledge of the existence of God, the freedom of the will, and the immortality of the soul, is impossible, because these questions transcend any possible sense experience. But though they cannot be objects of knowledge, they are nevertheless justified as essential postulates of a moral life. Kant's ethics, which he expounded in the *Critique of Practical Reason* (1788) and the earlier *Groundwork of the Metaphysics of Morals* (1785), was based on the principle known as the "categorical imperative," one formulation of which is, "Act only on that maxim through which you can at the same time will that it should become a universal law." His last great work, *The Critique of Judgment* (1790), concerns the nature of aesthetic judgment and the existence of teleology, or purposiveness, in nature. Kant's thought represents a turning point in the history of philosophy. In his own words, he effected a Copernican revolution: just as the founder of modern astronomy, Nicolaus Copernicus, had explained the apparent movements of the stars by ascribing them partly to the movement of the observers, so Kant had accounted for the existence of a priori synthetic knowledge by demonstrating that in knowing, it is not the mind that conforms to things but instead things that conform to the mind. See also analytic-synthetic distinction; deontological ethics; idealism; Kantianism.

Kantianism \'kan-tē-ə-ˌni-zəm, kän-tē-ə-ˌni-zəm\ System of critical philosophy created by Immanuel Kant and the philosophies that have arisen from the study of his writings. Kantianism comprises diverse philosophies that share Kant's concern to explore the nature and limits of human knowledge in the hope of raising philosophy to the level of a science. Each submovement of Kantianism has tended to focus on its own selection and reading of Kant's many concerns. In the 1790s there emerged in Germany the so-called semi-Kantians, who altered features of Kant's system they viewed as inadequate, unclear, or even wrong; its members included Friedrich Schiller, Friedrich Bouterwek (1766–1828), and Jakob Friedrich Fries (1773–1843). The period from 1790 to 1835 was the age of the post-Kantian idealists (see idealism). A major revival of interest in Kantian philosophy began c. 1860. See also Johann Gottlieb Fichte; G.W.F. Hegel; Neo-Kantianism; Friedrich Wilhelm Joseph von Schelling.

Kantorovich \ˌkän-tə-'rō-vich**, Leonid (Vitalyevich)** (b. Jan. 19, 1912, St. Petersburg, Russia—d. April 7, 1986, U.S.S.R.) Soviet mathematician and economist. A professor at Leningrad State University (1934–60), he developed the linear programming model as a tool of economic planning. He used mathematical techniques to show how decentralization of decision making in a planned economy ultimately depends on a system in which prices are based on the relative scarcity of resources. His nondogmatic critical analyses of Soviet economic policy often clashed with the views of his orthodox Marxist colleagues. His most notable work is *The Best Use of Economic Resources* (1959). In 1975 he and Tjalling Koopmans (1910–85) shared the Nobel Prize for their work on optimal allocation of scarce resources.

Kanuri \kə-'nůr-ē\ People of northeastern Nigeria and southeastern Niger, with smaller numbers in Chad, Cameroon, and Sudan. They number about four million. Their language, Kanuri, is one of the Nilo-Saharan languages. The Kanuri developed the powerful empire of Kanem-Bornu, which reached its peak in the 16th century. They have been Muslims since the 11th century. The Kanuri economy is based on millet agriculture and trade with the Fulani and Arab herders.

Kao-hsiung \'kaů-'shyůŋ\ Port city (pop., 2002 est.: 1,504,061), southwestern Taiwan. It is Taiwan's leading port and a major industrial centre. Settled late in the Ming dynasty, it became a treaty port in 1863 and a customs station in 1864. It grew in importance during the Japanese occupation (1895–1945) and served as the southern terminus of the main north-south railway line. The city was named Takao by the Japanese and was made a municipality in 1920. It came under Chinese rule in 1945.

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kaolinite \'kā-ə-lə-ˌnīt\ Group of common CLAY MINERALS that are hydrous aluminum silicates and constitute the principal ingredients of kaolin (china clay). The group includes kaolinite, dickite, nacrite, halloysite, and allophane. They are natural alteration products of feldspars, feldspathoids, and other silicates.

Kapalika and Kalamukha \kä-'pä-li-kə...'kä-lä-ˌmù-kə\ Members of either of two groups of extreme Hindu ascetics, prominent in India in the 8th–13th century. They were an offshoot of the Shaivites (see SHAIVISM), who worshiped SHIVA, and their notorious practices included human sacrifice. After sacrificing a BRAHMAN or other high-ranking person, they embraced a 12-year vow of self-abnegation that included eating and drinking from the skull of the sacrificed person and following tantric practices such as going about naked, eating the flesh of the dead, and smearing themselves with the ashes of corpses. Their modern successors are the Aghoris, or Aghorapanthis.

Kapila \'kə-pē-lə\ (fl. 550 BC?) Founder of the SAMKHYA school of Vedic philosophy in India. Legend says he was a descendant of MANU, the primal human being, and a grandson of the creator god, BRAHMA. He has also been thought of as an incarnation of VISHNU. In Buddhist sources he was a well-known philosopher whose students built Kapilavastu, the birthplace of BUDDHA Gautama. He lived as a hermit, and his ascetic regimen was said to have given him an inner store of such intense heat that he was capable of reducing 60,000 men to ashes.

Kaplan, Mordecai Menahem (b. June 11, 1881, Švenčionys, Lithu.—d. Nov. 8, 1983, New York, N.Y., U.S.) Lithuanian-born U.S. theologian. He came to the U.S. with his family in 1889. Ordained at the Jewish Theological Seminary, he later taught there for 50 years. In 1916 he organized the Jewish Center in New York as a secular community organization with a synagogue as its nucleus. In 1922 he founded the Society for the Advancement of Judaism, which became the core of RECONSTRUCTIONISM. Denying the literal accuracy of the BIBLE, he called for a new conception of God in an attempt to adapt Judaism to the modern world. He founded the journal *The Reconstructionist* in 1935; his books include *Judaism as a Civilization* (1934) and *Judaism without Superstition* (1958).

kapok \'kā-ˌpäk\ Fibre obtained from the large, tropical silk cotton, or kapok, tree (*Ceiba pentandra*, family Bombacaceae), which bears hundreds of seedpods filled with fibrous seeds. The tree is grown chiefly in Asia and Indonesia. Sometimes called silk cotton or Java cotton, this moisture-resistant, quick-drying, resilient, buoyant fibre has been used in life preservers and other water-safety equipment. Kapok is also used to stuff pillows, mattresses, and upholstery, as insulation, and as a cotton substitute in surgery. However, it is highly flammable, and the fibres are too brittle for spinning. Its importance has decreased with the development of foam rubber, plastics, and man-made fibres.

Kapoor, Raj (b. Dec. 14, 1924, Peshawar, India—d. June 2, 1988, New Delhi) Indian film actor and director. In the 1930s Kapoor worked as a clapper boy for Bombay Talkies and as an actor for Prithvi Theatres, two companies owned by his father. Kapoor's first major screen role was in *Aag* (1948; "Fire"), which he also produced and directed. In 1950 he formed his own Bombay (now Mumbai) film studio, RK, and the next year he achieved romantic stardom in *Awara* (1951; "The Vagabond"). He wrote, produced, directed, and starred in many successful films. Although he portrayed romantic leads in his early movies, his best-known characters were based on CHARLIE CHAPLIN's tramp. His use of sexual imagery often challenged traditionally strict Indian film standards, and many of his film songs became musical hits.

Kaposi \'ka-pə-sē\ **sarcoma** Usually lethal CANCER appearing as red-purple or blue-brown spots on the skin and other organs. It has been linked to one of the herpes viruses, and there is considerable debate about how it should be classified. When described in 1872 by Moritz Kaposi, it was extremely rare, confined to specific Mediterranean and African populations. Since c. 1980 it has become common in AIDS patients. More homosexual male HIV patients have developed it than heterosexual intravenous-drug-using HIV patients. Remissions have occurred, but there is no known cure.

Kapp Putsch \'käp-'půch\ (1920) In Germany, a coup d'état that attempted to overthrow the fledgling WEIMAR REPUBLIC. Its immediate cause was the government's attempt to demobilize two FREIKORPS brigades. One of the brigades took Berlin, with the cooperation of the Berlin army district commander. Wolfgang Kapp (1858–1922), a reactionary member of the Reichstag, formed a government with ERICH LUDENDORFF, and the legitimate republican regime fled to southern Germany. Within four days, a general strike by labour unions and the refusal by civil servants to follow Kapp's orders led to the coup's collapse.

Kara Koyunlu *or* **Qara Qoyunlu** \'kä-rä-ˌkȯ-yůn-'lü\ *Turkish* **"Black Sheep"** Turkmen tribal federation that ruled Azerbaijan and Iraq (c. 1375–1468). Their second leader, Kara Yūsuf (r. 1390–1400, 1406–20), secured their independence by seizing Tabrīz, the capital of the Jalāyrid dynasty. He was beaten back by the armies of TIMUR but regained Tabrīz in 1406. He captured Baghdad in 1410. His successor, Jihān Shah, died in battle against a rival Turkmen federation, the Ak Koyunlu, in 1466, and the empire fell in 1468.

Karachi \kä-'rä-chē\ City (pop., 1998: 9,269,265), Pakistan. Located in southern Pakistan on the Arabian Sea northwest of the mouth of the INDUS RIVER, it was a small fishing village when traders arrived in the early 18th century. It was captured by the British in 1839 and was a major port of the British Empire by 1914. The provincial capital of Sind from 1936, it was also the first capital of independent Pakistan (1947–59). It is Pakistan's principal seaport and a major industrial and commercial centre, and it is one of the world's most populous cities. It is the seat of the University of Karachi and the terminus of Pakistan's railway system.

Karadjordjević \ˌkar-ə-'jōr-jə-ˌvich\ **dynasty** Rulers descended from the Serbian rebel leader Karadjordje (1762–1817). It rivaled the OBRENOVIĆ DYNASTY for control of Serbia during the 19th century and ruled that country and its successor state, the Kingdom of SERBS, CROATS, AND SLOVENES (later Yugoslavia), in 1842–58 and 1903–45. See also ALEXANDER I; PETER I; PETER II.

Karadžić \kä-'rä-jēt^{y},\ *English* \kä-'rad-zich**, Radovan** (b. June 19, 1945, Petnjica, Yugos.) Bosnian Serb politician. He trained as a psychiatrist and also wrote poetry and children's books. In 1990 he helped found the Serbian Democratic Party of Bosnia and Herzegovina. In 1992, when the Bosnian Serbs declared an independent state, he became its president. With the support of Yugoslav Pres. SLOBODAN MILOŠEVIĆ and with Bosnian Serb military leader Gen. Ratko Mladic, Karadžić undertook a campaign of ETHNIC CLEANSING in Bosnia to purge it of non-Serbian peoples. In 1995 he was indicted by a UN war crimes tribunal. He was pressured into signing the Dayton peace accords and forced to resign as state president and party head in 1996. However, he continued to influence the Serb-controlled part of Bosnia and Herzegovina from a mountain hideaway outside Sarajevo. Despite attempts to arrest him, he was able to evade capture through the 1990s and into the early 21st century.

Karadžić \kä-'rä-jēt^{y},\ *English* \kä-'rad-zich**, Vuk Stefanović** (b. Nov. 6, 1787, Tršić, Serbia, Ottoman Empire—d. Feb. 6, 1864, Vienna) Serbian language scholar and folklorist. He was largely self-taught as a writer. After the failure of a Serb revolt against Turkish rule, he left for Vienna (1813), where he was introduced to formal scholarship by the Slavist Jernej Kopitar. In 1814 he published a grammar of Serbian (see SERBO-CROATIAN LANGUAGE) and in 1818 a dictionary; both promulgated a reformed CYRILLIC ALPHABET and a new literary language based on colloquial Serbian rather than the prevailing literary language, which mixed archaic Serbian with Russian Church Slavic (see OLD CHURCH SLAVONIC LANGUAGE). After decades of resistance and polemicizing, the renascent Serbian state accepted his reforms in 1868.

Karaganda See QARAGHANDY

Karaism *or* **Qaraism** \'kar-ə-ˌi-zəm\ Jewish religious movement that denied the authenticity of the oral law and defended the Hebrew Bible as the only basis of doctrine and practice. It originated in 8th-century Persia, where its members were called Ananites after Anan ben David, who worked out a code of life independent of the TALMUD. Members later adopted the name Karaites from the Hebrew *qara* ("to read"), emphasizing their reliance on a personal reading of the Bible. The movement spread through Egypt and Syria, winning only small numbers of followers and enduring many schisms. It still has about 10,000 members in Israel.

Karajan \'kär-ə-ˌyän**, Herbert von** (b. April 5, 1908, Salzburg, Austria—d. July 16, 1989, Anif, near Salzburg) Austrian conductor. A child prodigy on the piano, he attended Salzburg's Mozarteum. He took his first conducting post in Ulm in 1929. In 1933 he joined the Nazi Party, and under the Third Reich his reputation grew swiftly. After World War II he initially was not allowed to conduct, but in 1947 he began record-

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ing with the Vienna Philharmonic, the start of a legacy of some 800 recordings. His U.S. debut in 1955 was attended by controversy over his Nazi-era activities. That same year he became Wilhelm Furtwängler's successor at the Berlin Philharmonic, and he headed the Salzburg Festival from 1964 until his death.

Karak See Kaya

Karakoram Range Mountain system, south-central Asia. Extending 300 mi (480 km) from eastern Afghanistan to the Kashmir region, it is one of the highest mountain systems in the world; its loftiest peak is K2, at 28,251 ft (8,611 m), the world's second highest peak. Surrounded by other steep mountain ranges, the Karakorams are virtually inaccessible, although the completion of the Karakoram Highway in 1978 improved transportation in the region. Because of the harsh environment, the area is thinly populated.

Karakorum \ˌkä-rä-ˈkōr-əm\ Ancient capital, Mongol empire. Its ruins lie on the upper Orhon River in north-central Mongolia. It was settled c. 750. Genghis Khan established his headquarters there in 1220. In 1235 his son and successor, Ögödei, enclosed the city with walls and built a palace. Chinese forces invaded Mongolia and destroyed Karakorum in 1388. It was later partially rebuilt but was abandoned by the 16th century. The ruins are included in a regional UNESCO World Heritage site designated in 2004.

Karakul \ˈkar-ə-kəl\ Breed of sheep that originated in central or western Asia. They are raised chiefly for the skins of very young lambs, which have a glossy, tightly curled black coat (the "Persian lamb" of the fur trade). The wool of mature Karakul sheep, classified as carpet wool, is a mixture of coarse and fine fibres 6–10 in. (15–25 cm) long and varies from black to brown and gray.

Karakum Desert *or* **Kara-Kum Desert** \ˌkär-ə-ˈküm\ Desert area, Central Asia. Located in Turkmenistan, it is bounded to the east by the Amu Darya valley. It can be divided into three major regions: the elevated and wind-eroded Trans-Unguz in the north, the low-lying central plain, and the salt marshes of the southeast. It is populated by formerly nomadic Turkmen, who live by fishing in the Caspian Sea or raising livestock.

Karamanlis \ˌkär-ə-män-ˈlēs**, Konstantinos** *or* **Constantine Caramanlis** (b. March 8, 1907, Próti, near Sérrai, Macedonia, Ottoman Empire—d. April 23, 1998, Athens, Greece) Greek prime minister (1955–63, 1974–80) and president (1980–85, 1990–95). In various cabinet posts after World War II (1946–55), he helped rebuild Greece's wartorn economy. Chosen prime minister in 1955, he formed a government and a new conservative party, the National Radical Union. In 1960 he established an independent republic on Cyprus to ease tensions with Britain and Turkey over the island. He resigned in 1963 and lived in exile in Paris until 1974. Recalled as prime minister, he subordinated the military to civilian authority to restore democracy, averted war with Turkey over Cyprus, and oversaw the adoption of a new constitution that strengthened the presidency. In 1975 he held a referendum that resulted in the abolition of the monarchy. In 1980 he resigned as prime minister and was elected president. He helped effect Greece's entry into the European Community in 1981. He resigned in 1985, then was reelected president in 1990.

karaoke \ˌkar-ē-ˈō-kē\ *Japanese* **"empty orchestra"** Use of a device that plays instrumental accompaniments to songs with the vocal tracks removed, permitting the user to sing the lead. Karaoke apparently first appeared in the amusement quarter of Kōbe, Japan, where it became popular among businessmen in the late 1970s. It gained widespread popularity in the U.S. in the late 1980s. It is usually featured at bars, where patrons can perform on a stage and sing popular hits by reading lyrics electronically displayed on a monitor. A video film often accompanies the music.

karate Martial art in which an attacker is disabled by crippling kicks and punches. Emphasis is on concentration of as much of the body's power as possible at the point and instant of impact. Striking surfaces include the hand (particularly the knuckles and the hand's outer edge), ball of the foot, heel, forearm, knee, and elbow. In sporting matches (usually lasting about three minutes) and in sparring, blows and kicks are stopped short of contact. Performances are scored by a panel of judges. Karate evolved in East Asia over a period of centuries, becoming systematized in Okinawa in the 17th century, probably by people forbidden to carry weapons. It was imported into Japan in the 1920s and spread from there to other countries. See also tae kwon do.

Karbalāʾ \ˌkär-bä-ˈlä**, Battle of** (Oct. 10, 680) Brief engagement in which an Ummayad army sent by Yazīd I killed al-Ḥusayn ibn ʿAlī and a small group of his family and followers. Al-Ḥusayn, a grandson of the Prophet Muhammad, was on his way to Al-Kūfah, where he had been invited to press his claim to the caliphate, when he and his party were attacked and killed near the town of Karbalāʾ, Iraq. Most Shīʿites regard the anniversary of the battle as a holy day of mourning, and on that day they ritually reenact al-Ḥusayn's death; his tomb in Karbalāʾ is likewise considered a place of great sanctity. See also ʿAlī; *fitnah*; Muʿāwiyah I.

Kardelj \ˈkär-ˌdel^{y}**, Edvard** (b. Jan. 27, 1910, Ljubljana, Slvn., Austria-Hungary—d. Feb. 10, 1979, Ljubljana) Yugoslav revolutionary and administrator. He joined the outlawed Communist Party in 1926, was imprisoned from 1930 to 1932, and fled to the Soviet Union in 1934. Returning to Yugoslavia in 1937, he helped organize resistance to the German occupation in World War II and joined Tito in much of the Partisans' fighting. In 1946 he drew up the Soviet-inspired constitution after Tito became premier, and he directed the creation of all succeeding constitutions. He was the main architect of socialist self-management, which distinguished Yugoslavia's political and economic system from the Soviet system. In foreign affairs, he pioneered the concept of Yugoslav nonalignment.

Karen \kə-ˈren\ Any member of a variety of tribal peoples of southern Myanmar (Burma). Constituting the second largest minority in Myanmar, the Karen are not a unitary group in any ethnic sense, as they differ among themselves linguistically, religiously, and economically. Rather, they have defined themselves in terms of their common distrust of political domination by Myanmar, which has persisted since the country attained independence in 1948.

Karisimbi \ˌkä-rē-ˈsim-bē**, Mount** Peak, Virunga Mountains, east-central Africa. The highest peak in the Virungas, at a height of 14,787 ft (4,507 m), it lies on the boundary between Rwanda and Congo (Kinshasa) in Virunga National Park. It is the habitat of gorillas and is known for its exotic plants.

Karkar *or* **Qarqar** \ˈkär-ˌkär\ Ancient fortress on the Orontes River, western Syria. A strategic outpost, it was attacked by the Assyrians in 853 bc. It was defended by Aramaeans, led by Ben-hadad I of Damascus, and their allies, including King Ahab of Israel. In 720 bc it was the scene of a battle in which Sargon II of Assyria captured and burned it.

Karkūk \kir-ˈkük\ *or* **Kirkuk** City (pop., 2003 est.: 750,000), northeastern Iraq. Located north of Baghdad in the Kurdistan region, it is situated in one of the first areas in the Middle East where oil was discovered. Karkūk is a trade and export centre as well as a centre of Iraq's petroleum industry, with oil pipeline connections to Tripoli and to Yumurtalık on the Turkish coast. The city has traditionally had a Kurdish and Turkmen majority, but a large number of Arabs were resettled there in the late 20th century.

Karl Franz Josef See Charles I (Austria)

Karl-Marx-Stadt See Chemnitz

Karlfeldt \ˈkärl-felt**, Erik Axel** (b. July 20, 1864, Folkärna, Swed.—d. April 8, 1931, Stockholm) Swedish poet. His strong ties to the peasant culture of his rural homeland remained a dominant influence on his writing all his life. His essentially regional, tradition-bound poems, some published in English in *Arcadia Borealis* (1938), were very popular. He was elected to the Swedish Academy in 1904 and made its permanent secretary in 1912. He refused the Nobel Prize for Literature in 1918 but was awarded it posthumously in 1931.

Boris Karloff.
AP/WIDE WORLD PHOTOS

Karloff, Boris *orig.* **William Henry Pratt** (b. Nov. 23, 1887, London, Eng.—d. Feb. 2, 1969, Midhurst, West Sussex) British-U.S. actor. He immigrated to Canada from England in 1909 and acted with touring companies before moving to Hollywood, where he played minor

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roles in films from 1919. His tender, sympathetic performance in Hollywood's first important monster film, James Whale's *Frankenstein* (1931), received so much critical praise that he became an overnight sensation. He acted in more than 100 films, specializing in horror pictures such as *The Mummy* (1932), *The Mask of Fu Manchu* (1932), *Bride of Frankenstein* (1935), and *Son of Frankenstein* (1939), and his name became synonymous with the horror genre. He returned to the stage for highly acclaimed performances on Broadway in *Arsenic and Old Lace* (1941) and as Captain Hook in *Peter Pan* (1950). His most famous television performance was in the animated special *How the Grinch Stole Christmas* (1966), for which he provided the voices of both the Grinch and the narrator.

Karlovy Vary \'kär-lȯ-vē-'vär-ē\ *German* **Karlsbad** *or* **Carlsbad** City (pop., 2001 prelim.: 53,857), western Czech Republic. A health resort with sulfur springs, it was developed in 1358 by Holy Roman Emperor Charles IV. The Carlsbad Decrees were drawn up there in 1819.

Karlowitz, Treaty of See Treaty of Carlowitz

karma In Indian philosophy, the influence of an individual's past actions on his future lives or reincarnations. It is based on the conviction that the present life is only one in a chain of lives (see samsara). The accumulated moral energy of a person's life determines his or her character, class status, and disposition in the next life. The process is automatic, and no interference by the gods is possible. In the course of a chain of lives, people can perfect themselves and reach the level of Brahma, or they can degrade themselves to the extent that they return to life as animals. The concept of karma, basic to Hinduism, was also incorporated into Buddhism and Jainism.

Karma-pa See Dge-lugs-pa

Kármán \'kär-mən**, Theodore von** (b. May 11, 1881, Budapest—d. May 6, 1963, Aachen, W.Ger.) Hungarian-born U.S. engineer. After directing the Aeronautical Institute at Aachen, Germany (1912–30), he immigrated to the U.S., where he taught at the California Institute of Technology (1930–44) and later headed NATO's Advisory Group for Aeronautical Research and Development (1951–63). His pioneering work in aeronautics and astronautics included important contributions to fluid mechanics, turbulence theory, supersonic flight, mathematics in engineering, and aircraft structures. His jet-assisted takeoff (JATO) rocket provided the prototype for engines used in present-day long-range missiles. He contributed to the first assisted takeoff of U.S. aircraft with solid- and liquid-propellant rockets, the flight of aircraft with rocket propulsion alone, and the development of spontaneously igniting liquid propellants (later used in the Apollo modules). In 1963 he was awarded the first National Medal of Science.

Theodore von Kármán.
COURTESY OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA

Karnak Village, Upper Egypt. Its name has been given to the northern part of the ruins of Thebes on the Nile River's eastern bank (the southern part is called Luxor). Among its many religious buildings stood the largest of all Egyptian temples, the Temple of Amon. Itself a complex of temples, added to and altered many times, it reflects the fluctuating fortunes of the Egyptian empire. There are no fewer than 10 pylons, separated by courts and halls. The most striking feature is the vast hypostyle hall commissioned by Ramses I (r. 1292–90 BC), with an area of some 54,000 sq ft (5,000 sq m). Twelve enormous columns, some 80 ft (24 m) high, raised the roofing slabs of the central aisle to produce a clerestory. Karnak is part of a UNESCO World Heritage site (designated 1979) centred on Thebes.

Karnali River See Ghaghara River

Karnataka \kär-'nä-tə-kə\ *formerly* **Mysore** \mī-'sōr\ State (pop., 2001 prelim.: 52,733,958), southwestern India. Lying on the Arabian Sea, it is bordered by the states of Goa, Maharashtra, Andhra Pradesh, Tamil Nadu, and Kerala. It has an area of 74,051 sq mi (191,791 sq km); its capital is Bangalore. It occupies the plateau region of the southern Deccan and the hill region of the Western Ghats. The area was ruled by a series of Hindu dynasties before coming under British control in 1831. Mysore returned to native rule in 1881 as a princely state. Its name was changed to Karnataka ("lofty land") in 1973. About 80% of the population is engaged in agriculture. Rice and sugarcane are cultivated on the coastal plain, and coffee and tea are grown in the hill region. The population is largely Dravidian, and the Kannada language is widely spoken.

Kärnten \'kernt-ᵊn\ *or* **Carinthia** State (pop., 2004 est.: 559,078), southern Austria. Bordered by Italy and Slovenia, it occupies an area of 3,682 sq mi (9,536 sq km) and has its capital at Klagenfurt. Originally inhabited by Celts, it became part of the Roman province of Noricum. Made a separate duchy in 976, it was a crown land of the Habsburgs in 1335. After World War I, parts were claimed by Yugoslavia and Italy.

Karo \'kä-rō**, Joseph ben Ephraim** (b. 1488, Spain—d. March 24, 1575, Safed, Palestine) Spanish-born Jewish scholar. When the Jews were expelled from Spain in 1492, he and his parents settled in Turkey. Around 1536 he emigrated to Safed in Palestine, where he studied the Talmud and systematized the vast body of material produced by post-Talmudic writers. He was the author of the last great codification of Jewish law, the *House of Joseph*, which was later condensed as *The Well-Laid Table* and is still authoritative for Orthodox Judaism.

Károlyi \'kä-rȯl-yē**, Mihály, Count** (b. March 4, 1875, Fót, Hung., Austria-Hungary—d. March 20, 1955, Vence, France) Hungarian statesman. A member of one of the wealthiest families of the Hungarian aristocracy, he entered parliament in 1910 and tried to advance radical ideas in a conservative state, advocating universal suffrage, concessions to Hungary's non-Magyar subjects, and a policy of friendship with states other than Germany. After World War I he served as prime minister in 1918–19, and he tried unsuccessfully to gain a favourable peace settlement from the Allies. After two months as president of the short-lived Hungarian republic in 1919, he resigned and was replaced by Béla Kun. He fled abroad, but he returned to Hungary in 1946 and served as ambassador to France (1947–49).

Karpov \'kär-ˌpȯf**, Anatoly (Yevgenyevich)** (b. May 23, 1951, Zlatoust, U.S.S.R.) Russian chess master. His first great success was winning the 1969 World Junior (under 20) Championship. Karpov was declared world champion in 1975 when the reigning champion Bobby Fischer and the International Chess Federation (FIDE) could not agree on conditions for their title match. Karpov defended the title several times before losing it in 1985 to Garry Kasparov. Karpov regained the FIDE championship in 1993 after Kasparov was stripped of the title. In 1999 Karpov refused to defend his FIDE title, which was won by Alexander Khalifman of Russia.

Karsavina \kär-'sä-və-nə**, Tamara (Platonovna)** (b. March 9/10, 1885, St. Petersburg, Russia—d. May 26, 1978, Beaconsfield, Buckinghamshire, Eng.) Russian-born British dancer. She trained at the Imperial Ballet School in St. Petersburg and joined the Mariinsky Theatre company in 1902. She joined the Ballets Russes at its formation in 1909; dancing with Vaslav Nijinsky until 1913, she created most of the leading roles in Michel Fokine's neo-Romantic repertoire, including *Les Sylphides*, *Carnaval*, *Le Spectre de la rose*, and *The Firebird*. She settled in London, where she helped found the Royal Academy of Dancing in 1920 and the Camargo Society in 1930 and later coached Margot Fonteyn.

Karsh, Yousuf (b. Dec. 23, 1908, Mardin, Tur.—d. July 13, 2002, Boston, Mass., U.S.) Turkish-born Canadian photographer. As an Armenian in Turkey, he endured persecution before emigrating at 16 to Canada, where he joined his photographer uncle. He worked for a Boston portrait photographer (1928–31) then returned to Canada and soon opened his own studio in Ottawa. In 1935 he was appointed official portrait photographer of the Canadian government. His portrait of Winston Churchill (1941) brought him international fame. "Karsh of Ottawa" went on to photograph hundreds of

Karsh, self-portrait, 1988.
1988 KARSH OF OTTAWA/WOODFIN CAMP & ASSOC.

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the world's most prominent figures, including royalty, statesmen, artists, and writers, employing dramatic lighting techniques to produce idealized likenesses.

Karter *or* **Kartir** (fl. 3rd century AD, Iran) Persian high priest of Zoroastrianism. Under the protection of a series of Persian kings, he restored the purity of Zoroastrianism and tried to purge the kingdom of all other religions. His chief rival was the prophet Mani, founder of Manichaeism. At Karter's instigation, Mani was put in prison, where he eventually died. After Karter's death a degree of religious tolerance returned to Persia.

karting Driving and racing miniature, skeleton-frame, rear-engine automobiles called karts or GoKarts. The sport originated in the U.S. in the 1950s after the first kart had been assembled from unwanted lawn-mower parts. It thereafter developed into an international sport in Europe. Speeds of 100 mph (160 kph) are not uncommon.

Kārūn \kä-'rün\ **River** River, southwestern Iran. A tributary of the Shatt al-Arab, it rises in the Bakhtīārī Mountains and flows through mountains for 515 mi (829 km). The Ḥaffār Channel, dug in 986, changed its course, causing frontier disputes between Iran and the Ottoman Empire; Iran gained the right to the waterway by treaty in 1847.

Dam on the Kārūn River, Iran
DENNIS BRISKIN/TOM STACK & ASSOCIATES

Kasai River \kä-'sī\ River, central Africa. It is the chief southern tributary of the Congo River, measuring 1,338 mi (2,153 km) from its source in Angola to its confluence with the Congo. It runs east for its first 250 mi (400 km), then turns north to form the border between Angola and the Democratic Republic of the Congo (Zaire). It is unnavigable in the north, but water traffic is heavy from Kinshasa to Ilebo. After the Kasai is joined by the Kwango River, it is known as the Kwa.

Kasanje \kä-'sän-jā\ Historical African kingdom, on the upper Kwango River in what is now Angola. Founded in 1620 by a group from Lunda, its people became known as the Imbangala. By the mid-17th century, it had a thriving trade with the states of the interior and with Portuguese traders. Its monopoly of inland Portuguese-African trade lasted until 1850, when Ovimbundu opened alternative routes and markets. Occupied by the Portuguese, Kasanje was incorporated into Portuguese Angola in 1910–11.

Kasavubu \kä-sä-'vü-bü**, Joseph** (b. 1910?, Tshela, Belgian Congo—d. March 24, 1969, Boma) First president (1960–65) of independent Congo (Kinshasa). He held a variety of administrative posts before agreeing to serve as president in Patrice Lumumba's government. When Katanga province under Moise Tshombe seceded a few days after independence, Kasavubu threw his support to Tshombe and, together with Col. J. Mobutu (see Mobutu Sese Seko), ousted Lumumba. Four years later a split between Kasavubu and Tshombe enabled Mobutu to seize control.

Kasavubu
AP/WIDE WORLD PHOTOS

Kashmir Region of the northwestern Indian subcontinent. It is bounded to the northeast and east by China, to the south by India, to the west by Pakistan, and to the northwest by Afghanistan. The land is predominantly mountainous and includes K2 and other peaks of the Karakoram Range. India and Pakistan have disputed over the region since India's partition in 1947. Pakistan occupies the northern and western portions, and India administers the largest area, in the south and southeast, organized as the state of Jammu and Kashmir. In addition, China has held portions of the northeastern section since 1962.

kashruth \kä-'shrüt, 'kä-shrůth\ In Judaism, the rules forbidding the eating of certain foods and requiring that other foods be prepared in a specific way. These rules determine which foods can be called kosher. Most information regarding kashruth is found in the Hebrew Bible in the books of Leviticus, Deuteronomy, Genesis, and Exodus. Jews observing kashruth may eat only fish with scales and fins and animals that chew the cud and have cloven feet; shellfish and pork are thus forbidden. Animals and birds must be slaughtered according to ritual and with prayer. Meat and dairy products must be strictly separated; they may not be eaten at the same meal or from the same set of dishes. No restrictions apply to the use of fruits and vegetables. During Passover, bread and other baked goods must be made without leaven.

Kaskaskia \kas-'kas-kē-ə\ **River** River, Illinois, U.S. Rising near Urbana, it flows southwest to enter the Mississippi River after a course of 320 mi (515 km). The village of Kaskaskia, located near the junction of the river with the Mississippi, is near the site of a town founded by Jesuit missionaries in 1703. It was the capital of Illinois Territory (1809) and of the state (1818–20). It was severely damaged by floods several times.

Kasparov \kas-'pär-ôf**, Garry** (b. April 13, 1963, Baku, Azerbaijan, U.S.S.R.) Russian chess master. He became an international grandmaster following his victory in the 1980 World Junior (under 20) Championship. In 1984–85 Kasparov met world champion Anatoly Karpov in a match that was aborted after five months of play; in late 1985, Kasparov won a 24-game return match 13–11. The International Chess Federation (FIDE) stripped him of his title in 1993 in a conflict over the venue for a championship match, but the rest of the chess world still accepted him as champion. In 1996 Kasparov defeated IBM's custom-built chess computer Deep Blue in a match that attracted worldwide attention. In a 1997 rematch, an upgraded Deep Blue prevailed. In 2000 Kasparov lost a 16-game championship match to Vladimir Kramnik of Russia.

Katagum \kə-'tä-gəm\ Traditional emirate, northern Nigeria. The emirate became part of Katagum province under British rule in 1903. Its seat, also named Katagum, was transferred to Azare in 1916. The emirate became part of Bauchi state in 1926.

Kathiawar \ˌkä-tē-ə-'wär\ **Peninsula** Peninsula, southwestern Gujarat state, west-central India. Occupying an area of 23,000 sq mi (60,000 sq km), it is bounded by the Arabian Sea on the southwest. It was first occupied in prehistoric times and was settled in the 3nd–2nd millennium BC by Harappan peoples. It was ruled by many great dynasties beginning with the Mauryan empire in the 3rd century BC. The area came under Muslim rule in the 13th century and became part of the Mughal Empire in the 16th century. Many of its small princely states came under British protection after 1820. Made a part of Gujarat state in 1960, it is the site of a national park that contains the last wild Asiatic lions in India.

Kathmandu *or* **Katmandu** \ˌkat-man-'dü\ City (pop., 2000 est.: 701,499), capital of Nepal. Situated near the confluence of the Baghmati and Vishnumati rivers at an elevation of 4,344 ft (1,324 m), it was founded in 723. Its name refers to a temple (*kath*, "wood"; *mandir*, "temple") said to have been built from the wood of a single tree in 1596. The seat of the ruling Shah family of the Gurkha people since 1768, it is Nepal's most important business and commercial centre and the site of Tribhuvan University.

Katmai \'kat-ˌmī\ **National Park and Preserve** National park, southwestern Alaska, U.S., at the head of the Alaska Peninsula. Occupying an area of 4,090,000 acres (1,655,000 hectares), it was proclaimed a national monument in 1918 after the eruption of Novarupta in 1912. The eruption converted the valley into a wasteland known as the Valley of Ten Thousand Smokes, and the volcanic crater later became a lake. The park abounds in wildlife, including large numbers of brown and grizzly bears.

Katowice \ˌkä-tô-'vēt-sə\ City (pop., 2000 est.: 340,539), south-central Poland. Located in the midst of the coalfields of Upper Silesia, it was settled by 1598. It became a city in 1865, when coal mining began in the region. It became part of Poland in 1922 and has since incorporated surrounding villages. It is a centre of mining and heavy industry and an important rail junction.

Katsina \'kät-sē-nä\ City (pop., 1991: 259,315), northern Nigeria. Probably founded c. 1100, it was the capital of the kingdom of Katsina, one

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of the earliest Hausa states, and an ancient centre of learning. The city's Fulani emirs retain traditional and advisory roles. It is a market for local agricultural products as well as a centre for traditional crafts and industry.

Katsura \'kät-sù-rä\ **Imperial Villa** Estate constructed in 1620–24 on the southwestern edge of Kyōto, Japan. It was an outstanding attempt to integrate the styles of the Heian period with the architectural innovations spurred by the development of the tea ceremony. Carefully planned meandering paths lead to and from the central structures and through gardens dotted with small pavilions and tea huts offering orchestrated views. The main buildings, set into a landscape created for them, include three attached structures in a typical *shoin-zukuri* style.

Kattegat Arm of the North Sea, between Sweden and Jutland, Denmark. Its maximum width is 88 mi (142 km). It is connected with both the North and Baltic seas. Chief ports on its shores are Göteborg and Halmstad in Sweden and Århus in Denmark. It is an important commercial navigation passage and a popular summer vacation area.

katydid Any of numerous species in several subfamilies of the long-horned grasshopper family (Tettigoniidae). Generally green with long wings, katydids live on trees, bushes, or grasses, and many species resemble leaves. They are powerful jumpers; many species do not fly but merely flutter their wings during leaps. They feed chiefly on plant matter, though some also eat other insects. The true katydids of eastern North America are considered great singers; each species has its own repetitive song, which is produced only at night.

Fork-tailed bush katydid (*Scudderia furcata*).
E.S. ROSS

Katyn \ka-'tin\ **Massacre** Mass killing of Polish military officers by the Soviet Union in World War II. After the German-Soviet Nonaggression Pact (1939) and Germany's defeat of Poland, Soviet forces occupied eastern Poland and interned thousands of Polish military personnel. After the German invasion of the Soviet Union (1941), the Polish government-in-exile agreed to cooperate with the Soviets against Germany, and the Polish general forming the new army asked to have the Polish prisoners placed under his command, but the Soviet government informed him in December 1941 that most of those prisoners had escaped to Manchuria and could not be located. In 1943 the Germans discovered mass graves in the Katyn forest in western Russia. A total of 4,443 corpses were recovered; the victims had apparently been shot from behind and then piled in stacks and buried. The Soviet government claimed the invading German army had killed them, but it refused Polish requests to have the Red Cross investigate. In 1992 the Russian government released documents proving that the Soviet secret police were responsible for the executions and cover-up.

Kauffmann \'kaůf-ˌmän**, (Maria Anna) Angelica (Catharina)** (b. Oct. 30, 1741, Chur, Switz.—d. Nov. 5, 1807, Rome, Papal States) Swiss-born Italian painter. She began studying art in Italy as a child, showing great precocity, and in 1766 her friend Joshua Reynolds took her to London. There she became known for her decorative work with architects such as Robert Adam. Her pastoral compositions incorporate delicate and graceful depictions of gods and goddesses; though her paintings are Rococo in tone and approach, her figures are Neoclassical (see Classicism and Neoclassicism). Her portraits of female sitters are among her finest works. After marrying the painter Antonio Zucchi (1726–95), she returned to Italy in 1781.

Self-portrait, painting on canvas by Angelica Kauffmann; in the Staatliche Museen Preussischer Kulturbesitz, Berlin.
COURTESY OF THE STAATLICHE MUSEEN PREUSSISCHER KULTURBESITZ GEMALDEGALERIE, BERLIN/ART RESOURCE, NEW YORK

Kaufman, George S(imon) (b. Nov. 16, 1889, Pittsburgh, Pa., U.S—d. June 2, 1961, New York, N.Y.) U.S. playwright and director. He was drama critic for *The New York Times* (1917–30). Known for his caustic wit and talent for brilliant satire, he wrote many plays in collaboration with other writers, including Marc Connelly, Morrie Ryskind (1895–1985), and Edna Ferber. His most memorable collaboration was with Moss Hart, with whom he wrote *Once in a Lifetime* (1930), *You Can't Take It with You* (1936, Pulitzer Prize), and *The Man Who Came to Dinner* (1939).

Kaunas \'kaù-nəs\ *Russian* **Kovno** \'kȯv-nō\ City (pop., 2001: 378,943), southern Lithuania. Founded as a fortress in 1030, it passed to Russia in 1795 after the third partition of Poland. It was the capital of independent Lithuania (1920–40), then it was annexed by the Soviet Union. Many historic buildings survive in the Old Town. In addition to being an important industrial centre, it is an educational and cultural centre, with polytechnic, medical, and agricultural institutes.

Kaunda \kä-'ün-də**, Kenneth (David)** (b. April 28, 1924, Lubwa, near Chinsali, Northern Rhodesia) Political leader and first president (1961–91) of Zambia. Kaunda came to prominence in 1959–60 in the movement to stop Britain from establishing a federation of North and South Rhodesia and Nyasaland. As the first president of independent Zambia, he helped avert a civil war in the late 1960s but ended up imposing single-party rule. From the 1970s he led other southern African nations in confronting the white-minority governments of Rhodesia and South Africa. He increased Zambia's dependence on copper exports and on foreign aid, allowing agriculture, education, and social services to languish and poverty and unemployment to increase. Several attempted coups in the early 1980s were crushed; in 1990 he was forced to legalize opposition parties, and in 1991 he was voted out of office.

Kaunda.
CAMERA PRESS

Kautsky \'kaůt-skē**, Karl** (b. Oct. 16, 1854, Prague, Bohemia—d. Oct. 17, 1938, Amsterdam, Neth.) German Marxist theorist and leader. He was the author of the Erfurt Program adopted by Germany's Social Democrat Party in 1891, which committed the party to an evolutionary form of Marxism that rejected both the radicalism of Rosa Luxemburg and the evolutionary socialism of Eduard Bernstein. He founded the Marxist review *Neue Zeit* in 1883, which he edited in various European cities until 1917, and wrote several books about Marx's doctrines and about St. Thomas More. He joined the Independent Social Democrats in opposing World War I.

kava *or* **kava kava** \'kä-və\ Nonalcoholic, yellow-green, somewhat bitter beverage made from the root of the pepper plant (mainly *Piper methysticum*) in most South Pacific islands. It is traditionally consumed in the kava ceremony, which includes the ritual making and drinking of kava and a ceremonial feast. It is taken to relieve stress and anxiety and as a mood elevator.

Kavaratti \ˌkə-və-'rə-tē\ **Island** Island of the Lakshadweep union territory of India. Located in the Amindivi Islands in the Arabian Sea, off the Malabar Coast of southern India, it is 3.5 mi (5.6 km) long and has a maximum width of 0.75 mi (1.2 km). Its only town, Kavaratti (pop., 2001: 10,119), is the administrative centre of Lakshadweep. The town is noted for the ornately carved pillars and roofs of its mosques.

Kaveri River \'kä-və-rē\ *or* **Cauvery River** \'kȯ-və-rē\ River, southern India. Rising in southwestern Karnataka state, it flows southeast some 475 mi (765 km) to enter the Bay of Bengal. East of the city of Mysore it forms the island of Sivasamudram, on either side of which are scenic falls that descend about 320 ft (100 m). The river is the source for an extensive irrigation system and of hydroelectric power. It is considered one of India's sacred rivers.

Kaw River See Kansas River

Kawabata \'kä-wä-ˌbä-tä\ **Yasunari** (b. June 11, 1899, Ōsaka, Japan—d. April 16, 1972, Zushi) Japanese novelist. His writing echoes

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ancient Japanese forms in prose influenced by post-World War I French literary currents such as Dadaism (see DADA) and EXPRESSIONISM. His best-known novel is *Snow Country* (1948), the story of a forlorn geisha. His other major works (published together in 1952) are *A Thousand Cranes* and *The Sound of the Mountain*. The loneliness and preoccupation with death in many of his mature works may derive from his losing all his near relatives while he was young. He was awarded the Nobel Prize for Literature in 1968. He committed suicide shortly after his friend MISHIMA YUKIO.

Kawasaki \ˌkä-wä-'sä-kē\ City (pop., 2000 prelim.: 1,249,851) and port, Honshu, Japan. It lies on Tokyo Bay, between TOKYO and YOKOHAMA. Almost completely destroyed in World War II, it has since been rebuilt. It is a major industrial centre for machinery and chemicals manufacturing and has large shipbuilding facilities. It is the site of a 12th-century Buddhist temple.

Kawatake Mokuami \ˌkä-wä-'tä-kā-ˌmō-kü-'ä-mē\ *orig.* **Yoshimura Yoshisaburō** (b. March 1, 1816, Edo, Japan—d. Jan. 22, 1893, Tokyo) Japanese playwright. He apprenticed with the KABUKI playwright Tsuruya Namboku V and became chief playwright of the Kawarasaki Theatre (1843). He was noted for domestic plays that featured ordinary townspeople and picaresque plays that portrayed the lives of thieves. After 1868 he wrote historical plays that emphasized factual accuracy and pioneered the production of domestic plays that described the modernization and Westernization of early MEIJI PERIOD society. He retired in 1881 but continued to write dance dramas. He wrote more than 360 plays, and his works account for half the current kabuki repertory.

Kay, Alan (b. 1940, Springfield, Mass., U.S.) U.S. computer scientist. He received a Ph.D. from the University of Utah. In 1972 he joined Xerox's Palo Alto Research Center and continued work on the first OBJECT-ORIENTED PROGRAMMING language (Smalltalk) for educational applications. He contributed to the development of ETHERNET, laser printing, and CLIENT-SERVER ARCHITECTURE. He left Xerox in 1983 and became a fellow at Apple Computer in 1984. His design of a GRAPHICAL USER INTERFACE was used in Apple's Macintosh and later in Microsoft's Windows operating system. He was a fellow at the Walt Disney Co. (1996–2001) and the Hewlett-Packard Co. (from 2002).

Kay, John (b. July 16, 1704, near Bury, Lancashire, Eng.—d. 1764?, France) British machinist and engineer. In 1733 he received a patent for a "New Engine or Machine for Opening and Dressing Wool" that incorporated his FLYING SHUTTLE, an important step toward automatic WEAVING. Kay's invention so increased yarn consumption that it spurred the invention of spinning machines (including the SPINNING JENNY and SPINNING MULE), but its true importance lay in its adaptation in power LOOMS.

Kay, Ulysses (Simpson) (b. Jan. 7, 1917, Tucson, Ariz., U.S.—d. May 20, 1995, Englewood, N.J.) U.S. composer. A nephew of jazz cornetist KING OLIVER, he was an all-around musician from childhood. After graduating from the University of Arizona he went on to study at the Eastman School and with the composer PAUL HINDEMITH at Yale. He taught principally at the City University of New York, earning a reputation as a distinguished teacher. His music—Neoclassical in style but characterized by verve and warmth—received many awards; mostly orchestral or choral, it includes five operas and several film and television scores.

Kaya *or* **Karak** \'kä-räk\ *Japanese* **Mimana** Tribal league formed sometime before the 3rd century AD in southern Korea and lasting until its subjugation to SILLA in the 6th century. The people of Kaya are thought to have been closely related to the groups that crossed over from Korea to Japan a century or two earlier, and Kaya often enlisted Japan in its feuds with neighbouring Silla and PAEKCHE. The Kaya people invented a unique 12-stringed zither, the *kayagum*.

kayak \'kī-ˌak\ Type of CANOE covered by a deck except for a cockpit in which the paddler sits. It has a pointed bow and stern and no keel; the paddler faces forward, grasping a double-bladed paddle and dipping the blades alternately on either side. Usually built for one occupant, it can be designed for two or three. Kayaks were traditionally used for fishing and hunting by ESKIMOS, who stretched seal or other animal skins over a driftwood or whalebone frame and rubbed the skins with animal fat for waterproofing. The paddler wore an overlapping shield to allow the kayak to be righted without taking on water if it rolled over. Now often made of molded plastic or fiberglass, kayaks are widely used for recreation.

Kaye, Danny *orig.* **David Daniel Kaminski** (b. Jan. 18, 1913, New York, N.Y., U.S.—d. March 3, 1987, Los Angeles, Calif.) U.S. actor and comedian. He worked as a comic busboy in Catskills resorts from age 13 and later worked in vaudeville and nightclubs, developing his trademark pantomimes, rapid-fire nonsense songs, and physical antics. He was a success on Broadway in *The Straw Hat Revue* (1939) and *Lady in the Dark* (1940), in which he upstaged the legendary GERTRUDE LAWRENCE. His movie debut in *Up in Arms* (1944) was followed by starring roles in *The Secret Life of Walter Mitty* (1947), *The Inspector General* (1949), *Hans Christian Andersen* (1952), and *White Christmas* (1954). He starred on television in *The Danny Kaye Show* (1963–67). Much of his comedy material was written by his wife, Sylvia Fine. Kaye was awarded an honorary Academy Award in 1955. He began his long association with UNICEF in 1953 and logged thousands of miles (frequently piloting his own plane) on behalf of the organization. He was awarded the Jean Hersholt Humanitarian Award in 1982 and the French Legion of Honour in 1986.

Kaysone Phomvihan \kā-'sō-ne-'pȯm-vē-hän\ (b. Dec. 13, 1920, Na Seng, Laos—d. Nov. 21, 1992, Vientiane) Laotian revolutionary, prime minister (1975–91), and president (1991–92). Son of a Lao mother and a Vietnamese father, Kaysone met HO CHI MINH while studying law in Hanoi and returned to Laos to become the leader of the Pathet Lao, an anti-French revolutionary movement. In 1975 the Pathet Lao overthrew Laos's 600-year-old monarchy, and Kaysone became prime minister of the Lao People's Democratic Republic. He kept the country closely allied with Vietnam and isolated from Western influence until the end of the Cold War, when he first looked to France and Japan for financial aid. As president, he relaxed some government controls and released most political prisoners.

Kazakhstan *or* **Kazakstan** \kə-ˌzäk-'stän\ *officially* **Republic of Kazakhstan** Country, Central Asia. Area: 1,052,090 sq mi (2,724,900 sq km). Population (2005 est.): 15,186,000. Capital: ASTANA. Kazakhs, a

Turkic-speaking people who are the region's original inhabitants, make up more than half of the population; Russians constitute nearly one-third, as do small minorities of Ukrainians, Uzbeks, Germans, and others. Languages: Kazakh (official), Russian. Religions: Islam (mostly Sunni), Christianity. Currency: tenge. From the steppe and desert lands of western and central Kazakhstan, the terrain rises to high mountains in the southeast along the border with Kyrgyzstan and China. Its highest point is Mount Khan-Tengri, 22,949 ft (6,995 m) high. The country is intensively developed agriculturally, but much of the land area is used for pasture, with sheep and goats as the main livestock. Manufacturing includes cast iron and rolled steel; mining and oil drilling are also important. Kazakhstan is a republic with a parliament consisting of two chambers; its head of state and government is the president, assisted by the prime

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minister. The area came under Mongol rule in the 13th century. The Kazakhs consolidated a nomadic empire in the 15th–16th century. Under Russian rule by the mid-19th century, it became part of the Kirgiz Autonomous Republic formed by the Soviets in 1920, and in 1925 its name was changed to the Kazakh Autonomous S.S.R. Kazakhstan obtained its independence from the Soviet Union in 1991. After several years of economic troubles, it began a period of sustained growth.

Kazan \kə-'zän^{y}\ City (pop., 2001 est.: 1,090,200), capital of the Tatarstan republic, western Russia. Located at the confluence of the Volga and Kazanka rivers, it was founded in the 13th century by Mongols of the Golden Horde; it became the capital of an independent khanate in the 15th century. In 1552 Ivan IV (the Terrible) captured Kazan and subjugated the khanate. The city was burned in a revolt (1773–74), but after its reconstruction it grew in importance as a trading centre, and by the beginning of the 20th century it was one of the chief manufacturing cities of Russia.

Kazan \kə-'zan**, Elia** *orig.* **Elia Kazanjoglous** (b. Sept. 7, 1909, Constantinople, Ottoman Empire—d. Sept. 28, 2003, New York, N.Y., U.S.) U.S. stage and film director. At age four he immigrated to the U.S. with his family. An actor with the Group Theatre (1932–39), he became a noted Broadway director with plays such as *The Skin of Our Teeth* (1942), *A Streetcar Named Desire* (1947; film, 1951), *Death of a Salesman* (1949, Tony Award), *J.B.* (1958, Tony Award), and *Sweet Bird of Youth* (1959). In 1947 he cofounded the Actors Studio. He was praised for his naturalistic style in movies such as *A Tree Grows in Brooklyn* (1945), *Gentleman's Agreement* (1947, Academy Award), *On the Waterfront* (1954, Academy Award), and *East of Eden* (1955). Though bitterly attacked for his cooperation with the House Un-American Activities Committee in the early 1950s, in which he turned over names of suspected communists, he received an honorary Academy Award for lifetime achievement in 1999.

Kazan River \kə-'zan\ River, central Canada. Rising in Nunavut, it flows through several lakes to empty into Baker Lake after a course of 455 mi (732 km). It is one of the main streams of the Barren Grounds, an area northwest of Hudson Bay that has treeless plains marked by many swamps and lakes.

Kazantzákis \kä-zänt-'zä-kēs**, Níkos** (b. Dec. 2, 1885, Iráklion, Crete, Ottoman Empire—d. Oct. 26, 1957, Freiburg im Breisgau, W.Ger.) Greek writer. Educated in law and philosophy, he traveled widely and finally settled on the island of Aegina before World War II. He is best known for his widely translated novels, including *Zorba the Greek* (1946; film, 1964), *The Greek Passion* (1954), and *The Last Temptation of Christ* (1955; film, 1988). His works also include essays, travel books, tragedies, and translations of classics such as Dante's *Divine Comedy* and Goethe's *Faust*.

Kazembe \kä-'zem-bē\ Largest and most organized kingdom of the Lunda empire (see Luba-Lunda states) in central Africa. At the height of its power (c. 1800), Kazembe occupied the territory now included in the Shaba region of the Democratic Republic of the Congo and in northern Zambia. Created c. 1740 by explorers from western Lunda, it grew more powerful by annexing neighbouring states and became an important centre of trade between the African interior and the Portuguese and Arabs on the eastern coast. Civil war erupted in 1850, and the kingdom was destroyed c. 1890.

Kazin \'kā-zən**, Alfred** (b. June 5, 1915, Brooklyn, N.Y., U.S.—d. June 5, 1998, New York, N.Y.) U.S. literary critic. His sweeping historical study of modern American literature, *On Native Grounds* (1942), won him instant recognition. Much of his criticism appeared in *Partisan Review*, *The New Republic*, and *The New Yorker*. His books include *Starting Out in the Thirties* (1965), *New York Jew* (1978), *A Writer's America* (1988), and *God and the American Writer* (1997).

Kazvīn See Qazvīn

kea \'kē-ə\ Large, stocky parrot (*Nestor notabilis,* subfamily Nestorinae) of New Zealand. It lives in mountain habitats and is known for its curious and playful character. However, the kea occasionally tears into sheep carcasses to get at the fat around the kidneys; sometimes it attacks live sheep.

Kean, Edmund (b. March 17?, 1789, London, Eng.—d. May 15, 1833, London) British actor. He acted with a touring stage company from 1805, and in 1814 he won acclaim in London with his innovative portrayal of Shylock in *The Merchant of Venice*. He went on to specialize in other Shakespearean villains, including Richard III, Iago, and Macbeth. He also excelled at playing Othello and Hamlet, as well as Barabas in Christopher Marlowe's *The Jew of Malta*. Though praised for his passionate and sensational stage portrayals, he became unpopular for his ungovernable behaviour offstage, marked by excessive drinking and a suit for adultery (1825). His son Charles (1811–68) was an actor-manager noted for his revivals of Shakespearean plays.

Edmund Kean, detail of a pencil drawing by Samuel Cousins, 1814; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Kearny \'kär-nē**, Stephen Watts** (b. Aug. 30, 1794, Newark, N.J., U.S.—d. Oct. 31, 1848, St. Louis, Mo.) U.S. Army officer. He served in the War of 1812 and later on the western frontier. At the outbreak of the Mexican War, he was ordered to seize New Mexico and California. Using diplomacy to persuade Mexican troops to withdraw, he marched unopposed to Santa Fe, where in 1846 he proclaimed a civil government for the province. Heading to California, he was informed that the conquest had already been completed by Robert F. Stockton and John C. Frémont. He arrived to discover that Mexican rebels had retaken most of the province. He then joined forces with Stockton to defeat the rebels in 1847. After initial opposition from Frémont, who had persuaded Stockton to appoint him governor, Kearny pacified the rest of California and established a stable civil government. He was then sent to Mexico, where he died of yellow fever.

Keaton, Buster *orig.* **Joseph Francis Keaton IV** (b. Oct. 4, 1895, Piqua, Kan., U.S.—d. Feb. 1, 1966, Woodland Hills, Calif.) U.S. film actor and director. He acted with his parents in vaudeville (1899–1917), where he developed his mastery of comic falls and subtle timing and his trademark deadpan expression. His film debut in Fatty Arbuckle's *The Butcher Boy* (1917) was followed by several short films (1917–19). As head of his own production company (1920–28) he directed and starred in classic silent movies such as *The Navigator* (1924), *Sherlock, Jr.* (1924), *The General* (1927), and *Steamboat Bill, Jr.* (1928). For MGM he made *The Cameraman* (1928), but he was denied artistic control over his films, and his career declined. He later appeared in *Sunset Boulevard* (1950) and *Limelight* (1952). From the late 1940s his comedies were gradually revived, and he is now regarded as one of the greatest silent comedy stars.

Keaton, Diane *orig.* **Diane Hall** (b. Jan. 5, 1946, Los Angeles, Calif., U.S.) U.S. film actress. She acted on Broadway in *Hair* (1968) and with Woody Allen in *Play It Again, Sam* (1969), reprising her role in the movie version (1972). She played a supporting role in *The Godfather* (1972) and its sequels. She starred in various Allen movies, including *Sleeper* (1973), *Annie Hall* (1977, Academy Award), *Interiors* (1978), and *Manhattan* (1979). Her other films include *Looking for Mr. Goodbar* (1977), *Reds* (1981), *Mrs. Soffel* (1984), *First Wives Club* (1996), and *The Other Sister* (1999). Initially noted for her quirky comic roles, she developed into one of Hollywood's most respected dramatic actresses.

Keats, detail of an oil painting by Joseph Severn, 1821; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Keats, John (b. Oct. 31, 1795, London, Eng.—d. Feb. 23, 1821, Rome, Papal States) English Romantic poet. The son of a livery-stable manager, he had a limited formal education. He worked as a surgeon's apprentice and assistant for several years before devoting himself entirely to poetry at age 21. His first mature work was the sonnet "On First Looking into Chapman's

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Homer" (1816). His long *Endymion* appeared in the same year (1818) as the first symptoms of the tuberculosis that would kill him at age 25. During a few intense months of 1819 he produced many of his greatest works: several great odes (including "Ode on a Grecian Urn," "Ode to a Nightingale," and "To Autumn"), two unfinished versions of the story of the titan Hyperion, and "La Belle Dame Sans Merci." Most were published in the landmark collection *Lamia, Isabella, The Eve of St. Agnes, and Other Poems* (1820). Marked by vivid imagery, great sensuous appeal, and a yearning for the lost glories of the Classical world, his finest works are among the greatest of the English tradition. His letters are among the best by any English poet.

Keb See GEB

Kediri \kā-'dir-ē\ City (pop., 1995 est.: 253,760), eastern JAVA, Indonesia. It is located in the valley of the Brantas River, southwest of SURABAYA. In the 11th to 13th centuries it lay at the heart of a powerful Hindu kingdom, also named Kediri; after 1830 it became the capital of a residency under Dutch administration. The modern city is a trading centre for local agricultural products, including sugar, coffee, and rice.

Keeling Islands See COCOS ISLANDS

Keen, William (Williams) (b. Jan. 19, 1837, Philadelphia, Pa., U.S.—d. June 7, 1932, Philadelphia) First U.S. brain surgeon. He received his M.D. from Jefferson Medical College. He was one of the first to successfully remove a brain tumour (1888) and assisted in the removal of Pres. GROVER CLEVELAND's left upper jaw (1893), which contained a malignant tumour. In addition to his teaching and medical work, he edited *Surgery: Its Principles and Practice* (8 vol., 1906–13).

Kegon \'kā-gōn\ Buddhist philosophy introduced into Japan from China in the 8th century. The name Kegon (meaning "flower ornament") is a translation of the Sanskrit *avatamsaka*, after the school's chief text, the AVATAMSAKA-SUTRA, which deals with the buddha VAIROCANA. The school was founded in China as Huayan in the late 6th century and reached Japan c. 740. Kegon taught that all living things are interdependent and that the universe is self-creating, with Vairocana at its centre. Though the Kegon school is no longer an active faith teaching a separate doctrine, it continues to administer the famous TŌDAI TEMPLE monastery at Nara.

Keillor \'kē-lər**, Garrison (Edward)** (b. Aug. 7, 1942, Anoka, Minn., U.S.) U.S. radio entertainer and writer. He began writing for *The New Yorker* in college and worked as a staff writer there until 1992. In 1974 he created and hosted the public-radio humour and variety show *A Prairie Home Companion*, about the fictional Minnesota town Lake Wobegon. He then created a new program, *The American Radio Company* (1987–91), but revived *A Prairie Home Companion* in 1993. His books include *Lake Wobegon Days* (1985), *Leaving Home* (1987), *The Sandy Bottom Orchestra* (1996), and *Me* (1999).

Keino \'kā-nō**, Kip** *orig.* **Hezekiah Kipchoge Keino** (b. Jan. 17, 1940, Nandi Hills, Kenya) Kenyan distance runner. He was originally a goatherd and trained for distance running in the hill country. At the high-altitude 1968 Olympics in Mexico City, he won a silver medal in the 5,000-m race and, in one of running's greatest upsets, a gold medal in the 1,500-m race, beating Jim Ryun of the U.S. At the 1972 Olympics, Keino won a silver medal in the 1,500-m and a gold in the 3,000-m steeplechase.

Keita \'kā-tä**, Modibo** (b. June 4, 1915, Bamako, French Sudan—d. May 16, 1977, Bamako, Mali) First president of Mali (1960–68). Keita was instrumental in obtaining independence for Mali (then called French Sudan) from France (1960). As president, he nationalized key sectors of the economy and established close ties with communist countries. During an economic crisis in 1967 he launched an unpopular Maoist-inspired cultural revolution, and in 1968 he was overthrown and imprisoned for life.

Keitel \kī-'tel**, Harvey** (b. May 13, 1939/41, Brooklyn, N.Y., U.S.) U.S. film actor. He served in the U.S. Marine Corps and then studied at the Actors Studio. He made his film debut in *Who's That Knocking at My Door?* (1968) under MARTIN SCORSESE, with whom he often worked thereafter. Known for his signature accent and the intensity of his performances, he played supporting or starring roles in films such as *Mean Streets* (1973), *Taxi Driver* (1976), *Bad Timing* (1980), *Bugsy* (1991), *Thelma and Louise* (1991), *Reservoir Dogs* (1991), *The Piano* (1993), and *Red Dragon* (2002).

Keitel \'kī-tᵊl**, Wilhelm** (b. Sept. 22, 1882, Helmscherode, Ger.—d. Oct. 16, 1946, Nürnberg) German field marshal. After serving in World War I, he held administrative posts from 1918 to 1933, after which he became minister of war (1935) and head of the German armed forces high command (1938). Although one of ADOLF HITLER's most trusted lieutenants, he was generally regarded as a weak officer and served chiefly as Hitler's lackey. He signed the act of Germany's military surrender in 1945. After the war he was convicted at the NÜRNBERG TRIALS and executed as a war criminal.

Keizan Jōkin \'kā-zän-'jō-kēn\ (b. Nov. 13, 1268, Echizen province, Japan—d. Sept. 22, 1325, Noto province) Japanese Buddhist priest and founder of the Sōji Temple, one of the two head temples of the Sōtō sect of ZEN BUDDHISM. He joined the priesthood at age 12; after completing his studies, he taught the Sōtō doctrine for 10 years. He was named head priest at Shogaku Temple, which he affiliated with the Sōtō sect in 1321. It was destroyed by fire in 1898 and later rebuilt on its present site at Yokohama. Keizan devoted himself to building temples and spreading Sōtō teachings to all parts of Japan. Now called Taiso ("Great Master"), he is revered as the restorer of the Sōtō sect.

Kekri \'ke-krē\ In ancient Finnish religion, a feast day marking the end of the agricultural season and coinciding with the time when cattle were brought in from pasture for the winter. It originally fell on September 29 but was later moved to November 1, or ALL SAINTS' DAY. It was a time when the ancestor spirits visited their former homes and the living held feasts honoring the dead. Usually a family celebration, it was sometimes marked by a communal sacrifice of a sheep.

Kekule von Stradonitz \'kā-kü-lā-fôn-'shträ-dō-nits**, (Friedrich) August** *orig.* **(Friedrich) August Kekule** (b. Sept. 7, 1829, Darmstadt, Hesse—d. July 13, 1896, Bonn) German chemist who laid the groundwork for modern structural theory in organic chemistry. His early training in architecture may have helped him conceive his theories. In 1858 he showed that CARBON has a VALENCE of four and that its atoms can link together to form long chains. He is said to have dreamed in 1865 of a BENZENE molecule as a snake biting its own tail and thus conceptualized the six-carbon benzene ring; the facts of organic chemistry known up to that time then fell into place. He also did valuable work on mercury compounds, unsaturated acids, and thio acids and wrote a four-volume textbook.

Keller, Helen (Adams) (b. June 27, 1880, Tuscumbia, Ala., U.S.—d. June 1, 1968, Westport, Conn.) U.S. author and educator who was blind and deaf. Deprived by illness of sight and hearing at the age of 19 months, Keller soon became mute as well. Five years later she began to be instructed by Anne Sullivan (1866–1936), who taught her the names of objects by pressing the manual alphabet into her palm. Eventually Keller learned to read and write in BRAILLE. She wrote several books, including *The Story of My Life* (1902). Her childhood was dramatized in William Gibson's play *The Miracle Worker* (1959; film, 1962).

Helen Keller at age 66.
COURTESY OF THE AMERICAN FOUNDATION FOR THE BLIND

Kellogg, Frank B(illings) (b. Dec. 22, 1856, Potsdam, N.Y., U.S.—d. Dec. 21, 1937, St. Paul, Minn.) U.S. lawyer and diplomat. He represented the U.S. government in antitrust cases before serving in the U.S. Senate (1917–23) and as U.S. ambassador to Britain (1923–25). Appointed U.S. secretary of state (1925–29) by Pres. CALVIN COOLIDGE, he negotiated the multinational KELLOGG-BRIAND PACT, for which he was awarded the Nobel Prize for Peace in 1929. He later served on the Permanent Court of International Justice (1930–35).

Kellogg, John Harvey and W(ill) K(eith) (respectively b. Feb. 26, 1852, Tyrone, Mich., U.S.—d. Dec. 14, 1943, Battle Creek; b. April 7, 1860, Battle Creek—d. Oct. 6, 1951, Battle Creek) U.S. breakfast-cereal manufacturers. John was a physician and vegetarian who in 1876 helped found a Seventh-Day Adventist sanitarium in Battle Creek, Mich.

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There he developed various nut and vegetable products, including a flaked-wheat CEREAL to serve to patients, one of whom was C.W. POST. John's younger brother, W.K., founded the W.K. Kellogg Co. in 1906 to manufacture dry breakfast cereals, cornflakes being its sole product in the early years. It soon became a leading U.S. producer of these and other convenience foods; its current annual sales exceed $9 billion. The W.K. Kellogg Foundation is one of the country's largest philanthropic institutions.

Kellogg-Briand Pact \'kel-ˌäg-brē-'äⁿ\ *or* **Pact of Paris** (1928) International agreement not to use war as an instrument of national policy. It was conceived by ARISTIDE BRIAND, who hoped to engage the U.S. in a system of protective alliances to guard against aggression from a resurgent Germany. The U.S. secretary of state, FRANK KELLOGG, proposed a general multilateral treaty, and the French agreed. Most states signed the treaty, but its lack of enforceability and exceptions to its pacifist pledges rendered it useless. See also Pact of LOCARNO.

Kelly, Ellsworth (b. May 31, 1923, Newburgh, N.Y., U.S.) U.S. painter and sculptor. In 1948 the G.I. bill allowed him to travel to Paris, where he was exposed to various avant-garde developments. By 1949 he made his first completely abstract painting; he would create abstract work throughout his career. Kelly moved back to the U.S. in 1954. By the end of the decade he became a leading exponent of the hard-edge style of painting, in which abstract contours and large areas of flat colour are sharply and precisely defined. Influenced by the biomorphic abstractions of JEAN ARP and the paper cutouts of HENRI MATISSE, he used the clean geometric lines of his paintings in painted, cut-out sheet-metal sculptures. Kelly refined his pursuit of pure style throughout the late 20th century, eventually also pursuing printmaking and large-scale public sculpture.

Kelly, Gene *orig.* **Eugene Curran Kelly** (b. Aug. 23, 1912, Pittsburgh, Pa., U.S.—d. Feb. 2, 1996, Beverly Hills, Calif.) U.S. dancer, choreographer, actor, and movie director. After training at his mother's dance school in Pittsburgh, he moved to New York in 1938 and danced in Broadway musicals, creating the title role in *Pal Joey* in 1940. Beginning in 1942, his athletic style and carefree acting—exemplified in the popular *Anchors Aweigh* (1945), *On the Town* (1949), *An American in Paris* (1951), and *Singin' in the Rain* (1952), which he also helped choreograph and direct—became hallmarks of the movie musical. His achievements earned him a special Academy Award in 1951. He later choreographed and directed numerous other movies and created a ballet for the Paris Opéra (1960).

Kelly, George *orig.* **George Kelly Barnes, Jr.,** *known as* **Machine Gun Kelly** (b. 1897?, Memphis, Tenn., U.S.—d. July 17, 1954, Leavenworth, Kan.) U.S. gangster. He became notorious for committing a series of robberies and slayings in the Midwest. In 1933 he kidnapped the millionaire Charles F. Urschel; arrested soon afterward, he spent the rest of his life in prison. Though designated "Public Enemy No. 1," he was by no means the most dangerous criminal of his day.

Kelly, Grace *later* **Princess Grace of Monaco** (b. Nov. 12, 1929, Philadelphia, Pa., U.S.—d. Sept. 14, 1982, Monte Carlo, Monaco) U.S. film actress. She studied acting and made her Broadway debut in 1949. Her movie debut came in *Fourteen Hours* (1951). She gained critical and popular praise with her performances in *High Noon* (1952), *Mogambo* (1953), and *The Country Girl* (1954, Academy Award). ALFRED HITCHCOCK saw "sexual elegance" in her and put her in three of his films—*Dial M for Murder* (1954), *Rear Window* (1954), and *To Catch a Thief* (1955). She made her last movie, *High Society* (1956), before marrying Prince RAINIER III of Monaco. She died in a car accident after suffering a stroke on a winding mountain road in the Côte d'Azur.

Kelly, Walt(er Crawford) (b. Aug. 25, 1913, Philadelphia, Pa., U.S.—d. Oct. 18, 1973, Los Angeles, Calif.) U.S. cartoonist. From 1935 he produced animation drawings for Walt Disney Productions, and in the 1940s he worked as a commercial artist in New York. His best-known character, the opossum Pogo, first appeared in a comic book c. 1943. In 1948 *Pogo* began to be published as a daily comic strip in the *New York Star*, and it was soon appearing in many other newspapers. Skillfully drawn, with witty and literate text, it featured Pogo and his winning animal friends in Okefenokee Swamp, characters Kelly often used to satirize prominent political figures.

Kelly, William (b. Aug. 21, 1811, Pittsburgh, Pa., U.S.—d. Feb. 11, 1888, Louisville, Ky.) U.S. ironmaster. He purchased ironworks in Eddyville, Ky., and began experiments with an air blast to prepare pig for conversion to WROUGHT IRON. Because of the similarity of his apparatus to the first form of Bessemer converter (see BESSEMER PROCESS), he was awarded a U.S. patent on the pneumatic steel process. There is no evidence that he made steel in any of his trials.

kelp Any of about 30 genera of large seaweeds that make up the order Laminariales (brown ALGAE), found in colder seas. *Laminaria*, abundant along the Pacific coasts and the British Isles, is a source of commercial IODINE. Its stipe (stemlike structure) is 3–10 ft (1–3 m) long. The largest known kelp, *Macrocystis*, grows up to 215 ft (65 m) long. Its body, which has a large rootlike holdfast, a hollow stipe, and branching blades with hollow gas bladders, resembles that of higher plants. It is rich in minerals and algin, a complex carbohydrate used as an emulsifier to prevent crystal formation in ice cream. Species of kelp are widely eaten in East Asia.

Kelvin (of Largs), William Thomson, Baron *known as* **Lord Kelvin** (b. June 26, 1824, Belfast, County Antrim, Ire.—d. Dec. 17, 1907, Netherhall, Ayrshire, Scot.) British physicist. He entered the University of Glasgow at 10, published two papers by 17, and graduated from Cambridge University at 21. The next year he was awarded the chair of natural philosophy at the University of Glasgow, where he remained until retiring in 1899. He helped develop the second law of THERMODYNAMICS, and in 1848 he invented the absolute temperature scale named after him (see ABSOLUTE ZERO). He served as chief consultant for the laying of the first Atlantic cable (1857–58). His patent for a mirror galvanometer for receiving telegraph signals (1858) made him wealthy. His work in electricity and magnetism led ultimately to JAMES CLERK MAXWELL's theory of electromagnetism. He also contributed to the determination of the age of the Earth and the study of hydrodynamics. He was raised to the peerage in 1892. He published more than 600 scientific papers and received dozens of honorary degrees.

Kemal, Yashar *or* **Yasar Kemal** *orig.* **Kemal Sadik Gogçeli** (b. 1922, Hemite, Tur.) Turkish novelist of KURDISH descent. At age five Kemal saw his father murdered in a mosque and was himself blinded in one eye. He was arrested several times for his political activism. He is best known for his stories of village life and for his outspoken advocacy on behalf of the dispossessed. His novel *Memed, My Hawk* was translated into 20 languages and was filmed in 1984. Other works include *The Wind from the Plain* (1960), *The Undying Grass* (1968), and *To Crush the Serpent* (1976).

Kemeny \'kem-ə-nē**, John George** (b. May 31, 1926, Budapest, Hung.—d. Dec. 26, 1992, Hanover, N.H., U.S.) Hungarian-born U.S. mathematician and computer scientist. He emigrated to the U.S. with his family at 14. He took a year off from his undergraduate studies at Princeton University to work on the MANHATTAN PROJECT and was later a research assistant to ALBERT EINSTEIN. He received a Ph.D. in 1949 and joined the Dartmouth College faculty in 1953, where he worked to develop the mathematics department. In the mid 1960s he and Thomas E. Kurtz (b. 1928) developed the BASIC computer programming language. He was a pioneer in the promotion of "new math" and the use of computers in education. He served as president of Dartmouth (1970–91).

Kemp, Jack (French) (b. July 13, 1935, Los Angeles, Calif., U.S.) U.S. politician. He played professional gridiron football with the Buffalo (N.Y.) Bills. As a Republican member of the U.S. House of Representatives (1971–89), he championed conservative causes but also strongly supported civil rights legislation. After a failed presidential bid in 1988, he was appointed secretary of housing and urban development by Pres. George Bush (1989). In 1996 he ran unsuccessfully for vice president on a ticket with Republican BOB DOLE.

Kempe \'kemp**, Margery** (b. c. 1373—d. c. 1440) English mystic. She had 14 children before beginning a series of pilgrimages to Jerusalem, Rome, Germany, and Spain in 1414. Apparently illiterate, she dictated her autobiography, *Book of Margery Kempe*, describing her travels and her religious ecstasies in an unaffected style (c. 1432–36). It is one of the earliest autobiographies in English literature.

Kempton, (James) Murray (b. Dec. 16, 1917, Baltimore, Md., U.S.—d. May 5, 1997, New York, N.Y.) U.S. journalist. Educated at Johns Hopkins University, he was a reporter and then columnist with the *New York Post* from the 1940s. His political and social commentaries, noted for their uniquely rich and elegant style, moral insight, and sense of fair

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play, touched on many subjects, especially current affairs. Excepting two periods when he left the *Post*, he continued there until 1981; thereafter he wrote for *Newsday*, winning a Pulitzer Prize in 1985. His books include *Part of Our Time* (1955), on 1930s radical movements in the U.S.; and *The Briar Patch* (1973, National Book Award), on New York's prosecution of the Black Panthers.

Kenai \ˈkē-ˌnī\ **Fjords National Park** National park, southern Alaska, U.S. Located on the southern coast of the Kenai Peninsula and established as a national monument in 1978, it became a national park in 1980. Its area of 670,000 acres (271,100 hectares) includes the Harding Icefield and its outflowing glaciers as well as coastal fjords. The park's wildlife includes sea otters, seals, and seabirds.

kendo Japanese sport of fencing with bamboo swords. Derived from the fighting methods of the ancient SAMURAI, it was introduced in the 18th century. Contestants wear traditional protective garments, and the sword (*shinai*) is held with both hands. Points are awarded for blows delivered to various parts of the upper body. The first combatant to score two points wins the match.

Kendrew, Sir John Cowdery (b. March 24, 1917, Oxford, Oxfordshire, Eng.—d. Aug. 23, 1997, Cambridge, Cambridgeshire) British biochemist. He received his Ph.D. from the University of Cambridge and as a Cambridge fellow (1947–75) went on to study the structure of proteins. He determined the structure of the muscle protein myoglobin, which stores oxygen for use by the muscles. Using X-ray diffraction techniques and computers, he devised a three-dimensional model of the arrangement of the amino acid units in the myoglobin molecule, an achievement for which he shared a 1962 Nobel Prize with MAX FERDINAND PERUTZ.

Kennan, George F(rost) (b. Feb. 16, 1904, Milwaukee, Wis., U.S.—d. March 17, 2005, Princeton, N.J.) U.S. diplomat and historian. After graduating from Princeton University in 1925, he entered the U.S. foreign service, studied Russian language and culture at the University of Berlin (1929–31), and was assigned to the U.S. embassy in Moscow (1933–35). He served in Vienna, Prague, Berlin, and Lisbon, returning to Moscow during and after World War II. His concept of CONTAINMENT was presented in a highly influential article, signed "X," that appeared in *Foreign Affairs* magazine in July 1947. Kennan questioned the wisdom of conciliatory U.S. policy toward the Soviet Union, which he considered appeasement, and advocated instead U.S. counterpressure wherever the Soviets threatened to expand; this approach became the basis of U.S. policy toward the Soviet Union during the first decades of the COLD WAR. After brief service as an adviser to the State Department, he joined the Institute for Advanced Study at Princeton as professor of historical studies (1956–74); his tenure there was interrupted by a stint as U.S. ambassador to Yugoslavia (1961–63). He won simultaneous Pulitzer Prizes and National Book Awards for *Russia Leaves the War* (1956) and *Memoirs, 1925–50* (1967).

Kennebec River River, west-central Maine, U.S. It rises from Moosehead Lake and flows south for about 150 mi (240 km) to the Atlantic Ocean. It was explored by SAMUEL DE CHAMPLAIN in 1604–05. With its main tributary, the Androscoggin River, it forms Merrymeeting Bay, which extends 16 mi (26 km) to the Atlantic.

Kennedy, Anthony M(cLeod) (b. July 23, 1936, Sacramento, Calif., U.S.) U.S. jurist. A graduate of Harvard Law School, he practiced law in San Francisco and Sacramento before being appointed to the U.S. Circuit Court of Appeals in 1975. He was nominated to the U.S. Supreme Court in 1988 by Pres. RONALD REAGAN. His record generally reflected his conservative outlook, and he consistently voted against policies such as AFFIRMATIVE ACTION and abortion rights. His episodic departure from conservative jurisprudence stemmed from his civil libertarian perspective on certain individual rights.

Kennedy, Edward M(oore) *known as* **Ted Kennedy** (b. Feb. 22, 1932, Brookline, Mass., U.S.) U.S. senator. He is the youngest son of JOSEPH P. KENNEDY and the brother of JOHN F. KENNEDY and ROBERT F. KENNEDY. He graduated from Harvard University in 1956 and received a law degree from the University of Virginia in 1959. In 1962 he was elected to the former U.S. Senate seat of his brother John, who became president in 1960. Elected Democratic majority whip in 1969, he was considered a front-runner for the 1972 Democratic presidential nomination. In 1970 he was involved in a car accident on Chappaquiddick Island, near Martha's Vineyard, Mass., in which a companion in his car was drowned. Kennedy was found guilty of leaving the scene of an accident. Though he was reelected to the Senate in 1970, he decided against seeking the presidency in 1972. He won a third full term in 1976 and was again a serious contender for the Democratic nomination in 1980, but he withdrew during the convention. In subsequent years his presidential prospects were limited by memories of the Chappaquiddick incident and by his somewhat raffish personal life. In the 1980s and '90s he continued to represent Massachusetts in the Senate, where he was a forceful spokesman for liberal causes, including civil rights, consumer protection, and national health insurance.

Kennedy, John F(itzgerald) (b. May 29, 1917, Brookline, Mass., U.S.—d. Nov. 22, 1963, Dallas, Texas) 35th president of the U.S. (1961–63). The son of JOSEPH P. KENNEDY, he graduated from Harvard University in 1940 and joined the navy the following year. He commanded a patrol torpedo (PT) boat in World War II and was gravely injured in an attack by a Japanese destroyer; he was later decorated for heroism. Elected to the U.S. House of Representatives in 1946 and the U.S. Senate in 1952, he supported social-welfare legislation and became increasingly committed to civil rights; in foreign affairs, he supported the COLD WAR policies of the Truman administration. In 1960 he won the Democratic nomination for president, beating out LYNDON B. JOHNSON, who became his running mate. In his acceptance speech Kennedy declared, "We stand on the edge of a New Frontier"; thereafter the phrase "New Frontier" was associated with his programs. After a vigorous campaign managed by his brother ROBERT F. KENNEDY and aided financially by his father, he narrowly defeated the Republican candidate, RICHARD NIXON. He was the youngest person and the first Roman Catholic elected president. In his inaugural address he called on Americans to "ask not what your country can do for you, ask what you can do for your country." His legislative program, including massive income-tax cuts and a sweeping civil-rights measure, received little support in the Congress, though he did win approval of the PEACE CORPS and the ALLIANCE FOR PROGRESS. In 1961 he committed the U.S. to land a man on the Moon by the end of the decade. In foreign affairs he approved a plan drawn up during the Eisenhower administration to land an invasion force of Cuban exiles on their homeland, but the BAY OF PIGS INVASION (1961) was a fiasco. Determined to combat the spread of communism in Asia, he sent military advisers and other assistance to South Vietnam. During the CUBAN MISSILE CRISIS (1962) he imposed a naval blockade on Cuba and demanded that the Soviet Union remove its nuclear missiles from the island. In 1963 he successfully concluded the NUCLEAR TEST-BAN TREATY with Britain and the Soviet Union. In November 1963, while riding in a motorcade in Dallas, he was assassinated by a sniper, allegedly LEE HARVEY OSWALD. The killing is considered the most notorious political murder of the 20th century. Kennedy's youth, energy, and charming family brought him world adulation and sparked the idealism of a generation, for whom the Kennedy White House became known as "Camelot." Revelations about his powerful family and his personal life, especially concerning his extramarital affairs, tainted his image in later years. See also JACKIE KENNEDY ONASSIS.

John F. Kennedy, 1961.
AP/WIDE WORLD

Kennedy, Joseph P(atrick) (b. Sept. 6, 1888, Boston, Mass., U.S.—d. Nov. 18, 1969, Hyannis Port, Mass.) U.S. businessman and financier. He graduated from Harvard University in 1912. He was a bank president by age 25 and a millionaire at age 30. He became a shipbuilder, a motion-picture tycoon, and a large contributor to the Democratic Party. During the 1920s he acquired a large fortune by speculating in the stock market; he is also alleged to have traded in bootleg liquor during PROHIBITION. Later, as chairman of the Securities and Exchange Commission (1934–35), he outlawed the speculative practices, including insider trading and stock manipulation, that had made him rich. He was the first Irish American to serve as ambassador to Britain (1937–40). With his wife, Rose, he encouraged academic and athletic competitiveness in his children and expected the boys in the family—including JOHN F. KENNEDY, ROBERT F. KENNEDY, and EDWARD KENNEDY—to pursue careers in public ser-

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vice. His role in John Kennedy's narrow victory over Richard Nixon in the 1960 presidential election has long been the subject of controversy.

Kennedy, Robert F(rancis) (b. Nov. 20, 1925, Brookline, Mass., U.S.—d. June 6, 1968, Los Angeles, Calif.) U.S. politician. The son of Joseph P. Kennedy, he interrupted his education at Harvard University to serve in World War II; he was graduated from Harvard in 1948 and received a law degree from the University of Virginia in 1951. He managed the U.S. Senate campaign of his brother John F. Kennedy in 1952. In 1957 he became chief counsel to the Senate committee investigating labour racketeering; he resigned the post in 1960 to manage his brother's presidential campaign. As U.S. attorney general (1961–64), he led a drive against organized crime that resulted in the conviction of labour leader Jimmy Hoffa. In 1964 he was elected to the U.S. Senate from New York. He became a spokesman for liberal Democrats and a critic of the Vietnam policy of Lyndon B. Johnson. In 1968, while campaigning for the Democratic presidential nomination in Los Angeles, he was assassinated by Sirhan Sirhan, a Palestinian immigrant.

Kennedy, William (b. Jan. 16, 1928, Albany, N.Y., U.S.) U.S. novelist and journalist. He worked as a journalist in New York and Puerto Rico before returning in 1963 to his native Albany, N.Y., which he considered the source of his literary inspiration. His novels, which are set in Albany and contain elements of local history and the supernatural, include *The Ink Truck* (1969), *Legs* (1975), *Billy Phelan's Greatest Game* (1978), and *Ironweed* (1983, Pulitzer Prize; film, 1987).

Kennedy Center for the Performing Arts Huge cultural complex (opened 1971) in Washington, D.C., with a total of six stages, designed by Edward Durell Stone. The complex, surfaced in marble, makes use of the ornamental facade screens for which the architect was known. The three main theaters are entered from the Grand Foyer, which faces the Potomac River. The Concert Hall, the largest auditorium, has been designated a national monument; its acoustics are considered exceptional, and its embossed ceiling and crystal chandeliers have been much admired.

Kenneth I *or* **Kenneth MacAlpin** (d. c. 858, Forteviot, Scot.) First king of the united Scots of Dalriada and the Picts. He inherited (834?) the Scottish kingdom of Dalriada from his father, Alpin, who is thought to have been killed by the Picts. He also gained control over Pictavia, and from 843 the two kingdoms were gradually joined, an important step in the making of a unified Scotland. The union was probably accomplished both by intermarriage and by conquest.

Kent Administrative (pop., 2001: 1,329,653), geographic, and historic county, southeastern England. It lies along the English Channel. The Romans ruled the area from AD 43, using Canterbury as a base. It was invaded by Jutes and Saxons in the 5th century and became one of the kingdoms of Anglo-Saxon Britain. The king of Kent welcomed St. Augustine's Christian mission in 597; St. Thomas Becket was murdered in Canterbury cathedral in 1170. It has long been known as the "Garden of England," and such crops as apples, cherries, barley, and wheat are widely grown.

Kent, Earl of See Odo of Bayeux

Kent, James (b. July 31, 1763, Fredericksburgh, Putnam county, N.Y.—d. Dec. 12, 1847, New York, N.Y., U.S.) U.S. jurist who helped shape common law in the U.S. A lawyer at Poughkeepsie, N.Y., from 1785 and a New York state legislator from 1790, he taught law at Columbia University (1793–98, 1823–26) and later served as chief justice of the New York Supreme Court (1804–14) and chancellor of the Court of Chancery (1814–23), then the state's highest judicial office. As chancellor, he is said to have made U.S. equity jurisprudence effective for the first time. His *Commentaries on American Law* (1826–30) proved influential both in the U.S. and in England.

Kent, Rockwell (b. June 21, 1882, Tarrytown Heights, N.Y., U.S.—d. March 13, 1971, Plattsburgh, N.Y.) U.S. painter and illustrator. He studied architecture at Columbia University but later chose to study painting with William Merritt Chase and Robert Henri. He worked variously as an architectural draftsman, lobsterman, and ship's carpenter in Maine and traveled in Tierra del Fuego, Newfoundland, Alaska, and Greenland, gathering material for his paintings and travel books. His dramatic pen-and-ink drawings, strongly resembling woodcuts, appeared in many books by contemporary and classic writers and made him one of the most popular artists in the U.S., despite harassment for his radical leftist politics.

Kenton, Stan(ley Newcombe) (b. Feb. 19, 1912, Wichita, Kan., U.S.—d. Aug. 25, 1979, Los Angeles, Calif.) U.S. pianist, composer, arranger, and leader of one of the most popular and controversial big bands in jazz. Kenton formed his first band in 1941. The group exhibited the influence of Jimmy Lunceford's precise brass and gained a reputation for a bombastic orchestral approach. His players included saxophonist Art Pepper (1925–82), trumpeter Maynard Ferguson, drummer Shelly Manne (1920–84), and singers Anita O'Day (b. 1919) and June Christy (1925–90). His efforts to organize the training of student musicians represent some of the earliest instances of formal jazz education.

Kentucky *officially* **Commonwealth of Kentucky** State (pop., 2000: 4,041,769), southeastern central U.S. Bordered by Ohio, West Virginia, Virginia, Tennessee, Missouri, Illinois, and Indiana, it covers 40,411 sq mi (104,664 sq km); its capital is Frankfort. Among its geographical features are the Appalachian Mountains of the east, the interior lowlands, including the Bluegrass region, and the rich lowlands along the Mississippi River. Before the arrival of white settlers, the region was a hunting ground for Indian tribes, including the Shawnee, Iroquois, and Cherokee. Daniel Boone, among the first white settlers, arrived in 1769; a wave of immigration followed the American Revolution. Settlements began as part of a district of Virginia, but in 1792 Kentucky entered the Union as the 15th state. It was a border state during the American Civil War, remaining in the Union but providing troops to both sides. The opening of rail lines into the eastern coal country and the introduction of a tobacco economy spurred growth in the late 19th century. In the 1970s a nationwide energy shortage created a demand for coal, from which Kentucky prospered, but demand dropped in the 1980s and many jobs were lost. Manufacturing is the leading source of income, while tobacco is the chief crop. Kentucky is known for its bourbon whiskey and Thoroughbred horses; the Kentucky Derby is run annually at Churchill Downs.

Kentucky Derby One of the classic U.S. Thoroughbred horse races. It was established in 1875 and run annually on the first Saturday in May at Churchill Downs track in Louisville, Ky. With the Preakness and the Belmont Stakes, it makes up U.S. racing's coveted Triple Crown. The field is limited to three-year-olds. The track distance is 1.25 mi (2,000 m).

Kentucky Lake Reservoir, western Kentucky and western Tennessee, U.S. One of the world's largest manmade lakes, it is 184 mi (296 km) long and has more than 2,300 mi (3,700 km) of shoreline. It was created in 1944 when the Kentucky Dam was built on the Tennessee River. The dam is the largest in the Tennessee Valley Authority system, and it regulates the flow from the Tennessee River into the Ohio River.

Kentucky River Tributary of the Ohio River in north-central Kentucky, U.S. It is formed by the confluence of North, Middle, and South forks, which originate in the Cumberland Mountains. It is navigable along its 259-mi (417-km) course by means of locks. It empties into the Ohio River at Carrollton.

Kenya *officially* **Republic of Kenya** Country, eastern Africa. Area: 224,961 sq mi (582,646 sq km). Population (2005 est.): 33,830,000. Capital: Nairobi. With a small group of European settlers' descendants, there are dozens of ethnic groups, including the Kikuyu, Luhya, Luo, Kamba, Kalenjin, and Masai. Languages: Swahili, English (both official), Kikuyu, Luhya, Luo, others. Religions: Christianity (Roman Catholic, Protestant, other Christians); also traditional beliefs, Islam. Currency: Kenya shilling. Kenya can be divided into five regions: the Lake Victoria basin in the southwest; the vast plateau of eastern Kenya; the 250-mi- (400-km-) long coastal belt along the Indian Ocean; the highlands of the Mau Escarpment on the western side of the Great Rift Valley in western Kenya; and the highlands and mountains of the Aberdare Range on the eastern side of the Rift Valley, including Mount Kenya. It is noted for such wildlife as lions, leopards, elephants, buffalo, rhinoceroses, zebras, hippopotamuses, and crocodiles. About one-tenth of the land is arable, and more than one-third is used for grazing cattle, goats, and sheep. Agriculture employs much of the workforce, and tea and coffee are the leading exports. Kenya is a republic with one legislative house; its head of state and government is the president. The coastal region was dominated by Arabs until it was seized by the Portuguese in the 16th century. The Masai people held sway in the north and moved into central Kenya in the 18th century, while the Kikuyu expanded from their home region in south-central Kenya. The interior was explored by European missionaries in the 19th century. After the British took control, Kenya was established as a British protectorate (1895) and a crown colony (1920). The Mau Mau rebellion of the 1950s

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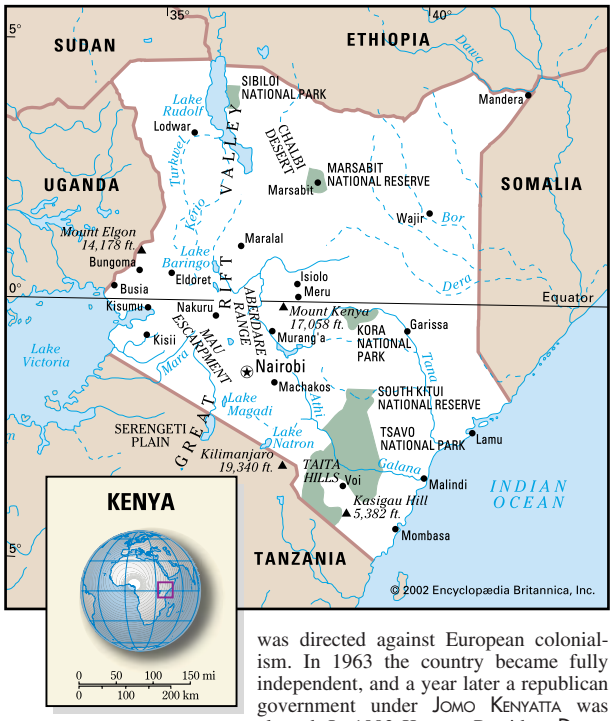

was directed against European colonialism. In 1963 the country became fully independent, and a year later a republican government under JOMO KENYATTA was elected. In 1992 Kenyan President DANIEL ARAP MOI allowed the country's first multiparty elections in three decades; however, the government continued to be marked by corruption and mismanagement.

Kenya, Mount *Swahili* **Kirinyaga** Extinct volcano, central Kenya. Lying just south of the Equator and rising to 17,058 ft (5,199 m), it is the highest mountain in Kenya. The first European to discover the mountain was Johann Ludwig Krapf in 1849. Mount Kenya National Park, occupying an area of 277 sq mi (718 sq km), contains a variety of large animals, including elephants and buffalo. The town of Nanyuki lies at the mountain's northwestern foot and is the chief base for ascents.

Kenyatta \ken-'yä-tə**, Jomo** (b. c. 1894, Ichaweri, British East Africa—d. Aug. 22, 1978, Mombasa, Kenya) First prime minister (1963–64) and then president (1964–78) of independent Kenya. Of KIKUYU descent, Kenyatta left the East African highlands c. 1920 to become a civil servant and political activist in Nairobi. He opposed a union of the British colonial territories of Kenya, Uganda, and Tanganyika. In 1945 he helped organize the sixth Pan-African Congress, attended by such figures as W.E.B. DU BOIS and KWAME NKRUMAH (see PAN-AFRICAN MOVEMENT). In 1953 he was sentenced to a seven-year prison term for directing the MAU MAU rebellion, though he denied the charges. In 1962 he negotiated the constitutional terms leading to Kenya's independence. As its leader he headed a strong central government, rejected calls to nationalize property, and made Kenya one of the most stable and economically dynamic African states. Critics complained of the dominance of his Kenya African National Union (KANU) party and the creation of a political and economic elite. Many of his policies were continued under his successor, DANIEL ARAP MOI.

Kenyatta
JOHN MOSS—BLACK STAR

Keokuk \'kē-ə-ˌkək\ (b. 1790?, along Rock River [near present-day Rock Island, Ill., U.S.]—d. 1848?, [in present-day Franklin county, Kan.]) SAUK Indian orator and politician. He engaged in a lifelong struggle for power with rival leader BLACK HAWK, who advocated resistance to white settlement on tribal lands. Keokuk instead urged accommodation and concession. Many Indians, witnessing the showering of gifts and honours on Keokuk by U.S. Indian agents and military leaders, turned to him for leadership. In 1832 Black Hawk led a short-lived resistance effort against white encroachments; Keokuk counseled peace and surrender, and he even provided advance warning to the U.S. of Black Hawk's intentions. For this assistance, the U.S. government named Keokuk leader of the Sauk nation in 1837. Keokuk responded by ceding the Illinois lands of his tribe and moving his people to Iowa. He continued to give away tribal land until his people were forced to settle on a reservation in Kansas, where he died in disgrace, despite the wealth and power he had accumulated.

Kepler, Johannes (b. Dec. 27, 1571, Weil der Stadt, Württemberg—d. Nov. 15, 1630, Regensburg) German astronomer. Born into a poor family, he received a scholarship to the University of Tübingen. He received an M.A. in 1594, after which he became a mathematics teacher in Austria. He developed a mystical theory that the cosmos was constructed of the five regular polyhedrons, enclosed in a sphere, with a planet between each pair. He sent his paper on the subject to TYCHO BRAHE, who invited Kepler to join his research staff. In attempting to understand atmospheric refraction of light, he became the first to explain accurately how light behaves within the eye, how eyeglasses improve vision, and what happens to light in a telescope. In 1609 he published his finding that the orbit of Mars was an ellipse and not the perfect circle hitherto presumed to be the orbit of every celestial body. This fact became the basis of the first of Kepler's three laws of planetary motion. He also determined that planets move faster as they near the Sun (second law), and in 1619 he showed that a simple mathematical formula related the planets' orbital periods to their distance from the Sun (third law). In 1620 he defended his mother from charges of witchcraft, thereby preserving his own reputation as well.

Kerala \'ker-ə-lə\ State (pop., 2001 prelim.: 31,838,619), southwestern India. Lying on the ARABIAN SEA, it is bordered by KARNATAKA and TAMIL NADU states, and it surrounds the coastal enclave of Mahe (part of PONDICHERRY union territory). It has an area of 15,005 sq mi (38,863 sq km), and its capital is TRIVANDRUM. During the 3rd century BC, it was an independent Dravidian kingdom known as Keralaputra. The Kulashekhara dynasty ruled the region in the 9th–12th centuries, when the regional MALAYALAM LANGUAGE took hold; it is still the dominant language. Portuguese intervention from 1498 was followed by Dutch rule in the 17th century. The Dutch were ousted in 1741 by the princely state of Travancore, which itself in the 1790s came under British protectorate status. It was given its present name in 1956. Kerala is one of India's most densely populated states.

keratin \'ker-ə-tən\ Fibrous structural PROTEIN of hair, nails, hooves, wool, feathers, and SKIN. A quarter of the AMINO ACIDS in keratin are cystine, whose ability to form strong bridging (disulfide) bonds with other cystine units accounts for keratin's great stability. Keratin does not dissolve in cold or hot water and does not easily undergo PROTEOLYSIS. Its fibres are 10–12% longer at maximum water content (about 16%) than when dry. The sulfurous smell of burning keratin is distinctive.

keratitis \ˌker-ə-'tī-təs\ INFLAMMATION of the cornea (see EYE). The conjunctiva may also be inflamed (keratoconjunctivitis). Depending on the cause, including dryness of the eye (from low tear production or inability to close the eye), chemical or physical injury, or certain diseases, it may or may not cause pain, VISUAL-FIELD DEFECTS (including blindness), and damage to the eye.

Kerensky \'ke-ryən-skē,\ *English* \ker-'en-skē**, Aleksandr (Fyodorovich)** (b. May 2, 1881, Simbirsk, Russia—d. June 11, 1970, New York, N.Y., U.S.) Russian political leader. A prominent lawyer, he joined the SOCIALIST REVOLUTIONARY PARTY and was elected to the fourth Duma (1912), where he became a noted orator. After the start of the RUSSIAN REVOLUTION OF 1917, he held posts in both the Petrograd soviet and the provisional government and became a popular figure. He became minister of war in May and prime minister in July. A moderate socialist, he sought to unify the factions but lost the support of the moderates and officers by dismissing the army commander in chief, LAVR KORNILOV, and of the left by refusing to implement their radical programs. When the BOLSHEVIKS seized power in October, he was unable to gather forces to defend

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his government. He went into hiding, then emigrated to western Europe in 1918. In 1940 he moved to the U.S., where he lectured at universities and wrote books on the revolution.

Kerguelen \'kər-gə-lən\ **Islands** Archipelago, southern Indian Ocean. It consists of the island of Kerguelen (also called Desolation Island) and about 300 islets, which together cover about 2,400 sq mi (6,200 sq km). Kerguelen Island, about 100 mi (160 km) long, has active glaciers and peaks up to 6,445 ft (1,965 m) high. Discovered in 1772 by the French navigator Yves-Joseph de Kerguélen-Trémarec, the archipelago was annexed to France in 1893 and became part of the French Southern and Antarctic Territories in 1955. Port-aux-Français is a scientific base on the main island.

Kermadec \kər-'mä-dek\ **Islands** Volcanic island group, South Pacific Ocean. Located northeast of AUCKLAND, N.Z., it includes Raoul, Macauley, and Curtis islands and l'Esperance Rock, and it has a total land area of 13 sq mi (34 sq km). Explored in the late 18th century by the British and the French, the islands were annexed to New Zealand in 1887. A meteorological communications station was built on Raoul, the largest island, in 1937, but permanent settlement is discouraged.

Kern, Jerome (David) (b. Jan. 27, 1885, New York, N.Y., U.S.—d. Nov. 11, 1945, New York City) U.S. composer, one of the major U.S. creators of the MUSICAL. Kern studied music in his native New York City and in Heidelberg, Ger., and he later gained theatrical experience in London. Returning to New York, he worked as a pianist and salesman for music publishers and wrote new numbers for European operettas. In 1912 he composed *The Red Petticoat*, the first musical to contain only his own music; its success was surpassed by *Very Good Eddie* (1915). Subsequent musicals include *Oh, Boy!* (1917) and *Sally* (1920). In 1927 his *Show Boat*, based on EDNA FERBER's novel and with lyrics by OSCAR HAMMERSTEIN, became the first American musical with a serious plot drawn from a literary source; it represents a landmark in the history of musical theatre. It was followed by *The Cat and the Fiddle* (1931), *Music in the Air* (1932), and *Roberta* (1933). After 1933 he composed for Hollywood. Kern's classic songs include "The Song Is You," "All the Things You Are," "Smoke Gets in Your Eyes," and "Ol' Man River."

kerogen \'ker-ə-jən\ *or* **kerogen shales** *or* **kerogenites** \'ker-ə-jə-ˌnīts\ Complex mixture of compounds with large molecules containing mainly hydrogen and carbon but also oxygen, nitrogen, and sulfur. Kerogen is a precursor of PETROLEUM and the organic component of OIL SHALES. It is waxy and insoluble in water; upon heating, it breaks down into recoverable gaseous and liquid substances resembling petroleum. It consists of compacted organic material, such as algae and other low plant forms, pollen, spores and spore coats, and insects.

kerosene *or* **kerosine** Organic compound, a clear, oily, highly flammable liquid with a strong odour, distilled from PETROLEUM (10–25% of total volume). It is a mixture of about 10 different types of fairly simple HYDROCARBONS, depending on its source. It is less volatile than gasoline, boiling at 285–610 °F (140–320 °C). It is burned in lamps, heaters, and furnaces and is used as a fuel or fuel component for diesel and tractor engines, jet engines, and rockets and as a solvent for greases and insecticides.

Kerouac \'ker-ə-ˌwak**, Jack** *orig.* **Jean-Louis Lebris de Kerouac** (b. March 12, 1922, Lowell, Mass., U.S.—d. Oct. 21, 1969, St. Petersburg, Fla.) U.S. poet and novelist. Born to a French-Canadian family, he attended Columbia University, served as a merchant seaman, and roamed the U.S. and Mexico before his first book appeared. At Columbia he met ALLEN GINSBERG and other kindred spirits, and he became a spokesman of what would be dubbed the BEAT MOVEMENT (a term he coined). He celebrated its code of poverty and freedom in *On the Road* (1957); his best-known novel, and the first written in the nonstop, unedited style that he advocated, it enjoyed a huge success among young people, for whom Kerouac became a romantic hero. All his novels, including *The Dharma Bums* (1958), *The Subterraneans* (1958), and *Desolation Angels* (1965), are autobiographical. His death at age 47 resulted from alcoholism.

Kerr \'kär, 'kər**, Deborah** *orig.* **Deborah Jane Kerr-Trimmer** (b. Sept. 30, 1921, Helensburgh, Dunbartonshire, Scot.) Scottish actress. After performing in British films such as *Major Barbara* (1940) and *Black Narcissus* (1947), she moved to Hollywood, where she was often cast in prim roles, though her part in *From Here to Eternity* (1953) was a departure from her ladylike image. Known for the poise and serenity she exhibited in portraying complex characters, she appeared in later films including *The King and I* (1956), *Tea and Sympathy* (1956), *Heaven Knows, Mr. Allison* (1957), *Separate Tables* (1958), *The Sundowners* (1960), and *The Night of the Iguana* (1964). She retired from the screen in 1969. She received a special Academy Award in 1994.

Kertanagara \ˌker-tə-'nä-gə-rə\ (fl. 13th century, Java) Last king (1268–92) of Tumapel (Singhasari) in Java. His birth reunited the two halves of the Javanese kingdom, and his name means "Order in the Realm." To bolster his kingdom against KUBLAI KHAN, he expanded it, marrying a princess of Champa (central Vietnam), sending envoys to Malayu (Sumatra), and conquering Bali. He refused to pay homage to Kublai Khan but was killed by a vassal before Kublai's armed forces arrived to punish him. Two early Javanese chronicles give contradictory pictures of the king: one describes him as drunken and incompetent; the other depicts him as a wise king and zealous follower of Tantric Buddhism. He is still venerated as one of Java's greatest rulers.

Stone sculpture thought to be Kertanagara in the form of *hari-hara ardhanari*, c. early 14th century; acquired by the Museum für Völker Kunde, Berlin, in 1865.
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Kertész \ker-'tesh**, André** (b. July 2, 1894, Budapest, Austro-Hungarian Empire—d. Sept. 27, 1985, New York, N.Y., U.S.) Hungarian-born U.S. photographer and photojournalist. He moved from Budapest to Paris in 1925 in search of opportunity and became a major contributor to European illustrated periodicals. He became friendly with many influential artists, including MARC CHAGALL and PIET MONDRIAN; his access to such figures allowed him to create a definitive portrait of the Parisian cultural milieu of the period. In 1928 he bought a Leica, a small handheld camera. The lightweight camera gave him the freedom to move about the streets of Paris and capture spontaneous moments of urban life, a subject that would fascinate him throughout his career. He arrived in New York City in 1936 intending to work for a commercial studio for a year, but stayed on, doing largely fashion photography for major U.S. magazines. He returned to his pursuit of urban life c. 1962, and in 1964 the Museum of Modern Art gave an exhibition of his works. His spontaneous, unposed pictures exerted a strong influence on magazine photography.

kerygma and catechesis \kə-'rig-mə, 'kir-ig-mə...ˌka-tə-'kē-səs\ In Christian theology, literally, preaching and teaching. Kerygma means the proclamation of the GOSPEL, especially by the APOSTLES as recorded in the NEW TESTAMENT. In the early church, catechesis referred to the oral instruction (geared to the general absence of literacy) given before BAPTISM to those who had accepted the message of salvation. As the practice of infant baptism spread, a shift took place to teaching the already baptized in preparation for full adult membership, and churches developed statements of basic doctrine called CATECHISMS.

Kesey \'kē-zē**, Ken (Elton)** (b. Sept. 17, 1935, La Junta, Colo., U.S.—d. Nov. 10, 2001, Eugene, Ore.) U.S. writer. He attended Stanford University and later served as an experimental subject and aide in a hospital, an experience that led to his novel *One Flew over the Cuckoo's Nest* (1962; film, 1975), which in the U.S. became one of the most widely read books of the 1960s. It was followed by *Sometimes a Great Notion* (1964) and several works of nonfiction that detailed Kesey's transformation from novelist to guru of the hippie generation. They recount psychedelic, fancy-free travels on a brightly painted bus with a group of friends, relatives, and fans who called themselves the Merry Pranksters. Their story is recounted in TOM WOLFE's *Electric Kool-Aid Acid Test* (1968), itself a minor classic of the era.

Kesselring, Albert (b. Nov. 20, 1885, Marktstedt, Bavaria, Ger.—d. July 16, 1960, Bad Nauheim, W.Ger.) German field marshal. He became

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chief of the German air staff in 1936 and commanded early air attacks on Poland, France, Britain, and the Soviet Union. In 1941 he was appointed commander in chief, south, to bolster Italy's efforts in North Africa and against Malta. He codirected the Axis campaign in North Africa with Erwin Rommel. After the Allied invasions of Sicily and Italy in 1943, he fought an effective defensive action that prevented an Allied victory in that theatre until 1944. Appointed commander in chief, west, in 1945, he was unable to stop the Allies' drive into Germany and surrendered the southern half of the German forces in May 1945. He was imprisoned for war crimes (1947–52).

kestrel \'kes-trəl\ Any of several birds of prey (genus *Falco*) known for hovering while hunting. Kestrels prey on large insects, birds, and small mammals. The male is more colourful than the female. Kestrels are mainly Old World birds, but one species, the American kestrel (*F. sparverius*), often called the sparrow hawk in the U.S., is common throughout North and South America. It is about 12 in. (30 cm) long, white or yellowish below, and reddish brown and slate-gray above with colourful markings on the head. The common kestrel (*F. tinnunculus*) of the Old World is larger and less colourful. See also falcon.

Male common kestrel (*Falco tinnunculus*).
WERNER LAYER—BRUCE COLEMAN LTD.

Ket See Siberian peoples

ketone \'kē-ˌtōn\ Any of a class of organic compounds containing a carbonyl group (—C═O; see functional group) bonded to two carbon atoms. Ketones can participate in many chemical reactions, though to a lesser extent than the related aldehydes. Many more complex organic compounds have ketones as building blocks. Their chief industrial use is as solvents and in the manufacture of explosives, lacquers, paints, and textiles. Acetone is the most important ketone; several sugars and some natural and synthetic steroids are ketones. In ketosis, ketones produced by lipid metabolism accumulate in the blood and urine in abnormal amounts, usually because of starvation or a metabolic disease such as diabetes mellitus.

Kettering, Charles F(ranklin) (b. Aug. 29, 1876, Loudonville, Ohio, U.S.—d. Nov. 25, 1958, Dayton, Ohio) U.S. engineer. In 1904 he developed the first electric cash register. With Edward Deeds he founded Delco c.. 1910; in 1916 Delco became a subsidiary of General Motors Corp., and Kettering served as vice president and director of research for GM (1920–47). Many of his inventions were instrumental in the evolution of the modern automobile, including the first electric starter (1912), antiknock fuels, leaded gasoline, quick-drying lacquer finishes (with Thomas Midgley, Jr.), the high-speed, two-cycle diesel engine, and a revolutionary high-compression engine (1951). He later cofounded the Sloan-Kettering Institute for Cancer Research in New York City.

kettledrums See timpani

Kevlar Trademarked name of poly-para-phenylene terephthalamide, a nylonlike polymer first produced by Du Pont in 1971. Kevlar can be made into strong, tough, stiff, high-melting fibres, five times stronger per weight than steel; it is used in radial tires, heat- or flame-resistant fabrics, bulletproof clothing, and fibre-reinforced composite materials for aircraft panels, boat hulls, golf-club shafts, and lightweight bicycles.

Kevorkian, Jack (b. May 26, 1928, Pontiac, Mich., U.S.) U.S. pathologist, advocate and practitioner of physician-assisted suicide. He expressed early interest in experimentation on death-row inmates who had been rendered unconscious rather than executed; his ideas negatively affected his medical career. In the 1980s he devised his "suicide machine," with which a person could commit suicide by merely pushing a button, and in the 1990s he assisted in the deaths of over 100 terminally ill persons. His actions provoked furious controversy and led to legislation and referenda; he was tried, convicted twice, and jailed, and his medical license was revoked. In 1998 he was convicted of murder for administering a lethal injection himself and was sentenced to 10–25 years in jail.

Kew Gardens *officially* **Royal Botanic Gardens, Kew** Botanic garden located at Kew, site of a former royal estate in the London borough of Richmond upon Thames. In 1759 Augusta, dowager princess of Wales and mother of George III, laid out a portion of her estate as a botanic garden. It became an eminent scientific institution under the unofficial directorship of Joseph Banks. In 1840 the gardens were donated to the nation. Under Sir William Jackson Hooker (1785–1865), they became the world's leading botanical institution. Today they are home to 50,000 different types of plants, a herbarium of more than 5 million dried specimens, and a library of more than 130,000 volumes. The three museums at Kew are devoted largely to economic plant products and a laboratory of plant genetics and classification.

key In music, system of pitches and harmonies generated from a scale of seven tones, one of which is predominantly important. Keys are a basic element of tonality and represent an outgrowth of modal music (see church mode). When a given piece is "in C," C is its "tonic," or central tone. Most Western music after c. 1600 is written in either a major or a minor key. The major scale consists of the interval pattern tone-tone-semitone-tone-tone-tone-semitone. The minor scale consistently differs from it by beginning with the pattern tone-semitone-tone, producing a minor third rather than a major third above the tonic.

key, cryptographic Secret value used by a computer together with a complex algorithm to encrypt and decrypt messages. Since confidential messages might be intercepted during transmission or travel over public networks, they require encryption so that they will be meaningless to third parties in order to maintain confidentiality. The intended recipient, and only the recipient, must also be able to decrypt them. If someone encrypts a message with a key, only someone else with a matching key should be able to decrypt the message. See also data encryption.

Key, David M(cKendree) (b. Jan. 27, 1824, Greene county, Tenn., U.S.—d. Feb. 3, 1900, Chattanooga, Tenn.) U.S. politician. Admitted to the bar in 1850, he practiced law in Chattanooga and became active in Democratic Party politics. He opposed secession by the South but served in the Confederate army during the American Civil War, rising to the rank of lieutenant colonel. After the war he worked to heal sectional grievances and restore the Union. He was appointed to the U.S. Senate (1875), succeeding former president Andrew Johnson, but two years later was defeated in a bid to retain the seat. When the disputed 1876 presidential election was turned over to a special Electoral Commission, the Republican candidate, Rutherford B. Hayes, secured the support of Southern Democrats by promising, among other things, to appoint a Southerner to his cabinet. Key was thus appointed postmaster general in 1877. From 1880 to 1894 Key was a U.S. district judge in Tennessee.

Key, Francis Scott (b. Aug. 1, 1779, Frederick county, Md., U.S.—d. Jan. 11, 1843, Baltimore, Md.) U.S. lawyer, author of "The Star Spangled Banner." After the burning of Washington, D.C., in the War of 1812 he was sent to secure the release of a friend from a British ship in Chesapeake Bay. He watched the British shelling of Fort McHenry during the night of Sept. 13–14, 1814; when he saw the U.S. flag still flying the next morning, he wrote the poem "Defense of Fort M'Henry." Published in the *Baltimore Patriot*, it was later set to the tune of an English drinking song, "To Anacreon in Heaven." The song was adopted as the U.S. national anthem in 1931.

Key West City (pop., 2000: 25,478), southwestern Florida, U.S. The southernmost city of the continental U.S., it lies on an island about 4 mi (6.5 km) long and 1.5 mi (2.4 km) wide in the western Florida Keys. The name is an English corruption of Cayo Hueso ("Bone Islet"), as it was called by Spanish explorers who found human bones there. In 1822 a U.S. naval depot was set up on Key West as a base of operations against pirates. Now a winter resort, Key West is also a tourist destination. Many writers and artists have lived there, and the homes of Ernest Hemingway and John James Audubon have been preserved.

Keynes \'kānz**, John Maynard, Baron Keynes of Tilton** (b. June 5, 1883, Cambridge, Cambridgeshire, Eng.—d. April 21, 1946, Firle, Sussex) British economist, known for his revolutionary theories on the causes of prolonged unemployment. The son of the distinguished economist John Neville Keynes (1852–1949), he served in the British treasury during World War I and attended the Versailles Peace Conference. He resigned in protest over the Treaty of Versailles, denouncing its provisions in *The Economic Consequences of the Peace* (1919), and he returned to teaching at the University of Cambridge. The international economic crisis

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of the 1920s and '30s prompted him to write *The General Theory of Employment, Interest and Money* (1935–36), the most influential economic treatise of the 20th century. It refuted laissez-faire economic theories, arguing that the treatment for economic DEPRESSION was either to enlarge private investment or to create public substitutes for private investment. Keynes argued that in mild economic downturns, MONETARY POLICY in the form of easier CREDIT and lower interest rates might stimulate investment. More severe crises called for deliberate public deficits (see DEFICIT FINANCING), either in the shape of public works or subsidies to the poor and unemployed. Keynes's theories were put into practice by many Western democracies, notably by the U.S. in the NEW DEAL. Interested in the design of new international financial institutions at the end of World War II, Keynes was active at the BRETTON WOODS CONFERENCE in 1944.

John Maynard Keynes, detail of a watercolour by Gwen Raverat, about 1908; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Kgalagadi Transfrontier Park Nature conservation area in the KALAHARI DESERT. It lies on the border of SOUTH AFRICA and BOTSWANA and occupies an area of 14,668 sq mi (37,991 sq km), with about three-quarters of it contained in Botswana. Its wildlife includes gemsboks, gnu (wildebeests), springbok, lions, jackals, and ostriches. It was officially established in 2000 by merging Kalahari Gemsbok National Park in South Africa with Gemsbok National Park in Botswana. Both parks were originally established in the 1930s to protect migratory animal populations that cross the border between the two countries.

KGB *Russian* **Komitet Gosudarstvennoy Bezopasnosti** ("Committee for State Security") Soviet agency responsible for intelligence, counterintelligence, and internal security. It was the descendant of earlier agencies. The Cheka was established in 1917 to investigate counterrevolution and sabotage. Its successor, the GPU (later OGPU), was the new Soviet Union's first secret-police agency (1923); it also administered corrective labor camps and oversaw the forcible collectivization of Russia's farms. By 1931 it had its own army and its spies and informers were ubiquitous. In 1934 it was absorbed into the NKVD, which carried out extensive purges. In 1941 the state-security and espionage functions were combined in the MGB. In 1954 the KGB was created. At its peak, it was the world's largest secret-police and espionage organization. It lost power under MIKHAIL GORBACHEV, especially after leading a failed coup d'état (1991). It was renamed after the dissolution of the Soviet Union, and its internal-security functions were segregated from its espionage and counterespionage operations.

Khābūr \'kä-ˌbu̇r\ **River** *Turkish* **Habur** River, southeastern Turkey and northeastern Syria. It rises in the mountains of southeastern Turkey and flows southeast to Syria, where it is joined by the Jaghjagh River; it then meanders south and empties into the EUPHRATES RIVER after a course of 200 mi (320 km). It is an important irrigation source for northeastern Syria.

Khachaturian \ˌkä-chə-'tu̇r-ē-ən**, Aram (Ilyich)** (b. June 6, 1903, Tbilisi, Georgia, Russian Empire—d. May 1, 1978, Moscow, U.S.S.R.) Soviet (Armenian) composer. He studied with Reinhold Glière (1875–1956) and Nikolay Myaskovsky (1881–1950). He gained international notice when SERGEY PROKOFIEV recommended one of his pieces for a Paris concert. Active in the composer's union, Khachaturian (along with DMITRY SHOSTAKOVICH and Prokofiev) was criticized by the government in 1948 for "formalist tendencies," though his music was in fact always conservative and accessible. After JOSEPH STALIN's death (1953), Khachaturian published a call for greater artistic freedom. His ballet scores include *Masquerade* (1944) and *Spartacus* (1954); *Gayane* (1943) contains the well-known "Sabre Dance." Other popular pieces include his piano and violin concertos.

Khadafy, Muammar al- See Muammar al-QADDAFI

Khafaje See TUTUB

Khalīl, Al- See HEBRON

Khalkís See CHALKÍS

Khama III (b. c. 1837, Mushu, Bechuanaland—d. Feb. 21, 1923, Serowe) South African chief. In 1885 he had Bechuanaland (now Botswana) declared a protectorate of the British Empire. He lent reinforcements to the British expedition that crushed LOBENGULA in 1893. His grandson Sir Seretse Khama (1921–80) was the first president of independent Botswana (r. 1966–80).

Khambhat \'kəm-bət**, Gulf of** *or* **Gulf of Cambay** \kam-'bā\ Inlet, ARABIAN SEA, on the western coast of INDIA, southeast of the KATHIAWAR PENINSULA. It is 120 mi (190 km) wide at its widest but narrows rapidly. It receives many rivers, including the Tapti and Mahi. Its orientation to the southwestern monsoon winds produces a high tidal range. All its ports have suffered from silting caused by tides and flood torrents. On its eastern side are Bharuch, one of India's oldest ports, and SURAT. At the gulf's head is the city of Khambhat (Cambay; pop., 2001: 80,452), which was mentioned by MARCO POLO as a busy port.

khan Historically, the ruler or monarch of a MONGOL tribe. Early on a distinction was made between the title of khan and that of *khākān*, or "great khan." Later the term *khan* was adopted by the SELJUQ and KHWĀREZM-SHĀH dynasties as a title for the highest nobility. Gradually it became an affix to the name of any Muslim property owner. Today it is often used as a surname.

Khanka \'kän-kə**, Lake** *Chinese* **Xingkai Hu** *or* **Hsing-K'ai Hu** \'shiŋ-'kī-'hü\ Lake on the boundary between Siberia and China. Most of the lake is in Russian territory while the northern shore is in China's HEILONGJIANG province. It varies in area from 1,500 to 1,700 sq mi (4,000 to 4,400 sq km), and much of its shore is swampland. Its outlet is a tributary of the USSURI RIVER.

Khanty See SIBERIAN PEOPLES

Khārijite \'kär-i-ˌjīt\ Member of the earliest Islamic sect, which emerged in the mid-7th century during conflicts over the succession of the caliphate (see CALIPH). The Khārijites ("separatists") took sides against ʿAlī, the Prophet's son-in-law (whose followers later made up the SHIʿITE branch of Islam), and led a series of uprisings, assassinating ʿAlī and harassing his rival MUʿĀWIYAH. They later caused further disruptions for the Umayyad caliphs. Their constant attacks on Muslim governments were based on their belief that the caliph should be chosen by the entire Muslim community. They called for a literal interpretation of the QUR'ĀN and were harsh and puritanical in the exercise of their religion. The movement's ʿIbādiyyah subsect survived into the 20th century in North Africa, Oman, and Zanzibar.

Kharj, Al- \ˌal-'kärj\ Oasis, east-central SAUDI ARABIA. It lies southeast of RIYADH and is administered with that city. Situated around a series of deep-water pools, it was chosen as the site of a government experimental farm in 1938. Its traditional dairy industry was greatly expanded in 1981 with inauguration of a meat and dairy combine.

Kharkiv \'kär-kəf\ City (pop., 2001: 1,470,000), northeastern Ukraine. Founded in 1655 as a military stronghold to protect Russia's southern borderlands, it became a seat of provincial government in 1732. It served as the capital of the Ukrainian Soviet Socialist Republic (1921–34). The second largest city in Ukraine, it is a heavy industry centre, manufacturing agricultural machinery and electrical equipment.

Khartoum \kär-'tüm\ City (pop., 2000 est.: 3,949,000), capital of The Sudan. Located just south of the confluence of the Blue and White NILE rivers, it was originally an Egyptian army camp (1821). The Mahdists besieged and destroyed the town in 1885, killing CHARLES GEORGE GORDON, the British governor-general. Reoccupied by the British in 1898, it served as the seat of the Anglo-Egyptian government until 1956, when it became the capital of the independent republic of The Sudan. A major trade and communications centre, it is the seat of several universities.

khat \'kät\ Slender, straight, East African tree (*Catha edulis*; family Celastraceae). Reaching a height of 80 ft (25 m), the khat tree has large, oval, finely toothed, bitter-tasting leaves. Its best-known relatives are the ornamentals EUONYMUS and BITTERSWEET. Khat leaves are chewed for the stimulants they contain, and the drug is central to social life in some countries.

Khatami \kä-tä-'mē**, Mohammad** *or* **Muḥammad Khātamī** (b. Sept. 29, 1943, Ardakān, Iran) President of Iran (1997–2005). After studying at a traditional *madrasah* in the holy city of Qom, he began political activities while studying philosophy at Eṣfahān University. He

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headed the Islamic Centre Hamburg in Germany during the Iranian Revolution (1979) and returned home to seek election to the Majles (parliament) in 1980. He served in government posts during the IRAN-IRAQ WAR (1980–90), as cultural adviser to Pres. Ali Akbar Hashemi Rafsanjani, and as head of the National Library (1992–97) before winning the presidency on a platform of social and economic reform. He was reelected by an overwhelming margin in 2001.

Khayr al-Dīn See BARBAROSSA

Khayyam, Omar See OMAR KHAYYAM

Khazar \kə-'zär\ Any member of a confederation of Turkic-speaking tribes that established a commercial empire in European Russia in the late 6th century. A people of the northern Caucasus region, the Khazars allied with the Byzantines against the Persians in the 7th century and warred with the Arabs until the mid-8th century. Their empire extended westward along the Black Sea, and they controlled trade routes and exacted tribute from their neighbors. The ruling class adopted Judaism and maintained close relations with the Byzantine emperors. The Khazar empire began to decline in the 10th century and was crushed by Kiev in 965.

Khensu See KHONS

Khiḍr See BARBAROSSA

Khiḍr \'ki-dər**, al-** Legendary Islamic figure endowed with immortality who became a popular saint, especially among sailors and SUFI mystics. His legend is based on a narrative from the QUR'ĀN, which tells how a "man of God" helps Mūsā (MOSES) search for a fish and at the same time performs seemingly senseless actions such as sinking a boat and killing a young man. By questioning him, Mūsā forfeits his patronage. Arab commentators embellished the story, giving him the name Khiḍr ("Green") and claiming that he turned green upon diving into the spring of life. In Pakistan he is identified with a water deity who protects mariners and river travelers. Among Sufis he is associated with the ever-living spiritual function that can guide people on the spiritual path.

Khíos See CHIOS

Khitan See LIAO DYNASTY

Khmelnytsky \kmyel-'nit-skē**, Bohdan (Zinoviy Mykhaylovych)** (b. c. 1595, Chigirin, Ukraine—d. Aug. 16, 1657, Chigirin) Ukrainian COSSACK leader (1648–57). Although he was educated in Poland and served with the Polish military, he fled to the fortress of the Zaporozhian Cossacks in 1648 and organized a rebellion among them. After winning support from dissatisfied Ukrainian peasants and townspeople, he marched against Poland. After years of war, he sought aid from the Russians in 1654, and they subsequently invaded Poland, achieving the transfer of Ukrainian lands from Polish to Russian control. His attempts to secure autonomy for his Cossack followers resulted only in their later subjection to Russian rule.

Khmer \kə-'mer\ *or* **Cambodian** *or* **Kampuchean** Any member of the ethnolinguistic group that constitutes most of the population of Cambodia. Smaller numbers of Khmer also live in southeastern Thailand and the Mekong River delta of southern Vietnam. Traditional Khmer are a predominantly agricultural people, subsisting on rice and fish and living in villages. Their crafts include weaving, pottery making, and metalworking. They follow THERAVADA Buddhism, which coexists with pre-Buddhist animistic beliefs. Indian culture has historically been a strong influence on Khmer culture.

Khmer language *or* **Cambodian language** MON-KHMER LANGUAGE spoken by more than seven million people in Cambodia (where it is the national language), southern Vietnam, and parts of Thailand. Khmer is written in a distinctive script, which, like the writing systems of Burmese, Thai, and Lao, is descended from the South Asian Pallava script (see INDIC WRITING SYSTEMS); the earliest inscription in Old Khmer is from the 7th century. During the ANGKOR period (9th–15th centuries), Khmer lent many words to Thai, Lao, and other languages of the region (see TAI LANGUAGES). Khmer itself has borrowed many learned words from SANSKRIT and PALI.

Khmer Rouge \kə-'mer-'rüzh\ *French* **"Red Khmer"** Radical communist movement that ruled Cambodia from 1975 to 1979. The Khmer Rouge, under the leadership of POL POT, opposed the government of the popular NORODOM SIHANOUK. They gained support after Sihanouk was toppled by LON NOL (1970) and after U.S. forces bombed the countryside in the early 1970s. In 1975 the Khmer Rouge ousted Lon Nol. Their extraordinarily brutal regime led to the deaths (from starvation, hardship, and execution) of one to two million people. Overthrown in 1979 by the Vietnamese, they retreated to remote areas and continued their struggle for power in Cambodia. The last Khmer Rouge guerrillas surrendered in 1998.

Khnum \'knüm\ *or* **Khnemu** \'kne-mü\ Ancient Egyptian god of fertility, associated with water and procreation. Worshiped as early as 2800 BC, he was represented as a ram with twisting horns or as a man with a ram's head. He was believed to have created humankind from clay like a potter. His main temple was at Elephantine, near present-day Aswan, and he formed a triad of deities with the goddesses Satis and Anukis. Khnum also had an important cult at Esna, south of Thebes.

Khoekhoe \'kȯi-ˌkȯi\ *or* **Khoikhoi** *formerly* **Hottentot (pejorative)** Group of peoples, speaking closely related KHOISAN LANGUAGES, who were among the first indigenous southern Africans encountered by Europeans. The precontact Khoekhoe were pastoralists who tended large herds of cattle and sheep. By 1800 Khoekhoe societies south of the Orange River in Cape Colony had been largely destroyed by disease and warfare, with the remnants either serving as bonded labourers for white farmers or blending into frontier communities of mixed descent, such as the GRIQUA. North of the Orange River in Namibia, the Nama are the largest Khoekhoe ethnic group, numbering about 230,000.

Khoisan \'kȯi-ˌsän\ **languages** Group of more than 20 languages presently spoken by perhaps several hundred thousand KHOEKHOE and SAN peoples of southern Africa. A number of Khoisan languages are now either extinct or spoken by very few people. Their most distinctive linguistic characteristic is the original and extensive use of CLICK consonants. The genetic unity of the Khoisan languages remains disputed.

Khomeini \kō-'mā-nē**, Ruhollah** *orig.* **Ruhollah Musavi** (b. May 17, 1900?, Khomeyn, Iran—d. June 3, 1989, Tehrān) Shīʿite cleric and leader of IRAN (1979–89). He received a traditional religious education and settled in Qom c. 1922, where he became a Shīʿite scholar of some repute and an outspoken opponent first of Iran's ruler, REZA SHAH PAHLAVI (r. 1926–41), and then of his son, MOHAMMAD REZA SHAH PAHLAVI (r. 1941–79). Popularly recognized as a grand AYATOLLAH in the early 1960s, he was imprisoned and then exiled (1964) for his criticism of the government. He settled first in Iraq—where he taught at the shrine city of Al-Najaf for some years—and then, in 1978, near Paris, where he continued to speak out against the shah. During that time he also refined his theory of *velāyat-e faqīh* ("government of the jurist"), in which the Shīʿite clergy—traditionally politically quiescent in Iran—would govern the state. Iranian unrest increased until the shah fled in 1979; Khomeini returned shortly thereafter and was eventually named Iran's political and religious leader (*rahbar*). He ruled over a system in which the clergy dominated the government, and his foreign policies were both anti-Western and anticommunist. During the first year of his leadership, Iranian militants seized the U.S. embassy in Tehrān—greatly exacerbating tensions with the U.S.—and the devastating IRAN-IRAQ WAR (1980–90) began.

Khons \'kȯns\ *or* **Khensu** \'ken-sü\ *or* **Chons** \'kȯns\ Ancient Egyptian moon god. He was the son of the god AMON and the goddess MUT. He was usually depicted as a young man wearing a lunar disk and a rearing cobra on his head. He was also associated with baboons and was sometimes equated with THOTH, another moon god. In the late New Kingdom (c. 1100 BC) a major temple was built for Khons in the Karnak complex at Thebes.

Khorana \kō-'rä-nə**, Har Gobind** (b. Jan. 9, 1922, Raipur, India) Indian-born U.S. biochemist. He received his Ph.D. from the University of Liverpool and later taught in Canada and the U.S., from 1970 at MIT. He shared a 1968 Nobel Prize with MARSHALL WARREN NIRENBERG and ROBERT WILLIAM HOLLEY for research that helped show how the genetic components of the cell nucleus control the synthesis of proteins. His contribution was to synthesize small nucleic acid molecules whose exact structure was known. Combined with the proper materials, his synthetic nucleic acids caused protein synthesis, just as in the cell; comparing these proteins with the nucleic acid showed which portions of the nucleic acid were the codes for each part of the protein. In 1970 he prepared the first artificial copy of a yeast gene.

Khorāsān \ˌkȯr-ä-'sän\ *or* **Khurāsān** \ˌkůr-ä-'sän\ Province (pop., 1996: 6,048,000), northeastern Iran. Its capital is MASHHAD. The region

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was first named by the Sāsānian dynasty, in whose language it means "Land of the Sun." It was overrun by Muslim armies c. 650. Under Arab rule, it encompassed a vast territory including what is now southern Turkmenistan and northern Afghanistan. It was conquered c. 1220 by Genghis Khan and c. 1380 by Timur. Its current frontiers, as a province of Iran, were defined in 1881. Its population is composed of many ethnic groups as a result of numerous migrations and invasions over the centuries. The languages spoken are Turkish, Persian, and Kurdish. The province gives its name to the handcrafted Khorāsān carpet.

Khorram-dīnān \ˌkȯr-ˌram-dē-'nän\ *or* **Khorramiyyeh** \ˌkȯr-ˌra-mē-'yeh\ Islamic sect that flourished in the 9th–11th centuries. Though they were Muslims, some members of this sect believed in transmigration of souls and in the Zoroastrian dualism of good and evil deities. Like the Shīʿites, they were partisans of ʿAlī in the succession of the caliphate, and they held that Islam should be led by descendants of Muhammad. They differed from the Shīʿites in insisting that the leadership should be hereditary in the person of Abū Muslim. Claiming to be a descendant of Abū, their leader Bābak led a rebellion against the Abbāsid Caliphate of Baghdad, which ended with his capture and execution in 838. The sect died out in the 11th century.

Khosrow \ˌkȯs-'raù\ **I** *or* **Khosrow Anūshīrvān** (d. 579) Persian king (r. 531–579) of the Sāsānian dynasty. He reformed taxation, reorganized the army, and launched military campaigns against the Hephthalites (a Central Asian people) and in Armenia, the Caucasus, and Yemen. He is said to have had Sanskrit texts imported for translation. Under his reign, chess was introduced from India, and astronomy, astrology, medicine, and philosophy flourished. The Avesta was purportedly codified under his reign, and in later eras his name became legend. Almost any pre-Islamic structure in Iran whose origin is unknown is credited to him.

Khosrow II *or* **Khosrow Parvīz** (d. 628) King of the Sāsānian dynasty (r. 590–628) whose military exploits extended the empire to its furthest extent. He came to the throne—assisted by Maurice, the emperor of the Byzantine Empire—in troubled times. When a new Byzantine emperor took the throne, however, Khosrow launched a war against the empire, seizing Armenia and central Anatolia. In 613 his forces took Damascus, and Jerusalem fell in 614. His fortunes suffered a reverse when Byzantine forces recaptured lost ground and killed his ablest generals. Revolution within the royal family followed, and Khosrow was executed. Under his reign, silverwork and carpet weaving reached a peak, and there is evidence of a renaissance in rock sculpture. After his death the empire rapidly declined, falling to the Arabs during the Islamic conquests in 640.

Khrushchev \krůsh-'chȯf,\ *English* \'krüsh-chef**, Nikita (Sergeyevich)** (b. April 17, 1894, Kalinovka, Ukraine, Russian Empire—d. Sept. 11, 1971, Moscow, Russia, U.S.S.R.) Soviet leader. The son of a miner, he joined the Communist Party in 1918. In 1934 he was elected to its Central Committee, and in 1935 he became first secretary of the Moscow party organization. He participated in Joseph Stalin's purges of party leaders. In 1938 he became head of the Ukrainian party and in 1939 was made a member of the Politburo. After Stalin's death in 1953, he emerged from a bitter power struggle as the party's first secretary, and Nikolay Bulganin became premier. In 1955, on his first trip outside the Soviet Union, Khrushchev showed his flexibility and the brash, extraverted style of diplomacy that would become his trademark. At the party's Twentieth Congress in 1956, he delivered a secret speech denouncing Stalin for his "intolerance, his brutality, his abuse of power." Thousands of political prisoners were released. Poland and Hungary used de-Stalinization to reform their regimes; Khrushchev allowed the Poles relative freedom, but he crushed the Hungarian Revolution by force (1956) when Imre Nagy attempted to withdraw from the Warsaw Pact. Opposition within the party crystallized in 1957, but Khrushchev secured the dismissal of his enemies and in 1958 assumed the premiership himself. Asserting a doctrine of peaceful coexistence with capitalist nations, he toured the U.S. in 1959, but a planned Paris summit with Pres. Dwight D. Eisenhower in 1960 was canceled after the U-2 Affair. In 1962 he attempted to place Soviet missiles in Cuba; in the ensuing Cuban missile crisis, he retreated. Ideological differences and the signing of the Nuclear Test-Ban Treaty (1963) led to a split with the Chinese. Agricultural failures that necessitated importation of wheat from the West, the China quarrel, and his often arbitrary administrative methods led to his forced retirement in 1964.

Nikita Khrushchev, 1960.
WERNER WOLF/BLACK STAR

Khuddaka Nikaya \'kù-də-kə-'nē-kə-yə\ (Pali: "Short Collection") Collection of Buddhist texts. It constitutes the fifth and last section of the Pali-language Sutta Pitaka, one of the sacred texts of Theravada Buddhism. Written between 500 BC and the 1st century AD, its contents include sermons and doctrinal and ethical discourses attributed to the Buddha. It also contains all the major poetic works of the Pali canon (see Tripitaka).

Khulna \'kůl-nə\ City (pop., 2001: city, 811,490; urban agglom., 1,287,987), southwestern Bangladesh. Located east-northeast of Kolkata (Calcutta), India, it is an important river port and trade centre and is connected by river steamer, road, and rail to the major cities of the southern Ganges- (Ganga-) Brahmaputra delta. A municipality since 1884, it is the seat of a university.

Khurāsān See Khorāsān

Khurīyā Murīyā \kù-'rē-yä-mù-'rē-yä\ **Islands** *or* **Kuria Muria** \'kůr-ē-ə-'můr-ē-ə\ **Islands** Island group, Oman. Located in the Arabian Sea off the country's southeastern coast, it comprises five mainly uninhabited islands with a total land area of 28 sq mi (73 sq km). Al-Ḥallānīyah Island, the largest, is sparsely inhabited. The sultan of Oman ceded the islands to Britain in 1854, and they became part of the British colony of Aden in 1937. Britain returned the islands to Oman in 1967.

Khwārezm \'kwä-ˌrez-ᵊm\ *or* **Khwārizm** \'kwä-ˌriz-ᵊm\ Historic region along the Amu Darya (ancient Oxus River), in modern Turkmenistan and Uzbekistan. It formed part of the empire of Achaemenian Persia in the 6th–4th centuries BC. The Arabs conquered it in the 7th century AD. In the following centuries it was ruled by many, including the Seljūqs, Khwārezm-shahs, Mongols, and Timurids, until the early 16th century, when it became the centre of the khanate of Khiva. In 1873 Russia conquered the region and made it a protectorate. After the Russian Revolution of 1917, the khanate was replaced by a Soviet republic, which was later dissolved and incorporated into the U.S.S.R.

Khwārezm-Shah \'kwä-ˌrez-ᵊm-'shä\ **dynasty** (c. 1077–1231) Dynasty that ruled Central Asia and Iran, first as vassals of the Seljūq dynasty and then independently. It was founded by a slave, Anūştegin Gharacha'ī, who was appointed governor of Khwārezm. At its peak under 'Alā' al-Dīn Muḥammad (r. 1200–20) and his son Jalāl al-Dīn Mingburnu (1220–31), the dynasty's territory extended from India to Anatolia. It fell to Genghis Khan in 1231.

Khwarizmi, al- See al-Khwarizmi

Khyber \'kī-bər\ **Pass** Pass in the Spīn Ghār (Safīd Kūh) Range on the border between Afghanistan and Pakistan. About 33 mi (53 km) long, it has historically been the gateway for invasions of the Indian subcontinent from the northwest; it was traversed by Persians, Greeks, Mughals, and Afghans from the north and by the British from the south. The Pashtun Afridi people of the Khyber area long resisted foreign control, but during the Second Anglo-Afghan War in 1879, the Khyber tribes came under British rule. It is now controlled by Pakistan.

Kiangsi See Jiangxi

Kiangsu See Jiangsu

Kiarostami, Abbas (b. June 22, 1940, Tehrān, Iran) Iranian director. Kiarostami was hired in 1969 by the Institute for the Intellectual Development of Children and Young Adults to establish its film division. The institute produced his first film as a director, the lyrical short *The Bread and Alley* (1970), which featured elements that define his work— improvised performances, documentary textures, and real-life rhythms. His first feature, *Mosafer* (1974), is a portrait of a troubled adolescent. *Where Is the Friend's Home?* (1987) gained him international acclaim, and he followed with several masterful films, including *Close-up* (1990), *Through the Olive Trees* (1994), *The Taste of Cherry* (1997), and *The Wind Will Carry Us* (1999). In the 1980s Kiarostami created documentaries exam-

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ining the lives of Iranian schoolchildren, and his film *ABC Africa* (2001) examined the blight of orphans in AIDS-ravaged Africa.

kibbutz \ki-'büts\ Israeli communal settlement in which all wealth is held in common and profits are reinvested in the settlement. The first kibbutz was founded in Palestine in 1909; most have since been agricultural. Adults live in private quarters; children are generally housed and cared for as a group. Meals are prepared and eaten communally. Members have regular meetings to discuss business and to take votes on matters requiring decisions. Jobs may be assigned by rotation, by choice, or by skill. The kibbutz movement declined dramatically in the late 20th century. But kibbutzim continued to play in important role in the tourism industry in Israel, attracting students and other short-term residents, mostly Jews from overseas seeking a link with the past. See also MOSHAV.

Kiche See QUICHE

Kickapoo North American Indian people related to the SAUK and FOX and living in Kansas, Oklahoma, and Texas, U.S., and northern Mexico. The name is a variant of the Algonquin word *kiwegapawa*, meaning "he stands about" or "he moves about." Their language is of the ALGONQUIAN family, and they formerly inhabited what is now south-central Wisconsin, U.S. The Kickapoo were formidable warriors, whose raids took them as far as the southern and northeastern U.S. About 1765, after dispatching the Illinois Indians, they settled near Peoria, Ill., but later moved under pressure from advancing whites to Missouri, Kansas, Oklahoma, Texas, and Mexico. By the 19th century, central tribal authority had broken down and chiefs of the various bands had become autonomous. The Kickapoo resisted acculturation and sought to retain their old ways. Some 3,500 people claimed sole Kickapoo descent in the 2000 U.S. census; this figure does not include those living in Mexico.

Kidd, Michael *orig.* **Milton Gruenwald** (b. Aug. 12, 1919, Brooklyn, N.Y., U.S.) U.S. dancer, choreographer, and director. He studied at the School of American Ballet, dancing with that company in 1937 and later with American Ballet Theatre, for which he choreographed *On Stage I* (1945). He choreographed many Broadway musicals, including four that won successive Tony Awards: *Guys and Dolls* (1951), *Can-Can* (1953), *Li'l Abner* (1956), and *Destry Rides Again* (1959). His film credits include *The Bandwagon* (1953), *Seven Brides for Seven Brothers* (1954), and *Hello, Dolly!* (1969).

Kidd, William *known as* **Captain Kidd** (b. c. 1645, Greenock, Renfrew, Scot.—d. May 23, 1701, London, Eng.) British privateer and pirate. He was sailing as a legitimate privateer for Britain when he was commissioned in 1695 to apprehend pirates who molested the ships of the East India Company. He himself turned pirate on the voyage, took several ships, and mortally wounded his gunner, William Moore. He surrendered in New York in 1699, having been promised a pardon. Sent to England for trial, he was found guilty of Moore's murder and five piracy counts, and he was hanged. Some of his treasure was recovered from Gardiners Island (off Long Island), but much has apparently never been found. After his death he attained semilegendary status and was romanticized as a dashing swashbuckler.

Kidder, Alfred V(incent) (b. Oct. 29, 1885, Marquette, Mich., U.S.—d. June 11, 1963, Cambridge, Mass.) U.S. archaeologist. Kidder received his Ph.D. from Harvard University (1914) for developing the first effective pottery typology relating to the prehistory of the southwestern U.S. He later extended these interests to a classic study (1924) of the development of the PUEBLO cultures and to the creation (1927) of a widely used archaeological classification system (the Pecos system) for the Southwest. In 1929 he also organized an interdisciplinary program that resulted in a far-reaching survey of cultural history in the Old and New Maya empires of Mexico and Central America. He taught at Phillips (Andover) Academy (1915–35) and at Harvard University (1939–50) and oversaw various programs at the Carnegie Institution (1927–50). He was considered the foremost archaeologist of the American Southwest and Mesoamerica of his generation.

kiddush \'ki-dəsh, ki-'düsh\ Jewish prayer or blessing recited over a cup of wine immediately before the meal on the eve of the SABBATH or a major festival, acknowledging the sanctity of the day that is beginning. It is usually performed by the head of the household, but it may involve all family members. After the recitation, each person sips wine from the cup. In the ASHKENAZI tradition, two loaves of bread on the table signify the manna gathered by the Israelites during their years of wandering in the wilderness.

Kiderlen-Wächter \'kē-dər-lən-'veḵ-tər**, Alfred von** (b. July 10, 1852, Stuttgart, Württemberg—d. Dec. 30, 1912, Stuttgart) German diplomat. A career diplomat, he became foreign secretary in 1910 and pursued a belligerent foreign policy, working to establish Germany as the leading power in Europe through the TRIPLE ALLIANCE. In the second of the MOROCCAN CRISES (1911), he refused conciliatory offers by the French government and excluded Britain from negotiations. Although German expansionists denounced the peace treaty as too lenient, Kiderlen's brusque and forceful posturing during the crisis significantly aggravated the international tensions that led to World War I.

kidnapping Crime of seizing, confining, abducting, or carrying away a person by force or fraud, often to subject him or her to involuntary servitude, in an attempt to demand a ransom, or in furtherance of another crime. Most countries consider it a grave offense punishable by a long prison sentence or death.

kidney One of a pair of organs that maintain water balance and expel metabolic wastes. Human kidneys are bean-shaped organs about 4 in. (10 cm) long, in the small of the back. They filter the entire 5-quart (about 4.5-liter) water content of the blood every 45 minutes. Glucose, minerals, and needed water are returned to the blood by reabsorption. The remaining fluid and wastes pass into collecting ducts, flowing to the ureter and bladder as urine. Each kidney has over 1 million functional units (NEPHRONS) involved in the process of filtration and reabsorption. The kidneys also secrete renin, an enzyme involved in blood pressure regulation. Disorders include KIDNEY FAILURE, KIDNEY STONES, and NEPHRITIS. See also URINARY SYSTEM. See illustration on following page.

kidney failure *or* **renal failure** Partial or complete loss of KIDNEY function. Acute failure causes reduced URINE output and blood chemical imbalance, including UREMIA. Most patients recover within six weeks. Damage to various kidney structures can result from chemical exposure, major blood loss, CRUSH INJURY, HYPERTENSION, severe BURNS, severe kidney infections, DIABETES MELLITUS, renal artery or urinary tract blockage, and liver diseases. Complications include HEART FAILURE, pulmonary edema, and high potassium levels. Chronic failure usually results from long-term kidney diseases. The blood becomes too acidic, bones can lose calcium, and nerves can degenerate. The kidneys can sustain life until they lose about 90% of their function. If one is removed, the other increases in size and function to compensate. Failure of both usually requires DIALYSIS or KIDNEY TRANSPLANT.

kidney stone *or* **renal calculus** Mass of minerals and organic matter that may form in a KIDNEY. URINE contains many SALTS in solution, and low fluid volume or high mineral concentration can cause these salts to precipitate and grow, forming stones. Large stones can block urine flow, be a focus for infection, or cause renal colic (painful spasms). They can obstruct the URINARY SYSTEM at various points. Treatment deals with any underlying problem (e.g., infection or obstruction), tries to dissolve stones with drugs or ULTRASOUND (lithotripsy), or removes large ones surgically.

kidney transplant *or* **renal transplant** Replacement of a diseased or damaged KIDNEY with one from a living relative or a legally dead donor. The former's tissue type is more likely to match, reducing the chance of rejection; but removal puts the donor at risk, and a kidney from a dead donor is more likely to be available. The new kidney is implanted and its blood vessels and ureter sewn in place. A near-normal life may be resumed within two months, but the drugs that prevent rejection leave the patient vulnerable to infection. See also TRANSPLANT.

Kido Takayoshi \'kē-dō-ˌtä-kä-'yō-shē\ *or* **Kido Kōin** \'kō-ēn\ (b. Aug. 11, 1833, Chōshū, Nagato province, Japan—d. May 26, 1877, Tokyo) With SAIGŌ TAKAMORI and ŌKUBO TOSHIMICHI, one of the three giants of the MEIJI RESTORATION of 1868. He became head of the government of the *HAN* (domain) of Chōshū and in that capacity plotted with Saigō and Ōkubo of Satsuma to overthrow the Tokugawa shogunate. In the new government, Kido was responsible for transferring the capital from Kyōto to Edo (renamed Tokyo) and for persuading the heads of the large *han* to return their domains to the emperor. He visited Europe in 1871 and on returning helped block a plan to invade Korea. In the late 1870s he worked for establishing a Western-style constitution.

Kiefer \'kē-fər**, Anselm** (b. March 8, 1945, Donaueschingen, Ger.) German painter. In 1970 he studied under the conceptual artist JOSEPH BEUYS. In such huge paintings as *Germany's Spiritual Heroes* (1973) he used visual symbols, somber colours, and naive drawing to comment with irony and sarcasm on Germany's tragic past. In the 1980s his colossal

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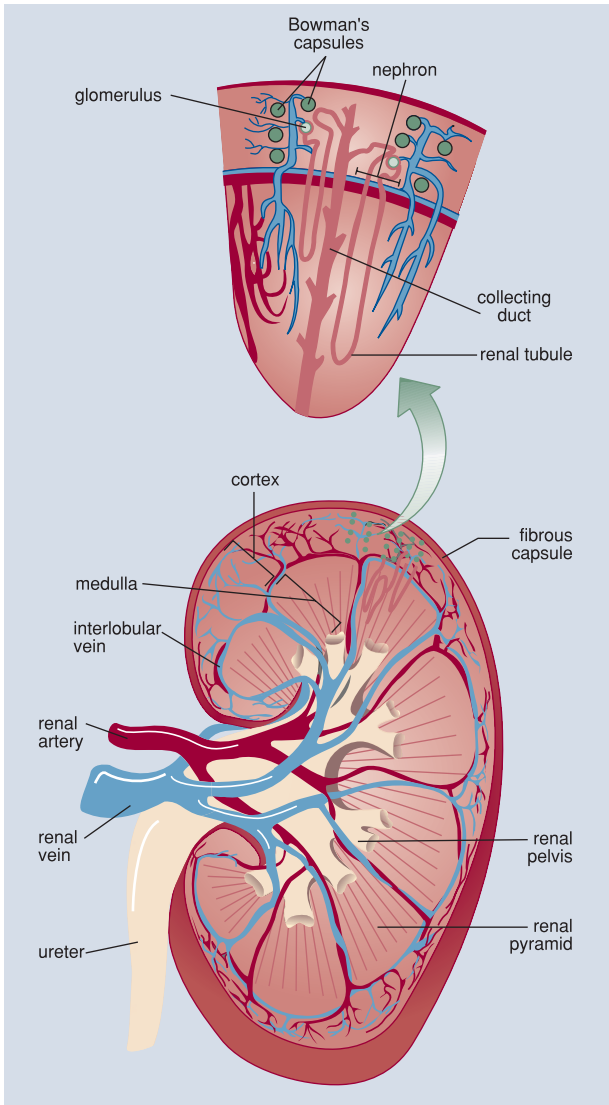

Cross section of a kidney. The kidney is made up of an outermost cortex, a middle medulla, and an inner pelvis. Blood enters via the renal artery, which branches into smaller vessels, each of which terminates in a tuft of capillaries (glomerulus). Fluids from the blood are forced out of the glomerulus into the surrounding Bowman's capsule during filtration. The glomerulus, Bowman's capsule, and associated renal tubule make up the nephron. Any important substances filtered from the blood (including glucose, minerals, and much of the water) are returned to it by reabsorption in the renal tubule. The medulla is divided into conical masses of tissue (renal pyramids) that contain the collecting ducts for the fluid (urine) not reabsorbed into the blood. Water is further removed from the urine as it passes through the collecting ducts into the funnel-shaped renal pelvis, which leads to the ureter.

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paintings acquired an intense physical presence by means of perspectival devices and unusual textures. He is one of the most prominent figures in late 20th-century NEO-EXPRESSIONISM.

Kiel \'kēl\ City (pop., 2002 est.: 232,242), capital of SCHLESWIG-HOLSTEIN state, northern Germany. A port at the eastern end of the Kiel Canal, it was founded in 1242. It entered the HANSEATIC LEAGUE in 1284; in 1773 Kiel became part of Denmark. Schleswig-Holstein passed to Prussia in 1866, and Kiel became its capital in 1917. An important naval base, it was the target of Allied bombing during World War II. It is the site of St. Nicholas Church (c. 1240), a ducal palace (c. 1280), and the Christian-Albrechts University of Kiel (founded 1665).

Kielland, Alexander (Lange) (b. Feb. 18, 1849, Stavanger, Nor.—d. April 6, 1906, Bergen) Norwegian novelist, short-story writer, and dramatist. Kielland, who was born into an aristocratic family, took a degree in law in 1871 and was a businessman for almost a decade. After a trip to Paris, he began to write. His first book of short stories was published in 1879, and he soon became dedicated to social reform. His influential novels include *Garman and Worse* (1880) and *Skipper Worse* (1882), both of which are set in and around Stavanger. He was perhaps the foremost prose stylist of his day, and, together with HENRIK IBSEN, BJØRNSTJERNE BJØRNSON, and JONAS LIE, he is considered one of the "big four" of 19th-century Norwegian literature.

Kienholz \'kēn-ˌhōlts**, Edward** (b. Oct. 23, 1927, Fairfield, Wash., U.S.—d. June 10, 1994, Hope, Idaho) U.S. sculptor. He pursued painting until he moved to Los Angeles and began producing large wooden reliefs for walls (1954). His controversial environmental sculptures, begun in the late 1950s, were elaborately detailed three-dimensional assemblages that harshly indicted U.S. society. His most famous walk-in scenes include *Roxy's*, a replica of a 1943 Los Angeles bordello, and *The Beanery*, a reproduction of a decrepit bar with 17 figures, piped-in smells, jukebox music, and background conversation. Critics labeled some of his images repulsive or pornographic.

Kieran the Younger See ST. CIARAN OF CLONMACNOISE

Kierkegaard \'kir-kə-ˌgärd**, Søren (Aabye)** (b. May 5, 1813, Copenhagen, Den.—d. Nov. 11, 1855, Copenhagen) Danish religious philosopher, regarded as the founder of EXISTENTIALISM. He studied theology at the University of Copenhagen. He is remembered for his critique of systematic rational philosophy, particularly Hegelianism, on the ground that actual life cannot be contained within an abstract conceptual system. With this stance, he intended to make possible an adequate consideration of faith and, accordingly, of religion—specifically Christianity. His works include *Either/Or* (1843), *Fear and Trembling* (1843), and *The Sickness unto Death* (1849). He insistently attacked the organized church in his later years; exhausted by the strain, he died at age 42. His work strongly influenced 20th-century Continental philosophers and theologians, including KARL BARTH, KARL JASPERS, MARTIN HEIDEGGER, and MARTIN BUBER.

Søren Kierkegaard, drawing by Christian Kierkegaard, c. 1840; in a private collection.

COURTESY OF THE ROYAL DANISH MINISTRY OF FOREIGN AFFAIRS

kieselguhr See DIATOMACEOUS EARTH

Kiev \'kē-ef\ *Ukrainian* **Kyyiv** \'kyiv\ City (pop., 2001: 2,611,000), capital of UKRAINE. Located along the DNIEPER RIVER, it was founded in the 8th century, and by the late 9th century its princes had expanded their territory to establish the state of KIEVAN RUS. In 1240 it was destroyed by the Tatars of the GOLDEN HORDE; after being rebuilt, it came successively under Lithuanian, Polish, and Cossack rule. It was incorporated into Russia in 1793, and in 1934 it became the capital of the Ukrainian Soviet Socialist Republic. It became Ukraine's national capital after the country achieved its independence in 1991. An important industrial city, it is also an educational and cultural centre; it is the seat of a state university and the Academy of Sciences of Ukraine.

Kievan Rus \'kē-vən-'rüs\ First eastern Slavic state. It was founded by the Viking Oleg, ruler of NOVGOROD from c. 879, who seized SMOLENSK and KIEV (882), which became the capital of Kievan Rus. Extending his rule, Oleg united local Slavic and Finnish tribes, defeated the KHAZARS, and, in 911, arranged trade agreements with Constantinople. Kievan Rus peaked in the 10th and 11th centuries under VLADIMIR I and YAROSLAV, becoming eastern Europe's chief political and cultural centre. At Yaro-

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slav's death in 1054, his sons divided the empire into warring factions. The 13th-century MONGOL conquest decisively ended its power.

Kigali \kē-'gä-lē\ City (pop., 1996 est.: 356,000), capital of RWANDA. Located in the middle of the country, it was a trading centre during the German colonial administration (after 1895) and a regional centre during the Belgian colonial period (1919–62). It became the capital of independent Rwanda in 1962. The fast-growing city was adversely affected by the country's political turmoil in the 1990s.

Kikuyu \ki-'kü-yü\ *or* **Gikuyu** Bantu-speaking people who live in the highland area of south-central Kenya, near Mount Kenya. Numbering some six million, they are the largest ethnic group in Kenya. They traditionally lived in separate domestic family homesteads, but during the MAU MAU rebellion the British colonial government moved them into villages for security purposes, and this arrangement became permanent. Their traditional economy rested on intensive hoe cultivation of millet and other crops; the main modern cash crops are coffee, corn, and fruits and vegetables. Many Kikuyu serve in government posts.

Kilauea \ˌkē-laù-'ā-ə\ Crater, eastern side of MAUNA LOA, HAWAII VOLCANOES NATIONAL PARK, U.S. The world's largest active volcanic crater, it is about 3 mi (5 km) long, 2 mi (3.2 km) wide, and 500 ft (150 m) deep, lying at an altitude of 4,090 ft (1,250 m). In its floor is the vent known as Halemaumau Pit, legendary home of the fire goddess Pele. Its frequent eruptions are usually contained within the vent as a boiling lake of lava, but occasionally the lava escapes; since 1983 a series of eruptions produced lava that reached the sea 30 mi (48 km) away.

Kilburn, Tom (b. Aug. 11, 1921, Dewsbury, Yorkshire, Eng.—d. Jan. 17, 2001, Manchester) British computer scientist. His book *A Storage System for Use with Binary Digital Computing Machines* (1947) influenced several U.S. and Russian organizations to adopt his techniques. With Frederic C. Williams (1911–77) he designed and built the Manchester Mark I (1949), the first stored-program computer, which led to the first commercial computer, the Ferranti Mark I (1949). In 1964 he formed Britain's first university computer science department and became its first professor. See also STORED-PROGRAM CONCEPT.

Kilby, Jack (St. Clair) (b. Nov. 8, 1923, Jefferson City, Mo., U.S.—d. June 20, 2005, Dallas, Texas) U.S. inventor. He studied at the University of Wisconsin. In 1958 he joined Texas Instruments; there he built the first INTEGRATED CIRCUIT, a device in which all of a circuit's components are integrated on a single semiconductor surface. He also coinvented a handheld calculator with a thermal printer that is used in portable data terminals. The owner of more than 60 patents, he received the National Medal of Science (1970), the Kyoto Prize (1993), and the Nobel Prize for Physics (2000), shared with HERBERT KROEMER and ZHORES ALFEROV.

kilim \kē-'lēm\ Pileless floor covering handwoven by TAPESTRY techniques in Anatolia, the Balkans, and parts of Iran. The name is also given to a variety of brocaded, embroidered, warp-faced, and other flat-woven rugs and bags. A common characteristic is a slit that occurs wherever two colours meet along a vertical line in the pattern. The finest examples are silk 16th–17th-century pieces from Kāshān, Iran. The largest kilims are produced in Turkey, as are smaller examples and prayer kilims (prayer rugs); Turkish weavers often use cotton for the white areas, and small details may be brocaded. The kilims of the southern Balkans, originally copies of Turkish types, gradually developed individual styles. Kilims become progressively less Asian in colour and pattern as the distance from Turkey increases.

Kilimanjaro \ˌki-lə-mən-'jä-rō\ Volcanic mountain, northeastern Tanzania. Situated in Kilimanjaro National Park (established 1973), it includes the peaks of three extinct volcanoes: Kibo, Mawensi, and Shira. Its highest peak is Kibo, which rises to 19,340 ft (5,895 m) and is the highest point in Africa. The first Europeans to see Kilimanjaro were German missionaries (1848). Kibo was first scaled in 1889 and Mawensi (16,896 ft [5,150 m]) in 1912.

Crater rim of Kilimanjaro at dawn.
GERALD CUBITT

killdeer Bird (*Charadrius vociferus*) that frequents grassy mudflats, pastures, and fields. Its name is suggestive of its loud, insistent whistle. It is about 10 in. (25 cm) long and has a brown back, a white belly, and two black breast bands. Killdeers breed throughout North America and in northwestern South America. They migrate only to escape snow, returning before most songbirds. They eat beetles, grasshoppers, dragonflies, and other insects. To protect their young from predators, killdeers will feign injury and flutter awkwardly away from the nest, luring predators with the promise of an easy kill.

killer whale *or* **orca** A species (*Orcinus orca*) of TOOTHED WHALE found in all seas from the Arctic to the Antarctic. Largest of the DOLPHINS, the male may be 30 ft (9 m) long and weigh over 10,000 lbs (4,500 kg). The killer whale is black, with white on the underparts, above each eye, and on each flank. The snout is blunt, and the strong jaws have 40–50 large, sharp, conical teeth. Killer whales live in groups of a few to about 50 individuals. They feed on fishes, cephalopods, penguins, and marine mammals; though they are fierce predators of seals and even other whales, there is no recorded instance of a killer whale attacking a human. They are often kept in captivity and trained as performers in marine shows.

Killer whale (*Orcinus orca*).
MIAMI SEAQUARIUM

killifish Any of a few hundred species of egg-laying topminnows (see GUPPY) in the family Cyprinodontidae. They are found worldwide in brackish, salt, and fresh water, including desert hot springs. Some species grow to 6 in. (15 cm) long. Killifish eat plant or animal material at the water's surface. Many species (e.g., the lyretail) are attractively coloured and are kept in home aquariums. Killifish are also valuable as bait and for mosquito control. Pupfish (*Cyprinodon*) inhabit California coasts and certain salt-lake shores in the western U.S. Some pupfish are listed as endangered; the Tecopa pupfish (*C. nevadensis*; 0.6 in. [1.5 cm] long) was declared extinct in 1981.

Killifish (*Fundulus chrysotus*)
GENE WOLFSHEIMER

Killy \kē-'lē**, Jean-Claude** (b. Aug. 30, 1943, Saint-Cloud, near Paris, France) French skier. Killy was reared in an Alpine ski resort. He became the European champion in 1965, and in 1966 he won the world combined championship (downhill, slalom, and giant slalom). In 1967 he won the first World Cup for men, repeating this triumph in 1968. In the 1968 Winter Olympics he became the second skier in history to sweep the Alpine events (after Austria's Toni Sailer in 1956). He retired in 1968 but returned as a professional in 1972.

kiln \'kiln, 'kil\ Oven for firing, drying, baking, hardening, or burning a substance, particularly clay products but originally also grain and meal. Modern kilns are used in ceramics to fire clay and porcelain objects, in metallurgy for roasting iron ores, for burning lime and dolomite, and in making portland cement.

kilt Knee-length, skirtlike garment worn by men as part of the traditional national garb, or Highland dress, of Scotland. It is made of permanently pleated wool and wrapped around the wearer's waist so that the pleats are in the back and the flat ends overlap in front. It is usually worn with the plaid, a rectangular length of cloth draped over the left shoulder. Both kilt and plaid are woven with a TARTAN pattern. The ensemble, which developed in the 17th century, is worn for ordinary purposes as well as for special occasions. Highland dress is the uniform of Scottish regiments in the British army; kilts were worn into battle as recently as World War II.

Kilwa (Kisiwani) \'kēl-wä\ Historical Islamic city-state, located on an island off the coast of what is now southern Tanzania. It became one of the most active commercial centres on the eastern coast of Africa by 1100, and gold coins were minted there. After being held briefly by the Portu-

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guese in the 16th century, it declined in importance and was abandoned. Extensive ruins remain, including those of mosques, a Portuguese fort, and a 13th–14th-century palace. The town of Kilwa on the Tanzanian coast was the site of a major centre for the export of slaves in the 19th century.

Kim Dae Jung \'kim-'dī-'jəŋ\ (b. Jan. 6, 1924, Hayi-do, Korea) South Korean politician and the first opposition leader to become president. He first entered politics in 1954, opposing the policies of Syngman RHEE, but did not win a seat in government until 1961. After being arrested several times in the 1970s, Kim was sentenced to death on charges of sedition and conspiracy; that sentence was commuted to 20 years in prison. In 1985, after a brief exile in the U.S., he resumed his role as a leader of the political opposition. In 1997 he was elected president of South Korea, serving from 1998 to 2003. In 2000 he received the Nobel Prize for Peace.

Kim Il-sung \'kim-'il-'sùŋ\ (b. April 15, 1912, Man'gyŏndae, Korea—d. July 8, 1994, P'yŏngyang) Communist leader of North Korea from 1948 until his death. When Korea was effectively divided between a Soviet-occupied northern half and a U.S.-supported southern half at the end of World War II, Kim Il-sung helped establish a communist provisional government and became its first premier. He invaded South Korea in an attempt to reunify the country, but the subsequent KOREAN WAR ended without reunification. After the war, Kim introduced a philosophy of self-reliance (*juche*) under which North Korea tried to develop its economy with little help from foreign countries. His omnipresent personality cult enabled him to rule unchallenged for 46 years in one of the world's most isolated and repressive societies.

Kim Jong Il \'kim-'chəŋ-'il\ *or* **Kim Chong Il** (b. Feb. 16, 1941, Siberia, Russia, U.S.S.R.) Son of KIM IL-SUNG. He was designated his father's successor in 1980 and became North Korea's de facto leader on his father's death in 1994. Known in North Korea as the Dear Leader, he makes few public appearances. After the onset of a severe famine (1995–98), he began to relax his country's extreme isolationism.

Kim Young Sam \'kim-'yəŋ-'sam\ (b. Dec. 20, 1927, Kŏje Island [near Pusan], Korea) South Korean moderate opposition leader who served as president (1993–98) after his party merged with the ruling party. First elected to South Korea's National Assembly in 1954, he served there until his expulsion in 1979 by Pres. Park Chung Hee, which touched off riots and demonstrations that preceded Park's assassination. After the military takeover by Gen. Chun Doo Hwan in 1980, Kim was put under house arrest until 1983. In 1990 he merged his party with the ruling Democratic Justice Party, a move that helped him win the presidency in 1992. He enacted reforms to end political corruption, and his term was one of rising prosperity for Korea until 1997, when Korea became caught up in an Asian financial crisis.

Kimberley City (pop., 2005 est.: urban area, 185,000), South Africa. It is the capital of Northern Cape province. Founded in 1871 shortly after the discovery of diamonds in the area, it was the capital of Griqualand West (1873–80) before it became part of Cape Colony. It was besieged by the Boers for four months (1899–1900) during the SOUTH AFRICAN WAR. Kimberley is home to several historical memorials and museums that honour its diamond-mining past. It is still a centre for mining and cutting diamonds. Its outskirts are marked by immense pits and heaps of earth, the aftermath of mining operations. The now-defunct Kimberley mine (now called the Big Hole) is nearby.

kimberlite *or* **blue ground** Dark, heavy, often fragmented igneous rock that may contain DIAMONDS in the rock matrix. Kimberlite is a MICA peridotite, an ultrabasic rock type with a complex and often highly altered mineral composition. It occurs in the Kimberley district of South Africa and the Kimberley and Lake Argyle regions of Australia, as well as near Ithaca, N.Y.

kimono Garment worn by Japanese men and women from the Early Nara period (645–724) to the present. The essential kimono is an ankle-length gown with long, full sleeves and a V-neck. It is lapped left over right across the chest and secured at the waist by a broad sash known as an obi. The contemporary wide obi dates only from the 18th century. Though the kimono is originally of Chinese origin, its great beauty is attributable to 17th- and 18th-century Japanese designers.

kindergarten School or class intended for children age four to six as a prominent part of PRESCHOOL EDUCATION. The kindergarten originated in the early 19th century as an outgrowth of the ideas and practices of ROBERT OWEN in Britain, JOHANN HEINRICH PESTALOZZI in Switzerland and his pupil FRIEDRICH FROEBEL (who coined the term) in Germany, and MARIA MONTESSORI in Italy. Kindergartens generally stress the social and emotional growth of the child, encouraging self-understanding through play activities and creative expression.

Kindi, al- *in full* **Yakub ibn Ishaq al-Sabah al-Kindi** (died c. 870) First prominent Islamic philosopher. He worked in Iraq under the caliphs al-MAMUN and al-Mutasim. One of the first Arab students of the Greek philosophers, he translated important Greek works into Arabic and tried to combine the views of PLATO and ARISTOTLE into a new system. His short treatises considered the philosophical questions set forth by NEOPLATONISM. He also wrote over 270 scientific treatises on such subjects as astrology, Indian arithmetic, sword manufacturing, and cooking.

kinematics \ˌki-nə-'ma-tiks\ Branch of physics concerned with the geometrically possible motion of a body or system of bodies, without consideration of the forces involved. It describes the spatial position of bodies or systems, their VELOCITIES, and their ACCELERATION. See also DYNAMICS.

kinesiology \ki-ˌnē-zē-'ä-lə-jē\ Study of the mechanics and anatomy of human movement and their roles in promoting health and reducing disease. Kinesiology has direct applications to fitness and health, including developing exercise programs for people with and without disabilities, preserving the independence of older people, preventing disease due to trauma and neglect, and rehabilitating people after disease or injury. Kinesiologists also develop more accessible furniture and environments for people with limited movement and find ways to enhance individual and team efficiency. Kinesiology research encompasses the biochemistry of muscle contraction and tissue fluids, bone mineralization, responses to exercise, how physical skills are developed, work efficiency, and the anthropology of play.

kinetic energy \kə-'net-ik\ Form of energy that an object has by reason of its motion. The kind of motion may be translation (motion along a path from one place to another), rotation about an axis, vibration, or any combination of motions. The total kinetic energy of a body or system is equal to the sum of the kinetic energies resulting from each type of motion. The kinetic energy of an object depends on its MASS and VELOCITY. For instance, the amount of kinetic energy *KE* of an object in translational motion is equal to one-half the product of its mass *m* and the square of its velocity *v*, or $KE = \frac{1}{2}mv^2$, provided the speed is low relative to the speed of light. At higher speeds, RELATIVITY changes the relationship.

kinetic sculpture Sculpture in which movement (as of a motor-driven part or a changing electronic image) is a basic element. Actual movement became an important aspect of sculpture in the 20th century. Pioneers such as NAUM GABO, MARCEL DUCHAMP, LÁSZLÓ MOHOLY-NAGY, and ALEXANDER CALDER produced movement by such means as water, mechanical devices, and air currents (as in Calder's MOBILES). Neo-Dadaist works such as JEAN TINGUELY's self-destructing *Homage to New York* (1960) embody the concept of a sculpture that functions as both an object and an event—a "happening."

kinetic theory of gases Theory based on a simple description of a gas, from which many properties of gases can be derived. Established primarily by JAMES CLERK MAXWELL and LUDWIG BOLTZMANN, the theory is one of the most important concepts in modern science. The simplest kinetic model is based on the assumptions that (1) a gas is composed of a large number of identical MOLECULES moving in random directions, separated by distances that are large compared to their size; (2) the molecules undergo perfectly elastic (no energy loss) collisions with each other and with the walls of the container; and (3) the transfer of KINETIC ENERGY between molecules is heat. This model describes a PERFECT GAS but is a reasonable approximation to a real gas. Using the kinetic theory, scientists can relate the independent motion of molecules of gases to their pressure, volume, temperature, viscosity, and heat conductivity.

king Male sovereign over a nation or territory, of higher rank than any other ruler except an EMPEROR. A king's female counterpart is a queen. Some kings have been elected, as in medieval Germany, but most inherit the position. The community may concentrate all spiritual and political power in the sovereign, or power may be shared constitutionally with other government institutions. Some kings are heads of state but not heads of government. In the past, some were regarded as semidivine representatives of God on Earth; others were viewed as gods in their own right or supernatural beings who became gods after death (see DIVINE KINGSHIP).

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Since the 17th century the power held by monarchs, particularly those in western Europe, has been widely regarded as deriving from the people. See also CONSTITUTIONAL MONARCHY; KHAN; MONARCHY; PHARAOH; TSAR.

King, B.B. *orig.* **Riley B. King** (b. Sept. 16, 1925, Itta Bena, near Indianola, Miss., U.S.) U.S. BLUES guitarist. Reared in the Mississippi Delta, he was influenced early by GOSPEL MUSIC. He worked for a time as a disc jockey in Memphis, where he acquired the nickname B.B. (for Blues Boy). His first hit, "Three O'Clock Blues" (1951), was followed by a long succession of others, including "Every Day I Have the Blues" and "The Thrill Is Gone." To his own impassioned vocal calls, King played single-string guitar responses with a distinctive vibrato, in a style influenced by Delta blues guitarists and jazz guitarist DJANGO REINHARDT. By the late 1960s rock guitarists were acknowledging his influence and introducing King and his guitar, Lucille, to the white public. He remains the most successful bluesman of all time.

B.B. King, 1972.
COURTESY OF SIDNEY A. SEIDENBERG, INC.

King, Billie Jean *orig.* **Billie Jean Moffitt** (b. Nov. 22, 1943, Long Beach, Calif., U.S.) U.S. tennis player. She won her first Wimbledon doubles championship in 1961 as part of the youngest team to do so. She went on to capture a record 20 Wimbledon titles (singles, women's doubles, and mixed doubles) from the mid-1960s to the mid-1970s; in 2003 her record was tied by MARTINA NAVRATILOVA. She also won several U.S. singles titles (1967, 1971–72, 1974) and the Australian (1968) and French (1972) titles. She was ranked first in the U.S. seven times and first in the world five times. In 1973 she defeated the 55-year-old former men's champion Bobby Riggs in a widely publicized "Battle of the Sexes." She was cofounder and first president (1974) of the Women's Tennis Association, and in 1974, with her husband, Larry King, she also founded World TeamTennis, of which she served as director. She wrote two autobiographies (with cowriters) and a history of women's tennis, and she cofounded the magazine *Womensport*.

Billie Jean King.
COLORSPORT

King, Larry *orig.* **Lawrence Harvey Zeiger** (b. Nov. 19, 1933, Brooklyn, N.Y., U.S.) U.S. talk-show host. He worked in Miami, Fla., as a radio disc jockey, talk-show host, and freelance broadcaster and writer (1957–78). He hosted the popular national radio talk show *The Larry King Show* (1978–94) and, since 1985, the television talk show *Larry King Live* on CNN. Known for his easygoing interviewing style with celebrities, news makers, and world leaders, he conducted more than 30,000 interviews on his two shows.

King, Martin Luther, Jr. (b. Jan. 15, 1929, Atlanta, Ga., U.S.—d. April 4, 1968, Memphis, Tenn.) U.S. civil-rights leader. The son and grandson of Baptist preachers, King became an adherent of nonviolence while in college. Ordained a Baptist minister himself in 1954, he became pastor of a church in Montgomery, Ala.; the following year he received a doctorate from Boston University. He was selected to head the Montgomery Improvement Association, whose boycott efforts eventually ended the city's policies of RACIAL SEGREGATION on public transportation. In 1957 he formed the SOUTHERN CHRISTIAN LEADERSHIP CONFERENCE and began lecturing nationwide, urging active nonviolence to achieve civil rights for African Americans. In 1960 he returned to Atlanta to become copastor with his father of Ebenezer Baptist Church. He was arrested and jailed for protesting segregation at a lunch counter; the case drew national attention, and presidential candidate JOHN F. KENNEDY interceded to obtain his release. In 1963 King helped organize the March on Washington, an assembly of more than 200,000 protestors at which he made his famous "I have a dream" speech. The march influenced the passage of the CIVIL RIGHTS ACT OF 1964, and King was awarded the 1964 Nobel Prize for Peace. In 1965 he was criticized from within the civil-rights movement for yielding to state troopers at a march in Selma, Ala., and for failing in the effort to change Chicago's housing segregation policies. Thereafter he broadened his advocacy, addressing the plight of the poor of all races and opposing the Vietnam War. In 1968 he went to Memphis, Tenn., to support a strike by sanitation workers; there on April 4, he was assassinated by JAMES EARL RAY. A U.S. national holiday is celebrated in King's honour on the third Monday in January.

Martin Luther King, Jr.
JULIAN WASSER

King, Rufus (b. March 24, 1755, Scarborough, Mass.—d. April 29, 1827, Jamaica, N.Y., U.S.) U.S. diplomat. He was a delegate to the Continental Congress (1784–87), where he called for a new constitution. He helped frame the CONSTITUTION OF THE UNITED STATES and effected its ratification by Massachusetts. In 1788 he moved to New York, where he was elected one of the state's first U.S. senators (1789–96, 1813–25). He became a strong leader of the FEDERALIST PARTY and introduced the antislavery provision of the 1787 document that formed part of the NORTHWEST ORDINANCES. He served as ambassador to Britain from 1796 to 1803 and from 1825 to 1826.

King, Stephen (Edwin) (b. Sept. 21, 1947, Portland, Maine, U.S.) U.S. writer. Educated at the University of Maine, he wrote a number of enormously popular books, which made him one of the world's best-selling writers. His books blend horror, the macabre, fantasy, and SCIENCE FICTION. *Carrie* (1974; film 1976), his first published novel and an immediate success, was followed by a long string of popular books, including *The Shining* (1977; film, 1980; television miniseries, 1997), *The Dead Zone* (1979; film, 1983), *Pet Sematary* (1983; film, 1989), and *Misery* (1987; film, 1990). Most of his novels have been adapted for television or film, and most have been translated into many languages.

King, W(illiam) L(yon) Mackenzie (b. Dec. 17, 1874, Berlin, Ont., Can.—d. July 22, 1950, Kingsmere, Que.) Prime minister of Canada (1921–26, 1926–30, 1935–48). The grandson of WILLIAM L. MACKENZIE, he was deputy minister of labour (1900–08) before being appointed Canada's first minister of labour (1909–11). Reelected to the Canadian Parliament (1919), he became leader of the Liberal Party. As prime minister, he favoured social reform without socialism; he led the government with support from an alliance of Liberals and Progressives. He effected a more independent relationship between the Commonwealth nations and Britain. During and after World War II he unified a country often divided between English and French constituents.

King, William Rufus de Vane (b. April 7, 1786, Sampson county, N.C., U.S.—d. April 18, 1853, Cahaba, Ala.) U.S. politician. A member of the U.S. House of Representatives from North Carolina from 1811, he resigned from the House in 1816 to serve as secretary of legation to William Pinkney, the U.S. minister plenipotentiary to Russia. Upon his return, he moved to Alabama and became one of the state's first U.S. senators (1819–44, 1848–52). As minister to France from 1844 to 1846, he convinced the French government not to interfere with the U.S. annexation of Texas. In 1852 he was elected U.S. vice president under FRANKLIN PIERCE, but he died shortly after taking the oath of office.

King Cotton Phrase used before the AMERICAN CIVIL WAR to denote the economic importance of Southern cotton production. The concept first appeared in the book *Cotton Is King* (1855) and was echoed by Southern politicians, who believed that cotton's economic and political power would bring victory if secession led to war. The South expected support from Britain, a major cotton importer, but Britain instead developed alternative sources of cotton within its empire. The South's dependence on cotton contributed to its economic weakness after the Civil War.

king crab *or* **Alaskan king crab** *or* **Japanese crab** Marine DECAPOD (*Paralithodes camtschatica*), an edible CRAB. It is found in the shallow waters off Japan and along the Alaska coast; it also inhabits the

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Bering Sea. One of the largest crabs, it often weighs 10 lbs (4.5 kg) or more. Its size and tasty flesh make it a valued food, and large numbers are fished commercially each year.

King George Sound Inlet of the Indian Ocean, southern coast of Western Australia. It has an area of 35 sq mi (91 sq km). Its harbours are Oyster Harbor and Princess Royal Harbor (the site of the port for the city of Albany). It was charted in 1791 by Capt. George Vancouver and was first used as a whaling base.

King George's War (1744–48) Inconclusive struggle between France and Britain for mastery of North America. Also called the American phase of the War of the Austrian Succession, the war involved disputes over boundaries of Nova Scotia and northern New England and control of the Ohio Valley. After bloody border raids by both sides, aided by their Indian allies, they signed the Treaty of Aix-la-Chapelle (1748), which restored conquered territory but failed to resolve colonial issues. See also French and Indian War.

King Philip's War (1675–76) Bloodiest conflict between American colonists and Indians in 17th-century New England. By 1660 colonial settlers, no longer dependent on Indians for survival, had pushed into Indian territory in Massachusetts, Connecticut, and Rhode Island. To protect their lands, the Wampanoag chief King Philip (Metacom) organized a federation of tribes, which in 1675 destroyed several frontier settlements. In retaliation the colonial militia burned Indian villages and crops. After Philip's death in 1676, Indian resistance collapsed. An estimated 600 settlers and 3,000 Indians were killed in the conflict.

king salmon See chinook salmon

king snake Any of seven species of snake (genus *Lampropeltis*, family Colubridae) found in numerous habitats from southeastern Canada to Ecuador. They kill by constriction; named for their practice of eating other snakes, they also take small mammals, amphibians, birds, and birds' eggs. They are mainly terrestrial and relatively slow-moving. Strikingly marked and smooth-scaled, they have a small head and are usually less than 4 ft (1.2 m) long, though some specimens may approach 7 ft (2 m). The common king snake, found throughout the U.S. and in northern Mexico, is usually black or dark brown, variously blotched, ringed, or speckled with yellow or white.

Common king snake (*Lampropeltis getula*).
JACK DERMID

King William's War (1689–97) Battle for North American territory between Britain, under King William III, and France. The war, which was the North American extension of the War of the Grand Alliance, involved French Canadians and New England colonists and their Indian allies. The British captured Port Royal, Acadia (later Nova Scotia), but failed to take Quebec. The French, under the count de Frontenac, won skirmishes at Schenectady, N.Y., and in New England but failed to take Boston. The war ended with the Treaty of Rijswijk (1697). See also French and Indian War.

kingdom of God *or* **kingdom of heaven** In Christianity, the spiritual realm over which God reigns as king, or the eventual fulfillment of God's will on earth. Although rare in pre-Christian Jewish literature, the idea of God as king was fundamental to Judaism, and Jewish ideas on the kingdom of God most likely shaped New Testament usage. The term is often used in the New Testament, and it was a central theme in the preaching of John the Baptist and Jesus. Theologians differ as to whether Jesus implied that the kingdom had arrived in his person or whether it was expected as a future event. Christian orthodoxy now holds that the kingdom has been partially realized by the presence of the church in the world and that it will be fully realized after the Last Judgment.

kingfish Any of various fishes, among them certain species of mackerel and a drum. The king mackerel, or kingfish (*Scomberomorus cavalla*), is a western Atlantic fish about 67 in. (170 cm) long and weighing 79 lbs (36 kg) or more. The kingfish, or whiting (*Menticirrhus saxatilis*), of the Atlantic, is notable among drums in that it lacks an air bladder.

kingfisher Any of about 90 species of birds (family Alcedinidae), many of which fish for their food. Solitary birds, kingfishers are found worldwide but are chiefly tropical. They have a large head, long and usually narrow bill, compact body, small feet, and usually a short or medium-length tail. Species range from 4 to 18 in. (10–45 cm) long; most have bright, boldly patterned plumage, and many are crested. They utter rattling or piping calls, and they plunge into the water for small fish and other aquatic animals. The only widespread North American species, the belted kingfisher (*Megaceryle alcyon*), is bluish gray above and white below. The forest kingfishers (e.g., kookaburra) have a broader bill.

Kings, Valley of the Narrow gorge, Upper Egypt, near the ancient city of Thebes. It is the burial site of nearly all of the kings (pharaohs) of the 18th–20th dynasties (1539–1075 BC), from Thutmose I to Ramses X. The valley contains 62 tombs, virtually all of which were robbed in antiquity. Only the tomb of Tutankhamen escaped pillage; after its excavation in the 1920s, its treasures were placed in the Egyptian Museum in Cairo. The longest tomb belongs to Queen Hatshepsut, whose burial chamber is nearly 700 ft (215 m) from the entrance. The largest tomb, built for the sons of Ramses II, contains scores of burial chambers. The valley is part of a UNESCO World Heritage site (designated 1979) centred on Thebes.

Kings Canyon National Park National park, Sierra Nevadas, south-central California, U.S. Occupying an area of 722 sq mi (1,870 sq km), it is administered along with the adjacent Sequoia National Park. Established in 1940, it contains giant sequoia trees. Its most spectacular feature is Kings Canyon on the Kings River, which was carved by glacial action.

Kings Mountain, Battle of (Oct. 7, 1780) Battle in the American Revolution between American revolutionaries and loyalists. About 2,000 frontiersmen were assembled to resist the British advance into North Carolina; they surrounded the 1,100 soldiers, mainly loyalists from New York and South Carolina, on Kings Mountain, S.C., near the border with North Carolina. The frontiersmen killed or captured almost all the loyalists, and the battle marked the beginning of the war's turn against the British.

kingship, divine See divine kingship

Kingsley, Charles (b. June 12, 1819, Holne Vicarage, Devon, Eng.—d. Jan. 23, 1875, Eversley, Hampshire) English clergyman and novelist. After studies at Cambridge, he became a parish priest and later chaplain to Queen Victoria, professor of modern history at Cambridge, and canon of Westminster. An enthusiastic advocate of Christian socialism, he published several novels about social problems before writing the very successful historical novels *Hypatia* (1853), *Westward Ho!* (1855), and *Hereward the Wake* (1866). Fearing the Anglican church's trend in the direction of Catholicism, he engaged in a famous controversy with John Henry Newman. His wholehearted acceptance of Charles Darwin's theory of evolution inspired his popular children's book *The Water-Babies* (1863).

Kingston City (pop., 1999 est.: metro. area, 655,000), capital and chief port of Jamaica. Located on the southeastern coast of the island, it was founded in 1692 after Port Royal was destroyed by an earthquake. It soon became the commercial centre of Jamaica and was made the political capital in 1872. Historic buildings include a 17th-century church, a moated fortress, and the 18th-century Headquarters House. It is the seat of the University of the West Indies.

Kingston, Maxine Hong *orig.* **Maxine Hong** (b. Oct. 27, 1940, Stockton, Calif., U.S.) U.S. writer. Born to an immigrant family, she examined the myths, realities, and cultural identities of Chinese and American families and the role of women in Chinese culture in her fiction and nonfiction. Her widely admired *The Woman Warrior* (1976) and *China Men* (1980) blend fact and fantasy to tell aspects of her family's history.

Kingston upon Hull *or* **Hull** City and unitary authority (pop., 2001: 243,595), geographic county of East Riding of Yorkshire, historic county of Yorkshire, England. It lies on the northern bank of the River Humber at its junction with the River Hull, 22 mi (35 km) from the North Sea. Hull was a medieval wool port that passed from the monks of Meaux Abbey to Edward I in 1293. For more than 400 years it was the chief shipping port for the inland waterways converging on the River Humber. Granted city status in 1897, it is a major national seaport, accommodating large oceangoing vessels. The medieval part of the city retains a number of historic buildings; its grammar school was founded in 1486.

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Kingstown Capital (pop., 1999 est.: 16,175), chief port of Saint Vincent and the Grenadines, West Indies. Located on the southwestern end of Saint Vincent island, it overlooks Kingstown Harbour. Its sites of interest include the Botanic Gardens (founded 1763), the oldest of its kind in the Western Hemisphere; Capt. William Bligh made his 1787 voyage on the *Bounty* to obtain breadfruit trees from Tahiti for this garden.

Kinnock, Neil (Gordon) (b. March 28, 1942, Tredegar, Monmouthshire, Wales) British politician. Elected to Parliament in 1970, he rose in the Labour Party ranks and was named to its national executive committee in 1978. After the party suffered its heaviest defeat in 48 years in 1983, he was elected party leader, the youngest in its history. By 1989 he had persuaded the party to abandon its radical policies on disarmament and large-scale nationalization. Although the party increased its numbers in Parliament, it lost the 1992 general election to the Conservatives, and Kinnock resigned as party leader. He became a vice president of the European Commission of the European Union in 1999.

Kinsey \'kin-zē**, Alfred (Charles)** (b. June 23, 1894, Hoboken, N.J., U.S.—d. Aug. 25, 1956, Bloomington, Ind.) U.S. zoologist and expert on human sexual behaviour. After earning a Ph.D. from Harvard University in 1920, he taught zoology at Indiana University, where he became the founder-director, in 1942, of the university's Institute for Sex Research (renamed the Kinsey Institute for Sex Research, Inc., in 1981). His inquiries into human sexuality led him to publish *Sexual Behavior in the Human Male* (1948) and *Sexual Behavior in the Human Female* (1953). These reports, based on 18,500 personal interviews, received extraordinary publicity for their conclusions about contemporary sexual mores and behaviour. Kinsey's methodologies and statistical samplings, however, have been highly questioned and criticized in recent years.

Kinsha River See Jinsha River

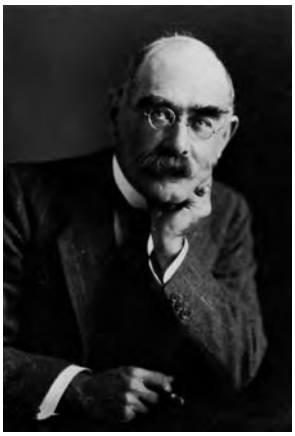
Kinshasa \kin-'shä-sə\ *formerly* **Léopoldville** Capital and largest city (pop., 1994 est.: 4,655,313), Democratic Republic of the Congo. Situated on the southern bank of the Congo River, it was founded as Léopoldville in 1881 by Henry Morton Stanley. It became the capital of the Belgian Congo in the 1920s. After World War II it emerged as the largest city in sub-Saharan Africa and became the capital of the independent republic in 1960. It was given its present name in 1966. A major river port and a commercial centre, it is the seat of the University of Kinshasa (1954).

kinship Socially recognized relationship between people who are or are held to be biologically related or who are given the status of relatives by marriage, adoption, or other ritual. Kinship is the broad term for all the relationships that people are born into or create later in life that are considered binding in the eyes of society. Every person belongs to a family of orientation (e.g., mother, father, brothers, and sisters); many adults also belong to a family of procreation (which includes a spouse or spouses and children). Familial bonds of descent and marriage may be traced through a genealogy, a written or oral statement of the names of individuals and their kin relations to one another. Inheritance and succession (the transmission of power and position in society) usually follow kinship lines. See also exogamy and endogamy; incest.

kiosk \'kē-äsk\ Originally, in Islamic architecture, an open circular pavilion consisting of a roof supported by pillars. The word has been applied to a Turkish summer garden pavilion and a type of early Persian mosque. Today the term refers to any small urban booth that dispenses newspapers, information, or tickets.

Kiowa \'kī-ə-ˌwȯ\ North American Indian people living mostly in Oklahoma, U.S., on a reservation they share with Comanche and Apache. Their language is of Kiowa-Tanoan language stock. The name Kiowa may be a variant of their name for themselves, Kai-i-gwu, meaning "Principal People." The Kiowa moved southward from western Montana and adopted the lifestyle of the Plains Indians. They hunted buffalo on horseback and lived in large three-poled tepees. They had warrior societies, the members of which attained rank according to their exploits in war. They believed that dreams and visions gave them supernatural power, and they participated in the sun dance ceremony. They were also noted for their pictographic portrayals, or "calendar histories," of important tribal events. They were among the last of the Plains peoples to capitulate to the U.S. Some 8,600 peoples claimed sole Kiowa descent in the 2000 U.S. census.

Kipling, (Joseph) Rudyard (b. Dec. 30, 1865, Bombay, India—d. Jan. 18, 1936, London, Eng.) Indian-born British novelist, short-story writer, and poet. The son of a museum curator, he was reared in England but returned to India as a journalist. He soon became famous for volumes of stories, beginning with *Plain Tales from the Hills* (1888; including "The Man Who Would Be King"), and later for the poetry collection *Barrack-Room Ballads* (1892; including "Gunga Din" and "Mandalay"). His poems, often strongly rhythmic, are frequently narrative ballads. During a residence in the U.S., he published a novel, *The Light That Failed* (1890); the two *Jungle Book*s (1894, 1895), stories of the wild boy Mowgli in the Indian jungle that have become children's classics; the adventure story *Captains Courageous* (1897); and *Kim* (1901), one of the great novels of India. He wrote six other volumes of short stories and several other verse collections. His children's books include the famous *Just So Stories* (1902) and the fairy-tale collection *Puck of Pook's Hill* (1906). He was awarded the Nobel Prize for Literature in 1907. His extraordinary popularity in his own time declined as his reputation suffered after World War I because of his widespread image as a jingoistic imperialist.



Rudyard Kipling.
Elliott and Fry

Kirchhoff \'kirk-hȯf**, Gustav Robert** (b. March 12, 1824, Königsberg, Prussia—d. Oct. 17, 1887, Berlin, Ger.) German physicist. Kirchhoff's laws (1845) allow calculation of the currents, voltages, and resistances of electrical networks (he was the first to show that current flows through a conductor at the speed of light) and generalized the equations describing current flow to three dimensions. With Robert Bunsen, he demonstrated that every element emits coloured light when heated at wavelengths specific to it, a fact that is the basis of spectrum analysis. They used this new research tool to discover cesium (1860) and rubidium (1861), and began a new era in astronomy when they applied it to the spectrum of the sun.

Kirchhoff's circuit rules \'kir-ˌkȯfs\ *or* **Kirchhoff's laws** Two statements, developed by Gustav Kirchhoff, about complex circuits that embody the laws of conservation (see conservation law) of electric charge and energy. They are used to determine the value of the electric current in each branch of the circuit. The first law states that the sum of the currents into a junction in the circuit equals the sum of the currents out of the junction. The second law states that around each loop in an electric circuit, the sum of the electromotive force is equal to the sum of all the potential drops (changes in voltage) across components in the loop. Using these rules, algebraic equations can be formulated to determine the value of currents in different loops in a circuit.

Kirchner \'kirk-nər**, Ernst Ludwig** (b. May 6, 1880, Aschaffenberg, Bavaria—d. June 15, 1938, near Davos, Switz.) German painter, printmaker, and sculptor. He was among the founders of the Expressionist group Die Brücke. Kirchner's highly personal style, influenced by Albrecht Dürer, Edvard Munch, and African and Polynesian art, was noted for its psychological tension and eroticism. He used simple, powerfully drawn forms and often garish colours to create intense, sometimes threatening works, such as his two versions of *Street, Berlin* (1907, 1913). Highly strung and often depressed, he took his own life when the Nazis declared his work "degenerate."

Street, Berlin, oil on canvas by Ernst Ludwig Kirchner, 1913; in the Museum of Modern Art, New York City.
Courtesy of the Museum of Modern Art, New York City

Kiribati \ˌkir-ə-'bä-tē, ˌkir-i-'bas, 'kir-i-ˌbas\ *officially* **Republic of Kiribati** Island country, central

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Pacific Ocean. It consists of 33 islands. The three major island groups are the Gilbert, Phoenix, and Line islands (excluding the three Line Islands that are U.S. territories); Kiribati also includes Banaba Island, the former capital of the Gilbert and Ellice Islands colony. Area (land): 313 sq mi (811 sq km). Population (2005 est.): 95,300. Capital: Bairiki, on Tarawa Atoll. The indigenous people are mostly Micronesians. Languages: English (official), Gilbertese. Religions: Christianity (mostly Roman Catholic; also Protestant); also Bahāʾī. Currency: Australian dollar. With the exception of Banaba (which is a coral island and higher in elevation), all the islands of Kiribati are low-lying coral atolls built on a submerged volcanic chain and encircled by reefs. Only about 20 of the islands are inhabited; nearly all of the population of Kiribati live in the Gilbert Islands. The economy is based on subsistence farming and fishing. Kiribati is a republic with one legislative house; its head of state and government is the president. The islands were settled by Austronesian-speaking people before the 1st century AD. Fijians and Tongans arrived c. the 14th century. In 1765 the British commodore John Byron discovered the island of Nikunau; the first permanent European settlers arrived in 1837. In 1916 the Gilbert and Ellice Islands and Banaba became a crown colony of Britain; the Phoenix Islands joined the colony in 1937. Most of the Line Islands joined the colony in 1972, but in 1976 the Ellice Islands were separated and in 1978 formed the country of Tuvalu. The colony became self-governing in 1977, and in 1979 it became the Republic of Kiribati.

Kirin See Jilin

Kiriwina Islands See Trobriand Islands

Kirkland, (Joseph) Lane (b. March 12, 1922, Camden, S.C., U.S.—d. Aug. 14, 1999, Washington, D.C.) U.S. labour-union leader. He served as an officer in the U.S. merchant marine and joined the American Federation of Labor (AFL) as a staff researcher in 1948. He was elected secretary-treasurer of the AFL-CIO in 1969 and succeeded George Meany as president in 1979. During Kirkland's tenure (1979–95), the AFL-CIO's membership and political influence waned due to shrinking employment in the U.S. manufacturing sector.

Kirkland, Samuel (b. Dec. 1, 1741, Norwich, Conn.—d. Feb. 28, 1808, Clinton, N.Y., U.S.) American clergyman. He was a Congregational missionary to Indian tribes of the Iroquois Confederacy and learned several Indian languages. In the American Revolution he served as chaplain to colonial troops and secured an alliance with the Oneida. He was rewarded with a land grant in New York state, where he founded the Hamilton Oneida Academy for Indian and white students (later Hamilton College).

Kirkwall Royal burgh and chief town (pop., 1995 est.: 7,000), Orkney Islands, Scotland. Located on Pomona Island off the northern tip of Scotland, it has evidence of Norse influence persisting as late as the building of the Cathedral of St. Magnus in the 12th century. Kirkwall functions mainly as a commercial and service centre for the Orkney Islands and is also the islands' historic county town (seat) and administrative centre. The exploitation of North Sea oil has led to development of offshore servicing and supply for the oil industry.

Kirkwood gaps Interruptions in the distribution of asteroids in the asteroid belt between Mars and Jupiter that appear where any of these small bodies' orbital periods would be a simple fraction of Jupiter's. Several zones of low density in the asteroid belt were noticed about 1860 by Daniel Kirkwood (1814–95), who explained the gaps as resulting from perturbations by Jupiter. Any object that revolved in one of these locations would be disturbed regularly by the planet's gravitational pull and eventually be moved to another orbit.

Kirov \'kē-rȯf**, Sergey (Mironovich)** *orig.* **Sergey Mironovich Kostrikov** (b. March 27, 1886, Urzhum, Vyatka province, Russia—d. Dec. 1, 1934, Leningrad, Russia, U.S.S.R.) Soviet political leader. After joining the Bolsheviks, he extended the Communist Party's control in Transcaucasia, and in 1926 Joseph Stalin appointed him head of the Leningrad party organization (1926). He modernized the city's industries, was elected to the Politburo (1930), and acquired power that nearly rivaled Stalin's. In 1934 he was assassinated by a young party member, Leonid Nikolayev, who was later shot, along with 13 suspected accomplices. Stalin, claiming that a widespread conspiracy of anti-Stalinist communists planned to assassinate the entire Soviet leadership, used the assassination as a pretext to institute the Purge trials. In 1956 Nikita Khrushchev suggested that Stalin had engineered Kirov's assassination.

Kirov Theatre See Mariinsky Theatre

Kirovabad See Gäncä

Kirstein \'kir-ˌstēn**, Lincoln (Edward)** (b. May 4, 1907, Rochester, N.Y., U.S.—d. Jan. 5, 1996, New York, N.Y.) U.S. dance authority, impresario, and writer. He graduated from Harvard, where he founded the literary magazine *Hound & Horn*. Financially independent, he focused his artistic interests on ballet and in 1933 persuaded the choreographer George Balanchine to move to the U.S. to found a ballet school and company. The School of American Ballet opened in 1934; Kirstein was its director from 1940 to 1989. He and Balanchine jointly established a series of ballet companies, culminating in the New York City Ballet (1948), of which he served as general director until 1989. He wrote seven books on ballet, including the classic history *Dance* (1935).

Kisangani \ˌkē-sän-'gä-nē\ *formerly (until 1966)* **Stanleyville** City (pop., 1994 est.: 417,517), northeastern Democratic Republic of the Congo. The nation's major inland port after Kinshasa, it is located on the Congo River, below Boyoma Falls. The city was founded in 1883 by Europeans and was known first as Falls Station and then as Stanleyville (for Henry Morton Stanley). It has been the major centre of the northern Congo since the late 1800s. It is the seat of the University of Kisangani (1963) and other institutions of higher education.

Kish Ancient Mesopotamian city-state located east of Babylon in what is now south-central Iraq. It lay on the Euphrates River before the course of the river changed. City ruins date to the 4th millennium BC and to Sumerian culture; archaeological evidence of the palace of Sargon and the temple of Nebuchadrezzar II has also been found.

Kishinev See Chisinau

Kishon River See Qishon River

Kissinger \'ki-sᵊn-jər**, Henry A(lfred)** (b. May 27, 1923, Fürth, Ger.) German-born U.S. political scientist and foreign-policy adviser (1969–76). He immigrated with his family to the U.S. in 1938. He taught at Harvard University, where he directed the Defense Studies Program (1959–69). He was appointed assistant for national security affairs by Pres. Richard Nixon in 1968 and served as head of the National Security Council from 1969 to 1975; he was secretary of state from 1973 to 1977. He developed the policy of détente toward the Soviet Union, which led to the Strategic Arms Limitation Talks agreements. He also initiated the first official U.S. contact with China. After helping to plan the U.S. bombing of Cambodia in 1969–70, he negotiated the cease-fire agreement that ended the Vietnam War, for which he shared the Nobel Prize for Peace in 1973 with Le Duc Tho (who refused it). In 1973 he helped foment a military coup in Chile that toppled that country's Marxist government. After leaving government service, he became an international consultant, lecturer, and writer.

Kit-Cat Club Association of early 18th-century Whig leaders that met in London. Members included the writers Richard Steele, Joseph Addison, and William Congreve and such political figures as Robert Walpole and the duke of Marlborough. They first met in the tavern of Christopher Cat, whose mutton pies were called kit-cats. Portraits of the 42 members were painted by Godfrey Kneller (1646–1723), and the specific size of the canvas (36 × 28 in. [91 × 71 cm]) used for the portraits became known as a kit-cat.

Kitaj \ki-'tī**, R(onald) B(rooks)** (b. Oct. 29, 1932, Chagrin Falls, Ohio, U.S.) U.S.-born British painter. He studied in New York City, Vienna, Oxford, and London. In the 1960s he was a prominent member of the Pop art movement in Britain. His works mingled the impersonal finish characteristic of Pop canvases with the loose, painterly brushwork of Abstract Expressionism but differed from the work of his Pop contemporaries in their complex and allusive figurative imagery. Kitaj's semiabstract paintings featured brightly coloured and imaginatively interpreted human figures portrayed in puzzling and ambiguous relation to one another. He exhibited internationally and taught at various British art schools.

Kitakami Mountains \kē-'tä-kä-mē\ Mountain range, northeastern Honshu, Japan. It parallels the Pacific coast and extends for about 155 mi (250 km) to the Ojika Peninsula. Its highest peak rises to 6,280 ft (1,914 m). Often referred to as the "Tibet of Japan," the Kitakami Range is the most culturally isolated region of Honshu. Until the mid-20th century relics of old agricultural practices survived, including the serf system known as Nago.

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Kitakyūshū \kē-'tä-,kyü-shü\ City (pop., 2000 prelim.: 1,011,491), Kyushu, Japan. It was created in 1963 by the amalgamation of several cities. Part of its long coastline is included in the Inland Sea National Park. It is one of Japan's leading manufacturing centres. Undersea tunnels and a bridge link the city with Shimonoseki, Honshu.

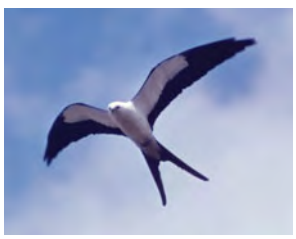
Kitami Mountains \kē-'tä-mē\ Mountain range, northeastern Hokkaido, Japan. Extending 180 mi (290 km) along the coast of the Sea of Okhotsk, its elevations range generally from 2,500 to 3,100 ft (750 to 950 m), but the highest reaches 6,500 ft (1,980 m).

Kitchener City (pop., 2001: 190,399), southeastern Ontario, Canada. It is situated in the Grand River valley, southwest of Toronto. Founded by Bishop Benjamin Eby and settled by German immigrants c. 1807, it was incorporated as a city in 1912. It was known successively a Sand Hill, Ebytown, and Berlin before being renamed in honour of H.H. Kitchener in 1916. The boyhood home of W.L. Mackenzie King is now preserved in Woodside National Historic Park.

Kitchener, H(oratio) H(erbert) *later* **Earl Kitchener (of Khartoum and of Broome)** (b. June 24, 1850, near Listowel, Co. Kerry, Ire.—d. June 5, 1916, at sea off Orkney Islands) British field marshal and imperial administrator. Trained as a military engineer, Kitchener served in posts in the Middle East and Sudan before being appointed commander in chief of the Egyptian army in 1892. In 1898 he crushed the rebellious Mahdist movement in the Battle of Omdurman and forced concessions from France in the Fashoda Incident. He entered the South African War as chief of staff in 1899, becoming commander in chief a year later. In the last 18 months of the war, he resorted to brutal methods, burning Boer farms and herding Boer women and children into concentration camps. He was later sent to India to reorganize the army there. A clash with Lord Curzon over control of the army resulted in Curzon's resignation in 1905. In 1911 Kitchener returned to Khartoum as proconsul of Egypt and the Sudan. As secretary of state for war during World War I, he organized armies on a scale unprecedented in British history and became a symbol of the national will to victory. He died on a mission to Russia when his ship was sunk by a German mine.

kite Light frame covered with paper or cloth, often provided with a balancing tail, and designed to be flown in the air at the end of a long string; it is held aloft by wind. Its name comes from the kite, a member of the hawk family. Kites have been in use in Asia from time immemorial, and religious significance is still connected to some ceremonial kite-flying there. In a famous experiment in 1752, Benjamin Franklin hung a metal key from a kite line during a storm to attract electricity. Kites were used to carry weather-recording devices aloft before the advent of balloons and airplanes. Types of kite commonly in use today include the hexagonal (or three-sticker), the malay (modified diamond), and the box kite, invented in the 1890s. Newer wing-like kites, with pairs of controlling strings for superior maneuverability, are also flown.

kite Any of numerous lightly built birds of prey that have a small head, partly bare face, short beak, and long, narrow wings and tail. They are found worldwide in warm regions. Some live on insects; others are primarily scavengers but also eat rodents and reptiles; a few eat only snails. In flight, kites slowly flap and then glide with wings angled back. Kites belong to three subfamilies of the family Accipitridae: Milvinae (true kites and snail kites), Elaninae (including the white-tailed kite, one of the few North American raptors increasing in number), and Perninae (including the swallow-tailed kite of the New World). See also hawk.



Swallow-tailed kite (*Elanoides forficatus*).
JAMES A. KERN

kithara \'ki-thə-rə\ Large lyre of Classical antiquity, the principal stringed instrument of the Greeks and later of the Romans. It had a box-shaped resonating body from which extended two parallel arms connected by a crossbar to which 3–12 strings were attached. It was held vertically and plucked with a plectrum; the left hand was used to stop and damp the strings. It was played by singers of the Greek epics, as well as by later professional accompanists and soloists.

kittiwake *or* **black-legged kittiwake** White oceanic gull (*Rissa tridactyla*) with pearl-gray mantle, black-tipped wings, black feet, and yellow bill. Kittiwakes nest on narrow cliff ledges along the North and South Atlantic coasts. The red-legged kittiwake (*R. brevirostris*) is found in the Bering Sea region.

kiva \'kē-və\ Underground chamber of the Pueblo Indian villages of the southwestern U.S., notable for the murals that decorate its walls. A small hole in its floor, the *sípapu*, serves as the symbolic place of origin of the tribe. Though the kiva's primary purpose is for ritual ceremonies, men also use it for political meetings or casual gatherings. Women are almost always excluded from the kiva. The traditional round slope of the earliest kiva, in contrast to the otherwise square or rectangular Pueblo architecture, recalls the circular pit houses of the prehistoric basket-weaving culture from which these tribes, primarily Hopi and Zuni, descend.

Kivu \kē-vü**, Lake** Lake, central East Africa. Located between Rwanda and the Democratic Republic of the Congo (Zaire), it occupies 1,040 sq mi (2,700 sq km), is 55 mi (90 km) long and 30 mi (48 km) wide, and has a maximum depth of 1,558 ft (475 m). Containing many islands, it was part of a larger body of water until volcanic outpourings along its northern shore created a dam that separated it from Lake Edward.

kiwi Any of three species (genus *Apteryx*) of chicken-sized, grayish brown ratite birds, found in New Zealand. Their Maori name refers to the male's shrill call. Kiwis have vestigial wings hidden within the plumage; nostrils at the tip (rather than the base) of the long flexible bill; soft, hairlike feathers; and stout, muscular legs. Each of the four toes has a large claw. Kiwis live in forests, where they sleep by day and forage for worms, insects and their larvae, and berries at night. They run swiftly and use their claws in defense when cornered.

Common kiwi (*Apteryx australis*)
PICTORIAL PARADE

kiwi fruit Edible fruit of the vine *Actinidia chinensis* (family Actinidiaceae), native to China and Taiwan and grown commercially in New Zealand and California. It became popular in the nouvelle cuisine of the 1970s. It has a slightly acid taste and is high in vitamin C. Kiwi can be eaten raw or cooked, and the juice is sometimes used as a meat tenderizer.

Kiyomori See Taira Kiyomori

Kızıl \ki-'zil\ **River** *ancient* **Halys River** River, central and north-central Turkey. The longest river wholly within Turkey and the largest in Anatolia, it rises in north-central Turkey and flows southwestward. It turns north and empties into the Black Sea after a total course of 734 mi (1,182 km). Unsuitable for navigation, it is a source of irrigation and hydroelectricity for the region.

KKK See Ku Klux Klan

Klaipeda \'klī-pə-də\ *German* **Memel** \'mā-məl\ City (pop., 2001: 192,954) and port, Lithuania. It lies on the channel that connects the Neman River with the Baltic Sea. A fortress built on the site in the early 13th century was destroyed in 1252 by the Teutonic Order, who built a new fortress called Memelburg. It came under Prussian control in the 17th century, and the town (Memel) was settled by Germans. In 1923 Memel became part of Lithuania and was renamed Klaipeda. Seized by Germany in 1939, it passed to the Soviet Union in 1945. Klaipeda became part of the newly independent Lithuania in 1991. The modern city has major shipbuilding yards and is the base for a large deep-sea fishing fleet.

Klamath \'kla-məth\ North American Plateau Indian people living mainly in Oregon, U.S. The name Klamath may be a variant of their name for the region (spelled Clemmat or Tlamath); it is the name by which they were known to the Chinook. They called themselves Maqlaq, meaning "The People," usually with an adjective (such as Ewksikni, "of the Lake"). They were primarily fishers and hunters of waterfowl. The Klamath were divided into relatively autonomous villages, each with its own leaders and medicine man; the villages would ally for war, and members of different villages often intermarried. Families lived in earth-covered lodges in winter and domed houses of poles and matting in summer. Sweat lodges

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doubled as community centres for religious activities. The Klamath's closely related neighbours were the Modoc. Together with the Modoc and the Yahooskin band of Snake Indians, they form an entity known as the Klamath Tribes. Some 2,700 people claimed sole Klamath descent in the 2000 U.S. census.

Klamath \'kla-məth\ **River** River, southern Oregon and northwestern California, U.S. Rising in Upper Klamath Lake just above Klamath Falls, Ore., it flows south and southwest for 250 mi (400 km) through the Klamath Mountains in California and empties into the Pacific Ocean.

Klausenburg See Cluj-Napoca

klebsiella \ˌkleb-zē-'e-lə\ Any of the rod-shaped bacteria that make up the genus Klebsiella. They are gram-negative (see gram stain), thrive better without oxygen than with it, and do not move. *K. pneumoniae*, also called Friedländer's bacillus, can infect the human respiratory tract and cause pneumonia and, as well as some other species, human urinary-tract and wound infections.

Klee \'klā**, Paul** (b. Dec. 18, 1879, Münchenbuchsee, Switz.—d. June 29, 1940, Muralto) Swiss painter. After studies in Germany and Italy, he settled in Munich, where he became associated with Der Blaue Reiter (1911). He taught at the Bauhaus (1920–31), then at the Düsseldorf Academy. He lost his post when the Nazis came to power in 1933 and returned to Switzerland. One of the foremost artists of the 20th century, he belonged to no movement, yet he assimilated and even anticipated some of the major artistic tendencies of his time. Using both representational and abstract approaches, he produced some 9,000 paintings, drawings, and watercolours in a great variety of styles. His works, which tend to be small in scale, are remarkable for their delicate nuances of line, colour, and tonality. In Klee's highly sophisticated art, irony and a sense of the absurd are joined to an intense evocation of the mystery and beauty of nature. Music figures prominently in his work—in his many images of opera and musicians, and to some extent as a model for his compositions. But literature had the greater pull on him; his art is steeped in poetic and mythic allusion, and the titles he gave to his pictures tend to charge them with additional meanings. His late paintings, anticipating his approaching death, are among his most memorable.

Klee, 1939.
AUFNAHME FOTOPRESS

Kleiber \'klī-bər**, Erich** (b. Aug. 5, 1890, Vienna, Austria—d. Jan. 27, 1956, Zürich, Switz.) Austro-Hungarian conductor. After his Prague debut in 1911, he held a series of posts that led him to the Berlin State Opera, where he was music director from 1923 to 1934. There he premiered important works such as Alban Berg's *Wozzeck* (1925). When the Nazis forbade the premiere of Berg's *Lulu* (1934), he managed to program the suite from the opera for his last concert. After moving to Buenos Aires, he was head of the German Opera at the Teatro Colón (1937–49). His son Carlos (b. 1930) also became an internationally celebrated conductor, especially of opera, with a reputation for perfectionism equal to his father's.

Klein, Calvin (Richard) (b. Nov. 19, 1942, New York, N.Y., U.S.) U.S. fashion designer. He attended the Fashion Institute of Technology. He opened his own company in 1968, when casual, hippie-style clothing was in fashion, but took a different direction by designing simple, understated, elegant clothing. Though noted at first for suits and coats, he gradually placed more emphasis on sportswear, particularly interchangeable separates. He was the first designer to win three consecutive Coty Awards for womenswear (1973–75). Over the course of the 1980s and '90s he became known for his clothing, cosmetics, linens, and other designer collections, as well as for his erotic advertising photographs, some of which have drawn public protest. His achievements represented the maturation of the American fashion industry.

Klein, Melanie *orig.* **Melanie Reizes** (b. March 30, 1882, Vienna, Austria—d. Sept. 22, 1960, London, Eng.) Austrian-British psychoanalyst. She married at age 21 and had three children before undergoing psychoanalysis with Ferenczi Sándor in Budapest, Hung. She studied the psychoanalysis of young children, joining the Berlin Psychoanalytic Institute (1921–26) and later moving to London. In works such as *The Psychoanalysis of Children* (1932) and *Narrative of a Child Analysis* (1961), she asserted that children's play was a symbolic way of controlling anxiety and that observation of free play with toys could serve as a means of determining early psychological impulses.

Klein, Yves (b. April 28, 1928, Nice, Fr.—d. June 6, 1962, Paris) French painter, sculptor, and performance artist. With no formal artistic training, he began in the mid 1950s to exhibit nonobjective paintings in which a canvas was uniformly covered in a single colour, usually blue; he also used the technique for sculptural figures and reliefs. In 1958 he produced a near-riot with an "exhibition of emptiness," an empty gallery painted white, titled *The Void*. He used a variety of unorthodox methods to produce pictures, such as imprints of the human body on paper or canvas (*anthropométries*). His work was deliberately extreme and experimental. A member of Fluxus, he greatly influenced the development of Minimalism.

Kleist \'klīst**, (Bernd) Heinrich (Wilhelm) von** (b. Oct. 18, 1777, Frankfurt an der Oder, Brandenburg—d. Nov. 21, 1811, Wannsee, near Berlin) German writer. He served seven years in the Prussian army, and his work first attracted attention when he was in prison accused as a spy. The grim and intense drama *Penthesilea* (1808) contains some of his most powerful poetry, and *The Broken Pitcher* (1808) is a masterpiece of dramatic comedy; they were followed by *Katherine of Heilbronn* (1810), *Die Hermannsschlacht* (1821), and *The Prince of Homburg* (1821). In 1811 he published a collection of eight masterly novellas, including *Michael Kohlhaas*, *The Earthquake in Chile,* and *The Marquise of O*. Embittered by a lack of recognition, he ended his unhappy life in a joint suicide with a young woman at age 34. He is now considered the first of the great 19th-century German dramatists, and his disturbing and densely written fictions are widely admired by writers.

Kleitias See Cleitias

Klemperer, Otto (b. May 14, 1885, Breslau, Ger.—d. July 6, 1973, Zürich, Switz.) German conductor. After studying composition with Hans Pfitzner (1869–1949), in 1905 he met Gustav Mahler, who recommended him for several positions, including chief conductor at the Hamburg Opera (1910). At the short-lived Kroll Opera (1927–31) he conducted the Berlin premieres of many important works by contemporary composers. In 1933 he fled Germany for the U.S., conducting in Los Angeles (1933–39) and studying with Arnold Schoenberg. A brain tumour in 1939 left him partly paralyzed. From the 1950s, though seated on the podium, he created a much-admired recorded legacy with London's Philharmonia Orchestra.

Kleophrades Painter See Cleophrades Painter

klezmer music *Yiddish* **"vessel of song"** Traditional music played by professional musicians (*klezmorim*) in the Jewish ghettos of eastern Europe, especially for weddings and other ceremonies. The klezmer tradition has its roots in medieval Europe. By the 19th century its style was well-developed, influenced not only by the liturgical music of the synagogue (which allows only unaccompanied singing), but also that of the local non-Jewish cultures. It is primarily lively dance music. Klezmer ensembles have varied considerably; in the U.S., where a klezmer revival began in the 1980s, a typical band consists of four to six musicians playing some combination of violin, clarinet, trumpet, trombone, tuba, accordion, double bass, and percussion.

Klimt, Gustav (b. July 14, 1862, Vienna, Austria—d. Feb. 6, 1918, Vienna) Austrian painter. In 1897, after a period as an academic muralist, his mature style emerged. Revolting against academic art in favour of a decorative style similar to Art Nouveau, he founded the Vienna Secession. His most successful works include *The Kiss* (1908) and a series of portraits of fashionable Vienna matrons. In these works he treated the human figure without shadow, conveying the sensuality of skin by surrounding it with areas of flat, highly ornamental areas of decoration. His later murals are characterized by precisely linear drawing and flat, decorative patterns of colour and gold leaf. He greatly influenced Oskar Kokoschka and Egon Schiele. See also Jugendstil.

Kline, Franz (b. 1910, Wilkes-Barre, Pa., U.S.—d. May 13, 1962, New York, N.Y.) U.S. painter. He studied art in London before settling in New York City. He became one of the leading artists of the Abstract Expres-

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SIONIST movement and was known for his use of inexpensive commercial paints and large house-painter's brushes to build graphic networks of rough bars of black paint on white backgrounds. He achieved a sense of majesty and power in such large-scale works as *Mahoning* (1956). In the late 1950s he introduced colour into his paintings.

Klinefelter syndrome Chromosomal disorder that occurs in one out of 500 males. With an extra X CHROMOSOME in each cell (XXY), patients look male, with firm, small TESTES, but they produce no sperm and may have enlarged breasts and buttocks and very long legs. TESTOSTERONE is low and pituitary reproductive hormones high. Intelligence is usually normal, but social adjustment can be difficult. Rarer variants cause additional abnormalities, including mental retardation. In the XX male syndrome, Y chromosome material has been transferred to another chromosome, causing changes typical of Klinefelter syndrome. All variants are treated with ANDROGENS.

Klinger, Max (b. Feb. 18, 1857, Leipzig, Ger.—d. July 5, 1920, near Naumburg) German painter, sculptor, and printmaker. He is known for his use of symbol, fantasy, and dreamlike situations, reflecting a late-19th-century awareness of psychological depths. His vivid, frequently morbid imaginings and his interest in the gruesome and grotesque can be seen in his Goyaesque etchings. He is best known for a series of pen-and-ink drawings called *Series upon the Theme of Christ and Fantasies upon the Finding of a Glove*, which tells a strange parable of a hapless young man and his obsessive involvement with a woman's elbow-length glove. He also created controversial treatments of religious themes. In his later years he worked primarily in sculpture. He had a deep influence on many artists, including EDVARD MUNCH, KÄTHE KOLLWITZ, MAX ERNST, and GIORGIO DE CHIRICO.

Klondike gold rush Canadian gold rush of the late 1890s. Gold was discovered on Aug. 17, 1896, near the confluence of the Klondike and YUKON rivers in western Yukon Territory. The news spread quickly, and by late 1898 more than 30,000 prospectors had arrived. Annual production peaked at $22 million worth of gold in 1900, and soon prospectors began moving on to Alaska. By the time mining ended in 1966, the area had yielded $250 million in gold.

Kluane \klü-'ò-nē\ **National Park** National park, southwestern Yukon, Canada. Located on the Alaskan border and established in 1972, it encompasses some 5,440,000 acres (2,201,500 hectares). Its focal point is Mount LOGAN, the highest peak in Canada. Kluane also has a large glacier system and abundant wildlife.

Kmart Corp. *formerly (until 1977)* **S.S. Kresge Co.** Major U.S. retail chain, marketing general merchandise primarily through discount and variety stores. It originated with a pair of 5-and-10-cent stores established in 1897 by S.S. KRESGE and a partner. Kresge's at first restricted the price of its merchandise to not more than 10 cents, but eventually to not more than one dollar. In 1962 Kresge's entered the large-scale discount retail market with construction of the first Kmart outside Detroit, Mich. With its success, the company expanded aggressively, erecting an average of 85 discount stores per year over the next two decades. In 1977 it became the second largest U.S. retailer. After introducing Martha Stewart as its spokesperson in 1987, Kmart became the exclusive retailer for the Martha Stewart Everyday brand in 1997. Kmart declared bankruptcy, however, in 2002 after years of increasingly damaging competition from the world's largest retailer, Wal-Mart, and other discount stores. It merged with SEARS, ROEBUCK AND CO. in 2005, becoming part of Sears Holdings Corporation.

Knesset \kə-'nes-ət\ (Hebrew: "Assembly") Unicameral national LEGISLATURE of Israel. The first Knesset opened in 1949. Its name and the number of its seats (120) are based on the Jewish assembly of biblical times; its traditions and organization are based on the Zionist Congress, the political system of the Jewish community in pre-Israel Palestine, and more loosely the British House of COMMONS. Its members are elected by proportional representation for four-year terms; candidates are chosen by their parties.

knight *French* **chevalier** \shə-'val-ˌyā\ *German* **Ritter** In the European Middle Ages, a formally professed cavalryman, generally a vassal holding land as a FIEF from the lord he served (see FEUDALISM). At about 7 a boy bound for knighthood became a page, then at 12 a damoiseau ("lordling"), varlet, or valet, and subsequently a shieldbearer or esquire. When judged ready, he was dubbed knight by his lord in a solemn ceremony. The Christian ideal of knightly behavior (see CHIVALRY) required devotion to the church, loyalty to military and feudal superiors, and preservation of personal honor. By the 16th century knighthood had become honorific rather than feudal or military.

Knight, Frank H(yneman) (b. Nov. 7, 1885, White Oak township, McLean county, Ill., U.S.—d. April 15, 1972, Chicago, Ill.) U.S. economist. He received his Ph.D. from Cornell University in 1916. He taught at the University of Chicago from 1927 to 1952; MILTON FRIEDMAN was one of the many students he influenced. His book *Risk, Uncertainty and Profit* (1921) distinguished between insurable and uninsurable RISKS and asserted that profit was the reward entrepreneurs earned for bearing uninsurable risk. His monograph "Economic Organization" is a classic exposition of MICROECONOMIC theory. He is considered the founder of the Chicago school of economics.

Knight Templar See TEMPLAR

Knights of Labor First important national labour organization in the U.S. Founded in 1869 by URIAH SMITH STEPHENS as the Noble Order of the Knights of Labor, it included both skilled and unskilled workers, and it proposed a system of workers' cooperatives to replace CAPITALISM. To protect its members from employers' reprisals, it originally maintained secrecy. Under TERENCE V. POWDERLY (1879–93) it favoured open ARBITRATION with management and discouraged strikes. National membership reached 700,000 in 1886. Strikes by militant groups and the HAYMARKET RIOT caused an antiunion reaction that rapidly reduced the organization's influence. A splinter group left to form the AFL (later AFL-CIO).

Knights of Malta *or* **Hospitallers** \'häs-ˌpi-tᵊl-ərz\ *in full (since 1961)* **Sovereign Military Hospitaller Order of St. John of Jerusalem, of Rhodes and of Malta** Religious order founded at Jerusalem in the 11th century to care for sick pilgrims. Recognized by the pope in 1113, the order built hostels along the routes to the Holy Land. The Hospitallers acquired wealth and lands and began to combine the task of tending the sick with waging war on Islam, eventually becoming a major military force in the CRUSADES. After the fall of the crusader states, they moved their headquarters to Cyprus and later to Rhodes (1309). They ruled Rhodes until it fell to the Turks in 1523; thereupon they moved to Malta, where they ruled until their defeat by NAPOLEON I in 1798. In 1834 they moved to their present headquarters in Rome.

knitting machine Machine for TEXTILE and garment production. Flatbed machines may be hand-operated or power-driven, and, by selection of colour, type of stitch, cam design, and Jacquard device (see JACQUARD LOOM), almost unlimited variety is possible. Modern circular machines may have 100 feeders, allowing each needle to pick up 100 threads per revolution. Both spring (invented c. 1589) and latch (invented 1847) needles are used, with the latter more common. Small bladelike units (sinkers) are inserted between every two needles to engage and hold the completed fabric. Machines may have pattern wheels controlling needle action to produce special stitches, and also a Jacquard mechanism. See also WILLIAM LEE.

Knopf \kə-'näpf, kə-'nȯpf**, Alfred A.** (b. Sept. 12, 1892, New York, N.Y., U.S.—d. Aug. 11, 1984, Purchase, N.Y.) U.S. publisher. He worked a short time in publishing before he and his wife, Blanche, founded their own firm, Alfred A. Knopf, Inc., in 1915. His appreciation of contemporary literature and his literary contacts helped make the firm renowned for publishing works of high literary quality. By the time of his death, authors published by the firm had won 16 Nobel and 27 Pulitzer prizes. In 1966 it became a subsidiary of RANDOM HOUSE, Inc. Knopf also published the *American Mercury* (1924–34), an influential periodical he cofounded with H.L. MENCKEN and George Jean Nathan.

Knossos \'nä-səs\ Ancient royal city, CRETE. It was King MINOS's capital and the centre of the MINOAN civilization. Settled by migrants from ASIA MINOR in the 7th millennium BC, it gave rise to a sophisticated BRONZE AGE culture. Two great palaces were built in the Middle Minoan period, the second c. 1720 BC after an earthquake leveled the city. About 1580 BC Minoan culture began to extend to mainland Greece, where it greatly influenced the MYCENAEAN culture. After its palace was destroyed by fire c. 1400 BC, it was reduced to town status, and Aegean political focus shifted to MYCENAE. Knossos was the site of the legendary labyrinth of DAEDALUS.

knot In cording, the interlacement of parts of one or more ropes, cords, or other pliable materials, commonly used to bind objects together. Knots

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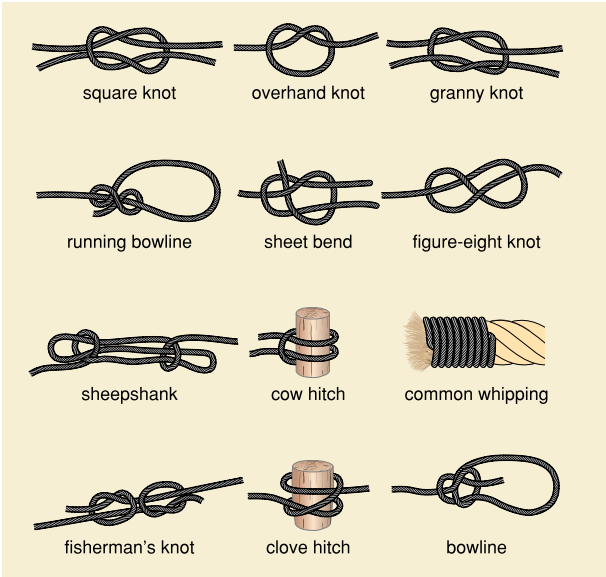
have existed from the time humans first used vines and cordlike fibers to bind stone heads to wood in primitive axes, and were also used in the making of nets and traps. Knot making became sophisticated when it began to be used in the ropes, or rigging, that controlled the sails of early sailing vessels, and thus became the province of sailors. Knots are still depended on by campers and hikers, mountaineers, fishermen, and weavers, among others.



Examples of common knots.
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knot theory Mathematical theory of closed curves in three-dimensional space. The number of times and the manner in which a curve crosses itself distinguish different KNOTS. The fewest possible crossings is three, for the overhand (trefoil) knot, which occurs in two mirror versions according to the directions in which the curve crosses itself. Knot theory has been used to understand both atomic and molecular structures (protein folding).

Know-Nothing Party *or* **American Party** U.S. political party of the 1850s. The party's precursor organization, the secret Order of the Star-Spangled Banner, was formed in New York City in 1849 from the anti-immigrant and anti-Roman Catholic movement, and lodges were soon established in other major cities. Members were instructed to reply to queries about their group with "I know nothing." As its membership and importance grew in the 1850s, the group slowly shed its clandestine character and took the official name American Party. The party called for restrictions on immigration and on naturalized citizenship. Many local and state candidates won offices in the 1852 election, and by 1855 there were 43 Know-Nothing members of Congress. At its 1856 convention the party split over the slavery issue; proslavery advocates left to join the Democrats and antislavery adherents joined the Republicans. By 1859 the party's influence was limited to the border states.

Knowles \'nōlz**, John** (b. Sept. 16, 1926, Fairmont, W.Va., U.S.—d. Nov. 29, 2001, Fort Lauderdale, Fla.) U.S. author. Educated at Yale University, he gained prominence for his first novel, *A Separate Peace* (1959), about the competitive friendship of two private-school students. Most of his novels, which include *Indian Summer* (1966), *Spreading Fires* (1974), and *Peace Breaks Out* (1981), are psychological examinations of characters caught in conflict between the wild and the pragmatic sides of their personalities.

Knox, Henry (b. July 25, 1750, Boston, Mass.—d. Oct. 25, 1806, Thomaston, Maine, U.S.) American Revolutionary officer. Active in the colonial militia, he joined the Continental Army and was sent by GEORGE WASHINGTON to transport British artillery captured in the Battle of TICONDEROGA. In mid-winter, he oversaw the transport of 120,000 lbs (55,000 kg) of artillery by oxen and horses over snow and ice 300 mi (480 km) to Boston. Promoted to general, he commanded the artillery in the battles of Monmouth and Yorktown, and in 1783 he succeeded Washington as commander of the army. He was secretary of war under the ARTICLES OF CONFEDERATION from 1785 to 1789 and served as the first U.S. secretary of war from 1789 to 1795.

Knox, John (b. c. 1514, near Haddington, East Lothian, Scot.—d. Nov. 24, 1472, Edinburgh) Scottish clergyman, leader of the Scottish Reformation and founder of Scottish PRESBYTERIANISM. Probably trained for the priesthood at the University of St. Andrews, he was ordained in 1540. He joined a group of Protestants who fortified St. Andrews Castle, but they were captured by French Catholics and carried away into slavery in 1547. Released through English intervention in 1549, he spent four years preaching in England, where he influenced developments in the Church of England. With the accession of the Catholic MARY I, he fled to the Continent. He served as pastor at Frankfurt am Main and Geneva until his return to Scotland in 1559. In England, ELIZABETH I made common cause with the Scottish Presbyterians, lest the French gain control of Scotland to support its Catholic monarch, MARY, QUEEN OF SCOTS. Knox survived conflicts with Mary and spent the rest of his life in setting up the Presbyterian church.

John Knox, engraving from *Icones*, by T. Beza, 1580.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Knox, Philander Chase (b. May 6, 1853, Brownsville, Pa., U.S.—d. Oct. 12, 1921, Washington, D.C.) U.S. lawyer and politician. After admission to the bar in 1875 he became a successful corporation lawyer in Pittsburgh. As legal counsel for the Carnegie Steel Company, he helped organize the UNITED STATES STEEL CORP. (1900–01). Appointed attorney general by Pres. THEODORE ROOSEVELT in 1901, he initiated several suits under the SHERMAN ANTITRUST ACT. He served in the U.S. Senate from 1904 to 1909. As secretary of state (1909–13) under Pres. WILLIAM H. TAFT, he helped develop the foreign policy of expanded U.S. investment later criticized as DOLLAR DIPLOMACY. During his second term in the Senate (1917–21), he opposed the formation of the LEAGUE OF NATIONS.

Knoxville City (pop., 2000: 173,890), eastern Tennessee, U.S. In 1786, Gen. James White, a former officer in the American Revolutionary army, established a frontier outpost near the Tennessee River. In 1791 White's Fort was renamed Knoxville for HENRY KNOX. It served as the capital of the state of Tennessee from 1796 to 1812 and from 1817 to 1818. During the AMERICAN CIVIL WAR, it was occupied by the Confederates until 1863. It is the seat of the University of Tennessee and Knoxville College as well as the headquarters of the TENNESSEE VALLEY AUTHORITY.

Knudsen \'knüd-sən, 'nüd-sən**, William Signius** *orig.* **Signius Wilhelm Poul Knudsen** (b. March 25, 1879, Copenhagen, Den.—d. April 27, 1948, Detroit, Mich., U.S.) Danish-U.S. industrialist. He immigrated to the U.S. in 1900. In 1914 he began supervising FORD MOTOR CO. assembly plants and directed the firm's construction of submarine patrol boats and other war matériel in World War I. He joined GENERAL MOTORS CORP. in 1922 and became president in 1937. He was appointed director of industrial production for the National Defense Research Committee and directed production of war matériel as head of the U.S. Office of Production Management.

Knut See CANUTE THE GREAT

Knuth \kə-'nüth**, Donald E(rvin)** (b. Jan. 10, 1938, Milwaukee, Wis., U.S.) U.S. computer scientist. Knuth earned a Ph.D. in mathematics in 1963 from the California Institute of Technology. A pioneer in computer science, he took time out during the 1970s from writing his highly acclaimed multivolume *The Art of Computer Programming* in order to develop TeX, a document-preparation system. Because of its precise control of special characters and mathematical formulas, TeX and its variants soon became standard for submitting typeset-ready scientific and mathematical research papers for publication. He has received many awards

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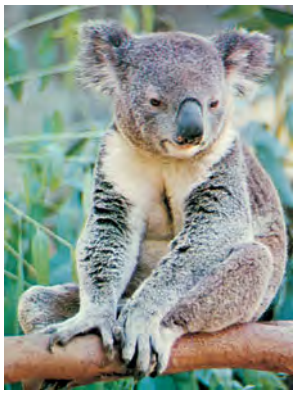
and honours, including the Kyoto Prize (1996), the Turing Award (1974), and the National Medal of Science (1979).

Ko Hung See GE HONG

koala Tree-dwelling MARSUPIAL (*Phascolarctos cinereus*) of coastal eastern Australia. About 24–33 in. (61–85 cm) long and tailless, the koala has a stout, pale gray or yellowish body; broad face; big, round, leathery nose; small, yellow eyes; and fluffy ears. Its feet have strong claws and some opposable digits. The koala feeds only on EUCALYPTUS leaves. The single offspring remains in the rearward-opening pouch for up to seven months. Koala populations have dwindled seriously, formerly because they were killed for their fur and now because of loss of habitat and the spread of disease.



Koala (*Phascolarctos cinereus*).
ANTHONY MERCIECA FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

koan \'kō-ˌän\ In ZEN Buddhism, a brief paradoxical statement or question used as a discipline in MEDITATION. The effort to solve a koan is designed to exhaust the analytic intellect and the will, leaving the mind open for response on an intuitive level. There are about 1,700 traditional koans, which are based on anecdotes from ancient Zen masters. They include the well-known example "When both hands are clapped a sound is produced; listen to the sound of one hand clapping."

kobdas \'gō-aù-ˌdēs\ Drum used for inducing trances and for DIVINATION by Sami SHAMANS. It consisted of a wooden frame over which a reindeer hide was stretched; the hide was covered with designs representing spirits or deities. In divination, the drum was beaten with a hammer made of reindeer antler, causing a triangular piece of bone or metal called an *arpa* to move along its surface. From these movements the shaman divined the nature of an illness or learned the location of lost or stolen objects.

Kōbe \'kō-bā\ City (pop., 2000 prelim.: 1,493,595), west-central HONSHU, Japan. It is situated on Ōsaka Bay and occupies a narrow shelf of land between mountains and the sea. With neighbouring cities ŌSAKA and KYŌTO, it is the centre of a major industrial zone. Until the MEIJI RESTORATION it was only a fishing village, but it grew rapidly in the late 19th century. It was severely bombed during World War II and was entirely rebuilt after 1945. It suffered a major earthquake in 1995. Kōbe is an important Japanese port and a centre of shipbuilding and steel production; it is the seat of Kōbe University.

Koblenz *or* **Coblenz** \'kō-ˌblents\ *ancient* **Confluentes** City (pop., 2002 est.: 107,730), western Germany. Situated at the junction of the RHINE and MOSELLE rivers, it was founded by the Romans in 9 BC. It was a Frankish royal seat in the 6th century AD and was chartered as a city in 1214. The French occupied the city in 1794, and it passed to Prussia in 1815. After World War I, Koblenz was the seat of the Inter-Allied Control Commission for the Rhineland (1919–29). Devastated in World War II, it has since been restored. It is a centre for the German wine trade; other industries include tourism and the manufacture of furniture, clothing, and chemicals.

Kobo Daishi See KUKAI

Kobuk \kō-'bůk\ **Valley National Park** National park, northwestern Alaska, U.S. Located north of the Arctic Circle, it was made a national monument in 1978 and a national park in 1980. Occupying an area of 1,750,421 acres (708,370 hectares), it preserves the Kobuk River valley, including the Kobuk and Salmon rivers, forest lands, and the Great Kobuk Sand Dunes. Archaeological sites reveal more than 10,000 years of human habitation. It protects caribou migration routes; other wildlife include grizzly and black bears, foxes, moose, and wolves.

Koch \'käch**, Ed(ward Irving)** (b. Dec. 12, 1924, New York, N.Y., U.S.) U.S. politician. After serving in the army during World War II, he graduated from New York University Law School. He was elected to the U.S. Congress in 1968, and in 1978 he was elected to the first of three terms as mayor of New York City. Koch is credited with bringing fiscal stability to the insolvent city and with instituting merit selection of city judges. His brash forthrightness made him an entertaining and popular figure, but his demeanour and his rhetoric increasingly came to be seen as unkind and divisive and eventually resulted in his defeat. He later became a columnist and talk-show host.

Koch \'kȯk\,\ *English* \'kȯk**, (Heinrich Hermann) Robert** (b. Dec. 11, 1843, Clausthal, Hannover—d. May 27, 1910, Baden-Baden, Ger.) German physician. As the first to isolate the ANTHRAX bacillus, observe its life cycle, and develop a preventive inoculation for it, he was the first to prove a causal relationship between a bacillus and a disease. He perfected pure-culture techniques, based on LOUIS PASTEUR's concept. He isolated the TUBERCULOSIS organism and established its role in the disease (1882). In 1883 he discovered the causal organism for CHOLERA and how it is transmitted and also developed a vaccination for RINDERPEST. Koch's postulates remain fundamental to pathology: the organism should always be found in sick animals and never in healthy ones; it must be grown in pure culture; the cultured organism must make a healthy animal sick; and it must be reisolated from the newly sick animal and recultured and still be the same. Awarded a Nobel Prize in 1905, he is considered a founder of bacteriology.

Köchel \'kœk-əl,\ *English* \'kər-shəl**, Ludwig (Alois Ferdinand) von** (b. Jan. 14, 1800, Stein, near Krems, Austria—d. June 3, 1877, Vienna) Austrian scholar and musicologist. After gaining a law degree, he tutored children of wealthy families and traveled, researching books on a number of different topics, including botany, mineralogy, and music. He is best known for his 1862 thematic catalog of Mozart's works (which are still identified by their "K numbers"), a monument of music scholarship. He also edited Ludwig van BEETHOVEN's letters.

Kocher \'kȯ-kər**, Emil Theodor** (b. Aug. 25, 1841, Bern, Switz.—d. July 27, 1917, Bern) Swiss surgeon. He was the first surgeon to remove the thyroid gland to treat GOITRE (1876). He later found that total removal could cause a state resembling cretinism, but that leaving part of the gland in place made this temporary. He introduced a surgical method for reducing shoulder dislocations, as well as many new surgical techniques, instruments, and appliances. A type of forceps and a gallbladder surgery incision named for him are still used. He adopted JOSEPH LISTER's principles of complete asepsis in surgery. In 1909 he won a Nobel Prize.

Kodak Co., Eastman See EASTMAN KODAK CO.

Kodály \'kō-ˌdī**, Zoltán** (b. Dec. 16, 1882, Kecskemét, Hung.—d. March 6, 1967, Budapest) Hungarian composer, ethnomusicologist, and music educator. He played various instruments as a child and studied simultaneously at the university and the Budapest Academy of Music, earning diplomas in composition and teaching and a doctorate in Hungarian folk song. With BÉLA BARTÓK, a lifelong friend, he compiled the important *Hungarian Folk Songs* (1906), and he continued to make field recordings until World War I made it impossible. He came to international attention with his *Psalmus hungaricus* (1923) and the opera *Háry János* (1926). Kodály created an individual style that was derived from Hungarian folk music, contemporary French music, and the religious music of the Italian Renaissance. He devoted much of his energy to developing a school music curriculum that would develop children's musicality, and the "Kodály method" remains in wide use.

Kodiak Island Island (pop., 2000: 13,913), Alaska, U.S. Lying in the Gulf of ALASKA, it is 100 mi (160 km) long and 10–60 mi (16–96 km) wide and has an area of 3,588 sq mi (9,293 sq km). The Kodiak National Wildlife Refuge covers 75% of the island and is the habitat of the Kodiak bear. Discovered in 1763 by a Russian fur trader, the island, known as Kikhtak, became the site in 1784 of the first Russian colony in America. Russian control ended in 1867; the island was renamed Kodiak in 1901. In 1964 a destructive earthquake lowered the island by 5–6 ft (1.5–1.8 m).

Koehler, Ted See Harold ARLEN

Koestler \'kest-lər**, Arthur** (b. Sept. 5, 1905, Budapest, Hung.—found dead March 3, 1983, London, Eng.) Hungarian-British novelist, journalist, and critic. He is best known for *Darkness at Noon* (1940); a political novel examining the moral danger in a totalitarian system that sacrifices means to an end, it reflects the events leading to his break with the Communist Party and his experience as a correspondent imprisoned by the fascists in the SPANISH CIVIL WAR. He also wrote of his disillusionment with

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communism in the essay collection *The God That Failed* (1949). His later works, mostly concerning science and philosophy, include *The Act of Creation* (1964) and *The Ghost in the Machine* (1967). Suffering from leukemia and Parkinson's disease and believing in voluntary euthanasia, he died with his wife in a suicide pact.

Koguryŏ \ˌkō-gůr-ˈyō\ Largest of the three kingdoms into which ancient Korea was divided until 668. Tradition sets its founding at 37 BC, but modern historians believe the tribal state was formed in the 2nd century BC. Eventually the northern half of the Korean peninsula, the Liaodong Peninsula, and much of Manchuria were under Koguryŏ's rule. Buddhism, Confucianism, and Daoism all influenced the kingdom, which fell to the allied forces of China's TANG DYNASTY and the southern Korean kingdom of SILLA in 668. Numerous surviving tomb paintings give a good picture of the life, ideology, and character of Koguryŏ's forceful, horse-riding northern people. See also PARHAE.

Koh-i-noor \ˈkō-ə-ˌnůr\ Famous Indian diamond with a history dating perhaps as far back as the 14th century. Originally a 191-carat stone that lacked fire (flashes of colour), it was recut to 109 carats in 1852 in an attempt to enhance its fire and brilliance. The Koh-i-noor (Hindi for "mountain of light") was acquired by the British in 1849 and became part of the CROWN JEWELS of Queen Victoria. It was incorporated into the state crown fashioned for Queen Elizabeth, consort of George VI, at her coronation in 1937.

kohen See COHEN

Kohima \ˈkō-hə-mə\ Town (pop. 2001 prelim.: 78,584), capital of NAGALAND state, northeastern India. It lies near the northern border of MANIPUR state in the NAGA HILLS. It marked the farthest point of the Japanese advance into British India during World War II. It was held briefly by Japanese troops during the Manipur campaign in 1944 but was retaken by the British. It is the site of Nagaland University.

Kohl \ˈkōl**, Helmut** (b. April 3, 1930, Ludwigshafen am Rhein, Ger.) Chancellor of West Germany (1982–90) and of reunified Germany (1990–98). After earning a doctorate at the University of Heidelberg, he was elected to the Rhineland-Palatinate legislature and became the state's minister president (1969). In 1973 he was elected chair of the CHRISTIAN DEMOCRATIC UNION, and in 1982 he became Germany's chancellor. Kohl's centrist policies included modest cuts in government spending and strong support for West German commitments to NATO. After the fall of the BERLIN WALL in 1989, Kohl concluded a treaty with East Germany that unified the two countries' economic systems. Absorption of the moribund East German economy proved difficult, and Kohl's government had to increase taxes and cut government spending after unification. In 1998 his coalition government with the Free Democratic Party was defeated by the Social Democrats under GERHARD SCHRÖDER. Revelations of serious financial irregularities during Kohl's chancellorship soon emerged, tainting his reputation and weakening his party.

Kohler, Kaufmann (b. May 10, 1843, Fürth, Bavaria—d. Jan. 28, 1926, New York, N.Y., U.S.) German-born U.S. rabbi. He was brought up in Orthodox Judaism but soon came under the influence of Reform leader ABRAHAM GEIGER. His early writings approached biblical texts critically and led to his exclusion from the German rabbinate. He emigrated to the U.S. in 1869 and served Reform congregations in Detroit, Chicago, and New York City. In 1885 he was the driving force in formulating the PITTSBURGH PLATFORM. He served as president of Hebrew Union College in Cincinnati 1903–21. His chief work was *Jewish Theology* (1918).

Köhler \ˈkō-lər**, Wolfgang** (b. Jan. 21, 1887, Tallinn, Estonia, Russian Empire—d. June 11, 1967, Enfield, N.H., U.S.) German-U.S. psychologist. His studies of problem solving by chimpanzees (*The Mentality of Apes*, 1917), in which he examined learning and perception as structured wholes, led to a radical revision of existing theory, and Köhler became a key figure in the development of GESTALT PSYCHOLOGY. He continued his research during the 1920s and early '30s at the University of Berlin, publishing *Gestalt Psychology* (1929, rev. 1947), but emigrated from Germany to the U.S. after the Nazi takeover and taught at Swarthmore College (1935–55). His other writings include *Dynamics in Psychology* (1940), *The Place of Values in a World of Facts* (1938), and *The Task of Gestalt Psychology* (1969).

kohlrabi \kōl-ˈrä-bē\ Form of CABBAGE (*Brassica oleracea*, Gongylodes group) of the MUSTARD FAMILY, which originated in Europe. Its most distinctive feature is the greatly enlarged, globular to slightly flattened stem that grows just above the soil. Its flesh resembles that of a turnip but is sweeter and milder. Low in calories, kohlrabi is an excellent source of vitamin C, minerals, and dietary bulk. The young tender leaves may be eaten as greens; the thickened stem is served raw or cooked. Though not widely grown commercially, it is popular in some regions.

Kohlrabi (*Brassica oleracea*)
W.H. HODGE

koine \kȯi-ˈnā\ Newly formed compromise language that usually arises from a leveling of features distinguishing dialects of a common base language, or of features distinguishing several closely related languages. The new language is hence deregionalized and does not reflect social or political dominance of any one group of speakers. The classical example of a koine (as well as the source of the term) is Hellenistic GREEK, which developed from Attic Greek through replacement of the most distinctively Attic features by features of Ionic or other dialects. A koine may serve as a LINGUA FRANCA and often forms the basis of a new standard language.

Koizumi Jun'ichirō (b. Jan. 8, 1942, Yokosuka, Kanagawa prefecture, Japan) Third-generation Japanese politician who became prime minister in 2001. Both Koizumi's father and grandfather served in the DIET (parliament). He ran unsuccessfully for his father's seat after the latter's death in 1969 but was elected in 1971. He held ministerial posts in 1988–89, 1992–93, and 1996–98. After unsuccessful bids for the presidency of the LIBERAL-DEMOCRATIC PARTY in 1995 and 1998, he won in April 2001 and was soon confirmed as prime minister. An unconventional advocate of reform, Koizumi appointed a cabinet that included a record five women. His economic policies included privatizing the country's postal savings system, reducing government spending, and ending the practice of supporting failing businesses.

Kokand See QOʿQON

Koko Nor *Chinese* **Qinghai Hu** *or* **Ch'ing-hai** \ˈchiŋ-ˈhī\ **Hu** Lake, QINGHAI province, China. The largest drainless mountain lake of Central Asia, it is 65 mi (105 km) long and 40 mi (64 km) wide; its surface area fluctuates seasonally between 1,600 and 2,300 sq mi (4,200 and 6,000 sq km). It is located in the Nan Mountains (Nan Shan) at an elevation of 10,515 ft (3,205 m). Formed by melting glaciers during the Late Pleistocene Epoch, the lake today receives the waters of some two dozen rivers and streams.

Kokoschka \kə-ˈkȯsh-kə**, Oskar** (b. March 1, 1886, Pöchlarn, Austria—d. Feb. 22, 1980, Villeneuve, Switz.) Austrian painter and writer. He studied and taught at the Vienna School of Arts and Crafts but was dissatisfied because the school omitted study of the human figure, his primary artistic interest. His early paintings were rendered in delicate, agitated lines and relatively naturalistic colours. After c. 1912 he became a leading exponent of EXPRESSIONISM; his portraits came to be painted with increasingly broader strokes of more varied colour and heavier outlines. While recovering from a wound received in World War I, he wrote, produced, and staged three plays; his *Orpheus and Eurydice* (1918) became an opera by ERNST KRENEK (1926). The landscapes he produced during 10 years of teaching and travel mark the second peak of his career. Shortly before World War II he fled to London, where his paintings became increasingly political and antifascist. He continued his political art after moving to Switzerland in 1953.

Kol Nidre \ˈkȯl-ˈni-drā\ Prayer sung in Jewish synagogues at the start of services on the eve of YOM KIPPUR. The prayer begins with an expression of repentance for all unfulfilled vows, oaths, and promises to God during the previous year. It was in use as early as the 8th century, perhaps as a means of annulling oaths forced on Jews by their Christian persecutors. The melody used by Ashkenazi Jews became famous when the composer MAX BRUCH used it in his *Kol Nidrei* (1880).

Kola nut (*Cola nitida*)
W.H. HODGE

kola nut *or* **cola nut** Caffeine-containing NUT of two evergreen trees

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(*Cola acuminata* and *C. nitida*) of the cocoa family (Sterculiaceae), native to tropical Africa and cultivated extensively in the New World tropics. The trees grow to 60 ft (18.3 m) in height and have oblong leathery leaves, yellow flowers, and star-shaped fruit. The nut has been used in medicines and in soft drinks, though American "colas" today instead use synthetic flavorings that mimic its taste. Kola nuts are also used where grown as a medium of exchange or are chewed to diminish sensations of hunger and fatigue, to aid digestion, and to combat intoxication, hangover, and diarrhea.

Kola Peninsula Promontory, northern Russia. It separates the White and Barents seas; it occupies 40,000 sq mi (100,000 sq km) and extends across the Arctic Circle. It consists of rock more than 570 million years old. The winter climate is severe; the largest town is the ice-free port of Murmansk on the northern coast. It has the world's largest deposits of apatite, used for fertilizer production.

Kolbe \'kōl-bə**, Saint Maksymilian Maria** *orig.* **Rajmund Kolbe** (b. Jan. 8, 1894, Zduńska Wola, near Lodz, Russian Empire—d. Aug. 14, 1941, Auschwitz; canonized Oct. 10, 1982; feast day August 14) Polish Franciscan priest martyred by the Nazis. Ordained in 1918, he founded the City of Mary Immaculate religious centre (1927) and became its superior, as well as director of Poland's chief Roman Catholic publishing complex. He was arrested by the Gestapo in 1939 and again in 1941 on charges of aiding Jews and the Polish underground. He was imprisoned at Warsaw, then shipped to Auschwitz, where he volunteered his life in place of that of a condemned inmate.

Kolchak \kōl-'chäk**, Aleksandr (Vasilyevich)** (b. Nov. 16, 1874, St. Petersburg, Russia—d. Feb. 7, 1920, Irkutsk, Siberia, Soviet Russia) Russian naval officer and political leader. He was forced to resign as commander of the fleet in the Black Sea after the Russian Revolution of 1917 began. After a coup d'état in Omsk in 1918, he gained power among the counterrevolutionary White Russians, and in 1919 he was recognized by them as supreme ruler of Russia. After initial successes against the Red Army, his armies were routed in 1919; the next year he was captured and executed by the Bolsheviks.

Kolkata *formerly* **Calcutta** City (pop., 2001: city, 4,580,546; metro. area, 13,205,697), northeastern India. Capital of West Bengal state, former capital (1772–1912) of British India, and India's second largest metropolitan area, it is located on the Hugli (Hooghly) River, about 90 mi (145 km) from the river's mouth. The British established a trading centre at the site in 1690, which grew and became the seat of the Bengal presidency in 1707. It was captured by the nawab of Bengal, who in 1756 imprisoned the British there (in a prison that was later known as the Black Hole); the city was retaken by the British under Robert Clive. It was an extremely busy 19th-century commercial centre, but it began to decline with the removal of the colonial capital to Delhi in 1912. The decline continued when Bengal was partitioned between India and Pakistan in 1947 and when Bangladesh was created in 1971. The flood of refugees from those political upheavals boosted the city's population but also significantly added to its widespread poverty. Despite its problems, Kolkata remains the dominant urban area of eastern India and a major educational and cultural centre.

Kollontay \ˌkä-lən-'tī**, Aleksandra (Mikhaylovna)** *orig.* **Aleksandra Mikhaylovna Domontovich** (b. March 31, 1872, St. Petersburg, Russia—d. March 9, 1952, Moscow, Russia, U.S.S.R.) Russian administrator and diplomat. As the first commissar for public welfare in the Bolshevik government (1917), she advocated simplifying marriage and divorce procedures and improving the status of women. She became the first woman to serve as an accredited minister to a foreign country when she was named minister to Norway (1923–25, 1927–30); she later served as minister to Mexico (1926–27) and Sweden (1930–45). In 1944 she conducted the negotiations that ended Soviet-Finnish hostilities in World War II.

Kollwitz \'kōl-ˌvits,\ *English* \'kōl-ˌwits**, Käthe** *orig.* **Käthe Schmidt** (b. July 8, 1867, Königsberg, East Prussia—d. April 22, 1945, near Dresden, Ger.) German graphic artist and sculptor. She studied painting in Berlin and Munich but devoted herself primarily to etchings, drawings, lithographs, and woodcuts. She gained firsthand knowledge of the miserable conditions of the urban poor when her physician husband opened a clinic in Berlin. She became the last great practitioner of German Expressionism and an outstanding artist of social protest. Two early series of prints, *Weavers' Revolt* (1895–98) and *Peasants' War* (1902–08), portray the plight of the oppressed with the powerfully simplified, boldly accentuated forms that became her trademark. After her son died in World War I, she created a cycle of prints dedicated to the theme of a mother's love. She was the first woman elected to the Prussian Academy of Arts, where she was head of the Master Studio for Graphic Arts (1928–33). The Nazis banned her works from exhibition. The bombing of her home and studio in World War II destroyed much of her work.

Self-Portrait with Hand on Forehead, etching by Käthe Kollwitz, 1910; in the National Gallery of Art, Washington, D.C.

B-7792 "SELF-PORTRAIT WITH HAND ON FOREHEAD," KÄTHE KOLLWITZ, NATIONAL GALLERY OF ART, WASHINGTON, D.C., ROSENWALD COLLECTION

Köln See Cologne

Kölreuter \'kœl-ˌrȯi-tər**, Josef Gottlieb** (b. April 27, 1733, Sulz, Württemberg—d. Nov. 12, 1806, Karlsruhe, Baden) German botanist. A pioneer in the study of plant hybrids, he was the first to develop a scientific application of the discovery (made in 1694 by Rudolph Camerarius) of sex in plants. Cultivating plants in order to study their fertilization and development, he performed experiments, particularly with the tobacco plant, that included artificial fertilization and the production of fertile hybrids between plants of different species. His results foreshadowed the work of Gregor Mendel. Kölreuter recognized the importance of insects and wind as agents of pollen transfer. He applied Carolus Linnaeus's sexual system of classification to lower plant forms. His work was not recognized until long after his death.

Kolyma \ˌkä-li-'mä\ **River** River, northeastern Siberia, eastern Russia. Rising in the Kolyma Mountains and emptying in the East Siberian Sea, it is 1,323 mi (2,129 km) long. It is navigable upstream to Verkhne-Kolymsk but is ice-free only from June to September. Under Joseph Stalin the goldfields of the upper Kolyma River valley held labour camps where more than one million prisoners died (1932–54).

Komarov \kə-mə-'rȯf**, Vladimir (Mikhaylovich)** (b. March 16, 1927, Moscow, Russia, U.S.S.R.—d. April 24, 1967, Kazakstan) Soviet cosmonaut. He joined the Soviet air force at age 15, became a pilot in 1949, and piloted Voskhod 1, the first craft to carry more than one human into space, in 1964. On his 1967 flight in Soyuz 1 he became the first Russian to have made two spaceflights. During the 18th orbit he attempted a landing; he died when the spacecraft reportedly became entangled in its main parachute at an altitude of several miles and fell back to Earth.

Komodo \kə-'mō-dō\ **dragon** Largest living lizard (*Varanus komodoensis*), a member of the monitor lizard family Varanidae. They live on Komodo Island and a few neighbouring islands in Indonesia. Driven almost to extinction, they are now protected. Komodos grow to 10 ft (3 m) long, weigh up to 300 lb (135 kg), and may live up to 100 years. They

Komodo dragon (*Varanus komodoensis*).

JAMES A. KERN

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dig a burrow as deep as 30 ft (9 m). Carrion is their main diet, but adults may eat smaller Komodos. They can run swiftly and occasionally attack and kill humans.

Komsomol \'käm-sə-ˌmäl\ Organization in the former Soviet Union for young people aged 14–28 years. Primarily a political organ for spreading Communist teachings and preparing future members of the Communist Party, it was organized in 1918. Members participated in health, sports, education, and publishing activities and various industrial projects. They were frequently favoured over nonmembers for employment, scholarships, and the like. Its membership reached its height, about 40 million, in the 1970s and early 1980s. It disbanded with the collapse of Soviet communism in the early 1990s.

Konbaung dynasty See Alaungpaya dynasty

Kondratev \kən-'drät-yəf**, Nikolay (Dmitriyevich)** *also spelled* **Kondratieff** (b. March 4, 1892—d. 1938?) Russian economist and statistician. In the 1920s he helped develop the first Soviet Five-Year Plan, for which he analyzed factors that would stimulate Soviet economic growth. After criticizing Joseph Stalin's plan for the total collectivization of agriculture, he was dismissed from his post as director of the Institute for the Study of Business Activity in 1928. He was arrested in 1930 and sentenced to prison; his sentence was reviewed in 1938, and he received the death penalty, which was likely carried out the same year. He is noted for his theory of 50-year business cycles known as Kondratev's waves. See also Gosplan.

Konev \'kȯ-nyəf**, Ivan (Stepanovich)** (b. Dec. 28, 1897, Lodeino, near Veliky Ustyug, Russia—d. May 21, 1973, Moscow, Russia, U.S.S.R.) Soviet general in World War II. When the Germans invaded the Soviet Union in 1941, Konev led the first counterattack of the war. He defeated Heinz Guderian's advance on Moscow and halted large German forces in 1942 and 1943. In 1944 his army was the first to march onto German soil; with the forces of Georgy K. Zhukov, it captured Berlin. After the war he served as commander in chief of Soviet ground forces (1946–50) and later of Warsaw Pact forces (1955–60).

Kong River River, Laos and Cambodia. Rising in central Vietnam southwest of Hue, it flows southwest for 300 mi (480 km), passing through southern Laos. It enters Cambodia east of the Mekong River and continues southwest across the northern Cambodian plateau to later join the Mekong.

Kongo *or* **Bakongo** Bantu-speaking peoples living along the Atlantic coast in Congo (Kinshasa), Congo (Brazzaville), and Angola. They engage in subsistence agriculture and raise cash crops (including coffee, cacao, and bananas); many live and work in towns. Descent is matrilineal, and most villages are independent of their neighbours. A Kongo kingdom existed from the 14th century; its wealth came from trade in ivory, hides, slaves, and a shell currency. It broke up into warring chiefdoms in 1665.

Königgrätz \'kœ-nik̲-ˌgrets**, Battle of** *or* **Battle of Sadowa** \'sä-dō-ˌvä\ (July 3, 1866) Decisive battle in the Seven Weeks' War between Prussia and Austria, fought at Sadowa, near Königgrätz, Bohemia (now Hradec Králové, Czech Republic). The Austrians, equipped with muzzle-loading rifles and relying heavily on the bayonet charge, were led by Ludwig von Benedek (1804–1881). The Prussians, led by Helmuth von Moltke, were armed with breech-loading needle guns; they used railroad transport to move their troops, a first in European warfare. The Prussian victory led to Austria's exclusion from a Prussian-dominated Germany.

Königsberg See Kaliningrad

Konkouré \ˌkȯŋ-kü-'rā\ **River** River, west-central Guinea, West Africa. Flowing west for 188 mi (303 km) to empty into the Atlantic Ocean, it is a source of hydroelectric power. Once a major hindrance to transportation between Conakry and the towns of Boffa and Boké, it is now bridged at Ouassou.

Konoe Fumimaro \kə-'nȯ-ā-ˌfü-mē-'mä-rō\ (b. Oct. 12, 1891, Tokyo, Japan—d. Dec. 16, 1945, Tokyo) Political leader and prime minister of Japan (1937–39, 1940–41), who tried unsuccessfully to restrict the power of the military and to keep Japan's war with China from widening into a world conflict. In 1941 he signed a nonaggression pact with the Soviet Union and participated in U.S.-mediated negotiations to try to resolve the conflict with China. Later that year he resigned over differences with Tōjō Hideki. During the war he was forced to leave the centre of politics; afterward he was a deputy minister in the Higashikuni cabinet. He committed suicide after being served an arrest warrant on suspicion of being a war criminal.

Konya \'kȯn-yä\ *ancient* **Iconium** City (pop., 1997: 623,333), central Turkey. First settled in the 3rd millennium BC, it is one of the oldest urban centres in the world. Influenced by Greek culture from the 3rd century BC, Iconium came under Roman rule by 25 BC. It was taken by the Seljūq dynasty c. 1072. Renamed Konya, it was a major cultural centre in the 13th century and was home to the Sufi brotherhood known as "whirling dervishes." Later ruled by the Mongols, it was annexed to the Ottoman Empire c. 1467. It declined during Ottoman rule but revived after the Istanbul-Baghdad railway opened in 1896. An important industrial centre, it is also a trade centre for the agricultural area surrounding it.

kookaburra *or* **laughing jackass** Eastern Australian species (*Dacelo gigas*) of forest kingfisher (subfamily Daceloninae). Its call, which sounds like fiendish laughter, can be heard very early in the morning and just after sunset. A gray-brown, woodland-dwelling bird, it reaches a length of 17 in. (43 cm), with a 3.2–4-in. (8–10-cm) beak. In its native habitat it eats invertebrates and small vertebrates, including venomous snakes. In western Australia and New Zealand, where it has been introduced, it has been known to attack chickens and ducklings.

Kookaburra (*Dacelo gigas*)
BUCKY REEVES FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Koolhaas \'kōl-ˌhäs**, Rem** (b. Nov. 17, 1944, Rotterdam, Neth.) Dutch architect. After studying architecture in London and working in New York City, in 1975 he opened his own firm in Rotterdam and London. He first achieved recognition with his book *Delirious New York* (1978), which profiled Manhattan's architectural development, suggesting that it was an organic process created through a variety of cultural forces. His best-known projects are large-scale structures, including the Kunsthal in Rotterdam, the Grand Palais exhibition hall in Lille, Fr., and a master plan for the MCA/Universal Studios site in Los Angeles. His book *S, M, L, XL* (1996) addressed the theme of size. In 1998 he won the design competition for a new campus centre at the Illinois Institute of Technology. He was awarded the Pritzker Architecture Prize in 2000.

Kooning, Willem de See Willem de Kooning

Kootenay National Park National park, southeastern British Columbia, Canada. Centred around the Kootenay River, the park occupies the western slopes of the Rocky Mountains, adjacent to Banff and Yoho national parks. Established as a national park in 1920, it covers 543 sq mi (1,406 sq km). From prehistoric times, the area was a major north-south travel route. Pictographs indicate that humans settled near the hot springs 11,000–12,000 years ago. The park's scenery is characterized by snowcapped peaks, glaciers, cascades, canyons, and verdant valleys. Wildlife includes wapiti (elk), moose, deer, bighorn sheep, and mountain goats.

Kootenay \'kü-tˀn-ˌā\ **River** River, western North America. Rising in the Rocky Mountains in Alberta, Can., it flows south through British Columbia. It continues into Montana and then turns north into Idaho, U.S., and back into British Columbia, where it joins the Columbia River, having traveled a course of 485 mi (780 km).

Köprülü \kœ-prü-'lü**, Fazıl Ahmed Pasha** (b. 1635, Vezirköprü, Anatolia, Ottoman Empire—d. Nov. 3, 1676, near Çorlu, Thrace) Grand vizier (1661–76) under the Ottoman sultan Mehmed IV. He started his career as a scholar but entered the civil service when his father became grand vizier. Having made the army more efficient, he campaigned successfully against Austria (1663), the Venetian republic in Crete (1669), and Poland (1672–76). He died during his last campaign.

Koraïs \kȯ-'rä-ēs**, Adamántios** (b. April 27, 1748, Smyrna, Anatolia—d. April 6, 1833, Paris, France) Greek scholar. He studied medicine in France but moved to Paris to pursue a literary career. He hoped to awaken the national aspirations of his countrymen and to increase awareness of the Greek heritage. His advocacy of a revived classicism had a great

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influence on Greek language and culture. His anthologies include the *Library of Greek Literature*, 17 vol. (1805–26), and the *Parerga*, 9 vol. (1809–27). Largely through his *Atakta* (composed 1828–35), the first Modern Greek dictionary, he created a new Greek literary language by combining elements of vernacular (Demotic) with Classical Greek.

Koran See Qur'ān

Korbut, Olga (Valentinovna) (b. May 16, 1955, Grodno, Belorussia, U.S.S.R.) Soviet gymnast. Korbut first competed in the U.S.S.R. championships in 1969. Appealingly diminutive, with a captivating smile, she was the first person ever to do a backward aerial somersault on the balance beam and the first to perform a backward release move on the uneven parallel bars. In the 1972 Olympic Games she won three gold medals (balance beam, floor exercises, and as a member of the winning U.S.S.R. team) and a silver medal (uneven parallel bars). In the 1976 Olympics she won a team gold medal and a silver for the balance beam.

Korda, Sir Alexander *orig.* **Sándor Laszlo Kellner** (b. Sept. 16, 1893, Pusztatúrpásztó, Hung.—d. Jan. 23, 1956, London, Eng.) Hungarian-born British film director and producer. He worked as a journalist in Budapest, where he founded a film magazine and, in 1917, became manager of the Corvin movie studio. He left Hungary in 1919 to make several films in Berlin, then went to Hollywood, where he directed movies such as *The Private Life of Helen of Troy* (1927). After moving to England in 1931, he founded London Film Productions. He helped develop Britain's film industry, directing and producing successful films such as *The Private Life of Henry VIII* (1933), *Catherine the Great* (1934), *The Scarlet Pimpernel* (1935), and *Rembrandt* (1936), and producing *The Third Man* (1949), *Summertime* (1955), and *Richard III* (1955). In 1942 he received the first British knighthood conferred on someone in the film industry.

Kordofan \ˌkȯr-də-'fan\ *or* **Kurdufan** \ˌkůr-dů-'fän\ Region, central Sudan. Lying west of the White Nile River, it was originally inhabited by Nubian-speaking peoples. Controlled by the Christian Tungur dynasty (900–1200 AD), it was later taken by Arabs, and in the 17th century a sultanate was established. Egyptian rule began in the 1820s. The slave trade played an important part in the region's economy until its eradication in 1878 by Charles George Gordon. Egyptian rule was ended by a revolt in 1882 led by al-Mahdī. Kordofan became a province of The Sudan in 1899.

Kordofanian languages Branch of the Niger-Congo language family. It is geographically separated from the rest of the Niger-Congo languages and is believed to represent the oldest layer of languages in the region. The Kordofanian branch consists of some 20 languages spoken by 250,000 to 500,000 people, mainly in the Nuba Hills of central Sudan.

kore \'kȯ-rā\ Type of freestanding statue of a maiden (the female counterpart of the kouros) that appeared with the beginning of Greek monumental sculpture (c. 700 BC) and remained to the end of the Archaic period (c. 500 BC). Carved from marble and originally painted, the kore is a draped female figure standing erect with feet together or one foot slightly advanced. One arm is often extended, holding an offering; the other is lowered, usually clasping a fold of drapery. As in all Greek art, the kore evolved from a highly stylized form to a more naturalistic one. Its prototypes are found in Egyptian and Mesopotamian art.

Korea *Korean* **Chosŏn** \'chō-sȯn\ *or* **Taehan** Former kingdom, a peninsula (Korean peninsula) on the eastern coast of Asia. In 1948 it was partitioned into two republics, North Korea and South Korea. According to tradition, the ancient kingdom of Chosŏn was established in the northern part of the peninsula probably by peoples from northern China in the 3rd millennium BC. Conquered by China in 108 BC, it later developed into the Three Kingdoms of Silla, Koguryŏ, and Paekche. Silla conquered the other two in the 7th century AD and ruled until 936, when the Paekche dynasty became prominent. Invaded by the Mongols in 1231, the kingdom of Chosŏn, with its capital at Seoul, was ruled by the Chosŏn (Yi) dynasty (see Yi Sŏng-gye) from 1392 to 1910. From c. 1636 it shut out foreign contacts but was forced after 1873 to open ports to Japan. Rivalry over Korea brought on the Russo-Japanese War (1904–05), after which Korea became a Japanese protectorate. Formally annexed to Japan in 1910, it was freed from Japanese control in 1945 at the end of World War II. After the war it was divided into two zones of occupation, Soviet in the north and U.S. in the south; the two republics were established in 1948. For Korea's later history, see North Korea and South Korea; see also Korean War.

Korea, North *officially* **Democratic People's Republic of Korea** Country, East Asia, occupying the northern half of the Korean peninsula. Area: 47,399 sq mi (122,762 sq km). Population (2005 est.):

22,488,000. Capital: P'yŏngyang. Ethnically, the population is almost completely Korean. Language: Korean (official). Religions: Ch'ŏndogyo, traditional beliefs, Christianity, Buddhism. Foreign missionaries were expelled during World War II. Currency: won. North Korea's land area largely consists of mountain ranges and uplands; its highest peak is the volcanic Mount Paektu (9,022 ft [2,750 m]). North Korea has a centrally planned economy based on heavy industry (iron and steel, machinery, chemicals, and textiles) and agriculture. Cooperative farms raise crops such as rice, corn, barley, and vegetables. The country is rich in mineral resources, including coal, iron ore, and magnesite. It is a republic with one legislature; the head of state and government is the chairman of the National Defense Commission. For early history, see Korea. After the Japanese were defeated in World War II, the Soviet Union occupied Korea north of latitude 38° N; there the Democratic People's Republic of Korea was established as a communist state in 1948. Seeking to unify the peninsula by force, it launched an invasion of South Korea in 1950, initiating the Korean War. UN troops intervened on the side of South Korea, and Chinese soldiers reinforced the North Korean army in the war, which ended with an armistice in 1953. Led by Kim Il-sung, North Korea became one of the most harshly regimented societies in the world, with a state-owned economy that failed to produce adequate supplies of food and consumer goods for its citizens. Under his son and successor, Kim Jong Il, the country endured periods of severe food shortages from the late 1990s that caused widespread famine. Hopes that North Korea was seeking to end its long isolation—notably through meetings between Kim and the leaders of South Korea (2000) and Japan (2002)—have been tempered by concerns over its nuclear weapons program.

Korea, South *officially* **Republic of Korea** Country, East Asia, occupying the southern half of the Korean peninsula. It is west of Japan and includes Cheju Island, located about 60 mi (97 km) south of the peninsula. Area: 38,572 sq mi (99,900 sq km). Population (2005 est.): 48,294,000. Capital: Seoul. The population is almost entirely ethnically Korean. Language: Korean (official). Religions: Christianity (Protestant, other Christians, Roman Catholic), traditional beliefs, Buddhism, new religions, Confucianism. Currency: won. Most of South Korea's land area consists of mountains and uplands; the densely populated lowlands are heavily cultivated for wet rice. The Naktong and Han are the principal rivers. The economy is based largely on services and manufacturing (including petrochemicals, electronic goods, and steel). South Korea is a

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republic with one legislative house; its head of state and government is the president, assisted by the prime minister. For early history, see KOREA. The Republic of Korea was established in 1948 in the portion of the Korean peninsula south of latitude 38° N, which had been occupied by the U.S. after World War II. In 1950 North Korean troops invaded South Korea, precipitating the KOREAN WAR. UN forces intervened on the side of South Korea, while Chinese troops backed North Korea in the war, which ended with an armistice in 1953. The devastated country was rebuilt with U.S. aid, and South Korea prospered in the postwar era, developing a strong export-oriented economy. It experienced an economic downturn beginning in the mid-1990s that affected many countries in the area. Efforts at reconciliation between North and South Korea, including the first-ever summit between their leaders (2000) and reunions between families from both countries, were accompanied by periods of continuing tension.

Korea Strait Channel between South Korea and southwestern Japan. Connecting the East China Sea with the Sea of JAPAN (East Sea), it is 120 mi (195 km) wide and is divided by the Tsushima islands at its centre. Its passage to the east is known as Tsushima Strait, site of the Battle of TSUSHIMA (1905); to the west it is called the Western Channel.

Korean language Official language of North Korea and South Korea, spoken by more than 75 million people, including substantial communities of ethnic Koreans living elsewhere. Korean is not closely related to any other language, though a distant genetic kinship to JAPANESE is now thought probable by some scholars, and an even more remote relationship to the ALTAIC LANGUAGES is possible. Korean was written with CHINESE characters to stand in various ways for Korean meanings and sounds as early as the 12th century, though substantial documentation is not evident until the invention of a unique phonetic script for it in 1443. This script, now called Hangul, represents syllables by arranging simple symbols for each PHONEME into a square form like that of a Chinese character. Grammatically, Korean has a basic subject-object-verb word order and places modifiers before the elements they modify.

Korean War (1950–53) Conflict arising after the post-World War II division of Korea, at latitude 38° N, into North Korea and South Korea. At the end of World War II, Soviet forces accepted the surrender of Japanese forces north of that line, as U.S. forces accepted Japanese surrender south of it. Negotiations failed to reunify the two halves, the northern half being a Soviet client state and the southern half being backed by the U.S. In 1950 North Korea invaded South Korea, and U.S. Pres. HARRY TRUMAN ordered troops to assist South Korea. The UN Security Council, minus the absent Soviet delegate, passed a resolution calling for the assistance of all UN members in halting the invasion. At first North Korean troops drove the South Korean and U.S. forces down to the southern tip of the Korean peninsula, but a brilliant amphibious landing at Inch'ŏn, conceived by Gen. DOUGLAS MACARTHUR, turned the tide in favour of the UN troops, who advanced near the border of North Korea and China. The Chinese then entered the war and drove the UN forces back south; the front line stabilized at the 38th parallel. MacArthur insisted on voicing his objections to U.S. war aims in a public manner and was relieved of his command by Truman. U.S. Pres. DWIGHT D. EISENHOWER participated in the conclusion of an armistice that accepted the front line as the de facto boundary between the two Koreas. The war resulted in the deaths of approximately 2,000,000 Koreans, 600,000 Chinese, 37,000 Americans, and 3,000 Turks, Britons, and other nationals in the UN forces.

Kornberg, Arthur (b. March 3, 1918, Brooklyn, N.Y., U.S.) U.S. biochemist and physician. He studied at the University of Rochester. In 1959 he joined the faculty at Stanford University. While studying how living organisms manufacture NUCLEOTIDES, his research led him to the problem of how nucleotides are strung together to form DNA molecules. Adding radioactive nucleotides to an enzyme mixture prepared from cultures of E. COLI, he found evidence of a reaction catalyzed by the enzyme that adds nucleotides to a preexisting DNA chain. He was the first to accomplish the cell-free synthesis of DNA. He shared a 1959 Nobel Prize with SEVERO OCHOA.

Korngold, Erich Wolfgang (b. May 29, 1897, Brünn, Austria-Hungary—d. Nov. 29, 1957, Hollywood, Calif., U.S.) U.S. composer of Austro-Hungarian birth. Son of a music critic, he had his childhood compositions praised by GUSTAV MAHLER and ARTUR SCHNABEL. He solidified his reputation with his operatic masterpiece, *Die tote Stadt* (1920). In 1934 he moved to Hollywood, and he became best known for his film scores, his broadly Romantic style proving very suitable to swashbuckling stories such as *Anthony Adverse* (1936, Academy Award) and *The Adventures of Robin Hood* (1938, Academy Award), as well as 17 others. His violin concerto (1946) has been frequently recorded.

Kornilov \kȯr-ˈnyē-lȯf**, Lavr (Georgiyevich)** (b. Aug. 30, 1870, Karkaralinsk, Western Siberia, Russian Empire—d. April 13, 1918, near Ekaterinodar, Russia) Imperial Russian general. A career army officer, he was a divisional commander in World War I. After the RUSSIAN REVOLUTION OF 1917, he was appointed army commander in chief by ALEKSANDR KERENSKY. Conflicts developed because of their opposing views on politics and the role of the army, and, when Kornilov sent troops toward Petrograd, Kerensky interpreted the move as an attempted coup and dismissed him. After being arrested, he escaped to command an anti-Bolshevik White army and was killed in battle.

Korolyov \kə-rəl-ˈyȯf**, Sergey (Pavlovich)** (b. Jan. 12, 1907, Zhitomir, Russia—d. Jan. 14, 1966, Moscow, Russia, U.S.S.R.) Soviet designer of guided missiles, rockets, and spacecraft. In 1933 he and F.A. Tsander launched the Soviet Union's first liquid-propellant rocket. During World War II Korolyov designed and tested liquid-fuel rocket boosters for military aircraft. After the war he improved the German V-2 MISSILE and supervised test firing of captured missiles. His work led to the world's first intercontinental ballistic missile (ICBM). He directed systems engineering for Soviet launch vehicles and spacecraft, including design, testing, construction, and launching of manned and unmanned spacecraft, and was the guiding genius behind the Soviet spaceflight program.

Koror \ˈkȯr-ˌȯr\ Island (pop., 2000: 13,303), PALAU, western Pacific Ocean. Lying southwest of Babelthuap island, the island of Koror has a land area of 3 sq mi (8 sq km). The town of Koror on the island was the administrative capital of all Japanese mandated islands in the Pacific from 1921 to 1945. Devastated during World War II, it was later developed as a commercial and tourist centre and served as the provisional capital of Palau. After the bridge between Koror and Babelthuap collapsed in 1996, a new bridge was built (opened 2002) while a new capital was under construction at Melekeok on Babelthuap.

Korsakoff syndrome *or* **Korsakoff psychosis** *or* **Korsakoff disease** Neurological disorder marked by severe AMNESIA despite clear perception and full consciousness, resulting from chronic alcoholism, head injury, brain illness, or THIAMIN deficiency. Persons with the syndrome typically cannot remember events in the recent or even immediate past; some retain memories only a few seconds. Longer periods—up to 20 years—may also be forgotten. Confabulation (recounting detailed, convincing "memories" of events that never happened) sometimes coexists with the syndrome, which may be transient or chronic.

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Korsakov, Nicolay Rimsky- See Nicolay Rimsky-Korsakov

Koryŏ \'kȯr-yō\ Korean kingdom ruled by a dynasty of the same name from 935 to 1392. During this period Korea began to form a distinctively Korean cultural tradition. The dynasty was formed by Gen. Wang Kŏn of Later Koguryŏ, who defeated the kingdoms of Silla and of Later Paekche to create a unified Korean peninsula in 936. In the late 10th century, a centralized bureaucratic system replaced the old aristocratic tribal system. The kingdom saw a flowering of the arts, particularly ceramics (Koryŏ celadon), and Buddhism and Confucianism were influential. In the 13th century Koryŏ endured a series of Mongol invasions, and in 1392 Yi Song-gye overthrew the shaky dynasty and founded the Chosŏn dynasty.

Kosala \'kō-sə-lə\ Ancient kingdom, northern India. Roughly corresponding to the historical region of Oudh, in what is now south-central Uttar Pradesh state, it extended into present-day Nepal. In the 6th century BC it rose to become one of the dominant states in northern India. The Buddha was born there. The kingdom of Magadha conquered Kosala by c. 459 BC, and it became known as Northern Kosala to distinguish it from a larger kingdom to the south known variously as Kosala, Southern Kosala, or Great Kosala.

Kosciusko \ˌkä-zē-'əs-kō**, Mount** Peak, southeastern New South Wales, Australia. Located in the Snowy Mountains of the Australian Alps, Mount Kosciusko is the highest mountain in mainland Australia, reaching 7,310 ft (2,228 m). It is located in Kosciusko National Park, which has an area of 2,498 sq mi (6,469 sq km); it is near Mounts Townsend, Twynam, North Ramshead, and Carruthers, whose melting snows feed the rivers and reservoirs that make up the Snowy Mountains Hydroelectric Scheme. The mountain was named in 1840 in honour of Tadeusz Kosciuszko.

Kościuszko \kȯsh-'chüsh-kō,\ *English* \ˌkä-sē-'əs-kō**, Tadeusz** (b. Feb. 4, 1746, Mereczowszczyzna, Pol.—d. Oct. 15, 1817, Solothurn, Switz.) Polish patriot who fought in the American Revolution. He studied military engineering in Paris and went to America in 1776, where he joined the colonial army. He helped build fortifications in Philadelphia, Pa., and at West Point, N.Y. As chief of engineers, he twice rescued the army of Gen. Nathanael Greene by directing river crossings. He also directed the blockade of Charleston, S.C. At the war's end he was awarded U.S. citizenship and made a brigadier general. He returned to Poland in 1784 and became a major general in the Polish army. In 1794 he led a rebellion against occupying Russian and Prussian forces, during which he defended Warsaw for two months, directing residents to build earthworks. He was jailed in Russia from 1794 to 1796, returned to the U.S. in 1797, and then left for France, where he continued efforts to secure Polish independence.

kosher See kashruth

Kosi River \'kō-sē\ River, Nepal and northern India. Rising from several tributaries in eastern Nepal, it runs south through the great plain of northern India. It empties into the Ganges River after a course of 450 mi (724 km).

Košice \'kȯ-shēt-sə\ City (pop., 2003 est.: 235,281), eastern Slovakia. Settled in the 9th century and chartered in 1241, it served as a trading settlement during the late Middle Ages. It developed rapidly after becoming part of Czechoslovakia in 1920. Occupied in 1938 by Hungary, it was liberated in 1945 and became the first seat of the postwar Czechoslovakian government. A part of independent Slovakia since 1993, it is the political, economic, and cultural centre of southeastern Slovakia.

Kosinski \kō-'sin-skē**, Jerzy (Nikodem)** (b. June 14, 1933, Łódź, Pol.—d. May 3, 1991, New York, N.Y., U.S.) Polish-born U.S. writer. He claimed that his horrific experiences as a Jew in World War II Poland and Russia caused him to be mute for much of his childhood. He studied political science and became a professor of sociology before immigrating to the U.S. in 1957. His novel *The Painted Bird* (1965) is a graphic, surrealistic tale of the horrors surrounding the war. Other successful novels were *Steps* (1968) and the satiric fable *Being There* (1970; film, 1979). After his suicide, it was revealed that much of his past had been fabricated.

Kosovo \'kȯ-sȯ-ˌvȯ\ *Albanian* **Kosova** Region (pop., 2001 est.: 2,325,000) within the republic of Serbia, Serbia and Montenegro. It occupies an area of 4,203 sq mi (10,887 sq km); its administrative capital is Priština. Before 1999, ethnic Albanians, most of whom are Muslims, made up about four-fifths of its population, with Serbs (mostly Christian) accounting for the bulk of the remainder. Kosovo was an autonomous region until 1989, when Serbia took control of Kosovo's administration, prompting protests from the region's Albanian population, which in 1990 voted to secede from Yugoslavia. Serbia responded by tightening its control of Kosovo, which led to the Kosovo conflict. From 1999 the region was administered by the UN.

Kosovo \'kō-sə-ˌvō**, Battle of** Either of two battles fought in the Serbian province of Kosovo. The first (June 13, 1389), between the Serbs under Prince Lazar and the Ottoman Empire led by Sultan Murad I, ended—despite Murad's death—in the defeat of Serbia and the encirclement of the crumbling Byzantine Empire by Ottoman armies. The battle, which led to three centuries of Serbian vassalage, has remained a central event in Serbian history. In the second battle (Oct. 17–20, 1448), between the Ottomans led by Murad II and a Hungarian-Walachian coalition under Hunyadi János, halted the last major effort by Christian Crusaders to free the Balkans from Ottoman rule.

Kosovo conflict (1998–99) Ethnic war in Kosovo, Yugoslavia. In 1989 the Serbian president, Slobodan Milošević, abrogated the constitutional autonomy of Kosovo. He and the minority of Serbs in Kosovo had long bristled at the fact that Muslim Albanians were in demographic control of an area considered sacred to Serbs (Kosovo was the seat of the Serbian Orthodox church, the inspiration for Serbian epic poetry, and the site of the Turkish defeat of the Serbs in 1389 and Serbian victory over the Turks in 1912). In response, the Albanian Kosovars began a campaign of nonviolent resistance. Growing tensions led in 1998 to armed clashes between Serbs and the Kosovo Liberation Army (KLA), which had begun killing Serbian police and politicians. The Contact Group (U.S., Britain, Germany, France, Italy, and Russia) demanded a cease-fire, the unconditional withdrawal of Serbian forces, the return of refugees, and unlimited access for international monitors. Although Milošević agreed to meet most of the demands, he failed to implement them. The KLA regrouped and rearmed during the cease-fire and renewed its offensive. The Serbs responded with a ruthless counteroffensive, inducing the UN Security Council to condemn the Serbs' excessive use of force, including ethnic cleansing (killing and expulsion), and to impose an arms embargo, but the violence continued. After diplomatic negotiations at Rambouillet, France, broke down, Serbia renewed its assault, and NATO responded with an 11-week bombing campaign that extended to Belgrade, accidentally destroyed the Chinese embassy, and significantly damaged Serbia's infrastructure. The bombing was halted after NATO and Yugoslavia signed an accord in June 1999 outlining Serbian troop withdrawal and the return of nearly 1,000,000 ethnic Albanian refugees as well as 500,000 displaced within the province; there were sporadic reprisals again Serbs who remained in Kosovo.

Kossuth \'kȯ-ˌshüt,\ *English* \'kä-ˌsüth**, Lajos** (b. Sept. 19, 1802, Monok, Hung.—d. March 20, 1894, Turin, Italy) Hungarian patriot. A lawyer from a noble family, he was sent to the national Diet (1832), where he developed his radical political and social philosophy. Imprisoned on political charges (1837–40), he later wrote for a reform journal and gained a devoted following. Reelected to the Diet (1847–49), he led the "national opposition," and after the February Revolution (1848) he persuaded the delegates to vote for independence from Austria. Appointed provisional governor, he became virtual dictator of Hungary. In 1849 Russian armies intervened on behalf of Austria, forcing Kossuth to resign. He fled to Turkey, where he was interned for two years. After his release he lectured in the U.S. and England, and later, from his home in Turin, he watched Hungary reconcile itself with the Austrian monarchy. After the Compromise of 1867, he retired from political life.

Lajos Kossuth, lithograph, 1856.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Kosygin \kə-'sē-gən**, Aleksey (Nikolayevich)** (b. Feb. 20, 1904, St. Petersburg, Russia—d. Dec. 18, 1980, Moscow, Russia, U.S.S.R.) Soviet statesman, premier of the Soviet Union (1964–80). He joined the Communist Party of the Soviet Union in 1927, and by 1939 he was a member of the Central Committee. After 1957 he worked closely with Nikita

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Khrushchev on economic matters, and in 1964, after Khrushchev's forced resignation, he replaced him as chair of the Council of Ministers, becoming head of the Soviet government. A competent and pragmatic economic administrator, he introduced reforms designed to modernize the Soviet economy. In the late 1960s and early 1970s he shared power with Leonid Brezhnev and Nikolay Podgorny, but his role decreased as Brezhnev's authority increased, and he retired in 1980.

koto Japanese musical instrument, a long zither with movable bridges and usually 13 strings. It is placed on the ground or a low table, and the strings are plucked by plectra on the fingers of the right hand while the left hand alters the pitch or ornaments the sound of individual strings by pressing or manipulating them on the other side of each bridge. The koto is played solo, in chamber ensembles—especially with the *shakuhachi* (a bamboo flute) and the samisen (a fretless lute)—and in gagaku music. The koto is Japan's national instrument.

Kotzebue \'kōt-sə-ˌbü**, August (Friedrich Ferdinand) von** (b. May 3, 1761, Weimar, Saxony—d. March 23, 1819, Mannheim, Baden) German playwright. He helped popularize poetic drama, which he infused with melodramatic sensationalism and sentimental philosophizing. Prolific (he wrote more than 200 plays) and facile, he is known for works such as the dramas *The Stranger* (1789) and *The Indian Exiles* (1790) and the comedies *Der Wildfang* (1798; "The Trapping of Game") and *Die deutschen Kleinstädter* (1803; "Small-Town Germans"). He was denounced by political radicals as a spy and stabbed to death.

Kou Qianzhi *or* **K'ou Ch'ien-chih** \'kō-'chyen-'jə\ (d. ad 448, Northern Wei empire, China) Chinese Daoist reformer. He probably began his career as a Daoist physician. In 415 he had a vision telling him that Daoism had been perverted by false teachings. He began to curb the orgiastic practices and mercenary spirit that had become associated with Daoism and to emphasize hygienic ritual and good works. His efforts won notice from the emperor and led to the establishment of Daoism as the state religion of China's Northern Wei dynasty. He also succeeded in having Buddhism proscribed and its adherents subjected to persecution. His reforms proved transitory, however, and Buddhism soon experienced a resurgence.

Koufax \'kō-ˌfaks**, Sandy** *in full* **Sanford Koufax** *orig.* **Sanford Braun** (b. Dec. 30, 1935, New York, N.Y., U.S.) U.S. baseball pitcher. Koufax's mother divorced when he was young, and he took the name of his stepfather. In his youth he played sports at the Jewish community centres in his native Brooklyn, and in high school he was known more as a basketball player than as a baseball player. He attended the University of Cincinnati on a basketball scholarship before joining the Brooklyn (later Los Angeles) Dodgers in 1955 as a left-handed thrower with a blazing fastball and a sharp breaking curveball. Once he gained control of his pitches he set several season records for strikeouts (including 382 in 1965), and his career average of one strikeout per inning is a rare accomplishment. In 1965 he pitched his fourth no-hit game, until 1981 a major-league record; the fourth no-hitter was also a perfect game (no player reached first base). Despite his early retirement in 1966 because of arthritis, he is regarded as one of baseball's greatest pitchers.

Koufax, 1966
AP/WIDE WORLD PHOTOS

kouros \'kü-ˌrȯs\ Archaic Greek statue representing a standing male youth. These large stone figures began to appear in Greece c. 700 bc and closely followed the Egyptian style of geometrical, rigid figures. Later forms reflect the Greeks' increased understanding of human anatomy and are more naturalistic. Kouroi sometimes represented the god Apollo, but more commonly served as votive offerings or grave markers. See also kore.

Koussevitzky \ˌkü-sə-'vit-skē**, Serge** *orig.* **Sergey Aleksandrovich Kusevitsky** (b. July 26, 1874, Vyshny Volochyok, Russia—d. June 4, 1951, Boston, Mass., U.S.) Russian-born U.S. conductor. A virtuoso double-bass player, he was self-taught as a conductor. With his father-in-law's financial help, he debuted with the Berlin Philharmonic in 1908. In the following years he founded his own orchestra, which toured the Volga by riverboat. After leaving the Soviet Union in 1920, he established the Concerts Koussevitzky series in Paris before becoming permanent conductor of the Boston Symphony Orchestra (1924–49). He gave about 100 premieres there, including commissioned works such as Igor Stravinsky's *Symphony of Psalms*, and many works by U.S. composers, inspiring his musicians to legendary performances by the force of his personality. The Tanglewood Music Center in Lenox, Mass., was established during his tenure in Boston.

Kovno See Kaunas

Kowloon \'kaù-'lün\ *or* **Jiulong** \'jyō-'lůŋ\ Peninsula on the Chinese mainland, part of the Hong Kong special administrative region. It lies just north of Hong Kong Island and is surrounded on three sides by Victoria Harbour; the New Territories adjoin it to the north. An industrial, commercial and tourist centre, it includes the urban area of Kowloon and New Kowloon (pop., 2001 prelim.: 2,025,800). Much of its territory consists of reclaimed land.

Koxinga See Zheng Chenggong

Koyukuk \'kȯi-ə-ˌkək\ **River** River, central Alaska, U.S. It rises on the southern slope of the Brooks Range and flows southwest for 500 mi (800 km) to join the Yukon River, of which it is a major tributary. It was named for the Koyukon, a local Indian people.

Kpelle \kə-'pel-ə\ People occupying central Liberia and part of Guinea. Numbering about one million, the Kpelle speak a Mande language of the Niger-Congo languages. They form about one-fifth of the population of Liberia. They are primarily rice farmers; cash crops include peanuts, sugarcane, and kola nuts. They are known for their elaborate secret societies (Poro for men, Sande for women), which serve a variety of social and political functions.

kraal \'krȯl, 'kräl\ In southern Africa, an enclosure or group of houses surrounding an enclosure for livestock, or the social unit that inhabits these structures. The term has been more broadly used to describe the associated way of life. Among some Zulus, the traditional kraal consists of a number of huts arranged in a circle around a cattle corral. Where polygyny is practiced, each wife often has her own hut. The word kraal has also been applied to the temporary encampments of the Masai of eastern Africa.

Kraepelin \ˌkrep-ə-'lēn**, Emil** (b. Feb. 15, 1856, Neustrelitz, Mecklenburg-Strelitz—d. Oct. 7, 1926, Munich, Ger.) German psychiatrist. He taught at the Universities of Heidelberg and Munich, where he developed an influential classification system for mental illness, the *Psychiatric Compendium* (nine eds., 1883–1926). He was the first to distinguish (in 1899) between manic-depressive psychosis (bipolar disorder) and dementia praecox (schizophrenia), and the first to distinguish three clinical varieties of the latter: catatonia, hebephrenia, and paranoia.

Krafft-Ebing \'kräft-'ā-biŋ**, Richard, Freiherr (Baron) von** (b. Aug. 14, 1840, Mannheim, Baden—d. Dec. 22, 1902, near Graz, Austria) German neuropsychiatrist. Educated in Germany and Switzerland, he taught psychiatry in the Austrian cities of Strasbourg, Graz, and Vienna, and he pursued studies that ranged from epilepsy and syphilis to genetic functions in insanity and sexual deviation. He also performed experiments in hypnosis. He is best remembered today for his *Psychopathia sexualis* (1886), a groundbreaking examination of sexual aberrations.

Kraft Foods, Inc. U.S. manufacturer and marketer of food products. It grew out of a wholesale cheese delivery business established in Chicago in 1903 by James L. Kraft. Incorporated as J.L. Kraft Bros. & Co. in 1909, it prospered by selling processed cheese to the U.S. Army during World War I. Held by various owners since 1930, Kraft was acquired in 1988 by Philip Morris Cos. (renamed Altria Group, Inc., in 2003), which also purchased Nabisco Holdings in 2000. Nabisco's business was integrated into Kraft's operations.

kraft process Chemical method for producing wood pulp using caustic soda and sodium sulfide as the liquor in which the pulpwood is cooked to loosen the fibres. The process (from German *kraft*, "strong") produces particularly strong and durable paper; another advantage is its capability of digesting pine chips; resins dissolve in the alkaline liquor and are recovered as tall oil, a valuable by-product. Recovery of sodium compounds is

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important in the economy of the process. In modern kraft mills, operations are completely contained; waste streams are recycled and reused, eliminating water pollution.

Krakatoa \ˌkra-kə-ˈtō-ə\ *or* **Krakatau** \ˌkra-kə-ˈtaù\ Island volcano in the centre of the Sunda Strait, between Java and Sumatra, Indonesia. Its eruption in 1883 was one of the most catastrophic in history. Its explosions were heard in Australia, Ceylon (Sri Lanka), and the Philippines, and large quantities of ash fell over an area of some 300,000 sq mi (800,000 sq km). It caused a tidal wave 120 ft (36 m) high that killed 36,000 people in Java and Sumatra. It erupted again in 1927 and has remained active.

Kraków *or* **Cracow** \ˈkrä-ˌküf,\ *English* \ˈkra-ˌkaù\ City (pop., 2005 est.: 757,430), southern Poland. Located on both sides of the upper Vistula River, it was the capital of a principality in 1138. After surviving a Mongol invasion in 1241, it was made the capital of a reunited Poland in 1320. Its importance diminished after the capital was moved to Warsaw in 1611. During the Partitions of Poland it came under Austrian rule. Returned to Poland in 1918, it was held by Germany during World War II. Rebuilt since the war, it is an industrial centre with a giant steelworks on the city's outskirts. Kraków is also a cultural centre. Its university was founded in 1364.

Kramer, Jack *orig.* **John Albert Kramer** (b. Aug. 1, 1921, Las Vegas, Nev., U.S.) U.S. tennis player and promoter. He won the Wimbledon singles (1947) and men's doubles (1946–47), the U.S. singles (1946–47), men's doubles (1940–41, 1943, 1947), and mixed doubles (1941) and was on the winning Davis Cup team in 1946. He played professional tennis from 1947 to 1952 and was instrumental in promoting open tennis, in which amateurs competed with professionals in major tournaments. He helped establish the Association of Tennis Professionals.

Kramnik, Vladimir (b. June 25, 1975, Tuapse, Russia, U.S.S.R.) Russian international chess grandmaster. He won the world championship in 2000 from his countryman Garry Kasparov. Kramnik learned to play when he was four years old from his father and began taking instruction at the local Pioneers (a Soviet youth organization) at the age of five. At age 11 he became a "candidate" master. Kramnik had success during his early years, winning the World Under 18 Championship in 1991 and a gold medal for his performance at the 1992 Men's Chess Olympiad. The years from 1992 to 2000 saw Kramnik move into the world's elite by winning numerous international chess tournaments.

Krasner, Lee *orig.* **Lenore Krassner** (b. Oct. 27, 1908, Brooklyn, N.Y., U.S.—d. June 19, 1984, New York, N.Y.) U.S. painter. Born to Russian immigrants, in 1937 she began to study with the painter Hans Hofmann, who exposed her to the work of Pablo Picasso and Henri Matisse. Synthesizing these European influences, Krasner developed her own style of geometric abstraction, which she grounded in floral motifs and rhythmic gesture. In 1940 she began exhibiting her work with that of other American artists who became known as Abstract Expressionists. After her 1945 marriage to painter Jackson Pollock, Krasner and Pollock both produced a large body of work, each under the other's influence. Krasner continued to paint throughout the 1970s.

Krasnoyarsk City (pop., 2002: 911,700), east-central Russia. Located on the upper Yenisey River, it was founded by Cossacks in 1628. In the late 17th century, it was often attacked by the Tatars and Kirghiz. The Trans-Siberian Railroad brought a period of rapid growth in the 1890s. A commercial and industrial centre, it is the site of one of the world's largest hydroelectric stations, built in the 1960s.

Kraus \ˈkraùs**, Karl** (b. April 28, 1874, Gitschin, Bohemia—d. June 12, 1936, Vienna, Austria) Austrian journalist, critic, playwright, and poet. In 1899 he founded *Die Fackel*, a literary and political review, and by 1911 he had become its sole author; he continued to publish it until the year of his death. Believing that language was of great moral and aesthetic importance, he wrote with masterly precision, and his writings exercised wide influence. His works, which are almost untranslatably idiomatic, include *Morality and Criminality* (an essay collection, 1908), *Proverbs and Contradictions* (a collection of aphorisms, 1909), and *The Last Days of Humanity* (a lengthy satirical drama, 1922).

Krebs, Edwin (Gerhard) (b. June 6, 1918, Lansing, Iowa, U.S.) U.S. biochemist. He received his medical degree from Washington University. With Edmond H. Fischer (b. 1920), he won a 1992 Nobel Prize for the discovery of reversible protein phosphorylation, a biochemical process that regulates the activities of proteins in cells and governs countless processes necessary for life. Errors in protein phosphorylation have been implicated in such diseases as diabetes, cancer, and Alzheimer disease.

Krebs, Sir Hans Adolf (b. Aug. 25, 1900, Hildesheim, Ger.—d. Nov. 22, 1981, Oxford, Eng.) German-born British biochemist. He fled Nazi Germany for England in 1933, where he taught at the Universities of Sheffield and Oxford. He was the first to describe the urea cycle (1932). He and Fritz Lipmann (1899–1986) received a 1953 Nobel Prize for their discovery in living organisms of the series of chemical reactions known as the tricarboxylic acid cycle (also called the citric acid cycle or Krebs cycle), a discovery of vital importance to a basic understanding of cell metabolism and molecular biology.

Krebs cycle See tricarboxylic acid cycle

Kreisler \ˈkrīs-lər**, Fritz** *orig.* **Friedrich Kreisler** (b. Feb. 2, 1875, Vienna, Austria—d. Jan. 29, 1962, New York, N.Y., U.S.) Austrian violinist and composer. He entered the Vienna Conservatory at age 7 and finished his musical studies by 12. After touring internationally as a teenager, he quit performing to study medicine. Returning to the violin, he scored successes in Berlin and Vienna (1898). He toured Europe and the U.S. until the start of World War I, and he premiered Edward Elgar's *Violin Concerto* in 1910. After recovering from a war wound, he resumed touring (1919–50). His concert programs frequently included many charming short pieces that he wrote, among them "Viennese Caprice" and "Pretty Rosemary."

kremlin Central fortress in medieval Russian cities, usually located at a strategic point along a river and separated from the surrounding parts of the city by a wall with ramparts, moat, towers, and battlements. Several capitals of principalities were built around old kremlins, which generally contained cathedrals, palaces, governmental offices, and munitions stores. The Moscow Kremlin (established 1156) served as the centre of Russian government until 1712 and again after 1918. Its crenellated brick walls and 20 towers were built in the 15th century by Italian architects. The palaces, cathedrals, and government buildings within the walls encompass a variety of styles, including Byzantine, Russian Baroque, and Classical.

Krenek, Ernst (b. Aug. 23, 1900, Vienna, Austria—d. Dec. 23, 1991, Palm Springs, Calif., U.S.) Austrian-born U.S. composer. He studied composition from age 16 with Franz Schreker (1878–1934) and first gained attention with his atonal *Second Symphony* (1923). After a brief Neoclassical phase, he reestablished his radical credentials with the jazz-influenced satiric opera *Johnny Strikes up the Band!* (1926), which created a sensation. Intrigued by Arnold Schoenberg's 12-tone method (see serialism), he devised his own version—which involved "rotation" of the set's order—for the opera *Karl V* (1933), the first 12-tone opera. He immigrated to the U.S. in 1937 and taught at several institutions, but his large body of work remained more highly esteemed in Europe.

Kresge \ˈkrez-gē**, S(ebastian) S(pering)** (b. July 31, 1867, Bald Mount, Pa., U.S.—d. Oct. 18, 1966, East Stroudsburg, Pa.) U.S. merchant. He worked as a traveling salesman before becoming a partner in 5-and-10-cent stores in Memphis, Tenn., and Detroit, Mich., in 1897. He opened several others in major Midwest cities, founding the S.S. Kresge Co. in 1907 (incorporated 1912). After World War II the firm expanded into large discount stores in the U.S., Puerto Rico, and Canada, which eventually numbered nearly 1,000. Kresge established a major charitable foundation in 1924. His retail empire became the foundation of the Kmart Corp.

Kretschmer \ˈkrech-mər**, Ernst** (b. Oct. 8, 1888, Wüstenrot, Ger.—d. Feb. 8, 1964, Tübingen, W.Ger.) German psychiatrist. In his best-known work, *Physique and Character* (1921), he attempted to correlate body build and physical constitution with character and mental illness, identifying three physical types—the pyknic (rotund), the athletic (muscular), and the asthenic (tall and thin)—and claiming that different psychiatric disorders were associated with each. His system was later adapted by the American psychologist William H. Sheldon (1899–1977), who renamed the types endomorph, mesomorph, and ectomorph and focused on their associated personality traits. Both theorists' work entered into popular culture and generated further research.

Kriemhild \ˈkrēm-ˌhilt\ *or* **Gudrun** In the *Nibelungenlied*, the gentle princess courted by Siegfried. Her grief at Siegfried's death transforms her into a "she-devil"; she exacts revenge by marrying Attila the Hun and killing her brother (who ordered Siegfried's death). She herself is also killed.

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In Norse legend, as Gudrun, she appears in tales of revenge. Kriemhild's story may have originated in confusion over events in the life of the historical Attila.

krill Any member of the CRUSTACEAN suborder Euphausiacea, comprising shrimplike animals that live in the open sea. The name also refers to the genus *Euphausia* within the suborder and sometimes to a single species, *E. superba*. The described species, numbering more than 80, range in size from about 0.25 to 2 in. (8–60 mm). Most have bioluminescent organs on the lower side, making them visible at night. They are an important source of food for various fishes, birds, and whales, particularly BLUE and FIN whales. Krill may occur in vast swarms at the ocean surface, where they feed at night, and at depths greater than about 6,000 ft (2,000 m). Because of their vast numbers and nutritive qualities (they are an especially rich source of vitamin A), krill have been regarded as a potential source of food for humans.

Krishna One of the most widely venerated Hindu gods, worshiped as the eighth incarnation of VISHNU and as the supreme deity. Many Krishna legends are drawn from the MAHABHARATA and the PURANAS. His earliest appearance is in the *Mahabharata* as the divine charioteer of Arjuna, whom Krishna convinces that the war Arjuna is about to fight is just (see BHAGAVADGITA). In later works Krishna was a slayer of demons, a secret lover of all devotees, and a devoted son and father. He also lifted the sacred hill of Govardhana on one finger to protect his devotees from INDRA's wrath. In art Krishna is often depicted with blue-black skin, wearing a loincloth and a crown of peacock feathers. As a divine lover, he is shown playing the flute, surrounded by adoring females.

Krishna River *formerly* **Kistna River** River, southern India. Rising in MAHARASHTRA state, it flows southeast and east across KARNATAKA and crosses ANDHRA PRADESH state before entering the Bay of BENGAL after a course of 800 mi (1,290 km).

Krishnamurti \ˌkrish-nə-ˈmu̇r-tē**, Jiddu** (b. 1895—d. 1986) Indian spiritual leader. He was educated in THEOSOPHY by ANNIE BESANT, who proclaimed him the coming "World Teacher," a messiah-like figure who would bring about world enlightenment. He became a teacher and writer, and from the 1920s he spent much time in the U.S. and Europe. He broke with formal theosophy in 1929 and renounced any claims to being a World Teacher, but he continued to be a popular lecturer. His desire, he said, was to set people free, a goal that could only be achieved through unflinching self-awareness. He established a number of Krishnamurti foundations in the U.S., Britain, and India to further his aims. His books include *The Songs of Life* (1931) and *Commentaries on Living* (1956–60).

Kristallnacht \krēs-ˈtäl-ˌnäk̲t\ *or* **Crystal Night** *or* **Night of Broken Glass** Night of violence against Jews, carried out by members of the German NAZI PARTY on Nov. 9–10, 1938, so called because of the broken glass left in its aftermath. The violence, instigated by JOSEPH GOEBBELS, left 91 Jews dead and hundreds seriously injured. About 7,500 Jewish businesses were gutted and some 1,000 synagogues burned or damaged. The GESTAPO arrested 30,000 Jewish males, offering to release them only if they emigrated and surrendered their wealth. The incident marked a major escalation in the Nazi program of Jewish persecution, foreshadowing the HOLOCAUST.

Kristeva \krē-stā-ˈvȧ,\ *English* \kri-ˈstā-və**, Julia** (b. June 24, 1941, Sliven, Bulg.) Bulgarian-born French psychoanalyst, critic, and educator. Professor of linguistics at the University of Paris VII, she is known for her writings in structuralist linguistics (see STRUCTURALISM), psychoanalysis, SEMIOTICS, and feminism. She was a protégé of ROLAND BARTHES, and she synthesized elements from such thinkers as JACQUES LACAN, MICHEL FOUCAULT, and MIKHAIL BAKHTIN in creating her own theories. Her novels include *The Samurai* (1990) and *The Old Man and the Wolves* (1991).

Kritios See CRITIUS AND NESIOTES

Krivoy Rog See KRYVYY RIH

Kroc, Ray(mond Albert) (b. Oct. 5, 1902, Chicago, Ill., U.S.—d. Jan. 14, 1984, San Diego, Calif.) U.S. restaurateur, a pioneer of the fast-food industry. He was working as a blender salesman when he discovered a restaurant in San Bernardino, Calif., owned by Maurice and Richard McDonald, who used an assembly-line format to prepare and sell a large volume of hamburgers, french fries, and milk shakes. Beginning in 1955 Kroc opened his first McDonald's drive-in restaurant in Des Plaines, Ill., paying the brothers a percentage of the receipts. He soon began selling franchises for new restaurants, and he instituted a training program for owner-managers that emphasized automation and standardization. At the time of his death there were some 7,500 McDonald's restaurants worldwide; with more than 25,000 restaurants in the early 21st century, McDonald's was the world's largest food-service retailer.

Ray Kroc
SYGMA

Kroeber \ˈkrō-bər**, A(lfred) L(ouis)** (b. June 11, 1876, Hoboken, N.J., U.S.—d. Oct. 5, 1960, Paris, Fr.) U.S. anthropologist. Trained under FRANZ BOAS (Ph.D., 1901), he later taught at the University of California at Berkeley. Kroeber's career nearly coincided with the emergence of academic, professionalized anthropology in the U.S. and contributed significantly to its development. He made valuable contributions to American Indian ethnology, New World archaeology, and the study of linguistics, folklore, kinship, and culture. His most influential books are considered to be *Anthropology* (1923) and *The Nature of Culture* (1952). His daughter, URSULA K. LE GUIN (b. 1929), was a noted science fiction and fantasy writer.

Kroemer, Herbert (b. Aug. 25, 1928, Weimar, Ger.) German physicist. He received a Ph.D. (1952) from Georg August University in Göttingen and later moved to the U.S., where he taught at several institutions. In 1957 he carried out theoretical calculations showing that a heterostructure transistor, which is made from several materials, would be superior to a conventional transistor, which is made from only one kind of material. His theory was later confirmed and led to the development of numerous electronic components that had a significant influence on communications technology and computers. He shared the 2000 Nobel Prize for Physics with ZHORES ALFEROV and JACK S. KILBY.

Kronos See CRONUS

Kronshtadt \ˈkrōn-ˌshtät\ **Rebellion** (1921) Internal uprising against Soviet rule in Russia after the RUSSIAN CIVIL WAR, conducted by sailors from the Kronshtadt naval base. The sailors had supported the BOLSHEVIKS in the RUSSIAN REVOLUTION OF 1917, but disillusionment with the government and inadequate food supplies after the civil war led them to demand economic and labour reform and political freedoms. The rebels were crushed by a force led by LEON TROTSKY and MIKHAYL TUKHACHEVSKY, and the survivors were shot or imprisoned. By dramatically demonstrating popular dissatisfaction with communist policies, the rebellion, along with several other major internal uprisings, led to the adoption of the NEW ECONOMIC POLICY.

Kronstadt See BRASOV

Kropotkin \krə-ˈpȯt-kən**, Peter (Alekseyevich)** (b. Dec. 21, 1842, Moscow, Russia—d. Feb. 8, 1921, Dmitrov, near Moscow) Russian revolutionary and geographer, foremost theorist of ANARCHISM. The son of a prince, he renounced his aristocratic heritage in 1871. Although he achieved renown in such fields as geography, zoology, sociology, and history, he shunned material success for the life of a revolutionist. He was imprisoned on political charges (1874–76) but escaped and fled to western Europe. He was imprisoned in France on trumped-up charges of sedition (1883–86), and in 1886 he settled in England, where he remained until the RUSSIAN REVOLUTION OF 1917 allowed him to return home. While

Peter Alekseyevich Kropotkin.
BROWN BROTHERS

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in exile, he wrote several influential books, including *Memoirs of a Revolutionist* (1899) and *Mutual Aid* (1902), in which he attempted to put anarchism on a scientific basis and argued that cooperation rather than conflict is the chief factor in the evolution of species. On his return to Russia, he was bitterly disappointed that the BOLSHEVIKS had made their revolution by authoritarian rather than libertarian methods, and he retired from politics.

Kru Group of peoples of Liberia and Côte d'Ivoire, including the Bassa, Krahn, Grebo, Klao (Kru), Bakwe, and Bete. They speak Kru languages of the NIGER-CONGO family and number some 2.5 million. Members of Kru ethnic groups, especially Klao, Grebo, and Bassa, are known as stevedores and fishermen all along the west coast of Africa and have established colonies in most ports from Dakar, Seneg., to Douala, Camer., the largest being in Monrovia, Liberia.

Kru languages Branch of the NIGER-CONGO LANGUAGE FAMILY. It consists of some 24 languages (or language clusters) spoken by some three million Kru people living in the forest regions of southwestern Côte d'Ivoire and southern Liberia.

Kruger, Paul *orig.* **Stephanus Johannes Paulus Kruger** (b. Oct. 10, 1825, Cradock district, Cape Colony—d. July 14, 1904, Clarens, Switz.) South African soldier and statesman, noted as the builder of the AFRIKANER nation. As a boy of 10, Kruger took part in the GREAT TREK and was impressed by the ability of the Boers to defend themselves against hostile African peoples and to establish an orderly government. When the British annexed the TRANSVAAL in 1877, Kruger became the recognized champion of his people in the struggle to regain independence. After leading a series of armed attacks, he succeeded in obtaining limited independence and was elected president of the restored republic (1883–1902). In 1895 he fended off an attempt by CECIL RHODES and LEANDER STARR JAMESON to end Boer control of the republic. His age prevented his participation in the SOUTH AFRICAN WAR and he retreated to the Netherlands; he died in Switzerland and was buried (December 1904) in Pretoria, S.Af.

Kruger National Park National park, South Africa. Located in the northeastern part of the country on the Mozambique border, it was created as a game sanctuary in 1898 and in 1926 became a national park named for Paul Kruger. It covers an area of 7,523 sq mi (19,485 sq km) and contains six rivers. It has a wide variety of wildlife, including elephants, lions, and cheetahs. In December 2002 it became part of Africa's largest game park when Kruger National Park was joined with Limpopo National Park in Mozambique and Gonarezhou National Park in Zimbabwe to form the Great Limpopo Transfrontier Park.

Krupa, Gene (b. Jan. 15, 1909, Chicago, Ill., U.S.—d. Oct. 16, 1973, Yonkers, N.Y.) U.S. bandleader and the first great drum soloist in JAZZ. Krupa had worked with Eddie Condon (1905–73) in Chicago before moving to New York City in 1929 and joining BENNY GOODMAN's big band in 1935. He quickly became the best-known drummer of his day, famous for the showmanship and technique displayed in extended drum solos such as that in "Sing, Sing, Sing." He formed his own successful band in 1938, featuring trumpeter ROY ELDRIDGE and singer Anita O'Day (b. 1919). Krupa's energetic playing became the model for many drummers of the SWING era.

Krupp \'krůp\ **family** German steel-manufacturing dynasty. Friedrich Krupp (1787–1826) founded a steel factory in Essen in 1811. On his death his son Alfred (1812–1887) took full charge of the faltering concern at age 14. He made a fortune supplying steel to the railways and manufacturing cannons; the performance of Krupp guns in the FRANCO-PRUSSIAN WAR of 1870–71 led to the firm's being called "the Arsenal of the Reich." At Alfred's death he had armed 46 nations. The rise of the German navy and the need for armour plates further enriched the company under his son Friedrich Alfred (1854–1902). By the time Friedrich Alfred's elder daughter, Bertha (1886–1957), inherited control of the firm, it employed more than 40,000 people. Her husband, Gustav von Bohlen (1870–1950), affixed Krupp to the beginning of his name; an ardent Nazi, he ran the Krupp empire until 1943, when he was succeeded by their son Alfried Krupp (1907–1967). The Krupp works used slave labour during World War II and were a major part of the Nazi war machine; Alfried was later convicted of war crimes at Nürnberg. An Allied order to break up the company in 1953 languished for lack of a buyer, and Alfried eventually restored the Krupp fortune. See also THYSSEN KRUPP STAHL.

Krupp GmbH See THYSSENKRUPP AG

Krupskaya \'krůp-skə-yə**, Nadezhda (Konstantinovna)** (b. Feb. 26, 1869, St. Petersburg, Russia—d. Feb. 27, 1939, Moscow, Russia, U.S.S.R.) Russian revolutionary, wife of VLADIMIR ILICH LENIN. A Marxist activist from the 1890s, she met Lenin c. 1894. Sentenced to three years in exile in 1898, she obtained permission to spend her term with Lenin in Siberia, where they were married. After 1901 she lived with Lenin in several European cities and helped found the BOLSHEVIK party faction. She returned to Russia in 1917 to spread Bolshevik propaganda after the revolution began, and later she served in several posts in the educational bureaucracy. After Lenin's death (1924), she remained aloof from intraparty struggles.

krypton \'krip-ˌtän\ Chemical ELEMENT, chemical symbol Kr, atomic number 36. One of the NOBLE GASES, it is colourless, odourless, tasteless, and almost totally inert, combining only with FLUORINE under very rigourous conditions. Krypton occurs in trace amounts in the atmosphere and in rocks and is obtained by fractional distillation of liquefied air. It is used in luminescent tubes, flash lamps, incandescent light bulbs, lasers, and tracer studies.

Kryvyy Rih \kri-'vi-'rik\ *Russian* **Krivoy Rog** \kri-'vȯi-'rȯk\ City (pop., 2001: 669,000), southeast-central Ukraine. Founded as a village by Cossacks in the 17th century, it grew slowly until a railway was constructed to the DONETS BASIN in 1884; it soon became a significant iron-mining city. It was seized by Germany in 1941 and retaken by the Soviet Union in 1944. Terny, which was annexed to the city in 1969, has a major uranium mine. The city is now a centre of industry as well as mining, with metallurgical plants, foundries, mills, and chemical works.

Kshatriya *or* **Ksatriya** \'kshə-trē-ə\ In Hindu India, the second-highest of the four VARNAS, or social classes, traditionally the military or ruling class. In ancient times before the CASTE system was completely defined, they were considered first in rank, placed higher than the BRAHMANS, or priestly class. The legend that they were degraded by an incarnation of VISHNU as a punishment for their tyranny may reflect a historical struggle for supremacy between priests and rulers. In modern times the Kshatriya varna includes members from a variety of castes, united by their status in government or the military or their land ownership.

Ksitigarbha \'kshi-ti-'gər-bə\ Buddhist BODHISATTVA widely revered in China and Japan. Known in India from the 4th century BC, he became popular in China as Dicang and in Japan as Jizō. He is the patron of the oppressed or dying, and he seeks to save the souls of the dead condemned to hell. In China he is the overlord of hell, and in Japan he is known for his kindness to the departed, particularly to dead children. Usually depicted as a monk with a nimbus around his shaved head, he carries a staff to force open the gates of hell and a flaming pearl to light up the darkness.

Ku Klux Klan (KKK) Either of two racist terrorist organizations in the U.S. The first was organized by veterans of the Confederate army, first as a social club and then as a secret means of resisting RECONSTRUCTION and restoring white domination over newly enfranchised blacks. Dressed in white robes and sheets, Klansmen whipped and killed freedmen and their white supporters in nighttime raids (see LYNCHING). It had largely accomplished its goals by the 1870s before gradually fading away. The second KKK arose in 1915, partly out of nostalgia for the Old South and partly out of fear of the rise of communism in Russia and the changing ethnic character of U.S. society. It counted Catholics, Jews, foreigners, and labour unions among its enemies. Its membership peaked in the 1920s at more than four million, but during the GREAT DEPRESSION the organization gradually declined. It became active again during the CIVIL RIGHTS MOVEMENT of the 1960s, attacking blacks and white civil rights workers with bombings, whippings, and shootings. By the end of the 20th century, growing racial tolerance had reduced its numbers to a few thousand.

Kuala Lumpur \'kwä-lə-'lům-ˌpůr\ City (pop., 2000 prelim.: 1,297,526), capital of MALAYSIA. Founded as a tin-mining camp in 1857, it was made capital of the Federated Malay States in 1895, of the independent Federation of Malaya in 1957, and of Malaysia in 1963. It was designated a municipality in 1972. The most important Malay city on the MALAY PENINSULA, it is a commercial centre and the site of the PETRONAS TWIN TOWERS, the world's tallest buildings when they were completed in 1998. Its educational institutions include the University of Malaya and a branch of the National University of Malaysia. In 1999 government offices began moving to the new administrative centre at Putrajaya just south of Kuala Lumpur.

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Kuan Han-ch'ing See GUAN HANQING

Kuan-yin See AVALOKITESVARA

Kuan Yü See GUAN YU

Kuang-chou See GUANGZHOU

Kuang-wu ti See GUANGWUDI

Kuban River \kü-'ban^{y}\ River, southwestern Russia. Rising on Mount ELBRUS, in the Republic of Georgia, it flows north then west to enter the Sea of AZOV. It is 563 mi (906 km) long. Much of its water is diverted for irrigation.

Kubitschek \'kü-bə-ˌchek\ **(de Oliveira), Juscelino** (b. Sept. 12, 1902, Diamantina, Braz.—d. Aug. 22, 1976, near Resende) President of Brazil (1956–61). He studied medicine but entered politics, becoming mayor of Belo Horizonte and later winning election to Congress. As president he promoted rapid development of the hydroelectric, steel, and other heavy industries and built 11,000 mi (18,000 km) of roads. He moved the government from Rio de Janeiro to BRASÍLIA, 600 mi (1,000 km) inland, to accelerate the settlement of Brazil's vast interior. One price of his ambitious development was rapid and persistent inflation, exacerbated by the need to spend large sums to aid the drought-stricken northeastern region. The military government that took power in 1964 forced him into exile (1965–67). On returning to Brazil, he became a banker.

Kublai Khan \'kü-blə-'kän\ (b. 1215—d. 1294) Grandson of GENGHIS KHAN who conquered China and established the YUAN, or Mongol, dynasty. When Kublai was in his 30s, his brother, the emperor MÖNGKE, gave him the task of conquering and administering SONG-DYNASTY China. Recognizing the superiority of Chinese thought, he gathered around himself Confucian advisers who convinced him of the importance of clemency toward the conquered. In subduing China and establishing himself there, he alienated other Mongol princes; his claim to the title of khan was also disputed. Though he could no longer control the steppe aristocracy effectively, he succeeded in reunifying China, subduing first the north and then the south by 1279. To restore China's prestige, Kublai engaged in wars on its periphery with Myanmar, Java, Japan, and the nations of eastern Southeast Asia, suffering some disastrous defeats. At home, he set up a four-tiered society, with the Mongols and other Central Asian peoples forming the top two tiers, the inhabitants of northern China ranking next, and those of southern China on the bottom. Posts of importance were allotted to foreigners, including MARCO POLO. Kublai repaired the GRAND CANAL and public granaries and made BUDDHISM the state religion. Although his reign was one of great prosperity, his politics were pursued less successfully by his followers.

Kublai Khan; in the National Palace Museum, Taipei
COURTESY OF THE NATIONAL PALACE MUSEUM, TAIPEI, TAIWAN, REPUBLIC OF CHINA

Kubrick \'kyü-brik**, Stanley** (b. July 26, 1928, New York, N.Y., U.S.—d. March 7, 1999, Childwickbury Manor, near St. Albans, Hertfordshire, Eng.) U.S. film director. He began his career as a photographer for *Look* magazine (1945–50). He directed two documentary films before directing his first feature film, *Fear and Desire* (1953). He won fame with *Paths of Glory* (1957), *Spartacus* (1960), *Lolita* (1962), *Dr. Strangelove* (1964), and the internationally acclaimed *2001: A Space Odyssey* (1968), which earned an Academy Award for special visual effects. His later movies include *A Clockwork Orange* (1971), *Barry Lyndon* (1975), *The Shining* (1980), *Full Metal Jacket* (1987), and *Eyes Wide Shut* (1999). His films are characterized by a cool visual style, meticulous attention to detail, and a detached, often ironic pessimism.

Küçük Kaynarca, Treaty of (1774) Pact signed after the RUSSO-TURKISH WAR of 1768–74, in Küçük Kaynarca (now Kaynardzha), Bulg., ending undisputed Ottoman control of the Black Sea. The treaty extended the Russian frontier to the southern Bug River and allowed Russia to navigate freely in Ottoman waters through the Bosporus Strait and the Dardanelles. Most far-reaching was a religious stipulation allowing Russia to represent Eastern Orthodox Christians in several regions, which Russia later interpreted as the right to intervene to protect Eastern Orthodox Christians anywhere in the Ottoman Empire.

kudu Slender African ANTELOPES of the genus *Tragelaphus*. The greater kudu lives in small groups in hilly bush country or open woods. It stands about 51 in. (1.3 m) high at the shoulder and has a fringe on the throat and a crest of hair on the neck and back. It is reddish brown to blue-gray, with a white mark between the eyes and narrow vertical white stripes on the body. The male has long, corkscrewlike horns. The lesser kudu lives in pairs or small groups in open bush country; it stands about 40 in. (1 m) high, has more tightly spiraled horns, and has two white patches on the throat and no throat fringe. Both species browse on shrubs and leaves.

kudzu vine \'kůd-ˌzü\ Fast-growing, twining, perennial, woody vine (*Pueraria lobata*, or *P. thunbergiana*) belonging to the pea family (see LEGUME). Transplanted from its native China and Japan to North America in the 1870s as an attractive ornamental that could be planted on steep soil banks to prevent erosion, kudzu has become a rampant weed in much of the southeastern U.S, where it readily spreads to form great canopies over trees, shrubs, and exposed soil. Roots survive even northern winters, and the hairy vine grows to a length of 60 ft (18 m) in one season. It has large leaves, late-blooming reddish-purple flowers, and flat, hairy seedpods. In its native range kudzu is grown for its edible, starchy roots and for a fiber made from its stems. It is also useful as a fodder or cover crop.

Kuei-chou See GUIZHOU

Kuei-yang See GUIYANG

Kuhn \'kün**, Thomas (Samuel)** (b. July 18, 1922, Cincinnati, Ohio, U.S.—d. June 17, 1996, Cambridge, Mass.) U.S. historian and philosopher of science. He taught at Berkeley (1956–64), Princeton (1964–79), and the Massachusetts Institute of Technology (1979–91). In his highly influential work *The Structure of Scientific Revolutions* (1962), he questioned the previously accepted view of scientific progress as a gradual accumulation of knowledge based on universally valid experimental methods and results, claiming that progress was often achieved by far-reaching "paradigm shifts." His other works include *The Copernican Revolution* (1957), *The Essential Tension* (1977), and *Black-Body Theory and the Quantum Discontinuity* (1978).

Kuiper \'kī-pər\ **belt** *or* **Edgeworth-Kuiper belt** Disk-shaped belt of billions of small, icy bodies orbiting the Sun beyond the orbit of NEPTUNE, mostly at distances 30–50 times Earth's distance from the Sun. Gerard Peter Kuiper (1905–73) proposed the existence of this large flattened distribution of objects in 1951 in connection with his theory of the origin of the solar system (see SOLAR NEBULA). Kenneth Edgeworth (1880–1972) independently had made similar proposals in 1943 and 1949. Whether the belt extends thinly as far as the OORT CLOUD is not known. Gravitational disturbances by Neptune of objects in the belt are thought to be the origin of most short-period COMETS. The first Kuiper belt object was discovered in 1992, although the orbit, icy composition, and diminutive size of PLUTO appear to qualify this body, traditionally considered a planet, as a giant Kuiper belt object.

Kūkai \'kü-ˌkī\ *or* **Kōbō Daishi** (b. July 27, 774, Byōbugaura, Japan—d. April 22, 835, Mount Kōya) Japanese Buddhist saint and founder of the SHINGON school. Born into an aristocratic family, Kūkai was given a CONFUCIAN education but soon converted to BUDDHISM. After studying in China (804–806) with Huiguo (746–805), he returned home to spread his doctrines, which emphasized magic formulas, ceremonials, and services for the dead. In 816 he built a temple on Mount Kōya, and he helped to establish the Shingon sect as one of the most popular forms of Japanese Buddhism. His major work, *Ten Stages of Consciousness*, traces the development of Confucianism, DAOISM, and Buddhism, representing Shingon as the highest stage. He was also a gifted poet, artist, and calligrapher.

kulak (Russian: "fist") Wealthy or prosperous landed peasant in Russia. Before the RUSSIAN REVOLUTION OF 1917, kulaks were major figures in peasant villages, often lending money and playing central roles in social and administrative affairs. In the WAR COMMUNISM period (1918–21), the Soviet government undermined the kulaks' position by organizing poor peasants to administer the villages and requisition grain from richer peasants. The kulaks regained their position under the NEW ECONOMIC POLICY, but in 1929 the government began a drive for rapid collectivization of agriculture and

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"liquidation of the kulaks as a class" (dekulakization). By 1934 most kulaks had been deported to remote regions or arrested and their land and property confiscated.

Kulturkampf \kůl-'tůr-ˌkämpf\ *German* **"culture struggle"** Bitter struggle by Otto von Bismarck to subject the Roman Catholic church to state controls. Bismarck, a staunch Protestant, doubted the loyalty of Catholics in his new German Empire and became concerned by the Vatican Council's 1870 proclamation on papal infallibility. In 1872 the state dissolved the Jesuit order in Germany. The May, or Falk, Laws of 1873 (applying only to Prussia) limited church powers, and in 1875 the state mandated civil marriage services. Bismarck retreated in the face of strong Catholic resistance, especially by the Center Party. By 1887, with many anti-Catholic laws repealed, Pope Leo XIII declared the conflict over.

Kumasi \kü-'mä-sē\ *formerly* **Coomassie** \kü-'ma-sē\ City (pop., 1998 est.: 578,000), south-central Ghana. A 17th-century Asante king chose the site for his capital and conducted land negotiations under a kum tree, which gave the town its name. Located on north-south trade routes, it became a major commercial centre. The British gained control of the city in 1874. Called the "Garden City of West Africa," it remains the seat of Asante kings. Its central market is one of the largest in western Africa. Kwame Nkrumah University of Science and Technology (1951) is located there.

Kumazawa Banzan \'kü-mä-ˌzä-wä-'bän-ˌzän\ (b. 1619, Kyōto, Japan—d. Sept. 9, 1691, Shimofusa) Japanese political philosopher. Born a rōnin, he was taken into service by the feudal lord of Okayama at age 15. Largely self-taught, he became a disciple of the Chinese Neo-Confucianist Wang Yangming. As chief minister of Okayama from 1647, he tried to put into practice the Confucian teachings on governance. Forced to resign in 1656, he spent the rest of his life studying and writing. He called for advancement in the government bureaucracy based on merit, not heredity, and advocated more government responsibility in economic life and less control by feudal lords. His ideas so infuriated the government that he was kept in custody or under surveillance the rest of his life.

Kumin \'kyü-min**, Maxine** *orig.* **Maxine Winokur** (b. June 6, 1925, Philadelphia, Pa., U.S.) U.S. poet. She studied at Radcliffe College. Her poetry, written primarily in traditional forms, deals with loss, fragility, family, and the cycles of life and nature. Her New Hampshire farm inspired *Up Country* (1972, Pulitzer Prize); later collections include the acclaimed *The Retrieval System* (1978), *Our Ground Time Here Will Be Brief* (1982), *Nurture* (1989), and *Connecting the Dots* (1996). She wrote numerous children's books, some with Anne Sexton, as well as novels and short stories.

kumquat \'kəm-ˌkwät\ Any of several evergreen shrubs or small trees of the genus *Fortunella* (rue, or citrus, family), or their fruit. Native to eastern Asia, kumquats are cultivated throughout the subtropics. The mainly thornless branches bear dark green, glossy leaves and white, orangelike flowers. The small, bright orange-yellow, round or oval fruit has mildly acid, juicy pulp and a sweet, edible, pulpy skin. Kumquats may be eaten fresh, preserved, or candied, or made into jams and jellies. In the U.S., hybrids have been produced with other citrus fruits.

Kun \'kün**, Béla** (b. Feb. 20, 1886, Szilágycseh, Transylvania, Austria-Hungary—d. Nov. 30, 1939?, U.S.S.R.) Hungarian communist leader. He fought in the Austrian army in World War I, was captured by the Russians, and became a Bolshevik. After returning to Hungary in 1918, he founded the Hungarian Communist Party. When Count Károlyi resigned in March 1919, Kun headed the new Hungarian Soviet Republic. He created a Red Army that reconquered much of the territory lost to Czechoslovaks and Romanians and eliminated moderate elements in the government. In August the regime collapsed, and Kun fled to Vienna and then Russia. As a leader of the Comintern, he tried to foment revolution in Germany and Austria in the 1920s. Eventually accused of "Trotskyism," he fell victim to Joseph Stalin's purge trials.

Béla Kun, drawing by Béla Uitz, 1930; in the Legújabbkori Történeti Múzeum, Budapest

COURTESY OF THE LEGUJABBKORI TORTENETI MUZEUM, BUDAPEST

kundalini \ˌkůn-də-'lē-nē\ In some tantric forms of Yoga, the cosmic energy believed to be within everyone. It is pictured as a coiled serpent lying at the base of the spine. Through a series of exercises involving posture, meditation, and breathing, a practitioner can force this energy up through the body to the top of the head. This brings about a sensation of bliss, as the ordinary self is dissolved into its eternal essence, atman.

Kundera \'kün-de-rä**, Milan** (b. April 1, 1929, Brno, Czech.) Czech-born French writer. He worked as a jazz musician and taught at Prague's film academy, but he gradually turned to writing. Though a member of the Communist Party for years, his works were banned after he participated in Czechoslovakia's short-lived liberalization movement (1967–68), and he was fired from his teaching positions. He immigrated to France in 1975 and was stripped of his Czech citizenship in 1979; he became a French citizen in 1981. His works combine erotic comedy with political criticism. *The Joke* (1967), his first novel, describes life under Stalin. *The Book of Laughter and Forgetting* (1979), a series of wittily ironic meditations on the modern state, and the novel *The Unbearable Lightness of Being* (1984; film, 1988) were banned in his homeland until 1989. His later books include *Immortality* (1990) and *Slowness* (1994).

Kunene River See Cunene River

kung fu *Pinyin* **gongfu** Chinese martial art that is simultaneously a spiritual and a physical discipline. It has been practiced at least since the Zhou dynasty (1111–255 BC). Its prescribed stances and actions are based on keen observations of human skeletal and muscular anatomy and physiology, and many of its movements are imitations of the fighting styles of animals. Its combative techniques resemble those used in karate and tae kwon do. Self-discipline is emphasized. Kung fu performed as exercise resembles t'ai chi ch'uan.

Kunitz \'kyü-nits**, Stanley (Jasspon)** (b. July 29, 1905, Worcester, Mass., U.S.) U.S. poet. He worked as an editor while contributing verse to magazines; much of it was collected in volumes such as *Selected Poems 1928–1958* (1958, Pulitzer Prize). With *The Testing-Tree* (1971), he began to write shorter, looser, more emotional poetry. Among his later collections, noted for their subtle craftsmanship and treatment of complex themes, are *The Coat Without a Seam* (1974), *The Lincoln Relics* (1978), *Next-to-Last Things* (1985), and *Passing Through* (1995). He was also U.S. poet laureate twice (1974–76, 2000–01).

Kunlun \'kün-'lün\ **Mountains** *or* **K'un-lun Mountains** Mountain system, east-central Asia. It extends for 1,250 mi (2,000 km) through the western regions of China. From the Pamirs of Tajikistan, it runs east along the border between Xinjiang and Tibet autonomous regions to the Sino-Tibetan ranges in Qinghai province. It divides the northern limit of the Plateau of Tibet from the interior plains of Central Asia. Its highest peak, Mount Muztag, measures 25,338 ft (7,723 m).

Kunming \'kün-'miŋ\ *or* **K'un-ming** City (pop., 2003 est.: 1,597,768), capital of Yunnan province, southern China. Situated on the northern shore of Lake Dian, it has long been a commercial centre at the junction of major trade routes. Originally known as Tuodong in the 8th–9th centuries AD and a part of the independent state of Nanzhao, it came under Chinese control with the Mongol invasion of 1253. The city became the provincial capital of Yunnan in 1276 and was visited by Marco Polo. It became a municipality in 1928 and was transformed into a modern city in 1937 during the Sino-Japanese War (1937–45), when Chinese evacuees from the north brought industrial plants and universities to Kunming.

Kunstler, William (Moses) (b. July 7, 1919, New York, N.Y., U.S.—d. Sept. 4, 1995, New York City) U.S. lawyer who defended a number of controversial clients in high-profile cases. After graduating from Yale University (1941) he served in the army in the Pacific during World War II, earning a Bronze Star. He graduated from Columbia Law School in 1948. In the 1950s and '60s he became involved with the American Civil Liberties Union and clients such as the antisegregationist Freedom Riders and Martin Luther King, Jr., not only defending them in court but becoming active in their causes. He gained national renown for his defense of the "Chicago Seven" on charges of conspiring to incite riots in Chicago during the 1968 Democratic national convention. In other cases that reflected his political leanings, he represented black power

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activists Stokely Carmichael and Bobby Seale, antiwar activist Daniel Berrigan, and prisoners accused in the aftermath of the deadly 1971 riot at the state prison in Attica, N.Y. Perhaps his most notorious clients were Mafia boss John Gotti and Sheikh Omar Abdel Rahman, who was convicted in 1995 of conspiring to blow up the World Trade Center.

Kuo Hsiang See Guo Xiang

Kuo Mo-jo See Guo Moruo

Kuomintang See Nationalist Party

Kura \kə-'rä, 'kůr-ə\ **River** *Azerbaijani* **Kür** *Georgian* **Mtkvari** River in Turkey, Georgia, and Azerbaijan. The largest river in Transcaucasia, it rises in eastern Turkey and flows north. After entering Georgia, it turns east and flows southeast to enter the Caspian Sea. It is 848 mi (1,364 km) long and used in places for irrigation.

Kurath \ků-'räth**, Hans** (b. Dec. 13, 1891, Villach, Austria—d. Jan. 2, 1992, Ann Arbor, Mich., U.S.) Austrian-born U.S. linguist. He immigrated to the U.S. in 1907. He is best known as the chief editor of the *Linguistic Atlas of New England*, 3 vol. (1939–43), the first linguistic atlas of a region of the U.S. His other works include *A Word Geography of the Eastern United States* (1949) and *The Pronunciation of English in the Atlantic States* (1961). Kurath was later editor in chief (1946–62) of the *Middle English Dictionary*.

Kurd Member of an ethnic and linguistic group native to parts of Iran, Iraq, and Turkey (see Kurdistan). Kurds speak one of two dialects of Kurdish, a West Iranian language related to Modern Persian. Traditionally nomadic, most were forced into farming by the redrawing of state borders after World War I (1914–18). Most Kurds are Sunnite Muslims; Sufism is widely practiced. Plans for a Kurdish state, promised by the Treaty of Sèvres (1920), which dissolved the Ottoman Empire, were never realized. Kurds in Turkey, Iran, and Iraq have been variously persecuted and pressured to assimilate; Iraqi attacks were particularly severe during the Iran-Iraq War (1980–90) and following the Persian Gulf War (1990–91). See also Kurdistan Workers' Party.

Kurdistan Mountainous region of Turkey, Iran, Iraq, and Syria, inhabited predominantly by Kurds. It covers about 74,000 sq mi (191,660 sq km), and its chief towns are Diyarbakır, Bitlis, and Van in Turkey, Mosul and Karkūk in Iraq, and Kermānshāh in Iran. Since early times the region has been the home of the Kurds, a people whose ethnic origins are uncertain. The Treaty of Sèvres, signed in 1920, provided for the recognition of a Kurdish state, but the agreement was never ratified.

Kurdistan Workers' Party (PKK) Kurdish nationalist party. It was founded in Turkish Kurdistan in 1978 and sought to establish an independent Kurdish state in southeastern Turkey. It attacked Turkish interests and fellow Kurds suspected of collaboration with the Turkish government, often from bases in Iraq and Syria. The group's leader, Abdullah Öcalan, was arrested by Turkey in 1999 and was thereafter tried and convicted of treason. At its peak, it claimed 5,000–10,000 members. See also Kurd.

Kurdufan See Kordofan

Kuria Muria Islands See Khuriyyā Muriyyā Islands

Kuril \'kyůr-ˌēl\ **Islands** Archipelago, eastern Russia. It extends for 750 mi (1,200 km) from the southern tip of Russia's Kamchatka Peninsula to the northeastern coast of Japan's Hokkaido island. The 56 islands cover 6,000 sq mi (15,600 sq km) and together with Sakhalin Island form an administrative region (pop., 2001 est.: 591,000) of Russia. The Kurils were originally settled by the Russians in the 17th–18th centuries. Japan seized the southern islands and in 1875 obtained the entire chain. After World War II they were ceded to the Soviet Union, and the Japanese population was repatriated and replaced by Soviets. Japan still claims historical rights to the southern islands and has tried repeatedly to regain them.

Kurisches Haff See Courland Lagoon

Kuropatkin \kü-rə-'pät-kin**, Aleksey (Nikolayevich)** (b. March 29, 1848, Shemchurino, Pskov province, Russia—d. March 23, 1925) Russian general. He was chief of staff during the Russo-Turkish War (1877–78), commander in chief in Caucasia in 1897, and minister of war (1898–1904). In the Russo-Japanese War (1904–05) he commanded the Russian troops in Manchuria; he resigned after the Russian defeat at the Battle of Mukden (1905).

Kurosawa \ˌkůr-ə-'saů-ə\ **Akira** (b. March 23, 1910, Tokyo, Japan—d. Sept. 6, 1998, Tokyo) Japanese film director. He studied painting before becoming an assistant director and scenarist at PCL (later Tōhō) movie studio (1936–43). He wrote and directed his first feature film, *Sanshiro Sugata,* in 1943, won notice with *Drunken Angel* (1948), starring Mifune Toshiro, and was internationally acclaimed for *Rashomon* (1950). His later classic films include *Ikiru* (1952), *Seven Samurai* (1954), *Throne of Blood* (1957), *Yojimbo* (1961), *Kagemusha* (1980), and *Ran* (1985). His ability to combine Japanese aesthetic and cultural elements with a Western sense of action and drama made him, in Western eyes, the foremost Japanese filmmaker.

Kursk, Battle of (July 5–Aug. 23, 1943) Unsuccessful German assault on the Soviet salient around Kursk, in western Russia, in World War II. The salient was a bulge in the Soviet lines that protruded 100 mi (160 km) westward into the German lines. The Germans planned a surprise attack to trap the Soviet forces but encountered Russian-laid minefields and antitank defenses. At the height of the assault, the Soviets counterattacked and forced a German withdrawal. The Battle of Kursk was the largest tank battle in history, involving some 6,000 tanks, two million troops, and 4,000 aircraft. It marked the decisive end of the German offensive on the Eastern Front and cleared the way for the great Soviet offensives of 1944–45.

Kursky Zaliv See Courland Lagoon

Kuryłowicz \ˌkůr-ə-'lō-vich**, Jerzy** (b. Aug. 26, 1895, Stanislav, Galicia, Austria-Hungary—d. Jan. 28, 1978, Kraków, Pol.) Polish historical linguist. His identification of the Hittite medial *h* in 1927 substantiated the existence of laryngeals, the Indo-European speech sounds postulated by Ferdinand de Saussure, and stimulated much research in Indo-European phonology. His books include *Apophony in Indo-European* (1956) and *The Inflectional Categories of Indo-European* (1964).

Kush See Cush

Kushan art *or* **Kusana art** Art produced during the Kushan dynasty (late 1st–3rd century AD), in an area that now includes parts of Central Asia, northern India, Pakistan, and Afghanistan. There are two major stylistic divisions among artifacts of the period: the imperial art of Iranian derivation, and the Buddhist art of mixed Greco-Roman and Indian sources. The former is exemplified by stiff, frontal portraits (including those on coins) emphasizing the individual's power and wealth. The second, more realistic, style is typified by the schools of Gandhara and Mathura art.

Kushner, Tony (b. July 16, 1956, New York, N.Y., U.S.) U.S. dramatist. He grew up in Lake Charles, La., and attended Columbia University and New York University. His early plays include *Yes, Yes, No, No* (1985). His major work, *Angels in America*, consists of two lengthy plays that deal with political issues and the AIDS epidemic of the 1980s. The first part, *Millennium Approaches* (1991), won a Pulitzer Prize and a Tony Award for best play; the second, *Perestroika* (1992), also won a Tony Award for best play. Later works include *Slavs* (1995), *Henry Box Brown* (1997), and the controversial *Homebody/Kabul* (2001), which addresses the relationship between Afghanistan and the West.

K'ut'aisi \ˌkə-tä-'ē-sē\ City (pop., 2002: 185,965), west-central Republic of Georgia. One of the oldest cities of Transcaucasia, it served as the capital of successive kingdoms in Georgia: Colchis, Iberia (Kartli), Abkhazia, and Imeretia. It was often caught in wars between Persians, Mongols, Turks, and Russians. Russia occupied it in the 18th century and made it a provincial seat. It is a major regional industrial and trade centre.

Kutch, Rann of See Rann of Kachchh

Kutuzov \kə-'tü-zȯf**, Mikhail (Illarionovich), Prince** *orig.* **Mikhail Illarionovich Golenishchev-Kutuzov** (b. Sept. 16, 1745, St. Petersburg, Russia—d. April 28, 1813, Bunzlau, Silesia) Russian army commander. In 1805 Kutuzov, an army officer, was given command of the joint Russian-Austrian army that opposed the French advance on Vienna. Following Austria's defeat in the Battle of Ulm, he retreated and preserved his army intact, but Alexander I engaged the French at the Battle of Austerlitz (1805), for which disaster Kutuzov was partly blamed. After Napoleon's army entered Russia in 1812, public pressure made Alexander appoint Kutuzov commander in chief. After waging minor engagements, he was forced to fight the inconclusive Battle of Borodino. When Napoleon led his troops in retreat from Moscow, Kutuzov forced

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the French army to leave Russia along the path it had devastated when it entered the country. He pursued the French into Prussia, destroying his opponent without fighting another major battle. Considered the finest Russian commander of his day, he appears as a major character in Leo Tolstoy's *War and Peace*.

Kuusinen \'kü-si-nən**, Otto V(ilhelm)** (b. Oct. 4, 1881, Laukaa, Fin.—d. May 17, 1964, Moscow, Russia, U.S.S.R.) Finnish-born Soviet politician. He joined the Social Democratic Party in Finland in 1905 and held various party posts. After Finland's short-lived socialist regime was overthrown in 1918, he fled to Russia, where he cofounded the Finnish Communist Party. He remained in exile to become secretary of the Comintern. In the Soviet-Finnish "Winter War" (1939–40) he was head of the pro-Soviet puppet Finnish government, and he later became president of the supreme soviet of the Karelo-Finnish Soviet Socialist Republic (1940–56). He was secretary of the Russian Communist Party's Central Committee (1946–53, 1957–64).

Kuwait *officially* **State of Kuwait** Country, Middle East, southwestern Asia. It is on the Arabian Peninsula at the northwest corner of the Persian Gulf. Area: 6,880 sq mi (17,818 sq km). Population (2005 est.): 2,847,000. Capital: Kuwait city. Its population is overwhelmingly Arab. Languages: Arabic (official), Persian, English. Religion: Islam (official). Currency: Kuwaiti dinar. Except for Al-Jahrā' oasis, at the western end of Kuwait Bay, and a few fertile patches in the southeastern and coastal areas, it is largely desert; annual precipitation totals 1–7 in. (25–180 mm). Kuwait has almost no arable land, but there is a small amount of pastureland for livestock. Its extensive petroleum and natural gas deposits are the basis of its economy. Its estimated reserves of petroleum represent roughly one-tenth of global reserves, ranking Kuwait third, behind Iraq and Saudi Arabia. It is a constitutional monarchy with one legislative body; the head of state and government is the emir, assisted by the prime minister. Traces of civilization on Faylakah, an island in Kuwait Bay, date to the 3rd millennium BC. These flourished until c. 1200 BC, when they disappeared from the historical record. Greek colonists again settled the island in the 4th century BC. The nomadic ʿAnizah tribe of central Arabia founded Kuwait city in 1710, and ʿAbd al-Raḥīm of the Ṣabāḥ dynasty became sheikh in 1756; the family continues to rule Kuwait. In 1899, to thwart German and Ottoman influences, Kuwait agreed to give Britain control of its foreign affairs. Following the outbreak of war with the Ottoman Empire in World War I (1914–18), Britain established a protectorate there. In 1961, after Kuwait had gained full independence from Britain, Iraq laid claim to Kuwait. British troops were sent to defend Kuwait; the Arab League recognized its independence, and Iraq dropped its claim. Iraq reasserted these claims in the aftermath of the Iraq-Iraq War and invaded and occupied Kuwait in 1990. A U.S.-led military coalition drove the Iraqi army out of Kuwait the next year (see First Persian Gulf War). Iraqi forces set fire to most of Kuwait's oil wells, but these were extinguished, and petroleum production soon returned to prewar levels.

Kuybyshev See Samara

Kuyper \'kœi-pər**, Abraham** (b. Oct. 29, 1837, Maassluis, Neth.—d. Nov. 8, 1920, The Hague) Dutch theologian and politician. After serving as a pastor (1863–74), he founded a Calvinist-oriented newspaper (1872) and was elected to the national assembly (1874). He formed the Anti-Revolutionary Party, the first organized Dutch political party, and built up a lower-middle-class following with a program that combined orthodox religious positions and a progressive social agenda. To provide Calvinist training for pastors, he founded the Free University at Amsterdam (1880), and in 1892 he founded the Reformed Churches in The Netherlands. As prime minister of The Netherlands (1901–05), he advocated a wider franchise and broader social benefits.

Kuznets \'kəz-nets**, Simon (Smith)** (b. April 30, 1901, Kharkov, Ukraine, Russian Empire—d. July 8, 1985, Cambridge, Mass., U.S.) Russian-U.S. economist and statistician. He immigrated to the U.S. in 1922 and joined the National Bureau of Economic Research in 1927; he later taught at the University of Pennsylvania (1930–54), Johns Hopkins University (1954–60), and Harvard University (1960–71). His work emphasized the complexity of underlying data in the construction of economic models, stressing the need for information on population structure, technology, labour quality, government structure, trade, and markets. He also described the existence of cyclical variations in growth rates (now called "Kuznets cycles") and their links with underlying factors such as population. In 1971 he received the Nobel Prize.

Kvasir \'kvä-sir\ In Norse mythology, the wisest of all men. He was born from the saliva from two rival groups of gods, the Aesir and the Vanir. As a teacher, he never failed to answer a question correctly. Two dwarfs, Fjalar and Galar, became tired of his great learning, and they killed him and distilled his blood in a magic cauldron. His blood, when mixed with honey by the giant Sattung, formed the mead that gave wisdom and poetic inspiration to those who drank it. Kvasir's story is told in the Edda *Braga Raedur*.

Kwa languages Branch of the Niger-Congo language family. Forty-five Kwa languages are spoken by approximately 20 million people in the southern areas of Côte d'Ivoire, Ghana, Togo, and Benin and in the extreme southwestern corner of Nigeria. Languages and language groups having more than a million speakers include Anyi and Baule in Côte d'Ivoire, Akan (including Asante, Fante, and Brong) and Guang in Ghana, and Gbe (including Ewe, Fon, and Anlo) in southeastern Ghana, Togo, and Benin.

Kwakiutl \ˌkwä-kē-'yü-tᵊl\ Northwest Coast Indian people who live along the shores of Vancouver Island, B.C., Can., and the mainland opposite. They speak Kwakwala, a Wakashan language, and call themselves Kwakwaka'wakw, meaning "Those Who Speak Kwakwala." Traditionally, the Kwakiutl subsisted mainly by fishing. They had a technology based largely on woodworking. Their society was stratified by rank, determined primarily by inheritance. The potlatch was elaborately developed and was often combined with dances and songs dramatizing ancestral experiences with supernatural beings. They continue to be known for their highly stylized art, which includes totem poles and striking masks. The Kwakiutl numbered about 3,000 in the 2001 Canadian census.

KwaNdebele \ˌkwän-dā-'bā-lā\ Former black enclave, central Transvaal province, South Africa. It was a self-governing "national state" for Transvaal Ndebele people, although it was never internationally recognized. Situated northeast of Johannesburg, it was founded in 1979, when

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many Transvaal Ndebele were expelled from Bophuthatswana. In 1994, after the abolition of APARTHEID, KwaNdebele became part of the new East Transvaal province, which was subsequently renamed Mpumalanga.

Kwando River River, southern Africa. Rising in central Angola, it flows southeast, forming part of the boundary between Angola and Zambia. It continues east along the northeastern border of Botswana and empties into the ZAMBEZI RIVER just above VICTORIA FALLS. Its total length is 457 mi (731 km).

Kwangju \'gwòŋ-'jü\ *formerly* **Koshu** City (pop., 2000: 1,350,948), southwestern South Korea, capital of South Chŏlla province. It occupies an area of 193 sq mi (501 sq km) and constitutes a metropolitan city (province) by itself. It has been a centre of trade and local administration since the Three Kingdoms (c. 57 BC); its modern industrial development began with a railway connection to SEOUL in 1914. Kwangju was the site of an armed uprising between civilians and the government in 1980. It is the seat of Chosŏn University (founded 1946).

Kwangsi Chuang See GUANGXI

Kwangtung See GUANGDONG

Kwanzaa *or* **Kwanza** \'kwän-zə\ African American holiday celebrated from December 26 to January 1 and patterned after African harvest festivals. It was created in 1966 by Maulana Karenga, a black-studies professor at California State University at Long Beach, as a nonreligious celebration of family and community. The name was taken from the Swahili phrase *matunda ya kwanzaa* ("first fruits"). Each day is dedicated to one of seven principles: unity, self-determination, collective responsibility, cooperative economics, purpose, creativity, and faith. Each evening, family members gather to light one of the candles in the *kinara*, a seven-branched candelabra; often gifts are exchanged. On December 31 community members gather for a feast, the *karamu*. Kwanzaa is now observed by more than 15 million people.

kwashiorkor \ˌkwä-shē-'ȯr-kər\ Condition caused by severe PROTEIN deficiency. It is common in tropical and subtropical regions in young children weaned on a diet chiefly of starchy foods such as grains, cassava, plantain, and sweet potato. It causes potbelly, EDEMA, weakness, irritability, dry skin with rash, reddish-orange hair discoloration, DIARRHEA, ANEMIA, and fat deposits in the liver. Mental development may be stunted. Adults who had the disease in childhood may be at risk of diseases such as CIRRHOSIS. Treatment is protein supplementation, often in the form of dried skim milk. For long-term prevention, development of high-protein plant mixtures based on local food preferences and availability is encouraged. Nondietary causes include inadequate absorption of nutrients by the intestines, chronic alcoholism, kidney disease, and trauma (e.g., infection, burns) causing abnormal protein loss.

Kweichow See GUIZHOU

Kworra River See NIGER RIVER

kyanite \'kī-ə-ˌnīt\ *or* **cyanite** \'sī-ə-ˌnīt\ *or* **disthene** \'dis-ˌthēn\ SILICATE MINERAL, one of several phases in the aluminum silicate (Al_2SiO_5) system. Its colour ranges from gray-green to black or blue, with blue and blue-gray being most common. It occurs in Switzerland, Italy, the Ural Mountains, and New England (U.S.). Kyanite is a raw material in the manufacture of spark plugs. A clear, deep-blue variety is sometimes cut as a gemstone.

Kyd \'kid**, Thomas** (b. Nov. 6, 1558, London, Eng.—d. c. December 1594, London) English dramatist. With *The Spanish Tragedie* (1592), he initiated the revenge tragedy, a favourite dramatic form in the Elizabethan and Jacobean eras in which the main motivation was revenge. One of the most popular plays of its time, it prepared the way for WILLIAM SHAKESPEARE's *Hamlet* and other plays. The only other play certainly by Kyd is *Cornelia* (1594). He was arrested and tortured in 1593 after "atheistical" documents were found in his room; he claimed the papers belonged to CHRISTOPHER MARLOWE, with whom he had shared lodgings. His reputation ruined, he died the next year at age 36.

Kydland, Finn E. (b. December 1943, Ålgård, near Stavanger, Nor.) Norwegian economist. Kydland was educated at the Norwegian School of Economics and Business Administration (B.S., 1968) and Carnegie Mellon University in Pittsburgh, Pa. (Ph.D., 1973), where EDWARD C. PRESCOTT advised him on his doctorate. Kydland, working with Prescott, demonstrated how a declared commitment to a low inflation rate by policy makers might create expectations of low inflation and unemployments rates. They also established the microeconomic foundation for business cycle analyses, showing that technology changes or supply shocks, such as oil price hikes, could be reflected in investment and relative price movements and thereby create short-term fluctuations around the long-term economic growth path. In 2004 Kydland shared the Nobel Prize for Economics with Prescott.

Kynewulf See CYNEWULF

Kyoga Lake Lake, south-central Uganda. It is formed by the VICTORIA NILE, which flows through it. It has a maximum depth of 25 ft (8 m), restricting navigation to shallow-draft vessels. About 80 mi (129 km) long, it has an area of 1,710 sq mi (4,429 sq km).

Kyōto City (pop., 2003 est.: 1,386,372), west-central HONSHU, Japan. It is situated northeast of ŌSAKA, and together with KŌBE it is part of a major urban-industrial region. The centre of Japanese culture and Japanese Buddhism, Kyōto ("Capital City") was the capital of Japan and the site of the imperial family residence for more than 1,000 years (794–1868). The modern city has venues that present NŌH THEATRE and KABUKI. It is a manufacturing centre, and many small workshops produce textiles and porcelain; tourism is also important. Buddhist temples, Shintō shrines, and other historic buildings are found throughout the city and surrounding area; 17 of these were collectively designated a UNESCO WORLD HERITAGE SITE in 1994. Its educational institutions include Kyōto University (founded 1897) and Dōshisha University (1875).

Kyrgyzstan \ˌkir-giz-'stan\ *officially* **Kyrgyz Republic** Country, Central Asia. In the southeast the Kok Shaal-Tau Range, part of the TIEN SHAN, forms the border with China. Area: 77,199 sq mi (199,945 sq km).

Population (2005 est.): 5,146,000. Capital: BISHKEK. The Kyrgyz make up about two-thirds of the population; most of the remainder consists of Uzbeks and Russians. Languages: Kyrgyz, Russian (both official). Religions: Islam (mostly Sunni); also Christianity. Currency: som. Kyrgyzstan is a largely mountainous country. At its eastern edge rises Victory (Pobedy) Peak, which at 24,406 ft (7,439 m) is the country's highest point of elevation. The country's valleys and plains, occupying only one-seventh of the total area, are home to most of its people. The economy is based largely on agriculture, including livestock raising and the cultivation of cereals, potatoes, cotton, and sugar beets. Gold mining and industries such as food processing and the production of machinery are also important. It is a republic with two legislative houses; its head of state and government is the president, assisted by the prime minister. The Kyrgyz, a nomadic people of Central Asia, settled in the Tien Shan

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region in ancient times. They were conquered by GENGHIS KHAN's son Jöchi in 1207. The area became part of the Qing dynasty of China in the mid-18th century. It came under Russian control in the 19th century, and its long rebellion against Russia (and later the Soviet Union) that began in 1916 resulted in a long period of brutal repression. Kirgiziya became an autonomous province of the Soviet Union in 1924 and was made the Kirgiz S.S.R. in 1936. Kyrgyzstan gained independence in 1991. It subsequently struggled with creating a democratic process and with establishing a stable economy.

Kyushu Island (pop., 2001 est.: 13,454,000), southernmost of Japan's four main islands. Located off the eastern coast of Asia, it is separated from HONSHU to the north by the Shimonoseki Strait and from SHIKOKU to the east by the Bungo Strait. The island, with an area of 14,177 sq mi (36,719 sq km), is mountainous; several famous peaks rise 5,000–6,000 ft (1,525–1,980 m) high, including Mount ASO. Its chief cities include FUKUOKA and KITAKYŪSHŪ. It was the first part of the Japanese empire opened to foreigners in the 19th century.

Kyzylkum \ki-'zil-'küm\ *Uzbek* **Qizilqum** *Kazakh* **Qyzylqum** Desert in Kazakhstan and Uzbekistan. Occupying roughly 115,000 sq mi (300,000 sq km), it lies between the SYR DARYA and the AMU DARYA rivers, southeast of the ARAL SEA. Desert plants grow on its sand ridges, serving as pasture for sheep, horses, and camels; there are several small oasis settlements. Its mineral resources include natural gas deposits and gold.

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La Brea \lə-'brā-ə\ **Tar Pits** Fossil field in Hancock Park (formerly Rancho La Brea), Los Angeles, Calif., U.S. It is the site of "pitch springs" oozing crude oil, discovered by Gaspar de Portolá's expedition in 1769. The tar pits contain the fossilized bones of Pleistocene mammals that became entrapped there; they include mammoths, mastodons, and sabre-toothed cats. The George C. Page Museum contains more than one million prehistoric specimens exhumed from the pits.

La Bruyère \lä-brüē-'yer**, Jean de** (b. August 1645, Paris, France—d. May 10/11, 1696, Versailles) French satiric moralist. As a tutor and librarian in a royal household, he observed aristocratic idleness, fads, and fashions. His *The Characters, or Manners of the Age, with the Characters of Theophrastus* (1688) was appended to his translation of Theophrastus and written in the latter's style. A masterpiece of French literature, it was an indictment of the vanity and pretensions around him. Eight editions of *Characters*, with expanded character sketches and topical allusions, appeared through 1694.

La Coruña See A Coruña

La Follette \lə-'fäl-ət**, Robert M(arion)** (b. June 14, 1855, Primrose, Wis., U.S.—d. June 18, 1925, Washington, D.C.) U.S. politician. He served as a county district attorney in Wisconsin (1880–84) and in the U.S. House of Representatives (1885–91). Advocating progressive reforms, he was elected governor of Wisconsin (1901–06). In the U.S. Senate (1906–24), he sponsored bills to restrict the power of the railroad companies. He founded *La Follette's Weekly* (1909) to broaden his reform movement, and he led Republican opposition to the policies of Pres. William H. Taft. He opposed U.S. entrance into World War I and policies of Pres. Woodrow Wilson that favoured big business. After the war he worked vigorously to expose corruption in government, including in the Teapot Dome scandal. As the presidential candidate of the Progressive Party in the 1924 election, he won five million votes, one-sixth of the total national vote. He died the next year; his son Robert (1895–1953) held his Senate seat from 1925 until 1947, when he was defeated by Joseph McCarthy.

La Fontaine \lä-fōⁿ-'ten**, Jean de** (b. July 8?, 1621, Château-Thierry, France—d. April 13, 1695, Paris) French poet. He made important contacts in Paris, where he was able to attract patrons and spend his most productive years as a writer. He is best known for his *Fables* (1668–94), which rank among the masterpieces of French literature. Comprising some 240 poems, they include timeless tales about simple countryfolk, heroes of Greek mythology, and the familiar animals of fables. Their chief theme is the everyday moral experience of humankind. His many lesser works include *The Loves of Cupid and Psyche* (1669), notable for its lucid, elegant prose. He was elected to the Académie Française in 1683.

La Galissonnière \lä-gä-lē-sȯn-'yer**, Roland-Michel Barrin, marquis de** (b. Nov. 10, 1693, Rochefort, France—d. Oct. 26, 1756, Montereau) French naval officer. While serving in the French navy (1710–36), he made several supply trips to New France and held various commands in the Atlantic. As commandant general of New France (1747–49), he sought unsuccessfully to fortify a link along the Ohio River between French Canada and the Louisiana settlements and to establish French settlements in Detroit and the Illinois country. In 1754 he was given command of a naval squadron assigned to protect French shipping from the Barbary pirates.

La Guajira \gwä-'hē-rä\ **Peninsula** Peninsula, northwestern coast of South America. It is bounded by the Caribbean Sea to the north and west and the Gulf of Venezuela to the southeast. Much of the peninsula lies in Colombia, and the rest is in Venezuela. Ríohacha, Colom. (pop., 1999 est.: 88,577), is its principal town; nearby natural gas fields are connected by pipeline with Barranquilla to the southwest.

La Guardia \lə-'gwär-dē-ə**, Fiorello H(enry)** (b. Dec. 11, 1882, New York, N.Y., U.S.—d. Sept. 20, 1947, New York City) U.S. politician, mayor of New York City (1933–45). He practiced law in New York City from 1910 before serving in the U.S. House of Representatives (1917, 1918–21, 1923–33). A progressive Republican, he cosponsored a bill that restricted the courts' power to ban strikes, boycotts, and picketing by organized labour; opposed Prohibition; and supported woman suffrage and child-labour laws. As New York's mayor, he fought Tammany Hall corruption and introduced reform programs for civic improvement through low-cost housing, social-welfare services, and new roads and bridges. A colourful figure with a flair for the dramatic, he enjoyed enormous popularity for his fearlessness and his lack of pretension. In 1945 he declined to run for a fourth term as mayor.

La Harpe \lä-'ärp**, Frédéric-César de** (b. April 6, 1754, Rolle, Vaud, Switz.—d. March 30, 1838, Lausanne) Swiss political leader. From 1784 he was tutor to the future Russian tsar Alexander I. He returned to Switzerland in 1794, then went to Paris to obtain French military support to secure independence for his native Vaud canton. In 1798 France invaded to establish the Helvetic Republic. A member of its Directory, La Harpe sought dictatorial powers, but he was deposed in 1800. He fled to France, and in 1814 he secured from Alexander a promise of Vaudois independence.

La Hontan \lä-ōⁿ-'täⁿ**, Louis-Armand de Lom d'Arce, baron de** (b. June 9, 1666, Mont-de-Marsan, France—d. 1715, Hannover, Hanover) French army officer and explorer. He served in New France (1683–93), commanded Ft.-St.-Joseph (now Niles, Mich.), and explored territory along the Wisconsin and Mississippi rivers (1688–89). In 1692 he stopped at Newfoundland and defended the French colonists at Plaisance against the English; after the governor there accused him of insubordination, he fled to Portugal in 1693 and thereafter remained in Europe. His *New Voyages to North-America* (1703) influenced the works of Montesquieu, Voltaire, and Jonathan Swift.

La Niña Cyclic counterpart to El Niño, consisting of a cooling of surface waters of the Pacific Ocean along the western coast of South America. While its local effects on weather and climate are generally the opposite of those associated with El Niño, its global effects can be more complex. La Niña events often follow El Niños, which occur at irregular intervals of about 5–10 years.

La Paz \lä-'päs\ City (pop., 2001: city, 789,558; 2003 metro. area est., 1,477,000), administrative capital of Bolivia. Located in west-central Bolivia, it is the world's highest capital, built over 12,000 ft (3,650 m) above sea level. The city centre lies in a canyon formed by the La Paz River. Founded in 1548 by the Spanish on the site of an Inca village, it was originally called Nuestra Señora de La Paz ("Our Lady of Peace"). Following the Battle of Ayacucho (1824), the decisive battle in the colony's wars of independence, the city was renamed La Paz de Ayacucho, though informally it continues to be called La Paz. Since 1898 it has been the administrative capital of Bolivia, though Sucre remains the judicial capital. It is Bolivia's principal industrial centre and also the site of the University of San Andrés (1830), the National Museum of Art, and the National Museum of Archaeology.

La Paz City (pop., 2000: 162,954), capital of Baja California Sur state, northwestern Mexico. Situated on La Paz Bay of the Gulf of California, it is a popular resort and the largest urban centre in the state. The bay was discovered by the Spanish in 1596; the town was established in the early 1800s and served as the capital of Baja California (1828–87). When the peninsula was divided between the U.S. and Mexico (1887), La Paz became the capital of the Mexican region.

La Perouse \ˌlä-pā-'rüz\ **Strait** *Japanese* **Sōya-kaikyō** *Russian* **Proliv Laperuza** International waterway between the Russian island of Sakhalin and the Japanese island of Hokkaido. The strait, named for the French explorer count de La Pérouse, separates the Sea of Okhotsk from the Sea of Japan (East Sea). It is 27 mi (43 km) wide at its narrowest part, and it varies in depth from 167 to 387 ft (51 to 118 m). Noted for its extremely strong currents, it is closed by ice in the winter.

La Plata City (pop., 1999 est.: 556,308), eastern Argentina. After Buenos Aires became the national capital, La Plata was chosen (1882) as the new seat of Buenos Aires province and was modeled on the U.S. capital of Washington, D.C. It was renamed for Argentine first lady Eva Perón in 1952, but after the overthrow of Pres. Juan Peron in 1955 it resumed its original name. Located near the Río de la Plata estuary, it is a seaport with a large artificial harbour. Its industries include meatpacking and oil refining.

La Plata River River, eastern central Puerto Rico. It flows about 45 mi (70 km) northwest and north, to empty into the Atlantic Ocean. Part of it is dammed to create a lake which provides hydroelectric power.

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La Rioja \ˌlä-rē-'ō-hä\ Autonomous community (pop., 2001: 276,702), province, and historical region, north-central Spain. Covering 1,944 sq mi (5,035 sq km), it was known until 1980 as Logroño; its capital is Logroño city. Historically belonging to old Castile, La Rioja's population is concentrated in the irrigated farmland (grapes, cereals, horticultural produce) along the Ebro River and its affluents. Upper Rioja produces some of Spain's finest wines. A highway runs through Lower Rioja linking Bilbao, Zaragoza, and Barcelona.

La Rochefoucauld \lä-rôsh-fü-'kō**, François VI, duke de** (b. Sept. 15, 1613, Paris, France—d. March 16/17, 1680, Paris) French writer. Of a noble family, he joined the army at an early age and was wounded several times. He later played a leading part in the Fronde but gradually won his way back into royal favour. He turned his energies to intellectual pursuits and became the leading exponent of the *maxime*, a French form of epigram that concisely expresses a harsh or paradoxical truth. *Maximes* (five eds., 1665–78), his principal achievement, consists of 500 reflections on human behaviour. His *Mémoires* (1664) recount the plots and campaigns of mutinous nobles during the Fronde.

La Salle \lə-'säl**, René-Robert Cavelier, sieur de** (b. Nov. 22, 1643, Rouen, France—d. March 19, 1687, near Brazos River [now in Texas, U.S.]) French explorer. In 1666 he left France for North America and was granted land near Montreal. He explored the Ohio River region (1669) and then worked with the count de Frontenac to extend French influence. He helped establish Fort Frontenac on Lake Ontario, where as seigneur he controlled the fur trade. He obtained authority from Louis XIV to explore the western frontier of New France and build new forts. He sailed down the Illinois River and with Henri de Tonty (1650?–1704) canoed down the Mississippi River to the Gulf of Mexico. There in 1682 La Salle claimed the entire Mississippi Basin for France, naming it Louisiana after Louis XIV. Back in France, he received authority to build a fort at the mouth of the Mississippi. Beset by losses of men and ships, he mistakenly landed at Matagorda Bay, Texas. After fruitless attempts to locate the Mississippi, he was killed by mutineers.

La Scala Opera house in Milan, Italy. Built in 1776 by Empress Maria Theresa of Austria (which country then ruled Milan), it replaced an earlier theatre that had burned. With the works of 19th-century composer Gioacchino Rossini, Italian opera regained international attention, and La Scala, as the site of many of Rossini's premieres, had by the 1830s become the opera landmark it has remained ever since. Associated with the main theatre are a smaller theatre, La Piccola Scala; a ballet company and ballet school; and a singing school.

La Tène \lä-'ten\ *French* **"The Shallows"** Archaeological site at the eastern end of Lake Neuchâtel, Switz. The name by extension applies to a late Iron Age culture of European Celts. La Tène culture originated in the mid-5th century BC, when the Celts came into contact with Greeks and Etruscans. It passed through several phases and regional variations during the next 400 years, as the Celts populated northern Europe and the British Isles, and ended in the mid-1st century BC, when most of the Celts came under Roman control. Objects of the early period are characterized by ornamental S-shapes, spirals, and round patterns. The middle period is notable for long iron swords, heavy knives, and burial in coffins or under stone heaps; findings with a later date, but still of the middle period, include decorated scabbards, broad-bladed spearheads, and wooden shields with iron supports. The final period, showing Roman influence, is distinguished by peasant's implements, such as iron sickles, scythes, axes, saws, and plowshares.

Gold disk found at Auvers, La Tène culture, 5th century BC.
COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS

La Tour \lə-'tůr**, Georges de** (b. March 19, 1593, Vic-sur-Seille, Lorraine, Fr.—d. Jan. 30, 1652, Lunéville) French painter. He was well known in his lifetime, especially for his depictions of candlelit subjects, then was forgotten until the 20th century, when the identification of works previously misattributed established his reputation as a giant of French painting. His early works were painted in a realistic manner and influenced by the dramatic chiaroscuro of Caravaggio. The paintings of La Tour's maturity are marked by a startling geometric simplification of the human form and by the depiction of interior scenes lit only by the glare of candles or torches. His religious paintings done in this manner have a monumental simplicity and a stillness that expresses both contemplative quiet and wonder. Little is known of his life, and only four or five of his paintings are dated. The chronology and authenticity of some works attributed to him are still debated.

"St. Joseph the Carpenter," oil on canvas by Georges de La Tour, *c.* 1645; in the Louvre, Paris
GIRAUDON—ART RESOURCE/EB INC.

La Vérendrye \lä-ˌver-ən-'drē**, Pierre Gaultier de Varennes et de** (b. Nov. 17, 1685, Trois-Rivières, New France—d. Dec. 5, 1749, Montreal) French-Canadian explorer. He served in the French army before becoming a fur trader in the region north of Lake Superior (1726). From the Indians he learned of a river that might lead to the Pacific Ocean, and with his sons he built a string of fur-trading posts from Ontario to Manitoba (1731–38). Two sons sent farther west became the first Europeans to explore areas of present-day Nebraska, Montana, and Wyoming, and they claimed South Dakota for France. The 30,000 beaver pelts La Vérendrye annually sent to Quebec broke the monopoly of the Hudson's Bay Co. Little appreciated in his lifetime, he was later considered one of the greatest explorers of the Canadian West.

Laayoune \lä-'yün\ *or* **El Aaiún** \ˌel-ī-'ün\ City (pop., 1998 est.: 164,000), North Africa. The capital (1940–76) of the overseas Spanish province of Western Sahara and since 1976 of the Laayoune province of Morocco (though Morocco's claim is not internationally recognized), Laayoune lies in the northern part of Western Sahara, 8 mi (13 km) inland from the Atlantic Ocean. It was developed by Spain in 1938 as the administrative and military centre of the Europeans living in the former province. It is Western Sahara's only major populated place. Nearby oases supply water.

Laban \'lä-bän**, Rudolf (von)** (b. Dec. 15, 1879, Bratislava, Austria-Hungary—d. July 1, 1958, Weybridge, Surrey, Eng.) Hungarian modern-dance teacher, inventor of the Labanotation system of dance notation. After studying dance in Paris, he opened his Choreographic Institute in Zürich, Switz., in 1915 and later founded branches in Italy, France, and central Europe. From 1919 to 1937 he worked in Germany, where in 1930–34 he was ballet director of the Berlin State Opera. In 1928 he published his method for recording all forms of human motion, which enabled choreographers to record the dancer's steps and other body movements, including their rhythm. In 1938 he joined his former pupil Kurt Jooss and taught dance in England, where he later formed the Art of Movement Studio. His system was further developed and maintained at centres in Essen, Ger., and New York.

Labdah See Leptis Magna

Labor, Knights of See Knights of Labor

Labor Day Annual holiday devoted to the recognition of working people's contribution to society. It is observed on the first Monday in September in the U.S. and Canada. It was first celebrated in New York City on Sept. 5, 1882, under the sponsorship of the Knights of Labor. Various U.S. states observed the holiday before 1894, when Congress passed a bill making Labor Day a national holiday. It is often celebrated with parades and speeches, as well as political rallies, and the day is sometimes the official kickoff date for national political campaigns in the U.S. In most other countries, workers are honoured on May Day.

Labor Relations Act, National See Wagner Act

laboratory Place where scientific research and development is conducted and analyses performed, in contrast with the field or factory. Most laboratories are characterized by controlled uniformity of conditions (constant temperature, humidity, cleanliness). Modern laboratories use a vast num-

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ber of instruments and procedures to study, systematize, or quantify the objects of their attention. Procedures often include sampling, pretreatment and treatment, measurement, calculation, and presentation of results; each may be carried out by techniques ranging from having an unaided person use crude tools to running an automated analysis system with computer controls, data storage, and elaborate readouts.

labour In economics, the general body of wage earners. In CLASSICAL ECONOMICS, labour is one of the three factors of production, along with CAPITAL and LAND. Labour can also be used to describe work performed, including any valuable service rendered by a human agent in the production of wealth, other than accumulating and providing capital. Labour is performed for the sake of its product or, in modern economic life, for the sake of a share of the aggregate product of the community's industry. The price per unit of time, or wage rate, commanded by a particular kind of labour in the MARKET depends on a number of variables, such as the technical efficiency of the worker, the demand for that person's particular skills, and the supply of similarly skilled workers. Other variables include training, experience, intelligence, social status, prospects for advancement, and relative difficulty of the work. All these factors make it impossible for economists to assign a standard value to labour. Instead, economists often quantify labour hours according to the quantity and value of the goods or services produced.

labour See PARTURITION

labour economics Study of how workers are allocated among jobs, how their rates of pay are determined, and how their efficiency is affected by various factors. The labour force of a country includes all those who work for gain in any capacity as well as those who are unemployed but seeking work. Many factors influence how workers are utilized and how much they are paid, including qualities of the labour force itself (such as health, level of education, distribution of special training and skills, and degree of mobility), structural characteristics of the economy (e.g., proportions of heavy manufacturing, technology, and service industries), and institutional factors (including the extent and power of LABOUR UNIONS and employers' associations and the presence of minimum-wage laws). Miscellaneous factors such as custom and variations in the BUSINESS CYCLE are also considered. Certain general trends are widely accepted by labour economists; for instance, wage levels tend to be higher in jobs that involve high risk, in industries that require higher levels of education or training, in economies that have high proportions of such industries, and in industries that are heavily unionized.

labour law Body of law that applies to matters such as employment, wages, conditions of work, LABOUR UNIONS, and labour-management relations. Laws intended to protect workers, including children, from abusive employment practices were not enacted in significant numbers until the late 19th century in Europe and slightly later in the U.S. In Asia and Africa, labour legislation did not emerge until the 1940s and '50s. Employment laws cover matters such as hiring, training, advancement, and UNEMPLOYMENT compensation. Wage laws cover the forms and methods of payment, pay rates, SOCIAL SECURITY, PENSIONS, and other matters. Legislation on working conditions regulates hours, rest periods, vacations, CHILD LABOUR, EQUALITY in the workplace, and health and safety. Laws on trade unions and labour-management relations address the status of unions, the rights and obligations of workers' and employers' organizations, COLLECTIVE BARGAINING agreements, and rules for settling STRIKES and other disputes. See also ARBITRATION; MEDIATION.

Labour Party British political party whose historic links with trade unions have led it to promote an active role for the state in the creation of economic prosperity and the provision of social services. In opposition to the CONSERVATIVE PARTY, it has been Britain's major democratic socialist party since the early 20th century. In 1900 the Trades Union Congress and the Independent Labour Party (founded 1893) established the Labour Representation Committee, which took the name Labour Party in 1906. In 1918 it became a socialist party with a democratic constitution, and by 1922 it had supplanted the LIBERAL PARTY as the official opposition party. In 1924 JAMES RAMSAY MACDONALD formed the first Labour government, with Liberal support. The party was out of power from 1935 until a spectacular recovery in 1945 brought in CLEMENT R. ATTLEE's government (until 1951), which introduced a system of social welfare, including a NATIONAL HEALTH SERVICE, and extensive nationalization of industry. Labour regained power under HAROLD WILSON (1964–70) and later JAMES CALLAGHAN (1974–79), but it foundered because of economic problems and worsening relations with its trade-union allies. In 1983 MICHAEL FOOT's radical program resulted in a massive Labour defeat. NEIL KINNOCK moved the party toward the centre, but only in 1997 did TONY BLAIR and his "New Labour" agenda succeed in returning Labour to power.

labour union Association of workers in a particular trade, industry, or plant, formed to obtain improvements in pay, benefits, and working conditions through collective action. The first fraternal and self-help associations of labourers appeared in Britain in the 18th century, and the era of modern labour unions began in Britain, Europe, and the U.S. in the 19th century. The movement met with hostility from employers and governments, and union organizers were regularly prosecuted. British unionism received its legal foundation in the Trade-Union Act of 1871. In the U.S. the same effect was achieved more slowly through a series of court decisions that whittled away at the use of injunctions and conspiracy laws against unions. The founding of the American Federation of Labor (AFL) in 1886 marked the beginning of a successful, large-scale labour movement in the U.S. The unions brought together in the AFL were craft unions, which represented workers skilled in a particular craft or trade. Only a few early labour organizers argued in favour of industrial unions, which would represent all workers, skilled or unskilled, in a single industry. The Congress of Industrial Organizations (CIO) was founded by unions expelled from the AFL for attempting to organize unskilled workers, and by 1941 it had assured the success of industrial unionism by organizing the steel and automotive industries (see AFL-CIO). The use of COLLECTIVE BARGAINING to settle wages, working conditions, and disputes is standard in all noncommunist industrial countries, though union organization varies from country to country. In Britain, labour unions displayed a strong inclination to political activity that culminated in the formation of the LABOUR PARTY in 1906. In France, too, the major unions became highly politicized; the Confédération Générale du Travail (formed in 1895) was allied with the Communist Party for many years, while the Confédération Française Démocratique du Travail is more moderate politically. Japan developed a form of union organization known as enterprise unionism, which represents workers in a single plant or multiplant enterprise rather than within a craft or industry.

Labov \lə-'bȯv**, William** (b. Dec. 4, 1927, Rutherford, N.J., U.S.) U.S. linguist. After working for many years as an industrial chemist, Labov began graduate work in 1961, focusing on regional and class differences in English pronunciation on Martha's Vineyard, Mass., and in New York City, and ways to quantify phonetic change and variation. Most of his later research dealt with the same issues in increasingly sophisticated ways, culminating in his monumental *Principles of Linguistic Change* (1994). The discovery that American English pronunciation was becoming regionally more rather than less divergent countered popular belief and attracted the attention of many outside his field.

Labrador Large peninsula, northeastern Canada. Divided between the provinces of Quebec and Newfoundland and Labrador, it occupies an area of about 625,000 sq mi (1,620,000 sq km). Its highest mountains are over 5,000 ft (1,520 m), and its coast is lined with islands. It forms the easternmost portion of the plateau known as the CANADIAN SHIELD. Politically, Labrador refers to the Newfoundland and Labrador portion of the peninsula; the Quebec portion is UNGAVA PENINSULA. Political control of the region was disputed by the two provinces until the Quebec-Newfoundland border was established in 1927.

Labrador Current Surface oceanic current flowing southward along the western side of the Labrador Sea. Originating at the Davis Strait, the current is a combination of the West Greenland Current, the Baffin Island Current, and inflow from Hudson Bay. It maintains temperatures of less than 32°F (0°C) and has a low salinity. The current is limited to the CONTINENTAL SHELF and reaches depths only slightly greater than 2,000 ft (600 m). It carries several thousand ICEBERGS southward each year.

labradorite \'la-brə-ˌdȯr-ˌīt\ Type of FELDSPAR mineral in the PLAGIOCLASE series that is often valued as a gemstone and as ornamental material for its red, blue, or green iridescence. The mineral is usually gray or brown to black and need not be iridescent. Labradorite is named for its occurrence on the coast of Labrador, Canada.

labyrinth *or* **maze** System of intricate passageways and blind alleys. Labyrinth was the name given by the ancient Greeks and Romans to buildings, entirely or partly underground, containing a number of chambers and passages that made egress difficult. From the European Renais-

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sance on, labyrinths or mazes consisting of intricate paths separated by high hedges were a feature of formal gardens.

Lacan \lä-'kän**, Jacques (-Marie-Émile)** (b. April 13, 1901, Paris, France—d. Sept. 9, 1981, Paris) French psychoanalyst. A practicing psychiatrist in Paris for much of his career, Lacan emphasized the primacy of language as the mirror of the unconscious mind and introduced the study of language into psychoanalytic theory. His major achievement was his reinterpretation of SIGMUND FREUD's work in terms of structural LINGUISTICS. He became a celebrity in France with *Écrits* (1966; *The Language of the Self*) and in the 1970s was a dominant figure in French cultural life as well as a strong influence on American psychoanalytic and literary theory.

Lacandón \ˌlä-kän-'dōn\ MAYAN Indians who live in a rich tropical rainforest on the border of Mexico and Guatemala. Largely isolated, they maintained a traditional way of life until modern times, fishing, hunting, and growing vegetables and fruits. They spin fibres and weave cloth, tan leather, and make pottery, flutes, dugout canoes, and nets. They have preserved their traditional beliefs. Their total number has declined, and only several hundred remain.

lace Ornamental openwork fabric formed by the looping, interlacing, braiding, or twisting of threads, originally primarily of linen. Almost all high-quality artistic lace is made by one of two techniques: needle lace involves a difficult technique that originated in Italy; bobbin lace is a more widespread craft that originated in Flanders. The art of lace is a European achievement. Fully developed lace did not appear before the Renaissance. By 1600 lace had become a fabric of luxury and an important article of commerce. The Industrial Revolution in the 19th century led to the use of machines to produce less-expensive lace made of cotton, and lace gradually disappeared from both men's and women's fashions. By 1920 the industry was dying. Fine handmade lace is still made in Belgium, Slovenia, and elsewhere, but chiefly as souvenirs.

Lacedaemon See SPARTA

lacemaking Methods of producing LACE. The popularity of handmade laces led to the invention of lacemaking machines in the 19th century (see JOHN HEATHCOAT). Early models required intricate engineering mechanisms. Later improvements included Nottingham-lace machines, primarily for coarse lace, and Barmens machines. Schiffli lace, a type of embroidery, is made by modern machines, evolved from a hand version, using needles with points at each end. Many types of machine-made laces are produced, frequently with geometrically shaped nets forming their backgrounds. The high strength and comparatively low cost of man-made fibre yarns have made sheer laces widely available.

lacewing Any of numerous species of insects in the order Neuroptera, especially those in the green lacewing and brown lacewing families. The green lacewing has long, delicate antennae, a slender greenish body, golden- or copper-coloured eyes, and two pairs of veined wings. It is found worldwide and flies near grasses and shrubs. It is also known as a stinkfly because it emits a disagreeable odour. The larva, with prominent sucking mouthparts, drains body fluids from aphids and other soft-bodied insects. The brown lacewing resembles the green lacewing but is smaller and brown.

Lacewing (*Chrysopa*)
A.E.MC.R. PEARCE—BRUCE COLEMAN LTD.

Lachaise \lä-'shez**, Gaston** (b. March 19, 1882, Paris, Fr.—d. Oct. 18, 1935, New York, N.Y., U.S.) French-born U.S. sculptor. Son of a cabinetmaker, he was trained in the decorative arts and studied sculpture at the École des Beaux-Arts (1898–1904). He was a designer of ART NOUVEAU decorative objects for RENÉ LALIQUE before immigrating to the U.S. in 1906. His most famous work, *Standing Woman* (1912–27), a female nude with ample breasts and thighs and sinuous, tapered limbs, typifies the image he worked and reworked throughout his career. He is also known for his portrait busts of JOHN MARIN, MARIANNE MOORE, E.E. CUMMINGS, and others. See photograph above.

Lachlan River \'lä-klən\ Chief tributary of the MURRUMBIDGEE RIVER, central NEW SOUTH WALES, Australia. Rising in the GREAT DIVIDING RANGE, it flows northwest and turns southwest, joining the Murrumbidgee after a course of 930 mi (1,500 km). Though usually perennial, it may run dry in severe drought years. It was explored in 1815 by George W. Evans and was named after Lachlan Macquarie, governor of New South Wales.

Standing Woman, bronze sculpture by Gaston Lachaise, 1932; in the Museum of Modern Art, New York City.
COURTESY OF THE MUSEUM OF MODERN ART, NEW YORK, MRS. SIMON GUGGENHEIM FUND

Lackland, John See JOHN (ENGLAND)

Laclos \lä-'klō**, Pierre (-Ambroise-François) Choderlos de** (b. Oct. 18, 1741, Amiens, France—d. Nov. 5, 1803, Taranto, Parthenopean Republic) French writer. He chose an army career but soon left it to become a writer. He is chiefly remembered for *Dangerous Liasions* (1782), one of the earliest psychological novels. The epistolary novel of a noble seducer and his female accomplice who take unscrupulous delight in their victims' misery, it caused an immediate sensation and was banned for years. Laclos later returned to the army and ultimately rose to the rank of general under Napoleon. His book retained its popularity into the 21st century, by which time it had been adapted several times, for film and for television.

Laconia \lə-'kō-nē-ə**, Gulf of** Inlet, southern IONIAN SEA southern coast of the PELOPONNESE, Greece. Cape Maléa, which divides the gulf from the Aegean Sea, was once feared by sailors for its treacherous winds and harborless coast. The major stream entering the gulf is the non-navigable Evrótas River.

Lacoste \lä-'kȯst**, (Jean-) René** (b. July 2, 1904, Paris, France—d. Oct. 12, 1996, Saint-Jean-de-Luz) French tennis player and sportswear entrepreneur. He was noted for a methodical game in which he tried to outlast his opponents. He won the Wimbledon (1925, 1928) and French (1925, 1927, 1929) singles titles and became the first foreigner to win the U.S. championship twice (1926, 1927), the second time beating BILL TILDEN. He also won various doubles matches. Nicknamed "the Crocodile," he retired in 1929 to form a sportswear company that featured a crocodile (later an alligator) emblem on its clothes.

lacquerwork Any of a variety of decorative objects or surfaces, usually of wood, to which a coloured, highly polished, and opaque type of varnish called lacquer has been applied. True lacquerwork is Chinese or Japanese in origin. The technique was copied in Europe, where it was known as "japanning," but European lacquerwork lacks the hardness and brilliance of Asian lacquer. True lacquer is the purified and dehydrated sap of the *Rhus vernicifera* tree, native to China and cultivated in Japan. Lacquer becomes extremely hard but not brittle on exposure to air and takes a high polish. Many thin layers are applied, allowed to dry, and smoothed before the surface is ready for decoration by carving, engraving, or inlay.

lacrosse (French: "the crosier") Outdoor goal-scoring sport played with sticks called crosses. A crosse has a long handle and a triangular head with a mesh pouch for catching, carrying, and throwing a hard rubber ball. The object of the game is to sling the ball into an opponent's goal (for one point). French settlers in Canada adapted the modern game from an ancient American Indian activity (baggataway) that was at once sport, combat training, and mystical ceremony. It became an organized sport in the late 19th century. Modern teams have 10 players. The game is divided into four periods of 15 minutes each. Lacrosse is especially popular as a collegiate sport and is played by both men and women. See illustration on following page.

lactation Production of milk by female mammals after giving birth. The milk is discharged by the MAMMARY GLANDS in the breasts. Hormones triggered by delivery of the placenta and by nursing stimulate milk production. Colostrum (milk that the mother produces in the first few days after giving birth) has more proteins, minerals, and antibodies and fewer calo-

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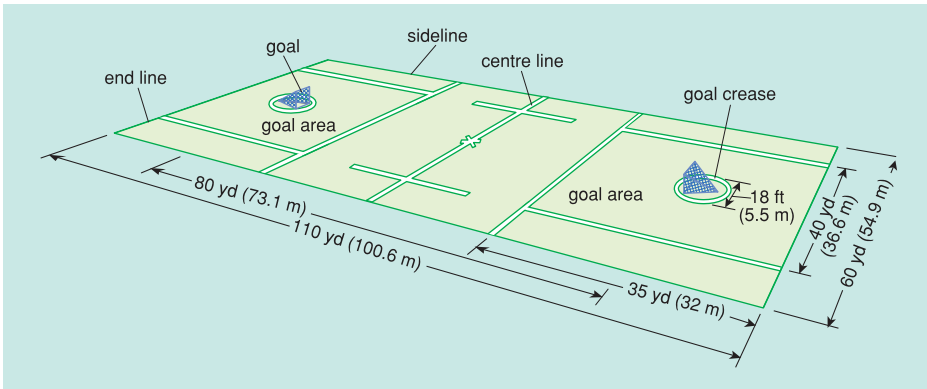

A typical men's lacrosse field. The women's game is often played on a larger field (120 x 82 yards), with the goals 100 yards apart, and usually without the outside boundary lines marked. The ball is put into play by a face-off at the middle of the field, and play is continuous except for goals, fouls, and time-outs. Players may kick the ball, but only the goalie may use his hands.
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ries and fats than the mature milk that develops later. Mature milk supplies nutrients, hormones, and substances that provide the infant with IMMUNITY against infectious agents. Most physicians recommend that babies be fed mother's milk exclusively for the first six months and that nursing continue through the first year. As the child is weaned, lactation tapers off; while nursing continues, FERTILITY is reduced. Problems with lactation may involve hormones, suckling pattern, physical difficulties, or emotional factors. Mothers taking certain drugs or with some diseases (e.g., AIDS) should not nurse, because of risks to the baby.

lactic acid CARBOXYLIC ACID found in certain plant juices, in blood and muscle, and in soil. In blood it occurs in the form of its SALTS (lactates) when GLYCOGEN is broken down in muscle; it can be reconverted to glycogen in the liver. Stiffness and soreness after prolonged heavy exercise are due to accumulated lactic acid in the muscles. The end product of bacterial FERMENTATION, lactic acid is the most common acidic constituent of fermented milk products (e.g., sour milk and cream, cheese, buttermilk, yogurt). It is used in other foods as a flavouring or preservative and industrially in tanning leather and dyeing wool and as a raw material or CATALYST in many chemical processes.

lactobacillus \ˌlak-tō-bə-'si-ləs\ Any of the rod-shaped, gram-positive (see GRAM STAIN) bacteria that make up the genus *Lactobacillus*. They are widely distributed in animal feeds, manure, and milk and milk products. Various species are used commercially in the production of sour milks, cheeses, and yogurt. Lactobacilli also play an important role in the manufacture of fermented vegetables (pickles and sauerkraut), beverages (beer, wine, and juices), sourdough breads, and some sausages. They inhabit but do not damage animal and human intestinal tracts. Commercial preparations of lactobacilli are used to restore normal intestinal flora after antibiotic therapy.

lactose Slightly sweet SUGAR (disaccharide) composed of two MONOSACCHARIDES, GLUCOSE and GALACTOSE, linked together. Lactose-intolerant adults, and more rarely infants, cannot digest lactose because they lack the ENZYME (lactase) that splits it into simpler sugars and suffer DIARRHEA and bloating when they eat foods containing it. Lactose, which makes up 2–8% of the milk of mammals, is the only common sugar of animal origin. Commercial lactose is obtained from whey, a liquid by-product of cheese. It is used in foods, in pharmaceuticals, and in nutrient broths used to produce penicillin, yeast, and riboflavin, and other products.

Ladakh \lə-'däk\ Region, eastern KASHMIR region, northwestern Indian subcontinent. It covers about 45,000 sq mi (117,000 sq km) and includes the western Himalayan Ladakh Range (see HIMALAYAS), the KARAKORAM RANGE, and the upper INDUS RIVER valley. Its capital is Leh. India and Pakistan fought over it before peace negotiations in 1949 gave its southern portion to India (which is part of the Indian state of JAMMU AND KASHMIR) and the rest to Pakistan. In the Sino-Indian War of 1962 China gained a portion of northeastern Ladakh. The region's boundaries are still in dispute.

Ladd-Franklin, Christine *orig.* **Christine Ladd** (b. Dec. 1, 1847, Windsor, Conn., U.S.—d. March 5, 1930, New York, N.Y.) U.S. scientist and logician. She fulfilled Ph.D. requirements at Johns Hopkins University in the 1880s, but, because women candidates were not recognized, she was not awarded her degree until 1926. In symbolic logic, she reduced syllogistic reasoning to an inconsistent triad with the introduction of the antilogism, a form that made the testing of deductions easier. The Ladd-Franklin theory of colour vision stressed increasing colour differentiation with evolution and assumed a photochemical model for the visual system. Her principal works are *The Algebra of Logic* (1883), *The Nature of Color Sensation* (1925), and *Color and Color Theories* (1929).

Ladies' Home Journal U.S. monthly magazine, one of the oldest in the country and long the trendsetter among women's magazines. Founded in 1883 as a supplement to the *Tribune and Farmer* (1879–85), it began an independent publication in 1884. Under the editorship (1889–1919) of EDWARD BOK, its circulation surpassed that of any other U.S. publication. Bok revolutionized the women's magazine field by offering high-quality fiction and nonfiction, establishing service departments that answered letters from readers, and conveying a sense of intimacy. After the mid-20th century *Ladies' Home Journal* was overtaken in circulation by its rival, *McCall's*. It was acquired in 1986 by the Meredith Corporation, which also publishes *Better Homes and Gardens*.

ladino \lə-'dē-nō\ Central American whose primary language is Spanish and who wears modern dress. Genetically ladinos may be of Indian, African, or mixed descent. An Indian may become a ladino by abandoning the Indian dress and customs. Many rural ladinos practice subsistence agriculture much like that of their Indian neighbours, but they tend to emphasize cash crops and modern farming techniques, which the Indians shun. In small towns ladinos commonly engage in commerce as well as farming. In the cities they engage in all occupations, from day labourer to university professor.

Ladino \lə-'dē-nō\ **language** *or* **Sephardic language** ROMANCE LANGUAGE spoken by Sephardic Jews in the Balkans, the Middle East, North Africa, Greece, and Turkey, though nearly extinct in many of these areas. Ladino is a very archaic form of Castilian SPANISH, mixed with HEBREW elements. It originated in Spain and was carried to its present speech areas by descendants of the Jews who were exiled from Spain after 1492. It preserves many words and grammatical usages that have been lost in modern Spanish. Ladino is usually written in the Hebrew alphabet.

Ladislas I *or* **Saint Ladislas** \'lä-dē-ˌsläs\ (b. June 27, 1040, Pol.—d. July 29, 1095, Nitra, Slvk.; canonized 1192; feast day June 27) King of Hungary (1077–95). He greatly expanded the boundaries of the kingdom, gaining land in Transylvania and occupying Croatia (1091). In the INVESTITURE CONTROVERSY he sided with the pope. Ladislas introduced Roman Catholicism to Croatia and persecuted pagans in his dominions. He also promulgated a legal code that brought order and prosperity to Hungary. He died while preparing for the First CRUSADE and was canonized in 1192.

Lado Enclave \'lä-dō\ Region, central Africa. It was located north of Lake ALBERT on the west bank of the Upper NILE RIVER, in what is now northern Uganda and southeastern Sudan. It was first explored by Europeans in 1841–42 and became a station for ivory and slave traders. Britain claimed the Upper Nile region in 1894 and leased to LEOPOLD II of Belgium the area known as the Lado Enclave. It was incorporated into the Anglo-Egyptian Sudan in 1910.

Ladoga \'lä-də-gə**, Lake** Lake, northwestern Russia. The largest lake in Europe, it covers an area of 6,700 sq mi (17,600 sq km). It is 136 mi (219 km) long and has an average width of 51 mi (82 km); its greatest depth is 754 ft (230 m). It contains 660 islands of more than 2.5 acres (1 hectare) in area. Its outlet is the NEVA RIVER, in the southwestern corner. Formerly divided between the U.S.S.R. and Finland, it now lies entirely

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within Russia. During the Siege of Leningrad (1941–44) in World War II, the lake was the lifeline that connected the city with the rest of the Soviet Union.

Ladrone Islands See Mariana Islands

ladybug *or* **ladybird beetle** Any of the approximately 5,000 widely distributed beetles of the family Coccinellidae. The name originated in the Middle Ages, when the beetle was dedicated to the Virgin Mary and called "beetle of Our Lady." Ladybugs are hemispheric and are usually 0.3–0.4 in. (8–10 mm) long. They have short legs and are usually brightly coloured with black, yellow, or reddish markings. Several generations are produced each summer. Ladybugs are often used to control such insect pests as aphids, scales, and mites, which they eat. Several species of ladybugs feed on plants.

ladyfish *or* **tenpounder** Species (*Elops saurus*, family Elopidae) of primarily tropical coastal marine fish. The ladyfish is slender and covered with fine silver scales; the dorsal and anal fins can be depressed into grooves. A predatory fish, it has small, sharp teeth and a bony throat plate between its mandibles. It is up to 35 in. (90 cm) long and weighs up to 30 lbs (14 kg). The young are transparent and eel-like.

lady's slipper Any member of several genera of orchids in which the lip of the flower is slipper-shaped. The genus *Cypripedium* has about 50 temperate and subtropical species. Two well-known species, the yellow lady's slipper (*C. calceolus*) and the pink lady's slipper, or moccasin flower (*C. acaule*), are found in temperate coniferous woods in early spring. Other genera include *Phragmipedium* and *Selenipedium* of the New World tropics, and the tropical Asian *Paphiopedilum*. Many hybrids have been developed.

Lady's slipper (*Cypripedium*)
GRANT HEILMAN

Laemmle \'lem-lē**, Carl** (b. Jan. 17, 1867, Laupheim, Ger.—d. Sept. 24, 1939, Beverly Hills, Calif., U.S.) German-born U.S. film producer. After immigrating to the U.S. in 1884, he worked at various jobs in Chicago before opening a nickelodeon there in 1906 and becoming a leading film distributor. He founded the Independent Motion Picture Co. in 1909 and induced stars such as Mary Pickford to join his studio. Fighting off monopoly control by the Motion Picture Patents Co., he produced 100 short films by 1910. In 1912 he merged with smaller companies to form Universal Pictures, and in 1915 he opened its 230-acre studio in California. His employees included Irving Thalberg and Harry Cohn. He is considered the father of the Hollywood star system. Financial setbacks forced him to sell the company in 1935.

Laetoli \lī-'tō-lē\ **footprints** Several trails of bipedal footprints, presumed to be those of Australopithecus *afarensis*, preserved in volcanic ash at Laetoli in northern Tanzania and dated to approximately 3.5 million years ago. They were discovered in 1978 by a team led by the Leakey family. The footprints indicate that the mechanism of weight and force transference through the early hominin foot was virtually identical to that of modern humans and suggest that two of the individuals, one larger and one smaller, walked together in stride and were close enough to have been touching. See also Lucy.

Laetus \'lī-təs**, Julius Pomponius** *or* **Giulio Pomponio Leto** (b. 1428, Diano, Kingdom of Naples—d. 1497, Rome) Italian humanist. As a youth he decided to dedicate his life to the study of the ancient world. In Rome he gathered other humanists around him in a semisecret society, the Academia Romana. Their celebration of ancient Roman rites aroused the suspicions of Pope Paul II, who briefly dissolved the Academia and imprisoned Laetus and his associates. Laetus's lack of rigour and critical spirit have led modern scholars to treat his writings with caution.

Lafayette, Marie-Joseph-Paul-Yves-Roch-Gilbert du Motier, marquis de (b. Sept. 6, 1757, Chavaniac, France—d. May 20, 1834, Paris) French military leader. Born to an ancient noble family of great wealth, he was a courtier at the court of Louis XVI but sought glory as a soldier. In 1777 he went to America, was appointed a major general, became a close friend of George Washington, and fought with distinction at the Battle of the Brandywine. He returned to France in 1779, persuaded Louis to send a 6,000-man force to aid the colonists, and returned to America in 1780 to command an army in Virginia and help win the Siege of Yorktown. Hailed as "the Hero of Two Worlds," he returned to France in 1782, became a leader of liberal aristocrats, and was elected to the Estates General in 1789. He presented the Declaration of the Rights of Man and of the Citizen to the National Assembly. Elected commander of the national guard of Paris, he sought to protect the king, favouring a constitutional monarchy. When his guards fired on a crowd of petitioners in the Champ de Mars (1791), he lost popularity and resigned his position. He commanded the army against Austria (1792), then defected to the Austrians, who held him captive until 1797. Returning to France, Lafayette became a gentleman farmer. In the Bourbon Restoration, he served in the Chamber of Deputies (1814–24) and commanded the national guard in the July Revolution (1830).

Laffite \lə-'fēt**, Jean** (b. 1780?, France—d. 1825?) French pirate. He led a band of privateers that preyed on Spanish ships and smuggled goods and slaves through New Orleans, where the group lived on islands south of the city. In the War of 1812 the British offered Laffite $30,000 for his allegiance in their planned attack on the city. He warned Louisiana officials of the attack but was not believed. He then offered his aid to Gen. Andrew Jackson, who accepted Laffite's help in the Battle of New Orleans. After the war Laffite returned to privateering against the Spanish.

Jean Laffite
THE BETTMANN ARCHIVE

Laffitte \lå-'fēt**, Jacques** (b. Oct. 24, 1767, Bayonne, France—d. May 26, 1844, Maisons-sur-Seine) French banker and politician. He became a partner in a Perregaux banking house in 1800 and head of the firm in 1804. As governor of the Bank of France (1814–19), he raised large sums of money for the provisional government in 1814 and for Louis XVIII during the Hundred Days. He saved Paris from a financial crisis in 1818. An early partisan of a constitutional monarchy under Louis-Philippe, he did much to secure Louis-Philippe's accession to the throne, and he briefly served as premier (1830–31) in the July Monarchy.

Jacques Laffitte, drawing by A. Devéria; in the Bibliothèque Nationale, Paris.
COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS

LaFontaine \lå-fō^{n}-'tan**, Sir Louis Hippolyte, Baronet** (b. Oct. 4, 1807, Boucherville, Lower Canada—d. Feb. 26, 1864, Montreal) Canadian statesman. Called to the bar in Lower Canada in 1829, he began his political career the following year, when he was elected to the provincial assembly for Terrebonne. He supported French-Canadian grievances against the British but opposed the rebellions of 1837–38. After the union of Upper and Lower Canada in 1841, he became the leader of Canada East (formerly Lower Canada). Appointed joint prime minister with Robert Baldwin (1842–43, 1848–51), he established responsible (i.e., representative) government for Canada. His Rebellion Losses Bill to compensate property owners for damages in 1837–38 provoked riots in Montreal but affirmed the strength of the government.

Lagash \'lā-ˌgash\ *modern* **Telloh** \'tel-ō\ Ancient capital in Sumer. It was located midway between the Tigris and Euphrates rivers in Babylonia,

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now in southeastern Iraq. Excavations have uncovered palace and temple ruins as well as CUNEIFORM texts that provide information about Sumer in the 3rd millennium BC. Founded in the Ubaid period (c. 5200–c. 3500 BC), it came under the control of SARGON of Akkad. It later prospered under Gudea, a governor nominally subject to the Guti. It was occupied as late as the Parthian era (247 BC–AD 224).

Engraved silver vase of King Entemena, from Lagash, Early Dynastic Period; in the Louvre, Paris
ARCHIVES PHOTOGRAPHIQUES

Lågen River \'lȯ-gən\ River, southeastern Norway. Rising in the Hardanger Plateau, it flows south to empty into the Skagerrak, an arm of the NORTH SEA. With a length of 209 mi (337 km), it is the third longest river in the country.

Lagerfeld, Karl (b. Sept. 10, 1938, Hamburg, Ger.) German fashion designer. After moving to Paris at age 14, he went on to create designs for such established labels as Pierre Balmain, Chloe, Valentino, and Fendi. He is best known as the creative power behind the modern revival of the house of Chanel, which he joined in 1983. Lagerfeld consistently managed to merge the spirit of the times with the chic, timeless identity established by the house's founder, GABRIELLE "COCO" CHANEL, making Chanel one of the most coveted and influential labels in late 20th-century fashion.

Lagerkvist \'lä-gər-ˌkvēst**, Pär (Fabian)** (b. May 23, 1891, Växjö, Swed.—d. July 11, 1974, Stockholm) Swedish novelist, poet, and dramatist. He was involved early in life with socialism and soon began to support literary and artistic radicalism. Though his early works are characterized by extreme pessimism, he declared his faith in humanity with his great prose monologue *The Triumph over Life* (1927). In the 1930s and '40s his writings protested fascism and brutality. The novel *The Dwarf* (1944) was his first best-seller and his first undisputed critical success. He won world recognition with the novel *Barabbas* (1950). He was awarded the Nobel Prize for Literature in 1951.

Lagerlöf \'lä-gər-ˌlœf**, Selma (Ottiliana Lovisa)** (b. Nov. 20, 1858, Mårbacka, Swed.—d. March 16, 1940, Mårbacka) Swedish novelist. She was working as a schoolmistress when she wrote her first novel, *Gösta Berlings saga* (1891), a chronicle of life in her native Värmland. Later works include *Jerusalem* (1901–02), which established her as Sweden's foremost novelist, and *The Wonderful Adventures of Nils* and its sequel (1906–07), a geography reader for children in fantasy form. A naturally gifted storyteller, she rooted her work in legend and saga. In 1909 she became the first woman and the first Swedish writer to win the Nobel Prize for Literature.

Laghouat \lä-'gwät\ Town (pop., 1998 prelim.: 96,342) and oasis, north-central Algeria. At the southern edge of the ATLAS MOUNTAINS, it was built on two hills that are extensions of Mount Tizigarine. It was settled in the 11th century and came under Moroccan and Ottoman control. Seized by the French in 1852, it reverted to Algeria in 1962.

lagoon Area of relatively shallow, quiet water with access to the sea but separated from it by sandbars, barrier islands, or coral reefs. Coastal lagoons have low to moderate tides and constitute about 13% of the world's coastline. Their water is colder than the sea in winter and warmer in summer. In warm regions, evaporation may more than balance any freshwater input and may result in hypersaline water and even the buildup of thick salt deposits. Coral-reef lagoons occur on marginal reefs such as the Great Barrier Reef, but the most spectacular examples, some more than 30 mi (50 km) across, are associated with Pacific ATOLLS.

Lagos \'lā-ˌgäs, 'lä-gəs\ City (pop., 1999: urban agglomeration, 12,763,000) and chief port, Nigeria. It is Nigeria's largest city, built on four main islands—Lagos, Iddo, Ikoyi, and Victoria—that are connected to each other and to the mainland by bridges. Its population is centered on Lagos Island, on the Bight of Benin. Part of the KINGDOM OF BENIN in the 16th century, it was inhabited largely by the Yoruba. Beginning in 1808, as Britain attempted to end the SLAVE TRADE, Lagos came into increasingly greater contact with the British. It was ceded to Britain in 1861, became a crown colony, and was governed from Sierra Leone (1866–74) and as part of the Gold Coast colony (1874–86). Joined with the protectorate of Southern Nigeria in 1906, it was made the capital of the colony of Nigeria in 1914. It was the capital (1960–91) of independent Nigeria until ABUJA became the new capital. It is a major trade and industrial centre.

Lagrange \lä-'grä"zh**, Joseph-Louis** *later* **count de L'Empire** (b. Jan. 25, 1736, Turin, Sardinia-Piedmont—d. April 10, 1813, Paris, France) Italian-born French mathematician who made important contributions to NUMBER THEORY and to classical and celestial mechanics. By age 25 he was recognized as one of the greatest living mathematicians because of his papers on wave propagation (see WAVE motion) and maxima and minima (see MAXIMUM; MINIMUM) of curves. His prodigious output included his textbook *Mécanique analytique* (1788), the basis for all later work in this field. His remarkable discoveries included the Lagrangian, a DIFFERENTIAL OPERATOR characterizing a system's physical state, and the Lagrangian points, points in space where a small body in the gravitational fields of two large ones remains relatively stable.

Laguna de Bay See Laguna de BAY

Laguna Madre See Laguna MADRE

Lahn River River, western Germany. A tributary of the RHINE RIVER, it rises in western Germany and after a southerly course reaches the Rhine at Lahnstein. It is 152 mi (245 km) long. Small barges are able to navigate to Giessen on the partly canalized river.

Lahore \lə-'hōr\ City (pop., 1998: 5,143,495), capital of Punjab province, northeastern PAKISTAN. The second largest city of Pakistan, it lies in the upper Indus plain on the RAVI RIVER. It was the capital of the Ghaznavid dynasty in the 12th century and was captured by the Mughal BĀBUR's troops in 1524; it was later under AKBAR and Jahāngīr. Ruled by Sikhs in the early 19th century, it passed to the British in 1849. After Indian independence, Lahore became part of Pakistan in 1947. It is the site of the mosque of Wazir Khan (1634); a mosque built by AURANGZEB; and the Shalimar gardens, laid out in 1641. It is the seat of Pakistan's oldest educational institution, the University of the Punjab (founded 1882).

Laibach \'lī-bäk̠**, Congress of** (Jan. 26–May 12, 1821) Meeting of the HOLY ALLIANCE powers that set the conditions for Austrian intervention in and occupation of the Kingdom of the Two Sicilies in action against the Neapolitan revolution (1820). The congress proclaimed its hostility to revolutionary regimes, agreed to abolish the Neapolitan constitution, and authorized the Austrian army to restore the absolutist monarchy. The British and French protested the decision.

Laing \'laŋ**, R(onald) D(avid)** (b. Oct. 7, 1927, Glasgow, Scot.—d. Aug. 23, 1989, St. Tropez, France) Scottish psychiatrist. In his widely read and highly controversial book *The Divided Self* (1960), his analysis of SCHIZOPHRENIA led him to theorize that insecurity about one's existence prompts a defensive reaction in which the self splits into separate components, generating psychotic symptoms, and he opposed standard schizophrenia treatments such as hospitalization and electroshock. He even opposed the concept of mental illness, viewing it as induced by family relationships and society, and radically reconceived the role of the psychiatrist. He later modified some of his controversial positions.

laissez-faire \ˌle-sā-'fer\ *French* **"allow to do"** Policy dictating a minimum of governmental interference in the economic affairs of individuals and society. It was promoted by the PHYSIOCRATS and strongly supported by Adam SMITH and JOHN STUART MILL. Widely accepted in the 19th century, laissez-faire assumed that the individual who pursues his own desires contributes most successfully to society as a whole. The function of the state is to maintain order and avoid interfering with individual initiative. The popularity of the laissez-faire doctrine waned in the late 19th century, when it proved inadequate to deal with the social and economic problems caused by INDUSTRIALIZATION. See also CLASSICAL ECONOMICS.

lake Relatively large body of slow-moving or standing water that occupies an inland basin. Lakes are most abundant in high northern latitudes and in mountain regions, particularly those that were covered by GLACIERS

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in recent geologic times. The primary sources of lake water are melting ice and snow, springs, rivers, runoff from the land surface, and direct precipitation. In the upper part of lakes there is a good supply of light, heat, oxygen, and nutrients, well distributed by currents and turbulence. As a result, a large number of diverse aquatic organisms can be found there. The most abundant forms are PLANKTON (chiefly DIATOMS), ALGAE, and flagellates. In the lower levels and in the sediments, the main forms of life are bacteria. See also LIMNOLOGY.

Lake Clark National Park and Preserve National park, southern Alaska, U.S. Located on the western shore of Cook Inlet, it was proclaimed a national monument in 1978 and a national park in 1980. Its total area is 3,653,000 acres (1,478,300 hectares). Lake Clark, more than 40 mi (65 km) long, is the largest of its glacial lakes; it feeds rivers that provide the most important spawning ground for red salmon in North America. The park includes glaciers, waterfalls, and active volcanoes.

Lake District Mountainous region, administrative county of Cumbria, northwestern England. Roughly coextensive with Lake District National Park, the country's largest, it occupies an area of 866 sq mi (2,243 sq km). It contains numerous lakes, including WINDERMERE (England's largest), Grasmere, and Coniston Water, as well as England's highest mountains, the loftiest being Scafell Pike, which rises to 3,210 ft (978 m). The district was home to several English poets, including WILLIAM WORDSWORTH, ROBERT SOUTHEY, and SAMUEL TAYLOR COLERIDGE, who celebrated its landscape. It became a national park in 1951.

Lake Dwellings Remains of various pre- and post-BRONZE AGE settlements within the margins of lakes in southern Germany, Switzerland, France, and Italy. The dwellings appear to have been built on platforms supported by piles above the water surface or above swampy areas along the water's edge. The platforms supported one- or two-room rectangular huts with beaten clay floors. Cattle and sheep were raised in some of the structures. Most dwellings seem to have burned, either by accident or by attack. Because the Lake Dwellers usually rebuilt new villages on the remains of the old, archaeologists were able to work out a cultural sequence confirming that the Bronze Age immediately followed the STONE AGE. See also CRANNOG.

Lake of the Ozarks See Lake of the OZARKS

Lake of the Woods See Lake of the WOODS

Lake Placid Village (pop., 2000: 2,638), northeastern New York, U.S., on Mirror Lake and Lake Placid, in the ADIRONDACK MOUNTAINS. The site was settled in 1800, but it was abandoned after crop failures. Resettled during the 1840s, it was promoted in 1850 as a summer resort, and MELVIL DEWEY founded the Lake Placid Club there in 1895. It is a year-round recreation area with numerous hotels, golf courses, ski resorts, and mountain scenery. It was the scene of the OLYMPIC GAMES in 1932 and 1980.

lake trout *or* **Mackinaw trout** *or* **Great Lakes trout** *or* **salmon trout** Large, voracious CHAR (*Salvelinus namaycush*) found widely from northern Canada and Alaska to New England and the Great Lakes, usually in deep, cool lakes. They are greenish gray and covered with pale spots. In spring, 5-lb (2.3-kg) lake trout are caught in shallow water; in summer, fish of up to 100 lbs (45 kg) are trolled in deep water. Lake trout were virtually eliminated from the Great Lakes by the sea LAMPREY, which entered through the Welland Canal in the 1930s. They have been introduced in the western U.S., South America, Europe, and New Zealand.

Lake Turkana remains Collection of HOMININ fossils found along the shores of Lake Turkana (Lake RUDOLF) in northwestern Kenya. The Koobi Fora site, excavated by the LEAKEY FAMILY and others, has proved to be the richest trove of hominin remains anywhere in the world, yielding fossils that represent perhaps 230 individuals, including members of *HOMO HABILIS*, *HOMO ERECTUS*, and *AUSTRALOPITHECUS*. On the western shore was found a remarkably well-preserved skeleton of an 11-year-old boy ("Turkana Boy") later classified as *H. ergaster* or *H. erectus* and dated to c. 1.8 million years ago. This surprisingly human specimen suggests that *H. ergaster* may have been the direct ancestor of the hominins that left Africa for Eurasia c. 1 million years ago. See also HUMAN EVOLUTION.

Lakewood Township (pop., 2000: 60,352), eastern New Jersey, U.S. Located southwest of Asbury Park, it was settled by the Dutch and English in 1800, and it was known successively as Three Partners' Mill, Washington's Furnace, Bergen Iron Works, and Bricksburg. It is now a popular resort and recreation area, and its population has tripled since the 1960s.

Lakshadweep \lək-'shäd-ˌwēp\ Union territory (pop., 2001 prelim.: 60,595) of India. Located in the Arabian Sea off India's southwestern coast, it includes 27 islands (10 of which are inhabited), with a total land area of 12 sq mi (32 sq km). The capital is KAVARATTI. Once ruled by the Hindu Kulashekhara dynasty, it became part of an Islamic dominion in the 12th century. Britain gained sovereignty over it in the 18th century and assumed direct administration in 1908. It passed to India in 1947 and became the nation's smallest union territory in 1956. Coconut palms are the agricultural mainstay, while fishing is the chief industry.

Lakshmi *or* **Laksmi** \'lək-shmē\ Hindu and Jain goddess of wealth and good fortune. The consort of VISHNU, she is said to have taken different forms to be with him in each of his incarnations. She is a principal object of worship during DIVALI, when her presence is sought in homes, temples, and businesses for the whole of the year to come.

Lalique \lä-'lēk**, René (Jules)** (b. April 6, 1860, Ay, Fr.—d. May 5, 1945, Paris) French jeweler and glassmaker. Trained in Paris and London, he opened his own firm in Paris in 1885 and soon acquired clients such as SARAH BERNHARDT. Reacting against machine-produced jewelry featuring precious gems, he designed elegant and fantastic jewelry with less conventional gemstones (tourmaline, cornelian, etc.) and materials such as horn. His designs contributed significantly to the ART NOUVEAU movement and later the ART DECO movement. His interest in architectural glass led him to develop the style of molded glass for which he is famous, characterized by iced surfaces, elaborate patterns in relief, and occasionally applied or inlaid colour.

Enamel, glass, and topaz hair ornament and brooch by Lalique, 1900; in the Victoria and Albert Museum, London
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

lama In TIBETAN BUDDHISM, a spiritual leader. Some lamas are considered to be reincarnations of their predecessors; others have won respect for their high level of spiritual development. The most honored of the reincarnate lamas is the DALAI LAMA; second in spiritual authority is the PANCHEN LAMA. The process of discovering the new incarnation of a lama, especially the Dalai Lama, is elaborate and exacting. Oracular messages, unusual signs during the lama's death or during a birth thereafter, and examinations of candidates identify a successor. The child thus identified as the lama's incarnation is given extensive monastic training from an early age.

Lamar \lə-'mär**, Mirabeau Buonaparte** (b. Aug. 16, 1798, Louisville, Ga., U.S.—d. Dec. 19, 1859, Richmond, Texas) U.S. politician. After an unsuccessful career as a merchant in Alabama, he served as secretary to the governor of Georgia and later became editor of a newspaper favouring states' rights. He then moved to Texas, where he became involved in the independence struggle against Mexico. As a cavalry commander, he helped win the Battle of San Jacinto (1836) and was later appointed secretary of war in the provisional Texas government. He was elected vice president of the Republic of Texas under SAM HOUSTON, whom he succeeded as president (1838–41). He initially opposed annexation to the U.S., but after 1844 he advocated statehood to ensure the continuation of slavery.

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Lamarck \lə-'märk**, Jean-Baptiste de Monet, knight de** (b. Aug. 1, 1744, Bazentin-le-Petit, Picardy, France—d. Dec. 18, 1829, Paris) French biologist. He is credited with the first use of the word *biology* (1802). He was one of the originators of the modern concept of the museum collection, an array of objects whose arrangement constitutes a classification under institutional sponsorship, maintained and kept up-to-date by knowledgeable specialists. He seems to have been the first to relate fossils to the living organisms to which they corresponded most closely. His notion that acquired traits could be inherited (called Lamarckism) was discredited after the 1930s by most geneticists except in the Soviet Union, where it dominated Russian genetics until the 1960s (see TROFIM LYSENKO). See also CHARLES DARWIN; DARWINISM.

Lamartine \là-mär-'tēn**, Alphonse de** (b. Oct. 21, 1790, Mâcon, France—d. Feb. 28, 1869, Paris) French poet and statesman. After brief military service under LOUIS XVIII, he turned to literature, writing verse tragedies and elegies. He is chiefly remembered for his successful first collection of poetry, the musical, evocative *Méditations poétiques* (1820), which established him as a key figure in French ROMANTICISM. From 1830 he was active in politics, speaking for the working classes. After France's SECOND REPUBLIC was proclaimed in 1848, he briefly headed the provisional government until the revolution was crushed. In later years he published novels, poetry, and historical works in a vain struggle against bankruptcy.

Lamashtu \lä-'mäsh-tü\ In MESOPOTAMIAN RELIGION, the most terrible of all female demons. The daughter of the sky god ANU, Lamashtu killed children, consumed human flesh and blood, blighted plants, spoiled rivers and streams, sent nightmares, caused miscarriages, and brought disease. She had seven names and was often described in incantations as "seven witches." She was portrayed on amulets as a lion- or bird-headed female figure kneeling on an ass, holding a double-headed serpent in each hand and suckling dogs or pigs at her breasts.

lamb Live SHEEP before the age of one year, and the flesh of such animals. The flesh of the mature ram or ewe at least one year old is called mutton; the meat of sheep 12–20 months old may be called yearling mutton. The meat of sheep 6–10 weeks old is usually sold as baby lamb, and spring lamb comes from sheep 5–6 months old. The primary lamb- and mutton-consuming countries (on a per capita basis) are New Zealand and Australia.

Lamb, Charles (b. Feb. 10, 1775, London, Eng.—d. Dec. 27, 1834, Edmonton, Middlesex) English essayist and critic. Lamb was employed as a clerk at East India House (headquarters for the East India Company) from 1792 to 1825. From 1796 he was guardian of his sister, the writer Mary Lamb (1764–1847), who, in a fit of madness (which proved recurrent), had killed their mother. He is best known for the often autobiographical essays he wrote under the pseudonym Elia for *London Magazine*, collected in *Essays of Elia* (1823) and *The Last Essays of Elia* (1833). Among the greatest of English letter writers, he included some of his most perceptive literary criticism, often in the form of marginalia, in letters. He collaborated with Mary on *Tales from Shakespear* (1807), a highly popular retelling of the plays for children.

Lamb, William See Viscount MELBOURNE

lambkill See SHEEP LAUREL

lamb's ears *or* **lamb's ear** Widely cultivated perennial herb (*Stachys byzantina*, or *S. olympica*) of the MINT family, native to South Asia. Covered with densely matted hairs, its silver-green leaves, which provide a pleasing contrast to green leaves and to bright- or soft-coloured flowers, make lamb's ears a hardy favourite in perennial gardens of the northeastern U.S.

Lamennais \lȧm-'ne**, (Hugues-) Félicité (-Robert de)** (b. June 19, 1782, Saint-Malo, France—d. Feb. 27, 1854, Paris) French priest and philosopher. With his brother Jean, he sketched a program of church reform in *Reflections on the State of the Church* (1808) and in 1814 produced a defense of ultramontanism (papal authority). Ordained a priest in 1816, he wrote the acclaimed *Essay on Indifference Toward Religion* (1817–23), which argued for the necessity of religion. After the JULY REVOLUTION (1830), he cofounded the journal *L'Avenir* to advocate democratic principles and church-state separation. Its principles were condemned by the pope in 1832. Lamennais's *The Words of a Believer* (1834), written in response, provoked another papal encyclical and led to Lamennais's severance from the church. Thereafter he wrote in the cause of republicanism and socialism.

Lamerie \lȧm-'rē**, Paul de** (b. April 9, 1688, 's Hertogenbosch, Neth.—d. Aug. 1, 1751, London, Eng.) Dutch-born British silversmith. His Huguenot parents had left France in the early 1680s and settled in England by 1691. After an apprenticeship with a London goldsmith, he registered his mark and opened a shop in 1713. Early in his career he made simple vessels such as tankards and teapots in an unadorned QUEEN ANNE STYLE; later he used more ornamentation. By the 1730s he had established his own version of the ROCOCO STYLE, seen in a 1737 cup with handles in the form of snakes.

laminar flow Fluid flow in which the fluid travels smoothly or in regular paths. The VELOCITY, PRESSURE, and other flow properties at each point in the fluid remain constant. Laminar flow over a horizontal surface may be thought of as consisting of thin layers, all parallel to each other, that slide over each other. It is common only where the flow channel is relatively small, the fluid is moving slowly, and its VISCOSITY is relatively high. Examples include the flow of oil through a thin tube and blood flow through capillaries. See also TURBULENT FLOW.

L'Amour \lä-'mȯr-, lä-'můr**, Louis** *orig.* **Louis Dearborn LaMoore** (b. March 22, 1908, Jamestown, N.D., U.S.—d. June 10, 1988, Los Angeles, Calif.) U.S. author of westerns. He left school at age 15 and traveled the world before beginning his writing career in the 1940s. He used pseudonyms, including Tex Burns and Jim Mayo, until *Hondo* (1953) became a successful film. His more than 100 works, mostly formula westerns that convincingly portray frontier life, have sold 200 million copies in 20 languages, and more than 30—including *Kilkenny* (1954), *The Burning Hills* (1956), *Guns of the Timberland* (1955), and *How the West Was Won* (1963)—were the basis of films.

lamprey \'lam-prē, 'lam-ˌprā\ Any of about 22 species of primitive, jawless fishes (with HAGFISHES in class Agnatha). Lampreys live in coastal and freshwater in temperate regions worldwide except Africa. Eel-like, scaleless animals, they are 6–40 in. (15–100 cm) long. Lampreys have well-developed eyes, a single nostril on top of the head, a cartilaginous skeleton, and a sucking mouth with horny teeth surrounding the round opening. They spend years as burrowing larvae; adults of most species move into the sea. They attach to fish with their mouth and feed on their host's blood and tissues. Some species will remain in freshwater, notably the sea lamprey, which entered the Great Lakes and nearly eliminated LAKE TROUT and other commercially important fishes there.

Lamprey (*Lampetra*) on rainbow trout.
OXFORD SCIENTIFIC FILMS/BRUCE COLEMAN LTD.

Lampsacus \'lamp-sə-kəs\ Ancient Greek colony on the Asian shore of the DARDANELLES. It was famous for its wines and was the chief seat of the worship of PRIAPUS. Colonized in 654 BC by Ionian Phocaea, it took part in the Ionian revolt against the Persian Achaemenian dynasty in 499 and later joined the DELIAN LEAGUE. When Athens fell in 405, it again came under Persian control until ALEXANDER THE GREAT captured it in 334. It was the home of the philosopher Strato of Lampsacus.

LAN See LOCAL AREA NETWORK

Lan Chang See LAN SANG

Lan-chou See LANZHOU

Lan Na One of the first major TAI (Siamese) kingdoms in Thai history. It was founded by Mangrai (r. c. 1259–1317) in the northern region of

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present-day Thailand; its capital was the city of Chiang Mai. Lan Na was a powerful state and a centre for the spread of THERAVADA Buddhism. Under Tilokaracha (r. 1441–87) it was famous for its Buddhist scholarship and literature. It remained independent until it was conquered by Myanmar (Burma) in the 16th century. The Siamese did not reassert control over the area until the 19th century.

Lan Sang \'län-'säŋ\ *or* **Lan Xang** \'län-'shäŋ\ *or* **Lan Chang** \'län-'chäŋ\ Laotian kingdom that flourished from the 14th century until it was split into two separate kingdoms in the 18th century. Conflict with its neighbours forced Lan Sang's rulers to move the capital from Luang Prabang to VIENTIANE in 1563, but the kingdom maintained its power.

Lan-Ts'ang Chiang See MEKONG RIVER

Lan Xang See LAN SANG

Lanao \lä-'naù**, Lake** *or* **Lake Sultan Alonto** Lake, west-central MINDANAO, Philippines. It is located in a plateau region north of a range of active volcanoes. The second largest lake in the Philippines, it occupies an area of 131 sq mi (340 sq km). It is about 20 mi (32 km) long and has a maximum width of 10 mi (16 km).

Lancang Jiang See MEKONG RIVER

Lancashire \'laŋ-kə-ˌshir\ Administrative (pop. 2001: 1,134,976), historic, and geographic county, northwestern England. The administrative county comprises 12 districts. In the early Middle Ages it was a province of the Anglo-Saxon kingdom of NORTHUMBRIA. The region included the ancestral lands of the house of LANCASTER. In the Industrial Revolution it became an important manufacturing region and a centre of the textile industry. Lancaster and PRESTON are its major market and industrial cities; it also has resort towns, including Blackpool, on the Irish Sea.

Lancaster, Burt(on Stephen) (b. Nov. 2, 1913, New York, N.Y., U.S.—d. Oct. 20, 1994, Century City, Calif.) U.S. film actor. He toured with circuses as an acrobat in the 1930s and served in North Africa and Italy during World War II. He first appeared in movie houses in *The Killers* (1946), which made him a star. He was noted for his portrayals of physically tough, emotionally sensitive characters. Lancaster's many films include *Come Back, Little Sheba* (1952), *From Here to Eternity* (1953), *The Rose Tattoo* (1955), *Sweet Smell of Success* (1957), *Elmer Gantry* (1960, Academy Award), *The Birdman of Alcatraz* (1962), *The Leopard* (1963), *Atlantic City* (1981), *Local Hero* (1983), and *Field of Dreams* (1989).

Lancaster, house of Cadet branch of the house of PLANTAGENET that provided three kings of England in the 15th century (HENRY IV, HENRY V, HENRY VI). The family name first appeared in 1267, when the title of earl of Lancaster was granted to HENRY III's son Edmund (1245–96). Edmund's grandson Henry (d. 1361) became the 1st duke of Lancaster, and the inheritance fell to his youngest daughter, Blanche, and to her husband, JOHN OF GAUNT. His son, Henry of Lancaster, became King Henry IV, and the duchy of Lancaster was merged in the crown. The Lancaster dynasty ended after the defeat of Henry VI by EDWARD IV of the house of YORK (see Wars of the ROSES), and the Lancaster claims were passed on to the house of TUDOR.

lancelet See AMPHIOXUS

Lancelot *or* **Launcelot** \'lan-sə-ˌlät, 'lan-sə-ˌlət\ One of the greatest knights in ARTHURIAN LEGEND, the lover of Guinevere and the father of GALAHAD. He first appeared in a 12th-century romance by CHRÉTIEN DE TROYES, and he is a major character in SIR THOMAS MALORY's *Morte Darthur*. His full name, Sir Lancelot du Lac, refers to his upbringing by the Lady of the Lake, the enchantress who carried him off in infancy and trained him to be a model of chivalry before sending him to Arthur's court. There he became the favorite of King Arthur and the lover of Queen Guinevere. His adultery with Guinevere caused him to fail in the quest for the GRAIL and set in motion the events that led to the destruction of CAMELOT. He was displaced as the model knight by Galahad, his son by the grailkeeper's daughter Elaine.

Lancet, The British medical journal established in 1823, published weekly from New York and London. Its founder and first editor, Thomas Wakley, considered at the time a radical reformer, stated that the intent of the new journal was to report on hospital lectures and describe important cases of the day. It has since played a significant role in medical and hospital reform movements in Britain and has become a highly prestigious medical journal around the world.

Lanchester \'lan-chəs-tər**, Frederick William** (b. Oct. 23, 1868, London, Eng.—d. March 8, 1946, Birmingham, Warwickshire) British automobile and aeronautics pioneer. Lanchester produced the first British automobile, a one-cylinder, five-horsepower model, in 1896. After he successfully produced improved models, financial backing enabled him to produce several hundred cars over the next few years, vehicles notable for a relative freedom from vibration, a graceful appearance, and a luggage rack. He published an important paper (1897) on the principles of heavier-than-air flight and later major texts on aeronautics.

Lancisi \län-'chē-zē**, Giovanni Maria** (b. Oct. 26, 1654, Rome, Papal States—d. Jan. 20, 1720, Rome) Italian anatomist and epidemiologist. He related the prevalence of MALARIA in swampy areas to the presence of mosquitoes and recommended swamp drainage to prevent it. He linked an increase in sudden deaths in Rome to causes such as hemorrhagic stroke, cardiac enlargement and dilation, and growths on heart valves and explored causes of heart enlargement. He also provided the first description of syphilitic aneurysms.

land In economics, the resource that encompasses the natural resources used in production. In CLASSICAL ECONOMICS, the three factors of production are land, LABOUR, and CAPITAL. Land was considered to be the "original and inexhaustible gift of nature." In modern economics, it is broadly defined to include all that nature provides, including minerals, forest products, and water and land resources. While many of these are renewable resources, no one considers them "inexhaustible." The payment to land is called RENT. Like land, its definition has been broadened over time to include payment to any productive resource with a relatively fixed supply.

Land, Edwin (Herbert) (b. May 7, 1909, Bridgeport, Conn., U.S.—d. March 1, 1991, Cambridge, Mass.) U.S. inventor and physicist. After briefly attending Harvard University, he cofounded the Land-Wheelwright Laboratories in Boston in 1932. Interested in light POLARIZATION, in 1932 he developed the polarizer (which he called the Polaroid J sheet), for which he envisioned numerous uses. By 1936, Land began to use types of Polaroid material in sunglasses and other optical devices. It was later used in camera filters and other optical equipment. In 1937 Land founded the POLAROID CORP. in Cambridge, Mass. In 1947 he demonstrated the revolutionary Polaroid Land Camera, which produced a finished print in 60 seconds; he introduced colour Polaroid film in 1963. His interest in light and colour resulted in a new theory of colour perception. He received more than 500 patents.

Land-Grant College Act of 1862 *or* **Morrill Act** Act of the U.S. Congress (1862) that provided grants of land to states to finance the establishment of colleges specializing in "agriculture and the mechanic arts." Named for its sponsor, Vermont Congressman Justin Smith Morrill (1810–98), it granted each state 30,000 acres (12,140 hectares) for each of its congressional seats. Funds from the sale of the land were used by some states to establish new schools; other states turned the money over to existing state or private colleges to create schools of agriculture and mechanic arts (known as "A&M" colleges). The military training required in the curriculum of all land-grant schools led to the establishment of the Reserve Officers Training Corps, an educational program for future army, navy, and air force officers. The second Morrill Act (1890) initiated regular appropriations to support land-grant colleges, which came to include 17 predominantly African American colleges and 30 American Indian colleges.

land mine Explosive charge buried just below the surface of the earth, used in military operations against troops and vehicles. It may be fired by the weight of vehicles or troops on it, the passage of time, or remote control. Though improvised land mines (buried artillery shells) were used in World War I, they only became important in warfare during World War II and have been widely used since. Most early mines had metal cases; later models were sometimes made of other materials to prevent magnetic detection. They are typically used to disrupt or prevent the massed attack of tanks or infantry, but in post–World War II conflicts they have also been used to render land useless to enemy civilian populations. A treaty banning land mines—not signed by the U.S., Russia, and China—went into effect in 1997. See also SUBMARINE MINE.

land reform Deliberate change in the way agricultural land is held or owned, the methods of its cultivation, or the relation of agriculture to the rest of the economy. The most common political objective of land reform is to abolish feudal or colonial forms of landownership, often by taking land away from large landowners and redistributing it to landless peas-

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ants. Other goals include improving the social status of peasants and coordinating agricultural production with industrialization programs. The earliest record of land reform is from 6th-century-BC Athens, where SOLON abolished the debt system that forced peasants to mortgage their land and labour. The concentration of land in the hands of large landowners became the rule in the ancient world, however, and remained so through the Middle Ages and the Renaissance. The FRENCH REVOLUTION brought land reform to France and established the small family farm as the cornerstone of French democracy. SERFDOM was abolished throughout most of Europe in the 19th century. The Russian serfs were emancipated in 1861, and the RUSSIAN REVOLUTION OF 1917 introduced collectivization of agriculture, attended by loss of capital and devastating famines. Land reform was instituted in a number of other countries where communists came to power, notably China. It remains a potent political issue in many parts of the world. See also ABSENTEE OWNERSHIP.

land tenure, feudal See FEUDAL LAND TENURE

Landau \län-'daů**, Lev (Davidovich)** (b. Jan. 22, 1908, Baku, Azerbaijan, Russian Empire—d. April 1, 1968, Moscow, Russia, U.S.S.R.) Soviet physicist. After graduating from Leningrad State University, he studied at NIELS BOHR's institute in Copenhagen. He is known for his work in low-temperature physics, atomic and nuclear physics, and solid-state, stellar-energy, and plasma physics. For explaining the phenomenon of liquid HELIUM, he was awarded a 1962 Nobel Prize. For his work in many areas of physics, his name is applied to Landau diamagnetism, Landau levels, Landau damping, the Landau energy spectrum, Landau cuts, and the Landau Institute for Theoretical Physics in Moscow.

Landers, Ann *orig.* **Esther Pauline Friedman** (b. July 4, 1918, Sioux City, Iowa, U.S.—d. June 22, 2002, Chicago, Ill.) U.S. newspaper columnist. She took over an advice column in the *Chicago Sun-Times* in 1955, adopting her now-familiar pseudonym, and made it into the most widely syndicated advice column in the U.S.; by the early 21st century her column appeared in more than 1,200 newspapers and had some 90 million readers. Her twin sister, Pauline, has written the competitive and equally well-known "Dear Abby" advice column (originally for the *San Francisco Chronicle*) since 1956.

Landini \län-'dē-nē**, Francesco** *or* **Francesco Landino** (b. c. 1335, Fiesole, near Florence—d. Sept. 2, 1397, Florence) Italian composer, organist, and poet. Blinded by smallpox as a child, he took up the study of music and the organ. He later became an organ builder as well as a composer, lyricist, and performer of more than 150 beautifully melodic two- and three-part songs. Landini's works represent about a quarter of the music that survives from the Italian ARS NOVA (14th century).

Landis, Kenesaw Mountain (b. Nov. 20, 1866, Millville, Ohio, U.S.—d. Nov. 25, 1944, Chicago, Ill.) U.S. federal judge and first commissioner of professional baseball. Landis was named for a Georgia mountain where his father had been wounded as a Civil War soldier. He practiced law in Chicago (1891–1905) before being appointed a U.S. district judge (1905–22). In 1907 he presided over a famous case in which Standard Oil Co. was found guilty of granting unlawful freight rebates and fined $29 million (his decision was later reversed). He was named baseball commissioner in 1920 in the aftermath of the BLACK SOX SCANDAL and became noted for his uncompromising measures to preserve the game's integrity. Though widely disliked for his stern, autocratic rule, he kept the post until his death.

Landis, 1928
UPI-EB INC.

ländler \'lent-lər\ Traditional couple dance of Austria and Bavaria. A gliding and turning dance to music in ¾ time, it was popular in the 18th–19th century in Vienna and influenced the later development of the WALTZ. Composers such as WOLFGANG AMADEUS MOZART, FRANZ SCHUBERT, ANTON BRUCKNER, and GUSTAV MAHLER wrote *ländlers* and *ländler*-inspired works.

landlord and tenant Parties to the leasing of real estate, whose relationship is bound by contract. The landlord, or lessor, is the owner; the tenant, or lessee, supplies payment in order to enjoy possession and use of the property for a specified period. Important forms of tenancy include tenancy for a fixed period, periodic (seasonal) tenancy, tenancy at will, and holdover tenancy (whereby a tenant remains after the contract has ended). See also REAL AND PERSONAL PROPERTY, RENT.

Landon, Alf *orig.* **Alfred Mossman Landon** (b. Sept. 9, 1887, West Middlesex, Pa., U.S.—d. Oct. 12, 1987, Topeka, Kan.) U.S. politician. He received a law degree from the University of Kansas in 1908 and entered the oil business in 1912. He became active in Progressive Party politics and campaigned in Kansas for the party's 1912 presidential candidate, THEODORE ROOSEVELT. He was elected governor of Kansas in 1932 and again in 1934, the only incumbent Republican governor to be reelected that year. As the Republican candidate in the presidential election of 1936 he lost in a landslide to Democratic incumbent FRANKLIN D. ROOSEVELT.

Landor, Walter Savage (b. Jan. 30, 1775, Warwick, Warwickshire, Eng.—d. Sept. 17, 1864, Florence, Italy) British writer. He was educated at Rugby School and Oxford but left both over disagreements with the authorities. A classicist, he originally wrote many of his works in Latin. Though he wrote lyrics, plays, and heroic poems, he is best remembered for his multivolume *Imaginary Conversations*, prose dialogues between historical personages (1824–53). He spent much of his life in France and Italy.

Landowska \lan-'dȯf-skə**, Wanda (Louise)** (b. July 5, 1879, Warsaw, Pol., Russian Empire—d. Aug. 16, 1959, Lakeville, Conn., U.S.) Polish-born U.S. harpsichordist and pianist. After establishing herself as a pianist and devoting much energy to musicological research, she had a harpsichord made for her by Pleyel in Paris. She first performed on this instrument at the Breslau Bach Festival in 1912, thus beginning the 20th-century revival of the instrument and sparking a new international interest in authentic performance practice. Her many recordings include the first recording of JOHANN SEBASTIAN BACH's *Goldberg Variations*, and she commissioned works such as MANUEL DE FALLA's *Harpsichord Concerto* and FRANCIS POULENC's *Concert champêtre*. As a Jew she was forced to flee the Nazis, and after 1940 she lived and taught in the U.S.

Landrum-Griffin Act (1959) Legislation in the U.S. designed to counter labour-union corruption. Officially called the Labor-Management Reporting and Disclosure Act, it instituted federal penalties for labour officials who misused union funds or prevented union members from exercising their legal rights. The legislation was passed in response to Senate investigations that uncovered connections between labour and ORGANIZED CRIME. Provisions included a strict ban on secondary boycotts (union efforts to stop one employer from dealing with another employer who is being struck or boycotted) and greater freedom for individual states to set the terms of labour relations within their borders.

Land's End Westernmost peninsula, CORNWALL, England. Its tip is the southwesternmost point of England and lies about 870 mi (1,400 km) from JOHN O' GROATS, traditionally considered the northernmost point of Britain. Off its coast lie dangerous reefs, one group of which, a mile from the mainland, is marked by the Longships lighthouse.

Landsat *officially* **Earth Resources Technology Satellites** Any of a series of unmanned U.S. scientific satellites. The first three were launched in 1972, 1975, and 1978. They were designed mainly to collect information about Earth's natural resources. They were also equipped to monitor atmospheric and oceanic conditions and to detect variations in pollution levels and other ecological changes. Three more Landsat satellites were launched successfully, in 1982, 1984, and 1999; radio communication with Landsat 6 was lost immediately after its launch in 1993.

landscape gardening Process of arranging land, plants, and objects for human use and enjoyment, usually with long and close-up views. Cyclical growth and seasonal changes provide a continuous sense of time and natural rhythms that is absent in buildings and sculptures. GARDENS and designed landscapes fill in the open areas in cities and create continuity between urban structures and open rural lands beyond. Landscape-gardening areas may be of any size, from small urban courtyards and suburban gardens to many thousands of acres in regional, state, or national

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parks. Every landscape garden reflects attitudes toward nature and humans, revealing much about a culture and a period.

Landseer, Sir Edwin (Henry) (b. March 7, 1802, London, Eng.—d. Oct. 1, 1873, London) British painter and sculptor. He studied with his father, an engraver and writer, and at the Royal Academy. He specialized in animals and developed great skill in depicting animal anatomy; he sometimes humanized his animal subjects to the point of sentimentality or moralizing (e.g., *Dignity and Impudence*, 1839). He achieved great professional and social success and was a favourite painter of Queen Victoria. He was elected to the Royal Academy in 1831 and knighted in 1850. As a sculptor, he is best known for his bronze lions at the base of Nelson's Column in Trafalgar Square (unveiled 1867).

landslide The movement of a mass of rock or soil down a slope. The term is used to describe a variety of phenomena, from rock falls to the gradual downhill flow of soil. Landslides occur when the force of gravity acting on the materials within a slope overcomes the material's resistance to shearing. Among the processes that can lead to a landslide are the steepening of a slope by natural erosion or excavation, the overloading of the slope by an inflow of water, and the motion caused by an earthquake.

Lane, Burton *orig.* **Burton Levy** (b. Feb. 2, 1912, New York, N.Y., U.S.—d. Jan. 5, 1997, New York City) U.S. songwriter. Lane worked in Tin Pan Alley, where he came to the attention of George Gershwin. His tunes were featured on Broadway from the early 1930s and were later heard in films, including *Babes on Broadway* (1942). His greatest success came with *Finian's Rainbow* (1947; film, 1968), for which he worked with lyricist E.Y. Harburg. He collaborated with Alan Jay Lerner on the film *Royal Wedding* (1951). Another joint effort with Lerner, *On a Clear Day You Can See Forever* (1965; film, 1970), gave Lane his last notable success.

Lanfranc \'lan-ˌfraŋk\ (b. c. 1010, Pavia, Lombardy—d. May 28, 1089, Canterbury, Kent, Eng.) Archbishop of Canterbury (1070–89). An Italian scholar who settled in Normandy, he joined the Benedictine monastery of Bec and was made its prior. He became a trusted adviser of William I (the Conqueror), who made Lanfranc the first abbot of St. Stephen's at Caen and nominated him as archbishop of Canterbury after the Norman Conquest of England. Lanfranc reformed and reorganized the English church, asserted the primacy of Canterbury over York, and introduced the moral components of Gregorian reform. He uncovered a conspiracy against the king (1075), and he secured the succession for William II against Robert II (1087). Lanfranc was also a renowned scholar and theologian who was noted for his criticism of Berengar of Tours's teaching on the Eucharist.

Lanfranco \län-ˈfräŋ-kō**, Giovanni** (b. Jan. 26, 1582, Parma—d. Nov. 30, 1647, Rome) Italian painter. He studied with Agostino Carracci. In 1602 he went to Rome to work with Annibale Carracci in the Farnese Palace. After Annibale's death, he became the leading fresco painter in Rome. His work shows the influence of Correggio's dynamic illusionism. His masterpiece is the *Assumption of the Virgin* in the dome of Sant'Andrea della Valle (1625–27), which he took over from his rival, Domenichino; with its vigorously painted figures floating in the clouds over the viewer, it is a pivotal work of the Baroque period. He worked in Naples 1633–46; his best-known work there is the dome of the chapel of San Gennaro in the cathedral (1641–46).

Lang, Fritz (b. Dec. 5, 1890, Vienna, Austria-Hungary—d. Aug. 2, 1976, Los Angeles, Calif., U.S.) Austrian-born U.S. film director. He studied architecture in Vienna and served in the Austrian army in World War I. While recovering from war wounds, he began to write screenplays. He found work at a movie studio in Berlin, where he later directed successful films such as *Between Two Worlds* (1921), *Dr. Mabuse* (1922), the two-part *The Nibelungen* (1924), the expressionistic *Metropolis* (1926), and *M* (1931). After making the anti-Nazi film *The Last Will of Dr. Mabuse* (1933), he left Germany for Paris and later Hollywood. His U.S. films, which equal his German films in their intensity, pessimism, and visual mastery, include *Fury* (1936), *You Only Live Once* (1937), *Ministry of Fear* (1944), *Rancho Notorious* (1952), and *The Big Heat* (1953). Many of his films deal with fate and man's inevitable working out of his destiny.

Langdell \'laŋ-dᵊl**, Christopher Columbus** (b. May 22, 1826, New Boston, N.H., U.S.—d. July 6, 1906, Cambridge, Mass.) U.S. legal educator. He studied law at Harvard (1851–54) and practiced in New York City until 1870, when he accepted a professorship and then the deanship at Harvard Law School (1870–95). His case method of teaching law, in which students read and discussed original authorities and derived for themselves the principles of the law, eventually became dominant in U.S. law schools. His *Selection of Cases on the Law of Contracts* (1871) was the first case-method textbook.

Lange \'laŋ**, Dorothea** (b. May 26, 1895, Hoboken, N.J., U.S.—d. Oct. 11, 1965, San Francisco, Calif.) U.S. documentary photographer. She studied photography and opened a portrait studio in San Francisco in 1919. During the Great Depression, her photos of homeless men led to her employment by a federal agency to bring the plight of the poor to public attention. Her photographs were so effective that the government established camps for migrants. Her *Migrant Mother* (1936) was the most widely reproduced of all Farm Security Administration pictures. She produced several other photo essays, including one documenting the World War II internment of Japanese-Americans.

Lange, Jessica (b. April 20, 1949, Cloquet, Minn., U.S.) U.S. film actress. She studied mime in Paris and worked as a model in New York before making her movie debut in *King Kong* (1976). She appeared in *All That Jazz* (1979) and *The Postman Always Rings Twice* (1981) and became a star with *Frances* (1982) and *Tootsie* (1982, Academy Award). Noted for her beauty and her ability to reveal the inner psyche of her characters, Lange won praise for her roles in *Country* (1984), *Sweet Dreams* (1985), and *Music Box* (1989) and in the televised versions of *Cat on a Hot Tin Roof* (1984) and *O Pioneers!* (1992). Her later films include *Blue Sky* (1994, Academy Award), *Rob Roy* (1995), *A Thousand Acres* (1997), and *Titus* (1999).

Langer, Susanne K(nauth) (b. Dec. 20, 1895, New York, N.Y., U.S.—d. July 17, 1985, Old Lyme, Conn.) U.S. philosopher. After receiving her Ph.D. from Harvard University in 1926, she taught at Harvard (1927–42) and at Columbia University (1945–50, 1954–61). In *Philosophy in a New Key* (1942), she presented a novel interpretation of the meaning of art. Her *Feeling and Form* (1953) proposed that art, especially music, is a highly articulated form of expression symbolizing intuitive knowledge of life patterns that ordinary language cannot convey. She traced the origin and development of the mind in her three-volume work *Mind: An Essay on Human Feeling*.

Langerhans, islets of *or* **islands of Langerhans** Irregularly shaped patches of endocrine tissue in the pancreas. The normal human pancreas has about one million of them. Beta cells, the most common islet cells, produce insulin to regulate blood glucose. (Inadequate production of insulin is characteristic of diabetes mellitus.) Alpha cells produce an opposing hormone, glucagon, which releases glucose from the liver and fatty acids from fat tissue; these favour insulin release and inhibit glucagon secretion. Delta cells produce somatostatin, which inhibits somatotropin (a major pituitary hormone), insulin, and glucagon; its metabolic role is not clear. Small numbers of another type of cell secrete pancreatic polypeptide, which slows down nutrient absorption. See also endocrine system.

Langland, William (b. c. 1330—d. c. 1400) Presumed author of the poem known as "Piers Plowman." Little is known of his life, though he clearly had a deep knowledge of theology and was interested in the asceticism of St. Bernard de Clairvaux. One of the greatest Middle English alliterative poems, "Piers Plowman" is an allegorical work in the form of a series of dream visions with a complex variety of religious themes; written in simple, colloquial language, it contains powerful imagery.

Langley, Samuel (Pierpont) (b. Aug. 22, 1834, Roxbury, Mass., U.S.—d. Feb. 27, 1906, Aiken, S.C.) U.S. astronomer and aeronautics pioneer. He taught for many years at the future University of Pittsburgh. He studied the effect of solar activity on weather and invented the bolometer (1878), a radiant-heat detector sensitive to extremely small temperature differences. He began conducting experiments on lift and drag of wings by building flying machines, and in 1896 one of his heavier-than-air machines became the first to achieve sustained unmanned flight, flying 3,000 ft (900 m) along the Potomac River.

Langmuir \'laŋ-ˌmyu̇r**, Irving** (b. Jan. 31, 1881, Brooklyn, N.Y., N.Y., U.S.—d. Aug. 16, 1957, Falmouth, Mass.) U.S. physical chemist. He received a Ph.D. from the University of Göttingen, Ger. As a researcher for General Electric (1909–50), he investigated electrical discharges in gases, electron emission, and the high-temperature surface chemistry of tungsten, making possible a great extension in the life of tungsten-filament

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lightbulbs. He developed a vacuum pump and the high-vacuum tubes used in radio broadcasting. He formulated theories of atomic structure and chemical bond formation, introducing the term covalence. He received a Nobel Prize in 1932.

Langton, Stephen (d. July 9, 1228, Slindon, Sussex, Eng.) English cardinal and archbishop of Canterbury (1207–28). Langton was living in Rome when Innocent III nominated him as archbishop of Canterbury to settle a disputed election. When King John refused to allow him into England, the pope excommunicated John (1209). John finally submitted and received Langton in 1213. The new archbishop encouraged baronial opposition to the king but opposed violence. He was present at the signing of the Magna Carta (1215) and influenced its provisions on ecclesiastical liberties.

Langtry, Lillie *orig.* **Emilie Charlotte Le Breton** (b. Oct. 13, 1853, Isle of Jersey, Channel Islands—d. Feb. 12, 1929, Monte-Carlo, Monaco) British actress. She married the socially prominent Edward Langtry in 1874 and later became known as the "Jersey Lily." A famous beauty, she caused a sensation when she became the first society woman to go on the stage, starring in *She Stoops to Conquer* (1881). She played to enthusiastic audiences in England and the U.S., notably in *As You Like It*. Her lovers included the Prince of Wales (later Edward VII). After her husband died, she married Hugo de Bathe (1899), and she later remodeled and managed the Imperial Theatre in London (1901–17).

Lillie Langtry
MANSELL COLLECTION

language System of conventional spoken or written symbols used by people in a shared culture to communicate with each other. A language both reflects and affects a culture's way of thinking, and changes in a culture influence the development of its language. Related languages become more differentiated when their speakers are isolated from each other. When speech communities come into contact (e.g., through trade or conquest), their languages influence each other. Most existing languages are grouped with other languages descended "genetically" from a common ancestral language (see historical linguistics). The broadest grouping of languages is the language family. For example, all the Romance languages are derived from Latin, which in turn belongs to the Italic branch of the Indo-European language family, descended from the ancient parent language, Proto-Indo-European. Other major families include, in Asia, Sino-Tibetan, Austronesian, Dravidian, Altaic, and Austroasiatic; in Africa, Niger-Congo, Afro-Asiatic, and Nilo-Saharan; and in the Americas, Uto-Aztecan, Maya, Otomanguean, and Tupian. Relationships between languages are traced by comparing grammar and syntax and especially by looking for cognates (related words) in different languages. Language has a complex structure that can be analyzed and systematically presented (see linguistics). All languages begin as speech, and many go on to develop writing systems. All can employ different sentence structures to convey mood. They use their resources differently for this but seem to be equally flexible structurally. The principal resources are word order, word form, syntactic structure, and, in speech, intonation. Different languages keep indicators of number, person, gender, tense, mood, and other categories separate from the root word or attach them to it. The innate human capacity to learn language fades with age, and languages learned after about age 10 are usually not spoken as well as those learned earlier. See also dialect.

language, philosophy of Philosophical study of the nature and use of natural languages and the relations between language, language users, and the world. It encompasses the philosophical study of linguistic meaning (see semantics), the philosophical study of language use in communication (see pragmatics), and philosophical reflection on the nature and scientific status of linguistic theories, known as the philosophy of linguistics. Major areas of investigation have included the theory of reference and the theory of truth. It was the dominant field in analytic philosophy for most the 20th century.

Languedoc \lä^{n}g-'dȯk\ Historical and cultural region, south-central France. Languedoc's name is derived from the traditional language of southern France, in which the word *oc* means "yes" (see Occitan language). From 121 BC the region was part of the Roman province of Gallia Narbonensis. With the fall of the Roman Empire, it was controlled by the Visigoths in the 5th century. During the Middle Ages it came under the counts of Toulouse. Religious wars (see Albigensian Crusade) in the 13th century brought it under the French crown. From the 16th to 18th centuries Languedoc was the scene of Protestant persecution that culminated in the war of the Camisards. Protestant revolt led to its division into *départments*.

Lanier \lə-'nir**, Willie (Edward)** (b. Aug. 21, 1945, Clover, Va., U.S.) U.S. gridiron football player. He was selected to the Little All-America Team while at Morgan State University. An outstanding defensive player, he played middle linebacker for the Kansas City Chiefs (1967–77). He helped the Chiefs defeat the favoured Minnesota Vikings in Super Bowl IV (1970) and was selected to eight consecutive Pro Bowls.

Lansbury, George (b. Feb. 21, 1859, near Halesworth, Suffolk, Eng.—d. May 7, 1940, London) British politician. As a member of the House of Commons (1910–12, 1922–40), he became known as a socialist and poor-law reformer, and he led the British Labour Party from 1931 to 1935. Pacifist in his leanings, he was unwilling to call for economic sanctions against Italy for its aggression in Ethiopia (1935), fearing it might lead to war, and lost his party leadership post. In 1937 he visited Adolf Hitler and Benito Mussolini in the vain hope that his personal influence could stop the movement toward war.

Lansdowne, Henry Charles Keith Petty-Fitzmaurice, 5th marquess of (b. Jan. 14, 1845, London, Eng.—d. June 3, 1927, Clonmel, County Tipperary, Ire.) Irish nobleman and British diplomat. He inherited his father's title and wealth in 1866 and served in William E. Gladstone's Liberal administration. In 1885, as governor-general of Canada (1883–88), he helped settle the rebellion led by Louis Riel. As viceroy of India (1888–94) under a Conservative government, he reorganized the police, reconstituted legislative councils, closed Indian mints to the free coinage of silver, and extended railway and irrigation works. As secretary of war (1895–1900), he was blamed for British unpreparedness in the South African War. As foreign secretary (1900–06), he concluded the Entente Cordiale.

L'Anse aux Meadows \ˌlans-ō-'me-ˌdōz\ Site on the northern tip of Newfoundland of the first known European settlements in the New World. Norse settlers may have established as many as three settlements there near the end of the 10th century. After initially fighting each other, the Norse settlers and the Inuit (whom the Norse called Skraeling) established a regular trade relationship. The settlements were soon abandoned, probably as the Norse withdrew from Greenland.

Lansing City (pop., 2000: 119,128), capital of Michigan, U.S. Located on the Grand River at its junction with the Red Cedar River, it was a recently settled site when the state capital was moved there from Detroit in 1847. Originally called Michigan, it adopted the name Lansing in 1848. Auto manufacturing began there in the late 19th century, and it is now a major automobile production centre. Adjacent East Lansing is the home of Michigan State University.

Lansky, Meyer *orig.* **Maier Suchowljansky** (b. July 4, 1902, Grodno, Russia—d. Jan. 15, 1983, Miami Beach, Fla., U.S.) Russian-born U.S. gangster. His family immigrated to New York in 1911. As a young man he joined Bugsy Siegel in auto theft, burglary, and liquor smuggling. In 1931 he allegedly organized the murder of crime boss Joe Masseria and joined Lucky Luciano in forming a national crime syndicate. By 1936 he had developed gambling operations in Cuba and the U.S., putting Siegel in charge of Las Vegas. In the 1960s he extended his gambling empire to the Bahamas and elsewhere in the Caribbean while continuing to run narcotics-smuggling, prostitution, labour-racketeering, and extortion rackets. His holdings in 1970 were estimated at $300 million. In 1979 the House of Representatives Assassinations Committee linked Lansky with Jack Ruby, the nightclub owner who killed Lee Harvey Oswald, the assassin of Pres. John F. Kennedy. Though convicted of income-tax evasion in 1973, he remained free on appeals.

lantana \lan-'tä-nə\ Any of more than 150 shrubs that make up the genus *Lantana* in the verbena family, native to the New World and African tropics. They are cultivated for their ornamental foliage, fragrant

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clusters of flowers, and colourful blue-black fruits. Common lantana (*L. camara*), a weed in the New World tropics, is much used as a garden plant elsewhere. It grows to 10 ft (3 m) and blooms almost continuously with yellow, orange, pink, or white flower heads. The aromatic leaves are rough and oval.

lanthanide \'lan-thə-ˌnīd\ Any of the series of 15 consecutive chemical ELEMENTS in the PERIODIC TABLE from lanthanum to lutetium (atomic numbers 57–71). With scandium and yttrium, they make up the RARE EARTH METALS. Their atoms have similar configurations and similar physical and chemical behaviour; the most common VALENCES are 3 and 4.

Lanzhou *or* **Lan-chou** \'län-'jō\ City (pop., 1999 est.: 1,429,673), capital of GANSU province, north-central China. Situated on the upper HUANG HE (Yellow River), it became part of the territory of Qin in the 6th century BC and later developed as a major trade centre on the SILK ROAD. It became the seat of Lanzhou prefecture under the SUI DYNASTY (581–618 AD) and the capital of Gansu province in 1666. It was badly damaged during the Muslim uprisings in 1864–75. A centre of Soviet influence in northwestern China in the early 20th century, it was the terminus of the 2,000-mi (3,200-km) Chinese-Soviet highway that was used during the Sino-Japanese War (1937–45) for the transport of Soviet supplies. It developed as an industrial and cultural centre after World War II. It is the seat of Lanzhou University.

Lao She \'laù-'shə\ *orig.* **Shu Qingchun** *or* **Shu Sheyu** (b. Feb. 3, 1899, Beijing, China—d. Aug. 24?, 1966, Beijing) Chinese writer. He worked as an educator before going to England in 1924, and he was inspired to write his first novel while reading the works of CHARLES DICKENS to improve his English. He originally championed strong, hard-working individuals but later expressed the futility of the individual's struggle against society, as in *Luotuo Xiangzi* (1936), the tragic story of a ricksha puller; *Rickshaw Boy*, an unauthorized translation with a happy ending (1945), became a U.S. best-seller. After the onset of the SINO-JAPANESE WAR, he wrote lesser patriotic and propagandistic plays and novels. In 1966 he fell victim to the CULTURAL REVOLUTION.

Laocoön \'lā-'ä-kō-ˌän\ In Greek legend, a seer and priest of APOLLO. He was the son of Agenor of Troy or the brother of AENEAS's father Anchises. Laocoön offended Apollo by breaking his priestly vow of celibacy and begetting children, and by warning the Trojans not to accept the wooden horse presented by the Greeks. While preparing to offer a sacrifice to POSEIDON, he and his two sons were crushed to death by sea serpents sent by Apollo.

Laos \'lä-ōs, 'laùs\ *officially* **Lao People's Democratic Republic** Country, Southeast Asia. Area: 91,429 sq mi (236,800 sq km). Population (2005 est.): 5,924,000. Capital: VIENTIANE. Major ethnic groups include the Lao-Lum (valley Lao), who make up about half of the population; the Lao-Tai, a highland tribal people; the Lao-Theung (Mon-Khmer), descendants of the region's earliest inhabitants; and the Lao-Soung group, including the HMONG and Man. Languages: Lao (official), English, Vietnamese, French. Religions: Buddhism, traditional beliefs. Currency: kip. Laos is largely mountainous, especially in the north; its highest point is Mount Bia (9,245 ft [2,818 m]). Tropical forests cover more than half of the country's total land area; only a tiny portion of its total area is suitable for agriculture. The floodplains of the MEKONG RIVER provide the country's only lowlands and its major wet-rice fields. Laos has a centrally planned economy based primarily on agriculture (including rice, sweet potatoes, sugarcane, cassava, and opium poppies) and international aid. It is a people's republic with one legislative house; its chief of state is the president, and its head of government is the prime minister. The Lao people migrated into Laos from southern China after the 8th century AD, displacing indigenous peoples. In the 14th century Fa Ngum founded the first Laotian state, Lan Xang. Except for a period of rule by Myanmar (Burma; 1574–1637), the Lan Xang kingdom ruled Laos until 1713, when it split into three kingdoms—Vien Chan, Champassak, and Luang Prabang. During the 18th century the rulers of the three Laotian kingdoms became vassals of Siam (Thailand). France gained control of the region in 1893, and Laos became a French protectorate. In 1945 Japan seized control and declared Laos independent. The area reverted to French rule after World War II. By the end of the First INDOCHINA WAR, the leftist Pathet Lao movement controlled two provinces of the country. The Geneva Conference of 1954 unified and granted independence to Laos. Pathet Lao forces fought the Laotian government and took control in 1975, establishing the Lao People's Democratic Republic; about one-tenth of the population fled into neighbouring Thailand. Laos held its first election in 1989 and promulgated a new constitution in 1991. Although its economy was adversely affected by the regional economic recession beginning in the mid-1990s, it realized a longtime goal in 1997 when it joined ASEAN.

Laozi *or* **Lao-tzu** \'laù-'dzə\ (fl. 6th century BC, China) First philosopher of Chinese DAOISM. He is traditionally named as the author of the DAODEJING, though modern scholars hold that the work had more than one author. Legends about his life abound, but little or no certain information survives. The historical Laozi, if he existed, may have been a scholar and caretaker of sacred books at the royal court of the ZHOU DYNASTY. According to legend, he was carried 72 years in his mother's womb, and he met CONFUCIUS as a young man. He is venerated as a philosopher by the Confucianists, as a saint or god by the common people of China, and as a divinity and the representative of the *dao* by Daoists.

laparoscopy \ˌla-pə-'räs-kə-pē\ *or* **peritoneoscopy** \ˌper-ət-ᵊn-ˌē-'äs-kə-pē\ Procedure for inspecting the ABDOMINAL CAVITY using a laparoscope; also surgery requiring use of a laparoscope. Laparoscopes use fibre-optic lights and small video cameras to show tissues and organs on a monitor. Laparoscopic surgical procedures include gallbladder, appendix, and tumour removal; tubal ligation; and hysterectomy. After carbon dioxide is pumped in to expand the space for the instruments, small incisions are made and the laparoscope and instruments inserted. Less invasive than traditional (open) surgery, laparoscopy reduces postoperative pain, recovery time, and length of hospital stay.

Lapidus \la-'pi-dəs**, Morris** (b. Nov. 25, 1902, Odessa, Russia—d. Jan. 18, 2001, Miami Beach, Fla., U.S.) Ukrainian-born U.S. architect. He came to the U.S. as a child and grew up in New York City. After earning an architectural degree, he worked in New York architectural firms from 1928 to 1942. In 1942 Lapidus moved to Miami Beach, where he ran his own firm until 1986. He designed numerous buildings there in the Art Deco style, including the Fontainebleau and Eden Roc hotels. He designed over 200 hotels worldwide as well as numerous office buildings, shopping centres, and hospitals.

lapis lazuli \ˌla-pəs-'la-zə-lē\ Semiprecious stone valued for its deep-blue colour caused by the presence of the mineral lazurite, which is the source of the pigment ultramarine. Lapis lazuli is not a single mineral but an intergrowth lazurite with calcite, pyroxene, and commonly small grains of PYRITE. The most important mines are in Afghanistan and Chile. Much of what is sold as lapis is an artificially dyed JASPER from Germany that shows colourless specks of clear, crystallized quartz and never the gold-like flecks of pyrite that are characteristic of lapis lazuli.

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Lapita culture \lä-'pē-tə\ Cultural complex of what were presumably the original human settlers of Melanesia, much of Polynesia, and parts of Micronesia. The Lapita people were originally from New Guinea or some other region of Austronesia. Seaborne explorers, they spread to the Solomon Islands (c. 1600 BC), then to Fiji, Tonga and the rest of western Polynesia (c. 1000 BC), and finally to Micronesia (c. 500 BC). They are known principally on the basis of the remains of their fired pottery, which was first extensively investigated at the site of Lapita in New Caledonia. They appear to have subsisted largely by fishing but may also have practiced some domestic agriculture and animal husbandry.

Laplace \lə-'pläs**, Pierre-Simon, marquis de** (b. March 23, 1749, Beaumont-en-Auge, France—d. March 5, 1827, Paris) French mathematician, astronomer, and physicist. He is best known for his investigations into the stability of the solar system and the theory of magnetic, electrical, and heat wave propagation. In his major lifework he applied Newtonian gravitational theory to the solar system to explain deviations of the planets from the orbits predicted by the theory (1773). NEWTON believed that only divine intervention could explain the solar system's equilibrium, but Laplace established a mathematical basis for it, the most important advance in physical astronomy since Newton. He continued to work on elucidating planetary perturbations through the 1780s. A work published in 1796 included his nebular hypothesis, which attributed the origin of the solar system to the cooling and contracting of a gaseous nebula, a theory that strongly influenced future thought on planetary origins. See also LAPLACE TRANSFORM; LAPLACE'S EQUATION.

Laplace transform In mathematics, an INTEGRAL TRANSFORM useful in solving DIFFERENTIAL EQUATIONS. The Laplace transform of a function is found by integrating the product of that function and the EXPONENTIAL FUNCTION e^{-pt} over the interval from zero to INFINITY. The Laplace transform's applications include solving linear differential equations with constant coefficients and solving boundary value problems, which arise in calculations relating to physical systems.

Laplace's equation In mathematics, a PARTIAL DIFFERENTIAL EQUATION whose solutions (harmonic functions) are useful in investigating physical problems in three dimensions involving gravitational, electrical, and magnetic fields, and certain types of fluid motion. Named for PIERRE-SIMON LAPLACE, the equation states that the sum of the second partial derivatives (the Laplace operator, or Laplacian) of an unknown function is zero. It can apply to functions of two or three variables, and can be written in terms of a differential operator as $\Delta F = 0$, where Δ is the Laplace operator.

Lapland Region, northern Europe. Located within the Arctic Circle, it stretches across northern Norway, Sweden, and Finland and into Russia's KOLA PENINSULA. Occupying an area of 150,000 sq mi (389,000 sq km), it is bounded by the Norwegian Sea, the BARENTS SEA, and the White Sea. Since it straddles several national borders, it does not exist as any unified administrative entity. It is named for the SAMI (Lapp) people, who have inhabited the region for several thousand years. Those still practicing reindeer herding have liberty of movement across national boundaries. Industries include mining and fishing.

Sami (Lapps) outside their reindeer-skin tent in Finnish Lapland

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lapwing Any of numerous bird species of the PLOVER family (Charadriidae), especially the Eurasian lapwing (*Vanellus vanellus*) of farmlands and grassy plains. Lapwings are about 12 in. (30 cm) long and have broad, rounded wings. Several species have crests, and some have wing spurs (sharp projections at the bend of the wing). The Eurasian lapwing is green-glossed black above with white cheeks, black throat and breast, white belly, and white tail with a black band. About 24 other species are found in South America, Africa, southern Asia, Malaya, and Australia.

Eurasian lapwing (*Vanellus vanellus*)

INGMAR HOLMASEN

L'Aquila \'lä-kwē-lä\ City (pop., 2001 prelim.: 63,121), capital of the ABRUZZI region, central Italy. The area was settled by the Sabini, an ancient Italic tribe, and the city was founded c. 1240. After being ruled by the Kingdom of Naples, it became part of the Kingdom of Italy in 1861. Located near the mountains of Gran Sasso d'Italia, it is a skiing centre and summer resort. Historic sites include a 14th-century cathedral and a 16th-century castle.

Laramide orogeny \'lar-ə-ˌmīd-ō-'rä-jə-nē\ Series of mountain-building events that affected much of western North America in Late CRETACEOUS and Early TERTIARY time (c. 65 million years ago). The Laramide orogeny originally was believed to mark the Cretaceous-Tertiary boundary. It is now considered to have consisted of many separate pulses of deformation that varied in intensity and age from place to place. Laramide rocks, however, were generally created around the Cretaceous-Tertiary time boundary.

larceny See THEFT

larch Any of about 10–12 species of coniferous trees that make up the genus *Larix* of the PINE family, native to cool temperate and sub-Arctic regions of the Northern Hemisphere. Though the larch has the pyramid shape typical of CONIFERS, it sheds its short, light-green, needlelike leaves in autumn. The most widespread North American larch, the tamarack, or eastern larch (*L. laricina*), matures in 100–200 years, may grow 40–100 ft (12–30 m) tall, and has gray to reddish-brown bark. Coarse-grained, strong, hard, and heavy, larch wood is useful in ship construction and for telephone poles, mine timbers, and railroad ties.

Lardner, Ring(gold Wilmer) (b. March 6, 1885, Niles, Mich., U.S.—d. Sept. 25, 1933, East Hampton, N.Y.) U.S. writer. He worked as a newspaper reporter, sportswriter, and columnist before he began publishing fiction. He won popular success with comic stories about a baseball player, some collected in *You Know Me, Al* (1916). Later collections, noted for their satire, narrative skill, and convincing vernacular language, include *How to Write Short Stories* (1924) and *The Love Nest* (1926). His son, the screenwriter Ring Lardner, Jr., was one of the HOLLYWOOD TEN and later wrote such hit movies as *M*A*S*H* (1970).

Laredo \lə-'rā-dō\ City (pop., 2000: 176,576), southern Texas, U.S. Located on the RIO GRANDE opposite Nuevo Laredo, Mex., it was established in 1755 by the Spanish and was named for Laredo, Spain. After the Texas revolt against Mexican rule in 1836, it became the seat of the Republic of the Rio Grande (1839–41). Occupied by the Texas Rangers in 1846, it was incorporated as a city in 1852. A rapidly growing city, its manufacturing includes electronic components and oil refining.

Lares \'lar-ˌēz\ In ROMAN RELIGION, guardian deities. Originally gods of cultivated fields, Lares were later worshiped in association with the PENATES, the gods of the household. The household Lar, considered the centre of the family cult, was often represented as a youthful figure holding a drinking horn and cup. Two Lares might be portrayed standing on either side of VESTA or some other deity. A prayer was said to the Lar or Lares every morning, and offerings were made at family festivals. Public Lares presided over local districts marked by a crossroads; state Lares (*praestites*), guardians of Rome, were worshiped in a temple on the Via Sacra.

large intestine End section of the intestine. It is about 5 ft (1.5 m) long, is wider than the SMALL INTESTINE, and has a smooth inner wall. In the first half, ENZYMES from the small intestine complete digestion, and bacteria produce many B vitamins and vitamin K. Over 24–30 hours, churning movements break down tough cellulose fibres and expose CHYME to the COLON's walls, which absorb water and electrolytes; absorption is its main function, along with storing fecal matter for expulsion. The more vigorous "mass movement" (gastrocolic reflex) occurs only two or three times a day to propel waste material toward the ANAL CANAL. Common afflictions include ULCERATIVE COLITIS, diverticulosis (see DIVERTICULUM), POLYPS, and TUMOURS.

Largo Caballero \'lär-gō-ˌkä-bäl-'yār-ō**, Francisco** (b. Oct. 15, 1869, Madrid, Spain—d. March 23, 1946, Paris, France) Spanish socialist leader and prime minister (1936–37). He joined the Spanish Socialist Workers' Party in 1894 and rose to become head of the party's trade-union federation in 1925. He cooperated with the dictatorship of Miguel PRIMO DE RIVERA, then served in the Second Republic as labour minister

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(1931–33). After the Popular Front's election victory in 1936, he became prime minister and tried to unify the leftist parties; however, an extreme-left uprising in Barcelona in 1937 during the Spanish Civil War caused a cabinet crisis and he was forced to resign. He went into exile in France and was interned by the Germans in World War II (1942–45).

Laristan \ˌlar-ə-ˈstan\ Region, southern Iran. Located on the Persian Gulf, it is a former province; its chief town is Lar. The region was ruled by the Muẓaffarid dynasty of Kermān until it was conquered by Timur. After his death in 1405, it was ruled by local chiefs under the Ṣafavid dynasty. The last such chief was put to death by ʿAbbās I (the Great), who ruled from 1587 to 1629.

lark Any of about 75 species of songbirds (family Alaudidae) found throughout the continental Old World. Only the horned, or shore, lark (*Eremophila alpestris*) is native to the New World. The bill may be small and narrowly conical or long and downward-curving, and the hind claw is long and sometimes straight. The plumage is plain or streaked and closely matches the soil in colour. Its body is 5–9 in. (13–23 cm) long. Flocks of larks forage for insects and seeds on the ground. All species have a high, thin, melodious voice. See also skylark.

Horned lark (*Eremophila alpestris*)
HERBERT CLARKE

Larkin, Philip (Arthur) (b. Aug. 9, 1922, Coventry, Warwickshire, Eng.—d. Dec. 2, 1985, Kingston upon Hull, Yorkshire) English poet. Educated at Oxford, Larkin became a librarian at the University of Hull, Yorkshire, in 1955; he would remain a librarian the rest of his life. He wrote two novels before becoming well known with his third volume of verse, *The Less Deceived* (1955), which expressed the antiromantic sensibility prevalent in English verse of his time. Later poetry volumes are *The Whitsun Weddings* (1964), *High Windows* (1974), and *Aubade* (1980). *All What Jazz* (1970) contains essays he wrote as a jazz critic for *The Daily Telegraph* (1961–71).

larkspur *or* **delphinium** Any of about 300 species of herbaceous plants that make up the genus *Delphinium* in the buttercup family, many of which are grown for their showy flower stalks. Annual larkspurs (sometimes separated as the genus *Consolida*) include the common rocket larkspur (*D. ajacis*, or *C. ambigua*) and its varieties, up to 2 ft (60 cm) tall, with bright blue, pink, or white flowers on branching stalks. Perennial larkspurs, often with blue flowers, include species that grow to 4.5 ft (1.4 m).

Dwarf larkspur (*Delphinium tricorne*)
LOUISE K. BROMAN FROM ROOT RESOURCES—EB INC.

Larne \ˈlärn\ Town (pop., 1991: 17,575), capital of Larne district (pop., 2001: 30,832), Northern Ireland. It is located on the Irish Sea north of Belfast. Edward Bruce landed nearby on his journey to accept the Irish throne in 1315. It developed as a holiday resort after 1900. The Antrim Coast Road, one of the greatest tourist attractions in Northern Ireland, begins at Larne. The district's economy is largely based on tourism and agriculture.

Larousse \lə-ˈrüs**, Pierre (Athanase)** (b. Oct. 23, 1817, Toucy, France—d. Jan. 3, 1875, Paris) French publisher, lexicographer, and encyclopaedist. Son of a blacksmith, he received a scholarship to study in Versailles. He founded his publishing house, Librairie Larousse, in Paris in 1852. It published textbooks, grammar books, and dictionaries, but his major work, reflecting his desire "to teach everyone about everything," was the combined dictionary and encyclopaedia *Grand dictionnaire universel du XIXe siècle*, 17 vol. (1866–76). Librairie Larousse continues to publish a multivolume encyclopaedia as well as dictionaries and smaller encyclopaedias.

Larsa *biblical* **Ellasar** Ancient capital of Babylonia, located on the Euphrates River in present-day southern Iraq. It was founded in prehistoric times and flourished in a period of Sumerian decline (c. 2000–c. 1760 BC), when long-distance trade connected the Euphrates with the Indus River valley. Hammurabi of Babylon gained control of the area in 1763 BC.

Larsen Ice Shelf Ice shelf in the northwestern Weddell Sea, adjoining the eastern coast of the Antarctic Peninsula. It is named for Capt. Carl A. Larsen, who explored the ice front by boat in 1893. The shelf originally covered an area of 33,000 sq mi (86,000 sq km), excluding the numerous small islands within it, but, as air temperatures over the Antarctic Peninsula warmed slightly in the second half of the 20th century, the shelf shrank dramatically. By the early 21st century, it covered only 40 percent of its former area.

Lartigue \lär-ˈtēg**, Jacques-Henri (-Charles-Auguste)** (b. June 13, 1894, Courbevoie, Fr.—d. Sept. 12, 1986, Nice) French painter and photographer. Born into a prosperous family, he was given a Brownie camera at age seven. From the beginning, his photographs were invariably informal shots of everyday subjects. In the 1910s and '20s Lartigue enthusiastically photographed subjects such as automobile races, fashionable ladies at the seashore and the park, and kite flying. These photographs reveal his free spirit and love of life, rather than a concern for photographic technique and craft, and often capture a sense of movement. When his work was discovered in the 1960s, it was acclaimed for its departure from formal, posed portraits and for its ingenuous charm and beguiling spontaneity.

larva Active, feeding stage in the development of many animals, occurring after birth or hatching and before the adult form is reached. Larvae are structurally different from adults and often are adapted to a different environment. Some species have free-living larvae but sessile (affixed) adults, the moving larvae thus helping to spread the species; others have aquatic larvae but terrestrial adults. Most larvae are tiny; many are dispersed by entering a host's body, where the adult form of the parasite emerges. Many invertebrates (e.g., cnidarians) have simple larvae. Flukes have several larval stages, and annelids, molluscs, and crustaceans have various larval forms. Insect larvae are called caterpillars, grubs, maggots, or worms; the larval stage of many insects may last much longer than the adult stage (e.g., some cicadas live 17 years as larvae and a week as adults). Echinoderms also have larval forms. The larvae of frogs and toads are called tadpoles. See also metamorphosis, pupa.

laryngeal \lə-ˈrin-jəl\ **cancer** Malignant tumour of the larynx. The larynx is affected by both benign and malignant tumours. Squamous-cell carcinoma, the most common laryngeal malignancy, is associated with smoking and alcohol consumption; it is more common in men. Prolonged hoarseness without pain is the major symptom and should always be investigated. Radiation therapy or surgery may be used to treat tumours.

laryngitis \ˌlar-ən-ˈjī-təs\ Inflammation of the larynx, causing hoarseness. Simple laryngitis usually occurs with infections such as the common cold. Other causes include inhalation of irritants. The larynx's lining becomes swollen and secretes mucus. In chronic laryngitis, caused by excessive smoking, drinking, or vocal-cord use, the larynx is dry and has polyps. Other types are caused by diphtheria spreading from the upper throat, tuberculosis bacteria spreading from the lungs, and advanced syphilis. The last can produce severe scarring and permanent hoarseness.

larynx \ˈlar-inks\ *or* **voice box** Hollow, tubular structure connecting the pharynx with the trachea, through which air passes on the way to the lungs. The larynx consists of a framework of cartilage plates, with a ridge in front (Adam's apple); the epiglottis, a flaplike projection up into the throat that covers the airway during swallowing to keep food and liquid from entering; and the vocal cords, whose vibration produces the sound of the voice (see speech). See illustration on following page.

Las Casas, Bartolomé de (b. August 1474, Sevilla?—d. July 17, 1566, Madrid) Spanish historian and missionary, called the Apostle of the Indies. He sailed on Christopher Columbus's third voyage (1498) and later became a planter on Hispaniola (1502). In 1510 he became the first priest ordained in the Americas. He devoted his life to protesting the mistreatment of the Indians, with whom he worked in Guatemala, Peru, Cuba, Nicaragua, and Mexico. His call for an end to the *encomienda* system aroused implacable opposition. His proposed and quickly regretted solution, the importation of slaves from Africa, was adopted, but the servitude of the Indians had already been irreversibly established. His *Brief*

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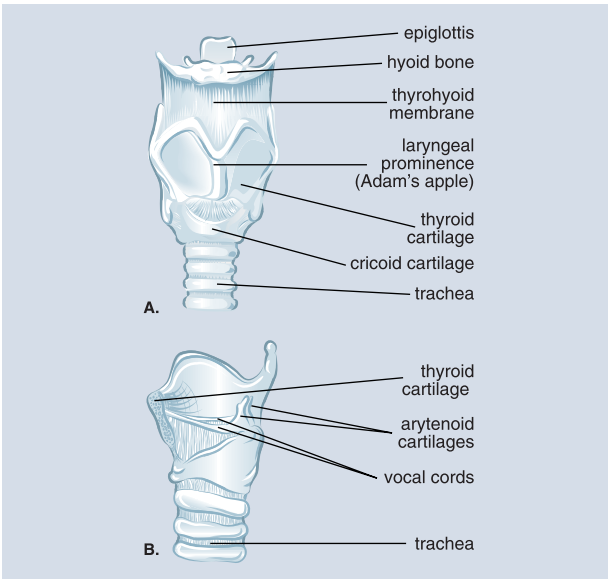

(A) Frontal view and (B) cutaway side view of the human larynx. The larynx is composed of cartilage plates that are joined together by muscles and ligaments. The thyroid cartilage, the largest, forms a prominence in front called the Adam's apple. The leaf-shaped epiglottis, attached to the upper part of the thyroid cartilage, closes during swallowing. The vocal cords in the cavity of the larynx are large folds in the mucous membrane lining the larynx. They stretch between the thyroid cartilage in front and the arytenoid cartilages in the back. As air passes between them, they vibrate to emit sound.

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Report on the Destruction of the Indians (1552) and his unfinished *History of the Indians* inspired Simón Bolívar and other revolutionary heroes. See also BLACK LEGEND.

Las Navas de Tolosa \läs-'nä-väs-thā-tō-'lō-sä**, Battle of** *or* **Battle of Al-ʻUqāb** \ˌál-ù-'käb\ (July 16, 1212) Major battle of the Christian reconquest of Spain. It occurred during a Christian Crusade against the Muslim ALMOHAD DYNASTY. Led by King Alfonso VIII, the combined armies of León, Castile, Aragon, Navarra, and Portugal found a secret route through a mountain pass in Andalusia (southern Spain) and surprised and defeated the Almohads at a site about 40 mi (65 km) north of Jaén.

Las Palmas *or* **Las Palmas de Gran Canaria** Seaport city (pop., 2001: 354,863), northeastern Grand Canary Island, Spain. The largest city and chief port of the CANARY ISLANDS, it was founded in 1478 and served as a base for the Spanish conquest of Tenerife and La Palma islands. It grew after the port was constructed in 1883. It is a year-round resort; historic sites include a 15th-century cathedral and the house of CHRISTOPHER COLUMBUS.

Las Vegas City (pop., 2000: 478,434), southeastern Nevada, U.S. It is famous for its luxury hotels, casinos, and nightclubs, located in the area known as "the Strip." Mormons from Utah settled the site in 1855 and abandoned it in 1857. It became a railroad town in 1905 and was incorporated in 1911. Gambling was legalized in 1931, and Las Vegas expanded rapidly after 1940. Its connections to crime syndicates began in 1946, when BUGSY SIEGEL opened the Flamingo Hotel. By the early 21st century it was one of the country's fastest-growing metropolitan areas, attracting a year-round population as well as tourists.

Lascaux \lä-'skō\ **Grotto** Cave near Montignac, Fr., that contains perhaps the most outstanding known display of prehistoric art. Discovered in 1940, it consists of a main cavern and several steep galleries, all magnificently decorated with engraved, drawn, and painted animals, some of them portrayed in a "twisted perspective." Among the most notable images are four great AUROCHS bulls, a curious unicorn-type animal that may represent a mythical creature, and a rare narrative composition involving a bird-man figure and a speared bison. About 1,500 bone engravings have also been found at the site, which has been dated to the late AURIGNACIAN period (c. 15,000 BC). Because of heavy tourist traffic, the cave was closed to the public in 1963, but a full-scale facsimile, Lascaux II, was opened in 1983. See also ROCK ART.

laser Device that produces an intense beam of coherent light (light composed of waves having a constant difference in PHASE). Its name, an acronym derived from "light amplification by stimulated emission of radiation," describes how its beam is produced. The first laser, constructed in 1960 by Theodore Maiman (born 1927) based on earlier work by CHARLES H. TOWNES, used a rod of ruby. Light of a suitable WAVELENGTH from a flashlight excited (see EXCITATION) the ruby ATOMS to higher energy levels. The excited atoms decayed swiftly to slightly lower energies (through PHONON reactions) and then fell more slowly to the ground state, emitting light at a specific wavelength. The light tended to bounce back and forth between the polished ends of the rod, stimulating further emission. The laser has found valuable applications in microsurgery, compact-disc players, communications, and holography, as well as for drilling holes in hard materials, alignment in tunnel drilling, long-distance measurement, and mapping fine details.

Lashley, Karl S(pencer) (b. June 7, 1890, Davis, W.Va., U.S.—d. Aug. 7, 1958, Paris, France) U.S. psychologist. He taught at the Universities of Minnesota (1920–29) and Chicago (1929–35) and at Harvard University (1935–55). In *Brain Mechanisms and Intelligence* (1929), he demonstrated that certain types of learning are mediated by the cerebral cortex as a whole, refuting the view that every psychological function is localized at a specific place on the cortex, and he showed that some parts of the brain system (e.g., the visual system) can take over the functions of other parts. He also studied the cortical basis of motor activities and the relation between brain mass and learning ability. His paper "The Problem of Serial Order in Behavior" (1951) played a major supporting role in the revolt against simple associative psychology.

Lasker, Emanuel (b. Dec. 24, 1868, Berlinchen, Prussia—d. Jan. 11, 1941, New York, N.Y., U.S.) German chess master and mathematician. He first won the world chess championship in 1894 and retained the title until his defeat by JOSE CAPABLANCA in 1921; his term remains the longest reign as champion. As the first chess master to demand high fees, he helped strengthen the financial status of chess professionals. He wrote the classic *Common Sense in Chess* (1896) as well as books on mathematics and philosophy. As a Jew, he was forced to leave Nazi Germany in 1933. With the loss of his property, he ended his eight-year retirement from chess, once again competing at the highest level.

Laski, Harold J(oseph) (b. June 30, 1893, Manchester, Eng.—d. March 24, 1950, London) British political scientist, educator, and political leader. Educated at the University of Oxford, he taught at McGill University and Harvard University before returning to Britain to work for the LABOUR PARTY. He later taught at the London School of Economics (1926–50). He argued in works such as *The State in Theory and Practice* (1935) that the economic difficulties of capitalism might lead to the destruction of political democracy, and he came to view SOCIALISM as the only alternative to FASCISM. He was an assistant to CLEMENT R. ATTLEE during World War II.

Lassalle \lä-'säl**, Ferdinand** *orig.* **Ferdinand Lasal** (b. April 11, 1825, Breslau, Prussia—d. Aug. 31, 1864, near Geneva, Switz.) German socialist, a founder of the German labour movement. He took part in the revolution of 1848–49 and established contact with KARL MARX and FRIEDRICH ENGELS. In 1859 he settled in Berlin and became a political journalist. His advocacy of an evolutionary approach to socialism through a democratic constitutional state based on universal suffrage led to his gradual estrangement from Marx. He helped form the General German Workers' Association (1863) and was elected its president, but associates rebelled against his authoritarian leadership. In 1864 he went to Switzerland for a rest, fell passionately in love, and was killed at age 39 in a duel with the woman's former fiancé.

Lassalle, *c.* 1860

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Lassen Peak *or* **Mount Lassen** Volcano, southern end of the Cascade Range, northeastern California, U.S. It erupted on May 30, 1914, and intermittently thereafter until 1921. The peak is 10,457 ft (3,187 m) high and is the principal attraction of Lassen Volcanic National Park, which occupies an area of 106,372 acres (43,047 hectares). In 1821 Luis Argüello, a Spanish officer, became the first European to discover the peak. It is named for Peter Lassen, an explorer who guided settlers through the area.

Lassus \ˈlä-sūs**, Orlande de** *or* **Orlando di Lasso** \ˈlä-sō\ *or* **Roland de Lassus** (b. 1530/32, Mons, Spanish Hainaut—d. June 14, 1594, Munich) Flemish composer. He began as a choirboy (with such a beautiful voice that he is said to have been kidnapped to sing elsewhere), and his first known position was in service to the Gonzaga family in Italy (1544). After 1556 he was based in Munich as kapellmeister to the duke of Bavaria, but he pursued an international career, traveling in Italy, Germany, Flanders, and France. He wrote more than 1,200 works, in every contemporary style and genre, sacred (including some 60 masses and 500 motets) and secular (including hundreds of madrigals and chansons), his attention to the correspondence of music and words being especially remarkable. Because of his range of styles (he always kept up with fashion) and because his works were printed widely during and after his lifetime, he influenced many composers and is regarded as one of the greatest masters of his century.

Last Mountain Lake Lake, southern central Saskatchewan, Canada. Draining southward into the Qu'Appelle River, and with an average width of 2 mi (3.2 km) and a length of 60 mi (96 km), it occupies an area of 89 sq mi (231 sq km). It is a popular fishing and resort area.

Lāt, al- Northern Arabian goddess of pre-Islamic times. A stone cube near Mecca was held sacred as part of her cult. Two other northern Arabian goddesses, Manāt and al-ʿUzzā, are associated with al-Lāt in the Qur'ān. According to a contentious account, Muhammad was said to have recognized these three as goddesses, but a new revelation led him to abandon his attempt to placate Meccan pagans, and he later ordered the sanctuaries of al-Lāt and the other two goddesses destroyed. The goddesses were worshiped by Arab tribes located as far away as Palmyra, Syria.

Late Baroque See Rococo style

latent heat Characteristic amount of energy absorbed or released by a substance during a change in physical state that occurs without a change in temperature. Heat of fusion is the latent heat associated with melting a solid or freezing a liquid. Heat of vaporization is the latent heat associated with vapourizing a liquid or condensing (see condensation) a vapour. For example, when water reaches its boiling point and is kept boiling, it remains at that temperature until it has all evaporated; all the heat added to the water is absorbed as latent heat of vaporization and is carried away by the escaping vapour molecules.

Later Le \ˈlē\ **dynasty** (1428–1788) Greatest and longest-lasting dynasty of traditional Vietnam. Its founder, Le Loi, drove the Chinese out of Vietnam and began the process of recovering the southern portion of the region from the kingdom of Champa. In 1471 the dynasty's greatest ruler, Le Thanh Tong (d. 1497), completed that work. He divided the country into provinces patterned on the Chinese model and established a triennial Confucian civil-service examination. After 1533 the Le rulers were only theoretically supreme, real power being held by the Trinh and Nguyen families. In 1771 a peasant uprising toppled the dynasty.

laterality *or* **hemispheric asymmetry** Characteristic of the human brain in which certain functions (such as language comprehension) are localized on one side in preference to the other. One example is handedness (the tendency to use one hand or the other to perform activities): Since the left and right cerebral hemispheres control the right and left sides of the body, respectively, right-handed people are typically left-dominant in terms of hemispheric control of various motor functions and also with respect to seeing (right-eyed) and language comprehension. Paul Broca first identified the brain centre for articulate speech in what is now called Broca's area. Later researchers discovered that functions involving logical or sequential analysis generally reside in the left hemisphere, while the right hemisphere seems to control processing of spatio-visual information and musical relations. More left-handers than right-handers display a reversal of hemispheric specialization or a more even distribution of functions between the two hemispheres. There is no general agreement about whether laterality is genetically transmitted, developed during gestation, or learned.

Lateran Council Any of five ecumenical councils of the Roman Catholic church held in the Lateran Palace in Rome. The First Lateran Council (1123), held during the papacy of Calixtus II, reiterated decrees of earlier ecumenical councils (condemning simony, forbidding clergymen to marry, etc.). The Second Lateran Council (1139) was called by Innocent II to end the schism created by the election of a rival pope. The Third Lateran Council (1179), held during the papacy of Alexander III, established a two-thirds majority of the College of Cardinals as a requirement for papal election and condemned the heresies of the Cathari. Innocent III called the Fourth Lateran Council (1215) in an effort to reform the church; its decrees obliged Catholics to make a yearly confession, sanctioned the doctrine of transubstantiation, and made preparations for a new Crusade. The Fifth Lateran Council (1512–17), convoked by Julius II, affirmed the immortality of the soul and restored peace among warring Christian rulers.

Lateran Treaty *or* **Lateran Pact** (1929) Pact of mutual recognition between Italy and the Vatican, signed in the Lateran Palace, Rome. The Vatican agreed to recognize the state of Italy, with Rome as its capital, in exchange for formal establishment of Roman Catholicism as the state religion of Italy, institution of religious instruction in the public schools, the banning of divorce, and recognition of papal sovereignty over Vatican City and the complete independence of the pope. A second concordat in 1985 ended Catholicism's status as the state religion and discontinued compulsory religious education.

laterite \ˈla-tə-ˌrīt\ Soil layer rich in iron oxide and sometimes aluminum, derived from a wide variety of rocks by leaching. It forms in tropical and subtropical regions where the climate is humid. Laterite is blackish brown to reddish and has been used as an iron ore and, in Cuba, as a source of nickel.

latex Any of several natural or synthetic colloidal suspensions (see colloid). Some latexes occur naturally in the cells of plants such as chicle and rubber trees. They are complex mixtures of organic compounds, including various gum resins, fats, or waxes and, in some instances, poisonous compounds, suspended in a watery medium with dissolved salts, sugars, tannins, alkaloids, enzymes, and other substances from which the latex (or natural rubber, the only available rubber until 1926) can be concentrated, coagulated, and vulcanized. Synthetic latexes (e.g., neoprene), made by emulsion polymerization from styrene-butadiene copolymer, acrylate resins, polyvinyl acetate, or other materials, are used as paints and coatings; the plastic, dispersed in the water, forms films by fusion as the water evaporates.

lathe \ˈlāth\ Machine tool that performs turning operations in which unwanted material is removed from a workpiece rotated against a cutting tool. Lathes are among the oldest and most important machine tools, used in France from 1569 and important in the Industrial Revolution in England, when they were adapted for metal cutting (see Henry Maudslay). Lathes (usually called engine lathes) today have a power-driven, variable-speed horizontal spindle to which the workholding device is attached. Operations include turning straight or tapered cylindrical shapes, grooves, shoulders, and screw threads and facing flat surfaces on the ends of cylindrical parts. Internal cylindrical operations include most of the common hole-machining operations, such as drilling, boring, reaming, counterboring, countersinking, and threading with a single-point tool or tap. See also boring machine.

Latimer, Hugh (b. c. 1485, Thurcaston, Leicestershire, Eng.—d. Oct. 16, 1555, Oxford) English Protestant martyr. The son of a prosperous yeoman farmer, he was educated at the University of Cambridge, where he came into contact with the doctrines of Martin Luther and converted to Protestantism. He supported Henry VIII's attempt to obtain a marriage annulment but was later excommunicated for refusing to accept the existence of purgatory or the need to venerate saints. He made a complete submission and briefly served as bishop of Worcester (1535–39). Again imprisoned on suspicion of heresy, he was freed with the accession of Edward VI, during whose brief reign he preached extensively. On Mary I's accession and the subsequent reversion to Catholicism, he was arrested for treason and burned at the stake.

Latin alphabet *or* **Roman alphabet** Most widely used alphabet, the standard script of most languages that originated in Europe. It developed before 600 BC from the Etruscan alphabet (in turn derived from the North Semitic alphabet by way of the Phoenician and Greek alphabets). The earliest known Latin inscriptions date from the 7th–6th cent. BC. The classical Latin alphabet had 23 letters, 21 derived from the Etruscan. In

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medieval times the letter J became differentiated from I, and U and W became differentiated from V, producing the 26-letter alphabet of modern English. In ancient Roman times there were two types of Latin script, capital letters and cursive. Uncial script, mixing both types, developed in the 3rd century AD.

Latin America Countries of SOUTH AMERICA and NORTH AMERICA (including CENTRAL AMERICA and the islands of the CARIBBEAN SEA) south of the U.S.; the term is often restricted to countries where either Spanish or Portuguese is spoken. The colonial era in Latin America began in the 15th–16th centuries when explorers such as CHRISTOPHER COLUMBUS and AMERIGO VESPUCCI made voyages of discovery to the New World. The CONQUISTADORES who followed, including HERNÁN CORTÉS and FRANCISCO PIZARRO, brought Spanish rule to much of the region. In 1532 the first Portuguese settlement was made in Brazil. The Roman Catholic church soon established many missions in Latin America. ROMAN CATHOLICISM is still the chief religion in most Latin American countries, though the number of Protestants and Evangelicals has grown. Spanish and Portuguese colonists arrived in increasing numbers; they enslaved the native Indian population, which was soon decimated by ill treatment and disease, and then imported African slaves to replace them. A series of movements for independence, led by José de SAN MARTÍN, SIMÓN BOLÍVAR, and others, swept Latin America in the early 19th century. Federal republics were promulgated across the region, but many of the new countries collapsed into political chaos and were taken over by dictators or military juntas, a situation that persisted into the 20th century. In the 1990s a trend toward democratic rule reemerged; in socialist-run countries many state-owned industries were privatized, and efforts toward regional economic integration were accelerated.

Latin American arts Visual, performing, and literary arts that developed in Mesoamerica, Central America, South America, and the Caribbean after contact with the Spanish and Portuguese beginning in 1492 and 1500, respectively. When Europeans arrived, they came with artistic traditions dating back to antiquity. For centuries, indigenous American peoples had similarly formed civilizations with their own unique artistic practices (see NATIVE AMERICAN ARTS). The importation of African slaves led to the presence of long-standing African arts in the region as well (see AFRICAN ARTS). At the time of colonization, the architecture of many native centres was destroyed and replaced with European-style churches and buildings. During this period, a combination of European and indigenous imagery led to unique religious sculptural and decorative art forms. As more European artists immigrated to the new land, Iberian artists brought with them elements of the styles that were current in Europe—such as the RENAISSANCE, BAROQUE, and ROCOCO—to art and architecture. The most notable regional style of the 18th century was known as Churrigueresque, an elaborately decorative style used in architecture, sculpture, and decorative arts. Throughout the 19th and 20th centuries, Latin American artists and architects continued to experiment with a variety of Western styles—including ROMANTICISM, NEOCLASSICISM, MODERNISM, and POSTMODERNISM—but increasingly adapted them to reflect Latin American themes and, often, political concerns. Indigenous music was varied before colonization. The main instruments seem to have been rattles or shakers (e.g., maracas) and flutes of numerous kinds, including PANPIPES. Under European influence, harps, violins, and guitars were adopted (see MARIACHI). Indigenous scales were three- or five-tone, and choral singing in parallel lines was common in some areas. Spanish and Portuguese music contributed verse forms and self-accompanied solo singing. African influences on rhythm have included the use of repetitive patterns to accompany extended improvisation and the prevalence of two- and four-beat patterns, particularly in Caribbean music; the African tradition can also be seen in the use of drums and of syncopation. Iberian dance rhythms and features, such as hand clapping and the use of scarves and handkerchiefs, carried over into many hybrid forms of music and dance. Especially in the 20th century, forms of popular music and dance—such as SALSA, TANGO, SAMBA, and bossa nova—represented a blending of native and Western traditions. During the colonial period, Latin American literature reflected trends in Spanish and Portuguese literature, and it consisted mostly of chronicles of conquest. As the colonies developed their own character and moved towards independence, patriotic writings became prominent. In the mid-19th century, the *cuadro de costumbres*, or sketch of contemporary customs, developed into a realistic novel of manners. Beginning in the late 19th century, authors in the MODERNISMO movement focused on "art for art's sake." Latin American literature came into its own in the 20th century, with movements such as MAGIC REALISM gaining international prominence. See also individual artists by name, such as FRIDA KAHLO; OSCAR NIEMEYER; and DIEGO RIVERA; and authors by name, such as JORGE LUIS BORGES; Gabriel GARCÍA MÁRQUEZ; and PABLO NERUDA.

Latin American Integration Association (LAIA) *formerly (until 1980)* **Latin American Free Trade Association (LAFTA)** International association of Latin American countries originally dedicated to improving its members' economic well-being through free trade. At its founding in 1960 LAFTA included Argentina, Brazil, Chile, Mexico, Paraguay, Peru, and Uruguay; by 1970 Ecuador, Colombia, Venezuela, and Bolivia had joined. The organization aimed to remove all trade barriers over 12 years, but its members' geographic and economic diversity made that goal impossible. LAFTA was superseded in 1980 by the LAIA, which established bilateral trading agreements between members, which were divided into three groups according to their level of economic development. Cuba was admitted with observer status in 1986, and it became a full member in 1999. See also INTER-AMERICAN DEVELOPMENT BANK.

Latin language INDO-EUROPEAN LANGUAGE of the ITALIC group; ancestor of the modern ROMANCE LANGUAGES. Originally spoken by small groups of people living along the lower TIBER RIVER, Latin spread with the growth of Roman political power, first throughout Italy and then through most of western and southern Europe and the central and western Mediterranean coastal regions of Africa. The earliest known Latin inscriptions date from the 7th century BC; Latin literature dates from the 3rd century BC. A gap soon appeared between literary (classical) Latin and the popular spoken language, Vulgar Latin. The Romance languages developed from DIALECTS of the latter. During the Middle Ages and much of the Renaissance, Latin was the language most widely employed in the West for scholarly and literary purposes. Until the latter part of the 20th century, its use was required in the liturgy of the Roman Catholic church.

latite \'lā-ˌtīt\ *or* **trachyandesite** \trā-kē-'an-də-ˌzīt\ Type of igneous rock that is abundant in western North America. Usually white, yellowish, pinkish, or gray, it is the volcanic equivalent of MONZONITE. Latites contain plagioclase FELDSPAR (andesine or oligoclase) as large, single crystals (phenocrysts) in a fine-grained matrix of orthoclase feldspar and augite.

latitude and longitude Coordinate system by which the position or location of any place on the Earth's surface can be determined and described. Latitude is a measurement of location north or south of the Equator. Lines of latitude are known as parallels, or parallels of latitude. Longitude is a measurement of location east or west of the prime meridian, which passes through Greenwich, Eng. The combination of meridians of longitude and parallels of latitude establishes a grid by which exact positions can be determined: for example, a point described as 40° N, 30° W is located 40° of arc north of the Equator and 30° of arc west of the Greenwich meridian.

Latium \'lā-shē-əm\ Ancient area, west-central Italy, on the Tyrrhenian Sea. The Latins (or Latini) came from Indo-European tribes that settled in the Italian peninsula during the 2nd millennium BC. By 500 BC the cities of Latium had formed the Latin League. War erupted between Rome and the Latins in 340 BC and ended in 338 BC with the defeat of the Latins and the dissolution of the league.

Latreille \là-'trāy**, Pierre-André** (b. Nov. 29, 1762, Brive-la-Gaillarde, Fr.—d. Feb. 6, 1833, Paris) French zoologist, regarded as the father of entomology. An ordained priest, in 1796 he published his *Summary of the Generic Characteristics of Insects, Arranged in a Natural Order,* which led to his becoming head of entomology at the National Museum of Natural History. His principal later work was his *Comprehensive Natural History of Crustaceans and Insects* (14 vol., 1802–05). The two works, representing the first detailed classification of insects and crustaceans, mark the beginnings of modern entomology. In 1829 he took the professorial chair vacated by JEAN-BAPTISTE LAMARCK.

Latrobe \lə-'trōb**, Benjamin Henry** (b. May 1, 1764, Fulneck, Yorkshire, Eng.—d. Sept. 3, 1820, New Orleans, La., U.S.) British-U.S. architect and civil engineer. He immigrated to the U.S. in 1795. His first important building was the State Penitentiary in Richmond, Va. In 1798, in Philadelphia, he designed the Bank of Pennsylvania, considered the first U.S. monument of the Greek Revival style. Pres. THOMAS JEFFERSON appointed him surveyor of public buildings. Latrobe inherited the task of completing the U.S. CAPITOL, and later rebuilt it after its destruction by the British. In Baltimore he designed the country's first cathedral (1818). He

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was active as an engineer, especially in the design of waterworks. He is widely regarded as having established architecture as a profession in the U.S.

Latter-day Saints, Church of Jesus Christ of See Mormon

lattice, crystal See crystal lattice

Lattre de Tassigny \'lå-trᵊ-də-tå-sēn-'yē\, **Jean (-Marie-Gabriel) de** (b. Feb. 2, 1889, Mouilleron-en-Pareds, France—d. Jan. 11, 1952, Paris) French military leader. After service in World War I and later in Morocco, he was promoted to general in 1939. An infantry division commander in World War II, he was imprisoned by the Germans (1940–43), but he escaped to North Africa. In 1944 he led the French army in the Allied landing operations in southern France and in the drive across France into southern Germany and Austria. He represented France at the signing of the German capitulation (1945). In 1950–51 he commanded French troops in the First Indochina War against the Viet Minh. He was made a marshal of France posthumously.

Latvia *officially* **Republic of Latvia** Country, northeastern Europe, along the shores of the Baltic Sea and the Gulf of Riga. Area: 24,938 sq mi (64,589 sq km). Population (2005 est.): 2,299,000. Capital: Riga. Less than

three-fifths of the population are Latvians, or Letts, who speak Latvian, one of two surviving Baltic languages. Russians make up about one-third of the population. Languages: Latvian (official), Russian. Religion: Christianity (Protestant, Roman Catholic, Eastern Orthodox). Currency: lats. The landscape is an undulating plain, with fairly flat lowlands alternating with hills. Latvia is a fully industrialized country. Heavy industry (notably the production of metals, ships, and railcars) once was more important than it is today; now leading manufactures include alcoholic beverages, wood products, foodstuffs, and textiles. Latvia is a multiparty republic with one legislative body; its chief of state is the president, and the head of government is the prime minister. It was settled by the Balts in ancient times. They came under the overlordship of the Varangians, or Vikings, in the 9th century and were later dominated by their German-speaking neighbours to the west, who Christianized Latvia in the 12th–13th century. The Order of the Brothers of the Sword conquered Latvia by 1230 and established German rule. From the mid-16th to the early 18th century the region was split between Poland and Sweden, but by the end of the 18th century all of Latvia had been annexed by Russia. Latvia declared its independence after the Russian Revolution of 1917. In 1939 it was forced to grant military bases to the Soviet Union, and in 1940 the Soviet Red Army invaded. Held by Nazi Germany (1941–44), the country was recaptured by the Soviets and incorporated into the Soviet Union. With the breakup of the Soviet Union, Latvia gained its independence in 1991. Subsequently it sought to privatize the economy and build ties with western Europe (becoming a member of the European Union in 2004), as well as to improve uneasy relations with Russia.

Latvian language *or* **Lettish language** East Baltic language spoken by some two million people in the Republic of Latvia and in diaspora communities, including about 85,000 speakers in North America. Like Lithuanian, it is sparsely attested until the first printed books in Latvian appear in 1585–86. The essentials of the present orthography, which employs the Latin alphabet with a number of diacritics, were adopted in 1908. Literary Latvian is based on the dialect spoken in Riga, Latvia's capital, though in recent years there has been a resurgence of literature in High Latvian (Latgalian), the dialect of eastern Latvia. Relative to Lithuanian, Latvian has undergone a number of striking sound changes, though the grammatical structures of the two languages are similar.

Laud, William (b. Oct. 7, 1573, Reading, Berkshire, Eng.—d. Jan. 10, 1645, London) Archbishop of Canterbury (1633–45) and religious adviser to Charles I. He became a privy councillor in 1627 and bishop of London in 1628, devoting himself to combating Puritanism and enforcing strict Anglican ritual. By the time he became archbishop of Canterbury, he had extended his authority over the whole country. He attacked the Puritan practice of preaching as dangerous, and he had Puritan writers such as William Prynne mutilated and imprisoned. Aided by his close ally the 1st earl of Strafford, Thomas Wentworth, Laud used his influence over the king to influence government social policy. By 1637, opposition to Laudian repression had grown, and Laud's attempts to impose Anglican forms of worship in Scotland provoked fierce resistance. In 1640 the Long Parliament met, and Laud was accused of high treason. His trial, which began in 1644 and was managed by Prynne, resulted in Laud's conviction and beheading.

Lauder \'lȯ-dər\, **Estée** *orig.* **Josephine Esther Mentzer** (b. July 1, 1908?, New York, N.Y., U.S.—d. April 24, 2004, New York) U.S. entrepreneur. She founded Estée Lauder, Inc., with her husband, Joseph, in 1946. Their innovative marketing techniques led to huge success from the 1960s on. Her son Leonard was named chief executive officer in 1982. The company's fragrance and cosmetics products, including Clinique cosmetics, Aramis men's products, as well as specialty lines such as Bobbi Brown, Origins, and Aveda, are sold in more than 130 countries. By the early 21st century the company was worth about $10 billion.

Laue \'laů-ə\, **Max (Theodor Felix) von** (b. Oct. 9, 1879, Pfaffendorf, near Koblenz, Ger.—d. April 23, 1960, Berlin, W.Ger.) German physicist. He taught at the University of Berlin (1919–43). He was the first to use a crystal to diffract X-rays, demonstrating that X-rays are electromagnetic radiation similar to light and that the molecular structure of crystals is a regularly repeating arrangement. For his work in crystallography he received the 1914 Nobel Prize for Physics. He championed Albert Einstein's theory of relativity and studied the quantum theory, the Compton effect, and the disintegration of atoms.

Lauenburg \'laů-ən-ˌbůrk\ Region and former duchy, northern Germany. It was established as a duchy under the Ascanian dynasty in the 13th century. In 1728 George Louis, elector of Hanover, became its ruler, thereby attaching it to Hanover. It came under Prussia after the Danish-Prussian War of 1864. The duchy was abolished in 1918, and the region has been part of the state of Schleswig-Holstein since 1946.

laughing gas See nitrous oxide

laughing jackass See kookaburra

Laughlin \'läk-lin\, **James** (b. Oct. 30, 1914, Pittsburgh, Pa., U.S.—d. Nov. 12, 1997, Norfolk, Conn.) U.S. publisher and poet. Born to a wealthy family, Laughlin founded New Directions press in 1936 after graduating from Harvard. He established the company initially to publish ignored yet influential writers, including William Carlos Williams and Ezra Pound, a friend and major influence on his life and work. New Directions editions of such authors as Dylan Thomas, Tennessee Williams, and Hermann Hesse (one of the many foreign authors it published in translation) eventually made the house, despite its small size, one of the most distinguished literary publishers in the U.S. Its inexpensive pocket-sized volumes had distinctive black-and-white covers that made them recognizable in any bookstore.

Laughton \'lȯ-tᵊn\, **Charles** (b. July 1, 1899, Scarborough, Yorkshire, Eng.—d. Dec. 15, 1962, Hollywood, Calif., U.S.) British actor. He made

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his London stage debut in 1926 and acted in plays such as *The Government Inspector*, *Medea*, and *Payment Deferred,* in which he made his New York debut in 1931. He appeared in movies from 1929 and earned international acclaim in *The Private Life of Henry VIII* (1933, Academy Award). With his bulky frame and ordinary face Laughton defied Hollywood typecasting and emerged as one of the most versatile performers of his generation. He played a wide range of character roles in films such as *Mutiny on the Bounty* (1935), *Ruggles of Red Gap* (1935), *The Hunchback of Notre Dame* (1939), *Witness for the Prosecution* (1957), and *Advise and Consent* (1962). He directed the memorable *The Night of the Hunter* (1955).

lauma \'laù-mä\ In Baltic folklore, a fairy who appeared as a beautiful naked maiden with long blond hair. Laumas lived in the forest near water or stones. They yearned for children, and as they were unable to give birth, they often kidnapped babies to rear as their own. Sometimes they married mortal men and became excellent wives, perfectly skilled in domestic work. Highly temperamental, laumas were seen as benevolent, motherly beings, helpful to orphans and poor girls but extremely vindictive when angered, particularly by disrespectful men. In Latvia and Lithuania in recent centuries, lauma has come to refer to a witch or hag.

Launcelot See LANCELOT

Launceston \'lȯn-sə-stən\ *formerly* **Patersonia** City (pop., 2001: 57,685) and port, northeastern TASMANIA, Australia. Launceston developed during the 1830s as a whaling port and market centre. It is now the largest population and commercial centre in northern Tasmania. An export hub for a fertile agricultural region, it also has industries, including machine-making factories. One of the world's first hydroelectric stations (built in 1895) lies within the city on the South Esk River.

launch vehicle ROCKET system that boosts a SPACECRAFT into Earth orbit or beyond Earth's gravitational pull. A wide variety of launch vehicles have been used to lift payloads ranging from satellites weighing a few pounds (or kilograms) to large modular components of SPACE STATIONS. Most launch vehicles are expendable (one-use) systems; many early ones were derived from intercontinental ballistic missiles (see ICBM). The Saturn V, which launched the spacecraft that carried humans to the Moon (see APOLLO), had three stages (see STAGED ROCKET). The U.S. SPACE SHUTTLE system (from 1981) represents a significant departure from expendable launch vehicles in that it is partially reusable—its manned orbiting component is designed for numerous flights, and its solid rocket boosters can be recovered and refurbished.

Laurana \laù-'rä-nä**, Francesco** (b. c. 1430, Vrana, Dalmatia, republic of Venice—d. before March 12, 1502, Avignon, Fr.) Italian sculptor and medalist. His early life is obscure. In 1453 he was commissioned to work on the Castel Nuovo in Naples. From 1461 to 1466 he was in Provence at the court of the duke of Anjou, for whom he executed a series of medals. His other documented works include Madonnas and bas-reliefs in Italy (chiefly Sicily and Naples) and France, as well as tombs and architectural sculptures in France. He is best known for his portrait busts of women, characterized by serene, detached dignity and aristocratic elegance.

"Eleonora of Aragon," portrait bust by Francesco Laurana; in the National Archaeological Museum, Palermo, Sicily.
ALINARI/ART RESOURCE, NEW YORK

Laurasia Hypothetical former supercontinent in the Southern Hemisphere, which included modern North America, Europe, and Asia (except peninsular India). The concept that the continents were at one time joined was first set forth in detail by ALFRED WEGENER in 1912. He envisioned a single great landmass, PANGAEA, which supposedly began to separate in the Late Triassic Epoch (227–206 million years ago). Subsequent research distinguished between a northern landmass, Laurasia, and GONDWANA. Laurasia is thought to have fragmented into the present continents largely during the MESOZOIC ERA. See also CONTINENTAL DRIFT.

Laurel, Stan; and Hardy, Oliver *original names, respectively,* **Arthur Stanley Jefferson** *and* **Oliver Norvell Hardy, Jr.** *known as* **Laurel and Hardy** (respectively b. June 16, 1890, Lancashire, Eng.—d. Feb. 23, 1965, Santa Monica, Calif., U.S.; b. Jan. 18, 1892, Harlem, Ga., U.S.—d. Aug. 7, 1957, North Hollywood, Calif.) U.S. film comedians. Laurel performed in circuses and vaudeville before settling in the U.S. (1910), where he began appearing in silent movies. Hardy, son of a Georgia lawyer, owned a movie house and acted in silent comedy films from 1913. They joined HAL ROACH's studio in 1926 and began performing together in early short films such as *Putting Pants on Philip* (1927). They made more than 100 comedies, including *Leave 'em Laughing* (1928), *The Music Box* (1932), *Sons of the Desert* (1933), and *Way Out West* (1937), and are considered Hollywood's first great comedy team. The skinny Laurel played the bumbling and innocent foil to the heavy, pompous Hardy as they converted simple, everyday situations into disastrous tangles of stupidity.

laurel family Family Lauraceae, composed of about 2,200 species of often aromatic and evergreen flowering plants in 45 genera. Included in this family are ornamentals and plants that produce cooking herbs, food fruits, and medicinal extracts. The genus *Laurus* includes bay laurel (*L. nobilis*), native to the Mediterranean, which provides bay leaves for cooking, essential oils for perfumery, and the wreaths that crowned victorious heroes and athletes in ancient Greece. Another genus, *Cinnamomum*, includes the CAMPHOR tree and CINNAMON. Also included in this family are the AVOCADO, MOUNTAIN LAUREL, and SASSAFRAS.

Lauren, Ralph *orig.* **Ralph Lifshitz** (b. Oct. 14, 1939, New York, N.Y., U.S.) U.S. fashion designer. Lauren grew up in the Bronx, in New York City. While working for a tie company, he was inspired to begin designing his own neckwear, and in 1967 he went into business for himself. From the inception of his brand, Lauren's creations were characterized by a moneyed style that evoked the look of English aristocracy, as adapted by the sporty, East-Coast American elite. His first menswear line in 1968 featured classic tweed suits, and his first womenswear line in 1971 continued his explorations of classic tailoring and good taste, but with a feminine twist. In 1972 Lauren debuted what would become his signature piece: the mesh sport shirt, available in a variety of colours and featuring his trademark emblem, the polo player. Throughout the following decades he explored new ideas—including Southwestern themes and safari looks—but maintained his central focus on classic American clothing. At the turn of the 21st century, the presence of both his shops and his brand name had become global.

Laurence, Margaret *orig.* **Jean Margaret Wemyss** (b. July 18, 1926, Neepawa, Man., Can.—d. Jan. 5, 1987, Lakefield, Ont.) Canadian writer. She lived in Africa with her engineer husband in the 1950s; her experiences there provided material for her early works. She is best known for depicting the lives of women struggling for self-realization in the male-dominated world of western Canada. Her works include the novels *The Stone Angel* (1964), *A Jest of God* (1966), and *The Fire-Dwellers* (1969) and the stories collected in *A Bird in the House* (1970) and *The Diviners* (1974). In the 1970s she turned to writing children's books.

Laurence, Saint See SAINT LAWRENCE

Laurentian \lȯ-'ren-chən\ **Mountains** Range forming the Quebec portion of the CANADIAN SHIELD, bounded by the Ottawa, ST. LAWRENCE, and Saguenay rivers. One of the oldest mountain ranges in the world, it consists of PRECAMBRIAN rocks more than 544 million years old. It has greatly eroded over time, and its highest peak measures only 3,905 ft (1,190 m). Two provincial parks there are popular vacation areas.

Laurentide Ice Sheet Principal glacial cover of North America during the PLEISTOCENE EPOCH (1.8 million–10,000 years ago). At its maximum extent it spread as far south as latitude 37° N and covered an area of more than 5 million sq mi (13 million sq km). In some areas its thickness reached 8,000–10,000 ft (2,400–3,000 m) or more.

Laurier \'lȯr-ē-ˌā**, Sir Wilfrid** (b. Nov. 20, 1841, Saint-Lin, Canada East—d. Feb. 17, 1919, Ottawa, Ont., Can.) Prime minister of Canada (1896–1911). He studied law at McGill University, where he was a leading member of the liberal Institut Canadien. He served in the Quebec legislature (1871–74) and the Canadian House of Commons (1874–1919), where in 1885 he delivered a plea for clemency for LOUIS RIEL. Leading the Liberal Party to victory in the election of 1896, he became prime minister, the first French Canadian and Roman Catholic to hold that office. He advo-

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cated unity between English and French Canadians, development of the western territories, protection of Canadian industry, and expansion of the transportation system. His insistence on protecting Canadian autonomy in its relations with Britain helped shape the modern concept of a British Commonwealth of independent states. His support for a treaty of reciprocity with the U.S. contributed to his government's defeat in 1911. Laurier is remembered as one of Canada's most outstanding statesmen.

Lausanne \lō-'zän**, Treaty of** (1923) Final treaty concluding World War I, between Turkey (successor to the Ottoman Empire) and the Allies. Signed in Lausanne, Switz., it replaced the Treaty of Sèvres (1920). It recognized the boundaries of the modern state of Turkey, as well as British possession of Cyprus and Italian possession of the Dodecanese, and the Turkish straits between the Aegean and Black seas were declared open to all shipping.

Lautrec, Henri de Toulouse- See Henri de Toulouse-Lautrec

lava Molten rock originating as magma in the Earth's mantle that pours out onto the Earth's surface through volcanic vents (see volcano) at temperatures of about 1,300–2,200 °F (700–1,200 °C). Mafic lavas, such as basalt, form flows known by the Hawaiian names *pahoehoe* and *aa*. *Pahoehoe* is smooth and gently undulating; the lava moves through natural pipes known as lava tubes. *Aa* is very rough, covered with a layer of loose, irregular fragments called clinker, and flows in open channels. Lava that starts out as *pahoehoe* may turn into *aa* as it cools. Lavas of intermediate composition form a block lava flow, which also has a top consisting largely of loose rubble, but the fragments are fairly regular in shape, mostly polygons with relatively smooth sides. See also bomb; nuée ardente.

Lava Beds National Monument Region, northern California, U.S. It features recent lava flows and related volcanic formations, including deep chasms, chimneys, and cinder cones that rise to 300 ft (90 m) in height. The main battle sites of the Modoc Indian war (1872–73) are located within the monument, which occupies an area of 72 sq mi (186 sq km). It was dedicated as a national monument in 1925.

Laval \lə-'väl\ City (pop., 2001: 343,005), southern Quebec, Canada. It occupies the whole of Jesus Island, 20 mi (32 km) long and 8 mi (12 km) wide, and is located north of Montreal. First settled in 1681, it was granted to the Society of Jesus (Jesuits) in 1699 and named for François de Laval, the first Roman Catholic Canadian bishop. Development of Jesus Island's Montreal suburbs began after 1945; in 1965 they were merged to form Laval. Development has been rapid with the opening of industrial parks there.

Laval \lä-'väl**, Carl Gustaf Patrik de** (b. May 9, 1845, Blasenborg, Swed.—d. Feb. 2, 1913, Stockholm) Swedish scientist, engineer, and inventor. Laval built his first impulse steam turbine in 1882. Further advances followed, including a reversible turbine for marine use. A Laval reaction turbine attained a speed of 42,000 revolutions per minute. By 1896 he was operating a complete power plant using an initial steam pressure of 3,400 lbs per sq in. He invented and developed the divergent nozzle to deliver steam to the turbine blades. His flexible shaft and double-helical gear formed the foundation for most subsequent steam turbine development.

Laval \lä-'väl**, Pierre** (b. June 28, 1883, Châteldon, France—d. Oct. 15, 1945, Paris) French politician. A member of the Chamber of Deputies (1914–19, 1924–27) and later the Senate (from 1927), he also held a number of cabinet posts, and, as France's premier (1931–32, 1935–36), he developed the widely denounced Hoare-Laval Pact. In 1940, as minister of state in Philippe Pétain's government (see Vichy France), he began negotiations with the Germans on his own initiative, which aroused suspicion. Pétain soon dismissed him, but in 1942 he returned as head of the government. He agreed to provide French labourers for German industries and announced in a speech that he desired a German victory. In 1945 he was tried and executed as a traitor to France.

Laval University French-language university in Quebec city, Quebec, Canada. Its predecessor institution, the Seminary of Quebec (founded 1663), is considered Canada's first institution of higher learning. The seminary was granted a university charter in 1852 and reorganized in 1970. Today the university has undergraduate and graduate degree programs in numerous fields.

lavender Any of about 20 species of evergreen shrubs that make up the genus *Lavandula* in the mint family, the leaves and flowers of which contain scented oil glands. The spikes of flowers are purple, less commonly pink or white. Native to the Mediterranean, lavender is cultivated widely. Several species yield essential oil for fine perfumes and cosmetics. The narrow fragrant leaves and flowers are dried for use in sachets and potpourris. Lavender is widely used in aromatherapy for its clean, fresh scent.

Spanish lavender (*Lavandula stoechas*). W.H. HODGE

Laver, Rod(ney George) (b. Aug. 9, 1938, Rockhampton, Queen., Austl.) Australian tennis player. He joined Australia's Davis Cup team when he was 18 years old and remained on the squad until 1962. Nicknamed "Rocket," he became the second male player (after Don Budge) to win the grand slam (1962) and the first to repeat the feat (1969). He turned professional in 1963 and in 1971 became the first tennis player to surpass $1 million in career prize money.

Lavoisier \lə-'vwä-zē-ˌā**, Antoine (-Laurent)** (b. Aug. 26, 1743, Paris, France—d. May 8, 1794, Paris) French chemist, regarded as the father of modern chemistry. His work on combustion, oxidation (see oxidation-reduction), and gases (especially those in air) overthrew the phlogiston doctrine, which held that a component of matter (phlogiston) was given off by a substance in the process of combustion. That theory had held sway for a century. He formulated the principle of the conservation of mass (i.e., that the weights of the reactants must add up to the weights of the products) in chemical reactions, clarified the distinction between elements and compounds, and was instrumental in devising the modern system of chemical nomenclature (naming oxygen, hydrogen, and carbon). He was among the first to use quantitative procedures in chemical investigations, and his experimental ingenuity, exact methods, and cogent reasoning, along with the resultant discoveries, revolutionized chemistry. He also worked on physical problems, especially heat, and on fermentation, respiration, and animals. Independently wealthy, he had a simultaneous career as a public servant of remarkable versatility in areas including finance, economics, agriculture, education, and social welfare. A reformer and political liberal, he was active in the French Revolution but came under increasing attack from extremists and was guillotined.

Lavrovsky \låv-'rôf-skē**, Leonid (Mikhaylovich)** (b. June 18, 1905, St. Petersburg, Russia—d. Nov. 26, 1967, Paris, Fr.) Russian dancer, choreographer, teacher, and Bolshoi Ballet director. He studied ballet in St. Petersburg until 1922 and soon was dancing leading roles with the Kirov Ballet, of which he became artistic director in 1938. During 1944–56 and 1960–64 he was chief choreographer of the Bolshoi Ballet, and he became director of its school in 1964. His choreographic work, which began in 1930, included *Fadetta* (1934), *Romeo and Juliet* (1940), *Giselle* (1944), *The Stone Flower* (1954), and *Night City* (1961).

law Discipline and profession concerned with the customs, practices, and rules of conduct that are recognized as binding by the community. Enforcement of the body of rules is through a controlling authority, such as a group of elders, a regent, a court, or a judiciary. Comparative law is the study of the differences, similarities, and interrelationships of different systems of law. Important areas in the study and practice of law include administrative law, antitrust law, business law, constitutional law, criminal law, environmental law, family law, health law, immigration law, intellectual property law, international law, labour law, maritime law, procedural law, property law, public interest law, tax law, trusts and estates, and torts. See also Anglo-Saxon law; canon law; civil law; common law; equity; Germanic law; Indian law; Islamic law (Sharīʿah); Israeli law; Japanese law; jurisprudence; military law; Roman law; Scottish law; Soviet law.

Law, (Andrew) Bonar (b. Sept. 16, 1858, Kingston, N.B., Can.—d. Oct. 30, 1923, London, Eng.) Prime minister of Britain (1922–23), the first born in a British overseas possession. Reared in Scotland, he was elected to the House of Commons in 1900 and became leader of the Conservative Party in 1911. He served as colonial secretary (1915–16) and as chancellor of the Exchequer (1916–18), and he was leader of the House of Commons (1916–21). After David Lloyd George's resignation in 1922, Law formed a Conservative government as prime minister, but he resigned seven months later because of ill health.

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Law, John (baptized April 21, 1671, Edinburgh, Scot.—d. March 21, 1729, Venice) Scottish monetary reformer. In 1705 he published the banking reform plan *Money and Trade Considered*, in which, unlike other mercantilists, he proposed a central bank as an agency for manufacturing money, as banknotes rather than as gold and silver. France agreed to try his plan in 1716, and he founded the Banque Générale, which was authorized to issue notes. He soon combined it with a company empowered to develop France's North American territories, particularly the lower Mississippi valley. His plan foundered; held responsible for the "Mississippi Bubble" speculative disaster, he fled to France and died in poverty in Venice.

law, philosophy of See JURISPRUDENCE

law code Systematic compilation of law or legal principles. The oldest extant fragments of a law code are tablets from the ancient city of Ebla dating to c. 2400 BC. The best-known ancient code is that of HAMMURABI. Roman legal records began in the 5th century BC, though the first formal codification, ordered by JUSTINIAN I, was not undertaken until the 6th century AD. In the Middle Ages and into the modern era, only local or provincial compilations were attempted. The first major national code was the NAPOLEONIC CODE, followed by the German, Swiss, and Japanese codes. In COMMON-LAW countries such as England and the U.S., law codes have traditionally been less important than the record of judicial decisions, though major codifications were completed in the U.S. in the 20th century (e.g., the *U.S. Code*, the *Uniform Commercial Code*). See also CIVIL LAW; GERMAN CIVIL CODE.

law of cosines Generalization of the PYTHAGOREAN THEOREM relating the lengths of the sides of any triangle. If a, b, and c are the lengths of the sides and C is the angle opposite side c, then $c^2 = a^2 + b^2 - 2ab \cos C$.

law of sines Principle of TRIGONOMETRY stating that the lengths of the sides of any triangle are proportional to the sines of the opposite angles. That is,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

when a, b, and c are the sides and A, B, and C are the opposite angles.

Law of the Sea See Law of the SEA

law report In COMMON LAW, a published record of a judicial decision that is cited by lawyers and judges as legal precedent in arguing and deciding cases. The report contains the title of the case, a statement of the facts, a brief case history, the opinion of the court, and the judgment rendered. It often contains a headnote, or analytical summary stating the points decided. The findings of trial courts are not ordinarily reported, but those of appellate courts are.

Lawamon See LAYAMON

Lawes, Henry and William (respectively baptized Jan. 5, 1596, Dinton, Wiltshire, Eng.—d. Oct. 21, 1662, London; baptized May 1, 1602, Salisbury, Wiltshire, Eng.—d. Sept. 24, 1645, Chester, Cheshire) English composers. Both brothers served at the court of CHARLES I. Henry became the leading English songwriter of his time; some 435 of his songs survive. His theatrical music includes that to JOHN MILTON's masque *Comus* (1634). William wrote a large quantity of instrumental music, mostly for string consorts. His music for some 25 dramatic productions, including works by BEN JONSON and WILLIAM DAVENANT, made him the principal English theatrical composer before HENRY PURCELL. He fought with the Royalists during the English Civil Wars and was killed at the siege of Chester.

lawn Fine-textured expanse of grass that is kept mowed. A common landscape design element of Western-style gardens and parks, lawns aid in giving a sense of scale and proportion. Made popular in the 18th century by Capability BROWN, the lawn is the antithesis of the French PARTERRE. In the 20th century the lawn became a ubiquitous feature of the gardens of U.S. single-family detached houses, serving to denote ownership and provide a buffer zone between street and private space.

lawn bowls See BOWLS

Lawrence, D(avid) H(erbert) (b. Sept. 11, 1885, Eastwood, Nottinghamshire, Eng.—d. March 2, 1930, Vence, France) English novelist, short-story writer, poet, and essayist. The son of a Midlands coal miner and an educated mother, he began to write in 1905 and earned a teaching certificate in 1908. FORD MADOX FORD published much of Lawrence's early work in the *English Review* and helped place his first novel, *The White Peacock* (1911). Lawrence often drew his themes from his own life and relationships. *Sons and Lovers* (1913) is a clearly autobiographical novel about working-class family life. In 1914 he married a German woman, Frieda Weekley. The object of hostility and suspicion during World War I because of his pacifism and her origins, the couple lived in various countries after 1919, never returning to England. *The Rainbow* (1915) and its sequel, *Women in Love* (1920), trace the sickness of modern civilization to the effects of industrialization upon the human psyche. *Kangaroo* (1923) describes the persecution he experienced during the war. *The Plumed Serpent* (1926) was inspired by his fascination with Aztec culture. Lawrence's writing is notable for its intensity and its erotic sensuality; several of his works, including *Lady Chatterley's Lover* (1928), were banned as obscene. He died of the tuberculosis that had plagued him from an early age.

Lawrence, Ernest O(rlando) (b. Aug. 8, 1901, Canton, S.D., U.S.—d. Aug. 27, 1958, Palo Alto, Calif.) U.S. physicist. He earned a Ph.D. at Yale University and taught physics at the University of California at Berkeley from 1929, where he built and directed (from 1936) its radiation laboratory. In 1929 he developed the CYCLOTRON, with which he accelerated protons to speeds high enough to cause nuclear disintegration. He later produced radioactive isotopes for medical use, instituted the use of neutron beams to treat cancer, and invented a colour-television picture tube. He worked with the MANHATTAN PROJECT, converting the Berkeley cyclotron to separate uranium-235 by mass spectrometry. For his invention of the cyclotron, he was awarded a 1939 Nobel Prize, and in 1957 he received the Enrico Fermi Award. Lawrence Berkeley Laboratory and Lawrence Livermore National Laboratory were named in his honour, as was element 103, lawrencium.

Lawrence, Gertrude *orig.* **Gertrud Alexandra Dagmar Lawrence Klasen** (b. July 4, 1898, London, Eng.—d. Sept. 6, 1952, New York, N.Y., U.S.) British actress. She began appearing on stage as a child, and she starred in musical revues such as NOËL COWARD's *London Calling* (1923) and GEORGE GERSHWIN's *Oh, Kay!* (1926). A longtime friend of Coward's, she performed in many of his comedies, notably *Private Lives* (1930); both the play and the stars set the tone that would characterize comedies of manners for a decade or more: sophistication, brittle wit, and chic. She was also acclaimed for her roles in the musicals *Lady in the Dark* (1941) and *The King and I* (1951).

Gertrude Lawrence
CECIL BEATON

Lawrence, Jacob (b. Sept. 7, 1917, Atlantic City, N.J., U.S.—d. June 9, 2000, Seattle, Wash.) U.S. painter. He moved with his family at 13 to New York City's Harlem. Art classes sponsored by the WORKS PROGRESS ADMINISTRATION in 1932 developed his talent. His works portray scenes of African American life and history with vivid, stylized realism. Gouache and tempera were Lawrence's characteristic media. His use of sombre browns and black for shadows and outlines in an otherwise vibrant palette lent his work a distinctive overtone. His best-known works are his series on historical and social themes, such as *Life in Harlem* (1942) and *War* (1947). His later works include a powerful series on the struggles of desegregation. From 1971 he taught at the University of Washington.

Lawrence, James (b. Oct. 1, 1781, Burlington, N.J., U.S.—killed in action June 1, 1813, in a sea battle off Boston, Mass.) U.S. naval officer. He served under STEPHEN DECATUR in the TRIPOLITAN WAR. In the WAR OF 1812 he commanded the USS *Hornet* in the capture of the British *Peacock*. Shortly thereafter he was promoted to captain of the USS *Chesapeake*. In 1813 he accepted a challenge from the British *Shannon* to a sea fight off the coast of Boston. The *Chesapeake* was defeated in less than an hour, and Lawrence was mortally wounded. His last words, "Don't give up the ship," came to express one of the U.S. Navy's most cherished traditions.

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Lawrence, John (Laird Mair) *later* **Baron Lawrence (of the Punjab and of Grately)** (b. March 4, 1811, Richmond, Yorkshire, Eng.—d. June 27, 1879, London) British viceroy and governor-general of India (1864–69). He worked in Delhi as an assistant judge, magistrate, and tax collector. After the First Sikh War (1845–46) he was made commissioner of the newly annexed district of Jullundur, where he subdued the hill chiefs, established courts and police posts, and curbed female infanticide and suttee. On the Punjab board of administration he abolished internal duties, introduced a uniform currency, and encouraged road and canal construction. As viceroy and governor-general from 1864, he promoted increased educational opportunities for Indians but resisted their appointment to high civil-service posts. He avoided entanglements in the affairs of Arabia, the Persian Gulf, and Afghanistan.

Lawrence, Saint *or* **Saint Laurence** (d. 258, Rome; feast day August 10) Roman martyr. He was one of seven deacons in Rome during the papacy of Sixtus II. When the pope was executed during the persecution of Christians under Valerian, the authorities asked Lawrence to surrender the churches' treasures to the state, and he responded by distributing the money to the poor, for which he was condemned to death. His fearless behavior at his execution was responsible for many conversions; according to one legend, he was roasted to death on a gridiron, remarking to his torturers, "I am cooked on that side; turn me over, and eat."

Lawrence, T(homas) E(dward) *byname* **Lawrence of Arabia** (b. Aug. 15, 1888, Tremadoc, Caernarvonshire, Wales—d. May 19, 1935, Clouds Hill, Dorset, Eng.) British scholar, military strategist, and author. He studied at Oxford, submitting a thesis on Crusader castles. He learned Arabic on an archaeological expedition (1911–14). During World War I (1914–18) he conceived the plan of supporting Arab rebellion against the Ottoman Empire as a way of undermining Germany's eastern ally, and he led Arab forces in a guerrilla campaign behind the lines, tying up many Ottoman troops. In 1917 his forces had their first major victory, capturing the port town of Al-ʿAqabah. He was captured later that year, but he escaped. His troops reached Damascus in 1918, but Arab factionalism and Anglo-French decisions to divide the area into British- and French-controlled mandates prevented the Arabs from forming a unified nation despite their victory. Lawrence retired, declining royal decorations. Under the name Ross, and later Shaw, he enlisted in the Royal Air Force (and briefly the Royal Tank Corps). He finished his autobiography, *The Seven Pillars of Wisdom*, in 1926. He was eventually posted to India; his experiences provided grist for his semifictional *The Mint*. He died in a motorcycle accident three months after his discharge.

laws, conflict of Opposition or contradiction in the applicable laws of different states or jurisdictions regarding the rights of the parties in a case. Rules have been created to help determine which set of laws is applicable in a given case, which judicial system is most appropriate for trying the case, and the extent to which other jurisdictions are expected to honour or enforce the outcome of the trial.

lawyer *or* **attorney** Person trained and licensed to prepare, manage, and either prosecute or defend a court action as an agent for another and who also gives advice on legal matters that may or may not require court action. Legal practice varies from country to country. In Britain, for example, lawyers are divided into barristers and solicitors. In the U.S. attorneys often specialize in limited areas of the law (e.g., criminal law, divorce, or probate). In France the most important type of legal professional is the *avocat*, roughly comparable to the English barrister. In Germany the chief distinction is between lawyers and notaries.

laxative Substance that promotes defecation. These include irritants (stimulants) such as cascara sagrada and castor oil, bulk formers such as bran and psyllium, saline laxatives such as Epsom salts or milk of magnesia, glycerin, lubricants such as mineral oil and some vegetable oils, and stool softeners. A high-fibre diet is more important than laxatives in correcting simple intestinal constipation.

Laxness \'läks-nes**, Halldór** *orig.* **Halldór Kiljan Gudjónsson** (b. April 23, 1902, Reykjavík, Ice.—d. Feb. 8, 1998, near Reykjavík) Icelandic novelist. He converted to Roman Catholicism while traveling in Europe as a young man but later dissociated himself from Christianity and turned to socialism, an ideology reflected in his novels from the 1930s and '40s. Works exploring the social issues of Iceland include *Salka Valka* (1936), which deals with the plight of working people in a fishing village; *Independent People* (1935), the story of an impoverished farmer's struggle for economic independence; and the nationalist trilogy *Iceland's Bell* (1943–46). His later works were more lyrical and introspective. He received the Nobel Prize for Literature in 1955.

Layamon \'lā-ə-mən\ *or* **Lawamon** \'lȯ-mən\ (fl. 12th century) Middle English poet. A priest who lived in Worcestershire, he is the author of the romance-chronicle the *Brut* (c. 1200), the outstanding product of the 12th-century English literary revival and the first work in English to treat the Arthurian legend. His source was Wace's *Roman de Brut*. In some 16,000 long alliterative lines, the *Brut* tells of Britain from the time of the landing of Brutus, great-grandson of the Trojan Aeneas, to the final Saxon victory over the Britons in 689.

layering *or* **layerage** Method of propagation in which plants are induced to regenerate missing parts from parts that are still attached to the parent plant. It occurs naturally for drooping black raspberry or forsythia stems, whose trailing tips root where they come in contact with the soil. They then send up new shoots from the newly rooted portion of the plant. For soil layering, lower stems are bent to the ground and covered with moist soil of good quality. For air layering, a branch is deeply slit and the wound is covered with a ball of earth or moss and kept moist until roots develop; the branch is then severed and transplanted. Layering was practiced by the ancient Egyptians and Greeks. See also cutting.

Lazarus In the New Testament, two apparently different people. In the Gospel According to Luke, he was the poor man in the parable of Dives and Lazarus, and in the Middle Ages he was honoured as the patron of lepers. In the Gospel According to John, Lazarus was the man whom Jesus raised from the dead. When Jesus visited Bethany, near Jerusalem, Lazarus's sister Mary lamented that if only Jesus had been there four days earlier, surely he could have prevented her brother from dying. Jesus went to the cave where Lazarus was entombed and commanded him to "come forth," and he did. The miracle, in the Gospel account, inspired some Jews to accept Jesus as the Messiah, and others reported it to Jewish leaders.

Lazarus, Emma (b. July 22, 1849, New York, N.Y., U.S.—d. Nov. 19, 1887, New York) U.S. writer. She was born into a cultured Jewish family and learned languages and the classics at an early age. Her first book (1867) caught the attention of Ralph Waldo Emerson, with whom she corresponded thereafter. She wrote a prose romance and translated Heinrich Heine's poems and ballads. She took up the defense of persecuted Jews c. 1881 and began working for the relief of new immigrants to the U.S. The famous closing lines to her poem "The New Colossus" (1883) were inscribed on the base of the Statue of Liberty (see Statue of Liberty National Monument), dedicated in 1886.

Lazio \'lät-sē-ō\ Region (pop., 2001 prelim.: 4,976,184), west-central Italy, fronting the Tyrrhenian Sea. Established in 1948, it covers an area of 6,642 sq mi (17,203 sq km); its capital is Rome. In the east are the central Apennines, and in the west lies a coastal plain. Until the late 19th century, most of its lowlands were marshy and malarial, but in the early 20th century these lands were drained and repopulated. Situated in the region previously known as Latium, it supports light industry, but the area is dominated by Rome.

LCD See liquid crystal display

LDP See Liberal-Democratic Party

Le Bon \lə-'bōⁿ**, Gustave** (b. May 7, 1841, Nogent-le-Rotrou, France—d. Dec. 13, 1931, Marnes-la-Coquette) French social psychologist. After receiving a doctorate in medicine, he traveled and wrote books on anthropology, but his interests later shifted to social psychology. In *The Crowd* (1895) he argued that the personality of the individual in a crowd becomes submerged and that the collective crowd mind comes to dominate.

Le Brun \lə-'brœⁿ**, Charles** (b. Feb. 24, 1619, Paris, France—d. Feb. 12, 1690, Paris) French painter and designer. After study in Paris and Rome, he received large decorative and religious commissions that made his reputation. Possessing extraordinary organizational as well as technical skills, as the first painter to Louis XIV he created or supervised the production of most of the paintings, sculptures, and decorative objects commissioned by the French government for three decades, notably for the Palace of Versailles. As director of the Academy of Painting and Sculpture and organizer of the French Academy at Rome, he was instrumental in establishing the characteristic homogeneity of French art in the 17th century.

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Le Carré \lə-kä-'rā**, John** *orig.* **David John Moore Cornwell** (b. Oct. 19, 1931, Poole, Dorset, Eng.) British novelist. As a member of the foreign service in West Germany from 1959, he acquired firsthand knowledge of international espionage. He began to write full-time after the success of his third novel, the realistic, suspenseful *The Spy Who Came in from the Cold* (1963). The trilogy *Tinker, Tailor, Soldier, Spy* (1974), *The Honourable Schoolboy* (1977), and *Smiley's People* (1980) centres on the intelligence agent George Smiley. Unlike other fictional spies, Smiley is decidedly unglamorous, lonely, and alienated. Le Carré's other novels include *The Little Drummer Girl* (1983), *The Russia House* (1989), and *The Night Manager* (1993). Many of his books were adapted for film or television.

Le Châtelier \lə-shä-təl-'yā**, Henry-Louis** (b. Oct. 8, 1850, Paris, France—d. Sept. 17, 1936, Miribel-les-Échelles) French chemist. A professor at the Collège de France and the Sorbonne, he is best known for the principle of Le Châtelier, which makes it possible to predict the effect that a change in conditions (TEMPERATURE, PRESSURE, or concentration of components) will have on a CHEMICAL REACTION. The principle, invaluable in the chemical industry in developing the most efficient and profitable chemical processes, may be stated thus: A system at EQUILIBRIUM, when subjected to a perturbation, responds in a way that tends to minimize its effect. Le Châtelier was also an authority on metallurgy, cements, glasses, fuels, explosives, and heat.

Le Corbusier \lə-kȯr-bu̇s-'yā\ *orig.* **Charles-Édouard Jeanneret** (b. Oct. 6, 1887, La Chaux-de-Fonds, Switz.—d. Aug. 27, 1965, Cap Martin, France) Swiss-born French architect and city planner. Born in a small Swiss town, he left home as a young man and developed many of his ideas during his travels through Europe (1907–11). After settling in Paris, Le Corbusier (his assumed name, from the surname of an ancestor) and the painter Amédée Ozenfant (1886–1966) formulated the ideas of Purism, an aesthetic based on the pure, simple geometric forms of everyday objects. His early work included theoretical plans for skyscraper cities and mass-produced housing; in one of his many essays on architecture from the period, he declared that "a house is a machine for living in." Works from the 1920s such as the Villa Savoye at Poissy, France (1929–30), with its structure raised on slender concrete pillars, open floor plan, long strip windows, and roof terrace, established him as a major proponent of the INTERNATIONAL STYLE. He and other architects working in this style aspired to clean, Modernist lines, yet Le Corbusier was the first architect to make a studied use of rough-cast concrete, a technique that gave his work a distinctly sculptural, expressive quality. His later works include the UNITÉ D'HABITATION and the lyrical chapel of Notre-Dame-du-Haut at Ronchamp, France (1950–55). His government buildings at Chandigarh, India (begun 1950), with their enormous concrete sunshades, sculptural facades, and swooping rooflines, represent the first large-scale application of his city-planning principles. Le Corbusier's many works, plans, and writings inspired later avant-garde architectural experiments throughout the world.

Le Gallienne \lə-'gal-yən**, Eva** (b. Jan. 11, 1899, London, Eng.—d. June 3, 1991, Weston, Conn., U.S.) British-born U.S. actress and director. After moving to New York City in 1915, she appeared in minor stage roles before starring in *Liliom* (1921). She founded the Civic Repertory Theatre (1926–33), where she directed and acted in plays by ANTON CHEKHOV, HENRIK IBSEN, and other playwrights not then familiar to U.S. audiences. She later cofounded the short-lived American Repertory Theatre (1946–47). Her most notable later stage appearance was in a 1976 revival of *The Royal Family*.

Le Guin \lə-'gwin**, Ursula K(roeber)** *orig.* **Ursula Kroeber** (b. Oct. 21, 1929, Berkeley, Calif., U.S.) U.S. writer of science fiction and fantasy. The daughter of ALFRED L. KROEBER and educated at Radcliffe College, she was influenced by the methods of anthropology and often included highly detailed descriptions of alien societies in her works. Among her novels are *The Left Hand of Darkness* (1969), *The Word for World Is Forest* (1972), *The Dispossessed* (1974), and *Always Coming Home* (1985) and the Earthsea series. She also wrote several volumes of essays on feminist issues, writing, and other topics.

Le Havre \lə-'hävrᵊ\ Seaport city (pop., 1999: 190,905), northern France. It lies along the ENGLISH CHANNEL and the SEINE RIVER estuary, northwest of PARIS. The second port of France after MARSEILLE, it serves as a base for exports; it is also an important industrial centre. It was only a fishing village until 1517, when FRANCIS I had a harbour built there. Enlarged and fortified in the 17th century under cardinal de RICHELIEU and LOUIS XIV, it was adapted to accommodate bigger vessels in the late 18th century. Most of the city was destroyed during World War II. Later rebuilt, the city's 17th-century church of Notre-Dame is one of the few surviving old buildings.

Le Loi \'lā-'lȯi\ *or* **Binh Dinh Vuong** \'bin-'din-'vwȯŋ\ *or* **Thuan Thien** \'twän-'tyen\ (b. 1385, Lam Son, Viet.—d. 1433) Vietnamese general who won back independence for Vietnam from China and founded the LATER LE DYNASTY (1428–1788). A wealthy landowner, he was affected by the social conditions of the common people, who suffered under the Chinese and the Vietnamese aristocracy. His series of revolts, begun in 1418, drove the Chinese out. From then on he maintained diplomatic relations with the Chinese Ming dynasty, even sending tribute; the Ming acknowledged his kingdom in 1428. Among his achievements were land reforms to help the peasants. He is the most honoured Vietnamese hero of his time.

Le Mans \lə-'mäⁿ\ **(Grand Prix d'Endurance)** Automobile race. It is perhaps the best-known automobile race in the world, run annually (with few exceptions) since 1923 at the Sarthe road-racing circuit, near Le Mans, France. The winner is the car that travels the greatest distance in a 24-hour period. The racing circuit is 8.3 mi (13.4 km) long, and the race is open only to sports cars (see SPORTS-CAR RACING).

Le Moyne de Bienville, Jean-Baptiste See Jean-Baptiste Le Moyne de BIENVILLE

Le Moyne d'Iberville, Pierre See Pierre Le Moyne d'IBERVILLE

Le Nain brothers \lə-'naⁿ\ French painters. By 1630 the three brothers—Antoine (c. 1600–1648), Louis (c. 1600–1648), and Mathieu (c. 1607–1677)—had established a workshop together in Paris. They are said to have worked in harmony, often collaborating on the same picture. Most notable of their works are the dignified and sympathetic genre paintings of peasant life. Their realism is unique in 17th-century French art. None of the brothers' works bears more than a surname, and today they are treated as a single painter.

Le Nôtre \lə-'nō-trᵊ**, André** (b. March 12, 1613, Paris, France—d. Sept. 15, 1700, Paris) French landscape architect. In 1637 he succeeded his father as master gardener to LOUIS XIII at the Tuileries Palace in Paris; he redesigned its gardens and extended the main avenue that later became the CHAMPS-ÉLYSÉES. LOUIS XIV placed him in charge of planning the gardens at the Palace of VERSAILLES, which Le Nôtre transformed from a muddy swamp to a park of splendid vistas. He designed numerous other parks and gardens in France, including those at Saint-Germain-en-Laye, Saint-Cloud, and FONTAINEBLEAU, and probably St. James's Park in London. His designs later influenced PIERRE-CHARLES L'ENFANT.

Le Pen, Jean-Marie (b. June 20, 1928, La Trinité, France) French nationalist politician. He was elected in 1956 to the National Assembly as its youngest member. Le Pen helped to found the National Front in 1972, becoming the party's leader later that year. The party emphasized the threat to France posed by immigration, particularly of Arabs from France's former North African colonies. The party also opposed European integration, favoured the reintroduction of capital punishment, and sought prohibitions on the building of additional mosques in France. Le Pen ran several times for the presidency; though he captured less than 1% of the vote in 1974, in 1988 and 1995 he won some 15%. In the presidential election of 2002 Le Pen finished second in the first round of voting, winning 18%, though he was easily defeated in the second round by JACQUES CHIRAC. Le Pen was widely regarded as the leader of French NEO-FASCISM, and his National Front party constituted the main right-wing opposition to the country's mainstream conservative parties from the 1970s through the turn of the 21st century.

Le Van Duyet \'lā-'vän-dzhu̇-'yet\ (b. 1763, Quang Ngai province, Viet.—d. July 30, 1832, Saigon) Vietnamese military strategist and government official. From his youth he was attached to the Vietnamese court. He acted as adviser to successive emperors and helped Prince Nguyen Anh (the future emperor Gia Long, founder of the NGUYEN DYNASTY) conquer all of Vietnam, making use of Western armaments and military techniques. When Gia Long's successor ordered the persecution of Roman Catholic missionaries, Duyet refused; he was indicted posthumously for his defiance but later was honoured.

leaching Loss of soluble substances and colloids from the top layer of soil by percolating precipitation. The materials are carried downward and

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are generally redeposited in a lower layer. This transport results in a porous and open top layer and a dense, compact lower layer. In areas of extensive leaching, the remaining quartz and hydroxides of iron, manganese, and aluminum form LATERITE. In such areas rapid bacterial action results in the absence of HUMUS in the soil, because fallen plant material is oxidized and the products are leached away.

Leacock, Stephen (Butler) (b. Dec. 30, 1869, Swanmore, Hampshire, Eng.—d. March 28, 1944, Toronto, Ont., Can.) British-born Canadian writer and lecturer. He immigrated to Canada with his parents at age six. Though he taught economics and political science at McGill University (1903–36) and wrote extensively on history and political economy, his true calling was humour. His fame rests on his many books of lighthearted sketches and essays, beginning with *Literary Lapses* (1910) and *Nonsense Novels* (1911). His humour is typically based on a comic perception of social foibles and the incongruity between appearance and reality in human conduct.

Leacock, photograph by Yousuf Karsh
© KARSH FROM RAPHO/PHOTO RESEARCHERS—EB INC.

lead Metallic chemical ELEMENT, chemical symbol Pb, atomic number 82. Lead is a soft, silvery white or grayish, malleable, ductile, dense METAL that conducts electricity poorly. Its stable ISOTOPES are all end products of radioactive decay of URANIUM and other heavy elements. Known since ancient times, lead is so durable and resistant to corrosion that Roman lead pipes are still usable. Lead is used in roofing, as cable coverings, and in pipes, conduits, and structures. Other uses are in storage BATTERIES, ammunition, and low-melting-point ALLOYS (e.g., solder, pewter) and as shielding against sound, vibrations, and radiation. Lead is rarely found free in nature; its major ore is the sulfide GALENA (PbS). Because it and its compounds are poisons (see LEAD POISONING), lead-based paints and gasoline additives have been phased out in many countries. Lead in compounds has VALENCE 2 and 4; an OXIDE (litharge, PbO) is the most widely used. Lead compounds are added to lead crystal (see GLASS), glazes, and ceramics and are used as pigments, drying agents for paints and varnishes, insecticides and herbicides, and fireproofing agents and in matches, explosives, and pyrotechnics. Almost half of all lead is recovered from recycled scrap. The "lead" in pencils is GRAPHITE.

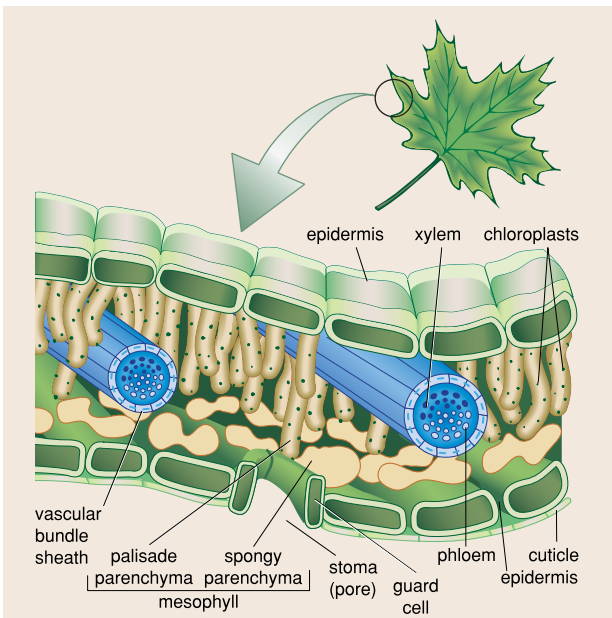
lead-210 dating Method of DATING that makes use of the ratio of the amount of the radioactive isotope lead-210 to that of the stable isotope lead-206. The method has been applied to the ores of URANIUM. Lead-210 dating is particularly useful for determining the ages of relatively recent marine sediments and so has been applied to studies concerned with the impact of human activity on the aquatic environment.

lead glance See GALENA

lead poisoning *or* **plumbism** Poisoning by accumulation of LEAD in the body. Large doses cause gastroenteritis in adults and brain disorders in children. Anemia, constipation and abdominal spasm, confusion, a progressive paralysis, and sometimes brain cancer result from chronic exposure. Children are particularly susceptible to nerve and brain damage; sensitive tests show that even low levels of lead can harm children and are linked to behavioral problems. Sources in the home include lead-based paint, lead drinking-water pipes, and lead-glazed tableware. Babies, who put things in their mouths, are at highest risk. Working where lead is used and exposure to some insecticides are other risk factors. The U.S. phase-out of lead in gasoline was completed in 1996; similar bans are being implemented worldwide. Treatment involves giving ANTIDOTES that bind (see CHELATE) the lead in the tissues.

Leadbelly *orig.* **Huddie William Ledbetter** (b. c. Jan. 21, 1885?, Mooringsport, La., U.S.—d. Dec. 6, 1949, New York, N.Y.) U.S. folk blues singer and songwriter. As a child he learned to play many instruments; he later worked as an itinerant musician with Blind Lemon Jefferson. In 1918 he was imprisoned for murder; he was pardoned in 1925 by the governor of Texas, who had visited the prison and heard him sing. Resuming a life of drifting, he was imprisoned for attempted murder in 1930; he was discovered in 1933 by folklorist JOHN LOMAX, who secured his release. Under Lomax's guidance he embarked on a concert tour, published 48 songs with commentary about Depression-era conditions of African Americans (1936), and recorded extensively. He worked with WOODY GUTHRIE in the group the Headline Singers. Leadbelly died penniless, but several of his songs, including "Goodnight, Irene," "The Midnight Special," and "Rock Island Line," soon became standards.

leaf Any flattened, green outgrowth from the stem of a VASCULAR PLANT. Leaves manufacture oxygen and GLUCOSE, which nourishes and sustains both plants and animals. Leaves and stem tissue grow from the same apical BUD. A typical leaf has a broad, expanded blade (lamina), attached to the stem by a stalklike petiole. The leaf may be simple (a single blade), compound (separate leaflets), or reduced to a spine or scale. The edge (margin) may be smooth or jagged. Veins transport materials to and from the leaf tissues, radiating from the petiole through the blade. They are arranged in a netlike pattern in dicot leaves and are parallel in monocot leaves (see COTYLEDON). The leaf's outer layer (epidermis) protects the interior (mesophyll), whose soft-walled, unspecialized green cells (parenchyma) produce carbohydrate food by PHOTOSYNTHESIS. In autumn the green CHLOROPHYLL pigments of deciduous leaves break down, revealing other pigment colors (yellow to red), and the leaves drop off the tree. Leaf scars that form during wound healing after the leaves drop are useful for identifying winter twigs. In CONIFERS, evergreen needles, which are a type of leaf, persist for two or three years.



Structures of a leaf. The epidermis is often covered with a waxy protective cuticle that helps prevent water loss from inside the leaf. Oxygen, carbon dioxide, and water enter and exit the leaf through pores (stomata) scattered mostly along the lower epidermis. The stomata are opened and closed by the contraction and expansion of surrounding guard cells. The vascular, or conducting, tissues are known as xylem and phloem; water and minerals travel up to the leaves from the roots through the xylem, and sugars made by photosynthesis are transported to other parts of the plant through the phloem. Photosynthesis occurs within the chloroplast-containing mesophyll layer.
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leaf-footed bug See SQUASH BUG

leaf insect *or* **walking leaf** Any of about 25 species of flat green insects (family Phylliidae) with a leaflike appearance. Leaf insects, which range from India to the Fiji Islands, are about 2.3 in. (60 mm) long. The female has large leathery forewings (tegmina) that lie edge to edge on the abdomen and resemble, in their vein pattern, the midrib and veins in a leaf. The hind wings have no function. The male has small tegmina and ample, non-leaflike, functional hind wings. The newly hatched young are reddish, but become green after feeding on leaves.

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leaf miner Any of various insect larvae that live and feed within a leaf, including CATERPILLARS, SAWFLY larvae, BEETLE and WEEVIL grubs, and DIPTERAN maggots. Most leaf-miner burrows or tunnels are either thin, winding, whitish trails or broad, whitish or brownish blotches. Though leaf miners do not usually cause injury, they mar the appearance of ornamental trees and shrubs. One method of control is to remove and burn infested leaves; spraying with nicotine solutions or dusting with insecticides is effective only when the adults are emerging.

leafhopper Any of the small, slender, often beautifully coloured and marked sap-sucking insects of the large family Cicadellidae. There is a leafhopper species for almost every type of plant. Most are less than 0.5 in. (12 mm) long. Leafhoppers can be serious economic pests. Their feeding may remove sap, destroy chlorophyll, transmit disease, or curl leaves; they also puncture the host plant while laying eggs. Hopperburn is a diseased condition caused by their injection of a toxin into the plant as they feed.

Red-banded leafhopper (*Graphocephala*)
STEPHEN COLLINS/PHOTO RESEARCHERS

League of Arab States See ARAB LEAGUE

League of Nations Organization for international cooperation established by the ALLIED POWERS at the end of WORLD WAR I. A league covenant, embodying the principles of collective security and providing for an assembly, a council, and a secretariat, was formulated at the PARIS PEACE CONFERENCE (1919) and contained in the Treaty of VERSAILLES. The covenant also set up a system of colonial mandates. Headquartered at Geneva, the League was weakened by the failure of the U.S., which had not ratified the Treaty of Versailles, to join the organization. Discredited by its failure to prevent Japanese expansion in Manchuria and China, Italy's conquest of Ethiopia, and Germany's seizure of Austria, the League ceased its activities during World War II. It was replaced in 1946 by the UNITED NATIONS.

Leahy \'lā-hē\, William D(aniel) (b. May 6, 1875, Hampton, Iowa, U.S.—d. July 20, 1959, Bethesda, Md.) U.S. naval officer. After graduating from the U.S. Naval Academy, he served in the Spanish-American War, the Philippine insurrection, and the Boxer Rebellion. He commanded a navy transport during World War I, when he began a friendship with FRANKLIN D. ROOSEVELT, then assistant secretary of the navy. He served as chief of naval operations (1937–39), as governor of Puerto Rico (1939), and as U.S. ambassador to France (1940). He was Roosevelt's chief of staff during World War II and continued in that post under HARRY S. TRUMAN. He was made a fleet admiral in 1944.

Leakey family Family of archaeologists and paleoanthropologists known for their discoveries of HOMININ and other fossil remains in eastern Africa. Louis S.B. Leakey (b. 1903—d. 1972), born of British missionary parents, grew up in Kenya, was educated at Cambridge University, and eventually (1931) began field research at OLDUVAI GORGE in Tanzania. He was joined there by his wife, Mary D. Leakey (b. 1913—d. 1996), who in 1959 uncovered remains of a form of *AUSTRALOPITHECUS*. The couple later uncovered the first known remains of *HOMO HABILIS*, as well as those of *Kenyapithecus*, a possible common ancestor of humans and apes that lived c. 14 million years ago. L.S.B. Leakey commissioned JANE GOODALL, Biruté Galdikas, and DIAN FOSSEY to undertake pioneering studies of chimpanzees, orangutans, and gorillas, respectively. Mary Leakey continued to make important discoveries, including the LAETOLI FOOTPRINTS, after her husband's death. Their son, Richard Leakey (b. 1944), is known for his work at the Koobi Fora site on the shores of LAKE TURKANA in Kenya, where he uncovered evidence of *H. habilis* dated as early as 2.5 million years ago. His wife, zoologist Meave Leakey (b. 1942), discovered two new hominin species.

Leal, Juan de Valdés See Juan de VALDES LEAL

Lean, Sir David (b. March 25, 1908, Croydon, Surrey, Eng.—d. April 16, 1991, London) British film director. He worked at Gaumont Studios from 1928, becoming head film editor. He codirected *In Which We Serve* (1942) with NOËL COWARD and was sole director of Coward's *Blithe Spirit* (1945) and *Brief Encounter* (1945). He directed film adaptations of *Great Expectations* (1946) and *Oliver Twist* (1948). Lean won wide acclaim for *The Bridge on the River Kwai* (1957, Academy Award) and later for *Lawrence of Arabia* (1962, Academy Award), *Dr. Zhivago* (1965), and *A Passage to India* (1984). His literate, epic productions featured spectacular cinematography and stunning locales.

Leaning Tower of Pisa White marble CAMPANILE in Pisa, Italy, famous for the uneven SETTLING of its foundation, which caused it to lean 5.5 degrees (about 15 ft [4.5 m]) from the perpendicular. Begun in 1173 as the third and final structure of the city's cathedral complex, it was designed to stand 185 ft (56 m) high. Work was suspended several times as engineers sought solutions; the tower, still leaning, was completed in the 14th century. Subsiding at the rate of 0.03 in (1.2 mm) a year, the structure was in danger of collapse, and in 1990 it was closed as engineers undertook a strengthening project that decreased the lean by 17 in (44 cm) to about 13.5 ft (4.1 m). The work was completed in May 2001.

Lear, Edward (b. May 12, 1812, Highgate, near London, Eng.—d. Jan. 29, 1888, San Remo, Italy) English painter and comic poet. From age 15 he earned his living by drawing. Employed to illustrate the earl of Derby's private menagerie in the 1830s, he later produced *Book of Nonsense* (1846) for the earl's grandchildren. His other works include *Nonsense Songs, Stories, Botany and Alphabets* (1871), containing "The Owl and the Pussy-Cat," and *Laughable Lyrics* (1877). He is best known for popularizing the LIMERICK. He also published volumes of bird and animal drawings and seven illustrated travel books. Epileptic and depressive, he lived mainly abroad after 1837.

Edward Lear, drawing by William Holman Hunt, 1857; in the Walker Art Gallery, Liverpool
COURTESY OF THE WALKER ART GALLERY, LIVERPOOL

Lear, Norman (Milton) (b. July 27, 1922, New Haven, Conn., U.S.) U.S. producer, writer, and director. He first worked in public relations and later in television as a comedy writer and director (1950–59). He wrote and produced movies such as *Come Blow Your Horn* (1963), *Divorce American Style* (1967), and *Cold Turkey* (1971) before returning to television to create and produce hit series such as *All in the Family* (1971–83), for which he received four Emmy Awards; *Maude* (1972–78); *Sanford and Son* (1972–77); and *The Jeffersons* (1975–85). He founded the progressive activist group People for the American Way.

Lear, William Powell (b. June 26, 1902, Hannibal, Mo., U.S.—d. May 14, 1978, Reno, Nev.) U.S. electrical engineer and industrialist. Following military service during World War I, he designed a practicable car radio and sold it to the future Motorola, Inc. During and after World War II, his companies Lear Avia and Lear, Inc., built radio navigators, autopilots, and other precision devices for Allied aircraft. In 1963 Lear formed Lear Jet, Inc., which produced small private and corporate jet aircraft. In 1964 he developed the stereo eight-track player for automobiles.

learned helplessness In psychology, a mental state in which a laboratory subject forced to bear aversive stimuli becomes unable or unwilling to avoid subsequent applications, even if they are "escapable," presumably through having learned that situational control is generally out of one's hands. Experiments, first on dogs and later on humans, led some researchers, including Martin E.P. Seligman (b. 1942) in *Helplessness* (1975), to believe that chronic failure, depression, and similar conditions are forms of learned helplessness. Critics have argued that different conclusions can be drawn from such tests and that broad generalizations are unwarranted.

learning Process of acquiring modifications in existing knowledge, skills, habits, or tendencies through experience, practice, or exercise. Learning includes associative processes (see ASSOCIATION; CONDITIONING), discrimination of SENSE-DATA, psychomotor and perceptual learning (see PERCEPTION), imitation, CONCEPT FORMATION, PROBLEM SOLVING, and insight learning. Animal learning has been studied by ethologists and comparative psychologists, the latter often drawing explicit parallels to human learning (see COMPARATIVE PSYCHOLOGY; ETHOLOGY). The first experiments concerning associative learning were conducted by IVAN PAVLOV in Russia and EDWARD L. THORNDIKE in the U.S. Critics of the early stimulus-response (S-R) theories,

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such as Edward C. Tolman, claimed they were overly reductive and ignored a subject's inner activities. Gestalt-psychology researchers drew attention to the importance of pattern and form in perception and learning, while structural linguists argued that language learning was grounded in a genetically inherited "grammar." Developmental psychologists such as Jean Piaget highlighted stages of growth in learning. More recently, cognitive scientists have explored learning as a form of information processing, while some brain researchers, such as Gerald Maurice Edelman, have proposed that thinking and learning involve an ongoing process of cerebral pathway building. Related topics of research include attention, comprehension, motivation, and transfer of training. See also behaviour genetics; behaviourism; educational psychology; imprinting; instinct; intelligence.

learning disabilities Chronic difficulties in learning to read, write, spell, or calculate, which are believed to have a neurological origin. Though their causes and nature are still not fully understood, it is widely agreed that the presence of a learning disability does not indicate subnormal intelligence. Rather it is thought that the learning-disabled have a neurologically based difficulty in processing language or figures, which must be compensated for with special learning strategies or with extra effort and tutoring. Examples of learning disabilities include difficulty in reading (dyslexia), writing (dysgraphia), and mathematics (dyscalculia). Learning disabilities may be diagnosed through testing, and children may be enrolled in programs offering special help; left unrecognized, learning disabilities may result not only in poor classroom performance but also in low self-esteem and disruptive behaviour.

least squares method Statistical method for finding a line or curve—the line of best fit—that best represents a correspondence between two measured quantities (e.g., height and weight of a group of college students). When the measurements are plotted as points on a graph and seem to fall near the same line, the least squares method may be used to determine the best-fitting line. The method uses calculus techniques to find the minimum of the sum of the squares of the vertical distances of each data point from the proposed line. More generally, the process is called regression or, when the fitted curve is a line, linear regression.

leather Animal skins and hides treated to preserve them and make them suitable for use. Tanning converts the otherwise perishable skin to a stable and nondecaying material. Though the skins of such diverse animals as ostrich, lizard, eel, and kangaroo have been used, the more common leathers come from cattle, including calf and ox; sheep and lamb; goat and kid; horse, mule, and zebra; buffalo; pig and hog; and seal, walrus, whale, and alligator. Leather making is an ancient art that has been practiced for more than 7,000 years. See also parchment.

Leavis \'lē-vəs**, F(rank) R(aymond)** (b. July 14, 1895, Cambridge, Cambridgeshire, Eng.—d. April 14, 1978, Cambridge) British literary critic. He attended and later taught at Cambridge University. He brought a new seriousness to criticism, believing that the critic's duty is to assess works according to the author's moral position. He cofounded *Scrutiny*, a journal (published 1932–53) often regarded as his greatest contribution to English letters. His books include *New Bearings in English Poetry* (1932) and *The Great Tradition* (1948), in which he reassessed the English novel.

Lebanese Civil War (1975–91) Civil conflict resulting from tensions among Lebanon's Christian and Muslim populations and exacerbated by the presence in Lebanon in the 1970s of fighters from the Palestine Liberation Organization (PLO). In 1975 Lebanon's Muslims and leftists supported the PLO and sought more political power; its Christians, seeking to maintain their political dominance, opposed the PLO. The factions fought fiercely through early 1976, and Lebanon became effectively partitioned, with the Christians in power in the north and the Muslims in the south. Fearing an expanded war, both Israel and Syria intervened on the side of the Christians, who had begun to lose ground. Fighting continued at a lower level of intensity until 1982, when Israel invaded southern Lebanon to destroy Palestinian guerrilla bases; PLO forces were driven out of Beirut, and by 1985 Israel had withdrawn from most of Lebanon, which by then was split internally over whether to accept Syria's leadership. In 1989 the Christian leader General Michel Aoun attempted to drive Syria from Lebanon but was defeated, and the Arab League mediated a peace deal; his removal from power in 1990 eliminated the largest obstacle to implementing a 1989 peace accord. In southern Lebanon, fighting between Israeli and Hezbollah forces continued even after Israel's final withdrawal from Lebanese territory in 2000.

Lebanese National Pact Power-sharing arrangement established in 1943 between Lebanese Christians and Muslims whereby the president is always a Christian and the prime minister a Sunnite Muslim. The speaker of the National Assembly must be a Shīʿite Muslim. Amendments made following the Lebanese Civil War transferred many presidential powers to a cabinet divided evenly between Christians and Muslims.

Lebanon *officially* **Lebanese Republic** Country, Middle East, southwestern Asia, on the eastern shore of the Mediterranean Sea. Area: 4,016 sq mi (10,400 sq km). Population (2005 est.): 3,577,000. Capital: Beirut.

The Lebanese are ethnically a mixture of Phoenician, Greek, Armenian, and Arab elements. Languages: Arabic (official), French, English. Religions: Islam, Christianity, Druze. Currency: Lebanese pound. Uplands include the Lebanon Mountains in the central region and the Anti-Lebanon and Hermon ranges along the eastern border; a low coastal plain stretches along the Mediterranean. The Litani River flows southward through the fertile Al-Biqāʿ (Beqaa) valley region. Originally, much of the country was forested—the cedars of Lebanon were famous in antiquity—but woodlands now cover only a tiny fraction of the country. Lebanon is not agriculturally self-sufficient and must rely on food imports. Its traditional role as the financial centre of the Middle East has been undermined since the outbreak of the Lebanese civil war (1975–76). It is a republic with one legislative house; its chief of state is the president, and the head of government is the prime minister. Much of present-day Lebanon corresponds to ancient Phoenicia, which was settled c. 3000 BC. In the 6th century AD, Christians fleeing Syrian persecution settled in northern Lebanon and founded the Maronite Church. Arab tribal peoples settled in southern Lebanon, and by the 11th century religious refugees from Egypt had founded the Druze faith. Part of the medieval Crusader states, Lebanon was later ruled by the Mamlūk dynasty. In 1516 the Ottoman Empire seized control; the Ottomans, who first ruled by proxy, ended the local rule of the Druze Shihāb princes in 1842. Deteriorating relations between religious groups resulted in the massacre of Maronites by Druze in 1860. France intervened, forcing the Ottomans to form an autonomous province for an area known as Mount Lebanon under a Christian governor. Following World War I (1914–18), the whole of Lebanon was administered by the French military as part of a French mandate; the country was fully independent by 1946. After the Arab-Israeli war of 1948–49, tens of thousands of Palestinian refugees settled in southern Lebanon. In 1970 the Palestine Liberation Organization (PLO) moved its headquarters to Lebanon and began raids into northern Israel. The Christian-dominated Lebanese government tried to curb them, and in response the PLO sided with Lebanon's Muslims in their conflict with Christians, fueling the descent

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into a civil war that split the country into numerous political and religious factions. In 1976–82 Syrian and UN troops tried to maintain a cease-fire. In 1982 Israeli forces invaded in an effort to drive Palestinian forces out of southern Lebanon; Israeli troops withdrew from all but a narrow buffer zone in the south by 1985. Thereafter, guerrillas from the Lebanese Shī'ite militia HEZBOLLAH clashed with Israeli troops regularly. Israeli troops completely withdrew from Lebanon in 2000.

Lebanon Mountains *Arabic* **Jabal Lubnān** \'ja-bəl-ˌlüb-'nän\ *ancient* **Libanus** Mountain range, Lebanon. Running parallel to the Mediterranean Sea coast, it is about 100 mi (160 km) long. The northern section is the highest part of the range and includes the loftiest peak, Qurnat al-Sawdā', at 10,131 ft (8,088 m) in elevation. On its western slopes are the remaining groves of the famous cedars of Lebanon. The snowy peaks may have given Lebanon its name in antiquity; *laban* is Aramaic for "white."

Lebowa \le-'bō-wə\ Former nonindependent black state, northeastern South Africa. It was designated by the South African government as the national territory for northern Sotho people, including the Pedi, Lovedu, and Kanga-Kone. It was granted self-government in 1972 and held its first election in 1973. After the abolition of APARTHEID in 1994, it became part of the new Northern (now Limpopo) province.

Lebrun \lə-'brœⁿ**, Albert** (b. Aug. 29, 1871, Mercy-le-Haut, France—d. March 6, 1950, Paris) French statesman and last president (1932–40) of France's THIRD REPUBLIC. Trained as a mining engineer, he served in the Chamber of Deputies (1900–20) and Senate (1920–32). He was elected president as a compromise candidate and served as a mediator and symbol of unity, rarely influencing policy. In 1940 he complied with the cabinet's decision to seek an armistice with Germany and acquiesced to his replacement by the VICHY FRANCE government. He was interned by the Germans (1943–44). In 1944 he acknowledged CHARLES DE GAULLE as head of the provisional government.

Lebrun, Elisabeth Vigée- See Elisabeth VIGEE-LEBRUN

Lechfeld \'leⱪ-ˌfelt**, Battle of** (955) Battle in which the German king OTTO I decisively defeated an invasion by the MAGYARS. Fought on the Lechfeld, a plain near present-day Augsburg, Germany, it marked the last Hungarian effort to invade Germany.

lecithin \'le-sə-thən\ Any of a class of PHOSPHOLIPIDS (also called phosphatidyl cholines) important in cell structure and METABOLISM. They are composed of PHOSPHATE, CHOLINE, GLYCEROL (as the ESTER), and two FATTY ACIDS. Various fatty acids pairs distinguish the various lecithins. Commercial lecithin, a wetting and emulsifying agent used in animal feeds, baking products and mixes, chocolate, cosmetics and soap, insecticides, paint, and plastics, is a mixture of lecithins and other phospholipids in an edible oil.

Leclerc \lə-'kler**, Jacques-Philippe** *orig.* **Philippe-Marie, viscount de Hauteclocque** (b. Nov. 22, 1902, Belloy-Saint-Leonard, France—d. Nov. 28, 1947, Colomb-Bechar, Alg.) French general in World War II. He was captured by the Germans in 1939, but escaped to England, where he took the pseudonym Leclerc to protect his family and joined the FREE FRENCH forces of CHARLES DE GAULLE. He achieved a number of military victories in French Equatorial Africa and North Africa, and in 1944 he commanded a French division in the Normandy Invasion. On August 25 he received the surrender of the German commander in Paris. He died in an airplane accident and was posthumously named marshal of France.

lectisternium \ˌlek-tə-'stər-nē-əm\ (from Latin *lectum sternere,* "to spread a couch") Ancient Greek and Roman rite in which a meal was offered to gods and goddesses whose images were laid on a couch placed in the street. When it originated in Greece, couches were prepared for three pairs of gods: APOLLO and Latona, HERACLES and DIANA, and MERCURY and NEPTUNE. During the feast, which lasted seven or eight days, citizens kept open house, debtors and prisoners were released, and every effort was made to banish sorrow. Other gods were later honoured with the same rite. In Christian times, the word was used for a feast in memory of the dead.

LED See LIGHT-EMITTING DIODE

Leda \'lē-də\ In Greek legend, the daughter of King Thestius of Aetolia and wife of King Tyndareus of Lacedaemon. Visited by ZEUS in the form of a swan, she conceived HELEN of Troy. Zeus was also sometimes said to be the father of her son Pollux, while Leda's own husband, Tyndareus, was held to be the father of his twin, Castor (see DIOSCURI). Tyndareus was also the father of Leda's daughter Clytemnestra, who married AGAMEMNON.

Lederberg \'lā-dər-ˌberg**, Joshua** (b. May 23, 1925, Montclair, N.J., U.S.) U.S. geneticist. He earned his Ph.D. at Yale University. With his student NORTON ZINDER, Lederberg discovered that certain viruses were capable of carrying a bacterial gene from one bacterium to another, a discovery that made bacteria as important a tool of genetic research as *Drosophila* and the bread mold *Neurospora*. He also developed breeding techniques for bacterial genetics. In 1958 he shared the Nobel Prize with GEORGE WELLS BEADLE and EDWARD L. TATUM for discovery of the mechanisms of genetic recombination in bacteria.

Ledo Road See STILWELL ROAD

Ledoux \lə-'dü**, Claude-Nicolas** (b. March 21, 1736, Dormans-sur-Marne, France—d. Nov. 19, 1806, Paris) French architect. In the 1760s and early 1770s he designed private houses in an innovative NEOCLASSICAL style, among them Madame du Barry's famous château at Louveciennes (1771–73). In the mid 1770s he planned a new saltworks and surrounding town at the Salines de Chaux, Arc-et-Senans; the design, in which rings of workers' dwellings enclosed a central factory, was designed both to facilitate production and ensure healthy conditions for the workers. His theatre at Besançon (1771–73) was revolutionary in its provision of seats for the general public as well as the upper classes. The elaborate *barrières* (tollhouses) he designed for Paris (1785–89) were ruinously expensive, and Ledoux was removed from the project. Arrested during the French Revolution, he did not practice architecture after his release.

Ledru-Rollin \lə-'drᾱ-rō-'laⁿ**, Alexandre-Auguste** (b. Feb. 2, 1807, Paris, France—d. Dec. 31, 1874, Fontenay-aux-Roses) French radical politician. He was elected to the Chamber of Deputies in 1839, but his insistence on the need for a republican government isolated him from other leftists. Following the FEBRUARY REVOLUTION, through his influence as minister of the interior in the provisional government (1848), elections for a new legislature were held for the first time under universal manhood suffrage. In 1849 he demanded the impeachment of Louis-Napoléon (later NAPOLEON III) and led an unsuccessful insurrection. He fled to England but returned to France after the amnesty of 1870.

Lee, Ann (b. Feb. 29, 1736, Manchester, Eng.—d. Sept. 8, 1784, Watervliet, N.Y., U.S.) British-American religious leader. A factory worker in her youth in Manchester, she joined the SHAKERS in 1758 and was acknowledged as their leader in 1770. Persecuted by the English authorities and compelled by what she believed was a vision, she immigrated to America in 1774. With a band of followers, she founded a settlement at Niskeyuna (present-day Watervliet), N.Y., in 1776, and thereafter her movement spread rapidly. Mother Ann, as she came to be known, was said to have performed miracles, including healing the sick by touch. She was imprisoned briefly for treason because of her pacifist doctrines and refusal to sign an oath of allegiance.

Lee, Bruce *orig.* **Lee Yuen Kam** (b. Nov. 27, 1940, San Francisco, Calif., U.S.—d. July 20, 1973, Hong Kong) U.S. film actor. The son of a touring Chinese opera star, he spent his childhood in Hong Kong, where he acted in several movies. He returned to the U.S., and in 1966 he landed a role in the television series *The Green Hornet*. In the early 1970s he became a popular star of martial-arts action films, including *Fist of Fury* (1972) and *Enter the Dragon* (1973), which gained an international cult following. His career was cut short by his sudden death at 33 from a brain edema suffered after taking a pain killer. Nevertheless, his films remained popular and became widely imitated. His son Brandon Lee (1965–93) was emerging as an action-movie star when he died in a shooting accident on a movie set.

Gypsy Rose Lee, 1944

COURTESY OF UNITED ARTISTS CORPORATION; PHOTOGRAPH, FROM THE MUSEUM OF MODERN ART FILM STILLS ARCHIVE, NEW YORK

Lee, Gypsy Rose *orig.* **Rose Louise Hovick** (b. Jan. 9, 1914, Seattle, Wash., U.S.—d. April 26, 1970, Los Angeles, Calif.) U.S. striptease artist. She appeared in a vaudeville act with her sister from 1919

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and made her debut in a BURLESQUE SHOW in 1929. She became the headliner at Billy Minsky's Republic Theatre on Broadway (1931) and appeared in the *Ziegfeld Follies* (1936). She was noted for her grace, style, and sophisticated wit. After retiring from burlesque (1937), she appeared in nightclubs and on television. Her autobiography, *Gypsy* (1957), was the basis for a successful 1959 musical (film, 1962).

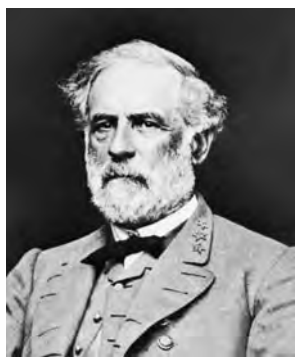
Lee, Harper (b. April 28, 1926, Monroeville, Ala., U.S.) U.S. novelist. The daughter of a lawyer, Lee attended the University of Alabama but left for New York City before obtaining a law degree. An editor helped her transform a series of short stories into the novel *To Kill a Mockingbird* (1960). Lee's only novel, it was nationally acclaimed, winning a Pulitzer Prize in 1961, and was adapted into a memorable film in 1962. The novel's hero is the white lawyer Atticus Finch, whose just and compassionate acts include an unpopular defense of a black man falsely accused of raping a white girl. The book continued to resonate into the 21st century.

Lee, Henry (b. Jan. 29, 1756, Prince William county, Va.—d. March 25, 1818, Cumberland Island, Ga., U.S.) American army officer and politician. In the AMERICAN REVOLUTION he rose to cavalry commander (earning the nickname "Light-Horse Harry") and led victories at Paulus Hook, N.J., and in the South. As governor of Virginia (1791–94), he commanded the army that suppressed the WHISKEY REBELLION (1794). In the U.S. House of Representatives (1799–1801), he wrote the resolution eulogizing GEORGE WASHINGTON as "first in war, first in peace, and first in the hearts of his countrymen." After 1800 Lee failed in several land and financial speculations and was twice imprisoned for debt. He was the father of ROBERT E. LEE.

Lee, Ivy Ledbetter (b. July 16, 1877, Cedartown, Ga., U.S.—d. Nov. 9, 1934, New York, N.Y.) U.S. PUBLIC RELATIONS pioneer. He worked as a newspaper reporter before becoming press representative for a group of coal miners in 1906 and for the PENNSYLVANIA RAILROAD CO. in 1912. His success in improving their public images brought him many powerful clients, including the Rockefeller interests. His greatest innovation was his frankness with the press, which he took care to notify of newsworthy developments at the companies he represented.

Lee, Peggy *orig.* **Norma Deloris Egstrom** (b. May 26, 1920, Jamestown, N.D., U.S.—d. Jan. 21, 2002, Los Angeles, Calif.) U.S. popular singer. She endured a difficult childhood after her mother's early death. Singing with a group in Chicago, she was engaged by BENNY GOODMAN as his principal singer in 1941. She began singing on her own in 1943 and also began collaborating on songs, often with her husband, Dave Barbour, including "Fever," "Mañana," and several songs for WALT DISNEY's *Lady and the Tramp* (1955). With her smooth, lightly husky voice, usually backed by jazz-influenced arrangements, she produced other hits such as "Lover" and "Is That All There Is?"

Lee, Richard Henry (b. Jan. 20, 1732, Stratford, Va.—d. June 19, 1794, Chantilly, Va., U.S.) U.S. statesman. As a member of the Virginia House of Burgesses (1758–75), he opposed the Stamp Act and the Townshend Acts. He helped initiate the COMMITTEES OF CORRESPONDENCE and was active in the First and Second CONTINENTAL CONGRESS. On June 7, 1776, he introduced a resolution calling for independence from Britain. Its adoption led to the DECLARATION OF INDEPENDENCE, which he signed, as he did the ARTICLES OF CONFEDERATION. He again served in Congress from 1784 to 1787, acting as its president in 1784. He opposed ratification of the CONSTITUTION OF THE UNITED STATES because it lacked a bill of rights. He later served in the first U.S. Senate (1789–92).



Robert E. Lee, 1865.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Lee, Robert E(dward) (b. Jan. 19, 1807, Stratford, Westmoreland county, Va., U.S.—d. Oct. 12, 1870, Lexington, Va.) U.S. and Confederate military leader. He was the son of HENRY LEE. After graduating from West Point, he served in the engineering corps and in the Mexican War under WINFIELD SCOTT. He transferred to the cavalry in 1855 and commanded frontier forces in Texas (1856–57). In 1859 he led U.S. troops against the slave insurrection attempted by JOHN BROWN at Harpers Ferry. In 1861 he was offered command of a new army being formed to force the seceded Southern states back into the Union. Though opposed to secession, he refused. After his home state of Virginia seceded, he became commander of Virginia's forces in the AMERICAN CIVIL WAR and adviser to JEFFERSON DAVIS, president of the Confederacy. Taking command of the Army of Northern Virginia (1862) after JOSEPH JOHNSTON was wounded, Lee repulsed the Union forces in the SEVEN DAYS' BATTLES. He won victories at BULL RUN, FREDERICKSBURG, and CHANCELLORSVILLE. His attempts to draw Union forces out of Virginia by invading the North resulted in failures at ANTIETAM and GETTYSBURG. In 1864–65 he conducted defensive campaigns against Union forces under ULYSSES S. GRANT that caused heavy Union casualties. Lee ended his retreat behind fortifications built at Petersburg and Richmond (see PETERSBURG CAMPAIGN). By April 1865 dwindling forces and supplies forced Lee, now general of all Confederate armies, to surrender at APPOMATTOX COURT HOUSE. After several months of recuperation, he accepted the post of president of Washington College (later WASHINGTON AND LEE UNIVERSITY), where he served until his death.

Lee, Spike *orig.* **Shelton Jackson Lee** (b. March 20, 1957, Atlanta, Ga., U.S.) U.S. film director. He grew up in Brooklyn, N.Y., and earned a master's degree in film at New York University. The comedy *She's Gotta Have It* (1986) brought him attention, but it was *Do the Right Thing* (1989), a portrait of racial tensions in Brooklyn, that brought him widespread acclaim. Many of his films focused on aspects of African American life, including *School Daze* (1988), *Jungle Fever* (1991), *Crooklyn* (1994), and *He Got Game* (1998). The epic *Malcolm X* (1992) and the documentary *Four Little Girls* (1997) showed Lee's versatility as a director.

Lee, William (b. 1550?, Calverton, Nottinghamshire, Eng.—d. 1610?, Paris, France) British inventor of the first KNITTING MACHINE. Lee's model (1589) was the only one employed for centuries, and its principle of operation remains in use. Elizabeth I twice denied him a patent because of her concern for the kingdom's hand knitters. With support from Henry IV of France, Lee later manufactured hosiery in Rouen.

Lee Kuan Yew (b. Sept. 16, 1923, Singapore) Prime minister of Singapore (1959–90). Born to a wealthy Chinese family, Lee studied at the University of Cambridge and became a lawyer and a socialist. He worked as a legal adviser to labour unions and won election to Singapore's legislative council in 1955, while the country was still a British crown colony. He helped Singapore achieve self-government and, running as an anticolonialist and anticommunist, was elected prime minister in 1959. His numerous reforms included the emancipation of women. He briefly entered Singapore in the Federation of Malaysia (1963–65); on its withdrawal, Singapore became a sovereign state. Lee industrialized the country and made Singapore the most prosperous nation in Southeast Asia. He achieved both labour peace and a rising standard of living for workers, though his mildly authoritarian government at times infringed on civil liberties.

Lee Kuan Yew
KEYSTONE

Lee Teng-hui \'lē-'dəŋ-'hwē\ (b. Jan. 15, 1923, near Tan-shui, Taiwan) First Taiwan-born president (1988–2000) of TAIWAN (Republic of China). He became president in 1988 after the death of CHIANG CHING-KUO. He was reelected in 1990 and won a landslide victory in 1996 in Taiwan's first direct presidential election. Lee favoured a policy of "flexible diplomacy" in dealing with the People's Republic of China. His successor, Chen Shui-bian (Ch'en Shui-pian) was the first president not from the NATIONALIST PARTY.

leech Any ANNELID worm of the class Hirudinea (about 300 known species), with a small sucker containing the mouth at the front end and a large sucker at the back end. Species range

European medicinal leech (*Hirudo medicinalis*).
JACQUES SIX

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from tiny to about 8 in. (20 cm) long. Leeches live primarily in freshwater or on land. Some species are predators, some eat organic debris, and others are parasitic. Aquatic leeches may feed on the blood of fishes, amphibians, birds, and mammals, or they may eat snails, insect larvae, and worms. True land leeches feed only on the blood of mammals. Substances in the leech's saliva anesthetize the wound area, dilate the blood vessels, and prevent the blood from clotting. For centuries, some species have been used to drain off blood. Hirudin, extracted from the European medicinal leech, is used medically as an anticoagulant.

Leech, John (b. Aug. 29, 1817, London, Eng.—d. Oct. 29, 1864, London) British caricaturist. He gave up the study of medicine to produce comic sketches and etchings for magazines, notably *Punch*. He collaborated with George Cruikshank but later departed from the horrific and satirical elements of traditional English caricature to develop his own style of comfortable, warmly humorous middle-class urbanity, underlining character by emphatic contrasts of stock types. With John Tenniel he created the image of John Bull, a jovial, foursquare Englishman, sometimes in a Union Jack waistcoat, with a bulldog at heel.

Leeds City and metropolitan borough (pop., 2001: 715,404), metropolitan county of West Yorkshire, historic county of Yorkshire, England. It lies along the River Aire, northeast of Manchester. It originated as an Anglo-Saxon township and was incorporated as a city in 1626, becoming an early centre of the woolen industry. The completion in 1816 of the Leeds and Liverpool Canal stimulated its growth, and the factory production of ready-made clothing expanded rapidly at the end of the 19th century. It is the seat of the University of Leeds.

leek Hardy, vigorous, biennial plant (*Allium porrum*) of the lily family, native to the eastern Mediterranean and the Middle East. It has a mild, sweet, onionlike flavour. In Europe it is widely used in soups and stews and is cooked whole as a vegetable. It became the national emblem of Wales following an ancient victory by an army of Welshmen who wore leeks as a distinguishing sign. The long, narrow leaves and nearly cylindrical bulb of the first season are replaced in the second season by a tall solid stalk bearing leaves and a large umbel with many flowers.

Leek (*Allium porrum*)
G.R. ROBERTS

Leeuwenhoek \'lā-vən-ˌhůk**, Antonie van** (b. Oct. 24, 1632, Delft, Neth.—d. Aug. 26, 1723, Delft) Dutch microscopist. In his youth he was apprenticed to a draper; a later civil position allowed him to devote time to his hobby: grinding lenses and using them to study tiny objects. With his simple microscopes—skillfully ground, powerful single lenses capable of high image quality—he observed protozoa in rainwater and pond and well water and bacteria in the human mouth and intestine. He also discovered blood corpuscles, capillaries, and the structure of muscles and nerves, and in 1677 he first described the spermatozoa of insects, dogs, and humans. His research on lower animals argued against the doctrine of spontaneous generation, and his observations helped lay the foundations for the sciences of bacteriology and protozoology.

Antonie van Leeuwenhoek, detail of a portrait by Jan Verkolje; in the Rijksmuseum, Amsterdam.
COURTESY OF THE RIJKSMUSEUM, AMSTERDAM

Leeward \'lü-ərd, 'lē-wərd\ **Islands** Arc of West Indian islands that constitute the most westerly and northerly of the Lesser Antilles, northeastern Caribbean Sea. The major islands are, from north to south, the Virgin Islands of the U.S. and the British Virgin Islands, Anguilla, St. Martin, Saint Kitts and Nevis, Antigua and Barbuda, Montserrat, and Guadeloupe. Just south of this chain is Dominica, sometimes classified as part of the Leeward Islands but usually designated as part of the Windward Islands.

Lefèvre d'Étaples \lə-'fevrᵊ-dā-'tȧplᵊ**, Jacques** (b. 1455, Étaples, Picardy—d. March 1536, Nérac, France) French humanist, theologian, and translator. Ordained a priest, he taught philosophy in Paris (1490–1507), after which he worked with the abbey of Saint-Germain-des-Prés. When suspected of Protestantism, he moved temporarily to Strasbourg and later to Nérac, where he was protected by the queen of Navarra. Casting off the influence of medieval Scholasticism, he promoted scriptural studies on the eve of the Reformation. He translated the Bible into French and wrote commentaries on St. Paul as well as philosophical and mystical works.

Lefkosía See Nicosia

left In politics, the portion of the political spectrum associated in general with egalitarianism and popular or state control of the major institutions of political and economic life. The term dates from the 1790s, when in the French revolutionary parliament the socialist representatives sat to the presiding officer's left. Leftists tend to be hostile to the interests of traditional elites, including the wealthy and members of the aristocracy, and to favour the interests of the working class (see proletariat). They tend to regard social welfare as the most important goal of government. Socialism is the standard leftist ideology in most countries of the world; communism is a more radical leftist ideology.

leg In a biped, the lower limb, jointed at the knee, supporting the body and used for walking and running. Its bones are the femur (thighbone), the longest bone in the human body; patella (kneecap); tibia (shin); and fibula. The biceps muscle of the thigh bends the leg; the quadriceps straightens it.

legal medicine See medical jurisprudence

legend Traditional story or group of stories told about a particular person or place. Formerly the term referred to a tale about a saint. Legends resemble folktales in content; they may include supernatural beings, elements of mythology, or explanations of natural phenomena, but they are associated with a particular locality or person. They are handed down from the past and are popularly regarded as historical though they are not entirely verifiable.

Léger \lā-'zhā**, Fernand** (b. Feb. 4, 1881, Argentan, Fr.—d. Aug. 17, 1955, Gif-sur-Yvette) French painter. Born to a peasant family, he worked as an architectural draftsman in Paris before studying art. Influenced by Paul Cézanne and early Cubism, Léger developed a painting style that combined bold colours with geometric and cylindrical forms arranged in highly disciplined compositions. His best-known works celebrated modern industrial technology by emphasizing shapes derived from machine parts. Though he was seriously injured in World War I, his art continued to affirm his faith in modern life and popular culture. In 1924 he conceived and directed *Ballet mécanique*, a nonnarrative film with photography by Man Ray.

Fernand Léger, photograph by Arnold Newman, 1941.
© ARNOLD NEWMAN

leghorn \'leg-ˌhȯrn, 'le-gərn\ Breed of chicken that originated in Italy; the only Mediterranean breed of importance today. Of the 12 varieties, the single-comb white leghorn is more popular than all the other leghorns combined; the leading egg producer of the world, it lays white eggs and is kept in large numbers in England, Canada, Australia, and the U.S.

Leghorn See Livorno

Legio Maria See Maria Legio

legion Military organization, originally the largest permanent unit in the Roman army. It was the basis of the military system by which imperial Rome conquered and ruled its empire. The early Roman Republic found

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the Greek PHALANX too unwieldy for fragmented fighting in the hills and valleys of central Italy. To replace it the Romans evolved a new tactical system based on small and flexible infantry units called maniples. These were grouped in larger units called cohorts, which ranged from 360 to 600 men, depending on the era. Ten cohorts made up a legion, which moved into battle with four cohorts in the first line and three each in the second and third lines. See also FOREIGN LEGION.

Legion of Honour *officially* **Order of the Legion of Honour** Highest-ranking order and decoration of the French republic. It was created by NAPOLEON in 1802 as a general military and civil order of merit. Membership is open to men and women, French citizens and foreigners, irrespective of rank, birth, or religion. Admission into the Legion requires 20 years of civil achievement in peacetime or extraordinary military bravery and service in times of war.

Legion of Mary Church See MARIA LEGIO

Legionnaire disease Type of PNEUMONIA, first identified in American Legion conventioneers in 1976, 29 of whom died. The cause was identified as a previously unknown bacterium, *Legionella pneumophila*, later revealed as causing earlier mysterious outbreaks at widely separated places. Usually, malaise and headache are followed by high fever and often chills, dry cough, shortness of breath, and pain, occasionally with mental confusion. Contaminated water (e.g., in water-distribution systems, humidifiers, and whirlpool spas) is usually suspected as the source. The disease is treated with antibiotics.

legislative apportionment *or* **legislative delimitation** Process by which representation is distributed among the constituencies of a representative assembly. In ancient Athens, every citizen represented himself, but throughout most of history representation has been restricted to certain social classes. With the growth of democracy, the extension of suffrage, and the rise of political parties, apportionment had to be methodically and mathematically arranged to ensure that the distribution of legislative seats would most accurately reflect the electorate's will. Territorial apportionment is currently the most common form. See also GERRYMANDERING, PROPORTIONAL REPRESENTATION.

legislature Lawmaking branch of a government. Before the advent of legislatures, the law was dictated by monarchs. Early European legislatures include the English PARLIAMENT and the Icelandic Althing (founded c. 930). Legislatures may be unicameral or bicameral (see BICAMERAL SYSTEM). Their powers may include passing laws, establishing the government's budget, confirming executive appointments, ratifying treaties, investigating the EXECUTIVE branch, impeaching and removing from office members of the executive and JUDICIARY, and redressing constituents' grievances. Members may be appointed or directly or indirectly elected; they may represent an entire population, particular groups, or territorial subdistricts. In presidential systems, the executive and legislative branches are clearly separated; in parliamentary systems, members of the executive branch are chosen from the legislative membership. See also BUNDESTAG; CONGRESS OF THE UNITED STATES; DIET; DUMA; EUROPEAN PARLIAMENT; KNESSET; Canadian PARLIAMENT.

legume \'le-ˌgyüm\ Any of about 18,000 species in about 650 genera of flowering plants that make up the order Fabales, consisting of the single family Leguminosae, or Fabaceae (the pea family). The term also refers to their characteristic fruit, also called a pod. Legumes are widespread on all habitable continents. Leaves of many members appear feathery, and flowers are almost universally showy. In economic importance, this order is surpassed only by the GRASS and SEDGE order (Cyperales). In the production of food, the legume family is the most important of any family. The pods are part of the diet of nearly all humans and supply most dietary protein in regions of high population density. In addition, legumes perform the invaluable act of NITROGEN FIXATION. Because they contain many of the essential AMINO ACIDS, legume seeds can balance the deficiencies of CEREAL protein. Legumes also provide edible oils, GUMS, fibers, and raw material for plastics, and some are ornamentals. Included in this family are ACACIA, ALFALFA, BEANS, BROOM, CAROB, CLOVER, COWPEA, LUPINE, MIMOSA, PEAS, PEANUTS, SOYBEANS, TAMARIND, and VETCH.

Lehár \'lā-ˌhär**, Franz (Christian)** *orig.* **Ferencz Christian Lehár** (b. April 30, 1870, Komárom, Hung., Austria-Hungary—d. Oct. 24, 1948, Bad Ischl, Austria) Hungarian composer. He began studying the violin at age 12 in Prague. In the 1890s he was a military bandmaster like his father; by the end of the decade he had moved to Vienna, where he became a popular composer of marches and waltzes. After 1901 he concentrated on orchestra conducting and on composing, notably his 40 witty and melodic operettas that embody the prewar Viennese spirit, including the popular *The Merry Widow* (1905), *The Countess of Luxembourg* (1909), and *The Land of Smiles* (1929).

Lehmbruck \'lām-brük**, Wilhelm** (b. Jan. 4, 1881, Meiderich, Ger.—d. March 25, 1919, Berlin) German sculptor, painter, and printmaker. His youthful work was academically realistic, but he grew to admire the works of AUGUSTE RODIN, and in 1910 he moved to Paris, where he produced paintings and lithographs as well as sculptures. He became one of the most important German EXPRESSIONIST sculptors, best known for his elongated nudes, such as *Kneeling Woman* (1911), which suggests a resigned pessimism. He returned to Germany at the outbreak of World War I and tended wounded soldiers in a hospital. *Seated Youth* (1917) reveals his profound depression; he committed suicide two years later.

Leiber \'lē-bər**, Jerry** (b. April 25, 1933, Baltimore, Md., U.S.) U.S. songwriter and producer. His family settled in Los Angeles, where he met Mike Stoller (b. 1933), who had moved there from New York. In 1950, while still in their teens, Leiber and Stoller became a songwriting and production team, among the first to produce recordings that combined pop music with RHYTHM AND BLUES. Their first successful collaboration came with "Hound Dog," recorded by Big Mama Thornton (1952) and later by ELVIS PRESLEY, who would record more than 20 of their songs. They wrote numerous songs for the Coasters, including "Yakety Yak." Other hits include "There Goes My Baby," "Stand by Me," and "Love Potion Number Nine." Their songs were recorded by the BEATLES, ARETHA FRANKLIN, JAMES BROWN, and Ben E. King, among many others.

Leibniz \'līb-nəts,\ *German* \'līp-nits**, Gottfried Wilhelm, Freiherr (baron) von Leibniz** (b. July 1, 1646, Leipzig, Saxony—d. Nov. 14, 1716, Hannover, Hanover) German philosopher, mathematician, inventor, jurist, historian, diplomat, and political adviser. He obtained a doctorate in law at age 20. In 1667 he began working for the elector of Mainz, in which position he codified the laws of the city, among other important tasks. He served the dukes of Braunschweig-Lüneburg as librarian and councillor (1676–1716). In 1700 he helped found the German Academy of Sciences in Berlin and became its first president. Though he wrote voluminously, he published little during his lifetime. In metaphysics he is known for his doctrine of the monad, according to which reality is ultimately constituted of simple substances (monads), each consisting of nothing but perception and appetite. Though each state of a monad is the cause of its succeeding state and the effect of its preceding one, there are no causal relations between monads; the appearance of causal relations between substances is accounted for by the supposition of a "pre-established harmony" between the perceptual states of different monads. His principle of the identity of indiscernibles states that an individual *x* and an individual *y* are identical if and only if they share all the same intrinsic, non-relational properties. His *Theodicy* (1710) sought to reconcile the goodness of God with the existence of evil in the world by asserting that only God is perfect and that the actual world is the "best of all possible worlds." This view was famously mocked by VOLTAIRE in his comic novel *Candide*. In mathematics, Leibniz explored the idea of a universal mathematical-logical language based on the binary number system (*De arte combinatoria* [1666]), though all the calculating devices that he later built used the decimal system. He discovered the FUNDAMENTAL THEOREM OF CALCULUS independently of ISAAC NEWTON; the acrimonious dispute over priority left England mathematically backward for more than a generation before Leibniz's superior notation and methods were adopted. He also made important contributions to optics and mechanics. He is considered the last great polymath of Western civilization.

Leibovitz, Annie *orig.* **Anna-Lou Leibovitz** (b. Oct. 2, 1949, Westbury, Conn., U.S.) U.S. photographer. She enrolled in the San Francisco Art Institute in 1967. In 1970, while still a student, she was given her first commercial assignment for *Rolling Stone* magazine. Leibovitz became the publication's chief photographer in 1973, and over the subsequent decade she created images of the major personalities of contemporary rock music. In 1983 she moved to *Vanity Fair* magazine, which broadened her pool of subjects to include film stars, athletes, and political figures, and in 1986 she began to pursue advertising photography. Many successful monographs of her photographs have been published.

Leicester \'les-tər\ City and unitary authority (pop., 2001: 279,921), geographic and historic county of LEICESTERSHIRE, central England. Located

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on the River Soar, it was settled by Romans. A considerable community by Norman times, it was the site of a Norman castle and abbey built in 1143, the ruins of which still stand. King Richard III was killed near Leicester in the Battle of Bosworth Field (1485). It was incorporated in 1589 and became an industrial centre after the arrival of the railway in 1832. The University of Leicester (founded 1957) is nearby.

Leicester, Earl of See Simon de Montfort

Leicester \'les-tər**, Robert Dudley, earl of** (b. June 24, 1532/33—d. Sept. 4, 1588, Cornbury, Oxfordshire, Eng.) English courtier and favourite of Elizabeth I. Imprisoned in 1553 for aiding the attempt by his father, the duke of Northumberland, to put Lady Jane Grey on the throne, he was released in 1554. Handsome and ambitious, he won Elizabeth's affection upon her accession (1558) and was made a privy councillor in 1559. When his wife died in 1560, it was rumoured that he had murdered her in order to marry Elizabeth. He became an active suitor of Elizabeth; though he failed to win the queen's hand, they remained close friends. In 1585 he was sent in command of an English force to assist the Netherlands in its revolt against Spain; he proved incompetent and was recalled (1587).

Leicestershire \'les-tər-ˌshir\ Administrative (pop., 2001: 609,579), historic, and geographic county, central England. It is located in the East Midlands region; the geographic county encompasses the entire administrative county together with the unitary authority of Leicester. The Soar River crosses the county from south to north on its way to join the River Trent. East of the Soar valley lies a territory famous for its fox hunts. Leicestershire has a pastoral agricultural tradition and is noted for production of Stilton cheese. Manufacturing industries are also important, at Leicester, for example.

Leiden *or* **Leyden** \'līd-ᵊn,\ *Dutch* \'lā-də\ Commune (pop., 1999: 117,389), western Netherlands. First mentioned in 922 as a possession of Utrecht diocese, it was governed by the court of Holland until 1420. It became a printing centre after the Elzevir family set up their press there c. 1581. The University of Leiden was founded in 1575, and the town became a centre of theology, science, and art. Leiden was the birthplace of painters Rembrandt van Rijn and Jan van Goyen, and the Pilgrims resided there for 11 years before they sailed to America in 1620.

Leif Eriksson *or* **Leif Eriksson the Lucky** *Norwegian* **Leiv Eriksson den Hepne** (fl. 11th century) Icelandic explorer, possibly the first European to reach North America. The second son of Erik the Red, he was on his way back from Norway to Greenland, where he had been sent by Olaf I Tryggvason to Christianize the natives (c. 1000), when he sailed off course and landed probably at Nova Scotia, which he called Vinland. This standard account comes from the Icelandic *Eiríks saga*. Another account, the *Groenlendinga saga*, says he learned of Vinland from a man who had been there 14 years earlier and that Leif reached North America after 1000.

Leigh \'lē**, Mike** *in full* **Michael Leigh** (b. Feb. 20, 1943, Salford, Lancashire, Eng.) British film director and playwright. His first play, *The Box Play* (1965), began the process of improvisation and collaboration with his actors that became the basis of his works for stage, television, and film, which usually depict lower- and working-class life with sharp humour and pathos. He made his film debut with *Bleak Moments* (1971) and later directed offbeat movies such as *High Hopes* (1988), *Life Is Sweet* (1991), and *Naked* (1993), for which he won best director at the Cannes Film Festival. The internationally acclaimed *Secrets and Lies* (1996) was followed by *Career Girls* (1997), *Topsy-Turvy* (1999), and *All or Nothing* (2002).

Leigh, Vivien *orig.* **Vivian Mary Hartley** (b. Nov. 5, 1913, Darjeeling, India—d. July 8, 1967, London, Eng.) British actress. She made her film debut in 1934 and her London stage debut in *The Mask of Virtue* (1935). After a well-publicized search she was chosen for the role of Scarlett in *Gone with the Wind* (1939, Academy Award), which brought her great fame. Noted for her delicate beauty, she later starred in *Waterloo Bridge* (1940), *That Hamilton Woman* (1941), *Anna Karenina* (1948), and *A Streetcar Named Desire* (1951), for which she won an Academy Award for her portrayal of the tragically delusional Blanche DuBois. From 1940 to 1960 she was married to Laurence Olivier, with whom she appeared in a number of successful London stage productions. She starred in a 1963 Broadway musical adaptation of *Tovarich*, a disastrous production for which Leigh nonetheless won a Tony Award.

Leighton \'lā-tᵊn**, Margaret** (b. Feb. 26, 1922, Barnt Green, near Birmingham, Worcestershire, Eng.—d. Jan. 13, 1976, Chichester, West Sussex) British actress. A member of the Old Vic company, she made her London debut in 1944 and her Broadway debut in 1946. She was acclaimed for her wide range of roles in plays such as *The Cocktail Party* (1950) and *The Applecart* (1953). She received Tony Awards for her Broadway appearances in *Separate Tables* (1956) and *The Night of the Iguana* (1962). Her most notable film roles were in *The Winslow Boy* (1948), *The Sound and the Fury* (1959), and *The Go-Between* (1971).

Leinster \'len-stər\ Province (pop., 2002 prelim.: 2,105,449), eastern Ireland. It covers an area of 7,645 sq mi (19,801 sq km). Its counties include Carlow, Dublin, Kildare, Kilkenny, Laoighis, Longford, Louth, Meath, Offaly, Westmeath, Wexford, and Wicklow. Its northern part, Meath, was once a separate kingdom. In the early Middle Ages, kings of Leinster fought constantly against the Uí Néill, the line of high kings whose capital was at Tara in Meath. In the late 15th and early 16th centuries, Leinster was virtually independent, under the earls of Kildare.

Leipzig \'līp-sik̲, 'līp-sig\ City (pop., 2002 est.: 493,052), east-central Germany. Situated in western Saxony state, it was in the 11th century a fortified town known as Urbs Libzi. It was granted municipal status by 1170, and its location on the principal trade routes of central Europe made it an important commercial centre. Several battles of the Thirty Years' War were fought near the city, which was also the site of the Battle of Leipzig (1813). Massive demonstrations in Leipzig in 1989 helped topple East Germany's communist regime. Historic features include the University of Leipzig (1409), the 13th-century church of St. Thomas, and the annual Leipzig Fair.

Leipzig, Battle of *or* **Battle of the Nations** (Oct. 16–19, 1813) Decisive defeat for Napoleon at Leipzig, resulting in the destruction of what was left of French power in Germany and Poland. Surrounded in the city, Napoleon's army was able only to thwart the allied attacks. As it began to retreat over the single bridge westward from the city, a frightened corporal blew up the bridge, leaving 30,000 French troops trapped in Leipzig to be taken prisoner. The battle was one of the most severe of the Napoleonic Wars; the French lost 38,000 men killed and wounded, and the allies lost 55,000.

Leipzig, University of State-supported university in Leipzig, Germany, founded in 1409. In the 1500s it was a centre of Reformation thought, and in the 18th and 19th centuries it became one of Europe's leading literary and cultural centres, attracting such students as Gottfried Wilhelm Leibniz, Johann Wolfgang von Goethe, Johann Gottlieb Fichte, and Richard Wagner. Between 1953 and 1990 it was named Karl Marx University of Leipzig.

leishmaniasis \ˌlēsh-mə-'nī-ə-səs\ Human protozoal infection spread by the bite of a bloodsucking sand fly. It occurs worldwide but is especially prevalent in tropical areas. It is caused by various species of the flagellate protozoan *Leishmania*, which infect rodents and canines. Visceral leishmaniasis, or kala-azar, occurs throughout the world but is especially prevalent in the Mediterranean area, Africa, Asia, and Latin America; it affects the liver, spleen, and bone marrow and is usually fatal if not treated. Cutaneous leishmaniasis is endemic in areas around the Mediterranean, in central and northern Africa, and in southern and western Asia; it is also found in Central and South America and parts of the southern U.S. It is characterized by lesions on the skin of the legs, feet, hands, and face, most of which heal spontaneously after many months.

Leisler \'līs-lər**, Jacob** (b. 1640, Frankfurt am Main—d. May 16, 1691, New York, N.Y.) German-born colonial insurrectionist. He immigrated to New Netherland (New York) in 1660 and became a wealthy merchant. Objecting to the British unification of New York and New England (1685–89), he led the revolt called Leisler's Rebellion, established himself as lieutenant governor of the province (1689–91), and called the first intercolonial congress (1690) to plan action against the French and Indians. When he reluctantly surrendered to a new British governor, he was charged with treason and hanged, along with his son-in-law.

leitmotiv \'līt-mō-ˌtēf\ In music, a melodic idea associated with a character or an important dramatic element. It is associated particularly with the operas of Richard Wagner, most of which rely on a dense web of associative leitmotifs. Most composers after Wagner (and some of his immediate predecessors) continued to use this musico-dramatic principle, but few as rigorously as he did.

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Leizhou \'lā-'jō\ **Peninsula** *or* **Lei-chou Peninsula** *conventional* **Luichow** \'lwē-'chaù\ **Peninsula** Peninsula off the southwestern coast of Guangdong province, southeastern China. Separated from Hainan Island by the Hainan Strait, it includes Kwangchowan, a territory leased by France from 1898 to 1945. Occupied by Japan in World War II, it was returned to Chinese control in 1946.

Leland \'lē-lənd**, Henry Martyn** (b. Feb. 16, 1843, Danville, Vt., U.S.—d. March 26, 1932, Detroit, Mich.) U.S. engineer and manufacturer. Trained as a machinist, he founded Leland & Faulconer Manufacturing Co. in Detroit in 1890 to build engines for automobile makers. In 1904 he merged the company into his newly founded Cadillac Motor Car Co., where he created the successful Model A Cadillac. In 1917 he founded the Lincoln Motor Co., which was purchased by Henry Ford in 1922. He was known for his rigorous standards; his innovations included the V-8 engine and adoption of the electric starter.

Lelang See Nangnang

Lemaître \lə-'me-trᵊ**, Georges** (b. July 17, 1894, Charleroi, Belg.—d. June 20, 1966, Louvain) Belgian astronomer and cosmologist. He served in the Belgian army during World War I, then entered a seminary and became a priest. In 1927 he became a professor of astrophysics at the University of London and proposed the big-bang model of the formation of the universe. Lemaître's theory, as modified by George Gamow, has become the leading theory of the universe's origin. Lemaître also studied cosmic rays and the three-body problem, which concerns the mathematical description of the motion of three mutually attracting bodies in space.

LeMay, Curtis E(merson) (b. Nov. 15, 1906, Columbus, Ohio, U.S.—d. Oct. 1, 1990, March Air Force Base, Calif.) U.S. Air Force officer. He joined the Army Air Corps in 1928. In World War II he developed advanced strategic bombardment techniques, including pattern bombing, and led bomber commands in Europe and the Pacific, where he launched firebombing raids on Japanese cities. As commander of U.S. air forces in Europe from 1945 to 1948, he directed the Berlin airlift (see Berlin blockade and airlift). From 1948 to 1957 he headed the U.S. Strategic Air Command, building it into a global strike force. He was chief of staff of the U.S. Air Force from 1961 to 1965. In 1968 he was the vice-presidential candidate on the third-party ticket headed by George Wallace.

Lemieux \lə-'myü**, Mario** (b. Oct. 5, 1965, Montreal, Que., Can.) Canadian ice-hockey player. In 1984 he made his professional debut as a member of the Pittsburgh Penguins and quickly became one of the sport's leading offensive threats, earning the nickname "Super Mario." He led his team to two Stanley Cup victories (1991–92). In 1992 Lemieux was found to have Hodgkin disease, but after surgery and radiation he returned to lead his team on a 17-game winning streak, an NHL record. He retired after the 1995–96 season with 613 goals and 881 assists. In 1999 he headed a group of investors that purchased the Penguins. He returned as a player in 2001, becoming the first owner-player in the history of modern sports. At the 2002 Winter Olympics he won a gold medal as a member of the Canadian men's hockey team.

lemming Any of several species of small rodents belonging to the family Cricetidae and found primarily in northern temperate and polar regions of North America and Eurasia. Lemmings have short legs, small ears, and long, soft fur. They are 4–7 in. (10–18 cm) long, including the stumpy tail, and are grayish or reddish brown above, paler below. They feed on roots, shoots, and grasses and live in burrows or rock crevices. They are noted for regular population fluctuations, and for their periodic migrations in spring and fall. Those of the Norway lemming (*Lemmus lemmus*) are the most dramatic, because many of the migrants drown in the sea. However, lemmings are hesitant to enter water and, contrary to legend, do not plunge into the sea in a deliberate death march.

Lemmon, Jack *orig.* **John Uhler Lemmon III** (b. Feb. 8, 1925, Boston, Mass., U.S.—d. June 27, 2001, Los Angeles, Calif.) U.S. actor. He attended Harvard University and acted in radio and television dramas before making his Broadway debut in 1953. He established his movie career in *Mister Roberts* (1955, Academy Award) and became noted for his character portrayals, often playing excitable, baffled individuals in movies such as *Some Like It Hot* (1959), *The Apartment* (1960), *The Odd Couple* (1968), and *The Out-of-Towners* (1970). His many other films include *Save the Tiger* (1973, Academy Award), *The China Syndrome* (1979), *Missing* (1982), and *Glengarry Glen Ross* (1992). He received an Emmy Award for his portrayal of a dying college professor in the television film *Tuesdays with Morrie* (1999).

lemon Small thorny tree or spreading bush (*Citrus limon*) of the rue (or citrus) family and its edible fruit. Under the yellow outer rind or peel is the white, spongy inner peel, the source of commercial pectin. The juicy pulp is acidic and rich in vitamin C and contains smaller amounts of B vitamins. The climates of coastal Italy and California are especially favourable for the cultivation of lemon trees, which in these regions produce fruit 6–10 times a year. Lemon juice enhances many dishes, and lemonade is a popular warm-weather beverage. Lemon by-products are used in beverages (citric acid), fruit jellies (pectin), and furniture polish (lemon oil).

Lemon (*Citrus limon*)
J. HORACE MCFARLAND CO.

lemon balm See balm

lemur \'lē-mər\ In general, any of the prosimian primates (including galagos), all of which have a naked, moist tip to their muzzle; comblike, forward-directed lower front teeth; and clawlike nails on the second toes of the feet. More strictly, the name refers to the typical lemurs (the nine species in the family Lemuridae), found only on Madagascar and the Comoro Islands, which have large eyes; a foxlike face; a slender, monkeylike body; and long hind limbs. All lemurs are docile and gregarious. Species range from 5 in. (13 cm) to about 2 ft (60 cm) long. The bushy tail may be longer than the body, and the woolly fur is reddish, gray, brown, or black. Most are active at night and spend most of their time in trees, eating fruits, leaves, buds, insects, and small birds and birds' eggs. A number of species are listed as endangered.

Lena \'lē-nə, 'lā-nə\ **River** River, east-central Russia, one of the longest rivers in the world. From its source in a Siberian mountain lake west of Lake Baikal, it flows 2,734 mi (4,400 km) north across Russia to enter the Arctic Ocean. Its basin covers an area of 961,000 sq mi (2,490,000 sq km), and it has many tributaries, including the Vitim and Olekma rivers. The land along its upper course and tributaries is rich in minerals, including gold and coal. Explorers first reached its delta on the Laptev Sea in the early 1630s.

lend-lease System promulgated by Pres. Franklin Roosevelt to give aid to U.S. allies in World War II. Faced with Britain's inability to pay cash for war materials and food, as required by U.S. law, Roosevelt asked Congress to allow repayment "in kind or property" from countries vital to U.S. defense. The Lend-Lease Act was passed in March 1941, despite arguments that it led the U.S. closer to war. Much of the $49 billion in aid went to British Commonwealth countries; the Soviet Union, China, and 40 other countries also received assistance. U.S. troops stationed abroad received about $8 billion in aid from the Allies.

L'Enfant \läⁿ-'fäⁿ,\ *English* \'län-ˌfänt**, Pierre-Charles** (b. Aug. 2, 1754, Paris, France—d. June 14, 1825, Prince Georges county, Md., U.S.) French-born U.S. engineer, architect, and urban planner. After studying in Paris, he volunteered as a soldier and engineer in the American Revolutionary Army. Congress made him major of engineers in 1783. In 1791 George Washington had him prepare a plan for a federal capital on the Potomac River. He designed a gridiron of blocks on which broad diagonal avenues were superimposed; focusing on the Capitol and presidential mansion, the plan incorporated green spaces and provided vistas of street intersections where monuments and fountains could be placed. Though he was dismissed in 1792 for his imperious attitude and died in poverty, his plan was later generally followed.

L'Engle \'leŋ-gəl**, Madeleine** *orig.* **Madeleine L'Engle Camp** (b. Nov. 29, 1918, New York, N.Y., U.S.) U.S. author of children's books. L'Engle pursued a career in theatre before publishing her first book, *The Small Rain* (1945). In *A Wrinkle in Time* (1962), she introduced a group of children who engage in a cosmic battle against a great evil; their adventures continue in *A Swiftly Tilting Planet* (1978) and other books. Her works often explore such themes as the conflict of good and evil, the nature of God, individual responsibility, and family life. She also has written adult fiction, poetry, and autobiography.

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length, area, and volume Dimensional measures of one-, two-, and three-dimensional geometric objects. All three are magnitudes, representing the "size" of an object. Length is the size of a LINE segment (see DISTANCE FORMULAS), area is the size of a closed region in a plane, and volume is the size of a solid. Formulas for area and volume are based on lengths. For example, the area of a CIRCLE equals π times the square of the length of its radius, and the volume of a rectangular box is the product of its three linear dimensions: length, width, and height.

length of a curve Geometrical concept addressed by INTEGRAL CALCULUS. Methods for calculating exact lengths of line segments and arcs of circles have been known since ancient times. ANALYTIC GEOMETRY allowed them to be stated as formulas involving coordinates (see COORDINATE SYSTEMS) of points and measurements of angles. CALCULUS provided a way to find the length of a curve by breaking it into smaller and smaller line segments or arcs of circles. The exact value of a curve's length is found by combining such a process with the idea of a LIMIT. The entire procedure is summarized by a formula involving the INTEGRAL of the function describing the curve.

Lenin, Vladimir (Ilich) *orig.* **Vladimir Ilich Ulyanov** (b. April 22, 1870, Simbirsk, Russia—d. Jan. 21, 1924, Gorki, near Moscow) Founder of the Russian Communist Party, leader of the RUSSIAN REVOLUTION OF 1917, and architect and builder of the Soviet state. Born to a middle-class family, he was strongly influenced by his eldest brother, Aleksandr, who was hanged in 1887 for conspiring to assassinate the tsar. He studied law and became a Marxist in 1889 while practicing law. He was arrested as a subversive in 1895 and exiled to Siberia, where he married NADEZHDA KRUPSKAYA. They lived in western Europe after 1900. At the 1903 meeting in London of the RUSSIAN SOCIAL-DEMOCRATIC WORKERS' PARTY, he emerged as the leader of the BOLSHEVIK faction. In several revolutionary newspapers that he founded and edited, he put forth his theory of the party as the vanguard of the PROLETARIAT, a centralized body organized around a core of professional revolutionaries; his ideas, later known as LENINISM, would be joined with KARL MARX's theories to form MARXISM-Leninism, which became the communist worldview. With the outbreak of the RUSSIAN REVOLUTION OF 1905, he returned to Russia, but he resumed his exile in 1907 and continued his energetic agitation for the next 10 years. He saw World War I as an opportunity to turn a war of nations into a war of classes, and he returned to Russia with the RUSSIAN REVOLUTION OF 1917 to lead the Bolshevik coup that overthrew the provisional government of ALEKSANDR KERENSKY. As revolutionary dictator of the Soviet state, he signed the Treaty of BREST-LITOVSK with Germany (1918) and repulsed counterrevolutionary threats in the RUSSIAN CIVIL WAR. He founded the COMINTERN in 1919. His policy of WAR COMMUNISM prevailed until 1921, and to forestall economic disaster he launched the NEW ECONOMIC POLICY. In ill health from 1922, he died of a stroke in 1924.

Leningrad See SAINT PETERSBURG

Leningrad, Siege of (Sept. 8, 1941–Jan. 27, 1944) Prolonged siege of the city of Leningrad (now St. Petersburg) by German forces in World War II. German forces invaded the Soviet Union in June 1941 and approached Leningrad from the west and south while Germany's Finnish allies came from the north. By November 1941 the city was almost completely encircled and its supply lines to the Soviet interior cut off. In 1942 alone, in excess of 650,000 of Leningrad's citizens died from starvation, disease, and shelling from distant German artillery. Sparse food and fuel supplies reached the city by barge in the summer and by sled in winter across Lake Ladoga. The supplies kept the city's arms factories operating and its two million inhabitants barely alive, while another one million children and sick and elderly people were evacuated. Soviet offensives in 1943 partially broke the German encirclement and were followed in January 1944 by a successful Soviet attack that drove the Germans westward from the city's outskirts, ending the siege.

Leninism Principles expounded by VLADIMIR ILICH LENIN to guide the transition of society from CAPITALISM to COMMUNISM. The tenets of MARXISM, which Lenin embraced, provided no concrete guidelines for the transition. Lenin believed that a small, disciplined, professional group of revolutionaries was needed to violently overthrow the capitalist system, and that a "dictatorship of the PROLETARIAT" must guide society until the day when the state would wither away. That day never came, and Leninism in practice meant state control of all aspects of life by the COMMUNIST PARTY and the creation of the first modern totalitarian state. See also BOLSHEVIK, STALINISM, TOTALITARIANISM.

Lenni Lenape See DELAWARE

Lennon, John (Winston) (b. Oct. 9, 1940, Liverpool, Merseyside, Eng.—d. Dec. 8, 1980, New York, N.Y., U.S.) British singer and songwriter. He wanted to be a sailor like his father but became a musician after hearing ELVIS PRESLEY's recordings. In 1957 he formed the band that became the BEATLES, and in the 1960s he achieved enormous success performing with the group and writing songs with PAUL MCCARTNEY. In the mid-1960s he began working on side projects in film and music, notably with the Japanese-U.S. avant-garde artist Yoko Ono (b. 1933), whom he married in 1969. Their political activism and social ideals were reflected in much of Lennon's early solo work, including the hit "Imagine," and attracted the attention of the U.S. government, which sought to have him deported. After 1975 he withdrew from public life; he and Ono returned with the album *Double Fantasy* shortly before his murder by a deranged fan. His sons, Julian (b. 1963) and Sean (b. 1975), also became musicians.

lens Piece of glass or other transparent substance that is used to form an image of an object by converging or diverging rays of light from the object. Because of the curvature of its surface, different rays of light are refracted (see REFRACTION) through different angles. A convex lens causes rays to converge on a single point, the focal point. A concave lens causes rays to diverge as though they are coming from a focal point. Both types cause the rays to form a visual image of the object. The image may be real—inverted and photographable or visible on a screen—or it may be virtual—erect and visible only by looking through the lens.

Lent In the Christian church, a period of penitential preparation for EASTER, observed since apostolic times. Western churches once provided for a 40-day fast (excluding Sundays), in imitation of JESUS' fasting in the wilderness; one meal a day was allowed in the evening, and meat, fish, eggs, and butter were forbidden. These rules have gradually been relaxed, and only Ash Wednesday—the first day of Lent in Western Christianity, when the penitent traditionally have their foreheads marked with ashes—and GOOD FRIDAY are now kept as Lenten fast days. Rules of fasting are stricter in the Eastern churches.

lentil Small annual LEGUME (*Lens esculenta*) and its lens-shaped, protein-rich, edible seed. One of the most ancient of cultivated foods, it is a good source of vitamin B, iron, and phosphorus. Of unknown origin, the lentil is widely cultivated throughout Europe, Asia, and North Africa; though little grown in the Western Hemisphere, its inclusion in the U.S. diet is increasing. Growing 6–18 in. (15–45 cm) high, the plant has compound leaves and pale blue flowers. Animals are fed the stalks and leaves as fodder.

Lenya, Lotte *orig.* **Karoline Blamauer** (b. Oct. 18, 1900, Penzing, Austria—d. Nov. 27, 1981, New York, N.Y., U.S.) Austrian-born U.S. actress-singer. Born into poverty, Lenya worked as a dancer and actress in Zürich and later in Berlin. She married the composer KURT WEILL in 1926 and began appearing in musical dramas by Weill and his longtime collaborator BERTOLT BRECHT, such as *Mahagonny* (1927) and *The Threepenny Opera* (1928; film, 1930). Lenya and Weill fled Nazi Germany for Paris, where she sang in Brecht's and Weill's *Seven Deadly Sins* (1933). The couple moved to New York City in 1935, and Lenya made her U.S. debut in *The Eternal Road* (1937). After Weill's death, she lent her inimitably husky voice to revivals throughout the 1950s, including a long-running production of *The Threepenny Opera*, and she later performed in *Brecht on Brecht* (1962), *Mother Courage and Her Children* (1965), and *Cabaret* (1966), as well as in films.

Leo (Latin: "Lion") In astronomy, the constellation lying between Cancer and Virgo; in ASTROLOGY, the fifth sign of the ZODIAC, governing approximately the period July 23–August 22. Its symbol, a lion, has been associated with the Nemean lion slain by HERACLES. The Nemean lion was considered invulnerable because its skin was impervious to arrows, but Heracles battered it to death with a club. ZEUS put the lion in the sky as a constellation.

Leo I, Saint *known as* **Leo the Great** (b. 4th century, Tuscany?—d. Nov. 10, 461, Rome; Western feast day November 10, Eastern feast day February 18) Pope (440–461). He was a champion of orthodoxy and a Doctor of the Church. When the monk Eutyches of Constantinople asserted that Jesus Christ had only a single divine nature, Leo wrote the *Tome,* which established the coexistence of Christ's human and divine natures. Leo's teachings were embraced by the Council of CHALCEDON (451), which also accepted his teaching as the "voice of Peter." Leo dealt capably with the invasions of barbaric tribes, persuading the HUNS not to attack Rome (452)

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and the VANDALS not to sack the city (455). Leo was also an exponent of the precept of papal primacy, and his personal example and letters and sermons contributed greatly to the growth of papal authority.

Leo III *known as* **Leo the Isaurian** \ī-'sȯr-ē-ən\ (b. c. 675, Germanicia, Commagene, Syria—d. June 18, 742, Constantinople) Byzantine emperor (717–41), founder of the Isaurian dynasty. A high-ranking military commander, he seized the throne with the help of Arab armies who hoped to subjugate the Byzantine Empire. He then successfully defended Constantinople against the Arabs (717–718). Having crowned his son CONSTANTINE V coemperor (720), Leo used his son's marriage to cement an alliance with the KHAZARS. Victory over the Arabs at Akroïnos (740) was crucial in preventing their conquest of Asia Minor. Leo issued an important legal code, the Ecloga (726). His policy of ICONOCLASM (730), which banned the use of sacred images in churches, engendered a century of conflict within the empire and further strained relations with the pope in Rome.

Leo IX, Saint *orig.* **Bruno, count von Egisheim und Dagsburg** (b. 1002, Egisheim, Alsace, Upper Lorraine—d. April 19, 1054, Rome; feast day April 19) Pope (1049–54). He was consecrated bishop of Toul in 1027. He was named pope by Emperor HENRY III but insisted on election by the clergy and people of Rome. His efforts to strengthen the papacy and eradicate clerical marriage and SIMONY laid the foundation for the Gregorian reform movement. His assertion of papal primacy and his military campaign against the Normans in Sicily (1053) alienated the Eastern church. His representatives excommunicated the patriarch of Constantinople. Though Leo had already died, their act triggered the SCHISM OF 1054.

Leo X *orig.* **Giovanni de' Medici** (b. Dec. 1, 1475, Florence—d. Dec. 1, 1521, Rome) Pope (1513–21), one of the most extravagant of the RENAISSANCE pontiffs. The second son of LORENZO DE' MEDICI, he was educated at his father's court in Florence and at the University of Pisa. He was named a cardinal in 1492, and in 1494 he was exiled from Florence by the revolt of GIROLAMO SAVONAROLA. He returned in 1500 and soon consolidated Medici control of the city. As pope, he became a patron of the arts, accelerating construction of ST. PETER'S BASILICA. He strengthened the papacy's political power in Europe, but his lavish spending depleted his treasury. He discouraged reforms at the fifth LATERAN COUNCIL, and he responded inadequately to the REFORMATION, excommunicating MARTIN LUTHER in 1521 and failing to address the need for change, a lapse that signaled the end of the unified Western church.

Leo XIII *orig.* **Vincenzo Gioacchino Pecci** (b. March 2, 1810, Carpineto Romano, Papal States—d. July 20, 1903, Rome) Pope (1878–1903). Born into the Italian nobility, he was ordained a priest in 1837 and entered the diplomatic service of the Papal States. He was appointed bishop of Perugia in 1846 and was named a cardinal in 1853. He was elected pope in 1878, and, despite his advanced age and frail health, he directed the church for a quarter of a century. Like his predecessor, PIUS IX, he opposed FREEMASONRY and secular liberalism, but he brought a new spirit to the papacy by adopting a conciliatory attitude toward civil governments and taking a more positive view of scientific progress.

Leo XIII, 1878
THE BETTMANN ARCHIVE

Leochares \lē-'ä-kə-ˌrēz\ (fl. 4th century BC, Greece) Greek sculptor to whom the *Apollo Belvedere* is often attributed. He worked for PHILIP II of Macedonia and his son, ALEXANDER THE GREAT, and was commissioned to produce gold and ivory statues of the royal family. He is said to have worked with SCOPAS on the Mausoleum at Halicarnassus, one of the SEVEN WONDERS OF THE WORLD, c. 350 BC.

León \lā-'ōn\ City (pop., 2001: 130,916), northwestern Spain. The city began as the camp of a Roman legion; its name is derived from the Latin *legio*. Held by the Goths during the 6th and 7th centuries, it then fell to the Moors, who ruled it until 850. In the 10th century, it became the capital of the kingdom of LEON. An industrial as well as a tourist centre, its site includes medieval churches.

León City (pop., 1995: 123,865), western Nicaragua. The second largest city in Nicaragua, it is the country's political and intellectual centre. It was founded by the Spanish on the edge of Lake MANAGUA in 1524; it was later destroyed by an earthquake and rebuilt in 1610 near the Pacific coast, northwest of MANAGUA. León was the capital of Nicaragua until 1855. It has had a long political and commercial rivalry with the city of GRANADA. It is the burial place of poet and diplomat RUBÉN DARÍO and the seat of the University of León.

Leon Medieval kingdom, northwestern Spain. Leon proper included the cities of LEÓN, SALAMANCA, and Zamora—the adjacent areas of Vallodolid and Palencia being disputed with CASTILE, originally its eastern frontier. It began as a Christian kingdom in the early 10th century when García I established his court on a former Roman legion campsite. Its rulers lost ground to the Moors during the 10th century but reconquered much territory in the 11th century. From 1037 to 1157 it was united with the kingdom of Castile, but it then regained its independence and was ruled by its own kings. It was permanently reunited with Castile in 1230. The modern autonomous community of CASTILE-LEÓN covers roughly the same area.

Léon, Arthur Saint- See Arthur SAINT-LÉON

Leonard, Buck *orig.* **Walter Fenner Leonard** (b. Sept. 8, 1907, Rocky Mount, N.C., U.S.—d. Nov. 27, 1997, Rocky Mount) U.S. baseball player. Leonard began his professional baseball career in the NEGRO LEAGUES in 1933. With his teammate JOSH GIBSON, he led the Homestead Grays to nine consecutive championships from 1937 through 1945. Known as a formidable home-run hitter and an outstanding first baseman, he was selected to the Negro leagues' East-West All-Star game a record 11 times.

Leonard, Sugar Ray *orig.* **Ray Charles Leonard** (b. May 17, 1956, Rocky Mount, N.C., U.S.) U.S. welterweight and middleweight boxer. Leonard was an outstanding amateur, winning 145 of 150 bouts, including a 1976 Olympic championship. He turned professional in 1977 and gained the world welterweight title in 1979 by defeating Wilfred Benítez. He lost the title to Roberto Duran in 1980 but recaptured it from him later that year. He retired in the early 1980s with a detached retina but made a comeback in 1984. In 1987 he went into the ring as a middleweight to defeat Marvin Hagler in one of boxing's great matches. He retired again in 1991. He was resoundingly defeated in a final comeback attempt in 1997. Known for his agility and finesse, he won 36 of his 39 professional matches. He later became a television commentator.

Leonardo da Vinci \'vin-chē\ (b. April 15, 1452, Anchiano, Republic of Florence—d. May 2, 1519, Cloux, France) Italian Renaissance painter, sculptor, draftsman, architect, engineer, and scientist. The son of a landowner and a peasant, he received training in painting, sculpture, and mechanical arts as an apprentice to ANDREA DEL VERROCCHIO. In 1482, having made a name for himself in Florence, he entered the service of the duke of Milan as "painter and engineer." In Milan his artistic and creative genius unfolded. About 1490 he began his project of writing treatises on the "science of painting," architecture, mechanics, and anatomy. His theories were based on the belief that the painter, with his powers of perception and ability to pictorialize his observations, was uniquely qualified to probe nature's secrets. His numerous surviving manuscripts are noted for being written in a backward script that requires a mirror to be read. In 1502–03, as military architect and engineer for CESARE BORGIA, he helped lay the groundwork for modern cartography. After five years of painting and scientific study back in Florence (1503–08), he returned to Milan, where his scientific work flourished. In 1516, after an interlude under MEDICI patronage in Rome, he entered the service of FRANCIS I of France; he never returned to Italy. Though only some 17 completed paintings survive, they are universally seen as masterpieces. The power of *The Last Supper* (1495–97) comes in part from its masterly composition. In the *Mona Lisa* (c. 1503–06) the features and symbolic overtones of the subject achieve a complete synthesis. The unique fame that Leonardo enjoyed in his lifetime and that, filtered by historical criticism, has remained undimmed to the present day rests largely on his unlimited desire for knowledge, a trait that guided all his thinking and behaviour.

Leoncavallo \lā-ˌōn-kä-'väl-lō**, Ruggero** (b. March 8, 1857/58, Naples, Kingdom of the Two Sicilies—d. Aug. 9, 1919, Montecatini Terme, near Florence, Italy) Italian composer. After attending Naples Conservatory and earning a doctorate in literature, he toured as a pianist while writing operas. His first, *Chatterton* (1878), was produced with little suc-

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cess, but its libretto attracted the interest of the publisher Giulio Ricordi. Giacomo Puccini's rejection of Leoncavallo's help with *Manon Lescaut* and Ricordi's rejection of his own projects caused him in anger to write the verismo one-act opera *Pagliacci* (1892) for Ricordi's rival. Though he wrote several other operas and operettas, *Pagliacci* was his only enduring success.

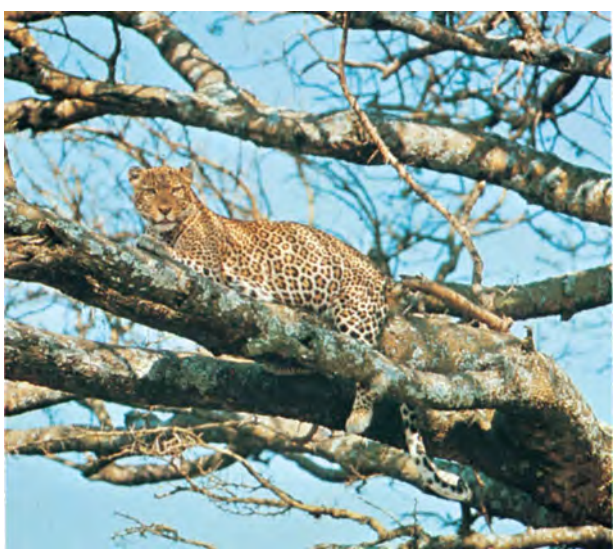
Leone \lā-'ō-nā**, Sergio** (b. Jan. 3, 1929?, Rome, Italy—d. April 30, 1989, Rome) Italian film director. After working as an assistant to Italian and U.S. directors, he made his directing debut with *The Colossus of Rhodes* (1961). He won a wide audience with *A Fistful of Dollars* (1964), the first of the violent Italian-made "spaghetti westerns"; the equally popular *For a Few Dollars More* (1965) and *The Good, the Bad, and the Ugly* (1966) also starred Clint Eastwood. Among his other films are the epics *Once upon a Time in the West* (1968) and *Once upon a Time in America* (1984). Many of his films were at first poorly received by critics, but Leone was eventually recognized for his meticulous care for historical accuracy and his powerful sense of visual composition.

Leonidas \lē-'ä-nə-dəs\ (d. 480 BC, Thermopylae, Locris [Greece]) King of Sparta (c. 490–480 BC). He is noted for his heroic stand against the Persians at the Battle of Thermopylae in 480. Seeing the hopelessness of the situation, he sent most of his troops in retreat and with his 300-man royal guard withstood the Persian army for two days, battling valiantly to the last man. He became the object of a hero cult at Sparta, and he stands as the epitome of bravery against overwhelming odds. The legend that Spartans never surrender derived from this episode.

Leonov \lē-'ä-nəf**, Aleksey (Arkhipovich)** (b. May 30, 1934, near Kemerovo, Russia, U.S.S.R.) Soviet cosmonaut. He joined the Soviet air force in 1953 and was selected for cosmonaut training in 1959. In 1965 he became the first person to perform a spacewalk. After exiting the spacecraft (Voskhod 2) and while tethered to the ship, Leonov made observations, took motion pictures, and practiced maneuvering in free fall before reentering the ship. A decade later he commanded the Soyuz craft that linked in orbit with the U.S. Apollo craft in July 1975.

Leontief \lē-'än-tē-ˌef**, Wassily** (b. Aug. 5, 1906, St. Petersburg, Russia—d. Feb. 5, 1999, New York, N.Y., U.S.) Russian-born U.S. economist. After studying at the universities of Leningrad (1921–25) and Berlin (1925–28), he immigrated to the U.S. in 1931. At Harvard University (1931–75) he articulated his input-output analysis. He also described what is known as the Leontief Paradox: that capital, not labour, is the scarce factor of production in the U.S. He was awarded the 1973 Nobel Prize. From 1975 until his death he taught at New York University.

leopard *or* **panther** Big cat (*Panthera pardus*) of the bush and forest, found throughout sub-Saharan Africa, in North Africa, and in Asia. The average leopard weighs 110–200 lbs (50–90 kg) and is about 6 ft (210 cm) long, excluding the 35-in. (90-cm) tail, and 24–28 in. (60–70 cm) high at the shoulder. The background colour is typically yellowish above and white below. The dark spots arranged in rosettes over much of the body lack a central spot, unlike those of the jaguar. The leopard is solitary and mainly nocturnal. An agile climber, it frequently stores the remains of its kills in tree branches. It generally preys on antelope and deer. It also hunts dogs and, in Africa, baboons. It sometimes takes livestock and may attack humans. The leopard is considered an endangered species by the U.S. but not by the IUCN (International Union for Conservation of Nature). See also cheetah; cougar; snow leopard.



Leopard (*Panthera pardus*)
LEONARD LEE RUE III

leopard seal *or* **sea leopard** Species (*Hydrurga leptonyx*) of generally solitary earless seal (family Phocidae) found in Antarctic and sub-Antarctic regions. It is the only seal that feeds on penguins, young seals, and other warm-blooded prey. It is slender and has a long head and long three-cusped cheek teeth. Named for its black-spotted gray coat, it attains a maximum length and weight (greater in the female) of about 12 ft (3.5 m) and 840 lbs (380 kg). It has a reputation for ferocity but is not known to make unprovoked attacks on humans.

Leopardi \ˌlā-ō-'pär-dē**, Giacomo** (b. June 29, 1798, Recanati, Papal States—d. June 14, 1837, Naples) Italian poet, scholar, and philosopher. Congenitally deformed, he suffered throughout his life from chronic ailments and frustrated hopes. His usually pessimistic poetry is admired for its brilliance, intensity, and effortless musicality. His verse collections include *Canzoni* (1824), *Versi* (1826), and *I canti* (1831). His finest poems are probably the lyrics called "Idillii" in early editions of his poetry. *Operette morali* (1827; "Minor Moral Works") is an influential philosophical exposition, mainly in dialogue form, of his doctrine of despair. He is considered among the great Italian writers of the 19th century.

Leopold I *orig.* **Léopold-Georges-Chrétien-Frédéric** (b. Dec. 16, 1790, Coburg, Saxe-Coburg-Saalfeld—d. Dec. 10, 1865, Laeken, Belg.) First king of the Belgians (1831–65). The son of Francis, duke of Saxe-Coburg-Saalfeld, he married Charlotte, daughter of the future English king George IV in 1816. After her death in 1817 Leopold continued to live in England until elected king of the newly formed Belgium. He helped strengthen the country's new parliamentary system and scrupulously maintained Belgian neutrality. Highly influential in European diplomacy, he used marriages to strengthen his ties. In 1832 he married the daughter of Louis-Philippe. In 1840 he helped arrange the marriage of his niece, Victoria, to his nephew, Prince Albert of Saxe-Coburg-Gotha. In 1857 he arranged the marriage of his daughter to Maximilian, archduke of Austria.

Leopold I (b. June 9, 1640 Vienna, Austria—d. May 5, 1705, Vienna) Holy Roman emperor (1658–1705). Son of Ferdinand III, Leopold was a devout Catholic destined for the church, but, when his elder brother died unexpectedly (1654), he became heir apparent to the Austrian Habsburg lands. He was crowned successively king of Hungary (1655) and of Bohemia (1656), and with his father's death Leopold became emperor in 1658. During his lengthy reign Austria emerged from a series of struggles to become a great European power. In 1683 the Turks besieged Vienna and were repulsed; war continued until the Turks were defeated and ceded control of Hungary in the Treaty of Carlowitz (1699). Leopold also entered into the War of the Grand Alliance, but the unfavourable peace treaty ceded Strasbourg to France. He was drawn into the War of the Spanish Succession, and he died before its end. His third marriage, to Eleonore of Palatinate-Neuburg, was a happy union that produced 10 children, including the future emperors Joseph I and Charles VI.

Leopold II *orig.* **Léopold-Louis-Philippe-Marie-Victor** (b. April 9, 1835, Brussels, Belg.—d. Dec. 17, 1909, Laeken) King of the Belgians (1865–1909). Succeeding his father, Leopold I, he led the first European efforts to develop the Congo River basin. In 1876 he founded an association to explore the Congo area, with Henry Morton Stanley as his main agent. Leopold formed the Congo Free State in 1885 and ruled as its sovereign. Under Leopold, the Congo became the scene of barbarous cruelty by the colonial masters; when news of the conditions there broke c. 1905, it provoked an international scandal. Under British and U.S. pressure, the region was removed from Leopold's personal rule and annexed to Belgium in 1908 as the Belgian Congo. Leopold was succeeded by his nephew, Albert I.

Leopold II (b. May 5, 1747, Vienna—d. March 1, 1792, Vienna) Holy Roman emperor (1790–92). Son of Maria Theresa and Emperor Francis I, he became duke of Tuscany in 1765. A practitioner of what has been

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termed enlightened despotism, he built an efficient state government and encouraged representative institutions. In 1790 he succeeded his brother Joseph II as emperor and retained many of Joseph's reforms. In 1792 he allied with Prussia against revolutionary France, precipitating the French Revolutionary Wars.

Leopold III *orig.* **Léopold-Philippe-Charles-Albert-Meinrad-Hubertus-Marie-Miguel** (b. Nov. 3, 1901, Brussels, Belg.—d. Sept. 25, 1983, Brussels) King of the Belgians (1934–51). He succeeded his father, Albert I, and favoured an independent foreign policy but not strict neutrality. In World War II he assumed command of the Belgian army, but he surrendered his encircled forces 18 days after the German invasion in May 1940. The Belgian government repudiated his decision to surrender and remain with his forces rather than join the government-in-exile in London. Under house arrest through the war, he later went to Switzerland (1945–50) to await resolution of the controversy. Though 58% of voters voted for his return to the throne, he abdicated in 1951 in favour of his son Baudouin.

Leopold, (Rand) Aldo (b. Jan. 11, 1887, Burlington, Iowa, U.S.—d. April 24, 1948, near Madison, Wis.) U.S. environmentalist. After attending Yale University, he worked for the U.S. Forest Service (1909–28), mainly in the Southwest. In 1924 the country's first national wilderness area (Gila Wilderness Area in New Mexico) was created at Leopold's urging. From 1933 to 1948 he taught at the University of Wisconsin. A fervent campaigner for the preservation of wildlife and wilderness areas, he was a director of the Audubon Society from 1935 and became a founder of the Wilderness Society in the same year. His *Game Management* (1933) was followed in 1949 by the posthumous *A Sand County Almanac*, which eloquently called for the preservation of ecosystems. Read by millions, it strongly influenced the budding environmental movement.

Leopold of Hohenzollern-Sigmaringen \ˌhō-ənt-ˈsól-ərn-ˈzē̱k-mä-ˌriŋ-ən**, Prince** (b. Sept. 22, 1835, Krauchenweis, Prussia—d. June 8, 1905, Berlin, Ger.) Prussian candidate for the Spanish throne. He was a member of the Swabian line of the Hohenzollern dynasty and the brother of Carol I of Romania. Chancellor Otto von Bismarck and Spain's de facto leader, Juan Prim (1814–70), persuaded the reluctant Leopold to accept the Spanish throne, left vacant in 1868. Under French diplomatic pressure, Leopold's candidacy was withdrawn, but Prussia refused to bow to French demands that it never be renewed. The Ems Telegram provoked the French into declaring war (see Franco-Prussian War).

Léopoldville See Kinshasa

Lepanto \lē-ˈpän-tō**, Battle of** (Oct. 7, 1571) Naval engagement between allied Christian forces (Venice, the pope, and Spain) and the Ottoman Turks during an Ottoman campaign to acquire the Venetian island of Cyprus. After four hours of fighting off the coast of Lepanto, Greece, the allies, under Juan de Austria, were victorious, capturing 117 galleys and thousands of men. The battle was of little practical value, since Venice would surrender Cyprus to the Turks in 1573, but it had a great impact on European morale and was the subject of paintings by Titian, Tintoretto, and Veronese.

lepidopteran \ˌle-pə-ˈdäp-tə-rən\ Any of the more than 100,000 species constituting the order Lepidoptera (Greek: "scaly wing"): butterflies, moths, and skippers. The name refers to the dusting of minute scales that covers the wings and bodies of these insects. A slender proboscis is used for sucking. Nearly all lepidopterans are plant eaters, and species are found on every continent except Antarctica. Females may lay from a few to a thousand or more eggs at a time. All lepidopterans undergo complete metamorphosis. Many types move from one region to another, sometimes crossing thousands of miles of ocean, but the only species that truly migrates—the same individuals making a two-way flight—is the monarch butterfly.

Lepidus \ˈle-pə-dəs**, Marcus Aemilius** (d. 13/12 BC) Roman consul (46, 42 BC) and triumvir (43–36). After the death of Julius Caesar, Lepidus controlled parts of Gaul, Spain, and Africa and wielded great influence. He and Mark Antony opposed the republican conspirators and in 43 formed the Second Triumvirate with Octavian (later Augustus). He acquired a second Spanish province but lost Spain and Gaul to Antony and Octavian, keeping only Africa. After helping defeat Sextus Pompeius (36), he challenged Octavian, but his soldiers defected and he was forced to retire.

Lepontine \li-ˈpän-ˌtīn\ **Alps** Segment of the central Alps along the Italian-Swiss border. It is bordered by the Pennine Alps in the west and southwest and the Italian lake district in the south; its highest peak, Mount Leone, rises to 11,657 ft (3,553 m) and lies at its western end. Important passes include Simplon, Saint Gotthard, Lukmanier, and San Bernardino.

leprechaun \ˈlep-rə-ˌkän\ In Irish folklore, a fairy in the form of a tiny old man wearing a cocked hat and leather apron. Solitary by nature, leprechauns lived in remote places and worked as shoemakers. Each was believed to possess a hidden crock of gold. If captured and threatened, a leprechaun might reveal the gold's hiding place, provided his captor never took his eyes off him. Usually the captor was tricked into glancing away, and the leprechaun vanished. The word derives from the Old Irish *luchorpan* ("little body").

Leprechaun, from the *Irish Fairy Book*, by Alfred Perceval Crave, 1909.
COURTESY OF THE FOLKLORE SOCIETY LIBRARY, UNIVERSITY COLLEGE, LONDON; PHOTOGRAPH, R.B. FLEMING

leprosy *or* **Hansen disease** Chronic disease of the skin, peripheral nerves, and mucous membranes of the nose, throat, and eyes, caused by the bacterium *Mycobacterium leprae*. In tuberculoid leprosy, cells of the immune system crowd into infected areas of the skin, forming hard nodules, or tubercles, that spread along nerve fibres. This type of reaction commonly leads to claw hand, gross deformity of the foot, and paralysis of muscles of the face, eye, and neck. In the lepromatous type, bacilli multiply freely in deep layers of the skin and spread widely through lymphatic channels and along nerve fibres, causing thickening and corrugation of the skin, raising soft nodules on the ears, nose, and cheeks, and sometimes destroying the septum of the nose and the palate. Leprosy has a long history. Until the 20th century, infected people were ostracized from society or at best segregated and cared for in isolated leper colonies. Today the disease is entirely curable through multidrug therapy, though tissue damage caused before drug treatment cannot be reversed. Some 600,000 new cases arise every year, mostly in Asia, Africa, Central and South America, and the Pacific Islands. About 60 percent of new cases occur in India.

Leptis Magna *modern* **Labdah** Largest city of ancient Tripolis, located near modern Al-Khums, Libya. Founded by the Phoenicians in the 6th century BC, it passed to Numidia in 202 BC but broke away in 111 BC to become an ally of Rome. The emperor Trajan made it a Roman colony. The waning of the Roman Empire caused its decline, and it was largely abandoned after the Arab conquest of AD 642. It has some of the best-preserved Roman ruins in North Africa.

lepton \ˈlep-tän\ Any member of a class of fermions that respond only to electromagnetic, weak, and gravitational forces and do not take part in strong interactions. Leptons have a half-integral spin and obey the Pauli exclusion principle. They can either carry one unit of electric charge or be neutral. The charged leptons are the electrons, muons, and taus. Each has a negative charge and a distinct mass. Each charged lepton has an associated neutral partner, or neutrino, which has no electric charge and very little if any mass.

Lerma River River, west-central Mexico. It rises southeast of Toluca and flows northwest and then south for 350 mi (560 km) to empty into Lake Chapala. The Río Grande de Santiago, which leads from Lake Chapala to the Pacific Ocean, is sometimes considered an extension of the Lerma. With its major tributaries, it constitutes Mexico's largest river system.

Lermontov \ˈlʸer-mən-təf**, Mikhail (Yuryevich)** (b. Oct. 15, 1814, Moscow, Russia—d. July 27, 1841, Pyatigorsk) Russian poet and novelist. His first volume of verse, *Spring*, was published in 1830, the year he entered Moscow University. He left the university two years later to enter cadet school. A guards officer after graduating in 1834, he was twice exiled to regiments in the Caucasus because of his passionately libertarian verse. He became popular for having suffered for his poetry, which combined civic and philosophical themes with deeply personal motifs. His mature poems include "Mtsyri" (1840) and "Demon" (1841). His novel *A Hero of Our Time* (1840), a reflection on contemporary society and the fortunes of his generation, is written in superb prose, and the portrait of its alienated hero profoundly influenced later Russian writers. Like Aleksandr Pushkin, to whom he is often compared, he died in a duel. He is remembered as his country's leading Romantic poet.

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Lerner, Alan Jay (b. Aug. 31, 1918, New York, N.Y., U.S.—d. June 14, 1986, New York City) U.S. librettist and lyricist. Born to a prosperous retailing family, he studied at Juilliard and Harvard. He wrote more than 500 radio scripts between 1940 and 1942, the year he met the composer Frederick Loewe. The two began collaborating, and their first Broadway success came with *Brigadoon* (1947; film, 1954). It was followed by *Paint Your Wagon* (1951; film, 1969). *My Fair Lady* (1956) was an unprecedented triumph, setting a record for the longest original run of any musical; the film version (1964) won seven Academy Awards. Their film musical *Gigi* (1958) received nine Academy Awards. *Camelot* followed in 1960 (film, 1967). Lerner also collaborated with Kurt Weill (*Love Life*, 1948) and Burton Lane (*On a Clear Day You Can See Forever*, 1965; film, 1970), among others. His film scripts include *An American in Paris* (1951, Academy Award).

Lerwick Town (pop., 1991: 7,336), administrative centre of the Shetland Islands, northern Scotland. It is on the eastern coast of the island of Mainland. Britain's northernmost town, it originated as a fishing village and is notable for its herring catch. The North Sea oil boom of the 1970s increased port traffic, and Lerwick became an oil supply and service base. It is the seat of the Shetland Islands council area.

Les Six See Les Six

Les Vingt See Les Vingt

Lesage \lə-'säzh**, Alain-René** *or* **Le Sage** (b. May 6, 1668, Sarzeau, France—d. Nov. 17, 1747, Boulogne) French novelist and playwright. He studied law in Paris but later abandoned his clerkship to devote himself to literature. His classic *The Adventures of Gil Blas of Santillane* (1715–35), one of the earliest realistic novels, was influential in making the picaresque novel a European literary fashion. A prolific satirical dramatist, he adapted Spanish models for his early plays, including the highly successful comedy *Crispin, Rival of His Master* (1707). He also composed more than 100 *comédies-vaudevilles* in the tradition of Molière.

Lesage \lə-'säzh**, Jean** (b. June 10, 1912, Montreal, Que., Can.—d. Dec. 12, 1980, near Quebec, Que.) Canadian politician. He served as Canadian minister of resources and development from 1953 to 1957. In 1958 he became leader of Quebec's Liberal Party. When the Liberals won the 1960 provincial elections, he became Quebec's premier. He called for social and cultural reform, appointing the first minister of education and modernizing the school system and the civil service. He developed close cultural ties between Quebec and France. After the Liberals were defeated in 1966, he served as opposition leader until 1970.

lesbianism *also called* **sapphism** *or* **female homosexuality,** the quality or state of intense emotional and usually erotic attraction of a woman to another woman. First used in the late 16th century, the word "lesbian" referred to the Greek island of Lesbos. The connotation of female homosexuality was added in the late 19th century, when an association was made with the poetry of Lesbian poet Sappho (c. 610–c. 580 BC). At the turn of the 21st century, issues of concern to lesbians in Europe and North America included legal recognition for same-sex unions, child-rearing rights, women's health-care, taxes, inheritance, and the sharing of medical benefits with a partner.

Lesbos \'lez-ˌbäs\ *or* **Mytilene** \ˌmit-ᵊl-'ē-nē\ *or* **Mitilíni** \ˌmē-tē-'lē-nē\ Third largest island (pop., 1991: 87,151) in the Aegean Sea. It occupies an area of 630 sq mi (1,630 sq km), and with two other islands it forms a Greek department. Its main town is Mytilene. Lesbos was the birthplace of the poet Sappho and is the source of the term *lesbian*. Inhabited since c. 3000 BC, it was settled in c. 1050 BC by the Aetolians. After being under Persian rule (527–479 BC), it joined the Delian League. In the Peloponnesian War, it fell to Sparta (405 BC), but then it was recovered for Athens (389 BC). It later flourished under Byzantium. It was ruled by the Ottoman Empire (1462–1911) before being annexed by Greece. Fishing is important economically, as is the export of olives.

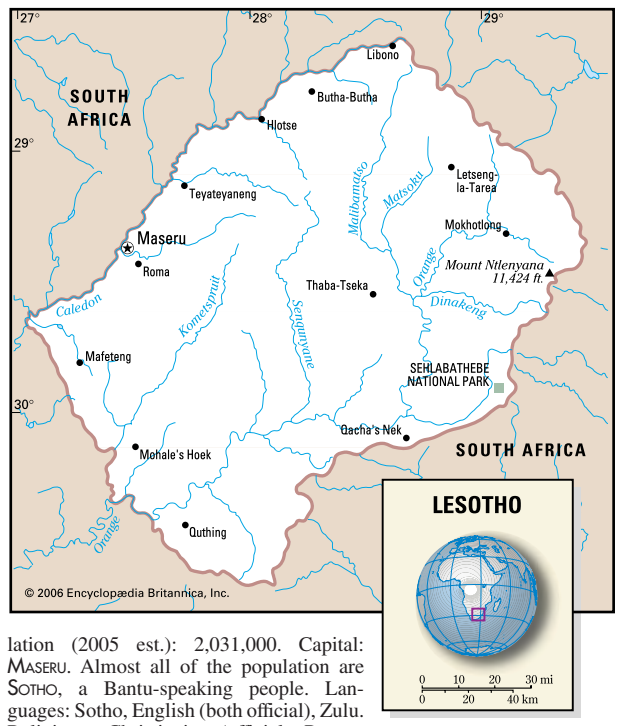
Leschetizky \ˌle-shə-'tit-skē**, Theodor** *orig.* **Teodor Leszetycki** (b. June 22, 1830, Łańcut, Pol., Austrian Empire—d. Nov. 14, 1915, Dresden, Ger.) Polish pianist and teacher. A prodigy, he studied in Vienna with Karl Czerny and Simon Sechter (1788–1867) from age 10 and was already a teacher by 14. In addition to performing, he became the most celebrated piano teacher of his time, first at the conservatory in St. Petersburg (1852–78) and thereafter in Vienna. His students included many of the most renowned pianists of their era, including Ignacy Paderewski and Artur Schnabel.

leshy \'lʲe-shəy\ In Slavic mythology, a forest spirit. The leshy is an antic spirit who enjoys playing tricks on people, though when angered he can be treacherous. He is seldom seen, but his voice can be heard in the forest laughing, whistling, or singing. He often takes the shape of a man, but his eyebrows, eyelashes, and right ear are missing, his head is pointed, and he lacks a hat and belt. In his native forest, the leshy is as tall as the trees, but the moment he steps beyond it, he shrinks to the size of grass. The leshy is familiar to most Slavs living in heavily forested areas.

Leslie, Frank *orig.* **Henry Carter** (b. March 29, 1821, Ipswich, Suffolk, Eng.—d. Jan. 10, 1880, New York, N.Y., U.S.) British-U.S. illustrator and journalist. The *Illustrated London News* published his early sketches. He moved to the U.S. in 1848. There he founded numerous newspapers and journals, including the *New York Journal* (1854), *Frank Leslie's Illustrated Newspaper* (1855)—having changed his name in 1857—and *Frank Leslie's Boys' and Girls' Weekly* (1866). His illustrations from Civil War battlefields earned him his greatest profits. His second wife, Miriam Florence Leslie (1836–1914), legally changed her name to Frank Leslie after his death and continued his business after his death, twice rescuing it from debt. When she died a wealthy woman, she left most of her estate to the feminist Carrie Chapman Catt in the service of the suffragist cause.

Leśniewski \lesh-'nyef-skē**, Stanisław** *or* **Stanisław Leshniewski** (b. March 30, 1886, Serpukhov, Russia—d. May 13, 1939, Warsaw) Polish logician and mathematician. As a professor at the University of Warsaw (1919–39), he became a cofounder and leading representative of the Warsaw school of logic. His distinctive contribution was the construction of three interrelated formal systems, to which he gave the Greek-derived names of protothetic, ontology, and mereology.

Lesotho \lə-'sü-ˌtü, lə-'sō-ˌtō\ *officially* **Kingdom of Lesotho** *formerly* **Basutoland** Country, southern Africa, an enclave lying within the Republic of South Africa. Area: 11,720 sq mi (30,355 sq km). Population (2005 est.): 2,031,000. Capital: Maseru. Almost all of the population are Sotho, a Bantu-speaking people. Languages: Sotho, English (both official), Zulu. Religions: Christianity (official; Roman Catholic, other Christians, Protestant); also traditional beliefs. Currency: loti. About two-thirds of the total area is mountainous; the highest point is Mount Ntlenyana (11,424 ft [3,482 m]). The Maloti Mountains in the central northwest are the source of two of South Africa's largest rivers, the Tugela and the Orange. Mineral resources are scant. Agriculture employs nearly two-fifths of the workforce; the chief farm products are corn, sorghum, and wheat. Livestock provides exports (cattle, wool,



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mohair). Industries focus mainly on light manufacturing (textiles and apparel, furniture, jewelry). Lesotho is a constitutional monarchy with two legislative houses; its chief of state is the king, and the head of government is the prime minister. Bantu-speaking farmers began to settle the area in the 16th century, and a number of chiefdoms arose. The most powerful of them organized the Basotho in 1824 and obtained British protection in 1843 as tension between the Basotho and the South African Boers increased. It became a British territory in 1868 and was annexed to the Cape Colony in 1871. The colony's effort to disarm the Basotho resulted in revolt in 1880, and four years later it separated from the colony and became a British High Commission Territory. It became independent in 1966. A new constitution, effective in 1993, ended seven years of military rule. At the beginning of the 21st century, Lesotho suffered from internal political problems and a deteriorating economy.

Lesse River \'les, 'le-sə\ River, southeastern Belgium. It rises in the Ardennes and meanders northwest for 52 mi (84 km), emptying into the Meuse River. It flows underground for about a mile at Han-sur-Lesse through the Grottoes of Han, renowned for their stalactites and stalagmites.

Lesseps \'le-səps**, Ferdinand (-Marie), viscount de** (b. Nov. 19, 1805, Versailles, France—d. Dec. 7, 1894, La Chenaie, near Guilly) French diplomat, builder of the Suez Canal. A career diplomat, he held posts in Egypt and elsewhere until 1849. In 1854 he was authorized by the viceroy of Egypt to build a canal across the isthmus of the Suez. He organized a company in 1858, with half its capital from French people, and construction began at Port Said in 1859. The Suez Canal was officially inaugurated in 1869. In 1879 Lesseps organized another company to build a Panama canal, but he gave up the project because of political and economic difficulties. He was prosecuted but cleared of charges of misappropriating funds, though French government members were accused of bribe taking.

Lesseps
CULVER PICTURES

Lesser Armenia See Little Armenia

Lesser Slave Lake Lake, central Alberta, Canada. Located northwest of Edmonton and south of Great Slave Lake, it occupies an area of 451 sq mi (1,168 sq km) and drains into the Athabasca River via the Lesser Slave River. Its name refers to the Slave (Dogrib) Indians, who once inhabited its shores.

Lessing, Doris (May) *orig.* **Doris May Tayler** (b. Oct. 22, 1919, Kermānshāh, Iran) British novelist and short-story writer. She lived on a farm in Southern Rhodesia (now Zimbabwe) 1924–49 before settling in England and beginning her writing career. Her works, which have often reflected her leftist political activism, are largely concerned with people caught in social and political upheavals. *Children of Violence* (1952–69), a semiautobiographical five-novel series featuring Martha Quest, reflects her African experience and is generally considered her most substantial work. *The Golden Notebook* (1962), her most widely read novel, is a feminist classic. Her masterful short stories are published in several collections. Other works include a science-fiction novel sequence, two novels published under an assumed name (Jane Somers), and autobiographical works, including *Under My Skin* (1994).

Lessing, Gotthold Ephraim (b. Jan. 22, 1729, Kamenz, Upper Lusatia, Saxony—d. Feb. 15, 1781, Braunschweig, Brunswick) German playwright and critic. After writing several light comedies, he became a theatre critic in Berlin in 1748. His play *Miss Sara Sampson* (1755) was the first German domestic tragedy. After studying philosophy and aesthetics in Breslau, he wrote the influential treatise *Laocoön: An Essay on the Limits of Painting and Poetry* (1766). *Minna von Barnhelm* (1767), his finest play, marks the beginning of classical German comedy. He was adviser to the first Hamburg national theatre and published his reviews as essays on the principles of drama in *Hamburg Dramaturgy* (1767–69). His *Wolfenbüttel Fragments* (1774–78) attacked orthodox Christianity, arousing great controversy. He also wrote the tragedy *Emilia Galotti* (1772) and the famous dramatic poem *Nathan the Wise* (1779).

Lethe \'lē-thē\ Ancient Greek personification of oblivion. She was the daughter of Eris (Strife). Her name was also applied to a river or plain in the realm of the dead. In the Orphic mysteries it was believed that the newly dead who drank from the River Lethe would lose all memory of their past existence. The initiated were taught to drink instead from Mnemosyne, the river of Memory.

Leto \'lē-tō\ In classical mythology, the mother of Apollo and Artemis. She was made pregnant by Zeus, and she wandered in search of a place to give birth until she found the barren island of Delos. The island was a floating rock borne about by the waves, but it was fixed to the bottom of the sea for the birth of Apollo and Artemis. In some versions, Leto's wanderings are ascribed to the jealousy of Zeus's wife, Hera.

Letterman, David (b. April 12, 1947, Indianapolis, Ind., U.S.) U.S. television talk-show host. He began his career as a stand-up comedian and was a guest host of Johnny Carson's *Tonight Show* from 1979. He hosted NBC's post-midnight *Late Night with David Letterman* (1982–93), winning six Emmy Awards and great popularity with his ironic, abrasive, flippant style of interviewing, which critics viewed as a parody of talk shows. Since 1993 he hosted *The Late Show with David Letterman* on CBS.

letterpress printing *or* **relief printing** *or* **typographic printing** In commercial printing, process by which many copies are produced by repeated direct impression of an inked, raised surface against sheets or a continuous roll of paper. Letterpress is the oldest traditional printing technique, the only important one from the time of Johannes Gutenberg (c. 1450) until lithography (late 18th century) and especially offset printing (early 20th century). The ink-bearing surface for a page of text was originally assembled letter by letter and line by line. The Monotype and Linotype were the first keyboard-activated typesetting machines. Letterpress can produce high-quality work at high speed, but requires much time to prepare and adjust the press. For the sake of speed, newspapers are now printed by the offset process.

Lettish language See Latvian language

lettre de cachet \'letrᵊ-də-ka-'shā\ (French: "letter with a seal") Letter bearing an official seal, signed by the king and countersigned by a secretary of state, used primarily to authorize someone's imprisonment without trial. An important instrument of administration under the ancien régime in France, lettres de cachet were greatly abused in the 17th–18th century. Their use was abolished in 1790.

lettuce Cultivated annual salad plant (*Lactuca sativa*) that produces clusters of crisp, water-filled leaves. The best-known varieties are head, or cabbage, lettuce (variety *capitata*); leaf, or curled, lettuce (variety *crispa*); cos, or romaine, lettuce (variety *longifolia*); and asparagus lettuce (variety *asparagina*). Head lettuce is further divided into butter heads and crisp heads (e.g., iceberg lettuce). In the U.S, large-scale farms grow mainly crisp-head varieties, shipping them nationwide. Small-scale, local farmers raise leaf and butter-head varieties. Lettuce is an early annual crop that grows best in cool weather and with ample water. Though usually consumed in salads, it may also be cooked.

Lettuce (*Lactuca sativa*, variety *capitata*)
DEREK FELL

leucine \'lü-ˌsēn\ One of the essential amino acids, present in most common proteins and particularly abundant in hemoglobin. One of the first amino acids discovered (1819), it is used in biochemical research and as a nutritional supplement.

leucite \'lü-ˌsīt\ One of the most common feldspathoid minerals, potassium aluminosilicate ($KAlSi_2O_6$). It occurs only in igneous rocks, particularly potassium-rich, silica-poor, recent lavas. Some important localities include Rome, Italy; Uganda; and Wyoming's Leucite Hills. Leucite is used as a fertilizer in Italy (because of its high potassium content) and as a source of commercial alum.

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Leucothea \lü-'kä-thē-ə\ In GREEK MYTHOLOGY, a sea goddess. She is first mentioned in the *Odyssey*, in which she rescued ODYSSEUS from drowning. She was traditionally identified with Ino, daughter of CADMUS, who incurred the wrath of HERA by caring for the infant DIONYSUS, ZEUS's son by SEMELE. Hera drove Ino and her son Melicertes mad, and they leaped into the sea, where they were changed into marine deities—Ino into Leucothea, Melicertes into Palaemon. A dolphin carried Melicertes' body to the Isthmus of Corinth, and the ISTHMIAN GAMES were instituted in his honour.

Leucothea giving Dionysus a drink from the Horn of Plenty, antique bas-relief; in the Lateran Museum, Rome
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leukemia CANCER of blood-forming tissues with high levels of LEUKOCYTES. Radiation exposure and hereditary susceptibility are factors in some cases. In acute leukemias, ANEMIA, fever, bleeding, and lymph-node swelling develop rapidly. Acute lymphocytic leukemia, found mostly in children, was once over 90% fatal in six months. Drug therapy can now cure more than half these children. Acute myelogenous (granulocytic) leukemia, found mostly in adults, has frequent remissions and recurrences, and few patients survive long. Chronic myelogenous leukemia most often begins in the 40s; weight loss, low fever, weakness, and other symptoms may not develop immediately. CHEMOTHERAPY helps the symptoms but may not prolong life. Chronic lymphocytic leukemia, mostly in the elderly, may be inactive for years. Survival rates are better than in myelogenous leukemia; most deaths are caused by infection or hemorrhage.

leukocyte \'lü-kə-ˌsīt\ *or* **white blood cell** *or* **white corpuscle** Any of several types of blood cells that help defend the body from INFECTION. The different mature forms—granulocytes, including neutrophils (heterophils), basophils, and eosinophils; monocytes, including macrophages; and LYMPHOCYTES—have different functions, including ingesting BACTERIA, PROTOZOANS, or infected or dead body cells; producing ANTIBODIES; and regulating the action of other leukocytes. They act mostly in the tissues and are in the bloodstream only for transport. Blood normally contains 5,000–10,000 leukocytes per cu mm.

leukoderma See VITILIGO

Levant \lə-'vänt\ Historical name for the countries along the shores of the eastern MEDITERRANEAN SEA. It was applied to the coastlands of ANATOLIA and Syria, sometimes extending from Greece to Egypt. The term was often associated with Venetian trading ventures. It was also used as a synonym for the Middle or Near East. In the 16th–17th centuries the term High Levant referred to the Far East (East Asia). The name Levant States was given to the French mandate of Syria and Lebanon after World War I (1914–18).

level Device for establishing a horizontal plane. It consists of a small, sealed glass tube containing liquid and an air bubble; the tube is fixed horizontally in a block or frame with a smooth lower surface. When the bubble is in the middle of the glass tube, the device is on a level surface; adjustment to the horizontal is indicated by movement of the bubble. The glass tube is slightly bowed, and the level's sensitivity is proportional to the radius of curvature.

Leveler Member of a republican faction in England during the ENGLISH CIVIL WARS and Commonwealth. The name was coined by the movement's enemies to suggest that its supporters wished to "level men's estates." The movement began in 1645–46 and demanded that sovereignty rest with the House of Commons (to the exclusion of king and lords), believing that manhood suffrage would make Parliament truly representative. The Levelers dominated the NEW MODEL ARMY, but the Putney debates in the army council discussing the Levelers' new social contract (1647) ended in deadlock. The generals restored army discipline by force, ending the Levelers' political power.

Leven \'lē-vən**, Loch** Lake, east-central Scotland. Roughly 3 mi (5 km) in diameter, it is one of the shallowest of the Scottish lochs, having an average depth of 15 ft (4.5 m). It contains a subspecies of BROWN TROUT known as Loch Leven trout. Castle Island, one of the lake's seven islands, has the ruins of a 14th-century castle where MARY, QUEEN OF SCOTS, was imprisoned (1567–68).

lever Simple MACHINE used to amplify physical FORCE. All early people used the lever in some form, for moving heavy stones or as digging sticks for land cultivation. Balance beams for weighing were probably used in Egypt c. 5000 BC; they consist of a bar pivoted at its center with weights on one end balancing the object on the other. As early as 1500 BC people were raising water and lifting soldiers over battlements using the swape or shadoof, a long lever pivoted near one end with a platform or container hanging from the short arm and counterweights attached to the long arm.

Lever Bros. \'lē-vər\ British soap and detergent manufacturer. Lever Bros. was founded in 1885 by William Hesketh Lever, later Viscount Leverhulme (1851–1925), and his brother, James Darcy Lever, to make and sell soap. The first company to market wrapped bars of soap made from vegetable oil instead of tallow, Lever Bros. expanded internationally with the help of energetic advertising slogans. It built a model industrial village at Port Sunlight in 1888 and offered employee benefits such as profit sharing and free insurance. William was elected to Parliament in 1906 and became a viscount in 1922. In 1929, Lever Bros. joined an association of European companies to form UNILEVER.

Levertov, Denise (b. Oct. 24, 1923, Ilford, Essex, Eng.—d. Dec. 20, 1997, Seattle, Wash., U.S.) English-born U.S. poet, essayist, and political activist. Levertov became a civilian nurse during World War II. She married an American writer after the war and moved to the U.S., where she was associated with the Black Mountain group, which included the poets Charles Olson and Robert Duncan. Influenced by the deliberate simplicity of WILLIAM CARLOS WILLIAMS's poetry, she wrote deceptively matter-of-fact verse on both personal and political themes. Among her poetry collections are *Here and Now* (1957), *The Sorrow Dance* (1967), and *The Freeing of the Dust* (1975).

Lévesque \lā-'vek**, René** (b. Aug. 24, 1922, New Carlisle, Que., Can.—d. Nov. 1, 1987, Montreal, Que.) Canadian politician. He joined the Canadian Broadcasting Corporation in 1946, became a war correspondent in Korea in 1952, and was a television commentator from 1956 to 1959. Elected to the Quebec legislature in 1960, he joined the administration of JEAN LESAGE. In 1967 he cofounded a separatist group that combined with others to form the PARTI QUÉBÉCOIS. In 1976 his party won control of the Quebec assembly, and he became premier. He proposed an independent Quebec in economic union with the rest of Canada, an arrangement he called "sovereignty-association." In 1980 his plan was rejected by the Quebec electorate. He resigned in 1985 because of failing health.

Levi \'lē-ˌvī\ In ancient Israel, the third son of the patriarch JACOB. Levi became head of the clans of religious functionaries known as Levites. Unlike the 12 tribes of ISRAEL, the Levites were given no allotment of land when CANAAN was conquered. They are thought to have performed subordinate services associated with public worship, serving as musicians, guardians, Temple officials, judges, and craftsmen.

Levi \'lā-vē**, Primo** (b. July 31, 1919, Turin, Italy—d. April 11, 1987, Turin) Italian writer and chemist. Two years after obtaining a degree in chemistry, Levi, who was Jewish, was captured by the Nazis and sent to Auschwitz as a slave labourer. His autobiographical works—*If This Is a Man*, or *Survival in Auschwitz* (1947), *The Reawakening* (1963), and *The Drowned and the Saved* (1986)—are restrained and moving accounts of and reflections on survival in the Nazi camps. His best-known work, *The Periodic Table* (1975), is a collection of 21 meditations, each named for a chemical element. The lingering effects of his wartime trauma may have led to his suicide.

Lévi \lā-'vē**, Sylvain** (b. March 26, 1863, Paris, France—d. Oct. 30, 1935, France) French scholar of Eastern religion, literature, and history. He taught at the Sorbonne (1889–94) and later for many years at the Collège de France (1894–1935). In 1929, with Takakusu Junjirō, he published a classic dictionary of BUDDHISM. His other writings include the standard treatise *The Indian Theater* (1890), *Nepal* (1905–08), and *India and the World* (1926); he also carried out pioneering studies of the Tocharian languages.

Lévi-Strauss \'lā-vē-'straůs**, Claude** (b. Nov. 28, 1908, Brussels, Belg.) Belgian-French social anthropologist and leading exponent of STRUCTURALISM. Lévi-Strauss originally studied philosophy at the University of

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Paris (1927–32) but went on to teach sociology at the University of São Paulo (1934–37) and to conduct field research on the Indians of Brazil. At the New School for Social Research in New York City (1941–45) he came under the influence of the linguist Roman Jakobson; he came to view culture as a system of communication, analogous to a language, and constructed models based on structural linguistics, information theory, and cybernetics to interpret them. He attempted to identify universal structures of the mind as reflected in myths, cultural symbols, and social organization. From 1950 to 1974 he was director of studies at the École Pratique des Hautes Études, and in 1959 he joined the faculty of the Collège de France. Among his major works are *The Elementary Structures of Kinship* (1949), *Tristes tropiques* (1955), *Structural Anthropology* (1961, vol. 2, 1973), and the four-volume *Mythologiques* (1964–71).

Claude Lévi-Strauss.
AP/WIDE WORLD PHOTOS

Levi Strauss & Co. Leading U.S. manufacturer of casual and active clothing, noted especially for its blue denim jeans. The company traces its origin to Levi Strauss (1829–1902), a Bavarian immigrant who sold dry goods to miners during the California gold rush. Hearing of the miners' need for durable pants, he hired a tailor to make garments out of tent canvas, later substituting denim. In 1873 he and an associate received a patent for the copper riveting they used to strengthen their pants. The company's most spectacular growth occurred after 1946, with the decision to concentrate wholly on manufacturing clothing under its own label. In 1959 it began exporting, and during the 1960s Levi jeans became enormously popular worldwide. The company went public in 1971 and was returned to private control (by Strauss's descendants) in 1985.

Lévinas, Emmanuel (b. Dec. 30, 1905 [Jan. 12, 1906, Old Style], Kaunas, Lith.—d. Dec. 25, 1995, Paris, France) French philosopher. He studied at the Universities of Strasbourg and Freiburg and received a doctorate in philosophy from the Institut de France in 1928. His philosophical work in the 1930s helped to introduce the phenomenology of Edmund Husserl and Martin Heidegger to France. Lévinas's best-known work, *Totality and Infinity* (1961), is a highly original phenomenological investigation of ethics and the self that takes as its starting point the face-to-face encounter between the "I" and the "Other." Extensively developed in *Otherwise Than Being; or, Beyond Essence* (1974) and other writings, this analysis challenged Western philosophical tradition by treating ethics rather than ontology as "first philosophy." Lévinas was also the author of religious studies, including *Difficult Freedom: Essays on Judaism* (1963) and *Nine Talmudic Readings* (1990).

Levine \lə-'vīn**, James (Lawrence)** (b. June 23, 1943, Cincinnati, Ohio, U.S.) U.S. conductor. He debuted as a pianist at age 10 with the Cincinnati Symphony Orchestra. At Juilliard he studied piano with Rosina Lhévinne (1880–1976) and conducting with Jean Morel (1903–75). He was assistant conductor of the Cleveland Orchestra from 1964 to 1970. A guest appearance conducting *Tosca* (1971) led to his appointment as principal conductor (1973) and later music director (1975) and artistic director (1986) of the Metropolitan Opera. He built the flagging Met orchestra into a virtuoso ensemble and became recognized as one of the world's greatest conductors. He served as director of Chicago's Ravinia Festival from 1973 to 1993.

Levinson, Barry (b. April 6, 1942, Baltimore, Md., U.S.) U.S. film director. He worked as a comedy writer for Carol Burnett and Mel Brooks in the 1970s, then made his directorial debut with *Diner* (1982), the first of several movies set in his native city. He followed it with *The Natural* (1984), *Young Sherlock Holmes* (1985), *Tin Men* (1987), and *Good Morning, Vietnam* (1987). Noted for his directorial versatility, ranging from drama and crime stories to political satire, he also created the highly popular *Rain Man* (1988, Academy Award), *Avalon* (1990), *Bugsy* (1991), *Sleepers* (1996), *Wag the Dog* (1997), and *The Perfect Storm* (2000).

levirate and sororate \'le-və-rət...'sȯr-ə-rət\ Customs or laws regulating marriage following the death of a spouse, or in some cases during the lifetime of the spouse. The levirate decrees a dead man's brother to be the widow's preferred marriage partner. In ancient Hebrew society, this practice served to perpetuate the line of a man who died childless. Often, the brother who marries his sister-in-law is a proxy for the deceased and no new marriage is contracted, since all progeny are acknowledged as the seed of the dead man. The sororate decrees the marriage of a man to his deceased wife's sister or, under so-called sororal polygyny, to the wife's younger sisters as they come of age. The latter was practiced by some American Indian tribes in the 19th century and continues among the Australian Aborigines.

Leviticus Rabbah \li-'vi-ti-kəs-rä-'bä\ (c. AD 450) Compilation of 37 compositions on topics suggested by the Old Testament Book of Leviticus. Their message is that the laws of history focus on the holy life of Israel (the Jewish people). If the Jews obey the laws of society aimed at Israel's sanctification, then the foreordained history will unfold as Israel hopes. Israel, for its part, can affect its own destiny. Thus salvation at the end of history depends on sanctification in the here and now.

Levitt, Helen (b. Aug. 31, 1913, New York, N.Y., U.S.) U.S. photographer. She began her career in photography at age 18. Her first show, "Photographs of Children," was held at the Museum of Modern Art in New York in 1943. It featured the subject matter—children, especially the underprivileged—and humanity that characterize much of her work. In the mid 1940s Levitt collaborated with the novelist James Agee, filmmaker Sidney Meyers, and painter Janice Loeb on *The Quiet One*, a prizewinning documentary about a young African American boy. For most of the 1960s she concentrated on film editing and directing. Levitt resumed her pursuit of photography in the 1970s.

Levittown Extensive suburban housing development in Hempstead, Long Island, N.Y. Developed 1946–51 by the firm of Levitt and Sons, Inc., it was an early example of a completely preplanned and mass-produced housing complex. It contained thousands of low-cost homes (with accompanying shopping centers, playgrounds, swimming pools, community halls, and schools). Levitt repeated the formula in Bucks County, Pa. (1951–55). The name Levittown became equated with similar developments built across the country in the postwar building boom. Though once widely deplored, his towns differ from other, usually monotonous, middle-class speculative developments in their meandering roads and lush plantings.

levodopa *or* **L-dopa** Organic compound (L-3,4-dihydroxyphenylalanine) from which the body makes dopamine, a neurotransmitter deficient in persons with parkinsonism. When given orally in large daily doses, levodopa can lessen the effects of the disease. However, it becomes less effective over time and causes abnormal involuntary movements (dyskinesia).

levulose See fructose

Lewes \'lü-əs\ Town (pop., 1998 est.: 14,900), Lewes district, administrative county of East Sussex, historic county of Sussex, England. It lies on the River Ouse 6 mi (10 km) north of the English Channel. In 1264 Simon de Montfort vanquished Henry III at the Battle of Lewes. Historic sites include the ruins of an 11th-century castle and the 16th-century Barbican House (home of Anne of Cleves). An administrative centre, Lewes has some light industry. Glyndebourne, a renowned opera centre, is nearby.

Lewin, Kurt (b. Sept. 9, 1890, Mogilno, Ger.—d. Feb. 12, 1947, Newtonville, Mass., U.S.) German-U.S. social psychologist. After training and teaching in Berlin, he immigrated to the U.S., where he taught at the University of Iowa (1935–45) and later became director of a group dynamics research centre at the Massachusetts Institute of Technology (1945–47). He is best known for his field theory of behaviour, which holds that human behaviour is a function of an individual's psychological environment. To fully understand and predict human behaviour, according to Lewin, one must view the totality of events in a person's psychological field, or "lifespace." His works include *A Dynamic Theory of Personality* (1935) and *Field Theory in Social Science* (1951).

Lewis, C(larence) I(rving) (b. April 12, 1883, Stoneham, Mass., U.S.—d. Feb. 3, 1964, Cambridge, Mass.) U.S. philosopher. He taught primarily at Harvard University (1920–53). His best-known works are *Mind and the World Order* (1929), *Symbolic Logic* (1932), *An Analysis of Knowledge and Valuation* (1947), and *The Ground and Nature of the Right* (1955). He maintained that knowledge is possible only where there

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is also a possibility of error. His position in epistemology represents a synthesis of EMPIRICISM and PRAGMATISM.

Lewis, C(live) S(taples) (b. Nov. 29, 1898, Belfast, Ire.—d. Nov. 22, 1963, Oxford, Oxfordshire, Eng.) Irish-born British scholar and writer. Lewis taught first at Oxford (1925–54) and later at Cambridge (1954–63). An early volume, the critical *Allegory of Love* (1936) on medieval and Renaissance literature, is often considered his finest scholarly work. He became known in England and the U.S. for several series of BBC radio broadcasts during the war years on the subject of Christianity. Many of his books embrace Christian APOLOGETICS; the best known is *The Screwtape Letters* (1942), a satirical epistolary novel in which an experienced devil instructs his young charge in the art of temptation. Also well known are *The Chronicles of Narnia* (1950–56), a series of seven children's stories (including *The Lion, the Witch, and the Wardrobe*, 1950) that have become classics of fantasy; and a science-fiction trilogy, known mostly for its first volume, *Out of the Silent Planet* (1938).

Lewis, (Frederick) Carl(ton) (b. July 1, 1961, Birmingham, Ala., U.S.) U.S. track-and-field athlete. He qualified for the 1980 Olympics but did not participate, because of the U.S. boycott of the Moscow games. At the 1984 Olympics he won the 100-m and 200-m races, the long jump, and the 4 × 100-m relay. At the 1988 Olympics he won the long jump (becoming the first athlete ever to win that event consecutively) and the 100-m race and received a silver medal in the 200-m. In 1992 he again won the long jump and anchored the winning U.S. 4 × 100-m relay team, and in 1996 he astounded observers by winning a fourth consecutive long-jump title.

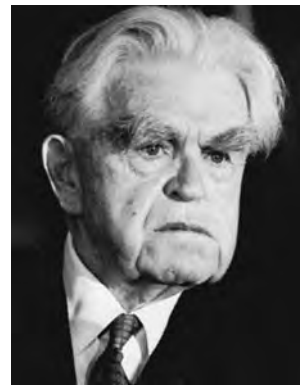
Lewis, David (Kellogg) (b. Sept. 28, 1941, Oberlin, Ohio, U.S.—d. Oct. 14, 2001, Princeton, N.J.) U.S. philosopher. He taught at the University of California at Los Angeles from 1966 to 1970 and thereafter at Princeton University. A wide-ranging thinker, Lewis made important—in some cases groundbreaking—contributions to a number of fields. He was best known for his extreme REALISM regarding POSSIBLE WORLDS; his defense of the IDENTITY THEORY in the PHILOSOPHY OF MIND (see also MIND-BODY PROBLEM); and his doctrine of "Humean supervenience" (named for the ENLIGHTENMENT philosopher DAVID HUME), according to which all truths about any possible world are determined by the distribution of properties attributable to specific points in space and time in that world (see SUPERVENIENCE). At the time of his death, he was widely considered the leading figure in ANALYTIC PHILOSOPHY.

Lewis, Edward B. (b. May 20, 1918, Wilkes-Barre, Pa., U.S.—d. July 21, 2004, Pasadena, Calif.) U.S. geneticist. He received a Ph.D. (1942) in genetics from the California Institute of Technology, where he taught from 1946 to 1988. By crossbreeding thousands of fruit flies, he discovered that genes are arranged on the chromosome in the order corresponding to body segments, an orderliness now known as the colinearity principle. Lewis's work helped explain mechanisms of general biological development, including the causes of deformities present at birth in humans. With Christiane Nüsslein-Volhard and Eric F. Wieschaus, he was awarded a 1995 Nobel Prize.

Lewis, Jerry *orig.* **Joseph Levitch** (b. March 16, 1926, Newark, N.J., U.S.) U.S. actor, director, and producer. In 1946 he developed a nightclub comedy routine with Dean Martin (1917–95), who played the suave crooner to Lewis's zany clown, and they appeared together in 16 movies, including *My Friend Irma* (1949) and *Pardners* (1956), before ending their partnership in 1956. Lewis then directed, produced, and acted in movies such as *The Bellboy* (1960) and *The Nutty Professor* (1963). These films, along with his collaborations with director Frank Tashlin, led many critics (especially in Europe) to regard Lewis as the comic heir to CHARLIE CHAPLIN and BUSTER KEATON. Since 1966 Lewis has hosted the U.S. annual Muscular Dystrophy Telethon.

Lewis, Jerry Lee (b. Sept. 29, 1935, Ferriday, La., U.S.) U.S. rock-and-roll musician. He began playing piano in his childhood, influenced by blues and gospel musicians. He attended Bible school in Texas but was expelled. Returning to Louisiana, he played in several bands, perfecting his signature "pumping" piano technique (the left hand maintaining a driving boogie pattern while the right played flashy ornamentation). His first hits came in 1957 with "Whole Lotta Shakin' Goin' On" and "Great Balls of Fire." In 1958 it was discovered that he had married a 13-year-old relative, and his record sales dropped. Though he had a few more hits, he concentrated on his famously energetic and uninhibited live performances. His career continued to be plagued by controversy.

Lewis, John L(lewellyn) (b. Feb. 12, 1880, near Lucas, Iowa, U.S.—d. June 11, 1969, Washington, D.C.) U.S. labour leader. The son of Welsh immigrants, he became a coal miner at age 15. He rose through the ranks of the UNITED MINE WORKERS OF AMERICA (UMWA) and from 1911 was also an organizer of the American Federation of Labor (AFL), with which the miners' union was affiliated. As president of the UMWA (1920–60), Lewis joined several other AFL union leaders in forming the Committee for Industrial Organization (1935) to organize workers in mass-production industries. On breaking with the AFL (see AFL-CIO), Lewis and other dissident union heads founded the Congress of Industrial Organizations. As its president (1936–40), Lewis presided over the often-violent struggle to introduce unionism into previously unorganized industries such as steel and automobiles. See also WILLIAM GREEN; LABOUR UNION; PHILIP MURRAY.

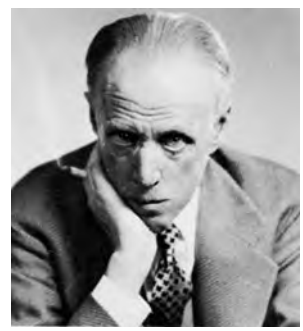


John L. Lewis, 1963
AP/WIDE WORLD PHOTOS

Lewis, Lennox *in full* **Lennox Claudius Lewis** (b. Sept. 2, 1965, London, Eng.) British boxer. His professional career began in 1989 in England. He won the World Boxing Council (WBC) heavyweight title in 1992, lost it in 1994, and recaptured it in 1997. In 1999 he faced American EVANDER HOLYFIELD, who held the heavyweight titles of the World Boxing Association (WBA) and the International Boxing Federation (IBF). In a controversial decision, the fight was called a draw. In the rematch that same year Lewis emerged as the undisputed champion, thereby unifying the heavyweight title. (The IBF and WBA portions of the title were later taken from Lewis because of disputes concerning mandatory fights, but he retained the WBC title and was still considered the undisputed champion by many in boxing.) In his 2002 bout with American MIKE TYSON, Lewis knocked Tyson out in the eighth round.

Lewis, Matthew Gregory (b. July 9, 1775, London, Eng.—d. May 4, 1818, at sea) English novelist and dramatist. The sensational success of his GOTHIC NOVEL *The Monk* (1796) earned him the nickname "Monk" Lewis. Its horror, violence, and eroticism brought it a wide readership, though it was universally condemned. Lewis also wrote a popular music drama in the same vein, *The Castle Spectre* (1798). After inheriting a large fortune in Jamaica in 1812, he sailed twice to the island to inquire about the treatment of slaves on his estates there, and he died at sea. *Journal of a West India Proprietor* (1834) attests to his humane and liberal attitudes.

Lewis, Meriwether (b. Aug. 18, 1774, near Charlottesville, Va.—d. Oct. 11, 1809, near Nashville, Tenn., U.S.) U.S. explorer. After serving in the militia during the Whiskey Rebellion (1794) in western Pennsylvania, he transferred into the regular army. In 1801 he became private secretary to Pres. THOMAS JEFFERSON, who selected him to lead the first overland expedition to the Pacific Northwest, including the area of the LOUISIANA PURCHASE. At Lewis's request, WILLIAM CLARK was appointed to share the command. The success of the LEWIS AND CLARK EXPEDITION (1804–06) was greatly due to Lewis's preparation and skill. At its conclusion, he and Clark each received 1,600 acres of land as a reward. Lewis was named governor of Louisiana Territory in 1808. He died under mysterious circumstances in an inn on the Natchez Trace while en route to Washington; whether his death resulted from murder or suicide is still a subject of controversy.



Sinclair Lewis.
THE GRANGER COLLECTION, NEW YORK

Lewis, (Harry) Sinclair (b. Feb. 7, 1885, Sauk Center, Minn., U.S.—d. Jan. 10, 1951, near Rome, Italy) U.S. novelist and social critic. He worked as a reporter and magazine writer before making his literary reputation with *Main Street* (1920),

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a portrayal of Midwestern provincialism. Among his other popular satirical novels puncturing middle-class complacency are *Babbitt* (1922), a scathing study of a conformist businessman; *Arrowsmith* (1925), a look at the medical profession; *Elmer Gantry* (1927), an indictment of fundamentalist religion; and *Dodsworth* (1929), the story of a rich American couple in Europe. He won the 1930 Nobel Prize for Literature, the first given to an American. His later novels include *Cass Timberlaine* (1945). Lewis's reputation declined in later years, and he lived abroad much of the time. He was married to Dorothy Thompson from 1928 to 1942.

Lewis, (Percy) Wyndham (b. Nov. 18, 1882, on a yacht near Amherst, Nova Scotia, Can.—d. March 7, 1957, London, Eng.) English artist and writer. The founder and principal exponent of Vorticism, Lewis began a short-lived Vorticist review titled *Blast* in 1914. His first novel, *Tarr*, appeared in 1918. *The Childermass* (1928) was followed by the huge satirical novel *The Apes of God* (1930) and *The Revenge for Love* (1937). In the 1930s he produced some of his most noted paintings, including *The Surrender of Barcelona* (1936). He also wrote essays, short stories, and two admired memoirs. Notorious in the 1930s for championing fascism, he later recanted those beliefs.

Lewis and Clark Expedition (1804–06) First overland expedition to the U.S. Pacific coast and back, led by Meriwether Lewis and William Clark. Initiated by Pres. Thomas Jefferson, the expedition set out to find an overland route to the Pacific, documenting its exploration through the new Louisiana Purchase. About 40 men, skilled in various trades, left St. Louis in 1804. They traveled up the Missouri River into present-day North Dakota, where they built Fort Mandan (later Bismarck) and wintered among the Mandan Sioux. They left the next spring, hiring Toussaint Charbonneau and his Indian wife, Sacagawea, who served as guide and interpreter. They traveled through Montana and by horse over the Continental Divide to the headwaters of the Clearwater River. They built canoes to carry them to the Snake River and then to the mouth of the Columbia River, where they built Fort Clatsop (later Astoria, Ore.) and spent the winter. On the journey back the group divided, then reunited to canoe down the Missouri to St. Louis, arriving to great acclaim in September 1806. All but one member of the expedition survived. The journals kept by Lewis and others documented Indian tribes, wildlife, and geography and did much to dispel the myth of an easy water route to the Pacific.

Lexington City (pop., 2000: 260,512), north-central Kentucky, U.S. Named in 1775 for Lexington, Mass., after the Battles of Lexington and Concord, it was chartered in 1782 and was the site of the first session of the Kentucky legislature (1792). Incorporated as a city in 1831, it merged with Fayette county in 1974 to create an urban county government. It is the seat of Transylvania University (founded 1780) and the University of Kentucky, and it is also the headquarters of the American Thoroughbred Breeders Association.

Lexington and Concord, Battles of (April 19, 1775) Initial skirmishes between British soldiers and American colonists that marked the beginning of the American Revolution. En route from Boston to seize the colonists' military stores at Concord, Mass., the British force of 700 was met at Lexington by 77 local minutemen (see minuteman) alerted by Paul Revere and others. Which side fired the first shot is unclear, and resistance soon ended. The British moved on to nearby Concord, where they were met by more than 300 American patriots and were forced to withdraw. On their march back to Boston, they were continually harried by colonists firing from behind barns, trees, and roadside walls. Deaths totaled 273 British and 95 Americans.

Leyden See Leiden

Leyden, Lucas van See Lucas van Leyden

Leyster \'lā-stər**, Judith** (b. July 28, 1609, Haarlem, Neth.—d. Feb. 10, 1660, Heemstede) Dutch painter. A brewer's daughter, she had gained membership in the Haarlem painters' guild by age 24. Many of her known works, primarily portraits, genre paintings, and still lifes, were formerly attributed to her male contemporaries. Though the influence of Frans Hals is clear, she was also interested in the Baroque style of the Utrecht school. She embraced a greater range of subjects than other Dutch painters of the era and was one of the first to depict domestic scenes.

Leyte \'lā-tē\ Island (pop., 2000: 1,952,496) of the Visayan group, eastern Philippines. Occupying an area of 2,785 sq mi (7,214 sq km), it lies southwest of Samar Island, with which it is linked by a 7,093-ft (2,162-m) bridge. Known to 16th-century Spanish explorers as Tandaya, it was under Spanish rule until the late 19th century. Under U.S. control in the early 20th century, its population grew rapidly. During World War II it was occupied by the Japanese, who were ousted by U.S. forces in the Battle of Leyte Gulf. It has two major cities, Ormoc and Tacloban.

Leyte Gulf, Battle of (Oct. 23–26, 1944) Decisive air and sea battle of World War II that gave the Allies control of the Pacific. After the U.S. amphibious landing on the Philippine island of Leyte (Oct. 20), the Japanese reacted with a plan to decoy the U.S. fleet north while moving three attack forces into Leyte Gulf. The U.S. discovery of one of the forces as it moved into position set off three days of continuous surface and air clashes. In the largest naval battle of the war, U.S. forces crippled the Japanese fleet and forced it to withdraw, allowing the U.S. to complete its invasion of the Philippines.

Lezama Lima \lā-'zä-mä-'lē-mä**, José** (b. Dec. 19, 1910, Havana, Cuba—d. Aug. 9, 1976, Havana) Cuban poet, novelist, and essayist. After studying law in Havana, Lezama was associated with several literary reviews and later with a literary group that published the work of young poets who revolutionized Cuban letters. Among his works are the poetry volumes *Muerte de Narciso* (1937) and *La fijeza* (1949) and the essay collections *Analecta del reloj* (1953) and *La expresión americana* (1957). The novel *Paradiso* (1966), considered his masterpiece, reaffirms his faith in his art and his own aestheticism in the face of the 1959 revolution, of which he largely disapproved.

Lhasa \'lä-sə\ Capital (pop., 2003 est.: 129,490), Tibet Autonomous Region, China. Located at an elevation of 11,975 ft (3,650 m) in the Tibetan Himalayas near the Lhasa River, it has served as the religious centre of Tibet since at least the 9th century AD. Lhasa became Tibet's capital in 1642 and remained so after the Chinese communists asserted control of the region in 1951; it was designated capital of the Tibet Autonomous Region in 1965. The 7th-century temple of Gtsug-lag-khang is considered the holiest in Tibet. Other landmarks include the temple of Klu-khang; the Potala Palace, the Dalai Lama's former winter residence; and monasteries. Lhasa is sometimes known as the "Forbidden City" because of its inaccessibility and the traditional hostility of its religious leaders toward outsiders.

Lhasa apso \'lä-sə-'äp-sō\ Breed of dog from Tibet. The Lhasa apso is hardy, intelligent, and watchful. Longer than it is tall, it stands 10–11 in. (25–28 cm) tall and weighs 13–15 lb (6–7 kg). It has a heavily haired tail that curls over its back and a long, profuse coat that covers its eyes. Its coat may be of various colours, but most breeders prefer golden-brown shades.

Lhasa apso
SALLY ANNE THOMPSON/EB INC.

L'Hôpital's rule \ˌlō-pē-'tälz\ Procedure of differential calculus for evaluating indeterminate forms such as 0/0 and ∞/∞ when they result from attempting to find a limit. It states that when the limit of $f(x)/g(x)$ is indeterminate, under certain conditions it can be obtained by evaluating the limit of the quotient of the derivatives of f and g (i.e., $f'(x)/g'(x)$). If this result is indeterminate, the procedure can be repeated. It is named for the French mathematician Guillaume de L'Hôpital (1661–1704), who purchased the formula from his teacher the Swiss mathematician Johann Bernoulli (1667–1748).

Lhotse \'lōt-'sā\ Peak in the Himalayas. Located on the Nepal-Tibet boundary and reaching 27,890 ft (8,501 m), it is one of the world's highest mountains. It is sometimes considered part of Mount Everest's massif because it is joined to that peak by a 25,000-ft (7,600-m) ridge. The Swiss climbers Fritz Luchsinger and Ernest Reiss made the first ascent of the mountain in 1956. Lhotse is Tibetan for "south peak." E^1 was its original survey symbol, denoting Everest-1, given it by the Survey of India in 1931.

Li Ao \'lē-'aù\ (b. 772, China—d. 841) Chinese scholar and high official of the Tang dynasty, who helped reinvigorate Confucianism at a time when it was severely challenged by Buddhism and Daoism. Little is known of Li's life, though he is believed to have known Han Yu. He was much influenced by Buddhism, and he helped integrate many Buddhist ideas into Confucianism. He anticipated the ideas of Neo-Confucianism by

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asserting that human nature and human destiny were central to Confucianism, and he helped establish Mencius as a figure almost equal to Confucius in the eyes of Neo-Confucians.

Li Bai *or* **Li Bo** *or* **Li Pai** *or* **Li Po** *or* **Taibai** (b. 701, Jiangyou, Sichuan province, China—d. 762, Dangtu, Anhui province) Chinese poet. A student of Daoism, he spent long periods wandering and served as an unofficial court poet. His lyrics are celebrated for their exquisite imagery, rich language, allusions, and cadence. A romantic, he was a famous wine drinker and wrote of the joys of drinking, as well as about friendship, solitude, nature, and the passage of time. Popular legend says that he drowned when, sitting drunk in a boat, he tried to seize the moon's reflection in the water. He rivals Du Fu for the title of China's greatest poet.

Li Chunfeng (b. 602, Qizhou, Yong county, China—d. 670, Chang'an) Chinese mathematician and astronomer. He was given a position in the Imperial Astronomical Bureau in 627 following his critique of the Wuyin calendar. He became the deputy director of the Imperial Astronomical Bureau about 641. He participated in the compilation of the official histories of the Jin (265–420) and Sui (581–618) dynasties, writing the chapters containing historical outlines of Chinese astronomy, astrology, metrology, and a mathematical theory of music. In 648 he became the director of the Imperial Astronomical Bureau, and he coedited a collection of mathematical treatises used as manuals in the Mathematical College of the State University. Later he prepared the Linde calendar, which was promulgated in 665 and used until 728.

Li \'lē-'dä-'jaù\ **Dazhao** *or* **Li Ta-chao** (b. Oct. 6, 1888, Hebei province, China—d. April 28, 1927, Beijing) Cofounder with Chen Duxiu of the Chinese Communist Party (CCP). Chief librarian and professor of history at Beijing University, Li became inspired by the success of the Russian Revolution and began to study and lecture on Marxism. In 1921 the study groups Li had created formally became the CCP. Li helped the new party carry out the policy of the Communist International (see Comintern) and cooperated with the Nationalist Party of Sun Yat-sen. His career was cut short when he was seized and hanged by the warlord Zhang Zuolin, but his ideas of a revolution of the impoverished peasantry were brought to fruition by Mao Zedong.

Li \'lē-'hůŋ-'jäŋ\ **Hongzhang** *or* **Li Hung-chang** (b. Feb. 15, 1823, Hefei, Anhui province, China—d. Nov. 7, 1901, Beijing) Chinese statesman who represented China in the series of humiliating negotiations at the end of the Sino-French War (1883–85), Sino-Japanese War (1894–95), and Boxer Rebellion (1900). Much earlier in his career, Li had helped with the suppression of the Taiping Rebellion (1850–64) and had put down the Nian Rebellion (c. 1852–68). At that time, he came in contact with Westerners (notably England's Charles George Gordon) and Western weapons and became convinced that China needed Western-style firepower if it wanted to protect its sovereignty. In 1870, when Li was appointed governor-general of the capital province, Zhili, he was able to build arsenals, found a military academy, establish two modern naval bases, purchase warships, and undertake other "self-strengthening" measures. Through modernization he hoped to preserve traditional China, but within traditional China Li's innovations could not develop fully, and he was fatally hampered by the system he was trying to protect.

Li Keran *or* **Li K'o-jan** *orig.* **Li Yongshun** *alias* **Sanqi** (b. March 26, 1907, Xuzhou, Jiangsu province, China—d. Dec. 5, 1989, Beijing) Chinese painter and art educator. While studying at the Shanghai Art College he was influenced by Kang Youwei, who advocated merging Eastern and Western art to create a new century in Chinese painting. At the Hangzhou National Art College (1929–32) Li studied with the French teacher André Claoudit and developed an abstract and structural painting style that showed the influence of German Expressionism. In 1932 he became a member of the leftist Yiba Art Society. In the 1940s he began to paint cowboys and water buffalo, revitalizing this traditional subject matter with an innovative technique of splashed ink. He joined the faculty of the Beijing National Art College in 1946. While he emulated ancient Chinese calligraphy, his training in oil painting also taught him to apply Western elements, such as chiaroscuro, to his work. In his later years, Li attracted many students and followers, who formed the "Li School" of the 1980s.

Li Po See Li Bai

Li Rui (b. Jan. 15, 1769, Yuanhe, China—d. Aug. 12, 1817, Yuanhe) Chinese mathematician and astronomer who made notable contributions to the revival of traditional Chinese mathematics and astronomy and to the development of the theory of equations. Having failed the Chinese civil service examinations several times, he could obtain no official position and had to make a poor living as an assistant to various mandarins. From about 1800 he began to study the works of the 13th-century mathematicians Li Ye and Qin Jiushao. He found that traditional Chinese methods of solving higher-degree equations had several advantages over algebraic methods that had been recently imported from the West. His *Kaifang shuo* (1820; "On the Method of Extraction") contains his work on the theory of equations: a rule of signs, a discussion of multiple roots and negative roots, and the rule that nonreal roots of an algebraic equation must exist in pairs.

Li Shanlan *also known as* **Li Renshu** *or* **Li Qiuren** (b. Jan. 2, 1811, Haining, Zhejiang province, China—d. Dec. 9, 1882, China) Chinese mathematician. He mastered both traditional Chinese and available Western mathematical treatises at a precocious age. In Shanghai in 1852, he met Alexander Wylie of the London Missionary Society and agreed to collaborate on the translation of Western works. Along with his near contemporary Hua Hengfang, Li left a permanent impression on Chinese mathematical nomenclature and exposition. From 1869 Li was professor of mathematics at the Tongwen Guan college, the first Chinese person to hold such a Western-style position in mathematics.

Li Shaojun \'lē-'shaù-'jün\ (fl. 2nd century BC, China) Chinese alchemist. He was the first person to assert that the Daoist's ultimate goal was to achieve the status of *xian*, immortal sage, and he was responsible for much of the mystical content of popular Daoist thought. Claiming to be several centuries old, he gained the confidence of the great Han emperor Wudi and persuaded him that he could become immortal by praying to Zao Jun, a mythical Chinese figure who produced gold dinnerware that conferred immortality, and by eating from a vessel that had been transmuted into gold. Because of Li's influence, prayers to Zao Jun became established in Daoist ritual, and Zao Jun came to be considered the first great Daoist divinity.

Li Si \'lē-'sü\ *or* **Li Ssu** (b. 280 BC?, Chu state, central China—d. 208 BC, Xianyang, Shaanxi province) Minister of the Qin dynasty in China who utilized the ideas of Hanfeizi to make the Qin the first centralized Chinese empire. His ordering of the "Qin bibliocaust"—the burning of all books—earned him the opprobrium of future generations of Confucian scholars.

Li Sixun *or* **Li Ssu-hsün** (b. 651—d. 716) Chinese painter. Li, who was related to the Tang imperial family, led an active political life and was given the honorary rank of general. His son, Li Zhaodao, was also a famous painter, and thus the father is sometimes called Big General Li and the son Little General Li. While no genuine works survive, both Li Sixun and Li Zhaodao are known to have painted in a highly decorative and meticulous fashion, employing the precise line technique derived from earlier artists such as Gu Kaizhi and Zhan Ziqian. Li is considered the chief exponent of a decoratively coloured landscape style of the Tang dynasty and the founder of the so-called Northern school of professional painters.

Li Ta-chao See Li Dazhao

Li Tang *or* **Li T'ang** (b. c. 1050—d. c. 1130) Chinese painter. He earned the highest rank in the academy of painting of Emperor Huizong, and after the North fell to the Mongols he went to the South and entered the academy of Emperor Song Gaozong. His landscapes serve as a vital link between the earlier, and essentially Northern, variety of monumental landscape, and the more lyrical Southern style of the Ma-Xia school (based on the work of Ma Yuan and Xia Gui). Li perfected the brushstroke texture known as the "ax stroke," which gives a tactile sense to painted rocks and suggests the precise and comprehensive reality that Southern Song artists sought to give their landscapes.

Li Ye *literary name* **Jingzhai** (b. 1192, Luangcheng, Hebei province, China—d. 1279, Yuanshi) Chinese mathematician and scholar-official who contributed to the solution of polynomial equations in one variable. When the Mongols invaded his home district in 1233, Li wandered homeless in Shanxi, Shandong, and Henan provinces. During this period he composed his main work, *Ceyuan haijing* (1248; "Sea Mirror of Circle Measurements"), which contains 170 problems based on one geometric diagram of a circular city wall circumscribed by a right-angled triangle. Although the problems are highly contrived, they enabled Li to list some 692 algebraic formulas for triangular areas and segment lengths. In 1264 Li was appointed to the Hanlin Academy by Kublai Khan. Li strongly criti-

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cized the political and intellectual climate of his time, though, and soon used ill health as a pretext to retire and live as a hermit.

Li Zhizao (b. 1565, Hangzhou, China—d. Nov. 1, 1630, Beijing) Chinese mathematician, astronomer, and geographer whose translations of European scientific books greatly contributed to the spread of Western science in China. In 1601 he met the Italian Jesuit Matteo Ricci, who baptized him in 1610. By engraving and printing numerous copies of Ricci's world map, Li altered many Chinese views of world geography. Li and Ricci translated Christopher Clavius's arithmetic primer *Epitome arithmeticae practicae* (1585; "Selected Arithmetic Methods") as *Tongwen suanzhi* (1614). This book systematically introduced European-style mathematical notation, while Li included complementary elements from traditional Chinese mathematics. He also brought together and published a series of books composed by the Jesuits with Chinese help, *Tianxue chuhan* (1629; "First Collection of Writings on Heavenly Learning"), that included 20 Western scientific and religious titles.

Li Zicheng \'lē-'dzü-'chəŋ\ *or* **Li Tzu-ch'eng** (b. Oct. 3, 1605?, Mizhi, Shaanxi province, China—d. 1645, Hubei province) Rebel leader who brought about the fall of China's MING DYNASTY (1368–1644). A former postal worker, he joined the rebel cause in 1631 following a great famine in the northern part of the country. In 1644 he proclaimed himself the first emperor of a new dynasty and marched on Beijing, which he took easily. His victory was short-lived; WU SANGUI, a general loyal to the Ming, called on the MANCHU tribes to drive him out, and he fled north, where he was probably killed by local villagers. See also DORGON.

liability, limited See LIMITED LIABILITY

liability insurance Insurance against claims of loss or damage for which a policyholder might have to compensate another party. The policy covers losses resulting from acts or omissions that are legally deemed to be negligent and that result in damage to the person, property, or legitimate interests of others. It was principally the introduction of the automobile that spurred the rapid growth of this form of insurance, which now extends to a great many activities in addition to driving, including MALPRACTICE insurance for doctors and other professionals, marine liability for boat owners and operators, and product liability for manufacturers of consumer goods. See also CASUALTY INSURANCE, CONSUMER PROTECTION.

liana \lē-'ä-nə\ *or* **liane** \lē-'än\ Any of various long-stemmed, woody VINES, especially of tropical rain forests, that are rooted in the soil and climb or twine around other plants as they grow upward. Lianas often form a tangled network, up to 330 ft (100 m) high, around and among the trees that support them.

Liao dynasty \'lyaù\ (907–1125) Dynasty formed by the nomadic Khitan tribes in much of present-day Manchuria, Mongolia, and the northeastern corner of China proper. The Chinese portion of the empire was governed on the TANG pattern, while the northern part was set up on a tribal basis. After the establishment of the SONG DYNASTY (960–1279), the Liao carried out a border war for control of northern China. Eventually the Song agreed to pay the Liao an annual tribute. The JUCHEN, former subjects of the Liao, destroyed the dynasty in 1125 but adopted most of its governmental system. The name "Cathay" for China derives from Khitay, another name for the Khitan.

Liao \'lyaù\ **River** River, LIAONING province and INNER MONGOLIA autonomous region, China. The East Liao rises in the mountains of Jilin province and the West Liao in southeastern Inner Mongolia. They merge and flow southwest as the Liao to empty into the Gulf of Liaodong, after a course of 836 mi (1,345 km). The river's drainage basin occupies 83,000 sq mi (215,000 sq km). It is navigable by small boats for about 400 mi (645 km) from its mouth.

Liaodong \'lyaù-'dùŋ\ **Peninsula** *or* **Liao-tung Peninsula** Peninsula, extending from the southern coastline of LIAONING province, northeastern China. It partly separates the BO HAI (Gulf of Chihli) on the west from Korea Bay on the east. It forms part of a mountain belt that continues in the Changbai Mountains; on the peninsula the range is known as the Qian Mountains. Near the southern tip of the peninsula lies the port of DALIAN.

Liaoning \'lyaù-'niŋ\ *formerly (1903–28)* **Fengtian** *or* **Feng-t'ien** \'fəŋ-'tyen\ Province (pop., 2002 est.: 42,030,000), northeastern China. It lies on the YELLOW SEA and is bordered by NORTH KOREA, JILIN and HEBEI provinces, and INNER MONGOLIA. With an area of 58,300 sq mi (151,000 sq km), it is the southernmost of the three provinces that form the region of MANCHURIA. Its capital is SHENYANG. It has four main topographical regions: the central plains, the LIAODONG PENINSULA, the western highlands, and the eastern mountain zone. In 1932–45 it was part of the Japanese puppet state of MANCHUKUO. Shenyang was taken by the Chinese communists in 1948. Liaoning is China's most industrialized province, producing steel, cement, crude oil, and electrical power.

liar paradox Paradox derived from the statement attributed to the Cretan prophet Epimenides (6th century BC) that all Cretans are liars. If Epimenides' statement is taken to imply that all statements made by Cretans are false, then since Epimenides was a Cretan, his statement is false (i.e., not all Cretans are liars). The paradox's simplest form arises from considering the sentence "This sentence is false." If it is true, then it is false, and if it is false, then it is true. Consideration of such semantic PARADOXES led logicians to distinguish between object language and metalanguage and to conclude that no language can consistently contain a complete semantic theory for its own sentences.

Liard River \'lē-ərd\ River, northwestern Canada. Rising in the Yukon Territory, it flows southeast through British Columbia. It then turns northeast and empties into the MACKENZIE RIVER in the Northwest Territories, after a course of 693 mi (1,115 km). Its upper course has rapids and canyons; its lower course is navigable for small boats. It is named for the liards (poplar trees) along its course.

Libby, Willard (Frank) (b. Dec. 17, 1908, Grand Valley, Colo., U.S.—d. Sept. 8, 1980, Los Angeles, Calif.) U.S. chemist. He studied at the University of California at Berkeley and later taught there and at the University of Chicago and UCLA. With the MANHATTAN PROJECT, he helped develop a method for separating URANIUM ISOTOPES and showed that TRITIUM is a product of cosmic radiation. In 1947 he and his students developed CARBON-14 DATING, which proved to be an extremely valuable tool for archaeology, anthropology, and earth science and earned him a 1960 Nobel Prize.

libel See DEFAMATION

Liber Augustalis See Constitutions of MELFI

Liberace \ˌlib-ə-'rä-chē\ *orig.* **Wladziu Valentino Liberace** (b. May 16, 1919, West Allis, Wis., U.S.—d. Feb. 4, 1987, Palm Springs, Calif.) U.S. pianist. Born to Polish and Italian immigrants, he appeared as a soloist with the Chicago Symphony Orchestra at age 16. He began giving concerts in flamboyant costumes with ornate pianos and candelabra, and though he occasionally performed with symphony orchestras, he built his career playing primarily popular music. Hugely successful, he hosted his own television variety series, *The Liberace Show* (1952–55, 1969), and appeared in films such as *Sincerely Yours* (1955). In later years he performed frequently in Las Vegas, Nev.

liberal arts College or university curriculum aimed at imparting general knowledge and developing general intellectual capacities, in contrast to a professional, vocational, or technical curriculum. In Classical antiquity, the term designated the education proper to a freeman (Latin *liber*, "free") as opposed to a slave. In the medieval Western university, the seven liberal arts were grammar, rhetoric, and logic (the *trivium*) and geometry, arithmetic, music, and astronomy (the *quadrivium*). In modern colleges and universities, the liberal arts include the study of literature, languages, philosophy, history, mathematics, and science.

Liberal-Democratic Party (LDP) Japan's largest political party, which held power almost continuously from its formation in 1955 until 1993. It was created through the amalgamation and transformation of various factions of the prewar RIKKEN SEIYŪKAI and Minseitō parties. The conservative LDP appeared threatened in the 1970s but survived; the end of the 1980s boom years (the "bubble economy"), financial crises, and political scandals finally caused the party to lose its majority in the Diet in 1993. It came back to power in a coalition government in 1994, and since then LDP prime ministers have included OBUCHI KEIZŌ and KOIZUMI JUN'ICHIRŌ.

Liberal Party British political party that emerged in the mid-19th century as the successor to the WHIGS. It was the major party in opposition to the CONSERVATIVE PARTY until 1918, after which it was supplanted by the LABOUR PARTY. It was initially supported by the middle class that was enfranchised by the REFORM BILL OF 1832. Earl RUSSELL's administration in 1846 is sometimes regarded as the first Liberal government, but the first unequivocally Liberal government was formed in 1868 by WILLIAM E.

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Gladstone. Under Gladstone, until 1894, the party's hallmark was reform; after 1884 it espoused Irish Home Rule. It championed individualism, private enterprise, human rights, and promotion of social justice; wary of imperial expansion, it was pacific and internationalist. During World War I it split into two camps, centred on H.H. Asquith and David Lloyd George. It continued as a minor party until 1988, when it merged with the Social Democratic Party to form the Liberal Democratic Party.

Liberal Party of Canada One of the two major Canadian political parties. It originated in two reformist opposition groups, Rouges and Clear Grits, that emerged in the mid-19th century in what are now the provinces of Quebec and Ontario, respectively. The first Liberal government was headed by Alexander Mackenzie (1873–78). The party regained power under Wilfred Laurier (1896–1911) and was the ruling party for much of the 20th century under such prime ministers as W.L. Mackenzie King, Louis Saint Laurent, Lester Pearson, Pierre Trudeau, and Jean Chrétien. Like the Conservative Party (later the Progressive Conservative Party), the Liberal Party comprises diverse regional, ethnic, religious, and class interests.

liberalism Political and economic doctrine that emphasizes the rights and freedoms of the individual and the need to limit the powers of government. Liberalism originated as a defensive reaction to the horrors of the European wars of religion of the 16th century (see Thirty Years' War). Its basic ideas were given formal expression in works by Thomas Hobbes and John Locke, both of whom argued that the power of the sovereign is ultimately justified by the consent of the governed, given in a hypothetical social contract rather than by divine right (see divine kingship). In the economic realm, liberals in the 19th century urged the end of state interference in the economic life of society. Following Adam Smith, they argued that economic systems based on free markets are more efficient and generate more prosperity than those that are partly state-controlled. In response to the great inequalities of wealth and other social problems created by the Industrial Revolution in Europe and North America, liberals in the late 19th and early 20th centuries advocated limited state intervention in the market and the creation of state-funded social services, such as free public education and health insurance. In the U.S. the New Deal program undertaken by Pres. Franklin D. Roosevelt typified modern liberalism in its vast expansion of the scope of governmental activities and its increased regulation of business. After World War II a further expansion of social welfare programs occurred in Britain, Scandinavia, and the U.S. Economic stagnation beginning in the late 1970s led to a revival of classical liberal positions favouring free markets, especially among political conservatives in Britain and the U.S. Contemporary liberalism remains committed to social reform, including reducing inequality and expanding individual rights. See also conservatism; individualism.

liberalism, theological School of religious thought characterized by concern with inner motivation as opposed to external controls. It was set in motion in the 17th century by René Descartes, who expressed faith in human reason, and it was influenced by such philosophers as Benedict de Spinoza, G. W. Leibniz, and John Locke. Its second stage, which coincided with the Romantic movement of the late 18th and 19th century, was marked by an appreciation of individual creativity, expressed in the writings of philosophers such as Jean-Jacques Rousseau and Immanuel Kant as well as of the theologian Friedrich Schleiermacher. The third stage, from the mid-19th century through the 1920s, emphasized the idea of progress. Stimulated by the Industrial Revolution and by Charles Darwin's *Origin of Species* (1859), thinkers such as T. H. Huxley and Herbert Spencer in England and William James and John Dewey in the U.S. focused on the psychological study of religious experience, the sociological study of religious institutions, and philosophical inquiry into religious values.

liberation theology Roman Catholic movement that originated in the late 20th century in Latin America and seeks to express religious faith by helping the poor and working for political and social change. It began in 1968, when bishops attending the Latin American Bishops' Conference in Medellín, Colom., affirmed the rights of the poor and asserted that industrialized nations were enriching themselves at the expense of the Third World. The movement's central text, *A Theology of Liberation* (1971), was written by the Peruvian priest Gustavo Gutiérrez (b. 1928). Liberation theologians have sometimes been criticized as purveyors of Marxism, and the Vatican has sought to curb their influence by appointing more conservative prelates.

Liberation Tigers of Tamil Eelam *or* **Tamil Tigers** Guerrilla organization seeking to establish an independent Tamil state in northern and eastern Sri Lanka. Formed in 1972, it is considered one of the world's most sophisticated and tightly organized insurgent groups. By 1985 it controlled the port of Jaffna and most of the Jaffna Peninsula in northern Sri Lanka. After losing control of Jaffna in 1987, it carried out several attacks, including the assassinations of the Sri Lankan president and the former Indian prime minister and a suicide bombing that killed 100 people in the capital of Colombo. Negotiations between the Tigers and the government broke down in the mid-1990s, and fighting subsequently intensified until February 2002 when a permanent cease-fire agreement was signed.

Liberia *officially* **Republic of Liberia** Republic, western Africa. Area: 37,743 sq mi (97,754 sq km). Population (2005 est.): 2,900,000. Capital: Monrovia. Liberia's ethnic groups include the Americo-

Liberians, descendants of the black freedmen who emigrated from the U.S. in the 19th century; and 16 indigenous peoples of the Mande, Kwa, and Mel linguistic groups. Languages: English (official), indigenous languages. Religions: traditional beliefs, Christianity, Islam. Currency: Liberian dollar. Liberia has coastal lowlands extending 350 mi (560 km) along the Atlantic; farther inland are hills and low mountains. Roughly one-fifth of Liberia consists of tropical rainforest. Agriculture is the main component of the economy, but only a portion of the arable land is cultivated. The country also has rich iron-ore reserves, which are a major source of exports. The principal cash crops are rubber, coffee, and cacao; the staple crops are rice and cassava. Constitutionally, Liberia is a republic with two legislative houses, and its head of state and government is the president; however, since 2003 it has been under a transitional government with a chairman. Africa's oldest republic, Liberia was established on land acquired for freed U.S. slaves by the American Colonization Society, which founded a colony at Cape Mesurado in 1821. In 1822 Jehudi Ashmun, a Methodist minister, became the director of the settlement and Liberia's real founder. In 1824 the territory was named Liberia, and its main settlement was named Monrovia. Joseph Jenkins Roberts proclaimed Liberian independence in 1847 and expanded its boundaries. Border disputes with the French and British lasted until 1892, when its boundaries were officially established. In 1980 a coup led by Gen. Samuel K. Doe marked the end of the Americo-Liberians' long political dominance over the indigenous Africans. A rebellion in 1989 escalated into a destructive civil war in the 1990s. A peace agreement was reached in 1996, but fighting broke out again in 1999 and lasted until 2003, when a transitional government was installed, backed by UN peacekeepers.

libertarianism Political philosophy that stresses personal liberty. Libertarians believe that individuals should have complete freedom of action, provided their actions do not infringe on the freedom of others. Liber-

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tarianism's distrust of government is rooted in 19th-century ANARCHISM. Typical libertarians oppose not only the income tax and other government impositions but also programs seen by many as beneficial, such as social security and the postal service. In the U.S. their views often crosscut traditional party boundaries (e.g., libertarians oppose gun control, as do most Republicans, but support the legalization of prohibited drugs, as do some liberal Democrats). Among the thinkers embraced by libertarians are HENRY DAVID THOREAU and AYN RAND.

Liberty, Sons of Organization of American colonists formed in 1765 to oppose the STAMP ACT. The name was taken from a speech by Isaac Barré in the British Parliament that referred to American colonials who opposed unjust British measures as "sons of liberty." The group agitated for colonial resistance and helped prevent enforcement of the Stamp Act. After the act's repeal, the organization continued to oppose British measures against the colonists.

Liberty Party (1840–48) U.S. political party formed by a splinter group of abolitionists. It was created by ARTHUR TAPPAN and THEODORE WELD in opposition to WILLIAM LLOYD GARRISON, who scorned political action as a futile way to end slavery. At its first party convention in 1840, JAMES BIRNEY was nominated for U.S. president. By 1844 the party had influenced undecided legislators in many local elections to adopt antislavery stands. In 1848 it dissolved when many of its members joined the Barnburners (see HUNKERS AND BARNBURNERS) to form the FREE SOIL PARTY.

libido \lə-'bē-dō\ Physiological and emotional energy associated with the sex drive. The concept was originated by SIGMUND FREUD, who saw the libido as linked not only with sexual desire but with all constructive human activity. He believed that psychiatric illnesses were the result of misdirecting or suppressing the libido. CARL GUSTAV JUNG used the term more broadly to encompass all life processes in all species.

Libra (Latin: "Scales") In astronomy, the constellation lying between Scorpio and Virgo; in ASTROLOGY, the seventh sign of the ZODIAC, governing approximately the period September 22–October 23. Its symbol is either a woman holding a balance scale or the scale alone. The woman is sometimes identified with Astraea, the Roman goddess of justice.

library Collection of information resources in print or in other forms that is organized and made accessible for reading or study. The word derives from the Latin *liber* ("book"). The origin of libraries lies in the keeping of written records, a practice that dates at least to the 3rd millennium BC in Babylonia. The first libraries as repositories of books were those of the Greek temples and those established in conjunction with the Greek schools of philosophy in the 4th century BC. Today's libraries frequently contain periodicals, microfilms, tapes, videos, compact discs, and other materials in addition to books. The growth of on-line communications networks has enabled library users to search electronically linked databases worldwide. See also LIBRARY SCIENCE.

library classification System of arrangement adopted by a library to enable patrons to locate its materials quickly and easily. Classifications may be natural (e.g., by subject), artificial (e.g., by alphabet, form, or numerical order), or accidental (e.g., chronological or geographic). They also vary in degree; some have minute subdivisions while others are broader. Widely used systems include the DEWEY DECIMAL CLASSIFICATION, the Library of Congress Classification, the Bliss Classification, and the Colon Classification; special libraries may devise their own unique systems.

Library of Alexandria See LIBRARY OF ALEXANDRIA

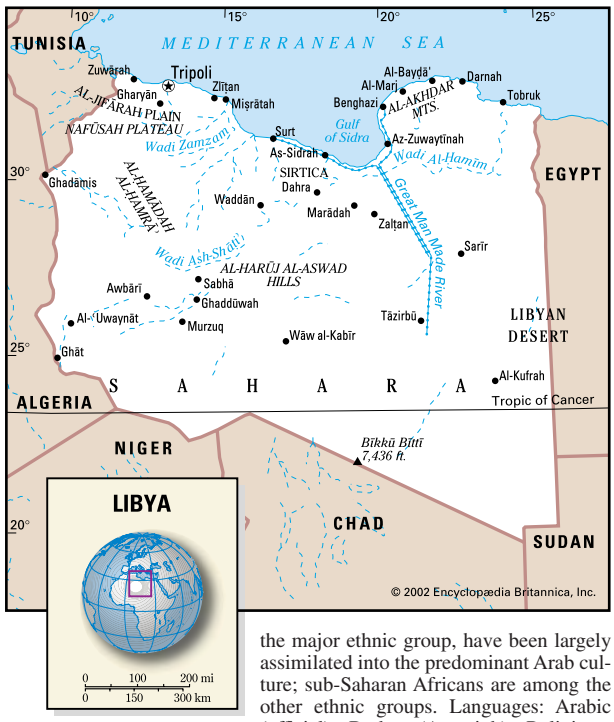
Library of Congress U.S. library, the largest and one of the greatest of what may be considered national libraries. Founded in Washington, D.C., in 1800, it was housed in the Capitol until the building was burned by British troops in 1814; it moved to permanent quarters in 1897. In addition to serving as a reference source for members of Congress and other government officers, it is outstanding among the learned institutions of the world, with magnificent collections of books, manuscripts, music, prints, and maps. It contains some 18 million books, 2.5 million recordings, 12 million photographs, 4.5 million maps, and more than 54 million manuscripts.

Library of Congress Classification *or* **LC Classification** System of library organization developed during the reorganization of the U.S. Library of Congress. It consists of separate, mutually exclusive, special classifications, often having no connection save the accidental one of alphabetical notation. The arrangement roughly follows groupings of social sciences, humanities, and natural and physical sciences. It divides the field of knowledge into 20 large classes and an additional class for general works. Each main class has a synopsis that also serves as a guide. The resulting order is from the general to the specific and from the theoretical to the practical. The LC Classification has largely replaced the DEWEY DECIMAL CLASSIFICATION in university, special, and government libraries.

library science Principles and practices of library operation and administration, and their study. It emerged as a separate field of study in the second half of the 19th century. The first training program for librarians in the U.S. was established by MELVIL DEWEY in 1887. In the 20th century, library science was gradually subsumed under the more general field of INFORMATION SCIENCE. Today's graduate programs in library and information science are accredited by the American Library Association (founded 1876) and prepare students for professional positions in other areas of the information industry as well.

Libreville \'lē-brə-ˌvil\ City (pop., 1993: 362,386), capital of GABON, located on the northern shore of the Gabon Estuary. Pongoue people first settled the region after the 16th century, followed by the Fang in the 19th century. The French built a fort on the estuary's northern bank in 1843, and in 1849 a settlement of freed slaves and a group of Pongoue villages were given the name Libreville. In 1850 France abandoned its fort and resettled on the plateau, now the commercial and administrative centre of the city. It is well industrialized and is Gabon's educational centre. Libreville was the capital of French Equatorial Africa from 1888 to 1904.

Libya *officially* **Socialist People's Libyan Arab Jamahiriya** \ˌja-mə-hi-'rē-yə\ Country, North Africa. Area: 679,362 sq mi (1,759,540 sq km). Population (2005 est.): 5,853,000. Capital: TRIPOLI. Berbers, once



the major ethnic group, have been largely assimilated into the predominant Arab culture; sub-Saharan Africans are among the other ethnic groups. Languages: Arabic (official), Berber (Amazigh). Religions: Islam (official; predominantly Sunni); also Christianity. Currency: Libyan dinar. All but two tiny fractions of Libya are covered by the SAHARA: Tripolitania in the northwest and Cyrenaica in the northeast. Tripolitania is Libya's most important agricultural region and its most populated area. The production and export of petroleum are the basis of Libya's economy; other resources include natural gas, manganese, and gypsum. Livestock raising, including sheep and goats, is important in the north. Libya is a socialist state with one policy-making body; the head of government is the prime minister, but MUAMMAR AL-QADDAFI has been the de facto head of state and real power in Libya since 1970. The early history is that of FEZZAN, CYRENAICA, and TRIPOLITANIA, which the Ottoman Empire combined under one regency in Tripoli in the 16th century. In 1911 Italy claimed

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control of Libya, and, by the outbreak of World War II (1939–45), 150,000 Italians had immigrated there. The scene of much fighting in the war, it became an independent state in 1951 and a member of the Arab League in 1953. The discovery of petroleum in 1959 brought wealth to Libya. A decade later, a group of army officers led by al-Qaddafi deposed the king and made the country an Islamic republic. Under al-Qaddafi, Libya supported the Palestinian Liberation Organization (PLO) and allegedly provided aid for international terrorist groups. Intermittent warfare with Chad that had begun in the 1970s ended with Libya's defeat in 1987. A U.S. trade embargo (endorsed by the UN), imposed on Libya in the 1990s for its purported connection to terrorism, began to be lifted in 2003.

Libyan Desert Northeastern portion of the Sahara, extending from eastern Libya through southwestern Egypt into northwestern Sudan. The highest point is Mount ʿUwaynat (6,345 ft [1,934 m]), located where the three countries meet. Harsh and arid, it is characterized by bare rocky plateaus and sandy plains.

Licchavi \'lich-ə-vē\ **era** (c. 450–c. 750) In Nepal, the period of rule by the Licchavi dynasty. The dynasty originated in India, used Sanskrit as a court language, and issued Indian-style coins. It maintained close ties to India and also had economic and political relations with Tibet, thus becoming a cultural centre linking central and southern Asia. The era ended when Amsuvarman founded the Thakuri dynasty in the mid-8th century.

lichee See litchi

lichen \'lī-kən\ Any of about 15,000 species of small, colourful, scaly plants that consist of a symbiotic association of algae (usually green) and fungi (see fungus). These extremely hardy, slow growers often are pioneer species in sparse environments such as mountaintops and the far North. Fungal cells, anchored to the substrate with hairlike growths (rhizines), form the base. In the body (thallus), numerous algal cells are distributed among fewer fungal cells. Through photosynthesis the algal cells provide simple sugars and vitamins for both partners in this symbiotic association. The fungal cells protect the algal cells from environmental extremes. Lichens may form a thin, crustlike, tightly bound covering over their substrate (e.g., cracks in rocks), or they may be small and leafy, with loose attachments to the substrate. Their colours range from brown to bright orange or yellow. In far northern Europe and Asia, lichens provide two-thirds of caribou and reindeer food. They have been the source of medicines and dyes.

Lichtenstein \'lik-tən-ˌstīn, 'lik-tən-ˌstēn**, Roy** (b. Oct. 27, 1923, New York, N.Y., U.S.—d. Sept. 29, 1997, New York City) U.S. painter, sculptor, and graphic artist. He at first embraced Abstract Expressionism, but in the 1960s he turned to Pop art for which he is best known. Especially popular are his brilliantly coloured paintings in the style of large-scale comic strips, such as *Whaam* (1963). In the mid 1960s he began making Pop versions of well-known paintings by artists such as Claude Monet, Pablo Picasso, and Henri Matisse. In the 1970s he also made sculptures, in which he reproduced Art Deco forms. In the 1980s he painted a five-story-high mural in a New York City office building.

Licinius \lə-'si-nē-əs\ *orig.* **Valerius Licinianus Licinius** (d. 325) Roman emperor (308–324). Born of Illyrian peasant stock, he advanced in the army and in 308 was appointed augustus by his friend the emperor Galerius. Because the empire was split up among several emperors at that time (see tetrarch), his domain was confined to Pannonia. After the death of Galerius in 311, he allied with Constantine I, defeated his competitor Maximinus in Asia Minor, and partitioned the empire (313). Although reputedly converted to Christianity, he grew alienated and launched a campaign of mild persecution against the Christians c. 320. Constantine soon drove him from power and had him executed.

Licking River River, eastern Kentucky, U.S. It flows about 320 mi (515 km) generally northwest to enter the Ohio River at Covington, Ky., opposite Cincinnati, Ohio. It courses through an area of saline springs, which originally attracted animals to its salt licks.

Licklider \'lik-ˌlid-ər**, Joseph Carl Robnett** (b. March 11, 1915, St. Louis, Mo., U.S.—d. June 26, 1990, Arlington, Mass.) U.S. scientist. He studied math and physics and received a doctorate in psychology from the University of Rochester (N.Y.). He lectured at Harvard University before joining the faculty at MIT (1949–57, 1966–85). As a group leader at the Advanced Research Projects Agency (ARPA) in the 1960s, he encouraged research into time-sharing and helped lay the groundwork for computer networking and ARPANET, the predecessor of the Internet. He is known for his extensive work on human-computer interaction and interfaces. His influence led to the first American advanced-degree programs in computer science.

licorice \'li-krish\ Perennial herb (*Glycyrrhiza glabra*) of the pea family (see legume) and the flavouring, confection, and medicine made from its roots. Native to southern Europe, the plant is cultivated around the Mediterranean and in parts of the U.S. It grows to 3 ft (1 m) and bears graceful compound leaves, blue-violet flower clusters, and flat, flexible seedpods 3–4 in. (7–10 cm) long. It is 42 times sweeter than table sugar, and its flavour, similar to anise, can mask unpleasant medicinal tastes.

Spanish licorice (*Glycyrrhiza glabra*).
A TO Z BOTANICAL COLLECTION/EB INC.

Liddell Hart \ˌlid-ᵊl-'härt**, Sir Basil (Henry)** (b. Oct. 31, 1895, Paris, France—d. Jan. 29, 1970, Marlow, Buckinghamshire, Eng.) British military historian and strategist. He left Cambridge University to join the British army at the outbreak of World War I and retired as a captain in 1927. He was an early advocate of air power and mechanized tank warfare. He wrote for London newspapers from 1925 to 1945. His writings on strategy, which emphasized the elements of mobility and surprise, were more influential in Germany than in France or England; his "expanding torrent" theory of attack became the basis for German blitzkrieg warfare in 1939–41. The author of more than 30 books, he was knighted in 1966.

Lie \'lē**, Jonas (Lauritz Idemil)** (b. Nov. 6, 1833, Hokksund in Eiker, Nor.—d. July 5, 1908, Stavern) Norwegian novelist. He wrote his first novel, *The Visionary or Pictures from Nordland* (1870), with his wife's collaboration. Later novels include *The Barque "Future"* (1872), *One of Life's Slaves* (1883), and the classic *The Family at Gilje* (1883), which deals with the position of women. He sought to reflect in his writings the nature, folk life, and social spirit of his country. With Henrik Ibsen, Bjornstjerne Bjornson, and Alexander Kielland (1849–1906), he is considered one of "the four great ones" of 19th-century Norwegian literature.

Lie \'lē**, Trygve** (b. July 16, 1896, Kristiania, Nor.—d. Dec. 30, 1968, Geilo) First secretary-general of the United Nations (1946–52). Educated in law at the University of Kristiania (Oslo), Lie was active in the Norwegian Labour Party before being appointed foreign minister of Norway's government-in-exile during World War II. As a member of the Norwegian delegation to the UN Conference on International Organization (1945), he helped draft the provisions for the United Nations Security Council. As secretary-general, he helped to secure the removal of Soviet troops from Iran; he also dealt with the first Arab-Israeli war and the India-Pakistan conflict over Kashmir. The Soviet Union ceased to cooperate with him after he supported UN intervention in the Korean War, and his effectiveness was further hampered by charges from anticommunist politicians in the U.S. that his secretariat had employed subversives. He resigned in 1952.

lie detector *or* **polygraph** Instrument for recording physiological phenomena (including blood pressure, pulse rate, and respiration) of a human subject as he or she answers questions asked by an operator. These data (recorded as graphs) are used as the basis for judging whether the subject is lying. The phenomena usually chosen for recording are those not easily controlled voluntarily. The types of questions asked, their wording, and the mode of presentation have a tremendous effect on the results and their reliability. Used in police interrogation and investigation since 1924, the lie detector is still controversial among psychologists and not always accepted as evidence in courts.

Liebermann \'lē-bər-ˌmän**, Max** (b. July 20, 1847, Berlin, Prussia—d. Feb. 8, 1935, Berlin, Ger.) German painter and etcher. The realism and simplicity of his first exhibited painting, *Women Plucking Geese* (1872), were in striking contrast to the Romantic, idealized art then in vogue. In the summer of 1873 he lived in Barbizon, where he became acquainted with the Barbizon school of painters; as a result of their influence, he brightened his palette and helped initiate the German school of Impressionism. In the 1880s he found his subjects in the orphanages and asylums for the old in Amsterdam and among the peasants and urban

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labourers of Germany and The Netherlands. As a supporter of such academically unpopular styles as Impressionism and Art Nouveau, he founded the Berlin Sezession (1899) but later became president of the conservative Berlin Academy.

Liebig \'lē-bi̇g**, Justus, Freiherr (baron) von** (b. May 12, 1803, Darmstadt, Hesse-Darmstadt—d. April 18, 1873, Munich, Bavaria) German chemist. He made many important contributions to the early systematization of organic chemistry and to biochemistry, chemical education, and agricultural chemistry. He was the first to demonstrate the existence of free radicals and did much to clarify the properties of acids. He developed simple analytical methods (see analysis) that greatly aided his work, analyzed many tissues and body fluids, and showed that plants use carbon dioxide, water, and ammonia. In later years his reputation became so great that he was regarded as the final authority in chemical matters, and he was often involved in scientific controversies.

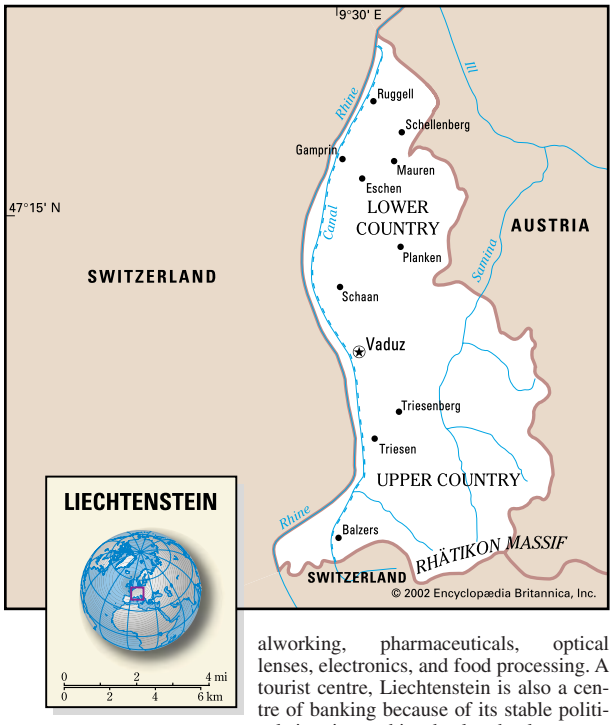
Liebknecht \'lēp-ˌkne̯kt**, Karl** (b. Aug. 13, 1871, Leipzig, Ger.—d. Jan. 15, 1919, Berlin) German socialist leader. Son of Wilhelm Liebknecht, he became a lawyer and a Marxist. In 1912 he entered the Reichstag and led the opposition to Germany's pre-World War I policy. In 1916 he was expelled from the Social Democratic Party for opposing its leadership and came into close alliance with Rosa Luxemburg, with whom he founded the Spartacists. He was imprisoned (1916–18) for advocating the overthrow of the government. In 1918 he played a leading role in forming the German Communist Party. A series of bloody clashes culminated in the January 1919 putsch in which Liebknecht resorted to force; he was shot on the pretext that he was attempting to escape arrest.

Karl Liebknecht, 1913
INTERFOTO-FRIEDRICH RAUCH, MUNICH

Wilhelm Liebknecht, *c.* 1890
ARCHIV FUR KUNST UND GESCHICHTE, BERLIN

Liebknecht, Wilhelm (b. March 29, 1826, Giessen, Hesse—d. Aug. 7, 1900, Berlin, Ger.) German socialist, cofounder of the German Social Democratic Party. Imprisoned for participating in the Revolutions of 1848, he lived in exile in England (1849–62), working closely with Karl Marx and Friedrich Engels. Prussia granted him amnesty in 1862, but Otto von Bismarck had him expelled again in 1865. In Leipzig he and August Bebel organized the Social Democratic Labour Party in 1869. He was imprisoned (1872–74) for his writings against the Franco-Prussian War. Bismarck's repression of the socialists brought about a merger with the followers of Ferdinand Lassalle in 1875. With the expiration of the Anti-Socialist Law (1878–90), this party became known as the German Social Democratic Party. Liebknecht continued as a leading spokesman, primarily as a writer for the party's newspaper, *Vorwärts*.

Liechtenstein \'lik-tən-ˌshtīn\ *officially* **Principality of Liechtenstein** Principality, western Europe. It is located between Switzerland and Austria. Area: 62 sq mi (160 sq km). Population (2005 est.): 34,800. Capital: Vaduz. The Liechtensteiners are descended from the Alemanni tribe that came into the region after AD 500. Languages: German (official), Alemanni dialect, Walser dialect. Religions: Christianity (predominantly Roman Catholic; also Protestant); also Islam. Currency: Swiss franc. The eastern two-thirds of Liechtenstein's small territory is composed of the foothills of the Rhätikon Massif, part of the central Alps. The western section of the country is occupied by the Rhine River floodplain. Liechtenstein has no natural resources of commercial value, and virtually all raw materials, including wood, have to be imported. Manufacturing includes metalworking, pharmaceuticals, optical lenses, electronics, and food processing. A tourist centre, Liechtenstein is also a centre of banking because of its stable political situation and its absolute bank secrecy. It is a constitutional monarchy with one legislative house; its chief of state is the prince, and the head of government is the prime minister. The Rhine plain was occupied for centuries by two independent lordships of the Holy Roman Empire, Vaduz and Schellenberg. The principality of Liechtenstein, consisting of these two lordships, was founded in 1719 and remained part of the Holy Roman Empire. It was included in the German Confederation (1815–66). In 1866 it became independent, recognizing Vaduz and Schellenberg as unique regions forming separate electoral districts. In 1921 it adopted Swiss currency, and in 1923 it joined the Swiss customs union. A coalition that ruled Liechtenstein for almost 60 years dissolved in 1997. Into the early 21st century Prince Hans Adam II continued his long-standing battle for constitutional changes that would increase his powers.



lied \'lēt\ German song, particularly an art song for voice and piano of the late 18th or the 19th century. The Romantic movement fostered serious popular poetry by poets such as Johann Wolfgang von Goethe. Composers often set such poetry to folk-influenced music, but the lied could also be highly sophisticated and even experimental. At first generally performed at private social gatherings, it eventually moved into the concert-hall repertoire. The most influential and prolific lied composer was Franz Schubert, who wrote more than 600; Robert Schumann, Felix Mendelssohn, Johannes Brahms, Hugo Wolf, Gustav Mahler, and Richard Strauss are most prominent in the lied's subsequent history.

Liège \'lyezh\ *Flemish* **Luik** \'lȯik\ City (pop., 2000 est.: 185,639), eastern Belgium. Located at the confluence of the Meuse and Ourthe rivers, it was inhabited in prehistoric times and was known to the Romans as Leodium. It became a town when St. Hubert transferred his see there in 721, and it was noted as a centre of learning in the Middle Ages. Annexed to France in 1795, it was later assigned with the rest of Belgium to The Netherlands in 1815. A centre of the successful revolt for Belgian independence in 1830, it is now an industrial research centre and a major port.

liege \lēj\ In European feudal society, an unconditional bond between a man and his overlord. Thus, if a tenant held estates from various overlords, his obligations to his liege lord, to whom he had paid "liege homage," were greater than his obligations to the other lords, to whom he had paid only "simple homage." See also feudal land tenure.

lien \lēn\ In law, a charge or encumbrance on property for the satisfaction of a debt or other duty. Common law developed two kinds of possessory lien: the specific (a lien on the specific property involved in a

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transaction) and the general (a lien for the satisfaction of a balance due, not confined to a specific property involved in a transaction). Courts of EQUITY may, through the device of the equitable lien, recognize a creditor's interest in a debtor's property. Statutory liens are also available; developers and building contractors, for example, may use their interest in an improved site as security for payment (a mechanic's lien).

Liezi *or* **Lieh-tzu** \'lye-'dzə\ (fl. 4th century BC, China) Chinese Daoist philosopher. He was one of the three primary philosophers who developed the tenets of Daoist thought, and he is the presumed author of the Daoist work *LIEZI*. Many of the writings traditionally attributed to him have been identified as later forgeries, but he is still widely believed to have been a historical figure.

Liezi *or* **Lieh-tzu** Chinese Daoist classic. Though LIEZI is traditionally named as its author, in its present form it probably dates from the 3rd or 4th century AD. Like earlier Daoist classics, it emphasizes the mysterious DAO (way). The "Yang Zhu" chapter acknowledges the futility of challenging the *dao* and asserts that all one can look forward to in life is sex, music, physical beauty, and material abundance. This fatalistic belief in a life of radical self-interest was a new development in DAOISM.

Lifar \'lē-ˌfär**, Serge** (b. April 2, 1905, Kiev, Ukraine, Russian Empire—d. Dec. 15, 1986, Lausanne, Switz.) Russian-born French dancer, choreographer, and ballet master. In 1923 he joined the BALLETS RUSSES, where he became lead dancer in 1925 and created title roles in several of GEORGE BALANCHINE's ballets. He worked at the Paris Opéra Ballet as lead dancer and ballet master (1929–45, 1947–58), choreographing more than 50 works, including *Prometheus* (1929), *Icarus* (1935), *Les Mirages* (1947), and *Les Noces fantastiques* (1955). He rebuilt the company as a separate performing group, emphasizing the importance of male dancers. He retired as a dancer in 1956 but continued to choreograph for various European companies.

Lifar in *Night,* 1930
BBC HULTON PICTURE LIBRARY

life State characterized by the ability to metabolize nutrients (process materials for energy and tissue building), grow, reproduce, and respond and adapt to environmental stimuli. Fossil evidence suggests that earth's first living organisms, BACTERIA and CYANOBACTERIA, arose about 3.5 billion years ago. All known life-forms possess either DNA or RNA. VIRUSES, which possess DNA and RNA, cannot reproduce without a host cell and do not metabolize nutrients, and it is uncertain whether they should be classified as living or nonliving. Scientists disagree on the likelihood of extraterrestrial life. See also DRAKE EQUATION.

Life U.S. picture magazine published weekly in New York City from 1936 to 1972 and in special editions thereafter. One of the most popular and widely imitated of U.S. magazines, it was founded by HENRY R. LUCE and quickly became a cornerstone of Time-Life Publications. From the start it emphasized photography, with gripping, superbly chosen news photographs, photographic features, and photo-essays by the best photographers; gradually more writing was added. Its war coverage—particularly that of World War II—was notably vivid, authentic, and moving. *Life* ceased publication largely because its costs outstripped revenues. It reappeared in special issues and then, from 1978 to 2000, as a monthly.

life insurance Method by which large groups of individuals equalize the burden of financial loss from death by distributing funds to the beneficiaries of those who die. Life insurance is most developed in wealthy countries, where it has become a major channel of saving and investing. There are three basic types of life-insurance contract. Term insurance is issued for a specified number of years; protection expires at the end of the period and there is no cash value remaining. Whole-life contracts run for the whole of the insured's life and also accumulate a cash value, which is paid when the contract matures or is surrendered; the cash value is less than the policy's face value. Endowment contracts run for a specified time period and pay their full face value at the end of the period.

life span Time between birth and death. It ranges from a mayfly's day to certain trees' thousands of years. Its limit appears to depend on heredity, but such factors as (in humans) disease, natural disasters, war, diet, and habits such as smoking reduce it. Maximum life span is theoretical; more meaningful is average life span, which life-insurance companies and actuaries analyze and tabulate. Long-lived progenitors tend to beget long-lived descendants. A very-low-calorie diet appears to prolong life. Reduced infant mortality and improved sanitation and nutrition account for much of the increase since c. 1800—from about 35 to over 70 years in most industrialized countries. The oldest well-documented age reached by a human is 122 years.

Liffey, River River, Ireland. Rising southwest of DUBLIN, it flows northwest, then runs west in the Kildare lowland. It crosses east through Dublin, where it is channeled into canals, and empties into Dublin Bay, an arm of the Irish Sea, after a course of 50 mi (80 km). The river is personified as Anna Livia Plurabelle in JAMES JOYCE's *Finnegans Wake*.

lift Upward-acting FORCE on an aircraft wing or AIRFOIL. An aircraft in flight experiences an upward lift force, as well as the thrust of the engine, the force of its own weight, and a DRAG force. The lift force arises because the speed at which the displaced air moves over the top of the airfoil (and over the top of the attached BOUNDARY LAYER) is greater than the speed at which it moves over the bottom and because the pressure acting on the airfoil from below is therefore greater than the pressure from above.

lift-slab construction Technique whereby concrete floor slabs are poured on the ground, one on top of the other, and then lifted into place on top of columns by hydraulic jacks. Used for very tall multistory buildings, this method offers substantial savings in formwork.

ligament Tough fibrous band of CONNECTIVE TISSUE that supports internal organs and holds bones together properly in JOINTS. It is composed of dense bundles of fibres and spindle-shaped cells (fibroblasts and fibrocytes), with little ground substance. White ligament is rich in sturdy, inelastic COLLAGEN fibres; yellow ligament is rich in tough elastic fibres, which allow more movement. See also TENDON.

ligand \'li-gənd, 'lī-gənd\ ATOM, group (see FUNCTIONAL GROUP), or MOLECULE attached to a central atom, usually of a TRANSITION ELEMENT, in a coordination or complex COMPOUND (see BONDING). It is almost always the electron-pair donor (NUCLEOPHILE) in a COVALENT BOND. Common ligands include the neutral molecules WATER (H_2O), ammonia (NH_3), and carbon monoxide (CO) and the ANIONS cyanide (CN^-), chloride (Cl^-), and hydroxide (OH^-). Rarely, ligands are CATIONS and electron-pair acceptors (ELECTROPHILES). Organic ligands include EDTA (see CHELATE) and nitrilotriacetic acid. Biological systems rely on ligands such as the PORPHYRIN in HEMOGLOBIN and CHLOROPHYLL, and numerous COFACTORS are ligands. In chelates, the ligand attaches at more than one point, sharing more than one electron pair, and is called bidentate or polydentate—having two or many "teeth." The ligands in a complex may be the same or different.

Ligeti \lē-'gā-tē**, György (Sándor)** (b. May 28, 1923, Diciosânmartin, Transylvania, Rom.) Hungarian (Transylvanian) composer. By 1950 he was teaching at the Budapest Academy, but not until he met KARLHEINZ STOCKHAUSEN and others in Vienna in 1956 did he find his compositional path. After a brief interest in electronic music, he gained international recognition for his avant-garde pieces for performers; these works dealt principally with shifting masses of sound and tone colours. His most famous work, *Atmosphères* (1961), was used in the film *2001: A Space Odyssey* (1968). The opera *Le Grand macabre* (1978) has been widely performed in Europe.

light That portion of the ELECTROMAGNETIC SPECTRUM visible to the human eye. It ranges from the red end to the violet end of the spectrum, with wavelengths from 700 to 400 nanometres and frequencies from 4.3×10^{14} to 7.5×10^{14} Hz. Like all ELECTROMAGNETIC RADIATION, it travels through empty space at a speed of about 186,000 mi/sec (300,000 km/sec). In the mid-19th century, light was described by James Clerk Maxwell in terms of electromagnetic waves, but 20th-century physicists showed that it exhibits properties of particles as well; its carrier particle is the PHOTON. Light is the basis for the sense of sight and for the perception of COLOUR. See also OPTICS; WAVE-PARTICLE DUALITY.

light-emitting diode (LED) SEMICONDUCTOR DIODE that produces visible or infrared light when subjected to an electric current, as a result of electroluminescence. Visible-light LEDs are used in many electronic devices as indicator lamps (e.g., an on/off indicator) and, when arranged in a matrix, to spell out letters or numbers on alphanumeric displays. Infrared LEDs are used in optoelectronics (e.g., in auto-focus cameras and television remote controls) and as light sources in some long-range fibre-

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optic communications systems. LEDs are formed by the so-called III-V compound semiconductors related to gallium arsenide. They consume little power and are long-lasting and inexpensive.

light fixture See LUMINAIRE

light-frame construction System of construction using many small and closely spaced members that can be assembled by nailing. It is the standard for U.S. suburban housing. The balloon-frame house with wood cladding, invented in Chicago in the 1840s, aided the rapid settlement of the western U.S. In North America, with its abundant softwood forests, the framed building enjoyed an extensive revival after World War II in the form of platform frames. In platform framing, each floor is framed separately, as contrasted with balloon framing, in which the studs (vertical members) extend the full height of the building. Freed from the heavy timbers of the POST-AND-BEAM SYSTEM, platform framing offers ease of construction. Carpenters first fabricate a floor, which consists of wood joists and subflooring. The floor often serves as a working platform on which the stud wall frames are fabricated in sections and then lifted into place. On top of this is placed a second floor or the roof. The roof is formed of rafters (sloping joists) or wood TRUSSES. The standard interior wall sheathing is gypsum board (drywall), which provides fire-resistance, stability, and a surface ready for finishing. Framed structures traditionally were constructed individually at each house site; today many of the framing elements are mass-produced elsewhere and assembled on-site.

light quantum See PHOTON

light-year Distance traveled by LIGHT moving in a vacuum in one year, at its accepted speed of 186,282 mi/second (299,792 km/second). It equals about 5.9 trillion mi (9.5 trillion km), 63,240 ASTRONOMICAL UNITS, or 0.307 PARSEC.

Lightfoot, Gordon (b. Nov. 17, 1938, Orillia, Ont., Can.) Canadian singer and songwriter. He began writing folk-oriented pop singles in the mid-1960s, including "Early Morning Rain" and "Ribbon of Darkness." His later hits include "If You Could Read My Mind" and "The Wreck of the *Edmund Fitzgerald*." His songs have been covered by singers ranging from BARBRA STREISAND to JERRY LEE LEWIS.

lighthouse Structure, usually with a tower, built onshore or on the seabed to signal danger or provide aid to seafarers. The first known lighthouse was the Pharos of Alexandria. The modern lighthouse dates only from the early 18th century. Initially made of wood, these towers were often washed away in severe storms. The first lighthouse made of interlocking masonry blocks was built on the treacherous Eddystone Rocks reef, off Plymouth, England (1759). Interlocking masonry blocks remained the principal material of lighthouse construction until they were replaced by concrete and steel in the 20th century. Modern construction methods have facilitated the building of offshore lighthouses. The most common illuminant is the electric-filament lamp. Refinements in lenses (e.g., the Fresnel lens) and reflectors made it possible to substantially increase the light's intensity. Radio and satellite-based navigation systems have greatly reduced the need for large lighthouses in sighting land.

lighting Use of an artificial source of light for illumination. It is a key element of architecture and interior design. Residential lighting uses mainly either INCANDESCENT LAMPS or FLUORESCENT LAMPS and often depends heavily on movable fixtures plugged into outlets; built-in lighting is typically found in kitchens, bathrooms, and corridors and in the form of hanging pendants in dining rooms and sometimes recessed fixtures in living rooms. Lighting in nonresidential buildings is predominantly fluorescent. High-pressure sodium-vapor lamps (see ELECTRIC DISCHARGE LAMP) have higher efficiency and are used in industrial applications. HALOGEN LAMPS have residential, industrial, and photographic applications. Depending on their fixtures, lamps (bulbs) produce a variety of lighting conditions. Incandescent lamps placed in translucent glass globes create diffuse effects; in recessed ceiling-mounted fixtures with reflectors, they can light walls or floors evenly. Fluorescent fixtures are typically recessed and rectangular, with prismatic lenses, but other types including indirect cove lights (see COVING) and luminous ceilings, in which lamps are placed above suspended translucent panels. Mercury-vapor and high-pressure sodium-vapor lamps are placed in simple reflectors in industrial spaces, in pole-mounted streetlight fixtures, and in indirect up-lighting fixtures for commercial applications.

lightning Visible discharge of electricity when part of the atmosphere acquires enough electrical charge to overcome the resistance of the air. During a thunderstorm, lightning flashes can occur within clouds, between clouds, between clouds and air, or from clouds to the ground. Lightning is usually associated with cumulonimbus CLOUDS (thunderclouds) but also occurs in nimbostratus clouds, in snowstorms and dust storms, and sometimes in the dust and gases emitted by a volcano. A typical lightning flash involves a potential difference between cloud and ground of several hundred million volts. Temperatures in the lightning channel are on the order of 30,000 K (50,000 °F). A cloud-to-ground flash comprises at least two strokes: a pale leader stroke that strikes the ground and a highly luminous return stroke. The leader stroke reaches the ground in about 20 milliseconds; the return stroke reaches the cloud in about 70 microseconds. The thunder associated with lightning is caused by rapid heating of air along the length of the lightning channel. The heated air expands at supersonic speeds. The shock wave decays within a metre or two into a sound wave, which, modified by the intervening air and topography, produces a series of rumbles and claps. See also THUNDERSTORM.

lightning bug See FIREFLY

lignin \'lig-nən\ Complex oxygen-containing organic compound, a mixture of POLYMERS of poorly known structure. After CELLULOSE, it is the most abundant organic material on Earth, making up one-fourth to one-third of the dry weight of WOOD, where it is concentrated in the cell walls. Removed from wood pulp in the manufacture of PAPER, it is used as a binder in particleboard and similar products and as a soil conditioner, filler in certain plastics, adhesive ingredient, and raw material for chemicals including DIMETHYL SULFOXIDE and vanillin (synthetic VANILLA flavouring).

lignite Yellow to dark brown, rarely black, COAL that has been formed from PEAT under moderate pressure; it is one of the first products of coalification and is intermediate between peat and SUBBITUMINOUS COAL. Dry lignite contains about 60–70% carbon. Almost half of the world's total coal reserves contain lignite and subbituminous coal, but lignite has not been exploited to any great extent because lignite is inferior to higher-rank coals (e.g., BITUMINOUS COAL) in heating value, ease of handling, and storage stability. In some areas, however, the scarcity of fuel has led to extensive developments.

Liguria Region (pop., 2001 prelim.: 1,560,748), northwestern Italy. Covering 2,092 sq mi (5,418 sq km) and located on the Ligurian Sea between France and Tuscany, it has its capital at GENOA. Under Roman rule from the 1st century BC, the region was briefly controlled by the Lombards and FRANKS during the Middle Ages. The city of Genoa emerged as a leading power as early as the 11th century, and by 1400 the entire region benefited from its maritime and commercial powers. In 1815 the Congress of VIENNA gave Liguria to the kingdom of Piedmont-Sardinia. It contributed significantly to the union of Italy in 1861. Its economy is based on agriculture, tourism, and industries centred on its major cities, including Genoa. La Spezia is a major naval base.

likelihood *or* **chance** In mathematics, a subjective assessment of possibility that, when assigned a numerical value on a scale between impossibility (0) and absolute certainty (1), becomes a probability (see PROBABILITY THEORY). Thus, the numerical assignment of a probability depends on the notion of likelihood. If, for example, an experiment (e.g., a die toss) can result in six equally likely possible outcomes, the probability of each is ⅙.

Likud \li-'küd\ Coalition of Israeli right-wing political parties. It was created by the 1973 merger of the Herut Party (1948) and the Liberal Party (1961), which itself was a merger of the General Zionists and the Progressives. From the late 1970s Likud alternated in power with the ISRAEL LABOUR PARTY. Likud generally was considered more skeptical than Labour of the peace process with the Palestinians and Israel's Arab neighbours, but when in power some Likud prime ministers made dramatic concessions on both fronts. Party leaders have included MENACHEM BEGIN, YITZHAK SHAMIR, and ARIEL SHARON. See also ARAB-ISRAELI WARS; IRGUN ZVAI LEUMI; VLADIMIR JABOTINSKY.

lilac Any of about 30 species of fragrant northern spring-flowering garden shrubs and small trees that make up the genus *Syringa* in the OLIVE family, native to eastern Europe and temperate Asia. Lilacs have deep green leaves and large, oval clusters of compound blooms coloured deep purple, lavender, blue, red, pink, white, or creamy yellow; they are often highly fragrant. The common lilac (*S. vulgaris*) reaches 20 ft (6 m) in height and produces many suckers (shoots from the stem or root). The name syringa was formerly used for the mock orange of the SAXIFRAGE family, and the butterfly bush (see BUDDLEIA) is commonly called "summer lilac."

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Lilburne, John (b. 1614?, Greenwich, near London, Eng.—d. Aug. 29, 1657, Eltham, Kent) English revolutionary. A Separatist, he joined the Puritan opposition to Charles I and helped smuggle Puritan pamphlets into England, for which he was imprisoned (1638–40). He became an officer in the Parliamentary army but resigned in 1645 rather than subscribe to the Solemn League and Covenant. He became a master propagandist for the Levelers and criticized Parliament for failing to meet their demands. He was imprisoned (1645–47) but remained very popular with Londoners and was twice acquitted of treason.

Lilith In Jewish folklore, a female demon. In rabbinic literature she is depicted either as Adam's first wife or as the mother of his demonic offspring after he separated from Eve outside Paradise (see Adam and Eve). The evil that Lilith directed against children could be counteracted by wearing an amulet bearing the names of the three angels who opposed her. A cult associated with Lilith survived into the 7th century AD.

Liliuokalani \li-ˌlē-ə-wō-kə-ˈlä-nē\ *orig.* **Lydia Kamakaeha** (b. Sept. 2, 1838, Honolulu, Hawaii—d. Nov. 11, 1917, Honolulu) Hawaiian queen, the last Hawaiian monarch to govern the islands (1891–93). She succeeded her brother, David Kalakaua, to the throne and tried to restore the traditional monarchy. She opposed the reciprocity treaty that gave commercial concessions to the U.S. In 1893 she was declared deposed by Sanford B. Dole and the Missionary Party, which favoured U.S. annexation. An uprising in her name was suppressed and the rebels jailed. To win pardons for her supporters, she formally abdicated in 1895. A talented musician, she composed the song "Aloha Oe."

Queen Liliuokalani.
COURTESY OF THE BERNICE P. BISHOP MUSEUM, HONOLULU

Lille \ˈlēl\ City (pop., 1999: city, 184,493; metro area, 1,000,900), northern France, situated on the Deûle River. Fortified in the 11th century, it changed hands several times during the Middle Ages. Louis XIV besieged and captured the city in 1667. It was taken by the duke of Marlborough in 1708 and ceded to France in 1713. It was occupied by the Germans during both World War I and World War II. It is traditionally France's textile centre; other industries include machinery manufacturing and chemical plants. Its museum has a rich art collection.

Lillie, Beatrice (Gladys) (b. May 29, 1894, Toronto, Ont., Can.—d. Jan. 20, 1989, Henley-on-Thames, Oxfordshire, Eng.) Canadian-born British comedienne. She made her London stage debut as a singer in 1914 and developed her comic genius in revues produced by André Charlot. She made her New York City debut in 1924, establishing an international reputation as a high-spirited star of sophisticated comedy. She appeared in various revues until 1939; after World War II she starred in the revue *Inside U.S.A.* (1948–50) and toured worldwide in *An Evening with Beatrice Lillie* (1952–56). Her last stage performances were in *Auntie Mame* (1958) and *High Spirits* (1964).

Beatrice Lillie
BROWN BROTHERS

Lilongwe \li-ˈlȯŋ-gwā\ Capital and second largest city (pop., 2003 est.: 597,619), Malawi. Lilongwe is located on an inland plain 50 mi (80 km) west of the southern end of Lake Malawi. An agricultural market centre for the fertile Central Region Plateau, it replaced Zomba as the national capital in 1975. The old part of the city functions as a service and commercial centre, while the newer district of Capital Hill houses government buildings and embassies, except for the country's judiciary, which is housed in the city of Blantyre.

Lily, William (b. 1468?, Odiham, Hampshire, Eng.—d. Feb. 25, 1522, London) English Renaissance scholar and classical grammarian. Having made a pilgrimage to Jerusalem and visited Greece and Italy, he became a pioneer of Greek learning in England and was appointed master of the school of St. Paul's in 1510. His grammar, which actually consisted of two books, one in English and the other in Latin, first appeared about 18 years after his death. Its use by royal order in all English grammar schools won it the name "the King's Grammar." With corrections and revisions, it continued to be used as late as the 19th century and influenced generations of English people's views of all languages, including English.

lily family Family Liliaceae (order Liliales), which contains about 4,000 species of flowering herbs and shrubs in 280 genera. The genus *Lilium* includes the true lilies. Native primarily to temperate and subtropical regions, these monocots (see cotyledon) usually have six-segmented flowers, three-chambered capsular fruits, and leaves with parallel veins. Among the oldest cultivated plants, true lilies are erect perennials with leafy stems, scaly bulbs, usually narrow leaves, and solitary or clustered flowers, some quite fragrant, in a variety of colours. Most species store nutrients underground in a bulb, corm, or tuber. Important garden ornamentals and houseplants in the family include aloe, bluebell, crocus, daylily, hosta, Solomon's seal, and tulip. Food-producing members include onion, garlic, and asparagus.

lily of the valley Fragrant perennial herb and sole species (*Convallaria majalis*) of the genus *Convallaria* (lily family), native to Eurasia and eastern North America. White, bell-shaped flowers droop in a row from one side of a leafless stalk, which bears usually two glossy leaves at its base. The fruit is a single red berry. Lily of the valley is cultivated in shaded garden areas in many temperate parts of the world.

Lima \ˈlē-mə\ City (pop., 1996 est.: city, 316,332; 1998 est.: metro area, 7,060,600), capital of Peru. It is located inland from the Pacific Ocean port of Callao and near the Andes Mountains. Its nickname, El Pulpo ("The Octopus"), refers to its sprawling metropolitan area. It was founded by Francisco Pizarro in 1535 on the feast of the Epiphany, prompting the name Ciudad de los Reyes ("City of Kings"), but the name never took. Lima later became the capital of the Viceroyalty of Peru. The city was destroyed by an earthquake in 1746 but was rebuilt. It grew rapidly during the 20th century and now accounts for nearly one-third of Peru's total population. It is the country's economic and cultural centre. Historic sites include the cathedral (begun in the 16th century) and the National University of San Marcos (1551).

Lima, José Lezama See José Lezama Lima

Liman von Sanders \ˈlē-män-fȯn-ˈzän-dərs**, Otto** (b. Feb. 17, 1855, Stolp, Pomerania—d. Aug. 22, 1929, Munich, Ger.) German general. He entered the German army in 1874 and rose to lieutenant general. He reorganized the Turkish army and made it an effective fighting force in World War I. In command of the Turkish army at Gallipoli, he and the Turkish commanders forced the Allies to end the Dardanelles Campaign and prevented the seizure of Constantinople.

Limavady \ˌli-mə-ˈva-dē\ Town (pop., 1991: 10,350), seat of Limavady district (pop., 2001: 32,422), Northern Ireland. The town is on the River Roe east of the old city of Londonderry. It dates from the Plantation of Ulster in the early 17th century; it was later settled by Protestant Scots. The district is primarily agricultural.

limb darkening In astrophysics, the gradual decrease in observed brightness of the disk of a star from its centre to its edge (limb). This phenomenon, readily apparent in photographs of the Sun, occurs because the solar atmosphere's temperature increases with depth. Looking at the Sun's centre, an observer sees the deepest, hottest layers, which emit the most light. At the limb, only the upper, cooler layers, which produce less light, are visible. Observations of solar limb darkening are used to determine the temperature structure of the Sun's atmosphere.

limbo In Roman Catholicism, a region between heaven and hell, the dwelling place of souls not condemned to punishment but deprived of the joy of existence with God in heaven. The concept probably developed in the Middle Ages. Two distinct kinds of limbo were proposed: the *limbus patrum* ("fathers' limbo"), where Old Testament saints were confined until

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liberated by JESUS in his "descent into hell"; and the *limbus infantum* or *limbus puerorum* ("children's limbo"), the abode of those who died without actual sin but whose original sin had not been washed away by BAPTISM or whose free will was restricted by mental deficiency. Today the Catholic church downplays the notion of limbo, and it is not an official part of church doctrine.

Limbourg \'lim-ˌbůrk\ **brothers** *or* **Limburg brothers** (fl. c. 1400–1416) Flemish illuminators. Sons of a sculptor, the three brothers—Pol, Herman, and Jehanequin de Limbourg—learned the goldsmith's art in Paris and entered the service of the duke de Berry, for whom they produced one of the most famous of all ILLUMINATED MANUSCRIPTS, a book of hours (private prayer book) known as the *Très riches heures du duc de Berry* (c. 1410–16). Since the brothers worked together, it is difficult to distinguish individual styles. They synthesized the achievements of their contemporaries into a style characterized by tall, aristocratic figures with lavish, curvilinear draperies and by highly naturalistic seasonal landscapes and scenes of peasant life. Their art did much to determine the course of EARLY NETHERLANDISH ART. Their deaths in the same year suggest that they died of plague.

lime Small shrublike tree (*Citrus aurantifolia*), widely grown in tropical and subtropical areas, and its edible acidic fruits. Stiff branches and twigs leave the thorny stem at irregular intervals and end in green leaves. Clusters of small white flowers produce small oval fruits with a thin, pale greenish yellow rind. The juicy pulp is more acidic and sweet than that of the LEMON. Limes are used to flavour many foods. High in vitamin C, they were formerly used in the British navy to prevent SCURVY; hence the nickname "Limey" for British sailors.

Lime (*Citrus aurantifolia*).
GRANT HEILMAN PHOTOGRAPHY

lime *or* **quicklime** *or* **calcium oxide** Inorganic compound, white or grayish white solid, chemical formula CaO, made by roasting LIMESTONE (calcium carbonate, $CaCO_3$) until all the carbon dioxide (CO_2) is driven off. One of the four most important basic chemical commodities, it is used as a REFRACTORY, as a flux in steel manufacture, as a CO_2 absorbent, to remove contaminants from stack gases, to neutralize various acids, in pulp and paper, in insecticides and fungicides, in sewage treatment, and in the manufacture of glass, calcium carbide, and sodium carbonate. Adding water to lime yields calcium hydroxide (slaked lime, calcium hydrate, hydrated lime, or caustic lime), which is used in mortar, plasters, cements, whitewash, hide dehairing, and water softening and purification and as a source of other calcium salts.

limelight Early form of theatrical lighting. The incandescent calcium light invented by Thomas Drummond in 1816 was first employed in a theatre in 1837 and was widely used by the 1860s. Its soft, brilliant light enabled it to be focused for spotlighting and to create effects such as sunlight and moonlight. The expression "in the limelight" referred to the most desirable acting area on the stage, the front and centre, which was illuminated by limelights. Electric lighting replaced limelight in the late 19th century.

limerick Popular form of short, humorous verse, often nonsensical and frequently ribald. It consists of five lines, rhyming *aabba*, and the dominant metre is anapestic, with two feet in the third and fourth lines and three feet in the others. The origin of the term is obscure, but a group of poets in County Limerick, Ire., wrote limericks in Irish in the 18th century. The first collections in English date from c. 1820. Among the most famous are those in EDWARD LEAR's *Book of Nonsense* (1846).

limes \'lē-mās\ *plural* **limites** *Latin* **"path"** In ancient Rome, a strip of open land along which troops advanced into unfriendly territory. It came to mean a Roman military road, fortified with watchtowers and forts. An example of this construction was the continuous system of fortifications and barriers extending 345 mi (555 km) along the Roman frontier in Germany and RAETIA. HADRIAN'S WALL also served as a *limes*. Though not impenetrable, the *limites* allowed the Romans to control communications along frontiers and deterred raiding parties. In the eastern and southern empire, *limites* were often used to guard caravan routes.

limestone Sedimentary rock composed mainly of CALCIUM carbonate ($CaCO_3$), usually in the form of CALCITE and, less commonly, ARAGONITE. It may contain considerable amounts of magnesium carbonate (DOLOMITE) as well. Most limestones have a granular texture; in many cases, the grains are tiny fragments of fossil animal shells. Much knowledge of the Earth's history has been derived from the study of FOSSILS embedded in limestone and other carbonate rocks. Limestone is used as a soil conditioner, in the manufacture of glass, and in agriculture. Ornamental varieties are used for flooring, exterior and interior facings of buildings, and monuments.

Limfjorden \'lēm-ˌfyȯr-dən\ Strait across northern Jutland, Denmark, connecting the North Sea and the Kattegat. It is 110 mi (180 km) long and is actually a series of fjords dotted with islands. In 1825 the North Sea broke through the western part, and the Thyborøn Kanal was cut to keep the outlet open.

limit Mathematical concept based on the idea of closeness, used mainly in studying the behaviour of FUNCTIONS close to values at which they are undefined. For example, the function $1/x$ is not defined at $x = 0$. For positive values of x, as x is chosen closer and closer to 0, the value of $1/x$ begins to grow rapidly, approaching INFINITY as a limit. This interplay of action and reaction as the independent VARIABLE moves closer to a given value is the essence of the idea of a limit. Limits provide the means of defining the DERIVATIVE and INTEGRAL of a function.

limitations, statute of Legislative act restricting the time within which legal proceedings may be brought, usually to a fixed period after the occurrence of the events that gave rise to the cause of action. Such statutes are enacted to protect persons against claims made after evidence has been lost, memories have faded, or witnesses have disappeared. The periods prescribed for different actions in different jurisdictions vary considerably.

limited liability Condition under which the loss that an owner (shareholder) of a business may incur is limited to the capital invested in the business and does not extend to personal assets. The forerunners of limited-liability companies were limited partnerships, which were common in Europe and the U.S. in the 18th and early 19th centuries. In limited partnerships, one partner is entirely liable for losses and the other partners are liable only for the amounts they invested in the business. After the Joint-Stock Companies Act (1844) in England made incorporation easier, joint-stock companies with limited liability for all members became widespread. The development of the limited-liability company was crucial to the rise of large-scale industry in the late 19th and 20th centuries, since it enabled businesses to mobilize CAPITAL from a variety of investors who were unwilling to risk their entire personal fortunes in their INVESTMENTS. See also RISK.

limited obligation bond See REVENUE BOND

limnology \lim-'nä-lə-jē\ Subdiscipline of HYDROLOGY that concerns the study of fresh waters, specifically lakes and ponds (both natural and manmade), including their biological, physical, and chemical aspects. François-Alphonse Forel (1841–1912) established the field with his studies of Lake Geneva. Limnology traditionally is closely related to hydrobiology, which is concerned with the application of the principles and methods of physics, chemistry, geology, and geography to ecological problems.

Limoges \lē-'mōzh\ **painted enamel** ENAMEL WORK made in Limoges, France, generally considered the finest painted enamel ware produced in Europe in the 16th century. The earliest examples show religious scenes in the late Gothic style, but Italian Renaissance motifs appeared c. 1520. Painting in GRISAILLE was later introduced. By the late 16th century the quality of the enamel ware had degenerated. See also LÉONARD LIMOSIN.

Limoges ware PORCELAIN, largely service ware, produced in Limoges, France, from the 18th century. FAIENCE of undistinguished quality was produced there from 1736, but the manufacture of hard-paste, or true, porcelain dates only from 1771. In 1784 the factory was acquired as an adjunct of the royal factory at Sèvres (see SÈVRES PORCELAIN), and the decorations of the two wares became similar. After 1858 Limoges became a mass exporter of porcelain to the U.S. under the name Haviland.

Limón \li-'mōn**, José (Arcadio)** (b. Jan. 12, 1908, Culiacán, Sinaloa, Mex.—d. Dec. 2, 1972, Flemington, N.J., U.S.) Mexican-born U.S. modern dancer, choreographer, and founder-director of the José Limón Dance Company. At age seven he moved to the U.S., where he later studied with

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Doris Humphrey and Charles Weidman and danced with their company (1930–40). He established his own company in 1947, with Humphrey as artistic director. His choreography conveyed modern-dance expression within a well-defined structure, as exemplified by works such as *The Moor's Pavane* (1949) and *Missa Brevis* (1958). The company toured worldwide during Limón's life and remained active after his death.

Limón, 1965
MARTHA SWOPE

limonite \'lī-mə-ˌnīt\ One of the major iron minerals, a hydrous ferric oxide of variable composition. Often brown and earthy, it is formed by alteration of other iron minerals, such as the hydration of hematite or the oxidation and hydration of siderite or pyrite.

Limonite (left) from Ironwood, Mich., and (right) from Montgomery, Pa.
COURTESY OF THE FIELD MUSEUM OF NATURAL HISTORY, CHICAGO; PHOTOGRAPH, JOHN H. GERARD/EB INC.

Limosin \lē-mō-'zaⁿ**, Léonard** *or* **Léonard Limousin** \'lē-mü-'zaⁿ\ (b. c. 1505, Limoges, Fr.—d. c. 1577, Limoges) French painter. The most accomplished member of a prominent Limoges family of enamelers, he is known for the revealing realism of the portraits he painted on Limoges ware. His earliest authenticated work is his *Passion of the Lord* (1532), a series of 18 enamel plaques after prints by Albrecht Dürer. He was later influenced by the Italian Mannerists who worked at Fontainebleau for Francis I, whom Limosin served as court painter. He was also an accomplished painter in oils.

Limousin \ˌli-mə-'zēn,\ *French* \ˌlē-mə-'zeⁿ\ Historical and government region, central France. Covering 6,541 sq mi (16,942 sq km), the modern administrative region of Limousin (pop., 1999: 710,939) is roughly coextensive with the region when it held provincial status. The capital is Limoges (pop., 1999: 133,960). Originally inhabited by the ancient Gallic tribe of Lemovices, the region was conquered by Rome c. 50 BC. Under the Carolingians, it was part of Aquitaine. On Eleanor of Aquitaine's marriage to King Henry II of England in 1152, it passed to English control. Subsequently fought over by England and France, it was finally annexed to the French crown under the French king Henry IV.

limpet \'lim-pət\ Any of various species of snails that have a flattened shell. Most marine species (subclass Prosobranchia) cling to rocks near shore. A common U.S. species is the Atlantic plate limpet (*Acmaea testudinalis*) of cold waters. Keyhole limpets have a slit or hole at the apex of the shell. Some limpets (subclass Pulmonata) live in brackish water and freshwater. See also mollusk.

European limpets (*Patella vulgata*) with acorn barnacles (*Balanus balanoides*)
NEVILLE FOX-DAVIES—BRUCE COLEMAN INC./EB INC.

Limpopo River River, South Africa. Rising as the Crocodile (Krokodil) River in the Witwatersrand, South Africa, it flows northeast along the border of South Africa and southeast across Mozambique to empty into the Indian Ocean. Along its middle course it divides South Africa from Botswana and Zimbabwe. It is 1,100 mi (1,800 km) long but is navigable only 130 mi (208 km) from the coast. The first European to visit it was Vasco da Gama, who named its mouth the Espíritu Santo River in 1498.

Lin, Maya (b. Oct. 5, 1959, Athens, Ohio, U.S.) U.S. architect and sculptor. The daughter of intellectuals who had fled China in 1948, she achieved fame in 1981 when her class assignment at Yale University won the nationwide Vietnam Veterans Memorial competition. Lin's award-winning design consisted of a polished black granite V-shaped wall inscribed with the names of the approximately 58,000 men and women who were killed or missing in action; the abstract nature of the design aroused a great deal of controversy. Her subsequent, vastly different designs include the major commissions for the Civil Rights Memorial in Montgomery, Ala. (1989), and the Women's Table at Yale (1993), as well as an earth sculpture for the University of Michigan (1994) and an extraordinary translucent clock, *Eclipsed Time*, installed in the ceiling of New York City's Pennsylvania Station (1994).

Lin Biao \'lin-bē-'au̇\ *or* **Lin Piao** (b. Dec. 5, 1907, Huanggang, Hubei province, China—d. Sept. 13, 1971?, Mongolia?) Chinese military leader and government official who played a prominent role in the Cultural Revolution. He joined the Socialist Youth League in 1925 and Chiang Kai-shek's Northern Expedition in 1926. When Chiang turned on the communists in 1927, Lin fled to join Mao. During the Long March Lin became legendary for never losing a battle, and he prevailed against the Japanese in the 1930s and the Nationalists in the 1940s. In the early 1960s his reformation and indoctrination of the army in accordance with Mao's teachings became a model for the rest of society, and during the Cultural Revolution he was designated Mao's successor. Subsequent events are unclear, but in September 1971 the Chinese government reported that Lin died in a plane crash in Mongolia in an attempt to flee China; his death has remained a mystery.

Lin Yutang *or* **Lin Yü-t'ang** (b. Oct. 10, 1895, Longxi, Fujian province, China—d. March 26, 1976, Hong Kong) Chinese writer. The son of a Presbyterian minister, he studied in the U.S. and Europe. In 1932 he established a highly successful Western-style satirical magazine of a type totally new to China; soon he introduced two other publications. A prolific writer of works in Chinese and English, he produced his first English-language book, *My Country and My People*, in 1935. From 1936 he lived chiefly in the U.S. His other works include *The Wisdom of China and India* (1942), books on Chinese history and philosophy, and highly acclaimed English translations of Chinese literary masterpieces.

Lin Zexu \'lin-'dzə-'shü\ *or* **Lin Tse-hsü** (b. Aug. 30, 1785, Houguan, Fujian province, China—d. Nov. 22, 1850, Chaozhu, Guangdong province) Leading Chinese scholar and official of the Qing dynasty, accepted as a national hero for his stance against the British before the Anglo-Chinese Opium War (1839–42). Lin passed the highest examination in the Chinese examination system and entered the Hanlin Academy and government. Having suggested to the emperor ways to suppress the opium trade, Lin found himself appointed imperial commissioner and dispatched to Guangzhou (Canton) to deal with the problem directly. He was so successful that, in retaliation for his destruction of their opium stocks, the British ravaged large parts of southern China, and Lin was quickly dismissed. He served loyally at his post of exile and was soon called back to important service. He died on his way to help suppress the Taiping Rebellion.

linac See linear accelerator

Linacre \'li-ni-kər**, Thomas** (b. c. 1460, Canterbury, Kent, Eng.—d. Oct. 20, 1524, London) English physician and classical scholar. Elected a fellow at Oxford in 1484, he became one of the first propagators of the humanist "New Learning" in England; his students included Desiderius Erasmus and St. Thomas More. Many prominent Londoners were his medical patients, including Henry VIII, whose approval he obtained in 1518 to found the Royal College of Physicians, which decided who should practice medicine in Greater London and which licensed physicians throughout the kingdom, ending the indiscriminate practice of medicine by barbers, clergymen, and others.

Lincoln City (pop., 2000: 225,581), capital of Nebraska, U.S. Laid out in 1859 and called Lancaster, it was renamed for Abraham Lincoln when it was chosen as the capital in 1867. The town was incorporated in 1869 and was the home of the politician William Jennings Bryan from 1887 to 1921. It is a railroad junction and commercial centre serving the surrounding agricultural region. Its institutions of higher education include the University of Nebraska, Union College, and Nebraska Wesleyan University.

Lincoln cathedral, Lincolnshire
RAY MANLEY-SHOSTAL/EB INC.

Lincoln *ancient* **Lindum** City and administrative district (pop., 2001: 85,616), administrative and historic

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county of Lincolnshire, eastern England. Under the name Lindum, it served as a Roman fortress, and by AD 71 it had become a settlement for retired soldiers. It later came under Danish rule, and in the Middle Ages it was one of England's major towns. Henry II gave the city its first charter in 1154. It is a market centre for an agricultural region and also possesses some manufacturing. It has many medieval buildings, including the cathedral (begun c. 1075).

Lincoln, Abraham (b. Feb. 12, 1809, near Hodgenville, Ky., U.S.—d. April 15, 1865, Washington, D.C.) 16th president of the U.S. (1861–65). Born in a Kentucky log cabin, he moved to Indiana in 1816 and to Illinois in 1830. After working as a storekeeper, a rail-splitter, a postmaster, and a surveyor, he enlisted as a volunteer in the Black Hawk War (1832) and was elected captain of his company. He taught himself law and, having passed the bar examination, began practicing in Springfield, Ill., in 1836. As a successful circuit-riding lawyer from 1837, he was noted for his shrewdness, common sense, and honesty (earning the nickname "Honest Abe"). From 1834 to 1840 he served in the Illinois state legislature, and in 1847 he was elected as a Whig to the U.S. House of Representatives. In 1856 he joined the Republican Party, which nominated him as its candidate in the 1858 Senate election. In a series of seven debates with Stephen A. Douglas (the Lincoln-Douglas Debates), he argued against the extension of slavery into the territories. Though morally opposed to slavery, he was not an abolitionist; indeed, he attempted to rebut Douglas's charge that he was a dangerous radical, by reassuring audiences that he did not favour political equality for blacks. Despite his loss in the election, the debates brought him national attention. In the 1860 presidential election, he ran against Douglas again and won by a large margin in the electoral college, though he received only two-fifths of the popular vote. The South opposed his position on slavery in the territories, and before his inauguration seven Southern states had seceeded from the Union. The ensuing American Civil War completely consumed Lincoln's administration. He excelled as a wartime leader, creating a high command for directing all the country's energies and resources toward the war effort and combining statecraft and overall command of the armies with what some have called military genius. However, his abrogation of some civil liberties, especially the writ of habeas corpus, and the closing of several newspapers by his generals disturbed both Democrats and Republicans, including some members of his own cabinet. To unite the North and influence foreign opinion, he issued the Emancipation Proclamation (1863); his Gettysburg Address (1863) further ennobled the war's purpose. The continuing war affected some Northerners' resolve and his reelection was not assured, but strategic battle victories turned the tide, and he easily defeated George B. McClellan in 1864. His platform included passage of the 13th Amendment outlawing slavery (ratified 1865). At his second inaugural, with victory in sight, he spoke of moderation in reconstructing the South and building a harmonious Union. On April 14, five days after the war ended, he was shot and mortally wounded by John Wilkes Booth.

Lincoln, Benjamin (b. Jan. 24, 1733, Hingham, Mass.—d. May 9, 1810, Boston) American Revolutionary officer. After serving in the Massachusetts militia (1755–76), he was appointed major general in the Continental Army. As commander of forces in the South in 1780, he was forced to surrender with 7,000 troops after the British victory at Charleston, S.C. Released in a prisoner exchange, he served in the Yorktown campaign in 1781. From 1781 to 1783 he served as secretary of war, and in 1787 he commanded the militia forces that suppressed Shays' Rebellion. From 1789 to 1809 he was collector for the port of Boston.

Lincoln Center for the Performing Arts Travertine-clad cultural complex on the western side of Manhattan (1962–68), built by a board of architects headed by Wallace K. Harrison (1895–1981). The buildings, situated around a plaza with a fountain, are the home of the Metropolitan Opera, the New York City Opera, the New York Philharmonic, the New York City Ballet, and the Juilliard School. Harrison himself designed the Metropolitan Opera building, and Eero Saarinen designed the Vivian Beaumont Theater. Philip Johnson's New York State Theater incorporates a Classical facade and a four-story lobby. Johnson also rebuilt Avery Fisher Hall (home of the New York Philharmonic), originally designed by Max Abramovitz, to correct acoustic deficiencies and improve the lobby spaces.

Lincoln-Douglas Debates Series of seven debates between Republican candidate Abraham Lincoln and Democratic Sen. Stephen A. Douglas in the 1858 Illinois senatorial campaign. They focused on slavery and its extension into the western territories. Lincoln criticized Douglas for his support of popular sovereignty and the Kansas-Nebraska Act, while Douglas accused Lincoln of advocating racial equality and disruption of the Union. Douglas won reelection, but Lincoln's antislavery position and oratorical brilliance made him a national figure in the young Republican Party.

Lincolnshire \'liŋ-kən-ˌshir\ Administrative (pop., 2001: 646,646), geographic, and historic county, eastern England. It lies along the North Sea from the Humber estuary to the Wash. Among its most important towns is Lincoln. Inhabited in prehistoric times, it developed as an area of Roman settlement. Anglo-Saxons later established the kingdom of Lindsey. Danish influence was also widespread through villages established by Danes. Geographically isolated, it remains primarily an agricultural region. Along the coast, tourism has grown.

Lind, James (b. 1716, Edinburgh, Scot.—d. July 13, 1794, Gosport, Hampshire, Eng.) Scottish naval surgeon and physician. Having observed thousands of scurvy, typhus, and dysentery cases and the shipboard conditions that caused them, he published *A Treatise on Scurvy* in 1754, a time when scurvy killed more British sailors than combat. He recommended giving citrus fruits and juices (sources of vitamin C) to sailors on long voyages, a practice known to the Dutch for nearly two centuries. When the practice was fully instituted in 1795, scurvy disappeared from the ranks "as if by magic." Lind also suggested shipboard delousing and use of hospital ships, and he arranged for distillation of seawater for drinking.

Lind, Jenny *orig.* **Johanna Maria Lind** (b. Oct. 6, 1820, Stockholm, Swed.—d. Nov. 2, 1887, Malvern, Worcestershire, Eng.) Swedish soprano. She became prima donna at the Royal Opera in Stockholm at age 18. Study with Manuel García (1805–1906) in 1841 averted damage from vocal strain. Her career expanded to Germany, then to Vienna and London, where she created a sensation. Her European fame caught the eye of P.T. Barnum, who arranged a U.S. tour (dubbing her "the Swedish Nightingale") that launched many modern publicity techniques. She left Barnum in 1851 and resumed singing in Europe, though much less frequently. In her later years she lived and taught in England.

Lindbergh, Charles A(ugustus) (b. Feb. 4, 1902, Detroit, Mich., U.S.—d. Aug. 26, 1974, Maui, Hawaii) Aviator who made the first nonstop solo flight across the Atlantic Ocean. He left college to enroll in army flying schools and became an airmail pilot in 1926. He obtained backing from St. Louis businessmen to compete for a prize for flying from New York to Paris, and in 1927 in the monoplane *Spirit of St. Louis* he made the flight in 33.5 hours, becoming an instant hero in the U.S. and Europe. In 1929 he married the writer Anne Morrow (1906–2001), who would later serve as his copilot and navigator. In 1932 their child was kidnapped and murdered, a crime that received worldwide attention. They moved to England to escape the publicity, returning to the U.S. in 1940 to criticism over his speeches calling for U.S. neutrality in World War II. During the war Lindbergh was an adviser to Ford Motor Company and United Aircraft Corporation. After the war he was a consultant to Pan American Airways and the U.S. Department of Defense and served on many aeronautical boards and committees. In 1953 he wrote the Pulitzer Prize-winning *The Spirit of St. Louis*.

Charles A. Lindbergh in front of his airplane *Spirit of St. Louis,* 1927.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

linden Any of about 30 species of trees that make up the genus *Tilia* (family Tiliaceae), native to the Northern Hemisphere. A few are outstanding deciduous ornamental and shade trees, with heart-shaped, coarsely toothed leaves, fragrant cream-coloured flowers, and small globular fruit. The American linden (*T. americana*), also called basswood or whitewood, grows as high as 130 ft (40 m). Its wood is used for beehives, crating, furniture, and packing material; like other linden species, it is also a popular bee tree, yielding a distinctive, pale, fragrant honey.

Lindisfarne *or* **Holy Island** Historic small island 2 mi (3 km) from the English Northumbrian coast. It became a religious centre in 635, when

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St. Aidan established a monastery and church there. It was abandoned in 875 because of the threat of Danish raids, but the monastery was refounded in 1082 and survived until the dissolution of the monasteries (1536–40) under Henry VIII. The manuscript of the Lindisfarne Gospels (c. 696–698) is one of the finest surviving illuminated manuscripts of the period. Lindisfarne's present-day parish church may occupy the site of St. Aidan's original monastery.

Lindisfarne Gospels Illuminated manuscript version of the four Gospels, produced in the late 7th century for the Northumbrian island monastery of Lindisfarne. The book was designed and executed by Eadfrith, who became bishop of Lindisfarne in 698. Illuminated in the Hiberno-Saxon style, the Lindisfarne Gospels (now in the British Library) show the fusion of Irish, Classical, and Byzantine elements. See also Book of Kells.

Lindsay, Howard (b. March 29, 1889, Waterford, N.Y., U.S.—d. Feb. 11, 1968, New York, N.Y.) U.S. playwright, actor, and producer known for his collaboration with Russel Crouse (1893–1966). Lindsay began his career as an actor, director, and playwright, and Crouse was a journalist before they were paired by producer Vinton Freedley to write librettos for the successful Cole Porter musicals *Anything Goes* (1934) and *Red, Hot and Blue* (1936). Their most popular play, *Life with Father* (1939), ran for over seven years and starred Lindsay as Father. They produced *Arsenic and Old Lace* (1940) and later wrote librettos for musicals such as *State of the Union* (1945, Pulitzer Prize) and *The Sound of Music* (1959).

Lindsay, (Nicholas) Vachel (b. Nov. 10, 1879, Springfield, Ill., U.S.—d. Dec. 5, 1931, Springfield) U.S. poet. In his youth, he began traveling the country reciting his poems in return for food and shelter, in an attempt to revive poetry as an oral art form of the common people. He first received widespread recognition for "General William Booth Enters into Heaven" (1913), about the founder of the Salvation Army. His works are full of powerful rhythms, vivid imagery, and bold rhymes and express an ardent patriotism, a passion for progressive democracy, and a romantic view of nature. His collections include *Rhymes to Be Traded for Bread* (1912), *The Congo* (1914), and *The Chinese Nightingale* (1917). He was responsible for discovering the work of Langston Hughes. Depressed and unstable in later years, he committed suicide by drinking poison.

line Basic element of Euclidean geometry. Euclid defined a line as an interval between two points and claimed it could be extended indefinitely in either direction. Such an extension in both directions is now thought of as a line, while Euclid's original definition is considered a line segment. A ray is part of a line extending indefinitely from a point on the line in only one direction. In a coordinate system on a plane, a line can be represented by the linear equation $ax + by + c = 0$. This is often written in the slope-intercept form as $y = mx + b$, in which m is the slope and b is the value where the line crosses the y-axis. Because geometrical objects whose edges are line segments are completely understood, mathematicians frequently try to reduce more complex structures into simpler ones made up of connected line segments.

line integral In mathematics, the integral of a function of several variables defined on a line or curve that has been expressed in terms of arc length (see length of a curve). An ordinary definite integral is defined over a line segment, whereas a line integral may use a more general path, such as a parabola or a circle. Line integrals are used extensively in the theory of functions of a complex variable.

Line Islands Chain of islands, central Pacific Ocean, south of the Hawaiian Islands. The Line Islands extend 1,600 mi (2,600 km) and have a land area of 193 sq mi (500 sq km). Of the northern group, Teraina (Washington) Island and the Tabuaeran (Fanning) and Kiritimati (Christmas) atolls belong to the Republic of Kiribati, while Kingman Reef, Palmyra Atoll, and Jarvis Island are U.S. territories. Kiribati also holds the central group (Malden and Starbuck islands) and the southern group (Vostok and Flint islands and Caroline Atoll).

Linear A and Linear B Linear forms of writing used by Aegean civilizations during the 2nd millennium BC. Examples of Linear A, a syllabary (a writing system in which one character represents a whole syllable) written from left to right, date from 1850 BC to 1400 BC. The language written in Linear A remains unknown. Linear B, adapted from Linear A, was borrowed from the Minoan civilization by the Mycenaean Greeks, probably c. 1600 BC, and used to write the Mycenaean Greek dialect. Examples of Linear B script have been found on clay tablets and vases from c. 1400–1200 BC. These texts represent the oldest known form of Greek. Linear B was deciphered as Greek in 1952 by Michael Ventris and John Chadwick.

linear accelerator *or* **linac** Type of particle accelerator that imparts a series of relatively small increases in energy to subatomic particles as they pass through a sequence of alternating electric fields set up in a linear structure. The small accelerations add together to give the particles a greater energy than could be achieved by the voltage used in one section alone. One of the world's longest linacs is the 2-mi (3.2-km) machine at the Stanford Linear Accelerator Center, which can accelerate electrons to energies of 50 billion electron volts. Much smaller linacs, both proton and electron types, have important practical applications in medicine and industry.

linear algebra Branch of algebra concerned with methods of solving systems of linear equations; more generally, the mathematics of linear transformations and vector spaces. "Linear" refers to the form of the equations involved—in two dimensions, $ax + by = c$. Geometrically, this represents a line. If the variables are replaced by vectors, functions, or derivatives, the equation becomes a linear transformation. A system of equations of this type is a system of linear transformations. Because it shows when such a system has a solution and how to find it, linear algebra is essential to the theory of mathematical analysis and differential equations. Its applications extend beyond the physical sciences into, for example, biology and economics.

linear approximation In mathematics, the process of finding a straight line that closely fits a curve (function) at some location. Expressed as the linear equation $y = ax + b$, the values of a and b are chosen so that the line meets the curve at the chosen location, or value of x, and the slope of the line equals the rate of change of the curve (derivative of the function) at that location. For most curves, linear approximations are good only very close to the chosen x. Yet much of the theory of calculus, including the fundamental theorem of calculus and the mean-value theorem for derivatives, is based on such approximations.

linear programming Mathematical modeling technique useful for guiding quantitative decisions in business, industrial engineering, and to a lesser extent the social and physical sciences. Solving a linear programming problem can be reduced to finding the optimum value (see optimization) of a linear equation (called an objective function), subject to a set of constraints expressed as inequalities. The number of inequalities and variables depends on the complexity of the problem, whose solution is found by solving the system of inequalities like a system of equations. The extensive use of linear programming during World War II to deal with transportation, scheduling and allocations of resources under constraints like cost and priority gave the subject an impetus that carried it into the postwar era. The number of equations and variables needed to model real-life situations accurately is large, and the solution process can be time-consuming even with computers. See also simplex method.

linear transformation In mathematics, a rule for changing one geometric figure (or matrix or vector) into another using a formula with a specified format. The format must be a linear combination, in which the original components (e.g., the x and y coordinates of each point of the original figure) are changed via the formula $ax + by$ to produce the coordinates of the transformed figure. Examples include flipping the figure over the x or y axis, stretching or compressing it, and rotating it. Every such transformation has an inverse, which undoes its effect.

linen Fibre, yarn, and fabric made from the flax plant. Flax is one of the oldest textile fibres used by humans; evidence of its use has been found in Switzerland's prehistoric lake dwellings. Fine linen fabrics have been discovered in ancient Egyptian tombs. The fibre is obtained by subjecting plant stalks to a series of operations, including retting (a fermentation process), drying, crushing, and beating. Linen is stronger than cotton, dries more quickly, and is more slowly affected by exposure to sunlight. Low elasticity, imparting a hard, smooth texture, makes linen subject to wrinkling. Because linen absorbs and releases moisture quickly and is a good conductor of heat, linen garments feel cool to wearers. Fine grades of linen are made into woven fabrics and laces for apparel and household furnishings.

linga *or* **lingam** In Hinduism, the symbol of the god Shiva and of generative power. Fashioned from wood, gems, metal, or stone, lingas are the main objects of worship in temples to Shiva and family shrines through-

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out India. Historically, the linga was a representation of the phallus, as sculptures from the 1st–2nd century AD, the earliest dates of linga worship, make clear, and most modern Hindus think of it in these terms. The stylization of the linga as a smooth cylindrical mass asserts an aniconic meaning. A sexual dimension remains in the most common form in which the linga appears today. The YONI, symbol of the female sex organ, often forms the base of the linga, a reminder that the male and female principles together represent the totality of existence. The linga is worshiped with offerings of flowers, water, fruit, leaves, and rice; the purity of the materials and the cleanliness of the worshiper are particularly stressed.

Sandstone *linga*, c. 900; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Lingayat \'liŋ-gə-yət\ Member of a Hindu sect that worships SHIVA as the only deity. It has a wide following in southern India. Its followers take their name ("linga-wearers") from the small LINGAS that both men and women wear on a cord around the neck. The Lingayats' belief in a single deity and their concept of BHAKTI (devotion) as an intuitive and loving knowledge of God show the influence of RAMANUJA. They reject BRAHMA and the authority of the VEDAS; their opposition to child marriage and the ill-treatment of widows anticipated the social reform movements of the 19th century.

Lingayen \ˌliŋ-gä-ˈyen\ **Gulf** Inlet, South CHINA SEA, northwestern coast of LUZON, Philippines. It is 26 mi (42 km) wide at its entrance and 36 mi (56 km) long. It has several islands, the largest of which is Cabarruyan Island. Dagupan, on the bay's southeast coast, is the principal commercial centre. It was the scene of Japanese and U.S. troop-landing operations during World War II.

lingcod Commercially popular fish species (*Ophiodon elongatus*) that is strictly marine, found along the Pacific coast of North America. It is a voracious predator with a large mouth and caninelike teeth. Lingcods are popular game and commercial fish that may reach a length of 5 ft (1.5 m). They have well-developed fins and tails. The meat, though greenish, is considered highly edible.

lingonberry Fruit of a small creeping plant (*Vaccinium vitis-idaea*) of the HEATH FAMILY, related to the BLUEBERRY and CRANBERRY. Also known as cowberry, foxberry, and mountain or rock cranberry, the lingonberry is a wild plant used for jelly and juice by northern Europeans and by Scandinavians in the U.S. The plants grow densely in the forest understory and, like cranberries, can be harvested by raking.

lingua franca \'liŋ-gwə-ˈfraŋ-kə\ Language used for communication between two or more groups that have different native languages. It may be a standard language—for example, English and French are often used for international diplomacy, and SWAHILI is used by speakers of the many different local languages of eastern Africa. A lingua franca may also be a PIDGIN, like Melanesian Pidgin, widely used in the southern Pacific. The term lingua franca (Latin: "Frankish language") was first applied to a pidgin based on French and Italian developed in the Mediterranean. See also CREOLE.

linguistics Study of the nature and structure of language. It traditionally encompasses SEMANTICS, SYNTAX, and PHONOLOGY. Synchronic linguistic studies aim to describe a language as it exists at a given time; diachronic studies trace a language's historical development. Greek philosophers in the 5th century BC who debated the origins of human language were the first in the West to be concerned with linguistic theory. The first complete Greek GRAMMAR, written by Dionysus Thrax in the 1st century BC, was a model for Roman grammarians, whose work led to the medieval and Renaissance vernacular grammars.

With the rise of historical linguistics in the 19th century, linguistics became a science. In the late 19th and early 20th centuries FERDINAND DE SAUSSURE established the structuralist school of linguistics (see STRUCTURALISM), which analyzed actual speech to learn about the underlying structure of language. In the 1950s NOAM CHOMSKY challenged the structuralist program, arguing that linguistics should study native speakers' unconscious knowledge of their language (competence), not the language they actually produce (performance). His general approach, known as transformational GENERATIVE GRAMMAR, was extensively revised in subsequent decades as the extended standard theory, the principles-and-parameters (government-binding) approach, and the minimalist program. Other grammatical theories developed from the 1960s were generalized phrase structure grammar, lexical-functional grammar, relational grammar, and cognitive grammar. Chomsky's emphasis on linguistic competence greatly stimulated the development of the related disciplines of PSYCHOLINGUISTICS and neurolinguistics. Other related fields are anthropological linguistics, COMPUTATIONAL LINGUISTICS, mathematical linguistics, SOCIOLINGUISTICS, and the PHILOSOPHY OF LANGUAGE.

linguistics, historical Branch of linguistics concerned with examining changes in PHONOLOGY, GRAMMAR, and SEMANTICS during a language's evolution, reconstructing earlier stages, and uncovering evidence of the influence of other languages. Its roots are in Classical and medieval writings on etymology and in the comparative study of Greek and Latin during the Renaissance. Only in the 19th century did more scientific language-analysis methods lead to the development of historical linguistics as a scholarly discipline. The Neogrammarians, a group of German linguists who formulated sound correspondences in the INDO-EUROPEAN LANGUAGES, were especially influential. In the 20th century the methods of historical linguistics were extended to other language groups.

linkage In mechanical engineering, a system of solid, usually metallic, links (bars) connected to two or more other links by pin joints (hinges), sliding joints, or ball-and-socket joints to form a closed chain or a series of closed chains. When one link is fixed, the possible movements of the other links relative to the fixed link and to one another depend on the number of links and the number and types of joints. With four pin-connected links, for example, the links all move in parallel planes, and regardless of which link is fixed, the others move in a fixed way relative to the fixed link. With various relative lengths of the links, this four-bar linkage becomes a useful mechanism for converting uniform rotary to non-uniform rotary motion or continuous rotary to oscillatory motion. It is the most commonly used linkage mechanism in machine construction.

linkage group All the GENES on a single CHROMOSOME. They are inherited as a group; during cell division they act and move as a unit rather than independently. Variations in linkage groups can occur if a chromosome breaks, and the sections join with the partner chromosome if it has broken in the same places. This exchange of genes between chromosomes, called crossing-over, usually occurs during MEIOSIS. Sex linkage is the tendency of a characteristic to be linked to one sex; sex-linked traits in humans include red-green colour blindness and hemophilia.

Linkletter, Art(hur Gordon) (b. July 17, 1912, Moose Jaw, Sask., Can.) Canadian-born U.S. broadcasting host. He served as emcee for the variety show *House Party* (1943–67), which involved the audience in spontaneous contests and activities; he created the show's popular segment "Kids Say the Darndest Things." He hosted another audience-participation show, *People Are Funny*, on radio (1943–59) and television (1954–61). He wrote more than 20 books, including the best-selling *Kids Say the Darndest Things* (1957), *I Wish I'd Said That* (1968), and *Old Age Is Not for Sissies* (1988).

Linnaeus \lə-ˈnē-əs**, Carolus** *Swedish* **Carl von Linné** (b. May 23, 1707, Råshult, Småland, Swed.—d. Jan. 10, 1778, Uppsala) Swedish botanist and explorer. He studied botany at Uppsala university and explored Swedish Lapland before going to Holland to study medicine

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(1735). There he became the first to develop principles for defining genera and species of organisms and to create a uniform system for naming them, BINOMIAL NOMENCLATURE. Linnaeus's system was based mainly on flower parts, which tend to remain unchanged during evolution. Though artificial, such a system was valuable in that it enabled students to place a plant rapidly in a named category. Linnaeus not only systematized the plant and animal kingdoms, but he also classified the mineral kingdom and wrote a study of the diseases known in his day. His manuscripts, herbarium, and collections are preserved by London's Linnaean Society. His works include *Systema Naturae* (1735), *Fundamenta Botanica* (1736), and *Species Plantarum* (1753).

Carolus Linnaeus, detail of a portrait by Alexander Roslin, 1775; in the Svenska Porträttarkivet, Stockholm.
COURTESY OF THE SVENSKA PORTRÄTTARKIVET, STOCKHOLM

linoleum Smooth-surfaced floor covering made from a mixture of oxidized linseed oil, resins, and other substances such as binder, fillers, and pigments, applied to a felt or canvas backing. Linoleum is flexible, warm, and unaffected by ordinary floor temperatures, and it does not readily burn. It is specially hardened to resist indentation and is not susceptible to damage from fats, oils, greases, or organic solvents.

Linotype \'lī-nə-ˌtīp\ Trademark name for a TYPESETTING machine by which characters are cast in type metal as a complete line, rather than as individual characters (as on the Monotype typesetting machine). It was patented in 1884 by OTTMAR MERGENTHALER. It has now been almost entirely supplanted by photocomposition. In Linotype, a keyboard is manipulated to compose each line of text. The slugs produced by the machine are rectangular solids of type metal (an alloy of lead, antimony, and tin) with raised characters that are a mirror image of the desired printed line. After hot-metal CASTING, the slug of type, air-cooled briefly, is placed in a "stick" for insertion in the proper position into the press form being made up. See also LETTERPRESS PRINTING, PRINTING.

Linux \'li-nəks\ Nonproprietary OPERATING SYSTEM (OS) for digital computers. In 1991 Linus Torvalds of Finland began asking for volunteer programmers over the INTERNET to collaborate on the development of a UNIX-like OS for PERSONAL COMPUTERS; the "1.0" release of Linux was in 1994. A true multiuser, multitasking system, Linux contained features (e.g., virtual memory, shared libraries, memory management, and TCP/IP networking) formerly only found on MAINFRAME computers. With its source code freely available, thousands of volunteers, as well as several companies that sell prepackaged Linux products, have contributed to the OS. A reliable, fast-performing system with good security features, Linux is popular for corporate computer NETWORK and Web SERVERS.

Linz \'lints\ *ancient* **Lentia** City (pop., 2001: 183,504), north-central Austria. Located on the DANUBE RIVER west of VIENNA and on the direct rail route between the Baltic and Adriatic seas, it originated as a Roman fortress. An important medieval trading centre, it was noted for its fairs in the 15th century. Linz was badly damaged in World War II. It is now a cultural centre and the seat of Johannes Kepler University.

lion Large, powerfully built CAT (*Panthera leo*), the proverbial "king of beasts." It is now found mainly in parts of sub-Saharan Africa, though about two hundred constitute an Asiatic race living under strict protection in India. Lions inhabit grassy plains and open savanna. The male is 6–7 ft (1.8–2.1 m) long, excluding the 3-ft (1-m) tail, stands about 4 ft (1.2 m) high at the shoulder, and weighs 370–500 lbs (170–230 kg). The female, or lioness, is considerably smaller. The male's coat is usually buff yellow or orange-brown; lionesses are more consistently tawny or sandy. The male's outstanding characteristic is his mane. Lions are unique among cats in that they live in a group, or pride, often consisting of about 15 individuals. Lionesses are the chief hunters. They prey on animals of all sizes, including hippopotamuses, but prefer wildebeests, antelopes, and zebras. After eating, a lion may rest for a week.

Male lion (*Panthera leo*).
R.I.M. CAMPBELL/BRUCE COLEMAN LTD.

Lion, Gulf of Gulf of the Mediterranean Sea, extending along the coast of southern France from the Spanish border to Toulon. Major ports along the gulf are MARSEILLE and Sète.

lionfish Any of several species of showy Indo-Pacific fish of the SCORPION-FISH family (Scorpaenidae), noted for their venomous fin spines, which can inflict painful, though rarely fatal, puncture wounds. Lionfish have enlarged pectoral fins and elongated dorsal fin spines, and each species bears a particular pattern of bold stripes. When disturbed, the fish spread and display their fins, and, if further pressed, present and attack with the dorsal spines. *Pterois volitans*, sometimes kept by fish fanciers, is striped with red, brown, and white and grows to about 12 in. (30 cm) long. Several smaller Indo-Pacific species of the genus *Dendrochirus* are also known as lionfish.

Lions Clubs, International Association of Civilian service club. The largest such organization in the world, it was founded in Dallas, Texas, U.S. in 1917 to foster a spirit of "generous consideration" among peoples of the world and to promote good government, good citizenship, and active interest in civic, social, commercial, and moral welfare. Its activities include general community welfare projects, aid to the blind, promotion of knowledge, and support for the UN. Lions Clubs operate in some 190 countries.

Lipari Islands See EOLIE ISLANDS

Lipchitz \'lip-shits**, Jacques** *orig.* **Chaim Jacob Lipchitz** (b. Aug. 10, 1891, Druskininkai, Lithuania, Russian Empire —d. May 26, 1973, Capri, Italy) Lithuanian-born French sculptor, he was also active in the U.S. Trained as an engineer in Vilnius, he turned to sculpture after moving to Paris in 1909. His early work was Cubist in style. Around 1925 he began producing a series of works known as "transparents," open-spaced, curvilinear bronzes, such as *Harpist* (1928), which would greatly influence the course of sculpture in the following quarter-century. After settling near New York City in 1941, he produced such massive works as *The Prayer* (1943) and *Bellerophon Taming Pegasus* (1966).

lipid \'lip-əd\ Any of a diverse class of organic compounds, found in all living things, that are greasy and insoluble in water. One of the three large classes of substances in foods and living cells, lipids contain more than twice as much energy (CALORIES) per unit of weight as the other two (PROTEINS and CARBOHYDRATES). They include the FATS and edible OILS (e.g., butter, olive oil, corn oil), which are primarily TRIGLYCERIDES; phospholipids (e.g., LECITHIN), which are important in cell structure and metabolism; WAXES of animal or plant origin; and sphingolipids, complex substances found in various tissues of the brain and nervous system. Since insolubility is the defining characteristic, CHOLESTEROL and related STEROIDS, carotenoids (see CAROTENE), PROSTAGLANDINS, and various other compounds are also classifiable as lipids.

lipid storage disease Any of a group of relatively rare hereditary disorders of FAT METABOLISM in which ENZYME defects cause distinctive types of LIPIDS to accumulate. They include TAY-SACHS DISEASE, Gaucher disease, Niemann-Pick disease, and Fabry disease. Several are untreatable and cause death before age five; others occur in adulthood.

Lipizzaner *or* **Lippizaner** \ˌli-pət-'sä-nər\ Breed of light HORSE named for the Austrian imperial stud at Lipizza, near Trieste, formerly part of Austria-Hungary. The founding of the breed, which has six strains, dates to 1580. Lipizzaners have a long back and a short, thick neck, average 15–16 hands (about 60–64 in., or 152–164 cm) in height and 1,000–1,300 lbs (450–585 kg) in weight, and are usually gray. Some are found in countries that were originally part of Austria-Hungary; a few have been exported to the U.S. The best known are those trained at Vienna's Spanish Riding School.

lipoprotein \ˌlī-pə-'prō-ˌtēn\ Any of a class of organic compounds that contain both LIPID (FAT) and PROTEIN. They may be soluble (those in egg yolk and blood plasma) or insoluble (those in cell membranes) in water and water solutions. Lipoproteins in blood plasma are the mode of transport for CHOLESTEROL, insoluble by itself. Low-density lipoproteins (LDLs) carry

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cholesterol from the liver, where it is made, to the cells, where it is used; high-density lipoproteins (HDLs) may carry excess cholesterol back to the liver for breakdown and excretion. LDL-bound cholesterol is primarily responsible for deposits in arteries (see ARTERIOSCLEROSIS) that can lead to CORONARY HEART DISEASE, ANGINA PECTORIS, MYOCARDIAL INFARCTION, or STROKE. HDL does not form such deposits and may actually retard or reduce their buildup.

Lippe \'li-pə\ Former German state. It lay between the TEUTOBURG FOREST and the WESER RIVER, and its capital was Detmold. A lordship in medieval times, it became a county in the 16th century. Dynastic divisions in the early 17th century resulted in two counties, Lippe and SCHAUMBURG-LIPPE. In 1720 it was made a principality. A member of the GERMAN CONFEDERATION in 1815, it became part of the German Empire in 1871 and of the WEIMAR REPUBLIC in 1918. In 1947 it was incorporated into North Rhine–Westphalia.

Lippe River River, western Germany. Rising on the western edge of the TEUTOBURG FOREST, it follows a westerly course of 155 mi (250 km) and enters the RHINE RIVER near Wesel. Once used for the transport of coal, timber, and agricultural produce, it now supplies water to the RUHR region canal system.

Lippi, Filippino (b. c. 1457, Prato, Republic of Florence—d. April 18, 1504, Florence) Italian painter. After the death of his father, FRA FILIPPO LIPPI, when Filippino was 12, he entered the workshop of SANDRO BOTTICELLI and absorbed many aspects of his style. One of his most important assignments was the completion of the frescoes in the Brancacci Chapel in Florence's Santa Maria del Carmine (c. 1485–87), left unfinished when MASACCIO died. His most popular painting is the *Vision of St. Bernard* altarpiece (c. 1480). His highly decorative frescoes in the Carafa Chapel in Santa Maria sopra Minerva, Rome (1488–93), and those in the Strozzi Chapel in Santa Maria Novella, Florence (completed 1502), anticipated Tuscan Mannerism of the 16th century.

Lippi, Fra Filippo (b. c. 1406, Florence—d. Oct. 8/10, 1469, Spoleto, Papal States) Italian painter. In 1421 he became a Carmelite monk at Santa Maria del Carmine in Florence, where MASACCIO was soon decorating the Brancacci Chapel with frescoes. Lippi himself painted frescoes in the church, much influenced by Masaccio's, then disappeared from the monastery in 1432. In 1434 he was in Padua, but in 1437 he returned to Florence under the protection of the MEDICI FAMILY and was commissioned to execute several works for convents and churches. His *Madonna and Child* (1437) and *Annunciation* (c. 1442) show a maturing style characterized by warm colouring and attention to decorative effects. Later critics have recognized in Lippi a "narrative" spirit that reflected the life of his time and translated into everyday terms the ideals of the early RENAISSANCE. In 1456, while painting in a convent in Prato, he fled with one of the nuns, Lucrezia Buti. The couple was later released from their individual vows and permitted to marry, and from that union was born the illustrious FILIPPINO LIPPI. The former friar returned often to Prato, and his frescoes in the cathedral there stand among his finest achievements.

"The Madonna and Child with Two Angels," by Fra Filippo Lippi, *c.* 1465; in the Uffizi, Florence
ALINARI—ART RESOURCE/EB INC.

Lippmann, Walter (b. Sept. 23, 1889, New York, N.Y., U.S.—d. Dec. 14, 1974, New York) U.S. newspaper commentator and author. Educated at Harvard, he became an editor at the fledgling *NEW REPUBLIC* (1914–17). His thinking influenced WOODROW WILSON, and he took part in the negotiations that culminated in the Treaty of Versailles. After writing for and editing the reformist *World*, he moved to the *New York Herald-Tribune,* where he began his "Today and Tomorrow" column in 1931; eventually widely syndicated, it won two Pulitzer Prizes (1958, 1962), and Lippmann became one of the most respected political columnists in the world. His books include *A Preface to Politics* (1913); *Public Opinion* (1922), perhaps his most influential work; *The Phantom Public* (1925); and *The Good Society* (1937).

Lipset, Seymour Martin (b. March 18, 1922, New York, N.Y., U.S.) U.S. sociologist and political scientist. He received his bachelor's degree from the City College of New York and his Ph.D. from Columbia University, where he later taught (1950–56). While teaching at the University of California, Berkeley (1956–66), he also served as director of its Institute of International Studies (1962–66). Since then he has taught at Harvard University, Stanford University, and George Mason University. His many books about class structure, elite behaviour, and political parties have significantly shaped the study of comparative politics.

Lipton, Sir Thomas J(ohnstone) (b. May 10, 1850, Glasgow, Scot.—d. Oct. 2, 1931, London, Eng.) British merchant who built the Lipton tea empire. He opened a small grocery in Glasgow that grew into a chain of retail shops throughout Britain. To supply his shops cheaply, Lipton bought tea, coffee, and cocoa plantations in Ceylon as well as English fruit farms, jam factories, and bakeries. In 1898 his business was organized into Lipton, Ltd.; he was knighted the same year and made a baronet in 1902. A keen yachtsman, he raced his Shamrock yachts five times unsuccessfully for the AMERICA'S CUP.

liquation \lī-'kwā-shən\ Technique for separating constituents of an ore, metal, or alloy by partial melting. When the material is heated to a temperature where one of the constituents melts and the other remains solid, the liquid constituent can be drained off. It was formerly used for extracting antimony minerals from ore, separating silver from copper with the use of lead as a solvent, and refining tin.

liqueur \li-'kər\ LIQUOR produced by combining a base spirit, usually BRANDY, with flavourings and sugar syrup. Alcohol content ranges from 24% to 60% by volume, and flavourings include fruits, nuts, herbs, spices, and such ingredients as coffee and chocolate. Liqueurs were probably first produced commercially by medieval monks and alchemists. Sweet and containing ingredients that promote digestion, they are popular as after-dinner drinks and are also used in mixed drinks and dessert dishes. Varieties include apricot liqueur, crème de menthe (mint-flavoured), curaçao (with green orange peel, from Curaçao), and proprietary brands such as Bénédictine (an herb liqueur), Grand Marnier (an orange liqueur from France's Cognac region), Irish Mist (flavoured with Irish whiskey and honey), and Kahlúa (coffee-flavoured).

liquid One of the three principal states of matter, intermediate between a gas and a solid. A liquid has neither the orderliness of a solid nor the randomness of a gas. Liquids have the ability to flow under the action of very small shear STRESSES. Liquids in contact with their own vapour or air have a SURFACE TENSION that causes the interface to assume the configuration of minimum area (i.e., spherical). Surfaces between liquids and solids have interfacial tensions that determine whether the liquid will wet the other material. With the exception of liquid metals, molten salts, and solutions of salts, the electrical conductivities of liquids are small.

liquid crystal Substance that flows like a liquid but maintains some of the ordered structure characteristic of a CRYSTAL. Some organic substances do not melt directly when heated but instead turn from a crystalline solid to a liquid crystalline state. When heated further, a true liquid is formed. Liquid crystals have unique properties. The structures are easily affected by changes in mechanical STRESS, ELECTROMAGNETIC FIELDS, temperature, and chemical environment. See also LIQUID CRYSTAL DISPLAY.

liquid crystal display (LCD) Optoelectronic device used in displays for watches, calculators, notebook computers, and other electronic devices. Current passed through specific portions of the LIQUID CRYSTAL solution causes the crystals to align, blocking the passage of light. Doing so in a controlled and organized manner produces visual images on the display screen. The advantage of LCDs is that they are much lighter and consume less power than other display technologies (e.g., CATHODE-RAY TUBES). These characteristics make them an ideal choice for flat-panel displays, as in portable laptop and notebook computers.

liquidity preference In economics, the premium that holders of wealth demand for exchanging ready money or bank deposits for safe, nonliquid assets such as government BONDS. As first used by JOHN MAYNARD KEYNES, liquidity preference referred to the demand for money as an asset. He hypothesized that the amount of money held for this purpose would vary inversely with the rate of INTEREST. Post-Keynesian analysis of

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liquidity preference has identified other factors that influence the demand for money, including income levels and the yields of various forms of wealth.

liquor See DISTILLED LIQUOR

Liri River \'lē-rē\ River, central Italy. It rises near Cappadocia and flows south and southeast through the APENNINES. Joined by other rivers, it turns southwest to empty into the Tyrrhenian Sea near Minturno. It is 98 mi (158 km) long. During World War II, the Liri valley was invaded by Allies as part of their advance on Rome.

Lisbon *Portuguese* **Lisboa** City (pop., 2001: 556,797), capital of PORTUGAL. The country's chief seaport and largest city, it lies on the TAGUS RIVER near the river's entrance into the Atlantic Ocean. It was under Roman rule from 205 BC; JULIUS CAESAR made it a municipium called Felicitas Julia. Ruled by a series of barbarian tribes from the 5th century, it was captured by Moors in the 8th century. The Crusaders under AFONSO I gained control of it in 1147, and it became the national capital in 1256. It flourished as a leading European trading city in the 14th–16th centuries. One of the greatest earthquakes ever recorded struck Lisbon in 1755, killing 30,000. Urban renewal following the earthquake was unrivaled in scope. Lisbon hosted the World's Fair (Expo '98). It is a major commercial, administrative, educational, and manufacturing centre. It was the birthplace of LUIS CAMÕES.

Lisburn Town (pop., 1991: 42,110), seat of Lisburn district (pop., 2001: 108,694), Northern Ireland. Located on the River Lagan southwest of BELFAST, it was a small village known as Lisnagarvey before English, Scots, and Welsh settled there in the 1620s as part of the Plantation of Ulster scheme. It later attracted French linen workers who introduced Dutch looms and reorganized the Ulster linen industry; the town is still an important linen-manufacturing centre. The district was created in 1973.

LISP \'lisp\ Powerful computer PROGRAMMING LANGUAGE designed for manipulating lists of data or symbols rather than processing numerical data, used extensively in ARTIFICIAL-INTELLIGENCE applications. It was developed in the late 1950s and early 1960s by a group headed by JOHN MCCARTHY at MIT. Its name derives from "list processor." Radically different from such other programming languages as ALGOL, C, C++, FORTRAN, and PASCAL, it requires large memory space and is slow in executing programs.

Lissitzky, El *or* **El Lisitsky** *orig.* **Lazar Markovich Lisitskii** (b. Nov. 10, 1890, Pochinok, near Smolensk, Russia—d. Dec. 30, 1941, Moscow) Russian painter, typographer, and designer. As a teacher at MARC CHAGALL's revolutionary art school in Vitebsk, he met KAZIMIR MALEVICH, whose influence is seen in a series of abstract paintings that were Lissitzky's major contribution to CONSTRUCTIVISM. In 1922, after the Soviet government turned against modern art, he went to Germany. There THEO VAN DOESBURG and LÁSZLÓ MOHOLY-NAGY transmitted his ideas to the West through their teaching at the BAUHAUS. In 1925 he returned to Russia and devoted himself to devising new techniques of printing, photomontage, and architecture.

List, (Georg) Friedrich (b. Aug. 6, 1789, Reutlingen, Württemberg, Ger.—d. Nov. 30, 1846, Kufstein, Austria) German-born U.S. economist. He first gained prominence as the founder of an association of German industrialists that favoured abolishing tariff barriers between the German states. Exiled in 1825 for his liberal views, he went to the U.S. In his *Outlines of American Political Economy* (1827) he maintained that a national economy in an early stage of industrialization required tariff protection to stimulate development. After becoming a U.S. citizen, he returned to Germany as U.S. consul at Baden (1831–34) and Leipzig (1834–37). His best-known work was *The National System of Political Economy* (1841). Financial and other difficulties eventually drove him to suicide.

Lister, Joseph *later* **Baron Lister (of Lyme Regis)** (b. April 5, 1827, Upton, Essex, Eng.—d. Feb. 10, 1912, Walmer, Kent) British surgeon and medical scientist. He received a medical degree from Oxford in 1852 and became an assistant to James Syme, the greatest surgical teacher of the day. In 1861 he was appointed surgeon to the Glasgow Royal Infirmary, where he observed that 45–50% of amputation patients died from sepsis (infection). Initially he theorized that airborne dust might cause sepsis, but in 1865 he learned of LOUIS PASTEUR's theory that microorganisms cause infection. Using PHENOL as an antiseptic, Lister reduced mortality in his ward to 15% within four years. Most surgeons were unconvinced until a widely publicized operation under antiseptic conditions was successful. By the time of his retirement in 1893, he had seen his principle accepted almost universally. He is regarded as the founder of antiseptic medicine.

Joseph Lister, 1857.
COURTESY OF THE WELLCOME TRUSTEES, LONDON

Liszt \'list**, Franz** *Hungarian* **Ferenc Liszt** (b. Oct. 22, 1811, Raiding, Hung.—d. July 31, 1886, Bayreuth, Ger.) Hungarian composer and pianist. Encouraged by his father, who was a talented amateur musician, Liszt developed an early interest in music and began composing at age eight. He studied piano with KARL CZERNY and composition with ANTONIO SALIERI in Vienna, making his debut there in 1822. After a Paris success in 1823, he toured Europe, but his father's early death (1828) and a disastrous love affair led to a desire to give up music for the priesthood. Hearing violinist NICCOLÒ PAGANINI perform in 1831, Liszt was inspired to develop his own technique to the utmost and to compose his first mature pieces, including the *Transcendental Études* (1837) and *Paganini Études* (1839). An affair with Countess Marie d'Agoult resulted in the birth of his daughter, Cosima (1837–1930), who would marry his friend, the composer RICHARD WAGNER. Liszt's brilliance and success were at their peak during the 1840s, when he toured Europe as a virtuoso, earning great adulation for his panache and his astounding technique. He ceased concertizing in the late 1840s to devote himself to composition and furthering the work of progressive composers. In the 1850s he wrote many of his most ambitious works, including *A Faust Symphony* (1854) and the *Piano Sonata in B Minor* (1853). In 1865 he took minor Roman Catholic church orders, though he never became a priest. His later output is remarkable in anticipating many 20th-century developments; for instance, his development of chromatic harmony influenced atonal music.

Franz Liszt, lithograph by Joseph Kriehuber, 1846.
COURTESY OF THE MUSEO TEATRALE ALLA SCALA, MILAN

Litani \li-'tä-nē\ **River** River, southern Lebanon. Rising west of BAALBEK, it flows southwest between the LEBANON and ANTI-LEBANON MOUNTAINS to enter the Mediterranean Sea south of Sidon. Its lower course is known as Qāsimiyyah. Although only 90 mi (145 km) long, the river irrigates one of Lebanon's most extensive farming regions, the BIQAʿ VALLEY.

litchi *or* **lichee** *or* **lychee** \'lē-chē, 'lī-chē\ Fruit of the tree *Litchi chinensis* (family Sapindaceae), believed to be native to southern China and adjacent regions but now also cultivated elsewhere. It has been a favourite fruit of the Cantonese since ancient times and is a popular dessert in U.S. Chinese restaurants. The fresh pulp tastes musky; when dried, it is acidic and very sweet. The handsome tree develops a compact crown of foliage, with compound leaves that are bright green year-round. Clusters of small, inconspicuous flowers form small, oval red fruits.

literacy Ability to read and write. The term may also refer to familiarity with literature and to a basic level of education obtained through the

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written word. In ancient civilizations such as those of the Sumerians and Babylonians, literacy was the province of an elite group of scholars and priests. Though more prevalent in classical Greece and Rome, it was often limited to members of the upper classes. The spread of literacy in Europe in the Middle Ages was evidenced by the use of writing for functions once conducted orally, such as the indenture of servants and the notation of evidence at trials. The rise of literacy in Europe was closely tied to great social transformations, notably the Protestant Reformation, which brought individual study of the Bible, and the development of modern science. The spread of literacy during the Reformation and the Renaissance was greatly facilitated by the development of PRINTING from movable type and by the adoption of vernacular languages in place of Latin. Compulsory schooling, established in Britain, Europe, and the U.S. in the 19th century, has led to high rates of literacy in the modern industrialized world.

literary criticism Discipline concerned with philosophical, descriptive, and evaluative inquiries about literature, including what literature is, what it does, and what it is worth. The Western critical tradition began with PLATO's *Republic* (4th century BC). A generation later, ARISTOTLE, in his *Poetics*, developed a set of principles of composition that had a lasting influence. European criticism since the Renaissance has primarily focused on the moral worth of literature and the nature of its relationship to reality. At the end of the 16th century, SIR PHILIP SIDNEY argued that it is the special property of literature to offer an imagined world that is in some respects superior to the real one. A century later JOHN DRYDEN proposed the less idealistic view that literature must primarily offer an accurate representation of the world for "the delight and instruction of mankind," an assumption that underlies the great critical works of ALEXANDER POPE and SAMUEL JOHNSON. A departure from these ideas appeared in the criticism of the Romantic period, epitomized by WILLIAM WORDSWORTH's assertion that the object of poetry is "truth…carried alive into the heart by passion." The later 19th century saw two divergent developments: an aesthetic theory of "art for art's sake," and the view (expressed by MATTHEW ARNOLD) that literature must assume the moral and philosophical functions previously filled by religion. The volume of literary criticism increased greatly in the 20th century, and its later years saw a radical reappraisal of traditional critical modes and the development of a multiplicity of critical factions (see DECONSTRUCTION; POSTSTRUCTURALISM; STRUCTURALISM).

literati Scholars in China and Japan whose poetry, calligraphy, and paintings were supposed primarily to reveal their cultivation and express their personal feelings rather than demonstrate professional skill. The concept of literati painters was first formulated in China in the Northern SONG DYNASTY but was enduringly codified in the MING DYNASTY by DONG QICHANG. In the 18th–19th century, literati painting became popular with the Japanese, who exaggerated elements of Chinese composition and brushwork. See also IKE NO TAIGA.

lithification Complex process whereby loose grains of sediment are converted into ROCK. Lithification may occur at the time a sediment is deposited or later. CEMENTATION is one of the main processes involved, particularly for sandstones and conglomerates. In addition, reactions take place within a sediment between various minerals and between minerals and the fluids trapped in the pores; these reactions may form new minerals or add to others already present in the sediment.

lithium Chemical ELEMENT, lightest alkali METAL, chemical symbol Li, atomic number 3. It is soft, white, lustrous, and very reactive, forming compounds in which it has VALENCE 1. The metal is used in certain ALLOYS, as a coolant in nuclear reactors, and (because of its reactivity) as a reagent, scavenger, and rocket fuel. Lithium HYDRIDE is used as a source of hydrogen; lithium hydroxide is used as an additive in storage BATTERIES and to absorb carbon dioxide. Halides (see HALOGEN) of lithium are used as moisture absorbents, and lithium SOAPS are used as thickeners in lubricating greases. Lithium carbonate is an important drug for treating DEPRESSION and BIPOLAR DISORDER.

litho-offset See OFFSET PRINTING

lithography \li-'thä-grə-fē\ PRINTING process that makes use of the immiscibility of grease and water. Aloys Senefelder of Prague (1771–1834) exploited the properties of a stone with a calcium carbonate base and a fine, porous surface, and perfected his printing process in 1798. In Senefelder's process, the stone, with a design drawn on it with crayon or greasy ink, was wetted with water; after various etching and protecting steps, it was brushed with oily ink; it retained the ink only on the design. This inked surface was then printed—either directly on paper, by a special press (as in most fine-art PRINTMAKING), or onto a rubber cylinder and thence onto paper (as in commercial printing). The method of preparing stones for hand printing, still the lithographic method preferred by artists, has hardly changed. Commercial lithographic printing on a modern rotary OFFSET PRINTING press can produce high-quality, finely detailed impressions at high speed, reproducing any material that can be photographed in the platemaking process. It now accounts for more than 40% of all printing, packaging, and publishing, more than twice the percentage produced by any other single printing process.

lithosphere Rigid, rocky outer layer of the Earth, consisting of the CRUST and the solid outermost layer of the upper MANTLE. It extends to a depth of about 60 mi (100 km). It is broken into about a dozen separate, rigid blocks, or plates (see PLATE TECTONICS). Slow convection currents deep within the mantle, generated by radioactive heating of the interior, are believed to cause the lateral movements of the plates (and the continents that rest on top of them) at a rate of several inches per year.

Lithuania *officially* **Republic of Lithuania** Country, northeastern Europe. Area: 25,212 sq mi (65,300 sq km). Population (2005 est.): 3,413,000. Capital: VILNIUS. Lithuanians make up about four-fifths of the

population; there are smaller numbers of Russians, Poles, and Belarusians. Languages: Lithuanian (official), Russian, Polish, Belarusian. Religion: Christianity (predominantly Roman Catholic; also Eastern Orthodox). Currency: litas. The country consists of low-lying plains alternating with hilly uplands, watered by rivers that meander westward to the Baltic Sea. Manufacturing, including metalworking, woodworking, and textile production, is especially important in the east and south. Agriculture focuses on livestock breeding, especially dairy farming and pigs, and the cultivation of cereals, flax, sugar beets, potatoes, and fodder crops. Lithuania is a multiparty republic with one legislative house; its head of state is the president, and the head of government is the prime minister. Lithuanian tribes united in the mid-13th century to oppose the TEUTONIC Knights. Gediminas, one of the grand dukes, expanded Lithuania into an empire that dominated much of eastern Europe in the 14th–16th centuries. In 1386 the Lithuanian grand duke became the king of Poland, and the two countries remained closely associated for the next 400 years. Lithuania was acquired by Russia in the Third Partition of POLAND in 1795 and joined in the Polish revolt in 1863. Occupied by Germany during World War I, it declared its independence in 1918. In 1940 the Soviet Red Army gained control of Lithuania, which was soon incorporated into the Soviet Union. Germany occupied Lithuania again from 1941, but the Red Army regained control in 1944. With the breakup of

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the U.S.S.R., Lithuania declared its independence in 1990 and gained full independence in 1991. In the 1990s and early 21st century it sought economic stability, and in 2004 it became a member of the European Union.

Lithuanian language East Baltic language spoken by more than four million people in the Republic of Lithuania and in diaspora communities, with perhaps 70,000 speakers in North America. Lithuanian is sparsely attested until 1547, when the first book in the language was printed. Efforts to develop a standard language in the late 19th century were dominated by speakers of the West High dialect spoken in German-ruled East Prussia. Among them was Jonas Jablonskis (1860–1930), whose orthography (based on the Latin alphabet with numerous diacritics) and grammar (1901) won official acceptance when Lithuania became independent. Lithuanian is renowned for its archaism among living Indo-European languages.

litmus \'lit-məs\ Mixture of coloured organic compounds obtained from several species of lichens. In the form of a water solution or as litmus paper, it is the oldest and most-used indicator of whether a substance is an acid or a base. It turns red or pink in acid solutions and blue or purple-blue in alkaline solutions.

Little Armenia *or* **Lesser Armenia** Ancient kingdom, southeastern coast of Anatolia. After initial struggles with the Byzantine Empire, it was established in Cilicia by the Armenian Rubenid dynasty in the 12th century and developed contacts with the West. It was influenced by cultural contacts with Crusaders and with Venetian and Genoese merchants. It was conquered by the Muslim Mamlūk dynasty in 1375.

Little Bighorn, Battle of the *or* **Custer's Last Stand** (June 25, 1876) Battle at the Little Bighorn River, Montana Territory, U.S., between federal troops led by Lt. Col. George Armstrong Custer and a band of Sioux and Cheyenne Indians. The U.S. government had ordered the northern Plains tribes to return to designated reservations and had sent troops under Gen. Alfred H. Terry to enforce the order. Terry hoped to surround an Indian encampment at the mouth of the Little Bighorn, but a party of some 200 soldiers led by Custer launched an early attack and was slaughtered. Government troops subsequently flooded into the area and forced the Indians to surrender.

Little Entente \än-'tänt\ Mutual defense arrangement formed in 1920–21 between Czechoslovakia, Yugoslavia, and Romania, with French support. It was directed against German and Hungarian domination in the Danube River basin and toward protection of its members' territorial integrity. It was successful in the 1920s, but after Adolf Hitler's rise to power (1933) its members adopted increasingly independent foreign policies. The entente collapsed after Germany annexed the Czech Sudetenland (1938).

Little League International baseball organization for children and youth, started in 1939 in Williamsport, Pa., by Carl E. Stotz and brothers Bert and George Bebble. The league originally included boys aged 8–12; girls were admitted in 1974. It now includes two upper divisions for youths aged 13–15 and 16–18. In the junior division the game is played on a field two-thirds the size of a professional baseball diamond. A season comprises about 15 games. The organization expanded rapidly after World War II; by the 1990s there were about 2.5 million players in some 30 countries. The Little League World Series is held in Williamsport each year in August.

little magazine Any of various small, usually avant-garde periodicals devoted to serious literary writings. The name signifies most of all a usually noncommercial manner of editing, managing, and financing. They were published from c. 1880 through much of the 20th century and flourished in the U.S. and England, though French and German writers also benefited from them. Foremost among them were two U.S. periodicals, *Poetry* and the more erratic and often more sensational *Little Review* (1914–29); the English *Egoist* (1914–19) and *Blast* (1914–15); and the French *transition* (1927–38).

Little Missouri River River, northwestern U.S. It rises in northeastern Wyoming and flows northeast across the southeastern corner of Montana and the northwestern corner of South Dakota. It continues north into North Dakota, turning east to empty into the Missouri River after a course of 560 mi (900 km). The Theodore Roosevelt National Park lies along its shores in North Dakota.

Little Richard *orig.* **Richard Wayne Penniman** (b. Dec. 5, 1932, Macon, Ga., U.S.) U.S. rhythm and blues singer and pianist. Born into a strict religious family, he sang and played piano in church but was later ejected from his home by his father, reportedly for homosexual behaviour. He performed in nightclubs, traveled with a medicine show, and recorded as a blues artist from the early 1950s. His first big hit came with "Tutti Frutti" (1956), an energetic performance that, with his penchant for the outrageous, set a standard for the emerging rock idiom. Similar hits followed, including "Long Tall Sally," "Lucille," and "Good Golly, Miss Molly." In 1957 he underwent a religious conversion and was later ordained a minister. He soon returned to music, becoming a regular attraction in Las Vegas, and he continued to tour and appear in films with much success. He was an original inductee into the Rock and Roll Hall of Fame.

Little Rock City (pop., 2000: 183,133), capital of Arkansas, U.S., located on the Arkansas River. In 1722 Bernard de la Harpe, a French explorer, named the site La Petite Roche for a rock formation on the riverbank. It became the capital of Arkansas in 1821. It was strongly anti-Union at the outbreak of the American Civil War; Federal troops occupied the city in 1863. It grew as the commercial centre of a farming region and as a hub of railway and river transportation. In 1957 federal troops were sent there to prevent state authorities from interfering with desegregation at Central High School. The state's largest city, it has many institutions of higher learning, including the University of Arkansas at Little Rock (1927).

Little St. Bernard Pass Mountain pass, Savoy Alps. Situated southwest of the Italian border in southeastern France, it connects Bourg-St.-Maurice, France, with La Thuile, Italy. Hannibal probably led the Carthaginian army over the pass on his way toward Rome in 218 BC. It was the principal route across the Alps into Gallia Comata, a province of Gaul, until Montgenèvre Pass was opened in 77 BC. Beside the pass is a hospice founded in the 11th century by St. Bernard of Menthon.

little theatre Movement in U.S. theatre to free dramatic forms and methods of production from the limitations of the large commercial theatres by establishing small experimental centres of drama. Young dramatists, stage designers, and actors influenced by the vital European theatre of the late 19th century, especially by the theories of Max Reinhardt, established community playhouses such as the Little Theatre, New York City (1912), the Little Theatre, Chicago (1912), and the Toy Theatre, Boston (1912). A few became important commercial producers; the Washington Square Players (1915), for example, later became the Theatre Guild (1918). Playwrights such as Eugene O'Neill, George S. Kaufman, and Maxwell Anderson found their early opportunities in the little theatres.

Little Turtle (b. c. 1752, near Fort Wayne, Ind.—d. July 14, 1812, Fort Wayne, Ind., U.S.) American Indian leader. Chief of the Miami tribe, he led raids on settlements in the Northwest Territory in the early 1790s. Defeated by Gen. Anthony Wayne at the Battle of Fallen Timbers (1794), he was obliged to sign the Treaty of Greenville (1795), which ceded to the U.S. much of Ohio and parts of Illinois, Indiana, and Michigan. He then advocated peace and prevented the Miami from joining the Shawnee confederacy of Tecumseh.

Littleton, Sir Thomas (b. 1422, probably at Frankley, Worcestershire, Eng.—d. Aug. 23, 1481, Frankley) British jurist. In a turbulent period he held several high offices, including judge of the Court of Common Pleas (from 1466). His *Littleton on Tenures* (1481 or 1482) was the earliest treatise on English law ever printed. It long remained the principal authority on English real property law.

liturgical drama Play acted in or near the church in the Middle Ages. The form probably dated from the 10th century, when the "Quem quaeritis" ("Whom do you seek") section of the Easter mass was performed as a small scene in the service. The plays gradually increased in length, with themes derived from biblical stories (particularly those of Easter and Christmas), and they flourished in the 12th–13th centuries. Their Latin dialogue was frequently chanted to simple melodies. They continued to be written into the 16th century, but the connection with the church eventually ended as the plays came under secular sponsorship and were acted in the vernacular. See also miracle play; morality play; mystery play.

Liturgical movement 19th- and 20th-century effort to encourage the active participation of the laity in the liturgy of the Christian churches by creating simpler rites more attuned to early Christian traditions and more relevant to modern life. The movement began in the Roman Catholic church in the mid-19th century and spread to other Christian churches in Europe and the U.S. The Second Vatican Council (1962–65) called for

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translation of Latin liturgies into the vernaculars of individual countries and the reform of all sacramental rites. The Lutheran Church revised the *Lutheran Book of Worship* in 1978, and the Episcopal Church adopted a revised *Book of Common Prayer* in 1979.

Litvinov \lyit-'vē-nȯf**, Maksim (Maksimovich)** *orig.* **Meir Walach** (b. July 17, 1876, Białystok, Pol.—d. Dec. 31, 1951, Moscow, Russia, U.S.S.R.) Soviet diplomat and commissar of foreign affairs (1930–39). He joined the Russian Social-Democratic Workers' Party (1898), was arrested for revolutionary activity (1901), and fled to Britain. In 1917–18 he represented the Soviet government in London, then returned to Russia, where he joined the Commissariat for Foreign Affairs and led Soviet delegations to disarmament conferences. As commissar for foreign affairs, he established diplomatic relations with the U.S. (1934), negotiated anti-German treaties with France and Czechoslovakia (1935), and urged the League of Nations to resist Germany (1934–38). He was dismissed before the signing of the German-Soviet Nonaggression Pact (1939). He served as ambassador to the U.S. (1941–43).

Liu Bang See Gaozu

Liu Shaoqi \lē-'ü-'shaù-'chē\ *or* **Liu Shao-ch'i** (b. Nov. 24, 1898, Ningxiang district, Hunan province, China—d. Nov. 12, 1969, Kaifeng, Henan province) Chairman of the People's Republic of China (1959–68) and chief theoretician of the Chinese Communist Party (CCP). An activist communist background from the 1920s helped Liu's rise within the CCP in the 1930s and '40s, while his excellent education and studies in the Soviet Union made him an effective spokesman for the new government in China. When Mao resigned as chairman after the failure of his Great Leap Forward, Liu assumed the title. His policies for revitalizing agriculture by permitting peasants to cultivate private plots and giving them monetary incentives were ones to which Mao later strongly objected. In 1968 Liu was purged from power for being a "capitalist roader" and Lin Biao was appointed Mao's successor. Not until 1974 was Liu's death in 1969 made public.

Liu Songnian *or* **Liu Sung-nien** (b. 1174—d. 1224, Qiantang, Zhejiang province, China) Chinese figure and landscape painter. Liu entered the Southern Song Painting Academy as a student in the Chunxi period (1174–89) and went on to become a *daizhao* ("painter-in-attendance") in the Shaoxi period (1190–94). During the reign of the emperor Ningzong (1195–1224) he was awarded the prestigious Golden Belt. Liu followed the tradition of Li Tang. Typically his works featured relatively large figures executed in a detailed manner and placed close to the spectator in the picture plane. The facial expressions of his figures are vivid, and the patterns in which their clothing drapes are very intricate. His most important landscape paintings depict a human in harmony with nature. Liu paved the way for an academic style that would be further developed by his contemporaries Ma Yuan and Xia Gui.

live oak Any of several North American ornamental and timber trees in the red-oak group of the genus *Quercus* in the beech family. The southern live oak (*Q. virginiana*) is a massive (50 ft, or 15 m, tall), durable evergreen tree. The trunk divides near the ground into several limbs that extend horizontally as much as two to three times the height of the tree. The elliptical leaves are dark green and glossy above, whitish and hairy below. A valuable timber tree, the southern live oak is also planted as a shade and avenue tree in the southern U.S. The oldest trees are 200–300 years old.

liver Largest gland in the body, with several lobes. It secretes bile; metabolizes proteins, carbohydrates, and fats; stores glycogen, vitamins, and other substances; synthesizes coagulation factors; removes wastes and toxic matter from the blood; regulates blood volume; and destroys old red blood cells. The portal vein carries blood from the gastrointestinal tract, gallbladder, pancreas, and spleen to the liver to be processed. A duct system carries bile from the liver to the duodenum and the gallbladder. Liver tissue consists of a mass of cells tunneled with bile ducts and blood vessels. About 60% are hepatic cells, which have more metabolic functions than any other cells. A second type, Kupffer cells, play a role in blood-cell formation, antibody production, and ingestion of foreign particles and cell debris. The liver manufactures plasma proteins, including albumin and clotting factors, and synthesizes enzymes that modify substances such as nutrients and toxins, filtered from the blood. Liver disorders include jaundice, hepatitis, cirrhosis, tumours, vascular obstruction, abscess, and glycogen-storage diseases.

Liverpool City (pop., 2001: 439,476), northwestern England, on the estuary of the River Mersey. It forms the nucleus of the metropolitan county of Merseyside in the historic county of Lancashire. King John granted its charter in 1207. Its growth was slow until the 18th century, when it expanded rapidly as a result of trade with the Americas and the West Indies, becoming Britain's most important port after London. The Liverpool and Manchester Railway (opened 1830) was the first in England to link two major cities. Heavily damaged in World War II, it declined in importance as a port and an industrial centre in the postwar era. The birthplace of the Beatles, it is also the seat of the University of Liverpool (1903).

Liverpool, Robert Banks Jenkinson, 2nd earl of (b. June 7, 1770, London, Eng.—d. Dec. 4, 1828, Fife House, Whitehall, London) British prime minister (1812–27). He entered the House of Commons in 1790 and became a leading Tory, serving as foreign secretary (1801–04), home secretary (1804–06, 1807–09), and secretary for war and the colonies (1809–12). The War of 1812 with the U.S. and the final campaigns of the Napoleonic Wars were fought during his premiership. He urged abolition of the slave trade at the Congress of Vienna (1814–15). Although sometimes overshadowed by his colleagues and by the duke of Wellington's military prowess, he conducted a sound administration.

liverwort Any of more than 8,000 species of small, nonvascular, spore-producing land plants that make up the class Hepatopsida (or Hepaticae) of bryophytes, found worldwide but mostly in the tropics. Thallose liverworts commonly grow on moist soil or damp rocks; leafy liverworts are found in similar habitats and on tree trunks in damp woods. Sexual (gametophyte) and asexual (sporophyte) generations alternate in the life cycle (see alternation of generations). The thallus of thallose liverworts, resembling a lobed liver, gives liverworts their name. Though not economically important to humans, liverworts provide food for animals, facilitate the decay of logs, and aid in the disintegration of rocks by their ability to retain moisture.

livestock Farm animals, with the exception of poultry. In Western countries the category encompasses primarily cattle, sheep, pigs, goats, horses, donkeys, and mules; other animals (e.g., buffalo, oxen, or camels) may predominate in other areas. See also ass, cow, dairy farming.

Living Theatre, The Theatrical avant-garde repertory company. It was formed in New York City in 1947 by Julian Beck (1925–85) and Judith Malina (b. 1926) to produce experimental plays, often on radical themes. Its first big success was Jack Gelber's *The Connection* (1959), a drama of drug addiction. After problems with U.S. tax authorities, the company was relocated to Europe (1964–68). It returned to New York City to present the confrontational *Paradise Now* (1968), a production intended to spark revolution. In the 1970s the group presented a cycle of plays in public spaces and nontraditional venues (Pittsburgh steel mills, Brazilian prisons, the streets of Palermo, Italy) under the collective title *The Legacy of Cain*. Thereafter the company performed again in theatres, continuing to examine new dramatic techniques. After 1999 The Living Theatre divided its time between headquarters in Italy and New York City.

living will Document specifying medical measures to be taken or withheld in the event the writer is disabled. Advances in medical technology now allow the body to be kept alive in circumstances that would normally result in death (e.g., inability to eat, breathe, or maintain the heartbeat), but many people do not want to be kept alive if there is no chance of recovery. Because it is impossible to express one's wishes when in a vegetative state, a living will allows them to be stated in advance. Such a document usually specifies conditions under which a do-not-resuscitate (DNR) order is to take effect and authorizes another person to make decisions on the patient's behalf.

Robert R. Livingston, portrait by Charles Willson Peale, c. 1782; in Independence National Historical Park, Philadelphia

COURTESY OF THE INDEPENDENCE NATIONAL HISTORICAL PARK COLLECTION, PHILADELPHIA

Livingston, Robert R. (b. Nov. 27, 1746, New York, N.Y.—d. Feb. 26, 1813, Clermont, N.Y.) U.S. law-

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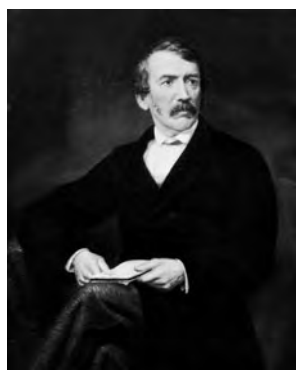
yer and diplomat. He served in the Continental Congress and helped draft the DECLARATION OF INDEPENDENCE. As New York state's first chancellor (1777–1801), he administered the oath of office to Pres. GEORGE WASHINGTON (1789). From 1781 to 1783 he was U.S. secretary of foreign affairs. As minister to France from 1801 to 1804, he helped effect the LOUISIANA PURCHASE. In partnership with ROBERT FULTON, he later received a steamboat monopoly for New York waters; the first vessel to operate on the Hudson River (1807) was named the *Clermont*, after his ancestral home.

Livingston, William (b. Nov. 30, 1723, Albany, N.Y.—d. July 25, 1790, Elizabeth, N.J.) American politician. He served in the New York legislature (1759–60), wrote political pamphlets and newspaper articles, and helped prepare a digest of New York laws for the period 1691 to 1756. He moved to New Jersey in 1772 and represented the colony in the Continental Congress (1774–76). As New Jersey's first governor (1776–90), he was a delegate to the CONSTITUTIONAL CONVENTION and led his state to an early ratification of the U.S. Constitution.

Livingstone, David (b. March 19, 1813, Lanarkshire, Scot.—d. May 1, 1873, Chitambo, Barotseland) Scottish missionary and explorer in Africa. Of working-class origins, Livingstone studied theology and medicine in Glasgow before being ordained (1840) and deciding to work in Africa to open up the interior for colonization, extend the Gospel, and abolish the slave trade. By 1842 he had already penetrated farther north of the Cape Colony frontier than any other white man. He was the first European to reach Lake NGAMI (1849) and the first to reach LUANDA from the interior (1854). He encountered and named VICTORIA FALLS (1855), journeyed across the continent to eastern Mozambique (1856, 1862), explored the Lake MALAWI region (1861–63), came across Lakes MWERU and BANGWEULU (1867), and penetrated to points farther east of Lake Tanganyika than any previous expedition had managed (1871). His attempt to find the source of the Nile (1867–71) failed. When he was found by HENRY MORTON STANLEY in 1871, his health was failing; he refused to leave, and in 1873 he was found dead by African aides. Livingstone produced a complex body of knowledge—geographic, technical, medical, and social—that took decades to mine. In his lifetime he stirred the imagination of English-speaking peoples everywhere and was celebrated as one of the great figures of British civilization.



David Livingstone, oil painting by F. Havill after photographs; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Livonia Region, eastern coast of Baltic Sea, north of Lithuania. Originally inhabited by the Livs, a Finno-Ugric people, it eventually expanded to include nearly all of modern Latvia and Estonia. In the 13th century it was conquered and Christianized by the Order of the Brothers of the Sword and organized into the Livonian confederation. A Russian invasion set off the Livonian War (1558–82), in which Russia, Poland, and Sweden seized portions of it. Sweden eventually gained control of most of it but ceded the region to Russia in 1721. In 1918 the northern portion became part of independent Estonia and the southern portion joined independent Latvia.

Livorno *English* **Leghorn** City (pop., 2001 prelim.: 148,143), TUSCANY region, central Italy, on the Ligurian Sea. Originally a fishing village, it came under Florentine rule in 1421. COSIMO I began construction of the Medici Harbour in the 16th century, and under Ferdinand I of Tuscany (1549–1609) the city became a haven for refugees. In the 18th century Leopold II enlarged the harbour and gave privileges to foreign merchants. Livorno became part of the Kingdom of Italy in 1860. One of Italy's largest ports, it has extensive commercial activities and a large shipbuilding yard. Historic sites include a cathedral and a 16th-century fort.

Livy \'li-vē\ *orig.* **Titus Livius** (b. 59/64 BC, Patavium, Venetia—d. AD 17, Patavium) Roman historian. Little is known of his life, most of which must have been spent in Rome. His lifework was a history of the city, written in 142 books; Books 11–20 and 46–142 have been lost, and those after Book 45 are known only from fragments and later summaries. Unlike earlier Roman historians, Livy played no part in politics, and as a result he presented history not as partisan politics but in terms of character and morality. The Latin prose style he developed suited his subject matter. His history, a classic in his lifetime, profoundly influenced the style and philosophy of historical writing down to the 18th century.

lizard Any of about 3,000 species of REPTILES constituting the suborder Sauria. They are most diverse and abundant in the tropics but are found from the Arctic Circle (one species) to southern Africa, South America, and Australia. Like SNAKES, lizards have scales, paired male copulatory organs, and a flexible skull. Typical lizards have a moderately cylindrical body, four well-developed legs (although some lizards are legless), a tail slightly longer than the head and body combined, and movable lower eyelids. They range in size from 1-in. (3-cm) GECKOS to the 10-ft (3-m) KOMODO DRAGON, but most are about 12 in. (30 cm) long. Ornamentation includes crests on the head, back, or tail; spines; brightly coloured throat fans; and throat frills. Most species feed on insects and rodents, but some, such as the IGUANA, eat plants. See also GILA MONSTER; HORNED TOAD.

Ljubljana \lē-ˌü-blē-'ä-nə\ City (pop., 2002 prelim.: 257,338), capital of SLOVENIA. Located on the Ljubljanica River, it is surrounded by the northern Dinaric ALPS. The site of the Roman city of Emona in the 1st century BC, it was destroyed in the 5th century AD and rebuilt by the Slavs as Luvigana. It passed to Carniola in the 12th century and came under HABSBURG rule in 1277. Taken by the French in 1809, it was the administrative seat of the ILLYRIAN PROVINCES until 1813 and the capital of the kingdom of Illyria from 1816 to 1849. It was the centre of Slovene nationalism under Austrian rule, and in 1918 it became part of the Kingdom of Serbs, Croats, and Slovenes (later Yugoslavia). It remained the Slovene capital after Slovenia's independence in 1992. A railroad and commercial centre, it is the site of the University of Ljubljana (founded 1595).

llama \'lä-mə\ Domesticated South American lamoid (see ALPACA), maintained in herds in Bolivia, Peru, Ecuador, Chile, and Argentina. The llama (*Lama glama*) is used primarily as a pack animal but also as a source of food, wool, hides, tallow for candles, and dried dung for fuel. A 250-lb (113-kg) llama can carry a load of 100–130 lb (45–60 kg) and travel 15–20 mi (25–30 km) a day. It can subsist on little water and a wide variety of plant materials. Though usually white, it may be solid black or brown, or white with black or brown markings. It is usually gentle, but when overloaded or mistreated it will lie down, hiss, spit and kick, and refuse to move. Not known to exist in the wild state, it appears to have been bred from GUANACOS during or before the INCA civilization.

Llandrindod \hlan-'drin-ˌdäd\ **Wells** Town (pop., 1991: 4,362), administrative centre of Powys county, historic county of Radnorshire, eastern Wales. Its medicinal waters were first discovered c. 1696, and in the 19th century it became a popular spa. The spa declined after World War II and closed in the 1960s but reopened in 1983. To the northwest lie the remains of a Roman fort.

Llano Estacado \'la-nō-ˌes-tə-'kä-dō\ *or* **Staked Plain** Plateau, southeastern New Mexico and western Texas, U.S. Occupying an area of about 30,000 sq mi (78,000 sq km), it is a semiarid plain with occasional pools of rainwater. Its soil supports grazing, dryland farming of grains, and irrigated cotton production. Production of petroleum and natural gas is also important. LUBBOCK and AMARILLO, Texas, are its most important cities.

Llanquihue \läŋ-'kē-wə**, Lake** Lake, south-central Chile. The country's largest lake, it has an area of about 330 sq mi (860 sq km); it is 22 mi (35 km) long and 25 mi (40 km) wide. In the distance stand volcanoes and beyond them, on the Argentine border, Mount Tronador (11,660 ft [3,554 m]). Popular resort towns are located on its shores.

Llosa, Mario Vargas See Mario VARGAS LLOSA

Lloyd, Chris Evert See Chris EVERT

Lloyd, Harold (b. April 20, 1893, Burchard, Neb., U.S.—d. March 8, 1971, Hollywood, Calif.) U.S. film comedian. He began to appear in one-reel comedies in 1913 and mastered the comic chase scene as a member of MACK SENNETT's troupe. He joined HAL ROACH's company and created his Lonesome Luke character in popular movies such as *Just Nuts* (1915). He developed his trademark white-faced character wearing round glasses in 1918. Noted for his use of physical danger as a source of laughter, he performed his own daring stunts, hanging from the hands of a clock far

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above the street in *Safety Last* (1923) and standing in for a football tackling-dummy in *The Freshman* (1925). He was the highest paid star of the 1920s. He received a special Academy Award in 1952.

Lloyd George of Dwyfor, David Lloyd George, Earl (b. Jan. 17, 1863, Manchester, Eng.—d. March 26, 1945, Ty-newydd, near Llanystumdwy, Caernarvonshire, Wales) British prime minister (1916–22). He entered Parliament in 1890 as a Liberal and retained his seat for 55 years. He served as president of the Board of Trade (1905–08), then as chancellor of the Exchequer (1908–15). Rejection of his controversial "People's Budget" (to raise taxes for social programs) in 1909 by the House of Lords led to a constitutional crisis and passage of the PARLIAMENT ACT OF 1911. He devised the National Insurance Act of 1911, which laid the foundation of the British WELFARE STATE. As minister of munitions (1915–16), he used unorthodox methods to ensure that war supplies were forthcoming during World War I. He replaced H.H. ASQUITH as prime minister in 1916, with Conservative support in his coalition government. His small war cabinet ensured speedy decisions. Distrustful of the competence of the British high command, he was constantly at odds with Gen. DOUGLAS HAIG. In the 1918 elections his decision to continue a coalition government further split the LIBERAL PARTY. He was one of the three great statesmen responsible for the Treaty of VERSAILLES at the PARIS PEACE CONFERENCE. He began the negotiations that culminated in the Anglo-Irish treaty of 1921. He resigned in 1922 and headed an ailing Liberal Party (1926–31).

Lloyd Webber, Andrew *later* **Baron Lloyd Webber** (b. March 22, 1948, London, Eng.) British composer. He studied at Oxford and at the Royal College of Music. His first collaboration with lyricist Tim Rice (b. 1944), *Joseph and the Amazing Technicolor Dreamcoat* (1968), was followed by the "rock opera" *Jesus Christ Superstar* (1971), which blended classical forms with rock music. Their last major collaboration was *Evita* (1978). Lloyd Webber's eclectic, rock-based works helped revitalize musical theatre. In both London and New York City, his musical *Cats* (1981), based on poems by T.S. ELIOT, became the longest-running musical in history. He later collaborated on *Starlight Express* (1984), *Phantom of the Opera* (1986), and *Sunset Boulevard* (1993), among other stage works. He was knighted in 1992 and ennobled in 1996.

Lloyd's of London Insurance marketing association in London, specializing in high-risk insurance services. Its history dates to 1688, when Edward Lloyd kept a London coffeehouse where merchants, seafarers, and marine-insurance underwriters met to transact business. The underwriters at Lloyd's eventually formed a marine-insurance association (incorporated 1871); it expanded to include other forms of insurance in 1911. After a series of financial scandals, the corporation was reorganized under the Lloyd's Act of 1982. Today Lloyd's consists of more than 20,000 individual members organized in several hundred syndicates, which are represented at Lloyd's by underwriting agents. Individual syndicate members, rather than the corporation, are liable for losses. Until record losses in the 1980s and '90s bankrupted some syndicate members, they had unlimited liability for business transacted for them; in 1993 that liability was limited. See also INSURANCE, LIABILITY INSURANCE.

Llull \'lyül'**, Ramon** *English* **Raymond Lully** (b. 1232/33, Ciutat de Majorca, Majorca—d. 1315/16, Tunis or near Majorca) Spanish (Catalan) mystic, poet, and missionary. He was reared at the court of Majorca, where he wrote lyrical troubadour poetry. He later traveled widely, attempting to convert Muslims to Christianity; he is said to have been stoned to death at Bejaïa. As a philosopher, he is best known as the inventor of an "art of finding truth." Primarily intended to support the church in its missionary work, it was also designed to unify all branches of knowledge. In his principal work, *Ars magna* (1305–08), he tried to depict all forms of knowledge, including theology, philosophy, and the natural sciences, as mutually analogous and manifestations of the godhead in the universe. His writings influenced Neoplatonic mysticism throughout medieval and early modern Europe. In Catalan culture, his allegorical novels *Blanquerna* (c. 1284) and *Felix* (c. 1288) enjoy wide popularity; he is also known for his treatise on chivalry, his animal fables, and an encyclopaedia of medieval thought.

Llyr \'hlir\ In CELTIC RELIGION, the leader of one of the two warring families of the gods. According to one interpretation, the Children of Llyr were the powers of darkness, constantly in conflict with the Children of Dôn, the powers of light. In Welsh tradition, Llyr and his son Manawydan were associated with the sea. Llyr's other children included BRÂN, Creidylad, and Branwen, wife of the sun god Matholwch, king of Ireland.

Llywelyn ap Gruffudd \hlə-'we-lin-ap-'gri-fith\ (d. Dec. 11, 1282, near Builth, Powys, Wales) Prince of Wales (1258–77). As prince of GWYNEDD in northern Wales from 1255, he sought to extend his rule throughout his native country, and he proclaimed himself prince of Wales in 1258. He fought the English lords of southern Wales (1262) and allied himself with HENRY III's opponent, SIMON DE MONTFORT. After Montfort's death, however, he signed a treaty recognizing Henry as overlord (1267). Llywelyn rebelled against EDWARD I but was defeated by him in 1277. He was killed in a final rebellion in 1282, and Wales soon fell entirely under English rule.

Llywelyn ap Iorwerth \hlə-'we-lin-ap-'yȯr-werth\ *known as* **Llywelyn the Great** (d. April 11, 1240, Aberconway, Gwynedd, Wales) Welsh prince. The grandson of a powerful Welsh prince, he was exiled as a child from GWYNEDD in northern Wales but returned in 1194 and deposed his uncle, gaining control of most of northern Wales by 1202. Though Llywelyn married King JOHN's daughter, the English king invaded Wales when Llywelyn's authority reached too far (1211). Llywelyn soon recovered his lands and allied with John's baronial opponents. HENRY III acknowledged his rule in most of Wales (1218), but by 1223 Llywelyn was forced to withdraw to the north.

Lo-lang See NANGNANG

load-bearing wall See BEARING WALL

loam Rich, friable (crumbly) soil with nearly equal parts of sand and silt, and somewhat less clay. The term is sometimes used imprecisely to mean earth or soil in general. Loam in subsoil receives varied minerals and amounts of clay by leaching (percolation) from the topsoil above.

Loanda See LUANDA

Lobachevsky \ˌlō-bə-'chev-skē**, Nikolay (Ivanovich)** (b. Dec. 1, 1792, Nizhny Novgorod, Russia—d. Feb. 24, 1856, Kazan) Russian mathematician. His entire life centred around the University of Kazan, where he studied and later (from 1816) taught. In 1829 he published his groundbreaking theory, a geometry that rejected EUCLID's PARALLEL POSTULATE. It was the final solution to a problem that had baffled mathematicians for 2,000 years. Lobachevsky also did distinguished work in the theory of infinite series, especially trigonometric series, as well as in INTEGRAL CALCULUS, ALGEBRA, and PROBABILITY. He was largely ignored during his lifetime; acceptance of his new geometry came a decade after his death, though much of the credit went to others. With Bolyai János of Hungary (1802–60), Lobachevsky is considered the founder of NON-EUCLIDEAN GEOMETRY.

Lobamba Town (pop., 1995 est.: 10,000), legislative capital of Swaziland. Located near MBABANE, it is in a densely populated rural area. It is, according to traditional SWAZI customs, the residence of the Queen Mother and is thereby the spiritual home of the Swazi nation. It is the site of parliamentary buildings and an official residence of the king.

lobbying Any attempt by a group or individual to influence the decisions of government. The term originated in 19th-century efforts to influence the votes of legislators, generally in the lobby outside a legislative chamber. The effort may be a direct appeal to a decision maker in either the executive or legislative branches, or it may be indirect (e.g., through attempts to influence public opinion). It may include oral or written efforts of persuasion, campaign contributions, public-relations campaigns, research supplied to legislative committees, and formal testimony before such committees. A lobbyist may be a member of a special-interest group, a professional willing to represent any group, or a private individual. In the U.S., the Federal Regulation of Lobbying Act (1946) requires that lobbyists and the groups they represent register and report contributions and expenditures.

lobelia family \lō-'bēl-yə\ Family Lobeliaceae, which contains about 750 species of flowering plants in 25 genera. Some are grown for their attractive, two-lipped flowers. Postlike and shaggy-tree forms are found on mountains in Africa. The family includes the CARDINAL FLOWER, great blue lobelia (*L. siphilitica*), and Indian tobacco (*L. inflata*). Once used for smoking and for the vomit-inducing ALKALOID in its roots, lobelia is now regarded as poisonous.

Lobengula \ˌlō-beŋ-'gyü-lə\ (b. c. 1836, Mosega, Transvaal—d. January 1894, near Bulawayo, Rhodesia) Second and last king of the South African NDEBELE nation. Son of the founder of the Ndebele kingdom, Mzilikazi, Lobengula succeeded to the throne in 1870 after a period of civil war. He attempted to form an alliance with the British, granting them first farming (1886) and then mineral (1888) concessions. Not satisfied, the

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British South Africa Co. under Cecil Rhodes undertook a military expedition that destroyed the Ndebele kingdom in 1893. See also Khama III.

lobotomy \lə-'bä-tə-mē\ Surgical procedure in which nerve pathways in a lobe or lobes of the brain are severed from those in other areas. Introduced in 1935 by António Egas Moniz and Almeida Lima, it came to be used to help grossly disturbed patients. Favoured for patients who did not respond to shock therapy, it did reduce agitation but often caused increased apathy and passivity, inability to concentrate, and decreased emotional response. It was widely performed until c. 1956, when drugs that were more effective in calming patients became available. Lobotomies are no longer performed; however, psychosurgery, the surgical removal of specific regions of the brain, is occasionally used to treat patients whose symptoms have resisted all other treatments.

lobster Any of numerous species of marine shrimplike decapods that are bottom-dwellers and mostly nocturnal. Lobsters scavenge for dead animals but also eat live fish, small mollusks and other bottom-dwelling invertebrates, and seaweed. One or more pairs of legs are often modified into pincers, usually larger on one side than the other. True lobsters have a distinct snout on the upper body shell. The American lobster (*Homarus americanus*) and scampi are the most commercially important, being highly prized as food. The American lobster, found from Labrador to North Carolina, weighs about 1 lb (0.5 kg) and is about 10 in. (25 cm) long when caught in shallow water. Most deepwater specimens weigh about 5.5 lbs (2.5 kg); some may weigh 40 lbs (20 kg). See also shellfish.

American lobster (*Homarus americanus*).
JOHN H. GERARD

local area network (LAN) Communications network consisting of many computers within a local area, such as a single building or company complex. Individual users can share data or files on a LAN as if the data or files resided on their respective computers; a central computer used for this purpose is called a server. Laser printers and other peripheral equipment can be connected to a LAN for common use. Coaxial and fibre-optic cables are popular communication lines for LANs because they provide fast data transmission and are easy to install. See also computer network.

Local Group Concentration of about 40 galaxies to which the Milky Way Galaxy belongs. Nearly half are dwarf elliptical galaxies, but the six largest are spiral or irregular galaxies. They are probably kept from separating by mutual gravitational attraction. The Milky Way system is near one end of the group; the great Andromeda Galaxy is near the other end, about two million light-years away.

Locarno, Pact of (1925) Multilateral treaty signed in Locarno, Switz., intended to guarantee peace in western Europe. Its signatories were Belgium, Britain, France, Germany, and Italy. Germany's borders with France and Belgium as set by the Treaty of Versailles were decreed inviolable, but its eastern borders were not. Britain promised to defend Belgium and France. Other provisions included mutual defense pacts between France and Poland and between France and Czechoslovakia. The treaty led to the Allied troops' departure from the Rhineland by 1930, five years ahead of schedule. See also Kellogg-Briand Pact.

"Madonna of the Rose Bower," painting on wood by Stefan Lochner; in the Wallraf-Richartz-Museum, Cologne.
COURTESY OF THE WALLRAF-RICHARTZ-MUSEUM, COLOGNE

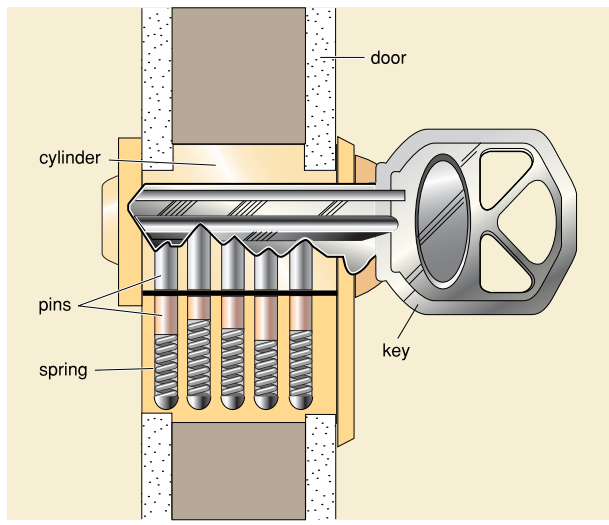
Loch Leven See Loch Leven

Loch Lomond See Loch Lomond

Loch Ness See Loch Ness

Lochner \'lȯk-nər**, Stefan** (b. c. 1400, Meersburg am Bodensee, Bishopric of Constance—d. 1451, Cologne) German painter. Nothing is known of his early life, but he may have studied in The Netherlands before settling in Cologne c. 1430, for Flemish influence is evident in his attention to minute details. Jan van Eyck's influence is seen in *The Adoration of the Magi*, his altarpiece for Cologne's great cathedral, but Lochner adds his own naturalistic observation and masterly sense of colour and design. Known for his highly mystical religious paintings, he is considered the greatest representative of the school of Cologne.

lock Mechanical or electronic device for securing a door or receptacle so that it cannot be opened except by a key or a code. The lock originated in the Middle East; the oldest known example was found near Nineveh. Possibly 4,000 years old, it is of the pin tumbler type, otherwise known as an Egyptian lock. The Romans were the first to use metal locks and to make small keys for them. They also invented wards, projections in the keyhole that prevent a key from turning unless it has slots that avoid the projections. Probably the most familiar lock today is the cylinder lock, a pin tumbler lock opened by a flat key with a serrated edge; the serrations raise pins in the cylinder to the proper heights, allowing the cylinder to turn. Also common are the unit lock, housed within a rectangular notch cut into the edge of a door, and the mortise lock, housed in a mortise cut into the door edge, the lock mechanism being covered on both sides. Other types include lever and combination locks. Electronic locks that open with a magnetic card key are popular for banks, hotel rooms, and offices.



A cylinder lock's tumbler consists of a series of pins arranged in pairs. The pins are spring-loaded to press against the contours of the inserted key. A wrong key will cause one or more of the pins to block the cylinder from turning; only when the tops of all the lower pins line up with the edge of the cylinder can the cylinder turn.
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Locke, John (b. Aug. 29, 1632, Wrington, Somerset, Eng.—d. Oct. 28, 1704, Oates, Essex) English philosopher. Educated at Oxford, principally in medicine and science, he later became physician and adviser to the future 3rd earl of Shaftesbury (1667–72). He moved to France, but after Shaftesbury's fall in 1683 he fled to the Netherlands, where he supported the future William III. Locke returned to England after the Glorious Revolution (1688) to become commissioner of appeals, a post he held until his death. In his major philosophical work, *Essay Concerning Human Understanding* (1690), he argued that knowledge begins in sensation or introspection rather than in innate ideas, as the philosophers of rationalism held. From sensation and reflection the mind receives "ideas," which are the material of knowledge. Some ideas represent actual qualities of objects (such as size, shape, or weight) and others perceived qualities, which do not exist in objects except as they affect observers (such as colour, taste, or smell); Locke called the former qualities "primary" and the latter "secondary." Ideas that are given directly in sensation or reflection are simple, and simple ideas may be "compounded" to form complex ideas. Locke did not succeed in giving a clear account of the origin of the idea of substance (it is "a something-I-know-not-what") or the idea of the "self," though his account of personal identity in terms of memory was influential. In the philosophy of language, he identified the meanings of words

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with ideas rather than things. In *Two Treatises of Government* (1690), he defended a doctrine of natural rights and a conception of political authority as limited and conditional on the ruler's fulfillment of his obligation to serve the public good. A classic formulation of the principles of political LIBERALISM, this work influenced the American and French revolutions and the CONSTITUTION OF THE U.S. He is considered the founding figure of British EMPIRICISM.

Lockheed Martin Corp. U.S. diversified company that is one of the world's largest aerospace manufacturers. It was established in 1995 through the merger of Lockheed Corp. (formed 1926 as Lockheed Aircraft Co.) and Martin Marietta Corp. (formed 1961 from the merger of Martin Co. and American-Marietta Co.). During World War II, Lockheed established a secret division ("Skunk Works") that became the leading U.S. developer of military aircraft (e.g., F-104 fighter, U-2 and SR-71 spy planes, and F-117A stealth fighter). In the early 1970s its financially troubled production of the L-1011 TriStar commercial jetliner necessitated its rescue from bankruptcy by massive U.S. government aid. Lockheed's work in missile development resulted in the Polaris, Poseidon, and TRIDENT submarine-launched ballistic missile systems; in the space sector its activities included the construction and systems integration of the HUBBLE SPACE TELESCOPE. In the early 1990s, in partnership with BOEING CO., it contracted to build the F-22 Raptor stealth fighter (first flown 1997). Martin Co.'s major business after World War II was the development of rockets (e.g., TITAN) and electronics systems for the U.S. government. Later, as Martin Marietta, it constructed the VIKING Mars landers and the Magellan spacecraft to Venus and designed and produced the external fuel tank for the SPACE SHUTTLE. In the mid-1990s Lockheed Martin formed a joint venture, International Launch Services, with the Russian firms ENERGIA and Khrunichev to market commercial space launch services.

lockjaw See TETANUS

lockout Tactic used by employers in labour disputes, in which employees are locked out of the workplace or otherwise denied employment. In the 1880s and '90s, factory owners in the U.S. often used lockouts against the KNIGHTS OF LABOR, which was struggling to organize industries such as meatpacking and cigar making. The lockout has been used less frequently in modern times, usually as part of a pact among members of employers' associations to frustrate LABOUR UNIONS by closing work facilities in response to STRIKES.

Locofoco \ˌlō-kō-ˈfō-kō\ **Party** Radical wing of the DEMOCRATIC PARTY organized in New York City in 1835. Made up largely of workingmen and reformers, the party opposed state banks, monopolies, tariffs, and special interests. Its name derives from the friction matches, known as locofocos, that radicals used to light candles when Democratic Party regulars tried to oust them from a TAMMANY HALL meeting by turning out the gas lights. Never a national party, the Locofocos reached the height of their influence when Congress passed the Independent Treasury Act (1840), which effected the primary Locofoco aim of complete separation of government and banking. The party was reabsorbed into the Democratic Party in the 1840s.

locomotion Any of various animal movements that result in progression from one place to another. Locomotion is classified as either appendicular (accomplished by special appendages) or axial (achieved by changing the body shape). Aquatic protozoans move by ciliary or flagellar appendages or by pseudopods, footlike appendages. Other forms of aquatic locomotion include walking on legs (some ARTHROPODS), crawling (by contracting the body muscles, anchoring to the substrate, and extending), and swimming by either hydraulic propulsion (e.g., JELLYFISH) or undulation (FISHES). Terrestrial arthropods and VERTEBRATES move by means of jointed appendages, the legs. Snakes and other limbless vertebrates crawl by means of muscular thrusts against the substrate. Flight is achieved by the forward thrust of WINGS.

locomotive Self-propelled vehicle used for hauling railroad cars on tracks. Early experimental steam locomotives were built in Wales and England by RICHARD TREVITHICK from 1803. The first practical steam locomotive, the *Rocket*, was developed in 1829 by GEORGE STEPHENSON, in whose "steam blast" system the steam from a multitube boiler drove pistons connected to a pair of flanged driving wheels. The first U.S. steam locomotive was built by JOHN STEVENS in 1825, and the first commercially usable locomotive, the *Tom Thumb*, by PETER COOPER in Baltimore in 1830. Later improvements enabled a locomotive to move up to 200 freight cars at 75 mph (120 kph). Steam from wood or coal fuel was the main source of power until the mid-20th century, though electric power had been used from the early 20th century, especially in Europe. After World War II DIESEL power replaced steam because of its higher efficiency and lower cost, though diesel-electric and gas turbine-electric combinations were also used.

locoweed Any of several species of poisonous plants of the genera *Astragalus* and *Oxytropis*, in the pea family (see LEGUME), native to the prairies of north-central and western North America. These low-growing plants (up to 1.5 ft [45 cm] high) have variably hairy, fernlike leaves and spikes of pealike flowers. They pose a danger to grazing animals because they contain a toxin that affects muscle control, producing frenzied behaviour, impaired vision, and sometimes death. Because they taste bad, livestock usually eat them only when other forage is scarce. Decaying locoweeds release toxins into the soil that are sometimes absorbed by otherwise harmless forage crops.

Locri Epizephyrii \ˈlō-ˌkrī-ˌe-pi-zə-ˈfir-ē-ˌī\ Ancient city in MAGNA GRAECIA, on the eastern coast of Italy's southwestern extremity. Founded by Greeks c. 680 BC, it was the first Greek community to have a written code of laws, the Locrian code (c. 660 BC). It founded colonies and resisted Athenian intervention during the PELOPONNESIAN WAR. Fickle in its allegiance, it was captured by Rome in 205 BC and destroyed by Sicilian Muslims in 915.

locust In botany, any of about 20 tree species in the genus *Robinia* of the pea family (see LEGUME), all native to eastern North America and Mexico. Best-known is the black locust (*R. pseudoacacia*), often called false acacia or yellow locust. Widely cultivated in Europe as an ornamental, it grows 80 ft (24 m) high and bears long, compound leaves. The fragrant white flowers hang in loose clusters. There are many varieties, some thornless. The black locust has long been used for erosion control and as a timber tree. The so-called honey locust (*Gleditsia triacanthos*), also of the pea family, is a North American tree commonly used as an ornamental and often found in hedges.

Black locust (*Robinia pseudoacacia*)
JOHN H. GERARD—EB INC.

locust Any of several species of GRASSHOPPERS (family Acrididae) that undergo population explosions and migrate long distances in destructive swarms. In North America the names *locust* and *grasshopper* are interchangable and used for any acridid; CICADAS are sometimes called locusts. In Europe, *locust* refers to large species and *grasshopper* to small ones. Locusts are found worldwide. Sporadic locust swarms may be explained by the theory that swarming species have a solitary phase (the normal state) and a gregarious phase. Nymphs that mature in the presence of many other locusts develop into the gregarious type; thus migratory swarms form as a result of overcrowding. Swarms may be almost unimaginably large, towering 5,000 ft (1,500 m) high; in 1889 a Red Sea swarm was estimated to cover 2,000 sq mi (5,000 sq km). Locust plagues can be extremely destructive of crops.

lodestone See MAGNETITE

lodge Originally an insubstantial dwelling, or one erected for a temporary occupational purpose (e.g., woodcutting or masonry) or for use during the hunting season. The lodge became a more permanent type of house as the lands around European mansions were developed as parks. The lodge was often the cottage of the gamekeeper, caretaker, gatekeeper, or gardener, or it could be a larger building for occupation by a higher-ranking person. Today the word suggests a rustic dwelling or inn in a natural setting, often one used seasonally (e.g., a ski lodge).

Lodge, Henry Cabot (b. May 12, 1850, Boston, Mass., U.S.—d. Nov. 9, 1924, Cambridge, Mass.) U.S. politician. He was the recipient of the first Ph.D. in political science awarded by Harvard University. He served in the U.S. House of Representatives from 1887 to 1893 and in the Senate from 1893 to 1924. He supported U.S. entry into World War I but opposed participation in the LEAGUE OF NATIONS; as chairman of the Senate's foreign relations committee he delayed action on the adoption of the Treaty of Versailles with its covenant establishing the League. He proposed amendments (the Lodge reservations) that would require Senate

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approval before the U.S. would accept certain League decisions. Pres. Woodrow Wilson refused to accept the amendments, and the Senate rejected the treaty.

Lodge, Henry Cabot (b. July 5, 1902, Nahant, Mass., U.S.—d. Feb. 27, 1985, Beverly, Mass.) U.S. politician and diplomat. The grandson of Sen. Henry C. Lodge, he served in the U.S. Senate (1937–44, 1947–52) and as U.S. representative to the UN (1953–60). In 1960 he was the Republican vice presidential candidate under Richard Nixon. During the 1960s he served as U.S. ambassador to South Vietnam and as ambassador to West Germany. In 1969 he was the chief U.S. negotiator at the Paris peace talks with North Vietnam. He later served as special envoy to the Vatican.

Lodi \'lō-dē**, Peace of** (1454) Treaty between Venice and Milan ending the war of succession to the Milanese duchy in favor of Francesco Sforza. It recognized Sforza as ruler of Milan and restored Venice's territories in northern Italy, including Brescia and Bergamo. It also provided for a 25-year mutual defensive pact to maintain existing boundaries and established an Italian League. The treaty created a balance of power among Venice, Milan, Naples, Florence, and the Papal States, and it began a 40-year period of relative peace.

Łódz \'wüch,\ *English* \'lōdz\ City (pop., 2001 prelim.: 793,217), central Poland. Located southwest of Warsaw, it was a village in the 14th century and gained municipal rights in 1798. The Russian-ruled Congress Kingdom of Poland established it as a centre of the textile industry in 1820, and by the late 19th century it was Poland's leader in the production of cotton textiles. It was occupied by the Germans during World Wars I and II. It is now a cultural centre and Poland's second largest city.

loess \'les, 'lō-əs\ Unstratified, geologically recent deposit of silty or loamy material that is usually buff or yellowish brown and is deposited chiefly by the wind. Loess is a sedimentary deposit composed largely of silt-sized grains that are loosely cemented by calcium carbonate. It is usually homogeneous and highly porous and is traversed by vertical capillaries that permit the sediment to fracture and form vertical bluffs.

Loesser \'le-sər**, Frank (Henry)** (b. June 29, 1910, New York, N.Y., U.S.—d. July 28, 1969, New York City) U.S. composer, librettist, and lyricist. The son of a piano teacher, in 1936 he moved to Hollywood, where he worked with Burton Lane, Jule Styne, Jimmy McHugh, and Hoagy Carmichael. His wartime songs include "Praise the Lord and Pass the Ammunition" and "What Do You Do in the Infantry?"; postwar hits include "On a Slow Boat to China" and "Baby It's Cold Outside" (Academy Award, 1949). His first Broadway musical was *Where's Charley?* (1948; film, 1952). In 1950 he produced *Guys and Dolls* (film, 1955), one of the greatest American musicals. It was followed by *The Most Happy Fella* (1956) and *How to Succeed in Business Without Really Trying* (1962, Pulitzer Prize). His work for film includes the score for *Hans Christian Andersen* (1952).

Loewe \'lō**, Frederick** (b. June 10, 1901, Berlin, Ger.—d. Feb. 14, 1988, Palm Springs, Calif., U.S.) German-born U.S. songwriter. Son of a Viennese tenor, Loewe was a piano prodigy; at age 13 he became the youngest soloist ever to appear with the Berlin Philharmonic Orchestra. He studied with Ferruccio Busoni and Eugène d'Albert. His song "Katrina," written at age 15, sold more than a million copies. Arriving in the U.S. in 1924, he contributed music to Broadway revues. In 1942 he met Alan Jay Lerner; their 18-year collaboration would produce five classic musicals. Personal differences ended their partnership after *Camelot* (1960), but they reunited to adapt their film *Gigi* (1958) for the stage (1973) and to write songs for the film *The Little Prince* (1974).

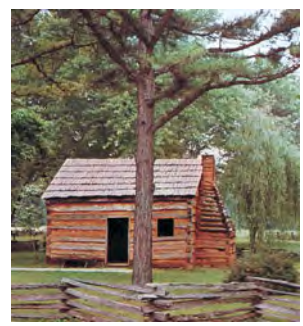
Loewy \'lō-ē**, Raymond (Fernand)** (b. Nov. 5, 1893, Paris, Fr.—d. July 14, 1986, Monaco) French-born U.S. industrial designer. After obtaining an advanced degree in electrical engineering, he immigrated in 1919 to New York City, where he worked as a fashion illustrator and designer of department store window displays. He opened his own design firm in 1929, and in the 1930s and '40s he designed a variety of household products with rounded corners and simplified, "streamlined" outlines. A refrigerator he designed for Sears, Roebuck & Co. (1934) won first prize at the 1937 Paris International Exposition. In later years his highly functional designs for everything from locomotives to soda dispensers helped shape U.S. industrial design.

Löffler \'lœf-lər**, Friedrich (August Johannes)** (b. June 24, 1852, Frankfurt an der Oder, Prussia—d. April 9, 1915, Berlin, Ger.) German bacteriologist. In 1884, with Edwin Klebs (1834–1913), he discovered the organism that causes diphtheria. Simultaneously with Émile Roux (1853–1933) and Alexandre Yersin (1863–1943), he indicated the existence of a diphtheria toxin. His demonstration that some animals are immune to diphtheria was basic to Emil von Behring's work in developing antitoxins. Löffler also discovered the cause of some swine diseases and identified, with Wilhelm Schütz, the organism that causes the horse disease glanders. With Paul Frosch he found that foot-and-mouth disease is caused by a virus (the first time a virus was found to be the agent of an animal disease) and developed a serum against it.

loft Upper space within a building, often open on one side, used for storage or other purposes (e.g., sleeping loft, hayloft). The term also refers to one of the upper floors in a factory or warehouse, typically undivided by partitions and now often converted to other uses, such as residences or artists' studios. In churches the rood loft is a display gallery above the rood screen (see cathedral), and a choir or organ loft is a gallery reserved for church singers and musicians. In theaters, the loft is the area above and behind the proscenium.

Lofting, Hugh (John) (b. Jan. 14, 1886, Maidenhead, Berkshire, Eng.—d. Sept. 26, 1947, Santa Monica, Calif., U.S.) British-born U.S. author and illustrator. He lived principally in the U.S. from 1912. He is known for his classic children's books about Doctor Dolittle, a chubby, gentle, eccentric physician to animals who learns their language the better to treat them. He originally created the character to entertain his children in letters he sent from the front during World War I. *The Story of Dr. Dolittle* (1920) won instant success; it was followed by *The Voyages of Dr. Dolittle* (1922, Newbery Medal), *Dr. Dolittle in the Moon* (1928), and *Dr. Dolittle's Return* (1933), among many other volumes.

log cabin Small, one-room house built of logs notched at the ends and laid one upon another with the spaces filled with plaster, moss, mortar, mud, or dried manure. In North America they were built by early settlers, hunters, loggers, and other wilderness dwellers. They have also been built in Europe, particularly Scandinavia. Though designs vary, a common style features a sloping, single-gabled timbered roof and small windows. Modern summer cottages may be built of logs (or given log-cabin siding) to achieve a rustic effect.



Log cabin, Abraham Lincoln's boyhood home, Knob Creek, Kentucky, originally built early 19th century.
WETTACH/SHOSTAL

Logan, James *orig.* **Tah-gah-jute** (b. c. 1725, probably at Shamokin, Pa.—d. 1780, near Lake Erie) American Indian leader. He was the son of the Oneida chief Shikellamy, who was a friend of the secretary of the Pennsylvania colony, James Logan (1674–1751). He moved to the Ohio River valley, where he became friendly with Indians and white settlers. After his family was massacred by a frontier trader in 1774, he led Indian raids on white settlements in Lord Dunmore's War. He refused to participate in peace negotiations, sending his grievances in a message known as "Logan's Lament." He was allied with the British in the American Revolution.

Logan, Mount Peak, St. Elias Mountains, southwestern Yukon Territory, Canada, near the Alaskan boundary. Reaching 19,524 ft (5,951 m), it is the highest mountain in Canada and is second in North America only to Mount McKinley. It is located in Kluane National Park, which occupies 8,500 sq mi (22,000 sq km). The summit was first reached in 1925. The peak was named for William Logan, founder of the Geological Survey of Canada.

loganberry Bramble plant (*Rubus loganobaccus*) of the rose family. It originated in Santa Cruz, Calif., in 1881, apparently as a natural hybrid between the wild blackberry of the Pacific coast and the red raspberry. It is grown in large quantities in Oregon and Washington and is cultivated in Britain and Tasmania. The loganberry is a vigorous, nearly trailing, blackberry-like plant with compound leaves and prickly canes. Its wine-red, tart berries are canned, frozen, used in preserves or pies, or made into wine.

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logarithm In mathematics, the power to which a base must be raised to yield a given number (e.g., the logarithm to the base 3 of 9, or $\log_3 9$, is 2, because $3^2 = 9$). A common logarithm is a logarithm to the base 10. Thus, the common logarithm of 100 (log 100) is 2, because $10^2 = 100$. Logarithms to the base *e*, in which $e = 2.71828\ldots$, called natural logarithms (ln), are especially useful in calculus. Logarithms were invented to simplify cumbersome calculations, since exponents can be added or subtracted to multiply or divide their bases. These processes have been further simplified by the incorporation of logarithmic functions into digital calculators and computers. See also JOHN NAPIER.

loggia \'lō-jē-ə\ Hall, gallery, or porch open to the air on one or more sides. It evolved in the Mediterranean region as an open sitting room with protection from the sun. It is often a roofed, arcaded open gallery on an upper story overlooking a court, though it can also be a separate arcaded or colonnaded structure. In medieval and Renaissance Italy, it was often used in conjunction with a public square, as in Florence's Loggia dei Lanzi (begun 1376).

logic Study of inference and argument. Inferences are rule-governed steps from one or more propositions, known as premises, to another proposition, called the conclusion. A deductive inference is one that is intended to be valid, where a valid inference is one in which the conclusion must be true if the premises are true (see DEDUCTION; VALIDITY). All other inferences are called inductive (see INDUCTION). In a narrow sense, logic is the study of deductive inferences. In a still narrower sense, it is the study of inferences that depend on concepts that are expressed by the "logical constants," including: (1) propositional connectives such as "not," (symbolized as $\neg$), "and" (symbolized as $\wedge$), "or" (symbolized as $\vee$), and "if-then" (symbolized as $\supset$), (2) the existential and universal quantifiers, "$(\exists x)$" and "$(\forall x)$," often rendered in English as "There is an *x* such that …" and "For any (all) *x*, …," respectively, (3) the concept of identity (expressed by "="), and (4) some notion of predication. The study of the logical constants in (1) alone is known as the PROPOSITIONAL CALCULUS; the study of (1) through (4) is called first-order PREDICATE CALCULUS with identity. The logical form of a proposition is the entity obtained by replacing all nonlogical concepts in the proposition by variables. The study of the relations between such uninterpreted formulas is called formal logic. See also DEONTIC LOGIC; MODAL LOGIC.

logic, many-valued FORMAL SYSTEM in which the well-formed formulae are interpreted as being able to take on values other than the two classical values of truth or falsity. The number of values possible for well-formed formulae in systems of many-valued logic ranges from three to uncountably many.

logic, philosophy of Philosophical study of the nature and scope of LOGIC. Examples of questions raised in the philosophy of logic are: "In virtue of what features of reality are the laws of logic true?"; "How do we know the truths of logic?"; and "Could the laws of logic ever be falsified by experience?" The subject matter of logic has been variously characterized as the laws of THOUGHT, "the rules of right reasoning," "the principles of valid argumentation," "the use of certain words called logical constants," and "truths based solely on the meanings of the terms they contain."

logic design Basic organization of the circuitry of a DIGITAL COMPUTER. All digital computers are based on a two-valued logic system—1/0, on/off, yes/no (see BINARY CODE). Computers perform calculations using components called logic gates, which are made up of INTEGRATED CIRCUITS that receive an input signal, process it, and change it into an output signal. The components of the gates pass or block a clock pulse as it travels through them, and the output bits of the gates control other gates or output the result. There are three basic kinds of logic gates, called "and," "or," and "not." By connecting logic gates together, a device can be constructed that can perform basic arithmetic functions.

logical positivism Early school of ANALYTIC PHILOSOPHY, inspired by DAVID HUME, the mathematical logic of BERTRAND RUSSELL and ALFRED NORTH WHITEHEAD, and LUDWIG WITTGENSTEIN's *Tractatus* (1921). The school, formally instituted at the University of Vienna in a seminar of Moritz Schlick (1882–1936) in 1922, continued there as the VIENNA CIRCLE until 1938. It proposed several revolutionary theses: (1) All meaningful discourse consists either of (a) the formal sentences of logic and mathematics or (b) the factual propositions of the special sciences; (2) Any assertion that claims to be factual has meaning only if it is possible to say how it might be verified; (3) Metaphysical assertions, including the pronouncements of religion, belong to neither of the two classes of (1) and are therefore meaningless. Some logical positivists, notably A.J. AYER, held that assertions in ethics (e.g., "It is wrong to steal") do not function logically as statements of fact but only as expressions of the speaker's feelings of approval or disapproval toward some action. See also RUDOLF CARNAP; EMOTIVISM; VERIFIABILITY PRINCIPLE.

logicism \'lä-ji-ˌsi-zəm\ In the philosophy of MATHEMATICS, the thesis that all mathematical propositions are expressible as or derivable from the propositions of pure LOGIC. GOTTLOB FREGE attempted to establish the thesis in his *Die Grundlagen der Arithmetik* (1884) and other works; BERTRAND RUSSELL argued for logicism in *The Principles of Mathematics* (1903) and attempted a formal proof with ALFRED NORTH WHITEHEAD in *Principia Mathematica* (1910–13).

logistic system See FORMAL SYSTEM

logistics \lō-'jis-tiks, lə-'jis-tiks\ In military science, all the activities of armed-force units in support of combat units, including transport, supply, communications, and medical aid. The term, first used by HENRI JOMINI, ALFRED THAYER MAHAN, and others, was adopted by the U.S. military in World War I and gained currency in other nations in World War II. Its importance grew in the 20th century with the increasing complexity of modern warfare. The ability to mobilize large populations has escalated military demands for supplies and provisions, and sophisticated technology has added to the cost and intricacy of weapons, communications systems, and medical care, creating the need for a vast network of support systems. In World War II, for instance, only about three in 10 U.S. soldiers served in a combat role.

Logone \lō-'gōn\ **River** River, north-central Africa. The chief tributary of the CHARI RIVER of the Lake Chad basin in equatorial Africa, it drains northeastern Cameroon and Chad. It flows 240 mi (390 km) northwest to join the Chari at N'DJAMENA, Chad. It is seasonally navigable for small steamers below Bongor.

logos (Greek: "word," "reason," "plan") In Greek philosophy and theology, the divine reason that orders the cosmos and gives it form and meaning. The concept is found in the writings of HERACLEITUS (6th century BC) and in Persian, Indian, and Egyptian philosophical and theological systems as well. It is particularly significant in Christian theology, where it is used to describe the role of JESUS as the principle of God active in the creation and ordering of the cosmos and in the revelation of the divine plan of salvation. This is most clearly stated in the Gospel of JOHN the Apostle, which identifies Christ as the Word (Logos) made flesh.

Logroño \lə-'grō-nyō\ City (2001: 133,058), capital of LA RIOJA autonomous community, Spain. Originating in Roman times, it owed its growth during the Middle Ages to its position on the pilgrimage route to SANTIAGO DE COMPOSTELA. An ancient walled town, it is a trade centre in an agricultural region and is known for its Rioja wine.

Lohengrin \'lō-ən-ˌgrēn,\ *English* \'lō-ən-ˌgrin\ Hero-knight of medieval Germanic legends. He was called the knight of the swan because he arrived in a boat drawn by a swan to help a noble lady in distress. He married her but forbade her to ask his origin; when she forgot this promise, he left her, never to return. The first version of his legend appeared c. 1210 in WOLFRAM VON ESCHENBACH's *Parzival*, in which the swan knight was the son and heir of Parzival (PERCEVAL). The anonymous 15th-century epic *Lorengel* provided the basis for RICHARD WAGNER's opera *Lohengrin* (1850).

Loire \'lwär\ **River** River, southeastern France. The longest river in France, it flows north and west for 634 mi (1,020 km) to the Bay of BISCAY, which it enters through a wide estuary below Saint-Nazaire. Embankments were built as early as the 12th century, and in subsequent centuries it was used extensively for the transport of goods. A canal system built in the 17th and 18th centuries is inadequate for modern vessels.

loka \'lō-kə\ In HINDUISM, the universe or any particular division of it. The most common division of the universe is the *tri-loka*, or three worlds (heaven, earth, and atmosphere, or heaven, world, and netherworld), each of which is divided into seven regions. Sometimes, instead of the *tri-loka*, 14 worlds are envisioned, seven above the earth and seven below. Whatever the division, it illustrates the basic Hindu concept of hierarchically ordered worlds.

Loki \'lō-kē\ In Norse mythology, a trickster who was able to change his shape and sex. His father was the giant Fárbauti, but he was included

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among the Aesir, a tribe of the gods. A companion of the great gods Odin and Thor, Loki helped them with his clever plans but sometimes embarrassed them. He also appeared as the enemy of the gods, entering their banquets uninvited and demanding drink. After causing the death of the god Balder, he was punished by being bound to a rock. Loki created a female, Angerboda, with whom he produced three evil progeny: Hel, the goddess of death; Jörmungand, the evil serpent surrounding the world; and Fenrir, the wolf.

Lollards Followers of John Wycliffe in late medieval England. The pejorative name (from Middle Dutch *lollaert*, "mumbler") had been applied earlier to European groups suspected of heresy. The first Lollard group centred on some of Wycliffe's colleagues at Oxford led by Nicholas of Hereford. In 1382 the archbishop of Canterbury forced some of the Oxford Lollards to renounce their views, but the sect continued to multiply. The accession of Henry IV in 1399 signaled a wave of repression. In 1414 a Lollard rising was quickly defeated by Henry V; it brought severe reprisals and marked the end of the Lollards' overt political influence. A Lollard revival began c. 1500, and by 1530 the old Lollard and the new Protestant forces had begun to merge. The Lollard tradition predisposed opinion in favor of Henry VIII's anticlerical legislation. The Lollards were responsible for a translation of the Bible by Nicholas of Hereford, and their core teachings included an emphasis on personal faith and the authority of the Bible and the rejection of clerical celibacy, transubstantiation, and indulgences.

Lomax \'lō-ˌmaks**, John** (b. Sept. 23, 1867, Goodman, Miss., U.S.—d. Jan. 26, 1948, Greenville, Miss.) U.S. ethnomusicologist. He attended Harvard University and soon thereafter began publishing collections of cowboy songs. In the 1930s he and his teenage son Alan (1915–2002) collected folk songs of the Southwest and Midwest. Jelly Roll Morton, Leadbelly, and Muddy Waters were perhaps the most significant of their many important discoveries; the Lomaxes' archive of Morton's performance and storytelling was of particular significance. Both men did important work at the Library of Congress's Archive of Folk Music. Their many books and anthologies spurred the folk music revival of the 1950s and '60s.

Lombard Any member of a Germanic people who from 568 to 774 ruled a kingdom in the region of Lombardy. Originally a pastoral tribe from northwestern Germany, the Lombards migrated southward and adopted an imperial military system. In the 6th century they moved into northern Italy, conquering the cities that had been left defenseless after the overthrow of the Ostrogoths by the Byzantine Empire. In the 8th century Liudprand, probably the greatest of the Lombard kings, steadily reduced the area of Italy still under Byzantine rule. When the Lombard kings invaded papal territories, Pope Adrian I sought aid from Charlemagne. In 773 the Franks besieged the Lombard capital, capturing Desiderius, the Lombard king; Charlemagne became king of the Lombards as well as of the Franks, and Lombard rule in Italy ended.

Lombard, Carole *orig.* **Jane Alice Peters** (b. Oct. 6, 1908, Fort Wayne, Ind., U.S.—d. Jan. 16, 1942, near Las Vegas, Nev.) U.S. film actress. She made her screen debut in *A Perfect Crime* (1921) and appeared in comedy shorts from 1925. She starred in the classic screwball comedy *Twentieth Century* (1934), which showcased her unique blend of sophisticated glamour and earthy audacity and established her as a leading comic actress. She appeared in a series of popular comedies, including *My Man Godfrey* (1936), *Nothing Sacred* (1937), *Mr. and Mrs. Smith* (1941), and *To Be or Not to Be* (1942). She married Clark Gable in 1939. She died in a plane crash while on tour to sell war bonds.

Lombard, Peter See Peter Lombard

Lombard League Italian league that resisted attempts by the Holy Roman emperors to curtail the liberties of the communes of Lombardy in northern Italy in the 12th–13th century. Founded in 1167, it was backed by Pope Alexander III, who saw it as an ally against Emperor Frederick I Barbarossa. After several military setbacks at the hands of the league, Frederick was forced to grant the Lombard cities communal liberties and jurisdiction under the Peace of Constance. The league again was renewed in 1226 and resisted Frederick II's attempt to reassert imperial power in northern Italy.

Lombardi, Vince(nt Thomas) (b. June 11, 1913, Brooklyn, N.Y., U.S.—d. Sept. 3, 1970, Washington, D.C.) U.S. football coach. He attended Fordham University, where he played on the famous line known as the "Seven Blocks of Granite." As head coach and general manager of the Green Bay Packers (1959–67), he imposed a strenuous regimen and led the team to five NFL championships (1961, 1962, 1965, 1966, 1967) and to victories in Super Bowls I and II (1967, 1968). Because of his success, he became a national symbol of single-minded determination to win. As coach, general manager, and part owner of the Washington Redskins in 1969, he led that team to its first winning season in 14 years.

Lombardo, Guy (Albert) (b. June 19, 1902, London, Ont., Can.—d. Nov. 5, 1977, Houston, Texas, U.S.) Canadian-born U.S. bandleader. He trained as a violinist and in 1917 formed his band, the Royal Canadians. They began broadcasting nationally from Chicago in 1927, and from 1929 he was the winter attraction at New York City's Roosevelt Grill, a booking repeated for more than 30 years. He later moved to the Waldorf-Astoria Hotel, continuing the famous New Year's Eve broadcasts, begun in 1954, that climaxed with "Auld Lang Syne." Though derided by critics as the "king of corn," Lombardo gained long-lasting popularity by conducting what was billed as "the sweetest music this side of heaven."

Lombardy \'läm-bər-dē\ Region (pop., 2003 est.: 9,108,645), northern Italy. Bounded on the north by Switzerland, it contains many Alpine peaks as well as the fertile valley of the Po River. Its capital is Milan. Inhabited by Celtic peoples from the 5th century BC, it was conquered by Rome after the Second Punic War and became part of Cisalpine Gaul. In AD 568–774 it was the centre of the kingdom of the Lombards. During the Middle Ages several of its towns became self-governing municipalities; they formed the Lombard League in the 12th century and won autonomy by defeating Frederick I Barbarossa in 1176. The area was later ruled by Spain (1535–1713), Austria (1713–96), and France (1796–1814). In 1859 Lombardy joined the newly unified Italy. Italy's most populous region, it is a thriving commercial area centred on Milan.

Lombok \'lȯm-ˌbȯk\ Island, Indonesia. It is one of the Lesser Sunda Islands, separated from Bali by the Lombok Strait and from Sumbawa by the Alas Strait. It is 70 mi (115 km) long and 50 mi (80 km) wide and occupies an area of 2,098 sq mi (5,435 sq km). It is divided by two mountain chains; its northern range includes Mount Rindjani (12,224 ft [3,726 m]), Indonesia's tallest mountain. It was ruled by the sultan of Makasar in 1640. The Balinese later seized control and established four kingdoms there; the Dutch ruled the kingdom of Mataram from 1843 and gained control of the entire island by the late 19th century. Following World War II, it became part of Indonesia.

Lomé \lō-'mā\ City (pop., 2003 est.: 676,400; urban agglom.: 749,700), capital of Togo. Located on the Gulf of Guinea in southwestern Togo, it was chosen as the capital of German Togoland in 1897 and developed as an administrative and commercial centre. Its port was modernized in the 1960s, and its deepwater harbour is a major shipping centre. It is the site of the University of Bénin (1965).

Loménie de Brienne \lō-mā-'nē-də-brē-'en**, Étienne Charles de** (b. Oct. 9, 1727, Paris, France—d. Feb. 19, 1794, Sens) French ecclesiastic and minister of finance (1787–88) before the French Revolution. Unable to cope with the worsening financial crisis, he resigned in favour of Jacques Necker. Made archbishop of Sens and then cardinal (1788), he was one of the few prelates who took the oath to the Civil Constitution of the Clergy (1790). He died in prison during the Reign of Terror.

Lomond \'lō-mən**, Loch** Lake, Scotland. Located at the southern edge of the Highlands, it is the country's largest lake 24 mi (39 km) long and 0.75 to 5 mi (1.2 to 8 km) wide, with an area of 27 sq mi (70 sq km). It drains by the short River Leven into the Firth of Clyde at Dumbarton. Its eastern shore near Ben Lomond is the region made famous by the outlaw Rob Roy.

Lomonosov \lə-ˌmə-'nȯ-səf**, Mikhail Vasilyevich** (b. Nov. 19, 1711, near Kholmogory, Russia—d. April 15, 1765, St. Petersburg) Russian scientist, poet, and grammarian, considered the first great Russian linguistic reformer. Educated in Russia and Germany, he established what became the standards for Russian verse in the *Letter Concerning the Rules of Russian Versification*. In 1745 he joined the faculty at the St. Petersburg Imperial Academy of Sciences, where he made substantial contributions to the physical sciences. He later wrote a Russian grammar and worked to systematize the Russian literary language, which had been an amalgam of Church Slavonic and Russian vernacular. He also reorganized the academy, founded Moscow State University (which now bears his name), and created the first coloured-glass mosaics in Russia.

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Lon Nol (b. Nov. 13, 1913, Prey Vêng, Camb.—d. Nov. 17, 1985, Fullerton, Calif., U.S.) Cambodian military and political leader. A magistrate in the French colonial service, he became successively head of the national police (1951), army chief of staff (1955), and commander in chief (1960). He was twice premier (1966–67, 1969–70) under NORODOM SIHANOUK. In 1970 he was the chief architect of the U.S.-supported coup that deposed Sihanouk. He abandoned Sihanouk's policy of neutrality in the Vietnam War and threw Cambodia's support behind the U.S. and South Vietnam. In 1972 he assumed total power in Cambodia; he fled to the U.S. in 1975 when the KHMER ROUGE takeover was imminent.

London *officially* **Greater London** Capital and largest city (pop., 2001: 7,172,036) of the United Kingdom, situated in southeastern England on the River THAMES. It is the political, industrial, cultural, and financial centre of the country. Formally known as the metropolitan county of Greater London (established 1965), it has an area of 659 sq mi (1,706 sq km) and consists of two regions: Inner London comprises 14 of London's 33 boroughs (including the original City of London), and Outer London encompasses the other 19 boroughs. Greater London is an administrative entity, with an elected mayor and assembly. Founded by the Romans as Londinium in the 1st century AD, it passed to the Saxons in the 5th–6th century. The Danes invaded England and London in 865. Following the Norman Conquest (1066), WILLIAM I (the Conqueror) established the central stronghold of the fortress known as the TOWER OF LONDON. Norman kings selected Westminster as their seat of government. The church known as WESTMINSTER ABBEY had been built earlier by EDWARD THE CONFESSOR. The largest city in Europe north of the Alps by 1085, it was struck by the BLACK DEATH in 1348–49. Trade grew significantly in the mid-16th century, fueled by the establishment of Britain's overseas empire. In 1664–65 the plague killed about 70,000 Londoners, and in 1666 the GREAT FIRE OF LONDON consumed five-sixths of the City of London; it was afterward rebuilt (see CHRISTOPHER WREN). London was the centre of world trade from the late 18th century to 1914. It opened the world's first electric underground railway in 1890. Severely damaged by German bombs in the Battle of BRITAIN during World War II, it was again rebuilt and grew rapidly in the postwar period. Among its sites of interest are BUCKINGHAM PALACE, the TATE GALLERIES, the National Gallery, the BRITISH MUSEUM, and the VICTORIA AND ALBERT MUSEUM.

London City (pop., 2001: metro area, 432,451), southeastern Ontario. It lies on the Thames River, near several of the GREAT LAKES. Its name and site were chosen in 1792 for the location of a capital of Upper Canada, but the plans failed to materialize. First settled in 1826, it was incorporated as a city in 1855. It became an important transportation and industrial centre as a result of its interlake location. It is the seat of the University of Western Ontario.

London, Great Fire of See GREAT FIRE OF LONDON

London, Great Plague of See GREAT PLAGUE OF LONDON

London, Jack *orig.* **John Griffith Chaney** (b. Jan. 12, 1876, San Francisco, Calif., U.S.—d. Nov. 22, 1916, Glen Ellen, Calif.) U.S. novelist and short-story writer. Born to poverty, the largely self-educated London became a sailor, hobo, Alaskan gold miner, and militant socialist. He gained a wide audience with his first book, *The Son of the Wolf* (1900), and the story "To Build a Fire" (1908). Thereafter he wrote steadily; his 50 books of fiction and nonfiction, including many romantic depictions of elemental struggles for survival as well as socialist tracts, include *The Call of the Wild* (1903), *The Sea-Wolf* (1904), *White Fang* (1906), *The Iron Heel* (1907), *Martin Eden* (1909), and *Burning Daylight* (1910). Though his work brought him wealth and fame, his suicide at age 40 was the result of alcoholism and mounting debt.

Jack London writing *The Sea Wolf*, 1904.
JACK LONDON STATE HISTORIC PARK

London, Treaty of (April 1915) Secret treaty between neutral Italy and the Allied forces of France, Britain, and Russia to bring Italy into World War I. The Allies wanted Italy's participation because of its border with Austria. Italy was promised Trieste, southern Tyrol, northern Dalmatia, and other territories in return for a pledge to enter the war within a month. Despite the opposition of most Italians, who favoured neutrality, Italy joined the war against Austria-Hungary in May.

London, University of Federation of more than 50 British institutions of higher learning, located primarily in London, England. It was established by liberals and religious dissenters in 1828, and it accepted for enrollment Roman Catholics, Jews, and other non-Anglicans. The first two colleges were University College and King's College. From 1849 a student enrolled in any university in the British Empire could be awarded a University of London degree after examination. By the early 20th century many institutions had become affiliated with the university, including Bedford College, the first British university to grant degrees to women; the London School of Economics and Political Science, now an internationally renowned centre for the social sciences; and three other institutions that later became the Imperial College of Science and Technology.

London Bridge Any of several successive structures spanning the River Thames. The Old London Bridge of nursery-rhyme fame was built by Peter of Colechurch between 1176 and 1209, replacing an earlier timber bridge. Because of obstructions encountered in building the cofferdams, the arch spans varied from 15 to 34 ft (4.6–10.4 m); the uneven construction resulted in frequent need for repair, but the bridge survived more than 600 years. Its roadway was loaded with a jumble of houses and shops, many projecting out over the river. It was demolished and replaced in the 1820s by New London Bridge, designed and built by John Rennie, Sr. (1761–1821), and his son John Rennie, Jr. (1794–1874). In the 1960s it was again replaced; the old masonry facing was dismantled and reerected at Lake Havasu City, Ariz., as a tourist attraction.

London Naval Conference (Jan. 21–April 22, 1930) Conference held in London to discuss naval disarmament and review the treaties of the WASHINGTON CONFERENCE. Representatives of Britain, the U.S., France, Italy, and Japan agreed to regulate submarine warfare and to place limits on new construction of cruisers, destroyers, submarines, and other warships. A treaty limiting battleship size was not signed, and the treaties renewed in 1935 were canceled on the outbreak of WORLD WAR II.

London Stock Exchange London marketplace for SECURITIES. It was formed in 1773 by a group of stockbrokers who had been doing business informally in local coffeehouses. In 1801 its members raised money for construction of a building in Bartholomew Lane; they established rules for the exchange the following year. In 1973 the London Stock Exchange merged with several regional British stock exchanges. In 1991 the exchange replaced its governing council with a board of directors, and it became a public limited company.

Londonderry *locally and historically* **Derry** District (pop., 2001: 105,066), northwestern Northern Ireland. It is also the name of a former traditional county, colonized by the English in 1609; the 1973 administrative reorganization broke up the county into several districts, including Londonderry. Bordered by the Irish republic and Lough Foyle, it is centred around the seaport city of LONDONDERRY. In 1969 the old city and the adjacent area were merged administratively, and in 1973 it became one of Northern Ireland's 26 districts.

Londonderry *locally and historically* **Derry** Seaport (pop., 1995 est.: 77,000) and district seat of LONDONDERRY, Northern Ireland. St. COLUMBA established a monastery there in the 6th century, but the settlement was repeatedly destroyed by Norse invaders. In 1600 an English force seized the city; shortly thereafter JAMES I of England granted the city to the citizens of London, who brought in Protestant settlers, and it was then that it became officially known as Londonderry. Growth of the modern city dates from the 1850s, when linen shirt making became important, and clothing manufacture remains a major industry. Home to two cathedrals, Anglican and Roman Catholic, it has been the site of terrorist violence. Steeped in the region's political turmoil, controversy surrounds the city's name. The British government officially refers to the city and district as Londonderry City, but since 1984 the nationalist-controlled city council has called itself the Derry City Council.

Long, Huey (Pierce) (b. Aug. 30, 1893, near Winnfield, La., U.S.—d. Sept. 10, 1935, Baton Rouge, La.) U.S. politician. Despite an impoverished background, he managed to obtain enough formal schooling to pass the bar in 1915. Politically ambitious, he was elected state railroad com-

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missioner at 25. His call for state regulation of the utilities and his attacks on the Standard Oil Company won him widespread popularity. As governor (1928–31) of Louisiana, he became nationally famous for his fiery oratory and unconventional behaviour, and his nickname, "Kingfish," became widely known. He implemented public works projects and education reform but used autocratic methods to control the state government. Elected to the U.S. Senate (1932–35), he sought national power with a Share-the-Wealth program. In 1935 he was assassinated by Carl A. Weiss, whose father Long had vilified. His brother Earl K. Long (1895–1960) later served as governor (1939–40, 1948–52, 1956–60).

Huey Long
UPI

Long Beach City (pop., 2000: 461,522), southwestern California, U.S. The site was originally an Indian trading camp, and Spanish ranches were located there in the 18th century. Laid out as Willmore City in 1880 and incorporated in 1888, it was renamed for its 8.5-mi (13.5-km) beach. The discovery of oil nearby in 1921 led to rapid growth. An earthquake in 1933 caused extensive damage. It is connected to the Los Angeles harbour by the Cerritos Channel. The British ocean liner *Queen Mary* has been moored in the harbour since 1969.

long-distance running In track and field, any foot race over 5,000 m in length. Marathons and cross-country running are also considered long-distance events. Women rarely ran in races beyond 3,000 m until the late 20th century.

Long Island Island (pop., 2000: 7,448,618), southeastern New York, U.S., lying between Long Island Sound and the Atlantic Ocean. It has four counties: Kings, Queens, Nassau, and Suffolk. Kings County (the borough of Brooklyn) and Queens County (the borough of Queens) form part of New York City. At its western end it is separated from the Bronx and Manhattan by the East River and from Staten Island by the Narrows. It is 118 mi (190 km) long, 12–23 mi (19–37 km) wide, and has an area of 1,401 sq mi (3,629 sq km). Its eastern portion has many beaches; it serves as a recreation area for New York City. Its southern shore, lined by sand spits (see Fire Island), shelters several bays, including Jamaica Bay. Originally inhabited by Indians (mostly Delaware), it was included in a grant to the Plymouth Co. It was settled by Dutch and English, but the whole island became part of the British colony of New York in 1664. It was the site of the Battle of Long Island (Aug. 27, 1776), an American defeat in the American Revolution.

Long Island Sound Body of water between the southern shore of Connecticut and the northern shore of Long Island, New York, U.S. It connects with the East River and with Block Island Sound. Covering 1,180 sq mi (3,056 sq km), it is 90 mi (145 km) long and 3–20 mi (5–32 km) wide. Its shores have many residential communities and summer resorts.

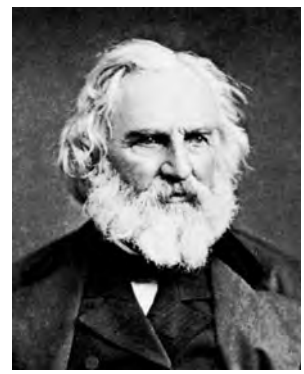
long jump *or* **broad jump** Track-and-field sport consisting of a horizontal jump for distance. It was formerly performed from both standing and running starts, as separate events, but the standing long jump is no longer included in major competitions. The running long jump was an event in the Olympic Games of 708 BC and in the modern Games from 1896. In 1948 the women's long jump became an Olympic event.

Long March (1934–35) Trek of 6,000 mi (10,000 km) by Chinese Communists, resulting in the relocation of their revolutionary base from southeastern China to northwestern China and the emergence of Mao Zedong as their undisputed leader. Having withstood four of Chiang Kai-shek's campaigns against their base area, the Communists were nearly defeated by his fifth attack. The remaining 85,000 troops broke through Nationalist lines and fled first westward under Zhu De and then north under Mao. By the time Mao arrived at Shaanxi, he was followed by only about 8,000 survivors, most of the rest having been killed by fighting, disease, and starvation (among the casualties were Mao's two children and a brother). At their new base the Communists were able to build up their strength at a safe remove from the Nationalists in preparation for their eventual victory in 1949.

Long Parliament Session of the English Parliament summoned in November 1640 by Charles I, so named to distinguish it from the Short Parliament of April–May 1640. Charles called the session to raise the money needed for his war against the Scots. Resistant to Charles's demands, the Parliament caused the king's advisers to resign and passed an act forbidding its own dissolution without its members' consent. Tension between the king and Parliament increased until the English Civil War broke out in 1642. After the king's defeat (1646), the army, led by Thomas Pride, exercised political power and in 1648 expelled all but 60 members of the Long Parliament. The remaining group, called the Rump, brought Charles to trial and execution (1649); it was forcibly ejected in 1653. In 1659, after the end of Oliver Cromwell's protectorate, the Parliament was reestablished; those who were excluded in 1648 were restored to membership. The Parliament dissolved itself in 1660.

longbow Leading missile weapon of the English from the 14th century into the 16th century. Probably of Welsh origin, it was usually 6 ft (2 m) tall and shot arrows more than a yard long. The best were made of yew, might require a force of 100 lbs (45 kg) to draw, and had an effective range of 200 yards (180 m). English archers used longbows in the Hundred Years' War, and the weapon played an important role in the battles of Crécy, Poitiers, and Agincourt. See also bow and arrow, crossbow.

Longfellow, Henry Wadsworth (b. Feb. 27, 1807, Portland, Mass., U.S.—d. March 24, 1882, Cambridge, Mass.) U.S. poet. Longfellow graduated from Bowdoin College and traveled in Europe before joining the modern-language faculties of Bowdoin (1829–35) and Harvard (1836–54). His *Voices of the Night* (1839), containing "The Psalm of Life" and "The Light of the Stars," first won him popularity. *Ballads and Other Poems* (1841), including "The Wreck of the Hesperus" and "The Village Blacksmith," swept the nation, as did his long poem *Evangeline* (1847). With *Hiawatha* (1855), *The Courtship of Miles Standish* (1858), and *Tales of a Wayside Inn* (1863), including "Paul Revere's Ride," he became the best-loved American poet of the 19th century. He later translated Dante's *Divine Comedy* (1867) and published his intended masterpiece, *Christus*, a trilogy on Christianity (1872). The hallmarks of his verse are gentleness, simplicity, and an idealized vision of the world.



Henry Wadsworth Longfellow.
HISTORICAL PICTURES SERVICE, CHICAGO

longhair Generic term for any member of breeds of domestic cats noted for their long, soft, flowing coat. Longhair breeds include Balinese, Birman, Cymric, Himalayan, Javanese, Norwegian forest cat, Maine coon cat, Persian, Ragdoll, Somali, and Turkish Angora. Though considered more lethargic than shorthair cats, longhairs are, like shorthairs, noted for playfulness, affection, and the ability to defend themselves if necessary.

Longhi \'lȯŋ-gē**, Pietro** *orig.* **Pietro Falca** (b. 1702, Venice—d. May 8, 1785, Venice) Italian painter. Son of a Venetian goldsmith, he studied painting in Bologna and thereafter became known for his scenes of everyday life among Venice's upper class and bourgeoisie. Popular for their charm and seeming naïveté, his paintings have a Rococo sense of the intimate and manifest the interest in social observation characteristic of the Enlightenment. He also painted landscapes and portraits.

longhouse Traditional communal dwelling of the Iroquois Indians until the 19th century. The longhouse was a rectangular box built out of poles, with doors at each end and saplings stretched over the top to form the roof, the whole structure being covered with bark. It was about 20 ft (6 m) wide and could be more than 200 ft (60 m) in length, depending on the number of families living in it. Down the middle of the house were fires, which were shared by families on either side. The term is also applied today to an Iroquois building designated as church and meeting hall, though its form is entirely different. See also pole construction.

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longitude See LATITUDE AND LONGITUDE

Longmen caves *or* **Lung-men caves** Series of Chinese cave temples carved into the rock of a high riverbank south of Luoyang, in HENAN province. Construction began late in the NORTHERN WEI DYNASTY (AD 386–535) and continued sporadically through the 6th century and the TANG DYNASTY. Delicately crafted to create ethereal effects in stone, the temples contain images of the BUDDHA clothed as a Chinese scholar. Work at Longmen culminated in 672–675 with the construction of a monumental shrine known as Fengxian Si, which includes a seated Buddha more than 35 ft (10.7 m) high.

Longshan culture *or* **Lung-shan culture** (2500–1900 BC) Neolithic culture of China's HUANG HE (Yellow River) valley. Large sites with rammed-earth walls have been found. Characteristic Longshan pottery has thin walls and is well crafted; there are tall-stemmed black cups with eggshell-thin walls as well as polished black beakers. Oracle bones were used for divination. There is evidence of differentiation in social status, and jade artifacts and traces of metallurgy have been found.

longship *or* **Viking ship** Sail-and-oar vessel widely used in northern Europe for more than 1,500 years. It was a 45–75-ft (14–23-m) GALLEY with up to 10 oars on a side, a square sail, and a 50–60-man capacity. Double-ended and built with overlapped planks, it was exceptionally sturdy in high seas. Examples have been found from as early as 300 BC. It carried the Vikings on their piratical raids of the 9th century and bore LEIF ERIKSSON to America in 1000. Dutch, French, English, and German merchants and warriors also used it.

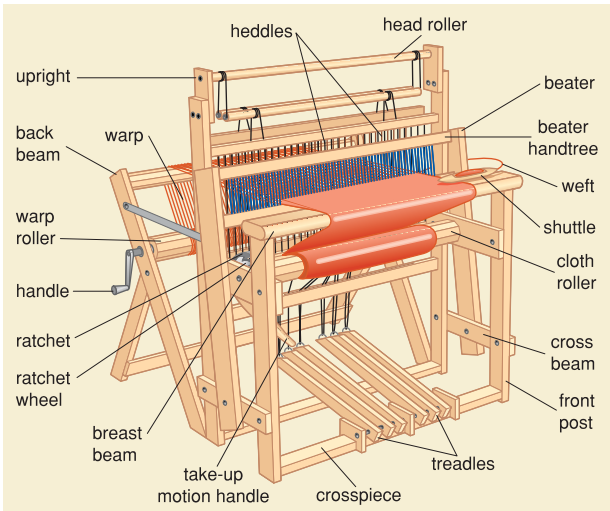
Longstreet, James (b. Jan. 8, 1821, Edgefield District, S.C., U.S.—d. Jan. 2, 1904, Gainesville, Ga.) U.S. army officer. He graduated from West Point but resigned from the U.S. Army when South Carolina seceded. Appointed brigadier general in the Confederate army, he fought in the battles of BULL RUN, ANTIETAM, and FREDERICKSBURG. He was second in command to ROBERT E. LEE at the Battle of GETTYSBURG, where his delay in attacking contributed to the Confederate defeat. He later directed the Confederate attack at CHICKAMAUGA. He was badly wounded in the Battle of the WILDERNESS but later resumed his command. He surrendered with Lee at APPOMATTOX COURT HOUSE. He later served as U.S. minister to Turkey (1880–81) and commissioner of Pacific railways (1898–1904).

Lönnrot \'lœn-růt**, Elias** (b. April 9, 1802, Sammatti, Swedish Finland—d. March 19, 1884, Sammatti, Russian Finland) Finnish folklorist and philologist. While serving as a medical officer for 20 years in a remote part of eastern Finland, Lönnrot collected linguistic information and folk poetry from the region's inhabitants. Believing that the short poems were fragments of a continuous epic, he added connective material of his own and assembled them into the *KALEVALA* (1835, enlarged 1849), which became the Finnish national epic. He also published *Old Songs and Ballads of the Finnish People* (1840–41) and other collections.

Lonsdale, Dame Kathleen *orig.* **Kathleen Yardley** (b. Jan. 28, 1903, Newbridge, County Kildare, Ire.—d. April 1, 1971, London, Eng.) Irish-born British crystallographer. In 1929 her X-ray crystallography techniques established the regular hexagonal arrangement of carbon atoms in molecules of benzene compounds. She developed a technique with which she measured (to seven figures) the distance between carbon atoms in diamond. She also applied crystallographic techniques to medical problems, in particular the study of bladder stones and certain drugs. In 1945 she became the first woman elected to the Royal Society of London, and in 1956 she was created Dame of the British Empire.

loofah *or* **luffa** \'lü-fə\ Any of six species of annual climbing vines, also called vegetable sponge or sponge gourd, that make up the genus *Luffa* in the GOURD family, native to the Old World tropics. Two species cultivated in temperate areas (*L. acutangula* and *L. aegyptiaca*) produce 1-ft (30-cm) cucumber-shaped fruits. Edible and greenish when young, these fruits become straw-coloured with age. On removal of the skin, pulp, and seeds, there remains a complex of closely netted vascular bundles (food- and water-carrying tubes) that resembles a sponge in texture. This spongelike product is used for bathing, for washing dishes, and as an industrial fibre.

loom Machine for WEAVING cloth. The earliest looms, from the 5th millennium BC, consisted of bars or beams forming a frame to hold a number of parallel threads in two alternating sets. By raising one set of these threads (which together formed the warp), it was possible to run a cross thread (a weft, or filling) between them. A SHUTTLE carried the filling strand through the warp. The fundamental operation of the loom remained unchanged, but over centuries many improvements were introduced in both Asia and Europe. The drawloom, probably invented in Asia for SILK weaving, provided a means for raising warp threads in groups as required by a pattern. In the 18th century JACQUES DE VAUCANSON and J.-M. JACQUARD mechanized this function by the ingenious use of punched cards; the cards programmed the mechanical drawboy, saving labour and eliminating errors (see JACQUARD LOOM). In England the inventions of JOHN KAY (FLYING SHUTTLE), EDMUND CARTWRIGHT (power drive), and others contributed to the INDUSTRIAL REVOLUTION, in which the loom and other TEXTILE machinery played a central role.



Principal parts of a traditional hand loom.
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loon *or* **diver** Any of four species (genus *Gavia*) of diving birds of North America and Eurasia. Loons range in length from 2 to 3 ft (60–90 cm). They have small pointed wings, webs between the front three toes, legs placed far back on the body, making walking awkward, and thick plumage that is mainly black or gray above and white below. They feed mainly on fishes, crustaceans, and insects. Almost wholly aquatic, they can swim long distances underwater and can dive to a depth of 200 ft (60 m). They are generally found singly or in pairs, but some species winter or migrate in flocks. They are known for their eerie, "laughing" cries.

Common loon, or great northern diver (*Gavia immer*)
WAYNE LANKINEN—BRUCE COLEMAN LTD.

looper *or* **cankerworm** *or* **inchworm** LARVA of any member of a large, widespread group (mostly in the family Geometridae, with some in the family Noctuidae) of MOTHS. Loopers move in a characteristic "inching" or "looping" gait by extending the front part of the body and bringing the rear up to meet it. Resembling twigs or leaf stems, they feed on foliage, and can seriously damage or destroy trees.

Loos \'lōs**, Adolf** (b. Dec. 10, 1870, Brno, Moravia, Austria-Hungary—d. Aug. 23, 1933, Kalksburg, near Vienna, Austria) Austrian architect. Educated in Dresden, Ger., he practiced in Vienna, though he spent extended periods in the U.S. and Paris. Opposed to both ART NOUVEAU and Beaux-Arts historicism, he announced as early as 1898 his intention to avoid the use of unnecessary ornament. His Steiner House in Vienna (1910) has been referred to by some architectural historians as the first completely modern dwelling; the main (rear) facade is a symmetrical, skillfully balanced composition of rectangles. His essays from this period, denouncing ornament and decoration, were equally influential. His best-known large structure is the Goldman and Salatsch Building in

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Vienna (1910), in which small amounts of Classical detail are offset by large areas of blank, polished marble. His work strongly influenced European Modernist architects after World War I.

Loos, Anita (b. April 26, 1893?, Sissons, Calif., U.S.—d. Aug. 18, 1981, New York, N.Y.) U.S. novelist and screenwriter. She was a child actress; at an early age she also began contributing sketches and articles to various periodicals. By age 20 she was a professional screenwriter for silent films. Her first novel, *Gentlemen Prefer Blondes* (1925), brought fame to Loos and her central character, the naive gold digger Lorelei Lee; a musical version (1949) starred Carol Channing (b. 1921), and a film (1953) starred Marilyn Monroe. Loos's later film scripts included *Blossoms in the Dust* (1941) and *I Married an Angel* (1942). She also wrote two memoirs, *A Girl Like I* (1966) and *Kiss Hollywood Good-Bye* (1974).

loosestrife Any ornamental plant of the family Lythraceae, especially in the genera *Lythrum* and *Decodon*, and two genera of the primrose family (*Lysimachia* and *Steironema*). Purple loosestrife (*Lythrum salicaria*), native to Eurasia, grows 2–6 ft (0.6–1.8 m) high on riverbanks and in ditches. Its branched stem bears whorls of narrow, pointed, stalkless leaves and ends in tall, tapering spikes of red-purple flowers. Introduced into North America early in the 19th century, it has become a noxious weed in many parts of the U.S. and Canada because its dense growth outcompetes native wetland vegetation that provides food and habitat for wildlife.

López (Michelsen), Alfonso (b. June 30, 1913, Bogotá, Colom.) President of Colombia (1974–78). Son of a former president, he served as senator, governor, and foreign minister before his 1974 landslide victory in Colombia's first competitive presidential election in 16 years. A liberal, he raised taxes on high incomes and took steps to curb inflation, but the elimination of price subsidies and a rise in unemployment led to labour unrest, land seizures by peasants, and guerrilla activity. In 1982 he was defeated in another run for the presidency.

Lopez (Knight), Nancy (b. Jan. 6, 1957, Torrance, Calif., U.S.) U.S. golfer. She left the University of Tulsa (Okla.) after her sophomore year to become a professional golfer. In her first full season in 1978, she won a record total of nine tournaments, including five in a row. She became a three-time winner of the Ladies' Professional Golf Association (LPGA) championship (1978, 1985, 1989) and a four-time LPGA Player of the Year. Her success and personality helped rejuvenate women's golf.

López Portillo \'lō-ˌpez-pȯr-'tē-yō\ **(y Pacheco), José** (b. June 16, 1920, Mexico City, Mex.—d. Feb. 17, 2004, Mexico City) President of Mexico (1976–82). He was a professor before joining the governments of Gustavo Díaz Ordaz and Luis Echeverría. As president, he emphasized attraction of foreign investment, tax concessions to stimulate industrial development, creation of nonagricultural jobs, and exploitation of oil and natural gas. His most significant political reform was to increase participation of minority parties, facilitating later challenges to the Institutional Revolutionary Party. Most of the wealth that flowed from expanded oil exports was squandered or pocketed by government and union officials. His administration was discredited by the huge foreign debt it amassed and charges of corruption. See also Pemex.

loquat \'lō-ˌkwät\ Subtropical evergreen tree (*Eriobotrya japonica*) of the rose family, related to the apple and other well-known fruit trees of the temperate zone. Usually less than 33 ft (10 m) tall, it is common in parks and gardens, often trained to ornamental flatttened shapes by espalier. Dense, fragrant, white flowers grow beyond clusters of leaves with serrated edges. The small yellow-orange fruits have a pleasant, mildly acid taste; they are eaten fresh, stewed, or as jelly or liqueur. The loquat is grown commercially (usually on a small scale) in many subtropical regions.

Loquat (*Eriobotrya japonica*)
G.R. ROBERTS

loran *abbreviation of* **long-range navigation** A land-based system of radio navigation in common use over the continental United States and in its coastal waters. It was developed during World War II for the U.S. military. A civilian version, Loran-C, was developed in the 1950s. Loran-C can be used to determine position within about 30 ft (10 m) by comparing signals from multiple stations. Loran-like systems operate in many coastal waters around the world. However, the availability of the global positioning system (GPS), with a typical accuracy of 3 ft (1 m), has begun to relegate loran to backup status.

Lorca, Federico García See Federico García Lorca

lord See feudalism

Lord Chamberlain's Men See Chamberlain's Men

lord chancellor British official who heads the judiciary and presides over the House of Lords. Until the 14th century the chancellor served as royal chaplain and king's secretary. The office acquired a more judicial character in the reign of Edward III (1327–77). Most of the office's power, exemplified in the administrations of St. Thomas Becket (died 1170) and Thomas, Cardinal Wolsey (died 1530), ceased to exist centuries ago. The judicial work of contemporary chancellors is confined to the House of Lords and the Privy Council. As speaker of the House of Lords, the chancellor states the question and takes part in debates.

Lord Dunmore's War (1774) Attack by Virginia militia on the Shawnee in Kentucky. The militiamen seized Fort Pitt on the western border, renaming it after their royal governor, Lord Dunmore, who had ordered attacks against the Shawnee, seen as a threat to white settlers then spreading into the Indian hunting grounds. Defeated at the Battle of Point Pleasant, the Shawnee signed a treaty giving up their hunting grounds. The war was probably started to divert Virginians from disagreements with royal administrators; as such, it has been called the first battle of the American Revolution.

Lorde \'lȯrd**, Audre (Geraldine)** (b. Feb. 18, 1934, New York, N.Y., U.S.—d. Nov. 17, 1992, St. Croix, U.S. Virgin Islands) U.S. poet and essayist. Born to West Indian parents, she worked as a librarian until 1968, when she began to write full-time. She is best known for her passionate writings on lesbian feminism and racial issues, including *Cables to Rage* (1970), *New York Head Shop and Museum* (1974), and *The Black Unicorn* (1978), often called her finest work. Her battle with cancer inspired *The Cancer Journals* (1980) and *A Burst of Light* (1988, National Book Award).

Lords, House of Upper house of Britain's bicameral Parliament. From the 13th and 14th centuries it was the house of the aristocracy. Until 1999 its membership included clergy, hereditary peers, life peers (peers appointed by the prime minister since 1958), and the judges of the Supreme Court of Judicature (Britain's final court of appeal). Though it predates the House of Commons and dominated it for centuries, its power has gradually diminished. Its power to affect revenue bills was constrained by the Parliament Act of 1911, and in 1949 its power to delay by more than a year the enactment of any bill passed by the Commons was revoked. In 1999 the hereditary peers lost their right to sit in the House of Lords, though an interim reform retains their voice in a more limited fashion. The body's chief value has been to provide additional consideration to bills that may be not be well formulated.

Lord's Prayer Prayer taught by Jesus to his disciples and used by all Christians as the basic prayer in common worship. It appears in two forms in the New Testament: a shorter version in Luke 11:2–4, and a longer version, part of the Sermon on the Mount, in Matthew 6:9–13. In both contexts it is offered as a model of how to pray. It is sometimes called the Pater Noster (Latin: "Our Father") for its first two words.

Lorelei \'lȯr-ə-ˌlī\ Rock on the bank of the Rhine River near Sankt Goarshausen in Germany. It produces an echo and is associated with the legend of a beautiful maiden who drowned herself over a faithless lover. She was transformed into a siren who lured fishermen to their death. Clemens Brentano claimed to have invented the essentials of the legend. Heinrich Heine's poem on the Lorelei has been set to music by more than 25 composers.

Loren \lō-'ren**, Sophia** *orig.* **Sofia Villani Scicolone** (b. Sept. 20, 1934, Rome, Italy) Italian film actress. After a poverty-stricken childhood in war-torn Naples, she became a model and movie extra in Rome. Coached by the producer Carlo Ponti (later her husband), she acted in Italian movies from 1950, including *The Gold of Naples* (1954). Her later films, in which she became noted for her statuesque beauty and earthy femininity, include *The Black Orchid* (1959), *El Cid* (1961), *Two Women*

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(1961, Academy Award), *Boccaccio '70* (1962), *Yesterday, Today, and Tomorrow* (1964), *Marriage Italian Style* (1964), and *A Special Day* (1977).

Sophia Loren in *Boccaccio '70* (1962). BROWN BROTHERS

Lorentz \'lōr-ˌents**, Hendrik Antoon** (b. July 18, 1853, Arnhem, Neth.—d. Feb. 4, 1928, Haarlem) Dutch physicist. He taught at the University of Leiden (1878–1912) and later directed Haarlem's Teyler Institute. In 1875 he refined James Clerk Maxwell's theory of electromagnetic radiation so that it explained the reflection and refraction of light. Aiming to devise a single theory to explain the relationship of electricity, magnetism, and light, he later suggested that atoms might consist of charged particles that oscillate and produce light. In 1896 his student Pieter Zeeman (1865–1943) demonstrated this phenomenon (see Zeeman effect), and in 1902 the two men were awarded the second Nobel Prize for Physics. In 1904 Lorentz developed the Lorentz transformations (including the so-called Fitzgerald-Lorentz contraction), mathematical formulas that relate space and time measurements of one observer to those of a second observer moving relative to the first. These formed the basis of Albert Einstein's special theory of relativity.

Lorentz-FitzGerald contraction *or* **space contraction** In relativity physics, the shortening of an object along the direction of its motion relative to an observer. Dimensions in other directions are not contracted. This concept was proposed by the Irish physicist George F. FitzGerald (1851–1901) in 1889 and later independently developed by Hendrik Antoon Lorentz. Significant at speeds approaching that of light, the contraction results from the properties of space and time, not from compression, cooling, or any similar physical disturbance. See also time dilation.

Lorentz transformations Set of equations in relativity physics that relate the space and time coordinates of two systems moving at a constant speed relative to each other, developed in 1904 by Hendrik Antoon Lorentz. Required to describe phenomena approaching the speed of light, these transformations express the concepts that space and time are not absolute; that length, time, and mass depend on the observer's relative motion; and that the speed of light in a vacuum is constant and independent of the motion of the observer or the source.

Lorenz, Edward (Norton) (b. May 23, 1917, West Hartford, Conn., U.S.) U.S. meteorologist. Following degrees from Dartmouth College and Harvard University in mathematics, he turned to weather forecasting in 1942 with the U.S. Army Air Corps. After World War II he joined MIT as a researcher, earned a doctorate in meteorology (1948), and stayed on as a professor. In the early 1960s, he discovered that the weather exhibits a nonlinear phenomenon known as sensitive dependence on initial conditions (see chaos theory). He explained this phenomenon, which makes long-range weather forecasting impossible, to the public as the "butterfly effect": in China a butterfly flaps its wings, leading to unpredictable changes in U.S. weather a few days later.

Lorenz \'lōr-ents**, Konrad (Zacharias)** (b. Nov. 7, 1903, Vienna, Austria—d. Feb. 27, 1989, Altenburg) Zoologist and founder (with Nikolaas Tinbergen) of modern ethology. While still a schoolboy he nursed sick animals from the nearby zoo. In 1935 he first elucidated and demonstrated the phenomenon of imprinting in ducklings and goslings. He later examined the roots of human aggression (in the best-selling *On Aggression*, 1963) and the nature of human thought. His other popular works include *King Solomon's Ring* (1949) and *Man Meets Dog* (1950). He shared a 1973 Nobel Prize with Tinbergen and Karl von Frisch.

Lorenzetti \ˌlō-rānt-'set-tē**, Pietro and Ambrogio** (respectively b. c. 1280/90, Siena?, Republic of Siena—d. c. 1348, Siena; b. c. 1290, Siena, Republic of Siena—d. c. 1348, Siena) Italian painters. Both brothers were possibly pupils of Duccio di Buoninsegna, whose influence is seen in Pietro's altarpiece in the Pieve di Santa Maria at Arezzo and in Ambrogio's early works. Ambrogio's works reveal an individualistic realism and preoccupation with three-dimensional space and form, most evident in his fresco series in Siena's Palazzo Pubblico (1338–39). These most important of Sienese frescoes reveal him to be an explorer of perspective and a political and moral philosopher. Pietro's dramatic frescoes in the lower church of San Francesco at Assisi (c. 1315) show his relation to the art of Giotto, though he departs from Giotto in his attention to detail. His *Birth of the Virgin* and Ambrogio's *Presentation in the Temple*, for Siena Cathedral (1342), are notable for their handling of perspective. With Simone Martini, the brothers were the principal exponents of Sienese art in the years before the Black Death, in which both presumably died.

Lorenzo Monaco \lō-'rent-sō-'mò-nä-kō\ *orig.* **Piero di Giovanni** (b. c. 1370/71, Siena, Republic of Siena—d. c. 1425, Florence, Republic of Florence) Italian painter. He took the vows of the Camaldolese order in Florence in 1391 (Monaco means "Monk"), but in 1402 he was enrolled in the painters' guild there under his lay name and living outside the monastery. His work combined the graceful lines and decorative feeling of the Sienese school with the traditions of the Florentine school. His *Coronation of the Virgin* (1413) reveals his predilection for swirling draperies and rhythmic, curvilinear forms and his understanding of light. His late frescoes in the Bartolini Chapel of Santa Trinità in Florence establish him as a master of Gothic art.

Lorenzo the Magnificent See Lorenzo de' Medici

Lorestan Bronze See Luristan Bronze

loris Any of three species of nocturnal, arboreal primates in the family Lorisidae. Lorises have soft gray or brown fur, huge eyes encircled by dark patches, and no tail. They move slowly and often hang by their feet, leaving their hands free to grasp branches or food. The slender loris (*Loris tardigradus*) of India and Sri Lanka is 8–10 in. (20–25 cm) long; it eats insects and small animals. The slow lorises (genus *Nycticebus*) of South Asia and the Malay Peninsula eat insects, small animals, fruit, and vegetation. *Nycticebus pygmaeus* is about 8 in. (20 cm) long; *N. coucang* is 10.5–15 in. (27–38 cm) long. Habitat degradation and hunting have seriously depleted loris populations.

Loris-Melikov \'lòr-is-'myāl-i-kòf**, Mikhail (Tariyelovich), Count** (b. Jan. 1, 1826, Tiflis, Russia—d. Dec. 24, 1888, Nice, France) Russian military officer and statesman. He commanded an army corps to notable victories in the Russo-Turkish War of 1877–78, for which he was made a count. As governor-general of the central Russian provinces (1879), he recommended administrative and economic reforms to alleviate social discontent. Impressed, Alexander II appointed him minister of the interior (1880) and approved his efforts to liberalize the Russian autocracy, but the tsar was assassinated before the reforms were enacted. Loris-Melikov resigned when Alexander III rejected his reforms.

Lorrain, Claude See Claude Lorrain

Lorraine Historical duchy of western Europe and government region of France. Originally known as Upper Lorraine and later simply as Lorraine, it was formed by the division of Lorraine (Lotharingia) into two duchies in 959. Upper Lorraine, in the region of the Meuse and Moselle rivers, was ruled by one ducal family from the 11th to the 15th century. Metz, Toul, and Verdun, outside the dukes' control, were seized by France in 1552. Lorraine came permanently under the French crown in 1766 and was divided into *départements* in 1790. After the Franco-Prussian War, part of Lorraine was ceded to Germany as part of Alsace-Lorraine. Roughly coextensive with the historical region of Lorraine, the current administrative *région* of Lorraine (pop., 1999: 2,310,376) covers 9,092 sq mi (23,547 sq km). Its capital is Metz.

Lorraine *or* **Lotharingia** \ˌlō-thə-'rin-jə\ Medieval region, present-day northeastern France. By the Treaty of Verdun (843), it became part of the realm of Lothar I. Inherited by his son Lothar, it became the kingdom of Lotharingia. After Lothar's death, it was contested by Germany and France and came under German control in 925.

Lorre \'lòr-ē**, Peter** *orig.* **László Loewenstein** (b. June 26, 1904, Rózsahegy, Hung.—d. March 23, 1964, Hollywood, Calif., U.S.) Hungarian-born U.S. film actor. He played bit parts with a German theatrical troupe before earning international fame as the psychotic murderer in the German film *M* (1931). He left Germany in 1933 and made his English-language debut in *The Man Who Knew Too Much* (1934). He went to Hollywood, where he played malevolent characters in movies such as *Mad Love* (1935), *The Maltese Falcon* (1941), *Casablanca* (1942), and

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The Beast with Five Fingers (1946). He also starred in the eight Mr. Moto detective movies (1937–39). He later directed and starred in the German film *The Lost One* (1951).

Los Alamos Town (pop., 2000: 11,909), north-central New Mexico, U.S. It lies on the Pajarito plateau of the Jemez Mountains, northwest of Santa Fe. The site was chosen by the U.S. government in 1942 as the location for the Manhattan Project, which developed the first atomic bomb. After World War II, the Los Alamos Scientific Laboratory developed the first nuclear fusion bomb. The town was built to house laboratory employees; it is still the site of a major nuclear research facility.

Los Angeles City (pop., 2000: 3,694,820), southern California, U.S. The second largest city in the U.S., it is situated between the San Gabriel Mountains and the Pacific Ocean. Bisected by the Santa Monica Mountains, which separate the neighbourhoods of Hollywood, Beverly Hills, and Pacific Palisades from the San Fernando Valley, it is near the San Andreas Fault, and earthquakes are frequent. It began in 1771 as a Spanish mission; in 1781 settlers claimed the land as El Pueblo de la Reyna de los Angeles (the Town of the Queen of the Angels). Taken by U.S. forces in the Mexican War, it prospered in the wake of the 1849 gold rush. Incorporated in 1850, the city grew rapidly after the arrival of the railroads in 1876 and 1885. In 1913 an aqueduct was built to supply it with water from the slopes of the Sierra Nevada. It was struck by a major earthquake in 1994. Sites of interest include early Spanish missions, the Getty Museum, the Los Angeles County Museum of Art, and the Museum of Contemporary Art. Educational institutions include the University of Southern California, Occidental College, and the University of California at Los Angeles.

Los Angeles Times Morning daily newspaper. Established in 1881, it was purchased and incorporated in 1884 by Harrison Gray Otis (1837–1917) under The Times-Mirror Co. (the hyphen was later dropped from the name). The newspaper prospered and became a power in conservative politics in California. It was long dominated by the Chandler family, beginning with Otis's son-in-law, Harry Chandler, in 1917. After Otis Chandler became publisher in 1960, its editorial policies changed; it developed from a conservative regional paper into a model of balanced and comprehensive journalism and was recognized as one of the world's great newspapers. The Times Mirror Company was acquired in June 2000 by the Tribune Company of Chicago, and the Chandler family received a significant ownership position in the Tribune Company. (See Chicago Tribune.)

Los Glaciares \ˌlȯs-glä-'syär-rās\ **National Park** National park, southwestern Argentina. Located in the Andes Mountains at the Chilean border, it was established in 1937 and has an area of 625 sq mi (1,618 sq km). It has two distinct regions: forests and grassy plains in the east and peaks, lakes, and glaciers in the west. Its highest point is Mount Fitzroy (11,073 ft [3,375 m]).

Lost Generation Group of U.S. writers who came of age during World War I and established their reputations in the 1920s; more broadly, the entire post–World War I American generation. The term was coined by Gertrude Stein in a remark to Ernest Hemingway. The writers considered themselves "lost" because their inherited values could not operate in the postwar world and they felt spiritually alienated from a country they considered hopelessly provincial and emotionally barren. The term embraces Hemingway, F. Scott Fitzgerald, John Dos Passos, E.E. Cummings, Archibald MacLeish, and Hart Crane, among others.

lost-wax casting Traditional method of producing molds for metal sculpture and other castings. It requires a positive, a core made of refractory material and an outer layer of wax. The positive can be produced either by direct modeling in wax over a prepared core (direct lost-wax casting), or by casting in a piece mold or flexible mold taken from a master cast. The wax positive is invested with a mold made of refractory materials and heated to melt the wax, leaving a narrow cavity between the core and the investment. Molten metal is poured into this cavity. When the metal has solidified, the investment and core are broken away. See also investment casting.

Lot Nephew of Abraham. He emigrated with Abraham from Ur to Canaan and settled in Sodom, a city so evil that God decided to destroy it. Warned by angels of the coming disaster, Lot fled the city with his family. His wife disobeyed God's orders by looking back at the burning city and was turned into a pillar of salt. Lot later had children by his own daughters, and they became the founders of the Moabite and Ammonite nations, enemies of Israel. See also Sodom and Gomorrah.

Lot River River, southern France. It flows 300 mi (480 km) west to join the Garonne River near Aiguillon. The river's course passes Cahors, the old capital of Quercy. It is navigable for part of its course but has little boat traffic.

Lothar \'lō-tär\ **I** *German* **Lothar** (b. 795—d. Sept. 29, 855, Abbey of Prüm, Ger.) Frankish emperor. The eldest son of Louis I (the Pious), he was crowned king in Bavaria (814) and coemperor with Louis (817). Lothar participated in the rebellion against Louis in 830 over the emperor's efforts to alter the succession plan, and he was returned to Italy after the revolt's failure. He led a second revolt against his father and deposed him (833), but Louis was restored to power the next year, and Lothar's rule was restricted to Italy. On his father's death (840) he attempted to gain sole control over the Frankish territories, but his brothers, Louis the German and Charles II (the Bald), defeated him (841). The Treaty of Verdun gave Lothar the middle realm, or heartland, of the Frankish dominions (from the North Sea to Italy) and the imperial title.

Lothair I, miniature from his psalter, 9th century; in the British Library (MS. Add. 37768)

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Lothar II *German* **Lothar** (b. early June 1075—d. Dec. 3/4, 1137, Breitenwang) German king (1125–37) and Holy Roman emperor (1133–37). The most powerful noble in Saxony, he took part in revolts (1112–15) against the German king Henry V. Elected king on Henry's death, he fought a war against the Hohenstaufen who claimed the throne (1125–29); his victory was a triumph for elective monarchy over hereditary succession. Lothar was crowned emperor as a reward for supporting Pope Innocent II (1133). He made peace with the Hohenstaufen (1135) but attacked Roger II of Sicily, driving him out of southern Italy (1136–37).

Lotharingia See Lorraine

Loti \lō-'tē**, Pierre** *orig.* **Louis-Marie-Julien Viaud** (b. Jan. 14, 1850, Rochefort, France—d. June 10, 1923, Hendaye) French novelist. As a naval officer, Loti visited the Middle East and East Asia, which later provided the exotic settings of his novels and reminiscences. His first novel, *Aziyadé* (1879), won him critical and popular success. Other novels include *An Iceland Fisherman* (1886), *Japan: Madam Chrysanthemum* (1887), and *Disenchanted* (1906). Among his recurring motifs are love, death, and despair at the passing of sensuous life. He reveals his compassion in such works as *The Book of Pity and of Death* (1890). His themes anticipated some of the preoccupations of French literature between the world wars.

lottery Drawing of lots in which prizes are distributed to the winners among persons buying a chance. A form of gambling, lottery in its modern form may be traced to 15th-century Europe. The Continental Congress in 1776 voted to establish a lottery to raise funds for the American Revolution. By the mid-19th century, in the wake of abuses by private organizers, U.S. states began passing antilottery laws. An 1878 Supreme Court opinion held that lotteries had "a demoralizing influence upon the people," and by the 1890s most had been eliminated. A revival began in the mid-1960s; many state governments seeking revenues instituted officially sanctioned, independently audited lotteries. In most such operations, the bettor buys a numbered receipt or writes down his or her number choices, a drawing is held, and the winners identify themselves. The value of the prizes is the amount remaining after expenses and the state's share are deducted from the pool. Winnings are usually subject to taxes. The top prize can grow into the tens of millions, usually causing a buying frenzy as it increases, but the odds against winning remain astronomical.

Lotto, Lorenzo (b. c. 1480, Venice—d. 1556, Loreto, Papal States) Italian painter. He worked in several cities other than Venice and devel-

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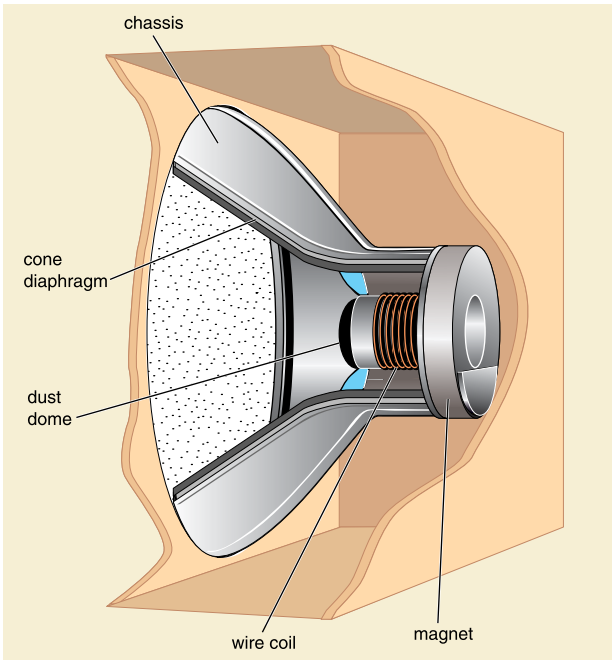
oped an idiosyncratic style. His late Renaissance-style work exhibits a preference for opulent colours and a faculty for narrative painting. His nervous temperament is evident in such works as the *Crucifixion* in Monte San Giusto (c. 1530), with its highly charged mysticism and crowded composition. Toward the end of his life (1554), he became a lay brother at the Santa Casa in Loreto to escape his critics and his debts. Though primarily a religious painter, he is best known today for his psychologically acute portraits.

lotus Any of several different plants whose flowers have been given symbolic meaning by many cultures. The lotus of the Greeks is *Ziziphus lotus* (family Rhamnaceae), a shrub native to southern Europe; wine made from its fruit was thought to produce contentment and forgetfulness. The Egyptian lotus is a white WATER LILY (*Nymphaea lotus*). The sacred lotus of the Hindus is an aquatic plant (*Nelumbo nucifera*) with white or delicate pink flowers; the lotus of eastern North America is *Nelumbo pentapetala*, a similar plant with yellow blossoms. *Lotus* is also a genus of the pea family (see LEGUME), containing about 100 species found in temperate regions of Europe, Asia, Africa, and North America; the 20 or more species in North America are grazed by animals. The lotus is a common ornament in architecture, and since ancient times it has symbolized fertility, purity, sexuality, birth, and rebirth of the dead.

Lotus Sutra Text central to the Japanese Tendai (Chinese TIANTAI) and NICHIREN sects of MAHAYANA Buddhism. It represents the BUDDHA as divine and eternal, having attained perfect enlightenment eons ago. All beings are invited to become fully enlightened Buddhas through the grace of innumerable BODHISATTVAS. Composed largely in verse, the sutra contains many charms and MANTRAS. First translated into Chinese in the 3rd century AD, it was extremely popular in China and Japan, where the simple act of chanting it was thought to bring salvation.

Lou Gehrig disease See AMYOTROPHIC LATERAL SCLEROSIS

loudspeaker *or* **speaker** In SOUND reproduction, device for converting electrical energy into acoustical (sound) signal energy that is radiated into a room or open air (see ACOUSTICS). The part of the speaker that converts electrical into mechanical energy is frequently called the motor, or voice coil. The motor vibrates a diaphragm that vibrates the air in immediate contact with it, producing a sound wave corresponding to the pattern of the original speech, music, or other acoustic signal. See illustration opposite.



Components of a loudspeaker. Electrical signals sent through the coil cause it to act as an electromagnet, which is alternately repelled by or attracted to the permanent magnet. This movement causes the cone diaphragm to vibrate, creating sound waves.

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Louganis \lü-'gā-nəs**, Greg(ory Efthimios)** (b. Jan. 29, 1960, San Diego, Calif., U.S.) U.S. diver, considered the greatest diver in history. He was trained early in dancing, tumbling, and acrobatics. During his diving career, he won an unprecedented 47 national and 13 world championships, including two Olympic gold medals (1984) and one silver (1976). In 1982 he became the first diver ever to earn a perfect score of 10, and the following year he received 99 points in springboard competition. He was known for his graceful, effortless style. In 1995 he revealed that he had AIDS.

Lough Erne See Lough ERNE

Lough Neagh See Lough NEAGH

Louis \'lü-ē\ **I** *known as* **Louis the Pious** (b. April 16, 778, Chasseneuil, near Poitiers, Aquitaine—d. June 20, 840, Petersau, an island in the Rhine River near Ingelheim) Frankish emperor (814–40). The son of CHARLEMAGNE, he was crowned coemperor with his father in 813 and became emperor in 814 on his father's death. As emperor, Louis implemented important religious and cultural reforms and formalized Carolingian relations with the pope. He also introduced a plan of succession that sought to preserve the integrity of the empire while respecting the Germanic tradition of dividing the realm among all heirs. The birth of the future CHARLES II (Charles the Bald) to his second wife, Judith, and alteration of the plan of succession provided Louis's older sons and a number of bishops with an excuse for rebellion. Twice deposed by his sons, he recovered the throne each time (830, 834), but at his death his surviving sons indulged in a bloody civil war that left the Carolingian empire in disarray.

Louis I *or* **Ludwig** \'lüt-vi̱k\ **I** (b. Aug. 25, 1786, Strasbourg, France—d. Feb. 29, 1868, Nice) King of Bavaria (1825–48). The son of MAXIMILIAN I, Louis won early acclaim as a liberal and a German nationalist, but after his accession he feuded with the Diet and came to distrust all democratic institutions. By 1837 the reactionary Bavarian government had begun to erode the liberal constitution of 1818 that Louis had worked to establish. An outstanding patron of the arts, he collected the art works that fill Munich's museums and transformed Munich into the artistic centre of Germany. His planning created the city's present layout and classic style. He caused scandal by his affair with LOLA MONTEZ, and at the outbreak of the REVOLUTIONS OF 1848 he abdicated in favour of his son MAXIMILIAN II.

Louis II *or* **Ludwig II** *also known as* **Mad King Ludwig** (b. Aug. 25, 1845, Nymphenburg Palace, Munich—d. June 13, 1886, Starnberger See, Bavaria) King of Bavaria (1864–86). The son of MAXIMILIAN II of Bavaria, he supported Prussia in the FRANCO-PRUSSIAN WAR (1870–71). He brought his territories into the newly founded German Empire in 1871 but concerned himself only intermittently with affairs of state, preferring a life of increasingly morbid seclusion. A lifelong patron of the composer RICHARD WAGNER, he developed a mania for extravagant building projects; the most fantastic, NEUSCHWANSTEIN, was a fairy-tale castle decorated with scenes from Wagner's operas. He drowned himself three days after he was formally declared insane.

Louis IV *or* **Ludwig IV** *known as* **Louis the Bavarian** (b. 1283, Munich, Ger.—d. Oct. 11, 1347, Munich) German king (1314–47) and uncrowned Holy Roman emperor (1328–47). As the Luxembourg candidate for emperor, he was opposed by the Habsburg candidate Frederick III of Austria. Both men were elected and crowned king in 1314, and Louis's forces defeated Frederick's army in 1322. A conflict with Pope JOHN XXII over the appointment of the imperial vicar in Italy led to his excommunication (1324). To placate his opponents, Louis agreed to rule jointly with Frederick, an arrangement that continued until Frederick's death (1330). He accepted the imperial crown from the Roman people instead of from the pope (1328) and backed the appointment of an ANTIPOPE. In 1346 Pope CLEMENT VI secured the election of a rival king, Charles of Moravia, and Louis died of a heart attack before finishing his preparations for war.

Louis VI *known as* **Louis the Fat** (b. 1081—d. Aug. 1, 1137) King of France (1108–37). He was effective ruler of France well before the death of his father, Philip I, in 1108, and he spent much time in subduing the unruly French barons. He fought HENRY I of England (1104–13, 1116–20) and prevented a threatened invasion by Emperor Henry V (1124). He died

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a month after arranging his son's marriage to Eleanor of Aquitaine, whereupon his son succeeded him as Louis VII.

Louis VII *known as* **Louis the Younger** (b. c. 1120—d. Sept. 18, 1180, Paris) King of France (1137–80). One of the Capetian kings, he married Eleanor of Aquitaine in 1137, thus temporarily extending his kingdom to the Pyrenees. Doubtful of her fidelity, he had the marriage annulled in 1152 and, after the death of his second wife, married Alix of Champagne, who bore him his son and heir, Philip II Augustus. Eleanor married the future Henry II of England, who took control of Aquitaine and carried on a long rivalry with Louis (1152–74) marked by recurrent warfare and constant intrigue. Louis was joined by Conrad III in leading the Second Crusade (1147–49), which failed in all its objectives.

Louis IX *or* **St. Louis** (b. April 25, 1214, Poissy, France—d. Aug. 25, 1279, near Tunis, Tun.; canonized Aug. 11, 1297; feast day August 25) King of France (1226–70). He inherited the throne at age 12. His mother served as regent until 1234, helping to subdue rebellious barons and Albigensian heretics (see Cathari). Louis led a Crusade (1248–50) in hopes of regaining Jerusalem and Damascus, but his troops were badly defeated by the Egyptians. On his return he reorganized the royal administrative system and standardized coinage. He built the extraordinary Sainte-Chapelle to house a religious relic believed to be Jesus' crown of thorns. Louis made peace with the English in the Treaty of Paris (1259), allowing Henry III to keep Aquitaine and neighboring lands but obliging him to declare himself Louis's vassal. He died of plague during a Crusade. The most popular of the Capetian kings, his reputation for justness and piety led the French to venerate him as a saint even before his canonization in 1297.

Louis XI (b. July 3, 1423, Bourges, France—d. Aug. 30, 1483, Plessis-les-Tours) King of France (1461–83). He plotted against his father, Charles VII, and was exiled to Dauphiné (1445), which he ruled as a sovereign state until Charles approached its borders with an army (1456). Louis then fled to the Netherlands, returning to France to become king on his father's death in 1461. He fought rebellious French princes (1465) and made concessions to Charles the Bold (1468). Seeking to strengthen and unify France, he destroyed the power of the Burgundians in 1477. He regained control of Boulonnais, Picardy, and Burgundy, took possession of Franche-Comté and Artois (1482), annexed Anjou (1471), and inherited Maine and Provence (1481).

Louis XII (b. June 27, 1462, Blois, France—d. Jan. 1, 1515, Paris) King of France (1498–1515). He became king on the death of his cousin Charles VIII. He annulled his marriage to marry Charles's widow, Anne of Brittany, and to reinforce the union of her duchy with France. He continued France's part in the Italian Wars, often with disastrous results. He conquered Milan in 1499, then lost it, but was later recognized as duke of Milan by Emperor Maximilian I. He concluded a treaty with Ferdinand V that partitioned Naples (1500), but the two kings went to war and Louis lost all of Naples (1504). In 1508 he consolidated the League of Cambrai, but when the league fell apart in 1510 its members joined England in a Holy League against France, invading it several times. Despite his failures, Louis was highly popular with the French, who called him the "Father of the People."

Louis XIII (b. Sept. 27, 1601, Fontainebleau, France—d. May 14, 1643, Saint-Germain-en-Laye) King of France (1610–43). He was the son of Henry IV and Marie de Médicis. His mother was regent until 1614 but continued to govern until 1617; she arranged Louis's marriage to the Spanish Anne of Austria in 1615. Resentful of his mother's power, Louis exiled her, but Cardinal de Richelieu, her principal adviser, reconciled them in 1620. In 1624 Louis made Richelieu his principal minister, and the two cooperated closely to make France a leading European power, consolidating royal authority in France and fighting to break the dominant rule of the Spanish and Austrian Habsburgs in the Thirty Years' War. Pro-Spanish Catholic zealots led by Marie de Médicis appealed to Louis to reject Richelieu's policy of supporting the Protestant states, but Louis stood by his minister and his mother withdrew into exile. France declared war on Spain in 1635 and had won substantial victories by the time Richelieu died in 1642. Louis was succeeded by his son Louis XIV.

Louis XIII style Style of the visual arts produced in France during the reign of Louis XIII, including the regency of his mother, Marie de Médicis, who introduced much of the art of her native Italy. The Mannerism of Italy and Flanders was so influential that a true French style did not develop until the mid-17th century, when the influence of Caravaggio was assimilated by Georges de La Tour and the Le Nain brothers, and the influence of the Carracci brothers was extended by Simon Vouet, who trained the academic painters of the next generation. The sculpture of the period was undistinguished. The most prolific area of the arts was architecture. Here, too, the Italian influence is seen, as in the Palais de Justice at Rennes and the Luxembourg Palace in Paris, both designed by Salomon de Brosse, and the chapel of the Sorbonne in Paris, designed by Jacques Lemercier. The furniture of the period is typically massive and solidly built and commonly decorated with cherubs, ornate scrollwork, fruit-and-flower swags, and grotesque masks.

Louis XIV *known as* **the Sun King** (b. Sept. 5, 1638, Saint-Germain-en-Laye, France—d. Sept. 1, 1715, Versailles) King of France (1643–1715), ruler during one of France's most brilliant periods and the symbol of absolute monarchy of the Neoclassical age. He succeeded his father, Louis XIII, at age four, under the regency of his mother, Anne of Austria. In 1648 the nobles and the Paris Parlement, who hated the prime minister, Cardinal Mazarin, rose against the crown and started the Fronde. In 1653, victorious over the rebels, Mazarin gained absolute power, though the king was of age. In 1660 Louis married Marie-Thérèse of Austria (1638–83), daughter of Philip IV of Spain. When Mazarin died in 1661, Louis astonished his ministers by informing them that he intended to assume responsibility for ruling the kingdom. A believer in dictatorship by divine right, he viewed himself as God's representative on earth. He was assisted by his able ministers, Jean-Baptiste Colbert and the marquis de Louvois. Louis weakened the nobles' power by making them dependent on the crown. A patron of the arts, he protected writers and devoted himself to building splendid palaces, including the extravagant Versailles, where he kept most of the nobility under his watchful eye. In 1667 he invaded the Spanish Netherlands in the War of Devolution (1667–68) and again in 1672 in the Third Dutch War. The Sun King was at his zenith; he had extended France's northern and eastern borders and was adored at his court. In 1680 a scandal involving his mistress, the marchioness de Montespan (1641–1707), made him fearful for his reputation, and he openly renounced pleasure. The queen died in 1683, and he secretly married the pious marchioness de Maintenon. After trying to convert French Protestants by force, he revoked the Edict of Nantes in 1685. Fear of his expansionism led to alliances against France during the War of the Grand Alliance (1688–97) and the War of the Spanish Succession (1701–14). Louis died at age 77 at the end of the longest reign in European history.

Louis XIV style Style of the visual arts produced in France during the reign of Louis XIV. In 1648 Charles Le Brun founded the Royal Academy of Painting and Sculpture, which rigidly dictated styles for the rest of the reign. The most influential painter was Nicolas Poussin, who forged the way for French Classicism (see Classicism and Neoclassicism). Sculpture reached a new zenith with the works of François Girardon and Pierre Puget. A national style in the decorative arts evolved through the Gobelin factory (see Gobelin family). Furniture was veneered, inlaid, heavily gilded, and commonly decorated with shells, satyrs, garlands, mythological heroes, and dolphins; the style is particularly associated with André-Charles Boulle. In architecture, Jean-Baptiste Colbert rigidly controlled the renovation of the Palace of Versailles, with landscaping by André Le Nôtre.

Louis XV (b. Feb. 15, 1710, Versailles, France—d. May 10, 1774, Versailles) King of France (1715–74). An orphan from age three, Louis succeeded to the throne on the death of his great-grandfather Louis XIV (1715), under the regency of Philippe II, duke d'Orléans (1674–1723). His marriage to Princess Marie Leszczynska of Poland (1703–68) in 1725 led to France's involvement in the War of the Polish Succession (1733–38). He chose André-Hercule de Fleury as his chief minister in 1726, and his own influence became perceptible only after Fleury's death in 1744. Louis's mistresses, particularly the marchioness de Pompadour, held considerable political influence. Louis brought France into the War of the Austrian Succession (1740–48) and the Seven Years' War (1756–63), by which France lost to Britain almost all its colonial possessions. As the crown's moral and political authority declined, the Parlements gained in power, preventing fiscal reform. The king died hated by his subjects.

Louis XV style Rococo style of French decorative arts during the reign of Louis XV, when artists produced exquisite decor for the homes of royalty and nobility. Emphasis was laid on the ensemble, so that paintings and sculptures became part of the decorative arts. The full range of richness in decorative techniques was represented—superb carving, ornamentation of all types of metal, inlay work in exotic woods, metal, mother-of-pearl, and ivory, and exquisite lacquered chinoiserie that rivaled products from East Asia. Fantasy joined nature and Asian themes in pro-

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viding decorative motifs. Notable artists and designers include Jean-Honoré Fragonard, François Boucher, and Jean-Baptiste Oudry.

Louis XVI (b. Aug. 23, 1754, Versailles, France—d. Jan. 21, 1793, Paris) Last king of France (1774–92) in the Bourbon line preceding the French Revolution. In 1770 he married Marie-Antoinette, and in 1774 he succeeded to the throne on the death of his grandfather, Louis XV. Immature and lacking in strength of character, he was unable to give the necessary support to his ministers, including Anne-Robert-Jacques Turgot and Jacques Necker, in their efforts to stabilize France's tottering finances. Restoration of the Parlements in 1774 shifted power to the aristocracy. Aristocratic opposition to the economic reforms of Charles-Alexandre de Calonne forced the king to summon the Estates-General in 1788, setting the Revolution in motion. Dominated by the reactionary court faction, he defended the privileges of the clergy and nobility. He dismissed Necker in 1789 and refused to sanction the achievements of the National Assembly. His resistance to popular demands was one cause for the royal family's forcible transfer from Versailles to the Tuileries palace in Paris. He lost credibility further when he attempted to escape the capital in 1791 and was caught at Varennes and returned to Paris. Thereafter he was dominated by the queen, who encouraged him to a policy of subterfuge instead of implementing the Constitution of 1791, which he had sworn to maintain. In 1792 the Tuileries was captured by the people and militia, and the First French Republic was proclaimed. When proof of his counterrevolutionary intrigues with foreigners was found, he was tried for treason. Condemned to death, he went to the guillotine in 1793. His dignity during his trial and execution only somewhat redeemed his reputation.

Louis XVI style Style of the visual arts produced in France from c. 1760 to the French Revolution. The predominant style in painting, architecture, sculpture, and the decorative arts was Neoclassicism—a reaction against the excesses of the Rococo style and a response to Jean-Jacques Rousseau's call for "natural" virtue, as well as a response to the excavations at Pompeii and Herculaneum. The most prominent painter was Jacques-Louis David, whose severe compositions recalled the style of Nicolas Poussin. The foremost sculptor of the day was Jean-Antoine Houdon. The style in furniture was classical, yet workmanship was more complex than in any earlier period. Jean-Henri Riesener and other German craftsmen were among the most prominent cabinetmakers. See also Classicism and Neoclassicism.

Louis XVII *orig.* **Louis-Charles** (b. March 27, 1785, Versailles, France—d. June 8, 1795, Paris) Titular king of France from 1793. The second son of Louis XVI and Marie-Antoinette, he became heir to the throne on his brother's death, shortly after the outbreak of the French Revolution. In 1792 he was imprisoned with the rest of the royal family. When his father was beheaded in 1793, the French émigré nobility proclaimed Louis-Charles king. He died in prison at age 10, but the secrecy surrounding his last months gave rise to rumours that he was not dead, and over the next few decades more than 30 persons claimed to be Louis XVII. DNA tests in 2000 established that the child who died in 1795 was in fact the son of Louis XIV and Marie-Antoinette.

Louis XVIII *orig.* **Louis-Stanislas-Xavier, count de Provence** (b. Nov. 17, 1755, Versailles, France—d. Sept. 16, 1824, Paris) King of France by title from 1795 and in fact from 1814 to 1824. He fled the country in 1791, during the French Revolution, and issued counterrevolutionary manifestos and organized émigré-nobility associations. He became regent for his nephew Louis XVII after the 1793 execution of Louis XVI, and at the dauphin's death in 1795 he proclaimed himself king. When the allied armies entered Paris in 1814, Charles-Maurice de Talleyrand negotiated the Bourbon Restoration and Louis was received with jubilation. He promised a constitutional monarchy, and the Charter of 1814 was adopted; after the interruption of the Hundred Days, when Napoleon returned from Elba, he resumed his constitutional monarchy. The legislature included a strong right-wing majority, and though Louis opposed the extremism of the ultras, they exercised increasing control and thwarted his attempts to heal the wounds left by the Revolution. He was succeeded at his death by his brother, Charles X.

Louis, Joe *in full* **Joseph Louis Barrow** (b. May 13, 1914, Lafayette, Ala., U.S.—d. April 12, 1981, Las Vegas, Nev.) U.S. boxer. Louis was born into a sharecropper's family and only began boxing after the family moved to Detroit. He won the U.S. Amateur Athletic Union title in 1934 and turned professional that year. During his career he defeated six previous or subsequent heavyweight champions: Primo Carnera, Max Baer, Jack Sharkey, James J. Braddock, Max Schmeling, and Jersey Joe Walcott. Nicknamed "the Brown Bomber," Louis gained the world heavyweight championship by defeating Braddock in 1937 and held the title until 1949. Two of Louis's most famous bouts, those with the German boxer Max Schmeling, were invested with nationalist and racial implications, as Schmeling was seen, unfairly, as the embodiment of Aryanism and the Nazi party. Louis lost to Schmeling in 1936 but defeated him in one round in 1938, causing much jubilation among Americans, and especially African Americans. He successfully defended his title 25 times (21 by knockout) before retiring in 1949. His service in the U.S. Army during World War II no doubt prevented him from defending his title many more times. He made unsuccessful comeback attempts against Ezzard Charles in 1950 and Rocky Marciano in 1951.

Louis, Morris *orig.* **Morris Louis Bernstein** (b. Nov. 24, 1912, Baltimore, Md., U.S.—d. Sept. 7, 1962, Washington, D.C.) U.S. painter. He studied painting at the Maryland Institute and worked as an easel painter for the WPA Federal Art Project. Inspired by Helen Frankenthaler's colour stain technique, in 1954 he began a series of paintings titled *Veils*, featuring stained vertical waves of colour; these works had an impersonal, nonpainterly quality. During this period he became associated with the New York school of Abstract Expressionism. His later work featured diagonal parallel streams of colour that flowed across the bottom corners of the picture plane. In his last series, *Stripes*, bunched, straight vertical bands of colour are surrounded by empty canvas.

Louis, St. See Louis IX

Louis-Napoléon See Napoleon III

Louis-Philippe *known as* **the Citizen King** (b. Oct. 6, 1773, Paris, France—d. Aug. 26, 1850, Claremont, Surrey, Eng.) King of the French (1830–48). Eldest son of the duke d'Orléans, he supported the new government at the outbreak of the French Revolution and joined the Revolutionary army in 1792 but deserted during the war with Austria (1793) and lived in exile in Switzerland, the U.S., and England. He returned to France on the restoration of Louis XVIII and joined the liberal opposition. Following the July Revolution (1830) and Charles X's abdication, he was proclaimed the "Citizen King" by Adolphe Thiers and elected by the legislature. During the subsequent July Monarchy, he consolidated his power by steering a middle course between the right-wing monarchists and the socialists and other republicans but resorted to repressive measures because of numerous rebellions and attempts on his life. He strengthened France's position in Europe and cooperated with the British in forcing the Dutch to recognize Belgian independence. Mounting middle-class opposition to his arbitrary rule and his inability to win allegiance from the new industrial classes caused his abdication during the February Revolution of 1848.

Louis the Bavarian See Louis IV

Louis the Fat See Louis VI

Louis the Pious See Louis I

Louis the Younger See Louis VII

Louisiade \lü-ˌē-zē-ˈäd\ **Archipelago** Island group, Papua New Guinea, southeast of New Guinea. Stretching for more than 100 mi (160 km), it occupies 10,000 sq mi (26,000 sq km) of the South Pacific Ocean. It has nearly 100 islands; the largest are Misima, Tagula, and Rossel. It was visited by the Spanish in 1606 and was named after Louis XV of France in 1768. Occupied by Japanese forces in 1942, the islands are near the site of the Battle of the Coral Sea.

Louisiana State (pop., 2000: 4,468,976), southern U.S. Lying on the Gulf of Mexico, it is bordered by Arkansas, Mississippi, and Texas. It covers 47,716 sq mi (123,584 sq km); its capital is Baton Rouge. It can be divided physically into the Mississippi River flood plain and delta and the low hills of the Gulf of Mexico coastal plain. It is the only U.S. state to be governed under the Napoleonic Code. Indian occupancy in the area probably spanned 16,000 years; at the time of European settlement the region was inhabited by the Caddo and Choctaw. French explorer La Salle descended the Mississippi River in 1682 and claimed the entire river basin for France. The city of New Orleans was founded in 1718, and Louisiana became a French crown colony in 1731. Colonization increased in the 1760s with the arrival of French-speaking Acadians (Cajuns) from Nova Scotia. Spain controlled the territory from 1762 to 1800; then it passed back to the French. The lands

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that constitute modern Louisiana were acquired by the U.S. as part of the Louisiana Purchase in 1803 and became the Territory of Orleans in 1804. Louisiana became the 18th U.S. state in 1812. It seceded from the Union in 1861 at the start of the American Civil War and was readmitted in 1868. The plantation economy continued with the farmer class denied land ownership, which contributed to the rise of the populist Huey Long in the 1920s. After World War II Louisiana experienced more rapid development with the rise of offshore oil and gas drilling. Soybeans are a major agricultural crop; tree farming and shrimp fishing are also important. Petroleum and natural gas are the chief mineral resources. In 2005 hurricanes devastated New Orleans and surrounding communities.

Louisiana Purchase Territory purchased by the U.S. from France in 1803 for $15 million. It extended from the Mississippi River to the Rocky Mountains and from the Gulf of Mexico to British America (Canada). In 1762 France had ceded Louisiana west of the Mississippi River to Spain, but Spain returned it to French control in 1800. Alarmed by this potential increase in French power, Pres. Thomas Jefferson threatened to form an alliance with Britain. Napoleon then sold the U.S. the entire Louisiana Territory, although its boundaries remained unclear; its northwestern and southwestern limits were not established until 1818–19. The purchase doubled the area of the U.S.

Louisville \'lü-i-ˌvil\ City (pop., 2000: 256,231), north-central Kentucky, U.S., located on the Ohio River. Settled in 1778 on Corn Island, it expanded the next year when the settlers moved ashore. Named for Louis XVI of France, it became an important river trading centre and was chartered as a city in 1828. During the American Civil War it served as a Union military headquarters and supply depot. The largest city in Kentucky, it is a leading producer of bonded bourbon whiskey and cigarettes. It is home to the University of Louisville (founded 1798) and Churchill Downs, the site of the Kentucky Derby.

Loup \'lüp\ River River, east-central Nebraska, U.S. It flows east to join the Platte River. It is 300 mi (485 km) long and is harnessed to produce hydroelectric power. Its name is derived from the French name (meaning "wolf") for the Skidi Indians.

Lourdes Pilgrimage site in southwestern France, situated southwest of Toulouse at the foot of the Pyrenees. The town and its fortress formed a strategic stronghold in medieval times, but its modern significance dates from 1858, when a 14-year-old girl had repeated visions of the Virgin Mary (see Bernadette of Lourdes). The visions were declared authentic by Pope Pius IX in 1862. The underground spring in the grotto where Bernadette had her visions was declared to have miraculous qualities, and Lourdes has since become one of the foremost destinations for Roman Catholic pilgrims. Nearly 3 million visit annually, many of them sick or disabled people hoping to be healed. A basilica was built above the grotto in 1876, and a vast underground church was added in 1958.

Lourenço Marques See Maputo

louse Any of some 3,300 species of small, wingless, parasitic insects of the order Phthiraptera. The order consists mainly of biting, or chewing, lice (parasites of birds and mammals) and sucking lice (see sucking louse). The louse's body is flattened. The eggs, or nits, are cemented to the hair or plumage of the host, and most species spend their entire lives on the bodies of host animals. Heavy infestations cause much irritation and may lead to secondary infections. In moving from host to host, lice may spread many diseases, including tapeworm infestation in dogs and murine typhus in rats.

Male human louse (*Pediculus humanus;* magnified about 15 ½ ×)
WILLIAM E. FERGUSON

louse, human Any of three types of sucking louse that infest humans. The body louse (mainly *Pediculus humanus humanus*, also called human louse or cootie) and head louse (*P. h. capitis*) are spread by person-to-person contact and through shared clothing, bedding, combs, and other personal items. Body lice carry the organisms that cause relapsing fever, trench fever, and typhus. Head lice may cause impetigo. Both are readily spread under conditions of overcrowding, especially among children. The crab louse, or pubic louse (*Phthirus pubis*) infests primarily the pubic region and occasionally other hairy regions. Its first pair of legs is smaller than the other two pairs, making it look like a crab. Crab lice are transmitted primarily through sexual intercourse. Lice infestations can be quickly cured with shampoos, soaps, and lotions containing benzene hexachloride, along with the thorough washing of bedding and clothing.

lousewort Any of about 500 species of herbaceous plants that make up the genus *Pedicularis* in the snapdragon family. The lousewort is found throughout the Northern Hemisphere but especially on the mountains of central and eastern Asia. The bilaterally symmetrical flowers sometimes have very unusual shapes. The flowers of the little elephant (*P. groenlandica*), for example, resemble the head, trunk, and ears of an elephant. Louseworts are semiparasitic on the roots of other plants.

Lousewort (*Pedicularis lanceolata*)
KITTY KOHOUT FROM ROOT RESOURCES—EB INC.

Louvain \lü-'vaⁿ**, Catholic University of** Either of two Belgian universities established in 1970, both descended from a renowned university founded in 1425 in Louvain. The original university included on its faculty in the early 1500s Desiderius Erasmus, Justus Lipsius, and Gerardus Mercator. The modern university was reorganized into separate units following student riots and government upheavals in 1969. At the Katholieke Universiteit te Leuven, the language of instruction is Dutch. At the Université Catholique de Louvain, located in Louvain-la-Neuve, instruction is in French.

louver \'lü-vər\ Arrangement of parallel, horizontal blades or slats of glass, wood, or other material designed to regulate airflow or light penetration. Louvers are often used in windows or doors to allow air or light in while keeping the elements out. They may be either movable or fixed. The term also refers to metal blades covering the intake and exhaust outlets of ventilation and air-conditioning units.

Louvois \lüv-'wä**, François-Michel Le Tellier** \lə-tāl-'yā**, marquis de** (baptized Jan. 18, 1639, Paris, France—d. July 16, 1691, Versailles) French secretary of state for war under Louis XIV and his most influential minister (1677–91). The son of Michel Le Tellier (1603–85), one of the most powerful officials in France, he was groomed by his father to replace him as war secretary. A brilliant administrator, Louvois brought his father's military reforms to fruition, making the French army one of the most formidable in Europe. He was complicit in the military policy that led up to the revocation of the Edict of Nantes (1685), and was also responsible for the destruction of the Palatinate (1688), which led to the War of the Grand Alliance.

Louvre \'lüvrᵊ\ **Museum** National museum and art gallery of France, in Paris. It was built as a royal residence, begun under Francis I in 1546 on the site of a 12th-century fortress. It ceased to be used as a palace when the court moved to Versailles in 1682, and plans were made in the 18th century to turn it into a public museum. In 1793 the revolutionary government opened the Grand Gallery; Napoleon built the northern wing; and two major western wings were completed and opened by Napoleon III. The completed Louvre included a vast complex of buildings forming two main quadrilaterals and enclosing two large courtyards. A controversial steel-and-glass pyramid entrance designed by I.M. Pei opened in 1989. The painting collection is one of the richest in the world, representing all periods of European art up to Impressionism; its collection of French 15th–19th-century paintings is unsurpassed.

lovage \'lə-vij\ Herb (*Levisticum officinale*) of the parsley family, native to southern Europe. It is cultivated for its stalks and foliage, which are used for tea, as a vegetable, and to flavour foods. Its rhizomes are used as a carminative, and the seeds are used for flavouring desserts. Oil obtained from the flowers is used in perfumery.

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Love Canal Neighbourhood in Niagara Falls, N.Y., the site of the worst environmental disaster involving chemical wastes in U.S. history. Originally the site of an abandoned canal, it became a dumping ground for nearly 22,000 tons of chemical waste in the 1940s and '50s. The canal was later filled in, and housing was built on it. The leakage of toxic chemicals into these homes was detected in 1978, and residents were discovered to have a high incidence of chromosome damage. After their evacuation, 1,300 former residents obtained a $20 million settlement from the dumping company and the city. In the early 1990s New York state ended its cleanup and declared parts of the area safe for residence.

lovebird Any of nine species of small parrots (genus *Agapornis,* subfamily Psittacinae) of Africa and Madagascar. Popular as pets for their pretty colours and the seemingly affectionate closeness of pairs, lovebirds are 4–6 in. (10–16 cm) long, chunky, and short-tailed. Most have a red bill and a prominent eye ring. The two sexes look alike. Large flocks forage in woods and scrublands for seeds and may damage crops. Hardy and long-lived, they are combative toward other birds and have a loud, squawky voice. Though not easy to tame, they can be taught to perform tricks and mimic human speech to a limited extent.

Lovebirds (*Agapornis personata*).
TONI ANGERMAYER

Lovejoy, Elijah P(arish) (b. Nov. 9, 1802, Albion, Maine, U.S.—d. Nov. 7, 1837, Alton, Ill.) U.S. newspaper editor and abolitionist. He moved to St. Louis in 1827. In 1833 he became editor of the *St. Louis Observer*, a Presbyterian weekly in which he wrote articles strongly condemning slavery. Under the threat of mob violence (1836), he moved his paper from the slave state of Missouri across the river to Alton, in the free state of Illinois. There mobs repeatedly destroyed his presses, and he was shot and killed while defending his building against an attack. News of his death strengthened abolitionist sentiment.

Lovelace, Ada King, countess of *orig.* **Augusta Ada Byron, Lady Byron** (b. Dec. 10, 1815, London, Eng.—d. Nov. 29, 1852, London) English mathematician. Her father was the poet Lord Byron. In 1835 she married William King, 8th Baron King; when he was created an earl in 1838, she became countess of Lovelace. Having studied with the famous mathematician-logician Augustus De Morgan, she was introduced to Charles Babbage's Difference Engine (calculator) and studied plans for his Analytical Engine (computer) as early as 1833. In 1843 she translated and annotated an article about the Analytical Engine by Italian mathematician Luigi Federico Menabrea. In correspondence with Babbage, she also described how the Analytical Engine could be "programmed" to calculate certain numbers; this work has been called the first computer program, and in consequence she has been called the first computer programmer. Ada, a computer programming language, is named for her.

Lovell \'lə-vəl**, Sir (Alfred Charles) Bernard** (b. Aug. 31, 1913, Oldland Common, Gloucestershire, Eng.) British radio astronomer. He received his Ph.D. from the University of Bristol, worked for the Air Ministry during World War II, and lectured at the University of Manchester after the war. He built the first giant radio telescope (1957) at Jodrell Bank, near Manchester; with a bowl diameter of 250 ft (76 m), the instrument is used for astronomical research and spacecraft tracking and communication.

low blood pressure See hypotension

Low Countries Coastal region, northwestern Europe, consisting of Belgium, The Netherlands, and Luxembourg. Known as the Low Countries because much of the land along the North Sea is below or at sea level, they are often called the Benelux countries, from the initial letters of their names.

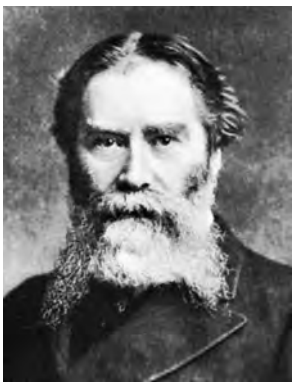
low relief See bas-relief

Lowell City (pop., 2000: 105,167), northeastern Massachusetts, U.S. Settled in 1653 as East Chelmsford, it became a major centre of cotton-textile manufacturing in the 19th century. It was renamed for industrialist Francis Lowell and was incorporated as a town in 1826. In the 20th century it began losing textile manufacturing to southern states, and it diversified into other industries. The Lowell National Historical Park (established 1978) commemorates the first textile mills in the U.S. It is the birthplace of the artist James McNeill Whistler and the seat of the University of Massachusetts Lowell.

Lowell, Amy (b. Feb. 9, 1874, Brookline, Mass., U.S.—d. May 12, 1925, Brookline) U.S. critic and poet. Born into the prominent Lowell family of Boston, she devoted herself to poetry at age 28 but published nothing until 1910. Her first volume, *A Dome of Many-Coloured Glass* (1912), was succeeded by *Sword Blades and Poppy Seed* (1914), which included her first poems in free verse and what she called "polyphonic prose." She became a leader of Imagism and was noted for her vivid and powerful personality and her scorn of conventional behaviour. Her other works include *Six French Poets* (1915), *Tendencies in Modern American Poetry* (1917), and *John Keats*, 2 vol. (1925).

Lowell, Francis Cabot (b. April 7, 1775, Newburyport, Mass., U.S.—d. Aug. 10, 1817, Boston) U.S. businessman. Born into a prominent Massachusetts family, Lowell closely studied the British textile industry while visiting Britain. With Paul Moody he devised an efficient power loom and spinning apparatus. His Boston Manufacturing Co. in Waltham (1812–14) was apparently the world's first mill in which were performed all operations converting raw cotton into finished cloth. His example greatly stimulated the growth of New England industry. Lowell, Mass., is named for him.

Lowell, James Russell (b. Feb. 22, 1819, Cambridge, Mass., U.S.—d. Aug. 12, 1891, Cambridge) U.S. poet, critic, editor, and diplomat. He received a law degree from Harvard but chose not to practice. In the 1840s he wrote extensively against slavery, including the *Biglow Papers* (1848), satirical verses in Yankee dialect. His other most important works are *The Vision of Sir Launfal* (1848), a long poem on the brotherhood of mankind; and *A Fable for Critics* (1848), a witty evaluation of contemporary authors. After his wife's death in 1853, he wrote mainly essays on literature, history, and politics. A highly influential man of letters in his day, he taught at Harvard, edited *The Atlantic Monthly* and *The North American Review*, and served as minister to Spain and ambassador to Britain.



James Russell Lowell.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Lowell, Percival (b. March 13, 1855, Boston, Mass., U.S.—d. Nov. 12, 1916, Flagstaff, Ariz.) U.S. astronomer. He was born into a distinguished Boston family. In the 1890s he built a private observatory in Flagstaff, Ariz., to study Mars. He championed the now-abandoned theory that intelligent inhabitants of a dying Mars had constructed a planetwide system of irrigation. He thought that the so-called canals of Mars (see Mars, canals of) were bands of cultivated vegetation dependent on this irrigation. Lowell's theory, long vigorously opposed, was finally put to rest by images received from the U.S. Mariner spacecraft. His prediction of a planet beyond Neptune was vindicated when Pluto was discovered in 1930.

Lowell, Robert *orig.* **Robert Traill Spence Lowell, Jr.** (b. March 1, 1917, Boston, Mass., U.S.—d. Sept. 12, 1977, New York, N.Y.) U.S. poet. Lowell was a descendant of a distinguished family that included James Russell Lowell and Amy Lowell. Though he turned away from his Puritan heritage, it forms the subject of much of his poetry. His first major work, *Lord Weary's Castle* (1946, Pulitzer Prize), contains "The Quaker Graveyard in Nantucket." *Life Studies* (1959) contains an autobiographical essay and 15 complex, confessional poems largely based on his family history and personal life, which included time in mental institutions. His activities in liberal causes in the 1960s influenced his next three volumes, including *For the Union Dead* (1964). His later collections include *The Dolphin* (1973, Pulitzer Prize).

Lower Canada See Canada East

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Lowry \'laù-rē**, (Clarence) Malcolm** (b. July 28, 1909, Birkhead, Cheshire, Eng.—d. June 27, 1957, Ripe, Sussex) British novelist, short-story writer, and poet. In his youth Lowry rebelled against his conventional upbringing and shipped to China as a cabin boy; he later lived in France, the U.S., Mexico, Canada, and Italy. His reputation rests on the novel *Under the Volcano* (1947), about the last desperate day of a dispirited alcoholic and former British consul in Mexico. Its juxtaposition of images of social decay and self-destructiveness was seen as a symbolic vision of Europe on the verge of World War II. Though critically praised, it received popular recognition only after Lowry's death at age 47, probably the result of alcoholism.

Loy, Myrna *orig.* **Myrna Williams** (b. Aug. 2, 1905, Radersburg, Mont., U.S.—d. Dec. 14, 1993, New York, N.Y.) U.S. film actress. She played bit parts in Hollywood movies before being cast as the exotic mistress in the 1925 production of *Ben-Hur*, which established her early film persona as a foreign vamp. She earned praise as the wittily sophisticated Nora Charles in *The Thin Man* (1934) and its sequels and in other movies such as *The Best Years of Our Lives* (1946), *Mr. Blandings Builds His Dream House* (1948), *Cheaper by the Dozen* (1950), and *Lonelyhearts* (1958). Dubbed the "Queen of Hollywood" during her heyday, she evinced equality in a male-dominated world, and her combination of beauty and brains made male audiences regard her as the ideal mate. She worked for the American Red Cross in World War II and later for UNESCO.

loyalist American colonist loyal to Britain in the AMERICAN REVOLUTION. About one-third of American colonists were loyalists, including officeholders who served the British crown, large landholders, wealthy merchants, Anglican clergy and their parishioners, and Quakers. Loyalists were most numerous in the South, New York, and Pennsylvania, but they did not constitute a majority in any colony. At first they urged moderation in the struggle for colonial rights; when denounced by radical patriots, they became active partisans. Some joined the British army, including 23,000 from New York; when captured in battle, they were treated as traitors. All states passed laws against them, confiscating or heavily taxing their property. Beginning in 1776, about 100,000 loyalists fled into exile, many to Canada. Public sentiment against them diminished after 1789, and punitive state laws were repealed by 1814.

Loyola, Saint Ignatius of *orig.* **Iñigo de Oñaz y Loyola** (b. 1491, Loyola, Castile—d. July 31, 1556, Rome; canonized March 12, 1622, feast day July 31) Spanish founder of the Society of Jesus (JESUITS). Born into the nobility, he began his career as a soldier. While convalescing from wounds inflicted by a French cannonball in 1521, he experienced a religious conversion. After a pilgrimage to Jerusalem, he pursued religious studies in Spain and France. In Paris he gathered about him the companions (including ST. FRANCIS XAVIER) who were to join him in founding the Jesuits. He was ordained a priest in 1537 and established the Society of Jesus in 1539. The new order received papal approval in 1540, and Loyola served as its general until his death, by which time it had branches in Italy, Spain, Germany, France, Portugal, India, and Brazil. Loyola described his mystical vision of prayer in *The Spiritual Exercises*. In his last years he laid the foundations of a system of Jesuit schools.

Lozi \'lō-zē\ *or* **Barotse** \bə-'rät-sə\ Complex of 25 Bantu-speaking peoples divided into six cultural groups centring on the area formerly known as Barotseland in western Zambia. Numbering more than 700,000, the Lozi move between two sets of villages in response to annual flooding. Their economy is based on agriculture, animal husbandry, and fishing. Their stratified society consists of aristocrats, commoners, and serfs.

LSD *in full* **lysergic acid diethylamide** Highly potent hallucinogenic drug. An organic compound, LSD can be derived from the ALKALOIDS ergotamine and ergonovine, found in the ERGOT fungus, but most LSD is produced synthetically. It can block the action of the NEUROTRANSMITTER SEROTONIN and produces marked deviations from normal perceptions and behaviour lasting 8–10 hours or longer. Mood shifts, time and space distortions, and impulsive behaviour may progress to paranoia and aggression. Flashbacks to LSD-induced hallucinations can occur years later. LSD is not an approved drug, and no clinically valuable uses have been found for it.

Lu Vassal state of ancient China that originated during the Western ZHOU and came to prominence in the WARRING STATES PERIOD of the Eastern Zhou dynasty. It is known as the birthplace of CONFUCIUS. The CHUNQIU ("Spring and Autumn Annals"), one of the Confucian Classics, records the major events at the court of Lu between 722 and 481 BC.

Lu Hsiang-shan See LU XIANGSHAN

Lu Hsün See LU XUN

Lu Jiuyuan See LU XIANGSHAN

Lü-ta See DALIAN

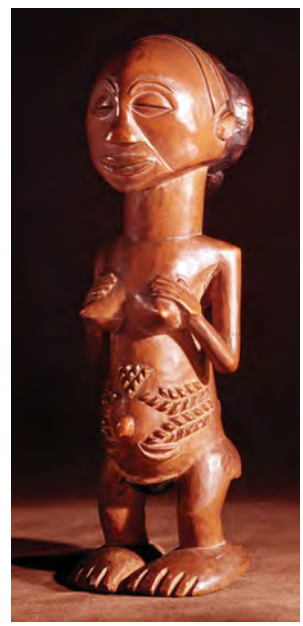
Lu Xiangshan *or* **Lu Hsiang-shan** \'lü-'shyäŋ-'shän\ *or* **Lu Jiuyuan** \'lü-'jyō-'ywän\ (b. 1139, Kiangsi, China—d. Jan. 10, 1193, China) Chinese Neo-Confucian philosopher of the Southern SONG DYNASTY. A government official and a teacher, he was the rival of the great Neo-Confucian rationalist ZHU XI. Lu taught that the highest knowledge of the way (DAO) comes from constant inner reflection and self-examination. In this process, one develops or recovers the fundamental goodness of one's nature. Lu's writings were published after his death, and his thought was revised three centuries later by WANG YANGMING, who established the Xinxue school of NEO-CONFUCIANISM, often called the Lu-Wang school.

Lu Xun *or* **Lu Hsün** \'lü-'shün\ *orig.* **Zhou Shuren** (b. Sept. 25, 1881, Shaoxing, Zhejiang province, China—d. Oct. 19, 1936, Shanghai) Chinese writer. He became associated with the nascent Chinese literary movement in 1918 (part of the larger MAY FOURTH MOVEMENT), when he published his short story "Diary of a Madman," a condemnation of traditional Confucian culture and the first Western-style story written wholly in Chinese. Though best known for his fiction, he was also a master of the prose essay, a vehicle he used especially late in life. He never joined the Communist Party himself, but he recruited many of his countrymen to communism and came to be considered a revolutionary hero.

Lualaba \ˌlü-ä-'lä-bä\ **River** River, central Africa. It is the headstream of the CONGO RIVER, and its 1,100-mi (1,800-km) course lies entirely within the Democratic Republic of the Congo. It is harnessed in places for hydroelectric power.

Luan \lù-'wän\ **River** River, HEBEI province, northeastern China. It rises in eastern INNER MONGOLIA and flows north, then curves to the southeast. It passes through the GREAT WALL and divides into a number of smaller rivers, discharging into the BO HAI (Gulf of Chihli) after a course of 545 mi (877 km). The river is navigable below Chengde.

Luanda \lù-'än-də\ *or* **Loanda** \lō-'än-də\ City (pop., 1999 est.: 2,555,000), capital of Angola. Situated on the Atlantic coast, it is Angola's largest city and its second busiest seaport. Founded in 1576 by Paulo Dias de Novais, it became the administrative centre for the colony of Angola in 1627. It was a major outlet for slave traffic to Brazil until the 19th century. It is a commercial and industrial area, with oil-refining capacity. It is the seat of the University of Luanda; the old fortress of São Miguel lies beyond the port. It was damaged during the persistent Angolan civil war that ended in 2002.



Female Luba ancestral statue of carved wood; in the Musée de l'Homme, Paris.
COURTESY OF THE MUSEE DE L'HOMME, PARIS

Luang Pradist Manudharm See PRIDI PHANOMYONG

Luba *or* **Baluba** Cluster of some 5.6 million Bantu-speaking peoples who share a common political history surrounding the LUBA-LUNDA STATES. They are savanna and forest dwellers who hunt and gather, engage in agriculture, and keep livestock; they also fish intensively in the Congo and its tributaries. They have associations for hunting, magic, and medicine and a well-developed oral tradition that includes epic cycles. Two groups are noted as wood-carvers.

Luba-Lunda states \'lü-bə-'lün-də\ Complex of states that flourished in Central Africa in the 16th–19th centuries. In the late 15th century a small group of ivory hunt-

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ers founded a state around which a number of satellites proliferated, spreading by the 17th century into the southern Congo Basin and what are now western Angola, and Zambia. The northeastern portion was inhabited by the Luba; the southwestern portion by the Lunda. These groups traded slaves and ivory to the Portuguese for cloth and other goods. In the 18th century migrants founded Kazembe farther southeast; it flourished until late in the 19th century, when it was colonized by the British.

Lubbock \'lə-bək\ City (pop., 2000: 199,564), northwestern Texas, U.S. Located south of AMARILLO, it was named for Tom S. Lubbock, a signer of the Texas declaration of independence. Formed in 1890 from Old Lubbock and Monterey, it developed as a ranching centre and was incorporated in 1909. A tornado in 1970 caused widespread damage. It is one of the nation's leading cotton markets and the centre of a diversified agricultural and industrial region. It is the seat of Texas Tech University (1923).

Lübeck \'lü-ˌbek\ City (population 2002 est.: 213,486), northern Germany. Founded on the site of a Slavic settlement in 1143, it developed as a trading post. It became a free city in 1226 and the seat of the HANSEATIC LEAGUE in 1358. It declined after the 16th century, and its trade was ruined during the NAPOLEONIC WARS. It revived after the Elbe-Lübeck canal was built in 1900. Its status as a self-governing entity ended in 1937, when the Nazis made it part of the Prussian province of SCHLESWIG-HOLSTEIN. It is one of Germany's largest Baltic ports. Historic sites include a 12th-century cathedral and several Gothic churches.

Lubitsch \'lü-bich**, Ernst** (b. Jan. 28, 1892, Berlin, Ger.—d. Nov. 30, 1947, Hollywood, Calif., U.S.) German-U.S. film director. He acted with MAX REINHARDT's German stage company (1911–14) and in short film comedies, then turned to directing costume dramas that were the first German films shown abroad, including *Passion* (1919), *Deception* (1920), and *The Loves of Pharaoh* (1921), as well as comedies such as *The Doll* (1919) and *The Oyster Princess* (1919). He moved to Hollywood in 1923 and developed a style of sophisticated wit and unerring narrative timing —the famous "Lubitsch touch"—in successful comedies such as *The Marriage Circle* (1924), *The Love Parade* (1929), *Trouble in Paradise* (1932), *Ninotchka* (1939), *The Shop Around the Corner* (1940), *To Be or Not to Be* (1942), and *Heaven Can Wait* (1943).

Lublin \'lü-blin\ City (pop., 2000 est.: 355,803), eastern Poland, situated on the Bystrzyca River. Founded as a stronghold in the late 9th century, the settlement received town rights in 1317. In 1795 it passed to Austria and in 1815 to Russia. In 1918 the first independent temporary Polish government was proclaimed in Lublin. In World War II the Nazi CONCENTRATION CAMP Majdanek was established in one of its suburbs. After the war Lublin served briefly as the seat of the national government. It is now an industrial and cultural centre for southeastern Poland.

lubrication Introduction of any of various substances between sliding surfaces to reduce wear and FRICTION. Lubricants may secondarily control corrosion, regulate temperature, electrically insulate, remove contaminants, or damp shock. Prehistoric peoples used mud and reeds to lubricate sledges, timbers, or rocks. Animal fat lubricated the axles of the first wagons and continued in wide use until crude OIL became the chief source of lubricants. Crude oil has been the basis of products designed for the specific lubricating needs of automobiles, aircraft, locomotives, turbojets, and all other power machinery. There are three basic varieties of lubrication: fluid-film (in which a fluid film completely separates sliding surfaces), boundary (in which the friction between surfaces is determined by the properties of the surfaces and properties of the lubricant other than VISCOSITY), and solid (used when liquid lubricants lack adequate resistance to load or temperature extremes). The principal lubricants are liquid, oily materials (petroleum-based or synthetic, and including greases); solids (such as graphite, molybdenum disulfide, soft metals, waxes, and plastics); and gases.

Lubumbashi \ˌlü-büm-'bä-shē\ *formerly (until 1966)* **Elisabethville** City (pop., 1994 est.: 851,381), Democratic Republic of the Congo. It was established by Belgian colonists in 1910 near the border with Zambia and grew to become the centre of one of the world's largest copper mining and smelting operations. It was the centre of Katanga province's secession movement in the early 1960s.

Luca da Cortona See Luca SIGNORELLI

Lucas, George (b. May 14, 1944, Modesto, Calif., U.S.) Film director and producer. He studied filmmaking at the University of Southern California. His first feature film, *THX 1138* (1971), was followed by the surprise success *American Graffiti* (1973). He wrote and directed the immensely popular science-fiction movie *Star Wars* (1977), which made innovative use of computerized special effects. He formed the production company Lucasfilms (1978) and its special-effects division Industrial Light and Magic and produced the *Star Wars* sequels—*The Empire Strikes Back* (1980) and *The Return of the Jedi* (1993)—as well as STEVEN SPIELBERG's *Raiders of the Lost Ark* (1981) and its sequels. He returned to directing with the first *Star Wars* prequel, *The Phantom Menace* (1999), which was followed by the other prequels *Attack of the Clones* (2002) and *Revenge of the Sith* (2005).

Lucas, Robert E., Jr. (b. Sept. 15, 1937, Yakima, Wash., U.S.) U.S. economist. He studied at the University of Chicago and began teaching there in 1975. He questioned the influence of JOHN MAYNARD KEYNES in MACROECONOMICS and the efficacy of government intervention in domestic affairs. He criticized the PHILLIPS CURVE for failing to provide for the dampened expectations of companies and workers in an inflationary economy. His theory of rational expectations, which suggests that individuals may alter the expected results of national fiscal policy by making private economic decisions based on anticipated results, won him the 1995 Nobel Prize. See also ECONOMETRICS; INFLATION.

Lucas (Huyghszoon) van Leyden \'lü-käs-vän-'lī-dən\ (b. 1489/94, Leiden, Neth.—d. before Aug. 8, 1533, Leiden) Netherlandish painter and engraver. He was trained by his father, a painter, but his great talent was as an engraver. Even such youthful prints as *Muhammad and the Monk Sergius* (1508) show great technical skill. In 1510, under the influence of ALBRECHT DÜRER, he produced two masterpieces of engraving, *The Milkmaid* and *Ecce Homo*, the latter much admired by REMBRANDT. He is thought to have developed the technique of etching on copper (instead of iron) plates; the softness of copper permitted him to combine etching and line engraving in the same print. He was also among the first to employ AERIAL PERSPECTIVE in prints. Though his paintings seldom attain the power of his engravings, he was an outstanding Netherlandish painter of his period; *The Last Judgment* (1526–27) is his most celebrated painting.

Luce, Clare Boothe *orig.* **Ann Clare Boothe** (b. March 10, 1903, New York, N.Y., U.S.—d. Oct. 9, 1987, Washington, D.C.) U.S. politician, dramatist, and socialite. She was born into poverty to parents who never married. From 1930 to 1934 she worked as an editor at *Vogue* and *Vanity Fair*. In the latter she published short sketches satirizing New York society, some of which were collected as *Stuffed Shirts* (1931). In 1935 she married HENRY R. LUCE, the publisher of *Time* and later *Life* magazine. Three of her witty plays were adapted into films: *The Women* (1936), *Kiss the Boys Goodbye* (1938), and *Margin for Error* (1939). From 1939 to 1940 she worked as a war correspondent for *Life* and recounted her experiences in *Europe in the Spring* (1940). As a member of the House of Representatives (1943–47), she became influential in Republican Party politics. She served as ambassador to Italy from 1953 to 1956, was a public supporter of BARRY GOLDWATER in the 1960s, and served on the President's Foreign Intelligence Advisory Board under Presidents Nixon, Ford, and Reagan in the 1970s and '80s. In 1983 she was awarded the Presidential Medal of Freedom. She is remembered for her fiesty demeanour and her acid wit, which she displayed in oft-quoted aphorisms such as, "No good deed goes unpunished."

Clare Boothe Luce.
CAMERA PRESS

Luce, Henry R(obinson) (b. April 3, 1898, Dengzhou, Shandong province, China—d. Feb. 28, 1967, Phoenix, Ariz., U.S.) U.S. magazine publisher. Luce was born to U.S. missionary parents. He graduated from Yale University in 1920. While at Yale he had met Briton Hadden, with whom he launched *TIME* in 1923. He added the business magazine *Fortune* in 1929 and *LIFE* magazine in 1936. Among other Luce magazines were *House & Home*, established in 1952, and *Sports Illustrated*, launched

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in 1954. His publications, founded as means of educating what Luce considered a poorly informed U.S. public, had many imitators, and Luce became one of the most powerful figures in the history of U.S. journalism. Both he and his wife, Clare Boothe Luce, had a major influence on the Republican Party and on national affairs.

Lucerne \lü-'sərn\ *German* **Luzern** \lüt-'sern\ City (pop., 2000: 59,496), central Switzerland. Located southwest of Zürich, on Lake Lucerne and its Reuss River outlet, it developed around an 8th-century monastery. It joined the Swiss Confederation in 1332. A stronghold of Catholicism during the Reformation, it later took part in the Sonderbund war. It is a tourist centre, with its medieval walls, towers, and covered bridges. Among its many monuments is the famous *Lion of Lucerne*, carved in rock, which commemorates the Swiss Guards slain while defending the Tuileries Palace in Paris in 1792.

Lucerne, Lake *German* **Vierwaldstättersee** \'fēr-vält-ˌshtet-ər-'zā\ **("Lake of the Four Forest Cantons")** Lake, central Switzerland. It is 24 mi (39 km) long and 0.5 to 2 mi (0.8 to 3 km) wide, with an area of 44 sq mi (114 sq km). It has a maximum depth of 702 ft (214 m). The "Cross of Lucerne" is formed by its four main basins, which are joined by narrow channels. Named after the city of Lucerne at its western end, it is in a region of resorts and tourist attractions.

Luchow See Hefei

Lucian \'lü-shən\ *or* **Lucianos** *Latin* **Lucianus** (b. c. AD 120, Samosata, Commagene, Syria—d. after 180, Athens) Ancient Greek rhetorician, pamphleteer, and satirist. As a young man he acquired a Greek literary education while traveling through western Asia Minor. He became a public speaker before turning to writing essays. His works, outstanding for their mordant wit, are a sophisticated critique of the shams and follies of the literature, philosophy, and intellectual life of his day. In such works as *Charon*, *Dialogues of the Dead*, *True History*, and *Nigrinus*, he satirized nearly every aspect of human behaviour. His best work of literary criticism is *How to Write History*.

Luciano \lü-'chä-nō**, Lucky** *orig.* **Salvatore Lucania later Charles Luciano** (b. Nov. 11, 1896, Lercara Friddi, Sicily, Italy—d. Jan. 26, 1962, Capodicino Airport, Naples) Italian-born U.S. gangster. He immigrated with his family to New York in 1906 and soon was involved in crime. In 1916 he conspired with Frank Costello, Meyer Lansky, and other young gangsters, earning the nickname "Lucky" by evading arrest and winning at craps. He joined the crime gang of Joe Masseria in 1920 and was soon directing Masseria's bootlegging, narcotics, and prostitution rackets. In 1931 he had both Masseria and rival boss Salvatore Maranzano murdered; by 1934 he was "boss of all bosses" in a national crime syndicate. Jailed for extortion in 1936, he continued to direct criminal operations from his prison cell. In 1946 his sentence was commuted, and he was deported to Italy, where he directed drug traffic and the smuggling of aliens into the U.S.

Lucifer In classical mythology, the morning star (the planet Venus at dawn), personified as a male figure. Lucifer (Latin: "Light-Bearer") carried a torch and served as herald of the dawn. In Christian times, Lucifer came to be regarded as the name of Satan before his fall; it was thus used by John Milton in *Paradise Lost*.

Lucite *or* **Plexiglas** *or* **Perspex** Trademark names of the organic compound polymethyl methacrylate, a synthetic polymer of methyl methacrylate. Colourless and highly transparent, the solid material has high dimensional stability and good resistance to weathering and shock. It is used in aircraft canopies and windows, in boat windshields, and as a general alternative to glass in many applications. An object made of Lucite has the unusual property of keeping a beam of light reflected within its surfaces and thus carrying the beam around bends and corners; Lucite is therefore used in devices for illuminating interior organs during surgery as well as for ornaments, medallions, and lenses.

Lucknow \'lək-ˌnaù\ City (pop., 2001 prelim.: 2,207,340), capital of Uttar Pradesh state, northern India, on the Gomati River southeast of Delhi. It was captured by the Mughal ruler Bābur in 1528 and under his grandson Akbar became part of Oudh province. In 1775 it became the capital of Oudh. It is now an important rail centre with paper factories and other industrial development. Notable sites include the Great Imambara (tomb) of one of the nabobs of Oudh, the Residency where the British were besieged during the Indian Mutiny of 1857, and the University of Lucknow.

Lucretius \lù-'krē-shəs\ *in full* **Titus Lucretius Carus** (fl. 1st century BC) Latin poet and philosopher. He is known for his long poem *On the Nature of Things,* the fullest extant statement of the physical theory of Epicurus. In it Lucretius established the main principles of atomism and refuted the rival theories of Heracleitus, Empedocles, and Anaxagoras; demonstrated the atomic structure and mortality of the soul; described the mechanics of sense perception, thought, and certain bodily functions; and described the creation and working of the world and of the celestial bodies and the evolution of life and human society.

Lucullus \lü-'kə-ləs**, Lucius Licinius** (b. c. 117—d. 57/56 BC) Roman general who served as consul in 74 BC. He fought alongside Sulla and was the only officer to take part in Sulla's march on Rome. After Sulla's death Lucullus maintained his power through intrigue. He commanded the legions that drove Mithradates from Bithynia and Pontus to Armenia and later invaded Armenia and defeated its king, Tigranes. Mutinies prevented his complete victory, and Lucullus was replaced by Pompey, whom he opposed in the Senate. His legendary hedonism and extravagance made the word Lucullan a synonym of "lavish."

Lucy Nickname for a remarkably complete (40% intact) hominin skeleton found by Donald Johanson at Hadar, Eth., in 1974 and dated to 3.2 million years ago. The specimen is usually classified as Australopithecus *afarensis* and suggests—by having long arms, short legs, an apelike chest and jaw, and a small brain but a relatively humanlike pelvis—that bipedal locomotion preceded the development of a larger (more humanlike) brain in hominin evolution. Lucy stood about 3 ft 7 in. (109 cm) tall and weighed about 60 lbs (27 kg). See also Hadar remains; Laetoli footprints; Sterkfontein.

lud \'lüd\ Among the Votyak and Zyryan peoples of Russia, a sacred grove, usually consisting of fir trees, where sacrifices were performed. Enclosed by a high fence, the lud contained a place for a fire and tables for the sacrificial meal. It was forbidden to break even a branch from a tree in the grove, which was watched over by a hereditary guardian. The annual sacrificial rite generally centered on an ancient tree dedicated to a deity. All food had to be consumed at the site, and the hides of sacrificed animals were hung from the trees. Groves were sacred in most other Finno-Ugric religions as well.

Luda See Dalian

Luddite Member of organized groups of early 19th-century English craftsmen who surreptitiously destroyed the textile machinery that was replacing them. The movement began in Nottingham in 1811 and spread to other areas in 1812. The Luddites, or "Ludds," were named after a probably mythical leader, Ned Ludd. They operated at night and often enjoyed local support. Harsh repressive measures by the government included a mass trial at York in 1813 that resulted in many hangings and banishments. The term Luddite was later used to describe anyone opposed to technological change.

Ludendorff \'lü-dᵊn-ˌdȯrf**, Erich** (b. April 9, 1865, Kruszewnia, near Poznań, Prussian Poland—d. Dec. 20, 1937, Munich, Ger.) German general. In 1908 he joined the German army general staff and worked under Helmuth von Moltke in revising the Schlieffen Plan. In World War I he was appointed chief of staff to Paul von Hindenburg, and the two won a spectacular victory at the Battle of Tannenberg. In 1916 the two generals were given supreme military control. They tried to conduct a total war by mobilizing the entire forces of the home front, and in 1917 Ludendorff approved unrestricted submarine warfare against the British, which led to the U.S. entry into the war. In 1918, after his offensive on the Western Front failed, he demanded an armistice, but then he insisted the war continue when he realized the severity of the Armistice conditions. Political leaders opposed him, and he resigned his post. Ludendorff insisted he had been betrayed, and for the next 20 years he led a bizarre life, becoming a leader of reactionary political movements and taking part in the Kapp Putsch (1920) and Beer Hall Putsch

Erich Ludendorff, c. 1930.
ARCHIV FÜR KUNST UND GESCHICHTE

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(1923). He served in Parliament as a National Socialist (1924–28) and developed a belief that "supernational powers"—Jewry, Christianity, Freemasonry—had deprived him and Germany of victory in World War I.

Ludlum, Robert (b. May 25, 1927, New York, N.Y., U.S.—d. March 12, 2001, Naples, Fla.) U.S. author of spy thrillers. He worked in the theatre as an actor and a successful producer and acted for television before turning to writing. Among his best-sellers were *The Scarlatti Inheritance* (1971), *The Osterman Weekend* (1972; film, 1983), *The Matarese Circle* (1979), and *The Bourne Identity* (1980; film, 1988, 2002). Though critics often found his plots unlikely and his prose uninspired, his fast-paced combination of international espionage, conspiracy, and mayhem proved enormously popular.

Ludwig I See LOUIS I

Ludwig II See LOUIS II

Ludwig IV See LOUIS IV

Ludwig, Carl F(riedrich) W(ilhelm) (b. Dec. 29, 1816, Witzenhausen, near Kassel, Hesse-Kassel—d. April 23, 1895, Leipzig, Ger.) German physician. He invented devices to record arterial blood-pressure changes, measure blood flow, and separate gases from blood (which established their role in blood purification). He was the first to keep animal organs alive outside the body. His paper on urine secretion in 1844 hypothesized a filtering role for the kidney. Nearly 200 of Ludwig's students became prominent scientists, and he is regarded as the founder of the physicochemical school of physiology.

Lueger \'lüg-gər**, Karl** (b. Oct. 24, 1844, Vienna, Austria—d. March 10, 1910, Vienna) Austrian politician. He was elected to the Vienna city council (1875) and to the Austrian parliament (1885), and he cofounded the Christian Social Party (1889). He effectively used the prevalent anti-Semitic and German nationalist currents in Vienna to advance his political objectives. He was elected mayor of Vienna in 1895 and transformed the Austrian capital into a modern city, bringing streetcars, electricity, and gas under city government control. He also developed parks, schools, and hospitals. He was instrumental in introducing universal suffrage in Austria (1907).

luffa See LOOFAH

Lufthansa *in full* **Deutsche Lufthansa AG** One of Europe's largest air-passenger, cargo, and airline-services companies. The airline originated in 1926 as Deutsche Luft Hansa AG and eventually was flying to destinations in South America and Southeast Asia before service was disrupted by World War II. The company took its current name in 1954 and began regular passenger air service in 1955. Originally a state-run airline, Lufthansa was privatized in the 1990s and began its multiyear acquisition of Swiss International Airlines in 2005. Lufthansa's businesses include vacation travel, air freight, and aircraft maintenance.

Lug See LUGUS

Lugano \lü-'gä-nō**, Lake** *or* **Lago Ceresio** \che-'res-yō\ Lake in Switzerland and Italy, located between MAGGIORE and COMO lakes. Straddling the border of the two countries, it has an area of 19 sq mi (49 sq km) and a maximum depth of 945 ft (288 m). Between Melide and Bissone, the lake is so shallow that a stone dam across it carries the St. Gotthard railway. The resort town of Lugano, on its shores in Switzerland, is Italian in appearance. See photograph above.

Lugard \lü-'gärd**, F(rederick) (John) D(altry)** *later* **Baron Lugard (of Abinger)** (b. Jan. 22, 1858, Fort St. George, Madras, India—d. April 11, 1945, Abinger, Surrey, Eng.) British colonial administrator. In Nigeria he served as high commissioner (1900–06) and governor and governor-general (1912–19). He fought as an officer in British campaigns in Asia and North Africa before accepting posts with the British East Africa Company, the Royal Niger Company, and other private enterprises. He succeeded, in advance of the French, in establishing trade routes centred at BUGANDA, the Middle Niger, and Bechuanaland. As the chief government administrator in Nigeria, he united the disparate northern and southern districts and greatly influenced British colonial policy by exercising control centrally through native rulers and respecting native legal systems and customs.

Lugdunensis \ˌləg-də-'nen-sis\ Roman province, one of the three administrative divisions of GAUL. It extended northwest from its capital at Lugdunum (modern LYON) and included the land between the SEINE and

Lake Lugano, near Lugano, Switz.
R.G. EVERTS—RAPHO/PHOTO RESEARCHERS

LOIRE rivers up to BRITTANY and the Atlantic coast. It was conquered by Julius CAESAR during the GALLIC WARS and became a Roman province in 27 BC under AUGUSTUS.

lugeing \'lü-zhiŋ\ Sled racing using a small sled that is ridden in a supine position. The sled, called a luge, is steered with the feet and subtle shoulder movements. Dating back to the 15th century, lugeing is a traditional winter sport in Austria and is also practiced in other countries. The course used is similar to that employed in BOBSLEDDING, and speeds above 90 mph (145 km/hr) are not uncommon. Lugeing became a Winter Olympics sport in 1964.

Lugones \lü-'gō-nās**, Leopoldo** (b. June 13, 1874, Villa María del Río Seco, Arg.—d. Feb. 19, 1938, Buenos Aires) Argentine poet, critic, and cultural ambassador. He initially worked as a journalist but thought of himself primarily as a poet. His early verse, collected in volumes such as *Mountains of Gold* (1897), reveals his affinity with MODERNISMO. Later he embraced political conservatism, and his poetry and prose treated national themes in a realistic style. He was director of the National Council of Education from1914 to 1938 and also produced histories of Argentina and studies and translations of classical Greek literature. He strongly influenced such younger writers as JORGE LUIS BORGES.

Lugosi \lə-'gō-sē**, Bela** *orig.* **Blasko Béla Ferenc Dezsö** (b. Oct. 20, 1882, Lugos, Hung.—d. Aug. 16, 1956, Los Angeles, Calif., U.S.) Hungarian-born U.S. film actor. He acted with the National Theatre in Budapest (1913–19) and appeared in German films before leaving for the U.S. in 1921. He directed and starred in the play *Dracula* in New York in 1927; he reprised the role, which was ideally suited for his aristocratic manner and heavy accent, in the movie *Dracula* (1931). His other horror movies include *The Black Cat* (1934), *Mark of the Vampire* (1935), *Son of Frankenstein* (1939), *Frankenstein Meets the Wolfman* (1943), and *The Body Snatcher* (1945). Lugosi declined into poverty and obscurity and eventually took roles in low-budget independent films. He was buried wearing the long, black cape that he had worn in *Dracula*.

Lugosi as Count Dracula
CULVER PICTURES

Lugus \'lü-gəs\ *or* **Lug** Major god of the CELTIC RELIGION. In Irish tradition, Lug Lámfota ("Lug of the Long Arm") was the sole survivor of triplet brothers. In Wales, as Lleu Llaw Gyffes ("Lleu of the Dexterous Hand"), he was said to be the son of the virgin goddess Aranrhod. His mother sought to destroy him, but his uncle Gwydion raised him and kept him safe. When his mother denied him a wife, Gwydion created a woman

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for him from flowers. His name is an element in such European and British place-names as Lyon, Leiden, and Carlisle.

Luhya *or* **Luyia** \'lü-yə\ Cluster of several closely related Bantu-speaking peoples of western Kenya. They emerged as a coherent group about 1945, when it was politically advantageous to possess a larger ethnic identity. Today, numbering some 3.8 million, the Luhya are the second-largest ethnic group in Kenya. They grow corn, cotton, and sugarcane as cash crops and millet, sorghum, and vegetables as staples, and they also keep livestock. Many have moved to urban areas seeking work.

Luichow Peninsula See LEIZHOU PENINSULA

Luini \lü-'ē-nē**, Bernardino** (b. c. 1480/85—d. 1532, Milan) Italian painter active in Milan. Little is known of his life. His earliest surviving works are a polyptych in a church near Como (c. 1510) and a fresco, *Madonna and Child* (1512), at the Cistercian monastery of Chiravalle, near Milan. Working in the Renaissance style, he was a prominent follower of LEONARDO DA VINCI in Lombardy; many of Luini's frescoes and altarpieces are in Lombardy churches. He also painted mythological subjects, most notably a *Europa* and a *Cephalus and Procris* (c. 1520), originally for a Milanese palace.

Lukács \'lü-ˌkäch**, György** (b. April 13, 1885, Budapest, Hung.—d. June 4, 1971, Budapest) Hungarian philosopher and critic. Born into a wealthy Jewish family, he joined the Hungarian Communist Party in 1918. In *History and Class Consciousness* (1923), he developed a Marxist philosophy of history and laid the basis for his literary criticism by linking the development of form in art with the history of the class struggle. A major figure during the 1956 Hungarian uprising, he was deported but was allowed to return in 1957. His works include the essay collection *Soul and Form* (1911) and *The Historical Novel* (1955). His earlier work, especially *Theory of the Novel* (1920) and *History and Class Consciousness* (1923), is now considered superior to his later Stalinist-influenced criticism, which celebrated the official Soviet policy of SOCIALIST REALISM.

Luke, Saint (fl. 1st century AD; feast day October 18) In Christian tradition, the author of the third GOSPEL and the Acts of the Apostles. He wrote in Greek and is considered the most literary of the NEW TESTAMENT writers. By his own account, he was not an eyewitness to the ministry of JESUS. He was a companion to St. PAUL, who called him the "beloved physician," and he is believed to have accompanied Paul on missionary journeys to Macedonia and Rome. Though little is known of his life, tradition holds that he was a Gentile and a native of Antioch in Syria and that he died a martyr.

Lula See Luiz SILVA

Lula da Silva, Luiz Inácio *known as* **Lula** (b. Oct. 6, 1945, Garanhuns, Pernambuco state, Braz.) Leader of Brazil's leftist Workers' Party. A former factory worker, Lula helped build a labour union movement into an important political party. In 1988 his party swept the municipal elections of São Paulo and other major cities. A leading contender for president in 1989, 1995, and 1998, proposing policies to help Brazil's working class, he lost each time to more conservative candidates. In 2002, however, he was successful in his bid for the presidency. See also Fernando COLLOR DE MELLO.

Lully \lü-'lē**, Jean-Baptiste** *orig.* **Giovanni Battista Lulli** (b. Nov. 28, 1632, Florence—d. March 22, 1687, Paris, France) Italian-born French composer. He was made a ward of the court after his mother died and was sent to a noble French household at age 13 as valet. There he learned guitar, organ, violin, and dancing and came to know the composer Michel Lambert (1610–96), who introduced him to society and later became his father-in-law. Lully became a dancer and musician for the king and at age 30 was put in charge of all royal music. In the 1660s he composed the incidental music for MOLIÈRE's plays as well as those of France's great tragedians. In the early 1670s he obtained the sole patent to present opera and produced the series of "lyric tragedies"—most with librettos by Philippe Quinault (1635–88)—for which he is known, including *Alceste* (1674), *Atys* (1676), and *Armide* (1686). The orchestra he developed was an important forerunner of the modern orchestra. A self-inflicted injury to his toe with his heavy conducting stick led to his death. His style of composition was imitated throughout Europe.

Lully, Raymond See Ramon LLULL

lumber Collective term for harvested wood, whether cut into logs, heavy timbers, or members used in light-frame construction. Lumber is classified as hardwood or softwood (see WOOD). The term often refers specifically to the products derived from logs in a sawmill. Conversion of logs to sawed lumber involves debarking, sawing into boards or slabs, resawing into thinner boards of varying sizes, edging, crosscutting to square the ends and remove defects, grading according to strength and appearance, and drying in the open air or in kilns. Drying below the fiber-saturation point results in shrinkage and generally greater strength, stiffness, and density and better prepares the wood for finishing. Preservatives are often applied to protect the wood from deterioration and decay.

Lumet \'lü-mət**, Sidney** (b. June 25, 1924, Philadelphia, Pa., U.S.) U.S. television and film director. He worked as a child actor in the Yiddish theatre and on Broadway. After serving in World War II, he directed plays and taught acting. He directed more than 200 television dramas for CBS (1951–57), including *Playhouse 90* and *Studio One* productions, before making his debut as a movie director with the acclaimed *Twelve Angry Men* (1957). He went on to direct commercially successful psychological dramas such as *The Fugitive Kind* (1960), *Fail Safe* (1964), *Serpico* (1973), *Dog Day Afternoon* (1975), *Network* (1976), *The Verdict* (1982), and *Night Falls on Manhattan* (1997).

Lumière \lü-'myer**, Auguste and Louis** (respectively b. Oct. 19, 1862, Besançon, France—d. April 10, 1954, Lyon; b. Oct. 5, 1864, Besançon, France—d. June 6, 1948, Bandol) French inventors. In 1882 Louis developed a method of making photographic plates, and by 1894 the brothers' factory was producing 15 million plates a year. They worked on improving THOMAS ALVA EDISON's Kinetoscope and patented their combination movie camera and projector, the Cinématographe, in 1895. Their film *La Sortie des ouvriers de l'usine Lumière* ("Workers Leaving the Lumière Factory"), which they showed to a paying audience in Paris in 1895, is considered the first motion picture. In 1896 the brothers, led by Louis, made more than 40 films recording everyday French life. They made the first newsreels, sending crews all over the world to shoot new material and show their films. In addition to the films he directed, Louis served as producer for some 2,000 films. The brothers also made basic innovations in colour photography.

Auguste Lumière
BOYER—H. ROGER-VIOLLET

luminaire *or* **light fixture** Complete lighting unit, consisting of one or more lamps (bulbs or tubes that emit light), along with the socket and other parts that hold the lamp in place and protect it, wiring that connects the lamp to a power source, and a reflector that helps direct and distribute the light. Fluorescent fixtures usually have lenses or louvers to shield the lamp (thus reducing glare) and redirect the light emitted. Luminaires include both portable and ceiling- or wall-mounted fixtures.

luminescence Process by which an excited material emits light in a process not caused solely by a rise in temperature. The EXCITATION is usually achieved with ULTRAVIOLET RADIATION, X RAYS, ELECTRONS, alpha particles, ELECTRIC FIELDS, or CHEMICAL ENERGY. The colour, or wavelength, of the light emitted is determined by the material, while the intensity depends on both the material and the input energy. Examples of luminescence include light emissions from neon lamps, luminescent watch dials, television and computer screens, fluorescent lamps, and fireflies. See also BIOLUMINESCENCE; FLUORESCENCE; PHOSPHORESCENCE.

luminism Painting style that emphasizes a particular clarity of light. It is characteristic of the works of a group of U.S. painters of the late 19th century, influenced by the HUDSON RIVER SCHOOL. Typically landscapes or seascapes, with sky occupying nearly half the composition, luminist works are distinguished by cool, clear colours and meticulously detailed objects modeled by light. The most prominent luminist painters were John Frederick Kensett, MARTIN JOHNSON HEADE, and Fitz Hugh Lane.

Lumumba \lə-'mùm-bə**, Patrice (Hemery)** (b. July 2, 1925, Onalua, Belgian Congo—d. January 1961, Katanga province, Republic of the Congo) African nationalist leader, first prime minister of the Democratic Republic of the CONGO (June–September 1960). Lumumba worked as a trade-union organizer before founding the Mouvement National Con-

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golais, Congo's first nationwide political party, in 1958. That same year his militant nationalism at a major Pan-African conference in Accra, Ghana, brought him to prominence. During negotiations in Belgium in 1960, he was asked to form the first independent Congolese government. His rival Moise Tshombe immediately announced the secession of Katanga province. When Belgian troops arrived to sustain the secession, Lumumba appealed first to the UN and then to the Soviet Union. He was dismissed by Pres. Joseph Kasavubu and, a short time later, assassinated by Tshombe loyalists. His death caused a scandal throughout Africa, where he was looked on as a leader of Pan-Africanism.

Lumumba
AGENCE DALMAS

Luna Any of a series of unmanned Soviet lunar probes, launched between 1959 and 1976, responsible for various lunar "firsts." Luna 2 (1959) was the first spacecraft to strike the Moon; Luna 3 (1959) was the first to circle the Moon and took the first photographs of its far side. Luna 9 (1966) made the first successful lunar soft landing. Luna 16 (1970) was the first unmanned spacecraft to carry lunar soil samples back to Earth. Luna 17 (1970) soft-landed a robot vehicle for exploration; it also contained television equipment and sent live pictures of several miles of the Moon's surface. See also Pioneer; Ranger; Surveyor.

Luna See Selene

luna moth Species (*Actias luna*) of saturniid moth of eastern North America. Lunas are pale green and have a wingspread of 4 in. (10 cm). The wings have a thin brown border, and each hind wing has a long tail-like projection. The larvae feed on the leaves of many kinds of trees and shrubs. See also moth.

Lunacharsky, Anatoly (Vasilyevich) (b. Nov. 23, 1875, Poltava, Ukraine, Russian Empire—d. Dec. 26, 1933, Menton, France) Russian politician and writer. Deported in 1898 for his revolutionary activities, he joined the Bolsheviks in 1904 and disseminated propaganda to Russian students and political refugees in foreign countries. He joined Vladimir Ilich Lenin in Russia in 1917 and was appointed commissar for education, a role in which he did much to ensure the preservation of works of art during the Russian Civil War. He encouraged innovation in the theatre and in education, and he published plays of his own.

Lunceford \'lənsfərd**, Jimmie** *orig.* **James Melvin Lunceford** (b. June 6, 1902, Fulton, Miss., U.S.—d. July 12, 1947, Seaside, Ore.) U.S. jazz musician and bandleader. Lunceford was a well-schooled musician who played saxophone and taught music before forming a band in 1929. Trumpeter and arranger Sy Oliver (1910–88) joined in 1933, bringing a crisp ensemble sound to the two-beat rhythmic approach of the band. Lunceford's band gained national attention after he succeeded Cab Calloway at Harlem's Cotton Club in 1934, and it was thereafter counted among the finest big bands of the swing era, rivaling those of Duke Ellington and Count Basie in popularity.

Lunda empire See Luba-Lunda states

Lundy, Benjamin (b. January 4, 1789, Sussex county, N.J., U.S.—d. Aug. 22, 1839, Lowell, Ill.) U.S. abolitionist and publisher. He worked in Virginia and Ohio, where he organized the Union Humane Society (1815), one of the first antislavery societies. In 1821 he founded a newspaper, the *Genius of Universal Emancipation*, which he edited in various places until 1835, when he began publishing another paper, the *National Enquirer* (later the *Pennsylvania Freeman*), in Philadelphia. He traveled in search of places for former slaves to settle, including Canada and Haiti.

lung Either of two light, spongy, elastic organs in the chest, used for breathing. Each is enclosed in a membrane (pleura). Contraction of the diaphragm and the muscles between the ribs draw air into the lungs through the trachea, which splits into two primary bronchi, one per lung. Each bronchus branches into secondary bronchi (one per lobe of lung), tertiary bronchi (one per segment of lung), and many bronchioles leading to the pulmonary alveoli. There oxygen in the inspired gas is exchanged for carbon dioxide from the blood in the surrounding capillaries. Adequate tissue oxygen supply depends on sufficient distribution of air (ventilation) and blood (perfusion) in the lungs. Lung injuries or diseases (e.g., emphysema, embolism, pneumonia) can affect either or both.

lung cancer Malignant tumour of the lung. Four major types (squamous-cell carcinoma, adenocarcinoma, large-cell carcinoma, and small-cell carcinoma) have roughly equal prevalence. Most cases are due to long-term cigarette smoking. Heavy smoking and starting smoking earlier in life increase the risk. Passive inhalation ("secondhand smoke") is linked to lung cancer in nonsmokers. Other risk factors include exposure to radon or asbestos. Symptoms, including coughing (sometimes with blood), chest pain, and shortness of breath, seldom appear until lung cancer is advanced, when treatment with surgery, chemotherapy, and radiation or some combination of the three is less effective. Most patients die within a year of diagnosis.

lung congestion Distention of blood vessels in the lungs and filling of the pulmonary alveoli with blood. It results from infection, hypertension, or inadequate heart function (e.g., left-sided heart failure). Congestion seriously impairs gas exchange, leading to breathing difficulty, bloody discharge in sputum, and bluish skin tint.

Lung-men caves See Longmen caves

Lung-shan culture See Longshan culture

Luni River \'lü-nē\ River, Rajasthan state, western India. Rising in the western Aravalli Range, where it is known as the Sagarmati, it flows southwest and enters a patch of desert before dissipating into the Rann of Kachchh, after a total course of 330 mi (530 km). Its Sanskrit name is Lavanavari ("Salt River"), referring to its high salinity. The major river in the region, it serves as a source of irrigation.

Lunt, Alfred and Lynn Fontanne *orig.* **Lillie Louise Fontanne** (respectively b. Aug. 19, 1892, Milwaukee, Wis., U.S.—d. Aug. 3, 1977, Chicago, Ill.; b. Dec. 6, 1887, Essex, Eng.—d. July 30, 1983, Genesee Depot, Wis.) U.S. acting team. Lunt made his acting debut in Boston in 1912 and starred in *Clarence* on Broadway (1919). Fontanne made her acting debut in London in 1909 and in New York City in 1910. She and Lunt married in 1922 and performed with the Theatre Guild from 1924 to 1929. They acted together in more than 25 plays, including *The Guardsmen* (1924) and *Design for Living* (1933), the latter of which Noël Coward wrote for them. Considered the foremost acting couple of the U.S. theatre, they were acclaimed for the subtlety and effortless cooperation of their performances, especially in comedies by Coward and George Bernard Shaw.

Lunyu \'lün-'yü\ *English* **Analects** One of four Confucian texts that, when published together in 1190 by Zhu Xi, made up the Four Books. Scholars consider *Lunyu* the most reliable source of the doctrine of Confucius. It covers almost all the basic ethical concepts of Confucianism—for example, ren (benevolence), *junzi* (the superior man), Tian (Heaven), *zhong yong* (doctrine of the mean), *li* (proper conduct), and *zheng ming* (rectification of names). It also contains many direct quotations from Confucius and personal glimpses of the sage as recorded by his disciples. See also Neo-Confucianism; *Zhong yong*.

Luo \lə-'wō\ People of the flat country near Lake Victoria in western Kenya and northern Uganda. They speak a language of the Nilo-Saharan family. Numbering 3.2 million, the Luo are the third-largest ethnic group in Kenya. They are settled agriculturalists who also keep cattle; many work as agricultural labourers and in urban occupations. Most are Christians. See also Nilot.

Lupercalia \ˌlü-pər-'kā-lē-ə\ Ancient Roman festival held each February 15. Its origins are uncertain, but the likely derivation of its name from *lupus* (Latin: "wolf") may signal a connection with a primitive deity who protected herds from wolves or with the legendary she-wolf who nursed Romulus and Remus. Each Lupercalia began with the sacrifice of goats and a dog; two of its priests (Luperci) were then led to the altar and their foreheads were anointed with blood. After all had feasted, the Luperci cut thongs from the skins of the sacrificed animals and ran around the Palatine hill, striking at any woman who came near them; a blow from the thong was supposed to bestow fertility.

lupine *or* **lupin** \'lü-pən\ Any of about 200 species of herbaceous and partly woody plants that make up the genus *Lupinus* in the pea family (see legume), found throughout the Mediterranean and especially on the prairies of western North America. Many are grown in the U.S. as orna-

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mentals, and a few species are useful as cover or forage crops. Herbaceous lupines, which grow up to 4 ft (1.25 m) tall, have low, divided leaves and an upright flower spike, and many are hybridized for gardens. The name comes from the Latin for "wolf" because these plants were once thought to deplete, or "wolf," minerals from the soil; in actuality some species aid soil fertility through NITROGEN FIXATION.

Lupino \lù-'pē-nō\ **family** British theatrical family. The earliest member, Signor Luppino, flourished c. 1610, probably in Italy. His descendant George William Luppino (1632–93), a puppet master, immigrated to England as a political refugee. A later descendant, the scenic artist and dancer Thomas Frederick Lupino (1749–1845), changed the spelling of the family name. Another family member, George Hook Lupino (1820–1902), had 16 children, 10 of whom were dancers. His eldest son, George Lupino (1853–1932), was a famous clown; George's son Barry Lupino (1884–1962) excelled in pantomime and musical comedy; another son, Stanley Lupino (1894–1942), performed in comedy revues. Stanley's nephew Henry Lupino (1892–1959), a Cockney comedian known as Lupino Lane, created the "Lambeth walk" dance in the musical *Me and My Girl* (1937). Stanley's daughter Ida Lupino (1916–95) moved in 1934 to the U.S., where she starred in movies such as *They Drive by Night* (1940), *The Sea Wolf* (1941), and *The Hard Way* (1942). One of the first female film directors, she was noted for *The Hitch-Hiker* (1953) and *The Bigamist* (1953), and she also directed several dramas for television.

lupus erythematosus \'lü-pəs-ˌer-ə-ˌthē-mə-'tō-səs\ Either of two inflammatory AUTOIMMUNE DISEASES, both more common in women. In the discoid type, a skin disease, red patches with grayish brown scales appear on the upper cheeks and nose (often in a butterfly pattern), scalp, lips, and/or inner cheeks. Sunlight worsens it. Antimalarial drugs may help. The second type, systemic (disseminated) lupus erythematosus (SLE), may affect any organ or structure, especially the skin (with marks like those of the discoid type), kidneys, heart, nervous system, serous (moisture-forming) membranes (e.g., in synovial joints or lining the abdomen), and lymph nodes, with acute episodes and remissions. Symptoms vary widely. Kidney and central-nervous-system involvement can be life-threatening. Treatment includes pain relief, control of inflammation, and trying to limit damage to vital organs.

Luria, A(leksandr) R(omanovich) (b. July 3, 1902, Kazan, Russia—d. 1977) Soviet neuropsychologist. After earning degrees in psychology, education, and medicine, he became professor of psychology at Moscow State University and later head of its department of neuropsychology. Influenced by his former teacher L.S. VYGOTSKY, he studied language disorders and the role of speech in mental development and retardation. During World War II Luria made advances in brain surgery and in the restoration of brain functions after trauma. He also developed theories concerning the functioning of the frontal lobe and the existence of zones of brain cells working in concert. His books include *Higher Cortical Functions in Man* (1966), *The Working Brain* (1973), and *Basic Problems of Neurolinguistics* (1976).

Luria \'lür-yä**, Isaac ben Solomon** (b. 1534, Jerusalem—d. Aug. 5, 1572, Safed, Syria) Jewish mystic and founder of a school of KABBALA. He was brought up in Egypt, where he pursued rabbinic studies. He dedicated himself to the study of the Kabbala with messianic fervour, and in 1570 he journeyed to a centre of the movement in Galilee. He died two years later in an epidemic, having written little. The Lurianic Kabbala, a collection of Luria's doctrines recorded after his death by a pupil, had great influence on later Jewish mysticism and on HASIDISM. It propounds a theory of the creation and later degeneration of the world and calls for restoration of the original harmony through ritual meditation and secret combinations of words.

Luria \'lůr-ē-ə**, Salvador (Edward)** (b. Aug. 13, 1912, Turin, Italy—d. Feb. 6, 1991, Lexington, Mass., U.S.) Italian-born U.S. biologist. He fled Italy for France in 1938, arriving in the U.S. in 1940. In 1942 he obtained an electron micrograph of phage particles that confirmed earlier descriptions of them as consisting of a round head and a thin tail. In 1943 he and MAX DELBRÜCK showed that viruses can undergo permanent changes in their hereditary material. He also proved that the simultaneous existence of phage-resistant bacteria with phage-sensitive bacteria in the same culture was a result of the selection of spontaneous bacterial mutants. In 1945 he and A.D. HERSHEY demonstrated the existence not only of such bacterial mutants but also of spontaneous phage mutants. The three men shared a 1969 Nobel Prize.

Luristan Bronze \'lůr-ə-ˌstan\ *or* **Lorestan Bronze** \'lȯr-ə-ˌstan\ Objects excavated since the late 1920s in the valleys of the Zagros Mountains in the Luristan region of western Iran. Dating from c. 1500 to c. 500 BC, they consist of utensils, weapons, jewelry, horse trappings, belt buckles, and ritual and votive objects. They are believed to have been produced either by the CIMMERIANS or by Indo-European peoples of MEDIA or PERSIA.

Lusaka \lü-'sä-kä\ City (pop., 1999 est.: metro. area, 1,577,000), capital of ZAMBIA. In the 1890s the area was taken by the British South Africa Company during the formation of Northern RHODESIA; it became the capital in 1935. After the federation of Northern and Southern Rhodesia in 1953, it was a centre of the civil disobedience movement that led to the creation of the independent state of Zambia in 1960, with Lusaka as its capital. Possessing some light industry, it is also a commercial centre for the surrounding agricultural region. The University of Zambia (founded 1965) is located nearby.

Lüshun \'lǖ-'shůn\ *or* **Lü-shun** *formerly* **Port Arthur** Former city, since 1950 a district of DALIAN city, LIAONING province, northeastern China. Situated at the southern tip of the LIAODONG PENINSULA, it was used as a staging post as early as the 2nd century BC. Fortified under the MING DYNASTY, it was captured by the MANCHUS in 1633 and served as the seat of a defense unit under the QING DYNASTY. In 1878 it became the chief base for China's first modern naval force. Leased to Russia in 1898, it was captured by Japan (1905) during the RUSSO-JAPANESE WAR and was made the seat of a provincial government. Under a 1945 treaty it became a Sino-Soviet military base; the Soviet forces withdrew in 1955.

Lusitania British ocean liner sunk by a German submarine off the coast of Ireland on May 7, 1915. The British Admiralty had warned the *Lusitania* to avoid the area and to use the evasive tactic of zigzagging, but the crew ignored these recommendations. Though unarmed, the ship was carrying munitions for the Allies, and the Germans had circulated warnings that the ship would be sunk. The loss of life—1,198 people drowned, including 128 U.S. citizens—outraged public opinion. The U.S. protested Germany's action, and Germany limited its submarine campaign against Britain. When Germany renewed unrestricted submarine warfare, the U.S. entered World War I in April 1917.

Lussac, Joseph Gay- See Joseph GAY-LUSSAC

lustre In mineralogy, the appearance of a mineral surface in terms of its light-reflecting qualities. Lustre depends on a mineral's refractivity (see REFRACTION), transparency, and structure. Variations in these properties produce different kinds of lustre, from metallic (e.g., gold) to dull (e.g., chalk).

lustred glass *or* **lustered glass** Art glass of the ART NOUVEAU style, delicately iridescent with rich colours, mimicking the iridescent sheen produced by the corrosion of ancient buried glassware. In 1893 LOUIS COMFORT TIFFANY founded the Stourbridge Glass Co. to produce lustred drinking glasses, bowls, vases, lamps, and jewelry. His lustred glass, produced by metallic pigments applied to opaque glass, produced a pearly sheen, whereas that produced in Europe in the 1870s used transparent glass, which resulted in a mirrorlike surface. Tiffany's wares were so popular that he made thousands of pieces annually until 1933.

lute Plucked STRINGED INSTRUMENT popular in 16th–17th-century Europe. It originated from the Arab *ʿūd*, which reached Europe in the 13th century. Like the *ʿūd*, the lute has a deep pear-shaped body with an ornamental soundhole, a fretted neck with a bent-back pegbox, and strings hitched to a bridge glued to the instrument's belly. In later years it acquired several unstopped bass strings. It became the preferred instrument for cultivated amateur musicians and acquired an extensive literature of song accompaniments and solo and consort music.

Angel playing a lute, from "Presentation in the Temple," painted altarpiece by Vittore Carpaccio, 1510; in the Accademia, Venice.
SCALA-ART RESOURCE

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Luther, Martin (b. Nov. 10, 1483, Eisleben, Saxony—d. Feb. 18, 1546, Eisleben) German priest who sparked the REFORMATION. The son of a miner, he studied philosophy and law before entering an Augustinian monastery in 1505. He was ordained two years later and continued his theological studies at the University of Wittenberg, where he became a professor of biblical studies. He was shocked by the corruption of the clergy on a trip to Rome in 1510 and was later troubled by doubts centring on fear of divine retributive justice. His spiritual crisis was resolved when he hit on the idea of JUSTIFICATION by faith, the doctrine that salvation is granted as a gift through God's grace. He urged reform of the Roman Catholic church, protesting the sale of INDULGENCES and other abuses, and in 1517 he distributed to the archbishop of Mainz and several friends his NINETY-FIVE THESES (according to legend, Luther nailed the theses to the door of the castle church in Wittenberg); the theses questioned Roman Catholic teaching and called for reform. In 1521 he was excommunicated by POPE LEO IX and declared an outlaw at the Diet of Worms (see WORMS, DIET OF). Under the protection of the elector of Saxony, Luther took refuge in Wartburg. There he translated the Bible into German; his superbly vigorous translation has long been regarded as the greatest landmark in the history of the GERMAN LANGUAGE. He later returned to Wittenberg, and in 1525 he married the former nun Katherina von Bora, with whom he raised six children. Though his preaching was the principal spark that set off the PEASANTS' WAR (1524–25), his vehement denunciation of the peasants contributed to their defeat. His break with Rome led to the founding of the Lutheran Church (see LUTHERANISM); the Lutheran confession of faith or, AUGSBURG CONFESSION, was produced with Luther's sanction by PHILIPP MELANCHTHON in 1530. Luther's writings included hymns, a liturgy, and many theological works.

Lutheranism Protestant movement founded on the principles of MARTIN LUTHER. Lutheranism arose at the start of the REFORMATION, after Luther posted his NINETY-FIVE THESES in Wittenberg. It spread through much of Germany and into Scandinavia, where it was established by law. It was brought to the New World by the colonists of New Netherland and NEW SWEDEN and spread through the U.S. Middle Atlantic states in the 18th century and the Midwest in the 19th century. Its doctrines are contained in the catechisms of Luther and in the AUGSBURG CONFESSION. Lutheran doctrine emphasizes SALVATION by faith alone and the primacy of the BIBLE as the church's authority. The Lutheran ministry is one of service—not special status—and is described as the priesthood of all believers. Lutherans accept two sacraments (baptism and the Eucharist) and believe in predestination to salvation. The Lutheran World Federation is based in Geneva. See also PIETISM.

lutite \'lü-ˌtīt\ Any fine-grained sedimentary rock consisting of clay- or silt-sized particles (less than 0.0025 in., or 0.06 mm, in diameter) that are derived principally from nonmarine (continental) rocks. Laminated lutites and lutites that split easily into thin layers are usually called SHALES. Other lutites may be called claystones, siltstones, or mudstones.

Lutosławski \ˌlü-tə-'släv-skē**, Witold** (b. Jan. 25, 1913, Warsaw, Pol.—d. Feb. 7, 1994, Warsaw) Polish composer. Trained in Warsaw, he initially became known as a pianist. His international reputation was secured by the premiere of his *Concerto for Orchestra* (1954), full of colour and based on folk elements, and later the *Funeral Music* for string orchestra (1958). From the late 1950s he incorporated limited aleatory (elements of chance; see ALEATORY MUSIC) effects in his works. His four brilliantly orchestrated symphonies, particularly the *Second* (1967) and *Third* (1983), are widely admired, as are his *Livre pour orchestra* (1968) and his *String Quartet* (1964).

Lutuli \lə-'tü-lē**, Albert (John Mvumbi)** (b. 1898, Rhodesia—d. July 21, 1967, Stanger, S.Af.) ZULU chief and president of the AFRICAN NATIONAL CONGRESS (1952–60). Trained at a mission school, Lutuli taught and served a small community as chief before being elected ANC president. He was frequently imprisoned for his anti-apartheid activities. He set forth his views in *Let My People Go* (1962). In 1960 he became the first African to be awarded the Nobel Prize for Peace.

Lutyens \'lə-chənz**, Sir Edwin L(andseer)** (b. March 29, 1869, London, Eng.—d. Jan. 1, 1944, London) British architect. His design for a house at Munstead Wood, Godalming, Surrey (1896), created for GERTRUDE JEKYLL, established his reputation. In the series of country houses he subsequently designed, many in collaboration with Jekyll, Lutyens adapted past styles to contemporary domestic life in delightful and original ways. For the new Indian capital at Delhi, he devised a plan based on a series of hexagons separated by broad avenues; his most important building there, the Viceroy's House (1912–30), combined aspects of Classical architecture with Indian motifs. After World War I he became architect to the Imperial War Graves Commission, for which he designed the Cenotaph in London (1919–20) and other memorials.

Luxembourg \'lůk-səm-ˌbürk,\ *English* \'lək-səm-ˌbərg\ *officially* **Grand Duchy of Luxembourg** Country, western Europe. Area: 999 sq mi (2,586 sq km). Population (2005 est.): 457,000. Capital: LUXEMBOURG.

Most of the population is ethnically French or German, though there is a proportion of foreign residents, chiefly Portuguese, Italians, French, Belgians, and Germans. Languages: Luxembourgian, French, German. Religion: Christianity (predominantly Roman Catholic). Currency: euro. The country has a maximum length of 51 mi (82 km) and a maximum width of 35 mi (56 km). It is divided into two regions: the Oesling, an extension of the Ardennes Mountains in the northern third of the country consisting of a high plateau dissected by river valleys; and the Bon Pays, or Gutland, a rolling plateau that occupies the rest of the land. Luxembourg's economy is largely based on heavy industry and international trade and banking, and its per capita income is among the highest in the world. It is a constitutional monarchy with two legislative houses; its chief of state is the grand duke, and the head of government is the prime minister. At the time of Roman conquest (53 BC), the area was inhabited by two Belgic tribes, the Treveri and the Mediomatrici. After AD 400, Germanic tribes invaded the region. It later came into CHARLEMAGNE's empire. Made a duchy in 1354, it was ceded to the house of BURGUNDY in 1443 and to the HABSBURGS in 1477. In the mid-16th century it became part of the Spanish Netherlands. The Congress of VIENNA in 1815 made it a grand duchy and awarded it to The Netherlands. After an uprising in 1830, its western portion became part of Belgium, while the remainder was held by The Netherlands. In 1867 the European powers guaranteed the neutrality and independence of Luxembourg. In the late 19th century it built a great steel industry by exploiting its extensive iron ore deposits. It was invaded and occupied by Germany in both world wars. Following World War II, it abandoned its neutrality by joining NATO in 1949. It joined the BENELUX ECONOMIC UNION in 1944 and the EUROPEAN COAL AND STEEL COMMUNITY, a forerunner of the EUROPEAN UNION, in 1952. Luxembourg ratified the MAASTRICHT TREATY on European Union in 1992 and adopted the euro as its official monetary unit in 1999.

Luxembourg City (pop., 2001 prelim.: 76,833), capital of LUXEMBOURG. A rocky promontory along the Alzette River was the site of a Roman fortress and later of a Frankish castle, around which the medieval town developed. Siegfried, count of Ardennes, purchased this castle and made the duchy of Luxembourg independent in 963. The strongest in Europe

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after Gibraltar, the castle was garrisoned by the Prussians as a bulwark of the German Confederation (1815–66); it was dismantled by treaty in 1867. Long an important road and railway focus, the city is also an important industrial and financial centre. It is the seat of the European Court of Justice and several administrative offices of the European Union.

Luxemburg \'lůk-səm-ˌbůrk,\ *English* \'lək-səm-ˌbərg**, Rosa** (b. March 5, 1871, Zamość, Pol., Russian Empire—d. Jan. 15, 1919, Berlin, Ger.) Polish-born German political radical, intellectual, and author. As a Jew in Russian-controlled Poland, she was drawn early into underground political activism. In 1889 she fled to Zürich, Switz., where she obtained her doctorate. Having become involved in the international socialist movement, in 1892 she cofounded what would become the Polish Communist Party. The Russian Revolution of 1905 convinced her that the world revolution would originate in Russia. She advocated the mass strike as the proletariat's most important tool. Imprisoned in Warsaw for agitation, she then moved to Berlin to teach and write (1907–14). Early in World War I she cofounded the Spartacus League (see Spartacists), and in 1918 she oversaw its transformation into the German Communist Party; she was murdered during the Spartacus Revolt less than a month later. She believed in a democratic path to socialism after a world revolution to overthrow capitalism and opposed what she recognized as Vladimir Ilich Lenin's emerging dictatorship.

Rosa Luxemburg.
INTERFOTO/FRIEDRICH RAUCH, MUNICH

Luxemburgian Dialect of German spoken exclusively in Luxembourg. A Moselle-Franconian dialect of the West Middle German group, enriched by many French words and phrases, Luxemburgian is spoken by all classes. Luxembourg's population is generally bilingual or trilingual. Luxemburgian is mostly used orally, French in government and the courts, and German in newspapers; all three languages are used in the schools.

Luxor \'lək-ˌsȯr, 'lůk-ˌsȯr\ *Arabic* **Al-Uqṣur** City (pop., 1996: 360,503), Upper Egypt. Its name has been given to the southern half of the ruins of Thebes. It is centred on the Great Temple of Amon, which was built on the eastern bank of the Nile River by King Amenhotep III in the 14th century BC. Tutankhamen and Horemheb completed the temple, and Ramses II added to it. Ruins include pillars and courts of the original temple as well as the remains of Coptic churches and a mosque. The modern city serves as a tourist centre and as a market for the surrounding agricultural district. See also Karnak.

luxury tax Excise levy on goods or services considered to be luxuries rather than necessities (e.g., jewelry and perfume). Luxury taxes may be levied with the intent of taxing the rich or in a deliberate effort to alter consumption patterns, either for moral reasons or in times of national emergency. Today revenue productivity generally overshadows the moral argument.

Luyia See Luhya

Luzon \lü-'zȯn\ Island (pop., 2000: 37,909,589), Philippines. The country's largest island, with an area of 40,420 sq mi (104,688 sq km), it is the site of Quezon City and Manila, the nation's capital. Located in the northern Philippine archipelago, it is bounded by the Philippine Sea, the Sibuyan Sea, and the South China Sea, and it is separated from Taiwan by the Luzon Strait. It represents one-third of the country's land area and half of its population. It is largely mountainous; in 1991 the eruption of Mount Pinatubo altered the island's geography. It is the country's leader in both industry and agriculture.

Luzon Strait Passage between northern Luzon, Philippines, and southern Taiwan. Connecting the China Sea on the west with the Philippine Sea on the east, and extending 200 mi (320 km), it is part of an important shipping route. A series of channels, it is dotted with the islands of the Batan and Babuyan island groups.

Lviv \lə-'vē-ü,\ *English* \lə-'vēf\ *or* **Lvov** \lə-'vȯf\ City (pop., 2001: 733,000), western Ukraine. Founded c. 1256 by Prince Daniel of Galicia, it came under Polish rule in 1349. Lviv became one of the great medieval trading towns and changed hands many times. It was taken by the Cossacks in 1648 and by the Swedes in 1704. Given to Austria in 1772, it became the capital of the Austrian province of Galicia. It passed to Poland in 1919, after an unsuccessful attempt by Ukrainians to set up a republic (1918). It was seized by the Soviet Union in 1939 and, after German occupation, annexed by the Soviets in 1945. It is now a centre for Ukrainian culture and the seat of a university (founded 1661).

Lvov \lə-'vȯf**, Georgy (Yevgenyevich), Prince** (b. Nov. 2, 1861, Popovka, near Tula, Russia—d. March 7, 1925, Paris, France) Russian politician, first head of the provisional government established during the Russian Revolution of 1917. In 1905 he joined the liberal Constitutional Democratic Party and was elected to the first Duma (1906). He became chairman of the All-Russian Union of Zemstvos (1914) and won the respect of political liberals and army commanders. In March 1917 he became premier but was unable to satisfy the increasingly radical demands of the populace. He resigned in July, after a major left-wing demonstration, in favour of Aleksandr Kerensky. Arrested when the Bolsheviks seized power, he escaped and settled in Paris.

Lyallpur See Faisalabad

Lyautey \lyō-'tā**, Louis-Hubert-Gonzalve** (b. Nov. 17, 1854, Nancy, France—d. July 21, 1934, Thorey) French soldier and first colonial administrator in Morocco under the protectorate (1912–56). Early in his career he served in French Indochina, Madagascar, and Algeria. As resident general in Morocco (1912–24), he pacified the colony and advocated the principle of indirect rule.

Lycaonia \ˌlī-kā-'ō-nē-ə\ Ancient region, southern Anatolia. Situated north of the Taurus Mountains in present-day Turkey, in ancient times it was bounded by the regions of Caria and Pamphylia. It was ruled by Alexander the Great, the Seleucids, the Attalids, and, finally, the Romans. Under Rome it was attached to Galatia and Cappadocia. From Seleucid times on, Iconium (modern Konya) served as its capital. It was visited by St. Paul and by the 4th century had developed an organized ecclesiastical system.

lyceum \lī-'sē-əm\ **movement** Form of adult education popular in the U.S. during the mid-19th century. The lyceums were voluntary local associations that sponsored lectures and debates on topics of current interest. The first was founded in 1826, and by 1834 there were approximately 3,000 in the Northeast and Midwest. They attracted such speakers as Ralph Waldo Emerson, Frederick Douglass, Henry David Thoreau, Daniel Webster, Nathaniel Hawthorne, and Susan B. Anthony. The movement began to decline with the outbreak of the Civil War and eventually blended into the postbellum Chautauqua movement. In their heyday the lyceums contributed to the broadening of the school curricula and the development of local museums and libraries.

lychee See litchi

Lycia \'li-shə\ Ancient district, southwestern Anatolia. Located along the Mediterranean Sea coast in present-day Turkey, in ancient times it was situated between the regions of Caria and Pamphylia. By the 8th century BC it was a thriving maritime country. It later fell to king Cyrus II of the Persian Achaemenian dynasty. Annexed to Roman Pamphylia in AD 43, after the 4th century it became a separate Roman province.

Lycurgus \lī-'kər-gəs\ (fl. 7th century BC?) Legendary founder of the legal institutions of ancient Sparta. Because ancient sources give differing accounts of his career, some scholars conclude that he was not a historical person, but many believe that a man named Lycurgus instituted drastic reforms in Sparta after the revolt of the helots in the 7th century BC. Lycurgus is thought to have devised the militarized communal system that made Sparta unique among Greek city-states and to have determined the powers of the council and the assembly.

Lycurgus (b. c. 390—d. 324 BC) Athenian orator and statesman. He supported Demosthenes in opposing Macedonia. As controller of state finances (338–326), he was noted for his efficient administration and vigorous prosecution of corrupt officials. He reconstituted the army and remodeled the fleet, carried on a major building program that included reconstruction of the theatre of Dionysus, produced the official edition of the dramas of Aeschylus, Sophocles, and Euripides, and worked to restore Athenian cults and festivals.

Lydia Ancient land, western Anatolia. Located in present-day Turkey, it was bounded on the west by the Aegean Sea and profoundly influenced

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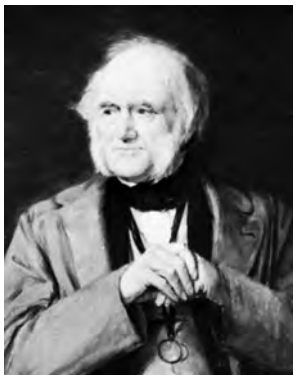
the Ionian Greeks in the 7th–6th centuries BC through such economic developments as the use of metallic coinage. It was conquered by the Persians under CYRUS II in 546 BC. It later passed to Syria and Pergamum, and under the Romans it became part of the province of Asia.

lye Alkaline (see ALKALI) liquid extracted by soaking wood ashes in water, commonly used for washing and in making SOAP. More generally, lye is any strong alkaline solution or solid, such as sodium hydroxide (CAUSTIC SODA) or potassium hydroxide (caustic potash).

Lyell \'lī-əl**, Sir Charles** (b. Nov. 14, 1797, Kinnordy, Forfarshire, Scot.—d. Feb. 22, 1875, London, Eng.) Scottish geologist. While studying law at the University of Oxford, he became interested in geology and later met such notable geologists as ALEXANDER VON HUMBOLDT and GEORGES CUVIER. Lyell came to believe that there were natural (as opposed to supernatural) explanations for all geologic phenomena, a position he supported with many examples in his three-volume *Principles of Geology* (1830–33). A recognized leader in his field, he gained the friendship of other well-known men of science, including the HERSCHEL FAMILY and CHARLES DARWIN, whose *Origin of Species* (1859) persuaded Lyell to accept evolution. Lyell was largely responsible for the general acceptance of the concept of UNIFORMITARIANISM in geology.



Charles Lyell, detail of a replica in oil by Lowes Cato Dickinson, 1883; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Lyly \'li-lē**, John** (b. 1554?, Kent, Eng.—d. November 1606, London) English writer. Educated at Oxford, Lyly gained fame in London with two prose romances, *Euphues* (1578) and *Euphues and His England* (1580). The novels inspired *euphuism*, an elegant, extravagant Elizabethan literary style, and made Lyly the first English prose stylist to leave an enduring impression on the language. As a dramatist he also contributed to the development of prose dialogue in English comedy, a genre to which he devoted himself almost exclusively after 1580. *Endimion* (performed 1588) is considered his finest play.

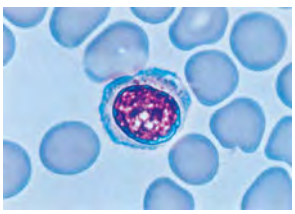
Lyme disease Tick-borne bacterial disease. It was identified in 1975 and named for Old Lyme, Conn. It is caused by a SPIROCHETE, *Borrelia burgdorferi*, transmitted by TICKS, which pick it up in the blood of infected animals, mostly deer. Humans can be bitten by ticks in tall grass or fallen leaves. Lyme disease has three stages: a target-shaped rash, often with flulike symptoms; migrating arthritic pain and neurological symptoms (disturbances to memory, vision, or locomotion); and crippling arthritis with symptoms like those of multiple sclerosis and sometimes with facial paralysis, meningitis, or memory loss. Most cases do not progress beyond the first stage, but those that do reach the third stage within two years. Prevention involves avoiding tick bites. Diagnosis can be difficult, especially if the initial rash is not noticed. Early antibiotic treatment can prevent progression. Advanced cases need more powerful antibiotics, and symptoms may recur.

lymph Pale fluid that bathes tissues, maintaining fluid balance and removing bacteria. It enters the blood system at a vein under the collarbone that it reaches via channels and ducts, being driven through them mainly by surrounding muscle activity. The lymphatic organs (SPLEEN and THYMUS) and LYMPH NODES filter out bacteria and other particles the lymph takes up from body tissues. Lymph contains LYMPHOCYTES and macrophages, the primary cells of the IMMUNE SYSTEM. See also LYMPHATIC SYSTEM.

lymph node Small, rounded mass of LYMPHOID TISSUE contained in CONNECTIVE TISSUE. They occur all along lymphatic vessels, with clusters in certain areas (e.g., neck, groin, armpits). They filter bacteria and other foreign materials out of LYMPH and expose them to LYMPHOCYTES and macrophages that can engulf them; these cells multiply in response to accumulation of such materials, which is why lymph nodes swell during INFECTIONS. The nodes also produce lymphocytes and ANTIBODIES, to be carried by lymph throughout the LYMPHATIC SYSTEM. In HODGKIN DISEASE and other LYMPHOMAS, malignant lymph cells proliferate, causing lymph node enlargement. Other cancers often invade lymphatic vessels, which can carry cells from the tumour to lymph nodes, where they are trapped and grow into secondary tumours. Lymph nodes are therefore removed in cancer surgery to detect or prevent tumour spread.

lymphatic system System of LYMPH NODES, vessels, and nodules and LYMPHOID tissue, including the THYMUS, SPLEEN, TONSILS, and BONE MARROW, through which LYMPH circulates and is filtered. Its primary function is to return proteins, waste products, and fluids to the blood; molecules too big to enter the CAPILLARIES pass through the more permeable walls of lymphatic vessels. Valves keep lymph flowing in one direction, more slowly than blood and at a lower pressure. The lymphatic system also has a role in the IMMUNE SYSTEM. Nodes filter bacteria and foreign matter from lymph. Smaller nodules, which often produce LYMPHOCYTES, form in areas more exposed to such materials. They can merge and become permanent, as in the tonsils. Blockage of a lymph vessel may cause fluid to collect in the tissues, producing lymphedema (tissue swelling). Other lymphatic system disorders include lymphocytic LEUKEMIAS and LYMPHOMA. See also RETICULOENDOTHELIAL SYSTEM.

lymphocyte Type of LEUKOCYTE fundamental to the IMMUNE SYSTEM, regulating and participating in acquired IMMUNITY. Each has receptor molecules on its surface that bind to a specific ANTIGEN. The two primary types, B CELLS and T CELLS, originate from stem cells in BONE MARROW and travel to LYMPHOID TISSUES. When a B cell binds to an antigen, it multiplies to form a clone of identical cells. Some of these, acted on by helper T cells, differentiate into plasma cells that produce ANTIBODIES against the antigen. Others (memory cells) multiply, providing long-term IMMUNITY to the antigen.



Human lymphocyte (phase-contrast microphotograph).
MANFRED KAGE—PETER ARNOLD

lymphoid tissue Cells, tissues, and organs composing the IMMUNE SYSTEM, including the BONE MARROW, THYMUS, SPLEEN, and LYMPH NODES. The most highly organized components are the thymus and lymph nodes, and the least organized are the cells that wander in the loose CONNECTIVE-TISSUE spaces under membranes lining most body systems, where they can establish lymph nodules (local LYMPHOCYTE production centre) in response to ANTIGENS. The most common lymphoid tissue cell is the lymphocyte. Others are macrophages, which engulf foreign materials and probably alter them to initiate the immune response, and reticular cells, which produce and maintain thin networks of fibres as a framework for most lymphoid organs. See also IMMUNITY; LYMPHATIC SYSTEM.

lymphoma \lim-'fō-mə\ Any of a group of malignant diseases (see CANCER) that usually start in the LYMPH NODES or LYMPHOID TISSUES. The two major types, HODGKIN DISEASE and non-Hodgkin lymphoma, each have several subtypes. Diagnosis of either type requires BIOPSY, usually from the lymph nodes. Non-Hodgkin lymphomas may be diffuse (widespread) or nodular (concentrated in nodules); nodular lymphomas generally develop more slowly.

Lynch, David (b. Jan. 20, 1946, Missoula, Mont., U.S.) U.S. director. Trained as an artist, he studied in Europe and began experimenting with film in the late 1960s. In 1977 he made his first feature, *Eraserhead*, a grotesque and nightmarish film that became a cult favourite. He directed the critically acclaimed *The Elephant Man* (1980), the science-fiction *Dune* (1984), and the bizarre mystery *Blue Velvet* (1986). He was noted for his disturbing and dark view of life. His later films include *Wild at Heart* (1990, Golden Palm), *Lost Highway* (1997), *The Straight Story* (1999), and *Mulholland Drive* (2001). He also created the offbeat television series *Twin Peaks* (1990–91).

lynching Execution of a presumed offender by a mob without trial, under the pretense of administering justice. It sometimes involves torturing the victim and mutilating the body. Lynching has often occurred under unsettled social conditions. The term derives from the name of Charles Lynch, a Virginian who headed an irregular court to persecute LOYALISTS during the AMERICAN REVOLUTION. In the United States, lynching was widely used in the post-Reconstruction South against blacks, often to intimidate other blacks from exercising their civil rights.

Lynd \'lind**, Robert (Staughton); and Lynd, Helen** *orig.* **Helen Merrell** (respectively b. Sept. 26, 1892, New Albany, Ind., U.S.—d. Nov.

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1, 1970, Warren, Conn.; b. March 17, 1894, La Grange, Ill., U.S.—d. Jan. 30, 1982, Warren, Ohio) U.S. sociologists. The Lynds taught for several decades at Columbia University and Sarah Lawrence College, respectively. In their collaboration on the studies *Middletown* (1929) and *Middletown in Transition* (1937), classics of sociological literature as well as popular successes, they became the first scholars to apply the methods of CULTURAL ANTHROPOLOGY to the study of a modern Western city (Muncie, Ind.).

Lynn, Loretta *orig.* **Loretta Webb** (b. April 14, 1935, Butcher Hollow, Ky., U.S.) U.S. COUNTRY MUSIC singer. Born in a coalminer's shack, Lynn married at age 13 and bore the first of six children the next year. In 1960 she released her first single, "Honky Tonk Girl," which became a hit. In 1962 she joined the GRAND OLE OPRY, and by the mid-1960s hits such as "Don't Come Home A-Drinkin'" made her one of country's biggest stars. In 1970 she released her signature song, "Coal Miner's Daughter"; it provided the title of a best-selling autobiography and a popular film (1980). Her half-sister, Crystal Gayle (b. 1951), also had a successful recording career.

Lynn Canal Deep fjord, southeastern Alaska, U.S. An important gateway to the Klondike region, it is 80 mi (129 km) long and 6 mi (10 km) wide. The northernmost fjord to penetrate the Coast Mountains, it was named in 1794 by Capt. George Vancouver for his birthplace, King's Lynn, Eng.

lynx Any of three species of short-tailed forest CAT (genus *Lynx*) found in Europe, Asia, and northern North America. The North American lynx (*Lynx canadensis*) is regarded as distinct from the Eurasian and Spanish (Iberian) species. The lynx has long legs, large paws, tufted ears, hairy soles, and a broad, short head. Its coat, which forms a bushy ruff on the neck, is tawny to cream-coloured and mottled with brown and black. Its dense, soft winter fur has been used for trimming garments. Lynx are approximately 30–40 in. (80–100 cm) long, without the 4–8-in. (10–20-cm) tail, and stand about 24 in. (60 cm) high at the shoulder. They weigh 20–45 lb (10–20 kg). Nocturnal and silent except during mating season, lynx live alone or in small groups. They climb and swim well and feed on birds, small mammals, and occasionally deer. Some regional populations of lynx are considered endangered.

Lyon \ˈlyōⁿ\ *English* **Lyons** \ˈlyōⁿ, ˈlī-ənz\ City (pop., 1999: city, 445,452; metro. area, 1,348,932), east-central France. Located at the confluence of the RHÔNE and SAÔNE rivers, it was founded as the Roman military colony Lugdunum in 43 BC (see LORRAINE) and became a principal city of Gaul. It was incorporated in 1032 into the Holy Roman Empire and in 1312 into the kingdom of France. It flourished economically in the 15th century, and by the 17th century it was the silk-manufacturing centre of Europe. It was a centre of the French RESISTANCE movement during World War II. A major river port, it has a diversified economy, including textile, metallurgical, and printing industries. Its many ancient buildings include a Roman theatre, a 12th-century Gothic cathedral, and a 15th-century palace.

Lyon, Councils of 13th and 14th ecumenical councils of the Roman Catholic Church. The First Council of Lyon was convened by Pope INNOCENT IV in 1245 after he fled to Lyon from the besieged city of Rome; the pope deposed the emperor, FREDERICK II, and urged support for Louis IX on the Seventh CRUSADE. At the Second Council in 1274, Pope GREGORY X nominally reunited the Eastern and Western churches, but the Greek clergy soon repudiated the union.

Lyon, Mary (Mason) (b. Feb. 28, 1797, near Buckland, Mass., U.S.—d. March 5, 1849, South Hadley) U.S. pioneer in higher education for women. She studied at various academies, supporting herself from age 17 by teaching. Her success as a teacher and administrator, and the demand for the young women she had trained, led to her plan for a permanent instructional institution for women. The school she founded in South Hadley, Mass., opened in 1837 as the Mount Holyoke Female Seminary (the forerunner of MOUNT HOLYOKE COLLEGE), and she served as its principal until her death.

lyre Stringed musical instrument consisting of a resonating body with two arms and a crossbar to which the strings extending from the resonator are attached. Lyrelike instruments existed in Sumer before 2000 BC. Greek lyres were of two types, the KITHARA and the lyra. The latter had a rounded body and a curved back—often a tortoiseshell—and a skin belly. It was the instrument of the amateur; professionals used the more elaborate kithara. In ancient Greece the lyre was an attribute of APOLLO and symbolized wisdom and moderation. In medieval Europe new varieties of lyre emerged that, like the kithara, were box lyres, although their precise relation to the lyres of Classical antiquity is not known. The lyres of modern East Africa probably reflect ancient diffusion of the instrument via Egypt.

East African bowl lyre; in the Pitt Rivers Museum, Oxford
COURTESY OF THE PITT RIVERS MUSEUM, OXFORD

lyrebird Either of two species of insectivorous suboscine PASSERINES (family Menuridae) named for the shape of their extremely long tail when spread in courtship display. Found in forests in southeastern Australia, lyrebirds are ground dwellers with chickenlike bodies. About 40 in. (1 m) in total length, the male superb lyrebird is the longest of the passerines. He displays in a small clearing, bringing his tail forward so that the beautiful white plumes form a canopy over his head and the lyre-like feathers stand out to the side. In this position, while prancing in rhythm, he sings far-carrying melodious notes interspersed with perfect mimicry of other creatures and even of mechanical sounds.

lyric Verse or poem that can, or supposedly can, be sung to musical accompaniment (in ancient times, usually a lyre) or that expresses intense personal emotion in a manner suggestive of a song. Lyric poetry expresses the thoughts and feelings of the poet and is sometimes contrasted with narrative poetry and verse drama, which relate events in the form of a story. The ELEGY, ODE, and SONNET are important forms of lyric poetry.

Lysander \lī-ˈsan-dər\ (d. 395 BC, Haliartus, Boeotia) Spartan leader in the PELOPONNESIAN WAR. In his first year as admiral he won the support of the Persian king Cyrus the Younger. He defeated the Athenian fleet at Notium (406), causing the dismissal of ALCIBIADES. In 405 he destroyed the Athenian fleet at the Battle of AEGOSPOTAMI; this action closed the grain route and starved the city into surrender. Lysander installed the THIRTY TYRANTS and made his friends governors of Athens's former empire. He suffered a defeat when Sparta allowed the restoration of democracy in Athens (403). Having led an army of Sparta's northern allies into Boeotia, he was killed while attacking Haliartus.

Lysenko \lə-ˈseŋ-kō**, Trofim (Denisovich)** (b. 1898, Karlovka, Ukraine, Russian Empire—d. Nov. 20, 1976, Kiev, Ukraine, U.S.S.R.) Soviet biologist and agronomist. During the Soviet famines of the 1930s, he proposed techniques for the enhancement of crop yields, rejecting orthodox Mendelian GENETICS on the basis of unconfirmed experiments, and gained a large popular following. As director of the Soviet Academy of Sciences' Institute of Genetics (1940–65), he became the controversial "dictator" of Stalinist biology. Claiming, among other things, that wheat plants raised in the appropriate environment would produce seeds of rye, he promised greater, more rapid, and less costly increases in crop yields than other biologists believed possible. Eventually his "grassland" system of crop rotation was abandoned in favour of cultivation with mineral fertilizers, and a hybrid-corn program based on the U.S. example was pursued. In 1964 Lysenko's doctrines were officially discredited, and intensive efforts were made toward reestablishing orthodox genetics in the Soviet Union.

Trofim Lysenko, 1938.
SOVFOTO

Lysias \ˈli-sē-əs\ (b. c. 445—d. c. 380 BC) Greek orator. He was a METIC (resident foreigner) in Athens, and as such he was forbidden to speak as

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a Roman citizen; all his speeches were delivered by others. He and his brother were seized by the ruling oligarchy in 404 as disaffected aliens; his brother was killed but Lysias escaped. He ranks with ANTIPHON as a writer of clear, simple prose of great effectiveness, and his style became one model for Attic Greek prose. Many of his writings survive.

Apoxyomenos, Roman marble copy of Greek bronze by Lysippus, c. 310 BC; in the Vatican Museum, Rome.
ANDERSON—ALINARI FROM ART RESOURCE

lysine \'lī-ˌsēn\ One of the essential AMINO ACIDS, present in many common PROTEINS. Its proportion in the proteins of some important food plants (including wheat and corn) is so small that populations dependent on these grains as the sole source of dietary protein suffer from lysine deficiency, affecting growth in children and general well-being in adults. It is used in biochemical and nutritional research, in pharmaceuticals, in fortified foods, and as a nutritional supplement and feed additive.

Lysippus \lī-'si-pəs\ *or* **Lysippos** (fl. 4th century BC, Sicyon, Greece) Greek sculptor. He was famous for the new and slender proportions of his figures and for their lifelike naturalism. He reportedly made more than 1,500 works, most in bronze. None survive, but some copies may be reliably ascribed to him, including *Apoxyomenos*, a young athlete scraping oil from his skin. Another key work is the colossal Heracles at Sicyon. He made many portrait busts of ALEXANDER THE GREAT from boyhood on; it was said that Alexander would have no other sculptor portray him.

lysogeny \lī-'sä-jə-nē\ Type of life cycle that takes place in a BACTERIOPHAGE after it infects certain types of bacteria. The bacteriophage's genome (entire collection of genes) enters the chromosome of the host bacterium and replicates together with it. No offspring viruses are produced; instead, the infecting virus lies dormant within the host's chromosome until the host is exposed to certain stimuli, such as ultraviolet light. At that point, the virus genome is removed from the host chromosome and begins to multiply, forming new viruses. Finally, the bacterial host is destroyed (lysed), releasing virus particles into the environment to infect new bacterial cells.

lysosome \'lī-sə-ˌsōm\ Membrane-enclosed organelle found in all eukaryotic cells (see EUKARYOTE) that is responsible for the cell's digestion of macromolecules, old cell parts, and microorganisms. Lysosomes contain a wide variety of enzymes that break down macromolecules such as nucleic acids, proteins, and polysaccharides. Many of the products of lysosomal digestion, including amino acids and nucleotides, are recycled back to the cell for use in synthesizing new cellular components.

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M16 rifle *or* **AR-15** Assault rifle adopted as a standard weapon by the U.S. Army in 1967. The M16, designed by Eugene M. Stoner in the 1950s for the ArmaLite Division of Fairchild Engine and Airplane Corp., has both semiautomatic and automatic capabilities. It weighs less than 9 lbs (3.6 kg) when equipped with a 30-round magazine, is 39 in. (99 cm) long, and fires a high-velocity .223-inch (5.56-mm) round. It can be fitted with a 40-mm grenade launcher. The M4 is a compact carbine version of the M16. See also Springfield rifle; AK-47.

M31 See Andromeda Galaxy

Ma, Yo-Yo (b. Oct. 7, 1955, Paris, France) French-born U.S. cellist. Born to Chinese parents in France, he made his cello debut at age five. He attended the Juilliard School and then Harvard University. Praised for his extraordinary technique and rich tone, Ma performed and recorded the standard cello repertoire and received a large number of commissions from contemporary composers. He is known for his many recordings with the pianist Emanuel Ax (b. 1949), for his collaborations with an unusual range of other musicians and artists, and for his energetic work on behalf of music programs for young people and a variety of international causes. In 1998 he founded the Silk Road Project, an arts organization that explores the historical and current exchange of ideas between Asian and Western cultures.

Ma-fa-mu-ts'o See Mapam Yumco

Ma Yuan *or* **Ma Yüan** (b. c. 1160/65, Qiantang, Zhejiang province—d. 1225) Chinese landscape painter. Born into a family of court painters, Ma Yuan began his career under the emperor Xiaozong, became *daizhao* ("painter-in-attendance") under Emperor Guangzong, and received the highest honour, the Golden Belt, under Emperor Ningzong. Apart from these facts, little is known about Ma's life. He occasionally painted flowers and figure subjects, but it was in landscape painting that his genius lay. He executed a number of large landscape screens, all of which are now lost. He also painted tall hanging scrolls depicting steep mountains with streams, waterfalls, and vigorously yet elegantly rendered pine trees. In many of his works, the mountains are pushed to one side, creating a "one corner" composition; between the distant mountains and the foreground rocks, where a scholar may be sitting, lies an expanse of empty space with a suggestion of mist or water. Ma's style was popular with late Song painters, and it is often difficult to distinguish his works from those of his followers. The romantic landscape style of Ma and his contemporary Xia Gui inspired a school of painting that came to be known as the Ma-Xia school, characterized by asymmetrical compositions with simplified ink tones and angular brushstrokes.

maa-alused \'mä-'ä-lü-ˌsed\ In Estonian folk religion, mysterious elves living under the earth. These small folk had suitably tiny possessions, and their world was differently oriented from the mortal world above them (up was down and right was left). People came in contact with them either by chance or at the elves' wish. Legends tell of distraught elves seeking help from humans in cases of difficult childbirth or illness. A human could marry an elf, but such marriages eventually dissolved. In Finland, such elves were called *maahiset*.

Maasai See Masai

Maastricht \mä-'strik̲t,\ *English* \'mä-strikt\ **Treaty** *officially* **Treaty on European Union** Agreement that established the European Union (EU) as successor to the European Community. It bestowed EU citizenship on every national of its member states, provided for the introduction of a central banking system and a common currency (see euro), and committed the member states to work toward a common foreign and security policy. Signed in 1992, it was ratified and took effect in 1993. See also European Court of Justice, European Parliament, Treaties of Rome.

Ma'at \'mä-ˌät\ In ancient Egyptian religion, the personification of truth, justice, and the cosmic order. Ma'at was the daughter of Re, the sun god, and she stood at the head of his bark as it traveled through the sky and the underworld. She was also associated with Thoth, the god of wisdom. The judgment of the dead was believed to be determined by the weighing of the heart of the deceased on a scale she balanced. In its abstract sense, *ma'at* was the divine order established at creation and reaffirmed at the accession of each new king of Egypt.

Maathai, Wangari (b. April 1, 1940, Nyeri, Kenya) Kenyan politician and environmental activist. Maathai was educated in the U.S. and later earned a Ph.D. (1971) at the University of Nairobi, where she then taught veterinary anatomy. In 1977, as a way of conserving land and empowering women, she founded the Green Belt Movement, which recruited women to plant trees in deforested areas; by the early 21st century, it was responsible for the planting of some 30 million trees. Over time the organization also came to include programs in civic and environmental education, advocacy, and job training. Maathai, an outspoken critic of government corruption and supporter of debt cancellation for poor African countries, was elected to Kenya's National Assembly in 2002 and later served as assistant minister of environment, natural resources, and wildlife (2003–05). In 2004 she received the Nobel Prize for Peace, becoming the first black African woman to win a Nobel Prize.

Mabinogion \mä-bē-'nȯg-yən,\ *English* \ˌma-bə-'nō-gē-ən\ Collection of 11 medieval Welsh tales based on mythology, folklore, and heroic legends. The tales have multiple authors and are versions of stories told and retold through the centuries. Among the finest are four stories known as "The Four Branches of the Mabinogi," written in the late 11th century. Some show Celtic, Norman, and French influence; "Peredur Son of Efrawg," for example, parallels Chrétien de Troyes's *Perceval*. Four other tales show little continental influence: "Kulhwch and Olwen," "Lludd and Llefelys," "The Dream of Macsen," and "The Dream of Rhonabwy."

Mabovich, Goldie See Golda Meir

Mabuse See Jan Gossart

Mac ind Óg See Maponos

Mac-Mahon \mȧk-mȧ-'ō[n]**, (Marie-Edme-Patrice-) Maurice, count de** *later* **duke de Magenta** (b. July 13, 1808, Sully, France—d. Oct. 17, 1893, Loiret) French soldier and second president (1873–79) of the Third Republic. Descended from an Irish Jacobite family, he began his army career in 1827 and distinguished himself in the Crimean War and in the Italian campaign at the Battle of Magenta (1859), after which he was made a marshal of France and duke de Magenta. He was governor-general of Algeria (1864–70) and later a commander in the Franco-Prussian War. He was appointed head of the Versailles Army, which defeated the Paris Commune in 1871. He was elected president after the resignation of Adolphe Thiers. During his term the Constitutional Laws of 1875 were promulgated. Mac-Mahon resigned following a constitutional crisis that was resolved in favour of parliamentary control of the government. Thereafter in the Third Republic, the office of president became largely honorific.

macadam \mə-'ka-dəm\ Form of pavement invented by John McAdam. McAdam's road cross-section consisted of a compacted subgrade of crushed granite or greenstone designed to support the load, covered by a surface of light stone to absorb wear and tear and shed water to the drainage ditches. In modern macadam construction, crushed stone or gravel is placed on the compacted base course and bound together with asphalt cement or hot tar. A third layer to fill the spaces is then added and rolled. Cement-sand slurry is sometimes used as the binder.

macadamia \ˌma-kə-'dā-mē-ə\ Any of about 10 species of ornamental evergreen trees, in the family Proteaceae, and their edible, richly flavoured dessert nuts. Macadamias originated in the coastal rainforests and scrubs of northeastern Australia.

Macadamia (*Macadamia ternifolia*)
WALTER DAWN

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Those grown commercially in Hawaii and Australia are principally of two species, the smooth-shelled *Macadamia integrifolia* and the rough-shelled *M. tetraphylla*. Macadamias are grown in quantity also in parts of Africa and South and Central America. Hard to propagate and slow to bear fruit, the trees grow only in rich, well-drained soil in areas receiving 50 in. (130 cm) of rain annually. Fragrant pink or white flower clusters on trees with large, shiny, leathery leaves produce bunches of 1–20 fruits. The nuts contain much fat but are a good source of minerals and vitamin B.

MacAlpin, Kenneth See KENNETH I

macaque \mə-'kak\ Any of about 12 primarily Asian species of omnivorous, diurnal MONKEYS (genus *Macaca*) with cheek pouches for carrying food. Some species have long tails, some have short tails, and some have none. Males are 16–28 in. (41–70 cm) long (excluding the tail) and weigh 12–40 lb (5.5–18 kg). Troops live in mountains and lowlands and along shores. The RHESUS MONKEY (*M. mulatta*) has been important to medical and psychological research. Malays train pig-tailed macaques (*M. nemestrina*) to pick coconuts. See also BARBARY APE; BONNET MONKEY; CELEBES BLACK APE.

MacArthur, Charles (Gordon) (b. Nov. 5, 1895, Scranton, Pa., U.S.—d. April 21, 1956, New York, N.Y.) U.S. journalist, playwright, and screenwriter. He worked as a reporter in Chicago and New York City (1914–26) before collaborating with Edward Shelden on the play *Lulu Belle* (1926). With BEN HECHT he wrote the Broadway hits *The Front Page* (1928; film, 1931) and *Twentieth Century* (1932; film, 1934) and several later plays noted for their graphic, crisp dialogue. Their screenplays included the film adaptations of their own plays and *Wuthering Heights* (1939), and they wrote and directed movies such as *Crime Without Passion* (1934), *The Scoundrel* (1935), and *Soak the Rich* (1936). He was married to actress HELEN HAYES.

MacArthur, Douglas (b. Jan. 26, 1880, Little Rock, Ark., U.S.—d. April 5, 1964, Washington, D.C.) U.S. general. Son of Gen. Arthur MacArthur (1845–1912), he graduated from West Point, of which he became superintendent (1919–22). He rose through the ranks to become general and army chief of staff (1930–35). In 1932 he commanded the troops that evicted the BONUS ARMY. In 1937 he took over command of the Philippine military. At the outbreak of World War II he was recalled to active duty; he led the combined Philippine-U.S. forces in the Philippines until it was overrun by the Japanese (1942). From Australia, he commanded U.S. forces in the South Pacific and directed the recapture of strategic islands, returning as promised ("I shall return") to liberate the Philippines in 1944. Promoted to general of the army, he received Japan's surrender on Sept. 2, 1945. As Allied commander of the postwar OCCUPATION of Japan (1945–51), he directed the restoration of the country's economy and the drafting of a democratic constitution. As commander of UN forces in the KOREAN WAR in 1950, he stemmed the advance of North Korean troops. His request for authority to bomb China was rejected by Pres. HARRY TRUMAN; when MacArthur made the dispute public, Truman relieved him of his command, for insubordination. He returned to the U.S. to a hero's welcome, though many deplored his egotism. He was twice (1948, 1952) seriously considered for the Republican Party nomination for president.

MacArthur-Forrest process See CYANIDE PROCESS

Macassar See UJUNG PANDANG

Macau \mə-'kaù\ *or* **Macao** *Chinese* **Aomen** \'aù-'men\ Special administrative region (pop., 2005 est.: 470,000), southern CHINA. Located on the South CHINA SEA coast about 40 mi (64 km) west of HONG KONG, it consists of a small peninsula, which projects from GUANGDONG province, and two small islands. Its total land area is 10.6 sq mi (27.5 sq km). Macau city is the administrative centre. Portuguese traders first arrived in Macau in 1513, and it soon became the chief market centre for trade between China and Japan. Portugal declared it an overseas province in 1844 and an overseas territory in 1951. In 1999 Portugal returned it to Chinese rule. Tourism and gambling are the mainstays of its economy.

Macaulay \mə-'kò-lē**, Thomas Babington, Baron Macaulay of Rothley** (b. Oct. 25, 1800, Rothley Temple, Leicestershire, Eng.—d. Dec. 28, 1859, Campden Hill, London) English politician, historian, and poet. While a fellow at Cambridge University, Macaulay published the first of his essays, on JOHN MILTON (1825), and gained immediate fame. After entering Parliament in 1830, he became known as a leading orator. From 1834 he served on the Supreme Council in India, supporting the equality of Europeans and Indians before the law and inaugurating a national educational system. He reentered Parliament on returning to England in 1838. He published *Lays of Ancient Rome* (1842) and *Critical and Historical Essays* (1843) before retiring to private life and beginning his brilliant *History of England*, 5 vol. (1849–61); covering the period 1688–1702, it established a WHIG interpretation of English history that influenced generations.

Thomas Babington Macaulay, detail of an oil painting by J. Partridge, 1840; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

macaw \mə-'kò\ Any of about 18 species of large tropical New World PARROTS (subfamily Psittacinae) with very long tails and big sickle-shaped beaks. Macaws eat fruits and nuts. They are easily tamed and often kept as pets; some learn to mimic human speech, but most only screech. A few have lived 65 years. Best known is the scarlet macaw (*Ara macao*), found from Mexico to Brazil, a 36-in. (90-cm) bright-red bird with blue and yellow wings, blue and red tail, and white face.

MacBride, Seán (b. Jan. 26, 1904, Paris, France—d. Jan. 15, 1988, Dublin, Ire.) Irish statesman. Born to Irish patriots—his mother was WILLIAM BUTLER YEATS's beloved Maud Gonne (1866–1953), and his father was Maj. John MacBride, executed for his part in the 1916 Easter Rising—he became chief of staff of the IRISH REPUBLICAN ARMY at age 24, but he eventually accepted the fact of partition and the futility of warfare. In 1936 he founded the Irish Republican Party; he served in the Irish legislature (1947–58) and as minister of external affairs (1948–51). He was the first chairman of AMNESTY INTERNATIONAL (1961–75). He also served as UN assistant secretary-general for South West Africa and Namibia (1973–77). In 1974 he was awarded the Nobel Prize for Peace for his efforts on behalf of human rights.

Maccabees \'ma-kə-ˌbēz\ (fl. 2nd century BC) Priestly family of Jews who organized a successful rebellion against ANTIOCHUS IV EPIPHANES in Palestine and reconsecrated the defiled Temple of JERUSALEM. The rebellion began under the leadership of the Jewish priest Mattathias after Antiochus sought to stamp out Judaism by forbidding all Jewish practices and desecrating the temple (167 BC). When Mattathias died (c. 166 BC), his son JUDAS MACCABAEUS recaptured Jerusalem and reconsecrated the temple, an event celebrated in the holiday HANUKKAH. After Judas's death, the war continued intermittently under his brothers Jonathan and Simon. The Maccabees formed the HASMONEAN DYNASTY.

Macchiaioli \ˌmäk-kē-ˌī-'ò-lē\ Group of 19th-century Tuscan painters who reacted against the rule-bound art academies and looked to nature for instruction. The Macchiaioli felt that patches (*macchia*) of colour were the most significant aspect of painting. They believed that the effect of a painting on the spectator should derive from the painted surface itself, rather than from any ideological message or narrative. The Macchiaioli used a sketch technique to record their initial impressions of nature—often as seen from a distance—by means of colour and light. Their theory, similar to that of the French IMPRESSIONISTS, was even more concerned with the experimental use of colour. The most outstanding artist of the group was the Florentine Giovanni Fattori.

MacDiarmid, Alan G. (b. April 14, 1927, Masterson, N.Z.) U.S. chemist. He earned Ph.D.'s in chemistry at the University of Wisconsin at Madison (1953) and the University of Cambridge (1955). He then began teaching at the University of Pennsylvania, becoming Blanchard Professor of Chemistry there in 1988. With ALAN J. HEEGER and SHIRAKAWA HIDEKI, he demonstrated that certain plastics can be chemically altered to be almost as conductive as metals. The discovery led scientists to uncover other conductive polymers, which contributed to the growing field of molecular electronics. In 2000 he received the Nobel Prize for Chemistry with Heeger and Shirakawa.

MacDiarmid \mək-'dər-məd**, Hugh** *orig.* **Christopher Murray Grieve** (b. Aug. 11, 1892, Langholm, Dumfriesshire, Scot.—d. Sept. 9, 1978, Edinburgh) Scottish poet. In 1922 he founded the monthly *Scottish Chapbook*, in which he published his lyrics and sparked the Scottish literary renaissance. A radical leftist, he rejected English as a medium and

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scrutinized modern society in verse written in "synthetic Scots," an amalgam of various dialects. A noted work is the extended rhapsody *A Drunk Man Looks at the Thistle* (1926). He later returned to standard English in such volumes as *A Kist of Whistles* (1947) and *In Memoriam James Joyce* (1955). He is regarded as Scotland's preeminent poet of the early 20th century.

Macdonald, Dwight (b. March 24, 1906, New York, N.Y., U.S.—d. Dec. 19, 1982, New York City) U.S. writer and film critic. He graduated from Yale University. During World War II he founded the magazine *Politics*, which featured the work of such figures as André Gide, Albert Camus, and Marianne Moore. One of the first serious film critics, he was a staff writer for *The New Yorker* (1951–71) and reviewed films for *Esquire* magazine (1960–66). Politically, he moved from Stalinism through Trotskyism and anarchism to pacifism. During the Vietnam War he urged young men to defy the draft. His best-known collection of essays is *Against the American Grain* (1963).

MacDonald, (James) Ramsay (b. Oct. 12, 1866, Lossiemouth, Moray, Scot.—d. Nov. 9, 1937, at sea en route to South America) British politician, first Labour Party prime minister of Britain (1924, 1929–31, 1931–35). He joined the precursor of the Labour Party in 1894 and was its secretary from 1900 to 1911. He was a member of the House of Commons (1906–18), where he served as leader of the Labour Party (1911–14), before he was forced to resign after opposing Britain's participation in World War I. Reelected to Parliament in 1922, he led the Labour opposition. He became prime minister in 1924 with Liberal Party support, but he was forced to resign later that year when Conservatives regained a majority. In 1929 Labour won a majority and he returned as prime minister. In 1931 he offered his resignation during the Great Depression but decided instead to remain in office as head of a national coalition until 1935, when Stanley Baldwin became prime minister. MacDonald remained in the government as lord president of the council until 1937.

Macdonald, Sir John (Alexander) (b. Jan. 11, 1815, Glasgow, Scot.—d. June 6, 1891, Ottawa, Ont., Can.) Canadian politician, first prime minister of the Dominion of Canada (1867–73, 1878–91). He immigrated to Canada as a child and practiced law in Kingston, Upper Canada (now Ontario), from 1836. From 1844 to 1854 he served in the Province of Canada's assembly. He cofounded the Liberal-Conservative Party (see Progressive Conservative Party of Canada) in 1854 and became premier of the Province of Canada in 1857. He worked for confederation and helped secure passage of the British North America Act, which created the Dominion of Canada (1867). As prime minister, he supported trade protectionism and aided the completion of the Pacific railway. In response to later challenges to Canadian unity, he advocated loyalty to the British Commonwealth and independence from the U.S.

Macdonnell Ranges Mountain system, south-central Northern Territory, Australia. Extending east and west of the town of Alice Springs for some 250 mi (400 km), its highest peak is Mount Ziel (4,954 ft [1,510 m]). The mountains were first explored in 1860 by John McDouall Stuart and were named after Richard Macdonnell, governor of South Australia.

Macdonough \mək-'dä-nə**, Thomas** (b. Dec. 31, 1783, The Trap, Del., U.S.—d. Nov. 10, 1825, at sea en route from the Mediterranean Sea to New York City) U.S. naval officer. He joined the navy in 1800 and served with Stephen Decatur in the Tripolitan War. In the War of 1812 he was ordered to cruise the lakes between Canada and the U.S. When British troops threatened Plattsburg, N.Y., site of U.S. Army headquarters on the northern frontier, he sailed his 14-ship fleet to meet the British 16-ship squadron on Lake Champlain. His victory there (Sept. 11, 1814) saved New York and Vermont from invasion.

MacDowell, Edward (Alexander) *orig.* **Edward Alexander McDowell** (b. Dec. 18, 1860, New York, N.Y., U.S.—d. Jan. 23, 1908, New York City) U.S. composer. He started piano lessons at age eight. While in Germany for further study, he impressed the composer Joachim Raff (1822–82), who urged him to write a piano concerto (1882), then introduced him to Franz Liszt, who assisted MacDowell with performances and publication. In 1888 he returned to the U.S. with his wife, and in 1896 he became Columbia University's first professor of music. Paresis made him unable to perform or compose after 1904, and he lapsed into insanity and died at age 47. His farm in Peterborough, N.H., became the MacDowell Colony for artists after his death. His most popular works are the *Second Piano Concerto in D Minor* (1886), the *Second Orchestral* ("*Indian*") *Suite* (1895), and piano sets such as *Woodland Sketches* (1896) and *Sea Pieces* (1898).

Macedonia *officially* **Republic of Macedonia** Country, Balkan Peninsula, southeastern Europe. Area: 9,928 sq mi (25,713 sq km). Population (2005 est.): 2,034,000. Capital: Skopje. About two-thirds of the

population are Macedonians, and about one-fourth are Albanians. Languages: Macedonian, Albanian. Religions: Christianity (predominantly Eastern Orthodox; also Roman Catholic), Islam. Currency: denar. Located on a high plateau studded with mountains, Macedonia is one of the poorest countries in Europe. Although its importance has diminished recently, agriculture remains central to the economy, with tobacco, fruit, vegetables, and wine notable. Sheepherding is also significant. The manufacturing base includes iron and steel, textiles, and chemicals and chemical products. Macedonia is a republic with one legislative house; its head of state is the president, and the head of government is the prime minister. The Macedonian region has been inhabited since before 7000 BC. Under Roman rule, part of the region was incorporated into the province of Moesia in AD 29. It was settled by Slavic tribes by the mid-6th century and was Christianized during the 9th century. Seized by the Bulgarians in 1185, it was ruled by the Ottoman Empire from 1371 to 1912. The north and centre of the region were annexed by Serbia in 1913 and became part of the Kingdom of Serbs, Croats, and Slovenes (later Yugoslavia) in 1918. When Yugoslavia was partitioned by the Axis Powers in 1941, Yugoslav Macedonia was occupied principally by Bulgaria. Macedonia once again became a republic of Yugoslavia in 1946. After Croatia and Slovenia seceded from Yugoslavia, fear of Serbian dominance prompted Macedonia to declare its independence in 1991. In deference to Greece, which also has an area traditionally known as Macedonia, the country joined the United Nations in 1993 under the name The Former Yugoslav Republic of Macedonia and normalized relations with Greece in 1995. Ethnic strife has periodically endangered national stability—e.g., in 2001, when pro-Albanian rebel forces in the north, near the Kosovo border, led guerrilla attacks on government forces.

Macedonian language See Bulgarian language

Macedonian Wars Three wars fought by Philip V of Macedonia and his successor, Perseus, against Rome (215–205 BC, 200–197, 171–167). The first war, fought by Rome in the context of the Second Punic War, ended favourably for the Macedonians. Rome was victorious in the next two wars. The Macedonian forces were assisted by Carthage and the Seleucids, Rome by the Aetolian League and Pergamum. After Rome's vic-

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tory at the Battle of Pydna (168), Macedonian territory was divided into four republics. Another conflict, fought in 149–148, may be considered a fourth Macedonian War; it resulted in a decisive Roman victory, and in its aftermath Macedonia became the empire's first province.

Macfadden, Bernarr *orig.* **Bernard Adolphus McFadden** (b. Aug. 16, 1868, near Mill Spring, Mo., U.S.—d. Oct. 12, 1955, Jersey City, N.J.) U.S. publisher and champion of physical health. A sickly orphan by age 11, he began in his teens to increase his strength as an act of defiance. In 1899 he began publishing *Physical Culture* magazine, and in later decades he built up a publishing empire, bringing out the first confession magazine, *True Story* (1919), followed by *True Romances* (1923), *True Detective Mystery Magazine* (1924), and other periodicals. Macfadden also toured widely to promote his message of vigorous physical exercise and to preach about the dangers of alcohol, drugs, gluttony, corsets, prudishness, tea, coffee, and white bread. Shocking to Victorian sentiments were his advocacy of a diet consisting of carrots, beans, nuts, and raw eggs and his encouragement of sleeping on the floor, nudity, and "physical love." To promote such "love," he encouraged openness about sexual matters and invented a device to enlarge men's penises. To exemplify fitness, he walked five miles daily to his office in Manhattan in bare feet while carrying a 40-pound bag of sand. He also staged the first physique (bodybuilding) contest in America (1903) and fostered the rise of fitness icon Charles Atlas. Macfadden's bids for the presidency, U.S. Senate, and governorship of Florida all failed. Physically fit into old age, he parachuted into Paris on his 84th birthday.

Mach \'mäk,\ *English* \'mäk**, Ernst** (b. Feb. 18, 1838, Chirlitz-Turas, Moravia—d. Feb. 19, 1916, Haar, Ger.) Austrian physicist and philosopher. After earning a doctorate in physics in 1860, he taught at the Universities of Vienna and Graz as well as Charles University in Prague. Interested in the psychology and physiology of sensation, in the 1860s he discovered the physiological phenomenon known as Mach's bands, the tendency of the human eye to see bright or dark bands near the boundaries between areas of sharply differing illumination. He later studied movement and acceleration and developed optical and photographic techniques for measuring sound waves and wave propagation. In 1887 he established the principles of supersonics and the Mach number, the ratio of the velocity of an object to the velocity of sound. He also proposed the theory of inertia known as Mach's principle. In *Contributions to the Analysis of the Sensations* (1886), he asserted that all knowledge is derived from sensory experience or observation.

Machado de Assis \mə-'shä-dō-dē-ä-'sēs**, Joaquim Maria** (b. June 21, 1839, Rio de Janeiro, Braz.—d. Sept. 29, 1908, Rio de Janeiro) Brazilian poet, novelist, and short-story writer. Machado began to write in his spare time while working as a printer's apprentice. By 1869 he was a successful man of letters. His witty, pessimistic works, rooted in European cultural traditions, include the eccentric first-person narrative *Epitaph of a Small Winner* (1881) and the novels *Philosopher or Dog?* (1891) and *Dom Casmurro* (1899), the latter his masterpiece. Considered the classic master of Brazilian literature, he became the first president of the Brazilian Academy of Letters in 1896.

Guillaume de Machaut, detail of a miniature from *Oeuvres de Guillaume de Machaut*, c. 1370–80; in the Bibliothèque Nationale (Ms. Fr. 1584).
COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS

Machaut \mä-'shō**, Guillaume de** *or* **Guillaume de Machault** (b. c. 1300, Machault, France—d. 1377, Reims) French poet and composer. After possibly receiving a university education and taking holy orders, he traveled throughout Europe as secretary to the king of Bohemia. He was appointed canon of Reims cathedral in 1337. After the king's death, Machaut was supported by several royal patrons, including the duke de Berry, and King Charles V. Beside 14 narrative poems incorporating short lyrics, he wrote more than 400 separate lyric poems. He wrote dozens of musical compositions in each of the genres of formes fixes. He also composed the first complete setting of the mass for four voices, and he was the outstanding figure of the Ars Nova. His poetry is noted chiefly for its technical innovations. Geoffrey Chaucer's *Book of the Duchesse* shows the influence of Machaut.

Machiavelli \ˌmä-kē-ə-'vel-ē**, Niccolò** (b. May 3, 1469, Florence—d. June 21, 1527, Florence) Italian statesman, historian, and political theorist. He rose to power after the overthrow of Girolamo Savonarola in 1498. Working as a diplomat for 14 years, he came in contact with the most powerful figures in Europe. He was dismissed when the Medici family returned to power in 1512, and during the next year he was arrested and tortured for conspiracy. Though soon released, he was not permitted to return to public office. His famous treatise *The Prince* (1513, published 1532) is a handbook for rulers; though dedicated to Lorenzo de' Medici, ruler of Florence from 1513, it failed to win Machiavelli his favour. Machiavelli viewed *The Prince* as an objective description of political reality. Because he viewed human nature as venal, grasping, and thoroughly self-serving, he suggested that ruthless cunning is appropriate to the conduct of government. Though admired for its incisive brilliance, the book also has been widely condemned as cynical and amoral, and "Machiavellian" has come to mean deceitful, unscrupulous, and manipulative. His other works include a set of discourses on Livy (completed c. 1518), the comedy *The Mandrake* (completed c. 1518), *The Art of War* (published 1521), and the *Florentine Histories* (completed c. 1525).

Niccolò Machiavelli, detail of an oil painting by Santi di Tito; in the Palazzo Vecchio, Florence.
ALINARI/ART RESOURCE, NEW YORK

machine Device that amplifies or replaces human or animal effort to accomplish a physical task. A machine may be further defined as a device consisting of two or more parts that transmit or modify force and motion in order to do work. The five simple machines are the lever, the wedge, the wheel and axle, the pulley, and the screw; all complex machines are combinations of these basic devices. The operation of a machine may involve the transformation of chemical, thermal, electrical, or nuclear energy into mechanical energy, or vice versa. All machines have an input, an output, and a transforming or modifying and transmitting device. Machines that receive their input energy from a natural source (such as air currents, moving water, coal, petroleum, or uranium) and transform it into mechanical energy are known as prime movers; examples include windmills, waterwheels, turbines, steam engines, and internal-combustion engines.

machine gun Automatic weapon capable of rapid, sustained fire, usually 500–1,000 rounds per minute. Developed in the late 19th century by such inventors as Hiram Maxim, it profoundly altered modern warfare. The World War I battlefield was dominated by the belt-fed machine gun, which remained little changed into World War II. Modern machine guns are classified into three groups: the squad automatic weapon, chambered for small-calibre assault-rifle ammunition and operated by one soldier; the general-purpose machine gun, firing full-power rifle ammunition and operated by two; and the heavy machine gun, firing rounds of 12.7 mm (.5 in) or higher and often mounted on an armoured vehicle. See also submachine gun.

machine language *or* **machine code** Elemental language of computers, consisting of a string of 0s and 1s. Because machine language is the lowest-level computer language and the only language that computers directly understand, a program written in a more sophisticated language (e.g., C, Pascal) must be converted to machine language prior to execution. This is done via a compiler or assembler. The resulting binary file (also called an executable file) can then be executed by the CPU. See also assembly language.

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machine tool Stationary, power-driven machine used to cut, shape, or form materials such as metal and wood. Machine tools date from the invention of the STEAM ENGINE in the 18th century; most common machine tools were designed by the middle of the 19th century. Today dozens of different machine tools are used in the workshops of home and industry. They are frequently classified into seven types: turning machines such as LATHES; SHAPERS and PLANERS; power DRILLS or DRILL PRESSES; MILLING machines; GRINDING MACHINES; power SAWS; and presses (e.g., PUNCH PRESSES).

machismo \mä-'chēz-mō\ Exaggerated pride in masculinity, perceived as power, often coupled with a minimal sense of responsibility and disregard of consequences. In machismo there is supreme valuation of characteristics culturally associated with the masculine and a denigration of characteristics associated with the feminine. It has for centuries been a strong current in Latin American politics and society. CAUDILLOS (military dictators), prominent in the history of Latin America, have typified machismo with their bold and authoritarian approach to government and their willingness to employ violence to achieve their ends.

Mach's principle \'mäks\ Hypothesis that the inertial forces acting on a body in accelerated motion are determined by the quantity and distribution of MATTER in the universe. ALBERT EINSTEIN found its suggested connection between geometry and matter helpful in formulating his theory of general RELATIVITY; unaware that GEORGE BERKELEY had proposed similar views in the 18th century, he attributed the idea to ERNST MACH. He abandoned the principle when he realized that INERTIA is assumed in the geodesic equation of motion (see GEODESY) and need not depend on the existence of matter elsewhere in the universe.

Machu Picchu \'mä-chü-'pēk-chü\ Ancient fortress city of the INCAS in the ANDES MOUNTAINS, south-central Peru. Perched near CUZCO in a narrow saddle between two sharp peaks, at an elevation of 7,710 ft (2,350 m), it escaped detection by the Spaniards, and its existence was made known only in 1911 by U.S. explorer Hiram Bingham. One of the few pre-Columbian urban centres found nearly intact, it is about 5 sq mi (13 sq km) in area and includes a temple and a citadel. The period of occupancy is uncertain. Made a UNESCO WORLD HERITAGE SITE in 1983, it is a popular tourist attraction.

Machu Picchu.
MAYES/FPG

MacIver \mə-'kē-vər**, Robert M(orrison)** (b. April 17, 1882, Stornoway, Outer Hebrides, Scot.—d. June 15, 1970, New York, N.Y., U.S.) Scottish-born U.S. sociologist and political scientist. He taught at the University of Aberdeen and later at Canadian and U.S. universities, principally Columbia (1915–26). He believed in the compatibility of individualism and social organization and saw societies as evolving from highly communal states to states in which individual functions and group affiliations were extremely specialized. His works included *The Modern State* (1926), *Leviathan and the People* (1939), and *The Web of Government* (1947).

Mack, Connie *orig.* **Cornelius (Alexander) McGillicuddy** (b. Dec. 22/23, 1862, East Brookfield, Mass., U.S.—d. Feb. 8, 1956, Philadelphia, Pa.) U.S. baseball manager and team executive. Mack played professional baseball (1886–96), usually as a catcher, before becoming manager of the Milwaukee Brewers (1897–1900) and the Philadelphia Athletics (1901–50). He was president of the Athletics from 1937 to 1953. His teams won 3,776 games and lost 4,025, both all-time records. He helped establish the AMERICAN LEAGUE.

Mackenzie \mə-'ken-zē**, Alexander** (b. Jan. 28, 1822, Logierait, Perth, Scot.—d. April 17, 1892, Toronto, Ont., Can.) Scottish-born Canadian politician, first Liberal prime minister of Canada (1873–78). He emigrated to Canada West (now Ontario) in 1842. In 1852 he became editor of a local Liberal newspaper and befriended GEORGE BROWN, leader of the Reform Party. When the Dominion of Canada was created in 1867, Mackenzie was elected to the House of Commons, where he led the Liberal opposition. As prime minister, his efforts at renewed reciprocity with the U.S. failed to address economic concerns, and his government was defeated in 1878. He resigned as leader of the opposition but held a seat in Parliament until his death.

Mackenzie, Sir Alexander (b. 1755?, Stornoway, Lewis and Harris, Outer Hebrides, Scot.—d. March 11, 1820, near Pitlochry, Perth) Scottish-born Canadian explorer. Immigrating to Canada as a young man, he entered a fur-trading firm in 1779. In 1788 he set up a trading post, Fort Chipewyan, on Lake Athabasca. From there he began an expedition (1789) that followed the Mackenzie River from Great Slave Lake to the Arctic Ocean. In 1793 he journeyed from Fort Chipewyan through the Rocky Mountains to the Pacific coast, thereby becoming the first European to complete a transcontinental crossing north of Mexico.

Mackenzie, Sir (Edward Montague) Compton (b. Jan. 17, 1883, West Hartlepool, Durham, Eng.—d. Nov. 30, 1972, Edinburgh, Scot.) British novelist and playwright. Educated at Oxford University, he gave up legal studies to finish his first play, *The Gentleman in Grey* (1906). During World War I he directed the Aegean Intelligence Service in Syria; when he wrote about those experiences in *Greek Memories* (1932), he was prosecuted under Britain's Official Secrets Act. He founded *Gramophone* magazine in 1923 and edited it until 1962. He served as rector of Glasgow University (1931–34) and as literary critic for the London *Daily Mail*; his more than 100 novels, plays, and biographies include 10 volumes of memoirs.

Mackenzie, Sir James (b. April 12, 1853, Scone, Perthshire, Scot.—d. Jan. 26, 1925, London, Eng.) Scottish cardiologist. He received his M.D. from the University of Edinburgh and practiced medicine in Lancashire for 25 years before moving to London. His classic *The Study of the Pulse* (1902) described an instrument called a polygraph, which simultaneously recorded arterial and venous pulses so that they could be correlated with the heartbeat to distinguish harmless from dangerous irregularities. A pioneer in the study of cardiac arrhythmia, he also proved the efficacy of digitalis for its treatment.

Mackenzie, William Lyon (b. March 12, 1795, Springfield, Angus, Scot.—d. Aug. 28, 1861, Toronto) Scottish-born Canadian journalist and political agitator. He immigrated to Canada in 1820 and became a merchant in Upper Canada (later Ontario). In 1824 he founded a newspaper in Queenston, the *Colonial Advocate*, in which he criticized the ruling oligarchy in Upper Canada. Elected to the province's assembly (1828–36), he was expelled six times by the conservative majority for his newspaper's invectives against the government. A list of Canadian grievances against British colonial rule that he published led to the recall of the province's governor. In 1837 he led 800 followers in an unsuccessful attempt to overthrow the provincial government. After attempting to rally his forces on Navy Island in the Niagara River, N.Y., he was jailed for violating U.S. neutrality laws. He returned to Canada in 1849 and later served in the Canadian Parliament (1851–58).

Mackenzie River River system, Northwest Territories, Canada. It flows northward from GREAT SLAVE LAKE into the Beaufort Sea of the Arctic Ocean. Its basin, with an area of 697,000 sq mi (1,805,200 sq km), is the largest in Canada. It is 1,025 mi (1,650 km) long and 1–2 mi (1.5–3 km) wide. With the Finlay River, its farthest headstream, the entire system is 2,635 mi (4,241 km) long, making it the second longest river in North America. It was discovered by the explorer ALEXANDER MACKENZIE in 1789.

mackerel Swift-moving, carnivorous, torpedo-shaped food and sport fishes (family Scombridae, order Perciformes) of temperate and tropical seas worldwide. Mackerels are 1–5.5 ft (30–170 cm) long. The common mackerel (*Scomber scombrus*) of the North Atlantic Ocean and the chub mackerel (*S. colias*) of the Pacific and Atlantic oceans are economically important, as are the Indian mackerels (genus *Rastrelliger*) and the frigate mackerels (genus *Auxis*). Other species (genus *Scomberomorus*) are favourite game fish. The name *mackerel* also refers to certain shark species (see MACKEREL SHARK), TUNA, and BONITO.

mackerel shark Any of several temperate-water SHARKS (genus *Lamna*) in a family (Isuridae) that also includes the GREAT WHITE SHARK and the MAKO shark group. The swift, active mackerel sharks have a crescent-shaped tail and slender teeth. They are gray or blue-gray above and paler below and about 10 ft (3 m) long. They eat fishes such as herring, mackerel, and salmon, sometimes taking fishermen's catches and damaging

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nets. They are fished commercially for food. Common species include the Atlantic mackerel shark, or porbeagle (*L. nasus*), and the Pacific mackerel shark, or salmon shark (*L ditropis*).

Mackerel shark (*Lamna nasus*)
PAINTING BY RICHARD ELLIS/ENCYCLOPÆDIA BRITANNICA, INC.

Mackinac \'ma-kə-ˌnȯ**, Straits of** Channel connecting Lake Michigan with Lake Huron. Forming an important waterway between the Upper and Lower peninsulas of Michigan, U.S., the straits are 30 mi (48 km) long and 4 mi (6 km) wide at their narrowest point. They are spanned by the Mackinac Bridge, a 3,800-ft (1,158-m) suspension bridge built in 1957.

Mackinac Island Island in the Straits of Mackinac, southeastern Upper Peninsula of Michigan, U.S. It is 3 mi (5 km) long. It was an ancient Indian burial ground called Michilimackinac when the British built a fort there in 1780. After the U.S. took possession in 1783, it became the headquarters of the American Fur Co. Occupied by the British during the War of 1812, the island returned to U.S. control in 1815. It has been a state park since 1895; automobiles are banned from the island. A popular tourist destination, the island is home to the Grand Hotel (1887), the world's largest summer hotel.

Mackinaw trout See lake trout

Mackintosh, Charles Rennie (b. June 7, 1868, Glasgow, Scot.—d. Dec. 10, 1928, London, Eng.) Scottish architect, furniture designer, and artist. A giant of the Arts and Crafts Movement, he is especially revered for his glass-and-stone studio building at the Glasgow School of Art (1896–1909), where he had attended classes. In the 1890s he achieved an international reputation creating unorthodox posters, craftwork, and furniture. Considered Britain's first designer of true Art Nouveau architecture, he produced work of an unrivaled lightness, elegance, and originality, as exemplified by four remarkable tearooms he designed in Glasgow (1896–1904). By 1914 he was dedicating all his energies to watercolour painting. The late 20th century saw a revival of interest in his work and the manufacture of reproductions of his chairs and settees, which were characterized by starkly simple geometric lines.

MacLaine, Shirley *orig.* **Shirley McLean Beaty** (b. April 24, 1934, Richmond, Va., U.S.) U.S. film actress. She worked as a dancer on Broadway. After replacing the injured star in *The Pajama Game* (1954), she was discovered by a film producer and made her movie debut in Alfred Hitchcock's *The Trouble with Harry* (1955). Known for her deft portrayal of charmingly eccentric characters, she went on to play comic and dramatic roles in *Some Came Running* (1959), *The Apartment* (1960), *Irma La Douce* (1963), *Sweet Charity* (1969), *The Turning Point* (1977), *Terms of Endearment* (1983, Academy Award), *Madame Sousatzka* (1988), and *Mrs. Winterbourne* (1996). She wrote several best-selling books, often about her mystical experiences, including *Out on a Limb* (1983) and *Going Within* (1989). She is the sister of Warren Beatty.

Maclean, Donald See Guy Burgess

Maclean's \mə-'klānz\ Weekly newsmagazine published in Toronto, the leading Canadian magazine. It provides coverage of Canadian affairs and world news from a Canadian perspective. Founded by John Bayne Maclean as *The Business Magazine* in 1905, its large-page format presented feature articles and fiction reflecting a conservative view of Canadian life and values and developed a reputation for outstanding photography. The magazine took its current name in 1911. After experiencing losses in the 1960s, *Maclean's* reduced its page size and moved from biweekly to monthly circulation in the 1970s; this continued until the magazine's finances revived, and in 1978 *Maclean's* became Canada's first weekly newsmagazine.

MacLeish \mə-'klēsh**, Archibald** (b. May 7, 1892, Glencoe, Ill., U.S.—d. April 20, 1982, Boston, Mass.) U.S. poet, playwright, teacher, and public official. He practiced law before leaving for France in 1923 to perfect his poetic craft. His early poems "Ars Poetica" (1926) and "You, Andrew Marvell" (1930) are often anthologized. He later expressed his concern for democratic ideals in "public" verse such as *Conquistador* (1932, Pulitzer Prize) and *Public Speech* (1936). Other works include *Collected Poems* (1952, Pulitzer Prize) and the verse drama *J.B.* (1958, Pulitzer Prize). He served as librarian of Congress (1939–44) and assistant secretary of state (1944–45) and later taught at Harvard (1949–62).

MacLennan \mə-'klen-ən**, (John) Hugh** (b. March 20, 1907, Glace Bay, Cape Breton, Nova Scotia, Can.—d. Nov. 7, 1990, Montreal, Que.) Canadian novelist and essayist. He was a Rhodes scholar at Oxford University and earned a doctorate at Princeton, then taught at McGill University (1951–81). His novels include *Barometer Rising* (1941), *Two Solitudes* (1945), *The Watch That Ends the Night* (1959), and *Voices in Time* (1980). He won five Governor-General's awards for his fiction and nonfiction. He is regarded as the first major English-speaking novelist to use Canadian themes.

Macleod \mə-'klaůd**, J(ohn) J(ames) R(ickard)** (b. Sept. 6, 1876, Cluny, near Dunkeld, Perth, Scot.—d. March 16, 1935, Aberdeen) Scottish physiologist. He taught in U.S., Canadian, and Scottish universities, becoming noted for his work on carbohydrate metabolism. With Frederick Banting and Charles Best he discovered insulin, an achievement for which he and Banting shared a Nobel Prize in 1923.

Macmillan, Daniel and Alexander (respectively b. Sept. 13, 1813, Isle of Arran, Buteshire, Scot.—d. June 27, 1857, Cambridge, Cambridgeshire, Eng.; b. Oct. 3, 1818, Irvine, Ayrshire, Scot.—d. Jan. 26, 1896, London?) Scottish booksellers and publishers. Apprenticed to a bookseller in Scotland at age 11, Daniel worked for London booksellers from 1837 to 1843. In 1843 he and his brother Alexander founded Macmillan & Co., a successful bookshop in Cambridge that began publishing textbooks in 1844 and novels in 1855. After Daniel's death, Alexander expanded the firm's list and founded *Macmillan's Magazine* (1859–1907), a literary periodical, and from 1869 *Nature*, still a leading scientific journal. He established offices abroad and published many important Victorian writers. Long led by Daniel's descendants, the company grew into one of the largest publishing firms in the world.

Macmillan, Harold *in full* **Maurice Harold Macmillan, 1st earl of Stockton, Viscount Macmillan of Ovenden** (b. Feb. 10, 1894, London, Eng.—d. Dec. 29, 1986, Birch Grove, Sussex) British prime minister (1957–63). He served in the House of Commons (1924–29, 1931–64) and held posts in Winston Churchill's wartime coalition government. After the war he served as minister of housing (1951–54), minister of defense (1954), foreign secretary (1955), and chancellor of the Exchequer (1955–57). In 1957 he became prime minister and leader of the Conservative Party. He worked to improve relations with the U.S. and visited Soviet leader Nikita Khrushchev in 1959. Domestically, Macmillan supported Britain's postwar social programs. His government began to lose popularity in 1961 because of a wage freeze and other deflationary measures and a Soviet espionage scandal involving John Profumo, secretary of state for war. He championed membership in the European Economic Community, though Britain's membership application was vetoed in 1963 by Charles de Gaulle. Demands for a new party leader led to his resignation in 1963. He wrote a series of memoirs (1966–75) and served as chair (1963–74) of his family's publishing house, Macmillan & Co.

MacMillan, Sir Kenneth (b. Dec. 11, 1929, Dunfermline, Fife, Scot.—d. Oct. 29, 1992, London, Eng.) British dancer and choreographer. After studies at the Sadler's Wells ballet school, he danced with its ballet companies from 1946. He choreographed his first work, *Somnambulism*, in 1953 and followed that with *Danses concertantes* (1955). His ballet *Romeo and Juliet* (1965) made an international impact. He was ballet director of the German Opera in Berlin (1966–69). In 1970 he was appointed director of the Royal Ballet; in 1977 he resigned to become its principal choreographer. His other successful ballets included *Anastasia* (1971), *Manon* (1974), and *Isadora* (1981).

MacNeice
CAMERA PRESS

MacNeice, Louis (b. Sept. 12, 1907, Belfast, Ire.—d. Sept. 3, 1963, London, Eng.) British poet and playwright. He published his first book of poetry, *Blind Fireworks* (1929),

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while studying at Oxford. In the 1930s he became known as one of a group of socially committed young poets that included W.H. Auden, C. Day-Lewis, and Stephen Spender. His volumes include *Autumn Journal* (1939) and *The Burning Perch* (1963). He wrote and produced radio verse plays for the BBC, notably *The Dark Tower* (1947), with music by Benjamin Britten. Among his prose works are *Letters from Iceland* (1937; with Auden) and *The Poetry of W.B. Yeats* (1941).

Macon \'mā-kən\ City (pop., 2000: 97,255), central Georgia, U.S. A fort was built near the site, and in 1806 a settlement grew up around it. Macon was laid out across the river in 1823, and it annexed the settlement in 1829; the town was named for Nathaniel Macon. During the American Civil War, it was a Confederate supply depot. A distribution centre in an agricultural region, it is the site of several institutions of higher learning and Robins Air Force Base, as well as the birthplace of the poet Sidney Lanier (1842–81).

Macon, Dave *orig.* **David Harrison Macon** (b. Oct. 7, 1870, Smart Station, Warren county, Tenn., U.S.—d. March 22, 1952, Readyville, Tenn.) U.S. country music singer and banjo player. He grew up in Nashville, where his parents ran a hotel that catered to traveling performers. He was in the mule business for 20 years; after the trucking industry put him out of business, he became a professional musician. Performing as Uncle Dave Macon, he entertained audiences with his jovial folk tunes, such as "Go Long Mule," and energetic showmanship. He is considered the first individual to become a star of the Grand Ole Opry, and he was an Opry regular from the mid-1920s until his death.

Macon, Nathaniel (b. Dec. 17, 1758, Edgecombe, N.C.—d. June 29, 1837, Warren county, N.C., U.S.) U.S. politician. He fought in the American Revolution and served in the North Carolina legislature (1781–85). Elected to the U.S. House of Representatives (1791–1815), he served as speaker (1801–07) and was a leading Anti-Federalist. In the Senate (1815–28) he continued to support states' rights and opposed legislation to strengthen the central government.

Macphail, Agnes Campbell (b. March 24, 1890, Grey county, Ont., Can.—d. Feb. 13, 1954, Toronto) Canadian politician. Originally a schoolteacher, she entered politics to represent the farmers in her region. In 1921, the first year women could vote in national elections in Canada, she was elected to the Canadian House of Commons as its first female member; she served until 1940. She advocated prison reform and women's rights as well as a protective tariff. She was the first female Canadian delegate to the League of Nations. Elected to the Ontario legislature (1943–45, 1948–51), she sponsored the province's first equal-pay legislation.

Macquarie \mə-'kwar-ē**, Lachlan** (b. Jan. 31, 1761, Ulva, Argyllshire, Scot.—d. July 1, 1824, London, Eng.) British soldier and colonial governor. He served with the British army in North America, Europe, the West Indies, and India; in 1809 he was appointed governor of New South Wales, Australia, where he replaced the corrupt military corps that had overthrown the previous governor, William Bligh. He began a program of public works construction and town planning that gave opportunities to Emancipists (freed convicts), established the colony's currency, and encouraged exploration and settlement. His policy favouring Emancipist agriculture angered the large landowners and sheep farmers (Exclusionists), and he was recalled in 1821.

Macquarie Harbour \mə-'kwar-ē\ Inlet of the Indian Ocean, western Tasmania, Australia. It is 20 mi (32 km) long and 5 mi (8 km) wide. Visited in 1815 by Capt. James Kelly, it was named after Lachlan Macquarie, governor of New South Wales. Its coast was the site of a penal colony 1821–33.

Macready \mə-'krē-dē**, William (Charles)** (b. March 3, 1793, London, Eng.—d. April 27, 1873, Cheltenham, Gloucestershire) English actor-manager. He made his debut in 1810, and by 1820 he was famous for his performances as Hamlet, Lear, and Macbeth. As theatre manager of London's Covent Garden (1837–39) and Drury Lane (1841–43), he introduced reforms such as full rehearsals, historically accurate costumes and sets, and a reversion to the original Shakespeare texts. He toured the U.S. in 1826, 1843, and 1848–49; his last tour ended with the Astor Place riot, caused by partisans of Edwin Forrest. He retired from the stage in 1851. His diary provides a view of 19th-century theatrical life.

macrobiotics Dietary practice based on the Chinese philosophy of balancing yin and yang (see yin-yang). It stresses avoiding foods that are classified as strongly yin (e.g., alcoholic beverages) or yang (e.g., meat) and relying mainly on near-neutral foods such as grains. In addition, foods that grow naturally in one's climate should be the mainstay of one's diet. Macrobiotics was first articulated in Asia in the 1930s and swept Europe and the U.S. in the late 1960s. Adherents maintain that not only can the quality of life be enhanced but that serious ailments such as cancer can be healed; critics counter that uninformed attempts to practice such a diet can lead to malnutrition.

macroeconomics Study of the entire economy in terms of the total amount of goods and services produced, total income earned, level of employment of productive resources, and general behaviour of prices. Until the 1930s, most economic analysis focused on specific firms and industries. The aftermath of the Great Depression and the development of national income and production statistics brought new interest to the field of macroeconomics. The goals of macroeconomic policy include economic growth, price stability, and full employment. See also microeconomics; national income accounting.

macromolecule Any very large molecule, composed of much larger numbers (hundreds or thousands) of atoms than ordinary molecules. Some macromolecules are individual entities that cannot be subdivided without losing their identity (e.g., certain proteins, with molecular weights into the millions). Others (polymers) are multiples of a repeating building block (monomer) in chains or networks (e.g., plastics, cellulose). Most macromolecules are in the size range typical of colloids.

macular degeneration Degeneration of the macula (central part of the retina), with corresponding visual-field defect. It is the leading cause of blindness in old age. Probably due to reduced blood circulation, it is now known to have a genetic component. It is twice as common in smokers as in nonsmokers, and it is also correlated with lifelong sun exposure. Peripheral vision usually remains, but loss of central visual acuity makes reading or fine work difficult or impossible, even with special magnifying eyeglasses. Some forms of macular degeneration can be halted (but not reversed) by laser surgery.

Macumba \mə-'küm-bə\ Afro-Brazilian religion characterized by the syncretism of traditional African religions, Brazilian spiritualism, and Roman Catholicism. Of the several Macumba sects in Brazil, the most important are Candomblé and Umbanda. African elements include an outdoor ceremonial site, the sacrifice of animals (e.g., cocks), spirit offerings (e.g., candles and flowers), and dances. Macumba rites are led by mediums, who fall prostrate in trances and communicate with holy spirits. Roman Catholic elements include the cross and the worship of saints, who are given African names.

Macy & Co. *in full* **R.H. Macy & Co., Inc.** Major U.S. department-store chain. Its main outlet, the 11-story store that occupies a city block in New York City's Herald Square, was for many years the largest single store in the country. Rowland H. Macy (1822?–1877) established the business in 1858; its red star trademark was derived from a tattoo he bore. The Straus family acquired part interest in the company in 1887, took full control in 1896, and expanded the business by purchasing or building branch stores around the country. Forced into bankruptcy in 1992, Macy's agreed to a merger with Federated Department Stores, Inc. in 1994.

mad cow disease *or* **bovine spongiform encephalopathy (BSE)** \'spən-ji-ˌfȯrm-in-ˌsef-ə-'läp-ə-thē\ Fatal neurodegenerative disease of cattle. Symptoms include behavioral changes (e.g., agitation), gradual loss of coordination and locomotive function, and, in advanced stages, weight loss, fine muscular contractions, and abnormal gait. Brain tissue becomes pitted with holes and spongy. Death usually follows within a year. The disease is similar to the neurodegenerative disease of sheep called scrapie. No treatment is known. A BSE epidemic in Britain that began in the mid-1980s is believed to have been caused by the use of cattle feed containing supplements made from ruminant carcasses and trimmings. Hundreds of thousands of infected cattle were slaughtered and the use of animal-derived protein supplements ended. The cause of both BSE and scrapie is attributed to an infectious aberrant protein called a prion. The unusual occurrence of Creutzfeldt-Jakob disease, another prion-related illness, in young people beginning in the mid-1990s may be linked to eating meat from cattle with BSE.

Madagascar *officially* **Republic of Madagascar** Country, occupying the island of Madagascar, in the western Indian Ocean off the southeast coast of Africa. The island is the world's fourth largest, about 975 mi (1,570 km) long and 355 mi (570 km) wide. It is separated from the African coast by the Mozambique Channel. Area: 226,658 sq mi (587,041 sq

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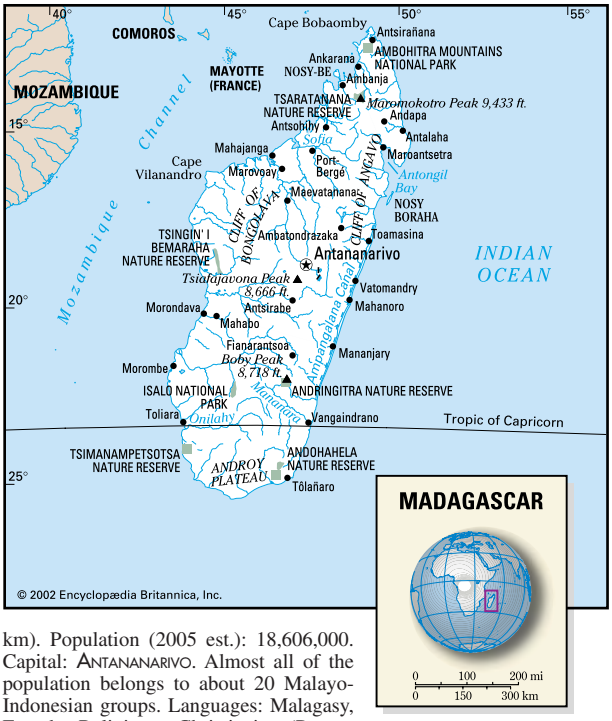

km). Population (2005 est.): 18,606,000. Capital: ANTANANARIVO. Almost all of the population belongs to about 20 Malayo-Indonesian groups. Languages: Malagasy, French. Religions: Christianity (Protestant, Roman Catholic), traditional beliefs, Islam. Currency: ariary. Madagascar's high central plateau rises to 9,436 ft (2,876 m) at the volcanic Tsaratanana massif; the island was once heavily forested, and forests still cover one-fifth of the land area. Agriculture dominates the economy; staple crops include rice and cassava, and cash crops include coffee, cloves, and vanilla. Madagascar is a republic with two legislative houses; its chief of state and head of government is the president, assisted by the prime minister. Indonesians migrated to Madagascar c. AD 700. The first European to visit the island was Portuguese navigator Diogo Dias in 1500. Trade in arms and slaves allowed the Malagasy kingdoms to develop at the beginning of the 17th century. In the 18th century the Merina kingdom became dominant; with British assistance, it gained control of a large part of Madagascar in the early 19th century. In 1868 Merina signed a treaty granting France commercial access to the northwestern coast, and in 1895 French troops took the island. Madagascar became a French overseas territory in 1946. In 1958 France agreed to let the territory decide its own fate; as the Malagasy Republic, it gained independence in 1960 and severed ties with France in the 1970s, taking its present name in 1975. A new constitution was adopted in 1998.

Madani \'mä-dä-nē**, Abbasi al-** (b. 1931, Sīdī ʿUqbah, Alg.) Cofounder, with ALI BELHADJ, of the Algerian ISLAMIC SALVATION FRONT (FIS). After earning a doctorate in London, he returned to Algeria to teach at the University of Algiers, where he became a leader of religious students. He traveled with other itinerant preachers around the country, exchanging ideas and preaching the outlines of a religious political movement. He was arrested after the first round of voting in the 1991–92 legislative elections. In 1999 he endorsed a peace agreement put forward by Algeria's president, Abdelaziz Bouteflika, between the FIS and the Algerian government.

Madariaga y Rojo \ˌmä-də-rē-ˈä-gə-ē-ˈrō-hō**, Salvador de** (b. July 23, 1886, La Coruña, Spain—d. Dec. 14, 1978, Locarno, Switz.) Spanish writer, diplomat, and historian. Abandoning an engineering career for journalism, he joined the League of Nations Secretariat in 1921 as a press member, served as ambassador to the U.S. and France, and was Spain's permanent delegate to the League (1931–36). When the Spanish Civil War broke out in 1936, he moved to England, returning only after FRANCISCO FRANCO's death. He wrote prolifically in English, German, French, and Spanish, his works including *Englishmen, Frenchmen, Spaniards* (1928), *Spain* (1942), *The Rise and Fall of the Spanish American Empire* (1945), and novels based on Latin American history.

madder family Family Rubiaceae, composed of about 6,500 species of herbs, shrubs, and trees in 500 genera. The leaves usually are large and evergreen in tropical species, deciduous in temperate species, and needlelike or scalelike in desert species. The plants may bear a single flower or many small flowers clustered together. Economically important products of the family include COFFEE, QUININE, IPECAC, the red dye alizarin (from the roots of common madder, *Rubia tinctorum*, and of *R. cordifolia*), and ornamentals including GARDENIAS.

Madderakka \'mäd-dä-ˌräh-kä\ Among the SAMI, the goddess of childbirth. She was assisted by three of her daughters—Sarakka, the cleaving woman; Uksakka, the door woman; and Juksakka, the bow woman—who watched over the child from conception through early childhood. Madderakka was believed to receive the soul of a child from Veralden-radien, the god who ruled the world; she then gave it a body, which Sarakka placed in the mother's womb.

Maddux, Greg *in full* **Gregory Alan Maddux** (b. April 14, 1966, San Angelo, Texas, U.S.) U.S. baseball player. Maddux was a star pitcher in high school and was drafted and brought up to the major leagues by the Chicago Cubs (1986–92). He joined the Atlanta Braves in 1993 as a free agent and helped them win the World Series in 1995. Known for his superior control and consistency, Maddux is the only pitcher ever to win the Cy Young pitching award four years in a row (1992–95). He rejoined the Cubs in 2004.

Madeira \mä-'dār-ə\ **Islands** Island group (pop., 2001 prelim.: 242,603) and autonomous region of Portugal, in the North Atlantic Ocean. Madeira, the largest of the Madeira Islands, is the site of the region's capital, FUNCHAL. Madeira Island is 34 mi (55 km) long and 14 mi (22 km) wide and has deep ravines and rugged mountains. Possibly known to ancient PHOENICIANS, it was rediscovered by the Portuguese navigator João Gonçalves Zarco, who founded Funchal in 1421. It allegedly had the world's first sugarcane plantation. Its Madeira wine has been an important export since the 17th century. Tourism is also important.

Madeira River River, western Brazil. A major tributary of the AMAZON RIVER, it is formed by the junction of the MAMORÉ and BENI rivers in Bolivia and flows north along the border between Bolivia and Brazil. It meanders northeast in Brazil to join the Amazon east of MANAUS. Measured from the upper reaches of the Mamoré, it is 2,082 mi (3,352 km) long.

Madero \mə-'der-ō**, Francisco (Indalécio)** (b. Oct. 30, 1873, Parras, Mex.—d. Feb. 22, 1913, Mexico City) Mexican revolutionary and president (1911–13). Son of a wealthy landowner, in 1908 he called for honest, participatory elections and an end to the long dictatorship of PORFIRIO DÍAZ. Jailed for sedition but released on bail, he incited an armed insurrection that led to Díaz's resignation. He was elected president in 1911. Handicapped by political inexperience and excessive idealism, he was quickly overwhelmed by conflicting pressures from conservatives and revolutionaries, and his administration ended in personal and national disaster when he was assassinated in 1913. See also MEXICAN REVOLUTION; PANCHO VILLA; EMILIANO ZAPATA.

Francisco Madero, c. 1910.
ARCHIVO CASASOLA

Madhya Pradesh \'mä-dyə-prə-'dāsh\ State (pop., 2001 prelim.: 60,385,118), central India. It is bordered by the states of RAJASTHAN, UTTAR PRADESH, CHHATTISGARH, MAHARASHTRA, and GUJARAT. Occupying an area of 119,016 sq mi (308,252 sq km), it is India's second largest state. Its capital is BHOPAL. It is the source of some of the most important rivers of India, including the NARMADA, the TAPI, the Mahanadi, and the Wainganga. It was part of the Mauryan empire of the 4th–3rd centuries BC and was ruled by numerous other dynasties. Under Islamic control from the 11th century, it was annexed by the Mughal Empire in the 16th century. It was under Maratha rule by 1760 and passed to the British early in the 19th century. The state was formed after India gained its independence in 1947; its boundaries were altered in 1956. In 2000 the eastern portion of the state

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was made into the new state of Chhattisgarh. Though Madhya Pradesh is rich in mineral resources, its economic mainstay is agriculture.

Madhyamika \mäd-'yə-mi-kə\ School in the MAHAYANA Buddhist tradition. Its name means "middle" and derives from its middle position between the realism of the SARVASTIVADA school and the idealism of the YOGACARA school. The most renowned Madhyamika thinker was NAGARJUNA.

Madison City (pop., 2000: 208,054), capital of Wisconsin, U.S. It is located in the south-central part of the state, on an isthmus between Lakes Mendota and Monona. Founded in 1836 and named for JAMES MADISON, it became the capital of Wisconsin Territory the same year. It was incorporated as a village in 1846 and as a city in 1856. Steady development followed the 1854 arrival of the railroad. Noted for its parks and wooded lakeshore, it is the commercial centre of an agricultural region. Educational and governmental services are economically important; it is the seat of the University of Wisconsin's main campus.

Madison, James (b. March 16, 1751, Port Conway, Va.—d. June 28, 1836, Montpelier, Va., U.S.) Fourth president of the U.S. (1809–17). After graduating from the College of New Jersey (now Princeton University), he served in the Virginia state legislature (1776–80, 1784–86). At the CONSTITUTIONAL CONVENTION (1787), his Virginia, or large-state, Plan furnished the Constitution's basic framework and guiding principles, earning him the title "father of the Constitution." To promote its ratification, he collaborated with ALEXANDER HAMILTON and JOHN JAY on the FEDERALIST PAPERS, a series of articles on the Constitution and republican government published in newspapers in 1787–88 (Madison wrote 29 of the 85 articles). In the U.S. House of Representatives (1789–97), he sponsored the BILL OF RIGHTS. He split with Hamilton over the existence of an implied congressional power to create a national bank; Madison denied such a power, though later, as president, he requested a national bank from Congress. In protest of the ALIEN AND SEDITION ACTS, he drafted one of the VIRGINIA AND KENTUCKY RESOLUTIONS in 1798 (THOMAS JEFFERSON drafted the other). From 1801 to 1809 he was Jefferson's secretary of state. Elected president in 1808, he immediately faced the problem of British interference with neutral U.S. merchant vessels, which Jefferson's Embargo Act (1807) had failed to discourage. Believing that Britain was bent on permanent suppression of American commerce, Madison proclaimed nonintercourse with Britain in 1810 and signed a declaration of war in 1812. During the ensuing WAR OF 1812 (1812–14), Madison and his family were forced to flee Washington, D.C., as advancing British troops burned the executive mansion and other public buildings. During Madison's second term (1813–17) the second BANK OF THE UNITED STATES was chartered and the first U.S. protective tariff was imposed. He retired to his Virginia estate, Montpelier, with his wife, Dolley (1768–1849), whose political acumen he had long prized. He participated in Jefferson's creation of the University of Virginia, later serving as its rector (1826–36), and produced numerous articles and letters on political topics.

Madonna In Christian art, a depiction of the Virgin MARY. Though often shown with the infant JESUS, the Madonna (Italian: "My lady") may also be represented alone. Byzantine art was the first to develop a set of Madonna types—the Madonna and child enthroned, the Madonna as intercessor, the Madonna nursing the child, and so on. Western art adapted and added to the Byzantine types during the Middle Ages, producing images of the Virgin that sought to inspire piety through beauty and tenderness. In the Renaissance and Baroque periods, the most popular image of the Madonna foreshadowed the CRUCIFIXION, showing the Virgin looking gravely away from the playful child.

The Grand-Duke's Madonna, oil painting by Raphael, 1505; in the Pitti Palace, Florence.
SCALA/ART RESOURCE, NEW YORK

Madonna *orig.* **Madonna Louise Ciccone** (b. Aug. 16, 1958, Bay City, Mich., U.S.) U.S. pop singer, songwriter, and actress. She studied dance at the University of Michigan and later with MARTHA GRAHAM and ALVIN AILEY. Her first hit single, "Holiday" (1983), forged an upbeat dance-club sound that sold 70 million albums by 1991, including *Like a Virgin* (1984). In music videos and in concert, she captivated fans and scandalized critics with provocatively sexual showmanship. Ever atop the latest trend, she incorporated TECHNO in *Music* (2000). Her films include *Desperately Seeking Susan* (1985), *Dick Tracy* (1990), and *Evita* (1996). Few female entertainers have attained her levels of power and control in the pop music industry.

Madras See CHENNAI

Madras See TAMIL NADU

madrasah \'mäd-rə-sə\ (Arabic: "school") Islamic theological seminary and law school attached to a MOSQUE. The residential madrasah was a newer building form than the mosque, flourishing in most Muslim cities by the end of the 12th century. The Syrian madrasahs in Damascus tended to follow a standardized plan: An elaborate facade led into a domed hallway and then into a courtyard where instruction took place, with at least one *eyvan* (vaulted hall) opening onto it. The madrasah at the Qalaun Mosque in Cairo (1283–85) has a unique cruciform *eyvan* on the richly carved *qibla* (wall facing Mecca) side and a smaller *eyvan* opposite. Residential cells for scholars occupy the other two sides.

Madre, Laguna Long narrow inlet of the Gulf of Mexico along the shore of southern Texas, U.S., and northeastern Mexico. Sheltered from the gulf by barrier islands, including PADRE ISLAND, it is divided into two sections by the delta of the RIO GRANDE; the U.S. portion extends south for 120 mi (190 km) from Corpus Christi Bay, and the Mexican portion extends north for 100 mi (160 km) from the mouth of the Soto la Marina River. The GULF INTRACOASTAL WATERWAY runs through it.

Madre de Dios River River, southeastern Peru and northwestern Bolivia. It rises in the easternmost range of the ANDES MOUNTAINS, in Peru, and flows east to the Bolivian border. There it turns northeast and crosses the tropical rainforest of northwestern Bolivia, joining the BENI RIVER after a course of more than 700 mi (1,100 km). A tributary of the AMAZON RIVER, it is navigable in its upper course and again below the Peru-Bolivia border.

Madrid City (pop., 2001: city, 2,938,723; metro. area, 5,086,635), capital of Spain and of MADRID autonomous community. Located on the central plateau of the Iberian Peninsula, 2,100 ft (635 m) above sea level, it is one of Europe's highest capitals. The original town grew up around the Moorish alcazar (castle), overlooking the Manzanares River. King ALFONSO VI captured the town from the Muslims in 1083. PHILIP II moved the Spanish court to Madrid in 1561, and in 1607 PHILIP III made it the official capital. It was occupied by French troops during the NAPOLEONIC WARS but returned to Spanish control in 1812. During the SPANISH CIVIL WAR (1936–39), Madrid was held by those loyal to the Republic. Spain's principal transportation centre for the interior provinces, it is an important commercial, industrial, and cultural centre. Major institutions include the PRADO MUSEUM and the University of Madrid.

Madrid \mä-'thrēth,\ *English* \mə-'drid\ Autonomous community (pop., 2001: 5,423,384), central Spain. It occupies an area of 3,100 sq mi (8,028 sq km), and its capital is MADRID. The province extends across the southern slopes of the Guadarrama Mountains and roughly coincides with the region drained by the Jarama, Henares, and Manzanares rivers. It was the scene of several decisive battles during the SPANISH CIVIL WAR (1936–39). All the national railways converge in the province. The Somo Mountain Pass provides access to the northeast through the central mountains.

madrigal Form of vocal chamber music, usually polyphonic and unaccompanied, of the 16th–17th centuries. It originated and developed in Italy, under the influence of the French CHANSON and the Italian *frottola*. Usually written for three to six voices, madrigals came to be sung widely as a social activity by cultivated amateurs, male and female. The texts were almost always about love; most prominent among the poets whose works were set to music are PETRARCH, TORQUATO TASSO, and BATTISTA GUARINI. In Italy, ORLANDE DE LASSUS, LUCA MARENZIO, DON CARLO GESUALDO, and CLAUDIO MONTEVERDI were among the greatest of the madrigalists; THOMAS MORLEY, THOMAS WEELKES, and JOHN WILBYE created a distinguished body of English madrigals.

Madura \mä-'dùr-ə\ *Dutch* **Madoera** Island, Jawa Timur province, Indonesia, off northeastern JAVA. Its capital is Pamekasan. With an area of 2,042 sq mi (5,290 sq km), it has a hilly terrain rising to more than

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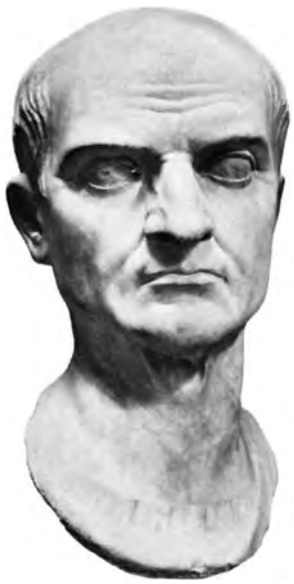
1,400 ft (430 m) in the east. Dutch influence was established in the late 17th century. Madura was attached to Java as a residency in 1885 and became part of Indonesia in 1949. Bull races, usually held in September, attract huge crowds.

Maeander River See MENDERES RIVER

Maecenas \mi-'sē-nəs**, Gaius (Cilnius)** (b. c. 70—d. 8 BC) Roman diplomat and literary patron. He claimed descent from Etruscan kings. Though highly influential in the state, he held no title, nor did he wish to be a senator. From 43 on he helped Octavian (later AUGUSTUS) diplomatically and domestically, administering Rome and Italy while Octavian was fighting POMPEIUS in 36 and Mark ANTONY in 31. He is best remembered as the generous patron of such writers as VIRGIL, HORACE, and PROPERTIUS; he used the work of such literati to glorify Augustus's regime. In 23, after the discovery of his brother-in-law's conspiracy against Augustus, he was forced to retire.



Gaius Maecenas, marble bust; in the Palazzo dei Conservatori, Rome
ALINARI—ART RESOURCE/EB INC.

Maekawa \ˌmä-ā-'kä-wä\ **Kunio** (b. May 14, 1905, Niigata-shi, Japan—d. June 27, 1986, Tokyo) Japanese architect. Maekawa worked as a drafter for LE CORBUSIER in Paris and for ANTONIN RAYMOND in Tokyo. In early works, such as Hinamoto Hall (1936) and the Dairen Town Hall (1938), he tried to counteract the pompous style of the Japanese imperialist regime. In the 1950s he continued to work primarily in the Brutalist style of Le Corbusier (see BRUTALISM). Buildings such as the Educational Centre in Fukushima (1955) and the Harumi flats and the Setagaya Community Centre, both in Tokyo (1959), reflect his efforts to use concrete in a manner appropriate to the material. His community centres influenced TANGE KENZO, who started out in Maekawa's office.

maenads and bacchantes \'mē-ˌnadz...bə-'känts, bə-kän-tēz\ Female followers of the Greek wine-god DIONYSUS. The word maenad comes from the Greek, meaning "mad" or "demented." During the orgiastic rites of Dionysus, maenads roamed the mountains and forests performing frenzied, ecstatic dances, and were believed to be possessed by the god. While under his influence they were supposed to have unusual strength; it was said they could tear animals or people to pieces (the fate met by ORPHEUS). As bacchantes they were named for Bacchus, the Roman counterpart of Dionysus.

Maes \'mäs**, Nicolaes** (b. 1634, Dordrecht, Neth.—d. Nov. 24, 1693, Amsterdam) Dutch painter. A native of Dordrecht, he went to Amsterdam c. 1650 to study with REMBRANDT, from whom he learned the BAROQUE style. Before his return to Dordrecht in 1653 he painted a few life-size Rembrandtesque genre scenes. From 1655 to 1660 he painted smaller domestic scenes, usually of women spinning, eavesdropping, reading the Bible, or cooking. In 1673 he moved permanently to Amsterdam and devoted himself to portraiture, abandoning intimacy and the deep glowing colours characteristic of Rembrandt for elegance and cooler tones reminiscent of ANTHONY VAN DYCK. He was a prolific painter, and he achieved great success with his portraits.

Maeterlinck \'mā-tər-ˌliŋk**, Maurice (Polydore-Marie-Bernard)** *later* **Comte Maeterlinck** (b. Aug. 29, 1862, Ghent, Belg.—d. May 6, 1949, Nice, France) Belgian playwright and poet. He studied law in Ghent but soon turned to writing poems and plays. His *Pelléas et Mélisande* (1892), considered the masterpiece of Symbolist drama (see SYMBOLIST MOVEMENT), was the basis of CLAUDE DEBUSSY's opera (1902). In his Symbolist plays, Maeterlinck used poetic speech, gesture, lighting, setting, and ritual to create images that reflect his protagonists' moods and dilemmas. His other writings include a collection of Symbolist poems (*Hothouses*, 1899) and plays such as *Monna Vanna* (1902), *The Blue Bird* (1908), and *The Burgomaster of Stilmonde* (1918). He was also noted for his popular treatments of scientific subjects, including *The Life of the Bee* (1901) and *The Intelligence of Flowers* (1907). Maeterlinck was awarded the Nobel Prize for Literature in 1911.

Maffei \mä-'fā\ **I and II** Two GALAXIES relatively close to the MILKY WAY GALAXY, first detected in the late 1960s by the Italian astronomer Paolo Maffei. Maffei I is a large elliptical galaxy, while Maffei II is a spiral galaxy. Though they are large and nearby, they are hidden in the Milky Way's zone of AVOIDANCE. At a distance of about 10 million light-years, they appear to be major members of one of the nearest galaxy groups outside the LOCAL GROUP.

Mafia Society of criminals of primarily Italian or Sicilian origin. The Mafia arose in Sicily in the late Middle Ages, possibly as a secret organization to overthrow the rule of foreign conquerors. It drew its members from the small private armies, or *mafie*, hired by landlords to protect their estates. By 1900 the Mafia "families" of western Sicily controlled their local economies. In the 1920s BENITO MUSSOLINI jailed most of the members, but they were released by the Allies after World War II and resumed their activities. In the 1970s their control of the heroin trade led to fierce rivalry among the clans, followed in the 1980s by renewed governmental efforts to imprison the Mafia leadership. In the U.S., Sicilian immigrants included former Mafia members who set up similar criminal operations. Their operations expanded from bootlegging in the 1920s to gambling, narcotics, and prostitution, and the Mafia, or Cosa Nostra, became the largest U.S. syndicated crime organization. About 24 Mafia groups or "families" controlled operations in the U.S.; the heads (or "dons") of the largest families formed a commission whose main function was judicial and could override a don's authority. At the beginning of the 21st century the Mafia's power was greatly diminished through convictions of top officials, defections, and murderous internal disputes. See also ORGANIZED CRIME.

mafic \'ma-fik\ **rock** In geology, any IGNEOUS ROCK dominated by the silicates pyroxene, amphibole, olivine, and mica. These minerals are high in magnesium and ferrous iron, and their presence gives mafic rock its characteristic dark colour. It is usually contrasted with FELSIC ROCK. Common mafic rocks include BASALT and GABBRO.

Mafikeng \'ma-fə-ˌkiŋ**, Siege of** Boer siege of a British military outpost in the SOUTH AFRICAN WAR at the town of Mafikeng (until 1980 spelled Mafeking) in northwestern South Africa in 1899–1900. The garrison, under the command of Col. ROBERT S. BADEN-POWELL, held out against the larger Boer force for 217 days until reinforcements could arrive. The rejoicing in British cities on news of the rescue produced the word *mafficking*, meaning wild rejoicing.

Magadha \'mə-gə-də\ Ancient kingdom, India, situated in present-day BIHAR and JHARKHAND states, northeastern India. An important kingdom in the 7th century BC, it absorbed the kingdom of Anga in the 6th century BC. Pataliputra (PATNA) was its capital. Its strength grew under the NANDA DYNASTY; under the MAURYAN dynasty (4th–2nd centuries BC), it comprised nearly the entire Indian subcontinent. It afterwards declined. Revived in the 4th century AD under the GUPTA DYNASTY, it was conquered by the Muslims in the late 12th century. It was the scene of many events in the life of the BUDDHA.

Magadi \mä-'gä-dē**, Lake** Lake, GREAT RIFT VALLEY, southern Kenya, east of Lake VICTORIA. It occupies an area of about 40 sq mi (104 sq km). Its bed consists almost entirely of soda deposits, which dye the waters a vivid pink.

magazine *or* **periodical** Printed collection of texts (essays, articles, stories, poems), often illustrated, that is produced at regular intervals. Modern magazines have roots in early printed pamphlets, broadsides, chapbooks, and almanacs. One of the first magazines was the German *Erbauliche Monaths-Unterredungen* ("Edifying Monthly Discussions"), issued from 1663 to 1668. In the early 18th century JOSEPH ADDISON and RICHARD STEELE brought out the influential periodicals *The Tatler* and *The* SPECTATOR; other critical reviews began in the mid 1700s. By the 19th century, magazines catering to specialized audiences had developed, including the women's weekly, the religious and missionary review, and the illustrated magazine. One of the greatest benefits to magazine publishing in the late 19th and early 20th centuries was the addition of advertisements as a means of financial support. Subsequent developments included more illustrations and vastly greater specialization. With the computer age, magazines ("e-zines") also became available over the INTERNET.

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Magdalen \'mag-də-lən\ **Islands** *French* **Îles de la Madeleine** \ˌēl-də-lə-mȧd-'len\ Island group of eastern Quebec, Canada. Located in the Gulf of St. Lawrence between Prince Edward Island and Newfoundland, the group comprises several islands and islets, with a total area of 88 sq mi (228 sq km). The largest include Havre-Aubert (Amherst) and Cap aux Meules (Grindstone). Discovered by Jacques Cartier in 1534, the islands are inhabited mainly by French Canadians.

Magdalena \ˌmag-də-'lā-nə\ **River** River, south-central and northern Colombia. It rises on the eastern slopes of the Andes Mountains in southern Colombia and flows northward for about 950 mi (1,530 km) to empty into the Caribbean Sea near Barranquilla. It has been a major commercial artery since the Spanish conquest, though its importance has diminished.

Magdalenian \ˌmag-də-'lē-nē-ən\ **culture** Stone-tool industry and artistic tradition of Upper Paleolithic Europe. It was named after the type site, La Madeleine in southwestern France. The Magdalenians lived some 11,000–17,000 years ago, at a time when reindeer, wild horses, and bison formed large herds. They appear to have lived a semi-settled life surrounded by abundant food. They killed animals with spears, snares, and traps and lived in caves, rock shelters, and tents. Magdalenian stone tools include blades, burins (chisel-like tools), scrapers, borers, and projectile points. Their bone tools—often engraved with animal images—include adzes, hammers, spearheads, harpoons, and eyed needles. Cave art in the early period is characterized by coarse black drawings, while that of the later period includes beautifully rendered realistic figures in polychrome, such as those at Altamira, Spain. Magdalenian culture disappeared as the climate warmed at the end of the fourth (Würm) glacial period (c. 10,000 BC) and herd animals became scarce.

Magdeburg \'mäg-də-ˌbůrk\ City (pop., 2002 est.: 229,755), capital of Saxony-Anhalt state, east-central Germany. Located on the Elbe River, it was a trading settlement as early as the 9th century, and by the 13th century it was a leading member of the Hanseatic League. It embraced the Reformation in 1524 and was governed by Protestant titular archbishops. In 1631, during the Thirty Years' War, it was burned and sacked. Captured by the French during the Napoleonic Wars, it soon passed to the Prussians, and in 1815 it became the capital of the province of Saxony. It was heavily bombed during World War II. One of Germany's most important inland ports, it is a railroad junction. The composer Georg Philipp Telemann was born there.

The cathedral at Magdeburg, Germany.
W. KRAMMISCH/BRUCE COLEMAN INC.

Magellan \mə-'jel-ən**, Ferdinand** *Portuguese* **Fernão de Magalhães** *Spanish* **Fernando de Magallanes** (b. c. 1480, Sabrosa, or Porto?, Port.—d. April 27, 1521, Mactan, Phil.) Portuguese navigator and explorer. Born to the nobility, Magellan from 1505 served in expeditions to the East Indies and Africa. Having twice asked King Manuel I for a higher rank and been refused, he went to Spain in 1517 and offered his services to King Charles I (later Emperor Charles V), proposing to sail west to the Moluccas (Spice Islands) to prove that they lay in Spanish rather than Portuguese territory. In 1519 he left Sevilla with five ships and 270 men. He sailed around South America, quelling a mutiny on the way, and discovered the Strait of Magellan. With three ships left, Magellan crossed the "Sea of the South," which he later called the Pacific Ocean because of their calm crossing. He was killed by natives in the Philippines, but two of his ships reached the Moluccas, and one, the *Victoria*, commanded by Juan de Elcano (1476?–1526), continued west to Spain, accomplishing the first circumnavigation of the world in 1522.

Magellan, Strait of *Spanish* **Estrecho de Magallanes** \ā-'strā-chō-thā-ˌmä-gä-'lyä-nās\ Strait, linking the Atlantic Ocean and Pacific Ocean, between the southern tip of South America and Tierra del Fuego. It extends westward from the Atlantic between Cape Vírgenes and Cape Espíritu Santo and curves northwest at Froward Cape to reach the Pacific. Lying mostly within Chilean territorial waters, it is about 350 mi (560 km) long and 2–20 mi (3–32 km) wide. Named for Spanish navigator Ferdinand Magellan, the first European to pass there (1520), it remained an important shipping route until the Panama Canal opened in 1914.

Magellanic \ˌma-jə-'la-nik\ **Cloud** Either of two irregular companion galaxies of the Milky Way Galaxy, named for Ferdinand Magellan, whose crew discovered them during the first voyage around the world. They share a gaseous envelope and lie about 22° apart in the sky near the southern celestial pole (see celestial sphere). They are visible to the unaided eye in the Southern Hemisphere but cannot be seen from northern latitudes. The Large Magellanic Cloud is more than 150,000 light-years from Earth; the Small Magellanic Cloud is roughly 200,000 light-years away. They are excellent laboratories for the study of the formation and evolution of stars.

Magenta \mə-'jen-tə**, Battle of** (June 4, 1859) Battle fought during the Franco-Piedmontese war against the Austrians (second War of Italian Independence) in Lombardy, northern Italy. The narrow French victory over the Austrians was an important step toward Italian independence, leading many districts and cities to throw off Austrian rule and join the cause of Italian unity.

Maggiore \mä-'jō-rā**, Lake** *ancient* **Lacus Verbanus** Lake, northern Italy and southern Switzerland, bordered on the north by the Swiss Alps. Occupying an area of 82 sq mi (212 sq km), it is Italy's second largest lake. It is 34 mi (54 km) long, with a maximum width of 7 mi (11 km) and a maximum depth of 1,220 ft (372 m). Traversed from north to south by the Ticino River, it is also fed by the Tresa River from Lake Lugano on the east. It is a popular resort area.

Magherafelt \ˌma-krə-'felt\ District (pop., 2001: 39,780), central Northern Ireland. It is bounded by the River Bann, Lake Neaghon, and the Sperrin Mountains. It was formerly part of County Londonderry but was organized as a separate district in 1973. The town of Magherafelt, originally settled as an English company (Plantation of Ulster) town, is the seat of the district and its marketing centre.

Maghrib \'mə-grəb\ *or* **Maghreb** Region of North Africa bordering the Mediterranean Sea. It comprises the coastal plains of Morocco, Algeria, Tunisia, and, often, Libya. In earlier times the term sometimes included parts of Muslim Spain. During Roman times the region was called Africa Minor, but, following the Muslim conquests of the 7th–8th centuries, it came to be known as the Maghrib ("West") inasmuch as it comprised the most westerly reaches of the Muslim world. The region has since developed its own unique culture within the larger Islamic world. Berbers and Arabs are the two main ethnic groups. Arabic is the predominant language. Berber and French are also widely spoken.

Magi \'mā-ˌjī\ In Christian tradition, wise men from the East who came to pay homage to the infant Jesus. According to Matthew 2:1–12, they followed a miraculous guiding star to Bethlehem and brought gifts of "gold and frankincense and myrrh." Herod asked them to report the location of Jesus' birth on their return journey, but an angel warned them of his evil intentions. In later Christian tradition they were said to be kings and were given the names Melchior, Balthasar, and Gaspar. Their visit was seen as evidence that the Gentiles as well as the Jews would worship Jesus, and it is celebrated in the feast of Ephiphany. See also magus. See photograph on opposite page.

magic Use of means (such as charms or spells) believed to have supernatural power over natural forces. It constitutes the core of many religious systems and plays a central social role in many nonliterate cultures. Magic is often distinguished from religion as being more impersonal and mechanical and emphasizing technique. Its techniques are usually regarded as means to specific ends (an enemy's defeat, rainfall, etc.),

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although another view ascribes a more symbolic, expressive character to such activity. Thus, a rainmaking ritual may both elicit rainfall and stress the symbolic importance of rain and the agricultural activities associated with it. Both the magician and the magical rite are typically surrounded by TABOOS, purification procedures, and other activities that draw the participants into the magical sphere. Strains of magic in Western tradition, formerly associated with heretics, alchemists, witches, and sorcerers, persist in modern times in the activities of satanists and others. The art of entertaining by performing apparently magical feats (sometimes called conjuring) relies on the use of sleight of hand and other means. See also SHAMAN, VODUN, WITCHCRAFT AND SORCERY.

magic realism *or* **magical realism** Latin-American literary phenomenon characterized by the matter-of-fact incorporation of fantastic or mythical elements into otherwise realistic fiction. The term was first applied to literature in the 1940s by the Cuban novelist Alejo Carpentier (1904–1980), who recognized the tendency of his region's contemporary storytellers as well as contemporary novelists to illuminate the mundane by means of the fabulous. Prominent practitioners include GABRIEL GARCIA MARQUEZ, JORGE AMADO, JORGE LUIS BORGES, MIGUEL ANGEL ASTURIAS, JULIO CORTAZAR, and Isabel Allende (born 1942). The term has been applied to literature and art outside of Latin America as well.

magic show See CONJURING

Maginot \mȧ-zhē-'nō**, André (-Louis-René)** (b. Feb. 17, 1877, Paris, France—d. Jan. 7, 1932, Paris) French politician. He was elected to the French Chamber of Deputies (1910) and fought in World War I, where he was severely wounded. He twice served as France's minister of war (1922–24, 1929–31) and was a strong advocate of military preparedness against Germany. He directed the beginning of construction of the defensive barrier in northeastern France that was later named the MAGINOT LINE in his honour.

Maginot Line \'ma-zhə-ˌnō\ Elaborate defensive barrier in northeastern France built in the 1930s. Named after its principal creator, ANDRE MAGINOT, it was an ultramodern defensive fortification along the French-German frontier. Made of thick concrete and supplied with heavy guns, it had living quarters, supply storehouses, and underground rail lines. However, it ended at the French-Belgian frontier, which German forces crossed in May 1940. They invaded Belgium (May 10), crossed the Somme River, struck at the northern end of the line (May 12), and continued around to its rear, making it useless.

magistrates' court In England and Wales, any of the inferior courts with primarily criminal jurisdiction covering a wide range of offenses, from minor traffic violations and public-health nuisances to somewhat more serious crimes, such as petty theft or assault. Magistrates' courts with similar jurisdictions, including jurisdiction over small civil claims, may be found in certain large U.S. municipalities.

The Adoration of the Magi, oil painting by Albrecht Dürer, 1504; in the Uffizi, Florence.
SCALA/ART RESOURCE, NEW YORK

magma Molten or partially molten rock from which IGNEOUS ROCKS form, usually consisting of silicate liquid. Magma migrates either at depth or to the Earth's surface, where it is ejected as LAVA. The interactions of several physical properties, including chemical composition, viscosity, content of dissolved gases, and temperature, determine the characteristics of magma. Numerous events that can occur during crystallization influence the resulting rock: separation of early crystals from liquid prevents reaction between them; magma can cool too rapidly for reaction to occur; and loss of volatiles may remove some components from the magma.

Magna Carta (Latin: "Great Charter") Document guaranteeing English political liberties, drafted at Runnymede, a meadow by the Thames, and signed by King JOHN in 1215 under pressure from his rebellious barons. Resentful of the king's high taxes and aware of his waning power, the barons were encouraged by the archbishop of Canterbury, STEPHEN LANGTON, to demand a solemn grant of their rights. Among the charter's provisions were clauses providing for a free church, reforming law and justice, and controlling the behavior of royal officials. It was reissued with alterations in 1216, 1217, and 1225. Though it reflects the feudal order rather than democracy, the Magna Carta is traditionally regarded as the foundation of British constitutionalism.

Magna Graecia \'mag-nə-'grē-shə\ *Latin* **"Great Greece"** Group of ancient Greek cities along the coast of southern Italy. Euboeans founded the first colonies, including CUMAE, c. 750 BC, and subsequently Spartans settled at Tarentum (TARANTO); Achaeans at Metapontum, SYBARIS, and Croton; Locrians at LOCRI EPIZEPHYRII; and Chalcidians at Rhegium (REGGIO DI CALABRIA). It was a busy commercial centre as well as the seat of the PYTHAGOREAN and ELEATIC systems of philosophy. After the 5th century BC, most of the cities declined in importance.

Magnani \män-'yä-nē**, Anna** (b. March 7, 1908, Rome, Italy—d. Sept. 26, 1973, Rome) Italian film actress. An illegitimate child brought up in poverty, she became a nightclub singer noted for her bawdy street songs. After acting in a touring company, she made her film debut in *The Blind Woman of Sorrento* (1934). She earned international fame for her role in ROBERTO ROSSELLINI's *Open City* (1945). She became known for her forceful portrayals of earthy, working-class women in films such as *The Miracle* (1948), *Bellissima* (1951), *The Rose Tattoo* (1955, Academy Award), *The Fugitive Kind* (1960), and *Mamma Roma* (1962).

Magnes \'mag-nəs**, Judah Leon** (b. July 5, 1877, San Francisco, Calif., U.S.—d. Oct. 27, 1948, New York, N.Y.) U.S.-born Israeli educator and religious leader. Ordained as a rabbi in 1900, he earned a doctorate at the University of Heidelberg in 1902. Serving as rabbi for three congregations in New York, he moved from Reform to Orthodox Judaism and became a Zionist. He drifted away from ZIONISM during World War I, preferring relief efforts for Jews in Palestine over political activism. After the war he became the principal founder and first president (1935–48) of the HEBREW UNIVERSITY OF JERUSALEM, working to advance Arab-Jewish reconciliation and advocating a binational Arab-Jewish state.

Magnesia ad Sipylum \mag-'nē-zhə-ad-'si-pi-ləm\ Ancient city, LYDIA, near modern Manisa, Turkey. Dating to the 5th century BC, it was located near the regions associated with NIOBE and TANTALUS. It was the site of a famous battle during the winter of 190–189 BC, when the Romans under SCIPIO AFRICANUS THE ELDER defeated the Seleucids under ANTIOCHUS III (the Great), forcing them back across the TAURUS MOUNTAINS. It suffered severe earthquakes, notably in AD 17, and there are few archaeological remains.

magnesium Chemical ELEMENT, one of the ALKALINE EARTH METALS, chemical symbol Mg, atomic number 12. The silvery white METAL does not occur free in nature, but compounds such as the SULFATE (Epsom salts), OXIDE (magnesia), and CARBONATE (magnesite) have long been known. The metal, which burns in air with a bright white light, is used in photographic flash devices, bombs, flares, and pyrotechnics; it is also a component of lightweight alloys for aircraft, spacecraft, cars, machinery, and tools. The compounds, in which it has VALENCE 2, are used as insulators and REFRACTORIES and in fertilizers, cement, rubber, plastics, foods, and pharmaceuticals (antacids, purgatives, LAXATIVES). Magnesium is an essential element in human nutrition; it is the COFACTOR in ENZYMES of carbohydrate METABOLISM and in CHLOROPHYLL.

magnet Any material capable of attracting IRON and producing a MAGNETIC FIELD outside itself. By the end of the 19th century, all known elements

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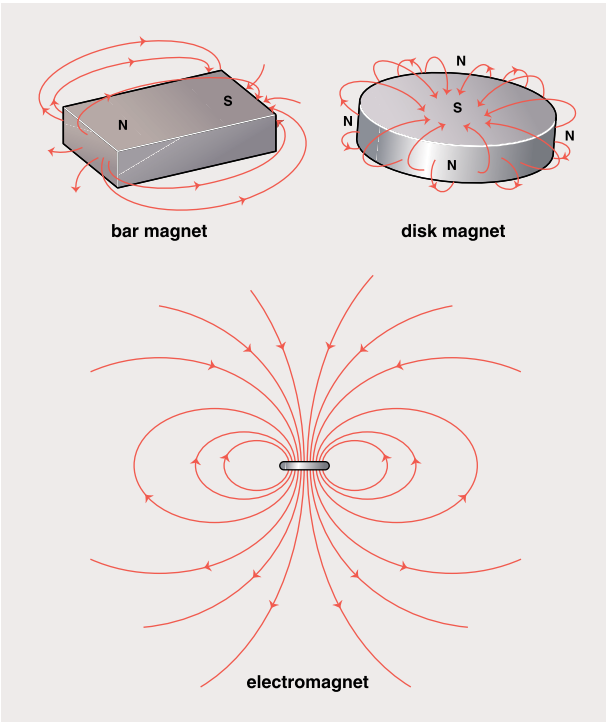
and many compounds had been tested for MAGNETISM, and all were found to have some magnetic property. However, only three elements—iron, NICKEL, and COBALT—exhibit FERROMAGNETISM. See also COMPASS, ELECTROMAGNET.



Magnets and their associated magnetic field lines. A permanent magnet (such as a bar or disk magnet) possesses a magnetic field by virtue of the alignment of all the magnetic particles it is composed of. An electromagnet is generated by a current flowing through a wire loop at the center of the field.
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magnetic dipole Tiny magnet with subatomic dimensions, equivalent to the flow of ELECTRIC CHARGE around a loop. Examples include ELECTRONS circulating around atomic nuclei, rotating atomic nuclei, and single SUBATOMIC PARTICLES with SPIN. On a large scale, these effects may add together, as in iron atoms, to make magnetic compass needles and bar magnets, which are macroscopic magnetic dipoles. The strength of a magnetic dipole, its magnetic moment, is a measure of its ability to turn itself into alignment with a given external MAGNETIC FIELD. When free to rotate, dipoles align themselves so that their moments point predominantly in the direction of the magnetic field. The SI unit for dipole moment is the ampere-square metre.

magnetic field Region around a magnet, ELECTRIC CURRENT, or changing ELECTRIC FIELD in which MAGNETIC FORCES are observable. The field around a permanent magnet or wire carrying a steady DIRECT CURRENT is stationary, while that around an ALTERNATING CURRENT or changing direct current is continuously changing. Magnetic fields are commonly represented by continuous lines of force, or magnetic flux, that emerge from north-seeking magnetic poles and enter south-seeking poles. The density of the lines indicates the magnitude of the field, the lines being crowded together where the magnetic field is strong. The SI unit for magnetic flux is the weber.

magnetic force Attraction or repulsion that arises between electrically charged particles that are in motion. While only electric forces exist among stationary ELECTRIC CHARGES, both electric and magnetic forces exist among moving electric charges. The magnetic force between two moving charges is the force exerted on one charge by a MAGNETIC FIELD created by the other. This force is zero if the second charge is traveling in the direction of the magnetic field due to the first and is greatest if it travels at right angles to the magnetic field. Magnetic force is responsible for the action of electric motors and the attraction between magnets and iron.

magnetic permeability Relative increase or decrease in the MAGNETIC FIELD inside a material compared with the magnetic field in which the material is located. In empty space the magnetic permeability is 1, because there is no matter to modify the field. Materials may be classified by the value of their magnetic permeability. Diamagnetic materials (see DIAMAGNETISM) have constant relative permeabilities of slightly less than 1. Paramagnetic materials (see PARAMAGNETISM) have constant relative permeabilities of slightly more than 1. The relative permeability of ferromagnetic materials (see FERROMAGNETISM) increases as the magnetizing field increases, reaches a maximum, and then decreases. Pure iron and some alloys have relative permeabilities of 100,000 or more.

magnetic resonance Absorption or emission of ELECTROMAGNETIC RADIATION by electrons or atomic nuclei in response to certain MAGNETIC FIELDS. The principles of magnetic resonance are used to study the atomic and nuclear properties of matter; two common laboratory techniques are NUCLEAR MAGNETIC RESONANCE and ELECTRON SPIN RESONANCE. In medicine, MAGNETIC RESONANCE IMAGING is used to produce images of human tissue.

magnetic resonance imaging (MRI) Computer production of images from MAGNETIC RESONANCE. The structural and biochemical information it provides is helpful in the diagnosis of abnormalities without the possibly harmful effects of X RAYS or GAMMA RAYS. It is invaluable in detecting and delineating tumours and in providing images of the brain, the heart, and other soft-tissue organs. MRI may produce anxiety because the patient must often lie quietly inside a narrow tube. Another disadvantage is that it requires a longer scanning time than other computer-assisted forms of scanning, which makes it more sensitive to motion and of less value in scanning the chest or abdomen. However, MRI images provide better contrast between normal and diseased tissue than those produced by other computer-assisted imagery.

magnetism Phenomenon associated with MAGNETIC FIELDS, the effects of such fields, and the motion of ELECTRIC CHARGES. Some types of magnetism are DIAMAGNETISM, PARAMAGNETISM, FERROMAGNETISM, and FERRIMAGNETISM. Magnetic fields exert forces on moving ELECTRIC CHARGES. The effects of such forces are evident in the deflection of an electron beam in a CATHODE-RAY TUBE and the motor force on a current-carrying CONDUCTOR. Other applications of magnetism range from the simple magnetic door catch to medical imaging devices and electromagnets used in high-energy PARTICLE ACCELERATORS.

magnetite *or* **lodestone** *or* **magnetic iron ore** Iron OXIDE MINERAL (Fe_3O_4), the chief member of one of the series of the spinel group. Minerals in this series form black to brownish, metallic, moderately hard octahedrons and masses in igneous and metamorphic rocks and in granite pegmatites, stony meteorites, and high-temperature sulfide veins. Magnetite, as the name implies, is strongly attracted to a magnet. It is a common constituent of iron ores. Magnetite with an intrinsic magnetic field (a natural magnet) is known as lodestone.

magneto \mag-ˈnē-tō\ Permanent-magnet alternating generator used mainly to produce electrical current for the IGNITION SYSTEM in various types of INTERNAL-COMBUSTION ENGINES, such as aircraft, marine, tractor, and motorcycle engines. The main parts of a magneto are a permanent-magnet rotor, a primary winding of a small number of turns of coarse wire, a secondary winding with a large number of turns of fine wire, a cam-type circuit breaker, and a capacitor. As the rotor turns, it produces a current in the primary winding, charging the capacitor. The cam breaks the circuit, and the magnetic field around the primary winding collapses. The capacitor releases its stored current into the primary winding, causing a reversed magnetic field. The collapse and reversal of the magnetic field produce a current in the secondary winding that is sent to the SPARK PLUGS.

magnetosphere Region around a PLANET (such as Earth) or a natural satellite that possesses a magnetic field (see GEOMAGNETIC FIELD) where magnetic phenomena and the high atmospheric conductivity caused by IONIZATION strongly influence the behaviour of charged particles (see ELECTRIC CHARGE). A planet or moon's magnetic field, like its gravitational field, becomes weaker with distance from the body. The SOLAR WIND sweeps a body's magnetosphere out away from the Sun in a "tail" trailing well beyond it.

magnitude In astronomy, the measure of the brightness of a star or other celestial body. The brighter the object, the lower the number assigned as a magnitude. In ancient times six magnitude classes were used, the first containing the brightest stars (see HIPPARCHUS). In the present

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system a difference of one magnitude is defined as a ratio of brightness of 2.512 times. Thus, a difference of five magnitudes corresponds to a brightness ratio of 100 to 1. Apparent magnitude is an object's brightness as seen from Earth (e.g., −26.7 for the Sun, about −11 for the Moon). Absolute magnitude is an object's brightness as it would be seen at a distance of 10 PARSECS (32.6 light-years; e.g., 4.8 for the Sun). See also ALBEDO; PHOTOMETRY.

magnolia Any of about 80 species of trees and shrubs in the genus *Magnolia*, native to North and Central America, the Himalayas, and East Asia. They are valued for their fragrant flowers and handsome leaves. *Magnolia* is one of 12 genera in the family Magnoliaceae, which contains 210 species. Magnolias are among the most primitive of flowering plants; their primitive features include long floral axes, spiral arrangement of flower parts, and simple water-conducting cells.

Magnus II Eriksson (b. 1316, Norway—d. Dec. 1, 1374, Sweden) King of Sweden (1319–63, as Magnus II) and Norway (1319–55, as Magnus VII). Grandson of Norway's Haakon V and nephew of the Swedish king, Magnus became ruler of both countries. Since he spent almost all his time in Sweden, Norwegian nobles arranged for his son Haakon's succession, and Magnus abdicated in 1355. He antagonized many Swedish nobles, raising taxes and curbing the economic power of the church and nobility. In 1356 he was forced to cede half his Swedish kingdom to his son Erik, and he began making concessions to the nobility. When he renewed his efforts to control the Swedish nobles, they deposed him.

Magnus effect Generation of a sidewise FORCE on a spinning cylindrical or spherical solid immersed in a fluid (liquid or gas) when there is relative motion between the spinning body and the fluid. Named after Heinrich Gustav Magnus (1802–1870), who first investigated the effect experimentally in 1853, it is responsible for the curved trajectory of a tennis or golf ball and affects the path of an artillery shell.

Magnus Pius, Sextus Pompeius See Sextus POMPEIUS MAGNUS PIUS

magpie Any of several genera of long-tailed songbirds of the CROW family (Corvidae). The black-billed magpie (*Pica pica*) is 18 in. (45 cm) long and strikingly pied (black-and-white), with an iridescent blue-green tail. It is found in North Africa, across Eurasia, and in western North America. A bird of farmlands and tree-studded open country, it eats insects, seeds, small vertebrates, the eggs and young of other birds, and fresh carrion. It makes a large, round nest of twigs cemented with mud, and is known for hoarding small, bright objects. Other species (in the genera *Cyanopica*, *Cissa*, and *Urocissa*) include the brilliant blue or green magpies of Asia.

Magritte \mä-'grēt**, René (-François-Ghislain)** (b. Nov. 21, 1898, Lessines, Belg.—d. Aug. 15, 1967, Brussels) Belgian painter. After study at the Belgian Academy of Fine Arts (1916–18), he designed wallpaper and did advertising sketches until the support of a Brussels art gallery enabled him to become a full-time painter. His early works were in the Cubist and Futurist styles, but in 1922 he discovered the work of GIORGIO DE CHIRICO and embraced SURREALISM with *The Menaced Assassin* (1927). Certain images appear over and over again in Magritte's works—the sea, wide skies, the female torso, the bourgeois "little man" in a bowler hat, rocks that hover overhead—and dislocations of space, time, and scale were common elements in his enigmatic and illogical paintings.

Magsaysay \mäg-'sī-ˌsī**, Ramon** (b. Aug. 31, 1907, Iba, Phil.—d. March 17, 1957, near Cebu) President of the Philippines (1953–57). Son of a Malay artisan, he was a schoolteacher before becoming a guerrilla leader during World War II. In 1950, as secretary of defense, he launched one of the most successful antiguerrilla campaigns in modern history, against insurgents of the HUKBALAHAP REBELLION. He deprived them of popular support by offering peasants land and tools and insisting that the army treat them with respect. By 1953 the Huks were no longer a threat, and Magsaysay was elected president. His efforts at reform were frustrated by a conservative Congress. He was killed in a plane crash before the end of his term.

maguey See CENTURY PLANT

magus \'mā-gəs\ Member of an ancient Persian clan specializing in cultic activities. The magi were a priestly caste during the SELEUCID, Parthian, and SASANIAN dynasties, and parts of the AVESTA are probably derived from them. Their PRIESTHOOD is believed to have served several religions, including ZOROASTRIANISM. From the 1st century AD onward, the word magus in its Syriac form (*magusai*) was applied to magicians and soothsayers, chiefly from BABYLONIA. As long as the Persian empire lasted there was a distinction between the Persian magi, credited with profound religious knowledge, and the Babylonian magi, often considered outright impostors. See also MAGI.

Magyar \'mag-ˌyär, 'mä-ˌjär\ Any member of the dominant ethnic group in Hungary. Speakers of a FINNO-UGRIC LANGUAGE, they migrated from their early home in the region of present-day Bashkortostan in eastern European Russia across the southern Russian and Ukrainian steppes into the northern Balkans in the 9th century. After collisions with neighbouring peoples, the Magyars crossed the Carpathians and settled in the middle basin of the Danube River in the late 9th century, subjugating Slavs and other peoples there. Skilled and fierce horsemen, they raided deep into the heart of Europe in the 10th century and were greatly feared until their defeat by OTTO I at the Battle of LECHFELD in 955. They adopted Christianity in the 11th century under King STEPHEN I, the founder of Hungary, who made the kingdom part of the European community.

Mah-jongg \ˌmä-'zhäŋ\ Game of Chinese origin usually played by four persons with 144 domino-like tiles that are drawn and discarded until one player secures a winning hand. The object of play is similar to that of the RUMMY card games. It is probably of 19th-century origin. The name was coined by J. P. Babcock, who introduced the game to the West after World War I. The mah-jongg set includes a pair of dice, a quantity of tokens or chips used for scorekeeping, and a rack for keeping tiles upright and keeping their faces hidden from other players.

Mahabharata \mə-ˌhä-'bä-rə-tə\ One of the two major SANSKRIT epics of India, valued for its literary merit and its religious inspiration. It tells of the struggle for supremacy between two groups of cousins, the Kauravas and the Pandavas. Many myths and legends are woven into the poem, along with didactic material on topics such as the proper conduct of a warrior and the way to attain emancipation from rebirth. Together with the second major epic, the *RAMAYANA*, it is an important source of information about the evolution of HINDUISM. Contained within the *Mahabharata* is the *Bhagavadgita*, Hinduism's single most important religious text. The sage Vyasa (fl. c. 5th century BC) is traditionally named as the *Mahabharata*'s author, but he probably compiled existing material. The poem reached its present form c. AD 400.

Mahan \mə-'han**, Alfred Thayer** (b. Sept. 27, 1840, West Point, N.Y., U.S.—d. Dec. 1, 1914, Quogue, N.Y.) U.S. naval officer and historian. He studied at the U.S. Naval Academy, and his nearly 40 years of active naval duty included fighting in the American Civil War. He was president of the Naval War College in Newport, R.I. (1886–89). His classic analysis *The Influence of Sea Power upon History, 1660–1783* (1890) argued that sea power was decisive in determining national supremacy. In *The Influence of Sea Power upon the French Revolution and Empire, 1793–1812* (1892), he stressed the interdependence of military and commercial control of the sea. Avidly read in Britain and Germany, both books greatly influenced the buildup of naval forces before World War I.

Alfred Thayer Mahan, 1897
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Maharashtra \ˌmä-hə-'räsh-trə\ State (pop., 2001 prelim.: 96,752,247), west-central India. It lies on the Arabian Sea and is bordered by the states of GUJARAT, MADHYA PRADESH, CHHATTISGARH, ANDHRA PRADESH, KARNATAKA, and GOA and the union territory of DADRA AND NAGAR HAVELI; its capital is MUMBAI (Bombay). Occupying an area of 118,800 sq mi (307,690 sq km), it covers much of the DECCAN plateau, containing the valleys of the KRISHNA, BHIMA, and GODAVARI rivers. The population is a mixture of ethnic groups; Marathi is the state language. The region was divided into Hindu kingdoms in the 8th–13th centuries; they were followed by a series of Muslim dynasties. A Maratha kingdom ruled by 1674, and by the 18th century a Maratha empire had been established. The British gained control early in the 19th century.

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When India won independence in 1947, the area was known as Bombay state; it was divided on linguistic lines in 1960, creating Gujarat in the north and Maharashtra in the south. Its economy is primarily agricultural; industries include oil-refining and cotton textiles.

Maharishi Mahesh Yogi *orig.* **Mahad Prasad Varma** (b. 1911?, India) Indian religious leader, founder of TRANSCENDENTAL MEDITATION (TM). He took a degree in physics before going to the Himalayas to study the ADVAITA school of VEDANTA religious thought with the yogi Guru Dev for 13 years. He arrived in the U.S. in 1959, preaching the virtues of TM; in the 1960s the BEATLES were perhaps his most celebrated followers. The Maharishi (the title means "Great Sage") returned to India in the late 1970s and moved to The Netherlands in 1990. His organization, which includes real estate holdings, schools, and clinics, was worth more than $3 billion in the late 1990s.

Mahasanghika \mə-ˌhä-ˈsəŋ-gi-kə\ Early Buddhist school in India that anticipated the MAHAYANA tradition. Its emergence in the 4th century BC, about 100 years after the BUDDHA's death, represented the first major schism in the Buddhist community. Though accounts of the second Buddhist council attribute the split to a dispute over rules, later texts emphasize differences between the Mahasanghikas and the Theravadins (see THERAVADA) regarding the nature of the Buddha and sainthood. The Mahasanghikas believed in a plurality of buddhas and held that the Buddha in his earthly existence was only an apparition.

Mahathir bin Mohamad \mä-ˈhä-tēr-bin-mō-ˈhä-məd\ *in full* **Datuk Seri Mahathir bin Mohamad** (b. Dec. 20, 1925, Alor Setar, Kedah, Malay states) Malaysian politician, prime minister (1981–2003). The son of a schoolmaster, Mahathir studied medicine and worked as a government medical officer before entering parliament in 1964, where he became a forceful advocate of policies to ensure economic success for ethnic Malays. Once prime minister, he was reelected repeatedly; under his leadership Malaysia achieved one of the most prosperous economies in Southeast Asia, rising literacy rates, and increased life expectancies. An economic downturn in the late 1990s precipitated a split between Mahathir and his deputy prime minister, Anwar Ibrahim, whom Mahathir dismissed in 1998; opposition to this action and other policies was suppressed. Following the SEPTEMBER 11 ATTACKS of 2001 in the U.S., he offered his support in the global war against terrorism, but he opposed the U.S.-led invasion of Iraq in 2003 and was noted for his frequent criticisms of the West.

Mahavira \mə-ˌhä-ˈvē-rə\ *orig.* **Vardhamana** (b. traditionally c. 599, Kshatriyakundagrama, India—d. traditionally 527 BCE, Pavapuri) Indian reformer of the Jain monastic community, last of the 24 TIRTHANKARAS, or saints, who founded JAINISM. Born into the warrior caste, he renounced the world at age 30 for a life of extreme asceticism. He had no possessions, not even rags to cover his body or a bowl for alms or food, and after 12 years he attained *kevala*, the highest stage of perception. An advocate of nonviolence and vegetarianism, he revived and reorganized Jain doctrine and established rules for its monastic order. His followers made five vows of renunciation (see JAIN *VRATA*).

Mahavira enthroned, miniature from the *Kalpa-sutra*, 15th-century western Indian school; in the Freer Gallery of Art, Washington, D.C.
COURTESY OF THE SMITHSONIAN INSTITUTION, FREER GALLERY OF ART, WASHINGTON, D.C.

Mahayana \mə-ˌhä-ˈyä-nə\ One of the three major Buddhist traditions. It arose in the 1st century AD and is widely followed today in China, Korea, and Japan, and Tibet. Mahayanists distinguish themselves from the more conservative THERAVADA Buddhists of Sri Lanka, Burma, Thailand, Laos, and Cambodia. Whereas the Theravadins view the historical Buddha as a (merely) human teacher of the truth, Mahayanists see him as an earthly manifestation of a celestial Buddha. Mahayanists revere BODHISATTVAS, key figures in universal salvation. Compassion, the chief virtue of the bodhisattva, is valued as highly as wisdom, the virtue emphasized by the ancient Buddhists. Within Mahayana Buddhism, some branches emphasize esoteric practices (e.g., SHINGON, TIBETAN BUDDHISM). See also KEGON, NICHIREN BUDDHISM, PURE LAND BUDDHISM, TIANTAI, ZEN.

mahdi *Arabic* **"divinely guided one"** In Islamic eschatology, a messianic deliverer who will bring justice to the earth, restore true religion, and usher in a short golden age before the end of the world. Though the mahdi is not mentioned in the QUR'ĀN and is questioned by SUNNITE theologians, he is important in SHĪʿITE doctrine. The doctrine of the mahdi gained currency during the religious and political upheavals of early ISLAM (7th–8th century) and received new emphasis in periods of crisis (e.g., after most of Spain was reconquered by Christians in 1212, and during Napoleon's invasion of Egypt). The title has been claimed by Islamic revolutionaries, notably in North Africa (see al-MAHDĪ; MAHDIST MOVEMENT).

Mahdī, al- *orig.* **Muḥammad Aḥmad ibn al-Sayyid ʿAbd Allāh** (b. Aug. 12, 1844—d. June 22, 1885, Omdurman, Sudan) Sudanese religious and political leader. The son of a shipbuilder in Nubia, he was brought up near KHARTOUM. After orthodox religious study, he turned to a mystical interpretation of Islam in the Sufi tradition, joined a religious brotherhood, and in 1870 moved to a hermitage with his disciples. In 1881 he proclaimed a divine mission to purify Islam and the governments that defiled it, targeting the Turkish ruler of Egypt and its dependency, Sudan. In 1885, after he defeated CHARLES GEORGE GORDON to capture Khartoum, he established a theocratic state, but he died the same year, probably of typhus. See also MAHDI; MAHDIST MOVEMENT; SUFISM.

Mahdist \ˈmä-dəst\ **movement** Religious and political movement founded by the Sudanese prophet al-MAHDĪ. He adopted the name al-Mahdī (meaning "Divinely Inspired One") because of his conviction that he had been divinely chosen to lead a holy war (JIHAD) against Sudan's Egyptian ruling class, who he believed had deserted the Islamic faith. His uprising began in 1881, and within four years he had conquered almost all the territory formerly occupied by Egypt, his crowning victory being the capture of KHARTOUM from Gen. CHARLES GEORGE GORDON in 1885. Establishing a new capital at OMDURMAN, he became head of an armed theocracy. When he died from illness, his disciple ʿABD ALLĀH succeeded him. Following initial victories, ʿAbd Allāh's forces were gradually hunted down by Anglo-Egyptian armies under H.H. KITCHENER and almost entirely destroyed in the Battle of OMDURMAN. The movement sustained a small following through the next century, but its political import had been destroyed.

Mahfouz \mä-ˈfüz**, Naguib** (b. Dec. 11, 1911, Cairo, Egypt) Egyptian writer. He worked in the cultural section of the Egyptian civil service from 1934 to 1971. His major work, the *Cairo Trilogy* (1956–57)—including the novels *Palace Walk*, *Palace of Desire*, and *Sukkariyah*—represents a penetrating overview of 20th-century Egyptian society. Subsequent works offer critical views of the Egyptian monarchy, colonialism, and contemporary Egypt. Other well-known novels include *Midaq Alley* (1947), *Children of Gebelawi* (1959), and *Miramar* (1967). He also wrote short-story collections, more than 30 screenplays, and several stage plays. In 1988 he became the first Arabic writer to win the Nobel Prize for Literature.

Mahican See MOHICAN

Mahilyow *Russian* **Mogilyov** City (pop., 2001 est.: 361,000), east-central Belarus, on the DNIEPER (Dnyapro) River. It was founded in 1267 as a fortress and became a town in 1526 while under Lithuanian rule. Later passing to Poland, it became Russian in the first partition of POLAND in 1772. In 1812 a major battle between NAPOLEON's troops and Russian forces was fought outside the town. It was severely damaged in World War II; rebuilt after the war, it is now a major industrial city.

Mahler, Gustav (b. July 7, 1860, Kaliště, Bohemia, Austrian Empire—d. May 18, 1911, Vienna, Austria) Austrian-Jewish composer and conductor. He attended the Vienna Conservatory, where he studied piano and composition. He wrote his first significant work, the cantata *Das Klagende Lied* (1880), as he was eking out an existence by giving lessons. In 1880 he became a conductor, and though his dictatorial manner was disliked and critics found his interpretations extreme, by 1886 he had achieved success in Prague. He also began the first of his 10 symphonies (1888–1910), his main compositional legacy. In 1897 he was named director of the Vienna Opera; his stormy reign there was acknowledged as an artistic success. He moved to the Metropolitan Opera in 1908

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and the New York Philharmonic in 1909–10. Ill with heart disease and mourning his daughter's death, he wrote the masterly orchestral song cycle *Das Lied von der Erde* (1908–09) and his ninth symphony. His orchestral songs *Des Knaben Wunderhorn* (1892–98) and *Kindertotenlieder* (1904; *Songs on the Deaths of Children*) are frequently performed. His emotionally charged and subtly orchestrated music drew together many different strands of Romanticism. Although his music was largely ignored for 50 years after his death, he was later regarded as an important forerunner of 20th-century techniques of composition.

Maḥmūd \mä-'müd\ **of Ghazna** (b. 971—d. April 30?, 1030, Ghazna, Ghaznavid empire) Son of the founder of the GHAZNAVID DYNASTY, Sebüktigin. After ascending the throne in 998, he gave nominal allegiance to the caliph of the ʿABBĀSID DYNASTY and in return was granted autonomy. He expanded his kingdom through some 17 invasions of the Punjab and northeastern India, carrying with him the banner of Islam. With the treasures he amassed, he transformed the city of Ghazna into a brilliant cultural centre. At his court were the scholar al-BĪRŪNĪ and the poet FERDOWSĪ.

mahogany family Family Meliaceae (order Sapindales), composed of 575 species in 51 genera of trees and (rarely) shrubs native to tropical and subtropical regions. Trees of the genus *Swietenia* and *Entandrophragma*, commonly called mahogany, and of the genus *Cedrela* (especially the cigar-box cedar, *C. odorata*) are economically important timber trees. The China tree (*Melia azedarach*), also called chinaberry, bead tree, and Persian lilac, is an ornamental Asian tree with fragrant, lilac-coloured flowers and attractive but poisonous round yellow fruits, often cultivated in tropical and warm temperate areas. Most members of the family have large compound leaves and branched flower clusters. A few have edible fruits.

Mahone \mə-'hōn**, William** (b. Dec. 1, 1826, Southampton county, Va., U.S.—d. Oct. 8, 1895, Washington, D.C.) U.S. politician and railroad magnate. After graduating from the Virginia Military Institute, he studied engineering while teaching. He joined the Norfolk–Petersburg Railroad as an engineer in 1851 and became the company's president 10 years later. In the AMERICAN CIVIL WAR he was appointed quartermaster general of the Confederacy but served with the army of northern Virginia, rising to major general. After the war he resumed railroading, becoming president of the Atlantic, Mississippi, and Ohio (later Norfolk & Western) Railroad (1867). He built a political base through railroad patronage but lost control of the railroad in the 1870s. Unable to win the Democratic Party nomination for governor (1877), he organized a coalition of African Americans and poor whites to form a political party, the Readjusters (1879), which succeeded in enacting reforms. He served as a Republican in the U.S. Senate (1880–87).

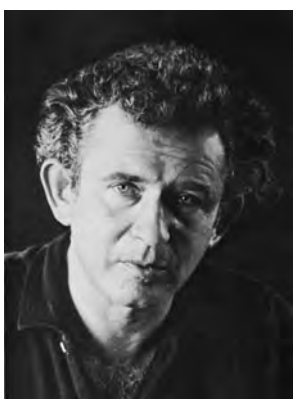
Maiano, Benedetto da See BENEDETTO DA MAIANO

Maidstone Town and borough (pop., 2001: 138,959), administrative and historic county of KENT, southeastern England. It is situated on the River Medway southeast of LONDON. Its name is derived from one given it in DOMESDAY BOOK. A residence of the Norman archbishops of CANTERBURY until the REFORMATION, it grew as a market town. Still an agricultural centre, it is located in England's largest hops-growing area, and brewing is important to its economy. Among many sites of architectural interest is the medieval archbishop's palace.

mail, chain See CHAIN MAIL

mail-order business See DIRECT-MAIL MARKETING

Mailer, Norman (b. Jan. 31, 1923, Long Branch, N.J., U.S.) U.S. novelist. He studied at Harvard University. He drew on his wartime service in the Pacific for his celebrated novel *The Naked and the Dead* (1948), which established him as one of the major American writers of the postwar decades. A flamboyant and controversial figure who often enjoyed antagonizing critics and readers, he has since commanded less respect for his fiction—which also includes the novels *An American Dream* (1965) and *Why Are We in Vietnam?* (1967)—than for journalistic works that convey actual events with the richness of novels, including *The Armies of the Night* (1968, Pulitzer Prize); *Miami and the Siege of Chicago* (1968); *Of a Fire on the Moon* (1970); and *The Executioner's Song* (1979, Pulitzer Prize), about the execution of a murderer. Mailer was a favourite target of feminists in the 1960s and '70s.



Mailer, 1968

NEWSWEEK PHOTO BY BERNARD GOTFRYD, COPYRIGHT NEWSWEEK, 1968

Maillol \mä-'yōl**, Aristide** (b. Dec. 8, 1861, Banyuls-sur-Mer, France—d. Sept. 27, 1944, near Banyuls-sur-Mer) French sculptor, painter, and printmaker. He was a painter and tapestry designer until he was almost 40, when eyestrain persuaded him to turn to sculpture. He rejected the highly emotional style of AUGUSTE RODIN and attempted to preserve and purify the Classical sculpture of Greece and Rome. Most of his works depict the mature female form and are characterized by emotional restraint, clear composition, and serene surfaces. After 1910 he was internationally famous and never lacked commissions. He resumed painting later in life and produced excellent woodcut illustrations for fine editions of Latin poets, but he remained preeminently a sculptor.

Maimon \'mī-mən**, Salomon** *orig.* **Salomon ben Joshua** (b. c. 1754, Nieswiez, grand duchy of Lithuania—d. Nov. 22, 1800, Nieder-Siegersdorf, Silesia) Polish Jewish philosopher. As a young man, he pursued Hebrew and rabbinic studies, adopting the name Maimon out of admiration for MOSES MAIMONIDES. His unorthodox commentaries on Maimonides earned him the enmity of other Jews, and he left Poland at age 25 to wander through Europe as a scholar and tutor. A skeptic who emphasized the limits of pure thought, he is best known for his *Search for the Transcendental Philosophy* (1790), a major critique of Kantian philosophy. His other writings include *Philosophical Dictionary* (1791) and *Critical Investigations of the Human Spirit* (1797).

Maimonides \mī-'mä-nə-ˌdēz**, Moses** *orig.* **Moses ben Maimon** (b. March 30, 1135, Córdoba—d. Dec. 13, 1204, Egypt) Jewish philosopher, jurist, and physician. He was obliged to practice his faith secretly after a revolutionary and fanatical Islamic sect, the ALMOHADS, captured Córdoba. To gain religious freedom, he settled in Egypt (1165), where he won fame for his medical skill and became court physician to the sultan SALADIN. Maimonides's first major work, begun at age 23 and completed 10 years later, was an Arabic commentary on the MISHNA. His other writings included a monumental code of Jewish law called the MISHNE TORAH (in Hebrew) and a classic work of religious philosophy, *The Guide of the Perplexed* (in Arabic), which was influenced by the teachings of ARISTOTLE and called for a more rational approach to Judaism. It also sought to reconcile science, philosophy, and religion. He is considered the greatest intellectual figure of medieval Judaism.

Main River \'mīn\ River, central Germany. Rising in northern Bavaria, and flowing west, it passes through FRANKFURT before emptying into the RHINE RIVER; it is 326 mi (524 km) long. It forms part of the Main-Danube Canal, which links the Rhine and DANUBE rivers to create a 2,200-mi (3,500-km) waterway from the North Sea to the Black Sea.

Maine \'men\ Historical region, northwestern France. A hereditary countship in the 10th century, it briefly fell under English rule and then was united with ANJOU in 1126. With Anjou and NORMANDY, it fell to France early in the 13th century. After alternating between English and French rule, it reverted to the French crown in 1481 and was made a duchy under LOUIS XIV.

Maine State (pop., 2000: 1,274,923), northeastern U.S. One of the NEW ENGLAND states, it lies on the Atlantic Ocean and is bordered by Canada and the U.S. state of New Hampshire. It covers 33,128 sq mi (85,801 sq km); its capital is AUGUSTA. The APPALACHIAN MOUNTAINS cross the state, rising to 5,268 ft (1,606 m) at Mount Katahdin; Maine's upland region has many lakes and valleys, and its Atlantic coast is rocky and scenic. Algonquian Indians were the earliest known inhabitants of the area. European settlers found the Penobscot and Passamaquoddy tribes living along the river valleys and coasts. The French included Maine as part of the province of ACADIA in 1603, and Britain included it in territory granted to the PLYMOUTH CO. in 1606. During the 17th century Britain established scattered settlements, but the area was a constant battleground until the British conquered the French in eastern Canada in 1763. Maine was governed as a district of MASSACHUSETTS from 1652 until it was admitted as the 23rd state of the Union under the MISSOURI COMPROMISE in 1820. Its Canadian boundary was established in 1842. The AMERICAN CIVIL WAR and the INDUSTRIAL REVOLUTION diverted workers and capital from Maine in the 19th century. In the 20th century it saw slow but steady economic gains, espe-

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cially in the southwestern coastal region. Its economy is based on agriculture and natural resources. Chief products include timber and wood products, potatoes, and lobsters. Tourism is also an important source of income.

Maine, destruction of the (Feb. 15, 1898) Incident preceding the Spanish-American War in which a mysterious explosion sank the U.S. battleship *Maine* in the harbour of Havana, Cuba, killing 260 sailors. The U.S. had sent the *Maine* to Havana in January 1898 to protect U.S. citizens and property after riots in Cuba's struggle for independence from Spain. U.S. anti-Spanish sentiment was inflamed by tabloid newspapers proclaiming "Remember the *Maine*, to hell with Spain!"; armed intervention followed in April. It is now believed that the explosion was caused internally.

Maine, Sir Henry (James Sumner) (b. Aug. 15, 1822, Kelso, Roxburgh, Scot.—d. Feb. 3, 1888, Cannes, France) British jurist and legal historian. He taught civil law at the University of Cambridge (1847–54) and lectured on Roman law at the Inns of Court. These lectures became the basis of his *Ancient Law* (1861) and *Early History of Institutions* (1875), which influenced both political theory and anthropology. In 1869 he became the first professor of comparative jurisprudence at the University of Oxford; in 1887 he became professor of international law at Cambridge. As a member of the council of the governor-general of India (1863–69), he shaped plans for the codification of Indian law. He was knighted in 1871.

Maine coon cat North America's only native breed of longhaired domestic cat. Though its origins are unknown, it was first shown in Boston in 1878. Maines are large, muscular, and heavy-boned; they may have been named for their raccoon-like tail. Excellent mousers, they are known for their gentleness, intelligence, and kind disposition, and are especially good with children and dogs. Most are brown tabbies.

mainframe Digital computer designed for high-speed data processing with heavy use of input/output units such as large-capacity disks and printers. They have been used for such applications as payroll computations, accounting, business transactions, information retrieval, airline seat reservations, and scientific and engineering computations. Mainframe systems, with remote "dumb" terminals, have been displaced in many applications by client-server architecture.

Maintenon \ma^{n}-tə-'nō^{n}**, Françoise d'Aubigné, marchioness de** *known as* **Madame de Maintenon** (baptized Nov. 28, 1635, Niort, Poitou, France—d. April 15, 1719, Saint-Cyr) Second wife of Louis XIV of France. After enduring an impoverished childhood, she married the poet Paul Scarron, 25 years her senior, in 1652. She presided over Scarron's literary salon, where she was intellectually formed. Widowed in 1660, she was left penniless, but with the help of influential friends she became governess in 1668 to the king's children born to his mistress, the marchioness de Montespan (1641–1707). In 1675 Louis bestowed the title of the Château de Maintenon and lands on her, and after the queen's death in 1683 he secretly married her, either in 1683 or 1697. Although she was blamed for being a bad influence on Louis politically, she maintained a climate of decency, dignity, and piety around him.

Mainz \'mīnts\ *French* **Mayence** \mä-'yä^{n}s\ City (pop., 2002 est.: 185,293), west-central Germany. Situated on the Rhine River opposite the mouth of the Main River, it was established as a Roman military camp c. 14 BC on the site of an earlier Celtic settlement. It became an archbishopric in AD 775, a free city in 1244, and the head of the Rhenish League in 1254. It was under French rule from 1797 to 1816 and then passed to Hesse-Darmstadt. It served as a fortress of the German Confederation and later of the German Empire until 1918. Severely damaged during World War II, it was rebuilt. The birthplace of Johannes Gutenberg, it is the seat of Johannes Gutenberg University.

maiolica See majolica

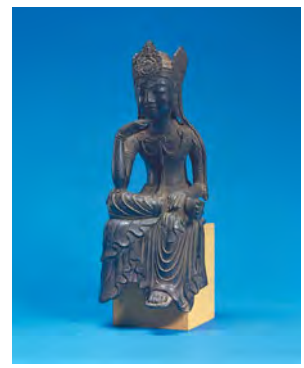
Maipuran languages See Arawakan languages

Maistre \'mestr^{ə}**, Joseph de** (b. April 1, 1753, Chambéry, France—d. Feb. 26, 1821, Turin, kingdom of Sardinia) French polemical writer and diplomat. A member of the Savoy senate, he moved to Switzerland after the French invasion of Savoy in 1792. He served under the king of Sardinia as envoy to Russia (1803–17), then settled in Turin as chief magistrate and minister of state of the Sardinian kingdom. He was an exponent of the absolutist, conservative tradition and opposed the progress of science and liberal beliefs in such works as *Essay on the Generative Principle of Political Constitutions* (1814), *On the Pope* (1819), and *The St. Petersburg Dialogues* (1821). It was as a logical thinker, pursuing consequences from an accepted premise, that Maistre excelled.

Maitland, Frederic William (b. May 28, 1850, London, Eng.—d. Dec. 19, 1906, Las Palmas, Canary Islands, Spain) British legal historian. He practiced law in London before joining the faculty of the University of Cambridge (1888). With Frederick Pollock he wrote *History of English Law Before the Time of Edward I* (1895), which became a standard authority on the subject. In 1887 he helped found the Selden Society for the study of English law.

Maitland (of Lethington), William (b. c. 1528, probably Lethington, East Lothian, Scot.—d. June 9?, 1573, Leith, Midlothian) Scottish statesman. As secretary to Mary, Queen of Scots (1560), he sought to unite the realms of England and Scotland by securing Mary recognition as the successor to Elizabeth I. With that aim, he supported the murders of David Riccio and Lord Darnley, and he joined a coalition of Protestant and Catholic nobles. After Mary fled to England in 1568, Maitland tried to restore her to power and broke with the supporters of the infant King James VI (later James I). In the ensuing civil war, he held Edinburgh Castle until forced to surrender; he died in prison.

Maitreya \mī-'trā-yə\ In Buddhist tradition, the future Buddha who will descend to earth to preach again the dharma (law) when the teachings of the Buddha Gautama have completely decayed. Until then, Maitreya is believed to be a bodhisattva residing in the Tusita heaven. Mentioned in scriptures from the 3rd century AD, he is the earliest bodhisattva around whom a cult developed and is still the only one generally honored by the Theravada tradition. His images, found throughout the Buddhist world, convey an air of expectancy and promise.



Miroku (Maitreya) in meditation, gilt bronze figure, Japanese, Asuka period, 7th century; in the Cleveland Museum of Art

THE CLEVELAND MUSEUM OF ART, JOHN L. SEVERANCE FUND, 50.86

maize See corn

Majapahit empire \ˌmä-jä-'pä-hit\ (13th–16th century) Last Indianized kingdom in Indonesia, based in eastern Java. It was founded by Vijaya, a prince of Singhasari who collaborated with the invading Mongol troops of Kublai Khan (see Kertanagara) to defeat a rival and then drove the Mongols out. Some scholars believe that Majapahit territory included present-day Indonesia and part of Malaysia; others maintain that it was confined to eastern Java and Bali. It reached its height in the mid-14th century under King Hayam Wuruk and his prime minister Gajah Mada. The rise of the Islamic states along the northern Java coast brought the empire to an end.

majolica \mə-'jä-li-kə\ *Italian* **maiolica** \mə-'yä-li-kə\ Tin-glazed earthenware introduced from Moorish Spain by way of the island of Majorca and produced in Italy from the 14th century. Majolica is usually restricted to five colours: cobalt blue, antimony yellow, iron red, copper green, and manganese purple; the purple and blue were used, at various periods, mainly for outline. White tin enamel was used also, for highlights or alone on the white tin glaze. The most common shape of the pottery was a display dish, decorated in the *istoriato* style, a 16th-century Italian narrative style that uses the pottery body solely as support for a purely pictorial effect. See also delftware; Faenza majolica; faience; Urbino majolica.

Major, John (b. March 29, 1943, London, Eng.) British politician and prime minister (1990–97). He was elected to the House of Commons as a member of the Conservative Party in 1979 and rose quickly through the party ranks. In 1989 Prime Minister Margaret Thatcher appointed him foreign secretary and then chancellor of the Exchequer. After Thatcher's resignation as prime minister and party leader in 1990, Major was elected as party leader, and in 1992 he led the party to a general election victory. Major's first years in office coincided with a long economic recession (1990–93). His government became increasingly unpopular, and Major

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himself was perceived as a colourless and indecisive leader. In 1997 the Conservatives lost by a landslide to the Labour Party, and Major was succeeded as prime minister by Tony Blair.

Majorca \mä-'jȯr-kə, mä-'yȯr-kə\ *Spanish* **Mallorca** \mä-'lyȯr-kə\ *ancient* **Balearis Major** Island, Balearic Islands (Baleares) autonomous community, Spain. The largest of the Balearic Islands, it lies in the western Mediterranean Sea and occupies an area of 1,405 sq mi (3,640 sq km). Palma, the capital of the autonomous community, is located on the island. The kingdom of Majorca was established by James I of Aragon in the 13th century and was united with Aragon in the 14th century. During the Spanish Civil War (1936–39), it was a base for Italian aid to the Nationalists. Now a popular tourist centre, it was a favourite destination of Frédéric Chopin, who wrote some of his finest mazurkas and preludes there.

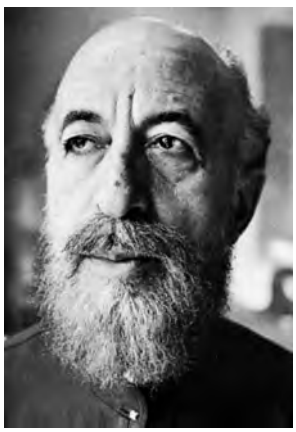
Majorelle \mä-yȯ-'rel**, Louis** (b. 1859, Toul, France—d. 1926, Nancy) French artist, cabinetmaker, and furniture designer. The son of a cabinetmaker, he was trained as a painter and studied under Jean-François Millet at the École des Beaux-Arts. After his father's death in 1879, he returned home to take charge of the family workshop. He moved from 18th-century reproductions to the developing Art Nouveau style and became one of its leading exponents. In his furniture he incorporated a flowing line into polished woods, highlighted by Art Nouveau bronze mounts.

Majuro \mä-'jü-rō\ Atoll (pop., 1999: 23,676) in the Ratak (eastern) chain of the Marshall Islands and capital of the Republic of the Marshall Islands, in the western Pacific Ocean. The atoll comprises 64 islets on a 25-mi (40-km) reef and has a total land area of 4 sq mi (10 sq km). It has the largest population of any of the Marshall Islands. The main settlement on Majuro is situated on three connected islands—Dalap, Uliga, and Darrit.

majuscule \'ma-jəs-ˌkyül, mə-'jəs-ˌkyül\ Uppercase, capital, or large letter in calligraphy, in contrast to the minuscule, lowercase, or small letter. All the letters in a majuscule script are contained between a single pair of real or theoretical horizontal lines. The earliest known Roman majuscule letters are in the style known as square capitals, distinguished by downstrokes that are heavier than upstrokes and by serifs (short strokes at right angles to the top and bottom of a letter). Square capitals were used mainly in inscriptions on Roman imperial monuments. Rustic capitals, used in books and official documents, formed a freer, more elliptical script. Roman cursive capitals, a running-hand script used for notes and letters, were a forerunner of the minuscule scripts that appeared later.

Makalu \'mə-kə-ˌlü\ Peak in the Himalayas, on the Nepalese-Tibetan border. Located east-southeast of Mount Everest, it reaches 27,766 ft (8,463 m), making it one of the world's highest mountains. Attempts to ascend its steep, glacier-covered sides did not begin until 1954. On May 15, 1955, two French climbers—Jean Couzy and Lionel Terray—reached the summit, and seven more members of their party arrived within two days.

Makarios \mä-'kär-ē-ˌōs\ **III** *orig.* **Mikhai Khristodolou Mouskos** (b. Aug. 13, 1913, Pano Panayia, Cyprus—d. Aug. 3, 1977, Nicosia) Archbishop and primate of the Orthodox Church of Cyprus and president of Cyprus (1959–77). Son of a poor shepherd, he was ordained in 1946; he became bishop in 1948 and archbishop in 1950. A supporter of Cyprus's union with Greece, opposing both independence and partition, he negotiated with the British governor of Cyprus (1955–56) but was arrested for sedition and exiled. In 1959 he accepted independence for Cyprus and was elected president, with a Turkish vice president. Twice reelected, he fled Cyprus following an attempted coup by the Greek Cypriot National Guard (1974). Despite a subsequent invasion by Turkey and the establishment of a separate Turkish Cypriot state in the north, he resisted partition of the country.



Makarios III
CAMERA PRESS

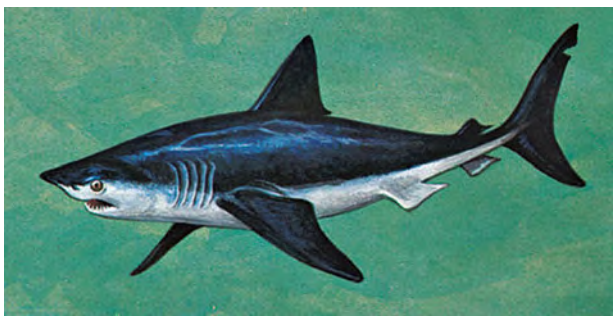
Makarova \mä-'kär-ə-və**, Natalia (Romanovna)** (b. Oct. 21, 1940, Leningrad, Russia, U.S.S.R.) Russian ballerina. She trained in Leningrad (St. Petersburg) and joined the Kirov (now Mariinsky) Ballet in 1959 to become a leading ballerina. In 1970 she defected while on tour in London and soon joined American Ballet Theatre. She performed as a guest artist with the Royal Ballet and other companies and is best known for her leading role in *Giselle*.

Makassar \mə-'ka-sər\ **Strait** Narrow passage of the west-central Pacific Ocean, Indonesia. Located between Borneo and Celebes (Sulawesi), it connects the Celebes Sea to the Java Sea. It is 500 mi (800 km) long and 80–230 mi (130–370 km) wide. It contains numerous islands, the largest of which are Laut and Sebuku. In 1942, during World War II, it was the scene of naval and air battles as the Allies tried to prevent the Japanese from occupying Borneo.

makeup In the performing arts, material used by actors for cosmetic purposes and to help create the characters they play. Not needed in Greek and Roman theatre because of the use of masks, makeup was used in the religious plays of medieval Europe, in which the angels' faces were painted red and those of God and Christ white or gold. In Elizabethan England, crude makeup methods included powdering the face with chalk (to play ghosts and murderers) or blackening it with burnt cork (to play Moors). As stage lighting improved in the 19th century, theatrical makeup became more artistic; stick greasepaint, invented by Ludwig Leichner in the 1860s, enabled actors to create more subtle characterizations. Stage makeup proved too heavy for motion pictures; in 1910 Max Factor created semiliquid greasepaint makeup suitable for early filmmaking, and in 1928 he created panchromatic makeup to keep pace with the development of incandescent lighting and more sensitive film. Makeup was later further modified for colour filmmaking and for television. See also cosmetics.

Makkah, Al- See Mecca

mako shark \'mā-kō\ Any of certain potentially dangerous sharks (genus *Isurus*) in the mackerel shark family (Isuridae). Two species are generally recognized: the Atlantic *I. oxyrinchus* and the Indo-Pacific *I. glaucus*. Makos range throughout tropical and temperate seas. Blue-gray, with a white belly, they are about 13 ft (4 m) long and weigh about 1,000 lbs (450 kg). They prey on fishes such as herring, mackerel, and swordfish. Outstanding game fish, they are prized for their fighting qualities and their spectacular repeated leaps out of the water.



Mako shark (*Isurus glaucus*)
PAINTING BY RICHARD ELLIS

Maktūm \mȧk-'tüm\ **dynasty** *or* **Āl Maktūm ("Maktūm family")** Ruling family of the emirate of Dubayy (Dubai) of the United Arab Emirates (UAE). One of the two members of the Āl Bū Falāsāh family to emigrate from Abu Dhabi to Dubayy in 1833 was Baṭī ibn Suhayl, father of Maktūm ibn Baṭī, the first ruler of Dubayy (r. 1833–52). The current ruler, Maktūm ibn Rāshid, who is also vice president of the UAE, is the ninth of the dynasty. The Maktūm are a branch of the same Banū Yās confederation that includes the Nahyān, rulers of Abu Dhabi.

Malabar Coast \'ma-lə-ˌbär\ Region, southwestern coast of India, stretching from the Western Ghats to the Arabian Sea. It now includes most of Kerala state and the coastal region of Karnataka state. It has sometimes been used to refer to the entire western coast of peninsular India. A large part of it was within the ancient kingdom of Keralaputra. The Portuguese established trading posts there; they were followed by the Dutch in the 17th century and the French in the 18th century. The British gained control of the region in the late 18th century.

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Malabo \mä-'lä-bō\ *formerly (until 1973)* **Santa Isabel** City (pop., 1995 est.: 47,500), capital of Equatorial Guinea. Located on the northern edge of the island of Bioko, it is the republic's commercial and financial centre. The main activity of its harbour is the export of cocoa, timber, and coffee. Its population fluctuated in the 1960s and '70s: the European population declined after 1969 riots there, and the African population declined when Nigerian contract workers returned to Nigeria in the mid 1970s.

Malacca \mə-'lä-kə**, Strait of** Channel connecting the Indian Ocean and the South China Sea. It lies between Sumatra and the Malay Peninsula. It is 500 mi (800 km) long and is funnel-shaped; only 40 mi (65 km) wide in the south, it broadens in the north to 155 mi (249 km). Numerous islets hinder passage at its southern entrance. The shortest sea route between India and China, it is one of the most heavily traveled shipping channels in the world.

Malacca, sultanate of (1403?–1511) Malay dynasty that ruled the great entrepôt of Malacca (Melaka) and its dependencies. Malacca, which commanded the main sea route between India and China, was founded by Paramesvara (died 1424), who converted to Islam and took the title Sultan Iskandar Shah in 1414. It benefited from the rearoused desire of Ming dynasty China to trade with the West. By the mid-1430s it had become a major commercial emporium; by the mid-15th century it was an important territorial power as well. The wealthy state encouraged literature, learning, and a lively political and religious life; the period of its ascendancy is considered the golden age of Malay history. The city fell to the Portuguese in 1511.

Malachi \'ma-lə-ˌkī\ The anonymous author of the biblical book of Malachi and the last of the Twelve (Minor) Prophets. The name comes from a Hebrew word meaning "my messenger." The book consists of dialogues in question-and-answer form, in which the prophet defends the justice of God to a community doubtful because its expectations of salvation for Israel are unfulfilled. Malachi calls for faithfulness to God's covenant and promises that the day of judgment will soon arrive. The book was probably written in the 5th century BC.

malachite \'ma-lə-ˌkīt\ Widespread carbonate mineral of copper, a hydrous copper carbonate, $Cu_2CO_3(OH)_2$. Because of its distinctive, bright green colour and its presence in the weathered zone of nearly all copper deposits, malachite serves as a prospecting guide. It is found in Siberia, France, Namibia, and Arizona. Malachite has been used as an ornamental stone and as a gemstone.

Malachy \'ma-lə-kē**, Saint** (b. 1094, Armagh, County Armagh, Ire.—d. Nov. 2/3, 1148, Clairvaux, France; canonized 1190; feast day November 3) Irish archbishop and religious reformer. He studied at Armagh and was ordained a priest in 1119. While serving as vicar to the archbishop of Armagh, he persuaded the Irish church to accept reforms promoted by Pope Gregory VII in the 11th century, and he introduced the Roman liturgy into Ireland. He served as bishop in Counties Down and Antrim before being named abbot of Iveragh, County Kerry. He became archbishop of Armagh in 1129 but resigned in 1137. In 1142 he introduced the Cistercians into Ireland. In 1190 he became the first Irish Catholic to be canonized.

Málaga \'mä-lä-gä\ Port city (pop., 2001: 524,414), southern Spain. It lies on a bay of the Mediterranean Sea at the mouth of the Guadalmedina River. It was founded by the Phoenicians in the 12th century BC and was later conquered by the Romans and the Visigoths. Under Moorish rule from 711 AD, it became one of the chief cities of Andalusia. It fell to Spanish rulers Ferdinand II and Isabella I in 1487. It is the foremost Spanish Mediterranean port after Barcelona; among its exports are fruit and Málaga wine. It was the birthplace of Pablo Picasso.

Malagasy \ˌma-lə-'ga-sē\ **peoples** Complex of about 20 ethnic groups in Madagascar. The largest group is the Merina ("Elevated People"), who primarily inhabit the central plateau. The second-largest group is the Betsimisaraka, who live generally in the east. The third is the Betsileo, who inhabit the plateau around Fianarantsoa. Others include the Tsimihety, the Sakalava, the Antandroy, the Tanala, the Antaimoro, and the Bara. All Malagasy peoples speak a dialect of Malagasy, an Austronesian language. The written language is a standardized version of the Merina dialect. Most Malagasy peoples live in rural areas and grow rice, cassava, and other crops. About half are Christian, while the rest practice their traditional religion based on ancestor worship.

Malaita \mä-'lā-tä\ Volcanic island, Solomon Islands, South Pacific Ocean. Located northeast of Guadalcanal, it is about 115 mi (185 km) long and 22 mi (35 km) across at its widest point and has an area of 1,870 sq mi (4,843 sq km). It is mountainous and covered with dense forests, and its interior has not yet been extensively explored.

Malāmatiyyah \ˌmä-lä-mä-'tē-ə\ Muslim mystic group in the Sufi tradition that flourished in Iran during the 8th century. The name, derived from the Arabic *la'ma* ("to be wicked"), refers to the group's focus on their own failings and misdeeds. The Malāmatiyyahs saw self-blame as conducive to detachment from worldly things and disinterested service to God. To avoid praise and respect, they hid their knowledge and piety, and they made known their faults as a reminder of the need for self-improvement, while remaining tolerant and forgiving toward others. See also Sufism.

Malamud \'ma-lə-ˌməd**, Bernard** (b. April 26, 1914, Brooklyn, N.Y., U.S.—d. March 18, 1986, New York, N.Y.) U.S. novelist and short-story writer. Born to Russian-Jewish immigrants, he was educated at City College of New York and Columbia University, and he later taught principally at Bennington College. His novels, which often make parables out of Jewish immigrant life, include *The Natural* (1952), about a baseball hero; *The Assistant* (1957), about a Jewish grocer and a Gentile hoodlum; and *The Fixer* (1966, Pulitzer Prize), often considered his finest novel. His genius is most apparent in his stories, collected in *The Magic Barrel* (1958), *Idiots First* (1963), *Pictures of Fidelman* (1969), and *Rembrandt's Hat* (1973).

malamute, Alaskan See Alaskan malamute

Malan \mə-'lan**, Daniel F(rançois)** (b. May 22, 1874, near Riebeeck West, Cape Colony—d. Feb. 7, 1959, Stellenbosch, S.Af.) South African politician. Malan obtained a doctorate in divinity (1905) and became a Dutch Reformed minister before entering parliament in 1918. He joined J.B.M. Hertzog's cabinet (1924–33) but broke with Hertzog to form the Purified Nationalist Party (1934). He reconciled with Hertzog in 1939 and assumed leadership of the National Party after Hertzog withdrew (1940). His party won the 1948 elections by appealing to Afrikaner racial sentiments. He formed South Africa's first exclusively Afrikaner government (1948–54) and instituted apartheid.

Mälaren \'mā-ˌlär-ən\ Lake, eastern Sweden. Located just west of Stockholm, it has an area of 440 sq mi (1,140 sq km) and a length of 75 mi (120 km); it is the country's third largest lake. Connected with the Baltic Sea by navigable channels, it has more than 1,200 islands.

malaria A serious relapsing infection caused by protozoa of the genus *Plasmodium* (see plasmodium), transmitted by the bite of the *Anopheles* mosquito. Known since before the 5th century BC, it occurs in tropical and subtropical regions near swamps. The roles of the mosquito and the parasite were proved in the early 20th century. Annual cases worldwide are estimated at 250 million and deaths at 2 million. Malaria from different *Plasmodium* species differs in severity, mortality, and geographic distribution. The parasites have an extremely complex life cycle; in one stage they develop synchronously inside red blood cells. Their mass fissions at 48- or 72-hour intervals cause attacks lasting 4–10 hours. Shaking and chills are followed by fever of up to 105 °F (40.6 °C), with severe headache and then profuse sweating as temperature returns to normal. Patients often have anemia, spleen enlargement, and general weakness. Complications can be fatal. Malaria is diagnosed by detecting the parasites in blood. Quinine was long used to alleviate the fevers. Synthetic drugs, such as chloroquine, destroy the parasites in blood cells, but many strains are now resistant. Carriers of a gene for a hemoglobinopathy have natural resistance. Malaria prevention requires preventing mosquito bites: eliminating mosquito breeding places and using insecticides or natural predators, window screens, netting, and insect repellent. See also protozoal disease.

Malawi \mä-'lä-wē\ *officially* **Republic of Malawi** *formerly* **Nyasaland** \nī-'a-sə-ˌland\ Country, southeastern Africa. Area: 45,747 sq mi (118,484 sq km). Population (2005 est.): 12,707,000. Capitals: Lilongwe and Blantyre (judicial). Almost the entire population consists of Bantu-speaking black Africans. Languages: English (official), Chewa, Lomwe. Religions: Christianity (Protestant, Roman Catholic), Islam, traditional beliefs. Currency: kwacha. Malawi's terrain is characterized by dramatic highlands and extensive lakes, with forests occupying about one-fourth of the total land area. The Great Rift Valley runs north-south

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and contains Lake Nyasa (Malawi). Agriculture employs some four-fifths of the workforce; staple crops include corn, peanuts, beans, and peas, and cash crops include tobacco, tea, sugarcane, and cotton. Coal mining and limestone quarrying also contribute to the economy. Major industrial products are food products, beverages, chemicals, and textiles. Malawi is a republic with one legislative house; its head of state and government is the president. Inhabited since 8000 BC, the region was settled by Bantu-speaking peoples between the 1st and 4th centuries AD. They established separate states, and c. 1480 they founded the Maravi Confederacy, which encompassed most of central and southern Malawi. In northern Malawi the Ngonde people established a kingdom c. 1600, and in the 18th century the Chikulamayembe state was founded. The slave trade flourished during the 18th–19th century; Islam and Christianity arrived in the region c. 1860. Britain established colonial authority in 1891, creating the Nyasaland Districts Protectorate. It became the British Central Africa Protectorate in 1893 and Nyasaland in 1907. The colonies of Northern and Southern Rhodesia and Nyasaland formed a federation (1951–53), which was dissolved in 1963. The next year Malawi achieved independence as a member of the British Commonwealth. In 1966 it became a republic, with Hastings Banda as president. In 1971 he was designated president for life, and he ruled for three decades before being defeated in multiparty presidential elections in 1994. A new constitution was adopted in 1995.

Malawi, Lake *or* **Lake Nyasa** \nī-'a-sə\ Lake, southern Africa, bounded on the west and south by Malawi, on the east by Mozambique, and on the north by Tanzania. It is the southernmost and third largest of the Great Rift Valley lakes. It is about 360 mi (580 km) long with an average width of 25 mi (40 km); it covers an area of 11,430 sq mi (29,604 sq km). It contains Likoma Island, site of an Anglican cathedral completed in 1911. On the heavily populated Malawi shore there are several government stations. The lake is fed by 14 rivers, and its sole outlet is the Shire River. There are about 200 recorded species of fish in the lake.

Malay \mə-'lā, 'mā-ˌlā\ Any member of an ethnic group that probably originated in Borneo and expanded into Sumatra and the Malay Peninsula. They constitute more than half the population of Peninsular Malaysia. They are mainly a rural people, growing rice for food and rubber as a cash crop. Heavily influenced by India, they were Hinduized before converting to Islam in the 15th century. Their culture has also been influenced by the cultures of the Thai, Javanese, and Sumatrans. Malay society has traditionally been somewhat feudal; class distinctions are still marked, and marriages have traditionally been arranged by parents and governed by Islamic law.

Malay Archipelago Largest group of islands in the world, located off the southeastern coast of Asia between the Indian and Pacific oceans. It consists of the more than 13,000 islands of Indonesia and some 7,000 islands of the Philippines. Formerly called the East Indies, the archipelago extends along the Equator for more than 3,800 mi (6,100 km). Principal islands include the Greater Sunda Islands (Sumatra, Java, Borneo, and Celebes), the Lesser Sundas, the Moluccas, New Guinea, Luzon, Mindanao, and the Visayan Islands.

Malay \mə-'lā, 'mā-ˌlā\ **language** Austronesian language with some 33 million first-language speakers in the Malay Peninsula, Sumatra, Borneo, and other parts of Indonesia and Malaysia. Because Malay was spoken on both sides of the Strait of Malacca, a crucial trade route between India and China, Malay-speaking groups were drawn into international commerce centuries before European penetration of the region, and Malay became a lingua franca in Indonesian ports, giving rise to a range of pidgins and creoles known as Bazaar Malay (Melayu Pasar). In 20th-century Indonesia, a standardized form of Malay was adopted as the national language, Indonesian; written in Latin letters, it is now spoken or understood by about 70% of the population. Similar standardizations of Malay comprise the national languages of Malaysia and Brunei. The oldest known Malay texts are 7th-century inscriptions from southern Sumatra in an Indic script (see Indic writing system); a continuous Malay literary tradition did not begin until the Islamization of the Malay Peninsula in the 14th century.

Malay Peninsula Peninsula, Southeast Asia. Comprising the mainland portion of Malaysia and southwestern Thailand, it occupies an area of 70,000 sq mi (181,300 sq km), has a width of 200 mi (322 km), and extends south for 700 mi (1,127 km) to Cape Balai, the southernmost point of the Asian continent; the island country of Singapore lies just south across the Johore Strait. Its central mountain range, rising to 7,175 ft (2,187 m) at Mount Tahan, divides the peninsula lengthwise and is the source of many rivers. Both its western and eastern coasts are exposed to monsoons. It has large tracts of tropical rainforest and is a major producer of rubber and tin.

Malayalam \ˌmä-lə-'yä-ləm\ **language** Dravidian language spoken by more than 36 million people mainly in the Indian state of Kerala. Malayalam is closely related to Tamil, from which it is estimated to have separated about the 10th century AD. The earliest literary composition in the language is from the 13th century. Like other major Dravidian languages, Malayalam has a number of regional dialects, social dialects that reflect differences in caste and religion, and marked distinctions in formal and informal usage. Literacy among Malayalam speakers is believed to be higher than literacy among speakers of any other Indian language.

Malayan Emergency (1948–60) Period of unrest following the creation of the Federation of Malaya (precursor of Malaysia) in 1948. The Communist Party of Malaya, which was mostly Chinese, was alarmed at the special guarantees of rights for Malays (including the position of sultans) and began a guerrilla insurgency, which was supported by only a minority of the Chinese. British efforts to suppress the insurgency militarily were unpopular, especially their relocation of rural Chinese into tightly controlled "New Villages"; when the British addressed political and economic grievances, the rebels became increasingly isolated, and the emergency ended. See also Tunku Abdul Rahman Putra Alhaj; Malayan People's Anti-Japanese Army.

Malayan People's Anti-Japanese Army (MPAJA) Guerrilla movement formed to oppose the Japanese occupation of Malaya (Peninsular Malaysia) during World War II. The British military, foreseeing a Japanese invasion, trained small groups of Malayans as guerrilla troops; these became the MPAJA. Members of the MPAJA, who were primarily Chinese communists, emerged as heroes from the war and attempted to seize power before the British military returned. Its leadership then went underground until 1948, when they initiated the uprising called the Malayan Emergency.

Malayo-Polynesian languages See Austronesian languages

Malaysia Country, Southeast Asia. It is composed of two regions—Peninsular, or West, Malaysia and East Malaysia—separated by 400 mi (650 km) of the South China Sea. West Malaysia occupies the southern half of the Malay Peninsula (Malaya) and is bordered to the north by Thailand. East Malaysia lies on the northwestern part of the island of Borneo and consists of the states of Sarawak and Sabah. Area: 127,355 sq mi

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(329,847 sq km). Population (2005 est.): 26,130,000. Capitals: Kuala Lumpur/Putrajaya. Because of Malaysia's location on the heavily traveled Strait of Malacca, the population is a highly diverse mix, in which ethnic Malays and Chinese form the largest groups and smaller ethnic groups include Indians, Pakistanis, and Tamils. Languages: Malay (official), Chinese, Indo-European languages. Religions: Islam (official), Buddhism, Christianity, Hinduism. Currency: ringgit. West Malaysia is largely mountainous; East Malaysia has coastal plains rising to hills and then to a mountainous core. Much of Malaysia is covered by rainforest. Tree crops, notably rubber and palm oil, are the most important cash crops; rice is the chief staple crop. Petroleum drilling and production and tin mining are important, as is the manufacture of electronic products, rubber goods, cement, and iron and steel products. Malaysia is a constitutional monarchy with two legislative houses; the chief of state is the paramount ruler, and the head of government is the prime minister. Malaya has been inhabited for 6,000–8,000 years. Small kingdoms existed in the 2nd–3rd century AD when adventurers from India first arrived. Sumatran exiles founded the city-state of Malacca c. 1400, and it flourished as a trading and Islamic religious centre until its capture by the Portuguese in 1511. Malacca passed to the Dutch in 1641. The British founded a settlement on Singapore Island in 1819, and by 1867 they had established the Straits Settlements, including Malacca, Singapore, and Penang. During the late 19th century, Chinese began to migrate to Malaya. Japan invaded Malaya in 1941 and captured Singapore in 1942. After Japan's defeat in 1945, opposition to British rule led to the creation of the United Malays National Organization (UMNO) in 1946, and in 1948 the peninsula was federated with Penang. Malaya gained independence from Britain in 1957, and the Federation of Malaysia was established in 1963. Its economy expanded greatly from the late 1970s, though it experienced the regional economic slump of the mid- to late 1990s; the economy subsequently recovered.

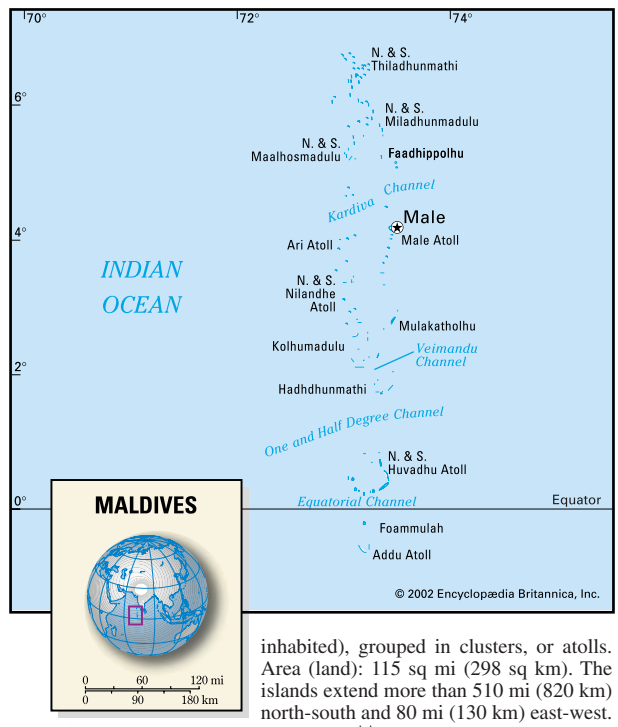
Malcolm II (b. c. 954—d. Nov. 25, 1034) King of Scotland (1005–34). He acquired the throne after killing Kenneth III and defeating a Northumbrian army at Carham (c. 1016). He became the first king to reign over territory roughly equivalent to modern Scotland. He tried to eliminate rivals to his grandson Duncan I, but Macbeth survived to challenge the succession.

Malcolm III Canmore (b. c. 1031—d. Nov. 13, 1093, near Alnick, Northumberland, Eng.) King of Scotland (1058–93). The son of King Duncan I, he lived in exile in England after Macbeth murdered his father. He defeated and killed Macbeth in 1057 and was crowned king, founding a dynasty that consolidated royal power in Scotland. He gave refuge to the Anglo-Saxon prince Edgar the Aetheling in 1066. Though he recognized William I as overlord in 1072, Malcolm made five raids into England, during the last of which he was killed.

Malcolm X *orig.* **Malcolm Little** *later* **El-Hajj Malik El-Shabazz** (b. May 19, 1925, Omaha, Neb., U.S.—d. Feb. 21, 1965, New York, N.Y.) U.S. black Muslim leader. He was raised in Michigan, where the family house was burned by the Ku Klux Klan; his father was later murdered and his mother was institutionalized. He moved to Boston, drifted into petty crime, and was sent to prison for burglary in 1946. He converted to the Black Muslim faith (Nation of Islam) the same year. On his release in 1952, he changed his last name to X to signify his rejection of his "slave name." Soon after meeting the Nation of Islam's leader, Elijah Muhammad, he became the sect's most effective speaker and organizer. He spoke with bitter eloquence against white exploitation of blacks and derided the civil rights movement and integration, calling instead for black separatism, black pride, and the use of violence for self-protection. Differences with Elijah Muhammad prompted Malcolm to leave the Nation of Islam in 1964. A pilgrimage to Mecca led him to acknowledge the possibility of world brotherhood and to convert to orthodox Islam. Rival Black Muslims made threats against his life, and he was shot to death at a rally in a Harlem ballroom. His celebrated autobiography (1965) was written by Alex Haley on the basis of numerous interviews conducted shortly before Malcolm's death.

Malcolm X
AP/WIDE WORLD PHOTOS

Maldives \'mȯl-ˌdēvz\ *officially* **Republic of Maldives** Archipelago country, north-central Indian Ocean southwest of Sri Lanka. It is a chain of about 1,200 small coral islands and sandbanks (some 200 of which are inhabited), grouped in clusters, or atolls. Area (land): 115 sq mi (298 sq km). The islands extend more than 510 mi (820 km) north-south and 80 mi (130 km) east-west. Population (2005 est.): 294,000. Capital: Male. The population is ethnically mixed; ancestors include Dravidian and Sinhalese peoples as well as Arabs, Chinese, and others from surrounding Asian areas. Languages:



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Divehi (official), Arabic. Religion: Islam (official; predominantly Sunni). Currency: rufiyaa. All the islands are low-lying, none rising more than 6 ft (1.8 m) above sea level. The atolls have sandy beaches, lagoons, and a luxuriant growth of coconut palms, together with breadfruit trees and tropical bushes. One of the world's poorest countries, the Maldives has a developing economy based on fishing, tourism, boatbuilding, and boat repairing. It is a republic with one legislative house; its head of state and government is the president. The archipelago was settled in the 5th century BC by Buddhists probably from Sri Lanka and southern India; according to tradition, Islam was adopted in 1153. The Portuguese held sway in Male in 1558–73. The islands were a sultanate under the Dutch rulers of Ceylon (Sri Lanka) during the 17th century. After the British gained control of Ceylon in 1796, the area became a British protectorate, a status formalized in 1887. The islands won full independence from Britain in 1965, and in 1968 a republic was founded and the sultanate abolished. The Maldives joined the British Commonwealth in 1982. Its economy has gradually improved, aided by the growth of tourism. In 2004 the archipelago was damaged by a large tsunami.

Maldon \'mȯl-dən**, Battle of** (991) Conflict fought between Saxons and victorious Viking raiders. The battle was commemorated in an Old English heroic poem, which described the war parties aligned on either side of a stream in Essex. It recorded the names of English deserters as well as those who stood fast against the Vikings.

Male \'mä-lē\ Chief atoll (pop., 2000: 74,069) and capital of the Maldives. Located in the centre of the Maldives, it comprises two groups of islets: North Male, which is 32 mi (51 km) by 23 mi (37 km); and South Male, which is 20 mi (32 km) by 12 mi (19 km). It has central courts, a government hospital, an international airport, and public and private schools. It is a trade and tourist centre.

Malebranche \mȧl-'brä^{n}sh**, Nicolas de** (b. Aug. 6, 1638, Paris, France—d. Oct. 13, 1715, Paris) French priest, theologian, and philosopher. His philosophy is an attempt to reconcile Cartesianism with the thought of St. Augustine and with Neoplatonism. Central to Malebranche's metaphysics is his doctrine of occasionalism, according to which what are commonly called "causes" are merely "occasions" on which God acts to produce effects. His principal work is *Search After Truth* (3 vol., 1674–75).

Malenkov \mə-'len-ˌkȯf**, Georgy (Maksimilianovich)** (b. Jan. 13, 1902, Orenburg, Russia—d. Jan. 14, 1988, near Moscow, Russia, U.S.S.R.) Soviet politician and prime minister (1953–55). He joined the Communist Party in 1920 and rose swiftly through the ranks as a close associate of Joseph Stalin. In 1946 he became a full member of the Politburo and deputy prime minister. After Stalin's death (1953), he was forced to yield his post as senior party secretary to Nikita Khrushchev, but as prime minister Malenkov worked to reduce arms appropriations, increase the production of consumer goods, and provide more incentives for collective farm workers. His programs were opposed by other party leaders, and he was forced to resign as prime minister (1955). Involved in the unsuccessful effort to depose Khrushchev, he was expelled from his other posts (1957) and from the party (1961) and was exiled to central Asia to manage a hydroelectric plant.

Malesherbes \mȧl-'erb**, Chrétien Guillaume de Lamoignon de** (b. Dec. 6, 1721, Paris, France—d. April 22, 1794, Paris) French royal administrator. A lawyer, he was made a counselor in the Parlement (high court) of Paris in 1744. As director of the press (1750–63), he allowed publication of many works by the philosophes, including Denis Diderot's *Encyclopédie*. In 1775 he became secretary of state for the royal household and instituted prison and legal reforms, including ending the misuse of lettres de cachet, and supported the economic reforms of the comptroller general, Anne-Robert-Jacques Turgot. He failed to win the king's support for his projects and resigned in 1776. In the French Revolution, he helped conduct the defense of Louis XVI (1792). He was arrested in 1793, tried for treason, and guillotined.

Malevich \mə-'lyā-vich**, Kazimir (Severinovich)** (b. Feb. 23, 1878, near Kiev, Russia—d. May 15, 1935, Leningrad) Russian painter and designer. He discovered Cubism on a trip to Paris in 1912 and returned to lead the Russian Cubist movement. In 1915 he exhibited paintings more abstractly geometrical than any seen before, consisting of simple geometrical forms painted in a limited palette, a style he called Suprematism. In 1917–18 he created his well-known *White on White* series, austere images of a white square floating on a white background. In 1919 he joined Marc Chagall at his revolutionary art school in Vitebsk, where he exerted a strong influence on El Lissitzky. In the 1920s he returned to representational painting but could not accede to the government's demand for Socialist Realism. Though his career was doomed, he greatly influenced Western art and design.

Malherbe \mə-'ler-bə**, François de** (b. 1555, in or near Caen, France—d. Oct. 16, 1628, Paris) French poet and theoretician. He converted to Roman Catholicism after receiving a Protestant education. In 1577 he became secretary to the governor of Provence, Henri d'Angoulême. His ode to the new queen, Marie de Médicis, made his name widely known, and he became court poet in 1605. His 200-odd surviving letters provide a picture of court life, and his commentary on the poetry of Philippe Desportes (1546–1606) reveal his principles of poetry: that it must demonstrate verbal harmony, propriety, and intelligibility.

Mali *officially* **Republic of Mali** Country, western Africa. Area: 482,077 sq mi (1,248,574 sq km). Population (2005 est.): 11,415,000. Capital: Bamako. The Bambara constitute about one-third of the total population. Other ethnic groups include the Fulani and the Berbers (Amazigh). Languages: French (official), Dogon, Bambara, Songhai, Soninke, Senufo, Arabic. Religions: Islam; also traditional beliefs, Christianity. Currency: CFA franc. Mali's terrain is largely flat, and in the north its plains stretch into the Sahara. The upper Niger River basin is in the south; nearly one-third of the total length of the Niger River flows through Mali. Only a tiny fraction of Mali's total land area is considered arable. Mineral reserves, which are largely unexploited, include iron ore, bauxite, gold, and copper. Agriculture constitutes the major economic activity. Staple crops include millet, sorghum, corn, and rice; cash crops include cotton and peanuts. Mali is a republic with one legislative house; its chief of state is the president, and the head of government is the prime minister. Inhabited since prehistoric times, the region was on a trans-Saharan caravan route. The Malinke empire of Mali was founded in the 12th century on the upper and middle Niger. In the 15th century the Songhai empire in the Timbuktu-Gao region gained control. Morocco invaded the area in 1591, and Timbuktu gradually declined in importance. In the mid-19th century the French conquered the area, which became part of French West Africa. In 1946 the area, known as the French Sudan, became an overseas territory of the French Union. In 1958 it was proclaimed the Sudanese Republic, and it joined with Senegal (1959–60) to form the Mali Federation. Senegal seceded, and in 1960 the independent Republic of Mali was formed. The government was overthrown by military coups in 1968 and 1991. Elections were held twice in the 1990s and again in 2002. The country has experienced continuing economic problems.

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Mali empire Trading empire that flourished in West Africa in the 13th–16th centuries. It developed from the state of Kangaba on the upper Niger River and was probably founded before AD 1000. The Malinke inhabitants of Kangaba acted as middlemen in the gold trade in ancient Ghana. Growing in the 13th century under the leadership of Sundiata, it continued to expand in the 14th century and absorbed Gao and Timbuktu. Its boundaries extended to the Hausa people in the east and to Fulani and Tukulor peoples in the west. It eventually outgrew its political and military strength, and many of its subject areas revolted. By c. 1550 it had ceased to be an important political entity.

Malinke \mə-'liŋ-kē\ *or* **Mandinka** *or* **Mandingo** Cluster of peoples occupying parts of Mali, Guinea, Côte d'Ivoire, Senegal, Gambia, and Guinea-Bissau. They speak a Mande language of the Niger-Congo family. Numbering 4.7 million, they are divided into numerous independent groups dominated by a hereditary nobility. One group, the Kangaba, has one of the world's most ancient dynasties; its rule has been virtually continuous since the 7th-century founding of the Mali empire. Most contemporary Malinke grow millet and sorghum and tend cattle. In religion they are divided among Islam and indigenous faiths.

Malinovsky, Rodion (Yakovlevich) (b. Nov. 23, 1898, Odessa, Ukraine, Russian Empire—d. March 31, 1967, Moscow, Russia, U.S.S.R.) Soviet marshal prominent in World War II. A corps commander in 1941, he rose to army-group commands and played an important role in the Battle of Stalingrad, then commanded the Soviet drives into Romania (1944) and Austria (1945). After the war he held command positions in the Soviet Far East (1945–55). As minister of defense (1957–67), he oversaw a buildup of Soviet military power.

Malinowski \ˌma-lə-'nȯf-skē**, Bronisław (Kasper)** (b. April 7, 1884, Kraków, Pol., Austria-Hungary—d. May 16, 1942, New Haven, Conn., U.S.) Polish-British anthropologist. He is principally associated with studies of the peoples of Oceania and with the school of thought known as functionalism. After taking degrees in philosophy, physics, and mathematics in Poland, Malinowski happened upon James George Frazer's *The Golden Bough* and went to study anthropology at the London School of Economics and Political Science (1910–16). Doing research in the Trobriand Islands, he lived in a tent among the people (see Trobriander), spoke the vernacular fluently, recorded "texts" freely on the scene as well as in set interviews, and observed reactions with an acute clinical eye. He was thus able to present a dynamic picture of social institutions that clearly separated ideal norms from actual behaviour and in doing so laid much of the basis for modern anthropological field research. He taught at the London School of Economics (1922–38) and Yale University (1938–42). He wrote several works that are now considered classics of anthropology, including *Argonauts of the Western Pacific* (1922) and *Magic, Science and Religion* (1948).

Malinowski
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Malla era Period of Nepal's history when the Kathmandu Valley was ruled by the Malla dynasty (10th–18th century). The Malla ruler Jaya Sthiti (r. c. 1382–95) introduced a legal and social code strongly influenced by contemporary Hindu principles. In the early 18th century one of Nepal's independent principalities, Gurkha, began to challenge the Mallas, who were at that time weakened by familial dissension and social and economic discontent. They were overthrown by the Gurkha ruler Prithvi Narayan Shah in 1769. See also Newar.

mallard \'mal-ərd\ Abundant "wild duck" (*Anas platyrhynchos*, family Anatidae) of the Northern Hemisphere, ancestor of most domestic ducks. The mallard is a typical dabbling duck in its general habits and courtship display. The drake of the common mallard (subspecies *A. p. platyrhynchos*) has a metallic green or purplish head, reddish breast, and light-gray body; the hen is mottled yellowish brown. Both sexes have a yellow bill and a purplish blue, white-bordered wing mark. Males and females of the Greenland mallard (*A. p. conboschas*) also differ markedly in plumage. In the other subspecies, both sexes resemble the female common mallard. Mallards are found throughout most of Asia, Europe, and northern North America.

Mallarmé \mȧ-lȧr-'mā**, Stéphane** (b. March 18, 1842, Paris, France—d. Sept. 9, 1898, Valvins, near Fontainbleau) French poet. With Paul Verlaine, he was a founder and leader of the Symbolist movement. A schoolteacher throughout his life, Mallarmé made steady progress in his parallel career as a poet. Perhaps partly owing to tragedies in his life, most of his verse expresses an intellectual longing to transcend reality and find refuge in an ideal world, as in the dramatic poems *Hérodiade* (1869) and *L'Après-midi d'un faune* (1876; "The Afternoon of a Faun"), which inspired Claude Debussy's famous prelude, and the typographically innovative *Un Coup de dés* (1897). After 1868 he devoted himself to writing complex, exquisitely wrought, and extraordinarily difficult poems about the nature of imagination itself. The poems were intended for what he called his *Grand oeuvre*, which he never completed.

Stéphane Mallarmé, 1891.
ARCHIVES PHOTOGRAPHIQUES

Malle \'mȧl**, Louis** (b. Oct. 30, 1932, Thumeries, France—d. Nov. 23, 1995, Beverly Hills, Calif., U.S.) French film director. He made his first feature film, *Frantic*, in 1957. Malle gained commercial success with *The Lovers* (1958), starring Jeanne Moreau, and he became a leading figure in the French New Wave. In *The Fire Within* (1963), *Thief of Paris* (1967), *Murmur of the Heart* (1971), and *Lacombe, Lucien* (1973), he achieved emotional realism and stylistic simplicity. In 1975 he moved to the U.S., where he directed films such as *Pretty Baby* (1978), *Atlantic City* (1980), *My Dinner with André* (1981), *Au revoir les enfants* (1987), and *Vanya on 42nd Street* (1994).

Mallet, Robert (b. June 3, 1810, Dublin, Ire.—d. Nov. 5, 1881, London, Eng.) Irish civil engineer and scientific investigator. He studied at Trinity College and in 1831 took charge of his father's Victoria foundry, which he expanded into the dominant foundry in Ireland. His commissions included the construction of railroad terminals, the Nore viaduct, the Fastnet Rock lighthouse, and several swivel bridges over the Shannon. His major innovation in bridge technology was buckled-plate flooring. He built an early form of seismograph and advanced the technique of making large castings of iron, such as heavy cannon.

Mallorca See Majorca

mallow family Family Malvaceae (order Malvales), which contains about 95 genera of herbs, shrubs, and small trees. Mallow species occur in all but the coldest parts of the world, but they are most numerous in the tropics. Hairs that branch into starlike patterns commonly cover some or most vegetative (nonflower) parts of these plants. The flowers are regular and often showy. Cotton is the most important member of the family economically. The green fruits of okra are edible. Many species are valued as ornamentals, including hollyhock and rose of Sharon.

Malmö \'mäl-ˌmœ\ Port city (pop., 2000 est.: city, 259,579; metro. area, 522,857), southern Sweden, located across the Sound from Copenhagen. Originally known as Malmhaug, it was chartered in the late 13th century. Following its union with Sweden in 1658, it suffered an economic decline, partly because of the loss of trade. The building of the harbour in 1775 and the arrival of the railroad after 1800 stimulated economic development. Sweden's third largest city, it is an important commercial centre. Its economy is based on export products, shipbuilding, and textile manufactures. Its historic buildings include a 16th-century fortress, the town hall, and the 14th-century St. Peter's Church.

malnutrition Condition resulting from inadequate diet or from inability to absorb or metabolize nutrients. Food intake may be insufficient to supply calories or protein (see kwashiorkor) or deficient in one or more

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essential VITAMINS or minerals. The latter case can lead to specific nutritional deficiency diseases (including BERIBERI, PELLAGRA, RICKETS, and SCURVY). Metabolic defects, especially of the digestive system, LIVER, KIDNEYS, or red blood cells, prevent proper DIGESTION, absorption, and metabolism of nutrients. See also NUTRITION.

Malory, Sir Thomas (fl. c. 1470) English author of *Le Morte Darthur* ("The Death of Arthur"). Even in the 16th century Malory's identity was unknown, but he is tentatively identified as a Welshman and knight who was imprisoned at various times. *Le Morte Darthur* (completed c. 1470) was the first account of ARTHURIAN LEGEND in English prose. Though based on French romances, it differs from its models in its emphasis on the brotherhood of the knights rather than on courtly love and on the conflicts of loyalty that destroy the fellowship. Only one extant manuscript predates its printing by WILLIAM CAXTON in 1485.

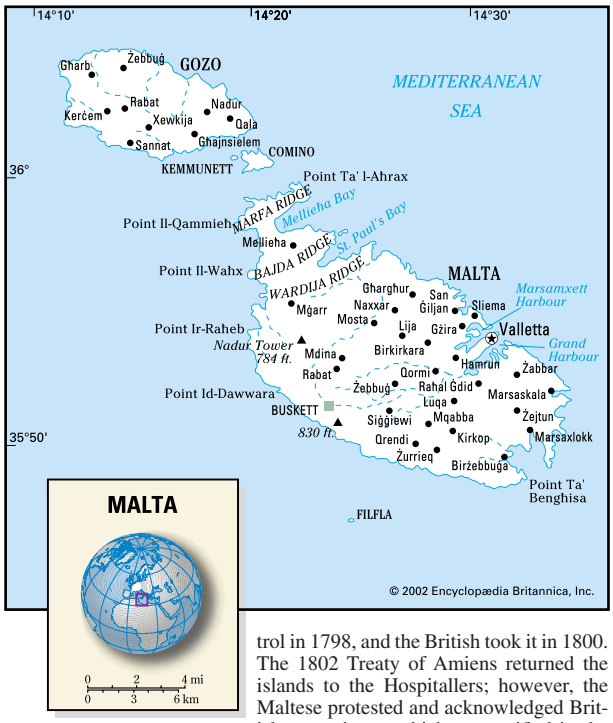
Malpighi \mal-'pē-gē**, Marcello** (b. March 10, 1628, Crevalcore, near Bologna, Papal States—d. Nov. 30, 1694, Rome) Italian physician and biologist. In 1661 he identified the pulmonary capillary network, proving WILLIAM HARVEY's theory on blood circulation. He discovered the taste buds and was the first to see red blood cells and realize that they gave blood its colour. He studied subdivisions of the liver, brain, spleen, kidneys, bone, and deeper skin layers (Malpighian layers), concluding that even the largest organs are composed of minute glands. Malpighi also studied insect larvae (especially the silkworm), chick embryology, and plant anatomy, seeing an analogy between plant and animal organization. He is regarded as the founder of microscopic anatomy and may be regarded as the first histologist.

malpractice NEGLIGENCE, misconduct, lack of ordinary skill, or breach of duty in the performance of a professional service (e.g., in medicine) that results in injury or loss. The plaintiff must usually demonstrate a failure by the professional to perform according to the field's accepted standards. Physicians, lawyers, accountants, and other professionals have increasingly been subject to malpractice suits in the U.S., causing a dramatic increase in malpractice insurance rates.

Malraux \mål-'rō**, André (-Georges)** (b. Nov. 3, 1901, Paris, France—d. Nov. 23, 1976, Paris) French novelist, art historian, and statesman. Imprisoned at age 21 by French colonial authorities while on an archaeological expedition in Cambodia, Malraux grew to be a fervent anticolonialist and advocate for social change. He became involved with revolutionary movements in Indochina and later fought in the Spanish Civil War and with the French Resistance during World War II. He was CHARLES DE GAULLE's minister of cultural affairs (1958–68). His novels, which often draw on his experiences, include *The Conquerors* (1928); *Man's Fate* (1933, Prix Goncourt), his masterpiece; and *Man's Hope* (1937). After 1945 he abandoned fiction for art history and criticism; *The Voices of Silence* (1951) is his major work of the period.

malt Grain product used in beverages and foods. Malt provides a basis for FERMENTATION and adds flavour and nutrients. It is made by steeping grain, usually BARLEY, in water and allowing partial GERMINATION to occur. The flavour of BEER primarily results from the malt from which it is made. The enzymes produced within the barley seed during germination break down STARCH into malt sugar, or maltose, which is then fermented by YEAST to yield alcohol and carbon dioxide. WHISKEY likewise is made with malt.

Malta Island country, south of Sicily in the Mediterranean Sea. It consists of the three inhabited islands Malta (the largest), Gozo, and Comino and the two uninhabited islets Comminotto and Filfla. Area: 122 sq mi (315 sq km). Population (2005 est.): 404,000. Capital: VALLETTA. Malta's population, nearly all native-born, has a mixture of Italian, Arab, British, and Phoenician heritage. Languages: Maltese, English (both official). Religion: Christianity (predominantly Roman Catholic [official]). Currency: Maltese lira. Although about one-third of its total land area is arable, Malta imports most of its food; tourism is its major industry. It is a republic with one legislative house; its chief of state is the president, and its head of government is the prime minister. Malta was inhabited as early as 3800 BC. Although there is limited evidence of a Phoenician presence, it seems clearer that the Carthaginians had arrived in Malta by the 6th century BC, and the island came under Roman control in 218 BC. In AD 60 ST. PAUL the Apostle was shipwrecked on the island and converted the inhabitants to Christianity. It was under Byzantine rule until the Arabs seized control in 870. In 1091 the Normans defeated the Arabs, and Malta was ruled by a succession of feudal lords until the early 16th century. In 1530 it came under the control of the Hospitallers; NAPOLEON seized control in 1798, and the British took it in 1800. The 1802 Treaty of Amiens returned the islands to the Hospitallers; however, the Maltese protested and acknowledged British sovereignty, which was ratified in the 1814 Treaty of Paris. Malta became self-governing in 1921 but reverted to a colonial regime in 1936. Malta was heavily bombed by Germany and Italy during World War II, and in 1942 it received Britain's George Cross for "heroism and devotion," the first time that this medal was not conferred to an individual. In 1964 Malta gained independence within the Commonwealth, and it became a republic in 1974. When its alliance with Britain ended in 1979, Malta proclaimed its neutral status. In 2004 it joined the European Union.



Malta, Knights of See KNIGHTS OF MALTA

Maltese Breed of TOY DOG named for the island of Malta, where it may have originated about 2,800 years ago. Delicate-looking but vigorous, affectionate, and lively, it was once the valued pet of the wealthy and aristocratic. It has a long, silky, pure-white coat, hanging ears, a compact body, and a plumed tail that curves over its back. It stands about 5 in. (13 cm) and weighs up to 7 lbs (3 kg).

Maltese language Principal language of Malta, developed from a DIALECT of ARABIC closely related to those of Algeria and Tunisia. It has been strongly influenced by the ROMANCE LANGUAGES, especially Italian. Maltese is the only form of Arabic written in the LATIN ALPHABET.

Malthus \'mal-thəs**, Thomas Robert** (b. Feb. 14/17, 1766, Rookery, near Dorking, Surrey, Eng.—d. Dec. 23, 1834, St. Catherine, near Bath, Somerset) British economist and demographer. Born into a prosperous family, he studied at the University of Cambridge and was elected a fellow of Jesus College in 1793. In 1798 he published *An Essay on the Principle of Population*, in which he argued that population will always tend to outrun the food supply—that the increase of population will take place, if unchecked, in a geometrical progression, while the means of subsistence will increase only in an arithmetical progression. He believed population would expand to the limit of subsistence and would be held there by famine, war, and ill health. He enlarged on his ideas in later editions of his work (to 1826). He argued that relief measures for the poor should be strictly limited since they tended to encourage the growth of excess population. His theories, though largely disproven, had great influence on contemporary social policy and on such economists as DAVID RICARDO.

Malvinas, Islas See FALKLAND ISLANDS

mamba \'mäm-bə\ Any of four or five species of slender, agile ELAPID snakes (genus *Dendroaspis*, or *Dendraspis*) having large scales and long

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front teeth. They inhabit sub-Saharan Africa, where they hunt small animals. The aggressive black mamba (*D. polylepis*), up to 14 ft (4.2 m) long, may be dull gray, greenish brown, or black, depending on age. It dens in rocky open country. It rears up to strike, biting a person's head or trunk. Its bite is nearly always fatal without antivenin treatment. The green mamba (e.g., *D. angusticeps*) is smaller (to 9 ft, or 2.7 m), more strongly arboreal, and less aggressive.

East African green mamba (*Dendroaspis angusticeps*).
E.S. ROSS

Mamet \'mam-it**, David (Alan)** (b. Nov. 30, 1947, Chicago, Ill., U.S.) U.S. playwright, director, and screenwriter. In 1973 he founded the St. Nicholas Theatre Co. in Chicago. He won wide notice with *Sexual Perversity in Chicago* (1974) and followed it with plays such as *American Buffalo* (1977) and *Glengarry Glen Ross* (1983, Pulitzer Prize). He became known for rapid-fire dialogue studded with obscenities and for his preoccupation with power relationships and corporate corruption. Mamet used the rhythms and rhetoric of everyday speech to delineate character, describe intricate relationships, and drive dramatic development. His later plays include *Speed-the-Plow* (1987), *Oleanna* (1992), and *The Cryptogram* (1994); his screenplays include *The Verdict* (1980) and *The Untouchables* (1986). He also wrote and directed films such as *House of Games* (1987) and *State and Main* (2000).

Mamlūk \'mam-ˌlük\ **dynasty** *or* **Mamluke** \'mam-ə-ˌlük\ **dynasty** (1250–1517) Rulers of Syria and Egypt. The term *mamlūk* is an Arabic word for slave. Slave soldiers had been used in the Islamic world since the 9th century, and they often exploited the military power vested in them to seize control from the legitimate political authorities. In 1250 a group of *mamlūk* generals seized the throne of the Ayyūbid dynasty on the death of the sultan Al-Malik al-Ṣāliḥ Ayyūb (r. 1240–49). The resulting dynasty legitimized its rule by reconstituting the caliphate of the ʿAbbāsid dynasty (destroyed by the Mongols in 1258) and by acting as patrons to the rulers of Mecca and Medina. Under Mamlūk rule the remaining crusaders were expelled from the eastern Mediterranean coast, and the Mongols were driven back from Palestine and Syria. Culturally, historical writing and architecture flourished during their rule. A shift in their ethnic makeup from Turkish to Circassian corresponded with their slow decline; their failure to adopt field artillery as weapons (except in siege warfare) contributed to their defeat by the Ottoman Empire in 1517. They afterward remained intact as a social class, however, and continued to exercise a high degree of political autonomy, though they were only one of several forces influencing Egyptian political life. Their power was finally broken by the Albanian-Egyptian officer Muḥammad ʿAlī in a massacre in 1811. See also Baybars I.

mammal Any member of the class (Mammalia) of warm-blooded vertebrates having four limbs (except for some aquatic species) and distinguished from other chordate classes by the female's milk-secreting glands and the presence of hair at some stage of development. Other unique characteristics include a jaw hinged directly to the skull, hearing through bones in the middle ear, a muscular diaphragm separating the pectoral and abdominal cavities, and nonnucleated mature red blood cells. Mammals range in size from the tiny shrew to the enormous blue whale. Monotremes (platypus and echidna) lay eggs; all other mammals bear live young. Marsupial newborns complete their development outside the womb, sometimes in a pouchlike structure. Placental mammals (see placenta) are born at a relatively advanced stage of development. The earliest mammals date from the late Triassic Period (which ended 206 million years ago); their immediate ancestors were the reptilian therapsids. For 70 million years mammals have been the dominant animals in terrestrial ecosystems, a consequence of two principal factors: the great behavioral adaptability provided by the ability of mammalian young to learn from their elders (a consequence of their dependence on their mothers for nourishment) and the physical adaptability to a wide range of climates and conditions provided by their warm-bloodedness. See also carnivore; cetacean; herbivore; insectivore; omnivore; primate; rodent.

mammary gland \'mam-ə-rē\ Milk-producing gland of female mammals, usually present but undeveloped and nonfunctional in males. Regulated by the endocrine system, it is derived from a modification of sweat glands. The mammary gland of a woman who has not borne children consists of a conical disk of glandular tissue, encased in fat that gives the breast its shape. The gland is made up of lobes drained by separate ducts that meet at the nipple. Pregnancy causes the cells lining the lobes to multiply, and lactation begins in response to hormones released starting at the time of birth. At the end of lactation, the glands return almost to their state before pregnancy. After menopause, they atrophy and are largely replaced by connective tissue and fat.

mammoth Any of several species (genus *Mammuthus*) of extinct elephants whose fossils have been found in Pleistocene deposits (beginning 1.8 million years ago) on every continent except Australia and South America. The woolly, Northern, or Siberian mammoth (*M. primigenius*) is the best-known species because the Siberian permafrost preserved numerous carcasses intact. Most species were about the size of modern elephants; some were much smaller. The North American imperial mammoth (*M. imperator*) grew to a shoulder height of 14 ft (4 m). Many species had a short, woolly undercoat and a long, coarse outer coat. Mammoths had a high, domelike skull and small ears. Their long, downward-pointing tusks sometimes curved over each other. Cave paintings show them traveling in herds. Mammoths survived until about 10,000 years ago; hunting by humans may have been a cause of their extinction. See also mastodon.

Mammoth Cave National Park National park, southwest-central Kentucky, U.S. The park, authorized in 1926 and established in 1941, occupies a surface area of 82 sq mi (212 sq km) that covers a system of limestone caverns. In 1972 a passage was discovered linking the Mammoth Cave and the Flint Ridge Cave System; the explored underground passages have a combined length of some 329 mi (530 km). The caves are inhabited by various animals that have undergone evolutionary adaptation to the dark, including cave crickets, blindfish, and blind crayfish. Mummified Indian bodies, possibly of pre-Columbian origin, have been found in the caves.

Mamoré \ˌmä-mō-'rā\ **River** River, north-central Bolivia. It rises in the Andes Mountains and in its upper course is sometimes known as Río Grande. It flows north to the Brazilian border, where it is joined by the Guaporé River; it forms the border of Bolivia and Brazil as far north as Villa Bella, where it joins the Beni River to form the Madeira River, after a total course of about 1,200 mi (1,900 km). It is navigable to Guajará-Mirim, Braz.

Mamoulian \mə-'mü-lē-ən**, Rouben** (b. Oct. 8, 1897, Tiflis, Georgia, Russian Empire—d. Dec. 4, 1987, Los Angeles, Calif., U.S.) Russian-U.S. director. After training as an actor at the Moscow Art Theatre, he moved to London in 1918, where he directed operettas and musicals. After immigrating to the U.S. in 1923, he worked for the Theatre Guild and directed the play *Porgy* (1927); he later directed the original production of its musical adaptation, *Porgy and Bess* (1935), and later musicals such as *Oklahoma!* (1943) and *Carousel* (1945). Invited to direct the film musical *Applause* (1929), he won acclaim for his innovative camera work; his later films include *City Streets* (1931), *Queen Christina* (1933) with Greta

Mamoulian
UPI

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GARBO, *Becky Sharp* (1935), *The Gay Desperado* (1936), *Blood and Sand* (1941), and *Silk Stockings* (1957). He was noted for the skillful blending of music and sound effects with an imaginative visual rhythm.

Ma'mūn \mä-'mün**, al-** (b. 786, Baghdad, Iraq—d. August 833, Tarsus, Cilicia) Seventh caliph (r. 813–833) of the ʿABBĀSID DYNASTY. He was the son of the celebrated HĀRŪN AL-RASHĪD and after his father's death (809) defeated his brother al-Amīn in a civil war (813) to assume the caliphate. Attempting to reconcile Sunnite and Shīʿite Muslims, he designated as his heir a Shīʿite, ʿAlī al-Riḍā, which failed to satisfy Shīʿite extremists and angered Sunnites. In any event, al-Ma'mūn was predeceased by his heir. He became a supporter of the MUʿTAZILITES, a theological school whose opinions on such issues as the nature of God and man's free will were at variance with accepted doctrine and found little popular support. His sponsorship of translations of Greek philosophical and scientific works and his building of observatories and libraries proved a more lasting legacy.

Man, Isle of Island, in the IRISH SEA off the northwestern coast of England. Area: 221 sq mi (572 sq km). Population (2002 est.): 76,900. It is a self-governing crown possession of Britain, with its own legislature. The popularly elected House of Keys constitutes one of the most ancient legislative assemblies in the world. Capital: Douglas (pop., 2001: 25,347). The island is about 30 mi (48 km) long and 10 mi (16 km) wide. The MANX breed of tailless cats is believed to have originated there. The isle was home to Irish missionaries beginning in the 5th century AD. It was held by the Norse (9th–13th centuries), Scots (13th–14th centuries), and English settlers (from the 14th century). It was made a crown possession in 1828.

Man, Paul de See Paul DE MAN

Man o' War (foaled 1917) U.S. Thoroughbred racehorse. In two seasons (1919–20), he won 20 of 21 races, including the Preakness and Belmont stakes. (He did not run in the Kentucky Derby.) He sired 64 stakes horses, including War Admiral, a TRIPLE CROWN winner (1937). In a 1950 Associated Press poll, Man o' War was voted the greatest horse of the first half of the 20th century.

man-o'-war bird See FRIGATE BIRD

Man Ray *orig.* **Emmanuel Radnitzky** (b. Aug. 25, 1890, Philadelphia, Pa., U.S.—d. Nov. 18, 1976, Paris, France) U.S. photographer, painter, and filmmaker. He grew up in New York City, where he studied architecture, engineering, and art. With MARCEL DUCHAMP he formed the New York DADA group in 1917 and produced READY-MADES. In 1921 he moved to Paris and became associated with the SURREALISTS. He rediscovered the technique for making "cameraless" pictures (photograms), which he called "rayographs," by placing objects on light-sensitive paper; he also experimented with the technique of solarization, which renders part of the image negative and part positive by exposing a print or negative to a flash of light during development. He turned to portrait and fashion photography and made a virtually complete record of the celebrities of Parisian cultural life of the 1920s and '30s. He also made important contributions as an avant-garde filmmaker in the 1920s.

mana \'mä-nə\ Among Polynesian and Melanesian peoples, a supernatural force or power that may be ascribed to persons, spirits, or inanimate objects. Mana may be either good or evil, beneficial or dangerous, but it is not impersonal; it is never spoken of except in connection with powerful beings or things. The term was first used in the 19th century in the West in connection with RELIGION, but mana is now regarded as a symbolic way of expressing the special qualities attributed to persons of status in a hierarchical society, of providing sanction for their actions, and of explaining their failures. See also ANIMISM.

managerial economics Application of economic principles to decision making in business firms or other management units. The basic concepts are drawn from MICROECONOMIC theory, but new tools of analysis have been added. Statistical methods, for example, are increasingly important in estimating current and future demand for products. The methods of operations research and programming provide scientific criteria for maximizing PROFIT, minimizing COST, and selecting the most profitable combination of products. Decision-making theory and GAME THEORY, which recognize the conditions of uncertainty and imperfect knowledge under which business managers operate, have contributed to systematic methods of assessing investment opportunities.

Managua \mä-'nä-gwä\ City (pop., 1995: 864,201), capital of NICARAGUA. Located on the southern shore of Lake MANAGUA, it was of minor importance during Spanish colonial times. It was selected as the nation's capital in 1857 when a choice between León and Granada could not be settled. It was devastated by earthquake and fire in 1931 and by another major earthquake in 1972. It was the scene of fighting in 1978–79 during the civil war. The largest city and commercial centre of Nicaragua, it has several institutions of higher education, including the University of Managua, now part of the National University of Nicaragua. Sites of interest include Darío Park, with its monument to poet RUBÉN DARÍO.

Managua, Lake *or* **Xolotlan** Lake, western Nicaragua. It occupies an area of 400 sq mi (1,035 sq km), extending 36 mi (58 km) long and 16 mi (25 km) wide. Located north of the city of MANAGUA, it is fed by numerous streams rising in the central highlands and is drained by the Tipitapa River, which flows into Lake NICARAGUA. Momotombo Volcano (4,199 ft [1,280 m]) is on the northwestern shore.

Manala \'mä-nä-ˌlä\ In Finnish mythology, the realm of the dead. Manala is ruled by the goddess Louhi, a fierce haglike creature. It is reached by crossing a fiery stream, the river of death, either over a narrow bridge or on a boat brought by a denizen of the other world. Though dark and gloomy, it is not a place of everlasting torment like the Christian HELL.

Manama \mä-'nä-mə\ *Arabic* **Al-Manāmah** City (pop., 1999 est.: 162,000), capital of BAHRAIN. Situated at the northeastern tip of Bahrain island, it is Bahrain's largest city, with about one-third of the emirate's population, and is one of the PERSIAN GULF's most important ports. A commercial and financial centre enriched by Bahrain's oil wealth, it is linked by causeway with the nearby island city of Muḥarraq. First mentioned in Islamic chronicles c. 1345, it was taken by the Portuguese in 1521 and by the Ṣafavid Persians in 1602. It has been held, with brief interruptions, by the Khalīfah dynasty since 1783. It was the seat of the British political resident for the Persian Gulf (1946–71), after which it became the capital of independent Bahrain.

Manapouri Lake \ˌmä-nä-'půr-ē\ Lake, southwestern SOUTH ISLAND, New Zealand. With a maximum depth of 1,455 ft (444 m), it is the deepest lake in the country. It is one of the Southern Lakes, located in FIORDLAND NATIONAL PARK. Its name derives from a Maori word meaning "lake of the sorrowing heart," and legend holds that its waters are the tears of dying sisters. It has an area of 55 sq mi (142 sq km) and drains a basin of 1,785 sq mi (4,623 sq km).

Manasarowar See MAPAM YUMCO

Manasseh ben Israel \mə-'na-sə-ben-'iz-rē-əl\ *orig.* **Manoel Dias Soeiro** (b. 1604, Lisbon?—d. Nov. 20, 1657, Middelburg, United Provinces of the Netherlands) Portuguese-born Dutch Hebrew scholar and Jewish leader. He was born to a family of MARRANOS whom persecution drove to Amsterdam. A brilliant theology student, he became rabbi of a Portuguese congregation in Amsterdam in 1622 and established the first Hebrew printing press there in 1626. In the belief that the MESSIAH would come only when the Jews were dispersed throughout the world, he lobbied the English government to allow Jews to live in England, and he wrote *Vindication of the Jews* (1656). His efforts led to unofficial English acceptance of Jewish settlement and, after his death, to the granting of an official charter of protection to the Jews of England in 1664.

manatee Any of three species (family Trichechidae) of slow-moving, shallow-water herbivorous mammals. Manatees have a tapered body ending in a rounded flipper, no hind flippers, and foreflippers near the head. The Caribbean manatee (*Trichechus manatus*) lives along coasts of the southeastern U.S. and northern South America; the Amazonian manatee (*T. inunguis*) and the West African manatee (*T. senegalensis*) inhabit rivers and estuaries. Adults are 8–15 ft (2.5–4.5 m) long and weigh up to 1,500 lbs (700 kg). Manatees live singly or in small herds and are protected by law in most areas. The manatee or its relative, the DUGONG, may have given rise to the folklore of mermaids. See also SEA COW.

Manaus \mä-'naůs\ City (pop., 2003 est.: 1,517,500), northwestern Brazil. Located in the heart of the Amazon rainforest, it lies along the northern bank of the NEGRO RIVER above its junction with the AMAZON RIVER. The first European settlement was a small fort built in 1669. The village, called Villa da Barra, became the capital of the Río Negro captaincy general in 1809. It prospered from 1890 to 1920 as the hub for the region's only supply of rubber, after which it declined. Though 900 mi (1,450 km) from

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the sea, it again became a major inland port and commercial centre, reviving economically in the mid-20th century. It has botanical gardens and an opera house, and the National Research Institute of Amazonia (INPA) and the Federal University of Amazonas are located there.

Manawatu \ˌmä-nä-ˈwä-tü\ **River** River, south-central North Island, New Zealand. The Manawatu flows northwest to pass between the Ruahine and Tararua ranges. It then runs southwest past Palmerston North to enter the South Taranaki Bight of the Tasman Sea. It is 113 mi (182 km) long.

Mance \ˈmäⁿs**, Jeanne** (b. Nov. 12, 1606, Langres, France—d. June 1673, Montreal) French founder of the first hospital in Montreal. A member of a French association that planned a utopian colony at Montreal, she sailed with the first settlers in 1641 and founded the Hôtel-Dieu de Montréal in 1644. After a trip to France (1657), she returned with Sisters Hospitallers to staff the hospital.

Mancha, La See Castilla-La Mancha

Manche, La See English Channel

Manchester City and metropolitan borough (pop., 1999: 431,000), in the metropolitan county of Greater Manchester, northwestern England. Lying northwest of London and east of Liverpool, it was the site of a Roman fort (AD 78–86) but was abandoned after the 4th century. By 919 the town of Manchester had sprung up nearby. In the 16th century it was important in the wool trade, and with the onset of the Industrial Revolution in the 18th century it became an important manufacturing city known for its textile production. The world's first modern railroad, the Liverpool and Manchester, opened in 1830. The city was beset by urban and industrial problems in the second half of the 20th century; thereafter it was redeveloped, ushering in a cultural renaissance. Its many educational institutions include the University of Manchester.

Manchester City (pop., 2000: 107,006), southern New Hampshire, U.S. Located on the Merrimack River, it is the state's largest city. It was settled in 1722–23 and incorporated as the town of Derryfield in 1751. One of America's first textile mills was built there in 1805, beginning a period of rapid industrial growth. Renamed Manchester in 1810, it was incorporated as a city in 1846. Canal systems built in the early 19th century opened navigation to Boston. The textile industry's decline in the 1930s spurred industrial diversification. It is the seat of St. Anselm College, Notre Dame College, and New Hampshire College.

Manchester, (Victoria) University of Public university in Manchester, England. It has its origins in a nonsectarian college for men founded in 1851. It became a university in 1880, having established colleges in Leeds and Liverpool which later (1903) became universities in their own right. Ernest Rutherford conducted important research on atomic physics at Manchester, and one of the first modern computers was built there in the late 1940s. The university grants undergraduate and advanced academic and professional degrees in a broad range of subjects.

Manchester school Political and economic school of thought led by Richard Cobden and John Bright that originated in meetings of the Manchester Chamber of Commerce in 1820 and dominated the British Liberal Party in the mid-19th century. Its followers believed in laissez-faire economic policies, including free trade, free competition, and freedom of contract, and were isolationist in foreign affairs. Its adherents tended to be businessmen, not theorists.

Manchu People, many of Juchen ancestry, who acquired a Manchu identity in the 17th century before conquering China and forming the Qing dynasty (1644–1911/12). Though official policy aimed to maintain the Manchus as a distinct people, this did not prevent considerable intermarriage and adoption of Chinese customs in areas of maximum contact with Chinese. China today recognizes the Manchu as a distinct ethnic group with over 10 million members living mainly in northeastern China.

Manchu dynasty See Qing dynasty

Manchu-Tungus \ˌman-ˈchü-tůŋ-ˈgüz\ **languages** *or* **Tungusic languages** Family of about 10 Altaic languages spoken by fewer than 55,000 people in Siberia, Mongolia, and northern China. All the languages have been losing ground for centuries as their speakers switch to the languages of surrounding populations—Russian and Yakut in Siberia, and Chinese, Turkic, and Mongolian languages in China. Evenki has about 10,000 speakers in Siberia and far northeastern China. Even has fewer than 6,000 speakers in northeastern Siberia and the Kamchatka Peninsula. Nanai has fewer than 7,000 speakers near the lower Amur River. Juchen, the tribal language of the founders of the Juchen dynasty, is now extinct, and Manchu is spoken by fewer than 100 people, though some 10 million inhabitants of northeastern China count themselves as ethnically Manchu. Effectively a dialect of Manchu is Xibe, spoken by 10,000 descendants of Manchu-speaking soldiers garrisoned at 18th-century military outposts.

Manchukuo \ˈman-ˈchü-ˈgwō\ *or* **Manchuguo** Puppet state created in 1932 by Japan out of the three historic provinces of Manchuria. After the Russo-Japanese War (1895), Japan gained control of the Russian-built South Manchurian Railway, and its army established a presence in the area; expansion in Manchuria was seen as necessary for Japan's status as an emerging world power. In 1931 the Japanese army created an excuse to attack Chinese troops there, and in 1932 Manchukuo was proclaimed an independent state. The last Qing emperor was brought out of retirement and made Manchukuo's ruler, but the state was actually rigidly controlled by the Japanese, who used it as their base for expansion into Asia. An underground guerrilla movement composed of Manchurian soldiers, armed civilians, and Chinese communists opposed the occupying Japanese, many of whom had come over to settle in the new colony. After Japan's defeat in 1945 the settlers were repatriated.

Manchuria \man-ˈchůr-ē-ə\ *or* **Northeast** *Chinese* **Dongbei** *or* **Tung-pei** \ˈdůŋ-ˈbā\ Historical region, northeastern China. It consists of the modern provinces of Liaoning, Jilin, and Heilongjiang; the northeastern portion of Inner Mongolia autonomous region is sometimes also included. Throughout the early Chinese dynasties, China had only limited control over Manchuria. In 1211 Genghis Khan invaded and occupied Manchuria. Chinese rebellions overthrew the Yuan dynasty of the Mongols in 1368, and the Ming dynasty was established. The Qing (Manchu) dynasty originated there (early 17th century) and eventually spread over China. Russia and Japan fought each other for a foothold in the region during the Russo-Japanese War (1904–05); after its defeat, Russia ceded southern Manchuria to Japan. The Japanese occupied all of Manchuria in 1931 and created the puppet state of Manchukuo in 1932. The Soviets captured Manchuria in 1945, and Chinese communist guerrillas soon came to power. In 1953 Beijing divided the region into its three current provinces. It is now one of China's most important industrial areas.

Mancini, Henry *orig.* **Enrico Nicola Mancini** (b. April 16, 1924, Cleveland, Ohio, U.S.—d. June 14, 1994, Beverly Hills, Calif.) U.S. composer. While serving in the army air force during World War II, he met Glenn Miller, and after the war he joined Miller's band as an arranger and pianist. He first gained wide attention with his jazz-inflected music for the television series *Peter Gunn* (1958), but he is perhaps best known for his humorous scores for Blake Edwards's *Pink Panther* movies. He worked extensively with Edwards throughout his career. He wrote scores for more than 80 films and won four Academy Awards for two songs—"Moon River" and "Days of Wine and Roses"—and for the film scores for *Breakfast at Tiffany's* (1961) and *Victor/Victoria* (1982). He also won 20 Grammy Awards and 2 Emmys.

Mancini \män-ˈchē-nē\ **family** Family of Italian sisters, noblewomen noted for their great beauty. Nieces of Jules Cardinal Mazarin, they moved to France at an early age. Laure Mancini, duchess de Mercoeur (1636–57), married Louis de Vendôme, duke de Mercoeur and grandson of King Henry IV. Olympe Mancini, countess de Soissons (1639–1708), was a mistress of Louis XIV. She was involved with her sister, Marie Anne, in the notorious "Affair of the Poisons" and was also accused of poisoning her husband; she was the mother of Prince Eugene of Savoy. Marie Mancini, princess de Colonna (1640–1715), was also a mistress of Louis XIV; Mazarin intrigued to prevent their marriage, and she spent most of her life in Spain. Hortense Mancini, duchess de Mazarin (1646–99), married Armand Charles de la Porté, who assumed the Mazarin title. After leaving her husband, she became a famous beauty at the English court of Charles II. Marie Anne Mancini, duchess de Bouillon (1649–1714), was known for her literary salon but was banished in 1680 for the alleged poisoning of the sorceress La Voisin (Catherine Monvoisin).

Mandaeanism \man-ˈdē-ə-ˌni-zəm\ Ancient Middle Eastern Gnostic sect surviving in Iraq and southwestern Iran. Like other dualistic systems, it stresses salvation of the soul through esoteric knowledge, or gnosis, of its divine origin. (Its name derives from *mandayya*, "having knowledge.") In its cosmology, evil Archons obstruct the soul's ascent through the

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heavenly spheres to reunion with the supreme deity. Unlike many Gnostic systems, Mandaeanism supports marriage and forbids sexual license. It is also characterized by elaborate cultic rituals, particularly for baptism. Mandaeans view JESUS as a false messiah but revere JOHN THE BAPTIST, whose life is chronicled in their sacred writings. See also DUALISM, GNOSTICISM.

mandala \'mən-də-lə\ In Tantric Hinduism and Buddhism (see VAJRAYANA), a diagram representing the universe, used in sacred rites and as an instrument of MEDITATION. The mandala serves as a collection point for universal forces. By mentally "entering" the mandala and moving toward its centre, one is guided through the cosmic processes of disintegration and reintegration. Mandalas may be painted on paper or cloth, drawn on the ground, or fashioned of bronze or stone. Two types of mandalas represent different aspects of the universe: the *garbha-dhatu* ("womb world"), in which the movement is from one to the many, and the *vajra-dhatu* ("diamond world"), from the many into one.

Mandalay City (pop., 2004 est.: 1,176,900), central MYANMAR (Burma). Situated on the IRRAWADDY RIVER, it is the country's second largest city, after YANGÔN. It was built in 1857–59 by King Mindon to replace Amarapura as his capital. The last capital of the Myanmar kingdom, it fell to Britain in 1885. It was nearly destroyed during the Japanese occupation in World War II. An important Buddhist religious centre, it is the site of the famous Mahamuni pagoda and of 730 pagodas that house marble tablets inscribed with Buddhist scriptures.

Mandan \'man-ˌdan\ North American PLAINS INDIAN people living mostly in North Dakota, U.S. Their name is probably of French derivation. The Mandan language, which is SIOUAN, is nearly extinct. The Mandan, who lived in dome-shaped, earth-covered lodges clustered in stockaded villages, planted corn, beans, pumpkins, and sunflowers, hunted buffalo, and made pottery and baskets. They held elaborate ceremonies, including the SUN DANCE and the bear ceremony, a healing and war-preparation rite. They had age-graded warrior societies as well as shamanistic and women's societies. Artists depicted heroic deeds on buffalo robes. GEORGE CATLIN portrayed Mandan life and people in a series of paintings. According to him, they called themselves Seepohskahnumahkahkee, meaning "People of the Pheasant." By the mid-19th century the Mandan, reduced by smallpox, were removed to North Dakota's Fort Berthold Reservation, where they live with the HIDATSA and the Arikara as the Three Affiliated Tribes. Some 350 people claimed sole Mandan descent in the 2000 U.S. census.

Mandarin In imperial China, a public official drawn from the ranks of the lesser officeholders who had achieved success in the CHINESE EXAMINATION SYSTEM. The word comes from the Portuguese version of the Malay term for a minister of state. It has come to mean a pedantic official, a bureaucrat, or a person of position and influence (and usually a traditionalist or reactionary mindset) in intellectual or literary circles. The Mandarin language is the most widely spoken of the CHINESE LANGUAGES.

Mande \'män-ˌdā, män-'dā\ **languages** Branch of the NIGER-CONGO LANGUAGE FAMILY. Mande comprises 40 languages of West Africa with more than 20 million speakers in a more or less contiguous area of southeastern Senegal, The Gambia, southern Mauritania, southwestern Mali, eastern Guinea, northern and eastern Sierra Leone, northern Liberia, and western Côte d'Ivoire. Substantial numbers are also found in Guinea-Bissau, Guinea, and Burkina Faso; and there are very much smaller, isolated pockets in the region. The most significant subgroup is the Mandekan complex—a continuum of languages and dialects, including those spoken by the BAMBARA, MALINKE, Maninka, and Dyula—spoken from Senegal, The Gambia, and Guinea east through Mali to Burkina Faso. Mande, spoken in Sierra Leone, also has more than a million speakers. Several independent writing systems based on the syllable were developed by speakers of Mande languages. The best-known is the Vai script, but Mende, Loma, and Kpelle also have their own scripts.

Mandeb, Strait of *or* **Bab el-Mandeb** \'bâb-âl-'mân-deb\ *Arabic* **Bāb al-Mandab** Strait that connects the RED SEA with the GULF OF ADEN. Its land boundaries are the ARABIAN PENINSULA (northeast) and the African coast (southeast), which are separated by some 20 mi (32 km). The strait is divided into two channels by Perim Island. Its name means "Gate of Tears," referring to the dangers that formerly attended its navigation.

Mandel \mäⁿ-'del**, Georges** *orig.* **Louis-Georges Rothschild** (b. June 5, 1885, Chatou, France—d. July 7, 1944, Fontainebleau) French political leader. A member of a prosperous Jewish family, he served as a personal aide to GEORGES CLEMENCEAU (1906–09, 1917–20), in the National Assembly (1919–24, 1928–40), and in cabinet posts (1934–40). As minister of the interior (1940), he supported PAUL REYNAUD's refusal to accept an armistice with Germany. Mandel was arrested in 1940, imprisoned in France and Germany, then returned to Paris in 1944, where he was shot on orders of the Vichy police chief.

Mandela \man-'del-ə**, Nelson** (b. July 18, 1918, Umtata, Cape of Good Hope, S.Af.) South African black nationalist leader and statesman. The son of a XHOSA chief, Mandela studied law at the University of Witwatersrand and in 1944 joined the AFRICAN NATIONAL CONGRESS (ANC). After the Sharpeville massacre (1960), he abandoned his nonviolent stance and helped found the "Spear of the Nation," the ANC's military wing. Arrested in 1962, he was sentenced to life imprisonment. He retained wide support among South Africa's black population and became an international cause célèbre. Released by Pres. F.W. DE KLERK in 1990, he replaced OLIVER TAMBO as president of the ANC in 1991. In 1993 Mandela and de Klerk were awarded the Nobel Peace Prize for their efforts to end APARTHEID and bring about the transition to nonracial democracy. In 1994 he was elected president in the country's first universal suffrage elections; by the time he stepped down in 1999, Mandela was the most universally respected figure of postcolonial Africa.

Nelson Mandela, 1990.
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Mandelbrot \'man-dəl-ˌbrōt**, Benoit B.** (b. Nov. 20, 1924, Warsaw, Pol.) Polish-born U.S. mathematician. He received a doctorate from the University of Paris and emigrated to the U.S. in 1958. He is best known for his work with fractals (a term he coined; see FRACTAL GEOMETRY), which, he showed, can occur in many different places in mathematics and in nature. He was influenced by Gaston Maurice Julia (1893–1978), whose work on dynamical systems theory had been forgotten until the 1970s, when Mandelbrot's fundamental computer experiments and use of computer graphics breathed new life into it. The Mandelbrot set is a mathematical set of imaginary numbers generated from a simple equation. It appears infinitely complex when graphed on a computer.

Mandelshtam \mən-dyil-'shtâm**, Osip (Emilyevich)** *or* **Osip Emilyevich Mandelstam** (b. Jan. 15, 1891, Warsaw, Pol., Russian Empire—d. Dec. 27, 1938, Vtoraya Rechka, near Vladivostok, Russia, U.S.S.R.) Russian poet and critic. He published his first poems in 1910. A leader of the Acmeist poets, who rejected the mysticism and abstraction of Russian Symbolism, he wrote intellectually demanding, apolitical verse in such volumes as *Tristia* (1922). In 1934 he was arrested for an epigram about JOSEPH STALIN. While suffering from mental illness, he composed the *Voronezh Notebooks*, which contain some of his finest lyrics. Arrested again in 1938, he died in custody at age 47. Most of his works went unpublished in the Soviet Union until after Stalin's death, and he was almost unknown to generations of Russians and in other countries until the mid 1960s.

Mander \'män-dər**, Karel van** (b. May 1548, Meulebeke, Flanders, Spanish Netherlands—d. Sept. 2, 1606, Amsterdam, Neth.) Dutch painter, poet, and writer. Born of a noble family, after much wandering he settled in Haarlem in 1583 and founded a successful academy of painting with HENDRIK GOLTZIUS and Cornelis Cornelisz (1562–1638). He is best known for *The Book of Painters* (1604), which contains about 175 biographies of Dutch, Flemish, and German painters of the 15th–16th centuries; it became for the northern countries what GIORGIO VASARI's *Lives of the Painters* had been for Italy.

Mandeville \'man-də-ˌvil**, Sir John** (fl. 14th century) English purported author of a collection of Middle English traveler's tales. The tales are selections from the narratives of genuine travelers, embellished with Mandeville's additions and described as his own adventures. *The Voyage and Travels of Sir John Mandeville, Knight* originated in French c. 1356–57; an English version appeared c. 1375. The narrator declares that he is

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writing of his travels in the years 1322 to 1356. Because most of the material was available in contemporary encyclopaedias and travel books, it is not clear whether the author ever traveled at all, but his literary skill and imagination have kept the book popular and highly readable. The actual author of the tales remains unknown. It is not certain that the English knight Sir John Mandeville ever existed.

Sir John Mandeville, detail from a manuscript, early 15th century; in the British Library (MS. Add. 24,189)
REPRODUCED BY PERMISSION OF THE BRITISH LIBRARY

Mandingo See MALINKE

Mandinka See MALINKE

mandolin \ˌman-də-ˈlin\ Small STRINGED INSTRUMENT related to the LUTE. It evolved in the 17th century in Italy, but its present form was strongly influenced by the 19th-century maker Pasquale Vinaccia (1806–82) of Naples. It has a pear-shaped body with a deeply vaulted back, a short fretted fingerboard, and four pairs of steel strings. (The American folk mandolin is a shallow, flat-backed version.) It is played with a plectrum; each pair of strings is strummed rapidly back and forth to produce a characteristic tremolo.

mandrake Any of six plant species of the genus *Mandragora* (NIGHTSHADE FAMILY), native to the Mediterranean and the Himalayas. The best-known species, *M. officinarum*, has a short stem bearing a tuft of ovate flowers, with a thick, fleshy, often forked root. The mandrake has long been known for its poisonous properties. In ancient times it was used as a narcotic and an aphrodisiac, and it was believed to have magical powers. When pulled from the ground, its forked root, supposed to resemble the human form, was said to utter a shriek that killed or drove mad anyone who heard it. Once pulled, however, the plant was said to provide soothing sleep, heal wounds, induce love, and facilitate pregnancy. In North America, the name "mandrake" is often used for the mayapple (*Podophyllum peltatum*), a spring forest wildflower.

mandrill Diurnal MONKEY (family Cercopithecidae, usually genus *Mandrillus*) of equatorial African rainforests, known for its striking colouring. The stout-bodied, primarily terrestrial mandrill has a short tail, prominent brow ridges, and small, close-set, sunken eyes. The ribbed bare skin on the adult male's cheeks is bright blue, with scarlet on the nose; the buttock pads are pink to crimson, shading to bluish; and the beard and neck are yellow. The adult male is about 3 ft (90 cm) long and weighs about 45 lb (20 kg); the female is duller and smaller. Mandrills eat fruit, roots, insects, and small reptiles and amphibians.

Mandrill (*Mandrillus sphinx*).
RUSS KINNE/PHOTO RESEARCHERS

Manes See MANI

Manet \mà-ˈnā**, Édouard** (b. Jan. 23, 1832, Paris, France—d. April 30, 1883, Paris) French painter and printmaker. His father, a prosperous civil servant, wanted him to pursue a naval career, but he was a poor student interested only in drawing. After having a few paintings accepted by the Salon, in 1863 the jury of the Salon rejected his *Déjeuner sur l'herbe*, and so Manet instead exhibited it at the Salon des Refusés (established to exhibit the many works rejected by the official Salon). This large canvas aroused loud disapproval from critics, who were offended by the presence of a naked woman in the company of two young men clothed in contemporary dress. At the Salon of 1865, his painting *Olympia*, created two years earlier, also caused a scandal: the painting's reclining female nude gazes brazenly at the viewer and is depicted in a harsh, brilliant light that obliterates traditional modeling and turns her into an almost two-dimensional figure. In the mid 1870s he became friendly with CLAUDE MONET and the other IMPRESSIONISTS; while Manet would not participate in their independent exhibitions, for a time he experimented with some of their techniques. In 1882 he created the painting *A Bar at the Folies-Bergère* (1882), a daring, controversial composition that was radical in its obliteration of the boundary between the viewer and what is viewed. The critical resistance to Manet's work did not abate until near the end of his career; it was not until the 20th century that his reputation was secured by art historians and critics. His daring, unflinching approach to his painting and to the art world assured both him and his work a pivotal place in the history of modern art.

A Bar at the Folies-Bergère, oil on canvas by Édouard Manet, 1882; in the Courtauld Institute Galleries, London.
COURTAULD INSTITUTE GALLERIES, LONDON (COURTAULD COLLECTION)

Manfred *Italian* **Manfredi** (b. c. 1232—d. Feb. 26, 1266, near Benevento, Kingdom of Naples) King of Sicily (1258–66). Born out of wedlock, the son of FREDERICK II, he was made vicar of Italy and Sicily for his half brother Conrad IV, but, following Conrad's death, Manfred sought the Sicilian crown for himself. He resisted Pope Alexander IV's efforts to assign the throne to an English rival, and, after fighting off a papal army, Manfred was crowned king in 1258. He became a defender of the Ghibellines in northern Italy (see GUELPHS AND GHIBELLINES). Pope Urban IV declared Charles of Anjou (later CHARLES I) king of Sicily, and Manfred fell in battle against Charles's army.

mangal-kavya \ˈməŋ-gəl-ˈkä-vyə\ Type of verse in honour of a god or goddess in BENGAL. Most *mangal-kavya* tell how a local deity established his or her worship on earth. They are often recited at the festivals of the deities they praise. Some have become so popular that performers sing them to entertain village audiences. Many variants exist, since each singer is free to change the verses. Most are written in a simple couplet form, using earthy imagery drawn from village, field, and river.

manganese \ˈmaŋ-gə-ˌnēz\ Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol Mn, atomic number 25. It is a silvery white, hard, brittle METAL, widely distributed in Earth's crust in combination with other elements. NODULES rich in manganese occur in huge quantities on the seafloor, but no economical way to mine them has been devised. More than 95% of the manganese produced is used in iron and steel alloys and much of the rest in nonferrous aluminum and magnesium alloys to improve their corrosion resistance and mechanical properties. Manganese compounds, in which it has various VALENCES, are used in fertilizers and textile printing and as reagents and raw materials. Potassium permanganate is used for disinfecting, deodorizing, and bleaching and as a reagent in ANALYSIS. Manganese is essential to plants for growth and to higher animals to promote the action of many ENZYMES.

mango EVERGREEN tree and fruit (*Mangifera indica*) of the SUMAC, or cashew, family, one of the most important and widely cultivated fruits of the tropical world. The yellow to orange fruit is juicy, distinctively spicy, and a rich source of vitamins A, C, and D. Mango fruit varies in shape, colour, and size from ovoid to long, from vividly red and yellow to dull green, and from plum- to melon-size. It is used in Theravada Buddhist

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ceremonies. The long-lived tree reaches 50–60 ft (15–18 m) and has long, lance-shaped leaves and clusters of small, pinkish, fragrant flowers.

mangrove Any of certain shrubs and trees of the families Rhizophoraceae, Verbenaceae, Sonneratiaceae, and Arecaceae (PALM) that grow in dense thickets or forests along tidal estuaries, in salt marshes, and on muddy coasts. The term also applies to the thickets and forests of such plants. Mangroves characteristically have prop roots (exposed, supporting roots). In addition, in many species respiratory, or knee, roots project above the mud and have small openings through which air enters, passing through the soft, spongy tissue to the roots beneath the mud. Mangrove fruits put out an embryonic root before they fall from the tree; the root may fix itself in the mud before the fruit separates from the parent. Likewise, branches and trunks put out adventitious roots which, once they are secure in the mud, send up new shoots. The common mangrove (*Rhizophora mangle*) grows to about 30 ft (9 m) tall and bears short, thick, leathery leaves on short stems, and pale-yellow flowers. Its fruit is sweet and wholesome.

Mangu See MÖNGKE

Manhae See HAN YONGUN

Manhattan Borough (pop., 2000: 1,537,195) of NEW YORK CITY, southeastern New York, U.S. It includes all of Manhattan island and three smaller islands in the EAST RIVER. Bounded by the HUDSON RIVER, Harlem River, East River, and Upper New York Bay, it is said to have been purchased by PETER MINUIT in 1626 from the Manhattan Indians with trinkets valued at 60 guilders. Incorporated as New Amsterdam in 1653, it was obtained by Britain in 1664 and renamed New York City. In 1898 Manhattan was chartered as one of five boroughs making up Greater New York. It is one of the world's great commercial, financial, and cultural centres. Among its many points of interest are CENTRAL PARK, the EMPIRE STATE BUILDING, the site of the former WORLD TRADE CENTER, the UNITED NATIONS headquarters, WALL STREET, the METROPOLITAN MUSEUM OF ART, the MUSEUM OF MODERN ART, LINCOLN CENTER for the Performing Arts, CARNEGIE HALL, COLUMBIA UNIVERSITY, the JUILLIARD SCHOOL, and New York University.

Manhattan Project (1942–45) U.S. government research project that produced the first ATOMIC BOMB. In 1939 U.S. scientists urged Pres. FRANKLIN D. ROOSEVELT to establish a program to study the potential military use of fission, and $6,000 was appropriated. By 1942 the project was codenamed Manhattan, after the site of Columbia University, where much of the early research was done. Research also was carried out at the University of California and the University of Chicago. In 1943 a laboratory to construct the bomb was established at LOS ALAMOS, N.M., and staffed by scientists headed by J. ROBERT OPPENHEIMER. Production also was carried out at Oak Ridge, Tenn., and Hanford, Wash. The first bomb was exploded in a test at Alamogordo air base in southern New Mexico. By its end the project had cost some $2 billion and had involved 125,000 people.

Mani \mä-'nē\ *or* **Manes** \mä-'nē, 'mā-nēz\ *or* **Manichaeus** \ˌma-nə-'kē-əs\ (b. April 14, 216, southern Babylonia—d. 274?, Gundeshapur) Persian founder of MANICHAEISM. He had his first vision of an angel in his boyhood, and when he was 24 the angel reappeared and called him to preach a new religion. He traveled to India and made converts there. The Persian king Shapur I permitted him to preach in the Persian empire, but, during the reign of Bahram I, Mani was attacked by Zoroastrian priests. After a 26-day trial he was sentenced to prison, where he died.

manic-depressive psychosis See BIPOLAR DISORDER

Manichaeism \'ma-nə-ˌkē-ˌi-zəm, ˌma-nə-'kē-ˌi-zəm\ Dualistic religion founded by MANI in Persia in the 3rd century AD. Inspired by a vision of an angel, Mani viewed himself as the last in a line of prophets that included ADAM, BUDDHA, ZOROASTER, and JESUS. His writings, now mostly lost, formed the Manichaean scriptures. Manichaeism held that the world was a fusion of spirit and matter, the original principles of good and evil, and that the fallen soul was trapped in the evil, material world and could reach the transcendent world only by way of the spirit. Zealous missionaries spread its doctrine through the Roman empire and the East. Vigorously attacked by both the Christian church and the Roman state, it disappeared almost entirely from Western Europe by the end of the 5th century but survived in Asia until the 14th century. See also DUALISM.

Manicouagan \ˌma-ni-'kwä-gən\ **River** River, eastern Quebec province, Canada. Rising near the Labrador border, it flows south to empty into the ST. LAWRENCE RIVER near its mouth. From its remotest headstream it is more than 340 mi (550 km) long. The region's dense forests are the source of its Indian name, meaning "where there is bark." The Daniel-Johnson Dam, one of the world's largest multiarch dams, generates hydroelectric power.

Manifest Destiny Concept of U.S. territorial expansion westward to the Pacific Ocean. The phrase was coined in 1845 by the editor John L. O'Sullivan, who described the U.S. annexation of Texas and, by extension, the occupation of the rest of the continent as a divine right of the American people. The term was used to justify the U.S. annexation of Oregon, New Mexico, and California and later U.S. involvement in Alaska, Hawaii, and the Philippines.

manifold In mathematics, a topological space (see TOPOLOGY) with a family of local COORDINATE SYSTEMS related to each other by certain classes of coordinate TRANSFORMATIONS. Manifolds occur in ALGEBRAIC GEOMETRY, DIFFERENTIAL EQUATIONS, and classical DYNAMICS. They are studied for their global properties by the methods of ALGEBRA and ALGEBRAIC TOPOLOGY and form a natural domain for the global ANALYSIS of differential equations. See also TENSOR ANALYSIS.

Manila City (pop., 2000: city, 1,581,082; metro. area, 9,932,560), capital of the PHILIPPINES. Located on LUZON island on the eastern shore of MANILA BAY, it is the chief port and the economic, political, and cultural centre of the Philippines. The walled Muslim settlement originally built on the site was destroyed by Spanish CONQUISTADORS, who founded the fortress city of Intramuros in 1571. It was briefly held by the British (1762–63) during the SEVEN YEARS' WAR. During the SPANISH-AMERICAN WAR, U.S. forces gained control of Manila in 1898. Occupied by the Japanese in 1942, it was widely damaged during the fight for its recapture by U.S. forces in 1945. In 1946 it became the capital of the newly independent Republic of the Philippines, and was rebuilt. QUEZON CITY became the capital in 1948, but Manila regained that position in 1976. In addition to its diversified industries, including shipbuilding and food processing, it is the seat of several universities.

Manila Bay Inlet of the South CHINA SEA extending into southwestern LUZON island, Philippines. Considered one of the world's great harbours, it forms a nearly landlocked body of water with an area of 770 sq mi (2,000 sq km). It measures 36 mi (58 km) across at its widest point. The decisive Battle of MANILA BAY, in the SPANISH-AMERICAN WAR, took place there in 1898. The Japanese gained control of the bay in 1942 during World War II, but it was recaptured by U.S. forces in 1945. Corregidor Island, the scene of intense fighting in the war, divides the bay's entrance into the South Channel and the North Channel.

Manila Bay, Battle of (May 1, 1898) Naval engagement in the SPANISH-AMERICAN WAR. The U.S. Asiatic Squadron under GEORGE DEWEY was ordered to sail from its Hong Kong base to destroy the Spanish fleet then in the Philippines. In one morning the guns of Dewey's squadron completely destroyed the Spanish ships anchored in Manila Bay. The Spanish suffered 381 casualties, the Americans fewer than 10. Manila later surrendered and was occupied by U.S. troops in August. The battle established the U.S. as a major naval power.

Manin \mä-'nēn**, Daniele** (b. May 13, 1804, Venice—d. Sept. 22, 1857, Paris, France) Italian leader of the RISORGIMENTO in Venice. A lawyer in the Austrian province of Venitia, Manin became a proponent of home rule and was imprisoned in 1848. He was freed following the rebellion that year and became president of the Venetian republic, reluctantly accepting union with the kingdom of Piedmont-Sardinia in the name of Italian unification. He led a heroic defense of Venice against an Austrian siege, but he was forced to surrender in 1849. Banished, he lived in Paris the rest of his life, but in 1868 his body was returned to liberated Venice for a state funeral.

manioc See CASSAVA

Manipur \'mə-ni-ˌpůr\ State (pop., 2001 prelim.: 2,388,634), northeastern India. Occupying an area of 8,621 sq mi (22,327 sq km), it is bordered by MYANMAR (Burma) and the states of NAGALAND, ASSAM, and MIZORAM; its capital is IMPHAL. Its two main physical features are the Manipur River valley and the western mountainous region. In 1762 and 1824 Manipur requested British assistance in repelling Burmese invasions. The British administered the area in the 1890s, but in 1907 a local government took over; a tribal uprising in 1917 led to a new government administered from Assam. In 1947 Manipur acceded to the Indian union;

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it was ruled as a union territory until it became a state in 1972. Agriculture and forestry are economic mainstays.

Manitoba \ˌma-ni-ˈtō-bə\ Province (pop., 2001: 1,119,583), central Canada. It is bounded by Nunavut, Hudson Bay, Ontario, Saskatchewan, and by the U.S.; its capital is Winnipeg. Three-fifths of its territory is covered by the Canadian Shield, an area of rocks, forests, and rivers. The region was first inhabited by the Inuit (Eskimo) and by the Cree, Assiniboin, and Ojibwa peoples. The Hudson's Bay Co. opened Manitoba to European influence, and the region became a focus of French and British competition for Canadian fur trade dominance; it was ceded by France to Britain in 1763. The Métis rebellion led to the passage of the Manitoba Act in 1870, making it the fifth province of the Dominion of Canada. Steamboat and rail transportation opened the province to settlers from Europe in the late 19th century. Though much of the economy is based on farming, lumbering, and mining, heavy industry has become important to an expanding Winnipeg.

Manitoba, Lake Lake, south-central Manitoba, Canada. Located northwest of Winnipeg, it drains into Lake Winnipeg. It is more than 125 mi (200 km) long and up to 28 mi (45 km) wide, with an area of 1,785 sq mi (4,624 sq km). It was discovered in 1738 by Pierre La Vérendrye, who named it Lac des Prairies. The name Manitoba is believed to come from the Algonquian word *maniot-bau* or *maniot-wapau* ("strait of the spirit").

Manitoba, University of Canadian public university in Winnipeg, founded in 1877. It has faculties of agricultural and food sciences, architecture, arts and sciences, education, engineering, law, graduate studies, management, medicine, human ecology, and social work, among other fields. Campus facilities include centres for the study of aging, defense and security, and diabetes.

Manizales \ˌmä-nē-ˈsä-lās\ City (pop., 1999 est.: 337,580), central Colombia. It is situated on a ridge of the Cordillera Central of the Andes Mountains, at an elevation of 6,975 ft (2,126 m) above sea level; its cathedral is visible for miles in all directions. Founded in 1848, it is the commercial centre of Colombia's most important coffee-growing district. It is connected by highway and railroad with Cali and by cableway with Mariquita. It is the seat of the University of Caldas.

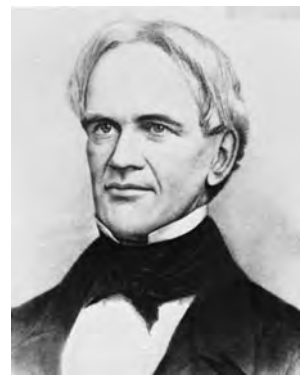
Manjusri \ˌmən-ˈjü-shrē\ In Mahayana Buddhism, the bodhisattva personifying supreme wisdom. He is usually considered a celestial being, though some traditions give him a human history. Sutras were composed in his honor by AD 250, and he appears in Buddhist art by AD 400. He is often shown wearing princely ornaments and holding aloft the sword of wisdom, and he is sometimes seated on a lion or a blue lotus. His cult spread widely in China in the 8th century, and Mount Wutai in Shanxi province, which is dedicated to him, is covered with his temples.

Manjusri, basalt figure from Java, 1343; formerly in the Museum für Indische Kunst, Staatliche Museen, Berlin (missing from 1945).
COURTESY OF THE MUSEUM FUR INDISCHE KUNST, STAATLICHE MUSEEN, BERLIN

Mankiewicz \ˈman-ki-ˌwits**, Joseph L(eo)** (b. Feb. 11, 1909, Wilkes-Barre, Pa., U.S.—d. Feb. 5, 1993, Mount Kisco, N.Y.) U.S. film director, producer, and screenwriter. He wrote scripts for Paramount from 1929 and later produced movies such as *The Philadelphia Story* (1940) and *Woman of the Year* (1942). Known for his witty, urbane dialogue and memorable characters, he wrote and directed films such as *A Letter to Three Wives* (1949, Academy Awards for best director and screenplay), *All About Eve* (1950, Academy Awards for best picture, director, and screenplay), and *The Barefoot Contessa* (1954), and directed *Julius Caesar* (1953), *Suddenly Last Summer* (1959), and the disastrously expensive *Cleopatra* (1963). His older brother, Herman (1897–1953), was a screenwriter and a famous wit, best remembered as the principal author of *Citizen Kane* (1941, Academy Award).

Manley, Michael (Norman) (b. Dec. 10, 1924, St. Andrew, Jam.—d. March 6, 1997, Kingston) Jamaican political leader. Son of a prime minister of Jamaica and a sculptor, Manley was a leader of the People's National Party and the National Worker's Union before becoming prime minister in 1972. His leftist government made significant improvements in housing, education, and health care, but a dramatic rise in oil prices precipitated an economic crisis. Much of the middle class fled the country, unemployment rose to 30%, and violence broke out in the run-up to the 1980 election, in which he was defeated. He was reelected in 1989, this time as a moderate; he stepped down in 1992 for health reasons.

Mann, Horace (b. May 4, 1796, Franklin, Mass., U.S.—d. Aug. 2, 1859, Yellow Springs, Ohio) U.S. educator, the first great American advocate of public education. Raised in poverty, Mann educated himself at the Franklin, Mass., town library and gained admission to Brown University. He later studied law and was elected to the state legislature. As state secretary of education he vigorously espoused educational reform, arguing that in a democratic society education should be free and universal, nonsectarian, and reliant on well-trained, professional teachers. In his later years he served in the U.S. Congress (1848–53) and as first president of Antioch College, (1853–59) and he worked resolutely to end slavery.



Horace Mann
COURTESY OF ANTIOCH COLLEGE, YELLOW SPRINGS, OHIO

Mann \ˈmän**, Thomas** (b. June 6, 1875, Lübeck, Ger.—d. Aug. 12, 1955, near Zürich, Switz.) German novelist and essayist, considered the greatest German novelist of the 20th century. After a brief period of office work, Mann devoted himself to writing, as had his elder brother Heinrich (1871–1950). *Buddenbrooks* (1901), his first novel, was an elegy for old bourgeois virtues. In the novella *Death in Venice* (1912), a sombre masterpiece, he took up the tragic dilemma of the artist in a collapsing society. Though ardently patriotic at the start of World War I, after 1919 he slowly revised his views of the authoritarian German state. His great novel *The Magic Mountain* (1924) clarified his growing espousal of Enlightenment principles as one strand of a complex and multifaceted whole. An outspoken opponent of Nazism, he fled to Switzerland on Adolf Hitler's accession; he settled in the U.S. in 1938 but returned to Switzerland in 1952. His tetralogy *Joseph and His Brothers* (1933–43) concerns the biblical Joseph. *Doctor Faustus* (1947), his most directly political novel, analyzes the darker aspects of the German soul. The often hilarious *Felix Krull, Confidence Man* (1954) remained unfinished. He is noted for his finely wrought style enriched by humour, irony, and parody and for his subtle, many-layered narratives of vast intellectual scope. His essays examined such figures as Leo Tolstoy, Sigmund Freud, Johann Wolfgang von Goethe, Friedrich Nietzsche, Anton Chekhov, and Friedrich Schiller. He received the Nobel Prize for Literature in 1929.

Mannerheim \ˈmä-nər-ˌhām**, Carl Gustaf (Emil)** (b. June 4, 1867, Villnäs, Fin.—d. Jan. 27, 1951, Lausanne, Switz.) Finnish soldier and president of Finland (1944–46). A career officer in the Russian imperial army (1889–1917), he commanded the anti-Bolshevik forces (1918) in the Finnish Civil War and expelled the Soviet forces. He served as regent of Finland (1918–19) until the new republic was declared. As chairman of the national defense council (1931–39) he oversaw construction of the Mannerheim line of fortifications across the Karelian Isthmus. As commander in chief of Finnish forces (1939–40, 1941–44), he won initial successes against greatly superior Soviet forces in the Russo-Finnish War (1939–40). Named president of the Finnish republic in 1944, he negotiated a peace agreement with the Soviets.

Mannerism Artistic style that predominated in Italy from the end of the High Renaissance in the 1520s to the beginnings of the Baroque period c. 1590. Mannerism originated in Florence and Rome but ultimately spread as far as central and northern Europe. A reaction to the harmonious Classicism and idealized naturalism of High Renaissance art, Mannerism was concerned with solving intricate artistic problems, such as portraying nudes in complex poses. The figures in Mannerist works fre-

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quently have graceful but queerly elongated limbs, small heads, and stylized facial features, while their poses seem difficult or contrived. The deep, linear perspectival space of High Renaissance painting is flattened and obscured so that the figures appear as a decorative arrangement of forms in front of a flat background of indeterminate dimensions. Mannerists sought a continuous refinement of form and concept, pushing exaggeration and contrast to great limits. After being superseded by the Baroque style, it was seen as decadent and degenerative. By the 20th century it was appreciated anew for its technical bravura and elegance. Major artists who practiced the style include PARMIGIANINO, FEDERICO ZUCCARO, and IL BRONZINO.

Mannheim City (pop., 2002: city, 308,385; metro. area, 1,568,679), southwestern Germany. One of Europe's largest inland ports, it is situated on the RHINE RIVER at the mouth of the NECKAR RIVER. It was a village in the 8th century, fortified by Elector Frederick IV, and chartered in 1607. The town was twice destroyed in wars during the 17th century and was rebuilt when the Palatine electors (see PALATINATE) moved their residence there in 1720. Destroyed again in 1795, the city was rebuilt and became a centre of the revolutionary movement in 1848. Mannheim is an industrial centre, manufacturing chemicals, textiles, and fertilizers.

Mannheim \'män-ˌhīm**, Karl** (b. March 27, 1893, Budapest, Austria-Hungary—d. Jan. 9, 1947, London, Eng.) Hungarian sociologist. Mannheim taught in Germany (University of Heidelberg, 1926–30; Frankfurt am Main, 1930–33) before the rise of Adolph Hitler. He was invited to England by political scientist HAROLD LASKI and for the rest of his career taught there (London School of Economics, 1933–43; University of London, 1943–47). He helped found the sociology of knowledge, the study of how knowledge is produced and maintained in societies. He emphasized the role that IDEOLOGY plays in shaping knowledge, a view he discussed in his major work, *Ideology and Utopia* (1929).

Manning, Henry Edward *known as* **Cardinal Manning** (b. July 15, 1808, Totteridge, Hertfordshire, Eng.—d. Jan. 14, 1892, London) British Roman Catholic cardinal. The son of a banker and member of Parliament, he was ordained a priest of the Church of England in 1833. A member of the OXFORD MOVEMENT, he became a Catholic in 1851 and was ordained a priest later that year. He rose rapidly in rank, being appointed archbishop of Westminster in 1865 and cardinal in 1875. He favoured the centralization of authority in the church (Ultramontanism) and supported stronger wording on PAPAL INFALLIBILITY than was eventually adopted by the First Vatican Council. He established many schools and was highly regarded for his concern for social welfare.

manorialism *or* **seignorialism** \sān-'yōr-ē-əl-i-zəm\ Political, economic, and social system by which the peasants of medieval Europe were tied to their land and their lord through SERFDOM. The basic unit was the manor, a self-sufficient landed estate, or FIEF, under the control of a lord. Free tenants paid rent or provided military service in exchange for the use of the land. Peasants farmed small plots of land and owed rent and labor to their lord, and most were not free to leave the estate. The manorial system was flourishing in Western Europe by the 8th century and had begun to decline by the 13th century, while in Eastern Europe it achieved its greatest strength after the 15th century.

Mansa Musa See MUSA

Mansfield, Katherine *orig.* **Kathleen Mansfield Beauchamp** (b. Oct. 4, 1888, Wellington, N.Z.—d. Jan. 9, 1923, Gurdjieff Institute, near Fontainebleau, France) New Zealand-born British writer. After moving to England at age 19, she secured her reputation with the story collection *Bliss* (1920). She reached the height of her powers in the collection *The Garden Party* (1922). Her delicate stories, which focus on psychological conflicts, are written in a distinctive prose style with poetic overtones that shows the influence of ANTON CHEKHOV. Her last five years were shadowed by tuberculosis, of which she died at age 34.

Katherine Mansfield
BBC HULTON PICTURE LIBRARY

Mansfield, Michael (Joseph) *known as* **Mike Mansfield** (b. March 16, 1903, New York, N.Y., U.S.—d. Oct. 5, 2001, Washington, D.C.) U.S. politician who was the longest-serving majority leader (1961–77) in the U.S. Senate. He worked in Montana copper mines and later taught history at Montana State University. He served in the U.S. House of Representatives from 1943 to 1953 and in the Senate from 1953 to 1977. An outspoken critic of U.S. involvement in the VIETNAM WAR, he sponsored a 1971 bill calling for a cease-fire and phased withdrawal. He was a persistent critic of Pres. RICHARD NIXON, especially during the WATERGATE SCANDAL. After retiring, he served as U.S. ambassador to Japan (1977–88).

Mansfield, William Murray, 1st earl of (b. March 2, 1705, Scone, Perthshire, Scot.—d. March 20, 1793, London, Eng.) British jurist. Called to the bar in 1730, he gained a wide reputation in 1737 when he eloquently supported before the House of Commons a merchants' petition to stop Spanish assaults on their ships. As chief justice of the King's Bench (1756–88), he conducted several scrupulously fair trials of persons accused of treason and seditious libel. He reduced an unwieldy mass of outmoded commercial law to a coherent body of rules, refined the law of contracts, and made major contributions to MARITIME LAW. He was a member of the cabinet three times, entrusting the great seal of his office to a committee so that he could retain the chief justiceship and still exert political power. In 1783 he declined cabinet office, preferring to serve as speaker of the House of Lords. THOMAS B. MACAULAY called him the father of modern Toryism.

Mansi See SIBERIAN PEOPLES

manslaughter See HOMICIDE

Manson, Charles (b. Nov. 12, 1934, Cincinnati, Ohio, U.S.) U.S. cult leader and mass murderer. From age 9 he spent a great deal of his life in the care of the state, first in juvenile reformatories and later in prison. By 1968, he had become the leader of the "Family," a communal religious cult in Los Angeles dedicated to studying and implementing his eccentric religious teachings. In 1969 he sent Family members to a house rented by the actress Sharon Tate and her husband ROMAN POLANSKI; there they murdered Tate and five friends, and elsewhere they killed three others. The trials of Manson and four of his followers in 1971 attracted national attention. Their death sentences were commuted to life imprisonment when California abolished the death penalty in 1972. Manson's crimes were the subject of the best-selling book *Helter Skelter* (1974), by the prosecutor in the case, Vincent Bugliosi.

manta ray *or* **devil ray** *or* **devilfish** Any of several genera of warm-water marine RAYS, constituting the family Mobulidae, that are wider than they are long. Extensions of the pectoral fins project from the front of the head, looking like devils' horns; these sweep plankton and small fishes into their mouths. The long, whiplike tail may have one or more stinging spines. Mantas swim near the surface by flapping their pectoral fins. The largest species, the powerful but inoffensive Atlantic manta, or giant devil, ray (*Manta birostris*), may grow to over 23 ft (7 m) wide; contrary to old tales, it does not envelop and eat divers.

Mantegna \män-'tān-yə**, Andrea** (b. 1431?, near Vicenza, Republic of Venice—d. Sept. 13, 1506, Mantua, March of Mantua) Italian painter. The son of a woodworker, he was adopted by Francesco Squarcione, a tailor-turned-painter; Mantegna was one of several pupils who later sued him for exploitation. At about 17 he established his own workshop and received an important commission for an altarpiece, now lost. His frescoes in Padua's Eremitani Church (1448–57), with their monumental figures and detailed treatment of Classical architecture, show that he had fully mastered perspective and foreshortening and was successfully experimenting with illusionistic effects, best seen in his frescoes of the GONZAGA family (completed 1474) in the Palazzo Ducale's Camera degli Sposi (Bridal Chamber) in Mantua, which transform the small interior room into an open-air pavilion. He was the first artist in northern Italy to work fully in the Renaissance style. He married a daughter of the BELLINI FAMILY in 1453 but did not join the Bellini studio. He later became court painter to Ludovico Gonzaga. His humanistic approach to antiquity and his spatial illusionism were to have far-reaching influence.

Mantineia \ˌman-tə-'nī-ə\ *or* **Mantinea** Ancient Greek city of ARCADIA, situated north of modern TRÍPOUS. At the first Battle of Mantineia in 418 BC, SPARTA defeated the coalition of Mantineia, Elis, Argos, and Athens. In 362 the Theban army defeated Spartan troops in an encounter nearby. In 207 Philopoemen, the Greek general of the ACHAEAN LEAGUE,

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defeated the Spartans at Mantineia. In the later Roman Empire, Mantineia dwindled to a mere village, and it finally disappeared under Ottoman rule.

mantis *or* **praying mantis** Any of more than 1,500 species of the INSECT suborder Mantodea (order Orthoptera). The long-bodied, slow-moving mantis (or mantid) eats only living insects, using its large forelimbs to capture and hold its struggling prey. The female is likely to eat the male after mating. The European *Mantis religiosa* and the Chinese mantis (*Tenodera aridifolia sinensis*) have been introduced to North America. The latter grows to 3–8 in. (8–20 cm) long. The name mantis ("diviner") reflects an ancient Greek belief in its supernatural powers.

mantle That part of the Earth that lies beneath the CRUST and above the central CORE. On average, the mantle begins about 22 mi (35 km) below the surface and ends at a depth of about 1,800 mi (2,900 km). Predominant in the rock material are OLIVINEs, PYROXENEs, and the silicate perovskite, a dense form of ENSTATITE.

Mantle, Mickey *in full* **Mickey Charles Mantle** (b. Oct. 20, 1931, Spavinaw, Okla., U.S.—d. Aug. 13, 1995, Dallas, Texas) U.S. baseball player. Mantle joined the New York Yankees in 1951 and became a powerful switch-hitting outfielder and first baseman. Between 1954 and 1961 "the Mick" led the American League four times in home runs, six times in runs, and once in RBIs, the latter occurring in the year (1956) that he won the triple crown for home runs, RBI, and batting average (.353). In 1961 he hit 54 home runs, finishing second in the home-run race behind his teammate ROGER MARIS, who broke BABE RUTH's season record that same year. Mantle had to play with his legs heavily taped for much of his career because of injuries to his ankles and knees. He retired in 1968 with a lifetime total of 536 home runs.

mantra In HINDUISM and BUDDHISM, a sacred utterance (syllable, word, or verse) believed to possess mystical or spiritual power. Mantras may be spoken aloud or uttered in thought, and they may be either repeated or sounded only once. Most have no apparent verbal meaning, but they are thought to have profound significance and to serve as distillations of spiritual wisdom. Repetition of a mantra can induce a trancelike state and can lead the participant to a higher level of spiritual awareness. Widely used mantras include OM in Hinduism and *om mani padme hum* in TIBETAN BUDDHISM.

Manu \'mə-nü\ In the mythology of India, the first man and the legendary author of the *MANU-SMṚTI*. Manu appears in the VEDAS as the performer of the first sacrifice. He is also known as the first king, and most rulers of medieval India claimed him as an ancestor. In the story of the great flood, Manu combines the characteristics of NOAH and ADAM. He built a boat after being warned of the flood by a fish. His boat came to rest on a mountaintop, and as the flood receded Manu poured out an oblation of milk and butter. A year later a woman calling herself the "daughter of Manu" was born from the waters, and these two became the parents of a new human race to replenish the earth.

Manu-smṛti \'mə-nü-'smri-tē\ *officially* **Manava-dharma-shastra** Most authoritative of the books of the Hindu law code (*Dharma-shastra*). It is attributed to the legendary first man and lawgiver, MANU. In its present form it dates from the 1st century BC. It prescribes the DHARMA of each Hindu, stating the obligations attached to his or her social class and stage of life. Making no distinction between religious and secular law, it deals with cosmogony, SACRAMENTS, and other religious topics as well as with marriage, hospitality, dietary restrictions, the conduct of women, and the law of kings.

Manual of Discipline *or* **Rule of the Community** Major document produced by the ESSENE community of Jews. The manual, written on scrolls found in 1947 in caves at QUMRĀN (see DEAD SEA SCROLLS), explains the sect's religious and moral ideals and describes its admission ceremony, mystical doctrines, and organizational and disciplinary statutes.

Manuel \mən-'wel\ **I** *known as* **Manuel the Fortunate** (b. May 31, 1469, Alcochete, Port.—d. December 1521, Lisbon) King of Portugal (1495–1521). He opened trade with India and Brazil, sending PEDRO ÁLVARES CABRAL on a voyage to East Asia (1500), and gained riches from VASCO DA GAMA's voyage around Africa. Manuel's claims to the newly discovered lands were confirmed by the pope and recognized by Spain. In order to marry the daughter of FERDINAND V and Isabella, he agreed to expel Jews and Muslims from Portugal (1496). His reign saw the founding of Portuguese outposts in India and the Malay Peninsula, and his explorers reached China in 1513. Manuel also centralized Portuguese administration, reformed the courts, and revised the legal code.

Manuel I Comnenus \'man-yù-əl...käm-'nē-nəs\ (b. Nov. 28, 1118—d. Sept. 24, 1180) Byzantine emperor (1143–80). The son of JOHN II COMNENUS, he renewed alliances in the West against the Normans in Sicily and Antioch. He took Apulia briefly (1155) but was defeated at Brindisi (1156) by a joint force of Germans, Venetians, and Normans, ending Byzantine control in Italy. He reasserted his authority over the Crusader states (1158–59) and extended his influence among the Hungarians and Serbs, adding Dalmatia, Croatia, and Bosnia to the empire in 1167. He launched a campaign against the Seljuq Turks (1176), and his defeat showed the waning of Byzantine power and ended his plan of restoring the Roman Empire.

Manuel II Palaeologus \'man-yù-əl...,pā-lē-'ä-lə-gəs\ (b. July 27, 1350—d. July 21, 1425) Byzantine emperor (1391–1425). He was crowned coemperor with his father, JOHN V PALAEOLOGUS, in 1373; his brother Andronicus IV seized the throne in 1376, but Manuel and his father regained it with Turkish aid in 1379. They were obliged to pay tribute to the sultan, who later helped them quash a rebellion by Andronicus's son (1390). Manuel was forced to live as a vassal at the Turkish court but escaped after his father's death (1391). A treaty in 1403 kept peace with the Turks until 1421, when Manuel's son and coemperor JOHN VIII meddled in Turkish affairs. After the Turks besieged Constantinople (1422) and took southern Greece (1423), Manuel signed a humiliating treaty and entered a monastery.

manufacturing Any INDUSTRY that makes products from raw materials by the use of manual labour or machines and that is usually carried out systematically with a division of labour. In a more limited sense, manufacturing is the fabrication or assembly of components into finished products on a fairly large scale. Among the most important manufacturing industries are those that produce aircraft, automobiles, chemicals, clothing, computers, consumer electronics, electrical equipment, furniture, heavy machinery, refined petroleum products, ships, steel, and tools. See also FACTORY; MASS PRODUCTION.

manure Organic material that is used to fertilize land, usually consisting of the feces and urine of domestic LIVESTOCK, with or without litter such as straw, hay, or bedding. Some countries also use human excrement ("night soil"). Though livestock manure is less rich in nitrogen, phosphorus, and potash than synthetic FERTILIZERS and therefore must be applied in much greater quantities, it is rich in organic matter, or HUMUS, and thus improves the capacity of the soil to absorb and store water, thereby preventing erosion. Because manure must be carefully stored and spread in order to derive the most benefit, some farmers decline to expend the necessary time and effort. Manufactured chemical fertilizers, though more concentrated and efficient, are also more costly and more likely to cause excess runoff and pollution. See also GREEN MANURE.

Manutius \mə-'nü-shəs**, Aldus, the Elder** *Italian* **Aldo Manuzio il Vecchio** (b. 1449, Bassiano, Papal States—d. Feb. 6, 1515, Venice) Italian printer, the leading figure of his time in printing, publishing, and typography. In 1490 he settled in Venice and gathered around him a group of compositors and Greek scholars. He produced the first printed editions of many Greek and Latin classics and is particularly associated with the production of small, carefully edited pocket-size books printed in inexpensive editions. The *Hypnerotomachia Poliphili* (1499) of Francesco Colonna, with outstanding woodcuts, was his most famous book. After his death, the Aldine Press, which he founded, was taken over by members of his family, who probably printed 1,000 editions between 1495 and 1595.

Manx cat Breed of DOMESTIC CAT believed to have come from the Isle of Man. Affectionate, loyal, and courageous, the compact Manx is distinguished by its taillessness and hopping gait. The rump is distinctly higher than the shoulders because the hind legs are longer than the forelegs. The Manx may be born with a tail, but ideally it should be tailless. The double coat may be any of several colours.

Manzanar \'man-zə-,när\ **Relocation Center** Internment facility for Japanese Americans during WORLD WAR II. Fear that Japan would invade the western U.S. with the aid of spies living in the U.S. led the government to force Japanese Americans in western states to relocate to one of ten camps, of which Manzanar, in California, was the first to be established and the best known. During its operation, over 11,000 people were confined there. The California centre was named a national historic site in 1992.

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Manzikert, Battle of (1071) Battle near the town of Manzikert (present-day Malazgirt, Turk.), in which the Seljuq Turks (see SELJUQ DYNASTY) under Sultan ALP-ARSLAN defeated the Byzantines under ROMANUS IV DIOGENES. Romanus had assembled a large army to confront the Turks and end their forays into Byzantine-ruled Anatolia. His troops included Turkmen mercenaries who deserted to the enemy the night before the battle; the Turks destroyed the Byzantine army and took Romanus prisoner. The battle was followed by the Seljuq conquest of most of Anatolia.

Manzoni, Alessandro (b. March 7, 1785, Milan, Italy—d. May 22, 1873, Milan) Italian novelist and poet. After spending much of his childhood in religious schools, Manzoni wrote a series of religious poems, *Sacred Hymns* (1815), and later two historical tragedies influenced by WILLIAM SHAKESPEARE, *Il conte di Carmagnola* (1820) and *Adelchi* (performed 1822). He is best known for the novel *The Betrothed*, 3 vol. (1827), a masterpiece of world literature and the most famous Italian novel of its century, in which, prompted by a patriotic urge to forge a language accessible to a wide readership, he employed a clear, expressive prose that became a model for many subsequent Italian writers. Manzoni's advocacy of a united Italy made him a hero of the RISORGIMENTO; his death prompted GIUSEPPE VERDI's great *Requiem*.

Alessandro Manzoni, oil painting by Francesco Hayez; in the Brera Gallery, Milan.
ALINARI—ART RESOURCE

Manzù \'mänd-zü**, Giacomo** *orig.* **Giacomo Manzoni** (b. Dec. 22, 1908, Bergamo, Italy—d. Jan. 17, 1991, Ardea) Italian sculptor. Apprenticed at an early age, he learned to work in wood, metal, and stone. In 1950, after making a name for himself with sculptures of more than 50 Roman Catholic cardinals and a series of female nudes, he was commissioned to create sculptural bronze doors for ST. PETER'S BASILICA. His sober realism and extremely delicate modeling achieved both severity and sensuousness of form.

Portrait of a Lady, bronze sculpture by Giacomo Manzù, 1946; in the Museum of Modern Art, New York City.
COURTESY OF THE MUSEUM OF MODERN ART, NEW YORK; A. CONGER GOODYEAR FUND

Mao Dun \'maù-'dün\ *or* **Mao Tun** *orig.* **Shen Dehong** *or* **Shen Yanbing** (b. July 4, 1896, Tongxiang, Zhejiang province, China—d. March 27, 1981, Beijing) Chinese literary critic, author, and editor. A founder of the League of Left-Wing Writers (1930), he served as minister of culture after the communist government was established (1949–64). Many Western critics consider his trilogy of novellas *Shi* (1930; "Eclipse") to be his masterpiece. English translations of his works include *Spring Silkworms and Other Stories* (1956) and the novel *Rainbow* (1992). He is generally considered China's greatest novelist of REALISM.

Mao Shan \'maù-'shän\ Sacred mountain in Jiangsu province in China, the focus of Daoist revelations to the visionary Yang Xi (AD 364–370). Yang Xi was visited by a group of perfected immortals (*zhenren*) from the heaven of Shangqing (Supreme Purity), who gave him a new set of scriptures and instructions on the coming apocalypse, during which the good were to take refuge in luminous caverns beneath such sacred mountains as Mao Shan. The Mao Shan revelations incorporated elements of BUDDHISM into Daoist thought and proposed reforms of DAOISM, including rejection of its sexual rites in favour of a spiritualized union with a celestial partner.

Mao Zedong \'maù-dzə-'dùŋ\ *or* **Mao Tse-tung** (b. Dec. 26, 1893, Shaoshan, Hunan province, China—d. Sept. 9, 1976, Beijing) Chinese Marxist theorist, soldier, and statesman who led China's communist revolution and served as chairman of the People's Republic of China (1949–59) and chairman of the CHINESE COMMUNIST PARTY (CCP; 1931–76). The son of a peasant, Mao joined the revolutionary army that overthrew the QING DYNASTY but, after six months as a soldier, left to acquire more education. At Beijing University he met LI DAZHAO and CHEN DUXIU, founders of the CCP, and in 1921 he committed himself to MARXISM. At that time, Marxist thought held that revolution lay in the hands of urban workers, but in 1925 Mao concluded that in China it was the peasantry, not the urban proletariat, that had to be mobilized. He became chairman of a Chinese Soviet Republic formed in rural Jiangxi province; its Red Army withstood repeated attacks from CHIANG KAI-SHEK's Nationalist army but at last undertook the LONG MARCH to a more secure position in northwestern China. There Mao became the undisputed head of the CCP. Guerrilla warfare tactics, appeals to the local population's nationalist sentiments, and Mao's agrarian policies gained the party military advantages against their Nationalist and Japanese enemies and broad support among the peasantry. Mao's agrarian Marxism differed from the Soviet model, but, when the communists succeeded in taking power in China in 1949, the Soviet Union agreed to provide the new state with technical assistance. However, Mao's GREAT LEAP FORWARD and his criticism of "new bourgeois elements" in the Soviet Union and China alienated the Soviet Union irrevocably; Soviet aid was withdrawn in 1960. Mao followed the failed Great Leap Forward with the CULTURAL REVOLUTION, also considered to have been a disastrous mistake. After Mao's death, DENG XIAOPING introduced social and economic reforms that began reversing the policies put in place by Mao. See also JIANG QING; LIU SHAOQI; MAOISM.

Maoism \'maù-ˌi-zəm\ Variation of MARXISM and LENINISM developed by MAO ZEDONG. It diverged from its antecedents in its agrarian focus: Mao substituted the dormant power of the peasantry (discounted by traditional Marxists) for the urban PROLETARIAT that China largely lacked. The Maoist faith in revolutionary enthusiasm and the positive value of the peasants' lack of sophistication as opposed to technological or intellectual elites fueled the GREAT LEAP FORWARD of the 1950s and the CULTURAL REVOLUTION of the 1960s and '70s. The disastrous consequences of both upheavals led Mao's successors to abandon Maoism as counterproductive to economic growth and social order. Maoism was embraced by insurgent guerrilla groups worldwide; under the KHMER ROUGE it became Cambodia's national ideology.

Maori \'maù-rē\ Any member of a Polynesian people of New Zealand. Maori traditional history describes their origins in terms of waves of migration from a mythical land between the 12th and 14th centuries, but archaeologists have dated habitations in New Zealand back to at least AD 800. Their first European contact was with ABEL JANSZOON TASMAN (1642), who did battle with a group of Maori. Later Europeans were initially welcomed, but the arrival of muskets, disease, Western agricultural methods, and missionaries corroded Maori culture and social structure, and conflicts arose. The British assumed formal control of New Zealand in 1840; war over land broke out repeatedly over the next three decades. By 1872 all fighting had ended and great tracts of Maori land had been confiscated. Today about 9% of New Zealanders are classified as Maori; nearly all have some European ancestry. Though largely integrated into modern urban life, many Maori keep alive traditional cultural practices and struggle to retain control of their ancestral lands.

map Graphic representation, drawn to scale and usually on a flat surface, of features—usually geographic, geologic, or geopolitical—of an area of the Earth or of any celestial body. Globes are maps represented on the surface of a sphere. Cartography is the art and science of making maps and charts. Major types of maps include topographic maps, showing features of the Earth's land surface; nautical charts, representing coastal and marine areas; hydrographic charts, which detail ocean depths and currents; and aeronautical charts, which detail surface features and air routes.

Mapam, Lake *Chinese* **Mapam Yumco** \'mä-ˌpäm-'yùm-kō\ *or* **Ma-fa-mu-ts'o** \ma-ˌfä-'mü-tsō\ *conventional* **Manasarowar** \ˌmä-nä-sä-'rō-ˌwär\ Lake in the HIMALAYAS, southwestern TIBET, China. Lying nearly 15,000 ft (4,570 m) above sea level, it is generally recognized as the highest body of fresh water in the world. It is prominent in Hindu mythology and is one of the most sacred places of pilgrimage for Hindus.

maple family Family Aceraceae, composed of about 200 species (in the genera *Dipteronia* in China and *Acer* across the Northern Hemisphere)

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of ornamental, shade, and timber trees. Maples are important ornamentals for lawns, along streets, and in parks. They offer a great variety of form, size, and foliage; many display striking autumn colour. The red maple (*A. rubrum*) is one of the most common trees in its native eastern North America, where it tolerates compacted wet soils and city pollution. Box elder (*A. negundo*) grows quickly to 30–50 ft (9–15 m) and resists drought, so early prairie settlers planted many for shade and for wood to make crates, furniture, paper pulp, and charcoal. The watery, sweet sap of the sugar maple (*A. saccharum*) is boiled down for syrup and sugar; the wood of certain sugar maples is used for furniture.

mapmaking See CARTOGRAPHY

Maponos \'mä-'pō-nōs\ *or* **Mac ind Óg** \'mȧ-kən-'dōg\ *or* **Oenghus** \'ē-nəs, 'òin-gəs\ In CELTIC RELIGION, a god similar to APOLLO who is often associated with healing. He appears in Welsh mythology as Mabon, who was carried off from his divine mother when he was three nights old. In Irish mythology he is said to be the son of DAGDA and of Boann, the personified sacred river of Irish tradition. He lived in the great Neolithic (and therefore pre-Celtic) passage grave of Newgrange.

Mapplethorpe \'mā-pəl-ˌthȯrp**, Robert** (b. Nov. 4, 1946, New York, N.Y., U.S.—d. March 9, 1989, Boston, Mass.) U.S. photographer. He attended the Pratt Institute (1963–70). By the mid 1970s he was pursuing what were to remain his favourite subjects throughout his career: still lifes, flowers, portraits of friends and celebrities, and homoerotic explorations of the male body. His compositions were generally stark, with his combination of cold studio light and precise focus creating dramatic tonal contrasts. His muscular male models were generally framed against plain backdrops, sometimes engaged in sexual activity or posed with sadomasochistic props such as leather and chains. His clear, unflinching style challenged viewers to confront this imagery. Moreover, the combination of his choice of subject matter with the photographs' formal beauty and grounding in art-historical traditions created what many saw as a tension between pornography and art. A posthumous retrospective exhibition of his work in 1990, funded partly by the NATIONAL ENDOWMENT FOR THE ARTS (NEA), stirred a debate about government subsidies of "obscene" art and provoked Congress to enact restrictions on future NEA grants.

mappō \'mäp-ˌpō\ In Japanese Buddhism, the age in which the BUDDHA's law will degenerate. The period following the death of the Buddha is divided into three ages: the age of the true law, the age of the copied law, and the age of the latter law, or the degeneration of the law. A new period, in which true faith will again flower, will then be ushered in by the BODHISATTVA MAITREYA (Japanese Miroku). Japanese Buddhists calculate that the age of *mappō* began in AD 1052. Since it is expected to continue for 10,000 years, the current era of human history continues to be the age of *mappō*.

Mapuche \mä-'pü-chē\ Most numerous group of Araucanian-speaking South American Indians (see ARAUCANIAN), who live in the central valley of Chile. They are noted for their 350-year struggle against Spanish and Chilean domination. In the 16th–18th centuries they learned to use horses in battle and united over great distances to fight Spanish incursions. After Chile gained independence in the 19th century, the government settled them on reservations. In the 1980s the reservation land was transferred to individuals, but their rights have become endangered by debt accrued to support their traditional, non-intensive agriculture.

Maputo \mä-'pü-tō\ *formerly (until 1976)* **Lourenço Marques** \lō-'rā"-sü-'mȧr-kish\ Port city (pop., 1997: 989,386), capital of MOZAMBIQUE. It lies on the northern bank of Espírito Santo Estuary of DELAGOA BAY, an inlet of the Indian Ocean. It derived its former name from the Portuguese trader who first explored the region in 1544. The town developed around a Portuguese fortress completed in 1787. Created a city town in 1887, it superseded Moçambique as the capital of Portuguese East Africa in 1907. Since the nation's independence in 1975, the collapse of tourism and reduced access to foreign trade have damaged the city's economy.

maqām \mȧ-'käm\ Spiritual stage that serves as a milestone on the path followed by Muslim mystics (Sufis) as they strive to reach the vision of and union with God. The Sufi progresses through his own spiritual efforts and through the guidance of SHEIKHS. In each *maqām* the Sufi strives to purify himself of all worldly inclinations and prepare himself to attain an ever higher spiritual level. Most Sufis identify seven major *maqām*s: repentance, fear of the Lord, renunciation, poverty, patience, trust, and satisfaction. See also SUFISM.

Maqtūl, al- See al-SUHRAWARDĪ

Mar del Plata Coastal city (pop., 1999 est.: 579,483), east-central Argentina. It was the site of a Spanish mission (1746–51). In 1856 Portuguese explorer Jose Coelho Mierelles founded the fishing village La Peregrina. Mar del Plata was established in 1874 and promoted as a seaside resort; it became a city in 1907. It is famous for its luxurious casino. In addition to tourism, its economy is based on construction, textiles, and commercial fishing and canning. It is the seat of the National University of Mar del Plata.

Mar-pa (b. 1012, Lhobrag, Tibet—d. 1096, Tibet) Tibetan religious leader. According to tradition, he was born to wealthy parents, and to curb his violent nature he was sent to a Tibetan monastery to study Buddhism. He later spent three periods studying under the yogi Naropa in India, returning to Tibet during the intervals and gathering disciples. A major figure in the revival of Buddhism in Tibet, he is known for his translations of Indian VAJRAYANA Buddhist texts and of mystical songs of the Indian Tantric tradition.

Mara Buddhist Lord of the Senses, who repeatedly tempted the BUDDHA Gautama. When Gautama seated himself under the BODHI TREE to await enlightenment, the evil Mara appeared in the guise of a messenger claiming that a rival had usurped the family throne. After sending a storm of rain, rocks, ashes, and darkness to frighten away the gods who had gathered, he challenged Gautama's right to sit beneath the tree and sent forth his three daughters, Trsna, Rati, and Raga (thirst, desire, and delight), to seduce Gautama, but to no avail. After the Buddha had achieved enlightenment, Mara pressed him to abandon any attempt to preach, but the gods successfully persuaded him to preach the law.

marabou \'mär-ə-ˌbü\ African STORK (*Leptoptilos crumeniferus*). Standing 5 ft (1.5 m) tall with a wingspread of 8.5 ft (2.6 m), the marabou is the largest of all storks. Mainly gray and white, it has a bald pinkish face and neck; a reddish, inflatable throat pouch; and a straight, heavy bill. Marabous eat carrion, often feeding with VULTURES, which they dominate.

Maracaibo \ˌmä-rä-'kī-bō\ City (pop., 2000 est.: 1,764,038), northwestern Venezuela. Located on the channel connecting Lake MARACAIBO with the Gulf of Venezuela, it is Venezuela's second largest city. Founded in 1571 as Nueva Zamora, it became a centre for inland trade after Gibraltar, at the head of the lake, was destroyed in 1669. It changed hands several times during Venezuela's struggle for independence from Spain. Within a decade of the discovery of oil in 1917, it became the oil metropolis of Venezuela and South America.

Maracaibo, Lake Inlet of the CARIBBEAN SEA, northwestern Venezuela. The largest natural lake in South America, it occupies an area of 5,130 sq mi (13,280 sq km), extending southward for 130 mi (210 km) from the Gulf of Venezuela and reaching a width of 75 mi (121 km). Many rivers flow into the lake, notably the CATATUMBO RIVER. It is in one of the world's richest oil-producing regions, which supplies about two-thirds of Venezuela's total petroleum output. Its oil fields are located along the eastern shore, extending 20 mi (32 km) into the lake.

Maradona, Diego Armando (b. Oct. 30, 1960, Villa Fiorito, near Buenos Aires, Arg.) Argentine football (soccer) player. A midfielder renowned for his ability to create scoring chances for himself and others, he led club teams to championships in Argentina, Italy, and Spain. He starred for the Argentine national team that won the 1986 World Cup. His performance included two memorable goals against England, one scored with his hand (the referee mistakenly thought the ball struck his head) and now remembered as the "Hand of God," and another that saw him dribble through a pack of defenders. He was twice suspended for use of banned substances. An Internet poll conducted by the Fédération Internationale de Football Association named Maradona the top player of the 20th century.

Marajó \ˌmä-rä-'zhō\ Island in the AMAZON RIVER delta, Brazil. The world's largest fluvial island, it is 183 mi (295 km) long and 124 mi (200 km) wide, with an area of about 15,500 sq mi (40,100 sq km). The main flow of the Amazon passes north of Marajó, but numerous narrow channels direct part of its water into the PARÁ RIVER, an estuary that separates the island from the mainland to the south. Archaeological remains in the eastern savanna are similar to those of pre-Columbian ANDEAN CIVILIZATION.

Marañón \ˌmä-rä-'nyōn\ **River** River, central Peru. Rising in the ANDES MOUNTAINS, it is part of the headwaters of the AMAZON RIVER. It flows northwest at elevations of about 12,000 ft (3,650 m) and descends through

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jungles in unnavigable rapids and falls; emerging from the most spectacular of these rapids, the Pongo de Manseriche, it is only 575 ft (175 m) above sea level. For the rest of its 879-mi (1,415-km) course, it meanders eastward, receiving the Huallaga River and then joining the Ucayali River to form the Amazon.

Marat \mä-'rä**, Jean-Paul** (b. May 24, 1743, Boudry, near Neuchâtel, Switz.—d. July 13, 1793, Paris, France) French politician and a leader of the radical Montagnard faction in the French Revolution. He was a well-known doctor in London in the 1770s. Returning to France in 1777, he was appointed physician at the court of Louis XVI's brother, the count d'Artois (later Charles X). Marat wrote scientific publications as well as political pamphlets. From 1789, as editor of the newspaper *L'Ami du Peuple*, he became an influential voice for radical measures against the aristocrats. He criticized moderate revolutionary leaders and warned against the émigré nobility, then advocated the execution of counterrevolutionaries. One of the most influential members of the National Convention (1792), he was actively supported by Parisians in street demonstrations. In April 1793 the Girondins brought him before a Revolutionary tribunal, but he was acquitted. In July a young Girondin supporter, Charlotte Corday, gained admittance to his room and stabbed him to death in his bath, making him a martyr to the people's cause.

Jean-Paul Marat, detail of a portrait by Joseph Boze, 1793; in the Museum of the History of Paris.
GIRAUDON/ART RESOURCE, NEW YORK

Maratha \mä-rə-'tä\ **confederacy** Maratha alliance formed in the 18th century in western India after Shivaji's Maratha kingdom collapsed under Mughal pressure. Under Shivaji's grandson, power fell to peshwas (chief ministers) from leading Maratha families, who ruled effectively in the early 18th century but quarreled as the century waned. The confederacy fell to the British in 1818.

Maratha Wars Three conflicts between the British and the Maratha confederacy in the late 18th and early 19th centuries. At the time, the confederacy controlled large portions of the Deccan and of the western coast of the Indian peninsula. The British lost the first conflict (1775–82), in which they supported one contender's bid for the office of *peshwa* (chief minister). They won the second (1803–05), defeating members of the confederacy who challenged their restoration of an ousted *peshwa*. The third war (1817–18) started after the British invaded Maratha territory in pursuit of robber bands. When Maratha forces rose against the British, they were defeated, Maratha territory was annexed, and British supremacy in India became complete.

marathon Long-distance footrace run on an open course of 26 miles 385 yards (42.2 km). First held at the revived Olympic Games in 1896, it commemorates the legendary feat of a Greek soldier who is said to have run from Marathon to Athens in 490 BC, a distance of about 25 mi (40 km), to report the Greek victory at the Battle of Marathon, after which he dropped dead. Marathons today are usually open events for both men and women, often run by thousands of participants, including the venerable Boston Marathon (established 1897). The women's marathon became an Olympic event in 1984.

Marathon, Battle of (490 BC) Decisive battle on the plain of Marathon outside Athens in the Persian Wars. Darius I led his enormous army against a much smaller Athenian force led by Miltiades. The Athenians attacked with great speed, while the Persian cavalry was absent, devastating the Persian line and resulting in Darius's departure from Greece. The victory was overwhelming: 6,400 Persians but only 192 Athenians died. It is said that a messenger ran about 25 mi (40 km) back to Athens, where he announced the victory before dying of exhaustion (see marathon). In another version, an Athenian runner was sent to Sparta before the battle to ask for help, running 150 mi (240 km) in two days; Sparta refused, so Athens fought with help only from Plataea.

Maravi confederacy \'mä-rə-vē\ Centralized system of government established in southern Africa c. 1480. It was created by members of related ethnolinguistic groups who had migrated from the north into what is now central and southern Malawi. Its seat was southwest of Lake Malawi, and at its peak in the 17th century it ruled an area stretching from the Zambezi River to the Mozambique coast. Its leaders traded with the Portuguese and Arabs in ivory, slaves, and iron. By 1720 it split into several autonomous factions.

marble Granular limestone or dolomite that has recrystallized under the influence of heat, pressure, and aqueous solutions. The main mineral in marble is calcite. Commercially, "marble" includes all decorative calcium-rich rocks that can be polished, as well as some serpentines. Marbles are used principally for buildings and monuments, interior decoration, statuary, tabletops, and novelties. Colour and appearance are their most important qualities. Statuary marble, the most valuable variety, must be pure white and of uniform grain size.

Marblehead Town (pop., 2000: 20,377), northeastern Massachusetts, U.S. Its harbour is sheltered by Marblehead Neck, a promontory about 1.5 mi (2.5 km) long. Settled in 1629 as a part of Salem, it was incorporated as a town in 1649 and developed as a fishing and shipbuilding centre. The port declined after the War of 1812. It is now a resort centre.

Marbury v. Madison (1803) First decision of the Supreme Court of the United States to declare an act of Congress unconstitutional, thus establishing the doctrine of judicial review. In 1801 newly elected Pres. Thomas Jefferson ordered Secretary of State James Madison to withhold from William Marbury the commission of his appointment by former Pres. John Adams as justice of the peace in the District of Columbia. Marbury then requested that the Supreme Court compel Madison to deliver his commission. In denying his request, the court held that it lacked jurisdiction because the section of the Judiciary Act passed by Congress in 1789 that authorized the Court to issue such a writ was unconstitutional and thus invalid. Chief Justice John Marshall, writing for the Court, declared that the Constitution must always take precedence in any conflict between it and a law passed by Congress.

Marc, Franz (b. Feb. 8, 1880, Munich, Ger.—killed in action March 4, 1916, near Verdun, France) German painter. His early works were academic, but exposure to Impressionism and Jugendstil lightened his style, and in 1911, with Vasily Kandinsky and other abstract painters, he became a founding member of the Blaue Reiter group. He believed that spiritual essence is best revealed through abstraction and was passionately interested in the art of "primitive" peoples, children, and the mentally ill. His own work consisted primarily of animal studies, since he believed nonhuman forms of life to be the most expressive manifestation of the vital force of nature.

marcasite \'mär-kə-ˌsīt\ Iron sulfide mineral that forms pale bronze-yellow crystals; the name cockscomb marcasite refers to the shape of a common form of its crystals. Marcasite has the same chemical formula as pyrite (FeS_2) but a different internal (atomic) structure. It is less stable than pyrite, being easily decomposed, and is much less common.

Marceau \mär-'sō**, Marcel** (b. March 22, 1923, Strasbourg, France) French mime. After serving in World War II, he studied with the pantomimist Étienne Decroux and had his first success in the role of Arlequin in *Baptiste*. He formed a mime troupe (1948–64) and earned worldwide acclaim in the 1950s with his production of the "mimodrama" of Nikolay Gogol's *Overcoat*. In 1978 he founded a school of mimodrama in Paris. He is noted for his eloquent, deceptively simple portrayals, including his celebrated white-faced character Bip, reminiscent of Pierrot and of Charlie Chaplin's tramp. See also mime and pantomime.

Gabriel Marcel, 1951
H. ROGER-VIOLLET

Marcel, Gabriel (-Honoré) (b. Dec. 7, 1889, Paris, France—d. Oct. 8, 1973, Paris) French philosopher, dramatist, and critic. His philosophical works explore aspects of human existence (e.g., trust, fidelity, hope, and despair) which had traditionally been dismissed as unamenable to philosophical consideration. His use

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of PHENOMENOLOGY was independent of the work of EDMUND HUSSERL, considered the founder of the phenomenological movement. Marcel was the first French proponent of EXISTENTIALISM.

Marcellus, Marcus Claudius (b. c. 268—d. 208 BC, near Venusia, Apulia) Roman general. Elected CONSUL in 222, he fought in Gaul and won the *spolia opima* ("spoils of honour"), awarded for killing an enemy chief in single combat, for the third and last time in Roman history. He was consul again in 215 and 214. Serving in Sicily (214–211) in the Second PUNIC WAR, he took Syracuse after a two-year siege; his troops sacked the city and carried its art treasures to Rome. He served again as consul in 210 and 208. While fighting HANNIBAL near Venusia, he was caught in an ambush and killed.

Marcellus \mär-'se-ləs**, Marcus Claudius** (b. 42—d. 23 BC, Baiae, Campania [Italy]) Roman leader. Nephew of AUGUSTUS (he was the son of Augustus's sister Octavia), Marcellus was Augustus's presumed heir. He married Augustus's daughter JULIA in 25 BC and later that year served with Augustus in Spain. Great hopes had rested with him, and his unexpected death led to problems of succession.

march Musical form having an even metre with strongly accented beats, originally intended to facilitate military marching. Development of the European march may have been stimulated by the Ottoman invasions of the 14th–16th centuries. Marches were not notated until the late 16th century; until then, time was generally kept by percussion alone, often with improvised fife embellishment. With the extensive development of BRASS INSTRUMENTS, especially in the 19th century, marches became widely popular and were often elaborately orchestrated. Composers such as WOLFGANG AMADEUS MOZART, LUDWIG VAN BEETHOVEN, and GUSTAV MAHLER wrote marches, often incorporating them into their operas, sonatas, or symphonies. The later popularity of JOHN PHILIP SOUSA's band marches was unmatched.

March, Frederic *orig.* **Frederick Ernest McIntyre Bickel** (b. Aug. 31, 1897, Racine, Wis., U.S.—d. April 14, 1975, Los Angeles, Calif.) U.S. actor. He began acting on Broadway, and his parody of John Barrymore in a touring production of *The Royal Family* earned him a five-year contract with Paramount Pictures; he reprised the role in the retitled screen adaptation, *The Royal Family of Broadway* (1930). He subsequently appeared in more than 65 films, including *Dr. Jekyll and Mr. Hyde* (1932, Academy Award), *A Star Is Born* (1937), *The Best Years of Our Lives* (1946, Academy Award), *Death of a Salesman* (1951), and *Inherit the Wind* (1960). He starred on the stage, often with his wife, Florence Eldridge, in plays such as *The Skin of Our Teeth* (1942) and *Long Day's Journey into Night* (1956, Tony Award). A versatile stage and film actor, his cerebral approach occasionally resulted in stolid, emotionally unconvincing performances, but it more often produced compelling, complex characterizations.

March Laws Reform measures enacted by the Hungarian Diet in 1848 (see REVOLUTIONS OF 1848) that sought to create a modern national Magyar state. The program, presented to the Diet by KOSSUTH Lajos, provided for internal Hungarian control of its own national guard, budget, and foreign policy. The laws were constitutionally confirmed by Emperor FERDINAND I in April 1848. Austria denied the validity of the laws after the revolution was defeated (1849), but Hungary continued to insist on their legality. The Austrians reimposed their domination of Hungary until, under the COMPROMISE OF 1867, Hungary received full internal autonomy.

March on Rome See March on ROME

Marchand \mär-'shä^{n}**, Jean** (b. Dec. 20, 1918, Champlain, Que., Can.—d. Aug. 28, 1988, Saint-Augustin, Que.) Canadian politician. After graduating from Laval University, he became a prominent union leader in Quebec. From 1961 to 1965 he was president of the Confederation of National Trade Unions. He was elected to the Canadian House of Commons in 1965 and served in the cabinet of LESTER PEARSON until 1968. From 1968 to 1976 he held cabinet posts under PIERRE TRUDEAU. Elected to the Canadian Senate in 1976, he served as speaker from 1980 to 1983.

Marche \'märsh\ Historic region, central France. Once part of LIMOUSIN, it was made a separate frontier countship (march) in the 10th century. During the 12th and 13th centuries it was divided into western and eastern halves. It was held by the Bourbons (1342–1435) and by the Armagnacs (1435–77). Confiscated by FRANCIS I in 1527, it was granted to the widows of French kings (1574–1643). It was a province of France until the FRENCH REVOLUTION.

Marche \'mär-kā\ Region (pop., 2001 prelim.: 1,463,868), central Italy. It covers an area of 3,743 sq mi (9,693 sq km) and is situated between the Adriatic Sea and the region of UMBRIA and crossed by the APENNINES; its only level land is along its river valleys and on the Adriatic shore near ANCONA, its capital. Originally inhabited by Gauls and Picenes, it came under Roman rule by AD 292. During the early Middle Ages the southern part was ruled by the Lombards and the northern part by the Byzantines. Conflicts arose in 12th and 13th centuries with powerful feudal families and the attempt of the popes to reestablish their temporal authority; this culminated in 1631, when the duchy of Urbino was incorporated into the PAPAL STATES. Marche joined the Kingdom of Italy in 1860. An agricultural area, it has some industrial development.

Marciano \ˌmär-shē-'ä-nō**, Rocky** *orig.* **Rocco Francis Marchegiano** (b. Sept. 1, 1923, Brockton, Mass., U.S.—d. Aug. 31, 1969, near Newton, Ia.) U.S. boxer and world heavyweight champion. Marciano began boxing in the army in World War II. An unscientific but hard-punching and exceptionally durable fighter, he won the championship title in 1952 by defeating Jersey Joe Walcott and relinquished it upon retiring in 1956. He was undefeated in 49 professional fights, scoring 43 knockouts.

Marco Polo See Marco POLO

Marco Polo Bridge Incident Conflict in 1937 between Chinese and Japanese troops near the Marco Polo Bridge outside Beijing. The incident was a culmination of the growing tensions between the two sides—increasing Japanese aggression and Chinese reaction against it—after Japan had occupied northeastern China and established its puppet state of MANCHUKUO in 1931. The skirmish expanded into a general war between Japan and China.

Marconi, Guglielmo (b. April 25, 1874, Bologna, Italy—d. July 20, 1937, Rome) Italian physicist and inventor. He began experimenting with radio waves in 1894. In 1896 he went to England, where he developed a successful system of radio telegraphy. His work on the development of shortwave wireless communication constitutes the basis of nearly all modern radio broadcasting. His improved aerials greatly extended the range of radio signaling. In 1899 he established communication across the English Channel. In 1900 he established the American Marconi Co. In 1901 he sent signals across the Atlantic for the first time. He acquired numerous patents, though probably his most famous one, No. 7777, for an apparatus that enabled several stations to operate on different wavelengths without interference, was later overturned. Marconi shared the 1909 Nobel Prize for Physics with K. Ferdinand Braun (1850–1918). He was made a marquis and was nominated to the Italian Senate (1929), and he was elected president of the Royal Italian Academy (1930).

Guglielmo Marconi, c. 1908.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Marcos, Ferdinand (Edralin) (b. Sept. 11, 1917, Sarrat, Phil.—d. Sept. 28, 1989, Honolulu, Hawaii, U.S.) Philippine head of state (1966–86). The son of a politician, he practiced as a trial lawyer before serving under MANUEL ROXAS, the first president of the independent Philippines. He was himself elected president in 1966. In his first term he made progress in agriculture, industry, and education, but in 1972 he imposed martial law, and his later years in power were noted for rampant government corruption, economic stagnation, political repression, and the steady growth of a communist insurgency. Following public outcry over the assassination of the opposition leader Benigno Aquino (1932–83) and Marcos's apparently fraudulent electoral victory over Aquino's widow, CORAZON AQUINO, Marcos was forced into exile in Hawaii, U.S. There he and his wife, Imelda, were indicted on racketeering charges related to embezzling billions of dollars from the Philippine economy. After his death she returned to the Philippines, where she was tried and convicted of corruption; the ruling was later overturned.

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Marcus, Rudolph A. (b. July 21, 1923, Montreal, Que., Can.) Canadian-born U.S. chemist. Educated at McGill University, he worked at the Polytechnic Institute of Brooklyn (from 1951), the University of Illinois (from 1964), and the California Institute of Technology (from 1978). He studied electron transfer in redox reactions in the 1950s and '60s, finding that subtle changes in the molecular structures of the reactants and the solvent molecules around them influence the ability of electrons to move between the molecules. He also discovered the parabolic relationship between the driving force of an electron-transfer reaction and the reaction's rate. His work, which has shed light on fundamental phenomena such as photosynthesis, cell metabolism, and simple corrosion, won him a 1992 Nobel Prize.

Marcus Aurelius \ˌmär-kəs-ȯ-'rēl-yəs\ *in full* **Caesar Marcus Aurelius Antoninus Augustus** *orig.* **Marcus Annius Verus** (b. April 26, AD 121, Rome—d. March 17, 180, Vindobona [Vienna] or Sirmium, Pannonia) Roman emperor (161–180). He was born into a wealthy and prominent family. HADRIAN arranged that Marcus and Lucius Verus be adopted by the designated future emperor ANTONINUS PIUS, who dutifully groomed Marcus as his heir. On his accession, Marcus nevertheless shared power with his adoptive brother as coemperor, though he himself remained the more dominant. His reign was marked by numerous military crises, all the major frontiers being threatened by invasion. Struggles against the Parthians (162–166) were successful, but returning troops brought a devastating plague to Rome. With a concurrent German invasion, Roman morale declined; the Germans were repulsed, but Verus died during the campaign (169). Marcus made his son COMMODUS coemperor in 177. Though a man of gentle character and wide learning, Marcus opposed Christianity and supported persecution of its adherents. His *Meditations* on STOICISM, considered one of the great books of all times, gives a full picture of his religious and moral values. His reign is often thought to mark the Golden Age of Rome.

Marcus Aurelius, bas-relief depicting his triumphal entry into Rome in a quadriga; in the Palazzo dei Conservatori, Rome.
ALINARI/ART RESOURCE, NEW YORK

Marcuse \mär-'kü-zə**, Herbert** (b. July 19, 1898, Berlin—d. July 29, 1979, Starnberg, Ger.) German-U.S. political philosopher. A member of the FRANKFURT SCHOOL, he fled Germany after the Nazi seizure of power in 1933. After working in U.S. intelligence in World War II, he taught at several universities, principally Brandeis University (1954–65) and the University of California at San Diego (1965–76). In his best known and most influential work, *One-Dimensional Man* (1964), Marcuse argued that society under advanced capitalism is unfree and repressive and that modern man has become intellectually and spiritually complacent through his psychological dependence on the blandishments of consumer society, a phenomenon he termed "repressive desublimation." He was also hostile to the Soviet system. His works were popular among student leftists, especially after the 1968 student rebellions at Columbia University and the Sorbonne. His other writings include *Eros and Civilization* (1955) and *Counterrevolution and Revolt* (1972).

Marcy, William L(earned) (b. Dec. 12, 1786, Southbridge, Mass., U.S.—d. July 4, 1857, Ballston Spa, N.Y.) U.S. politician. From 1823 to 1829 he was comptroller of New York state and a leading member of the "Albany Regency," a group of powerful state Democrats. He was a justice of the state supreme court from 1829 to 1831. In the U.S. Senate (1831–33), he championed the SPOILS system, remarking that "To the victor belong the spoils of the enemy." He served as governor of New York (1833–39), as U.S. secretary of war (1845–49), and as U.S. secretary of state (1853–57).

Mardi Gras \'mär-dē-ˌgrä\ (French: "Fat Tuesday") CARNIVAL celebrated on or culminating on Shrove Tuesday, the day before Ash Wednesday, the start of LENT. Traditionally, households consumed all the remaining foods that would be forbidden during Lent (e.g., eggs) on that day. It is a one-day event in France, but in the U.S. it lasts several days in New Orleans, where it is marked by parades, street celebrations, and extravagant costumes.

Marduk \'mär-ˌdük\ *or* **Bel** In Mesopotamian religion, the chief god of the city of BABYLON and the national god of BABYLONIA. He began as a god of thunderstorms, and according to legend he became lord of all the gods after conquering the monster of primeval chaos, TIAMAT. Marduk's star was the planet Jupiter, and his sacred animals were horses, dogs, and a dragon with a forked tongue, representations of which adorned Babylon's walls.

mare \'mär-ā\ Any flat, low, dark plain on the MOON. Maria are huge impact basins containing lava flows marked by ridges, depressions (graben), and faults; though *mare* means "sea" in Latin, they lack water. The best-known is probably Mare Tranquillitatis ("Sea of Tranquillity"), the site of the APOLLO 11 manned Moon landing. Most of the approximately 20 major maria are on the side of the Moon that always faces Earth; they are its largest surface features and can be seen from Earth with the unaided eye. The dark features of the "man in the moon" are maria.

Mare, Walter De la See Walter DE LA MARE

Marengo \mə-'reŋ-gō**, Battle of** (June 14, 1800) Narrow victory for NAPOLEON against Austria in the NAPOLEONIC WARS, fought on the Marengo Plain in northern Italy. The initial French force was overpowered, but when the Austrian commander gave up command to a subordinate in the belief that victory was secured, French reinforcements forced the Austrians into retreat. The victory resulted in the French occupation of Lombardy and secured Napoleon's military and civilian authority in Paris.

Marenzio \mä-'rents-yō**, Luca** (b. 1553, Coccaglio, near Brescia, Republic of Venice—d. Aug. 22, 1599, Rome) Italian composer. He was probably trained as a choirboy in Brescia, and he was in service with Cardinal Luigi d'Este in Rome from 1578 to 1586. The cardinal's patronage enabled the publication in the 1580s of the first 10 of his 25 books of MADRIGALS, the works for which he is best known and whose style became influential in Italy and England. His later madrigals, more serious in tone, use dissonance and chromaticism to reflect their texts, and they are sometimes linked into cycles. He also composed some 75 sacred motets.

Marfan syndrome Rare hereditary disorder of CONNECTIVE TISSUE. Affected persons are tall, with long, thin limbs and spiderlike fingers (arachnodactyly). The lens of the eye is dislocated, and many have GLAUCOMA or DETACHED RETINA. Heart muscle abnormalities and various malfunctions and malformations occur; rupture of the AORTA is the most common cause of death. Severity varies; affected individuals may die young or live essentially normal lives. The underlying abnormality cannot be cured, but some of the defects can be surgically corrected.

Margaret of Angoulême \ä^{n}-gü-'lem\ *or* **Margaret of Navarra** *French* **Marguerite d'Angoulême** (b. April 11, 1492, Angoulême, France—d. Dec. 21, 1549, Odos-Bigorre) Queen consort of Henry II of Navarra and an outstanding figure of the French Renaissance. She was the daughter of the count d'Angoulême. When her brother FRANCIS I acceded to the crown in 1515, she became highly influential in his court. After her first husband died, she married Henry in 1525. She was noted as a patron of humanists and reformers and of such writers as FRANÇOIS RABELAIS. She was a writer and poet herself; her most important work was the *Heptaméron*, 72 tales modeled on BOCCACCIO's *Decameron* and published posthumously in 1558–59.

Margaret of Antioch, Saint *or* **Saint Marina** (fl. 3rd or 4th century, Antioch, Syria; Eastern feast day July 13; Western feast day July 20) Early Christian martyr. Tradition held that she was a virgin during the reign of DIOCLETIAN. When she refused to marry the Roman prefect of Antioch, she was tortured and beheaded. Her designation as patron saint of expectant mothers (especially those in difficult labour) was based on the story that during her trials she was swallowed by Satan in the form of a dragon and later disgorged unharmed. Widely venerated in the Middle Ages, she is now thought to have been fictitious.

Margaret of Austria (b. Jan. 10, 1480, Brussels—d. Dec. 1, 1530, Mechelen, Spanish Netherlands) Habsburg ruler who was regent of the Netherlands (1507–15, 1519–30) for her nephew, the future emperor CHARLES V. In 1497 she married the infante John, heir to the Spanish kingdoms, who died a few months later. In 1501 she married Philibert II, duke of Savoy, who died in 1504. Appointed regent by her father, Emperor MAXIMILIAN I, she pursued a pro-English foreign policy. In the 1520s she

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extended the Habsburg dominion in the northeastern Netherlands and negotiated the Treaty of Cambrai (1529), called the "Ladies' Peace," with Louise of Savoy (1494–1547), regent for Francis I.

Margaret of Austria, detail of a painting attributed to Bernard van Orley, c. 1505; in Windsor Castle, Berkshire
ROYAL COLLECTION © HER MAJESTY QUEEN ELIZABETH II

Margaret of Parma (b. 1522, Oudenaarde, Spanish Netherlands—d. Jan. 18, 1586, Ortona, Kingdom of Naples) Duchess of Parma, Habsburg regent, and governor-general of the Netherlands (1559–67). The illegitimate daughter of Emperor Charles V, she was married first (1536) to Alessandro de' Medici, who was murdered in 1537, and then (1538) to Ottavio Farnese, duke of Parma. Appointed to govern the Netherlands by her half brother, Philip II of Spain, Margaret tried to appease the nobility with more moderate treatment of Protestants, but she brought in an army in 1567 after Calvinist extremists attacked Catholic churches. Philip then sent the duke of Alba, who assembled a Spanish army and enforced stern measures against dissident Protestants, precipitating open revolt. Margaret resigned when Alba assumed power.

Margaret of Scotland, Saint (b. c. 1045, probably Hungary—d. Nov. 16, 1093, Edinburgh; canonized 1250; feast day November 16, Scottish feast day June 16) Patron saint of Scotland. Sister of Edgar the Aetheling, she married Malcolm III Canmore, and three of their sons succeeded to Scotland's throne. She founded abbeys, worked for justice, improved conditions for the poor, and persuaded Malcolm to initiate a series of ecclesiastical reforms that transformed Scotland's religious and cultural life.

Margaret of Valois \väl-'wä\ *or* **Margaret of France** *French* **Marguerite** *known as* **Queen Margot** \mȧr-'gō\ (b. May 14, 1553, Saint-Germain-en-Laye, France—d. March 27, 1615, Paris) Queen consort of Navarra who played a secondary part in the Wars of Religion (1562–98). The daughter of Henry II of France, her relations with her brothers Charles IX and the future Henry III were strained, and she had an early affair with Henri, duke de Guise, leader of the extremist Catholic party. She was married in 1572 to the Protestant king of Navarra, the future Henry IV of France, to seal the peace between Catholics and Protestants, but days later the Massacre of Saint Bartholomew's Day began. Aware of her involvement in conspiracies, Henry III banished her to the castle at Usson in 1586. She granted her husband an annulment in 1600 and lived out her life in Paris. She was known for her beauty, learning, and licentious life; her *Mémoires* provide a vivid picture of France during her lifetime.

Margaret Tudor (b. Nov. 29, 1489, London, Eng.—d. Oct. 18, 1541, Methven, Perth, Scot.) Queen consort of King James IV of Scotland (1503–13). The daughter of King Henry VII of England, she was married to James to improve relations between England and Scotland. After her husband's death (1513), she became regent for her son, James V (1512–1542). When she married the pro-English earl of Angus (1514), she was forced to give up the regency, but she played a key role in the conflict between the pro-French and pro-English factions in Scotland, shifting her allegiances to suit her financial interests. She obtained an annulment from Angus (1527) to marry Henry Stewart, Baron Methven, who became James's chief adviser.

margarine Food made from one or more vegetable or animal fats or oils mixed with milk and other ingredients. It is used in cooking and as a spread as a substitute for butter. Margarine was developed by the French chemist Hippolyte Mège-Mouriès in the late 1860s. The fats used have varied widely; polyunsaturated oils such as corn, canola, and sunflower oil, considered more healthful than saturated fats, are common today.

Margherita Peak \ˌmär-ge-'rē-tə\ Highest summit of the Ruwenzori Range in East Africa. It is situated on the border between Uganda and the Democratic Republic of the Congo (Zaire). The higher of the two peaks on Mount Stanley, the central mountain of the Ruwenzori, it rises to 16,795 ft (5,119 m) between Lake Albert and Lake Edward. First climbed in 1906 by an Italian expedition, it was named for Queen Margherita of Italy. It is the third-highest mountain in Africa, after Kilimanjaro and Mount Kenya.

margin In finance, the amount by which the value of collateral pledged as security for a loan exceeds the amount of the loan. This excess provides the lender a "margin" of safety over and above the collateral offered and thus makes extending a loan a more attractive proposition. The size of the margin varies with the type of collateral, the stability of its market price, and the credit standing of the borrower. The term *margin* is also used in reference to securities transactions. When securities are purchased "on margin," the buyer supplies a percentage of the purchase price in cash, pledges the security as collateral, and borrows the remainder from the broker. The U.S. Federal Reserve Board (see Federal Reserve System) sets minimum margin requirements on loans made for the purpose of buying securities, so as to prevent excessive use of credit for speculation in stocks, as happened before the stock-market crash of 1929.

marginal-cost pricing In economics, the practice of setting a product's price equal to the additional (marginal) cost of producing one more unit of output. The producer charges an amount equal to the cost of the additional economic resources. The policy is used to maintain a low selling price or to keep a business operating during a period of poor sales. Because fixed costs such as rent and building maintenance must be paid whether a company produces or not, a firm experiencing temporary difficulties may decide to remain in production and sell the product at marginal cost, since its losses will be no greater than if it ceased production.

marginal productivity theory In economics, the theory that firms will pay a productive agent only what he or she adds to the financial earnings of the firm. Developed by writers such as John Bates Clark and Philip Henry Wicksteed at the end of the 19th century, marginal productivity theory holds that it is unprofitable to buy, for example, a man-hour of labour if it costs more than it contributes to its buyer's income. The amount in excess of costs that a productive input yields is the value of its marginal product; the theory posits that every type of input should be paid the value of its marginal product.

marginal utility In economics, the additional satisfaction or benefit (utility) that a consumer derives from buying an additional unit of a commodity or service. The law of diminishing utility implies that utility or benefit is inversely related to the number of units already owned. For example, the marginal utility of one slice of bread offered to a family that has five slices will be great, since the family will be less hungry and the difference between five and six is proportionally significant. An extra slice offered to a family that has 30 slices will have less marginal utility, since the difference between 30 and 31 is proportionally smaller and the family's appetite may be satisfied by what it already has. The concept grew out of attempts by 19th-century economists to explain the fundamental economic reality of price.

marguerite \ˌmär-gə-'rēt\ Any of several genera of golden daisylike flowers in the composite family. Yellow or white ray flowers and yellow disk flowers are borne in the compact flower heads. Marguerites are cultivated as garden ornamentals, especially golden marguerite, also called yellow chamomile (*Anthemis tinctoria*). See also chamomile, daisy.

Maria Legio \mə-'rē-ə-'lā-gē-ˌō\ *or* **Legio Maria** *or* **Legion of Mary Church** Independent African church influenced by Roman Catholicism. It originated in Kenya in 1963 when two Catholics of the Luo group, Simeon Ondeto and Gaundencia Aoko, claimed to have undergone prophetic experiences. The church, which offers healing by prayer and exorcism of evil spirits, adds features of Pentecostalism to Catholic worship and hierarchy. In its first year it gained about 90,000 adherents, but membership had dropped to 50,000 by the end of the decade. It rejects Western and traditional medicines, alcohol, tobacco, and dancing but accepts polygamy and is strongly nationalistic.

Maria Theresa \tə-'rā-sə\ *German* **Maria Theresia** (b. May 13, 1717, Vienna, Austria—d. Nov. 29, 1780, Vienna) Archduchess of Austria and queen of Hungary and Bohemia (1740–80). She was the eldest daughter of Emperor Charles VI, who promulgated the Pragmatic Sanction to allow her to succeed to the Habsburg domains. Opposition to her succession led in 1740 to the War of the Austrian Succession. After Emperor Charles VII died (1745), she obtained the imperial crown for her husband, who became Francis I. She helped initiate financial and educational reforms, promoted commerce and the development of agriculture, and

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reorganized the army, all of which strengthened Austria's resources. Continued conflict with Prussia led to the Seven Years' War and later to the War of the Bavarian Succession. After her husband's death (1765), her son became emperor as Joseph II. She criticized many of his actions but agreed to the partition of Poland (1772). A key figure in the power politics of 18th-century Europe, Maria Theresa brought unity to the Habsburg monarchy and was considered one of its most capable rulers. Her 16 children also included Marie-Antoinette and Leopold II.

mariachi \ˌmär-ē-'ä-chē\ Traditional Mexican street ensemble. In the 19th century, mariachis consisted solely of stringed instruments, including violin, guitar, guitarrón, vihuela, mandolin, and double bass; since the 1920s they have generally included trumpets and often other wind instruments as well. The mariachi repertoire includes songs and lively dance music.

Mariam, Mengistu Haile See Mengistu Haile Mariam

Mariana Islands \ˌmar-ē-'a-nə\ *formerly* **Ladrone Islands** \lə-'drōn\ Island group, western Pacific Ocean. Located east of the Philippines, it comprises 15 islands and is divided politically into Guam and the Northern Mariana Islands. The population is descended from the pre-Spanish Chamorro people and Spanish, Mexican, German, Philippine, and Japanese settlers. Spanish cultural traditions are strong. After Ferdinand Magellan became the first European to discover them in 1521, they were visited frequently but were not colonized until 1668, at which time Jesuit missionaries changed their name to honor Mariana of Austria, regent of Spain.

Mariana Trench Submarine trench in the floor of the western North Pacific Ocean. It is the deepest known depression on the surface of the Earth, with a maximum depth of 36,201 ft (11,034 m). The trench extends from southeast of Guam to northwest of the Mariana Islands, a distance of more than 1,580 mi (2,550 km), and has a mean width of 43 mi (69 km). See also deep-sea trench.

Mariátegui \ˌmä-rē-'ä-tā-gē**, José Carlos** (b. June 14, 1895, Lima, Peru—d. April 16, 1930, Lima) Peruvian political leader and essayist. In 1919 he was sent to study in Italy, where he met leading socialists of the day, including Maxim Gorky. At first a strong supporter of APRA, he split with that movement to form the Peruvian Communist Party in 1928. While emphasizing the economic aspects of Marxism in his writings, he recognized the value of religion and myth in his treatment of the Indians and advocated a greater social and political role for them. His influence is seen in the Maoist Shining Path revolutionary movement.

Ma'rib \'mar-ib\ Ancient city ruins, north-central Yemen. The ancient fortified city of Ma'rib was the centre of the pre-Islamic state of Saba' (950–115 BC). It was located on one of the caravan routes between the Mediterranean Sea and the Arabian Peninsula, and it prospered through its trading monopoly on frankincense and myrrh. The ancient Ma'rib Dam was built c. 7th cent BC to regulate the waters of the Wadi Sadd; some 1,800 ft (550 m) long, it irrigated more than 4,000 acres (1,600 hectares) and supported a densely settled agricultural region. The dam was destroyed in the 6th century AD.

mariculture See aquaculture

Marie-Antoinette (-Josèphe-Jeanne d'Autriche-Lorraine) (b. Nov. 2, 1755, Vienna—d. Oct. 16, 1793, Paris, France) Queen consort of Louis XVI of France. The daughter of Emperor Francis I and Maria Theresa, she was married in 1770 to the French dauphin. After he became king (1774), she was criticized for her extravagance and frivolous circle of court favourites. She was unjustly implicated in the Affair of the Diamond Necklace (1786), which discredited the monarchy. After the French Revolution began, she influenced Louis to resist attempts by the National Assembly to restrict the royal prerogative. She became the target of agitators, who attributed to her the celebrated remark, after being told the people had no bread, "Let them eat cake!" She tried to save the crown by negotiating secretly with monarchist factions and with her brother, Emperor Leopold II. News of her intrigues further enraged the French and led to the overthrow of the monarchy (1792). After a year in prison, she was tried and guillotined in 1793.

Marie-Antoinette, detail of a portrait by Élisabeth Vigée-Lebrun; in the Château de Versailles.
CLICHE MUSEES NATIONAUX

Marie de France (fl. 12th century) French poet, the earliest known woman poet of France. She wrote verse narratives on romantic and magical themes and may have inspired the musical lais of the later troubadours. She probably wrote in England and may have based her fables on an English source; her verses were dedicated to a "noble" king, either Henry II of England or his son. She also wrote a collection of fables, the *Ysopet*.

Marie de Médicis \də-mā-dē-'sēs\ *Italian* **Maria de' Medici** (b. April 26, 1573, Florence—d. July 3, 1642, Cologne) Queen consort of Henry IV of France. The daughter of Francesco de' Medici, of the noted Medici family, she was married in 1600 to Henry as his second wife. On his assassination in 1610, she became regent for their son, Louis XIII. Guided by the unscrupulous marquess d'Ancre, she squandered state revenues and bought the loyalty of rebellious nobles. After Ancre was assassinated, Louis assumed the throne (1617) and exiled Marie to Blois. She tried to raise a revolt and won favourable peace terms through her adviser, the future cardinal de Richelieu. Restored to the king's council (1622), she obtained a cardinal's hat for Richelieu and persuaded Louis to make him chief minister. Richelieu gradually withdrew from Marie's influence and by 1628 was opposing her policies. She attempted to have him dismissed, but Louis rejected her plot and banished Marie from court. In 1631 she fled to Brussels, where she later died in poverty.

Marie-Louise *German* **Maria-Luise** (b. Dec. 12, 1791, Vienna, Austria—d. Dec. 17, 1847, Parma) Austrian archduchess and second wife of Napoleon. The eldest daughter of Emperor Francis II, she was married to Napoleon (1810) and gave birth to his long-desired heir, the future Napoleon II, in 1811. When Napoleon abdicated (1814), Marie-Louise returned to Vienna with their son. She ignored Napoleon's entreaties to join him in exile and again after his return to France (1815). Made duchess of Parma, Piacenza, and Guastalla (1816), she ruled in accordance with Austrian prescriptions. After Napoleon's death (1821), she contracted morganatic marriages with Adam Adalbert, count von Neipperg, who died in 1829, and in 1834 with Charles René, count de Bombelles.

Marie-Louise, detail of a portrait by Joseph Franque; in the Château de Versailles.
ALINARI/ART RESOURCE, NEW YORK

marigold Any of about 30 species of annual herbaceous plants that make up the genus *Tagetes* in the composite family, native to southwestern North America. The name also refers to the pot marigold (calendula) and unrelated plants of several families. Marigolds include popular garden ornamentals such as African marigold (*T. erecta*) and French marigold (*T. patula*), which have solitary or clustered red, orange, and yellow flowers and usually finely cut leaves. Because the strongly scented leaves discourage insect pests, marigolds are often planted among vegetable crops.

French marigold (*Tagetes patula*).
ROBERT BORNEMANN/PHOTO RESEARCHERS

Mariinsky \mär-'yin-skē\ **Theatre** *or* **Maryinsky Theatre,** *formerly* **Kirov Theatre** Russian

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imperial theatre in St. Petersburg. The theatre opened in 1860 and was named for Maria Aleksandrovna, wife of the reigning tsar. Ballet was not performed there until 1880 and was presented regularly only after 1889, when the Imperial Russian Ballet became its resident company and acquired the Mariinsky name. The theatre's name was changed to the State Academic Theatre (1917–35) and later to the Kirov (for Sergey Kirov) State Academic Theatre for Opera and Ballet (1935–91); it reverted to its original name in 1991. Its resident ballet company, the celebrated Mariinsky (or Kirov) Ballet, tours worldwide.

marijuana \ˌmar-ə-ˈwä-nə\ Indian hemp plant (*Cannabis sativa*) or the crude drug made of its dried and crushed leaves or flowers. The active ingredient is tetrahydrocannabinol (THC). Also called pot, grass, and weed, the drug has long been used as a sedative or analgesic; it was in use in China by the 3rd millennium BC and had reached Europe by AD 500. Today it is used worldwide, though it has been generally illegal at least since the International Opium Convention of 1925. Its psychological and physical effects, including mild euphoria and alterations in vision and judgment, vary with strength and amount consumed, the setting, and the user's experience. Chronic use is not physically habit-forming but may be mildly psychologically habit-forming. Marijuana has been shown to be medically therapeutic for patients with glaucoma, AIDS, and the side effects of chemotherapy; in 2001 Canada became the first country to legalize the use of marijuana by people with terminal illnesses and chronic conditions. Supporters of legalization claim that it is a more benign drug than alcohol; opponents contend that it is addictive and leads to use of more serious drugs. A resin from the plant is the source of hashish.

marimba Xylophone with resonators under each bar. The original African instrument uses tuned calabash resonators. In Mexico and Central America, where it was brought by African slaves, the wooden bars may be affixed to a frame supported by legs or hung at the player's waist. The orchestral marimba uses long metal tubes as resonators.

Marin \ˈmar-ən**, John** (b. Dec. 23, 1870, Rutherford, N.J., U.S.—d. Oct. 1, 1953, Cape Split, Maine) U.S. painter and printmaker. He worked as an architectural draftsman before studying painting. After exposure to Cubism and German Expressionism, he developed a personal form of expressionism, consisting of semiabstract images based on objective reality. While watercolour usually produces delicate, transparent effects, Marin's command of the medium allowed him to use it to render the monumental power of New York City and the relentless surge of the sea.

"Maine Islands," watercolour by John Marin, 1922; in the Phillips Collection, Washington, D.C.
COURTESY OF THE PHILLIPS COLLECTION, WASHINGTON, D.C.

Marín, Luis Muñoz See Luis Munoz Marin

Marina See Espírito Santo

Marina, Saint See Saint Margaret of Antioch

marine Member of a military force trained for service at sea and in land operations related to naval campaigns. They existed as far back as the 5th century BC, when the Greek fleets were manned by *epibatai*, or heavily armed sea soldiers. In the Middle Ages ordinary soldiers were often assigned to shipboard duty; not until the naval wars of the 17th century was the distinct role of marines rediscovered almost simultaneously by the British and the Dutch, who raised the first two modern marine corps, the Royal Marine (1664) and the Koninklijke Nederlandse Corps Mariniers (1665). See also U.S. Marine Corps.

marine biology Science that deals with the animals and plants of the sea and estuaries and with airborne and terrestrial organisms that depend directly on bodies of saltwater for food and other necessities. Marine biologists study the relations between ocean phenomena and the distribution and adaptations of organisms. Of particular interest are adaptations to the chemical and physical properties of seawater, the movements and currents of the ocean, the availability of light at various depths, and the composition of the sea floor. Other important areas of study are marine food chains, the distribution of economically important fish and crustaceans, and the effects of pollution. In the later 19th century, the emphasis was on collecting and cataloging marine organisms, for which special nets, dredges, and trawls were developed. In the 20th century, improved diving equipment, submersible craft, and underwater cameras and television have made direct observation possible.

marine geology *or* **geologic oceanography** Scientific discipline concerned with all geologic aspects of the continental shelves and slopes and the ocean basins. Marine geology originally focused on marine sedimentation and the interpretation of bottom samples. The advent of the concept of seafloor spreading, however, broadened its scope. Many investigations of the oceanic ridge system, the magnetism of rocks on the seafloor, geochemical analyses of deep brine pools, and seafloor spreading and continental drift may be considered within the general realm of marine geology.

marine geophysics Subdiscipline of geophysics that is concerned with ocean phenomena. The main techniques and areas of study include heat-flow data, seismic reflection and refraction techniques, geomagnetics, and gravity studies. The principal concepts in marine geophysics are seafloor spreading, continental drift, and plate tectonics.

marine sediment Any deposit of insoluble material, primarily rock and soil particles, transported from land areas to the ocean by wind, ice, and rivers, as well as the remains of marine organisms, products of submarine volcanic activity, and chemical precipitates from seawater that accumulate on the seafloor.

Mariner \ˈmar-ə-nər\ Any of a series of unmanned U.S. space probes sent near Venus, Mars, and Mercury. Mariners 2 (1962) and 5 (1967) passed Venus within 22,000 mi (35,000 km) and 2,500 mi (4,000 km), respectively, and made measurements of temperature and atmospheric density. Mariners 4 (1965), 6 and 7 (1969), and 9 (1971–72) obtained striking photographs of the surface of Mars and analyzed its atmosphere and magnetic field. Mariner 10 is the only spacecraft ever to have visited Mercury (1974–75).

Marinetti \ˌmä-rē-ˈnät-tē**, Filippo Tommaso (Emilio)** (b. Dec. 22, 1876, Alexandria, Egypt—d. Dec. 2, 1944, Bellagio, Italy) Italian-French writer, the ideological founder of Futurism. In early poetry such as *Destruction* (1904), he showed the vigour and anarchic experimentation with form that would characterize his later work. Futurism officially began with the 1909 publication of his manifesto in the Paris newspaper *Le Figaro*. His ideas were quickly adopted in Italy, and he later elaborated on his theory in a novel and several dramatic works. Arguing that fascism was Futurism's natural extension, he became an active fascist and lost most of his following in the 1920s.

Marini, Marino (b. Feb. 27, 1901, Pistoia, Italy—d. Aug. 6, 1980, Viareggio) Italian sculptor and painter. Working primarily in bronze, he concentrated on two major images: the earthbound woman and the horse and rider. His sensitivity to form and surface owes much to Etruscan and Roman works, but the inner tension of his bold, straining figures reflects an Expressionist sensibility. His portrait busts, as of Igor Stravinsky (1950), capture the spiritual substratum of his subjects. In the 1940s he turned to painting nearly abstract works.

Marīnid \ˈmar-i-ˌnid\ **dynasty** Berber dynasty that followed the Almohad dynasty in North Africa in the 13th–15th centuries. The Marīnids were

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a tribe of the Zanātah group, which was allied to the Umayyads in Córdoba. In 1248 a Marīnid leader, Abū Yaḥyā, captured Fès and made it the Marīnid capital. The capture of Marrakech (1269) made the Marīnids the masters of Morocco. They waged inconclusive war in Spain and Africa that gradually depleted their resources, reducing the realm to anarchy in the 15th century. Saʿdī sharifs captured Fès in 1554.

Marino, Dan(iel Constantine), Jr. (b. Sept. 15, 1961, Pittsburgh, Pa., U.S.) U.S. gridiron football quarterback. Chosen by the Miami Dolphins in the first round of the 1983 NFL draft, he set all-time career records for passes completed (4,453 in 7,452 attempts), yards passing (55,416), and touchdown passes (385) and for 21 other categories. In 1984 he became the first quarterback to pass for more than 5,000 yards in a single season (5,084) and the first to complete over 40 touchdown passes (48) in a season.

Marino, Giambattista (b. Oct. 18, 1569, Naples—d. March 25, 1625, Naples) Italian poet, founder of the school of Marinism (later *secentismo*), which dominated 17th-century Italian poetry. Trained as a lawyer, Marino chose not to practice and instead found immense success with poetry that he managed to get published despite censorship. His most important work, a labour of 20 years, is *Adonis* (1623), an enormous poem (45,000 lines) that relates, with many digressions, the love story of Venus and Adonis. His work, praised throughout Europe, far surpassed that of his imitators, who carried his complicated wordplay and elaborate conceits and metaphors to such extremes that *Marinism* became a pejorative term.

Mariology \ˌmar-ē-ˈä-lə-jē\ Study of doctrines concerning Mary, the mother of Jesus, or the content of those doctrines. The New Testament contains little information about Mary, though the tradition that she remained a virgin despite giving birth to Jesus was accepted in the early church. Various feast days in her honour were established in both the Eastern and Western liturgical traditions, and she became an especially important figure in Roman Catholicism. Pius IX proclaimed the doctrine of the Immaculate Conception in 1854. Mary is seen as the spiritual mother and heavenly intercessor of every Catholic and as a partner with Jesus in the redemption of human beings. In 1950 Pius XII proclaimed the doctrine that at her death Mary was bodily assumed into heaven.

Marion, Francis *known as* **The Swamp Fox** (b. c. 1732, Winyah, S.C.—d. Feb. 26, 1795, Berkeley county, S.C., U.S.) American Revolutionary commander. He fought the Cherokee (1759) and later served as a member of the provincial assembly (1775). In the American Revolution he commanded troops in South Carolina. After the surrender of Gen. Benjamin Lincoln to the British at Charleston, S.C. (1780), he slipped away to the swamps, gathered together his band of guerrillas, and began leading bold raids on British positions. For a daring rescue of American troops surrounded by the British at Parkers Ferry, S.C. (1781), he received the thanks of Congress. He was then appointed a brigadier general.

marionette Puppet figure manipulated from above by strings attached to a wooden cross or control. The figure, also called a string puppet, is usually manipulated by nine strings, attached to each leg, hand, shoulder, and ear and at the base of the spine. Additional strings give more sensitive control of movement, and some marionettes can be made to imitate almost every human and animal action. Early marionettes were controlled by an iron rod instead of strings, a form that survived in Sicily. In the 18th century, marionette operas were extremely popular, and they are still performed today in Salzburg to Mozart's music. See also puppetry.

Maris \ˈmar-əs**, Roger** *in full* **Roger Eugene Maris** (b. Sept. 10, 1934, Hibbing, Minn., U.S.—d. Dec. 14, 1985, Houston, Texas) U.S. baseball player. Maris's family moved from Minnesota to North Dakota when he was 10, and there he excelled in high school sports, playing American Legion baseball in Fargo in the summer. An outfielder and left-handed hitter, he played for the Cleveland Indians, the New York Yankees, and the St. Louis Cardinals. In 1961 his one-season total of 61 home runs broke Babe Ruth's long-standing record of 60, edging out his Yankee teammate Mickey Mantle. Maris's record stood until 1998, when it was broken by Mark McGwire's 70 and Sammy Sosa's 66. See also Barry Bonds.

Maritain \mȧ-rē-ˈtaⁿ**, Jacques** (b. Nov. 18, 1882, Paris, France—d. April 28, 1973, Toulouse) French philosopher. Reared a Protestant, he converted to Roman Catholicism in 1906. His thought, which is based on Aristotelianism and Thomism, incorporates ideas of other Classical and modern philosophers and draws upon anthropology, sociology, and psychology. Among the dominant themes in his work are: that science, philosophy, poetry, and mysticism are among many legitimate ways of knowing reality; that the individual person transcends the political community; that natural law expresses not only what is natural in the world but also what is known naturally by human beings; that moral philosophy must take into account other branches of human knowledge; and that people holding different beliefs must cooperate in the formation and maintenance of salutary political institutions. Among his major works are *Art and Scholasticism* (1920), *The Degrees of Knowledge* (1932), *Art and Poetry* (1935), *Man and the State* (1951), and *Moral Philosophy* (1960).

maritime law *or* **admiralty law** *or* **admiralty** Body of legal rules that governs ships and shipping. One early compilation of maritime regulations is the 6th-century Digest of Justinian. Roman maritime law and the 13th-century Consolat de Mar ("Consulate of the Sea") both brought temporary uniformity of maritime law to the Mediterranean, but nationalism led many countries to develop their own maritime codes. Maritime law deals mainly with the eventualities of loss of a ship (e.g., through collision) or cargo, with insurance and liability relating to those eventualities, and with collision compensation and salvage rights. There has been an increasing tendency to make maritime laws uniform; the chief organization overseeing maritime law is the International Maritime Committee, composed of the maritime law associations of several countries.

Maritime Provinces Canadian provinces of New Brunswick, Nova Scotia, and Prince Edward Island. They are located on the Atlantic Coast and the Gulf of St. Lawrence. With Newfoundland and Labrador they form the Atlantic Provinces. The name Acadia was applied to much of the region during French colonial rule, until it was ceded to the British in 1713.

Maritsa \mə-ˈrēt-sə\ **River** *Greek* **Évros** \ˈev-ˌrȯs\ *Turkish* **Meriç** \me-ˈrēch\ River, southeastern Europe. Rising southeast of Sofia, Bulg., it flows east and southeast across Bulgaria, briefly forms the Bulgaria-Greece border, and then runs along the Greece-Turkey border. At Edirne it changes direction, flowing southwest to enter the Aegean Sea after a course of about 300 mi (480 km).

Marius \ˈmar-ē-əs**, Gaius** (b. c. 157, Cereatae, near Arpinum, Latium—d. Jan. 13, 86 BC, Rome) General and consul who redesigned the Roman army. He secured command of the army in Africa (107) and solved the chronic manpower shortage by enlisting landless citizens for the first time. He defeated Jugurtha in 106. At Rome he held unconstitutional successive consulships (104–100) while it was threatened by the Cimbri and the Teutones, whom he fought and defeated. He held a command during the Social War and was awarded another in 88 to replace Sulla as Asian commander and confront Mithradates. When an outraged Sulla marched on Rome, Marius fled for his life. He returned forcibly in 87, was elected consul for the seventh time, and ruthlessly murdered his opponents.

Marivaux \mȧ-rē-ˈvō**, Pierre (Carlet de Chamblain de)** (b. Feb. 4, 1688, Paris, France—d. Feb. 12, 1763, Paris) French playwright. Born into an aristocratic family, he joined Paris salon society, which he described in his journalistic writings. The loss of his fortune in 1720 and the death of his young wife a few years later prompted him to embark on a serious literary career. He wrote his first plays, including the tragedy *Annibal* (1720), for the Comédie-Française, but he preferred to write for the Italian commedia dell'arte theatre in Paris, for which he produced *Harlequin Brightened by Love* (1723) and *The Game of Love and Chance* (1730). His nuanced feeling and clever wordplay became known as *marivaudage*. He also wrote the satirical plays *Isle of Slaves* (1725), *Isle of Reason* (1727), and *The New Colony* (1729).

marjoram *or* **sweet marjoram** \ˈmär-jə-rəm\ Perennial herb (*Majorana hortensis*) of the mint family, or its fresh or dried leaves and flowering tops. Native to the Mediterranean and western Asia, marjoram is cultivated as an annual where winter temperatures kill the plant. It is used to flavor many foods. Various other aromatic herbs or undershrubs of the genera *Origanum* (see oregano) and *Majorana* of the mint family are also called marjoram.

Mark (the Evangelist), Saint (fl. 1st century, Jerusalem—d. traditionally Alexandria, Egypt; Western feast day April 25; Eastern feast day September 23) Christian evangelist to whom the second Gospel is traditionally ascribed. He joined Saints Paul and Barnabas on their first missionary journey but left them at Perga and returned to Jerusalem. He may also have aided St. Peter in Rome, and some scholars believe that Mark's

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Gospel is based on Peter's account of his experiences as one of the Twelve Apostles. If this is true, it was probably written shortly after Peter's death c. AD 65. The Egyptian church claims Mark as its founder, and he is patron saint of the Italian cities of Aquileia and Venice. His symbol is the lion.

Mark Antony See Mark ANTONY

market Means by which buyers and sellers are brought into contact with each other and goods and services are exchanged. The term originally referred to a place where products were bought and sold; today a market is any arena, however abstract or far-reaching, in which buyers and sellers make transactions. The COMMODITY EXCHANGES in London and New York, for example, are international markets in which dealers communicate by telephone and computer links as well as through direct contact. Markets trade not only in tangible commodities such as grain and livestock but also in financial instruments such as SECURITIES and CURRENCIES. CLASSICAL ECONOMISTS developed the theory of perfect competition, in which they imagined free markets as places where large numbers of buyers and sellers communicated easily with each other and traded in commodities that were readily transferable; prices in such markets were determined only by SUPPLY AND DEMAND. Since the 1930s, economists have focused more often on the theory of imperfect competition, in which supply and demand are not the only factors that influence the operations of the market. In imperfect competition the number of sellers or buyers is limited, rival products are differentiated (by design, quality, brand name, etc.), and various obstacles hinder new producers' entry into the market.

market research Study of the requirements of specific markets, the acceptability of products, and methods of developing and exploiting new markets. Various strategies are used for market research: past sales may be projected forward; surveys may be made of consumer attitudes and product preferences; and new or altered products may be introduced experimentally into designated test-market areas. Formal market research dates back to the 1920s in Germany and the 1930s in Sweden and France. After World War II, U.S. firms led in the use and refinement of market-research techniques, which spread throughout much of Western Europe and Japan.

marketing Activities that direct the flow of goods and services from producers to consumers. In advanced industrial economies, marketing considerations play a major role in determining corporate policy. Once primarily concerned with increasing sales through ADVERTISING and other promotional techniques, corporate marketing departments now focus on credit policies (see CREDIT), product development, customer support, distribution, and corporate communications. Marketers may look for outlets through which to sell the company's products, including retail stores, DIRECT-MAIL MARKETING, and WHOLESALING. They may make psychological and demographic studies of a potential market, experiment with various marketing strategies, and conduct informal interviews with target audiences. Marketing is used both to increase sales of an existing product and to introduce new products. See also MERCHANDISING.

marketing board Organization set up by a government to regulate the buying and selling of a certain commodity within a specified area. The simplest type of board is designed to carry out MARKET RESEARCH, promote sales, and furnish information; it is usually financed by a fee levied on all sales of the product concerned. Examples include the Sri Lanka Tea Board and the Ghana Cocoa Board. Other boards are empowered to regulate terms and conditions of sale, usually by establishing packing standards and quality analysis. The primary goal of most marketing boards is to stabilize PRICES, especially of products intended for the export market, where price fluctuations are often extreme. The boards may raise average prices through manipulation of commodity flows, with the objective of maintaining reasonably high levels of demand at all times. Marketing boards such as the Washington State Apple Commission are used for products whose perishability requires that outlets be set up in advance. See also CARTEL.

Markham \'mär-kəm\ City (pop., 1991: 154,000), southeastern Ontario. It is situated on the Rouge River, northeast of TORONTO. Settled in 1794, the town was named for William Markham, archbishop of York. It annexed the nearby township of Markham in 1971.

Markham, Beryl *orig.* **Beryl Clutterbuck** (b. Oct. 26, 1902, Leicester, Leicestershire, Eng.—d. Aug. 3, 1986, Nairobi, Kenya) British pilot, adventurer, and writer. Raised in British East Africa, she became a horse trainer and breeder, training several Kenya Derby winners. Turning to aviation, she carried goods, people, and mail to far corners of Africa, and in 1936 she made a historic east-to-west solo flight across the North Atlantic from England to Cape Breton Island. In 1942 she published her celebrated memoir, *West with the Night*.

Markham River River, eastern Papua New Guinea. It rises in northeastern mountains and flows southeast for 110 mi (180 km) to enter the Huon Gulf of the Solomon Sea, south of Lae. It is named for Clements Markham of the Royal Geographical Society. During World War II its valleys were the scene of fighting in 1943 between Japan and the Allies. The area around the river suffered severe earthquakes in 1993.

Markova \mär-'kō-və**, Dame Alicia** *orig.* **Lilian Alicia Marks** (b. Dec. 1, 1910, London, Eng.—d. Dec. 2, 2004, Bath) British ballerina. She made her debut with SERGEY DIAGHILEV'S BALLETS RUSSES in 1924 and became a leading ballerina noted for her ethereal lightness. At the Vic-Wells Ballet (1931–35; now the ROYAL BALLET) she became the first English dancer to dance the lead in *Giselle*. With her frequent partner ANTON DOLIN, she formed and directed several Markova-Dolin companies (1935–38) and the Festival Ballet (1950–52; now the English National Ballet). She continued to dance as a guest artist with many companies worldwide, admired for her interpretations of roles in *Les Sylphides* and *Swan Lake*, among others. She retired from the stage in 1963 and served as director of the Metropolitan Opera Ballet (1963–69).

markup language Standard text-encoding system consisting of a set of symbols inserted in a text document to control its structure, formatting, or the relationship among its parts. The most widely used markup languages are SGML, HTML, and XML. The markup symbols can be interpreted by a device (computer, printer, browser, etc.) to control how a document should look when printed or displayed on a monitor. A marked-up document thus contains two types of text: text to be displayed and markup language on how to display it.

marl Earthy mixture of fine-grained minerals, which range widely in composition. LIME (calcium carbonate) is present as shell fragments of snails and BIVALVES, or as powder mixed with clay and silica-containing silt. Large deposits contain 80–90% calcium carbonate and less than 3% magnesium carbonate. With decreasing amounts of lime, calcium-containing marls are called clays and clayey limestones. Marls rich in POTASH (potassium carbonate), called greensand marls, are used as water softeners. Marls have also been used in the manufacture of insulating material and PORTLAND CEMENT, as liming material, and in making bricks.

Marlborough, John Churchill, 1st duke of (b. May 26, 1650, Ashe, Devon, Eng.—d. June 16, 1722, Windsor, near London) British military commander. He served with distinction at Maastricht (1673), was promoted rapidly, and advanced at court, in part because his wife (see Sarah Jennings, duchess of MARLBOROUGH) was a confidant of Princess (later Queen) ANNE. On the accession of JAMES II in 1685, Churchill was made a lieutenant general and effective commander in chief. In 1688 he transferred his allegiance to WILLIAM III, who rewarded him with the earldom of Marlborough and a succession of commands in Flanders and Ireland. His relationship with William deteriorated in the 1690s. Queen Anne appointed him commander of English and Dutch forces in the War of the SPANISH SUCCESSION, and for his successes he was created duke of Marlborough (1702). His victory at the Battle of BLENHEIM (1704) helped change the balance of power in Europe. In gratitude, he was granted a royal manor, where BLENHEIM PALACE was built. His outstanding military tactics continued to produce victories, notably at Ramillies (1706) and Oudenaarde (1708). His influence with Queen Anne and financial backing for the war were undermined by intrigue between Tories and Whigs. After his Whig allies lost the election of 1710, he was dismissed on charges of misuse of public money. He retired from public life, though he was restored to favour by GEORGE I in

John Churchill, 1st duke of Marlborough, painting attributed to John Closterman; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

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1714. Considered one of England's greatest generals, he secured a reputation in Europe that was unrivaled until the rise of Napoleon.

Marlborough, Sarah Jennings, duchess of (b. May 29, 1660, Sandridge, Hertfordshire, Eng.—d. Oct. 18, 1744, London) Wife of John Churchill, duke of MARLBOROUGH. A childhood friend of Princess (later Queen) ANNE, she entered the household of Anne's father, the duke of York. She married Churchill in 1678 and served as a lady of the bedchamber after Anne's marriage (1683). When Anne acceded to the throne (1694), the Marlboroughs enjoyed great favour at court. Sarah's influence grew until her strong Whig sympathies alienated Anne, who dismissed her in 1711. The Marlboroughs retired to BLENHEIM PALACE, which Sarah completed building after her husband's death in 1722.

Marley, Bob *orig.* **Robert Nesta Marley** (b. Feb. 6, 1945, Nine Miles, St. Ann, Jam.—d. May 11, 1981, Miami, Fla., U.S.) Jamaican singer and songwriter. Born in the hill country of Jamaica to a white father and a black mother, Marley was living in the Kingston slum known as Trench Town in the early 1960s when he formed the Wailers with Peter Tosh and Bunny Livingston (Bunny Wailer). Mixing the Jamaican musical forms of ska and rock steady with rock, they helped to pioneer REGGAE and became its first international stars with releases such as *Catch a Fire* (1973), *Exodus* (1977), and *Uprising* (1980). Marley's political lyrics, grounded in his belief in the Jamaican religious movement RASTAFARI and calling for social and economic justice, made him a voice for the poor and dispossessed. His reputation grew after his death from cancer at age 36.

marlin Any of four species (genus *Makaira*, family Istiophoridae) of deep-blue to blue-green marine fish with a long body, a long dorsal fin, a rounded spear extending from the snout (which it uses to club the fish it feeds on), and usually pale vertical stripes. They are highly prized for sport and food. Species range in weight from about 100 lbs (45 kg) to more than 1,500 lbs (700 kg). The Indo-Pacific black marlin (*M. nigicans*) has a distinctive, stiff pectoral fin set at an angle.

Marlowe, Christopher (baptized Feb. 26, 1564, Canterbury, Kent, Eng.—d. May 30, 1593, Deptford, near London) British poet and playwright. The son of a Canterbury shoemaker, he earned a degree from Cambridge University. From 1587 he wrote plays for London theatres, starting with *Tamburlaine the Great* (published 1590), in which he established dramatic BLANK VERSE. *Tamburlaine* was followed by *Dido, Queen of Carthage* (published 1594), cowritten with THOMAS NASHE; *The Massacre at Paris* (c. 1594); and *Edward II* (1594). His most famous play is *The Tragicall History of Doctor Faustus* (published 1604), which uses the dramatic framework of a MORALITY PLAY in its presentation of a story of temptation, fall, and damnation. *The Jew of Malta* (published 1633) may have been his final work. His poetry includes the unfinished long poem *Hero and Leander*. Known for leading a disreputable life, he died a violent death at age 29 in a tavern brawl; he may have been assassinated because of his service as a government spy. His brilliant, though short, career makes him WILLIAM SHAKESPEARE's most important contemporary in English drama.

Marmara \'mär-mə-rə**, Sea of** Inland sea lying between the Asian and European parts of Turkey. It is connected with the BLACK SEA through the BOSPORUS, and with the AEGEAN SEA through the DARDANELLES. It is 175 mi (280 km) long and nearly 50 mi (80 km) wide, and it occupies an area of 4,382 sq mi (11,350 sq km). The sea has two distinct island groups. The Kızıl Islands in the northeast are primarily resort areas. The Marmara Islands in the southwest are rich in granite, slate, and marble, which have been quarried since antiquity.

marmoset Any species of arboreal, diurnal, long-tailed South American MONKEY (family Callitrichidae) classified in two groups: eight species with short tusks (lower canine teeth), called marmosets, and 25 with long tusks, called TAMARINS. Marmosets move in a quick, jerky manner and eat insects and sometimes fruit and small animals. Members of the common marmoset genus *Callithrix* are 6–10 in. (15–25 cm) long, excluding the 10–16-in. (25–40-cm) tail. The dense, silky fur is white, reddish, or blackish; the ears are generally tufted. Marmosets have been kept as pets since the early 17th century.

marmot \'mär-mət\ Any of about 14 species (genus *Marmota*) of stout-bodied, diurnal, terrestrial SQUIRRELS found in North America, Europe, and Asia. Marmots are 12–24 in. (30–60 cm) long, excluding the short tail, and weigh 7–17 lbs (3–7.5 kg). Most species live in burrows or among boulders. They frequently sit upright and emit a whistling alarm call. Marmots live almost entirely on green plants, storing fat for hibernation. The black-and-white hoary marmot (*M. caligata*), of Siberia and northwestern North America, which hibernates for up to nine months, is hunted for food and fur. The yellow-bellied marmot (*M. flaviventris*) inhabits the western U.S. and British Columbia. See also WOODCHUCK.

Olympic marmot (*Marmota olympus*). E.R. DEGGINGER

Marne, First Battle of the (Sept. 6–12, 1914) Military offensive by French and British troops in WORLD WAR I. After the invading German forces had moved to within 30 mi (50 km) of Paris at the MARNE RIVER, JOSEPH-JACQUES-CÉSAIRE JOFFRE counterattacked and halted the German advance. French reinforcements were driven to the front by 600 Paris taxis, the first automotive transport of troops. French and British troops forced the Germans to retreat north of the Aisne River, where they dug in to conduct the TRENCH WARFARE of the next three years. The Allied success thwarted Germany's plan for a quick victory on the Western Front.

Marne, Second Battle of the (July 15–18, 1918) Last large German attack in WORLD WAR I. As part of its final offensive to split the French forces, German troops under ERICH LUDENDORFF crossed the Marne River but were met by strong French resistance under FERDINAND FOCH. Allied counterattacks, especially at the Marne salient, forced the Germans to retreat to their former position along the Aisne and Vesle rivers.

Marne \'märn\ **River** River, northeastern France. It flows northwest into the SEINE RIVER near PARIS. It is navigable for 220 mi (350 km) of its total length of 326 mi (525 km) and has extensive canals. Its valley was the scene of crucial battles in WORLD WAR I (see First Battle of the MARNE; Second Battle of the MARNE).

Maroni \mä-'rō-nē\ **River** River forming the border between FRENCH GUIANA and SURINAME, South America. It rises in the Tumuc-Humuc Mountains near the Brazilian border and descends northward to enter the Atlantic Ocean at Point Galibi, Suri., after a course of 450 mi (725 km). Its upper course is known as the Litani in Suriname or Itany in French Guiana; its middle course is called the Lawa or Aoua. Shallow-draft vessels can navigate about 60 mi (100 km) upstream from the river's mouth.

Maronite Church \'mar-ə-ˌnīt\ Eastern-rite community centered in LEBANON (see EASTERN RITE CHURCH). It traces its origin to St. Maron, a Syrian hermit of the 4th–5th century AD, and St. John Maron, under whom the invading Byzantine forces were defeated in 684. For several centuries the Maronites were considered heretics, followers of Sergius, patriarch of Constantinople, who taught that Jesus had only a divine will and not a human will. No permanent affiliation with Rome took place until the 16th century. A hardy mountain people, the Maronites preserved their freedom in Lebanon during the Muslim caliphate. In 1860 the Ottoman government incited a massacre of the Maronites by the DRUZE, an event that led to the establishment of Maronite autonomy within the Ottoman empire. The Maronites obtained self-rule under French protection in the early 20th century. Since the establishment of a fully independent Lebanon in 1943, they have constituted a major religious group in the country. Their spiritual leader (after the pope) is the patriarch of Antioch, and the church retains the ancient West Syrian liturgy.

Marot \mä-'rō**, Clément** (b. 1496?, Cahors, France—d. September 1544, Turin, Savoy) French poet. While imprisoned in 1526 for defying Lenten abstinence regulations, he wrote some of his best-known works, including "The Inferno," an allegorical satire on justice. He held several court posts; his long service to FRANCIS I was only briefly interrupted. One of the greatest poets of the French Renaissance, he markedly influenced the style of his successors with his use of the forms and imagery of Latin poetry. When not writing official court poems, he spent most of his time translating the Psalms.

Marquesas \mär-'kā-səz\ **Islands** Island group (pop., 1996: 8,064), FRENCH POLYNESIA. Located in the central South Pacific Ocean northeast of Tahiti, the Marquesas comprise 10 islands. The southeastern group includes Hiva Oa, the largest and most populous island and the burial place of artist PAUL GAUGUIN; Fatu Hiva and Tahuata; and the uninhabited Motane and Fatu Huku. The northwestern group comprises Nuku Hiva,

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Ua Pu, Ua Huka, Eiao, and Hatutu. The Spanish explorer Àlvaro de Mendaña de Neira named the islands for the marquesa de Mendoza in 1595. Annexed by France in 1842, the Marquesas form an administrative division of French Polynesia with headquarters at Taiohae on Nuku Hiva.

marquess \'mär-kwəs\ *or* **marquis** \mär-'kē\ European title of nobility, ranking in modern times immediately below a DUKE and above a COUNT or earl. The wife of a marquess is a marchioness or marquise. The term originally denoted a count holding a march, or mark (frontier district).

Marquess of Queensberry rules See QUEENSBERRY RULES

marquetry \'mär-kə-trē\ Decorative work in which thin pieces of wood, metal, or organic material, such as shell or mother-of-pearl, are affixed in intricate patterns to the flat surfaces of furniture. Marquetry became popular in late 16th-century France and spread throughout Europe as the demand for luxurious home furnishings rose in the next two centuries. See also ANDRÉ-CHARLES BOULLE.

Marquette \mär-'ket**, Jacques** *known as* **Père Marquette** (b. June 1, 1637, Laon, France—d. May 18, 1675, Ludington, Mich.) French missionary and explorer. Ordained a Jesuit priest, he arrived in Quebec in 1666 to preach among the Ottawa. He helped found missions at Sault Ste. Marie in 1668 and St. Ignace in 1671 (both now in Michigan). In 1673 he accompanied LOUIS JOLLIET on his exploration of the Mississippi River, traveling south to the mouth of the Arkansas River. They returned via the Illinois River to Green Bay on Lake Michigan, where Marquette remained. In 1674 he set out to found a mission among the Illinois Indians, reaching the site of present-day Chicago. His journal of his voyage with Jolliet was published in 1681.

Márquez, Gabriel García See Gabriel GARCÍA MÁRQUEZ

Marr, Nikolay (Yakovlevich) (b. Jan. 6, 1865, Kutaisi, Georgia, Russian Empire—d. Dec. 20, 1934, Leningrad, Russia, U.S.S.R.) Russian linguist, archaeologist, and ethnographer. A specialist in CAUCASIAN LANGUAGES, he published collections of literature in the GEORGIAN and ARMENIAN languages and tried to prove a relationship between the Caucasian and AFROASIATIC LANGUAGES and the BASQUE LANGUAGE. His theory that all languages evolved from one original language and that the creation of language was a class-related phenomenon was adopted as official Soviet linguistic doctrine until 1950, when Stalin denounced it.

Marrakech *or* **Marrakesh** \mə-'rä-kish, ˌmar-ə-'kesh\ City (pop., 2004: 823,154), west-central MOROCCO. One of the four imperial cities, it lies in the centre of the Haouz plain. It was founded in the mid-11th century by Yūsuf ibn Tāshufīn as the capital of the ALMORAVID DYNASTY. It fell to the ALMOHAD DYNASTY in 1147, passed to the MARĪNID DYNASTY in 1269, and was the capital under the Saʿdid dynasty in the 16th century. In the premodern era, it was one of Islam's great cities. In 1912 it was captured by the French, who dominated the city until 1956. Now a popular tourist destination, it has many historical buildings and a well-known souk within its ancient city centre (designated a UNESCO WORLD HERITAGE SITE in 1985).

Marrano \mä-'rä-nō\ Spanish Jew who converted to Christianity to escape persecution but continued to practice Judaism secretly. During fierce persecutions in the late 14th century, many Jews died rather than renounce their faith, but at least 100,000 converted to Christianity in order to survive. In time the Marranos came to form a compact society within Spain, growing rich and gaining political power. They were viewed with suspicion, and the name Marrano was originally a term of abuse. Resentment against them led to riots and massacres in 1473. In 1480 the INQUISITION intensified the persecution, and thousands of Marranos lost their lives. In 1492 a royal edict ordered the expulsion of all Jews who refused to renounce their faith. Many Marranos settled in North Africa and Western Europe. By the 18th century, emigration and assimilation had led to the disappearance of the Marranos in Spain.

marriage Legally and socially sanctioned union, usually between a man and a woman, that is regulated by laws, rules, customs, beliefs, and attitudes that prescribe the rights and duties of the partners and accords status to their offspring (if any). The universality of marriage is attributed to the many basic social and personal functions it performs, such as procreation, regulation of sexual behaviour, care of children and their education and socialization, regulation of lines of DESCENT, DIVISION OF LABOUR between the sexes, economic production and consumption, and satisfaction of personal needs for SOCIAL STATUS, affection, and companionship. Until modern times marriage was rarely a matter of free choice, and it was rarely motivated by romantic love. In most eras and most societies, permissible marriage partners have been carefully regulated. In societies in which the extended FAMILY remains the basic unit, marriages are usually arranged by the family. The assumption is that love between the partners comes after marriage, and much thought is given to the socioeconomic advantages accruing to the larger family from the match. Some form of DOWRY or BRIDEWEALTH is almost universal in societies that use arranged marriages. The rituals and ceremonies surrounding marriage are associated primarily with religion and fertility and validate the importance of marriage for the continuation of a family, CLAN, TRIBE, or society. In recent years the definition of marriage as a union between members of opposite sexes has been challenged, and in 2000 The Netherlands became the first country to legalize same-sex marriages. See also BRIDEWEALTH; DIVORCE; DOWRY; EXOGAMY AND ENDOGAMY; POLYGAMY.

marriage chest See CASSONE

marriage law Body of legal specifications and requirements and other laws that regulate the initiation, continuation, and validity of marriages. In western Europe most marriage law derives from Roman Catholic canon law. Although the church regards marriage as a sacred, indissoluble union, modern western European and U.S. marriage law treats it as a civil transaction. Marriage law allows only monogamous unions; partners must be above a certain age and not within prohibited degrees of blood relationship; and they must be free to marry and give consent to the marriage. DIVORCE is now almost universally allowed. Although Islamic law regards marriage as a contract between the two spouses for the "legalization of intercourse and the procreation of children," it is also considered a gift from God or a kind of service to God; the Islamic practice of POLYGAMY was always limited and has waned. Polygamous marriages are permitted under customary laws in many African countries, though there has been a growing trend toward monogamy. Marriage law in present-day China and Japan resembles that in the West. Although most jurisdictions restrict marriage to a union between a man and a woman, same-sex marriages have been legalized in The Netherlands, Belgium, Spain, and Canada. Civil unions or domestic partnerships between persons of the same sex, which entail many of the rights and obligations assumed by married couples, are recognized in numerous other jurisdictions, including several European countries and some U.S. states. Other U.S. jurisdictions, while not recognizing civil unions or domestic partnerships, grant a range of legal rights to same-sex couples.

Marriott \'mar-ē-ˌät**, J(ohn) Willard** (b. Sept. 17, 1900, Marriott, Utah, U.S.—d. Aug. 13, 1985, Wolfeboro, N.H.) U.S. businessman who founded one of the largest U.S. hotel and restaurant organizations. The son of a Mormon rancher, he opened a rootbeer and barbecue stand in Washington, D.C., in 1927. By the end of World War II his chain of Hot Shoppe family restaurants extended over the entire East Coast, and in 1957 he opened his first hotel. His son J. Willard Marriott, Jr., succeeded him as president of the Marriott Corp. in 1964. At the time of the elder Marriott's death, the Marriott Corp. had 140,000 employees in 26 countries and total annual sales of $3.5 billion. He was posthumously awarded the Presidential Medal of Freedom in 1988.

Marryat \'mar-ē-ət**, Frederick** (b. July 10, 1792, London, Eng.—d. Aug. 9, 1848, Langham, Norfolk) English naval officer and novelist. He served in the Royal Navy from age 14 until he retired in 1830 as a captain. He then began a series of adventure novels—including *The King's Own* (1830), *Peter Simple* (1834), and *Poor Jack* (1840)—marked by a lucid, direct narrative style, humour, and incidents drawn from his varied experience at sea. His *Children of the New Forest* (1847), set during the English Civil Wars, is a classic of children's literature.

Mars Ancient Roman god of war and protector of Rome, second only to JUPITER in importance. His festivals occurred in the spring (March) and fall (October). Until the time of AUGUSTUS, Mars had only two temples in Rome. His sacred spears were kept in a sanctuary; on the outbreak of war, the consul had to shake the spears, saying "Mars vigila!" ("Mars, awake!") Under Augustus, Mars became not only the guardian of Rome in its military affairs but the emperor's personal guardian. He was identified with the Greek god ARES.

Mars Fourth PLANET from the Sun, named after the Roman god of war. Its mean distance from the Sun is 141 million mi (227 million km). Its day is 24.6 Earth hours and its year about 687 Earth days. It has two small moons, Phobos and Deimos. Mars's equatorial diameter is 4,220 mi (6,792 km), about half that of Earth, and it is less dense than Earth. Its

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mass is about one-tenth of Earth's and its surface gravity about one-third as strong. No magnetic field has been detected on Mars, suggesting, as does its low density, the absence of a substantial metallic core. Like Earth, it has seasons and an atmosphere, but its average daytime surface temperature is only −10 °F (−20 °C). Mars's thin atmosphere is mainly carbon dioxide, with some nitrogen and argon and traces of water vapour. Spacecraft images show a cratered surface, with volcanoes, lava plains, flood channels, and canyons, many large by Earth standards; OLYMPUS MONS, for example, is the largest known volcano in the solar system. Wind is an important element on Mars, sculpting features such as dunes and occasionally causing global dust storms. In the distant past Mars appears to have had a denser, warmer atmosphere and much more water than at present. Images from the Mars Global Surveyor spacecraft suggest that some liquid water may have flowed near the planet's surface in relatively recent times. No life has been detected on the planet.

Mars, canals of Apparent systems of straight-line markings on the surface of MARS, now known to be an illusion caused by the chance alignment of large craters and other surface features. Giovanni Virginio Schiaparelli (1835–1910) observed about 100 of what he described as channels. PERCIVAL LOWELL called them canals and believed them to be evidence of intelligent life. Most astronomers could not see them, and many doubted their reality. The controversy was finally resolved only when pictures from MARINER spacecraft showed nothing resembling a network of channels.

Mars Pathfinder First spacecraft to land on MARS since the VIKING 1976 missions. Launched in 1996 by NASA, Pathfinder descended to the Martian surface in July 1997 using parachutes, rockets, and air bags. It then deployed instruments, including Sojourner, a small, six-wheeled robotic rover, which explored as far as 1,600 ft (500 m) from the lander and sent pictures back for over a month. The mission's main objective was to show that low-cost Mars landings and exploration are feasible.

Marsalis \mär-'sa-ləs**, Wynton** (b. Oct. 18, 1961, New Orleans, La., U.S.) U.S. trumpeter and composer. Marsalis was a trumpet prodigy and was recognized as an important soloist in both the classical and jazz traditions at an early age. He joined ART BLAKEY's Jazz Messengers (1980–82) before leading his own groups. As a composer he has written ballet and concert works, and he won the 1997 Pulitzer Prize for his oratorio *Blood on the Fields*. He also worked on Ken Burns's *Jazz* miniseries and was a catalyst in the revival of broad interest in JAZZ.

Marseille *or* **Marseilles** \mär-'sā\ City (pop., 1999: city, 797,486; metro. area, 1,349,772), southeastern France. One of the Mediterranean's major seaports and the second largest city in France, it is located on the Gulf of Lion, west of the French RIVIERA. It was settled by Greeks during the 7th century BC and was annexed by the Romans, who called it Massilia, in 49 BC. It declined along with the Roman Empire but revived as a commercial port during the CRUSADES era; it passed to the French crown in 1481. The plague of 1720 killed half of its population. In the 19th century the development of France's colonial empire added to the city's importance. Following World War II, rapid industrial growth took place around the port complex at Fos-sur-Mer and in suburbs such as Marignane and Vitrolles.

marsh Freshwater or marine wetland ecosystem characterized by poorly drained mineral soils and by plant life dominated by grasses. Fewer plant species grow in marshes than on well-watered but not waterlogged land; grasses, sedges, and reeds or rushes are most common. Commercially, rice is by far the most important freshwater marsh plant: it supplies a major portion of the world's grain. Salt marshes are formed on intertidal land by seawater flooding and draining, and salt-marsh grasses will not grow on permanently flooded flats. See also SWAMP.

Marsh, Dame (Edith) Ngaio (b. April 23, 1895, Christchurch, N.Z.—d. Feb. 18, 1982, Christchurch) New Zealand writer of detective stories. Originally an artist, she later acted in and produced Shakespearean repertory theatre (1938–64). She is known for her mystery stories featuring Inspector Roderick Alleyn of Scotland Yard. With novels such as *Overture to Death* (1939), *Final Curtain* (1947), *Death of a Fool* (1956), and *Dead Water* (1963), she helped make the detective story a respectable literary genre.

Marsh, O(thniel) C(harles) (b. Oct. 29, 1831, Lockport, N.Y., U.S.—d. March 18, 1899, New Haven, Conn.) U.S. paleontologist. He spent his entire career at Yale University (1866–99) as the first professor of vertebrate paleontology in the U.S. From 1870 he led scientific expeditions to the West; in 1871 his party discovered the first pterodactyl found in the U.S. In 1882 he was placed in charge of the U.S. Geological Survey's work in vertebrate paleontology, aggravating a fierce rivalry between him and EDWARD D. COPE. Credited with discovering more than 1,000 fossil vertebrates and describing at least 500 more, Marsh published major works on toothed birds, gigantic horned mammals, and North American dinosaurs. His books include *Fossil Horses in America* (1874) and *Introduction and Succession of Vertebrate Life in America* (1877).

Marsh, Reginald (b. March 14, 1898, Paris, France—d. July 3, 1954, Bennington, Vt., U.S.) U.S. painter and printmaker. Born to American parents in Paris and educated at Yale University, from 1922 to 1925 he produced a daily column of drawings of vaudeville acts for the *New York Daily News*. In 1925 he became an original member of the staff of *The New Yorker* magazine, for which he drew humorous illustrations and metropolitan scenes. In 1929 he began painting scenes of city life, including Coney Island crowds and Bowery derelicts. He taught at the Art Students League from 1934 until his death.

marsh gas See METHANE

marsh mallow Perennial herbaceous plant (*Althaea officinalis*) of the MALLOW FAMILY, native to eastern Europe and northern Africa and naturalized in North America. Found usually in marshy areas near the sea, the marsh mallow has strongly veined, heart-shaped or oval leaves and pinkish flowers borne on stalks about 6 ft (1.8 m) tall. The root was formerly processed to make marshmallows.

marsh marigold Perennial herbaceous plant (*Caltha palustris*) of the BUTTERCUP family, native to wetlands in Europe and North America. It is grown in boggy wild gardens. The plant has a hollow stem, heart-shaped or round leaves, and glossy pink, white, or yellow flowers composed solely of sepals (petals are absent). The stems, leaves, and roots are sometimes cooked and eaten as a vegetable, though the fresh plant is poisonous. See also COWSLIP.

Marshall, Alfred (b. July 26, 1842, London, Eng.—d. July 13, 1924, Cambridge, Cambridgeshire) British economist, one of the founders of English neoclassical economics. The first principal of University College, Bristol (1877–81), and a professor at the University of Cambridge (1885–1908), he reexamined and extended the ideas of classical economists such as ADAM SMITH and DAVID RICARDO. His best-known work, *Principles of Economics* (1890), introduced several influential economic concepts, including elasticity of demand, CONSUMER'S SURPLUS, and the representative firm. His writings on the theory of value proposed time as a factor in analysis and reconciled the classical cost-of-production principle with the theory of MARGINAL UTILITY. See also CLASSICAL ECONOMICS.

Marshall, George C(atlett) (b. Dec. 31, 1880, Uniontown, Pa., U.S.—d. Oct. 16, 1959, Washington, D.C.) U.S. Army officer and statesman. After graduating from the Virginia Military Institute, he served in the Philippines (1902–03) and in World War I. He was later an aide to Gen. JOHN PERSHING (1919–24) and assistant commandant of the army's infantry school (1927–33), where he taught many future commanders. As chief of staff of the U.S. Army (1939–45), he directed army operations throughout World War II. After his retirement in 1945, Pres. HARRY TRUMAN sent him to China to mediate the civil war there. As secretary of state (1947–49), Marshall proposed the European aid program known as the MARSHALL PLAN and initiated discussions that led to the formation of NATO. He resigned because of ill health but was called back by Truman to become secretary of defense (1950–51) and to prepare the armed forces for the KOREAN WAR. In 1953 he was awarded the Nobel Prize for Peace.

Marshall, John (b. Sept. 24, 1755, near Germantown, Va.—d. July 6, 1835, Philadelphia, Pa., U.S.) U.S. patriot, politician, and jurist. In 1775 he joined a regiment of minutemen and served as a lieutenant under Gen. GEORGE WASHINGTON in the AMERICAN REVOLUTION. After his discharge (1781), he served in the Virginia legislature and on Virginia's executive council (1782–95), gaining a reputation as a leading Federalist. He supported ratification of the U.S. Constitution at the state's ratifying convention. He was one of three commissioners sent to France in 1797–98 (see XYZ AFFAIR); he later served as secretary of state (1800–01) under Pres. JOHN ADAMS. In 1801 Adams named Marshall chief justice of the SUPREME COURT OF THE UNITED STATES, a post he held until his death. He participated in more than 1,000 decisions, writing 519 himself. During his tenure, the Supreme Court set forth the main structure of the government; its groundbreaking decisions included *MARBURY V. MADISON*, which established JUDI-

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CIAL REVIEW; *McCULLOCH V. MARYLAND*, which affirmed the constitutional doctrine of "implied powers"; the DARTMOUTH COLLEGE CASE, which protected businesses and corporations from much government regulation; and *GIBBONS V. OGDEN*, which established that states cannot interfere with Congress's right to regulate commerce. Marshall is remembered as the principal founder of the U.S. system of constitutional law.

Marshall, Paule *orig.* **Paule Burke** (b. April 9, 1929, Brooklyn, N.Y., U.S.) U.S. writer. She was born to Barbadian parents and attended Brooklyn College. Her autobiographical first novel, *Brown Girl, Brownstones* (1959), was acclaimed for its acute rendition of dialogue. Her short story "Reena" (1962) was one of the first pieces of fiction to feature a college-educated, politically active black woman as its protagonist. Her most eloquent statement of her belief in black Americans' need to rediscover their African heritage is the novel *Praisesong for the Widow* (1983). *The Fisher King* (2000) is a story of love and family conflict.

Marshall, Thomas R(iley) (b. March 14, 1854, North Manchester, Ind., U.S.—d. June 1, 1925, Washington, D.C.) U.S. politician. As governor of Indiana (1909–13) he sponsored a broad program of social legislation. In 1912 he was elected vice president on a ticket with WOODROW WILSON. He became the first vice president in nearly 100 years to serve two terms (1913–21). When Wilson suffered a stroke that partially paralyzed him in 1919, Marshall refused to assume the powers of the presidency without a congressional resolution and written requests from first lady Edith Wilson and the president's doctor. A popular public official, he was heard to remark during a tedious debate, "What this country needs is a really good five-cent cigar."

Marshall, Thurgood (b. July 2, 1908, Baltimore, Md., U.S.—d. Jan. 24, 1993, Bethesda, Md.) U.S. jurist and civil-rights advocate. He received his law degree from Howard University in 1933. From 1936 he worked for the NAACP, becoming its chief counsel in 1940. He won 29 of the 32 cases he argued before the SUPREME COURT OF THE UNITED STATES, including the landmark *BROWN V. BOARD OF EDUCATION* (1954) and others that established EQUAL PROTECTION for African Americans in housing, voting, employment, and education. He served as U.S. solicitor general (1965–67) before being appointed in 1967 to the Supreme Court by Pres. LYNDON B. JOHNSON, becoming the first African American Supreme Court justice. Marshall was a steadfast liberal during his tenure on the Court, and he maintained his previous views concerning the need for equitable and just treatment of the nation's minorities by the state and federal governments. He retired in 1991.

Marshall Islands *officially* **Republic of the Marshall Islands** Island country, central Pacific Ocean. It is composed of two parallel chains of low-lying coral atolls: the Ratak, or Sunrise, to the east and the Ralik, or Sunset, to the west. The chains lie 125 mi (200 km) apart and extend some 800 mi (1,290 km) northwest to southeast. The islands and islets number more than 1,200. Area: 70 sq mi (181 sq km). Population (2005 est.): 56,300. Capital: MAJURO. The indigenous people are Micronesian. Languages: Marshallese, English (both official). Religion: Christianity (Protestant, Roman Catholic, other Christians). Currency: U.S. dollar. The largest atoll is Kwajalein, consisting of about 90 islets, with a total land area of 6 sq mi (16 sq km). Much of Kwajalein is used as a missile-testing range by the U.S. military, which provides a major source of revenue to the Marshall Islands. Subsistence farming, fishing, and the raising of pigs and poultry are the principal economic activities. The Marshall Islands is a republic with two legislative houses; its head of state and government is the president. The islands were sighted in 1529 by the Spanish navigator Álvaro Saavedra (or de Saavedra). Germany purchased the islands from Spain in 1885 and declared them a protectorate the following year. Japan seized them in 1914 and after 1919 administered them as a League of Nations mandate. During World War II the U.S. seized Kwajalein and Enewetak, and the Marshall Islands were made part of the UN Trust Territory of the Pacific Islands under U.S. jurisdiction in 1947. BIKINI and Enewetak atolls served as testing grounds for U.S. nuclear weapons from 1946 to 1958. The Marshall Islands became an internally self-governing republic in 1979. It signed the compact of free association with the U.S. in 1982 and became fully self-governing in 1986. The compact was amended in 2004.

Marshall Plan (1948–51) U.S.-sponsored program to provide economic aid to European countries after World War II. The idea of a European self-help plan financed by the U.S. was proposed by GEORGE MARSHALL in 1947 and was authorized by Congress as the European Recovery Program. It provided almost $13 billion in grants and loans to 17 countries and was a key factor in reviving their economies and stabilizing their political structures. The plan's concept was extended to less-developed countries under the POINT FOUR PROGRAM.

Marshfield Bay See COOS BAY

Marsic War See SOCIAL WAR

Marsilius of Padua (b. c. 1280, Padua, Kingdom of Italy—d. c. 1343, Munich) Italian political philosopher. He was consultant to the GHIBELLINES until condemned as a heretic (1327) after writing *Defensor pacis* (1320–24) and fleeing to the court of LOUIS IV of Bavaria. He helped declare Pope JOHN XXII a heretic, install NICHOLAS V as antipope, and crown Louis emperor (1328). In his secular concept of the state, the power of the church is limited, and political power lies with the people, a theory that influenced the modern idea of the state.

Marston, John (b. Oct. 7, 1576, Oxfordshire, Eng.—d. June 25, 1634, London) English dramatist. He began his literary career as a poet in 1598 but soon turned to writing for the theatre. One of the most vigorous satirists of his era, he wrote all his plays before taking holy orders in 1609. His best-known work is the tragicomedy *The Malcontent* (1604), which rails at the iniquities of a lascivious court. Also notable is *The Dutch Courtezan* (produced 1603–04), one of the cleverest comedies of its time. Though he satirized and feuded with BEN JONSON, the two collaborated on *Eastward Hoe* (1605; with George Chapman) and *Love's Martyr* (1607).

Marston Moor, Battle of (July 2, 1644) First major Royalist defeat in the ENGLISH CIVIL WARS. Royalist forces under Prince RUPERT relieved the siege of York and pursued the Parliamentary forces to nearby Long Marston. A surprise counterattack by Parliamentary forces under OLIVER CROMWELL caused heavy losses to Royalist troops. With the fall of York, CHARLES I lost control of the north, and Cromwell emerged as the leading Parliamentary general.

marsupial \mär-'sü-pē-əl\ Any MAMMAL of the infraclass Marsupialia, characterized by premature birth and continued development outside the womb. The young remain attached to the mother's teats for a period corresponding to the late stages of fetal development of a placental mammal. More than 170 species (e.g., BANDICOOTS, KANGAROOS, KOALAS, WOMBATS) are found in Australia, New Guinea, and nearby islands. About 65 species of OPOSSUM occur in the Americas and seven species of ratlike marsupials in South America. Many species have a pouch (marsupium), a fold of skin covering the nipples on the mother's lower belly, where the young continue their development.

"Peleus Taming Thetis," pelike by the Marsyas Painter, c. 340–330 BC; in the British Museum
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Marsyas \mär-'sē-əs\ **Painter** (fl. c. 350–325 BC, Greece) Greek painter of the late Classical period, known for two containers, both dated 340–330 BC. Both are painted in the so-called Kerch style, named for the area north of the Black Sea where many such vessels were excavated. Characterized by slender, mannered forms, elaborate decoration, and polychrome effects, the Kerch style is thought to be the last major style of Attic RED-FIGURE POTTERY.

marten Any of several forest-dwelling CARNIVORE species (genus *Martes,* family Mustelidae). Species differ in size and colour, but they resemble WEASELS in general proportions, and their fur is valuable. Their total length is 20–40 in. (50–100 cm), and they may weigh 2–5 lb (1–2.5 kg) or more. Martens hunt

Stone marten (*Martes foina*)
REINHARD/REISER—BAVARIA-VERLAG

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alone, feeding on animals, fruit, and carrion. The fur of the American marten (*M. americana*) of northern North America is sometimes sold as sable. Other species include the pine, baum, or sweet marten (*M. martes*) of Europe and Central Asia and the yellow-throated marten, or honey dog (*M. flavigula*), named for its preference for sweet foods, of southern Asia. See also FISHER; POLECAT.

Martha's Vineyard Island, Atlantic Ocean, off the southeastern coast of Massachusetts, U.S. Situated across Vineyard Sound from CAPE COD, it is nearly 20 mi (32 km) long and 2–10 mi (3–16 km) wide. It was first described in 1602 by Bartholomew Gosnold and was named for its wild grapevines. Purchased by Thomas Mayhew in 1641, it was considered part of New York before being ceded to Massachusetts in 1692. It was once a centre of the whaling and fishing industries; it is now a popular summer resort.

Martí \mär-'tē\ **(y Pérez), José Julián** (b. Jan. 28, 1853, Havana, Cuba—d. May 19, 1895, Dos Ríos) Cuban poet, essayist, and patriot. Involved in an 1868 revolutionary uprising, Martí was deported to Spain, where he received a law degree and continued his political activities and writing. He later lived in various countries, spending most of 1881–95 in New York City. He organized and unified the movement for Cuban independence and died in battle. As a writer, he is noted for his personal prose and deceptively simple verse on themes of a free and united America. His essays, such as those in *Our America* (1881), are often considered his greatest contribution to Latin American letters. He is the national hero of Cuba.

Martial \'mär-shəl\ *Latin* **Marcus Valerius Martialis** (b. c. AD 38/41, Bilbilis, Hispania—d. c. 103) Roman poet. Born in a Roman colony in what is now Spain, Martial went to Rome as a young man. There he associated with such figures as SENECA, Lucan, and JUVENAL and enjoyed the patronage of the emperors TITUS and DOMITIAN. His early poetry, some marred by gross adulation of Titus, was undistinguished. He is renowned for his 12 books of EPIGRAMS (86–102?), a form he virtually created. Pointed and often obscene, they provide a picture of Roman society during the early empire that is remarkable both for its completeness and for its accurate portrayal of human foibles.

martial art Any of several arts of combat and self-defense that are widely practiced as sport. There are armed and unarmed varieties, most based on traditional fighting methods used in East Asia. In modern times, derivatives of armed martial arts include KENDO (fencing with wooden swords) and *kyudo* (archery). Unarmed varieties include AIKIDO, JUDO, KARATE, KUNG FU, and TAE KWON DO. Because of the influence of Taoism and Zen Buddhism, there is a strong emphasis in all the martial arts on the practitioner's mental and spiritual state. A hierarchy of expertise, ranging from the novice ("white belt") to the master ("black belt"), is usually recognized. See also T'AI CHI CH'UAN; JUJITSU.

martial law Temporary rule of a designated area by military authorities in time of emergency when the civil authorities are deemed unable to function. Under martial law, civil rights are usually suspended, and the activities of civil courts are restricted or supplanted entirely by military tribunals. Such "acts done by necessity" are limited only by INTERNATIONAL LAW and the conventions of civilized warfare. Though temporary in theory, a state of martial law may in fact continue indefinitely. See also HUMAN RIGHTS; WAR CRIMES.

Martin V *orig.* **Oddo Colonna** (b. 1368, Genazzano, Papal States—d. Feb. 20, 1431, Rome) Pope (1417–31). His election at the Council of Constance marked the end of the Western SCHISM. He condemned conciliar theory (see CONCILIAR MOVEMENT) and any appeals of papal judgment on matters of faith. Martin rejected French efforts to persuade him to live at Avignon (see AVIGNON PAPACY). Instead he returned to Rome (1420), where he helped to rebuild the ruined city. He also tried to recover control of the PAPAL STATES. He mediated in the HUNDRED YEARS' WAR and organized crusades against the HUSSITES, and he asserted the rights of the church against the crown.

martin Any of several species of songbirds in the family Hirundinidae. In the U.S., the name refers to the purple martin (*Progne subis*), at 8 in. (20 cm) long, the largest U.S. SWALLOW. The sand martin, or bank swallow (*Riparia riparia*), a 5-in. (12-cm) brown-and-white bird, breeds throughout the Northern Hemisphere, nesting in sandbank burrows. The house martin (*Delichon urbica*), blue-black above and white-rumped, is common in Europe. The African river martin (*Pseudochelidon eurystomina*) of the Congo is black, with red eyes and bill.

Martin, Agnes (b. March 22, 1912, Macklin, Sask., Can.—d. Dec. 16, 2004, Taos, N.M., U.S.) Canadian-born U.S. painter. She moved to the U.S. in 1931 and became a U.S. citizen in 1950. She studied at Columbia University and taught at the University of New Mexico. In 1958 she had her first solo exhibition. Martin was a prominent exponent of geometric abstraction, and, for her, a gray grid of intersecting penciled lines became the ultimate geometric composition. Her gridlike abstractions were also noted for their light-soaked appearance and quiet effect. In the 1970s she produced printed equivalents of her paintings; a notable series of silkscreens, *On a Clear Day* (1973), was produced after her mathematically annotated sketches. Martin was one of the leading practitioners of ABSTRACT EXPRESSIONISM in the 20th century.

Martin, Mary (Virginia) (b. Dec. 1, 1913, Weatherford, Texas, U.S.—d. Nov. 3, 1990, Rancho Mirage, Calif.) U.S. singer and actress. She co-owned a dancing school in her native Weatherford, Texas, before moving in 1938 to New York City, where she won a small part in the musical *Leave It to Me* and became famous for her rendition of "My Heart Belongs to Daddy." She appeared in movies before returning to Broadway to star in *One Touch of Venus* (1943). Martin originated the role of Nellie Forbush in *South Pacific* (1949–53) and later starred in *Peter Pan* (1954, Tony Award; television version, 1955), *The Sound of Music* (1959, Tony Award), and *I Do, I Do* (1966).

Martin, Paul *in full* **Paul Joseph Martin, Jr.** (b. Aug. 28, 1938, Windsor, Ont., Can.) Canadian prime minister (2003–06). The son of Paul Joseph Martin, who served as a minister in four Liberal governments, the younger Martin studied law at the University of Toronto and was called to the bar in 1966. Instead of practicing law, however, he joined Canada Steamship Lines, a freight carrier he purchased in 1981. From 1993 to 2002 Martin, a member of the LIBERAL PARTY, served as minister of finance in Prime Minister JEAN CHRÉTIEN's government. Highly successful in the post, Martin eliminated a large budget deficit, achieved five consecutive budget surpluses, and secured the largest tax cut in Canadian history. In 2003 Martin succeeded Chrétien as leader of the Liberal Party and as prime minister. He was elected prime minister in his own right in 2004 but was ousted from office following his party's defeat in the 2006 Canadian general election.

Martin, Steve (b. Aug. 14, 1945, Waco, Texas, U.S.) U.S. comedian and writer. He began writing for the Smothers Brothers in 1967. In the 1970s he wrote for and performed on shows such as *Saturday Night Live*. His slapstick and absurdist humour were showcased in *The Jerk* (1979), which he both wrote and starred in. His other film comedies include *All of Me* (1984), *Roxanne* (1987), *Little Shop of Horrors* (1986), *Dirty Rotten Scoundrels* (1988), *Parenthood* (1989), *L.A. Story* (1991), *Bowfinger* (1999), and *Bringing Down the House* (2003). He wrote the stage play *Picasso at the Lapin Agile* (1995).

Martin du Gard \mär-ta^{n}-dü-'gär**, Roger** (b. March 23, 1881, Neuilly-sur-Seine, France—d. Aug. 22, 1958, Bellême) French novelist and dramatist. Originally trained as a paleographer and archivist, he brought to his literary works a spirit of objectivity and a scrupulous regard for detail. He first attracted attention with the novel *Jean Barois* (1913), the story of an intellectual torn between the Roman Catholic faith of his childhood and the scientific materialism of his maturity. He is best known for the eight-novel cycle *Les Thibault* (1922–40), the record of a family's development that chronicles the social and moral issues facing the French bourgeoisie in the pre-World War I era. He received the 1937 Nobel Prize for Literature.

Martin of Tours \'tür**, Saint** (b. c. 316, Sabaria, Pannonia—d. Nov. 8, 397, Candes, Gaul; Western feast day, November 11; Eastern feast day November 12) Patron saint of France. Born a pagan, he converted to Christianity at age 10. He was forced to join the Roman army but asked to be released because service was incompatible with his Christianity. After imprisonment he settled in Poitiers and then became a missionary on the Balkan Peninsula. He returned to Poitiers in 360 and founded the first monastery in Gaul. In 371 he was made bishop of Tours. A second monastery he founded, at Mormoutier, became a great monastic complex. St. Martin was known as a miracle worker in his own lifetime and was one of the first venerated saints who was not a martyr.

Martineau \'mär-ti-ˌnō**, Harriet** (b. June 12, 1802, Norwich, Norfolk, Eng.—d. June 27, 1876, near Ambleside, Westmorland) English essayist, novelist, and economic and historical writer. She became prominent among English intellectuals of her time despite deafness and other

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disabilities. She first gained a large reading public with a series popularizing classical economics, published in several collections (1832–34). Her chief historical work was *The History of the Thirty Years' Peace, A.D. 1816–1846* (1849), a widely read popular treatment. Her most scholarly work is a condensed translation of *The Positive Philosophy of Auguste Comte* (1853). Her best-regarded novel is *Deerbrook* (1839).

Martínez Montañés, Juan See Juan Martínez Montañés

Martini, Simone (b. c. 1284, Siena, Republic of Siena—d. 1344, Avignon, Provence) Italian painter. An exponent of Gothic art, he did much to spread the influence of Sienese painting. Duccio di Buoninsegna influenced his use of harmonious, pure colour, but his graceful, decorative lines were inspired by French Gothic art, as seen in his *Maestà* fresco (1315), which depicts the Madonna as a Gothic queen holding court beneath a Gothic canopy. His equestrian portrait of Guidoriccio da Fogliano (1328) was an important precedent for Renaissance equestrian portraits.

Martinique \ˌmär-tə-ˈnēk\ Island (pop., 2002 est.: 386,000) of the Windward Islands, West Indies, and overseas department of France. It is 50 mi (80 km) long and 22 mi (35 km) wide and occupies an area of 436 sq mi (1,128 sq km). Largely mountainous, its highest point, Mount Pelée, is an active volcano. Its capital is Fort-de-France. Tourism is the basis of its economy. Carib Indians, who had ousted earlier Arawak inhabitants, resided on the island when Christopher Columbus visited it in 1502. In 1635 a Frenchman established a colony there, and in 1674 it passed to the French crown. The British captured and held the island from 1762 to 1763 and occupied it again during the Napoleonic Wars, but each time it was returned to France. Made a department of France in 1946, it remained under French rule despite a communist-led independence movement in the 1970s.

Martins, Peter (b. Oct. 27, 1946, Copenhagen, Den.) Danish-born U.S. dancer, choreographer, and director of the New York City Ballet. He trained at the Royal Danish Ballet School and became a member of its company in 1965. He joined the New York City Ballet in 1969 as a principal dancer and created roles in ballets such as Jerome Robbins's *Goldberg Variations* (1971) and George Balanchine's *Duo Concertante* (1972). He began choreographing for the company in 1977 with *Calcium Light Night*. After Balanchine's death in 1983, Martins became codirector (until 1990) and then sole director of the company.

Martinson, Harry (Edmund) (b. May 6, 1904, Jämshög, Swed.—d. Feb. 11, 1978, Stockholm) Swedish novelist and poet. He spent his childhood in foster homes and his young adulthood as a merchant seaman, labourer, and vagrant. He described his early experiences in two autobiographical novels, *Flowering Nettle* (1935) and *The Way Out* (1936), and in travel sketches. Among his best-known works are the poetry collection *Trade Wind* (1945), the novel *The Road* (1948), and the epic poem *Aniara* (1956). In 1949 he became the first self-taught working-class writer ever elected to the Swedish Academy. He shared the 1974 Nobel Prize for Literature with Eyvind Johnson.

Martinů \mär-ˈtē-nü**, Bohuslav (Jan)** (b. Dec. 8, 1890, Polička, Bohemia—d. Aug. 28, 1959, Liestal, Switz.) Czech (Bohemian) composer. He started composing at age 10 but was expelled from the conservatory for neglecting his studies. His early pieces combined the influences of Czech folk music and French composer Claude Debussy's music. In Paris (1923–40) he gained a reputation for his colourful ballet scores and experimented with Neoclassicism, jazz, and ragtime. He composed many works, including six symphonies, operas (including *Julietta*, 1938), and large choral works (including *The Epic of Gilgamesh*, 1955), but he did little to promote his music.

Martov \ˈmär-ˌtȯf**, L.** *orig.* **Yuly Osipovich Tsederbaum** (b. Nov. 24, 1873, Constantinople, Ottoman Empire—d. April 4, 1923, Berlin, Ger.) Russian revolutionary. He first lived in Vilna, where he belonged to the Bund, a Jewish socialist group. In 1895 he and Vladimir Ilich Lenin formed the St. Petersburg Union of Struggle for the Liberation of the Working Class. After his arrest and exile to Siberia (1896–99), he joined Lenin in Switzerland as an editor of *Iskra*. From 1903 Martov supported the Menshevik faction of the Russian Social-Democratic Workers' Party and became its leader (1905–07). After the Russian Revolution of 1917, he supported the Bolshevik government in the Russian Civil War but later opposed many of its dictatorial measures. He left Russia in 1920 and edited the *Socialist Courier* in Berlin.

martyr Person who voluntarily suffers death rather than deny his or her religion. Readiness for martyrdom was a collective ideal in ancient Judaism, notably in the era of the Maccabees, and its importance has continued into modern times. Roman Catholicism sees the suffering of martyrs as a test of their faith. Many saints of the early church underwent martyrdom during the persecutions of the Roman emperors. Martyrs need not perform miracles to be canonized. In Islam, martyrs are thought to comprise two groups of the faithful: those killed in jihad and those killed unjustly. In Buddhism, a bodhisattva is regarded as a martyr because he voluntarily postpones enlightenment to alleviate the suffering of others.

Marvell \ˈmär-vəl**, Andrew** (b. March 31, 1621, Winestead, Yorkshire, Eng.—d. Aug. 18, 1678, London) English poet and politician. He was employed as a tutor, including to Oliver Cromwell's ward, before becoming an assistant to John Milton in the foreign office in 1657. From 1659 he held a seat in Parliament. His reputation as one of the finest secular Metaphysical poets (see Metaphysical poetry) is based on a small body of brilliant lyric verse, notably "To His Coy Mistress" (1681) and "The Garden." Among his other works are classical odes, such as "An Horatian Ode upon Cromwell's Return from Ireland" (1650); political verse satires opposing the government after the Restoration, such as *Last Instructions to a Painter* (1667); and prose satires.

Marx, Karl (Heinrich) (b. May 5, 1818, Trier, Rhine province, Prussia [Ger.]—d. March 14, 1883, London, Eng.) German political philosopher, economic theorist, and revolutionary. He studied humanities at the University of Bonn (1835) and law and philosophy at the University of Berlin (1836–41), where he was exposed to the works of G.W.F. Hegel. Working as a writer in Cologne and Paris (1842–45), he became active in leftist politics. In Paris he met Friedrich Engels, who would become his lifelong collaborator. Expelled from France in 1845, he moved to Brussels, where his political orientation matured and he and Engels made names for themselves through their writings. Marx was invited to join a secret left-wing group in London, for which he and Engels wrote the Communist Manifesto (1848). In that same year, Marx organized the first Rhineland Democratic Congress in Germany and opposed the king of Prussia when he dissolved the Prussian Assembly. Exiled, he moved to London in 1849, where he spent the rest of his life. He worked part-time as a European correspondent for the *New York Tribune* (1851–62) while writing his major critique of capitalism, *Das Kapital* (3 vol., 1867–94). He was a leading figure in the First International from 1864 until the defection of Mikhail Bakunin in 1872. See also Marxism; communism; dialectical materialism.

Marx Brothers U.S. comedy team. The original five brothers were Chico (orig. Leonard) (1886–1961), Harpo (orig. Adolph Arthur) (1888–1964), Groucho (orig. Julius Henry) (1890–1977), Gummo (orig. Milton) (1893–1977), and Zeppo (orig. Herbert) (1901–79). They formed a vaudeville act with their mother, Minnie, called "The Six Musical Mascots" (1904–18). Gummo left the act early on, and the brothers later became "The Four Marx Brothers." They won fame with their first Broadway play,

Groucho, Harpo, and Chico Marx
THE BETTMANN ARCHIVE

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I'll Say She Is (1924), which was followed by *The Cocoanuts* (1925; film, 1929) and *Animal Crackers* (1926; film, 1930). They later starred in *Monkey Business* (1931), *Horse Feathers* (1932), *Duck Soup* (1933), *A Night at the Opera* (1935), and *Room Service* (1938), among other films, developing a skillful blend of visual and verbal humour, with Groucho supplying wisecracks and a running commentary as counterpoint to the frantic, anarchic activities of the silent Harpo and the Italian-accented Chico. Zeppo left the act in 1934, and the act disbanded in 1949. Groucho later hosted the television quiz program *You Bet Your Life* (1950–61).

Marxism Ideology and socioeconomic theory developed by Karl Marx and Friedrich Engels. The fundamental ideology of communism, it holds that all people are entitled to enjoy the fruits of their labour but are prevented from doing so in a capitalist economic system, which divides society into two classes: nonowning workers and nonworking owners. Marx called the resulting situation "alienation," and he said that when the workers repossessed the fruits of their labour, alienation would be overcome and class divisions would cease. The Marxist theory of history posits class struggle as history's driving force, and it sees capitalism as the most recent and most critical historical stage—most critical because at this stage the proletariat will at last arise united. The failure of the European Revolutions of 1848 and an increasing need to elaborate on Marxist theory, whose orientation is more analytical than practical, led to adaptations such as Leninism and Maoism; in the late 20th century the collapse of the Soviet Union and China's adoption of many elements of a free-market economy seemed to mark the end of Marxism as an applicable economic or governmental theory, though it retains interest as a critique of market capitalism and a theory of historical change. See also *Communist Manifesto*; dialectical materialism; socialism; Stalinism; Trotskyism.

Mary *or* **St. Mary** *or* **Virgin Mary** (fl. beginning of the Christian Era) Mother of Jesus. According to the Gospels, she was betrothed to St. Joseph when the archangel Gabriel appeared to her to announce the coming birth of Jesus. Other incidents in the Gospels in which she appears include the visit to Elizabeth, mother of John the Baptist; the birth of Jesus and his presentation in the Temple; the coming of the Magi and the flight to Egypt; the marriage at Cana in Galilee; the attempt to see Jesus while he was teaching; and watching at the cross. Eastern Orthodoxy, Roman Catholicism, and most Protestant denominations hold Jesus to have been divinely conceived and Mary to have remained a virgin. The Roman Catholic church also holds to the doctrine of her Immaculate Conception and her bodily assumption into heaven. Catholics pray to Mary as an intercessor. See also Mariology.

Mary See Merv

Mary I *or* **Mary Tudor** (b. Feb. 18, 1516, Greenwich, near London, Eng.—d. Nov. 17, 1558, London) Queen of England (1553–58). The daughter of King Henry VIII and Catherine of Aragon, she was declared illegitimate after Henry's divorce and new marriage to Anne Boleyn (1533). In 1544 Mary was restored to court and granted succession to the throne. After becoming queen (1553), she married Philip II of Spain, restored Roman Catholicism, and revived the laws against heresy. The resulting persecution of Protestant rebels and the execution of some 300 heretics earned her the hatred of her subjects and the nickname "Bloody Mary." She waged an unsuccessful war against France that in 1558 resulted in the loss of Calais, England's last foothold on the Continent.

Mary II (b. April 30, 1662, London, Eng.—d. Dec. 28, 1694, London) Queen of England (1689–94). The daughter of King James II, a Catholic convert, she was reared as a Protestant and in 1677 married to her cousin, William of Orange. They lived in Holland until English nobles opposed to James's pro-Catholic policies invited William and Mary to assume the English throne. After William landed with a Dutch force (1688), James fled, and Mary and William (as King William III) became corulers of England (1689). Mary enjoyed great popularity, and her Dutch tastes had an influence on English pottery, landscape gardening, and interior design. She died of smallpox at age 32.

Mary, Queen of Scots *orig.* **Mary Stuart** (b. Dec. 8, 1542, Linlithgow Palace, West Lothian, Scot.—d. Feb. 8, 1587, Fotheringhay Castle, Northamptonshire, Eng.) Queen of Scotland (1542–67). She became queen when her father, James V (1512–42), died six days after her birth. She was sent by her mother, Mary of Guise, to be raised at the court of the French king Henry II and was married in 1558 to his son Francis II. After Francis's brief rule as king (1559–60) ended with his premature death, Mary returned to Scotland (1561), where she was distrusted because of her Catholic upbringing. In 1565 the red-haired queen married her ambitious cousin Henry Stewart, Lord Darnley, and became a victim of intrigues among the Scottish nobles. Darnley conspired with them to murder her confidant David Riccio. After the birth of her son James (later James I of England) in 1566, Mary was estranged from Darnley, who was murdered in 1567. Ignoring objections by the jealous Scottish nobility, she married James Hepburn, earl of Bothwell (1535?–78), a suspect in Darnley's murder. The rebellious nobles deserted her army at Carberry Hill and forced her to abdicate in favour of her son (1567). After failed attempts to win back the throne, she sought refuge in England with her cousin Elizabeth I, who arranged to keep her in captivity. Several uprisings by English Catholics in Mary's favour convinced Elizabeth to have Mary tried and condemned; she was beheaded at Fotheringhay Castle in 1587.

Mary Magdalene, Saint (fl. 1st century, Palestine; feast day July 22) Follower of Jesus and the first person to see the resurrected Christ. According to Luke 8:2 and Mark 16:9, Jesus cleansed her of seven demons. She accompanied him in Galilee, and she witnessed his Crucifixion and burial. On Easter morning she went with two other women to anoint the corpse, but the tomb was empty. Christ later appeared to her and instructed her to tell the Apostles that he was ascending to God. Popular tradition has long associated her with the repentant prostitute who anointed Christ's feet.

Maryinsky Theatre See Mariinsky Theatre

Maryland State (pop., 2000: 5,296,486), eastern U.S. A Middle Atlantic state, it is deeply indented by Chesapeake Bay and is bordered by Pennsylvania, Delaware, Virginia, the District of Columbia, and West Virginia. It covers 10,460 sq mi (27,091 sq km); its capital is Annapolis. The state's main geographic regions are the coastal plain along Chesapeake Bay, the rich farming country of the Piedmont plateau, and the Appalachian Mountains. First occupied by late Ice Age hunters c. 10,000 BC, the area was later inhabited by the Nanticoke and Piscataway tribes. Capt. John Smith charted the Chesapeake Bay region in 1608. Maryland was included in a charter given by the British king to Cecil Calvert, Lord Baltimore. Leonard Calvert, his brother, founded the first settlement in 1634 at St. Marys City. Maryland became the first American colony to establish religious freedom. Its boundary dispute with Pennsylvania was settled in the 1760s with the drawing of the Mason-Dixon Line. In 1788 Maryland became the seventh state to ratify the U.S. Constitution. The state ceded the District of Columbia as the site for a new federal capital in 1791. It was involved in the War of 1812 (see Fort McHenry). The U.S. Naval Academy was founded at Annapolis in 1845. Maryland remained in the Union during the American Civil War, but strong Southern sentiments resulted in the imposition of martial law. After the war, it prospered as an important entrepôt for consumer goods to the South and Midwest. During the 20th century its proximity to the national capital spurred population growth. Its economy is based primarily on government services and manufacturing.

Masaccio \mə-'zä-chē-ˌō\ *orig.* **Tommaso di Giovanni di Simone Guidi** (b. Dec. 21, 1401, Castel San Giovanni, Duchy of Milan—d. autumn 1428, Rome, Papal States) Italian painter. Little is known about him until 1422, when he entered the artists' guild in Florence. Giotto probably influenced his massive figures and spare composition, but the gestural and emotional expression in his rendering of the human body are closer in spirit to Donatello. In his most famous work, the frescoes in the Brancacci Chapel of Florence's Santa Maria del Car-

The Tribute Money, fresco by Masaccio, 1425; in the Brancacci Chapel, Santa Maria del Carmine, Florence.
SCALA/ART RESOURCE, NEW YORK CITY

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mine (c. 1425–28), painted in conjunction with his sometime partner, Masolino, his figures are constructed with strongly differentiated areas of light and dark that give them a three-dimensional effect. His *Trinity* fresco (c. 1427–28) in Florence's Santa Maria Novella is the first extant example of the systematic use of one-point perspective in a painting. He went to Rome in 1428 and died there so suddenly that some people suspected he had been poisoned. The rationality, realism, and humanity of the art he created in his brief six years of work inspired the major Florentine Renaissance painters of the mid-15th century and ultimately influenced the course of Western painting.

Masada \mə-'sä-də\ Ancient mountain fortress, southeastern Israel. It occupies the entire top of a mesa, which is 1,424 ft (434 m) tall and has an area of 18 acres (7 hectares). Its fortifications were built by Herod the Great in the 1st century BC; it was captured by the Zealots, a Jewish sect, in their revolt against Rome in AD 66. After the fall of Jerusalem, Masada, the last remnant of Jewish rule in Palestine, refused to surrender. In 73, after a lengthy siege, it was finally taken by the Romans, who found that nearly all of the some 1,000 Zealots there had committed suicide rather than be captured. In the 20th century, the fortress became a symbol of Jewish national heroism; it is now one of Israel's most visited tourist attractions.

Masai *or* **Maasai** \ma-'sī\ Nomadic herders of southern Kenya and northern Tanzania. They speak a language (usually called Maa) of the Nilo-Saharan family. Numbering some 900,000, the Masai subsist almost entirely on the meat, blood, and milk of their cattle herds. A kraal, consisting of a large circular thornbush fence around a ring of mud-dung houses, holds four to eight families and their herds. Polygamy is common among older men. All men are grouped into age sets. Young men traditionally live in isolation in the bush for varying lengths of time in order to develop strength, courage, and endurance. See also Nilot.

Masamune \ˌmä-sä-'mù-ne\ *orig.* **Okazaki Gorōnyūdō** (b. 1264?, Japan—d. 1343?, Kamakura) Japanese swordsmith. Masamune was appointed chief swordsmith by the emperor Fushimi in 1287. He founded the Sōshū school of swordmaking, in which blades were made entirely of steel and hardened throughout. It marked an important advance in metallurgical technique that was significantly ahead of the technical level in Europe or elsewhere in Asia.

Masaryk \'mä-sə-rik**, Jan (Garrigue)** (b. Sept. 14, 1886, Prague, Bohemia, Austria-Hungary—d. March 10, 1948, Prague, Czech.) Czech statesman. The son of Tomáš Masaryk, he entered the foreign service of the newly independent Czechoslovakia in 1919 and served as ambassador to Britain from 1925 to 1938. During World War II he was foreign minister of the Czechoslovak provisional government in London (1940–45) and later Prague (1945–48). At the request of Pres. Edvard Beneš, he remained at his post after the communist takeover in 1948. Two weeks later he either jumped or was pushed to his death from a window in the foreign office.

Masaryk, Tomáš (Garrigue) (b. March 7, 1850, near Gölding, Moravia, Austrian Empire—d. Sept. 14, 1937, Lány, Czech.) First president of Czechoslovakia (1918–35). After receiving a doctorate from the University of Vienna, he taught philosophy at the Czech University of Prague (1882) and wrote on the Czech Reformation; his most important works were a study of Marxism (1898) and *Russia and Europe* (1913). In the Austrian Reichsrat (1891–93, 1907–14), he supported democratic policies and criticized Austria-Hungary's alliance with Germany. In 1915 he went to western Europe, where he organized the Czech national council, which in 1918 gained recognition as the de facto government of the future Czechoslovakia. He negotiated its liberation as one of the Fourteen Points in the projected post-World War I peace settlement. Elected president of the new country (1918–35), he was occupied with settling conflicts between the Czech and Slovak parties.

Masbate \mäs-'bā-tā\ Island (pop. 2000: 707,668) of the Visayan group, central Philippines. The V-shaped island occupies an area of 1,262 sq mi (3,269 sq km); its capital is Masbate (pop., 2000: 71,441). Explored by Spain in the late 16th century, it was ruled by the Spanish until the Spanish-American War, when the U.S. gained control. It was occupied by the Japanese during World War II but was recovered by the U.S. in 1945. Gold has been mined for centuries near Aroroy in the north.

Mascagni \mäs-'kän-yē**, Pietro** (b. Dec. 7, 1863, Livorno, Italy—d. Aug. 2, 1945, Rome) Italian composer. He began to compose when very young. At the Milan Conservatory he studied with Amilcare Ponchielli (1834–86) and was Giacomo Puccini's roommate, but he was expelled. Taking conducting jobs with touring opera companies, he started writing operas and won a contest with his one-act *Cavalleria rusticana* (1890); it was an instant success from its premiere, and it remains his best-known work.

Masefield, John (b. June 1, 1878, Ledbury, Herefordshire, Eng.—d. May 12, 1967, near Abingdon, Berkshire) English poet. He went to sea in his youth, then lived precariously for several years in the U.S. before settling in London. He is best known for his poems of the sea, *Salt-Water Ballads* (1902, including "Sea Fever" and "Cargoes"), and for his long narrative poems, such as *The Everlasting Mercy* (1911), containing phrases of colloquial coarseness that were unknown in earlier 20th-century English verse. After he became poet laureate in 1930, his poetry became more austere. He also wrote adventure novels, sketches, and works for children.

maser \'mā-zər\ Device that produces and amplifies electromagnetic radiation in the microwave range of the spectrum. The first maser was built in 1951 by Charles H. Townes. Its name is an acronym for "microwave amplification by stimulated emission of radiation." The wavelength produced by a maser is so constant and reproducible that it can be used to control a clock that will gain or lose no more than a second over hundreds of years. Masers have been used to amplify faint signals returned from radar and communications satellites, and have made it possible to measure faint radio waves emitted by Venus, giving an indication of the planet's temperature. The maser was the principal precursor of the laser.

Maseru \'ma-zə-ˌrü\ City (pop., 1999 est.: metro. area, 373,000), capital of Lesotho. It lies on the Caledon River near the border with Free State province, Republic of South Africa. In 1869 the chief of the Basotho (Sotho) nation, Moshoeshoe I, founded the town near his mountain stronghold of Thaba Bosiu. Diamond mining is important economically. The country's only urban centre, Maseru is the site of government buildings as well as a technical school and Lesotho Agricultural College. Roma, to the southeast, is the seat of the National University of Lesotho (1945).

Mashhad \'måsh-håd, mə-'shad\ *or* **Meshed** \mə-'shed\ City (pop., 1996: 1,887,405), northeastern Iran. It is situated in the valley of the Kashaf River. For centuries it has been an important trade centre along the caravan routes and highways of the Middle East. It was damaged in a Mongol attack in 1220 and was sacked by Turkmen and Uzbeks in the 16th–17th centuries. Nādir Shah (r. 1736–47) made Mashhad his capital. The city is the burial place of Hārūn al-Rashīd and a site of pilgrimage for Shī'ite Muslims visiting the tomb of the eighth Shī'ite imam, 'Alī al-Riḍā'.

Masinissa \ˌma-sə-'ni-sə\ (b. c. 240—d. 148 BC) Ruler of the North African kingdom of Numidia. Originally an ally of Carthage, he switched sides to help Rome after being persuaded by Scipio Africanus the Elder (206). After winning the Battle of Zama (202), he was awarded a larger kingdom. Though displeased with the presence of Cato's army in Africa (149), he remained faithful to Rome and a client of the Scipios until his death.

Masjed-e Shah \'mås-jid-i-'shä\ Celebrated 17th-century mosque in Eṣfahān, Iran. The mosque, part of the rebuilding effort of the Ṣafavid shah 'Abbās I, was located at the centre of Eṣfahān, along a great central mall called the *maydān*. Along with neighbouring structures of the period, it is notable for its logically precise vaulting and use of coloured tiles.

mask Object worn either to disguise or protect the face or to project the image of another personality or being. Masks have been used in art and religion since the Stone Age. In most primitive societies, their form is dictated by tradition, and they are thought to have supernatural power. Death masks, associated with the return of the spirit to the body, were used in ancient Egypt, Asia, and the Inca civilization, and were sometimes kept as portraits of the dead. Masks worn on holidays such as Halloween and Mardi Gras signal festivity and license. They have also been widely used in the theater, beginning with the Greek drama and continuing through medieval mystery plays, and the Italian commedia dell'arte, as well as in other theater traditions (e.g., Japanese No drama).

Maslow \'maz-lō**, Abraham H(arold)** (b. April 1, 1908, New York, N.Y., U.S.—d. June 8, 1970, Menlo Park, Calif.) U.S. psychologist. He taught at Brooklyn College (1937–51) and Brandeis University (1951–69). A practitioner of humanistic psychology, he is known for his theory of "self-actualization." In *Motivation and Personality* (1954) and *Toward a Psychology of Being* (1962), Maslow argued that each person has a hier-

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archy of needs that must be satisfied, ranging from basic physiological requirements to love, esteem, and, finally, self-actualization. As each need is satisfied, the next higher level in the emotional hierarchy dominates conscious functioning.

masochism \'ma-sə-ˌki-zəm, 'ma-zə-ˌki-zəm\ Psychosexual disorder in which an individual achieves erotic release by being subjected to pain or humiliation. The term is derived from the name of Leopold von Sacher-Masoch, a 19th-century Austrian novelist who wrote extensively about the sexual enjoyment he derived from verbal and physical abuse. The amount of pain involved can vary; it is usually sought out and to some degree controlled by the masochist. Masochistic and sadistic traits often occur in the same individual.

Masolino \ˌmä-sō-'lē-nō\ *orig.* **Tommaso di Cristoforo Fini** (b. 1383, Panicale, Romagna—d. probably 1440–47, Florence, Republic of Florence) Italian painter. He came from the same district in Tuscany as his younger contemporary MASACCIO, with whom his career is closely linked. The two worked together on frescoes for the Brancacci Chapel in Florence's Santa Maria del Carmine. Masaccio's influence is evident in Masolino's contributions, but upon Masaccio's death Masolino returned to the more decorative Gothic style of his earlier years.

Mason, George (b. 1725, Fairfax county, Va.—d. Oct. 7, 1792, Fairfax county, Va., U.S.) American Revolutionary statesman. The owner of a large plantation, he became active in efforts to promote the westward expansion of the colonies. In 1774 he helped his neighbour GEORGE WASHINGTON draft the Fairfax Resolves (1774), which called for a boycott of English goods. In 1776 he drafted the Virginia state constitution and the VIRGINIA DECLARATION OF RIGHTS, which influenced THOMAS JEFFERSON and was used as a model by other states. A member of the Virginia House of Delegates (1776–88), he attended the CONSTITUTIONAL CONVENTION but did not sign the CONSTITUTION OF THE UNITED STATES, which he believed granted large and indefinite powers to the central government.

George Mason, detail of an oil painting by L. Guillaume after a portrait by J. Hesselius; in the collection of the Virginia Historical Society
COURTESY OF THE VIRGINIA HISTORICAL SOCIETY

Mason, James (b. May 15, 1909, Huddersfield, Yorkshire, Eng.—d. July 27, 1984, Lausanne, Switz.) British film actor. After studying architecture at the University of Cambridge, he made his screen debut in *Late Extra* (1935) and soon became a star in British films such as *The Man in Grey* (1943), *The Seventh Veil* (1945), and *Odd Man Out* (1947). He moved to Hollywood in the late 1940s but continued to make films in Britain as well. Noted for his urbane characterizations of flawed individuals, he appeared in more than 100 movies, including *Madame Bovary* (1949), *A Star Is Born* (1954), *North by Northwest* (1959), *Lolita* (1962), *Georgy Girl* (1966), *The Boys from Brazil* (1978), and *The Verdict* (1982).

Mason, James Murray (b. Nov. 3, 1798, Fairfax county, Va., U.S.—d. April 28, 1871, Alexandria, Va.) U.S. politician. A grandson of GEORGE MASON, he practiced law in his native Virginia from 1820. He served in the state legislature (1826, 1828–32), the U.S. House of Representatives (1837–39), and the U.S. Senate (1847–61). An advocate of secession, he resigned his Senate seat in 1861. Appointed Confederate commissioner to England, he was captured at sea with JOHN SLIDELL aboard the *Trent* and imprisoned for two months (see TRENT AFFAIR). Released in 1862, he remained in England until 1865 but was unable to win support for the Confederate cause.

Mason-Dixon Line Originally, the boundary between Maryland and Pennsylvania. The 233-mi (375-km) line was surveyed by Charles Mason and Jeremiah Dixon in 1765–68 to define the disputed boundaries between the land grants of the Penns, proprietors of Pennsylvania, and the Baltimores, proprietors of Maryland. The term was first used in congressional debates leading to the MISSOURI COMPROMISE (1820) to describe the dividing line between the slave states to its south and the free-soil states to its north. It is still used as the figurative dividing line between the North and South.

masonry Craft of building in stone, BRICK, or block. By 4000 BC, Egypt had developed an elaborate cut-stone technique. In Crete, Italy, and Greece, cyclopean work overcame material weaknesses by using enormous irregularly shaped stones without mortar, thereby reducing the number of joints. African stonemasons also were skilled at mortarless work, and Japanese mortarless castle walls resisted collapse during earthquakes. The Roman inventions of concrete and mortar permitted the development of the ARCH into one of the basic construction forms and gave rise to a number of variations in the facing used for walls: squared stone blocks, concrete studded with rough stones, concrete with diagonal stone courses, brick- and tile-faced concrete, and mixed brick and stone. The Assyrian and Persian empires, which lacked stone outcroppings, used sun-dried clay bricks. Stone and clay were the primary masonry materials in the Middle Ages and later. PRECAST-CONCRETE blocks, often used as infill in modern steel framing, did not effectively compete with brick until the 20th century. Brick and block are often combined or used in CAVITY WALLS. Glass-block walls, which utilize steel rods to reinforce the mortar joints, admit light and afford greater protection against intruders and vandals than ordinary glass. See also ADOBE, building STONE.

Masqat See MUSCAT

masque Short dramatic entertainment performed by masked actors. It originated in the folk ceremony known as mummery (see MUMMING PLAY) and evolved into elaborate court spectacles in the 16th–17th centuries. A masque presented an allegorical theme using speeches, dances, and songs, in a performance often embellished with rich costumes and spectacular scenery. The genre reached its height in 17th-century England when the court poet, BEN JONSON, collaborating with INIGO JONES on many notable masques (1605–34), gave it literary force. The masque later developed into OPERA.

mass Quantitative measure of INERTIA, or the resistance of a body to a change in motion. The greater the mass, the smaller is the change produced by an applied force. Unlike WEIGHT, the mass of an object remains constant regardless of its location. Thus, as a satellite moves away from the gravitational pull of the Earth, its weight decreases but its mass remains the same. In ordinary, classical chemical reactions, mass can be neither created nor destroyed. The sum of the masses of the reactants is always equal to the sum of the masses of the products. For example, the mass of wood and oxygen that disappears in combustion is equal to the mass of water vapour, carbon dioxide, smoke, and ash that appears. However, ALBERT EINSTEIN's special theory of RELATIVITY shows that mass and energy are equivalent, so mass can be converted into energy and vice versa. Mass is converted into energy in NUCLEAR FUSION and NUCLEAR FISSION. In these instances, conservation of mass is seen as a special case of a more general conservation of mass-energy. See also CRITICAL MASS.

mass Celebration of the EUCHARIST in the Roman Catholic church. It is considered a sacramental reenactment of the death and resurrection of JESUS as well as a true sacrifice in which the body and blood of Jesus (the bread and wine) are offered to God. It is also seen as a sacred meal that unifies and nourishes the community of believers. The mass includes readings from Scripture, a sermon, an offertory, a eucharistic prayer, and communion. The rite was greatly changed after the Second VATICAN COUNCIL, notably in the adoption of vernacular languages in place of Latin. See also SACRAMENT, TRANSUBSTANTIATION.

mass action, law of Fundamental law of chemical kinetics (the study of rates of CHEMICAL REACTIONS), formulated in 1864–79 by the Norwegian scientists Cato M. Guldberg (1836–1902) and Peter Waage (1833–1900). The law states that the REACTION RATE of any simple chemical reaction is proportional to the product of the molar concentrations of the reacting substances, each raised to the power corresponding to the number of MOLECULES of that substance in the reaction.

mass-energy equation See EINSTEIN'S MASS-ENERGY RELATION

mass flow *or* **convection** In physiology, the mechanism responsible for movement of air from the atmosphere into the LUNGS and for movement of BLOOD between the lungs and the tissues. It is one of two principal mechanisms of exchange by which oxygen and carbon dioxide move between the environment and the tissues, the other being DIFFUSION. Local

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flows (e.g., through skeletal muscles during exercise) can be increased selectively, increasing the exchange of gases between tissue cells and the capillaries.

mass movement *or* **mass wasting** Bulk movements of soil and rock debris down slopes, or the sinking of confined areas of the Earth's ground surface. The term *mass wasting* refers only to gravity-driven processes that move large masses of earthen material from one place to another. The term *mass movement* includes the sinking of confined areas.

mass production Application of the principles of specialization, DIVISION OF LABOUR, and standardization of parts to the manufacturing of goods on a large scale. Modern mass-production methods have led to such improvements in the cost, quality, quantity, and variety of goods available that the largest global population in history is now sustained at the highest general standard of living ever. The requirements for mass production of a particular product include the existence of a market large enough to justify a large investment; a product design that can use standardized parts (see INTERCHANGEABLE PARTS) and processes; a physical layout that minimizes materials handling; division of labour into simple, short, repetitive steps (see TIME-AND-MOTION STUDY); continuous flow of work; and tools designed specifically for the tasks to be performed. See also ASSEMBLY LINE.

mass spectrometry *or* **mass spectroscopy** Analytic technique by which chemical substances are identified by sorting gaseous IONS by mass using ELECTRIC and MAGNETIC fields. A mass spectrometer uses electrical means to detect the sorted ions, while a mass spectrograph uses photographic or other nonelectrical means; either device is a mass spectroscope. The process is widely used to measure masses and relative abundances of different ISOTOPES, to analyze products of a separation by liquid or gas CHROMATOGRAPHY, to test vacuum integrity in high-vacuum equipment, and to measure the geological age of minerals.

mass transit Transportation systems, usually publicly but sometimes privately owned and operated, designed to move large numbers of people in various types of vehicles in cities, suburbs, and large metropolitan areas. Modern mass transit is an outgrowth of industrialization and urbanization. In the 1830s early mass transit in New York City included horse-drawn buses, which were soon replaced by fixed-rail horse-drawn trolleys. By 1900 motorized BUSES had appeared in Europe and America. With the advent of electricity, STREETCARS and SUBWAYS were introduced in many large cities. In the 20th century the AUTOMOBILE's increasing popularity undermined mass transit development; fixed-rail streetcar systems were widely removed to provide space for cars. Concern over air pollution has revived interest in light-rail transit and has led to regional mass transit systems.

Massachusetts *officially* **Commonwealth of Massachusetts** State (pop., 2000: 6,349,097), northeastern U.S. One of the NEW ENGLAND states, it lies on the Atlantic Ocean and is bordered by Vermont, New Hampshire, Rhode Island, Connecticut, and New York. It covers 8,262 sq mi (21,399 sq km); its capital is BOSTON. The state's soils are poor and rocky, and agriculture plays a limited role in the economy, although cranberry farming is important. The region was inhabited by Algonquian Indian peoples when the first English settler, Bartholomew Gosnold, arrived in 1602. PLYMOUTH was settled by the PILGRIMS, who arrived on the *Mayflower* in 1620. The MASSACHUSETTS BAY COLONY was founded and governed by the Massachusetts Bay Co., spurring Puritan settlement. It joined the NEW ENGLAND CONFEDERATION in 1643 and acquired MAINE in 1652. The southeastern and central settlements in the state experienced KING PHILIP'S WAR in 1675. After losing its first charter in 1684, it became part of the Dominion of New England in 1686. Its second charter in 1691 granted the colony jurisdiction over Maine and Plymouth. In the 18th century Massachusetts became a centre of resistance to British colonial policy; it was the scene of the BOSTON TEA PARTY and of uprisings at the Battles of LEXINGTON AND CONCORD that marked the beginning of the AMERICAN REVOLUTION. In 1788, it became the sixth state to ratify the U.S. Constitution. It was in the forefront of the 19th century INDUSTRIAL REVOLUTION and was known for its textile mills. Today its major industries are electronics, high technology, and communications. It is well-known as the location of many institutions of higher learning. Tourism is important especially in the CAPE COD region and the BERKSHIRES.

Massachusetts Bay Colony Early English colony in MASSACHUSETTS. It was settled in 1630 by a group of 1,000 Puritan refugees from England (see PURITANISM). In 1629 the Massachusetts Bay Co. had obtained an English charter allowing it to trade and colonize in New England. Puritan stockholders envisioned the colony as a refuge from religious persecution in England, and they transferred control of the company to the emigrants in Massachusetts. Led by JOHN WINTHROP, the colonists founded their colony on the CHARLES RIVER at what would become BOSTON. In 1684 England annulled the company's charter and in 1691 established royal government under a new charter, which merged PLYMOUTH colony and Maine into the Massachusetts Bay Colony.

Massachusetts Institute of Technology (MIT) U.S. private university in Cambridge, famous for its scientific and technological training and research. Founded in 1861, MIT has schools of architecture and planning, engineering, humanities and social sciences, management (the Sloan School), and science and a college of health sciences and technology. Though it is best known for its programs in engineering and the physical sciences, other areas such as economics, political science, urban studies, linguistics, and philosophy are also strong. Among its facilities are a nuclear reactor, a computation centre, geophysical and astrophysical observatories, a linear accelerator, a space research centre, supersonic wind tunnels, an artificial-intelligence laboratory, a centre for cognitive science, and an international-studies centre.

massage \mə-'säzh\ Systematic, scientific manipulation of body tissues with the hands to relieve pain and reduce swelling, relax muscles, and speed healing after strains and sprains. It has been used for more than 3,000 years by the Chinese. Early in the 19th century, the Swedish physician Per Henrik Ling (1776–1839) devised a massage system for joint and muscle ailments, which was later extended to relieve deformities of arthritis and re-educate muscles following paralysis. Manipulations include light or hard stroking, compression (kneading, squeezing, and friction), and percussion (striking with the edges of the hands in rapid alternation). In ACUPRESSURE, a style of massage derived from China, pressure is exerted on Chinese ACUPUNCTURE points for healing effects. See also PHYSICAL MEDICINE AND REHABILITATION.

Massasoit \ˌmas-ə-'sȯit\ (b. c. 1590, near present Bristol, R.I.—d. 1661, near Bristol) American Indian chief. He was the grand sachem (intertribal chief) of the Wampanoag Indians, who inhabited parts of Massachusetts and Rhode Island. In March 1621, several months after the *Mayflower* landed, he journeyed to Plymouth and established peaceful relations with the settlers, with whom he shared techniques of planting, fishing, and cooking. In 1623 he was nursed back to health from a serious illness by grateful Pilgrims. After his death, good will gradually dissolved, leading to the bloody KING PHILIP'S WAR (1675), which was led by his son METACOM.

Masséna \mȧ-sā-'nȧ**, André, duke de Rivoli** *later* **prince d'Essling** (b. May 6, 1758, Nice, France—d. April 4, 1817, Paris) French general. Entering the military in 1775, he served in the Revolutionary government's army and rose to general in 1793. In campaigns against the Austrians in Italy, he became NAPOLEON's most trusted officer; he then commanded the French army in Switzerland, defeating the Russians at Zürich (1799). Sent by Napoleon to restore the demoralized army of Italy, he successfully defended Genoa against Austrian besiegers and enabled the French victory at the Battle of MARENGO. He was made a marshal in 1804 and duke de Rivoli in 1808. He displayed heroism against the Austrians, notably at Aspern-Essling and the Battle of WAGRAM (1809), and Napoleon made him prince d'Essling (1810). In command of the French forces in Portugal and Spain (1810–11), he was defeated by the British under the duke of WELLINGTON. Masséna was relieved of his command and returned to Paris, where he supported the restoration of the monarchy.

Massenet \ˌma-sᵊn-'ā**, Jules (-Émile-Frédéric)** (b. May 12, 1842, Montaud, near Saint-Étienne, France—d. Aug. 13, 1912, Paris) French composer. He attended the Paris Conservatoire from 1851. When his family left Paris in 1854, he ran away to continue his studies, playing piano and drums and teaching to support himself. His hard work paid off when he won the Prix de Rome in 1863, and he began writing operas in 1867. His reputation was established with his oratorio *Marie-Magdeleine* (1873), and his *Le Roi de Lahore* was performed at the Paris Opéra in 1877. There followed the series of successes for which he is chiefly known, including *Hérodiade* (1881), *Manon* (1884), *Le Cid* (1885), *Esclarmonde* (1889), *Werther* (1892), *Thaïs* (1894), and *Don Quichotte* (1910).

Massey, (Charles) Vincent (b. Feb. 20, 1887, Toronto, Ont., Can.—d. Dec. 30, 1967, London, Eng.) Canadian administrator, first Canadian governor-general of Canada (1952–59). He taught history at the University of Toronto from 1913 to 1915. During World War I he served

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as associate secretary of the cabinet war committee. After the war he operated a farm-machinery business until 1925. Active in Liberal Party politics, he served in the cabinet of W.L. Mackenzie King (1925) and was later Canada's first minister to the U.S. (1926–30) and high commissioner for Canada in Britain (1935–46). After serving as chancellor of the University of Toronto (1947–52), he was named governor-general. His brother was the actor Raymond Massey (1896–1983).

Massif Central \ma-'sēf-sä^{n}-'träl\ Plateau region, south-central France. It is bordered by the lowlands of Aquitaine, the Loire basin, the Rhône-Saône valley, and the Mediterranean coastlands of Languedoc. Comprising about one-sixth of France, it occupies an area of 35,006 sq mi (90,665 sq km). It consists mainly of plateaus with elevations of 2,000 to 3,000 ft (600 to 900 m). Its highest peak is Puy de Sancy, which reaches 6,184 ft (1,885 m). It is the source of many rivers, including the Loire, Allier, Cher, and Creuse.

Massine \ma-'sēn**, Léonide** *orig.* **Leonid Fyodorovich Miassin** (b. Aug. 9, 1896, Moscow, Russia—d. March 15, 1979, Cologne, W.Ger.) Russian-born French dancer, teacher, and choreographer. He joined the Ballets Russes in 1914 and produced his first ballet, *Midnight Sun*, in 1915; this was followed by *Parade* (1917), *The Three-Cornered Hat* (1919), and *Pulcinella* (1920). He extended Michel Fokine's reforms by enriching the characterization of many roles. During 1932–38 he was principal dancer and choreographer for the Ballet Russe de Monte Carlo. His ballets *Les Présages* (1933), *Choreartium* (1933), and *Rouge et noir* (1939) displayed innovative choreography and set designs and were among the first dances based on symphonies. In 1938–42 he directed his re-formed Ballet Russe de Monte Carlo, and he became artistic director of a new Ballet de Monte Carlo in 1966.

Massinger \'ma-sin-jər**, Philip** (b. 1583, near Salisbury, Wiltshire, Eng.—d. March 1639/40, London) English playwright. After a period during which he collaborated with playwrights such as John Fletcher, Massinger began c. 1620 to write independently. From 1625 he was associated with the theatrical company The King's Men. His 15 surviving solo works are noted for their social realism and satirical power. They include the comedies *A New Way to Pay Old Debts* (c. 1624), his most popular and influential play, and *The City Madam* (c. 1632), both of which probed economic and social issues, and the historical tragedy *The Roman Actor* (c. 1626).

Masson \mä-'sō^{n}**, André (-Aimé-René)** (b. Jan. 4, 1896, Balagny, France—d. Oct. 28, 1987, Paris) French painter and graphic artist. After studying painting in Brussels and Paris, he was severely wounded in World War I, and an overriding pessimism penetrated his art. He joined the Surrealist movement in 1924 and became the leading practitioner of automatism. In the late 1920s and '30s he produced turbulent images of violence, psychic pain, eroticism, and physical metamorphosis, using sinuous lines to delineate abstract biomorphic forms. He lived in Spain (1934–36) and later the U.S. (1941–45), where he became an important link between Surrealism and Abstract Expressionism. He later returned to France and concentrated on landscape painting.

mastaba \'mas-tə-bə\ (Arabic: "bench") Rectangular superstructure of ancient Egyptian tombs, built of mud brick or, later, stone, with sloping walls and a flat roof. A deep shaft descended to the underground burial chamber. Old Kingdom mastabas were used chiefly for nonroyal burials. Storage chambers were stocked with food and equipment, and walls were often decorated with scenes showing the deceased's expected daily activities. What had earlier been a niche on the side grew into a chapel with an offering table and a false door through which the spirit of the deceased could leave and enter the burial chamber.

mastectomy \ma-'stek-tə-mē\ Surgical removal of a breast, usually because of breast cancer. If the cancer has spread, radical mastectomy may remove surrounding tissue and/or nearby structures, including chest muscles and lymph nodes. Modified radical mastectomy leaves at least the main chest muscle, has an equally high survival rate, and makes reconstruction easier. Simple mastectomy is removal of the breast only. Lumpectomy is removal of the tumour only.

master of the animals See master of the animals

Masters, Edgar Lee (b. Aug. 23, 1869, Garnett, Kan., U.S.—d. March 5, 1950, Philadelphia, Pa.) U.S. poet and novelist. He grew up on his grandfather's farm and became a lawyer in Chicago. He wrote undistinguished poetry and plays before publishing *Spoon River Anthology* (1915), his major work. Its 245 free-verse epitaphs in the form of monologues are spoken from the grave by the former inhabitants of a fictitious small town, who tell of their bitter, unfulfilled lives in its dreary confines.

Edgar Lee Masters
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.; PHOTOGRAPH, ARNOLD GENTHE

Masters, William H(owell); and Johnson, Virginia E(shelman) (respectively b. Dec. 27, 1915, Cleveland, Ohio, U.S.—d. Feb. 16, 2001, Tucson, Ariz.; b. Feb. 11, 1925, Springfield, Missouri, U.S.) U.S. human-sexuality research team. Together (as physician and psychologist, respectively), they founded and codirected the Masters & Johnson Institute in St. Louis. They observed couples having sex under laboratory conditions, using biochemical equipment to record sexual stimulations and reactions. Their book *Human Sexual Response* (1966) was considered the first comprehensive study of the physiology and anatomy of human sexual activity (see sexual response). They were married in 1971 and continued to collaborate after their divorce in 1993.

Masters Tournament Invitational golf competition held annually since 1934 at the Augusta National Golf Club, Augusta, Ga., U.S. One of the world's most prestigious golf contests, it comprises 72 holes of stroke play (the player with the lowest score wins). The course, famous for its beauty and for the speed and difficulty of its greens, was designed by Bobby Jones and Alister MacKenzie. The tournament is held during the first full week in April.

Masterson, Bat *orig.* **Bartholomew Masterson** (b. Nov. 27, 1853, Henryville, Canada East—d. Oct. 25, 1921, New York, N.Y., U.S.) Canadian-born U.S. lawman and gambler. He grew up on successive family farms in New York, Illinois, and Kansas. In Dodge City, Kan., he worked as a buffalo hunter and Indian scout (1873–75), as sheriff of Ford county (1877–79), and as deputy U.S. marshal (1879). In Tombstone, Ariz. (1880–81), he worked briefly with Wyatt Earp at the Oriental Saloon. He lived a gambler's life in Denver (1887–1902) and then moved to New York City, where he was a deputy U.S. marshal (1905–07) and later a prominent sports editor for the *Morning Telegraph*.

mastication See chewing

mastiff Breed of powerful but gentle dog of Europe and Asia dating to 3000 BC. Mastiffs fought bears, lions, tigers, bulls, and gladiators in Roman arenas and were used in English bull- and bear-baiting rings. The mastiff stands 28–30 in. (70–75 cm) tall and weighs 165–185 lbs (75–85 kg). It has a broad head, short dark muzzle, and dark drooping ears. Its short coat is apricot, silver fawn, or brindled. The bullmastiff, a bulldog-mastiff crossbreed standing 24–27 in. (61–69 cm) tall and weighing 100–130 lbs (45–59 kg), is used as a police and guard dog.

Mastiff
SALLY ANNE THOMPSON/EB INC.

mastitis \ma-'stī-təs\ Inflammation of the breast. Acute mastitis, usually caused by bacteria, begins almost exclusively in the first three weeks of nursing and can be cured with antibiotics without stopping nursing. The breasts may become swollen, red, hard, and tender; without treatment abscesses may occur. Mastitis can be localized or widespread, and the breast's lymphatic system may be involved. Girls may have brief hormone-induced breast inflammation soon after birth and during puberty. Chronic mastitis usually occurs in systemic diseases (e.g., tuberculosis, syphilis). One rare type is seen mostly in older women with a history of difficult nursing. Some mastitis cases resemble certain cancers.

mastodon \'mas-tə-ˌdän\ Any of several extinct elephant species (genus *Mastodon*) that lived worldwide 23.7 million–10,000 years ago or later

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in North America, where they were contemporaneous with historic American Indian groups. Well-preserved remains are quite common. Mastodons ate leaves and had small grinding teeth and long, parallel, upward-curving upper tusks; males also had short lower tusks. Shorter than modern elephants, they had long, heavily built bodies and short, pillarlike legs. Their long hair was reddish brown. The skull was similar to that of modern elephants but lower and flatter, and the ears were small. Human hunting may have played a role in the mastodon's extinction. See also MAMMOTH.

mastoiditis \ˌmas-ˌtȯid-ˈī-təs\ INFLAMMATION of the mastoid process, a bony projection just behind the ear, almost always due to OTITIS media. It may spread into small cavities in the bone, blocking their drainage. Very severe cases infect the whole middle ear cleft. It causes pain behind the ear and on the side of the head. Temperature and pulse rate may rise. Tissues over the bone may swell until an ABSCESS develops, indicating destruction of the bone's outer layer. Complications of inward spread include abscess inside the skull, THROMBOSIS, and INNER-EAR infection; meningitis is a serious danger. Now rare with treatment of otitis media, mastoiditis usually responds to early ANTIBIOTIC treatment; if not, surgical drainage with removal of all diseased bone is necessary.

Mastroianni \mäs-trȯy-ˈä-nē**, Marcello** (b. Sept. 28, 1924, Fontana Liri, Italy—d. Dec. 19, 1996, Paris, France) Italian film actor. He made his film debut in 1947 and was a well-known actor in Italy by the mid-1950s. Darkly handsome, with a screen persona alternately winning and morose, he won international fame in films such as LUCHINO VISCONTI's *White Nights* (1957) and FEDERICO FELLINI's *La dolce vita* (1960). He acted in more than 100 movies, including *8½* (1963), *Yesterday, Today, and Tomorrow* (1963), *We All Loved Each Other So Much* (1975), *Dark Eyes* (1987), and *Voyage to the Beginning of the World* (1997).

masturbation Erotic stimulation of one's own genital organs, usually to achieve orgasm. Masturbatory behavior is common in infants and adolescents, and is indulged in by many adults as well. Studies indicate that over 90% of U.S. males and 60–80% of U.S. females have masturbated at one time or another. Christian moral teaching condemned masturbation as the sin of Onan, who in the Old Testament was censured for spilling his seed, and the Roman Catholic Church still officially condemns it.

Masurian \mə-ˈzůr-ē-ən\ **Lakeland** Lake district, northeastern Poland, containing more than 2,000 lakes. It extends 180 mi (290 km) eastward from the lower VISTULA RIVER to the Poland-Belarus border and occupies an area of 20,000 sq mi (52,000 sq km). It was the scene of Russian defeats in 1914–15 during World War I. It came under Russian control in January 1945 but was later granted to Poland by the POTSDAM CONFERENCE.

Mata Hari *orig.* **Margaretha Geertruida Zelle** (b. Aug. 7, 1876, Leeuwarden, Neth.—d. Oct. 15, 1917, Vincennes, near Paris, France) Dutch courtesan and alleged spy in World War I. In 1895 she married Campbell MacLeod, a Scottish officer, and lived in Java and Sumatra (1897–1902), after which they returned to Europe and separated. In 1905 she began to dance in Paris, calling herself Mata Hari (a Malay expression for the sun). Beautiful and exotic and willing to dance virtually nude, she soon had numerous lovers, including military officers. Details of her spying activities are unclear, but she apparently spied for Germany from 1916. She was arrested by the French in 1917, tried by a military court, and shot by firing squad.

Mata Hari.
H. ROGER-VIOLLET/HARLINGUE

Matabele See NDEBELE

matador In BULLFIGHTING, the principal performer, who works the capes and attempts to dispatch the bull with a sword thrust between the shoulder blades. Most of the techniques used by modern matadors were established in the 1910s by Juan Belmonte (b. 1894–d. 1962) of Spain. The matador's traditional costume, which offers no protection, is known as the "suit of lights." The audience judges the matador according to his skill, grace, and daring. Almost every matador is gored at least once a season with varying degrees of severity, and many have received fatal wounds in the ring.

Matamba \mä-ˈtäm-bə\ Historic African kingdom of the MBUNDU people, located northeast of LUANDA, Angola. A strong state in the early 16th century, it came into conflict with the Portuguese colonists of Angola. About 1630 it was conquered by Nzinga, ex-ruler of NDONGO, who strengthened it and stopped Angola's eastward expansion in the 1670s. A 1684 treaty remained in effect until the Portuguese seized part of Matamba's territory in 1744. The rest of it, assigned to Angola by European treaties of 1870–1900, remained a self-governing kingdom until it was occupied by Portuguese troops in the early 20th century.

Matamoros City (pop., 2000: 376,279), northern TAMAULIPAS state, Mexico. It is situated on the southern bank of the RIO GRANDE, across from Brownsville, Texas, U.S. Founded in 1824, it was the scene of bitter fighting in the MEXICAN WAR and was occupied by U.S. troops in 1846. It is now one of Mexico's chief ports of entry for tourists and a trade centre.

Matapédia \ˌma-tə-ˈpē-dē-ə\ **Valley** Valley of the Notre Dame Mountains, GASPÉ PENINSULA, eastern Quebec province, Canada. Extending for some 60 mi (100 km), it forms a direct lowland route through the mountains from the ST. LAWRENCE RIVER to the Atlantic coast. It serves as an important transportation route between the MARITIME PROVINCES and the Canadian mainland. It is drained by the Matapédia River, which flows 50 mi (80 km) to join the Restigouche River.

Mataram \mə-ˈtä-rəm\ Historic kingdom, JAVA. Originally a vassal state of Pajang, it became powerful under Senapati, who became its first king in the late 16th century. Its territory expanded in the early 17th century, but the kingdom later began to decline. In the mid-18th century it lost both power and territory to the Dutch EAST INDIA CO., and was a vassal state of the company by 1749. Wars of succession in 1755 led to its division into the regions of Surakarta and Yogyakarta.

matchlock Device for igniting GUNPOWDER, invented in the 15th century. The first mechanical ignition system, it represented a major advance in small-arms manufacture. It consisted of an S-shaped arm, called a serpentine, that held a match, and a trigger device that lowered the serpentine so the lighted match would fire the priming powder in the pan at the side of the barrel. The flash in the pan penetrated a small port in the breech and lit the main charge. Though slow and somewhat clumsy, the matchlock was useful because it protected all the working elements inside the lock and freed the user's hand. Early matchlock guns included the MUSKET.

maté *or* **yerba maté** \ˈmä-tā\ Stimulating tealike beverage, popular in many South American countries, brewed from the dried leaves of an evergreen shrub or tree (*Ilex paraguariensis*) related to HOLLY. It contains caffeine and tannin but is less astringent than tea. To brew maté, the dried leaves (*yerba*) are placed in dried hollow gourds (*matés* or *culhas*) decorated with silver and covered with boiling water and steeped. The tea is sucked from the gourd with a tube, often made of silver, with a strainer at one end to catch leaf particles. Though usually served plain, maté is sometimes flavored with milk, sugar, or lemon juice.

Silver vessel for the preparation and serving of maté; in a private collection.
LIBRAIRIE LAROUSSE

material implication See IMPLICATION

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materialism In METAPHYSICS, the doctrine that all of reality is essentially of the nature of matter. In the philosophy of MIND, one form of materialism, sometimes called central-state materialism, asserts that states of the mind are identical to states of the human brain. In order to account for the possible existence of mental states in creatures that do not share the human nervous system (e.g., octopuses and Martians), proponents of functionalism identified particular mental states with the functional or causal roles those states play with respect to other physical and mental states of the organism; this allows for the "multiple realizability" of the same mental state in different physical states. (Strictly speaking, functionalism is compatible with both materialism and non-materialism, though most functionalists are materialists.) As a form of materialism, functionalism is "nonreductive," because it holds that mental states cannot be completely explained in terms that refer only to what is physical. Though not identical with physical states, mental states are said to "supervene" on them, in the sense that there can be no change in the former without some change in the latter. "Eliminative" materialism rejects any aspect of the mental that cannot be explained wholly in physical terms; in particular, it denies the existence of the familiar categories of mental state presupposed in FOLK PSYCHOLOGY. See also IDENTITY THEORY; MIND-BODY PROBLEM.

materials science Study of the properties of solid materials and how those properties are determined by the material's composition and structure, both macroscopic and microscopic. Materials science grew out of solid-state physics, metallurgy, ceramics, and chemistry, since the numerous properties of materials cannot be understood within the context of any single discipline. With a basic understanding of the origins of properties, materials can be selected or designed for an enormous variety of applications, from structural steels to computer microchips. Materials science is therefore important to many ENGINEERING fields, including electronics, aerospace, telecommunications, information processing, nuclear power, and energy conversion. See also MECHANICS, METALLOGRAPHY, STRENGTH OF MATERIALS, TESTING MACHINE.

mathematical physics Branch of mathematical ANALYSIS that emphasizes tools and techniques of particular use to physicists and engineers. It focuses on VECTOR SPACES, MATRIX algebra, DIFFERENTIAL EQUATIONS (especially for boundary value problems), INTEGRAL EQUATIONS, INTEGRAL TRANSFORMS, INFINITE SERIES, and COMPLEX VARIABLES. Its approach can be tailored to applications in electromagnetism, classical MECHANICS, and QUANTUM MECHANICS.

mathematical programming Application of mathematical and computer programming techniques to the construction of deterministic models, principally for business and economics. For models that only require linear algebraic equations, the techniques are called LINEAR PROGRAMMING; for models that require more complex equations, it is called nonlinear programming. In either case, models frequently involve hundreds or thousands of equations. The discipline emerged during World War II to solve large-scale military LOGISTICS problems. Mathematical programming is also used in planning civilian production and transportation schedules and in calculating economic growth.

mathematics Science of structure, order, and relation that has evolved from counting, measuring, and describing the shapes of objects. It deals with logical reasoning and quantitative calculation. Since the 17th century it has been an indispensable adjunct to the physical sciences and technology, to the extent that it is considered the underlying language of science. Among the principal branches of mathematics are ALGEBRA, ANALYSIS, ARITHMETIC, COMBINATORICS, EUCLIDEAN and NON-EUCLIDEAN geometries, GAME THEORY, NUMBER THEORY, NUMERICAL ANALYSIS, OPTIMIZATION, PROBABILITY, SET THEORY, STATISTICS, TOPOLOGY, and TRIGONOMETRY.

mathematics, foundations of Scientific inquiry into the nature of mathematical theories and the scope of mathematical methods. It began with EUCLID's *Elements* as an inquiry into the logical and philosophical basis of mathematics—in essence, whether the AXIOMS of any system (be it EUCLIDEAN GEOMETRY or CALCULUS) can ensure its completeness and consistency. In the modern era, this debate for a time divided into three schools of thought: LOGICISM, formalism, and INTUITIONISM. Logicists supposed that abstract mathematical objects can be entirely developed starting from basic ideas of sets and rational, or logical, thought; a variant of logicism, known as mathematical PLATONISM, views these objects as existing external to and independent of an observer. Formalists believed mathematics to be the manipulation of configurations of symbols according to prescribed rules, a "game" independent of any physical interpretation of the symbols. Intuitionists rejected certain concepts of logic and the notion that the AXIOMATIC METHOD would suffice to explain all of mathematics, instead seeing mathematics as an intellectual activity dealing with mental constructions (see CONSTRUCTIVISM) independent of language and any external reality. In the 20th century, GÖDEL'S THEOREM ended any hope of finding an axiomatic basis of mathematics that was both complete and free from contradictions.

mathematics, philosophy of Branch of philosophy concerned with the EPISTEMOLOGY and ONTOLOGY of mathematics. Early in the 20th century, three main schools of thought—called LOGICISM, formalism, and INTUITIONISM—arose to account for and resolve the crisis in the foundations of mathematics. Logicism argues that all mathematical notions are reducible to laws of pure thought, or logical principles; a variant known as mathematical PLATONISM holds that mathematical notions are transcendent Ideals, or Forms, independent of human consciousness. Formalism holds that mathematics consists simply of the manipulation of finite configurations of symbols according to prescribed rules; a "game" independent of any physical interpretation of the symbols. Intuitionism is characterized by its rejection of any knowledge- or evidence-transcendent notion of truth. Hence, only objects that can be constructed (see CONSTRUCTIVISM) in a finite number of steps are admitted, while actual infinities and the law of the excluded middle (see laws of THOUGHT) are rejected. These three schools of thought were principally led, respectively, by BERTRAND RUSSELL, DAVID HILBERT, and the Dutch mathematician Luitzen Egbertus Jan Brouwer (1881–1966).

Mather \'ma-thər**, Cotton** (b. Feb. 12, 1663, Boston, Massachusetts Bay Colony—d. Feb. 13, 1728, Boston) American Puritan leader. The son of INCREASE MATHER, he earned a master's degree from Harvard College and was ordained a Congregational minister in 1685, after which he assisted his father at Boston's North Church (1685–1723). He helped work for the ouster of the unpopular British governor of Massachusetts, EDMUND ANDROS (1689). Though his writings on witchcraft fed the hysteria that resulted in the SALEM WITCH TRIALS, he disapproved of the trials and argued against the use of "spectral evidence." His best-known writings include *Magnalia Christi Americana* (1702), a church history of New England, and his *Diary* (1711–12). His *Curiosa Americana* (1712–24) won him membership in the Royal Society of London. He was an early supporter of smallpox inoculation. See also CONGREGATIONALISM; PURITANISM.

Cotton Mather, portrait by Peter Pelham; in the collection of the American Antiquarian Society, Worcester, Mass.
COURTESY OF THE AMERICAN ANTIQUARIAN SOCIETY, WORCESTER, MASS.

Mather, Henry See Charles S. and Henry M. GREENE

Mather, Increase (b. June 21, 1639, Dorchester, Massachusetts Bay Colony—d. Aug. 23, 1723, Boston) American Puritan leader. The son of a Puritan cleric, he was educated at Harvard College and at Trinity College, Dublin. He returned to New England and served as minister of Boston's North Church (1661–1723). He and his son COTTON MATHER lobbied successfully for the removal of the hated governor of Massachusetts, EDMUND ANDROS, and obtained a new charter for the colony in 1691. He served as president of Harvard College (1685–1701). His writings include *Case of Conscience Concerning Evil Spirits Personating Men* (1693), which helped end the SALEM WITCH TRIALS. See also PURITANISM.

Mathewson, 1909
CULVER PICTURES

Mathewson, Christy *in full* **Christopher Mathewson** (b. Aug. 12, 1880, Factoryville, Pa.,

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U.S.—d. Oct. 7, 1925, Saranac Lake, N.Y.) U.S. baseball pitcher. Mathewson played football and baseball for Bucknell University and was one of the first college-educated men to enter the major leagues. Throwing right-handed for the New York Giants (1900–16), he won more than 20 games in each of 13 seasons, and 30 or more in four of those years. He ranks third in all-time wins (373) and shutouts (80) and fourth in earned run average (2.13). He played for and managed the Cincinnati Reds (1916–18) and later served as president of the Boston Braves (1923–25). He died of tuberculosis at 45.

Mathias \mə-'thī-əs**, Bob** *in full* **Robert Bruce Mathias** (b. Nov. 17, 1930, Tulare, Calif., U.S.) U.S. decathlete. He suffered from anemia as a child and turned to athletics to gain strength. In 1948, at age 17, he won a gold medal in the Olympic DECATHLON, becoming the youngest gold medalist ever to win an Olympic track-and-field event. He won a second decathlon gold medal in 1952; that same year he played fullback on Stanford University's gridiron football team at the Rose Bowl. He won all 11 decathlon competitions he entered in his career. He later served in the U.S. House of Representatives.

Mathura art \'mə-tə-rə\ Buddhist visual art that flourished in the trading and pilgrimage center of Mathura, Uttar Pradesh, India, from the 2nd century BC to the 12th century AD. Standing and seated Buddhas are represented with broad shoulders, large chest, legs apart, and feet firmly planted, conveying a sense of enormous energy. Female figures are frankly sensuous.

A *yaksi* (female nature spirit) holding tray and pitcher, red sandstone relief from Mathura, Uttar Pradesh, India, 2nd century AD; in the Archaeological Museum, Mathura.
P. CHANDRA

Matilda *or* **Maud** (b. 1102, London, Eng.—d. Sept. 10, 1167, near Rouen, Fr.) Daughter of HENRY I of England and claimant to the English throne. She married Emperor Henry V in 1114; he died in 1125, and she made a second marriage to Geoffrey Plantagenet. Her brother's death in 1120 left her as Henry I's sole legitimate heir, and Henry named her as his successor in 1127. STEPHEN of Blois, Henry's nephew, seized the throne on the king's death in 1135, and his army defeated Matilda's supporters in 1141. She continued her resistance and retired to Normandy in 1148. Her son became HENRY II of England, and she remained his adviser and oversaw his continental possesions.

Matilda of Canossa \kə-'nä-sə\ *Italian* **Matilde** *known as* **Matilda the Great Countess** (b. 1046, Lucca, Tuscany—d. July 24, 1115, Bondeno, Romagna) Countess of Tuscany. A close friend of Pope GREGORY VII, she backed him in his struggle against King HENRY IV (see INVESTITURE CONTROVERSY), and it was at her castle at Canossa that the king performed his barefoot penance before Gregory (1077). After Henry's second excommunication, she was intermittently at war with him until his death (1106), sometimes donning armour to lead her own troops, and she helped finance the pope's military operations and encouraged Henry's son Conrad to rebel against his father (1093). Her unwavering support for the popes of Rome was honoured by her reburial in St. Peter's Basilica in 1634.

Matisse \mä-'tēs**, Henri (-Émile-Benoît)** (b. Dec. 31, 1869, Le Cateau, Picardy, Fr.—d. Nov. 2, 1954, Nice) French painter, sculptor, and graphic artist. He was a law clerk when he became interested in art. After study with GUSTAVE MOREAU at the École des Beaux-Arts, he exhibited four paintings at the Salon and scored a triumph when the government bought his *Woman Reading* (1895). Self-confident and venturesome, he experimented with pointillism but eventually abandoned it in favour of the swirls of spontaneous brushwork and riots of colour that became known as FAUVISM. Though his subjects were largely domestic and figurative, his works exhibit a distinctive Mediterranean verve. He also took up sculpture and would produce some 60 pieces during his lifetime. The ARMORY SHOW exhibited 13 of his paintings. In 1917 he moved to the French Riviera, where his paintings became less daring but his output remained prodigious. After 1939 he became increasingly active as a graphic artist and in 1947 published *Jazz*, a book of reflections on art and life with brilliantly coloured illustrations made by "drawing with scissors": the motifs were pasted together after being cut out of sheets of coloured paper. He was ill during most of his last 13 years; he designed the magnificent Chapelle du Rosaire at Vence (1948–51) as a gift to the Dominican nuns who cared for him. His well-known paintings include *Joy of Life* (1906), *The Red Studio* (1915), *Piano Lesson* (1916), and *The Dance I* and *The Dance II* (1931–33).

Matlock Town (pop., 1995 est.: 14,000), Derbyshire Dales district, administrative and historic county of DERBYSHIRE, north-central England. It consists of a group of settlements built along the River DERWENT, in a region noted for its beautiful valleys and rugged hills. Between Cromford (site of RICHARD ARKWRIGHT's first water-powered mill in 1771) and the 16th-century Matlock Bridge, the river runs through a narrow gorge. The town was once a famous spa offering hydropathic treatment.

Mato Grosso \'mä-tü-'grō-sü\ State (pop., 2003 est.: 2,651,335), southwestern Brazil. It covers an area of 348,788 sq mi (903,358 sq km), and its capital is Cuiabá. It is bounded by Bolivia on the southwest and west. Cuiabá was founded in 1719 after gold was discovered nearby. In 1748 Mato Grosso became an independent captaincy, in 1822 a province of the empire, and in 1889 a state of the federal union. One of the few great frontier regions still in existence, it consists of grassland, dense forest, and highland plains, with some areas that remain largely unexplored.

matriarchy \'mā-trē-ˌär-kē\ Social system in which familial and political authority is wielded by women. Under the influence of CHARLES DARWIN's theories of evolution and, particularly, the work of the Swiss anthropologist Johann Jakob Bachofen (b. 1815, Basel, Switz.—d. 1887, Basel), some 19th-century scholars believed that matriarchy followed a stage of general promiscuity and preceded male ascendancy (patriarchy) in human society's evolutionary sequence. Like other elements of the evolutionist view of culture, the notion of matriarchy as a universal stage of development is now generally discredited, and the modern consensus is that a strictly matriarchal society has never existed. Nevertheless, in those societies in which matrilineal DESCENT occurs, access to socially powerful positions is mediated through the maternal line of kin. See also SOCIOCULTURAL EVOLUTION.

matrix Set of numbers arranged in rows and columns to form a rectangular array. Matrix elements may also be differential operators, vectors, or functions. Matrices have wide applications in engineering, physics, economics, and statistics, as well as in various branches of mathematics. They are usually first encountered in the study of SYSTEMS OF EQUATIONS represented by matrix equations of the form $Ax = B$, which may be solved by finding the inverse of matrix A or by using an algebraic method based on its DETERMINANT.

matsuri \'mät-sü-ˌrē\ Civil or religious festival in Japan, especially a SHINTŌ shrine festival. It traditionally has two parts: a solemn ritual of worship and a joyous celebration. The participants first purify themselves (see *HARAI*) by periods of abstinence and by bathing. The inner doors of the shrine are then opened, a drum or bells are sounded, and the deity or sacred power (*kami*) is called to descend. The ritual continues with offerings, prayers, and ceremonial music and dancing. The celebration usually includes a feast, dancing, theatrical performances, divination, and athletic contests. A portable shrine housing the *kami* is often taken out and carried in procession.

Matsushita \mät-'sü-shi-tə\ **Electric Industrial Co., Ltd.** Major Japanese manufacturer of electric appliances and consumer electronics products. Founded in 1918 by Matsushita Konosuke (1894–1989) to produce electric lamp sockets and plugs, the company was incorporated in 1935. In the 1930s it manufactured a variety of electrical products, including radios and phonographs. In the 1950s it added television sets, tape recorders, and household appliances; a decade later it brought out microwave ovens, air conditioners, and videotape recorders. It markets prod-

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ucts under such brand names as Panasonic, JVC, and Quasar. Matsushita is noted for its heavy investment in research and development. Its headquarters are in Kadoma, near Ōsaka; it has manufacturing and sales subsidiaries in many overseas markets.

Matteotti \ˌmä-tā-'ȯt-tē**, Giacomo** (b. May 22, 1885, Fratta Polesine, Italy—d. June 10, 1924, Rome) Italian Socialist leader. A lawyer, he joined the Italian Socialist Party and was elected to the Chamber of Deputies in 1919. As head of the Socialists in 1924, he strongly denounced the Fascist Party. Two weeks after his speech, he was kidnapped and murdered by fascists. The murder created a worldwide scandal, and BENITO MUSSOLINI took responsibility as head of the Fascist Party and dared his critics to prosecute him. Opposition was weak, and the Matteotti crisis enabled Mussolini to further consolidate his power.

matter Material substance that constitutes the observable universe and, together with ENERGY, forms the basis of all objective phenomena. ATOMS are the basic building blocks of matter. Every physical entity can be described, physically and mathematically, in terms of interrelated quantities of MASS, INERTIA, and GRAVITATION. Matter in bulk occurs in several states; the most familiar are the gaseous (see GAS), LIQUID, and SOLID states (PLASMAS, GLASSES, and various others are less clearly defined), each with characteristic properties. According to ALBERT EINSTEIN's special theory of RELATIVITY, matter and energy are equivalent and interconvertible (see CONSERVATION LAW).

Matterhorn *French* **Mont Cervin** \ˌmȯⁿ-ser-'veⁿ\ *Italian* **Monte Cervino** \'mȯn-tā-cher-'vē-nō\ Mountain in the ALPS, on the border between Italy and Switzerland. Rising to 14,692 ft (4,478 m), it appears from the Swiss side to be an isolated peak, but it is actually the end of a ridge. The Italian slope is more difficult to climb than the Swiss slope. It was first scaled on July 14, 1865, by British explorer Edward Whymper, who ascended the Swiss side. Three days later Giovanni A. Carrel led an Italian group in the first ascent from the Italian side.

The Matterhorn overlooking an Alpine valley.
© CORBIS

Matthau \'ma-thaù**, Walter** (b. Oct. 1, 1920, New York, N.Y., U.S.—d. July 1, 2000, Santa Monica, Calif.) U.S. actor. He began his career as a child actor in Yiddish theatre and appeared on Broadway in plays such as *Once More, with Feeling* (1958) and *A Shot in the Dark* (1962). He worked steadily as a character actor on the stage and on television in the early 1950s and made his film debut in *The Kentuckian* (1955). He won stardom with his stage role in *The Odd Couple* (1965), which he reprised in the 1968 film version with his frequent costar, JACK LEMMON. Known for his rumpled face, nasal bray, and razor-sharp timing, Matthau appeared in numerous other films, including *The Fortune Cookie* (1966, Academy Award), *Charley Varrick* (1973), *The Sunshine Boys* (1975), *Grumpy Old Men* (1993), and *I'm Not Rappaport* (1996).

Matthew, Saint (fl. 1st century AD, Palestine; Western feast day September 21, Eastern feast day November 16) One of the Twelve APOSTLES, traditional author of the first GOSPEL. According to the Gospels, he was a tax collector known as Levi when Jesus called him to be a disciple. Other information about him is scarce. The Gospel of Matthew is directed at a Jewish-Christian audience in a Jewish environment and may have been written originally in Hebrew, but it is now doubted that the apostle Matthew was its author. Tradition holds that Matthew conducted his ministry in Judaea, after which he served as a missionary to Ethiopia and Persia. Legend differs as to whether he died a martyr's death.

Matthews, Leigh (b. Jan. 3, 1952, Frankston, Victoria, Austl.) Australian Rules football player. A tenacious forward, he was legendary for his robust play and extraordinary skills. He played for Hawthorn (1969–85), scoring 915 goals and helping the team to four league titles. He enjoyed subsequent success as a coach at Collingwood (1986–95) and Brisbane (1999–), guiding both teams to league titles. He was inducted into the Australian Football Hall of Fame and elevated to Legend in 1996.

Matthias I *or* **Matthias Corvinus** \mə-'thī-əs...kȯr-'vī-nəs\ *Hungarian* **Mátyás Corvin** *orig.* **Mátyás Hunyadi** (b. Feb. 24, 1443, Kolozsvár, Transylvania—d. April 6, 1490, Vienna) King of Hungary (1458–90). He spent much of his reign combating the claims of the HABSBURG DYNASTY and attempting to reconstruct the Hungarian state after decades of feudal anarchy. He raised taxes, modernized the army, and codified Hungarian law. After fighting off Turks on Hungary's southern border, Matthias organized a defensive system against them. He gained control of Bosnia (1463) but lost a struggle with Poland for Bohemia. Long a rival of Emperor FREDERICK III, he occupied Vienna and other Habsburg lands, but after his death his conquests were lost.

Matthiessen \'math-ə-sən**, Peter** (b. May 22, 1927, New York, N.Y., U.S.) U.S. naturalist and writer. He attended Yale University and worked as a fisherman on Long Island before undertaking his extensive world travels. His nonfiction, much of it inspired by his career as a naturalist, includes *Wildlife in America* (1959), *The Snow Leopard* (1978, National Book Award), and *In the Spirit of Crazy Horse* (1983). His novels include *At Play in the Fields of the Lord* (1965; film, 1991), *Far Tortuga* (1975), and *Killing Mister Watson* (1990). *The Cloud Forest* (1996) is a chronicle of his travels in South America.

mattock \'ma-tək\ Picklike digging implement, one of the oldest tools of agriculture. It resembles the modern hoe but with a stone or wooden blade rather than a metal one, set at right angles to a long wooden handle. Though large-scale agriculture uses plows, harrows, and rotary hoes that open many rows of a field simultaneously, home gardeners and horticulturists may still use mattocks to loosen dirt and to chop weeds.

Māturīdiyyah \mä-ˌtůr-ē-'dē-ə\ Muslim orthodox school of theology named after its founder, Abū Manṣūr Muḥammad al-Māturīdī (d. 944). It is characterized by reliance on the QUR'ĀN with minimal reasoning and little scope for interpretation. On the question of free will, it once emphasized the absolute omnipotence of God and allowed only limited freedom of action, but it later stated unequivocally that humans have the utmost freedom to act. Unlike the ASHʿARIYYAH (followers of al-AshʿarÄ«), who believed that only God could determine whether a person was saved, the Māturīdiyyah asserted that a Muslim who sincerely performed all religious duties as prescribed in the Qur'ān was assured of a place in heaven.

Mau Mau \'maù-ˌmaù\ Militant KIKUYU-led nationalist movement of the 1950s in Kenya. The Mau Mau (the name's origin is uncertain) advocated violent resistance to British domination in Kenya. In response to actions by Mau Mau rebels, the British Kenya government banned the movement in 1950 and launched a series of military operations between 1952 and 1956. Some 11,000 Kikuyu, 100 Europeans, and 2,000 African loyalists were killed in the fighting; another 20,000 Kikuyu were put into detention camps. Despite their losses, Kikuyu resistance spearheaded the independence movement, and JOMO KENYATTA, jailed as a Mau Mau leader in 1953, became prime minister of independent Kenya in 1963. In 2003 the ban on the Mau Mau was lifted.

Mauchly \'mäk-lē**, John W(illiam)** (b. Aug. 30, 1907, Cincinnati, Ohio, U.S.—d. Jan. 8, 1980, Ambler, Pa.) U.S. physicist and engineer. He joined the faculty at the University of Pennsylvania after completing his graduate studies. During World War II he and J. PRESPER ECKERT were asked by the U.S. Army to devise ways to accelerate the recomputation of artillery firing tables, for which they eventually developed the electronic computer ENIAC. The two men formed a computer-manufacturing firm in 1948, and in 1949 they produced the Binary Automatic Computer (BINAC), which used magnetic tape instead of punched cards for data storage. Their third computer, the UNIVAC I, was designed to handle business data.

Maud See MATILDA

Maudslay \'mȯdz-lē**, Henry** (b. Aug. 22, 1771, Woolwich, Kent, Eng.—d. Feb. 14, 1831, London) British engineer and inventor. The son of a workman, he became the inventor of machines fundamentally important to the INDUSTRIAL REVOLUTION, most outstandingly the metal LATHE. He also invented methods for printing calico cloth and for desalting seawater for ships' boilers, as well as a measuring machine that was accurate to 0.0001 in. (0.00025 cm), and he designed and built many stationary and marine engines. Several outstanding engineers, notably JAMES NASMYTH and JOSEPH WHITWORTH, learned their profession in Maudslay's shop. See also JOSEPH BRAMAH.

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Maugham \'môm**, W(illiam) Somerset** (b. Jan. 25, 1874, Paris, France—d. Dec. 16, 1965, Nice) English novelist, playwright, and short-story writer. He abandoned a short career in medicine when his first novel, *Liza of Lambeth* (1897), had some success. His plays, mainly Edwardian social comedies, brought him financial security. His reputation rests primarily on the novels *Of Human Bondage* (1915), *The Moon and Sixpence* (1919), *Cakes and Ale* (1930), and *The Razor's Edge* (1944), all of which were adapted for film and some for television. His short stories often portray the confusion of Europeans in alien surroundings. His works, regarded less highly today than formerly, are characterized by a clear, unadorned style, cosmopolitan settings, and a shrewd understanding of human nature.

W. Somerset Maugham.
MICHAEL OCHS ARCHIVES/VENICE, CALIF.

Mauna Kea \ˌmau̇-nä-'kē-ə\ Dormant volcano, north-central Hawaii island, Hawaii, U.S. Rising to 13,796 ft (4,205 m), it is the highest point in the state and is the chief feature of a state park occupying 500 acres (202 hectares). Its name means "white mountain," referring to its snowcapped peak. Its dome is 30 mi (48 km) across and is the site of a major astronomical observatory. The volcano's lava flows have buried the southern slopes of the Kohala Mountains to the northwest, and its own western and southern slopes are covered with lava from its neighbour, Mauna Loa.

Mauna Loa Volcano, south-central Hawaii island, Hawaii, U.S. Located in Hawaii Volcanoes National Park, it is one of the world's largest mountain masses. It rises to 13,678 ft (4,169 m) and has a dome 75 mi (120 km) long and 64 mi (103 km) wide. Mokuaweoweo, its pit crater, has an area of nearly 4 sq mi (10 sq km) and a depth of 500–600 ft (150–180 m). It has averaged one eruption every 3.5 years since 1832. Many of its eruptions are confined within Mokuaweoweo; others are from fissures and vents. Its lava flows occupy more than 2,000 sq mi (5,120 sq km) of the island. See also Kilauea.

Maupassant \mō-pä-'säⁿ**, (Henry-René-Albert-) Guy de** (b. Aug. 5, 1850, Château de Miromesnil?, near Dieppe, France—d. July 6, 1893, Paris) French writer of short stories. His law studies were interrupted by the Franco-Prussian War; his experience as a volunteer provided him with material for some of his best works. Later, as a civil-service employee, he became a protégé of Gustave Flaubert. He first gained attention with "Boule de Suif" (1880; "Ball of Fat"), probably his finest story. In the next 10 years he published some 300 short stories, six novels, and three travel books. Taken together, his stories present a broad, naturalistic picture of French life from 1870 to 1890. His subjects include war, the Norman peasantry, the bureaucracy, life on the banks of the Seine, the emotional problems of the different classes, and, ominously, hallucination. Maupassant was phenomenally promiscuous, and before he was 25 years old his health was being eroded by syphilis. He attempted suicide in 1892 and was committed to an asylum, where he died at age 42. He is generally considered France's greatest master of the short story.

Guy de Maupassant, photograph by Nadar (Gaspard-Félix Tournachon), c. 1885.
ARCHIVES PHOTOGRAPHIQUES

Mauretania Ancient region of North Africa, corresponding to present-day northern Morocco and western and central Algeria. It was settled by the Phoenicians and Carthaginians from the 6th century BC. Its later inhabitants were known to the Romans as the Mauri and Massaeyli. It was annexed to Rome c. AD 42 and divided into two provinces. It became virtually independent in the 5th century but was overrun by the Vandals and then by the Arabs in the 7th century.

Mauriac \mȯr-'yȧk**, François** (b. Oct. 11, 1885, Bordeaux, France—d. Sept. 1, 1970, Paris) French writer. Mauriac grew up in a pious and strict Catholic family, and he subsequently placed at the heart of all his works the soul grappling with the problems of sin, grace, and salvation. He is best known for his austere, psychological novels, including *Young Man in Chains* (1913); *The Kiss to the Leper* (1922); *Thérèse* (1927); *Vipers' Tangle* (1932), often considered his masterpiece; and *A Woman of the Pharisees* (1941). He wrote polemical works against totalitarianism and fascism in the 1930s and worked with the Resistance during World War II. In 1952 he was awarded the Nobel Prize for Literature.

Maurice of Nassau *Dutch in full* **Maurits, prince van Oranje, count van Nassau** (b. Nov. 13, 1567, Dillenburg, Nassau—d. April 23, 1625, The Hague) Dutch general and statesman. The son of William I (the Silent), he was invested in 1585 as stadtholder (chief executive) of the northern provinces of the Netherlands. With political direction from Johan van Oldenbarnevelt, Maurice consolidated the power of the provinces against Spain and made them trade and shipping centres. He used military planning and siege warfare to defeat Spanish forces in the north and east but failed to take the southern Netherlands and was forced to conclude a truce with Spain in 1609. His development of military strategy and tactics made the Dutch army the most modern in Europe. In 1618 he consolidated his political power after removing Oldenbarnevelt from office, and as prince of Orange, count of Nassau, he became effectively king of the Netherlands.

Maurier, Daphne du See Daphne du Maurier

Maurier, George du See George du Maurier

Mauritania *officially* **Islamic Republic of Mauritania** Country, northwestern Africa. It is bordered by the Atlantic Ocean. Area: 398,000 sq mi (1,030,700 sq km). Population (2005 est.): 3,069,000. Capital: Nouakchott. The Moors (of mixed Arab-Berber and Sudanic descent) constitute the great majority of the population. Languages: Arabic (official), Fulani, Soninke, Wolof (all national). Religion: Islam (official; predominantly Sunni). Currency: ouguiya. Most of Mauritania is made up of low-lying desert that forms the extreme western part of the Sahara. Only a tiny fraction of its land is arable, but almost two-fifths is suitable for grazing, and the herding of goats, sheep, and camels occupies a significant portion of the largely nomadic population. Ocean fishing and iron ore production are

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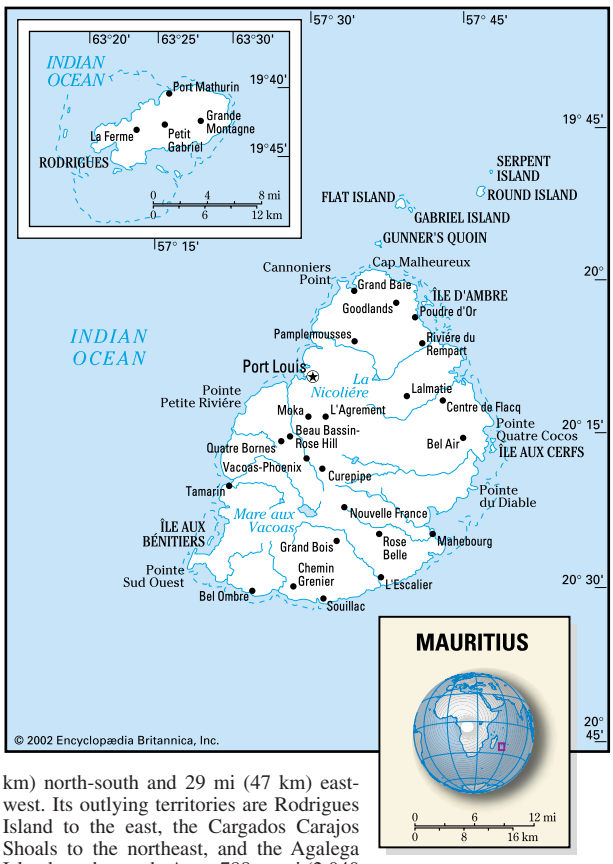
major sources of revenue. Mauritania is a republic with two legislative houses; its head of state and government is the president, assisted by the prime minister. Inhabited in ancient times by Sanhaja Berbers, in the 11th–12th century it was the centre of the Berber Almoravid dynasty, which imposed Islam on many of the neighbouring peoples. Arab tribes arrived in the 15th century and formed several powerful confederations: Trarza and Brakna, which dominated the Sénégal River region; Kunta in the east; and Rigaibāt in the north. The Portuguese arrived in the 15th century. France gained control of the coastal region in 1817, and in 1904 a formal French protectorate was extended over the territory. In 1920 it was added to French West Africa as a territory. In 1960 Mauritania achieved independence and left the French Community. The country's first president, Moktar Ould Daddah, was ousted in a coup in 1978, and a military government was established. In 1991 a new constitution was adopted, and a civilian government was installed in 1992. The country has faced continued economic hardship and political unrest.

Mauritius \mȯ-'ri-shəs\ *officially* **Republic of Mauritius** Island country, lying east of Madagascar in the western Indian Ocean. The central independent island state of the Mascarene group, it extends 38 mi (61



km) north-south and 29 mi (47 km) east-west. Its outlying territories are Rodrigues Island to the east, the Cargados Carajos Shoals to the northeast, and the Agalega Islands to the north. Area: 788 sq mi (2,040 sq km). Population (2005 est.): 1,245,000. Capital: Port Louis. About two-thirds of the population are of South Asian descent, and most of the rest are of mixed European, South Asian, and African ancestry. Languages: English (official), Creole (lingua franca), various ethnic languages. Religions: Hinduism, Christianity, Islam. Currency: Mauritian rupee. Volcanic in origin and almost surrounded by coastal reefs, Mauritius rises to 2,710 ft (826 m) at Petite Rivière Noire Peak. The chief water source is Lake Vacoas. About half of the land is arable; sugarcane is the major crop, though the government has sponsored agricultural diversification. The country depends heavily on food imports, mainly rice. The population density is one of the highest in the world. The island was visited, but not settled, by the Portuguese in the early 16th century. The Dutch took possession (1598–1710), called it Mauritius for the governor Maurice of Nassau, and attempted to settle it (1638–58, 1664–1710) before abandoning it to pirates. The French East India Company occupied it, renamed it Île de France in 1721, and governed it until the French Ministry of Marine took over its administration in 1767. Sugar planting was the main economic activity, and the colony prospered. The British captured the island in 1810 and were granted formal control of it under the Treaty of Paris in 1814; the name Mauritius was reinstated and slavery abolished. In the late 19th century, competition from beet sugar caused an economic decline, compounded by the opening of the Suez Canal in 1869. After World War II Mauritius adopted political and economic reforms, and in 1968 it became an independent state within the Commonwealth. In 1992 it became a republic. It has successfully diversified its economy, notably into clothing manufacturing.

Maurois \mōr-'wä**, André** *orig.* **Émile Herzog** (b. July 26, 1885, Elbeuf, France—d. Oct. 9, 1967, Paris) French writer. An officer in the British army during World War I, Maurois had his first literary success with *The Silences of Colonel Bramble* (1918), a humorous commentary on warfare and the British character. His novels include *Bernard Quesnay* (1926) and *Whatever Gods May Be* (1928). He is best known for biographies with the narrative interest of novels; his subjects included Percy B. Shelley, Lord Byron, Victor Hugo, and Marcel Proust.

Maurras \mȯ-'räs**, Charles (-Marie-Photius)** (b. April 20, 1868, Martigues, France—d. Nov. 16, 1952, Tours) French writer and political theorist. In 1891 he cofounded a group of poets opposed to the Symbolist movement and later known as the *école romane*. An ardent monarchist, he cofounded *L'Action Française* (1899), a review whose "integral nationalism" promoted the idea of the supremacy of the state; it became the party organ of the reactionary Action Française. He also wrote philosophical short stories and poetry. During World War II he was a strong supporter of the government of Philippe Pétain, for which he was imprisoned (1945–52).

Mauryan \'maù-rē-ən\ **empire** (c. 321–c. 185 BC) In ancient India, a state centred at Pataliputra (later Patna) near the junction of the Son and Ganges (Ganga) rivers. After the death of Alexander the Great, Chandragupta Maurya (Candra Gupta), the dynastic founder, carved out an empire that encompassed most of the subcontinent except for the Tamil south. Ashoka (r. c. 269–232 BC), the famous Buddhist emperor, left stone edicts that include some of the oldest deciphered original texts of India. The empire declined after Ashoka's death, but in its heyday it was an efficient and highly organized autocracy. See also Gupta dynasty; Nanda dynasty.

mausoleum Large, impressive tomb, especially a stone building with places for entombment of the dead aboveground. The word is derived from Mausolus, whose widow raised a splendid tomb at Halicarnassus (c. 353–350 BC). Probably the most ambitious mausoleum is the Taj Mahal.

Mausolus \mȯ-'sō-ləs\ (d. 353 BC) Satrap (governor) of Caria in South Asia Minor. Nominally under the control of the Persian empire, he took advantage of upheaval in Asia Minor to gain independence. He was influential among the Greek cities of Ionia and instigated the revolt of Athens's allies in 357. He endowed his capital, Halicarnassus, with fine buildings. His sister and wife, Artemisia II, finished building his tomb, the Mausoleum. It was designed by the Greek architect Pythius and considered one of the Seven Wonders of the World.

Mauss \'mōs**, Marcel** (b. May 10, 1872, Épinal, Fr.—d. Feb. 10, 1950, Paris) French sociologist and anthropologist. Mauss was the nephew of Émile Durkheim, who contributed much to his intellectual formation and with whom he collaborated in such important works as *Suicide* (1897) and *Primitive Classification* (1901–02). His most influential independent work was *The Gift* (1925), a highly original comparative study of the relation between forms of gift exchange and social structure. He taught at the École Pratique des Hautes Études and Collège de France and cofounded the University of Paris's Institut d'Ethnologie. His views on ethnological theory and method influenced Claude Lévi-Strauss, A.R. Radcliffe-Brown, Bronisław Malinowski, and Edward Evans-Pritchard.

Mawlana See Jalal ad-Din ar-Rumi

mawlid \'maù-lid\ *or* **milad** \ˌmē-'lad\ In Islam, the birthday of a holy figure, especially Muhammad. His birthday is fixed by tradition as the 12th day of the month of Rabīʿ I (actually the day of his death). First celebrated by the Muslim faithful in the 13th century, Muhammad's birthday was preceded by a month of merrymaking, which ended with animal sacrifices and a torchlight procession. The day of the *mawlid* included a public sermon and a feast. Though *mawlid* festivities are considered

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idolatrous by some Islamic fundamentalists, they continue to be widely celebrated throughout the Muslim world and have been extended to popular saints and the founders of Sufi brotherhoods.

Mawṣil, Al- See MOSUL

Maxim, Sir Hiram (Stevens) (b. Feb. 5, 1840, Sangerville, Maine, U.S.—d. Nov. 24, 1916, London, Eng.) U.S.-British inventor. Son of a Maine farmer, he was apprenticed to a carriage maker. He became chief engineer of the U.S. Electric Lighting Co. (1878–81), for which he introduced carbon filaments for electric lightbulbs. At his lab in London he began working on a fully automatic MACHINE GUN; in 1884 he succeeded with a design that used the recoil of the barrel to eject the spent cartridges and reload the chamber. He also developed his own smokeless GUNPOWDER, cordite. Soon every army was equipped with Maxim guns or adaptations. His other inventions included a hair-curling iron, a pneumatic gun, and an airplane (1894). His Maxim Gun Co. was eventually absorbed into Vickers, Ltd. His son Hiram Percy (1869–1936) invented the Maxim silencer for RIFLES, which he adapted to mufflers and other technologies, and designed the Columbia electric automobile.

Maximian \mak-'sim-ē-ən\ *in full* **Marcus Aurelius Valerius Maximianus** (b. c. AD 250, Sirmium, Pannonia Inferior—d. c. July 310) Roman emperor with DIOCLETIAN (286–305). Assigned the government of the West, he could not suppress revolts in Gaul and Britain; CONSTANTIUS I CHLORUS took charge of these, leaving him Italy, Spain, and Africa. Though known as a persecutor of Christians, he probably acted on Diocletian's orders. He reluctantly abdicated with Diocletian but recanted to support his son Maxentius's claim as caesar. Forced to abdicate again, he lived at the court of his son-in-law, CONSTANTINE I. After raising a failed revolt against Constantine, he committed suicide.

Maximilian *orig.* **Ferdinand Maximilian Joseph** (b. July 6, 1832, Vienna, Austria—d. June 19, 1867, near Querétaro, Mex.) Archduke of Austria and emperor of Mexico (1864–67). The younger brother of FRANCIS JOSEPH I of Austria-Hungary, he served in the Austrian navy and as governor-general of the Lombardo-Venetian kingdom. He accepted the offer of the Mexican throne, naively believing that the Mexicans had voted him their king. In fact, the offer was a scheme between Mexican conservatives, who wanted to overthrow Pres. BENITO JUÁREZ, and NAPOLEON III, who wanted to collect a debt from Mexico and had imperialist ambitions there. Intending to rule with paternal benevolence, Maximilian upheld Juárez's reforms, to the fury of the conservatives. The end of the American Civil War allowed the U.S. to intervene on Juárez's behalf; French forces that had been supporting Maximilian left at the request of the U.S., and Juárez's army retook Mexico City. Refusing to abdicate, Maximilian was defeated and executed.

Maximilian.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Maximilian I (b. April 17, 1573, Munich—d. Sept. 27, 1651, Ingolstadt, Bavaria) Duke of Bavaria (1597–1651) and elector from 1623. Succeeding his father as duke, he restored the duchy to solvency, revised the law code, and built an effective army. Opposed to the Protestant cause, he established the CATHOLIC LEAGUE (1610). In the THIRTY YEARS' WAR he gave military aid to Austria against the Palatine elector Frederick V and, with military victories by count von TILLY, obtained both territory and the electorship of Bavaria (1623). Threatened by an independent army under ALBRECHT W.E. VON WALLENSTEIN, he forced the general's dismissal in 1630. Maximilian later fought unsuccessfully against France and Sweden and made a separate peace to retain the electorship.

Maximilian I *orig.* **Maximilian Joseph** (b. May 27, 1756, Mannheim, Palatinate—d. Oct. 13, 1825, Munich) First king of Bavaria (1806–25). A member of the house of WITTELSBACH, in 1799 he inherited its territories as Maximilian IV Joseph, elector of Bavaria. Forced by Austria to enter the war against France, he signed a separate peace in 1801. Distrustful of Austria, he supported the French war effort (1805–09) through Bavaria's membership in the CONFEDERATION OF THE RHINE. He received territories by which he crowned himself king of Bavaria (1806). After 1813 he allied with Austria to guarantee the integrity of his kingdom and gave up sections of western Austria in return for territories on the western bank of the Rhine. Aided by his chief minister, count von Montgelas (1759–1838), Maximilian made Bavaria into an efficient, liberal state under a new constitution (1808) and charter (1818) that established a bicameral parliament.

Maximilian I (b. March 22, 1459, Wiener Neustadt, Austria—d. Jan. 12, 1519, Wels) German king and Holy Roman emperor (1493–1519). The eldest son of Emperor FREDERICK III and a member of the HABSBURG DYNASTY, he gained BURGUNDY's lands in the Netherlands by marriage in 1477 but was later forced to give Burgundy to LOUIS XI (1482). He retook most of the Habsburg lands in Austria from the Hungarians by 1490, and, after being crowned Holy Roman emperor, he drove the Turks from the empire's southeastern borders. He fought a series of wars against the French, helping to force them out of Italy in 1496 but losing Milan to them in 1515. He lost Switzerland as well but acquired the TIROL peacefully. He acquired Spain for the Habsburgs through his children's marriages, gained influence in Hungary and Bohemia, and built an intricate network of European alliances. A popular monarch, he encouraged culture and the arts.

Maximilian II (b. Nov. 28, 1811, Munich—d. March 10, 1864, Munich) King of Bavaria (1848–64). Son of King LOUIS I, he succeeded to the throne on his father's abdication in 1848. He proposed a league of smaller states as a "third force" in German affairs but was opposed by the dominant states of Austria and Prussia. He successfully introduced liberal reforms in Bavaria, including freedom of the press and ministerial responsibility. He made Munich a centre of culture and gave support to such scholars as LEOPOLD VON RANKE. He was succeeded by his son LOUIS II.

Maximilian II (b. July 31, 1527, Vienna, Austria—d. Oct. 12, 1576, Regensburg) Holy Roman emperor (1564–76). Son of the future emperor FERDINAND I, he was a humanist Christian who favoured compromise between Catholics and Protestants. He became king of Bohemia in 1562 and succeeded to the imperial throne in 1564. He extended religious tolerance and worked for reform of the Roman Catholic church. He failed to achieve his political goals; an unsuccessful campaign against the Turks ended in a truce in 1568 that compelled him to continue to pay tribute to the sultan.

maximum In mathematics, a point at which a FUNCTION's value is greatest. If the value is greater than or equal to all other function values, it is an absolute maximum. If it is merely greater than any nearby point, it is a relative, or local, maximum. In CALCULUS, the DERIVATIVE equals zero or does not exist at a function's maximum point. Techniques for finding maximum and minimum points motivated the early development of calculus and have made it easier to solve problems such as finding the dimensions of a container that will hold the most for a given amount of material used to make it. See also MINIMUM, OPTIMIZATION.

Maximus the Greek (b. 1480, Árta, Greece—d. 1556, near Moscow, Russia; feast day January 21) Greek scholar and linguist. Educated in Paris, Venice, and Florence, he became part of a circle of humanist scholars and was influenced by the Dominican reformer GIROLAMO SAVONAROLA. He became a Greek Orthodox monk and was chosen to translate Greek liturgical and theological texts into Russian, thus making possible the dissemination of Byzantine culture throughout Russia. In Moscow he became involved in a religious controversy when he joined a faction called the Nonpossessors, who advocated renunciation of property ownership by the church. Arrested for heresy in 1525, he was imprisoned for 20 years in a monastery. After his death he was venerated as a saint.

Maxwell, James Clerk (b. June 13, 1831, Edinburgh, Scot.—d. Nov. 5, 1879, Cambridge, Cambridgeshire, Eng.) Scottish physicist. He published his first scientific paper at age 14, entered the University of Edinburgh at 16, and graduated from Cambridge University. He taught at Aberdeen University, King's College London, and Cambridge (from 1871), where he supervised the building of Cavendish Laboratory. His most revolutionary achievement was his demonstration that light is an electromagnetic wave, and he originated the concept of ELECTROMAGNETIC RADIATION. His field equations (see MAXWELL'S EQUATIONS) paved the way for ALBERT EINSTEIN's special theory of relativity. He established the nature of Saturn's rings, did important work on colour perception, and produced the kinetic theory of gases. His ideas formed the basis for QUANTUM MECHANICS and ultimately for the modern theory of the structure of atoms and molecules.

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Maxwell, (Ian) Robert *orig.* **Jan Ludvik Hoch** (b. June 10, 1923, Slatina-Selo, Czech.—d. Nov. 5, 1991, at sea off the Canary Islands) Czech-British publisher. Of Jewish origin, he lost many family members in the Holocaust but managed to reach Britain and become an army officer. After the war he founded Pergamon Press, which became a major publisher of trade journals and scientific books. In the 1980s he revived the British Printing Corp. and purchased the Mirror Group Newspapers, though his financial practices were officially questioned. Among the U.S. acquisitions of Maxwell Communications were the *New York Daily News* (1991) and the publishing house Macmillan. The revelation of fraudulent financial dealings aimed at bolstering his collapsing empire was followed by his death by drowning from his yacht in the Atlantic. It was assumed to have been a suicide.

Maxwell, William (b. Aug. 16, 1908, Lincoln, Ill., U.S.—d. July 31, 2000, New York, N.Y.) American editor and author. Maxwell taught English at the University of Illinois before joining the staff of *The New Yorker* magazine. In his 40 years there, he edited writers such as John Cheever, J.D. Salinger, Eudora Welty, and Mavis Gallant. He himself was the author of spare, evocative short stories and novels. Perhaps his best-known work is *The Folded Leaf* (1945), about the friendship of two small-town boys. Among his other works are the novels *The Château* (1961) and *So Long, See You Tomorrow* (1980) and the short-story collection *All the Days and Nights* (1995).

Maxwell's equations Four equations, formulated by James Clerk Maxwell, that together form a complete description of the production and interrelation of electric and magnetic fields. The statements of these four equations are (1) electric field diverges from electric charge, (2) there are no isolated magnetic poles, (3) electric fields are produced by changing magnetic fields, and (4) circulating magnetic fields are produced by changing electric fields and by electric currents. Maxwell based his description of electromagnetic fields on these four statements.

May beetle See June beetle

May Day In Europe, the day (May 1) for traditional springtime celebrations. It probably originated in pre-Christian agricultural rituals. Celebrations included a May king and queen, a Maypole, and people carrying trees, green branches, or garlands. May Day was designated an international labour day by the International Socialist Congress of 1899, and it remains the standard Labour Day worldwide, with a few exceptions, including Canada and the U.S. A major holiday in the Soviet Union and other communist countries, it was the occasion for important political demonstrations.

May Fourth Movement Chinese intellectual revolution and sociopolitical reform movement (1917–21). In 1915 young intellectuals inspired by Chen Duxiu began agitating for the reform and strengthening of Chinese society through acceptance of Western science, democracy, and schools of thought, one objective being to make China strong enough to resist Western imperialism. On May 4, 1919, reformist zeal found focus in a protest by Beijing's students against the Versailles Peace Conference's decision to transfer former German concessions in China to Japan. After more than a month of demonstrations, strikes, and boycotts of Japanese goods, the government gave way and refused to sign the peace treaty with Germany. The movement spurred the successful reorganization of the Nationalist Party and gave birth to the Chinese Communist Party. See also Treaty of Versailles.

maya \'mī-ə\ In Hinduism, a powerful force that creates the cosmic illusion that the phenomenal world is real. The word maya originally referred to the wizardry with which a god can make human beings believe in what turns out to be an illusion, and its philosophical sense is an extension of this meaning. The concept is especially important in the Advaita school of the orthodox system of Vedanta, which sees maya as the cosmic force that presents the infinite Brahman as the finite phenomenal world.

Maya \'mī-ə\ Group of Mesoamerican Indians who between AD 250 and 900 developed one of the Western Hemisphere's greatest civilizations. By AD 200 they had developed cities containing palaces, temples, plazas, and ball courts. They used stone tools to quarry the immense quantities of stone needed for those structures; their sculpture and relief carving were also highly developed. Mayan hieroglyphic writing survives in books and inscriptions. Mayan mathematics featured positional notation and the use of the zero; Mayan astronomy used an accurately determined solar year and precise tables of the positions of Venus and the Moon. Calendrical accuracy was important for the elaborate rituals and ceremonies of the Mayan religion, which was based on a pantheon of gods. Ritual bloodletting, torture, and human sacrifice were employed in an attempt to propitiate the gods, ensure fertility, and stave off cosmic chaos. At the height of its Classic period, Mayan civilization included more than 40 cities of 5,000–50,000 people. After 900 the civilization declined rapidly for unknown reasons. Descendants of the Maya are now subsistence farmers in southern Mexico and Guatemala. See also Chichén Itzá; Copán; Lacandón; Maya codices; Maya language; Quiché; Tikal; Tzeltal; Tzotzil; Uxmal.

Maya Codices Books in Mayan hieroglyphic writing that survived the Spanish conquest. They are made of fig-bark paper folded like an accordion, with covers of jaguar skin. Though most Mayan books were destroyed as pagan by Spanish priests, four are known to have survived: the Dresden Codex, probably dating from the 11th or 12th century, a copy of earlier texts of the 5th–9th century; the Madrid Codex, dating from the 15th century; the Paris Codex, slightly older than the Madrid Codex; and the Grolier Codex, discovered in 1971 and dated to the 13th century. They deal with astronomical calculations, divination, and ritual.

Maya languages *or* **Mayan languages** Family of about 30 American Indian languages and language complexes, spoken by more than three million people, mainly in southern Mexico and Guatemala. While some have few remaining speakers, Yucatec in Mexico and K'iche (Quiché), Kaqchikel (Cakchiquel), Mam, and Q'eqchi' (Kekchí) in Guatemala count speakers in the hundreds of thousands. Maya languages were recorded in an indigenous script (see Maya Codices; Mayan hieroglyphic writing), as well as in colonial documents in a Spanish-based orthography, including the *Popol Vuh* and the Yucatec prophetic texts known as the *Books of Chilam Balam*.

Mayakovsky \mə-ˌyə-'kȯf-skē**, Vladimir (Vladimirovich)** (b. July 19, 1893, Bagdadi, Georgia, Russian Empire—d. April 14, 1930, Moscow, Russia, U.S.S.R.) Russian poet. Repeatedly jailed for subversive activity, he began writing poetry during solitary confinement in 1909. On his release he became the spokesman for Futurism in Russia, and his poetry became conspicuously self-assertive and defiant. He was the leading poet of the Russian Revolution of 1917 and the early Soviet period, producing declamatory works saturated with politics and aimed at mass audiences, including "Ode to Revolution" (1918) and "Left March" (1919) and the drama *Mystery Bouffe* (performed 1921). Disappointed in love, increasingly alienated from Soviet reality, and denied a visa to travel abroad, he committed suicide at age 36.

Mayan \'mī-ən\ **hieroglyphic writing** System of writing used by people of the Maya civilization from about the 3rd century AD to the 17th century. Of the various scripts developed in pre-Columbian Mesoamerica, Mayan writing is by far the most elaborate and abundantly attested: about 800 signs have been inventoried in more than 5,000 instances (see Maya Codices). Signs—some representational, some quite abstract—are either logographic, representing words, or syllabic, representing consonant-vowel sequences. Typically, up to five signs are fit into tight square or rectangular clusters, which are further arranged into rows or grids. The language of Classic Period writing (c. AD 250–900) is generally thought to be Cholan, ancestral to several modern Maya languages; later inscriptions were in Yucatec. By the 1990s scholars had an accurate grasp of 60–70% of Mayan inscriptions, with some texts almost completely readable and some still quite opaque. Most inscriptions record significant events and dates in the lives of Mayan rulers.

Mayer, Louis B(urt) *orig.* **Eliezer Mayer** *or* **Lazar Mayer** (b. July 4, 1885, Minsk, Russian Empire—d. Oct. 29, 1957, Los Angeles, Calif., U.S.) Russian-born U.S. film executive. He immigrated to Canada and then the U.S. with his family and worked in his father's scrap-iron business from age 14. He bought a small nickelodeon near Boston in 1907, and by 1918 he owned the largest chain of movie theatres in New England. He founded a film production company in Hollywood in 1917 and merged it with other companies to form MGM in 1925. Under his leadership, MGM became Hollywood's largest and most prestigious studio, aided by his artistic director, Irving Thalberg. Mayer had under contract many of the outstanding screen stars of the day, including Greta Garbo, Clark Gable, and Judy Garland. He was considered the most powerful Hollywood executive until his forced retirement in 1951. He was the chief founder of the Academy of Motion Picture Arts and Sciences.

Mayer \'mī-ər**, Maria (Gertrude)** *orig.* **Maria (Gertrude) Goeppert** (b. June 28, 1906, Kattowitz, Ger.—d. Feb. 20, 1972, San

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Diego, Calif, U.S.) German-born U.S. physicist. She immigrated to the U.S. in 1930, where she taught at various universities. She worked on the separation of URANIUM ISOTOPES for the MANHATTAN PROJECT. Her work in theoretical physics led to the explanation of properties of atomic nuclei based on a structure of "shells" occupied by protons and neutrons. For her work she was awarded a 1963 Nobel Prize, which she shared with Hans Jensen (1907–73) and EUGENE WIGNER.

Mayerling affair See RUDOLF

Mayfield, Curtis (b. June 3, 1942, Chicago, Ill., U.S.—d. Dec. 26, 1999, Roswell, Ga.) U.S. singer-songwriter and guitarist. He became a vocalist and guitarist with the Impressions in 1957. Together with Sam Gooden (bass) and Fred Cash (low tenor), Mayfield (high tenor) devised a much imitated vocal style. Mayfield was a self-taught guitarist, and when he tuned his instrument to a natural chord, he achieved a subtle lyricism that was also influential. Mayfield's songs, including "It's All Right" (1963), "People Get Ready" (1965), and "Choice of Colors" (1969), were inspirational and humanistic. The high point of his solo career (from 1970) was the influential soundtrack to *Superfly* (1972), and he became a major force in the development of the musical style known as funk. He was paralyzed when a lighting tower fell on him during a concert in 1990.

mayflower See TRAILING ARBUTUS

Mayflower Compact (1620) Document signed by 41 male passengers on the *Mayflower* before landing at PLYMOUTH (Massachusetts). Concerned that some members might leave to form their own colonies, WILLIAM BRADFORD and others drafted the compact to bind the group into a political body and pledge members to abide by any laws that would be established. The document adapted a church covenant to a civil situation and was the basis of the colony's government.

mayfly Any INSECT of the order Ephemeroptera, found around streams and ponds. The approximately 2,000 species are up to 1.6 in. (4 cm) long, have triangular membranous forewings, smaller round hind wings, and two or three long, threadlike tails. Wings are held vertically when at rest. Chewing mouthparts in the aquatic larvae are vestigial in the adult, which lives just long enough to mate and reproduce. Males "dance" in large swarms to attract females. The adult's entire life span is usually only a few hours (though at least one species lives as long as two days), and poets have used the mayfly as a symbol of life's ephemeral nature.

mayhem CRIME of willfully and permanently crippling, mutilating, or disfiguring any part of another's body. Some jurisdictions do not distinguish between mayhem and other types of battery. JAPANESE LAW treats all batteries similarly; INDIAN LAW divides bodily harms into "hurts" and "grievous hurts." In most U.S. states mayhem is encompassed by assault and aggravated assault.

Mayhew, Henry (b. 1812, London, Eng.—d. July 25, 1887, London) English journalist and sociologist. He studied law but soon turned to journalism. In 1841 he founded the highly successful *PUNCH*. A vivid and voluminous writer, he is best known for *London Labour and the London Poor* (1851–62), an evocation of the sights and sounds of the working-class districts of London, which influenced CHARLES DICKENS and other writers. He also wrote plays, farces, fairy tales, and novels, some in collaboration with his brother Augustus Septimus Mayhew (1826–75).

Henry Mayhew, engraving after a photograph
BBC HULTON PICTURE LIBRARY

Mayo family Family of U.S. physicians. William Worrall Mayo (b. May 31, 1819, near Manchester, Eng.—d. March 6, 1911, Rochester, Minn., U.S.) came to the U.S. in 1845. He opened a surgical practice in Rochester, Minn., in 1863, and in 1889 he opened St. Mary's Hospital with his two sons and the Sisters of St. Francis. His elder son, William James (b. June 29, 1861, Le Sueur, Minn.—d. July 28, 1939, Rochester), specialized in surgery of the abdomen, pelvis, and kidney and served as administrator. Charles Horace (b. July 19, 1865, Rochester—d. May 26, 1939, Chicago, Ill.), a gifted surgeon in all areas, originated modern procedures in goitre surgery, neurosurgery, and orthopedic surgery. About 1900 the partnership was changed to a voluntary association of physicians and specialists, later known as the Mayo Clinic. In 1915 the brothers established the Mayo Foundation for Medical Education and Research, which offers graduate training in medicine and related subjects.

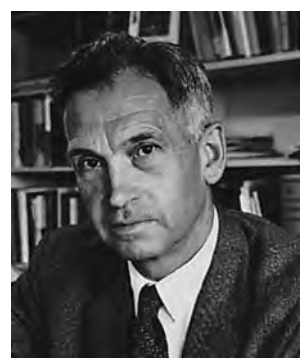
Mayon \mä-'yōn\ **Volcano** *or* **Mount Mayon** Active volcano, southeastern LUZON, Philippines. One of the world's most perfect volcanic cones, it has a base 80 mi (130 km) in circumference and rises to 7,943 ft (2,421 m). It is popular with climbers and campers and is the centre of Mayon Volcano National Park, which occupies 21 sq mi (55 sq km). It has erupted more than 30 times since 1616; an eruption in 1993 killed 75 people. Its most destructive eruption was in 1814, when the town of Cagsawa was buried.

mayor Political leader of a municipal corporation. Mayors are either appointed or elected for a limited term. In Europe until the mid-19th century, most mayors were appointed by the central government; in France, they are still agents of the central government. In the U.S., they are either directly elected by the populace or chosen by an elected council. Some fulfill only ceremonial functions, executive power being held by a professional manager hired by the legislature. A mayor's powers may include the power to make appointments, veto legislation, administer budgets, and manage administrative functions. See also CITY GOVERNMENT.

Mayotte \mä-'yȯt\ Southeasternmost island (pop., 2002 est.: 165,000) of the COMOROS archipelago, a French overseas territorial collectivity. Located northwest of Madagascar, it occupies an area of 144 sq mi (373 sq km); Mamoutzo is its chief town and capital designate. Dzaoudzi, the current capital, is its other main city and port. Most of its people are of Malagasy origin. Originally inhabited by descendants of BANTU and Malayo-Indonesian peoples, it was converted to Islam by Arab invaders in the 15th century. Taken by Malagasy people from Madagascar at the end of the 18th century, it came under French control in 1843. Together with the other Comoros islands and Madagascar, it became part of a single French overseas territory in the early 20th century. It has been administered separately since 1975, when the three northernmost islands of the Comoros declared independence.

maypole Tall wooden pole garlanded with flowers and greenery and often hung with ribbons that are woven into complex patterns by dancers in a ceremonial folk dance. The custom probably originated in ancient fertility rites that involved dancing around a living tree in the springtime. In many European countries, notably England, the pole is set up on May 1 as part of MAY DAY festivities. Similar ribbon dances were performed in India and in pre-Columbian Latin America.

Mayr \'mīr**, Ernst (Walter)** (b. July 5, 1904, Kempten, Ger.—d. Feb. 3, 2005, Bedford, Mass., U.S.) German-born U.S. biologist. He received a Ph.D. (1926) from the University of Berlin and immigrated to the U.S. in the early 1930s. While a curator at the American Museum of Natural History (1932–53), he wrote more than 100 papers on avian taxonomy. From 1953 to 1975 he taught at Harvard University. His early studies of speciation and of founder populations made him a leader in the development of the modern synthetic theory of EVOLUTION. In 1940 Mayr proposed a definition of species that won wide acceptance and led to the discovery of some previously unknown species. His influential works include *Systematics and the Origin of Species* (1942) and *The Growth of Biological Thought* (1982).



Ernst Mayr
COURTESY OF THE DEPARTMENT OF LIBRARY SERVICES, THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NEG. NO. 334102

Mays, Willie (Howard) (b. May 6, 1931, Westfield, Ala., U.S.) U.S. baseball player. Mays played for the Birmingham Black Barons in the National Negro League when he was only 16. The "Say Hey Kid" later played principally for the New York (later San Francisco) Giants in the

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major leagues (1951–72). A brilliant centre fielder and a powerful right-handed hitter, he ranks among the all-time top five in home runs (660), runs (2,062), and extra-base hits (1,323) and among the top 10 for runs batted in (1,903) and hits (3,283). Mays is considered one of the greatest all-around players in the history of the game.

Willie Mays.
UPI

Maysles \'mā-zəlz**, Al(bert) and David** (respectively b. Nov. 26, 1926, Brookline, Mass., U.S.; b. Jan. 10, 1932, Boston, Mass., U.S.—d. Jan. 3, 1987, New York, N.Y.) U.S. documentary filmmakers. Albert made his first documentary, *Psychiatry in Russia*, in 1955. In 1962 the brothers began to collaborate on documentaries in the CINÉMA VÉRITÉ style, which they called "direct cinema," and gained notoriety for their films *Salesman* (1969) and *Gimme Shelter* (1970), both made with Charlotte Zwerin. Their later films include *Christo's Valley Curtain* (1972), *Grey Gardens* (1975), and *Vladimir Horowitz* (1985).

Mazarin \ˌma-zə-'ra^{n}**, Jules Cardinal** *orig.* **Giulio Raimondo Mazarini** (b. July 14, 1602, Pescina, Abruzzi, Kingdom of Naples—d. March 9, 1661, Vincennes, France) Italian-French cardinal and statesman. A member of the papal diplomatic service (1627–34), he negotiated an end to the War of the Mantuan Succession between France and Spain. He served as papal nuncio to the French court (1634–36), where he admired cardinal de RICHELIEU. He worked for French interests in the papal court, then entered the service of France and became a naturalized French citizen (1639) and a cardinal (1641). After the deaths of Richelieu (1642) and LOUIS XIII (1643), Mazarin was appointed first minister of France by ANNE OF AUSTRIA, regent for LOUIS XIV, and he directed Louis's education. A highly influential adviser to the young king, he helped train a staff of able administrators. His foreign policy established France's supremacy among the European powers, effecting the Peace of WESTPHALIA (1648) and the Treaty of the PYRENEES (1659). A patron of the arts, Mazarin founded an academy of painting and sculpture and compiled a large library.

Jules Cardinal Mazarin, detail of a portrait by Philippe de Champaigne; in the Musée Condé, Chantilly, France.
COURTESY OF THE MUSEE CONDE, CHANTILLY, FR.; PHOTOGRAPH, GIRAUDON/ART RESOURCE, NEW YORK

Mazatlán \ˌmä-sä-'tlän\ Port city (pop., 2000: 327,989), southwestern SINALOA state, north-central Mexico. It occupies a peninsula overlooking Olas Altas Bay on the Gulf of CALIFORNIA. It is Mexico's largest Pacific Ocean port, and its island-studded harbour is known for its fine sandy beaches. Lying diagonally across the gulf from the tip of BAJA CALIFORNIA, it provides a communications link between Baja and the mainland. Mazatlán, called the "Pearl of the Pacific," is a fishing centre and a popular tourist resort.

Mazda \'mäz-də\ **Motor Corp.** Japanese automotive manufacturer. Founded in 1920 as a cork plant, the firm was called Toyo Kogyo Co. from 1927 until 1984, when it adopted the name Mazda Motor Corp. It began producing trucks in 1931 and supplied the Japanese armed forces during World War II; its factory survived the atomic bombing of Hiroshima because it lay shielded behind a hill. In the 1960s it began manufacturing passenger cars and marketing them in the U.S. After enduring a slump in the 1970s, it became one of the largest auto manufacturers in Japan. Mazda has supplied axles and other automotive products to FORD MOTOR CO., and by the turn of the 21st century, Ford had acquired a significant ownership share in Mazda. Its headquarters are in Hiroshima.

Mazdakism \'maz-də-ˌki-zəm\ Dualistic religion that arose in Iran in the late 5th cent AD. Its origins are uncertain, and no Mazdakite scriptures survive. It is named for Mazdak, its main Persian proponent in the 5th century, who converted the Sasanid king Kavadh I. It held that there were two original principles, Light (or Good) and Darkness (or Evil), which accidentally became mixed, producing the world. Humans' duty was to strive to release Light in the world through moral conduct. Mazdakism was suppressed in the 6th century by Persian nobles and Zoroastrian clergy who objected to its tenets concerning the common holding of property and women, but it survived in secret until the 8th century. See also DUALISM, ZOROASTRIANISM AND PARSIISM.

maze See LABYRINTH

Mazia \'mā-zē-ə**, Daniel** (b. Dec. 18, 1912, Scranton, Pa., U.S.—d. June 9, 1996, Monterey, Calif.) U.S. cell biologist. He received his Ph.D. from the University of Pennsylvania. His research focused on various aspects of cell reproduction, including MITOSIS and regulation. He is best known for isolating the structure responsible for cell division, research that he carried out with Katsuma Dan (1905?–96) in 1951.

Mazowiecki \ˌmä-zō-'vyet-skē**, Tadeusz** (b. April 18, 1927, Płock, Pol.) Polish politician. After studying law, he cofounded and edited the independent Catholic monthly *Więź* (1958–81). A principal adviser to the SOLIDARITY labour movement, he was appointed its newspaper editor (1981) by LECH WAŁĘSA. After the 1989 national elections, he was appointed prime minister of a coalition government of Solidarity and communist members. He undertook radical economic reforms to develop a free-market economy, which helped stabilize Poland's consumer-goods market and increased exports but caused high unemployment. He lost his bid for president in 1990 and was replaced as prime minister in 1991.

mazurka \mə-'zər-kə\ Polish folk dance in ¾ time for a circle of couples, characterized by stamping feet and clicking heels, traditionally danced to the music of bagpipes. Originating in Masuria (northeastern Poland) in the 16th century, it became popular at the Polish court and spread to Russia and Germany, reaching England and France by the 1830s. The 50 piano mazurkas by FRÉDÉRIC CHOPIN reflected and extended the dance's popularity. It had no set figures and allowed improvisation among its more than 50 different steps.

Mazzini \mät-'sē-nē**, Giuseppe** (b. June 22, 1805, Genoa—d. March 10, 1872, Pisa, Italy) Italian patriot and a major figure in the making of modern Italy. A lawyer, he joined the secret independence group CARBONARI. After he was imprisoned for its activities, he moved to Marseille (1831), where he founded the patriotic movement YOUNG ITALY. He later expanded his plan for a world republican federation and in Switzerland founded Young Europe. In London (1837) he continued his revolutionary activities by correspondence with agents worldwide. He founded the People's International League (1847) and received support from English liberals. In 1848 he returned to Italy to help govern the short-lived Republic of Rome, but returned to England after the pope reestablished control in Rome. Mazzini founded the Friends of Italy (1851) and backed unsuccessful uprisings in Milan, Mantua, and Genoa. An uncompromising republican, he disapproved of the new united Kingdom of Italy (1861). See also RISORGIMENTO.

Mbabane \əm-bä-'bä-nā\ Capital and largest town (pop., 1998 est.: 60,000) of SWAZILAND. Located in western Swaziland, it developed near the cattle kraal of the Swazi king Mbandzeni in the late 19th century. The actual town was founded in 1902, when the British assumed control of Swaziland and set up an administrative headquarters there. A Mozambican railway link near Mbabane was established in 1964, primarily to export iron ore extracted in the region; production of the ore had virtually ceased by the late 1970s.

Mbeki \em-'bek-ē**, Thabo** (b. June 18, 1942, Idutywa, Transkei) President of South Africa (from 1999). The son of an anti-APARTHEID activist, he studied economics at Sussex University in Britain, then received military training in the Soviet Union. He was appointed deputy president by NELSON MANDELA following South Africa's first elections (1994) based on universal suffrage and soon took control of the government's day-to-day workings. Less charismatic than Mandela, Mbeki has been criticized for his views on the biology of AIDS. He has been particularly involved in South Africa's post-apartheid economic growth strategy.

mbira \em-'bir-ə\ *or* **thumb piano** African musical instrument consisting of a set of tuned metal or bamboo tongues attached to a board or

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resonator. The tongues are depressed and released with the thumbs and fingers to produce melodies and song accompaniments. The mbira dates to at least the 16th century in Africa, and it was imported to Latin America by slaves.

Mboya \em-'bȯi-ə**, Tom** *orig.* **Thomas Joseph Mboya** (b. Aug. 15, 1930, Kilima Mbogo, near Nairobi, Kenya—d. July 5, 1969, Nairobi) Kenyan political leader. During the Mau Mau rebellion (1952–56) and the period leading up to Kenyan independence (1963), the Oxford-educated Mboya headed the Kenya Federation of Labour. In 1960 he helped found the dominant Kenyan African National Union Party (KANU). After independence he served in top administrative posts in Jomo Kenyatta's government. His assassination in 1969 shocked the nation and exacerbated tensions between the dominant Kikuyu and other ethnic groups, especially Mboya's own Luo.

Mbundu \em-'bün-dü\ Group of Bantu-speaking peoples of north-central Angola. In the 15th century they founded the Ndongo kingdom, a rival of the Kongo kingdom. It was destroyed by the Portuguese in the late 1600s. In the 1970s the Mbundu provided the main support for the Marxist-oriented Popular Movement for the Liberation of Angola (MPLA), which assumed power in 1976. Today they number about 2.3 million.

MCA *in full* **Music Corporation of America** Entertainment conglomerate. It was founded in Chicago in 1924 by Jules Stein as a talent agency. In the 1960s it bought Decca Records and Universal Pictures, and today it produces films, music, and television shows. It was acquired by Matsushita of Japan in 1990.

McAdam, John (Loudon) (b. Sept. 21, 1756, Ayr, Ayrshire, Scot.—d. Nov. 26, 1836, Moffat, Dumfriesshire) Scottish inventor of the macadam road surface. He made an early fortune in his uncle's New York countinghouse (1770–83). Back in Scotland, he noted the poor condition of the highways near his estate and undertook experiments in road making. He recommended that roads be raised above the adjacent ground for good drainage and covered, first with larger stones and then with smaller stones, the whole mass to be bound with fine gravel or slag. In 1823 his views were officially adopted, and in 1827 he was appointed Britain's Surveyor General of Metropolitan Roads. Macadamization was quickly adopted in other countries and did much to facilitate travel and communication.

McAdoo \'ma-kə-ˌdü**, William G(ibbs)** (b. Oct. 31, 1863, near Marietta, Ga., U.S.—d. Feb. 1, 1941, Washington, D.C.) U.S. public official. In 1892 he moved to New York, where he organized the Hudson and Manhattan Railway companies (later consolidated), which built tunnels under the Hudson River. A prominent supporter of Woodrow Wilson in the 1912 presidential campaign, he was appointed secretary of the treasury by Wilson in 1913; he married Wilson's daughter in 1914. During World War I he directed fund-raising drives that yielded $18 billion for the war effort. He was later director general of U.S. railroads (1917–19) and U.S. senator from California (1933–38).

McCarthy, Cormac *orig.* **Charles McCarthy, Jr.** (b. July 20, 1933, Providence, R.I., U.S.) U.S. novelist. He grew up in Tennessee and dropped out of the University of Tennessee to join the Air Force. He began writing in 1959. His novels, known for their natural observation, morbid realism, and violence, are in the Southern gothic tradition. They include *The Orchard Keeper* (1965), *Outer Dark* (1968), *Blood Meridian* (1985), and the widely read Border Trilogy (*All the Pretty Little Horses*, 1992; *The Crossing*, 1994; *Cities of the Plain*, 1999).

McCarthy, Eugene J(oseph) (b. March 29, 1916, Watkins, Minn., U.S.—d. Dec. 10, 2005, Washington, D.C.) U.S. politician. He taught at the College of St. Thomas in St. Paul, Minn., before being elected to the U.S. House of Representatives (1949–59) and later the Senate (1959–71). A liberal Democrat, he became an outspoken critic of the Vietnam War. In 1968 he ran for the Democratic Party presidential nomination. His initial successes convinced Pres. Lyndon B. Johnson not to seek reelection. After losing the nomination to Hubert H. Humphrey, McCarthy decided not to run for reelection to the Senate. He made another unsuccessful attempt at the Democratic nomination in 1972 and ran unsuccessfully for president as an independent in 1976. His presidential bids in 1988 and 1992 also failed.

McCarthy, John (b. Sept. 4, 1927, Boston, Mass., U.S.) U.S. computer scientist. He received his Ph.D. from Princeton University. A pioneer in the field of artificial intelligence, he created LISP in 1958. He also developed ideas about the processing characteristics of trees (as used in computing), as distinct from nets. He is a recipient of the Turing Award (1971), the Kyoto Prize (1988), and the National Medal of Science (1990).

McCarthy, Joseph R(aymond) (b. Nov. 14, 1908, near Appleton, Wis., U.S.—d. May 2, 1957, Bethesda, Md.) U.S. politician. He was a Wisconsin circuit judge (1940–42) before enlisting in the Marine Corps in World War II. In 1946 he upset Robert La Follette, Jr., to win election to the U.S. Senate. He remained little known until 1950, when he publicly charged that 205 communists had infiltrated the U.S. State Department. Reelected in 1952, he obtained the chairmanship of the Senate's permanent subcommittee on investigations, and for the next two years he investigated various government departments and questioned innumerable witnesses about their suspected communist affiliations. To his supporters, McCarthy was a dedicated patriot and a guardian of genuine Americanism; to his detractors, he was an irresponsible witch-hunter who was undermining the nation's traditions of civil liberties. The persecution of innocent persons on the charge of being communists and the forced conformity that this practice engendered in American public life came to be known as McCarthyism. His influence waned after 1954, when exposure of his truculent interrogative tactics in nationally televised hearings helped to turn public opinion against him. Later that year he was censured by the Senate for conduct "contrary to Senate traditions."

McCarthy, Mary (Therese) (b. June 21, 1912, Seattle, Wash., U.S.—d. Oct. 25, 1989, New York, N.Y.) U.S. novelist and critic. She served on the editorial staff of the *Partisan Review* from 1937 to 1948. She began writing fiction at the urging of her second husband, Edmund Wilson. Her work is noted for bitingly satiric commentaries on marriage, the impotence of intellectuals, and the role of women in contemporary urban America. Her novels include *The Company She Keeps* (1942); *The Group* (1963), her most popular work; *Birds of America* (1971); and *Cannibals and Missionaries* (1979). She also wrote two autobiographies, *Memories of a Catholic Girlhood* (1957) and *How I Grew* (1987).

McCartney, Sir (James) Paul (b. June 18, 1942, Liverpool, Eng.) British singer and songwriter. Born to a working-class family, he learned piano but switched to guitar after hearing American rock-and-roll recordings. In the mid-1950s he met John Lennon, with whom he formed the Quarrymen, which evolved into the Beatles. He and Lennon cowrote scores of songs, including some of the most popular songs of the 20th century. He released his first solo album in 1970. With his wife, the photographer Linda Eastman (1941–98), he formed the group Wings; their hit albums include *Band on the Run* (1973) and *Wings at the Speed of Sound* (1976). After the band dissolved, McCartney had a string of hits in the 1980s. In Rio de Janeiro in 1990, he set a world record by performing before a paying audience of more than 184,000. He was knighted in 1997.

McCarty, Maclyn (b. June 9, 1911, South Bend, Ind., U.S.—d. Jan. 2, 2005, New York, N.Y.) U.S. biologist. He received an M.D. (1937) at Johns Hopkins School of Medicine. With Oswald Avery and Colin M. MacLeod he provided the first experimental evidence that the genetic material of living cells is composed of DNA. In their classic experiments (1944), the introduction of certain material from one type of pneumococcus bacteria into another type transformed the receiving bacteria into the type from which the material had been taken. The substance responsible for the change was DNA.

McClellan, George B(rinton) (b. Dec. 3, 1826, Philadelphia, Pa., U.S.—d. Oct. 29, 1885, Orange, N.J.) U.S. Army officer. After graduating from West Point, he served in the Mexican War and then returned to West Point to teach military engineering. In 1855–56 he undertook a mission to the Crimea to study European methods of warfare. In 1857 he resigned his commission to become chief of engineering for the Illinois Central Railroad (1857); he became president of the Ohio and Mississippi Railroad in 1860. At the outbreak of the American Civil War he was commissioned in the regular army and placed in command of the department of the Ohio. Appointed general in chief of the army by Abraham Lincoln in 1861, he organized the army into an efficient fighting force but refused to take the offensive in the fall of that year, prompting Lincoln to issue his General War Order (1862) calling for forward movement of all armies. McClellan cautiously conducted the Peninsular Campaign but failed to take Richmond, and he fought indecisively in the Seven Days' Battles. At the Battle of Antietam he failed to destroy Robert E. Lee's army, and Lincoln removed him from command. In 1864 he was the unsuccessful

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Democratic candidate for president against Lincoln. From 1872 to 1877 he was president of the Atlantic and Great Western Railroad.

McClintock, Barbara (b. June 16, 1902, Hartford, Conn., U.S.—d. Sept. 2, 1992, Huntington, N.Y.) U.S. geneticist. She received her doctorate from Cornell University. In the 1940s and '50s, her experiments with variations in the coloration of kernels of corn revealed that genetic information is not stationary. She isolated two control elements in genetic material and found not only that they moved but that the change in position affected the behaviour of neighbouring genes, and she suggested that these elements were responsible for the diversity in cells during an organism's development. Her pioneering research, whose importance was not recognized for many years, eventually resulted in her being awarded a 1983 Nobel Prize.

McClung, Clarence E(rwin) (b. April 6, 1870, Clayton, Calif., U.S.—d. Jan. 17, 1946, Swarthmore, Pa.) U.S. zoologist. He received his Ph.D. from the University of Kansas. His study of the mechanisms of heredity led to his hypothesis (1901) that an extra, or accessory, chromosome determined sex. The discovery of the sex-determining chromosome provided some of the earliest evidence that a given chromosome carries a definable set of hereditary traits. McClung also studied how the behaviour of chromosomes in the sex cells of different organisms affects their heredity.

McClung, Nellie *orig.* **Nellie Mooney** (b. Oct. 20, 1873, Chatsworth, Ont., Can.—d. Sept. 1, 1951, Victoria, B.C.) Canadian writer and reformer. After marrying in 1896, she became prominent in the TEMPERANCE MOVEMENT. Her *Sowing Seeds in Danny* (1908), a novel about life in a small western town, became a national best-seller. She lectured widely on WOMAN SUFFRAGE and other reforms in Canada and the U.S. and served in the Alberta legislature (1921–26).

McCormack, John (b. June 14, 1884, Athlone, County Westmeath, Ire.—d. Sept. 16, 1945, near Dublin) Irish-U.S. tenor. He toured with Dublin's cathedral choir as a boy, studied voice in Milan, and made his Italian debut in 1906. He debuted the next year in London in *Cavalleria rusticana*, and an international operatic career ensued, especially in the U.S., for the next decade. From 1918 he concentrated on recitals and recordings, ranging from German lieder to sentimental popular songs. His Irish songs were particularly beloved.

McCormick, Cyrus Hall (b. Feb. 15, 1809, Rockbridge county, Va., U.S.—d. May 13, 1884, Chicago, Ill.) U.S. industrialist and inventor. He is generally credited with the development (from 1831) of the mechanical REAPER, which revolutionized the harvesting of grain. By 1850 the McCormick reaper was known throughout the U.S.; its prizes and honours, including the Grand Medal of Honour at the 1855 Paris exposition, made it famous around the world. In 1902 the McCormick Harvesting Co. joined with other companies to form International Harvester Co., with McCormick's son Cyrus, Jr., as its first president.

Cyrus McCormick.
CULVER PICTURES

McCormick, Robert R(utherford) *known as* **Colonel McCormick** (b. July 30, 1880, Chicago, Ill., U.S.—d. April 1, 1955, Wheaton, Ill.) U.S. newspaper editor and publisher. He was a grandnephew of CYRUS H. MCCORMICK and grandson of JOSEPH MEDILL, editor and publisher of the *CHICAGO TRIBUNE*. He was president of the Chicago Tribune Co. from 1911 and sole editor and publisher of the *Tribune* from 1925. Under his direction the paper achieved the largest circulation among U.S. standard-sized newspapers and led the world in newspaper advertising revenue. His idiosyncratic editorials made him the personification of reactionary journalism in the U.S.

McCrea \mə-'krā**, Joel (Albert)** (b. Nov. 5, 1905, South Pasadena, Calif., U.S.—d. Oct. 20, 1990, Woodland Hills, Calif.) U.S. film actor. He worked in Hollywood as a stuntman and bit player before getting his first leading role in *The Silver Horde* (1930). His films—many of them westerns in which he portrayed a dependable, even-tempered man speaking in a resonant American twang—include *The Most Dangerous Game* (1932), *Wells Fargo* (1937), *Union Pacific* (1939), *Foreign Correspondent* (1940), *Sullivan's Travels* (1941), *The Virginian* (1946), and *Ride the High Country* (1962).

McCullers, Carson *orig.* **Lula Carson Smith** (b. Feb. 19, 1917, Columbus, Ga., U.S.—d. Sept. 29, 1967, Nyack, N.Y.) U.S. novelist and short-story writer. She studied at Columbia and New York universities and eventually settled in New York's Greenwich Village. A series of strokes she suffered as a child left her partly paralyzed. She typically set her stories in small Southern communities and depicted the inner lives of lonely people. Her novels include *The Heart Is a Lonely Hunter* (1940), perhaps her finest work; *Reflections in a Golden Eye* (1941); *The Member of the Wedding* (1946), which she adapted into a play (1950); and *The Ballad of the Sad Café* (1951), dramatized by EDWARD ALBEE in 1963. Each of these was adapted for film.

McCulloch, Hugh (b. Dec. 7, 1808, Kennebunk, Maine, U.S.—d. May 24, 1895, near Washington, D.C.) U.S. financier and statesman. After teaching school in Boston, he moved in 1833 to Fort Wayne, Ind., where he was a lawyer and then a banker. Appointed U.S. secretary of the treasury (1865–69), he attempted to return the U.S. to the gold standard by withdrawing from circulation the paper money that had been issued during the AMERICAN CIVIL WAR, but he was thwarted by public opposition. He was again secretary of the treasury from 1884 to 1885.

Hugh McCulloch
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

McCulloch v. Maryland (1819) Decision of the SUPREME COURT OF THE UNITED STATES that affirmed the constitutional doctrine of Congress's implied powers. The case concerned the legitimacy of the authority of a newly created national bank to control the issuance of currency by the states, including Maryland. The unanimous opinion, written by JOHN MARSHALL, established that Congress possesses not only the powers expressly conferred on it by the Constitution but also the authority appropriate to the utilization of such powers, in this case the creation of such a bank. This doctrine, drawn from the "elastic clause" of Article 1, became a significant factor in the steady growth of federal powers. It also bolstered the power of JUDICIAL REVIEW established in *MARBURY V. MADISON* (1803).

McDonnell Douglas Corp. U.S. manufacturer of jet fighters, commercial aircraft, and space vehicles. It was formed in the 1967 merger of the McDonnell Aircraft Co. (founded 1939) and the Douglas Co. (1921). During World War II, Douglas contributed 29,000 warplanes, one-sixth of the U.S. airborne fleet. After the war, it dominated commercial air routes with its DC-6 and DC-7. With the development of commercial jets, Douglas began to lag behind BOEING CO. and sought a merger with McDonnell, which had grown quickly during World War II and had continued to be a major defense supplier, designing the first carrier-based jet fighter. After the merger McDonnell Douglas produced widely used jet fighters (including the F-4 Phantom, A-4 Skyhawk, F-15 Eagle, and F-18 Hornet) as well as LAUNCH VEHICLES and CRUISE MISSILES. It was bought by Boeing in 1997. See also LOCKHEED-MARTIN.

McEnroe, John (Patrick), Jr. (b. Feb. 16, 1959, Wiesbaden, W.Ger.) U.S. tennis player. He grew up in Douglaston, N.Y. An athletic serve-and-volley player, he won three consecutive U.S. Open singles titles (1979–81) and a fourth in 1984. He also won the Wimbledon singles in 1981, 1983, and 1984, as well as several doubles titles. Known for his temper tantrums and invective on court, he became the first player ejected from a grand-slam match in nearly 30 years.

McFadden, Daniel L. (b. July 29, 1937, Raleigh, N.C., U.S.) U.S. economist and winner of the 2000 NOBEL PRIZE in Economic Sciences, along with JAMES HECKMAN, for development of methods for analyzing individual or household behaviour. McFadden studied physics (B.S. 1957) and economics (Ph.D. 1962) at the University of Minnesota. He taught

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economics at the University of California, Berkeley (1963–79 and from 1990), Yale University (1977–78), and the Massachusetts Institute of Technology (1978–91). In 1974 McFadden developed conditional logit analysis—a method for determining how people make choices that maximize the utility of their decisions. His work has helped predict usage rates for MASS TRANSIT, and his statistical methods have been applied to labour-force participation, health care, housing, and the environment.

McGill University Privately endowed but state-supported university in Montreal, Quebec, Canada. It was founded in 1821 through a gift left by the Scottish-born Canadian merchant James McGill (1744–1813). It is internationally known for its work in chemistry, medicine, and biology. In addition, it has faculties of agricultural and environmental sciences, arts, dentistry, education, engineering, law, management, music, religious studies, and science. The language of instruction is English, though students may write examinations in French.

McGillivray \mə-'gil-ə-ˌvrā**, Alexander** (b. c. 1759—d. Feb. 17, 1793, Pensacola, Fla.) Principal chief of the CREEK Indians in the years following the American Revolution. Of French and Creek descent, he was tutored by whites in Charleston, S.C., before being made a Creek chief. Distrustful of American land speculators, he signed a treaty (1784) with the Spanish in Florida putting the Creek under Spain's protection. After repeated U.S. entreaties, he agreed to American sovereignty over Creek lands as long as the Creek could remain there free of American encroachments.

McGovern, George S(tanley) (b. July 19, 1922, Avon, S.D., U.S.) U.S. politician. After earning a doctorate in history at Northwestern University, he taught at Dakota Wesleyan University in South Dakota. Active in Democratic politics from 1948, he was elected to the U.S. House of Representatives (1957–61) and the U.S. Senate (1963–81), where he held important hearings on hunger in the U.S. He was a leading critic of the U.S. role in the VIETNAM WAR. In 1972 he won the Democratic presidential nomination but lost the general election to Pres. RICHARD NIXON by a large margin. He was reelected to the Senate in 1974 but lost his seat in 1980. He returned to to teaching, lecturing, and writing and remained a prominent spokesman for liberal causes.

McGraw, John (Joseph) (b. April 7, 1873, Truxton, N.Y., U.S.—d. Feb. 25, 1934, New Rochelle, N.Y.) U.S. baseball player and manager. McGraw was a star infielder for the Baltimore National League team in the 1890s. His batting average of .391 in 1899 remains the highest ever for a third baseman. As manager of the New York Giants (1902–32), he led the team to 10 National League championships and 3 World Series titles (1905, 1921, 1922). For his shrewdness and veneer of harshness, he acquired the nickname "Little Napoleon."

John McGraw, 1910.
THE BETTMANN ARCHIVE

McGuffey, William Holmes (b. Sept. 23, 1800, Pennsylvania, U.S.—d. May 4, 1873, Charlottesville, Va.) U.S. educator remembered chiefly for his series of elementary readers. McGuffey taught in the Ohio frontier schools and then at Miami University (1826–36). His elementary school series, starting with *The Eclectic First Reader*, was published between 1836 and 1857. Collections of didactic tales, aphorisms, and excerpts from great books, the readers reflect McGuffey's view that the proper education of young people required their introduction to a wide variety of topics and practical matters. They became standard texts in nearly all states for the next 50 years and sold more than 125 million copies. In these years McGuffey also served as president of Cincinnati College (1836–39) and of Ohio University, Athens (1839–43). He was a founder of the common school system of Ohio. In 1845 he was elected to the chair of mental and moral philosophy at the UNIVERSITY OF VIRGINIA, Charlottesville, a position he held until his death.

McGwire, Mark (David) (b. Oct. 1, 1963, Pomona, Calif., U.S.) U.S. baseball player. McGwire played first base in college, then joined the Oakland Athletics in 1987 and quickly displayed the strength that would become his trademark. His 49 home runs hit during his first season in the majors set a record, and he was named the American League's Rookie of the Year. In 1989 his .343 postseason batting average guided Oakland to the World Series championship. Injuries plagued him in 1993–95. Traded to the St. Louis Cardinals in 1997, he hit 58 homers. In 1998 he topped ROGER MARIS's 37-year-old season record of 61 home runs. He and SAMMY SOSA thrilled fans with their home-run competition, and McGwire achieved the new record with 70; the record was broken in 2001 by BARRY BONDS (73). In 1999 McGwire hit 65 home runs. Following the 2001 season he retired from professional play.

McHugh, Jimmy *orig.* **James Francis McHugh** (b. July 10, 1894, Boston, Mass., U.S.—d. May 23, 1969, Beverly Hills, Calif.) U.S. song composer. McHugh became a TIN PAN ALLEY song plugger and began writing songs for Broadway and COTTON CLUB revues. His extensive work for Broadway and Hollywood included collaborations with FRANK LOESSER, JOHNNY MERCER, and especially DOROTHY FIELDS, with whom he wrote "I Can't Give You Anything but Love" and "On the Sunny Side of the Street."

McKay, Claude (b. Sept. 15, 1890, Jamaica, British West Indies—d. May 22, 1948, Chicago, Ill., U.S.) Jamaican-born U.S. poet and novelist. He published two volumes of Jamaican dialect verse before moving to the U.S. in 1912. With the publication of the poetry volumes *Spring in New Hampshire* (1920) and *Harlem Shadows* (1922), he emerged as the first and most militant voice of the HARLEM RENAISSANCE. An advocate of civil rights and racial solidarity, in his writings he searched among the common people for a distinctive black identity. His *Home to Harlem* (1928) was the most popular novel by an American black to that time. He lived abroad in various countries from 1922 to 1934.

McKellen, Sir Ian (Murray) (b. May 25, 1939, Burnley, Lancashire, Eng.) British actor. Educated at Cambridge University, he made his professional stage debut in 1961 and won acclaim as Richard II and Edward II at the Edinburgh Festival in 1969. He cofounded the Actors' Co. in 1971 but left in 1974 to join the Royal Shakespeare Co. A versatile and passionate actor, he has played in a repertory ranging from Elizabethan to contemporary. In 1981 he won a Tony Award for *Amadeus*. His films include *Plenty* (1985), *Scandal* (1988), *Richard III* (1995), and *Gods and Monsters* (1998), and in 2001 he played the wizard Gandalf in the film version of J.R.R. TOLKIEN's *Lord of the Rings*. He has been a vocal supporter of gay rights since 1988. He was knighted in 1991.

McKim, Charles Follen (b. Aug. 24, 1847, Chester County, Pa., U.S.—d. Sept. 14, 1909, St. James, Long Island, N.Y.) U.S. architect. He was educated at Harvard University and in Paris at the École des Beaux-Arts. In 1879 he joined William Rutherford Mead and STANFORD WHITE to found McKim, Mead & White, the most successful U.S. architectural firm of its time. Until 1887 the firm excelled at SHINGLE STYLE residences. In later years it championed the formal Renaissance tradition and its Classical antecedents, helping to inspire a Neoclassical revival. Among the widely admired examples of McKim's formal planning are the Boston Public Library (1887), the Columbia University Library (1893), the building program of the World's Columbian Exposition in Chicago (1893, with DANIEL H. BURNHAM and RICHARD MORRIS HUNT), and in New York City the Morgan Library (1903) and the magnificent Pennsylvania Railway Station (1904–10; demolished 1963).

McKinley, Mount *Athabascan* **Denali** \də-'nä-lē\ Highest mountain in North America. Located near the centre of the Alaska Range in south-central Alaska, U.S., and in DENALI NATIONAL PARK, it rises to 20,320 ft (6,194 m). The northern peak was first scaled in 1910, and in 1913 Hudson Stuck and Harry Karstens ascended the southern peak, the true summit. It was named Densmores Peak in 1889 after a prospector but was renamed in 1896 in honour of Pres. WILLIAM MCKINLEY.

McKinley, William (b. Jan. 29, 1843, Niles, Ohio, U.S.—d. Sept. 14, 1901, Buffalo, N.Y.) 25th president of the U.S. (1897–1901). He served in the AMERICAN CIVIL WAR as an aide to Col. RUTHERFORD B. HAYES, who later encouraged his political career. He served in the U.S. House of Representatives (1877–91), where he favoured protective tariffs; he was the principal sponsor of the McKinley Tariff of 1890. With the support of MARK HANNA, he won two terms as governor of Ohio (1892–96). As the Republican presidential candidate in 1896 he decisively defeated Demo-

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crat William Jennings Bryan. In 1897 he signed the Dingley Tariff, the highest protective tariff in American history to that time. In 1898 the USS *Maine* exploded and sank in the harbour of Havana, Cuba, then a colony of Spain; believing the Spanish responsible, McKinley demanded independence for the island, which Spain refused. The U.S. easily won the brief Spanish-American War. McKinley supported ratification of the peace treaty that ceded the Spanish possessions of Puerto Rico, Guam, and the Philippines to the U.S., claiming that the U.S. had an obligation to assume responsibility for "the welfare of an alien people." Following his inauguration in 1901 he began a speaking tour of the western states, during which he urged control of the trusts and commercial reciprocity to boost foreign trade. On Sept. 6, 1901, he was fatally shot by an anarchist, Leon Czolgosz. He was succeeded by Theodore Roosevelt.

William McKinley
LIBRARY OF CONGRESS, WASHINGTON, D.C.

McLuhan \mək-'lü-ən**, (Herbert) Marshall** (b. July 21, 1911, Edmonton, Alta., Can.—d. Dec. 31, 1980, Toronto, Ont.) Canadian communications theorist and educator. He taught from 1946 at the University of Toronto and became popular for his aphorism "the medium is the message," which summarized his view of the potent influence of "hot media"—television, computers, and other electronic information disseminators—in shaping styles of thinking and thought, whether in sociology, art, science, or religion. He regarded the printed book, a "cool medium," as fated to disappear. His highly influential works include *The Gutenberg Galaxy* (1962), *Understanding Media* (1964), and *The Medium Is the Massage* (with Q. Fiore, 1967).

McMahon Line Frontier between Tibet and Assam in British India, negotiated between Tibet and Britain at the end of the Shimla (Simla) Conference in 1913–14. It was named for the chief British negotiator, Sir Henry McMahon. China refused to recognize the boundary on the grounds that Tibet, being subordinate to China, could not make treaties. A conflict in 1962 between India and China failed to resolve the border dispute; China still considers the boundary illegal.

McMaster University Privately endowed university in Hamilton, Ontario, Canada. It was founded in 1887 through a gift from Sen. William McMaster (1811–87). It offers undergraduate and graduate degree programs in the sciences, humanities, social sciences, business, engineering, and other fields. Campus resources include a nuclear reactor, education research facilities, and the Bertrand Russell Archives.

McMurdo Sound Bay, western extension of the Ross Sea, Antarctica. Lying at the edge of the Ross Ice Shelf, the channel is 92 mi (148 km) long and up to 46 mi (74 km) wide; it has been a major centre for Antarctic explorations. First discovered in 1841 by Scottish explorer James C. Ross, it served as one of the main access routes to the Antarctic continent. Ross Island, on the shores of the sound, was the site of headquarters for British explorers Robert Falcon Scott and Ernest Shackleton.

McMurtry, Larry (Jeff) (b. June 3, 1936, Wichita Falls, Texas, U.S.) U.S. novelist. The son of a rancher, he is noted for novels set in the American West, often in Texas. *The Last Picture Show* (1966) examines the isolation of small-town life. *Lonesome Dove* (1985, Pulitzer Prize) is part of an epic frontier series that also includes *Streets of Laredo* (1993), *Dead Man's Walk* (1995), and *Comanche Moon* (1997). His other novels include *Horseman, Pass By* (1961), *Terms of Endearment* (1975), and *Buffalo Girls* (1990). Many of his novels were adapted for film or television.

McNally, Terrence (b. Nov. 3, 1939, St. Petersburg, Fla., U.S.) U.S. dramatist. He worked as a newspaper reporter, as tutor for the children of John Steinbeck, and as stage manager at the Actors Studio. His plays, which often explore relationships and are characterized by dark humour, include *Bad Habits* (1971), *Master Class* (1995), *Love! Valour! Compassion!* (1995, Tony Award; film, 1997), and the controversial *Corpus Christi* (1998, Tony Award). He wrote the book for the musical *Kiss of the Spider Woman* (1993).

McNamara \'mak-nə-mar-ə**, Robert S(trange)** (b. June 9, 1916, San Francisco, Calif., U.S.) U.S. secretary of defense (1961–68). He graduated from the University of California at Berkeley (1937), earned a graduate degree at the Harvard Business School (1939), and later joined the Harvard faculty. He developed logistical and statistical systems for the military during World War II. After the war, he was one of the "Whiz Kids" hired to revitalize the Ford Motor Company, and in 1960 he became the first president of the company who was not a member of the Ford family. In 1961 he was appointed secretary of defense by John F. Kennedy. Though initially a supporter of U.S. involvement in the Vietnam War, by 1967 he advocated peace negotiations; his opposition to the bombing of North Vietnam caused him to lose influence with Pres. Lyndon B. Johnson. He resigned in 1968 to become president of the World Bank (1968–81).

McNeill, Don (b. Dec. 23, 1907, Galena, Ill., U.S.—d. May 7, 1996, Evanston, Ill.) U.S. radio entertainer. He entered radio in the 1920s as part of a singing team. In 1933 he took over as host of an NBC morning program in Chicago and created *The Breakfast Club*. Usually unscripted, it relied on listeners' comments, poems, and folksy humour. It was the longest-running show in radio network history when it ended in 1968.

McPhee, John (Angus) (b. March 8, 1931, Princeton, N.J., U.S.) U.S. journalist and nonfiction writer. He attended Princeton University. After working as an associate editor at *Time* (1957–64), he became a staff writer at *The New Yorker* in 1965. His nonfiction covers a wide variety of topics. His first book was on Bill Bradley; places he has written about include New Jersey, Alaska, the American West (several books), and Switzerland; other topics include the citrus industry, aeronautical engineering, the birch-bark canoe, and nuclear terrorism. He has taught journalism at Princeton since 1975. His later works include *Annals of the Former World* (1998, Pulitzer Prize).

McPherson, Aimee Semple *orig.* **Aimee Elizabeth Kennedy** (b. Oct. 9, 1890, near Ingersoll, Ont., Can.—d. Sept. 27, 1944, Oakland, Calif., U.S.) Canadian-born U.S. Pentecostal evangelist. Born on a farm, she began preaching at age 17, and in 1908 she went as a missionary to China with her husband, Robert Semple. After his death she came to the U.S., where her second marriage, to Harold McPherson, ended in 1918 when she became an itinerant evangelist and healer. She settled in Los Angeles and founded the International Church of the Foursquare Gospel. For nearly 20 years she preached to large audiences at her Angelus Temple; she also built a radio station, wrote books and pamphlets, and established about 200 missions. In 1926 she disappeared mysteriously for five weeks; on her reappearance her tale of kidnapping was greeted with skepticism. A third marriage ended in divorce, and she faced numerous trials for financial irregularities. She died from an accidental overdose of sleeping pills.

McQueen, (Terence) Steve(n) (b. March 24, 1930, Beech Grove, Ind., U.S.—d. Nov. 7, 1980, Juárez, Mex.) U.S. film actor. He served time in a reform school and a stint in the U.S. Marines before studying acting in New York City. He won notice on Broadway in *A Hatful of Rain* (1955) and made his screen debut in *Somebody up There Likes Me* (1956), then starred in the television series *Wanted: Dead or Alive* (1958–61). Cool and stoical, his loner heroes spoke through actions and rarely with words in films such as *The Great Escape* (1963), *The Sand Pebbles* (1966), *Bullitt* (1968), *The Thomas Crown Affair* (1968), *Papillon* (1973), and *The Towering Inferno* (1974).

McRae, Carmen (b. April 8, 1920, New York, N.Y., U.S.—d. Nov. 10, 1994, Beverly Hills, Calif.) U.S. singer and pianist. McRae was influenced by Billie Holiday and Sarah Vaughan. She began her career in 1943 singing at Minton's Playhouse in Harlem, absorbing the innovations of the first bebop musicians. Working as a soloist from the mid-1950s, McRae became one of the most accomplished scat singers and ballad interpreters in jazz.

Me 109 See Messerschmitt 109

Me Nam River See Chao Phraya River

mead Alcoholic beverage fermented from honey and water. It can be light or rich, sweet or dry, or even sparkling. Alcoholic drinks made from honey were common in ancient Scandinavia, Gaul, Teutonic Europe, and Greece; they were particularly common in northern Europe, where grapevines do not flourish. By the 14th century, ale and sweetened wine were surpassing mead in popularity. Today mead is made as a sweet or dry wine of low alcoholic strength. Spiced mead is called metheglin.

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Mead, George Herbert (b. Feb. 27, 1863, South Hadley, Mass., U.S.—d. April 26, 1931, Chicago, Ill.) U.S. philosopher, sociologist, and social psychologist prominent in the development of PRAGMATISM. He studied at Oberlin College, graduated from Harvard University (B.A., 1888), and went on to study philosophy and psychology at the Universities of Leipzig and Berlin (1888–91). Mead then taught philosophy and psychology at the University of Michigan (1891–94) with JOHN DEWEY and CHARLES HORTON COOLEY. In 1894 he joined Dewey in moving to the University of Chicago and taught there the rest of his life. Mead's focus was the relationship between the self and society, particularly the emergence of the human self in the process of social interaction. His works include *The Philosophy of the Present* (1932) and *Mind, Self, and Society* (1934). See also INTERACTIONISM.

Mead, Lake Reservoir of the HOOVER DAM, on the Arizona-Nevada border in the U.S. One of the largest man-made lakes in the world, it was formed by the damming of the COLORADO RIVER. Lake Mead is 115 mi (185 km) long and 1–10 mi (1.6–16 km) wide; it has a capacity of over 31 million acre ft (38 billion cubic m), with a surface area of 229 sq mi (593 sq km). It was named after Elwood Mead, commissioner of reclamation. Lake Mead National Recreation Area (established 1936) has an area of 2,338 sq mi (6,055 sq km) and extends 240 mi (386 km) along the river.

Mead, Margaret (b. Dec. 16, 1901, Philadelphia, Pa., U.S.—d. Nov. 15, 1978, New York, N.Y.) U.S. anthropologist. She studied under FRANZ BOAS and RUTH BENEDICT at Columbia University and did fieldwork in Samoa before completing her Ph.D. (1929). The first and most famous of her 23 books, *Coming of Age in Samoa* (1928), presents evidence in support of cultural determinism with respect to the formation of personality or TEMPERAMENT. Her other books include *Sex and Temperament in Three Primitive Societies* (1935), *Male and Female* (1949), and *Culture and Commitment* (1970). Her theories caused later 20th-century anthropologists to question both the accuracy of her observations and the soundness of her conclusions. In her later years she became a prominent voice on such wide-ranging issues as women's rights and nuclear proliferation, and her great fame owed as much to the force of her personality and her outspokenness as to the quality of her scientific work. She served in curatorial positions at the American Museum of Natural History for over 50 years.

Meade, George G(ordon) (b. Dec. 31, 1815, Cádiz, Spain—d. Nov. 6, 1872, Philadelphia, Pa., U.S.) U.S. general in the AMERICAN CIVIL WAR. He was the son of a U.S. naval agent in Spain. After graduating from West Point in 1835, he worked as a surveyor. He reentered the army in 1842 and in 1861 was commissioned brigadier general in the Pennsylvania volunteers. He fought at Bull Run, Antietam, and Chancellorsville. Three days before the Battle of GETTYSBURG, he replaced JOSEPH HOOKER as commander of the Army of the Potomac. At Gettysburg he repulsed the Confederate attack but was criticized for failing to pursue ROBERT E. LEE's forces. From 1864 he was subordinate to Gen. ULYSSES S. GRANT, whom he served loyally. After the war he commanded several military departments.

meadowlark Any sharp-billed, plump songbird of the genus *Sturnella* (family Icteridae), 8–11 in. (20–28 cm) long. The two North American species are streaked brown above and have a yellow breast crossed by a black V; the short tail has distinctive white outer feathers. The eastern, or common, meadowlark (*S. magna*), from eastern Canada to Brazil, has a simple four-note whistle; the western meadowlark (*S. neglecta*), from western Canada to Mexico, has an intricate fluting song. Meadowlarks eat insects in summer and seeds in fall and winter. Their nests are grass domes hidden in fields.

mealybug Any insect of the family Pseudococcidae (order Homoptera). Not a true BUG, the mealybug is covered by a white sticky powder resembling cornmeal. The females, about 0.4 in. (1 cm) long, and "crawlers" (the active young) cluster along the veins and undersides of leaves, especially of citrus trees and potted plants; the males are active two-winged fliers. Common species are the citrus mealybug (*Pseudococcus citri*) and the citrophilus mealybug (*P. gahani*).

mean life In RADIOACTIVITY, the average lifetime of all the nuclei of a particular unstable atomic species. This time interval is the sum of the lifetimes of all the individual unstable nuclei in a sample, divided by the total number of unstable nuclei present. It is the reciprocal of the decay constant. For a given isotope, the mean life is always 1.443 times its HALF-LIFE. For example, lead-209 decays to bismuth-209 with a half-life of 3.25 hours and a mean life of 4.69 hours.

mean, median, and mode In mathematics, the three principal ways of designating the average value of a list of numbers. The arithmetic mean is found by adding the numbers and dividing the sum by the number of numbers in the list. This is what is most often meant by an average. The median is the middle value in a list ordered from smallest to largest. The mode is the most frequently occurring value on the list. There are other types of means. A geometric mean is found by multiplying all values in a list and then taking the root of that product equal to the number of values (e.g., the square root if there are two numbers). The geometric mean is typically used in cases of exponential growth or decline (see EXPONENTIAL FUNCTION). In STATISTICS, the mean of a RANDOM VARIABLE is its expected value—i. e., the theoretical long-run arithmetic mean of the outcomes of repeated trials, such as a large number of tosses of a die.

mean-value theorems In mathematics, two theorems, one associated with DIFFERENTIAL CALCULUS and one with INTEGRAL CALCULUS. The first proposes that any differentiable FUNCTION defined on an interval has a mean value, at which a TANGENT LINE is parallel to the line connecting the endpoints of the function's graph on that interval. For example, if a car covers a mile from a dead stop in one minute, it must have been traveling exactly a mile a minute at some point along that mile. In integral calculus, the mean value of a function on an interval is, in essence, the arithmetic mean (see MEAN, MEDIAN AND MODE) of its values over the interval. Because the number of values is infinite, a true arithmetic mean is not possible. The theorem shows how to find the mean value using a definite INTEGRAL. See also ROLLE'S THEOREM.

meander \mē-'an-dər\ Extreme U-bend in a stream, usually occurring in a series, that is caused by flow characteristics of the water. Meanders form in stream-deposited sediments and may stack up upstream of an obstruction, resulting in a gooseneck or extremely bowed meander. A cutoff may form through the gooseneck and allow the former meander bend to be sealed off as an OXBOW LAKE. Silt deposits may eventually fill the lake to form a MARSH or a meander scar.

Meanders, Owens River, near Mammoth Lakes, Calif.
© BARRIE ROKEACH—AERIAL/TERRESTRIAL PHOTOGRAPHY

meaning In philosophy and linguistics, the sense of a linguistic expression, sometimes understood in contrast to its referent. For example, the expressions "the morning star" and "the evening star" have different meanings, though their referent (Venus) is the same. Some expressions have meanings but no referents ("the present king of France") or referents but no meanings ("that"). The literal or conventional meaning of an expression may differ from what a speaker of that expression means by uttering it on a particular occasion; this is the case with similes, statements uttered ironically, and statements that convey various "conversational implicatures," as in the following examples: "She entered the house and shot him" implicates that she shot him in the house after she entered it, though this is not part of the sentence's literal meaning; "John has three sons" implicates that John has no more than three sons, though again the sentence does not literally say this. Other non-literal aspects of meaning include the potential for carrying out various "speech acts" (see SPEECH ACT THEORY); e.g., uttered in the appropriate circumstances, the sentence "I christen thee the *Joseph Stalin*," constitutes the act of naming a ship, and the sentence "I am cold" constitutes a request to close the window. See also PRAGMATICS; SEMANTICS.

Meany, George (b. Aug. 16, 1894, New York, N.Y., U.S.—d. Jan. 10, 1980, Washington, D.C.) U.S. labour leader. A plumber by trade, he joined the United Association of Plumbers and Steam Fitters in 1915 and rose through the ranks as a union official. He was elected secretary-treasurer of the American Federation of Labor (AFL) in 1939 and became its president in 1952. He led the merger of the AFL and the Congress of Industrial Organizations (CIO) in 1955, helping reconcile the two federations despite their competitiveness and long-standing differences. Conservative and anticommunist, as president of the AFL-CIO (1955–79) he steered the

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U.S. labour movement away from radicalism. Feisty and often dictatorial, he expelled the TEAMSTERS UNION from the AFL-CIO in 1957, and he lost the UNITED AUTOMOBILE WORKERS in 1967 after disputes with WALTER REUTHER. Meany wielded considerable influence in the Democratic Party through the 1970s.

measles *or* **rubeola** \ˌrü-bē-ˈō-lə, rü-ˈbē-ˈə-lə\ Highly contagious viral childhood disease. It initially resembles a severe cold with red eyes and fever; a blotchy rash and higher fever later develop. After recovery, patients have lifelong immunity. Adult patients tend to have more severe cases. ANTIBIOTICS now prevent death from secondary infections. Measles itself, for which there is no drug, requires only bed rest, eye protection, and steam for bronchial irritation. A vaccine developed in the 1960s proved not to give permanent immunity and is too heat-sensitive for use in tropical areas. The worldwide incidence of measles continues to rise. Research is currently directed toward development of a more stable vaccine. See also RUBELLA.

measure theory In mathematics, a generalization of the concepts of length and area (see LENGTH, AREA, AND VOLUME) to arbitrary sets of points not composed of line segments or rectangles. A measure is any rule for associating a number with a set. The result must be nonnegative and also additive, meaning that the measure of two nonoverlapping sets equals the sum of their individual measures. This is simple enough for sets consisting of line segments or rectangles, but the measure of sets such as curved regions or intervals with missing points requires more abstract methods, including LIMITS and upper and lower bounds.

measurement Association of numbers with physical quantities and natural phenomena by comparing an unknown quantity with a known quantity of the same kind. WEIGHTS and measures are standard quantities with which such comparisons are made. The earliest ones measured mass (weight), volume (liquid or dry measure), length, and area using units mostly based on dimensions of the human body. The cubit, representing the distance from elbow to fingertips, was the most widespread unit of measure in the ancient world. As such units were standardized, more were added, including units of temperature, luminosity, pressure, and electric current. Measurements made by the senses instead of by measurement devices are called estimates (see ESTIMATION).

meat Flesh and other edible parts of animals, particularly MAMMALS, used for food. Not only the MUSCLES and FAT but also organs such as the liver, kidney, and heart are consumed as meat. Meat is valued as a complete-PROTEIN food, containing all the AMINO ACIDS necessary for the human body. It is digested slowly, largely because of the presence of fats. Worldwide, PORK is the most widely consumed meat; BEEF is second. Mutton and lamb, goat, venison, and rabbit are other common meats. The U.S. produces and consumes about a third of the world's meat, while much of the world's population eats little if any meat, though it is generally prized.

Mecca *Arabic* **Al-Makkah** \ˌal-ˈmä-kə\ City (pop., 1992: 965,697), western Saudi Arabia. The holiest city of ISLAM, it was the birthplace of the Prophet MUHAMMAD. It was his home until AD 622, when he was forced to flee to MEDINA (see also HIJRAH); he returned and captured the city in 630. It came under the control of the Egyptian MAMLŪK DYNASTY in 1269 and of the OTTOMAN EMPIRE in 1517. King IBN SAʿŪD occupied it in 1925, and it became part of the Kingdom of Saudi Arabia. It is a religious centre to which Muslims must attempt a pilgrimage (see HAJJ) once during a lifetime; only Muslims may enter Mecca. Services related to pilgrimages are the main economic activity. It is the site of the Ḥaram Mosque, which contains the KAʿBAH.

mechanical advantage Force-amplifying effectiveness of a simple MACHINE (LEVER, WEDGE, WHEEL and AXLE, PULLEY, or SCREW). The theoretical mechanical advantage of a system is the ratio of the FORCE that performs the useful work to the force applied, assuming there is no friction in the system. In practice, the actual mechanical advantage will be less than the theoretical value by an amount determined by the amount of friction.

mechanical efficiency See EFFICIENCY

mechanical energy Sum of a system's KINETIC ENERGY (KE) and POTENTIAL ENERGY (PE). Mechanical energy is constant in a system that experiences no dissipative forces such as friction or air resistance. For example, a swinging pendulum that experiences only gravitation has greatest KE and least PE at the lowest point on the path of its swing, where its speed is greatest and its height least. It has least KE and greatest PE at the extremities of its swing, where its speed is zero and its height is greatest. As it moves, energy is continuously passing back and forth between the two forms. Neglecting friction and air resistance, the pendulum's mechanical energy is constant.

mechanical engineering Branch of ENGINEERING concerned with the design, manufacture, installation, and operation of ENGINES, MACHINES, and MANUFACTURING processes. Mechanical engineering involves application of the principles of DYNAMICS, control, THERMODYNAMICS and heat transfer, FLUID MECHANICS, STRENGTH OF MATERIALS, MATERIALS SCIENCE, ELECTRONICS, and MATHEMATICS. It is concerned with MACHINE TOOLS, motor vehicles, textile machinery, packaging machines, printing machinery, metalworking machines, welding, air conditioning, refrigerators, agricultural machinery, and many other machines and processes essential to an industrial economy.

mechanical system Any building service using machines. They include PLUMBING, ELEVATORS, ESCALATORS, and HEATING and AIR-CONDITIONING systems. The introduction of mechanization in buildings in the early 20th century brought about major adjustments; the new equipment demanded floor space, and the design team began to include electrical and HVAC (heating, VENTILATING, and air-conditioning) engineers. Heating and cooling changed dramatically. Modern buildings, with their large heat gains, turned central heating into little more than a supplement. Heat removal is a much more serious burden, especially in warm weather. The roofs of high-rises are occupied by cooling towers and mechanical PENTHOUSES; entire floors are often dedicated to the containment of blowers, compressors, water chillers, boilers, pumps, and generators.

mechanics Science of the action of forces on material bodies. It forms a central part of all physical science and engineering. Beginning with NEWTON'S LAWS OF MOTION in the 17th century, the theory has since been modified and expanded by the theories of QUANTUM MECHANICS and RELATIVITY. Newton's theory of mechanics, known as classical mechanics, accurately represented the effects of forces under all conditions known in his time. It can be divided into statics, the study of EQUILIBRIUM, and DYNAMICS, the study of motion caused by forces. Though classical mechanics fails on the scale of ATOMS and molecules, it remains the framework for much of modern science and technology.

mechanism In mechanical construction, the means of transmitting and modifying motion in a MACHINE or an assembly of mechanical parts. The chief characteristic of the mechanism of a machine is that all members have constrained motion; that is, the parts can move only in certain ways in relation to each other. Despite its complexity, the mechanism of a machine can always be analyzed as a group of simple basic mechanisms, each of which contains members that transmit motion from one moving link to another. In general, motion is transmitted in one of three ways: by a wrapping connector such as a CHAIN DRIVE or BELT DRIVE, by direct contact as in a CAM or GEAR, or by a pin-connected LINKAGE.

mechanism Form of MATERIALISM that holds that all natural processes can be explained in terms of laws of matter in motion. Upholders of mechanism were mainly concerned with eliminating from science all occult entities, such as substantial form, that could not be empirically observed or mathematically treated. It thus opposed the use of teleological assumptions as explanatory principles in natural science (see TELEOLOGY). See also ATOMISM.

mechanization Use of MACHINES, either wholly or in part, to replace human or animal labour. Unlike AUTOMATION, which may not depend at all on a human operator, mechanization requires human participation to provide information or instruction. Mechanization began with human-operated machines to replace the handwork of craftspeople; today computers are frequently used to control mechanized processes.

mechanoreception \ˌme-kə-nō-ri-ˈsep-shən\ Ability to detect and respond to mechanical stimuli in one's environment. A slight deformation of a mechanoreceptive NEURON causes an electric charge at its surface, activating a response. Mechanoreceptors in "pain spots" (pressure points) in the skin (probably clusters of nerve endings) vary in sensitivity. They respond to a wide range of stimuli, sometimes with a REFLEX (e.g., a pricked finger pulled away before the brain registers pain). The structures that respond to sound (see EAR), sense orientation with respect to gravity (see INNER EAR), or detect the position and movement of limbs (see PROPRIOCEPTION) are mechanoreceptors. Some animals have mechanoreceptors that detect water motion or air currents. See also SENSE.

Mecherino See Domenico BECCAFUMI

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Meckel, Johann Friedrich (b. Oct. 17, 1781, Halle, Prussia—d. Oct. 31, 1833, Halle) German anatomist. He was the first to describe the embryonic cartilage (Meckel cartilage) that becomes part of the lower jaw in fishes, amphibians, and birds and also described a congenital pouch (Meckel diverticulum) of the small intestine. He wrote a treatise on pathological anatomy and an atlas of human abnormalities.

Med fly See MEDITERRANEAN FRUIT FLY

medal Piece of metal struck with a design to commemorate a person, place, or event. Medals can be of various sizes and shapes, ranging from large medallions to small plaques, or plaquettes. Most medals are made of gold, silver, bronze, or lead, the precious metals being used for the finer productions. The art of the medalist began in the mid-15th century with bronze medals of Italian Renaissance rulers and humanists. Some of the most beautiful were made by BENVENUTO CELLINI.

Henry IV and Marie de Medicis portrayed on the obverse side of a bronze-gilt medal by Guillaume Dupré, 1603; in the National Gallery of Art, Washington, D.C.
COURTESY OF THE NATIONAL GALLERY OF ART, WASHINGTON, D.C., SAMUEL H. KRESS COLLECTION

Medan \mā-'dän\ City (pop., 1995 est.: 1,843,919), northeastern Sumatra. After tobacco plantations were introduced in 1873, Medan became the commercial centre of an agricultural region where cash crops, including tobacco and rubber, were raised for export. It was made a city by the Dutch in 1886. It was occupied by the Japanese during World War II. The sultan of Deli's palace dates to the 19th century. Medan is the seat of the University of North Sumatra and the Islamic University of North Sumatra.

Medawar \'me-də-wər**, Sir Peter B(rian)** (b. Feb. 28, 1915, Rio de Janeiro, Braz.—d. Oct. 2, 1987, London, Eng.) Brazilian-born British zoologist. Educated at Oxford, he began transplant research in 1949. His finding (1953) that adult animals injected with foreign cells early in life accept skin grafts from the original donor or its twin lent support to MACFARLANE BURNET's hypothesis that cells learn, during and just after birth, to distinguish "own" from "foreign." He found that nonidentical cattle twins accept skin grafts from each other, proving that antigens "leak" between the embryos' yolk sacs, and showed with mice that each cell contains genetic antigens important to immunity. His work deflected immunology from dealing with the fully developed immunity mechanism to attempting to alter the mechanism itself (e.g., suppression of transplant rejection). He and Burnet shared a 1960 Nobel Prize.

Medea \mə-'dē-ə\ In GREEK MYTHOLOGY, the daughter of King Aeetes of Colchis. After helping JASON, leader of the ARGONAUTS, to obtain the Golden Fleece from her father, the two were married and she returned with him to Iolcos, where she killed the king who had deprived Jason of his inheritance. Forced into exile, the couple settled in Corinth. In EURIPIDES' tragedy *Medea*, Jason later deserts her for the daughter of King Creon, and Medea takes revenge by killing Creon, his daughter, and her own two children by Jason before fleeing to Athens.

Médecins Sans Frontières See DOCTORS WITHOUT BORDERS

Medellín \ˌmā-thā-'yēn\ City (pop., 2003: 1,955,753), northwestern Colombia. It is one of the country's largest cities and is heavily industrialized. Founded in 1675 as a mining town, it grew rapidly after the completion of the PANAMA CANAL and the arrival of the railroad in 1914. It is now noted for its textile mills, clothing factories, and steel mills. It is one of Colombia's largest trading centres for coffee. It also became a centre for the illegal international distribution of narcotics (mainly cocaine) in the late 20th century.

Media \'mē-dē-ə\ Ancient country, Middle East. It was situated in present-day northwestern Iran and was home to the Medes, an Iranian people. In 625 BC Cyaxares united the area's tribes into a kingdom. In 614 BC he captured ASHUR and later defeated the Assyrian empire and seized territory in Iran, northern Assyria, and Armenia. In 550 BC it became part of the new Persian ACHAEMENIAN DYNASTY under CYRUS II. ALEXANDER THE GREAT occupied it in 330 BC. In the partition of his empire, southern Media was given to the Macedonians and then to the SELEUCIDS; northern Media became the kingdom of Atropatene, which passed to Parthia, Armenia, and Rome. In 226 BC the whole of Media passed to the SĀSĀNIANS, another Persian dynasty.

median See MEAN, MEDIAN, AND MODE

mediation In law, a nonbinding intervention between parties to promote resolution of a grievance, reconciliation, settlement, or compromise. It is used especially in labour disputes. In many industrialized countries, the government provides mediation services in order to protect the public interest. In the U.S., the National Mediation Board functions in this capacity. Mediation is also commonly used in international conflicts. See also ARBITRATION.

medical examiner See CORONER

medical imaging See DIAGNOSTIC IMAGING

medical jurisprudence *or* **legal medicine** Science of applying medical facts to legal problems. Routine tasks include filling out birth and death certificates, deciding insurance eligibility, and reporting infectious disease. Perhaps more significant is medical testimony in court. When merely relating observations, doctors are ordinary witnesses; interpreting facts based on medical knowledge makes them expert witnesses, required to present their opinions without bias toward the side that called them. Conflicts between medicine and law can occur, usually over medical confidentiality. See also FORENSIC MEDICINE.

Medicare and Medicaid U.S. government programs in effect since 1966. Medicare covers most people 65 or older and those with long-term disabilities. Part A, a hospital insurance plan, also pays for home health visits and hospice care. Part B, a supplementary plan, pays for doctors' services, tests, and other services. Requirements and benefits are complex. Patients pay deductibles and copayments. Medicaid, a joint federal-state program, covers low-income people under age 65 and those who have exhausted Medicare benefits. It pays for hospital care, doctors' services, nursing-home care, home health services, family planning, and screening. Participating states must offer Medicaid to all persons on public assistance but decide their own eligibility guidelines. Many physicians refuse to treat Medicaid patients because of low reimbursement levels.

Medici, Alessandro de' (b. 1510/11, Florence—d. Jan. 5–6, 1537, Florence) First duke of Florence (1532–37). A member of the elder branch of the MEDICI FAMILY, he was probably the illegitimate son of Cardinal Giulio de' Medici (later Pope CLEMENT VII). The pope made Cardinal Passerini regent in Florence for Alessandro, but they were forced to flee when the unpopular regency provoked a revolt in 1527. An agreement between the pope and Emperor CHARLES V restored the Medici in Florence (1530), and Alessandro was declared a hereditary duke (1532). A tyrannical ruler, he sought to solidify his control by marrying Charles V's daughter, MARGARET OF AUSTRIA, in 1536. In an unsuccessful attempt to cause a revolt, a distant cousin, Lorenzino de' Medici (1514–48), murdered Alessandro in 1537.

Medici \'me-də-ˌchē**, Cosimo de'** *known as* **Cosimo the Elder** (b. Sept. 27, 1389, Florence—d. Aug. 1, 1464, Careggi, near Florence) Founder of one of the main lines of the MEDICI FAMILY. The son of the Florentine banker Giovanni di Bicci de'Medici (1360–1429), Cosimo represented the Medici bank and handled papal finances, becoming the wealthiest man of his time. Another leading family, the Albizzi, had him imprisoned (1433) and tried to assassinate him, but a year later the Medici regained power in Florence, and Cosimo triumphantly returned. He was the architect of the Peace of LODI (1454). An alliance with the SFORZAS of Milan provided him with troops to crush a coup d'état in 1458, after which he created a Senate composed of 100 loyal supporters (the Cento). He was a patron of scholarship and the arts, including such figures as DONATELLO and FILIPPO BRUNELLESCHI.

Medici, Cosimo I de' See COSIMO I

Medici, Giovanni de' *orig.* **Lodovico** (b. April 6, 1498, Forli, Papal States—d. Nov. 30, 1526, Mantua, marquisate of Mantua) Italian general. A member of the younger branch of the MEDICI FAMILY, he was the son of Giovanni de' Medici, who died soon after his birth, and Caterina Sforza, of the powerful SFORZA FAMILY of Milan. He took his father's name, trained as a soldier, and fought for a Medici cousin, Pope LEO X, in 1516–17 and 1521. In the service of the French (1522, 1525) he fought with the army of the League of Cognac in 1526 and was mortally wounded in the battle

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near Mantua. He was known as Giovanni dalle Bande Nere ("of the Black Bands") for the black banners his army (or bands) carried in mourning for Leo X after 1521.

Medici, Giuliano de' (b. 1479—d. March 17, 1516, Florence) Ruler of Florence (1512–13). A member of the elder branch of the MEDICI FAMILY, he was the son of Lorenzo de' MEDICI. In 1494 his brother, Piero de' Medici, was ousted as ruler of Florence by the republicans, aided by the French. In 1512 Pope JULIUS II demanded that Florence enter his Holy League against France and allow the exiled Medici to return to Florence. Giuliano returned as ruler (Piero having died in 1503) and used harsh measures to suppress a conspiracy. In 1513, after another brother became Pope LEO X, he went to Rome as a cardinal. In 1515 he received the French title of duke de Nemours.

Medici, Lorenzo de' *known as* **Lorenzo the Magnificent** (b. Jan. 1, 1449, Florence—d. April 9, 1492, Careggi, near Florence) Florentine statesman and patron of arts and letters. The grandson of COSIMO DE'MEDICI, he was the most brilliant of the MEDICI FAMILY. He ruled FLORENCE with his younger brother, Giuliano, from 1469. Giuliano was assassinated in 1478 by the Pazzi, a leading Florentine banking family, which was in league with Pope SIXTUS IV (who did not support the assassination) and the king of Naples. Lorenzo's direct appeal to the king allowed him to regain power in Florence, and he was sole ruler of the city until his death. His 13-year-old son Giovanni was created a cardinal by Pope Innocent VIII and later became pope as LEO X. Lorenzo used the Medici riches to patronize many artists, including SANDRO BOTTICELLI, LEONARDO DA VINCI, and MICHELANGELO, and he remains perhaps the most famous patron of all time. His policies bankrupted the Medici bank, but the political power of the Medici remained strong in Florence and Tuscany.

Lorenzo de' Medici, terra-cotta bust by Andrea del Verrocchio, c. 1485; in the National Gallery of Art, Washington, D.C.

COURTESY OF THE NATIONAL GALLERY OF ART, WASHINGTON, D.C., SAMUEL H. KRESS COLLECTION, 1943

Medici family Italian bourgeois family that ruled Florence and later Tuscany from c. 1430 to 1737. The family, noted for its often tyrannical rulers and its beneficent patrons of the arts, also provided the church with four popes (LEO X, CLEMENT VII, Pius IV, and Leo XI) and married into the royal families of Europe, notably in France (CATHERINE de Médicis and MARIE de Médicis). The effective founder of the family was Giovanni di Bicci de' Medici (1360–1429), a merchant who amassed great wealth in trade and was the virtual ruler of Florence from 1421 to 1429. From his two sons derived the major branches of the family. The so-called elder branch began with Cosimo de' MEDICI. His grandson, Lorenzo de' MEDICI, or Lorenzo the Magnificent, greatly expanded the family's power. His son Giuliano de' MEDICI became duke de Nemours. Another son, Giovanni, became Pope Leo X. Lorenzo's great-granddaughter was Catherine de Médicis. Another of Cosimo's grandsons, Giulio de' Medici (1478–1534) became pope as Clement VII. His probable illegitimate son, Alessandro de' MEDICI, a tyrant, was the last of the direct male line of the elder branch. The so-called younger branch of the family began with Giovanni's younger son Lorenzo de' Medici. His son Giovanni married Caterina Sforza of the powerful SFORZA FAMILY, and their son Giovanni de' MEDICI became a noted general. His son COSIMO I became duke of Florence, and Cosimo's son Francesco de' Medici (1541–87) was the father of Marie de Médicis. Cosimo I's grandson Cosimo II (1590–1621) gave up the family practice of banking and commerce. Cosimo II's grandson Cosimo III (1642–1723) was a weak ruler, under whom Tuscany's power declined. His son Gian Gastone de' Medici (1671–1737), who died without issue, was the last grand duke of Tuscany.

medicine Set of scientific fields related to prevention, DIAGNOSIS, and treatment of disease and maintenance of health, practiced in doctors' offices, HEALTH MAINTENANCE ORGANIZATION facilities, hospitals, and clinics. In addition to FAMILY PRACTICE, INTERNAL MEDICINE, and specialties for specific body systems, it includes research, PUBLIC HEALTH, EPIDEMIOLOGY, and PHARMACOLOGY. Each country sets its own requirements for medical degrees (M.D.'s) and licenses. Medical boards and councils set standards and oversee medical education. Boards of certification have stringent requirements for physicians seeking to practice a specialty and stress continuing education. Advances in therapy (see THERAPEUTICS) and diagnosis have raised complex legal and moral issues in areas such as ABORTION, EUTHANASIA, and patients' rights. Recent changes include treating patients as partners in their own care and taking cultural factors into consideration.

Medicine Bow Mountains Northwest section of the Front Range, in the central ROCKY MOUNTAINS, U.S. Averaging a height of 10,000 ft (3,050 m), the mountains run southeast for about 100 mi (160 km) from Medicine Bow, Wyo., to Cameron Pass, Colo., just northwest of ROCKY MOUNTAIN NATIONAL PARK. The highest summit, Medicine Bow Peak, reaches 12,014 ft (3,662 m). The name refers to the practices of local Indians, who collected wood for bows in the area and held ceremonial medicine dances.

medicine man Priestly healer or SHAMAN, especially among the American Indians. The medicine man (often a woman in some societies) commonly carries a kit of objects such as feathers, stones, or hallucinogenic plants that have magical associations. The work of healing often involves the extraction—by sucking, pulling, or other means—of offending substances from the patient's body. Singing, recitation of myths, and other ceremonies often accompany the healing rite.

Médicis, Catherine de See CATHERINE DE MÉDICIS

Médicis, Marie de See MARIE DE MÉDICIS

Medill \mə-'dil**, Joseph** (b. April 6, 1823, near Saint John, N.B., Can.—d. March 16, 1899, San Antonio, Texas, U.S.) Canadian-born U.S. editor and publisher. Born into a family of shipbuilders, he studied law in the U.S. and was admitted to the bar in 1846. He turned to newspaper publishing in 1849. As managing editor of the *Chicago Tribune* (from 1855), he set its antislavery editorial policy. He helped found the Republican Party (1854) and worked for ABRAHAM LINCOLN's nomination. As mayor of Chicago (1871–74), he helped establish the Chicago Public Library (1872–74). In 1874 he resigned as mayor and acquired a controlling share in the *Chicago Tribune*. Four of his grandchildren, including ROBERT MCCORMICK, also ran newspapers.

Medina *Arabic* **Al-Madīnah** \ˌal-mä-'dē-nə\ *ancient* **Yathrib.** City (pop., 1992: 608,295), western Saudi Arabia, north of MECCA. It developed from an oasis settled by Jews c. AD 135. In 622 the Prophet MUHAMMAD fled from Mecca to Medina (see HIJRAH). It served as capital of the Islamic state until 661. Held by the Ottoman Empire (1517–1804), it then was seized by the WAHHĀBIYYAH. An Ottoman-Egyptian force retook it in 1812. Ottoman rule ceased during World War I (1914–18), and in 1925 it fell to the forces IBN SAʿŪD. A sacred city of ISLAM, it is second only to Mecca as a place of Muslim pilgrimage; among its many mosques is the Prophet's Mosque, containing the tomb of Muhammad.

medina worm See GUINEA WORM

meditation Private religious devotion or mental exercise, in which techniques of concentration and contemplation are used to reach a heightened level of spiritual awareness. The practice has existed in all religions since ancient times. In Hinduism it has been systematized in the school of YOGA. One aspect of Yoga, *dhyana* (Sanskrit: "concentrated meditation"), gave rise to a school of its own among the Buddhists, becoming the basis of ZEN. In many religions, meditation involves verbal or mental repetition of a single syllable, word, or text (e.g., a MANTRA). Visual images (e.g., a MANDALA) or mechanical devices such as PRAYER WHEELS or ROSARIES can be useful in focusing concentration. In the 20th century, movements such as TRANSCENDENTAL MEDITATION emerged to teach meditation techniques outside a religious context.

Mediterranean fruit fly *or* **Med fly** FRUIT FLY (*Ceratitis capitata*) proven to be particularly destructive to citrus crops, at great economic cost. The Med fly lays up to 500 eggs in citrus fruits (except lemons and sour limes), and the larvae tunnel into the fruit, making it unfit for human consumption. Because of this pest, quarantine laws regulating fruit importation have been enacted worldwide.

Mediterranean Sea Inland sea enclosed by Europe, Africa, and Asia. Its west-east extent is approximately 2,500 mi (4,000 km), while its average north-south extent is about 500 mi (800 km). The Mediterranean Sea occupies an area of about 970,000 sq mi (2,510,000 sq km). It has a maximum depth of about 16,000 ft (4,900 m). In the west the Strait of GIBRAL-

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TAR connects the Mediterranean with the Atlantic Ocean. In the northeast the Sea of MARMARA, the DARDANELLES, and the BOSPORUS link it with the BLACK SEA. The SUEZ CANAL connects the Mediterranean with the RED SEA in the southeast. A submarine ridge between SICILY and Africa divides the sea into eastern and western parts, which are subdivided into the Adriatic, Aegean, Tyrrhenian, Ionian, and Ligurian seas. Its largest islands are MAJORCA, CORSICA, SARDINIA, SICILY, CRETE, CYPRUS, and RHODES. The RHÔNE, PO, and NILE rivers form its only large deltas.

Medusa In GREEK MYTHOLOGY, the most famous of the monsters known as GORGONS. Anyone who looked directly at Medusa turned to stone. She was the only Gorgon who was mortal. The hero PERSEUS, looking only at her reflection in a shield given to him by ATHENA, killed her by cutting off her head. Perseus later gave the severed head to Athena, who placed it in her shield; according to another account, he buried it in the marketplace of ARGOS.

medusa \mi-'dü-sə\ In zoology, one of the two principal CNIDARIAN body forms; the typical form of the JELLYFISH. Its name derives from its tentacles, resembling the snakes borne by MEDUSA in place of hair. The medusoid body is bell- or umbrella-shaped. Hanging downward from the center is a stalklike structure, the manubrium, bearing the mouth at its tip. The mouth opens into the main body cavity, which connects with radial canals extending to the outer rim of the bell. A free-swimming form, the medusa moves by rhythmic muscular contractions of the bell, providing a slow propulsive action against the water. The other principal cnidarian body type is the POLYP.

Medusa stage of a jellyfish
TOM MCHUGH—PHOTO RESEARCHERS

Meegeren \'mā-k̲ə-rə,\ *English* \'mā-gə-rən**, Han van** *orig.* **Henricus Antonius van Meegeren** (b. Oct. 10, 1889, Deventer, Neth.—d. Dec. 30, 1947, Amsterdam) Dutch art forger. He forged at least 14 "Old Masters" and sold them at enormous profit; critics had hailed his *Christ and the Disciples at Emmaus* as a JOHANNES VERMEER masterpiece. His activities came to light after World War II, when a commission was established to restore to their owners artworks collected by Nazi leaders. Discovering a work purportedly by Vermeer among those amassed by HERMANN GÖRING, the commission traced it to Meegeren. Charged with collaboration, he confessed. He died of a heart attack before his one-year sentence began.

meerkat *or* **suricate** Colonial species (*Suricata suricatta*) of the mongoose family (Herpestidae). It is a burrowing CARNIVORE found in southwestern Africa that differs from mongooses in having four (rather than five) toes on each foot. Meerkats are noted for their constant vigilance for predators. This sentinel behaviour involves one member of the group finding an elevated position, standing on its hind legs, and alerting the group of danger when it is seen. The meerkat grows to a total length of 17–24 in. (43–60 cm). Insects and other small animals constitute most of its diet, but bulbous roots are also eaten for the water they contain. It is diurnal and easily tamed as a pet. The yellow mongoose (*Cynictis penicillata*) is sometimes called the red meerkat.

meerschaum \'mir-shəm, 'mir-ˌshȯm\ Fibrous hydrated magnesium silicate that is opaque and white, gray, or cream in colour. Also called sepiolite, meerschaum (German: "sea foam") is easily fashioned, and has been used in jewelry and for tobacco pipes. It is soft when first extracted, but it hardens on drying. Meerschaum is an alteration product of SERPENTINE. The most important commercial deposit is the plain of Eskişehir, Tur., where it is found as irregular nodules in alluvial deposits; it also occurs in France, Greece, the Czech Republic, the U.S., and elsewhere.

megalith Huge, often undressed stone used in various types of NEOLITHIC and Early BRONZE AGE monuments. The most ancient form of megalithic construction is probably the dolmen, a type of burial chamber consisting of several upright supports and a flat roofing slab. Another form is the menhir, a simple upright stone usually placed with others to form a circle, as at STONEHENGE and Avebury in England, or a straight alignment, as at Carnac in France. The meaning of megalithic monuments remains largely unknown, but all share certain architectural and technical features suggesting that their creators sought to impose a conspicuously human design on the landscape and imbue it with cultural symbols. See also ROCK ART.

megalopolis \ˌme-gə-'lä-pə-lis\ A major conurbation. Generally the term describes any densely populated social and economic entity encompassing two or more cities and the increasingly urbanized space between them. It particularly came to describe the urbanized region of the northeastern U.S. that arose in the second half of the 20th century. Stretching between the metropolitan areas of BOSTON on the northeast to WASHINGTON, D.C., on the southwest, it included the metropolitan areas of NEW YORK CITY, PHILADELPHIA, and BALTIMORE, Md. The name, meaning "great city," was coined by French geographer Jean Gottmann.

Megalopolis \ˌme-gä-'lȯ-pȯ-lēs\ Ancient city, central Peloponnese, Greece. Occupying both banks of the Helisson River, it was founded in 371–368 BC by Epaminondas of THEBES as the seat of the ARCADIAN LEAGUE. Attacked several times by SPARTA, it joined the ACHAEAN LEAGUE in 234 BC. It declined rapidly after being plundered by Cleomenes III of Sparta in 223 BC, and by the 2nd century AD it lay in ruins. The nearby modern town lies in a rich lignite-bearing region that fuels thermal power stations.

Megara \'me-gə-rə\ Port city (pop., 1991: urban agglom., 20,403), Greece. Situated on the Saronic Gulf and west of Athens, it served as the capital of ancient Megaris. A maritime power, by the 7th century BC it had established colonies in Sicily, Chalcedon, Byzantium, Bithynia, and Crimea. During the PELOPONNESIAN WAR (431–404 BC) it was subjugated by Athens and forced into financial ruin. In the 4th century AD it recovered some prosperity, but in 1500 it was depopulated by the Venetians. It was the birthplace of Eucleides, founder of the MEGARIAN SCHOOL of philosophy.

Megarian school \me-'gar-ē-ən\ *or* **Megarics** School of philosophy founded in Greece in the early 4th century BC by Eucleides of Megara (died c. 380 BC). It is noted more for its criticism of ARISTOTLE and its influence on Stoic logic (see STOICISM) than for its doctrines. Among Eucleides' successors was Eubulides of Miletus, who criticized Aristotle's doctrines of categories, movement, and potentiality. Other Megarians were Diodorus Cronus (fl. 4th century BC) and Stilpo (fl.c. 380–300 BC); Stilpo taught ZENO OF CITIUM, and Menedemus (339?–c. 265 BC). The school died out at the beginning of the 3rd century BC.

megaron \'me-gə-ˌrän\ In ancient Greece and the Middle East, an architectural form consisting of a porch, vestibule, and large hall with a central hearth. The megaron was found in all Mycenaean palaces and also in houses. It probably originated in the Middle East, later attaining the uniquely Aegean aspect of the open porch supported by columns.

Meghalaya \ˌmā-gə-'lā-ə\ State (pop., 2001 prelim.: 2,306,069), northeastern India. Occupying an area of 8,660 sq mi (22,429 sq km), it is bordered by BANGLADESH and ASSAM state. Its few urban centres include SHILLONG, its capital. The tribal hill people of Meghalaya trace their origin to pre-Aryan times in India. The area came under nominal British rule in the 19th century; it was included in Assam and was made a separate state in 1972. Although it has vast mineral resources, its economy centres on agriculture.

Meghna River \'māg-nə\ River, Bangladesh. It is formed by the SURMA RIVER. Flowing south, it is joined southeast of DHAKA by the Padma River, which is formed from the waters of the GANGES and BRAHMAPUTRA rivers. After a course of about 164 mi (264 km) it empties into the Bay of BENGAL through four mouths. A river of depth and velocity, it is navigable all year but often dangerous. At spring tide the sea rushes upriver in a single 20-ft (6-m) wave.

Megiddo \mi-'gi-dō\ City, ancient Palestine. It occupied a strategic location at the crossing of military and trade routes; it was also famous as a battlefield and is thought to be the biblical ARMAGEDDON. The first town was built early in the 4th millennium BC. It was captured by the Egyptian king THUTMOSE III c. 1468 BC. It later passed to the Israelites, and King SOLOMON rebuilt it as a military centre. British Gen. EDMUND HENRY HYNMAN ALLENBY defeated Ottoman forces near the site in 1918.

Meher Baba \'mā-hər-'bä-bä\ *orig.* **Merwan Sheriar Irani** (b. Feb. 25, 1894, Poona, India—d. Jan. 31, 1969, Ahmednagar) Indian spiritual master. Born into a Zoroastrian family of Persian descent, he created

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a system of spiritual beliefs according to which the goal of life was to realize the oneness of God, from whom the whole universe emanates. Convinced that his calling was to awaken the world to that realization through love, he worked zealously with the poor and the physically and mentally ill. Though he attracted a sizable following in India and abroad, he did not try to establish a religion. For the last 44 years of his life he maintained silence, communicating by means of gestures and an alphabet board. His tomb at Meherabad is a place of pilgrimage.

Mehmed \me-'met\ **II** *byname* **Mehmed the Conqueror** (b. March 30, 1432, Adrianople, Thrace, Ottoman Empire—d. May 3, 1481, near Constantinople) Ottoman sultan (1444–46, 1451–81). His father, Murad II, abdicated in his favour when Mehmed was 12 but reclaimed the throne two years later in the aftermath of a Christian Crusade. Mehmed regained the throne when his father died (1451) and began to plan the conquest of Constantinople (ISTANBUL), the feat for which he is most renowned. In 1453 he captured the city and undertook returning it to its previous level of grandeur. In the next 25 years he conquered large sections of the Balkans. Under his reign, criminal and civil laws were codified in one body of law; he collected a library of Greek and Latin works and had eight colleges built.

Mei Juecheng (b. May 19, 1681, Xuan Cheng, Anhui province, China—d. Nov. 20, 1763, China) Chinese court official, mathematician, and astronomer. He learned mathematics from his grandfather MEI WENDING. In 1713 he joined the Mengyangzhai (imperial bureau created to synthesize Western and Chinese scientific knowledge) as one of the chief editors of *Lüli yuanyuan* (c. 1723; "Source of Mathematical Harmonics and Astronomy"). Purely a work of Chinese authorship, the *Lüli yuanyuan* reapportioned credit to Chinese scholars for many discoveries that earlier Jesuit-Chinese compendiums had credited to Europeans. Studying Western algebra enabled Mei to decipher Chinese mathematical treatises from the Song (920–1279) and Yuan (1206–1368) dynasties whose methods had been lost; this led him to expound a theory of the Chinese origin of Western knowledge. While now acknowledged as grossly overstated, Mei's views helped to revive interest in traditional Chinese mathematics and remained highly influential for many decades.

Mei Wending (b. 1633, Xuangcheng, Anhui province, China—d. 1721, China) Chinese writer on astronomy and mathematics whose work represented an association of Chinese and Western knowledge. In his comparative study, *Lixue yiwen* (c. 1701; "Inquiry on Mathematical Astronomy"), Mei tried to situate the new European knowledge properly within the historical framework of Chinese knowledge. In *Jihe bubian* ("Complements of Geometry") he calculated the volumes and relative dimensions of regular and semi-regular polyhedrons by traditional Chinese methods. Mei helped rehabilitate traditional Chinese mathematics. The comprehensive collection of his works, *Lisuan quanshu*, was published in 1723.

Meidias \'mā-dē-əs\ **Painter** (fl. c. 420–400 BC, Greece) Greek vase painter known for his theatrical "florid" style. A large hydria (water vessel) with scenes from the rape of the daughters of Leucippus and of Heracles in the garden of the Hesperides, now in the British Museum, is representative of his work.

Meier \'mī-ər**, Richard (Alan)** (b. Oct. 12, 1934, Newark, N.J., U.S.) U.S. architect. Educated at Cornell University, Meier's early experience included work with the firm of Skidmore, Owings & Merrill and with MARCEL BREUER. Early in his career he executed a series of spectacular private residences. These houses typically feature refinements of and variations on classic Modernist principles—pure geometry, open space, and an emphasis on light—and they often display a crisp whiteness that contrasts sharply with the natural setting; the Douglas House, Harbor Springs, Mich. (1973), is a dramatically sited example. Building upon the success of his residences, beginning in the mid 1970s Meier began to receive large public commissions. These structures are characterized by geometric clarity and order, which is often punctuated by curving ramps and railings, and by a contrast between the light-filled, transparent surfaces of public spaces and the solid white surfaces of interior, private spaces. His Getty Center in Los Angeles (1984–97), with its terraced gardens, is a resplendent acropolis in travertine stone. Meier received the 1984 Pritzker Architecture Prize.

Meiji \'mā-jē\ **Constitution** Constitution of Japan from 1890 to 1947. After the MEIJI RESTORATION (1868), Japan's leaders sought to create a constitution that would define Japan as a capable, modern nation deserving of Western respect while preserving their own power. The resultant document called for a bicameral parliament (the DIET) with an elected lower house and a prime minister and cabinet appointed by the emperor. The emperor was granted supreme control of the army and navy. A privy council composed of the Meiji leaders (see GENRO), created prior to the constitution, advised the emperor and wielded actual power. Voting restrictions, which limited the electorate to about 5% of the adult male population, were loosened over the next 25 years, resulting in universal male suffrage. Political parties made the most of their limited power in the 1920s, but in the 1930s the military was able to exert control without violating the constitution. After World War II, a U.S.-approved constitution stating that "sovereign power resides with the people" replaced the Meiji Constitution. See also ITŌ HIROBUMI.

Meiji emperor *orig.* **Mutsuhito** (b. Nov. 3, 1852, Kyōto, Japan—d. July 30, 1912, Tokyo) Emperor of Japan during whose reign (1867–1912) the Tokugawa shogunate was overthrown, Japan was transformed into a world power, and the imperial throne came to the forefront of the political scene after centuries of being overshadowed by shogunal rule. He believed in the need to modernize Japan along Western lines. Under the Meiji emperor the domains (*han*) and old class system were abolished, a new school system was introduced, and the MEIJI CONSTITUTION was promulgated. Also during his reign Taiwan was annexed after the SINO-JAPANESE WAR (1894–95), Korea was annexed (1910), and Japan defeated Russia in the RUSSO-JAPANESE WAR (1904–05). See also TOKUGAWA PERIOD; MEIJI PERIOD; MEIJI RESTORATION.

Meiji period (1868–1912) Period in Japanese history beginning with the enthronment of the MEIJI EMPEROR and ending with his death. It was a time of rapid modernization and westernization. Feudal domains were abolished and replaced with prefectures; DAIMYO and SAMURAI were relieved of their special privileges. Not all samurai were happy with the changes, and there were numerous rebellions, notably that of SAIGŌ TAKAMORI. To secure a strong central government, a national army was formed and universal conscription was enacted. A new agricultural tax was instituted to finance the new government, and a decimal currency was introduced. Eager to encourage economic growth, the government aided the textile industry, established railways and shipping lines, and founded an ironworks. Education was also reformed, and compulsory coeducational elementary schools were introduced. By 1912 the goals of the reforming movement called the MEIJI RESTORATION had been largely accomplished: the unequal treaties with Western powers had been revised, the country was developing well economically, and its military power had won the respect of the West. See also CHARTER OATH; MEIJI CONSTITUTION.

Meiji Restoration Overthrow of Japan's Tokugawa shogunate (see TOKUGAWA PERIOD) and restoration of direct imperial rule (through the MEIJI EMPEROR) in 1868. In the 19th century the shogunate's policy of isolation was challenged by Russia, England, and the U.S., making Japanese feudal leaders aware of Japan's vulnerability to superior Western firepower. After the visit of Commodore MATTHEW PERRY, the country was forced to sign a series of unequal treaties, which, as in China, gave Western nations special privileges in Japan. In response, young SAMURAI from feudal domains historically hostile to the Tokugawa regime took up arms against the government. In January 1868 they announced the restoration of the emperor to power, and in May 1869 the last Tokugawa forces surrendered. The revolutionaries had the emperor issue the CHARTER OATH, which promised a break with the feudal class restrictions of the past and a search for knowledge that could transform Japan into a "rich country with a strong military." The restoration ushered in the MEIJI PERIOD, a time of rapid modernization and Westernization. See also CHŌSHŪ; II NAOSUKE; ŌKUBO TOSHIMICHI; SAIGŌ TAKAMORI; SATSUMA; TOSA.

Meillet \me-'ye**, Antoine** (b. Nov. 11, 1866, Moulins, France—d. Sept. 21, 1936, Châteaumeillant) French linguist. He argued that any attempt to account for linguistic change must recognize that language is a social phenomenon. His *Introduction to the Comparative Study of the Indo-European Languages* (1903) explained the relationships of the INDO-EUROPEAN LANGUAGES to each other and to their parent tongue. Meillet suggested that languages that develop farther from a centre of common origin are less disturbed by changes at the point of origin and more likely to retain archaic characteristics. He produced authoritative grammars of classical ARMENIAN and Old Iranian and made notable contributions to Slavic studies.

Meinhof \'mīn-ˌhȯf**, Carl** (b. July 23, 1857, Barzwitz, near Schlawe, Pomerania, Prussia—d. Feb. 10, 1944, Greifswald, Ger.) German scholar of African languages. A specialist in the BANTU LANGUAGES who also studied KHOISAN and other African language families, he was one of the first

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to treat African languages in terms of PHONETICS and MORPHOLOGY. His books include *Outline of the Phonetics of the Bantu Languages* (1899) and *Principles of the Comparative Grammar of the Bantu Languages* (1906).

Meinong \'mī-nȯŋ**, Alexius, Ritter (knight) von Handschuchsheim** (b. July 17, 1853, Lemberg, Galicia, Austrian Empire—d. Nov. 27, 1920, Graz, Austria) Austrian philosopher and psychologist. He taught at the University of Graz from 1889 until his death. Like his teacher FRANZ BRENTANO, Meinong considered INTENTIONALITY, or object-directedness, to be the basic feature of mental states. He maintained that objects of thought have a kind of character or nature (*Sosein*; sometimes rendered "subsistence") that is distinct from being, or existence (*Sein*), which they may lack; thus the golden mountain or the round square "subsist" as objects of thought, though they do not exist in the world of sense experience. Meinong's view briefly influenced BERTRAND RUSSELL. His major writings include *On Possibility and Probability* (1915) and *On Emotional Presentation* (1917).

meiosis \mī-'ō-səs\ *or* **reduction division** Division of a gamete-producing cell in which the NUCLEUS splits twice, resulting in four sex cells (gametes, or eggs and sperm), each possessing half the number of CHROMOSOMES of the original cell. Meiosis is characteristic of organisms that reproduce sexually and have a diploid set of nuclear chromosomes (see PLOIDY). Before meiosis, chromosomes replicate and consist of joined sister strands (chromatids). Meiosis begins as homologous paternal and maternal chromosomes line up along the midline of the cell. The chromosomes exchange genetic material by the process of crossing-over (see LINKAGE GROUP), in which chromatid strands from homologous pairs entangle and exchange segments to produce chromatids containing genetic material from both parents. The pairs then separate and are pulled to opposite ends of the cell, which then pinches in half to form two daughter cells, each containing a haploid set (half the usual number) of double-stranded chromosomes. In the second round of meiotic division, the double-stranded chromosomes of each daughter cell are pulled apart, resulting in four haploid gametes. When two gametes unite during fertilization, each contributes its haploid set of chromosomes to the new individual, restoring the diploid number. See also MITOSIS.

Meïr \mā-'ir\ (fl. 2nd century AD) Rabbi and scholar of Palestine. He fled Palestine during the persecutions that followed the BAR KOKHBA revolt in AD 132–35 but later returned and helped reestablish the SANHEDRIN. The patriarch of the Sanhedrin eventually threatened him with excommunication over a question of protocol, and he left for Asia Minor, where he had been born. Known for his great dialectical skill, he is cited repeatedly in the TALMUD and is remembered as the greatest of the *tannaim*, a group of masters of the Jewish oral law. Legends of his miraculous powers sprang up during the Middle Ages.

Meir \me-'ir**, Golda** *orig.* **Goldie Mabovitch** *later* **Goldie Myerson** (b. May 3, 1898, Kiev, Russian Empire—d. Dec. 8, 1978, Jerusalem) Ukrainian-born Israeli stateswoman, fourth prime minister of Israel (1969–74). Her family immigrated to Milwaukee, Wis., U.S., in 1906, where she became a leader of the Milwaukee Labor Zionist Party. In 1921 she and her husband immigrated to Palestine, where she emerged as a forceful negotiator with British authorities during World War II (1939–45). A signer of Israel's declaration of independence in 1948, she served in the Knesset (parliament; 1949–74) and held the posts of minister of labour (1949–56) and foreign minister (1956–66). As prime minister, she sought diplomatic solutions to ease the region's tensions. The failure of her government to anticipate an Arab attack during the Yom Kippur War of 1973 (see ARAB-ISRAELI WARS) led her to resign six months later.

Golda Meir
DENNIS BRACK/BLACK STAR

Meir of Rothenburg *orig.* **Meir ben Baruch** (b. c. 1215, Worms, Franconia—d. May 2, 1293, Ensisheim Fortress, Alsace) German Jewish scholar. After studying in France, he served as rabbi in several communities in Germany, notably Rothenburg, where he opened a Talmudic school. He became famous as an authority on rabbinic law, writing notes and commentary on the Talmud and acting for nearly half a century as the supreme court of appeals for Jews of Germany and surrounding countries. Persecution prompted him to flee Germany with a group of followers in 1286, but he was caught and imprisoned for the rest of his life in an Alsatian fortress.

Meissen porcelain \'mī-sᵊn\ German hard-paste, or true, PORCELAIN produced at the Meissen factory, near Dresden in Saxony (now Germany), from 1710 until the present day. It was the first successfully produced true porcelain in Europe and dominated the style of European porcelain until c. 1756. The high point of the Meissen factory was reached after 1731 with the modeling of JOHANN JOACHIM KANDLER. The onion pattern, introduced c. 1739, was widely copied. Meissen porcelain is marked with crossed blue swords.

Meissen hard-paste porcelain bird, *c.* 1750; in the Victoria and Albert Museum, London
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, EB INC.

Meissonier \ˌmā-sᵊn-'yā**, Juste-Aurèle** (b. 1693/95, Turin, Savoy—d. July 31, 1750, Paris, France) French goldsmith, designer, and architect. Appointed goldsmith and cabinetmaker to LOUIS XV in 1726, he became a leading originator of the influential ROCOCO STYLE. His highly inventive work included fantastic grottoes, animated metalwork designs, snuffboxes, watch cases, sword hilts, and tureens. His sketches for interior decoration, furniture, and goldsmith designs became widely known through engravings. Few of his architectural plans were realized.

meistersinger \'mī-stər-ˌsiŋ-ər, 'mī-stər-ˌziŋ-ər\ *German* **"master singer"** Any of certain German musicians and poets, chiefly of the artisan and trading classes, in the 14th to 16th centuries. These amateur guilds spread throughout Germany until most towns had one. Their main activity was monthly singing contests. Because of their educational aims of fostering morality and religious belief, they came to be instrumental in promulgating the Protestant message during the REFORMATION, though their music is not regarded as highly distinguished. The most famous meistersinger, Hans Sachs (1494–1576), devoted his art exclusively to the Lutheran cause after 1530.

Meitner \'mīt-nər**, Lise** (b. Nov. 7, 1878, Vienna, Austria—d. Oct. 27, 1968, Cambridge, Cambridgeshire, Eng.) German physicist. She worked at Berlin's Kaiser Wilhelm Institute (1912–38), also teaching at the University of Berlin (1926–38). At a laboratory that she set up with OTTO HAHN, the two isolated the radioactive isotope protactinium-231. In the 1930s, with Hahn and Fritz Strassmann (1902–80), she investigated the products of neutron bombardment of uranium. She left Germany in 1938 for Sweden. After Hahn and Strassmann demonstrated that barium appears in neutron-bombarded uranium, she and her nephew Otto Frisch (1904–79) explained the physical characteristics of this division and in 1939 proposed the term *fission* for the process. She shared the 1966 Enrico Fermi Award with Hahn and Strassmann. Element 109, meitnerium, is named in her honour.

Mekhilta \mə-'kil-tə\ Hebrew commentary on the Book of EXODUS. One of the exegetic commentaries known as the Halakhic Midrashim, the *Mekhilta* presents a composite of three kinds of materials concerning the Book of Exodus: exegeses of certain passages, propositional and argumentative essays on theological principles, and topical articles on the written and oral TORAH. It was produced by a Talmudic school founded by ISHMAEL BEN ELISHA c. AD 300 and known as the House of Ishmael. The name *Mekhilta* (Hebrew: "measure") refers to its use as a rule or norm for conduct. See also HALAKHAH, MIDRASH, TALMUD.

Meknès \mek-'nes\ City (pop., 1994: 459,958), north-central Morocco. It was one of Morocco's four imperial cities, founded in the 10th century by a Berber tribe. Originally a group of villages among olive groves, it became the Moroccan capital in 1673 under Maulāy Ismāʾīl, who built palaces and mosques that earned for Meknès the name "Versailles of Morocco." After his death it declined, and in 1911 it was occupied by the French. It is now a commercial centre for agricultural products, fine embroidery, and carpets.

Mekong \'mā-'kȯŋ\ **River** *Chinese* **Lancang Jiang** *or* **Lan-Ts'ang Chiang** \'län-'tsäŋ-'jē-'äŋ\ Longest river of Southeast Asia. Rising in

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southern Qinghai province, China, it flows south through eastern Tibet and across the highlands of Yunnan province. It then forms part of the border between Myanmar (Burma) and Laos, as well as between Laos and Thailand. It runs through Laos and Cambodia before entering the South China Sea in a delta south of Ho Chi Minh City in Vietnam after a course of 2,700 mi (4,350 km). Vientiane, Laos, and Phnom Penh, Camb., stand on its banks. Since 1957 the Mekong Committee, an international effort, has initiated projects to harness the river for hydroelectricity and irrigation.

Melanchthon \mə-'laŋk-thən,\ *German* \mā-'läŋ̲k-tòn**, Philipp** *orig.* **Philipp Schwartzerd** (b. Feb. 15, 1497, Bretten, Palatinate—d. April 19, 1560, probably Wittenberg, Saxony) German Protestant reformer. His education in Germany was greatly influenced by humanist learning, and he was named professor of Greek at Wittenberg in 1518. A friend and defender of Martin Luther, Melanchthon was the author of *Loci communes* (1521), the first systematic treatment of the principles of the Reformation, and of the Protestant creed known as the Augsburg Confession (1530). He also reorganized the entire educational system of Germany, founding and reforming several of its universities. His willingness to compromise with Catholics on theological issues in his later years became controversial.

Philipp Melanchthon, engraving by Albrecht Dürer, 1526.
COURTESY OF THE STAATLICHE MUSEEN KUPERSTICHKABINETT, BERLIN

Melanesia \ˌme-lə-'nē-zhə\ Island group, South Pacific Ocean. A subdivision of Oceania, it lies northeast of Australia and south of the Equator and includes New Guinea, the Admiralty Islands, the Bismarck and Louisiade archipelagoes, the Solomon Islands, the Santa Cruz Islands, New Caledonia and the Loyalty Islands, Vanuatu, Fiji, Norfolk Island, and numerous others. Two distinct populations and cultures exist in the region. The Papuans, who have inhabited the area for 40,000 years, devised one of the earliest agricultural systems and developed the Papuan languages. Seafaring peoples with an Austronesian language and a Southeast Asian cultural tradition settled in the area about 3,500 years ago.

melanin \'me-lə-nən\ Any of several organic compounds, dark biological pigments that give coloration (shades of yellow to brown) to skin, hair, feathers, scales, eyes, and some internal tissues, notably the substantia nigra in the brain. In humans, melanins help protect the skin against the damaging effects of ultraviolet radiation, but melanoma may arise from cells that produce it. The amount in the skin depends on both genetic and environmental factors. Melanin is produced from the amino acid tyrosine; albinos lack the enzyme that catalyzes that reaction (see albinism).

melanism, industrial See industrial melanism

melanoma \ˌme-lə-'nō-mə\ Dark-coloured malignant tumour of skin cells that produce the protective skin-darkening pigment melanin. Melanomas are prone to metastasize (see cancer) and are associated with the highest death rate of any skin cancer. Removal, together with a collar of surrounding healthy skin, cures melanoma if done early. A common cause of melanoma is skin damage from sunlight. It is very rare in persons with dark skin.

melatonin \ˌme-lə-'tō-nən\ Hormone secreted by the pineal gland of most vertebrates. It appears to be important in regulating sleeping cycles; more is produced at night, and test subjects injected with it become sleepy. Melatonin may be involved in seasonal affective disorder. In mammals other than humans, melatonin may act as a cue to breeding and mating in season.

Melba, Dame Nellie *orig.* **Helen Porter Mitchell** (b. May 19, 1861, Richmond, near Melbourne, Austl.—d. Feb. 23, 1931, Sydney) Australian soprano. After study with Mathilde Marchesi (1821–1913) in Paris, she debuted in Brussels in *Rigoletto* (1887), and in the next six years she sang in all the major opera houses of the world. One of the most celebrated coloraturas in the years preceding World War I, she sang mostly at Covent Garden after 1902. Concentrating on a few Italian and French operas, she possessed abundant technique and vocal beauty. Two foods, Melba toast and peach Melba, were named for her.

Melbourne \'mel-bərn\ City (pop., 1999 est.: 3,417,200), capital of Victoria, southeastern Australia. Situated at the head of Port Phillip Bay and the mouth of the Yarra River, the area was discovered by Europeans in 1802 and incorporated into the colony of New South Wales. The first settlement was founded in 1835 by settlers from Tasmania, and in 1837 it was named for the British prime minister, Lord Melbourne. Made the capital of Victoria in 1851, it grew rapidly with the gold rush of the early 1850s. It served as the first capital of the Australian commonwealth (1901–27), until Canberra became the new capital. Second in size to Sydney, it is an industrial, commercial, and financial centre and the seat of several universities, including the University of Melbourne.

Melbourne, University of Public university in Melbourne, Austl. Founded as a liberal arts college in 1853, in subsequent decades it added schools or faculties of agriculture, architecture, commerce, dentistry, education, engineering, law, medicine, music, and veterinary medicine. It continued to expand during the 20th century, adding programs in nuclear science, applied economic research, and South and Southeast Asian studies.

Melbourne (of Kilmore), William Lamb, 2nd Viscount (b. March 15, 1779, London, Eng.—d. Nov. 24, 1848, Brocket, near Hatfield, Hertfordshire) British prime minister (1834, 1835–41). A lawyer, he entered the House of Commons in 1806 and the House of Lords in 1829. Although a Whig, he served in Tory governments as chief secretary for Ireland (1827–28) and advocated political rights for Roman Catholics. He served as home secretary (1830–34) in Earl Grey's Whig government, reluctantly supporting the Reform Bill of 1832. As prime minister (1834), he gained the support of Whigs and moderate Tories and opposed further parliamentary reform and efforts to repeal the Corn Laws. In his second administration (1835–41), he became the young Queen Victoria's valued chief political adviser. His firm stand in foreign policy averted war with France over Syria (1840). His wife, Lady Caroline Lamb (1785–1828), was a minor novelist, famous for her affair with Lord Byron in 1812–13.

Melchior \'mel-kē-ˌȯr**, Lauritz (Lebrecht Hommel)** (b. March 20, 1890, Copenhagen, Den.—d. March 18, 1973, Santa Monica, Calif., U.S.) Danish-U.S. tenor. He debuted as a baritone in 1913 but further study extended his range upward, and he made his tenor debut as Tannhäuser in 1918. Additional training readied him for Bayreuth, where he sang (1924–31), and he remained the preeminent Wagnerian tenor of his time, regularly singing (often opposite Kirsten Flagstad) at Covent Garden (until 1939) and the Metropolitan Opera (1926–50) and making many recordings.

Melchizedek \mel-'ki-zə-ˌdek\ Canaanite king and priest revered by Abraham. In the Book of Genesis, Abraham rescues his kidnapped nephew, Lot, from the Mesopotamians, and on returning from battle he meets Melchizedek, king of Salem (probably another name for Jerusalem), who gives him bread and wine and blesses him in the name of "God Most High." St. Paul's Epistle to the Hebrews treats Melchizedek as a foreshadowing of Christ.

Melfi \'mel-fē**, Constitutions of** *or* **Liber Augustalis** (1231) Legal code drawn up by Emperor Frederick II for the kingdom of Sicily. Based on Roman and canon law, the constitutions centralized royal administration, established greater efficiency in the courts, and rationalized civil and criminal procedures in the interests of justice.

Méliès \mā-'yes**, Georges** (b. Dec. 8, 1861, Paris, France—d. Jan. 21, 1938, Paris) French filmmaker. He was a professional magician and manager-director of the Théâtre Robert-Houdin in Paris when he saw the first movies made by Auguste and Louis Lumière in 1895. In his film experiments he exploited the basic camera tricks of slow motion, dissolve, and fade-out. The first to film fiction narratives, from 1899 to 1912 he made more than 400 films, which combined illusion, comic burlesque, and pantomime in fantasy productions, including *A Trip to the Moon* (1902). He also filmed reconstructed news events as an early form of

Méliès
RENE DAZY—J.P. ZIOLO

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newsreel. Overtaken by the commercial growth of the film industry, he was forced to sell his studio in 1913.

Melilla \mə-'lē-yä\ Spanish enclave and autonomous community (pop., 2001: 66,411), North Africa. It covers 5 sq mi (12 sq km) and is a military station and seaport. Located on Morocco's northern coast, it was successively colonized by the Phoenicians, Greeks, and Romans. It fell as a Berber town to Spain in 1497 and remained Spanish despite a long history of attack and siege. In the early 20th century Spain modernized its port and made it an administrative centre for Spanish Morocco. It was the first Spanish town to rise against the Popular Front government in 1936, helping to precipitate the Spanish Civil War. It was retained by Spain when Morocco achieved independence in 1956.

Melkarth See Melqart

Mello, Fernando Collor de See Fernando Collor de Mello

Mellon, Andrew W(illiam) (b. March 24, 1855, Pittsburgh, Pa., U.S.—d. Aug. 26, 1937, Southampton, N.Y.) U.S. financier. He joined his father's banking house in 1874 and through the next three decades built up a financial empire by supplying capital for corporations in industries such as aluminum, steel, and oil. He helped found the Aluminum Co. of America (Alcoa) and the Gulf Oil Corp., and he joined Henry Clay Frick to found Union Steel Co. and Union Trust Co. By the early 1920s he was one of the richest men in the U.S. As secretary of the Treasury (1921–32) he persuaded Congress to lower taxes in order to encourage business expansion. He was praised for the economic boom of the 1920s but criticized during the Great Depression, and in 1932 he resigned to serve as ambassador to England. A noted art collector and philanthropist, Mellon donated an extensive art collection and $15 million to establish the National Gallery of Art.

melodrama Sentimental drama marked by extravagant theatricality, subordination of character development to plot, and focus on sensational incidents. It usually has an improbable plot that features such stock characters as the noble hero, the long-suffering heroine, and the hard-hearted villain, and it ends with virtue triumphing over vice. Written by such playwrights as Guilbert de Pixérécourt and Dion Boucicault, melodramas were popular in Europe and the U.S. during the 19th century. They often featured spectacular events such as shipwrecks, battles, fires, earthquakes, and horse races. Melodrama died out as a theatrical form in the early 20th century but remained popular in silent film. It can still be seen in contemporary film genres such as the action movie.

melody Rhythmic succession of single tones organized as an aesthetic whole. The melody is often the highest line in a musical composition. Melodies may suggest their own harmony or counterpoint. As fundamental as rhythm and metre (and more so than harmony), melody is common to all musical cultures.

melon Any of the seven groups of *Cucumis melo*, a trailing vine grown for its edible, sweet, musky-scented fruit. Members of the horticulturally diverse gourd family, melons are frost-tender annuals native to central Asia but widely grown in many cultivated varieties in warm regions worldwide. They have soft, hairy, trailing stems, large round to lobed leaves, yellow flowers, and large flat seeds. The fruits of the numerous cultivated varieties differ greatly in size, shape, surface texture, flesh colour, flavour, and weight. Examples include cantaloupe, honeydew, and casaba. Plants resembling true melons include the watermelon, the Chinese watermelon, the melon tree (see papaya), and the melon shrub, or pear melon (*Solanum muricatum*).

Melos \'mē-ˌläs\ *Greek* **Mílos** \'mē-ˌlȯs\ Island (pop., 1991: 4,302) of the Cyclades, Greece. It is 14 mi (23 km) long and occupies an area of 58 sq mi (151 sq km). Melos (Mílos) is the chief town. On the ancient acropolis of Adamanda, the *Venus de Milo* (now in the Louvre Museum) was found in 1820. The settlement of Phylakopi, dating from 1550 BC, was destroyed c. 1100 BC by Dorian settlers. In 416 BC Melos was conquered by Athens, which killed the entire male population in reprisal for the island's neutrality in the Peloponnesian War. Lysander later restored the island to the Dorians, but it never recovered its prosperity. Later, under Crusader rule, it formed part of the duchy of Naxos.

Melqart *or* **Melkarth** Phoenician god, the chief deity of Tyre and of two of its colonies, Carthage and Gadir (Cádiz, Spain). Probably a sun god, he was often depicted as a bearded figure wearing a high, rounded hat and a kilt; he held an Egyptian ankh as a symbol of life and an ax as a symbol of death. His sanctuary in Tyre was the scene of annual winter and spring festivals and is believed to have been the model for Solomon's temple in Jerusalem.

meltdown Occurrence in which a huge amount of thermal energy and radiation is released as a result of an uncontrolled chain reaction in a nuclear power reactor. The chain reaction that occurs in the reactor's core must be carefully regulated by control rods, which absorb neutrons, and a moderator, which reduces their energy. If the core becomes too hot, it can melt, releasing large amounts of radiation. See also Chernobyl accident.

melting point Temperature at which the solid and liquid states of a pure substance can exist in equilibrium. As heat is applied to a solid, its temperature increases until it reaches the melting point. At this temperature, additional heat converts the solid into a liquid without a change in temperature. The melting point of solid water (ice) is 32°F (0°C). Though the melting point of a solid is generally considered to be the same as the freezing point of the corresponding liquid, they may differ because a liquid may freeze into different crystal systems and impurities can lower the freezing point.

Melville, Herman *orig.* **Herman Melvill** (b. Aug. 1, 1819, New York, N.Y., U.S.—d. Sept. 28, 1891, New York City) U.S. writer. Born to a wealthy New York family that suffered great financial losses, Melville had little formal schooling and began a period of wanderings at sea in 1839. In 1841 he sailed on a whaler bound for the South Seas; the next year he jumped ship in the Marquesas Islands. His adventures in Polynesia were the basis of his successful first novels, *Typee* (1846) and *Omoo* (1847). After his allegorical fantasy *Mardi* (1849) failed, he quickly wrote *Redburn* (1849) and *White-Jacket* (1850), about the rough life of sailors. *Moby-Dick* (1851), his masterpiece, is both an intense whaling narrative and a symbolic examination of the problems and possibilities of American democracy; it brought him neither acclaim nor reward when published. Increasingly reclusive and despairing, he wrote *Pierre* (1852), which, intended as a piece of domestic "ladies" fiction, became a parody of that popular genre, *Israel Potter* (1855), *The Confidence-Man* (1857), and magazine stories, including "Bartleby the Scrivener" (1853) and "Benito Cereno" (1855). After 1857 he wrote verse. In 1866 a customs-inspector position finally brought him a secure income. He returned to prose for his last work, the novel *Billy Budd, Foretopman*, which remained unpublished until 1924. Neglected for much of his career, Melville came to be regarded by modern critics as one of the greatest American writers.

Melville Island One of the largest of the Parry Islands, in the Arctic Ocean, Canada. Located north of Victoria Island, it is 200 mi (320 km) long and 30–130 mi (50–210 km) wide, with an area of 16,274 sq mi (42,149 sq km). It has no human inhabitants, but it supports musk oxen and has natural-gas deposits. It was discovered in 1819 by William Parry.

Melville Island Island in the Timor Sea, off the coast of Northern Territory, Australia. It is 80 miles (130 km) long and 55 mi (88 km) wide, with an area of 2,240 sq mi (5,800 sq km). It was sighted by the Dutch in 1644; the British built Fort Dundas there in 1824. Melville Island, known to Aboriginals as Yermalner, is one of the few areas in Australia still occupied by its original Aboriginal peoples, the Tiwi, and in 1978 ownership of the island passed from the Australian government to the Tiwi Land Council.

Melville Sound See Viscount Melville Sound

membrane In biology, the thin layer that forms the outer boundary of a living cell or of an internal cell compartment. The outer boundary is the plasma membrane, and the compartments enclosed by internal membranes are called organelles. Biological membranes have a dual function: separation of vital but incompatible metabolic processes conducted in the organelles; and passage of nutrients, wastes, and metabolic products between organelles and between the cell and the outside environment. Membranes consist largely of a double layer of lipids in which are embedded large proteins, many of which transport ions and water-soluble molecules across the membrane. See also cytoplasm, eukaryote.

membrane structure Structure with a thin, flexible surface (membrane) that carries loads primarily through tensile stresses. There are two main types: tent structures and pneumatic structures. The Denver International Airport (1995) features a terminal building roofed by a white membrane stretched from steel masts.

Memel See Klaipeda

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Memel \'mā-məl\ **dispute** Post-World War I dispute over sovereignty of the former German Prussian territory of Memelland. Located on the Baltic Sea north of the Memel River, the area was mainly inhabited by Lithuanians. In 1919 at the PARIS PEACE CONFERENCE, the newly formed state of Lithuania requested annexation of the area. A commission recommended formation of a free state, but Lithuanian inhabitants of the region took over the government in 1923. Protests by the Allied Powers resulted in the signing of the Memel Statute to establish Memelland as an autonomous region within Lithuania.

Memling \'mem-liŋ**, Hans** *or* **Hans Memlinc** \'mem-liŋk\ (b. c. 1430/35, Seligenstadt, near Frankfurt am Main—d. Aug. 11, 1494, Bruges) Flemish painter. He settled in Bruges in 1465 and established a large workshop that became very successful and made him one of the city's wealthiest citizens. Though somewhat derivative of the works of contemporary Flemish painters (JAN VAN EYCK, DIRCK BOUTS, HUGO VAN DER GOES, and particularly ROGIER VAN DER WEYDEN), his art has great charm and a distinctive character. Memling's religious paintings and portraits of wealthy patrons (e.g., *Tommaso Portinari and His Wife*, c. 1468) were, and remain, enormously popular.

"Diptych with Madonna and Martin van Nieuwenhove" (left wing), oil on panel by Hans Memling, 1487; in the Memling-Museum, Brugge, Bel.
COURTESY OF THE MEMLING-MUSEUM, BRUGGE, BEL., PHOTOGRAPH, © A.C.L., BRUSSELS

Memminger \'me-mən-jər**, Christopher G(ustavus)** (b. Jan. 9, 1803, Nayhingen, Württemberg—d. March 7, 1888, Charleston, S.C., U.S.) German-born U.S. public official. He immigrated to the U.S. in his teens and became a successful lawyer in Charleston, S.C. After South Carolina seceded from the Union (1860), he helped draft the provisional constitution of the Confederacy and was appointed its secretary of the treasury (1861–64). To raise money, he issued increasing amounts of paper currency, which depreciated greatly by 1863. Held responsible for the collapse of Confederate credit, he resigned in 1864. After receiving a presidential pardon, he returned to the practice of law.

Memnon In GREEK MYTHOLOGY, a king of the Ethiopians. The son of Tithonus (of the Trojan royal house) and Eos (Dawn), he fought bravely for his uncle PRIAM against the Greeks, and was slain by ACHILLES. Moved by the tears of Eos, ZEUS granted him immortality. His companions, changed into birds, came every year to fight and lament over his grave. In Egypt his name was connected with the colossal stone statues of AMENHOTEP III near THEBES; the harplike sounds these statues emitted when touched by the rays of the rising sun were believed to be the voice of Memnon responding to the greeting of his mother, Eos.

memoir History or record composed from personal observation and experience. Closely related to AUTOBIOGRAPHY, a memoir differs chiefly in the degree of emphasis on external events. Unlike writers of autobiography, who are concerned primarily with themselves as subject matter, writers of memoir usually have played roles in, or have closely observed, historical events, and their main purpose is describing or interpreting those events.

Memorial Day *or* **Decoration Day** U.S. holiday. Originally held (1868) in commemoration of soldiers killed in the AMERICAN CIVIL WAR, its observance later extended to all U.S. war dead. Most states conform to the federal practice of observing it on the last Monday in May, but some retain the traditional day of celebration, May 30. National observance is marked by the placing of a wreath on the Tomb of the Unknowns in Arlington National Cemetery. Flags, insignia, and flowers are placed on the graves of veterans in local cemeteries.

Memorial University of Newfoundland Canadian public university in St. John's, founded in 1925. It offers undergraduate and graduate programs in the sciences, arts and humanities, social sciences, business administration, education, engineering, medicine, and other fields. Campus facilities include centres for research in ocean resources, maritime history, and political economy.

memory In DIGITAL COMPUTERS, a physical device used to store such information as data or programs on a temporary or permanent basis. Most digital computer systems have two types of memory, the main memory and one or more auxiliary storage units. In most cases, the main memory is a high-speed RAM. Auxiliary storage units include HARD DISKS, FLOPPY DISKS, and magnetic tape drives. Besides main and auxiliary memories, other forms of memory include ROM and optical storage media such as VIDEODISCS and COMPACT DISCS (see CD-ROM).

memory Power or process of recalling or reproducing what has been learned or experienced. Research indicates that the ability to retain information is fairly uniform among normal individuals; what differs is the degree to which persons learn or take account of something to begin with and the kind and amount of detail that is retained. ATTENTION, MOTIVATION, and especially ASSOCIATION facilitate this process. Visual images are generally better remembered than are other forms of sense-data. Memory prodigies, or people with "photographic" or "eidetic" memories, often draw heavily on visual associations, including mnemonics. Many psychologists distinguish between short- and long-term memory. The former (variously said to last 10 seconds to 3 minutes) is less subject to interference and distortion than the latter. Long-term memory is sometimes divided into episodic (i.e., event-centred) and semantic (i.e., knowledge-centred) memory. Various models of memory have been proposed, from the Enlightenment notion of impressions made on brain tissues (restyled as "memory molecules" or coded "engrams" in the 20th century) to B.F. SKINNER's "black box" to more recent ideas concerning INFORMATION PROCESSING or the formation of neuronal groups. Disorders of or involving memory include ALZHEIMER DISEASE, AMNESIA, KORSAKOFF syndrome, POST-TRAUMATIC STRESS DISORDER, and senile dementia. See also HYPNOSIS.

Memphis Capital of ancient Egypt during the Old Kingdom (c. 2575–c. 2130 BC), located on the western bank of the NILE RIVER, south of modern CAIRO. Founded c. 2925 BC by Menes, it was by the 3rd dynasty a flourishing community. Despite the rivalry of Heracleopolis and THEBES, it remained important, particularly in the worship of PTAH. Beginning in the 8th century BC, it fell successively to Nubia, Assyria, Persia, and Macedonia under ALEXANDER THE GREAT. Its importance as a religious centre was undermined by the rise of Christianity and then of Islam. It was abandoned after the Muslim conquest of Egypt in AD 640. Its ruins include the great temple of Ptah, royal palaces, and an extensive necropolis. Nearby are the pyramids of SAQQARA and those at GIZA.

Memphis City (pop., 2000: 650,100), southwestern Tennessee, U.S. Situated above the Mississippi River where the borders of Arkansas, Mississippi, and Tennessee meet, it was founded in 1819 on the site of a CHICKASAW Indian village and a U.S. fort. It was incorporated as a city in 1826. A Confederate military centre at the start of the AMERICAN CIVIL WAR, it was captured by Union forces in 1862. In the 1870s yellow fever killed more than 5,000 residents, and the city was forced into bankruptcy. Rechartered in 1893, it was the state's largest city by 1900. Sites of interest include Beale Street, made famous by W.C. HANDY as the birthplace of the blues; and Graceland, the mansion of ELVIS PRESLEY. It is the seat of several educational institutions, including the University of Memphis.

Memphremagog \ˌmem-fri-ˈmā-ˌgäg**, Lake** Lake that crosses the U.S.-Canadian border. Extending from northern Vermont, U.S., into southern Quebec, Can., it is 27 mi (43 km) long and only 1–2 mi (1.5–3 km) wide for most of its length. It has several large bays, including Fitch Bay and Sargents Bay. At its northern end the lake drains into the St. François River. Its name is an Algonquian term meaning "where there is a big expanse of water."

Menai Strait \'mē-ˌnī\ Channel of the IRISH SEA separating the Isle of ANGLESEY from the mainland of northern Wales. It extends 15 mi (24 km) and varies in width from 600 ft (180 m) to 2 mi (3 km). Two famous bridges span the strait: THOMAS TELFORD's suspension road bridge of 1827 and ROBERT STEPHENSON's Britannia tubular railway bridge of 1849.

Menander \mə-ˈnan-dər\ (b. c. 342—d. c. 292 BC) Athenian dramatist. He produced his first play in 321 BC, and in 316 he won a festival prize with *Dyscolus* ("The Misanthrope"), the only one of his plays for which a complete text still exists. By the end of his career he had written more than 100 plays and had won eight victories at Athenian dramatic festivals. Menander was considered by ancient critics the supreme poet of Greek NEW COMEDY. He excelled at presenting characters such as stern fathers, young lovers, and intriguing slaves. As adapted by the Romans PLAUTUS and TERENCE, his plays influenced the later development of Renaissance comedy.

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Mencius \'men-shē-əs\ *Chinese* **Mengzi** *or* **Meng-tzu** \'məŋ-'tsə\ *orig.* **Meng K'o** (b. c. 372—d. c. 289 BC) Chinese philosopher. The book *Mencius* contains statements on innate human goodness, a topic warmly debated by followers of Confucius up to modern times. That the four principles (*si duan*)—the feelings of commiseration, shame, courtesy, and right and wrong—are all inborn in humans was a self-evident truth to Mencius; the four principles, when properly cultivated, will develop into the four cardinal virtues of *ren* (benevolence), righteousness, decorum, and wisdom. His development of orthodox Confucianism earned him the title "second sage."

Mencius, detail, ink and colour on silk; in the National Palace Museum, Taipei
COURTESY OF THE NATIONAL PALACE MUSEUM, TAIPEI, TAIWAN, REPUBLIC OF CHINA

Mencius *or* **Mengzi** *or* **Meng-tzu** Chinese Confucian text concerning government, written by Mencius. The book maintains that the welfare of the common people comes before every other consideration. When a ruler no longer practices benevolence and righteousness, the mandate of heaven (his right to rule) is withdrawn and he should be removed. *Mencius* did not become a classic until the 12th century, when it was published by Zhu Xi together with Daxue, Zhongyong, and Lunyu (*Analects*) as the Four Books. See also Confucianism.

Mencken, H(enry) L(ouis) (b. Sept. 12, 1880, Baltimore, Md., U.S.—d. Jan. 29, 1956, Baltimore) U.S. controversialist, humorous journalist, and critic. Mencken worked on the staff of the *Baltimore Sun* for much of his life. With George Jean Nathan (1882–1958), he coedited *The Smart Set* (1914–23) and cofounded and edited (1924–33) the *American Mercury*, both important literary magazines. Probably the most influential U.S. literary critic in the 1920s, he often used criticism to jeer at the nation's social and cultural weaknesses. *Prejudices* (1919–27) collects many of his reviews and essays. In *The American Language* (1919; supplements 1945, 1948) he brought together American expressions and idioms; by the time of his death he was perhaps the leading authority on the language of the U.S.

H.L. Mencken.
COURTESY OF THE ENOCH PRATT FREE LIBRARY, BALTIMORE; PHOTOGRAPH, ROBERT KNIESCHE

Mendel \'men-dəl**, Gregor (Johann)** (b. July 22, 1822, Heinzendorf, Austria—d. Jan. 6, 1884, Brünn, Austria-Hungary) Austrian botanist and plant experimenter. He became an Augustinian monk in 1843 and later studied at the University of Vienna. In 1856, working in his monastery's garden, he began the experiments that led to his formulation of the basic principle of heredity. He crossed varieties of the garden pea that had maintained constant differences in such single alternative traits as tallness and dwarfishness, flower colour, and pod form. He theorized that the occurrence of the visible alternative traits of the plants, in the constant varieties and in their descendants, was due to the occurrence of paired elementary units of heredity, now known as genes. What was new in Mendel's interpretation of his data was his recognition that genes obey simple statistical laws. His system proved to be of general application and is one of the basic principles of biology. He achieved fame only after his death, through the work of Carl Erich Correns, Erich Tschermak von Seysenegg, and Hugo de Vries, who independently obtained similar results and found that both the experimental data and the general theory had been published 34 years previously.

Mendele Moykher Sforim \'men-də-lə-mō-'ker-sfä-'rēm\ *or* **Mendele Mokher Sefarim** \ˌsef-ə-'rēm\ *orig.* **Sholem Yankev Abramovitsh** *Yiddish* **"Mendele the Book Peddler"** (b. Nov. 20, 1835, Kopyl, near Minsk, Russia—d. Dec. 8, 1917, Odessa) Russian author. He lived much of his life in Ukraine, becoming a rabbi and head of a traditional school (Talmud Torah) at Odessa. His stories, written with lively humour and gentle satire, are invaluable in the study of Jewish life in Eastern Europe at the time when its traditional structure was giving way. His greatest work is *The Travels and Adventures of Benjamin the Third* (1875), a panorama of Jewish life in Russia. He is considered the founder of both modern Yiddish and modern Hebrew narrative literature and the creator of modern literary Yiddish.

Mendeleyev \ˌmen-də-'lā-əf**, Dmitry (Ivanovich) Mendeleyev** *also spelled* **Mendeleev** (b. Feb. 8, 1834, Tobolsk, Siberia, Russia—d. Feb. 2, 1907, St. Petersburg) Russian chemist. He taught at the University of St. Petersburg (1867–90) and later served as director of Russia's bureau of weights and measures. He made a fundamental contribution to chemistry by establishing in 1869 the principle of periodicity of the elements. His first periodic table was based on arranging the elements in ascending order of atomic weight and grouping them by similarity of properties. Mendeleyev's theory allowed him to predict the existence and atomic weights of several elements not discovered until years later.

Mendelsohn \'men-dəls-ˌzōn**, Erich** (b. March 21, 1887, Allenstein, Ger.—d. Sept. 15, 1953, San Francisco, Calif., U.S.) German architect. While studying architecture in Munich, he was influenced by the Blaue Reiter group of Expressionist artists. Mendelsohn's Einstein Tower, Potsdam (1919–21), a highly sculptural structure, reflects his early preoccupation with science fiction. In the 1920s he designed a number of imaginative structures, including the Schocken stores in Stuttgart (1927) and Chemnitz (1928), notable for their prominent use of glass in strongly horizontal compositions. He fled the Nazis in 1933 and eventually settled in the U.S.; his American works include the Maimonides Hospital, San Francisco (1946).

Mendelssohn (-Bartholdy), (Jakob Ludwig) Felix (b. Feb. 3, 1809, Hamburg—d. Nov. 4, 1847, Leipzig) German composer. Grandson of the philosopher Moses Mendelssohn, he grew up in a wealthy Jewish family that had converted to Protestantism. He began to compose at age 11; at 16 he wrote his first masterpiece, the *String Octet in E Flat Major* (1825), followed by the *Overture to A Midsummer Night's Dream* (1826). In 1829 he conducted the first performance in 100 years of Johann Sebastian Bach's *St. Matthew Passion*, greatly contributing to the Bach revival. He wrote the first of a series of elegant piano works, *Songs Without Words*, in 1830. His *Reformation* (1832) and *Italian* (1833) symphonies date from this period. He observed Classical models and practices while initiating key aspects of Romanticism, which exalted emotions and the imagination above rigid forms and traditions. After serving as music director of the Catholic city of Düsseldorf (1833–35), he took the parallel position in Protestant Leipzig. There he built up the Gewandhaus Orchestra, making Leipzig the musical capital of Germany. In his last decade he produced great works such as the *Scottish Symphony* (1842), the violin concerto (1844), and the oratorio *Elijah* (1846). His beloved sister, Fanny Mendelssohn Hensel (1805–47), had been considered his equal in musical talent as a girl, but she was discouraged from composing until her marriage to the painter Wilhelm Hensel (1794–1861); she eventually wrote more than 500 works. Her death was a severe shock to Mendelssohn; years of overwork simultaneously caught up with him, and he died six months after her.

Mendelssohn, Moses *orig.* **Moses ben Menachem** (b. Sept. 26, 1729, Dessau, Anhalt—d. Jan. 4, 1786, Berlin, Prussia) German Jewish philosopher and scholar. The son of an impoverished scribe, he began his career as a tutor but eventually won fame for his philosophical writings, which would become influential among the 19th-century U.S. Transcendentalists. He combined Judaism with the rationalism of the Enlightenment, becoming one of the principal figures in the Haskala, which helped bring Jews into the mainstream of European culture. His works include *Phädon* (1767), a defense of the immortality of the soul, and *Jerusalem* (1783), on the relationship of religion and the state. His friend Gotthold Lessing based the protagonist of his celebrated drama *Nathan the Wise* on Mendelssohn. He was the grandfather of the composer Felix Mendelssohn.

Mendenhall Glacier Blue ice sheet, 12 mi (19 km) long, 1.5 mi (2.4 km) wide, and more than 100 ft (30 m) high. It flows from the southern half of the huge Juneau Icefield, which lies in the Boundary Ranges in southeastern Alaska, U.S. A relic of the Little Ice Age (16th century to the mid-19th century), it recedes about 100–150 ft (30–45 m) a year. The adjacent Mendenhall Lake began to form about 1900 and is now 1.5 mi (2.4 km) long and 1 mi (1.6 km) wide.

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Menderes \men-'der-əs**, Adnan** (b. 1899, Aydın, Ottoman Empire—d. Sept. 17, 1961, İmralı, Tur.) Turkish prime minister (1950–60). Son of an aristocrat, he entered parliament as a member of Mustafa Kemal Atatürk's Republican People's Party (1930). In 1945 he cofounded the first opposition party, the Democrat Party, and won the premiership in the 1950, 1954, and 1957 elections. His policies included seeking closer ties with Muslim states, encouraging private enterprise, and lifting restraint on religious expression. Intolerant of critics, he instituted press censorship. In challenging Atatürk's ideals, he earned the enmity of the army and was overthrown (1960) and executed.

Menderes \ˌmen-de-'res\ **River** Name of two rivers in Turkey. The first (Turkish: Büyük Menderes) runs through southwestern Turkey. It empties into the Aegean Sea after a course of 363 mi (584 km). Its Classical name, Maeander (whence the English *meander*), is derived from the winding course of its lower reaches. The second (Turkish: Küçük Menderes) was known in antiquity as the Scamander; it rises in northwestern Turkey and flows 60 mi (97 km) west across the plain of ancient Troy, emptying into the Dardanelles.

Mendès-France \ma^{n}-des-'frä^{n}s**, Pierre** (b. Jan. 11, 1907, Paris, France—d. Oct. 18, 1982, Paris) French politician and premier (1954–55). Born into a Jewish family, he became a lawyer and served in the Chamber of Deputies (1932–40). In World War II he was imprisoned by the Vichy government but escaped to London, where he joined the Free French air force and served in finance posts in Charles de Gaulle's provisional government. As a legislator in postwar France (1946–58), he criticized government policies on economics and the wars in Indochina and North Africa. In 1954 he became premier; he ended France's involvement in Indochina and also helped effect autonomy for Tunisia. His proposed economic reforms led to his defeat in 1955. He sought without success to make the Radical-Socialist Party the centre of the noncommunist left and opposed de Gaulle's presidency.

Menelaus \ˌme-nə-'lā-əs\ In Greek mythology, the king of Sparta and the younger son of Atreus. When his wife, Helen, was abducted by Paris, he asked the other Greek kings to join him in an expedition against Troy, thus beginning the Trojan War. He served under his brother Agamemnon. At the war's end he recovered Helen and brought her back to Sparta instead of killing her as he had intended. Having forgotten to appease the gods of defeated Troy, he endured a hard voyage home, and many of his ships were lost.

Menem \'me-nem**, Carlos (Saúl)** (b. July 2, 1930, Anillaco, Arg.) President of Argentina (1989–99). The son of Syrian immigrants, he converted to Roman Catholicism and joined the Peronist movement in 1956. He held typical Peronist views, favouring nationalism, expansion of the government, large raises for wage earners, and tax breaks for businesses. By the time he took office, however, inflation had risen to 28,000% and Argentina was in crisis; he consequently abandoned his party orthodoxy in favour of a fiscally conservative policy and succeeded in stabilizing the economy. A flamboyant figure, he enjoyed great popularity despite his controversial pardoning of convicted human-rights violators connected with the period of military rule. In 2001 Menem was placed under house arrest after he was indicted for illegal arms dealing, but he was released in 2002.

Menéndez de Avilés \mə-'nen-dəs-dā-ˌä-və-'lās**, Pedro** (b. Feb. 15, 1519, Avilés, Spain—d. Sept. 17, 1574, Santander) Spanish conquistador. He ran away to sea at 14 and rose to captain of the Indies fleet (1554–63). He was sent to Florida to establish a colony and remove a potential threat to Spain's American possessions posed by a French settlement on the St. Johns River. In 1565 he entered the bay of St. Augustine, where he built a fort. He attacked the French colony at Fort Caroline and massacred its entire population, calling its members heretics. He then explored the Atlantic coast and built a string of forts, firmly establishing Spain's control of Florida.

Menéndez Pidal \mā-ˌnān-dāth-pē-'t͟häl**, Ramón** (b. March 13, 1869, La Coruña, Spain—d. Nov. 14, 1968, Madrid) Spanish language scholar. His work on the origins of the Spanish language and his critical editions of literary texts generated a revival of the study of medieval Spanish poetry and chronicles. His writings include *Manual of Historical Spanish Grammar* (1904), *The Cid and His Spain* (1929), and *The Spaniards in Their History* (1947). He was twice president of the Spanish Academy.

Mengele \'meŋ-gə-lə**, Josef** (b. March 16, 1911, Günzburg, Ger.—d. Feb. 7, 1979, Enseada da Bertioga, near São Paulo, Braz.) German Nazi doctor. Influenced by the racial ideology of Alfred Rosenberg, in 1934 Mengele joined the research staff of the newly founded Institute for Hereditary Biology and Racial Hygiene. An ardent Nazi, he served in World War II as medical officer with the SS. In 1943 he was appointed chief doctor at Auschwitz-Birkenau, where he selected incoming Jews for labour or extermination, becoming known as the "Angel of Death," and conducted medical experiments on inmates in pseudoscientific racial studies. After the war he escaped to South America, where he died in 1979 under the name of Wolfgang Gerhard, a Nazi he befriended in Brazil and whose identity he assumed.

Mengistu Haile Mariam \men-'gis-ˌtü-'hī-lē-'mȧr-yȧm\ (b. 1937, Kefa province, Eth.) Ethiopian army officer and head of state (1974–91). Mengistu headed a group of rebel soldiers that overthrew Haile Selassie (1974). After assassinating his rivals, Mengistu became the new regime's acknowledged strongman. By 1978 he had crushed a major rebellion in Eritrea and, with Soviet and Cuban help, an invasion of the Ogaden region by the Somalis. In the 1980s he faced new rebellions in Eritrea and Tigray, and devastating droughts and famines drew attention to his failed agricultural policies. With the withdrawal of Soviet support in 1991, his power was weakened and he fled to Zimbabwe.

Mengs \'meŋs**, Anton Raphael** (b. March 22, 1728, Aussig, Bohemia—d. June 29, 1779, Rome, Papal States) German painter. After study in Dresden and Rome, he became painter to the Saxon court in Dresden in 1745. Back in Rome in the late 1740s and again in the early 1750s, he developed an enthusiasm for Classical antiquity. His fresco *Parnassus* (1760–61) at the Villa Albani helped establish the ascendancy of Neoclassical painting. He also worked extensively for the Spanish court in Madrid. He was regarded as Europe's greatest living painter in his day, but his reputation has since declined.

menhaden \men-'hā-d^{ə}n\ *or* **pogy** Any of several species of Atlantic coastal fishes (genus *Brevoortia* of the herring family), used for oil, fish meal (mainly for animal feed), and fertilizer. Menhaden have a deep body, sharp-edged belly, large head, and tooth-edged scales. Adults are about 15 in. (38 cm) long and weigh 1 lb (0.5 kg) or less. Dense schools of menhaden range from Canada to South America. When feeding, they swim with mouth agape and gill openings widespread to strain out plankton.

menhir \'men-ˌhir\ Type of ancient megalithic stone monument (see megalith). Menhirs were simple upright stones, sometimes of great size, erected chiefly in Western Europe. Arrangements of menhirs often form vast circles, semicircles, or ellipses. Many were built in Britain, the best-known sites being Stonehenge and Avebury in Wiltshire. Menhirs were also placed in parallel rows, called alignments, the most famous being the Carnac alignments in northwestern France, with 2,935 menhirs. These were probably used for ritual processions.

Menilek II \'men-ə-ˌlek\ *orig.* **Sahle Miriam** (b. Aug. 17, 1844, Ankober, Shewa, Eth.—d. Dec. 12, 1913, Addis Ababa) King of the semi-independent state of Shewa, or Shoa (1865–89), and emperor of Ethiopia (1889–1913). Captured and imprisoned for 10 years after his father, King Malakot of Shewa, was deposed by Tewodros II, he escaped in 1865 and returned to Shewa to assume the title of *negus* (king). On the death of Emperor Yohannes IV (r. 1872–89), he ascended to the Ethiopian throne, taking his crown name from Menilek I, legendary son of Solomon and the queen of Sheba. When Italy sought to make Ethiopia a protectorate, Menilek roundly defeated its forces at the Battle of Adwa (1896). In later years he expanded the empire, initiated modern educational programs, and built up the country's infrastructure.

Menilek II, detail of an oil painting by Paul Buffet, 1897; in the Senate Palace, Paris.
J.E. BULLOZ

Menindee Lakes \mə-'nin-dē\ Series of reservoirs, western New South Wales, Australia. Located near

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the town of Menindee, they are part of the Darling River Conservation Scheme. The lakes are flooded through creeks linking them with the Darling River. The total capacity of the Menindee Lakes Storage Scheme is 2 million acre-ft (2.47 billion cubic-m). Menindee is an Aboriginal word meaning "egg yolk."

meninges \mə-'nin-jēz\ Three fibrous membranes that surround the brain and spinal cord to protect the central nervous system. The pia mater, a very thin membrane, adheres to the surface of the brain and spinal cord. The subarachnoid space, containing cerebrospinal fluid, separates the pia mater from a second membrane, the arachnoid. Around the brain, fine filaments connect these two membranes, which are believed to be impermeable to fluid. The third membrane, the dura mater, is strong, thick, and dense. It envelops the arachnoid, covers the inside of the skull, and surrounds and supports the large venous channels carrying blood from the brain. Several septa divide it and support different parts of the brain. In the spine, the dura mater and the arachnoid mater are separated by the subdural space; the arachnoid and pia mater are separated by the subarachnoid space. The extradural space (between the dura mater and the wall of the vertebral canal) is the site of epidural anesthesia (see anesthesiology).

meningitis \ˌme-nən-'jī-təs\ Inflammation of the meninges. Bacteria (including meningococcus, among others), often from infection elsewhere, produce the most dangerous forms. Symptoms develop rapidly: vomiting, then severe bursting headache, then stiff neck. Young children may have convulsions. The patient may die within hours. Pus in cerebrospinal fluid can block brain passages and spinal spaces, leading to life-threatening hydrocephalus. Speedy diagnosis (by lumbar puncture) and treatment (with antibiotics) can prevent brain damage and death. Viral meningitis usually has a short course and requires no therapy.

meningococcus \mə-ˌniŋ-gə-'kä-kəs\ *Neisseria meningitidis*, the bacterium that causes meningococcal meningitis in humans, the only natural hosts in which it causes disease. Meningococci are spherical, frequently occur in pairs, and are strongly gram-negative (see gram stain). They enter the nasal passage and may cause no symptoms (up to 30% of the population may harbour them between epidemics), or they may enter the bloodstream and produce the symptoms of meningitis.

Menninger \'men-iŋ-ər\ **family** U.S. physicians and pioneers in psychiatric treatment. Charles Frederick Menninger (1862–1953) was born in Tell City, Ind., and began practicing medicine in Topeka, Kan., in 1889. He saw the benefit of group medical practice after visiting the Mayo family's clinic in 1908. His son Karl (1893–1990) was born in Topeka and received psychiatric training in Boston. In 1919 the two founded the Menninger Diagnostic Clinic for the practice of general medicine and psychiatry. With Charles's youngest son, William (1899–1966), they established the Menninger Sanitarium and Psychopathic Hospital (1925). Their belief that the mentally ill should be treated, not merely institutionalized, attracted attention and other scientists, and they made significant strides in establishing psychiatry as a legitimate science. In 1931 the sanitarium became the first training facility for nurses specializing in psychiatric care, and in 1933 it opened a neuropsychiatric residency program for physicians. They formed the Menninger Foundation in 1941 and the Menninger School of Psychiatry in Topeka four years later.

Menno Simonsz. \'sī-mənz, 'sē-mȯns\ *or* **Menno Simons** (b. 1496, Witmarsum, Friesland—d. Jan. 31, 1561, near Lübeck, Holstein) Dutch Anabaptist leader. Born into a peasant family, he was ordained a Roman Catholic priest, but, doubting the doctrine of transubstantiation, he came under the influence of Lutheranism and withdrew from the church in 1536. Convinced that infant baptism was wrong and that only people of mature faith were eligible for membership in the church, he became a leader in the peaceful wing of the Anabaptist movement in 1537. Pronounced a heretic, he was in constant danger of arrest for the rest of his life but continued to organize Anabaptist groups. He wrote and printed many theological works, and his followers founded the Mennonite Church.

Menno Simons, engraving by Christopher van Sichem, 1605–08.
COURTESY OF THE MENNONITE LIBRARY AND ARCHIVES, NORTH NEWTON, KANSAS

Mennonite \'me-nə-ˌnīt\ Member of a Protestant church named for Menno Simonsz. They trace their origins to the Swiss Brethren (established 1525), nonconformists who rejected infant baptism and stressed the separation of church and state. Persecution scattered them across Europe; they found political freedom first in the Netherlands and northern Poland, and from there moved to Ukraine and Russia. They first emigrated to North America in 1663. Many Russian Mennonites emigrated to the U.S. Midwest and to Canada in the 1870s when they lost their exemption from Russian military service. Today Mennonites are found in many parts of the world, especially in North and South America. Their creed stresses the authority of the Scriptures, the example of the early church, and baptism as a confession of faith. They value simplicity of life, and many refuse to swear oaths or serve in the military. The various Mennonite groups include the strictly observant Amish and Hutterites as well as the more moderate Mennonite church.

Menominee \mə-'nä-mə-ˌnē\ North American Indian people who live mostly in northeastern Wisconsin, U.S., in a small portion of their traditional territory along the Menominee River at the present-day Wisconsin-Michigan border. Their name is derived from an Ojibwa word meaning "person of the wild rice." Their language is a member of the Algonquian language family. At the time of first contact, the Menominee lived in villages of dome-shaped houses and collected wild plants, fished, and hunted to obtain food. Originally organized into clans, their social organization changed as a result of the fur trade, when they scattered in mobile bands. In 1852 the U.S. government moved most of the tribe to a reservation in Wisconsin. Sporadic uprisings occurred into the early 20th century, and political opposition was renewed in the 1960s and '70s. There are about 8,000 enrolled members of the Menominee.

menopause Final cessation of menstruation, ending female fertility. It usually begins between ages 45 and 55. A gradual decline in function of the ovaries reduces estrogen production. Ovulation becomes irregular and gradually ceases. The length of the menstrual cycle and periods may vary; flow may lessen or increase. Adjustment of the endocrine system to estrogen reduction causes hot flashes, often at night, with a warm sensation, flushing, and sweating; other symptoms, such as irritability and headaches, may be related more to reactions to aging. Removal or destruction of the ovaries to treat disease causes artificial menopause, with similar but more sudden effects. Changes in hormone balance usually cause no physical or mental disturbances. However, the protective effect of estrogen against osteoporosis and atherosclerosis is lost, and risks of fracture and coronary heart disease increase.

menorah \mə-'nōr-ə\ Multibranched candelabra used by Jews during the festival of Hanukkah. It holds nine candles (or has nine receptacles for oil). Eight of the candles stand for the eight days of Hanukkah—one is lit the first day, two the second, and so on. The ninth candle, or *shammash* ("servant") light—usually set in the centre and raised above the others—is used to light the others. The menorah is an imitation of the seven-branched golden candelabra of the Tabernacle, which signified the seven days of creation. The menorah is also an ancient symbol of Jewish identity and the official symbol of the modern state of Israel.

Roman soldiers carrying the menorah from the Temple of Jerusalem, AD 70; detail of a relief on the Arch of Titus, Rome, AD 81.
ALINARI/ART RESOURCE, NEW YORK

Menotti \mə-'nä-tē**, Gian Carlo** (b. July 7, 1911, Cadegliano, Italy) Italian-born U.S. composer, librettist, and stage director. Having written an opera by age 10, he spent his early teens absorbing the repertoire at La Scala. Arturo Toscanini recommended study at the Curtis Institute; there he met Samuel Barber, who would become his lifelong companion. In 1939 he produced the radio opera *The Old Maid and the Thief*; *The Island God* (1942) was an unsuc-

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cessful commission for the Metropolitan Opera. *The Medium* (1946) had a Broadway run, and *The Consul* (1950, Pulitzer Prize) was also successful. The highly popular *Amahl and the Night Visitors* (1951), for television, was followed by *The Saint of Bleecker Street* (1955, Pulitzer Prize). In 1958 he founded the Festival of Two Worlds in Spoleto, Italy; it enjoyed great success, and in 1977 he founded a New World counterpart in Charleston, S.C.

Menshevik \'men-shə-vik\ Member of the non-Leninist wing of the Russian Social-Democratic Workers' Party. The group evolved in 1903 when L. Martov called for a mass party modeled after western European groups, as opposed to Vladimir Ilich Lenin's plan to restrict the party to professional revolutionaries. When Lenin's followers obtained a majority on the party central committee, they called themselves Bolsheviks ("those of the majority"), and Martov and his group became the Mensheviks ("those of the minority"). The Mensheviks played active roles in the Russian Revolution of 1905 and in the St. Petersburg soviet, but they became divided over World War I and later by the Russian Revolution of 1917. They attempted to form a legal opposition party but in 1922 were permanently suppressed.

Menshikov \'myen-shi-kȯf**, Aleksandr (Danilovich)** (b. Nov. 16, 1673, Moscow, Russia—d. Nov. 23, 1729, Berezov, Siberia, Russian Empire) Russian soldier and administrator. In 1686 he became an orderly for Peter I and soon was the tsar's favourite. Menshikov led troops to victories in the Second Northern War, including the Battle of Poltava, after which he received the title of field marshal (1709). As an administrator from 1714, he was criticized for corrupt practices as he amassed power and wealth. After Peter's death in 1725, Menshikov succeeded in having his ally Catherine I proclaimed empress, making him the virtual ruler of Russia. After her death in 1727, he arranged to have his daughter marry the young Tsar Peter II, but his enemies turned Peter against him and forced Menshikov's exile to Siberia.

menstruation Periodic discharge from the vagina of blood, secretions, and shed mucous lining of the uterus (endometrium). The endometrium prepares to receive a fertilized egg by thickening and producing secretions. If the egg released by the ovary is not fertilized, the endometrium breaks down and is expelled by contractions of the uterus. The first menstruation (menarche) occurs after other changes of puberty, usually at 11–13 years of age, apparently triggered by the passing of a weight threshold. Bleeding may be irregular or heavy at first. In adult women, menstrual periods begin at an average interval of 28 days and last about five days; some variation among women and in the same woman is normal. Uterine contractions are felt as cramps. The amount of blood lost is usually less than 1.7 oz (50 ml). Menstruation ends with menopause. Menstrual disorders include dysmenorrhea (painful menstruation) and amenorrhea (no bleeding), heavy or light bleeding, and uterine bleeding. See also premenstrual syndrome.

mental disorder Any illness with a psychological origin, manifested either in symptoms of emotional distress or in abnormal behaviour. Most mental disorders can be broadly classified as either psychoses or neuroses (see neurosis; psychosis). Psychoses (e.g., schizophrenia and bipolar disorder) are major mental illnesses characterized by severe symptoms such as delusions, hallucinations, and an inability to evaluate reality in an objective manner. Neuroses are less severe and more treatable illnesses, including depression, anxiety, and paranoia as well as obsessive-compulsive disorders and post-traumatic stress disorders. Some mental disorders, such as Alzheimer disease, are clearly caused by organic disease of the brain, but the causes of most others are either unknown or not yet verified. Schizophrenia appears to be partly caused by inherited genetic factors. Some mood disorders, such as mania and depression, may be caused by imbalances of certain neurotransmitters in the brain; they are treatable by drugs that act to correct these imbalances (see psychopharmacology). Neuroses often appear to be caused by psychological factors such as emotional deprivation, frustration, or abuse during childhood, and they may be treated through psychotherapy. Certain neuroses, particularly the anxiety disorders known as phobias, may represent maladaptive responses built up into the human equivalent of conditioned reflexes.

mental hygiene Science of maintaining mental health and preventing disorders to help people function at their full mental potential. It includes all measures taken to promote and preserve mental health: rehabilitation of the mentally disturbed, prevention of mental illness, and aid in coping in a stressful world. Community mental health acknowledges the relation between mental health, population pressures, and social unrest. It also deals with social problems, from drug addiction to suicide prevention. Treatment of the mentally ill through the ages has ranged from neglect, ill treatment, and isolation to active treatment and integration into the community, often in response to crusading reformers. Prevention of mental illness includes prenatal care, child-abuse awareness programs, and counseling for crime victims. Treatment includes psychotherapy, drug therapy, and support groups. One of the most important efforts is public education to combat the stigma still attached to mental illness and encourage those affected to seek treatment.

mental retardation Subaverage intellectual ability that is present from birth or infancy and is manifested by abnormal development, learning difficulties, and problems in social adjustment. A standardized intelligence test is a common method of identification. Individuals with IQ scores of 53–70 are usually classified as mildly retarded and are able to learn academic and pre-vocational skills with some special education. Those with scores of 36–52 are classified as moderately retarded and are able to learn functional academic skills and undertake semiskilled work under supervised conditions. Those in the severe (21–35) and profound (below 21) ranges require progressively more supervision or full-time custodial care. Mental retardation can be caused by genetic disorders (such as Down's syndrome), infectious diseases (such as meningitis), metabolic disorders, poisoning from lead, radiation, or other toxic agents, injuries to the head, and malnutrition.

menthol Crystalline organic compound of the isoprenoid family. It has a strong, minty, cooling odour and taste. It is obtained from the oil of the Japanese mint or made synthetically and is used in cigarettes, cosmetics, chest rubs, cough drops, toothpastes, and flavourings. Of its two optical isomers (see optical activity; isomerism), only l-menthol has the desirable cooling effect.

Menuhin \'men-yə-wən**, Yehudi, Lord Menuhin of Stoke d'Abernon** (b. April 22, 1916, New York, N.Y., U.S.—d. March 12, 1999, Berlin, Ger.) U.S.-born British violinist and conductor. Raised in San Francisco, he made his debut at age seven. In 1927 he studied with George Enescu (1881–1955) in Paris; he returned to perform to tremendous acclaim in New York the same year and went on to astound audiences worldwide with his precocious depth and proficiency. From 1959 he lived in London, but he did not become a British citizen until 1985. He directed the Bath Festival (1958–68) and the Gstaad Festival from 1956. In 1958 he founded his own chamber orchestra. Often accompanied by his pianist sister, Hephzibah (1920–81), he also made recordings with the sitarist Ravi Shankar.

Menzies \'men-ˌzēz**, Sir Robert (Gordon)** (b. Dec. 20, 1894, Jeparit, Victoria. Austl.—d. May 16, 1978, Melbourne) Australian statesman and prime minister (1939–41, 1949–66). A successful lawyer, he served as Australia's attorney general (1934–39). Leader of the United Australia Party, he served as prime minister (1939–41). He organized the Liberal Party in 1944 and again became premier in 1949. In the 1950s he fostered industrial growth in Australia and immigration from Europe. He strengthened military ties with the U.S. and encouraged the ANZUS Pact and Australia's membership in the Southeast Asia Treaty Organization. He retired in 1966 after the longest ministry in Australian history.

mer \'mer\ Among the Cheremi and Udmurt peoples of Russia, a sacred grove where people of several villages gathered periodically to hold religious festivals and sacrifice animals to nature gods. The groves where the mer festivals were held were not fenced (see lud) and did not have permanent altars. Mer festivals were infrequent; five years or more might elapse between them.

mercantile agency Specialized organization that supplies information on the creditworthiness and financial strength of business firms. The first such agency, the Mercantile Agency, was founded in New York City in 1841. It provided information to businesses that were expanding nationally and were unable to assess the credit history of prospective customers in distant locations. It changed its name to R. G. Dun & Co. after 1859 and merged with the Bradstreet Co. in 1933 to form Dun & Bradstreet, Inc., the best-known mercantile agency. Mercantile agencies may provide information on all types of business firms or may limit their investigations to firms in a particular line of trade or a particular region. Most agencies provide both general and special reports. General reports, issued periodically on all firms investigated by the agency, assign a rat-

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ing to the firm's financial statement and creditworthiness. Special reports containing more detailed information are issued to clients of the agency on request. See also CREDIT BUREAU.

mercantile law See BUSINESS LAW

mercantilism Economic theory and policy influential in Europe from the 16th to the 18th century that called for government regulation of a nation's economy in order to increase its power at the expense of rival nations. Though the theory existed earlier, the term was not coined until the 18th century; it was given currency by ADAM SMITH in his *Wealth of Nations* (1776). Mercantilism's emphasis on the importance of gold and silver holdings as a sign of a nation's wealth and power led to policies designed to obtain precious metals through trade by ensuring "favourable" trade balances (see BALANCE OF TRADE), meaning an excess of exports over imports, especially if a nation did not possess mines or have access to them. In a favourable trade balance, payments for the goods or services had to be made with gold or silver. Colonial possessions were to serve as markets for exports and as suppliers of raw materials to the mother country, a policy that created conflict between the European colonial powers and their colonies, in particular fanning resentment of Britain in the North American colonies and helping bring about the American Revolution. Mercantilism favoured a large population to supply labourers, purchasers of goods, and soldiers. Thrift and SAVING were emphasized as virtues because they made possible the creation of CAPITAL. Mercantilism provided a favourable climate for the early development of CAPITALISM but was later severely criticized, especially by advocates of LAISSEZ-FAIRE, who argued that all trade was beneficial and that strict government controls were counterproductive.

Mercator \mər-'kā-tər**, Gerardus** *orig.* **Gerard Kremer** (b. March 5, 1512, Rupelmonde, Flanders—d. Dec. 2, 1594, Duisburg, Duchy of Cleve) Flemish cartographer. He received a master's degree in 1532 from the University of Louvain (Belgium), where he settled. By 24 he was a skilled engraver, calligrapher, and scientific-instrument maker. He and his colleagues made Louvain a centre for construction of maps, globes (terrestrial and celestial), and astronomical instruments. He was appointed court cosmographer to Duke Wilhelm of Cleve in 1564, and in 1569 he perfected what has become known as the Mercator projection, in which parallels and meridians are rendered as straight lines spaced so as to produce at any point an accurate ratio of latitude to longitude. It permitted mariners to steer a course over long distances, plotting straight lines without continually adjusting compass readings. While the meridians are equally spaced parallel vertical lines, the lines of latitude are spaced farther and farther apart as their distance from the Equator increases; on world maps the projection greatly enlarges areas distant from the Equator.

mercenary \'mər-sᵊn-ˌer-ē\ Hired professional soldier who fights for any state or nation without regard to political principles. From the earliest days of organized warfare, governments supplemented their military forces with mercenaries. After the Hundred Years' War (1337–1453), Swiss soldiers were hired out all over Europe by their own cantonal governments and won a high reputation. Rulers of the German state of Hesse also hired out their soldiers, and Hessian troops fought for the British in the AMERICAN REVOLUTION. Since the late 18th century, most mercenaries have been individual soldiers of fortune.

Mercer, Johnny *orig.* **John Herndon Mercer** (b. Nov. 18, 1909, Savannah, Ga., U.S.—d. June 25, 1976, Bel Air, Calif.) U.S. songwriter. After moving to New York City in the late 1920s, Mercer began to write lyrics while supporting himself as an actor. He later joined PAUL WHITEMAN's orchestra as singer and master of ceremonies. In 1939 he joined BENNY GOODMAN's *Camel Caravan* radio show. In 1942 Mercer cofounded Capitol Records. On Broadway, he collaborated with HAROLD ARLEN on *St. Louis Woman* (1946) and *Saratoga* (1959) and also provided lyrics for *Seven Brides for Seven Brothers* (1954), *Li'l Abner* (1956), and *Foxy* (1964). His songs for films won four Academy Awards. He collaborated with composers such as HOAGY CARMICHAEL, HENRY MANCINI, JEROME KERN, and JIMMY VAN HEUSEN and is credited with more than 1,000 lyrics, including those for "Ac-cent-tchu-ate the Positive," "One for My Baby," "Autumn Leaves," and "Moon River."

mercerization \ˌmər-sə-rə-'zā-shən\ Chemical treatment applied to COTTON fibres or fabrics to make them permanently able to accept dyes and various chemical finishes more easily. The method, patented in 1850 by the English calico printer John Mercer, also gives cotton cloth increased TENSILE STRENGTH and greater absorptive properties. Higher-quality cotton goods are usually mercerized. The treatment consists of dipping the yarn or fibre in a solution of sodium HYDROXIDE and then treating the material with water or acid to neutralize the sodium hydroxide.

merchandising Element of MARKETING concerned especially with the sale of goods and services to customers. One aspect of merchandising is ADVERTISING, which aims to capture the interest of the segment of the population most likely to buy the product. Merchandising also involves product display; companies provide retailers with display and promotional materials and negotiate shelf space for their products. The development of sales strategies includes the determination of pricing, discounts, and special offers; the invention of sales pitches; and the identification of avenues for sales, including store-based RETAILING and alternative means such as DIRECT-MAIL MARKETING, telemarketing, commercial Web sites, VENDING MACHINES, and door-to-door sales.

Merchant, Ismail See James IVORY

merchant marine Commercial ships of a nation, whether privately or publicly owned, and the personnel who operate such ships, as distinct from the personnel of naval vessels. Merchant ships are used to transport people, raw materials, and manufactured goods. Merchant fleets can be important economic assets for nations with limited natural resources or a small industrial base. By carrying the commerce of other nations on the seas, a merchant fleet contributes to its home nation's foreign-exchange earnings, promotes trade, and provides employment. The U.S. Merchant Marine Academy (founded 1943) is in Kings Point, N.Y.

Mercia \'mər-shə\ Ancient kingdom, central England. One of the Anglo-Saxon kingdoms of the Heptarchy, it comprised the border areas, corresponding to modern STAFFORDSHIRE, DERBYSHIRE, NOTTINGHAMSHIRE, and northern WEST MIDLANDS and WARWICKSHIRE. OFFA, who ruled from 757 to 796, created a single state from the River Humber to the English Channel. After Offa's death, Mercia declined, overshadowed by WESSEX. In 877 the Danes divided Mercia into English and Danish sections. After the reconquest of the Danish lands in the early 10th century, it came under the rule of Wessex.

Mercury In ROMAN RELIGION, the god of merchants, commonly identified with the Greek messenger of the gods, HERMES. His temple on Rome's Aventine Hill was dedicated in 495 BC. The goddess Maia was identified as his mother, and the two were honoured in a festival on May 15. Mercury is sometimes depicted holding a purse, symbolic of his business functions. More often he is given the attributes of Hermes and portrayed wearing winged sandals or a winged cap and carrying a CADUCEUS.

mercury *or* **quicksilver** Metallic chemical ELEMENT, chemical symbol Hg, atomic number 80. Mercury is the only elemental METAL that is liquid at ordinary temperatures, with a freezing point of −38 °F (−39 °C) and a boiling point of 674 °F (356.9 °C). Silvery white, dense, toxic (see MERCURY POISONING), and a good conductor of electricity, mercury is occasionally found free in nature but usually occurs as the red sulfide ore, CINNABAR (HgS). It has many uses—in dental and industrial AMALGAMS, as a CATALYST, in electrical and measuring apparatus and instruments (e.g., thermometers), as the CATHODE in electrolytic cells, in mercury-vapour lamps, and as a coolant and neutron absorber in NUCLEAR POWER plants. Many of mercury's compounds, in which it has VALENCE 1 or 2, are pigments, pesticides, and medicinals. It is a dangerous pollutant because it concentrates in animal tissues in increasing amounts up the food chain.

Mercury Innermost PLANET of the SOLAR SYSTEM. Its average distance from the Sun is about 36 million mi (58 million km), but its highly elliptical orbit carries it 7.5 million mi (12 million km) nearer to and farther from the Sun. It is the second-smallest major planet (after Pluto), having a diameter of about 3,030 mi (4,880 km) and a mass about one-eighteenth of Earth's. With the shortest period of revolution (only 88 Earth days) and the highest average orbital speed (30 mi/second, or 48 km/second) of any planet, it is aptly named after the fleet-footed Roman messenger god. It spins very slowly, making one complete rotation relative to the stars every 59 Earth days, while its solar day (from one sunrise to the next) is 176 Earth days, owing to its revolution around the Sun. Its surface is heavily cratered. Its most impressive feature is perhaps the 800-mi (1,300-km) Caloris Basin, formed by a huge METEORITE impact. Mercury also has steep cliffs that extend for hundreds of miles. The discovery of a magnetic field in its vicinity suggests it has a large iron core, which would account for a mean density almost as high as Earth's. Its atmosphere is

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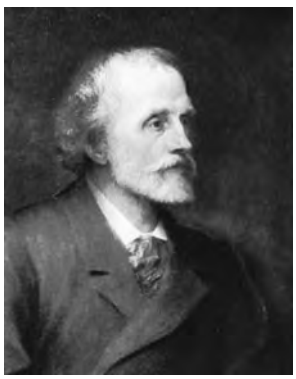
negligible; its surface gravity, about one-third that of Earth's, holds an exceedingly tenuous layer of gases. Temperatures at its surface change dramatically, ranging from a high that can exceed 800 °F (425 °C) on the sunward side to a low of about −290 °F (−180 °C) at the end of its night.

Mercury First series of U.S. manned spaceflights (1961–63), which began about three weeks after YURY A. GAGARIN became the first human in space. In May 1961 ALAN B. SHEPARD rode the first Mercury space capsule, Freedom 7, on a 15-minute, 302-mi (486-km) suborbital flight, attaining a maximum altitude of 116 mi (186 km). The first U.S. manned flight in orbit was that of the Friendship 7, carrying JOHN H. GLENN, JR., in February 1962; it completed three orbits. The last Mercury flight, Faith 7, launched in May 1963, was the longest, making 22 orbits in about 34 hours.

mercury poisoning Harmful effects of MERCURY compounds. Manufacture of paints, various household items, and pesticides uses mercury; the finished product and the waste products released into air and water may contain mercury. The aquatic FOOD CHAIN can concentrate organic mercury compounds in fish and seafood, which, if eaten by humans, can affect the central NERVOUS SYSTEM, impairing muscle, vision, and cerebral function, leading to PARALYSIS and sometimes death (see MINAMATA DISEASE). Acute mercury poisoning causes severe digestive-tract inflammation. Mercury accumulates in the kidneys, causing UREMIA and death. Chronic poisoning, from occupational inhalation or skin absorption, causes metallic taste, oral inflammation, blue gum line, extremity pain and tremor, weight loss, and mental changes (depression and withdrawal). Drugs containing mercury can cause sensitivity reactions, sometimes fatal. In young children, acrodynia (pink disease) is probably caused by an organic mercury compound in house paints.

Meredith, George (b. Feb. 12, 1828, Portsmouth, Hampshire, Eng.—d. May 18, 1909, Box Hill, Surrey) English novelist and poet. Though ostensibly launched on a law career at age 18, he concentrated instead on writing poems and articles and making translations. Because they brought in little money, he turned to writing prose. The novel *The Ordeal of Richard Feverel* (1859) is typical of his best work, rich in allusion, metaphor, lyrical prose, witty dialogue, and psychological insight. It failed to make him wealthy, and he was forced to begin reading manuscripts for a publisher. Writing in his spare time, he produced a comedy, *Evan Harrington* (1860), and a volume of poems, *Modern Love* (1862). He finally won critical and popular acclaim with the novels *The Egoist* (1879) and *Diana of the Crossways* (1885). His works are noted for their use of interior monologue and their treatment of women as equals of men.



George Meredith, detail of an oil painting by G.F. Watts, 1893; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Meredith, James (Howard) (b. June 25, 1933, Kosciusko, Miss., U.S.) U.S. civil rights leader. He grew up in poverty in Mississippi, the most racially segregated state in the U.S. In 1961 he applied for admission to the all-white University of Mississippi. He won a legal battle to be admitted, but federal troops and Justice Department officials had to be brought in to enforce the court order. While participating in a voter-registration drive after his graduation from "Ole Miss," he was shot and wounded by a white supremacist.

merengue \mə-'reŋ-gā\ Couple dance from the Dominican Republic or Haiti, danced throughout Latin America. Originally a folk dance, it has become a ballroom dance, where it is danced with a limping step, the weight always on the same foot. Varieties include the jaleo and juangomero. Dominican merengue music became widely popular in the late 20th century.

mereology \ˌmir-ē-'ä-lə-jē\ Branch of LOGIC, founded by STANISŁAW LEŚNIEWSKI, that studies class expressions and the relations between parts and wholes. It rejects the hierarchy of sets generated in SET THEORY through the member-of relation and instead proposes a part-whole relationship. It has attracted philosophers of logic and mathematics who are nominalists (see UNIVERSAL), those who suspect set theory of being inherently Platonistic, and those who are otherwise suspicious of the complex entities proposed by, and the complicated assumptions needed for, set theory.

merganser *or* **fish duck** Any species of the DIVING DUCK genus *Mergus*. Essentially freshwater birds, they are classified as a sea duck (tribe Mergini). Mergansers have a long body and a narrow, serrated, hooked bill for catching fish. The males of all but the common merganser, or goosander (*M. merganser*), are crested. The common merganser, the hooded merganser (*M. cucullatus*), the red-breasted merganser (*M. serrator*), and the smew (*M. albellus*), a small, compact merganser with a short bill, live in northern regions; the only southern species is the Brazilian merganser (*M. octosetaceus*). Mergansers are called trash ducks because their flesh is rank. See also SHELDUCK.

Mergenthaler \'mər-gən-ˌthä-lər**, Ottmar** (b. May 11, 1854, Hachtel, Württemberg—d. Oct. 28, 1899, Baltimore, Md., U.S.) German-U.S. inventor. He immigrated to the U.S. in 1872. While working in a Baltimore machine shop he began experimenting with type molds, and in 1884 he patented the LINOTYPE typesetting machine. The reduced costs achieved by thus speeding up the typesetting process led to a dramatic expansion of all kinds of publishing.

merger Combination of two or more independent business corporations into a single enterprise, usually involving the absorption of one or more firms by a dominant firm. The dominant firm may purchase the other firm's assets with cash or SECURITIES, purchase the other firm's STOCK, or issue its own stock to the other firm's stockholders in exchange for their shares in the acquired firm (thus acquiring the other company's assets and liabilities). In horizontal mergers, both firms produce the same commodity or service for the same market. In vertical mergers, a firm acquires either a supplier or a customer. If the merged business is not related to that of the acquiring firm, the new corporation is called a conglomerate. The reasons for mergers are various: the acquiring firm may seek to eliminate a competitor, to increase its efficiency, to diversify its products, services, and markets, or to reduce its taxes.

Mergui Archipelago \mər-'gwē\ Group of more than 200 islands in the Andaman Sea off the coast of southeastern Myanmar. The largest island is Mali Kyun (Tavoy Island) at its northern end. Other major islands in the group include Kadan (King), Thayawthadangyi (Elphinstone), Daung (Ross), Saganthit (Sellore), Bentinck, Letsok-aw (Domel), Kanmaw (Kisseraing), Lanbi (Sullivan's), and Zadetkyi (St. Matthew's). Mountainous and jungle-covered, the islands are inhabited chiefly by the Selungs.

Mérida City (pop., 2000: 660,884), capital of YUCATÁN state, southeastern Mexico. It lies near the northwestern tip of the YUCATÁN PENINSULA, south of Progreso; its port is on the Gulf of Mexico. It was founded in 1542 on the site of the ancient MAYA city of T'ho. It has numerous colonial buildings and a 16th-century cathedral. Yucatán University and the Regional Technical Institute of Mérida are located there. It serves as a tourist base for trips to nearby Maya cities, including CHICHÉN ITZÁ, Dzibilchaltún, UXMAL, and Kabáh.

Mérida \'mā-rē-thä\ *ancient* **Emerita Augusta** Town (pop., 2001: 50,271), capital of the autonomous community of EXTREMADURA, western Spain. Situated on the northern bank of the Guadiana River, it was founded by the Romans in 25 BC. It served as the capital of the province of Lusitania and became one of the most important towns in Iberia. Occupied in AD 713 by the Moors, it was recaptured in 1228 by Alfonso IX of Leon, who granted it to the Knights of Santiago. It is known for its Roman ruins, including a bridge, an amphitheatre, and an aqueduct. The modern town's economy is based on agricultural trade and tourism.

Mérimée \mā-rē-'mā**, Prosper** (b. Sept. 28, 1803, Paris, France—d. Sept. 23, 1870, Cannes) French short-story writer and dramatist. In youth a student of languages and literatures, he wrote his first play, *Cromwell* (1922), at age 19. His passions were mysticism, history, and the unusual. His stories, often mysteries, were inspired mainly by Spanish and Russian sources, notably ALEKSANDR PUSHKIN; they include *Mateo Falcone* (1829), the collection *Mosaïque* (1833), and the novellas *Colomba* (1840) and *Carmen* (1845), the basis of GEORGES BIZET's opera. He also wrote works of history and archaeology, historical fiction, and literary criticism and carried on correspondences that were published posthumously. He became a senator in 1853.

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Merino Breed of medium-sized SHEEP originating in Spain that has become prominent worldwide. It has a white face, white legs, and crimped fine-wool fleece. Known as early as the 12th century, it may have been a Moorish importation. Well adapted to semiarid climates and to nomadic pasturing, it has served as foundation stock for many sheep breeds and strains.

meristem \'mer-ə-ˌstem\ In plants, region of cells capable of division and growth. Meristems are classified by location as apical, or primary (at root and shoot tips), lateral, or secondary (in the vascular CAMBIUM and cork cambium), or intercalary (at internodes, stem regions between the places at which leaves attach, and at leaf bases, especially in certain monocots, e.g., grasses). Apical meristems give rise to the primary plant body. Lateral meristems provide increase in stem girth. Injured tissues can convert other cells to new meristem for wound healing.

Meristem
J.M. LANGHAM

Merkabah *or* **Merkava** \ˌmer-kä-'vä\ Throne or chariot of God, as described by EZEKIEL. It became an object of visionary contemplation for Jewish mystics in Palestine in the 1st century AD; in the 7th–11th century, Merkabah mysticism was centered in BABYLONIA. Merkabah mystics courted ecstatic visions that involved a dangerous ascent through celestial hierarchies to the throne of God. Hostile angels guarded the gates to the seven "heavenly dwellings," and a successful journey required magical formulas. The TALMUD warns that of four men who engaged in Merkabah, only one had a true vision; of the others, one died, one went mad, and one became an apostate.

Merkel, Angela *orig.* **Angela Dorothea Kasner** (b. July 17, 1954, Hamburg, W.Ger.) German politician and prime minister (2005–). Merkel, who grew up in East Germany, earned a doctorate in physics at the University of Leipzig (1978) and later settled in East Berlin, where she worked as a quantum chemist. In 1990, shortly before Germany's reunification, she joined the Christian Democratic Union (CDU). Elected as a Bundestag deputy later that year, she became the protégé of German Chancellor Helmut Kohl, who appointed her to several ministerial positions. In 1999 a finance scandal hit the CDU, and Merkel drew attention for her criticism of Kohl. The following year she was elected CDU leader. In 2005 the CDU and its sister party, the Christian Social Union, won the general election but failed to capture a majority. A deal was reached that gave Merkel the chancellorship in a coalition government. She was sworn in on Nov. 22, 2005, becoming the first woman to hold the office.

Merleau-Ponty \mer-lō-pōⁿ-'tē**, Maurice** (b. March 14, 1908, Rochefort, France—d. May 4, 1961, Paris) French philosopher. With JEAN-PAUL SARTRE and SIMONE DE BEAUVOIR he founded the journal *Les Temps Modernes* in 1945. From 1949 he taught at the Sorbonne. He was the leading exponent of PHENOMENOLOGY in France. Though greatly influenced by EDMUND HUSSERL, he rejected Husserl's theory of our knowledge of other persons, grounding his own view instead in bodily behaviour and perception. He defended Soviet communism until the Korean War, when he became disillusioned.

Merlin Magician and wise man in ARTHURIAN LEGEND. In GEOFFREY OF MONMOUTH's *History of the Kings of England*, Merlin was an adviser to King Arthur, with magical powers that recalled his Celtic origins. Later narratives made him a prophet of the GRAIL and gave him credit for the idea of the Round Table. In SIR THOMAS MALORY's *Morte Darthur* he brought Arthur to the throne and served as his mentor throughout his reign. His downfall was linked to his infatuation for an enchantress, who imprisoned him after learning the magic arts from him.

merlin *or* **pigeon hawk** Small blue-gray FALCON (*Falco columbarius*, family Falconidae), with a narrowly white-banded tail, found at high latitudes in Canada, the western U.S. south to Colorado, the British Isles, Scandinavia, and Iceland. Most migrate to just south of the breeding range, but some go as far as northern South America. The merlin inhabits wet, open country or conifer and birch woods. It usually lays its eggs on the ground in bushes, but may occupy an old rook or magpie nest in a tree. An aggressive hunter, it was once much used in FALCONRY.

Merlin (*Falco columbarius*).
ERIC HOSKING

Merman, Ethel *orig.* **Ethel Agnes Zimmerman** (b. Jan. 16, 1909, Astoria, N.Y., U.S.—d. Feb. 15, 1984, New York, N.Y.) U.S. singer and actress. Merman, who had never taken voice lessons, worked as a secretary before her first professional singing engagement in 1929. She made her stage debut in George and Ira Gershwin's *Girl Crazy* (1930) (see GEORGE GERSHWIN; IRA GERSHWIN). Her brassy, ebullient style and powerful voice made her a favoured performer for IRVING BERLIN, COLE PORTER, and others. In the mid-1930s Merman made her first Hollywood appearance, and she later starred on her own radio show. Her many Broadway successes include *Anything Goes* (1934), *Red, Hot and Blue* (1936), *Annie Get Your Gun* (1946), *Call Me Madam* (1950), and *Gypsy* (1959).

Meroë \'mer-ō-ˌwē\ City, ancient KUSH, northeastern Africa. Situated on the eastern bank of the NILE RIVER, north of modern Kabūshiyyah, Sudan, it was the southern administrative centre for the kingdom of Kush, beginning c. 750 BC. After the sack of Napata (c. 590), it became the capital of the kingdom. It included the region between the Nile and Atbara rivers, where the Meroitic language developed. It survived a Roman invasion but fell to Aksumite armies in the 4th century AD. The ruins of its temples and palaces still exist near Kabūshiyyah.

Merovingian \ˌmer-ə-'vin-jən\ **art** Visual arts produced under the MEROVINGIAN DYNASTY of the 5th–8th centuries AD. They consisted mainly of small-scale metalwork, little of which has survived, and several important manuscripts. The style blends Roman Classical style with native Germanic-Frankish traditions, which favoured abstraction and geometric patterning. The human figure was rarely attempted; artists were concerned primarily with surface design. Though modest, Merovingian art was influential long after the end of the dynasty.

Merovingian dynasty (476–750) Frankish dynasty considered the first French royal house. It was named for Merovech (fl. c. 450), whose son Childeric I (d. 482?) ruled a tribe of Salian FRANKS from his capital at Tournai. His son, CLOVIS I, united nearly all of Gaul in the late 5th century except Burgundy and present-day Provence. On his death the realm was divided among his sons, but by 558 it was united under his last surviving son, CHLOTAR I. The pattern of dividing and then reuniting the realm continued for generations. After the reign of DAGOBERT I (623–639), the authority of the Merovingian kings declined, and real power gradually came to rest in the hands of the mayors of the palace. In 751 the last Merovingian king, Childeric III, was deposed by PIPPIN III, the first of the CAROLINGIAN DYNASTY. See also BRUNHILD; CHILDEBERT II; CHILPERIC I; FREDEGUND; SIGEBERT I.

Merrick, David *orig.* **David Margulois** (b. Nov. 27, 1912, St. Louis, Mo., U.S.—d. April 25, 2000, London, Eng.) U.S. theatrical producer. He practiced law until 1949, when he became a producer in New York City. His first independent production, *Clutterbuck* (1949), was followed over the next 40 years by more than 85 other Broadway shows, including *Look Back in Anger* (1957), *The Entertainer* (1958), *Gypsy* (1959), *Oliver!* (1963), *Hello, Dolly!* (1964), and *42nd Street* (1980). Many of his productions were critical and commercial successes, and he was known for his skillful use of publicity.

Merrick, Joseph See ELEPHANT MAN

Merrill, Charles E(dward) (b. Oct. 19, 1885, Green Cove Springs, Fla., U.S.—d. Oct. 6, 1956, Southampton, N.Y.) U.S. investment banker. He held a series of jobs before joining a Wall Street firm in 1911. In 1914 he cofounded the investment-banking firm Merrill, Lynch & Co., which soon became the broker for some of the largest chain-store SECURITIES, including S.S. Kresge Co. and J.C. Penney Co. He helped create Safeway Stores in 1926 and founded *Family Circle* magazine six years later. Foreseeing the crash of 1929, he advised many of his clients to lighten their stock holdings. In the 1930s the firm focused on underwriting and invest-

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ment banking, but in 1940 it returned to brokerage. The company (now Merrill Lynch, Pierce, Fenner & Smith), which had 115 offices in the U.S. at the time of Merrill's death, is today among the largest retail brokerage houses in the U.S. He was the father of poet James Merrill.

Merrill, James (Ingram) (b. March 3, 1926, New York, N.Y., U.S.—d. Feb. 6, 1995, Tucson, Ariz.) U.S. poet. Son of a founder of the investment firm Merrill Lynch, he attended Amherst College. Inherited wealth enabled him to devote his life to poetry. His lyric and epic poems are known for their fine craftsmanship, erudition, and wit. Many of his later works were stimulated by sessions with a Ouija board. His collections include *Nights and Days* (1966), the trilogy of *Divine Comedies* (1976, Pulitzer Prize), *Mirabell: Books of Number* (1978), and *Scripts for the Pageant* (1980), published together in *The Changing Light at Sandover* (1982). *A Different Person*, his memoir, was published in 1993. His last book of poetry, *A Scattering of Salts*, was published posthumously in 1995.

Merrimack River River, northeastern U.S. Rising in the White Mountains of central New Hampshire, it flows south into Massachusetts, then turns northeast and empties into the Atlantic Ocean after a total course of 110 mi (177 km). The main cities along the river include Concord, Manchester, and Nashua, N.H., and Lowell, Lawrence, and Haverhill, Mass.; they used the river to power their textile mills in the 19th century.

Mersey, River River, northwestern England. It flows west through the southern suburbs of Manchester and is joined by the Irwell in its canalized form as the Manchester Ship Canal. The Mersey is itself modified by the canal as far as Warrington, where it becomes tidal. At Runcorn it is joined by the Weaver, and it forms the Mersey Estuary, the harbour of Liverpool. It enters the Irish Sea after a course of 70 mi (110 km).

Mersey \'mər-zē\ **River** River, northern Tasmania, Australia. Fed by the Dasher and Fisher rivers, the Mersey flows 91 mi (146 km) north, east, and again north to enter an estuary at Latrobe and then empty into Bass Strait at Devonport. The stream cuts a gorge up to 2,000 ft (600 m) deep; its water is harnessed there for hydroelectric power.

Merseyside \'mər-zē-ˌsīd\ Metropolitan county (pop., 2001: 1,362,034), northwestern England. Located on the estuary of the River Mersey, it comprises five metropolitan boroughs: Knowsley, St. Helens, Sefton, Wirral, and the city of Liverpool. The areas to the north of the Mersey, including Liverpool, form part of the historic county of Lancashire, while the borough of Wirral to the south belongs to the historic county of Cheshire. In 1986 it lost its administrative functions, which it held from 1974, and it is now a geographic and ceremonial county without administrative authority. During the 17th century many ships sailing from Liverpool, its main harbour, were engaged in the West Indies slave trade. In the 19th century the area benefited from U.S. cotton imports. Merseyside residents possess a distinctive local dialect, "scouse," that provides the region with a strong identity. It was bombed heavily during World War II. It is famous for its contributions to national popular culture, from the Beatles to its football teams and its noted golf links.

Merton, Robert K(ing) *orig.* **Meyer R. Schkolnick** (b. July 4, 1910, Philadelphia, Pa., U.S.—d. Feb. 23, 2003, New York, N.Y.) U.S. sociologist. After receiving a Ph.D. from Harvard University in 1936, Merton taught there and at Tulane University before moving to Columbia University, where he was a professor from 1941 to 1979. His diverse interests included deviant behaviour, the sociology of science, and mass communications, and he generally advanced a functionalist approach to the study of society. He was awarded a National Medal of Science in 1994. Among his writings are *Mass Persuasion* (1946), *Social Theory and Social Structure* (1949), *On the Shoulders of Giants* (1965), and *The Sociology of Science* (1973). See also bureaucracy; functionalism.

Merton, Thomas *later* **Father M. Louis** (b. Jan. 31, 1915, Prades, France—d. Dec. 10, 1968, Bangkok, Thai.) U.S. monk and Roman Catholic writer. Educated in England, France, and the U.S., Merton taught English at Columbia University before entering a Trappist order in Kentucky. In 1949 he was ordained a priest. His early works, on spiritual themes, include poetry collections; the autobiographical *Seven Storey Mountain* (1948), which brought him international fame and led many readers to the monastic life; and *The Waters of Siloe* (1949), a history of the Trappists. In the 1960s his writings tended toward social criticism, Eastern philosophy, and mysticism. He was accidentally electrocuted at a monastic convention in Thailand.

Merv Ancient city, Central Asia. Lying near the modern town of Mary (formerly Merv) in Turkmenistan, it is mentioned in ancient Persian texts as Mouru and in cuneiform inscriptions as Margu and was the seat of a satrapy (province) of the Persian Achaemenian dynasty. Under the Arabs in the 7th century AD, it was rebuilt and served as a base for Muslim expansion into Central Asia. A great centre of Islamic learning under the caliphs of the ʿAbbāsid dynasty, it reached its zenith under the Seljuq sultan Sanjar (r. 1118–57). It was destroyed by the Mongols in 1221 and was rebuilt in the 15th century. It was occupied by the Russian Empire in 1884.

Merwin, W(illiam) S(tanley) (b. Sept. 30, 1927, New York, N.Y., U.S.) U.S. poet and translator. He attended Princeton University and earned critical acclaim with his first poetry collection, *A Mask for Janus* (1952). He became known for the spare style of his poetry, which often expresses concerns about the natural environment and our relation to it. His volumes include *The Lice* (1967), *The Carrier of Ladders* (1970, Pulitzer Prize), and *Travels* (1993). His translations, often collaborations with others, range from plays of Euripides and Federico García Lorca to epics to ancient and modern works from Chinese, Sanskrit, and Japanese.

Mesa \'mā-sə\ City (pop., 2000: 396,375), south-central Arizona, U.S., located near Phoenix. It was settled in 1878 by Mormons who used ancient Hohokam Indian canals for irrigation (see Hohokam culture); it was incorporated as a town in 1883 and as a city in 1930. A Salt River reclamation project enabled the community to grow fruit and raise other crops. The city grew rapidly through industrialization after World War II. It is the site of Mesa Community College and Mesa Southwest Museum.

mesa \'mā-sə\ (Spanish: "table") Flat-topped tableland with one or more steep sides, common in the Colorado Plateau regions of the U.S.; a butte is similar but smaller. Both are formed by erosion; during denudation, or downcutting and stripping, areas of harder rock in a plateau act as flat protective caps for portions of underlying land situated between such places as stream valleys, where erosion is especially active. This results in a table mountain (mesa) or fortress hill.

Mesa Verde \'mā-sə-'ver-dē\ **National Park** National park, southwestern Colorado, U.S. It was established in 1906 to preserve prehistoric Indian cliff dwellings. Occupying a high tableland area of 52,085 acres (21,078 hectares), it contains hundreds of pueblo ruins up to 13 centuries old. The most striking are multistoried apartments built under overhanging cliffs. Cliff Palace, the largest, was excavated in 1909 and contains hundreds of rooms, including kivas, the circular ceremonial chambers of the Pueblo Indians.

mescaline \'mes-kə-lin\ Hallucinogen, the active principle in the flowering heads of the peyote cactus. An alkaloid related to epinephrine and norepinephrine and first isolated in 1896, mescaline is usually extracted from the peyote and purified, but can also be synthesized. When it is taken as a drug, its hallucinogenic effects begin in two to three hours and may last over 12 hours; the hallucinations vary greatly among individuals and from one time to the next, but they are usually visual rather than auditory. Side effects include nausea and vomiting.

Meselson \'me-səl-sən**, Matthew Stanley** (b. May 24, 1930, Denver, Colo., U.S.) U.S. molecular biologist. He received his Ph.D. from California Institute of Technology; from 1964 he taught at Harvard University. He conducted research with Franklin Stahl that showed that, during cell division, DNA splits into its two component strands, each of which acquires a newly synthesized partner strand before passing into one of the daughter cells.

Meshed See Mashhad

Meslamtaea \ˌmes-lam-'tē-ə\ In Mesopotamian religion, the god of the city of Cuthah in Akkad. The name of his temple, Emeslam or Meslam ("luxuriant *mesu* tree"), may indicate that he was originally a tree god. Later he was identified as the ruler of the netherworld and the spouse of its queen, Ereshkigal. He was the son of Enlil, god of the atmosphere, and Ninlil, goddess of grain, and he often appears in hymns as a warrior. He sometimes visited terrible plagues on his people and their herds.

Mesmer \'mez-mər**, Franz Anton** (b. May 23, 1734, Iznang, Swabia—d. March 5, 1815, Meersburg) German physician. After studying medicine at the University of Vienna, he developed his theory of "animal magnetism," which held that an invisible fluid in the body acted according to the laws of magnetism and that disease was caused by obstacles to the free circulation of this fluid. In Mesmer's view, harmony

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could be restored by inducing "crises" (trance states often ending in delirium or convulsions). In the 1770s he carried out dramatic demonstrations of his ability to "mesmerize" his patients using magnetized objects. Accused by Viennese physicians of fraud, he left Austria and settled in Paris (1778), where he also came under fire from the medical establishment. Though his theories were eventually discredited, his ability to induce trance states in his patients made him the forerunner of the modern use of HYPNOSIS.

Mesoamerican civilization Complex of aboriginal cultures that developed in parts of Mexico and Central America before the Spanish conquest in the 16th century. This civilization and the ANDEAN CIVILIZATION in South America constituted a New World counterpart to those of ancient Egypt, Mesopotamia, and China. Humans have been present in Mesoamerica from as early as 21,000 BC; a shift from hunting and gathering to agriculture, which began c. 7000 BC as the climate warmed with the end of the Ice Age, was completed by c. 1500 BC. The earliest great Mesoamerican civilization, the OLMEC, dates to c. 1150 BC. The Middle Formative period (900–300 BC) was a time of increased cultural regionalism and the rise of the ZAPOTEC people. Civilizations of the Late Formative and Classic periods (lasting until c. AD 900) include the MAYA and the civilization centred at TEOTIHUACÁN; later societies include the TOLTEC and the AZTEC. See also CHICHÉN ITZÁ; MIXTEC; MONTE ALBÁN; NAHUA; NAHUATL LANGUAGE; TENOCHTITLÁN; TIKAL.

Mesoamerican religions Religions of the pre-Columbian cultures of Mexico and Central America, notably the OLMEC, MAYA, TOLTEC, and AZTEC. All religions of Mesoamerica were polytheistic. The gods had to be constantly propitiated with offerings and sacrifices. The religions also shared a belief in a multilevel universe that had gone through five creations and four destructions by the time of the Spanish conquest. Mesoamerican religions heavily emphasized the astral bodies, particularly the sun, the moon, and Venus, and the observations of their movements by astronomer-priests were extraordinarily detailed and accurate. The Aztecs approached the supernatural through a complex calendar of ceremonies that included songs, dances, acts of self-mortification, and human sacrifices performed by a professional priesthood, in the belief that the welfare of the universe depended on offerings of blood and hearts as nourishment for the sun. The Mayan religion likewise called for human sacrifices, though on a smaller scale. Information on the astronomical calculations, divination, and ritual of the Mayan priests has been gathered from the MAYA CODICES. See also MESOAMERICAN CIVILIZATION.

Mesolithic \ˌme-zə-'li-thik\ **Period** *or* **Middle Stone Age** Ancient technological and cultural stage (c. 8000–2700 BC) between the PALEOLITHIC and NEOLITHIC periods in northwestern Europe. Mesolithic hunters, using a tool kit of chipped and polished stone together with bone, antler, and wooden tools, achieved a greater efficiency than their predecessors and were able to exploit a wider range of animal and vegetable food sources. Immigrant Neolithic farmers probably absorbed many indigenous Mesolithic hunters and fishers. There is no direct counterpart to the Mesolithic outside Europe, and the term is no longer used to reflect a hypothetical worldwide sequence of SOCIOCULTURAL EVOLUTION.

meson \'me-ˌzän\ Any member of a family of SUBATOMIC PARTICLES composed of a QUARK and an antiquark (see ANTIMATTER). Mesons are sensitive to the STRONG FORCE, have integral SPIN, and vary widely in MASS. Though unstable, many mesons last a few billionths of a second, long enough to be observed with particle detectors. They are readily produced in the collisions of high-energy subatomic particles (e.g., in COSMIC RAYS).

Mesopotamia Region between the TIGRIS and EUPHRATES rivers in the Middle East, constituting the greater part of modern Iraq. The region's location and fertility gave rise to settlements from c. 10,000 BC, and it became the cradle of some of the world's earliest civilizations and the birthplace of writing. It was first settled by the Sumerians, who were succeeded by the Akkadians and later by the Babylonians. Successive peoples came to dominate the region until the rise of the Persian Achaemenian dynasty in the 6th century BC. The Achaemenids were overthrown by Alexander the Great in the early 4th century BC, and Mesopotamia was ruled by the SELEUCID DYNASTY from c. 312 BC until the mid-2nd century BC, when it became part of the Parthian empire. In the 7th century AD the region was conquered by Muslim Arabs. The region's importance declined after the Mongol invasion in 1258. Rule by the Ottoman Empire over most of the region began in the 16th century. The area became a British mandate in 1920; the following year Iraq was established there.

Mesopotamian religions \ˌme-sə-pə-'tā-mē-ən\ Religious beliefs and practices of the Sumerians and Akkadians, and later of their successors, the Babylonians and Assyrians, who inhabited ancient MESOPOTAMIA. The deities of SUMER were usually associated with aspects of nature, such as fertility of the fields and livestock. The gods of ASSYRIA and BABYLONIA, rather than displacing those of Sumer and AKKAD, were gradually assimilated into the older system. Among the most important of the many Mesopotamian gods were ANU, the god of heaven; Enki, the god of water; and Enlil, the earth god. Deities were often associated with particular cities. Astral deities such as SHAMASH and SIN were also worshiped. The Mesopotamians were skilled astrologers who studied the movements of the heavenly bodies. Priests also determined the will of the gods through the observation of omens, especially by reading the entrails of sacrificed animals. The king functioned as the chief priest, presiding at the new-year festival held in spring, when the kingship was renewed and the triumph of the deity over the powers of chaos was celebrated.

Mesozoic \ˌme-zə-'zō-ik\ **Era** Second of the Earth's three major geologic eras and the interval during which the continental landmasses as known today were separated from the supercontinents LAURASIA and GONDWANA by CONTINENTAL DRIFT. It lasted from c. 248 to c. 65 million years ago and includes the TRIASSIC, JURASSIC, and CRETACEOUS periods. The Mesozoic saw the evolution of widely diversified and advanced flora and fauna, quite different from those that had developed earlier during the PALEOZOIC ERA or that would develop later during the CENOZOIC ERA.

mesquite \mə-'skēt\ Any of the spiny, deep-rooted shrubs or small trees that make up the genus *Prosopis* of the pea family (see LEGUME). Mesquites form extensive thickets in areas from South America to the southwestern U.S. Two races occur: one of tall trees (50 ft [15 m]), the other low and far-reaching, called running mesquite. Water-seeking roots grow as deep as 70 ft (20 m). Stems bear compound olive-green to white hairy leaves, then dense, cream-coloured CATKINS of flowers, followed by clusters of long, narrow, pale yellow beans. In warmer parts of the U.S., mesquites are considered pests and are eradicated. Cattle eat the beans, which contain a sweet pulp. The wood, formerly used in railroad ties, now has value only for unusual furniture and trinkets and as aromatic firewood.

Mesrob \mes-'rōp**, Saint** *or* **Saint Mesrop Mashtots** \mash-'tōts\ (b. c. 360, Hatsik, Armenia—d. Feb. 17, 440; Armenian feast day, February 19) Armenian theologian and linguist. A scholar of classical languages, he became a monk c. 395 and eventually founded several monasteries, spreading the Gospel in remote areas of Armenia. He systematized or invented the Armenian alphabet and sponsored the first translation of the Bible into Armenian (c. 410). He also wrote biblical commentaries and translated other theological works, and he helped establish Armenia's golden age of Christian literature. See also ARMENIAN LANGUAGE.

Messene \me-'sā-nā, mə-'sē-nē\ Ancient city, southwestern PELOPONNESE, Greece. It is located north of the modern city of the same name. Founded c. 369 BC as the site of the new capital of Messenia, Messene formed a strategic barrier against SPARTA, along with MEGALOPOLIS, MANTINEA, and ARGOS. It survived several Macedonian and Spartan sieges but fell to PHILIP II of Macedonia in 338 BC. Nothing is known of its history after the 2nd century BC.

Messenia \mə-'sē-nē-ə**, Gulf of** Gulf of the Ionian Sea, on the coast of the southwestern PELOPONNESE, Greece. On the west side of the gulf is the port of Koróni, originally settled by Argives after the First Messenian War (c. 735–715 BC) and reoccupied during the Middle Ages by refugees from the north. The French landed at the Gulf of Messenia in 1828 during the War of GREEK INDEPENDENCE to drive the Turks from the Peloponnese.

Messerschmitt, Willy (b. June 26, 1898, Frankfurt am Main, German Empire—d. Sept. 17, 1978, Munich, W.Ger.) German aircraft designer. From 1926 he was chief designer and engineer at the Bayerische Flugzeugwerke in Augsburg, Ger., which in 1938 became Messerschmitt AG. In 1939 his first military aircraft, the MESSERSCHMITT 109 (Me 109), set a speed record of 481 mph (775 km/hr). In World War II his factory produced 35,000 Me 109's for the German air force, as well as the Me 110 bomber, the Me 163 rocket-propelled plane, and the Me 262, the first combat jet. Under a postwar ban on aircraft production, his firm made prefab housing and sewing machines until 1958.

Messerschmitt 109 (Me 109) FIGHTER AIRCRAFT of Nazi Germany. Originally designed in 1934 by WILLY MESSERSCHMITT at the Bavarian Air-

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plane Co. (BFW), it was also known as the Bf 109. Modified after seeing action in the Spanish Civil War, it became Germany's premier fighter for much of World War II. The model used in the BATTLE OF BRITAIN was a single-seat, single-engine monoplane with a top speed of 350 mph (570 kph) and a ceiling of 35,000 ft (10,500 m). It was faster in a dive than the British SPITFIRE but was limited in range by a small fuel capacity. By 1944 improved Allied fighters such as the P-51 had outstripped it.

Messiaen \mes-'yä^{n}**, Olivier (-Eugène-Prosper-Charles)** (b. Dec. 10, 1908, Avignon, France—d. April 27, 1992, Clichy, near Paris) French composer. At age 11 he entered the Paris Conservatoire, where he won five first prizes. In 1931 he became principal organist at the church of the Sainte-Trinité, where he would remain for 40 years. He wrote his *Quartet for the End of Time* in a German POW camp. After the war, he taught at the Conservatoire (1947–78), where his students included PIERRE BOULEZ, KARLHEINZ STOCKHAUSEN, and IANNIS XENAKIS. His main source of inspiration was his quasi-mystical devout Catholic faith. His love of nature is evident in his many works inspired by birdsong. He also was influenced rhythmically by his study of Indian music, and he systematically explored nontonal harmonic materials. Major works include *Vingt regards sur l'enfant Jésus* (1944) and *Catalogue d'oiseaux* (1958) for piano, *La Nativité du Seigneur* (1935) for organ, the *Turangalîla-symphonie* (1948), *Et expecto resurrectionem mortuorum* (1964), and the opera *Saint François d'Assise* (1983).

Olivier Messiaen.

messiah In JUDAISM, the expected king of the line of DAVID who will deliver the Jews from foreign bondage and restore Israel's golden age. The term used for the messiah in the Greek NEW TESTAMENT, *christos*, was applied to JESUS, who is accepted by Christians as the promised redeemer. Messiah figures also appear in various other religions and cultures; SHIITE Muslims, for example, look for a restorer of the faith known as the MAHDI, and MAITREYA is a redeeming figure in Buddhism.

Messier \mās-'yā,\ *English* \'me-sē-ˌā\ **catalog** List of about 109 STAR clusters, NEBULAE, and GALAXIES compiled by the French astronomer Charles Messier (1730–1817), who discovered many of them. Still a valuable guide to amateur astronomers, it was superseded by the New General Catalogue (NGC); both NGC and M reference numbers remain in common use.

Messina *ancient* **Zankle** City (pop., 2001 prelim.: 236,621), northeastern SICILY, Italy. Founded by Greeks in the 8th century BC, it was destroyed by Carthaginians in 397 BC. The Romans took the rebuilt city in 264 BC, precipitating the First PUNIC WAR. After the war it became a free city allied with Rome. It was taken successively by the Goths, Byzantines, Arabs, Normans, Spaniards, and finally (in 1860) Italians. Heavily bombed during World War II, it was rebuilt. It is now an important Italian port. Sites of interest include the cathedral and the university (founded 1548).

Messina, Antonello da See ANTONELLO DA MESSINA

Messina, Strait of *ancient* **Fretum Siculum** Channel between southern Italy and northeastern Sicily. It is 2 to 10 mi (3 to 16 km) wide. The city of MESSINA lies on its bank in SICILY, opposite Reggio di Calabria. Ferry service across the strait links Messina with the Italian mainland.

Mesta River See NÉSTOS RIVER

mestizo \mes-'tē-zō\ Any person of mixed blood. In Spanish America the term denotes a person of combined Indian and European extraction. In some countries, such as Ecuador, it has acquired social and cultural connotations: a pure-blooded Indian who has adopted European dress and customs is called a mestizo (or *cholo*). In Mexico the term's meaning has varied so greatly that it has been abandoned in census reports. In the Philippines it denotes a person of mixed foreign (e.g., Chinese) and native ancestry. See also LADINO.

metabolism \mə-'ta-bə-ˌli-zəm\ Sum of all the CHEMICAL REACTIONS that take place in every CELL of a living organism, providing energy for the processes of life and synthesizing new cellular material. The term *intermediary metabolism* refers to the vast web of interconnected chemical reactions by which all the cell's constituents, many rarely found outside it, are created and destroyed. Anabolic reactions use energy to build complex MOLECULES from simpler organic compounds (e.g., PROTEINS from AMINO ACIDS, CARBOHYDRATES from SUGARS, FATS from FATTY ACIDS and GLYCEROL); catabolic reactions break complex molecules down into simpler ones, releasing chemical energy. For most organisms, the energy comes ultimately from the Sun, whether they obtain it by PHOTOSYNTHESIS and store it in organic compounds or by consuming those organisms that do so. In some BACTERIA in special environments such as DEEP-SEA VENTS, the energy comes from chemical reactions instead. Energy is transferred within the cell and the organism by ATP; anabolic reactions consume it, and catabolic reactions generate it. Every cellular chemical reaction is mediated by a specific ENZYME. The process that breaks down a substance is usually not the reverse of the process that makes it, using a different enzyme. See also DIGESTION; FERMENTATION; GLYCOLYSIS; TRICARBOXYLIC ACID CYCLE.

Metabolist \mə-'ta-bə-list\ **school** Japanese architectural movement of the 1960s. TANGE KENZŌ launched the movement with his Boston Harbor Project design (1959), which included two gigantic A-frames hung with "shelving" for homes and other buildings. Led by Tange, ISOZAKI ARATA, Kikutake Kiyonori (b. 1928), and Kurokawa Kisho (b. 1934), the Metabolists focused on structures that combined high-tech imagery, BRUTALISM, and megastructures (multifunctional complexes that verge on self-containment). The Metabolist manifestos put out at the World Design Conference in 1960 paved the way for such later projects as PAOLO SOLERI's Arcosanti. Their advocacy of such devices as artificial land platforms above cities, which grew out of a desire for economy of land use, revolutionized architectural thinking.

Metacom \'me-tə-ˌkäm\ *or* **Metacomet** *or* **King Philip** (b. 1638, Massachusetts—d. Aug. 12, 1676, Rhode Island) Wampanoag Indian sachem (head of a confederation of Algonquian tribes). His father, MASSASOIT, had negotiated peace with the Pilgrims in 1621. Embittered by the subsequent humiliations to which he and his people were continually subjected by whites, Metacom in June 1675 led a confederation of Wampanoag, Narragansett, ABENAKI, Nipmuck, and MOHAWK warriors into battle. Known as King Philip's War, the ensuing conflict was the most brutal Indian war in New England history. After considerable loss of life and property on both sides, the confederation began to disintegrate, and food became scarce. Metacom returned to his ancestral home, where he was betrayed and killed in 1676 by an Indian informant allied with the colonists. He was beheaded and quartered, and his head was displayed on a pole for 25 years at Plymouth.

metal Any of a class of substances with, to some degree, the following properties: good heat and electricity conduction, malleability, ductility, high light reflectivity, and capacity to form positive IONS in solution and HYDROXIDES rather than ACIDS when their OXIDES meet water. About three-quarters of the ELEMENTS are metals; these are usually fairly hard and strong crystalline (see CRYSTAL) solids with high chemical reactivity that readily form ALLOYS with each other. Metallic properties increase from lighter to heavier elements in each vertical group of the PERIODIC TABLE and from right to left in each row. The most abundant metals are aluminum, iron, calcium, sodium, potassium, and magnesium. The vast majority are found as ORES rather than free. The cohesiveness of metals in a crystalline structure is attributed to metallic BONDING: The ATOMS are packed close together, with their very mobile outermost ELECTRONS all shared throughout the structure. Metals fall into the following classifications (not mutually exclusive and most not rigidly defined): ALKALI METALS, ALKALINE EARTH METALS, TRANSITION ELEMENTS, noble (precious) metals, platinum metals, lanthanide (RARE EARTH) metals, ACTINIDE metals, light metals, and heavy metals. Many have essential roles in NUTRITION or other biochemical functions, often in trace amounts, and many are toxic as both elements and compounds (see MERCURY POISONING, LEAD POISONING).

metal fatigue Weakened condition of METAL parts of MACHINES, vehicles, or structures caused by repeated stresses or loadings, ultimately resulting in FRACTURE under a STRESS much weaker than that necessary to cause fracture in a single application. Fatigue-resistant metals have been developed and their performance improved by surface treatments, and fatigue stresses have been significantly reduced in aircraft and other applications by designing to avoid stress concentrations.

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metal point *or* **silverpoint** Method of drawing with a small sharpened metal rod—of lead, copper, gold, or most commonly silver—on specially prepared paper or parchment. Silverpoint produces a fine gray line that oxidizes to a light brown; the technique is best suited for small-scale work. It first appeared in medieval Italy and achieved great popularity in the 15th century. Albrecht Dürer and Leonardo da Vinci were its greatest exponents. It went out of fashion in the 17th century with the rise of the graphite pencil but was revived in the 18th century by the miniaturists and in the 20th century by Joseph Stella.

"Study of Hands," silverpoint heightened with white on pink grounded paper by Leonardo da Vinci; in Windsor Castle, Berkshire, Eng.
REPRODUCED BY GRACIOUS PERMISSION OF HER MAJESTY QUEEN ELIZABETH II

metallography \ˌme-tᵊl-ˈä-grə-fē\ Study of the structure of metals and alloys, particularly using microscopic and X-ray diffraction techniques. Visual and optical microscopic observation of metal surfaces and fractures can reveal valuable information about the crystalline, chemical, and mechanical makeup of the material. In electron microscopes a beam of electrons instead of a beam of light is directed onto the specimen. The development of transmission electron microscopes has made it possible to examine internal details of very thin metal foils. X-ray diffraction techniques are used to study phenomena related to the grouping of the atoms themselves. See also materials science, Henry C. Sorby.

metallurgy \ˈme-tᵊl-ˌər-jē\ Art and science of extracting metals from their ores and modifying the metals for use. Metallurgy usually refers to commercial rather than laboratory methods. It also concerns the chemical, physical, and atomic properties and structures of metals and the principles by which metals are combined to form alloys. Metals are extracted from crude ore in two phases, mineral processing (also known as ore dressing) and process metallurgy. In mineral processing, the ore is broken down to isolate the desired metallic elements from the crude ore. In process metallurgy, the resulting minerals are reduced to metal, alloyed, and made available for use. See also blast furnace; powder metallurgy; smelting.

metalogic \ˈme-tə-ˌlä-jik\ Study of the syntax and the semantics of formal languages and formal systems. It is related to, but does not include, the formal treatment of natural languages (e.g., English, Russian, etc.). Metalogic has led to a great deal of work of a mathematical nature in axiomatic set theory, model theory, and recursion theory (in which functions that are computable in a finite number of steps are studied).

metalwork Useful and decorative objects fashioned of various metals. The oldest technique is hammering. After c. 2500 BC, casting was also used, molten metal being poured into a mold and allowed to cool. Various decorative techniques are used. Gold and silver have been worked since ancient times. Gold and silver objects were in such demand in the 12th century that gold- and silversmiths organized guilds. High-quality gold and silver objects were produced in pre-Columbian America. Copper was worked in ancient Egypt and was widely used for household utensils in 17th–18th-century Europe. Both bronze and brass were widely used in ancient Greece. Pewter plates and tankards were made in the Middle Ages and remained popular until they were superseded by cheaper earthenware and porcelain in the 18th century. Wrought iron has been used for decorative hinges, gates, and railings since the 16th century. Lead has traditionally been used for roof coverings.

metamorphic rock Any of a class of rocks that result from the alteration of preexisting rocks in response to changing geological conditions, including variations in temperature, pressure, and mechanical stress. The preexisting rocks may be igneous, sedimentary, or other metamorphic rocks. The structure and mineralogy reflect the particular type of metamorphism that produced the rock and the composition of the parent rock. Metamorphic rocks are commonly classified by type of facies, predictable mineral assemblages associated with certain temperature and pressure conditions (see, e.g., granulite facies).

metamorphism Mineralogic and structural changes in solid rocks caused by physical conditions different from those under which the rocks originally formed. Changes produced by surface conditions such as compaction are usually excluded. The most important agents of metamorphism are temperature (from 300°–2,200°F, or 150°–1200°C), pressure (from 10 to several hundred kilobars, or 150,000 to several million lbs. per sq in.), and stress. Dynamic metamorphism results from mechanical deformation with little long-term temperature change. Contact metamorphism results from increases in temperature with minor differential stress, is highly localized, and may occur relatively quickly. Regional metamorphism results from the general increase, usually correlated, of temperature and pressure over a large area and a long period of time, as in mountain-building processes. See also metamorphic rock.

metamorphosis In biology, any striking developmental change of an animal's form or structure, accompanied by physiological, biochemical, and behavioral changes. The best-known examples occur among insects, which may exhibit complete or incomplete metamorphosis (see nymph). The complete metamorphosis of butterflies, moths, and some other insects involves four stages: egg, larva (caterpillar), pupa (chrysalis or cocoon), and adult. The change from tadpole to frog is an example of metamorphosis among amphibians; some echinoderms, crustaceans, mollusks, and tunicates also undergo metamorphosis.

metaphor Figure of speech in which a word or phrase denoting one kind of object or action is used in place of another to suggest a likeness or analogy between them (as in "the ship plows the seas" or "a volley of oaths"). A metaphor is an implied comparison (as in "a marble brow"), in contrast to the explicit comparison of the simile ("a brow white as marble"). Metaphor is common at all levels of language and is fundamental in poetry, in which its varied functions range from merely noting a likeness to serving as a central concept and controlling image.

Metaphysical painting *Italian* **Pittura Metafisica** Style of painting that flourished c. 1910–20 in the works of the Italian painters Giorgio de Chirico and Carlo Carrà (1881–1966). The movement began with Chirico, whose dreamlike works with sharp contrasts of light and shadow often had a vaguely threatening, mysterious quality. Chirico, his younger brother Alberto Savinio, and Carrà formally established the school and its principles in 1917. Their representational but bizarre and incongruous imagery produces disquieting effects and had a strong influence on Surrealism in the 1920s.

Metaphysical poetry Highly intellectualized poetry written chiefly in 17th-century England. Less concerned with expressing feeling than with analyzing it, Metaphysical poetry is marked by bold and ingenious conceits (e.g., metaphors drawing sometimes forced parallels between apparently dissimilar ideas or things), complex and subtle thought, frequent use of paradox, and a dramatic directness of language, the rhythm of which derives from living speech. John Donne was the leading Metaphysical poet; others include George Herbert, Henry Vaughan, Andrew Marvell, and Abraham Cowley.

metaphysics Branch of philosophy that studies the ultimate structure and constitution of reality—i.e., of that which is real, insofar as it is real. The term, which means literally "what comes after physics," was used to refer to the treatise by Aristotle on what he himself called "first philosophy." In the history of Western philosophy, metaphysics has been understood in various ways: as an inquiry into what basic categories of things there are (e.g., the mental and the physical); as the study of reality, as opposed to appearance; as the study of the world as a whole; and as a theory of first principles. Some basic problems in the history of metaphysics are the problem of universals—i.e., the problem of the nature of universals and their relation to so-called particulars; the existence of God; the mind-body problem; and the problem of the nature of material, or external, objects. Major types of metaphysical theory include Platonism, Aristotelianism, Thomism, Cartesianism (see also dualism), idealism, realism, and materialism.

metasomatic \ˌme-tə-sō-ˈma-tik\ **replacement** Process of simultaneous solution and deposition in which one mineral replaces another. It is the method by which wood is petrified (silica replaces the wood fibres), minerals form pseudomorphs (new minerals that preserve the characteristic outward form of the earlier mineral that was replaced), or an ore mineral assemblage takes the place of an earlier rock type. Replacement minerals may themselves be replaced, and definite mineral successions have been established. Replacement deposits may be highly valuable ore deposits.

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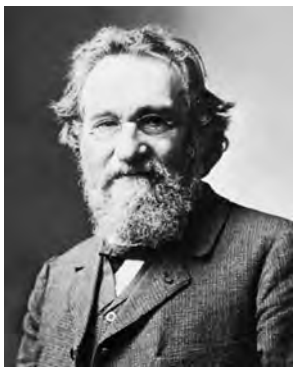
metastable \ˌme-tə-ˈstā-bəl\ **state** Excited state (see EXCITATION) of an ATOM, NUCLEUS, or other system that has a longer lifetime than the ordinary excited states and generally has a shorter lifetime than the ground state. It can be considered a temporary energy trap or a somewhat stable intermediate stage of a system of which the energy may be lost in discrete amounts. The many photochemical reactions of mercury are a result of the metastable state of mercury atoms, and RADIATION from metastable oxygen atoms accounts for the characteristic green colour of the aurora borealis and aurora australis.

Metastasio \ˌmā-tä-ˈstäz-yō**, Pietro** *orig.* **Antonio Domenico Bonaventura Trapassi** (b. Jan. 3, 1698, Rome—d. April 12, 1782, Vienna) Italian poet and opera librettist. His name was changed by his adoptive father, who left the youth enough money to embark on a career as a poet. His first libretto, *Didone abbandonata* (1724), was so successful that he was soon known throughout Italy. Important librettos such as *Enzio* (1728) and *Semiramide* (1729) soon followed. He was invited to Vienna as court poet by CHARLES VI. His 27 three-act librettos were set in more than 800 operas in the 18th and early 19th century by composers such as ANTONIO VIVALDI, GEORGE HANDEL, CHRISTOPH GLUCK, JOSEPH HAYDN, WOLFGANG AMADEUS MOZART, and LUIGI CHERUBINI.

Metaxas \ˌmet-äk-ˈsäs**, Ioannis** (b. April 12, 1871, Ithaca, Greece—d. Jan. 29, 1941, Athens) Greek general and premier (1936–41). He rose in the Greek army to become chief of staff (1913–17). An ardent monarchist, he left Greece when King CONSTANTINE I was deposed in 1917, but he returned in 1920. After the monarchy's fall in 1923, he led an opposition ultraroyalist party until the monarchy was restored in 1935. He was appointed premier in 1936 and, with royal authority, established a dictatorship. He suppressed political opposition, carried out some beneficial economic and social reforms, and brought a united country into the Western alliance in World War II.

Metchnikoff \ˈmech-ni-ˌkȯf**, Élie** *orig.* **Ilya Ilich Mechnikov** (b. May 16, 1845, near Kharkov, Ukraine, Russian Empire—d. July 16, 1916, Paris, France) Russian zoologist and microbiologist. In 1888 LOUIS PASTEUR offered him a post at the Pasteur Institute, and he succeeded Pasteur as director in 1895. Working with starfish, he discovered amoebalike cells in their systems that engulf foreign bodies such as bacteria. He established that phagocytes (as he named these cells, using the Greek for "devouring cells") are the first line of defense against acute infection in most animals. This phenomenon, now known as phagocytosis, is fundamental to immunology. He shared a 1908 Nobel Prize with PAUL EHRLICH.



Élie Metchnikoff.
H. ROGER-VIOLLET

metempsychosis See REINCARNATION

meteor *or* **shooting star** *or* **falling star** Streak of light in the sky that results when a particle or small chunk of stony or metallic matter from space enters Earth's ATMOSPHERE and is vapourized by FRICTION. The term is sometimes applied to the falling object itself, properly called a meteoroid. Most meteoroids, traveling at five times the speed of sound or more, burn up in the upper atmosphere, but a large one may survive its fiery plunge and reach the surface as a solid body (METEORITE). See also METEOR SHOWER.

meteor shower Entry into Earth's atmosphere of multiple meteoroids (see METEOR), traveling in parallel paths, usually spread over several hours or days. Most meteor showers come from matter released during passage of a COMET close to the Sun, and they recur annually as Earth crosses the comet's orbital path. Meteor showers are usually named for a constellation (e.g., Leonid for Leo) or star in their direction of origin. Most showers are visible as a few dozen meteors per hour, but occasionally Earth crosses an especially dense concentration of meteoroids, as in the great Leonid meteor shower of 1833, in which hundreds of thousands of meteors were seen in one night all over North America.

meteorite Any interplanetary particle or chunk of stony or metallic matter (meteoroid) that survives passage through Earth's atmosphere and strikes the ground or that reaches the surface of another planet or moon. On Earth the speed of entry—at least 7 mi/second (11 km/second)—generates enough FRICTION with the air to vaporize part or all of the meteoroid and produce a streak of light (METEOR). Though vast numbers of meteoroids enter Earth's atmosphere each year, only a few hundred reach the ground.

meteorite crater Depression that results from the impact of a METEORITE with a solid object in space. Impact craters have been discovered on Earth, the Moon, Mars, other planets and satellites, and asteroids; they probably occur on unprotected surfaces of similar bodies throughout the universe. Impact craters are much less common on Earth than on the Moon, partly because friction burns up most of the smaller bodies that enter Earth's atmosphere. Thus, any craters formed on Earth's surface tend to be larger than the average size of all entering meteorites.

Meteorite craters on the surface of the Moon, photographed by Lunar Orbiter IV
COURTESY OF NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

meteoritics \ˌmē-tē-ə-ˈri-tiks\ Study of the chemistry and mineralogy of METEORITE samples that have been collected on Earth and of METEORS as they pass through Earth's atmosphere. These studies provide information about the age of meteorites, the conditions under which they formed, where they come from, and the geological history of their bodies of origin, including comets, asteroids, Mars, and the Moon. The field of study is especially important for understanding the early history and evolution of the SOLAR SYSTEM.

meteorology Scientific study of atmospheric phenomena, particularly of the TROPOSPHERE and lower STRATOSPHERE. Meteorology entails the systematic study of weather and its causes, and provides the basis for WEATHER FORECASTING. See also CLIMATOLOGY.

methadone \ˈme-thə-ˌdōn\ Organic compound, a potent synthetic NARCOTIC drug, the most effective form of treatment for addiction to HEROIN and other narcotics (see DRUG ADDICTION). It has been widely used in heroin-addiction programs in the U.S. since the 1960s. Though addictive itself, it is easier to stop using than heroin. It also causes no euphoric effects and does not lead to development of tolerance, so increasing doses are not required. A person taking a daily maintenance dose does not experience either heroin withdrawal symptoms or a heroin rush from any attempt to resume heroin, so heroin's psychological hold on the user can be broken.

methanal See FORMALDEHYDE

methane *or* **marsh gas** Organic compound, chemical formula CH_4, colourless, odourless GAS that occurs in NATURAL GAS (called firedamp in coal mines) and from bacterial decomposition of vegetation in the absence of oxygen (including in the rumens of cattle and other RUMINANTS and in the gut of TERMITES). The simplest member of the PARAFFIN HYDROCARBONS, methane burns readily, forming CARBON DIOXIDE and WATER if supplied with enough OXYGEN for complete combustion or CARBON MONOXIDE if the oxygen is insufficient. Mixtures of 5–14% methane in air are explosive and have caused many mine disasters. The chief source of methane is natural gas, but it can also be produced from coal. Abundant, cheap, and clean, methane is used widely as a fuel in homes, commercial establishments, and factories; as a safety measure, it is mixed with trace amounts of an odorant to allow its detection. It is also a raw material for many industrial materials, including fertilizers, explosives, chloroform, carbon tetrachloride, and carbon black, and is the principal source of METHANOL.

methanol *or* **methyl alcohol** *or* **wood alcohol** Simplest of the ALCOHOLS, chemical formula CH_3OH. Once produced by destructive distillation of wood, it is now usually made from the METHANE in natural gas. Methanol is an important industrial material; its derivatives are used in great quantities for making a vast number of compounds, among them many important synthetic dyes, resins, drugs, and perfumes. It is also used in automotive antifreezes, in rocket fuels, and as a solvent. It is flammable

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and explosive. A clean-burning fuel, it may substitute (at least in part) for GASOLINE. It is also used for DENATURATION of ETHANOL. A violent poison, it causes blindness and eventually death when drunk.

methionine \mə-'thī-ə-ˌnēn\ SULFUR-containing essential AMINO ACID, present in many common PROTEINS, particularly egg ALBUMIN. It is used in pharmaceuticals, in enriched foods, and as a nutritional supplement and feed additive.

Method acting See STANISLAVSKY METHOD

Methodism Protestant religious movement originated by JOHN WESLEY in 18th-century England. Wesley, an Anglican clergyman, underwent an epiphany in 1738 in which he felt an assurance of personal salvation, and he soon began open-air preaching. Methodism began as a movement to revitalize the Church of England and did not formally break with the church until 1795. The Methodists' well-organized system of church government combined a strong central authority with effective local organization and the employment of lay preachers. Especially successful among the working class in industrial areas, the movement expanded rapidly in the 19th century. The Methodist Episcopal Church was founded in the U.S. in 1784, and Methodist circuit riders won many followers on the frontier. British and U.S. missionaries have since spread Methodism throughout the world. Methodist doctrine emphasizes the power of the Holy Spirit, the need for a personal relationship with God, simplicity of worship, and concern for the underprivileged.

Methodius, St. See Sts. CYRIL AND METHODIUS

Methuselah \mə-'thü-zə-lə\ Biblical patriarch who lived to the age of 969. The son of Enoch, he is mentioned in GENESIS as a descendant of Seth, the son of Adam and Eve begotten after CAIN. He is remembered as the world's oldest human being. He was the father of Lamech and grandfather of NOAH; his later descendants included ABRAHAM, JACOB, and DAVID.

methyl alcohol See METHANOL

metic \'me-tiks\ (Greek, *metoikos*) Any resident foreigner, including freed slaves, in ancient Greece. Although metics were free, they lacked full benefits of citizenship. For a small tax they enjoyed the protection of the law and most of a citizen's duties, including supporting public funds, financing festivals, and serving in the military, but they could neither marry a citizen nor own land. They were found in most states, Sparta being an exception. In Athens they represented one-third of the free population.

Métis \mā-'tēs\ In Canadian history, a person of mixed Indian and French or Scottish ancestry. The first Métis were the offspring of local Indian women and European fur traders in the Red River area of what is now southern Manitoba. They call themselves the Forgotten People. Their language, Michif, is a French and Cree trade language. Only a small percentage of people can speak Michif, although attempts are being made to preserve it. For more than half a century the Métis cultivated a distinctive way of life and came to think of themselves as a nation. The Métis culture, particularly clothing, artwork, music, and dance, can be characterized as colourful and unique. They resisted the Canadian takeover of the Northwest in 1869, established a provisional government under the leadership of LOUIS RIEL, and in 1870 negotiated a union with Canada that resulted in the establishment of the province of Manitoba. In 2003 Canada granted the Métis legal recognition as a native group, with the same broad hunting rights as full-status Indians. By the early 21st century the estimated number of Métis in western Canada was more than 550,000.

metre Basic unit of length in the METRIC SYSTEM and the INTERNATIONAL SYSTEM OF UNITS. In 1983 the General Conference on Weights and Measures decided that the accepted value for the speed of light would be exactly 299,792,458 metres per second, so the metre is now defined as the distance traveled by light in a vacuum in 1/299,792,458 second. One metre is equal to about 39.37 in. in the U.S. Customary System.

metre In poetry, the rhythmic pattern of a poetic line. Various principles have been devised to organize poetic lines into rhythmic units. Quantitative verse, the metre of Classical Greek and Latin poetry, measures the length of time required to pronounce syllables, regardless of their stress; combinations of long and short syllables form the basic rhythmic units. Syllabic verse is most common in languages that are not strongly accented, such as French or Japanese; it is based on a fixed number of syllables within a line. Accentual verse occurs in strongly stressed languages, such as the Germanic; only stressed syllables within a line are counted. Accentual-syllabic verse is the usual form in English poetry; it combines syllable counting and stress counting. The most common English metre, iambic pentameter, is a line of 10 syllables, or 5 iambic feet; each foot contains an unstressed syllable followed by a stressed syllable. FREE VERSE does not follow regular metrical patterns. See also PROSODY.

metre See RHYTHM AND METRE

metric space In mathematics, a set of objects equipped with a concept of distance. The objects can be thought of as points in space, with the distance between points given by a DISTANCE FORMULA, such that: (1) the distance from point A to point B is zero if and only if A and B are identical, (2) the distance from A to B is the same as from B to A, and (3) the distance from A to B plus that from B to C is greater than or equal to the distance from A to C (the triangle inequality). Two- and three-dimensional EUCLIDEAN SPACES are metric spaces, as are INNER PRODUCT SPACES, VECTOR SPACES, and certain topological spaces (see TOPOLOGY).

metric system International decimal system of weights and measures, based on the METRE (m) for length and the kilogram (kg) for mass, originally adopted in France in 1795. All other metric units were derived from the metre, including the gram (g) for weight (1 cc of water at its maximum density) and the litre (l, or L) for capacity (0.001 cu m). In the 20th century, the metric system became the basis for the INTERNATIONAL SYSTEM OF UNITS, which is now used officially almost worldwide.

metrical foot See metrical FOOT

Metro-Goldwyn-Mayer, Inc. See MGM

metrology \me-'trä-lə-jē\ Science of MEASUREMENT. Measuring a quantity means establishing its ratio to another fixed quantity of the same kind, known as the unit of that kind of quantity. A unit is an abstract idea, defined either by reference to a randomly chosen material standard or to a natural phenomenon. For example, the METRE, the standard of length in the METRIC SYSTEM, was formerly defined (1889–1960) by the separation of two lines on a particular metal bar, but it is now defined as the distance traveled by light in a vacuum in 1/299,792,458 second. See also INTERNATIONAL SYSTEM OF UNITS.

Metropolitan Museum of Art Most comprehensive collection of art in the U.S. and one of the foremost in the world. It was incorporated in New York City in 1870, and the present building in Central Park on Fifth Avenue was opened in 1880. The Metropolitan was built with the private fortunes of businessmen; today it is owned by the city but supported mainly by private endowment. Its outstanding Egyptian, Mesopotamian, East Asian, Middle Eastern, Greek and Roman, European, pre-Columbian, and U.S. collections include—in addition to paintings, sculpture, and graphic arts—architecture, glass, ceramics, textiles, metalwork, furniture, arms and armour, and musical instruments. It also incorporates a Costume Institute and the Thomas J. Watson Library, one of the world's greatest art and archaeology reference collections. Much of the medieval collection is housed at The Cloisters in Manhattan's Fort Tryon Park; its building (1938) incorporates parts of medieval monasteries and churches.

Metropolitan Opera Leading U.S. opera company, based in New York City. Founded by a group of millionaires who had failed to get boxes at the Academy of Music, it opened in 1883. The Met soon outlived its frivolous origin, becoming the American equivalent of LA SCALA in Milan and second to no opera house in the world in the quality of the singers it attracted. Originally sited at Broadway and 39th Street, it moved into its new home at LINCOLN CENTER FOR THE PERFORMING ARTS in 1966.

Metsys \'met-sīs**, Quentin** (b. c. 1465/66, Louvain, Brabant—d. 1530, Antwerp) Flemish artist. According to tradition, Metsys (whose name was also spelled Massys and Matsys) was trained as a blacksmith but studied painting after falling in love with an artist's daughter. He was admitted to the Antwerp artists' guild in 1491. His most celebrated paintings are two large triptych altarpieces, *The Holy Kinship* (1507–09) and *The Entombment of Christ* (1508–11), both of which exhibit strong religious feelings and precision of detail. He painted many notable portraits, including one of DESIDERIUS ERASMUS. He was the first important painter of the Antwerp school, and the first Flemish artist to effect a genuine synthesis of the northern European and Italian RENAISSANCE traditions.

Metternich \'me-tər-ˌnik̲\ **(-Winneburg-Beilstein), Klemens (Wenzel Nepomuk Lothar), prince von** (b. May 15, 1773, Coblenz, archbishopric of Trier—d. June 11, 1859, Vienna, Austria) Austrian statesman. He served in the diplomatic service as Austrian minister

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in Saxony (1801–03), Berlin (1803–05), and Paris (1806–09). In 1809 Francis I of Austria (see Emperor Francis II) appointed him minister of foreign affairs, a position he would retain until 1848. He helped promote the marriage of Napoleon and Francis's daughter Marie-Louise. By skillful diplomacy and deceit, he kept Austria neutral in the war between France and Russia (1812) and secured its position of power before finally allying with Prussia and Russia (1813). In gratitude for his diplomatic achievements, the emperor created Metternich a hereditary prince. As the organizer of the Congress of Vienna (1814–15), he was largely responsible for the policy of balance of power in Europe to ensure the stability of European governments. After 1815 he remained firmly opposed to liberal ideas and revolutionary movements. He was forced to resign by the revolution of 1848. He is remembered for his role in restoring Austria as a leading European power.

Metternich, black and white chalk drawing by Anton Graff, c. 1803–05; in the Kupferstichkabinett, Dresden, Ger.
COURTESY OF THE STAATLICHE KUNSTSAMMLUNGEN, DRESDEN, GER.

Metz \'metz\ *French* \'mes\ City (pop., 1999 est.: 123,776), northeastern France. It derives its name from the Mediomatrici, a Gallic tribe who made the city their capital. Fortified by the Romans, it became a bishopric in the 4th century AD. It passed to Frankish rule in the 5th century and became the capital of Lorraine in 843. It prospered as a free town within the Holy Roman Empire. Taken by the French in 1552, it was formally ceded to France in 1648. It fell to German rule in 1871 but was returned to France after World War I. It is the birthplace of Paul Verlaine.

Porte des Allemands (Gate of the Germans), Metz, France.
P. SALOU—SHOSTAL

Meuse River \'mœz,\ *English* \'myüz\ *Dutch* **Maas** \'mäs\ River, western Europe. It rises in northeastern France and flows north into Belgium, where it forms part of the border between Belgium and The Netherlands. It divides at Venlo, Neth., one branch flowing into the Hollandsch Canal (an outlet of the North Sea) and another joining the Waal River to become the Merwede River, which eventually empties into the North Sea. The Meuse is 590 mi (950 km) long, and it is an important waterway in western Europe. Its valley was the scene of heavy fighting in World War I. The crossing of the Meuse was critical to Germany's invasion of France in 1940 in World War II.

mews Row of stables and coach houses with living quarters above, built behind houses, especially in 17th–18th-century London. Most have been converted into modernized dwellings. The term originally referred to the royal stables in London, built where the king's hawks once stayed at molting ("mew") time.

Mexicali City (pop., 2000 est.: 550,000), capital of Baja California (Norte) state, northwestern Mexico. It lies in the Mexicali Valley, an extension of the Imperial Valley of the U.S., in northeastern Baja California. It extends across the Mexico-U.S. border to Calexico, Calif. Its name, formed from the first two syllables of Mexico and California, was chosen as a gesture of international friendship. Its economy is chiefly based on tourism and the processing and distribution of cotton, fruits, vegetables, and cereals. It is the seat of the Autonomous University of Baja California.

Mexican process See patio process

Mexican Revolution (1910–20) Lengthy struggle that began with the overthrow of Porfirio Díaz, whose elitist and oligarchic policies had caused widespread dissatisfaction. Francisco Madero, Pancho Villa, Pascual Orozco, and Emiliano Zapata amassed supporters, and in 1911 Madero was declared president, but his slow-paced reforms alienated both former allies and foes. He was deposed by Gen. Victoriano Huerta, whose own drunken and despotic dictatorship quickly fell to Villa, Venustiano Carranza, and Álvaro Obregón. Carranza declared himself president in 1914 over Villa's objections and, after further bloodshed, prevailed. He oversaw the writing of the liberal constitution of 1917 but did little to implement its key provisions; in 1920 he was killed while fleeing a rebellion. With the election of the reform-minded Obregón, the revolutionary period ended, though sporadic clashes continued until Lázaro Cárdenas took office in 1934.

Mexican War *or* **Mexican-American War** (1846–48) War between the U.S. and Mexico. It grew from a border dispute after the U.S. annexed Texas in 1845; Mexico claimed that the southern border of Texas was the Nueces River, while the U.S. claimed it was the Rio Grande. A secret mission by John Slidell to negotiate the dispute and purchase New Mexico and California for up to $30 million was aborted when Mexico refused to receive him. In response to the snub, Pres. James Polk sent troops under Zachary Taylor to occupy the disputed land between the two rivers. In April 1846 Mexican troops crossed the Rio Grande and attacked Taylor's troops; Congress approved a declaration of war in May. Ordered to invade Mexico, Taylor captured Monterrey and defeated a large Mexican force under Antonio Santa Anna at the Battle of Buena Vista in February 1847. Polk then ordered Gen. Winfield Scott to move his army by sea to Veracruz, capture the city, and march inland to Mexico City. Scott followed the plan, meeting resistance at Cerro Gordo and Contreras, and entered Mexico City in September. Under the Treaty of Guadalupe Hidalgo, Mexico ceded to the U.S. nearly all of present New Mexico, Utah, Nevada, Arizona, California, Texas, and Colorado for $15,000,000 and U.S. assumption of its citizens' claims against Mexico. Casualties included about 13,000 American deaths, all but 1,700 of which were caused by disease. The war, which made a national hero of Taylor, reopened the slavery-extension issue supposedly settled by the Missouri Compromise.

Mexico *officially* **United Mexican States** Country, southern North America. The Rio Grande forms part of its northeastern border with the U.S. Area: 758,449 sq mi (1,964,375 sq km). Population (2005 est.): 107,029,000. Capital: Mexico City. More than three-fifths of Mexico's people are mestizos, about one-fifth are American Indians, and the bulk of the rest are of European ancestry. Languages: Spanish (official); more than 50 Indian languages are spoken. Religion: Christianity (predominantly Roman Catholic; also Protestant). Currency: Mexican peso. Mexico has two major peninsulas, the Yucatán in the southeast and Baja California in the northwest. The high Mexican Plateau forms the core of the country and is enclosed by mountain ranges: the Sierra Madre Occidental, the Sierra Madre Oriental, and the Cordillera Neo-Volcánica. The last has the country's highest peak, the volcano Citlaltépetl, which reaches 18,406 ft (5,610 m). Mexico has a mixed economy based on agriculture, manufacturing, and the extraction of petroleum and natural gas. About one-eighth of the land is arable; major crops include corn, wheat, rice, beans, coffee, cotton, fruits, and vegetables. Mexico is the world's largest producer of silver, bismuth, and celestite. It has significant reserves of oil and natural gas. Manufactures include processed foods, chemicals, transport vehicles, and electrical machinery. It is a republic with two legislative houses; its head of state and government is the president. Humans may have inhabited Mexico for more than 20,000 years, and the area produced a string of great early civilizations, including the Olmec, Toltec, and Maya. The Aztec empire, another important civilization located in Mexico, was conquered in 1521 by Spanish explorer Hernán Cortés, who established Mexico City on the site of the Aztec capital, Tenochtitlán. Francisco de

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Montejo conquered the remnants of Maya civilization in 1526, and Mexico became part of the Viceroyalty of New Spain. In 1821 rebels negotiated independence from Spain, and in 1823 a new congress declared Mexico a republic. In 1845 the U.S. voted to annex Texas, initiating the Mexican War. Under the Treaty of Guadalupe Hidalgo in 1848, Mexico ceded a vast territory in what is now the western and southwestern U.S. The Mexican government endured several rebellions and civil wars in the late 19th and early 20th centuries (see Mexican Revolution). During World War II (1939–45) it declared war on the Axis Powers, and in the postwar era it was a founding member of the United Nations (1945) and the Organization of American States (1948). In 1993 it ratified the North American Free Trade Agreement. The election of Vicente Fox to the presidency (2000) ended 71 years of rule by the Institutional Revolutionary Party. See table on opposite page.

México \'me-hē-ˌkō\ State (pop., 2000: 13,096,686), central Mexico. It covers 8,245 sq mi (21,355 sq mi), and its capital is Toluca. Almost completely surrounding the Federal District and Mexico City, it contains many preconquest ruins, including Tenayuca, Malinalco, and Teotihuacán. The average elevation exceeds 10,000 ft (3,000 m), which creates a cool climate. The population density is the highest of any Mexican state. The economy is based on agriculture and manufacturing.

Mexico, Gulf of Gulf, southeastern coast of North America, connected to the Atlantic Ocean by the Straits of Florida and to the Caribbean Sea by the Yucatán Channel. Covering an area of 600,000 sq mi (1,550,000 sq km), it is bounded by the U.S., Mexico, and Cuba. It has a maximum depth, in the Mexico Basin, of 17,070 ft (5,203 m). The Gulf Stream enters it from the Caribbean Sea and flows out to the Atlantic. The Mississippi and the Rio Grande are the major rivers draining into the gulf. Its major ports are Veracruz in Mexico, and Galveston, New Orleans, Pensacola, and Tampa in the U.S.

Mexico, National Autonomous University of Mexican government-financed university in Mexico City, founded in 1551. The original university building, dating from 1584, was demolished in 1910, and the university was moved to a new campus in 1954. Between 1553

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Mexican Presidents from 1917

President	Term	President	Term
Venustiano Carranza*	1917–20	Adolfo Ruiz Cortines	1952–58
Adolfo de la Huerta	1920	Adolfo López Mateos	1958–64
Álvaro Obregón	1920–24	Gustavo Díaz Ordaz	1964–70
Plutarco Elías Calles	1924–28	Luis Echeverría Álvarez	1970–76
Emilio Portes Gil	1928–30	José López Portillo	1976–82
Pascual Ortíz Rubio	1930–32	Miguel de la Madrid	1982–88
Abelardo L. Rodríguez	1932–34	Carlos Salinas de Gortari	1988–94
Lázaro Cárdenas	1934–40	Ernesto Zedillo	1994–2000
Manuel Ávila Camacho	1940–46	Vicente Fox	2000–
Miguel Alemán	1946–52		

*Claimed the presidency as early as 1914.

and 1867 the university was controlled by the Roman Catholic church. After 1867, independent professional schools of law, medicine, engineering, and architecture were established by the government. The university was given administrative autonomy in 1929. It offers a broad range of programs in all major academic and professional subjects.

Mexico City *Spanish* **Ciudad de México** \ˌsyü-ˈthäth-thā-ˈme-hē-ˌkō\ City (pop., 2000: city, 8,605,239; 2003 metro. area est., 18,660,000), capital of Mexico. Located at an elevation of 7,350 ft (2,240 m), it is officially coterminous with the Federal District, which occupies 571 sq mi (1,477 sq km). Mexico City is one of the world's largest cities and one of the world's fastest-growing metropolitan areas. It generates about one-third of Mexico's industrial production. It lies on an ancient lake bed, the site of the Aztec capital, Tenochtitlán, which was taken by the Spanish explorer Hernán Cortés in 1521. It was the seat of the Viceroyalty of New Spain throughout the colonial period. Captured by Mexican revolutionaries under Gen. Agustín de Iturbide in 1821, it was seized by the U.S. in 1847 during the Mexican War and by the French (1863–67) under Maximilian. It was greatly improved during the rule of Porfirio Díaz (1876–80, 1884–1911). In 1985 it was struck by a severe earthquake that killed at least 7,000 people. The old city centre, the Zócalo, has many historic buildings, including the Metropolitan Cathedral (built on the site of an Aztec temple) and the National Palace (built on the ruins of the palace of Montezuma II). Its educational institutions include the National Autonomous University of Mexico (founded 1551), the College of Mexico, and the Ibero-American University. The city was designated a UNESCO World Heritage Site in 1987.

Meyer \ˈmī-ər**, Adolf** (b. Sept. 13, 1866, Niederweningen, Switz.—d. March 17, 1950, Baltimore, Md., U.S.) Swiss-born U.S. psychiatrist. He immigrated to the U.S. in 1892 and taught principally at Johns Hopkins University (1910–41). He developed a concept of human behaviour—ergasiology, or psychobiology—that sought to integrate psychological and biological study. Meyer emphasized accurate case histories, suggested a role of childhood sexual feelings in mental problems in the years preceding wide recognition of Sigmund Freud's theories, and decided that mental illness results essentially from personality dysfunction rather than brain pathology. He became aware of the importance of social environment in mental disorders, and his wife interviewed patients' families in what is considered the first psychiatric social work.

Meyerbeer \ˈmī-ər-ˌbār**, Giacomo** *orig.* **Jakob Liebmann Meyer Beer** (b. Sept. 5, 1791, Tasdorf, near Berlin, Ger.—d. May 2, 1864, Paris, Fr.) German composer. Brother of the astronomer Wilhelm Beer and the playwright Michael Beer, he achieved early success as a pianist. After he studied vocal writing in Italy, his Italian operas were well received. In Paris from c. 1825, he undertook work on a libretto by Eugène Scribe, and his *Robert le Diable* (1831) was one of opera's greatest triumphs from its premiere. Three later grand operas also became part of the international repertoire: *Les Huguenots* (1836), *Le Prophète* (1849), and *L'Africaine* (1864). Richard Wagner's criticism of Meyerbeer's "desertion" of German music, tainted by jealousy and anti-Semitism, led to neglect of his music for many years, but Meyerbeer exercised unmistakable influence on both Giuseppe Verdi and Wagner himself.

Meyerhof \ˈmī-ər-ˌhōf**, Otto** (b. April 12, 1884, Hanover, Ger.—d. Oct. 6, 1951, Philadelphia, Pa., U.S.) German biochemist. His work on glycolysis remains a basic contribution to the understanding of muscle action, despite the need for later revision. He shared with Archibald V. Hill (1886–1977) a 1922 Nobel Prize for his research on metabolism in muscle. His chief published work was *The Chemical Dynamics of Life Phenomena* (1924).

Meyerhold \ˈmī-ər-ˌhōlt**, Vsevolod (Yemilyevich)** (b. Feb. 9, 1874, Penza, Russia—d. Feb. 2, 1940, Moscow) Russian theatrical producer and director. He acted with the Moscow Art Theatre in 1898 and formulated his avant-garde theories of symbolic theatre. Opposed to the naturalism of Konstantin Stanislavsky, he directed plays in a nonrepresentational style that became known as biomechanics. After 1908 he staged plays in St. Petersburg that drew from commedia dell'arte and Asian theatre. He was noted for his direction of *The Magnificent Cuckold* (1920) and for his controversial production of *The Queen of Spades* (1935). Condemned by Soviet critics for his artistic individuality and opposition to Socialist Realism, he was arrested and imprisoned in 1939 and was probably executed.

mezzotint \ˈmet-sō-ˌtint\ (from Italian *mezza tinta*, "halftone") Engraving produced by pricking the surface of a metal plate with innumerable small holes that will hold ink. When the engraving is printed, the ink produces large areas of tone with soft, subtle gradations. Engraved or etched lines are often introduced to give the design greater definition. Mezzotint was invented in Holland by German-born Ludwig von Siegen in the 17th century but thereafter was practiced primarily in England. Its adaptability to making colour prints made it ideal for the reproduction of paintings. After the invention of photography, it was rarely used. In recent years the technique has been revived, especially by U.S. and Japanese printmakers.

Mfecane \em-fe-ˈkä-nā\ ("The Crushing") Series of Zulu and other Nguni wars and forced migrations in the early 19th century that changed the demographic, social, and political configuration of southern and central Africa. Set in motion by the rise of the Zulu military kingdom under Shaka, it took place in the context of drought, social unrest, and competition for trade. Ethnic group was set against ethnic group in an ever-increasing radius, resulting in the creation of large refugee populations as well as the establishment of new kingdoms under the Basuto, Gaza, Ndebele, and Swazi peoples.

MGM *in full* **Metro-Goldwyn-Mayer, Inc.** U.S. corporation and film studio. It was formed when the film distributor Marcus Loew, who bought Metro Pictures in 1920, merged it with the Goldwyn production company in 1924 and with Louis B. Mayer Pictures in 1925. Louis B. Mayer was executive head of the studio for 25 years, assisted by production manager Irving Thalberg. It reached its peak in the 1930s and '40s, when it had most of Hollywood's famous stars under contract. It produced such hits as *Grand Hotel* (1932), *The Philadelphia Story* (1940), *Gaslight* (1944), *Ben-Hur* (1959), *Doctor Zhivago* (1965), and *2001: A Space Odyssey* (1968). It was especially celebrated for its lavish musicals, including *The Wizard of Oz* (1939), *On the Town* (1949), *An American in Paris* (1951), *Singin' in the Rain* (1952), and *Gigi* (1958). MGM began to decline in the 1950s and sold off many of its assets in the 1970s. It diversified into hotels and casinos and later merged with United Artists Corp. as MGM/UA Entertainment. In 1986 it was bought by Ted Turner, who resold the production and distribution units. Various transfers of ownership led to its purchase in 1992 by Crédit Lyonnais, which restored the name MGM Inc. It was subsequently bought by Tracinda Corp.

MI5 *in full* **Military Intelligence (Unit 5)** British Security Service. Originally organized in 1909 to counter German espionage, in 1931 it assumed wider responsibility for assessing threats to national security, including communist subversion and subsequently fascism. Today the Security Service Act (1989) forms its statutory basis. As Britain's domestic-security intelligence agency, its purpose is to protect the country against threats such as terrorism, espionage, and subversion. Since the passing of the Security Service Act (1996), its role has been expanded to include supporting law-enforcement agencies in the field of organized crime.

Miami North American Indian people who live mostly in Oklahoma and Indiana, U.S. They call themselves Twitwee (Twatwa), which to them represents the call of the crane. The name Miami is a derivation of their Ojibwa name, Oumami, meaning "People of the Peninsula." Their traditional homeland is spread across Illinois, northern Indiana, and Ohio. The Miami language belongs to the Algonquian family. The staple of the Miami diet was corn, though they also hunted bison. Each village consisted of mat-covered dwellings and a large house in which councils and ceremonies were held. A secret medicine society conducted rites aimed

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at ensuring tribal welfare. In the 19th century the Miami ceded most of their lands to the U.S., with one band remaining in Indiana and the rest removing to a reservation in Oklahoma. In the 2000 U.S. census some 3,800 people claimed sole Miami descent. See also Little Turtle.

Miami City (pop., 2000: 362,470), southeastern Florida, U.S., situated on Biscayne Bay at the mouth of the Miami River. The southernmost large city in the continental U.S., it has a beach 7 mi (11 km) long. A Spanish mission was founded near the site in 1567, but permanent settlement did not begin until 1835, when U.S. forces built Fort Dallas for the removal of Seminole Indians to the West. The arrival of the railway in 1896 spurred development, and Miami was incorporated the same year. The city has been damaged by occasional hurricanes, notably in 1926 and 1935. Nearly 300,000 Cuban refugees have arrived since 1959 (see Cuba), establishing "Little Havana" within the city. It is a major resort and retirement centre, and its port handles the world's largest number of cruise-ship passengers. It is also a banking centre. Educational institutions include the University of Miami and Florida International University.

Miami Beach City (pop., 2000: 87,933), southeastern Florida, U.S. It is situated on an island across Biscayne Bay from Miami. Until 1912 the site was a mangrove swamp. John S. Collins and Carl F. Fisher pioneered real estate development and built a bridge across the bay; the area was dredged to form an island measuring 7.4 sq mi (19 sq km), with an 8-mi (13-km) beach. The city, incorporated in 1915, is now a luxury resort and convention centre. It is connected with Miami by several causeways and is noted for its Art Deco architecture.

Miao See Hmong

Miao-Yao languages See Hmong-Mien languages

mica \'mī-kə\ Any of a group of hydrous potassium, aluminum silicate minerals that exhibit a two-dimensional sheet, or layer, structure. A very abundant variety of mica is muscovite; two other common varieties are biotite and phlogopite. Micas have various industrial uses. The varieties that contain little iron are used as thermal or electrical insulators in appliances and in such electrical devices as capacitors. In ground form, micas are used in the manufacture of wallpaper, roofing paper, and paint. Ground micas also serve as lubricants, absorbents, and packing material.

mica, black See biotite

Micah \'mī-kə\ (fl. 8th century BC) One of the 12 Minor Prophets in the Bible, traditional author of the book of Micah. (His prophecy is part of a larger book, The Twelve, in the Jewish canon.) He probably began to prophesy before the fall of the northern kingdom of Israel in 721 BC. Modern scholars usually attribute the book's first three chapters, which predict judgment from God on idolaters and unjust leaders, to Micah. Much of the rest, which promises the establishment of a kingdom of peace in Zion, probably dates from several centuries later.

Michael In the Bible and the Qur'ān, one of the archangels. The captain of the heavenly hosts, he was invoked by early Christian armies against the heathen. In Christian tradition he is thought to escort the soul into the presence of God at the time of death. In art he is depicted as a warrior, sword in hand, in triumph over a dragon. His feast day, known in England as Michaelmas, is September 29. See also Mīkā'īl.

Michael (b. Oct. 25, 1921, Sinaia, Rom.) King of Romania. After his father, the future king Carol II, had been excluded from the royal succession (1926), Michael was proclaimed king under a three-member regency. Carol reclaimed the throne in 1930, and Michael was reduced to crown prince. With Carol's abdication in 1940, Michael again became king but was in effect a prisoner of the military dictator Ion Antonescu. In 1944 he helped lead the coup that overthrew the military regime and severed Romania's ties with the Axis powers. He strongly opposed the communists' subsequent rise to power, but was forced to abdicate in 1947. He went into exile in Switzerland and became an executive with a U.S. brokerage firm. In 1997 his Romanian citizenship was restored; he subsequently visited the country and sought the return of property holdings that were confiscated.

Michael *or* **Michael Romanov** \rō-'mä-nəf, 'rō-mə-ˌnäf\ *Russian* **Mikhail Fyodorovich Romanov** (b. July 22, 1596—d. July 23, 1645, Moscow) Tsar of Russia (1613–45) and founder of the Romanov dynasty. A young nobleman elected as tsar after the chaotic Time of Troubles, he allowed his mother's relatives to direct the government early in his reign. They restored order to Russia and made peace with Sweden (1617) and Poland (1618). In 1619 his father, released from captivity in Poland, returned to Russia and became coruler. Michael's father dominated the government, increasing contact with western Europe and strengthening central authority and serfdom. After his death in 1633, Michael's maternal relatives once again held sway.

Michael VIII Palaeologus \ˌpā-lē-'äl-ə-gəs\ (b. 1224 or 1225—d. Dec. 11, 1282, Thrace) Nicaean emperor (1259–61) and Byzantine emperor (1261–82), founder of the Palaeologan dynasty. Appointed regent for the six-year-old son of Theodore II (1258), he seized the throne and blinded the rightful heir. He recovered Constantinople from the Latins (1261) and allied with the pope against his rivals, briefly reuniting Greek and Roman churches in 1274 (see Councils of Lyon). In 1281 the new pope, Martin IV, excommunicated him and declared Charles of Anjou's planned campaign against Byzantium to be a holy Crusade against the schismatic Greeks. The Sicilian Vespers prevented Charles's expedition and thus saved Byzantium from a second occupation by the Latins.

Michael Cerularius \ˌker-ü-'lär-ē-əs\ (b. c. 1000, Constantinople—d. Jan. 21, 1059, Madytus, near Constantinople) Greek Orthodox patriarch of Constantinople (1043–58). He thwarted Constantine IX's efforts to ally the Byzantine and Roman empires against the Normans, and he closed Latin churches in Constantinople that refused to use the Greek language and liturgy (1052). When negotiations broke down between Michael and the papal legates sent by Leo IX, each side excommunicated the other, initiating the Schism of 1054. Michael forced Constantine to support the schism, but in 1058 he was exiled by Constantine's successor.

Michelangelo (di Lodovico Buonarroti) (b. March 6, 1475, Caprese, Republic of Florence—d. Feb. 18, 1564, Rome, Papal States) Italian sculptor, painter, architect, and poet. He served a brief apprenticeship with Domenico Ghirlandaio in Florence before beginning the first of several sculptures for Lorenzo de' Medici. After Lorenzo's death in 1492, he left for Bologna and then for Rome. There his *Bacchus* (1496–97) established his fame and led to a commission for the *Pietà* (now in St. Peter's Basilica), the masterpiece of his early years, in which he demonstrated his unique ability to extract two distinct figures from one marble block. His *David* (1501–04), commissioned for the cathedral of Florence, is still considered the prime example of the Renaissance ideal of perfect humanity. On the side, he produced several Madonnas for private patrons and his only universally accepted easel painting, *The Holy Family* (known as the *Doni Tondo*). Attracted to ambitious sculptural projects, which he did not always complete, he reluctantly agreed to paint the ceiling of the Sistine Chapel (1508–12). The first scenes, depicting the story of Noah, are relatively stable and on a small scale, but his confidence grew as he proceeded, and the later scenes evince boldness and complexity. His figures for the tombs in Florence's Medici Chapel (1519–33), which he designed, are among his most accomplished creations. He devoted his last 30 years largely to the *Last Judgment* fresco in the Sistine Chapel, to writing poetry (he left more than 300 sonnets and madrigals), and to architecture. He was commissioned to complete St. Peter's Basilica, begun in 1506 and little advanced since 1514. Though it was not quite finished at Michelangelo's death, its exterior owes more to him than to any other architect. He is regarded today as among the most exalted of artists.

Jules Michelet, detail of an oil painting by Thomas Couture; in the Carnavalet Museum, Paris.
GIRAUDON—ART RESOURCE

Michelet \mēsh-'le**, Jules** (b. Aug. 21, 1798, Paris, France—d. Feb. 9, 1874, Hèyres) French nationalist historian. He taught history and philosophy before he was appointed head of the historical section of the Record Office in 1831. His time there provided him with unique resources for his life's work, the 17-volume *Histoire de France* (1833–67). His method, an attempt to resurrect the past by immersing his own personality in his narrative, resulted in a historical synthesis of great dramatic power, though the 11 volumes that appeared from 1855 to 1867 are distorted by his hatred of priests and kings, hasty or abusive treatment of documents, and mania for symbolic interpretation. His other works

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include the vivid and impassioned *Histoire de la révolution française*, 7 vol. (1847–53). In his later years he wrote a series of lyrical books on nature, displaying his superb prose style.

Michelin \ˌmē-shə-ˈlaⁿ\ *in full* **Compagnie Générale des Etablissments Michelin** Leading French manufacturer of tires and other rubber products. It was founded in 1888 by the Michelin brothers, André (1853–1931) and Édouard (1859–1940), to manufacture tires for bicycles and horse-drawn carriages. It introduced pneumatic tires for automobiles in the 1890s and soon became one of the major European tire producers. Michelin opened its first foreign plant in Turin in 1906 and has since expanded production in many countries; it was reorganized as a HOLDING COMPANY in 1951. It also publishes a famous series of travel guides and road maps. Its headquarters are at Clermont-Ferrand.

Michelson \ˈmī-kəl-sən**, A(lbert) A(braham)** (b. Dec. 19, 1852, Strelno, Prussia—d. May 9, 1931, Pasadena, Calif., U.S.) Prussian-born U.S. physicist. His family immigrated to the U.S. in 1854. He studied at the U.S. Naval Academy and in Europe and later taught principally at the University of Chicago (1892–1931), where he headed the physics department. He invented the interferometer, with which he used light to make extremely precise measurements. He is best remembered for the MICHELSON-MORLEY EXPERIMENT, undertaken with Edward W. Morley (1838–1923), which established that the speed of light is a fundamental constant. Using a more refined interferometer, Michelson measured the diameter of the star Betelgeuse, the first substantially accurate determination of the size of a star. In 1907 he became the first American scientist to receive a Nobel Prize.

Michelson-Morley experiment Attempt to detect the VELOCITY of the Earth with respect to ether, a hypothetical medium in space formerly proposed to carry light waves. It was first performed in Berlin in 1881 by A.A. MICHELSON and refined in the U.S. in 1887 by Michelson and Edward W. Morley (1838–1923). The procedure assumed that if the speed of light were constant with respect to the ether, the motion of the Earth could be detected by comparing the speed of light in the direction of the Earth's motion and the speed of light at right angles to the Earth's motion. No difference was found, and the result discredited the ether theory. As a result, ALBERT EINSTEIN proposed in 1905 that the speed of light is a universal constant.

Michener \ˈmich-nər**, James A(lbert)** (b. Feb. 3, 1907?, New York, N.Y., U.S.—d. Oct. 16, 1997, Austin, Texas) U.S. novelist and short-story writer. Michener was a foundling discovered in Doylestown, Pa., and he was raised as a Quaker. From 1944 to 1946 he was a naval historian in the South Pacific, the setting of his early fiction; his *Tales of the South Pacific* (1947, Pulitzer Prize) was adapted as the Broadway musical *South Pacific* (1949; film, 1958). He is best known for epic and detailed novels drawing on extensive research, including *Hawaii* (1959; film, 1966), *Iberia* (1968), *Centennial* (1974), *Chesapeake* (1978), *Space* (1982), and *Mexico* (1992).

Michigan State (pop., 2000: 9,938,444), midwestern U.S. Surrounded almost entirely by the GREAT LAKES, it is divided into two large land segments: the Upper and Lower peninsulas. The Lower Peninsula is bordered to the south by Indiana and Ohio; the Upper Peninsula is bounded by Wisconsin to the west. Michigan, including the Great Lakes, covers 96,716 sq mi (250,493 sq km); its capital is LANSING. The western region of the Upper Peninsula is a rugged upland rich in minerals, and the remainder of the state consists of lowlands and rolling hills. The area was originally inhabited by ALGONQUIAN-speaking Indians. The French arrived in the 17th century, founding SAULT STE. MARIE in 1668 and DETROIT in 1701; fur trading was their primary activity. The English gained control of Michigan in 1763 following the FRENCH AND INDIAN WAR, and it passed to the U.S. in 1783. It was included in the NORTHWEST TERRITORY in 1787 and in Indiana Territory in 1800. Michigan Territory was organized on the Lower Peninsula in 1805. Though surrendered to the British in the WAR OF 1812, U.S. rule was restored in 1813 by the victory of OLIVER HAZARD PERRY at the Battle of Lake Erie. A boundary dispute with Ohio, known as the Toledo War, was settled by U.S. President Andrew Jackson, with Michigan receiving the Upper Peninsula and statehood as compensation. In 1837 it became the 26th U.S. state. Throughout the AMERICAN CIVIL WAR, it made major contributions to the Union cause. In the 20th century its economy was dominated by the automotive industry.

Michigan, Lake Third largest of the five GREAT LAKES and the only one lying wholly within the U.S. Bordered by the states of Michigan, Wisconsin, Illinois, and Indiana, it connects with Lake HURON through the Straits of MACKINAC in the north. It is 321 mi (517 km) long and up to 118 mi (190 km) wide, with a maximum depth of 923 ft (281 m); it occupies an area of 22,300 sq mi (57,757 sq km). The first European to discover it was the French explorer JEAN NICOLET in 1634; the explorer LA SALLE brought the first sailing ship there in 1679. It now attracts international shipping as part of the Great Lakes–St. Lawrence Seaway. The name is derived from the Algonquian word *michigami* or *misschiganin*, meaning "big lake."

Michigan, University of U.S. state university with its main campus in Ann Arbor and branch campuses in Flint and Dearborn. It originated as a preparatory school in Detroit in 1817 and moved to Ann Arbor in 1837. Today it is one of the nation's leading research universities, consisting of a college of literature, science, and the arts and numerous graduate and professional schools. Special facilities include a nuclear reactor, a hospital complex, an aerospace engineering laboratory, a Great Lakes research centre, and the Gerald R. Ford Presidential Library.

Michizane See SUGAWARA MICHIZANE

Michoacán \ˌmē-chō-ä-ˈkän\ State (pop., 2000: 3,985,667), southwestern Mexico. It covers 23,138 sq mi (59,928 sq km), and its capital is MORELIA. Bounded by the Pacific Ocean, it rises from a narrow coastal plain to the SIERRA MADRE. Important cities include Morelia, Uruapan, Zamora, and Pátzcuaro. In the 1530s the Dominican Vasco de Quiroga established the first successful missions among the Tarascan Indians around Lake Pátzcuaro. The state lies in an area of great volcanic activity; Mount Jorullo was formed by an eruption in 1759, and PARÍCUTIN was created by an eruption that lasted nearly a decade (1943–52). Michoacán produces a wide range of forest products and tropical crops.

Mickey Mouse Famous character of WALT DISNEY's animated cartoons. He was introduced in *Steamboat Willie* (1928), the first animated cartoon with sound. Mickey was created by Disney, who also provided his high-pitched voice, and was usually drawn by the studio's head animator, Ub Iwerks. Noted for his overlarge head and round black ears, he became the star of more than 100 cartoon shorts. The *Mickey Mouse Club* was one of the most popular television shows for children in the U.S. in the 1950s, and the signature black cap with mouse ears worn by the show's stars became one of the most widely distributed items in merchandising history.

Mickiewicz \mʸēts-ˈkʸe-vʸēch**, Adam (Bernard)** (b. Dec. 24, 1798, Zaosye, near Nowogródek, Belorussia, Russian Empire—d. Nov. 25, 1855, Constantinople, Tur.) Polish poet. A lifelong apostle of Polish national freedom and one of Poland's greatest poets, Mickiewicz was deported to Russia for his revolutionary activities in 1823. His *Poetry*, 2 vol. (1822–23), was the first major Polish Romantic work; it contained two parts of *Forefathers' Eve*, a cycle combining folklore and mystic patriotism. Mickiewicz left Russia in 1829 and eventually settled in Paris. There he wrote *The Books of Our Pilgrimage* (1832), a prose interpretation of the history of the Poles; and his masterpiece, the poetic epic *Pan Tadeusz* (1834), which describes the life of the Polish gentry in the early 19th century.

Micmac *or* **Mi'kmaq** North American Indian people living in Quebec, Nova Scotia, Newfoundland, New Brunswick, and Prince Edward Island, Can.; and in Aroostook, Maine, and near Boston, Mass., U.S. The Micmac comprise the largest of the Indian tribes of Canada's eastern Maritime Provinces. Early chronicles describe them as fierce and warlike, but they were among the first Indians to accept Jesuit teachings and intermarry with the settlers of New France. The Micmac formed a confederacy of several CLANS. In winter they hunted caribou, moose, and small game; in summer they fished, gathered shellfish, and hunted seals. They were expert canoeists. In the 17th–18th centuries they were allies of the French against the English. Estimates of the current population vary. The total population of Micmac in the U.S. and Canada is probably about 20,000.

Micon \ˈmī-ˌkän\ *or* **Mikon** (fl. 5th century BC, Greece) Greek painter and sculptor. A contemporary and pupil of POLYGNOTUS, he joined him in developing the treatment of space and perspective in Greek painting. Micon is known for the mural painting on the Stoa Poikile (Painted Stoa [portico]) on the agora at Athens and for the paintings at the Theseum at Athens. His innovations in spatial elaboration helped initiate the decline of Greek pottery painting.

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microbiology Scientific study of microorganisms, a diverse group of simple life-forms including PROTOZOANS, ALGAE, MOLDS, BACTERIA, and VIRUSES. Microbiology is concerned with the structure, function, and classification of these organisms and with ways of controlling and using their activities. Its foundations were established in the later 19th century, with the work of LOUIS PASTEUR and ROBERT KOCH. Since then, many disease-causing microorganisms have been identified and means of controlling their harmful effects have been developed. In addition, means of channeling the activities of various microorganisms to benefit medicine, industry, and agriculture have been discovered. Molds, for example, produce ANTIBIOTICS, notably PENICILLIN. See also BACTERIOLOGY, GENETIC ENGINEERING.

microchip See INTEGRATED CIRCUIT

microcircuit See INTEGRATED CIRCUIT

microclimate Climatic condition in a relatively small area, within a few feet above and below the Earth's surface and within canopies of vegetation. Microclimates are affected by such factors as temperature, humidity, wind and turbulence, dew, frost, heat balance, evaporation, the nature of the soil and vegetation, the local topography, latitude, elevation, and season. Weather and climate are sometimes influenced by microclimatic conditions, especially by variations in surface characteristics.

microcline Common FELDSPAR mineral, one form of potassium aluminosilicate ($KAlSi_3O_8$) that occurs in many rock types. Green specimens are called amazonstone and may be used as gems. It is an end-member composition in the alkali feldspar series. See also ORTHOCLASE.

micrococcus \ˌmī-krō-'kä-kəs\ Any of the spherical BACTERIA that make up the genus *Micrococcus*. Widespread in nature, these gram-positive (see GRAM STAIN) cocci (see COCCUS) are usually not considered to cause disease. They are normal inhabitants of the human body and may even be essential in keeping the balance among the various microorganisms found on the skin. Some species are found in the dust of the air, in soil, in marine waters, and on the skin of vertebrates. Certain species are found in milk and can result in spoilage.

microcomputer Small DIGITAL COMPUTERS whose CPU is contained on a single integrated SEMICONDUCTOR chip. As large-scale and then very large-scale integration (VLSI) have progressively increased the number of TRANSISTORS that can be placed on one chip, the processing capacity of microcomputers has grown immensely. The PERSONAL COMPUTER is the most common example of a microcomputer, but high-performance microcomputer systems are widely used in business, in engineering, and in "smart" machines in manufacturing. See also INTEGRATED CIRCUIT, MICROPROCESSOR.

microeconomics Study of the economic behaviour of individual consumers, firms, and industries and the distribution of total production and income among them. It considers individuals both as suppliers of LAND, LABOUR, and CAPITAL and as the ultimate consumers of the final product, and it examines firms both as suppliers of products and as consumers of labour and capital. Microeconomics seeks to analyze the MARKET or other mechanisms that establish relative prices among goods and services and allocate society's resources among their many possible uses. See also MACROECONOMICS.

microelectromechanical system (MEMS) Miniature devices formed by combining mechanical parts and electronic circuits, typically on a semiconductor chip, with dimensions from tens to a few hundred micrometres (millionths of a metre). Common applications for MEMS include sensors, actuators, and process-control units.

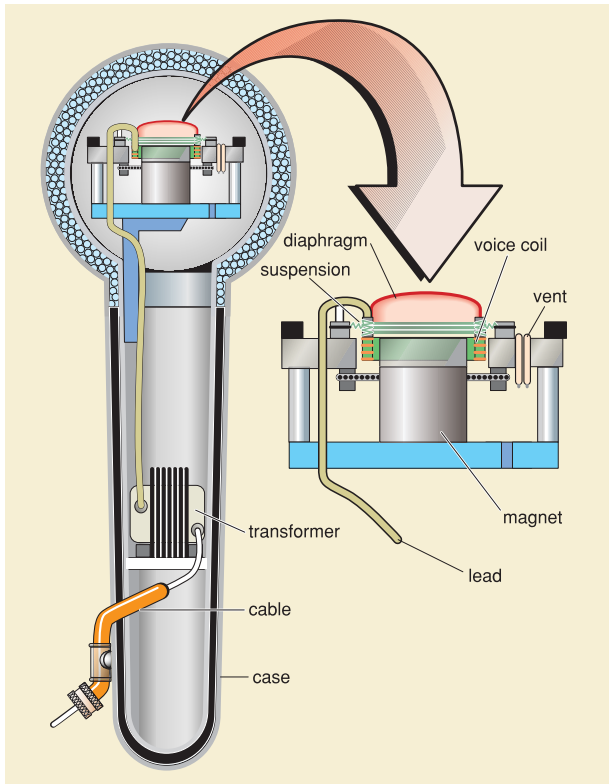
micromanipulation See MICROSURGERY

micrometer (caliper) \mī-'krä-mə-tər\ Instrument for making precise linear measurements of dimensions such as diameters, thicknesses, and lengths of solid bodies. It consists of a C-shaped frame with a movable jaw operated by a screw. The accuracy of the measurements depends on the accuracy of the screw-nut combination.

Micronesia Island group, western Pacific Ocean. A subdivision of OCEANIA, it comprises KIRIBATI, GUAM, NAURU, the Northern MARIANAS, the Federated States of MICRONESIA, the MARSHALL ISLANDS, and PALAU. Located mostly north of the Equator, Micronesia includes the westernmost of the Pacific Islands.

Micronesia, Federated States of Island country, western Pacific Ocean. It comprises the four states Yap, Chuuk (Truk), Pohnpei (Ponape), and Kosrae, all in the CAROLINE ISLANDS. Area: 271 sq mi (701 sq km). Population (2005 est.): 113,400. Capital: PALIKIR, on Pohnpei, the largest island. The people are Micronesian. Languages: Malayo-Polynesian languages, English. Religion: Christianity (mostly Roman Catholic; also Protestant). Currency: U.S. dollar. The islands and atolls extend about 1,750 mi (2,800 km) east-west and about 600 mi (965 km) north-south. U.S. government grants constitute the main source of revenue; subsistence farming and fishing are the principal economic activities. Micronesia is a republic in free association with the U.S.; it has one legislative house, and its head of state and government is the president. The islands were probably settled by people from eastern Melanesia some 3,500 years ago. They were colonized by Spain in 1886 and came under Japanese rule after World War I. They were captured by U.S. forces during World War II, and in 1947 they became part of the UN Trust Territory of the Pacific Islands, administered by the U.S. The islands became an internally self-governing federation in 1979. In 1982 it signed a compact of free association with the U.S., which is responsible for Micronesia's defense.

microphone Device for converting sound waves into electric power that has wave characteristics essentially similar to those of the sound. By proper design, a microphone may be given directional characteristics so that it will pick up sound primarily from a single direction, from two directions, or more or less uniformly from all directions. In addition to their use in telephone transmitters, microphones are most widely applied in hearing aids, sound-recording systems (principally magnetic and digital tape recorders), and public-address systems.



In a moving-coil microphone, sound waves cause the diaphragm to vibrate, and this oscillating motion causes a wire voice coil to move back and forth through a magnetic field, generating a current that varies in proportion to the original sound wave. This varying current is transmitted through a wire lead to a transformer, which converts it to a current that can be carried by wire cable to a recorder or loudspeaker.

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microprocessor Miniature electronic device that contains the arithmetic, logic, and control circuitry needed to function as a DIGITAL COMPUTER'S CPU. Microprocessors are INTEGRATED CIRCUITS that can interpret and execute program instructions as well as handle arithmetic operations. Their development in the late 1970s enabled computer engineers to

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develop MICROCOMPUTERS. Microprocessors led to "intelligent" terminals, such as bank ATMs and point-of-sale devices, and to automatic control of much industrial instrumentation and hospital equipment, programmable microwave ovens, and electronic games. Many automobiles use microprocessor-controlled ignition and fuel systems.

microprogramming Process of writing microcode for a MICROPROCESSOR. Microcode is low-level code that defines how a microprocessor should function when it executes MACHINE-LANGUAGE instructions. Typically, one machine-language instruction translates into several microcode instructions. On some computers, the microcode is stored in ROM and cannot be modified; on some larger computers, it is stored in EPROM and therefore can be replaced with newer versions.

microscope Instrument that produces enlarged images of small objects, allowing them to be viewed at a scale convenient for examination and analysis. Formed by various means, the image is received by direct imaging, electronic processing, or a combination of these methods. The most familiar type of microscope is the optical, or light, microscope, in which LENSES are used to form the image. Other types of microscopes use the wave nature of various physical processes, the most important being the electron microscope (see ELECTRON MICROSCOPY), which uses a beam of ELECTRONS in its image formation. Crude microscopes date to the mid-15th century, but not until 1674 were the powerful microscopes of A. VAN LEEUWENHOEK able to detect phenomena as small as protozoa.

Microsoft Corp. U.S. computer firm, the leading developer of personal-computer software systems and applications. Microsoft, headquartered in Redmond, Wash., also publishes books and multimedia titles and manufactures hardware. It was founded in 1975 by BILL GATES and Paul G. Allen (b. 1954), who adapted BASIC for use on PERSONAL COMPUTERS. They licensed versions of it to various companies, developed other programming languages, and in 1981 released MS-DOS for the IBM PC. The subsequent adoption of MS-DOS by most other personal-computer manufacturers generated vast revenues for Microsoft, which became a publicly owned corporation in 1986. It issued the first version of Microsoft Word, its popular word-processing program, in 1983, and Microsoft Windows, a GRAPHICAL USER INTERFACE for MS-DOS-based computers, in 1985. In 2001 Microsoft released Xbox, a video game console that quickly captured second place in the $10 billion video gaming market. In 2002 Microsoft launched Xbox Live, a BROADBAND gaming network for their consoles.

microsurgery *or* **micromanipulation** Surgical technique for operating on minute structures, with specialized, tiny precision instruments under observation through a microscope, sometimes equipped with cameras to show the operation on a monitor. Microsurgery permits operations that were once impossible—surgery on the delicate bones of the inner and middle ear, reattachment of severed limbs or digits, repair of the retina, and removal of tumours intricately embedded in vital structures.

microtubule \ˌmī-krō-ˈtü-byül\ Tubular structure enclosed by a membrane found within animal and plant cells. Of varying length, they have several functions. They help give shape to many cells and are major components of cilia and flagella, participate in the formation of the spindle during cell division (MITOSIS), and assist the movement of vesicles from the cell bodies of nerve cells toward the ends of those cells' long extensions (axons) and back to the cell bodies.

microwave Portion of the ELECTROMAGNETIC SPECTRUM that is situated between RADIO WAVES and INFRARED RADIATION. Microwaves have wavelengths ranging from 30 cm to 1 mm, corresponding to frequencies from about 1 gigahertz (10^9 Hz) to 1 terahertz (10^{12} Hz). They are the principal carriers of television, telephone, and data transmissions between stations on Earth and between the Earth and satellites. RADAR beams are short pulses of microwaves used to locate ships and planes, track weather systems, and determine the speeds of moving objects. Microwaves are absorbed by water and fat in foodstuffs and produce heat from the inside (see microwave oven). Materials such as glass and ceramics do not absorb microwaves, and metals reflect them. See also MASER.

microwave oven Appliance that cooks food by means of high-frequency ELECTROMAGNETIC RADIATION. A microwave oven is a relatively small, boxlike oven that raises the temperature of food by subjecting it to a high-frequency ELECTROMAGNETIC FIELD. The microwaves are absorbed by water, fats, sugars, and certain other molecules, whose resulting vibrations produce heat. The heating thus occurs inside the food, without warming the surrounding air. This process greatly reduces cooking time; baking and other tasks that may require an hour or more in a conventional oven can be completed in minutes in a microwave oven.

Mid-Atlantic Ridge Submarine ridge lying along the floor of the central Atlantic Ocean. It is a long mountain chain running about 10,000 mi (16,000 km) in a north-south direction, curving from the Arctic Ocean to the southern tip of Africa. The mountains sometimes reach above sea level, forming such islands or island groups as Ascension, SAINT HELENA, and Tristan da Cunha.

mid-ocean ridge See OCEANIC RIDGE

Midas \ˈmī-dəs\ In Greek and Roman legend, a king of PHRYGIA. Midas captured the satyr Silenus but treated him kindly, and as a reward was granted a wish by DIONYSUS. He asked that everything he touched turn to gold; but after turning his daughter to gold when she embraced him, he asked to be released from his wish. In another legend Midas was invited to judge a music contest between APOLLO and the satyr Marsyas. When Midas decided against Apollo, Apollo punished him by giving him donkey's ears. See also SATYR AND SILENUS.

Midas See MISSILE DEFENSE ALARM SYSTEM

Middle Ages Period in European history traditionally dated from the fall of the ROMAN EMPIRE to the dawn of the RENAISSANCE. In the 5th century the Western Roman Empire endured declines in population, economic vitality, and the size and prominence of cities. It also was greatly affected by a dramatic migration of peoples that began in the 3rd century. In the 5th century these peoples, often called barbarians, carved new kingdoms out of the decrepit Western Empire. Over the next several centuries these kingdoms oversaw the gradual amalgamation of barbarian, Christian, and Roman cultural and political traditions. The longest-lasting of these kingdoms, that of the Franks, laid the foundation for later European states. It also produced CHARLEMAGNE, the greatest ruler of the Middle Ages, whose reign was a model for centuries to come. The collapse of Charlemagne's empire and a fresh wave of invasions led to a restructuring of medieval society. The 11th–13th centuries mark the high point of medieval civilization. The church underwent reform that strengthened the place of the pope in church and society but led to clashes between the pope and emperor. Population growth, the flourishing of towns and farms, the emergence of merchant classes, and the development of governmental bureaucracies were part of cultural and economic revival during this period. Meanwhile, thousands of knights followed the call of the church to join the CRUSADES. Medieval civilization reached its apex in the 13th century with the emergence of GOTHIC ARCHITECTURE, the appearance of new religious orders, and the expansion of learning and the university. The church dominated intellectual life, producing the SCHOLASTICISM of St. THOMAS AQUINAS. The decline of the Middle Ages resulted from the breakdown of medieval national governments, the great papal schism, the critique of medieval theology and philosophy, and economic and population collapse brought on by famine and disease.

Middle Congo See Republic of the CONGO

Middle East *or* **Mideast** *or* **Near East** Geographic region where Europe, Africa, and Asia meet. It is an unofficial and imprecise term that now generally encompasses the lands around the southern and eastern shores of the Mediterranean Sea—notably Egypt, Jordan, Israel, Lebanon, and Syria—as well as Iran, Iraq, and the countries of the Arabian Peninsula. Afghanistan, Libya, Turkey, and The Sudan are sometimes also included. The term was formerly used by Western geographers and historians to describe the region from the Persian Gulf to Southeast Asia; Near East is sometimes used to describe the same area.

Middle English Vernacular spoken and written in England c. 1100–1500, the descendant of OLD ENGLISH and the ancestor of Modern English. It can be divided into three periods: Early, Central, and Late. The Central period was marked by the borrowing of many Anglo-Norman words and the rise of the London dialect, used by such poets as JOHN GOWER and GEOFFREY CHAUCER in a 14th-century flowering of English literature. The dialects of Middle English are usually divided into four groups: Southern, East Midland, West Midland, and Northern.

Middle West See MIDWEST

Middlebury College Private liberal arts college in Middlebury, Vt., founded in 1800. It is known for its curriculum emphasizing writing, literature, and modern languages. Middlebury sponsors the Bread Loaf Writers' Conference, an annual gathering for established and aspiring authors.

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Middlesbrough \'mi-dᵊlz-brə\ Town and unitary authority (pop., 2001: 134,487), geographic county of North Yorkshire, historic county of Yorkshire, England. Situated on the southern bank of the River Tees, it was formed in 1830 with the arrival of the railway to the site of a new coal-exporting port. Its development was later fostered by the discovery of ironstone nearby.

Middlesex Historic county, southeastern England, situated along the River Thames. Its earliest settlements date from 500 BC; Belgic tribes arrived in the 1st century BC, followed by the Romans, who established outposts along the river. It was colonized by Saxons in the early 5th century AD. Situated between the East and West Saxons, it obtained its name (meaning "middle Saxons") by AD 704. Middlesex was established as an administrative county in 1888. In 1965 Greater London incorporated parts from the former county.

Middleton, Thomas (b. April? 1580, London, Eng.—d. July 4, 1627, Newington Butts, Surrey) British playwright. Middleton studied at Oxford University and had written three books of poetry by 1600. He learned to write plays by collaborating with John Webster and others on works for the producer Philip Henslowe. His tragedies *Women Beware Women* (c. 1621) and *The Changeling* (1622, with William Rowley) are considered his masterpieces. His comedies, which picture a society dazzled by money, include *Michaelmas Terme* (c. 1605), *A Trick to Catch the Old-one* (1608), *A Mad World, My Masters* (1608), *A Chast Mayd in Cheapeside* (c. 1613), and *A Game at Chess* (1625).

middot \mē-'dōt\ In Jewish biblical interpretation, the principles used to explicate the meaning of biblical words or passages. The middot are used especially to determine the bearing that a passage has on a new question or situation. The first known middot were compiled by Hillel in the 1st century BC; others were compiled by Ishmael ben Elisha (c. AD 100) and Eliezer ben Yose the Galilaean (c. AD 150). Among the best-known are the *kol wa-homer* ("how much more"), in which the interpreter proceeds from a minor to a major premise, and the *gezera shawa* (comparison of similar expressions or laws), in which an inference is made by analogy.

Mideast See Middle East

Midgard In Norse mythology, the dwelling place of humankind. According to legend, it was made from the body of the first created being, the giant Aurgelmir (Ymir). The gods killed him and rolled his body into the central void of the universe, forming the land from his flesh, the oceans from his blood, the mountains from his bones, and so on. Aurgelmir's skull, held up by four dwarfs, became the dome of the heavens. The sun, moon, and stars were made of scattered sparks caught in the skull.

midge Any of a group of tiny dipterans, sometimes called gnats and classified as nonbiting (family Chironomidae), biting (family Ceratopogonidae), or gall (family Cecidomyiidae) midges. Nonbiting midges resemble mosquitoes but are harmless. Humming swarms can be found around water in late afternoon. The often blood-red, aquatic larvae (bloodworms) are important food for aquatic animals. Biting midges (no-see-ums) are the smallest bloodsucking insect (about 0.04 in., or 1 mm, long). Punkies or sand flies (genera *Culicoides* and *Leptoconops*) attack humans but do not transmit disease; many species attack other insects. Gall-midge larvae cause tissue swellings (galls) in plants.

Midge (Chironomidae)
N.A. CALLOW/EB INC.

Midgley, Thomas, Jr. (b. May 18, 1889, Beaver Falls, Pa., U.S.—d. Nov. 2, 1944, Worthington, Ohio) U.S. engineer and chemist. After studying at Cornell University, he worked as an industrial researcher and administrator. In 1921 he discovered the effectiveness of tetraethyl lead as an antiknock additive for gasoline. He also discovered dichlorodifluoromethane, a refrigerant sold commercially as Freon-12 (see Freon), which with related compounds came into universal use as refrigerants and later as aerosol propellants. Midgley conducted extensive research on natural and synthetic rubbers and discovered one of the first catalysts for "cracking" (breaking down) hydrocarbons.

Midhat Pasha \mid-'hät-pä-'shä\ (b. October 1822, Constantinople, Ottoman Empire—d. May 8, 1883, Al-Ṭā'if, Arabian Peninsula) Civil servant and grand vizier of the Ottoman Empire. As governor of Niš and Baghdad, his successful reforms earned the respect of the sultan Abdülaziz, who in 1872 appointed him grand vizier, a post he held only three months. In 1876 he helped depose Abdülaziz and eventually replaced him with Abdülhamid II. Again appointed grand vizier, he was dismissed after six months. Afterward, he was banished but later was recalled and made governor of Smyrna. He then was arrested and convicted for Abdülaziz's death. His death sentence was commuted to permanent exile. See also Tanzimat.

MIDI \'mi-dē\ *in full* **Musical Instrument Digital Interface** Protocol for transmission of musical data between digital components, such as synthesizers and a computer's sound card. MIDI uses 8-bit asynchronous serial transmission with a data rate of 31.25 kilobytes per second. The transmitted data do not directly represent musical sound but specify various aspects (pitch, loudness, starting and stopping points in time). The data are then applied to waveforms stored digitally on a computer chip to create a specific sound.

Midrash \mē-'dräsh, 'mi-ˌdräsh\ In Judaism, a large collection of writings that examine the Hebrew Bible in the light of oral tradition. Midrashic activity reached its height in the 2nd century AD with the schools of Ishmael ben Elisha and Akiba ben Joseph. The Midrashim are divided into two groups: Halakhah, which clarify legal issues; and Haggadah, nonlegal writings intended simply to enlighten. The Midrashim are extensively quoted in the Talmud.

Midway *formerly* **Brooks Islands** Unincorporated U.S. territory, central Pacific Ocean. Midway consists of two coral islands, Eastern and Sand islands, with a total land area of 2 sq mi (5 sq km); there is no permanent population. Claimed for the U.S. in 1859 by Capt. N.C. Brooks, the islands were formally annexed in 1867. Their location, over 1,300 mi (2,100 km) northwest of Honolulu, gave them strategic importance for U.S. forces during World War II, and in 1941 the U.S. Navy established an air and submarine base there. The Battle of Midway (1942) took place in nearby waters. Midway also served as a commercial air base. Its airfield was closed in 1993.

Midway, Battle of (June 3–6, 1942) Major World War II naval battle between the U.S. and Japan. Japanese naval forces under Yamamoto Isoroku sought to seize Midway Island by engaging the numerically inferior U.S. Pacific fleet. U.S. intelligence had broken the Japanese naval code, and the U.S. prepared for the assault by mobilizing about 115 land-based aircraft as well as three aircraft carriers. On June 3 its bombers began striking Japan's carrier force. Japan was unable to match the U.S. air power and, after heavy losses, abandoned efforts to land on Midway. The battle brought the Pacific naval forces of Japan and the U.S. to approximate parity and marked the turning point of the war between the two countries.

Midwest *or* **Middle West** Region, northern and central U.S., lying midway between the Appalachian and Rocky mountains, and north of the Ohio River. As defined by the federal government, it comprises the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. It includes much of the Great Plains, the region of the Great Lakes, and the upper Mississippi River valley.

midwifery \mid-'wif-ər-ē\ Art of attending women in childbirth. It is known to date to ancient biblical, Greek, and Roman times. It declined in the Middle Ages, when childbirth carried high mortality for mothers and infants, but advanced considerably in the 17th–19th century. Later, with advances in obstetrics and gynecology, most women gave birth in hospitals. In the 1960s, the natural childbirth movement, feminism, and other factors renewed interest in the personal care given by midwives. In the U.S., certified nurse-midwives (CNMs)—registered nurses trained in midwifery—accept only low-risk patients. If problems develop, a physician is called. CNMs also provide pre- and postnatal care and reproductive health advice. Lay midwives usually have no formal training, are unlicensed, and deliver (at home) about three-fourths of infants born throughout the world, mostly in developing countries and rural areas of developed nations.

Mies van der Rohe \ˌmēs-ˌvan-də-'rō-ə**, Ludwig** *orig.* **Maria Ludwig Michael Mies** (b. March 27, 1886, Aachen, Ger.—d. Aug. 17, 1969, Chicago, Ill., U.S.) German-born U.S. architect and designer. Mies learned masonry from his father and later worked in the office of

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PETER BEHRENS. His first great work was the German Pavilion for the 1929 International Exposition in Barcelona, Spain, a travertine platform with chromed steel columns and spaces defined by planes of extravagant onyx, marble, and frosted glass. The steel-and-leather Barcelona chair he designed for the space went on to become a 20th-century classic. He was director of the BAUHAUS in 1930–33, first in Dessau and then, during its final months, in Berlin. After moving to the U.S. in 1937, he became director of the School of Architecture at Chicago's Armour Institute (now the Illinois Institute of Technology), where he designed the school's new campus (1939–41). The INTERNATIONAL STYLE, with Mies its undisputed leader, reached its zenith during the next 20 years. His other projects included Chicago's Lake Shore Drive Apartments (1949–51), and the SEAGRAM BUILDING (1956–58, with Philip Johnson) in New York City. These buildings, steel skeletons sheathed in glass curtain-wall facades, exemplify Mies's dictum that "less is more." His later works include Berlin's New National Gallery (1963–68). Modernist steel-and-glass office buildings influenced by his work were built all over the world over the course of the 20th century.

The Lake Shore Drive Apartments, Chicago, designed by Mies van der Rohe; photographed in 1955
EZRA STOLLER C. ESTO

Miescher \'mē-shər**, Johann Friedrich** (b. Aug. 13, 1844, Basel, Switz.—d. Aug. 26, 1895, Davos) Swiss biologist. In 1869 he discovered a substance containing both phosphorus and nitrogen in the nuclei of white blood cells found in pus. The substance, first named nuclein because it seemed to come from cell nuclei, became known as nucleic acid after Miescher separated it into a protein and an acid component. He also was one of the earliest researchers to propose that it is the carbon dioxide concentration (rather than the oxygen concentration) in the blood that regulates breathing.

Mieszko \'myesh-kō\ **I** (b. c. 930—d. May 25, 992) Prince or duke of Poland (963?–992). He accepted Christianity from Rome (966) to avoid forced conversion by the Germans and the incorporation of Poland into the Holy Roman Empire. He expanded Poland southward into Galicia and northward as far as the Baltic Sea.

Mifune \mi-'fü-nā\ **Toshirō** (b. April 1, 1920, Tsingtao, Shantung province, China—d. Dec. 24, 1997, Mitaka, near Tokyo, Japan) Japanese film actor. After serving in the Japanese army in World War II, he made his screen debut in *These Foolish Times* (1947). He followed it with *Drunken Angel* (1948) and achieved international fame in *Rashomon* (1950). He acted in more than 100 films and was known internationally for his energetic, flamboyant portrayals of samurai characters in the films of KUROSAWA Akira, including *Seven Samurai* (1954), *The Hidden Fortress* (1958), *Yojimbo* (1961), and *Sanjuro* (1962); he also played legendary samurai Miyamoto Musashi in three films. His other films include *Throne of Blood* (1957), *The Lower Depths* (1957), *Red Beard* (1965), and *Midway* (1976).

MiG \'mig\ Any member of a family of Russian military FIGHTER AIRCRAFT produced by a design bureau founded in 1939 by Artem Mikoyan and Mikhail Gurevich. The early MiGs, built in World War II, were propeller-driven. The MiG-15, first flown in 1947, was among the best of the early jet fighters; it saw extensive combat in the Korean War. The MiG-21, a lightweight, single-engine interceptor introduced in 1955, became the principal fighter of North Vietnam and was built for more than 40 other countries. More modern jets include the MiG-29, a single-seat, twin-engine air-to-air fighter that can also be used for ground attack.

MiG *officially* **ANPK imeni A.I. Mikoyana** *formerly* **OKB-155** Russian design bureau that is the country's major producer of jet fighters. The company originated in 1939 within another Soviet design bureau as a department under Artem Mikoyan and his deputy, Mikhail Gurevich. Three years later it became the independent bureau OKB-155. Its first design, a single-engine interceptor (first flown 1940), eventually bore the name MiG-1 ("MiG" being an acronym based on "Mikoyan" and "Gurevich"). After World War II it produced the first Soviet jet fighter, the MiG-9 (1946), and followed on with some of the U.S.S.R.'s most notable high-speed aircraft (see MiG [fighter aircraft]). The last major fighters designed under Mikoyan (died 1970) were the variable-wing MiG-23 (entered service 1972), and the MiG-25 (introduced 1970; capable of about Mach 3). The organization later produced several new designs, including the MiG-29 and MiG-31 (both first flown in the 1970s). In the late 1980s its formal name became ANPK imeni A.I. Mikoyana. In the 1990s, after the breakup of the Soviet Union, MiG was consolidated with several other major firms into the giant state-owned aerospace complex VPK MAPO. MiG diversified modestly into the civilian passenger plane market and continued to develop advanced fighter concepts, including the 1.42 (1.44I) multifunctional fifth-generation fighter (first flown 2000).

Mighty Five, The see FIVE, THE

migmatite \'mig-mə-ˌtīt\ Rock composed of a metamorphic host material that is streaked or veined with granite; the name means "mixed rock." Many migmatites probably represent partial fusion of the metamorphic host; some components of the rock are fused and gather to produce the streaks of granite. Migmatite also can form near large intrusions of granite when some of the magma is injected into neighbouring METAMORPHIC ROCKS.

migraine Recurrent vascular HEADACHE, usually on one side of the head. Severe throbbing pain is sometimes accompanied by nausea and vomiting. Some migraine patients have warning symptoms (an "aura") before the headache, including visual disturbance, weakness, numbness, or dizziness. If a stimulus (e.g., a particular food or drink) is found to trigger attacks, avoidance can prevent them. Drugs may be taken as an attack begins (to abort it) or daily by patients with very frequent attacks (to prevent them or reduce their severity).

migrant labour Semiskilled or unskilled workers who move from one region to another, offering their services on a temporary, usually seasonal, basis. In North America, migrant labour is generally employed in agriculture and moves seasonally from south to north following the harvest. In Europe and the Middle East, migrant labour usually involves urban rather than agricultural employment and calls for longer periods of residence. The migrant labour market is often disorganized and exploitative. Many workers are supervised by middlemen such as labour contractors and crew leaders, who recruit and transport them and dispense their pay. Labourers commonly endure long hours, low wages, poor working conditions, and substandard housing. In some countries, child labour is widespread among migrant labourers, and even in the U.S. those children who do not work often do not go to school, since schools are usually open only to local residents. Workers willing to accept employment on these terms are usually driven by even worse conditions in their home countries. Labour organizing is made difficult by mobility and by low rates of literacy and political participation, though some migrant labourers in the U.S. have been unionized. See also CESAR CHAVEZ.

migration, human Permanent change of residence by an individual or group, excluding such movements as NOMADISM and MIGRANT LABOUR. Migrations may be classed as internal or international and as voluntary or forced. Voluntary migration is usually undertaken in search of a better life; forced migrations include expulsions during war and the transportation of slaves or prisoners. The earliest humans migrated from Africa to all the continents except Antarctica within about 50,000 years. Other mass migrations include the forced migration of 20 million people as slaves from Africa to North America in the 16th–19th centuries and the Great Atlantic Migration of 37 million people from Europe to North America between 1820 and 1980. War-related forced migrations and refugee flows continue to be very large, as are voluntary migrations from developing nations to industrialized ones. Internal migrations have tended to be from rural areas to urban centers.

mihrab \'mē-rəb\ *Arabic* **miḥrāb** Semicircular prayer niche in the *qiblah* wall (the wall facing Mecca) of a MOSQUE, reserved for the prayer leader (*imām*). The mihrab originated in the reign of the Umayyad caliph al-Walīd I (705–715), when the famous mosques at Medina, Jerusalem, and Damascus were built. It was adapted from the prayer niches common in Coptic Christian monasteries. Mihrabs are usually ornately decorated.

Mikā'īl \mi-'käl\ In ISLAM, the counterpart of the biblical archangel MICHAEL. Mīkā'īl is mentioned only once in the QUR'ĀN, but, according to legend, he and JIBRĪL were the first angels to obey God's order to worship

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Adam. The two are credited with purifying Muhammad's heart before his ascension to heaven (see *mirʿāj*). Mīkāʾīl is said to have been so shocked at the sight of hell when it was created that he never laughed again. He is also believed to have helped the Muslims win their first significant military victory in Arabia in 624.

Mikan \'mī-kən**, George (Lawrence)** (b. June 18, 1924, Joliet, Ill., U.S.—d. June 1, 2005, Scottsdale, Ariz.) U.S. basketball player and executive. He was an outstanding centre at DePaul University, where he also took his law degree. Standing about 6 ft 10 in. (2.08 m) tall, he was the first of the dominant big men in post-World War II professional basketball. He played for the Minneapolis Lakers (now the Los Angeles Lakers) in 1947–54 and 1955–56, leading them to six championships. He was later named the first commissioner of the American Basketball Association (1967–69). An Associated Press poll in 1950 named him the greatest basketball player of the first half of the 20th century.

Mikołajczyk \ˌmē-kȯl-'ī-chik**, Stanisław** (b. July 18, 1901, Holsterhausen, near Gelsenkirchen, Ger.—d. Dec. 13, 1966, Washington, D.C., U.S.) Polish statesman. He cofounded the Peasant Party and served as its leader (1931–39). After the German invasion of Poland (1939), he fled to London, where he served in the Polish government-in-exile as prime minister (1943–44). He returned in 1945 and became second deputy premier in the communist-dominated provisional government. He tried to effect a democratic government, but persecution of the noncommunist Peasant Party forced him to flee in 1947 to Britain and then the U.S.

Mikon See Micon

Mikoyan \ˌmē-kō-'yän**, Anastas (Ivanovich)** (b. Nov. 25, 1895, Sanain, Armenia—d. Oct. 21, 1978, Moscow, Russia, U.S.S.R.) Russian statesman. After joining the Bolsheviks in 1915, he became a party leader in the Caucasus. His support of Joseph Stalin earned him a post on the Communist Central Committee (1923). He was commissar of trade from 1926, a member of the Politburo from 1935, and deputy premier (1946–64), directing the country's trade. He supported Nikita Khrushchev's rise to power and became his close adviser and a first deputy premier of the Soviet Union. He was chairman of the Presidium of the Supreme Soviet (1964–65).

milad See Mawlid

Milan \mə-'lan, mə-'län\ *Italian* **Milano** \mē-'lä-nō\ Capital (pop., 2001 prelim.: 1,182,693), Lombardy region, northern Italy. The area was settled by the Gauls c. 600 BC. Known as Mediolanum, it was conquered by the Romans in 222 BC. Attacked in AD 452 by Attila and in 539 by the Goths, it fell to Charlemagne in 774. Milan's power grew in the 11th century, but it was destroyed by the Holy Roman Empire in 1162. Rebuilt as part of the Lombard League in 1167, Milan achieved independence in 1183. In 1450 Francesco Sforza founded a new dynasty there; after 1499 it was ruled alternately by the French and the Sforza family until 1535, when the Habsburgs obtained it. Napoleon took power in 1796, and in 1805 it became the capital of his kingdom of Italy. It was incorporated into unified Italy in 1860. Milan was heavily damaged during World War II but was rebuilt. It is Italy's most important economic centre, with industrial development and textile manufacturing. It is noted for its fashion industry and production of electronic goods and is also Italy's financial centre. Its historic sites include the medieval Duomo, Europe's third largest cathedral; the Palazzo di Brera (1651); the 15th-century monastery that houses Leonardo da Vinci's *Last Supper*; and La Scala opera house.

Milan Decree (Dec. 17, 1807) Economic policy in the Napoleonic Wars. It was part of the Continental System invoked by Napoleon to blockade trade with the British. It expanded the blockade of continental ports to those of neutral ships trading with Britain and eventually affected U.S. shipping.

mildew Conspicuous mass of threadlike hyphae (see mycelium) and fruiting structures produced by various fungi (division Mycota; see fungus). Mildew grows on cloth, fibres, leather goods, and plants, using these substances as food for growth and reproduction. Downy mildew and powdery mildew are plant diseases that affect hundreds of species.

mile Any of various units of distance, including the statute mile of 5,280 ft (1.61 km). It originated from the Roman *mille passus*, or "thousand paces," which measured 5,000 Roman ft (4,840 English ft [1,475 km]). A nautical mile is the length on the Earth's surface of one minute of arc or, by international definition, 1,852 m (6,076.12 ft [1.1508 statute mi]); it remains in universal use in both marine and air transportation. A knot is one nautical mile per hour. See also International System of Units; metric system.

Miletus \mī-'lē-təs\ Ancient Greek city of western Anatolia. Before 500 BC it was the greatest Greek city in the east. Distinguished as a commercial and colonial power, it was also known for its intellectual figures, including Thales, Anaximander, Anaximenes, and Hecataeus. Ruled by Greek tyrants, it later passed successively under the control of Lydia and the Persian Achaemenian dynasty. About 499 BC Miletus led the Ionian revolt that sparked the Persian Wars, and it was destroyed by the Persians in 494 BC. After the Greeks defeated the Persians, it joined the Delian League. It fell to Alexander the Great in 334 BC but retained its commercial importance. By the 6th century AD its two harbours had silted up, and it was eventually abandoned. Now an archaeological site, it is located near the mouth of the Menderes River.

Milford Sound Inlet of the Tasman Sea, southwestern coast of South Island, New Zealand. About 2 mi (3 km) wide, the sound extends inland for 12 mi (19 km). It was named by a whaler in the 1820s for its resemblance to Milford Haven in Wales. It is the northernmost fjord in Fiordland National Park and is the site of Milford Sound town, one of the region's few permanently inhabited places.

Milhaud \mē-'yō**, Darius** (b. Sept. 4, 1892, Aix-en-Provence, France—d. June 22, 1974, Geneva, Switz.) French composer. Milhaud studied at the Paris Conservatoire, then at the Schola Cantorum with Vincent d'Indy. He became known as one of Les Six, a group of young French composers. His music is characterized by polytonality (simultaneous use of different keys), as in *Saudades do Brazil* (1921); though dissonant, his compositions retain a lyrical quality. The influence of jazz is audible in his best-known work, the ballet *The Creation of the World* (1923). He wrote many ballets, operas, and film scores in the 1920s, culminating in the grand opera *Christophe Colomb* (1928). Milhaud had a longtime association with the Aspen Music Festival, which he helped found in 1949.

miliaria \ˌmi-lē-'ar-ē-ə\ Inflammatory skin disorder, with multiple small sites at sweat pores. Blockage of ducts causes sweat to escape into various levels of the skin and produce different inflammatory reactions. The most common type, known as prickly heat, results when sweat escapes into the epidermis. Pinhead blisters or pimplelike bumps occur mostly on the trunk and limbs and cause itching and burning. It mainly affects infants in tropical climates. See also perspiration, sweat gland.

Military Academy, U.S. See United States Military Academy

military engineering Art and practice of designing and building military works and of building and maintaining lines of military transport and communications. It includes both tactical support (see tactics) on the battlefield, including construction of fortifications and demolition of enemy installations, and strategic support (see strategy) away from the front lines, such as construction or maintenance of airfields, ports, roads, railroads, bridges, and hospitals. Its most notable feat in ancient times was the Great Wall of China. The preeminent military engineers of the ancient Western world were the Romans, who maintained their power by constructing not only forts and garrisons but roads, bridges, aqueducts, harbors, and lighthouses. See also civil engineering.

military government Administration of territory by an occupying power. The definition does not cover military forces stationed in neutral or friendly territory that share administrative responsibilities with local civil authorities. Military government must also be distinguished from military law and martial law. Its control lasts until it either gives up power voluntarily or is overthrown. The term is popularly used for rule of a country by its own military, whether it comes to power through a coup d'état or is the legitimate governing body.

military law Law prescribed by statute for governing the armed forces and their civilian employees. It in no way relieves military personnel of their obligations to their country's civil code or to the codes of international law. Mutiny, insubordination, desertion, misconduct, and other offenses injurious to military discipline constitute violations of military law; offenders may be subject to court-martial. Lesser offenses may be penalized summarily by a commanding officer (e.g., through the withdrawal of privileges or the cancellation of liberty).

military unit Group of a prescribed size with a specific combat role within a larger military organization. The chief units in the ancient world

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were the Greek PHALANX and the Roman LEGION. Modern units originated in the 16th–18th century, when professional armies reemerged in Europe after the end of the Middle Ages. Since then the basic units—company, BATTALION, BRIGADE, and division—have remained in use. The smallest unit today is the squad, which has 7–14 soldiers and is led by a sergeant. Three or four squads make up a PLATOON, and two or more platoons make up a company, which has 100–250 soldiers and is commanded by a captain or a major. Two or more companies make up a battalion, and several battalions form a brigade. Two or more brigades, along with various specialized battalions, make up a division, which has 7,000–22,000 troops and is commanded by a major general. Two to seven divisions make up an army corps, commanded by a lieutenant general, which with 50,000–300,000 troops is the largest regular army formation, though in wartime two or more corps may be combined to form a field army (commanded by a general), and field armies in turn may be combined to form an army group.

militia \mə-'li-shə\ Military organization of citizens with limited military training who are available for emergency service, usually for local defense. In many countries the militia is of ancient origin. The Anglo-Saxons required every able-bodied free male to serve. In colonial America it was the only defense against hostile Indians when regular British forces were not available. In the AMERICAN REVOLUTION the militia, called the Minutemen, provided the bulk of the American forces. Militias played a similar role in the WAR OF 1812 and the AMERICAN CIVIL WAR. State-controlled volunteer militias in the U.S. became the National Guard. British militia units, begun in the 16th century for home defense and answerable to the county sheriff or lord lieutenant, were absorbed into the regular army in the 20th century. Today various paramilitary organizations, from U.S. white supremacists to revolutionaries in the developing world, use the term *militia* to accentuate their populist origins.

milk Liquid secreted by the mammary glands of female mammals to nourish their young. The milk of domesticated animals is also an important food source for humans. Most milk consumed in Western countries is from cows; other important sources include sheep, goats, water buffalo, and camels. Milk is essentially an emulsion of FAT and PROTEIN in water, along with dissolved sugar, minerals (including CALCIUM and PHOSPHORUS), and VITAMINS, particularly VITAMIN B COMPLEX. Commercially processed cow's milk is commonly enriched with vitamins A and D. Many countries require PASTEURIZATION to protect against naturally occurring and artificially introduced microorganisms. Cooling further prevents spoilage (souring and curdling). Fat from whole milk (about 3.5% fat content) can be removed in a separator to produce CREAM and leave low-fat milk (1–2% fat) or skim milk (0.5% fat). Milk is usually homogenized, forced under high pressure through small openings to distribute the fat evenly. It may also be condensed, evaporated, or dehydrated for preservation and ease of transport. Other dairy products include BUTTER, CHEESE, and YOGURT.

Milk, Harvey (Bernard) *orig.* **Glimpy Milch** (b. May 22, 1930, Woodmere, Long Island, N.Y., U.S.—d. Nov. 27, 1978, San Francisco, Calif.) U.S. political leader. After graduating from college, he served in the U.S. Navy and was discharged in 1955 (although Milk claimed that he was dishonourably discharged due to his homosexuality, military records do not support the allegation). He later settled in San Francisco and soon gained a following as a leader of the city's gay community. In 1977 he was elected to the city's Board of Supervisors, becoming one of the first openly gay elected officials in U.S. history. In 1978 Milk and the city's mayor, George Moscone (1929–78), were shot and killed in City Hall by Dan White, a conservative former city supervisor. At White's murder trial, his attorneys argued that his judgment had been impaired by eating junk food (a tactic later derided as the "Twinkie defense"); his conviction on the less serious charge of voluntary manslaughter sparked riots in the city. Milk was the subject of numerous books and movies, including the 1984 documentary *The Times of Harvey Milk*, which received an Academy Award.

Milken, Michael R. (b. July 4, 1946, Encino, Calif., U.S.) U.S. financier and entrepreneur. He studied at the University of Pennsylvania's Wharton School and went to work in 1969 for what was to become Drexel Burnham Lambert Inc., an investment-banking company. In 1971 he became head of its bond-trading department. He persuaded many of his clients to invest in JUNK BONDS issued by new or financially troubled companies; the capital he raised financed a new class of "corporate raiders" who carried out numerous mergers, acquisitions, hostile takeovers, and leveraged buyouts in the 1980s. By the end of the decade, the junk-bond market was worth $150 billion, and Drexel was a leading financial firm. In 1986 its client Ivan Boesky, convicted of INSIDER TRADING, implicated Milken and the firm in his dealings. Charged with securities fraud and heavily fined, Drexel declared bankruptcy in 1990 when the junk-bond market collapsed. Milken pled guilty to securities fraud the same year and was sentenced to 10 years in prison and a $600-million fine; released after 22 months, he since made a second fortune.

milkweed family Family Asclepiadaceae, composed of about 2,000 species of flowering herbaceous plants or shrubby climbers in more than 280 genera. Most family members have milky juice, podlike fruits, and tufted silky-haired seeds that drift on wind currents to new locations for sprouting. Common milkweed (*Asclepias syriaca*) and bloodflower (*A. curassavica*) often are cultivated as ornamentals. *Hoya carnosa*, commonly called wax plant because of its waxy white flowers, is often grown indoors as a potted plant. The family also includes some SUCCULENTS, some PITCHER PLANTS, and BUTTERFLY WEED.

Milky Way Galaxy Large spiral GALAXY (roughly 150,000 light-years in diameter) that contains Earth's SOLAR SYSTEM. It includes the multitude of stars whose light is seen as the Milky Way, the irregular luminous band that encircles the sky defining the plane of the galactic disk. The Milky Way system contains hundreds of billions of stars and large amounts of interstellar gas and dust. Because the dust obscures astronomers' view of many of its stars, large areas could not be studied before the development of INFRARED ASTRONOMY and radio astronomy (see RADIO AND RADAR ASTRONOMY). Its precise constituents, shape, and true size and mass are still not known; it is believed to contain large amounts of DARK MATTER and a massive BLACK HOLE at its core. The Sun lies in one of the Galaxy's spiral arms, about 27,000 light-years from the centre.

Mill, James (b. April 6, 1773, Northwater Bridge, Forfarshire, Scot.—d. June 23, 1836, London, Eng.) Scottish philosopher, historian, and economist. After studying at the University of Edinburgh and teaching, he went to London in 1802, where he met JEREMY BENTHAM and became a major promulgator of Bentham's UTILITARIANISM. He wrote for several journals, including the *Edinburgh Review* (1808–13), and contributed articles on government and education to the *Encyclopaedia Britannica*. He helped found London University in 1825. After completing his *History of British India* (3 vol., 1817), he was appointed an official in India House (1819) and later became head of the examiner's office (1830). His criticism of British rule led to changes in the government of India. His *Elements of Political Economy* (1821) summarized the views of DAVID RICARDO, and his *Analysis of the Phenomena of the Human Mind* (1829) associated psychology with utilitarianism, a doctrine continued by his son, JOHN STUART MILL. Mill is considered the founder of philosophical radicalism.

Mill, John Stuart (b. May 20, 1806, London, Eng.—d. May 8, 1873, Avignon, France) British philosopher and economist, the leading expositor of UTILITARIANISM. He was educated exclusively and exhaustively by his father, JAMES MILL. By age 8 he had read in the original Greek Aesop's *Fables*, Xenophon's *Anabasis*, and all of Herodotus, and he had begun a study of Euclid's geometry; at age 12 he began a thorough study of scholastic logic. In 1823 he cofounded the Utilitarian Society with JEREMY BENTHAM, though he would later significantly modify the utilitarianism he inherited from Bentham and his father to meet the criticisms it encountered. In 1826 he and Bentham cofounded London University (now University College). From 1828 to 1856 he was an assistant examiner in India House, where from 1836 he was in charge of the East India Company's relations with the Indian states. In the 1840s he published his great systematic works in logic and political economy, chiefly *A System of Logic* (2 vol., 1843) and *Principles of Political Economy* (2 vol., 1848). As head of the examiner's office in India House from 1856 to 1858 he wrote a defense of the company's government of India when the transfer of its powers was proposed. In 1859 he published *On Liberty*, a trenchant defense of individual freedom. His *Utilitarianism* (1863) is a closely reasoned attempt to answer objections to his ethical theory and to address misconceptions about it; he was especially insistent that "utility" include the pleasures of the imagination and the gratification of the higher emotions and that his system include a place for settled rules of conduct. In 1869 he published *The Subjection of Women* (written 1861), now the classical theoretical statement of the case for woman suffrage. Prominent as a publicist in the reforming age of the 19th century, he remains of lasting interest as a logician and ethical theorist. See also MILL'S METHODS.

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Millais \'mi-ˌlā, mi-'lā**, Sir John Everett** (b. June 8, 1829, Southampton, Hampshire, Eng.—d. Aug. 13, 1896, London) British painter and illustrator. In 1848 he became a founding member of the PRE-RAPHAELITES, a group founded in opposition to contemporary academic painting. His period of greatest achievement came in the 1850s, with *The Return of the Dove to the Ark* (1851) and one of his greatest public successes, *The Blind Girl* (1856), a tour de force of Victorian sentiment and technical facility. He was popular as a portraitist and also as a book illustrator, notably for the novels of ANTHONY TROLLOPE.

The Blind Girl, oil painting by Sir John Everett Millais, 1856; in the Birmingham City Museum and Art Gallery, Birmingham, Eng.
COURTESY OF THE BIRMINGHAM MUSEUMS AND ART GALLERY

Milland \mi-'land**, Ray** *orig.* **Reginald Truscott-Jones** (b. Jan. 3, 1907, Neath, Glamorganshire, Wales—d. March 10, 1986, Torrance, Calif., U.S.) Welsh-born U.S. actor. He made his film debut in 1929 and moved to Hollywood in 1930. The debonair romantic leading man in many movies of the 1930s and '40s, he won acclaim for his performance as an alcoholic writer in *The Lost Weekend* (1945, Academy Award) and also played dramatic parts in *The Big Clock* (1948), *Something to Live For* (1952), and *Dial M for Murder* (1954). In his later years, he generally only played minor roles. He also directed several movies in the 1950s and early '60s.

Millay, Edna St. Vincent (b. Feb. 22, 1892, Rockland, Maine, U.S.—d. Oct. 19, 1950, Austerlitz, N.Y.) U.S. poet and dramatist. Her work is filled with the imagery of the Maine coast and countryside. In the 1920s, when she lived in Greenwich Village, she came to personify the romantic rebellion and bravado of youth. Among her volumes are *Renascence* (1917); *A Few Figs from Thistles* (1920); *The Harp Weaver* (1923, Pulitzer Prize); *The Buck in the Snow* (1928), which introduced a more sombre tone; the sonnet sequence *Fatal Interview* (1931); and *Wine from These Grapes* (1934).

Mille, Agnes de See AGNES DE MILLE

millefleurs tapestry \mēl-'flərz\ *French* **"thousand flowers"** TAPESTRY characterized by a background motif of many small flowers. Most millefleurs tapestries show secular scenes or allegories. They are thought to have been made first in the Loire district of France in the mid-15th century. As they became popular, they were produced in many parts of France and the Low Countries until the end of the 16th century.

millennialism *or* **millenarianism** Belief in the millennium of Christian prophecy (Revelation 20), the 1,000 years when Christ is to reign on earth, or any religious movement that foresees a coming age of peace and prosperity. There are two expressions of millennialism. Premillennialism holds that the Second Coming of Christ will occur before the millennium and will initiate the final battle between good and evil, which will be followed by the establishment of the 1,000-year kingdom on earth or in heaven. Postmillennialism maintains that Jesus will return after the creation of the millennial kingdom of peace and righteousness, which prepares the way for the Second Coming. Throughout the Christian era, periods of social change or crisis have tended to lead to a resurgence in millennialism. The legend of the last emperor and the writings of JOACHIM OF FIORE are important examples of medieval millennialism, and, during the Reformation, ANABAPTISTS, Bohemian Brethren, and other groups held millennial beliefs. It is now associated especially with such Protestant denominations as the ADVENTISTS, JEHOVAH'S WITNESSES, and MORMONS. In a broader sense, many non-Christian traditions, including PURE LAND BUDDHISM and the GHOST DANCE religion, are understood as millennialist.

millennium Period of 1,000 years. The GREGORIAN CALENDAR, put forth in 1582 and subsequently adopted by most countries, did not include a year 0 in the transition from BC (years before Christ) to AD (those since his birth). Thus, the 1st millennium is defined as spanning years 1–1000 and the 2nd years 1001–2000. Although numerous popular celebrations marked the start of the year 2000, the 21st century and 3rd millennium AD began on Jan. 1, 2001.

millennium bug See Y2K BUG

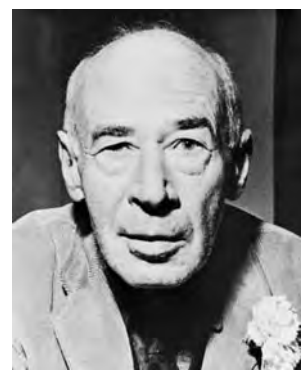
miller *or* **owlet moth** Any of the more than 20,000 MOTH species in the LEPIDOPTERAN family Noctuidae, common worldwide. Some species have a 1-ft (30-cm) wingspan, the largest of any moth, but most species have a wingspan of 1.5 in. (4 cm) or less. The wings are usually dull-coloured. Both larvae and adults of most species feed at night. Adults feed on fruits, sap, and nectar. The larvae of many species are agricultural pests (e.g., CUTWORM, BOLLWORM) that feed on foliage and seeds, bore into stems and fruits, and eat or sever roots. A few species prey on SCALE INSECTS.

Miller, Arthur (b. Oct. 17, 1915, New York, N.Y., U.S.—d. Feb. 10, 2005, Roxbury, Conn.) U.S. playwright. He began writing plays while a student at the University of Michigan. His first important play, *All My Sons* (1947), was followed by his most famous work, *Death of a Salesman* (1949, Pulitzer Prize), the tragedy of a man destroyed by false values that are in large part the values of his society. Noted for combining social awareness with a searching concern for his characters' inner lives, Miller wrote many other plays, including *The Crucible* (1953), which uses a plot about the Salem witch trials to attack McCarthyism, *A View from the Bridge* (1955), *After the Fall* (1964), *The Last Yankee* (1992), and *Resurrection Blues* (2002). He also wrote short stories, essays, and the screenplay for *The Misfits* (1961), which starred his second wife, MARILYN MONROE.

Miller, George A(rmitage) (b. Feb. 2, 1920, Charleston, W.Va., U.S.) U.S. psychologist. He taught at Harvard, Rockefeller, and Princeton universities. He is known for his work in cognitive psychology, particularly communication and psycholinguistics. In *Plans and the Structure of Behavior* (with Eugene Galanter and Karl Pribram, 1960), Miller examined how knowledge is accumulated and organized into a practical "image" or plan. His other works, including *Language and Communication* (1951) and *The Science of Words* (1991), focus on the psychology of language and communication. He received the National Medal of Science in 1991.

Miller, (Alton) Glenn (b. March 1, 1904, Clarinda, Iowa, U.S.—d. Dec. 16, 1944, at sea) U.S. trombonist and leader of one of the most popular dance bands of the SWING era. Miller formed his band in 1937. His music was characterized by the precise execution of arrangements that featured a clarinet leading the saxophone section. Miller disbanded in 1942 to join the war effort by leading a military band. He was traveling from London to Paris by plane when the craft disappeared over the English Channel and was never recovered. His recordings of numbers such as "Moonlight Sonata," "Chattanooga Choo-Choo," "In the Mood," and "String of Pearls" are classics of the era.

Miller, Henry (Valentine) (b. Dec. 26, 1891, New York, N.Y., U.S.—d. June 7, 1980, Pacific Palisades, Calif.) U.S. writer and perennial bohemian. Miller wrote about his Brooklyn, N.Y., childhood in *Black Spring* (1936). *Tropic of Cancer* (1934), a monologue about his life as an impoverished expatriate in Paris, and *Tropic of Capricorn* (1939), which draws on his earlier New York phase, were banned as obscene in the U.S. and Britain until the 1960s. *The Air-Conditioned Nightmare* (1945) is a critical account of a tour of the U.S. He settled on the California coast, where he became the centre of a colony of admirers and wrote his *Rosy Crucifixion* trilogy, *Sexus*, *Plexus*, and *Nexus* (U.S. ed., 1965).



Henry Miller.
CAMERA PRESS

Miller, Jonathan (Wolfe) (b. July 21, 1934, London, Eng.) British director, writer, and actor. After earning a medical degree at Cambridge University, he made his professional stage debut at the Edinburgh Festival in the hit satirical revue *Beyond the Fringe* (1960). As a director of plays, he gained notoriety for

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his controversial interpretations of classic works. His innovative opera productions, such as PYOTR TCHAIKOVSKY's *Eugene Onegin*, for the English National Opera and other groups have become internationally celebrated. He wrote the BBC medical series *The Body in Question* (1977) and *States of Mind* (1982).

Miller, Neal E(lgar) (b. Aug. 3, 1909, Milwaukee, Wis., U.S.—d. March 23, 2002, Hamden, Conn.) U.S. psychologist. He earned his Ph.D. from Yale University and remained at Yale's Institute of Human Relations to continue his experiments on learning. In *Social Learning and Imitation* (1941) and *Personality and Psychotherapy* (1950), he and John Dollard presented a theory of motivation based on the satisfaction of psychosocial drives, combining elements of earlier reinforcement theories of behaviour and learning. Miller suggested that behaviour patterns were produced through the modification of biologically or socially derived drives by conditioning and reinforcement. He taught at Rockefeller University (1966–81).

Millerand \mēl-'rä^{n}**, Alexandre** (b. Feb. 10, 1859, Paris, France—d. April 7, 1943, Versailles) French politician. He was an editor of socialist journals (1883–98) and served in the Chamber of Deputies from 1885 to 1920. He implemented reforms while serving in various governments as minister of commerce (1899–1901), public works (1909–10), and war (1912–15). He became premier in 1920, and, as leader of a moderate coalition, was elected president of France (1920–24). After advocating a revision of the constitution to strengthen the power of the presidency, he was forced to resign by the CARTEL DES GAUCHES. He served in the Senate from 1927 to 1940.

millet Any of various GRASSES (family Poaceae, or Gramineae), that produce small edible seeds used as forage crops and as food CEREALS. Most millets range in height from 1 to 4 ft (0.3 to 1.3 m). Except for pearl millet (*Pennisetum glaucum*, or *P. americanum*), seeds remain enclosed in hulls after threshing. Cultivated in China since at least the 3rd millennium BC, millets are today an important food staple in much of Asia, Russia, and western Africa. High in carbohydrates, they are somewhat strong in taste and cannot be made into leavened bread, so they are consumed mainly in flatbreads and porridges or prepared and eaten much like rice. In the U.S. and western Europe they are used chiefly for pasture or to produce HAY.

millet \mə-'let\ Turkish term referring to an autonomous religious community under the OTTOMAN EMPIRE (c. 1300–1923). Each millet was responsible to the central government for obligations such as taxes and internal security and also had responsibility for social and administrative functions not provided by the state. Beginning in 1856, a series of secular legal reforms known as the TANZIMAT ("Reorganization") eroded much of their administrative autonomy.

Millet \mē-'yā,\ *English* \mi-'lā**, Jean-François** (b. Oct. 4, 1814, Gruchy, France—d. Jan. 20, 1875, Barbizon) French painter. Born to a peasant family, he studied with a painter in Paris, but when one of his two submissions to the Salon was rejected (1840), he returned to Cherbourg, where initially he painted mostly portraits. His first success came with *The Milkmaid* (1844), and in 1848 another peasant scene, *The Winnower*, was shown at the Salon. In 1849 he settled in the village of Barbizon. Because he continued to exhibit peasant scenes that emphasized the labours of rustic life, he was accused of being a socialist, but his aims were not political. His *Angelus* (1859) became one of the most popular paintings of the 19th century. In his later life he was linked with the BARBIZON SCHOOL.

Millikan, Robert (Andrews) (b. March 22, 1868, Morrison, Ill., U.S.—d. Dec. 19, 1953, San Marino, Calif.) U.S. physicist. He received his doctorate from Columbia University and taught physics at the University of Chicago (1896–1921) and the California Institute of Technology (from 1921). To measure electric charge, he devised the MILLIKAN OIL-DROP EXPERIMENT. He verified ALBERT EINSTEIN's photoelectric equation and obtained a precise value for the Planck constant. He was awarded a 1923 Nobel Prize.

Millikan oil-drop experiment \'mil-ə-kən\ First method for direct measurement of the ELECTRIC CHARGE of a single ELECTRON, originally performed in 1909 by ROBERT MILLIKAN. He used a microscope to measure the rate of descent of tiny oil droplets directed through the top of a box. By halting the descent of droplets carrying their own electric charge by means of precisely adjusting the voltage between the box's metal top and bottom, he discovered that the electric charges on the drops were all whole-number multiples of a lowest value, the elementary electric charge itself, and thus that electric charge exists in basic natural units.

milling See FULLING

milling machine MACHINE TOOL that rotates a circular tool with numerous cutting edges arranged symmetrically about its axis, called a milling cutter. The metal workpiece is usually held in a vise clamped to a table that can move in three perpendicular directions. Cutters of many shapes and sizes are available for a wide variety of milling operations. Milling machines cut flat surfaces, grooves, shoulders, inclined surfaces, dovetails, and T-slots. Various form-tooth cutters are used for cutting concave forms and convex grooves, for rounding corners, and for cutting gear teeth.

millipede Any of about 10,000 species of the ARTHROPOD class Diplopoda, found worldwide. Most species live in and eat decaying plant matter. Some injure living plants, and a few are predators and scavengers. Millipedes are 1–11 in. (2.5–28 cm) long and have from 11 to more than 100 diplosomites, double segments formed from the fusion of two segments. The head is legless; the next three segments have one pair of legs each; and the remaining segments have two pairs each. In defense, millipedes do not bite; most species tuck headfirst into a tight coil, and many secrete a pungent, toxic liquid or gas.

Mills, Billy *in full* **William Mervin Mills** (b. June 30, 1938, Pine Ridge, S.D., U.S.) U.S. athlete. Part Oglala Sioux, he spent his early years on a reservation in Pine Ridge and was orphaned at age 12. At the University of Kansas he excelled in track. He became the first American to win an Olympic gold medal in the 10,000-m race (1964), in an electrifying upset victory over Australian Ron Clarke. In 1965 he set an outdoor world record in the 6-mi run and U.S. records in the 10,000-m and indoor 3-mi races.

Mills, C(harles) Wright (b. Aug. 28, 1916, Waco, Texas, U.S.—d. March 20, 1962, Nyack, N.Y.) U.S. sociologist. After studying at the University of Texas (B.A., M.A., 1939) and the University of Wisconsin (Ph.D., 1941), Mills joined the faculty of Columbia University; there he became associated with the theories of MAX WEBER and with issues regarding the role of intellectuals in modern life, and he contributed to the development of a critical sociology in the U.S. and abroad. Mills believed social scientists should shun "abstracted empiricism" and become activists on behalf of social change. His radical analysis of U.S. business and society appeared in *White Collar* (1951) and *The Power Elite* (1956); other works include *The Causes of World War Three* (1958) and *The Sociological Imagination* (1959). A colourful public figure, he wore black leather and rode a motorcycle. His death at 45 resulted from heart disease.

Mill's methods Five methods of experimental reasoning distinguished by JOHN STUART MILL in his *System of Logic* (1843). Suppose one is interested in determining what factors play a role in causing a specific effect, E, under a specific set of circumstances. The method of agreement tells us to look for factors present on all occasions when E occurs. The method of difference tells us to look for some factor present on some occasion when E occurs and absent on an otherwise similar occasion when it does not. The joint method of agreement and difference combines the two previous methods. The method of residues applies when part of E is explicable by reference to known factors, and tells us to attribute the "residue" to the remaining circumstances under which E occurs. The method of concomitant variation is used when E can be present in various degrees; if we identify a factor F, such as temperature, whose variations are positively or negatively correlated with variations in E, for instance, size, then we can infer that F is causally connected with E.

millstone Either of two flat, round stones used for grinding grain to make flour. The stationary bottom stone is carved with shallow grooved channels that radiate from the centre. The upper stone rotates horizontally, and has a central hole through which grain is poured. The channels of the bottom stone lead the grain onto the flat grinding section, called the land, and to the edge, where it emerges as flour. The best millstones are made from French buhrstone, quarried near Paris. In the U.S., quartz conglomerate, quartzite, sandstone, or granite is used. Stone-ground flour accounts for only a small proportion of milled flour today.

Milne \'miln**, A(lan) A(lexander)** (b. Jan. 18, 1882, London, Eng.—d. Jan. 31, 1956, Hartfield, Sussex) English writer. He joined the

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staff of *Punch* in 1906 and produced successful light comedies and a memorable detective novel, *The Red House Mystery* (1922), before verses written for his son Christopher Robin grew into the collections *When We Were Very Young* (1924) and *Now We Are Six* (1927), which became beloved classics. Stories about the adventures of Christopher Robin and the toy animals Pooh, Piglet, Kanga, Roo, Tigger, Rabbit, Owl, and Eeyore are told in the immensely popular *Winnie-the-Pooh* (1926) and *The House at Pooh Corner* (1928).

A.A. Milne, pen and ink drawing by P. Evans, c. 1930; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Milne Bay Inlet of the South Pacific Ocean, Papua New Guinea. Located at the southeastern end of the island of New Guinea, the bay is 30 mi (50 km) long and 6–8 mi (10–13 km) wide. A Spanish explorer charted the bay in 1606; it was named by the British for Adm. Alexander Milne in 1873. European interest in it increased during the 1889–99 gold rush. Samarai, an island in the China Strait, became a boomtown from which prospectors spread through the islands of Milne Bay and to the mainland. As a Japanese base of operations in World War II, Milne Bay was the scene of Japan's first major setback in 1942, and it served as an Allied base for the remainder of the war.

Milner, Alfred *later* **Viscount Milner (of St. James's and Cape Town)** (b. March 23, 1854, Giessen, Hesse-Darmstadt—d. May 13, 1925, Sturry Court, near Canterbury, Kent, Eng.) British high commissioner in South Africa (1897–1905). At the crucial Bloemfontein Conference with Pres. Paul Kruger (1899), Milner advocated granting full citizenship to the Uitlanders (British residents in the Transvaal) after five years' residence. Kruger opposed the policy but was prepared to make concessions. Milner was not, claiming that "war has got to come"; Boer forces invaded Natal four months later, marking the beginning of the South African War. Milner later served as secretary for war (1916–19) and colonial secretary (1919–21).

Milon \'mī-ˌlän\ **of Croton** *or* **Milo of Croton** (fl. late 6th century BC) Ancient Greek athlete. The most renowned wrestler of antiquity, he won numerous Olympic and Pythian games. His name has long been synonymous with extraordinary strength, and he is said to have carried an ox on his shoulders across the Olympic stadium.

Milošević \mi-'lō-sə-ˌvich**, Slobodan** (b. Aug. 29, 1941, Požarevac, Serbia, Yugos.—found dead March 11, 2006, The Hague, Neth.) Serbian nationalist politician and president of Serbia (1989–97). He joined the Communist Party at age 18 and later became head of the state-owned gas company and president of a major Belgrade bank. Advised by his wife, a communist ideologue, he became head of the Communist Party in Belgrade (1984) and later in Serbia (1987). He replaced party leaders with his supporters, and in 1989 the Serbian assembly named him president of the republic. He maintained his power by repression and control of the mass media. He abrogated the constitutional autonomy of the Albanian province of Kosovo in 1989, which contributed to the secessionist movements in Slovenia, Croatia, and Macedonia and the breakup of Yugoslavia in 1991. He then supported Serbian militias fighting Muslims in Bosnia and Croatia (see Bosnian conflict) but later signed a peace agreement (1995) on behalf of the Bosnian Serbs. In 1999, after pro-independence insurgents began killing Serbian police and politicians, he retaliated with ruthless attacks on the province (see Kosovo conflict). NATO responded with a massive bombing campaign of Serbian targets. The subsequent ethnic cleansing of the province by troops under Milošević's command drove hundreds of thousands of Albanian Kosovars to other countries as refugees and earned him worldwide loathing as a war criminal. In 2000 he was defeated in national elections. The following year he was arrested and extradited to The Netherlands to stand trial for genocide, war crimes, and crimes against humanity. The trial began in February 2002 but was frequently delayed because of Milošević's poor health. On March 11, 2006, he was found dead in his prison cell.

Miłosz \'mē-lôsh**, Czesław** (b. June 30, 1911, Šateiniai, Lith., Russian Empire—d. Aug. 14, 2004, Kraków, Pol.) Polish-U.S. author, translator, and critic. Miłosz was a socialist by the time he published his first book of verse at age 21. During the Nazi occupation of Poland, he was active in the resistance. After serving briefly as a diplomat for communist Poland, he immigrated to the U.S., where he taught for decades at the University of California at Berkeley; he became a naturalized U.S. citizen in 1970. His poetry, including such collections as *Bells in Winter* (1978), is noted for its classical style and preoccupation with philosophical and political issues. His well-known essay collection *The Captive Mind* (1953) condemned the accommodation of many Polish intellectuals to communism. U.S. critic Helen Vendler wrote that Miłosz's *Treatise on Poetry* (1957) seemed to her "the most comprehensive and moving poem" of the latter half of the 20th century. He was awarded the Nobel Prize for Literature in 1980.

Milstein \'mil-ˌstīn, 'mil-ˌstēn**, César** (b. Oct. 8, 1927, Bahía Blanca, Arg.—d. March 24, 2002, Cambridge, Cambridgeshire, Eng.) Argentinian-born British immunologist. In 1975 Milstein and Georges Köhler (1946–95) fused short-lived, highly specific lymphocytes with the cells of a myeloma, a type of tumour that can reproduce indefinitely. The hybrid cells, like lymphocytes, secreted antibody to a single antigen and, like myeloma cells, perpetuated themselves. This enabled production of large quantities of pure antibodies against single antigenic characteristics (monoclonal antibodies). Milstein, Köhler, and Niels K. Jerne (1911–94) shared the Nobel Prize in 1984.

Miltiades \mil-'tī-ə-ˌdēz\ **the Younger** (b. c. 554, Athens—d. probably 489 BC, Athens) Athenian general. He was sent by Hippias to strengthen Athenian control of the sea routes from the Black Sea and made himself a petty tyrant there. He fought the Scythians with Darius I in 513 and supported the Persians until the Ionian revolt (499–494). When the revolt failed, he fled to Athens and led the Athenian army to victory at the Battle of Marathon (490). He was put on trial and fined the next year for a failed naval expedition meant to punish Paros for collaborating with Persia; he died in prison soon after from a gangrenous wound.

Milton, John (b. Dec. 9, 1608, London, Eng.—d. Nov. 8, 1674, Chalfont St. Giles, Buckinghamshire) English poet. A brilliant youth, Milton attended Cambridge University (1625–32), where he wrote poems in Latin, Italian, and English; these included "L'Allegro" and "Il Penseroso", both published later in *Poems* (1645). During 1632–38 he engaged in private study—writing the masque *Comus* (1637) and the extraordinary elegy "Lycidas" (1638)—and toured Italy. Concerned with the Puritan cause in England, he spent much of 1641–60 pamphleteering for civil and religious liberty and serving in Oliver Cromwell's government. His best-known prose is in the pamphlets *Areopagitica* (1644), on freedom of the press, and *Of Education* (1644). He lost his sight c. 1651, and thereafter dictated his works. His disastrous first marriage ended with his wife's death in 1652; two later marriages were more successful. After the Restoration he was arrested as a noted defender of the Commonwealth but was soon released. In *Paradise Lost* (1667), his epic masterpiece on the Fall of Man written in blank verse, he uses his sublime "grand style" with superb power; his characterization of Satan is a supreme achievement. He further expressed his purified faith in God and the regenerative strength of the individual soul in *Paradise Regained* (1671), an epic in which Christ overcomes Satan the tempter, and *Samson Agonistes* (1671), a tragedy in which the Old Testament figure conquers self-pity and despair to become God's champion. Considered second only to William Shakespeare in the history of English-language poetry, Milton had an immense influence on later literature; though attacked early in the 20th century, he had regained his place in the Western canon by mid century.

Milwaukee City (pop., 2000: 596,974) and lake port, southeastern Wisconsin, U.S. The state's largest city, it is situated on Lake Michigan. Visited by French missionaries and fur traders in the 17th century, it was called *Mahn-a-waukee Seepe* ("Gathering Place by the River") by local Indians. Although settled in 1800, the town did not develop until the Indians relinquished their claims in 1831–33. Milwaukee was formed in 1839 and incorporated in 1846. It was a centre of German immigration until c. 1900. It is a major Great Lakes port, shipping especially grain; it also produces electrical machinery. It has several educational institutions, including Marquette University and the University of Wisconsin-Milwaukee.

Milyukov \mʸil-yü-'kȯf**, Pavel (Nikolayevich)** (b. Jan. 27, 1859, Moscow, Russia—d. March 3, 1943, Aix-les-Bains, France) Russian poli-

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tician and historian. He taught history at Moscow University until 1895 and wrote the acclaimed *Outlines of Russian Culture* (3 vol., 1896–1903). A liberal who admired the political values of democratic countries, he cofounded the progressive Constitutional Democratic Party in 1905 and led the party in the Duma (1907–17). In 1917 he helped form the provisional government under Prince Georgy Y. Lvov and served briefly as minister of foreign affairs. He tried to form a moderate coalition against the Bolsheviks but was forced to leave Russia and eventually settled in Paris.

Mimamsa \mē-'mäm-sä\ Probably the earliest of the six orthodox systems (darshans) of Indian philosophy. Mimamsa is fundamental to Vedanta and has deeply influenced Hindu law. Its aim is to give rules for the interpretation of the Vedas and to provide a philosophical justification for the observance of Vedic ritual. The earliest work of the system, the *Mimamsa-sutra* of Jaimini (c. 4th century BC), was followed by the writings of a long line of interpreters and teachers, notably Kumarila Bhatta and Prabhakara Mishra (8th century). Kumarila is credited with using Mimamsa to defeat Buddhism in India; Prabhakara was a realist who believed that sense perceptions were true.

Mimana See Kaya

mime and pantomime Dramatic performance in which a story is told solely by expressive body movement. Mime appeared in Greece in the 5th century BC as a comic entertainment that stressed mimetic action but included song and spoken dialogue. A separate Roman form developed from c. 100 BC and centred on crude and licentious subjects. Roman pantomime differed from Roman mime by its loftier themes and its use of masks, which called for expression through posture and hand gestures. Mime was also important in Asian drama from ancient times, and it is an element in major Chinese and Japanese dramatic forms (e.g., Nō theatre). The Roman tradition of pantomime was modified in the 16th-century commedia dell'arte, which in turn influenced the 18th-century French and English comic interludes that developed into 19th-century pantomime, a children's entertainment emphasizing spectacle. Modern Western mime developed into a purely silent art in which meanings are conveyed through gesture, movement, and expression. Famous mimes include Jean-Gaspard Deburau, Étienne Decroux (who developed a systematic language of gesture), and Marcel Marceau. Charlie Chaplin was an accomplished mime, as were Sid Caesar and the circus clown Emmett Kelly.

Marcel Marceau, French mime, as Bip, a character of his own invention, playing the violin.
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mimicry Similarity between organisms that confers a survival advantage on one. In Batesian mimicry, an organism lacking defenses mimics a species that does have defenses. In Müllerian mimicry, all species in a group are similar even though all individually have defenses. In aggressive mimicry, a predatory species mimics a benign species so that it can approach its prey without alarming it, or a parasitic species mimics its host. Some plant species mimic the colour patterns and scents of animals for the purposes of pollination and dispersal. Mimicry differs from camouflage in that camouflage hides the organism, whereas mimicry benefits the organism only if the organism is detected.

Mimir \'mē-mir\ In Norse mythology, the wisest of the gods of the tribe Aesir. He was also believed to be a water spirit. Mimir was sent by the Aesir as a hostage to the rival gods (the Vanir), but he was decapitated and his head was returned to the Aesir. Odin preserved the head in herbs and gained knowledge from it. Other tales claim that Mimir lived by a well beneath the roots of Yggdrasill, the world tree, and that he was a smith who taught the hero Siegfried his craft.

mimosa \mə-'mō-sə\ Any member of the more than 450 species that make up the genus *Mimosa* in the family Mimosaceae, native to tropical and subtropical areas throughout both hemispheres. Most are herbaceous plants or undershrubs; some are woody climbers; a few are small trees. They are often prickly. Mimosas are widely cultivated for the beauty of their foliage and for their interesting response to light and mechanical stimuli: the leaves of some species droop in response to darkness and close up their leaflets when touched. The name comes from this "mimicking" of animal sensibility. The roots of some species are poisonous; others contain skin irritants. Many acacias are commonly but incorrectly called mimosas. See also sensitive plant.

Min River River, central Fujian province, southeastern China. Rising in the mountains near the Fujian-Jiangxi border, it flows southeast to empty into the China Sea after a course of 358 mi (577 km). The arrival of a railway system in 1957 increased its use for navigation, and there are transshipment points along it.

Min River River, Sichuan province, south-central China. Rising in the Min Mountains of northern Sichuan, it flows southward along the western side of the Sichuan Basin and empties into the Yangtze River (Chang Jiang) at Yibin. It is navigable for most of its 350-mi (560-km) course.

Minamata disease \ˌmi-nə-'mä-tə\ Disease first identified in 1956 in Minamata, Japan. A fishing port, Minamata was also the home of Nippon Chisso Hiryo Co., a manufacturer of chemical fertilizer, carbide, and vinyl chloride. Methyl mercury discharged from the factory contaminated fish and shellfish, which in turn caused illness in the local inhabitants who consumed them and birth defects in their children. The sometimes fatal disease was the first whose cause was recognized as industrial pollution of seawater. It aroused worldwide concern and stimulated the development of the environmental movement.

Minamoto Yoritomo \ˌmē-nä-'mō-tō-ˌyò-rē-'tō-mō\ (b. 1147, Japan—d. Feb. 9, 1199, Kamakura) Founder of the Kamakura shogunate, or *bakufu*. A member of the Minamoto warrior clan, Yoritomo was banished in his youth as a consequence of his father's revolt against the reigning Taira family. In exile Yoritomo found support for his cause in Hōjō Tokimasa (see Hōjō family), and in 1185 he defeated the Taira. In 1192 the cloistered emperor (see *insei*) granted him the title of shogun, which made him the supreme authority over all military forces in the country. He established his own governors (*shugo*) and stewards (*jitō*) throughout Japan, thereby creating a governmental infrastructure in competition with, and gradually superseding, that of the imperial court. He was thus able to rule without actually overthrowing the emperor, a pattern that was to be emulated by future shogunates. See also Kamakura period; Gempei War.

Minamoto Yoshitsune \ˌmē-nä-'mō-tō-ˌyò-shēt-'sùn-ā\ (b. 1159, Japan—d. June 15, 1189, Fort Koromogawa, Mutsu province, Japan) Charismatic half brother of Minamoto Yoritomo who helped bring him victory against the Taira family (see Taira Kiyomori). He was raised in a monastery but ran away at 15 to join Yoritomo. On Yoritomo's orders, Yoshitsune seized Kyōto and then attacked and defeated the remaining Taira forces along Japan's Inland Sea. Yoritomo became jealous of Yoshitsune and, though Yoshitsune eluded him for several years, eventually was able to have him killed. The Japanese have long considered Yoshitsune to be the epitome of the underdog hero; many legends, stories, kabuki plays, and even films celebrate his adventures with his faithful follower, the monk Benkei. See also Gempei War.

Minangkabau \ˌmē-näŋ-kä-'baù\ Any member of the largest ethnic group on the island of Sumatra, Indon. Though Muslim, the Minangkabau are matrilineal. Traditionally, the wife remained with her maternal relatives after marriage; her husband continued to live with his mother but visited his wife. The domestic unit, a community house, held a head woman, her sisters, their daughters, and their children and visiting husbands. Today that kinship structure has declined, and more men have left their villages to establish their own households with wives and children. Traditional Minangkabau are farmers, and their crafts include wood carving, metalwork, and weaving. Some migrated to Malaya (Peninsular Malaysia) in the 1850s to participate in the rapid expansion of Malayan tin mining; over time immigrants switched to farming, and in the 20th century they came to control most of Malaya's retail trade. The Minangkabau number two to five million.

Minas Basin \'mī-nəs\ Eastern inlet of the Bay of Fundy, into central Nova Scotia. Up to 25 mi (40 km) wide and more than 50 mi (80 km)

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long, it has some of the highest tides in the world; fluctuations exceeding 50 ft (15 m) have been recorded. Samuel de Champlain named it "Le Bassin des Mines" in 1604 after the mineral deposits found along its shores.

Minch, the Sea channel between the Outer Hebrides islands and the northwestern coast of Scotland. Its width varies from 25 to 45 mi (40 to 70 km), and it has great depth and a rapid current. Little Minch, its southern extension, lies between the island groups of the Outer and Inner Hebrides.

mind, philosophy of Branch of philosophy that studies the nature of mind and its various manifestations, including intentionality, sensation and sense perception, feeling and emotion, traits of character and personality, the unconscious, volition, thought, memory, imagination, and belief. It is distinguished from empirical studies of the mind (e.g., psychology, biology, physiology, sociology, and anthropology) by its method, which emphasizes the analysis and clarification of concepts. See also cognitive science.

mind-body problem Metaphysical problem of the relationship between mind and body. The modern problem stems from the thought of René Descartes, who is responsible for the classical formulation of dualism. Descartes's interactionism had many critics even in his own day. Thomas Hobbes denied the existence of mental substance. Materialism of a sort was also supported by Descartes's correspondent Pierre Gassendi (1592–1655). Benedict de Spinoza posited a single substance of which the mental and the material are attributes; his theory is known as psycho-physical parallelism. More recent views include the double-aspect theory, identity theory, eliminative materialism (which denies the reality of the familiar categories of mental state posited in so-called folk psychology), and theories of supervenience.

Mindanao \ˌmin-də-ˈnä-ˌō, ˌmin-də-ˈnaù\ Island (pop., 2000: 16,136,921), southern Philippines. The second largest island in the Philippines, it has an area of 36,537 sq mi (94,630 sq km); it is 324 mi (521 km) long and 293 mi (471 km) wide. It is mountainous and contains active volcanoes, including Mount Apo, the highest peak in the Philippines. The rare monkey-eating eagle is unique to the island. Islam spread throughout Mindanao in the 16th century. It was visited by Ferdinand Magellan in 1521. It was later claimed by Spain, but the resistance of its Muslim inhabitants kept it largely independent of Spanish authority. The autonomous region of Muslim Mindanao, in the western and southwestern portions of the island, was created in 1990.

Mindanao River *formerly* **Cotabato River** \ˌkō-tä-ˈbä-tō\ Main river of central Mindanao, Philippines. It meanders northwest to enter Illana Bay in two tributaries, the Cotabato and Tamentaka, after a 200-mi (320-km) course. The river system waters a fertile basin and is a major inland-transportation artery.

Mindon \ˈmin-ˈdȯn\ (b. 1814, Amarapura, Myanmar—d. Oct. 1, 1878, Mandalay) King of Myanmar (Burma; r. 1853–78). He came to power after the Second Anglo-Burmese War. He was unable to persuade the British to return Pegu (in southern Myanmar) and was also forced to make large economic concessions. Domestically, his reign was a time of numerous reforms and great cultural and religious flowering. In 1857 he built the new capital, Mandalay, with palaces and monasteries that are masterpieces of traditional Myanmar architecture. He held the Fifth Buddhist Council there in 1871 in an effort to revise and purify the Pali scriptures.

Mindoro Island (pop., 2000: 1,062,068), west-central Philippines. It is separated from Luzon on the north by the Verde Island Passage. It is 80 mi (130 km) long and 50 mi (80 km) wide, with an area of 3,759 sq mi (9,735 sq km). First visited by the Spanish in 1570, it came under U.S. rule in 1901. It was occupied by the Japanese during World War II. The tamaraw, a small water buffalo, is unique to the island.

Mindszenty \mēnd-ˈshen-tē**, József** *orig.* **Pehm József** (b. March 29, 1892, Csehimindszent, near Szombathely, Austria-Hungary—d. May 6, 1975, Vienna, Austria) Hungarian cardinal who opposed fascism and communism. Ordained a priest in 1915, he was arrested as an enemy of totalitarian governments in 1919 and again in 1944. He was appointed primate of Hungary in 1945 and made a cardinal in 1946. Refusing to permit Hungary's Roman Catholic schools to be secularized by the communists, he was arrested in 1948 and convicted of treason the next year. Sentenced to life imprisonment, he was freed in the Hungarian Revolution (1956). When the communists regained control, he sought asylum in the U.S. embassy in Budapest and lived there for 15 years, refusing Vatican requests to leave Hungary. He relented in 1971, settled in Vienna, and was retired as primate of Hungary in 1974.

mine See land mine, submarine mine

Miner, Jack *orig.* **John Thomas Miner** (b. April 10, 1865, Dover Centre, Ohio, U.S.—d. Nov. 3, 1944, Kingsville, Ont., Can.) Canadian naturalist. After moving to Canada in 1878, he established a bird sanctuary in 1904 on his farm in Kingsville, Ont. Banding more than 50,000 ducks between 1910 and 1915, he made the first complete banding records of North American birds. In 1931 his friends established the Jack Miner Migratory Bird Foundation to ensure the continuation of his work. He received the Order of the British Empire in 1943.

mineral Any naturally occurring homogeneous solid that has a definite (but not fixed) chemical composition and a distinctive internal crystal structure. Minerals are usually formed by inorganic processes. Synthetic equivalents of various minerals, such as emeralds and diamonds, are manufactured for commercial purposes. Although most minerals are chemical compounds, a small number (e.g., sulfur, copper, gold) are elements. Minerals combine with each other to form rocks. For example, granite consists of the minerals feldspar, quartz, mica, and amphibole in varying amounts. Rocks are generally, therefore, an intergrowth of various minerals.

mineral processing *or* **ore dressing** Mechanical treatment of crude ores to separate the valuable minerals. Mineral processing was at first applied only to ores of precious metals but later came to be used to recover other metals and nonmetallic minerals. It is also used during coal preparation to enrich the value of raw coal. The primary operations are comminution and concentration. Comminution is carried out by large jaw crushers and by smaller cylindrical grinding mills. Common methods of concentration are gravity separation and flotation separation. Gravity methods include jigging (ground ore is fed into a pulsating body of water so that the heavier mineral fractions settle out, leaving lighter wastes at the top) or washing the ore down inclined planes, spirals, or shaking tables so that mineral and waste fractions settle in different areas. See also beneficiation; mining.

mineralogy Scientific study of minerals, including their physical properties, chemical composition, internal crystal structure, occurrence and distribution in nature, and origins or conditions of formation. Mineralogic studies range from description and classification of new or rare minerals to analysis of crystal structure and laboratory or industrial synthesis of mineral species. The methods employed include physical and chemical identification tests, determination of crystal symmetry and structure, optical examination, X-ray diffraction, and isotope analysis.

Minerva In Roman religion, the goddess of handicrafts, the professions, the arts, and, later, war. She was commonly identified with the Greek Athena. Some scholars believe that worship of Minerva began when Athena's cult was introduced at Rome from Etruria. Minerva was one of the Capitoline triad, along with Jupiter and Juno, and her shrine in Rome was a meeting place for craftsmen's guilds. The worship of Minerva attained its greatest vogue under the emperor Domitian, who claimed her special protection.

minesweeper Naval vessel used to clear submarine mines from an expanse of water. In naval warfare, they are used to clear mines from sealanes to protect merchant shipping as well as to clear paths for warships to engage in battle or amphibious warfare. The earliest examples used sweeping wires with sawlike projections to cut the cables anchoring submarine mines and allow them to rise to the surface, where they would be destroyed by gunfire. The wide use of magnetic mines (set off by the magnetic field of steel ships) in the Korean War led to wood-hulled minesweepers.

Ming dynasty (1368–1644) Chinese dynasty that provided an interval of native rule between eras of Mongol and Manchu dominance. The Ming, one of the most stable but autocratic of dynasties, extended Chinese influence farther than did any other native rulers of China. Under the Ming, the capital of China was moved from Nanjing to Beijing, and the Forbidden City was constructed. Naval expeditions led by Zheng He paved the way for trade with Southeast Asia, India, and eastern Africa. During the Ming dynasty, novels were written in the vernacular, while philosophy benefited from the work of Wang Yangming in Neo-Confucianism. Ming monochrome porcelain became famous throughout the world, with imitations created in Vietnam, Japan, and Europe.

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Minggantu *Chinese* **Ming Antu,** *Mongolian* **Minganto** (b. ?—d. c. 1763) Chinese astronomer and mathematician. A Mongolian of the Plain White Banner (see BANNER SYSTEM), Minggantu first appeared in official Chinese records in 1712 as a student in the Imperial Astronomical Bureau. He spent his whole career there, at a time when Jesuit missionaries were in charge of calendar reforms. He took part in the compilation of the imperially commissioned *Lüli yuanyuan* (c. 1723; "Source of Mathematical Harmonics and Astronomy"), and from 1737 to 1742 he worked with the Jesuits on the revision of its astronomical section. In 1759 he became director of the Imperial Astronomical Bureau. He left an unfinished mathematical manuscript, the *Geyuan milü jiefa* ("Quick Methods for the Circle's Division and Precise Ratio"), which his student Chen Jixin completed in 1774.

Mingus, Charles (b. April 22, 1922, Nogales, Ariz., U.S.—d. Jan. 5, 1979, Cuernavaca, Mex.) U.S. JAZZ composer, bassist, and bandleader. Mingus played in the groups of LIONEL HAMPTON, DUKE ELLINGTON, and Red Norvo, ultimately working with many of the innovators of BEBOP. In 1953 he organized the Jazz Workshop ensemble, which played a spirited combination of loosely arranged passages and improvisation, incorporating elements of the BLUES and free jazz. As a pioneering bandleader and virtuoso bassist, Mingus remained an uncompromising and innovative force in jazz for the rest of his career. He was one of the most important and colourful figures in modern jazz.

Minhow See FUZHOU

miniature painting Small, detailed painting, usually a portrait, executed in watercolour on vellum (parchment), prepared card, copper, or ivory that can be held in the hand or worn as a piece of jewelry. The name derives from the *minium*, or red lead, used to emphasize initial letters in medieval illuminated manuscripts. Combining the traditions of illumination and the Renaissance medal, it flourished from the early 16th to the mid-19th century. The earliest datable examples were painted in France by JEAN CLOUET THE YOUNGER at the court of FRANCIS I; in England H. Holbein the Younger produced masterpieces in miniature under HENRY VIII and inspired a long tradition of the practice, known as "limning." NICHOLAS HILLIARD served as miniature painter to ELIZABETH I for more than 30 years. In the 17th–18th centuries, painting in enamel on metal became popular in France. In Italy ROSALBA CARRIERA introduced the use of ivory (c. 1700) as a luminous surface for transparent pigments, stimulating a great revival of the medium in the late 18th century. By the mid-19th century miniature paintings were regarded as luxury items and rendered obsolete by the new medium of photography.

Minimalism Twentieth-century movements in art and music characterized by extreme simplicity of form and rejection of emotional content. In the visual arts, Minimalism originated in New York City in the 1950s as a form of abstract art and became a major trend in the 1960s and '70s. The Minimalists believed that a work of art should be entirely self-referential; personal elements were stripped away to reveal the objective, purely visual elements. Leading Minimalist sculptors include CARL ANDRE and DONALD JUDD; Minimalist painters include ELLSWORTH KELLY and AGNES MARTIN. In music, Minimalism arose in the 1960s. It employs a steady pulsing beat, incessant repetition of tones and chords with only gradual changes in their components, a slow rate of harmonic change, and little or no counterpoint. Its principal antecedents are the musics of India and Southeast Asia. Its most important early practitioners include La Monte Young (b. 1935), Terry Riley (b. 1935), whose *In C* (1964) is perhaps its most seminal work, STEVE REICH, PHILIP GLASS, and JOHN ADAMS.

minimum In mathematics, a point at which the value of a function is lowest. If the value is less than or equal to all other function values, it is an absolute minimum. If it is merely less than at any nearby point, it is a relative, or local, minimum. In CALCULUS, the DERIVATIVE equals zero or does not exist at a function's minimum point. See also MAXIMUM, OPTIMIZATION.

minimum wage Wage rate established by COLLECTIVE BARGAINING or by government regulation, specifying the lowest rate at which workers may be employed. A legal minimum wage is one mandated by government for all workers in an economy, with few exceptions. Privately negotiated minimum wages determined by collective bargaining apply to a specific group of workers in the economy, usually in specific trades or industries. The modern minimum wage, combined with compulsory arbitration of labour disputes, first appeared in Australia and New Zealand in the 1890s. In 1909 Britain established trade boards to set minimum wage rates in certain trades and industries. The first minimum wage in the U.S. (which applied only to women) was enacted by Massachusetts in 1912. Minimum wage laws or agreements now exist in most nations.

mining Excavation of materials from the Earth's crust, including those of organic origin, such as coal and petroleum. Modern mining is costly and complicated. First, a mineral vein that can likely produce enough of the desired substance to justify the cost of extraction must be located. Then the size of the vein or deposit is determined, and mining engineers decide the best way to mine it. Most of the world's yearly mineral production is extracted by surface mining, which includes open-pit mining, strip mining, and quarrying. For ore bodies that lie a considerable distance below the surface, underground mining must be considered. In both techniques, excavating and extracting mineral substances involve costly combinations of drilling, blasting, hoisting, and hauling, as well as measures for health and safety and reduction of environmental impact.

mink Either of two species of nocturnal, semiaquatic carnivores in the WEASEL family (Mustelidae) that are trapped and raised commercially for their pelts. American mink (*Mustela vison*), found throughout North America except in arid parts of the southwestern U.S., is 17–29 in. (43–74 cm) long and weighs up to 3.5 lb (1.6 kg). The Eurasian species (*M. lutreola*) is slightly smaller. The rich brown coat consists of a dense, soft underfur overlaid with glossy guard hairs. Except for furs in the rare mutant colours produced by crossbreeding, wild mink fur is more valuable than "ranch mink."

American mink (*Mustela vison*). KARL H. MASLOWSKI

Minkowski \miŋ-ˈkôf-skē**, Oskar** (b. Jan. 13, 1858, Aleksotas, Russian Empire—d. July 18, 1931, Fürstenberg an der Havel, Ger.) German physiologist and pathologist. While researching DIABETES MELLITUS in 1884, he found that beta-hydroxybutyric acid and a decrease in blood bicarbonate cause diabetic acidosis (low blood pH) and that diabetic coma is accompanied by decreased blood carbon dioxide and can be treated by alkali therapy. Experiments on dogs with Joseph von Mering (1849–1908) led Minkowski to propose that the pancreas is the source of an "antidiabetic" substance, now known to be insulin. He also demonstrated that the liver produces bile pigments and uric acid.

Minneapolis City (pop., 2000: 382,618), eastern Minnesota, U.S. The state's largest city, it is situated on the MISSISSIPPI RIVER near the mouth of the MINNESOTA RIVER. With ST. PAUL across the river it forms the Twin Cities metropolitan area. Visited by French missionary LOUIS HENNEPIN in 1680, the area developed as a military outpost. On the eastern bank was the village of St. Anthony (inc. 1855), on the western bank, Minneapolis village (inc. 1856). In 1872 the two merged as the city of Minneapolis, which developed as a centre of the lumber and flour-milling industries. Still a grain market for the surrounding agricultural region, it is also a manufacturing centre. Its educational institutions include the University of Minnesota.

Minnelli, Vincente (b. Feb. 28, 1910, Chicago, Ill., U.S.—d. July 25, 1986, Los Angeles, Calif.) U.S. film director. He was a stage manager and costume designer from age 16, achieved success as a Broadway director c. 1935, and moved to Hollywood in 1940. He combined a daring use of colour with imaginative camera work in films such as *Cabin in the Sky* (1943), *Meet Me in St. Louis* (1944), *The Pirate* (1948), *An American in Paris* (1951), and *Gigi* (1958, Academy Award), infusing a new sophistication and vitality into filmed musicals. He also made several notable dramas, including *Father of the Bride* (1950), *The Bad and the Beautiful* (1952), and *Lust for Life* (1957). He was married to JUDY GARLAND (1945–51). Their daughter, the singer and actress Liza Minnelli (b. 1946), won a Tony Award for her performance in *Flora, the Red Menace* (1965) and an Oscar for *Cabaret* (1972).

minnesinger \ˈmi-nə-ˌsiŋ-ər, ˈmi-nə-ˌziŋ-ər\ (from German, *Minne*: "love") Any of certain German poet-musicians, c. 1150–c. 1325, parallel to the TROUBADOURS and TROUVÈRES. Like their French counterparts, the minnesingers' subjects were not limited to love but also included politics and ethics. Originally members of the high nobility, minnesingers later came from the emerging middle class and had an economic as well as social interest in singing. WALTHER von der Vogelweide, Neidhardt von Reuental (c. 1180–c. 1250), and TANNHÄUSER were among the most famous of the minnesingers.

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Minnesota State (pop., 2000: 4,919,479), midwestern U.S. Bordered by Canada and the U.S. states of Wisconsin, Iowa, South Dakota, and North Dakota, it covers 86,943 sq mi (225,182 sq km); its capital is St. Paul. The most northerly of the 48 contiguous U.S. states, it has extensive woodlands, fertile prairies, and numerous lakes. Before European settlement, the region was inhabited by the Ojibwa (Chippewa) and the Dakota (Sioux) tribes. French explorers arrived in search of the Northwest Passage in the mid 17th century. The northeastern portion passed to the British in 1763 and then to the U.S. in 1783, becoming part of the Northwest Territories in 1787. The southwestern portion was acquired by the U.S. in 1803 as part of the Louisiana Purchase, and the northwestern portion was ceded to the U.S. by the British by treaty in 1818. The first permanent U.S. settlement was made in 1819, when Fort Snelling was founded. The Minnesota Territory, established in 1849, included present-day Minnesota and the eastern sections of North and South Dakota. Minnesota became the 32nd U.S. state in 1858. The Sioux Uprising in southern Minnesota in 1862 resulted in the death of 500 civilians, soldiers, and Indians. Commercial iron-ore production began in 1884, and after the huge iron reserves of the Mesabi Range were discovered in 1890, the population at Duluth and Superior grew rapidly. Today agriculture, especially grains, meat, and dairy products, is the basis of the economy. Mineral resources include iron ore, granite, and limestone.

Minnesota Mining & Manufacturing Co. See 3M

Minnesota River River, southern Minnesota, U.S. Rising on the South Dakota–Minnesota boundary, it flows southeast then turns northeast to join the Mississippi River just south of St. Paul, after a course of 332 mi (534 km). Once known as the St. Peter or St. Pierre, it was important to early explorers and fur traders.

minnow Small fishes, especially of the carp family (Cyprinidae), as well as some rockfish (family Umbridae) and killifishes (family Cyprinodontidae). The numerous species of North American cyprinid minnows are freshwater fishes, 2.4–12 in. (6–30 cm) long. Many are valuable as food for fishes, birds, and other animals and as live bait. The bluntnose (*Pimephales notatus*) and fathead (*P. promelas*) minnows, the common shiner, and the American roach are good bait species. The term also refers to the young of many large fish species. The minnow of Europe and northern Asia (*Phoxinus phoxinus*) is about 3 in. (7.5 cm) long and varies from golden to green.

Mino da Fiesole \'mē-nō-dä-fyā-'zō-lā\ (b. 1429, Poppi, Republic of Florence—d. 1484, Florence) Italian sculptor. Probably trained in Florence, he was active both in Florence and Rome, where he created monuments (especially wall tombs) and busts of cardinals and other prominent individuals. Among the earliest Renaissance portrait sculptures, his works were greatly admired in the 19th century but are now considered less inspired than those of Desiderio da Settignano, Antonio Rossellino (1427–79), and other eminent contemporaries.

Minoan \mi-'nō-ən\ Any member of a non-Indo-European people who flourished (c. 3000–c. 1100 BC) on the island of Crete during the Bronze Age. The sea was the basis of their economy and power. Their sophisticated culture, based at Knossos, was named for the legendary King Minos. It represented the first high civilization in the Aegean area. The Minoans exerted great influence on the Mycenaean culture of the Greek islands and mainland. Minoan culture reached its peak c. 1600 BC and was noted for its cities and palaces, extended trade contacts, and use of writing (see Linear A and Linear B). Its art included elaborate seals, pottery, and, notably, the vibrant frescoes decorating palace walls, which depicted both religious and secular scenes, including goddesses reflective of a matriarchal religion. Palace ruins show evidence of paved streets and piped water. Familiar Minoan art motifs are the snake (symbol of the goddess) and the bull and leaping dancer, also of mystical significance.

Minos \'mī-nəs\ In Greek legend, a king of Crete, the son of Zeus and Europa. He gained the throne with the aid of Poseidon and also became ruler of the Aegean islands. His wife Pasiphaë fell in love with a bull and gave birth to the Minotaur, which was imprisoned in the Labyrinth. Minos waged war against Athens and exacted a tribute of youths and maidens to feed the Minotaur until Theseus killed the monster with the aid of Minos's daughter Ariadne. Minos was killed in Sicily when boiling water was poured over him as he was taking a bath. Many scholars now consider that Minos was a royal or dynastic title for the priestly rulers of Bronze Age, or Minoan, civilization in Knossos (Minoan means "of Minos").

Minot \'mī-nət\, George (Richards) (b. Dec. 2, 1885, Boston, Mass., U.S.—d. Feb. 25, 1950, Brookline, Mass.) U.S. physician. He received his medical degree from Harvard University. He reversed anemia in dogs (induced by excessive bleeding) with a diet of raw liver; subsequently he and William Murphy (1894–1987) found that eating raw liver reversed pernicious anemia in humans. They shared a Nobel Prize in 1934 with George Whipple for their treatment of the previously invariably fatal disease. He and Edwin Joseph Cohn prepared liver extracts that, taken orally, were the main treatment for pernicious anemia until 1948, when vitamin B_{12} was isolated.

Minotaur \'mi-nə-ˌtȯr\ In Greek mythology, a monster of Crete with the body of a man and the head of a bull. It was the offspring of Pasiphaë, wife of King Minos, and a snow-white bull sent by Poseidon and intended for sacrifice. When Minos kept it instead, the god punished him by making his wife fall in love with the bull. The Minotaur (whose name means "Minos bull") was imprisoned in the Labyrinth built by Daedalus. After defeating Athens in a war, Minos forced the Athenians to send human tribute to be devoured by the Minotaur. The third year the tribute was sent, Theseus volunteered to go, and with the help of Ariadne he killed the monster.

Minsk Capital (pop., 2001 est.: 1,699,000) and largest city of Belarus. Settled before 1067, it became the seat of a principality in 1101. It passed to Lithuania in the 14th century and later to Poland. Annexed by Russia in the second partition of Poland in 1793, it became a provincial centre. Minsk was occupied by French troops in 1812. It grew in importance as an industrial centre after the arrival of the railways in 1870. During World War I it was occupied first by the Germans and then by the Poles. It was almost entirely destroyed in World War II, especially during the Soviet advance in 1944. Once the capital of the Belorussian S.S.R., it remained the capital when Belarus gained independence in 1991. It is the country's administrative and industrial centre.

Minsky, Marvin (Lee) (b. Aug. 9, 1927, New York, N.Y., U.S.) U.S. computer scientist. He received a Ph.D. from Princeton University and joined the faculty at MIT, where he remained for his entire career. His research contributed to advances in artificial intelligence, cognitive psychology, neural networks (he built the first neural-network simulator in 1951), and the theory of Turing machines. A pioneer in robotics, he built some of the first mechanical hands with tactile sensors, visual scanners, and accompanying software and computer interfaces. He influenced many robotic projects outside MIT and worked to build into machines the human capacity for commonsense reasoning. In his *The Society of Mind* (1987), 270 interconnected one-page ideas reflect the structure of his theory. He received the Turing Award in 1969.

minstrel Wandering musician of the Middle Ages, often of low status. The term (and equivalents such as Latin *ioculator* and French *jongleur*) was applied in medieval times to people ranging from singing beggars to traveling musicians hired by towns for special occasions to court jesters. The modern folksinger is a descendant. See also minstrel show.

minstrel show Form of entertainment popular in the U.S. in the 19th and early 20th centuries. It originated in the 1830s with the popular white performer Thomas D. Rice, known as "Jim Crow," who wore the stylized makeup called blackface and performed songs and dances in a stereotyped imitation of African Americans. Blackfaced white minstrel troupes were particularly popular in the U.S. and England in 1840–80 and included groups such as the Christy Minstrels, who played on Broadway for 10 years and had songs composed for them by Stephen Foster. The minstrel show included an opening chorus and frequent exchanges of jokes between the emcee, Mr. Interlocutor, and the end men, Mr. Tambo (who played the tambourine) and Mr. Bones (who rattled the bones), interspersed with ballads, comic songs, and instrumental numbers (usually on the banjo and violin), as well as individual acts, soft-shoe dances, and specialty numbers. Minstrel troupes composed of African Americans were formed after the Civil War; in general, minstrel shows were the only theatrical medium in which black performers of the period could support themselves. Minstrel shows had effectively disappeared by the early 20th century, but the effects of their racial stereotyping persisted in performance mediums well into mid century.

mint In botany, any strong-scented herb of the genus *Mentha*, composed of about 25 species of perennial herbs, and certain related genera of the mint family (Lamiaceae, or Labiatae), which contains about 3,500 species of flowering plants in about 160 genera. Mints are important to humans as herb plants useful for flavour, fragrance, and medicinal prop-

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erties. True mints have square stems, oppositely arranged aromatic leaves. Small flowers usually pale purple, pink, or white, are arranged in clusters, either forming separate whorls or crowded together in a terminal spike. All *Mentha* species contain volatile oil in resinous dots in the leaves and stems. Included in this genus are PEPPERMINT, SPEARMINT, MARJORAM, ROSEMARY, and THYME; other members of the mint family include LAVENDER, HYSSOP, and CATNIP.

mint In economics, a place where coins are made according to exact compositions, weights, and dimensions, usually specified by law. The first state mint was probably established by the Lydians in the 7th century BC. The art spread through the Aegean Islands into Italy and other Mediterranean countries, as well as to Persia and India. The Romans laid the foundations of modern minting standards. Coining originated independently in China in the 7th century BC and spread to Japan and Korea. In medieval Europe, mints proliferated as every feudal authority—kings, counts, bishops, and free cities—exercised the mint privilege; the wide variation in coinage that resulted often handicapped commerce. Most countries now operate only one mint, though the U.S. has two active mints, in Philadelphia and Denver. Proof sets of coins for coin collectors are minted in San Francisco. Countries not large or prosperous enough to establish a national mint have their coins struck in foreign mints. Many mints perform functions other than minting, notably refining precious metals and manufacturing medals and seals. See also CURRENCY, MONEY.

minuet \ˌmin-yə-ˈwet\ Dignified couple dance derived from a French folk dance, dominant in European court ballrooms in the 17th–18th century. Using small, slow steps to music in ¾ time, dancers often performed choreographed figures combined with stylized bows and curtsies. The most popular dance of the 18th-century aristocracy, it fell from favour after the French Revolution in 1789. It was of great importance in art music; commonly incorporated into the SUITE c. 1650–1775, it was the only dance form retained in the SYMPHONY, SONATA, STRING QUARTET, and other multimovement art-music genres up to c. 1800.

Minuit \ˈmin-yə-wət**, Peter** (b. c. 1589, Wesel, Kleve—d. June 1638, Caribbean Sea) Dutch colonial governor of New Netherland. In 1626 the Dutch West India Co. named him director general of the colony on MANHATTAN Island. According to legend, to legitimize Dutch occupation of the island he persuaded the Indians to sell it for a handful of trinkets worth about 60 guilders ($24). At the island's southern tip he founded New Amsterdam. He was recalled to Holland (1631) and later was sent to establish the colony of New Sweden on Delaware Bay, where he again purchased land from the Indians and built Fort Christina (later Wilmington, Del.) in 1638.

minuscule \ˈmi-nəs-ˌkyül, mi-ˈnəs-ˌkyül\ Lowercase letters in CALLIGRAPHY, in contrast to MAJUSCULE, or uppercase letters. Unlike majuscules, minuscules are not fully contained between two real or hypothetical lines; their stems can go above or below the line. Developed by ALCUIN in the 8th century, it allowed the division of writing into sentences and paragraphs by beginning sentences with capital letters and ending them with periods. The script was originally rounded, but gradually the strokes became heavier until it became what is now known as Gothic or BLACK LETTER SCRIPT.

minuteman Colonial soldier of the AMERICAN REVOLUTION. Minutemen were first organized in Massachusetts in September 1774, when revolutionary leaders sought to eliminate Tories, or British sympathizers, from the militia by replacing all officers. One-third of the members of each new regiment was to be ready for military duty "at a minute's warning." Their first great test took place at the Battles of LEXINGTON AND CONCORD. On July 18 the Continental Congress recommended that other colonies organize minuteman units.

Minuteman missile U.S. ICBM first deployed in 1962. Its three generations—the Minuteman I (1962–73), the Minuteman II (1966–95), and the Minuteman III (from 1970)—have constituted most of the land-based nuclear arsenal of the U.S. since the 1960s. They were the first U.S. ICBMs to be based in underground silos, use solid fuel, and be fitted with multiple independently targeted reentry vehicles (see MIRV). Under the terms of the STRATEGIC ARMS REDUCTION TALKS, the Minuteman II force was dismantled and the Minuteman III scheduled for downgrading to a single warhead.

Miocene \ˈmī-ə-ˌsēn\ **Epoch** Major division of the TERTIARY PERIOD, from 23.8 to 5.3 million years ago. The extensive fossil record of terrestrial life during the Miocene provides a fairly complete picture of the development of vertebrates, especially mammals. Miocene mammals were essentially modern, and half of the known modern families are present in the Miocene record. The horse evolved, mainly in North America, and advanced primates, including apes, were present in southern Europe. Some interchange of faunas occurred in the Northern Hemisphere between the Old and New Worlds. Free communication was possible between Africa and Eurasia, but South America and Australia remained isolated.

Miquelon See SAINT-PIERRE AND MIQUELON

Mir Russian SPACE STATION. It consists of a core module launched in 1986 and five additional modules launched separately over the next decade and attached to the core unit to create a large, versatile space laboratory. The third generation of Russian space stations (see SALYUT), Mir featured six docking ports for modules and other spacecraft, expanded living quarters, more power, and modernized research equipment. It supported human habitation between 1986 and 2000, including an uninterrupted stretch of occupancy of almost 10 years, and it hosted a series of U.S. astronauts in 1995–98 as part of a Mir-SPACE SHUTTLE cooperative endeavour. In 1995, Valery Polyakov (b. 1942) set a world endurance record of nearly 438 days in space aboard Mir. In March 2001 the abandoned station was brought down in a controlled reentry, with the surviving pieces falling into the Pacific Ocean.

Mīr Sayyid ʿAlī (fl. 16th century) Persian miniature painter. Born in Tabrīz, he went to India about 1545. He and fellow countryman ʿABD AL-ṢAMAD instructed the artists of the imperial atelier, most of them Indians, and thereby helped to found the school of MUGHAL PAINTING. He supervised part of the production of the illustrations to the Mughal manuscript *Dāstān-e Amīr Ḥamzeh* ("Stories of Amir Hamzeh"). The few paintings by him that have survived reveal that he was a highly gifted painter, wielding a delicate brushstroke and great powers of observation.

Mira Bai \ˈmē-rä-ˈbä-ē\ (b. 1450?, Kudaki, India—d. 1547?, Dwarka, Gujarat) Rajput princess and Hindu mystic whose songs are popular in northern India. According to legend, Mirabai dedicated her life to KRISHNA after her husband's death. She received sadhus and pilgrims at her private temple dedicated to Krishna and composed songs of devotion to him, unorthodox pursuits for a widow. Her poems allude to two attempts on her life, both foiled miraculously. When a delegation of Brahmans sought to return her to her husband's kingdom, she disappeared. Only two poems bearing her signature can be dated before the 18th century, but her story is the most familiar among those of northern Indian saints.

Mirabeau \mē-rä-ˈbō**, Honoré-Gabriel Riqueti, count de** *orig.* **Honoré-Gabriel Riqueti** (b. March 9, 1749, Bignon, near Nemours, France—d. April 2, 1791, Paris) French politician and orator. Son of the economist Victor Riqueti (1715–89), he suffered his father's disfavour; often imprisoned for intrigues and wild behaviour (1774–80), he wrote several essays on prison life. In 1789 he was elected to the ESTATES GENERAL from the Third Estate. A skilled orator, he was popular with the people and was influential in the early years of the FRENCH REVOLUTION. He advocated a constitutional monarchy and tried to mediate between the absolute monarchists and the revolutionaries. He was elected president of the National Assembly in 1791, but he died shortly thereafter.

Mirabéllo, Gulf of Gulf of the AEGEAN SEA on the northern coast of CRETE, Greece. The gulf is separated by a promontory from the Bay of Sitías on the east. Olonte and Lato are ruined Classical settlements; at Gourniá and on the islets of Psíra and Mókhlos are the remains of Late MINOAN I (1600–1450 BC) settlements.

miracle Extraordinary event attributed to a supernatural power. Belief in miracles exists in all cultures and nearly all religions. The UPANISHADS assert that the experience of religious insight and transformation is the only "miracle" worth considering, but popular HINDUISM attributes miraculous powers to the ascetic yogis. CONFUCIANISM had little room for miracles. DAOISM, however, mingled with Chinese folk religion to produce a rich crop of miracles. Though BUDDHA Gautama deprecated his own miraculous powers as devoid of spiritual significance, accounts of his miraculous birth and life were later woven into his legend and into those of later Buddhist saints. Miracles are taken for granted throughout the Hebrew scriptures and were fairly common in the Greco-Roman world. The NEW TESTAMENT records miracles of healing and other wonders performed by JESUS. Miracles also attest to the holiness of Christian saints. MUHAMMAD renounced miracles as a matter of principle (the QUR'ĀN was the great

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miracle), but his life was later invested with miraculous details. Muslim popular religion, particularly under the influence of SUFISM, abounds in miracles and wonder-working saints.

miracle play Type of vernacular drama performed in the Middle Ages, presenting a real or fictitious account of the life, miracles, or martyrdom of a saint. The genre evolved from the LITURGICAL DRAMAS of the 10th–11th centuries, which were intended to enhance church calendar festivals. By the 13th century the plays were separated from church services and performed at public festivals by members of craft guilds and other amateur actors. Most miracle plays concerned either the Virgin Mary or St. NICHOLAS, both of whom had active cults in the Middle Ages. See also MORALITY PLAY; MYSTERY PLAY.

mirage \mə-'räzh\ In optics, the deceptive appearance of a distant object caused by the bending of light rays (REFRACTION) in layers of air of varying density. Under certain conditions, such as over a stretch of pavement or desert air heated by intense sunshine, the air cools rapidly with elevation and therefore increases in density and refractive power. Sunlight reflected down from the upper portion of an object will be directed through the cool air in the normal way; although the light would not be seen ordinarily because of the angle, it curves upward after it enters the rarefied hot air near the ground, thus being refracted to the observer's eye as though it had originated below the heated surface. When the sky is the object of the mirage, the land is mistaken for a lake or sheet of water.

mi'raj \'mi-räj\ In Islamic tradition, the ascension of MUHAMMAD into heaven. One night, according to the tradition, Muhammad was visited by two archangels, who opened his body and purified his heart of all doubt, error, and paganism. He was carried to heaven, where he ascended the seven levels to reach the throne of God. Along the way he and the archangel JIBRĪL met the prophets ADAM, Yaḥyā (JOHN THE APOSTLE), ʿĪsā (JESUS), Yūsuf (JOSEPH), Idrīs, Ḥarūn (AARON), Mūsā (MOSES), and Ibrāhīm (ABRAHAM) and visited hell and paradise. He learned that he was more highly regarded by God than all the other prophets. The *miʿraj* is popularly celebrated with readings of the legend on the 27th day of Rajab, called the *Laylatʿ al-Mirāj* ("Night of the Ascension").

Miranda \mi-'ran-də**, Carmen** *orig.* **Maria do Carmo Miranda da Cunha** (b. Feb. 9, 1909, Lisbon, Port.—d. Aug. 5, 1955, Beverly Hills, Calif., U.S.) Brazilian singer and actress. In the 1930s she was the most popular recording artist in Brazil, where she appeared in five films. Recruited by a Broadway producer, she starred in *The Streets of Paris* (1939), then made her U.S. film debut in *Down Argentine Way* (1940). Typecast as the "Brazilian Bombshell" and given such caricatural roles as "The Lady in the Tutti-Frutti Hat" in *The Gang's All Here* (1943), she became the highest-paid female performer in the U.S. during World War II. Her final U.S. film was *Scared Stiff* (1953).

Miranda \mē-'rän-dä**, Francisco de** (b. March 28, 1750, Caracas—d. July 14, 1816, Cádiz, Spain) Venezuelan revolutionary who helped pave the way for his country's independence. He joined the Spanish army but fled to the U.S. in 1783, where he met leaders of the AMERICAN REVOLUTION and formed plans for the liberation of South America, which he envisioned ruled by an Incan emperor and a bicameral legislature. He launched an unsuccessful invasion of Venezuela in 1806 and returned at the request of SIMÓN BOLÍVAR to fight again in 1810. He assumed dictatorial powers in 1811 when independence was declared but succumbed to a Spanish counterattack and signed an armistice. Fellow revolutionaries, viewing his surrender as traitorous, thwarted his attempt to escape. He died in a Spanish prison cell.

Miranda v. Arizona (1966) U.S. Supreme Court decision that specified a code of conduct for police during interrogations of criminal suspects. *Miranda* established that the police are required to inform arrested persons that they have the right to remain silent, that anything they say may be used against them, and that they have the right to an attorney. The case involved a claim by the plaintiff that the state of Arizona, by obtaining a confession from him without having informed him of his right to have a lawyer present, had violated his rights under the Fifth Amendment regarding SELF-INCRIMINATION. The 5-to-4 decision shocked the law-enforcement community; several later decisions limited the scope of the Miranda safeguards. See also rights of the ACCUSED.

Mirim \mē-'rēm\ **Lagoon** *Spanish* **Laguna Merín** \mā-'rēn\ Tidewater lake separating eastern Uruguay from the extreme southern tip of Brazil. It is about 118 mi (190 km) long and 30 mi (48 km) across at its widest point, covering an area of 1,542 sq mi (3,994 sq km). A low, marshy bar 10–35 mi (17–59 km) wide and containing small lagoons separates it from the Atlantic Ocean. It is navigable by shallow-draft vessels.

Miró \mē-'rō**, Joan** (b. April 20, 1893, Barcelona, Spain—d. Dec. 25, 1983, Palma de Mallorca) Spanish (Catalan) artist. He attended a commercial school and worked as an office clerk until a mental breakdown persuaded his artisan father to permit him to study art. From the beginning he sought to express concepts of nature metaphorically. From 1919 on he lived alternately in Spain and Paris, where he came under the influence of DADAISM and SURREALISM. The influence of PAUL KLEE is apparent in his "dream pictures" and "imaginary landscapes" of the late 1920s, in which linear configurations and patches of colour look almost as though they had been set down randomly. His mature style evolved from the tension between this fanciful, poetic impulse and his vision of the harshness of modern life. He worked extensively in lithography and produced numerous murals, tapestries, and sculptures for public spaces.

Joan Miró, photograph by Yousuf Karsh, 1966.
KARSH/WOODFIN CAMP AND ASSOCIATES

MIRV \'mərv\ *in full* **multiple independently targeted reentry vehicle** Any of several nuclear warheads carried on the front end of a ballistic missile. The technique allows separately targeted nuclear warheads to be released from the missile on different trajectories, thus attacking several targets from only one launcher. MIRVed ballistic missiles were first deployed by the U.S. and then the Soviet Union in the 1970s, followed by Britain and France in the 1980s and possibly China in the 1990s. Because multiple warheads represent a significant increase in firepower, they have often been an issue in arms control negotations. The STRATEGIC ARMS REDUCTION TALKS commit both the U.S. and Russia to limit the number of MIRVs on some missiles.

miscarriage *or* **spontaneous abortion** Spontaneous expulsion of an EMBRYO or FETUS from the UTERUS before it can live outside the mother. More than 60% are caused by an inherited defect in the fetus, which might result in a fatal abnormality. Other causes may include acute infectious disease, especially if it reduces the fetus's oxygen supply; abnormalities of the uterus that have physical or hormonal origins; and death of the fetus from umbilical-cord knotting. The main sign of impending miscarriage is vaginal bleeding.

misdemeanour See FELONY AND MISDEMEANOUR

Mises \'mē-zes**, Ludwig (Edler) von** (b. Sept. 29, 1881, Lemberg, Austria-Hungary—d. Oct. 10, 1973, New York, N.Y., U.S.) Austrian-U.S. economist whose theories followed those of the AUSTRIAN SCHOOL OF ECONOMICS. He taught at the University of Vienna (1913–38) before immigrating to the U.S. and joining the New York University faculty (1945–69). In *The Anti-Capitalistic Mentality* (1956), an examination of U.S. socialism, he dealt with the opposition to the free market by intellectuals, who, in his view, bear an unwarranted resentment toward mass demand, which is the basis of prosperity in big business.

Mishima \'mē-shē-mä\ **Yukio** *orig.* **Hiraoka Kimitake** (b. Jan. 14, 1925, Tokyo, Japan—d. Nov. 25, 1970, Tokyo) Japanese writer. Having failed to qualify physically for military service in World War II, Mishima worked in a Tokyo factory and after the war studied law. He won acclaim with his first novel, *Confessions of a Mask* (1949). Many of his characters are obsessed with unattainable ideals and erotic desires, as in *The Temple of the Golden Pavilion* (1956). His epic *The Sea of Fertility*, 4 vol. (1965–70), is perhaps his most lasting achievement. He strongly opposed Japan's close ties to the West in the postwar era (notably the new constitution that forbade rearmament) and yearned to preserve Japan's martial spirit and reverence for the emperor. In a symbolic gesture of these beliefs, he died by committing SEPPUKU (ritual disembowelment) after seizing a military headquarters. He is often considered one of Japan's most important 20th-century novelists.

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Mishna *or* **Mishnah** \mēsh-'nä, 'mish-nə\ Oldest authoritative collection of Jewish oral law, supplementing the written laws in the Hebrew Scriptures. It was compiled by a series of scholars over two centuries and was given final form in the 3rd century AD by JUDAH HA-NASI. Annotations by later scholars in Palestine and Babylonia resulted in the GEMARA; the Mishna and Gemara are usually said to make up the TALMUD. The Mishna has six major sections, on daily prayer and agriculture, SABBATH and other religious ritual, married life, civil and criminal law, the Temple of JERUSALEM, and ritual purification.

Mishne Torah \mēsh-'ne-tō-'rä\ Extensive commentary on the TALMUD, composed in the 12th century by MOSES MAIMONIDES. Its 14 volumes deal with laws covering such subjects as ethical conduct, civil affairs, torts, marriage and divorce, and gifts to the poor. Maimonides intended the Mishne Torah to combine religious law and philosophy and to serve as a vehicle for teaching rather than merely to prescribe conduct.

Miskito Coast See MOSQUITO COAST

Miskolc \'mish-ˌkōlts\ City (pop., 2001: 184,125), northeastern Hungary. It lies on the eastern margin of the Avas Hills. Caves in the limestone hills, inhabited from prehistoric times, now serve as cellars for the wine-making industry. Settled by Germanic tribes, Sarmatians and Avars, the town was conquered by the Hungarians in the 10th century. It was invaded by the Mongols in the 13th century. It became a free city in the 15th century. A major industrial centre, it produces iron and steel. Historic buildings include a 13th-century Gothic church.

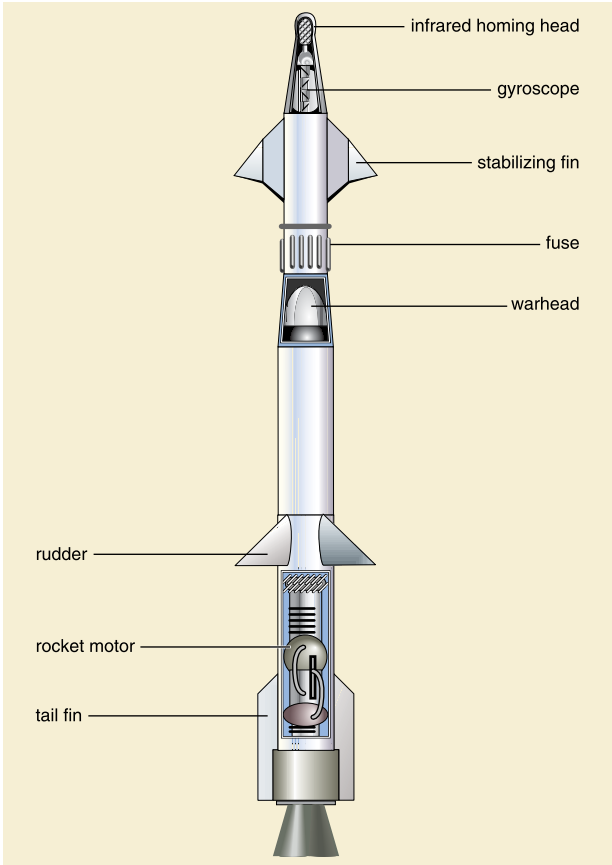
misrepresentation In law, any false or misleading expression of fact, usually with the intent to deceive or defraud. It most commonly occurs in insurance and real-estate contracts. False advertising may also constitute misrepresentation. Any contract that contains or constitutes a misrepresentation is usually rendered void, and the injured party may insist that the misrepresentation be made good.

missile ROCKET-propelled weapon designed to deliver an explosive warhead with great accuracy at high speed. Missiles vary from small tactical weapons effective out to only a few hundred feet to much larger strategic weapons with ranges of several thousand miles. They were not developed in any significant way until after World War II. Almost all contain some form of guidance and control mechanism and are therefore often called GUIDED MISSILES. An unguided military missile, as well as any launch vehicle used to penetrate the upper atmosphere or place a satellite in space, is usually called a rocket. A propeller-driven underwater missile is called a TORPEDO, and a guided missile powered along a low, level flight path by an air-breathing jet engine is called a CRUISE missile. With the development of ICBMs, missiles became central to COLD WAR strategy. See also ANTIBALLISTIC MISSILE, MINUTEMAN MISSILE, V-1 MISSILE, V-2 MISSILE. See illustration opposite.

Missile Defense Alarm System (Midas) Any of a series of unmanned U.S. military satellites developed to provide warning of surprise attacks by Soviet intercontinental ballistic missiles (ICBM). Midas was the first such warning system in the world. Launched in the early 1960s, the reconnaissance satellites were equipped with infrared sensors capable of detecting the heat of a ballistic missile's rocket exhaust shortly after firing.

mission Organized effort to spread the Christian faith. St. PAUL evangelized much of Asia Minor and Greece, and the new religion spread rapidly along the trade routes of the Roman Empire. The advance of Christianity slowed with the disintegration of the Roman Empire after AD 500 and the growth of Arab power in the 7th–8th century, but Irish and Anglo-Saxon missionaries continued to spread the faith in western and northern Europe, while missionaries of the Greek church in Constantinople worked in eastern Europe and Russia. Missions to Islamic areas and Asia began in the medieval period, and when Spain, Portugal, and France established overseas empires in the 16th century, the Roman Catholic church sent missionaries to the Americas and the Philippines. A renewed wave of Roman Catholic missionary work in the 19th century focused on Africa and Asia. Protestant churches were slower to undertake foreign missions, but in the 19th and early 20th century there was a great upsurge in Protestant missionary activity. Missionary work continues today, though it is often discouraged by the governments of former European colonies that have won independence.

Mission style *or* **Spanish Mission style** Style of the missions established by Spanish Franciscans in Florida, Texas, Arizona, New Mexico, and especially California (1769–1823). Their portals were often handsomely ornate, but the overall impression is one of simple geometric volumes of white stucco complemented by sharply incised windows and simplified interior details. Mission style also commonly refers to a style largely created in the early 20th century by GUSTAV STICKLEY, who marketed a line of plain, heavy oak furnishings inspired by those of the Spanish missions, as well as a series of house designs to suit modest incomes.



Components of an infrared-homing ("heat-seeking") air-to-air missile.
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Mississauga \ˌmi-sə-'sȯ-gə\ City (pop., 2001: 612,925), southeastern Ontario, Canada. Situated at the western end of Lake ONTARIO, southwest of TORONTO, it was settled in the early 19th century on land purchased from the Mississauga Indians. Mississauga became a town in 1968 and a city in 1974. Both a residential suburb of Toronto and an important industrial centre, it is also the site of the Lester B. Pearson International Airport.

Mississippi State (pop., 2000: 2,844,658), south-central U.S. Lying on the Gulf of Mexico, it is bordered by Tennessee, Alabama, Louisiana, and Arkansas. It covers 47,695 sq mi (123,530 sq km); its capital is JACKSON. Its landscape ranges from hills and pine woods to plains and river lowlands. Before European settlement, the area was inhabited by several Indian tribes, including the CHOCTAW, Natchez, and Chickasaw. It became part of French-controlled Louisiana, and Biloxi was settled in 1699. The northern portion was ceded to the U.S. in 1783; the southern portion was included in the Mississippi Territory (created 1798), which expanded in 1804 to include most of the present-day state. Mississippi became the 20th U.S. state in 1817. A plantation-based economy using slave labour developed in the 1820s. It seceded from the Union in 1861 and gave the Confederacy its president, JEFFERSON DAVIS. The Union capture of VICKSBURG in 1863 proved a turning point in the AMERICAN CIVIL WAR. It was readmitted to the Union in 1870 and adopted a constitution aimed at blocking RECONSTRUCTION in 1890. The state became a battleground in the struggle against

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racial segregation in the 1960s: the state's effort to block the admission of James Meredith to the University of Mississippi triggered riots in 1962; local civil rights leader Medgar Evers was murdered in 1963. After 1969, when the federal government ordered the integration of the state's segregated school system, Mississippi's long-standing racial traditions began a gradual change. Today, its economy is based on agricultural products, including cotton and soybeans. Manufactured goods include textiles and electrical equipment.

Mississippi River River, central U.S. It rises at Lake Itasca in Minnesota and flows south, meeting its major tributaries, the Missouri and the Ohio rivers, about halfway along its journey to the Gulf of Mexico. It enters the Gulf southeast of New Orleans, after a course of 2,350 mi (3,780 km). It is the largest river in North America, and with its tributaries it drains an area of 1.2 million sq mi (3.1 million sq km). Spanish explorer Hernando de Soto was the first European to discover the river in 1541. French explorers Louis Jolliet and Jacques Marquette traveled down it in 1673 as far as the Arkansas River. French explorer La Salle reached the delta in 1682 and claimed the entire Mississippi region for France, as Louisiana. France kept control over the upper river, but the lower portion passed to Spain in 1769. It was designated the western boundary of the U.S. in 1783. France sold it to the U.S. in 1803 as part of the Louisiana Purchase. During the American Civil War, Union forces captured Vicksburg, Miss., in 1863, breaking the Confederate hold on the river. As the central river artery of the U.S., it is one of the busiest commercial waterways in the world.

Mississippian culture Last major prehistoric cultural development in North America, c. AD 800–1550. It spread over much of the southeast and the mid-continent, especially in the major river valleys. It was based on intensive cultivation of corn, beans, squash, and other crops. Each large town dominated a group of satellite villages. Each had a central ceremonial plaza with one or more pyramidal or oval earthen mounds surmounted by a temple, a pattern indicating a connection to Central America. The immense Cahokia Mounds near present-day Collinsville, Ill., U.S., was the culture's largest urban centre. Craftwork was executed in copper, shell, stone, wood, and clay. The culture had already begun to decline by the time Europeans first penetrated the southeast. See also Southeastern Indian; Woodland culture.

Mississippian Period In North America, an interval of geologic time roughly equivalent to what is internationally designated the Early Carboniferous Period (354–323 million years ago). Because the rocks associated with this period are typified by those in the Mississippi valley, some U.S. geologists prefer the designation Mississippian to the European term Early Carboniferous.

Missouri State (pop., 2000: 5,595,211), midwestern U.S. Bordered by Iowa, Illinois, Kentucky, Tennessee, Arkansas, Oklahoma, Kansas, and Nebraska, it covers 69,709 sq mi (180,546 sq km); its capital is Jefferson City. The Missouri River runs from west to east across the state. The area north of it has rolling hills and fertile plains, the area south has deep valleys and swift streams. The region was originally inhabited by various Indian peoples, one of which, the Missouri, gave the state its name. The first permanent European settlement was made in 1735 at Ste. Genevieve by French hunters and lead miners. St. Louis was founded in 1764. The U.S. gained control of the region in 1803 as part of the Louisiana Purchase. It was part of Louisiana Territory in 1805 and Missouri Territory in 1812. An influx of U.S. settlers occurred after the War of 1812. Missouri became the 24th state in 1821, but only after the Missouri Compromise allowed its admission as a slave state. It suffered much tension between slaveholders and abolitionists, evidenced in the Dred Scott decision in 1857. Missouri remained in the Union during the American Civil War, though its citizens fought on both sides. After the war, its economic growth expanded and was celebrated in the St. Louis Exhibition of 1904. After World War II, its economy shifted from agriculture to manufacturing. It leads the nation in lead production, based mainly in the Ozarks region.

Missouri Compromise (1820) Act passed by the U.S. Congress admitting Missouri to the Union as the 24th state. After the territory requested statehood without slavery restrictions, Northern congressmen tried unsuccessfully to attach amendments restricting further slaveholding. When Maine (originally part of Massachusetts) requested statehood, a compromise led by Henry Clay allowed Missouri admission as a slave state and Maine as a free state, with slavery prohibited from then on in territories north of Missouri's southern border. Clay's compromise appeared to settle the slavery-extension issue but highlighted the sectional division.

Missouri Plan Method of selecting judges that originated in the state of Missouri and was later adopted elsewhere. Designed to overcome the weaknesses of the elective system, the plan permits the governor to select a judge from a list of nominees recommended by a special commission, but requires that the judge be approved in a public referendum after serving a period of time.

Missouri River River, central U.S. The longest tributary of the Mississippi River, it rises in the Rocky Mountains of southwestern Montana. It flows east to central North Dakota and south across South Dakota, forming sections of the South Dakota–Nebraska boundary, the Nebraska-Iowa boundary, the Nebraska-Missouri boundary, and the Kansas-Missouri boundary. It then meanders east across central Missouri to join the Mississippi River north of St. Louis, after a total course of 2,315 mi (3,726 km). It has been nicknamed "Big Muddy" because of the amount of silt that it carries. The first Europeans to visit its mouth were French explorers Jacques Marquette and Louis Jolliet in 1673. The first exploration of the river from its mouth to its headwaters was made in 1804–05 by the Lewis and Clark Expedition. Since the mid 20th century, programs have been instituted along its banks to check its turbulent flooding and to harness it for irrigation.

Missouri River, Little See Little Missouri River

Misti \'mēs-tē\ **Volcano** *Spanish* **Volcán Misti** Volcano, Andes Mountains, southern Peru. It is flanked by Chachani and Pichupichu volcanoes and rises to 19,098 ft (5,821 m) above sea level, towering over the city of Arequipa. Its pristine snowcapped cone is thought to have had religious significance for the Incas, and it has inspired legends and poetry. Now dormant, it last erupted during an earthquake in 1600.

mistletoe Any of many species of semiparasitic green plants of the families Loranthaceae and Viscaceae, especially those of the genera *Viscum*, *Phoradendron*, and *Arceuthobium*, all members of the Viscaceae family. *V. album*, the traditional mistletoe of literature and Christmas celebrations, is found throughout Eurasia. This yellowish evergreen bush (2–3 ft, or 0.6–0.9 m, long) droops on the branch of a host tree. The thickly crowded, forking branches bear small leathery leaves and yellowish flowers, which produce waxy-white berries containing poisonous pulp. A modified root penetrates the bark of the host tree and forms tubes through which water and nutrients pass from the host to the slow-growing but persistent parasite. The North American counterpart is *P. serotinum*. Mistletoe was formerly believed to have magical and medicinal powers, and kissing under hanging mistletoe was said to lead inevitably to marriage.

Leaves and berries of American mistletoe (*Phoradendron serotinum*)
JOHN H. GERARD

Mistral \mē-'strål**, Frédéric** (b. Sept. 8, 1830, Maillane, France—d. March 25, 1914, Maillane) French poet. A leader of the 19th-century revival of Provençal, Mistral cofounded the Félibrige, an influential association for maintaining the customs and language of Provence and later the whole of southern France. He devoted 20 years to creating a scholarly dictionary of Provençal. His literary output includes lyrics; short stories; *Memoirs of Mistral* (1906), his best-known work; and long narrative poems, including *Mirèio* (1859) and *The Song of the Rhône* (1897), his two greatest works. He shared the 1904 Nobel Prize for Literature with José Echegaray.

Frédéric Mistral, etching, 1864
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

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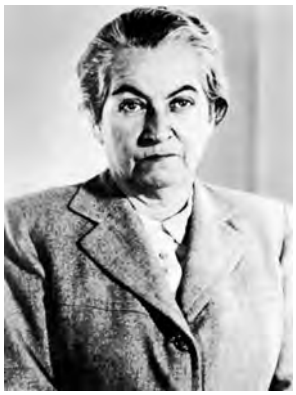
Mistral \mēs-'träl**, Gabriela** *orig.* **Lucila Godoy Alcayaga** (b. April 7, 1889, Vicuña, Chile—d. Jan. 10, 1957, Hempstead, N.Y., U.S.) Chilean poet. Mistral combined writing with a career as a cultural minister and diplomat and as a professor in the U.S. Her reputation as a poet was established in 1914 when she won a prize for three "Sonnets of Death." Her passionate lyrics, with love of children and of the downtrodden as principal themes, are collected in such volumes as *Desolación* (1922), *Tala* (1938), and *Lagar* (1954). In 1945 she became the first Latin American woman to win the Nobel Prize for Literature.



Gabriela Mistral, 1941.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

MIT See MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Mitanni \mi-'ta-nē\ Ancient kingdom of upper MESOPOTAMIA. It extended from the EUPHRATES RIVER nearly to the TIGRIS RIVER and flourished from about 1500 to 1360 BC. Founded by Indo-Iranians who settled among the Hurrian peoples of the region, it competed with Egypt for control of Syria. Under King Saustatar in the 15th century BC, the soldiers of Mitanni looted the Assyrian palace in ASHUR. In the mid-14th century BC, Wassukkani, its capital, was sacked by the Hittites, and the kingdom became part of the HITTITE empire as Hanigalbat. Shortly afterward it was made an Assyrian province.

Mitchell, Arthur (b. March 27, 1934, New York, N.Y., U.S.) U.S. dancer, choreographer, and director of the Dance Theatre of Harlem. He studied at the High School for the Performing Arts in New York City. He began dancing in Broadway musicals and worked with several ballet companies before joining the NEW YORK CITY BALLET in 1956 as its first African American dancer. He created roles in several of GEORGE BALANCHINE's ballets, including *A Midsummer Night's Dream* (1962) and *Agon* (1967), before leaving the company in 1972. In 1968 he cofounded a ballet school, and its company, the Dance Theatre of Harlem, made its debut in 1971. He has continued as its director and choreographer.

Mitchell, Billy *orig.* **William Mitchell** (b. Dec. 29, 1879, Nice, France—d. Feb. 19, 1936, New York, N.Y., U.S.) French-born U.S. aviator. He enlisted in the army and served in the Spanish-American War. He became the top U.S. air commander in World War I, initiating mass-bombing formations and leading an attack involving 1,500 planes. An outspoken advocate of a separate air force, he foresaw the replacement of the battleship by the bomber. When a navy dirigible was lost in a storm (1925), he accused the U.S. war and navy departments of incompetence; charged with insubordination, he was court-martialed and suspended from duty. He resigned in 1926 but continued to champion air power and to warn of advances by foreign air forces. In 1948 he was posthumously honoured by the new U.S. Air Force with a special medal.

Mitchell, John (Newton) (b. Sept. 5, 1913, Detroit, Mich., U.S.—d. Nov. 9, 1988, Washington, D.C.) U.S. public official. A prominent attorney in New York City, he practiced with RICHARD NIXON after their firms merged in 1967. In 1968 he managed Nixon's successful presidential campaign. As U.S. attorney general (1969–72), he was criticized for prosecuting war protesters, approving wiretaps without court authorization, and attempting to block publication of the PENTAGON PAPERS. He resigned to direct Nixon's reelection campaign but was soon caught up in the WATERGATE SCANDAL. Convicted of conspiracy, obstruction of justice, and perjury, he served 19 months in prison.

Mitchell, Joni *orig.* **Roberta Joan Anderson** (b. Nov. 7, 1943, Fort McLeod, Alta., Can.) Canadian singer and songwriter. Mitchell studied art in Calgary, where she began to sing in clubs. She eventually settled in Laurel Canyon, Calif., U.S. Several early songs, including "Both Sides Now" and "Woodstock," became hits for other artists. While her early recordings, such as *Clouds* (1969) and *Blue* (1971), were folk-oriented and reflected the idealism of the time, later releases, including *Court and Spark* (1974), *Hejira* (1976), *Mingus* (1979, with CHARLES MINGUS) and *Turbulent Indigo* (1994), were marked by strong pop and jazz influences. Her notably original lyrics and musical settings made her one of the preeminent female songwriters of the late 20th century.

Mitchell, Margaret (b. Nov. 8, 1900, Atlanta, Ga., U.S.—d. Aug. 16, 1949, Atlanta) U.S. writer. Mitchell attended Smith College and then wrote for *The Atlanta Journal* before spending 10 years writing her one book, *Gone with the Wind* (1936, Pulitzer Prize; film, 1939). A story of the American Civil War and Reconstruction from the white Southern point of view, it was almost certainly the largest-selling novel in the history of U.S. publishing to that time. A parody of the book, as told from a slave's point of view, *The Wind Done Gone* by Alice Randall, was published in 2001.

Mitchell, Mount Peak, western North Carolina, U.S. The highest U.S. peak east of the Mississippi River, it rises to 6,684 ft (2,037 m). It is situated in North Carolina's Black Mountains, part of the BLUE RIDGE system, within Mount Mitchell State Park and the Pisgah National Forest. Formerly called Black Dome, it was renamed for Elisha Mitchell, who surveyed it as the highest point in the eastern U.S. in 1835; he died on the mountain and is buried at its summit.

Mitchell, Peter Dennis (b. Sept. 29, 1920, Mitcham, Surrey, Eng.—d. April 10, 1992, Bodmin, Cornwall) British chemist. He discovered how the distribution of ENZYMES in mitochondrial membranes helps them use energy from HYDROGEN IONS to convert ADP to ATP. He received a 1978 Nobel Prize for formulating the chemiosmotic theory, which explains how energy is generated in the mitochondria of living cells.

Mitchell, Wesley C(lair) (b. Aug. 5, 1874, Rushville, Ill., U.S.—d. Oct. 29, 1948, New York, N.Y.) U.S. economist. Educated at the University of Chicago under THORSTEIN VEBLEN and JOHN DEWEY, he later taught at several universities, including Columbia (1913–19, 1922–44). He helped found the National Bureau of Economic Research in 1920 and was its director of research until 1945. His work greatly influenced the development of quantitative studies of economic behaviour in the U.S. and abroad, and he was the foremost expert of his day on BUSINESS CYCLES.

Mitchell River River, northern QUEENSLAND, Australia. Rising in the Eastern Highlands, it flows for 350 mi (560 km) northwest across Cape York Peninsula to the Gulf of CARPENTARIA. Fed by several rivers, it varies seasonally and may be dry for three months each year. It was explored in 1845 by Ludwig Leichhardt and was named for Thomas Mitchell, surveyor general for New South Wales. Crocodiles abound along its banks.

Mitchum, Robert (Charles Duran) (b. Aug. 6, 1917, Bridgeport, Conn., U.S.—d. July 1, 1997, Santa Barbara county, Calif.) U.S. film actor. Expelled from high school in New York City, he spent his teenage years wandering the country and working odd jobs. After joining an acting company in California, he made his screen debut in 1943, acting in several Hopalong Cassidy westerns. He won praise for his role in *The Story of G.I. Joe* (1945). With his trademark sleepy-eyed, tough-guy appearance, he usually played loners and villains, in movies (many of them B movies that have grown in critical esteem over time) such as *Out of the Past* (1947), *The Lusty Men* (1952), *The Night of the Hunter* (1955), *Thunder Road* (1958), *Cape Fear* (1962), *The Friends of Eddie Coyle* (1973), and *Farewell, My Lovely* (1975). In his later years, he starred in the television miniseries *Winds of War* (1983) and *War and Remembrance* (1988–89).

mite Any of about 20,000 species of tiny ARACHNIDS (subclass Acari, sometimes Acarina or Acarida). Species range from microscopic to 0.25 in. (6 mm) long. Mites live in water and soil, on plants, and as plant and animal parasites. Both parasitic and nonparasitic forms transmit plant and animal diseases. Itch mites (family Sarcoptidae), which burrow into the skin of humans and animals, cause the highly contagious disease scabies. A few species transmit tapeworms to cattle. Grain mites (family Glycyphagidae) damage stored products and irritate the skin of those who handle the products. House dust allergy is caused by species of the common genus *Dermatophagoides*. See also CHIGGER.

Red velvet mite (*Dinothrombium;* magnified about five times)
ANTHONY BANNISTER—NATURAL HISTORY PHOTOGRAPHIC AGENCY/EB INC.

Mitford, Nancy (b. Nov. 28, 1904, London, Eng.—d. June 30, 1973, Versailles, France) British writer. Born into an eccentric, aristocratic fam-

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ily, she became known for her witty satiric novels of upper-class life, including the quasi-autobiographical *The Pursuit of Love* (1945), *Love in a Cold Climate* (1949), *The Blessing* (1951), and *Don't Tell Alfred* (1960). A volume of essays she coedited, *Noblesse Oblige* (1956), popularized the distinction between linguistic usages that are "U" (upper-class) and "non-U." Her sister Jessica (1917–96) was a noted writer on U.S. society whose best-known book was *The American Way of Death* (1963).

Mithra \mē-'trȧ, 'mith-rə\ In Indo-Iranian myth, the god of light. He was born bearing a torch and armed with a knife, beside a sacred stream and under a sacred tree, a child of the earth itself. He soon rode, and later killed, the life-giving cosmic bull, whose blood fertilizes all vegetation. This deed became the prototype for a bull-slaying fertility ritual. As god of light, Mithra was associated with the Greek HELIOS and the Roman Sol Invictus. The first written reference to Mithra dates to 1400 BC. See also MITHRAISM.

Mithradates VI Eupator \ˌmith-rə-'dā-tēz...'yü-pə-ˌtȯr\ *known as* **Mithradates the Great** *Latin* **"Born of a Noble Father"** (d. 63 BC, Panticapaeum) King of PONTUS (120–63 BC) and enemy of Rome. As a boy he was coruler with his mother from c. 120, then overthrew her to become sole ruler in 115. He gradually conquered areas along the western and southern regions of the Black Sea. He waged three wars against Rome, called the Mithradatic Wars (88–85, 83–82, 74–63). Though he originally seemed a champion to Greeks seeking relief from the Roman threat, his defeat by SULLA (86) destroyed that hope. When it became necessary, he extorted money and supplies from his Greek territories in Asia Minor. Greek revolts led to cruel reprisals. Greece turned to Rome after 86 but suffered under the harsh demands of both until Mithradates was conclusively defeated by POMPEY. He was one of the few leaders to successfully challenge Roman expansion in Asia.

Mithradates VI, bust in the Louvre, Paris
CLICHE MUSEES NATIONAUX, PARIS

Mithraism \'mith-rə-ˌi-zəm\ Ancient Iranian religion based on the worship of MITHRA, the greatest of Iranian deities before the coming of ZOROASTER in the 6th century BC. It spread from India through Persia and the Hellenic world; in the 3rd–4th century AD, soldiers of the Roman empire carried it as far west as Spain, Britain, and Germany. The most important Mithraic ceremony was the sacrifice of the bull, an event associated with the creation of the world. Mithraic ceremonies were held by torchlight in subterranean caverns. A form of Mithraism in which the old Persian ceremonies were given a Platonic interpretation was popular in the 2nd–3rd century AD in the Roman empire, where Mithra was honored as the patron of loyalty to the emperor. After CONSTANTINE I accepted CHRISTIANITY in the early 4th century, Mithraism rapidly declined.

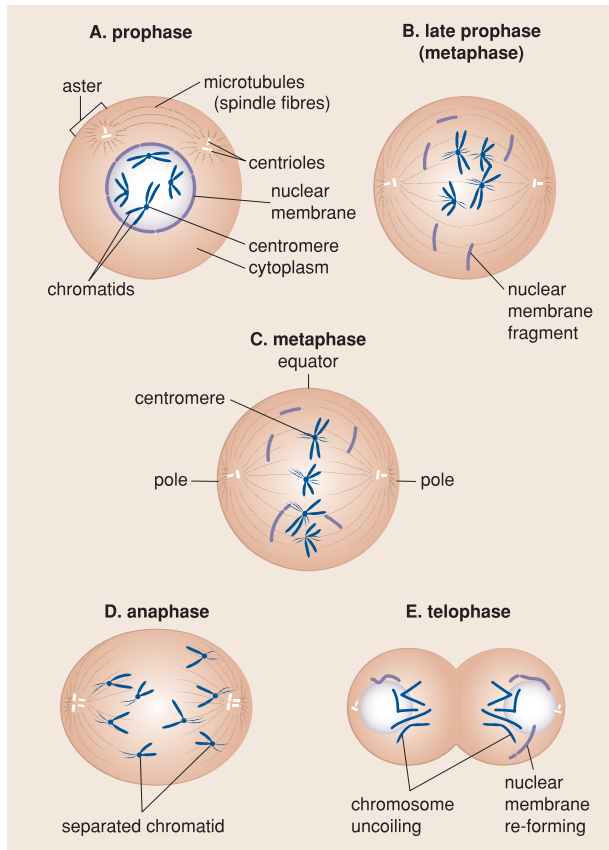
mitigating circumstance See EXTENUATING CIRCUMSTANCE

Mitilíni See LESBOS

Mitla \'mēt-lä\ Village and archaeological site, OAXACA state, southern Mexico. It lies at an elevation of 4,855 ft (1,480 m), surrounded by the mountains of the SIERRA MADRE del Sur. It was established as a sacred burial site by the ZAPOTEC, who used it until c. AD 900. The Mixtec moved down from northern Oaxaca sometime between 900 and 1500 and took possession of Mitla. The modern village, composed of thatched huts and adobe houses, serves as a base for the study of the ruins.

Mito \'mē-tō\ Japanese *HAN* (domain) belonging to one of the three branches of the Tokugawa family from which the SHOGUN was chosen during the TOKUGAWA PERIOD. During the 19th century, nationalists from Mito adopted the slogan "Sonnō jōi" ("Revere the emperor, expel the barbarians"). Tokugawa Nariaki (1800–60), DAIMYO of Mito at the time of Commodore MATTHEW PERRY's mission to Japan, called for Japan's continued isolation, supported by greater national unity and military renovation. See also II NAOSUKE; MEIJI RESTORATION; YOSHIDA SHŌIN.

mitosis \mī-'tō-səs\ Cell division, or reproduction, in which a cell gives rise to two genetically identical daughter cells. Strictly applied, the term describes the duplication and distribution of CHROMOSOMES. Prior to mitosis, each chromosome is replicated, producing two strands (chromatids) attached at a centromere. During mitosis, the membrane around the cell's nucleus dissolves and the chromatids of each chromosome are separated and pulled to each end of the cell. As the nuclear membrane re-forms around each set of chromosomes, the cytoplasm of the parent cell begins to divide to form two daughter cells. Following mitosis, the cell membrane pinches in to separate the daughter cells. Mitosis is essential to life because it provides new cells for growth and for replacement of worn-out cells. It may take minutes or hours, depending on the kind of cells and species of organisms. It is influenced by time of day, temperature, and chemicals. See also CENTROMERE, MEIOSIS.



Stages of mitosis. A. Prophase. Replicated chromosomes, consisting of two daughter strands (chromatids) attached by a centromere, coil and contract. Two pairs of specialized organelles (centrioles) begin to move apart, forming a bridge of hollow protein cylinders known as microtubules (spindle fibres) between them. Microtubules also extend in a radial array (aster) from the centrioles to the poles of the cell. B. Late prophase. As the centrioles move apart, the nuclear membrane breaks down and microtubules extend from each centromere to opposite sides or poles of the cell. C. Metaphase. The centromeres align in a plane midway between the poles known as the equator, or metaphase plate. During late metaphase, each centromere divides into two, freeing sister chromatids from each other. D. Anaphase. Sister chromatids are drawn to opposite ends as centromeric microtubules shorten and polar microtubules lengthen, causing the poles to move farther apart. E. Telophase. Chromosomes uncoil, microtubules disappear, and the nuclear membrane re-forms around each set of daughter chromosomes. The cytoplasm begins to pinch in to create two daughter cells.
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Mitra In Vedic HINDUISM, one of the gods in the category of Adityas, or sovereign principles of the universe. He represents friendship, integrity, harmony, and all other qualities necessary to maintain order in human existence. He is usually paired with Varuna, the guardian of the cosmic

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order, whose powers he complements as guardian of the human order. As spirit of the day, he is sometimes associated with the sun. His Iranian counterpart is MITHRA.

Mitre \'mē-trā**, Bartolomé** (b. June 26, 1821, Buenos Aires—d. Jan. 18, 1906, Buenos Aires) President of Argentina (1862–68). An exiled critic of the dictator JUAN MANUEL DE ROSAS, he helped defeat Rosas by leading Uruguayan forces against him, then led a successful campaign to make Buenos Aires the capital of a united Argentina. Once elected president, he suppressed the rural CAUDILLOS, extended mail and telegraph service, organized public finances, established new courts, and founded the newspaper *La Nación* (1870) and the Argentine Academy of History. See also JUSTO JOSÉ DE URQUIZA.

Mitscher \'mich-ər**, Marc A(ndrew)** (b. Jan. 26, 1887, Hillsboro, Wis., U.S.—d. Feb. 3, 1947, Norfolk, Va.) U.S. naval officer. A graduate of the U.S. Naval Academy at Annapolis, Md. (1910), Mitscher qualified as the 33rd naval pilot in 1916. In the years that followed, he helped develop naval aviation and integrate it into the fleet. In World War II he commanded the aircraft carrier *Hornet* in the Battle of MIDWAY. He later commanded aircraft carrier attacks in the battles of the Philippine Sea and LEYTE GULF and at IWO JIMA and OKINAWA. In 1946 he was promoted to admiral and made commander in chief of the U.S. Atlantic fleet.

Mitsubishi Corp. Loose consortium of independent Japanese companies. The first Mitsubishi company was a trading and shipping concern established in 1873 by Iwasaki Yataro. Several subsidiaries were created after World War I, and by the 1930s Mitsubishi was Japan's second-largest *ZAIBATSU*. During World War II it was a major military contractor, its best-known product being the ZERO fighter plane. By the end of the war Mitsubishi controlled some 200 companies. The *zaibatsu* was broken up by U.S. occupation forces, and the STOCK of the subsidiary firms was sold to the public. After the occupation, the independent Mitsubishi companies began to reassociate. The group today consists of hundreds of worldwide subsidiaries and affiliates organized into several business groups such as chemicals, electronics, and machinery.

Mitterrand \mē-tə-'rä^{n}**, François (-Maurice-Marie)** (b. Oct. 26, 1916, Jarnac, France—d. Jan. 8, 1996, Paris) President of France (1981–95). After serving in World War II, he was elected to the National Assembly (1946) and held cabinet posts in 11 Fourth Republic governments (1947–58). Moving to the political left, he opposed CHARLES DE GAULLE's government and ran unsuccessfully against him in 1965 but won 32% of the vote. In 1971 he became secretary of the FRENCH SOCIALIST PARTY and made it the majority party of the left, which led to his election as president in 1981. With a leftist majority in the National Assembly, he introduced radical economic reforms, which were modified when a right-wing majority regained power in 1986. Reelected president in 1988, he strongly promoted European integration. His domestic policy was less successful, and France experienced high unemployment. In 1991 he appointed Edith Cresson (b. 1934) prime minister, the first French woman to hold that office (1991–92). A defeat for the Socialists in the legislative elections of 1993 further moderated Mitterrand's policies.

François Mitterrand.
CAMERA PRESS/GLOBE PHOTOS

Mix, Tom *orig.* **Thomas Hezikiah Mix** (b. Jan. 6, 1880, Mix Run, Pa., U.S.—d. Oct. 12, 1940, near Florence, Ariz.) U.S. film actor. He worked as a cowhand and a deputy sheriff and served in the army and in the Texas Rangers before joining a Wild West show in 1906. He made his screen debut as a roughriding hero in 1910 and soon became a star of silent westerns. Over the years his horse, Tony, became almost as famous as Mix himself. Mix appeared in more than 200 one- and two-reelers and feature films, many of which he also produced or directed. His career declined with the coming of sound.

Mixco \'mēsh-kō\ City (pop., 1994: 209,791), south-central Guatemala. It is a western suburb of GUATEMALA CITY and supplies the capital with produce.

Mixtec \mēs-'tek\ Indian population in southern Mexico. They attained a high degree of civilization in AZTEC and pre-Aztec times, leaving behind written records. Today they practice shifting cultivation and also hunt, fish, herd, and gather wild foods. Their crafts include ceramics and weaving. Nominally Roman Catholic and active in church brotherhoods (*cofradías*), they blend pre-Christian beliefs and practices with Catholic rituals.

Mizoguchi Kenji \ˌmē-zō-'gù-chē-'ken-jē\ (b. May 16, 1898, Tokyo, Japan—d. Aug. 24, 1956, Kyōto) Japanese film director. After studying painting, he became an actor at the Nikkatsu studio in 1919 and made his debut as a director in 1922. His early films include *Street Sketches* (1925), *Tokyo March* (1929), *Osaka Elegy* (1936), and *The Story of the Last Chrysanthemums* (1939). His pictorially beautiful films, of which he made more than 80, often dealt with the conflict between modern and traditional values. He won international acclaim for *Ugetsu monogatari* (1953), an allegorical commentary on postwar Japan. He was also noted for his films about women, including *The Love of Actress Sumako* (1947), *Women of the Night* (1948), and *Street of Shame* (1956).

Mizoram \mi-'zȯ-rəm\ State (pop., 2001 prelim.: 891,058), northeastern India. Occupying an area of 8,139 sq mi (21,081 sq km), it is bounded by MYANMAR (Burma) and BANGLADESH and the states of TRIPURA, ASSAM, and MANIPUR. It is largely mountainous; its capital is AIZAWL. The various ethnic groups of Mizoram are known collectively as the Mizo (Lushai), and they speak a variety of Tibeto-Burman dialects. They were in revolt against India for decades, and the establishment of Mizoram as a union territory in 1972 failed to appease them. The conflict was settled in 1987 with the promotion of Mizoram to statehood and the election of a Mizo-led state government. The economy is based on agriculture.

Mizuno Tadakuni \mē-'zùn-ō-ˌtä-dä-'kü-nē\ (b. July 19, 1794, Edo [Tokyo], Japan—d. March 12, 1851, Edo) Chief adviser to the 12th Tokugawa SHOGUN, Tokugawa Ieyoshi (r. 1837–53). In the face of social and economic decline, Mizuno tried to implement a series of reforms that would return late TOKUGAWA-PERIOD Japan to the martial simplicity of the early days of the shogunate. He enacted sumptuary laws, canceled SAMURAI debts, decreed a price and wage cut, and tried to force unauthorized peasant migrants to leave the cities and return to the countryside. These so-called Tempo Reforms failed, and Mizuno was removed from office.

Mjollnir \'myœl-nir, 'myȯl-nir\ In Norse myth, the hammer of THOR and the symbol of his power. Forged by dwarfs, the hammer never failed Thor as a weapon or as an instrument of sanctification. It had many magical qualities, including the ability to return to Thor's hand after it had been thrown. It was stolen by the giant Thrym, who asked as ransom the hand of FREYJA. When Freyja refused to go to Thrym, Thor, masquerading as Freyja, managed to seize the hammer, which had been brought out to consecrate Freyja as Thrym's bride, and slaughtered Thrym and the other giants.

Mjøsa \'mœ-sä**, Lake** Lake, southeastern Norway. It lies north of OSLO, at the southern end of Gudbrands Valley. The country's largest lake, it serves as a link between the LÅGEN RIVER to the north and the Vorma-Glåma river system to the south. Occupying an area of 142 sq mi (368 sq km), it is 62 mi (100 km) long and 1 to 9 mi (1.6 to 14 km) wide. Lillehammer, at its northern end, and Hamar, on its eastern shore, are the largest lakeshore towns.

Mo-tzu See MOZI

moa Any of 13–25 species of extinct RATITE of New Zealand constituting the order Dinornithiformes. Species ranged from turkey-sized to 10 ft (3 m) high. Moas were swift runners that defended themselves by kicking. They were hunted for their flesh (eaten as food), bones (used as weapons and ornaments), and eggs (used for water vessels). The larger moas were probably extinct by the late 17th century; a few smaller species may have survived into the 19th century. Moas browsed and grazed on seeds, fruits, leaves, and grasses. They laid a single large egg in a hollow in the ground.

Moab \'mō-ˌab\ Kingdom, ancient Palestine. Located east of the DEAD SEA in what is now southwestern Jordan, it was bounded by EDOM and the land of the Amorites. The MOABITES were closely related to the Israelites but were sometimes at war with them and sometimes allied to them. The Moabite Stone, found at DIBON, recorded the 9th-century-BC victories of the Moab king Mesha, especially those over Israel. Moab was conquered by the BABYLONIANS in 582 BC.

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Moabites \'mō-ə-ˌbīts\ Semitic people who lived in the highlands east of the Dead Sea (now in W-central Jordan). The Moabites' culture dates from the late 14th century BC to 582 BC, when they were conquered by the Babylonians. According to the Old Testament, they were descended from Moab, a son of Lot. Though their language, religion, and culture were closely related to those of the Israelites, the Moabites were not part of the Israelite community. David's great-grandmother Ruth was a Moabite. The Moabite Stone, a stela discovered in 1868, is the only written document of any length that survives from Moab; it tells of King Omri of Israel's reconquest of Moabite lands, which the Moabites ascribed to the anger of their god, Chemosh. See also Dibon.

moai \'mō-ˌī\ **figure** Small wooden statue of uncertain religious significance, carved on Easter Island. The figures, thought to represent ancestors who live on in the form of skeletons, are of two types: *moai kavakava* (male), with a beaklike nose and goatee and occasionally an animal or a human figure incised on the head; and *moai paepae* (female), which have a flat, relieflike quality and large eyes. They were sometimes used for fertility rites but more often for harvest celebrations, when the first picking of fruits was heaped around them as offerings.

Mobil Corp. Former name of one of the largest U.S. holding companies, primarily engaged in petroleum operations but with major interests in chemical products and retailing. Mobil's roots are in two 19th-century oil companies, Vacuum Oil Co. (founded 1866) and Standard Oil Co. of New York (or Socony, 1882). Their 1931 merger created Socony-Vacuum Corp., which became Socony Mobil Oil Corp. (1955) and then Mobil Oil Corp. (1966). In 1974 Mobil Corp., the holding company, was created when Mobil Oil Corp. bought Marcor Inc. in an effort to diversify. By 1988 Mobil had sold Marcor's major non-oil-related portions, including Montgomery Ward, to refocus on petroleum products. Mobil Oil Corp. developed a full range of petroleum operations from exploration to marketing, with major production in the Gulf of Mexico, California, the Atlantic coast, Alaska, the North Sea, and Saudi Arabia. It merged with Exxon Corp. to become Exxon Mobil Corp. in 1999.

Mobile \'mō-ˌbēl, mō-'bēl\ City (pop., 2000: 198,915), southwestern Alabama, U.S. Situated on Mobile Bay at the mouth of the Mobile River, the site was explored by Spaniards in 1519. French colonists built a fort near the river's mouth in 1702. It served as the capital of French Louisiana until about 1719. It was ceded to the British in 1763 and captured by the Spanish during the American Revolution. It was seized by the U.S. during the War of 1812 and incorporated as a town in 1819. During the American Civil War it was an important Confederate port, but Federal forces won the Battle of Mobile Bay and captured the city. The state's only seaport, it is a major industrial and manufacturing centre and the site of several institutions of higher education.

mobile \'mō-ˌbēl\ Abstract sculpture that has moving parts, driven either by motors or by the natural force of air currents. Its revolving parts create a new visual experience of constantly changing volumes and forms. The term was initially suggested by Marcel Duchamp for a 1932 Paris exhibition of such works by Alexander Calder, who became the mobile's greatest exponent.

Lobster Trap and Fish Tail, mobile of painted steel wire and sheet aluminum by Alexander Calder, 1939; in the Museum of Modern Art, New York City.
COLLECTION, THE MUSEUM OF MODERN ART, NEW YORK, GIFT OF THE ADVISORY COMMITTEE

Mobile Bay Inlet of the Gulf of Mexico, extending 35 mi (56 km) north to the mouth of the Mobile River in southwestern Alabama, U.S. It is 8–18 mi (13–29 km) wide and enters the gulf through a dredged channel between Dauphin Island and Mobile Point. During the American Civil War it was the scene of the Battle of Mobile Bay.

Mobile Bay, Battle of (Aug. 5, 1864) Naval engagement in the American Civil War. The Union fleet under David Farragut sailed into Mobile Bay, Ala., breaching the protective string of mines (torpedoes) and engaging the Confederate ironclad *Tennessee*. After a two-hour battle, the Union fleet won control of the bay. With the surrender of nearby Fort Morgan, the former Confederate port of Mobile was sealed off from Confederate blockade runners.

mobilization Organization of a nation's armed forces for active military service in time of war or other national emergency. It includes recruiting and training, building military bases and training camps, and procuring and distributing weapons, ammunition, uniforms, equipment, and supplies. Full mobilization involves summoning all of a nation's resources to support the military effort; for example, civilians may gather raw materials needed by the military, conserve scarce resources such as gasoline for military use, or sell war bonds to fund the war effort.

Möbius \'mœ-bē-ûs,\ *English* \'mō-bē-əs**, August Ferdinand** (b. Nov. 17, 1790, Schulpforta, Saxony—d. Sept. 26, 1868, Leipzig) German mathematician and theoretical astronomer. He began teaching at the University of Leipzig in 1815, and established his reputation with many publications. His mathematical papers are chiefly concerned with geometry. He introduced homogeneous coordinates into analytic geometry and dealt with geometric transformations, in particular projective transformations. He was a pioneer in topology; in a memoir discovered after his death he discussed the properties of one-sided surfaces, including the famous Möbius strip.

Mobutu Sese Seko \mə-'bü-tü-'sā-sā-'sā-kō\ *orig.* **Joseph-Désiré Mobutu** (b. Oct. 14, 1930, Lisala, Belgian Congo—d. Sept. 7, 1997, Rabat, Mor.) President of Zaire (now the Democratic Republic of the Congo), 1965–97. Mobutu served in the Belgian Congolese army and as a journalist before joining Patrice Lumumba in independence negotiations in Brussels in 1960. When independence was achieved, the coalition government of Pres. Joseph Kasavubu and Premier Lumumba put Mobutu in charge of defense. In a rift between Kasavubu and Lumumba, Mobutu helped Kasavubu seize control. Four years later, in a power struggle between Pres. Kasavubu and then Premier Moise Tshombe, Mobutu removed Kasavubu in a coup and assumed the presidency. He established single-party rule and Africanized all European names, changing his own to Mobutu Sese Seko ("All-Powerful Warrior"). His repressive regime failed to spur economic growth; corruption, mismanagement, and neglect led to decline, while Mobutu himself amassed one of the largest personal fortunes in the world. He was overthrown by Laurent Kabila in 1997 and died in exile in Morocco.

mocambo See quilombo

moccasin Either of two species of pit viper: the water moccasin or the Mexican moccasin (*Agkistrodon bilineatus*). The Mexican moccasin, or cantil, is a dangerous snake of lowland regions from the Rio Grande to Nicaragua. About 3 ft (1 m) long, it is brown or black with narrow, irregular, whitish bars on its back and sides. See also copperhead.

Moche \'mō-chā\ Dominant civilization on the northern coast of present-day Peru in the 1st–8th centuries AD. The name comes from the great site of Moche in the Moche River valley, which was apparently the capital of the Moche peoples. Their settlements extended along northern Peru's hot, arid coast from the Lambayeque River valley south to the Nepeña River valley. They irrigated extensively, and their agriculture supported many urban centres, which featured stepped pyramids. They were skilled metalworkers and produced sophisticated craft goods, including fine mold-made pottery. The cause of their demise is unknown. See also Andean civilization.

Mask of copper and gold alloy with eyes of shell, found in the Huaca de la Luna, Moche River valley about 400 BC–AD 600; in the Linden-Museum, Stuttgart, Ger.
FERDINAND ANTON

mockingbird Any of several New World birds of a family (Mimidae) known for their mimicry of birdsong. The common, or northern, mockingbird (*Mimus polyglottos*) can imitate the songs of 20 or more species within 10 minutes. About 10 in. (27 cm) long, it is gray, with darker, white-marked wings and tail. It ranges from

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the northern U.S. to Brazil; it has been introduced into Hawaii and thrives in suburban areas. It sings from perches, even at night, and vigorously defends its territory. Other *Mimus* species range from Central America to Patagonia, and the blue mockingbird (genus *Melanotis*) inhabits much of Mexico. Various subspecies of the Galápagos mockingbird (genus *Nesomimus*) inhabit the different islands.

Moctezuma II See Montezuma II

modal \'mō-dᵊl\ **logic** Formal systems incorporating modalities such as necessity, possibility, impossibility, contingency, strict implication, and certain other closely related concepts. The most straightforward way of constructing a modal logic is to add to some standard nonmodal logical system a new primitive operator intended to represent one of the modalities, to define other modal operators in terms of it, and to add axioms and/or transformation rules involving those modal operators. For example, one may add the symbol L, which means "It is necessary that," to classical propositional calculus; thus, Lp is read as "It is necessary that p." The possibility operator M ("It is possible that") may be defined in terms of L as $Mp = \neg L\neg p$ (where $\neg$ means "not"). In addition to the axioms and rules of inference of classical propositional logic, such a system might have two axioms and one rule of inference of its own. Some characteristic axioms of modal logic are: (A1) $Lp \supset p$ and (A2) $L(p \supset q) \supset (Lp \supset Lq)$. The new rule of inference in this system is the Rule of Necessitation: If p is a theorem of the system, then so is Lp. Stronger systems of modal logic can be obtained by adding additional axioms. Some add the axiom $Lp \supset LLp$; others add the axiom $Mp \supset LMp$.

mode In music, any of a variety of concepts used to classify scales and melodies. In Western music, the term is particularly used for the medieval church modes. Keys in tonal music are normally said to be in either major or minor mode, depending particularly on the third degree of the scale. Indian ragas can be regarded as modes. The concept of mode may involve much more than simply a classification of scales, extending to embrace an entire vocabulary of melodic formulas and perhaps other aspects of music that traditionally occur in tandem with a given set of formulas. The term *mode* has also been used for purely rhythmic patterns such as those of the Ars Antiqua, which were based on ancient Greek poetic metres.

mode See mean, median, and mode

Model T Automobile built by the Ford Motor Co. from 1908 until 1927, the first widely affordable mass-produced car. Assembly-line production methods introduced by Henry Ford in 1913 enabled the price of this five-seat touring car to drop from $850 in 1908 to $300 in 1925. Over 15 million Model T's were built. The car was offered in several body styles, all mounted on a standard chassis. Various colors were initially available, but after 1913 its sole color was black. It was replaced by the popular Model A in 1928.

modem \'mō-ˌdəm\ Electronic device that converts digital data into analog (modulated-wave) signals suitable for transmission over analog telecommunications circuits (e.g., traditional phone lines) and demodulates received analog signals to recover the digital data transmitted. The "modulator/demodulator" thus makes it possible for existing communications channels to support a variety of digital communications, including e-mail, Internet access, and fax transmissions. An ordinary modem, operating over traditional phone lines, has a data transmission speed limit of about 56 kilobits per second. ISDN lines allow communications at over twice that rate, and cable modems and DSL lines have transmission rates of over a million bits per second.

modem, cable See cable modem

Modena \'mō-dā-nä\ City (pop., 2001 prelim.: 175,442), Emilia-Romagna region, northern Italy. It lies between the Secchia and Panaro rivers, northwest of Bologna. An ancient Etruscan city, it was made a Roman colony in 183 BC. It was attacked and pillaged by the Huns under Attila and later by the Lombards. It passed to the house of Este in 1288. It was taken by France in 1796 and made part of Napoleon's kingdom of Italy in 1805. It reverted to Este rule in 1815 before joining unified Italy in 1860. The automobile industry is important to its economy; it is also an agricultural market centre. Sites of interest include the 11th-century cathedral and the university (founded 1175).

modern dance Theatrical dance that developed in the U.S. and Europe in the 20th century as a reaction to traditional ballet. Precursors included Loie Fuller and Isadora Duncan. Formal teaching of modern dance began with the establishment of the Denishawn schools by Ruth St. Denis and Ted Shawn in 1915. Many of their students, principally Doris Humphrey and Martha Graham, further contributed to modern dance's definition as a technique based on principles of fall and recovery (Humphrey) and of contraction and release (Graham). Movement often stressed the expression of emotional intensity and contemporary subjects rather than focusing on the formal, classical, and often narrative aspects of ballet. Later developments included a revolt in the 1950s against Graham's expressionism, led by Merce Cunningham, whose choreography included ballet technique and the element of chance. See also Agnes de Mille; Hanya Holm; José Limón; Alwin Nikolais; Anna Sokolow; Paul Taylor; Twyla Tharp.

Modern Jazz Quartet (MJQ) U.S. jazz ensemble. It was founded in 1951 by pianist John Lewis (1920–2001), vibraphonist Milt Jackson (1923–99), drummer Kenny Clarke (1914–85), and bassist Ray Brown (1926–2002). They originally worked together as the rhythm section for Dizzy Gillespie's big band in 1946. The quartet established a reserved and subtle approach to the modern jazz innovations of the mid-1940s, incorporating elements of classical chamber music with original compositions and jazz standards. Percy Heath (1923–2005) replaced Brown in 1952, and Connie Kay (1927–94) replaced Clarke in 1955. The group disbanded in 1974 but reunited for annual tours beginning in the 1980s. Upon Kay's death, Percy's brother Albert ("Tootie") Heath (b. 1935) joined the group.

Modernism In the arts, a radical break with the past and concurrent search for new forms of expression. Modernism fostered a period of experimentation in the arts from the late 19th to the mid-20th century, particularly in the years following World War I. In an era characterized by industrialization, rapid social change, advances in science and the social sciences (e.g., Darwinism, Freudian theory), Modernists felt a growing alienation incompatible with Victorian morality, optimism, and convention. The Modernist impulse is fueled in various literatures by industrialization and urbanization, by the search for an authentic response to a much-changed world. Among English-language writers, the best-known Modernists are T.S. Eliot, James Joyce, Gertrude Stein, and Virginia Woolf. Composers, including Arnold Schoenberg, Igor Stravinsky, and Anton Webern, sought new solutions within new forms and used as-yet-untried approaches to tonality. In dance a rebellion against both balletic and interpretive traditions had its roots in the work of Émile Jaques-Delcroze, Rudolf Laban, and Loie Fuller. Each of them examined a specific aspect of dance—such as the elements of the human form in motion or the impact of theatrical context—and helped bring about the era of modern dance. In the visual arts the roots of Modernism are often traced back to painter Édouard Manet, who beginning in the 1860s broke away from inherited notions of perspective, modeling, and subject matter. The avant-garde movements that followed—including Impressionism, Post-Impressionism, Cubism, Futurism, Expressionism, Constructivism, De Stijl, and Abstract Expressionism—are generally defined as Modernist. Over the span of these movements, artists increasingly focused on the intrinsic qualities of their media—e.g., line, form, and colour—and moved away from inherited notions of art. By the beginning of the 20th century, architects also had increasingly abandoned past styles and conventions in favour of a form of architecture based on essential functional concerns. In the period after World War I these tendencies became codified as the International style, which utilized simple, geometric shapes and unadorned facades and which abandoned any use of historical reference; the buildings of Ludwig Mies van der Rohe and Le Corbusier embodied this style. After World War II the style manifested itself in clean-lined, unadorned glass skyscrapers and mass housing projects.

Modernismo Spanish-language literary movement of the late 19th–early 20th century, founded by Rubén Darío. Reacting against the sentimental romantic writers then popular in Latin America, *modernistas* wrote on exotic themes and often about artificial worlds—the ancient past, the distant Orient, and the lands of childhood fancy and sheer creation. With "art for art's sake" as their creed, they brought about the greatest revitalization of language and poetic technique in Spanish since the 17th century. Its adherents included Peru's José Santos Chocano (1875–1934) and Cuba's José Martí. Though the movement was over by 1920, its influence continued well into the 20th century.

modernization Transformation of a society from a rural and agrarian condition to a secular, urban, and industrial one. It is closely linked with industrialization. As societies modernize, the individual becomes increasingly important, gradually replacing the family, community, or occupational group as the basic unit of society. Division of labour, characteristic

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of industrialization, is also applied to institutions, which become more highly specialized. Instead of being governed by tradition or custom, society comes to be governed according to abstract principles formulated for that purpose. Traditional religious beliefs often decline in importance, and distinctive cultural traits are often lost.

Modersohn-Becker \'mō-dər-ˌzōn-'be-kər**, Paula** *orig.* **Paula Becker** (b. Feb. 8, 1876, Dresden, Ger.—d. Nov. 30, 1907, Worpswede) German painter. After studying art in London and Paris, she became one of the first artists to introduce French Post-Impressionism into German art. While her early work is meticulously naturalistic, her later paintings, such as *Self-Portrait with a Camellia* (1907), combine a lyrical naturalism with the broad areas of simplified colour characteristic of Paul Gauguin and Paul Cézanne. Since her painting is more concerned with the expression of her inner feelings than with the accurate portrayal of reality, she is frequently called an Expressionist. She died at 31 while giving birth to her first child.

Self-Portrait with a Camellia, oil on canvas by Paula Modersohn-Becker, 1907; in the Museum Folkwang, Essen, Germany.

COURTESY OF THE MUSEUM FOLKWANG, ESSEN, GERMANY.

Modesto City (pop., 2000: 188,856), central California, U.S., east of San Francisco. Founded in 1870 by the Central Pacific Railway, it was called Modesto (Spanish: "modest") when W.C. Ralston, a railway director, modestly declined to have the community named in his honour. It was incorporated as a city in 1884. It is a shipping centre for the surrounding agricultural region that includes fruit, nut orchards, and wineries.

Modigliani \ˌmō-dēl-'yä-nē**, Amedeo** (b. July 12, 1884, Livorno, Italy—d. Jan. 24, 1920, Paris, France) Italian painter and sculptor. After studying art in Italy, he settled in Paris (1906), where he exhibited several paintings at the Salon des Indépendants in 1908. Following the advice of Constantin Brancusi, he studied African sculpture and in 1912 exhibited 12 stone heads whose simplified and elongated forms reflect African influence. When he returned to painting, his portraits and nudes—characterized by asymmetry of composition, elongation of the figure, and a simplification of outline—reflected the style of his sculpture. By almost eliminating chiaroscuro, he achieved a sculptural quality by the strength of his contours and the richness of juxtaposed colours. In 1917 he began painting a series of female nudes that, with their warm, glowing colours and sensuous, rounded forms, are among his best works. His work reflects his lifelong admiration for Italian Renaissance masters, as well as the influence of Paul Cézanne and Brancusi. He died at 35 of tuberculosis.

Self-portrait by Amedeo Modigliani, oil on canvas, 1919; in the Museum of Contemporary Art of the University of São Paulo, Brazil.

COURTESY OF THE MUSEU DE ARTE CONTEMPORANEA DA UNIVERSIDADE DE SAO PAULO, GIFT OF MR. FRANCISCO M. SOBRINHO AND MRS. YOLANDA PENTEADO; PHOTOGRAPH, GERSON ZANINI

Modigliani \ˌmō-dēl-'yä-nē**, Franco** (b. June 18, 1918, Rome, Italy—d. Sept. 25, 2003, Cambridge, Mass., U.S.) Italian-born U.S. economist. He fled fascist Italy for the U.S. in 1939 and earned a doctorate from the New School for Social Research in 1944. He taught at several universities, including the Massachusetts Institute of Technology (1962–88; thereafter professor emeritus). His work on personal savings prompted him to formulate the life-cycle theory, which asserts that individuals build up savings during their younger working lives for use during their own old age and not as an inheritance for their descendants. In order to analyze financial markets, he invented a technique for calculating the value of a company's expected future earnings that became a basic tool in corporate decision making and finance. He received the Nobel Prize in 1985.

Modoc \'mō-ˌdäk\ North American Plateau Indian people living mostly in Oregon, U.S. Their language is of Penutian language stock, and their traditional homeland is south of the Cascade Range in northern California. Their economy was based on hunting and gathering, and they lived much like their closely related neighbours the Klamath. In 1864 the U.S. government forced the Modoc to live on Klamath lands, giving rise to the Modoc War of 1872–73. About 80 families retreated to the California Lava Beds but eventually surrendered and were removed to Oklahoma. Survivors were permitted to return to Oregon in 1909. Together with the Klamath and the Yahooskin band of Snake Indians, they form an entity known as the Klamath Tribes. About 500 people claimed sole Modoc descent in the 2000 U.S. census.

modulation In electronics, a technique for impressing information (voice, music, picture, or data) on a radio-frequency carrier wave by varying one or more characteristics of the wave in accordance with the signal. There are various forms of modulation, each designed to alter a particular characteristic of the carrier wave. The most commonly altered characteristics include amplitude (see AM), frequency (see FM), phase, pulse sequence, and pulse duration.

modulation In music, the transition from one mode or key to another. There are three principal methods of modulation in classical harmony: diatonic, in which a pivot chord is common to both keys; chromatic, in which the notes of the pivot chord are altered by a semitone; and enharmonic, in which the notes of the pivot chord, while retaining their original tones, simply assume different names. Modulation may be transitory, as in the course of thematic development, or structural, contributing to the harmonic definition of the form.

module \'mä-ˌjül\ In architecture, a unit adopted to regulate the dimensions, proportions, or construction of the parts of a building. Modules based on the diameter of a column were used in Classical architecture. In Japanese architecture, room sizes were determined by combinations of standard rice mats called tatami. Both Frank Lloyd Wright and Le Corbusier used modular proportioning systems. Standardized modular design reduces waste, lowers costs, and offers ease of erection, flexible arrangement, and variety of use; however, most architects and producers of building materials continue to use modules based on their own special needs and interests.

modulus, bulk See bulk modulus

modus ponens and modus tollens \'mō-dəs-'pō-nənz...'tò-ləns\ (Latin: "method of affirming" and "method of denying") In logic, two types of inference that can be drawn using a hypothetical proposition—i.e., from a proposition of the form "If p, then q" (symbolically $p \supset q$). Modus ponens refers to inferences of the form $p \supset q$; p, therefore q. Modus tollens refers to inferences of the form $p \supset q$; $\neg q$, therefore, $\neg p$. An example of modus tollens is the following: "If an angle is inscribed in a semicircle, then it is a right angle; this angle is not a right angle; therefore, this angle is not inscribed in a semicircle."

Moeris \'mir-əs**, Lake** Extinct lake, northern Egypt. It once occupied the Al-Fayyūm depression, now the site of the much smaller Lake Qārūn. Its waters began falling in Paleolithic times as a result of silt accumulation in the channel that flowed from the Nile River. During the Middle Kingdom (c. 2040–1786 BC), dredging renewed access to the Nile's waters. Land-reclamation projects in the 3rd century BC drained the lake, opening 450 sq mi (1,200 sq km) of alluvial soil that was irrigated by canals. The region declined after the first two centuries of Roman rule.

Moero, Lac See Lake Mweru

Moesia \'mē-shə\ Province of the Roman Empire, southeastern Europe. Bordered by the Danube River and the Black Sea, it was conquered by Rome

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(30–28 BC) and became a Roman province in AD 15. During the Dacian Wars (AD 85–89) it was divided into two provinces: Moesia Superior and Moesia Inferior. Despite barbarian invasions, it remained part of the Eastern Roman Empire until the 7th century, when it was occupied by Slavs and Bulgarians.

Mogadishu \ˌmō-gə-ˈdē-shü\ City (pop., 1999 est.: metro. area, 1,162,000), capital of SOMALIA, located north of the Equator on the Indian Ocean. Founded in the 10th century by Arab settlers, it carried on trade with the Arab states and later with the Portuguese. It fell under control of the sultan of Zanzibar in 1871. Italy leased the port in 1892 and purchased it in 1905. Subsequently the capital of Italian SOMALILAND and of the Somalia trust territory, it became the capital of independent Somalia in 1960. Civil war, beginning in the 1980s, caused widespread destruction in the city.

Mogilyov See MAHILYOW

Mogollon \ˌmō-gə-ˈyōn\ **culture** Complex of North American Indians who lived in what is now southeastern Arizona and southwestern New Mexico, U.S., c. 200 BC–AD 1200. The first pottery in the Southwest was made by the Mogollon; its high quality from the beginning suggests that the craft may have been imported from Mexico. The early economy was based on gathering wild plant foods and hunting small game. Corn cultivation emerged c. AD 500. At this time houses also became more elaborate, being constructed of stone masonry. In the final, or Mimbres, period (1050–1200), new patterns of house design (multilevel PUEBLOS centred on a plaza) and pottery (crisp black-on-white designs of animals or geometric lines) emerged, suggesting contact with the ANASAZI peoples to the north. For unknown reasons, Mogollon culture came to an end in the 13th century.

Mogul dynasty See MUGHAL DYNASTY

Mohammed, Warith Deen *orig.* **Wallace D. Muhammad** (b. Oct. 30, 1933, Detroit, Mich., U.S.) U.S. religious leader. The son of ELIJAH MUHAMMAD, head of the NATION OF ISLAM, Mohammed assumed leadership of the organization when his father died in 1975. He reformulated the Nation's teachings, rejecting the beliefs that white people were "blue-eyed devils" and that Elijah Muhammad was a prophet, and moved the Nation toward orthodox SUNNI Islam. In 1976 Mohammed renamed the organization the World Community of al-Islam in the West; the name was changed to the American Muslim Mission in 1978 and to the Muslim American Society in 1985. He also changed his own name to Warith Deen Mohammed. A minority led by LOUIS FARRAKHAN split from Mohammed in 1978 and reestablished the Nation of Islam according to the precepts of Elijah Muhammad. In 2000 Mohammed and Farrakhan recognized each other as fellow Muslims. See also ISLAM.

Mohave See MOJAVE

Mohawk North American Indian people, the easternmost group of the IROQUOIS CONFEDERACY, living in Canada and the U.S. Their language is a member of the IROQUOIAN LANGUAGE family. Their name for themselves is Kahniakehake, which means "People of the Flint" and within the confederacy they were considered to be the "Keepers of the Eastern Door." The Mohawk lived near what is now Schenectady, N.Y. They were semisedentary; women practiced corn agriculture, while men hunted during the fall and winter and fished during the summer. Related families lived together in LONGHOUSES. Most Mohawk sided with the British in both the FRENCH AND INDIAN WAR and the American Revolution, in the latter under JOSEPH BRANT. They number more than 35,000 and have a wide reputation as structural ironworkers; many have been hired in the building of major bridges.

Mohawk River River, east-central New York, U.S. The HUDSON RIVER's largest tributary, it flows 148 mi (238 km) south and east to join the Hudson at Waterford, north of Troy. The Mohawk Valley (Mohawk Trail) was the historic route of westbound pioneers through the APPALACHIAN MOUNTAINS into the GREAT LAKES region. The Five Nations of the IROQUOIS CONFEDERACY lived in the valley, which was a major battleground during the FRENCH AND INDIAN WAR and the AMERICAN REVOLUTION.

Mohegan \mō-ˈhē-gən\ ALGONQUIAN-speaking North American Indian people who once inhabited the area of southeastern Connecticut, U.S. They later seized land in Massachusetts and Rhode Island from other tribes. Their economy was based on corn cultivation, hunting, and fishing. In the 17th century the Mohegan and the PEQUOT tribes were ruled jointly by a Pequot chief, but a rebellion led to Mohegan independence and the destruction of the Pequot. Having made an alliance with the English, the Mohegan were the only important tribe remaining in southern New England after KING PHILIP'S WAR (1675–76). Today there is a remnant (approx. 1,000) near Norwich, Conn.

Mohenjo Daro Ancient city on the bank of the Indus River, in present-day southern Pakistan. At about 3 mi (5 km) in circuit, it was the largest city of the INDUS CIVILIZATION in the 3rd–2nd millennium BC, and it probably served as the capital of an extensive state. It was fortified, and its citadel contained, according to archaeological finds, an elaborate bath, a granary, and two halls of assembly.

Mohican \mō-ˈhē-kən\ *or* **Mahican** \mə-ˈhē-kən\ North American Indian people living mostly in northeastern Wisconsin, U.S. Their original territory was the upper Hudson River valley above the Catskill Mountains. Their name for themselves is Muh-he-con-neok, meaning "The People of the Waters That Are Never Still." The Mahican consisted of five major divisions governed by hereditary sachems (chiefs) assisted by elected counselors. They lived in strongholds of 20–30 houses situated on hills or in woodlands. In 1664 they were forced by the MOHAWK to move to what is now Stockbridge, Mass., where they became known as the Stockbridge Indians. Later they moved to Wisconsin. Some 1,200 people claimed sole Mohican descent in the 2000 U.S. census. James Fenimore COOPER drew a romanticized portrait of the declining Mohican in *The Last of the Mohicans* (1826).

Mohism See MOZI

Moho \ˈmō-ˌhō\ *or* **Mohorovičić** \ˌmō-hə-ˈrō-və-ˌchich\ **discontinuity** Boundary between the Earth's CRUST and its MANTLE. The Moho lies at a depth of about 22 mi (35 km) below continents and about 4.5 mi (7 km) beneath the oceanic crust. Modern instruments have determined that the velocity of SEISMIC WAVES increases rapidly at this boundary. The Moho was named for ANDRIJA MOHOROVIČIĆ.

Moholy-Nagy \ˈmȯ-hȯi-ˈnädʲ**, Lászlo** (b. July 20, 1895, Bacsbarsod, Hung.—d. Nov. 24, 1946, Chicago, Ill., U.S.) Hungarian painter, photographer, and art teacher. After studying law in Budapest, he went to Berlin in 1919, and in 1923 he took charge of the metal workshop of the BAUHAUS as well as the *Bauhausbook* series of publications. As a painter and photographer he worked predominantly with light. His "photograms" were composed directly on film, and his "light modulators" (oil paintings on transparent or polished surfaces) included mobile light effects. As an educator, he developed a widely accepted curriculum to develop students' natural visual gifts instead of specialized skills. Fleeing Nazi Germany in 1935, he went to London and then to Chicago, where he organized and headed the New Bauhaus.

Mohorovičić, Andrija (b. Jan. 23, 1857, Volosko, Croatia, Austrian Empire—d. Dec. 18, 1936, Zagreb, Yugos.) Croatian meteorologist and geophysicist who discovered the boundary between the Earth's CRUST and the MANTLE, later named the Mohorovičić discontinuity, or MOHO. A professor at the Main Technical School in Zagreb, he was also director of its meteorologic observatory from 1892. From observations of SEISMIC WAVES, he deduced that the solid Earth consists of an outer and inner layer and that between them lies a distinct boundary. He also devised a technique for locating earthquake epicentres and calculated the travel time of seismic waves. He was an early advocate of earthquake-resistant construction.

Mohs \ˈmōz\ **hardness** Rough measure of the resistance of a smooth surface to scratching or abrasion, expressed in terms of a scale devised by German mineralogist Friedrich Mohs in 1812. Minerals are ranked in comparison with the Mohs scale, which is made up of 10 minerals that have been given arbitrary hardness values on a scale from 1 (least hard, or talc) to 10 (hardest, or diamond). See table on following page.

Moi \ˈmȯi**, Daniel (Toroitich) arap** (b. 1924, Sacho, Kenya Colony) Five-term president of Kenya (1978–2002). Trained as a teacher, Moi served in the cabinet and as vice president (1967–78) under Pres. JOMO KENYATTA before succeeding him as president. Head of the dominant Kenya African National Union (KANU) party, he governed autocratically, finally permitting multiparty elections in 1991, when international pressure forced his hand. His subsequent electoral victories (1992, 1997) led to civil unrest and charges of stealing the elections. During his time in office some sectors of the economy grew, but critics have attributed this to the strong political patronage system. Under Kenya's constitution, Moi was

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Mohs Hardness Scale

Mineral	Mohs no.	Other materials	Description
Talc	1		very easily scratched by the fingernail; has a greasy feel
Gypsum	2	~2.2 fingernail	can be scratched by the fingernail
Calcite	3	~3.2 copper penny	very easily scratched with a knife and just scratched with a copper coin
Fluorite	4		very easily scratched with a knife but not as easily as calcite
Apatite	5	~5.1 pocketknife ~5.5 glass plate	scratched with a knife with difficulty
Orthoclase	6	~6.5 steel needle	cannot be scratched with a knife, but scratches glass with difficulty
Quartz	7	~7.0 streak plate	scratches glass easily
Topaz	8		scratches glass very easily
Corundum	9		cuts glass
Diamond	10		used as a glass cutter

not allowed to stand in the 2002 presidential election and was succeeded by the winner, opposition candidate Mwai Kibaki.

Moiseyev \mȯi-'sā-ef**, Igor (Aleksandrovich)** (b. Jan. 21, 1906, Kiev, Ukraine, Russian Empire) Russian dancer, choreographer, and founder-director of the State Academic Folk Dance Ensemble, popularly called the Moiseyev Ensemble. He joined the Bolshoi Ballet in 1924. In 1936 he became head choreographer at Moscow's Theatre of Folk Art, and he later founded the State Academic Folk Dance Ensemble, in which ballet professionals performed dances from all U.S.S.R. republics. His choreography combined authentic folk-dance steps with theatrical effects, and he created more than 170 dances for the ensemble. The ensemble served as a model for other countries in subsequently forming their own folk-dance ensembles.

Mojave \mō-'hä-vē\ *or* **Mohave** North American Indian farmers living mostly in Arizona, U.S. The Mojave language is a member of the Yuman language family. The traditional territory of the people was the Mojave Desert along the lower Colorado River. This valley was a patch of green surrounded by barren desert. In addition to farming, the Mojave fished, hunted, and gathered wild plants. The essential social unit was the patrilineal family. There were no settled villages; wherever there was suitable floodland for farming, the Mojave built scattered houses. They believed in a supreme creator and attached great significance to dreams, considered the source of all special powers. About 1,500 Mojave live on or near the Colorado River reservation in Arizona.

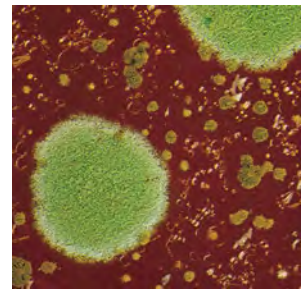
Mojave \mō-'hä-vē\ **Desert** *or* **Mohave Desert** Arid region, southeastern California, U.S. Occupying more than 25,000 sq mi (65,000 sq km), it extends from the Sierra Nevada to the Colorado Plateau and merges with the Great Basin Desert to the north and the Sonoran Desert to the south and southeast. Together with the Sonoran, Great Basin, and Chihuahuan deserts it forms the North American Desert. The Mojave Desert receives an average annual rainfall of 5 in. (13 cm). It is the location of Joshua Tree National Park.

moksha *or* **moksa** \'mōk-shə\ In Hinduism and Jainism, the ultimate spiritual goal, the soul's release from the bonds of transmigration. The soul, once entered upon a bodily existence, remains trapped in a chain of successive rebirths until it has attains the perfection or enlightenment that allows it release. The methods by which release is sought and attained differ from one philosophical school to the next, but most schools consider moksha to be the highest purpose of life.

mol See mole

Molcho \'mȯl-k̲ō**, Solomon** *orig.* **Diogo Pires** (b. c. 1500, Portugal—d. 1532, Mantua) Portuguese Jewish martyr. Born into a Marrano family, he became royal secretary in a Portuguese high court of justice. When an Arabian adventurer, David Reubeni (d. c. 1532), arrived in Portugal, mystic visions convinced Pires that Reubeni was a herald of the messiah. After circumcising himself and changing his name, he preached the coming of the messiah in Turkey, Palestine, and Rome. In 1532 he and Reubeni were imprisoned by Charles V and turned over to the Inquisition. Molcho refused to recant his faith and was burned at the stake.

mold In biology, a conspicuous mass of mycelium and fruiting structures produced by various fungi (division Mycota; see fungus). Molds of the genera *Aspergillus*, *Penicillium*, and *Rhizopus* are associated with food spoilage and plant diseases, but some have beneficial uses, as in the manufacture of antibiotics (e.g., penicillin) and certain cheeses. *Neurospora*, or orange bread mold, has been invaluable in the study of biochemical genetics. Water molds live in fresh or brackish water or wet soils, absorbing dead or decaying organic matter. See also slime mold.



Mold on surface of jelly
INGMAR HOLMASEN

mold In manufacturing, a cavity or surface in which a fluid or plastic substance is shaped into a desired finished product. A molten substance, such as metal or plastic, is poured or forced into a mold and allowed to harden. Molds are made of various materials, depending on the application; sand is frequently used for metal casting, hardened steel for molds for plastic materials, and plaster for various purposes. See also ingot, patternmaking, tool and die making.

Mold Town (pop., 1995 est.: 9,000), historic and present county of Flintshire, northeastern Wales. Situated between the industrial centres of Deeside and Wrexham, it grew up around a motte-and-bailey castle built by the Normans in the 12th century. In the area native Briton Christians had defeated the pagan Picts and Scots in a battle waged in AD 430. Long a market hub, it is the administrative centre and historic county seat of Flintshire.

Moldavia \mäl-'dā-vē-ə\ Former principality, southeast-central Europe. Located on the lower Danube River, it was founded in the 14th century by the Vlachs and achieved independence in 1349. In the mid-16th century it was part of the Ottoman Empire. In 1774 it came under Russian control; it soon lost its northwestern territory, Bukovina, to Austria and its eastern portion and Bessarabia to Russia. In 1859 Moldavia and Walachia formed the state of Romania. In 1918 the territories earlier ceded by Moldavia joined Romania. In 1924 the Soviet Union created a Moldavian Autonomous Soviet Socialist Republic on territory east of the Dniester River, within the Ukrainian S.S.R. See also Moldova.

molding In architecture and the decorative arts, a defining, transitional, or terminal element that serves to contour or outline edges and surfaces. The surface of a molding may be plain or modeled with recesses and reliefs, which either maintain a constant profile along its length or are set in rhythmically repeated patterns. Types of flat or angular moldings are the fascia, chamfer (or bevel), and fillet (narrow band). Single curved moldings include the cavetto (concave, with a quarter-circle profile), scotia (deep concave), flute (grooved), ovolo (convex, with a quarter-circle profile), torus (semicircular convex), roll (rounded convex), and astragal (narrow semicircular convex). Among the most common compound moldings are the projecting, double-curved cyma recta or ogee, often used as a crown molding, and the cyma reversa, used for crown or base. The profiles of moldings are traditionally enhanced by flower or leaf forms, geometric motifs, or spirals. See illustration opposite.

Moldova \mȯl-'dȯ-və\ *officially* **Republic of Moldova** Country, northeastern Balkan Peninsula, southeastern Europe. It is bordered by Ukraine and Romania. Area: 13,068 sq mi (33,845 sq km). Population (2005 est.): 4,206,000. Capital: Chişinău. Nearly half the population is Moldovan; there also are large numbers of Russians and Ukrainians, especially in the Transnistria region, east of the Dniester River. Languages: Romanian (officially designated as Moldovan), Russian, Ukrainian. Religions: Christianity (mostly Eastern Orthodox, also other Christians); also Islam. Currency: leu. Most of Moldova is a fertile region lying between the Dniester and Prut rivers; the northern and central regions of the country are forested. The economy is based on agriculture; the major farm products are grapes, winter wheat, corn, and dairy products. Industry is centred on food processing. Moldova is a republic with one legislative body; its head of state is the president, and the head of government is the prime minister. The area of present-day Moldova consists of that part of the historic principality of Moldavia lying east of the Prut River (part of Romania before 1940) and, adjoining it on the south, the region of Bessa-

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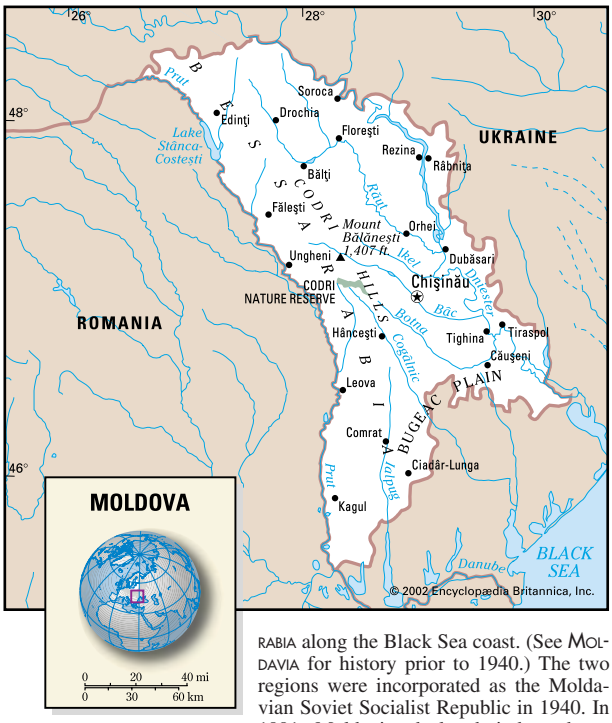
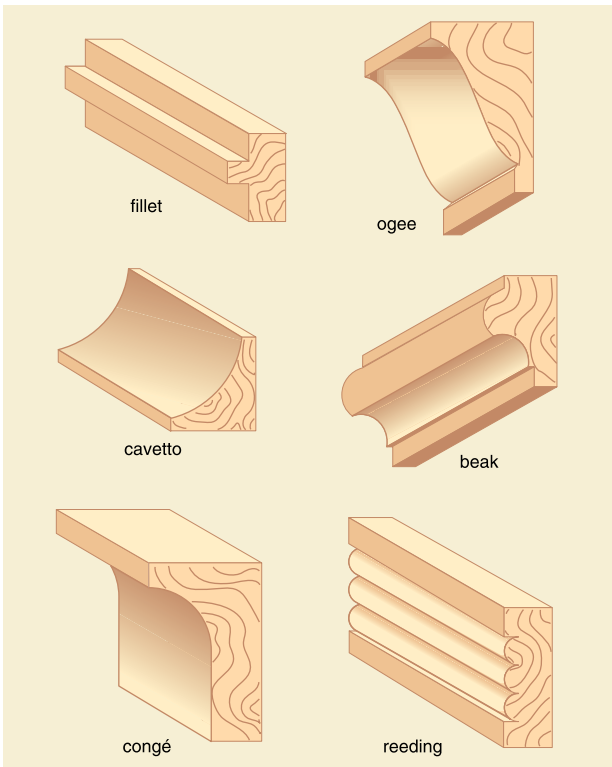


RABIA along the Black Sea coast. (See MOLDAVIA for history prior to 1940.) The two regions were incorporated as the Moldavian Soviet Socialist Republic in 1940. In 1991 Moldavia declared independence from the Soviet Union. It adopted the Romanian spelling of Moldova, having earlier legitimized use of the Roman rather than the Cyrillic alphabet. Moldova was admitted to the UN in 1992. In 2000 it abandoned its semipresidential form of government to become a parliamentary republic.



Examples of common molding styles.
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mole *or* **mol** \'mōl\ Standard unit for measuring everyday quantities of such minute entities as ATOMS or MOLECULES. For any substance, the number of atoms or molecules in a mole is AVOGADRO'S NUMBER (6.02×10^{23}) of particles. Defined exactly, it is the amount of pure substance containing the same number of chemical units that there are in exactly 12 g of CARBON-12. For each substance, a mole is its ATOMIC WEIGHT, MOLECULAR WEIGHT, or FORMULA WEIGHT in GRAMS. The number of moles of a solute in a litre of SOLUTION is its molarity (M); the number of moles of solute in 1,000 g of SOLVENT is its molality (m). The two measures differ slightly and have different uses. See also STOICHIOMETRY.

mole Any burrowing, often blind INSECTIVORE in the family Talpidae (including 42 species of true moles) or Chrysochloridae (18 species of golden moles). Most species have short legs and tail, a pointed head, velvety grayish fur, no external ears, and a strong odour. They range from 3.5 to 8 in. (9 to 20 cm) long. The forelimbs are rotated outward like oars and have broad or pointed claws on the toes. Moles are active day and night, digging surface tunnels in search of earthworms, grubs, and other invertebrates and excavating deep (10 ft [3 m]), vented burrows (molehills) for occupancy. The star-nosed mole (*Condylura cristata*) of northeastern North America has 22 pink, tentacle-like touch organs radiating from its muzzle.

mole Pigmented flat or fleshy SKIN mark, made up mostly of cells that produce MELANIN, which gives moles their light to dark brown or black colour and, in the dermis, a bluish cast. Thicker moles also contain nerve elements and connective tissue. Moles often begin in childhood, usually as flat spots between the dermis and epidermis. Those that remain there are more likely to become malignant. Most move into the dermis and become slightly raised. In children, moles may undergo changes resembling cancer but are benign. Malignant MELANOMA can begin in moles but almost never before puberty. During pregnancy, moles may enlarge and new ones may appear. Moles sometimes disappear with age. The term *nevus* refers to a congenital skin mark, whereas a mole may develop after birth. Epidermal nevi are usually the same colour as the surrounding skin.

molecular biology Field of science concerned with the chemical structures and processes of biological phenomena at the molecular level. Having developed out of the related fields of BIOCHEMISTRY, GENETICS, and BIOPHYSICS, the discipline is particularly concerned with the study of PROTEINS, NUCLEIC ACIDS, and ENZYMES. In the early 1950s, growing knowledge of the structure of proteins enabled the structure of DNA to be described. The discovery in the 1970s of certain types of enzymes that can cut and recombine segments of DNA (see RECOMBINATION) in the CHROMOSOMES of certain bacteria made recombinant-DNA technology possible. Molecular biologists use that technology to isolate and modify specific GENES (see GENETIC ENGINEERING).

molecular weight MASS of a molecule of a substance, based on 12 as the atomic weight of CARBON-12. It is calculated in practice by summing the ATOMIC WEIGHTS of the atoms making up the substance's molecular formula. The molecular weight of a hydrogen molecule (chemical formula H_2) is 2 (after rounding off); for many complex organic molecules (e.g., PROTEINS, POLYMERS) it may be in the millions.

molecule Smallest identifiable unit into which a pure substance can be divided and retain its composition and chemical properties. Division into still smaller parts, eventually ATOMS, involves destroying the BONDING that holds the molecule together. For NOBLE GASES, the molecule is a single atom; all other substances have two (diatomic) or more (polyatomic) atoms in a molecule. The atoms are the same in ELEMENTS, such as hydrogen (H_2), and different in COMPOUNDS, such as glucose ($C_6H_{12}O_6$). Atoms always combine into molecules in fixed proportions. Molecules of different substances can have the same constituent atoms, either in different proportions, as in carbon monoxide (CO) and carbon dioxide (CO_2), or bonded in different ways (see ISOMER). The COVALENT BONDS in molecules give them their shapes and most of their properties. (The concept of molecules has no significance in solids with IONIC BONDS.) ANALYSIS with modern techniques and computers can determine and display the size, shape, and CONFIGURATION of molecules, the positions of their nuclei and electron clouds, the lengths and angles of their bonds, and other details. ELECTRON MICROSCOPY can even produce images of individual molecules and atoms. See also MOLECULAR WEIGHT. See illustration on following page.

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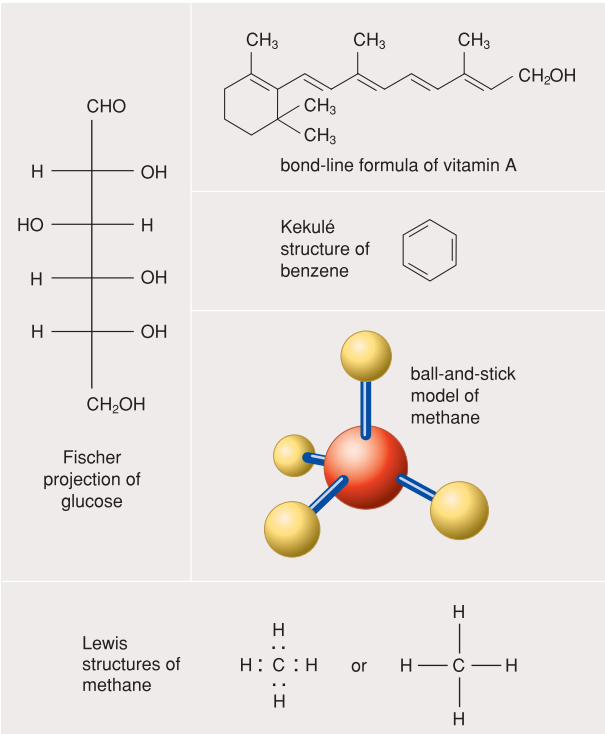

Several methods of representing a molecule's structure. In Lewis structures, element symbols represent atoms, and dots represent electrons surrounding them. A pair of shared electrons (covalent bond) may also be shown as a single dash. The ball-and-stick model better illustrates the spatial arrangement of the atoms. For aromatic compounds, the Kekulé structure is common, in which each bond is represented by a dash, carbon atoms are implied where two or more lines meet, and hydrogen atoms are usually omitted. Bond-line formulas, similar to the Kekulé structure, are often used for complex nonaromatic organic compounds. Sugars are often drawn as Fischer projections, in which the carbon "backbone" is drawn as a straight vertical line, with carbon atoms implied where horizontal lines intersect the vertical one.

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Moley, Raymond (Charles) (b. Sept. 27, 1886, Berea, Ohio, U.S.—d. Feb. 18, 1975, Phoenix, Ariz.) U.S. educator and political adviser. He taught political science at Columbia University from 1923 to 1954. In the 1920s he prepared studies of criminal justice in a number of cities for New York Gov. Franklin D. Roosevelt. When Roosevelt was preparing for his 1932 presidential campaign, Moley formed the Brain Trust to advise him on national issues. Moley wrote many of Roosevelt's campaign speeches and coined the term New Deal. From 1937 to 1968 he was a contributing editor of *Newsweek* magazine.

Molière \mȯl-'yer\ *orig.* **Jean-Baptiste Poquelin** (baptized Jan. 15, 1622, Paris, France—d. Feb. 17, 1673, Paris) French playwright, actor, and director. The son of a prosperous upholsterer, he left home to become an actor in 1643, joining forces with the Béjart family. He cofounded the troupe known as the Illustre Théâtre and toured the French provinces (1645–58), writing plays and acting in them. After his troupe was established in a permanent theatre in Paris under the patronage of Louis XIV, he won acclaim in the court and among bourgeois audiences for his comedy *The Affected Young Ladies* (1659). His other major plays include *The School for Wives* (1662), *Tartuffe* (1664; initially banned by religious authorities), *The Misanthrope* (1666), *The Miser* (1669), *The Bourgeois Gentleman* (1670), and *The Imaginary Invalid* (1673). His plays compose a portrait of all levels of 17th-century French society and are marked by their good-humoured and intelligent mockery of human vices, vanities, and follies. Despite his success, he never ceased to act and direct. Taken ill during a performance, he died of a hemorrhage within a day and was denied holy burial. He is considered the greatest French dramatist and the father of modern French comedy.

Molise \mō-'lē-zā\ Autonomous region (pop., 2001 prelim.: 316,548), south-central Italy. Its western sector is part of the Apennines, and the remainder consists mostly of low mountains and hills. Under Lombard rule during the early Middle Ages, it was controlled by the duchy of Benevento. In the 13th century it successively came under Angevin, Spanish, and Bourbon rulers. In 1860 it was joined to Abruzzi to form Abruzzi e Molise, which was incorporated into the Kingdom of Italy. In 1965 Abruzzi e Molise was divided back into the separate regions of Abruzzi and Molise. It is one of Italy's most rural regions; its capital, Campobasso, is the only city of any size.

Mollet \mȯ-'le**, Guy** (b. Dec. 31, 1905, Flers-de-l'Orne, France—d. Oct. 3, 1975, Paris) French politician. An English teacher in Arras, he joined the Socialist Party in 1921 and became head of the socialist teachers' union in 1939. After serving in World War II, he was elected to the Chamber of Deputies and became secretary-general of the Socialist Party (1946–69). With Pierre Mendès-France, he led the Republican Front to victory and became premier (1956–57). Failures in dealing with the Algerian rebellion and the Suez Crisis led to the government's defeat, but Mollet continued to serve as a deputy and as mayor of Arras.

Mollet
HARLINGUE/H. ROGER-VIOLLET

mollusk *or* **mollusc** Any of some 75,000 species of soft-bodied invertebrate animals (phylum Mollusca), many of which are wholly or partly enclosed in a calcium carbonate shell secreted by the mantle, a soft covering formed from the body wall. Between the mantle and the body is the mantle cavity. Mollusks occur in most habitats from the deep sea to high mountains. Living mollusks are usually grouped into eight classes: Gastropoda (see gastropod), Bivalvia or Pelecypoda (see bivalve), Cephalopoda (see cephalopod), Scaphopoda (tusk shells), Aplacophora (Solenogasters), Caudofoveata (sometimes included in the Aplacophora order), Polyplacophora (chitons), and Monoplacophora. Mollusks are economically important as food, and their shells are widely used in jewelry and decorative items. See illustration opposite.

Molly Maguires (1862–76) Secret organization of U.S. coal miners in Pennsylvania and West Virginia. To protest poor working conditions and employment discrimination in the 1860s, the Irish-American miners formed a group named for an Irish widow who had led antilandlord agitators in Ireland. Acts of sabotage and terrorist murders in the coalfields were blamed on the group, and mine owners hired a Pinkerton detective, James McParlan, to infiltrate the organization. Based on his testimony in the widely publicized trials (1875–77), 10 "Mollies" were convicted of murder and hanged.

Molnár \'mōl-ˌnär**, Ferenc** (b. Jan. 12, 1878, Budapest, Hung.—d. April 1, 1952, New York City, N.Y., U.S.) Hungarian writer. He published his first stories at age 19 and achieved his first success with the play *The Devil* (1907). Among his other plays, some adapted as films, are *Liliom* (1909), which was also adapted as the musical *Carousel*; *The Swan* (1920); and *The Red Mill* (1923). Some of his stories, especially those in *Music* (1908), are masterpieces that reveal the problems of the poor. Of his many novels, only *The Paul Street Boys* (1907) was a success.

Moloch \'mō-ˌlōk, 'mä-lək\ Ancient Middle Eastern deity to whom children were sacrificed. The laws given to Moses by God expressly forbade the Israelites to sacrifice children to Moloch, as the Egyptians and Canaanites did. A shrine to Moloch outside the walls of Jerusalem was destroyed during the reign of Josiah the reformer.

Molotov \'mȯ-lə-ˌtȯf**, Vyacheslav (Mikhaylovich)** *orig.* **Vyacheslav Mikhaylovich Skryabin** (b. March 9, 1890, Kukarka, Russia—d. Nov. 8, 1986, Moscow, Russia, U.S.S.R.) Soviet political leader. A member of the Bolsheviks from 1906, he worked in provincial Communist Party organizations from 1917. A staunch supporter of Joseph Stalin, he became secretary of the Central Committee in 1921. Promoted to the Politburo in 1926, he purged the Moscow party organization of anti-Stalinists (1928–30). He served as prime minister (1930–41) and as the country's foreign minister (1939–49, 1953–56). He

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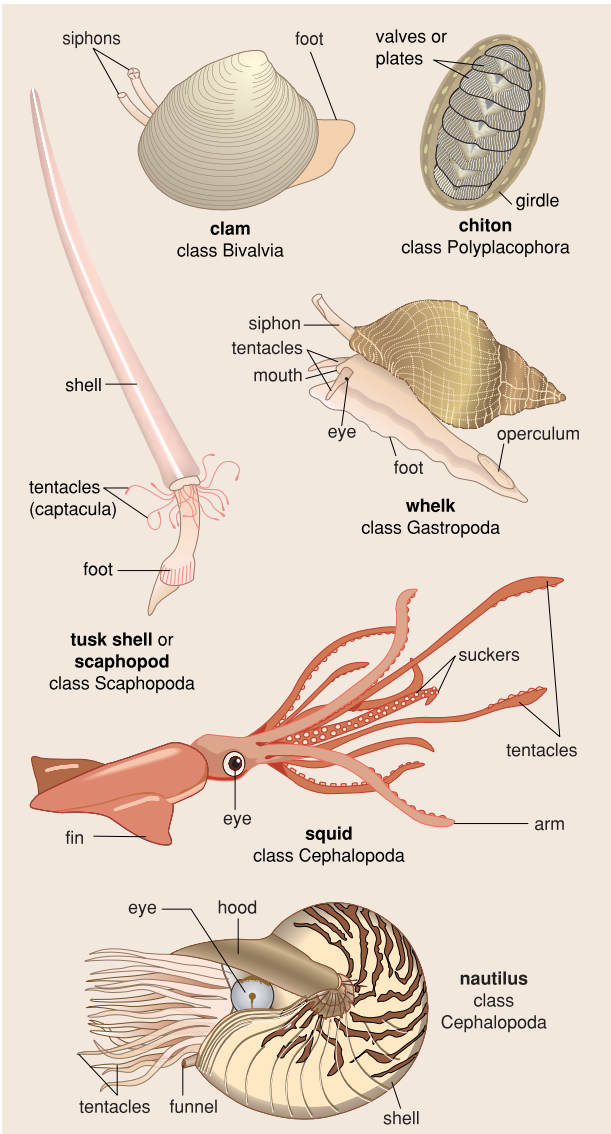
negotiated the German-Soviet Nonaggression Pact in 1939, and in World War II he ordered the production of the crude bottle bombs later called "Molotov cocktails." He arranged the alliances with the U.S. and Britain and was the Soviet spokesman at the Allied conferences during and after the war. After being dismissed in 1956 by Nikita Khrushchev, Molotov joined an unsuccessful attempt to depose Khrushchev (1957) and lost all his party offices; in 1962 he was expelled from the Communist Party.



Representative mollusks. Bivalves have a shell with two halves. Filter feeders, they take in food and water through a tubular siphon. In the clam, a muscular foot is used for burrowing and creeping. The chitons, typically found adhering to rocks and shells, have shells divided into eight overlapping plates. Tusk shells, or scaphopods, are burrowing mollusks with a shell open at both ends; with the larger end buried in the sand, they feed on microorganisms captured by the tentacles. The whelks, like most gastropods (univalves), have a single shell, which is usually coiled; when threatened, the body can be pulled into the shell, which is closed by a plate (operculum). Cephalopods have a well-developed head and a foot divided into numerous tentacles. The two long tentacles of the squid are used to capture prey, and the short arms transfer food to the mouth. The nautilus is the only cephalopod that has retained an exterior shell; by regulating the amount of gas and fluid in the interior chambers, it can regulate its buoyancy.

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molting Shedding or casting off of an animal's outer layer or covering and formation of its replacement. Regulated by hormones, molting occurs throughout the animal kingdom. It includes the shedding and replacement of horns, hair, skin, and feathers and the process by which a nymph or other organism sheds an external skeleton for the purpose of growth or change in shape.

Moltke, Helmuth (Johannes Ludwig) von (b. May 25, 1848, Gersdorff, Mecklenburg—d. June 18, 1916, Berlin, Ger.) German soldier. A nephew of Helmuth von Moltke, he rose rapidly in the German army and served as adjutant to his uncle from 1882. He was appointed quartermaster general in 1903 and chief of the German general staff in 1906. At the outbreak of World War I, he applied the Schlieffen Plan, devised by his predecessor, but his inability to revise the plan to cope with tactical and command errors contributed to the halt of the German offensive in the Battle of the Marne (1914). He was relieved of his command shortly after and died a broken man two years later.

Moltke \'mōlt-kə**, Helmuth (Karl Bernhard), count von** (b. Oct. 26, 1800, Parchim, Mecklenburg—d. April 24, 1891, Berlin, Ger.) Prussian general. He joined the Prussian army in 1822 and was appointed to its general staff in 1832. After a stint as adviser to the Turkish army (1835–39), he traveled widely and wrote several books on history and travel. In 1855 he served as personal aide to the Prussian prince Frederick William (later Frederick III), then was selected as chief of the Prussian general staff (1857–88). Highly intelligent and militarily creative, he reorganized the Prussian army and devised new strategic and tactical command methods for modern mass armies. He directed the strategies that produced victories in the Prussian and German wars against Denmark (1864), against Austria in the Seven Weeks' War (1866), and against France in the Franco-Prussian War (1870–71). He was created count in 1870 and field marshal in 1871.

Moluccas \mō-'lə-kəz\ *Indonesian* **Maluku** \mä-'lü-kü\ Island group (pop., 1999 est.: 2,223,000), eastern Indonesia, lying between Sulawesi and New Guinea. The Moluccas comprise three large islands (Halmahera, Ceram, and Buru) and many smaller ones. Their combined area is about 30,066 sq mi (77,871 sq km). They constitute the Indonesian provinces of Maluku and North Maluku; the provincial capitals are, respectively, Ambon and Ternate. The population is ethnically diverse, including Malays and Papuans and people of Dutch, Portuguese, and Javanese descent. Known as the "Spice Islands," the Moluccas were part of the Asian spice trade before being discovered by the Portuguese in 1511, and they were fought over by the Spanish, English, and Dutch, eventually coming under the Dutch. Occupied by the Japanese during World War II, the islands were afterward incorporated into the state of East Indonesia and then into the Republic of Indonesia in 1949.

molybdenum \mə-'lib-də-nəm\ Metallic chemical element, one of the transition elements, chemical symbol Mo, atomic number 42. It is a silvery gray, relatively rare metal with a high melting point (4,730 °F [2,610 °C]) that does not occur uncombined in nature. Since molybdenum and its alloys have useful strength at temperatures that melt most other metals and alloys, they are used in high-temperature steels. Applications include reaction vessels; aircraft, missile, and automobile parts; and electrodes, heating elements, and filament supports. Some molybdenum compounds (in which it has various valences) are used as pigments and catalysts. Molybdenum disulfide is a solid lubricant, used alone or added to greases and oils.

Mombasa \mōm-'bä-sə\ City (pop., 1989: 461,753), Kenya, located on the island of Mombasa off the southern coast of Kenya. The island has an area of 5.5 sq mi (14.25 sq km) and is linked to the mainland by causeway, bridge, and ferry; the city includes a mainland area of 100 sq mi (259 sq km). Founded by Arab traders in the 11th century, it was visited in 1498 by the Portuguese navigator Vasco da Gama. With its strategic position for the Indian Ocean trade, it was continually fought over, passing among the Arabs, Persians, Portuguese, and Turks until 1840, when Zanzibar gained control. It came under British administration in 1895 and was the capital of the East Africa Protectorate until 1907. It is Kenya's chief port and second largest city; it is also a major agricultural market.

moment See torque

momentum Product of the mass of a particle and its velocity. Newton's second law of motion states that the rate of change of momentum is proportional to the force acting on the particle. Albert Einstein showed that the mass of a particle increases as its velocity approaches the speed of light.

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At the speeds treated in classical MECHANICS, the effect of speed on the mass can be neglected, and changes in momentum are the result of changes in velocity alone. If a constant force acts on a particle for a given time, the product of the force and the time interval, the impulse, is equal to the change in momentum. For any array of several objects, the total momentum is the sum of the individual momenta. See also ANGULAR MOMENTUM.

Mommsen \'mȯm-zən**, (Christian Matthias) Theodor** (b. Nov. 30, 1817, Garding, Schleswig—d. Nov. 1, 1903, Charlottenburg, near Berlin, German Empire) German historian and writer. After studying law, he did research in Italy and became a master of epigraphy, the study and interpretation of inscriptions. In 1848 he became a professor of law at Leipzig, but he was soon dismissed for his participation in liberal political activities; he later held teaching posts elsewhere. He remained politically minded all his life. He is most famous for his *History of Rome*, 4 vol. (1854–56, 1885), considered his masterpiece. He edited the *Corpus Inscriptionum Latinarum* (from 1863), a comprehensive collection of Latin inscriptions that greatly advanced understanding of life in the ancient world. His *Roman Constitutional Law*, 3 vol. (1871–88), represented the first codification of Roman law. His lifetime scholarly output was immense, his publications numbering almost 1,000. He received the 1902 Nobel Prize for Literature.

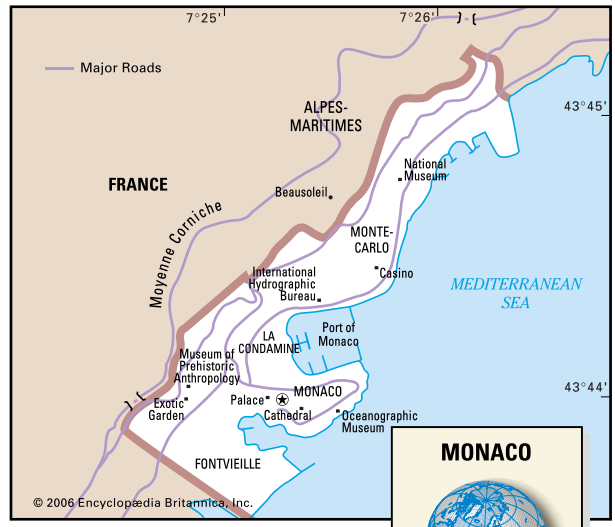
Mon \'mȯn\ Any member of a people thought to have originated in western China and currently living in the eastern delta region of Myanmar (Burma) and in west-central Thailand. They have lived in their present area for the last 1,200 years and brought Myanmar its writing (Pali) and its religion (Buddhism). Rice and teak are their most important agricultural products. Today they number more than 1.1 million. See also DVARAVATI; MON KINGDOM.

Mon-Khmer \'mōn-kə-'mer\ **languages** Family of about 130 AUSTROASIATIC LANGUAGES, spoken by more than 80 million people in South and Southeast Asia. VIETNAMESE has far more speakers than all other Austroasiatic languages combined. Other languages with many speakers are Muong, with about a million speakers in northern Vietnam; KHMER; Kuay (Kuy), with perhaps 800,000 speakers; and Mon, spoken by more than 800,000 people in southern Myanmar and parts of Thailand. Of all the Mon-Khmer languages, only Mon, Khmer, and Vietnamese have written traditions dating earlier than the 19th century. Old Mon, which is attested from the 7th century, was written in a script of South Asian origin that was later adapted by the Burmese (see MON KINGDOM; INDIC WRITING SYSTEMS). Typical phonetic features of Mon-Khmer languages are a large vowel inventory and lack of TONE distinctions.

Mon kingdom Kingdom of the MON people, who were powerful in Myanmar (Burma) in the 9th–11th centuries, in the 13th–16th centuries, and briefly in the mid-18th century. By 825 they had founded their capital city, Thaton, and the city of Pegu. The Mon kingdom was defeated by the Burman kingdom of PAGAN. When Pagan fell to the Mongols (1287), the Mon regained their independence and their former territory. They were defeated again in 1539. They reestablished Pegu briefly in the 18th century, but it was destroyed by Alaungpaya (see ALAUNGPAYA DYNASTY) in 1757. See also DVARAVATI.

Monaco \'mä-nə-ˌkō\ *officially* **Principality of Monaco** Independent principality, southern Europe, on the Mediterranean Sea near the France-Italy border. Area: 0.75 sq mi (1.95 sq km). Population (2005 est.): 32,700. Nearly half of Monaco's population are French citizens; minorities include Italians and Britons; less than one-fifth of the population are of Monegasque descent. Language: French (official). Religions: Christianity (predominantly Roman Catholic [official]); also Judaism. Currency: euro. Inhabited since prehistoric times, the area was known to the Phoenicians, Greeks, Carthaginians, and Romans. In 1191 the Genoese took possession of it. In 1297 the reign of the Grimaldi family began. The Grimaldis allied themselves with France except for the period from 1524 to 1641, when they were under the protection of Spain. France annexed Monaco in 1793, and it remained under French control until the fall of NAPOLEON, when the Grimaldis returned. In 1815 it was put under the protection of Sardinia. A treaty in 1861 called for the sale of the towns of Menton and Roquebrune to France and the establishment of Monaco's independence. Monaco, situated along the CÔTE D'AZUR, is one of Europe's most luxurious resorts, known for its MONTE-CARLO gambling centre, international sports-car races, and beaches. In 1997 the 700-year rule of the Grimaldis, then under Prince RAINIER, was celebrated. See map above.

Monaco, Lorenzo See LORENZO MONACO



monarch butterfly Species (*Danaus plexippus*, family Danaidae) of milkweed BUTTERFLY, occurring worldwide but mainly in the Americas. It is the only LEPIDOPTERAN species to make a true migration (a two-way flight by the same individual). In North America, thousands of monarchs gather in autumn, migrate southward, sometimes more than 1,800 mi (2,900 km), and return north in spring. The distinctive coloration of the adult's wings (reddish brown, with black veins, a black border, and two rows of spots) warns predators of its bad taste. Several other species derive protection by mimicking its coloration.

monarchy Undivided SOVEREIGNTY or rule by a single person, who is the permanent head of state. The term is now used to refer to countries with hereditary sovereigns. The monarch was the ideal head of the new nation-states of the 16th and 17th centuries; his powers were nearly unlimited (see ABSOLUTISM), though in Britain PARLIAMENT was able to restrict the sovereign's freedom of action, particularly through the MAGNA CARTA (1215) and the BILL OF RIGHTS (1689). The old idea that the monarch represented (within the limits of his dominions) the rule of God over all things culminated in the 17th century in the doctrine of the divine right of KINGS (see DIVINE KINGSHIP), exemplified by LOUIS XIV. Monarchical absolutism adapted to the ENLIGHTENMENT by evolving into "benevolent despotism," as typified by the rule of CATHERINE II of Russia. The FRENCH REVOLUTION dealt absolute monarchy a crushing blow, and World War I effectively destroyed what remained of it, the rulers of Russia, Germany, and Austria-Hungary being held responsible for the war and postwar misery. The institution developed into the CONSTITUTIONAL MONARCHY in western Europe, though absolute (or near-absolute) monarchies continue to exist in the Middle East.

monarchy, constitutional See CONSTITUTIONAL MONARCHY

monastery Local community or residence of a religious order, particularly an order of monks. Christian monasteries originally developed in Egypt, where the monks first lived as isolated hermits and then began to coalesce in communal groups. Monasteries were later found throughout the Christian world and often included a central space for church, chapels, fountain, and dining hall. In the MIDDLE AGES they served as centres of worship and learning and often played an important role for various European rulers. The *vihara* was an early type of Buddhist monastery, consisting of an open court surrounded by open cells accessible through an entrance porch. Originally built in India to shelter monks during the rainy season, *viharas* took on a sacred character when small STUPAS and images of the Buddha were installed in the central court. In western India, *viharas* were often excavated into rock cliffs. See also ABBEY.

monasticism Institutionalized religious movement whose members are bound by vows to an ascetic life of prayer, meditation, or good works. Members of monastic orders (monks) are usually celibate, and they live apart from society either in a community of monks or nuns or as religious

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recluses. The earliest Christian monastic communities were founded in the deserts of Egypt, most notably by the hermit St. Anthony of Egypt (251–356). It was given its more familiar cenobitic form by St. Pachomius (c. 290–346). St. Basil the Great composed a very influential rule for the eastern church, and John Cassian (360–465) helped spread monasticism to western Europe. The Benedictine order, founded by St. Benedict of Nursia in the 6th century, called for moderation of ascetic practices and established worship services at regular hours. Throughout the Middle Ages, monasticism played a vital role not only in spreading Christianity but also in preserving and adding to literature and learning. It underwent periodic reforms, notably by the Cluniacs in the 10th century and the Cistercians in the 12th century, and saw the founding of mendicant orders such as the Dominicans and Franciscans. Monasticism has also been important in Eastern religions. In early Hindu times (c. 600–200 BC) there were hermits who lived in groups (ashrams), though they did not lead a strictly organized communal life. Jainism may be the first religion to have had an organized monastic life, which was characterized by extreme asceticism. Buddhist monks observe a moderate rule that avoids extremes of self-indulgence and self-mortification.

Monck \'məŋk**, George, 1st duke of Albermarle** (b. Dec. 6, 1608, Great Potheridge, Devon, Eng.—d. Jan. 3, 1670, London) English general. He served with the Dutch army against the Spanish in the Netherlands (1629–38) and later suppressed a rebellion in Ireland (1642–43). He fought in Ireland and Scotland in the English Civil Wars, then served in Scotland as commander (1650) and governor (1654). Appointed a general at sea (1652) in the Anglo-Dutch Wars, he played a leading part in the English naval victories. In 1660 he was the chief architect of the Restoration of the Stuart monarchy, for which he was created duke of Albemarle.

Mond, Ludwig (b. March 7, 1839, Kassel, Hesse-Kassel—d. Dec. 11, 1909, London, Eng.) German-British chemist and industrialist. After immigrating to England in 1862, he improved the Solvay process for making sodium carbonate (soda ash) and developed a process for extracting nickel from its ores. He was a founder of the important chemical firm Brunner, Mond and Co. and of the Mond Nickel Co.

Mondale, Walter F(rederick) (b. Jan. 5, 1928, Ceylon, Minn., U.S.) U.S. politician. He was active in Minnesota's Farmer-Labor Party and worked for Hubert H. Humphrey's U.S. Senate campaign in 1948. After graduating from the University of Minnesota law school in 1956, he was Minnesota's attorney general from 1960 to his appointment in 1964 to fill Humphrey's unexpired Senate term when Humphrey won election as vice president under Lyndon B. Johnson. He won election to the Senate in 1966 and reelection in 1972. In 1976 he was elected vice president under Jimmy Carter. In 1984 he won the Democratic presidential nomination but lost the election to Ronald Reagan. He resumed his law practice and later served as ambassador to Japan (1993–96). In 2002 he campaigned for a seat in the U.S. Senate after Paul Wellstone, a Minnesota senator, died in a plane crash days before the election; Mondale was narrowly defeated.

Monde \'mōⁿd**, Le** *French* **"The World"** Daily newspaper published in Paris, one of the most important and widely respected newspapers in the world. It was established in 1944, just after the German army left the city, as an independent organ free of government or private subsidies. Covering national and world news in depth from the start, it soon earned a reputation for accuracy and independence. Its writers present their own views, with the result that the paper reveals no consistent ideological outlook, causing it to earn both praise and criticism from every part of the French political spectrum.

Mondino de' Luzzi \mōn-'dē-nō-dā-'lüt-sē\ *Latin* **Mundinus** (b. c. 1270, Bologna, Italy—d. c. 1326, Bologna) Italian physician and anatomist. Mondino reintroduced the systematic teaching of anatomy, abandoned for many centuries, into the medical curriculum and did dissections at public lectures. His *Anathomia Mundini* (1316, printed 1478) was the standard handbook for dissectors until the time of Andreas Vesalius. Though it followed Galen's teachings slavishly, with sometimes inaccurate descriptions of internal organs, it inaugurated a new era in the dissemination of anatomical knowledge.

Mondrian \'mȯn-drē-ˌän**, Piet** *orig.* **Pieter Cornelis Mondriaan** (b. March 7, 1872, Amersfoort, Neth.—d. Feb. 1, 1944, New York, N.Y., U.S.) Dutch painter. At the insistence of his father, headmaster of a Calvinist school, he obtained an education degree, but then immediately began taking painting lessons. His first paintings were exhibited in 1893; his early work reflected the influence of avant-garde trends such as Post-Impressionism and Cubism. In 1917 Mondrian and three other painters founded the art periodical and the movement known as De Stijl. The group advocated a style called "neoplasticism," which entailed complete rejection of visually perceived reality as subject matter and the restriction of a pictorial language to its most basic elements of the straight line, primary colours, and the neutrals of black, white, and gray. He painted in this style for the next 20 years, until he fled war-torn Paris for London and then New York City in 1940. Inspired by the city's pulsating life and the new rhythms of musical forms such as jazz, he replaced his austere patterns with a series of small squares and rectangles that coalesced into a flow of colourful vertical and horizontal lines. His late masterpieces (e.g., *Broadway Boogie-Woogie*, 1942–43) express this new vivacity. The consistent development of Mondrian's art toward complete abstraction was an outstanding feat in the history of modern art, and his work foreshadowed the rise of abstract art in the 1940s and '50s.

moneran See bacteria, prokaryote

Monet \mō-'nā**, Claude** (b. Nov. 14, 1840, Paris, France—d. Dec. 5, 1926, Giverny) French landscape painter. Monet spent his early years in Le Havre, where his first teacher, Eugène Boudin, taught him to paint in the open air. Moving to Paris, he formed lifelong friendships with other young painters, including Pierre-Auguste Renoir, Alfred Sisley, and Paul Cézanne. Beginning in the mid 1860s, Monet pursued a new style; rather than trying to reproduce faithfully the scene before him in detail, he recorded on the spot the impression that relaxed, momentary vision might receive. In 1874 he helped organize an independent exhibition, apart from the official Salon, of work he and his friends produced in this style. One of Monet's works at the exhibition, *Impression: Sunrise* (1872), inspired the journalist Louis Leroy to give the group its name. Throughout the 1870s, Monet and the other Impressionists explored this style and exhibited together. By 1881 the original group had begun to disintegrate; only Monet continued with the same fervour to carry on the scrutiny of nature. In his mature works Monet developed his method of producing a series of several studies of the same motif (e.g., haystacks, 1891, and Rouen Cathedral, 1894), changing canvases as the light or his interest shifted. In 1893, in the garden at his home in Giverny, Monet created the water-lily pond that inspired his most famous works, the lyrical *Nymphéas* (waterlilies) paintings. Wildly popular retrospective exhibitions of his work toured the world during the last decades of the 20th century and established his unparalleled public appeal, sustaining his reputation as one of the most significant and popular figures in the modern Western painting tradition.

monetarism School of economic thought that maintains that the money supply is the chief determinant of economic activity. Milton Friedman and his followers promoted monetarism as an alternative to Keynesian economics (see John Maynard Keynes); their economic theories became influential in the 1970s and early 1980s. Monetarism holds that a change in the money supply directly affects and determines production, employment, and price levels, though its influence is evident only over a long and often variable period of time. Fundamental to the monetarist approach is the rejection of fiscal policy in favour of "monetary rule." Friedman and others asserted that fiscal measures such as tax-policy changes or increased government spending have little significant effect on the fluctuations of the business cycle. They argued that government intervention in the economy should be kept to a minimum and asserted that economic conditions would change before specific policy measures designed to address them could take effect. Steady, moderate growth of the money supply, in their view, offered the best hope of assuring a constant rate of economic growth with low inflation. U.S. economic performance in the 1980s cast doubts on monetarism, and the proliferation of new types of bank deposits made it difficult to calculate the money supply.

monetary policy Measures employed by governments to influence economic activity, specifically by manipulating the money supply and interest rates. Monetary and fiscal policy are two ways in which governments attempt to achieve or maintain high levels of employment, price stability, and economic growth. Monetary policy is directed by a nation's central bank. In the U.S., monetary policy is the responsibility of the Federal Reserve System, which uses three main instruments: open-market operations, the discount rate, and reserve requirements. In the post-World War II era, economists reached a consensus that, in the long run, inflation results when the money supply grows at too rapid a rate. See also monetarism.

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money Commodity accepted by general consent as a medium of economic exchange. It is the medium in which PRICES and values are expressed; it circulates from person to person and country to country, thus facilitating trade. Throughout history various commodities have been used as money, including seashells, beads, and cattle, but since the 17th century the most common forms have been metal coins, paper notes, and bookkeeping entries. In standard economic theory, money is held to have four functions: to serve as a medium of exchange universally accepted in return for goods and services; to act as a measure of value, making possible the operation of the price system and the calculation of COST, PROFIT, and loss; to serve as a standard of deferred payments, the unit in which loans are made and future transactions are fixed; and to provide a means of storing wealth not immediately required for use. Metals, especially gold and silver, have been used for money for at least 4,000 years; standardized coins have been minted for perhaps 2,600 years. In the late 18th and early 19th century, banks began to issue notes redeemable in gold or silver, which became the principal money of industrial economies. Temporarily during World War I and permanently from the 1930s, most nations abandoned the GOLD STANDARD. To most individuals today, money consists of coins, notes, and bank deposits. In terms of the economy, however, the total MONEY SUPPLY is several times as large as the sum total of individual money holdings so defined, since most of the deposits placed in banks are loaned out, thus multiplying the money supply several times over. See also SOFT MONEY.

money, quantity theory of Economic theory relating changes in the price level to changes in the quantity of money. It has often been used to analyze the factors underlying INFLATION and DEFLATION. The quantity theory was developed in the 17th and 18th centuries by philosophers such as JOHN LOCKE and DAVID HUME and was intended as a weapon against MERCANTILISM. Drawing a distinction between MONEY and wealth, advocates of the quantity theory argued that if the accumulation of money by a nation merely raised prices, the mercantilist emphasis on a favourable BALANCE OF TRADE would only increase the supply of money without increasing wealth. The theory contributed to the ascendancy of FREE TRADE over PROTECTIONISM. In the 19th–20th centuries it played a part in the analysis of BUSINESS CYCLES and in the theory of rates of FOREIGN EXCHANGE.

money market Set of institutions, conventions, and practices whose aim is to facilitate the lending and borrowing of money on a short-term basis. The money market is, therefore, different from the capital market, which is concerned with medium- and long-term CREDIT. The transactions that occur on the money market involve not only banknotes but assets that can be turned into cash at short notice, such as short-term government SECURITIES and BILLS OF EXCHANGE. Though the details and mechanism of the money market vary greatly from country to country, in all cases its basic function is to enable those with surplus short-term funds to lend and those with the need for short-term credit to borrow. This function is accomplished through middlemen who provide their services for a profit. In most countries the government plays a major role in the money market, acting both as a lender and borrower and often using its position to influence the MONEY SUPPLY and INTEREST rates according to its MONETARY POLICY. The U.S. money market covers financial instruments ranging from bills of exchange and government securities to funds from CLEARINGHOUSES and CERTIFICATES OF DEPOSIT. In addition, the FEDERAL RESERVE SYSTEM provides considerable short-term credit directly to the banking system. The international money market facilitates the borrowing, lending, and exchange of currencies between countries.

money order Certificate requiring the issuer to pay a certain sum of MONEY on demand to a specific person or organization. Money orders provide a fast, safe, and convenient means of transferring small sums of money. They are issued by governments (usually through postal authorities), banks, and other qualified institutions to buyers who pay the issuer the face amount of the money order plus a service charge. Because they are exchangeable for cash on demand, they are a generally accepted means of payment. The AMERICAN EXPRESS CO. began issuing money orders in 1882; the company also created the first traveler's checks nine years later. See also CURRENCY.

money supply Liquid assets held by individuals and banks. The money supply includes coins, CURRENCY, and demand deposits (checking accounts). Some economists consider time and savings deposits to be part of the money supply because such deposits can be managed by governmental action and are nearly as liquid as currency and demand deposits. Other economists believe that deposits in mutual savings banks, SAVINGS AND LOAN ASSOCIATIONS, and CREDIT UNIONS should be counted as part of the money supply. CENTRAL BANKS regulate the money supply to stabilize their national economies. See also MONETARY POLICY.

Möngke \'mȯŋ-kā\ (b. 1208, Mongolia—d. 1259, Sichuan province, China) MONGOL leader. Grandson of GENGHIS KHAN and brother of KUBLAI KHAN, he was elected great khan in 1251. Under Möngke, the MONGOLS conquered Iran, Iraq, and Syria as well as the Thai kingdom of Nan-chao and the area of present-day Vietnam. He died before the Mongols could complete the conquest of China, which happened under the reign of Kublai.

Mongkut \ˌmȯŋ-'küt\ *or* **Phrachomklao** \ˌprä-ˌkȯm-'klaù\ *or* **Rama IV** (b. Oct. 18, 1804, Bangkok, Siam—d. Oct. 15, 1868, Bangkok) King of Siam (Thailand; r. 1851–68). The 43rd child of King Rama II, he was a Buddhist monk and scholar before he ascended the throne. His reformed Buddhism grew into the Thammayut order, which today occupies the intellectual centre of Thai Buddhism. Mongkut's intellectual pursuits also brought him into contact with Western thought. As king, he fully opened Siam to Western commerce and combined tolerance and shrewdness to help ensure its survival as an independent nation. The reminiscences of an English governess employed in his household became the basis for the musical comedy *The King and I*.

Mongo Any of several peoples living in the African equatorial forest. They speak a dialect of a common language, Mongo or Nkundo, which belongs to the NIGER-CONGO LANGUAGE family. The Mongo traditionally cultivated cassava and bananas in addition to hunting, fishing, and gathering. Mongo religion emphasizes ANCESTOR WORSHIP and nature spirits; it also features magic and witchcraft. Their art has been mainly oral, and they have a rich talking-drum and song literature. They number some five million.

Mongol Member of an Asian people originally from the Mongolian plateau who share a common language and a nomadic tradition of herding sheep, cattle, goats, and horses. In the 10th–12th centuries the Khitans (see LIAO DYNASTY), Juchen (Chin dynasty), and TATARS, all Mongol peoples, ruled in MONGOLIA, but Mongol power was greatest in the 13th century, when GENGHIS KHAN, his sons (including ÖGÖDEI), and his grandsons BATU and KUBLAI KHAN, created one of the world's largest empires. It declined greatly in the 14th century, when China was lost to the MING DYNASTY, and the GOLDEN HORDE was defeated by Muscovy. Ming incursions effectively ended Mongol unity, and by the 15th–16th centuries only a loose federation existed. Today the plateau is divided between independent Mongolia and Chinese-controlled INNER MONGOLIA. Other Mongols live in Siberia. Tibetan Buddhism is the principal Mongol religion.

Mongol dynasty See YUAN DYNASTY

Mongolia *or* **Outer Mongolia** Country, north-central Asia, between Russia and China. Area: 603,909 sq mi (1,564,116 sq km). Population (2005 est.): 2,550,000. Capital: ULAANBAATAR. Some four-fifths of the population are Mongols; minorities consist of Kazakhs, Russians, and Chinese. Languages: Khalkha Mongolian, Turkic languages, Russian, Chinese. Religions: traditional beliefs, Buddhism, Islam. Currency: tugrik. Mongolia has an average elevation of about 5,200 ft (1,580 m) above sea level. Three mountain ranges stretch across the north and west: the Altai, the Hangayn (Khangai), and the Hentiyn (Khentei). The south and east are occupied by the GOBI DESERT. Livestock raising, especially sheepherding, accounts for nearly three-fourths of the total value of agricultural production; wheat is the major crop. Mongolia's rich mineral resources include coal, iron ore, and copper. Mongolia is a republic with one legislative house; its chief of state is the president, and the head of government is the prime minister. In Neolithic times it was inhabited by small groups of hunters and nomads. During the 3rd century BC it became the centre of the XIONGNU tribal league. Turkic-speaking peoples held sway in the 4th–10th centuries AD. In the early 13th century GENGHIS KHAN united the Mongol tribes and conquered Central Asia. His successor, ÖGÖDEI, conquered the JIN DYNASTY of CHINA in 1234. KUBLAI KHAN established the YUAN (Mongol) dynasty in China in 1279. The Mongols were confined to their original homeland in the steppes after the 14th century. Ligdan Khan (ruled 1604–34) attempted to unite Mongol tribes against the MANCHU, but after his death the Mongols became part of the Chinese QING DYNASTY. After the fall of the Qing in 1912, Mongol princes, supported by Russia, declared Mongolia's independence from China, and in 1921 the Soviet Red Army helped drive off Chinese and Russian forces. The Mongolian

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People's Republic was established in 1924. The country adopted a new constitution in 1992 and shortened its name to Mongolia.

Mongolian languages Family of about eight ALTAIC LANGUAGES spoken by five to seven million people in central Eurasia. All Mongolian languages are relatively closely related; those languages whose speakers left the core area in Mongolia the earliest tend to be the most divergent. The most remote language is Mogholi (Moghul, Mongol), now spoken by fewer than 200 people in western Afghanistan. Less divergent are the languages of several ethnic groups in northwestern China, eastern Qinghai, and adjacent parts of Gansu and Inner Mongolia, altogether spoken by fewer than 500,000 people. The core languages are Mongolian proper, the dominant dialect in the Republic of Mongolia and the basis of Modern Standard Mongolian, and a group of peripheral dialects. The core group of Mongolian speakers traditionally have used Classical Mongolian as their literary language; it is written in a vertical alphabetic script borrowed from the UIGHURS (see TURKIC LANGUAGES). Modern Mongolian was written in this script until 1946, when the People's Republic of Mongolia introduced a script using a modified CYRILLIC ALPHABET. With political democratization in the 1990s, the old script has been revived. In Inner Mongolia it has been in continuous use.

Mongoloid See RACE

mongoose Any of the 37 species of CARNIVORES constituting the family Herpestidae, found in Africa, Asia, and southern Europe. RUDYARD KIPLING's famous "Rikki-tikki-tavi" was an Indian, or gray, mongoose (*Herpestes edwardsii*); the MEERKAT is also a member of the mongoose family. Species range from 7 to 35 in. (17 to 90 cm) long, excluding the furry 6–12-in. (15–30-cm) tail. Mongooses have short legs, a pointed nose, and small ears. Most species are active during the day. The gray to brown fur may have light flecks or dark markings. Mongooses live in burrows, alone, in pairs, or in large groups, and they eat small mammals, birds, reptiles, eggs, and fruit. A few species are semiaquatic. Though not immune to venom, some species attack and kill poisonous snakes by cracking the skull with a powerful bite.

monism \'mō-ˌni-zəm\ In METAPHYSICS, the doctrine that the world is essentially one substance or contains only one kind of substance. Monism is opposed both to DUALISM and to PLURALISM. Examples of monism include MATERIALISM, PANTHEISM, and metaphysical IDEALISM. See also BENEDICT DE SPINOZA.

monitor IRONCLAD warship originally designed for use in shallow harbours and rivers to blockade the Confederate states in the AMERICAN CIVIL WAR. The original ironclad, built by JOHN ERICSSON, was named *Monitor* Its innovative design included minimal exposure above the waterline, a heavily armoured deck and hull, and a revolving gun turret. The inconclusive Battle of the MONITOR AND MERRIMACK (1862) was the first between ironclad warships. Never seaworthy, the *Monitor* sank during a gale off Cape Hatteras that same year, but the U.S. Navy built many improved monitors during the war. The British navy kept its monitors in service as late as World War II.

Monitor and Merrimack, Battle of the (March 9, 1862) Naval engagement in the AMERICAN CIVIL WAR at Hampton Roads, Va. The *Merrimack*, originally a federal frigate, had been salvaged by the Confederates, fitted with iron armor, and renamed the *Virginia*. It sank several wooden Union warships before meeting the Union's *Monitor*. After a four-hour battle, both ships were damaged, but each side claimed victory. Both ships were destroyed later in 1862, the *Virginia* by its crew to avoid capture and the *Monitor* in a storm. The battle is notable as history's first duel between ironclad warships and as the beginning of a new era in naval warfare.

monitor lizard Any of about 30 species of LIZARDS (genus *Varanus*, family Varanidae), found in the Old World tropics and subtropics. Most have an elongated head and neck, a heavy body, a long tail, and well-developed legs. The smallest monitor grows to 8 in. (20 cm), but several species (e.g., the KOMODO DRAGON) are very large. The two-banded, or water, monitor (*V. salvator*), of South Asia, grows to 9 ft (2.7 m). The perenty (*V. giganteus*), of Australia, grows to 8 ft (2.4 m). The so-called earless monitor (*Lanthanotus borneensis*), a rare lizard of Borneo and the only species of the family Lanthanotidae, grows to 16 in. (40 cm) long.

monk See MONASTICISM

Monk, Meredith (Jane) (b. Nov. 20, 1942, Lima, Peru) Peruvian-born U.S. composer and performance artist. She was raised in Connecticut and New York and attended Sarah Lawrence College. She soon formed her first group, The House (1968), to explore extended vocal techniques (many learned from study of other cultures) in combination with dance, film, theatre, and other elements, in genre-defying works such as *Juice* (1969). One of the original creators of PERFORMANCE ART, she has remained unique and unclassifiable.

Monk, Thelonious (Sphere) (b. Oct. 10, 1917, Rocky Mount, N.C., U.S.—d. Feb. 17, 1982, Englewood, N.J.) U.S. JAZZ pianist and composer. Monk grew up in New York City. He worked as the house pianist at Minton's Playhouse in New York (1940–43), where the expanding harmonic vocabulary of BEBOP was developed. He performed with COLEMAN HAWKINS, Cootie Williams (1908?–85), and DIZZY GILLESPIE before making recordings under his own name beginning in 1947. His highly idiosyncratic, percussive playing made frequent use of sharp dissonances and insistent rhythms unusual in jazz. His best-known composition, "'Round Midnight," has become a jazz standard.

monkey Any member of two tropical anthropoid PRIMATE groups: OLD WORLD monkeys and NEW WORLD monkeys. Almost all species are tropical or subtropical, and almost all are diurnal. Most species are arboreal, using all four limbs to leap from tree to tree. They can sit upright and stand erect. Most species run along branches rather than swinging arm over arm like the APES. Monkeys are highly social omnivores, organized in clans as large as several hundred individuals headed by an old male. Sexually mature males of all species are always potent, and all nonpregnant females have a monthly menstrual cycle. Most species bear a single young, which is reared by the mother for years.

monkey puzzle tree Evergreen ornamental and timber CONIFER (*Araucaria araucana*) of the family Araucariaceae, native to the Andes Mountains of South America. The tree may grow to 150 ft (45 m) in height and 5 ft (1.5 m) in diameter. The rigid, overlapping, needle-pointed leaves are spirally arranged on stiff branches, which form a tangled, prickly network that discourages animals from climbing the tree. The NORFOLK ISLAND PINE is a relative.

Monkey puzzle tree (*Araucaria araucana*).
ERNEST MANEWAL/SHOSTAL

monkeypox Viral disease of both animals and humans that causes symptoms similar to those of SMALL-

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POX, though less severe. The monkeypox virus is usually found in primates and rodents in Central and West Africa but has spread to other parts of the world through the export of infected small mammals. It can be transmitted to humans through an animal bite and from person to person through prolonged close contact. Symptoms of the disease include fever, headache, general malaise and fatigue, and swollen lymph nodes. A rash of raised bumps appears on the infected person's face and body. Treatment is limited to alleviating symptoms. Outbreaks are contained by isolating patients and controlling the trade of animals.

monkfish Any of 10–12 species (genus *Squatina*, family Squatinidae) of SHARKS having a flattened head and body, with winglike pectoral and pelvic fins that make them resemble RAYS. The tail bears two dorsal fins, and behind each eye is a prominent spiracle. Monkfish grow up to 6.25 ft (2.5 m) long. They inhabit tropical and warm temperate waters of continental shelves worldwide. The angelfish, or angel shark (*S. squatina*), is often caught for food in European waters. The term monkfish is also used for the unrelated food species of the genus *Lophius*, bottom-dwelling goosefish with enormous mouths and "fishing rod" lures extending from their heads.

Monmouth \'män-məth**, James Scott, duke of** *orig.* **James Fitzroy** *or* **James Crofts** (b. April 9, 1649, Rotterdam, Neth.—d. July 15, 1685, London, Eng.) British military leader. The illegitimate son of CHARLES II of England, he lived in Paris with his mother. In 1662 he was brought to England as a favourite of the king, who created him duke of Monmouth. He married the Scottish heiress Anne Scott, duchess of Buccleuch, and took her surname. A member of the king's guard from 1668, he commanded troops in the ANGLO-DUTCH WAR and against Scottish rebels in 1679. He was championed for the royal succession by the anti-Catholic Whigs, but after the unsuccessful RYE HOUSE PLOT he took refuge in the Netherlands (1684). Returning after Charles's death to challenge JAMES II, he and his army of peasants were defeated, and he was captured and beheaded.

Duke of Monmouth, oil painting after W. Wissing, *c.* 1683; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Monnet \mȯ-'nā**, Jean** (b. Nov. 9, 1888, Cognac, France—d. March 16, 1979, Houjarray) French economist and diplomat. He managed his family's brandy business before becoming a partner of an investment bank (1925). In World War II he chaired a Franco-British economic committee and proposed a Franco-British union. In 1947 he created and directed the successful Monnet Plan to rebuild and modernize France's economy. In 1950, with ROBERT SCHUMAN, he proposed the plan for the EUROPEAN COAL AND STEEL COMMUNITY, predecessor of the EUROPEAN ECONOMIC COMMUNITY and the EUROPEAN UNION, and served as its first president (1952–55). He was also the founder and president of the action committee for the United States of Europe (1955–75).

monocot See COTYLEDON, FLOWERING PLANT

Monod \mȯ-'nō**, Jacques (Lucien)** (b. Feb. 9, 1910, Paris, France—d. May 31, 1976, Cannes) French biochemist. In 1961 he and FRANCOIS JACOB proposed the existence of messenger RNA (mRNA), theorizing that the messenger carries the information encoded in the base sequence to the RIBOSOMES, where the sequence of bases of the messenger RNA is translated into the sequence of amino acids of a protein. In advancing the concept of gene complexes that they called OPERONS, they suggested the existence of a class of genes that regulate the function of other genes by regulating the synthesis of mRNA. The two shared a 1965 Nobel Prize with André Lwoff (1902–94).

monody \'mä-nə-dē\ Accompanied solo song style of the early 17th century. It represented a reaction against the contrapuntal style (based on the combination of simultaneous melodic lines) of the 16th-century MADRIGAL and MOTET. Ostensibly in an attempt to emulate ancient Greek music, composers placed renewed emphasis on proper articulation as well as expressive interpretation of texts, and they thus replaced COUNTERPOINT with simply accompanied RECITATIVE. This resulted in a decisive distinction between melody and accompaniment, which coincides with the early appearance of basso CONTINUO. A collection of songs published by GIULIO CACCINI in 1602 exemplifies early monody. See also OPERA; RECITATIVE.

monogram Originally a cipher consisting of a single letter, later a design or mark consisting of two or more letters intertwined. The letters thus interlaced may be either all the letters of a name or the initial letters of the given names and surname of a person for use on notepaper, seals, or elsewhere. Many early Greek and Roman coins bear the monograms of rulers or towns. Most famous is the sacred monogram, which is formed by the conjunction of the first two Greek letters of ΧΡΙΣΤΟΣ (Christ), usually with the α (alpha) and ω (omega) of the Apocalypse on each side of it. The Middle Ages were extremely prolific in inventing ciphers for ecclesiastical, artistic, and commercial use. Related devices are the colophons used for identification by publishers and printers, the HALLMARKS of goldsmiths and silversmiths, and the logos adopted by corporations.

monomer \'mä-nə-mər\ MOLECULE of any of a class of mostly organic compounds that can react with other molecules of the same or other compounds to form very large molecules (POLYMERS). The essential feature of monomer molecules is the ability to form chemical bonds (see BONDING) with at least two other monomer molecules (polyfunctionality). Those able to react with two others can form only chainlike polymers; those able to react with three or more can form cross-linked, network polymers. Examples of monomers (and their polymers) are styrene (polystyrene), ETHYLENE (POLYETHYLENE), and AMINO ACIDS (PROTEINS).

Monongahela \mə-ˌnän-gə-'hē-lə\ **River** River, northern West Virginia, U.S. It flows north past Morgantown into Pennsylvania and joins the ALLEGHENY RIVER at PITTSBURGH to form the OHIO RIVER, after a total course of 128 mi (206 km). In its upper reaches it is used for hydroelectric power. Made navigable by means of locks for 106 mi (170 km), it serves as a major barge route.

mononucleosis \ˌmä-nō-ˌnü-klē-'ō-səs**, infectious** *or* **glandular fever** Common infection, caused by EPSTEIN-BARR VIRUS. It occurs most often at ages 10–35. Infected young children usually have little or no illness but become immune. Popularly called "the kissing disease," it is spread mostly by oral contact with exchange of saliva. It usually lasts 7–14 days. The most common symptoms are malaise, sore throat, fever, and lymph-node enlargement. Liver involvement is usual but rarely severe. The spleen often enlarges and in rare cases ruptures fatally. Less frequent features include rash, PNEUMONIA, ENCEPHALITIS (sometimes fatal), MENINGITIS, and peripheral NEURITIS. Relapse and second attacks are rare. Diagnosis may require blood analysis. There is no specific therapy.

monophony \mə-'nä-fə-nē\ Music consisting of a single unaccompanied melodic line. The concept often also includes melody that is accompanied by a drone or by drumming. GREGORIAN CHANT and BYZANTINE CHANT constitute the oldest written examples of monophonic repertory.

Monophysite heresy \mə-'nä-fə-ˌsīt\ (5th–6th century AD) Doctrine that emphasized the single nature (the term means literally "of one nature") of Christ, as a wholly divine being rather than part-divine and part-human. Monophysitism began to appear in the 5th century; though condemned as a heresy at the Council of CHALCEDON (451), it was tolerated by such Byzantine leaders as JUSTIN II, THEODORA, and ZENO, resulting in a full-fledged schism between East and West. Several Monophysite churches, including the COPTIC ORTHODOX CHURCH, were founded in the 6th century.

monopolistic competition Market situation in which many independent buyers and sellers may exist but competition is limited by specific market conditions. The theory was developed almost simultaneously by Edward Hastings Chamberlin in his *Theory of Monopolistic Competition* (1933) and JOAN V. ROBINSON in her *Economics of Imperfect Competition* (1933). It assumes product differentiation, a situation in which each seller's goods have some unique properties, thereby giving the seller some monopoly power. See also MONOPOLY; OLIGOPOLY.

monopoly Exclusive possession of a market by a supplier of a product or service for which there is no substitute. In the absence of competition, the supplier usually restricts output and increases PRICE in order to maximize PROFITS. The concept of pure monopoly is useful for theoretical discussion but is rarely encountered in actuality. In situations where having more than one supplier is inefficient (e.g., for electricity, gas, or water), economists refer to "natural monopoly" (see PUBLIC UTILITY). For monopoly to exist there must be a barrier to the entry of competing firms. In the case

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of natural monopolies, the government creates that barrier. Either local government provides the service itself, or it awards a franchise to a private company and regulates it. In some cases the barrier is attributable to an effective PATENT. In other cases the barrier that eliminates competing firms is technological. Large-scale, integrated operations that increase efficiency and reduce production costs confer a benefit on firms that adopt them and may confer a benefit on consumers if the lower costs lead to lower product prices. In many cases the barrier is a result of anticompetitive behaviour on the part of the firm. Most free-enterprise economies have adopted laws to protect consumers from the abuse of monopoly power. The U.S. ANTITRUST LAWS are the oldest examples of this type of monopoly-control legislation; public-utility law is an outgrowth of the English common law as it pertains to natural monopolies. Antitrust law prohibits MERGERS and acquisitions that lessen competition. The question asked is whether consumers will benefit from increased efficiency or be penalized with a lower output and a higher price. See also OLIGOPOLY.

monoprint See MONOTYPE

monopsony \mə-'näp-sə-nē\ In economic theory, market situation in which there is only one buyer. An example of pure monopsony is a firm that is the only buyer of labour in an isolated town; such a firm would be able to pay lower wages to its employees than it would if other firms were present. Though cases of pure monopsony are rare, monopsonistic elements are found wherever there are many sellers and few purchasers.

monorail Electric railway that runs on a single rail either above or under the railway cars. The first systems were introduced in the early 20th century; the earliest probably opened in 1901 in Wuppertal, Germany. Short-run monorails have since been built in such cities as Tokyo and Seattle. Because of higher costs and slower speeds than conventional rail systems, the monorail has not gained wide support. High-speed monorail vehicles that use magnetic levitation have been undergoing research for many years.

monosaccharide \ˌmä-nə-'sa-kə-ˌrīd\ Any of the simple SUGARS that serve as building blocks for CARBOHYDRATES. They are classified based on their backbone of carbon (C) atoms: Trioses have three carbon atoms, tetroses four, pentoses five, hexoses six, and heptoses seven. The carbon atoms are bonded to hydrogen atoms (—H), hydroxyl groups (—OH; see FUNCTIONAL GROUP), and carbonyl groups (—C═O), whose combinations, order, and CONFIGURATIONS allow a large number of stereoisomers (see ISOMER) to exist. Pentoses include xylose, found in woody materials; arabinose, found in GUMS from conifers; ribose, a component of RNA and several VITAMINS; and deoxyribose, a component of DNA. Important hexoses include GLUCOSE, GALACTOSE, and FRUCTOSE. Monosaccharides combine with each other and other groups to form a variety of disaccharides, POLYSACCHARIDES, and other carbohydrates.

monosodium glutamate (MSG) White crystalline substance, a sodium SALT of the amino acid GLUTAMIC ACID. MSG is used to intensify the natural flavour of meats and vegetables. It elicits a unique taste, called in Japan *umami*, different from the four basic tastes. Originally derived from seaweed and first used in Japan in 1908, it has become a common ingredient in Chinese and Japanese cooking. MSG in large amounts may have physical effects, including an allergic reaction commonly called "Chinese restaurant syndrome."

monotheism \'mä-nə-ˌthē-ˌi-zəm\ Belief in the existence of one god. It is distinguished from POLYTHEISM. The earliest known instance of monotheism dates to the reign of AKHENATON of Egypt in the 14th century BC. Monotheism is characteristic of JUDAISM, CHRISTIANITY, and ISLAM, all of which view God as the creator of the world, who oversees and intervenes in human events, and as a beneficent and holy being, the source of the highest good. The monotheism that characterizes Judaism began in ancient Israel with the adoption of Yahweh as the single object of worship and the rejection of the gods of other tribes and nations without, initially, denying their existence. Islam is clear in confessing one, eternal, unbegotten, unequaled God, while Christianity holds that a single God is reflected in the three persons of the Holy TRINITY.

monotreme \'mä-nə-ˌtrēm\ Any of three living species of egg-laying MAMMALS (order Monotremata): the PLATYPUS and two species of ECHIDNA. Monotremes are found only in Australia, Tasmania, and New Guinea. Except for their egg laying, they have mammalian characteristics, such as mammary glands, hair, and a complete diaphragm. They lack teats; the young suck milk through pores on the mother's skin. The earliest fossil monotremes, found in Australia, are only about 2 million years old and differ little from present species. Monotremes probably originated from a line of mammal-like reptiles different from the line that gave rise to placental mammals and MARSUPIALS.

monotype *or* **monoprint** In art PRINTMAKING, a technique prized because of its unique textural qualities. Monotypes are made by drawing with printer's ink or oil paint onto glass or a plate of metal or stone. The drawing is then pressed by hand onto a sheet of absorbent paper or printed on an etching press. The pigment remaining on the plate is usually insufficient to make another print unless the original design is reinforced. Subsequent prints invariably differ from the first, because variations in repainting and printing are inevitable. In the 19th century, WILLIAM BLAKE and EDGAR DEGAS experimented with the technique.

Monro family Family of Scottish physicians. Three generations of the family made the University of Edinburgh an international centre of medical teaching, holding the chair of anatomy for 126 years (1720–1846) without interruption. Alexander *primus* (b. Sept. 8, 1697, London, Eng.—d. July 10, 1767, Edinburgh, Scot.) lectured in anatomy and surgery; his anatomical preparations were outstanding, and, though not a surgeon, he advanced many new ideas for instruments and dressings. His son Alexander *secundus* (b. May 22, 1733, Edinburgh—d. Oct. 2, 1817, Edinburgh) began lecturing in his second year of medical study; of the three, he is judged the greatest teacher and anatomist, and his research also covered pathology and physiology. Alexander *tertius* (b. Nov. 5, 1773, Edinburgh—d. March 10, 1859, Craiglockheart, near Edinburgh) relied largely on the notes handed down to him.

Monroe, Bill *orig.* **William Smith Monroe** (b. Sept. 13, 1911, Rosine, Ky., U.S.—d. Sept. 9, 1996, Springfield, near Nashville, Tenn.) U.S. singer, songwriter, and mandolin player, inventor of the BLUEGRASS style. Monroe began to play professionally in 1927 and later toured with his brother Charlie. They made their first recordings in 1936 and recorded 60 songs over the next two years. He formed the Blue Grass Boys in 1939. His bluegrass sound emerged fully in 1945, when banjoist Earl Scruggs (b. 1924) and guitarist LESTER FLATT joined his band. The Blue Grass Boys established the classic makeup of a bluegrass group—mandolin, fiddle, guitar, banjo, and upright bass—and bequeathed its name to the genre itself. Monroe continued to perform until shortly before his death.

Monroe, Harriet (b. Dec. 23, 1860, Chicago, Ill., U.S.—d. Sept. 26, 1936, Arequipa, Peru) U.S. editor. She worked on various newspapers in the city as an art and drama critic while privately writing verse and verse plays. In 1912 she founded *POETRY* magazine, securing the backing of wealthy patrons and inviting contributions from a wide range of poets. Monroe's open-minded editorial policy and awareness of the importance of the Modernist revolution in contemporary poetry made her a major influence in its development.

Monroe, James (b. April 28, 1758, Westmoreland county, Va.—d. July 4, 1831, New York, N.Y., U.S.) Fifth president of the U.S. (1817–25). After serving in the AMERICAN REVOLUTION, he studied law under THOMAS JEFFERSON, then governor of Virginia. From 1783 to 1786 he served in the Congress under the ARTICLES OF CONFEDERATION. In 1790 he was elected to the U.S. Senate, where he opposed the adminstration of GEORGE WASHINGTON. He nevertheless became Washington's minister to France in 1794, though he was recalled two years later for misleading the French about U.S. politics. From 1799 to 1802 he served as governor of Virginia. In 1803 Pres. Jefferson sent him to France to help negotiate the LOUISIANA PURCHASE; he was then appointed minister to Britain (1803–07). He returned to Virginia and was again elected governor in 1810, though he resigned the office after 11 months to serve as U.S. secretary of state (1811–17) and secretary of war (1814–15). He

James Monroe, oil sketch by E.O. Sully, 1836, after a contemporary portrait by Thomas Sully; in Independence National Historical Park, Philadelphia.
COURTESY OF THE INDEPENDENCE NATIONAL HISTORICAL PARK COLLECTION, PHILADELPHIA

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served two terms as president, presiding in a period that became known as the Era of Good Feelings. He oversaw the Seminole War of 1817–18 and the acquisition of the Floridas (1819–21), and he signed the Missouri Compromise (1820). With Secretary of State John Quincy Adams, he developed the principles of U.S. foreign policy later called the Monroe Doctrine.

Monroe, Marilyn *orig.* **Norma Jean Mortenson** (b. June 1, 1926, Los Angeles, Calif., U.S.—d. Aug. 5, 1962, Los Angeles) U.S. film actress. She endured a loveless childhood and a brief teenage marriage. After working as a photographer's model, she made her screen debut in 1948 and won bit parts in *The Asphalt Jungle* (1950) and *All About Eve* (1950). She achieved stardom as a blonde sex symbol in the comedies *Gentlemen Prefer Blondes* (1953), *How to Marry a Millionaire* (1953), and *The Seven Year Itch* (1955). After studying at the Actors Studio, she starred in more-ambitious films, including *Bus Stop* (1956), *Some Like It Hot* (1959), and *The Misfits* (1961). Her private life, which included marriages to Joe DiMaggio and Arthur Miller, was widely publicized. She died at age 36 of an apparently self-administered barbiturate overdose. Her vulnerability and sensuousness combined with her death raised her to the status of an American cultural icon.

Marilyn Monroe.
BROWN BROTHERS

Monroe Doctrine U.S. foreign-policy statement first enunciated by Pres. James Monroe on Dec. 2, 1823, declaring the Western Hemisphere off-limits to European colonization. Concerned that the European powers would attempt to restore Spain's former colonies, he declared, inter alia, that any attempt by a European power to control any nation in the Western Hemisphere would be viewed as a hostile act against the U.S. It was reiterated in 1845 and 1848 by Pres. James K. Polk to discourage Spain and Britain from establishing footholds in Oregon, California, or on Mexico's Yucatán Peninsula. In 1865 the U.S. massed troops on the Rio Grande to back up demands that France withdraw from Mexico. In 1904 Pres. Theodore Roosevelt added the Roosevelt Corollary, stating that in the event of flagrant wrongdoing by a Latin American state, the U.S. had the right to intervene in its internal affairs. As the U.S. became a world power, the Monroe Doctrine came to define the Western Hemisphere as a U.S. sphere of influence. See also Good Neighbor Policy.

Monrovia Port city (pop., 1999 est.: metro. area, 479,000), capital of Liberia, located on the Atlantic coast. It was founded in 1822 by the American Colonization Society as a settlement for freed U.S. slaves and named for Pres. James Monroe. Bushrod Island contains the artificial harbour and free port of Monrovia, the only such port in West Africa. It is Liberia's largest city and its administrative and commercial centre. Many of the city's buildings were damaged during the civil war that began in 1990, and its increased population includes many formerly rural people displaced by the war. It is the seat of the University of Liberia.

Monsarrat \ˌmän-sə-ˈrat**, Nicholas (John Turney)** (b. March 22, 1910, Liverpool, Eng.—d. Aug. 8, 1979, London) British novelist. Trained in law, he served with the Royal Navy (1940–46), chiefly on dangerous Atlantic convoy runs. He put his experience to account in such books as *H.M. Corvette* (1942) and his best-known work, *The Cruel Sea* (1951), a best-seller that vividly captures life aboard a small ship in wartime. His later work includes *The Story of Esther Costello* (1953) and *Smith and Jones* (1963).

monsoon Major wind system that seasonally reverses its direction (e.g., one that blows for six months from the northeast and six months from the southwest). The most prominent examples occur in Africa and southern Asia. The primary cause of monsoons is the difference between annual temperature trends over land and sea. Seasonal changes in temperature are large over land but small over oceans. A monsoon blows from cold toward warm regions: from sea toward land in summer and from land toward sea in winter. Most summer monsoons produce copious amounts of rain; winter monsoons tend to cause drought.

Mont, Allen Du See Allen B. Du Mont

Mont Blanc See Mont Blanc

Mont-Saint-Michel \mō^{n}-sa^{n}-mē-ˈshel\ Rocky, almost circular islet rising out of Mont-Saint-Michel Bay between Brittany and Normandy, northwestern France. It only becomes an island at high tide. Around its base are medieval walls and towers, above which rise the village's clustered buildings, with an ancient abbey crowning the mount. Over the centuries it has been a pilgrimage center, fortress, and prison. The fine abbey church has an imposing 11th-century Romanesque nave and an elegant Flamboyant-style Gothic choir. The exterior walls of the Gothic monastery building combine the power of a military fortress and the simplicity of a religious building. Some of the houses bordering the island's narrow, winding streets date back to the 15th century.

montage \män-ˈtäzh\ *French* **"mounting"** Pictorial technique in which cut-out illustrations, or fragments of them, are arranged together and mounted on a support, producing a composite picture made from several different pictures. It differs from collage in using only ready-made images chosen for their subject or message. The technique is widely used in advertising. Photomontage uses photographs only. In motion pictures, montage is the sequential assembling of separate pieces of thematically related film by the director, film editor, and visual and sound technicians, who cut and fit each part with the others to produce visual juxtapositions and complex audio patterns.

Montagnais and Naskapi \ˌmän-tən-ˈyā...ˈnas-kə-pē\ Two related North American Indian peoples living in Quebec and Labrador, Can. They speak almost identical Algonquian dialects. The Montagnais, whose name is French, meaning "Mountaineers," traditionally occupied a large forested area above the northern shores of the Gulf of St. Lawrence. They lived in birch-bark wigwams and subsisted on moose, salmon, eel, and seal. The Naskapi, whose name is derived from a Montagnais word meaning "savage," lived farther north on the Labrador plateau, where they hunted caribou and fished. Both groups used canoes in summer and sleds and snowshoes in winter. Religious belief centred on *manitou*, or supernatural power; much importance was attached to nature and animal spirits. The basic social unit was the nomadic band. Both groups now call themselves Innu—not to be confused with Inuit (see Eskimo)—meaning "People." Together the Montagnais and Naskapi total some 20,000, the vast majority of whom are Montagnais.

Montagnard \ˌmō^{n}-ˌtän-ˈyär\ *French* **"Mountain Man"** Radical deputy in the National Convention during the French Revolution. The Montagnards were so called because they sat on the higher benches (the "Mountain") above the uncommitted deputies of the "Plain." The Montagnards emerged in 1792 as opponents of the moderate Girondins and later associated with the radical Jacobin Club in the Committee of Public Safety. After the Thermidorian Reaction, many Montagnards were executed or purged from the convention, and they became a minority called the *crête* ("crest").

Montagu \ˈmän-tə-ˌgyü**, Lady Mary Wortley** *orig.* **Lady Mary Pierrepont** (baptized May 26, 1689, London, Eng.—d. Aug. 21, 1762, London) English writer, the most colourful Englishwoman of her time. A prolific letter writer, Montagu is remembered chiefly for 52 superb letters chronicling her stay in Constantinople, where her husband was ambassador from 1716 to 1718. On their return, they introduced the Middle Eastern practice of smallpox vaccination into England. Also a poet, essayist, feminist, and eccentric, she was a friend of John Gay and Alexander Pope, who later turned against and satirized her. Among her writings are six "town eclogues," witty adaptations of Virgil; a lively attack on Jonathan Swift (1734); and essays dealing with feminism and the moral cynicism of her time.

Montaigne \mō^{n}-ˈten^{y},\ *English* \män-ˈtān**, Michel (Eyquem) de** (b. Feb. 28, 1533, Château de Montaigne, near Bordeaux, France—d. Sept. 23, 1592, Château de Montaigne) French courtier and author. Born into the minor nobility, Montaigne received an excellent Classical education (speaking only Latin up to age 6) before studying law and serving as counselor at the Bordeaux Parliament. There he met the lawyer Étienne de La Boétie, with whom he formed an extraordinary friendship; the void left by La Boétie's death in 1563 likely led Montaigne to begin his writing career. He retired to his château in 1571 to work on his *Essais* (1580, 1588), a series of short prose reflections on many subjects that form

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one of the most captivating and intimate self-portraits ever written. At once deeply critical of his time and deeply involved in its struggles, he sought understanding through self-examination, which he developed into a description of the human condition and an ethic of authenticity, self-acceptance, and tolerance. Though most of his later years were devoted to writing, he occasionally served as mediator in episodes of religious conflict in his region and beyond, and served as mayor of Bordeaux during the troubled period 1581–85. See also ESSAY.

Montale \mōn-'tä-lā**, Eugenio** (b. Oct. 12, 1896, Genoa, Italy—d. Sept. 12, 1981, Milan) Italian poet, prose writer, editor, and translator. Montale began his literary activities after World War I, cofounding a journal, writing for other journals, and serving as a library director in Florence. His first book of poems, *Cuttlefish Bones* (1925), expressed the bitter pessimism of the postwar period. He was identified with HERMETICISM in the 1930s and '40s, and his works became progressively introverted and obscure. With *The Storm and Other Poems* (1956) his writing showed the increasing skill, warmth, and directness characteristic of his late period. His stories and sketches were collected in *The Butterfly of Dinard* (1956). He received the Nobel Prize for Literature in 1975.

Montalembert \mōⁿ-tä-läⁿ-'ber**, Charles (-Forbes-René), count de** (b. April 15, 1810, London, Eng.—d. March 13, 1870, Paris, France) French politician and historian. He began his political career as a journalist for several Catholic journals, became a leader of the liberal Roman Catholics in the July monarchy, and was a member of the House of Peers (1835–48). A champion of civil and religious liberties, he opposed NAPOLEON III's policies after 1851. He wrote such historical works as *The Catholic Interest in the 19th Century* (1852), *The Political Future of England* (1856), and *Monks of the West* (1863–77).

Montana State (pop., 2000: 902,195), northwestern U.S. Bordered by Canada and the U.S. states of North Dakota, South Dakota, Wyoming, and Idaho, it covers 147,046 sq mi (380,849 sq km); its capital is HELENA. Montana straddles the GREAT PLAINS to the east and the ROCKY MOUNTAINS to the west. Unique among the states, its rivers flow into three of the continent's primary watersheds: the Pacific, the Gulf of Mexico, and Hudson Bay. At the time of European settlement the region was inhabited by various Indian tribes, including the CHEYENNE, BLACKFOOT, NEZ PERCÉ, and CROW. Most of Montana was obtained by the U.S. through the LOUISIANA PURCHASE of 1803. The western part was disputed until 1846, when Britain relinquished its claim to the area. The LEWIS AND CLARK EXPEDITION explored Montana in 1804–06. St. Mary's Mission, established in 1841 by Roman Catholic missionaries, became the first permanent town as Stevensville. Gold was discovered in the early 1860s; grazing of cattle and sheep was introduced later that decade, leading to bitter battles with the Indians, whose hunting grounds were destroyed. Montana Territory was established in 1864. Though the U.S. troops of GEORGE ARMSTRONG CUSTER were defeated and slain at the Battle of the LITTLE BIGHORN in 1876, the Indians ceased fighting in 1877 and were placed on reservations. Montana became the 41st state in 1889. Vast deposits of copper were found in the 1890s, and mining was the economic mainstay for almost a century. The state's economy now emphasizes tourism.

Montana, Joe *in full* **Joseph Clifford Montana, Jr.** (b. June 11, 1956, New Eagle, Pa., U.S.) U.S. football quarterback. He played for the University of Notre Dame, leading his team to the national championship in 1977. Playing with the San Francisco 49ers from 1979 to 1993, he led the team to Super Bowl championships in 1982, 1985, 1989, and 1990. He maintained one of the highest passing-completion rates in the NFL, with a career average of 63.2. His career totals for passes completed (3,409), yards passing (40,551), and touchdown passes (273) are among the highest on record. He finished his career with the Kansas City Chiefs (1993–95) and was inducted into the Pro Football Hall of Fame in 2000.

Montand \mōⁿ-'täⁿ**, Yves** *orig.* **Ivo Livi** (b. Oct. 13, 1921, Monsummano Alto, Italy—d. Nov. 9, 1991, Senlis, France) Italian-born French actor and singer. Raised in Marseille, he was the protégé of the famous chanteuse EDITH PIAF in the late 1940s. He married the actress Simone Signoret (1921–85) in 1951. International renown came with his appearance in the film *Wages of Fear* (1953). In Hollywood he starred opposite MARILYN MONROE in *Let's Make Love* (1960), and their romantic affair was widely publicized. His later films included *Z* (1969), *Jean de Florette*, and *Manon of the Spring* (both 1987). For most of his life he was known as a supporter of left-wing causes. He enjoyed great success as a singer, especially in France.

Montañés \ˌmōn-tän-'yās**, Juan (de) Martínez** (b. March 16, 1568, Alcalá la Real, Jaén, Spain—d. June 18, 1649, Sevilla) Spanish sculptor. After studying in Granada, he established his studio in Sevilla (Seville) and was instrumental in the transition from MANNERISM to the BAROQUE. He became known as *el dios de la madera* ("the god of wood") because of his great skill at wood carving. His output and influence over 50 years were enormous. Montañés is remembered for his wood altars and altar figures covered with polished gold and coloured paint, which are realistic yet idealized. His work influenced not only the sculptors and altar makers of Spain and Latin America but also the Spanish painters of his century.

Montanism \'mänˌtə-ˌni-zəm\ Heretical Christian movement founded in AD 156 by Montanus. Having converted to Christianity, Montanus fell into a trance and began to prophesy. Others joined him, and the movement spread through Asia Minor. The Montanists held that the HOLY SPIRIT was speaking through Montanus and that the Second Coming was imminent. The bishops of Asia Minor excommunicated the Montanists (c. 177), but the movement continued in the East as a separate sect; it also flourished in Carthage, where its most illustrious convert was TERTULLIAN. It had almost died out by the 5th–6th century, though some remnants survived into the 9th century.

Montcalm \mänt-'kälm\ **(de Saint-Véran), Louis-Joseph de Montcalm-Grozon, marquis de** (b. Feb. 28, 1712, Château de Candiac, France—d. Sept. 14, 1759, Quebec) French military leader. He joined the French army at age 12 and fought in several European conflicts. In 1756 he was placed in command of French troops in North America, but his commission excluded most military resources in Canada. He forced the British to surrender their post at Oswego and captured Fort William Henry (1757). At the Battle of TICONDEROGA (1758), he repulsed an attack by 15,000 British troops with a force of just 3,800 men. Promoted to lieutenant general, he received authority over military affairs in Canada. In 1759 a British force of 8,500 troops under Gen. JAMES WOLFE marched on Quebec; in the ensuing Battle of QUEBEC, Montcalm fought with conspicuous gallantry and was mortally wounded.

Monte Albán \'mōn-tā-ˌäl-'bän\ Ridgetop site of the ruins of the ancient centre of ZAPOTEC culture, located near Oaxaca, Mex. Construction at the site began around the 8th century BC. Monte Albán reached its height AD 250–700. The site contains great plazas, truncated pyramids, a *tlachtli* court for an ancient ballgame, underground passageways, and about 170 tombs, the most elaborate yet uncovered in the New World. The great plaza atop the highest hill is flanked by four platforms; two temples stand on the platform to the south. In its final phase, Monte Albán was inhabited by the MIXTEC.

Monte-Carlo Resort (pop., 2000: 15,507), one of the four sections (*quartiers*) of MONACO. It is situated northeast of Nice on the French RIVIERA. In 1856 Charles III of Monaco granted a charter allowing a joint-stock company to build a casino, which opened in 1861. The district around it, called Monte-Carlo, became a luxurious playground for the world's wealthy. The government took over the casino's operating company in 1967.

Monte Carlo method Statistical method of approximating the solution of complex physical or mathematical systems. The method was adopted and improved by JOHN VON NEUMANN and STANISLAW ULAM for simulations of the ATOMIC BOMB during the MANHATTAN PROJECT. Because the method is based on random chance, it was named after a gambling resort.

Monte Cassino Principal monastery of the BENEDICTINE order, located in Latium, central Italy. It was founded c. 529 by St. BENEDICT OF NURSIA and reached its peak under Desiderius (later Pope VICTOR III), who was abbot 1058–87. Its buildings were destroyed by the Lombards (c. 581), the Arabs (883), an earthquake (1349), and World War II bombardment (1944), but were rebuilt each time. It was reconsecrated in 1964.

Montego \män-'tē-gō\ **Bay** Seaport (pop., 2000 est.: 89,859), northwestern Jamaica, located northwest of KINGSTON. It lies on the site of a large ARAWAK village visited by CHRISTOPHER COLUMBUS in 1494. The Spanish, ousted by the British after 150 years, destroyed most of the original buildings. One of Jamaica's largest cities, it is a commercial centre and busy port. It is also a popular tourist resort noted for its white sandy beaches.

Montenegro \ˌmōn-tā-'nā-grō\ Constituent republic of SERBIA AND MONTENEGRO. Area: 5,333 sq mi (13,812 sq km). Population (2003): 620,145.

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The capital is Podgorica. The republic's name ("Black Mountain") refers to its ancient stronghold near the Adriatic Sea, Mount Lovcen, which rises to 5,738 ft (1,749 m). Montenegro's landscape ranges from arid hills to forests and fertile valleys. The majority of its population are Montenegrins who follow the Eastern Orthodox Church; there are sizable Muslim and Albanian minorities. Under the Roman Empire the region was part of the province of Illyricum. Settled by Slavs in the 7th century, it was incorporated in the Serbian empire in the late 12th century. It retained its independence following the defeat of the Serbians by the Ottoman Empire in 1389 at the Battle of Kosovo. Often at war with the Ottomans and Albanians, it began an alliance with Russia early in the 18th century. In the Balkan Wars of 1912–13, it cooperated against the Ottoman Empire. It supported Serbia during and after World War I. It was then absorbed into Serbia; the union became part of the Kingdom of Serbs, Croats, and Slovenes (from 1929, Yugoslavia). During World War II Montenegro was occupied by the Italians and was the scene of heavy fighting. In 1946 the federal constitution of the new Yugoslavia made Montenegro one of Yugoslavia's six nominally autonomous federated units. In 1992, one year after the breakup of Yugoslavia, Montenegro and Serbia combined as the new Federal Republic of Yugoslavia. In 2003, following agitation for independence in Montenegro, the Serbian, Montenegrin, and Yugoslav parliaments ratified a new constitutional agreement that maintained the federation; the accord renamed the country Serbia and Montenegro and gave Montenegro significant autonomy over its own affairs.

Monterrey City (pop., 2000: 1,110,997), capital of Nuevo León state, northern Mexico. It lies at an elevation of about 1,750 ft (530 m). It was founded in 1579, but its growth was slow until the late 19th century. In 1846 it was taken by U.S. Gen. Zachary Taylor in the Mexican War. In 1882 rail connections were established with Laredo, Texas, U.S., and in 1930 construction began on the Inter-American Highway, leading to the development of large-scale smelting and heavy-industry enterprises. It has several institutions of higher education.

Montesquieu \ˌmän-təs-ˈkyü**, Charles-Louis de Secondat, baron de (La Brède et de)** (b. Jan. 18, 1689, Château La Brède, near Bordeaux, France—d. Feb. 10, 1755, Paris) French philosophe and satirist. Born into a noble family, he held public office in Bordeaux from 1714. His satirical *Persian Letters* (1721) was hugely successful. From 1726 he traveled widely to study social and political institutions. His magnum opus, the enormous *The Spirit of the Laws* (1750), contained an original classification of governments by their manner of conducting policy, an argument for the separation of the legislative, judicial, and executive powers, and a celebrated but less influential theory of the political influence of climate. The work profoundly influenced European and American political thought and was relied on by the framers of the U.S. Constitution. His other works include *Causes of the Greatness and Decadence of the Romans* (1734).

Montessori \ˌmän-tə-ˈsȯr-ē**, Maria** (b. Aug. 31, 1870, Chiaravalle, near Ancona, Italy—d. May 6, 1952, Noordwijk aan Zee, Neth.) Italian educator. Montessori took a degree in medicine (1894) and worked in a clinic for retarded children before going on to teach at the University of Rome. In 1907 she opened her first children's school, and for the next 40 years she traveled throughout Europe, India, and the U.S., lecturing, writing, and setting up Montessori schools. Today there are hundreds of such schools in the U.S. and Canada alone; their principal focus is on preschool education, but some provide elementary education to grade 6. The Montessori system is based on belief in children's creative potential, their drive to learn, and their right to be treated as individuals. It relies on the use of "didactic apparatuses" to cultivate hand-eye coordination, self-directedness, and sensitivity to prematheматical and preliterary instruction.

Monteverdi \ˌmän-tə-ˈver-dē**, Claudio (Giovanni Antonio)** (baptized May 15, 1567, Cremona, Duchy of Milan—d. Nov. 29, 1643, Venice) Italian composer. The first of his nine books of madrigals appeared in 1587, the second in 1590. He visited the court of the Gonzagas in Mantua, and his next book (1592) shows freer use of dissonance and close coordination of music and words. He married in 1599 and settled in Mantua. Attacked in 1600 for the even freer dissonance in his newest works, he replied that music now had two "practices," the stricter first practice for sacred works and the more expressive second practice for secular music. It was his first opera, *Orfeo*, performed in 1607, that finally established him as a composer of large-scale music rather than of exquisite miniature works. In 1610 he completed his great *Vespers*. Having long tried to obtain his release from Mantua, he was finally granted it in 1612, and the next year he was put in charge of music at San Marco Basilica, Venice. After the first opera house opened in Venice (1637), he wrote his last three operas, including *Il ritorno d'Ulisse in patria* (1640) and the remarkable *Incoronazione di Poppea* (1643). Monteverdi is the first great figure of Baroque music, a remarkable innovator who synthesized the elements of the new style to create the first Baroque masterpieces of both sacred and secular music.

Montevideo \ˌmän-tə-vi-ˈdā-ō\ Port city (pop., 2004: 1,383,416), capital of Uruguay. Situated on the northern shore of the Río de la Plata estuary, it was founded by the Spanish in 1726 to stem the Portuguese advance into the area from Brazil. From 1807 to 1830 it was alternately occupied by British, Spanish, Argentine, Portuguese, and Brazilian forces. It became the capital of newly independent Uruguay in 1830. A major seaport of South America, it is the commercial, political, and cultural centre of Uruguay. It is the site of Uruguay's only institutions of higher education, which include the Universidad de la República and the Universidad del Trabajo del Uruguay.

Montez \ˈmän-ˌtez**, Lola** *orig.* **Marie Dolores Eliza Rosanna Gilbert** (b. 1818, Limerick, Ire.—d. Jan. 17, 1861, New York, N.Y., U.S.) Irish adventuress and dancer who achieved notoriety as the mistress of King Louis I of Bavaria. After a few dance lessons in Spain, she toured Europe, billing herself as a Spanish dancer. While in Munich in 1846, she became Louis's mistress and influenced him toward supporting liberal and anti-Jesuit policies. Her power over the king provoked angry reactions in the government in 1848, forcing her to flee and causing his abdication. After further tours, she settled in New York City.

Montezuma II *or* **Moctezuma II** (b. 1466—d. c. June 30, 1520, Tenochtitlán, near modern Mexico City) Ninth emperor of the Aztecs. In 1502 he inherited from his uncle an empire of five to six million people that stretched from present-day Mexico to Nicaragua. Aztec belief in the prophesied return of the god Quetzalcóatl, whose description the conquistador Hernán Cortés resembled, contributed to his downfall. Cortés, who had made alliances with tribes eager to be rid of Aztec domination, held Montezuma prisoner in Tenochtitlán, and he died in custody.

Montezuma Castle National Monument National monument, central Arizona, U.S. Situated in the Verde River valley, it occupies an area of 2.6 sq mi (6.7 sq km). Declared a national monument in 1906, it is the site of the country's best-preserved pre-Columbian Pueblo Indian cliff dwellings. The "castle" is a five-story, 20-room adobe brick structure, dating from c. AD 1100, built into the cliff face about 80 ft (24 m) above the valley floor. To the northeast is Montezuma Well, a large sinkhole rimmed with communal dwellings.

Montfort \mōⁿ-ˈfȯr**, Simon de** (b. 1165?—d. June 25, 1218, Toulouse, France) French leader of the Albigensian Crusade. From 1209 he led a Crusade against the Cathari heretics, and he became governor of the lands he conquered in southern France. The fourth Lateran Council gave him Toulouse (1215), but Raymond VI, count of Toulouse, refused to accept defeat, and Montfort was killed while besieging the city. His eldest son ceded the Montfort lands in southern France to King Louis VIII.

Montfort, Simon de *later* **Earl of Leicester** (b. c. 1208, Montfort, Ile-de-France, France—d. Aug. 4, 1265, Evesham, Worcestershire, Eng.) The second son of Simon de Montfort, he gave up Montfort lands in France but revived the family claim to the English earldom of Leicester. His marriage to Henry III's sister (1238) offended the barons and led to his temporary exile. Simon distinguished himself on a Crusade to the Holy Land (1240–42) and joined Henry's failed invasion of France (1242). Sent to pacify Gascony (1248), he was censured for his harsh methods there and recalled. He joined the other leading barons in forcing Henry to accept the Provisions of Oxford. When Louis IX annulled the Provisions, Simon defeated and captured Henry (1264) and summoned (1265) what became the beginning of the modern Parliament. He governed England for less than a year before being defeated and killed by Henry's son Edward.

Montgolfier \mōⁿ-gōl-ˈfyā**, Joseph-Michel; and Montgolfier, Jacques-Étienne** (respectively b. Aug. 26, 1740, Annonay, France—d. June 26, 1810, Balaruc-les-Bains; b. Jan. 6, 1745, Annonay, France—d. Aug. 2, 1799, en route from Lyon to Annonay) French designers of the hot-air balloon. The brothers discovered that heated air collected in a lightweight bag would cause the bag to rise. In 1783 they demonstrated their discovery with a balloon that rose 3,000 ft (1,000 m) and remained

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aloft 10 minutes. Later that year they sent a sheep, a duck, and a rooster up as passengers, and they followed that experiment with the first manned untethered balloon flight.

Montgomery City (pop., 2000: 201,568), capital of Alabama, U.S. The site was inhabited by Indian mound builders in prehistoric times. About 1717 the French built Fort Toulouse on the river above the present site of Montgomery. The city was founded in 1819 and named for Gen. Richard Montgomery; it became the state capital in 1846. In 1861, during the American Civil War, it served briefly as the capital of the Confederacy; it was captured by Union troops in 1865. It was a centre of the civil rights movement, notably the protests organized by Martin Luther King, Jr. Located southeast of Birmingham, it serves as the commercial centre of an agricultural region, trading in cotton and livestock and producing fertilizer. It is the seat of Alabama State University and several other institutions of higher education.

Montgomery (of Alamein), Bernard Law Montgomery, 1st Viscount (b. Nov. 17, 1887, London, Eng.—d. March 24, 1976, near Alton, Hampshire) British general in World War II. Educated at Sandhurst, he distinguished himself in World War I and remained in the army, becoming known as a tough and efficient leader. In World War II he commanded the British army in the North Africa Campaign and forced the German retreat from Egypt after the Battle of El Alamein (1942). He commanded troops in the Allied invasion of Sicily and Italy (1943) and in the Normandy Campaign, leading the British-Canadian army group across northern France and into northern Germany. Promoted to field marshal, he became chief of the imperial staff (1946–48) and later deputy commander of NATO (1951–58). A cautious, thorough strategist, "Monty" often exasperated fellow Allied commanders, including Dwight D. Eisenhower, but his insistence on complete readiness ensured his popularity with his troops.

Montgomery, L(ucy) M(aud) (b. Nov. 30, 1874, Clifton, P.E.I., Can.—d. April 24, 1942, Toronto, Ont.) Canadian novelist. She worked as a teacher and journalist before achieving worldwide success with *Anne of Green Gables* (1908). The sentimental story of a spirited orphan girl, it drew on her childhood experiences and the rural life of her native Prince Edward Island. Six sequels, following Anne through motherhood, were less successful. Montgomery also produced another series of juvenile books, several collections of stories, and two books for adults.

Montgomery, Wes *orig.* **John Leslie Montgomery** (b. March 6, 1923/25, Indianapolis, Ind., U.S.—d. June 15, 1968, Indianapolis) U.S. jazz guitarist. He began playing guitar in his teens, and his principal early inspiration was the late-swing guitarist Charlie Christian. Montgomery was a member of Lionel Hampton's band (1948–50) before forming a small group with his brothers. His finest recordings are small-group efforts made after 1959, although he achieved commercial success using accompanying orchestras in the 1960s. His unconventional technique, using his thumb rather than a plectrum, made possible his frequent use of octaves and chords in solos. He was probably the most influential guitar improviser in modern jazz.

Montgomery Ward & Co. Former U.S. retail merchandising company. It was founded in Chicago in 1872 by Aaron Montgomery Ward (1844–1913), who bought merchandise wholesale and sold it directly to farmers. He distributed the world's first mail-order catalog and offered a money-back guarantee. The company opened its first retail stores in 1926, and by 1930 retail sales exceeded catalog sales. It ended its mail-order business in 1985, and in 1997 it scaled back operations after filing for bankruptcy protection. Another bankruptcy in December 2000 caused the company to close its 250 stores and go out of business the following year. See also direct-mail marketing; Sears, Roebuck and Company.

Montherlant \mōⁿ-ter-'läⁿ**, Henry (-Marie-Joseph-Millon) de** (b. April 21, 1896, Paris, France—d. Sept. 21, 1972, Paris) French novelist and dramatist. Born into a noble family, he wrote stylistically concise works that reflect his own egocentric and autocratic personality. His major work of fiction is a cycle of four novels (1936–39) translated as *The Girls*, which describes the relationship between a libertine novelist and his adoring female victims. In the 1940s he turned to theatre; his best dramatic works include *Malatesta* (1946), *Port-Royal* (1954), and *La Guerre civile* (1965).

Monticello \ˌmän-tə-'se-lō, ˌmän-tə-'che-lō\ Home of Thomas Jefferson, located southeast of Charlottesville, Va. Designed by Jefferson and constructed 1768–1809, it is one of the finest examples of the early Classical Revival style in the U.S. Jefferson took the floor plan of the house from an English pattern book; the facade was influenced by the work of Andrea Palladio. The final structure is a three-story brick-and-frame building with 35 differently shaped rooms. An octagonal dome dominates the structure; below it, a balustrade runs around the roof's edge.

Montmorency \mōⁿ-mȯ-räⁿ-'sē\ *English* \ˌmänt-mə-'ren-sē**, Anne, duke de** (b. March 15, 1493, Chantilly, France—d. Nov. 12, 1567, Paris) French soldier and constable of France. Named for his godmother, Queen Anne of Brittany, he served three kings—Francis I, Henry II, and Charles IX—in war and peace. He fought in numerous wars in northern Italy and southern France against Emperor Charles V and in campaigns against the Huguenots. In 1529 he helped negotiate the Peace of Cambrai between France and Charles V. He was created constable of France in 1538, and he became a duke and peer in 1551. Wounded at the Battle of Saint-Denis, he died two days later.

Montpelier \mänt-'pēl-yər\ City (pop., 2000: 8,035), capital of Vermont, U.S. Named for Montpellier, France, it commanded the main pass through the Green Mountains and was chartered in 1781 by proprietors from Massachusetts and western Vermont. It became the state capital in 1805 and defeated attempts by other cities, including Burlington, to succeed it as capital. In addition to providing state government services, it bases its economy on financial services and the local ski industry. It is the site of a campus of Norwich University/Vermont College and was the birthplace of Adm. George Dewey.

Montpellier \mōⁿ-pel-'yā\ City (pop., 1999: 225,392), southern France, near the Mediterranean coast. Founded in the 8th century, it later came under control of Aragon and the king of Majorca. It developed as a trading station for spice imports in the 10th century and acquired a charter in 1141. It reverted to France in the 14th century and served as a Huguenot stronghold until its capture by Louis XIII in 1622. It then became the administrative capital of the Languedoc region. The city's schools of medicine and law date from the 12th century, and the University of Montpellier was founded in 1220. The city is a tourist centre, and its industries include food processing and electronics. Historic sites include France's oldest botanical gardens (founded 1593) and a 14th-century Gothic cathedral.

Montreal \ˌmän-trē-'ȯl\ City (pop., 2001: metro. area, 3,426,350), southeastern Canada. It occupies about one-third of Île de Montréal (Montreal Island), near the confluence of the Ottawa and St. Lawrence rivers. The metropolitan area encompasses Montréal and other islands, as well as both shores of the St. Lawrence. It is built on the slopes of a mountain, Mont-Royal, from which the city's name is derived. English and French are spoken throughout the city, which is the chief centre of French-Canadian industry and culture. The site was occupied by the Huron Indian settlement of Hochelaga when visited by French explorer Jacques Cartier in 1535. The first European settlement was founded by the French in 1642 and was given the name Ville-Marie de Montréal. Rapid colonization based on the fur trade began in the first half of the 18th century, and the city soon grew beyond its walls. It surrendered to British forces in 1760 and, with all of New France, became part of the British North American empire in 1763. Montreal served as the capital of Canada from 1844 to 1849. It is one of Canada's chief ports for both oceangoing and inland shipping. It is Canada's second-largest city and a major cultural centre, with a complex of theatre and concert halls and several museums. It is the seat of the English-language McGill University and Concordia University, and of the French-language University de Montréal and the University du Québec à Montréal.

Montreal, University of Canadian public French-language university founded in Montreal, Quebec, in 1878. It provides instruction in the arts and sciences, education, law, medicine, theology, architecture, social work, criminology, and other fields. Affiliated schools include a polytechnic school and a school of advanced business studies.

Montreux \'mȯⁿ-'trœ\ Resort town (pop., 2000: 22,455), western Switzerland, on the eastern shore of Lake Geneva. It was formed by the merger in 1962 of the villages of Le Châtelard, Les Planches, and Veytaux. The nearby 13th-century Château de Chillon was made famous by Lord Byron's poem "Prisoner of Chillon." It hosts a popular annual jazz festival.

Montreux \mōⁿ-'trœ\ **Convention** (1936) Agreement concerning the Dardanelles strait. In response to Turkey's request to refortify the area,

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the signers of the Treaty of Lausanne and others met in Montreux, Switz., and agreed to return the zone to Turkish military control. The convention allowed Turkey to close the straits to all warships when it was at war and to permit merchant ships free passage. See also Straits Question.

Montrose \män-'trōz**, James Graham, 5th earl and 1st marquess of** (b. 1612—d. May 21, 1650, Edinburgh, Scot.) Scottish general in the English Civil Wars. He served in the Covenanter army that invaded northern England (1640) but remained a royalist. Appointed lieutenant-general by Charles I (1644), he led his royalist army of Highlanders and Irish to victories in major battles in Scotland. After Charles's defeat in 1645, Montrose fled to the European continent. He returned to Scotland in 1650 with 1,200 men, but he was defeated, captured, and hanged.

Montserrat Island (pop., 2001 est.: 3,600) and British crown colony, West Indies. Situated in the eastern Caribbean Sea, it occupies an area of 40 sq mi (102 sq km); it is 11 mi (18 km) long and 7 mi (11 km) wide. It was visited and named by Christopher Columbus in 1493 and was colonized by the British and Irish in 1632. France later held it briefly, but from 1783 it remained British. Its colonial economy was based on cotton and sugar plantations that used African slave labour. It was part of the colony of Leeward Islands from 1871 to 1956 and then of the Federation of the West Indies from 1958 to 1962. It was rebuilt after a devastating hurricane in 1989. A major eruption of the Soufrière Hills volcano in 1996 led to the evacuation of the southern half of the island and the abandonment of its capital, Plymouth. By 1998 more than two-thirds of its mid-1990s population had left the island.

Monty Python('s Flying Circus) British comedy troupe. The innovative group, formed in the early 1960s, came to prominence in the 1970s, first on television and later in films. Its members, most of whom met while attending the University of Cambridge, included Graham Chapman (1941–89) and John Cleese (coauthors of most of their skits and films) as well as Terry Jones (b. 1942), Terry Gilliam (b. 1940), Eric Idle (b. 1943), and Michael Palin (b. 1943). The troupe's parodies of British life and television and their array of absurd characters surprised and delighted international audiences. Their films include *Monty Python and the Holy Grail* (1975) and *Monty Python's Life of Brian* (1979).

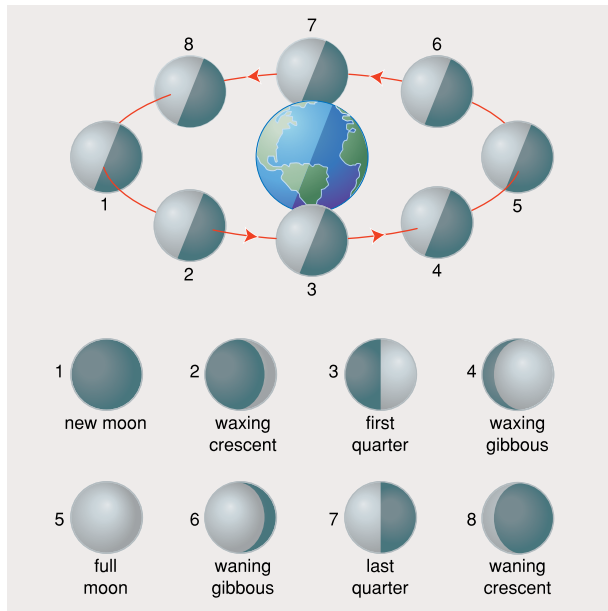
Monumentum Ancyranum \ˌmän-yù-'men-təm-ˌan-sir-'ā-nəm\ (after AD 14) Latin and Greek inscription on the temple of Rome and Augustus at Ancyra (Ankara, Tur.). Known as the *Res gestae divi Augusti* ("Achievements of the Divine Augustus"), it represents the official account of his reign. It was composed by Augustus himself, who directed in his will that it be engraved on pillars at his mausoleum in Rome. The originals are missing, the copies at Ancyra being two of many.

monzonite \män-'zō-ˌnīt, 'män-zə-ˌnīt\ Type of igneous rock that contains abundant and approximately equal amounts of plagioclase and potash feldspar, as well as other minerals. The type region is Monzoni, Italy, in the Italian Tirol; similar rocks have been described from Montana, Norway, Sakhalin Island, and other localities. Monzonite is not rare, but it generally occurs in rather small, heterogeneous masses mixed with diorites, pyroxenites, or gabbros.

mood *or* **mode** In grammar, a category that reflects the speaker's view of an event's reality, likelihood, or urgency. Often marked by special verb forms (inflections), moods include the indicative, for factual or neutral situations (e.g., "You did your work"); the imperative, to convey commands or requests ("Do your work"); and the subjunctive. The subjunctive's functions vary widely. It may express doubt, possibility, necessity, desire, or future time. In English it often indicates a condition contrary to fact (e.g., "If he were to work here, he would have to learn to be punctual").

Moody, Dwight L(yman) (b. Feb. 5, 1837, East Northfield, Mass., U.S.—d. Dec. 22, 1899, Northfield, Mass.) U.S. Protestant evangelist. Raised on a farm in Massachusetts, he moved first to Boston, where he converted to evangelical Christianity in 1856, and then to Chicago, where he prospered in business. He gave up business in 1860 and engaged in missionary work with the YMCA (1861–73). He founded Moody Church and preached in the slums, emphasizing literal interpretation of the Bible and the need to prepare for the Second Coming. In 1870 he teamed up with the hymn writer Ira D. Sankey (1840–1908), and they began a series of highly popular revival tours in Britain and the U.S. Moody founded the Northfield School (1879), the Mount Hermon School (1881), and the Chicago Bible Institute (1889; now the Moody Bible Institute).

Moon Sole natural satellite of Earth, which it orbits from west to east at a mean distance of about 238,900 mi (384,400 km). It is less than one-third the size of Earth (diameter about 2,160 mi, or 3,476 km, at its equator), about one-eightieth as massive, and about two-thirds as dense. Its surface gravity is about one-sixth that of Earth, and its gravitational pull is largely responsible for Earth's tides. The Moon shines by reflected sunlight, but its albedo is only 7.3%. It rotates on its axis in about 29.5 days, in exactly the time it takes to orbit Earth, and it therefore always presents the same face to Earth. However, that face is lit by the Sun at different angles as the Moon revolves around Earth, causing it to display different phases over the month, from new to full. Most astronomers believe the Moon formed from a cloud of fragments ejected into Earth orbit when a Mars-sized body struck the proto-Earth early in the solar system's history. Its surface has been studied by telescope since Galileo first observed it in 1609 and firsthand by a total of 12 U.S. astronauts during the six successful lunar landing missions of the Apollo program. The dominant process affecting the surface has been impacts, both from micrometeorite bombardment, which grinds rock fragments into fine dust, and from meteorite strikes, which produced the craters profusely scattered over its surface mostly early in its history, over four billion years ago. The maria (see mare) are huge, ancient lava flows. In the late 1990s unmanned spacecraft found possible signs of water ice near the Moon's poles. More generally, a moon is any natural satellite orbiting a planet or other nonstellar body.



As the Moon revolves around Earth, the amount of its illuminated half seen from Earth slowly increases and decreases (waxes and wanes). The cycle takes about 29½ days.

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Moon, Sun Myung (b. Jan. 6, 1920, Kwangju Sangsa Ri, P'yŏngan-puk province, Korea) South Korean religious leader. Convinced that he was designated by God as a successor to Jesus, Moon began to preach a new religion, loosely based on Christianity, in North Korea in 1946. After being imprisoned by North Korean authorities, he escaped or was released and went to South Korea, where he founded the Unification Church in 1954 and built a multimillion-dollar business empire. In 1973 he moved his headquarters to Tarrytown, N.Y., U.S., where he became the focus of controversies over fund-raising techniques, tax evasion, and the indoctrination of followers (popularly called Moonies). In 1982 Moon was convicted of tax evasion, sentenced to 18 months in prison, and fined $25,000. He has also suffered from a damaging exposé by his daughter-in-law. In the 1990s the church began operations in Brazil, where its purchase of large tracts of rainforest has been widely criticized.

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Moor Any member of the Muslim population of Spain, of mixed Arab, Spanish, and Berber origins. North African Muslims (called by their Latin name Mauri—i.e., natives of Roman Mauretania) invaded Spain in the 8th century and, under the UMAYYAD and ALMORAVID dynasties, created the great Arab Andalusian civilization in such cities as Córdoba, Toledo, Granada, and Sevilla. The Christian reconquest of Spain under ALFONSO VI began in the 11th century; from then until the Moors' final defeat in 1492 and for another century thereafter, many Moors settled as refugees in North Africa. See also MUDEJARS.

Moore, Archie *orig.* **Archibald Lee Wright** (b. Dec. 13, 1913, Benoit, Miss., U.S.—d. Dec. 9, 1998, San Diego, Calif.) U.S. boxer. Moore began boxing in the 1930s but had difficulty advancing because contending fighters thought him too formidable. In 1952 he defeated Joey Maxim to win the world light-heavyweight championship. He held the crown until 1962, when he was disqualified for failing to meet the leading contender, Harold Johnson. From 1936 to 1963 he fought 229 bouts and won 194 of them, 141 by knockouts. He later became a film actor and youth worker.

Moore, Brian (b. Aug. 25, 1921, Belfast, N.Ire.—d. Jan. 10, 1999, Malibu, Calif., U.S.) Irish-born Canadian novelist. Moore immigrated to Canada in 1948 and was a writer for the *Montreal Gazette* from 1952. He is best known for his first novel, *The Lonely Passion of Judith Hearne* (1955; film, 1987), about an aging spinster whose pretensions to gentility are gradually dissolved in alcoholism. His later novels include *The Luck of Ginger Coffey* (1960), *The Emperor of Ice Cream* (1965), *The Doctor's Wife* (1976), and *The Magician's Wife* (1998). His novels were very different from each other in voice, setting, and incident but alike in their lucid, elegant, and vivid prose.

Moore, Clement Clarke (b. July 15, 1779, New York, N.Y., U.S.—d. July 10, 1863, Newport, R.I.) U.S. scholar remembered for the ballad that begins "'Twas the night before Christmas." Moore cofounded General Theological Seminary and taught Oriental and Greek literature there (1821–50). He is said to have composed "A Visit to St. Nicholas" to amuse his children on Christmas 1822, and it was published anonymously in the *Troy* (N.Y.) *Sentinel*, on Dec. 23, 1823. In 2000 it was determined that the poem was probably the work of Henry Livingston, Jr. (1748–1828).

Moore, Ely (b. July 4, 1798, near Belvidere, N.J., U.S.—d. Jan. 27, 1860, Lecompton, Kansas Territory) U.S. publisher. A printer and newspaper editor, he was elected the first president of New York's federation of craft unions (1833). The following year he was elected chairman of the National Trades Union, which joined with TAMMANY HALL to elect him to the U.S. House of Representatives. In the House he helped generate support for the 10-hour workday. When his second term expired in 1839, he became surveyor of the port of New York and then editor of the *Warren Journal* in New Jersey.

Moore, G(eorge) E(dward) (b. Nov. 4, 1873, London, Eng.—d. Oct. 24, 1958, Cambridge, Cambridgeshire) British philosopher, one of the founders of ANALYTIC PHILOSOPHY. While a fellow at the University of Cambridge (1898–1904), he published two influential papers, "The Nature of Judgment" (1899) and "The Refutation of Idealism" (1903), that did much to break the hold of absolute IDEALISM on British philosophy. Also published during this period was his major ethical work, *Principia Ethica* (1903), in which he argued that "good" is a simple and unanalyzable quality that is knowable by direct apprehension. His intuitionism was the dominant metaethical position in Britain for the next 30 years, and it exerted considerable influence within the BLOOMSBURY GROUP of artists and intellectuals. In epistemology, Moore is remembered for his "common sense" philosophy, according to which human beings know to be true many propositions about themselves and the world that are inconsistent with idealist and skeptical doctrines (e.g., "The Earth has existed for many years"). His general position was that, because no argument for idealism or skepticism is as certain as the commonsense view, idealism and skepticism can be rejected out of hand. He was professor of philosophy at Cambridge from 1925 to 1939. From 1921 to 1947 he edited the journal *Mind*.

Moore, Henry (b. July 30, 1898, Castleford, Eng.—d. Aug. 31, 1986, Much Hadham) English sculptor and graphic artist. The son of a coal miner, he was enabled to study at the Royal College of Art by a rehabilitation grant after being wounded in World War I. His early works were strongly influenced by the Mayan sculpture he saw in a Paris museum. From c. 1931 on he experimented with abstract art, combining abstract shapes with the human figure and at times leaving the human figure behind altogether. When materials grew scarce during World War II, he concentrated on drawings of Londoners sheltering from bombs in Underground stations. Commissions for a *Madonna and Child* and a family group turned his style from abstraction to the more humanistic approach that became the basis of his international reputation. He returned to experimentation in the 1950s with angular, pierced standing figures in bronze. Much of his work is monumental, and he is particularly well known for a series of reclining nudes. Among his major commissions were sculptures for UNESCO's Paris headquarters (1957–58), Lincoln Center (1963–65), and the National Gallery of Art (1978).

Moore, Marianne (Craig) (b. Nov. 15, 1887, St. Louis, Mo., U.S.—d. Feb. 5, 1972, New York City, N.Y.) U.S. poet. She attended Bryn Mawr College and later settled in Brooklyn, N.Y., with her mother. After 1919 she devoted herself to writing, contributing poetry and criticism to many journals. She edited the influential journal *The Dial* (1925–29). Her poetry volumes include *Observations* (1924) and *Collected Poems* (1951, Pulitzer and Bollingen Prizes, National Book Award). In her highly disciplined poems she distilled moral and intellectual insights from close observation of objective detail, especially in the animal world, often in innovative stanzaic forms. In her much-anthologized "Poetry" (1921) she called for poems that present "imaginary gardens with real toads in them." In her late years the winningly eccentric Moore, in her cape and tricornered hat, became an icon of sprightly gentility.

Marianne Moore, 1957
IMOGEN CUNNINGHAM

Moore, Mary Tyler (b. Dec. 29, 1936, Brooklyn, New York, N.Y., U.S.) U.S. television and film actress. She studied dance and appeared in commercials and in minor roles on television before costarring in the hit *Dick Van Dyke Show* (1961–66; two Emmy Awards). She achieved even greater success as the star of *The Mary Tyler Moore Show* (1970–77; four Emmy Awards), which became the most popular situation comedy of the 1970s. She also won an Emmy for her role in the television miniseries *Stolen Babies* (1993). Her films include *Ordinary People* (1980) and *Flirting with Disaster* (1996).

Moore, Stanford (b. Sept. 4, 1913, Chicago, Ill., U.S.—d. Aug. 23, 1982, New York, N.Y.) U.S. biochemist. He shared a 1972 Nobel Prize with Christian Anfinsen (1916–95) and William Stein (1911–80) for research on the molecular structures of PROTEINS. He is best known for his applications of CHROMATOGRAPHY to the analysis of AMINO ACIDS and PEPTIDES obtained from proteins and biological fluids and for the use of those analyses in determining the structure of the ENZYME ribonuclease.

Moore, Thomas (b. May 28, 1779, Dublin, Ire.—d. Feb. 25, 1852, Wiltshire, Eng.) Irish poet, satirist, composer, and singer. Moore graduated from Trinity College and studied law in London, where he became a close friend of Lord BYRON and PERCY BYSSHE SHELLEY. His collections *Irish Melodies* and *National Airs* (1807–34) consist of 130 original poems set to folk melodies, including "The Minstrel Boy," "Believe Me, if All Those Endearing Young Charms," and "The Last Rose of Summer." Performed by Moore for London's aristocracy, they aroused sympathy and support for Irish nationalists. His reputation among his contemporaries rivaled that of Byron and WALTER SCOTT. His poem *Lalla Rookh* (1817), a romantic Oriental fantasy, became the most translated poem of its time. In 1824 he was entrusted with Byron's memoirs; he burned them, presumably to protect Byron. He later published biographies of Byron and others, as well as a *History of Ireland* (1827).

moorhen *or* **common gallinule** Bird of the migratory GALLINULE species (*Gallinula chloropus*, family Rallidae) of Europe, Africa, and eastern North America. Moorhens are blackish and have a scarlet frontal shield (fleshy plate on the forehead). In North America, the moorhen is sometimes called the Florida gallinule.

moose Largest species (*Alces alces*) in the DEER family (Cervidae), found in northern North America and Eurasia. It is called ELK in Europe. Moose

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have long legs, a bulbous and mobile muzzle, short neck and tail, and a brown, shaggy, coarse coat. They stand 5–7 ft (1.5–2 m) tall and weigh up to 1,800 lb (820 kg). Males have enormous flattened, tined antlers that are shed and regrown annually. Moose wade in forest-edged lakes and streams, eating submerged aquatic plants, and browse on leaves, twigs, and bark. They are usually solitary, but North American moose often assemble in bands in winter. They range throughout the Canadian coniferous forests and those of the northern U.S. They have been protected from extermination by regulation of hunting. See also WAPITI.

Bull moose (*Alces alces*) in velvet
© LEONARD LEE RUE III—PHOTO RESEARCHERS, INC.

Moose River River, northeastern Ontario, Canada. It flows northeast for more than 60 mi (100 km) to empty into JAMES BAY. A wide stream, it is actually the estuary for several rivers, including the Abitibi and Mattagami.

moraine \mə-'rān\ Accumulation of rock debris (till) carried or deposited by a GLACIER. The material may range in size from blocks or boulders to sand and clay, is unstratified when dropped by the glacier, and shows no sorting or bedding. Several kinds of moraines are recognized, depending on how they are deposited by the glacier; these include lateral moraines along the margins of the glacier and terminal moraines at its leading edge.

Medial moraine of Gornergletscher (Gorner Glacier) in the Pennine Alps near Zermatt, Switz.
JEROME WYCKOFF

moral psychology In psychology, study of the development of the moral sense—i.e., of the capacity for forming judgments about what is morally right or wrong, good or bad. The U.S. psychologist Lawrence Kohlberg hypothesized that people's development of moral standards passes through several levels. At the early level, that of preconventional moral reasoning, the child uses external and physical events (such as pleasure or pain) as the source for moral decisions; his standards are based strictly on what will avoid punishment or bring pleasure. At the intermediate level, that of conventional moral reasoning, the child or adolescent views moral standards as a way of maintaining the approval of authority figures, chiefly his parents, and acts in accordance with their precepts. At the third level, that of postconventional moral reasoning, the adult bases his moral standards on principles that he himself has evaluated and accepts as inherently valid, regardless of society's opinion. Beginning in the 1970s Kohlberg's work was criticized by psychologists and philosophers influenced by feminism. According to Carol Gilligan, Kohlberg's stages are inherently sexist, because they equate moral maturity with an orientation toward moral problems that is socially instilled in males but not in females. Whereas the male "ethic of rights and justice" treats morality in terms of abstract principles and conceives of moral agents as essentially autonomous, acting independently of their social situations according to general rules, the female "ethic of care" treats morality in terms of concrete bonds to particular individuals based on feelings of care and responsibility and conceives of moral agents as connected and interdependent through their feelings of care and responsibility for each other.

Morales \mō-'rä-lās**, Luis de** (b. c. 1509, Badajoz, Spain—d. May 9, 1586, Badajoz) Spanish painter. He lived all his life in Badajoz, leaving only for occasional commissions. He is considered Spain's greatest MANNERIST painter and is known especially for his emotional religious paintings. He always worked on panels, often depicting such subjects as the Ecce Homo, the Pietà, and the Virgin and Child. His paintings show the influence of LEONARDO DA VINCI and RAPHAEL and are marked by detailed execution and the anguished asceticism of 16th-century Spain.

"The Virgin and Child," panel by Luis de Morales; in the National Gallery, London
COURTESY OF THE NATIONAL GALLERY, LONDON; PHOTOGRAPH, A.C. COOPER

morality play Allegorical drama of 15th–16th-century Europe. The plays' characters personified moral qualities (such as charity or vice) or abstractions (such as death or youth). One of the main types of vernacular drama of its time, it provided a transition from LITURGICAL DRAMA to professional secular drama. The plays were short works, usually performed by semiprofessional acting troupes that relied on public support. *Everyman* (c. 1495), featuring Everyman's summons by Death and his journey to the grave, is considered the greatest morality play. See also MIRACLE PLAY; MYSTERY PLAY.

Morandi \mȯ-'rän-dē**, Giorgio** (b. July 20, 1890, Bologna, Italy—d. June 18, 1964, Bologna) Italian painter and etcher. He first exhibited his paintings with the FUTURISTS and was closely associated with the METAPHYSICAL PAINTERS, but he is identified with neither school. He repeatedly returned to the subject matter of simple, geometric still lifes of bottles, jars, and boxes; by returning to the same subject matter, he was able to move past content to an exploration of pure form (i.e., line, colour, shape). His contemplative approach gave his landscapes and still lifes a delicacy of tone and subtlety of design. As instructor of etching at Bologna's Academy of Fine Arts (1930–56), he had a profound influence on Italian graphic artists.

Morava River \'mȯ-rä-vä\ *German* **March** \'märk\ River, eastern Czech Republic. It rises in mountains and flows south to enter the DANUBE RIVER just above BRATISLAVA, Slovakia, after a course of 227 mi (365 km). In its lower course it first divides the Czech Republic from Slovakia and then divides Slovakia from Austria. It gives its name to MORAVIA, the area around it.

Morava River River, Serbia, Serbia and Montenegro. Formed by the confluence of the South (Južna) Morava and West (Zapadna) Morava rivers, it flows north to enter the DANUBE RIVER, after a course of 137 mi (221 km). The total area of the Morava River basin is 14,457 sq mi (37,444 sq km), corresponding almost to the political definition of SERBIA.

Moravia \mə-'rā-vē-ə\ Region, central Europe. Bounded by Bohemia, Silesia, Slovakia, and northeastern Austria and crossed by the MORAVA RIVER, it was inhabited from the 4th century BC. It was dominated by the Avars in the 6th and 7th centuries AD and later settled by Slavic tribes, and in the 9th century it became the state of Great Moravia and included BOHEMIA as well as parts of modern Poland and Hungary. It was destroyed by the MAGYARS in 906. In 1526 it came under HABSBURG rule. After the Revolution of 1848 Moravia became an Austrian crown land with its capital at BRNO. In 1918 it was incorporated into the new state of Czechoslovakia. Germany annexed parts of it in 1938; after World War II they were restored to Czechoslovakia. It was included in the Czech Socialist Republic created in 1968 and in the CZECH REPUBLIC in 1993.

Moravia \mō-'räv-yä**, Alberto** *orig.* **Alberto Pincherle** (b. Nov. 28, 1907, Rome, Italy—d. Sept. 26, 1990, Rome) Italian journalist, novelist, and short-story writer. He worked as a journalist in Turin and as a foreign correspondent in London. *Time of Indifference* (1929), his first novel, is a scathing study of middle-class moral corruption. His works were censored by BENITO MUSSOLINI's fascists and placed on the *INDEX LIBRORUM PRO-*

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HIBITORUM. Later important novels, many of them portrayals of social alienation and loveless sexuality, include *The Conformist* (1951; film, 1971), *Two Women* (1957; film, 1961), and *The Empty Canvas* (1960). His books of short stories include *Roman Tales* (1954) and *More Roman Tales* (1959). He was married to the writer Elsa Morante (1918–85).

Moravian Church Protestant denomination founded in the 18th century. It traces its origins to the Unity of Brethren, a 15th-century HUSSITE movement in Bohemia and Moravia. The original Brethren movement was eroded by persecution, but it was renewed in 1722 at Herrnhut, a theocratic community established in Saxony. In America the Moravians founded Bethlehem, Pa. (1740), and several other settlements, and carried out missionary work among the Indians. The Moravians ordain bishops but are governed by synods of elected representatives; they are guided by the Bible as their only rule of faith and worship.

moray \mə-'rā, 'mȯr-ˌā\ Any of about 80 species (family Muraenidae) of shallow-water EELS inhabiting all tropical and subtropical seas. They live among reefs and rocks and hide in crevices. Their skin is thick, smooth, scaleless, and usually vividly marked or coloured. Most species lack pectoral fins. Morays have a wide mouth and strong, sharp teeth for seizing and holding prey (chiefly other fishes). They attack humans only when disturbed. Most species are less than 5 ft (1.5 m) long, but *Thyrsoidea macrurus*, of the Pacific Ocean, may grow to more than 11 ft (3.5 m). Morays are sometimes eaten, but their flesh may be toxic and can cause illness or death if consumed.

Green moray (*Gymnothorax funebris*). CARLETON RAY/PHOTO RESEARCHERS

Moray Firth \'mər-ē\ Inlet of the NORTH SEA, northeastern Scotland. It extends inland for 39 mi (63 km) and is 16 mi (29 km) wide at its widest point. Its inner reaches are divided by a peninsula, the Black Isle, into two smaller inlets, Cromarty Firth and the Firth of Inverness; the city of INVERNESS lies there.

Mordecai \'mȯr-də-ˌkī\ In the biblical book of Esther, the cousin or guardian of ESTHER. Mordecai was a Jew who offended Haman, minister of King Ahasuerus. Haman persuaded the king to order Mordecai's execution and the destruction of all the Jews in the Persian empire, but Esther, Ahasuerus's beloved Jewish queen, pleaded for him to change his mind, and Ahasuerus ordered Haman hanged, named Mordecai to his position, and allowed the Jews to strike out against their enemies. The deliverance of the Jews of Persia from destruction is celebrated in the festival of PURIM.

More, Saint Thomas (b. Feb. 7, 1477, London, Eng.—d. July 6, 1535, London; canonized May 19, 1935; feast day June 22) English statesman and humanist. He studied at Oxford and was successful as a lawyer from 1501. He served as an undersheriff of London (1510–18) and endeared himself to Londoners as a fair judge and consultant. He wrote the notable *History of King Richard III* (1513–18) and the renowned *Utopia* (1516), which was an immediate success with humanists, including DESIDERIUS ERASMUS. In 1517 More was named to the king's council, and he became HENRY VIII's secretary and confidant. In 1523 he was elected speaker of the House of Commons. He wrote *A Dialogue Concerning Heresies* (1529) to refute heretical writings. After the fall of Cardinal WOLSEY (1529), More succeeded him as lord chancellor, but he resigned in 1532 when he could not affirm Henry's divorce from Catherine. He also refused to accept the Act of SUPREMACY. In 1534 More was charged with high treason and imprisoned in the Tower of London, where he wrote his *Dialogue of Comfort Against Tribulation*. In 1535 he was tried and sentenced to death by hanging, which the king commuted to beheading.

Moreau \mȯ-'rō**, Gustave** (b. April 6, 1826, Paris, France—d. April 18, 1898, Paris) French painter. He developed a distinctive style in the SYMBOLIST mode, becoming known for his erotic paintings of mythological and religious subjects. Such works as *Oedipus and the Sphinx* (1864) and *Dance of Salome* (1876) have often been described as decadent. He made a number of technical experiments, including scraping his canvases; his nonfigurative paintings, done in a loose manner with thick impasto, have led some to call him a herald of ABSTRACT EXPRESSIONISM.

Moreau, Jeanne (b. Jan. 23, 1928, Paris, France) French film actress. At age 20 she became the youngest member of the COMÉDIE-FRANÇAISE. She made her screen debut in *The Last Love* (1949) and won acclaim for her roles in LOUIS MALLE's *Frantic* (1957) and *The Lovers* (1958). Though not conventionally beautiful, she became noted for her sensuality and sophistication. She starred in *Moderato cantabile* (1960), *La notte* (1961), and *Jules et Jim* (1961), playing a woman loved by two men in the movie that established her as an international star, and later in *The Trial* (1962), *Diary of a Chambermaid* (1964), and *The Bride Wore Black* (1968). She also directed films, including *Lumière* (1976) and *L'Adolescente* (1978).

Morehouse College Private, historically black, men's liberal arts college in Atlanta, Ga. It was founded as the Augusta Institute, a seminary, in 1867 and renamed in 1913 in honour of Henry L. Morehouse, an administrator. It offers programs in business, education, humanities, and physical and natural sciences. It is part of an educational consortium in which six institutions, including SPELMAN COLLEGE, exchange faculty, students, facilities, and curricula. Notable alumni include MARTIN LUTHER KING, JR., civil rights leader JULIAN BOND, and filmmaker SPIKE LEE.

morel \mə-'rel\ Any of various species of edible MUSHROOMS in the genera *Morchella* and *Verpa*. Morels have a convoluted or pitted head, or cap, vary in shape, and occur in diverse habitats. The edible *M. esculenta*, found in woods during early summer, is among the most highly prized edible fungi. The bell morel (*Verpa*), an edible mushroom with a bell-shaped cap, is found in woods and in old orchards in early spring. False morels, or lorchels, are represented by the genera *Gyromitra* and *Helvella*. Most species of *Gyromitra* are poisonous.

Morelia \mō-'rāl-yä\ City (pop., 2000: 549,996), capital of MICHOACÁN state, west-central Mexico. It was founded in 1541 as Valladolid, at the site of a Tarascan Indian settlement. It replaced Pátzcuaro as the provincial capital in 1582. During the Mexican wars for independence it served briefly as the base of operations for the revolution; in 1828 its name was changed from Valladolid to Morelia in honor of revolutionary leader José María Morelos. It is the commercial centre of an agricultural region. Its educational institutions include the University of Michoacán and the Colegio San Nicolás (1540), Mexico's oldest institution of higher learning.

Morelos \mō-'rā-lōs\ State (pop., 2000: 1,555,296), central Mexico. It covers 1,911 sq mi (4,950 sq km), and its capital is Cuernavaca. Located on the southern slope of the central Mexican plateau, it is one of the country's most flourishing agricultural states, with valleys that produce a variety of agricultural products. It was named for José María Morelos and was the birthplace of EMILIANO ZAPATA, both of whom were heroes of Mexico's wars for independence.

Moreton \'mōr-tᵊn\ **Bay** Inlet of the Pacific Ocean, southeastern coast of QUEENSLAND, Australia. It is 65 mi (105 km) long and 20 mi (32 km) wide, and it serves as the gateway to BRISBANE. In 1770 British navigator Capt. JAMES COOK named the bay (misspelling it) for the earl of Morton. The first settlement on the mainland was a penal colony established at Redcliffe in the early 19th century.

Morgan Breed of light HORSE founded by a Vermont horse (foaled 1793, died 1821) named after his owner, Justin Morgan (1747–1797). The "Justin Morgan horse," a blend of THOROUGHBRED, ARABIAN, and other elements, was a compact, heavily muscled, short-legged horse of great style, energy, and endurance. Because he alone founded the breed, he is the world's best example of prepotency (ability to pass one's traits to one's offspring). Modern Morgans are used mostly for riding. They are 14.1–15.2 hands (57–61 in., 145–155 cm) high, weigh 900–1,100 lbs (400–500 kg), and resemble the Arabian in conformation and endurance.

Morgan, Daniel (b. 1736, Hunterdon county, N.J.—d. July 6, 1802, Winchester, Va., U.S.) American Revolutionary army officer. He was commissioned a captain of the Virginia riflemen and fought under BENEDICT ARNOLD in the unsuccessful assault on Quebec (1775). In 1777 he joined Gen. HORATIO GATES in the Battle of Saratoga. In 1780 he was made brigadier general and fought in the South, defeating a large British force at Cowpens, S.C. In 1794 he led Virginia militiamen to help suppress the WHISKEY REBELLION.

Morgan, Sir Henry (b. 1635, Llanrhymney, Glamorgan, Wales—d. Aug. 25, 1688, probably Lawrencefield, Jam.) Welsh buccaneer. In the second ANGLO-DUTCH WAR, he commanded buccaneers against the Dutch colonies in the Caribbean. After capturing Puerto Príncipe in Cuba and sacking the city of Portobelo, he set out in 1670 with 36 ships and 2,000 buccaneers to capture the major Spanish colonial city of Panamá, defeated a large Spanish force, and sacked and burned the city. On the return journey, he

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deserted his followers and took most of the booty. In 1674 he was knighted and sent to Jamaica as deputy governor. An exaggerated account of Morgan's exploits created his popular reputation as a bloodthirsty pirate.

Morgan, J(ohn) P(ierpont) (b. April 17, 1837, Hartford, Conn., U.S.—d. March 31, 1913, Rome, Italy) U.S. financier. The son of a financier, he began his career as an accountant in 1857 and became an agent for his father's banking company in 1861. In 1871 he was named a partner in the firm of Drexel, Morgan, which became the chief source of U.S. government financing. In 1895 it became J.P. Morgan and Co. In the 1880s and '90s Morgan reorganized several major railroads, notably the Erie Railroad and the Northern Pacific. He was instrumental in achieving railroad rate stability and discouraging overly chaotic competition, and he became one of the world's most powerful railroad magnates, controlling about 5,000 mi (8,000 km) of railway by 1902. After the panic of 1893, Morgan formed a syndicate to supply the U.S. Treasury's depleted gold reserves. He led the financial community in averting a general financial collapse following the stock-market panic of 1907. He financed a series of giant industrial consolidations, organizing the mergers that formed General Electric, United States Steel Corp., and International Harvester Co. (see Navistar International Corp.). A noted art collector, he donated many artworks to the Metropolitan Museum of Art; his book collection and the building that housed it became the Pierpont Morgan Library in New York City.

Morgan, J(ohn) P(ierpont), Jr. (b. Sept. 7, 1867, Irvington, N.Y., U.S.—d. March 13, 1943, Boca Grande, Fla.) U.S. banker and financier. He joined J.P. Morgan and Co. in 1892 and took control of it in 1913 on the death of his father, J.P. Morgan. In World War I he served as purchasing agent in the U.S. for the British and French governments and organized the underwriting of more than $1.5 billion in Allied bonds. He pooled funds with other bankers in an unsuccessful attempt to prevent the crash of 1929. The Banking Act of 1933 compelled his firm to separate its investment-banking and commercial-banking activities. Morgan, Stanley and Co. became a new investment-banking firm, while Morgan himself remained head of J.P. Morgan & Co., which was from then on strictly a commercial-banking firm.

Morgan, Joe *in full* **Joseph Leonard Morgan** (b. Sept. 19, 1943, Bonham, Texas, U.S.) U.S. baseball player. Morgan was named Rookie of the Year in 1965, his first full season with the Houston Astros. During each of his eight seasons with the Cincinnati Reds (1972–79) he made the All-Star team as second baseman. He was named the National League's Most Valuable Player in 1975 and 1976, when he led the Reds to consecutive World Series championships. He broke Rogers Hornsby's record for home runs by a second baseman, with 266 (later broken by Ryne Sandberg with 277). In 1990 Morgan was inducted into the Baseball Hall of Fame.

Morgan, John (b. June 10, 1735, Philadelphia, Pa., U.S.—d. Oct. 15, 1789, Philadelphia) U.S. medical educator. He studied medicine in Europe before returning to the American colonies to found their first medical school in 1765 at the University of Pennsylvania. As North America's first professor of medicine, he required a liberal education of his students and separated medicine, surgery, and pharmacology into distinct disciplines, policies widely opposed by colonial physicians. He was made head of the army's medical system in 1775; however, the Continental Congress did not let him organize the system and dismissed him in 1777, holding him responsible for the war's high death rate. Though absolved in 1779, he never recovered, and he died an impoverished recluse.

Morgan, Julia (b. Jan. 20, 1872, San Francisco, Calif., U.S.—d. Feb. 2, 1957, San Francisco) U.S. architect. She received an engineering degree from the University of California at Berkeley. The first female architecture student at the École des Beaux-Arts in Paris (1898), she later became California's first licensed woman architect. Morgan then commenced 40 years of architectural work that resulted in some 800 buildings, most of them in California, particularly in San Francisco. She opened her own architectural office in 1904, and the devastation of the San Francisco earthquake of 1906 provided her with the opportunity to design hundreds of homes and many churches, office buildings, and educational buildings in the Bay area. She is best remembered for designing William Randolph Hearst's private castle at San Simeon (1919–38).

Morgan, Lewis Henry (b. Nov. 21, 1818, near Aurora, N.Y., U.S.—d. Dec. 17, 1881, Rochester, N.Y.) U.S. ethnologist and a principal founder of scientific anthropology. Morgan developed a deep interest in the American Indians and in 1846 was eventually adopted by the Seneca. His *Systems of Consanguinity and Affinity of the Human Family* (1871) was a world survey of kinship systems that sought to establish connections between cultures and particularly to establish the Asiatic origin of the American Indians. This work led to a comprehensive theory of sociocultural evolution, set forth in *Ancient Society* (1877). He claimed that advances in social organization arose primarily from changes in food production and that society had progressed from a hunting-and-gathering stage ("savagery") to one of settled agriculture ("barbarism") to modern "civilization." This theory, with the related theory that society originated in a state of sexual promiscuity and advanced through various forms of family life before culminating in monogamy, is now obsolete. For many years, however, Morgan was the dean of American anthropology, and his pioneering ideas influenced the theories of Karl Marx and Friedrich Engels, among others.

Morgan, Thomas Hunt (b. Sept. 25, 1866, Lexington, Ky., U.S.—d. Dec. 4, 1945, Pasadena, Calif.) U.S. zoologist and geneticist. He received his doctorate from Johns Hopkins University. As a professor at Columbia University (1904–28) and California Institute of Technology (1928–45), he conducted important research on heredity. Like many of his contemporaries, Morgan found Charles Darwin's theory of natural selection implausible because it could not be tested experimentally, and he objected to Mendelian and chromosome theories, arguing that no single chromosome could carry specific hereditary traits. His opinion changed as a result of his studies of *Drosophila*. He developed the hypothesis of sex-linked traits. He adopted the term *gene* and concluded that genes were possibly arranged in a linear fashion on chromosomes. He was awarded the Nobel Prize in 1933. See also Calvin Blackman Bridges.

Morgan le Fay ("Morgan the Fairy") Enchantress in Arthurian legend. Skilled in the arts of healing and changing shape, she ruled Avalon, the island where King Arthur retreated to be healed of his wounds after his last battle. She had learned her magic powers from books and from Merlin. In other stories she is Arthur's sister and enemy, and seduces him to produce a son who later kills Arthur.

Morgenthau \'mȯr-gən-ˌthȯ**, Henry, Jr.** (b. May 11, 1891, New York, N.Y., U.S.—d. Feb. 6, 1967, Poughkeepsie, N.Y.) U.S. public official. He was editor of *American Agriculturist* (1922–33) and a close friend of Franklin D. Roosevelt. As secretary of the treasury in Roosevelt's cabinet (1934–45), he was responsible for financing the programs of the New Deal and the enormous military expenditures of World War II. Over $370 billion was spent during the period, three times more money than was spent by the 50 previous secretaries of the treasury. He resigned after Roosevelt's death and retired to his farm.

Morghāb \mȯr-'gäb\ **River** *or* **Murgab River** \mȯr-'gäb\ River, northwestern Afghanistan and southeastern Turkmenistan. It flows generally west and then north into Turkmenistan and is about 600 mi (970 km) long. It forms the border between Turkmenistan and Afghanistan for several miles. North of Mary (Merv), it disappears into the sands of the Karakum Desert.

Mörike \'mœ-rē-kə**, Eduard Friedrich** (b. Sept. 8, 1804, Ludwigsburg, Württemberg—d. June 4, 1875, Stuttgart) German lyric poet. A clergyman, Mörike suffered all his life from psychosomatic illnesses and retired at age 39, supplementing his pension by lecturing on literature. His small literary output includes the novel *Maler Nolten* (1832), fairy tales, and *Mozart on the Way to Prague* (1856), a humorous examination of the problems of artists in a world uncongenial to art. His best works are his exquisite lyrics, notably the "Peregrina" poems, which immortalize a youthful love, and sonnets to a onetime betrothed; many were set to music by Hugo Wolf.

Morison, Samuel Eliot (b. July 9, 1887, Boston, Mass., U.S.—d. May 15, 1976, Boston) U.S. biographer and historian. He taught at Harvard University for 40 years. To give authenticity to his writings on maritime history, he undertook numerous voyages and during wartime served on 12 ships as a commissioned officer in the U.S. Naval Reserve. His works include *Admiral of the Ocean Sea* (1942, Pulitzer Prize), on Christopher Columbus; *John Paul Jones* (1959, Pulitzer Prize); the monumental *History of U.S. Naval Operations in World War II*, 15 vol. (1947–62); and *The Oxford History of the American People* (1965).

Morison, Stanley (b. May 6, 1889, Wanstead, Essex, Eng.—d. Oct. 11, 1967, London) English typographer, scholar, and historian of printing.

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He attained much of his printing and typographic experience by working for publishing houses. He served as editor of the influential typographic journal *The Fleuron* (1926–30). He worked for *The Times* (London) in various capacities, including editor of *The Times Literary Supplement* (1929–60). He is best known as the designer of Times New Roman, which was adopted as *The Times*'s basic typeface in 1932, and went on to become the most successful new typeface of the 20th century.

Morisot \mȯ-rē-'zō**, Berthe** (b. Jan. 14, 1841, Bourges, France—d. March 2, 1895, Paris) French painter and printmaker. Granddaughter of Jean-Honoré Fragonard, she studied with Camille Corot, but the major influence over her work was Édouard Manet, whose brother she later married. She exhibited regularly with the Impressionists. None of her exhibits proved commercially successful, but she outsold Claude Monet, Pierre-Auguste Renoir, and Alfred Sisley. Her colouring was delicate and subtle, often with a subdued emerald glow, and her subjects were often members of her family. She is best known for her extremely loose brushwork and for the sensitivity she brought to her female subjects.

Morita \mȯ-'rē-tə**, Akio** (b. Jan. 26, 1921, Nagoya, Japan—d. Oct. 3, 1999, Tokyo) Japanese entrepreneur, cofounder of Sony Corp. The son of an old sake-brewing family, Morita was trained as a physicist. In 1946 he and Ibuka Masaru cofounded the Tokyo Telecommunications Engineering Corp., which changed its name to Sony Corp. in 1958. Primarily responsible for finances and marketing, Morita adopted U.S. advertising techniques and established Sony's first U.S. plant in 1972. He became chief executive officer in 1971 and chairman of the board in 1976, in which post he served until 1994. Under his direction Sony became a world-renowned manufacturer of consumer electronics.

Morley (of Blackburn), John Morley, Viscount (b. Dec. 24, 1838, Blackburn, Eng.—d. Sept. 23, 1923, Wimbledon, London) English politician and historian. He worked as a journalist in London from 1860, mainly as editor of the liberal *Fortnightly Review* (1867–82). A supporter of William E. Gladstone, Morley served in the House of Commons (1883–95, 1896–1908). As chief secretary for Ireland (1886, 1892–95), he helped prepare the Irish Home Rule bills. As secretary for India (1905–10), he brought elected Indian representation into the government. He also wrote acclaimed historical works, including biographies of Gladstone, Voltaire, Jean-Jacques Rousseau, and Oliver Cromwell.

Morley, Thomas (b. 1557/58, Norwich, Norfolk, Eng.—d. October 1602, London) English composer, organist, and music theorist. He was educated at Oxford and studied with William Byrd. Though he composed a number of anthems and psalms, he is best known for his secular songs, including those published in the *First Booke of Ayres* (1600), and for the treatise *A Plaine and Easie Introduction to Practicall Musick* (1597). By editing and printing several anthologies of Italian music (often reworked), he was instrumental in bringing the Italian madrigal to England. He also edited *The Triumphes of Oriana* (published 1603), the most significant collection of English madrigals.

Mormon Member of the Church of Jesus Christ of Latter-day Saints or of a sect closely related to it (e.g., the Community of Christ). The Mormon religion was founded by Joseph Smith, who claimed to have received an angelic vision telling him of the location of golden plates containing God's revelation; this he published in 1830 as the *Book of* Mormon. Smith and his followers accepted the Bible as well as the Mormon sacred scriptures but diverged significantly from orthodox Christianity, especially in their assertion that God exists in three distinct entities as Father, Son, and Holy Spirit. Mormons also believe that faithful members of the church will inherit eternal life as gods. Other unique doctrines include the belief in preexisting souls waiting to be born and in salvation of the dead through retroactive baptism. The church became notorious for its practice of polygamy, though it was officially sanctioned only between 1852 and 1890. Smith and his followers migrated from Palmyra, N.Y., to Ohio, Missouri, and finally Illinois, where Smith was killed by a mob in 1844. In 1846–47, under Brigham Young, the Mormons made a 1,100-mi (1,800-km) trek to Utah, where they founded Salt Lake City. In the early 21st century, the church had a worldwide membership of nearly 10 million, swelled yearly by the missionary work that church members, both men and women, are encouraged to perform.

Mormon, Book of Holy scripture of the Mormons, supplemental to the Bible. First published in 1830, it is held by all branches of Mormonism to be a divinely inspired work translated by the founder of their religion, Joseph Smith. It relates the history of a tribe of Hebrews who migrated from Jerusalem to America c. 600 BC. They eventually split into two groups: the Lamanites, who were ancestors of the American Indians; and the Nephites, who were instructed by Jesus before being destroyed by the Lamanites. The prophet Mormon recorded their history on gold tablets, which were buried and remained hidden for centuries. Moroni, Mormon's son, appeared to Smith in angelic form and revealed their location.

morning-glory family Family Convolvulaceae, composed of about 1,400 species of flowering plants in 50 genera, widely cultivated for their colourful, funnel-shaped flowers. Most are twining and erect herbaceous plants; a few are woody vines, trees, or shrubs. The family is widespread in both tropical and temperate areas. Most popular morning glories are of the genus *Ipomoea*, as is the sweet potato. Several species of bindweeds are agricultural pests. The seeds of two species, *Rivea corymbosa* and *I. violacea*, contain hallucinogenic compounds of historical interest.

Morny \mȯr-'nē**, Charles-Auguste-Louis-Joseph, duke de** (b. Oct. 21, 1811, Paris, France—d. March 10, 1865, Paris) French politician. Half brother of Louis-Napoléon (later Napoleon III), Morny devoted himself to Parisian society and to making a fortune before serving in the Chamber of Deputies (1842–48, 1849). Appointed minister of the interior in 1851, he organized the plebiscite that made Louis-Napoléon dictator. As president of the legislature (1856–65), he tried unsuccessfully to persuade Napoleon III to give France more liberty.

Moro Any member of several Muslim peoples living in the southern Philippines. The Moros, who constitute about 5% of the Philippine population, are not ethnically different from other Filipinos, but, with a separate Islamic faith and local cultures, they have been the object of prejudice and neglect. They have a centuries-long history of conflict with ruling powers: first with Roman Catholic Spanish colonialists (16th–19th century), later with U.S. occupation troops, and finally with the independent Philippine government. Although the Moro National Liberation Front—which espoused Moro separatism and led a violent insurgency in the late 1960s and '70s—split into factions at the end of the 1970s, the insurgency continued. Provisions for the expansion of the Autonomous Region of Muslim Mindanao, established in the late 1980s, were included in a 1996 treaty, but some separatists continue to hold out for complete independence.

Moro, Aldo (b. Sept. 23, 1916, Maglie, Italy—d. May 9, 1978, near or in Rome) Italian politician and premier of Italy (1963–64, 1964–66, 1966–68, 1974–76, 1976). A professor of law at the University of Bari, he was elected to the legislature in 1946. He served in several cabinet posts, then became secretary of the Christian Democrat Party (1959–63). As premier of Italy, he included socialists in his coalition governments. In 1976 he became president of the Christian Democrats and remained influential in Italian politics. In 1978 he was kidnapped in Rome by the Red Brigades; after the government refused to release Red Brigades members on trial in Turin, he was murdered by his captors.

Moroccan crises (1905–06, 1911) Two European incidents centring on Germany's attempt to block France's control of Morocco and to restrict French power. While visiting Tangier in 1905, the German emperor William II issued a statement of support for Moroccan independence, which caused international panic. The crisis was resolved at the Algeciras Conference (1906), which recognized France's special political interests in Morocco. The second crisis occurred in 1911 when a German gunboat arrived in Agadir, ostensibly to protect German economic interests during a local uprising. The French objected and made preparations for war, as did Britain, but a settlement was negotiated that gave France rights to a protectorship over Morocco. In return, Germany acquired part of the French Congo.

Morocco *officially* **Kingdom of Morocco** Country, North Africa. Area: 177,117 sq mi (458,730 sq km). Population (2005 est.): 31,478,000. Capital: Rabat. Arabized Berbers (Amazigh) are the country's largest ethnolinguistic group; there are French, Spanish, and Bedouin minorities. Languages: Arabic (official), Berber, French. Religion: Islam (official; mostly Sunni). Currency: dirham. Morocco is a mountainous country with an average elevation of 2,600 ft (800 m) above sea level. A mountain chain known as the Rif runs along the northern coast; the Atlas Mountains rise in the country's centre and include Mount Toubkal (13,665 ft [4,165 m]), Morocco's highest peak. The area is a zone of severe seismic activity, and earthquakes are frequent. Fertile lowlands support agriculture; major crops include barley, wheat, and sugar beets. Morocco is one of the world's largest suppliers of phosphate. Its industrial centre is Casablanca,

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the largest city. It is a constitutional monarchy with two legislative houses; its chief of state and head of government is the king, assisted by the prime minister. The Berbers entered Morocco near the end of the 2nd millennium BC. Phoenicians established trading posts along the Mediterranean coast during the 12th century BC, and Carthage had settlements along the Atlantic coast in the 5th century BC. After the fall of Carthage, the region's leaders became loyal allies of Rome, and in AD 42 it was annexed by the Romans as part of the province of Mauretania. It was invaded by Muslims in the 7th century. The Almoravid dynasty conquered it and the Muslim areas of Spain in the mid-11th century; the Almohad dynasty overthrew the Almoravids in the 12th century and in turn were conquered by the Marīnid dynasty in the 13th century. After the fall of the Marīnids in the mid-15th century, the Sa'dī dynasty ruled for a century, beginning c. 1550. Attacks by Barbary Coast pirates compelled Europeans to enter the area; the French fought Morocco over the boundary with Algeria, Europeans obtained trading rights in 1856, and the Spanish seized part of Moroccan territory in 1859. Morocco was a French protectorate from 1912 until its independence in 1956. In the 1970s it reasserted claim to the Spanish Sahara (see Western Sahara), and in 1976 Spanish troops withdrew from the region, leaving behind the Algerian-supported Saharan guerrillas of the Polisario movement. Relations with Mauritania and Algeria deteriorated, and fighting over the region continued. Attempts at mediation have been made by the international community.

Moroni Town (pop., 1995: 340,168), capital of the Comoros Islands, located on Grande Comore (Njazidja) island in the Indian Ocean. Founded by Arabic-speaking settlers, it is the largest settlement of the Comoros and has served as the capital since 1958. The port of Moroni consists of a small quay in a natural cove. The town retains an Arabic character and has several mosques, including Chiounda, a pilgrimage centre.

morpheme In linguistics, the smallest grammatical unit of speech. It may be an entire word (*cat*) or an element of a word (*re-* and *-ed* in *reappeared*). In so-called isolating languages, like Vietnamese, each word contains a single morpheme; in languages such as English, words often contain multiple morphemes. The study of morphemes is included in morphology.

Morpheus In Greek and Roman mythology, the god of dreams. He was one of the sons of Hypnos (Somnus), god of sleep. Morpheus sent human shapes of all kinds to the dreamer, while his brothers Phobetor and Phantasus sent the forms of animals and inanimate objects.

morphine Heterocyclic compound, narcotic analgesic alkaloid originally isolated from opium. It is among the most powerful naturally occurring compounds in its ability to reduce pain and distress; its calming effect protects the system against exhaustion in traumatic shock, internal hemorrhage, congestive heart failure, and other debilitating conditions. Morphine is usually given by injection but may be taken by mouth. Its most serious drawback is its addictiveness; many doctors are reluctant to use amounts adequate to relieve severe pain, even though short-term use in such cases rarely leads to drug addiction. This remains controversial even in terminal cases, when addiction is arguably irrelevant; another issue in such cases is that large doses depress respiration and may thus hasten death.

morpho Any species of New World tropical brush-footed butterflies in the genus *Morpho* (family Nymphalidae). Microscopic ridges on the wing scales break up and reflect light, producing the iridescent blue of the males of some species. The generally duller-coloured females have broader, less graceful wings. The hairy larvae feed on plants and live and pupate in a communal web. Some species have poisonous hairs that can cause a rash on human skin. Morphos are raised commercially in South America for use in jewelry, lamp shades, pictures, and tray inlays.

Morpho butterfly (*Morpho nestira*).
APPEL COLOR PHOTOGRAPHY

morphology \mȯr-'fä-lə-jē\ In biology, the study of the size, shape, and structure of organisms in relation to some principle or generalization. Whereas anatomy describes the structure of organisms, morphology explains the shapes and arrangement of parts of organisms in terms of such general principles as evolutionary relations, function, and development.

morphology In linguistics, the internal construction system of words and its study. Languages vary widely in the number of morphemes a word can have. English has many words with multiple morphemes (e.g., *replacement* is composed of *re-*, *place*, and *-ment*). Many American Indian languages have a highly complex morphology; other languages, such as Chinese, have a simple one. Morphology includes the grammatical processes of inflection, marking categories like person, tense, and case (e.g., the *-s* in *jumps* marks the third-person singular in the present tense), and derivation, the formation of new words from existing words (e.g., *acceptable* from *accept*).

Morrill Act See Land-Grant College Act of 1862

Morris, Gouverneur (b. Jan. 31, 1752, Morrisania house, Manhattan—d. Nov. 6, 1816, Morrisania house) American statesman and financial expert. He was admitted to the bar (1771) and served in the New York Provincial Congress (1775–77) and the Continental Congress (1778–79). He distrusted the democratic tendencies of colonists who wanted to break with England, but his belief in independence led him to join their ranks. As assistant superintendent of finance (1781–85), he proposed the decimal coinage system that became the basis for U.S. currency. A delegate to the Constitutional Convention, he helped write the final draft of the Constitution of the United States. He served as minister to France (1792–94) and as a U.S. Senator (1800–03), and he was the first chairman of the Erie Canal commission (1810–16).

Morris, Mark (b. Aug. 29, 1956, Seattle, Wash., U.S.) U.S. dancer and choreographer. He formed the Mark Morris Dance Group in 1980. It was the resident company at the Théâtre Royal de la Monnaie in Brussels (1988–91), returned to the U.S. in 1991, and made its permanent home in Brooklyn in 2001. Known for his daring style, he has choreographed many works for his own company as well as for opera productions and television performances, including *The Hard Nut* (1991), his modernized version of *The Nutcracker*.

Morris, Robert (b. Jan. 31, 1734, Liverpool, Merseyside, Eng.—d. May 8, 1806, Philadelphia, Pa., U.S.) British-born American financier and politician. He immigrated to join his father in Maryland in 1747 and entered a Philadelphia mercantile firm the following year. As a member of the Continental Congress in the American Revolution, he practically controlled the financial operations of the war from 1776 to 1778, borrowing money from the French, requisitioning from the states, and even advancing money from his own pocket. He established the Bank of North

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America (1781) and served as U.S. superintendent of finance (1781–84) under the Articles of Confederation. He was a delegate to the Annapolis Convention and the Constitutional Convention and served in the U.S. Senate (1789–95). After investing heavily in land speculation, he went bankrupt and spent more than three years in a debtors' prison before his release in 1801.

Morris, Robert (b. Feb. 9, 1931, Kansas City, Mo., U.S.) U.S. artist. His first one-man exhibition of paintings was held in San Francisco in 1957. In 1960, while living in New York City, he began producing large, monochromatic geometric sculptures, groups of which he exhibited in specific spatial relationships. His work of this period greatly affected the Minimalist movement, which sought to reduce art to its essence by eliminating personal expression and historical allusion. From the late 1960s, however, Morris moved toward a more spontaneous, if anonymous, expressiveness. He experimented in a wide variety of forms, including the "happening"; "dispersal pieces," in which materials were strewn in apparent randomness on the gallery floor; and environmental projects. His work of the 1970s showed a preoccupation with paradoxes of mental and physical imprisonment.

Morris, William (b. March 24, 1834, Walthamstow, near London, Eng.—d. Oct. 3, 1896, Hammersmith) British painter, designer, craftsman, poet, and social reformer, founder of the Arts and Crafts Movement. Born into a wealthy family, he studied medieval architecture at Oxford. He was apprenticed to an architect, but visits to Europe turned him toward painting. In 1861, with Dante Gabriel Rossetti, Edward Burne-Jones, Ford Madox Brown, and others, he founded Morris, Marshall, Faulkner & Co., an association of "fine art workmen" based on the medieval guild. They produced furniture, tapestry, stained glass, fabrics, carpets, and most notably wallpaper designs. In 1891 Morris founded the Kelmscott Press, and over the next seven years it produced 53 titles in 66 volumes; its *Works of Geoffrey Chaucer* is one of the greatest examples of the art of the printed book. Though he sought to produce fine art objects for the masses, only the rich could afford his expensive handmade products. A utopian socialist, he did much to develop British socialism; in 1884 he formed the Socialist League. In 1877 he founded the Society for the Protection of Ancient Buildings, one of the world's first preservationist groups. He wrote several volumes of poetry and many prose romances, as well as the four-volume epic *Sigurd the Volsung* (1876). His works and writings revolutionized Victorian taste, and he ranks as one of the largest cultural figures of 19th-century Britain.

William Morris, drawing by C.M. Watts.
THE MANSELL COLLECTION

Morris dance Ritual folk dance mainly danced in rural England from about the 15th century. The name, a variant of "Moorish," possibly arose in reference to the dancers' blacking their faces as part of the ritual disguise. It is principally a fertility dance, performed especially in the spring. Danced by groups of men often dressed in white and wearing bells on their legs, the steps are varied and intricate and are maintained in a jog-trot while handkerchiefs are waved in both hands. It calls for individual characters such as a hobbyhorse and a fool.

Morris Jesup, Cape Cape, in the Peary Land region, northern Greenland, on the Arctic Ocean. Situated 440 mi (710 km) from the North Pole, it is one of the world's most northerly points of land. Robert E. Peary was the first explorer to reach it in 1900; it was named for Morris K. Jesup, a merchant-banker who financed polar expeditions.

Morrison, Jim *orig.* **James Douglas Morrison** (b. Dec. 8, 1943, Melbourne, Fla., U.S.—d. July 3, 1971, Paris, France) U.S. rock singer and songwriter. He studied film at the University of California in Los Angeles, where he met Ray Manzarek (b. 1935); with Robbie Krieger (b. 1946) and John Densmore (b. 1945), they formed the psychedelic rock group the Doors, taking their name from Aldous Huxley's book on mescaline, *The Doors of Perception*. The dark-edged eroticism of Morrison's baritone voice and pseudo-poetic lyrics helped make the band one of rock's most potent, controversial, and theatrical acts. Their popular hits of the 1960s included "Light My Fire" and "Hello I Love You." Morrison was known for his drinking and drug use and outrageous stage behaviour. In 1971 he left the Doors to write poetry and moved to Paris, where he died of heart failure.

Morrison, Toni *orig.* **Chloe Anthony Wofford** (b. Feb. 18, 1931, Lorain, Ohio, U.S.) U.S. writer. She studied at Howard and Cornell universities, taught at various universities, and worked as an editor before publishing *The Bluest Eye* (1970), a novel dealing with some of the shocking realities of the lives of poor blacks, and *Sula* (1973). The brilliant *Song of Solomon* (1977) brought her national attention. Her later novels include *Tar Baby* (1981), *Beloved* (1987, Pulitzer Prize), *Jazz* (1992), and *Paradise* (1998). The African American experience, particularly that of women, is the principal theme of her fiction. Her use of fantasy, her sinuous poetic style, and her interweaving of mythic elements give her stories texture and great power. She was awarded the Nobel Prize for Literature in 1993.

Morristown National Historical Park Historical park, Morristown, N.J., U.S. In the American Revolution the Continental army under George Washington had its main winter campsite there in 1776–77 and 1779–80. Established in 1933, the park covers 1,684 acres (682 hectares). It includes the house that served as Washington's headquarters and other artifacts of the Revolution.

Morrow, Dwight W(hitney) (b. Jan. 11, 1873, Huntington, W.Va., U.S.—d. Oct. 5, 1931, Englewood, N.J.) U.S. lawyer and diplomat. He practiced law in New York City (1905–14), helping draft a workers' compensation law (1911). He became a partner in J.P. Morgan & Co. (1914–27) and organized the Kennecott Copper Corp. During World War I he was an adviser to the Allied Maritime Transport Council, and after the war he helped devise a national aviation policy. He served as ambassador to Mexico (1927–30). He briefly served in the U.S. Senate (1931) before his death. His daughter Anne married Charles A. Lindbergh.

Morse, Carlton E. (b. June 4, 1901, Jennings, La., U.S.—d. May 24, 1993, Sacramento, Calif.) U.S. radio writer and producer. He worked as a newspaper reporter before joining NBC radio as a writer in 1930. Morse wrote, directed, and produced many radio programs, including the highly popular soap opera *One Man's Family* (1932–59; television, 1949–52), the drama *I Love a Mystery* (1939–44, 1949–52), and the soap opera *The Woman in My House* (1951–59).

Morse, Samuel F(inley) B(reese) (b. April 27, 1791, Charlestown, Mass., U.S.—d. April 2, 1872, New York, N.Y.) U.S. painter and inventor. The son of a distinguished geographer, he attended Yale University and studied painting in England (1811–15). He returned home to work as an itinerant painter; his portraits still rank among the finest produced in the U.S. He cofounded the National Academy of Design and served as its first president (1826–45). Independent of similar efforts in Europe, he developed an electric telegraph (1832–35), believing his to be the first. He developed the system of dots and dashes that became known internationally as Morse code (1838). Though denied support from Congress for a transatlantic telegraph line, he received congressional support for the first U.S. telegraph line, from Baltimore to Washington; on its completion in 1844 he sent the message "What hath God wrought!" His patents brought him fame and wealth.

Morse code System for representing letters, numerals, and punctuation marks by a sequence of dots, dashes, and spaces. It is transmitted as electrical pulses of varied lengths or analogous mechanical or visual signals, such as flashing lights. The original system was invented by Samuel F.B. Morse in 1838 for his telegraph; the International Morse Code, a simpler and more precise variant with codes for letters with diacritic marks, was devised in 1851. With minor changes, this code has remained in use for certain types of radiotelegraphy, including amateur radio.

mortar Short-range artillery piece with a short barrel and low muzzle velocity that fires an explosive projectile in a high-arched trajectory. Large mortars were used against fortifications and in siege operations from medieval times through World War I. Since 1915, small portable models have been standard infantry weapons, especially for mountain or trench warfare. Medium mortars, with a caliber of about 3–4 in. (70–90 mm), a range of up to about 2.5 mi (4 km), and a bomb weight of up to 11 lbs (5 kg), are now widely used.

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mortar Material used in building construction to bond brick, stone, tile, or concrete blocks into a structure. The ancient Romans are credited with its invention. Mortar consists of sand mixed with cement and water. The resulting substance must be sufficiently flexible to flow slightly but not collapse under the weight of the masonry units. Before the 19th-century invention of PORTLAND CEMENT, masons used thin joints of lime mortar, which required greater precision than the thicker joints of portland-cement mortar and were not as strong. For tilework, a very thin mortar called grout is used. Pointing is the process of finishing a masonry joint.

mortgage In Anglo-American law, the method by which a debtor (mortgagor) conveys an interest in property to a creditor (mortgagee) as security for the payment of a money debt. The modern mortgage has its roots in medieval Europe. Originally, the mortgagor gave the mortgagee ownership of the land on the condition that the mortgagee would return it once the mortgagor's debt was paid off. Over time, it became the practice to let the mortgagor remain in possession of the land; it then became the mortgagor's right to remain in possession of the land so long as there was no default on the debt.

Morton, James Douglas, 4th earl of (b. c. 1516—d. June 2, 1581, Edinburgh, Scot.) Scottish nobleman. Appointed chancellor by MARY, QUEEN OF SCOTS, in 1563, he conspired with other Protestant nobles to murder Mary's adviser DAVID RICCIO and probably was involved in the murder of Lord DARNLEY. He led the nobles that drove Mary's husband, the earl of Bothwell, from Scotland and forced her to abdicate in favour of her infant son, James (later JAMES I of England). He became regent for James in 1572 and restored the rule of law to Scotland. Resented by the other nobles, he was forced to resign in 1578; he was later charged with complicity in Darnley's murder and executed.

Morton, Jelly Roll *orig.* **Ferdinand Joseph La Menthe** (b. Oct. 20, 1890, New Orleans, La., U.S.—d. July 10, 1941, Los Angeles, Calif.) U.S. pianist and the first important composer in jazz. In his youth Morton was apparently active as a gambler, pool shark, and procurer. A pioneer RAGTIME piano player, he toured the country as a pianist from 1904, making his first recordings in Chicago in 1923 with his ensemble the Red Hot Peppers. An exponent of the New Orleans tradition, Morton achieved success integrating elements of ragtime with improvised and arranged ensemble passages, often on his own compositions such as "King Porter Stomp." By the early 1930s Morton's fame had been overshadowed by that of LOUIS ARMSTRONG and other emerging innovators.

Mosaddeq \'mȯs-ad-ˌdek**, Mohammad** (b. 1880, Tehrān, Ṣafavid Persia—d. March 5, 1967, Tehrān, Iran) Iranian politician and nationalist leader. After law school in Switzerland, he served in the government until Reza Khan became shah (1925). After Reza Shah was deposed in 1941, Mosaddeq was reelected to the parliament (1944). Following Mosaddeq's successful nationalization of the British-owned Anglo-Iranian Oil Company, Mohammad Reza Shah PAHLAVI (r. 1941–79) was virtually forced to appoint him premier (1951). Tension between the monarch and the premier crested, however, and the shah attempted to dismiss him in 1953. The resulting unrest forced the shah to flee the country until a coup, backed by British and U.S. intelligence services, drove Mosaddeq from power. Convicted of treason, he spent three years in prison and the rest of his life under house arrest.

mosaic Surface decoration of small coloured components—such as stone, glass, tile, or shell—closely set into an adhesive ground. Mosaic pieces, or tesserae, are usually small squares, triangles, or other regular shapes. Mosaics cannot create the variations of light and shadow that paintings can, but glass tesserae can achieve a greater brilliance, especially those to which gold and silver foil have been applied. This technique was responsible for the great shimmering mosaics of the Byzantine period. The earliest known mosaics date from the 8th century BC and were made of pebbles, a technique refined by the Greeks in the 5th century. The Romans used mosaics widely, particularly for floors. Pre-Columbian Americans favoured mosaics of garnet, turquoise, and mother-of-pearl, which usually encrusted shields, masks, and cult statues.

Mosby \'mōz-bē**, John Singleton** (b. Dec. 6, 1833, Edgemont, Va., U.S.—d. May 30, 1916, Washington, D.C.) U.S. guerrilla leader. He joined the Confederate cavalry in the AMERICAN CIVIL WAR and was a scout with JEB STUART's troops. He led guerrilla units, called Mosby's Rangers, on raids on Union outposts in northern Virginia and Maryland, disrupting supply and communication lines. His capture of a Union general and 100 of his men behind federal lines (1863) earned him promotion to colonel. After the war he resumed his law practice, and he later served as U.S. consul to Hong Kong (1878–85) and as assistant attorney in the U.S. Justice Department (1904–10).

Mosca \'mō-skä**, Gaetano** (b. April 1, 1958, Palermo, Sicily, Kingdom of the Two Sicilies—d. Nov. 8, 1941, Rome, Italy) Italian political theorist. Educated at the University of Palermo, he taught constitutional law there (1885–88) and at the Universities of Rome (1888–96) and Turin (1896–1908). A member of the Italian chamber of deputies from 1908, he was made senator for life by VICTOR EMMANUEL III in 1919. In works such as *The Ruling Class* (1896) he argued that, historically and properly, society has been governed by minorities, whether military, religious, oligarchic, or aristocratic.

Mosconi, Willie *in full* **William Joseph Mosconi** (b. June 27, 1913, Philadelphia, Pa., U.S.—d. Sept. 16, 1993, Haddon Heights, N.J.) U.S. pocket billiards player. The son of a billiards parlor owner, Mosconi began playing professionally in the early 1930s. Known for his accurate rapid-fire shooting, he was world champion 15 times between 1941 and 1957 and once had a run of 526 consecutive balls.

Moscow \'mäs-kō, 'mäs-kaù\ *Russian* **Moskva** \mȧs-'kvȧ\ Capital and largest city (pop., 2001 est.: 8,546,000) of Russia. It is located on both sides of the MOSKVA RIVER in western Russia, about 400 mi (640 km) southeast of ST. PETERSBURG and about 600 mi (970 km) east of Poland. Inhabited since Neolithic times, the site was first mentioned as a village in 1147 and became the capital of the principality of Moscow (Muscovy) in the late 13th century. It expanded in the 15th and 16th centuries under its grand dukes IVAN III and IVAN IV and became the capital of a united Russia (1547–1712). In 1812 it was occupied by the French under NAPOLEON and was almost entirely destroyed by fire. In 1918 it became the capital of the UNION OF SOVIET SOCIALIST REPUBLICS and expanded greatly. It suffered much damage from German bombing in World War II. In 1993 it was the scene of armed conflict between opposing government factions after the dissolution of parliament by BORIS YELTSIN. The spiritual home of the Russian Orthodox church for more than 600 years, it is a political, industrial, transportation, and cultural centre. Its most notable structure is the KREMLIN, a medieval fortress on the Moskva with RED SQUARE along its eastern wall. The Lenin Mausoleum is nearby, and St. Basil's Cathedral is at the southern end of the square. Moscow is also home to the Bolshoi Theatre, MOSCOW STATE UNIVERSITY, and many other institutions of higher education.

Moscow Art Theatre Russian theatre specializing in theatrical naturalism. It was founded in 1898 by KONSTANTIN STANISLAVSKY (as artistic director) and Vladimir Nemirovich-Danchenko (administrative director) with the goal of replacing old-fashioned histrionic acting and heavy-handed staging with a simpler and truer style. It opened with ALEKSEY TOLSTOY's *Tsar Fyodor Ioannovich* and won its first major success with ANTON CHEKHOV's *The Seagull*. Along with other plays by Chekhov, the theatre mounted new works by writers such as MAKSIM GORKY and MAURICE MAETERLINCK. Its company received acclaim on European and U.S. tours in 1922 and influenced later theatrical development worldwide. Since 1939 it has been known as the Moscow Academic Art Theatre.

Moscow River See MOSKVA RIVER

Moscow school School of late medieval Russian icon and mural painting. It succeeded the NOVGOROD SCHOOL as the dominant school of painting when Moscow rose to a leading position in the movement to expel the Mongols. The school flowered first under the influence of the painter Theophanes the Greek (c. 1330/40–1405), who moved to Moscow from Novgorod c. 1400 and introduced complexity of composition, subtle colour, and almost impressionistic rendering of figures. His most distinguished successor was ANDREI RUBLEV. From 1430 to the end of the century, Moscow grew in prestige and sophistication as the Mongols were driven out of Russia. When Constantinople fell to the Turks in 1453, Moscow became the

"The Savior," icon painted on panel by Andrei Rublev, Moscow school, 1411; in the State Tretyakov Gallery, Moscow.
NOVOSTI-SOVFOTO

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centre of Eastern Orthodoxy, and the new prestige of the Russian Orthodox church led to a new didactic iconography that expounded mysteries, rites, and dogma. By the 17th century the Stroganov school of Moscow artists assumed the leadership of Russian art.

Moscow State University *in full* **Lomonosov Moscow State University** Government-operated university in Moscow, Russia. Founded in 1755 by the linguist Mikhail Lomonosov with support from Elizabeth, empress of Russia, it is the oldest, largest, and most prestigious university in Russia. By the late 19th century it had established itself as a major centre of scientific research and scholarship. Moscow State University supports more than 350 departments, a number of research institutes and laboratories, several observatories, and various affiliated museums. Its library ranks among the largest in Russia (9 million volumes).

Moselle River *or* **Mosel River** \mō-'zel,\ *German* \'mō-zəl\ River, western Europe, about 340 mi (545 km) long. Rising in northeastern France, it flows north, forming part of the border between Germany and Luxembourg, then northeast into the Rhine River at Koblenz, Ger. In this part of the valley are the vineyards that produce the famous Moselle wines. The river, which is navigable for most of its course, passes Nancy, Metz, and Thionville in France and Trier in Germany. Among its chief tributaries are the Orne and the Saar.

Moser-Pröll \'mō-zər-'prōl**, Annemarie** *orig.* **Annemarie Pröll** (b. March 27, 1953, Kleinarl, Austria) Austrian downhill skier. She began skiing at age 4. She won downhill and slalom silver medals in the 1972 Winter Olympics and a downhill gold medal in 1980. She holds the all-time record of six women's World Cup championships, including five in succession (1971–75). She established a career record for both men and women in individual World Cup races won (59).

Moses (fl. 14th–13th century BC) Prophet of Judaism. According to the Book of Exodus, he was born in Egypt to Hebrew parents, who set him afloat on the Nile in a reed basket to save him from an edict calling for the death of all newborn Hebrew males. Found by the pharaoh's daughter, he was reared in the Egyptian court. After killing a brutal Egyptian taskmaster, he fled to Midian, where Yahweh (God) revealed himself in a burning bush and called Moses to deliver the Israelites from Egypt. With the help of his brother Aaron, Moses pleaded with the pharaoh for the Israelites' release. The pharaoh let them go after Yahweh had visited a series of plagues on Egypt, but then sent his army after them. Yahweh parted the waters of the Red Sea to allow the Israelites to pass, then drowned the pursuing Egyptians. Yahweh made a covenant with the Israelites at Mount Sinai and delivered the Ten Commandments to Moses, who continued to lead his people through 40 years of wandering in the wilderness until they reached the edge of Canaan. He died before he could enter the Promised Land. Authorship of the first five books of the Bible (see Torah) is traditionally ascribed to him.

Moses, Edwin (b. Aug. 31, 1955, Dayton, Ohio, U.S.) U.S. track-and-field athlete. He went to Morehouse College on an academic scholarship but starred in track. He won the gold medal for the 400-m hurdle in the 1976 and 1984 Olympics and set four successive world records in the event between 1976 and 1983.

Moses, Grandma *orig.* **Anna Mary Robertson** (b. Sept. 7, 1860, Greenwich, N.Y., U.S.—d. Dec. 13, 1961, Hoosick Falls, N.Y.) U.S. painter. She began to produce embroidery pictures after her husband died in 1927. When arthritis impaired her embroidering, she turned to painting. She had her first exhibition in a drugstore in 1938 at age 78. She went on to produce more than 1,000 nostalgic, naively executed scenes of turn-of-the-century rural life (e.g., *Catching the Thanksgiving Turkey*, *Over the River to Grandma's House*). By 1939 her pictures were being exhibited internationally, and from 1946 they were regularly reproduced on holiday greeting cards.

Moses, Robert (b. Dec. 18, 1888, New Haven, Conn., U.S.—d. July 29, 1981, West Islip, N.Y.) U.S. public official. He began his long career in public service in New York City's bureau of municipal research. In 1919 Gov. Alfred E. Smith appointed him chief of staff of the New York state reconstruction commission and, in 1924, head of both the New York and Long Island state park commissions. For 40 years in these and related positions, Moses supervised the vast expansion of the park system and the construction of numerous roads, bridges, tunnels, and housing projects in and around the city, reshaping it on a grand scale in often controversial ways.

Moses de León *orig.* **Moses ben Shem Tov** (b. c. 1240, León—d. 1305, Arevalo) Reputed author of the Sefer ha-Zohar, the most important work of Jewish mysticism. Little is known of his life, though he is believed to have lived in Guadalajara (the centre for Spanish adherents of the Kabbala) until 1290 and later to have traveled widely. He represented the *Zohar* as an ancient book that he had discovered, but it is more likely a work of his own authorship.

moshav \mō-'shäv\ (Hebrew: "settlement") Israeli cooperative community that combines privately farmed land and communal marketing, sometimes with light industry as well. The land on a moshav belongs to the state or the Jewish National Fund. The first successful moshavim were organized in the 1920s. New immigrants were directed to these settlements in the early years of the State of Israel. See also kibbutz.

Moshoeshoe \mō-'shwā-ˌshwā\ *or* **Mshweshwe** \em-'shwā-ˌshwā\ (b. c. 1786, near the upper Caledon River, northern Basutoland—d. March 11, 1870, Thaba Bosiu, Basutoland) Founder and first paramount chief of Sotho (later Basutoland; now Lesotho). In the 1830s and '40s he carefully played off British and Boer interests against one another. Involved in a series of wars, he proved a skillful tactician. In 1868 the British annexed Sotho, and Moshoeshoe's power waned. His descendant Moshoeshoe II (1938–96) was the first king of independent Lesotho.

Moskva \mȧs-'kvȧ\ **River** *or* **Moscow River** River, flowing through Moscow province and part of Smolensk province, western Russia. The river is 312 mi (502 km) long and drains an area of 6,800 sq mi (17,600 sq km). It runs through the city of Moscow to join the Oka River just below Kolomna. The river flows southeast through the Volga basin. It is navigable from Moscow and is an important source of the city's water supply.

Mosley, Sir Oswald (Ernald), 6th Baronet (b. Nov. 16, 1896, London, Eng.—d. Dec. 3, 1980, Orsay, near Paris, France) English politician and fascist. He served in the House of Commons (1918–31) as, successively, a Conservative, an Independent, and a Labourite. After a visit to Italy, he founded the British Union of Fascists in 1932. With his followers, he distributed anti-Semitic propaganda, conducted hostile demonstrations in the Jewish sections of eastern London, and wore Nazi-style uniforms. During World War II he was interned (1940–43) with his wife, Diana Guinness, a sister of Jessica and Nancy Mitford and friend of Adolf Hitler. In 1948 Mosley founded the Union Movement, an amalgam of right-wing book clubs.

mosque Islamic public place of prayer. The *masjid jāmiʿ*, or "congregational mosque," is the centre of community worship and the site of Friday prayer services. Though the mosque—originally a sacred plot of ground—has been influenced by local architectural styles, the building has remained essentially an open space, usually roofed, with a minaret sometimes attached. Statues and pictures are not permitted as decoration. The *minbar*, a seat at the top of steps placed at the right of the mihrab, is used by the preacher (*khaṭīb*) as a pulpit. Occasionally there is also a *maqṣūrah*, a box or wooden screen originally used to shield a worshiping ruler from assassins. The minaret, originally any elevated place but now usually a tower, is used by the muezzin (crier) to proclaim the call to worship five times each day. During prayer, Muslims orient themselves toward the *qiblah* wall, which is invariably oriented toward the Kaʿbah in Mecca. The mosque has traditionally been the centre of social, political, and educational life in Islamic societies.

Mosque of Omar See Dome of the Rock

mosquito Any of 2,500 dipteran species in the family Culicidae. The females of most species require a blood meal to mature their eggs. Through bloodsucking, females of various species (genera *Aedes*, *Anopheles*, and *Culex*) transmit human diseases, including dengue fever, encephalitis, filariasis, malaria, yellow fever, and elephantiasis. The adult has a long proboscis, a slender, elongated body, and long, fragile legs. The males (and sometimes the females) feed on plant juices. The female's characteristic sound is made by the vibration of thin membranes on the thorax. The females lay their eggs on the surface of a body of usu-

Mosquito (*Theobaldia anulata*)
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ally stagnant water, and the eggs hatch into aquatic larvae (wrigglers). In the far north larvae pass the winter frozen into ice. The wrigglers are eaten by fishes and aquatic insects, the adults by birds and dragonflies. Control measures have included elimination of breeding sites, application of surface films of oil to clog the larvae's breathing tubes, and use of larvicides.

Mosquito Coast *or* **Miskito Coast** Region along the coast of eastern Nicaragua and Honduras. It comprises a lowland about 40 mi (65 km) wide that skirts the Caribbean Sea for about 225 mi (360 km). It was visited by CHRISTOPHER COLUMBUS in 1502, but Europeans had little contact with the area until the rise of the buccaneers in the 17th century, after which England established a protectorate there. It is named for the Miskito Indians. Spain, Nicaragua, and the U.S. disputed England's protectorate until the CLAYTON-BULWER TREATY (1850). In 1894 the region was incorporated into Nicaragua, but the northern part was granted to Honduras in 1960 by the International Court of Justice. The chief town is Bluefields, at the mouth of the Escondido River in Nicaragua.

moss Any of at least 12,000 species of small, spore-bearing land plants in the BRYOPHYTE division, found worldwide except in salt water. Mosses are simple and ancient plants that have survived nearly unchanged since the PERMIAN PERIOD (290–248 million years ago). Commonly found in moist, shady locations (e.g., forest floors), mosses may range in size from microscopic to more than 40 in. (1 m) long. They prevent erosion and release nutrients from the substrates on which they grow. The life cycle shows clear ALTERNATION OF GENERATIONS between the sexual GAMETOPHYTE, with stemlike and leaflike structures that produce eggs and swimming sperm, and the SPOROPHYTE, a raised stalk that ends in a spore case (sporangium). Mosses also reproduce asexually by branching. The economically important genus *Sphagnum* forms PEAT. Many so-called mosses are not bryophytes, including Irish moss (a red form of ALGAE); beard moss, Iceland moss, oak moss, and reindeer moss (all LICHENS); Spanish moss (a name used variously for a lichen or an air plant of the pineapple family); and club moss (an evergreen herb of the family Lycopodiaceae).

Moss, Stirling (b. Sept. 17, 1929, London, Eng.) British Formula One racing driver. He won his first event in 1950 in England and went on to win scores of races, including the British Grand Prix and the Monaco Grand Prix (three times). In 1962 an accident ended his career. In all he won 16 Grand Prix events and is considered the greatest driver never to win a world championship.

Mossad \mō-'säd\ *Hebrew* **Mossad Merkazi le-Modiin U-letafkidim Meyuhadim ("Central Institute for Intelligence and Security")** Most important of Israel's major intelligence agencies. The Mossad carries out foreign espionage and covert political and paramilitary operations. Its director reports directly to the prime minister. It has enjoyed considerable success in operations against the country's Arab neighbours and Palestinian organizations, and it has an excellent reputation internationally for its effectiveness. Its secret agents are credited with the apprehension of ADOLF EICHMANN in Argentina, the execution of the killers of Israeli athletes at the 1972 Olympics, and the rescue of Israeli hostages in the ENTEBBE INCIDENT. In the late 20th and early 21st centuries, the Mossad was criticized for its treatment of detainees, many of whom were allegedly tortured and killed while in custody, and for its efforts to assassinate some Palestinian political leaders.

Mossi \'mȯ-sē\ People of Burkina Faso and other parts of western Africa, mainly Mali and Togo. They speak Mooré, a GUR language of the NIGER-CONGO family. Mossi society, organized as in the former MOSSI STATES (c. 1500–1895), is divided into royalty, nobles, commoners, and formerly slaves. The *morho naba* ("big lord") occupies a court in OUAGADOUGOU. In the colonial era the Mossi acted as trading intermediaries between the forest states and the cities of the Niger. Today most of the nearly six million Mossi are sedentary farmers.

Mossi states Complex of independent western African kingdoms (c. 1500–1895) around the headwaters of the VOLTA RIVER, within present-day Burkina Faso and Ghana. Though tradition held that their ancestors came from the east, perhaps in the 13th century, the kingdoms' origins are obscure. The MOSSI people harassed the empires of MALI and SONGHAI and vied for control of the NIGER RIVER. From c. 1400 the states acted as trading intermediaries between the forest states and the cities of the Niger. They remained independent until the French invasions of the late 19th century.

most-favoured-nation treatment Guarantee of same trading opportunities (i.e., tariff concessions) already granted to the most favoured nation (MFN). It is a method of establishing equal trading opportunities among states by making originally bilateral agreements multilateral. Attempts to guarantee equal trading opportunities were incorporated into commercial treaties as far back as the early 17th century. The Anglo-French treaty signed in 1860 became the model for many later TRADE AGREEMENTS, establishing a set of interlocking tariff concessions (see TARIFF) later extended worldwide by most-favoured-nation treatment. MFN treatment has always applied primarily to the duties charged on imports, but specific provisions have extended the principle to other areas of economic contact, including property rights, PATENTS, and COPYRIGHTS. See also GENERAL AGREEMENT ON TARIFFS AND TRADE; RECIPROCITY; WORLD TRADE ORGANIZATION.

Mostel \mä-'stel**, Zero** *orig.* **Samuel Joel Mostel** (b. Feb. 28, 1915, New York, N.Y., U.S.—d. Sept. 8, 1977, Philadelphia, Pa.) U.S. actor. He initially worked both on Broadway and in film, but after being blacklisted in Hollywood after 1955, he worked principally in theatre in New York City. He gave acclaimed performances in *Ulysses in Nighttown* (1958) and *Rhinoceros* (1961), and he had lead roles in the musicals *A Funny Thing Happened on the Way to the Forum* (1962) and *Fiddler on the Roof* (1964). His later films included MEL BROOKS's *The Producers* (1968) and *The Front* (1976), a film about the blacklisting era. Mostel was also a serious painter throughout his life.

Mosul \mō-'sül, 'mō-səl\ *Arabic* **Al-Mawṣil** \ˌál-maù-'sēl\ City (pop., 2003 est.: 1,800,000), northwestern IRAQ. Located across the TIGRIS RIVER from the ruins of ancient NINEVEH, which it succeeded, Mosul prospered until 1258, when it was ravaged by the MONGOLS. It was a centre of the OTTOMAN EMPIRE (c. 1534–1918). After World War I (1914–18) it was occupied by the British and in 1926 was ceded to Iraq. The country's second largest city and a chief commercial centre in the northwest, it has manufacturing (cement, textiles) and an oil refinery and nearby oil fields. It has many ancient buildings, some dating from the 13th century, including the Great Mosque and the Red Mosque.

Motagua \mō-'tä-gwä\ **River** River, eastern Guatemala. It is the country's longest river, flowing about 250 mi (400 km) east and northeast into the Gulf of Honduras near the Honduran border. Locally the river is called the Silbapec near its source and the Río Grande farther downstream. It is a major transportation artery for bananas, coffee, and other crops raised in its eastern valleys.

motel Hotel designed for persons traveling by automobile, with convenient parking space provided (the name blends the words "motor hotel"). Originally usually consisting of a series of separate or attached roadside cabins, motels serve commercial and business travelers and persons attending conventions and business meetings as well as vacationers and tourists. By 1950 the automobile was the principal mode of travel in the U.S., and motels were built near large highways, just as hotels had been built near railroad stations.

motet Latin choral composition, generally in one movement. Its origins are in the 13th century, when words (French *mots*) began to be added to originally wordless polyphonic lines in settings of plainchant. It grew directly out of the clausula, a polyphonic decoration of a portion of ORGANUM, but it soon split off to become a separate composition, while retaining a meaningless fragment of chant text and melody in the tenor part. The upper texts often became a confusing mixture of sacred and secular—and even anticlerical—poems, indicating its intended performance in courtly as well as ecclesiastical settings. The motet was the most important musical genre of the 13th century and an essential vehicle for the development of polyphony. In the Renaissance, sacred motets, now employing a single text, were written by composers such as JOSQUIN des Prez, ORLANDE DE LASSUS, and WILLIAM BYRD, though it remains unclear how often they were performed in church settings. In the 17th–18th centuries, motets were written by JEAN-BAPTISTE LULLY, MARC-ANTOINE CHARPENTIER, HEINRICH SCHÜTZ, and JOHANN SEBASTIAN BACH. After c. 1750 the genre declined, and its distinguishing characteristics became diffuse.

moth Any of several thousand LEPIDOPTERAN species, found in all but polar habitats. Moths are chiefly nocturnal and have a stouter body, duller colouring, and proportionately smaller wings than BUTTERFLIES. They have distinctive feathery antennae and, when at rest, fold their wings, wrap them around the body, or hold them extended at their sides. Wingspans range from less than 1 in. (2.5 cm) to about 1 ft (30 cm). The life cycle has four stages: egg, LARVA (caterpillar, or worm), PUPA (chrysalis), and adult (imago). Both larvae and adults of most species are plant eaters, and

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many seriously damage forests, agricultural crops, and fabrics. See also BAGWORM MOTH; GYPSY MOTH; HAWK MOTH; LUNA MOTH; MILLER; SATURNIID MOTH; SILKWORM MOTH; TIGER MOTH; TUSSOCK MOTH.

Mother Goose Fictitious old woman, reputedly the source of the body of traditional children's songs and verses known as NURSERY RHYMES. Often pictured as a beak-nosed, sharp-chinned old woman riding on the back of a flying gander, she was first associated with nursery rhymes in *Mother Goose's Melody* (1781), published by the successors of JOHN NEWBERY. The name apparently derived from the title of CHARLES PERRAULT's collection of fairy tales *Ma Mère l'oye* (1697; "My Mother Goose"). The persistent rumour that Mother Goose was an actual Boston woman is false.

Mother Jones See Mary Harris JONES

Mother Lode Country Former gold-rush belt, SIERRA NEVADA foothills, central California, U.S. It was about 150 mi (240 km) long but only a few miles wide. The GOLD RUSH was sparked by the 1848 discovery of placer gold on JOHN SUTTER's property. The term *mother lode* evolved from the miners' concept of one main quartz vein with subsidiary offshoot veins. Exhaustion of the main gold streaks and a government-enforced price structure for gold caused mining operations to cease there in the 1930s. The area is dotted with scores of ghost camps and old mining towns.

Mother's Day and Father's Day Holidays. In the U.S. a nationwide observance of Mother's Day was suggested by Anna Jarvis of Grafton, W.Va., and in 1908 formal observances were held in churches in Grafton and Philadelphia. By 1911 every state celebrated the occasion on the second Sunday in May. It was formalized by Congress in 1914. In Britain, Mother's Day is celebrated in mid-Lent as Mothering Sunday. During the Middle Ages a custom developed of allowing those who had moved away to visit their home parishes and their mothers on Laetare Sunday, the fourth Sunday of Lent. Many other countries also celebrate the holiday on this date, while some mark the observance at other times of the year. Father's Day was first celebrated in 1910 in Spokane, Wash., through efforts of Sonora Dodd and the YMCA. Celebrated on the third Sunday in June, it became a legal holiday in 1972. Both days were originally largely religious holidays but have been commercialized with the sending of greeting cards and the giving of gifts.

Motherwell, Robert (b. Jan. 24, 1915, Aberdeen, Wash., U.S.—d. July 16, 1991, Provincetown, Mass.) U.S. painter, writer, and teacher. He received an art scholarship at 11, but he earned degrees from Stanford and Harvard before deciding to become a serious painter. He espoused ABSTRACT EXPRESSIONISM from the beginning of his career, and his erudite writings were largely responsible for the intellectual tone of the movement. In his *Elegy to the Spanish Republic* painting series, begun in 1949 and continued over three decades, he developed a limited repertory of simple, serene black forms that were applied to the picture plane in a way that created a sense of slow, solemn movement. Though he worked in various styles, his reputation rests on his pioneering work as a founder and principal exponent of Abstract Expressionism.

Motherwell, photograph by Arnold Newman, 1959
© ARNOLD NEWMAN

motion Change in position of a body relative to another body or with respect to a frame of reference or coordinate system. Motion occurs along a definite path, the nature of which determines the character of the motion. Translational motion occurs if all points in a body have similar paths relative to another body. Rotational motion occurs when any line on a body changes its orientation relative to a line on another body. Motion relative to a moving body, such as motion on a moving train, is called relative motion. Indeed, all motions are relative, but motions relative to the Earth or to any body fixed to the Earth are often assumed to be absolute, as the effects of the Earth's motion are usually negligible. See also BROWNIAN MOTION; PERIODIC MOTION; SIMPLE HARMONIC MOTION; SIMPLE MOTION; UNIFORM CIRCULAR MOTION.

motion, equation of Mathematical formula that describes the MOTION of a body relative to a given frame of reference, in terms of the position, VELOCITY, or ACCELERATION of the body. In classical MECHANICS, the basic equation of motion is Newton's second law (see NEWTON'S LAWS OF MOTION), which relates the force on a body to its MASS and ACCELERATION. When the force is described in terms of the time interval over which it is applied, the velocity and position of the body can be derived. Other equations of motion include the position-time equation, the velocity-time equation, and the acceleration-time equation of a moving body.

motion picture *or* **movie** Series of still photographs on film, projected in rapid succession onto a screen. Motion pictures are filmed with a movie camera, which makes rapid exposures of people or objects in motion, and shown with a movie projector, which reproduces sound synchronized with the images. The principal inventors of motion-picture machines were THOMAS ALVA EDISON in the U.S. and the LUMIÈRE brothers in France. Film production was centred in France in the early 20th century, but by 1920 the U.S. had become dominant. As directors and stars moved to HOLLYWOOD, movie studios expanded, reaching their zenith in the 1930s and '40s, when they also typically owned extensive theatre chains. Moviemaking was marked by a new internationalism in the 1950s and '60s, which also saw the rise of the independent filmmaker. The sophistication of special effects increased greatly from the 1970s. The U.S. film industry, with its immense technical resources, has continued to dominate the world market to the present day. See also COLUMBIA PICTURES; MGM; PARAMOUNT COMMUNICATIONS; RKO; UNITED ARTISTS; WARNER BROTHERS.

motion sickness Sickness caused by contradiction between external data from the eyes and internal cues from the balance centre in the INNER EAR. For example, in seasickness the inner ear senses the ship's motion, but the eyes see the still cabin. This stimulates stress hormones and accelerates stomach muscle contraction, leading to dizziness, pallor, cold sweat, and nausea and vomiting. Minimizing changes of speed and direction may help, as may reclining, not turning the head, closing the eyes, or focusing on distant objects. Drugs can prevent or relieve motion sickness but may have side effects. Pressing an ACUPUNCTURE point on the wrist helps some people.

motion study See TIME-AND-MOTION STUDY

motivation Factors within a human being or animal that arouse and direct goal-oriented behaviour. Motivation has long been a central subject of study in psychology. Early researchers, influenced by CHARLES DARWIN, ascribed much of animal and human behaviour to INSTINCT. SIGMUND FREUD believed that much of human behaviour was also based on irrational instinctive urges or unconscious motives. WALTER B. CANNON proposed that basic human drives served homeostatic functions by directing energies toward the reduction of physiological tensions. Behavioral psychologists, in contrast, stress the importance of external goals in prompting action, while humanistic psychologists examine the role of felt needs. Cognitive psychologists have found that a motive sensitizes a person to information relating to that motive: a hungry subject, for example, will perceive food stimuli as larger than other stimuli. See also BEHAVIOUR GENETICS; HUMAN NATURE; LEARNING.

Motley, Marion (b. June 5, 1920, Leesburg, Ga., U.S.—d. June 27, 1999, Cleveland, Ohio,) U.S. gridiron football player. He played fullback and linebacker for South Carolina State University and the University of Nevada. In 1946 he helped desegregate professional football by joining the Cleveland Browns as a fullback. A bruising rusher, he established himself as a running back and helped the Browns to five consecutive league championships (All-American Football Conference, 1946–49; NFL, 1950).

Motocross racing
KINNEY JONES

motocross Form of motorcycle racing in which cyclists compete on a closed course marked out over natural or simulated rough terrain. Courses vary widely but must be 1.5–5 km (1–3 mi) in length, with steep inclines, hairpin turns, and mud. Motorcycles are grouped into

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classes according to engine displacement (e.g., 125-, 250-, 500-cc). It is probably the most physically demanding motorcycle sport.

Motoori Norinaga \ˌmō-tō-ˈō-rē-ˌnō-rē-ˈnä-gä\ (b. June 21, 1730, Matsuzaka, Japan—d. Nov. 5, 1801, Matsuzaka) Japanese Shintō scholar. Trained as a physician, he came under the influence of the Kokugaku movement, which stressed the importance of Japan's literary heritage. The critical methods he used in his commentaries on Japanese classics provided the theoretical foundation of the modern Shintō revival. Rejecting Buddhist and Confucian interpretations, he traced the genuine spirit of Shintō to Japanese myths and sacred traditions. He reaffirmed the ancient Japanese concept of *musubi* (the mysterious power of all creation and growth), which has become one of the main tenets of modern Shintō.

motorcycle Bicycle or tricycle propelled by an INTERNAL COMBUSTION ENGINE. The first motor tricycle was built in 1884 in England, and the first gasoline-engine motorcycle was built by GOTTLIEB DAIMLER in 1885. Motorcycles were widely used after 1910, especially by the armed forces in World War I. After 1950 a larger, heavier motorcycle was used mainly for touring and sport competitions. The moped, a light, low-speed motor bicycle that can also be pedaled, was developed mainly in Europe, and the sturdier Italian-made motor scooter also became popular for its economy.

motorcycle racing Sport of running motorcycles on tracks, closed circuits, or natural terrain. The main types are (1) road racing, conducted on a course made up wholly or partly of public roads; (2) trials, conducted both on and off the highway; (3) speedway racing, conducted on a short, flat, oval dirt track; (4) drag racing, conducted on a straight quarter-mile strip of pavement; (5) hill climbs, conducted on a large dirt mound; and (6) MOTOCROSS. The first international road race took place in Douran, France, in 1905. The most famous race is the Tourist Trophy, established on Britain's Isle of Man in 1907. Motorcycle racing in North America began in 1903; since 1937 the Daytona 200-mi (320-km) race has been the leading U.S. race.

Motorola, Inc. U.S. manufacturer of wireless communications, electronic systems, and semiconductors. The company was founded in 1928 in Chicago by brothers Paul and Joseph Galvin as the Galvin Manufacturing Corp. In 1930 Galvin introduced a low-cost automobile radio under the brand name Motorola, later adding Motorola police radios, home radios, phonographs, two-way radios, and television sets. The company changed its name to Motorola in 1947. Foreseeing a future demand for transistors, Motorola became a leading manufacturer of them in 1958, after licensing a transistor design from Bell Laboratories. Transistor technology led to the development of microprocessors, which Motorola marketed to computer makers in 1974. Although the company worked with IBM Corp. and Apple Computer in 1993 to develop the first consumer RISC (reduced-instruction-set computing) chip, Motorola realized greater success as a producer of embedded microprocessors—ubiquitous in kitchen appliances, pagers, video games, and handheld personal computers. Motorola was also a leader in the development of cellular telephone systems, and many of its cell phone designs became status symbols.

Motown U.S. recording company that gave its name to the hugely popular style of SOUL MUSIC that it created in the 1960s. It was founded in Detroit, Mich., in 1959 by the songwriter Berry Gordy, Jr. (b. 1929). (Motown, a contraction of "Motor Town," refers to Detroit's automotive industry.) It scored its first nationwide hits with "Shop Around" (1960) by the Miracles (see SMOKEY ROBINSON) and "Please Mr. Postman" (1961) by the Marvelettes. Its roster soon included the Temptations, the Four Tops, the SUPREMES, MARVIN GAYE, and STEVIE WONDER. The songwriting team Holland-Dozier-Holland (see BRIAN AND EDDIE HOLLAND) helped create the "Motown sound," which typically featured lyrical ballads sung to an infectiously rhythmic accompaniment. Motown became one of the most successful black-owned businesses and one of the most influential independent record companies in U.S. history. Later Motown names included the Isley Brothers, Gladys Knight and the Pips, and, in 1969, the Jackson 5 (see MICHAEL JACKSON). Motown continued to produce best-selling recordings by new artists such as Lionel Richie into the 1980s. Gordy moved the company headquarters to Los Angeles in 1971, and he finally sold the label to MCA in 1988.

Mott, Lucretia *orig.* **Lucretia Coffin** (b. Jan. 3, 1793, Nantucket, Mass., U.S.—d. Nov. 11, 1880, near Abington, Pa.) U.S. social reformer and women's rights advocate. She attended a Quaker boarding school near Poughkeepsie, N.Y., where she later taught. In 1811 she married a fellow teacher, James Mott, and she became an official Quaker minister in 1821. The Motts were active in the antislavery campaign, and Lucretia lectured widely on social reform. In 1848 she and ELIZABETH CADY STANTON organized the SENECA FALLS CONVENTION, and she thereafter devoted her attention primarily to women's rights, writing articles and lecturing widely. After the AMERICAN CIVIL WAR, she also worked for voting rights for freedmen. See also ABOLITIONISM; WOMAN SUFFRAGE.

Moultrie \ˈmül-trē, ˈmōl-trē**, William** (b. Dec. 4, 1730, Charleston, S.C.—d. Sept. 27, 1805, Charleston, S.C., U.S.) American Revolutionary officer. He served in the provincial assembly of South Carolina (1752–62) and gained military experience fighting the Cherokee. In the American Revolution he took command of a log fort on Sullivan's Island in Charleston harbour, where he repulsed a British attack in 1776. The fort was named in his honour, and he was made a brigadier general. He fought the British at Beaufort, S.C. (1779), but surrendered with the fall of Charleston (1780). He later served as governor of South Carolina (1785–87, 1792–94).

Mound Builders See HOPEWELL CULTURE

Mount, William Sidney (b. Nov. 26, 1807, Setauket, N.Y., U.S.—d. Nov. 19, 1868, Setauket) U.S. painter. He was apprenticed at 17 to his older brother as a sign painter. After studying drawing at the National Academy of Design, he painted historical subjects, but he later turned to genre painting and achieved immediate success with such works as *Rustic Dance After a Sleigh Ride* (1830). His portrayals of country life, affectionate and humorous without being sentimental, are a valuable record of his time. He was one of the first and most notable U.S. genre painters.

Mount Aspiring National Park Park, western SOUTH ISLAND, New Zealand. Established in 1964, it has an area of 1,223 sq mi (3,167 sq km), including much of the SOUTHERN ALPS and Mount Aspiring (9,932 ft [3,027 m]). Its southern boundary is FIORDLAND NATIONAL PARK. The park's landscape is varied, including glaciers, mountains, gorges, waterfalls, and passes, and it is the source of headwaters of seven major rivers. Birds common in the park include the tui, bellbird, fantail, and gray warbler. It is part of a regional UNESCO WORLD HERITAGE SITE designated in 1990.

Mount Cook National Park Park, west-central SOUTH ISLAND, New Zealand. Established in 1953, it has an area of 270 sq mi (700 sq km) and shares a western boundary with Westland National Park. It extends along the crest of the SOUTHERN ALPS. There are some 27 peaks higher than 10,000 ft (3,000 m) in the park, including Mount Cook (Aoraki, Aorangi), the highest point in New Zealand at 12,316 ft (3,754 m). More than one-third of the park is covered by permanent snow and glacial ice. It is part of a regional UNESCO WORLD HERITAGE SITE designated in 1990.

Mount Holyoke College Private liberal arts college for women in South Hadley, Mass. Founded by Mary Lyon as a female seminary in 1837, it was one of the first institutions of higher education for women in the U.S. Baccalaureate courses are taught in the humanities, science and mathematics, and social sciences. Mount Holyoke is part of an educational consortium with AMHERST, Hampshire, and SMITH colleges and the University of Massachusetts at Amherst.

Mount of Olives See Mount of OLIVES

Mount Rushmore National Memorial Colossal sculpture, BLACK HILLS, southwestern South Dakota, U.S. Sculptures of the heads of presidents GEORGE WASHINGTON, THOMAS JEFFERSON, THEODORE ROOSEVELT, and ABRAHAM LINCOLN are carved on the granite face of the mountain, which is 5,725 ft (1,745 m) high. The four heads, each about 60 ft (18 m) high, represent, respectively, the nation's independence, democratic process, leadership in world affairs, and equality. The memorial was dedicated in 1927. Work on it was carried out during 1927–41 under the direction of GUTZON BORGLUM.

Mount Vernon Home and burial place of GEORGE WASHINGTON. It is located in northern Virginia, U.S., on the POTOMAC RIVER near WASHINGTON, D.C. The estate was inherited by Washington in 1752. Near the 18th-century Georgian mansion is a plain brick tomb, built at Washington's direction, that holds his remains and those of his wife and several family members. After the U.S. government declined to buy it, in 1858 the Mount Vernon Ladies' Association of the Union raised $200,000 and purchased the house and 200 acres (80 hectares) of the estate; the association still maintains the site.

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Mount Wilson Observatory Astronomical OBSERVATORY located atop Mount Wilson, near Pasadena, California, U.S. Founded in 1904 by George Ellery Hale (1868–1938), it was operated jointly with PALOMAR OBSERVATORY as Hale Observatories (1948–80). Its largest optical telescope, with a diameter of 100 in. (2.5 m), enabled EDWIN HUBBLE and his associates to discover evidence of an EXPANDING UNIVERSE and to estimate its size.

mountain Landform that rises well above its surroundings, generally exhibiting steep slopes, a relatively confined summit area, and considerable local relief (inequalities of elevation). Mountains are considered larger than hills, but the term has no standardized geologic meaning. Mountains are formed by the folding, faulting, or upwarping of the Earth's surface due to the movement of plates (see PLATE TECTONICS) or by the emplacement of volcanic rock onto the surface. For example, the Himalayan Mountains where India meets the Eurasian Plate were formed by a collision between plates that caused extreme compressional folding and the uplifting of large areas. The mountain ranges around the Pacific basin are attributed to the sinking of one plate beneath another. See also PLATEAU.

mountain ash Any of several shrubs or trees of the genus *Sorbus*, in the ROSE family, native to the Northern Hemisphere. They are widely cultivated as ornamentals for their white flower clusters and bright-orange fruits. Most noteworthy are the handsome American mountain ash, or dogberry (*S. americana*), and European mountain ash (*S. aucuparia*), also called rowan, or quickbeam. The European species grows to 60 ft (18 m), twice as high as the American species.

mountain goat *or* **Rocky Mountain goat** RUMINANT (BOVID species *Oreamnos americanus*) of the Yukon to the northern Rockies that is more closely related to ANTELOPES than to GOATS. Stocky, with a hump at the withers, mountain goats stand about 40 in. (1 m) at the shoulder. Both sexes bear short, hollow, slightly backward-curving, black horns. The shaggy, coarse white hair covers a thick, woolly underfur, and a beard frames the slender muzzle. The hooves are black. Mountain goats are agile climbers and can leap more than 12 ft (3.5 m). They live in small bands above the timberline, eating moss, lichen, and scrub foliage.

Mountain goat (*Oreamnos americanus*)
EARL KUBIS—ROOT RESOURCES

mountain laurel Flowering evergreen shrub (*Kalmia latifolia*) of the HEATH FAMILY, occurring in most mountainous regions of eastern North America. It grows to about 3–18 ft (1–6 m) in height and has oval leaves. The rosy, pink, or white flowers appear in large clusters above the foliage. The shrub is popular in landscape plantings.

mountain lion See COUGAR

mountain sheep See BIGHORN

mountaineering *or* **mountain climbing** Sport of attaining, or attempting to attain, high points in mountainous regions, mainly for the joy of the climb. The pleasures of mountaineering lie not only in the conquest of the peak but also in the physical and spiritual satisfactions brought about through intense personal effort, ever-increasing proficiency, and contact with natural grandeur. The greater rewards do not come without considerable risk and danger. The first great peak ascended in modern times was Mont BLANC, in 1786. Other Alpine peaks followed, capped by the ascent of the MATTERHORN in 1865. By the 1910s, most peaks of the Andes, the Rockies, and other Western Hemisphere ranges had been climbed, including Mount MCKINLEY (1913). Beginning in the 1930s a series of successful ascents of mountains in the Himalayas occurred; the summits of many of the Himalayan mountains were not reached until the 1950s, however. Of these climbs, the best known is the 1953 ascent of Mount EVEREST by EDMUND HILLARY and TENZING NORGAY. In the 1960s mountaineering became an increasingly technical sport, emphasizing the use of specialized anchoring, tethering, and grappling gear in the ascent of vertical rock or ice faces.

Mountbatten (of Burma), Louis Mountbatten, 1st Earl *orig.* **Louis Francis Albert Victor Nicholas, prince of Battenberg** (b. June 25, 1900, Frogmore House, Windsor, Eng.—d. Aug. 27, 1979, Donegal Bay, off Mullaghmore, County Sligo, Ire.) British statesman and naval commander. Son of Prince Louis of BATTENBERG and great-grandson of Queen VICTORIA, he entered the Royal Navy in 1913 and became an aide to the prince of Wales in 1921. In World War II he was allied commander for Southeast Asia (1943–46) and directed the recapture of Burma. Appointed viceroy of India (1947), he administered the transfer of power from Britain to the independent nations of India and Pakistan and served as the first governor-general of India (1947–48). He became first sea lord (1955–59) and chief of the United Kingdom Defense Staff (1959–65). In 1979, while on a sailing visit to Ireland, he was assassinated by Irish terrorists who planted a bomb on his boat.

Mountbatten family See BATTENBERG FAMILY

Mounties See ROYAL CANADIAN MOUNTED POLICE

mourning dove Species (*Zenaida macroura*) of PIGEON (family Columbidae), the common wild pigeon of North America. They have long, pointed tails, and the sides of the neck are violet and pink. Their name comes from their call's haunting, mournful tone. Mourning doves are migratory; the northernmost populations migrate the farthest south. They are popular game birds. See also DOVE.

Mourning dove (*Zenaida macroura*)
ALVIN E. STAFFAN—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

mouse Any of many species (family Muridae) of small, scampering RODENTS. They are distinguished from RATS principally by their smaller size. Mice are basically Asian in origin, but species have been introduced worldwide. Species in other rodent families (e.g., DEER MOUSE, POCKET MOUSE) are called mice without scientific basis. Mice eat grains, roots, fruit, grass, and insects. They can become pests but are mostly beneficial; they are the main prey of most furbearers and of predators that might otherwise take more valuable prey. The white laboratory mouse is a form of HOUSE MOUSE. See also FIELD MOUSE.

House mouse (*Mus musculus*).
INGMAR HOLMASEN

mouse Hand-controlled electromechanical device for interacting with a DIGITAL COMPUTER that has a GRAPHICAL USER INTERFACE. The mouse can be moved around on a flat surface to control the movement of a cursor on the computer display screen. Equipped with one or more buttons, it can be used to select text, activate programs, or move items around the screen by quickly pressing and releasing one of the buttons ("clicking") or by keeping a button depressed while moving the device ("clicking and dragging").

mouse deer See CHEVROTAIN

Mouskos, Mikhai Khristodolou See MAKARIOS III

Mousterian \mü-'stir-ē-ən\ **industry** Tool culture traditionally associated with the NEANDERTHALS in Europe, western Asia, and northern Africa during the early fourth (Würm) glacial period (c. 40,000 BC). The Mousterian tool assemblage included small hand axes made from disk-shaped cores; flake tools such as scrapers and points; toothed, sawlike instruments produced by making notches on a flake; and round limestone balls, believed to have served as bolas. Wooden spears were used to hunt large game such as the MAMMOTH and woolly rhinoceros. Mousterian implements disappeared abruptly from Europe with the passing of the Neanderthals.

mouth *or* **oral cavity** *or* **buccal cavity** \'bək-əl\ Orifice through which food and air enter the body. It opens to the outside at the lips and empties into the throat at the rear and is bounded by the lips, cheeks, hard and soft PALATES, and glottis. Its chief structures are the teeth (see TOOTH), TONGUE, and PALATE. It is the site of CHEWING and SPEECH formation. The mouth is lined by mucous membranes containing small GLANDS that, along with the SALIVARY GLANDS, keep it moist and clear of food and other debris.

mouth organ See HARMONICA

mouth-to-mouth resuscitation See ARTIFICIAL RESPIRATION

L M N

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movie See MOTION PICTURE

Moyle District (pop., 2001: 15,933), Northern Ireland. It stretches along the northern coast of Ireland and includes Rathlin Island and part of the Antrim Mountains. A cave on Rathlin Island is said to have been the hiding place of ROBERT I in 1306. BALLYCASTLE is Moyle's administrative seat. The Giant's Causeway, along the coastal cliffs, and five of the nine Glens of Antrim are in Moyle.

Moynihan, Berkeley George Andrew *later* **Baron Moynihan (of Leeds)** (b. Oct. 2, 1865, Malta—d. Sept. 7, 1936, Carr Manor, Leeds, Yorkshire, Eng.) British surgeon and teacher of medicine. He wrote or cowrote authoritative monographs on surgery to treat diseases of various abdominal organs, as well as *Abdominal Operations* (1905), a standard text for two decades, and *Duodenal Ulcer* (1910), which secured his reputation as a clinical scientist. He stressed obtaining medical evidence from living bodies on the operating table rather than from autopsies. He helped found the *British Journal of Surgery* (1913) and organizations to promote nationwide and international communication among surgeons and specialists. He was raised to the peerage in 1929.

Moynihan, Daniel Patrick (b. March 16, 1927, Tulsa, Okla., U.S.—d. March 26, 2003, Washington, D.C.) U.S. scholar and politician. He grew up in poverty in New York City. After serving in the U.S. navy in World War II, he attended Tufts University, where he earned a doctorate in 1961. From 1961 to 1965 he worked at the U.S. Labor Department, where he cowrote a controversial report that attributed the educational problems of African Americans to the instability of urban African American families. He taught at Harvard (1966–77) and held advisory posts in the administration of RICHARD NIXON. He was ambassador to India (1973–75) and U.S. representative to the UN (1975–76). He ran successfully for the U.S. Senate from New York in 1976; though he was a Democrat, his candidacy was opposed by many Democratic liberals. Reelected three times, he retired in 2001. In 2000 he received the Presidential Medal of Freedom.

Mozambique \ˌmō-zäm-'bēk\ *officially* **Republic of Mozambique** *formerly* **Portuguese East Africa** Country, southeast coast of Africa. Area: 313,661 sq mi (812,379 sq km). Population (2005 est.):

19,407,000. Capital: MAPUTO. The great majority of the people are Bantu-speaking Africans. Ethnolinguistic groups include the Makua, Tsonga, Malawi, Shona, and YAO peoples. Languages: Portuguese (official), BANTU, SWAHILI. Religions: traditional beliefs, Christianity, Islam. Currency: metical. Mozambique may be divided into two broad regions: the lowlands in the south and the highlands in the north, separated by the ZAMBEZI RIVER. It has a centrally planned, developing economy based on agriculture, international trade, and light industry. Some industries were nationalized after 1975. Mozambique is a republic with one legislature; its head of state and government is the president. Inhabited in prehistoric times, it was settled by Bantu peoples c. the 3rd century AD. Arab traders occupied the coastal region from the 14th century, and the Portuguese controlled the area from the early 16th century. The slave trade later became an important part of the economy and, although outlawed in the mid-18th century, continued illegally. In the late 19th century, private trading companies began to administer parts of the inland areas. It became an overseas province of Portugal in 1951. An independence movement became active in the 1960s, and, after years of war, Mozambique was granted independence in 1975. A single-party state under Frelimo (the Mozambique Liberation Front), it was wracked by civil war in the 1970s and '80s. In 1990 a new constitution ended its Marxist collectivism and introduced privatization, a market economy, and multiparty government. A peace treaty was signed with the rebels in 1992.

Mozambique Channel Strait, western Indian Ocean. Located between Madagascar and Mozambique, it is about 950 mi (1,530 km) long, 250–625 mi (400–1,000 km) wide, and has a maximum depth of 10,000 ft (3,000 m). An important shipping route for eastern Africa, it receives all major Madagascar rivers and fronts the ports of Mahajanga and Toliara in Madagascar. Along the Mozambican coast are the mouth of the ZAMBEZI RIVER and the ports of MAPUTO and BEIRA.

Mozarabic \mō-'zar-ə-bik\ **art** Architecture and religious arts of the Mozarabs, Christians who lived in the Iberian Peninsula after the Arab invasion of 711. Exposure of the conquered Christians to Islamic culture and art forms proved influential, and their art became a synthesis of the two traditions. The subject matter is Christian, but the style shows the assimilation of Islamic decorative motifs and forms. Islamic influence is seen especially in Mozarabic architecture, with its horseshoe-shaped arches and ribbed domes. Through the emigration of Mozarabs, Islamic influence in the arts spread northward into the rest of Europe.

Mozart \'mōt-ˌsärt**, Wolfgang Amadeus** *orig.* **Johannes Chrysostomus Wolfgangus Theophilus Mozart** (b. Jan. 27, 1756, Salzburg, Archbishopric of Salzburg—d. Dec. 5, 1791, Vienna) Austrian composer. Son of the violinist and composer Leopold Mozart (1719–87), he was born the year of the publication of Leopold's best-selling treatise on violin playing. He and his older sister, Maria Anna (1751–1829), were prodigies; at age five he began to compose and gave his first public performance. From 1762 Leopold toured throughout Europe with his children, showing off the "miracle that God allowed to be born in Salzburg." The first round of touring (1762–69) took them as far as France and England, where Wolfgang met JOHANN CHRISTIAN BACH and wrote his first symphonies (1764). Tours of Italy followed (1769–74); there he first saw the string quartets of JOSEPH HAYDN and wrote his own first Italian opera. In 1775–77 he composed his violin concertos and his first piano sonatas. His mother died in 1779. He returned to Salzburg as cathedral organist and in 1781 wrote his opera seria *Idomeneo*. Chafing under the archbishop's rule, he was released from his position in 1781; he moved in with his friends the Weber family and began his independent career in Vienna. He married Constanze Weber, gave piano lessons, and wrote *The Abduction from the Seraglio* (1782) and many of his great piano concertos. The later 1780s were the height of his success, with the string quartets dedicated to Haydn (who called Mozart the greatest living composer), the three great operas on LORENZO DA PONTE's librettos—*The Marriage of Figaro* (1786), *Don Giovanni* (1787), and *Così fan tutte* (1790)—and his superb late symphonies. In his last year he composed the opera *The Magic Flute* and his great *Requiem* (left unfinished). Despite his success, he always lacked money (possibly because of gambling debts and a fondness for fine clothes) and had to borrow heavily from friends. His death at age 35 may have resulted from a kidney infection. No other composer left such an extraordinary legacy in so short a lifetime.

Mozi *or* **Mo-tzu** \'mō-'dzə\ (b. 470?, China—d. 391? BC, China) Chinese philosopher. Originally a follower of CONFUCIUS, Mozi evolved a doctrine of universal love that gave rise to a religious movement called Mohism. Like Confucius, he spent much of his life traveling from one feudal state to another in search of a prince who would allow him to put his teachings into practice. The *Mozi*, the principal Mohist work, condemned offensive war and urged people to lead a simple life harmful to none. Mohism won a considerable body of followers, but it died out after the 2nd century BC.

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MP3 *abbreviation of* **MPEG-1, audio layer 3** Standard technology and format for the compression of audio signals into very small computer files. For example, sound data from a COMPACT DISC (CD) can be compressed to one-twelfth the original size without sacrificing sound quality. Because of small file size and ease of production from CD sources, the MP3 format is very popular for transmitting music files over the INTERNET. Although recording companies have sued many WEB SITES for facilitating the exchange of such copyrighted material, many now provide sample songs in MP3 format to promote CD sales, and some musicians bypass recording companies and issue their songs over the Internet in MP3 format only. See also DATA COMPRESSION.

MRI See MAGNETIC RESONANCE IMAGING

MS See MULTIPLE SCLEROSIS

MS-DOS \ˌem-ˌes-ˈdȯs\ *in full* **Microsoft Disk Operating System** OPERATING SYSTEM for PERSONAL COMPUTERS. MS-DOS was based on DOS, developed in 1980 by Seattle Computer Products. MICROSOFT CORP. bought the rights to DOS in 1981, and released MS-DOS with IBM's PC that year. Thereafter, most manufacturers of personal computers licensed MS-DOS as their operating system; by the early 1990s more than 100 million copies had been sold. WINDOWS, a GRAPHICAL USER INTERFACE program based on MS-DOS, became a popular alternative with the release of Version 3.0 in 1990; Windows 95 fully integrated the operating system and the graphical interface.

MSG See MONOSODIUM GLUTAMATE

Mshweshwe See MOSHOESHOE

MTV *in full* **Music Television** U.S. cable television network, established in 1980 to present videos of musicians and singers performing new rock music. MTV won a wide following among rock-music fans worldwide and greatly affected the popular-music business. Soon virtually every major pop or rock performer was making videos to be shown on MTV, and the reception of their videos directly affected future sales. The network later expanded to include original programming such as the animated *Beavis and Butthead* and the reality series *Real World*, separate international networks (e.g., MTV Europe, MTV Latin America, and MTV Russia), and the MTV Video Music Awards. MTV is controlled by the media conglomerate Viacom Inc.

Muʿāwiyah \mü-ˈä-wē-yə\ **I** (b. c. 602, Mecca, Arabian Peninsula—d. April/May 680, Damascus, Syria) First caliph (661–680) of the UMAYYAD DYNASTY. Born into a clan that initially rejected MUHAMMAD's preaching, he accepted Islam only after Muhammad had conquered Mecca. As governor of Damascus he built up the Syrian army until it was strong enough to resist attacks of the BYZANTINE EMPIRE. He opposed the leadership of ʿAlī, the fourth caliph, and eventually took the field against him. He claimed the caliphate after ʿAlī's death. To win the loyalty of non-Syrian Arabs, he introduced methods by which the tribes could keep the caliph informed of their interests. He channeled tribal aggressiveness into anti-Byzantine campaigns and in North Africa sent forces that captured Tripolitania and Ifrīqiyyah. To administer his large empire, he adopted Roman and Byzantine procedures, employing Christian bureaucrats whose families had served in Byzantine governments. By securing his son as his successor, he established hereditary rule. Though disparaged by later Muslim historians for deviating from Muhammad's leadership style and by Shīʿites for his role in usurping the authority of ʿAlī and his family, he is often portrayed in the Arabic literary tradition as the ideal ruler.

Ḥosnī Mubārak, 1982.
BARRY IVERSON/GAMMA

Mubārak \mü-ˈbä-räk**, Ḥosnī** (b. May 4, 1928, Al-Minūfiyyah governorate, Egypt) President of Egypt (from 1981). He attended a Soviet air academy and, as air force commander (from 1972), planned Egypt's opening moves in the 1973 ARAB-ISRAELI WAR. Named vice president in 1975, he became president on ANWAR EL-SĀDĀT's assassination in 1981. He maintained relations with Israel while working to restore Egypt to its traditional position as the most influential of the Arab states. In the 1990s Mubārak's government faced a rise in domestic terrorism, and he survived several assassination attempts. In 2005 he easily won Egypt's first multicandidate presidential election.

Mucha \ˈmü-ˌkȧ**, Alphonse** *orig.* **Alfons Maria Mucha** (b. July 24, 1860, Ivančice, Moravia, Austrian Empire—d. July 14, 1939, Prague, Czech.) Czech painter and designer. After study in Prague, Munich, and Paris, he became the principal designer of posters advertising the stage appearances of SARAH BERNHARDT; he designed sets and costumes for her as well. His many opulent posters and magazine illustrations made him one of the foremost designers in the ART NOUVEAU style. In 1922, after Czechoslovakia had become independent, he settled in Prague and designed the new republic's stamps and banknotes.

"Cycles Perfecta," poster by Alphonse Mucha to advertise an English brand of bicycle, 1902.
POSTERS PLEASE, INC.

muckraker Any of a group of U.S. writers identified with pre-World War I reform and exposé literature. The term, first used derisively, originated in an allusion THEODORE ROOSEVELT made in 1906 to a passage in JOHN BUNYAN's *Pilgrim's Progress* about a man with a muckrake who "could look no way but downward." Later it took on favourable connotations of social concern and exposure of corruption and injustice. The movement emerged from the YELLOW JOURNALISM of the 1890s and from popular magazines, such as a 1903 issue of *McClure's Magazine* with articles by LINCOLN STEFFENS, Ray Stannard Baker (1870–1946), and IDA TARBELL on municipal government, labour, and trusts. The best-known muckraking novel is UPTON SINCLAIR's *The Jungle* (1906).

mudang \ˈmü-ˌdäŋ\ In Korean religion, a priestess who effects cures, tells fortunes, soothes spirits of the dead, and wards off evil. Her male counterpart is called a *paksu*. The principal occasion for a performance by a *mudang* is the *kut*, a trance ritual in which singing and dancing invite happiness and repel evil. The *kut* addresses a series of gods or spirits, such as the gods of childbirth, harvest, and households. After an altar is set on the floor and offerings are made, the *mudang* goes into a trance, during which the god is said to arrive, to be placated, and then to communicate a message intended for the client.

Mudejar \mü-ˈthā-här\ (from Arabic *mudajjan*: "permitted to remain") Any member of a group of Muslims who remained in Spain after the Christian reconquest of the Iberian Peninsula (11th–15th century). In return for payment of a tax, the Mudejars were a protected minority, allowed to keep their religion, language, and customs. They formed separate communities in larger towns, where they were subject to their own Muslim laws. By the 13th century they had begun to use Spanish, which they wrote in Arabic characters. After 1492 they were forced to leave Spain or convert to Christianity, and by the early 17th century more than three million Spanish Muslims had been expelled.

mudflow Flow of water that contains large amounts of suspended particles and silt. Mudflows usually occur on steep slopes where vegetation is too sparse to prevent rapid erosion, but they can also occur on gentle slopes under certain conditions. Factors other than slope include heavy precipitation in a short period and easily erodible material.

Mudge, Thomas (b. September 1715, Exeter, Devon, Eng.—d. Nov. 14, 1794, Newington Place, Surrey) British watchmaker. In 1765 he invented the lever escapement, the most dependable and widely used device for regulating the movement of the spring-driven WATCH. He later worked to improve the marine CHRONOMETER.

mudor suan \mü-ˈdōr-shü-ˈän\ Ceremony in which the Votyaks or Udmurts (peoples of the Ural Mountains) consecrated a new family or

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clan shrine when the ancestral home was too small to accommodate all its members and a new site had to be blessed. The main ceremony consisted of taking ashes from the hearth of the ancestral shrine (*kuala*) and transferring them to the shrine at the new location, which was then considered a subsidiary of the ancestral *kuala*.

mudra \mù-'drä\ In BUDDHISM and HINDUISM, a symbolic gesture of the hands and fingers used in ceremonies, dance, sculpture, and painting. Hundreds of mudras are used in ceremony and dance, often in combination with movements of the wrists, elbows, and shoulders. In ceremonies, especially in Buddhism, a mudra acts as a kind of seal, affirming a mystical or magical vow or utterance, such as a prayer to ward off evil. A mudra often accompanies the utterance of a MANTRA.

mufti \'mu̇f-tē\ Islamic legal authority charged with issuing an opinion (fatwa) in answer to an inquiry by a judge or a private individual. Such a judgment requires extensive knowledge of the QUR'ĀN and the ḤADĪTH as well as of legal precedents. During the Ottoman Empire the mufti of Istanbul was Islam's chief legal authority, presiding over the whole judicial and theological hierarchy. The development of modern legal codes in Islamic countries has significantly reduced the authority of mufti, and they now deal only with questions of personal status such as inheritance, marriage, and divorce.

Mugabe \mù-'gä-bā**, Robert (Gabriel)** (b. Feb. 21, 1924, Kutama, Southern Rhodesia) First prime minister (1980–87) and executive president (from 1987) of Zimbabwe. With JOSHUA NKOMO, Mugabe led a Marxist-inspired guerrilla war that forced the white-dominated government of IAN SMITH to accept universal elections, which Mugabe's party, Zimbabwe African National Union (ZANU), easily won. He formed a coalition government with Nkomo's Zimbabwe African People's Union (ZAPU), but he removed Nkomo in 1982. In 1984 the two parties were merged as ZANU–Patriotic Front, as Mugabe moved to convert Zimbabwe from a parliamentary democracy into a one-party socialist state. His rule was marked by violence and intimidation and by a decreasing tolerance of political opposition.

Muggeridge, Malcolm (Thomas) (b. March 24, 1903, Croydon, Surrey, Eng.—d. Nov. 24, 1990, Hastings, East Sussex) British journalist and social critic. A lecturer in Cairo in the late 1920s, he worked for newspapers in the 1930s before serving in British intelligence during World War II. He then resumed his journalistic career, including a stint as editor of *Punch* (1953–57). An outspoken and controversial iconoclast, he targeted liberalism and other aspects of contemporary life with his stinging wit and elegant prose. He was early an avowed atheist but moved gradually to embrace Roman Catholicism at age 79. He wrote some 30 books, including satiric novels and religious accounts, and from the 1950s was a popular interviewer, panelist, and documentarian on British television.

Mughal \'mü-gəl\ **architecture** Building style that flourished in India under the Mughal emperors from the mid16th to the late 17th century. The Mughal period marked a striking revival of Islamic architecture in northern India, where Persian, Indian, and various provincial styles were fused to produce works of great refinement. White marble and red sandstone were favoured materials. Most of the early Mughal buildings used arches only sparingly, relying on post-and-beam construction. The use of the double dome, a recessed archway inside a rectangular *fronton* (arena), and parklike surroundings are typical of the SHAH JAHAN period (1628–58), when Mughal design reached its zenith. Symmetry and balance between the parts of a building were stressed, as was delicate ornamental detail. Important Mughal undertakings include the TAJ MAHAL and the palace-fortress at Delhi (begun 1638).

Mughal \'mü-gəl\ **dynasty** *or* **Mogul** \'mō-gəl\ **dynasty** Muslim dynasty that ruled most of northern India from the early 16th to the mid-18th century. The dynasty's rulers, descended from TIMUR and GENGHIS KHAN, included unusually talented rulers over the course of seven generations, and the dynasty was further distinguished by its emperors' efforts to integrate Hindus and Muslims into a united Indian state. Prominent among the Mughal rulers were the founder, BĀBUR (r. 1526–30); his grandson AKBAR (r. 1556–1605); and SHAH JAHĀN. Under AURANGZEB (r. 1658–1707) the empire reached its greatest extent, but his intolerance sowed the seeds for its decline. It broke up under pressure from factional rivalries, dynastic warfare, and the invasion of northern India in 1739 by NĀDIR SHAH.

Mughal painting Style of painting, confined mainly to book illustrations and miniatures, that evolved in India during the MUGHAL DYNASTY (16th–19th centuries). In the initial phases the technique often involved a team of artists: one determined the composition, a second did the actual colouring, and a specialist in portraiture worked on individual faces. Probably the earliest example of Mughal painting is the illustrated folktale *Tuti-nameh* ("Tales of a Parrot"). Essentially a court art, it flourished under the emperors' patronage and declined when they lost interest. See also MUGHAL ARCHITECTURE.

Bird perched on rocks, Mughal painting, *c.* AD 1610; in the State Museum, Hyderābād, Andhra Pradesh, India
P. CHANDRA

Mugwump Member of the reform faction of the early REPUBLICAN PARTY. In 1884 the Mugwumps refused to support the Republican presidential candidate, JAMES BLAINE, whom they considered politically corrupt, and campaigned instead for Democratic nominee GROVER CLEVELAND, whom they saw as a reformer. The term, derived from an Indian word for "war leader," had been used in political slang to mean "kingpin" and was applied to the breakaway group by a New York newspaper. In U.S. political slang *mugwump* came to mean any independent voter; the term was later adopted in England.

Muhammad *or* **Mohammed** (b. c. 570, Mecca, Arabia—d. June 8, 632, Medina) Arab prophet who established the religion of ISLAM. The son of a merchant of the ruling tribe, he was orphaned at age six. He married a rich widow, Khadījah, with whom he had six children, including Fāṭimah, a daughter. According to tradition, in 610 he was visited by the angel Gabriel, who informed Muhammad that he was the messenger of God. His revelations and teachings, recorded in the QUR'ĀN, are the basis of Islam. He began to preach publicly c. 613, urging the rich to give to the poor and calling for the destruction of idols. He gained disciples but also acquired enemies, whose plan to murder Muhammad forced him to flee MECCA for MEDINA in 622. This flight, known as the HIJRAH, marks the beginning of the Islamic era. Muhammad's followers defeated a Meccan force in 624; they suffered reverses in 625 but repelled a Meccan siege of Medina in 627. He won control of Mecca by 629 and of all Arabia by 630. He made his last journey to Mecca in 632, establishing the rites of the HAJJ, or pilgrimage to Mecca. He died later that year and was buried at Medina. His life, teachings, and miracles have been the subjects of Muslim devotion and reflection ever since.

Muhammad I Askia \mù-'hä-mad...ās-'kē-ə\ *or* **Muhammad Ture** \'tu̇r-ˌā\ (d. March 2, 1538, Gao, Songhai empire) West African statesman and military leader. In 1493, after wresting power from SONNI 'ALĪ's son Sonni Baru, Muhammad created an Islamic state whose civil code was the Qur'ān and whose official writing was Arabic. He set up an exemplary administration and remained in power until overthrown by his son, Askia Mūsā, in 1528.

Muḥammad V *orig.* **Sīdī Muḥammad ibn Yūsuf** (b. Aug. 10, 1909, Fès, Mor.—d. Feb. 26, 1961, Rabat) Sultan (1927–57) and king (1957–61) of Morocco. On his father's death, he was appointed sultan of French-ruled Morocco over his two brothers, largely because the French expected him to be more compliant. His nationalist feelings were subtly expressed throughout his rule. He protected Moroccan Jews from the Vichy occupation in World War II (1939–45). In 1953 the French exiled him for two years, but sustained nationalist pressure forced them to let him return. In 1956 he negotiated independence from France; the following year he took the title of king.

Muhammad, Elijah *orig.* **Elijah Poole** (b. Oct. 7, 1897, Sandersville, Ga., U.S.—d. Feb. 25, 1975, Chicago, Ill.) U.S. black separatist and leader of the NATION OF ISLAM. The son of sharecroppers and former slaves, he moved to Detroit in 1923. He joined the Nation of Islam and established its second temple, in Chicago; on the disappearance of its founder, Wallace D. Fard, in 1934, he became head of the movement. He was jailed for advocating draft evasion during World War II, but he continued to build membership of the Black Muslims in the postwar era. His relentless call for a separate nation for African Americans, whom he declared to be Allah's

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chosen people, prompted his most famous disciple, MALCOLM X, to break with the group in 1964. He moderated his views in his later years.

Muḥammad ʿAbd al-Raʾūf al-Qudwah al-Ḥusaynī See YĀSIR ʿARAFĀT

Muḥammad ʿAlī (b. 1769, Kavala, Macedonia, Ottoman Empire—d. Aug. 2, 1849, Alexandria, Egypt) Viceroy of Egypt (1805–48) for the OTTOMAN EMPIRE and founder of the dynasty that ruled Egypt until 1953. He reorganized Egyptian society in the aftermath of the Napoleonic occupation, eliminating the remnants of the Mamlūks (see MAMLŪK DYNASTY), restricting native merchants and artisans, and stamping out peasant rebellions. He nationalized most land, introduced the cultivation of cash crops, and attempted to develop modern industry, but his efforts were undermined by a lack of trained workers, the deleterious effects of excessive taxation, and a common disaffection with peasant conscription. He succeeded in securing for his family the hereditary right to rule Egypt and The Sudan (1841), which opened the way to eventual independence from Ottoman domination. See also ʿABBĀS I.

Muḥammad ibn ʿAbd al-Karīm al-Khaṭṭābī See ABD EL-KRIM

Muḥammad ibn Tughluq \mù-'hä-mád-ˌi-bən-ˌtəg-'lək\ (b. c. 1290, Delhi, India—d. March 20, 1351, Sonda) Second sultan (r. 1325–51) of the Tughluq dynasty, who briefly extended the rule of the Delhi sultanate of northern India over most of the subcontinent. He transferred the capital from Delhi to Deogir (now Daulatabad) in an attempt to consolidate his hold on southern India; the resultant migration of northerners to the south spread the Urdu language there. He tried to enlist the services of the *ʿulamāʾ* (Muslim clerics) but was rebuffed; his overtures to the Sufis met a similar fate. His agricultural innovations included crop rotation and state farms as well as improvements in irrigation. Though he desired to create a more equitable social order, his harshness undermined his authority: during his reign he contended with 22 rebellions.

Muḥāsibī \mù-ˌhä-sē-'bē, mù-ˌḵä-sē-'bē**, al-** (b. c. 781, Al-Baṣrah—d. 857, Baghdad) Sufi theologian. He was reared in Baghdad in a prosperous family. He evolved a rationalist theology, advancing his ideas in didactic conversations with his pupils and in books written in the form of dialogues. His principal work minimized asceticism and acts of outward piety in favour of inward self-examination. Near the end of his life, he was persecuted as a heretic, but he was later seen as having anticipated the doctrines of Muslim orthodoxy.

Muhlenberg family \'mü-lən-ˌberk,\ *English* \'myü-lən-ˌbərg\ Distinguished U.S. family associated with the state of Pennsylvania and the Lutheran church. Henry Melchior Mühlenberg (1711–87) emigrated to Pennsylvania from Germany and served as overseer of all the Lutheran churches from New York to Maryland; in 1748 he founded the first Lutheran synod in America. His eldest son, John Peter Gabriel (1746–1807), was a Lutheran minister, a brigadier general in the Continental Army, and a member of Congress. Frederick Augustus Conrad (1750–1801), the second son, was a Lutheran minister who served in the Continental Congress and later became the first Speaker of the House of Representatives. William Augustus (1796–1877), grandson of Frederick Augustus Conrad, became an Episcopal priest and was the founder of St. Paul's College on Long Island and St. Luke's Hospital in New York City. Frederick Augustus Muhlenberg (1818–1901), nephew of the earlier Frederick Augustus, was a Lutheran clergyman and educator who served as the first president of Muhlenberg College in Allentown.

John Muir.
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Muir \'myůr**, John** (b. April 21, 1838, Dunbar, East Lothian, Scot.—d. Dec. 24, 1914, Los Angeles, Calif., U.S.) U.S. naturalist and conservationist. Muir emigrated from Scotland with his family to Wisconsin in 1849. An 1867 accident caused him to abandon an industrial career and devote himself to nature. He began his efforts to establish a federal forest conservation policy in 1876. His writings swung public opinion in favour of Pres. GROVER CLEVELAND's proposal for national forest reservations and influenced Pres. THEODORE ROOSEVELT's conservation program, and he was largely responsible for establishing SEQUOIA and YOSEMITE national parks (1890). He was the chief founder and first president of the SIERRA CLUB (1892–1914). In 1908 the U.S. government established the MUIR WOODS NATIONAL MONUMENT in Marin Co., California.

Muir Woods National Monument National woodland, northern California, U.S. A virgin stand of coastal REDWOODS, it covers an area of 554 acres (224 hectares) near the Pacific coast, northwest of SAN FRANCISCO. Some of the trees are more than 300 ft (90 m) high, 15 ft (5 m) in diameter, and 2,000 years old. The park, established in 1908, was named in honour of the naturalist JOHN MUIR.

Muisca See CHIBCHA

mujahideen \mü-ˌja-hi-'dēn\ *Arabic* **mujāhidūn ("those engaged in jihad")** In its broadest sense, those Muslims who proclaim themselves warriors for the faith. Its Arabic singular, *mujāhid*, was not an uncommon personal name from the early Islamic period onward. However, the term did not gain popular currency as a collective or plural noun referring to "holy warriors" until the 18th century in India, where it became associated with Muslim revivalism. In the 20th century the term was used most commonly in Iran and Afghanistan. In Iran the Mojāhedin-e Khalq ("Mujahideen of the People"), a group combining Islamic and Marxist ideologies, engaged in a long-term guerrilla war against the leadership of the Islamic republic. The name was most closely associated, however, with members of a number of guerrilla groups operating in Afghanistan that opposed invading Soviet forces and eventually toppled the Afghan communist government during the AFGHAN WAR (1979–92). Rival factions thereafter fell out among themselves precipitating the rise of one faction, the TALIBAN. Like the term *JIHAD*—to which it is lexicographically connected—the name has been used rather freely, both in the press and by Islamic militants themselves, and often has been used to refer to any Muslim groups engaged in hostilities with non-Muslims or even with secularized Muslim regimes.

Mukden See SHENYANG

Mukden Incident \'můk-dən\ (1931) Seizure of the Manchurian city of Mukden (now Shenyang, China). Responding to Russian pressure from the north and to the increasingly successful unification of China by CHIANG KAI-SHEK, the Japanese garrison in Manchuria used the pretext of an explosion along its railway to occupy Mukden. With reinforcements from the Japanese colony of Korea, its army had occupied all of Manchuria within three months. The Chinese withdrew and allowed the Japanese to establish the state of MANCHUGUO.

mulberry family Family Moraceae, composed of about 1,000 species of deciduous or EVERGREEN trees in about 40 genera, found mostly in tropical and subtropical regions. Plants of the family contain a milky latex and produce multiple fused fruits. Edible fruits grow on the common mulberry (genus *Morus*), FIG (in the largest genus, *Ficus*), and BREADFRUIT. Silkworms (see SILKWORM MOTH) feed almost exclusively on the leaves of the white mulberry (*M. alba*). Among the ornamentals in the family are the paper mulberry and the OSAGE orange (*Maclura pomifera*). Other species include the India RUBBER TREE, which is often placed in office lobbies, and the wide-spreading BANYAN tree.

mule Offspring of a male ASS and a female HORSE. The less common cross of a female ass and a male horse is called a hinny. Most mules are sterile. The mule resembles the horse in height and in shape of neck and croup (rump); it resembles the ass in its long ears, small hooves, and short mane. The coat is usually brown or bay. Mules are 12–17.5 hands (50–70 in., 120–180 cm) high and weigh 600–1,500 lbs (275–700 kg). They have been used as pack animals for at least 3,000 years because of their ability to withstand hardships.

Mule deer buck (*Odocoileus hemionus*).
HARRY ENGELS FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

mule deer Large-eared DEER (*Odocoileus hemionus*) of western

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North America that lives alone or in small groups at high altitudes in summer and lower altitudes in winter. Mule deer stand 3–3.5 ft (90–105 cm) and are yellowish brown in summer, grayish brown in winter. The tail is white with a black tip, except on the black-tailed deer (*O. h. columbianus*), a Pacific Northwest subspecies. The male's antlers fork twice above a short tine near the base; a mature male normally has five tines on each antler. It is related to the WHITE-TAILED DEER.

mullah \'mə-lə\ Muslim title applied to a scholar or religious leader, especially in the Middle East and the Indian subcontinent. It means "lord" and has also been used in North Africa as an honorific attached to the name of a king, sultan, or member of the nobility. The title is now given to a variety of religious leaders, including teachers in religious schools, scholars of canon law, leaders of prayer in the mosques (IMAMS), and reciters of the QUR'ĀN (QURRĀ'). The word can also refer to the entire class that upholds the traditional interpretation of Islam.

Muller \'mə-lər**, Hermann Joseph** (b. Dec. 21, 1890, New York, N.Y., U.S.—d. April 5, 1967, Indianapolis, Ind.) U.S. geneticist. He attended Columbia University. The possibility of consciously guiding human evolution provided the initial motivation for his research, leading him to work in the Soviet Union's Institute of Genetics. He later assisted the Republican forces in the Spanish Civil War before returning to the U.S. in 1940; he thereafter taught principally at Indiana University (1945–67). In 1926 he first induced genetic mutations through the use of X rays, and he demonstrated that mutations are the result of breakages in chromosomes and of changes in individual genes. His receipt of the Nobel Prize in 1946 increased his opportunities to publicize the dangers posed by accumulating spontaneous mutations in the human gene pool as a result of industrial processes and radiation, and he devoted much energy to increasing public awareness of the genetic dangers of radiation.

Müller \'mʉ̄-lər**, Johannes Peter** (b. July 14, 1801, Koblenz, France—d. April 28, 1858, Berlin, Ger.) German physiologist, comparative anatomist, and natural philosopher. He studied at the Universities of Bonn and Berlin and later taught at both. His discovery that each sense organ responds to stimuli differently implied that external events are perceived only by the changes they produce in sensory systems. His investigations in physiology, evolution, and comparative anatomy contributed to knowledge of reflexes, the secretion and coagulation processes, the composition of blood and lymph, vision, and hearing. His studies of tumour cell structure began to establish pathological histology as a branch of science.

mullet Any of fewer than 100 species (family Mugilidae) of abundant, commercially valuable schooling fishes found in brackish or fresh waters throughout tropical and temperate regions. Mullets frequent shallow, inshore areas, searching the sand or mud for microscopic plants and small animals. They are silvery and 1–3 ft (30–90 cm) long, with large scales, a short snout, a cigar-shaped body, a forked tail, and two distinct dorsal fins, the first containing four stiff spines. The common, or striped, mullet (*Mugil cephalus*), cultivated in some areas, is a well-known species found worldwide.

Mulligan, Gerry *orig.* **Gerald Joseph Mulligan** (b. April 6, 1927, Queens Village, Long Island, N.Y., U.S.—d. Jan. 20, 1996, Darien, Conn.) U.S. JAZZ saxophonist, pianist, composer, arranger, and bandleader. He worked as staff arranger for GENE KRUPA's band in 1946, later writing arrangements and playing for the MILES DAVIS nonet's *Birth of the Cool* recordings (1949). Mulligan became one of the best-known exponents of cool jazz (see BEBOP). In 1952 he formed a pianoless quartet featuring trumpeter CHET BAKER.

Mullis, Kary B(anks) (b. Dec. 28, 1944, Lenoir, N.C., U.S.) U.S. biochemist. He received his doctorate from the University of California at Berkeley. In 1983 he invented the POLYMERASE CHAIN REACTION, with which scientists can determine the order of nucleotides in a gene, use genetic fingerprinting to identify individuals by their DNA patterns, study evolution, and make medical diagnoses. He did his prizewinning research at Cetus Corp. and later became a freelance consultant. He shared a 1993 Nobel Prize with Michael Smith (b. 1932). He is known for his freewheeling personal style and his iconoclastic opinions and writings, including *Dancing Naked in the Mind Field* (1998).

Mulroney \məl-'rü-nē**, (Martin) Brian** (b. March 20, 1939, Baie-Comeau, Que., Can.) Prime minister of Canada (1984–93). The son of an electrician in a paper-and-pulp town, he grew up bilingual in English and French. He began practicing law in Montreal in 1965. In 1974 he served on a commission to investigate crime in Quebec's construction industry. From 1977 to 1983 he was president of the Iron Ore Company. Elected leader of the PROGRESSIVE CONSERVATIVE PARTY in 1983, he became prime minister when the party defeated the Liberals in the general election in 1984. Creating a coalition of Quebec nationalists and western conservatives, he advocated unification while recognizing Quebec as a "distinct society." He sought U.S. cooperation on acid rain and trade policies and helped negotiate NAFTA. He retired from politics in 1993.

Brian Mulroney, 1993.
RICK FRIEDMAN/BLACK STAR

Multan \mʉl-'tän\ City (pop., 1998: 1,182,000), central Pakistan, near the CHENAB RIVER. An ancient city, it was taken by ALEXANDER THE GREAT in 326 BC. It fell to the Muslims c. AD 712. For three centuries it remained the outpost of ISLAM in what was then India. It was subject to the Delhi sultanate and the Mughal Empire and was captured by the Afghans (1779) and the Sikhs (1818) before being subjugated by the British (1849–1947). It is a commercial and industrial centre, with textile mills, glass factories, and cottage industries, including pottery and camelskin work. It is the site of many Muslim shrines and an ancient Hindu temple.

multimedia Computer-delivered electronic system that allows the user to control, combine, and manipulate different types of media, such as text, sound, video, computer graphics, and animation. The most common multimedia machine consists of a PERSONAL COMPUTER with a sound card, MODEM, digital speaker unit, and CD-ROM. Interactive multimedia systems under commercial development include CABLE TELEVISION services with computer interfaces that enable viewers to interact with TV programs; high-speed interactive audiovisual communications systems, including video game consoles, that rely on digital data from FIBRE-OPTIC lines or digitized wireless transmission; and VIRTUAL REALITY systems that create small-scale artificial sensory environments.

multinational corporation Any corporation registered and operating in more than one country at a time, usually with its headquarters in a single country. A firm's advantages in establishing itself multinationally include both vertical and horizontal economies of scale (reductions in cost that result from an expanded level of output). Critics usually regard the multinational corporation as destructive of local economies abroad and as prone to monopolistic practices. See also CONGLOMERATE.

multiple birth Birth of more than one child from one pregnancy. Twins are most common, born in 1 of about every 80 pregnancies. Identical twins develop from a single fertilized egg, which splits into two genetically identical embryos (though physical traits may be modified during their development); they occur randomly but are more likely in older mothers. Incomplete or late division results in CONJOINED TWINS. Fraternal twins develop from two eggs fertilized by two sperm and are no more genetically alike than are other siblings. Most common among persons of African ancestry and least common among those of Asian ancestry, fraternal twins seem to run in families. Repeated twinning produces triplets, quadruplets, and so on; these multiples may be identical, fraternal, or a combination. The use of fertility drugs has increased the number of high-order multiple births. Medical and psychological "twin studies" compare fraternal and identical twins to learn about genetic influences on various characteristics and diseases.

multiple integral In CALCULUS, the INTEGRAL of a FUNCTION of more than one variable. As the integral of a function of one variable over an interval results in an area, the double integral of a function of two variables calculated over a region results in a volume. Functions of three variables have triple integrals, and so on. Like the single integral, such constructions are useful in calculating the net change in a function that results from changes in its input values.

multiple personality disorder See DISSOCIATIVE IDENTITY DISORDER

multiple sclerosis \sklə-'rō-səs\ Disease of the BRAIN and SPINAL CORD in which gradual, patchy destruction of the myelin sheath of nerve fibres

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causes interruption or disordered transmission of nerve impulses. Its early symptoms may include limb weakness or trembling, visual problems, sensory disturbances, unsteady walking, and defective bladder control, which come and go irregularly. Attacks grow more severe, and some symptoms become permanent, sometimes with eventual complete PARALYSIS. Average survival from onset is about 25 years, but a rare acute form progresses over months. The cause remains uncertain and treatment unsatisfactory. Corticosteroids may ease symptoms. MS may be due to a delayed immune response that attacks the myelin sheaths; suggested causes include various common viruses. Dietary causes have also been suggested.

multiplexing Process of transmitting multiple (but separate) signals simultaneously over a single channel or line. Because the signals are sent in one complex transmission, the receiving end has to separate the individual signals. The two main types of multiplexing methods are time-division multiplexing (TDM) and frequency-division multiplexing (FDM). In TDM (typically used for digital signals) a device is given a specific time slot during which it can use the channel. In FDM (typically used for analog signals) the channel is subdivided into subchannels, each with a different frequency width that is assigned to a specific signal. Optical-fibre networks can use DWDM (dense wavelength-division multiplexing), in which different data signals are sent in different wavelengths of light in the fibre-optic medium.

multiplier In economics, a numerical coefficient showing the effect of a change in one economic variable on another. One macroeconomic multiplier, the autonomous expenditures multiplier, relates the impact of a change in total national investment on the nation's total income; it equals the ratio of the change in total income to the change in investment. If, for example, the total investment in an economy is increased by $1 million, a chain reaction of increases in consumption is set off. Producers of raw materials used in the investment projects and workers employed in the projects gain $1 million in income. If they spend on average three-fifths of that income, $600,000 will be added to the incomes of others. The makers of the goods they buy will in turn spend three-fifths of their new income on consumption. The process continues such that the amount by which total income increases may be computed by an algebraic formula. In this case, the multiplier equals $1/(1 - 3/5)$, or 2.5. This means that a $1 million increase in investment creates a $2.5 million increase in total income. Other multipliers include the money multiplier, which measures money creation resulting from a change in MONETARY POLICY; the government spending multiplier, which measures the change in national income resulting from changes in FISCAL POLICY; and the tax multiplier, which measures the changes in national income resulting from a change in taxes. The concept of the multiplier process was popularized in the 1930s by JOHN MAYNARD KEYNES as a means of measuring the effect of government spending.

multiprocessing Mode of computer operation in which two or more processors (see CPU) are connected and are active at the same time. In such a system, each processor is executing a different program or set of instructions, thus increasing computation speed over a system that has only one processor (which means only one program can be executed at a time). Because the processors must sometimes access the same resource (as when two processors must write to the same disk), a system program called the task manager has to coordinate the processors' activities.

multitasking Mode of COMPUTER operation in which the computer works on multiple tasks at the same time. A task is a computer program (or part of a program) that can be run as a separate entity. On a single-processor system, the CPU can perform preemptive (also called time slicing or time sharing) multitasking, where it executes part of one program, then switches to another program, and then returns to the first one. On MULTIPROCESSING systems, each processor can handle a separate task.

Mumbai \'məm-ˌbī\ *formerly* **Bombay** City (pop., 2001 prelim.: city, 11,914,398; metro. area, 16,368,084), capital of MAHARASHTRA state, western India. Located partly on Mumbai Island, it is flanked by Mumbai Harbour and the ARABIAN SEA. It is India's principal port on that sea and one of the largest and most densely populated cities in the world. The town was acquired by the Portuguese in 1534. It was ceded to the English as part of the dowry of CATHERINE OF BRAGANZA, who married CHARLES II in 1661. Granted to the British EAST INDIA COMPANY in 1668, it became the company's headquarters in 1672, and in 1708 it was made the centre of British authority in India. After the opening of the SUEZ CANAL in 1869, Mumbai grew to be the largest distributing entrepôt in India. It remains India's economic hub and the heart of financial and commercial activity, its cultural and education centre, and headquarters of its film industry.

Mumford, Lewis (b. Oct. 19, 1895, Flushing, N.Y., U.S.—d. Jan. 26, 1990, Amenia, N.Y.) U.S. architectural critic, urban planner, and cultural historian. After studying at the City College of New York and at the New School for Social Research, he taught at various universities and wrote for *THE NEW YORKER*, *The Dial*, and other magazines. In works such as *Technics and Civilization* (1934), *The City in History* (1961), and *The Myth of the Machine* (3 vol., 1967–70), Mumford analyzed the effects of technology and urbanization on human societies, criticizing the dehumanizing tendencies of modern technological society and urging that it be brought into harmony with humanistic goals and aspirations. See also URBAN PLANNING.

mumming play *or* **mummers' play** Traditional dramatic entertainment. Mumming plays, which feature the death of a champion who is restored to life by a doctor, are still performed in a few villages of England and Northern Ireland. Originally mummers were bands of masked persons who during winter festivals in Europe paraded through the streets and entered houses to dance or play dice in silence. Thus the name has been connected with words such as *mumble* and *mute* and non-English words meaning "mask." Mumming plays probably have links with primitive ceremonies marking important stages in the agricultural year.

mummy Body embalmed or preserved for burial in the manner of the ancient Egyptians. The process varied from age to age in Egypt, but it always involved removing the internal organs, treating the body with resin, and wrapping it in linen bandages. (In later Egyptian times, the organs were replaced after treatment.) Among the many other peoples who practiced mummification were those of the TORRES STRAIT, near Papua New Guinea, and the INCAS.

mumps *or* **epidemic parotitis** \ˌpar-ə-ˈtīt-əs\ Acute contagious viral disease with inflammatory swelling of the SALIVARY GLANDS. Epidemics often occur, mostly among 5- to 15-year-olds. Cold symptoms with low fever are followed by swelling and stiffening in front of the ear, often on both sides. This rapidly spreads toward the neck and under the jaw. Pain is seldom severe, with little redness, but chewing and swallowing are difficult. During recovery in patients past puberty, other glands may be affected, but usually not seriously. The testes may atrophy, but sterility is very rare. While inflammation of the brain and MENINGES is fairly common, chances of recovery are good. Mumps needs no special treatment, and patients usually develop immunity. Vaccination can prevent it.

Muna \'mü-nə\ **Island** Island, east-central Indonesia. Located in the Flores Sea off the southeastern coast of CELEBES (Sulawesi), it is 63 mi (101 km) long and 35 mi (56 km) wide and has an area of 1,124 sq mi (2,911 sq km). It has a hilly, forested surface, rising to 1,460 ft (445 m). The Muna, a Muslim people who speak an Austronesian language, practice a simple agriculture, growing rice and tubers. The hoglike babirusa and the marsupial cuscus are found on the island. The main town and principal port is Raha, on the northeastern coast.

Munaẓẓamat al-Taḥrīr al-Filasṭīniyyah See PALESTINE LIBERATION ORGANIZATION

Munch \'mu̇ŋk**, Edvard** (b. Dec. 12, 1863, Løten, Norway—d. Jan. 23, 1944, Ekely) Norwegian painter and printmaker. His life and art were marked by the deaths of both parents, his brother, and his sister during his childhood, and the mental illness of another sister. He received little formal training, but the encouragement of a circle of artists in Christiania (now Oslo) and exposure to IMPRESSIONISM and POST-IMPRESSIONISM helped him develop a highly original style. It was principally through his work of the 1890s, a series of paintings on love and death in which he gave form to mysterious

Edvard Munch, self-portrait, lithograph, 1895; in the Albertina, Vienna
COURTESY OF THE ALBERTINA, VIENNA

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and dangerous psychic forces, that he made crucial contributions to modern art. *The Scream* (1893), his most famous work, is often seen as a symbol of modern humanity's spiritual anguish. His etchings, lithographs, drypoints, and woodcuts closely resemble his paintings in style and subject matter. After a nervous breakdown in 1908–09, therapy lent his work a more positive, extroverted tone, but his art never recovered its former intensity. His work influenced the proponents of German Expressionism.

Munda \'mən-də**, Battle of** (45 BC) Conflict that ended the Roman civil war between the forces of Pompey the Great and Julius Caesar. The two forces met in Spain, where the late Pompey's sons had seized Córdoba in revolt. Caesar lured the Pompeians from their high ground to do battle; when the rebels maneuvered a contingent to meet a cavalry charge, it was mistaken for a retreat by their army, which broke and fled, and Caesar claimed victory.

Munda \'mün-də\ **languages** Family of about 17 languages spoken in India, Bangladesh, and Nepal that together with Mon-Khmer comprises the Austroasiatic superfamily. Munda languages are spoken by more than seven million people, all members of tribal groups living mainly in hilly and forested regions. Most significant are Santali, with more than four million speakers concentrated in northern Orissa, southern and eastern Bihar, northwestern Bengal, and the Nepal-Assam border; Ho, with about 750,000 speakers mainly in Bihar and Orissa; Mundari, with about 850,000 speakers scattered over northeastern India; and Korku, the westernmost Munda language, spoken by about 320,000 in southern Madhya Pradesh and northern Maharashtra. Munda languages differ from all other Austroasiatic languages in complexity of morphology and in having basic subject-object-verb rather than subject-verb-object word order.

Mundell, Robert A(lexander) (b. Oct. 24, 1932, Kingston, Ont., Can.) Canadian-born economist who received the Nobel Prize in Economic Sciences in 1999 for his work on monetary dynamics and optimum currency areas. Mundell earned degrees from the University of British Columbia (B.A., 1953), the University of Washington (M.A., 1954), and the Massachusetts Institute of Technology (Ph.D., 1956). He taught economics at the University of Chicago (1956–57) and Columbia University (1974–). Through research for the International Monetary Fund, Mundell analyzed the effect of exchange rates on monetary policies. In 1961 he theorized that an economic region characterized by free movement of labour and trade could support a single currency. His theories contributed to the creation of the euro, the single currency adopted by the European Union on Jan. 1, 1999.

Munich \'myü-nik\ *German* **München** \'mün-kən\ City (pop., 2002 est.: city, 1,227,958; metro. area, 1,893,715), capital of Bavaria, Germany. Located along the Isar River, it was founded c. 1158 at the site of an ancient monastery. It became the capital of Bavaria under the ruling Wittelsbach family. The city developed as a centre of music and theatre through the 19th century. After World War I it became a centre of right-wing political ferment; it was the site of the 1923 Beer Hall Putsch, Adolf Hitler's attempted rising against the Bavarian government, and subsequent Nazi Party activities. It was the site for the signing of the 1938 Munich agreement. In World War II it suffered heavily from Allied bombing. Some medieval structures survived, including the cathedral and town hall. Today Munich is a trade, cultural, educational, and industrial centre known for its many museums and for manufacturing and beer and ale brewing.

Munich, University of *German in full* **Ludwig-Maximilians Universität München** Autonomous university supported by the state of Bavaria, Germany. It was founded in Ingolstadt in 1472 and modeled after the University of Vienna. During the Protestant Reformation it was a centre of Roman Catholic opposition to Martin Luther. In 1799 schools of economics and political science were added, and in 1826 it moved to Munich, where agricultural and technical programs were founded.

Munich agreement (1938) Settlement reached by Germany, France, Britain, and Italy permitting German annexation of Czechoslovakia's Sudetenland. Adolf Hitler's threats to occupy the German-populated part of Czechoslovakia stemmed from his avowed broader goal of reuniting Europe's German-populated areas. Though Czechoslovakia had defense treaties with France and the Soviet Union, both countries agreed that areas in the Sudetenland with majority German populations should be returned. Hitler demanded that all Czechoslovaks in those areas depart; when Czechoslovakia refused, Britain's Neville Chamberlain negotiated an agreement permitting Germany to occupy the areas but promising that all future differences would be resolved through consultation. The agreement, which became synonymous with appeasement, was abrogated when Hitler annexed the rest of Czechoslovakia the next year.

Munich Putsch See Beer Hall Putsch

Muñoz Marín \mün-'yōs-mə-'rēn**, Luis** (b. Feb. 18, 1898, San Juan, P.R.—d. April 30, 1980, San Juan) Statesman and four-term governor of Puerto Rico (1948–64). Educated in the U.S., he became editor of the newspaper *La Democracia* and was elected to the Puerto Rican senate in 1932. Early in his career he advocated independence from the U.S., but later he worked closely with the U.S.-appointed governor to improve conditions in Puerto Rico. He achieved success with Operation Bootstrap, a program for rapid economic growth. When Puerto Rico received the right to elect its own governor in 1948, he was overwhelmingly elected and repeatedly reelected. He achieved his goal of making Puerto Rico a commonwealth.

Muñoz Rivera \'mün-yōs-rē-'ver-ä**, Luis** (b. July 17, 1859, Barranquitas, P.R.—d. Nov. 15, 1916, Santurce) Puerto Rican statesman, publisher, and patriot. In 1889 he founded the newspaper *La Democracia*, which crusaded for Puerto Rican self-government. He was instrumental in obtaining Puerto Rico's charter of home rule from Spain in 1897. He was president of the first autonomist cabinet, but he resigned after Spain ceded Puerto Rico to the U.S. His son Luis Muñoz Marín was governor of Puerto Rico.

Munro \mən-'rō**, Alice** *orig.* **Alice Anne Laidlaw** (b. July 10, 1931, Wingham, Ont., Can.) Canadian writer. She is known for exquisitely drawn short stories, usually set in rural Ontario and peopled by characters of Scotch-Irish stock. Her collections *Dance of the Happy Shades* (1968), *Who Do You Think You Are?* (1978), and *The Progress of Love* (1986) won the Governor General's Award for Fiction. Her other collections include *Something I've Been Meaning to Tell You* (1974), *The Moons of Jupiter* (1982), *Friend of My Youth* (1986), *Open Secrets* (1994), *The Love of a Good Woman* (1998), and *Hateship, Friendship, Courtship, Loveship, Marriage* (2001).

Munsey, Frank Andrew (b. Aug. 21, 1854, Mercer, Maine, U.S.—d. Dec. 22, 1925, New York City, N.Y.) U.S. newspaper and magazine publisher. He managed a telegraph office before moving to New York City, where he founded *Golden Argosy* (1882), later renamed *Argosy Magazine*; and *Munsey's Magazine* (1889), the first inexpensive, general-circulation, illustrated magazine in the U.S. He acquired several newspapers in Baltimore and New York, some of which disappeared in profitable mergers. He viewed his publications purely as moneymaking enterprises and maintained colourless editorial policies. He left most of his large fortune to the Metropolitan Museum of Art in New York City.

Münster \'mün-stər\ City (pop., 2002 est.: 267,197), western Germany. Founded in 804 as a bishopric, it was named Münster in 1068 and was chartered in 1137. A member of the Hanseatic League from the 13th century, it was seized by the Anabaptists in 1535. The Peace of Westphalia was signed in Münster in 1648, and in 1815 Münster became the capital of Prussian Westphalia. Although it suffered heavy damage in World War II, most of its historic buildings were restored or rebuilt, including the 13th-century cathedral and 14th-century town hall. It is a centre of Westphalian culture.

Munster Province (pop., 2002 prelim.: 1,101,266), southern Ireland. It has an area of 9,315 sq mi (24,127 sq km). The region was ruled by a southern clan, which gradually extended its power over Munster by c. AD 400. In the 10th century Vikings invaded and eventually settled in Waterford and Limerick. After the 12th-century Anglo-Norman invasion, it was ruled by the feudal families of Fitzgerald and Butler. It now comprises the counties of Clare, Cork, Kerry, Limerick, Tipperary (North Riding and South Riding), and Waterford.

Chinese muntjac (*Muntiacus reevesi*)
KENNETH W. FINK—ROOT RESOURCES

muntjac \'mənt-ˌjak\ *or* **barking deer** Any of about seven species of solitary, nocturnal deer, native to

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Asia and introduced into England and France, that constitute the genus *Muntiacus* (family Cervidae). Named for their cry, most species stand 15–25 in. (40–65 cm) high, weigh 33–77 lbs (15–35 kg), and are grayish, reddish, or brown. Males have tusklike upper canine teeth and short one-branched antlers. Bony ridges extend from the antler base onto the face. The giant muntjac (88–110 lbs, or 40–50 kg) was discovered in northern Vietnam in 1993–94. Fea's muntjac (*M. feae*), of Myanmar and Thailand, is endangered, and other muntjac species are threatened.

Müntzer \'mənt-sər**, Thomas** *or* **Thomas Munzer** (b. sometime before 1490, Stolberg, Thuringia—d. May 27, 1525, Mühlhausen) German religious reformer. A student of theology and an associate of Martin Luther, he served as a pastor until his socialism and mystical doctrines led to his removal. His belief in the inner light of the Holy Spirit as opposed to the authority of the Bible alienated the Lutherans. He preached widely, championing the common people, and in 1525 he organized the working classes of Mühlhausen. He led the Peasants' Revolt in Thuringia in 1524–25; after the defeat of his forces, he was tortured, tried, and executed.

muqarnas See stalactite work

Muqi Fachang *or* **Mu-hsi Fa-ch'ang** (fl. 13th century, Sichuan province, China) Chinese Chan (Japanese: Zen) Buddhist painter. Toward the end of the Southern Song dynasty (1127–1279), Muqi fled to a monastery near Hangzhou. He painted a variety of subjects—including landscapes, flowers, still lifes, and more orthodox iconographic subjects. The most famous paintings associated with Muqi include *Six Persimmons* and a triptych with a white-robed Guanyin flanked on either side by a scroll of monkeys and a crane. The paintings vary in style and subject matter, but there is throughout a sense of immediate vision and a totally responsive hand, expressed with broad and evocative washes of ink. His paintings on Chan themes stimulated many copies in Japan.

Murābiṭūn, al- See Almoravid dynasty

Murad, Ferid (b. Sept. 14, 1936, Whiting, Ind., U.S.) U.S. pharmacologist. He received his M.D. and Ph.D. from Western Reserve University (later Case Western Reserve University). Murad showed that nitroglycerin and related heart drugs induce the formation of nitric oxide, a gas that increases the diameter of blood vessels. Along with Robert F. Furchgott and Louis J. Ignarro, he was awarded a 1998 Nobel Prize for the discovery that nitric oxide acts as a signaling molecule in the cardiovascular system. Their combined work uncovered an entirely new mechanism for how blood vessels relax and widen. This discovery led to the development of the drug Viagra, which is used to treat erectile dysfunction.

mural Painting applied to and made integral with the surface of a wall or ceiling. Its roots can be found in the universal desire that led prehistoric peoples to create cave paintings—the desire to decorate their surroundings and express their ideas and beliefs. The Romans produced large numbers of murals in Pompeii and Ostia, but mural painting (not synonymous with fresco) reached its highest degree of creative achievement in Europe with the work of such Renaissance masters as Masaccio, Fra Angelico, Leonardo da Vinci, Michelangelo, and Raphael. In the 20th century, the mural was embraced by artists of the Cubist and Fauve movements in Paris, revolutionary painters in Mexico (e.g., Diego Rivera, José Clemente Orozco, David Alfaro Siqueiros), and Depression-era artists under the sponsorship of the U.S. government (e.g., Ben Shahn, Thomas Hart Benton).

Murasaki Shikibu \mu-'rä-sä-kē-'shē-kē-bu\ (b. c. 978, Kyōto, Japan) Japanese writer. Her real name is unknown, and the primary source of knowledge about her life is a diary she kept (1007–10). Her *Tale of Genji* (completed c. 1010) is a long and complex tale, concerned mostly with the loves of Prince Genji and the women in his life. Supremely sensitive to human emotions and the beauties of nature, it provides delightful glimpses of life at the court of the empress Jōtō mon'in, whom Murasaki served. It is generally considered the greatest work of Japanese literature and perhaps the world's first novel.

Murat \mə-'rä**, Joachim** (b. March 25, 1767, La Bastide-Fortunière, France—d. Oct. 13, 1815, Pizzo, Calabria) French soldier and king of Naples (1808–15). He served in Italy and Egypt as a daring cavalry commander, and later he aided Napoleon in his coup d'état (1799) and married Napoleon's sister Caroline Bonaparte. He helped win the Battle of Marengo (1800). Appointed governor of Paris, he was promoted to marshal in 1804. After victories at the Battles of Austerlitz (1805) and Jena (1806), he was made king of Naples (1808), where he carried out administrative and economic reforms and encouraged Italian nationalism. He led troops in Napoleon's Russian campaign at the Battle of Borodino (1812) but left the army during its retreat from Moscow. He supported Napoleon again during the Hundred Days in 1815, but he was defeated with his Neapolitan forces at the Battle of Tolentino and was later taken prisoner and shot.

Murat, detail of a drawing by Antoine-Jean Gros; in the École des Beaux-Arts, Paris.
CLICHE MUSEES NATIONAUX, PARIS

Murchison River River, Western Australia, Australia. Sporadically flowing west to the Indian Ocean, it is 440 mi (708 km) long. In 1891 the river's name was given to one of Australia's richest goldfields, and some gold is still mined in the area. Kalbarri National Park is on the lower Murchison, where the river cuts a scenic gorge through the coastal range.

Murcia \'mər-shə\ Autonomous community (pop., 2001: 1,197,646), province, and historic region, southeastern Spain. It covers 4,368 sq mi (11,314 sq km), and its capital is the city of Murcia. It was an independent Moorish kingdom until its annexation by Castile in 1243. The autonomous community was established in 1982. The Segura River flows through its centre, irrigating rich farmland and orchards. The ports of Cartagena, Mazarrón, and Aguilas have grown with the development of shipping and mining along the coastal plain. Principal crops are grain, olives, grapes, and melons.

Murcia City (pop., 2001: 370,745), capital of the autonomous community of Murcia, southeastern Spain. The site was settled before the Roman occupation of Spain in the 3rd century BC. It became the Muslim city of Mursīyah in AD 825, when it was made a provincial capital by the emir of Córdoba. It was the birthplace of Ibn al-ʿArabī (1165). The Segura River divides the city into older and newer parts. The 14th-century cathedral was restored in the 18th century. It is a communications and agricultural-trade centre for surrounding areas. Its silk industry dates from Moorish times.

murder See homicide

Murder, Inc. Popular name for an arm of the U.S. national crime syndicate founded c. 1930 in Brooklyn, N.Y., to threaten, maim, or murder designated victims for a price. Its services were available to any syndicate member anywhere in the country; many of its victims were themselves syndicate members who were killed for "business reasons." Its principal figures were Louis Buchalter, known as Louis Lepke, and Albert Anastasia. Investigated by Thomas Dewey, it was exposed in 1940–41 by a former member, Abe "Kid Twist" Reles, who described some 70 murders and suggested hundreds more; he himself died mysteriously in the middle of the investigation.

Murdoch \'mər-ˌdäk**, Dame (Jean) Iris** (b. July 15, 1919, Dublin, Ire.—d. Feb. 8, 1999, Oxford, Oxfordshire, Eng.) British novelist and philosopher. A graduate of the University of Oxford, she worked as a university lecturer while pursuing her writing career. Her first published work was a study of Jean-Paul Sartre (1953). Her novels, including *The Bell* (1958), *A Severed Head* (1961), *The Black Prince* (1973), *The Sea, the Sea* (1978), and *The Book and the Brotherhood* (1987), typically have convoluted plots featuring philosophical and comic elements. Her nonfiction philosophical works include *The Sovereignty of Good* (1970) and *Metaphysics as a Guide to Morals* (1992). Her decline under Alzheimer disease was chronicled by her husband, the critic John Bayley, in *Elegy for Iris* (1999).

Murdoch, (Keith) Rupert (b. March 11, 1931, Melbourne, Vic., Austl.) Australian-U.S. newspaper publisher and media entrepreneur. Son of a famous Australian war correspondent and publisher, he inherited two Adelaide newspapers in 1954 and boosted their circulation by emphasizing crime, sex, scandal, sports, and human interest stories, while taking an outspokenly conservative editorial stance. He used this approach with soaring success with papers bought in Australia, Britain, and the U.S. by his global media holding company, The News Corporation Ltd. He also acquired conventional and respected publications, including *The Times* of

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London. In the 1980s and ’90s he expanded into book and electronic publishing, television broadcasting, and film and video production. His holdings include the *New York Post*; Fox, Inc. (see FOX BROADCASTING CO.); HarperCollins Publishers; British Sky Broadcasting; and Star TV, a pan-Asian television service.

Mureș \'mü-resh\ **River** River, rising in the eastern CARPATHIAN MOUNTAINS, east-central Romania. It flows west across northern Romania and across the Hungarian border to join the TISZA RIVER at Szeged, Hung.; it is about 450 mi (725 km) long. It is the Tisza’s most important tributary and a significant traffic route; it is navigable for small boats for more than 200 mi (320 km).

Murgab River See MORGHAB RIVER

muriatic acid See HYDROCHLORIC ACID

Murillo \mù-'rē-ō,\ *English* \myù-'ri-lō**, Bartolomé Esteban** (baptized Jan. 1, 1618, Sevilla, Spain—d. April 3, 1682, Sevilla) Spanish painter. The most popular Baroque religious painter of 17th-century Spain, he is noted for his idealized figures, most of them painted for religious orders and the confraternities of his native Sevilla (Seville). His early works were executed in the naturalistic style of FRANCISCO DE ZURBARÁN, but with the development of his mature style in the 1650s he soon surpassed the older master in fame and popularity. The softly modeled forms, rich colours, and broad brushwork of the later paintings, such as the *Immaculate Conception* of 1652 (his favourite subject), reveal the influence of 16th-century Venetian and Flemish Baroque painters. Murillo’s works were copied and imitated throughout Spain and its empire, and he was the first Spanish painter to achieve fame outside the Spanish world.

Murji’ah \'mùr-jē-ə\ One of the earliest sects of ISLAM to believe in the postponement of judgment on those who have committed serious sins, recognizing that God alone is able to decide whether a Muslim has lost his faith. The Murji’ah flourished during the 7th–8th century, a period of strife in the Muslim community. Unlike the Khārijites, a militant sect that wanted to oust serious sinners from the community and declare JIHAD against them, the Murji’ah, who advocated leaving great sinners to God, claimed that no one who had professed Islam could be declared an infidel. When the Khārijites revolted against the UMAYYAD DYNASTY, the Murji’ah declared that revolt against a Muslim ruler could not be justified under any circumstances. The Murji’ah were moderates who emphasized the love and goodness of God.

Murmansk Seaport (pop., 1999 est.: 382,700), northwestern Russia. Situated on the eastern shore of Kola Bay near the BARENTS SEA, it is the world’s largest city north of the ARCTIC CIRCLE. Its ice-free harbour makes it Russia’s only port with unrestricted access to the Atlantic. Founded in 1915 as a supply port in World War I, it was a base for the British, French, and U.S. forces against the BOLSHEVIKS in 1918; it also served as a major supply base during World War II. In addition to a Russian naval base, it has a large fishing fleet and fish-processing industry.

Murnau \'mùr-ˌnaù**, F.W.** *orig.* **Friedrich Wilhelm Plumpe** (b. Dec. 28, 1889, Bielefeld, Ger.—d. March 11, 1931, Hollywood, Calif., U.S.) German film director. After studying at the University of Heidelberg, he became a protégé of MAX REINHARDT in Berlin. During World War I he served as a combat pilot and made propaganda films. He directed his first feature in 1919 and won international acclaim for *Nosferatu* (1922), which is regarded by many as the most effective screen adaptation of BRAM STOKER’s *Dracula*, and *The Last Laugh* (1924). In 1927 he moved to Hollywood, where he made films such as *Sunrise* (1927), his masterpiece, and *Tabu* (1931; with ROBERT FLAHERTY). Murnau’s films revolutionized the art of cinematic expression by using the camera subjectively to interpret the emotional state of a character.

Muromachi period In Japanese history, period of military government (BAKUFU, or shogunate) from the 14th to the 16th century. The *bakufu* was established in 1338 by the SAMURAI (warrior) Ashikaga Takauji. Although the *bakufu* lasted in name until 1573, when the last of the Ashikaga SHOGUNS was deposed, the Ashikaga in fact lost control of Japan during the ŌNIN WAR (1467–77). The Muromachi period was, despite considerable turbulence and unrest, a time of great cultural growth, during which ZEN Buddhism, NŌ THEATRE and other literary forms, and *sumi-e* (Chinese-style ink painting) flourished. See also ASHIKAGA FAMILY; DAIMYO; KANŌ SCHOOL.

Murphy, Audie (Leon) (b. June 20, 1924, near Kingston, Texas, U.S.—d. May 28, 1971, near Roanoke, Va.) U.S. war hero and actor. Enlisting in the army in 1942, he became the most decorated U.S. soldier of World War II. He killed hundreds of Germans, and he once jumped onto a burning tank destroyer to turn its machine gun on enemy troops. In 1945 he received the Congressional Medal of Honor. On the strength of his heroic status, he became a movie actor after the war, starring in films such as *The Red Badge of Courage* (1951), *To Hell and Back* (1955), and *The Quiet American* (1958). He died when his private plane crashed. He was buried in Arlington National Cemetery with full military honours.

Murphy, Frank *orig.* **William Francis Murphy** (b. April 13, 1890, Harbor Beach, Mich., U.S.—d. July 19, 1949, Detroit, Mich.) U.S. Supreme Court justice (1940–49). After serving in World War I, he held several elective posts, including mayor of Detroit (1930–33). He was governor-general (1933–35) and U.S. high commissioner (1935–36) of the Philippines. Elected governor of Michigan (1937–38), he refused to use troops to break sit-down strikes by automobile workers. As U.S. attorney general (1939–40), he established the Justice Department’s civil rights unit. Appointed to the SUPREME COURT OF THE UNITED STATES by Pres. FRANKLIN D. ROOSEVELT, he strongly defended civil rights and dissented in a case upholding the internment of Japanese Americans during World War II.

Frank Murphy
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Murphy, Isaac Burns (b. 1861, Fayette county, Ky., U.S.—d. Feb. 12, 1896, Louisville, Ky.) U.S. jockey. He was one of the first jockeys to pace his mount for a charge down the homestretch—a technique soon described as the “grandstand finish.” He was the first three-time winner of the Kentucky Derby (1884, 1890, and 1891), and his career winning percentage of 34.5 has never been equaled. At his peak in the late 1880s, he became the highest-paid athlete in America, earning close to $20,000 a year. He was the first jockey elected to the National Museum of Racing’s Hall of Fame and one of only two African Americans inducted.

Murray, George Redmayne (b. June 20, 1865, Newcastle-upon-Tyne, Northumberland, Eng.—d. Sept. 21, 1939, Mobberley, Cheshire) British physician. After receiving his M.D. from the University of Cambridge, he became a pioneer in the treatment of endocrine disorders. He was one of the first to use extracts of animal thyroid glands to relieve a form of hypothyroidism.

Murray, Sir James (Augustus Henry) (b. Feb. 7, 1837, Denholm, Roxburghshire, Scot.—d. July 26, 1915, Oxford, Oxfordshire, Eng.) Scottish lexicographer. He taught in a grammar school (1855–85). His *Dialect of the Southern Counties of Scotland* (1873) and a major article on English for *Encyclopædia Britannica* (1878) established him as a leading philologist. He was hired by the Philological Society as editor of the vast *New English Dictionary on Historical Principles*, later called the *OXFORD ENGLISH DICTIONARY*, in 1879, and he applied himself to the work with legendary energy and resourcefulness. The first volume appeared in 1884, and by his death he had completed about half the dictionary.

Murray, Philip (b. May 25, 1886, Blantyre, Lanark, Scot.—d. Nov. 9, 1952, San Francisco, Calif., U.S.) Scottish-born U.S. labour leader. After immigrating to the U.S. in 1902, he became a coal miner in Pennsylvania. He joined the UNITED MINE WORKERS OF AMERICA and rose through the ranks to serve as vice president (1920–42) under JOHN L. LEWIS. When Lewis became president of the newly formed Congress of Industrial Organizations (CIO) in 1936, he delegated Murray to create an industry-wide steelworkers’ union (see UNITED STEELWORKERS OF AMERICA). Murray succeeded Lewis as CIO president in 1940 and held the post until his death. See also AFL-CIO.

Murray River Principal river of Australia. Rising near Mount KOSCIUSKO, in southeastern NEW SOUTH WALES, it flows across southeastern Australia from the Snowy Mountains to the GREAT AUSTRALIAN BIGHT of the Indian Ocean; it is 1,610 mi (2,590 km) long. It forms the boundary

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between Victoria and New South Wales and then turns south and flows into Encounter Bay through Lake Alexandrina. River shipping was important in the 19th century, but navigation practically ceased with growing competition from railways and the demand for irrigation water. The river valley is of great economic importance, fostering the production of grains, fruit, and wine, and the raising of cattle and sheep.

murre \'mər\ Any of certain black-and-white seabirds (genus *Uria*, family Alcidae) that are about 16 in. (40 cm) long and breed from the Arctic Circle to Nova Scotia, California, Portugal, and Korea. Murres nest in vast numbers on sheer cliffs. When half grown, the single chick enters the sea with its parents to escape gulls and skuas. In autumn the birds swim south. See also guillemot.

Common murres (*Uria aalge*), ringed phase at left
R.J. TULLOCH—BRUCE COLEMAN INC./EB INC.

Murrow, Edward (Egbert) R(oscoe) (b. April 25, 1908, Greensboro, N.C., U.S.—d. April 27, 1965, Pawling, N.Y.) U.S. radio and television broadcaster. Murrow joined CBS in 1935 and two years later became head of its European Bureau. He became famous for his eyewitness reports of World War II events such as the German occupation of Austria. After the war, with Fred Friendly, he produced *Hear It Now*, an authoritative radio news digest, and for television the comparable *See It Now*. He also produced *Person to Person* and other television programs. In the 1950s he was an influential force for the free dissemination of information, producing a notable exposé of the tactics of Sen. Joseph McCarthy that contributed to the demise of McCarthyism.

Murrumbidgee \ˌmə-rəm-'bi-jē\ **River** River, southeastern New South Wales, Australia. The major right-bank tributary of the Murray River, it flows west from the Great Dividing Range near Canberra to join the Murray 140 mi (225 km) from the Victoria border; it is about 1,050 mi (1,690 km) long. The Murrumbidgee Irrigation Area involves more than 1,000 sq mi (2,600 sq km) of farmland and supports livestock pastures and the cultivation of grapes, citrus fruits, wheat, cotton, and rice.

Mūsā \'mü-sä\ *or* **Mousa** (d. 1332/37?) Emperor (*mansa*) of the West African Mali empire from 1307 (or 1312). Mūsā left a realm notable for its extent and riches (he built the Great Mosque at Timbuktu), but he is best remembered for the splendour of his pilgrimage to Mecca (1324), which awakened the world to Mali's stupendous wealth and stimulated a desire among North Africans and Europeans to locate its source. Under Mūsā, Mali became one of the largest empires in the world and Timbuktu grew to be a major commercial city.

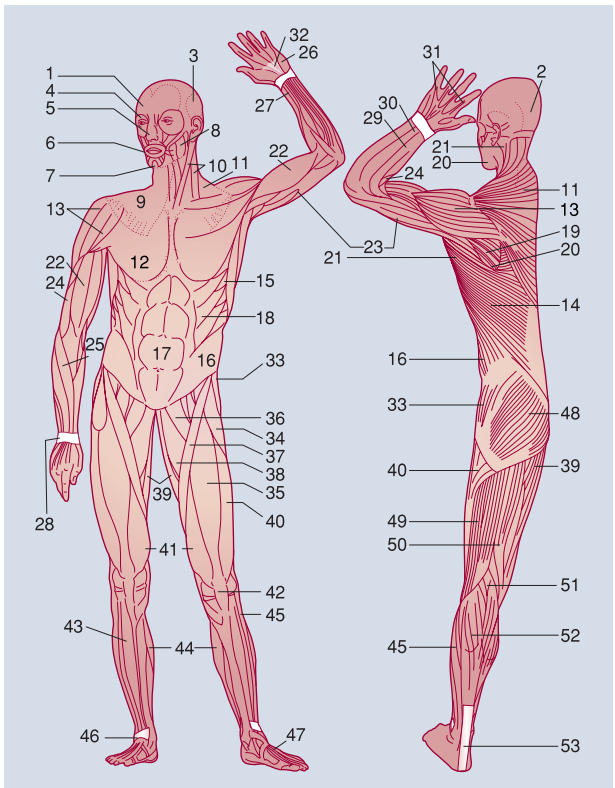
Musandam \mə-'san-dəm\ **Peninsula** Northeastern extension of the Arabian Peninsula. It partially separates the Gulf of Oman from the Persian Gulf to form the Strait of Hormuz to the north. Part of Oman, it is divided from the rest of the country by the United Arab Emirates. It is a mountainous region with a rocky coast that is hazardous to passing ships. Fishing is the main industry, and there are reserves of petroleum and natural gas off the western coast. The port town of Dībā al-Ḥiṣn is on the southeastern coast.

Musavi, Ruhollah See Ruhollah Khomeini

Muscat *or* **Masqat** \'məs-ˌkät\ City (pop., 2003: city, 24,769; urban agglom., 638,000), capital of Oman, located on the Gulf of Oman. Situated on a cove surrounded by volcanic mountains, it came under Persian control in the 6th century BC, and Islam was introduced into the region in the 7th century AD. The Portuguese gained control in 1508 and made Muscat a trading post and naval base until they were expelled in 1650. Held again by the Persians (1650–1741), it later became part of the sultanate of Oman. Two 16th-century Portuguese forts overlook the city; the sultan's Indian-style palace is built at the edge of the sea.

Muscat and Oman See Oman

muscle Contractile tissue that produces motion for functions, including body movements, digestion, focusing, circulation, and body warmth. It can be classified as striated, cardiac, and smooth or as phasic and tonic (responding quickly or gradually to stimulation, respectively). Striated muscle, whose fibres appear striped under a microscope, is responsible for voluntary movement. Most of these muscles are phasic. They are attached to the skeleton and move the body by contracting in response to signals from the central nervous system; contraction is achieved by the sliding of thin filaments (of actin) between thick ones (of myosin); stretch receptors in the tissue provide feedback, allowing smooth motion and fine motor control. The branched fibres of cardiac muscle give it a netlike structure; contraction originates in the heart's muscle tissue itself with a signal from the natural pacemaker; vagus and sympathetic nerves control heart rate. Smooth muscle, the muscle of internal organs and blood vessels, is generally involuntary and tonic; its cells can operate either collectively or individually (in response to separate nerve endings) and have different shapes. Disorders of voluntary muscle cause weakening, atrophy, pain, and twitching. Some systemic diseases (e.g., dermatomyositis, polymyositis) can cause muscle inflammation. See also abdominal muscle; muscle tumour; muscular dystrophy; myasthenia gravis.



Major muscles of the human body. (1) frontalis, (2) occipitalis, (3) temporalis, (4) orbicularis of eye, (5) nasalis, (6) orbicularis of mouth, (7) mentalis, (8) masseter, (9) platysma, (10) sternocleidomastoid, (11) trapezius, (12) pectoralis major, (13) deltoid, (14) latissimus dorsi, (15) anterior serratus, (16) external oblique, (17) rectus abdominis, (18) internal oblique, (19) infraspinatus, (20) teres minor, (21) teres major, (22) biceps, (23) triceps, (24) brachialis, (25) long radial extensor of wrist, (26) short palmaris, (27) pronator quadratus, (28) annular ligament of the carpus, (29) common extensor of digits, (30) ulnar extensor of wrist, (31) tendons of extensors of digits and wrists, (32) palmar aponeurosis, (33) gluteus medius, (34) tensor of the fascia lata, (35) rectus femoris, (36) pectineus, (37) sartorius, (38) long adductor of thigh, (39) gracilis, (40) vastus lateralis, (41) vastus medialis, (42) patella, (43) anterior tibialis, (44) medial head of gastrocnemius, (45) soleus, (46) annular ligament of ankle, (47) short extensor, (48) gluteus maximus, (49) biceps of thigh, (50) semitendinosus, (51) plantaris, (52) lateral head of gastrocnemius, (53) Achilles' tendon.
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Muscle Shoals Former rapids, Tennessee River, northwestern Alabama, U.S. At about 37 mi (60 km) long, it was a navigation hazard but is now submerged under at least 9 ft (3 m) of water by the Wilson, Wheeler, and Pickwick Landing dams, which completely eliminated the rapids. Manufacturing plants and hydroelectric power facilities are administered by the

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TENNESSEE VALLEY AUTHORITY (TVA). The city of Muscle Shoals (pop., 2000: 11,924) developed from the TVA complex in the Wilson Dam area.

muscle tumour Abnormal tissue growth in or originating from MUSCLE tissue. There are three major types. Leiomyomas are tumours of smooth muscles, seen most often in the uterus but also in the digestive, urinary, and female genital systems. Part of the tumour may become malignant, but it usually does not spread or recur. Rhabdomyomas occur most often in cardiac muscle. Some forms spread, and it may remain contained in tissue or become diffuse and hard to remove. Rhabdomyomas involving both smooth and striated muscle are often malignant and may grow very large. The several types of rhabdomyosarcoma are rare; they arise in skeletal muscle, usually in the leg or arm, and are extremely malignant.

muscovite \'məs-kə-ˌvīt\ *or* **common mica** *or* **potash mica** *or* **isinglass** Abundant SILICATE mineral that contains potassium and aluminum and has a layered atomic structure. It is the most common member of the MICA group. Because it occurs in thin, transparent sheets, it was used in Russia for window panes and became known as Muscovy glass (isinglass), hence its name. Muscovite is usually colourless but may be light gray, brown, pale green, or rose red. Its low iron content makes it a good electrical and thermal insulator.

muscular dystrophy \'dis-trə-fē\ Inherited disease that causes progressive weakness in the skeletal (and occasionally heart) muscle. Muscle tissue degenerates and regenerates randomly and is replaced by scar tissue and fat. There is no specific treatment. Physical therapy, braces, and corrective surgery may help. Duchenne muscular dystrophy, the most common, strikes only males. Symptoms, including frequent falls and difficulty in standing up, start in boys 3–7 years old; muscle wasting progresses from the legs to the arms and then the diaphragm. Pulmonary infection or respiratory failure usually causes death before age 20. The gene can now be detected in female carriers and male fetuses. Becker dystrophy, also sex-linked, is less severe and begins later. Patients remain able to walk and usually survive into their 30s and 40s. Myotonic muscular dystrophy affects adults of both sexes, with MYOTONIA and degeneration two to three years later, along with cataracts, baldness, and gonadal atrophy. Limb-girdle dystrophy affects the pelvic or shoulder muscles in both sexes. Facioscapulohumeral (face, shoulder-blade, and upper-arm) dystrophy starts in childhood or adolescence and affects both sexes; after initial symptoms of difficulty raising the arms, the legs and pelvic muscles can be affected; the main facial effect is difficulty in closing the eyes. Life expectancy is normal.

Muse In Greco-Roman religion and myth, any of a group of sister goddesses, daughters of ZEUS and Mnemosyne (Memory). A festival was held in their honour every four years near Mount Helicon, the centre of their cult in Greece. They probably began as the patron goddesses of poets, though later their range was extended to include all the liberal arts and sciences. Nine Muses are usually named: Calliope (heroic or epic poetry), Clio (history), Erato (lyric or love poetry), Euterpe (music or flutes), Melpomene (tragedy), Polyhymnia (sacred poetry or mime), Terpsichore (dancing and choral song), Thalia (comedy), and Urania (astronomy).

museum Public institution dedicated to preserving and interpreting the primary tangible evidence of humans and their environment. Types of museums include general (multidisciplinary) museums, natural-history museums, science and technology museums, history museums, and art museums. In Roman times the word referred to a place devoted to scholarly occupation (see MUSEUM OF ALEXANDRIA). The public museum as it is known today did not develop until the 17th–18th century. The first organized body to receive a private collection, erect a building to house it, and make it publicly available was the University of Oxford; the resulting Ashmolean Museum opened in 1683. The 18th century saw the opening of great museums such as the BRITISH MUSEUM, LOUVRE, and UFFIZI GALLERY. By the early 19th century the granting of public access to formerly private collections had become common. What followed for the next 100 years was the worldwide founding of museums intended for the public. In the 20th century, museums have broadened their roles as educational facilities, sources of leisure activity, and information centres. Many sites of historical or scientific significance have been developed as museums. Museum attendance has increased greatly, often attracted by "blockbuster" exhibitions, though museums have had to become more financially resourceful due to constraints in public funding.

Museum of Modern Art (MOMA) Museum in New York City, the world's most comprehensive collection of U.S. and European art from the late 19th century to the present. It was founded in 1929 by a group of private collectors. The original building on 53rd St. opened in 1939; a later addition and sculpture garden were designed by PHILIP JOHNSON (1953). A condominium tower and western wing, doubling the exhibition space, were completed in 1984. Its collections of Cubist, Surrealist, and Abstract Expressionist paintings are extensive; other holdings include sculpture, graphic arts, industrial design, architecture, photography, and film. Through its permanent collections, exhibitions, and many publications, it exerts a strong influence on public taste and artistic production.

Museveni \mü-'sə-ven-ˌē**, Yoweri (Kaguta)** (b. 1944, Mbarra district, Uganda) President of Uganda (from 1986). As a university student he led a group allied with African liberation movements. When IDI AMIN came to power in 1971, Museveni went into exile. He founded the Front for National Salvation, which helped topple Amin in 1979. He replaced MILTON OBOTE as president in 1986, winning election to the post in 1996. Though he rejected multiparty democracy, he allowed a free press and private enterprise. He is credited with bringing stability and economic growth to Uganda, though his support for rebels in other African countries has been controversial.

Musgrave, Thea (b. May 27, 1928, Barnton, Edinburgh, Scot.) Scottish composer. She studied with NADIA BOULANGER and AARON COPLAND, and she later taught at the University of California at Santa Barbara (1970–78) and elsewhere in the U.S. She has written a number of dramatic concertos, some of which reflect her interest in music's spatial dimension, but she is best known for her operas, including *The Voice of Ariadne* (1973), *Mary, Queen of Scots* (1977), and *Simon Bolívar* (1995).

Mushet \'məsh-ət**, Robert Forester** (b. 1811, Coleford, Gloucestershire, Eng.—d. January 1891, Coleford) British steelmaker. He was the son of the ironmaster David Mushet (1772–1847). Robert's discovery in 1868 that adding tungsten to STEEL greatly increases its hardness even after air cooling produced the first commercial steel ALLOY, a material that formed the basis for the development of tool steels for the machining of metals. Mushet also discovered that the addition of manganese to steel produced by the BESSEMER PROCESS improved the steel's ability to withstand rolling and forging at high temperatures.

mushroom Fleshy spore-bearing structure of certain fungi (see FUNGUS), typically of the class Basidiomycetes. It arises from the MYCELIUM, which may live hundreds of years or a few months, depending on its food supply. Some species grow cellular strands (hyphae) in all directions, forming a circular mat with a "fairy ring" of fruiting bodies around the outside. Popularly, "mushroom" refers to the edible sporophores, while "toadstool" refers to inedible or poisonous sporophores, but there is no scientific distinction between the two names. Mushrooms are classified by cap shape. Umbrella-shaped sporophores with spore-shedding gills on the undersurface are found chiefly in the AGARIC family (Agaricaceae). Mushrooms that bear spores in an easily detachable layer on the underside of the cap belong to the family Boletaceae. Together the agarics and boletes include most of the forms known as mushrooms. The highly prized edible CHANTERELLE is a bolete. The MORELS (class Ascomycetes) are popularly included with the true mushrooms because of their shape and fleshy structure. Since some poisonous mushrooms closely resemble edible ones, mushrooms intended for eating must be accurately identified. Mushroom poisoning can cause nausea, diarrhea, vomiting, cramps, hallucinations, coma, and sometimes death. See illustration opposite.

mushroom poisoning *or* **toadstool poisoning** Sometimes fatal effect of eating any of the 70–80 species of poisonous MUSHROOMS, or toadstools. Many contain toxic ALKALOIDS. The most deadly, *Amanita phalloides* ("death cup"), causes violent abdominal pain, vomiting, and bloody diarrhea. Severe liver, kidney, and central-nervous-system damage lead to coma. Over half the victims die. Treatment with thioctic acid, glucose, and penicillin or by filtering the blood with charcoal may be effective. *A. muscaria* causes vomiting, diarrhea, excessive perspiration, and confusion, with recovery within 24 hours. *Gyromitra esculenta* toxin is usually destroyed by cooking, but in susceptible people it affects the central nervous system and breaks down blood cells, causing jaundice. Some poisonous mushrooms resemble harmless ones, so extreme caution is needed in wild-mushroom gathering.

Musial \'myü-zē-əl**, Stan(ley Frank)** (b. Nov. 21, 1920, Donora, Pa., U.S.) U.S. baseball player. Musial played his entire career for the St. Louis Cardinals (1941–63), starting as a pitcher but switching to the outfield and ultimately to first base. A left-handed batter, "Stan the Man" became

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one of the game's great hitters. His lifetime totals of hits (3,630), runs (1,949), and times at bat were second only to those of Ty Cobb, his total of runs batted in (1,951) was the fourth-highest of all time, and his total of extra-base hits (1,477) was only surpassed later by Hank Aaron. Popular among fans for his unfailing graciousness, he became a Cardinals executive after retirement.

Musial
PICTORIAL PARADE-EB INC.

music Art concerned with combining vocal or instrumental sounds for beauty of form or emotional expression, usually according to cultural standards of rhythm, melody, and, in most Western music, harmony. Music most often implies sounds with distinct pitches that are arranged into melodies and organized into patterns of rhythm and metre. The melody will usually be in a certain key or mode, and in Western music it will often suggest harmony that may be made explicit as accompanying chords or counterpoint. Music is an art that, in one guise or another, permeates every human society. It is used for such varied social purposes as ritual, worship, coordination of movement, communication, and entertainment.

music box Mechanical musical instrument in which projecting pins on a revolving brass cylinder or disk, encoding a piece of music, pluck tuned steel tongues. It was probably invented c. 1780 in Switzerland. With its modular cylinders or disks, it was a popular domestic instrument until displaced by the player piano and phonograph.

German music box, with disk in playing position, from Leipzig, *c.* 1900
COURTESY OF THE MUSICAL WONDER HOUSE, WISCASSET, MAINE; PHOTOGRAPH, JOHN SPINKS

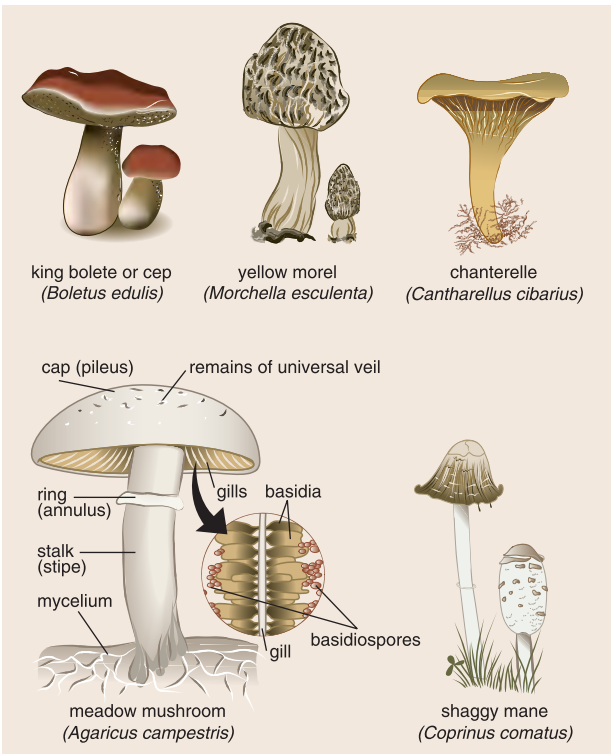
music hall and variety theatre Popular entertainment that featured successive acts by singers, comedians, dancers, and actors. The form derived from the taproom concerts given in city taverns in England in the 18th–19th centuries. To meet the demand for entertainment for the working class, tavern owners often annexed nearby buildings as music halls, where drinking and smoking were permitted. The originator of the English music hall as such was Charles Morton, who built Morton's Canterbury Hall (1852) and Oxford Hall (1861) in London. Leading performers included Lillie Langtry, Harry Lauder (1870–1950), and Gracie Fields. Music halls evolved into larger, more respectable variety theatres, such as London's Hippodrome and the Coliseum. Variety acts combined music, comedy acts, and one-act plays and featured celebrities such as Sarah Bernhardt and Herbert Tree. See also vaudeville.

musica ficta *Latin* **"feigned music"** In medieval and Renaissance music, the practice of inserting unnotated chromatic notes (see chromaticism) during performances. According to treatises of the times, it was left to the performers to "correct" certain intervals. Which intervals were to be changed, and how and under what circumstances, varied over time. This practice was responsible for the introduction of accidentals (sharps, flats, naturals) into musical notation. It also influenced the evolution of the major and minor keys on which most Western music came to be based, for it modified the medieval church modes to resemble the major and minor scales.

musical *or* **musical comedy** Theatrical production that is characteristically sentimental and amusing in nature, having a simple but distinctive plot and offering music, dancing, and dialogue. Its roots can be traced to 18th- and 19th-century genres such as ballad opera, singspiel, and opéra comique. *The Black Crook* (1866), often called the first musical comedy, attracted patrons of opera and serious drama as well as those of burlesque shows. European composers such as Sigmund Romberg brought to the U.S. a form of operetta that was the generic source for musical comedy. George M. Cohan ushered in the genre's heyday, and in the 1920s and '30s it entered its richest period with the works of Jerome Kern, George Gershwin and Ira Gershwin, Cole Porter, Richard Rodgers, and Oscar Hammerstein. Kern and Hammerstein's *Show Boat* (1927) was perhaps the first musical to employ music thoroughly integrated with the narrative. The genre flourished in the 1950s with works by composers such as Leonard Bernstein, but it began to decline in the late 1960s, by which time musicals had begun to diverge in many different directions, incorporating elements such as rock music, operatic styling, extravagant lighting and staging, social comment, nostalgia, and pure spectacle. Later notable musical composers included Stephen Sondheim and Andrew Lloyd Webber.

musical notation Written, printed, or other visual representation of music. There are two basic approaches to notating music. Tablature (such as guitar chord diagrams) depicts the actions a performer is to take (in particular, showing where to put the fingers to produce a given sound). Symbolic notation describes the sounds themselves and includes methods that vary from assigning pitches different letters of the alphabet to representing a given combination of notes by a graphic sign. The Western notation system combines rhythmic notation (the appearance of a note indicates its duration) with pitch notation (the line or space on a staff where a note is placed indicates its pitch). Thus, a single symbol shows both pitch and duration, and a string of these symbols notates both melody and rhythm. See illustration on following page.

musicology Scholarly and scientific study of music. In the late 18th and early 19th centuries, such study was done by amateurs such as Ludwig von Köchel. As interest in earlier music grew, greater professionalism was required, including the ability to decipher and assess musical manuscripts and historical documents. Musicology's first great monument was the first edition of Johann Sebastian Bach's complete works (1851–99). The scope of musicology may be summarized as covering the study of the history and phenomena of music, including (1) form and notation, (2)



A mushroom typically consists of a stalk (stipe) and a cap (pileus). As the mushroom develops from an underground mycelium and pushes upward, it is protected by a thin membrane (universal veil), which eventually ruptures, leaving fragments on the cap. Another membrane, attaching the cap to the stalk, also ruptures, allowing the cap to expand and leaving a remnant ring (annulus) on the stalk. Radiating rows of gills are found on the cap's undersurface; these bear the club-shaped reproductive structures (basidia) which form minute spores known as basidiospores, of which a single mushroom may produce millions.
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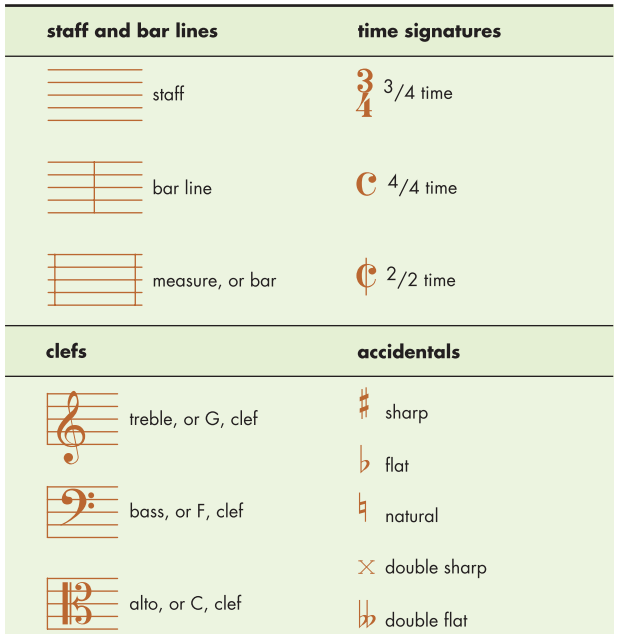

Common symbols used in modern musical notation.
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biography, (3) the development of musical instruments, (4) music theory (harmony, melody, modes, etc.), and (5) aesthetics, acoustics, and physiology of the voice, ear, and hand. In recent decades music theory has again become a separate specialization.

musk ox Arctic RUMINANT (BOVID species *Ovibos moschatus*) with a musky odour, large head, and small ears. The neck, legs, and tail are short. Males stand 5 ft (1.5 m) tall and may weigh almost 900 lb (400 kg). Both sexes have horns. The broad-based horns of males, up to 2 ft (60 cm) long, start at the middle of the head, dip downward along the sides, and then curve upward. The shaggy, dark brown coat reaches nearly to the feet. Eskimos make a fine cashmerelike cloth from the thick wool undercoat, which is shed in summer. Musk oxen travel in herds of 20–30, eating grass, lichen, willow, and other low-growing plants. See photograph above.

muskellunge \'məs-kə-ˌlənj\ Species (*Esox masquinongy*) of somewhat uncommon PIKE valued as a fighting game fish and, to a lesser extent, as a food fish. It inhabits weedy rivers and lakes of the North American Great Lakes region. It averages about 20 lbs (9 kg), but may grow to 6 ft (1.8 m) long and weigh 80 lbs (36 kg) or more, making it the largest fish in the pike family. The lower part of the cheeks and the gill covers are scaleless.

Musk oxen (*Ovibos moschatus*).
LEONARD LEE RUE III

musket Muzzle-loading shoulder firearm developed in 16th-century Spain. Designed as a larger version of the harquebus, muskets were fired with MATCHLOCKS until FLINTLOCKS were developed in the 17th century; flintlocks were replaced by percussion locks in the early 19th century. Early muskets were often handled by two persons and fired from a portable rest. Typically 5.5 ft (1.7 m) long and weighing about 20 lbs (9 kg), they fired a ball about 175 yards (160 m) with little accuracy. Later types were smaller, lighter, and accurate enough to hit a person at 80–100 yards (75–90 m). The musket was replaced in the mid-19th century by the breech-loading RIFLE.

Muskogean \məs-'kō-jē-ən\ **languages** Family of about eight North American Indian languages spoken or formerly spoken across much of what is now the southeastern U.S. In the 16th century Koasati (Coushatta) and Alabama were probably spoken in what is now northern Alabama, Creek (Muskogee) and Hitchiti in Alabama and Georgia, and Apalachee in the Florida Panhandle. To the west were Chickasaw in northern Mississippi and western Tennessee and Choctaw in central Mississippi. By the mid-19th century Apalachee was long extinct, and the forced removals of the 1830s (see TRAIL OF TEARS) had pushed most of the remaining Muskogean-speakers either west of the Mississippi or into Florida, where the SEMINOLE continue to speak a dialect of Creek in central Florida and Mikasuki (Miccosukee) in the Everglades. The extant Muskogean languages continue to be spoken, at least by adults, with Choctaw (in Oklahoma and Mississippi) having the most speakers.

muskrat Either of two semiaquatic, brown RODENT species (family Cricetidae) native to marshes, shallow lakes, and streams of North America and introduced into Europe. The compact, heavy-bodied muskrat, or musquash (*Ondatra zibethica*), is about 12 in. (30 cm) long, not including the long, scaly, flat tail. The partially webbed hind feet have a stiff, bristly fringe. Anal sacs produce a musky secretion. The commercially valuable fur consists of long, stiff, glossy guard hairs overlying a dense, soft underfur. Muskrats live in either a burrow dug into the bank or a reed-and-rush mound built in the water. They eat sedges, reeds, roots, and an occasional aquatic animal. The round-tailed muskrat, or Florida water rat (*Neofiber alleni*), is smaller.

Muskrat (*Ondatra zibethica*).
JOHN H. GERARD

Muslim Brotherhood *Arabic* **Al-Ikhwān al-Muslimūn** Religio-political organization founded in Egypt in 1928 by Ḥasan al-Bannā (1906–49) that promoted the QUR'ĀN and ḤADĪTH as the proper basis for society. It quickly gained many followers throughout North Africa and the Middle East and influenced the development of Muslim groups in other regions. It became politicized after 1938, rejecting Westernization, modernization, and secularization. Suppressed in Egypt after a 1954 assassination attempt

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on Gamal Abdel Nasser, it operated clandestinely in the 1960s and '70s. Beginning in the late 1980s, it experienced an upsurge; though its candidates were often listed under other parties, Brotherhood candidates competed in legislative elections in Egypt and Jordan.

Muslim calendar See Muslim calendar

Muslim League *orig.* **All India Muslim League** Political group that led the movement calling for a separate Muslim country to be created out of the partition of British India (1947). The league was founded in 1906, and in 1913 it adopted self-government for India as its goal. For several decades it supported Hindu-Muslim unity in an independent India, but in 1940, fearing Hindu domination, the league called for a separate state for India's Muslims. After the creation of Pakistan in 1947, the Muslim League (as the All Pakistan Muslim League) became Pakistan's dominant political party, but it gradually declined in popularity and by the 1970s had disappeared altogether. See also Mohammed Ali Jinnah.

mussel Any of numerous bivalve species of either the marine family Mytilidae, found worldwide, or the freshwater superfamily Unionacea, called naiads, found mostly in the U.S. and Southeast Asia. Marine mussels are usually wedge-shaped or pear-shaped and 2–6 in. (5–15 cm) long. They may be smooth or ribbed and often have a hairy covering. The shells of many species are dark blue or greenish brown on the outside and pearly on the inside. Mussels attach themselves to solid objects or to one another, often forming dense clusters. Some burrow into soft mud or wood. They are eaten by birds and starfishes, and some species are raised commercially for food.

Atlantic ribbed mussels (*Modiolus demissus*)
WALTER DAWN

Musset \mǖ-'sā**, (Louis-Charles-) Alfred de** (b. Dec. 11, 1810, Paris, France—d. May 2, 1857, Paris) French poet and playwright. A member of a noble family, Musset came under the influence of Romanticism in adolescence and produced his first work, *Stories of Spain and of Italy*, in 1830. After an early play failed, he published historical tragedies and comedies but refused to let them be performed. He is best remembered for his poetry, including light satirical pieces and poems of dazzling technical virtuosity, as well as passionate, eloquent lyrics such as "La Nuit d'octobre" (1837). A fitful love affair with George Sand inspired some of his finest work.

Mussolini, Benito (Amilcare Andrea) *known as* **Il Duce** \il-'dü-chā\ (b. July 29, 1883, Predappio, Italy—d. April 28, 1945, near Dongo) Italian dictator (1922–43). An unruly but intelligent youth, he became an ardent socialist and served as editor of the party newspaper, *Avanti!* (1912–14). When he reversed his opposition to World War I, he was ousted by the party. He founded the pro-war *Il Popolo d'Italia*, served with the Italian army (1915–17), then returned to his editorship. Advocating government by dictatorship, he formed a political group in 1919 that marked the beginning of fascism. A dynamic and captivating orator at rallies, he organized the March on Rome (1922) to prevent a socialist-led general strike. After the government fell, he was appointed prime minister, the youngest in Italian history. He obtained a law to establish the fascists as the majority party and became known as *Il Duce* ("The Leader"). He restored order to the country and introduced social reforms and public works improvements that won widespread popular support. His dreams of empire led to the invasion of Abyssinia (later Ethiopia) in 1935. Supported in his fascist schemes by Adolf Hitler but wary of German power, Mussolini agreed to the Rome-Berlin Axis and declared war on the Allies in 1940. Italian military defeats in Greece and North Africa led to growing disillusionment with Mussolini. After the Allied invasion of Sicily (1943), the Fascist Grand Council dismissed him from office. He was arrested and imprisoned but rescued by German commandos, then became head of the Hitler-installed puppet government at Salò in northern Italy. As German defenses in Italy collapsed in 1945, Mussolini tried to escape to Austria but was captured and executed by Italian partisans.

Benito Mussolini.
H. ROGER-VIOLLET

Mussorgsky \mù-'sòrg-skē**, Modest (Petrovich)** (b. March 21, 1839, Karevo, Russia—d. March 28, 1881, St. Petersburg) Russian composer. Composing without training in his teens, he met several of the composers with whom he later made up The Five, a group with the common goal of creating a nationalist school of Russian music. He received his first composition lessons from Mily Balakirev in 1857; he soon resigned from his military regiment to devote himself to music. He held a series of government jobs, but his worsening alcoholism eventually made him unemployable. His personal decline was accompanied by maturity as a composer, and he wrote his major works, including the symphonic poem *Night on Bald Mountain* (1867), the great opera *Boris Godunov* (1868), and the famous piano cycle *Pictures at an Exhibition* (1874). His 65 songs describe vivid scenes of Russian life and realistically reproduce the inflections of the spoken Russian language. After Mussorgsky's death, his works were published in drastically edited form, purged of their distinctive starkness and unorthodox harmonies; the original versions were made available in 1928.

Mustafa Kemal See Mustafa Kemal Atatürk

Mustang See P-51

mustard family Family Brassicaceae (or Cruciferae), composed of 350 genera of mostly herbaceous plants with peppery-flavored leaves. The pungent seeds of some species lead the spice trade in volume traded. Mustard flowers take the form of a Greek cross, with four petals, usually white, yellow, or lavender, and an equal number of sepals. The seeds are produced in podlike fruits. Members of the mustard family include many plants of economic importance that have been extensively altered and domesticated by humans. The most important genus is *Brassica* (see brassica); turnips, radishes, rutabagas, and many ornamental plants are also members of the family. As a spice, mustard is sold in seed, powder, or paste form.

Mut \'müt\ In Egyptian religion, a sky goddess and divine mother. Mut may have originated either in the Nile River delta or in Middle Egypt. During the 18th dynasty (1539–1292 BC), she became the companion of the god Amon at Thebes. Amon, Mut, and the young god Khons (said to be her son) formed the Theban triad. The name Mut means "mother," and her role was that of an older woman among the gods. She was usually represented as a woman wearing a double crown; she was also sometimes depicted with the head of a lioness.

mutagen \'myü-tə-jən\ Any agent capable of altering a cell's genetic makeup by changing the structure of the hereditary material, DNA. Many forms of electromagnetic radiation (e.g., cosmic rays, X rays, ultraviolet light) are mutagenic, as are various chemical compounds. The effects of some mutagens are increased or suppressed in some organisms by the presence of certain other, nonmutagenic substances; oxygen, for example, makes cells more sensitive to the mutagenic effects of X rays.

Mutanabbī \ˌmù-tȧ-'nȧb-bē**, (Abū al-Ṭayyib Aḥmad ibn Ḥusayn) al-** (b. 915, Al-Kūfah, Iraq—d. Sept. 23, 965, near Dayr al-ʿĀqūl) Poet regarded by many as the greatest in the Arabic language. Al-Mutanabbī received an education, unusual for his time and rank, because of his poetic talent. He lived among the Bedouin and, claiming to be a prophet, led an unsuccessful Muslim revolt in Syria. After two years' imprisonment he recanted and became a wandering poet, eventually leaving Syria for Egypt and Iran. He primarily wrote panegyrics in a flowery, bombastic style marked by improbable metaphors. His poetic voice is proud and arrogant in tone, and his verse is crafted with consummate skill and artistry. His powerful influence on Arabic poetry persisted into modern times.

mutation Alteration in the genetic material of a cell that is transmitted to the cell's offspring. Mutations may be spontaneous or induced by outside factors (mutagens). They take place in the genes, occurring when one base is substituted for another in the sequence of bases that determines the genetic code, or when one or more bases are inserted or deleted from a gene. Many mutations are harmless, often masked by the presence of a dominant normal gene (see dominance). Some have serious consequences; for example, a particular mutation inherited from both parents results in sickle-cell anemia. Only mutations that occur in the sex cells (eggs or

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sperm) can be transmitted to the individual's offspring. Alterations caused by these mutations are usually harmful. In the rare instances in which a mutation produces a beneficial change, the percentage of organisms with this gene will tend to increase until the mutated gene becomes the norm in the population. In this way, beneficial mutations serve as the raw material of EVOLUTION.

Mu'tazilah \mü-'tä-zi-lə\ In ISLAM, one of two early religious groups. The term applies primarily to members of a theological school that flourished in Al-BAṢRAH and BAGHDAD in the 8th–10th century. These Mu'tazilah were the first Muslims to employ systematically the categories and methods of Hellenistic philosophy to derive their dogma. The tenets of their faith included belief in the oneness of God (*tawḥīd*), advocation of human free will (the ability to choose between good and evil), and the fundamental belief in God's fairness (i.e., God will punish only those deserving of punishment). Their doctrine of a created QUR'ĀN (the eternal nature of which was advocated by their opponents) held sway in the caliphal court briefly in the early 9th century and was the first instance in the Muslim world in which political authorities attempted to enforce any form of doctrinal rigour; the Mu'tazilah theological program soon lost political sway, however, and had faded by the 13th century. Though it was ultimately abandoned by SUNNITE Muslims (the group's methods came to be accepted by some SHĪ'ITE groups), its true importance lay in the fact that it forced other theological groups to embrace a more rigorous dialectical method (see KALĀM).

mutiny Any concerted resistance to lawful military authority. Mutiny was formerly regarded as a most serious offense, especially aboard ships at sea. Wide disciplinary powers were given the commanding officer, including the power to inflict CAPITAL PUNISHMENT without a COURT-MARTIAL. With the development of radio communications, the threat diminished and harsh punishment was prohibited in the absence of a court-martial.

Mutsuhito See MEIJI EMPEROR

mutual fund *or* **unit trust** *or* **open-end trust** Company that invests the funds of its subscribers in diversified SECURITIES and issues units representing shares in those holdings. It differs from an INVESTMENT TRUST, which issues shares in the company itself. While investment trusts have a fixed capitalization and a limited number of shares for sale, mutual funds make a continuous offering of new shares at net asset value (plus a sales charge) and redeem their shares on demand at net asset value, determined daily by the market value of the securities they hold.

Muwaḥḥidūn, al- North African dynasty: see ALMOHAD DYNASTY; Arabian religious group: see WAHHĀBĪ

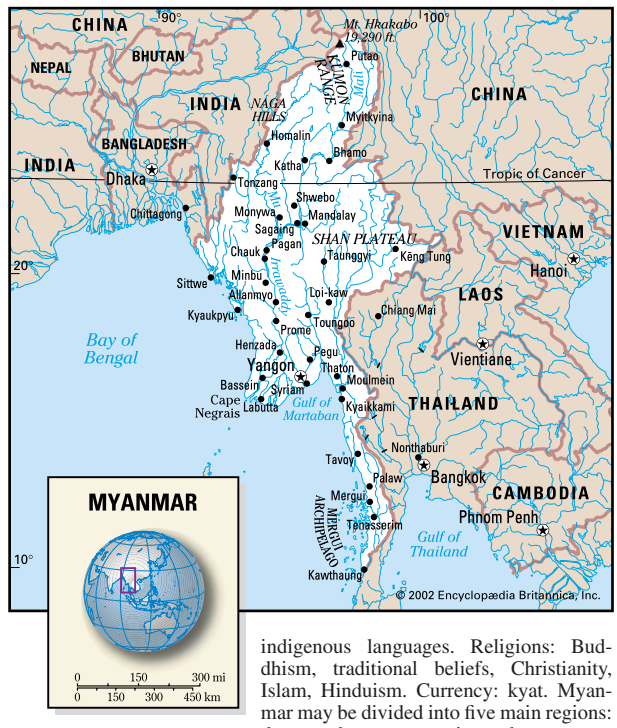
Muybridge \'mī-ˌbrij**, Eadweard** *orig.* **Edward James Muggeridge** (b. April 9, 1830, Kingston upon Thames, Surrey, Eng.—d. May 8, 1904, Kingston upon Thames) English photographer. He immigrated to the U.S. from England as a young man, and in 1868 his photos of Yosemite Valley made him famous. Hired by LELAND STANFORD to photograph a trotting horse in motion, to test Stanford's contention that it lifted all four legs simultaneously, he developed a special fast shutter for his battery of 12 to 24 cameras, and in 1877 he proved Stanford right. He lectured widely on animal locomotion, illustrating his lectures with his zoopraxiscope, a predecessor of the movie projector. His extensive photographic studies of human movement (1884–87) have been useful to artists and scientists.

Mwene Matapa \'mwā-nā-mȧ-'tȧ-pə\ Title borne by a line of kings ruling a South African territory between the Zambezi and Limpopo rivers, in what is now Zimbabwe and Mozambique, from the 14th to the 17th century. Their domain, often called Matapa (or Mutapa), is associated with the historical site of GREAT ZIMBABWE in southeastern Zimbabwe.

Mweru, Lake \'mwā-rü\ *French* **Lac Moero** \ˌlȧk-mwā-'rō\ Lake, central Africa. It is located on the boundary between southeastern Democratic Republic of the Congo (Zaire) and Zambia, west of the southern tip of Lake TANGANYIKA. Part of the CONGO RIVER system, it is 76 mi (122 km) long and has a surface area of 1,900 sq mi (4,920 sq km). The Luapula River, a headstream of the Congo River, flows through it. The Bangweulu Swamps adjoin the lake.

My Lai \'mē-'lī\ **Massacre** (March 16, 1968) Mass killing of as many as 500 unarmed villagers by U.S. soldiers in the hamlet of My Lai during the VIETNAM WAR. A company of U.S. soldiers on a search-and-destroy mission against the hamlet found no armed Viet Cong there but nonetheless killed all the elderly men, women, and children they could find; few villagers survived. The incident was initially covered up by high-ranking army officers, but it was later made public by former soldiers. In the ensuing courts-martial, platoon leader Lt. William Calley was accused of directing the killings and was convicted of premeditated murder and sentenced to life in prison; but Pres. RICHARD NIXON intervened on his behalf, and he was paroled after three years. The massacre and other atrocities revealed during the trial divided the U.S. public and contributed to growing disillusionment with the war.

Myanmar \'myän-ˌmär\ *or* **Burma** *officially* **Union of Myanmar** Country, Southeast Asia, on the Bay of BENGAL and the ANDAMAN SEA. Area: 261,228 sq mi (676,577 sq km). Population (2005 est.): 46,997,000. Capitals: YANGÔN (Rangoon)/Pyinmana. Inhabitants are chiefly Burman; others include Chin, Shan, and Karen. Languages: Burmese (official), many



indigenous languages. Religions: Buddhism, traditional beliefs, Christianity, Islam, Hinduism. Currency: kyat. Myanmar may be divided into five main regions: the northern mountains, the western ranges, the coastal plains, the central lowlands, and the Shan Plateau in the east. Major rivers are the IRRAWADDY and the SALWEEN. The tropical climate is greatly influenced by the monsoons of southern Asia. Only about one-sixth of this largely mountainous land is arable. It has a centrally planned, developing economy that is largely nationalized and based on agriculture and trade. Rice is the most important crop and principal export; teak is also important. Myanmar is ruled by a military regime; its head of state and government is the chairman of the State Peace and Development Council, assisted by the prime minister. The area was long inhabited, with the Mon and Pyu states dominant from the 1st century BC to the 9th century AD. It was united in the 11th century under a Burmese dynasty that was overthrown by the Mongols in the 13th century. The Portuguese, Dutch, and English traded there in the 16th–17th century. The modern Myanmar (Burmese) state was founded in the 18th century by ALAUNGPAYA. Conflict with the British over ASSAM resulted in a series of wars, and Myanmar fell to the British in 1885. Under British control, it became Burma, a province of India. It was occupied by Japan in World War II and became independent in 1948. The military took power in a coup in 1962 and nationalized major economic sectors. Civilian unrest in the 1980s led to antigovernment rioting that was suppressed by force. In 1990 opposition parties won in national elections, but the army continued in control. Trying to negotiate for a freer government amid the unrest, AUNG SAN SUU KYI was awarded the Nobel Peace Prize in 1991.

myasthenia gravis \ˌmī-əs-'thē-nē-ə-'gra-vəs\ Chronic AUTOIMMUNE DISEASE causing MUSCLE weakness. Autoantibodies block the response of muscle cells to ACETYLCHOLINE. Muscles weaken with repeated use but regain

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their strength after rest. The pattern varies, but usually muscles used in eye movements, facial expressions, chewing, swallowing, and respiration are affected first, then neck, trunk, and limb muscles. Severe cases impede breathing. Anticholinesterase drugs stimulate nerve-impulse transmission, and corticosteroids may help. Removal of the THYMUS has improved severe cases. Remission lasting several years may occur.

mycelium \mī-'sē-lē-əm\ Mass of branched, tubular filaments (hyphae) of fungi (see FUNGUS) that penetrate soil, wood, and other organic matter. The mycelium makes up the THALLUS (undifferentiated body) of a typical fungus. The mass may be microscopic in size or developed into visible structures, such as brackets, MUSHROOMS, PUFFBALLS, or TRUFFLES. The mycelium produces SPORES, directly or through special fruiting bodies.

Mycenae \mī-'sē-nē\ Prehistoric city, northeastern PELOPONNESE, Greece. A natural rock citadel, it was the legendary capital of AGAMEMNON. It flourished during the BRONZE AGE, building the distinctive MYCENAEAN civilization. It was at its height in the Aegean c. 1400 BC and declined c. 1100 BC with the invasion of the DORIANS from the north. Excavations at Mycenae began in 1840, but the most celebrated discoveries there were those by HEINRICH SCHLIEMANN c. 1876. Ruins include the Lion Gate, acropolis, granary, and several royal BEEHIVE TOMBS and shaft graves.

Mycenaean \ˌmī-sə-'nē-ən\ Any member of a group of warlike Indo-European peoples who entered Greece from the north starting c. 1900 BC and established a BRONZE AGE culture on the mainland and nearby islands. Their culture was dependent on that of the MINOANS of Crete, who for a time politically dominated them. They threw off Minoan control c. 1400 and were dominant in the Aegean until they themselves were overwhelmed by the next wave of invaders c. 1150. MYCENAE continued to exist as a city-state into the period of Greek dominance, but by the 2nd century AD it was in ruins. Mycenaean myths and legends lived on through oral transmission into later stages of Greek civilization and form the basis of Homeric epic and Greek tragedy. Their language is believed to be the most ancient form of Greek.

mycobacterium \ˌmī-kō-bak-'tir-ē-əm\ Any of the rod-shaped BACTERIA that make up the genus *Mycobacterium*. The two most important species cause TUBERCULOSIS and LEPROSY in humans; another species causes tuberculosis in both cattle and humans. Some mycobacteria live on decaying organic matter; others are parasites. Most are found in soil and water in a free-living form or in diseased tissue of animals. Various antibiotics have had some success against mycobacterium infections.

mycology \mī-'kä-lə-jē\ Study of fungi (see FUNGUS), including MUSHROOMS and YEASTS. Many fungi are useful in medicine and industry. Mycological research has led to the development of such antibiotic drugs as PENICILLIN, STREPTOMYCIN, and TETRACYCLINE. Mycology also has important applications in the dairy, wine, and baking industries and in the production of dyes and inks. Medical mycology is the study of fungus organisms that cause disease in humans.

mycoplasma \ˌmī-kō-'plaz-mə\ Any of the BACTERIA that make up the genus *Mycoplasma*. They are among the smallest of bacterial organisms. The cell varies from a spherical or pear shape to that of a slender branched filament. *Mycoplasma* species are gram-negative (see GRAM STAIN) and do not require oxygen. They are colonial microorganisms that lack cell walls. They are parasites of joints and the mucous membranes lining the respiratory, genital, or digestive tracts of cud-chewing animals, carnivores, rodents, and humans. Toxic by-products excreted by the bacteria accumulate in the host's tissues, causing damage. One species causes a widespread but rarely fatal pneumonia in humans.

mycorrhiza \ˌmī-kə-'rī-zə\ Product of close association between the branched, tubular filaments (hyphae) of a FUNGUS and the ROOTS of higher plants. The association usually enhances the nutrition of both the host plant and the fungal symbiont. The establishment and growth of certain plants (e.g., citrus plants, orchids, pines) depends on mycorrhizae; other plants survive but do not flourish without their fungal symbionts.

mycoses See FUNGAL DISEASES

mycotoxin TOXIN produced by a FUNGUS. Numerous and varied, mycotoxins can cause hallucinations, skin inflammation, liver damage, hemorrhages, miscarriage, convulsions, neurological disturbances, and/or death in livestock and humans. The best-known mycotoxins are AFLATOXIN, ERGOT toxin, and the agents of MUSHROOM POISONING.

Myerson, Goldie See GOLDA MEIR

mynah *or* **myna** \'mī-nə\ Any of several Asian songbird species of the STARLING family (Sturnidae). The hill mynah (*Gracula religiosa*) of southern Asia, called the grackle in India, is about 10 in. (25 cm) long and glossy black with white wing patches, yellow wattles, and orange bill and legs. In the wild, it chuckles and shrieks; caged, it learns to imitate human speech far better than its chief rival, the gray PARROT. The common, or Indian, mynah (*Acridotheres tristis*) was introduced into Australia, New Zealand, and Hawaii. The crested mynah (*A. cristatellus*), native to China and Indonesia, was introduced into British Columbia, Canada, but has not spread.

myositis \ˌmī-ə-'sī-təs\ INFLAMMATION of MUSCLE tissue, often from bacterial, viral, or parasitic INFECTION but sometimes of unknown origin. Most types destroy muscle and surrounding tissue. Bacteria may directly infect muscle (usually after injury) or produce substances toxic to it. Some chronic diseases (e.g., TUBERCULOSIS, third-stage SYPHILIS) can involve the muscles. Parasites (e.g., TAPEWORMS, PROTOZOANS) in contaminated food enter the bloodstream from the intestines and lodge in muscle.

myotonia \ˌmī-ə-'tō-nē-ə\ Disorder causing difficulty relaxing contracted voluntary MUSCLES. All or only a few may be affected. Myotonia seems to originate in the muscles (myopathy) rather than the NERVOUS SYSTEM. Certain TOXINS can cause it. A hereditary form, myotonia congenita (Thomsen disease), can affect eyelid and eye motion, swallowing, or talking. Quick movements cause muscle stiffening. There is also a myotonic form of MUSCULAR DYSTROPHY. ANALGESICS, ANESTHETICS, and anticonvulsant drugs can alleviate the symptoms.

Myra \'mī-rə\ Ancient city, LYCIA, southern coast of ANATOLIA. Its location was near the modern city of Kale in southwestern TURKEY. Ancient ruins dating from the 5th to 3rd centuries BC include an acropolis, a magnificent theatre, and several rock-cut tombs that resemble wooden houses and shrines. St. PAUL is known to have visited Myra in the 1st century AD, and St. NICHOLAS was bishop of the city in the 4th century. It was the capital of Byzantine Lycia until it fell to the ʿAbbāsids in 808.

Myrdal \'mūr-ˌdäl,\ *English* \'mir-ˌdäl**, (Karl) Gunnar** (b. Dec. 6, 1898, Gustafs, Dalarna, Swed.—d. May 17, 1987, Stockholm) Swedish economist and sociologist. He received his Ph.D. from Stockholm University and taught there from 1933 until 1967. His early work emphasized pure theory, but he later focused on applied economics and social problems. He explored the social and economic problems of African Americans in the U.S. (1938–40) and in 1944 published the classic study *An American Dilemma*, in which he presented his theory that poverty breeds poverty. In regard to development economics, he argued that rich and poor countries, rather than converging economically, might well diverge, the poor countries becoming poorer as the rich countries enjoyed economies of scale and the poor ones were forced to rely on primary products. In 1974 he shared the Nobel Prize with Friedrich von HAYEK. His wife, Alva Myrdal (1902–86), was a sociologist, diplomat, UN administrator, and antiwar activist; she shared the 1982 Nobel Peace Prize with Alfonso García Robles.

Myron \'mī-rən\ (b. c. 480 BC, Greece—d. 440 BC) Greek sculptor. An older contemporary of PHIDIAS and POLYCLITUS, he was considered by the ancients one of the most versatile and innovative of all Attic sculptors. He was the first Greek sculptor to combine a mastery of movement with a gift for harmonious composition. Working almost exclusively in bronze, he is best known for his studies of athletes in action, particularly the *Discus Thrower*, c. 450 BC.

Discus Thrower, Roman marble copy of Greek bronze by Myron, c. 450 BC; in the National Roman Museum, Rome.
ALINARI—ART RESOURCE

myrtle Any of the evergreen shrubs in the genus *Myrtus* (family Myrtaceae). Authorities differ widely over the number of species included; most occur in South America, while some are found in Australia and New Zealand. Common myrtle (*M. communis*) is native to the Mediterranean and the Middle East and is cultivated in southern England and the warmer portions of North America. Other plants known as myrtle include the MOUNTAIN LAUREL and PERIWINKLE. The

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family Myrtaceae, commonly called the myrtle family, includes the plants that produce the spices ALLSPICE and CLOVES, and the genus *Eucalyptus*. See also CRAPE MYRTLE.

Mysore \mī-'sōr\ City (pop., 2001 prelim.: 742,261), southern KARNATAKA state, southern India. Situated midway between the KAVERI and Kabbani rivers, the site was inhabited before the 3rd century BC. The city was the capital of the princely state of Mysore (1799–1831), then it was occupied by the British. The state's second largest city, it is an important industrial centre producing textiles, chemicals, and foodstuffs. Sites of interest include the 17th-century British residency, the maharaja's palace, and the University of Mysore (founded 1916). Nearby Chamundi Hill has a monolith representing Nandi, the sacred bull of the Hindu deity SHIVA.

Mysore See KARNATAKA

mystery play Vernacular drama of the Middle Ages. It developed from the LITURGICAL DRAMA and usually represented a biblical subject. In the 13th century, craft guilds began producing mystery plays at sites removed from the church, adding apocryphal and satirical elements to the dramas. In England groups of 25–50 plays were later organized into lengthy cycles, such as the Chester plays and the Wakefield plays. In England the plays were often performed on moveable pageant wagons, while in France and Italy they were acted on stages with scenery representing heaven, earth, and hell. Technical flourishes such as flying angels and fire-spouting devils kept the spectators' attention. The genre of the mystery play declined by 1600. See also MIRACLE PLAY; MORALITY PLAY.

mystery religion Any of various secret cults of the Greco-Roman world. Derived from primitive tribal ceremonies, mystery religions reached their peak of popularity in Greece in the first three centuries AD. Their members met secretly to share meals and take part in dances and ceremonies, especially initiation rites. The cult of DEMETER produced the most famous of the mystery religions, the ELEUSINIAN MYSTERIES, as well as the ANDANIA MYSTERIES. DIONYSUS was worshiped in festivals that included wine, choral singing, sexual activity, and mime. The Orphic cult, by contrast, based on sacred writings attributed to ORPHEUS, required chastity and abstinence from meat and wine. Mystery cults also attached to ATTIS, ISIS, and JUPITER DOLICHENUS, among others.

mystery story Work of fiction in which the evidence related to a crime or to a mysterious event is so presented that the reader has an opportunity to consider solutions to the problem, the author's solution being the final phase of the piece. The mystery story is an age-old popular genre and is related to several other forms. Elements of mystery may be present in narratives of horror or terror, pseudoscientific fantasies, crime stories, accounts of diplomatic intrigue, affairs of codes and ciphers and secret societies, or any situation involving an enigma. See also DETECTIVE STORY; GOTHIC NOVEL.

mysticism Spiritual quest for union with the divine. Forms of mysticism are found in all major religions. HINDUISM, with its goal of absorption of the soul in the All, is inherently predisposed to mystical experience. BUDDHISM emphasizes MEDITATION as a means of moving toward NIRVANA. In ISLAM, SUFISM employs metaphors of intoxication and of the love between bride and bridegroom to express the desire for union with the divine. In JUDAISM, the foundations of mysticism were laid in the visions of the biblical prophets and were later developed in the KABBALA and in HASIDISM. Mysticism has appeared intermittently in CHRISTIANITY, notably in the writings of St. AUGUSTINE and St. TERESA OF ÀVILA, and in the works of Meister ECKHART and his 14th-century successors.

myth Traditional story of ostensibly historical events that serves to unfold part of the worldview of a people or explain a practice, belief, or natural phenomenon. Myths relate the events, conditions, and deeds of gods or superhuman beings that are outside ordinary human life and yet basic to it. These events are set in a time altogether different from historical time, often at the beginning of creation or at an early stage of prehistory. A culture's myths are usually closely related to its religious beliefs and rituals. The modern study of myth arose with early 19th-century ROMANTICISM. Wilhelm Mannhardt, JAMES GEORGE FRAZER, and others later employed a more comparative approach. SIGMUND FREUD viewed myth as an expression of repressed ideas, a view later expanded by CARL GUSTAV JUNG in his theory of the "collective unconscious" and the mythical ARCHETYPES that arise out of it. BRONISŁAW MALINOWSKI emphasized how myth fulfills common social functions, providing a model or "charter" for human behaviour. CLAUDE LÉVI-STRAUSS discerned underlying structures in the formal relations and patterns of myths throughout the world. MIRCEA ELIADE and RUDOLF OTTO held that myth is to be understood solely as a religious phenomenon. Features of myth are shared by other kinds of literature. Origin tales explain the source or causes of various aspects of nature or human society and life. FAIRY TALES deal with extraordinary beings and events but lack the authority of myth. SAGAS and EPICS claim authority and truth but reflect specific historical settings.

myxedema \ˌmik-sə-'dē-mə\ Physiological reaction to low levels of thyroid hormone in adults, either due to THYROID-GLAND removal, lack of function, or atrophy, or secondary to a PITUITARY-GLAND disorder. Gradual changes include enlarged tongue, thick, puffy skin, drowsiness, cardiac enlargement, and slow metabolism. Low thyroid hormone affects levels of other hormones, and may result in low blood sodium and disorders of the reproductive system (including reduced fertility), adrenal glands, and circulatory system. Treatment is with thyroid hormone.

Myxomycetes See SLIME MOLD

myxovirus \ˌmik-sō-'vī-rəs\ Any of a group of VIRUSES that are agents of INFLUENZA and can cause the common COLD, MUMPS, and MEASLES in humans, canine DISTEMPER, rinderpest in cattle, and Newcastle disease in fowl. The virus particle is encased in a fatty membrane, variable in shape from spheroidal to threadlike, and studded with spikelike protein projections; it contains RNA. These viruses react with a protein on the surface of red blood cells; many of them cause red blood cells to clump together.

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NAACP *in full* **National Association for the Advancement of Colored People** Oldest and largest U.S. civil rights organization. It was founded in 1909 to secure political, educational, social, and economic equality for African Americans; W.E.B. Du Bois and Ida B. Wells were among its 60 founders. Headquartered in Baltimore, Md., the NAACP has undertaken litigation, political activity, and public education programs. In 1939 it organized the independent Legal Defense and Education Fund as its legal arm, which sued for school desegregation in *Brown v. Board of Education* (1954). During World War II it pressed for desegregation of the armed forces, which was achieved in 1948. In 1967 its general counsel, Thurgood Marshall, became the U.S. Supreme Court's first African American justice.

Naber, John (b. Jan. 20, 1956, Evanston, Ill., U.S.) U.S. swimmer. He swam for the University of Southern California, winning 15 championships. At the 1976 Olympics he won four gold medals and a silver; his world-record times in the 100-m and 200-m backstroke stood for seven years.

Nabis \'nä-bēz\ (from Hebrew *navi*, "prophet" or "seer") Group of French artists who paved the way for the development of abstract art in the early 20th century. The Nabis preached that a work of art is the visual expression of an artist's synthesis of nature and his or her personal aesthetic. They were influenced by Paul Gauguin and the Pont-Aven school, as well as by Japanese woodcuts, Symbolist painting, and the Pre-Raphaelites. Paul Sérusier (1865–1927), the group's founder, painted the first Nabi work, *Landscape at the Bois d'Amour at Pont-Aven* (also called *Talisman*; 1888). Original members included Pierre Bonnard and Édouard Vuillard; a later member was Aristide Maillol.

Nabisco *in full* **National Biscuit Company** Former U.S. snack food and bakery product company. It was formed in 1989 when the American Biscuit Company merged with the New York Biscuit Company and went on to introduce a number of popular consumer brands such as Oreo cookies (1912) and Ritz crackers (1934). After being acquired by R.J. Reynolds in 1985 and becoming part of RJR Nabisco, Nabisco was sold to Philip Morris Cos. (renamed Altria Group, Inc.), which was the parent company of Kraft Foods, Inc.

Nabokov \nə-'bō-kəf, 'na-bə-ˌkȯf**, Vladimir (Vladimirovich)** (b. April 22, 1899, St. Petersburg, Russia—d. July 2, 1977, Montreux, Switz.) Russian-born U.S novelist and critic. Born to an aristocratic family, he had an English-speaking governess. He published two collections of verse before leaving Russia in 1919 for Cambridge University, but by 1925 he had turned to prose as his main genre. During 1919–40 he lived in England, Germany, and France. His life before he moved to the U.S. in 1940 is recalled in his superb autobiography, *Speak, Memory* (1951). Beginning with *King, Queen, Knave* (1928), his writing began to feature intricate stylistic devices. His novels are principally concerned with the problem of art itself, presented in various disguises, as in *Invitation to a Beheading* (1938). Parody is frequent in *The Gift* (1937–38) and later works. His novels written in English include the notorious and greatly admired best-seller *Lolita* (1955), which brought him wealth and international fame; *Pale Fire* (1962); and *Ada* (1969). His critical works include a monumental translation of and commentary on Aleksandr Pushkin's *Eugene Onegin*, 4 vol. (1964).

Nabokov, 1968
© PHILIPPE HALSMAN

Nabu \'nä-ˌbü\ Major god in the Assyrian-Babylonian pantheon, the son of Marduk. He was patron of the art of writing and a god of vegetation. As the recorder of the fates assigned to humans by the gods, Nabu's symbols were the clay tablet and the stylus. His holy city was Borsippa. Goddesses associated with Nabu were Nana, a Sumerian deity; the Assyrian Nissaba; and the Akkadian Tashmetum.

Nabuco \nä-'bü-kō\ **(de Araújo), Joaquim (Aurelio Barretto)** (b. Aug. 19, 1849, Recife, Braz.—d. Jan. 17, 1910, Washington, D.C., U.S.) Leader of Brazil's abolitionist movement. Both in the national Chamber of Deputies (from 1878) and in the Brazilian Anti-Slavery Society, which he founded, Nabuco worked tirelessly to end slavery in Brazil. Emancipation was proclaimed in 1888, and in the ensuing economic disruption the emperor Pedro II was overthrown (1889) and a republic established. A monarchist, Nabuco retired from public life until 1900, when he accepted the republic and entered its service. As ambassador to the U.S. he distinguished himself as an advocate of Pan-Americanism.

Nadar \nȧ-'dȧr\ *orig.* **Gaspard-Félix Tournachon** (b. April 5, 1820, Paris, France—d. March 21, 1910, Paris) French photographer, caricaturist, and writer. When his father's bankruptcy forced him to leave medical school in 1838, he settled in Paris and began selling caricatures to humour magazines. By 1853 he had become an expert photographer and had opened a portrait studio. His studies of prominent Parisians such as Charles Baudelaire (1855) and Eugène Delacroix (1855) were exceptional in their naturalness, in contrast to the stiff formality of most portraits of the time. His studio became a favourite meeting place of the Paris intelligentsia and was the site of the first Impressionist exhibit. A tireless innovator, in 1855 he patented the idea of using aerial photographs in mapmaking and surveying, and in 1858 he himself made the first successful aerial photograph, from a balloon. He also wrote novels, essays, satires, and autobiographical works.

Nader, Ralph (b. Feb. 27, 1934, Winsted, Conn., U.S.) U.S. lawyer and consumer advocate. The son of Lebanese immigrants, he attended Princeton University and Harvard Law School. In 1963 he left his private law practice in Hartford, Conn., to hitchhike to Washington, D.C., where he began public interest work. His concern about unsafe car designs resulted in the best-selling book *Unsafe at Any Speed* (1965), which led directly to the passage of national auto-safety standards. Since then he and his associates, known as "Nader's Raiders," have performed numerous studies on consumer health, safety, and financial issues and have lobbied for greater government regulation of business and industry in a variety of areas. He was instrumental in the passage of the Freedom of Information Act (1966) and in establishing the Occupational Safety and Health Administration (OSHA), the Consumer Product Safety Commission, and the Environmental Protection Agency. He also founded the consumer organization Public Citizen and the U.S. Public Interest Research Group, an umbrella organization for other public interest research groups. As the Green Party candidate in the 2000 U.S. presidential election, he won 3% of the national vote. His work has had major and lasting effects on many aspects of American life.

Nādir Shāh, painting by an unknown artist, *c.* 1740; in the Victoria and Albert Museum, London
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

Nādir Shāh \nä-'dēr-'shä\ (b. Oct. 22, 1688, Kobhan, Ṣafavid Iran—d. June 1747, near Fatḥābād) Iranian conqueror and ruler. Originally a bandit of the Turkish Afshar tribes, he helped restore Ṭahmāsp II of the Ṣafavid dynasty to Iran's throne, defeating the Ghilzay Afghan usurper Maḥmūd. He later deposed Ṭahmāsp II to place the latter's infant son on the throne; he made himself regent, then deposed the son and took the throne himself in 1736. He engaged in constant warfare with his neighbours, enlarging his empire from the Indus River to the Cauca-

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sus Mountains. Suspicious of those around him and capriciously cruel, he was assassinated by his own troops.

NAFTA *in full* **North American Free Trade Agreement** Trade pact signed by Canada, the U.S., and Mexico in 1992, which took effect in 1994. Inspired by the success of the European Community in reducing trade barriers among its members, NAFTA created the world's largest free-trade area. It basically extended to Mexico the provisions of a 1988 Canada-U.S. free-trade agreement, calling for elimination of all trade barriers over a 15-year period, granting U.S. and Canadian companies access to certain Mexican markets, and incorporating agreements on labour and the environment. See also General Agreement on Tariffs and Trade; World Trade Organization.

Nag Hammadi \ˈnäg-ˌhäm-ˈma-dē\ Town in Upper Egypt on the Nile. In 1945 a collection of 13 codices containing 53 Gnostic texts (scriptures and commentaries) was found nearby at the site of an ancient settlement on the river's eastern bank. Written in the Coptic language, the texts were composed in the 2nd or 3rd century and copied in the 4th century. They include accounts of the life of Jesus and his sayings after his resurrection, predictions of the apocalypse, and theological treatises. As the only surviving documents written by Gnostics themselves, they constitute a major source of knowledge about Gnosticism.

naga \ˈnä-gə\ In Hindu and Buddhist mythology, a semidivine being, half human and half serpent. *Naga*s can assume either wholly human or wholly serpentine form. They live in an underground kingdom filled with beautiful palaces that are adorned with gems. Brahma is said to have relegated the *naga*s to the nether regions and to have commanded them to bite only the truly evil or those destined to die prematurely. *Naga*s are also associated with waters—rivers, lakes, seas, and wells—and are regarded as guardians of treasure. In Buddhism it is believed that the snake king sheltered the Buddha from rain for seven days while he was meditating.

Naga Hills Hill region, northeastern India and northwestern Myanmar (Burma). A northern extension of the Arakan Mountains system, the hills reach a height of 12,552 ft (3,826 m) at Mount Saramati on the frontier. The densely forested hills receive heavy monsoon rains. The area is inhabited by tribes of Naga peoples living in small villages.

Nagaland State (pop., 2001 prelim.: 1,988,636), northeastern India. It borders Myanmar (Burma) and the states of Manipur, Assam, and Arunachal Pradesh and has an area of 6,401 sq mi (16,579 sq km). Its capital is Kohima. Except for a small area of plain, the entire state is covered with ranges of hills that are northward extensions of the Arakan Mountains system. Myanmar ruled the region from 1819 to 1826, when the British began annexing its hill areas. The Naga people accepted statehood within an independent India in 1963. There are more than 20 major Naga tribes and subtribes, with different dialects and customs. About two-thirds are Christian, and most others are Hindu or Muslim. Agriculture is the mainstay of the economy. Crops include rice, millet, sugarcane, potatoes, and tobacco.

Nagarjuna \nä-ˈgär-jù-nə\ (b. 150—d. c. 250) Indian monk and philosopher, founder of the Madhyamika school of Buddhism. Born into a Brahman family, he underwent a spiritual conversion when he studied the doctrines of Mahayana Buddhism. His *Fundamental Wisdom of the Middle Way* and *The Dialectical Method* are critical analyses of false views about how existence arises, the means of knowledge, and the nature of reality. He established the concept of sunyata—emptiness, or the lack of an absolute reality behind the changing forms of existence—as a fundamental tenet of the Madhyamika school.

Nagasaki City (pop., 2003 est.: 418,523), western Kyushu, Japan. It is a seaport and commercial city at the mouth of the Urakami River, where it empties into Nagasaki Harbour. It was the only Japanese port open to foreign trade in 1639–1859. After the Portuguese and English traders were expelled in 1639, only the Dutch, Chinese, and Koreans were allowed into the harbour. In the 19th century it was the winter port of the Russian Asiatic fleet (until 1903). It became a major shipbuilding centre in the early 20th century. In 1945 the second atomic bomb attack was carried out there by the U.S. during World War II; some 40,000 were killed immediately, up to 40,000 more died soon after, and many more were injured. The bomb also destroyed about 40% of the city's buildings. Nagasaki has been rebuilt and is a spiritual centre for movements to ban nuclear weapons.

Nagorno-Karabakh Region (pop., 2002 est.: 144,300), southwestern Azerbaijan. It occupies an area of about 1,700 sq mi (4,400 sq km) on the northeastern flank of the Karabakh Range. The region was formerly part of Iran but was annexed by Russia in 1813. In 1923 it was established as an autonomous province of the Azerbaijan S.S.R. In 1988 the region's Armenian majority demonstrated against Azerbaijanian rule, and in 1991 (after the breakup of the Soviet Union) war broke out between the two ethnic groups. Since 1994 it has been controlled by ethnic Armenians, though officially it remains part of Azerbaijan.

Nagoya City (pop., 2000 prelim.: 2,171,378), southern Honshu, Japan. Located east of Kyōto, at the head of Ise Bay, it is one of Japan's leading industrial cities. Manufactures include textiles, watches, bicycles, sewing machines, machine tools, chemicals, and ceramics. The city dates from 1610, when a great castle was erected by the Owari branch of the Tokugawa shogunate; the castle was destroyed during World War II and rebuilt in 1959. The city's educational and cultural institutions include Nagoya University and the Tokugawa Art Museum. The Atsuta Shrine and the Ise Shrine located there are the oldest and most highly esteemed Shintō shrines in Japan.

Nagpur \ˈnäg-ˌpůr\ City (pop., 2001 prelim.: 2,051,320), northeastern Maharashtra state, India. It is situated along the Nag River, almost at the geographic centre of India. Founded in the 18th century by a Gond prince, it became the capital of members of the Maratha confederacy. In the 19th century it was under British control. The city's products include textiles, iron goods, pharmaceuticals, transport equipment, cotton, and oranges. It is dominated by the centrally located former British fort. It is an educational and cultural centre.

nagual \nä-ˈgwäl\ *or* **nahual** \nä-ˈwäl\ In some Mesoamerican religions, a personal guardian spirit that resides in an animal. The person who wishes to find his nagual goes to sleep in an isolated spot, and the animal that appears in a dream or that confronts him when he awakens will thereafter be his guardian spirit. Many modern Mesoamerican Indians believe that the first creature to cross over the ashes spread before a newborn baby becomes the child's nagual. In some areas, nagual refers to the animal into which men with magical powers can transform themselves to do evil.

Nagy \ˈnädʸ**, Imre** (b. June 7, 1896, Kaposvár, Hung., Austria-Hungary—d. June 16, 1958, Budapest, Hung.) Hungarian politician. He fought in World War I, was captured by the Russians, and joined the Red Army. He lived in Moscow (1929–44), then returned to Hungary under the Soviet occupation and held several ministerial posts. An advocate for peasants' rights, he became premier (1953–55) but was ousted for his independent ideas. During the Hungarian Revolution (1956), he again served as premier and sought to establish Hungary's independence from Soviet domination. He made an unsuccessful appeal to the West for help against the invading Soviet troops, and he was arrested, tried, and executed.

Nagy, László Moholy- See László Moholy-Nagy

Nahanni \nä-ˈhä-nē\ **National Park** National park, southwestern Northwest Territories, Canada. Established in 1972, it occupies an area of 1,177,700 acres (476,968 hectares). Its central feature is the South Nahanni River, a tributary of the Liard River; it flows southeast from the Mackenzie Mountains and is 350 mi (563 km) long. The park also contains three large canyons and a variety of birds, wildlife, and flowers.

Nahḍah \ˈnä-hə-də**, Ḥizb al-** *Arabic* **"Renaissance Party"** Tunisian political party founded in 1981 by Rachid al-Ghannouchi and Abdelfattah Mourou (ʿAbd al-Fattāḥ Mūrū) as the Islamic Tendency Movement. Its platform called for a fairer distribution of economic resources, the establishment of multiparty democracy, and the injection of more religiosity in daily life; it claims to seek these goals through nonviolent means. After 1984 the party was reorganized to operate clandestinely as well as publicly; it took its current name in 1988. Though the government of Zine el-Abidine Ben Ali has treated party members less harshly than did that of Habib Bourguiba, it remains illegal.

Nahua \ˈnä-wə\ Indian population of Mexico and Central America, of whom the Aztec are the best known. Modern-day Nahua are agricultural, practicing shifting cultivation and working both common and private land. They are skilled weavers, using fibres of the maguey plant, wool, and cotton. Nahua parents and godparents have strong ties in a fictive kin relationship. Though they profess Roman Catholicism, the Nahua believe in witchcraft and recognize a variety of supernatural beings. See also Nahuatl language.

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nahual See NAGUAL

Nahuatl \'nä-ˌwä-tᵊl\ **language** UTO-AZTECAN LANGUAGE of Mexico, which continues to be spoken by more than a million modern Mexicans in various markedly divergent dialects. Nahuatl was the language of perhaps the majority of the inhabitants of pre-Conquest central Mexico, including Tenochtitlán (now MEXICO CITY), the capital of the AZTEC empire. Soon after the Conquest in the 1520s, Nahuatl began to be written in a Spanish-based orthography, and an abundance of documents survive from the colonial period, including annals, municipal records, poetry, formal addresses, and *The History of the Things of New Spain*, a remarkable compendium of Nahua culture compiled by Indian informants under the direction of the Franciscan friar Bernardino de Sahagún (1499–1590).

Nahuel Huapí \nä-'wel-wä-'pē**, Lake** Lake, in the eastern foothills of the ANDES MOUNTAINS, southwestern Argentina, near the Chilean border. The largest lake in Argentina's lake district, it has an area of about 215 sq mi (560 sq km) and a depth of nearly 1,500 ft (460 m). It is dotted with islands, including Victoria Island, the site of a forestry research station. The lake region was designated the NAHUEL HUAPÍ NATIONAL PARK in 1934.

Nahuel Huapí National Park National park, southwestern Argentina. Originating as a reserve in 1903 with a large donation of private land, it became Argentina's first national park in 1934. The park and adjacent nature reserve now cover about 2,740 sq mi (7,100 sq km) and include dense forests, rivers, glaciers, and snow-clad peaks, including El Tronador ("The Thunderer"), Mount Catedral, and Lake NAHUEL HUAPÍ.

Nahum \'nā-(h)əm\ (fl. late 7th century BC) One of the 12 Minor Prophets in the Bible, traditional author of the book of Nahum. (His prophecy is part of a larger book, The Twelve, in the Jewish canon.) The prophet Nahum is identified only as a resident of Elkosh. His subject is the collapse of the Assyrian empire and the fall of its capital, NINEVEH (612 BC), which he views as a demonstration of God's desire to punish the wickedness of the Assyrians, Israel's longtime enemies.

Nahyān \ˌnä-hə-'yan\ **dynasty** *or* **Āl Nahyān ("Nahyān family")** Ruling family of the emirate of ABU DHABI, a constituent part of the UNITED ARAB EMIRATES (UAE). The family were originally BEDOUIN of the Banū Yās confederation of Arabia from around the oases of Liwā'. The first emir arrived in the late 1770s and established a commercial port on the island. The current emir, Sheikh Zāyid ibn Sulṭan Āl Nahyān, is also president of the UAE.

nail In construction and carpentry, a slender metal shaft, pointed at one end and flattened at the other end, used as a FASTENER. Most often used to join pieces of wood, nails are also used with plastic, drywall, masonry, and concrete. They are usually made of steel but can also be made of stainless steel, iron, copper, aluminum, or bronze. The pointed end is called the point, the shaft is called the shank, and the flattened part is called the head.

nail Structure made of KERATIN that grows on the back of the end of each finger and toe. Nails consist of a root, under the skin; a translucent plate, attached to a nail bed beneath; and a free edge. Nail plate (and probably bed) cells are produced at the root and pushed forward as new cells form behind them. They die and turn white as they reach the free edge and lose contact with the richly vascularized nail bed, which supplies them with nutrients. Fingernails grow continuously at about 0.5 mm per week; toenails grow more slowly. They protect the tips of fingers and toes and help the fingers pry, pick up small objects, and scratch.

Nain brothers, Le See LE NAIN BROTHERS

Naipaul \'nī-ˌpȯl**, Sir V(idiadhar) S(urajprasad)** (b. Aug. 17, 1932, Trinidad) Trinidadian novelist. Descended from Hindu Indians who immigrated to Trinidad as indentured servants, Naipaul left Trinidad in 1950 to attend Oxford University and settled in England. He won critical recognition with *A House for Mr. Biswas* (1961), about an immigrant's attempt to assert his identity and independence. Other novels that explore, in an often harshly critical tone, the disintegration and alienation typical of postcolonial nations include *In a Free State* (1971, Booker Prize), *Guerrillas* (1975), and *A Bend in the River* (1979). He also wrote *The Enigma of Arrival* (1987), *Half a Life* (2001), and nonfictional studies of India. Naipaul was awarded the Nobel Prize for Literature in 2001.

Nairobi \nī-'rō-bē\ City (pop., 1999: 2,143,254), capital of Kenya. It is located in south-central Kenya at an elevation of about 5,500 ft (1,680 m). Founded c. 1899 as a colonial railroad site, it became the capital of BRITISH EAST AFRICA in 1905. As a government and trade centre, it attracted many settlers from rural Kenya, making it one of the largest cities in Africa. When Kenya gained independence in 1963, it remained the capital, with its area greatly expanded by the new constitution. It is Kenya's principal commercial and industrial city, producing beverages, processed food, cigarettes, and furniture. The city exports many products via the port of MOMBASA. Noted institutions and landmarks include the University of Nairobi and the National Museum of Kenya. Tourism is an important industry, with NAIROBI NATIONAL PARK attracting many visitors.

Nairobi National Park National park, Kenya. Located about 5 mi (8 km) south of NAIROBI, it was established in 1946. It has an area of 45 sq mi (117 sq km). It is noted for wildlife, including lions, gazelles, black rhinoceroses, giraffes, antelopes, zebras, numerous reptiles, and hundreds of bird species.

Naismith \'nā-ˌsmith, 'nāz-məth**, James A.** (b. Nov. 6, 1861, Almonte, Ont., Can.—d. Nov. 28, 1939, Lawrence, Kan., U.S.) Canadian-born U.S. physical education instructor, inventor of BASKETBALL. He studied theology but excelled in sports. At the YMCA Training School in Springfield, Mass. (1890–95), he was asked to devise a new indoor winter sport. His version of basketball called for nine players (later reduced to five) per team and the use of peach baskets (later netted hoops) as goals. He was coach of the basketball team at the University of Kansas (1898–1937). He is also credited with inventing the protective helmet for gridiron football players. The Naismith Memorial Basketball Hall of Fame was incorporated in Springfield in 1959.

James A. Naismith holding a ball and a peach basket, the first basketball equipment.
UPI

Naivasha \nī-'vä-shä**, Lake** Lake, southwest-central Kenya. It is located in the GREAT RIFT VALLEY, at 6,180 ft (1,884 m) above sea level. The lake's area fluctuates, ranging between about 44 and 383 sq mi (114 and 991 sq km). It has no known outlet. It serves as a weekend resort for residents of NAIROBI, to the southeast.

naive art *also called* **outsider art** Work of artists in sophisticated societies who lack or reject formal training. Naive artists, not to be confused with hobbyists, create with the same passion as trained artists but without formal knowledge of methods. Naive works are often extremely detailed, with a tendency toward the use of brilliant, saturated colours and a characteristic absence of perspective, which creates the illusion of figures floating in space. Well-known naive artists include HENRI ROUSSEAU and GRANDMA MOSES.

Najd See NEJD

Nakae Tōju \'nä-kä-ˌe-'tō-jù\ *orig.* **Gen** *or* **Mokken** (b. April 21, 1608, Ōmi province, Japan—d. Oct. 11, 1648, Ōmi province) Japanese Neo-Confucian scholar. A feudal retainer, he left his post in 1634 and returned to his native village to carry out his obligations to his widowed mother. There he taught and studied the works of ZHU Xi, but eventually he abandoned Zhu's philosophy for the idealist thought of WANG Yangming. Like Wang, he believed truth was to be discovered through intuition and reflection rather than empirical investigation and that the universe's unifying principle exists in the human mind, not in the external world. He believed that a concept could be fully understood only when acted upon; this emphasis on action made him popular with 19th- and 20th-century Japanese nationalists.

Nakhon Ratchasima \ˌnä-ˌkȯn-ˌrä-chə-'sē-mä\ City (pop., 1999 est.: 181,400), northeastern Thailand. It is the area's transportation, commercial, financial, and governmental centre. It grew rapidly during the 1960s and '70s with the buildup of its Royal Thai Air Force Base, from which U.S. warplanes operated during the VIETNAM WAR. Nearby are restored 11th-century KHMER temples, a major tourist attraction.

Nakhon Si Thammarat \ˌnä-ˌkȯn-ˌsē-ˌtä-mə-'rät\ Town (pop., 1999 est.: 105,176), southern Thailand, on the eastern coast of the MALAY PENINSULA. The walled town, one of Thailand's oldest, was founded more than 1,000 years ago. It was the capital of a powerful state that controlled the midsection of the peninsula and was often called Ligor until the early 20th

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century. It is the area's commercial centre and site of the Wat Mahathudu temple complex. The town is noted for its NIELLO work in silver.

Nalanda \nä-'lən-də\ Buddhist monastic centre, often spoken of as a university, in northern Bihar state, India. Though it is traditionally dated to the time of the BUDDHA (6th–5th centuries BC), archaeological excavations date its foundations to the 5th century AD. It housed a population of several thousand teachers and students. Topics studied included logic, grammar, astronomy, and medicine. The Chinese pilgrims XUANZANG and Yijing provided vivid accounts of Nalanda in the late 7th century. Nalanda continued to flourish through the 12th century and became a centre of religious sculpture. It was probably sacked during Muslim raids c. 1200 and never recovered.

Nalchik \'näl^{y}-chik\ City (pop., 1999 est.: 234,700), southwestern Russia. It lies along the Nalchik River where the river leaves the Caucasian foothills. Founded as a Russian fortress in 1818, it gained importance after the RUSSIAN REVOLUTION OF 1917. It is a popular holiday, climbing, and health resort, and it has a university and research institute. It contains considerable industry, including engineering and hydrometallurgy.

Namath \'nā-məth**, Joe** *in full* **Joseph William Namath** (b. May 31, 1943, Beaver Falls, Pa., U.S.) U.S. football quarterback. He developed his quarterback skills at the University of Alabama. An exceptional passer, in his third season with the New York Jets (1965–77) he threw for a record 4,007 yards. Though long hampered by knee injuries, by the time of his retirement he had set seasonal and career records for most games with 300 yards or more gained in passing. The nickname "Broadway Joe" reflected his fondness for New York nightlife.

Namatjira, Albert (b. July 28, 1902, Hermannsburg, near Alice Springs, N.Terr., Austl.—d. Aug. 8, 1959, Alice Springs) Australian Aboriginal painter. A member of the Aranda tribe, Namatjira learned European watercolour painting techniques at a Lutheran mission school. In 1936 he sold his first painting, and, in 1938, he sold all 41 watercolours on display in his first major solo exhibition in Melbourne. He exhibited his work—generally depictions of the desertlike landscape of central Australia—frequently in the next two decades and became well known in Australia and overseas. One of his paintings was presented to Queen Elizabeth II in 1954.

Nambudiri \nəm-'bü-drē\ Dominant CASTE of the Indian state of Kerala. Rigidly orthodox, its members regard themselves as the representatives of the ancient VEDIC RELIGION and of the traditional Hindu code. They place great emphasis on their priestly status and do not normally engage in business. The chief landowners of Kerala, they derive their wealth from their landholdings.

name One or more words designating an individual entity. The names of certain specific people, places, and things, called proper nouns, are capitalized. Types of names include personal names (Sheila, Raul), placenames (London, Nairobi), titles of works of art (*Mona Lisa*, *Paradise Lost*), brand names (Sanka, Vaseline), names of historical events or eras (War of the Roses, Renaissance), and political, artistic, or philosophical movements (Progressivism, Cubism). Personal names may pass from one culture to another, often changing form—Jochanan (Hebrew), Johann (German), John (English), Ian (Scottish), etc. Family names (surnames) are of more recent origin; the conventions that govern them have existed only since the 11th century. Many hereditary family names came from given names—for example, Alfred, the son of John, might be called Alfred Johnson. Others came from place-names or occupations—Henri from the town of Avignon might become Henri d'Avignon, and Robert, a blacksmith, might become Robert Smith.

Namib Desert \'nä-mib\ Desert region, extending 1,200 mi (1,900 km) from Namibe, Angola, along the entire coast of Namibia to the Olifants River in South Africa. It is an almost rainless area, 50–80 mi (80–130 km) wide over most of its length, traversed by rail lines linking WALVIS BAY with the Republic of South Africa. It is basically a smooth platform of bedrock of various types and ages. In the southern half the platform is covered with sand. The eastern part, the Inner Namib, supports large numbers of antelope. The shore area has a dense population of marine birds, including flamingos, pelicans, and penguins.

Namibia \nə-'mi-bē-ə\ *officially* **Republic of Namibia** Country, southwest coast of Africa. Area: 318,580 sq mi (825,118 sq km). Population (2005 est.): 2,030,000. Capital: WINDHOEK. About one-third of the people are Ovambo. Others include Nama, Kavango, Herero, and San.

Languages: English (official), various Bantu languages (notably Ovambo), Afrikaans, San. Religions: Christianity (Protestant, Roman Catholic, other Christians); also traditional beliefs. Currency: Namibian dollar. Namibia may be divided into three broad regions: the NAMIB DESERT, the Central Plateau, and the KALAHARI DESERT. The economy is based largely on agriculture and on the production and export of diamonds. Namibia is a republic with two legislative houses; its head of state and government is the president. Long inhabited by indigenous peoples, it was explored by the Portuguese in the late 15th century. In 1884 it was annexed by Germany as German South West Africa. It was captured in World War I by South Africa (and subsequently called South West Africa until 1968), which received it as a mandate from the LEAGUE OF NATIONS in 1919 and refused to give it up after World War II. A UN resolution in 1966 ending the mandate was challenged by South Africa in the 1970s and '80s. Through long negotiations involving many factions and interests, Namibia achieved independence in 1990. The country has been severely affected by the AIDS epidemic; a large proportion of the population has become infected with HIV.

Namri Songtsen See GNAM-RI STRONG-BTSAN

Nan-ching See NANJING

Nanak \'nä-nək\ (b. April 15, 1469, Rai Bhoi di Talvandi, near Lahore, India—d. 1539, Kartarpur, Punjab) Indian founder of SIKHISM. Born into a Hindu merchant CASTE, he worked as a storekeeper until a spiritual experience incited him to leave his job and family and begin a 20-year phase of travel. He eventually settled in Kartarpur, a village in Punjab, to which he attracted many disciples, and he became the first GURU of the Sikhs. His doctrine stressed the unity and uniqueness of God and offered salvation through disciplined meditation on the divine name. It stipulated that meditation must be inward and rejected all external aids such as idols, temples, mosques, scriptures, and set prayers. After his death the stories told of his life were collected in anthologies called the *Janam-sakhi*s.

Nanchang *or* **Nan-ch'ang** City (pop., 2003 est.: 1,419,813), capital of JIANGXI province, southeastern China. An old walled city on the right bank of the GAN RIVER, it was founded in 201 BC. In AD 959 it became the capital of the Southern Tang dynasty. At the end of the MONGOL period it was a battleground between the founder of the MING DYNASTY and local warlords. In the early 16th century a rebellion was launched against the Ming regime. Nanchang suffered from the TAIPING REBELLION. In 1927 it was the site of revolutionary activities of the Chinese Communist Party. Since 1949 it has become industrialized; its products include textiles, milled rice, and automotive parts.

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Nanda dynasty Family that ruled Magadha, in northern India (c. 343–c. 321 BC). Legends regarding the low-class origins and ruthless conquests of its founder, Mahapadma, are supported by classical scholarship. The brief period of Nanda rule, along with the succeeding and more lengthy tenure of the MAURYAN EMPIRE, represent the political aspect of a great transitional epoch in which settled agriculture and the growing use of iron resulted in production surpluses and the growth of cities. There are references to the wealth of the Nandas, their sizable military, and administrative initiatives such as irrigation projects.

Nanga Parbat \'nəŋ-gə-'pər-bət\ Peak, western HIMALAYAS. It is located in the Pakistani-administered portion of the KASHMIR region. In 1895 the British climber Albert F. Mummery led the first expedition to the 26,660-ft (8,126-m) summit, but he died in the attempt. Severe weather and frequent avalanches caused the deaths of at least 30 other climbers before the Austrian Hermann Buhl reached the top in 1953.

Nangnang *or* **Lelang** *or* **Lo-lang** Colony of China in northern Korea, established during the HAN DYNASTY (206 BC–AD 220). It was located near modern-day P'yŏngyang, and from there the Chinese incorporated southern Korea and parts of Japan into their sphere of influence. The Chinese maintained a commandery there for 400 years. Its presence introduced the local people to wet-rice cultivation and iron and high-fired ceramic technology.

Nanjing \'nän-'jiŋ\ *or* **Nan-ching** *conventional* **Nanking** \'nan-'kiŋ\ City (pop., 2003 est.: 2,966,000), capital of JIANGSU province, east-central China. Located on the southeastern bank of the YANGTZE RIVER (Chang Jiang) northwest of SHANGHAI, the site has been inhabited for thousands of years. The present city was founded in 1368 by the MING DYNASTY, which had its capital there (1368–1421). It was taken by the British in the OPIUM WARS of 1842 and was largely destroyed in 1864 after having served (since 1853) as the capital of the TAIPING REVOLUTIONARIES. Nanjing was opened as a treaty port in 1899 and was the NATIONALIST capital from 1928 to 1937; it was then taken by the Japanese, and it was the site of the NANJING MASSACRE in the Sino-Japanese War of 1937–45. It was occupied by communist forces in 1949 and became the provincial capital in 1952. Nanjing is a port city and a major industrial and communications centre with a number of universities and colleges. Nearby monuments include mausoleums of SUN YAT-SEN and a Ming emperor.

Nanjing, Treaty of (Aug. 29, 1842) Treaty that ended the first OPIUM WAR, the first of the unequal treaties between China and foreign imperialist powers. China paid the British an indemnity, ceded the territory of HONG KONG, and agreed to establish a "fair and reasonable" tariff. British merchants, who had previously been allowed to trade only at GUANGZHOU (Canton), were now permitted to trade at five "treaty ports" and with whomever they pleased (see CANTON SYSTEM). The treaty was supplemented in 1843 by the British Supplementary Treaty of the Bogue, which allowed British citizens to be tried in British courts and granted Britain any rights in China that China might grant to other countries. See also British EAST INDIA COMPANY; LIN ZEXU.

Nanjing Massacre *or* **Rape of Nanjing** (December 1937–January 1938) Mass killing and rape of Chinese people in Nanjing by Japanese soldiers after the Japanese had captured the city on Dec. 13, 1937. The Japanese commander ordered the destruction of Nanjing, which had been the Nationalist Chinese capital. Estimates of the number killed range from 100,000 to more than 300,000, and tens of thousands of rapes were committed. Japanese wartime brutality in China contributed to cool relations between the two countries into the 21st century. See also WAR CRIME; WORLD WAR II.

Nanna See SIN

Nanni di Banco \'nän-nē-dē-'bäŋ-kō\ (b. 1384/90?, Florence, Republic of Florence—d. 1421, Florence) Florentine sculptor. Trained by his father, a sculptor who worked on the cathedral of Florence, Nanni received his first important commission from that cathedral, a life-size marble statue of the prophet Isaiah. The classically influenced *Four Crowned Saints* (c. 1411–13) for Or San Michele is considered his masterpiece. He is thought to have been the teacher of the DELLA ROBBIA FAMILY. His work exemplifies the stylistic transition from GOTHIC to RENAISSANCE in early 15th-century Italy.

Nanning \'nän-'niŋ\ *or* **Nan-ning** *formerly (1913–45)* **Yung-ning** \'yùŋ-'niŋ\ City (pop., 2003 est.: 1,031,672), capital of GUANGXI province, southern China. Located on the banks of the Yung River, it was the site of a county seat first established in AD 318. A frontier prefecture under the SONG DYNASTY, it was later ruled successively by the MING and QING dynasties and was opened to foreign trade in 1907. It was occupied by the Japanese during the Sino-Japanese War (1937–45), although it was briefly a U.S. air base. It was a supply base for communist forces during the anti-French war in Indochina (see INDOCHINA WARS) and the VIETNAM WAR. Formerly known mainly as a commercial and administrative centre, it now also has diversified manufacturing.

nanotechnology Manipulation of atoms, molecules, and materials to form structures on the scale of nanometres (billionths of a metre). These nanostructures typically exhibit new properties or behaviours due to QUANTUM MECHANICS. In 1959 RICHARD FEYNMAN first pointed out some potential quantum benefits of miniaturization. A major advancement was the invention of molecular-beam epitaxy by Alfred Cho and John Arthur at Bell Laboratories in 1968 and its development in the 1970s, which enabled the controlled deposition of single atomic layers. Scientists have made some progress at building devices, including computer components, at nanoscales. Faster progress has occurred in the incorporation of nanomaterials in other products, such as stain-resistant coatings for clothes and invisible sunscreens.

Nansen \'nän-sən**, Fridtjof** (b. Oct. 10, 1861, Store-Frøen, near Kristiania, Nor.—d. May 13, 1930, Lysaker, near Oslo) Norwegian explorer and statesman. In 1888 he led the first expedition to cross the ice fields of Greenland. On a later expedition, in 1895, in an attempt to reach the North Pole, he reached the farthest northern latitude then attained. He engaged in scientific research (1896–1917) and led oceanographic expeditions in the North Atlantic in 1900 and 1910–14. He undertook diplomatic missions as Norway's first minister to Britain (1906–08) and as head of Norway's delegation to the new League of Nations (1920). He directed the repatriation from Russia of over 400,000 prisoners of war for the League and organized famine relief in Russia for the Red Cross. In 1922 he was awarded the Nobel Prize for Peace; he used the prize money for international relief work. In 1931 the Nansen International Office for Refugees was established in Geneva.

Nantahala \ˌnan-tə-'hā-lə\ **River** River, western North Carolina, U.S. It flows 40 mi (64 km) north through the Nantahala National Forest into the Little Tennessee River and is noted for whitewater rafting and its scenery. The Nantahala Gorge is the subject of many CHEROKEE legends.

Nantes \'nänt\ *Breton* **Naoned** \'nà-ned\ *ancient* **Condivincum** City (pop., 1999: 270,251), northwestern France. Located on the LOIRE RIVER, west of TOURS, it derives its name from the Namnètes, a Gallic tribe settled there before the Romans conquered GAUL. The HUNS, the NORMANS, and dukes of BRITTANY claimed it before it passed to France in 1499. It rallied to King HENRY IV of France after he signed the Edict of NANTES in 1598. During the FRENCH REVOLUTION its populace suffered many executions. Occupied by German troops in World War II, it was heavily damaged by Allied bombing; it was taken by U.S. troops in 1944. Rebuilt into a major economic centre, it has important industrial plants and shipbuilding yards. It also boasts a castle, a cathedral, a university, and an art museum.

Nantes, Edict of (April 13, 1598) Law promulgated by HENRY IV of France to grant religious liberty and full civil rights to the Protestant HUGUENOTS. It stipulated that Protestant pastors were to be paid by the state, and public worship was permitted in most of the kingdom, though not in Paris. It also restored Catholicism in all areas where Catholic practice had been interrupted by the Wars of RELIGION. The edict was resented by the Catholic clergy; Cardinal de RICHELIEU annulled its political clauses in 1629, and the full edict was revoked by LOUIS XIV in 1685.

Nantucket Island (pop., 2000: 9,520), Atlantic Ocean, south of CAPE COD, Mass., U.S. It is separated from MARTHA'S VINEYARD by the Muskeget Channel. Of glacial origin, it has sandy beaches, a good harbour, and a moderate climate. Purchased from the PLYMOUTH colony in 1641, it became part of New York and was settled in 1659, then ceded to Massachusetts in 1692. In the 1690s Quakers began arriving on the island. It was a whaling centre in the 18th century. The summer tourist trade is now its economic mainstay.

naos See CELLA

napalm \'nā-ˌpäm\ Organic compound, the aluminum SOAP or SALT of a mixture of FATTY ACIDS, used to thicken GASOLINE for use as an incendiary in FLAMETHROWERS and firebombs. The thickened mixture, itself also called napalm, burns more slowly and can be propelled more accurately and over

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greater distances than gasoline. When it comes in contact with surfaces, including the human body, it sticks tenaciously and continues to burn. It was developed and first used by the U.S. in World War II. Its use in the Vietnam War became highly controversial.

Napata \'na-pə-tə\ Town in ancient Egypt. Located below the fourth cataract of the Nile River in the northern part of what is now The Sudan, it was the capital (c. 750–590 BC) of the Nubian kingdom of Kush and was part of the homeland of the Karmah culture. From the early 18th dynasty it came under Egyptian influence. Ruins in the area include pyramids and temples.

naphthalene \'naf-thə-ˌlēn\ Simplest of the fused (condensed) ring hydrocarbons, an aromatic compound composed of two benzene rings sharing two adjacent carbon atoms ($C_{10}H_8$). It is a white solid at room temperature, very volatile, with a characteristic odour. Naphthalene is an important raw material in the manufacture of dyes and synthetic resins and has been used as a moth repellent.

Napier \'nā-pər**, John** (b. 1550, Merchiston Castle, near Edinburgh, Scot.—d. April 4, 1617, Merchiston Castle) Scottish mathematician and champion of Protestantism. He divided his life between attacks on the church of Rome and the pursuit of numerical calculations. On a number of occasions he urged James IV of Scotland to deal firmly with the Catholic threat. From 1594 he worked on developing secret weapons, including a metal chariot with small holes through which shot could be fired. He developed the concept of the logarithm to facilitate calculations involving multiplication, division, roots, and powers. He also introduced the decimal point as a notation for decimal fractions. The set of calculating rods he designed was a precursor to the slide rule.

Naples *Italian* **Napoli** \'nä-pō-lē\ *ancient* **Neapolis** City (pop., 2001 prelim.: 993,386), capital of Campania, southern Italy. Located on the northern side of the Bay of Naples, southeast of Rome, it was founded c. 600 BC by refugees from an ancient Greek colony; it was conquered by the Romans in the 4th century BC. Part of the realms of the Byzantines and then the Saracens, in the 11th century it was conquered by the Norman ruler of Sicily, and through the 19th century it was the capital of the Kingdom of the Two Sicilies and the Kingdom of Naples. It was entered by Giuseppe de Garibaldi's expedition in 1860. Heavily damaged in World War II by Allied and German bombing, it was later rebuilt, but it suffered severe earthquake damage in 1980. It is a commercial and cultural centre and a major port with diversified industries. Among the city's attractions are medieval castles, an abundance of churches, numerous museums, including the National Archaeological Museum of Greco-Roman antiquities, and a university.

Naples, Bay of Semicircular inlet of the Tyrrhenian Sea, southern Italy. It extends southeastward for 20 mi (32 km) from Cape Miseno to Campanella Point. It is noted for its scenic beauty, which is enhanced by the volcanic hills surrounding it, including Mount Vesuvius. Its major port is Naples, and along its shore are ruins of the ancient cities of Pompeii and Herculaneum.

Naples, Kingdom of Former kingdom comprising the southern portion of the Italian peninsula. The region was held successively by Romans, Byzantines, Lombards, and Saracens before it was conquered by Normans in the 11th century and incorporated into their kingdom of Sicily. It became a separate kingdom in 1282, but it was reunited with Sicily in 1442 as one of the Two Sicilies. Again separating from Sicily in 1458, it was claimed by France and then by Spain, which ruled it for two centuries. It was ceded to the Austrian Habsburgs in 1713 but was conquered in 1734 by the Spanish Bourbons, who reestablished the Kingdom of the Two Sicilies. Napoleon annexed it to France and then made it an independent kingdom (1806–15), after which the Bourbons were restored. In 1860 Naples and Sicily voted for unification with northern Italy.

Napo \'nä-pō\ **River** River, northeastern Ecuador and northeastern Peru. It rises in Ecuador and flows east across the Peruvian border through dense rainforests for about 550 mi (885 km) to empty into the Amazon River. It is an important transport route. Cattle are raised along its banks, and the forests yield rubber, chicle, and timber.

Napoleon *French* **Napoléon Bonaparte** *orig. Italian* **Napoleone Buonaparte** (b. Aug. 15, 1769, Ajaccio, Corsica—d. May 5, 1821, St. Helena Island) French general and emperor (1804–15). Born to parents of Italian ancestry, he was educated in France and became an army officer in 1785. He fought in the French Revolutionary Wars and was promoted to brigadier general in 1793. After victories against the Austrians in northern Italy, he negotiated the Treaty of Campo Formio (1797). He attempted to conquer Egypt (1798–99) but was defeated by the British under Horatio Nelson in the Battle of the Nile. The Coup of 18–19 Brumaire brought him to power in 1799, and he installed a military dictatorship, with himself as First Consul. He introduced numerous reforms in government, including the Napoleonic Code, and reconstructed the French education system. He negotiated the Concordat of 1801 with the pope. After victory against the Austrians at the Battle of Marengo (1800), he embarked on the Napoleonic Wars. The formation of coalitions of European countries against him led Napoleon to declare France a hereditary empire and to crown himself emperor in 1804. He won his greatest military victory at the Battle of Austerlitz against Austria and Russia in 1805. He defeated Prussia at the Battles of Jena and Auerstedt (1806) and Russia at the Battle of Friedland (1807). He then imposed the Treaty of Tilsit on Russia, ending the fourth coalition of countries against France. Despite his loss to Britain at the Battle of Trafalgar, he sought to weaken British commerce and established the Continental System of port blockades. He consolidated his European empire until 1810 but became embroiled in the Peninsular War (1808–14). He led the French army into Austria and defeated the Austrians at the Battle of Wagram (1809), signing the Treaty of Vienna. To enforce the Treaty of Tilsit, he led an army of about 600,000 into Russia in 1812, winning the Battle of Borodino, but was forced to retreat from Moscow with disastrous losses. His army greatly weakened, he was met by a strong coalition of allied powers, who defeated him at the Battle of Leipzig (1813). After Paris was taken by the allied coalition, Napoleon was forced to abdicate in 1814 and was exiled to the island of Elba. In 1815 he mustered a force and returned to France to reestablish himself as emperor for the Hundred Days, but he was decisively defeated at the Battle of Waterloo. He was sent into exile on the remote island of St. Helena, where he died six years later. One of the most celebrated figures in history, Napoleon revolutionized military organization and training and brought about reforms that permanently influenced civil institutions in France and throughout Europe.

Napoleon II, duke von Reichstadt *orig.* **Napoléon-François-Charles-Joseph Bonaparte** (b. March 20, 1811, Paris, France—d. July 22, 1832, Schönbrunn, Austria) The only son of Napoleon and Marie-Louise, he was born during Napoleon's reign as emperor and styled "King of Rome." On Napoleon's abdication (1814), Marie-Louise took her son to live at the court of her father, Emperor Francis II, rather than allow him to remain in France as the focus of resistance as Napoleon II. Given the Austrian title of duke of Reichstadt, he was controlled by Klemens, prince von Metternich. In 1830 Bonapartist insurgents attempted to restore Reichstadt as Napoleon II, but he was already ill with tuberculosis, which would kill him.

Napoleon III *or* **Louis-Napoléon** *orig.* **Charles-Louis-Napoléon Bonaparte** (b. April 20, 1808, Paris, France—d. Jan. 9, 1873, Chislehurst, Kent, Eng.) Emperor of France (1852–70). The nephew of Napoleon, he spent his youth in exile in Switzerland and Germany (1815–30). With the death in 1832 of Napoleon's son, Napoléon-François-Charles-Joseph Bonaparte, duke von Reichstadt, he became the claimant to the French throne. After an abortive coup d'état, he was exiled by King Louis-Philippe to the U.S. After another attempted coup (1840), he was arrested, tried, and imprisoned. He escaped to England (1846) and returned to Paris (1848), where he was elected to the national assembly. He evoked the legend of Napoleon to win the popular vote as president of the Second Republic. Attempting to expand his power, he staged a coup in 1851 and made himself dictator; in 1852, as Napoleon III, he became emperor of the Second Empire. Seeking to reestablish French power, he led France into the Crimean War and helped negotiate the treaty at the Congress of Paris (1856). He sided with Sicily against Austria (1859) and was victorious at the Battle of Solferino. He aided Italy in achieving unity and annexed

Napoleon III, detail of a portrait by Hippolyte Flandrin; in the Versailles Museum.
H. ROGER-VIOLLET

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Savoy and Nice (1860). He promoted liberalized policies within France, which enjoyed prosperity during much of his reign. In the 1860s he gradually introduced political liberalization. He expected material rewards from his "Latin empire" after installing Maximilian as emperor of Mexico (1864–67) but was disappointed. He kept France neutral in the Austro-Prussian War (1866), but in 1870 Otto von Bismarck contrived to involve France in the disastrous Franco-Prussian War. After leading his troops to defeat in the Battle of Sedan (September 1870), Napoleon surrendered and was deposed as emperor.

Napoleonic Code *French* **Code Civil** French civil code enacted by Napoleon in 1804. It clarified and made uniform the private law of France and followed Roman law in being divided into three books: the law of persons, things, and modes of acquiring ownership of things. In Louisiana, the only civil-law state in the U.S., the civil code of 1825 (revised in 1870 and still in force) is closely connected to the Napoleonic Code. See also law code.

Napoleonic Wars (1799–1815) Series of wars that ranged France against shifting alliances of European powers. Originally an attempt to maintain French strength established by the French Revolutionary Wars, they became efforts by Napoleon to affirm his supremacy in the balance of European power. A victory over Austria at the Battle of Marengo (1800) left France the dominant power on the continent. Only Britain remained strong, and its victory at the Battle of Trafalgar (1805) ended Napoleon's threat to invade England. Napoleon won major victories in the Battles of Ulm and Austerlitz (1805), Jena and Auerstedt (1806), and Friedland (1807) against an alliance of Russia, Austria, and Prussia. The resulting Treaties of Tilsit (1807) and the Treaty of Schönbrunn (1809) left most of Europe from the English Channel to the Russian border either part of the French Empire, controlled by France, or allied to it by treaty. Napoleon's successes resulted from a strategy of moving his army rapidly, attacking quickly, and defeating each of the disconnected enemy units. His enemies' responding strategy was to avoid engagement while withdrawing, forcing Napoleon's supply lines to be overextended; the strategy was successfully used against him by the duke of Wellington in the Peninsular War and by Mikhail, Prince Barclay de Tolly, in Russia. In 1813 the Quadruple Alliance formed to oppose Napoleon and amassed armies that outnumbered his. Defeated at the Battle of Leipzig, he was forced to withdraw west of the Rhine River, and after the invasion of France (1814) he abdicated. He rallied a new army to return in the Hundred Days (1815), but a revived Quadruple Alliance opposed him. His final defeat at the Battle of Waterloo was caused by his inability to surprise and to prevent the two armies, led by Wellington and Gebhard von Blücher, from joining forces to defeat him. With his second abdication and exile, the era of the Napoleonic Wars ended.

nappe \'nap\ In geology, a large body or sheet of rock that has been moved by faulting or folding a distance of about 1 mi (1.5 km) or more from its original position. A nappe may be the hanging wall of a low-angle thrust fault (a fracture in the rocks of the Earth's crust caused by contraction), or it may be a large recumbent fold (i.e., an undulation in the stratified rocks that have an essentially horizontal axial plane); both processes position older rocks over younger rocks.

Naqādah *or* **Naqada** \nə-'kä-də\ Archaeological site, east-central Egypt. Located on the west bank of the Nile River north of ancient Karnak, it contains the remains of a Neolithic town and burial grounds of the predynastic period (before c. 2925 BC). It was first excavated by British archaeologist Flinders Petrie in the late 19th century. A modern town at the site has pottery and silk industries.

Nara period (710–784) Period of Japanese history during which the emperor resided in Nara. The capital city was modeled on the capital of Tang-dynasty China, Chang'an, from whom the Japanese borrowed extensively in this period. Buddhism, which had entered Japan a little more than a century earlier, rose in popularity, and many temples and statues were commissioned. The Chinese writing system was introduced and modified by the Japanese (see Japanese writing system), allowing two official histories and the earliest Japanese poetry collections to be produced. The Taihō Code, adopted officially in 701, was based on Chinese law, and the Chinese equal-field system of land distribution, though no longer rigorously enforced, continued to remain in effect. The imperial state extended its frontiers to include southern Kyushu and northern Honshu.

Narayan(swami) \nə-'rī-ən\, R(asipuram) K(rishnaswami) (b. Oct. 10, 1906, Madras, India—d. May 13, 2001, Madras) Indian writer. Narayan briefly worked as a teacher before devoting himself to writing. His first novel, *Swami and Friends* (1935), recounts the adventures of a group of schoolboys. His novels, which typically portray human relationships and the ironies of Indian daily life in which modern urban existence clashes with ancient tradition, include *The English Teacher* (1945), *The Guide* (1958), *The Man-Eater of Malgudi* (1961), *The Vendor of Sweets* (1967), *A Tiger for Malgudi* (1983), and *The World of Nagaraj* (1990). He also wrote short stories, memoirs, and modern prose versions of Indian epics.

Narayanan, Kocheril Raman (b. Oct. 27, 1920, Uzhavoor, India—d. Nov. 9, 2005, New Delhi) President of India (1997–2002). He was the first member of the country's lowest social caste—the group traditionally considered to be untouchable—to occupy the office. Raised in poverty, he attended the University of Travancore on a scholarship and graduated from the London School of Economics with top academic honours. In 1949 he became a diplomat, despite opposition from upper-caste officials, and was ambassador to several countries, including China and the U.S. After serving as a cabinet minister in parliament, he was named vice president in 1992 and president in 1997.

Narbonensis \ˌnär-bə-'nen-səs\ *or* Gallia Narbonensis Ancient Roman province between the Alps, the Mediterranean Sea, and the Cévennes Mountains, comprising what is now southeastern France. Part of Roman Gallia (see Gaul), it was originally called Provincia (see Provence) and was renamed Gallia Narbonensis under Augustus. It became fully Romanized and was governed by a proconsul. The mild climate attracted many Roman immigrants. Vineyards prospered, olive groves were cultivated, and splendid buildings were erected. The province was also famous for its culture, especially the schools at Massilia (see Marseille).

narcissism \'när-sə-ˌsi-zəm\ Mental disorder characterized by extreme self-absorption, an exaggerated sense of self-importance, and a need for attention and admiration from others. First identified by Havelock Ellis in 1898, the disorder is named for the mythological Narcissus, who fell in love with his own reflection. In addition to an inflated self-image and addiction to fantasy, narcissism is characterized by an unusual coolness and composure, which is shaken only when the narcissistic confidence is threatened, and by the tendency to take others for granted or to exploit them. According to Sigmund Freud, narcissism is a normal stage in children's development, but it is considered a disorder when it occurs after puberty.

Narcissus \när-'si-səs\ In Greek mythology, a beautiful youth who fell in love with his own reflection. He was the son of the river god Cephissus and the nymph Leriope. His mother was told by a seer that he would have a long life, provided he never saw his own reflection. His callous rejection of the nymph Echo or of his lover Ameinias drew upon him the gods' vengeance: he fell in love with his own image in the waters of a spring and wasted away. The narcissus flower sprang up where he died.

narcissus \när-'si-səs\ Any of about 40 species of bulbous, fragrant, ornamental plants that make up the genus *Narcissus* in the amaryllis family, native mainly to Europe. Popular spring garden flowers include the daffodil, or narcissus (*N. pseudonarcissus*), the jonquil (*N. jonquilla*), and poet's narcissus (*N. poeticus*). The stem usually bears one large blossom. The central crown of each yellow, white, or pink flower ranges in shape from the form of a trumpet, as in the daffodil, to a ringlike cup, as in the poet's narcissus. Rushlike or flattened leaves arise from the base of the plant. Though poisonous, the bulbs were once used in medicines.

Daffodil (*Narcissus pseudonarcissus*).
WALTER CHANDOHA

narcolepsy Sleep disorder with sudden, uncontrollable spells of daytime sleep and disturbances of nighttime sleep. It usually begins in youth or early adulthood and is presumably due to dysfunction of certain brain structures. Narcoleptics can fall asleep anywhere and anytime—for instance, while talking, eating, or driving. Sleep usually lasts a moment, rarely over an hour, and the narcoleptic is easily awakened. Sleep paralysis, normal when falling asleep or waking, occurs during full consciousness in narcolepsy, with brief but complete inability to move.

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narcotic Drug that produces analgesia (see ANALGESIC), narcosis (stupor or sleep), and DRUG ADDICTION. In most people narcotics also produce euphoria. Those that occur naturally in the OPIUM POPPY, notably MORPHINE, have been used since ancient Greek times. The main therapeutic use of narcotics is for pain relief. Most countries limit the production, sale, and use of narcotics because of their addictive properties and detrimental effects and the incidence of drug abuse. With the development in the 19th century of the hypodermic needle and of HEROIN, five to 10 times as potent as morphine, the use and abuse of narcotics increased dramatically. A narcotic overdose can cause central nervous system depression, respiratory failure, and death.

Narmada River \nər-'mə-də\ *or* **Nerbudda River** River, central India. Rising in MADHYA PRADESH state, it is 801 mi (1,289 km) long. It flows west into the Gulf of KHAMBHAT, and forms the traditional boundary between Hindustan and the DECCAN. Called Namade by the Greek geographer PTOLEMY in the 2nd century AD, it has always been an important route between the Arabian Sea and the GANGES RIVER valley. It is a pilgrimage route for Hindus who regard it their most sacred river after the Ganges.

Narodnik \nä-'rȯd-ˌnik\ *Russian* **Populist** Member of a 19th-century socialist movement in Russia. In the 1860s and '70s the movement attracted intellectuals who believed that political propaganda among the peasants (*narod*, "people") would lead to their revolt and the liberalization of the tsarist regime. Attempts to arouse the peasants produced police persecution and arrests, which drove the socialists to more radical methods, including terrorism. The revolutionary group Land and Freedom, led by GEORGY PLEKHANOV, was formed in the mid-1870s and continued to work among the peasantry until it split in 1879. The movement's populist ideology was revived in the 20th century by the SOCIALIST REVOLUTIONARY PARTY.

Narragansett \ˌnar-ə-'gan-sət\ **Bay** Inlet of the Atlantic Ocean, southeastern Rhode Island, U.S. It extends north for 28 mi (45 km) into the state, almost dividing it into two parts. The bay includes Rhode, Prudence, and Conanicut islands and Mount Hope Bay, which is crossed by one of New England's longest bridges. Since colonial times it has been an active shipping centre; its chief ports are PROVIDENCE and NEWPORT. Much of the bay's area is devoted to fishing and recreation.

Narses \'närˌsēz\ (b. c. 480, Armenia—d. 574, probably Rome or Constantinople) Byzantine general under JUSTINIAN I. A eunuch, he commanded the imperial bodyguard and rose to become grand chamberlain. He helped to quell a riot in 532 and save Justinian's throne; his loyalty to the emperor brought him into the confidence of the emperor's wife THEODORA. In 538 Narses was sent on a military expedition to retake Italy, but his inability to cooperate with the commander allowed the OSTROGOTHS to triumph. He returned to Italy in 551 and conquered the Ostrogothic kingdom. He held power in Italy until removed by Justinian's successor (567). It was rumoured that Narses had invited the Lombards, who conquered much of Italy, into the peninsula in retaliation for his dismissal.

narthex Long, narrow porch, usually colonnaded or arcaded, crossing the entire width of a church at its entrance. The narthex is usually separated from the NAVE by columns or a pierced wall. In Byzantine churches the space is divided into two parts: An exonarthex forms the outer entrance to the building and bounds the esonarthex, which opens onto the nave.

narwhal *or* **narwal** \'närˌwäl\ *or* **narwhale** \'närˌwāl\ TOOTHED WHALE (*Monodon monoceros,* family Monodontidae) of the Arctic, found in groups of 15–20 along coasts and sometimes in rivers. Narwhals are mottled gray, attain a length of 11.5–16 ft (3.5–5 m), and have no dorsal fin. They have only two teeth, at the upper jaw tip. The male's left tooth is a straight, protruding tusk, up to 8.9 ft (2.7 m) long, that is grooved on the surface in a left-handed spiral. It was prized in medieval times as the unicorn horn. The tusk is thought to have evolved as a sexual display. Narwhals eat fishes, cephalopods, and crustaceans. They are hunted by humans for their tusks and meat. See photograph opposite.

NASA *in full* **National Aeronautics and Space Administration** Independent U.S. government agency established in 1958 for research and development of vehicles and activities for aeronautics and space exploration. Its goals include improving human understanding of the universe, the solar system, and Earth and establishing a permanent human presence in space. NASA, previously the National Advisory Committee for Aeronautics (NACA), was created largely in response to the Soviet Union's launch of SPUTNIK in 1957. Its organization was well under way in 1961, when Pres. JOHN F. KENNEDY proposed that the U.S. put a man on the Moon by the end of the 1960s (see APOLLO). Later unmanned programs (e.g., VIKING, MARINER, VOYAGER, GALILEO) explored other PLANETS and interplanetary space, and orbiting observatories (e.g., the HUBBLE SPACE TELESCOPE) have studied the cosmos. NASA also developed and launched various SATELLITES with Earth applications, such as LANDSAT and communications and weather satellites. It planned and developed the SPACE SHUTTLE and led the development and construction of the INTERNATIONAL SPACE STATION.

NASDAQ \'naz-dak\ *in full* **National Association of Securities Dealers Automated Quotations** U.S. market for over-the-counter securities. Established in 1971 by the National Association of Securities Dealers (NASD), NASDAQ is an automated quotation system that reports on the trading of domestic securities not listed on the regular stock exchanges. It publishes two composite PRICE INDEXES daily as well as bank, insurance, transportation, utilities, and industrial indexes. By the 1990s it had surpassed the AMERICAN STOCK EXCHANGE (AMEX) to become the second largest U.S. securities market, in terms of market capitalization, after the NEW YORK STOCK EXCHANGE. Members register with the SECURITIES AND EXCHANGE COMMISSION and meet requirements for assets, capital, public shares, and shareholders. In 1999 it merged with AMEX to form the Nasdaq-Amex Market Group, and in 2000 NASD sold nearly half its interest in NASDAQ to private investors. See also OVER-THE-COUNTER MARKET.

Naseby \nāz-bē**, Battle of** (June 14, 1645) Decisive battle in the ENGLISH CIVIL WARS between the Parliamentary NEW MODEL ARMY and the royalist army of CHARLES I. The two armies met near Naseby, south of Leicester, and deployed along parallel ridges. The 10,000-man royalist force under Prince RUPERT drove back part of the Parliamentary cavalry but then engaged in wild pursuit, leaving the royalist infantry exposed. The more disciplined Parliamentary force under OLIVER CROMWELL regrouped and counterattacked, routing the royalists and taking 4,000 prisoners. With the loss of his best soldiers, Charles could no longer meet the New Model Army in open battle and effectively lost the war.

Nāṣer od-Dīn Shāh See NĀṢIR AL-DĪN SHĀH

Nash, John (b. 1752, London?, Eng.—d. May 13, 1835, Cowes, Isle of Wight) British architect and city planner. From 1798 Nash was employed by the Prince of Wales. Acquiring considerable wealth, he built for himself East Cowes Castle, Isle of Wight (1798), which had much influence on GOTHIC REVIVAL architecture. He subsequently dotted England and Ireland with castles, houses, and cottages in the Gothic or Italianate style. Regent's Park, London (1811), comprises a canal, lake, wooded area, botanical garden, and, on the periphery, shopping arcades and picturesque groupings of residences. In 1821 he began to reconstruct Buckingham House, London, as a royal palace; dismissed before completing the project, he faced an inquiry into its cost and structural soundness. Nash's East and West Park Villages, London (completed after his death by his chief assistant, James Pennethorne), served as models for "garden suburbs" of separate houses informally arranged.

Nash, John Forbes (b. June 13, 1928, Bluefield, W.Va., U.S.) U.S. mathematician. He earned a doctorate from Princeton University at 22. He began teaching at Massachusetts Institute of Technology in 1951 but left in the late 1950s because of mental illness; thereafter he was informally associated with Princeton. Beginning in the 1950s with his influ-

Narwhal (*Monodon monoceros*)
PAINTING BY RICHARD ELLIS

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ential thesis "Non-cooperative Games," Nash established the mathematical principles of GAME THEORY. His theory, known as the Nash solution or Nash equilibrium, attempted to explain the dynamics of threat and action among competitors. Despite its practical limitations, it was widely applied by business strategists. He shared the 1994 Nobel Prize in Economics with John C. Harsanyi (b. 1920) and Reinhard Selten (b. 1930). A film version of his life, *A Beautiful Mind* (2001), won an Academy Award for best picture.

Nash, (Frederic) Ogden (b. Aug. 19, 1902, Rye, N.Y., U.S.—d. May 19, 1971, Baltimore, Md.) U.S. writer of humorous poetry. Nash sold his first verse in 1930 to *The New Yorker*, on whose staff he worked. In 1931 he published *Hard Lines*, the first of 20 collections that include *The Bad Parents' Garden of Verse* (1936), *I'm a Stranger Here Myself* (1938), and *Everyone but Thee and Me* (1962). His audacious, quotable verse employs delightfully impossible rhymes, puns, and ragged stanzas, often interrupted by digressions. He wrote several children's books and the lyrics for the musicals *One Touch of Venus* (1943) and *Two's Company* (1952).

Nashe \'nash**, Thomas** (b. 1567, Lowestoft, Suffolk, Eng.—d. c. 1601, Yarmouth, Norfolk?) English pamphleteer, poet, dramatist, and novelist. The first of the English prose eccentrics, Nashe wrote in a vigorous combination of colloquial diction and idiosyncratic coined compounds that was ideal for controversy. Among his works are the satire *Pierce Penilesse His Supplication to the Divell* (1592); the masque *Summers Last Will and Testament* (1592, published 1600); *The Unfortunate Traveller* (1594), the first PICARESQUE NOVEL in English; and *Nashes Lenten Stuffe* (1599). The play *Dido, Queen of Carthage* (1594) was a collaboration with CHRISTOPHER MARLOWE.

Nashville City (pop., 2000: 545,524), capital of Tennessee, U.S. It is located on the CUMBERLAND RIVER. Founded in 1779 as Nashborough, it was incorporated as the town of Nashville in 1784. It became a city in 1806 and the state capital in 1843. During the AMERICAN CIVIL WAR, it was occupied by Federal troops (1862). The war's last major battle (1864) took place outside the city. It is a financial and commercial centre, producing shoes, clothing, glass, and tires. Important industries include printing, publishing, and recording. Well known for COUNTRY AND WESTERN MUSIC, it is the site of Opryland U.S.A. and the Country Music Hall of Fame and Museum. It is the home of many universities, including VANDERBILT and Fisk.

Nashville Convention (1850) Two-session meeting of proslavery U.S. Southerners. In 1849 Mississippi held a convention at the urging of JOHN C. CALHOUN, calling for all slaveholding states to send delegates to Nashville, Tenn., to form a united front against perceived Northern aggression. Delegates from nine Southern states met in June 1850; though extremists favoured SECESSION, moderate Whigs and Democrats prevailed. The group adopted 28 resolutions defending slavery but was willing to allow an extension to the Pacific of the boundary established in the MISSOURI COMPROMISE. After the COMPROMISE OF 1850, a smaller group of delegates met in November; dominated by extremists, it denounced the compromise and called again for secession.

Näsi, Lake *or* **Lake Näsijärvi** \'na-sē-ˌyar-vē\ Lake, southwestern Finland. About 20 mi (32 km) long and 8 mi (13 km) wide at its widest point, it is the largest of the Pyhä lakes. Its southern banks are flat and barren, but the northern shore is more developed. Ferries have operated on the lake since 1858.

Nāṣir al-Dīn Shāh \nä-'sēr-ål-'dēn-'shä\ *or* **Nāṣer od-Dīn Shāh** (b. (b. July 17, 1831, Tehrān, Iran—d. May 1, 1896, Tehrān) QĀJĀR DYNASTY shah of Iran (1848–96) who began his reign as a reformer but became increasingly conservative. Domestically, he curbed the power of the clergy in secular affairs, introduced telegraph and postal services, built roads, opened the first school offering education along Western lines, and launched Iran's first newspaper. Later in his rule, however, he steadfastly refused to deal with the growing pressure for reforms. He granted a series of concessionary rights to foreigners in return for large payments. Foremost among these was a 50-year concession given in 1890 on the purchase, sale, and processing of all tobacco in the country, which led to a national boycott of tobacco and the withdrawal of the concession the following year. The incident—popularly termed the "Tobacco Rebellion"—is often considered to be the origin of modern Iranian nationalism.

Nāṣir-e Khusraw \nå-'ser-e-ḵos-'rō\ (b. 1004, Qubādiyān, Khorāsān—d. c. 1072/ 77, Yumgān, Central Asia) Persian poet, theologian, and propagandist. Born into a family of government officials who belonged to the SHIʿITE branch of Islam, he attended school only briefly. In 1045 he made a pilgrimage to Mecca and then traveled to Palestine and Egypt, which was then ruled by the Shīʿite FĀṬIMID DYNASTY. He returned to his homeland to serve as a missionary for the Fāṭimid's Ismāʿīlī sect of Shīʿites, but his efforts aroused the hostility of the majority SUNNITES and he was obliged to flee. Considered one of the greatest Persian writers, he is remembered for his didactic and devotional poetry as well as for his *Diary of a Journey Through Syria and Palestine*.

Nāṣirah, Al- See NAZARETH

Naskapi See MONTAGNAIS AND NASKAPI

Nasmyth \'nā-ˌsmith**, James** (b. Aug. 19, 1808, Edinburgh, Scot.—d. May 7, 1890, London, Eng.) Scottish engineer. Son of the artist Alexander Nasmyth (1758–1840), he is known mainly for his invention of the steam hammer (1839), an important metallurgical tool of the INDUSTRIAL REVOLUTION. He also devised tools such as a planing machine, a steam pile driver, and a hydraulic punching machine, and he manufactured more than 100 steam locomotives. He retired at 48 to devote himself to his hobby, astronomy.

Naṣrānī \näs-'rå-nē**, Cape** *or* **Ra's Naṣrānī** \'rås-ˌnäs-'rå-nē\ Inlet and cape, southeastern coast of the SINAI Peninsula, Egypt. The site of an Egyptian military base, it was captured by Israeli forces in the Sinai campaign of 1956 (see SUEZ CRISIS). After the SIX-DAY WAR in 1967, Israel again occupied the site before withdrawing from the Sinai Peninsula in the early 1980s. In 1972 a new town, Ophira (now Sharm al-Shaykh), was built there. The region has been developed as a recreational and tourist area.

Nassau Historical region of Germany, former duchy, western part of modern HESSE. It is a thickly forested and hilly area north and east of the Rhine, crossed by the LAHN RIVER and the Taunus Mountains. The title "Count of Nassau" was first assumed in the 12th century. Nassau joined the CONFEDERATION OF THE RHINE and became a duchy in 1806. It was annexed by Prussia in 1866. The present-day royal heads of The Netherlands and Luxembourg are descended from this family, called the house of Nassau.

Nassau City (pop., 1999 est.: 214,000), capital of The Bahamas. Located on the northeastern coast of New Providence island, it was settled by the English in the 17th century and became a rendezvous for pirates in the 18th century. Forts were built there to ward off attacks by encroaching Spaniards. During the AMERICAN CIVIL WAR, it became a base for Confederate blockade runners. It is now a popular resort; its economy is based on tourism.

Nasser, Gamal Abdel *also spelled* **Jamāl ʿAbd al-Nāsir** (b. Jan. 15, 1918, Alexandria, Egypt—d. Sept. 28, 1970, Cairo) Egyptian army officer who was prime minister (1954–56) and president (1956–70) of Egypt. In his youth, he took part in anti-British demonstrations. As an army officer, he led a coup that deposed the royal family (1952) and installed Gen. Muḥammad Naguib as head of state. In 1954 he deposed Naguib and made himself prime minister. The MUSLIM BROTHERHOOD tried to assassinate him but failed. In 1956 he promulgated a constitution that made Egypt a one-party socialist state with himself as president. In the same year, he nationalized the Suez Canal (see SUEZ CRISIS) and secured Soviet assistance to build the ASWAN HIGH DAM after the U.S. and Britain canceled their offer of aid. Soon thereafter, Egypt weathered an attack by British, French, and Israeli forces. A charismatic figure, he aspired to lead the Arab world and succeeded briefly in forming the United Arab Republic with Syria (1958–61). He led the Arab world in the disastrous SIX-DAY WAR against Israel but had tentatively accepted a U.S. peace plan for Egypt and Israel when he died of a heart attack. He was succeeded by ANWAR EL-SĀDĀT.

Gamal Abdel Nasser, photograph by Yousuf Karsh.
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Nasser, Lake *or* **Lake Nubia** Lake, southern Egypt and northern Sudan. About 300 mi (480 km) long, it was formed in the 1960s by the construction of the Aswan High Dam in order to control the annual floods of the Nile River, whose waters now feed the lake. Its waters, when discharged downstream, have brought some 1,250 sq mi (3,240 sq km) of additional land under irrigation. Its formation flooded a number of archaeological sites, including those found at Abu Simbel. In The Sudan it is known as Lake Nubia.

Nast, Thomas (b. Sept. 27, 1840, Landau, Baden—d. Dec. 7, 1902, Guayaquil, Ecua.) German-born U.S. political cartoonist. He arrived in the U.S. at six, and from 1862 to 1886 he worked as a cartoonist for *Harper's Weekly*. His cartoons in support of the Northern cause in the American Civil War were so effective that Abraham Lincoln called him "our best recruiting sergeant." Many of his most effective cartoons were attacks on the New York City political machine of William Marcy Tweed in the 1870s; one led to Tweed's identification and arrest in Spain. Nast originated the Republican Party's elephant, the Democratic Party's donkey, and one of the most popular images of Santa Claus. Left destitute by the failure of a brokerage house, he was appointed U.S. consul in Ecuador, where he died.

Thomas Nast, self-portrait etching, 1892
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

nasturtium \nas-'tər-shəm\ Any of various annual plants of the genus *Tropaeolum* (family Tropaeolaceae), native to Mexico, Central America, and northern South America, and cultivated elsewhere as garden plants. Brilliant yellow, orange, or red flowers are funnel-shaped and have a long spur that contains sweet nectar. The peppery-tasting leaves and flowers are sometimes used in salads, and the young flower buds and fruit are sometimes used as seasoning. *Nasturtium* also is a genus of aquatic herbs in the mustard family (see watercress).

Common nasturtium (*Tropaeolum majus*).
DEREK FELL

Natal \nə-'täl\ Seaport and city (pop., 2002 est.: 734,500), northeastern Brazil. It is situated near the mouth of the Potengi River on the Atlantic Ocean coast. Founded by the Portuguese in 1597 near the site of a fort, Natal was given town status in 1611. It is the capital and principal commercial centre of the state of Rio Grande do Norte; it is also a busy port and naval base. It is the seat of the State University of Rio Grande do Norte. The Marine Research Institute and the Barreira do Inferno rocket base are located in the vicinity.

Natal \nə-'täl\ Former province, southeastern Republic of South Africa. The area was occupied for centuries by Bantu-speaking peoples. It was given the name Natal by Vasco da Gama when he sighted the harbour of Port Natal (now Durban) on Christmas Day (Portuguese Natal) in 1497. The first European settlers arrived in 1824. In 1837 Afrikaners arrived in the interior and, after they defeated the Zulu there, established the Republic of Natal. Annexed by the British in 1843, it was extended by numerous acquisitions. During the South African War, Natal was invaded by Afrikaner forces, which were checked by the British. In 1910 it became a province of the Union of South Africa and in 1961 of the Republic of South Africa. The fragmented, nonindependent black state, or homeland, of KwaZulu was later created within Natal, which was the scene of clashes by rival black factions (see African National Congress; Inkatha Freedom Party). After the South African elections of 1994, the region was united to form the province of KwaZulu/Natal.

Nataraja \ˌnə-tə-'rä-jə\ The Hindu god Shiva in his form as the cosmic dancer. The most common images show him with four arms and flying locks, dancing on a dwarf (a symbol of human ignorance) and encircled by a ring of flames. The Nataraja sculpture shows Shiva as the source of all movement within the cosmos, represented by the loop of flames. The dance's purpose is to release humans from illusion; the place where the god performs the dance is believed to lie both at the centre of the universe and within the human heart.

Nataraja, dancing Shiva, Indian bronze image, 12th–13th century AD; in the Museum of Asiatic Art, Amsterdam.
COURTESY OF THE RIJKSMUSEUM, AMSTERDAM

Natchez Trace Old road, southeastern U.S. It follows an Indian trail (or trace) to the northeast from Natchez, Miss., across northwestern Alabama to Nashville, Tenn., and is more than 500 mi (800 km) long. A wagon road constructed in the early 19th century was used by traders and settlers. Among its historical landmarks are the Emerald and Bynum Indian ceremonial mounds and Chickasaw Village, in Mississippi, and Napier Mine and Metal Ford in Tennessee.

Nathan (fl. 10th century BC) Prophet at the courts of David and Solomon in ancient Israel. In II Samuel, God establishes his covenant with David through Nathan, who also appears rebuking David for taking Bathsheba from her husband. As punishment, David was not allowed to build the Temple at Jerusalem, since Nathan had a vision informing him that its construction must be postponed until Solomon succeeded to the throne. Nathan later anointed the new king, securing Solomon's place against rivals, and may have recorded events during the reigns of David and Solomon.

Nathans, Daniel (b. Oct. 30, 1928, Wilmington, Del., U.S.—d. Nov. 16, 1999, Baltimore, Md.) U.S. microbiologist. He received a medical degree from Washington University. Working principally at Johns Hopkins University, he used the restriction enzyme isolated from a bacterium by Hamilton O. Smith to investigate the structure of the DNA of a monkey virus (SV40), the simplest virus known to produce cancer. His construction of a genetic map of the virus was the first application of restriction enzymes to the problem of identifying the molecular basis of cancer. He shared a 1978 Nobel Prize with Smith and Werner Arber.

nation People whose common identity creates a psychological bond and a political community. Their political identity usually comprises such characteristics as a common language, culture, ethnicity, and history. More than one nation may comprise a state, but the terms nation, state, and country are often used interchangeably. A nation-state is a state populated primarily by the people of one nationality.

Nation, Carry (Amelia) *orig.* **Carry Moore** (b. Nov. 25, 1846, Garrard county, Ky., U.S.—d. June 9, 1911, Leavenworth, Kan.) U.S. temperance advocate. Though she held a teaching certificate, her education was intermittent. In 1867 she married a young physician but soon left him because of his alcoholism. In 1877 she married David Nation, a lawyer, who would divorce her for desertion in 1901. After a 1890 U.S. Supreme Court decision weakened the prohibition laws of Kansas, where she was living, she joined the temperance movement; she came to believe that the unlawfulness of saloons meant they could be destroyed with impunity. A tall and heavy woman, she would march alone or with hymn-singing supporters into saloons and sing, pray, and shout while she smashed

Carry Nation.
BROWN BROTHERS

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their fixtures and stock with a hatchet. Jailed many times, she paid her fines with proceeds from her lectures and sales of souvenir hatchets.

Nation, The U.S. weekly journal of opinion, the oldest continuously published U.S. periodical. Founded in 1865 by Frederick Law Olmsted and Edwin L. Godkin (1831–1902) as a reformist publication, it was sold to the *New York Evening Post* in 1881 and was a weekly edition of the paper until 1914. While Oswald Garrison Villard (1872–1949) was owner and editor (1918–34), it moved decisively to the political left and has remained there under subsequent owners and editors, as during its outspoken opposition to Sen. Joseph McCarthy and to U.S. involvement in the Vietnam War. In circulation it is one of the largest intellectual journals in America.

Nation of Islam *or* **Black Muslims** African American religious movement that mingles elements of Islam and black nationalism. It was founded in 1931 by Wallace D. Fard, who established its first mosque in Detroit, Mich. Fard retired into obscurity and his assistant Elijah Muhammad, who founded a second temple in Chicago, took over in 1934. He asserted the moral and cultural superiority of Africans over whites and urged African Americans to renounce Christianity as a tool of the oppressors. His teachings also included the traditional Islamic tenets of monotheism, submission to God, and strong family life. The Nation of Islam grew quickly after World War II, and in the early 1960s it achieved national prominence through the work of Malcolm X. Leadership disputes led Malcolm to form a separate organization and finally to his assassination in 1965. In the 1970s Elijah Muhammad was succeeded by his son, Wallace D. Muhammad (b. 1933), who renamed the organization the American Muslim Mission. In 1985 he dissolved the Mission, urging its members to become orthodox Muslims. A splinter group headed by Louis Farrakhan retains the movement's original name and principles. In the early 21st century there were approximately 10,000 members of the Nation of Islam.

National Aeronautics and Space Administration See NASA

National Assembly *French* **Assemblée Nationale** French parliamentary body. The name was used first during the French Revolution to designate the revolutionary assembly formed by representatives of the Third Estate (1789) and then as a short form for the National Constituent Assembly (1789–91). It was used again when the National Assembly of 1871–75 drafted a new constitution. In the Third Republic (1875–1940), the name designated the two houses of parliament, the Senate and the Chamber of Deputies. In the Fourth Republic (1946–58) and Fifth Republic (from 1958), the name was applied only to the lower house (the former Chamber of Deputies). The National Assembly consists of 577 deputies, elected in single-seat constituencies for five-year terms.

National Association for the Advancement of Colored People See NAACP

national bank In the U.S., any commercial bank chartered and supervised by the federal government and operated by private individuals. National banks were created during the Civil War under the National Bank Act of 1863 to combat financial instability caused by state banks and to help finance the war effort. When these banks purchased federal bonds and deposited them with the comptroller of the currency, they were permitted to circulate national bank notes, thereby creating a stable, uniform national currency. After the Civil War, the government began to retire the bonds issued during the war, which reduced the number of national bank notes that could be issued. Concern over the inflexibility of national bank notes led to the formation of the Federal Reserve System in 1913, which all national banks were required to join. The U.S. Treasury assumed the obligation of issuing national bank notes in 1935, effectively ending the issue of money by private commercial banks.

National Basketball Association (NBA) U.S. professional basketball league. It was formed in 1949 by the merger of two rival organizations, the National Basketball League (founded 1937) and the Basketball Association of America (1946). In 1976 the NBA was augmented by the absorption of four teams from the former American Basketball Association (founded 1967). The NBA membership is divided into two conferences, each with three divisions. The Eastern Conference consists of the Atlantic Division (Boston Celtics, New Jersey Nets, New York Knicks, Philadelphia 76ers, Toronto Raptors), the Central Division (Chicago Bulls, Cleveland Cavaliers, Detroit Pistons, Indiana Pacers, Milwaukee Bucks), and the Southeast Division (Atlanta Hawks, Charlotte Bobcats, Miami Heat, Orlando Magic, Washington Wizards). The Western Conference consists of the Northwest Division (Denver Nuggets, Minnesota Timberwolves, Portland Trail Blazers, Seattle SuperSonics, Utah Jazz), the Pacific Division (Golden State Warriors, Los Angeles Clippers, Los Angeles Lakers, Phoenix Suns, Sacramento Kings), and the Southwest Division (Dallas Mavericks, Houston Rockets, Memphis Grizzlies, New Orleans Hornets, San Antonio Spurs).

National Broadcasting Company See NBC

National Collegiate Athletic Association (NCAA) Organization that administers U.S. intercollegiate athletics. It was formed in 1906 but did not acquire significant powers to enforce its rules until 1942. Headquartered at Indianapolis, Ind., it functions as a general legislative and administrative authority, formulating and enforcing rules of play for various sports and eligibility criteria for athletes. It has about 1,200 member schools and conducts about 80 national championships in a total of about 20 sports.

National Convention *French* **Convention Nationale** Governing assembly (1792–95) of the French Revolution. Comprising 749 deputies elected after the overthrow of the monarchy (1792), it sought to provide a new constitution for France. The struggle between the radical Montagnards and the moderate Girondins dominated the Convention until the Girondins were purged in 1793. The democratic constitution already approved by the Convention was not put into effect while the Montagnards controlled the assembly (1793–94). After the Thermidorian Reaction (1794), the balance of power in the Convention was held by members of the Plain. The Girondins were recalled, and the Constitution of 1795 was approved for the Directory regime that replaced the Convention.

national debt *or* **public debt** Total indebtedness of a government, especially as evidenced by securities issued to investors. The national debt grows whenever the government operates a budget deficit—that is, when government spending exceeds government revenues in a year. To finance its debt, the government can issue securities such as bonds or treasury bills. The level of national debt varies from country to country, from less than 10% of the gross domestic product (GDP) to more than double it. Public borrowing is thought to have an inflationary effect on the economy and thus is often used during recessions to stimulate consumption, investment, and employment. See also deficit financing; John Maynard Keynes.

National Education Association (NEA) Voluntary association of U.S. teachers, administrators, and other educators associated with elementary and secondary schools and colleges and universities. Founded in 1857 as the National Teachers Assn., it is among the world's largest professional organizations. Operating much like a labour union, it represents its members through numerous state and local affiliates. It seeks to improve the schools and working conditions, advance the cause of public education, promote federal legislation, and sponsor research.

National Endowment for the Arts (NEA) Independent agency of the U.S. government that supports the creation, dissemination, and performance of the arts. It was created by the U.S. Congress in 1965 and funds projects in literature, music, theatre, film, dance, fine arts, sculpture, and crafts. The majority of NEA grants go directly to institutions such as art museums, not-for-profit theatres, and symphony orchestras; to arts programs in schools; and to support events such as folk arts festivals. Some individual artists are funded for specific projects as well. Grants are often awarded by the NEA in cooperation with state and local arts agencies. NEA funding dropped in the 1990s, as Congressional opposition arose in response to certain NEA-supported projects.

National Endowment for the Humanities (NEH) U.S. independent agency. Founded in 1965, it supports research, education, preservation, and public programs in the humanities. It provides grants to museums, libraries, archives, television programs, historic sites, translation and editorial projects by academic presses, educational and research institutions, and individuals.

National Film Board of Canada (NFB) Canadian department of film production. It was established in 1939 and directed by John Grierson (1898–1972), who developed the studio into a leading producer of documentaries, including the World War II propaganda films *Canada Carries On* and *The World in Action*. The studio also made high-quality animated movies by Norman McLaren (1914–87) and others, and it later expanded to produce feature films, including *The Luck of Ginger Coffey* (1964), *The Apprenticeship of Duddy Kravitz* (1974), and *The Company of Strangers* (1990).

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National Football League (NFL) Major professional football organization in the U.S. It was founded in 1920 at Canton, Ohio; its first president was Jim Thorpe. In 1970 it merged with the rival American Football League (founded 1959). Beginning with the 2002 season, it was divided into two conferences, each with four divisions. The National Conference consists of the East Division (Dallas Cowboys, New York Giants, Philadelphia Eagles, and Washington Redskins), the South Division (Atlanta Falcons, Carolina Panthers, New Orleans Saints, and Tampa Bay Buccaneers), the North Division (Chicago Bears, Detroit Lions, Green Bay Packers, and Minnesota Vikings), and the West Division (Arizona Cardinals, St. Louis Rams, San Francisco Forty-Niners, and Seattle Seahawks). The American Conference consists of the East Division (Buffalo Bills, Miami Dolphins, New England Patriots, and New York Jets), the South Division (Houston Texans, Indianapolis Colts, Jacksonville Jaguars, and Tennessee Titans), the North Division (Baltimore Ravens, Cincinnati Bengals, Cleveland Browns, and Pittsburgh Steelers), and the West Division (Denver Broncos, Kansas City Chiefs, Oakland Raiders, and San Diego Chargers). The league season culminates with the Super Bowl, the annual championship game between the winners of the National and American conferences.

national forest In the U.S., any of numerous forest areas under federal supervision for the purposes of conserving water, timber, wildlife, fish, and other renewable resources and providing public recreation areas. Administered by the U.S. Department of Agriculture's Forest Service, in the early 21st century the forests numbered 155 and occupied 352,000 sq mi (911,700 sq km) in 40 states and Puerto Rico. They were founded in 1891 as a system of forest reserves and were renamed national forests in 1907. See also Gifford Pinchot.

National Gallery of Art Museum in Washington, D.C., part of the Smithsonian Institution. It was founded in 1937 when Andrew W. Mellon donated his collection of European paintings to the U.S. He also donated funds to construct the gallery's Neoclassical building, opened in 1941. Now known as the West Building, it is connected by plaza and underground concourse to the East Building, designed by I.M. Pei (completed 1978). The museum houses an extensive collection of U.S. and European paintings, sculpture, decorative arts, and graphic arts from the 12th to 21st centuries; especially well represented are works by Italian Renaissance, 17th-century Dutch, and 18th- and 19th-century French artists.

National Gallery of Canada National art museum founded in Ottawa in 1880. Its holdings include extensive collections of Canadian art as well as important European works. Its nucleus was formed with the donation of diploma works by members of the Royal Canadian Academy. In 1911 the drawing collection was formed (1913–24) with important works by Albrecht Dürer and Rembrandt, and the photography collection was begun in 1967. A new building opened in 1988; the Canadian Centre for the Visual Arts opened in 1991 and a multimedia learning centre in 1996. The museum circulates several hundred exhibitions to other cities throughout the country each year.

National Geographic Society U.S. scientific society founded in 1888 in Washington, D.C., by a small group of eminent explorers and scientists "for the increase and diffusion of geographic knowledge." At the turn of the 21st century it had approximately nine million members. It has supported more than 7,000 major scientific projects and expeditions, including those of Robert E. Peary, Richard E. Byrd, the Leakey family, Jacques-Yves Cousteau, Jane Goodall, and Dian Fossey. It has published numerous books, atlases, and bulletins and has created hundreds of television documentaries. *National Geographic Magazine* is a monthly magazine of geography, archaeology, anthropology, and exploration. It became a leader in reproducing colour photographs and printing photographs of undersea life, views from the stratosphere, and animals in their natural habitats. It also became famous for articles containing substantial information on environmental, social, and cultural aspects of the regions covered. See also Gilbert Grosvenor.

National Guard, U.S. Reserve group organized by the U.S. Army and Air Force. Every state and territory of the U.S. has a National Guard, which can be called on by state governors during emergencies such as riots and natural disasters. Guard units may also be ordered into active duty for up to two years by the U.S. president in the event of a national emergency. Enlistment in the National Guard is voluntary.

National Health Service (NHS) Comprehensive government public-health service in Britain covering virtually the entire population, established in 1946. Financed primarily by general taxes, most services are free. General practitioners and dentists are paid per patient registered with them and may also have private patients. Hospital and specialist services are provided in government hospitals and other facilities by salaried professionals. Local health authority services provide maternity and child welfare, home nursing, and other preventive services. The NHS has provided generally good health care at relatively low cost, but the increasing expense of hospital stays has caused financial strain.

National Hockey League (NHL) Organization of professional North American ice-hockey teams. The league was formed in 1917 by five Canadian teams; the first U.S. team, the Boston Bruins, was added in 1924. It today consists of 30 teams in two conferences and six divisions. The Eastern Conference includes the Atlantic Division (New Jersey Devils, New York Islanders, New York Rangers, Philadelphia Flyers, and Pittsburgh Penguins), the Northeast Division (Boston Bruins, Buffalo Sabres, Montreal Canadiens, Ottawa Senators, and Toronto Maple Leafs), and the Southeast Division (Atlanta Thrashers, Carolina Hurricanes, Florida Panthers, Tampa Bay Lightning, and Washington Capitals). The Western Conference includes the Central Division (Chicago Blackhawks, Columbus Blue Jackets, Detroit Red Wings, Nashville Predators, and St. Louis Blues), the Northwest Division (Calgary Flames, Colorado Avalanche, Edmonton Oilers, Minnesota Wild, and Vancouver Canucks), and the Pacific Division (Mighty Ducks of Anaheim, Dallas Stars, Los Angeles Kings, Phoenix Coyotes, and San Jose Sharks). At the end of the regular winter season, the top teams in each division engage in a play-off for the Stanley Cup.

national income accounting Set of principles and methods used to measure a country's income and production. There are two ways of measuring national economic activity: the expenditure approach, which measures the money value of the total output of goods and services in a given period (usually a year); and the income approach, which measures the total income derived from economic activity after allowing for capital consumption. The most commonly used indicator of national output is the gross domestic product (GDP). National income may be derived from gross national product (GNP) by making allowances for certain non-income costs included in the GNP, such as indirect taxes, subsidies, and depreciation. National income thus calculated represents the aggregate income of the owners of the factors of production; it is the sum of wages, salaries, profits, interest, dividends, rent, and so on. The data accumulated for calculating the GDP and national income may be manipulated in various ways to show various relationships in the economy. Common uses of the data include breakdowns of GDP according to type of product, breakdowns of national income by type of income, and analyses of the sources of financing (e.g., personal savings, company funds, or national deficits).

National Institutes of Health (NIH) U.S. government agency that conducts or supports biomedical research. It is made up of numerous specialized institutes (e.g., National Cancer Institute; National Heart, Lung, and Blood Institute; National Institute on Aging; National Institute of Child Health and Human Development; and National Institute of Mental Health). Part of the Department of Health and Human Services, it also trains health researchers; disseminates information; and maintains other offices and divisions, the National Library of Medicine (the foremost source of medical information in the U.S.), and several research centres.

National Labor Relations Act See Wagner Act

National Labor Relations Board (NLRB) U.S. government agency charged with administering the National Labor Relations Act (1935). The three-member NLRB, appointed by the president, organizes elections to determine whether employees wish to be represented by a labour union in collective bargaining and monitors labour practices by employers and unions. It does not initiate investigations; its involvement must be sought by employers, individuals, or unions. Though it lacks enforcement power for its orders, it can prosecute cases in court.

National League (NL) Oldest existing U.S. major-league professional baseball organization. The league was founded in 1876. Its supremacy was challenged by several rival organizations over the years, of which only the American League has survived; beginning in 1903, the champions of the two leagues have engaged in an annual World Series competition. Today the National League consists of 16 teams aligned in three divisions. In the Eastern Division are the Atlanta Braves, Florida Marlins (Miami), New York Mets, Philadelphia Phillies, and Washington (D.C.) Nationals. In the Central Division are the Chicago Cubs, Cincin-

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nati Reds, Houston Astros, Milwaukee Brewers, Pittsburgh Pirates, and St. Louis Cardinals. In the Western Division are the Arizona Diamondbacks (Phoenix), Colorado Rockies (Denver), Los Angeles Dodgers, San Diego Padres, and San Francisco Giants.

National Liberal Party *German* **Nationalliberale Partei** Political party that was active first in Prussia and the North German Confederation from 1867, then in Germany in 1871–1918. From 1871 until 1879 the National Liberals, under the leadership of Rudolf von Bennigsen and Johannes von Miquel, enthusiastically supported Chancellor Otto von Bismarck in the Reichstag (parliament) and constituted a virtual government party, winning more seats than any other party. After losing many seats in the election of 1879, the party split over the issue of giving the Reichstag control over revenues. It formed a coalition with the Conservatives in 1890, but its influence waned thereafter.

National Liberation Front Title used by nationalist, usually socialist, movements in various countries since World War II. In Greece, the National Liberation Front-National Popular Liberation Army was a communist-sponsored resistance group that operated in occupied Greece during the war. In Vietnam, the National Front for the Liberation of the South was formed in 1960 to overthrow the South Vietnamese government (see Viet Minh). In Algeria, the National Liberation Front, successor to the body that directed Algeria's war of independence (1954–62), was the only constitutionally legal party from 1962 to 1989. In Uruguay, the leftist guerrilla Tupamaro National Liberation Front (1963) battled police and the army from 1967 to 1972; it later became a legal political party. In the Philippines, the Moro National Liberation Front (1968) espoused separatism for the Moros; during the last three decades of the 20th century, its insurgency resulted in about 100,000 deaths. The Corsican National Liberation Front (1976), the largest and most violent Corsican nationalist movement, remained active into the 21st century. See also Sandinistas.

national monument In the U.S., any of numerous areas reserved by the federal government for the protection of objects or places of historical, scientific, or prehistoric interest. They include natural physical features, remains of Indian cultures, and places of historical importance. In 1906 Pres. Theodore Roosevelt established the first national monument, Devils Tower, in Wyoming. They are administered by the National Park Service of the U.S. Department of the Interior.

National Organization for Women (NOW) U.S. women's rights organization. It was founded in 1966 by Betty Friedan to promote equal rights for women, particularly in the area of employment. With some 500,000 members (both women and men) and 550 chapters, it addresses, through lobbying and litigation, issues such as child care, pregnancy leave, and abortion and pension rights. In the 1970s its major concern was passage of the Equal Rights Amendment to the Constitution, though the amendment failed in 1982. NOW has been more successful at the state level, where it has lobbied for state equal rights amendments and comparable-worth (equal pay for equal work) legislation.

national park Area set aside by a national government for the preservation of its natural environment. Most national parks are kept in their natural state. Those in the U.S. and Canada emphasize land and wildlife preservation, those in Britain focus mainly on the land, and those in African nations focus primarily on animals. The world's first national park, Yellowstone, was established in the U.S. by Pres. Ulysses S. Grant in 1872. Canada's first national park, Banff, was established in 1885. Japan and Mexico established their first national parks in the 1930s; Britain's national parks date to 1949. The U.S. National Park Service, established in 1916, now also manages national monuments, preserves, recreation areas, and seashores, as well as lakeshores, historic sites, parkways, scenic trails, and battlefields. See also national forest.

National Party *in full* **National Party of South Africa** South African political party that ruled the country in 1948–94. Its following included most Afrikaners and many English-speaking whites. It was founded in 1914 by J.B.M. Hertzog as the National Party of South Africa and sought to rally Afrikaners against the Anglicizing policies of the government of Louis Botha and Jan Smuts. After winning the 1948 elections, the party enacted a mass of racial legislation, a policy that the party named apartheid. In 1961 it severed ties with the Commonwealth and made South Africa a republic. In the 1990s, under F.W. de Klerk of the National Party, the government began to repeal racially discriminatory laws. The National Party was defeated in South Africa's first universal elections in 1994 but participated in a coalition government with its longtime rival, the African National Congress. With the enactment of a new constitution in 1996, the Nationalists resigned from the government in protest, marking their first time out of government since 1948. In 1998 the party changed its name to the New National Party. After several years of declining popularity, in 2005 the party's federal council voted in favour of disbanding the party. See also P.W. Botha.

National Public Radio (NPR) U.S. public radio network. It was established by the Corporation for Public Broadcasting in 1970 to provide programming to U.S. noncommercial and educational radio stations. While initially providing programs on the arts, after 1983 the network focused largely on news programming. It features the daily programs *Morning Edition* and *All Things Considered*, as well as the interview programs *Fresh Air* and *Talk of the Nation*.

National Recovery Administration (NRA) (1933–35) U.S. government agency established to stimulate business recovery during the Great Depression. As part of the National Industrial Recovery Act (1933), the NRA established codes to eliminate unfair trade practices, reduce unemployment, and set minimum wages and maximum hours. The U.S. Supreme Court invalidated the act in 1935 because it gave quasi-legislative powers to the executive branch. Many of its provisions appeared in subsequent legislation.

National Republican Party U.S. political party formed after the Jeffersonian Republicans split in 1825. The National Republicans included followers of John Quincy Adams and Henry Clay and opponents of Andrew Jackson. Adams, the incumbent president, ran as the party's unsuccessful candidate in the 1828 presidential election. Its 1832 presidential nominee was Clay, whose platform endorsing a high tariff, internal improvements, and the Bank of the United States (see Bank War). After losing again to Jackson, the party joined with conservatives and other anti-Jackson forces to form the Whig Party.

National Rifle Association (NRA) Governing organization for the sport of shooting with rifles and pistols. It was founded in Britain in 1860. The U.S. organization, formed in 1871, has a membership of some four million. Both the British and the U.S. groups sponsor regional and national shooting competitions and offer gun safety programs. The U.S. NRA, one of the most powerful political lobbies in the country, has vigorously opposed many legislative proposals for the control of firearms.

National Security Agency (NSA) U.S. intelligence agency responsible for cryptographic and communications intelligence and security. Established in 1952 by a presidential directive (not by law), it has operated largely without Congressional oversight. Its director has always been a general or an admiral. Its mission includes the protection and formulation of codes, ciphers, and other cryptology as well as the interception, analysis, and solution of coded transmissions. It conducts research into all forms of electronic transmission and operates listening posts around the world for the interception of signals. A target for penetration by foreign intelligence services, until recently it maintained no contact with the public or the press. Though its budget and the number of its employees is secret, the NSA is acknowledged to be far larger than the Central Intelligence Agency, possessing financial resources that rival those of the world's largest companies.

National Security Council (NSC) U.S. agency that advises the president on domestic, foreign, and military policies related to national security. With the Central Intelligence Agency, it was established by the 1947 National Security Act. It provides the White House with a foreign-policy-making instrument independent of the State Department. It has four members—the president, vice president, and secretaries of state and defense—and its staff is headed by the national security adviser.

National Socialism *or* **Nazism** Totalitarian movement led by Adolf Hitler as head of Germany's Nazi Party (1920–45). Its roots lay in the tradition of Prussian militarism and discipline and German Romanticism, which celebrated a mythic past and proclaimed the rights of the exceptional individual over all rules and laws. Its ideology was shaped by Hitler's beliefs in German racial superiority and the dangers of communism. It rejected liberalism, democracy, the rule of law, and human rights, stressing instead the subordination of the individual to the state and the necessity of strict obedience to leaders. It emphasized the inequality of individuals and "races" and the right of the strong to rule the weak. Politically, National Socialism favoured rearmament, reunification of the Ger-

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man areas of Europe, expansion into non-German areas, and the purging of "undesirables," especially Jews. See also FASCISM.

nationalism Loyalty and devotion to one's NATION or country, especially as above loyalty to other groups or to individual interests. Before the era of the nation-state, the primary allegiance of most people was to their immediate locality or religious group. The rise of large, centralized states weakened local authority, and society's increasing secularization weakened loyalty to religious groups, though shared religion—along with common ethnicity, political heritage, and history—is one of the factors that draws people together in nationalist movements. Early nationalist movements in 18th- and early 19th-century Europe were liberal and internationalist, but they gradually became more conservative and parochial. Nationalism is considered a major contributing cause of World War I, World War II, and many other wars of the modern era. In Africa and Asia in the 20th century, nationalist movements often arose in opposition to COLONIALISM. After the fall of the Soviet Union, powerful nationalist sentiments in eastern Europe and the former Soviet republics contributed to ethnic conflicts, such as those in the territories of the former Yugoslavia.

Nationalist Party *or* **Kuomintang** *or* **Guomindang** \'gwō-'min-'däŋ\ Political party that governed all or part of mainland China from 1928 to 1949 and subsequently ruled Taiwan. Founded by Song Jiaoren (1882–1913) and led by SUN YAT-SEN, it evolved from a revolutionary league working to overthrow the QING DYNASTY into a political party. In the early 1920s the party received guidance from the Soviet Bolshevik party; until 1927 it collaborated with the CHINESE COMMUNIST PARTY. Sun's program, which stressed nationalism, democracy, and people's livelihood, was ineffectively implemented by his successor, CHIANG KAI-SHEK, who became increasingly conservative and dictatorial. During World War II, Chiang focused on suppressing the Chinese communists at the expense of defending the country from the Japanese; in 1949 the Nationalists were driven from the mainland to Taiwan. There they maintained a monopoly on political power until 1989, when the first legal opposition party won seats in the legislature. The first non-Nationalist president was elected in 2000. See also WANG JINGWEI.

nationality Affiliation with a particular NATION or sovereign state. People, business corporations, ships, and aircraft all have nationalities. Nationality is inferior to CITIZENSHIP, insofar as the latter implies a full set of political privileges and the former does not. Countries have limited rights to determine which of their inhabitants will be their nationals. People generally acquire a nationality by birth within a particular country's territory, by inheritance from one or both parents, or by NATURALIZATION. It may change or be augmented or taken away if a country cedes control of the territory where one lives to another country.

Nations, Battle of the See Battle of LEIPZIG

Native American See AMERICAN INDIAN

Native American arts Literary, performing, and visual arts of the indigenous peoples of the Western Hemisphere. Folktales have long been a part of the social and cultural life of diverse groups of American Indian and Inuit peoples. These tales were passed on orally by storytellers whose presentation could shape the power of a story. One technique they frequently employed was the repetition of incidents. Elements of mythology—which vary from region to region—are also central. Any definition of a Native American musical style is complicated by the variety between tribes and within tribal repertoires. An evident feature of much music is male dominance. Equally evident is its limitation to a single singer, who performs without harmonization and with percussion accompaniment. The singing voice is well supported from the diaphragm and has a pulsating quality caused by the rhythmic expulsion of breath. Melodies are generally sparse, sometimes even monotone; only rarely do songs expand beyond the notes of the pentatonic (five-tone) scale. Among the instruments used are drums, rattles, and sometimes wind instruments such as the PANPIPE. The dances of Native American peoples represent forms passed down over centuries and modified through interaction with foreign and other Indian cultures. Their origins lie in religious rites; in attempts to invoke magic and thus cure illness or assure success in food production, hunting, and warfare; and in such life-passage rites as birth, puberty, and death. Patterns within the dance reflect complex relations of rank and gender, and the dancers themselves often represent different religious symbols. Characteristic of Indian dancers is a slightly forward-tilted posture, forward raising of the knee, flat-footed stamp or toe-heeled action, and tendencies towards muscular restraint and relaxation in gesture. Native American visual arts also vary widely from tribe to tribe and region to region. The particular utilitarian form that Native American art took on often reflected the social organization of the cultures involved; for example, political and military societies found their major art forms in weaponry, pageantry of costume, and panoply. Working with the materials natural to their respective homelands, the various Indian cultures also produced art that reflected their environment; for example, those living in forested regions became gifted sculptors in wood. Some of the best Native American artwork was applied to those objects intended to please a deity, soothe the angry gods, and placate or frighten evil spirits. Among the many media explored by Native American cultures are WEAVING, POTTERY, BASKETRY, wooden SCULPTURE, clayware, quillwork, EMBROIDERY, BEADWORK, TOTEM POLES, MURALS, and MASKS. Architectural achievements are also varied and include the monumental stone cliff dwellings of the American Southwest and the enormous Pyramid of Quetzalcoatl at Cholula in Mexico. See also KACHINA; NAVAJO WEAVING; ORAL TRADITION; PUEBLO POTTERY; TRICKSTER TALE.

Native American Church *or* **peyotism** Religious movement among North American Indians involving the drug PEYOTE. Peyote was first used to induce supernatural visions in Mexico in pre-Columbian times; its use extended north into the Great Plains in the 19th century, and peyotism is now practiced among more than 50 tribes. Peyotist beliefs, which combine Indian and Christian elements, vary from tribe to tribe. They involve worship of the Great Spirit, a supreme deity who deals with humans through various other spirits. In many tribes peyote is personified as Peyote Spirit and is associated with JESUS. The rite often begins on Saturday evening and continues through the night. The Peyote Road is a way of life calling for brotherly love, family care, self-support through work, and avoidance of alcohol.

Native Dancer (foaled 1950) U.S. Thoroughbred racehorse. He won the Preakness and Belmont stakes in 1953 but finished second in the Kentucky Derby. In 1954 he was named Horse of the Year. He won 21 of 22 total starts, achieving widespread popularity as the first horse whose major victories were seen on national television.

native element Any of the 19 chemical elements that occur as MINERALS and are found in nature uncombined with other elements. They are commonly divided into three groups: metals (platinum, iridium, osmium, iron, zinc, tin, gold, silver, copper, mercury, lead, chromium); semimetals (bismuth, antimony, arsenic, tellurium, selenium); and nonmetals (sulfur, carbon). Members of the group of native elements form under widely varying physicochemical conditions and in very different rock types. Many deposits are sufficiently abundant to be commercially important.

NATO *in full* **North Atlantic Treaty Organization** International military alliance created to defend western Europe against a possible Soviet invasion. A 1948 collective-defense alliance between Britain, France, The Netherlands, Belgium, and Luxembourg was recognized as inadequate to deter Soviet aggression, and in 1949 the U.S. and Canada agreed to join their European allies in an enlarged alliance. A centralized administrative structure was set up, and three major commands were established, focused on Europe, the Atlantic, and the English Channel (disbanded in 1994). The admission of West Germany in 1955 led to the Soviet Union's creation of the opposing Warsaw Treaty Organization, or WARSAW PACT. France withdrew from military participation in 1966. Since NATO ground forces were smaller than those of the Warsaw Pact, the balance of power was maintained by superior weaponry, including intermediate-range nuclear weapons. After the Warsaw Pact's dissolution and the end of the Cold War in 1991, NATO withdrew its nuclear weapons and attempted to transform its mission. It involved itself in the Balkan conflicts of the 1990s. Article 5 of the North Atlantic Treaty stated that an attack on one signatory would be regarded as an attack on the rest. This article was first invoked in 2001 in response to the terrorist SEPTEMBER 11 ATTACKS against the U.S. Additional countries joined NATO in 1999 and 2004 to bring the number of full members to 26.

Natsume Sōseki \ˌnä-tsù-'mā-'sō-ˌse-kē\ *known as* **Sōseki** *orig.* **Natsume Kinnosuke** (b. Feb. 9, 1867, Edo, Japan—d. Dec. 9, 1916, Tokyo) Japanese novelist. Originally a teacher, Natsume made his literary reputation with two very successful comic novels, *I Am a Cat* (1905–06) and *Botchan* (1906). After 1907 he gave up teaching and produced sombre works dealing with human attempts to escape from loneliness, including *The Wayfarer* (1912–13), *The Gate* (1910), *Kokoro* (1914), and

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Grass on the Wayside (1915). The first writer of modern realistic novels in Japan, he articulately and persuasively depicted the plight of the alienated modern Japanese intellectual.

natural bridge *or* **natural arch** Naturally created arch formation resembling a bridge. Most are erosion features that occur in sandstone or limestone. Some are formed by the collapse of part of a cavern roof. Others may be produced by entrenched rivers eroding through MEANDER necks to form cutoffs. Still others are produced by exfoliation (separation of successive thin shells) and may be enlarged by wind erosion.

Natural Bridges National Monument National monument, southeastern Utah, U.S. Comprising three large natural bridges carved by two winding streams, it was established in 1908. The largest bridge, Sipapu, is 222 ft (68 m) high and spans 261 ft (80 m). Pictographs were carved on another of the bridges, Kachina, by early cliff dwellers.

natural childbirth Any of the systems (e.g., the Lamaze method) of managing birth without drugs or surgery. All begin with classes to teach pregnant women about the birth process, including when to push and what breathing and relaxation techniques to use at which stage. The goal is to reduce fear and muscle tension, which can increase the pain of labour, and to make the mother an active participant in the process. The father or another partner usually attends the classes with the mother and coaches her during the birth. See also MIDWIFERY; OBSTETRICS AND GYNECOLOGY.

natural gas Colourless, highly flammable gaseous HYDROCARBON consisting primarily of methane and ethane. It may also contain heavier hydrocarbons, carbon dioxide, hydrogen, hydrogen sulfide, nitrogen, helium, and argon. It commonly occurs in association with crude oil (see PETROLEUM). Natural gas is extracted from wells drilled into the Earth. Some natural gas can be used as it comes from the well, without any refining, but most requires processing. It is transported either in its natural gaseous state by pipeline or, after liquefaction by cooling, by tankers. Liquefied natural gas occupies only about 1/600 of the volume of the gas. It has grown steadily as a source of energy since the 1930s.

natural law In JURISPRUDENCE and POLITICAL PHILOSOPHY, a system of right or justice common to all humankind and derived from nature rather than from the rules of society, or positive law. The concept can be traced to ARISTOTLE, who held that what was "just by nature" was not always the same as what was "just by law." In one form or another, the existence of natural law was asserted by the Stoics (see STOICISM), CICERO, the Roman jurists, ST. PAUL, ST. AUGUSTINE, GRATIAN, ST. THOMAS AQUINAS, JOHN DUNS SCOTUS, William of OCKHAM, and FRANCISCO SUÁREZ. In the modern period, HUGO GROTIUS insisted on the validity of natural law even on the assumption that God does not exist, and THOMAS HOBBES defined a law of nature as "a precept of general rule found out by reason, by which a man is forbidden to do that which is destructive of his life." Hobbes attempted to construct an edifice of law by rational deduction from a hypothetical "state of nature" and a SOCIAL CONTRACT of consent between rulers and subjects. JOHN LOCKE departed from Hobbes in describing the state of nature as an early society in which free and equal men observe the natural law. JEAN-JACQUES ROUSSEAU postulated a savage who was virtuous in isolation and actuated by two principles "prior to reason": self-preservation and compassion. The authors of the U.S. DECLARATION OF INDEPENDENCE refer only briefly to "the Laws of Nature" before citing equality and other "unalienable" rights as "self-evident." The French DECLARATION OF THE RIGHTS OF MAN AND OF THE CITIZEN asserts liberty, property, security, and resistance to oppression as "imprescriptible natural rights." Interest in the concept of natural law declined dramatically in the 19th century, partly as a result of skeptical attacks by JEREMY BENTHAM and other proponents of UTILITARIANISM; it was revived in the mid-20th century in light of the crimes committed by the Nazi regime during World War II. Skepticism of natural law and natural rights remained strong, however, and later writers almost invariably talked of HUMAN RIGHTS rather than natural rights.

natural selection Process that results in adaptation of an organism to its environment by means of selectively reproducing changes in its GENOTYPE. Variations that increase an organism's chances of survival and procreation are preserved and multiplied from generation to generation at the expense of less advantageous variations. As proposed by CHARLES DARWIN, natural selection is the mechanism by which EVOLUTION occurs. It may arise from differences in survival, fertility, rate of development, mating success, or any other aspect of the life cycle. MUTATION, GENE FLOW, and GENETIC DRIFT, all of which are random processes, also alter GENE abundance. Natural selection moderates the effects of these processes because it multiplies the incidence of beneficial mutations over generations and eliminates harmful ones, since the organisms that carry them leave few or no descendants. See also SELECTION.

naturalism Aesthetic movement of the late 19th to early 20th century. The movement was inspired by the principles and methods of natural science, especially DARWINISM, which were adapted to literature and art. In literature, naturalism extended the tradition of REALISM, aiming at an even more faithful, pseudoscientific representation of reality, presented without moral judgment. Characters in naturalistic literature typically illustrate the deterministic role of heredity and environment on human life. The movement originated in France, where its leading exponent was ÉMILE ZOLA. In America it is associated with the work of writers such as STEPHEN CRANE and THEODORE DREISER. Visual artists associated with naturalism chose themes from life, capturing subjects unposed and not idealized, thus giving their works an unstudied air. Following the lead of the Realist painter GUSTAVE COURBET, painters chose themes from contemporary life, and many deserted the studio for the open air, finding subjects among peasants and tradespeople, capturing them as they found them. As a result, finished canvases had the freshness and immediacy of sketches. Zola, the spokesman for literary naturalism, was also the first to champion ÉDOUARD MANET and the Impressionists (see IMPRESSIONISM).While naturalism was short-lived as a historical movement, it contributed to art an enrichment of realism, new areas of subject matter, and a largeness and formlessness that was closer to life than to art. Its multiplicity of impressions conveyed the sense of a world in constant flux.

naturalism In philosophy, the theory that affirms that all beings and events in the universe are natural and therefore can be fully known by the methods of scientific investigation. Though naturalism has often been equated with MATERIALISM, it is much broader in scope. Strictly speaking, naturalism has no ontological bias toward any particular set of categories of reality: DUALISM and MONISM, ATHEISM and THEISM, IDEALISM and materialism are all compatible with it. Naturalism was most influential in the 1930s and '40s, chiefly in the U.S. among philosophers such as F.J.E. Woodbridge (1867–1940), Morris R. Cohen (1880–1947), JOHN DEWEY, Ernest Nagel (1901–85), Sidney Hook (1902–89), and W.V.O. QUINE.

naturalistic fallacy FALLACY of treating the term "good" (or any equivalent term) as if it were the name of a natural property. In 1903 G.E. MOORE presented in *Principia Ethica* his "open-question argument" against what he called the naturalistic fallacy, with the aim of proving that "good" is the name of a simple, unanalyzable quality, incapable of being defined in terms of some natural quality of the world, whether it be "pleasurable" (JOHN STUART MILL) or "highly evolved" (HERBERT SPENCER). Since Moore's argument applied to any attempt to define good in terms of something else, including something supernatural such as "what God wills," the term "naturalistic fallacy" is not apt. The open-question argument turns any proposed definition of good into a question (e.g., "Good means pleasurable" becomes "Is everything pleasurable good?")—Moore's point being that the proposed definition cannot be correct, because if it were the question would be meaningless.

naturalization Process of granting NATIONALITY or CITIZENSHIP to an ALIEN. It may be granted after voluntary application or through legislation, marriage to a citizen, or parental action. Involuntary naturalization occurs when one's home territory is annexed by a foreign state. Qualifications for naturalization may include a minimum residency period, a minimum age, law-abiding character, good health, self-sufficiency, satisfactory knowledge of the new country, and willingness to give up one's former nationality.

Nature Conservancy Nonprofit organization dedicated to environmental conservation and the preservation of biodiversity, founded in 1951, that operates the largest private system of nature sanctuaries in the world. It owns and manages more than 1,500 preserves throughout the U.S., comprising more than 9 million acres (3.8 million hectares) of ecologically significant land, and has expanded into Latin America and the Pacific. Government-administered programs identify the relative abundance of plant and animal species and the habitats they need to survive, and the Conservancy then acquires—through gifts, exchanges, easements, debt-for-nature swaps, purchases, and other nonconfrontational arrangements—areas that are home to threatened species.

nature/nurture controversy See BEHAVIOUR GENETICS

Naucratis \'nȯ-krə-təs\ Ancient Greek settlement, in Egypt's NILE RIVER delta. It was founded in the 7th century BC and flourished as a centre of

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trade and cultural relations between Greece and Egypt. It declined after Alexander the Great's conquest of Egypt and the founding of Alexandria in 332 BC. In 1884 archaeologist Flinders Petrie discovered the site and helped excavate it.

Nauru \nä-'ü-rü\ *officially* **Republic of Nauru** Island country, southeastern Micronesia, western South Pacific Ocean. Area: 8 sq mi (21 sq km). Population (2005): 10,200. Capital: Yaren (district). About two-thirds of the population are indigenous Nauruans. Languages: Nauruan, English. Religion: Christianity (mostly Protestant; also Roman Catholic). Currency: Australian dollar. Nauru is a coral island with a central plateau 100–200 ft (30–60 m) high. A thin strip of fertile land encircling the island is the major zone of human settlement. It lacks harbours; ships must anchor to buoys beyond a reef. Nauru once had the world's largest concentration of phosphate, and its economy was based on phosphate mining and processing; however, the deposits have been depleted, and the economy has been converting to fishing and other ventures. Nauru is a republic with one legislative house; its head of state and government is the president. It was inhabited by Pacific Islanders when the first British explorers arrived in 1798 and named it Pleasant Island because of their friendly welcome. Annexed by Germany in 1888, it was occupied by Australia at the start of World War I, and in 1919 it was placed under a joint mandate of Britain, Australia, and New Zealand. During World War II it was occupied by the Japanese. Made a UN trust territory under Australian administration in 1947, Nauru gained complete independence in 1968 and became a full member of the Commonwealth and the UN in 1999.

nausea Discomfort in the pit of the stomach associated with disgust for food and a feeling that vomiting will follow, as it often does. Nausea results from irritation of nerve endings in the stomach or duodenum, which stimulate brain centres that control nausea and vomiting. Nausea can be a symptom of minor or serious disorders. Common causes include indigestion (from eating too fast or from stress around mealtime), food poisoning, motion sickness, and pregnancy (morning sickness). Nausea may also arise from any cause of abnormal lack of appetite (e.g., shock, pain, influenza, badly fitting dentures, liver or kidney disease). Simple nausea often is relieved by vomiting.

nautilus \'nȯ-tᵊl-əs\ Either of two genera of cephalopods. The pearly, or chambered, nautilus (genus *Nautilus*) lives in the outermost chamber of its smooth, coiled, usually 36-chambered shell, about 10 in. (25 cm) in diameter. A connecting tube adjusts the gases in the chambers, allowing the shell to act as a float. Nautiluses search the ocean bottom for shrimp or other prey, which they capture with up to 94 small, suckerless, contractile tentacles. The paper nautilus (genus *Argonauta*) feeds on plankton near the surface of tropical and subtropical seas. The female resembles an octopus but has a thin, unchambered, coiled shell, 12–16 in. (30–40 cm) in diameter. The much smaller male has no shell.

Chambered nautilus (*Nautilus*)
DOUGLAS FAULKNER

Nautilus Any of at least three historic submarines. Robert Fulton built one of the earliest submersible craft in 1800 in France; his *Nautilus* had a collapsible mast and sail for surface propulsion and a hand-turned propeller for power. Andrew Campbell and James Ash of Britain built a *Nautilus* submarine driven by battery-powered electric motors in 1886. The name was also chosen for the world's first nuclear-powered submarine, launched by the U.S. Navy in 1954. Capable of longer submersion than any previous submarine, it made a historic trip under the ice cap of the North Pole from Point Barrow, Alaska, to the Greenland Sea in 1958.

Navajo \'na-və-ˌhō\ *or* **Navaho** North American Indian people living mostly in northwestern New Mexico, Arizona, and southeastern Utah, U.S. The Navajo speak an Athabaskan language related to that of the Apache. The Navajo and Apache migrated from Canada to the Southwest c. AD 900–1200, after which the Navajo came under the influence of the Pueblo Indians. Painted pottery and the famous Navajo rugs, as well as sandpainting, are products of this influence. The craft of silversmithing probably came from Mexico in the mid-19th century. The traditional economy was based on farming and later herding of sheep, goats, and cattle. The basic social unit was the band. Religion focused on the emergence of the first people from worlds beneath the Earth's surface. In 1863 the U.S. government ordered Col. Kit Carson to put an end to Navajo and Apache raiding; his offensives resulted in the incarceration of about 8,000 Navajo and the destruction of crops and herds. Today many Navajo live on or near the Navajo Reservation (24,000 sq mi [64,000 sq km] in New Mexico, Arizona, and Utah); thousands earn their living as transient workers. Their language has been tenaciously preserved; they used it to great effect during World War II by transmitting coded messages in Navajo. The Navajo are the most populous Native American group in the U.S., with about 270,000 individuals claiming sole Navajo descent in the 2000 U.S. census.

Navajo National Monument National monument, northern Arizona, U.S. Covering 360 acres (146 hectares), it comprises three historic cliff dwellings: Betatakin (Navajo: "Ledge House"), Keet Seel ("Broken Pottery"), and Inscription House, among the best-preserved and most elaborate cliff dwellings known. The largest, Keet Seel, was first discovered by whites in 1895; the three sites were made a national monument in 1909. The dwellings were the principal home of the Kayenta Anasazi c. 1250–1300. The 135 rooms of Betatakin are tucked into a cliffside alcove 452 ft (138 m) high and 370 ft (113 m) wide. Also situated in a cliff alcove are the 160 rooms and 6 kivas (ceremonial houses) of Keet Seel. Inscription House (closed to the public) has 74 rooms.

Navajo weaving Blankets and rugs made by the Navajo, considered among the best-made textiles produced by Native Americans of the U.S. By 1500 the Navajo were well established in what is now the southwestern U.S., where they began to practice weaving when they turned from a seminomadic life to agriculture. From the Hopi they learned how to make looms and weave fabrics on a large scale; but whereas the Hopi limited their designs to striped patterns, the Navajo introduced geometric shapes, diamonds, lozenges, and zigzags. Traditionally Navajo blankets were made of natural-coloured wool or wool in dark colours produced by dyes made from roots, herbs, and minerals. After the introduction of aniline dyes in the late 19th century, Navajo weavers began using brighter wools and a broader range of decorative motifs.

Naval Academy, U.S. See United States Naval Academy

Naval Limitation, International Conference on See Washington Conference

naval warfare Military operations conducted on, under, or over the sea and waged against other seagoing vessels or targets on land or in the air. The earliest naval attacks were raids by the armed men of a tribe or town using fishing boats or merchant ships. The first warships were galleys, replaced in the 16th and 17th centuries by sail-driven warships equipped with cannons. The British victory over the Spanish Armada (1588) marked a major development: British galleons refused to allow the Spanish ships to get close enough for boarding and hand-to-hand combat and instead pounded them with guns of superior firing capability. Ships of the line and cruisers emerged in the 17th and 18th centuries. In the later 19th century, steam replaced sail propulsion, and ironclads offered greater protection against the increasing power of guns. The battleship, developed in these years, reigned until World War II, when the Pearl Harbor attack proved that bombers launched from aircraft carriers could sink any and all surface ships. Since then, naval air power—missiles as well as carrier-based planes—has been the primary weapon of the world's fleets. Submarines also play a major role in naval warfare.

navaratra In Hinduism, a 9-day festival followed on the 10th day by the *dasehra* celebration. The festival includes feasting, visiting, public concerts, plays, and fairs. Among the goddess Durga's followers, who are especially numerous in Bengal and Assam, the Durga-puja is celebrated during this period; in other parts of India, *dasehra* is associated with the victory of Rama over Ravana, acted out in a pageant climaxed by the burning of effigies of demons.

Navarino \ˌnä-vä-'rē-nō**, Battle of** (Oct. 20, 1827) Naval engagement in the War of Greek Independence against Turkey. A fleet of British, French, and Russian ships was sent to aid Greece by intercepting supplies for the Egyptian-Turkish fleet anchored in the Navarino Bay in the Peloponnese. Shortly after it entered the harbour, the superior guns of the European fleet sent three-fourths of the larger Egyptian-Turkish fleet to

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the bottom and forced others aground. The defeat marked the last significant battle between wooden sailing ships and led to Turkey's evacuation from Greece.

Navarra *English* **Navarre** Autonomous community (pop., 2001: 555,829) and province, northern Spain. Established in 1982, it has an area of 4,012 sq mi (10,391 sq km) and is bordered by France. It is approximately coextensive with the Spanish part of the historical kingdom of NAVARRA. The PYRENEES dominate the northern half of the province, and a Mediterranean climate prevails in the south. Manufacturing industries are clustered around the commercial centre and capital, PAMPLONA.

Navarra *English* **Navarre** \nə-'vär\ Ancient kingdom, northern Spain, bordered by France, ARAGON, CASTILE, and the BASQUE COUNTRY. It encompassed the modern autonomous community of NAVARRA and part of the modern French department of Pyrénées-Atlantiques. It was conquered by the Romans, then the Visigoths, and CHARLEMAGNE. It became an independent kingdom in the 10th century. A succession of French dynasties ruled Navarra after 1234. Incorporated into Castile in 1515, it was united to the French crown when Henry of Navarre became King HENRY IV of France in 1589.

Navarro \nä-'vä-rō**, Fats** *orig.* **Theodore Navarro** (b. Sept. 24, 1923, Key West, Fla., U.S.—d. July 7, 1950, New York, N.Y.) U.S. JAZZ trumpeter. Navarro replaced DIZZY GILLESPIE in the big band of BILLY ECKSTINE in 1946, acquiring a reputation as a virtuoso player capable of executing complex phrases with rare grace. He participated in the burgeoning jazz milieu based around 52nd St. in New York City in the late 1940s, working with BEBOP innovators such as BUD POWELL, CHARLIE PARKER, and Tadd Dameron (1917–65). Addiction to heroin curtailed his activity, and he died of tuberculosis.

Navas de Tolosa, Battle of Las See Battle of LAS NAVAS DE TOLOSA

nave Main part of a Christian church, extending from the entrance (the NARTHEX) to the TRANSEPT or chancel (area around the altar). In a basilican church (see BASILICA), which has side aisles, nave refers only to the central section. Medieval naves were generally divided into many bays, producing the effect of great length. During the Renaissance, the nave format became more flexible, and the nave was divided into fewer compartments, giving a feeling of spaciousness and balanced proportion among the height, length, and width, as in ST. PAUL'S CATHEDRAL.

Nave, Salisbury Cathedral, England, begun 1220
A.F. KERSTING

navigation Science of directing a craft by determining its position, course, and distance traveled. Early mariners followed landmarks visible on shore and studied prevailing winds for clues to direction. The Phoenicians and Polynesians sailed out of sight of land and used the stars to set their course. The COMPASS (first used by the Chinese c. 1100) was the first navigational aid that gave a constant reference point, though its accuracy was limited, especially in heavy seas. Modern compasses are stabilized by GYROSCOPES and housed in binnacles that compensate for the craft's motion. Ship speed was first calculated by dropping overboard a log attached to a reel of line knotted at regular intervals; the number of knots exposed while the log drifted and a sandglass emptied gave the vessel's speed in knots (nautical mph). Charts are another essential navigational tool. Fixing a position requires charts detailing known locations, together with instruments that calculate a vessel's bearing relative to them. The earliest instrument for determining latitude was the quadrant, which measured the altitude of the polestar or the noonday sun. Other early instruments included the SEXTANT and the ASTROLABE. Longitude (used for navigation with increasing success in the 17th–18th century) was fixed using CHRONOMETERS and tables showing positions of celestial bodies throughout the year. In the 20th century, radio beacons and satellite networks allowed aircraft and ships to determine their position. Dead reckoning uses an accurate history of a vessel's headings and speeds drawn from gyroscopes and from computerized measurements of the craft's acceleration. See also GLOBAL POSITIONING SYSTEM.

Navigation Acts English laws in the 17th–18th centuries that required the use of English or colonial ships to carry English trade. The laws were designed to encourage English shipbuilding and restrict trade competition from England's commercial rivals, especially the Dutch. The acts of the 18th century gradually restricted trade by the American colonies and contributed to growing colonial resentment with the imposition of additional duties on sugar, tobacco, and molasses.

Navistar International Corp. Leading U.S. truck manufacturer. It originated as International Harvester Co., which was incorporated in 1902, merging McCormick Harvesting Machine Co. (founded by CYRUS H. MCCORMICK to market his mechanical reaper) with four smaller machinery makers. It became a pioneer in motorized trucks when it introduced its high-wheeled "auto wagons" for farmers. It began producing tractors in the 1930s and soon became a major manufacturer of earth-moving equipment. Facing economic difficulties in the early 1980s, it sold most of its U.S. construction-equipment business and disposed of its farm-equipment line to concentrate almost entirely on trucks, and in 1986 the company changed its name to Navistar International.

Navratilova \ˌnav-rə-ti-'lō-və**, Martina** (b. Oct. 18, 1956, Prague, Czech.) Czech-born U.S. tennis player. She became the undisputed top-seeded player in the world in 1979 after winning the Wimbledon women's singles and doubles. In 1982 she won 90 of 93 matches, and in 1983 she won 86 of 87 matches. In 1984 she was honoured for winning the grand slam but later was denied the title on a technicality. By 1987 she had won 37 individual grand-slam championships, and by 1994 she had won 56, ranking second only to MARGARET SMITH COURT. By 1992 she had accumulated more championships (158) than any other player, male or female, in tennis history, and she retired in 1994 with 167 titles. In 2000 she returned to professional play, competing in several doubles events. In 2003 she won the mixed doubles at Wimbledon, tying BILLIE JEAN KING for most Wimbledon titles (20). With the victory, Navratilova, who was 46, became the oldest player to win at Wimbledon.

navy Warships and craft of every kind maintained by a nation for fighting on, under, or over the sea. A large modern navy includes AIRCRAFT carriers, CRUISERS, DESTROYERS, FRIGATES, SUBMARINES, MINESWEEPERS and minelayers, gunboats, and various types of support, supply, and repair ships, as well as naval bases and ports. Naval ships are the chief means by which a nation extends SEA POWER. Their two chief functions are to achieve sea control and sea denial. Control of the sea enables a nation and its allies to carry on maritime commerce, amphibious assaults, and other seaborne operations that may be essential in wartime. Denial of the sea deprives enemy merchant vessels and warships of safe navigation. See also U.S. NAVY.

Náxos \'nak-säs\ Largest island (pop., 1991: 14,838) of the CYCLADES, Greece. It is about 22 mi (35 km) long and 16 mi (26 km) wide, with an area of 165 sq mi (427 sq km). The capital and chief port, Náxos, on the western coast, is on the site of the island's ancient and medieval capitals. In ancient times, it was famous for its wines and the worship of DIONYSUS. In mythology, it is where THESEUS abandoned ARIADNE. In the 7th–6th centuries BC a deep-grained white marble was exported for statuary. It was captured by the Persians in 490 BC and by Athens in 471 BC. A Venetian duchy ruled from 1207 to 1566; it was later ruled by the Turks. In 1830 it joined the Greek kingdom. Ruins of a Mycenaean settlement (see MYCENAE) have been found there. Nàxos produces white wine, citrus, and emery.

Nayar \'nä-yər\ Hindu CASTE of the Indian state of KERALA. Before the British conquest in 1792, the Nayar caste supplied Kerala's royalty and nobility, militia, and land managers. During British rule, Nayars became prominent in politics, medicine, education, and law. Unlike most Hindus, Nayars traditionally were matrilineal, and fathers had no rights or obligations with regard to their children. Plural marriage, in which both men and women could receive multiple "visiting" spouses, was practiced until the 19th century. Laws passed in the 1930s enforced monogamy and gave children full rights of INHERITANCE from the father.

Nayarit \ˌnī-ə-'rēt\ State (pop., 2000: 920,185), west-central Mexico. It covers an area of 10,417 sq mi (26,979 sq km), and its capital is TEPIC. The SIERRA MADRE rises steeply from the Pacific littoral and cuts the terrain into gorges and valleys. Peaks include the volcanoes Ceboruco and Sangangüey. The coastal lagoons are well-known bird refuges. The main river, Grande de Santiago, flowing from Lake CHAPALA, is sometimes considered a continuation of the LERMA RIVER. The economy is primarily based on agriculture.

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Nazarene \'na-zə-ˌrēn\ Any member of the Brotherhood of St. Luke, an association formed in 1809 by young German, Swiss, and Austrian painters in reaction against Neoclassicism. It was the first effective anti-academic movement in European painting. The members acquired the originally derisive nickname Nazarenes because of their affectation of biblical style of hair and dress. The Nazarenes believed that all art should serve a moral or religious purpose. They admired medieval and early Renaissance painters and rejected most subsequent painting, believing it abandoned religious ideals in favour of artistic virtuosity. Members lived and worked together in a semimonastic existence, trying to imitate the teaching situation of the medieval workshop. The leading members were Friedrich Overbeck (1789–1869), Franz Pforr (1788–1812), and Peter von Cornelius (1783–1867).

Nazareth *Hebrew* **Naẓerat** \ˌnä-zə-'rät\ *Arabic* **Al-Nāṣirah** \en-'nä-sē-ˌrä\ Town (pop., 2000 est.: 69,604), northern Israel, southeast of Haifa. It is Israel's largest Arab city. In the New Testament, it is the childhood home of Jesus. It contains many Christian churches and is a pilgrimage centre. Captured by Christians several times during the Crusades, it was taken by the Ottoman Empire in 1517. It was part of British-mandate Palestine from 1918 and part of Israel from 1948. Christian Arabs form the majority of the population.

Nazi Party German political party of National Socialism. Founded in 1919 as the German Workers' Party, it changed its name to the National Socialist German Workers' Party when Adolf Hitler became leader (1920–21). The nickname Nazi was taken from the first word of its full name, Nationalsozialistische Deutsche Arbeiter-Partei. The party grew from its home base in Bavaria and attracted members from disaffected elements throughout Germany. It organized strong-arm groups (later the SA) to protect its rallies. Though the failed Beer Hall Putsch diminished the party's influence, the effects of the Great Depression brought millions of new members, and in 1932 the party became the largest bloc in the Reichstag. After Hitler was named chancellor in 1933, he obtained passage of the Enabling Act, and his government declared the Nazi party to be the only political party in Germany and required bureaucrats to become members. The party controlled virtually all activities in Germany until Germany's defeat in World War II (1945), after which the party was banned.

NBA See National Basketball Assn.

NBC *in full* **National Broadcasting Co.** Major U.S. commercial broadcasting company. It was formed in 1926 by RCA Corp., General Electric Co. (GE), and Westinghouse and was the first U.S. company to operate a broadcast network. Directed by RCA's president David Sarnoff, it became wholly owned by RCA in 1930. NBC was initially divided into the semi-independent Blue Network, based on station WJZ, and the Red Network, based on WEAF, each with links to stations in other cities. By 1938 the Red Network carried 75% of NBC's programs. The Blue Network was sold in 1941 and became the American Broadcasting Co. (ABC). NBC entered television broadcasting in a weakened position, and by 1952 it trailed CBS in audience ratings, though it gradually regained its leading position. In 1986 RCA was sold to GE; in 1987 NBC sold its radio networks. In the 1990s NBC expanded its cable television programming, creating MSNBC (an alliance with Microsoft) and CNBC (an alliance with Dow Jones).

NCAA See National Collegiate Athletic Assn.

NCR Corp. U.S. manufacturer of cash registers, computers, and information-processing systems. It was founded in 1884 as National Cash Register Co. by John H. Patterson, who bought a failing maker of cash registers in Dayton, Ohio. He improved the design, sent out an aggressive sales force, and hired repairmen to service his products after sale. The company expanded in the 20th century, introducing accounting machines in the 1920s, electronic products during World War II, computer hardware and software in the 1960s, and microelectronics in the 1970s. In 1991 it was purchased by AT&T Corp. and renamed AT&T Global Information Solutions. When AT&T split into three companies in 1996, NCR Corp. was spun off and assumed its former name.

Ndebele \en-də-'bā-lā\ *formerly* **Matabele** \ˌmad-ə-'bā-lā\ Bantu-speaking people who live primarily around the city of Bulawayo, Zimb., but also in Botswana. They originated early in the 19th century as an offshoot of the Nguni of Natal, moving first to Basutoland (now Lesotho) and ultimately to Matabeleland (Zimbabwe). Under Lobengula they grew in power but were defeated by the British in 1893. Today they are a farming and herding people numbering more than 1.5 million. They differ from the Ndebele of South Africa, whose women are known worldwide for their elaborate beadwork and the strong geometric designs they paint on the walls of their houses.

N'Djamena \ˌən-jä-'mā-nä\ *formerly* **Fort-Lamy** \ˌfȯr-lə-'mē\ City (pop., 1993: metro. area, 530,965), capital of Chad. It lies adjacent to Cameroon on the eastern bank of the Chari River, where it joins the Logone River. Founded in 1900 as Fort-Lamy, it remained a small settlement until after Chad's independence in 1960. In 1973 its name was changed to N'Djamena. It was occupied by Libyan forces in 1980–81 during the civil war that began in the 1960s. It is an important marketplace for cotton, cattle, and fish. It is the site of the nation's only university, the University of Chad (founded 1971).

Ndongo \ən-'dȯŋ-gō\ Historical African kingdom of Mbundu people. Established c. 1500 in what is now Angola, it instituted trade relations with the Portuguese of São Tomé in the 16th century. When Portugal tried to take it over, some 100 years of fighting ensued. It was absorbed into Angola c. 1670.

Ne Win \'nā-'win**, U** *or* **Shu Maung** \'shü-'maůŋ\ (b. May 24, 1911, Paungdale, Burma—d. Dec. 5, 2002, Yangôn, Myanmar) Leader of Burma (Myanmar) from 1962 to 1988. He became involved in the Burmese independence movement in the mid-1930s. During World War II he initially served in the Japanese-sponsored army but later helped organize underground resistance to the Japanese. In 1962 he ousted the elected prime minister U Nu; his subsequent regime combined military dictatorship with a socialist economic program. Burma became isolated and impoverished under Ne Win, and he resigned in 1988. He continued to exercise power behind the scenes, however, until shortly before his death.

NEA See National Education Association; National Endowment for the Arts

Neagh \'nā**, Lough** Lake, east-central Northern Ireland. It is the largest lake in the British Isles, with an area of 153 sq mi (396 sq km). It is about 15 mi (24 km) wide and 18 mi (29 km) long, though it is only about 40 ft (12 m) deep. Ancient deposits in Toome Bay, on its northwestern shore, have yielded the oldest recorded human artifacts in Ireland. In 1959 flood-control works significantly lowered the lake level.

Neanderthal \nē-'an-dər-ˌthäl, nā-'än-dər-ˌtäl\ Species of the human genus (*Homo*) that inhabited much of Europe and the Mediterranean lands c. 200,000–28,000 years ago. The name derives from the discovery in 1856 of remains in a cave above Germany's Neander Valley. Some scholars designate the species as *Homo neanderthalensis* and do not consider Neanderthals direct ancestors of modern humans (*Homo sapiens*). Others regard them as a late archaic form of *H. sapiens* that was absorbed into modern human populations in some areas while simply dying out in others. Neanderthals were short, stout, and powerful. Cranial capacity equaled or surpassed that of modern humans, though their braincases were long, low, and wide. Their limbs were heavy, but they seem to have walked fully erect and had hands as capable as those of modern humans. They were cave dwellers who used fire, wielded stone tools and wooden spears to hunt animals, buried their dead, and cared for their sick or injured. They may have used language and may have practiced a primitive form of religion. See also Mousterian industry.

near-death experience Mystical or transcendent experience reported by people who have been on the threshold of death. The near-death experience varies with each individual, but characteristics frequently include hearing oneself declared dead, feelings of peacefulness, the sense of leaving one's body, the sense of moving through a dark tunnel toward a bright light, a life review, the crossing of a border, and meetings with other spiritual beings, often deceased friends and relatives. Near-death experiences are reported by about one-third of those who come close to death. Cultural and physiological explanations have been offered, but the causes remain uncertain. Typical aftereffects include greater spirituality and decreased fear of death.

Near East See Middle East

Nebraska State (pop., 2000: 1,711,263), west-central U.S. Bordered by South Dakota, Iowa, Missouri, Kansas, Colorado, and Wyoming, it covers 77,353 sq mi (200,343 sq km); its capital is Lincoln. The Missouri River is on its eastern boundary. The North Platte and South Platte unite in southwest-central Nebraska to form the Platte River. Various prehistoric

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peoples inhabited the area as early as 8000 BC. Indian tribes living in the area include PAWNEE, Oto, and Omaha in the east and centre, as well as Oglala, SIOUX, ARAPAHO, and COMANCHE in the west. The U.S. bought the territory from France as part of the LOUISIANA PURCHASE in 1803. In 1804 the LEWIS AND CLARK EXPEDITION visited the Nebraska side of the Missouri River. It became part of Nebraska Territory with the KANSAS-NEBRASKA ACT of 1854. Nebraska was admitted to the Union as the 37th state in 1867. Soon after, the population increased, and as Indian resistance on the frontier was broken, settlement extended to Nebraska's panhandle. At the turn of the 20th century, it experienced a short but influential POPULIST MOVEMENT. In 1937 it established a unicameral legislature, the only one in the country. Most of the state is agricultural; its industries include food processing and machinery. Petroleum is the principal mineral resource. In addition to Lincoln, OMAHA is the state's other cultural and industrial centre.

Nebuchadnezzar II See NEBUCHADREZZAR II

Nebuchadrezzar \ˌneb-yə-kəd-'re-zər\ **II** *or* **Nebuchadnezzar** \ˌneb-yə-kəd-'ne-zər\ (b. c. 630—d. c. 561 BC) Second and greatest king of the Chaldean dynasty of BABYLONIA. He began his military career as an administrator (c. 610 BC) and ascended the throne on his father's death, just after winning Syria from the Egyptians (605 BC). He attacked Judah, capturing Jerusalem in 597 and recapturing it in 587/586, and deporting prominent citizens to BABYLON. He devoted time and energy to restoring Babylon, by paving roads, rebuilding temples, and digging canals. At least in folk tradition, he is credited with building the Hanging Gardens of Babylon.

nebula \'neb-yə-lə\ Any of various tenuous clouds of gas and dust in interstellar space. Nebulae constitute only a small percentage of a GALAXY's mass. Dark nebulae (e.g., the COALSACK) are very dense, cold molecular clouds that appear as large, obscure, irregularly shaped areas in the sky. Bright nebulae (e.g., the CRAB NEBULA, PLANETARY NEBULA) appear as faintly luminous, glowing surfaces; they emit their own light or reflect that of stars near them. The term *nebula* also formerly referred to galaxies outside the MILKY WAY GALAXY.

nebular hypothesis See SOLAR NEBULA

NEC Corp. Major Japanese computer, electronics, and telecommunications equipment manufacturer. Nippon Electric Company, Ltd. (officially NEC Corp. in 1983), was founded in 1899 with funding from the WESTERN ELECTRIC CO. INC. of the U.S. NEC was the first Japanese joint venture with a foreign company. As Japan's preeminent telecommunications company, NEC contributed to developments in mobile telephony, fibre-optic networks, private-branch exchanges (PBXs), and microwave, digital, and satellite communications systems. Besides mainframe computers, NEC was an early manufacturer of personal computers (PCs). In 1997 NEC merged its North American PC operations with Zenith Data Systems and Packard Bell to form Packard Bell-NEC, Inc.

necessity In LOGIC and metaphysics, a modal property of a true proposition whereby it is not possible for the proposition to be false and of a false proposition whereby it is not possible for the proposition to be true. A proposition is logically necessary if it instantiates a law of logic or can be made to instantiate a law of logic through substitution of definitionally equivalent terms. Examples are "It is raining now or it is not raining now" and "All men are human beings" (assuming "men" can be replaced with "male human beings"). Necessary propositions are sometimes said to be true or false (as the case may be) in all POSSIBLE WORLDS. A contingently true or false proposition is thus one that is true in some possible worlds and false in others (e.g., "France is a democracy"). All true logically necessary propositions are analytic (see ANALYTIC-SYNTHETIC DISTINCTION) and knowable A PRIORI. Some philosophers recognize a second category of "metaphysically" necessary propositions that are not analytic and generally not a priori; examples include identity statements such as "Water is H_2O."

Nechako \ni-'cha-kō\ **River** River, central British Columbia, Canada. The major tributary of the FRASER RIVER, it flows east for nearly 150 mi (240 km). The Stuart River, a tributary 258 mi (415 km) long, joins it between Fort Fraser and Prince George, where it parallels the Canadian National Railway. In 1952 the Nechako was bisected by Kenney Dam, which created a reservoir whose overflow generates electricity.

Neckar River \'ne-kär\ River, southwestern Germany. It rises in the BLACK FOREST near the headwaters of the DANUBE RIVER and is 228 mi (367 km) long. It flows north and northeast, passing STUTTGART. Its picturesque valley becomes broader and deeper, passing hills crowned by feudal castles. It flows past HEIDELBERG and enters the RHINE RIVER at MANNHEIM.

Necker \nā-'ker, 'ne-kər**, Jacques** (b. Sept. 30, 1732, Geneva, Switz.—d. April 9, 1804, Coppet) Swiss-born French financier and director-general of finance under LOUIS XVI. He became a banker in Paris, and, after becoming wealthy from speculating during the Seven Years' War, he was appointed minister of Geneva in Paris (1768). He retired from banking in 1772 and became France's director-general of finance in 1777. Despite his cautious reforms, he was forced to resign in 1781 over opposition to his scheme to help finance the AMERICAN REVOLUTION. He was recalled in 1788 to rescue the almost bankrupt France, and he proposed financial and political reforms that included a limited constitutional monarchy. Opposition from the royal court led to Necker's dismissal on July 11, 1789, an event that provoked the storming of the BASTILLE. After serving again briefly (1789–90), he retired to Geneva. GERMAINE DE STAËL was his daughter.

necropolis \ni-'krä-pə-ləs\ (Greek: "city of the dead") Extensive and elaborate burial place serving an ancient city. The locations of these cemeteries varied. Many in Egypt, such as the necropolis of western Thebes, were situated across the Nile River opposite the cities. In Greece and Rome a necropolis often lined the roads leading out of town. A necropolis was discovered in the 1940s under ST. PETER'S BASILICA in Rome.

nectarine Smooth-skinned PEACH (*Prunus persica* 'nectarina'), grown throughout warmer temperate regions. They result when some peaches self-pollinate or are crossed so that they express a genetic factor for smooth skin. Nectarines are commonly eaten fresh or cooked in desserts and jams; they are a good source of vitamins A and C.

Nectarine (*Prunus persica* var. *nectarina*)
J.C. ALLEN AND SON

Needham, John Turberville (b. Sept. 10, 1713, London, Eng.—d. Dec. 30, 1781, Brussels, Belg.) British naturalist. He was a Roman Catholic priest, whose reading about microscopic organisms led him to study natural history in London and Paris (1746–49). He became a strong supporter of the theory that life arose from inorganic matter (spontaneous generation) and that life processes cannot be explained by the laws of chemistry and physics (vitalism). In 1750 he presented his theory of spontaneous generation and attempted to offer scientific evidence supporting it.

needle Basic implement used in sewing or embroidering and, in variant forms, for knitting and crocheting. The sewing needle is small, slender, and rodlike. One end is sharply pointed to make passing it through fabric easy; the other end has a slot (called an eye) to carry a THREAD. Modern sewing needles are made of steel. Crocheting needles are eyeless and have a hook on one end; they are usually of steel or plastic. Knitting needles are long, made of various materials, and bluntly pointed at one or both ends, sometimes with a knob at the end opposite the point.

needlefish Any of about 60 species (family Belonidae) of primarily marine, edible, carnivorous fishes found throughout temperate and tropical waters. Needlefish are adept jumpers and have a long, slender jaw with sharp teeth. They are long, slim, and silvery, with a blue or green back. The largest species grows to 4 ft (1.2 m) long. The garfish (*Belone belone*) occurs in Europe, and the houndfish (*Tylosurus crocodilus*) is found everywhere in the tropics.

needlepoint Type of embroidery in which the stitches are counted and worked with a needle over the threads, or mesh, of a canvas foundation. It was known as canvas work until the early 19th century. If the canvas has 16 or more mesh holes per linear inch, the embroidery is called petit point; most needlepoint was petit point in the 16th–18th century. Needlepoint as it is known today originated in the 17th century, when the fashion for furniture upholstered with embroidered fabrics prompted the development of a more durable material to serve as the embroidery's foundation. Wool is generally used for needlepoint, silk yarn less often. Needlepoint kits, con-

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taining canvas stamped with a design and all the materials needed for the project, were sold as early as the mid-18th century. See also BARGELLO.

Nefertiti \ˌne-fər-ˈtē-tē\ (fl. 14th century BC) Queen of Egypt and wife of AKHENATON (r. 1353–36 BC). She is known from her portrait bust found at TELL EL-AMARNA, the king's new capital. She may have been an Asian princess from Mitanni. She appears with Akhenaton in reliefs at Tell el-Amarna and followed his new cult of the sun god ATON. Of her six daughters, two became queens of Egypt. In the 12th year of Akhenaton's reign, Nefertiti either retired after losing favour or died.

Nefertiti, painted limestone bust, about 1350 BC; in the Egyptian Museum, Berlin

BILDARCHIV PREUSSISCHER KULTURBESITZ, ÄGYPTISCHES MUSEUM, STAATLICHE MUSEEN ZU BERLIN—PREUSSISCHER KULTURBESITZ, BERLIN; PHOTOGRAPH, JURGEN LIEPE

Negev \ˈne-ˌgev\ *or* **Ha-Negev** Desert region, southern Israel. Bounded by the SINAI Peninsula and the Jordan Rift Valley, it has an area of about 4,700 sq mi (12,200 sq km). It was a pastoral region in biblical times and an important source of grain for the Roman Empire. After the Arab conquest of Palestine (7th century AD), it was left desolate, and for more than 1,200 years it had only a small population of BEDOUIN. Modern agricultural development began with three KIBBUTZim in 1943; others were founded after World War II (1939–45), when irrigation projects were initiated. Assigned to Israel in the partition of Palestine in 1948, it was the scene of clashes between Israeli and Egyptian forces in 1948–49. It is the site of many preplanned Israeli settlements, including the port city of Elat, Israel's outlet to the Red Sea. Beersheba is an important administrative centre. The region produces grain, fruit, and vegetables; mineral resources include potash, bromine, and copper.

negligence In law, failure to exercise the degree of care expected of a person of ordinary prudence in protecting others from a risk of harm. It may render one civilly and sometimes criminally liable for resulting injuries. The doctrine of negligence does not require the elimination of all risk, but rather only foreseeable and unreasonable risk. Thus a higher standard applies to explosives manufacturers than to manufacturers of kitchen matches. The plaintiff must ordinarily prove the defendant's negligence with a preponderance of evidence. See also CONTRIBUTORY NEGLIGENCE.

negotiable instrument Transferable document (e.g., a bank note, check, or draft) containing an unconditional promise or order to pay a specified amount to its holder upon demand or at a specified time. In the U.S., the Uniform Commercial Code governs negotiable instruments.

Negritude \nā-grē-ˈtüd\ Literary movement of the 1930s, '40s, and '50s. It began among French-speaking African and Caribbean writers living in Paris as a protest against French colonial rule and the policy of assimilation. Its leading figures—LÉOPOLD SENGHOR of Senegal, AIMÉ CÉSAIRE of Martinique, and Léon Damas (1912–78) of French Guiana—began to examine Western values critically and to reassess African culture. The group believed that the value and dignity of African traditions and peoples must be asserted, that Africans must look to their own heritage for values and traditions, and that writers should use African subject matter and poetic traditions. The movement faded in the early 1960s after its objectives had been achieved in most African countries.

Negro leagues Associations of teams of black baseball players active largely between 1920 and the late 1940s. The principal leagues were the Negro National League, originally organized by Rube Foster in 1920, and the Negro American League, organized in 1937. The most noted teams included the Homestead (Pa.) Grays, who won nine pennants in the years 1937–45 and included the great hitters COOL PAPA BELL, BUCK LEONARD, and JOSH GIBSON. In the mid 1930s the Pittsburgh Crawfords included SATCHEL PAIGE and the clutch-hitter William Julius "Judy" Johnson. The Kansas City Monarchs, after winning four national championships, lost JACKIE ROBINSON to the Brooklyn Dodgers; the breaking of the colour barrier in major and minor league baseball led to the Negro leagues' decline.

Negro \ˈnā-grō\ **River** *or* **Guainía** \gwī-ˈnē-ə\ **River** River, northwestern South America. A major tributary of the AMAZON RIVER, it rises in the rainforest of eastern Colombia, where it is known as the Guainía, and forms a section of the border between Colombia and Venezuela. It crosses Brazil and joins the Amazon at MANAUS. It is about 1,400 mi (2,250 km) long and is a major transport artery. Its name comes from its jet-black colour, which is caused by the decomposition of organic matter and its low silt content.

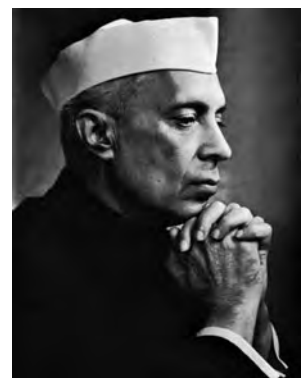
Negro River River, central Uruguay. It rises in the southern highlands of Brazil. Flowing southwest across Uruguay, it is dammed at the Rincón del Bonete Reservoir, the largest artificial lake in South America, with an area of roughly 4,000 sq mi (10,400 sq km). The river joins the URUGUAY RIVER at Soriano. Although it is about 500 mi (800 km) long, it is navigable for only about 45 mi (70 km) upstream from its mouth.

Negroid See RACE

Negros \ˈnā-grōs\ Island (pop., 2000: 3,691,784) in the VISAYAN group, central Philippines. It is the fourth largest island of the archipelago and is shaped like a boot. The island is about 135 mi (217 km) long and has an area of 4,907 sq mi (12,710 sq km). It produces about half of all Philippine sugar and is one of the wealthiest and most politically influential regions in the country. BACOLOD, on the northwestern coast, is its largest city and an important sugar exporter.

Nehemiah \ˌnē-ə-ˈmī-ə\ (fl. 5th century BC) Jewish leader who supervised the rebuilding of JERUSALEM. His story is told in the biblical book of Nehemiah. He was cupbearer to the Persian ruler Artaxerxes I soon after the end of the BABYLONIAN EXILE, when the Temple of JERUSALEM had been rebuilt but the Jewish community was still weak and fragmented. Around 444 BC he was put in charge of Jerusalem's reconstruction, and he organized the rebuilding of the city walls. He also revived adherence to Mosaic law and forbade intermarriage with non-Jews. His work as a reformer was later continued by EZRA.

Nehru \ˈnā-rü**, Jawaharlal** (b. Nov. 14, 1889, Allahabad, India—d. May 27, 1964, New Delhi) First prime minister of independent India (1947–64). Son of the independence advocate Motilal Nehru (1861–1931), Nehru was educated at home and in Britain and became a lawyer in 1912. More interested in politics than law, he was impressed by MOHANDAS K. GANDHI's approach to Indian independence. His close association with the INDIAN NATIONAL CONGRESS began in 1919; in 1929 he became its president, presiding over the historic Lahore session that proclaimed complete independence (rather than dominion status) as India's political goal. He was imprisoned nine times between 1921 and 1945 for his political activity. When India was granted limited self-government in 1935, the Congress Party under Nehru refused to form coalition governments with the Muslim League in some provinces; the hardening of relations between Hindus and Muslims that followed ultimately led to the partition of India and the creation of Pakistan. Shortly before Gandhi's assassination in 1948, Nehru became the first prime minister of independent India. He attempted a foreign policy of nonalignment during the COLD WAR, drawing harsh criticism if he appeared to favour either camp. During his tenure, India clashed with Pakistan over the Kashmir region and with China over the Brahmaputra River valley. He wrested Goa from the Portuguese. Domestically, he promoted democracy, socialism, secularism, and unity, adapting modern values to Indian conditions. His daughter, INDIRA GANDHI, became prime minister two years after his death.



Jawaharlal Nehru, photograph by Yousuf Karsh, 1956.

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Nei Monggol See INNER MONGOLIA

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Neilson \'nēl-sən**, James Beaumont** (b. June 22, 1792, Shettleston, Lanark, Scot.—d. Jan. 18, 1865, Queenshill, Kirkcudbright) Scottish inventor. Working at the Glasgow Gasworks (1817–47), he introduced the use of a hot-air blast for the SMELTING of IRON ore. It had been believed that a blast of cold air was the most efficient smelting method (see WILLIAM FAIRBAIRN); Neilson demonstrated that the opposite was true, patenting his idea in 1828. Use of the hot blast tripled iron output per ton of coal, permitted iron to be recovered from lower-grade ores, and made possible the efficient use of raw coal and lower grades of coal instead of COKE and the construction of larger smelting furnaces.

Neiman Marcus \ˌnē-mən-'mär-kəs\ U.S. department-store chain. It was founded in Dallas, Texas, in 1907 by Herbert Marcus, his sister Carrie Marcus Neiman, and her husband, A.L. Neiman. From the beginning it featured unusual merchandise, particularly extravagant and outlandish gifts (including camels and Chinese junks) intended to appeal to the rich, in addition to a more standard selection for moderate-income customers. The company acquired luxury New York retailer Bergdorf Goodman in 1987. It also operates a mail-order business through catalogs.

Neith \'nēt\ Ancient Egyptian goddess, patroness of the city of SAIS in the Nile River delta. Neith was worshiped in predynastic times (c. 3000 BC), and several queens of the 1st dynasty were named after her. She also became an important goddess in the city of MEMPHIS. She was usually depicted as a woman wearing a red crown, holding crossed arrows and a bow. She was the mother of SEBEK and, later, of RE.

Nejd \'nezhd\ *or* **Najd** \'nəzhd\ Region of central SAUDI ARABIA. Comprising a rocky plateau sloping eastward from the mountains of the HEJAZ, it is sparsely settled, except for a few fertile oases. In the mid-18th century it became the centre of the WAHHĀBI, members of a puritanical Islamic movement that by 1803 had expanded into MECCA. Nejd has been under the rule of the SAʿŪD DYNASTY almost continuously since 1824. It was united with the Hejaz and became the independent kingdom of Saudi Arabia in 1932.

Nelson, (John) Byron (b. Feb. 4, 1912, Fort Worth, Texas, U.S.) U.S. golfer. "Lord Byron," as he was known to the golf world, began his career as a caddie at the age of 12 and became a professional golfer in 1932. He won the U.S. Open (1939), the Masters (1937, 1942), and the PGA championship (1940, 1945), setting records in 1945 when he won 18 out of 30 tournaments, 11 in succession.

Nelson, Horatio Nelson, Viscount *known as* **Lord Nelson** (b. Sept. 29, 1758, Burnham Thorpe, Norfolk, Eng.—d. Oct. 21, 1805, at sea, off Cape Trafalgar, Spain) British naval commander. He entered the navy in 1770 and served in the West Indies from 1777 to 1783. In 1793 he was sent to support the British allies against the French in the Mediterranean. After the British victory against the Spanish and French in the Battle of Cape St. Vincent (1797), he was promoted to rear admiral. In 1798 he pursued NAPOLEON's fleet to Egypt, where he won the decisive Battle of the NILE. During a prolonged stay in Naples for his ships' repairs, he pursued a love affair with Emma, Lady HAMILTON. For helping restore the Neapolitan king FERDINAND I to power (1799), he was created duke di Bronte. As second in command of an expedition to attack Denmark, he skillfully won the Battle of COPENHAGEN (1801) and was appointed commander in chief of the navy. In 1805 he was sent to the Mediterranean to meet the threat posed by the French fleet in Napoleon's scheme to invade England. In the ensuing Battle of TRAFALGAR, Nelson, aboard his flagship *Victory*, was shot by a French sniper from the *Redoutable* and died just as the British fleet secured its victory. His death was widely mourned, and he became England's most popular hero. His brilliant tactical command assured British naval supremacy for over 100 years.

Nelson, Willie (b. April 30, 1933, Fort Worth, Texas, U.S.) U.S. COUNTRY MUSIC singer and songwriter. His grandfather taught him to play guitar, and by age 10 he was performing at local dances. After working as a disc jockey, in 1961 he moved to Nashville, Tenn., where he wrote hit songs for dozens of country, rhythm-and-blues, and pop singers; these songs include "Hello Walls," "Night Life," and "Crazy." Returning to Texas, he released the hit album *Red Headed Stranger* (1975); it was followed by *Wanted: The Outlaws*, which outsold every country album that had preceded it, and *Stardust* (1978), with songs by HOAGY CARMICHAEL and IRVING BERLIN. He has recorded with at least 75 other singers, including Waylon Jennings (b. 1937). In the 1980s he organized annual Farm Aid festivals to raise money for farmers. His later albums include the critically acclaimed *Teatro* (1998).

Nelson River River, north-central Manitoba, Canada. Flowing out of northern Lake WINNIPEG into HUDSON BAY, it is 400 mi (644 km) long. It was discovered in 1612 by the English explorer Thomas Button, and a trading post of the HUDSON'S BAY COMPANY was established there c. 1670. Fur traders used the river as an inland route. The Hudson Bay Railway now follows most of the river's course.

Neman \'ne-mən\ **River** *Lithuanian* **Nemunas** \'ne-mü-ˌnäs\ *Belarusian* **Nyoman** River, central Europe. Rising in Belarus, south of MINSK, it flows west into Lithuania and between Lithuania and Kaliningrad province, Russia, to empty into the BALTIC SEA. It is 582 mi (937 km) long and navigable for most of its length. It was known as the Memel River in the former eastern Prussia and as the Russ 22 mi (35 km) from its mouth. It was the scene of many battles between Russian and German forces in World War I.

Nemanja, Stefan See STEFAN NEMANJA

nematode \'ne-mə-ˌtōd\ *or* **roundworm** Any of more than 15,000 named and many more unnamed species of WORMS in the class Nematoda (phylum Aschelminthes). Nematodes include plant and animal parasites and free-living forms found in soil, freshwater, saltwater, and even vinegar and beer malts. They are bilaterally symmetrical and usually tapered at both ends. Some species have separate sexes; others are hermaphroditic. They range from microscopic to about 23 ft (7 m) long. Nematode parasites can occur in almost any body organ but are most common in the digestive, circulatory, or respiratory system. Hookworms, PINWORMS, and EELWORMS are nematodes. See also FILARIAL WORM, GUINEA WORM, TRICHINA.

Nematode (*Ascaris lumbricoides*)
JAVIER PALAUS SOLER—OSTMAN AGENCY

Nemea, Battle of \'nē-mē-ə\ (394 BC) Battle in the Corinthian War (395–387 BC). The conflict took place when a coalition of Greek city-states determined to destroy Sparta's ascendancy after its victory in the PELOPONNESIAN WAR. The outnumbered Spartans were victorious, crushing first the Athenians and then the Thebans, Corinthians, and Argives.

Nemerov \'nem-ər-ˌȯf**, Howard** (b. March 1, 1920, New York, N.Y., U.S.—d. July 5, 1991, University City, near St. Louis, Mo.) U.S. poet. He attended Harvard University and served as a pilot in World War II before teaching at various colleges, including Bennington. His verse, marked by irony and self-deprecatory wit, is often about nature; it appears in several volumes beginning with *The Image and the Law* (1947) and including *Collected Poems* (1977, Pulitzer Prize, National Book Award). His fiction includes *The Homecoming Game* (1957) and *A Commodity of Dreams and Other Stories* (1960). He was poet laureate of the U.S. (1988–90). His sister DIANE ARBUS was a notable photographer.

Nemesis \'ne-mə-səs\ Greek goddess of retribution. In the earliest Greek religion she was worshiped as a fertility goddess. Later legends told how ZEUS, in the form of a swan, coupled with her in the form of a goose. Nemesis then laid the egg from which HELEN of Troy was born (in other versions LEDA was said to be Helen's mother). Nemesis dealt out punishments that expressed the gods' disapproval of human presumption. Her cult was also popular in Rome, particularly among soldiers.

Nemi \'nā-mē**, Lake** *ancient* **Lacus Nemorensis** Crater lake in the Alban Hills, southeast of Rome, Italy. Its area is about 0.67 sq mi (1.7 sq km), and it is 110 ft (34 m) deep. Nearby were a temple and grove sacred to the goddess DIANA. Two ships dating from the reign of CALIGULA were raised from the lake bottom in the 1920s but were burned by the retreating German army in 1944, toward the end of World War II.

Nen River *formerly* **Nonni River** River, northeastern China. It is the main tributary of the SUNGARI (Songhua) River. It rises on the eastern slopes of Da Hinggan Range in northern HEILONGJIANG province and flows south, forming part of the border between Heilongjiang and JILIN provinces and watering the fertile northern section of the Manchurian plain. It is about 740 mi (1,190 km) long and is an important route; much of it is navigable.

nene \'nā-ˌnā\ *or* **Hawaiian goose** Species (*Branta sandvicensis*) of GOOSE, the state bird of Hawaii. A close relative of the CANADA GOOSE, the

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nene is a nonmigratory, nonaquatic species with shortened wings and half-webbed feet. It is about 25 in. (65 cm) long and has a gray-brown barred body and black face. It feeds on berries and grasses on high lava slopes. Predation by introduced mammals (including dogs, cats, pigs, and mongooses) and human hunting had reduced the population to a few small flocks by 1911. It has since been successfully bred in captivity, but flocks released in the wild have failed to form self-sustaining colonies.

Nenni, Pietro (Sandro) (b. Feb. 9, 1891, Faenza, Italy—d. Jan. 1, 1980, Rome) Italian politician. He joined the Italian Socialist Party (PSI) in 1921 and edited its newspaper, *Avanti!* (1922–26). After criticizing the Fascist Party and Benito Mussolini, he was arrested and fled to Paris (1926). In the Spanish Civil War, he cofounded the Garibaldi Brigade. He was imprisoned in Germany and Italy in World War II, then became leader of the PSI; he led the left wing in alliance with the Communist Party until 1956. In 1963 he allied the PSI with the Christian Democrats and served as vice premier in three successive cabinets and as foreign minister (1968–69).

Neo-Confucianism In China, a rationalistic revival of Confucianism in the 11th century that influenced Chinese thought for 800 years. The movement sought to reestablish the supremacy of the Confucian heritage over the increasingly popular Buddhism and Daoism. Its two principal schools of thought were the Lixue (School of Principle), whose chief philosopher was Zhu Xi, and the Xinxue (School of Mind), represented by Lu Xiangshan and Wang Yangming. Neo-Confucianism was introduced into Japan by Zen Buddhists and became the guiding philosophy of the Tokugawa period (1603–1867), providing a heavenly sanction for the existing social order. Its emphasis on classical literature led to renewed interest in the Japanese classics and a revival of Shintō studies.

neo-Darwinism Theory of evolution that represents a synthesis of Charles Darwin's theory in terms of natural selection and modern population genetics. The term was first used after 1896 to describe the theories of August Weismann (1834–1914), who asserted that his germ-plasm theory made impossible the inheritance of acquired characteristics and supported natural selection as the only major process that would account for biological evolution.

Neo-Expressionism Art movement, chiefly of painters, that dominated the European and American art market in the early to mid-1980s. It was controversial both in the quality of its production and in the highly commercialized aspects of its presentation. Its practitioners, including Julian Schnabel and Anselm Kiefer, reacted to the highly intellectualized abstract art of the 1970s by creating dramatic, gestural paintings that incorporated some figurative elements and recognizable symbols. Their art was characterized by a tense yet playful presentation of objects in a "primitivist" manner, vivid colour harmonies, large scale, and a sense of inner tension and alienation. See also Expressionism.

Neo-Impressionism Movement in French painting of the late 19th century, in reaction against the realism of Impressionism. The Neo-Impressionists, led by Georges Seurat and Paul Signac, applied paint to canvas in dots of contrasting pigments, scientifically chosen so that adjacent dots would blend from a distance into a single colour. The technique is known as pointillism. Whereas the Impressionists captured the fugitive effects of colour and light, the Neo-Impressionists crystallized them into immobile monumentality.

Neo-Kantianism Revival of Kantianism in German universities that began c. 1860. At first primarily an epistemological movement, Neo-Kantianism slowly extended over the whole domain of philosophy. The first decisive impetus toward reviving Immanuel Kant's ideas came from natural scientists. Hermann von Helmholtz applied physiological studies of the senses to the question of the epistemological significance of spatial perception raised by *The Critique of Pure Reason* (1781). Neo-Kantianism reached its apex in the early 20th-century Marburg school, which included Hermann Cohen (1842–1918) and Paul Natorp (1854–1924). They repudiated Helmholtz's naturalism and reaffirmed the importance of the transcendental method. Ernst Cassirer, another Marburg-school figure, brought Kantian principles to bear on the whole realm of cultural phenomena. Wilhelm Windelband (1848–1915) and Heinrich Rickert (1863–1936) introduced Kantianism into the philosophy of history. Neo-Kantianism also influenced the phenomenology of Edmund Husserl and of the early works of Martin Heidegger.

Neo-Paganism Any of several movements that attempt to revive the polytheistic religions of Europe and the Middle East. Largely a product of the 1960s, contemporary Neo-Paganism has flourished particularly in the U.S., Britain, and Scandinavia. Its adherents often have deep ecological concerns and an attachment to nature; many worship an earth-mother goddess and center their rituals on the change of the seasons. Since the late 1970s, Neo-Paganism has also attracted feminists open to female personifications of the deity. Major Neo-Pagan groups include the Church of All Worlds, Feraferia, Pagan Way, the Reformed Druids of North America, the Church of the Eternal Source, and the Viking Brotherhood. See also Wicca.

Neo-Thomism \ˌnē-ō-ˈtä-ˌmi-zəm\ Modern revival of the philosophical and theological system developed by St. Thomas Aquinas and his later commentators. Neo-Thomism follows Aquinas in distinguishing between the realms of nature (in which reason and philosophy hold sway) and supernature (in which faith and theology are dominant). Aquinas's thought was presented in philosophy and theology courses or manuals, especially in the Dominican Order, through the 17th and 18th centuries, though most manuals of this period were watered with the opinions of other Schoolmen and remained remote from modern concerns. The modern revival of authentic Thomism began in the 19th century under the influence of the Jesuits and the papacy, who sought a sound philosophical foundation on which to develop responses to contemporary intellectual and social problems. After the mid-20th century neo-Thomists attempted to develop an adequate philosophy of science, to take into account the findings of phenomenology and psychiatry, and to evaluate the ontologies of existentialism and naturalism. See also Jacques Maritain.

Neoclassical architecture Revival of Classical architecture during the 18th and early 19th centuries. The movement concerned itself with the logic of entire Classical volumes, unlike Classical revivalism (see Greek Revival), which tended to reuse Classical parts. Neoclassical architecture is characterized by grandeur of scale; simplicity of geometric forms; Greek, especially Doric (see order), or Roman detail; dramatic use of columns; and a preference for blank walls. The new taste for antique simplicity represented a general reaction to the excesses of the Rococo style. Neoclassicism thrived in the U.S. and Europe, with examples occurring in almost every major city. Russia's Catherine II transformed St. Petersburg into an unparalleled collection of Neoclassical buildings as advanced as any contemporary French and English work. By 1800 nearly all new British architecture reflected the Neoclassical spirit (see Robert Adam; John Soane). France's boldest innovator was Claude-Nicolas Ledoux, who had a central role in the evolution of Neoclassical architecture. In the U.S. Neoclassicism continued to flourish throughout the 19th century, as many architects looked to make the analogy between the young country and imperial Rome when designing major government buildings. The style also spread to colonial Latin America.

Neoclassicism See Classicism and Neoclassicism

neoconservatism U.S. political movement. It originated in the 1960s among conservatives and some liberals who were repelled by or disillusioned with what they viewed as the political and cultural trends of the time, including leftist political radicalism, lack of respect for authority and tradition, and hedonistic and immoral lifestyles. Neoconservatives generally advocate a free-market economy with minimum taxation and government economic regulation; strict limits on government-provided social-welfare programs; and a strong military supported by large defense budgets. Neoconservatives also believe that government policy should respect the importance of traditional institutions such as religion and the family. Unlike most conservatives of earlier generations, neoconservatives maintain that the United States should take an active role in world affairs, though they are generally suspicious of international institutions, such as the United Nations and the World Court, whose authority could intrude upon American sovereignty or limit the country's freedom to act in its own interests. See also conservatism.

neodymium Metallic chemical element, chemical symbol Nd, atomic number 60. Silvery white in colour, it is a rare earth metal and one of the lanthanide series. It is a component of important alloys, among them misch metal (15% neodymium), used in lighter flints and various metallurgical processes. Alloyed with iron and boron, neodymium is the basis for powerful permanent magnets used in computer hard drives, lightweight earphones, and numerous other applications. Neodymium compounds are employed as ceramics glazes. The crude oxide counteracts the greenish cast imparted to glass by iron contaminants, and a very pure oxide is used to make a vivid purple glass. Neodymium is added to glass or other host

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materials to form the active elements for certain solid-state LASERS. Glass containing a mixture of neodymium and praseodymium (another rare earth element) is used in glassblowers' goggles.

neofascism Political philosophy and movement that arose in Europe in the decades following World War II. Like earlier fascist movements, neofascism advocated extreme nationalism, opposed liberal individualism, attacked Marxist and other left-wing ideologies, indulged in racist and xenophobic scapegoating, and promoted populist right-wing economic programs. Unlike the fascists, however, neofascists placed more blame for their countries' problems on non-European immigrants than on leftists and Jews, displayed little interest in taking lebensraum (German: "living space") through the military conquest of other states, and made concerted efforts to portray themselves as democratic and "mainstream." The National Front in France, led by JEAN-MARIE LE PEN, and the Liberal-Democratic Party in Russia, led by Vladimir Zhirinovsky, are often cited as neofascist.

Neolithic \ˌnē-ə-ˈli-thik\ **Period** *or* **New Stone Age** Final stage of technological development or cultural evolution among prehistoric humans. It is characterized by the use of stone tools shaped by polishing or grinding, the domestication of plants or animals, the establishment of permanent villages, and the practice of such crafts as pottery and weaving. The Neolithic followed the PALEOLITHIC PERIOD (and in northwestern Europe the MESOLITHIC) and preceded the BRONZE AGE. Its beginning is associated with the villages that emerged in South Asia c. 9000 BC and flourished in the TIGRIS and EUPHRATES river valleys from c. 7000 BC. Farming spread northward throughout Eurasia, reaching Britain and Scandinavia only after 3000 BC. Neolithic technologies also spread to the Indus River valley of India by 5000 BC and to the Huang Ho valley of China by c. 3500 BC. The term is not applied to the New World, though Neolithic modes of life were achieved independently there by c. 2500 BC.

neon Chemical ELEMENT, chemical symbol Ne, atomic number 10. One of the NOBLE GASES, neon is colourless, odourless, tasteless, and completely unreactive. It occurs in minute amounts in the atmosphere and is obtained by fractional DISTILLATION of liquefied air. When under low pressure, it glows a bright orange-red if an electric current is passed through it. It was discovered in 1898, and since the 1920s its chief use has been in luminous tubes and bulbs.

neoplasm See TUMOR

Neoplatonism Form of PLATONISM developed by PLOTINUS in the 3rd century AD and modified by his successors. It came to dominate the Greek philosophical schools and remained predominant until the teaching of philosophy by pagans ended in the late 6th century. It postulated an all-sufficient unity, the One, from which emanated the Divine Mind, or LOGOS, and below that, the World Soul. Those transcendent realities were thought to support the visible world. All things emanated from the One, and individual souls could rise to mystical union with the One through contemplation. Though Plotinus's thought in some respects resembles GNOSTICISM, he was passionately opposed to that doctrine.

neoprene \ˈnē-ə-ˌprēn\ Any of a class of elastomers (rubberlike synthetic organic compounds of high molecular weight) made by POLYMERIZATION of the MONOMER 2-chloro-1,3-butadiene and vulcanized (cross-linked, like RUBBER), by sulfur, metallic oxides, or other agents. These synthetic rubbers, discovered in 1931 (see W.H. CAROTHERS), are generally too expensive to use in making tires, but their resistance to chemicals and oxidation (see OXIDATION-REDUCTION) makes them valuable in specialized applications, including shoe soles, hoses, adhesives, gaskets, seals, and foamed articles.

Neorealism *or* **neorealismo** Italian aesthetic movement that flourished especially after World War II. It sought to deal realistically with the events leading up to the war and with their resulting social problems. Rooted in the 1920s, it was similar to the *verismo* ("realism") movement, from which it originated, but differed in that its upsurge resulted from the intense feelings inspired by fascist repression, the Resistance, and the war. Neorealist writers include ITALO CALVINO, ALBERTO MORAVIA, and CESARE PAVESE. During the fascist years many Neorealist writers went into hiding, were imprisoned or exiled, or joined the Resistance. The movement reemerged in full strength after the war. Neorealism in film embraced a documentary-like objectivity; actors were often amateurs, and the action centred on commonplace situations. Often crudely and hastily made, Neorealist productions stood in stark contrast to traditional escapist feature films. Two notable examples of Neorealist films are ROBERTO ROSSELLINI's *Open City* (1945) and VITTORIO DE SICA's *The Bicycle Thief* (1948).

Neosho \nē-ˈō-shō\ **River** *or* **Grand River** River, southeastern Kansas and northeastern Oklahoma, U.S. It rises in east-central Kansas and flows into Oklahoma, where it is also known as the Grand, to join the ARKANSAS RIVER near Fort Gibson. It flows about 460 mi (740 km). Neosho is an OSAGE Indian word meaning "clear and abundant water." The crossing of the river at Council Grove was a starting point for the SANTA FE TRAIL.

Nepal \nə-ˈpȯl\ *officially* **Kingdom of Nepal** Country, southern Asia. Area: 56,827 sq mi (147,181 sq km). Population (2005 est.): 27,133,000. Capital: KATHMANDU. Most of the people are Nepalese of Indo-

Aryan ancestry; there is a significant minority of Tibeto-Nepalese peoples. Languages: Nepali (official), English, various others. Religions: Hinduism (official); also Buddhism, Islam. Currency: Nepalese rupee. Nepal contains some of the most rugged mountainous terrain in the world. The Great HIMALAYAS, including Mount EVEREST, are in its central and northern parts. As a result of its years of geographic and self-imposed isolation, it is one of the world's least-developed countries. Its market economy is mostly based on agriculture, including livestock raising; tourism is also important. Nepal is a constitutional monarchy with a bicameral parliament; its chief of state is the king, and the head of government is the prime minister. The region developed under early Buddhist influence, and dynastic rule dates from about the 4th century AD. It was formed into a single kingdom in 1769 and fought border wars with China, Tibet, and British India in the 18th–19th centuries. Its independence was recognized by Britain in 1923. A new constitution in 1990 restricted royal authority and accepted a democratically elected parliamentary government. Nepal signed trade agreements with India in 1997. The country was stunned in 2001 when the crown prince killed most members of the royal family, including himself.

nepheline \ˈne-fə-ˌlēn\ *or* **nephelite** Most common FELDSPATHOID mineral, an aluminosilicate of sodium and potassium ($Na_3KAl_4Si_4O_{16}$). It is sometimes used as a substitute for feldspars in the manufacture of glass and ceramics.

nepheline syenite \ˈsī-ə-ˌnīt\ Medium- to coarse-grained IGNEOUS ROCK, a member of the alkali-syenite group, which consists largely of feldspar and nepheline. Nepheline syenite from Canada is used to replace feldspar in the manufacture of ceramic and glass products.

nephrite \ˈne-ˌfrīt\ Gem-quality, usually green SILICATE MINERAL in the tremolite-actinolite-ferrotremolite series of AMPHIBOLES. It is the less prized

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but more common of the two types of JADE and may be distinguished from JADEITE by its splintery fracture and oily lustre. Nephrite occurs in low-grade (formed under low-temperature, low-pressure conditions), regionally metamorphosed rocks. Important deposits occur in China, Siberia, New Zealand, Switzerland, Alaska, and Wyoming.

nephritis \ni-'frī-təs\ INFLAMMATION of the kidneys. There are numerous kinds, involving different kidney tissues. The most common type is BRIGHT DISEASE. Symptoms vary with the type of nephritis; severe cases can result in KIDNEY FAILURE. Causes include infection, ALLERGY or AUTOIMMUNE DISEASE, blockage in the URINARY SYSTEM, and hereditary diseases. Treatment addresses the cause where possible.

nephrology \ni-'frä-lə-jē\ Branch of medicine dealing with KIDNEY function and diseases. An understanding of kidney physiology is important not only in treating kidney disease but in knowing the effect of drugs, diet, and HYPERTENSION on kidney disease, and vice versa. The first scientific observations of the kidney were made in the mid-17th century by Lorenzo Bellini (1643–1704) and MARCELLO MALPIGHI; CARL LUDWIG was the first to elaborate on their true physiological function (1844). A key development in nephrology was the permanent arteriovenous shunt (1960), which made repeated hemodialysis feasible, instantly changing the outlook for chronic-renal-disease patients from certain death to 90% survival. See also DIALYSIS, KIDNEY FAILURE, KIDNEY STONE, KIDNEY TRANSPLANT, NEPHRON.

nephron Functional unit of the KIDNEY that removes waste and excess substances from the blood to produce URINE. Each of the million or so nephrons in each kidney is a tubule 1.2–2.2 in. (30–55 mm) long. At one end it is closed, expanded, and folded into a double-walled cuplike structure (Bowman's capsule) enclosing a cluster of CAPILLARIES (glomerulus). Fluid forced out of the blood through the capillary walls of the glomerulus into Bowman's capsule flows into the adjacent renal tubule, where water and nutrients are selectively reabsorbed from the fluid back into the blood, and ELECTROLYTES such as sodium and potassium are balanced in several distinct sections along its length. The final concentrated product is urine. See also URINARY SYSTEM.

Neptune Eighth PLANET from the Sun, discovered in 1846 and named for the Roman god of the sea. It has an average distance from the Sun of 2.8 billion mi (4.5 billion km), taking nearly 164 years to complete one orbit and rotating every 16.11 hours. Neptune has more than 17 times Earth's mass, 58 times its volume, and 12% stronger gravity at the top of its atmosphere. It has an equatorial diameter of 30,775 mi (49,528 km). Neptune consists largely of hydrogen and helium. It has no solid surface; its interior is believed to consist of a fluid mixture of rock, ices, and gas. Its atmosphere contains substantial amounts of methane gas, whose absorption of red light causes Neptune's deep blue-green colour. The VOYAGER 2 space probe in 1989 discovered winds of over 1,570 mi/hour (700 m/second), the fastest known for any of the Sun's planets, and dark spots that appear to be storms similar to Jupiter's GREAT RED SPOT. Neptune receives little solar radiation, but it radiates substantially more energy than it receives, which indicates an internal heat source. Neptune's weak magnetic field traps charged particles in a belt around the planet. Neptune has a system of rings, made up largely of dust-size particles, and at least 13 moons; the largest is TRITON, almost as big as Earth's Moon.

Neptune holding his trident, classical sculpture; in the Lateran Museum, Rome
ALINARI—ART RESOURCE

Neptune In ROMAN RELIGION, the god of water. Neptune was originally the god of fresh water, but by 399 BC he was identified with the Greek god POSEIDON and thus became a deity of the sea. His female counterpart, Salacia, probably began as a goddess of spring water but was later equated with the Greek goddess Amphitrite. Neptune's festival (Neptunalia) took place in the heat of summer (July 23), when fresh water was scarcest. In art Neptune is often given Poseidon's attributes, the trident and dolphin.

Nerbudda River See NARMADA RIVER

Nerchinsk, Treaty of (1689) Peace settlement between Russia and QING-DYNASTY China that checked Russia's eastward expansion. Russia lost easy access to the Sea of Okhotsk but gained the right of passage to Beijing for its trade caravans. The treaty also gained China's implied recognition of Russia as a state of equal status, something other European countries could not accomplish. The Nerchinsk treaty was the basis of Russo-Chinese relations until 1858–60.

Nereid \'nir-ē-əd\ In GREEK MYTHOLOGY, any of the daughters of the sea god NEREUS and of Doris, daughter of Oceanus. The Nereids, who numbered 50 or 100, were depicted as young girls who inhabited any water, salt or fresh, and were benign toward humanity. They were popular figures in Greek literature. The best known were Amphitrite, consort of POSEIDON; THETIS, wife of Peleus (king of the Myrmidons) and mother of ACHILLES; and Galatea, a Sicilian loved by the Cyclops POLYPHEMUS.

Nereus \'nir-ē-əs\ Greek sea god. The son of Pontus (a personification of the sea) and GAEA, he was noted for his gift of prophecy and his ability to change his shape. He lived at the bottom of the sea with his daughters, the NEREIDS. HERACLES wrestled with him in a variety of shapes in order to gain his advice about recovering the golden apples of the Hesperides.

Nereus struggling with Heracles, detail from a Greek water jar found at Vulci, c. 490 BC; in the British Museum
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Nergal In MESOPOTAMIAN RELIGION, a secondary god of the Sumero-Akkadian pantheon. He was identified with Irra, the god of scorched earth and war, and with Meslamtaea. The city of Cuthah was the center of his cult. In the 1st millennium BC he was described as a benefactor who hears prayers, restores the dead to life, and protects agriculture and flocks. Later he was called a "destroying flame" and was depicted as a god of pestilence, hunger, and devastation. The other sphere of Nergal's power was the underworld, where he ruled as king and where the goddess Ereshkigal was his queen.

Neri \'nā-rē**, Saint Philip** (b. July 21, 1515, Florence—d. May 26, 1595, Rome; canonized 1622; feast day May 26) Roman Catholic mystic. He went to Rome to pursue religious studies in 1533. In 1548 he cofounded a society of laymen dedicated to the care of pilgrims, the poor, and the sick. After his ordination in 1551 he moved to the community of San Girolamo della Carità in Rome. From 1564 to 1575 he was rector of the church of San Giovanni, and in 1575 GREGORY XIII granted him Santa Maria in Vallicella, where he established his Congregation of the Oratory, a group of priests and clerics engaged in devotion and charitable activities. One of the outstanding mystics of the Counter-Reformation, he was noted for his eloquence as a preacher.

Nernst \'nernst**, Walther Hermann** (b. June 25, 1864, Briesen, Prussia—d. Nov. 18, 1941, Muskau, Ger.) German scientist, one of the founders of modern PHYSICAL CHEMISTRY. He taught at the Universities of Göttingen and Berlin until forced to retire in 1933 by the Nazi regime. Nernst's researches on the theory of electric cells (see BATTERY), the thermodynamics of chemical EQUILIBRIUM, the properties of vapours at high temperatures and of solids at low temperatures, and the mechanism of photochemistry have had important applications. His formulation of the third law of THERMODYNAMICS gained him a 1920 Nobel Prize. He also invented an improved electric light and an electronically amplified piano.

Nero *in full* **Nero Claudius Caesar Augustus (or Drusus) Germanicus** *orig.* **Lucius Domitius Ahenobarbus** (b. Dec. 15, AD 37, Antium, Latium—d. June 9, 68, Rome) Roman emperor (54–68). He was adopted by CLAUDIUS when the emperor married Nero's mother, AGRIPPINA THE YOUNGER, and took the throne after Claudius died. He was guided by his tutor, SENECA, and by Agrippina until he murdered her and broke free of his advisers. By respecting the Senate and leaving imperial administration alone, he became popular in the east, but BOUDICCA's revolt in Britain (61), unemployment, and contempt for his frivolousness and excesses caused dissatisfaction. In 64 a fire, possibly lit at his orders,

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destroyed much of Rome; he persecuted the Christians as scapegoats and proceeded to build a garish palace, the Domus Aurea, on lands that had been privately held. With his reign in decline, he murdered his wife, Octavia, as well as her successor, Poppaea, ordered Seneca to kill himself, and executed senators who criticized him. Revolts in Gaul and Spain were led by Galba, who was declared emperor by his army. Nero came to be regarded as mad, giving public lyre and theatrical performances to the disgust of his subjects. Condemned by the Senate, he chose suicide over execution.

Nero, portrait bust; in the Roman National Museum, Rome.
ANDERSON—ALINARI FROM ART RESOURCE

Nerses \'ner-sēz\ **I the Great, Saint** (b. c. 310—d. 373?; feast day, February 19) Patriarch of the Armenian church from c. 353. A descendant of St. Gregory the Illuminator (240–332), Nerses became the most important figure in Armenia during his patriarchate, establishing monastic and charitable institutions and schools. He was a supporter of King Pap of Armenia but broke with him over his fostering of religious ties with the court of Constantinople, which led to Pap's instigating the murder of Nerses.

Nerthus \'ner-thùs\ Ancient Germanic goddess. Tacitus refers to her as Mother Earth and says she was worshiped by seven tribes. Her worship centered on a temple in a sacred grove on an island in the Baltic Sea. She was believed to enjoy visiting her people. Her presence was discerned by her priest, and while she was among them her people lived in peace. Her identification with the god Njörd suggests that she may have been a hermaphrodite.

Neruda \nā-'rü-thä**, Pablo** *orig.* **Neftalí Ricardo Reyes Basoalto** (b. July 12, 1904, Parral, Chile—d. Sept. 23, 1973, Santiago) Chilean poet and diplomat. He began writing poetry at age 10, and at 20 he published his most widely read work, *Twenty Love Poems and a Song of Despair* (1924), inspired by an unhappy love affair. In 1927 he was named an honorary consul, and he later represented Chile in several Asian and Latin American countries; late in life he was ambassador to France. While in Asia he began *Residence on Earth* (1933, 1935, 1947), a verse cycle remarkable for its examination of social decay and personal isolation. In 1945 he was elected senator and joined the Communist Party; he later spent years in exile when the government turned toward the right. *Canto General* (1950), his great epic poem about the American continents, was deeply influenced by Walt Whitman and is the culminating expression of his political beliefs. *Elemental Odes* (1954) celebrates common, everyday objects. He was awarded the Nobel Prize for Literature in 1971.

Pablo Neruda.
CAMERA PRESS

Nerva \'nər-və\ *in full* **Nerva Caesar Augustus** *orig.* **Marcus Cocceius Nerva** (b. c. AD 35—d. Jan. 28, 98) Roman emperor (96–98), first of the Five Good Emperors. A member of a distinguished senatorial family, Nerva served twice as consul (71, 90). After an undistinguished career, he was chosen to succeed Domitian because of his age, dignity, and lack of children who would succeed him. He rejected Domitian's autocratic tyranny but completed Domitian's building projects and instituted his administrative and financial reforms. He adopted Trajan as his heir.

nerve See neuron

nerve gas Weapon of chemical warfare that affects the transmission of nerve impulses through the nervous system. The organophosphorus nerve agents Tabun, Sarin, and Soman were developed by Germany during World War II but not used. They and a newer agent, VX, were produced in huge quantities by the U.S. and Soviet Union during the Cold War; their stockpiling and use during war are now banned by the Chemical Weapons Convention of 1993. A single droplet of VX or Sarin, if inhaled or in contact with the skin, can be absorbed into the bloodstream and paralyze the nervous system, leading to respiratory failure and immediate death. Sarin was used in 1995 in a lethal attack in the Tokyo subways by members of Aum Shinrikyo.

Nervi \'ner-vē**, Pier Luigi** (b. June 21, 1891, Sondrio, Italy—d. Jan. 9, 1979, Rome) Italian engineer and building contractor. He became internationally renowned for his invention of ferro-cement, a material of his own invention composed of dense concrete heavily reinforced with evenly distributed steel mesh that together give it both lightness and strength. His first significant projects included a series of airplane hangars in Italy (1935–41) conceived as concrete vaults with huge spans. In addition to designing buildings, he succeeded in building a sailboat with a ferro-cement hull only 0.5 in. (1.25 cm) thick. Ferro-cement was vital to his complex for the Turin Exhibition (1949–50), a prefabricated, corrugated cylindrical 309-ft (93-m) arch. Nervi worked on the UNESCO headquarters in Paris (1950) with Marcel Breuer and helped design Italy's first skyscraper, the Pirelli Building in Milan (1955–59). Although Nervi's primary concern was never aesthetic, many of his works nonetheless achieved remarkable expressive force.

nervous system System of specialized cells (neurons, or nerve cells) that conduct stimuli from a sensory receptor through a neuron network to the site (e.g., a gland or muscle) where the response occurs. In humans, it consists of the central and peripheral nervous systems, the former consisting of the brain and spinal cord and the latter of the nerves, which carry impulses to and from the central nervous system. The cranial nerves handle head and neck sensory and motor activities, except the vagus nerve, which conducts signals to visceral organs. Each spinal nerve is attached to the spinal cord by a sensory and a motor root. These exit between the vertebrae and merge to form a large mixed nerve, which branches to supply a defined area of the body. Disorders include amyotrophic lateral sclerosis, chorea, epilepsy, myasthenia gravis, neural tube defect, parkinsonism, and poliomyelitis. Effects of disorders range from transient tics and minor personality changes to major personality disruptions, seizures, paralysis, and death.

Nesiotes See Critius and Nesiotes

Ness, Eliot (b. April 19, 1903, Chicago—d. May 7, 1957, Coudersport, Pa.) U.S. law-enforcement official. He was 26 years old when he was hired as a special agent of the U.S. Department of Justice to head its Chicago Prohibition bureau, with the express purpose of breaking up the bootlegging network of Al Capone. He formed a nine-man team of extremely dedicated and unbribable officers, "the Untouchables"; the evidence they collected helped send Capone to prison for income-tax evasion in 1931. After Prohibition was ended in 1933, Ness headed the alcohol-tax unit of the U.S. Treasury department (1933–35); he was later director of public safety in Cleveland (1935–41) and director of a division of the Federal Security Agency (1941–45).

Ness, Loch Lake, Highland council area, Scotland. It is 788 ft (240 m) deep and about 23 mi (36 km) long and has the largest volume of fresh water in Britain. It forms part of the Caledonian Canal system developed by Thomas Telford. On its shores are remains of two fortresses. Surface oscillations, or seiches, caused by differential heating, are common. Reports of an aquatic monster inhabiting Loch Ness date back centuries but remain unproved.

Nesselrode \nyis-syil^{y}-'rōd-yi,\ *English* \'ne-səl-ˌrōd**, Karl (Robert Vasilyevich), Count** (b. Dec. 13, 1780, Lisbon, Port.—d. March 23, 1862, St. Petersburg, Russia) Russian statesman. After serving in the Russian diplomatic service, he acted as minister of foreign affairs (1822–56) and as chancellor (1845–62). He sought to influence the Ottoman Empire with the Treaty of Hünkâr İskelesi (1833) and the Straits Convention (1841). He supported aid to Austria in suppressing the Hungarian uprising (1848). His policy of promoting Russia's influence in the Balkans helped precipitate the Crimean War. He negotiated the subsequent treaty at the Congress of Paris.

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nest Structure built by an animal as a permanent home or for bearing and rearing offspring. The social insects build systems of chambers and tunnels, above or below ground. Fishes' nests vary from shallow depressions in sand to enclosed structures constructed of vegetation. Certain frog species build mud-basin nests or floating masses of hardened froth. Alligators use mud and vegetation and cobras use leaves and forest litter to build a nest for their eggs. The most common type of bird nest is a cup-shaped or domed structure of twigs, leaves, mud, and feathers. Many mammals, especially small ones, build nests in trees, on the ground, or in burrows.

Nest of the American robin.
JEFF FOOTT/BRUCE COLEMAN INC.

Nestlé SA Multinational manufacturer of food products. Headquartered in Vevey, Switz., it operates branches and subsidiaries in more than 70 countries. Its products include condensed and powdered milk, baby foods, chocolate, cheese, instant coffee and tea, condiments, and frozen foods. Its history dates to 1866, when two Swiss firms were established, the Anglo-Swiss Condensed Milk Co. and a company founded by Henri Nestlé to manufacture the first infant formula. In 1905 they merged to become the Nestlé and Anglo-Swiss Condensed Milk Co. Nestlé created the first milk chocolate and in 1937 the first instant coffee, which it produced under the name Nescafé. It acquired various other firms, including Crosse & Blackwell in 1960, Stouffer Corp. in 1973, Carnation Co. in 1984, and Ralston Purina pet foods in 2001. Acquisitions have helped the company maintain its ranking as the world's largest food company. Nestlé adopted its present name in 1977.

Nestor In Greek legend, the king of Pylos in Elis. All his brothers were killed by Heracles, but Nestor survived. In Homer's *Iliad* he appeared as an elder statesman who entertained the warriors with tales of his youthful exploits. He brought 90 ships to aid the Greeks in their war against Troy. When, at the war's end, the Greeks sailed for home, Nestor went in a different direction and missed the storm Athena sent to disperse their ships. In the *Odyssey* Telemachus, son of Odysseus, came to Elis looking for his father, and Nestor entertained him.

Nestorian Member of a Christian sect that originated in Asia Minor and Syria in the 5th century AD, inspired by the views of Nestorius. Nestorians stressed the independence of Christ's divine and human natures. Nestorian scholars played a prominent role in the formation of Arab culture after the Arab conquest of Persia; Nestorianism also spread to India, China, Egypt, and Central Asia, where certain tribes were almost entirely converted. Today the Nestorians are represented by the Church of the East, or Persian church, usually referred to in the West as the Assyrian or Nestorian church. Most of its members, who number more than 200,000, live in Iraq, Syria, and Iran.

Nestorius (b. 4th century, Germanicia, Syria Euphratensis, Asia Minor—d. c. 451, Panopolis, Egypt) Founder of Nestorian Christianity. Born of Persian parents, he studied in Antioch and was ordained a priest. As bishop of Constantinople from 428, he aroused controversy when he objected to Cyril of Alexandria's granting Mary the title of Theotokos ("God-Bearer"), which he believed compromised Christ's full humanity. In 431 the Council of Ephesus condemned his teaching as heresy on the ground that he denied the reality of Christ's incarnation, and Nestorius went into exile, first in the Libyan desert and then in Upper Egypt. Nestorianism was adopted by the Persian church, whose members still adhere to his ideas.

Néstos River *or* **Mesta River** River, southwestern Bulgaria and northeastern Greece. It rises in the northwestern Rhodope Mountains and flows southeast for 150 mi (240 km) into the northern Aegean Sea opposite the island of Thásos. As it crosses the Bulgarian frontier into Greece, it divides Macedonia from Thrace.

Netherlands, Austrian See Austrian Netherlands

Netherlands, Republic of the United See Dutch Republic

Netherlands, Spanish See Spanish Netherlands

Netherlands, The *officially* **Kingdom of The Netherlands** *byname* **Holland** Country, northwestern Europe. Area: 16,034 sq mi (41,528 sq km). Population (2005 est.): 16,300,000. Capital: Amsterdam.

Seat of government: The Hague. Most of the people are Dutch. Languages: Dutch (official), English. Religions: Christianity (Roman Catholic, Protestant); also Islam. Currency: euro. The Netherlands' southern and eastern region consists mostly of plains and a few high ridges; its western and northern region is lower and includes polders on the site of the Zuiderzee and the common delta of the Rhine, Meuse, and Schelde rivers. Coastal areas are almost completely below sea level and are protected by dunes and artificial dikes. Although densely populated, the country has a low birthrate. Its developed market economy is based largely on financial services, light and heavy industries, and trade. It is a constitutional monarchy with a parliament comprising two legislative houses; its chief of state is the monarch, and the head of government is the prime minister. Celtic and Germanic tribes inhabited the region at the time of the Roman conquest. Under the Romans trade and industry flourished, but by the mid-3rd century AD Roman power had waned, eroded by resurgent Germanic tribes and the encroachment of the sea. A Germanic invasion (406–407) ended Roman control. The Merovingian dynasty followed the Romans but was supplanted in the 7th century by the Carolingian dynasty, which converted the area to Christianity. After Charlemagne's death in 814, the area was increasingly the target of Viking attacks. It became part of the medieval kingdom of Lotharingia (see Lorraine), which avoided incorporation into the Holy Roman Empire by investing its bishops and abbots with secular powers, leading to the establishment of an Imperial Church. Beginning in the 12th century, much land was reclaimed from the sea as dike building occurred on a large scale; Flanders developed as a textiles centre. The dukes of Burgundy gained control in the late 14th century. By the early 16th century the Low Countries came to be ruled by the Spanish Habsburgs. The Dutch had taken the lead in fishing and shipbuilding, which laid the foundation for Holland's remarkable 17th-century prosperity. Culturally, this was the period of Jan van Eyck, Thomas à Kempis, and Desiderius Erasmus. Calvinism and Anabaptist doctrines attracted many followers. In 1581 the seven northern provinces, led by Calvinists, declared their independence from Spain, and in 1648, following the Thirty Years' War, Spain recognized Dutch independence. The 17th century was the golden age of Dutch civilization. Benedict de Spinoza and René Descartes enjoyed the intellectual freedom, and Rembrandt and Johannes Vermeer painted their masterpieces. The Dutch East India Co.

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secured Asian colonies, and the country's standard of living soared. In the 18th century Dutch maritime power declined; the region was conquered by the French during the French revolutionary wars and became the Kingdom of Holland under Napoleon (1806). The Netherlands remained neutral in World War I and declared neutrality in World War II but was occupied by Germany. After the war it lost the Netherlands Indies (Indonesia from 1949) and Netherlands New Guinea (in 1962; now Irian Jaya). It joined NATO in 1949 and was a founding member of the European Economic Community (later renamed the European Community and now embedded in the European Union). At the outset of the 21st century The Netherlands benefitted from a strong, highly regulated mixed economy but struggled with the social and economic challenges of immigration.

Netherlands Antilles \an-'ti-lēz\ *formerly* **Curaçao** \ˌkůr-ə-'sō, ˌkyůr-ə-'saů\ Nonmetropolitan island territory of The Netherlands (pop., 2005 est.: 183,000), in the Caribbean Sea. Area: 308 sq mi (800 sq km). It consists of two widely separated groups of islands: Sint Eustatius, the southern section of St. Martin, and Saba making up the northern group, at the northern end of the Leeward Islands; and Curaçao and Bonaire (and also Aruba until 1986) constituting the southern group, about 500 mi (800 km) to the southwest, off the coast of Venezuela. The capital, on Curaçao, is Willemstad. Originally inhabited by Arawak and Carib Indians, the islands were encountered in the late 15th century and claimed for Spain. In the 17th century the Dutch gained control, and in 1845 the islands became the Netherlands Antilles. In 1954 they became an integral part of The Netherlands, with full autonomy in domestic affairs. Aruba seceded from the federation in 1986.

Neto \'nā-tü**, (Antônio) Agostinho** (b. Sept. 17, 1922, Icolo e Bengo, Angola—d. Sept. 10, 1979, Moscow, Russia, U.S.S.R.) Poet, physician, and first president of Angola. In 1948 Neto joined a movement aimed at rediscovering indigenous Angolan culture. He studied medicine in Lisbon and returned to Angola in 1959 as a doctor. In 1960 he was arrested in the presence of his patients by colonial authorities, who opened fire when the patients protested. He was imprisoned in Portugal for two years before escaping to join the Marxist Movimento Popular de Libertação de Angola (MPLA), whose president he became in 1962. When Angola became independent in 1975, he was proclaimed president, though he never controlled all the country's territory (see Jonas M. Savimbi). His poems were widely recognized in the Portuguese-speaking world.

nettle family Family Urticaceae, composed of about 45 genera of herbaceous plants, shrubs, small trees, and a few vines, found mostly in tropical regions. Many species, especially the nettles (*Urtica*) and Australian nettle trees (*Laportea*), have on their stems and leaves stinging hairs that break the skin and release a fluid that irritates it for hours. Ornamental species include artillery plant (*Pilea microphylla*) and baby tears (*Helxine soleiroli*), both creeping plants. The trumpet tree (*Cecropia peltata*), a species of the New World tropics, has hollow stems that are inhabited by biting ants. Ramie, or China grass (*Boehmeria nivea*), produces a valuable fibre. Some nettles can be cooked and eaten.

network In broadcasting, a radio or television company that produces programs for broadcast to member stations. See ABC, CBS, CNN, NBC, PBS.

network, computer Two or more computers and peripheral equipment (e.g., printers) that are connected with one another for the purpose of exchanging data electronically. Two basic network types are local area networks (LANs) and wide-area networks. Wide-area networks connect computers and smaller networks to larger networks over greater geographical areas, including different continents. Communications may occur over cables, fibre optics, or satellites, but most computer users access the network with a modem, using telephone lines. The largest wide-area network is the Internet. In the 1990s the World Wide Web was introduced and became the most popular way to access other Internet sites.

network, neural See neural network

Netzahualcóyotl \nā-ˌtsä-wäl-'kō-ˌyō-tᵊl\ City (pop., 2000: 1,225,083), central Mexico. It is a suburb of Mexico City and is one of Mexico's largest municipalities. Settlement began just after 1900, when Lake Texcoco was reduced in size and large areas of land were uncovered along the southern shore. To the north is Xochiaca Dam (built 1946), which protects the city from floods.

Neubrandenburg \'nȯi-ˌbrän-dən-ˌbůrk\ City (pop., 2002 est.: 71,723), northeastern Germany, near the northern end of Tollense Lake. It was founded in 1248 as a fortified outpost, became part of Mecklenburg in about 1300, and prospered from its weaving industry and as a market centre. In the 17th–19th centuries it was plundered during the Thirty Years' War, devastated by fire, and battered by the Napoleonic Wars. Its medieval fortifications are well preserved, but most of its buildings were destroyed by bombing in World War II. Much rebuilt after 1952, it has engineering, food-processing, and chemical industries.

Neuchâtel, Lake \ˌnœ̄-shä-'tel\ Lake, western Switzerland. With an area of 84 sq mi (218 sq km), it is the largest lake entirely within Switzerland. It is a survivor of a former glacial lake in the lower Aare valley, at the base of the Jura Mountains. On the northern shore is La Tène, a prehistoric site, which dates to the late Iron Age culture.

Neue Sachlichkeit \ˌnȯi-ə-'zäk̲-li̲k̲-ˌkīt\ *German* **"New Objectivity"** Movement in German painting of the 1920s and early 1930s reflecting the cynicism and resignation of the post-World War I period. The term was coined in 1925 by Gustav Hartlaub, director of the Mannheim Kunsthalle, for an exhibition including works by George Grosz, Otto Dix, and Max Beckmann, the movement's leading exponents. They worked in a realistic style, as opposed to the prevailing styles of abstraction and Expressionism, using meticulous detail to portray evil in smooth, cold, and static images derived from Italian Metaphysical painting for the purpose of violent social satire. The movement ended in the 1930s with the rise of Nazism.

Neue Zürcher Zeitung \'nȯi-ə-'tsůr-k̲ər-'tsī-tůŋ\ *German* **"New Zürich Newspaper"** Daily newspaper published in Zürich, Switz., generally considered one of the world's great newspapers. Founded as the weekly *Zürcher Zeitung* in 1780, it took its present name in 1821. In 1868 it became a joint-stock company, with shares held by Zürich citizens. Two daily editions were published by 1869, and three by 1894. From its founding it has appealed to readers interested in deep coverage of international news. Austere in demeanour, it is characterized by careful, nonsensational reporting, highly informed and extremely thorough analysis, and background information supplied as context for every major story.

Neuilly \nœ̄-'yē**, Treaty of** (November 27, 1919) Peace treaty between Bulgaria and the Allied Powers after World War I, signed at Neuilly-sur-Seine, France. Bulgaria was forced to reduce its army to 20,000 men, cede lands to Yugoslavia and Greece that involved the transfer of 300,000 people, and pay reparations to the Allies.

Neumann \'nȯi-ˌmän**, (Johann) Balthasar** (b. 1687, Eger, Bohemia, Austrian Habsburg domain—d. Aug. 19, 1753, Würzburg) German architect. Born in Bohemia, Neumann moved to Würzburg in 1711. In 1719 he began work on a new palace for the prince-bishop, Johann Philipp Franz von Schönborn, that was especially noted for its grand staircase. Friedrich Karl von Schönborn, who was elected prince-bishop of Würzburg in 1729, went on to became Neumann's greatest patron, putting Neumann in charge of all major building projects in Würzburg and Bamberg, including palaces, public buildings, bridges, a water system, and many churches. One of Neumann's best works was the pilgrimage church at Vierzehnheiligen (1743–53). A master of the late Baroque style, he made ingenious use of domes and barrel vaults to create sequences of round and oval spaces possessing an airy elegance lit by huge windows; the lively interplay of these elements was accented by lavish use of decorative plasterwork, gilding, statuary, and murals.

Neumann, John von See John von Neumann

neural network Type of parallel computation in which computing elements are modeled on the network of neurons that constitute animal nervous systems. This model, intended to simulate the way the brain processes information, enables the computer to "learn" to a certain degree. A neural network typically consists of a number of interconnected processors, or nodes. Each handles a designated sphere of knowledge, and has several inputs and one output to the network. Based on the inputs it gets, a node can "learn" about the relationships between sets of data, sometimes using the principles of fuzzy logic. For example, a backgammon program can store and grade results from moves in a game; in the next game, it can play a move based on its stored result and can regrade the stored result if the move is unsuccessful. Neural networks have been used in pattern recognition, speech analysis, oil exploration, weather prediction, and the modeling of thinking and consciousness.

neural tube defect Congenital defect of the brain or spinal cord from abnormal growth of their precursor, the neural tube (see embryology), usu-

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ally with spine or skull defects. The tube may fail to close properly, have parts missing, or have a blockage (see HYDROCEPHALUS). In spina bifida, vertebrae are open over the back of the spinal cord, usually at the base. This may not affect function if no further defects (local absence of skin or MENINGES, protrusion of tissue, defect opening into the spinal cord) exist. The more serious forms can cause paralysis and impair bladder and bowel function. In encephalocele, a meningeal sac containing brain tissue protrudes from the skull. The effects depend on the amount of tissue involved. Adequate folic-acid intake by women of childbearing age reduces the risk of neural tube defects. Early surgery can prevent or minimize disability.

neuralgia \nyù-'ral-jə\ Pain of unknown cause in the area covered by a peripheral sensory nerve. In trigeminal neuralgia (tic douloureux), brief attacks of severe shooting pain along a branch of the trigeminal nerve (in front of the ear) usually begin after middle age, more often in women. Initially weeks or months apart, they become more frequent and easily triggered by touching the affected area, talking, eating, or cold. Analgesics help, but permanent cure requires surgery. Glossopharyngeal neuralgia causes recurring severe pain, most often in men over 40. Excruciating pains begin in the throat and radiate to the ears or down the neck, with or without a trigger (e.g., sneezing, yawning, chewing). Usually separated by long intervals, attacks subside before analgesics take effect. Surgery may help in extreme cases. See also NEURITIS.

Neurath \'nói-rät**, Konstantin, baron von** (b. Feb. 2, 1873, Klein-Glattbach, Ger.—d. Aug. 14, 1956, Enzweihingen, W.Ger.) German diplomat. He entered the diplomatic service in 1903 and served as minister to Denmark (1919–22), ambassador to Italy (1922–30), and ambassador to Britain (1930–32). As Germany's foreign minister (1932–38), he lent respectability to ADOLF HITLER's expansionist foreign policy. As "protector" of Bohemia and Moravia (1939–41), he was accused of being too lenient and was replaced by REINHARD HEYDRICH. After World War II, he was tried and imprisoned for war crimes (1946–54).

neuritis \nyù-'rī-təs\ INFLAMMATION of one or several nerves. The cause may be mechanical, vascular, allergic, toxic, metabolic, or viral. Symptoms—tingling, burning, or stabbing pains with sensory nerves and anything from muscle weakness to paralysis with motor nerves—are usually confined to the part of the body served by the inflamed nerve. In Bell palsy, facial nerve inflammation causes a characteristic facial muscle distortion. Analgesics can relieve the pain. Once the underlying cause is treated, recovery is usually rapid but may be incomplete in severe cases, with residual motor and sensory disturbances. See also NEURALGIA.

neurology Medical specialty concerned with NERVOUS SYSTEM function and disorders. Clinical neurology began in the mid-19th century, when mapping of the functional areas of the brain first began and understanding of the causes of conditions such as EPILEPSY improved. The development of ELECTROENCEPHALOGRAPHY in the 1920s aided in the diagnosis of neurological disease, as did the development of COMPUTED AXIAL TOMOGRAPHY in the 1970s and nuclear MAGNETIC RESONANCE IMAGING in the 1980s. In addition to dealing with physical disorders (e.g., tumours, trauma), neurology is unique among medical specialties in its intersection with PSYCHIATRY. Greater understanding of the brain chemistry of disorders such as SCHIZOPHRENIA and DEPRESSION has led to a wide array of effective drugs that nevertheless work best in conjunction with PSYCHOTHERAPY. Side effects of drug or surgical therapy can be serious, and many nervous system disorders have no effective treatment.

neuron *or* **nerve cell** Any of the cells of the NERVOUS SYSTEM. Sensory neurons relay information from sense organs, motor neurons carry impulses to muscles and glands, and interneurons transmit impulses between sensory and motor neurons. A typical neuron consists of dendrites (fibres that receive stimuli and conduct them inward), a cell body (a nucleated body that receives input from dendrites), and an axon (a fibre that conducts the nerve impulse from the cell body outward to the axon terminals). Both axons and dendrites may be referred to as nerve fibres. Impulses are relayed by NEUROTRANSMITTER chemicals released by the axon terminals across the synapses (junctions between neurons or between a neuron and an effector cell, such as a muscle cell) or, in some cases, pass directly from one neuron to the next. Large axons are insulated by a myelin sheath formed by fatty cells called Schwann cells. Bundles of fibres from neurons held together by CONNECTIVE TISSUE form nerves. See illustration opposite.

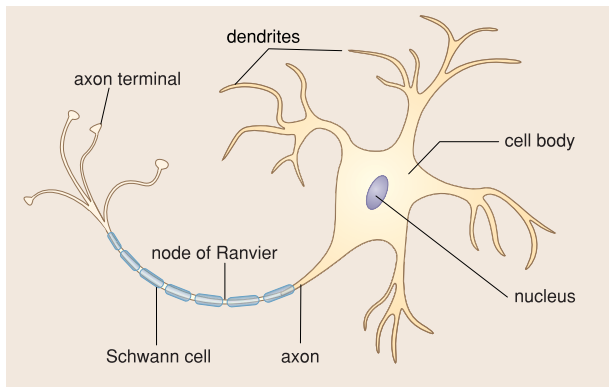
neuropathy \nù-'rä-pə-thē\ Disorder of the peripheral NERVOUS SYSTEM. It may be genetic or acquired, progress quickly or slowly, involve motor, sensory, and/or autonomic (see AUTONOMIC NERVOUS SYSTEM) nerves, and affect only certain nerves or all of them. It can cause pain or loss of sensation, weakness, PARALYSIS, loss of REFLEXES, muscle ATROPHY, or, in autonomic neuropathies, disturbances of blood pressure, heart rate, or bladder and bowel control; impotence; and inability to focus the eyes. Some types damage the NEURON itself, others the myelin sheath that insulates it. Examples include CARPAL TUNNEL SYNDROME, AMYOTROPHIC LATERAL SCLEROSIS, POLIOMYELITIS, and SHINGLES. Causes include diseases (e.g., DIABETES MELLITUS, LEPROSY, SYPHILIS), injury, TOXINS, and VITAMIN deficiency (e.g., BERIBERI). See also NEURALGIA; NEURITIS.

neuropsychology Science concerned with the integration of psychological observations on behaviour with neurological observations on the central NERVOUS SYSTEM (CNS), including the BRAIN. The field emerged through the work of PAUL BROCA and Carl Wernicke (1848–1905), both of whom identified sites on the CEREBRAL CORTEX involved in the production or comprehension of language. Great strides have since been made in describing neuroanatomical systems and their relation to higher mental processes. The related field of neuropsychiatry addresses itself to disorders such as APHASIA, KORSAKOFF SYNDROME, TOURETTE SYNDROME, and other CNS abnormalities. See also LATERALITY.

neurosis Mental and emotional disorder that affects only part of the PERSONALITY, is accompanied by a less distorted perception of reality than in a PSYCHOSIS, and is characterized by various physiological and mental disturbances (such as visceral symptoms and impaired concentration). The neuroses include ANXIETY attacks, certain forms of DEPRESSION, HYPOCHONDRIASIS, hysterical reactions, OBSESSIVE-COMPULSIVE DISORDERS, PHOBIAS, various SEXUAL DYSFUNCTIONS, and some TICS. They have traditionally been thought to be based on emotional CONFLICT in which a blocked impulse seeks expression in a disguised response or symptom. Behavioral psychologists regard them as learned, inappropriate responses to stress, which can be unlearned.

neurotransmitter Chemical released by NEURONS to stimulate neighbouring neurons, allowing impulses to be passed from one cell to the next throughout the NERVOUS SYSTEM. A nerve impulse arriving at the axon terminal of one neuron stimulates release of a neurotransmitter, which crosses the microscopic gap (see SYNAPSE) in milliseconds to the adjoining neuron's dendrite. Many chemicals are believed to act as neurotransmitters. The few that have been identified include ACETYLCHOLINE, DOPAMINE, and SEROTONIN. Some neurotransmitters activate neurons; others inhibit them. Some mind-altering drugs act by changing synaptic activity.

Neuschwanstein \'nói-'shvän-ˌshtīn\ **Castle** Elaborate castle built on a rock ledge over the Pöllat Gorge in the Bavarian Alps, near Füssen, Ger. Begun in 1869 at the behest of Bavaria's LOUIS II, this lavish stronghold is an eccentric romantic reconstruction of a medieval castle, complete with



Structure of a neuron. Dendrites, usually branching fibres, receive and conduct impulses to the cell body, where inputs arriving from various dendrites are integrated. Nerve impulses are conducted along the axon. When an impulse reaches the axon terminals, neurotransmitter chemicals are released into a gap (synapse) between the neuron and a neighbouring cell, and the impulse is transmitted to an adjacent neuron or effector cell (as of a muscle or gland). Schwann cells surround large axons, forming an insulating sheath. Spaces (nodes of Ranvier) between Schwann cells serve to conduct the nerve impulse quickly along the axon.
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a walled courtyard, indoor garden, towers, and an artificial cave. Its two-story throne room is modeled after a Byzantine basilica. Wall paintings depict scenes from Richard Wagner's operas.

Neusiedler \'nȯi-ˌzēd-lər\ **Lake** *Hungarian* **Fertő-tó** \'fer-tœ̄-'tō\ Lake, eastern Austria and northwestern Hungary. The shallow lake was formerly entirely within Hungary, but in 1922 the northern two-thirds were transferred to Austria. Formed during the Pleistocene Epoch, it is Austria's lowest point, 377 ft (115 m) above sea level. Heavy reed growth along its shores supports many species of birds, which are protected by an international sanctuary and a biological station.

Neustria \'nü-strē-ə\ During the Merovingian period, the western part of the kingdom of the Franks after the 6th-century conquest by Clovis. The eastern kingdom was Austrasia. Neustria corresponded roughly to the area of present-day France west of the Meuse River and north of the Loire River. The name later denoted a much smaller area; by the 11th–12th centuries it was sometimes used synonymously with Normandy.

neutering See castration

Neutra \'nȯi-trä,\ *English* \'nü-trə**, Richard (Joseph)** (b. April 8, 1892, Vienna, Austria—d. April 16, 1970, Wuppertal, W.Ger.) Austrian-born U.S. architect. Educated in Vienna and Zürich, Neutra moved to the U.S. in 1923. His most important early work was the Lovell House, Los Angeles (1927–29), which features glass expanses and cable-suspended balconies. Shortly after World War II, Neutra created his most memorable works: the Kaufmann Desert House, Palm Springs, Calif. (1946–47), and the Tremaine House, Santa Barbara, Calif. (1947–48). Elegant and precise, these houses are considered exceptionally fine examples of the International Style, which Neutra helped introduce into the U.S. Carefully placed in the landscape, Neutra's houses often have patios or porches that make the outdoors seem part of the house. He believed that architecture should be a means of bringing man back into harmony with nature and with himself and was particularly concerned that his houses reflect the way of life of the owner. His later works included office buildings, churches, housing projects, and cultural centres. His many writings include *Survival Through Design* (1954).

neutralism See nonaligned movement

neutrality Legal status of a country arising from its abstention from all participation in a war between other countries, the maintenance of an attitude of impartiality toward the belligerents, and the recognition by the belligerents of this abstention and impartiality. Historically, the rights of neutral countries typically included freedom from use or occupation of their territory by any warring party, maintenance of diplomatic relations with other neutrals and belligerents, freedom of their citizens to go about their business, and respect for their intent to be neutral. In both World War I and World War II, many of the basic concepts of neutrality ceased to be respected, and by the late 20th century the freedom of the neutral had been sharply reduced.

neutrino \nü-'trē-nō\ Fundamental particle with no electric charge, little mass, and a spin value of ½. Neutrinos belong to the lepton family of subatomic particles. There are three types of neutrino, each associated with a charged lepton: the electron, the muon, and the tau. Neutrinos are the most penetrating of subatomic particles because they react with matter only by the weak force. They do not cause ionization, because they are not electrically charged. All types of neutrino have masses much smaller than their charged partners.

neutrino \nü-'trē-nō\ **problem, solar** Shortfall in the expected number of neutrinos produced by the Sun that are detected on Earth. Long-running experiments begun in the 1960s found only one-third to two-thirds the number of neutrinos predicted by theory to arrive from the Sun, where they are emitted as a result of nuclear fusion in the solar core. The discrepancy implied either that the theory of solar energy production was wrong or that neutrinos transformed en route to Earth in a way that made some of them seem to vanish. By the early 2000s strong evidence had been gathered in support of the latter explanation—that neutrinos "oscillate" in flight among their different types, not all of which could be detected in the experiments. For this to occur, neutrinos must have at least a tiny mass, though the specific values remained to be determined.

neutron One of the constituent particles of every atomic nucleus except ordinary hydrogen. Discovered in 1932 by James Chadwick (1891–1974), it has no electric charge and has nearly 1,840 times the mass of the electron. Free neutrons undergo beta decay with a half-life of about 10 minutes. Thus, they are not readily found in nature, except in cosmic rays. They are a penetrating form of radiation. When bombarded with neutrons, various elements undergo nuclear fission and release more free neutrons. If enough free neutrons are produced, a chain reaction can be sustained. This process led to the development of nuclear power as well as the atomic bomb. Neutron beams produced in cyclotrons and nuclear reactors are important probes of matter, revealing details of structure in both organic and inorganic susbtances.

neutron bomb *or* **enhanced radiation warhead** Small thermonuclear weapon that produces minimal blast and heat but releases large amounts of lethal radiation. The blast and heat are confined to a radius of only a few hundred yards; within a somewhat larger area, the bomb throws off a massive wave of neutron and gamma radiation, which is extremely destructive to living tissue. Such a bomb could be used with deadly efficiency against tank and infantry formations on the battlefield without endangering towns or cities only a few miles away. It can be carried in a missile or delivered by a howitzer or even an attack aircraft.

neutron star Any of a class of extremely dense, compact stars thought to be composed mainly of neutrons with a thin outer atmosphere of primarily iron atoms and electrons and protons. Though typically about 12 mi (20 km) in diameter, they have a mass roughly twice the Sun's and thus extremely high densities (about 100 trillion times that of water). Neutron stars have very strong magnetic fields. A solid surface differentiates them from black holes. Below the surface, the pressure is much too high for individual atoms to exist; protons and electrons are compacted together into neutrons. The discovery of pulsars in 1967 provided the first evidence of the existence of neutron stars, predicted in the early 1930s and believed by most investigators to be formed in supernova explosions. See also white dwarf star.

Neva \nye-'vä\ **River** River, northwestern Russia. It flows 46 mi (74 km) from Lake Ladoga west to the Gulf of Finland in the Baltic Sea. It is navigable by large ships but is usually frozen from November to April. The city of St. Petersburg is at its mouth. Its banks were the scene of a battle in 1240 in which Alexander Nevsky, prince of Novgorod, defeated the Swedes.

Nevada State (pop., 2000: 1,998,257), western U.S. Bordered by Oregon, Idaho, Utah, Arizona, and California, it covers 110,567 sq mi (286,368 sq km); its capital is Carson City. The Black Rock Desert is in the northwest; the Colorado River forms its extreme southeastern boundary. Human settlement in the area has spanned more than 20,000 years, and evidence of prehistoric inhabitants include dwelling remains and rock art. Early inhabitants included the Shoshone and Paiute Indians. Spanish missionaries in the 18th century and fur traders in the 1820s arrived before major exploration and mapping were done by John C. Frémont and Kit Carson (1843–45). Nevada was part of the land ceded to the U.S. by Mexico in 1848 and was included in the Utah Territory (1850–61). Settlements increased after the discovery of the Comstock Lode, a rich silver deposit, at Virginia City in 1859. It became the Territory of Nevada in 1861 and the 36th U.S. state in 1864. It began its transition to a modern economy during the Great Depression when gambling was legalized. Construction of the Hoover Dam aided the economy of southern Nevada. In the 1950s the state became the main testing site for atomic-energy experiments. The traditional bases of its economy, mining and agriculture, are overshadowed by government activity and tourism, the latter centred on Las Vegas, Reno, and Lake Tahoe.

Nevelson, Louise *orig.* **Leah Berliavsky** (b. Sept. 23?, 1899/1900, Kiev, Russia—d. April 17, 1988, New York, N.Y., U.S.) Ukrainian-born U.S. sculptor. Born in Kiev, she moved with her family to Maine in 1905. She studied at New York's Art Students League and with Hans Hofmann in Munich (1931). Her early figurative sculptures feature blockish, interlocking masses and found objects that anticipate her mature style. By the 1950s she was working almost exclusively in abstract forms. She is best known for the large, monochromatic abstract sculptures of this period, consisting of open-faced wooden boxes stacked to make freestanding walls. Within the boxes are highly suggestive collections of abstract-shaped objects mingled with pieces of architectural debris and other found objects skillfully arranged to produce a sense of mystery and then painted a single colour, usually black. She is recognized as one of the foremost sculptors of the 20th century.

Neville, Richard See Earl of Warwick

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Nevins, Allan (b. May 20, 1890, Camp Point, Ill., U.S.—d. March 5, 1971, Menlo Park, Calif.) U.S. historian. He worked nearly 20 years as a journalist before joining the faculty at Columbia University (1928–58). His best-known works include biographies of U.S. political and industrial figures, including *Grover Cleveland* (1932, Pulitzer Prize) and *Hamilton Fish* (1936, Pulitzer Prize), and his eight-volume history of the American Civil War, comprising *Ordeal of the Union* (1947), *The Emergence of Lincoln* (1950), and *The War for Union* (1959–71). In 1948 he inaugurated at Columbia the first oral history program in the U.S.

Nevsky, Alexander See Saint Alexander Nevsky

New Age movement Movement that spread through occult communities in the 1970s and '80s. It looked forward to a "New Age" of love and peace and offered a foretaste of the coming era through personal transformation and healing. The movement's strongest supporters were followers of esotericism, a religious perspective based on the acquisition of mystical knowledge. At its height, the movement attracted millions of Americans, who practiced astrology, yoga, and channeling and used crystals as healing tools. Adherents sought to bring about global transformation, and in 1987 many participated in the Harmonic Convergence, an attempt to accomplish that goal.

New Britain *formerly* **Neu-Pommern** \nȯi-'pȯ-mərn\ Largest island (population 1999 est.: 435,000) in the Bismarck Archipelago, Papua New Guinea. It was visited and named by English explorer William Dampier in 1700. After periods under German, Australian, and Japanese rule, it became part of Papua New Guinea in 1975 when that nation attained independence. It is crescent-shaped and heavily forested, and it has several volcanoes. Its highest peak, Mount Sinewit, at 7,999 ft (2,438 m), erupted violently in 1937. Commercial products include coconuts, cocoa, and palm oil. Its harbours include Blanche Bay, Talasea, and Jacquinot Bay.

New Brunswick Province (pop., 2001: 729,498), one of the three Maritime Provinces, eastern Canada. Bordered by the U.S. and the Canadian province of Quebec, it lies on the Gulf of St. Lawrence and the Northumberland Strait (east) and the Bay of Fundy (south); it is connected with Nova Scotia by the Isthmus of Chignecto. Its capital, Fredericton, is home to the University of New Brunswick (founded 1785; Canada's oldest university). New Brunswick was part of the original Acadia; it was colonized by the French in the 18th century, then captured by the British, who expelled the French-speaking Acadians in 1755 and incorporated the area into Nova Scotia. After the American Revolution, some 14,000 loyalists from the U.S. settled there. As a result of this large influx, it was separated from Nova Scotia, and the province of New Brunswick was established in 1784. In 1867 it became an original member of the Dominion of Canada. Forests cover 90% of the province, whose major cities include Saint John and Moncton. Forestry and lumbering are the largest industries, followed by commercial fishing.

New Brunswick, University of Canadian public university in Fredericton, founded in 1785. It has faculties of administration, arts, computer science, education, engineering, forestry, graduate studies, law, nursing, physical education, science, and business and additional programs in business, languages, and social sciences. A branch campus is located in Saint John.

New Caledonia French overseas territory (pop., 2005 est.: 237,000), southwestern South Pacific Ocean. It consists of the islands of New Caledonia and Walpole, the Isle of Pines, and several other island groups. Its capital is Nouméa. The main island, New Caledonia, has rich deposits of nickel that are among the largest in the world. Archaeological excavations indicate an Austronesian presence in the area c. 2000–1000 BC. The islands were visited by Capt. James Cook in 1774 and by various navigators and traders in the 18th–19th century. They were occupied by France in 1853 and were a penal colony from 1864 to 1897. New Caledonians joined the Free French cause of Charles de Gaulle in 1940; the islands were the site of Allied bases during the Pacific war. They became a French overseas territory in 1946. In 1987 residents voted by referendum to remain part of France.

New Church *or* **Swedenborgians** Church whose members follow the teachings of Emanuel Swedenborg. Swedenborg did not himself found a church, but he believed that his writings would be the basis of a "new church," which he associated with the "new Jerusalem" mentioned in the Book of Revelation. In 1788, soon after his death, a group of his followers established a church in London. The first Swedenborgian society in the U.S. was organized in Baltimore in 1792. Baptism and the Lord's Supper are the two sacraments of the church, and New Church Day (June 19) is added to the established Christian festivals. There are three New Church groups: the General Conference of the New Church, the General Convention of the New Jerusalem in the U.S.A., and the General Church of the New Jerusalem.

New Comedy Greek drama from c. 320 BC to the mid-3rd century BC that offers a mildly satiric view of contemporary Athenian society. Unlike Old Comedy, which parodies public figures and events (see Aristophanes), New Comedy features fictional average citizens in domestic life. The chorus, the representative of forces larger than life, is reduced to a small band of musicians and dancers. Plays usually involve the conventionalized situation of thwarted lovers and contain stock characters. Menander introduced the New Comedy and became its most famous exponent; Plautus and Terence translated its plays for the Roman stage. Elements of New Comedy influenced European drama down to the 18th century.

New Criticism *or* **formalism** Post–World War I school of Anglo-American literary theory that insisted on the intrinsic value of a work of art and focused attention on the individual work alone as an independent unit of meaning. New Critics were opposed to the practice of bringing historical or biographical data to bear on the interpretation of a work. The primary critical technique was analytic (or "close") reading of the text, concentrating on its language, imagery, and emotional or intellectual tensions. Critics associated with the movement include I. A. Richards, William Empson, John Crowe Ransom, and R. P. Blackmur (1904–1965).

New Deal U.S. domestic program of Pres. Franklin Roosevelt to bring economic relief (1933–39). The term was taken from Roosevelt's speech accepting the 1932 presidential nomination, in which he promised "a new deal for the American people." New Deal legislation was enacted mainly in the first three months of 1933 (Roosevelt's "hundred days") and established such agencies as the Civil Works Administration and the Civilian Conservation Corps to alleviate unemployment, the National Recovery Administration to revive industrial production, the Federal Deposit Insurance Corp. and the Securities and Exchange Commission to regulate financial institutions, the Agricultural Adjustment Administration to support farm production, and the Tennessee Valley Authority to provide public power and flood control. A second period of legislation (1935–36), often called the second New Deal, established the National Labor Relations Board, the Works Progress Administration, and the social security system. Some legislation was declared unconstitutional by the U.S. Supreme Court, and some programs did not accomplish their aims, but many reforms were continued by later administrations and permanently changed the role of government. See also Public Works Administration.

New Delhi \'de-lē\ City (pop., 2001 prelim.: 294,783), capital of India, on the western bank of the Yamuna River, south of Old Delhi in Delhi capital territory. Built from 1912 to 1929, it was formally opened in 1931, when it became the capital. In contrast to the convoluted street plan of Old Delhi, New Delhi has an orderly, diagonal pattern and gives a feeling of openness and quiet. The main east-west axis is Central Vista Park, a thoroughfare lined with government buildings, museums, and research centres.

New Democratic Party Canadian democratic socialist political party. Formed in 1961 from the Co-operative Commonwealth Federation, it favours a mixed public-private economy, broadened social benefits, and an internationalist foreign policy. It formed governments in Saskatchewan, Manitoba, and British Columbia intermittently from the 1940s to the 1990s, in the Yukon Territory from the 1980s, and in Ontario in the 1990s. At the national level, however, it has enjoyed only marginal success. The NDP draws much of its support from the farmers of Manitoba and Saskatchewan and the urban workers of British Columbia and Ontario.

New Economic Policy (NEP) Economic policy of the Soviet Union (1921–28). A temporary retreat from the failed War Communism policy of extreme centralization and doctrinaire socialism, the new measures included the return of most agriculture, retail trade, and light industry to private ownership (though the state retained control of heavy industry, banking, transport, and foreign trade) and the reintroduction of money into the economy. The policy allowed the economy to recover from years of war. In 1928 chronic grain shortages prompted Joseph Stalin to begin to eliminate private ownership of farmland and to collectivize agriculture under state control, effectively ending the NEP. By 1931 state control was reimposed over all industry and commerce.

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New England Region, northeastern U.S. It consists of the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut and has an area of 66,667 sq mi (172,668 sq km). Named by John Smith, who explored its shores in 1614, it was later settled by English Puritans (see Puritanism). The New England colonies, fueled by self-sufficient farmers, evolved representative governments. The area's numerous harbours soon promoted the growth of overseas commerce and a vigorous shipbuilding industry. In the 18th century it became a hotbed of agitation for independence from Britain, and its patriots played leading roles in the American Revolution.

New England Confederation *or* **United Colonies of New England** Organization of four American colonies. In 1643 delegates from Massachusetts, Connecticut, New Haven, and Plymouth met to solve trade, boundary, and religious disputes and to form a common defense against the French, Dutch, and Indians. They drew up articles of agreement and established a directorate of eight commissioners. The confederation was weakened by its advisory status and by the 1665 merger of Connecticut and New Haven. It was active in King Philip's War but dissolved in 1684 when the Massachusetts charter was revoked.

New England Range Upland area, northeastern New South Wales, Australia. Part of the Great Dividing Range, it stretches about 200 mi (320 km) parallel to the eastern coast, constituting Australia's largest plateau region. The highest point, Round Mountain, is 5,300 ft (1,615 m). New England National Park, on the eastern slope of the range, is one of several semitropical and temperate rainforest areas designated a UNESCO World Heritage site in 1986.

New England Renaissance See American Renaissance

New France Possessions of France in North America from 1534 to the Treaty of Paris in 1763. After the first land claim for France by Jacques Cartier (1534), the company of New France was established in 1627. With the explorations by Samuel de Champlain, Jacques Marquette, La Salle, Louis Jolliet, and others, the boundaries of New France expanded beyond the lower St. Lawrence River to include the Great Lakes and the Mississippi Valley. From 1689 rivalry between England and France affected their possessions in North America. The French and Indian War (1754–63) resulted in the cession of Canada and the territory east of the Mississippi River to England and the territory west of the Mississippi to Spain, with France keeping only the islands of St.-Pierre and Miquelon off the coast of Newfoundland.

New Goa See Panaji

New Granada, Viceroyalty of Spanish viceroyalty in northwestern South America during colonial times. The region was conquered by the Spanish in the 16th century and was initially subject to the Viceroyalty of Peru. It became a separate viceroyalty—first established temporarily in 1717, and later permanently in 1739—that included the modern countries of Colombia, Panama, Venezuela, and Ecuador. Its capital was Santa Fé (modern Bogotá). It was liberated from Spain in 1823.

New Guinea *Indonesian* **Irian** \ˌir-ē-ˈän\ Island, eastern Malay Archipelago, western Pacific Ocean, north of Australia. Divided roughly in half between Indonesia (west) and Papua New Guinea (east), New Guinea is the second largest island in the world (after Greenland). It is about 1,500 mi (2,400 km) long and 400 mi (650 km) wide at its widest point, with an area of about 309,000 sq mi (800,000 sq km). The terrain ranges from lowland rainforest to fertile highlands and a rugged mountainous spine; its climate is tropical. Copper and gold are its chief mineral resources. The majority of the people of New Guinea are subsistence farmers.

New Hampshire State (pop., 2000: 1,235,786), northeastern U.S. One of the New England states, it is bordered by Canada and the U.S. states of Maine, Massachusetts, and Vermont; the Atlantic Ocean lies to the southeast. New Hampshire covers 9,283 sq mi (24,043 sq km); its capital is Concord. The Connecticut River forms its western boundary with Vermont. The White Mountains in its central part contain Mount Washington. The region was inhabited by Algonquin Indians (see Algonquian languages) when the first English people settled near Portsmouth in 1623. The area came under the jurisdiction of Massachusetts in 1641 and became a separate crown colony in 1679. It was the first colony to declare its independence from Britain in 1776. Following the nation's establishment, the state grew rapidly. Agriculture flourished and manufacturing developed along the rivers. Portsmouth became a major shipbuilding centre. The economy is now based primarily on manufacturing and tourism, although dairy farming and granite quarrying are also important. Because it holds the nation's earliest presidential primary, it has furnished the first testing ground for many candidacies. Dartmouth and the University of New Hampshire are two of the state's prominent educational institutions.

New Haven City (pop., 2000: 123,626), south-central Connecticut, U.S. A port of entry on Long Island Sound, it was originally settled in 1638 and became part of the colony of Connecticut in 1665. It was the co-capital with Hartford until 1875. New Haven was sacked by loyalist forces during the American Revolution (1779), and during the American Civil War it was a centre of abolitionist activity (see abolitionism). A number of famous inventors made the city a centre of industrial technology, including Charles Goodyear, Eli Whitney, and Samuel F.B. Morse. It is the home of Yale University and several other educational and cultural institutions.

New Hebrides See Vanuatu

New Ireland *formerly* **Neu-Mecklenburg** \nōi-ˈme-klən-ˌberg\ Island and province (pop., 1999 est.: 111,906), Bismarck Archipelago, Papua New Guinea. The island has an area of 3,340 sq mi (8,651 sq km) and is about 200 mi (320 km) long. The terrain is largely mountainous. The province includes many nearby smaller islands. It was discovered by Dutch navigators in 1616 but was little known before 1884, when it became part of a German protectorate. After World War I it was mandated to Australia. The island was occupied by the Japanese in World War II. When Papua New Guinea gained independence in 1975, it became part of that country. Most of the inhabitants live in the north. Copra production dominates commercial development.

New Jersey State (pop., 2000: 8,414,350), eastern U.S. Lying on the Atlantic Ocean, it is bordered by New York, Delaware, and Pennsylvania. It covers 7,790 sq mi (20,176 sq km); its capital is Trenton. The Hudson River forms its northeastern boundary; the Delaware River, its western boundary. Before European colonization, the region was inhabited by Delaware Indian tribes. Although it was sighted by Giovanni Verrazzano and Henry Hudson, it was first settled by Dutch and Swedish traders. It was the site of numerous battles during the American Revolution, including one led by Gen. George Washington in 1776, after crossing the Delaware (see Battles of Trenton and Princeton). It was the third state to ratify the U.S. Constitution in 1787. Between the Revolutionary and Civil wars, it underwent tremendous industrialization, abetted by the construction of canals and, later, railways. Although known as the "Garden State," a name influenced by its 18th-century agricultural fertility, its economy is based primarily on manufacturing, and it has many research facilities and laboratories. Tourism, led by Atlantic City, is also important. Chief cities include Newark, Jersey City, Paterson, and Elizabeth.

New Mexico State (pop., 2000: 1,819,046), southwestern U.S. Bordered by Mexico and the U.S. states of Colorado, Oklahoma, Texas, and Arizona, it covers 121,598 sq mi (314,939 sq km); its capital is Santa Fe. In the west, it is crossed north-south by the Continental Divide. The Rio

Soap-tree yucca (*Yucca elata*) growing in the gypsum sand of White Sands National Monument, New Mexico, U.S.
TOM ALGIRE

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Grande bisects the state and for a short distance forms the boundary with Texas. Human settlement in the area has probably spanned 10,000 years. Before the Navajo and Apache arrived in the 15th century, an agricultural Indian civilization had developed irrigation systems, pueblos, and cliff dwellings, whose ruins still dot the state. Spaniards from Mexico claimed the area for Spain in the 16th century, and in 1540 Francisco Vázquez de Coronado explored it. The first settlement was at Santa Fe in 1610. Missionaries were active in the 1600s. It became part of Mexico in 1821 and was ceded to the U.S. in 1848 at the end of the Mexican War. The Territory of New Mexico was established by Congress in 1850. It became the 47th U.S. state in 1912 and retained its frontier image. World War II spurred economic and social change, bringing research facilities, including that at Los Alamos. The economy today is largely dependent on the export of raw materials and on federal government expenditures; oil and natural gas are also important. The University of New Mexico and a fine arts community are in Albuquerque.

New Model Army (1645) Army that won the English Civil Wars for Parliament. It was formed to provide a well-trained force drawn from all parts of England instead of the limited local militias. The new army also replaced the private armies raised by individual generals that lacked a unified command. Under Baron Fairfax and Oliver Cromwell, the New Model Army won the Battle of Naseby and effectively ended the first phase of the Civil Wars.

New Nationalism American political policy espoused by Theodore Roosevelt. Influenced by Herbert Croly's *The Promise of American Life* (1910), Roosevelt used the phrase in a speech in which he tried to reconcile the liberal and conservative wings of the Republican Party. New Nationalism called for federal intervention to promote social justice and the economic welfare of the underprivileged. In 1912, as the presidential candidate of the Progressive Party, Roosevelt ran unsuccessfully on a platform based on the precepts of New Nationalism. See also Robert La Follette.

New Orleans City (pop., 2000: 484,674), southeastern Louisiana, U.S. Situated between the Mississippi River and Lake Pontchartrain, it is the state's largest city and a major deepwater port. Founded in 1718 by French colonist Jean-Baptiste Le Moyne de Bienville, it was ceded to Spain in 1763. In 1800 it was ceded back to France and three years later sold to the U.S. by Napoleon. Incorporated in 1805, it was the state capital from 1812 to 1849. During the American Civil War the city was captured and occupied by Union forces (1862). A notable tourist centre, its attractions include Mardi Gras and the French Quarter, a popular tourist area noted for its nightclubs and Creole architecture and cuisine. It is also a medical, industrial, and educational centre. It was devastated by Hurricane Katrina in August 2005, when the levees protecting the city were breached and nearly all the city was flooded.

New Orleans, Battle of (1815) Battle between the U.S. and Britain during the War of 1812. Late in 1814 a British fleet of more than 50 ships commanded by Gen. Edward Pakenham (1778–1815) sailed into the Gulf of Mexico and prepared to attack New Orleans. Gen. Andrew Jackson, commander of the U.S. Army of the Southwest, which consisted chiefly of militiamen and volunteers, fought the British regulars who stormed their position on Jan. 8, 1815. His troops were so effectively entrenched behind earthworks and the British troops so exposed that the fighting was brief, ending in a decisive U.S. victory, a British withdrawal, and the death of Gen. Pakenham. The battle was without military value, since the Treaty of Ghent ending the war had been signed in December, but the news had been slow to arrive. The victory nevertheless raised national morale, enhancing Jackson's reputation as a hero and preparing his way to the presidency.

New Orleans, Battle of (April 24–25, 1862) Naval action in the American Civil War. A Union squadron of 43 ships led by David Farragut entered the Mississippi River below New Orleans and breached the chain cables stretched across the river as a defense. The 3,000 Confederate troops under Mansfield Lovell withdrew northward and the city fell. The Union army under Benjamin Butler entered the city on May 1 and began an occupation that lasted until the end of the war. The loss of New Orleans was a major blow to the Confederacy.

New Orleans jazz See Dixieland

New Realism Early 20th-century movement in metaphysics and epistemology that opposed the idealism dominant in British and U.S. universities. Early leaders included William James, Bertrand Russell, and G. E. Moore, who adopted the term realism to signal their opposition to idealism. In 1910 William Pepperel Montague, Ralph Barton Perry, and others signed an article entitled "The Program and First Platform of Six Realists," and followed it with a cooperative volume, *The New Realism* (1912). In defending the independence of known things, New Realism affirmed that in cognition "the content of knowledge, that which lies in or before the mind when knowledge takes place, is numerically identical with the thing known" (a form of direct realism). To some realists, this epistemological monism seemed unable to give a satisfactory explanation of the mind's proneness to error.

new religious movement (NRM) Any religion originating in recent centuries having characteristic traits including eclecticism and syncretism, a leader who claims extraordinary powers, and a "countercultural" aspect. Regarded as outside the mainstream of society, NRMs in the West are extremely diverse but include millennialist movements (e.g., the Jehovah's Witnesses), Westernized Hindu or Buddhist movements (e.g., the Hare Krishna movement), so-called "scientific" groups (e.g., Scientology), and nature religions (see Neo-Paganism). In the East they include China's 19th-century Taiping movement (see Taiping rebellion) and present-day Falun Gong movement, Japan's Tenrikyo and PL Kyodan, and Korea's Ch'ondogyo and Unification Church. Some NRMs fade away or meet tragic ends; others, such as the Mormon church, eventually become accepted as mainstream.

New Republic, The Weekly journal of opinion, founded in 1914 by Willard Straight, with Herbert Croly as editor. Long one of the most influential liberal magazines in the U.S., it early reflected the progressive movement and sought reforms in U.S. government and society. Its popularity declined in the 1920s when liberalism was out of favour but revived in the 1930s. After initially opposing Pres. Franklin D. Roosevelt's administration, it supported Roosevelt's New Deal. After becoming editor in 1946, former U.S. vice president Henry Wallace moved the magazine further left until he was forced to resign. In the early 1980s the magazine began to display an array of commentary reflecting the resurgence of conservatism in U.S. politics.

New River River, southwestern Virginia and southern West Virginia, U.S. It is formed in North Carolina and flows north across Virginia into West Virginia, where it joins the Gauley River to form the Kanawha River. It is about 255 mi (410 km) long and is spanned by one of the longest steel-arch bridges in the world, the New River Gorge bridge near Fayetteville, W.Va., whose main span is 1,700 ft (518 m).

New School University *formerly* **New School for Social Research** Private university in New York City. It was established in 1919 as an informal centre for adult education and soon became the first American university to specialize in continuing education. In 1934 it established a graduate faculty of political and social sciences, staffed mainly by refugee academics from Nazi Germany. It also includes a liberal arts college, a graduate school of management and urban policy, the Mannes College of Music, and the Parsons School of Design.

New Siberian Islands Island group, Arctic Ocean, northeastern Russia, north of eastern Siberia. The islands divide the Laptev Sea from the East Siberian Sea. They are separated from the Siberian mainland by Dmitry Laptev Strait. With an area of about 14,500 sq mi (38,000 sq km), they are snow-covered for more than nine months of the year. Arctic fox, northern deer, lemming, and many species of birds inhabit the islands.

New South Wales State (pop., 2001: 6,609,304), southeastern Australia. Bounded by Queensland, the Pacific Ocean, Victoria, and South Australia, it has an area of 309,130 sq mi (800,640 sq km); the capital is Sydney. The dominant geographic feature is the Great Dividing Range. Inhabited from prehistoric times, New South Wales was claimed for Britain by Capt. James Cook in 1770. The colony included the entire continent except for Western Australia. The interior was explored throughout the 19th century and colonies were set up there, separate from New South Wales. In 1901 it became part of the Commonwealth of Australia. The state ceded the area of the Australian Capital Territory in 1911. New South Wales is the centre of commercial farming, industry, and culture in Australia.

New Spain, Viceroyalty of Former Spanish viceroyalty (1535–1821), principally in North America. At various times it included what is now the southwestern U.S. (as well as Florida and parts of the coast of the Gulf of Mexico), Mexico, Central America north of Panama, much of the West Indies, and the Philippines. Mexico City was the seat of the gov-

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ernment, which also had jurisdiction over Spain's Caribbean possessions. The first viceroy sent Francisco Vázquez de Coronado on his northern expeditions. The viceroyalty succumbed to the coalition forged by Agustín de Iturbide in 1821.

New Sweden Only Swedish colony in North America, on the Delaware River, extending from the site of present-day Trenton, N.J., U.S., to the mouth of the river. It was established by the New Sweden Co. led by Peter Minuit in 1638, when Fort Christina was built at what is now Wilmington, Del. It was captured by the Dutch in 1655 under Peter Stuyvesant. The Swedish colonists were allowed to keep their lands and continue their customs under Dutch rule.

New Testament Second of the two major divisions of the Christian Bible. Christians see the New Testament as the fulfillment of the promise of the Old Testament. It recounts the life and ministry of Jesus and interprets their meaning for the early church, focusing especially on the new covenant created between God and the followers of Jesus. There are 27 books in the New Testament: four Gospels, or stories of the life and teachings of Christ; the Acts of the Apostles, a historical narrative of the first years of the Christian church; 21 epistles, or letters of advice and instruction to early Christians; and the Book of Revelation, a description of the coming apocalypse. Most were written in the later 1st century AD, though none can be dated precisely. Only two authors are known for certain: St. Paul, credited with 13 epistles; and St. Luke, writer of the third gospel and the Book of Acts. Attributions of other authors range from highly likely (for the other three gospels) to completely unknown (for the Epistle to the Hebrews). These documents circulated among the early churches and were used as preaching and teaching sources. The earliest known list of the current New Testament canon dates from AD 367 in a work by St. Athanasius. A church council of 382 gave final approval to the list.

New Thought Mind-healing movement that originated in the U.S. in the 19th century. Its earliest proponent, Phineas P. Quimby (1802–66), was a mesmerist who taught that illness is mental. New Thought was influenced by philosophers ranging from Plato to Emanuel Swedenborg, Georg Wilhelm Friedrich Hegel, and Ralph Waldo Emerson and in turn influenced Mary Baker Eddy's Christian Science. The International New Thought Alliance (formed 1914) asserts that sin and illness stem from incorrect thinking. New Thought groups emphasize Jesus as a teacher and healer and proclaim his kingdom as being within each person.

new town Form of urban planning designed to relocate populations away from large cities by grouping homes, hospitals, industry and cultural, recreational, and shopping centers to form entirely new, relatively autonomous communities. The new-town movement was anticipated by the Utopian Ebenezer Howard in the early 20th century (see garden city). The first official new towns were proposed in Britain's New Towns Act of 1946. The idea found favor in other countries, especially in the U.S., Western Europe, and Soviet Siberia. New towns outside Britain often failed to incorporate enough of the mixed-use atmosphere that gives a town vitality. A dramatic increase in commuting and use of the car obviated the need for new towns to be so self-contained.

New Wave *French* **nouvelle vague** Group of individualistic French film directors of the late 1950s, including Claude Chabrol, François Truffaut, Jean-Luc Godard, Louis Malle, Eric Rohmer, Alain Resnais, and others. Most of the New Wave directors were associated with the important film magazine *Cahiers du Cinéma*, in which they developed the highly influential auteur theory, calling for films to express the director's personal vision. Their films were characterized by a brilliance of technique that sometimes overshadowed the subject matter. Among the most important New Wave films were Godard's *Breathless* (1959), Truffaut's *The 400 Blows* (1959), and Resnais's *Hiroshima mon amour* (1959).

New World monkey Any of some 100 species of monkeys (the platyrrhine ["flat-nosed"] monkeys) that inhabit tropical Central and South America. Platyrrhines have a broad nose, with a wide septum separating the outwardly directed nostrils, and relatively unopposable thumbs. Most species have a long tail, which in a few species is prehensile. They are divided by zoologists into five families: the marmosets and tamarins; the titis, sakis, and uakaris; the spider monkeys and woolly monkeys; the capuchin monkeys and squirrel monkeys; and the durukulis. See also Old World monkey.

New Year's Day First day of the new year, celebrated with religious, cultural, and social observances around the world. It is usually marked by rites and ceremonies that symbolize casting off the old year and rejoicing in the new. Most of the world recognizes January 1 as the start of a new year because the Gregorian calendar, from its papal origin in 1582, has become the international reference for treaties, corporate contracts, and other legal documents. Nevertheless, numerous religious and national calendars have been retained. For example, in the Persian calendar (used in Iran and Afghanistan) New Year's Day falls on the spring equinox (March 20 or 21 in the Gregorian calendar). The more widely employed Islamic (Hijrī) calendar is based on 12 lunar months of 29 or 30 days; thus, the Islamic New Year's Day gradually regresses through the longer Gregorian calendar. The Hindu new year starts on the day following the first new moon on or after the spring equinox. The Chinese new year begins at sunset on the new moon in the sign of Aquarius (late January or early February). The Hebrew calendar is based on 12 lunar months (13 in certain years) of 29 or 30 days; the Jewish New Year's Day, or Rosh Hashanah, can fall anytime from September 6 to October 5 in the Gregorian calendar.

New York State (pop., 2000: 18,976,457), eastern U.S. It is bordered by Canada and the U.S. states of Vermont, Massachusetts, Connecticut, New Jersey, and Pennsylvania; Lake Erie and Lake Ontario are to the west and the Atlantic Ocean to the southeast. New York covers 53,013 sq mi (137,304 sq km); its capital is Albany. The Hudson, St. Lawrence, Delaware, and Niagara rivers all form parts of its boundaries. The Adirondack Mountains are in the northeast; the Catskills are in the east. Before European colonization, Algonquins (see Algonquian languages) and Iroquois inhabited the area. In 1524 Giovanni Verrazzano visited New York Bay. The 1609 explorations of Henry Hudson and Samuel de Champlain led to settlement. In 1664 the Dutch colony, New Netherland, led by Peter Stuyvesant, surrendered to the British and was renamed New York. The French and Indian War resulted in skirmishes in northern and central New York; its conclusion confirmed English dominance in the region. In the American Revolution, it was the scene of many battles, including those of Ticonderoga and Saratoga, and of Benedict Arnold's treason at West Point. New York adopted the first state constitution (1777). The capital moved from New York City to Albany in 1797. The opening of the Erie Canal in 1825 spurred development of the western part of the state. In the 19th century the growing influence in New York City of Tammany Hall caused tension between the city and the state. The economy was once based largely on manufacturing in cities, including Buffalo, Rochester, and Syracuse. It is now dominated by service industries, concentrated in New York City.

New York, State University of (SUNY) Largest university system in the U.S. Founded in 1948, it consists of university centres in Albany, Binghamton, Buffalo, and Stony Brook; colleges of arts and sciences in Brockport, Buffalo, Cortland, Fredonia, Geneseo, New Paltz, Old Westbury, Oneonta, Oswego, Plattsburgh, Potsdam, and Purchase; three medical centres (two in New York City and one in Syracuse); several two-year agricultural and technical colleges; a nonresidential continuing-education program (Empire State College); over 30 community colleges; and various other specialized units.

New York Central Railroad Major U.S. railroad. It was founded in 1853 to consolidate 10 railroads that paralleled the Erie Canal between Albany and Buffalo, the oldest being the Mohawk and Hudson, New York state's first railway (established 1831). Cornelius Vanderbilt won control of the New York Central in 1867 and combined it with his New York and Hudson railroads running from Manhattan to Albany. The system grew until it had 10,000 mi (16,000 km) of track linking New York with Boston, Montreal, Chicago, and St. Louis. The New York Central began to decline after World War II, and in 1968 it merged with its chief competitor, the Pennsylvania Railroad Co., to form the Penn Central Transportation Co. The merger failed, and the railroad was forced into bankruptcy in 1970. Its passenger services were taken over by Amtrak in 1971, and its other railroad assets were transferred to Conrail in 1976.

New York City City (pop., 2000: 8,008,278), southeastern New York, at the mouth of the Hudson River. The largest city in the U.S. and an important seaport, it consists of five boroughs: the Bronx, Brooklyn, Manhattan, Queens, and Staten Island. The site of a Dutch trading post on Manhattan Island, it was colonized as New Amsterdam by Dutch director general Peter Minuit, who bought it from the Indians in 1626. The colony surrendered to the British in 1664 and was renamed New York. It was the capital of the state (1784–97) and of the U.S. (1789–90). The economy grew after the opening of the Erie Canal in 1825, and the city

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expanded rapidly after the American Civil War, developing transportation and communications systems. In 1898 the five boroughs were merged into a single city. Long a magnet for immigrants to the U.S., it is a centre of world trade and finance, media, art, entertainment, and fashion. Because of its prominence and its central role in world commerce, the city was a target for acts of terrorism. In September 2001, hijackers intentionally flew airliners into the twin towers of the World Trade Center, destroying them and destroying or damaging several adjacent buildings; the attacks killed some 2,800 people. See September 11 attacks.

New York City Ballet Preeminent U.S. ballet company. The company is descended from the American Ballet, which was founded by George Balanchine and Lincoln Kirstein in 1935 and revived as the Ballet Society in 1946; it assumed its current name in 1948. Under Balanchine's artistic direction, the company became the leading U.S. ballet troupe, combining European classical ballet with American characterization and innovation and exerting enormous influence on American dance. It moved to its permanent home, the New York State Theater at Lincoln Center, in 1964. Later artistic directors Jerome Robbins and Peter Martins contributed numerous works to its repertoire. Its leading dancers have included Maria Tallchief, Edward Villella, Jacques d'Amboise, and Suzanne Farrell.

New York Daily News Morning daily tabloid newspaper published in New York City. It was founded in 1919 by Joseph Medill Patterson and his cousin Robert McCormick as a subsidiary of the Tribune Co. of Chicago. The first successful tabloid-format newspaper in the U.S., it quickly attracted a large readership with sensational coverage of crime, scandal, and violence; it also included lurid photographs, cartoons, and entertainment features. It was an early user of wirephotos and developed a large staff of photographers. In 1993 it was bought by Mortimer B. Zuckerman.

New York Public Library Largest city public library in the U.S. and one of the great libraries of the world. It was established in 1895, and its central building opened in 1911. Its holdings include more than 10 million books and more than 10 million manuscripts, as well as large collections of pictures, maps, books for the blind, films, and microfilms.

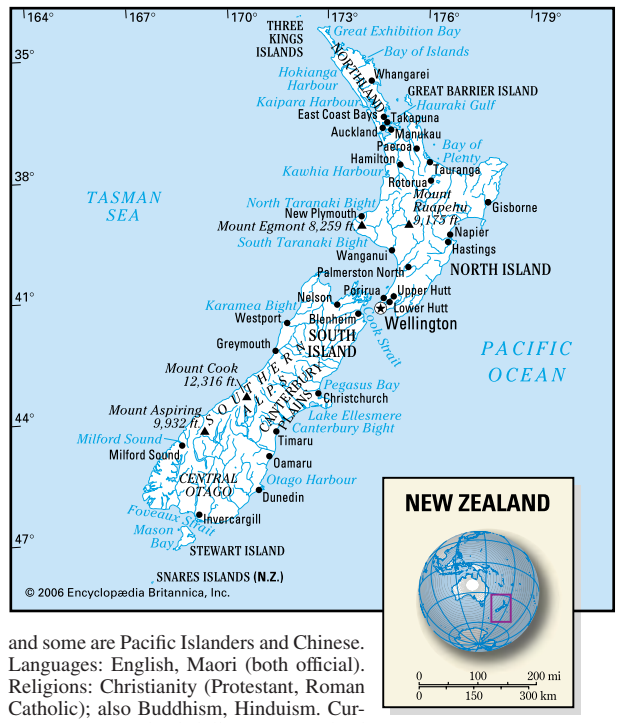
New York school Painters who participated in the development of contemporary art, particularly Abstract Expressionism, in or around New York City in the 1940s and '50s. During and after World War II, leadership in avant-garde art shifted from war-torn Europe to New York, and the New York school maintained a dominant position in world art into the 1980s. Abstract Expressionism, Minimalism, Pop art, and the new realist styles of the late 1960s, among others, all had their beginnings in New York. See also action painting.

New York Stock Exchange (NYSE) World's largest marketplace for securities. The exchange began as an informal meeting of 24 men in 1792 on what is now Wall Street in New York City. It was formally constituted as the New York Stock and Exchange Board in 1817, and its present name was adopted in 1863. Since 1868 membership has been obtained by purchasing a seat from an existing member; membership has been limited to 1,366 since 1953. The exchange provided capital for the industrialization of the U.S. in the 19th century. After the Panic of 1837 it began to demand that companies disclose information about their finances to the public as a condition of offering stock. The stock-market crash of 1929 led to regulation by the Securities and Exchange Commission. To be listed on the NYSE, a company must earn $2.5 million before taxes, have more than one million shares of stock outstanding, give common stockholders voting rights, and publish periodic financial statements. See also American Stock Exchange; NASDAQ.

New York Times, The Morning daily newspaper, long the U.S. newspaper of record. From its establishment in 1851 it has aimed to avoid sensationalism and to appeal to cultured, intellectual readers. In 1896 it was bought by Adolph Ochs, who built it into an internationally respected daily. Its prestige was notably enhanced by its coverage of the sinking of the *Titanic* and of the two world wars. In the 1970s it became involved in controversy with its publication of the Pentagon Papers. Later in the decade, under the direction of Ochs's grandson, Arthur Ochs Sulzberger, its organization and staff underwent sweeping changes, including the introduction of a national edition printed at regional sites. Today it is perhaps the most respected and influential newspaper in the world. It is the flagship of The New York Times Co., whose interests include other newspapers (including the *Boston Globe*), magazines, and broadcast and electronic media.

New Yorker, The U.S. weekly magazine, famous for its varied literary fare and humour. It was founded in 1925 by Harold Ross, who was its editor until 1951. Initially focused on New York City's amusements and social and cultural life, it gradually acquired a broader scope, encompassing literature, current affairs, and other topics. Aimed at a sophisticated, liberal audience, it became renowned for its short fiction, cartoons, major (occasionally book-length) nonfiction pieces, and detailed reviews in the arts. It was sold in 1985 to Samuel I. Newhouse, Jr. (see Newhouse family). Since Ross, its editors have been William Shawn (1952–87), Robert Gottlieb (1987–92), Tina Brown (1992–98), and David Remnick (from 1998).

New Zealand Island country, South Pacific Ocean. Area: 104,454 sq mi (270,534 sq km). Population (2005 est.): 4,096,000. Capital: Wellington. Most of the people are of European origin; about one-tenth are Maori,



and some are Pacific Islanders and Chinese. Languages: English, Maori (both official). Religions: Christianity (Protestant, Roman Catholic); also Buddhism, Hinduism. Currency: New Zealand dollar. New Zealand consists of the North Island and the South Island, which are separated by Cook Strait, and several smaller islands. Both main islands are bisected by mountain ranges. New Zealand has a developing market economy based largely on agriculture (dominated by sheep raising), small-scale industries, and services. It is a constitutional monarchy with one legislative house; its chief of state is the British monarch represented by the governor-general, and the head of government is the prime minister. Polynesian occupation dates to c. AD 1000. First sighted by Dutch explorer Abel Janszoon Tasman in 1642, the main islands were charted by Capt. James Cook in 1769. Named a British crown colony in 1840, the area was the scene of warfare between colonists and native Maori through the 1860s. The capital was moved from Auckland to Wellington in 1865, and in 1907 the colony became the Dominion of New Zealand. It administered Western Samoa from 1919 to 1962 and participated in both World Wars. When Britain joined the European Economic Community in the early 1970s, its influence led New Zealand to expand its export markets and diversify its economy. New Zealand also became more independent in its foreign relations and took a strong stand against nuclear proliferation. The literacy rate is nearly 100%. The cultural milieu is predominantly European, although there has been a revival of traditional Maori culture and art, and Maori social and economic activism have been central to political developments in New Zealand since the late 20th century.

Newar \'nā-'wär\ People living in the Kathmandu Valley in Nepal. They make up about half the population of the valley. Most are Hindu, but some practice an Indian form of Buddhism. The Newar have a wide range of

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occupations; they have traditionally been noted as architects and artisans, the builders of the famous temples and shrines of Kathmandu. Painting and sculpture flourished among them in the 10th–16th centuries. The Newar population of Nepal is estimated to be about 540,000.

Newark \'nü-ərk\ City (pop., 2000: 273,546) and port of entry, northeastern New Jersey, U.S., west of New York City. It was founded in 1666 by Puritans and was chartered as a township in 1693. It was the site of the College of New Jersey (1748–56; now Princeton University). In 1776 the city served as a supply base for Gen. George Washington. It was incorporated as a city in 1836. The largest city in the state, it was the scene of major civil disturbances in 1967. It is a highly diversified industrial, transportation, and insurance centre. It was the birthplace of Aaron Burr and Stephen Crane.

Newbery, John (b. 1713, Waltham St. Lawrence, Berkshire, Eng.—d. Dec. 22, 1767, London) English publisher. In 1744 he set up a bookshop and publishing house in London, and it became one of the first to publish children's books, including *A Little Pretty Pocket-Book* and *Little Goody Two-Shoes*. In 1781 his firm published the first collection of nursery rhymes associated with Mother Goose. He is commemorated by the Newbery Medal, awarded annually since 1922 by the American Library Association for the most distinguished contribution to children's literature in the U.S. It is presented along with the Caldecott Medal (see Randolph Caldecott), awarded for the best children's picture book.

Newcastle (-under-Lyme), Thomas Pelham-Holles, 1st duke of (b. July 21, 1693—d. Nov. 17, 1768, London, Eng.) British politician. He inherited lands from his father and uncle that by 1714 made him one of the wealthiest Whig landowners in England. He helped bring about the succession of George I, for which he received the title of duke (1715). Chosen by Robert Walpole as secretary of state, he served from 1724 to 1754, then succeeded his brother Henry Pelham as prime minister (1754–56, 1757–62). Noted for his skill in distributing patronage to secure parliamentary support for a particular ministry, Newcastle wielded great political influence in the reigns of George I and George II.

Newcastle (-upon-Tyne), William Cavendish, 1st duke of (b. c. 1593—d. Dec. 25, 1676, Welbeck, Nottinghamshire, Eng.) British Royalist commander in the English Civil Wars. Through inheritances and royal favour, he became very wealthy. In 1642 he was given command of the four northern English counties and raised the siege of York (1642). After the Royalist defeat at the Battle of Marston Moor, he left England for France and Holland. He returned at the Restoration and regained his estates. A patron of poets and dramatists, he also wrote several comedies.

Newcastle upon Tyne *or* **Newcastle** City and metropolitan borough (pop., 2001: 259,573), metropolitan county of Tyne and Wear, historic county of Northumberland, northeastern England, on the River Tyne. It dates from the Roman period and derives its name from the Norman castle built in 1080 by Robert II of Normandy, the oldest son of William I (the Conqueror). At first an important wool trade centre, it became a major mining area and coal-shipping port in the 16th century. It was among the world's largest ship-repairing facilities; its economy now rests on associated marine and heavy engineering industries. The city is also an educational centre and features a 14th-century church.

Newcomen \'nü-kə-mən**, Thomas** (b. Feb. 28, 1663, Dartmouth, Devon, Eng.—d. Aug. 5, 1729, London) British engineer. In 1712 he built his atmospheric steam engine, a precursor of James Watt's engine. In the Newcomen engine, atmospheric pressure pushed the piston down after the condensation of steam had created a vacuum in the cylinder. Newcomen engines were used for some years in the draining of mines and in raising water to power waterwheels.

Newell, Allen (b. March 19, 1927, San Francisco, Calif., U.S.—d. July 19, 1992, Pittsburgh, Pa.) U.S. cognitive scientist. He taught at Carnegie Mellon University from 1961 until his death. In the late 1950s and early 1960s he collaborated with Herbert Simon in constructing an influential model of human problem solving (*Human Problem Solving*, 1972). His later work was concerned with artificial intelligence, and he is known for his development of computer models of human cognition and the development of a unified theory of cognition (*Unified Theories of Cognition*, 1990). In 1992 he received the National Medal of Science.

Newfoundland Dog breed developed in Newfoundland, possibly from crosses between native dogs and the Great Pyrenees dogs that Basque fishermen introduced into North America in the 17th century. Noted for sea rescues, the gentle, patient Newfoundland stands 26–28 in. (66–71 cm) and weighs 110–150 lbs (50–68 kg). Powerful hindquarters, a large lung capacity, large webbed feet, and a heavy, oily coat enable it to swim in cold waters. It has also been used as a watchdog and draft animal. The typical Newfoundland is solid black; the Landseer Newfoundland is usually black and white.

Newfoundland, Memorial University of See Memorial University of Newfoundland

Newfoundland \'nü-fənd-lənd\ **and Labrador** Province (pop., 2001: 512,930), one of the four Atlantic provinces of Canada. Consisting of the island of Newfoundland and Labrador on the mainland, and bounded by Quebec, it extends into the North Atlantic Ocean and is the easternmost part of North America. Its capital is St. John's. It was originally settled by Indians and Eskimos. Viking ruins from c. AD 1000 have been found in the northern part of the island. John Cabot claimed the island for England in 1497; the first colony was established at St. John's in 1583. France and England disputed possession of the area, and though England retained control with the 1713 Peace of Utrecht, controversies over fishing rights continued through the 19th century. A province since 1949, it includes the Grand Banks fishing grounds. Fishing, mainly for cod, was virtually the only industry until the early 20th century, when western Labrador's vast iron reserves began to be exploited.

Newhouse family Family that built a large publishing empire in the U.S. in the late 20th century. The family's fortunes began with Samuel Irving Newhouse (1895–1979), who, as a clerk at age 17, made a failing newspaper in Bayonne, N.J., profitable. From the early 1920s he bought and turned around other papers; at his death his company, Advance Publications Inc., owned 31 newspapers, 7 magazines, 5 radio stations, 6 television stations, and 15 cable television systems. Led by his sons Samuel I. Newhouse, Jr. (b. 1928), and Donald E. Newhouse (b. 1930), Advance Publications greatly expanded, buying several book publishers, including Random House (sold to Bertelsmann AG in 1998), and becoming one of the largest U.S. magazine publishers with titles such as *The New Yorker*, *Vanity Fair*, *Vogue*, *Glamour*, *Bride's*, and *Gourmet*.

Newman, Arnold (Abner) (b. March 3, 1918, New York, N.Y., U.S.) U.S. photographer. He studied art at the University of Miami, then worked in the photography studio of a Miami department store. In 1946 he opened his own studio in New York City, where he specialized in portraits of well-known people posed in settings associated with their work. His "environmental portraiture" greatly influenced 20th-century portrait photography. His best-known portraits include those of Max Ernst, Alfred Stieglitz, Georgia O'Keeffe, Igor Stravinsky, Pablo Picasso, and Jean Cocteau.

Newman, Barnett *orig.* **Baruch Newman** (b. Jan. 29, 1905, New York, N.Y., U.S.—d. July 3, 1970, New York City) U.S. painter. Born to Polish immigrant parents, he studied at the Art Students League and City College. With Robert Motherwell and Mark Rothko, he cofounded the school called "Subject of the Artist" (1948), which held open sessions and lectures for other artists. He developed a style of mystical abstraction and achieved his breakthrough with *Onement I* (1948), in which a single stripe (or "zip") of orange vertically bisects a field of dark red. This austerely geometric style became his trademark and had a great influence on artists such as Ad Reinhardt and Frank Stella.

Newman, John Henry *known as* **Cardinal Newman** (b. Feb. 21, 1801, London, Eng.—d. Aug. 11, 1890, Birmingham, Warwick) English churchman and man of letters. He attended the University of Oxford, where in 1833 he became the leader of the Oxford Movement, which stressed the Catholic elements in the English religious tradition and sought to reform the Church of England. He was received into the Roman Catholic church in 1845, but he came under suspicion among the more rigorous clergy because of his quasi-liberal spirit. A challenge from Charles Kingsley prompted him to write an eloquent exposition of his spiritual history, the widely admired *Apologia pro Vita Sua* (1864). The work assured his place in the church, and in 1879 he became a cardinal-deacon. He also wrote theological works, religious poetry, and several hymns, including "Lead, Kindly Light."

Newman, Paul (b. Jan. 26, 1925, Cleveland, Ohio, U.S.) U.S. film actor. He studied drama at Yale University and the Actors Studio and first appeared on Broadway in *Picnic* (1953). In 1954 he made his screen debut in the disastrous biblical epic *The Silver Chalice*. He won favourable notice in *Somebody up There Likes Me* (1956) and *The Long Hot Sum-*

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mer (1958). In many of his best-remembered roles, he captured the darker, less heroic aspects of a character's nature, as in such successful films as *The Hustler* (1961), *Hud* (1963), *Cool Hand Luke* (1967), *Butch Cassidy and the Sundance Kid* (1969), *The Color of Money* (1986; Academy Award), and *Nobody's Fool* (1994). He directed and produced films such as *Rachel, Rachel* (1968) and *The Glass Menagerie* (1987), both of which starred his wife, Joanne Woodward. In 1982 he launched the successful "Newman's Own" line of food products, with its profits going to a number of charitable causes.

Newport Town (pop., 1995 est.: 22,000), Isle of WIGHT, in the historic county of Hampshire, England. It was probably the Roman settlement of Medina; there is no trace of SAXON settlement. The first charter was granted between 1177 and 1184, and the borough was incorporated in 1608. It is the Isle of Wight's trade and agricultural centre.

Newport City (pop., 2000: 26,475) and port of entry, southeastern Rhode Island, U.S., at the mouth of NARRAGANSETT BAY. Founded in 1639 by colonists from Massachusetts, it became a haven for religious refugees. With PROVIDENCE, it was the joint capital of the state until 1900. Newport has held many of the AMERICA'S CUP yacht races, and it is a centre for naval education. It also is the site of one of CORNELIUS VANDERBILT's mansions (The Breakers) and the Touro synagogue, which is the oldest in the U.S.

Newport Town, port, and county borough (pop., 2001 est.: 137,017), historic county of Monmouthshire, Wales, at the BRISTOL CHANNEL mouth of the River Usk. By c. 1126 it was a medieval borough with a castle. The city was chartered in 1385. It was industrialized in the 19th century and was the scene of Chartist riots in 1839 (see CHARTISM). Industries include steel and aluminum.

Newport News City (pop., 2000: 180,150) and port of entry, southeastern Virginia, U.S., at the mouth of the JAMES RIVER. The site was settled in 1621 by 50 colonists from Ireland. It was incorporated as a city in 1896 and was an important embarkation point in both World Wars. With NORFOLK and PORTSMOUTH, it constitutes the Port of HAMPTON ROADS. It is the site of one of the largest shipyards in the world, producing luxury liners, aircraft carriers, and nuclear-powered submarines.

Newry and Mourne District (pop., 2001: 87,058), southeastern Northern Ireland. Bordered by the Irish Sea and the republic of Ireland, it is divided in two by the Newry Canal, the first major canal in the British Isles, built 1730–41. Limestone and granite are quarried in the Mourne Mountains. The administrative seat is at Newry.

news agency *or* **news service** *or* **wire service** Organization that gathers, writes, and distributes news to newspapers, periodicals, radio and television broadcasters, government agencies, and other users. It does not publish news itself but supplies news to subscribers, who, by sharing costs, obtain services they could not otherwise afford. All the mass media depend on agencies for the bulk of the news they carry. Some agencies focus on special subjects or on a local area or nation. Many news agencies are cooperatives, with members providing news from their area to a pool for general use. The largest news agencies are United Press International, ASSOCIATED PRESS, REUTERS, and AGENCE FRANCE-PRESSE.

newscast Radio or television broadcast of news events. News gathering and broadcasting by the radio networks began in the mid-1930s and increased significantly during World War II. The television newscast began in 1948 with 15-minute programs that resembled movie newsreels. The current U.S. format employs a newscaster or anchorperson reading news stories, with interpolated audiotape (for radio) or videotape (for television) and live reports from remote journalists. Noted newscasters have included EDWARD R. MURROW, WALTER CRONKITE, and David Brinkley.

Newsday Evening daily tabloid newspaper published in Long Island, N.Y. It was established in 1940, as the residential suburbs in Nassau and Suffolk counties began to expand. Following a liberal-independent policy, it has specialized in reporting serious local news. The newspaper itself has earned three Pulitzer Prizes for meritorious public service, and its writers and reporters have earned many more. *Newsday* is owned by the Tribune Co., which acquired the paper through its merger with the Times Mirror Co.

newsgroup INTERNET forum for discussion of specific subjects. Newsgroups are organized into subjects (e.g., automobiles); each typically has several subgroups (e.g., classic cars, Formula One racing cars). A person starts a threaded discussion by "posting" (uploading) an article; the follow-up replies (including replies to replies) comprise the discussion. A newsgroup name usually consists of an abbreviation (e.g., "rec" for the recreation newsgroup) followed by subgroup names separated by dots (e.g., "rec.music.jazz"). Viewing and posting messages requires a news reader, a program that connects the user to an Internet news server. Most newsgroups are connected via Usenet, a worldwide network that uses the Network News Transfer PROTOCOL (NNTP). See also BULLETIN-BOARD SYSTEM.

newspaper Publication usually issued daily, weekly, or at other regular times that provides news, views, features, and other information of public interest and often carries advertising. Forerunners of the modern newspaper appeared as early as ancient Rome (see ACTA). More or less regular papers printed from movable type appeared in Germany, Italy, and the Netherlands in the early 17th century. The first English daily was *The Daily Courant* (1702–35). Though preceded by official papers, James Franklin's *New-England Courant* (1721) was the first independent newspaper in Britain's North American colonies. By 1800 the principles of a free press and a basic formula for both serious and popular papers were taking root in much of Europe and the U.S. In the 19th century the number of U.S. papers and their circulations rose dramatically, owing to wider literacy, broadening appeal, lower prices, and technological advances in typesetting, printing, communications, and transport. By late in the century, newspapers had achieved great power. Competition for readers often led to sensationalism and, in the 20th century, gave rise to the so-called tabloids (see YELLOW JOURNALISM). Since 1900 newspaper publishing worldwide has expanded greatly; in large countries it has experienced consolidation driven by media conglomerates or through the acquisitions of smaller papers by larger ones.

Newsweek U.S. weekly newsmagazine, published in New York City. Founded (as *News-Week*) in 1933 by Thomas J.C. Martyn, a former editor of *TIME*, it merged with *Today* magazine in 1937. It initially offered a rather drab survey of the news with columns of analysis. After World War II it grew livelier, especially after its purchase by Philip Graham, publisher of *The* WASHINGTON POST, in 1961. It has a strong reputation for accurate, brisk, and vivid reporting and, like *Time*, presents news in terse summary form, organized by departments.

newt *or* **eft** Any of more than 40 SALAMANDER species (family Salamandridae) prevalent in the southeastern U.S. and Mexico and also found in Asia and Great Britain. Aquatic species are called newts; terrestrial species are called efts. Newts have a long, slender body, and the tail is higher than it is wide. They eat earthworms, insects, snails, and other small animals. Both aquatic and terrestrial species breed in ponds. The three species (genus *Triturus*) in Britain are sometimes called tritons. The red eft (*Notophthalmus viridescens*) of eastern North America is bright red during its terrestrial youth, after which it becomes permanently aquatic and dull green.

Warty newt (*Triturus cristatus*)
TONI ANGERMAYER

newton Absolute unit of FORCE, abbreviated N, in the metre-kilogram-second (MKS) system of physical units (see INTERNATIONAL SYSTEM OF UNITS). It is defined as the force necessary to provide a mass of 1 kg with an acceleration of 1 m per second per second. One newton is equal to a force of 100,000 dynes in the centimetre-gram-second (CGS) system, or a force of about 0.2248 lb in the foot-pound-second (English or U.S.) system. It is named for ISAAC NEWTON, whose second law of motion describes the changes a force can produce in the motion of a body.

Newton, Huey P(ercy) (b. Feb. 17, 1942, Monroe, La., U.S.—d. Aug. 22, 1989, Oakland, Calif.) U.S. African American activist. Though illiterate when he graduated from high school, he taught himself to read before attending college. He met Bobby Seale (b. 1936) while attending the San Francisco School of Law, and in 1966 they formed the BLACK PANTHER PARTY. In 1974 Newton was accused of murder and fled to Cuba; on his return in 1977, he was freed after two trials ended in hung juries. In 1980 he received a doctorate in social philosophy from the University of California at Santa Cruz. In 1989 he was sentenced to six months in jail

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for misusing money intended for a Black Panther-founded school; later that year he was discovered shot dead on a street in Oakland, Calif.

Newton, Sir Isaac (b. Jan. 4, 1643, Woolsthorpe, Lincolnshire, Eng.—d. March 31, 1727, London) English physicist and mathematician. The son of a yeoman, he was raised by his grandmother. He was educated at Cambridge University (1661–65), where he discovered the work of René Descartes. His experiments passing sunlight through a prism led to the discovery of the heterogeneous, corpuscular nature of white light and laid the foundation of physical optics. He built the first reflecting telescope in 1668 and became a professor of mathematics at Cambridge in 1669. He worked out the fundamentals of calculus, though this work went unpublished for more than 30 years. His most famous publication, *Principia Mathematica* (1687), grew out of correspondence with Edmond Halley. Describing his works on the laws of motion (see Newton's laws of motion), orbital dynamics, tidal theory, and the theory of universal gravitation, it is regarded as the seminal work of modern science. He was elected president of the Royal Society of London in 1703 and became the first scientist ever to be knighted in 1705. During his career he engaged in heated arguments with several of his colleagues, including Robert Hooke (over authorship of the inverse square relation of gravitation) and G.W. Leibniz (over the authorship of calculus). The battle with Leibniz dominated the last 25 years of his life; it is now well established that Newton developed calculus first, but that Leibniz was the first to publish on the subject. Newton is regarded as one of the greatest scientists of all time.

Newton's law of gravitation Statement that any particle of matter in the universe attracts any other with a force (F) that is proportional to the product of their masses (m_1 and m_2) and inversely proportional to the square of the distance (R) between them. In symbols: $F = G(m_1m_2)/R^2$, where G is the gravitational constant. Isaac Newton put forth the law in 1687 and used it to explain the observed motions of the planets and their moons, which had been reduced to mathematical form by Johannes Kepler early in the 17th century.

Newton's laws of motion Relations between the forces acting on a body and the motion of the body, formulated by Isaac Newton. The laws describe only the motion of a body as a whole and are valid only for motions relative to a reference frame. Usually, the reference frame is the Earth. The first law, also called the law of inertia, states that if a body is at rest or moving at constant speed in a straight line, it will continue to do so unless it is acted upon by a force. The second law states that the force F acting on a body is equal to the mass m of the body times its acceleration a, or $F = ma$. The third law, also called the action-reaction law, states that the actions of two bodies on each other are always equal in magnitude and opposite in direction.

Newtown Saint Boswells \'nüt-ᵊn-sənt-'bäz-wəlz\ Village (pop., 1991: 1,108), Scottish Borders council area, historic county of Roxburghshire, southeastern Scotland. It lies on the Edinburgh-Carlisle railway. Before 1929 its population consisted mainly of railroad employees. Since then its main function has changed to local governmental administration, and it has important livestock sales and a campus of Borders College. Dryburgh Abbey, founded in 1150, has the tombs of Sir Walter Scott and Field Marshal Douglas Haig.

Newtownabbey \ˌnüt-ᵊn-'a-bē\ Town and district (pop., 2001: 79,995), eastern Northern Ireland, established in 1973. The town was formed in 1958 from seven villages and is a residential continuation of Belfast. It is surrounded by modern industrial complexes that manufacture tires, telephones, and textiles. The district's light agricultural activity is centred around the administrative seat of Ballyclare.

Newtownards \ˌnüt-ᵊn-'ärdz\ Town (pop., 1991: 24,301), district seat of Ards, Northern Ireland. Settled in 1608 on the site of a ruined monastery, it is located east of Belfast. It is now a manufacturing centre.

Ney, Michel, duke d'Elchingen (b. Jan. 10, 1769, Sarrelouis, France—d. Dec. 7, 1815, Paris) French army officer, the best-known of Napoleon's marshals. He distinguished himself in the French Revolutionary Wars and rose to general in 1799. A supporter of Napoleon, he was created marshal of France in 1804 and duke d'Elchingen in 1808 after victories in the Napoleonic Wars. He led French forces in the Battle of Friedland (1807) and at the Battle of Borodino (1812). In the French retreat from Moscow, he courageously commanded the exposed rear guard and earned Napoleon's praise as "the bravest of the brave." After Napoleon's abdication, Ney favoured Louis XVIII but rallied to Napoleon's support in the Hundred Days and commanded troops at the unsuccessful Battle of Waterloo. After the Bourbon Restoration, he was court-martialed and shot by firing squad.

Neyshābūr \ˌnā-shä-'bür\ *or* **Nīshāpūr** \ˌnē-shə-'pür\ Town (pop., 1996: 158,847), northeastern Iran. Its name derives from its founder, the Sāsānian king Shāpūr I. One of the four great cities of the region of Khorāsān, it was the residence of the 5th-century Sāsānian king Yazdegerd II. It declined by the mid-7th century but flourished again under the Ṭāhirid (821–873) and Sāmānid (819–999) dynasties. It was the residence of the Seljūq sultan Toghrïl Beg in the 11th century but again declined in the 12th century. The tombs of the renowned poet and scholar Omar Khayyam and the mystic poet Farīd al-Dīn ʿAṭṭār are nearby.

Nez Percé \'nez-'pərs\ North American Indian people living mainly in Idaho, U.S. Their language belongs to the Penutian language group, and their traditional homeland is an area centring on the Snake River in central Idaho, western Oregon, and western Washington. The name Nez Percé, applied by French Canadian trappers, means "Pierced Noses"; they call themselves Nimíipuu (Nee-me-poo), meaning "The Real People." Their culture was primarily that of the Plateau Indians, with some Plains Indian influence. Their domestic life centred on small villages near streams with abundant salmon; they also hunted small game and collected wild plant foods. After acquiring horses, they began to hunt bison and became more warlike, eventually becoming one of the dominant tribes in the region. Through a series of treaties in the mid-1800s, their traditional territory was severely reduced; the tragic Nez Percé War (1877), led by Chief Joseph, was the result. At the turn of the 21st century, they numbered some 3,300.

Neẓāmī \'nez-ˌȯ-ˌmē\ *or* **Niẓāmī** *orig.* **Ilyās Yūsuf Niẓāmī Ganjawī** (b. c. 1141, Ganja, Seljūq empire—d. 1209, Ganja) Greatest romantic epic poet in Persian literature. Little is known of his life, except that he spent it in what is now Azerbaijan. Only a handful of his *qaṣīdah*s (odes) and ghazels have survived; his reputation rests on his great *Khamseh* ("The Quintuplet"), a group of five poems totaling 30,000 couplets, in which he brought a colloquial and realistic style to the epic. The fourth poem, *The Seven Beauties*, is considered his masterpiece.

NFL See National Football League

Ngami \əŋ-'gä-mē**, Lake** Shallow lake, northwestern Botswana, north of the Kalahari Desert. It was a large lake, estimated at more than 170 mi (275 km) in circumference when the explorer David Livingstone sighted it in 1849. The lake varies in size with the amount of rainfall, and, although it is much smaller today than in Livingstone's time, it is rich in birdlife.

NGO See nongovernmental organization

Ngo Dinh Diem \'ŋō-'din-dē-'em,\ *English* \en-'gō-'din-dē-'em\ (b. Jan. 3, 1901, Quang Binh province, Viet.—d. Nov. 2, 1963, Cho Lon, S.Viet.) President of South Vietnam (1955–63). Of noble birth, Diem was on friendly terms with the Vietnamese imperial family and served as Emperor Bao Dai's minister of the interior (1933), but he resigned when the French would not accept his legislative reforms. He turned down an invitation to join Ho Chi Minh's forces and lived in self-imposed exile until invited back in 1954 by Bao Dai to serve as prime minister of South Vietnam. In 1955 he ousted the emperor and made himself president. He refused to carry out elections mandated by the Geneva Accords of 1954, ruled autocratically, and showed preference to fellow Roman Catholics in an overwhelmingly Buddhist country. An unpopular leader, Diem was assassinated by his generals in 1963.

Ngonde See Nyakyusa

Ngugi wa Thiong'o \ᵊŋ-'gü-gē-wä-'thyȯŋ-gō\ *orig.* **James Thiong'o Ngugi** (b. Jan. 5, 1938, Limuru, Kenya) Kenyan novelist. Educated in Uganda and England, he wrote the first major novel in English by an East African; the popular *Weep Not, Child* (1964) is the story of a family drawn into the struggle for Kenyan independence. His other novels include *A Grain of Wheat* (1967) and *Petals of Blood* (1977). As he became more sensitive to the effects of colonialism, he adopted his traditional name and wrote in the Bantu language of the Kikuyu people. He also wrote plays and numerous essays on literature, culture, and politics.

Nguni \en-'gü-nē\ Cluster of related ethnic groups living in South Africa, Swaziland, and Zimbabwe. They include the Xhosa, Zulu, Swazi, and Ndebele. They speak very closely related Bantu languages—some of which are unique among Niger-Congo languages in having click sounds, absorbed from contact with their Khoisan-speaking neighbours. The

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Nguni were dispersed from their original homeland in what is now Eastern Cape province and KwaZulu-Natal by the MFECANE disturbances of the 1820s and the expansion of European power.

Nguyen \'ŋwē-ən,\ *English* \'nü-ən, en-gī-'en\ **dynasty** (1802–1945) Last Vietnamese dynasty. During the 16th century, while the emperors of the LATER LE DYNASTY were nominally in control, the Nguyen family came to rule southern Vietnam in an essentially independent fashion. Emperor Gia Long (1762–1820), founder of the dynasty, conquered all of Vietnam in 1802; his successors modeled their administration on the Chinese QING dynasty (1644–1911/12). The French invaded in 1858 and eventually took control of the entire country. They retained the Nguyen emperors as rulers of Annam (central Vietnam) and Tonkin (northern Vietnam) but not of southern Vietnam (Cochinchina). BAO DAI, the last emperor, abdicated following the Vietnamese nationalists' proclamation of independence in 1945.

NHL See NATIONAL HOCKEY LEAGUE

Ni Zan *or* **Ni Tsan** (b. 1301, Wuxi, Jiangsu province, China—d. 1374) Chinese artist. He was a part of the group of Chinese painters later known as the Four Masters of the Yuan dynasty (including Wu Zhen, Huang Gongwang, and Wang Meng). Although Ni was born to wealth, he chose not to serve the foreign Mongol dynasty of the Yuan and instead lived a life of retirement and scholarship. He was characterized by his contemporaries as particularly quiet and fastidious, qualities that are found in his art. In his paintings, usually landscapes, he used elements sparingly, favoured ink monochrome, and left great areas of the paper untouched. His works are characterized by a sombre quiet, and they often feature a rustic hut, a few trees or other indications of plant life, and elemental landforms. He was much imitated by later painters, making originals by him difficult to authenticate.

niacin \'nī-ə-sən\ *or* **nicotinic** \ˌni-kə-'tē-nik, ˌni-kə-'ti-nik\ **acid** *or* **vitamin B_3** Water-soluble VITAMIN of the VITAMIN B COMPLEX, essential to growth and health in animals, including humans. It is found in the body only in combined form as a COENZYME, nicotinamide adenine dinucleotide (NAD), which is involved in the METABOLISM of CARBOHYDRATES and the oxidation of SUGAR derivatives and other substances. One of the most stable vitamins, it survives most cooking and most preserving processes. It is widely found in dietary sources, especially lean meat. Deficiency causes PELLAGRA. It is used as a drug to reduce high CHOLESTEROL levels in the blood.

Niagara Falls Great falls of the NIAGARA RIVER, on the U.S.-Canadian border. They are divided by Goat Island into the Horseshoe (or Canadian) Falls and the American Falls. At the foot of the American Falls is the Cave of the Winds, a large rocky chamber formed by erosion. The river below the falls flows between high cliffs, forming Whirlpool Rapids. Bridges spanning the river include Rainbow Bridge between the U.S. and Canadian cities of Niagara Falls. French missionary LOUIS HENNEPIN visited in 1678. Tourism is a major industry, and the falls are a hydroelectric centre.

Niagara River River forming the U.S.-Canada boundary between western New York and southern Ontario. Its high flow and steep descent make it one of the best sources of hydroelectric power in North America. It connects Lake ERIE with Lake ONTARIO, and NIAGARA FALLS lies about halfway along its course. The U.S. and Canadian cities of the same name are on either bank of the river. It is navigable from Lake Erie to the upper rapids.

Niamey \'nyä-mā\ City (pop., 1999: metro. area, 731,000), capital of Niger, along the NIGER RIVER. Originally an agricultural village of Maouri, Zerma, and FULANI peoples, it became the capital of Niger colony in 1926 and grew rapidly after World War II. At the intersection of trade routes, it has residents from other parts of Niger, as well as YORUBA and HAUSA traders, merchants, officials, and craftsmen from Nigeria, Benin, and Togo. It is a commercial centre and home to Université Abdou Moumouni (1971).

Nian Rebellion *or* **Nien Rebellion** \'nyän\ (c. 1852–68) Rebellion in northern China during the QING DYNASTY. The Nian, a secret society, was probably a reincarnation of the WHITE LOTUS Society; it attracted poor peasants, salt smugglers, and army deserters who used guerrilla hit-and-run tactics to attack the wealthy and redistribute the plundered goods among the needy. They took over local militias and formed their own armies. They were finally crushed by LI HONGZHANG, who defeated them using modern weapons and blockade lines. See also TAIPING REBELLION.

Niarchos \nē-'är-kōs**, Stavros (Spyros)** (b. July 3, 1909, Athens, Greece—d. April 15, 1996, Zürich, Switz.) Greek shipping magnate. He first bought ships to transport wheat for his family's flour mill, then established his own shipping firm, Niarchos Group, in 1939. His ships were used by Allied forces in World War II, and after the war he used the insurance money he gained from ships sunk in combat to buy oil tankers. He favoured large ships, and many of his supertankers (of which Niarchos Ltd. at its height operated more than 80) set world records for size and carrying capacity. His longtime rivalry with ARISTOTLE ONASSIS was famous.

Nias \'nē-əs\ Island, western INDONESIA, in the Indian Ocean. The largest island in a chain along the western coast of SUMATRA, it has an area of 1,842 sq mi (4,772 sq km). Most of the people are animists (see ANIMISM) and speak dialects of the AUSTRONESIAN LANGUAGE family. The chief village is Gunungsitoli on the northeastern coast. Megalithic monuments and wooden sculptures honouring the dead or representing fertility are common on the island. Tourism (notably surfing) has become important. Coastal areas were devastated by an earthquake-generated TSUNAMI in 2004.

Nibelungenlied \'nē-bə-ˌlùŋ-ən-ˌlēt\ *German* **"Song of the Nibelungs"** Middle High German epic poem written c. 1200 by an unknown poet from the Danube region in what is now Austria. It is preserved in three main 13th-century manuscripts. Elements of great antiquity are discernible in the poem, traceable to Old Norse literature, stories in the *Poetic* EDDA, and Scandinavian SAGAS. The principal characters are Prince SIEGFRIED, Queen BRUNHILD, Princess Kriemhild, her brother King Gunther, and his henchman Hagen; the story focuses on deceit, revenge, and slaughter. Many variations and adaptations of the poem appeared in later centuries, including RICHARD WAGNER's opera cycle *Der Ring des Nibelungen* (1853–74).

Nicaea \nī-'sē-ə\ Independent principality (1204–61) of the fragmented BYZANTINE EMPIRE. Founded in 1204 by THEODORE I LASCARIS, it was the political and cultural centre from which a restored Byzantium arose in the mid-13th century under MICHAEL VIII PALAEOLOGUS. It extended from the BLACK SEA coast east of the Sangarius River southwest across western Anatolia to MILETUS and the Menderes (Maeander) River. It became a centre of Greek education, especially under Theodore II Lascaris, who founded an imperial school. It declined after 1261, when Michael VIII regained the Byzantine capital of Constantinople.

Nicaea \nī-'sē-ə**, Council of** (AD 325) First ecumenical council of the Christian Church, held at Nicaea (now Iznik, Turkey). Called by Emperor CONSTANTINE I, the council condemned ARIANISM and drew up the NICENE CREED. It failed to set a uniform date for Easter.

Nicaragua *officially* **Republic of Nicaragua** Country, Central America. Area: 50,337 sq mi (130,373 sq km). Population (2005 est.): 5,487,000. Capital: MANAGUA. Most of the people are MESTIZOS. Languages: Spanish (official), indigenous Indian languages, English. Religion: Christianity (predominantly Roman Catholic; also Protestant). Currency: córdoba oro. Nicaragua's western half consists of thickly forested mountain ranges and fertile valleys. Parallel to the Pacific coast is a belt of about 40 dormant and active volcanoes. The eastern coastline along the Caribbean Sea is known as the MOSQUITO COAST. Earthquakes are common and sometimes severe. Nicaragua has a developing market economy based largely on agriculture, light industries, and trade. It is a republic with one legislative house; its head of state and government is the president. The area has been inhabited for thousands of years, most notably by the MAYA. CHRISTOPHER COLUMBUS arrived in 1502, and Spanish explorers discovered Lake NICARAGUA soon thereafter. Nicaragua was governed by Spain until the early 1820s. It became a part of Mexico (1822–23) and then part of the United Provinces of Central America until 1838, when full independence was achieved. The U.S. intervened in political affairs by maintaining troops there (1912–33). Ruled by the dictatorial SOMOZA FAMILY (1937–79), Nicaragua was taken over by the SANDINISTA party after a popular revolt. The Sandinistas were then opposed by armed insurgents, the U.S.-backed CONTRAS, from 1981. The Sandinista government nationalized several sectors of the economy but lost national elections in 1990. The new government reprivatized many public enterprises. See map on opposite page.

Nicaragua, Lake Lake, southwestern Nicaragua. It is 102 mi (164 km) long, with a surface area of about 3,100 sq mi (8,000 sq km). The largest freshwater lake between the U.S. and Peru, it is connected to Lake MANAGUA by the Tipitapa River and is drained by the SAN JUAN RIVER. It is the only freshwater lake in the world containing marine animal life,

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including sharks, swordfish, and tarpon. Its largest island, Ometepe, is the preeminent site in Nicaragua for pre-Columbian archaeological finds.

Nice \'nēs\ *ancient* **Niceaea** City (pop., 1999: city, 342,738; metro. area, 888,784) southeastern France. It is located on the Côte d'Azur of the Mediterranean Sea, near the Italian border. Founded by Greeks c. 350 BC, it was conquered by Romans in the 1st century AD and became a trading station. It was held by the counts of Provence in the 10th century. In 1388 it passed to the counts of Savoy. The city was ceded to France in 1860. Sheltered by beautiful hills, Nice has a pleasant climate and is the leading resort of the French Riviera.

Nicene Creed \'nī-ˌsēn, nī-'sēn\ Ecumenical Christian statement of faith accepted by the Roman Catholic, Eastern Orthodox, Anglican, and major Protestant churches. Originally written in Greek, it was long thought to have been drafted at the Council of Nicaea (325), but is now believed to have been issued by the Council of Constantinople (381), based on a baptismal creed already in existence.

Nicephorus II Phocas \nī-'se-fə-rəs...'fō-kəs\ (b. 912, Cappadocia—d. Dec. 10/11, 969, Constantinople) Byzantine emperor (963–969). A powerful military commander, he fought the Arabs in the east, liberated Crete from its Arab rulers (961), and gained control of the eastern Mediterranean. After the death of Romanus II, Nicephorus cooperated in a plot to seize the throne, accepting the crown (963) and marrying Theophano, the regent of the two legitimate heirs. He continued his exploits against the Arabs but was surrounded by discontent and intrigue at home; he retired to a fortified palace, where he was killed by former friends guided by his wife and his chief lieutenant.

niche \'nich\ Smallest unit of a habitat that is occupied by an organism. A habitat niche is the physical space occupied by the organism; an ecological niche is the role the organism plays in the community of organisms found in the habitat. The activities of an organism and its relationships to other organisms are determined by its particular structure, physiology, and behaviour.

Nichiren \'nē-chē-ˌren\ *orig.* **Zennichi** (b. March 30, 1222, Kominato, Japan—d. Nov. 14, 1282, Ikegami) Japanese Buddhist prophet, founder of Nichiren Buddhism. The son of a fisherman, he entered a Buddhist monastery at age 11. After an exhaustive study of all the major Buddhist schools in Japan, he concluded in 1253 that the Lotus Sutra was the only doctrine suitable for his age and predicted calamity for Japan if all other sects were not abandoned. This pronouncement caused him to be banished from his monastery. He also claimed that Japan was the chosen country of Buddhism, from which Buddhist salvation would spread to other lands. He was later exiled to an island in the Sea of Japan, where in 1272 he wrote his major work, *Liberation from Blindness*.

Nichiren Buddhism One of the largest schools of Japanese Buddhism, founded by Nichiren. It believes that the essence of the Buddha's teachings are contained in the Lotus Sutra and that the beliefs of other Buddhist schools are erroneous. In Nichiren Buddhism, the chanting of the title of the Lotus Sutra can lead to salvation. After Nichiren's death the school split into various subsects, notably Nichiren-shu, which controls the temple founded by Nichiren at Mount Minobu, and Nichiren-sho-shu, which is headquartered in a temple at the foot of Mount Fuji. Nichiren-sho-shu has adherents in the U.S.; in Japan its lay organization is the Soka-gakkai.

Nicholas *Russian* **Nikolay Nikolayevich** (b. Nov. 18, 1856, St. Petersburg, Russia—d. Jan. 5, 1929, Antibes, France) Russian grand duke. The nephew of Tsar Alexander II, he entered the imperial army (1872) and served in the Russo-Turkish War (1877–78). As inspector general of calvary (1895–1905), he introduced reforms in training and equipment. From 1905 he commanded the St. Petersburg military district, and in 1914 he was appointed head of all Russian forces. A popular commander, he led the army to early successes in World War I but was hampered by shortages. Dismissed in 1915 by Nicholas II, he commanded in the Caucasus (1915–17). After the Russian Revolution of 1917 he moved to France, where he led an organization to unite anticommunist Russian émigrés.

Nicholas, Saint *or* **Santa Claus** (fl. 4th century, Myra, Lycia, Asia Minor; feast day December 6) Minor saint associated with Christmas. Probably bishop of Myra, he is reputed to have provided dowries for three poor girls to save them from prostitution and to have restored to life three children who had been chopped up by a butcher. He became the patron saint of Russia and Greece, of charitable fraternities and guilds, and of children, sailors, unmarried girls, merchants, and pawnbrokers. After the Reformation his cult disappeared in all the Protestant countries of Europe except Holland, where he was known as Sinterklaas. Dutch colonists brought the tradition to New Amsterdam (now New York City), and English-speaking Americans adopted him as Santa Claus, who is believed to live at the North Pole and to bring gifts to children at Christmas.

Merry Old Santa Claus by Thomas Nast.
BETTMANN/CORBIS

Nicholas I *Russian* **Nikolay Pavlovich** (b. July 6, 1796, Tsarkoye Selo, near St. Petersburg, Russia—d. March 2, 1855, St. Petersburg) Tsar of Russia (1825–55). He was the son of Paul I and was trained as an army officer. In 1825 he succeeded his brother Alexander I as emperor and suppressed the Decembrist revolt. His reign came to represent autocracy, militarism, and bureaucracy. To enforce his policies, he created such agencies as the Third Section (political police). In foreign policy, Nicholas quelled an uprising in Poland (1830–31) and aided Austria against a Hungarian uprising (1849). His designs on Constantinople led to war with Turkey (1853) and drew other European powers into the Crimean War. He was succeeded by his son Alexander II.

Nicholas II *orig.* **Gerard of Burgundy** (b. Lorraine—d. July 19/26, 1061, Florence) Pope (1058–61). Known as an advocate of reform, he was bishop of Florence before being elected pope in opposition to the antipope Benedict X. At the Lateran Council of 1059 he reformed the process of papal election, placing it in the hands of the cardinals and limiting the emperor's role. The German bishops voided his decree (1061), revealing growing tensions between empire and papacy. Nicholas brought about a diplomatic revolution, which worsened relations with Germany and its weak regent, when he sought an alliance with the Normans in southern Italy and invested Robert Guiscard as duke of Apulia, Calabria, and Sicily (1059). His legislation against clerical marriage and simony was an important part of the Gregorian reform movement.

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Nicholas II *Russian* **Nikolay Aleksandrovich** (b. May 18, 1868, Tsarskoye Selo, near St. Petersburg, Russia—d. July 16/17, 1918, Yekaterinburg) Tsar of Russia (1894–1917). Son of Alexander III, he received a military education and succeeded his father as tsar in 1894. He was an autocratic but indecisive ruler and was devoted to his wife, Alexandra, who strongly influenced his rule. His interest in Asia led to construction of the Trans-Siberian Railroad and also helped cause the disastrous Russo-Japanese War (1904–05). After the Russian Revolution of 1905, he agreed reluctantly to a representative Duma but restricted its powers and made only token efforts to enact its measures. His prime minister, Pyotr Stolypin, attempted reforms, but Nicholas, increasingly influenced by Alexandra and Grigory Rasputin, opposed him. After Russia suffered setbacks in World War I, Nicholas ousted the popular grand duke Nicholas as commander in chief of Russian forces and assumed command himself, at the bidding of Alexandra and Rasputin. His absence from Moscow and Alexandra's mismanagement of the government caused increasing unrest and culminated in the Russian Revolution of 1917. Nicholas abdicated in March 1917 and was detained with his family by Georgy Y. Lvov's provisional government. Plans for the royal family to be sent to England were overruled by the local Bolsheviks. Instead the family was sent to the city of Yekaterinburg, where they were executed in July 1918.

Nicholas V *orig.* **Tommaso Parentucelli** (b. Nov. 15, 1397, Sarzana, Republic of Genoa—d. March 24, 1455, Rome) Pope (1447–55). Soon after his election, he ended the schism caused by the rivalry between popes and church councils. He restored peace to the Papal States, won Poland's allegiance, and gained the support of Austria by promising to crown Frederick III as Holy Roman emperor. Nicholas initiated the Peace of Lodi (1455) in order to end strife in Italy, and he tried to stamp out simony and other corrupt practices in the church. A patron of art and scholarship, he rebuilt many of Rome's architectural treasures and founded the Vatican Library. Although Nicholas was the first of the Renaissance popes, his failure to promote real religious reform helped bring about the Reformation of the 16th century.

Nicholas Brothers U.S. tap-dancing duo. Fayard Antonio Nicholas (b. Oct. 20, 1914, Mobile, Ala., U.S.—d. Jan. 24, 2006, Los Angeles, Calif.) and his brother Harold Lloyd Nicholas (b. March 17, 1921, Winston-Salem, N.C.—d. July 3, 2000, New York, N.Y.) developed the "classical tap" form, combining jazz dance, ballet, and acrobatics with tap. They gained fame at a young age while dancing at Harlem's Cotton Club (1932–39); they went on to appear in films such as *Stormy Weather* (1943), as well as on Broadway and later on television. They began their careers at a time when opportunities were few and stereotyped roles the norm for black entertainers, but they rose above this marginalization and enhanced the art of tap with their elegance and sensational showmanship.

Nicholas of Cusa (b. 1401, Kues, Trier—d. Aug. 11, 1464, Todi, Papal States) German cardinal, mathematician, scientist, and philosopher. Ordained a priest in 1440, he was made a cardinal in Italy and became bishop there in 1450. In *On Catholic Concordance* (1433), he supported the supremacy of the general councils of the church over the papacy's authority (see conciliar movement). However, after witnessing the failure of the Council of Basel to unify the church or enact reform, he reversed his position and became an ardent supporter of the pope. Skilled in nearly every branch of learning, he anticipated the work of Nicolaus Copernicus by discerning a movement in the universe that did not centre on the Earth. He also carried out botanical experiments and collected ancient manuscripts. In his discourse *On Learned Ignorance* (1440), he described the learned man as one who is aware of his own ignorance.

Nicholas of Verdun (fl. c. 1150–1210, Flanders) French enamelist and goldsmith, considered the greatest of his day. He was an important figure during the transition from late Romanesque to early Gothic style. His best-known work is the altarpiece of the Abbey Church of Klosterneuburg, Austria (1181), which reveals his mastery of metalworking and the technique of champlevé enameling, in which compartments hollowed out from a metal base are filled with vitreous enamel. The altar is the most ambitious of its kind in the 12th century.

Nichols, Mike *orig.* **Michael Igor Peschkowsky** (b. Nov. 6, 1931, Berlin, Ger.) German-born U.S. stage and film director. He and his parents fled Germany for the U.S. in 1938. After studying at the University of Chicago and the Actors Studio, he formed a comic improvisational group in Chicago. He and Elaine May (b. 1932) toured with and recorded a set of brilliant social-satire routines. He later directed several Broadway hits, including *Barefoot in the Park* (1963), *The Odd Couple* (1965), and *Plaza Suite* (1968). His first film, *Who's Afraid of Virginia Woolf?* (1966), was followed by *The Graduate* (1967, Academy Award); his later films include *Catch-22* (1970), *Silkwood* (1983), *Working Girl* (1988), and *Primary Colors* (1998). His productions focused on the absurdities and horrors of modern life as revealed in personal relationships.

Nicholson, Jack (b. April 22, 1937, Neptune, N.J., U.S.) U.S. film actor. He acted in low-budget movies before earning acclaim for his role in *Easy Rider* (1969). He followed it with such successful films as *Five Easy Pieces* (1970), *Carnal Knowledge* (1971), *Chinatown* (1974), *One Flew over the Cuckoo's Nest* (1975, Academy Award), *The Shining* (1980), *Terms of Endearment* (1983, Academy Award), *Prizzi's Honor* (1985), *Batman* (1989), *Hoffa* (1992), and *As Good As It Gets* (1997, Academy Award). Noted for his devilish grin and his portrayals of unconventional outsiders, he has attained iconic status as one of the most popular and admired stars of his time.

Nicias \'ni-shē-əs\ (b. c. 470—d. 413 BC, Sicily) Athenian leader. He was renowned for his enormous wealth. Seeking to end the Peloponnesian War (431–404), in 421 he negotiated a 50-year alliance (the Peace of Nicias), which held for six years before the ambitions of Alcibiades led to renewed warfare. In 415 Nicias reluctantly shared command of a Sicilian expedition with Lamachus and Alcibiades. When Alcibiades was recalled and Lamachus died, Nicias, himself seriously ill, lost the advantage they had achieved in the siege of Syracuse; when he tried to escape, his troops were overwhelmed and he was captured and executed.

nickel Metallic chemical element, one of the transition elements, chemical symbol Ni, atomic number 28. Nickel is silvery white, tough, harder than iron, ferromagnetic (see ferromagnetism), and highly resistant to rusting and corrosion. It occasionally occurs free and is fairly common but not often concentrated in igneous rocks. As pure metal, it is used to coat other metals (see plating) and as a catalyst. In alloys, it is used in coins, Monel metal, nickel silver, nickel-chrome and stainless steels, permanant magnets, and cutlery. Its compounds, in which it most often has valence 2, have a variety of industrial uses, as catalysts and mordants (see dye) and in electroplating.

Nicklaus \'nik-ləs**, Jack (William)** (b. Jan. 21, 1940, Columbus, Ohio, U.S.) U.S. golfer, one of the greatest in the game's history. Nicklaus won the U.S. Amateur Championship twice (1959, 1961) while attending Ohio State University. After turning professional in 1962, he won the U.S. Open four times (1962, 1967, 1972, 1980), the Masters Tournament six times (1963, 1965, 1966, 1972, 1975, 1986), the PGA Championship five times (1963, 1971, 1973, 1975, 1980), and the British Open three times (1966, 1970, 1978). He was a member of the winning U.S. World Cup team six times and was a record three-time individual World Cup winner (1963, 1964, 1971). By 1986 "the Golden Bear" had played in 100 major championships, finishing in the top three 45 times. He combined skill and power with remarkable concentration and composure under pressure. In 2005 Nicklaus retired from tournament play with 73 PGA wins—a number exceeded only by Sam Snead with 82—and a record 18 major professional championship titles.

Jack Nicklaus, 1982.
FOCUS ON SPORTS INC.

Nicobar Islands See Andaman and Nicobar Islands

Nicolet \ˌni-kə-ˈlā**, Jean** (b. 1598, Cherbourg, France—d. Nov. 1, 1642, Sillery, Que., Can.) French explorer in North America. In 1618 he traveled to New France, where he lived with Indian tribes. He learned several Indian languages and became the interpreter for the French colony at Three Rivers (1633). He journeyed into Huron territory, canoeing with several Indians through the Straits of Mackinac to became the first European to see Lake Michigan (1634). He later explored the region of present-day Wisconsin.

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Nicolls, Richard (b. 1624, Ampthill, Bedfordshire, Eng.—d. May 28, 1672, in the North Sea, off Suffolk, Eng.) English colonial governor of New York. In 1664 he forcibly seized the Dutch colony of New Amsterdam and renamed the province and its main city for his patron, the duke of York. He thereby became the first governor of the English colony of New York. An efficient administrator, he issued the colony's first legal code in 1665. He returned to England in 1668 and resumed his duties as gentleman of the bedchamber to the duke.

Nicopolis \nə-'kä-pə-ləs**, Battle of** (September 25, 1396) Turkish victory over an army of European crusaders. When the Ottoman Turks besieged Constantinople (1395), MANUEL II PALAEOLOGUS appealed to Europe for help. The king of Hungary organized a crusade intended to expel the Turks from the Balkans and then march to Jerusalem. The crusaders laid siege to Nicopolis, the main Turkish stronghold on the Danube River, but Turkish forces arrived from Constantinople and slaughtered most of the crusaders. The battle ended international efforts to halt Turkish expansion into the Balkans and central Europe.

Nicopolis \nə-'kä-pə-lis\ **Actia** Ancient city, northwestern Greece. Its ruins lie about 4 mi (6 km) north of Préveza. It was founded in 31 BC by Octavian (later AUGUSTUS) to commemorate his victory over MARK ANTONY and CLEOPATRA at the Battle of ACTIUM. It became the capital of the coastal region, encompassing ACARNANIA and EPIRUS, and was famous for its buildings and for the Actian Games. Destroyed in the 4th century AD and rebuilt, it was finally destroyed by Bulgarians in the 11th century. Its ruins include a basilica, a Roman theatre, and an aqueduct.

Nicosia \ˌni-kə-'sē-ə\ *Greek* **Lefkosia** \'lef-kō-'sē-ə\ *Turkish* **Lefkoşa** City (pop., 2004 est.: Greek sector, 219,200; 1996: Turkish sector, 39,973), capital of CYPRUS. Lying on the Pedieos River, it is bordered by mountains to the north and south. It was a kingdom in the 7th century BC and has been the capital of the island since the 10th century AD. It came successively under the control of the Byzantines, Venetians, and Ottomans; the British held it from 1878 until 1960. During the 20th century the city grew beyond the existing circular Venetian walls. The population in the surrounding area is engaged mainly in agriculture. A UN buffer zone has separated the city's Greek and Turkish sectors since 1974.

nicotine Principal ALKALOID of TOBACCO, occurring throughout the plant but mostly in the leaves. It is a HETEROCYCLIC COMPOUND, containing a PYRIDINE ring; its chemical formula is $C_{10}H_{14}N$. Nicotine is the chief addictive ingredient (see DRUG ADDICTION) in cigarettes and cigars and in snuff. It has a unique biphasic effect: Inhaled in short puffs it is a stimulant, but when inhaled slowly and deeply it can be a tranquilizer. In larger doses, nicotine is a highly toxic poison, used as an insecticide, fumigant, and vermifuge.

nicotinic acid See NIACIN

Nicoya \nē-'kō-yä**, Gulf of** Inlet of the Pacific Ocean, northwestern coast of Costa Rica. It is formed by the protrusion of the Nicoya Peninsula from the mainland and extends north and northwest for about 50 mi (80 km). The Tempisque, Abangares, and Tárcoles rivers empty into the gulf. It has several islands, including Chira, the largest, and San Lucas. The largest town and port on the shores of the gulf is Puntarenas.

Nicoya Peninsula Peninsula, western Costa Rica. It is bounded to the west and south by the Pacific Ocean, to the northeast by the Cordillera de Guanacaste, and to the southeast by the Gulf of NICOYA. It measures about 85 mi (140 km) from northwest to southeast. Descendants of the pre-Columbian Chorotega-Mangues Indians reside in villages on the peninsula.

Niebuhr \'nē-ˌbůr**, Barthold Georg** (b. Aug. 27, 1776, Copenhagen, Den.—d. Jan. 31, 1831, Bonn, Prussia) German historian. Niebuhr held posts in state service in Denmark and Prussia before resigning to become state historiographer. In 1810 he began a series of lectures at the University of Berlin that were the basis of his great work, the enormously influential *History of Rome* (1811–32). In it he introduced skepticism to historical scholarship, showing how to analyze historical sources, discard worthless material, and lay bare elements from which historical facts could be reconstructed, and thereby initiating a new era in historiography.

Niebuhr \'nē-ˌbůr**, Reinhold** (b. June 21, 1892, Wright City, Mo., U.S.—d. June 1, 1971, Stockbridge, Mass.) U.S. theologian. The son of an evangelical minister, he studied at Eden Theological Seminary and Yale Divinity School. He was ordained in the Evangelical Synod of North America in 1915 and served as pastor of Bethel Evangelical Church in Detroit, Mich., until 1928. His years in that industrial city made him a critic of capitalism and an advocate of socialism. From 1928 to 1960 he taught at New York's Union Theological Seminary. His influential writings, which forcefully criticized liberal Protestant thought and emphasized the persistence of evil in human nature and social institutions, include *Moral Man and Immoral Society* (1932), *The Nature and Destiny of Man*, 2 vol. (1941–43), and *The Self and the Dramas of History* (1955).

Reinhold Niebuhr, 1963
COURTESY OF THE RARE BOOK DEPARTMENT, UNION THEOLOGICAL SEMINARY LIBRARY, NEW YORK CITY

niello \nē-'e-lō\ Black metallic alloy of sulfur with silver, copper, or lead, used to fill designs that have been engraved on the surface of a metal object, usually of silver. The black sulfides are powdered, and after the engraved silver has been moistened, the powder is spread on it. When the metal is heated, the niello melts and runs into the engraved channels. After the excess niello is scraped away, the surface is polished. The contrast of the black niello against the bright surface produces an attractive decorative effect. During the height of its popularity in the Renaissance, the technique was widely used for embellishing liturgical as well as utilitarian objects. Nielli (objects decorated with niello) were produced in ancient Rome and 9th-century England. In Russia niello work is known as Tula work.

Nielsen, Carl (August) (b. June 9, 1865, Sortelung, near Norre Lyndelse, Den.—d. Oct. 3, 1931, Copenhagen) Danish composer. He studied violin and trumpet as a child and began composing by imitating classical models. In 1890 he went to Germany to learn of newer developments and met JOHANNES BRAHMS, whose music came to influence his own. His individual style—still following classical forms but using intense CHROMATICISM combined with a lyric, melodic strain—emerged after 1900. The last five of his six symphonies (1902–25) are the core of his work, but he also composed many short orchestra pieces, piano and chamber music, concertos for violin, flute, and clarinet, and a wind quintet.

Nielsen ratings National ratings of the popularity of U.S. television shows. Developed by A.C. Nielsen in 1950, the system now samples television viewing in about 5,000 homes. A meter attached to each television set records the channel being watched and sends the data to a computer centre; individual buttons record which person in each household is watching a given program. Separate surveys are done for many large media market areas. The ratings project each program's total audience; for example, a rating of 20 denotes that 20% of U.S. households tuned in to a particular program. Commercial television networks use the ratings to set advertising rates for each program as well as to determine which programs to continue and to cancel.

Niemeyer \'nē-ˌmī-ər\ **(Soares Filho), Oscar** (b. Dec. 15, 1907, Rio de Janeiro, Braz.) Brazilian architect. Beginning in 1934, he worked in the office of Lúcio Costa, an early exponent of the Modern movement in Brazil. Niemeyer's first major independent project was the plan for Pampulha (1941), a suburb of Belo Horizonte. The project is notable for the free-flowing forms used in many of its buildings. Other commissions followed, and in 1947 Niemeyer represented Brazil in the planning of the United Nations buildings in New York City. In 1956 Niemeyer was asked to design the new capital city of Brasília; he agreed to design the government buildings but suggested a national competition for the master plan, a competition subsequently won by his mentor, Costa. Niemeyer served as chief architect for NOVA-CAP, the government building authority in Brasília, from 1956 to 1961. Among the Brasília buildings designed by Niemeyer are the President's Palace, the Brasília Palace Hotel, the presidential chapel, and the cathedral. Active into his nineties, he was commissioned to design the mushroomlike Museum of Contemporary Art in Niterói, Braz. (1991). With its lyrical and sculptural forms, his work is free-flowing and optimistic. Niemeyer received the Pritzker Architecture Prize in 1988.

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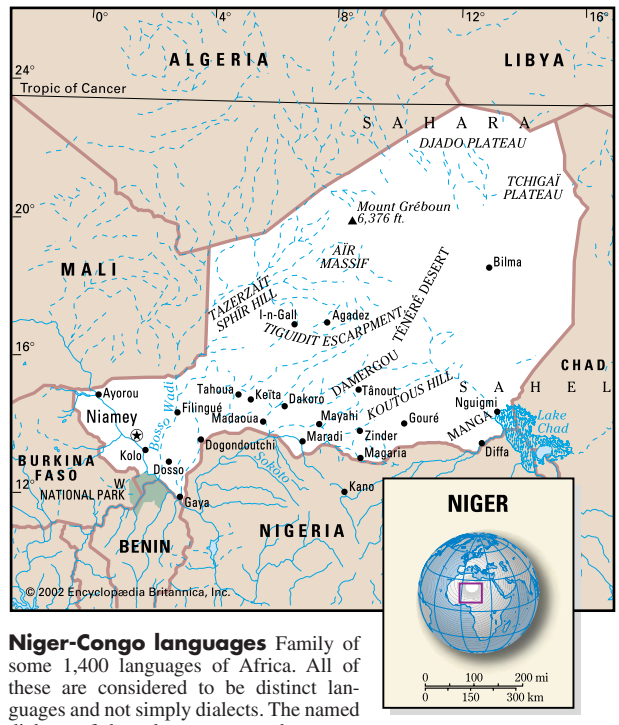
Niemöller \'nē-ˌmœl-ər\, **(Friedrich Gustav Emil) Martin** (b. Jan. 14, 1892, Lippstadt, Ger.—d. March 6, 1984, Wiesbaden, W.Ger.) German theologian. A war hero as a submarine commander in World War I, he became a minister in 1924. When the Nazis came to power in 1933, he protested their interference in church affairs and helped combat discrimination against Christians of Jewish background. As founder of the anti-Nazi Confessing Church, he worked to oppose Adolf Hitler. Arrested in 1937, he was interned until 1945. After the war he helped rebuild the Evangelical Church. Increasingly disillusioned with prospects for demilitarization, he became a controversial pacifist; for his efforts to extend friendship ties to Soviet-bloc countries, he received the Lenin Peace Prize (1967) and West Germany's Grand Cross of Merit (1971).

Nien Rebellion See Nian Rebellion

Niepce \'nyeps\, **(Joseph-) Nicéphore** (b. March 7, 1765, Chalon-sur-Saône, France—d. July 5, 1833, Chalon-sur-Saône) French inventor. In 1807 Niepce and his brother invented an internal-combustion engine (fueled with lycopodium powder). In 1813 he began experiments with lithography. He is best remembered for his experiments with photography, which he called heliography. In 1826–27, using a camera, he made a view from his workroom window on a pewter plate—the first permanently fixed image from nature. In 1829 he began a partnership with L.-J.-M. Daguerre to perfect and exploit heliography, but he died before they had achieved any further advance.

Nietzsche \'nē-chə, 'nē-chē\, **Friedrich (Wilhelm)** (b. Oct. 15, 1844, Röcken, Saxony, Prussia—d. Aug. 25, 1900, Weimar, Thuringian States) German-Swiss philosopher and writer, one of the most influential of modern thinkers. The son of a Lutheran pastor, he studied at Bonn and Leipzig and at age 24 became professor of Classical philology at the University of Basel. He became close to the older Richard Wagner, in whose operas he saw the potential for the revival of Western civilization, but broke with Wagner angrily in 1876. His *Birth of Tragedy* (1872) contained major insights into ancient Greek drama; like *Untimely Meditations* (1873), it is dominated by a Romantic perspective also influenced by Arthur Schopenhauer. Mental and physical problems forced him to leave his position in 1878, and he spent 10 years attempting to recover his health in various resorts while continuing to write prolifically. His works from *Human, All Too Human* (1878) to *The Gay Science* (1882) extol reason and science, experiment with literary genres, and express his emancipation from his earlier Romanticism. His mature writings, particularly *Beyond Good and Evil* (1886), *A Genealogy of Morals* (1887), and *Thus Spake Zarathustra* (1883–92), were preoccupied with the origin and function of values in human life. If, as he believed, life neither possesses nor lacks intrinsic value and yet is always being evaluated, then such evaluations can usefully be read as symptoms of the evaluator's condition. He fulminated against Christianity and announced the death of God. His major breakdown in 1889 marked the virtual end of his productive life. He was revered by Adolf Hitler for his dislike of democracy and his heroic ideal of the *Übermensch* (Superman), though the Nazis perverted Nietzsche's thought and ignored much in it that was hostile to their aims. His analyses of the root motives and values that underlie traditional Western religion, morality, and philosophy affected generations of theologians, philosophers, psychologists, poets, novelists, and playwrights.

Niger \'nī-jər, nē-'zher\ *officially* **Republic of Niger** Country, western Africa, on the southern edge of the Sahara. Area: 459,286 sq mi (1,189,546 sq km). Population (2005 est.): 12,163,000. Capital: Niamey. More than half the people are Hausa; there are also Songhai-Zerma and Kanuri. Languages: French (official), Hausa, Arabic. Religions: Islam (predominantly Sunni); also traditional beliefs. Currency: CFA franc. A landlocked country, Niger is characterized by savanna in the south and desert in the centre and north; most of the population lives in the south. The Niger River dominates in the southwest and the Aïr Massif (a mountainous region) in the north-central part of the country. Niger has a developing economy based largely on agriculture and mining. It is a republic with one legislative body; its head of state and government is the president, assisted by the prime minister. There is evidence of Neolithic culture in the region, and there were several precolonial kingdoms. First explored by Europeans in the late 18th century, it became part of French West Africa in 1904. It became an overseas territory of France in 1946 and gained independence in 1960. The first multiparty elections were held in 1993. Ibrahim Baré Maïnassara led a military coup in 1996, but after his assassination in 1999 the country returned to democratic government. See map above.



Niger-Congo languages Family of some 1,400 languages of Africa. All of these are considered to be distinct languages and not simply dialects. The named dialects of these languages number many thousands more, not to mention the variant names for those languages and dialects. Niger-Congo languages are spoken by about 85% of the population of Africa, from Dakar, Senegal, in the west to Mombasa, Kenya, and in the east and south to Cape Town, S.Af. The name Niger-Congo was introduced in 1955 by Joseph H. Greenberg. As understood today, Niger-Congo has nine branches: Mande, Kordofanian, Atlantic (formerly West Atlantic), Kru, Gur, Kwa, Ijoid, Adamawa-Ubangi (formerly Adamawa-Eastern), and Benue-Congo.

Niger River *or* **Joliba** \'jäl-ə-bə\ *or* **Kworra** \'kwȯr-ə\ Principal river of western Africa. The third longest on the continent, it rises in Guinea near the Sierra Leone border and flows into Nigeria and the Gulf of Guinea. It is 2,600 mi (4,183 sq km) long, and its middle course is navigable for about 1,000 mi (1,600 km). Peoples living along the Niger include the Bambara, the Malinke, and the Songhai. It was explored by Mungo Park beginning in 1796.

Nigeria *officially* **Federal Republic of Nigeria** Country, western Africa. Area: 356,669 sq mi (923,768 sq km). Population (2005 est.): 131,530,000. Capital: Abuja. There are more than 250 ethnic groups, including Hausa, Fulani, Yoruba, and Igbo. Languages: English (official), Hausa. Religions: Christianity (Protestant, other Christians, Roman Catholic), Islam, traditional beliefs. Currency: naira. Nigeria consists of plateaus and the lowlands between them, which are major river basins fed especially by the Niger River. It has a developing mixed economy based largely on petroleum production and agriculture; manufacturing is growing in importance. Services, trade, and transportation employ more than two-fifths of the workforce. Nigeria is a federal republic with two legislative bodies; its head of state and government is the president. Inhabited for thousands of years, the region was the centre of the Nok culture from 500 BC to AD 200 and of several precolonial empires, including Kanem-Bornu, Benin, and Oyo. The Hausa and Fulani also had states. Visited in the 15th century by Europeans, it became a centre for the slave trade. The area began to come under British control in 1861 and was made a British colony in 1914. Nigeria gained independence in 1960 and became a republic in 1963, with Nnamdi Azikiwe as president. Ethnic strife soon led to military coups, and military groups ruled the country from 1966 to 1979 and from 1983 to 1999. Civil war between the federal government and the former Eastern Region, Biafra (1967–70), ended in Biafra's surrender after the death by starvation of perhaps a million Biafrans. In 1991 the capital was moved from Lagos to Abuja. The government's execution of

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Ken Saro-Wiwa in 1995 led to international sanctions, and civilian rule was finally reestablished in 1999. By far the most populous nation in Africa, Nigeria suffers from rapid population increase, political instability, foreign debt, slow economic growth, a high rate of violent crime, and rampant government corruption.

Night of the Long Knives (June 30, 1934) Purge of Nazi leaders by Adolf Hitler. Fearing that the paramilitary SA had become too powerful, Hitler ordered his elite SS guards to murder the organization's leaders, including Ernst Röhm. Also killed that night were hundreds of other perceived opponents of Hitler, including Kurt von Schleicher and Gregor Strasser.

nighthawk Any of several species of North and South American birds in the whippoorwill family (Caprimulgidae) that are buff, reddish, or grayish brown, usually with light spots or patches, and 6–14 in. (15–35 cm) long. They fly about at night, especially at evening and dawn, catching flying insects in their mouths. The common nighthawk (*Chordeiles minor*), or bullbat, inhabits most of North America, migrating to South America in winter. It is about 8–12 in. (20–30 cm) long and grayish brown, with a white throat and wing patches. It has a sharp nasal call. During courtship it dives swiftly, creating audible whirring sounds.

nightingale Any of several small Old World thrushes (family Turdidae) renowned for their song. The name refers in particular to the Eurasian nightingale (*Erithacus megarhynchos*), a brown bird, 6.5 in. (16 cm) long, with a rufous tail. It sings day and night from perches in shubbery. Its strong and varied song, with prominent crescendo effects, has been regarded for centuries throughout Europe and Asia as the most beautiful of all birdsongs. The thrush nightingale, or sprosser (*E. luscinia*), is a closely related, more northerly species with slightly darker plumage. The term is also applied to other birds with rich songs (e.g., the wood thrush).

Eurasian nightingale (*Erithacus megarhynchos*)
H. REINHARD—BRUCE COLEMAN INC.

Nightingale, Florence (b. May 12, 1820, Florence, Italy—d. Aug. 13, 1910, London, Eng.) Italian-born British nurse, founder of trained nursing as a profession. As a volunteer nurse, she was put in charge of nursing the military in Turkey during the Crimean War. Her first concern was sanitation: patients' quarters were infested with rats and fleas, and the water allowance was one pint per head per day for all purposes. She used her own finances to purchase supplies. She also spent many hours in the wards; her night rounds giving personal care to the wounded established her image as the "Lady with the Lamp." Her efforts to improve soldiers' welfare led to the Army Medical School and a Sanitary Department in India. She started the first scientifically based nursing school, was instrumental in setting up training for midwives and nurses in workhouse infirmaries, and helped reform workhouses. She was the first woman awarded the Order of Merit (1907).

nightjar *or* **goatsucker** Any of about 60–70 species of birds (family Caprimulgidae) found almost worldwide in temperate to tropical regions. The name is sometimes applied to all birds in the order Caprimulgiformes. (The name goatsucker derives from an old belief that they sucked goat's milk at night.) Nightjars are gray, brown, or reddish brown. They eat flying insects at night. The common nightjar (*Caprimulgus europaeus*) has a flat head; wide, bristle-fringed mouth; large eyes; and soft plumage that results in noiseless flight. It is about 12 in. (30 cm) long. Its North American relatives include the nighthawk and whippoorwill.

nightshade family Family Solanaceae, composed of at least 2,400 species of flowering plants in about 95 genera. Though found worldwide, the nightshades are most abundant in tropical Latin America. Many are economically important as food or medicinal plants. Among the most important are the potato, eggplant, tomato, garden pepper, tobacco, and many garden ornamentals, including the petunia. The medicinally significant nightshades are potent sources of such alkaloids as nicotine, atropine, and scopolamine; they include deadly nightshade (belladonna), jimsonweed (*Datura stramonium*), henbane, and mandrake. The genus *Solanum* contains almost half the species in the family. The species usually called nightshade in North America and England is *S. dulcamara*, also called bittersweet and woody nightshade.

nihilism \'nī-ə-ˌli-zəm, 'nē-ə-ˌli-zəm\ Any of various philosophical positions that deny that there are objective foundations for human value systems. In 19th-century Russia the term was applied to a philosophy of skepticism that opposed all forms of aestheticism and advocated utilitarianism and scientific rationalism; it was popularized through the figure of Bazarov in Ivan Turgenev's *Fathers and Sons* (1862). Rejecting the social sciences, classical philosophical systems, and the established social order, nihilism rejected the authority of the state, the church, and the family. It gradually became associated with political terror and degenerated into a philosophy of violence.

Nijinska \nə-'zhin-skə**, Bronislava** *orig.* **Bronislava Fominitshna Nizhinskaya** (b. Jan. 8, 1891, Minsk, Russia—d. Feb. 21, 1972, Pacific Palisades, Calif., U.S.) Russian-born U.S. dancer, choreographer, and teacher. She trained at the Imperial Ballet School in St. Petersburg and joined the Mariinsky Theatre company in 1908. She danced with the Ballets Russes in Paris from 1909, as did her brother, Vaslav Nijinsky. She choreographed several ballets for the company, including *Les Noces* (1923), *The Blue Train* (1924), and *Les Biches* (1924). During the 1920s and 1930s she created works for other companies, including her own (1932–37). In 1938 she moved to Los Angeles, where she opened a school, and she continued to work as a guest choreographer into the early 1960s.

Nijinsky in *Spectre de la rose.*
COURTESY OF THE DANCE COLLECTION, THE NEW YORK PUBLIC LIBRARY AT LINCOLN CENTER, ROGER PRYOR DODGE COLLECTION

Nijinsky \nə-'zhin-skē**, Vaslav** *orig.* **Vatslav Fomich Nizhinsky** (b. March 12, 1890, Kiev, Ukraine, Russian Empire—d. April 8, 1950, London, Eng.) Russian ballet dancer. After early lessons from his parents, famous dancers with

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their own company, he and his sister, Bronislava Nijinska, trained further in St. Petersburg, and he joined the Mariinsky Theatre company in 1907. With his spectacular leaps and unrivaled grace, he was an immediate success, dancing leading roles in *Giselle*, *Swan Lake*, and *Sleeping Beauty*, often with Anna Pavlova and Tamara Karsavina. In 1909 he joined the new Ballets Russes, and he created many roles in Michel Fokine's ballets, including *Carnaval*, *Les Sylphides*, *Le Spectre de la rose*, *Petrushka*, and *Daphnis and Chloe*. In 1912–13 he choreographed *The Afternoon of a Faun*, *Jeux*, and *The Rite of Spring*, all of which caused scandals. His marriage in 1913 led to his dismissal from the company by his mentor, Sergey Diaghilev. He continued to perform but with less success. His intensifying mental illness led to his retirement in 1919, and he lived mostly in mental institutions in Switzerland, France, and England until his death. His status as a legend is unequaled in the history of dance.

Nijmegen \'nā-ˌmā-ɣə**, Treaties of** (1678–79) Peace treaties that ended the Franco-Dutch War. In the treaty between France and the Dutch Republic, France agreed to return Maastricht and to suspend the anti-Dutch tariff of 1667. In the treaty between France and Spain, Spain gave up regions to France that gave it a protected northeastern border and secured the safety of Paris. By negotiating separate treaties, France gained advantages over its enemies in the war.

Nike \'nī-kē, 'nē-kā\ Greek goddess of victory. She was the daughter of the giant Pallas and the river Styx. Nike was originally an attribute of both Athena and Zeus, represented as a small figure carried in their hand. She gradually came to be recognized as a mediator between gods and mortals, and was frequently shown carrying a palm branch, wreath, or staff as the messenger of victory. When depicted on her own, she was often a winged figure hovering over the victor in a competition. At Rome she was worshiped as Victoria.

Nike, sculpture from a bronze vessel, probably made in a Greek city of southern Italy, *c.* 490 BC; in the British Museum
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Nike Inc. U.S. sportswear company. It was founded in 1964 as Blue Ribbon Sports by Bill Bowerman (b. 1911), a track-and-field coach at the University of Oregon, and his former student Phil Knight (b. 1938). They opened their first retail outlet in 1966, launched the Nike brand shoe in 1972, and renamed the company Nike Inc. in 1978. In 1979 it claimed 50% of the U.S. running shoe market. In 1980 the company went public. Part of Nike's success is owed to endorsements by such athletes as John McEnroe, Michael Jordan, and Mia Hamm. In the 1990s the company suffered from revelations about conditions in its overseas factories, but it remained a top producer of athletic shoes and clothing.

Nikolais \'nē-kə-līz**, Alwin** (b. Nov. 25, 1910, Southington, Conn., U.S.—d. May 8, 1993, New York, N.Y.) U.S. dancer, choreographer, composer, and designer. He studied modern dance with various teachers, including Hanya Holm, whose assistant he later became. In 1948 he became director of the Henry Street Playhouse in New York City, and in 1951 he formed the Nikolais Dance Theater to present his productions of integrated motion, sound, shape, and colour. Nikolais directed the Center for Contemporary Dance in Angers, Fr. (1979–81). In 1989 his company merged with another to form the Nikolais and Murray Louis Dance Company.

Alwin Nikolais.
MARTHA SWOPE

Nikon \'nyē-kən\ *orig.* **Nikita Minin** (b. 1605, Veldemanovo, Russia—d. Aug. 27, 1681, en route to Moscow) Leader of the Russian Orthodox church. Born a peasant, he rose through the ranks of the priesthood to become patriarch of Moscow and all Russia in 1652. Granted sovereign power during the absence of Tsar Alexis on military campaigns, he purged Russian religious books and practices of what he considered corruptions, and he exiled his opponents. His reforms troubled many believers and led to a schism in the church (see Old Believers) as well as to widespread disaffection (see Doukhobors), and his high-handedness alienated Alexis. In 1666 a council of Greek patriarchs convened by Alexis stripped Nikon of all priestly functions but retained his reforms.

Nile, Battle of the (Aug. 1, 1798) Battle between the British fleet under Horatio Nelson and French Revolutionary forces at Abū Qīr Bay, near Alexandria, Egypt. In a plan to constrict British trade routes by invading Egypt, Napoleon ordered the French fleet to sail from its port of Toulon to Alexandria. The French eluded the British fleet to reach Abū Qīr Bay, where they anchored in a defensive line. Nelson discovered the French at twilight and ordered an immediate attack. In an all-night battle, the British destroyed or captured all but two of the 13 French ships. The decisive victory isolated Napoleon's army in Egypt and secured British control of the Mediterranean.

Nile perch Large food and game fish (family Latidae) found in the Nile and other African rivers and lakes. The Nile perch (*Lates niloticus*) has a large mouth and is greenish or brownish above, silvery below. It grows to about 6 ft (1.8 m) and weighs 300 lbs (140 kg). It has a slender body, a protruding lower jaw, a rounded tail, and two dorsal fins. Other species in the same family are found in African river systems and in Asian and Australian estuaries and coastal waters. The members of the family are sometimes classified with snooks (family Centropomidae).

Nile River *Arabic* **Baḥr al-Nīl** \bär-al-'nēl\ River, eastern and northeastern Africa. The longest river in the world, it is about 4,132 mi (6,650 km) long from its remotest headstream (which flows into Lake Victoria) to the Mediterranean Sea. After leaving the lake, it flows generally north through Uganda, The Sudan, and Egypt. Its major tributaries—including the Al-Ghazāl (Gazelle) River, the Blue Nile, and the Atbara River—join it before it enters Lake Nasser near the Egypt-Sudan border. Below the Aswan High Dam, which impounds the lake, it continues northward to its delta near Cairo, where it empties into the Mediterranean. The first use of the Nile for irrigation in Egypt began when seeds were sown in the mud left after its annual floodwaters had subsided. It has supported continuous human settlement for at least 5,000 years, and networks of canals and waterworks have been built since the 19th century. The Aswan High Dam, built in 1959–70, provides flood protection, hydroelectric power, and a dependable water supply for both crops and humans. The Nile is also a vital waterway for the transport of people and goods.

Nilo-Saharan \ˌnī-lō-sə-'hä-rən\ **languages** Group of perhaps 115 African languages spoken by more than 27 million people from Mali to Ethiopia and from southernmost Egypt to Tanzania. The concept of Nilo-Saharan as a single stock combining a number of earlier groupings was introduced in 1963 by Joseph H. Greenberg; most Africanists accepted it as a working hypothesis, though shifts have taken place. In terms of numbers of speakers, the most significant divisions of Nilo-Saharan languages include Central Sudanic, Fur, Nilotic, Nubian, Saharan, Songhai, and Surmic. Songhai is spoken by more than 2 million people in Mali and Niger, and Kanuri (a Saharan language) is spoken by about 4.5 million in northeastern Nigeria and adjacent Chad and Niger. Central Sudanic comprises languages of southern Chad, southern Sudan, and northeastern Congo (Kinshasa). Nubian languages (including the only Nilo-Saharan language with an ancient written tradition) are spoken along the Nile in northern Sudan and southern Egypt. The Nilotic languages are spoken by some 14 million people (see Nilotes), including the Dinka, Nuer, Luo, Turkana, Kalenjin, and Masai.

Nilot *plural* **Nilotes** Any member of a cluster of east-central African peoples living in southern Sudan, northern Uganda, and western Kenya. The name refers to the region of the Upper Nile and its tributaries, where most of them live. Nilotic languages belong to the Eastern Sudanic group of the Nilo-Saharan family. A notable shared physical characteristic is their average height, men commonly reaching 7 ft (210 cm). The Acholi, Dinka, Luo, Masai, Nandi, Nuer, and Shilluk are classed as Nilotes. Altogether they number about seven million.

Nilsson, Birgit *orig.* **Märta Birgit Svensson** (b. May 17, 1918, Västra Karup, Swed.—d. Dec. 25, 2005, Västra Karup) Swedish soprano. She made her debut in Stockholm in 1946, and she performed in the complete *Ring* cycle of Richard Wagner in Munich (1954–55). She went on to sing most of the major Wagnerian soprano roles at Bayreuth between 1954 and 1970; she was acclaimed as the greatest Wagnerian soprano of her time for the astonishing power and capacities of her rich voice. From 1959 she

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often sang at the Metropolitan Opera in New York City. Her other significant roles included Richard Strauss's Elektra and Salome, Giacomo Puccini's Turandot, and Ludwig van Beethoven's Leonore. She retired in 1984.

Nimbarka (fl. 13th century, South India) Indian yogi and founder of the devotional sect called Nimbarkas or Nimandi. Little is known of his life except that he was a Brahman and a notable astronomer. Like Ramanuja, he believed that the creator god and the souls he created were distinct but shared in the same substance, and he stressed devotion to Krishna as the only means of liberation from the cycle of rebirth. The Nimanda sect flourished in the 13th–14th century in eastern India.

Nimeiri \nə-'mer-ē**, Gaafar Mohamed el-** (b. Jan. 1, 1930, Wad Nubawi, Omdurman, Sudan) President of The Sudan (1971–85). In 1969 he helped overthrow the civilian regime of Ismaʿīl al-Azharī. Nimeiri's own government was temporarily ousted in 1971, but he was returned to office following a plebiscite. He granted autonomy to the Southern Sudan in 1972, inaugurated one of the world's largest sugar-refinery projects (1981), and sought to develop agriculture. His attempts to impose Islamic law were resisted by Christians and others in the south, which led to his fall from power.

Nîmes \'nēm\ *ancient* **Nemausus** City (pop., 1999: 133,424), southern France. It was the capital of a Gaulish tribe that submitted to Rome in 121 BC. Augustus founded a new city there, and for five centuries it was one of the principal cities of Roman Gaul. It was plundered by the Vandals and Visigoths in the 5th century AD and occupied by Moors in the 8th century. It passed to the French crown in 1229. Damaged in 1815 during fighting between royalists and Bonapartists, it returned to prosperity with the coming of the railways in the late 19th century. It is noted for its Roman remains, including an amphitheatre, an aqueduct, and the Maison Carée (an ancient temple restored in 1789).

Tour Magne, a ruined Roman tower, Nîmes, Fr.
ART RESOURCE—EB INC.

Nimitz \'ni-mits**, Chester W(illiam)** (b. Feb. 24, 1885, Fredericksburg, Texas, U.S.—d. Feb. 20, 1966, near San Francisco, Calif.) U.S. naval officer. He graduated from the U.S. Naval Academy in 1905 and served in World War I with the U.S. Atlantic submarine force. He rose to become chief of the navy's bureau of navigation in 1939. After the Japanese attack on Pearl Harbor, he was made commander in chief of the U.S. Pacific fleet, which won the battles of Midway and the Coral Sea (1942). In succeeding years, the historic battles of the Solomon Islands (1942–43), the Gilbert Islands (1943), and Iwo Jima and Okinawa (1945) were fought under his direction. The Japanese surrender was signed aboard his flagship, the USS *Missouri*. From 1945 to 1947 he served as chief of naval operations.

Nimrūd See Calah

Nin \'nēn, 'nin**, Anaïs** (b. Feb. 21, 1903, Neuilly, France—d. Jan. 14, 1977, Los Angeles, Calif., U.S.) French-born U.S. author. Daughter of the Cuban composer Joaquín Nin (1878–1949), she began her literary career in Paris in 1932. In the 1940s she moved to New York, where she published novels and short stories at her own expense. Her writing, including the novel *Cities of the Interior*, 5 vol. (1959), shows the influence of Surrealism and psychoanalysis. She won late recognition in 1966 with the publication of the first volume of her personal diaries; seven more volumes followed. Her account of her long incestuous relationship with her father was published posthumously.

Niña, La See La Niña

9-11 attacks See September 11 attacks

Ninety-five Theses Propositions for debate on the question of indulgences, written by Martin Luther and, according to legend, posted on the door of the castle church in Wittenberg, Ger., on Oct. 31, 1517. This event is now seen as the beginning of the Protestant Reformation. The theses were written in response to the selling of indulgences to pay for the rebuilding of St. Peter's Basilica in Rome. They represented an implicit criticism of papal policy and stressed the spiritual, inward character of the Christian faith. Widely circulated, they aroused much controversy. In 1518 Luther published a Latin manuscript with explanations of the theses.

Nineveh \'ni-nə-və\ Oldest and most populous city of ancient Assyria, on the eastern bank of the Tigris River opposite modern Mosul, Iraq. Its greatest development was under Sennacherib and Ashurbanipal in the 7th century BC. It was captured and destroyed by Nabopolassar of Babylonia and his allies, the Scythians and Medes, in 612 BC. Excavations made in 1845–51 revealed palaces, a library, city walls, and many gates and buildings.

Ningxia *or* **Ningsia** \'niŋ-'shyä\ *in full* **Hui Autonomous Region of Ningxia** Autonomous region (pop., 2002 est.: 5,720,000), northern China. It is bounded by Shaanxi and Gansu provinces and Inner Mongolia autonomous region and has an area of 25,600 sq mi (66,400 sq km). China's Great Wall runs along its northeastern boundary. The capital is Yinchuan. It is nearly coextensive with the ancient kingdom of the Tangut people, whose capital was captured by Genghis Khan in the early 13th century. The region is mostly desert and is sparsely settled, but the vast plain of the Huang He (Yellow River) in the north has been irrigated for centuries; over the years many canals have been built.

Ninhursag \nin-'kůr-ˌsäg\ In Mesopotamian religion, the city goddess of Adab and of Kish. Worshiped especially by the herders of northern Mesopotamia, she was the goddess of the stony, rocky ground, and she had the power to produce wildlife in the foothills and in the desert. A mother figure, she was the goddess of birth; she also appeared as a sorrowing mother in her lament for her son, a young colt. Her husband was the god Shulpae, and among their children was Mululil, a dying god whose death was mourned in yearly rites.

Niño, El See El Niño

Ninsun \'nin-ˌsůn\ In Mesopotamian religion, the city goddess of Kullab. Worshiped especially by herders in southern Mesopotamia, she was originally represented as a cow and was considered to be the divine power behind all the qualities that herders wanted in their cattle. She was also represented in human form and could give birth to human offspring. Her son was the wild bull Dumuzi, whom she lamented in a yearly ritual, and her husband was the legendary hero Lugalbanda. Her Sumerian counterparts included Ninhursag.

Ninurta \ni-'nůr-tä\ In Mesopotamian religion, the city god of Girsu. The son of Enlil and Ninlil, he was the god of thunder and of the spring rains and floods as well as the god of the plow. His original name was Imdugud ("Raincloud"), and his earliest form was that of the thundercloud represented as an enormous black bird roaring its thunder cry from a lion's head. Eventually Ninurta was given human form, and his original shape was assigned to his ancient enemy. His festival marked the beginning of the plowing season.

Niobe \nī-'ō-bē\ In Greek mythology, the prototype of the bereaved mother. The daughter of Tantalus, she married King Amphion of Thebes and bore him six sons and six daughters. She made the mistake of boasting of her fertility to the Titaness Leto, who had only two children, Apollo and Artemis. As punishment for her pride, Apollo killed all of Niobe's sons and Artemis all her daughters. Niobe was so overwhelmed with grief that the gods turned her into a rock on Mount Sipylus (near modern Izmir, Turkey), which weeps endlessly as the snow above it melts.

Apollo and Artemis killing the children of Niobe, red-figure calyx krater by the Niobid Painter, c. 455–450 BC; in the Louvre, Paris.
CLICHE MUSEES NATIONAUX, PARIS

Niobid \nī-'ō-bid\ **Painter** (fl. c. 475–450 BC, Greece) Greek vase painter, named for a calyx krater showing the death of the children of Niobe. Because the Niobid Painter made a deliberate effort to express space and depth by arranging figures on different levels, the vessel is thought to reflect the innovative technique of the now lost mural paintings of Polygnotus.

Niobrara \ˌnī-ə-'brar-ə\ **River** River, Wyoming and Nebraska, U.S. Flowing east across Wyoming's high

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plains and Nebraska's sandhills and low plains, it joins the Missouri River at the village of Niobrara, Neb., at the South Dakota line. It is 431 mi (694 km) long. The Agate Fossil Beds National Monument is located on the river, north of Scottsbluff, Neb.

Nipigon \'ni-pi-ˌgän**, Lake** Lake, Ontario, Canada. Located north of Lake Superior and northeast of Thunder Bay, it is about 70 mi (110 km) long and 50 mi (80 km) wide and has an area of 1,870 sq mi (4,840 sq km). It lies at an elevation of 1,050 ft (320 m) and has a maximum depth of 540 ft (165 m). Its Indian name means "deep, clear water." It is studded with many wooded islands, and large bays characterize its shoreline. Its outlet is the Nipigon River, which flows into Lake Superior.

Nipissing \'ni-pə-ˌsiŋ**, Lake** Lake, southeastern Ontario, Canada. Located midway between the Ottawa River and Georgian Bay, it is 50 mi (80 km) long and 30 mi (48 km) wide, with an area of 321 sq mi (832 sq km). A remnant of glacial Lake Algonquin, it contains many islands. The French River drains the lake as it flows west into Georgian Bay. It was discovered by Étienne Brûlé c. 1610 and was later a fur-trading route linking the Ottawa River with the upper Great Lakes.

Nippur \ni-'půr\ Ancient Mesopotamian city southeast of Babylon. Located in what is now southeastern Iraq, it was originally on the Euphrates River, whose course later changed. By 2500 BC it was the centre of worship of the Sumerian storm god Enlil (see Sumer). Parthian construction (see Parthia) later buried Enlil's sanctuary, and the city fell into decay in the 3rd century AD. It was abandoned in the 12th or 13th century. Excavations have revealed temples, a ziggurat, and thousands of clay tablets that are a primary source of information on ancient Sumerian civilization. Also uncovered were an Akkadian tomb (see Akkad) and a large temple devoted to the Mesopotamian goddess of healing.

Female figure, made of gypsum, with a gold mask that stood at a temple altar in Nippur, c. 2700 BC; in the Iraq Museum, Baghdad

COURTESY OF THE IRAQ MUSEUM, BAGHDAD; PHOTOGRAPH, DAVID LEES

Nirenberg \'nir-ən-ˌbərg**, Marshall Warren** (b. April 10, 1927, New York, N.Y., U.S.) U.S. biochemist. He received his Ph.D. from the University of Michigan. He demonstrated that each possible triplet (codon) of the four different kinds of nitrogen-containing bases found in DNA and (in some viruses) in RNA (with three exceptions) ultimately causes the incorporation of a specific amino acid into a cell protein. His research earned him a Nobel Prize in 1968, which he shared with Robert William Holley and Har Gobind Khorana, whose work, like Nirenberg's, helped show how genetic instructions in the cell nucleus control the composition of proteins.

nirvana \nir-'vä-nə\ (Sanskrit: "Extinction") In Indian religious thought, the transcendent state of freedom achieved by the extinction of desire and of individual consciousness. Nirvana is the supreme goal of the disciplines of meditation, particularly in Buddhism. Release from desire (and consequent suffering) and the continuous round of rebirths constitutes enlightenment, or the experience of nirvana. Theravada Buddhism conceives of nirvana as tranquillity and peace; Mahayana Buddhism equates it with *sunyata* (emptiness), *dharma-kaya* (the essence of the Buddha), and *dharma-datu* (ultimate reality).

Niš *or* **Nish** \'nēsh\ City (pop., 2000 est.: 182,583), southeast of Belgrade, Serbia, Serbia and Montenegro. The ancient Roman city was mentioned by Ptolemy in the 2nd century AD. It was the birthplace of Constantine I (c. 280), who adorned it with many buildings. Bomb damage in World War II and postwar construction erased much of its Turko-Byzantine style. It was held at various periods by Bulgarians, Hungarians, and Turks. During the Turkish period it became an important station on the route from Istanbul to Hungary. It was ceded to Serbia by the Treaty of Berlin in 1878 and was its capital until 1901. It is a railroad junction and commercial centre.

Nīshāpūr See Neyshābūr

Nissan \'nē-'sän\ **Motor Co., Ltd.** Japanese automaker. Headquartered in Tokyo, Nissan manufactures cars, trucks, and commercial equipment. Formed from the merger of two smaller firms in 1925, it adopted its present name in 1934. In World War II the company produced military vehicles; seized by Allied forces in 1945, it did not return to full production until 1955. Nissan's sales grew rapidly after it entered the world market in the 1960s, and it established assembly plants in several countries, including Australia, Germany, Mexico, and the U.S. In 1999 the French automaker Renault bought a 37% stake in the company and later increased its share.

NIST See Bureau of Standards

nitrate Any salt or ester of nitric acid (HNO_3). The salts are inorganic compounds with ionic bonds, containing the nitrate ion (NO_3^-) and any cation. Many, particularly ammonium nitrate, are used as agricultural fertilizers (see saltpeter). Their runoff in surface water and groundwater can cause serious illness in humans. The esters are organic compounds with covalent bonds, having the structure $R—O—NO_2$, in which R represents an organic combining group such as methyl, ethyl, or phenyl.

nitre See saltpetre

nitric \'nī-trik\ **acid** Inorganic compound, colourless, fuming, highly corrosive liquid, chemical formula HNO_3. A common laboratory reagent, it is important in the manufacture of fertilizers and explosives (including nitroglycerin), as well as in organic syntheses, metallurgy, ore flotation, and reprocessing of spent nuclear fuel. A strong acid, it is toxic and can cause severe burns. It attacks most metals and is used for etching steel and photoengraving.

nitric oxide Colourless, toxic gas (NO), formed from nitrogen and oxygen by the action of electric sparks or high temperatures or, more conveniently, by the action of dilute nitric acid on copper or mercury. First prepared c. 1620 by Jan B. Helmont, it was first studied in 1772 by Joseph Priestley, who called it "nitrous air." An industrial procedure for the manufacture of hydroxylamine is based on the reaction of nitric oxide with hydrogen in the presence of a catalyst. The formation of nitric oxide from nitric acid and mercury is applied in a volumetric method of analysis for nitric acid or its salts. The gas is synthesized via enzyme-catalyzed reactions in humans and other animals, where it serves as a signaling molecule. Among its numerous biological roles, it causes dilation of blood vessels and as such is an important regulator of blood pressure. Nitric oxide is one of the components of air pollution generated by internal-combustion engines.

nitrifying bacteria \'nī-trə-ˌfī-iŋ\ Small group of oxygen-requiring bacteria that use nitrogen as an energy source. These microorganisms are important in the nitrogen cycle as converters of soil ammonia to nitrates, compounds usable by plants. The nitrification process requires two distinct groups: bacteria that convert ammonia to nitrites, and bacteria that convert nitrites to nitrates. In agriculture, irrigation with dilute solutions of ammonia results in an increase in soil nitrates through the action of nitrifying bacteria. See also denitrifying bacteria.

nitrite \'nī-ˌtrīt\ Any salt or ester of nitrous acid (HNO_2). The salts are inorganic compounds with ionic bonds, containing the nitrite ion (NO_2^-) and any cation. The esters are organic compounds with covalent bonds, having the structure $R—O—N—O$, in which R represents a carbon-containing combining group and the bonding is from carbon to oxygen. These covalent nitrites are constitutional isomers (see isomerism) of the nitro compounds, nitric acid derivatives ($R—NO_2$), in which the bonding is from carbon to nitrogen. Nitrites are used as food preservatives and color enhancers, though they are so toxic they have caused deaths and combine with amines to produce carcinogens. They are used in medicine to dilate blood vessels.

nitro compound \'nī-ˌtrō\ Any of a class of chemical compounds in which the nitro group ($—NO_2$) forms part of the molecular structure. The most common examples are organic compounds, isomers of nitrite esters in which a carbon atom is linked by a covalent bond to the nitro group's nitrogen atom. Many nitro compounds are commercially used as explosives, solvents, or raw materials and chemical intermediates. They are generally made by a reaction between nitric acid and an organic compound.

nitrogen Gaseous chemical element, chemical symbol N, atomic number 7. A colourless, odourless, tasteless gas, it makes up 78% of Earth's atmosphere and is a constituent of all living matter. As the nearly unre-

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active diatomic molecule N_2, it is useful as an inert atmosphere or to dilute other gases. Nitrogen is commercially produced by DISTILLATION of liquefied air. NITROGEN FIXATION, achieved naturally by soil microbes and industrially by the HABER-BOSCH PROCESS, converts it to water-soluble compounds (including AMMONIA and NITRATES). Industrially, ammonia is the starting material for most other nitrogen compounds (especially nitrates and NITRITES), whose main uses are in agricultural fertilizers and explosives. In compounds, nitrogen usually has VALENCE 3 or 5. It forms several OXIDES including NITROUS OXIDE (N_2O; laughing gas), NITRIC OXIDE (NO), nitrogen dioxide (NO_2), and other forms (such as N_2O_3 and N_2O_5). Some of the nitrogen oxides, often referred to generically as NO_x, are notorious as contributors to urban AIR POLLUTION. Other compounds include the nitrides, exceptionally hard materials made from nitrogen and a metal; CYANIDES; azides, used in detonators and percussion caps; and thousands of organic compounds containing nitrogen in FUNCTIONAL GROUPS or in a linear or ring structure (see HETEROCYCLIC COMPOUND). See also NITROGEN CYCLE.

nitrogen cycle Circulation of NITROGEN in various forms throughout nature. Nitrogen is essential to life, but in the atmosphere it is in a form (the diatomic molecule N_2) unavailable to most organisms. NITROGEN FIXATION by microbes turns this nitrogen into NITRATES and other compounds, which plants or algae assimilate into their tissues. Animals that eat plants in turn incorporate the compounds into their own tissues. Microbes decompose the remains and waste of all living things into AMMONIA (ammonification); the ammonia may leave the soil through vaporization into the air or leaching into water. Ammonia remaining in soil may be transformed by bacteria into nitrates (nitrification), which then can be reassimilated into living organisms, or into free nitrogen (denitrification), which reenters the atmosphere. Hence, once fixed from air, some nitrogen goes through the cycle repeatedly without returning to the gaseous state.

nitrogen fixation Any natural or industrial process that causes free NITROGEN in the air to combine chemically with other elements to form more reactive nitrogen compounds such as AMMONIA, NITRATES, or NITRITES. Soil microorganisms (e.g., *Rhizobium* bacteria living in root nodules of LEGUMES) are responsible for more than 90% of all nitrogen fixation. Though nitrogen is part of all PROTEINS and essential in both plant and animal METABOLISM, plants and animals cannot use elemental nitrogen such as the nitrogen gas (N_2) that forms 80% of the atmosphere. Symbiotic nitrogen-fixing bacteria invade the root hairs of host plants, where they multiply and stimulate the formation of root nodules, enlargements of plant cells and bacteria in close association. Within the nodules the bacteria convert free nitrogen to nitrates, which the host plant uses for its development. Nitrogen fixation by bacteria associated with legumes is of prime importance in agriculture. Before the use of synthetic FERTILIZERS in the industrial countries, usable nitrogen was supplied as MANURE and by CROP ROTATION that included a legume crop.

nitrogen narcosis *or* **nitrogen euphoria** *or* **raptures of the deep** Effects of breathing nitrogen under increased pressure. In divers breathing compressed air, nitrogen saturates the nervous system, causing an intoxicating light-headed, numb feeling, then slowed reasoning and dexterity, and then emotional instability and irrationality. Severe cases progress to convulsions and blackout. Susceptibility varies, and severity increases with depth, but there are no aftereffects. Physical function remains normal, and divers may be unaware of the growing irrationality that can cause them to rise too fast (see DECOMPRESSION SICKNESS) or let their air supply run out. Helium, which dissolves less easily in body tissues, is substituted for nitrogen for deep dives.

nitroglycerin \ˌnī-trə-ˈgli-sə-rən\ *or* **glyceryl trinitrate** Organic compound, powerful explosive and ingredient of most forms of DYNAMITE. It is a colourless, oily, somewhat toxic liquid with a sweet, burning taste. Its safe use as a blasting explosive became possible after ALFRED P. NOBEL developed dynamite in the 1860s with an inert porous material (moderator) such as CHARCOAL or DIATOMACEOUS EARTH. Nitroglycerin is also used in a mixture in rocket propellants. In medicine, it is used to dilate blood vessels, especially to ease ANGINA PECTORIS.

nitrous oxide \ˈnī-trəs\ *or* **laughing gas** Inorganic compound, one of the OXIDES of NITROGEN. A colourless gas with a pleasantly sweetish odour and taste, it has an ANALGESIC effect when inhaled; it is used as an ANESTHETIC (often called just "gas") in dentistry and surgery. This effect is preceded by mild hysteria, sometimes with laughter, hence the name *laughing gas*. It is also used as a propellant in food aerosols and as a leak detector.

Nivernais \ˌnē-vər-ˈnā\ Historical region, central France. Originally part of BURGUNDY, it became a county c. 10th century. FRANCIS I of France made it a duchy in 1539 for Francis of Cleves. In 1659 it was sold to Cardinal MAZARIN. His descendants possessed it until the FRENCH REVOLUTION, when it was the last great FIEF to be reunited to the French crown. During the ANCIEN RÉGIME it was administered from Nevers.

Nixon, Richard M(ilhous) (b. Jan. 9, 1913, Yorba Linda, Calif., U.S.—d. April 22, 1994, New York, N.Y.) 37th president of the U.S. (1969–74). He studied law at Duke University and practiced in California (1937–42). After serving in World War II, he was elected to the U.S. House of Representatives (1946). As a member of the House Un-American Activities Committee, he received national attention for his hostile questioning of ALGER HISS. In 1950 he was elected to the Senate following a bitter campaign in which he unfairly portrayed his opponent as a communist sympathizer; the epithet "Tricky Dick" dates from this period. He won the vice presidency in 1952 as the running mate of Republican DWIGHT D. EISENHOWER. During the campaign he delivered a nationally televised address, the "Checkers" speech (named for the dog he admitted receiving as a political gift), to rebut charges of financial misconduct. He and Eisenhower were reelected easily in 1956. As the Republican presidential candidate in 1960, he lost narrowly to JOHN F. KENNEDY. After failing to win the 1962 California gubernatorial race, he announced his retirement from politics and criticized the press, declaring that it would not "have Dick Nixon to kick around anymore." He moved to New York to practice law. He reentered politics by running for president in 1968, narrowly defeating HUBERT H. HUMPHREY with his "southern strategy" of seeking votes from southern and western conservatives in both parties. As president, he began to withdraw U.S. military forces from South Vietnam while resuming the bombing of North Vietnam. His expansion of the VIETNAM WAR to Cambodia and Laos in 1970 provoked widespread protests in the U.S. He established direct relations with China and made a state visit there in 1972, the first by a U.S. president. On a visit to the Soviet Union later that year, he signed agreements resulting from the STRATEGIC ARMS LIMITATION TALKS between the U.S. and the Soviet Union held between 1969 and 1972, known as SALT I. In domestic affairs, Nixon responded to persistent inflation and increasing unemployment by devaluing the dollar and imposing unprecedented peacetime controls on wages and prices. His administration increased funding for many federal civil-rights agencies and proposed legislation that created the Occupational Safety and Health Administration (OSHA) and the ENVIRONMENTAL PROTECTION AGENCY (EPA). In 1972 he won reelection with a landslide victory over GEORGE MCGOVERN. Assisted by HENRY A. KISSINGER, he concluded a peace agreement with North Vietnam (1973), though the war did not come to an end until 1975. His administration helped to undermine the coalition government of Chile's Marxist Pres. SALVADOR ALLENDE, leading to Allende's overthrow in a military coup in 1973. Nixon's second term was overshadowed by the WATERGATE SCANDAL, which stemmed from illegal activities by Nixon and others related to the burglary and wiretapping of the headquarters of the Democratic Party. After lengthy congressional investigations and facing near-certain impeachment, Nixon resigned the presidency on Aug. 8, 1974, the first president to do so. Though never convicted of wrongdoing, he was pardoned by his successor, GERALD FORD. In retirement, he wrote his memoirs and several books on foreign policy, which modestly rehabilitated his reputation and earned him a role as an elder statesman and foreign-policy expert.

Niẓām al-Mulk \nē-ˈzȧm-ůl-ˈmülk\ *orig.* **Abū ʿAlī Ḥasan ibn ʿAlī** (b. c. 1018/19, Ṭūs, Khorāsān, Iran—d. Oct. 14, 1092, Nahāvand) Persian VIZIER of the Turkish SELJŪQ DYNASTY sultans. He worked for the rulers of the GHAZNAVID DYNASTY before serving ALP-ARSLAN as governor of Khorāsān. In 1063 he was made vizier, a position he occupied for 30 years, serving Alp-Arslan's son Malik-Shah from the latter's ascension. Believing that a ruler's power should be absolute and that the ruler should preserve the kingdom's stability and traditions, he recorded his views in the *Seyāsatnāmeh* ("Book of Government"). He is seen as the quintessential vizier and as a staunch Sunnite Muslim. He promoted the MADRASAH as a centre of learning, partly to combat Shīʿite propaganda. He was murdered, likely by an Ismāʿīlī ASSASSIN, after falling out of favour with Malik-Shah.

Niẓāmī See NEẒĀMĪ

Nizam's Dominions See HYDERABAD

Nizāriyyah See ASSASSIN

Nizhny Novgorod \ˈnizh-nē-ˈnȯv-gə-rət\ *formerly (1932–90)* **Gorky** City (pop., 2002: 1,311,200), western RUSSIA. It is located on the

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southern bank of the Volga River at its confluence with the Oka River. Founded in 1221, it was annexed to Moscow in 1392. It was strategically important in the Russian conquest of the Volga through the mid-16th century. In 1932 it was renamed for Maksim Gorky, who was born there. Under the Soviet regime it was a place of internal exile for Andrey Sakharov. The city has several 16th- and 17th-century buildings and is one of Russia's major industrial centres.

Njáls \'nyaůls\ **saga** *or* **Njála** \'nyaů-lä\ *or* **Burnt Njáll** \'bərnt-'nyaůl\ Icelanders' saga, one of the longest and finest. Set in a society where blood ties impose inescapable obligations and honour demands vengeance for past injuries, it presents the most comprehensive picture of Icelandic life in the heroic age. Its overriding mood is tragic pessimism. Its vividly drawn characters, who range from comic to sinister, include two heroes—Gunnar (Gunther), a brave, guileless, generous youth, and Njál, a wise and prudent man endowed with prophetic gifts.

Njörd \'nyȯrd, 'nyȯrth\ Norse god of the wind and of the sea and its riches. His aid was invoked in seafaring and hunting, and he was the god of prosperity. He was the father of Freyr and Freyja by his sister. Njörd's tribe, the Vanir, gave him as a hostage to the rival tribe of Aesir, and the giantess Skadi chose him as her husband. The marriage failed because Njörd preferred to live in Nóatún, his home by the sea, whereas Skadi was happier in her father's mountain dwelling place. Several traditions hold that Njörd was a divine ruler of the Swedes.

Nkomo \en-'kō-mō**, Joshua (Mqabuko Nyongolo)** (b. June 19, 1917, Semokwe Reserve, Matabeleland, Rhodesia—d. July 1, 1999, Harare, Zimb.) Zimbabwean (formerly Rhodesian) black nationalist. Nkomo helped lead the guerrilla war against white rule in Rhodesia, but his forces played a less important role than those of Robert Mugabe. As leader of the Zimbabwe African People's Union (ZAPU), he became Mugabe's longtime rival. They participated in a coalition government in 1980–82, but Nkomo was removed following a breach between them. ZAPU and Mugabe's Zimbabwe African National Union (ZANU) merged in 1987 to form ZANU–Patriotic Front, and Nkomo became a vice president in Mugabe's government in 1990.

Nkrumah \en-'krü-mə**, Kwame** (b. September 1909, Nkroful, Gold Coast—d. April 27, 1972, Bucharest, Rom.) Nationalist leader and president of Ghana (1960–66). Nkrumah worked as a teacher before going to the U.S. to study literature and socialism (1935–45). In 1949 he formed the Convention People's Party, which advocated nonviolent protests, strikes, and noncooperation with the British authorities. Elected prime minister of the Gold Coast (1952–60) and then president of independent Ghana, Nkrumah advanced a policy of Africanization and built new roads, schools, and health facilities. After 1960 he devoted much of his time to the Pan-African movement, at the expense of Ghana's economy. Following an attempted coup in 1962, he increased authoritarian controls, withdrew from public life, increased contacts with communist countries, and wrote works on political philosophy. With the country facing economic ruin, he was deposed in 1966 while visiting Beijing.

Nkrumah, 1962
MARC AND EVELYNE BERNHEIM/WOODFIN CAMP AND ASSOCIATES

no-till farming *or* **till-less agriculture** Cultivation technique in which the soil is disturbed only along the slit or hole into which seeds are planted. Reserved detritus from previous crops covers and protects the seedbed. Primary benefits are a decreased rate of soil erosion; reduced need for equipment, fuel, and fertilizer; and significantly less time required for tending crops. The method also improves soil-aggregate formation, microbial activity in the soil, and water infiltration and storage. Conventional tillage controls weed growth by plowing and cultivating, but no-till farming selectively uses herbicides to kill weeds and the remains of the previous crop. No-till farming is one of several primitive farming methods revived as conservation measures in the 20th century.

Noah Biblical character from Genesis. The son of Lamech and ninth in descent from Adam, he was a man of blameless piety, who was chosen by God to perpetuate the human race after his wicked contemporaries had perished in the flood. On God's instructions, Noah built an ark and took into it one male and one female of each of the world's animals. After the waters receded, God set a rainbow in the sky as a guarantee of his promise never again to curse the earth. Noah was the father of Shem, Ham, and Japheth, from whom the entire human race is supposed to have descended. Noah is also said to have been the originator of vineyard cultivation.

noaide \nō-'ī-dē\ In Sami religion, a shaman who mediates between his clients and various supernatural beings and forces. To aid people suffering from illness or other serious troubles, the noaide performs a dramatic séance, which includes divination, trance, confrontation of supernatural beings, and the ritual treatment of the patient. The noaides can accomplish both good and evil, and their powers were formerly much feared.

Nobel \ˌnō-'bel**, Alfred (Bernhard)** (b. Oct. 21, 1833, Stockholm, Swed.—d. Dec. 10, 1896, San Remo, Italy) Swedish chemist, engineer, and industrialist. His attempts to find a safe way to handle nitroglycerin resulted in the invention of dynamite and the blasting cap. He built a network of factories to manufacture dynamite and corporations to produce and market his explosives. He went on to develop more powerful explosives and to construct and perfect detonators for explosives that did not explode on simple firing (e.g., when lit with a match). Nobel registered more than 350 patents, many unrelated to explosives (e.g., artificial silk and leather). A complex personality, both dynamic and reclusive, he was a pacifist but was labeled the "merchant of death" for inventing explosives used in war. Perhaps to counter this label, he left most of his immense fortune, from worldwide explosives and oil interests, to establish the Nobel Prizes, which would become the most highly regarded of all international awards.

Nobel Prize Any of the prizes awarded annually by four institutions (three Swedish and one Norwegian) from a fund established under the will of Alfred B. Nobel. The will specified that awards should be given "to those who, during the preceding year, shall have conferred the greatest benefit on mankind." Since 1901, prizes have been awarded for physics, chemistry, physiology or medicine, literature, and peace; since 1969, a sixth prize, established by the Bank of Sweden, has been awarded in economic sciences. The Nobel Prizes are regarded as the most prestigious prizes in the world. See tables on opposite and following pages.

noble gas *or* **inert gas** Any of the six chemical elements that make up the rightmost group of the periodic table as usually arranged: helium, neon, argon, krypton, xenon, and radon. All are colourless, odourless, and nonflammable and occur in tiny amounts in the atmosphere (though helium is the most plentiful element in the universe). Their stable electronic configurations, with no unpaired electrons to share, make them extremely unreactive—hence "noble" (i.e., aloof) or inert—though the three heaviest, with outer electrons held less firmly, can form compounds (mainly with fluorine). These gases absorb and give off electromagnetic radiation in a much less complex way than other substances, a property exploited in their use in fluorescent lighting devices and discharge lamps. They glow with a characteristic colour when confined in a transparent container at low pressure with an electric current passing through it. Their very low boiling and melting points make them useful as refrigerants for low-temperature research (see cryogenics).

nocturne Nineteenth-century character piece for piano. The name was first used c. 1812 by the Scottish composer John Field (1782–1837) for works employing a lyrical melody over an accompaniment of broken chords. Frédéric Chopin's romantic nocturnes, similar in style, are the most celebrated.

nodule \'nä-jül\ In geology, a rounded mineral concretion that is distinct from, and may be separated from, the formation in which it occurs. Nodules usually are elongated and have a knobby irregular surface; they are generally oriented parallel to the bedding. Chert and flint, clay ironstone, and phosphorites commonly occur as nodules. Manganese-rich nodules are found on the ocean floor.

Noel-Baker (of the City of Derby), Philip John Noel-Baker, Baron *orig.* **Philip John Baker** (b. Nov. 1, 1889, London, Eng.—d. Oct. 8, 1982, London) British statesman and advocate of disarmament. He worked for the League of Nations secretariat (1919–22) and taught international relations at the University of London (1924–29). He served

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Nobel Prize winners[1]

	physics		chemistry		literature		physiology or medicine		peace		economic science
1901	Wilhelm Röntgen	Ger.	Jacobus van't Hoff	Neth.	Sully Prudhomme; poet	France	Emil von Behring	Ger.	Jean-Henri Dunant	Switz.	prize not awarded until 1969
									Frédéric Passy	France	
1902	Hendrik Antoon Lorentz	Neth.	Emil Fischer	Ger.	Theodor Mommsen; historian	Ger.	Ronald Ross	U.K.	Élie Ducommun	Switz.	
	Pieter Zeeman	Neth.							Charles-Albert Gobat	Switz.	
1903	Henri Becquerel	France	Svante Arrhenius	Sweden	Bjørnstjerne Bjørnson; novelist, poet, dramatist	Norway	Niels R. Finsen	Den.	Randal Cremer	U.K.	
	Marie Curie	France[2]									
	Pierre Curie	France									
1904	Lord Rayleigh	U.K.	Sir William Ramsay	U.K.	José Echegaray y Eizaguirre; dramatist	Spain	Ivan Pavlov	Russia	Institute of International Law	(founded 1873)	
					Frédéric Mistral; poet	France					
1905	Philipp Lenard	Ger.	Adolf von Baeyer	Ger.	Henryk Sienkiewicz; novelist	Poland	Robert Koch	Ger.	Bertha von Suttner	Austria	
1906	J.J. Thomson	U.K.	Henri Moissan	France	Giosuè Carducci; poet	Italy	Camillo Golgi	Italy	Theodore Roosevelt	U.S.	
							Santiago Ramón y Cajal	Spain			
1907	A.A. Michelson	U.S.[2]	Eduard Buchner	Ger.	Rudyard Kipling; poet, novelist	U.K.	Alphonse Laveran	France	Ernesto Teodoro Moneta	Italy	
									Louis Renault	France	
1908	Gabriel Lippmann	France	Ernest Rutherford	U.K.	Rudolf Eucken; philosopher	Ger.	Paul Ehrlich	Ger.	Klas Pontus Arnoldson	Sweden	
							Élie Metchnikoff	Russia	Fredrik Bajer	Den.	
1909	Ferdinand Braun	Ger.	Wilhelm Ostwald	Ger.	Selma Lagerlöf; novelist	Sweden	Emil Kocher	Switz.	Baron d'Estournelles de Constant	France	
	Guglielmo Marconi	Italy									
									Auguste Beernaert	Belgium	
1910	Johannes van der Waals	Neth.	Otto Wallach	Ger.	Paul von Heyse; poet, novelist, dramatist	Ger.	Albrecht Kossel	Ger.	International Peace Bureau	(founded 1891)	
1911	Wilhelm Wien	Ger.	Marie Curie	France[2]	Maurice Maeterlinck; dramatist	Belgium	Allvar Gullstrand	Sweden	Tobias Asser	Neth.	
									Alfred Fried	Austria	
1912	Nils Gustaf Dalén	Sweden	Victor Grignard	France	Gerhart Hauptmann; dramatist	Ger.	Alexis Carrel	France	Elihu Root	U.S.	
			Paul Sabatier	France							
1913	Heike Kamerlingh Onnes	Neth.	Alfred Werner	Switz.[2]	Rabindranath Tagore; poet	India	Charles Richet	France	Henri-Marie Lafontaine	Belgium	
1914	Max von Laue	Ger.	Theodore Richards	U.S.	(no award)	—	Robert Bárány	Austria	(no award)	—	
1915	Lawrence Bragg	U.K.	Richard Willstätter	Ger.	Romain Rolland; novelist	France	(no award)	—	(no award)	—	
	William Bragg	U.K.									
1916	(no award)	—	(no award)	—	Verner von Heidenstam; poet	Sweden	(no award)	—	(no award)	—	
1917	Charles Barkla	U.K.	(no award)	—	Karl Gjellerup; novelist	Den.	(no award)	—	International Committee of the Red Cross	(founded 1863)	
					Henrik Pontoppidan; novelist	Den.					
1918	Max Planck	Ger.	Fritz Haber	Ger.	Erik Axel Karlfeldt (declined)	Sweden	(no award)	—	(no award)	—	
1919	Johannes Stark	Ger.	(no award)	—	Carl Spitteler; poet, novelist	Switz.	Jules Bordet	Belgium	Woodrow Wilson	U.S.	
1920	Charles Guillaume	Switz.	Walther Nernst	Ger.	Knut Hamsun; novelist	Norway	August Krogh	Den.	Léon Bourgeois	France	
1921	Albert Einstein	Switz.[2]	Frederick Soddy	U.K.	Anatole France; novelist	France	(no award)	—	Karl Branting	Sweden	
									Christian Lous Lange	Norway	
1922	Niels Bohr	Den.	Francis Aston	U.K.	Jacinto Benavente y Martínez; dramatist	Spain	A.V. Hill	U.K.	Fridtjof Nansen	Norway	
							Otto Meyerhof	Ger.			
1923	Robert Millikan	U.S.	Fritz Pregl	Austria	William Butler Yeats; poet	Ireland	F.G. Banting	Canada	(no award)	—	
							J.J.R. Macleod	U.K.			
1924	Manne Siegbahn	Sweden	(no award)	—	Wladyslaw Reymont; novelist	Poland	Willem Einthoven	Neth.	(no award)	—	
1925	James Franck	Ger.	Richard Zsigmondy	Austria	George Bernard Shaw; dramatist	Ireland	(no award)	—	Sir Austen Chamberlain	U.K.	
	Gustav Hertz	Ger.							Charles G. Dawes	U.S.	
1926	Jean Perrin	France	The Svedberg	Sweden	Grazia Deledda; novelist	Italy	Johannes Fibiger	Den.	Aristide Briand	France	
									Gustav Stresemann	Ger.	
1927	Arthur Holly Compton	U.S.	Heinrich Wieland	Ger.	Henri Bergson; philosopher	France[2]	Julius Wagner-Jauregg	Austria	Ferdinand Buisson	France	
	C.T.R. Wilson	U.K.							Ludwig Quidde	Ger.	

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Nobel Prize winners[1] (continued)

	physics		chemistry		literature		physiology or medicine		peace		economic science
1928	Owen Richardson	U.K.	Adolf Windaus	Ger.	Sigrid Undset; novelist	Norway	Charles Nicolle	France	(no award)	—	
1929	Louis-Victor de Broglie	France	Hans von Euler-Chelpin	Sweden[2]	Thomas Mann; novelist	Ger.	Christiaan Eijkman	Neth.	Frank B. Kellogg	U.S.	
			Arthur Harden	U.K.			Sir Frederick Hopkins	U.K.			
1930	Sir Chandrasekhara Raman	India	Hans Fischer	Ger.	Sinclair Lewis; novelist	U.S.	Karl Landsteiner	U.S.[2]	Nathan Söderblom	Sweden	
1931	(no award)	—	Friedrich Bergius	Ger.	Erik Axel Karlfeldt; poet (posthumous award)	Sweden	Otto Warburg	Ger.	Jane Addams	U.S.	
			Carl Bosch	Ger.					Nicholas Murray Butler	U.S.	
1932	Werner Heisenberg	Ger.	Irving Langmuir	U.S.	John Galsworthy; novelist	U.K.	Edgar D. Adrian	U.K.	(no award)	—	
							Sir Charles Sherrington	U.K.			
1933	P.A.M. Dirac	U.K.	(no award)	—	Ivan Bunin; poet, novelist	U.S.S.R	Thomas Hunt Morgan	U.S.	Sir Norman Angell	U.K.	
	Erwin Schrödinger	Austria									
1934	(no award)	—	Harold Urey	U.S.	Luigi Pirandello; dramatist	Italy	George R. Minot	U.S.	Arthur Henderson	U.K.	
							William P. Murphy	U.S.			
							George H. Whipple	U.S.			
1935	James Chadwick	U.K.	Frédéric Joliot-Curie	France	(no award)	—	Hans Spemann	Ger.	Carl von Ossietzky	Ger.	
			Irène Joliot-Curie	France							
1936	Carl Anderson	U.S.	Peter Debye	Neth.	Eugene O'Neill; dramatist	U.S.	Sir Henry Dale	U.K.	Carlos Saavedra Lamas	Arg.	
	Victor Hess	Austria					Otto Loewi	Ger.			
1937	Clinton Davisson	U.S.	Norman Haworth	U.K.	Roger Martin du Gard; novelist	France	Albert Szent-Györgyi	Hung.	Viscount Cecil of Chelwood	U.K.	
	George Paget Thomson	U.K.	Paul Karrer	Switz.							
1938	Enrico Fermi	Italy	Richard Kuhn (declined)[3]	Ger.	Pearl Buck; novelist	U.S.	Corneille Heymans	Belgium	Nansen International Office for Refugees	(founded 1931)	
1939	Ernest Lawrence	U.S.	Adolf Butenandt (declined)[3]	Ger.	Frans Eemil Sillanpää; novelist	Finland	Gerhard Domagk (declined)[3]	Ger.	(no award)	—	
			Leopold Ruzicka	Switz.[2]							
1943[4]	Otto Stern	U.S.[2]	George de Hevesy	Hung.	(no award)	—	Henrik Dam	Den.	(no award)	—	
							Edward A. Doisy	U.S.			
1944	Isidor Rabi	U.S.[2]	Otto Hahn	Ger.	Johannes V. Jensen; novelist	Den.	Joseph Erlanger	U.S.	International Committee of the Red Cross	(founded 1863)	
							Herbert S. Gasser	U.S.			
1945	Wolfgang Pauli	Austria	Artturi Virtanen	Finland	Gabriela Mistral; poet	Chile	Ernst Boris Chain	U.K.[2]	Cordell Hull	U.S.	
							Sir A. Fleming	U.K.			
							Sir Howard Florey	Austl.			
1946	P.W. Bridgman	U.S.	John Northrop	U.S.	Hermann Hesse; novelist	Switz.[2]	Hermann J. Muller	U.S.	Emily Greene Balch	U.S.	
			Wendell Stanley	U.S.					John R. Mott	U.S.	
			James Sumner	U.S.							
1947	Sir Edward Appleton	U.K.	Sir Robert Robinson	U.K.	André Gide; novelist, essayist	France	Carl F. Cori	U.S.[2]	American Friends Service Committee	U.S.	
							Gerty T. Cori	U.S.[2]			
							Bernardo Houssay	Arg.	Friends Service Council	U.K.	
1948	Patrick Blackett	U.K.	Arne Tiselius	Sweden	T.S. Eliot; poet, critic	U.K.[2]	Paul Müller	Switz.	(no award)	—	
1949	Yukawa Hideki	Japan	William Giauque	U.S.	William Faulkner; novelist	U.S.	António Egas Moniz	Port.	Lord Boyd-Orr	U.K.	
							Walter Rudolf Hess	Switz.			
1950	Cecil Powell	U.K.	Kurt Alder	Ger.	Bertrand Russell; philosopher	U.K.	Philip S. Hench	U.S.	Ralph Bunche	U.S.	
			Otto Diels	Ger.			Edward C. Kendall	U.S.			
							Tadeus Reichstein	Switz.[2]			
1951	Sir John Cockcroft	U.K.	Edwin McMillan	U.S.	Pär Lagerkvist; novelist	Sweden	Max Theiler	S.Af.	Léon Jouhaux	France	
	E.T.S. Walton	Ireland	Glenn Seaborg	U.S.							
1952	Felix Bloch	U.S.[2]	A.J.P. Martin	U.K.	François Mauriac; poet, novelist, dramatist	France	Selman A. Waksman	U.S.[2]	Albert Schweitzer	Alsace	
	E.M. Purcell	U.S.	R.L.M. Synge	U.K.							
1953	Frits Zernike	Neth.	Hermann Staudinger	Ger.	Sir Winston Churchill; historian, orator	U.K.	Hans A. Krebs	U.S.[2]	George C. Marshall	U.S.	
							Fritz A. Lipmann	U.S.[2]			
1954	Max Born	U.K.[2]	Linus Pauling	U.S.	Ernest Hemingway; novelist	U.S.	John F. Enders	U.S.	Office of the United Nations High Commissioner for Refugees	(founded 1951)	
	Walther Bothe	Ger.					Frederick Robbins	U.S.			
							Thomas H. Weller	U.S.			
1955	Polykarp Kusch	U.S.[2]	Vincent du Vigneaud	U.S.	Halldór Laxness; novelist	Iceland	Axel Hugo Theorell	Sweden	(no award)	—	
	Willis Lamb, Jr.	U.S.									

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Nobel Prize winners[1] (continued)

	physics		chemistry		literature		physiology or medicine		peace		economic science	
1956	John Bardeen	U.S.	Sir Cyril Hinshelwood	U.K.	Juan Ramón Jiménez; poet	Spain	André F. Cournand	U.S.[2]	(no award)	—		
	Walter H. Brattain	U.S.	Nikolay Semyonov	U.S.S.R.			Werner Forssmann	Ger.				
	William Shockley	U.S.					Dickinson Richards	U.S.				
1957	Tsung-Dao Lee	China	Sir Alexander Todd	U.K.	Albert Camus; novelist, dramatist	France	Daniel Bovet	Italy[2]	Lester B. Pearson	Canada		
	Chen Ning Yang	China										
1958	Pavel A. Cherenkov	U.S.S.R.	Frederick Sanger	U.K.	Boris Pasternak; novelist, poet (declined)	U.S.S.R	George W. Beadle	U.S.	Dominique Georges Pire	Belgium		
	Ilya M. Frank	U.S.S.R.					Joshua Lederberg	U.S.				
	Igor Y. Tamm	U.S.S.R.					Edward L. Tatum	U.S.				
1959	Owen Chamberlain	U.S.	Jaroslav Heyrovský	Czech.	Salvatore Quasimodo; poet	Italy	Arthur Kornberg	U.S.	Philip Noel-Baker	U.K.		
	Emilio Segrè	U.S.[2]					Severo Ochoa	U.S.[2]				
1960	Donald Glaser	U.S.	Willard Libby	U.S.	Saint-John Perse; poet	France	Sir Macfarlane Burnet	Austl.	Albert Lutuli	S.Af.		
							Peter B. Medawar	U.K.				
1961	Robert Hofstadter	U.S.	Melvin Calvin	U.S.	Ivo Andrić; novelist	Yugos.	Georg von Békésy	U.S.[2]	Dag Hammarskjöld (posthumous award)	Sweden		
	Rudolf Mössbauer	Ger.										
1962	Lev D. Landau	U.S.S.R.	John C. Kendrew	U.K.	John Steinbeck; novelist	U.S.	Francis H.C. Crick	U.K.	Linus Pauling	U.S.		
			Max F. Perutz	U.K.[2]			James D. Watson	U.S.				
							Maurice Wilkins	U.K.				
1963	J. Hans D. Jensen	Ger.	Giulio Natta	Italy	George Seferis; poet	Greece	Sir John Eccles	Austl.	International Committee of the Red Cross	(founded 1863)		
	Maria Goeppert Mayer	U.S.[2]	Karl Ziegler	Ger.			Alan Lloyd Hodgkin	U.K.				
	Eugene Paul Wigner	U.S.[2]					Andrew Huxley	U.K.	League of Red Cross Societies	(founded 1919)		
1964	Nikolay G. Basov	U.S.S.R.	Dorothy M.C. Hodgkin	U.K.	Jean-Paul Sartre; philosopher, dramatist (declined)	France	Konrad Bloch	U.S.[2]	Martin Luther King, Jr.	U.S.		
	Aleksandr M. Prokhorov	U.S.S.R.					Feodor Lynen	Ger.				
	Charles H. Townes	U.S.										
1965	Richard P. Feynman	U.S.	R.B. Woodward	U.S.	Mikhail Sholokhov; novelist	U.S.S.R	François Jacob	France	United Nations Children's Fund (UNICEF)	(founded 1946)		
	Julian S. Schwinger	U.S.					André Lwoff	France				
	Tomonaga Shin'ichiro	Japan					Jacques Monod	France				
1966	Alfred Kastler	France	Robert S. Mulliken	U.S.	Shmuel Yosef Agnon; novelist	Israel[2]	Charles B. Huggins	U.S.[2]	(no award)	—		
							Francis Peyton Rous	U.S.				
					Nelly Sachs; poet	Sweden[2]						
1967	Hans A. Bethe	U.S.[2]	Manfred Eigen	Ger.	Miguel Ángel Asturias; novelist	Guat.	Ragnar A. Granit	Sweden	(no award)	—		
			Ronald G.W. Norrish	U.K.			Haldan Keffer Hartline	U.S.				
			George Porter	U.K.			George Wald	U.S.				
1968	Luis W. Alvarez	U.S.	Lars Onsager	U.S.[2]	Kawabata Yasunari; novelist	Japan	Robert W. Holley	U.S.	René Cassin	France		
							Har Gobind Khorana	U.S.[2]				
							Marshall W. Nirenberg	U.S.				
1969	Murray Gell-Mann	U.S.	Derek H.R. Barton	U.K.	Samuel Beckett; novelist, dramatist	Ireland	Max Delbrück	U.S.[2]	International Labour Organisation	(founded 1919)	Ragnar Frisch	Norway
			Odd Hassel	Norway			A.D. Hershey	U.S.			Jan Tinbergen	Neth.
							Salvador E. Luria	U.S.[2]				
1970	Hannes Alfvén	Sweden	Luis F. Leloir	Arg.[2]	Aleksandr Solzhenitsyn; novelist	U.S.S.R	Julius Axelrod	U.S.	Norman E. Borlaug	U.S.	Paul A. Samuelson	U.S.
	Louis Néel	France					Ulf von Euler	Sweden				
							Sir Bernard Katz	U.K.[2]				
1971	Dennis Gabor	U.K.[2]	Gerhard Herzberg	Canada[2]	Pablo Neruda; poet	Chile	Earl W. Sutherland, Jr.	U.S.	Willy Brandt	Ger.	Simon Kuznets	U.S.[2]
1972	John Bardeen	U.S.	Christian B. Anfinsen	U.S.	Heinrich Böll; novelist	Ger.	Gerald M. Edelman	U.S.	(no award)	—	Kenneth J. Arrow	U.S.
	Leon N. Cooper	U.S.	Stanford Moore	U.S.			Rodney Porter	U.K.			Sir John Hicks	U.K.
	John R. Schrieffer	U.S.	William H. Stein	U.S.								
1973	Leo Esaki	Japan	Ernst Fischer	Ger.	Patrick White; novelist	Austl.	Karl von Frisch	Austria	Henry Kissinger	U.S.	Wassily Leontief	U.S.[2]
	Ivar Giaever	U.S.[2]	Geoffrey Wilkinson	U.K.			Konrad Lorenz	Austria	Le Duc Tho (declined)	North Vietnam		
	Brian D. Josephson	U.K.					Nikolaas Tinbergen	U.K.[2]				
1974	Antony Hewish	U.K.	Paul J. Flory	U.S.	Eyvind Johnson; novelist	Sweden	Albert Claude	U.S.[2]	Sato Eisaku	Japan	Friedrich von Hayek	U.K.
	Sir Martin Ryle	U.K.			Harry Martinson; novelist, poet	Sweden	Christian R. de Duve	Belgium	Seán MacBride	Ireland	Gunnar Myrdal	Sweden
							George E. Palade	U.S.[2]				
1975	Aage N. Bohr	Den.	John W. Cornforth	U.K.	Eugenio Montale; poet	Italy	David Baltimore	U.S.	Andrey D. Sakharov	U.S.S.R.	Leonid V. Kantorovich	U.S.S.R.
	Ben R. Mottelson	Den.[2]	Vladimir Prelog	Switz.			Renato Dulbecco	U.S.[2]			Tjalling C. Koopmans	U.S.[2]
	L. James Rainwater	U.S.					Howard M. Temin	U.S.				

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Nobel Prize winners[1] (continued)

	physics		chemistry		literature		physiology or medicine		peace		economic science	
1976	Burton Richter	U.S.	William N. Lipscomb	U.S.	Saul Bellow; novelist	U.S.[2]	Baruch S. Blumberg	U.S.	Mairéad Corrigan	N.Ire.	Milton Friedman	U.S.
	Samuel C.C. Ting	U.S.					D. Carleton Gajdusek	U.S.	Betty Williams	N.Ire.		
1977	Philip W. Anderson	U.S.	Ilya Prigogine	Belgium	Vicente Aleixandre; poet	Spain	Roger Guillemin	U.S.	Amnesty International	(founded 1961)	James Meade	U.K.
	Sir Nevill F. Mott	U.K.					Andrew Schally	U.S.			Bertil Ohlin	Sweden
	John H. Van Vleck	U.S.					Rosalyn S. Yalow	U.S.				
1978	Pyotr L. Kapitsa	U.S.S.R.	Peter D. Mitchell	U.K.	Isaac Bashevis Singer; novelist	U.S.[2]	Werner Arber	Switz.	Menachem Begin	Israel	Herbert A. Simon	U.S.
	Arno A. Penzias	U.S.[2]					Daniel Nathans	U.S.	Anwar el-Sadat	Egypt		
	Robert W. Wilson	U.S.					Hamilton O. Smith	U.S.				
1979	Sheldon Glashow	U.S.	Herbert C. Brown	U.S.[2]	Odysseus Elytis; poet	Greece	Allan M. Cormack	U.S.[2]	Mother Teresa of Calcutta	India[2]	Sir W. Arthur Lewis	U.K.
	Abdus Salam	Pak.	Georg Wittig	W.Ger.			Godfrey N. Hounsfield	U.K.			Theodore W. Schultz	U.S.
	Steven Weinberg	U.S.										
1980	James W. Cronin	U.S.	Paul Berg	U.S.	Czeslaw Milosz; poet	U.S.[2]	Baruj Benacerraf	U.S.[2]	Adolfo Pérez Esquivel	Arg.	Lawrence R. Klein	U.S.
	Val Logsdon Fitch	U.S.	Walter Gilbert	U.S.			Jean Dausset	France				
			Frederick Sanger	U.K.			George D. Snell	U.S.				
1981	Nicolaas Bloembergen	U.S.[2]	Fukui Kenichi	Japan	Elias Canetti; novelist, essayist	Bulg.	David H. Hubel	U.S.[2]	Office of the United Nations High Commissioner for Refugees	(founded 1951)	James Tobin	U.S.
	Arthur L. Schawlow	U.S.	Roald Hoffmann	U.S.[2]			Roger W. Sperry	U.S.				
	Kai M. Siegbahn	Sweden					Torsten N. Wiesel	Sweden				
1982	Kenneth G. Wilson	U.S.	Aaron Klug	U.K.[2]	Gabriel García Márquez; novelist, journalist, social critic	Colom.	Sune K. Bergström	Sweden	Alva Myrdal	Sweden	George Stigler	U.S.
							Bengt I. Samuelsson	Sweden	Alfonso García Robles	Mexico		
							John R. Vane	U.K.				
1983	Subrahmanyan Chandrasekhar	U.S.	Henry Taube	U.S.	William Golding; novelist	U.K.	Barbara McClintock	U.S.	Lech Walesa	Poland	Gerard Debreu	U.S.
	William A. Fowler	U.S.										
1984	Simon van der Meer	Neth.	Bruce Merrifield	U.S.	Jaroslav Seifert; poet	Czech.	Niels K. Jerne	U.K.-Den.	Desmond Tutu	S.Af.	Sir Richard Stone	U.K.
	Carlo Rubbia	Italy					Georges J.F. Köhler	W.Ger.				
							César Milstein	Arg.				
1985	Klaus von Klitzing	W.Ger.	Herbert A. Hauptman	U.S.	Claude Simon; novelist	France	Michael S. Brown	U.S.	International Physicians for the Prevention of Nuclear War	(founded 1980)	Franco Modigliani	U.S.
			Jerome Karle	U.S.			Joseph L. Goldstein	U.S.				
1986	Gerd Binnig	W.Ger.	Dudley R. Herschbach	U.S.	Wole Soyinka; playwright, poet	Nigeria	Stanley Cohen	U.S.	Elie Wiesel	U.S.[2]	James M. Buchanan	U.S.
	Heinrich Rohrer	Switz.	Yuan T. Lee	U.S.			Rita Levi-Montalcini	Italy				
	Ernst Ruska	W.Ger.	John C. Polanyi	Canada								
1987	J. Georg Bednorz	W.Ger.	Donald J. Cram	U.S.	Joseph Brodsky; poet, essayist	U.S.[2]	Tonegawa Susumu	Japan	Oscar Arias Sánchez	Costa Rica	Robert M. Solow	U.S.
	K. Alex Müller	Switz.	Jean-Marie Lehn	France								
			Charles J. Pedersen	U.S.								
1988	Leon M. Lederman	U.S.	Johann Deisenhofer	W.Ger.	Naguib Mahfouz; novelist	Egypt	Sir James W. Black	U.K.	United Nations peacekeeping forces		Maurice Allais	France
	Melvin Schwartz	U.S.	Robert Huber	W.Ger.			Gertrude B. Elion	U.S.				
	Jack Steinberger	U.S.	Hartmut Michel	W.Ger.			George H. Hitchings	U.S.				
1989	Hans G. Dehmelt	U.S.	Sidney Altman	U.S.	Camilo José Cela; novelist	Spain	J. Michael Bishop	U.S.	Dalai Lama	Tibet	Trygve Haavelmo	Norway
	Wolfgang Paul	W.Ger.	Thomas R. Cech	U.S.			Harold E. Varmus	U.S.				
	Norman F. Ramsey	U.S.										
1990	Jerome I. Friedman	U.S.	Elias James Corey	U.S.	Octavio Paz; poet, essayist	Mexico	Joseph E. Murray	U.S.	Mikhail Sergeyevich Gorbachev	U.S.S.R.	Harry M. Markowitz	U.S.
	Henry W. Kendall	U.S.					E. Donnall Thomas	U.S.			Merton H. Miller	U.S.
	Richard E. Taylor	Canada									William F. Sharpe	U.S.
1991	Pierre-Gilles de Gennes	France	Richard R. Ernst	Switz.	Nadine Gordimer; novelist	S.Af.	Erwin Neher	Ger.	Aung San Suu Kyi	Myanmar	Ronald H. Coase	U.S.
							Bert Sakmann	Ger.				
1992	Georges Charpak	France	Rudolph A. Marcus	U.S.[2]	Derek Walcott; poet	St. Lucia	Edmond H. Fischer	U.S.	Rigoberta Menchú	Guat.	Gary S. Becker	U.S.
							Edwin G. Krebs	U.S.				
1993	Russell A. Hulse	U.S.	Kary B. Mullis	U.S.	Toni Morrison; novelist	U.S.	Richard J. Roberts	U.K.	F.W. de Klerk	S.Af.	Robert W. Fogel	U.S.
	Joseph H. Taylor, Jr.	U.S.	Michael Smith	Canada			Phillip A. Sharp	U.S.	Nelson Mandela	S.Af.	Douglass C. North	U.S.
1994	Bertram N. Brockhouse	Canada	George A. Olah	U.S.	Oe Kenzaburo; novelist	Japan	Alfred G. Gilman	U.S.	Yasir Arafat	Palestinian	John C. Harsanyi	U.S.[2]
	Clifford G. Shull	U.S.					Martin Rodbell	U.S.			John F. Nash	U.S.
									Shimon Peres	Israel	Reinhard Selten	Ger.
									Yitzhak Rabin	Israel		

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Nobel Prize winners[1] (continued)

	physics		chemistry		literature		physiology or medicine		peace		economic science	
1995	Martin L. Perl	U.S.	Paul Crutzen	Neth.	Seamus Heaney; poet	Ireland	Edward B. Lewis	U.S.	Joseph Rotblat	U.K.[2]	Robert E. Lucas, Jr.	U.S.
	Frederick Reines	U.S.	Mario Molina	U.S.[2]			Christiane Nüsslein-Volhard	Ger.	Pugwash Conferences on Science and World Affairs	(founded 1957)		
			F. Sherwood Rowland	U.S.			Eric F. Wieschaus	U.S.				
1996	David M. Lee	U.S.	Robert F. Curl, Jr.	U.S.	Wisława Szymborska; poet	Poland	Peter C. Doherty	Ausl.	Carlos Ximenes Belo	Timorese	James A. Mirrlees	U.K.
	Douglas D. Osheroff	U.S.	Sir Harold W. Kroto	U.K.			Rolf M. Zinkernagel	Switz.	José Ramos-Horta	Timorese	William Vickrey	U.S.
	Robert C. Richardson	U.S.	Richard E. Smalley	U.S.								
1997	Steven Chu	U.S.	Paul Boyer	U.S.	Dario Fo; playwright, actor	Italy	Stanley B. Prusiner	U.S.	International Campaign to Ban Landmines	(founded 1992)	Robert C. Merton	U.S.
	Claude Cohen-Tannoudji	France[2]	Jens C. Skou	Den.					Jody Williams	U.S.	Myron S. Scholes	U.S.
	William D. Phillips	U.S.	John E. Walker	U.K.					John Hume	N.Ire.	Amartya Sen	India
1998	Robert B. Laughlin	U.S.	Walter Kohn	U.S.[2]	José Saramago; novelist	Port.	Robert F. Furchgott	U.S.	David Trimble	N.Ire.		
	Horst L. Störmer	U.S.[2]	John A. Pople	U.S.			Louis J. Ignarro	U.S.				
	Daniel C. Tsui	U.S.[2]					Ferid Murad	U.S.				
1999	Gerardus 't Hooft	Neth.	Ahmed H. Zewail	Egypt-U.S.	Günter Grass; novelist	Ger.	Günter Blobel	U.S.[2]	Doctors Without Borders	(founded 1971)	Robert A. Mundell	Canada
	Martinus J.G. Veltman	Neth.										
2000	Zhores I. Alferov	Russia	Alan J. Heeger	U.S.	Gao Xingjian; novelist, playwright	France[2]	Arvid Carlsson	Sweden	Kim Dae Jung	S.Kor.	James J. Heckman	U.S.
	Jack S. Kilby	U.S.	Alan G. MacDiarmid	U.S.[2]			Paul Greengard	U.S.			Daniel L. McFadden	U.S.
	Herbert Kroemer	Ger.	Shirakawa Hideki	Japan			Eric Kandel	U.S.[2]				
2001	Eric A. Cornell	U.S.	William S. Knowles	U.S.	Sir V.S. Naipaul; novelist	U.K.[2]	Leland H. Hartwell	U.S.	United Nations	(founded 1945)	George A. Akerlof	U.S.
	Wolfgang Ketterle	Ger.	Noyori Ryoji	Japan			R. Timothy Hunt	U.K.			A. Michael Spense	U.S.
	Carl E. Wieman	U.S.	K. Barry Sharpless	U.S.			Sir Paul M. Nurse	U.K.	Kofi Annan	Ghana	Joseph E. Stiglitz	U.S.
2002	Raymond Davis, Jr.	U.S.	John B. Fenn	U.S.	Imre Kertész; novelist	Hung.	Sydney Brenner	U.K.	Jimmy Carter	U.S.	Daniel Kahneman	U.S.-Israel
	Riccardo Giacconi	U.S.	Tanaka Koichi	Japan			H. Robert Horvitz	U.S.			Vernon L. Smith	U.S.
	Koshiba Masatoshi	Japan	Kurt Wüthrich	Switz.			John E. Sulston	U.K.				
2003	Alexei A. Abrikosov	U.S.	Peter Agre	U.S.	J.M. Coetzee; novelist	S.Af.	Paul C. Lauterbur	U.S.	Shirin Ebadi	Iran	Robert F. Engle	U.S.
	Vitaly L. Ginzburg	Russia	Roderick MacKinnon	U.S.			Sir Peter Mansfield	U.K.			Clive W.J. Granger	U.K.
	Anthony J. Leggett	U.S.										
2004	David J. Gross	U.S.	Aaron Ciechanover	Israel	Elfriede Jelinek; novelist, playwright	Austria	Richard Axel	U.S.	Wangari Muta Maathai	Kenya	Finn E. Kydland	Norway
	H. David Politzer	U.S.	Avram Hershko	Israel			Linda B. Buck	U.S.			Edward C. Prescott	U.S.
	Frank Wilczek	U.S.	Irwin Rose	U.S.								
2005	Roy J. Glauber	U.S.	Yves Chauvin	France	Harold Pinter; playwright, poet	U.K.	Barry J. Marshall	Ausl.	Mohamed ElBaradei	Egypt (founded 1957)	Robert J. Aumann	Israel-U.S.
	John L. Hall	U.S.	Robert H. Grubbs	U.S.			J. Robin Warren	Ausl.	International Atomic Energy Agency (IAEA)		Thomas C. Schelling	U.S.
	Theodor W. Hänsch	Ger.	Richard R. Schrock	U.S.								

[1]Nationality given is the citizenship of recipient at the time award was made. [2]Naturalized citizen. [3]Adolf Hitler forbade Germans to accept Nobel prizes (January 1937).
[4]No awards made 1940–42.

in the House of Commons (1929–31, 1936–70) and in ministerial posts (1945–61). He helped draft the UN charter, and he campaigned widely for peace through multilateral disarmament. An Olympic runner in 1912, 1920, and 1924, he later served as president of UNESCO's International Council on Sport and Physical Recreation (1960–82). In 1959 he was awarded the Nobel Prize for Peace.

Nogi Maresuke \'nō-gē-ˌmä-'rās-kā\ (b. December 1849, Edo [Tokyo], Japan—d. Sept. 13, 1912, Tokyo) General in MEIJI-PERIOD Japan. He served as governor of Taiwan and fought in the RUSSO-JAPANESE WAR. On the death of the MEIJI EMPEROR, Nogi and his wife committed ritual suicide by SEPPUKU (self-disembowlment), considered the ultimate SAMURAI act of loyalty. This action affected such Meiji-period writers as NATSUME SŌSEKI and Mori Ōgai (1862–1922) and illuminated the contrast between Japan's feudal past and rapidly modernizing present.

Noguchi \nō-'gü-chē**, Isamu** (b. Nov. 17, 1904, Los Angeles, Calif., U.S.—d. Dec. 30, 1988, New York, N.Y.) U.S. sculptor and designer. He spent his early years in Japan. After premedical studies at Columbia University, he became CONSTANTIN BRANCUSI's assistant in Paris. He was influenced as well by ALBERTO GIACOMETTI, ALEXANDER CALDER, PABLO PICASSO, and JOAN MIRÓ. His medical training suggested to him the interrelatedness of bone and stone. Much of his work consists of elegantly abstracted, rounded forms in highly polished stone. His long collaboration with MARTHA GRAHAM resulted in stage sets for many ballets, and he also designed many public sculptures, sculptural gardens, and playgrounds, as well as furniture.

Noh theatre *or* **No theatre** Classic Japanese theatrical form. One of the world's oldest extant theatrical forms, Noh theatre has a heroic theme, a chorus, and highly stylized action, costuming, and scenery. Its all-male performers are storytellers who use their visual appearances and movements to suggest their tale rather than enact it. Noh (from Japanese *nō*, meaning "talent" or "skill") developed from ancient forms of dance-drama and became a distinctive form in the 14th century. The five types of Noh plays are the *kami* ("god") play, which involves a sacred story of a SHINTŌ shrine; the *shura mono* ("fighting play"), which centres on warriors; the *katsura mono* ("wig play"), which has a female protagonist; the *gendai mono* ("present-day play") or *kyōjo mono* ("madwoman play"), which is varied in content; and the *kiri* or *kichiku* ("final" or "demon") play, which features devils and strange beasts. Kan'ami (1333–84) and his son Zeami (1363–1443) wrote many of the most beautiful Noh texts; more than 200 remain in the modern Noh repertoire.

noise Undesired sound that is intrinsically objectionable or that interferes with other sounds being listened to. In electronics and information theory, noise refers to those random, unpredictable, and undesirable signals, or changes in signals, that mask the desired information content. In radio, this noise is called static; in television, it is called snow. White noise is a complex signal or sound covering the entire range of component frequencies, or TONES, all of which possess equal intensity.

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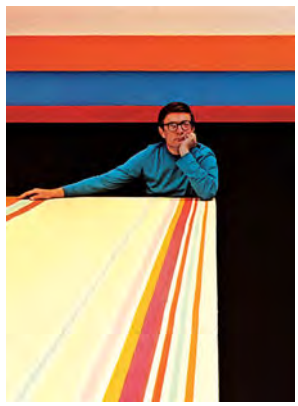
Nok culture Ancient Iron Age African culture. It existed on the Benue Plateau of Nigeria between about 500 BC and AD 200 and was first discovered in 1928 in the village of Nok. Artifacts having similar features were found over an area that stretched about 300 miles (480 km) east to west and 200 miles (320 km) north to south. The most characteristic of these are hollow, coil-built clay figurines of animals and stylized human beings, usually heads. Other artifacts include iron and stone tools and stone ornaments.

nökhör \'nœ-kœr\ *Mongol* **"comrade"** In Mongolia during the time of Genghis Khan (c. 1160–1227), one who forswore loyalty to family and clan to devote himself to following a leader to whom he attached himself. Many of Genghis Khan's best generals were *nökhör*. In modern times the word is used more loosely.

Nolan, Sir Sidney (b. April 22, 1917, Melbourne, Austl.—d. Nov. 27, 1992, London, Eng.) Australian artist. Early in his career he created greatly simplified abstractions. In the mid 1940s he began to paint the local desolate desert landscapes in a more representational style. In his mature work he often applied unusual media—such as polyvinyl acetate—to masonite, glass, or canvas. Apart from his landscapes, most of his works dealt with Australian historical or legendary characters and events—notably, the bushranger Ned Kelly.

Noland, Kenneth (b. April 10, 1924, Asheville, N.C., U.S.) U.S. painter. Noland attended Black Mountain College in North Carolina and studied under the French sculptor Ossip Zadkine in Paris (1948–49). He and Morris Louis, influenced by the work of Helen Frankenthaler, worked together on the technique of staining with thinned paints. This method presented pure, saturated colour as an integral part of the canvas. He employed his colours in concentric rings and parallels that were shaped and proportioned in relation to the shape of the canvas. Noland taught at the Institute of Contemporary Arts (1950–52) and at Catholic University (1951–60), both in Washington, D.C., and at Bennington College (1968) in Vermont.



Noland, photograph by Arnold Newman, 1967
© ARNOLD NEWMAN

Nolde \'nōl-də**, Emil** *orig.* **Emil Hansen** (b. Aug. 7, 1867, Nolde, near Bocholt, Ger.—d. April 15, 1956, Seebüll, near Niebüll, W.Ger.) German Expressionist painter, printmaker, and watercolourist. Born to a peasant family, he carved wood for a living and came late to painting. Though briefly a member of Die Brücke (1906–07), he was essentially a solitary painter. Fervently religious and racked by a sense of sin, he created such works as *Dance Around the Golden Calf* (1910), in which the figures' erotic frenzy and demonic faces are rendered with deliberately crude draftsmanship and dissonant colours. On an ethnological expedition to the East Indies (1913–14), he was impressed by the power of the art he saw there. Back in Europe, he produced brooding landscapes (e.g., *Marsh Landscape*, 1916) and colourful flowers. As a printmaker he was noted especially for the stark black-and-white effect of his crudely incised woodcuts. Although he was an early advocate of Germany's National Socialist Party, the party declared his art "degenerate" and forbade him to paint. His late, postwar works reveal his disillusionment.

nomadism Way of life of peoples who do not live continually in the same place but move cyclically or periodically. It is based on temporary centres whose stability depends on the available food supply and the technology for exploiting it. A hunting and gathering society is a type of nomadic group. Pastoral nomads, who depend on domestic livestock, migrate in an established territory to find pasture for their animals. Tinker or trader nomads, such as the Roma (Gypsies; see Rom) and the Irish and Scottish Travellers, are associated with a larger society but maintain their mobile way of life. Nomadism declined in the 20th century as urban centres expanded and governments sought to regulate or eliminate it.

Nome Seaport (pop., 2000: 3,505), western Alaska, U.S., on the southern side of the Seward Peninsula. Founded as a mining camp called Anvil City after the discovery of gold at nearby Anvil Creek in 1898, it became a centre of the Alaskan gold rush of 1899–1903. Its population, estimated at 20,000 in 1900, had dwindled to 852 by 1920. Gold mining remained the chief occupation until the dredge fields were closed in 1962. The finish line for the Iditarod trail sled race, it also serves as a supply centre for northwestern Alaska.

non-Euclidean geometry Any theory of the nature of geometric space differing from the traditional view held since Euclid's time. These geometries arose in the 19th century when several mathematicians working independently explored the possibility of rejecting Euclid's parallel postulate. Different assumptions about how many lines through a point not on a given line could be parallel to that line resulted in hyperbolic geometry and elliptic geometry. Mathematicians were forced to abandon the idea of a single correct geometry; it became their task not to discover mathematical systems but to create them by selecting consistent axioms and studying the theorems that could be derived from them. The development of these alternative geometries had a profound impact on the notion of space and paved the way for the theory of relativity. See also Nikolay Lobachevsky, Bernhard Riemann.

nonaligned movement In international politics, the group of states sharing the peacetime policy of avoiding political or economic affiliations with major power blocs. At its beginning the nonaligned movement consisted primarily of Asian and African states that were once colonies of the Western powers and were wary of being drawn into a new form of dependence by the West or by the communist bloc. Founded by Jawaharlal Nehru, Gamal Abdel Nasser, and others, the movement held its first official meeting in 1961 in Bandung, Indon.; 25 countries attended. Meetings have since been held on a three-year schedule. While the Soviet Union existed, the movement tended to seek development assistance from both the U.S. and the Soviet Union but to refrain from forming political or military alliances with either country. Since the dissolution of the Soviet Union in 1991, the nonaligned movement has been chiefly concerned with debt forgiveness and with development of fairer trade relationships with the West. By the early 21st century the movement had more than 110 members.

noncognitivism Denial of the characteristic cognitivist thesis that moral sentences are used to express factual statements. Noncognitivists have proposed various alternative theories of meaning for moral sentences. In *Language, Truth and Logic* (1936), A. J. Ayer stated the emotivist thesis that moral sentences are not statements at all (see emotivism). In *The Language of Morals* (1952), Richard M. Hare (born 1919) agreed that in making moral judgments we are not primarily seeking to describe anything, but claimed that neither are we simply expressing our attitudes; instead, he suggested that moral judgments prescribe—that is, are a form of imperative sentence (see prescriptivism).

Nonconformist Any English Protestant who does not conform to the doctrines or practices of the established Church of England. The term was first used after the Restoration of the monarchy in 1660 to describe congregations that had separated from the national church. Such congregations, also called Separatists or Dissenters, often rejected Anglican rites and doctrines as being too close to Catholicism. In the late 19th century, Nonconformists of various denominations joined together to form the Free Church Federal Council. In England and Wales the term is generally applied to all Protestant denominations outside Anglicanism, including Baptists, Congregationalists, Unitarians, Presbyterians, Methodists, Quakers, and Churches of Christ.

nondirective psychotherapy *or* **client-centered therapy** Type of psychotherapy in which the counselor refrains from interpretation or explanation but encourages the client to establish a person-to-person relationship with him or her and to talk freely. It originated with Carl R. Rogers and influenced later individual and group therapies. The goal is to enable the client to see him- or herself more clearly and react more openly with the therapist and others. The client determines the course, speed, and duration of treatment.

nongovernmental organization (NGO) Organization that is not part of any government. A key distinction is between not-for-profit groups and for-profit corporations; the vast majority of NGOs are not-for-profit. In some countries, particularly socialist ones, some NGOs are government-organized. The purposes of NGOs cover the entire range of human interests and may be domestic or international in scope. Many NGOs are key sources of information for governments on issues such as

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human rights abuses and environmental degradation. Some NGOs fulfill quasi-governmental functions for ethnic groups that lack a state of their own. NGOs may be financed by private donations, international organizations, governments, or a combination of these. In Britain, quasi-autonomous nongovernmental organizations, or "quangos," are organizations that have nonelected boards and receive public funds which they also disburse. See also AMNESTY INTERNATIONAL; GREENPEACE; WORLD WILDLIFE FUND.

Nonni River See NEN RIVER

Nono, Luigi (b. Jan. 29, 1924, Venice, Italy—d. May 8, 1990, Venice) Italian composer. A law student, he also studied music with Gian Francesco Malipiero (1882–1973), Bruno Maderna (1920–73), and Hermann Scherchen (1891–1966). He came to public attention in 1950 with his work *Variazioni Canoniche*, orchestral variations on a 12-tone theme of ARNOLD SCHOENBERG, whose daughter Nuria he married in 1955. An avowed communist, Nono often produced works of political substance, many of which sparked controversy and reaction. He employed aleatory (chance) techniques and SERIALISM, sometimes fragmenting language and using electronically manipulated sounds. His best-known work is the opera *Intolleranza* (1961).

nonobjective art See ABSTRACT ART

Nonpartisan League Alliance of U.S. farmers to gain protection from wheat monopolies. Founded in North Dakota in 1915 by Arthur Townley, it demanded that mills, grain elevators, banks, and hail-insurance companies be state owned. In 1916 its candidate, Lynn Frazier, was elected governor of North Dakota, and the state legislature enacted its program in 1919. The league declined after the 1920s and affiliated with the Democrats in 1956.

nonrepresentational art See ABSTRACT ART

nonsense verse Humorous or whimsical verse that features absurd characters and actions and often contains evocative but meaningless words coined for the verse. It is unlike the ritualistic gibberish of children's counting-out rhymes in that it makes such words sound purposeful. It differs from other comic verse in its resistance to any rational or allegorical interpretation. Most nonsense verse has been written for children and is modern, dating from the beginning of the 19th century. Examples include EDWARD LEAR's *Book of Nonsense* (1846), LEWIS CARROLL's "Jabberwocky" (1871), and HILAIRE BELLOC's *Bad Child's Book of Beasts* (1896). See also LIMERICK.

nonsteroidal anti-inflammatory drugs See NSAIDs

Nootka \'nůt-kə\ *or (since 1980)* **Nuu-chah-nulth** Any of several bands of NORTHWEST COAST INDIAN people of southwestern Vancouver Island, B.C., Can., and northwestern Washington, U.S. The name Nuu-chah-nulth, which they adapted in preference to Nootka (given them by others), means "Along the Mountains." They speak a Wakashan language. Culturally related to the KWAKIUTL, the Nootka were specialized whale hunters. They moved seasonally, returning to their principal homesites during the winter. Local groups were usually socially and politically independent. The most important religious ceremony was the shaman's dance, a reenactment of mythological themes that ended with a POTLATCH. Today the Nuu-chah-nulth number about 6,000.

Nootka Sound Controversy (1790) Dispute between Spain and Britain over ship seizures off the western Canadian coast. Spain seized four British trading ships in Nootka Sound, an inlet of Vancouver Island, Can., in accordance with Spanish claims to the northwestern coast of America. Britain threatened war, maintaining that sovereignty necessitated actual occupation of the land. Spain yielded to British demands and signed an agreement acknowledging the right of each country to trade and establish settlements on unoccupied land.

Nora Ancient city, southwest of CAGLIARI, SARDINIA. Ruins from the 7th century BC indicate that the site was first settled by PHOENICIANS. It was the capital of Sardinia after the Roman annexation in the 1st century AD. Excavations have revealed a wealthy imperial Roman city with a theatre, an aqueduct, a temple of Juno, a nymphaeum, and private villas overlying a typical Phoenician port.

noradrenaline See NOREPINEPHRINE

Nordenskiöld \'nür-dən-ˌshœld**, (Nils) Adolf Erik, Frihere (baron)** (b. Nov. 18, 1832, Helsinki, Fin.—d. Aug. 12, 1901, Dalbyö, Swed.) Finnish-born Swedish geologist, mineralogist, geographer, and explorer. In 1858 he settled in Stockholm and became professor and curator of mineralogy at the Swedish State Museum. He led several expeditions to the Arctic island of Spitsbergen between 1864 and 1873, and in 1870 he led an expedition to western Greenland. In 1878–79, on the steam vessel *Vega*, he sailed from Norway to Alaska on the first expedition to successfully navigate the NORTHEAST PASSAGE. He was created a baron on his return. In 1883 he became the first to break through the great sea ice barrier of the southeast Greenland coast.

Nordic skiing Skiing techniques and events of Scandinavian origin that include CROSS-COUNTRY SKIING and SKI JUMPING. Nordic events were included in the first Winter Olympics in 1924. See also ALPINE SKIING.

norepinephrine \ˌnȯr-ˌep-ə-'nef-rən\ *or* **noradrenaline** One of two CATECHOLAMINE HORMONES (EPINEPHRINE is the other) secreted by the ADRENAL GLANDS, as well as at nerve endings, as a NEUROTRANSMITTER. It resembles adrenaline chemically and in its actions on the body, which mimic sympathetic NERVOUS SYSTEM stimulation. It constricts most blood vessels and is given for certain types of SHOCK. Norepinephrine is formed from TYROSINE and converted to epinephrine. It was discovered by Ulf von Euler-Chelpin (1905–83) in the mid-1940s.

Norfolk \'nȯr-fək\ Administrative and historic county (pop., 2001: 796,733), eastern England. Bounded by Suffolk (south), Cambridgeshire and Lincolnshire (west), and the North Sea (north and east), it is low-lying and has reed swamps, including the famous Broads that resulted from medieval peat cutting and a subsequent change in sea level. Paleolithic, Mesolithic, and Neolithic artifacts have been found, including impressive STONE AGE flint mines in Breckland. In the Middle Ages the region's prosperity depended mainly on wool. Among the county's most important cities is NORWICH. The economy is now largely agricultural.

Norfolk City (pop., 2000: 234,403), southeastern Virginia, U.S. A port of entry on the Elizabeth River, it is located just south of HAMPTON ROADS. Founded in 1682, it was incorporated as a borough in 1736. It was destroyed by fires in 1776 and 1799. YELLOW FEVER killed 10% of the population in 1855. During the AMERICAN CIVIL WAR the city was occupied by Union troops. Prosperity resumed after 1870 when railroads linked the port to other trade centres. With NEWPORT NEWS and PORTSMOUTH it makes up the Port of Hampton Roads. Shipping, shipbuilding, and light industry are the major economic activities. Norfolk is the headquarters of the U.S. Atlantic Fleet and NATO's Supreme Allied Command, Atlantic.

Norfolk, Thomas Howard, 2nd duke of (b. 1443—d. May 21, 1524, Framlingham, Suffolk, Eng.) English noble prominent in the reigns of HENRY VII and HENRY VIII. Son of the 1st duke of Norfolk, he was made steward of the royal household and created earl of Surrey in 1483. While fighting for RICHARD III, he was taken prisoner (and his father killed) in the Battle of BOSWORTH FIELD. After his release in 1489, he commanded the defense of the Scottish borders and later defeated the Scots at the Battle of FLODDEN. Norfolk later served as lord treasurer and a privy councillor, and he helped arrange the marriage of MARGARET TUDOR to JAMES IV of Scotland. In 1520 he was guardian of England during Henry VIII's absence in France.

Norfolk, Thomas Howard, 3rd duke of (b. 1473—d. Aug. 25, 1554, Kenninghall, Norfolk, Eng.) English noble prominent in the reign of HENRY VIII. Son of the 2nd duke of NORFOLK, he was made lord high admiral in 1513 and helped rout the Scots at the Battle of FLODDEN. Succeeding his father as duke (1524), he led the faction opposed to Cardinal WOLSEY, whom he replaced as president of the royal council in 1529. He supported the marriage of his niece ANNE Boleyn to Henry (1533), but later (as lord high steward) he presided over her trial (1536). He skillfully suppressed the PILGRIMAGE OF GRACE rebellion and by 1540 was the most powerful of Henry's councillors. His position weakened after his niece CATHERINE Howard was put to death (1542) and his son Henry Howard (1517–47) was executed for treason. Imprisoned as an accessory to his son, he was released by Queen MARY in 1553.

Norfolk, Thomas Howard, 4th duke of (b. March 10, 1538, Kenninghall, Norfolk, Eng.—d. June 2, 1572, London) English noble executed for his intrigues against Queen ELIZABETH I. He was the grandson of the 3rd duke of NORFOLK, whom he succeeded as duke in 1554. In favour with both Queen MARY and Queen Elizabeth, Norfolk commanded the English forces that invaded Scotland in 1559–60. He led the commission to resolve problems between MARY, QUEEN OF SCOTS, and Scotland's Prot-

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estant nobility (1568). He became involved in a plan to free Mary from imprisonment by marrying her and was arrested after a failed revolt by Catholic nobles (1569). Released in 1570, Norfolk was drawn into another plot to install Mary on the English throne through a Spanish invasion of England; discovery of the plot led to his arrest and execution.

Norfolk Island Island territory of Australia, southern Pacific Ocean. Located midway between New Caledonia and New Zealand, the island has an area of 13 sq mi (35 sq km). Discovered by Capt. James Cook in 1774, it became a British penal colony (1788–1814, 1825–55). The population of Pitcairn Island was moved here in 1856, and many residents of Norfolk Island are descended from crew members of HMS *Bounty*. Of volcanic origin, it has generally rugged terrain with abundant Norfolk Island pine. The major industry is tourism.

Norfolk Island pine Evergreen timber and ornamental conifer (*Araucaria excelsa*, or *A. heterophylla*) of the family Araucariaceae, native to Norfolk Island in the South Pacific Ocean. In nature this pine grows to a height of 200 ft (60 m), with a trunk sometimes reaching 10 ft (3 m) in diameter. The wood of large trees is used in construction, furniture, and shipbuilding. The sapling stage is grown worldwide as a houseplant and as an outdoor ornamental in regions with a Mediterranean climate. The monkey puzzle tree is a relative.

Norfolk Island pine (*Araucaria excelsa*).
ROBERT C. HERMES-THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Noricum Ancient kingdom and Roman province, west-central Europe. It was located roughly south of the Danube River and north of modern Italy. Originally controlled by a Celtic confederacy, it was annexed by Augustus c. 15 BC. Its rich iron and gold mines were worked by the Romans. Latin inscriptions on coins indicate a Romanized culture. Emperor Claudius enhanced the significance of several of Noricum's towns and recruited soldiers from the area for the Praetorian Guard c. AD 50. The Franks settled there by the end of the 5th century AD.

Noriega \ˌnȯr-ē-ˈä-gə\ (Morena), Manuel (Antonio) (b. Feb. 11, 1938, Panama City, Pan.) Panamanian general who was the actual power behind a civilian president. Born into a poor family, he attended military school in Peru and joined Panama's National Guard on his return. As chief of military intelligence in the 1970s, he cooperated with the Central Intelligence Agency and negotiated the release of U.S. freighter crews held by Cuba, but he was tainted by persistent reports of drug trafficking and brutality. In 1989, as head of the armed forces, he canceled election results that displeased him. The U.S. government then invaded Panama, primarily to capture Noriega. He was brought to trial in the U.S., convicted of racketeering, drug trafficking, and money laundering, and sentenced to 40 years in prison. His jail term was later reduced.

normal distribution In statistics, a frequency distribution in the shape of the classic bell curve. It accurately represents most variations in such attributes as height and weight. Any random variable with a normal distribution has a mean (see mean, median, and mode) and a standard deviation that indicates how much the data as a whole deviate from the mean. The standard deviation is smaller for data clustered closely around the mean value and larger for more dispersed data sets.

Norman Any of the Vikings, or Norsemen, who settled in northern France (or the Frankish kingdom) and their descendants. As pagan pirates from Denmark, Norway, and Iceland, they raided the European coast in the 8th century. They settled in the lower Seine valley by c. 900. In 911 they were granted territory around what is now Rouen by King Charles III and then extended their territory westward. They founded the duchy of Normandy, governed by a line of rulers who called themselves counts or dukes of Normandy. Though the Normans converted to Christianity and adopted the French language, they continued to display their Viking ancestors' recklessness and appetite for conquest. In the 11th century they seized England in the Norman Conquest and colonized southern Italy and Sicily. The Normans also participated in the reconquest of Spain and in the Crusades, and the Normans of Italy and Sicily were rivals of the Byzantine emperors.

Norman, Greg(ory John) (b. Feb. 10, 1955, Mount Isa, Queen., Austl.) Australian golfer. After losing the 1984 U.S. Open in an 18-hole playoff, he won the British Open in 1986 and repeated that victory in 1993. Nicknamed "the Great White Shark" for his light blond hair and his aggressive style, he had compiled 78 career individual victories by 1998. Though he was one of the top PGA career money winners, victory in the most prestigious tournaments often eluded him—he lost the Masters Tournament by one stroke in 1986 and 1987 and has been the runner-up in eight major tournaments. His gracious attitude after his loss to Nick Faldo in the 1996 Masters won him a large number of fans.

Norman, Jessye (b. Sept. 15, 1945, Augusta, Ga., U.S.) U.S. soprano. She won the Munich International Music Competition in 1968 and debuted in Berlin as Elisabeth in *Tannhäuser* (1969). She appeared at La Scala, Milan, in 1972 and made recital debuts in London and New York City the next year. Having garnered extraordinary praise for years, she made her Metropolitan Opera debut in *Les Troyens* in 1983, confirming her reputation as perhaps the greatest soprano of her generation. An imposing stage presence with a vibrant and flexible voice, her operatic and concert repertoire encompasses an exceptionally wide range.

Norman Conquest (1066) Military conquest of England by William, duke of Normandy (later William I), mainly through his victory over Harold II at the Battle of Hastings. Edward the Confessor had designated William as his successor in 1051. When Harold, duke of Wessex, was crowned king of England in 1066 instead, William assembled an invasion force of 5,000 knights. After defeating Harold's army near Hastings on October 14 and advancing to London, he was crowned king in Westminster Abbey on Christmas Day, 1066. Native revolts continued until 1071, notably in Northumbria. The Norman Conquest brought great social and political changes to England, linking the country more closely with western Europe and replacing the old English aristocracy with a Norman aristocracy. The English language was subjected to a long period of influence by Anglo-French, which remained in literary and courtly use until the reign of Edward III and in legal reporting until the 17th century.

Normandy *French* **Normandie** \nȯr-mä^{n}-ˈdē\ Historic and cultural region, northwestern France. The capital was Rouen. It has been inhabited since Paleolithic times. Its Celtic population was conquered by the Romans c. 56 BC, when it became part of the province of Lugdunensis. Invaded by Vikings in the 8th century AD, it was ceded to their chief, Rollo, in 911 by Charles III (the Simple) of France. The Vikings became known as Normans, hence the region's name. William, duke of Normandy, united Normandy and England (Norman Conquest, 1066) and became William I (the Conqueror) of England. Normandy became a province of France in 1450 and was divided into several departments after the French Revolution. It was the site of the World War II Allied invasion of German-occupied France in 1944 (see Normandy Campaign). The region has retained its rural character despite the growth of towns along the lower Seine valley.

Normandy Campaign Allied invasion of northern Europe in World War II that began on June 6, 1944, with the largest amphibious landing in history in Normandy, France. Also called Operation Overlord, the landing transported 156,000 U.S., British, and Canadian troops across the English Channel in over 5,000 ships and 10,000 planes. Commanded by Gen. Dwight D. Eisenhower, the Allied forces landed at five beaches on the Normandy coast and soon established lodgement areas, despite stiff German resistance and heavy losses at the code-named Omaha Beach and Juno Beach. Allied air supremacy prevented rapid German reinforcements, and discord between Adolf Hitler and his generals stalled crucial counterattacks. Though delayed by heavy fighting near Cherbourg and around Caen, the Allied ground troops broke out of the beachheads in mid-July and began a rapid advance across northern France. The Normandy Campaign is traditionally considered to have concluded with the liberation of Paris on Aug. 25, 1944.

Norodom \ˈnȯr-ə-dəm *orig.* **Vody** (b. 1834, Cambodia—d. April 24, 1904, Phnom Penh) King of Cambodia (r. 1860–1904). Cambodia had been under the joint vassalage of Vietnam and Siam (Thailand) since 1802. After the death of Norodom's father in 1860, the Siamese asserted sole dominion over Cambodia by refusing to allow the Vietnamese to participate in Norodom's crowning. France opposed Siamese claims on the country and forced Norodom to accept French protection. He was crowned in 1864, and during his reign France dominated Cambodian affairs.

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Norodom Sihanouk \ˌsē-ə-ˈnük\ *in full* **Preah Bat Samdech Preah Norodom Sihanouk** (b. Oct. 31, 1922, Phnom Penh, Camb.) Cambodia's king (1941–55 and 1993–2004); he also held other posts. He abdicated in favour of his father in 1955, becoming his father's prime minister; he became head of state on his father's death in 1960. During the Vietnam War he steered a neutral course between the radical right and left in both his foreign and internal policies. Overthrown by Lon Nol in 1970, he campaigned for the Khmer Rouge but was imprisoned after they came to power, and most of his family was killed. Released in the face of a Vietnamese invasion (1979), he denounced both the Vietnamese and the Khmer Rouge. In 1982 he became president of a fragile coalition of resistance groups. Following UN-sponsored elections in 1993, Cambodia's National Assembly voted to restore the monarchy, and Sihanouk again became king. He abdicated on Oct. 7, 2004, and his son Norodom Sihamoni, chosen to succeed him, was crowned king on October 29.

Norris, (Benjamin) Frank(lin) (b. March 5, 1870, Chicago, Ill., U.S.—d. Oct. 25, 1902, San Francisco, Calif.) U.S. novelist and short-story writer. Norris initially worked as an overseas correspondent and in publishing. He became the first important American author to embrace naturalism. *McTeague* (1899) is a portrait of an acquisitive society. He adopted a more humanitarian ideal beginning with his masterpiece, *The Octopus* (1901), the first novel of a projected trilogy dealing with the economic and social forces involved in the wheat industry. The second part, *The Pit*, appeared in 1903, but the third was unwritten at his death. Despite romanticizing tendencies, his works present a vivid, authentic picture of life in California in his day.

Norris, George W(illiam) (b. July 11, 1861, Sandusky, Ohio, U.S.—d. Sept. 2, 1944, McCook, Neb.) U.S. politician. He served in the U.S. House of Representatives from 1903 to 1913. In the U.S. Senate (1913–43) he drafted the 20th Amendment to the Constitution of the United States, which abolished the so-called lame-duck session of Congress. He also worked for the introduction of presidential primaries and for direct election of U.S. senators. He introduced the bill establishing the Tennessee Valley Authority and coauthored the Norris-La Guardia Act, which restricted the use of injunctions in labour disputes. An independent Republican, he said he "would rather be right than regular."

Norsemen See Vikings

North, Alex (b. Dec. 4, 1910, Chester, Pa., U.S.—d. Sept. 8, 1991, Pacific Palisades, Calif.) U.S. film composer and conductor. North studied at the Curtis Institute and Juilliard. In the early 1930s he traveled to Moscow and became the sole American member of the Union of Soviet Composers. He composed ballet scores for Martha Graham and others and later studied and conducted in Mexico City. North's score for *A Streetcar Named Desire* (1951), the first jazz-based film score, brought him to prominence. His dozens of films over 30 years include *Spartacus* (1960), *Who's Afraid of Virginia Woolf?* (1966), and *Prizzi's Honor* (1985).

North (of Kirtling), Frederick, Lord *later* **earl of Guilford** (b. April 13, 1732, London, Eng.—d. Aug. 5, 1792, London) English prime minister (1770–82). Elected to Parliament at age 22, he served as lord of the treasury (1759–65) and as chancellor of the Exchequer (1767–70). As prime minister, he gave vacillating support to both harsh and conciliatory measures toward the American colonies before the American Revolution. Although only a halfhearted supporter of the war, he was a pliant agent of George III. He resigned on hearing the news of Charles Cornwallis's defeat at the Siege of Yorktown. In 1783 he formed a brief coalition with his former Whig opponent Charles James Fox.

North, Simeon (b. July 13, 1765, Berlin, Conn., U.S.—d. Aug. 25, 1852, Middletown, Conn.) U.S. firearms manufacturer. He supplied pistols and rifles to the U.S. government from 1799. He developed the use of interchangeable parts in manufacturing (see armoury practice; mass production) and the first-known milling machine. In 1825 he built a breech-loading rifle with fully interchangeable parts.

North Africa campaigns (1940–43) Battles in World War II for control of North Africa. After the 1940 victory by Italian troops in Egypt, the Italians were driven back into Libya by British troops. German reinforcements led by Erwin Rommel forced the British to retreat into Egypt after the defense of Tobruk. In 1942 the British under Bernard Law Montgomery counterattacked at the Battles of El Alamein and pushed the Germans west into Tunisia. In November 1942 U.S. and British forces under Dwight D. Eisenhower landed in Algeria and Morocco, then moved east into Tunisia. In May 1943 the Allies, advancing from east and west, defeated the Axis forces and forced the surrender of 250,000 Axis troops.

North America Continent, Western Hemisphere. The third-largest continent on earth, it lies mostly between the Arctic Circle and the Tropic of Cancer. It is almost completely surrounded by bodies of water, including the Pacific Ocean, the Bering Strait, the Arctic Ocean, the Atlantic Ocean, and the Caribbean Sea and Gulf of Mexico. Area: 9,361,791 sq mi (24,247,039 sq km). Population (2001 est.): 454,225,000. Shaped like an inverted triangle, North America was apparently the first continent to achieve its current approximate size and shape. Its geologic structure is built around a stable platform of Precambrian rock called the Canadian Shield. To the southeast are the Appalachian Mountains and to the west are the younger and much taller Cordilleras. These mountains extend the length of the continent and occupy about one-third of the total land area. The Rocky Mountains constitute the eastern Cordillera. The highest point is Mount McKinley. The Mississippi River basin, including its major tributaries, the Missouri and Ohio, occupies more than one-eighth of the continent's total area. Generally temperate climatic conditions prevail. Arable land accounts for about one-eighth of the land area and forests for about one-third. English, the primary language of the U.S., predominates, followed by Spanish; French is spoken in parts of Canada. Most of the continent's population of European descent is found in the U.S. and Canada. Intermarriage between whites and Indians was common in Mexico, and mestizos constitute about three-fifths of the Mexican population. North America has a mixture of developed, partly developed, and developing economies, adequate reserves of most metallic resources, and the world's largest reserves of cadmium, copper, lead, molybdenum, silver, and zinc. It is the world's leading food producer, largely because of mechanized and scientific farming in the U.S. and Canada. Among the continent's democratically governed states are Canada, Mexico, Costa Rica, and the U.S. The nations of North America have sought hemispheric unity as members of the Organization of American States, which also includes South American countries. They also sought stronger economic ties, and in 1992 Canada, the U.S., and Mexico signed the North American Free Trade Agreement (NAFTA), which called for the elimination of most tariffs and other trade barriers between the three countries. The first inhabitants were American Indians, who migrated from Asia about 20,000 years ago. The greatest pre-Columbian civilizations were in Mesoamerica (see Mesoamerican civilization) and included the Olmec, Maya, Toltec, and Aztec, who were conquered by the Spanish. The continent long remained sparsely settled and undeveloped. Beginning in the 17th century it underwent a profound transformation with the coming of Europeans and the Africans they introduced as slaves. The style of life became Latin American south of the Rio Grande and Anglo-American to the north, with enclaves of French culture in Canada and Louisiana. Slavery, practiced in the 16th–19th centuries, added a significant minority culture of African origin, especially in the U.S. and the Caribbean (see West Indies). The huge industrial economy of the U.S., its abundant resources, and its military strength give the continent considerable global influence. See map on following page.

North American Free Trade Agreement See NAFTA

North Atlantic Treaty Organization See NATO

North Canadian River River, south-central Oklahoma, U.S. It rises in a high plateau in New Mexico and flows east through the Texas and Oklahoma panhandles past Oklahoma City, joining the Canadian River in the Eufaula Reservoir. The North Canadian River is 800 mi (1,287 km) long. Above the mouth of the Wolf River, one of its tributaries, the North Canadian is know as Beaver River.

North Carolina State (pop., 2000: 8,049,313), southern Atlantic region, U.S. Lying on the Atlantic Ocean, it is bordered by Virginia, South Carolina, and Tennessee. It covers 52,671 sq mi (136,417 sq km); its capital is Raleigh. Ranges of the Appalachian Mountains, including the Great Smoky Mountains, are in the west; the Blue Ridge Mountains are in the east. Several Indian peoples inhabited the area before Europeans arrived. The coast was explored by Giovanni da Verrazzano in 1524, and the first English settlement in the New World was established at Roanoke Island in 1585. It formed part of the Carolina grant of 1663. A provincial congress in 1776 gave the first explicit sanction of independence by an American colony, and North Carolina was invaded by British troops in 1780. An original state of the Union, it was the 12th to ratify the Constitution. Its 18th-century agricultural economy based on slave labour continued into the 19th century. It seceded from the Union in 1861; fol-

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lowing the American Civil War, it annulled the secession order and abolished slavery, and it was readmitted to the Union in 1868. In the 1940s its economy improved as some of the nation's largest military installations, including Fort Bragg, were located there. It has a large rural population but is also the leading industrial state of its region, and it has an expanding high technology industry in the Raleigh-Durham area. Products include tobacco, corn, and furniture.

North Carolina, Regulators of See Regulators of North Carolina

North Cascades National Park National park, northwestern Washington, U.S. Established in 1968 to preserve mountain snowfields, glaciers, alpine meadows, and lakes in the northern part of the Cascade Range, it covers an area of 504,781 acres (204,278 hectares). The Ross Lake National Recreation Area separates the park into two sections, the northern unit extending to the Canadian border and the southern unit adjoining the Lake Chelan National Recreation Area.

North Dakota State (pop., 2000: 642,200), U.S. Situated in the north-central region, it is bordered by Canada and the U.S. states of Minnesota, South Dakota, and Montana. It covers 70,704 sq mi (183,123 sq km); its capital is Bismarck. The Missouri River crosses it; the Red River forms its eastern boundary. There is evidence of prehistoric inhabitation throughout the state. At the time of European contact, it was inhabited by various tribes of Plains Indians. It became part of the U.S. with the Louisiana Purchase of 1803. The northeastern corner was added by a treaty with Great Britain in 1818. In 1804–05 the Lewis and Clark Expedition wintered there among the Indians. In 1861 it became part of the Dakota Territory. Separated from South Dakota, it was admitted to the Union in 1889 as the 39th state. In the 20th century North Dakota's history was marked by the increasing mechanization of agriculture, the enlargement of farms, and the loss of a rural population. In the 1950s it became an oil-producing state, and in the 1960s air bases and missile sites were built there. Its larger cities include Fargo, Grand Forks, and Minot.

Theodore Roosevelt National Park, North Dakota, U.S.
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North Down District (pop., 2001: 76,323), eastern Northern Ireland. Located on the southern shores of Belfast Lough, it was established in 1973, with Bangor as its administrative seat. Most of the working population is employed in Belfast. Tourism flourishes, and Bangor is a popular seaside resort.

North German Confederation (1867–71) Union of the German states north of the Main River, formed after Prussia's victory in the Seven Weeks' War. The confederation recognized the individual states' rights but was effectively controlled by Prussia, whose king served as its president and whose chancellor was Otto von Bismarck. Its constitution served as a model for that of the German Empire, with which it merged in 1871.

North Island Island (pop., 2001 est.: 2,849,724), New Zealand. The smaller of the country's two principal islands, it is separated from South Island by the Cook Strait. It has an area of 44,702 sq mi (115,777 sq km). A growing majority of the population of New Zealand lives on North Island, concentrated in the cities of Wellington and Auckland.

North Korea See North Korea

North Platte River River, Colorado, Wyoming, and Nebraska, U.S. One of the two main arms of the Platte River, it rises in northern Colorado, flows north into Wyoming, then turns east and southeast across the Nebraska border to join the South Platte and form the Platte. It is 680 mi (1,094 km) long and is part of an irrigation, power, and flood-control project of the Missouri River basin. It has large reservoirs and dams.

North Pole Northern end of the Earth's geographic axis, located at latitude 90° N. It is the northern point from which all meridians of longitude start. Lying in the Arctic Ocean and covered with drifting pack ice, it has six months of constant sunlight and six months of total darkness each year. Robert E. Peary claimed to have reached the pole by dogsled in 1909, but that is now in dispute; Roald Amundsen and Richard E. Byrd claimed to have reached it by air in 1926. The geographic pole does not coincide with the magnetic North Pole, which in the early 21st century lay at about 82°45′ N, 114°25′ W, or with the geomagnetic North Pole, which is at about 79°45′ N, 71°45′ W.

North Sea *ancient* **Mare Germanicum** Arm of the Atlantic Ocean. Extending south from the Norwegian Sea between Norway and the British Isles, it connects the Skagerrak (channel between Norway and Denmark) with the English Channel. It is about 600 mi (970 km) long and 350 mi (560 km) wide, with an average depth of 308 ft (94 m). Parts of the sea feature deep trenches, while others have excellent fishing, renowned fisheries, and extensive oil and natural gas deposits.

North Star See Polaris

North West Co. (1783–1821) British-Canadian fur-trading company. Its operations were centred around the Lake Superior region and the valleys of the Red, Assiniboine, and Saskatchewan rivers. It later spread north and west to the Arctic and Pacific oceans. When its competitor, the Hudson's Bay Co., established a colony on the Red River (1811–12), North West workers destroyed the colony in the Seven Oaks Massacre. Hudson's Bay workers retaliated by destroying the North West post at Fort Gibraltar. The British government pressured the two companies to merge in 1821 as the Hudson's Bay Co.

North York Former city (pop., 2001: 608,288), southeastern Ontario, Canada. In 1998 it joined the cities of Etobicoke, Scarborough, Toronto, and York and the borough of East York to become the City of Toronto. North York became a borough in 1967 and a city in 1979. Planned industrial and residential development protects more than 4,000 acres (1,620 hectares) of parks and open space. York University and the Black Creek Pioneer Village are among its attractions.

North Yorkshire Administrative (pop., 2001: 569,660) and geographic county, part of the historic county of Yorkshire, northern England. Its administrative seat is Northallerton. Prehistoric sites show evidence of a military Roman occupation. In the Middle Ages it was a peripheral region of England with numerous castles of the great landowning families. Monastic orders, including the Cistercians, grew wealthy from sheep farming. The area played a significant part in the Wars of the Roses and the English Civil Wars. The modern economy is mainly agricultural.

Northampton Town and borough (pop., 2001: 194,477), administrative and historic county of Northamptonshire, in the Midlands region, England. Originating c. 1100 as a walled town with a castle, it was granted its first charter in 1189. In 1460, during the Wars of the Roses, King Henry VI was captured in Northampton by Yorkists. The town walls survived until the Restoration, when they were torn down under King Charles II as punishment for supporting the Parliamentarians. Now a retail and marketing centre, it also supports light industry.

Northampton, Henry Howard, earl of (b. Feb. 25, 1540, Shottesham, Norfolk, Eng.—d. June 15, 1614, London) English noble noted for his intrigues in the reigns of Elizabeth I and James I. Younger brother of the 4th duke of Norfolk, he was implicated in efforts to free Mary, Queen of Scots. He successfully sought favour with the Scottish king James VI, who, on his accession as James I of England, made Howard a privy councillor (1603) and earl of Northampton (1604). As a judge at the trials of Walter Raleigh (1603) and Guy Fawkes (1605), he pressed for conviction.

Northamptonshire \nȯr-'thamp-tən-ˌshir\ Administrative (pop., 2001: 629,676) and historic county of the East Midlands region, England. It has remains of early settlements, including pre-Celtic and Roman. Norman and early English building styles coexist with mansions and country

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houses from as early as the 13th century. The county was largely pro-Parliament during the English Civil Wars. It combines traditional rural life with a modern economy of varied industries in centres such as Northampton, the county seat, and Corby.

Northcliffe (of Saint Peter), Alfred Charles William Harmsworth, Viscount (b. July 15, 1865, Chapelizod, near Dublin, Ire.—d. Aug. 14, 1922, London, Eng.) British newspaper publisher. After an impoverished childhood and a few attempts to make a quick fortune, he joined his brother, Harold Sidney Harmsworth (1868–1940), in publishing popular periodicals that formed the basis of Amalgamated Press, at the time the world's largest periodical publishing empire. In 1896 he started the *Daily Mail*, one of the first British newspapers to popularize its coverage to appeal to a mass readership. He also founded the *Daily Mirror* (1903) and bought *The Times* (1908), transforming it into a modern newspaper. His influence was greatest in shifting the press away from its traditional informative role to that of the commercial exploiter and entertainer of mass publics. He has been considered the most successful publisher in the history of the British press.

Northeast Passage Maritime route along the northern coast of Europe and Asia. It lies between the Atlantic and Pacific oceans mainly off northern Siberia. Early explorers included Willem Barents, Olivier Brunel, and Henry Hudson. In 1778 Capt. James Cook saw both sides of the Bering Strait and demonstrated that Asia and North America are two separate continents. The passage was first traversed by Adolf Erik Nordenskiöld in 1878–79. Since the late 1960s it has been kept open in summer by icebreakers.

Northern Dvina \dvē-'nä\ **River** *Russian* **Severnaya** \'sye-vyir-nə-yə\ **Dvina** River, northern Russia. Formed by the junction of the Sukhona and Yug rivers, it is one of the largest and most important waterways of the northern European part of Russia. It flows northwest for 462 mi (744 km) and enters the Dvina inlet of the White Sea below the city of Arkhangelsk. Navigable for most of its length, it was used by early fur hunters and colonists, and monasteries and towns were established at important confluences. It retains its economic importance and is linked with the Volga-Baltic Waterway via the Sukhona River.

Northern Expedition (1926–27) Campaign of the Chinese Nationalist army, led by Chiang Kai-shek, that advanced north from Guangzhou (Canton) to the Yangtze River (Chang Jiang) battling warlord forces. The Northern Expedition was aided by Soviet arms and advisers and by a propaganda corps that preceded them. After defeating the warlords, the Nationalist army turned on Britain as the chief imperialist power and primary enemy. In response, the British returned their concessions in Hankou and Jiujiang but prepared to defend Shanghai. The alliance between the communists and the Nationalists fell apart at that point: when communist-led labour unions captured Shanghai for Chiang he attacked and suppressed them, and when he set up his new government in Nanjing he expelled the communists from it. See also Zhang Zuolin.

Northern Ireland Part of the United Kingdom of Great Britain and Northern Ireland occupying the northeastern portion of the island of Ireland. Area: 5,461 sq mi (14,144 sq km). Population (2001): 1,685,267. Capital: Belfast. It is bounded by the republic of Ireland, the Irish Sea, the North Channel, and the Atlantic Ocean. Northern Ireland is often referred to as the province of Ulster. The people are descended from indigenous Irish and immigrants from England and Scotland. Language: English (official). Religions: Protestantism (the majority) and Roman Catholicism (a minority). Currency: pound sterling. Northern Ireland's industries include engineering, shipbuilding (which has been in severe decline), automobile manufacturing, textiles, food and beverage processing, and clothing. The service industry employs about three-fourths of the workforce, and manufacturing employs less than one-fifth of workers. Agriculture is important, with most farm income derived from livestock. Northern Ireland shares most of its history with the republic of Ireland, though Protestant English and Scots immigrating in the 16th–17th centuries tended to settle in Ulster. In 1801 the Act of Union created the United Kingdom, which united Great Britain and Ireland. In response to mounting Irish sentiment in favour of Home Rule, the Government of Ireland Act was adopted in 1920, providing for two partially self-governing units in Ireland: the northern six counties constituting Northern Ireland and the southern counties now making up the republic of Ireland. In 1968 civil rights protests by Roman Catholics sparked violent conflicts with Protestants and led to the occupation of the province by British troops in the early 1970s. The Irish Republican Army (IRA) mounted a prolonged campaign of violence in an effort to force the withdrawal of British troops as a prelude to Northern Ireland's unification with Ireland. In 1972 Northern Ireland's constitution and parliament were suspended, bringing the province under direct rule by the British. Violence continued for three decades before dropping off in the mid-1990s. In 1998 talks between the British government and the IRA resulted in a peace agreement that provided for extensive Home Rule in the province. In 1999 power was devolved to an elected assembly, though the body was hampered by factional disagreements. Sporadic sectarian strife continued in the early 21st century, as the IRA gradually carried out decommissioning (disarming).

Northern Mariana Islands Self-governing commonwealth (pop., 2005 est.: 80,400) in political union with the U.S., in the western Pacific Ocean. Composed of 22 islands north of Guam, the Northern Marianas extend 450 mi (720 km) and have an area of 184 sq mi (477 sq km). The capital, Chalan Kanoa, is on Saipan. Saipan, Tinian, and Rota are the principal inhabited islands. Others include Alamagan and Agrihan; Pagan was evacuated for a time after a 1981 volcanic eruption. The indigenous people are Micronesian; other inhabitants are Chamorro and Filipino. The islands were discovered by Ferdinand Magellan in 1521. They were colonized by Spain in 1668. Sold by Spain to Germany in 1899, they were occupied by Japan in 1914 and became a Japanese mandate from the League of Nations after 1919. They were the scene of fierce fighting in World War II; Tinian was the base for U.S. planes that dropped atomic bombs on Hiroshima and Nagasaki. The Northern Marianas were granted to the U.S. as a UN trust territory in 1947 and became self-governing in 1978 (when the residents became U.S. citizens). The UN trusteeship ended in 1986.

Northern Pacific Railway Co. Major U.S. railroad that operated between St. Paul and Seattle. It was chartered by Congress in 1864 to build a line from Lake Superior to the Pacific coast. Financed by Jay Cooke until 1873, it was later completed with Henry Villard's backing. Financially troubled in the 1890s, it was reorganized by J. P. Morgan. He shared control of it with James J. Hill, whose Great Northern Railway Co. was a competitor and who sought to combine the two railroads with the Chicago, Burlington and Quincy through the Northern Securities Co. This arrangement was declared a violation of antitrust laws by the Supreme Court in 1904, but the three railroads remained financially linked and in 1970 were permitted to merge as the Burlington Northern, Inc. Burlington Northern acquired the St. Louis-San Francisco Railway Co. in 1980 and the Santa Fe Pacific Corp. in 1995.

Northern Rhodesia See Zambia

Northern Territory Territory (pop., 2001 prelim.: 200,019), northern Australia. It covers an area of 520,900 sq mi (1,349,130 sq km). Its capital is Darwin; the only other sizable town is Alice Springs. Most of the people are of European descent; about one-fifth are Australian Aboriginals. It consists mainly of tableland, with the Simpson Desert in the southeast and the Arnhem Land plateau in the north. It was inhabited by Aboriginals for thousands of years; they held Ayers Rock as central to their culture. The coast was explored by the Dutch in the 17th century and surveyed in the early 19th century by Matthew Flinders. First included as part of New South Wales, it was annexed to South Australia in 1863. It reverted to being under direct control of the Commonwealth of Australia in 1911. The northern parts were bombed by the Japanese in World War II and occupied by Allied troops. It was granted self-government within the Commonwealth in 1978. It remains sparsely inhabited; its economy rests on cattle farming, mining, government services, and a growing tourism industry.

Northern War, First (1655–60) Final stage of the struggle over the Polish-Swedish succession. In 1655 the Swedish king Charles X Gustav declared war on Poland on the pretext that it refused to recognize him as king. In alliance with Brandenburg, Sweden invaded Poland with initial success, but when Russia, Denmark, and Austria declared war on Sweden, Brandenburg deserted to join the coalition. The Swedes were driven from Poland but later twice invaded Denmark. The war ended with the Polish sovereigns renouncing their claim to the Swedish throne and the Swedes acquiring Skåne from Denmark.

Northern War, Second *or* **Great Northern War** (1700–21) Military conflict to challenge Sweden's supremacy in the Baltic area. Sweden's expansion in the Baltic Sea coastlands antagonized Russia, Denmark-Norway, and Saxony-Poland, which formed an anti-Swedish coalition in 1698. They attacked Swedish-held regions in 1700, but Sweden's Charles XII successfully countered the attacks and restored the sta-

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tus quo. The Russians eventually succeeded in establishing their power on the eastern Baltic coast, and Peter I the Great founded his new capital of St. Petersburg there in 1703. Sweden renewed its attack on Russia in 1707, but was defeated at the Battle of Poltava (1709). Despite an alliance with Turkey against Russia (1710–11), Swedish forces suffered defeats in its territories by the revived anti-Swedish coalition, which by then included England and Prussia. Charles opened peace negotiations in 1717, but in 1718 he invaded southeastern Norway, where he was killed. His successor, Frederick I (1676–1751), negotiated peace settlements in 1719–21, including the Treaty of Nystad, which ceded Estonia, Livonia, and other territory to Russia. The war marked the decline of Swedish influence and the emergence of Russia as a major power.

Northern Wei dynasty *or* **Toba dynasty** (AD 386–534/35) Longest-lived and most powerful of the northern Chinese dynasties that ruled after the Han dynasty fell and before the Sui and Tang dynasties reunified China. Founded by Toba tribesmen, the Northern Wei defended its territory against other northern nomads and by 439 had unified all of northern China. The Wei lifestyle became more sedentary, and the Toba people, impressed by Chinese culture, began to emulate the Chinese. To bring into cultivation land abandoned during war, hundreds of thousands of peasants were relocated and allocated land under the equal-field system of land distribution. The rulers of the Northern Wei were great patrons of Buddhism, and the period is noted for its Buddhist art, particularly at the caves of Yungang. The one exception, the emperor Taiwu, persecuted Buddhists and supported Daoism.

Northern Wei sculpture Chinese sculpture, dominated by simple images of the Buddha, dating from the era of the Northern Wei dynasty (AD 386–534/535). The art represents the first major influence of Buddhism on China, and may be divided into two major periods. The first style (c. 452–494), an amalgam of foreign influences traceable to the Buddhist art of India, is characterized by heavy stylization of blocky volumes. The second style (c. 494–535) clothes the Buddha in the costume of the Chinese scholar and emphasizes a sinuous cascade of drapery falling over an increasingly flattened figure.

Northrop \'nôr-thrəp**, John Howard** (b. July 5, 1891, Yonkers, N.Y., U.S.—d. May 27, 1987, Wickenberg, Ariz.) U.S. biochemist. He worked most of his career on the staff of New York City's Rockefeller Institute for Medical Research (1916–61). His early research on fermentation processes led to a study of enzymes essential for digestion, respiration, and general life processes. He established that enzymes obey the laws of chemical reactions, and he crystallized pepsin, trypsin, and chymotrypsin and their zymogens. With James Sumner and Wendell Meredith Stanley he shared a 1946 Nobel Prize.

Northumberland Administrative (pop., 2001: 307,186) and historic county, northeastern England. It includes several islands, including Lindisfarne (Holy Island), and much of the ancient Anglo-Saxon kingdom of Northumbria. The landscape is varied, with coastal plains in the east, the rugged Cheviot Hills and moors in the west, and industrial areas in the southern River Tyne valley. It was the site of prehistoric settlement before the Roman domination began in AD 122, when Hadrian's Wall was built. It was the scene of border warfare with Scotland until the union of Scotland with England in 1603. Good farmland is limited; industrial complexes produce heavy machinery.

Northumberland, John Dudley, duke of (b. 1502—d. Aug. 22, 1553, London, Eng.) English politician. After serving as deputy governor of English-occupied Calais (1538) and lord high admiral (1542), he fought in the invasion of Scotland (1544) and captured the French city of Boulogne (1544). He was created earl of Warwick (1546) and in 1547 became a member of the regency council that governed for the young Edward VI. After engineering the fall of the duke of Somerset, Warwick assumed control of the regency (1550). He made himself duke of Northumberland in 1551 and ordered Somerset's arrest and execution in 1552. He imposed strict conformity to Protestant doctrine in support of the Reformation. In 1553 he persuaded the dying Edward VI to will the crown to Northumberland's daughter-in-law, Lady Jane Grey; thwarted by supporters of Mary Tudor (Mary I), he was arrested and executed for treason.

Northumbria Anglo-Saxon kingdom of Britain. Located between the River Humber and the Firth of Forth, it extended from the Irish Sea to the North Sea. Its religious, artistic, and intellectual achievements in the 7th–8th centuries were epitomized by such centres as Lindisfarne and the monasteries of Wearmouth and Jarrow. Jarrow, with its fine library, was the home of the Venerable St. Bede. After Northumbria's expansion in the 7th century, it became the most powerful of the Anglo-Saxon kingdoms before being destroyed by the Danes, who captured York in 866. In 944 the last Scandinavian ruler of York was expelled, and Northumbria became an earldom within the kingdom of England.

Northwest Coast Indian Any member of the North American Indian peoples inhabiting a narrow but rich belt of coastland and offshore islands from southeast Alaska to northwestern California. A signal feature of Northwest Coast society was the emphasis on each individual's hereditary social rank. A person's position within a local group depended on his genealogical closeness to the legendary group ancestor. For food the peoples of the area depended primarily on five species of salmon; herring; oil-rich "candlefish," or eulachon; smelt; cod; halibut; and mollusks—all of which were abundant. Water transport was highly important, and all groups made efficient dugout canoes. Northwest Coast woodworking was facilitated by the natural abundance of easily worked timbers, especially red cedar and redwood. Groups of the Northwest Coast include, from north to south, Tlingit, Haida, Tsimshian, northern Kwakiutl (Heiltsuq), Bella Coola, southern Kwakiutl, Nootka, Coast Salish, Chinook, and a series of lesser divisions.

Northwest Ordinances (1784, 1785, 1787) Measures enacted by the U.S. Congress for the division and settlement of the Northwest Territory, the frontier region extending north of the Ohio River to the Great Lakes and west of Pennsylvania to the Mississippi River. The original ordinance, written by Thomas Jefferson, divided the territory into self-governing districts and set population requirements for statehood. The final ordinance, written partly by Rufus King, set land-grant sizes and prices, provided public land for schools, outlawed slavery, and guaranteed civil liberties. It established the principle of admitting new states on equal terms with the original 13 states.

Northwest Passage Sea passage between the Atlantic and Pacific oceans along the northern coast of North America. The search for a commercial sea route around the American land barrier dates from the end of the 15th century and attracted explorers such as Jacques Cartier, Francis Drake, Martin Frobisher, and Capt. James Cook. The passage was finally navigated successfully in 1903–05 by Roald Amundsen. As a modern trade route it has been only marginally useful, because of the difficulties in navigating around the polar ice cap and the giant icebergs in the Atlantic between Greenland and Baffin Island and in the Pacific in the Bering Strait. The U.S. and Canadian governments have tried to encourage international commerce in the passage, noting how much it would shorten many international shipping distances. However, the cost of strengthening ships against ice and potentially high insurance rates for vessels used in Arctic service have been factors inhibiting the development of the Northwest Passage as a trade route.

Northwest Territories Territory (pop., 2001 est.: 40,900), northern Canada. Bounded by the Yukon Territory, Hudson Bay, and Nunavut, it stretches across the roof of the North American continent, reaching into the Arctic Circle. The capital is Yellowknife. It includes many islands, including Victoria Island; the Mackenzie River; and Great Bear and Great Slave lakes. More than half the people are Inuit (Eskimos) and American Indians. In the 18th century the mainland was explored by Samuel Hearne for the Hudson's Bay Company and by Alexander Mackenzie. European settlers were mainly whalers, fur traders, and missionaries until the 1920s, when oil was discovered and the territorial administration was formed. Mining is the principal industry and centres on the petroleum and natural gas fields in the western Arctic coastal regions.

Northwestern University Private university in Evanston, Illinois, U.S., founded in 1851. It is a comprehensive research institution that includes a college of arts and sciences and schools of music, education, social policy, graduate studies, law, medicine, and dentistry. It also includes the Medill School of Journalism, the McCormick School of Engineering and Applied Science, and the Kellogg Graduate School of Management. Research facilities include centres for the study of learning, urban affairs and policy, and superconductivity.

Norway *officially* **Kingdom of Norway** Country, western Scandinavian Peninsula, northern Europe. Area: 125,004 sq mi (323,758 sq km). Population (2005 est.): 4,617,000. Capital: Oslo. Most of the people are Norwegian, though there are several ethnic minorities, including some 30,000 to 40,000 Sami (Lapps). Language: Norwegian (official). Religion: Christianity (predominantly Evangelical Lutheran [official]). Currency:

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Norwegian krone. Norway is among Europe's largest countries. It is a mountainous land with extensive plateau regions in its southwestern and central parts. Traditionally a fishing and lumbering country, it greatly increased its mining and manufacturing activities since World War II. It has a developed economy largely based on services, petroleum and natural gas production, and light and heavy industries. Literacy is virtually 100%. Norway is a constitutional monarchy with one legislative house; its chief of state is the king, and the head of government is the prime minister. Several principalities were united into the kingdom of Norway in the 11th century. It had the same king as Denmark from 1380 to 1814, when it was ceded to Sweden. The union with Sweden was dissolved in 1905, and Norway's economy grew rapidly. It remained neutral during World War I, although its shipping industry played a vital role in the conflict. It declared its neutrality in World War II but was invaded and occupied by German troops. Norway maintains a comprehensive welfare system and is a member of NATO. Its citizens rejected membership in the European Union in 1994.

Norway lobster See scampi

Norwegian language North Germanic language of the West Scandinavian branch, spoken by some five million people in Norway and the U.S. Old Norwegian became a separate language by the end of the 12th century. Middle Norwegian became the tongue of most native speakers about the 15th century. Modern Norwegian has two rival forms. Dano-Norwegian (Bokmål, or Riksmål), the more popular, stems from written Danish used during the union of Denmark and Norway (1380–1814; see Kalmar Union). It is used in national newspapers and most literary works. New Norwegian (Nynorsk), based on western rural dialects, was created by Ivar Aasen (1813–96) in the mid-19th century to carry on the tradition of Old Norse. Both languages are used in government and education. Plans to unite them gradually in a common language, Samnorsk, were officially abandoned in 2002.

Norwegian Sea Open sea, Northern Hemisphere. It is bordered by Greenland, Iceland, Spitsbergen, and Norway. A submarine ridge linking Greenland, Iceland, the Faroe Islands, and northern Scotland separates the Norwegian Sea from the Atlantic Ocean. The sea is crossed by the Arctic Circle, but the warm Norway Current that flows northeast off the Norway coast produces generally ice-free conditions. Colder currents mixing with this warm water create excellent fishing grounds.

Norwich \'nȯr-ich\ City (pop., 2001: 121,553), administrative and historic county, Norfolk, England. Located on the River Wensum northeast of London, it had become an important market centre when it was sacked and occupied by the Danes in the 11th century. It was among the most prosperous English provincial towns for centuries; its economy was fostered by Edward III, who induced Flemish weavers to settle there, and by the influx of immigrants during the reign of Elizabeth I. One of England's largest centres of footwear manufacturing, it features a Norman castle and cathedral. It is the traditional regional capital of East Anglia and the site of a cathedral founded shortly after the Norman Conquest.

nose Prominent structure between and below the eyes. With the complex nasal cavity behind it, it functions for breathing and smelling. Behind the front section (vestibule), which includes the nostrils, it is divided vertically by three convoluted ridges (conchae) into air passages. In the highest one, the olfactory region, a small segment of mucous membrane lining contains neurons covered by a moisture layer, in which microscopic particles in inhaled air dissolve and stimulate the neurons. The rest of the cavity warms and moistens inhaled air and filters particles and bacteria out of it. Sinus cavities in the bone on both sides of the nose drain into the air passages. During swallowing, the soft palate closes off the back of the nose against food.

Nossob \'nō-ˌsäb\ **River** *or* **Nosop** \'nō-ˌsäp\ **River** River, southern Africa. Rising in central Namibia, it flows southeast through the western Kalahari Desert and forms part of the border between Botswana and South Africa, bisecting the Kalahari Gemsbok National Park (now part of Kgalagadi Transfrontier Park). It joins the Auob River before emptying into the Molopo River, which flows into the Atlantic Ocean. It is about 500 mi (800 km) long. Because of irregular rainfall, in the 20th century the lower Nossob's riverbed contained flowing water only a few times.

nostoc \'nä-ˌstäk\ Any of the cyanobacteria that make up the genus *Nostoc*. The cells are arranged in beadlike chains grouped together in a gelatinous mass. Ranging from microscopic to walnut-sized, nostoc masses may be found on soil and floating in still water. A special thick-walled cell has the ability to withstand drying for long periods of time. After 70 years of dry storage, cells of one species can germinate into filaments when moistened. Like most other cyanobacteria, nostocs contain two pigments and are capable of nitrogen fixation.

Nostradamus \ˌnäs-trə-'dā-məs\ *orig.* **Michel de Notredame** (b. Dec. 14, 1503, Saint-Rémy, France—d. July 2, 1566, Salon) French astrologer and physician known for his prophecies. He practiced medicine in southern France from 1529 and gained a reputation for his innovative treatment of plague victims in 1546–47. He began making prophecies in 1547, and in 1555 they were published in a book titled *Centuries*. He wrote them in rhymed quatrains, using a cryptic style that mingled French, Latin, Spanish, and Hebrew. Catherine de Médicis invited him to her court as an astrologer, and in 1560 he was appointed physician to Charles IX. His prophecies are still widely read; readers have discovered apparent predictions of such world events as the French Revolution and World War I.

Nostratic \nȯ-'strat-ik\ **hypothesis** Proposal of an overarching northern Eurasian language family, still of uncertain validity. Holger Pedersen was the first to suggest that the Indo-European, Uralic, Altaic, Afroasiatic, and other language families might belong in one broad category (Nostratic). In the 1960s Vladislav Illich-Svitych made a detailed case in favour of the hypothesis and added Kartvelian (see Caucasian languages) and Dravidian to the list; he began reconstructing Proto-Nostratic but died in 1966 before finishing. Important contributions to this theory were also made by the Russian-born Israeli linguist Aron Dolgopolsky. The hypothesis remains highly controversial.

notary *or* **notary public** Public officer who certifies and attests to the authenticity of writings (e.g., deeds) and takes affidavits, depositions, and protests of negotiable instruments. The notary is commissioned by the state and may act only within the territory authorized by state statutes. Most states set maximum fees for notarial services and require that a notarial seal or stamp be impressed on documents authenticated by a notary public. In the civil-law countries of western Europe and in Latin American and French areas of North America, the role of the notary is more significant, being roughly equivalent to that of a lawyer who specializes in real estate, sales, mortgages, and the settlement of estates but who may not appear in court.

notation, musical See musical notation

Noto \'nō-tō\ **Peninsula** Peninsula, Honshu, Japan. Jutting north into the Sea of Japan (East Sea), it encloses Toyama Bay. The largest penin-

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sula on the northern Honshu coast, it extends north for 50 mi (80 km) and has a width of about 19 mi (30 km). The town of Wajima, on the peninsula's northern coast, is known for its women pearl divers and its production of elaborate lacquerware. Parts of the peninsula were designated national park land in 1968.

Nôtre, André Le See André Le Nôtre

Notre Dame, University of Private university in Notre Dame, near South Bend, Indiana, U.S. It was founded in 1842 and reorganized in the 1920s; it became coeducational in 1972. It is affiliated with the Roman Catholic church. It has colleges of arts and letters, science, engineering, and business administration. It also has a graduate school and a law school.

Notre-Dame de Paris \nō-trᵊ-'dȧm-də-pȧ-'rē\ (1163–c. 1350) Gothic cathedral on the Île de la Cité in Paris. Probably the most famous Gothic cathedral, Notre-Dame is a superb example of the Rayonnant style. Two massive Early Gothic towers (1210–50) crown the western facade, which is divided into three stories and has doors adorned with Early Gothic carvings and surmounted by a row of figures of Old Testament kings. The single-arch flying buttresses at the eastern end are notable for their boldness and grace. Its three great rose windows, which retain their 13th-century glass, are of awe-inspiring beauty.

Notre-Dame de Paris.
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Notre-Dame school Composers of organum at the cathedral of Notre-Dame de Paris in the late 12th and early 13th centuries. Léonin (c. 1135–1201?) is credited with composing two-voice florid organum characterized by a rhythmically patterned "melisma" (a series of notes sung on one syllable) added to each sustained note of the plainchant (see Gregorian chant). He may have devised the rhythmic notation (ligatures) that made this possible or at least codified the important system of rhythmic modes. His younger contemporary Pérotin (fl. c. 1200) is said to have edited, extended, and added parts to Léonin's *Magnus liber organi* ("Great Book of Organum") and created the first three- and four-voice textures known in world music. See also Ars Antiqua.

Notte, Gherardo delle See Gerrit van Honthorst

Nottingham \'nä-tiŋ-em\ City and unitary authority (pop., 2001: 266,995), geographic and historic county of Nottinghamshire, north-central England. Located on the River Trent, northeast of Birmingham, the original Saxon town was held by the Danes in the 9th century and became part of the Danelaw. It was the scene of three parliaments in the 14th century. In 1642, on Standard Hill, King Charles I raised his standard at the outbreak of the English Civil Wars. Nottingham Castle stands on that site. The link between Nottingham and Robin Hood is commemorated by a statue on Castle Green. The city has a distinctive lace quarter. It is the site of the University of Nottingham.

Nottinghamshire \'nä-tiŋ-em-ˌshir\ Administrative (pop., 2001: 748,503), geographic, and historic county, East Midlands, north-central England. It has coalfields and railway lines in the west, and in its centre it contains a broad belt of infertile sandstone. It is the location of the medieval forest of Sherwood, the haunt of Robin Hood, which stretched north from the city of Nottingham. Farmland is found in the Vales of Trent and Belvoir, where agriculture includes dairy farming. The chief river is the Trent, along which there are numerous thermal electric power stations. The southwestern part of the county is densely populated and heavily industrialized.

Nouakchott \nù-'äk-ˌshät\ City (pop., 1999 est.: metro. area, 881,000), capital of Mauritania. It is on a plateau near the Atlantic coast of western African, north-northeast of Dakar, Senegal. It was a small village until Mauritania was granted full independence from France in 1960. Then the city was developed as the capital of the new nation. It was a major refugee centre during the Saharan droughts of the 1970s and grew rapidly. A port facility was built nearby for the export of petroleum and copper.

Nouméa \nü-'mā-ə\ *formerly* **Port-de-France** \ˌpȯr-də-'frä^{n}s\ Town (pop., 1996: 76,293), port, and capital of New Caledonia territory. Located on the southwestern coast of New Caledonia Island, it was founded in 1854 as Port-de-France. The city is situated on an excellent deepwater harbour protected by Nou Island and a reef. It has modern buildings, a large public market, and St. Joseph's Cathedral, an old stone structure.

nouvelle cuisine \nü-'vel-kwi-'zēn\ Style in international cuisine developed in France in the 1960s and '70s that stresses freshness, lightness, and clarity of flavour, as distinct from the richer and more calorie-laden classic haute cuisine. Dishes commonly include sauces made of vegetable and fruit purees, novel combinations of foods in small quantities, and elegant displays highlighting details of texture and colour.

nova Any of a class of stars whose luminosity temporarily increases by several thousand up to a million times normal. Most appear to be close binary stars, one of which is a white dwarf star drawing in matter from the other until it becomes unstable, causing an outburst in which the outer layer of material is shed. A nova reaches maximum luminosity within hours after its outburst and may shine intensely for several days or even a few weeks; it then slowly returns to its former level. The process can repeat at intervals ranging from a few dozen to hundreds of thousands of years. Stars that become novas are usually too faint to see with the unaided eye until their sudden increase in luminosity, sometimes great enough to make them readily visible in the night sky. To observers, such objects may appear to be new stars; hence their name (Latin for "new"). See also supernova.

Nova Scotia \ˌnō-və-'skō-shə\ Province (pop., 2001: 943,000), Canada, one of the Maritime Provinces. It comprises the peninsula of Nova Scotia, Cape Breton Island, and a few small adjacent islands, and it is bounded by the Northumberland Strait, the Gulf of St. Lawrence, the Atlantic Ocean, the Bay of Fundy, and New Brunswick. Its capital is Halifax. The region was first visited by Vikings c. AD 1000 and was inhabited by Micmac Indians when John Cabot claimed it for England in 1497. French settlers in 1605 adopted the Micmac name Acadia for the region. English and Scottish colonists arrived by 1621. The conflict between France and England over control of the area was ended by the 1713 Peace of Utrecht, which awarded it to England. In the 1750s, the British expelled most of the French settlers. Following the American Revolution, many loyalists emigrated there. It joined the Dominion of Canada in 1867 as one of the original members. The province's economic mainstays are fishing, shipbuilding, and transatlantic shipping.

Novalis, detail of an engraving by Edouard Eichens, 1845
COURTESY OF THE STAATLICHE MUSEEN ZU BERLIN, GERMANY; PHOTOGRAPH, WALTER STEINKOPF

Novalis \nō-'vä-lis\ *orig.* **Friedrich Leopold, Baron von Hardenberg** (b. May 2, 1772, Oberwiederstedt, Prussian Saxony—d. March 25, 1801, Weissenfels, Saxony) German Romantic poet and theorist. Born into a noble family, he took his pseudonym from a former family name. He studied law and then mining and in 1799 became a mine inspector. His beautiful *Hymns to the Night* (1800) expresses his grief on the death of his young fiancée. In his last years before his own death from tuberculosis at age 28, he drafted a philosophical system based on idealism and produced his most

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significant poetic work. His mythical romance *Heinrich von Ofterdingen* (1802) describes a young poet's mystical and romantic searchings.

Novara \nō-'vä-rä**, Battle of** (March 23, 1849) Battle of the first Italian war of independence at Novara, Italy, near Milan. Austrian troops under Joseph Radetzky defeated a larger Italian force under Charles Albert, king of Sardinia-Piedmont. The defeat revealed Piedmont's lack of support from the smaller Italian states and led to the abdication of Charles Albert.

Novartis AG Swiss pharmaceutical company. It was formed through the 1996 merger of two Swiss firms: Ciba (see Ciba-Geigy) and Sandoz, a chemical company with interests in pharmaceuticals, nutrition, and agriculture. Novartis's products include generic drugs, eye-care products, consumer health-care products, and pharmaceuticals. In 2002 the company created an ethics committee to evaluate research involving human stem cells.

novel Fictional prose narrative of considerable length and some complexity that deals imaginatively with human experience through a connected sequence of events involving a group of persons in a specific setting. The genre encompasses a wide range of types and styles, including picaresque, epistolary, gothic, romantic, realist, and historical novels. Though forerunners of the novel appeared in a number of places, including Classical Rome and 11th-century Japan, the European novel is usually said to have begun with Miguel de Cervantes's *Don Quixote*. The novel was established as a literary form in England in the 18th century through the work of Daniel Defoe, Samuel Richardson, and Henry Fielding. The typical elements of a conventional novel are plot, character, setting, narrative method and point of view, scope, and myth or symbolism. These elements have been subject to experimentation since the earliest appearance of the novel. Compare antinovel. See also novella; short story.

novella Story with a compact and pointed plot, often realistic and satiric in tone. Originating in Italy during the Middle Ages, it was often based on local events; individual tales often were gathered into collections. The novella developed into a psychologically subtle and structured short tale, with writers frequently using a frame story to unify tales around a theme, as in Giovanni Boccaccio's *Decameron*. The term is also used to describe a work of fiction intermediate in length—and sometimes complexity—between a short story and a novel. Examples of novellas include Fyodor Dostoyevsky's *Notes from the Underground* (1864), Joseph Conrad's *Heart of Darkness* (1902), Thomas Mann's *Death in Venice* (1912), and Henry James's *The Aspern Papers* (1888).

Noverre \nō-'ver**, Jean-Georges** (b. April 29, 1727, Paris, Fr.—d. Oct. 19, 1810, Saint-Germain-en-Laye) French dancer and choreographer. His treatise *Letters on Dancing and Ballets* (1760) stressed the need for unified dramatic structure by integrating story, music, choreography, and set design, as opposed to the loosely connected episodes of the dance suite that then prevailed. This innovative approach—called *ballet d'action*, or "ballet with a story"—brought major reforms in ballet production. His invention of *ballet d'action* was challenged by Gasparo Angiolini, who had developed a simpler approach to the new form. In 1776 Noverre became ballet master of the Paris Opéra.

Novgorod \'nȯv-gə-rət\ City (pop., 2002: 217,200), northwestern Russia. Located on the Volkhov River north of Lake Ilmen, it is one of the oldest Russian cities. First mentioned in the chronicles of AD 859, it came under Rurik c. 862. It was of great importance in the 11th to 15th centuries, when it was the capital of the principality of Novgorod. It prospered by trade with Central Asia, Byzantium, and the Hanseatic League. The centre of the Novgorod school of painting, it was ruled by Alexander Nevsky in the 13th century. It became a rival of Moscow, was destroyed by Ivan IV in 1570, and declined with the rise of St. Petersburg. It was held by the Germans in World War II and suffered heavy damage. Many historic buildings were later restored, and these were designated a UNESCO World Heritage site in 1992. The city is a centre of tourism.

Novgorod school Important school of Russian medieval icon and mural painting that flourished around Novgorod in the 12th–16th centuries. Novgorod, Russia's cultural centre in the 13th–14th centuries, when most of the rest of the country was occupied by the Mongols, preserved the Byzantine traditions that formed the basis of Russian art but introduced lighter and brighter colours, flatter forms, softening of facial types, and increasing use of a graceful, rhythmic line to define form. Until the early 14th century, artistic activity was dominated by mural painting. A new artistic impetus was provided by the introduction of the iconostasis. When icons were displayed together on the iconostasis rather than scattered about the walls of the church, they demanded a coherent overall impression, which was achieved by strong, rhythmic lines and colour harmonies. Figures took on the elongated shape that became standard in Russian art. In the 16th century artistic leadership passed to the Moscow school.

"Miracle of St. George over the Dragon," icon by an anonymous artist of the Novgorod school, egg tempera on panel, beginning of the 15th century; in the State Tretyakov Gallery, Moscow, I.A. Ostroukhov Collection
NOVOSTI PRESS AGENCY

Novi Sad \'nȯ-vē-'säd\ *Hungarian* **Újvidék** \'ü-ē-ˌvē-ˌdāk\ City (pop., 2000 est.: 179,626), Serbia, Serbia and Montenegro. The administrative capital of the autonomous region of the Vojvodina, it is a transit port on the Danube River, northwest of Belgrade. Founded in the 17th century, it was part of Hungary until the formation of Yugoslavia in 1918. The city is an ethnically diverse agricultural centre; its economy suffered badly during the 1990s Balkan upheavals.

Novosibirsk \ˌnō-vȯ-si-'birsk\ *formerly (1895–1925)* **Novonikolayevsky** City (pop., 2001 est.: 1,393,200), south-central Russia, in Asia. The capital of Novosibirsk province, it is the chief city of western Siberia and lies on the Ob River where the latter is crossed by the Trans-Siberian Railroad. The city began in 1893 and was named for Tsar Nicholas II in 1895. During World War II many Russian factories from the west were moved there. It is renowned for industry and scientific research. As Siberia's cultural and educational centre, it developed the satellite town Akademgorodok with research institutes and a university.

NOW See National Organization for Women

Noyce, Robert (Norton) (b. Dec. 12, 1927, Burlington, Iowa, U.S.—d. June 3, 1990, Austin, Texas) U.S. engineer. He received a Ph.D. from MIT. In 1957 he launched Fairchild Semiconductor, one of the first electronics firms in what came to be called Silicon Valley. Simultaneously but independently, he and Jack Kilby invented the integrated circuit computer chip in 1959. With his colleague Gordon Moore, he founded Intel Corporation. in 1968. In 1988 Noyce became president of Sematech, Inc., a research consortium formed and financed jointly by industry and the U.S. government to keep the U.S. semiconductor industry at the forefront of semiconductor manufacturing technology.

Noyes \'nȯiz**, John Humphrey** (b. Sept. 3, 1811, Brattleboro, Vt., U.S.—d. April 13, 1886, Niagara Falls, Ont., Can.) U.S. social reformer. While studying for the ministry at Yale, Noyes declared his belief in "perfectionism," announcing that he had achieved a state of sinlessness. Because his views were in direct opposition to the prevailing Calvinism, he was forced to leave Yale. In 1836 he organized a community of "Bible communists" in Putney, Vt., where he advocated free love and "complex" marriage as opposed to "simple," or monogamous, marriage. Arrested for adultery in 1846, he fled to Oneida, N.Y., where he established the Oneida Community, which he led until 1879, when he fled to Canada to avoid legal action. He wrote several books on perfectionism and a history of U.S. utopian communities.

Nozick, Robert (b. Nov. 16, 1938, Brooklyn, N.Y., U.S.—d. Jan. 23, 2002, Cambridge, Mass.) U.S. philosopher. He received a Ph.D. in philosophy at Princeton University in 1963 and taught at Harvard University from 1969 until his death. His best-known work, *Anarchy, State, and Utopia* (1974), is a closely argued and highly original defense of the libertarian "minimal state" (a state whose powers are limited to those necessary to protect citizens against violence, theft, and fraud) and a critique of the social-democratic liberalism of his Harvard colleague John Rawls. Against anarchism, Nozick argued that the minimal state is justified because it would arise in a state of nature through transactions that would not violate anyone's natural rights (see natural law); against liberalism and ideologies farther left, he argued that no more than the minimal state is justified because any state with more extensive powers would violate the

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natural rights of its citizens. Nozick emphasized that the minimal state as he envisioned it could encompass smaller communities in which the central public authority would have more than minimal powers. Because each such community would be free to realize its own idea of the good society, the minimal state, according to Nozick, constitutes a "framework for utopia."

NPR See National Public Radio

NRA See National Recovery Administration, National Rifle Assn.

NSAIDs \'en-ˌsedz, 'en-ˌsādz\ *or* **nonsteroidal anti-inflammatory drugs** Drugs that reduce inflammation and are effective against pain (see analgesic) and fever. Most are available without prescription and are usually used for short periods for mild pain. Aspirin is technically an NSAID, but the term is generally applied to a newer class of drugs, including ibuprofen and similar drugs (e.g., naproxen, ketoprofen) that, like aspirin, inhibit prostaglandin synthesis. They act with fewer side effects, but aspirin-sensitive people should not use them.

Nu See Nun

Nu, U *orig.* **Thakin Nu** (b. May 25, 1907, Wakema, Burma—d. Feb. 14, 1995, Yangôn, Myanmar) Burmese independence leader and prime minister of Burma (Myanmar; 1948–58, 1960–62). A prominent nationalist activist since his student days, U Nu became the first prime minister of independent Burma in 1948. Though an able statesman, he was plagued by ethnic-minority insurrections and economic difficulties. He resigned in 1958, was reinstated in 1960, and was overthrown and imprisoned by Ne Win in 1962. After his release he organized resistance to Ne Win. He made an unsuccessful bid for power after Ne Win's government fell in 1988.

Nu River See Salween River

Nubia Ancient region of the Nile River valley, northeastern Africa. Its borders originally extended north to include Aswān and, before completion of the Aswan High Dam, the first cataract of the Nile in Upper Egypt. The region now encompasses part of The Sudan and southern Egypt and contains the Nubian Desert in the northeast. For about 1,800 years in ancient times it was politically dominated by Egypt, although Nubian kings did sit on the Egyptian throne during the 25th dynasty. The kingdom of Kush and its culture were centred in southern Nubia. Later Nubia was the centre of a powerful state with Dunqulah as its capital (6th–14th centuries AD), after which it was captured by the Arabs. The region was conquered by Egypt in 1820–22.

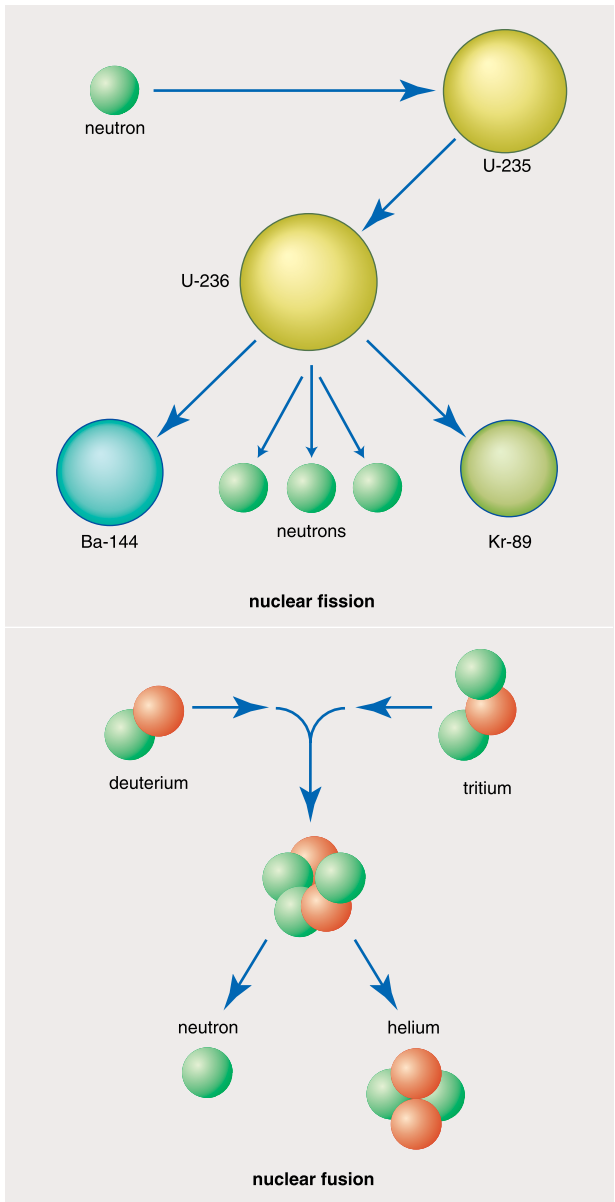
Nubia, Lake See Lake Nasser

Nubian Desert Desert, northeastern Sudan. It is separated from the Libyan Desert by the Nile River valley to the west. Rocky and rugged with some dunes, it is essentially a sandstone plateau interspersed with many wadis (seasonal rivers) that die out before reaching the Nile. Precipitation averages less than 5 in (13 cm) annually.

nuclear energy *or* **atomic energy** Energy released from atomic nuclei in significant amounts. In 1919 Ernest Rutherford discovered that alpha rays could split the nucleus of an atom. This led ultimately to the discovery of the neutron and the release of huge amounts of energy by the process of nuclear fission. Nuclear energy is also released as a result of nuclear fusion. The release of nuclear energy can be controlled or uncontrolled. Nuclear reactors carefully control the release of energy, whereas the energy release of a nuclear weapon or resulting from a core meltdown in a nuclear reactor is uncontrolled. See also chain reaction, nuclear power, radioactivity.

nuclear fission Division of a heavy atomic nucleus into two fragments of roughly equal mass, accompanied by the release of a large amount of energy, the binding energy of the subatomic particles. The energy released in the fission of one uranium nucleus is about 50 million times greater than that released when a carbon atom combines with oxygen atoms in the burning of coal. The energy appears as kinetic energy of the fragments, which converts to thermal energy as the fragments collide in matter and slow down. Fission also releases two or three free neutrons. The free neutrons can bombard other nuclei, leading to a series of fissions called a chain reaction. The energy released from nuclear fission is used to generate electricity, to propel ships and submarines, and is a source of the vast destructive power of nuclear weapons. See illustration opposite.

nuclear fusion Process by which nuclear reactions between light elements form heavier ones, releasing huge amounts of energy. In 1939 Hans Bethe suggested that the energy output of the sun and other stars is a result of fusion reactions among hydrogen nuclei. In the early 1950s American scientists produced the hydrogen bomb by inducing fusion reactions in a mixture of the hydrogen isotopes deuterium and tritium, forming a heavier helium nucleus. Though fusion is common in the sun and other stars, it is difficult to produce artificially and is very difficult to control. If controlled nuclear fusion is achieved, it might provide an inexpensive energy source because the primary fuel, deuterium, can be extracted from ordinary water, and eight gallons of water could provide the energy equivalent to 2,500 gallons of gasoline. See illustration below.



Top: Uranium-235 combines with a neutron to form an unstable intermediate, which quickly splits into barium-144 and krypton-89 plus three neutrons in the process of nuclear fission. Bottom: Deuterium and tritium combine by nuclear fusion to form helium plus a neutron.

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nuclear magnetic resonance (NMR) Selective absorption of very high-frequency radio waves by certain atomic nuclei subjected to a strong

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stationary MAGNETIC FIELD. Nuclei that have at least one unpaired PROTON or NEUTRON act like tiny magnets. When a strong magnetic field acts on such nuclei, it sets them into PRECESSION. When the natural FREQUENCY of the precessing nuclear magnets corresponds to the frequency of a weak external radio wave striking the material, energy is absorbed by the nuclei at a frequency called the resonant frequency. NMR is used to study the molecular structure of various solids and liquids. MAGNETIC RESONANCE IMAGING, or MRI, is a version of NMR used in medicine to view soft tissues of the human body in a hazard-free, noninvasive way.

nuclear medicine Medical specialty using radioactive ELEMENTS or ISOTOPES for diagnosis and treatment of disease. A radioisotope is introduced into the body (usually by injection). The radiation it emits, detected by a scanner and recorded, reflects its distribution in different tissues and can reveal the presence, size, and shape of abnormalities in various organs. The isotopes used have short half-lives and decay before RADIOACTIVITY causes any damage. Different isotopes tend to concentrate in particular organs (e.g., iodine-131 in the thyroid). Radioactive substances are also implanted to treat small, early-stage cancers. This yields a slow, continuous dose that limits damage to normal cells while destroying tumour cells. See also COMPUTED AXIAL TOMOGRAPHY; DIAGNOSTIC IMAGING; POSITRON EMISSION TOMOGRAPHY; RADIATION THERAPY; RADIOLOGY.

Nuclear Non-proliferation Treaty (NPT) *officially* **Treaty on the Non-proliferation of Nuclear Weapons** International agreement intended to prevent the spread of nuclear technology. It was signed by the U.S., Britain, the Soviet Union, and 59 other countries in 1968. The three major signatories agreed not to assist states lacking nuclear weapons to obtain or produce them; the nonnuclear signatories agreed not to attempt to obtain nuclear weapons in exchange for assistance in developing nuclear power for peaceful purposes. France and China, both nuclear powers, declined to ratify the treaty until 1992, and some nuclear powers, including Israel and Pakistan, have never signed it. In 1995, when the treaty was due to expire, it was extended indefinitely by a consensus vote of 174 countries at the United Nations. See also NUCLEAR TEST-BAN TREATY.

nuclear physics Branch of PHYSICS dealing with the structure of the atomic NUCLEUS and RADIATION from unstable nuclei. A principal research tool of nuclear physics is a high-energy beam of particles, such as PROTONS or ELECTRONS, directed as projectiles against nuclear targets. By analyzing the directions and energies of the recoiling particles and any resulting nuclear fragments, nuclear physicists can obtain details of nuclear structure, the STRONG FORCE that binds nuclear components together, and the release of energy from the nucleus.

nuclear power Energy produced by NUCLEAR FISSION of heavy atomic nuclei. About one-third of all electric power worldwide now comes from nuclear power plants. The navies of many countries include nuclear-powered warships; almost half of U.S. combat warships are nuclear-powered. Most commercial nuclear reactors are thermal reactors. Two types of light-water reactors in use throughout the world are the boiling-water reactor and the pressurized-water reactor. In the liquid-metal fast-breeder reactor, fuel is utilized 60 times more effectively than in light-water reactors. See also NUCLEAR ENERGY.

nuclear reactor Device that can initiate and control a self-sustaining series of NUCLEAR-FISSION reactions. Neutrons released in one fission reaction may strike other heavy nuclei, causing them to fission. The rate of this chain reaction is controlled by introducing materials, usually in the form of rods, that readily absorb neutrons. Typically, control rods made of cadmium or boron are gradually inserted into the core if the series of fissions begins to proceed at too great a rate, which could lead to MELTDOWN of the core. The heat released by fission is removed from the reactor core by a coolant circulated through the core. Some of the thermal energy in the coolant is used to heat water and convert it to high-pressure steam. This steam drives a turbine, and the turbine's mechanical energy is then converted into electricity by means of a generator. Besides providing a valuable source of electric power for commercial use, nuclear reactors also serve to propel certain types of military surface vessels, submarines, and some unmanned spacecraft. Another major application of reactors is the production of radioactive isotopes that are used extensively in scientific research, medical therapy, and industry.

Nuclear Regulatory Commission (NRC) U.S. independent REGULATORY AGENCY that oversees the civilian use of nuclear energy. Established in 1974 to replace the Atomic Energy Commission, the NRC licenses the construction and operation of nuclear reactors and other facilities and the ownership and use of nuclear materials. It issues standards, rules, and regulations for the maintenance of licenses, and it regularly inspects nuclear facilities to ensure compliance with public health and safety, environmental quality, national security, and antitrust laws. The NRC also investigates nuclear accidents, conducts public hearings, and reviews power-plant operations. Its commissioners are appointed by the president of the U.S.

nuclear species See NUCLIDE

Nuclear Test-Ban Treaty *officially* **Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water** Treaty that prohibits all tests of NUCLEAR WEAPONS except those conducted underground. U.S.-Soviet test-ban talks began after concerns arose in the 1940s and '50s about the dangers of radioactive fallout from above-ground nuclear tests. These talks made little progress until the CUBAN MISSILE CRISIS of 1962. In the following year, Britain, the U.S., and the Soviet Union signed the treaty, and more than 100 other governments soon followed. France and China were notable nonsignatories. In 1996 the treaty was replaced by the Comprehensive Test-Ban Treaty, which will not take effect until it is signed by all 44 countries with nuclear power plants. India refuses to do so on the ground that the treaty lacks disarmament provisions and permits nonexplosive testing. See also NUCLEAR NON-PROLIFERATION TREATY.

nuclear weapon *or* **atomic weapon** *or* **thermonuclear weapon** Bomb or other warhead that derives its force from NUCLEAR FISSION, NUCLEAR FUSION, or both and is delivered by an aircraft, missile, or other system. Fission weapons, commonly known as ATOMIC BOMBS, release energy by splitting the nuclei of uranium or plutonium atoms; fusion weapons, known as HYDROGEN BOMBS or thermonuclear bombs, fuse nuclei of the hydrogen isotopes tritium or deuterium. Most modern nuclear weapons actually combine both processes. Nuclear weapons are the most potent explosive devices ever invented. Their destructive effects include not only a blast equivalent to thousands of tons of TNT but also blinding light, searing heat, and lethal radioactive FALLOUT. The number of nuclear weapons reached its peak in the 1980s, when the U.S. had some 33,000 and the Soviet Union 38,000. Since the end of the Cold War both countries have decommissioned or dismantled thousands of warheads. Other declared nuclear powers are the United Kingdom, France, China, India, and Pakistan. Israel is widely assumed to possess nuclear weapons, and North Korea, Iran, and Iraq often have been accused of seeking to build them. Some countries, such as South Africa, Brazil, and Argentina, have acknowledged pursuing nuclear weapons in the past but have abandoned their programs. See also NUCLEAR NON-PROLIFERATION TREATY; NUCLEAR TEST-BAN TREATY.

nuclear winter Environmental devastation that some scientists contend would result from a nuclear war. The basic cause, as hypothesized, would be huge fireballs created by exploding nuclear warheads, which would ignite great fires (firestorms). Smoke, soot, and dust would be lifted to high altitudes and driven by winds to form a uniform belt encircling the Northern Hemisphere. The clouds could block out all but a fraction of the Sun's light, and surface temperatures would plunge for as much as several weeks. The semidarkness, killing frosts, and subfreezing temperatures, combined with high doses of RADIATION, would interrupt plant photosynthesis and could thus destroy much of the Earth's vegetation and animal life. Other scientists dispute the results of the original calculations, and, though such a nuclear war would undoubtedly be devastating, the degree of damage to life on the Earth remains controversial.

nucleic \nü-'klē-ik, nù-'klā-ik\ **acid** Any of the organic compounds making up the genetic material of living cells. Nucleic acids direct the course of PROTEIN synthesis, thereby regulating all cell activities. Their transmission from one generation to the next is the basis of HEREDITY. The two main types, DNA and RNA, are composed of similar materials but differ in structure and function. Both are long chains of repeating NUCLEOTIDES. The sequence of PURINES and PYRIMIDINES (bases)—ADENINE (A), GUANINE (G), CYTOSINE (C), and either THYMINE (T; in DNA) or URACIL (U; in RNA)—in the nucleotides, in groups of three (triplets, or codons), constitutes the GENETIC CODE.

nucleolus See NUCLEUS

nucleophile \'nü-klē-ə-ˌfīl\ ATOM or MOLECULE that contains an ELECTRON pair available for BONDING and in CHEMICAL REACTIONS therefore seeks a posi-

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tive centre, such as the NUCLEUS of an atom or the positive end of a polar molecule (see COVALENT BOND; ELECTRIC DIPOLE). In the Lewis electron theory (see ACID-BASE THEORY), advanced by the U.S. chemist Gilbert Lewis (1875–1946) in 1923, nucleophiles are by definition Lewis bases. Examples include the hydroxide ion (OH^-), the ions of the HALOGENS chlorine, bromine, and iodine (Cl^-, Br^-, and I^-, respectively), ammonia (NH_3), and water (H_2O). See also BASE; ELECTROPHILE.

nucleoprotein \ˌnü-klē-ō-ˈprō-ˌtēn\ Macromolecular complex consisting of a PROTEIN linked to a NUCLEIC ACID, either DNA or RNA. The proteins that combine with DNA are generally of characteristic types called HISTONES and protamines. The resulting nucleoproteins (deoxynucleoproteins) make up the CHROMOSOMES of living cells. Many VIRUSES are little more than organized agglomerations of deoxynucleoproteins. Many specific RNA nucleoproteins are also known; they have diverse cellular functions.

nucleoside \ˈnü-klē-ə-ˌsīd\ Any of a class of organic compounds, including structural subunits of NUCLEIC ACIDS. Each consists of a molecule of a five-carbon SUGAR (RIBOSE in RNA, deoxyribose in DNA) and a nitrogen-containing base, either a PURINE or a PYRIMIDINE. The base URACIL occurs in RNA, THYMINE in DNA, and ADENINE, GUANINE, and CYTOSINE in both, as part of the nucleosides uridine, deoxythymidine, adenosine or deoxyadenosine, guanosine or deoxyguanosine, and cytidine or deoxycytidine. Nucleosides usually have a PHOSPHATE group attached, forming NUCLEOTIDES. Usually obtained by decomposition of nucleic acids, nucleosides are important in physiological and medical research. Those that are not part of nucleic acids include puromycin and certain other ANTIBIOTICS produced by fungi.

nucleosynthesis \ˌnü-klē-ō-ˈsin-thə-səs\ Production on a cosmic scale of all the chemical ELEMENTS from one or perhaps two simple types of atomic nuclei (see NUCLEUS), those of HYDROGEN and HELIUM. Elements differ in the number of PROTONS and ISOTOPES of each element by the number of NEUTRONS in their nuclei. One type of nucleus can be transformed into another by adding or removing protons, neutrons, or both, processes that go on in STARS. Many of the first 26 elements (up to iron) and their present cosmic abundances can be accounted for by successive NUCLEAR FUSION reactions, beginning with HYDROGEN, in stellar cores. Heavier elements are believed to be created in the death of stars during SUPERNOVA explosions, by capture of successive neutrons by lighter nuclei and decay of some of these neutrons into protons (with ejection of an ELECTRON and a NEUTRINO each time).

nucleotide \ˈnü-klē-ə-ˌtīd\ Any of a class of organic compounds, including the structural units of NUCLEIC ACIDS. Each consists of a NUCLEOSIDE and one or more PHOSPHATE groups. In nucleic acids, the phosphate of one nucleotide joins to the sugar of the next to form the backbone. Important nucleotides that are not part of nucleic acids include ATP, cyclic AMP (needed in GLYCOGEN breakdown), and certain COENZYMES.

nucleus Specialized structure occurring in most CELLS (except BACTERIA) and separated from the rest of the cell by the nuclear membrane. This membrane seems to be continuous with the cell's ENDOPLASMIC RETICULUM and has pores that permits the passage of large molecules. The nucleus controls and regulates the cell's activities (e.g., growth and metabolism) and carries the GENES. Nucleoli are small bodies often seen within the nucleus that play an important part in the synthesis of RNA and protein. A cell normally contains only one nucleus.

nucleus Central, positively charged core of an ATOM. It consists of positively charged PROTONS and neutral NEUTRONS, known collectively as nucleons, held together by the STRONG FORCE. The number of nucleons can range from 1 to about 270, depending on the element. ISOTOPES are atoms of the same element that have the same number of protons but different numbers of neutrons. Some nuclei, especially heavier ones, are unstable, or radioactive (see RADIOACTIVITY), emitting energy in the form of alpha rays (see ALPHA DECAY), beta rays (see BETA DECAY), or GAMMA RAYS. The nucleus makes up nearly all the MASS but only a minute fraction of the volume of the atom.

nuclide *or* **nuclear species** Species of ATOM as characterized by the number of PROTONS, NEUTRONS, and the energy state of the NUCLEUS. A nuclide is characterized by its mass number and its ATOMIC NUMBER. To be regarded as distinct, a nuclide must have an energy content sufficient for a measurable lifetime, usually more than 10^{-10} second. Nuclear ISOMERS, which have the same number of protons and neutrons but differ in energy content and RADIOACTIVITY, are also distinct nuclides. Nuclides are associated with radioactive decay and may be stable or unstable. There are about 1,700 known nuclides, of which about 300 are stable and the rest radioactive.

nudibranch \ˈn(y)ü-də-ˌbraŋk\ *or* **sea slug** Any marine GASTROPOD in the order Nudibranchia. Most nudibranchs lack a shell, mantle cavity (see MOLLUSK), and gills, and breathe through the body surface. The delicately colored body, up to 16 in. (43 cm) long, has bizarre defensive outgrowths, called cerata, that discharge nematocysts ingested from CNIDARIAN prey. Antennalike organs arise from the head. Nudibranchs occur in shallow waters of all oceans, where they feed chiefly on other invertebrates, particularly SEA ANEMONES. Some species can swim; others are bottom creepers. The term sea slug sometimes refers to all members of the subclass Opisthobranchia.

nuée ardente \nü-ˈā-är-ˈdänt\ *French* **"fiery or glowing cloud"** Highly destructive, incandescent mass of gas-enveloped particles that is associated with volcanic eruptions. These glowing avalanches, as they are sometimes called, can move down even slight inclines at speeds as high as 100 mph (160 kph). The temperature of the gases can reach 1,100–1,300 °F (600–700 °C). Nuées ardentes are exceedingly destructive, killing all living things in their path. Most occur in the circum-Pacific region known as the Ring of Fire. See also TUFF.

Nuer \ˈnü-ər\ People of the marsh and savanna living on both banks of the Nile River in southern Sudan. They speak an Eastern Sudanic language of the NILO-SAHARAN family. The Nuer are cattle-raising people who also cultivate millet and spear fish. They spend the rainy season in permanent villages on the higher ground and the dry season in riverside camps. Feuding between clans is common, as is warfare with the DINKA. They number 1.5 million. See also NILOT.

Nuevo León \ˈnwā-vō-lā-ˈōn\ State (pop., 2000: 3,834,141), northeastern Mexico. It covers an area of 25,067 sq mi (64,924 sq km), and its capital is MONTERREY. The SIERRA MADRE Oriental crosses the state from northwest to southeast. The region became a state in 1824 and was occupied by U.S. troops during the MEXICAN WAR. Its iron and steel industries were the first heavy industry in Latin America; the state also supports agricultural and textile enterprises.

nuisance In law, an act, object, or practice that interferes with another's rights or interests by being offensive, annoying, dangerous, obstructive, or unhealthful. Such activities as obstructing a public road, polluting air and water, operating a house of prostitution, or keeping explosives are public nuisances and constitute criminal violations. A private nuisance is an activity or condition (e.g., excessive noise, disagreeable odor) that interferes with the use and enjoyment of one's property and that may be a cause of action in civil litigation. An attractive nuisance is something on one's property that poses a risk to children or others who may be attracted to it.

Nujoma \nü-ˈjō-mə**, Sam(uel Shafiihuma)** (b. May 12, 1929, Owambo, South West Africa) First president (1990–2005) of independent Namibia. In the late 1950s Nujoma helped found the Ovamboland People's Organization, forerunner of the SOUTH WEST AFRICA PEOPLE'S ORGANIZATION (SWAPO). He became SWAPO's first president in 1960, and, after years of petitioning the UN to compel South Africa to release control of South West Africa, he authorized armed resistance (1966). In 1989, after some 30 years in exile, he led SWAPO to victory in the UN-supervised elections.

Nuku'alofa \ˌnü-kü-ä-ˈlō-fə\ Town (pop., 1999 est.: 36,360), capital, and chief port of Tonga. Located on the northern shore of Tongatapu Island in the southern Pacific Ocean, it has a deep-draft harbour that is protected by reefs. Commercial activities centre on the export of copra and bananas. Landmarks include the 19th-century royal palace, a chapel, and royal tombs.

Nullarbor \ˈnə-lə-ˌbȯr\ **Plain** Vast limestone plateau, southern Australia. It lies along the south coast of western South Australia and eastern Western Australia, extending north from the GREAT AUSTRALIAN BIGHT to the GREAT VICTORIA DESERT. It occupies 100,000 sq mi (260,000 sq km) of generally flat surface in bedrock. The name Nullarbor is derived from the Latin *nullus arbor* ("no tree"). The Nullarbor National Park preserves rare vegetation and fauna. The plain has many limestone caves, including Koonalda Cave, an archaeological site. The park is crossed by the world's longest stretch of straight railroad track (330 mi [530 km]).

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nullification Doctrine upholding the right of a U.S. state to declare null and void an act of the federal government. First enunciated in the VIRGINIA AND KENTUCKY RESOLUTIONS (1798), it was expanded by JOHN C. CALHOUN in response to the Tariff of 1828. Calhoun maintained that a state "interposition" could block enforcement of a federal law. The South Carolina legislature agreed by passing the Ordinance of Nullification (1832), threatening to secede if the federal government forced collection of the 1828 tariff duties. Pres. ANDREW JACKSON asserted the supremacy of the federal government. The U.S. Congress passed a compromise tariff bill reducing the duties but also passed the Force Bill, which authorized federal enforcement of the law. The South Carolina legislature rescinded its ordinance, but the conflict highlighted the danger of nullification.

number Basic element of mathematics used for counting, measuring, solving equations, and comparing quantities. They fall into several categories. The counting numbers are the familiar 1, 2, 3 . . . ; whole numbers are the counting numbers and ZERO; INTEGERS are the whole numbers and the negative counting numbers; and the RATIONAL NUMBERS are all possible quotients formed by integers, including FRACTIONS. These numbers can be symbolically represented by terminating or repeating decimals. IRRATIONAL NUMBERS cannot be represented by fractions of integers or repeating decimals and must be represented by special symbols such as $\sqrt{2}$, e, and π. Together, the rational and irrational numbers constitute the REAL NUMBERS, which form an algebraic field (see FIELD THEORY), as do the COMPLEX NUMBERS. While the counting numbers and rational numbers come about as the means of counting, calculating, and measuring, the others arose as means of solving equations. See also TRANSCENDENTAL NUMBER.

number system Method of writing numerals to represent numbers. The use of ZERO as a placeholder was the greatest advance in number systems. The most common system is the decimal system, in which 10 symbols (the HINDU-ARABIC NUMERALS) denote multiples of powers of 10 by their position relative to the decimal point. Computers have brought greater awareness of the binary number system, in which two symbols, 0 and 1, represent multiples of powers of 2.

number theory Branch of mathematics concerned with properties of and relations among INTEGERS. It is a popular subject among amateur mathematicians and students because of the wealth of seemingly simple problems that can be posed. Answers are much harder to come up with. It has been said that any unsolved mathematical problem of any interest more than a century old belongs to number theory. One of the best examples, recently solved, is FERMAT'S LAST THEOREM.

numerical analysis Branch of applied mathematics that studies methods for solving complicated equations using arithmetic operations, often so complex that they require a computer, to approximate the processes of ANALYSIS (i.e., CALCULUS). The arithmetic model for such an approximation is called an ALGORITHM, the set of procedures the computer executes is called a PROGRAM, and the commands that carry out the procedures are called CODE. An example is an algorithm for deriving π by calculating the perimeter of a regular polygon as its number of sides becomes very large. Numerical analysis is concerned not just with the numerical result of such a process but with determining whether the ERROR at any stage is within acceptable bounds.

numerical control (NC) Control of a system or device by direct input of data in the form of numbers, letters, symbols, words, or a combination of these forms. It is a principal element of COMPUTER-INTEGRATED MANUFACTURING, particularly for controlling the operation of machine tools. NC is also essential to the operation of modern industrial ROBOTS. The two basic types of NC systems are point-to-point, in which a device is programmed to perform a series of motions with fixed starting and stopping points, and continuous-path, in which a point-to-point programmed device has sufficient memory to be "aware" of its former actions and their results and to act in accordance with this information.

numerology Use of numbers to interpret a person's character or divine the future. It is based on the assertion by PYTHAGORAS that all things can be expressed in numerical terms because they are ultimately reducible to numbers. Using a method analogous to that of the Greek and Hebrew alphabets (in which each letter also represented a number), modern numerology attaches a series of digits to an inquirer's name and uses these, along with the date of birth, to reveal the person's true nature and prospects.

Numidia \nü-'mi-dē-ə\ Ancient country, North Africa, approximately coextensive with modern Algeria. During the Second Punic War (see PUNIC WARS), its two great tribes divided, one supporting the Romans and the other the Carthaginians. The tribal chief MASINISSA was made king of Numidia after the Roman victory in 201 BC. After the destruction of CARTHAGE, thousands fled to Numidia, which became a Roman province in 46 BC. Its capital was Cirta, and the chief city was Hippo, which was the see of St. AUGUSTINE. After its conquest by the VANDALS in AD 429, Roman civilization there declined rapidly; some pockets of native culture survived, however, and even continued after the Arab conquest in the 8th century.

Nun \'nün\ *or* **Nu** Oldest of the Egyptian gods and father of RE, the sun god. Nun represented the dark, turbulent waters out of which the cosmos was churned. Since it was believed that the primeval ocean continued to surround the ordered cosmos, the creation myth was reenacted each day as the sun rose from the waters. Nun was also thought to exist as subsoil water and as the source of the annual flooding of the NILE.

Nun River \'nün\ River, southern Nigeria. Considered the direct continuation of the NIGER RIVER, it flows southwest to the Gulf of GUINEA, at Akassa. It was a trade route in the 19th century, when the IGBO kingdom controlled commerce. Petroleum was discovered along the Nun in 1963, and oil is piped from the oil fields along the Trans-Niger Pipeline.

Nunavut \'nü-nə-ˌvüt\ Territory (pop., 2001: 26,745), north-central Canada. Nunavut (Inuit: "Our Land") is the result of Canada's largest land claim settlement, created to give the Inuit (see ESKIMO), representing 85% of its population, a greater voice in Canadian government. Occupying an area of 772,000 sq mi (2,000,000 sq km), or one-fifth of Canada's landmass, it comprises the central and eastern parts of the former NORTHWEST TERRITORIES, including BAFFIN and ELLESMERE islands. Its capital is IQALUIT. The area was settled by Inuit from 4500 BC to AD 1000. Vikings probably visited during the Middle Ages, but the first records of exploration are from MARTIN FROBISHER's 1576 search for the NORTHWEST PASSAGE. The mainland was explored by Englishman Samuel Hearne in 1770–72. After passing through British possession, it was transferred to Canada in 1870. In 1976 a political organization called for the creation of a territory to settle Inuit claims in the Northwest Territories. The proposal was approved by the Canadian government in 1993. Nunavut's first elections were held in February 1999, and the territory was inaugurated on April 1, 1999.

Nūr al-Hilmī \'nůr-ˌål-'hil-mē**, Burhanuddin bin Muhammad** (b. 1911, Kota Bharu, Malaya—d. Oct. 25, 1969, Taiping, Malaysia) Malay nationalist leader. After serving the administration of the Japanese occupation during the war, Nūr al-Hilmī became a prominent left-wing leader who worked for an independent and multiracial Malaysia. In 1956 he became president of the Pan-Malayan Islamic Party, which became the principal opposition party in Malaysian politics. Detained in 1965 for allegedly pro-Indonesian activities, he was released in 1966; he remained nominal president of the party until his death.

Nuremberg See NÜRNBERG

Nureyev \nů-'rā-yef**, Rudolf (Hametovich)** (b. March 17, 1938, Irkutsk, Russia, U.S.S.R.—d. Jan. 6, 1993, Paris, Fr.) Russian ballet dancer. After studying ballet in Leningrad (1955–58), he joined the Kirov Ballet as a soloist. He defected during the company's tour to Paris in 1961. Thereafter he danced as a guest artist with many companies, especially the ROYAL BALLET, where he regularly partnered MARGOT FONTEYN. His performances, combining an intensely romantic sensibility with stunning muscularity and technique, made him an international star. He choreographed new versions of *Romeo and Juliet*, *Manfred*, and *The Nutcracker*. From 1983 to 1989 he was artistic director of the Paris Opéra Ballet.

Nureyev and Margot Fonteyn
KEYSTONE

Nurhachi \'nůr-'hä-chē\ (b. 1559, Manchuria—d. Sept. 30, 1626) Chieftain of one branch of the Juchen (later called MANCHU), whose attack on China in 1618 presaged his son DORGON's conquest. Nurhachi first defeated a rival in his own tribe and then subdued the other four Juchen

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tribes in his immediate area. During this time, he also established a Manchu state and enlisted the scholar Erdeni to create a Manchu writing system. He organized his troops under the BANNER SYSTEM. In 1616 Nurhachi proclaimed himself KHAN and called his dynasty Jin, harking back to the Juchen Jin dynasty of the 12th century. In 1626 he was defeated by the Chinese and died of battle wounds. See also HONGTAIJI; QING DYNASTY.

Nūrī al-Saʿīd \ˌnůr-ē-ål-så-ˈēd\ (b. 1888, Baghdad, Iraq—d. July 14, 1958, Baghdad) Iraqi soldier and longtime prime minister of Iraq. He entered the army in 1909, when Iraq was a province of the OTTOMAN EMPIRE. Captured by the British during World War I (1914–18), he joined a British-backed Arab revolt against the Ottomans. After the war he joined the Iraqi government under the Hāshimite king FAYṢAL I. Prime minister on 14 different occasions, he was pro-British and supported the monarchy. In 1958 he supported a union with Jordan that was strongly opposed by the military. He was killed in the coup that followed.

Nurmi, Paavo (Johannes) (b. June 13, 1897, Turku, Fin.—d. Oct. 2, 1973, Helsinki) Finnish track athlete. The outstanding long-distance runner of his generation, he captured nine gold medals and three silver in three Olympic Games (1920, 1924, 1928), setting two records at the 1924 games in a little over an hour. He held the world record for the mile run for eight years (1923–31). For his prowess he was nicknamed "the Flying Finn."

Paavo Nurmi, 1931.
UPI

Nürnberg \ˈnu̇ərn-ˌberk\ *also known as* **Nuremberg** City (pop., 2002 est.: city, 491,307; metro. area, 1,018,211), BAVARIA, southern Germany, on the Pegnitz River. It grew up around a castle in the 11th century, and in 1219 it received its first charter. It became one of the greatest of the German free imperial cities, reaching the height of its power in the 16th century. In 1806 it became part of the kingdom of Bavaria. In the 1930s it was a centre of the NAZI PARTY; the site of the Nazis' annual NÜRNBERG RALLIES, in 1935 it gave its name to the anti-Semitic NÜRNBERG LAWS. It was severely damaged in World War II. After the war it was the scene of the NÜRNBERG TRIALS. The city was rebuilt and is now a commercial and manufacturing centre. Nürnberg's historic sites include the 11th-century royal palace. Its Academy of Arts (founded 1662) is the oldest in Germany. The city was the birthplace of ALBRECHT DÜRER.

Nürnberg Laws (1935) Two measures designed by ADOLF HITLER and approved by a NAZI PARTY convention at Nürnberg, Ger., on Sept. 15, 1935. The laws deprived Jews of German citizenship and forbade marriage or sexual relations between Jews and "citizens of German or cognate blood." Supplementary decrees defined a Jew as a person with at least one Jewish grandparent and declared that Jews could not vote or hold public office.

Nürnberg Rallies Massive rallies held by the NAZI PARTY in Nürnberg, Ger., to showcase its power. After smaller rallies at party conventions in 1923 and 1927, the first large-scale rally was held in 1929 and featured the nationalistic pageantry that marked subsequent annual rallies (1933–38). Attended by hundreds of thousands of Nazis, the rallies were carefully staged to reinforce party enthusiasm with martial songs, massed banners and flags, goose-step marches, torchlight processions, and lengthy orations by ADOLF HITLER and other Nazi leaders.

Nürnberg trials (1945–46) Trials of former NAZI PARTY leaders held in Nürnberg, Ger. At the end of World War II, the International Military Tribunal was established by the U.S., Britain, France, and the Soviet Union to indict and try former Nazis as war criminals. The tribunal defined the offenses as crimes against peace (planning and waging of war in violation of treaties), crimes against humanity (extermination, deportation, and GENOCIDE), and WAR CRIMES. After 216 court sessions, 3 of the original 22 defendants were acquitted, 4 (including KARL DÖNITZ and ALBERT SPEER) were sentenced to prison for terms of 10 to 20 years, 3 (including RUDOLF HESS) were sentenced to life imprisonment, and 12 (including WILHELM KEITEL, JOACHIM VON RIBBENTROP, ALFRED ROSENBERG, ARTHUR SEYSS-INQUART, and JULIUS STREICHER) were sentenced to death by hanging. HERMANN GÖRING committed suicide before he could be executed, and MARTIN BORMANN was convicted in absentia.

Nurse, Sir Paul M. (b. Jan. 25, 1949, Norwich, Norfolk, Eng.) British scientist. He earned a Ph.D. from the University of East Anglia in 1973 and was a professor at the University of Oxford from 1987 to 1993. In 1996 he was named director general of the Imperial Cancer Research Fund (now Cancer Research UK). In the mid-1970s he conducted research on yeast and discovered the gene that regulates different phases of the cell cycle. He later found the corresponding gene in humans. His work aided in the understanding of cancer cell development. Nurse shared a Nobel Prize with R. TIMOTHY HUNT and LELAND H. HARTWELL in 2001.

nurse shark Only Atlantic species (*Ginglymostoma cirratum*) of 25 carpet SHARK species (family Orectolobidae). Yellow- or gray-brown, sometimes with dark spots, it may grow to over 13 ft (4 m) long. It may attack swimmers, especially when provoked, but is not related to the dangerous gray nurse (*Odontaspis arenarius*), a SAND SHARK.

nursery Place where plants are grown for transplanting, for use as stocks for budding and grafting, or for sale. Nurseries produce and distribute woody and herbaceous plants, including ornamental trees, shrubs, and bulb crops. While most nursery-grown plants are ornamental, the nursery business also includes fruit plants and certain PERENNIAL vegetables used in home gardens (e.g., asparagus, rhubarb). See also FLORICULTURE.

nursery rhyme Verse customarily told or sung to small children. Though the oral tradition of nursery rhymes is ancient, the largest number date from the 16th, 17th, and (most frequently) 18th centuries. Apparently most rhymes were originally composed for adults, many as popular ballads and songs. The earliest known published collection is *Tommy Thumb's* (*Pretty*) *Song Book* (1744), including "Little Tom Tucker," "Sing a Song of Sixpence," and "Who Killed Cock Robin?" The most influential collection was *Mother Goose's Melody* (1781), including "Jack and Jill," "Ding Dong Bell," and "Hush-a-bye Baby on the Tree Top."

nursing Health-care profession providing physical and emotional care to the sick and disabled and promoting health in all individuals through activities including research, health education, and patient consultation. Nursing gained recognition in the 19th century with the activities of FLORENCE NIGHTINGALE. Many nurses have specialties (e.g., psychiatry, critical care). Nurse-practitioners, clinical nurse specialists, nurse-anesthetists, and nurse-midwives undertake tasks traditionally performed by physicians. Nursing degrees go as high as the doctorate, and staff positions include administration. In addition to health-care settings, nurses practice in schools, the military, industry, and private homes. Community (public health) nurses educate the public on topics such as nutrition and disease prevention.

nursing home Facility for care (usually long-term) of patients who are not sick enough to need hospital care but are not able to remain at home. Historically, most residents were elderly or ill or had chronic irreversible and disabling disorders, and medical and nursing care was minimal. Today nursing homes have a more active role in health care, helping patients prepare to live at home or with a family member when possible. They help conserve expensive hospital facilities for the acutely ill and improve the prospects of the chronically disabled. However, quality of care varies widely, and the potential for abuse exists.

Nuṣayriyyah See ʿALAWIYYAH

Nut \ˈnüt\ In EGYPTIAN RELIGION, a goddess of the sky. She represented the vault of the heavens and was often depicted as a woman arched over the earth god GEB. Nut was believed to swallow the sun in the evening and to give birth to it again in the morning. She was sometimes portrayed as a cow, the form she took to carry the sun god, RE, on her back to the sky. On five days preceding the New Year, Nut gave birth successively to the deities OSIRIS, HORUS, SETH, ISIS, and Nephthys.

nut Dry, hard, one-seeded FRUIT consisting of a kernel, usually oily, surrounded by a hard or brittle shell that does not split open at maturity. Nuts include CHESTNUTS, FILBERTS, and WALNUTS; but other so-called nuts are botanically seeds (BRAZIL NUT, PISTACHIO), LEGUMES (PEANUT), or drupes (ALMOND and COCONUT). Most edible nuts are well known as dessert nuts. Some nuts are sources of oil or fat. Not all nuts are edible; some are used for ornament.

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nut In technology, a fastening device consisting of a square or hexagonal block, usually of metal, with a hole in the centre having internal, or female, threads that fit on the male threads of an associated BOLT or SCREW. Bolts or screws with nuts are widely used for fastening machine and structural components. See also FASTENER.

nuthatch Any of about 22 species (genus *Sitta*, family Sittidae) of songbirds that are 4–7.5 in. (9.5–19 cm) long and have a short, square tail, short neck, and thin, pointed bill. Most are forest dwellers; some live in rocky areas. Nuthatches search tree trunks and rocks for insects, often descending headfirst. They also eat seeds, which they may store for winter. The nest is a grass- or hair-lined cavity. Nuthatches are most common from Eurasia to Japan and southward; four species occur in North America. Most are bluish above and white or reddish below; there may be a black eye stripe or a cap.

European nuthatch (*Sitta europaea*)
BRUCE COLEMAN LTD.

nutmeg Spice made from the seed of a tropical tree (*Myristica fragrans*), native to the Moluccas of Indonesia. It has a distinctive pungent fragrance and is used in cooking and sachets and as incense. The tree yields fruit eight years after sowing, reaches its prime in 25 years, and bears fruit for 60 years or longer. The name nutmeg is also applied in different countries to other fruits or seeds, including the Brazilian nutmeg (*Cryptocarya moschata*), the Peruvian nutmeg (*Laurelia aromatica*), and the California nutmeg (*Torreya californica*).

Nutmeg (*Myristica fragrans*)
G.R. ROBERTS

nutria *or* **coypu** Semiaquatic South American RODENT (*Myocastor coypus*) in the hutia family (Capromyidae). The nutria has small ears, a long, rounded, scaly tail, partially webbed hind feet, and broad orange incisors. It is about 40 in. (1 m) long, including the tail, and may weigh 18 lbs (8 kg). Its reddish brown fur consists of coarse guard hairs overlying a soft undercoat. The nutria lives in a shallow burrow along a pond or river and mainly eats aquatic plants. Because their fur is valuable, nutrias were introduced into North America and Europe, and in some places have become pests that damage crops and compete with other wildlife.

Nutria (*Myocastor coypus*) feeding.
DOUGLAS FISHER

nutrition Processes of taking in and utilizing food substances. Food generates energy and supplies materials used in body tissues and processes. CALORIES are supplied by CARBOHYDRATES (SUGARS and STARCHES), FATS, and PROTEINS. Other nutrients include minerals, VITAMINS, and dietary FIBRE. Minerals are used in many ways—IRON for HEMOGLOBIN; CALCIUM for bones, teeth, and cellular processes; SODIUM and POTASSIUM to regulate HOMEOSTASIS, IODINE to produce thyroid HORMONES. Trace minerals have functions that are less well-understood. Fibre is not broken down chemically in the body but aids DIGESTION, lowers blood CHOLESTEROL, and may help prevent some CANCERS and HYPERTENSION. Different amounts of these nutrients exist in different foods; a varied diet ensures an adequate supply. Nutritional supplements, required by some people, do not compensate for an unhealthy diet. Sufficient WATER is always essential. Inadequate nutrient intake or absorption leads to MALNUTRITION and disease.

Nuuk \'nük\ *or* **Godthåb** \'gôt-ˌhȯp\ City (pop., 2000 est.: 13,838), capital of GREENLAND. Located on the southwestern coast near the mouth of Godthåb Gulf, it is Greenland's main port. The modern city dates from 1721, when a Norwegian missionary founded a colony near the site of Vesterbygden, a 10th-century Norse settlement. It is the seat of the parliament and supreme court and has foreign consulates, a teachers' college, and research stations. Government administration, hunting, fishing, and farming are the main occupations. Most transportation is by boat or helicopter.

Nüwua *or* **Nu Kua** \'nüē-'gwä\ In Chinese mythology, the patroness of matchmakers. As wife or sister of the legendary emperor Fuxi, she helped establish norms for marriage (including the use of go-betweens) and regulated conduct between the sexes. She is represented with a human head and the body of a snake or fish. She repaired the pillars of the heavens and the broken corners of the earth, which the rebel Gong Gong had destroyed in a fit of anger, and her beautiful palace was said to be the prototype for the walled cities of China.

Nyakyusa \nyȧk-'yü-sə\ *or* **Ngonde** \əŋ-'gȯn-dā\ Bantu-speaking people living north of Lake MALAWI in Tanzania, and in Malawi. They speak a BANTU LANGUAGE of the Niger-Congo family. Traditionally they lived in unique age villages. All the boys of a district aged 11–13 would leave their paternal homes and establish a new hamlet, eventually marrying and bringing their wives there; their native village would die as its founders died in old age. With modern land shortages, this practice has largely stopped. The Nyakyusa, who are primarily hoe cultivators, number more than one million.

nyala \nē-'ä-lə\ Slender ANTELOPE (*Tragelaphus angasi*) of South Africa having a crest of hair along the back from head to tail and standing 3.5 ft (110 cm). The male, which has loosely spiraled horns and a long fringe on the throat and underparts, is dark brown with reddish brown on the lower legs, white on the face and neck, and vertical white stripes on the body. The female is reddish brown with more conspicuous striping. Nyalas live alone or in small groups in forests. The rare mountain nyala (*T. buxtoni*) of central Ethiopia is grayish brown.

Nyasa, Lake See Lake MALAWI

Nyasaland See MALAWI

Nyaya \'nyä-yə\ One of the six DARSHANS (orthodox systems) of Indian philosophy, important for its analysis of logic and epistemology and for its detailed model of the reasoning method of inference. Like other darshans, Nyaya is both a philosophy and a religion; its ultimate concern is to bring an end to human suffering, which results from ignorance of reality. It recognizes four valid means of knowledge: perception, inference, comparison, and testimony.

Nyerere \ni-'rar-ē**, Julius (Kambarage)** (b. March 1922, Butiama, Tanganyika—d. Oct. 14, 1999, London, Eng.) First prime minister of independent Tanganyika (1961), first president of Tanzania (1964–85), and the major force behind the ORGANIZATION OF AFRICAN UNITY (OAU; now African Union). He taught in Catholic schools before studying history and economics in Britain. As leader of the Tanganyika African National Union (TANU), he advocated peaceful change, social equality, and ethnic harmony. In elections in 1958–60 TANU won many seats in the legislature. As president he collectivized village farmlands, carried out mass literacy campaigns, and instituted universal education. He sought to make Tanzania economically self-sufficient, an effort that ultimately failed. In 1979 he authorized the invasion of Uganda to overthrow IDI AMIN. Within the OAU he advocated the overthrow of white-supremacist governments in South Africa, Rhodesia, and South West Africa. After retiring from politics in 1990, Nyerere devoted the rest of his life to farming and diplomacy.

Nyerere, 1981
HANOS/LIAISON AGENCY

Nyiragongo \ˌnyē-rä-'gȯŋ-gō**, Mount** Active volcano, VIRUNGA MOUNTAINS, east-central Africa. It lies in the volcano region of VIRUNGA NATIONAL PARK, eastern Congo (Kinshasa), near the border with Rwanda. It is 11,385 ft (3,470 m) high, with a main crater 1.3 mi (2 km) wide and 820 ft (250 m) deep containing a liquid lava pool. Some older craters are noted for their plant life.

Nykvist \'nüē-kvist,\ *English* \'nī-kvist**, Sven** (b. Dec. 3, 1922, Moheda, Swed.) Swedish cinematographer. He joined the Swedish movie

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company Sandrews in 1941, shot his first film in 1945, and his first for INGMAR BERGMAN in 1953. He became Bergman's regular cinematographer at Svensk Filmindustri in 1960. Best known for his subtle, luminous camera work in a long series of Bergman films, he won Academy Awards for *Cries and Whispers* (1972) and *Fanny and Alexander* (1983). With U.S. directors, he shot movies such as *The Unbearable Lightness of Being* (1988) and *Crimes and Misdemeanors* (1989).

nylon Any synthetic PLASTIC material composed of polyamides of high MOLECULAR WEIGHT and usually, but not always, manufactured as a fibre. Nylons were developed by Du Pont in the 1930s. The successful production of a useful fibre by chemical synthesis from compounds readily available from air, water, and coal or petroleum stimulated expansion of research on POLYMERS, leading to a rapidly growing family of synthetics. Nylon can be made to form fibres, filaments, bristles, or sheets to be manufactured into YARN, TEXTILES, and cordage, and it can also be formed into molded products. It has high resistance to wear, heat, and chemicals. Most applications are in the form of filaments in such articles as hosiery, parachutes, and outerwear. See also W. H. CAROTHERS.

nymph In GREEK MYTHOLOGY, any of a large class of minor female divinities. Nymphs were usually associated with features of the natural world, such as trees and water. Though not immortal, they were extremely long-lived, and they tended to be well disposed toward humans. They were grouped according to the sphere of nature with which they were connected.

nymph In entomology, the sexually immature form of insects that undergo incomplete METAMORPHOSIS (e.g., GRASSHOPPERS). The nymph is similar to the adult but differs in body proportions and (in winged species) has only wing buds, which develop into wings after the first few molts (see MOLTING). During each successive growing stage (instar), the nymph begins to resemble the adult more closely. The nymphs of aquatic species (also called naiads), such as DRAGONFLIES, have gills and other modifications for an aquatic existence. At maturity, they float to the surface or crawl out of the water, undergo a final molt, and emerge as winged adults.

nymphaeum \nim-ˈfē-əm\ Ancient Greek and Roman sanctuary consecrated to water nymphs. Nymphaea also served as reservoirs and assembly chambers for weddings. The name, originally denoting a natural grotto with springs, later referred to an artificial grotto or building filled with plants, sculpture, fountains, and paintings. Nymphaea existed at Corinth, Antioch, and Constantinople, and remains have been found in Rome, Asia Minor, Syria, and northern Africa.

Nymphenburg porcelain German hard-paste, or true, PORCELAIN produced in Bavaria from the mid-18th century to the present day. Its fame rests on its figures, particularly those in the ROCOCO STYLE modeled between 1754 and 1763 by Franz Anton Bustelli (1723–1763). Tableware and vases produced at the factory in Nymphenburg, on the outskirts of Munich, often contain ozier, or basketwork, pattern borders.

Nyoro \ˈnyȯr-ō\ *or* **Bunyoro** Bantu-speaking people of west-central Uganda. Until the 18th century the Bunyoro kingdom included present-day Uganda. It declined in the 18th and 19th century, surrendering its preeminence to the BUGANDA kingdom. It was brought into the Uganda Protectorate by the British. Today the Nyoro, numbering about 700,000, live in scattered settlements and cultivate millet, sorghum, and plantains.

Nystad, Treaty of See Second NORTHERN WAR

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Oahu \ō-'wä-hü\ Island (pop., 2000: 876,165) of Hawaii, U.S. Situated between the islands of Kauai and Molokai, it occupies 607 sq mi (1,574 sq km) and is the third largest and most densely populated of the Hawaiian Islands. Of volcanic origin, it has two parallel mountain groups, the Koolau Range and Waianae Ranges, which are connected by a central plateau. It is the site of Honolulu, Pearl Harbor, and Waikiki. Military installations, tourism, pineapples, and sugar are important to its economy.

oak Any of about 450 species of ornamental and timber trees and shrubs that make up the genus *Quercus* in the beech family, found throughout temperate climates. Oaks are deciduous trees that bear spring catkins (male flowers) and spikes (female flowers) on the same tree. The leaves have lobed, toothed, or smooth margins. The fruit is the acorn. They are hardy and long-lived shade trees. White oaks have smooth leaves and rapidly germinating sweet acorns; red, or black, oaks have bristle-tipped leaves and bitter, hairy acorns. Red- and white-oak lumber is used in construction, flooring, furniture, millwork, barrel making, and the production of crossties, structural timbers, and mine props. The genus includes many ornamentals and natural hybrids.

Oakland City (pop., 2000: 399,484), western California, U.S., on the eastern side of San Francisco Bay. Settled by the Spanish in 1820, it was incorporated as a city in 1854. In 1869 it was chosen as the terminus of the first transcontinental railroad, which led to the development of its deepwater port. It suffered damage and loss of life in the earthquake of 1989, which also damaged the Bay Bridge that connects it with San Francisco. Lake Merritt, near the central business district, is a wildfowl refuge surrounded by parkland. Several colleges are located in Oakland.

Oakley, Annie *orig.* **Phoebe Anne Moses** (b. Aug. 13, 1860, Darke county, Ohio, U.S.—d. Nov. 3, 1926, Greenville, Ohio) U.S. sharpshooter. As a child she won acclaim for her marksmanship. She later toured vaudeville circuits with her marksman husband, Frank Butler. In 1885 they joined Buffalo Bill's Wild West Show; she was one of the show's star attractions for most of the next 16 years. Oakley's famous act included shooting off the end of a cigarette held in Butler's lips, hitting the thin edge of a playing card from 30 paces, and shooting distant targets while looking into a mirror. In 1887 she was presented to Queen Victoria, and later in Berlin she performed her cigarette trick with, at his insistence, Crown Prince William (later Kaiser William II) holding the cigarette.

OAS See Organization of American States

oasis Fertile tract of land that occurs in a desert wherever a permanent supply of fresh water is available. Oases vary in size from about 2.5 acres (1 hectare) around small springs to vast areas of naturally watered or irrigated land. Underground water sources account for most oases; their springs and wells are supplied from sandstone aquifers whose intake areas may be more than 500 mi (800 km) away. Two-thirds of the population of the Sahara live in oases, where the date palm is the main source of food; the palm also provides shade for growing citrus fruits, figs, peaches, apricots, vegetables, and cereal grains.

Oates, Joyce Carol (b. June 16, 1938, Lockport, N.Y., U.S.) U.S. writer. Oates taught at the University of Windsor (1967–78) and Princeton University (from 1978). Beginning with the story collection *By the North Gate* (1963) and the novel *With Shuddering Fall* (1964), she wrote prolifically, often portraying people whose intensely experienced lives end in bloodshed and self-destruction owing to forces beyond their control. Her major novels include *them* (1969), *Do with Me What You Will* (1973), *Foxfire* (1993), and *Beasts* (2002). Also significant is a parodic gothic series including *Bellefleur* (1980), *A Bloodsmoor Romance* (1982), and *Mysteries of Winterthurn* (1984).

Oates, Titus (b. Sept. 15, 1649, Oakham, Rutland, Eng.—d. July 12/13, 1705, London) English fabricator of the Popish Plot. Son of a Baptist preacher, he was ordained in the Church of England. Although jailed for perjury in 1674, he became chaplain to the Protestants in the household of the Catholic 6th duke of Norfolk in 1677. In 1678, with the fanatically anti-Catholic Israel Tonge, he invented the Popish Plot, a fictitious Jesuit conspiracy to kill Charles II and place his Catholic brother James (later James II) on the throne. Oates's testimony caused some 35 persons to be executed, but inconsistencies in his story emerged, and he was convicted of perjury and imprisoned in 1685; released in 1688, he died in obscurity.

oats Hardy cereal plant (*Avena sativa*), cultivated in temperate regions, that is able to live in poor soil. The edible starchy grain is used primarily as livestock feed, but is also processed into rolled oats and oat flour for human consumption. High in carbohydrates, oats also provide protein, fat, calcium, iron, and B vitamins. Oat straw is used for animal feed and bedding.

OAU See Organization of African Unity

Oaxaca \wä-'hä-kä\ State (pop., 2000: 3,438,765), southern Mexico. Bounded by the Pacific Ocean, it occupies 36,275 sq mi (93,952 sq km) and includes most of the Isthmus of Tehuantepec. The capital is Oaxaca city. The Sierra Madre del Sur ends at the isthmus. Remains of pre-Columbian Zapotec and Mixtec structures are found at Mitla and Monte Albán. It has the largest population of Indian descent in Mexico. It is an agricultural and mining area.

Oaxaca *in full* **Oaxaca de Juárez** City (pop., 2000: 251,846), capital of Oaxaca state, southern Mexico. It lies in the fertile Oaxaca Valley, about 5,000 ft (1,500 m) above sea level. Founded in 1486 as an Aztec garrison and conquered by the Spanish in 1521, it had an important role in Mexican history and was the home of Benito Juárez and Porfirio Díaz. It is noted for its 16th-century architecture and its handicrafts.

Ob \'ób\ **River** River, west-central Russia. Flowing across western Siberia northwestward from the Altai Mountains of central Asia, it courses through the Gulf of Ob into the Kara Sea of the Arctic Ocean. It is about 2,268 mi (3,650 km) long. Its middle course is through taiga, swampy coniferous forest with expanses of marshland. In the north are vast stretches of icy, treeless tundra. The Ob is an important source of hydroelectric power and one of Siberia's major transportation routes during the six months of the year when it is not frozen.

Obadiah \ˌō-bə-'dī-ə\ (fl. between the 9th and 6th century BC) One of the 12 Minor Prophets in the Bible, traditional author of the book of Obadiah. The shortest book of the Hebrew scriptures, it consists of one chapter of 21 verses. (It is part of a larger book, The Twelve, in the Jewish canon.) Nothing is known of Obadiah, whose name means "servant of Yahweh (God)." He castigates Edom for failing to help Israel repel foreign invaders and announces that the Day of Judgment is near for all nations. The final verses predict the restoration of the Jews to their native land.

O'Bail, John See Cornplanter

obelisk Tapered four-sided pillar, originally erected in pairs at the entrance to ancient Egyptian temples. The Egyptian obelisk was carved from a single piece of stone, usually granite, and embellished with hieroglyphics. It was wider at its square or rectangular base than at its pyramidal top, and could be over 100 ft (30 m) high. During the Roman empire, many obelisks were transported from Egypt to Italy. A well-known modern obelisk is the Washington Monument.

Oberammergau See Passion play

Oberlin College Private liberal arts college in Oberlin, Ohio. Founded in 1833, it was the first U.S. college to admit women and the first to admit black students on an equal footing with whites. In its early years it was a station on the Underground Railroad. It has faculties of arts, communications, foreign languages, law, letters, mathematics, psychology, public service, science, and social sciences, as well as a music conservatory.

obesity Excessive body fat. It is usually caused by sedentary habits and a diet high in fat, alcohol, or total calories. Calories consumed but not used are stored as fat. Rare causes include glandular defects and excess steroids (see Cushing syndrome). Obesity raises the risk of heart disease and diabetes mellitus. Treatment, by reducing calorie intake and increasing exercise, is best undertaken with a doctor's advice.

obia *or* **obeah** \'ō-bē-ə\ In West African folklore, a gigantic animal that steals into villages by night to kidnap girls on behalf of witches. In some Caribbean cultures the word is used to refer to overpowering and extremely evil forms of witchcraft and sorcery. Bewitched objects, bur-

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ied with the intent of causing harm, are sometimes called obia. A person who uses the power of obia is called an obiama or obiaman.

object-oriented programming (OOP) Computer programming that emphasizes the structure of data and their encapsulation with the procedures that operate upon it. It is a departure from traditional or procedural programming. OOP languages incorporate objects that are self-contained collections of computational procedures and DATA STRUCTURES. Programs can be written by assembling sets of these predefined objects in far less time than is possible using conventional procedural languages. OOP has become extremely popular because of its high programming productivity. C++ and Objective-C (early 1980s) are object-oriented versions of C that have gained much popularity. See also JAVA.

oblation In Christianity, the offering up by the faithful of any gift for use usually by the clergy, the church, or the sick or poor. The bread and wine offered for consecration in the EUCHARIST are oblations. In the Middle Ages children dedicated to a monastery and left there to be brought up were called oblates. Later, oblates were laity who lived at or in close connection with a monastery but who did not take religious vows. Members of certain Roman Catholic communities take the title oblate (e.g., the Oblates Regular of St. Benedict).

oboe Double-reed WOODWIND INSTRUMENT. The oboe developed out of the more powerful SHAWM in the early 17th century. Intended (unlike the shawm) for indoor use with stringed instruments, its tone was softer and less brilliant. With its sweet but piercing sound, it was by the end of the 17th century the principal wind instrument of the orchestra and military band and, after the violin, the leading solo instrument of the time. The early oboe had only 2 keys, but in France by 1839 the number of keys had gradually increased to 10. With the decline in popularity of the military band, the oboe likewise declined somewhat in popularity. Today the orchestra generally includes two oboes. The oboe d'amore, an alto oboe with a pear-shaped bell, was especially popular in the 18th century; the modern alto oboe is the ENGLISH HORN.

Obote \ō-'bō-tā**, (Apollo) Milton** (b. Dec. 28, 1924, Akoroko village, Lango, Uganda—d. Oct. 10, 2005, Johannesburg, S.Af.) First prime minister (1962–70) and president (1966–71, 1980–85) of Uganda. Elected to the Legislative Council in 1958, he led his country to independence in 1962. As prime minister, he accepted a constitution that granted federal status to five traditional kingdoms, including BUGANDA, but in 1966 he sent troops under Gen. IDI AMIN to subdue Buganda's ruler, Mutesa II, and later abolished all the kingdoms. Obote was overthrown in a 1971 coup led by Amin, but, after Amin was deposed in 1979, Obote returned to Uganda and established a repressive government. He was again ousted in 1985 and eventually settled in Zambia.

Milton Obote.
PETER KEMP/AP

Obraztsov \ˌō-brəst-'sȯf**, Sergey Vladimirovich** (b. July 5, 1901, Moscow, Russia—d. May 8, 1992, Moscow) Russian puppeteer. While working as an actor in Moscow (1922–31), he gave independent vaudeville-style puppet shows. In 1931 he was chosen to be the first director of Moscow's State Central Puppet Theatre. There his performances, displaying technical excellence and stylistic discipline, established puppetry as an art form in the Soviet Union, and on worldwide tours he inspired the formation of several rod-puppet theatres. His notable productions included *Aladdin's Magic Lamp* (1940), *An Unusual Concert* (1946), and *Don Juan* (1976).

Obrecht \'ō-ˌbrekt**, Jakob** (b. Nov. 22, 1452, Bergen-op-Zoom, Brabant—d. 1505, Ferrara) Flemish composer. Little is known of his origins or education, but in 1484 he was appointed instructor of choirboys at Cambrai cathedral and then held a position in Brugge. His compositional style is notable for its warm, graceful melodies and clear harmonies. Most outstanding are his 29 masses; he also wrote about 30 motets and some secular music. Despite his contemporary renown, he had little influence on later composers, since his works were not widely distributed and his intellectual but exuberant music came to seem old-fashioned with the advent of JOSQUIN des Prez.

Obregón \ˌō-brā-'gōn**, Álvaro** (b. Feb. 19, 1880, Alamos, Mex.—d. July 17, 1928, Mexico City) President of Mexico (1920–24). A skillful military leader who fought for the moderate presidents FRANCISCO MADERO and VENUSTIANO CARRANZA during the MEXICAN REVOLUTION, he was largely responsible for the liberal constitution of 1917. In response to Carranza's increasingly reactionary policies, Obregón took a leading role in the revolt that deposed him and was himself elected president in 1920. He managed to impose relative peace and prosperity on his war-torn country. He was elected again in 1928 but was shot and killed before assuming office.

Obrenović dynasty \ȯ-'bren-ə-ˌvēt^{y}\ Family that provided Serbia with five rulers between 1815 and 1903. Its founding member, Miloš (1780–1860), was prince of Serbia (1815–39, 1858–60). His elder son, Milan III, reigned only 26 days before dying in 1839. Miloš's second son, Michael III, was prince on two occasions (1839–42, 1860–68). A cousin, Milan IV (1854–1901), became prince in 1868 and then king of Serbia (1882–89). His son Alexander (1876–1903) succeeded him as king in 1889, but he was assassinated in 1903.

O'Brian, Patrick *orig.* **Richard Patrick Russ** (b. Dec. 12, 1914, near London, Eng.—d. Jan. 2, 2000, Dublin, Ire.) British writer. He was the eighth of nine children; an early marriage ended in divorce, and after World War II he married again, changed his name, and moved to a small, secluded coastal town in France near the Spanish border. He received little critical notice until age 54, when he began publishing his 18th-century seafaring series featuring Capt. Jack Aubrey and ship's surgeon Stephen Maturin; it eventually numbered 20 books (1969–99) and was compared with the works of HERMAN MELVILLE, ANTHONY TROLLOPE, and MARCEL PROUST.

O'Brien, Flann *orig.* **Brian Ó Nuallain** (b. Oct. 5, 1911, Strabane, County Tyrone, Ire.—d. April 1, 1966, Dublin) Irish novelist, dramatist, and newspaper columnist. Under the name Myles na gCopaleen, he wrote a column for the *Irish Times* for 26 years. He is most celebrated for the novel *At Swim-Two-Birds* (1939), a literary experiment that combines folklore, legend, humour, poetry, and linguistic games. His other novels include *The Hard Life* (1961) and *The Dalkey Archive* (1964).

O'Brien, Lawrence *in full* **Lawrence Francis O'Brien, Jr.** (b. July 7, 1917, Springfield, Mass., U.S.—d. Sept. 28, 1990, New York, N.Y.) U.S. political official. He managed JOHN F. KENNEDY's successful campaigns for the U.S. Senate (1952, 1958) and presidency (1960). He later served as Kennedy's special assistant (1961–65), as U.S. postmaster general (1965–68), as chairman of the Democratic National Committee (1968–69, 1970–73), and as commissioner of the National Basketball Association (1975–84).

O'Brien, William Smith (b. Oct. 17, 1803, Dromoland, County Clare, Ire.—d. June 18, 1864, Bangor, Caernarvonshire, Wales) Irish political insurgent. He served in the British House of Commons (1828–48) and initially supported the Anglo-Irish legislative union (see Act of UNION). In 1843 he joined the anti-union Repeal Association, and in 1846 he broke with DANIEL O'CONNELL to lead the radical Young Ireland movement. In 1848 he supported violent revolution and led an abortive insurrection in County Tipperary. Convicted of high treason, he received a death sentence that was commuted to exile in Tasmania. He was released in 1854 and pardoned in 1856.

William Smith O'Brien, lithograph by H. O'Neill after a daguerreotype by Glukman, 1848
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

obscenity Act, utterance, writing, or illustration that is deemed deeply offensive according to contemporary community standards of morality and decency. Though most societies have placed restrictions on the content of literary and graphic works, it was not until relatively modern times that sexuality became a major focus of societal concern. One of the first systematic efforts to suppress books

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deemed to be immoral or heretical was undertaken by the Roman Catholic church in the 16th century. Modern obscenity laws can be viewed as direct responses to the social and technological changes (e.g., the creation of the printing press and the development of the Internet) that have permitted the wide and easy distribution of sexually explicit materials. The Supreme Court of the United States has ruled that materials are obscene if they appeal predominantly to a prurient interest in sexual conduct, depict or describe sexual conduct in a patently offensive way, and lack serious literary, artistic, political, or scientific value. Material deemed obscene under this definition is not protected in the U.S. by the free-speech guarantee of the 1st Amendment. See also freedom of speech; pornography.

observatory Structure containing telescopes and other instruments for observing celestial objects and phenomena. Observatories can be classified by the part of the electromagnetic spectrum they can receive. Most are optical, observing in and near the region of the visible spectrum. Some are equipped to detect radio waves; others (space observatories) are Earth satellites and other spacecraft that carry special telescopes and detectors to study celestial sources of high-energy radiation (e.g., gamma rays, ultraviolet radiation, X-rays) from above the atmosphere. Stonehenge may have been an early predecessor of the optical observatory. Perhaps the first observatory that used instruments to accurately measure the positions of celestial objects was built c. 150 BC by Hipparchus. The first notable premodern European observatory was that at Uraniborg, built for Tycho Brahe in 1576. Observatory House, in Slough, Eng., built and operated by William Herschel (see Herschel family), was one of the technical wonders of the 18th century. Today the world's largest groupings of optical telescopes are atop Mauna Kea, in Hawaii, and Cerro Tololo, in Chile. Other major observatories include Arecibo Observatory; Mount Wilson Observatory; Palomar Observatory; and Royal Greenwich Observatory.

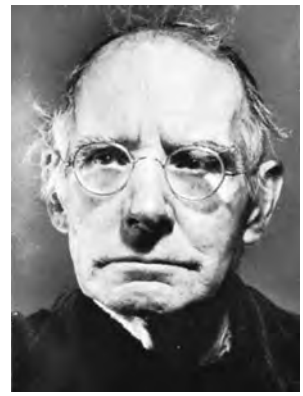
obsessive-compulsive disorder Mental disorder in which an individual experiences obsessions or compulsions, either singly or together. An obsession is a persistent disturbing preoccupation with an unreasonable idea or feeling (such as of being contaminated through shaking hands with someone). A compulsion is an irresistible impulse to perform an irrational act (such as repeatedly washing the hands). The two phenomena are usually, but not always, linked in the obsessive-compulsive person. Onset of the illness has been linked to malregulation of the neurotransmitter serotonin as well as to the ill effects of high stress.

obsidian Natural glass of volcanic origin that is formed by the rapid cooling of viscous lava. It has a glassy lustre and is slightly harder than window glass. It is typically jet black, but the presence of hematite (iron oxide) produces red and brown varieties, and tiny gas bubbles may create a golden sheen. It is sometimes used as a semiprecious stone. Obsidian was used by American Indians and others for weapons, implements, tools, and ornaments, and by the ancient Aztecs and Greeks for mirrors.

obstetrics and gynecology \ˌgī-nə-ˈkä-lə-jē\ Medical and surgical specialty concerned with the management of pregnancy and childbirth and with the health of the female reproductive system. Obstetrics, first practiced by midwives, developed as a medical discipline in the 17th–19th centuries, adopting the use of forceps in delivery, anesthetics, and antiseptic methods. The last two made cesarean section possible. Obstetricians confirm pregnancy, diagnose ectopic pregnancy, conduct prenatal care, perform amniocentesis, deliver babies, and perform abortions. In the late 20th century a backlash against the excessive medicalization of birth led to a revival of midwifery and encouragement of natural childbirth. Gynecologists do routine pelvic exams, take samples for Pap smears, advise on and prescribe birth control, and treat reproductive system disorders (e.g., endometriosis, hormonal imbalances, problems with menstruation and menopause). They perform surgery to prevent conception (tubal ligation), repair pelvic injuries, and remove cysts and tumours from the uterus, cervix, and ovaries. Both specialties are involved in diagnosis and treatment of infertility. See also hysterectomy.

Obuchi \ˈō-bù-chē**, Keizō** (b. June 25, 1937, Nakanojō, Japan—d. May 14, 2000, Tokyo) Japanese politician. A graduate of Waseda University, he was first elected to the Diet (legislature) in 1963, where he spent 12 terms, serving as chairman of the finance committee (1976) and minister for foreign affairs (1997). As Japan's prime minister (1998–2000), Obuchi had to deal with Japan's flagging economy and the related Asian economic crisis.

O'Casey, Sean *orig.* **John Casey** (b. March 30, 1880, Dublin, Ire.—d. Sept. 18, 1964, Torquay, Devon, Eng.) Irish playwright. Born to a poor Protestant family, he educated himself and worked from age 14 at manual labour. He embraced the Irish nationalist cause, changed his name to its Irish form, and became active in the labour movement and its paramilitary Irish Citizen Army. By 1915 he had turned from politics to writing realistic tragicomedies about Dublin slum dwellers in war and revolution. The Abbey Theatre produced three of his earliest and best plays—*The Shadow of a Gunman* (1923), *Juno and the Paycock* (1924), and *The Plough and the Stars* (1926)—which caused riots by Irish patriots. When his antiwar play *The Silver Tassie* was rejected by the Abbey, O'Casey moved to England, where it was produced in 1929. His later plays include *Red Roses for Me* (1946); he also published a six-volume autobiography (1939–56).



O'Casey, photograph by J. Bown
CAMERA PRESS

Occam, William of See William of Ockham

Occam's razor See Ockham's razor

occasionalism Type of mind-body dualism that maintains that apparent interactions between mental and physical events are in reality the result of God's constant causal action. Starting from Descartes's mind-body dualism, the occasionalists, whose most prominent exponents were Nicolas de Malebranche and Arnold Geulincx, drew the conclusions that there can be no interaction between mind and body, and that all causality is immanent, within one order or the other, and any appearance of mind affecting body or of body affecting mind must be explained as the result of a special intervention by God, who, on the occasion of changes in one substance, produces corresponding changes in the other.

Occitan \ˈäk-sə-ˌtan\ **language** *or* **Provençal** \ˌprō-ˌvän-ˈsäl, ˌprä-vən-ˈsäl\ **language** Romance language spoken in Occitania, a region of southern France. The 1.5 million people of this region use Occitan dialects in everyday life and French as their official and cultural language. The term *langue d'oc* is based on the use of the word *oc* for "yes." The name *Provençal* originally referred to the dialects of the Provence region, used by medieval troubadours and as a standard and literary language in France and northern Spain in the 12th–14th centuries. Today's major dialects are those of Limousin, Auvergnat, Provence, and Languedoc. Gascon, spoken in southwestern France and usually classified as an Occitan dialect, is sometimes considered a distinct language. Occitan is closely related to Catalan and, despite recent French influences, has more in common with Spanish than with French.

occultism Theories, practices, and rituals based on esoteric knowledge of the world of spirits and unknown forces. The wide range of occult beliefs and practices includes astrology, alchemy, divination, magic, and witchcraft and sorcery. Devotees of occultism seek to explore spiritual mysteries through what they regard as higher powers of the mind. The Western tradition of occultism has its roots in Hellenistic magic and alchemy (especially the Hermetic writings ascribed to Thoth) and in the Jewish mysticism associated with the Kabbala.

Occupation (of Japan) (1945–52) Military occupation of Japan by the Allied Powers after its defeat in World War II. Theoretically an international occupation, in fact it was carried out almost entirely by the U.S. under Gen. Douglas MacArthur. During the Occupation period, Japanese soldiers and civilians from abroad were repatriated to Japan, arms industries were dismantled, and political prisoners were released. Wartime leaders stood trial for war crimes, and seven were executed. A new constitution, vesting power in the people, replaced the Meiji Constitution; in it Japan renounced its right to wage war, the emperor was reduced to ceremonial status, and women were given the right to vote. The Occupation administration also carried out land reform, reducing the number of farmers who were tenants from 46% to 10%, and began the breakup of the zaibatsu (business conglomerates). Labour unions were initially encouraged, but as fears of leftist organizations grew with the advent of the Cold War, stronger governmental control of labour was supported. The education system, seen as elitist, was revised to resemble the U.S. system. Though

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the U.S. wanted to end the Occupation in 1947, the Soviet Union vetoed a peace treaty with Japan; a treaty was signed in 1951, and the Occupation ended the following year.

occupational disease Illness associated with a particular occupation. The Industrial Revolution's long working hours, dim light, lack of fresh air, and dangerous machinery fostered illness and injury in general, but certain occupations (e.g., mining) carry particular risks (e.g., black lung, a type of PNEUMOCONIOSIS). Twentieth-century innovations (including use of new chemicals and radioactive materials) caused an increase in certain cancers (e.g., leukemia and bone cancer in workers exposed to radiation) and injuries. So-called "sick buildings" (in which pathogens grow in air circulation systems) contribute to health problems among office workers. Occupational medicine also covers work-related emotional stresses. See also ASBESTOSIS; INDUSTRIAL MEDICINE.

occupational medicine See INDUSTRIAL MEDICINE

occupational therapy Use of activities to promote health and independence, particularly after the acute phase of illness. Such therapy is often vital for reorienting patients unable to work for long periods. Occupational therapists assess patients' abilities, tailor programs to restore physical function, and devise ways to help those with permanent limitations carry out everyday functions. See also PHYSICAL MEDICINE AND REHABILITATION.

occupational training See EMPLOYEE TRAINING

ocean Large, continuous body of salt water. Ocean covers nearly 71% of the Earth's surface and is divided into major oceans and smaller seas. The three principal oceans, the Pacific, Atlantic, and Indian, are largely delimited by land and submarine topographic boundaries. All are connected to what is sometimes called the Southern Ocean, the waters encircling Antarctica. Important marginal seas, primarily in the Northern Hemisphere, are partially enclosed by landmasses or ISLAND ARCS. The largest are the Arctic Ocean and adjacent seas, Caribbean and adjacent waters, Mediterranean, Bering Sea, Sea of Okhotsk, Yellow and China Seas, and Sea of Japan.

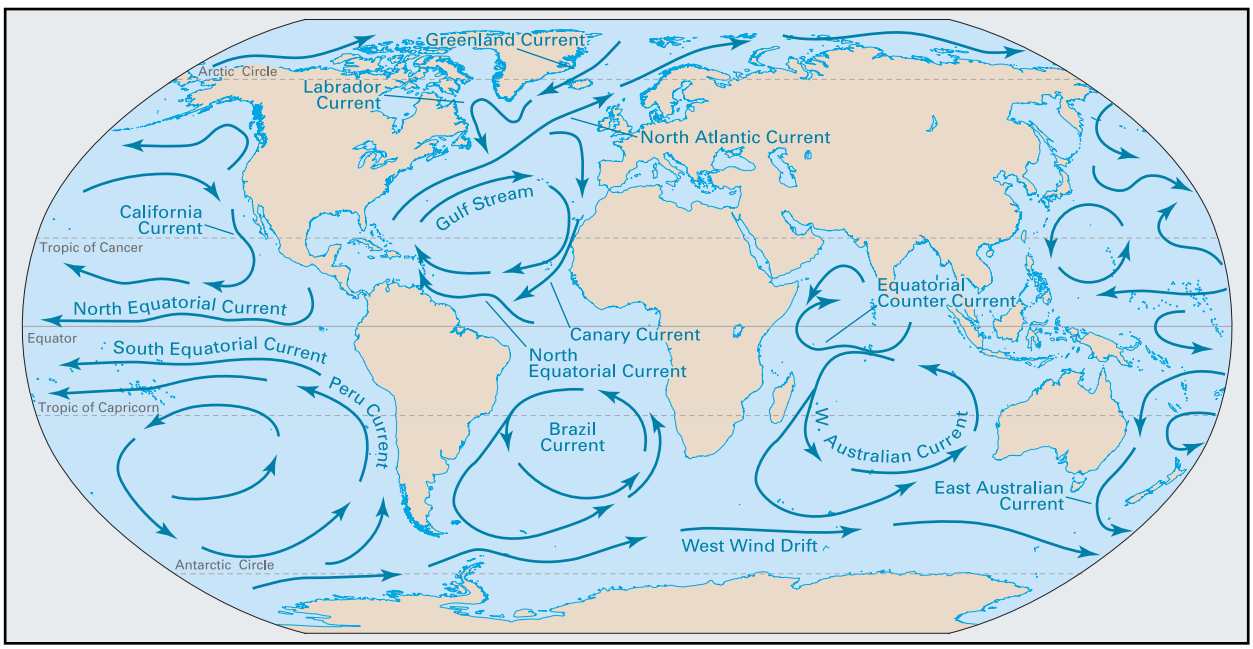
ocean current Horizontal and vertical circulation system of ocean waters, produced by gravity, wind friction, and water density variation. CORIOLIS FORCES cause ocean currents to move clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere and deflect them about 45° from the wind direction. This movement creates distinctive currents called gyres. Major ocean currents include the Gulf Stream–North Atlantic–Norway Current in the Atlantic Ocean, the Peru (Humboldt) Current off South America, and the West Australia Current.

ocean liner Large merchant ship that visits designated ports on a regular schedule, carrying whatever cargo and passengers are available on the date of sailing. The first liners were operated in the North Atlantic, notably by SAMUEL CUNARD of Britain, beginning in 1840. Their heyday lasted from the late 19th to the mid-20th century. Many were extraordinarily luxurious. Among the most famous were Cunarders such as the *Mauretania* and the *Queen Mary*; the German *Vaterland* (later renamed *Leviathan*), for many years the largest ship afloat; the ill-fated *TITANIC*; and the *United States*. Their reign ended in the 1960s with the rise of jet travel, but liners ranging from cruise ships to refrigerated cargo ships continued to sail.

ocean perch See REDFISH

Oceania \ˌō-shē-'a-nē-ə\ Collective name for the islands scattered throughout most of the Pacific Ocean. The term especially refers to islands of the central and southern Pacific, including those of MICRONESIA, MELANESIA, and POLYNESIA; NEW ZEALAND is often included and sometimes AUSTRALIA. In its most restricted sense, excluding Australia but including PAPUA NEW GUINEA, Oceania includes more than 10,000 islands and has a land area of about 317,000 sq mi (821,000 sq km). See map on following page.

Oceanic \ˌō-shē-'a-nik\ **arts** Literary, performing, and visual arts of the Pacific islands of OCEANIA, including Australia as well as Polynesia, Melanesia, and Micronesia. Their isolation and wide range of environmental conditions led to the development of a rich variety of artistic styles. Religion and ritual strongly influence every aspect of Oceanic life, and their association with the arts is especially close. Religious symbolism infuses not only the objects, dances, and speeches used in ritual but also the materials and tools used to create them. Oceanic literature includes both complex oral traditions and a more modern body of works written primarily in English. The traditional oral transmission of literature necessitated rhythmic cadences and stock formulas to aid memory. Favoured subjects are tales of the gods and spirits and creation myths. Musical styles are multitudinous, though all regions, with some Melanesian exceptions, emphasize vocals using instruments to produce supranormal voices. Consequently most instruments are technically crude though often elaborately decorated in keeping with their extramusical function as gifts and cult objects. Polynesian song and dance is rooted in societal structure, and chants praise chiefs or high-ranking guests while the dancers' movements



Major surface currents of the world's oceans. Subsurface currents also move vast amounts of water, but are not known in such detail.

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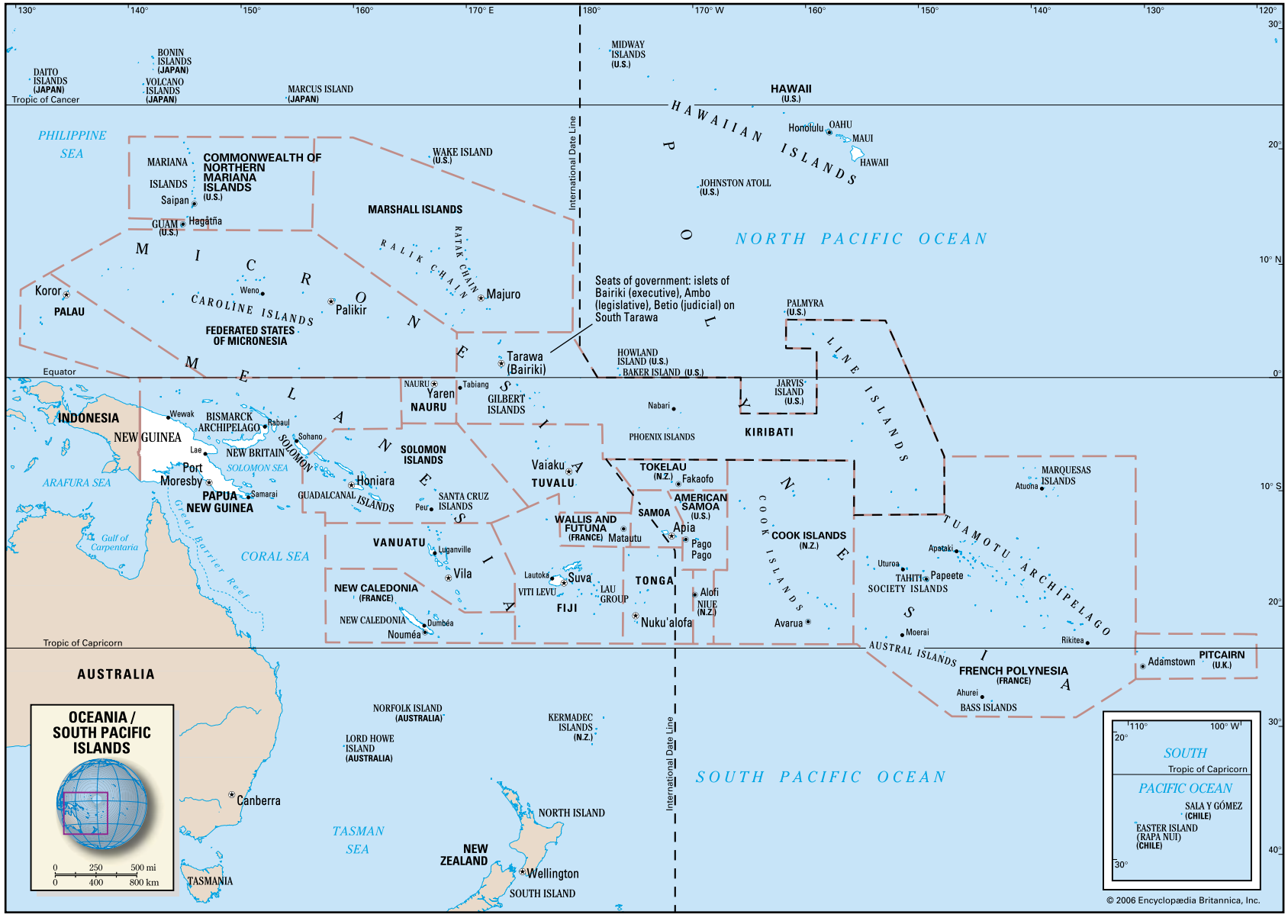
OCEANIA / SOUTH PACIFIC ISLANDS
0 250 500 mi
0 400 800 km
130° 140° 150° 160° 170° E 180° 170° W 160° 150° 140° 130° 120°
30° 20° 10° N 0° 10° S 20° 30° 40°
Tropic of Cancer
Equator
Tropic of Capricorn
International Date Line
NORTH PACIFIC OCEAN
SOUTH PACIFIC OCEAN
PHILIPPINE SEA
ARAFURA SEA
CORAL SEA
TASMAN SEA
Gulf of Carpentaria
Great Barrier Reef
HAWAIIAN ISLANDS
MICRONESIA
MELANESIA
POLYNESIA
LINE ISLANDS
TUAMOTU ARCHIPELAGO
SOCIETY ISLANDS
COOK ISLANDS
AUSTRAL ISLANDS
CAROLINE ISLANDS
RALIK CHAIN
RATAK CHAIN
HAWAII (U.S.)
Honolulu
OAHU
MAUI
HAWAII
JOHNSTON ATOLL (U.S.)
MIDWAY ISLANDS (U.S.)
WAKE ISLAND (U.S.)
DAITO ISLANDS (JAPAN)
BONIN ISLANDS (JAPAN)
VOLCANO ISLANDS (JAPAN)
MARCUS ISLAND (JAPAN)
MARIANA ISLANDS
COMMONWEALTH OF NORTHERN MARIANA ISLANDS (U.S.)
Saipan
GUAM (U.S.)
Hagåtña
MARSHALL ISLANDS
Majuro
Koror
PALAU
Weno
Palikir
FEDERATED STATES OF MICRONESIA
Seats of government: islets of Bairiki (executive), Ambo (legislative), Betio (judicial) on South Tarawa
Tarawa (Bairiki)
PALMYRA (U.S.)
HOWLAND ISLAND (U.S.)
BAKER ISLAND (U.S.)
JARVIS ISLAND (U.S.)
KIRIBATI
Nabari
PHOENIX ISLANDS
NAURU
Yaren
Tabiang
GILBERT ISLANDS
INDONESIA
Wewak
NEW GUINEA
BISMARCK ARCHIPELAGO
Rabaul
Sohano
NEW BRITAIN
Lae
Port Moresby
Samarai
PAPUA NEW GUINEA
SOLOMON SEA
SOLOMON ISLANDS
Honiara
GUADALCANAL
SANTA CRUZ ISLANDS
Peur
VANUATU
Luganville
Vila
NEW CALEDONIA (FRANCE)
NEW CALEDONIA
Dumbéa
Nouméa
NORFOLK ISLAND (AUSTRALIA)
LORD HOWE ISLAND (AUSTRALIA)
KERMADEC ISLANDS (N.Z.)
AUSTRALIA
Canberra
TASMANIA
NORTH ISLAND
SOUTH ISLAND
NEW ZEALAND
Wellington
Vaiaku
TUVALU
TOKELAU (N.Z.)
Fakaofo
AMERICAN SAMOA (U.S.)
SAMOA
Apia
Pago Pago
WALLIS AND FUTUNA (FRANCE)
Matautu
TONGA
Alofi
NIUE (N.Z.)
Nuku'alofa
FIJI
VITI LEVU
LAU GROUP
Lautoka
Suva
COOK ISLANDS (N.Z.)
Avarua
Atuona
MARQUESAS ISLANDS
Uturoa
Apataki
TAHITI
Papeete
Moerai
Rikitea
Adamstown
PITCAIRN (U.K.)
FRENCH POLYNESIA (FRANCE)
Ahurei
BASS ISLANDS
110° 100° W
20°
30°
SOUTH Tropic of Capricorn PACIFIC OCEAN
SALA Y GÓMEZ (CHILE)
EASTER ISLAND (RAPA NUI) (CHILE)
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narrate rather than act out the meaning. Australian and Melanesian dance has a historical function describing the activities of gods and ancestors—in the latter instance, dancers don elaborate costumes and masks. In all the islands the significant movements are made with the upper half of the body, while the feet merely keep time. The visual arts display ingenious use of environmental possibilities: a staggering range of materials are used, often in collage-style combination. Wood is the main artistic medium; secondary materials included clay, shell, and stone. Extant works include wooden masks, clubs, and religious effigies; carved stone sculptures; feather cloaks and helmets; and bark cloth stenciled with bold, dense geometric designs The most famous monuments of Oceanic art are the gargantuan stone figures of EASTER ISLAND. With the arrival of European colonists, the arts in these regions began to reflect European traditions and styles. See also BISJ POLE.

oceanic \ˌō-shē-'a-nik\ **plateau** *or* **submarine plateau** Large submarine elevation rising sharply at least 660 ft (200 m) above the surrounding seafloor and having an extensive, relatively flat or gently tilted summit. Most plateaus are steplike interruptions of the CONTINENTAL SLOPES. Some, however, occur well beyond the continental margins. They stand alone, high above the surrounding seafloor, and are believed to be fragments of continents that were isolated during CONTINENTAL DRIFT and SEAFLOOR SPREADING.

Oceanic religions Non-Christian religions practiced in OCEANIA. Traditional Melanesian religions, which are giving way under the pressures of Christianity and capitalism, hold that ancestral ghosts and other spirits are participants in daily life. Their presence and effects are manifested in dreams, in divination, and in human successes and failures. Magic is widely practiced, and sorcery is seen as the major cause of death and illness. The traditional religions of Micronesia, which have largely died out, recognized several high gods and many other spirits, including the spirits of ancestors and the dead. Magic played an important role. In Polynesia, each of the gods, whether high or local, had its own ritual requirements, and schools of priests were often required to carry them out. All things were believed to possess MANA, which had to be protected by complicated rules and taboos. The Polynesians often offered human sacrifices on important occasions, such as the formal investiture of a priest or chief. With the introduction of modern goods, the peoples of all these islands became susceptible to CARGO CULTS.

oceanic ridge Continuous, submarine mountain chain extending approximately 50,000 mi (80,000 km) through all the world's oceans, separating them into distinct basins. The main ridge extends down the middle of the Atlantic Ocean, passes between Africa and Antarctica, turns north to the Indian Ocean, then continues between Australia, New Zealand, and Antarctica and across the Pacific basin to the mouth of the Gulf of California. Lateral ridges extend from islands on the axis of the oceanic ridge to coasts of adjacent continents. The oceanic ridge system is the largest feature of the Earth's surface after the continents and the ocean basins themselves; it is explained by the theory of PLATE TECTONICS as a boundary between diverging plates where molten rock is brought up from deep beneath the Earth's crust. See also SUBDUCTION ZONE.

oceanic trench See DEEP-SEA TRENCH

oceanography Scientific discipline concerned with all aspects of the world's oceans and seas, including their physical and chemical properties, origin and geology, and life forms. Research entails sampling seawater and marine life, remote sensing of oceanic processes with aircraft and satellites, and exploration of the seafloor. Oceanography aids in predicting weather and climate, in exploitation of the Earth's resources, and in understanding the effects of pollutants. See also MARINE GEOLOGY.

Oceanside City (pop., 2000: 161,029), southwestern California, U.S. Located along the Pacific coast on the Gulf of Santa Catalina, north of SAN DIEGO, it is a beach resort. The city was incorporated in 1888, and its growth was spurred in 1942 by the opening of a U.S. Marine Corps base, Camp Pendleton, to the north. Nearby is the restored Mission San Luis Rey (founded 1798).

ocelot \'ä-sə-ˌlät\ Species (*Leopardus pardalis*) of CAT found in forests, grasslands, and brush-covered regions from Texas to northern Argentina. The ocelot is 36–52 in. (90–130 cm) long, excluding the 12–16-in. (30–40-cm) tail. It stands about 18 in. (45 cm) and weighs 24–35 lbs (11–16 kg). The upper body varies from whitish to tawny yellow to gray. The head, neck, and body are marked by specific patterns of black stripes and spots: spots on the head, two stripes on each cheek, oblong spots arranged in chainlike bands on the body, and bars or blotches on the tail. The ocelot hunts at night for small mammals, birds, reptiles, and fish. It is listed as an endangered species in the U.S.

Ocelot (*Felis*, or *Leopardus, pardalis*).
WARREN GARST/TOM STACK AND ASSOCIATES

Ochoa, Ellen (b. May 10, 1958, Los Angeles, Calif., U.S.) U.S. astronaut. She earned a master's degree (1981) and a doctorate (1985) in electrical engineering at Stanford University. Specializing in the development of optical systems, she later helped create several systems and methods that were awarded patents. In 1990 Ochoa was selected to participate in NASA's astronaut program, and the following year she completed her training to become the first Hispanic female astronaut. In April 1993 she served as mission specialist aboard the shuttle *Discovery*. Ochoa's later missions included traveling to the International Space Station in 1999 and 2002.

Ochoa \ō-'chō-ə**, Severo** (b. Sept. 24, 1905, Luarca, Spain—d. Nov. 1, 1993, Madrid) Spanish-born U.S. molecular biologist. He received his M.D. and subsequently studied in Germany and Britain before immigrating to the U.S. in 1941, where he taught principally at New York University. In 1955, while researching high-energy phosphates, he discovered an enzyme in bacteria that enabled him to synthesize RNA. The enzyme normally breaks down RNA, but in a test tube it runs its natural reaction in reverse. It has been valuable in enabling scientists to understand and recreate the process whereby the hereditary information contained in genes is translated into enzymes that determine each cell's functions and character. With ARTHUR KORNBERG he received a 1959 Nobel Prize.

Ochs \'äks**, Adolph Simon** (b. March 12, 1858, Cincinnati, Ohio, U.S.—d. April 8, 1935, Chattanooga, Tenn.) U.S. newspaper publisher. Ochs grew up in Tennessee, where he worked for various newspapers. At age 20 he borrowed $250 to become proprietor of the moribund *Chattanooga Times*, which he developed into one of the South's leading newspapers. He gained control of the financially faltering *NEW YORK TIMES* in 1896. Despising YELLOW JOURNALISM, he adopted the slogan "All the News That's Fit to Print" and emphasized comprehensive and trustworthy news gathering. Under his ownership the *Times* became one of the world's outstanding newspapers. From 1900 he was a director of the ASSOCIATED PRESS. Ochs's son-in-law, ARTHUR H. SULZBERGER, was the first in a succession of family heirs to lead the New York Times Co.

Ockeghem \'ō-kə-gem**, Johannes** *or* **Jean d'Ockeghem** (b. c. 1410—d. Feb. 6, 1497, Tours, France?) Flemish composer and singer. He is first mentioned as a member of an Antwerp choir in 1443. He held a series of posts in the Low Countries and France; he may have been associated with Gilles Binchois (c. 1400–60) and GUILLAUME DUFAY, and Antoine Busnois (c. 1430–92) may have been his student. Though universally admired, his output over a career of more than 50 years was small, comprising 14 mass cycles, about 10 motets, and about 20 chansons. His richly sonorous works often reflect intricate structural principles.

Ockham \'ä-kəm**, William of** *or* **William of Occam** (b. c. 1285, Ockham, Surrey?, Eng.—d. 1347/49, Munich, Bavaria) English Franciscan philosopher, theologian, and political writer. A late Scholastic thinker, he is regarded as the founder of a form of nominalism, the school of thought that denies that UNIVERSALS have any reality apart from the individual things signified by the universal or general term. He is also remembered as the originator of the medieval rule of logical economy known as OCKHAM'S RAZOR. He was excommunicated by Pope JOHN XXII for his defense of the Franciscan notion of poverty and the rights of the empire against the papacy.

Ockham's razor Methodological principle of parsimony in scientific explanation. Traditionally attributed to William of OCKHAM, the principle prescribes that entities are not to be multiplied beyond necessity. In practice, this means that if a phenomenon can be explained without assuming

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the existence of an entity, then philosophers and scientists should not assume the entity's existence. The history of science provides many examples of the principle's application (e.g., the rejection by scientists of the hypothesis of a luminiferous ether in response to Albert Einstein's Special Theory of Relativity). See also materialism.

Ocoee \ō-'kō-ē\ **River** River, rising in the Blue Ridge in northeastern Georgia and flowing through southeastern Tennessee, U.S. In northern Georgia it is called the Toccoa River; at the Blue Ridge Dam its waters form Blue Ridge Lake. Three other dams on the river are all in Tennessee. The four dams are run by the Tennessee Valley Authority. The river is about 70 mi (115 km) long.

O'Connell, Daniel *known as* **the Liberator** (b. Aug. 6, 1775, near Cahirciveen, County Kerry, Ire.—d. May 15, 1847, Genoa, Kingdom of Sardinia) Irish nationalist leader. A lawyer, he gradually became involved in the struggle for Catholic Emancipation, organizing nationwide "aggregate meetings" of Irish Catholics to petition for their legal rights. In 1823 he cofounded the Catholic Association, which won support from Irish political and church leaders. After helping win passage of the 1829 Emancipation Act, which allowed Irish Catholics to serve in the British Parliament, he was elected to the House of Commons. He supported the Whig Party in return for Irish reform measures but became disenchanted with the administration's inaction. In 1839 he formed the Repeal Association to dissolve the Anglo-Irish Act of Union. A series of illegal mass meetings in Ireland led to his arrest for sedition in 1843. After his release in 1844, he faced dissension from William Smith O'Brien's radical Young Ireland movement.

O'Connor, Feargus Edward (b. c. July 18, 1796, Connorville, County Cork, Ire.—d. Aug. 30, 1855, London, Eng.) Irish leader of Chartism. He practiced law and served in the British Parliament (1832–35). He turned to radical agitation in England and was active in the Chartist movement as a popular public speaker. His journal *Northern Star* (1837) gave his views wide circulation. He became the Chartists' leader in 1841 but was unable to effect passage of the Chartist petition in 1848. After a mental collapse, he was declared insane in 1852.

O'Connor, (Mary) Flannery (b. March 25, 1925, Savannah, Ga., U.S.—d. Aug. 3, 1964, Milledgeville, Ga.) U.S. writer. She spent most of her life on her mother's farm in Milledgeville, Ga. A devout Roman Catholic, she usually set her works in the rural South and often examined the relationship between the individual and God by putting her characters in grotesque and extreme situations. Her first novel, *Wise Blood* (1952), combines a keen ear for common speech, a caustic religious imagination, and a flair for the absurd that characterized all of her work. With the story collections *A Good Man Is Hard to Find* (1955) and *Everything That Rises Must Converge* (1965), she was acclaimed as a master of the form. Her other work of fiction was the novel *The Violent Bear It Away* (1960). Long crippled by lupus, she died at age 39. The Flannery O'Connor Award for Short Fiction is the preeminent American award of its kind.

O'Connor, Frank *orig.* **Michael O'Donovan** (b. 1903, Cork, County Cork, Ire.—d. March 10, 1966, Dublin) Irish writer. Brought up in poverty, O'Connor became a librarian and a director of Dublin's Abbey Theatre. He won popularity in the U.S. for short stories in which apparently trivial incidents illuminate Irish life. They appeared in volumes including *Guests of the Nation* (1931) and *Crab Apple Jelly* (1944) and in *The New Yorker* magazine. He also wrote critical studies on Irish life and literature and translations of Gaelic works of the 9th–20th centuries, including the great 17th-century satire *The Midnight Court* (1945).

O'Connor, Sandra Day *orig.* **Sandra Day** (b. March 26, 1930, El Paso, Texas, U.S.) U.S. jurist. After graduating first in her law school class at Stanford University (1950), she entered private practice in Arizona. She served as an assistant state attorney general (1965–69) before being elected in 1969 to the state senate, where she became the first woman in the U.S. to hold the position of majority leader (1972–74). After serving on the superior court of Maricopa county and the state court of appeals, she was nominated in 1981 by Pres. Ronald Reagan to the Supreme Court of the United States, becoming the first female justice in the court's history. Known for her dispassionate and meticulously researched opinions, she proved to be a moderate and pragmatic conservative who sometimes sided with the court's liberal minority on social issues (e.g., abortion rights). O'Connor retired from the court in 2006.

OCR *in full* **optical character recognition** Scanning and comparison technique intended to identify printed text or numerical data. It avoids the need to retype already printed material for data entry. OCR software attempts to identify characters by comparing shapes to those stored in the software library. The software tries to identify words using character proximity and will try to reconstruct the original page layout. High accuracy can be obtained by using sharp, clear scans of high-quality originals, but it decreases as the quality of the original declines.

Octavian See Caesar Augustus

October Manifesto Document issued by Tsar Nicholas II in October 1905. In response to the unrest caused by the Russian Revolution of 1905 and on the advice of his minister Sergey Witte, Nicholas promised to guarantee civil liberties and establish a popularly elected Duma. The manifesto satisfied the moderate revolutionaries, and further unrest was crushed. In 1906 the Fundamental Laws were established to serve as a constitution and to create the Duma. The Duma was in fact given only a limited voice in the government, and the civil rights actually granted were far less substantial than those promised by the manifesto.

October Revolution See Russian Revolution of 1917

octopus In general, any eight-armed cephalopod of the order Octopoda; specifically, members of a large, widely distributed group (genus *Octopus*) of shallow-water species. Species range from about 2 in. (5 cm) to 18 ft (5.5 m) long with an arm span up to 30 ft (9 m). The head is usually only slightly demarcated from the saccular body. Each arm is contractile and bears fleshy suckers. Two sharp beaks and a filelike organ in the mouth drill crustacean shells and rasp away flesh. Most octopuses crawl along the bottom; when alarmed, they may jet-propel themselves backward, and they sometimes eject an inky substance to cloud the water and protect themselves from predators. They can change colour rapidly, a reflection of their environment or mood. The common octopus (*O. vulgaris*) is thought to be the most intelligent of all invertebrates.

Octopus granulatus, a South African species.
ANTHONY BANNISTER FROM THE NATURAL HISTORY PHOTOGRAPHIC AGENCY-EB INC.

oculus \'ä-kyə-ləs\ (Latin: "eye") In architecture, any of several elements resembling an eye, such as a round or oval window or the round opening at the top of some domes (see Pantheon). The capital of an Ionic column features an oculus in the form of a disk at the centre of each of its spiral scrolls.

Oda Nobunaga \'ō-dä-ˌnō-bù-'nä-gä\ (b. 1534, Owari province, Japan—d. June 21, 1582, Kyōto) With Toyotomi Hideyoshi and Tokugawa Ieyasu, one of the three unifiers of premodern Japan. He brought the domain of his birth, Owari, under his control and followed that success by defeating the huge forces of a neighbouring daimyo. In 1562 he formed an alliance with Ieyasu, and together they captured Kyōto, which Nobunaga controlled from 1573, thereby ending the Ashikaga shogunate (see Muromachi period). He then turned his attention to crushing the militant Tendai Buddhist monks of Enryaku temple, destroying their headquarters in 1571. He spent the next decade fighting the fanatically religious Ikkō sect, defeating their fortress-monastery in Ōsaka in 1580. His efforts to weaken the strength of the Buddhist temples extended to permitting Jesuit missionaries to build a church in Kyōto; his own interest in Christianity was purely political. In 1582 he had conquered central Japan and was attempting to extend his control over western Japan when he was wounded by a discontented general and committed suicide.

ode Ceremonious lyric poem on an occasion of dignity in which personal emotion and universal themes are united. The form is usually marked by exalted feeling and style, varying line length, and complex stanza forms. The term *ode* derives from a Greek word alluding to a choric song, usually accompanied by a dance. Forms of odes include the Pindaric ode, written to celebrate public events such as the Olympic games, and the form associated with Horace, whose intimate, reflective odes have two- or four-line stanzas and polished metres. Both were revived during

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the Renaissance and influenced Western lyric poetry into the 20th century. The ode (*qaṣīdah*) also flourished in pre-Islamic Arabic poetry.

Odense \'ü-ən-zə,\ *English* \'ō-den-sə\ City and municipality (2000 est.: 183,912), north-central Funen Island, Denmark. Sacred in pagan times as the sanctuary of Odin, the Norse god of war, it first appears in records c. AD 1000. A bishop's seat from the 10th century, it became a centre of pilgrimage to the shrine of Canute IV. It was burned in 1247, but many medieval structures remain. It grew after its port and harbour were built and the Odense Canal was opened in 1804. Denmark's third largest city, it is a shipbuilding and manufacturing centre. The home of Hans Christian Andersen, who was born there, is now a museum.

Oder-Neisse Line \'ō-dər-'nī-sə\ Polish-German border along the Oder and Neisse rivers proposed by the Allied Powers at the end of World War II. After inconclusive talks at the Yalta Conference to redraw the Polish-German border so as to grant more territory to Poland, the Soviet Union unilaterally occupied all territory east of its preferred Oder-Neisse line. The U.S. and Britain, dubious about Soviet domination of an enlarged Poland, protested the action but eventually agreed to the provisional border, which was not recognized by West Germany until it signed treaties with the Soviet Union and Poland in 1970.

Oder \'ō-dər\ **River** *or* **Odra** \'ȯ-drä\ **River** *ancient* **Viadua** River, northern Europe. It flows from its source in the Oder Mountains in the Czech Republic north through western Poland, where it forms the boundary between Poland and Germany. As the second largest river emptying into the Baltic Sea, it is economically important as a transport route. Navigable for 475 mi (765 km), it is connected by canal with the Vistula River and with the western European waterway system. It was partially internationalized under the Treaty of Versailles in 1919. Considered German until the 1945 Potsdam settlement, it was formally recognized as the Polish-German border in 1950 by East Germany and in 1970 by West Germany.

Odessa City (pop., 2001: 1,029,000), southwestern Ukraine. A Tatar fortress was established in Odessa in the 14th century. The city was ceded to Russia in 1791 and became its second most important port after Saint Petersburg, with grain as its principal export. It was a centre of revolutionary activity in 1905 (see Russian Revolution of 1905), and it suffered heavy damage in World War II. Odessa is a major seaport and industrial centre, with shipbuilding, engineering, and oil refineries. It is also a cultural centre, with a university, museums, and theatres.

Odets \ō-'dets**, Clifford** (b. July 18, 1906, Philadelphia, Pa., U.S.—d. Aug. 14, 1963, Hollywood, Calif.) U.S. playwright. He acted with repertory companies in 1923–28 and joined the Group Theatre in 1931. His first play, the social-protest drama *Waiting for Lefty* (1935), helped establish his and the company's reputation. He followed it with *Awake and Sing!* (1935) and *Golden Boy* (1937). In the late 1930s he moved to Hollywood, where he wrote screenplays and directed the movies *None but the Lonely Heart* (1944) and *The Story on Page One* (1959). His later plays include *The Big Knife* (1949), *The Country Girl* (1950), and *The Flowering Peach* (1954).

odeum \ō-'dē-əm\ Comparatively small, often semicircular roofed theater of ancient Greece and Rome used for musical performances. One still in use was built by Herodes Atticus at the base of the Athenian Acropolis (AD 161). Odea were constructed in most cities of the Roman empire for use as assembly halls as well as for performances. See also amphitheater.

Odin \'ō-din\ *or* **Wotan** \'vō-ˌtän\ One of the principal Norse gods. A war god from earliest times, Odin appeared in Scandinavian heroic literature as the protector of heroes. Fallen warriors were believed to join him in Valhalla. Odin was the great magician among the gods and was associated with runic writing. His eight-legged horse, Sleipnir, could gallop through the air and over the sea. Odin was usually depicted as a tall old man with a flowing beard and only one eye (the other he gave in exchange for wisdom); he wore a cloak and a wide-brimmed hat and carried a spear. The wolf and the raven were dedicated to him.

Odo of Bayeux \'ō-dō...bä-'yœ\ *or* **Earl of Kent** (b. c. 1036—d. February 1097, Palermo) Bishop of Bayeux, Normandy, and half brother of William I (the Conqueror). He fought in the Battle of Hastings and probably commissioned the Bayeux Tapestry. Made earl of Kent in 1067, he guarded southeastern England and ruled (with others) in William's absence. William imprisoned him (1082–87) for raising troops without royal permission, and he later joined a rebellion in support of Robert II. He helped organize the First Crusade and died on his way to the Holy Land.

Odoacer \ˌō-dō-'ā-sər\ *or* **Odovacar** \ˌō-dō-'vā-kər\ (b. c. 433—d. March 15, 493, Ravenna) First barbarian king of Italy (476–493). A German warrior in the Roman army, he led a revolt against the usurper Orestes (475). He was proclaimed king by his troops in 476, the date that traditionally marks the end of the Western Roman Empire. Odoacer paid homage to the Eastern emperor, Zeno, but asserted his own right to rule Italy. He conquered Dalmatia (482), defeated the Rugi (487–488), and retook Sicily from the Vandals. By attacking the Eastern Empire, he alienated Zeno, who encouraged the Ostrogothic king Theodoric to invade Italy (489). Theodoric captured almost the entire peninsula and killed Odoacer after inviting him to a banquet.

Odra River See Oder River

Odum, Howard W(ashington) (b. May 24, 1884, near Bethlehem, Ga., U.S.—d. Nov. 8, 1954, Chapel Hill, N.C.) U.S. sociologist. In 1920 Odum joined the faculty of the University of North Carolina, where he established its departments of sociology and public welfare and founded the journal *Social Forces* (1922). His scholarly focus was folk sociology, particularly of Southern blacks, for whom he urged equal opportunity. His books include *Southern Regions of the United States* (1936) and *American Regionalism* (1938, with Harry Moore).

Odysseus \ō-'di-sē-əs\ *Roman* **Ulysses** \yü-'li-sēz\ Hero of Homer's *Odyssey*. According to Homer, Odysseus was the king of Ithaca. His shrewdness, resourcefulness, and endurance enabled him to capture Troy (through the device of the Trojan horse) and endure nine years of wandering and adventures before reaching his home in Ithaca, where his wife, Penelope, and son, Telemachus, awaited him. Classical opinion was divided on whether he was an unscrupulous politician or a wise and honourable statesman. Odysseus has been one of the most frequently portrayed figures in literature, treated by numerous Greek and Roman poets and by later writers such as William Shakespeare (*Troilus and Cressida*), Níkos Kazantzákis (*The Odyssey: A Modern Sequel*), and (metaphorically) by James Joyce (*Ulysses*) and Derek Walcott (*Omeros*).

Odysseus slaying the suitors, detail of a red-figure *skyphos* from Tarquinii, c. 450 BC; in the Staatliche Museen zu Berlin, Ger.
COURTESY OF THE STAATLICHE MUSEEN ZU BERLIN, GER.

Ōe \'ō-e\ **Kenzaburō** (b. Jan. 31, 1935, Ehime prefecture, Shikoku, Japan) Japanese novelist. Ōe first attracted attention on the literary scene while still a student at the University of Tokyo. His works, written in a rough prose style that at times nearly violates the natural rhythms of Japanese, reflect his life and epitomize the rebellion of the post-World War II generation. They include *A Personal Matter* (1964), which uses the birth of an abnormal baby to investigate the problem of culturally disinherited youth; *Hiroshima Notes* (1965); and *The Silent Cry* (1967). He received the Nobel Prize for Literature in 1994.

OECD See Organization for Economic Cooperation and Development

Oedipus \'e-də-pəs, 'ē-də-pəs\ In Greek mythology, a king of Thebes who unwittingly killed his father and married his mother. In the most familiar version of the story, Laius, king of Thebes, was warned by an oracle that his son would slay him. When his wife, Jocasta, bore a son, he exposed the baby on a mountainside, but the infant Oedipus was saved by a shepherd and adopted by the king of Corinth. In early manhood, as Oedipus traveled toward Thebes, he met Laius, who provoked a quarrel; in the

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ensuing fracas, Oedipus killed him. He then rid Thebes of the destructive Sphinx by answering her riddle; as a reward he was given the throne of Thebes and the hand of the widowed queen—his mother. They had four children, including Antigone. When at last they learned the truth, Jocasta committed suicide and Oedipus blinded himself and went into exile. Oedipus has served as the hero of many tragedies, most notably Sophocles' *Oedipus Rex* and *Oedipus at Colonus*.

Oedipus complex In psychoanalytic theory, a desire for sexual involvement with the parent of the opposite sex and a sense of rivalry with the parent of the same sex. The term was introduced by Sigmund Freud in his *Interpretation of Dreams* (1899) and is derived from the mythological Oedipus, who killed his father and married his mother; its female analogue is the Electra complex. Considered a normal stage in the development of children ages three to five, it ends when the child identifies with the parent of the same sex and represses its sexual instincts. Freud believed that the process of overcoming the Oedipus complex gave rise to the superego.

Oehlenschläger \'œ-lens-ˌleg-ər**, Adam Gottlob** (b. Nov. 14, 1779, Vesterbro, Den.—d. Jan. 20, 1850, Copenhagen) Danish poet and dramatist, considered the national poet of Denmark. He became the leader of Romanticism in Danish literature with his poem *The Golden Horns* (1802). Important collections of his poetry, with several lyrical dramas, appeared in 1802 and 1805. His plays drawing on Nordic history and mythology include *Earl Haakon the Great* (1807). His most significant later work is the poetic epic *The Gods of the North* (1819), a kind of modern *Edda*.

Oenghus See Maponos

Oerter \'ör-tər**, Al(fred)** (b. Sept. 19, 1936, Astoria, N.Y., U.S.) U.S. discus thrower. He won gold medals at four consecutive Olympic Games (1956, 1960, 1964, 1968) and set world records four times between 1962 and 1964. He was the first to throw the discus over 200 ft.; he recorded his best throw (212.5 ft [64.78 m]) at the 1968 Olympics.

O'Faolain \ō-'fā-lən, ō-'fa-lən**, Sean** *orig.* **John Francis Whelan** (b. Feb. 22, 1900, Cork, County Cork, Ire.—d. April 20, 1991, Dublin) Irish writer. He became involved in anti-British activities during the Irish insurrection (1918–21) and taught (1926–33). After achieving success with his first story collection, *Midsummer Night Madness* (1932), and the novel *A Nest of Simple Folk* (1933), he wrote full-time. He is known for carefully crafted, lyrical short stories about Ireland's lower and middle classes, often examining the decline of the nationalist struggle or the oppressive provincialism of Irish Catholicism. His other works include *Bird Alone* (1936), *A Life of Daniel O'Connell* (1938), and *Vive moi!* (1964), his autobiography.

Off-Broadway Small-scale theatrical productions in New York City. The term was first used to refer to experimental plays produced on low budgets in small theatres, which provided an alternative to the commercially oriented Broadway theatres. Off-Broadway theatres grew in quality and importance after 1952, with the success of José Quintero's productions. Plays by Edward Albee, Sam Shepard, and Lanford Wilson were first produced off Broadway, as were avant-garde works by Eugène Ionesco, Samuel Beckett, and Harold Pinter. Many new plays are now staged in well-equipped Off-Broadway houses, and Off-Broadway theatre has its own set of awards, the Obies. As production costs increased, smaller and more experimental theatres emerged; these were quickly labeled Off-Off-Broadway.

Offa \'ȯ-fə\ (d. July 796) One of the most powerful kings in Anglo-Saxon England. He became king of Mercia (757–796) after seizing power during a civil war. He extended his rule over most of southern England and married his daughters to the rulers of Wessex and Northumbria. Eager to form European diplomatic ties, Offa signed a commercial treaty with Charlemagne (796) and allowed the pope to increase his control over the English church. He built Offa's Dyke to divide Mercia from Welsh lands.

Offa's Dyke Earthwork in western England. It stretches 169 mi (270 km) from the River Severn near Chepstow to the seaward end of the River Dee's estuary. It was built by Offa of Mercia to fortify the boundary between his kingdom and the lands of the Welsh; for centuries it marked the England-Wales boundary. It consisted of a plain bank (in places some 60 ft [18 m] high) and a ditch (12 ft [3.7 m] deep). Many sections remain, and a walking path now runs its length.

Offenbach \'ȯ-fən-ˌbäk**, Jacques** *orig.* **Jacob Offenbach** (b. June 20, 1819, Cologne—d. Oct. 5, 1880, Paris, France) German-born French composer. Son of a cantor, he studied at the Paris Conservatoire but had to leave for lack of funds. He first wrote theatre music as conductor of the Théâtre-Français (from 1850); in 1855 he opened his own theatre, Bouffes-Parisiens, for which he wrote many celebrated one-act works. He began writing longer operettas and had a string of hits, including *Orpheus in the Underworld* (1858), *La Belle Hélène* (1864), *La Vie Parisienne* (1866), and *The Grand Duchess of Gérolstein* (1867). Offenbach is credited with writing in a fluent, elegant style and with a highly developed sense of both characterization and satire. He spent his last three years on his only grand opera, *The Tales of Hoffmann*, which remained unfinished at his death and was first produced in 1881.

Office of Strategic Services (OSS) (1942–45) U.S. agency formed for the purpose of obtaining information about and sabotaging the military efforts of enemy nations during World War II. It was headed by William J. ("Wild Bill") Donovan (1883–1959). With some 12,000 staff, the OSS collected and analyzed information on areas of the world in which U.S. military forces were operating. It used agents inside Nazi-occupied Europe, including Berlin; carried out counterpropaganda and disinformation activities; produced analytical reports for policy makers; and staged special operations (e.g., sabotage and demolition) behind enemy lines to support guerrillas and resistance fighters. Many of its functions were later assumed by the Central Intelligence Agency.

offset printing *or* **offset lithography** *or* **litho-offset** In commercial printing, a widely used technique in which the inked image on a printing plate is imprinted on a rubber cylinder and then transferred (offset) to paper or other material. The rubber cylinder gives great flexibility, permitting printing on wood, cloth, metal, leather, and rough paper. In offset printing the matter to be printed is neither raised above the surface of the printing plate (as in letterpress printing) nor sunk below it (as in intaglio, or gravure, printing). Offset printing, a development of lithography, is based on the principle that water and grease do not mix, so that a greasy ink can be deposited on grease-treated printing areas of the plate, while nonprinting areas, which hold water, reject the ink. The offset plate is usually of zinc or aluminum or a combination of metals, with the surface treated to render it porous and then coated with a photosensitive material. Exposure to an image hardens the coating on printing areas; the coating on nonprinting areas is washed away, leaving wetted metal that will reject ink. See also xerography.

offshore bar See sandbar

O'Flaherty, Liam (b. Aug. 28, 1896, Inishmore, Aran Islands, County Galway, Ire.—d. Sept. 7, 1984, Dublin) Irish novelist and short-story writer. He abandoned his training for the priesthood and became a soldier in World War I, a migrant labourer in the Americas and the Middle East, and a revolutionary in Ireland. A leading writer of the Irish literary renaissance, he combined brutal naturalism, psychological analysis, poetry, and biting satire with an abiding respect for the Irish people. His novels include *Thy Neighbour's Wife* (1923), *The Informer* (1925; film, 1935), *Skerrett* (1932), *Famine* (1937), and *Insurrection* (1950).

Ogaden \ˌō-gə-'den\ Region, eastern Ethiopia. In the triangular wedge that juts into Somalia, it is a dry, barren plain sparsely populated by Somali-speaking nomadic pastoralists. Conquered in the late 19th century by the Ethiopian emperor Menilek II, it was invaded by Italy in 1935 and made part of Italian East Africa. Liberated in 1941, it remained under British administration until 1948. It was invaded by Somalia in 1977 and retaken by Ethiopia in 1978, with help from Cuba and the Soviet Union.

Ogata Kenzan \ō-'gä-tä-'ken-ˌzän\ *orig.* **Ogata Shinsei** (b. 1663, Kyōto, Japan—d. June 3, 1743, Edo) Japanese potter, calligrapher, and painter. Many of his designs reflect his classical Chinese and Japanese education. The *iro-e* ("colour painting") of his pottery is particularly fine, and his calligraphy, seen in his wares and paintings, was distinctive. His best-known works include a plate with a picture of a cedar grove and the *Hana-kago* ("Flower Baskets"), a watercolour hanging scroll.

Ogbomosho \ˌōg-bō-'mō-shō\ City (pop. 1995 est.: 711,900), southwestern Nigeria. Founded in the mid-17th century, it was an outpost of the Oyo empire until the Muslim Fulani conquests in the early 19th century. As a centre of resistance, the walled town attracted many Oyo refugees. Located northeast of Ibadan, it is one of Nigeria's largest urban centres. It is also a trading centre and rail junction.

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ogham \'ä-gəm\ **writing** *or* **ogam writing** *or* **ogum writing** Alphabetic script used for writing the Irish and Pictish (see Picts) languages on stone monuments, mostly c. AD 400–600. In its simplest form, it consists of four sets of strokes, or notches, each set containing five letters composed of from one to five strokes, thus creating 20 letters. A fifth set of five symbols, called *forfeda* ("extra letters"), was probably a later development. Most inscriptions are short and consist only of names. Of the more than 400 inscriptions known, about 330 are from Ireland.

Ogilvy \'ō-gəl-vē**, David M(ackenzie)** (b. June 23, 1911, West Horsley, Surrey, Eng.—d. July 21, 1999, near Bonnes, France) British advertising executive. After an Oxford education, he worked as an apprentice chef and stove salesman before taking a job in an advertising agency. He spent a year in the U.S. learning American advertising techniques. In 1948, with Anderson Hewitt, he formed Hewitt, Ogilvy, Benson & Mather, which became one of the world's largest advertising firms. He is noted for reminding his colleagues that "the consumer is not a moron," and his ads for brands such as Schweppes and Rolls-Royce were admired for their creativity.

Oglethorpe, James (Edward) (b. Dec. 22, 1696, London, Eng.—d. June 30/July 1, 1785, Cranham Hall, Essex, Eng.) English army officer. After serving in the British army from 1712 to 1722, he entered Parliament, where he became interested in prison reform. In 1732 he secured a charter for a colony in what became Georgia, where debtors could start a new life and persecuted Protestants could practice freely. He accompanied the first settlers to found Savannah (1733) and led the defense of the territory against attacks by Spain (1739, 1742). He returned to England in 1743.

Ögödei \'ō-gə-ˌdā\ (b. 1185, Mongolia—d. 1241, Karakorum) Son of Genghis Khan who succeeded his father in 1229 and greatly expanded the Mongol empire. He established his headquarters in central Mongolia and built the capital city of Karakorum. Like his father, he carried out simultaneous campaigns by relying on generals who acted independently but were subject to his orders. Allying himself with China's Southern Song dynasty, Ögödei attacked the Jüchen dynasty in northern China, taking its capital in 1234. Meanwhile, his nephew Batu defeated Russia while other generals were attacking Iran and Iraq. Only Ögödei's death (during a drinking bout) prevented the Mongols from invading western Europe. See also Golden Horde; Kublai Khan; Möngke.

Ogooué River *or* **Ogowe** \ˌō-gō-'wā\ **River** River, west-central Africa, mainly in Gabon. It rises in the Republic of the Congo and flows northwest, then west, emptying into the Atlantic Ocean south of Port-Gentil after a course of 750 mi (1,200 km). It is navigable for less than one-third of its length but is heavily used for shipping goods, including lumber, to the coast.

ogum writing see ogham writing

O'Hara, John (Henry) (b. Jan. 31, 1905, Pottsville, Pa., U.S.—d. April 11, 1970, Princeton, N.J.) U.S. novelist and short-story writer. O'Hara developed the objective, straightforward style he used in his fiction while working as a critic and reporter in New York City. His works stand as a social history of upwardly mobile Americans of the 1920s through the 1940s. Among them are the popular novels *Appointment in Samarra* (1934); *Butterfield 8* (1935; film, 1960); *Pal Joey* (1940), adapted as a musical; *Ten North Frederick* (1955; film, 1958); and *From the Terrace* (1958; film, 1960).

O'Higgins, Bernardo (b. probably Aug. 20, 1776/78, Chillán, Chile, Viceroyalty of La Plata—d. October 1842, Peru) South American revolutionary leader and first Chilean head of state (1817–23). The illegitimate son of a Spanish officer of Irish origin, he was educated in Peru, Spain, and England, where his Chilean nationalism was awakened. When Napoleon invaded Spain (1808) and Spanish control of Chile relaxed, he became a member of Chile's new congress. He led the defensive forces when Chile was invaded by royalists from Peru in 1814; defeated, he fled to Argentina. He returned in 1817 with José de San Martín and defeated the Spanish. Elected supreme director of Chile, he established a working governmental organization, but his reforms antagonized conservatives and he resigned.

Ohio State (pop., 2000: 11,353,140), U.S., north-central region. Bordered by Michigan, Pennsylvania, West Virginia, Kentucky, and Indiana, it covers 44,828 sq mi (116,104 sq km). Its capital is Columbus. Lake Erie is on its northern boundary; the Ohio River forms part of its southeastern and southern boundary. Ohio was originally inhabited by prehistoric Hopewell mound builders, who disappeared c. AD 400. The earliest European explorers found the area occupied by Miami, Shawnee, and other Indian peoples. The region was ceded to Britain by France after the French and Indian War. In 1803 it became the 17th state and the first state carved out of the Northwest Territory (see Northwest Ordinances). During the 19th century, it became one of the first great industrial states because of its location, transport facilities, and natural resources, including coal, petroleum, and natural gas. Although manufacturing is its most important economic activity, nearly two-thirds of the state is still farmland. It was the birthplace or residence of eight U.S. presidents—William H. Harrison, Ulysses S. Grant, Rutherford B. Hayes, James Garfield, Benjamin Harrison, William McKinley, William H. Taft, and Warren G. Harding. Its major cities include Columbus, Cleveland, Cincinnati, Toledo, Akron, and Dayton.

Ohio Co. Organization of Englishmen and Virginia colonists, established in 1748 to promote trade with American Indians and secure British control of the Ohio River valley for settlement. Activity in the area claimed by France led to the last French and Indian War (1754). A separate organization, the Ohio Co. of Associates (1786), founded Marietta, Ohio, the first permanent settlement north of the Ohio River.

Ohio Idea Proposal to redeem American Civil War bonds in paper money instead of gold. The plan, part of the debate between hard-money advocates and soft-money or Greenback movement supporters after the Civil War, was sponsored by George Pendleton and was especially popular in the Midwest. Endorsed by the Democratic Party in 1868, it died with the election of Ulysses S. Grant and passage of the Public Credit Act (1869), which provided for payment of government obligations in gold.

Ohio River Major river, eastern central U.S. Formed by the confluence of the Allegheny and Monongahela rivers, it flows northwest out of Pennsylvania, and west and southwest to form the state boundaries of Ohio–West Virginia, Ohio-Kentucky, Indiana-Kentucky, and Illinois-Kentucky. After a course of 975 mi (1,569 km), it empties into the Mississippi River at Cairo, Ill. It is navigable and has supported commerce since the earliest settlements. The river's strategic importance was recognized by the 1750s. After the French and Indian War, the English controlled the territory around the river.

Ohio State University U.S. state university system consisting of a main campus in Columbus and branches in five other locations. It was established in 1870 as a land-grant institution. The main campus is a comprehensive research institution, with colleges of agriculture, dentistry, law, medicine, and veterinary medicine. Research facilities include a transportation research centre, a freshwater laboratory, a supercomputer centre, and a polar research centre.

Ohm, Georg Simon (b. March 16, 1789, Erlangen, Bavaria—d. July 6, 1854, Munich) German physicist. While teaching mathematics at the Jesuits' College in Cologne (1817–27), he discovered that the flow of electric current through a conductor is directly proportional to the potential difference, or voltage, and inversely proportional to the resistance. He resigned when his theory (Ohm's law) was coldly received. His theory soon came to be widely recognized, and he subsequently taught in Nürnberg (1833–49) and Munich (1849–54). The physical unit measuring electrical resistance was named for him.

Ohm, detail of a lithograph
HISTORIA-PHOTO

Ohm's law Relationship between the potential difference (voltage), electric current, and resistance in an electric circuit. In 1827 Georg Simon Ohm discovered that at constant temperature, the current I in a circuit is directly proportional to the potential difference V, and inversely proportional to the resistance R, or $I = V/R$. Resistance is generally measured in ohms (Ω). Ohm's law may also be expressed in terms of the electromotive force E of an electric energy source, such as a battery, or $E = IR$. In an alternating-current circuit, when the combination of resistance and reactance, called impedance Z, is constant, Ohm's law is applicable and $V/I = Z$.

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oil Any greasy substance liquid at room temperature and insoluble in water. It may be a fixed (nonvolatile) oil, an ESSENTIAL OIL, or a mineral oil (see PETROLEUM). Fixed oils and FATS (derived from animals and plants) have the same chemical composition—both are ESTERS of GLYCEROL and FATTY ACIDS. These oils have a variety of industrial and food uses. Linseed, tung, and other drying oils are highly unsaturated (see SATURATION); these and large quantities of soybean, sunflower, and safflower oils (also constituents of foods) are used in paints and varnishes. When exposed to air they absorb oxygen and polymerize (see POLYMERIZATION), forming a tough coating. Some specialty oils and oil derivatives are also used in leather dressing and textile manufacture.

oil-drop experiment See MILLIKAN OIL-DROP EXPERIMENT

oil painting Painting in oil colours, a medium consisting of pigments suspended in drying oils. Oil paint enables both fusion of tones and crisp effects and is unsurpassed for textural variation. The standard consistency of oil paint is a smooth, buttery paste. It is applied with brushes or a thin palette knife, usually onto a stretched linen canvas. Finished oil paintings are often coated with varnish. Oil as a painting medium is recorded as early as the 11th century, though the practice of easel painting with oil colours stems directly from 15th-century techniques of painting with tempera (see TEMPERA PAINTING). In the 16th century oil colour emerged as the basic painting material in Venice; it has been the most widespread medium for easel paintings ever since.

oil seal *or* **shaft seal** In MACHINES, a device that prevents the passage of fluids along a rotating shaft. Seals are necessary when a shaft extends from a housing (enclosure) containing oil, such as a pump or a gearbox. Leather, synthetic rubber, and silicones are among the materials used for the sealing ring. See also BEARING.

oil shale Any fine-grained SEDIMENTARY ROCK that contains solid organic matter (KEROGEN) and yields significant quantities of oil when heated. This SHALE OIL is a potentially valuable FOSSIL FUEL, but the present methods of mining and refining it are expensive, damage the land, pollute the water, and produce carcinogenic wastes. Thus, oil shale will probably not be exploited on a wide scale until other petroleum resources have been nearly depleted. Estonia, China, and Brazil have facilities for producing relatively limited quantities, and the U.S. government operates an experimental plant in Colorado.

Oise \'wäz\ **River** River, northern France. It is formed by the confluence of two streams, one rising near Chimay in Belgium and the other near Rocroi in France. Flowing southwest into the SEINE, the Oise is 188 mi (302 km) long. It is a link in the canal system between the Seine and the canals of northern France.

Oisín See OSSIAN

Oistrakh \'ȯi-ˌsträk**, David (Fyodorovich)** (b. Sept. 30, 1908, Odessa, Ukraine, Russian Empire—d. Oct. 24, 1974, Amsterdam, Neth.) Russian violinist. After his debut in 1928, he entered and won a number of prestigious competitions. He performed for Soviet troops at the front during World War II and made debuts in the West in the 1950s. DMITRY SHOSTAKOVICH dedicated both his violin concertos to him. Oistrakh taught at the Moscow Conservatory from 1934; one of his most distinguished students was his son Igor (b. 1931), who himself joined the conservatory's faculty in 1958.

Ojibwa \ō-'jib-wā\ *or* **Chippewa** \'chi-pə-ˌwȯ\ North American PLAINS INDIAN people living mostly in southern Canada and the north-central U.S. Ojibwa is an Algonquian language. The people's name, spelled Ojibwe in Canada and given as Chippewa in official U.S. documents, is derived from an Algonquian word *ojib-ubway*, meaning "puckering," probably referring to a type of moccasin. They call themselves Anishinaabe or Anishinabek, meaning "Spontaneously Created" or "Original Man." They formerly inhabited a region north of the Great Lakes but during the 17th–18th centuries moved west to what is now northern Minnesota. Each Ojibwa tribe was divided into migratory bands. In the autumn, bands separated into family units for hunting; in summer, families gathered at fishing sites. They grew corn and collected wild rice. The Midewiwin, or Grand Medicine Society, was the major Ojibwa religious organization. The Ojibwa are one of the largest Native American groups in North America today, numbering about 50,000 in the U.S. and more than 100,000 in Canada. They are closely related to the Ottawa and Potawatomi.

Ojukwu \ō-'jük-wü**, Odumegwu** (b. Nov. 4, 1933, Nnewi, Nigeria) Governor of Eastern Region, Nigeria (1966–67), and head of the secessionist state of BIAFRA (1967–70). A member of the IGBO, Ojukwu was educated at Oxford University. He was appointed head of the traditional Igbo homelands in the east following the overthrow of Nigeria's civilian government by Igbo military leaders. He stayed on in that capacity even after members of the opposition HAUSA and YORUBA staged a successful countercoup. Mounting secessionist pressures compelled him to declare the Eastern Region an independent state in 1967. Following the Biafra conflict he fled to Côte d'Ivoire; he returned to Nigeria in 1982.

Oka \ō-'kä\ **River** River, western RUSSIA. The largest right-bank tributary of the VOLGA RIVER, it flows 932 mi (1,500 km) north to Kaluga, then east to join the Volga at NIZHNY NOVGOROD. Navigable for most of its length, except during winter, it is an important trade artery for lumber and grain.

okapi \ō-'kä-pē\ RUMINANT species (*Okapia johnstoni*) in the GIRAFFE family that lives alone in Congo rain forests, eating leaves and fruit. Its neck and legs are proportionately shorter than the giraffe's, and females, which are larger than males, stand about 5 ft (1.5 m) at the shoulder. The sleek coat is deep brown on the front of the body; the upper legs are black-and-white-striped, and the lower legs are white, with black rings above the hooves. The male's short horns are covered with skin except at the tips.

Okapi (*Okapia johnstoni*)
KENNETH W. FINK—ROOT RESOURCES

Okavango \ˌō-kä-'väŋ-gō\ **River** *in Angola* **Cubango River** River, southwest-central Africa. It is the fourth longest river system in the region. Rising in central Angola, it forms a section of the boundary between Angola and Namibia. It empties into the Okavango Swamp, a large wetland north of Lake NGAMI in northern Botswana, after a course of about 1,000 mi (1,600 km). It is unnavigable except for small craft, and its banks are sparsely settled; a major problem for inhabitants is control of the TSETSE FLY. The Moremi Wildlife Reserve in the northeastern corner of the swamp teems with wildlife.

Okeechobee \ˌō-kə-'chō-bē**, Lake** Lake, southeastern Florida, U.S. It is the third largest freshwater lake wholly within the country. It drains to the sea through the EVERGLADES. It is a remnant of the prehistoric Pamlico Sea, and its name means "Big Water" in the language of the Hitchiti Indians. There is a Seminole reservation on the lake's northwestern shore.

O'Keeffe, Georgia (b. Nov. 15, 1887, near Sun Prairie, Wis., U.S.—d. March 6, 1986, Santa Fe, N.M.) U.S. painter. She studied art in Chicago and New York City, where she met and married the photographer ALFRED STIEGLITZ. By the early 1920s, her highly individualistic painting style had emerged, as typified by such works as *Black Iris* (1926). Her subjects were often enlarged views of the skulls and other bones of animals, flowers and plant organs, shells, rocks, mountains, and other natural forms. Her mysteriously suggestive images of bones and flowers set against a perspectiveless space have inspired a variety of erotic, psychological, and symbolic interpretations. Her later works celebrate the clear skies and desert landscapes of New Mexico, where she moved after her

"Near Abiquiu, New Mexico," oil on canvas by Georgia O'Keeffe, 1930; in the Metropolitan Museum of Art, New York City
THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, ALFRED STIEGLITZ COLLECTION, 1963 (63.204), REPRODUCED BY PERMISSION OF THE ESTATE OF GEORGIA O'KEEFFE, COPYRIGHT 1984/85 BY THE METROPOLITAN MUSEUM OF ART; PHOTOGRAPH BY MALCOLM VARON

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husband's death in 1946. She is regarded by critics as one of the most original and important American artists, and her works are highly popular among the general public.

Okefenokee \ˌō-kə-fə-ˈnō-kē\ **Swamp** Swamp and wildlife refuge, southeastern Georgia and northeastern Florida, U.S. It has an area of more than 600 sq mi (1,550 sq km). Located about 50 mi (80 km) inland from the Atlantic coast, it is bounded by the low, sandy Trail Ridge, which prevents direct drainage into the Atlantic. It has diverse and abundant wildlife. Exotic flowers, such as rare orchids, abound. In 1937 a large area of the swamp, almost all in Georgia, was made the Okefenokee National Wildlife Refuge.

Okhotsk \ə-ˈkȯtsk**, Sea of** Arm of the northwestern Pacific Ocean. Bounded by the Siberian coast, the Kamchatka Peninsula and the Kuril Islands, Hokkaido, and Sakhalin Island, it covers 611,000 sq mi (1,580,000 sq km). It connects the ports of the Russian Far East. Ice floes impede navigation in winter, and dense fog is a hindrance during the summer.

Okinawa \ˌō-kē-ˈnä-wä\ Island of Japan, located in the Ryukyu archipelago, in the East China Sea. The largest island in the Ryukyu chain, it is about 70 mi (112 km) long and 7 mi (11 km) wide, with an area of 463 sq mi (1,199 sq km). It was the site of severe fighting between the U.S. and Japan in World War II. In April 1945 U.S. troops made an amphibious landing on Okinawa, which was heavily defended by the Japanese. In a three-month-long campaign, both sides sustained heavy casualties before U.S. forces gained control of the island. In 1972 the United States returned jurisdiction over Okinawa to Japan, though U.S. military installations remained.

Oklahoma State (pop., 2000: 3,450,654), southwest-central U.S. Bordered by Colorado, Kansas, Missouri, Arkansas, Texas, and New Mexico, it covers 69,898 sq mi (181,035 sq km). Its capital is Oklahoma City. The Red River forms its southern boundary; the Arkansas River flows across northeastern Oklahoma. Its highest point is Black Mesa (4,973 ft [1,516 m]), located in the Panhandle. Evidence of inhabitation by the Clovis and Folsom cultures 15,000–10,000 years ago has been found. Until the expedition of Francisco Vázquez de Coronado in 1541, the area was home to representatives of at least three major Indian language groups. Spanish control of the area lasted until 1800, when it passed to the French. In 1803 the area became part of the U.S. with the Louisiana Purchase. In 1828 the U.S. Congress reserved Oklahoma for settlement by Indians, and it became known as Indian Territory. In 1890 the western part was organized as Oklahoma Territory. The two were merged and admitted to the union as the 46th state in 1907. Cattle raising and farming are the mainstays of the economy. Mineral products include natural gas, petroleum, coal, and stone. The state's heritage is reflected in Indian and cowboy museums. A barge system links the state's second major city, Tulsa, to the Gulf of Mexico.

Oklahoma City City (pop., 2000: 506,132), capital of Oklahoma, U.S. Settled during the Oklahoma land rush in 1889, it was incorporated as a city in 1890 and became the state capital in 1910. It expanded rapidly after the discovery of petroleum in the area in 1928. The largest city in the state and its main commercial, financial, industrial, and transportation centre, it is the chief marketing and processing point for the livestock industry. It is home to the National Cowboy Hall of Fame, Myriad Gardens, and an annual rodeo competition. In 1995 it was the site of a deadly act of domestic terrorism, when the Alfred P. Murrah Federal Building was bombed, killing 168 people and injuring 500.

okra Herbaceous, hairy, annual plant (*Hibiscus esculentus* or *Abelmoschus esculentus*), of the mallow family, grown for its edible fruit. Okra leaves are deeply notched; flowers are yellow with a crimson centre. The fruit, or pod, is a tapering, 10-angled capsule 4–10 in. (10–25 cm) long. Only the tender, unripe fruit is eaten; it is prepared in a number of ways and is a defining ingredient of the gumbos of the southern U.S. Because of its large amount of mucilage (a gelatinous substance), okra is used to thicken broths. In some countries the seeds are used as a substitute for coffee.

Okra (*Hibiscus esculentus*, or *Abelmoschus esculentus*).
DEREK FELL

Oktoberfest Annual festival in Munich, Germany, lasting two weeks and ending on the first Sunday of October. It began in 1810 as a horse race celebrating the wedding of the crown prince of Bavaria, later King Louis I (1786–1868). The race was soon combined with the state agricultural fair, and food and drink were offered. In the late 20th century the Munich breweries celebrated Oktoberfest by setting up large temporary beer halls, each seating 3,000–5,000 people, and hiring bands to entertain the crowds as they ate and drank. Total beer consumption during the festival exceeds a million gallons.

Ōkubo Toshimichi \ˈō-kù-bō-ˌtō-shē-ˈmē-chē\ (b. Sept. 26, 1830, Kagoshima, Japan—d. May 14, 1878, Tokyo) Japanese samurai leader from the domain of Satsuma who, with Saigō Takamori, arranged an alliance with the domain of Chōshū to work for the overthrow of the Tokugawa shogunate (see Tokugawa period) and the restoration of the emperor as head of government. After the Meiji Restoration of 1868, Ōkubo became a dominant figure in the new government. He traveled to the West and returned convinced that Japan needed rapid economic development and modernization to survive. He supported the establishment of technical schools, loans to private businesses, and government-sponsored factory development. In 1873 he argued against those who favoured invading Korea and prevailed. He was assassinated in 1878 by discontented samurai. See also Kido Takayoshi; Meiji period.

Ōkuma Shigenobu \ˈō-kù-mä-ˌshē-ge-ˈnō-bù\ (b. March 11, 1838, Saga, Japan—d. Jan. 10, 1922, Tokyo) Japanese politician of the Meiji period who twice served as prime minister. His initial contribution to the new government was to oversee the reorganization of Japan's fiscal system. Later, after making radical proposals for a new Japanese constitution and exposing corruption in proposed sales of government property, he was forced out of government. In 1882 he formed the Rikken Kaishintō ("Progressive Party"), which favoured English parliamentary government. With Itagaki Taisuke he created a new party in 1898, the Kenseitō ("Constitutional Party"). They formed a short-lived government with Ōkuma as prime minister. Ōkuma's second tenure as prime minister (1914–16) was more successful. He is also remembered as the founder of Waseda University (1882). See also Meiji Constitution.

Okumura Masanobu \ˌō-kù-ˈmůr-ä-ˌmä-sä-ˈnō-bù\ *or* **Genpachi** \gen-ˈpä-chē\ *orig.* **Okumura Shinmyō** (b. 1686, Edo, Japan—d. 1764/68, Edo) Japanese painter and publisher of illustrated books. His style is noted for its vividness and graceful, restrained lines. He was one of the first Japanese artists to adopt Western perspective, to which he was introduced by Chinese prints. He produced large-scale prints depicting scenes such as the insides of theatres and stores. Such prints were called *uki-e* ("looming picture") for their foreshortened perspective. He is also said to have founded the format of *habahiro hashira-e*, or wide, vertical prints.

Ōkuninushi \ˈō-kù-nē-ˈnù-shē\ Central hero in the mythology of the Izumo branch of Shintō in Japan. Ōkuninushi built the world with the help of the dwarf deity Sukunahikona, and he ruled Izumo until the appearance of the divine grandchild, Ninigi. In modern Japanese folk belief, Ōkuninushi is a god who heals and who makes marriages happy.

Olaf I Tryggvason \ˈō-läf-ˈtrœg-və-sȯn\ (b. c. 964—d. c. 1000) Viking king of Norway (995–c. 1000). The son of a Norwegian chieftain, he joined Viking attacks on England in 991 and 994. He returned to Norway and was accepted as king on the death of Haakon the Great in 995. Olaf imposed Christianity on the Norwegian coast but had little influence in the interior. His missionaries introduced Christianity to the Shetland, Faroe, and Orkney islands and to Iceland and Greenland. He was killed in the Battle of Svolder, which is celebrated in medieval Scandinavian poetry.

Olaf II Haraldsson \hä-räl-sȯn\ *or* **Saint Olaf** (b. c. 995—d. July 29, 1030, Stiklestad, Nor.; feast day July 29) King of Norway (1016–28). A Viking warrior, he fought against the English in 1009–11 but assisted Ethelred II against the Danes in 1013. He returned to Norway after his conversion to Christianity and gained control over the country by 1016. Olaf sent missionaries throughout his realm, and his religious code (1024) established the Church of Norway. He was driven out of Norway by Canute the Great (1028) and was killed trying to reconquer the country two years later. He became a national hero and the patron saint of Norway.

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Olaf V *Norwegian in full* **Olav Alexander Edward Christian Frederik** (b. July 2, 1903, Appleton House, near Sandringham, Norfolk, Eng.—d. Jan. 17, 1991, Oslo, Nor.) King of Norway (1957–91). Son of King Haakon VII, Olaf became a celebrated sportsman, winning the gold medal in yachting at the 1928 Olympics. In World War II he lived in exile with his family in England and was named head of the Norwegian armed forces in 1944. From 1955 he served as regent for his father, whom he succeeded as king in 1957. Like other constitutional monarchs, Olaf's duties were largely ceremonial.

Olaf V, 1973
KNUDSENS FOTOSENTER

Olajuwon \ə-'lä-zhù-ˌwän\, Hakeem (Abdul) (b. Jan. 21, 1963, Lagos, Nigeria) Nigerian-born U.S. basketball player. He attended the University of Houston and led its team to the NCAA finals in 1983 and 1984. In 1994 the 7-ft (2.13-m) Olajuwan led the Houston Rockets to the NBA championship. Nicknamed "the Dream," he holds the all-time record for blocked shots (3,830) and finished his career with 26,946 points and 13,748 rebounds.

Olbers's paradox Paradox of why the sky is dark at night. If the universe is endless and uniformly populated with luminous stars, every line of sight must end at the surface of a star and the night sky should be bright with no dark spaces between stars. This paradox is widely attributed to Heinrich Wilhelm Olbers (1758–1840), who discussed it in 1823, though Johannes Kepler first advanced the problem in 1610 as an argument against the notion of a limitless universe with infinite stars. The paradox has since been resolved: we can see no farther than the light-travel distance within the lifetime of the universe, and light becomes redshifted to invisibility (see redshift).

Olbia \'ōl-byä\ *formerly* **Terranova Pausania** Town (pop., 2001 prelim.: 40,746), northeastern Sardinia, Italy. Originally a Greek colony, it passed to the Romans and was the site of a Roman victory over the Carthaginian general Hanno in 259 BC. It was rebuilt by Pisan colonists in 1198 and named Terranova Pausania. Renamed Olbia in 1939, it is the main passenger port for connections with the Italian mainland. It has Phoenician and Roman ruins.

Old Believers Russian dissenters who refused to accept liturgical reforms imposed on the Russian Orthodox Church by Nikon in 1652–58. Numbering in the millions in the 17th century, the Old Believers endured persecution for years, and several of their leaders were executed. They split into a variety of sects, of which the two main groups were the Popovtsy (priestly sects) and Bezpopovtsy (priestless sects). In 1971 the council of the Russian Orthodox Church rescinded all the anathemas of the 17th century and recognized the full validity of the old rites.

Old Catholic church Any of a group of Western Catholic churches that separated from Rome after the First Vatican Council promulgated the doctrine of papal infallibility (1869–70). Old Catholic churches in the Netherlands, Germany, Switzerland, Austria, Poland, and elsewhere joined together in 1889 to form the Union of Utrecht. The Old Catholics accept the Bible, the Apostles' and Nicene creeds, and the seven sacraments. Their chief authority in church government is the conference of bishops. They have long used the vernacular in public worship; confession to a priest is not obligatory, and in some Old Catholic churches the celibacy of the clergy is optional.

Old Church Slavonic language *or* **Old Church Slavic language** Oldest attested Slavic language, known from a small corpus of 10th- or 11th-century manuscripts, most written in the Glagolitic alphabet (see Cyrillic alphabet). The Old Church Slavonic documents, all translations from Christian ecclesiastical texts, resulted from the mission to the Moravian Slavs of Saints Cyril and Methodius, though all but one of the surviving manuscripts were actually copied in South Slavic-speaking areas. Beginning in the 11th century, the influence of the vernacular languages in cultural focal areas (Serbia, Bulgaria-Macedonia, Ukraine, and Russia) led to regional variations in Church Slavonic. It remained the literary language of Eastern Orthodoxy in South Slavic and East Slavic lands into modern times and is still the liturgical language of Slavic Orthodoxy and the Slavic Eastern rite church.

Old English *or* **Anglo-Saxon** Language spoken and written in England before AD 1100. It belongs to the Anglo-Frisian group of Germanic languages. Four dialects are known: Northumbrian (in northern England and southeastern Scotland), Mercian (central England), Kentish (southeastern England), and West Saxon (southern and southwestern England). Mercian and Northumbrian are often called the Anglian dialects. Most extant Old English writings are in the West Saxon dialect. The great epic poem of Old English is *Beowulf*; the first period of extensive literary activity occurred in the 9th century. Old English had three genders (masculine, feminine, neuter) for nouns and adjectives; nouns, pronouns, and adjectives were also inflected for case. Old English had a greater proportion of strong (irregular) verbs than does Modern English, and its vocabulary was more heavily Germanic. See also Middle English; English language.

Old English script See black letter script

Old English sheepdog Shaggy working dog developed in early 18th-century England and used primarily to drive sheep and cattle to market. It has a shuffling, bearlike gait and a dense, solid-coloured or white-marked gray or blue-gray coat. It stands 21–26 in. (53–66 cm) tall and weighs over 55 lb (25 kg). Its long, dense, weather-resistant coat covers the eyes but does not obscure vision. The tail is usually removed soon after birth.

Old Farmer's Almanac See Farmer's Almanac

Old Ironsides See USS Constitution

Old Norse language Classical Germanic language used c. 1150–1350, the literary language of the Icelandic sagas, skaldic poetry, and Eddas. The terms Old Norse and Old Icelandic are sometimes used interchangeably because Icelandic records of this period are more plentiful and of greater literary value than those in the other Scandinavian languages, but Old Norse also embraces the ancestors of modern Norwegian, Danish, Swedish, and Faroese.

Old Point Comfort Historic point and part of the city of Hampton, southeastern Virginia, U.S. It is located at the entrance to Hampton Roads, opposite Norfolk. Named by the colonists of Jamestown in 1607, it has been the site of fortifications, including Fort George and Fort Monroe, since 1609. The latter was a Union base during the American Civil War. It was a popular seaside resort in the 19th and early 20th centuries.

Old Testament Sacred scriptures of Judaism and, with the New Testament, of Christianity. Written almost entirely in the Hebrew language between 1200 and 100 BC, the Old Testament (also called the Hebrew Bible or Tanakh) is an account of God's dealings with the Hebrews as his chosen people. In the Hebrew Bible, the first six books tell how the Israelites became a people and settled in the Promised Land, the following seven books describe the development of Israel's monarchy and the messages of the prophets, and the last 11 books contain poetry, theology, and some additional historical works. Christians divided some of the original Hebrew books into two or more parts, specifically, Samuel, Kings, and Chronicles (two parts each), Ezra-Nehemiah (two separate books), and the Minor Prophets (12 separate books). The content of the Old Testament varies according to religious tradition, the Jewish, Roman Catholic, and Protestant canons all differing from each other as to which books they include. See also Apocrypha, Bible.

Old Vic London theatre company. The company's theatre opened in 1818 as the Royal Coburg; renamed the Royal Victoria in 1833, it became popularly known as the Old Vic. The company, managed by Lilian Baylis, began a regular Shakespeare season in 1914. From the 1930s it was noted for its memorable productions of Shakespeare's plays and other classics, with actors such as John Gielgud, Laurence Olivier, and Ralph Richardson. The company was dissolved in 1963 and formed the nucleus of the new National Theatre, which performed at the Old Vic theatre until moving to a new building in 1976.

Old World monkey Any of some 100 species of monkeys (the catarrhine ["downward-nosed"] monkeys) that live in Africa, on the Red Sea coast of Arabia, and in Asia from Afghanistan to Indonesia. Catarrhines generally have a narrow nose, a narrow septum, close-set nostrils directed forward or down, bony ear passages, two premolars in each half of each

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jaw, a nonprehensile tail (if any), and hard patches of bare skin (ischial callosities) on the buttocks. Zoologists gather all Old World monkeys into a single family, Cercopithecidae. There are two subfamilies: Cercopithecinae, or monkeys with cheek pouches (MACAQUES, BABOONS, VERVETS, MANDRILLS, and others); and Colobinae, or leaf monkeys (langurs, COLOBUS MONKEYS, PROBOSCIS MONKEYS, and others). See also NEW WORLD MONKEY.

Oldenbarnevelt \ˌōl-dən-ˈbär-nə-vəlt**, Johan van** (b. Sept. 14, 1547, Amersfoort, Spanish Netherlands—d. May 13, 1619, The Hague, Neth.) Dutch statesman and a founding father of Dutch independence. A lawyer in the province of Holland, he helped WILLIAM I negotiate the Union of Utrecht (1579). Appointed "great pensionary" of Holland, he mobilized Dutch resources for the military goals of MAURICE OF NASSAU. As foreign secretary of the Union's seven provinces, he negotiated a triple alliance with France and England against Spain (1596). He later concluded the Twelve Years' Truce with Spain (1609), which reaffirmed Holland's dominant role in the republic. In 1617 he sided with the moderate Arminians in religious strife against the stricter Calvinists (known as Counter-Remonstrants) and Prince Maurice; he was arrested in 1618, convicted of religious subversion, and beheaded.

Oldenburg Former German state, since 1946 part of Lower SAXONY, Germany. It was held by the counts of Oldenburg from c. 1100 until 1667, when it passed to Denmark. In the late 18th century it was ruled by the bishop of Lübeck, who was made duke of Oldenburg by JOSEPH II, the Holy Roman emperor. It became a grand duchy in the early 19th century and took Prussia's side in the Austro-Prussian War of 1866. It joined the German Empire in 1871. Its last grand duke abdicated in 1918. The 17th-century grand-ducal palace in the city of Oldenburg (pop., 2002 est.: 155,908) is now a state museum of art and culture.

Oldenburg, Claes (Thure) (b. Jan. 28, 1929, Stockholm, Swed.) Swedish-born U.S. POP ART sculptor. The son of a consular official, he spent part of his early life in the U.S. He graduated from Yale University and attended the Art Institute of Chicago before doing freelance illustrations for magazines. He turned to sculpture after moving to New York City in 1956. Like other practitioners of Pop art, he chose banal subjects from consumer culture, but for "soft sculptures" such as *Giant Clothespin* (1976) and *Giant Soft Shuttlecock* (1995) he chose subjects with close human associations. His frequent use of soft, yielding vinyl gave the objects human, often sexual overtones.

Oldowan \ˈäl-də-wən\ **industry** STONE-TOOL INDUSTRY of the early PALEOLITHIC (beginning c. 2.5 million years ago) characterized by crudely worked pebble tools. Oldowan tools, made of quartz, quartzite, or basalt, are chipped in two directions to form simple, rough implements for chopping, scraping, or cutting. The industry is associated with early hominids, such as *HOMO HABILIS* and possibly also *AUSTRALOPITHECUS robustus*, and has been found at OLDUVAI GORGE (from which its name derives), Lake Turkana (see LAKE TURKANA REMAINS), and the Afar region of Ethiopia. Oldowan tools were made for nearly 1.5 million years before the emergence of the ACHEULEAN INDUSTRY.

Olduvai \ˈōl-də-ˌvī, ˈōl-də-ˌwā\ **Gorge** Archaeological site on the eastern Serengeti Plain, northern Tanzania. It is a steep-sided ravine about 30 mi (48 km) long and 295 ft (90 m) deep. Deposits exposed in the sides of the gorge cover a time span from c. 2,100,000 to 15,000 years ago and have yielded the remains of more than 50 HOMININS as well as the most complete sequence of stone tool industries. The site first came to public notice in 1959 when Louis and Mary Leakey (see LEAKEY FAMILY) uncovered the first specimens of *Paranthropus*, a hominin related to *AUSTRALOPITHECUS*. Remains of *HOMO HABILIS*, *HOMO ERECTUS*, and *HOMO SAPIENS* have since been found. These discoveries have strengthened the argument that the human lineage originated in Africa. See also STONE TOOL INDUSTRY; OLDOWAN INDUSTRY.

oleander \ˈō-lē-ˌan-dər\ Any of the ornamental evergreen shrubs of the genus *Nerium* (DOGBANE FAMILY), which have poisonous milky juice. Numerous varieties of flower colour in the common oleander, or rosebay (*N. oleander*), have been introduced from greenhouse culture and are grown outdoors in warmer climates. All parts of the plant are very toxic if eaten, and contact with them may cause skin irritation.

oleaster family \ˈō-lē-ˌas-tər\ Family Elaeagnaceae, composed of three genera of hardy shrubs and small trees, found in the Northern Hemisphere, especially in steppe and coastal regions. The plants' tiny, distinctive scales give them a silvery or rust-coloured sheen. Many members of the family perform NITROGEN FIXATION. The berries of several species are edible. Ornamental shrubs in this family include buffalo berry or silverberry (*Shepherdia argentea*), oleaster or Russian olive (*Elaeagnus angustifolia*), and sea buckthorn (*Hippophae rhamnoides*).

olefin \ˈō-lə-fən\ *or* **alkene** Any unsaturated HYDROCARBON containing one or more pairs of carbon atoms linked by a double bond (see COVALENT BOND, SATURATION). Olefins may be classified by whether the double bond is in a ring (cyclic) or a chain (acyclic, or aliphatic) or by the number of double bonds (monoolefin, diolefin, etc.). Rare in nature, olefins are obtained by the cracking of PETROLEUM fractions at high temperatures. The simplest ones (ETHYLENE, propylene, butylene, butadiene, and isoprene) are the basis of the PETROCHEMICALS industry. They react by adding other chemical agents at the double bond to form derivatives or POLYMERS.

Olga, Saint *or* **Saint Helga** (b. c. 890—d. 969, Kiev; feast day July 11) Princess of Kiev. The first recorded female ruler in Russia, she served as regent of Kiev (945–964) after the assassination of her husband Igor I (877?–945); she avenged his death by having his murderers scalded to death. Probably baptized (c. 957) at Constantinople, she became the first member of the ruling family of Kiev to adopt Christianity. She was canonized as the first Russian saint of the Orthodox church.

oligarchy \ˈä-li-ˌgär-kē, ˈō-li-ˌgär-kē\ Rule by the few, often seen as having self-serving ends. Aristotle used the term pejoratively for unjust rule by bad men, contrasting oligarchy with rule by an ARISTOCRACY. Most classic oligarchies have resulted when governing elites were recruited exclusively from a ruling class, which tends to exercise power in its own interest. The term is considered outmoded today because "few" conveys no information about the nature of the ruling group.

Oligocene \ˈä-li-gō-ˌsēn\ **Epoch** Major division of the TERTIARY PERIOD, from c. 33.7 to 23.8 million years ago. It follows the EOCENE EPOCH and precedes the MIOCENE EPOCH. The term (from the Greek for "few recent forms") refers to the small number of modern animals that originated during this epoch. Oligocene climates appear to have been temperate, and many regions were nearly tropical. Grasslands expanded, and forested regions dwindled. The vertebrates of the northern continents had an essentially modern aspect that is a result less of the appearance of new forms than of the extinction of archaic vertebrates at the close of the Eocene.

oligopoly \ˌäl-ə-ˈgä-pə-lē\ Market situation in which producers are so few that the actions of each of them have an impact on price and on competitors. Each producer must consider the effect of a price change on the others. A cut in price by one may lead to an equal reduction by the others, with the result that each firm will retain about the same share of the market as before but with a lower profit margin. Competition in oligopolistic industries thus tends to manifest itself in nonprice forms such as advertising and product differentiation. Oligopolies in the U.S. include the steel, aluminum, and automobile industries. See also CARTEL, MONOPOLY.

oligosaccharide \ˌä-li-gō-ˈsa-kə-ˌrīd\ Any CARBOHYDRATE with a few (between 3 and about 6 to 10) units of simple SUGARS (MONOSACCHARIDES). A wide variety of oligosaccharides are made by partially breaking down POLYSACCHARIDES. Most of the few naturally occurring oligosaccharides are found in plants; those in animals tend to be combined in glycoproteins.

olive Subtropical, broad-leaved tree (*Olea europaea*) or its edible fruit. The olive was being grown on the island of Crete c. 3500 BC, and Semitic peoples apparently were cultivating it as early as 3000 BC. Its cultivation was important to the ancient Greeks and Romans and spread to all the countries bordering the Mediterranean. Today olives are grown primarily for olive oil, valued both for its distinctive taste and fragrance and for its dietary benefits. Fresh olives must be treated to neutralize their extreme bitterness before they can be eaten. The olive family (Oleaceae) comprises about 900 species in 24 genera of woody plants. Native to forested regions, members of the family grow worldwide except in the Arctic; they are evergreen in tropical and warm temperate climes and deciduous in colder zones. The family includes ASH trees, which yield HARDWOOD timber, and horticultural favourites such as the LILAC, JASMINE, PRIVET, and FORSYTHIA. Many members of the family are cultivated for their beautiful and fragrant flowers.

Oliver, King *orig.* **Joseph Oliver** (b. May 11, 1885, Abend, La., U.S.—d. April 8, 1938, Savannah, Ga.) U.S. JAZZ cornetist and bandleader. Oliver grew up in New Orleans and established himself as the city's preeminent cornetist, coleading a band with trombonist Kid Ory (1886–1973) before moving to Chicago in 1918. In 1922 Oliver hired his

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New Orleans protégé Louis Armstrong to join him in Chicago in his Creole Jazz Band. Their recordings together, including "Dipper Mouth Blues," are jazz classics.

Olives, Mount of Limestone ridge, east of Jerusalem. Frequently mentioned in the Bible, it is holy both in Judaism and in Christianity. Politically it is part of the municipality of Greater Jerusalem under Israeli administration. Its slopes have been the most sacred burial ground in Judaism for centuries. The peak generally regarded as the Mount of Olives is 2,652 ft (808 m) in elevation. Nearby is the site held by tradition to be the Garden of Gethsemane, which is associated with the betrayal and Crucifixion of Jesus.

Olivetti & C. SpA \ˌä-lə-'ve-tē\ Historic Italian electronics and telecommunications company. Founded in 1908 by Camillo Olivetti (1868–1943), the firm began by making typewriters. Camillo's son Adriano studied manufacturing and plant management in the U.S. in the 1920s, and as company president from 1938 made Olivetti into Europe's principal maker of business machines. The company later produced calculators, microcomputers, and copiers. In 1982 its U.S. subsidiary was purchased by Docutel Corp. In the late 1990s Olivetti sold off its money-losing computer business and remade itself as a telecommunications company with holdings in mobile and fixed-line telephones. It became a subsidiary of Telecom Italia in 1993.

Olivier \ə-'li-vē-ˌā**, Laurence (Kerr), Baron Olivier (of Brighton)** (b. May 22, 1907, Dorking, Surrey, Eng.—d. July 11, 1989, near London) British actor, director, and producer. He began his professional career in 1926 and joined the Old Vic company in 1937, playing many major Shakespearean roles. With Ralph Richardson he codirected the Old Vic (1944–50), and he acted in some of its greatest productions, including *Richard III*, *Henry IV*, and *Oedipus Rex*. He was knighted in 1947. From 1950 he directed and acted under his own management; his notable productions included *Antony and Cleopatra* and *The Entertainer* (1957). He was the founding director of the National Theatre (1962–73), one of whose theatres is now named for him. In 1970 he was created a life peer, the first actor ever to be so honoured. His many films include *Wuthering Heights* (1939), *Rebecca* (1940), *Hamlet* (1948, Academy Award), *The Entertainer* (1960), and *Othello* (1965). He was married to the actresses Vivien Leigh and (from 1961) Joan Plowright (b. 1929).

olivine \'ä-lə-ˌvēn\ Any member of a group of common magnesium, iron silicate minerals. Olivines occur in many igneous rocks and are a major constituent of the Earth's upper mantle. They also have been found in some lunar rocks and in many meteorites. Olivine forms yellow to greenish yellow crystals and is sometimes used in making bricks. Transparent green olivine (precious olivine) is called peridot.

Olmec \'äl-ˌmek\ First elaborate pre-Columbian culture of Mesoamerica. The Olmec lived in the lowland gulf coast of what is now southern Mexico. Developing a wide trading network, their cultural influence spread north to the Valley of Mexico and south to Central America; later native religions and iconography throughout Mesoamerica have Olmec roots. Their oldest known building site, San Lorenzo, which dates to c. 1150 BC, is remarkable for its colossal stone sculptures of human heads. The dominant motif in Olmec art is the figure of a god that is a hybrid of a jaguar and a human infant. Olmec buildings, monuments, and art style all indicate a complex and nonegalitarian society.

Olmsted, Frederick Law (b. April 26, 1822, Hartford, Conn., U.S.—d. Aug. 28, 1903, Brookline, Mass.) U.S. landscape architect. He traveled throughout the American South in the 1850s and won fame for several books describing its slaveholding culture. During an extended vacation in Europe, he became profoundly impressed with English landscaping, which he described in *Walks and Talks of an American Farmer in England* (1852). In 1857 he was hired as superintendent of New York City's newly planned Central Park. With the architect Calvert Vaux (1824–95), he won a competition to design the park, and he became its chief architect in 1858. The result was a nature-lover's paradise incorporating lawns, woods, ponds, and meandering paths; it represented one of the first attempts in the U.S. to apply art to the improvement of nature in a public park. Other Olmsted parks include Prospect Park in Brooklyn, New York City; a Niagara Falls, N.Y., park project; an extensive system of parks and parkways in Boston; and the World's Columbian Exposition (later Jackson Park) in Chicago. As chairman of the first Yosemite commission, he helped secure the area as a permanent public park.

Olmütz \'ōl-mütz**, Punctation of** (Nov. 29, 1850) Agreement signed at Olmütz (now Olomouc, Cz.Rep.) between Prussia and Austria. In response to an appeal from the elector of Hesse for help against rebellious subjects, Prussia and Austria sent troops. They threatened to clash, and when Russia sided with Austria, Prussia withdrew. In the Olmütz agreement, Prussia gave up its plans to create a union of German states without Austria and accepted Austria's reconstitution of the German Confederation. Prussia resented the diplomatic reverse and considered itself humiliated.

Olney, Richard (b. Sept. 15, 1835, Oxford, Mass., U.S.—d. April 8, 1917, Boston, Mass.) U.S. statesman. As U.S. attorney general (1893–95) under Pres. Grover Cleveland, he set a precedent by using an injunction to break the Pullman Strike (1894). Appointed U.S. secretary of state in 1895, he was confronted with Venezuela's request for support in its border dispute with Britain over the boundary between Venezuela and British Guiana. Olney's aggressive note to Britain, known as the Olney Corollary, demanded that Britain submit the dispute to arbitration and reasserted U.S. sovereignty in the Western Hemisphere in accordance with the Monroe Doctrine. The matter was in fact settled by arbitration two years after Olney's retirement in 1897.

Olt \'ōlt\ **River** River, southern Romania. It rises close to the headwaters of the Mureş River in eastern Transylvania at an elevation of 5,900 ft (1,800 m). It is 308 mi (496 km) long and flows south through the southern Carpathian Mountains to enter the Danube River opposite Nikopol. There are several resorts and spas along its course through the mountains.

Olympia Ancient sanctuary and site of the Olympic Games, northwestern Peloponnese, southern Greece. Located 10 mi (16 km) inland from the Ionian Sea, it was on the northern bank of the Alpheus River. A centre of Greek religious worship, it held the primarily athletic contests in honour of Zeus every four years, beginning in 776 BC. In the temple of Zeus, built c. 460 BC, was the statue of Zeus by Phidias, one of the Seven Wonders of the World. Excavations have uncovered many ruins, including temples and the stadium.

Olympia City (pop., 2000: 42,514), capital of Washington state, U.S. It lies at the southern end of Puget Sound, southwest of Tacoma. Originally called Smithfield, it was renamed for the nearby Olympic Mountains and incorporated as a city in 1859. It developed port facilities and a lumber-based economy, supplemented by oyster farming and other industries. Its harbour is the site of a large merchant reserve fleet. Located at the base of the Olympic Peninsula, it is the gateway to Olympic National Park.

Olympic Games Sports festival. In ancient Greece it was a Panhellenic festival held every fourth year and made up of contests of sports, music, and literature. Since 1896 the name has been used for a modified

Sites of the Modern Olympic Games

Year	Summer	Winter	Year	Summer	Winter
1896	Athens	*	1968	Mexico City	Grenoble
1900	Paris	*	1972	Munich	Sapporo
1904	St. Louis	*	1976	Montreal	Innsbruck
1908	London	*	1980	Moscow	Lake Placid
1912	Stockholm	*	1984	Los Angeles	Sarajevo
1916	†	*	1988	Seoul	Calgary
1920	Antwerp	*	1992	Barcelona	Albertville
1924	Paris	Chamonix	1994	‡	Lillehammer
1928	Amsterdam	St. Moritz	1996	Atlanta	
1932	Los Angeles	Lake Placid	1998		Nagano
1936	Berlin	Garmisch-Partenkirchen	2000	Sydney	
1940	†	†	2002		Salt Lake City
1944	†	†	2004	Athens	
1948	London	St. Moritz	2006		Turin
1952	Helsinki	Oslo	2008	Beijing	
1956	Melbourne	Cortina	2010		Vancouver
1960	Rome	Squaw Valley	2012	London	
1964	Tokyo	Innsbruck			

*The Winter Games were not held until 1924.
†Games were not held during World Wars I and II.
‡After 1992 the Summer and Winter Games were held on a staggered two-year schedule.

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revival of the ancient Games, consisting of international athletic contests held at four-year intervals. The original Games included footraces, the discus and javelin throws, the long jump, boxing, wrestling, the pentathlon, and chariot races. After the subjugation of Greece by Rome, the Games declined; they were finally abolished about AD 400. They were revived in the late 19th century through efforts led in part by Pierre, baron de COUBERTIN; the first modern Games were held in Athens. The first Winter Games were held in 1924. The direction of the modern Olympic movement and the regulation of the Games are vested in the International Olympic Committee, headquartered at Lausanne, Switz. Until the 1970s the Games adhered to a strict code of amateurism, but since that time professional players have also been allowed to participate. Programs for the Summer Games include competition in ARCHERY, BASEBALL, BASKETBALL, BOXING, CANOEING, CYCLING, DIVING, equestrian sports, FENCING, FIELD HOCKEY, FOOTBALL (soccer), GYMNASTICS, HANDBALL, JUDO, the modern PENTATHLON, ROWING, SAILING, SHOOTING, SOFTBALL, SWIMMING, TABLE TENNIS, TENNIS, TRACK AND FIELD (athletics), the TRIATHLON, VOLLEYBALL, WATER POLO, WEIGHTLIFTING, and WRESTLING. The program for the Winter Games includes the BIATHLON, BOBSLEDDING, ICE HOCKEY, LUGEING, SKELETON SLEDDING, SNOWBOARDING, and numerous ice SKATING and SKIING events. Events are periodically added and dropped.

Olympic Mountains Segment of the Pacific Coast Ranges, northwestern Washington, U.S. The mountains extend across the Olympic Peninsula south of the Strait of JUAN DE FUCA and west of PUGET SOUND within OLYMPIC NATIONAL PARK. The chief peaks are Mount Olympus, at 7,965 ft (2,428 m), and Mount Constance, at 7,743 ft (2,360 m). There is heavy rainfall, creating rainforests dominated by Douglas fir and Sitka spruce. Some trees are nearly 300 ft (90 m) high and 8 ft (2.5 m) in diameter.

Olympic National Park National park, northwestern Washington, U.S. Established in 1938 to preserve the OLYMPIC MOUNTAINS and their forests and wildlife, it covers 1,442 sq mi (3,735 sq km); it includes a strip of Pacific Northwest shoreline geographically separated from the rest of the park. There are more than 60 glaciers in the park. The western part includes rainforests; the eastern slopes feature lakes; and the ocean shore section contains scenic beaches and three Indian reservations.

Olympus, Mount Mountain peak, northeastern Greece. At 9,570 ft (2,917 m), it is the highest mountain in Greece. It is part of the Olympus range, lying on the border between Macedonia and THESSALY, near the Gulf of Salonika. The summit is snowcapped and often has cloud cover. In ancient Greece, it was regarded as the abode of the gods and the site of the throne of ZEUS.

Olympus Mons Large VOLCANO on MARS, the largest known volcano in the solar system. It consists of a central structure that ascends about 13 mi (21 km) above Mars's mean radius and is 335 mi (540 km) wide at the base; it is surrounded by an outward-facing cliff rising as much 6 mi (10 km) above the surrounding area. At the summit is a crater 53 mi (85 km) in diameter. For comparison, Earth's largest volcano, MAUNA LOA, is 75 mi (120 km) wide at the base and rises 5.6 mi (9 km) above the ocean floor.

Olynthus \ō-'lin-thəs\ Ancient Greek city, on the Chalcidice Peninsula, northeastern Greece. From the late 5th century BC it was the head of a strong confederacy of Greek towns known as the Chalcidian League. It was destroyed by PHILIP II in 348 BC. Excavations have revealed the grid plan of the ancient town and provided material for studying the relationship between Classical and Hellenistic Greek art.

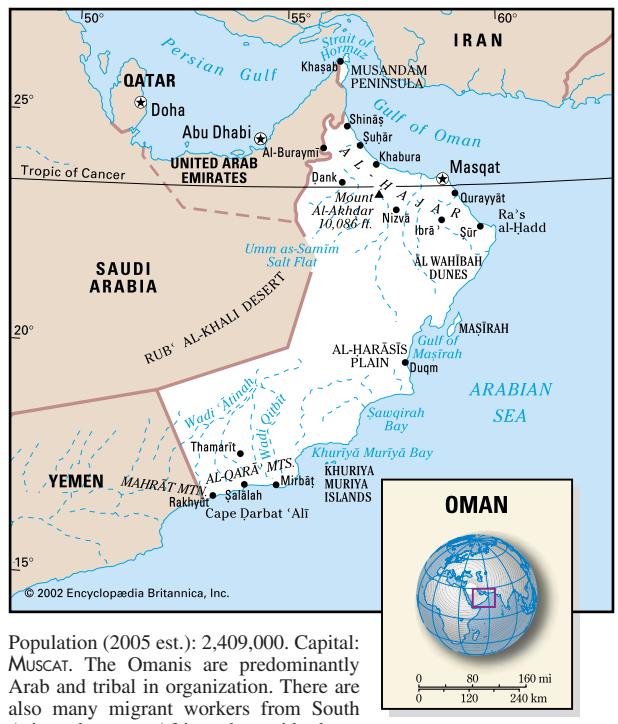
om \'ōm\ In HINDUISM and other Indian religions, a sacred syllable considered the greatest of all MANTRAS. The syllable *om* is composed of the three sounds *a-u-m* (in the SANSKRIT LANGUAGE, the vowels *a* and *u* join to become *o*), which represent three important triads: earth, atmosphere, and heaven; the major Hindu gods, BRAHMA, VISHNU, and SHIVA; and the sacred Vedic scriptures, Rig, Yajur, and Sama (see VEDIC RELIGION). Thus om mystically embodies the essence of the universe. It is uttered at the beginning and end of Hindu prayers, chants, and meditation and is also freely used in Buddhist and Jain rituals.

Omagh \'ō-mä\ District (pop., 2001: 47,735) and town (pop., 1991: 18,000), Northern Ireland. Formerly in County Tyrone, the district was established in 1973. The area was ruled by the ancient O'Neill family (5th–16th centuries), passing to English rule after the flight of Hugh O'Neill in 1607. It was the site of sectarian violence in 1998, when a car bomb killed 29 people. Most of the land is grazed by dairy cattle or sheep, and the rivers contain salmon and trout. Omagh town, the district seat, is a market and light-manufacturing centre.

Omaha \'ō-mə-ˌhȯ, 'ō-mə-ˌhä\ City (pop., 2000: 390,007), eastern Nebraska, U.S., on the Missouri River, north of its junction with the Platte River. The city's name, meaning "upstream people," referred to the Omaha Indians. Omaha was founded in 1854 and incorporated as a city in 1857. In 1863 it became the starting point for the UNION PACIFIC RAILROAD Co.'s first transcontinental railroad and soon grew into a centre of trade and industry. The largest city in the state, it is a major livestock and grain market, as well as a railroad, meat-packing, and insurance centre. It is home to the University of Nebraska and the Joslyn Art Museum.

O'Mahony, John (b. 1816, near Mitchelstown, County Cork, Ire.—d. Feb. 6, 1877, New York, N.Y., U.S.) Irish-American founder of the U.S. branch of the Fenian Brotherhood (see FENIAN MOVEMENT), an Irish secret revolutionary society. An Irish resistance leader, he fled to New York in 1853, where he founded and led (1858–66) the Fenians. By 1865 the American Fenian group had become large and prosperous and was sending money and arms to Ireland. O'Mahony reluctantly backed the Irish Fenians' decision to stage military raids in Canada against the British, part of a scheme to hold Canada hostage for the cause of Irish freedom. The raids failed and he resigned, but he was later called out of retirement (1872–77). See also JOHN O'NEILL.

Oman \ō-'män\ *officially* **Sultanate of Oman** *formerly* **Muscat and Oman** Country, Middle East, southwestern Asia. It is on the southeast coast of the ARABIAN PENINSULA. Area: 119,500 sq mi (309,500 sq km).



Population (2005 est.): 2,409,000. Capital: MUSCAT. The Omanis are predominantly Arab and tribal in organization. There are also many migrant workers from South Asia and eastern Africa who reside there. Languages: Arabic (official), others. Religions: Islam (official); also Hinduism, Christianity. Currency: Omani rial. Oman is a hot, arid country with high humidity along the coast. The Ḥajar Mountains parallel the shore of the Gulf of Oman, reaching an elevation of more than 10,000 ft (3,000 m). A broad expanse of sandy desert covers much of the country. Oman has a developing mixed economy, and the production and export of petroleum is its largest sector. It is a hereditary monarchy, with an advisory council; its head of state and government is the sultan. Human habitation dates to about the 3rd millennium BC. The Omani tribal system dates to Arab migration during the 2nd century AD. It was ruled by imams (Muslim religious leaders) of the Ibāḍī sect from the early Islamic period (mid-8th century) until the 12th century, when local rule was established. The Portuguese controlled the coastal areas c. 1507–1650, when they were expelled. The Āl Bū Saʿīd, a dynasty founded in the mid-18th century, still rules Oman. The kingdom expanded into eastern Africa in the 18th–19th century, where its capital was at ZANZIBAR. Oil was discovered in 1964. In 1970 the sultan was

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deposed by his son, who began a policy of modernization, and under him Oman joined the Arab League and the United Nations. In the First Persian Gulf War, Oman cooperated with the forces allied against Iraq. It subsequently continued to expand its foreign relations.

Oman, Gulf of Northwestern arm of the Arabian Sea, between the eastern part of the Arabian Peninsula and Iran. It is about 230 mi (370 km) wide and 340 mi (545 km) long and connects with the Persian Gulf through the Strait of Hormuz. It is the only entrance to the Persian Gulf from the Arabian Sea and Indian Ocean and is important as a shipping route for the oil-producing area around the Persian Gulf.

Omar, Mosque of See Dome of the Rock

Omar Khayyam \ˌō-ˌmär-ˌkī-ˈyäm\ *byname of* **Ghiyāth al-Dīn Abū al-Fatḥ ʿUmar ibn Ibrāhīm al-Neyshābūrī al-Khayyāmī** (b. May 18, 1048, Neyshābūr, Khorāsān—d. Dec. 4, 1131, Neyshābūr) Persian poet, mathematician, and astronomer. Educated in the sciences and philosophy, he was renowned in his country and time for his scientific achievements, but few of his prose writings survive. His verses attracted little attention until his *robāʿīyāt* ("quatrains") were loosely translated into English by Edward FitzGerald and published in 1859. Many of the quatrains (each of which was intended as an independent poem) are of doubtful attribution; most scholars agree on the authenticity of about 50, with controversy over some 200 others.

ombudsman \ˈäm-ˌbůdz-mən\ *Swedish* **representative** Representative assigned by a large organization or a government to investigate citizen complaints and suggest solutions. An ombudsman's office was established by the Swedish constitution of 1809. The idea soon spread to other Scandinavian countries and later to New Zealand, Britain, Germany, Israel, and some states or provinces in the U.S., Australia, and Canada. An ombudsman's responsibility is to receive and investigate complaints and to serve as an independent and impartial arbiter in recommending what may be done to satisfy the complainant or in explaining why no action is necessary. Ombudsmen are now used in universities, corporations, municipalities, and institutions such as hospitals.

Omdurman \ˌäm-dər-ˈman\ City (pop., 1993 est.: 1,267,000), east-central Sudan. It is situated on the left bank of the Nile River just below the confluence of the Blue and White Niles. It was an insignificant village until the victory of al-Mahdī over the British in 1885. It grew rapidly after al-Mahdī and his successor, ʿAbd Allāh, made it their capital. It was captured by Anglo-Egyptian forces in 1898 but continued to develop into the cultural, religious, and commercial centre of The Sudan. Sites of interest include ʿAbd Allāh's house (now a museum) and the tomb of al-Mahdī.

The tomb of al-Mahdī in Omdurman, The Sudan.
CHARLES BEERY/SHOSTAL ASSOCIATES

Omega Centauri \ō-ˈmā-gə-sen-ˈtȯr-ī\ Brightest globular cluster, located in the constellation Centaurus. It has a magnitude of 3.7 and is visible to the unaided eye as a faint luminous patch. One of the nearer globular clusters (about 17,000 light-years away), it is estimated to contain hundreds of thousands of stars, including several hundred variable stars. John Herschel (see Herschel family) was the first to recognize it as a star cluster and not a nebula.

omen Observed phenomenon that is interpreted as signifying good or bad fortune. The many and varied omens that the ancients noted included lightning, cloud movements, the flights of birds, and the paths of sacred animals. Each type of omen was gauged according to specific meaningful characteristics, such as the kinds of bird in flight or the direction of flight in relation to the observer.

Ometecuhtli \ˌō-mā-ˈtā-ˌkůt-lē\ Aztec deity, the Lord of Duality or Lord of Life. With his female counterpart, Omecíhuatl (Lady of Duality), he lived in Omeyocan, the 13th and highest Aztec heaven. He was represented by symbols of fertility, and his image was adorned with ears of corn. He was the only Aztec god to have neither a temple nor a formal cult. Seeing him as remote in the heavens, the Aztecs assumed he would never interact with them directly, but they felt his presence in rituals and in the rhythms of nature.

omnivore \ˈäm-nə-ˌvōr\ Animal that eats both plant and animal matter. Most omnivorous species do not have highly specialized food-processing structures or food-gathering behaviour. Many animals generally considered carnivores are actually omnivorous; for example, the red fox eats fruits and berries as well as mammals and birds. See also herbivore.

Omsk \ˈȯmsk\ City (pop., 2002: 1,133,900), west-central Russia. It is located in southwestern Siberia at the confluence of the Irtysh and Om rivers. Founded in 1716 as a military stronghold, Omsk became a city in 1804. It remained the headquarters of the Siberian Cossacks until the late 19th century. In 1918–19 it was the seat of the anti-Bolshevik government of Adm. Aleksandr Kolchak. Its growth was spurred by the building of the Trans-Siberian Railroad in the 1890s and the onset of World War II. Pipelines from the Volga-Urals and western Siberian oil fields supply the refinery, and the petrochemical industry is also is important.

On See Heliopolis

Onassis, Aristotle (Socrates) (b. Jan. 20, 1906, Smyrna, Tur.—d. March 15, 1975, Neuilly-sur-Seine, near Paris, France) Greek shipping magnate and international businessman. The son of a tobacco dealer, he started a tobacco-importing business in Buenos Aires, Arg. He was made consul general after negotiating a trade agreement for the Greek government. A millionaire by age 25, he bought his first freight ships in 1932. In the 1940s and '50s his fleet grew until it was larger than the navies of many countries. He acquired business interests in Monte Carlo, and from 1957 to 1974 he owned and operated Olympic Airways, the Greek national airline. He conducted a long affair with Maria Callas, and in 1968 married Jacqueline Kennedy (see Jacqueline Kennedy Onassis).

Onassis, Jacqueline Kennedy *orig.* **Jacqueline Bouvier** (b. July 28, 1929, Southampton, N.Y., U.S.—d. May 19, 1994, New York, N.Y.) U.S. first lady, socialite, and editor. After graduating from George Washington University in 1951 she took a job as a reporter-photographer at the *Washington Times-Herald*. In 1953 she married Sen. John F. Kennedy, who became president in 1961. As first lady, she restored the White House to its original Federal style and conducted a televised tour of the residence. Her graciousness, elegance, and beauty endeared her to the American public, and her broad culture and ease in speaking Spanish and French impressed foreign leaders. After her husband's assassination in 1963 she moved to New York with their children, Caroline (b. 1957) and John, Jr. (1960–99). In 1968 she married Aristotle Onassis. After his death in 1975, she returned to New York, where she became a book editor.

Oñate \ōn-ˈyä-tā**, Juan de** (b. 1550?, New Spain—d. 1630) Spanish conquistador. The son of wealthy parents in Zacatecas, New Spain, he married a granddaughter of Hernán Cortés. He received permission to govern the colony of New Mexico, which he founded in 1598. He sent exploring parties throughout the American Southwest to search for gold and led an expedition into present-day Kansas in 1601. Still searching for gold, he explored the region west to the Colorado River and south to the Gulf of California (1604). He resigned in 1607. Tried for his brutal treatment of Indians and settlers while governor, he was found guilty and exiled from the colony in 1614.

onchocerciasis See river blindness

oncogene \ˈäŋ-kə-ˌjēn\ Gene that can cause cancer. It is a sequence of DNA that has been altered or mutated from its original form, the proto-oncogene (see mutation). Proto-oncogenes promote the specialization and division of normal cells. A change in their genetic sequence can result in uncontrolled cell growth, ultimately causing the formation of a cancerous tumour. In humans, proto-oncogenes can be transformed into oncogenes in three ways: point mutation (alteration of a single nucleotide base pair), translocation (in which a segment of the chromosome breaks off and attaches to another chromosome), or amplification (increase in the number of copies of the proto-oncogene). Oncogenes were first discovered in certain retroviruses and were later identified as cancer-causing agents in many animals. See also J. Michael Bishop; Harold Varmus.

Ondaatje \än-ˈdä-chā**, (Philip) Michael** (b. Sept. 12, 1943, Colombo, Ceylon) Sri Lankan-born Canadian novelist and poet. He immigrated to Montreal at age 19 and attended the University of Toronto and

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Queen's University. His fascination with the American West led to one of his most celebrated works, the pastiche *The Collected Works of Billy the Kid* (1970). His novel *The English Patient* (1992, Booker Prize; film, 1996) won him international recognition; it was followed by *Anil's Ghost* (2000). His musical poetry and prose are a blend of myth, history, jazz, memoirs, and other forms.

Onega \ə-'nye-gə**, Lake** Lake, northwestern Russia. Located between Lake Ladoga and the White Sea, it is the second-largest lake in Europe. It has an area of 3,753 sq mi (9,720 sq km) and is 154 mi (248 km) long. It empties into the Svir River and is frozen for about half of each year. It is connected with the Baltic and White seas by canal and with the Volga River basin by a waterway, enabling it to play an important part in international trade and transport.

Oneida \ō-'nī-də\ North American Indian people living mainly in what is now central New York and Wisconsin, U.S., and Canada. They constitute one of the original five nations of the Iroquois Confederacy. Their language is Iroquoian. They call themselves Oneyoteaka, meaning "People of the Standing Stone." The Oneida were semisedentary and practiced corn agriculture. Longhouses sheltered families related through maternal descent and belonging to one of three clans, Bear, Turtle, or Wolf. Each community had a local council that guided the chief or chiefs. The Oneida supported the colonist cause in the American Revolution and were attacked by the pro-British Iroquois under Joseph Brant. By the mid-19th century most Oneida had dispersed. They number some 12,000.

Oneida Community Utopian religious community founded by John H. Noyes in Oneida, N.Y., in 1848. Noyes, who believed that the Second Coming of Jesus Christ had occurred in AD 70, and his disciples formed their first religious society in Putney, Vt., in 1841 in order to establish the millennial kingdom. Their practice of "complex marriage," according to which each adult community member was married to each adult of the opposite sex, aroused the hostility of the townspeople, and they were obliged to move to Oneida. The Oneida group lived communally and flourished for 30 years, supporting itself by farming and manufacturing steel traps, silverware, and other items. The community broke up in 1879, and two years later the remaining members reorganized it as a commercial enterprise, which is noted for the manufacture of silver plate.

O'Neill, Eugene (Gladstone) (b. Oct. 16, 1888, New York, N.Y., U.S.—d. Nov. 27, 1953, Boston, Mass.) U.S. playwright. The son of a touring actor, he spent an itinerant youth as a seaman, heavy drinker, and derelict, then began writing plays while recovering from tuberculosis (1912). His one-act *Bound East for Cardiff* (1916) was produced by the experimental Provincetown Players, which also staged his other early plays (1916–20). *Beyond the Horizon* was produced on Broadway in 1920, earning him his first Pulitzer Prize. Enormously prolific, he often wrote about tortured family relationships and the conflict between idealism and materialism. Soon recognized as a major dramatist, he became widely translated and produced. His many plays of the 1920s include *The Emperor Jones* (1921), *The Hairy Ape* (1922), *Anna Christie* (1922; Pulitzer Prize), *Desire Under the Elms* (1925), *The Great God Brown* (1926), and *Strange Interlude* (1928; Pulitzer Prize). Among his later plays are *Mourning Becomes Electra* (1931), *Ah! Wilderness* (1933; his only comedy), *The Iceman Cometh* (1946), and the autobiographical *Long Day's Journey into Night* (produced 1956; Pulitzer Prize), considered his masterpiece. O'Neill was awarded the Nobel Prize for Literature in 1936, the first U.S. playwright so honoured.

O'Neill, John (b. March 8, 1834, County Monaghan, Ire.—d. Jan. 7, 1878, Omaha, Neb., U.S.) Irish-born military leader of the American branch of the Fenians, a secret Irish nationalist society. He arrived in the U.S. in 1848 and settled in Tennessee, where he joined the Fenians. A supporter of its scheme to invade Canada to win Irish freedom from Britain, in 1866 he led a group of 600 men across the Niagara River and captured Fort Erie before fleeing back to the U.S. In 1870 he led a raid along the Vermont border that was repulsed; he led another raid on Manitoba in 1871. See also John O'Mahony.

Ōnin War \'ō-nin\ (1467–77) Civil war in central Japan that destroyed the remnants of central governmental authority and led to a century of warfare. The conflict sprang from a succession dispute, with one powerful clan supporting the brother of the Ashikaga shogun (military ruler) and another supporting the shogun's infant son. It ended in stalemate, but clans across Japan became involved in hopes of increasing their territory through victory. The nation was at last reunified in the late 16th and early 17th centuries under Oda Nobunaga, Toyotomi Hideyoshi, and Tokugawa Ieyasu. See also Muromachi period; Warring States period.

onion Herbaceous biennial plant (*Allium cepa*) of the lily family, probably native to South Asia but now grown worldwide, and its edible bulb. Among the hardiest and oldest garden-vegetable plants, onions bear a cluster of small, greenish white flowers on one or more leafless stalks. The leaf base swells to form the underground mature edible onion. Onions are pungent; because they contain a sulfur-rich volatile oil, peeling or slicing them can cause a person's eyes to tear. Onions vary in size, shape, colour, and pungency. Though low in standard nutrients, they are valued for their flavour. Onions have been claimed to cure colds, earaches, and laryngitis and have been used to treat animal bites, powder burns, and warts; like their close relative garlic, they are being studied for other suspected beneficial qualities. See also allium.

Onion (*Allium cepa*)
WALTER CHANDOHA

Onnes, Heike Kamerlingh See Heike Kamerlingh Onnes

Onsager \'ön-ˌsä-gər**, Lars** (b. Nov. 27, 1903, Oslo, Nor.—d. Oct. 5, 1976, Coral Gables, Fla., U.S.) Norwegian-born U.S. chemist. He immigrated to the U.S. and taught principally at Yale University. His development of a general theory of irreversible chemical processes, described as the "fourth law of thermodynamics," gained him a 1968 Nobel Prize. He also applied the laws of thermodynamics to systems not in equilibrium. His explanation of the movement of ions in solution as related to turbulence and fluid density had a major effect on the development of physical chemistry.

Ontario Province (pop., 2001: 11,874,400), the second largest in Canada. Situated between Hudson Bay and James Bay and the St. Lawrence River–Great Lakes chain, it is bordered by the U.S. and the Canadian provinces of Quebec and Manitoba. It covers 412,581 sq mi (1,068,580 sq km). Its capital is Toronto. Before European settlement, the area was inhabited by Iroquois and Algonquin Indian tribes. In the 17th century it was visited by French explorers and missionaries. It passed to the British in 1763 after the French and Indian War. It was the scene of many battles in the War of 1812. The area was known as Canada West from 1841 until 1867, when it became one of four provinces of the new Dominion of Canada. Northern Ontario has a rocky and rugged terrain with thick forests, bogs, lakes, and extensive mineral reserves. Southern Ontario is an important farming and industrial region and is the centre of Canada's population and urban development. Ottawa, the national capital, is also in Ontario.

Ontario, Lake Smallest and easternmost of the Great Lakes of North America. Bounded by New York and Ontario, and with the U.S.-Canada border passing through it, the lake is roughly elliptical; its major axis, 193 mi (311 km) long, lies nearly east to west, and its greatest width is 53 mi (85 km). The Niagara River is the lake's main feeder. There are five islands at its eastern end, where the lake discharges into the St. Lawrence River near Kingston, Ont. The Welland Canal and the Niagara River connect it to Lake Erie to the southwest. It was visited by Samuel de Champlain in 1615; its early French name was Lac Frontenac. Ports on the lake include Toronto and Hamilton, Ont., and Rochester and Oswego, N.Y.

ontological argument Argument that proceeds from the idea of God to the reality of God. It was first clearly formulated by St. Anselm in his *Proslogion* (1077–78); a later famous version is given by René Descartes. Anselm began with the concept of God as that than which nothing greater can be conceived. To think of such a being as existing only in thought and not also in reality involves a contradiction, since a being that lacks real existence is not a being than which none greater can be conceived. A yet greater being would be one with the further attribute of existence. Thus the unsurpassably perfect being must exist; otherwise it would not be unsurpassably perfect. This is among the most discussed and contested arguments in the history of thought.

ontology Theory of being as such. It was originally called "first philosophy" by Aristotle. In the 18th century Christian Wolff contrasted ontology, or general metaphysics, with special metaphysical theories of

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souls, bodies, or God, claiming that ontology could be a deductive discipline revealing the essences of things. This view was later strongly criticized by David Hume and Immanuel Kant. Ontology was revived in the early 20th century by practitioners of phenomenology and existentialism, notably Edmund Husserl and his student Martin Heidegger. In the English-speaking world, interest in ontology was renewed in the mid-20th century by W.V.O. Quine; by the end of the century it had become a central discipline of analytic philosophy. See also idealism; realism; universal.

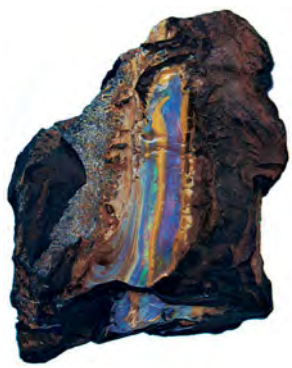
onychophoran \ˌä-ni-'kä-fə-rən\ Any of about 90 species of free-living terrestrial invertebrates in the class Onychophora (sometimes considered a phylum). They are sometimes called velvet worms for their velvety skin. The common genus *Peripatus* occurs in the West Indies, Central America, and northern South America. Onychophorans are slender and segmented; each segment has a pair of short legs. Species range from 0.6 to 6 in. (14–150 mm) long. They live in humid, hidden spots: in forest litter, wood crevices, termite nests, or the soil, sometimes to a depth of more than 3 ft (1 m). They use their jaws to open captured prey (often small insects) and suck out the juices.

onyx \'ä-niks\ Striped, semiprecious variety of the silica mineral agate with white and black alternating bands. Other varieties include carnelian onyx, with white and red bands, and sardonyx, with white and brown bands. Its properties are the same as those of quartz. Onyx is used in carved cameos and intaglios because its layers can be cut to show a colour contrast between the design and the background. It is found worldwide, but chiefly in India and South America.

Oort cloud Vast spherical cloud of small, icy bodies orbiting the Sun at distances ranging from about 0.3 light-year to one light-year or more that is probably the source of most long-period comets. In 1950 the Dutch astronomer Jan Hendrik Oort (1900–92) noted that no comets have orbits that would indicate an interstellar origin. He proposed that the Sun is surrounded by billions of these objects, which are only occasionally detectable when they enter the inner solar system. The Oort cloud is believed to be composed of primordial bodies dating from the formation of the solar system (see solar nebula). Whether the Oort cloud merges, in its inner region, into the disk-shaped Kuiper belt is not known.

Op art *or* **Optical art** Branch of mid-20th-century geometric abstract art that deals with optical illusion. Op art painters devised complex optical spaces by manipulating repetitive forms such as parallel lines, checkerboard patterns, and concentric circles or by creating chromatic tension from the juxtaposition of complementary colours, thereby creating the illusion of movement. Principal artists of the Op movement in the late 1950s and the '60s include Victor Vasarely, Bridget Riley (b. 1931), and Larry Poons (b. 1937).

opal A hydrated, noncrystalline silica mineral used extensively as a gemstone. Its chemical composition is similar to that of quartz but generally with a variable water content. Pure opal is colourless, but impurities generally give it various dull colours ranging from yellow and red to black. Black opal is especially rare and valuable. White opal and fire opal, characterized by yellow, orange, or red colour, are much more common. Various forms of common opal are widely used as abrasives, insulation material, and ceramic ingredients. Opal is most abundant in volcanic rocks, especially in areas of hot-spring activity. The finest gem opals have been found in Australia; other areas that yield gem material include Japan, Mexico, Honduras, India, New Zealand, and the U.S.



Black opal from Australia; in the collection of the Department of Earth Sciences, Washington University, St. Louis, Mo.
JOHN H. GERARD

OPEC *in full* **Organization of the Petroleum Exporting Countries** Multinational organization established in 1960 to coordinate the petroleum production and export policies of its members. Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela were the original members; they were joined by Qatar (1961), Indonesia and Libya (1962), Abu Dhabi (1967; membership transferred to the United Arab Emirates, 1974), Algeria (1967), and Nigeria (1971). Ecuador (1973) and Gabon (1975) are no longer OPEC members. Policy decisions are taken by consensus at its Vienna headquarters. In 1973 OPEC began a series of oil price increases in retaliation for Western support of Israel in the 1973 Arab-Israeli war, and OPEC members' income greatly increased as a result. Internal dissent, the development of alternative energy sources in the West, and Western exploitation of oil sources in non-OPEC countries subsequently combined to reduce the organization's influence. OPEC countries supply about two-fifths of the world's oil consumption and possess about two-thirds of the world's proven oil reserves.

open cluster *or* **galactic cluster** Any group of Population I (see Populations I and II) stars with a common origin, held together by mutual gravitation (not to be confused with a cluster of galaxies). Stars in open clusters are much more scattered than those in globular clusters. All known open clusters contain from about 10 to 1,000 or more stars (about half contain fewer than 100) and have diameters of 5–75 light-years. More than 1,000 have been discovered in the Milky Way Galaxy; well-known examples include the Pleiades and the Hyades.

Open Door policy Statement of U.S. foreign policy toward China. Issued by U.S. secretary of state John Hay (1899), the statement reaffirmed the principle that all countries should have equal access to any Chinese port open to trade. The U.S. sent notes to Britain, Germany, France, Italy, Japan, and Russia explaining the policy to prevent them from establishing separate spheres of influence in China. Their replies were evasive, but the U.S. considered them acceptances of the policy. Japan's violation of the policy in 1937 led the U.S. to impose an oil embargo. The policy was discontinued with the communist takeover of China in 1949.

open-heart surgery Any surgical procedure opening the heart and exposing one or more of its chambers, most often to repair valve disease or correct congenital heart malformations (see congenital heart disease). Invention of the heart-lung machine (see artificial heart), which allows the heart to be stopped during surgery, made it possible. The first successful open-heart surgery was performed in the U.S. in 1953 by John H. Gibbon, Jr., to close an atrial septal defect.

open-hearth process *or* **Siemens-Martin process** Steelmaking technique that for most of the 20th century accounted for most steel made in the world. William Siemens made steel from pig iron in a reverberatory furnace of his design in 1867. The same year the French manufacturer Pierre-Émile Martin (1824–1915) used the idea to produce steel by melting wrought iron with steel scrap. Siemens used the waste heat given off by the furnace: he directed the fumes from the furnace through a brick checkerwork, heating it to a high temperature, and then used the same path to introduce air into the furnace; the preheated air significantly increased the flame temperature. The open-hearth process furnace (which replaced the Bessemer process) has itself been replaced in most industrialized countries by the basic oxygen process and the electric furnace. See also reverberatory furnace.

open market operation Any of the purchases and sales of government securities and commercial paper by a central bank in an effort to regulate the money supply and credit conditions. Open market operations can also be used to stabilize the prices of government securities. When the central bank buys securities on the open market, it increases the reserves of commercial banks, making it possible for them to expand their loans and investments. It also increases the price of government securities, equivalent to reducing their interest rates, and decreases interest rates generally, thus encouraging investment. If the central bank sells securities, the effects are reversed. Open market operations are usually performed with short-term government securities such as treasury bills.

opera Musical drama made up of vocal pieces with orchestral accompaniment, overtures, and interludes. Opera was invented at the end of the 16th century in an attempt by the Camerata (an academy of Florentine poets, musicians, and scholars) to imitate ancient Greek drama, which was known to have been largely sung or chanted. Since no actual Greek music was known, composers had considerable freedom in reconceiving it. Imitations of Greek pastoral poetry became the basis for early opera libretti. The first operas, *Dafne* by Jacopo Peri (1561–1633) in 1598 and by Giulio Caccini about the same time, are now lost; the earliest surviving opera is Peri's *Euridice* (1600). They consisted of lightly accompanied vocal melody closely imitating inflected speech. Claudio Monteverdi, the greatest early operatic figure, composed the first masterpiece, *Orfeo*, in 1607; unlike its predecessors, it is scored for a small orchestra. With this work,

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RECITATIVE began to be clearly distinguished from ARIA, an achievement that would prove decisive for opera's future success. In France, JEAN-BAPTISTE LULLY produced a prototype for courtly opera that influenced French opera through the mid-18th century. JEAN-PHILIPPE RAMEAU, GEORGE FRIDERIC HANDEL, and CHRISTOPH WILLIBALD GLUCK were the most significant opera composers of the first two-thirds of the 18th century; their works were surpassed by the brilliant operas of WOLFGANG AMADEUS MOZART. In the early 19th century, GIOACCHINO ROSSINI and GAETANO DONIZETTI dominated Italian opera. In the later 19th century the greatest works were those of GIUSEPPE VERDI and RICHARD WAGNER; the latter, with his bold innovations, became the most influential operatic figure since Monteverdi. RICHARD STRAUSS and GIACOMO PUCCINI wrote the most popular late 19th- and early 20th-century operas. Though the death of Puccini in 1924 is often cited as the end of grand opera, new and often experimental works—by composers such as ALBAN BERG, BENJAMIN BRITTEN, GIAN CARLO MENOTTI, JOHN ADAMS, and PHILIP GLASS—continued to be produced to critical acclaim. Opera entered the 21st century as a vibrant and global art form. See also BALLAD OPERA; OPERETTA.

operating system (OS) SOFTWARE that controls the operation of a COMPUTER, directs the input and output of data, keeps track of files, and controls the processing of COMPUTER PROGRAMS. Its roles include managing the functioning of the computer hardware, running the applications programs, serving as an interface between the computer and the user, and allocating computer resources to various functions. When several jobs reside in the computer simultaneously and share resources (MULTITASKING), the OS allocates fixed amounts of CPU time and MEMORY in turn or allows one job to read data while another writes to a printer and still another performs computations. Through a process called time-sharing, a large computer can handle interaction with hundreds of users simultaneously, giving each the perception of being the sole user. Modern computer operating systems are becoming increasingly machine-independent, capable of running on any HARDWARE platform; a widely used platform-independent operating system in use today on MAINFRAME computers is UNIX. Most PERSONAL COMPUTERS run on Microsoft's WINDOWS operating system, which grew out of and eventually replaced MS-DOS. See also LINUX.

operationalism In the philosophy of SCIENCE, the attempt to define all scientific concepts in terms of specifically described operations of measurement and observation. The length of a rod, for example, may be defined as the number of times a certain stick can be laid end to end alongside it. Propositions that are not amenable to verification through measurement and observation are rejected as meaningless (see also LOGICAL POSITIVISM). Operationalists rejected the idea of nature as a thing-in-itself existing behind the appearances observed in experimentation. Operationalism is closely associated with the work of the U.S. physicist Percy W. Bridgman (1882–1961).

operations management See PRODUCTION MANAGEMENT

operations research Application of scientific methods to management and administration of military, government, commercial, and industrial systems. It began during World War II in Britain when teams of scientists worked with the Royal Air Force to improve radar detection of enemy aircraft, leading to coordinated efforts to improve the entire system of early warning, defense, and supply. It is characterized by a systems orientation, or systems engineering, in which interdisciplinary research teams adapt scientific methods to large-scale problems that must be modeled, since laboratory testing is impossible. Examples include resource allocation and replacement, inventory control, and scheduling of large-scale construction projects.

operator, differential See DIFFERENTIAL OPERATOR

operetta Musical drama similar to OPERA, usually with a romantically sentimental plot, employing songs, dances, and orchestral interludes interspersed with spoken dialogue. The modern tradition begins with JACQUES OFFENBACH, who wrote some 90 operettas and inspired a Viennese tradition that began with the works of Franz von Suppé and JOHANN STRAUSS. In Britain most of the 14 comic operettas (1871–96) of W.S. GILBERT and ARTHUR SULLIVAN have been enduringly popular. In the U.S. the works of such European immigrant composers as VICTOR HERBERT and RUDOLF FRIML were widely popular in the early 20th century. See also MUSICAL.

operon \'ä-pər-ˌän\ Genetic regulatory system of single-celled organisms (PROKARYOTES) and their viruses, in which GENES coding for functionally related proteins are clustered along the DNA, enabling their expression to be coordinated in response to the cell's needs. By providing a means to produce proteins only when and where they are required, the operon allows the cell to conserve energy. A typical operon consists of a group of structural genes that code for enzymes involved in a metabolic pathway, such as the biosynthesis of an amino acid. A single unit of messenger RNA is transcribed from the operon and is then translated into separate proteins. Operons are controlled by various regulatory elements that respond to environmental cues. The operon system was first proposed by FRANÇOIS JACOB and JACQUES MONOD in the early 1960s.

Opet \'ō-ˌpet\ Ancient Egyptian festival of the New Year. In the celebration of Opet, statues of AMON and MUT and their son KHONS were carried down the Nile on barges in a ritual journey from their shrines at KARNAK to the temple of LUXOR. There the statues remained about 24 days, a festival time for Luxor. The images were returned to Karnak by the same route in a second public appearance that closed the festival.

Ophite \'ä-ˌfīt, 'ō-ˌfīt\ Member of any of several Gnostic sects that flourished in the Roman empire in the 2nd century AD and for several centuries thereafter. The sects shared a dualistic theology, opposing a beneficent and entirely spiritual Supreme Being to a chaotic and evil material world. To the Ophites, the human dilemma resulted from the mixture of these conflicting spiritual and material elements in human nature. Only gnosis, the esoteric knowledge of good and evil, could redeem one from the bonds of matter. See also DUALISM, GNOSTICISM.

ophthalmology \ˌäf-thəl-'mä-lə-jē\ Medical specialty dealing with the EYES, dating to 1805. FRANS C. DONDERS's 1864 advances in OPTICS allowed EYEGLASSES to be fitted to vision problems. The ophthalmoscope made it possible to look inside the eye and relate eye defects to internal conditions. More recent advances include eye exams, early treatment of congenital defects, and eye banks to store corneas for transplants. Ophthalmologists test visual function and examine the eye for faulty development, disease, injury, degeneration, aging, or refractive errors. They prescribe treatment for eye disease and lenses for refraction and perform surgery when needed. See also OPTOMETRY, VISUAL-FIELD DEFECT.

Ophüls \'ō-fᾱls**, Max** *orig.* **Max Oppenheimer** (b. May 6, 1902, Saarbrücken, Ger.—d. March 26, 1957, Hamburg, W.Ger.) German film director. An actor, stage director, and producer in Germany and Austria (1921–30), he gained renown as a film director with *Liebelei* (1933). He left Nazi Germany and directed popular but undistinguished films in France, Russia, Italy, and The Netherlands until 1940, when he moved to the U.S. In Hollywood he directed *The Exile* (1947), *Letter from an Unknown Woman* (1948), and *The Reckless Moment* (1949). He returned to France to make *The Roundabout* (1950), *House of Pleasure* (1952), and *The Sins of Lola Montes* (1955), considered his masterpiece. His son, Marcel (b. 1927), worked in France principally as a maker of documentary films, most notably *The Sorrow and the Pity* (1971), which examines French conduct under German occupation.

Opie, Eugene Lindsay (b. July 5, 1873, Staunton, Va., U.S.—d. March 12, 1971, Bryn Mawr, Pa.) U.S. pathologist. He received his M.D. from Johns Hopkins University. Early in his career, he correctly deduced that degenerative changes in the islets of Langerhans caused DIABETES MELLITUS and theorized that blockage of the junction of the bile and pancreatic ducts caused acute PANCREATITIS. He later showed that TUBERCULOSIS (TB) was spread by contact, including from one family member to another. His work led to use of X-ray films to detect asymptomatic TB, the sputum test to predict the chance of its spread, and injection of heat-killed tubercle bacilli to prevent infection.

opium Organic compound, a NARCOTIC drug known since ancient Greek times, obtained from exuded juice of immature fruit capsules of the OPIUM POPPY. Opium has legitimate medical uses, as the source of the ALKALOIDS CODEINE and MORPHINE and their derivatives. It is also used illicitly, either raw or purified as alkaloids and their derivatives (including HEROIN). Opium alkaloids of one type (e.g., morphine, codeine) act on the NERVOUS SYSTEM, mimicking the effects of ENDORPHINS; they are ANALGESIC, narcotic, and potentially addicting (see DRUG ADDICTION). Those of a second type, including papaverine and noscapine, relieve smooth muscle spasms and are not analgesic, narcotic, or addicting. Habitual opium use produces physical and mental deterioration and shortens life. Overdose can cause death by depressing RESPIRATION.

opium poppy Flowering plant (*Papaver somniferum*) of the family Papaveraceae, native to Turkey. OPIUM, MORPHINE, CODEINE, and HEROIN are

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all derived from the milky fluid found in its unripe seed capsule. A common garden annual in the U.S., the opium poppy bears blue-purple or white flowers 5 in. (13 cm) wide on plants about 3–16 ft (1–5 m) tall, with lobed or toothed silver-green foliage. It is also grown for its tiny nonnarcotic ripe seeds, which are kidney-shaped and grayish blue to dark blue; the seeds are used in bakery products and for seasoning, oil, and birdseed.

Opium Wars Two trading wars of the mid-19th century in China. The first (1839–42 was between China and Britain, and the second (1856–60; also called the Arrow War or Anglo-French War) was between China and a British-French alliance. Trade developed between China and Western countries from the late 16th century. The Chinese, accustomed to tributary relationships with others, required that Westerners pay for Chinese goods with silver currency. To offset a growing negative flow of silver at home, the British created a market for opium in China and began importing it there illegally. As demand for opium grew, China tried to stop the practice, and hostilities broke out. Britain quickly triumphed, and the resultant Treaty of Nanjing (Nanking;1842; the first of a series of unequal treaties between China and Western countries and, eventually, Japan) was a blow to China. The outbreak of the second war resulted in the Treaty of Tianjin (Tientsin; 1858), which required further Chinese concessions. When China refused to sign subsequent treaties, Beijing (Peking) was captured and the emperor's summer palace burned. The overall result of these conflicts was to weaken the Chinese imperial system, greatly expand Western influence in China, and pave the way for such uprisings as the Taiping and Boxer rebellions. See also Canton system; British East India Company; Lin Zexu.

Oporto See Porto

opossum Any of about 66 species (family Didelphidae) of New World, mostly arboreal, nocturnal marsupials. Highly adaptable and prolific, opossums have changed little in millions of years. The North American species, the stout-bodied common, or Virginia, opossum (*Didelphis marsupialis*), grows to 40 in. (100 cm) long. It is largely white and has an opposable clawless toe on each hind foot; with its long, hairless, prehensile tail, it resembles a large rat. Up to 25 grublike, 0.07-oz (2-g) newborns compete for the 13 nipples in the pouch, where the survivors spend four or five weeks; they spend the following eight to nine weeks clinging to the mother's back. The common opossum may feign death ("play possum") if surprised. It eats small animals, insects, and fruit, and sometimes domestic poultry and cultivated grain. See also possum.

Virginia, or common, opossum (*Didelphis virginiana*).
ROBERT J. ELLISON—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Oppenheimer, J(ulius) Robert (b. April 22, 1904, New York, N.Y., U.S.—d. Feb. 18, 1967, Princeton, N.J.) U.S. theoretical physicist. He graduated from Harvard University, did research at Cambridge University, and earned a doctorate from Göttingen University. He returned to the U.S. to teach at the California Institute of Technology (1929–47). His research focused on energy processes of subatomic particles, and he trained a generation of American physicists. In World War II he was named director of the army's atomic-bomb project, later known as the Manhattan Project, and set up the laboratory in Los Alamos, N.M., that remains a principal weapons-research laboratory. He directed the Institute for Advanced Study in Princeton (1947–66). He strongly opposed the development of the hydrogen bomb, and in 1953 he was suspended from secret nuclear research as an alleged communist sympathizer and a security risk; the case, which pitted him against Edward Teller, became a worldwide cause célèbre. In 1963 he was reinstated and awarded the Enrico Fermi Award.

opportunity cost In economic terms, the opportunities forgone in the choice of one expenditure over others. For a consumer with a fixed income, the opportunity cost of buying a new dishwasher might be the value of a vacation trip never taken or several suits of clothes unbought. The concept of opportunity cost allows economists to examine the relative monetary values of various goods and services.

opposition, square of Geometrical representation of the traditional logical relations of opposition (contradictories, contraries, subalterns) among the four types of propositions (universal affirmative or A-proposition, universal negative or E, particular affirmative or I, particular negative or O) in the Aristotelian doctrine of the syllogism. At the top left is the A; at the top right is the E; below the A is the I; and below the E is the O. The A and the O, like the E and I, are contradictories (diagonal relations); the A and the E are contraries; and the I is subaltern to (hence implied by) the A, the O subaltern to the E. Whereas contradictories have opposite truth-values (one true, the other false), contraries cannot both be true but can both be false.

optical activity Ability of a substance to rotate the plane of polarization of a beam of light passed through it, either as crystals or in solution. Clockwise rotation as one faces the light source is "positive," or dextrorotary; counterclockwise rotation "negative," or levorotary. Louis Pasteur was the first to recognize that molecules with optical activity are stereoisomers (see isomerism). Optical isomers occur in pairs that are nonsuperimposable mirror images of one another. They have the same physical properties except for their effect on polarized light; in chemical properties they differ only in their interactions with other stereoisomers (see asymmetric synthesis).

optical character recognition See OCR

optical scanner See optical scanner

optics Science concerned with the production and propagation of light, the changes it undergoes and produces, and closely related phenomena. Physical optics deals with the nature and properties of light; geometric optics deals with the formation of images by mirrors, lenses, and other devices that use light. Optical data processing involves manipulation of the information content of an image formed by coherent (one-wavelength) optical systems. The study of optics has led to the development of devices such as eyeglasses and contact lenses, telescopes, microscopes, cameras, binoculars, lasers, and optical fibres (see fibre optics).

Optimates and Populares \ˌäp-ti-ˈmā-tēz...ˌpäp-yə-ˈlar-ēz\ Ideological positions in ancient Rome that became defined in the early 1st century BC. Both groups came from the wealthier classes. The Optimates (Latin: "Best Ones," "Aristocrats") promoted the dominance of the Senate and the proper balance of the constitution. The Populares ("Demagogues," "Populists") used and defended the powers of the popular assemblies and the office of tribune and advocated such measures as land distribution, debt cancellation, and subsidized grain allowances. Their polarization led to civil wars—notably those between Julius Caesar and Pompey and between Octavian (Augustus) and Mark Antony—and the fall of the republic with Augustus's accession.

optimization Field of applied mathematics whose principles and methods are used to solve quantitative problems in disciplines including physics, biology, engineering, and economics. Questions of maximizing or minimizing functions arising in the various disciplines can be solved using the same mathematical tools (see maximum; minimum). In a typical optimization problem, the goal is to find the values of controllable factors determining the behaviour of a system (e.g., a physical production process, an investment scheme) that maximize productivity or minimize waste. The simplest problems involve functions (systems) of a single variable (input factor) and may be solved with differential calculus. Linear programming was developed to solve optimization problems involving two or more input variables. See also simplex method.

optometry \äp-ˈtä-mə-trē\ Profession concerned with examining the eyes for defects or faults of refraction. Optometrists prescribe optical aids (e.g., eyeglasses, contact lenses), supervise eye exercise programs to treat vision problems, and examine the eyes for disorders such as glaucoma and cataracts. They are generally not licensed to prescribe drugs or trained to perform surgery. See also ophthalmology.

opuntia \ō-ˈpən-shə\ Any plant of the genus *Opuntia*, the largest genus of the cactus family. Native to the New World, it has characteristic small bristles with backward-facing barbs. Subgroups are based on the form of the stem segments: chollas have cylindrical joints, while prickly pears have flat joints. Sizes range from tiny, cold-hardy forms to treelike varieties. In the Northern Hemisphere, opuntia is found farther north than any other cactus.

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Opus Dei *Latin* **"work of God"** Roman Catholic lay and clerical organization whose actions and beliefs have been both criticized and praised. Its members seek personal Christian perfection, strive to implement Christian ideals in their chosen occupations, and promote Christian values to society as a whole. Opus Dei, in full Prelature of the Holy Cross and Opus Dei, was founded in 1928 in Spain by Josemaría Escrivá de Balaguer y Albá (canonzied in 2002). It is theologically conservative and accepts the teaching authority of the church without question. It was granted special status as the first and only personal prelature in the church by Pope John Paul II in 1982 and has established numerous vocational schools and universities. It is also highly controversial, accused of secrecy, using cult-like recruiting practices, and having grand political ambitions. There are separate organizations for men and women, which, since 1982, have been headed by a prelate elected by its members. At the beginning of the 21st century priests constituted only a tiny percentage of the organization, numbering roughly 1,600 of the nearly 84,000 members living in 80 countries.

oracle Source of a divine communication delivered in response to a petitioner's request. Ancient Greece and Rome had many oracles. The most famous was that of Apollo at Delphi, where the medium was a woman over 50 called the Pythia. After bathing in the Castalian spring, she apparently would descend into a basement cell, mount a sacred tripod, and chew the leaves of the laurel, sacred to Apollo. Her utterances, which were often highly ambiguous, were interpreted by priests. Other oracles, including those at Claros (Apollo), Amphicleia (Dionysus), Olympia (Zeus), and Epidaurus (Asclepius), were consulted through various other methods; for example, the oldest of the oracles, that of Zeus at Dodona, spoke through the whispering of the leaves of a sacred oak. At some shrines, the inquirer would sleep in the holy precinct and receive an answer in a dream.

oral tradition Cultural information passed on from one generation to the next by storytellers. The forms of oral tradition include poetry (often chanted or sung), folktales, and proverbs as well as magical spells, religious instruction, and recollections of the past. Music and rhyme commonly serve as both entertainment and aids to memory. Epic poems concerning the destiny of a society or summarizing its myths often begin as oral tradition and are later written down. In oral cultures, oral tradition is the only means of communicating knowledge. The prevalence of radio, television, and newspapers in Western culture has led to the decline of oral tradition, though it survives among old people and some minority groups as well as among children, whose games, counting rhymes, and songs are transmitted orally from generation to generation.

Oran \ō-'rän\ City (pop., 1998: 692,516), northwestern Algeria. Situated on the Mediterranean Sea, it is about midway between Tangier, Morocco, and Algiers. With the adjacent Mers el-Kebir, it is the country's second largest port. Founded in the 10th century by Andalusians as a base for trade with the northern African hinterland, it was held by the Spanish until 1708, when it fell to the Ottomans. It was devastated by an earthquake in 1790. In 1792 the Ottomans settled a Jewish community there. In 1831 it was occupied by the French, who established a modern port and naval base. In World War II (1939–45) it came under the control of the Allied Powers. Most of its European inhabitants left after Algerian independence in 1962. It is divided into a waterfront and the old and new city sections built on terraces above it.

orange Any of several species of small trees or shrubs in the genus *Citrus* of the rue (or citrus) family and their fruits. Grown in tropical and subtropical regions, the nearly round fruits have leathery, oily rinds and edible, juicy inner flesh rich in vitamin C. Key commercial species include the China (sweet, or common) orange; the mandarin orange (including tangerines); and seedless navel oranges. The tree has broad, glossy, medium-size evergreen leaves, leafstalks with narrow wings, and very fragrant flowers. It bears fruit abundantly for 50–80 years. Oranges do not improve in quality off the tree, so they are picked when fully ripe. A sizeable portion of the U.S. crop is processed for frozen concentrated juice. By-products include essential oils, pectin, candied peel, orange marmalade, and stock feed.

Orange, house of Princely dynasty and royal family of The Netherlands. The title began with William I (the Silent), prince of Orange-Nassau, who was stadtholder (viceroy) of the Netherlands, as were his descendants until 1795. In 1815 William VI became William I, king of The Netherlands. Through his descendants, the male line of the royal dynasty continued until 1890, when Wilhelmina, daughter of William III, became queen. In 1908 she decreed that her descendants should be styled princes and princesses of Orange-Nassau.

Orange Free State Former province, central South Africa. Before the arrival of the Europeans, the area was the home of Bantu-speaking peoples. Afrikaners came in large part during the Great Trek of the 1830s. Britain administered the territory from 1848 to 1854; then the independent Orange Free State was established. British rule was reimposed following the South African War in 1902, though self-government was later restored. In 1910 it became the Orange Free State province of the Union of South Africa (from 1961 the Republic of South Africa). After the South African elections of 1994, it became the province of Free State. Blacks make up about 80% of the population; most of the whites speak Afrikaans. The province's capital is Bloemfontein.

Orange River River, southern Africa. It rises in the Lesotho Highlands as the Sinqu River and flows west as the Orange across South Africa. It passes the southern edge of the Kalahari Desert and winds through the Namib Desert before draining into the Atlantic Ocean in South Africa. It forms the border between South Africa and Namibia. It is about 1,300 mi (2,100 km) long. There are some irrigated sections along the river and many dams but no large towns.

orangutan \ə-'raŋ-ə-ˌtaŋ\ *or* **orang** Species (*Pongo pygmaeus*, family Hominidae) of arboreal great ape, found only in the lowland swamp forests of Borneo and Sumatra but originally in the tropical forests of South Asia as well. The orangutan (Malaysian for "person of the forest") has a short thick body, long arms, short legs, and shaggy reddish hair. Males are about 4.5 ft (137 cm) tall and weigh about 185 lb (85 kg); females are smaller. Orangutans are placid, deliberate, ingenious, and persistent. Males have flat, fatty cheekpads and a baglike, pendulous swelling at the throat. Orangutans use all four limbs to walk and climb. They eat mostly figs and other fruits and some leaves, bark, and insects. They sleep in trees on a platform built of interwoven branches. Adults are solitary and live far apart, coming together only for a brief courtship. The mother carries and nurses the single young for almost three years. Though generally silent, the adult male has a loud, roaring "long call." The orangutan is an endangered species.

Male orangutan (*Pongo pygmaeus*) with cheek pads.
RUSS KINNE/PHOTO RESEARCHERS

Oranjestad \ō-'rän-yə-ˌstät\ Seaport and chief administrative town (pop., 2000: 26,355), Aruba, Netherlands Antilles. It is located on the western coast of this Caribbean island. It is a free port and a petroleum-processing and shipping centre.

oratorio Large-scale musical composition on a sacred subject for solo voices, chorus, and orchestra. The term derives from the oratories, community prayer halls set up by St. Philip Neri in the mid 16th century in a Counter-Reformation attempt to provide locales for religious edification outside the church itself, and the oratorio remained a nonliturgical (and non-Latin) form for moral musical entertainment. The first oratorio, really a religious opera, was written in 1600 by Emilio del Cavaliere, and the oratorio's development closely followed that of opera. Giacomo Carissimi produced an important body of Italian oratorios, and Marc-Antoine Charpentier transferred the oratorio to France in the later 17th century. In Germany the works of Heinrich Schütz anticipate the oratorio-like Passions of Johann Sebastian Bach. The most celebrated oratorio composer was George Frideric Handel; his great English works include the incomparable *Messiah* (1742). Handel inspired Franz Joseph Haydn's great *Creation* (1798) and exerted great influence on the 19th-century oratorio, whose composers include Hector Berlioz, Felix Mendelssohn, and Franz Liszt. Though the oratorio thereafter declined, 20th-century oratorio composers included Edward Elgar, Igor Stravinsky, Arthur Honegger, and Krzysztof Penderecki.

Orbison, Roy (b. April 23, 1936, Vernon, Texas, U.S.—d. Dec. 6, 1988, Hendersonville, Tenn.) U.S. singer and songwriter. He formed his first

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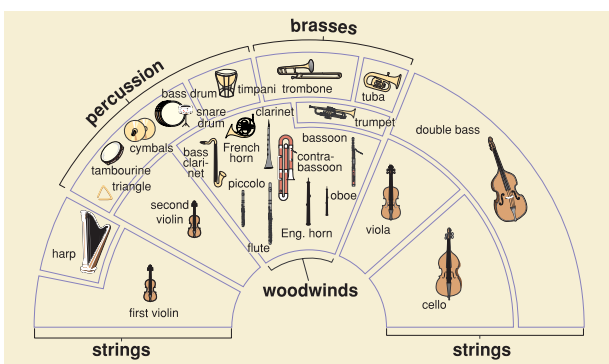
musical group at age 13. His first single, "Ooby Dooby" (1956), was followed in the early 1960s by a string of hits, carefully crafted ballads of loneliness and heartache that included "Only the Lonely," "I Can't Stop Loving You," "Crying," "In Dreams," and "Oh, Pretty Woman." He was known for his soaring voice, one of the most operatic in all rock music. His career waned after the death of his wife in a motorcycle accident (1966) and the death of two sons in a fire (1968). He made a comeback in the 1980s; with Bob Dylan, George Harrison (1943–2001), and Tom Petty (b. 1953) he formed the band the Traveling Wilburys.

orbital Mathematical expression, called a WAVE FUNCTION, that describes properties characteristic of no more than two ELECTRONS near an atomic nucleus or molecule. An orbital can be considered a three-dimensional region in which there is a 95% probability of finding an electron. Atomic orbitals are designated by a combination of numerals and letters (e.g., 1*s*, 2*p*, 3*d*, 4*f*). The numerals are the principal quantum number and are related to the atomic energy level and distance from the nucleus; the letters indicate the orbital's angular momentum and hence its shape. An *s* orbital with zero net orbital angular momentum is spherical. A *p* orbital with one fundamental unit of angular momentum, $\hbar$, is shaped somewhat like a dumbbell ($\hbar$ is Planck's constant, h, divided by 2π). The shapes of the other orbitals are more complicated. Molecular orbitals have geometries determined by the overlap of two or more atomic orbitals and are designated by Greek symbols, e.g., σ and π.

orca See KILLER WHALE

Orcagna \ôr-'kän-yä**, Andrea** *orig.* **Andrea di Cione** (b. c. 1308, Florence?, Republic of Florence—d. c. 1368, Florence) Florentine painter, sculptor, and architect. A goldsmith's son, he was the leading member of a family of painters and the most prominent Florentine artist of the mid 14th century. His altarpiece for the Strozzi Chapel in Florence's Santa Maria Novella (1354–57) shows his ability to unify the multiple panels of a polyptych. As a sculptor he is known for a single work: the tabernacle in the guild oratory of Or San Michele (1352–60), a decorative structure of great complexity that is among the finest examples of the expressive art that sprang up in Tuscany after the Black Death. He was employed as architect on Florence's Duomo (cathedral) in 1357 and 1364–67.

orchestra Instrumental ensemble of varying size and composition. Today the term *orchestra* usually refers to the traditional large Western ensemble of bowed STRINGED INSTRUMENTS with BRASS, WOODWIND, and PERCUSSION instruments, with several players to each string part. The development of the orchestra coincides with the early history of OPERA. A major antecedent of the modern orchestra was that of the mid-17th-century French court, especially as employed by Jean-Baptiste Lully; it was dominated by 24 bowed strings but also often included woodwind instruments. Trumpets, horns, and timpani were often added in the early 18th century and were standard by the time of Franz Joseph Haydn. During the 19th century there was a considerable expansion, particularly in the number and variety of wind and percussion instruments; some works called for well over 100 musicians. The symphony orchestra changed little in the 20th century. See also ORCHESTRATION.



Standard layout of a modern symphony orchestra.
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orchestration Art of choosing which instruments to use for a given piece of music. The sections of the ORCHESTRA historically were separate ensembles: the stringed instruments for indoors, the woodwind instruments for outdoors, the horns for hunting, and trumpets and drums for battle or royal ceremony. Once entirely dependent on what was available or customary, composers began to explore the musical potential of instrumental combinations with the advent of the modern orchestra in the mid- to late 18th century. The first great orchestration text was written by Hector Berlioz in 1844.

orchid Any of the 15,000–35,000 species in 400–800 genera of nonwoody perennial plants that make up the family Orchidaceae. Bearing attractive flowers, orchids grow in most of the nonpolar world, especially in tropical regions, in soil or on other plants. Hybrids with showy flowers for the commercial trade come from the genera *Cattleya*, *Cymbidium*, *Vanda*, and *Laelia*. Flowers vary widely in size, colour, and shape, but all are bilaterally symmetrical and have three sepals. Most orchids photosynthesize, but some live on dead organic material or absorb food from a fungus living in their roots. Vanilla is extracted from the seedpod of the genus *Vanilla*. Many folk medicines, local beverages, and foods are prepared from parts of orchid plants.

Orchid (*Polystachya bella*).
SVEN SAMELIUS

orchitis \ôr-'kī-təs\ INFLAMMATION and swelling of the TESTES, caused by infection (most often MUMPS) or chemical or physical injury. The testicles' rich blood and lymphatic supply block most infections in the absence of severe injury. Usual symptoms are high fever, sudden pain in the testicle, nausea and vomiting, and swelling, tightness, and tenderness of the gland. Fluids with pus or blood may accumulate in the scrotum, which is generally red and thickened. Treatment may include antibiotics, bed rest, support of the testes, compresses, and surgery or drainage.

Orchomenus \ôr-'kä-mə-nəs\ Ancient city, northwestern Boeotia, Greece. It was the northernmost fortified town in Mycenaean times and controlled a large part of Boeotia. In c. 550 BC it became one of the first cities to coin money, thereby gaining fame for its wealth. It was frequently attacked and finally destroyed by Thebes in the 4th century BC. Excavations have revealed that it was an important Neolithic and Bronze Age site, with a beehive temple and palace.

Orczy \'ōrt-sē**, Emmuska (Magdalena Rosalia Marie Josepha Barbara), Baroness** (b. Sept. 23, 1865, Tarnaörs, Hung.—d. Nov. 12, 1947, London, Eng.) Hungarian-born British novelist. The daughter of a noted musician, she was educated in Brussels and Paris and studied art in London. She became famous as the author of *The Scarlet Pimpernel* (1905), a swashbuckling adventure set in the era of the French Revolution. Her sequels did not match its great popular success. She also wrote detective stories.

Ord River River, northeastern Western Australia. The Ord rises in the Albert Edward Range and flows east and north to the Cambridge Gulf; it is about 200 mi (320 km) long. Discovered in 1879 by Alexander Forrest, it was named for Harry Ord, governor of Western Australia. The Ord River Project is designed to prevent flooding and collect irrigation water.

ordeal In customary law, a test of guilt or innocence in which the accused undergoes dangerous or painful tests believed to be under supernatural control. Ordeals by fire or water are the most common. Burns suffered while passing through fire (as in Hindu custom) or rejection (i.e., being buoyed up) by a body of water (as in witch trials) would be regarded as proof of guilt. In ordeal by combat, as in the medieval duel, the victor is said to win not by his own strength but because supernatural powers have intervened on the side of the right.

order In CLASSICAL ARCHITECTURE, any of several styles defined by the particular type of COLUMN, base, CAPITAL, and ENTABLATURE they use. There are five major orders: Doric, Ionic, and Corinthian (all developed in Greece), and Tuscan and Composite (developed in Rome). The form of the capital is an order's most distinguishing characteristic. Both the Doric and Ionic orders originated in wooden temples. The Doric is squat and simple. The Ionic, distinguished by the scrolls, or volutes, on its capital, resembles a

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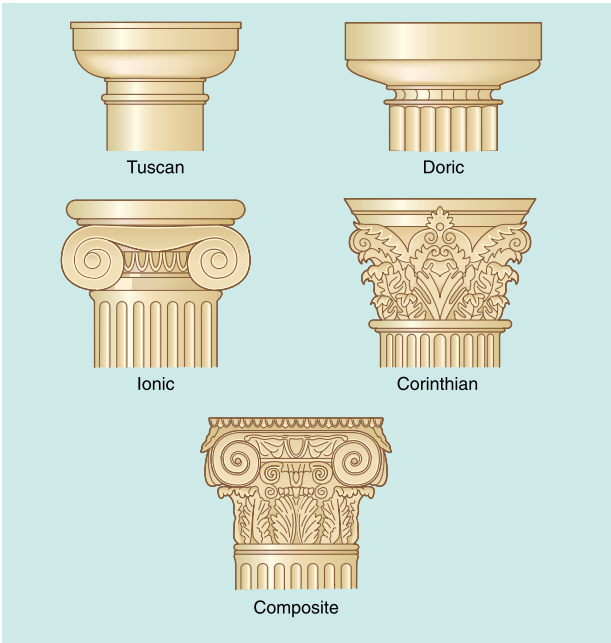
capital I. The Corinthian capital is more ornate, with carved acanthus leaves and scrolls. The Romans modified the Greek orders to produce the Tuscan (a simplified form of the Doric) and Composite (a combination of the Ionic and Corinthian) orders. See also COLOSSAL ORDER.



Capital styles for the five major orders of Classical architecture.
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order in council In Britain, a regulation traditionally issued by the sovereign on the advice of the PRIVY COUNCIL. In modern practice, an order is issued only on the advice of ministers, and the minister in charge of the department concerned with the order's subject matter is responsible to Parliament for its contents. Most orders in council today are issued to implement legislation passed by Parliament.

Order of the Garter See Order of the GARTER

ordinary differential equation Equation containing DERIVATIVES of a FUNCTION of a single VARIABLE. Its order is the order of the highest derivative it contains (e.g., a first-order DIFFERENTIAL EQUATION involves only the first derivative of the function). Because the derivative is a rate of change, such an equation states how a function changes but does not specify the function itself. Given sufficient initial conditions, however, such as a specific function value, the function can be found by various methods, most based on INTEGRATION.

Ordovician \ˌȯr-də-ˈvi-shən\ **Period** Interval of geologic time, 490–443 million years ago, the second oldest period of the PALEOZOIC ERA. It follows the CAMBRIAN and precedes the SILURIAN. During the Ordovician, many of the landmasses were aligned in the tropics. Life was dominated by marine invertebrates, but some forms of land plants may have appeared during the middle of the period. Spores suggesting a tropical terrestrial environment have been found in rocks of that age.

Ordzhonikidze \ər-jən-yik-ˈyēd-zə**, Grigory (Konstantinovich)** (b. Oct. 24, 1886, Goresha, Russia—d. Feb. 18, 1937, Moscow, Russia, U.S.S.R.) Russian communist leader. After the RUSSIAN REVOLUTION OF 1917, he became chairman of the Caucasian bureau (1921) and helped the Red Army conquer Georgia, forcing its merger with Armenia and Azerbaijan into the Transcaucasian Federal Republic and then into the Soviet Union. He became a member of the Politburo (1930) and commissar for heavy industry (1932), but in the mid-1930s he opposed JOSEPH STALIN's industrial policy. His sudden death was ascribed to natural causes, but NIKITA KHRUSHCHEV later charged (1956) that Stalin had driven him to suicide.

ore Aggregate of economically important MINERALS that is sufficiently rich to separate for a profit. Although more than 3,500 mineral species are known, only about 100 are considered ore minerals. The term originally applied only to metallic minerals (see NATIVE ELEMENT) but now includes such nonmetallic substances as SULFUR, calcium fluoride (FLUORITE), and barium sulfate (BARITE). Ore is always mixed with unwanted rocks and minerals, known collectively as gangue. The ore and the gangue are mined together and then separated. The desired element is then extracted from the ore. The metal may be still further refined (purified) or alloyed with other metals.

oregano Flavourful dried leaves and flowering tops of any of various perennial herbs of the MINT family, particularly *Origanum vulgare*. Oregano is an essential ingredient of Mediterranean cuisines; in the U.S., use of oregano rose sharply in the late 20th century, largely because of the popularity of pizza. Native to the Mediterranean and western Asia, the herbs are now naturalized in parts of Mexico and the U.S.

Oregon State (pop., 2000: 3,421,399), U.S., northwestern region. Lying on the Pacific Ocean, it is bordered by Washington, Idaho, Nevada, and California. It covers 97,073 sq mi (251,419 sq km). Its capital is SALEM. The COLUMBIA RIVER forms its northern boundary; the SNAKE RIVER is its upper eastern boundary. The CASCADES RANGE, with Mount HOOD, is in western central Oregon. First sighted by Spanish explorers, it was visited by FRANCIS DRAKE in 1579 and by JAMES COOK in 1778. The area was inhabited by many American Indian peoples when in 1792 Capt. Robert Gray explored the COLUMBIA RIVER, giving the U.S. a claim to the region. The river's mouth was reached by the LEWIS AND CLARK EXPEDITION in 1805. The first white settlement was founded at Astoria in 1811 by the fur trader JOHN J. ASTOR. Settlement of the area accelerated from c. 1843 with mass migration over the OREGON TRAIL. It was part of the Oregon Territory and was admitted to the Union as the 33rd state in 1859. The state's economy is dependent on its forests, farms, and livestock. Salmon and shellfish are the bases of the fishing industry. Centres of population, arts, and education are PORTLAND, EUGENE, and Medford.

Oregon Caves National Monument National monument, southwestern Oregon, U.S. It is a single cave comprising a series of chambers joined by subterranean corridors on four levels. Located in the Siskiyou Mountains near the California border, the monument was established in 1909. It has an area of 488 acres (197 hectares). It contains many stalagmites, STALACTITES, and other formations.

Oregon Question Dispute over ownership of the Pacific Northwest region of North America. Spain, Russia, the U.S., and Britain all had claims to the region based on exploration or settlement. Spain vacated its claims after the NOOTKA SOUND CONTROVERSY and in an 1819 treaty with the U.S. The U.S. and Britain established a joint claim over the Oregon Country in 1818. Russia abandoned its claims in separate treaties (1824–25). A compromise Oregon Treaty between the U.S. and Britain (1846) drew the U.S.-Canada land boundary at 49°N.

Oregon Trail Major U.S. route to the Northwest in the 19th century. It stretched about 2,000 mi (3,200 km), from Independence, Mo., to the Columbia River region of Oregon. First used by fur traders and missionaries, it was heavily used in the 1840s by travelers to Oregon, including settlers of the "great migration," led by MARCUS WHITMAN. Of all western trails, it was in use for the longest period, surviving competition from the railroad by serving as a trail for eastward cattle and sheep drives.

Orestes \ȯ-ˈres-tēz\ In GREEK MYTHOLOGY, the son of AGAMEMNON and Clytemnestra. According to HOMER, Orestes was away when his father returned from TROY to meet his death at the hands of Aegisthus, his wife's lover. On reaching manhood, Orestes avenged his father by killing Aegisthus and Clytemnestra. AESCHYLUS's dramatic trilogy the *Oresteia* recounts the murder and the pursuit of Orestes by the FURIES for the crime of matricide. In EURIPIDES' *Iphigeneia in Tauris*, Orestes is reunited with his sister IPHIGENEIA and regains his father's kingdom.

Øresund \ˈœ-rə-ˌsən\ Almost tideless strait between SJÆLLAND island, Denmark, and Skåne, Sweden, connecting the Kattegat Strait with the BALTIC SEA. It is one of the busiest sea lanes in the world, though ice sometimes impedes navigation in severe winters. Three large islands within it divide the waters into channels. The strait's principal ports are COPENHAGEN and Helsingør in Denmark and MALMÖ and Hälsingborg in Sweden.

Orff, Carl (b. July 10, 1895, Munich, Ger.—d. March 29, 1982, Munich) German composer and music educator. He trained at the Munich Academy and held several musical posts thereafter. In the 1920s he grew interested in early Baroque music and the association of music with movement.

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In 1924 he cofounded a school for which he devised a comprehensive music education program (Orff Schulwerk) involving improvisation on specially designed gamelan-like percussion instruments; the program has since come into wide international use. He typically used repetitive rhythms, bare harmonies, and powerfully direct vocal parts, as in his best-known work, the secular oratorio *Carmina Burana* (1937), which is based on a manuscript of medieval poems.

organ Keyboard instrument in which pressurized air produces notes by means of a series of tuned pipes. The simplest organs consist of a single rank of pipes, each corresponding to a single key. They are arranged over a wind chest connected to the keys by a set of valves and fed with a supply of air by electrically or mechanically activated bellows. By pulling out knobs, called stops, the player engages new ranks of pipes. Two distinct types of pipes are used: flue pipes (both open and stopped) produce sound by directing air against the edge of an opening in the pipe, whereas reed pipes sound by means of a thin metal tongue inside the pipe that vibrates against a fixed projection next to it. A large organ may have five or more banked keyboards, or manuals, each of which controls a distinctive group of pipes. Most organs also have pedalboards played with the feet. A large organ's pipes may vary in length from about 1 in. to 32 ft (2.5 cm to 10 m), resulting in a huge nine-octave range. The earliest organ (c. 250 BC) was the Greek *hydraulis*, in which the wind was regulated by water pressure. The bellows-fed organ appeared about the 7th century AD. The organ became firmly associated with the church by the 10th century. As organs became widespread, different regions pursued different modes of construction and sought different tonal ideals. The Baroque German organ is ideally suited to polyphony, while the French taste for variety of timbres eventuated in Aristide Cavaillé-Coll's vast "orchestral" organs. See also harmonium.

The Bruckner Organ, 18th century; in the church of the Abbey of Sankt Florian, Austria
TONI SCHNEIDERS

Organ Pipe Cactus National Monument National monument, southwestern Arizona, U.S., at the Mexican border. It was established in 1937. With an area of 330,689 acres (133,929 hectares), it preserves segments of the mountainous Sonoran Desert and is named for the organ-pipe cactus. Wildlife includes Gila monsters, antelope, coyotes, and a variety of birds.

organic compound Substance whose molecules contain one or more (often many more) carbon atoms (excluding carbonates, cyanides, carbides, and a few others; see inorganic compound). Until 1828 (see urea), scientists believed that organic compounds could be formed only by life processes (hence the name). Since carbon has a far greater tendency to form molecular chains and rings than do other elements, its compounds are vastly more numerous (many millions have been described) than all others known. Living organisms consist mostly of water and organic compounds: proteins, carbohydrates, fats, nucleic acids, hormones, vitamins, and a host of others. Natural and synthetic fibres and most fuels, drugs, and plastics are organic. Hydrocarbons contain only carbon and hydrogen; organic compounds with other functional groups include carboxylic acids, alcohols, aldehydes, ketones, phenols, ethers, esters, and other, more complex, molecules, including heterocyclic compounds, isoprenoids, and amino acids.

organic farming *or* **organic gardening** System of crop cultivation that uses biological methods of fertilization and pest control as substitutes for chemical fertilizers and pesticides, which are regarded by supporters of organic methods as harmful to health and the environment and unnecessary for successful cultivation. It was initiated as a conscious rejection of modern agri-chemical techniques in the 1930s by the British agronomist Sir Albert Howard. Miscellaneous organic materials, including animal manure, compost, grass turf, straw, and other crop residues, are applied to fields to improve both soil structure and moisture-holding capacity and to nourish soil life, which in turn nourishes plants. (Chemical fertilizers, by contrast, feed plants directly.) Biological pest control is achieved through preventive methods, including diversified farming, crop rotation, the planting of pest-deterrent species, and the use of integrated pest management techniques. Bioengineered strains are avoided. Since organic farming is time-consuming, organically grown produce tends to be expensive. Organic produce formerly accounted for a minuscule portion of total American farm output, but it has seen a huge proportional increase in sales in recent years.

Organization for Economic Cooperation and Development See Organization for Economic Cooperation and Development

Organization of African Unity (OAU) See African Union

Organization of American States (OAS) International organization formed in 1948 to replace the Pan-American Union. It promotes economic, military, and cultural cooperation among its members, which include almost all the independent states of the Western Hemisphere. (Cuba's membership was suspended in 1962.) The OAS's main goals are to maintain peace in the Western Hemisphere and to prevent intervention in the region by any outside state. Since the end of the Cold War in the early 1990s, the OAS has more actively encouraged democratic government in member states, in part by organizing missions to observe and monitor elections. See also Alliance for Progress; Inter-American Development Bank.

Organization of Petroleum Exporting Countries See OPEC

organizational psychology See industrial psychology

organizational relations See industrial relations

organized crime Crime committed on a national or international scale by a criminal association; also, the associations themselves. Such associations engage in offenses such as cargo theft, fraud, robbery, kidnapping for ransom, and the demanding of "protection" payments. Their principal source of income derives from the supply of illegal goods and services for which there is continuous public demand, such as drugs, prostitution, "loan-sharking" (i.e., the lending of money at extremely high interest rates), and gambling. They are characterized by a hierarchy of ranks with assigned responsibilities; the coordination of activities among subgroups; the division of geographic territory among different associations; a commitment to total secrecy; efforts to corrupt law-enforcement authorities; and the use of extreme violence, including murder, against rival associations, informers, and other enemies. International rings of smugglers, jewel thieves, and drug traffickers have existed throughout Europe and Asia, and Sicily and Japan have centuries-old criminal organizations. In the U.S., organized crime flourished in the 20th century, especially during the Prohibition era. In the late 20th and early 21st centuries, it became immensely powerful in Russia, taking advantage of a weak and impoverished government and widespread official corruption. See also Mafia; yakuza.

organum \'ȯr-gə-nəm\ Early polyphonic setting of plainchant (see Gregorian chant), the earliest form of counterpoint. The oldest written organum (c. 900), which evidently reflects a prevailing improvisational practice, consists of two lines moving simultaneously, note against note, the added line often paralleling the chant line a fourth or a fifth below. Later the added line acquired greater melodic individuality and independence. Organum consisting of more than one note against each chant note (florid or melismatic organum) appeared by the early 12th century. Three- and four-voice organum were first composed by the Notre-Dame school. Organum died out with the advent of the 13th-century motet.

Orhon River *or* **Orkhon** \'ȯr-ˌkȯn\ **River** River, north-central Mongolia. Some 700 mi (1,130 km) long, it rises from the slopes of the Hangayn Mountains and flows east, then north past the ruins of Karakorum. The 8th-century funerary stelae discovered in the river's valley in 1889 contain some of the oldest known Turkic writing, called the Orhon inscriptions. The river is navigable for shallow-draft vessels only in July and August.

oriel Bay window in an upper story, supported from below by projecting corbels. Usually semihexagonal or rectangular in plan, oriels first became prevalent early in the 15th century. They were often placed over gateways or entrances to manor houses and public buildings of the late Gothic and Tudor periods. In cities of North Africa and the Middle East, the *moucharaby* is an oriel that uses grills or lattices in place of glass and shutters. See also brise-soleil.

Orient Express Luxury train that ran from Paris to Constantinople (Istanbul) for over 80 years (1883–1977). Developed by the Belgian businessman Georges Nagelmackers, its luxuriously furnished cars became

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the symbol of glamour for European society. Europe's first transcontinental express train, it covered over 1,700 mi (2,740 km); after 1919 the route extended from Calais and Paris to Lausanne and via the Simplon Pass to Milan, Venice, Zagreb, and beyond. Service was suspended during both world wars. Discontinued in 1977, it was revived in 1982 to run between London and Venice as the "Venice Simplon Orient Express."

orientation In architecture, the position of a building on its site. In Mesopotamia and Egypt, as well as in pre-Columbian Central America, a building's important features, such as entrances and passages, faced the rising sun. Mosques are oriented so that the MIHRAB faces Mecca. Christian churches have usually been oriented with the apse or altar at the eastern end. Orientation is frequently planned to take maximum advantage of daily and seasonal variations of sunlight. A structure's optimal orientation is usually a compromise between its function, location, and the prevailing environmental factors of solar radiation, light, humidity, and wind that make up the site's microclimate.

orienteering Cross-country footrace in which each participant uses a map and compass to navigate between checkpoints along an unfamiliar course. Introduced in Sweden in 1918, it later spread throughout Europe. World championships have been held since 1966. Runners set out at intervals; the winner is the runner who completes the course in the fastest time. Orienteering is also practiced by cyclists, canoeists, horseback riders, and skiers.

origami See PAPER FOLDING

Origen \'ȯr-i-jən\ *orig.* **Oregenes Adamantius** (b. c. 185, probably Alexandria, Egypt—d. c. 254, Tyre, Phoenicia) Greek theologian, one of the Fathers of the Church. Probably the son of a Christian martyr, Origen studied philosophy in Alexandria and served as head of its catechetical school for 20 years. He later settled in Palestine and founded a school of philosophy and theology. He traveled widely as a preacher; he was imprisoned and tortured during the persecutions of the emperor DECIUS in 250 but survived to die several years later. His greatest work, the *Hexapla*, is a synopsis of six versions of the Hebrew scriptures. His writings, influenced by NEOPLATONISM and STOICISM, stress that providence seeks to restore all souls to their original blessedness and emphasize the centrality of the Word (LOGOS) in the cosmos. He held that even Satan was not beyond repentance and salvation, a view for which he was condemned. Although attacked as a heretic, Origen remained an influential thinker throughout late antiquity and the Middle Ages.

original sin In Christian doctrine, the condition or state of SIN into which each human being is born, or its origin in ADAM's disobedience to God when he ate the fruit of the tree of knowledge of good and evil. His guilt was transmitted to his descendants. Though GENESIS describes Adam's sufferings as the consequence of his disobedience, it does not make Adam's sin hereditary. The main scriptural basis of the doctrine is found in the writings of St. PAUL; St. AUGUSTINE helped make humanity's sinful nature a central element in orthodox Christian theology. Medieval theologians continued to explore the issue, and THOMAS AQUINAS offered a more optimistic view of human nature in his teachings on original sin than had Augustine. MARTIN LUTHER and JOHN CALVIN accepted a more Augustinian understanding, and modern evolutionary theory and biblical source criticism raised new challenges for the definition of original sin.

Orinoco \ˌōr-ē-'nō-kō\ **River** Major river, South America. It rises on the western slopes of the Parima Mountains along the border between Venezuela and Brazil. It flows in a giant arc through Venezuela for about 1,700 mi (2,740 km) and enters the Atlantic Ocean near the island of Trinidad. It forms part of the border between Colombia and Venezuela. With its tributaries, it is the northernmost of South America's four major river systems. The aquatic fauna include the PIRANHAS and the Orinoco CROCODILE. The river basin is largely inhabited by indigenous Indian groups.

oriole Any songbird of 24 species in the Old World genus *Oriolus* (family Oriolidae) or 30 species in the New World genus *Icterus* (family Icteridae). Males typically are black and yellow or black and orange, with some white. Females are less colourful. Orioles are not easily seen but may be detected by their loud whistling and jarring notes. All are insect eaters (several species also eat fruit) in woodlands and gardens, chiefly in warm regions. The only European species is the 9.5-in. (24-cm) golden oriole (*O. oriolus*). Other *Oriolus* species are found in Africa, Asia, and Australia. The Baltimore oriole (*I. galbula*) breeds in North America east of the Rocky Mountains. See photograph above.

Golden oriole (*Oriolus oriolus*)
H. SCHREMPP—BRUCE COLEMAN INC.

Orion \ə-'rī-ən\ In GREEK MYTHOLOGY, a powerful hunter. He was sometimes said to be the son of POSEIDON. He drove the wild beasts out of the island of Chios and fell in love with Merope, daughter of the island's king. Disapproving of Orion, the king had him blinded, but his vision was restored by the rays of the rising sun. He later went to Crete to live and hunt with ARTEMIS. Some legends hold that he was killed by Artemis or APOLLO out of jealousy; another tells that he was fatally bitten by a scorpion. After his death the gods placed him in the sky as a constellation.

Orion \ə-'rī-ən\ **Nebula** Bright NEBULA, faintly visible to the unaided eye in the sword of the hunter's figure in the constellation Orion. About 1,500 light-years from Earth, it contains hundreds of very hot young stars clustered about a group of four massive stars known as the Trapezium. Radiation primarily from these four stars excites the nebula to glow. Discovered in the early 17th century, it was the first nebula to be photographed (1880).

Orissa State (pop., 2001 prelim: 36,706,920), eastern India. It lies on the Bay of BENGAL and is bordered by ANDHRA PRADESH, CHHATTISGARH, JHARKHAND, and WEST BENGAL states. It occupies an area of 60,119 sq mi (155,707 sq km), and its capital is BHUBANESHWAR; Cuttack is the largest city. Part of the ancient kingdom of KALINGA, it was a stronghold of HINDUISM before its conquest by the Afghan rulers of Bengal in 1568, when it became part of the Mughal Empire. It was ruled by Britain from 1803 until India's independence in 1947 and became a state in 1950. Situated in a tropical savanna that is subject to cyclones, it has a largely rural population, which is engaged mainly in agriculture. Crops include rice, oilseed, jute, and sugarcane. It has a rich artistic heritage and contains some of the best examples of Indian art and architecture.

Orizaba See CITLALTÉPETL

Orkhon River See ORHON RIVER

Orkney Islands Island group (pop., 2001: 19,245), Scotland. Lying north of the Scottish mainland, it comprises more than 70 islands and islets and constitutes the Orkney council area. The Orkney Islands, only 20 of which are inhabited, were the Orcades of ancient Classical literature. There is much evidence of prehistoric inhabitants. Norse raiders arrived in the late 8th century AD and colonized the islands in the 9th century. Thereafter they were ruled by Norway and Denmark until Scotland annexed them in 1472. It is a prosperous agricultural area. KIRKWALL is the administrative seat.

Orlando City (pop., 2000: 185,951), central Florida, U.S. Settlement began c. 1844 around an army post. It was renamed in 1857 to honour Orlando Reeves, an army sentry killed during the SEMINOLE WARS. After 1950 the development of the aerospace complex at Cape CANAVERAL and, after 1971, of nearby DISNEY WORLD boosted the city's population and economy. It is also the centre of a citrus farming region.

Orlando, Vittorio Emanuele (b. May 19, 1860, Palermo, Italy—d. Dec. 1, 1952, Rome) Italian politician and prime minister (1917–19). He was elected to Italy's Chamber of Deputies in 1897 and served in cabinet positions from 1903. As prime minister, he led Italy's delegation to the PARIS PEACE CONFERENCE, but he was unable to obtain concessions from the Allies for Italian-claimed territory and resigned. As president of the Chamber of Deputies (1919–25), he resigned in protest against the electoral fraud of BENITO MUSSOLINI's Fascist Party. He was president of the postwar Constituent Assembly (1946–47).

Orléans \ȯr-lā-'äⁿ\ *ancient* **Aurelianum** City (pop., 1999: 113,126), capital of the Centre *région*, north-central France. It was conquered by Julius CAESAR in 52 BC and became an intellectual centre under CHARLEMAGNE. It was a major cultural centre in the Middle Ages and became a royal duchy under PHILIP VI in 1344. During the HUNDRED YEARS' WAR, the English siege in 1429 was relieved by JOAN OF ARC, known as the Maid of Orléans, and her troops. Located on the LOIRE RIVER in a fertile valley, it is important for market gardening, horticulture, and textile production.

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Orléans, house of Name of the cadet or junior branch of the Valois and Bourbon houses of France. Of the four dynasties of princes, Philippe I (1336–75) died without an heir. Descendants of the second dynasty, headed by Louis I (1372–1407), held the title until 1545. The third dynasty was headed by Gaston (1608–60), whose title from 1626 passed to the fourth dynasty under Philippe I (1640–1701), younger brother of Louis XIV. Philippe's descendants included Louis-Philippe-Joseph, duke d'Orléans, and Louis-Philippe, king of France from 1830 to 1848.

Orléans, Louis-Philippe-Joseph, duke d' *known as* **Philippe Égalité** (b. April 13, 1747, Saint-Cloud, France—d. Nov. 6, 1793, Paris) French Bourbon prince who supported popular democracy in the French Revolution. A cousin of Louis XVI, he disapproved of Marie-Antoinette and lived away from the royal court at Versailles. In 1787 he was exiled to his estates for challenging the king's authority. In 1789 he was elected to the Estates General and soon joined the Third Estate. After joining the Jacobin Club (1791), he renounced his title of nobility (1792) and accepted the name Philippe Égalité from the Paris Commune. In the National Convention, he supported the radicals, but, after his son Louis-Philippe defected to the Austrians, he was accused of conspiracy, arrested, and guillotined.

Orlov \ər-'lȯf**, Aleksey (Grigoryevich), Count** (b. Oct. 5, 1737, Lyutkino, Tver province, Russia—d. Jan. 5, 1808, Moscow) Russian military officer. He became an officer in the Russian guards and adviser to his brother Count Grigory G. Orlov, with whom he planned the overthrow of Peter III (1762) and the installation of Catherine II as empress. Promoted to major general, he was given command of the Russian fleet in the Russo-Turkish War.

Orlov, Grigory (Grigoryevich), Count (b. Oct. 17, 1734, Lyutkino, Tver Province, Russia—d. April 24, 1783, Neskuchnoye, near Moscow) Russian military officer and lover of Catherine II. An artillery officer, he fought in the Seven Years' War. While stationed in St. Petersburg, he met the grand duke Peter (later Peter III) and his wife, Catherine, whose lover Orlov became c. 1760. After Peter ascended the throne (1762), Orlov and his brother, Count Aleksey Orlov, planned the coup d'état that overthrew Peter and made Catherine empress of Russia. As Catherine's close adviser, he proposed agrarian reforms to help the serfs, but little was accomplished. He lost favour at court c. 1772.

Ormandy, Eugene *orig.* **Jenö Ormandy Blau** (b. Nov. 18, 1899, Budapest, Austria-Hungary—d. March 12, 1985, Philadelphia, Pa., U.S.) Hungarian-born U.S. conductor. A violin prodigy, he became professor of violin at the Budapest Royal Academy at age 17. In 1921 he went to New York City, where he played in and conducted a theatre orchestra; he gained national prominence as conductor of the Minneapolis Symphony Orchestra (1931–36). He shared conductorship of the Philadelphia Orchestra with Leopold Stokowski for two years before becoming sole conductor in 1938, and he led the orchestra until he was made laureate in 1980. Ormandy shaped the orchestra's sound by developing the lush, velvety string colour that became its trademark, and the orchestra made scores of recordings under him.

ormolu \'ȯr-mə-ˌlü\ (from French *dorure d'or moulu*, "gilding with gold paste") Gold-coloured alloy made up of copper, zinc, and sometimes tin in various proportions but usually at least 50% copper. It is used in mounts (ornaments on borders, edges, and as angle guards) for furniture and for other decorative purposes. After the molten alloy has been poured into a mold and allowed to cool, it is gilded with powdered gold mixed with mercury. It is then fired at a temperature that evaporates the mercury, leaving a gold surface. Ormolu was first produced in France in the mid-17th century, and France remained its main centre of production. See photograph opposite.

Ormonde, James Butler, 12th earl and 1st duke of (b. Oct. 19, 1610, London, Eng.—d. July 21, 1688, Kingston Lacy, Dorset) Anglo-Irish statesman. Born into the prominent Butler family of Ireland, he succeeded to the earldom of Ormonde in 1632. In service to the English crown in Ireland from 1633, he fought against the Catholic rebellion from 1641. He concluded a peace with the Catholic confederacy in 1649, then rallied support for Charles II, but he was forced to flee when Oliver Cromwell landed at Dublin. He was Charles's adviser in exile (1650–60). After the Restoration he was appointed lord lieutenant of Ireland (1662–69, 1677–84), where he encouraged Irish commerce and industry. He was created a duke in 1682.

Ormuz See Hormuz

ornamentation In music, the addition of notes for expressive and aesthetic purposes. For example, a long note may be ornamented by repetition or by alternation with a neighboring note ("trill"); a skip to a non-adjacent note can be filled in with the intervening notes; or the resolution of a dissonance (see consonance and dissonance), because of its inevitability, can be delayed.

ornamentation In architecture, applied embellishment in various styles that is a distinguishing characteristic of buildings, furniture, and household items. Ornamentation often occurs on entablatures, columns, the tops of buildings, and around entryways and windows, especially in the form of mouldings. Throughout antiquity and into the Renaissance, and later for religious buildings, applied ornament was very important, often having symbolic meaning. The anthemion petal motif was especially popular on the moldings of ancient Greek cornices. Other motifs from antiquity include the Egyptian cartouche (oval), fretwork (banding) of capitals, fluting and reeding of columns, bas-relief egg-and-dart moldings (with alternating oval and pointed forms), and scrollwork such as that found on Ionic capitals and in the running-dog pattern (or wave scroll). Brattishing refers to the continuous embellishment around the top of a wall, common in the Gothic period. The diaper motif, an allover pattern of small repeated shapes, was also often used in this period. The use of strapwork (interlaced scrollwork), which originated with Islamic metalwork, is characteristic of Mannerist architecture and furniture.

Orne \'ȯrn\ **River** River, northwestern France. It is 94 mi (152 km) long and flows through the Orne and Calvados departments past Caen into the English Channel. Its bridges were seized by the Allied forces during the World War II Normandy Campaign in June 1944.

ornithischian \ˌȯr-nə-'this-kē-ən\ Any of the "bird-hipped" dinosaur species (order Ornithischia), herbivores with hip bones arranged like those of modern birds, with the pubis bone pointed backward. Many species had a toothless, horny beak and powerful cheek teeth. Ornithischians flourished from the Late Triassic to the Late Cretaceous Epoch (227–65 million years ago). Many species (in the suborder Cerapoda) were bipedal and had ornate skull structures. Some were quadrupedal, with a massive head culminating in a great bony frill. Other quadrupeds (in the suborder Thyreophora) had small heads and were heavily plated and armoured along the back, and some had armour on the flanks and head as well. See also protoceratops; saurischian; stegosaur; triceratops.

ornithology Branch of zoology dealing with the study of birds. Early writings on birds were largely anecdotal (including folklore) or practical (e.g., treatises on falconry and game-bird management). From the mid-18th century on, ornithology progressed from the description and classification of new species discovered in scientific expeditions to the examination of internal anatomy to the study of bird ecology and ethology. Ornithology is one of the few scientific fields in which nonprofessionals make substantial contributions; the field observations of birders provide valuable information on behaviour, ecology, distribution, and migration. Other information is gained by means of radar, radio transmitters, portable audio equipment, and bird banding, which provides information on longevity and movements.

Secretary decorated with ormolu mounts, marquetry, and intarsia, French, c. 1770; in the Wallace Collection, London

COURTESY OF TRUSTEES OF THE WALLACE COLLECTION, LONDON

orogeny \ȯ-'rä-jə-nē\ Mountain-building event, generally one that occurs in a geosyncline. Orogeny tends to occur during a relatively short geologic time frame. It is usually accompanied by folding and faulting of strata and by the deposition of sediments in areas adjacent to the orogenic belt. Orogenies may result from continental collisions, the underthrusting of continents by oceanic plates, the overriding of oceanic ridges by continents, and other causes. See also Acadian orogeny, Alleghenian orogeny, Alpine orogeny, Laramide orogeny, Taconic orogeny.

Oromo \ō-'rō-mō\ *pejorative* **Galla** Major ethnic group of Ethio-

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pia, numbering more than 20 million, or nearly one-third of the population, and occupying much of its central and south-central regions. They speak a Cushitic language of the Afroasiatic family. They are a diverse group, having assimilated and intermarried with other peoples since the 16th century. Traditionally the Oromo were nomadic herders, but today most are settled agriculturalists. Politically they are largely subjugated to the dominant Amhara. In religion they are divided among Islam, the Ethiopian Orthodox faith, and traditional beliefs.

Orontes \ō-'rän-tēz\ **River** River, Middle East. Rising in the Biqāʿ Valley of Lebanon and flowing north between the Lebanon and Anti-Lebanon mountains, it passes the cities of Ḥimṣ and Ḥamāh in Syria, where it has been dammed to form Ḥimṣ Lake. Northwest of Ḥamāh it enters Turkey, where it flows west past the ancient city of Antioch and empties into the Mediterranean Sea. It is unnavigable for most of its 355 mi (571 km) length but is an important source of water for irrigation.

Orozco \ō-'rōs-kō**, José Clemente** (b. Nov. 23, 1883, Ciudad Guzmán, Mex.—d. Sept. 7, 1949, Mexico City) Mexican mural painter. When he lost his left hand at 17, he abandoned architectural studies for painting, pursuing Mexican themes. As a caricaturist for a revolutionary paper, he explored Mexico City's slums and painted a series of watercolours, *House of Tears*, on the lives of prostitutes. The reaction of moralists forced him to flee to the U.S. in 1917, but in 1919 the new government of Álvaro Obregón welcomed him back, and he joined Diego Rivera and David Alfaro Siqueiros in creating large-scale murals for public buildings, in which he continued his radical social commentary. Again forced to abandon Mexico in 1927, he worked until 1934 in the U.S., where his style evolved and matured in murals from coast to coast. In 1934, his international reputation firmly established, he returned to Mexico and embarked on his most technically impressive and emotionally expressive murals, including *Catharsis* (1934), in the Palacio de Bellas Artes. He was a leader among those who raised Mexican art to a position of international eminence.

Orpheus Greek legendary hero who sang and played the lyre so beautifully that animals, trees, and rocks danced around him. When his wife, Eurydice, was killed by a snake, he went to the underworld in search of her, and his music and grief so moved Hades that he agreed to let Orpheus take Eurydice back to the land of the living on the condition that neither of them look back as they left. On seeing the Sun, Orpheus turned to share his delight with Eurydice, and she disappeared. Orpheus was later torn to pieces by maenads, and his head, still singing, floated to Lesbos, where an oracle of Orpheus was established. By the 5th century BC, a Hellenistic mystery religion (the Orphic mysteries), based on Orpheus's songs and teachings, had arisen. His story became the subject of some of the earliest operas.

Orphic mysteries See mystery religions

Orphism Trend in Cubism that gave priority to colour. Its name, bestowed in 1912 by Guillaume Apollinaire, recalls not only the legendary Orpheus but the Symbolist painters' description of Paul Gauguin's use of colour as "Orphic art." Among the painters who worked in this style were Robert Delaunay, Fernand Léger, Francis Picabia, and Marcel Duchamp. The best-known example is Delaunay's abstract *Simultaneous Composition: Sun Disks* (1912–13), in which superimposed circles of colour have their own rhythm and movement.

Orr, Bobby *in full* **Robert Gordon Orr** (b. March 20, 1948, Parry Sound, Ont., Can.) Canadian-born U.S. ice-hockey player. He was signed to a junior amateur contract by Boston Bruins scouts when he was 12. He joined the Bruins in 1966 and played with them for 10 seasons, helping them to the playoffs in eight consecutive seasons and to two Stanley Cup victories (1970, 1972). The first defenseman to lead the National Hockey League in scoring (1970, 1975), he is the only player ever recognized as the most valuable defenseman eight years in a row (1967–68 to 1974–75).

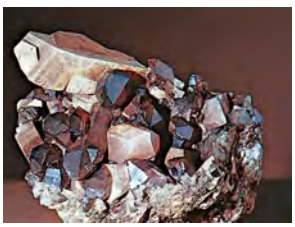
Orr (number 4), 1968
CANADA WIDE—PICTORIAL PARADE/EB INC.

Ørsted \'œr-stəd**, Hans Christian** (b. Aug. 14, 1777, Rudkøbing, Den.—d. March 9, 1851, Copenhagen) Danish physicist and chemist. In 1820 he discovered that electric current in a wire can deflect a magnetized compass needle, a phenomenon that inspired the development of electromagnetic theory. His 1820 discovery of piperine, one of the pungent components of pepper, was an important contribution to chemistry, as was his preparation of metallic aluminum in 1825. In 1824 he founded a society devoted to the spread of scientific knowledge among the general public. In 1932 the oersted was adopted as the physical unit of magnetic field strength.

Ortega \ȯr-'tā-gə\ **(Saavedra), (José) Daniel** (b. Nov. 11, 1945, La Libertad, Nic.) President of Nicaragua (1984–90). In 1963 he became a member of the Sandinista National Liberation Front and organized urban resistance to the corrupt dictatorship of the Somoza family. Jailed and later exiled, he returned secretly to Nicaragua and helped unite opposition to Somoza. After the Sandinistas prevailed in 1979, he coordinated the ruling junta; in 1984 he was elected Nicaragua's president. U.S. efforts to destabilize his government led to economic hardship and a protracted war, and Ortega lost his bid for reelection in 1990, 1996, and again in 2001. See also Violeta Chamorro; contras.

Ortega y Gasset \ȯr-'tā-gä-ē-gä-'set**, José** (b. May 9, 1883, Madrid, Spain—d. Oct. 18, 1955, Madrid) Spanish philosopher. He taught at the University of Madrid from 1911 and lived abroad from 1931 to 1946. Though influenced by Neo-Kantianism, he diverged from it in works such as *Adam in Paradise* (1910), *Quixote's Meditations* (1914), and *Modern Theme* (1923). He saw individual life as the fundamental reality; for absolute reason he substituted reason as a function of life; for absolute truth he substituted the perspective of each individual. Sharing his generation's preoccupation with Spain's problems, he founded the periodicals *España* (1915), *El sol* (1917), and *Revista de Occidente* (1923). Of his other works, the best known are *Invertebrate Spain* (1922) and *The Revolt of the Masses* (1929), which foreshadowed the Spanish Civil War. He greatly influenced Spain's 20th-century cultural and literary renaissance.

orthoclase \'ȯr-thə-ˌklās\ Common alkali feldspar mineral, potassium aluminosilicate ($KAlSi_3O_8$), that usually occurs as variously coloured grains in granite. Orthoclase is used in the manufacture of glass and ceramics; occasionally, transparent crystals are cut as gems. It is primarily important as a rock-forming mineral, however, and is abundant in igneous rocks, pegmatites, and gneisses. The feldspar minerals consist of sodium, potassium, and calcium aluminosilicates, and any feldspar may be chemically classed by the percentage of each of these three pure compounds, called end-members. Orthoclase is the potassium-bearing end-member of the system. Microcline is a lower temperature structural form of the same chemical composition as orthoclase.



Orthoclase from Serra de Peneda, Portugal
EMIL JAVORSKY/EB INC.

Orthodox Catholic Church See Eastern Orthodoxy

Orthodox Judaism Religion of Jews who adhere strictly to traditional beliefs and practices; the official form of Judaism in Israel. Orthodox Jews hold that both the written law (Torah) and the oral law (codified in the Mishna and interpreted in the Talmud) are immutably fixed and remain the sole norm of religious observance. Orthodox Judaism has held fast to such practices as daily worship, dietary laws, intensive study of the Torah, and separation of men and women in the synagogue. It also enjoins strict observance of the Sabbath and does not permit instrumental music during communal services. A leading center of Orthodoxy in the U.S. is New York's Yeshiva Univ.

orthogonal polynomials A system of polynomials that are mutually orthogonal (orthogonality is the higher-dimensional analog of perpendicularity), useful in solving differential equations arising in physics and engineering. The study of such systems began with Adrien-Marie Legendre (1752–1833), who employed a system now known as Legendre polynomials in the solution of problems in celestial mechanics. Other famous examples are the sets of Hermite and Chebyshev polynomials.

orthogonality \ȯr-ˌthä-gə-'na-lə-tē\ In mathematics, a property synonymous with perpendicularity when applied to vectors but applicable

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more generally to FUNCTIONS. Two elements of an INNER PRODUCT SPACE are orthogonal when their inner product—for vectors, the dot product (see VECTOR OPERATIONS); for functions, the definite INTEGRAL of their product—is zero. A set of orthogonal vectors or functions can serve as the basis of an inner product space, meaning that any element of the space can be formed from a linear combination (see LINEAR TRANSFORMATION) of the elements of such a set.

orthopedics \ˌȯr-thə-ˈpē-diks\ *or* **orthopedic surgery** Medical specialty concerned with the SKELETON and its associated structures. Orthopedists treat FRACTURES, strained MUSCLES, torn LIGAMENTS and TENDONS, and other injuries and deal with acquired and congenital skeletal deformities and the effects of degenerative diseases such as OSTEOARTHRITIS. Originally dependent on heavy braces and splints, orthopedics now uses bone grafts, hip and other joint replacements, prostheses (see PROSTHESIS), special footwear, and braces to enhance mobility. Orthopedics uses the techniques of PHYSICAL MEDICINE AND REHABILITATION and OCCUPATIONAL THERAPY in addition to those of traditional medicine and surgery.

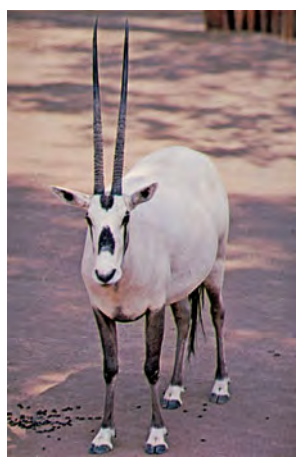
Orton, Joe *orig.* **John Kingsley Orton** (b. Jan. 1, 1933, Leicester, Leicestershire, Eng.—d. Aug. 9, 1967, London) British dramatist. Originally an unsuccessful actor, he turned to writing, finding success in 1964 when his radio play *The Ruffian on the Stair* was broadcast by the BBC. His three full-length plays, *Entertaining Mr. Sloane* (1964), *Loot* (1965), and *What the Butler Saw* (produced posthumously, 1969), were black comedies that scandalized audiences with their examination of moral corruption, violence, and sexual rapacity. Orton's career was cut short when he was murdered by K.L. Halliwell, his lifelong companion, who afterward committed suicide.

Orūmiyyeh, Daryācheh-ye See Lake URMIA

Orwell, George *orig.* **Eric Arthur Blair** (b. 1903, Motihari, Bengal, India—d. Jan. 21, 1950, London, Eng.) British novelist, essayist, and critic. Instead of accepting a scholarship to a university, Orwell went to Burma to serve in the Indian Imperial Police (1922–27), an experience that changed him into a literary and political rebel. On returning to Europe, he lived in self-imposed poverty, gaining material for *Down and Out in Paris and London* (1933), and became a socialist. He went to Spain to report on the SPANISH CIVIL WAR and stayed to join the Republican militia. His war experiences, which gave him a lifelong dread of communism (he would later provide British intelligence services with lists of his fellow British communists), are recounted in *Homage to Catalonia* (1938). His novels typically portray a sensitive, conscientious, emotionally isolated individual at odds with an oppressive or dishonest social environment. His most famous works are the anti-Soviet satirical fable *Animal Farm* (1945) and *Nineteen Eighty-four* (1949), a dystopic vision of totalitarianism whose influence was widely felt in the postwar decades. His literary essays are also admired.

George Orwell.
BBC COPYRIGHT

oryx Any of four species (genus *Oryx*) of large stocky ANTELOPES living in herds on African and Arabian deserts and plains. Oryxes are 40–47 in. (102–120 cm) high. They have a mane and a tufted tail. The coat is grayish brown, whitish, or white, depending on the species, with dark patches on the face and forehead, a dark streak on either side of the eye, and various dark markings on the body and legs. Both sexes have long, sharp-tipped, straight or curved horns.



Arabian oryx (*Oryx leucoryx*)
ROD MOON—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Osage \ō-ˈsāj\ North American PLAINS INDIAN people living mostly in Oklahoma, U.S. Their language is SIOUAN. The name Osage is a French-derived version of their name for themselves, Wazhazhe. They lived variously in the Piedmont and Ozark plateaus and the western Missouri and southeastern Kansas prairies. Their culture was marked by the combination of village agriculture and buffalo hunting. Their villages consisted of LONGHOUSES; TEPEES were used during the hunting season. Their religious ceremonies divided clans into symbolic sky and earth groups. In the late 19th century the Osage were removed to a reservation in Oklahoma. The discovery of oil there made them a uniquely prosperous tribe. They number more than 18,000.

Osage \ō-ˈsāj, ˈō-ˌsāj\ **River** River, western Missouri, U.S. Formed by the junction of the Marais des Cygnes and Little Osage rivers, it is about 500 mi (800 km) long and is one of the principal tributaries of the MISSOURI RIVER. It flows east and northeast through Lake of the OZARKS and enters the Missouri just east of Jefferson City, Mo.

Ōsaka \ō-ˈsä-kä,\ *Japanese* \ˈō-sä-kä\ *ancient* **Naniwa** City (pop., 2000 prelim.: 2,598,589) and seaport, west-central HONSHU, Japan, on the northeastern shore of Ōsaka Bay. A long-established city and port, Naniwa was made a castle town by TOYOTOMI HIDEYOSHI in the 16th century. It was the leading commercial city of Japan during the TOKUGAWA PERIOD and the leading industrial city from the late 19th century. It was badly damaged by U.S. bombing during World War II. Once noted for its large textile industry, it is now a leading financial centre with heavy industries including machinery, iron and steel, and chemicals. With KŌBE and KYŌTO, it is part of Japan's second largest urban and industrial agglomeration. It is also a cultural and educational centre, with several universities and theatres.

Osborne, John (James) (b. Dec. 12, 1929, London, Eng.—d. Dec. 24, 1994, Shropshire) British playwright and film producer. Initially an actor, he cowrote his first play, *The Devil Inside Him* (1950), with Stella Linden. His *Look Back in Anger* (1956; film, 1959) ushered in a spate of vigorously realistic plays about contemporary British working-class life, making Osborne the first of the postwar ANGRY YOUNG MEN. His next play, *The Entertainer* (1957; film, 1960), told the story of a failing music-hall comedian; it was commissioned by the actor LAURENCE OLIVIER, who starred in the stage and film versions. Osborne wrote the screenplay for the film *Tom Jones* (1963, Academy Award), and his other plays include *Luther* (1961) and *Inadmissible Evidence* (1964).

John Osborne
UPI/BETTMANN NEWSPHOTOS

Oscan \ˈäs-kən\ **language** ITALIC LANGUAGE formerly spoken in southern and central Italy, related closely to UMBRIAN and more distantly to LATIN. It was probably the native tongue of the SAMNITE people of Italy's central mountainous region. Oscan was gradually displaced by Latin and apparently became extinct by the end of the 1st century AD. Modern knowledge of it comes from some 250 inscriptions written in a colonial LATIN ALPHABET, the GREEK ALPHABET, and an alphabet derived from that used for ETRUSCAN.

Osceola \ˌä-sē-ˈō-lə\ (b. c. 1804, Georgia, U.S.—d. Jan. 30, 1838, Charleston, S.C.) SEMINOLE Indian leader during the Second SEMINOLE WAR. The war began in 1835 when the U.S. government attempted to

Osceola, detail of a lithograph by George Catlin, 1838
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

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force the Seminole off their traditional lands in Florida and into the Indian territory west of the Mississippi River. Osceola and his followers employed guerrilla tactics and forced a truce. During negotiations he was arrested and removed to a military fort at Charleston, S.C., where he died.

oscillator Mechanical or electronic device that produces a back-and-forth PERIODIC MOTION. A PENDULUM is a simple mechanical oscillator that swings with a constant amplitude, requiring the addition of energy at each swing only to compensate for the energy lost because of air resistance or friction. In electronic oscillators, ELECTRONS oscillate with a constant period and also require the addition of energy to replace energy loss. Electronic oscillators are used to generate ALTERNATING CURRENT and high-frequency currents for carrier waves in radio broadcasting. They are incorporated in a wide variety of electronic equipment.

oscilloscope \ə-'si-lə-ˌskōp\ *or* **cathode-ray oscilloscope** Electronic display device used to produce patterns on a screen that are the graphical representations of electrical signals. Time is normally on the horizontal axis, and a function of the voltage generated by the input signal to the oscilloscope on the vertical axis; four or more plots can be simultaneously shown. Because almost any physical phenomenon can be converted into a corresponding electric voltage, oscilloscopes find commercial, engineering, and scientific applications in acoustic research, television-production engineering, and electronics design.

Oshogbo \ō-'shōg-bō\ City (pop., 1996 est.: 476,800), Nigeria. Located northeast of IBADAN, it lies along the Oshun River. Originally settled by the Ilesha from Ibokun, it remained a small town until the early 19th century when an influx of YORUBA fleeing from FULANI conquerors arrived. In 1840 it was the scene of a battle won by Ibadan that proved to be the turning point in the Fulani-Yoruba wars. It was made part of Oyo state in 1976 and the capital of the newly created state of Osun in 1991. It is a trade centre for cocoa and palm oil; weaving and dyeing cotton cloth and growing tobacco are other local occupations.

Osiris \ō-'sī-rəs\ Ancient Egyptian god of the underworld. Osiris was slain by the god SETH, who tore apart the corpse and flung the pieces all over Egypt. The goddess ISIS, consort of Osiris, and her sister Nephthys found the pieces and gave new life to Osiris, who became the ruler of the underworld. Isis and Osiris then conceived HORUS. In the Egyptian concept of divine kingship, the king at death became Osiris and the new king was identified with Horus. Osiris also represented the power that brought life out of the earth. Festivals reenacting his fate were celebrated annually in towns throughout Egypt.

Osler \'ōs-lər**, Sir William** (b. July 12, 1849, Bond Head, Canada West, Can.—d. Dec. 29, 1919, Oxford, Oxfordshire, Eng.) Canadian physician and professor. He became the first to identify blood PLATELETS (1873) and later taught at the medical school at McGill University (1875–84) and then at Johns Hopkins University's medical school (1889–1905). There he helped transform clinical teaching; students studied patients in the wards and took their problems to the lab, and experts pooled their knowledge to benefit both patient and student in public teaching sessions. Osler's *Principles and Practice of Medicine* (1892) became the most popular medical textbook of its day. He was involved in the formation of two physicians' associations and the *Quarterly Journal of Medicine*. Osler nodes on the hand are seen in some cardiac infections, and two blood disorders also bear his name.

William Osler, at the bedside of a patient, while professor of medicine at Johns Hopkins, 1888–1904.
COURTESY OF THE OSLER LIBRARY, MCGILL UNIVERSITY, MONTREAL

Oslo \'äz-lō,\ *Norwegian* \'üs-lü\ *formerly (1624–1925)* **Christiania** City and municipality (pop., 2002 est.: municipality, 512,589), capital of Norway. It lies at the northern end of Oslo Fjord and constitutes a separate county. It was founded by King HARALD III SIGURDSSON c. 1050. Haakon V built the Akershus fortress c. 1300. After it was destroyed by fire in 1624, King CHRISTIAN II of Denmark-Norway built a new town farther west and called it Christiania. It grew in the 19th century, partly by absorbing neighbouring towns, and replaced BERGEN as Norway's largest and most influential city. It was renamed Oslo in 1925 and developed rapidly after World War II. It is the country's principal commercial, industrial, and transportation centre, and its harbour is the largest and busiest in Norway.

osmosis \äz-'mō-səs\ Spontaneous passage or DIFFUSION of water or other SOLVENT through a semipermeable membrane. If a solution is separated from a pure solvent by a membrane that is permeable to the solvent but not to the solute, the solution will tend to become more dilute by absorbing solvent through the membrane. The pressure caused by the migration of solvent through the membrane is called osmotic pressure.

osprey \'äs-prē, 'äs-prā\ *or* **fish hawk** Species (*Pandion haliaetus*) of long-winged HAWK found along seacoasts and large interior waterways. Ospreys are about 26 in. (65 cm) long and brown above and white below, with some white on the head. An osprey flies over the water, hovers above its prey, and then plunges feet first, seizing the fish in its long, curved talons. Ospreys breed on all continents except South America, where they live only in winter. They usually nest, singly or in colonies, high in trees or on cliffs. Bioaccumulation of pesticides caused populations to dwindle in the 20th century, but they are now recovering.

Osroëne *or* **Osrhoene** \ˌäz-rə-'wē-nē\ Ancient kingdom, northwestern MESOPOTAMIA. Located between the TIGRIS and EUPHRATES rivers, it was situated across the modern frontier of Turkey and Syria, with its capital at Edessa (modern ŞANLIURFA, Tur.). Founded in c. 136 BC, it commanded strategic trade and military routes (1st century BC–2nd century AD). At different times it was allied with either PARTHIA or ROME. The kingdom was abolished by the Roman emperor CARACALLA in AD 216. In the 4th–7th centuries AD it was dominated by the wars between the BYZANTINE EMPIRE and the Persian Sāsānian dynasty. Under various Arab dynasties, it became a centre of reaction against Hellenism and the headquarters of Chaldean Syriac literature and learning. It fell to the Muslims in 638.

OSS See OFFICE OF STRATEGIC SERVICES

Osservatore Romano \ȯ-ˌser-vä-'tȯ-rā-rō-'mä-nō**, L'** *Italian* **"The Roman Observer"** Daily newspaper published in VATICAN CITY, one of the most influential papers in Italy and the de facto voice of the Holy See. Founded in 1861, it was subsidized by the Vatican from its start and was bought outright in 1890 by Pope LEO XIII. It regularly details the pope's activities and prints the text of papal speeches as the Vatican newspaper of record; it also reports and comments on political developments, stressing editorials and commentary over news and noting the religious and moral implications of events, institutions, and trends.

Ossian \'äs-ē-ən, 'äsh-ən\ *Gaelic* **Oisín** \'ōsh-yin\ Irish warrior-poet of the FENIAN CYCLE of hero tales. The name Ossian became known throughout Europe in 1762–63 when the Scottish poet James Macpherson (1736–96) published the epics *Fingal* and *Temora*, which he represented as translations of works by the 3rd-century Gaelic poet Ossian. The poems were widely acclaimed and influential in the Romantic movement, but their authorship was later doubted, notably by SAMUEL JOHNSON (1775), and they were eventually determined to have been written largely by Macpherson.

Ossianic ballads \ˌä-sē-'a-nik, ˌä-shē-'a-nik\ Irish Gaelic and Scottish lyric and narrative poems dealing with the legendary Finn MacCumhaill and his war band. They are named for Oisín (Ossian), the chief bard of the FENIAN CYCLE. Part of a common Scots-Irish Gaelic tradition, the ballads consist of more than 80,000 lines dating from the 11th to the 18th century. Unlike earlier Fenian literature, which reflected mutual respect between pagan and Christian tradition, they are stubbornly pagan and anticlerical, full of lament for past glories and contempt for the Christian present. Most of the poetry claimed for Oisín was in fact written by Scottish poet James Macpherson (1736–1796).

Ossianic cycle See FENIAN CYCLE

Ossory \'ä-sə-rē\ Ancient kingdom, Ireland. It became a semi-independent state within the kingdom of Leinster (c. 1st century AD). In the 9th century its king, Cerball, allied himself with the Norse invaders. His Irish descendants became known as the Fitzpatricks. The modern diocese of Ossory, with its see at Kilkenny, approximates the size of the ancient state.

Ostade \ȯs-'tä-də**, Adriaen van** (b. Dec. 10, 1610, Haarlem, Neth.—buried May 2, 1685, Haarlem) Dutch painter and printmaker.

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Known for his Baroque genre paintings of peasant life, he also did religious subjects, portraits, and landscapes. The most important influence on his style was the work of Adriaen Brouwer. Like Brouwer, he delighted in scenes such as tavern brawls, usually in dimly lit interiors, as in *Carousing Peasants in an Interior* (c. 1638). He employed a broad, vigorous technique in a subdued range of colours. After he adopted a brighter palette in the 1640s, his subjects became less ribald, and from the 1650s he painted many of them in outdoor settings.

Ostend \ä-'stend\ **Manifesto** (1854) Secret document written by U.S. diplomats at Ostend, Belg., describing a plan to acquire Cuba from Spain. On orders from U.S. secretary of state William Marcy, three U.S. diplomats—minister to Britain James Buchanan, minister to France John Y. Mason, and minister to Spain Pierre Soulé—devised a plan to purchase or, if necessary, seize Cuba for the U.S. Publication of the aggressively worded document, and Soulé's advocacy of slavery, caused Marcy to denounce it.

osteoarthritis \ˌäs-tē-ō-är-'thrī-təs\ *or* **osteoarthrosis** *or* **degenerative joint disease** Most common joint disorder, afflicting over 80% of those who reach age 70. It does not involve excessive inflammation and may have no symptoms, especially at first. Cartilage softens and wears away, and bone grows in its place, distorting the joint's surface and causing pain, stiffness, and limited movement, usually in weight-bearing joints (vertebrae, knees, hips). Treatment may include analgesics, rest, weight loss, corticosteroids, and/or physical medicine and rehabilitation or an exercise program. Hip or knee replacement or surgical removal of unhealthy tissue may be needed.

osteogenesis imperfecta \ˌäs-tē-ō-'je-nə-səs-ˌim-pər-'fek-tə\ Group of connective-tissue diseases in which the bones are very fragile. Several forms probably reflect different degrees of expression of the same disorder. Persons with osteogenesis imperfecta type I are normal at birth, but fractures occur easily; in van der Hoeve syndrome the sclerae are bluish, bone deformities in the skull cause deafness, double-jointedness occurs, and skin is abnormally thin. Babies with osteogenesis imperfecta type II, if not stillborn, are born with fractures, and fractures continue to occur, causing severe crippling; survival to adulthood is rare.

osteopathy \ˌäs-tē-'ä-pə-thē\ Health-care profession founded by the U.S. physician Andrew Taylor Still (1828–1917) as a reform movement against the rather primitive 19th-century drugs and surgical techniques. It emphasizes the relationship between musculoskeletal structure and organ function. Osteopathic physicians learn to recognize and correct structural problems through manipulative and other therapies. Osteopathic hospitals provide general or specialized health care, including maternity and emergency care.

osteoporosis \ˌäs-tē-ō-pə-'rō-səs\ Generalized loss of bone density, causing skeletal weakness. Around age 40, the rate of bone resorption in humans starts to exceed the rate of bone formation. Women experience accelerated bone loss after menopause, when the estrogen level decreases. When the amount of bone falls below a certain threshold, fractures occur with little or no trauma. Prevention begins with adequate calcium intake in youth, when bone mass is built, and then throughout life. Weight-bearing exercise and vitamin D are important at all ages. Medications can inhibit bone resorption or prevent bone loss in patients who are at risk for developing osteoporosis.

Ostia \'ä-stē-ə\ Ancient Roman town. Originally at the mouth of the Tiber River, it would now be about 4 mi (6 km) upstream. The modern seaside resort of Ostia, Italy, is near the ancient city. It was probably founded in the 4th century BC and developed as a naval station, major port, and centre of the grain trade. It reached the height of its prosperity in the 2nd century AD, when it had a population of about 50,000. It suffered from the decline of the Roman economy in the 3rd century and from barbarian raids in the 5th century. Its Roman ruins were quarried for building materials in the Middle Ages and for sculptors' marble during the Renaissance. Excavations began in the 19th century, and about two-thirds of the Roman town can now be seen.

ostomy \'äs-tə-mē\ Surgical opening in the body, or the operation creating it, usually to allow discharge of wastes through the abdominal wall. It may be temporary, to relieve strain on damaged organs, or permanent, to replace normal channels congenitally missing or surgically removed (usually to treat cancer). A loop of bowel (the colon in colostomy and the ileum in ileostomy) is cut and the end brought through to the abdominal surface. Waste usually exits into a self-adhering bag worn over the opening, or an internal pouch may be made from body tissue.

Ostpolitik \'ôst-pó-li-ˌtēk\ (German: "Eastern Policy") West German foreign policy begun in the late 1960s. Initiated by Willy Brandt as foreign minister and then chancellor, the policy was one of détente with Soviet-bloc countries, recognizing the East German government and expanding commercial relations with other Soviet-bloc countries. Treaties were concluded in 1970 with the Soviet Union, renouncing the use of force in their relations, and with Poland, recognizing Germany's 1945 losses east of the Oder-Neisse Line. The policy was continued by Chancellor Helmut Schmidt.

Ostrasia See Austrasia

Ostrava \'ô-strə-və\ City (pop., 2001 prelim.: 319,293), northeastern Czech Republic, at the confluence of the Opava and Oder rivers near the Moravian Gap. It was founded c. 1267 as a fortified town by Bruno, bishop of Olomouc, to protect the entry to Moravia from the north. Its castle was demolished in 1495. Historic buildings include a 13th-century church.

ostrich Two-toed, long-necked ratite (*Struthio camelus*, family Struthionidae) found in Africa, the largest living bird. An adult male ostrich may be nearly 9 ft (2.75 m) tall and weigh more than 330 lb (150 kg). Males are black, with white wing and tail plumes; females are brown. Ostriches live in flocks of 5–50, usually among grazing animals, and eat plants and an occasional small animal. Roaring, hissing males fight for three to five hens, which lay 15–60 eggs in a communal nest scraped in the ground. The male sits at night; the females take turns by day. One-month-old chicks can run with adults, at 40 mph (65 km/hr). To escape detection, an ostrich may lie on the ground with its neck outstretched, a habit that may have given rise to the notion that ostriches bury their heads in the sand.

Ostrogoth \'äs-trə-ˌgäth\ Member of a division of the Goths (Ostrogoth means "Eastern Goth") who built an empire north of the Black Sea in the 3rd century and established a kingdom in Italy in the late 5th century. At its zenith in the 4th century, the Ostrogoth empire stretched from the Don to the Dniester (in present-day Ukraine) and from the Black Sea to southern Belarus. The Ostrogoths were conquered by the Huns c. 370 and remained part of the Huns' empire until the mid 5th century. When the Hun empire collapsed (455), the Ostrogoths emerged as an independent people once again. Their greatest ruler, Theodoric, led the Ostrogothic invasion of Italy and declared himself king (493). Theodoric maintained good relations with the native population, especially the senatorial class, throughout most of his reign and promoted a cultural revival. The turmoil in Italy following his death provided the Byzantine emperor Justinian I with the opportunity to invade the peninsula. The ensuing war lasted almost 20 years (c. 535–54) and ended the national existence of the Ostrogoths.

Ostrovsky \ˌə-'strȯf-skē**, Aleksandr (Nikolayevich)** (b. April 12, 1823, Moscow, Russia—d. June 14, 1886, Shchelykovo) Russian playwright. His second play, *The Bankrupt* (1850), exposed bogus bankruptcy cases and led to his dismissal from the civil service. Most of his plays treat characters from the Russian merchant class; they include the comedies *Poverty Is No Disgrace* (1853), *The Thunderstorm* (1859), and *The Snow Maiden* (1873), adapted as an opera by Nikolay Rimsky-Korsakov. With his 47 plays Ostrovsky created a Russian national repertoire, and he is considered the greatest representative of the Russian realistic period.

Ostwald \'ôst-ˌvält**, (Friedrich) Wilhelm** (b. Sept. 2, 1853, Riga, Latvia—d. April 4, 1932, near Leipzig, Ger.) Russian-German physical chemist. He moved to Germany in 1887. He wrote the influential *Textbook of General Chemistry*, 2 vol. (1885–87). With Jacobus H. van't Hoff in 1887 he founded the *Zeitschrift für physikalische Chemie*, which became for many years the most important journal in the field. His work at the University of Leipzig (1887–1906) established it as a great school of physical chemistry. In 1888 he discovered Ostwald's law of dilution of an electrolyte. He gave the first modern definition of a catalyst in 1894 and was awarded the Nobel Prize in 1909 for his work on catalysis. His process for the conversion of ammonia to nitric acid proved of great industrial importance. He is regarded as one of the founders of the field of physical chemistry.

O'Sullivan, Timothy H. (b. c. 1840, New York, N.Y., U.S.—d. Jan. 14, 1882, Staten Island, N.Y.) U.S. photographer. He learned photogra-

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phy in Mathew B. Brady's studio in New York City, and during the American Civil War he photographed on many fronts as one of Brady's team. Perhaps his best-known picture is *Harvest of Death* (1863), showing Confederate dead at Gettysburg. O'Sullivan left Brady's employ over the issue of receiving proper credit for his work. After the war O'Sullivan often portrayed vast landscapes. He took part in surveys in Panama as well as in the western and southwestern U.S. and was appointed chief photographer for the Treasury Department in 1880.

Oswald, Lee Harvey (b. Oct. 18, 1939, New Orleans, La., U.S.—d. Nov. 24, 1963, Dallas, Texas) Accused assassin of Pres. John F. Kennedy. While serving in the U.S. Marines (1956–59) he began to express pro-Soviet and politically radical views. Shortly after his discharge he moved to the Soviet Union, where he unsuccessfully tried to become a Soviet citizen. He returned to the U.S. in 1962 with his Russian wife and daughter but retained his radical political beliefs. In April 1963 he allegedly shot at but missed Edwin Walker, an ultrarightist retired general. In October he took a job at the Texas School Book Depository in Dallas. On Nov. 22, 1963, from a window on its sixth floor, he allegedly fired three shots that killed Kennedy and wounded Gov. John B. Connally while the two men were riding in the president's motorcade. Oswald killed a patrolman who had detained him, but he was soon captured and arraigned. On November 24, while being transferred to an interrogation office, he was fatally shot by Jack Ruby, a nightclub owner.

other minds, problem of In epistemology, the problem of explaining how it is possible for one person to know anything about the quality of another person's inner experience, or even that other people have inner experiences at all. According to a standard example, because each person's pain sensation is private, one cannot really know that what another person describes as pain is really qualitatively the same as what one describes as pain oneself. Though the physical manifestations the other person exhibits can be perceived, it seems that only the other person can know the contents of his mind. The traditional justification for belief in other minds, the argument from analogy, was given its classic formulation by John Stuart Mill: because my body and outward behaviour are observably similar to the bodies and behaviour of others, I am justified by analogy in believing that others have feelings like my own and are not simply automatons. In the mid-20th century the argument from analogy was severely criticized by followers of the later Ludwig Wittgenstein. An approach to the problem of other minds from the perspective of existentialism is contained in *Being and Nothingness* (1943), by Jean-Paul Sartre.

Otis, Harrison Gray (b. Oct. 8, 1765, Boston, Mass.—d. Oct. 28, 1848, Boston, Mass., U.S.) U.S. politician. A nephew of James Otis, he practiced law and served in the Massachusetts legislature (1796–97, 1802–05), the U.S. House of Representatives (1797–1801), the state senate (1805–13, 1814–17), and the U.S. Senate (1817–22). He was later mayor of Boston (1829–32). A Federalist, he opposed the War of 1812 and was a leader of the Hartford Convention.

Otis, James (b. Feb. 5, 1725, West Barnstable, Mass.—d. May 23, 1783, Andover, Mass., U.S.) American Revolutionary statesman. He argued before the colonial court against the British-imposed writs of assistance (1761), reportedly stating "Taxation without representation is tyranny." He served in the provincial legislature (1761–69) and was a leading opponent, along with Samuel Adams, of the Stamp Act. He wrote political pamphlets upholding the colonists' cause, including *The Rights of the British Colonies Asserted and Proved* (1764). Struck on the head in a scuffle with a British official in 1769, he later became mentally unbalanced.

otitis \ō-'tī-təs\ Inflammation of the ear. Otitis externa is dermatitis, usually bacterial, of the auditory canal and sometimes the external ear. It can cause a foul discharge, pain, fever, and sporadic deafness. Otitis media is due to allergy or viral or bacterial infection of the middle ear. The bacterial form may be acute (causing earache, fever, and pus and requiring antibiotics) or chronic. It can invade the bone (mastoiditis), requiring surgery. Otitis in the inner ear (labyrinthitis) often arises from respiratory infection, syphilis, or otitis media. Symptoms include vertigo, vomiting, and hearing loss. Recovery is usually quick unless there is pus formation, which can destroy the inner-ear structures, causing permanent deafness in that ear.

otolaryngology \ˌō-tō-ˌlar-ən-'gä-lə-jē\ *or* **otorhinolaryngology** \ˌō-tō-ˌrī-nō-ˌlar-ən-'gä-lə-jē\ Medical specialty dealing with the ear, nose, and throat (see larynx, pharynx). The connection of these structures became known in the late 19th century. Otolaryngologists use an otoscope to examine the eardrum and a laryngoscope (developed in 1855) to inspect the larynx. They also test hearing and prescribe hearing aids. The operating microscope (developed in 1921) and flexible endoscopy now permit them to operate on delicate internal structures.

Otomanguean \ˌō-tə-'mäŋ-gā-ən\ **languages** Diverse family of more than 20 American Indian languages and language clusters concentrated in central and southern Mexico, with more than a million speakers. Several of the language clusters, such as Otomí (dispersed through eastern central Mexico), Chinantecan, Mixtecan, and Zapotecan (all spoken in the state of Oaxaca), are highly differentiated and may be considered language families in themselves. Otomanguean languages differ in many ways from other American Indian languages, for example, in the extensive use of tone.

Otomi \ˌō-tə-'mē\ Mesoamerican Indian population living in the central plateau region of Mexico. Traditionally, they practice shifting cultivation and raise livestock. Their crafts include spinning, weaving, pottery, and basketry, and their dress varies from traditional to modern. *Compadrazgo,* fictive kinship based on the relationship of godparent to godchild, is central to their society. Ritual obligations also bind a child's parents and godparents in a close relationship. They profess Roman Catholicism but identify the major saints with pre-Christian deities.

O'Toole, Peter (Seamus) (b. Aug. 2, 1932, Connemara, County Galway, Ire.) British actor. He studied drama at the Royal Academy of Dramatic Art. He made his London debut in 1956 and played Hamlet in the National Theatre's inaugural production in 1963. His film debut came in *Kidnapped* (1960), and he won international acclaim for *Lawrence of Arabia* (1962), for which he won a British Academy Award. Noted for his wit and intensity, he often played uncertain heroes or eccentrics, starring in films such as *Becket* (1964), *The Lion in Winter* (1968), *The Ruling Class* (1972), *The Stunt Man* (1980), *My Favorite Year* (1982), *The Last Emperor* (1987), and *Phantoms* (1998). His acting range extends from classical drama to contemporary farce. He received an Emmy Award for his performance as Bishop Cauchon in the television miniseries *Joan of Arc* (1999).

otorhinolaryngology See otolaryngology

ottava rima \ō-'tä-və-'rē-mə\ Italian stanza form composed of eight 11-syllable lines, rhyming *abababcc*. It originated in the late 13th and early 14th centuries and was established by Giovanni Boccaccio as the standard form for Italian epic and narrative verse. When the form appeared in English, the lines were shortened to 10 syllables. In the 17th–18th century, English ottava rima was written in iambic pentameter and used for heroic poetry. Notably effective in Lord Byron's *Beppo* (1818) and *Don Juan* (1819–24), it was also used by Edmund Spenser, John Milton, John Keats, Percy B. Shelley, Robert Browning, and William Butler Yeats.

Ottawa \'ä-tə-wə\ City (pop., 2001: 774,072), capital of Canada. It is located in southeastern Ontario, on the Ottawa, Gatineau, and Rideau rivers. The area was inhabited by American Indians when it was visited by Samuel de Champlain in 1613, and the nearby rivers served traders and explorers over the next two centuries. Its settlement developed after the construction of the Rideau Canal in 1826. Originally named Bytown, it was incorporated as the city of Ottawa in 1855. To resolve political disputes between Toronto and Quebec City and between Montreal and Kingston, it was selected as Canada's capital by Queen Victoria in 1857. In 2001 the city's population grew significantly after it was amalgamated with several local municipalities. The federal government is the major employer; many commercial and financial associations are also located there. It is the site of several educational and cultural institutions, including the National Arts Centre and the National Gallery of Canada.

Ottawa River River, eastern central Canada, the chief tributary of the St. Lawrence River. It rises in the Laurentian plateau of western Quebec and flows west to form the Quebec-Ontario border before joining the St. Lawrence west of Montreal. It is 790 mi (1,271 km) long and forms innumerable lakes. Explored by Samuel de Champlain in 1613, it became a major route for explorers, fur traders, and missionaries to the Great Lakes. In the 19th century the Rideau Canal was completed, linking Ottawa to Lake Ontario, and lumbering became important. It is now a source of hydroelectric power.

otter Any of 13 species of semiaquatic, web-footed carnivores in the weasel family (Mustelidae), found throughout Africa, North and South America, Europe, and Asia. Otters have the same general proportions as weasels. Size varies among species, but total length is typically 3–7 ft

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(1–2 m), and weight is 6.5–60 lb (3–26 kg); the large SEA OTTER is an exception. Otter fur—e.g., that of North American river otters—is highly valued. Most species live near rivers, some live near lakes or streams, and the sea otter is completely marine. Otters eat small aquatic animals. They are inquisitive and playful; a favourite sport is sliding down mud or snow banks.

River otter (*Lutra canadensis*).
KENNETH W. FINK—ROOT RESOURCES

Otto I *known as* **Otto the Great** (b. Nov. 23, 912—d. May 7, 973, Memleben, Thuringia) Duke of Saxony (936–61), German king (936–73), and emperor (962–73). He extended the frontiers of the German kingdom, winning territory from the Slavs in the east, forcing the Bohemians to pay tribute (950), and gaining influence in Denmark and Burgundy. In 951 Otto became king of the Lombards and married the queen of Italy. He quelled a rebellion by his son in 955 and defeated the MAGYARS in the Battle of LECHFELD. Crowned emperor by Pope John XII in 962, he deposed John in 963 and replaced him with Leo VIII. He returned to Italy (966–72) to subdue Rome, and he betrothed his son, Otto II, to a Byzantine princess (972). He also extended his authority over the church and promoted missionary activity in lands he had conquered. By his death, Otto had created the most powerful state in western Europe and laid the foundation for the later Holy Roman Empire.

Otto III (b. July 980—d. Jan. 23, 1002, near Viterbo, Italy) German king (983–1002) and emperor (996–1002). He was elected German king at age 3, and his mother and grandmother served as regents until he came of age in 994. He went to Rome to put down a rebellion (996) and installed his cousin as Gregory V, the first German pope. After returning in 997 to quell another revolt, he made Rome the centre of his empire. He saw himself as leader of world Christianity and hoped to revive the glory of ancient Rome in a universal Christian state. When Rome rebelled against him (1001), he requested help from Bavaria but died before it arrived.

Otto IV *or* **Otto of Brunswick** (b. 1175/1182—d. May 19, 1218, Harzburg Castle, Lower Saxony) German king and Holy Roman emperor. He was elected German king (1198) by the Guelph faction (see GUELPHS AND GHIBELLINES) but was opposed by the HOHENSTAUFENS, who elected PHILIP of Swabia. The two factions were at war for several years, but after Philip's murder in 1208 a new election gave the throne to Otto. He was crowned emperor (1209) by Pope INNOCENT III after agreeing not to claim Sicily. When he violated this pact and conquered southern Italy (1210), the German princes invited FREDERICK II to replace him. With his uncle, JOHN of England, Otto invaded France, Frederick's ally; defeated at the Battle of BOUVINES, he was deposed in 1215.

Otto, Nikolaus August (b. June 10, 1832, Holzhausen, Nassau—d. Jan. 26, 1891, Cologne, Ger.) German engineer who developed the four-stroke INTERNAL-COMBUSTION ENGINE. He built his first gasoline-powered engine in 1861, and in 1876 he built an internal-combustion engine using the four-stroke cycle (four strokes of the piston for each explosion), which offered the first practical alternative to the STEAM ENGINE as a POWER source. Though the four-stroke cycle was patented in 1862 by Alphonse Beau de Rochas (1815–93), it is commonly known as the Otto cycle since Otto was the first to build such an engine.

Rudolf Otto, 1925.
FOTO-JANNASCH, MARBURG

Otto, Rudolf (b. Sept. 25, 1869, Peine, Prussia—d. March 6, 1937, Marburg, Ger.) German theologian, philosopher, and historian of religion. He taught at the Universities of Göttingen and Breslau, then settled in Marburg in 1917. His theories on religion were influenced by his journeys to Africa and Asia to study non-Christian faiths and by the writings of IMMANUEL KANT and FRIEDRICH SCHLEIERMACHER. In *The Idea of the Holy* (1917), Otto coined the term *numinous* to designate the nonrational element of religious experience—the awe, fascination, and blissful exultation inspired by the perception of the divine. He believed that religion provided an understanding of the world that was distinct from and beyond that of science. His other books include *Mysticism East and West* (1926), *India's Religion of Grace and Christianity* (1930), and *The Kingdom of God and Son of Man* (1938).

Ottoman Empire Former empire centred in ANATOLIA. It was named for Osman I (1259–1326), a Turkish Muslim prince in BITHYNIA who conquered neighbouring regions once held by the SELJŪQ DYNASTY and founded his own ruling line c. 1300. Ottoman troops first invaded Europe in 1345, sweeping through the Balkans. Though defeated by TIMUR in 1402, by 1453 the Ottomans, under MEHMED II (the Conquerer), had destroyed the BYZANTINE EMPIRE and captured its capital, Constantinople (now ISTANBUL), which henceforth served as the Ottoman capital. Under Selim I (r. 1512–20) and his son SÜLEYMAN I (the Magnificent; 1520–66), the Ottoman Empire reached its greatest peak. Süleyman took control of parts of Persia, most of Arabia, and large sections of Hungary and the Balkans. By the early 16th century the Ottomans had also defeated the MAMLŪK DYNASTY in Syria and Egypt; and their navy under BARBAROSSA soon seized control of much of the BARBARY COAST. Beginning with Selim, the Ottoman sultans also held the title of CALIPH, the spiritual head of Islam. Ottoman power began to decline in the late 16th century. Ottoman forces repeatedly besieged Vienna. After their final effort at taking the Austrian capital failed (1683), that and subsequent losses led them to relinquish Hungary in 1699. Corruption and decadence gradually undermined the government. In the late 17th and 18th centuries the RUSSO-TURKISH WARS and wars with Austria and Poland further weakened the empire, which in the 19th century came to be called the "sick man of Europe." Most of its remaining European territory was lost in the BALKAN WARS (1912–13). It sided with Germany in World War I (1914–18); postwar treaties dissolved the empire, and in 1922 the sultanate was abolished by MUSTAFA KEMAL ATATÜRK, who proclaimed the Republic of Turkey the following year. See also JANISSARY; TURK; YOUNG TURKS.

Ottonian \ä-'tō-nē-ən\ **art** Painting, sculpture, and other visual arts produced during the reigns of the German Ottonian emperors and their first successors from the Salic house (950–1050). Though it drew on the heritage of CAROLINGIAN ART, it developed a style of its own, particularly in painting and sculpture. Manuscript illuminators of the period were less concerned with naturalism than with expression through sober, dramatic gesture and a heightened use of colour. Ottonian large-scale wooden crucifixes and wooden reliquaries covered with gold leaf marked a return to sculpture in the round. Bronze casting, an antique art practiced by the Carolingians, flourished as well. Ottonian architecture was more regulated than Carolingian, with simple interior spaces and a more systematic layout. Ottonian architects provided impetus for the monumentality of ROMANESQUE ARCHITECTURE.

Otway, Thomas (b. March 3, 1652, Trotton, near Midhurst, Sussex, Eng.—d. April 14, 1685, London) English dramatist and poet. A failed actor, he turned to writing and had immense success with *Don Carlos* (produced 1676), considered the best of his rhymed heroic plays. His other plays include *The Orphan* (1680), a blank-verse domestic tragedy; *The Souldier's Fortune* (1680), a comedy; and his masterpiece, *Venice Preserv'd* (1682), one of the greatest theatrical successes of the period. A forerunner of sentimental drama, he is outstanding for his convincing presentations of human emotions in an age of heroic but artificial tragedies. *The Poet's Complaint of His Muse* (1680) is a powerful, gloomy autobiographical poem.

Ouachita \'wä-shə-ˌtȯ\ **River** *formerly* **Washita River** River, southwestern Arkansas and eastern Louisiana, U.S. Rising in the Ouachita Mountains, it flows southeast to join the RED RIVER after a course of 605 mi (973 km). Its lower reaches are known as the Black River. It has been a navigation route since the late 18th century; six locks and dams had been built on it by 1924.

Ouagadougou \ˌwä-gä-'dü-gü\ City (pop., 1993 est.: 690,000), capital of Burkina Faso, western Africa. It was the capital of the historic MOSSI kingdom of Wagadugu, which was founded in the 15th century. The Mossi king still lives in the city, though his powers have been eclipsed by the French colonial and postindependence administrations. A manufacturing

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centre, it is the country's largest city and is connected by rail to Abidjan, Côte d'Ivoire. A biennial film festival, the largest in Africa, is held in the city.

Oudh \'aůd\ Former province of British India. Now the northeastern portion of Uttar Pradesh state, it received its name from Ayodhya, the capital of the ancient kingdom of Kosala, which was nearly coextensive with modern Oudh. It was taken by Muslim invaders in the 12th century, became part of the Mughal Empire in the 16th century, and was annexed by the British in 1856. In 1877 it was joined with Agra to form the United Provinces of Agra and Oudh. After India's independence in 1947 it became part of Uttar Pradesh.

Oudry \ü-'drē**, Jean-Baptiste** (b. March 17, 1686, Paris, France—d. April 30, 1755, Beauvais) French Rococo painter, tapestry designer, and illustrator. Like his paintings, Oudry's tapestries were highly regarded for their tonal subtlety and lively study of nature. His services were sought by Peter I the Great of Russia, the queen of Sweden, and Louis XV, who commissioned him to paint portraits of his dogs and appointed him official painter of the royal hunts.

Ouida \'wē-də\ *orig.* **Maria Louise Ramé** *or* **Maria Louise de la Ramée** (b. Jan. 1, 1839, Bury St. Edmunds, Suffolk, Eng.—d. Jan. 25, 1908, Viareggio, Italy) English novelist. Among her novels, most of them extravagant, melodramatic romances of fashionable life, are *Held in Bondage* (1863), *Strathmore* (1865), *Chandos* (1866), *Under Two Flags* (1867), and *Moths* (1880). She also wrote animal stories, including the popular *A Dog of Flanders* (1872). She settled in Florence in 1874, where reckless extravagance reduced her to acute poverty in later life.

Ouija board \'wē-jə\ Device for obtaining messages from the spirit world, sometimes used by a medium during a séance. The name derives from the French and German words for "yes" (oui/ja). The Ouija board is an oblong piece of wood or cardboard with letters of the alphabet inscribed in a half-moon along the edge. A small heart-shaped board is placed on top of it. Participants each lightly place a finger on the small board, which spirits supposedly move around on the larger board. As it touches the letters it may spell out words or sentences.

ounce Unit of weight in the avoirdupois system, the traditional European system of weight, which was incorporated into the British Imperial system and the U.S. system of weights and measures (see measurement). The ounce is equal to 1/16 lb (437.5 grains). In the troy and apothecaries' systems (two other traditional systems of weight), it is equal to 1/12 troy or apothecaries' lb (480 grains). The avoirdupois ounce is equal to 28.35 g, the troy ounce to 31.1 g. As a unit of volume, the fluid ounce is equal to 1/16 of a pint (29.57 ml) in the U.S. system, and to 1/20 of a pint (28.41 ml) in the British Imperial system. See also gram, International System of Units, metric system, pound.

ounce See snow leopard

Ouranus See Uranus

Ouse \'üz**, River** *or* **Great Ouse** River, central and eastern England. It rises in Northamptonshire and flows 156 mi (251 km) past Buckingham, Bedford, Huntington, and St. Ives to Earith, then to the North Sea. Locks make the river navigable upstream to Bedford.

Ouse, River River, northeastern England. It is formed in North Yorkshire and flows through York and Selby to join the River Aire. It merges with the River Trent to form the River Humber. The lower Ouse is a major transport route for industrial products and raw materials.

ousel See ouzel

Outer Banks Chain of barrier islands, North Carolina coast, U.S. Extending southward 175 mi (282 km) along the coast, it stretches from the Virginia border to Cape Lookout. Generally covered with sand dunes, the islands range from a few feet to more than 100 ft (160 m) in height. Most are linked by roads and causeways; there are numerous beaches, making the Outer Banks a popular resort area. Once a hideout for pirates and a place of shipwrecks, the islands have several historical sites, including Roanoke Island and Kitty Hawk, site of the Wright brothers' first powered flight.

Outer Mongolia See Mongolia

outwash Deposit of sand and gravel carried by running water from the melting ice of a glacier and laid down in stratified deposits. An outwash may be as much as 330 ft (100 m) thick at the edge of a glacier, and it may extend for many miles. Outwashes are the largest glacial deposits and provide a considerable source of windblown material.

Ouyang Xiu \'ō-'yäŋ-'shyü\ *or* **Ou-yang Hsiu** (b. 1007, Mianyang, Sichuan province, China—d. 1072, Yingzhou, Anhui province) Chinese poet, historian, and statesman. He served in various official positions but was repeatedly demoted or banished for his outspokenness. He called himself Zuiweng ("Old Drunkard"), built a pavilion of that name, and wrote an essay about it that is one of the most celebrated works in Chinese literature. Later put in charge of civil-service examinations, he favoured those who wrote in the simple, ancient style known as *guwen* and failed those who used literary embellishments, thus setting a new course in Chinese literature. His own writings in the *guwen* style, including *Xintangshu* (1060; "New History of the Tang Dynasty"), became a model that was long emulated. When the *Xintangshu* was finished, Ouyang was rapidly promoted to the highest councils of state, leaving a remarkable record in social, financial, and military affairs. He was falsely accused of having an affair with his daughter-in-law, a charge that injured his prestige. He repeatedly asked to be relieved of his duties, but instead he was sent to be magistrate successively in Anhui, Shandong, and Henan. As the leader of the reform movement of poetry and prose in the Northern Song dynasty, Ouyang established a monumental reputation by his epoch-marking creative works, and he is renowned as one of the Eight Great Masters of Tang and Song.

ouzel *or* **ousel** \'ü-zəl\ Species (*Turdus torquatus*) of songbird in the thrush family, characterized by a white crescent on the breast. A blackish bird, about 10 in. (25 cm) long, it breeds locally in uplands from Britain and Norway to the Middle East. The name was formerly applied to a closely related European blackbird (*T. merula*). The dipper is often called water ouzel.

Ring-ouzel (*Turdus torquatus*).
DRAWING BY JOHN P. O'NEILL/EB INC.

ovarian cancer Malignant tumour of the ovaries. Risk factors include early age of first menstruation (before age 12), late onset of menopause (after age 52), absence of pregnancy, presence of specific genetic mutations, use of fertility drugs, and personal history of breast cancer. Symptoms such as abdominal swelling, pelvic pressure or pain, and unusual vaginal bleeding often do not appear until ovarian cancer is advanced. Surgery, sometimes followed by chemotherapy or radiation therapy, is an effective treatment for most ovarian cancers.

ovary \'ō-və-rē\ In zoology, the female reproductive organ (see reproductive system) that produces eggs and sex hormones (estrogen and progesterone). Human females have two ovaries, almond-shaped organs about 1.5 in. (4 cm) long. They contain hollow balls of cells (follicles) that hold immature eggs. About 150,000–500,000 follicles usually are present at birth; by young adulthood, only about 34,000 remain. The number continues to decrease until menopause, when the few remaining follicles decay and the ovaries shrink and produce far less estrogen. Only 300–400 follicles mature and release an egg, which develops into an embryo if fertilized or, if not, passes from the body with menstruation. In botany, an ovary is the enlarged base of a flower's female organ (pistil). It contains ovules, which develop into seeds when fertilized, and matures into a fruit.

over-the-counter market Trading in stocks and bonds that does not take place on stock exchanges. Such trading occurs most often in the U.S., where requirements for listing stocks on the exchanges are strict. Schedules of fees for buying and selling securities are not fixed in the over-the-counter market, and dealers derive their profits from the markup of their selling price over the price they paid. Many bond issues and preferred-stock issues, including U.S. government bonds, are listed on the New York Stock Exchange but have their chief market over-the-counter. Other U.S. government securities, as well as state and municipal bonds, are traded over-the-counter exclusively. Institutional investors such as mutual funds often trade over-the-counter because they are given volume discounts not offered on the exchanges. The regulation of the over-the-counter market is carried out largely by the National Association of Securities Dealers,

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created by Congress in 1939 to establish rules of conduct and protect members and investors from abuses. See also NASDAQ.

overpopulation Situation in which the number of individuals of a given species exceeds the number that its environment can sustain. Possible consequences are environmental deterioration, impaired quality of life, and a population crash (sudden reduction in numbers caused by high mortality and failure to produce viable offspring).

overtone In acoustics, a faint higher tone contained within almost any musical tone. A body producing a musical pitch—such as a taut string or a column of air within the tubular body of a wind instrument—vibrates not only as a unit but simultaneously also in sections, resulting in the presence of a series of overtones within the fundamental tone (i.e., the one identified as the actual pitch). Harmonics are a series of overtones resulting when the partial vibrations are of equal sections (e.g., halves, thirds, fourths). Partials are nonharmonic overtones—that is, tones the frequencies of which lie outside the harmonic series. Overtones contribute greatly to the TIMBRE of a given sound source, even though few listeners are aware of hearing any pitch except the fundamental. There are a few rare examples of the human voice creating overtones, notably in the chants of the Tibetan monks and the songs of the Tuvan throat singers. The latter can sometimes produce two overtones.

overture Musical introduction to a larger, often dramatic, work. Originating with CLAUDIO MONTEVERDI's *Orfeo* (1607), overtures served as openings for operas. The large-scale two- or three-part "French overture" invented by JEAN-BAPTISTE LULLY (1658) for his operas and ballets was widely imitated for a century. The sinfonia, the standard Italian overture form in the late 17th and 18th centuries, was a principal precursor of the three-part SONATA FORM and thus provided the model for the earliest symphonies, which consisted of three movements. In the 19th century, overtures independent of any larger work usually illustrated a literary or historical theme (see SYMPHONIC POEM). Overtures to OPERETTAS and MUSICALS have traditionally been medleys of their themes.

Ovett \ō-'vet**, Steve** *in full* **Stephen Michael Ovett** (b. Oct. 9, 1955, Brighton, Sussex, Eng.) British runner. He was the winner of gold (in the 800-m race) and bronze medals at the 1980 Olympic Games. In the course of his career, Ovett set six world records; however, his best-known races were those that pitted him against his countryman and rival SEBASTIAN COE.

Ovid \'ä-vid\ *Latin* **Publius Ovidius Naso** (b. March 20, 43 BC, Sulmo, Roman Empire—d. AD 17, Tomis, Moesia) Roman poet. A member of Rome's knightly class, Ovid dutifully started an official career but soon abandoned it for poetry. His first work, *The Loves*, was an immediate success. It was followed by *Epistles of the Heroines*; *The Art of Beauty*; *The Art of Love*, one of his best-known works; and *Remedies for Love*, all reflecting the sophisticated, pleasure-seeking society in which he moved. He was a well-established poet when he undertook perhaps his greatest work, *Metamorphoses*, on legends of transformations of human beings into nonhuman forms by gods; and *Fasti* ("Calendar"), an account of the Roman year and its religious festivals. His verse had immense influence because of its imaginative interpretations of classical myth and its supreme technical accomplishment. For unclear reasons, in AD 8 AUGUSTUS banished him to Tomis on the Black Sea; despite Ovid's many pleas, he was never allowed to return. He described his life in an autobiographical poem in *Sorrows*. He was extensively read and imitated in the Renaissance, and his influence was felt into modern times.

Oviedo \ō-'vyā-thō\ *ancient* **Asturias** City (pop., 2001: 201,154), capital of ASTURIAS, northwestern Spain. Oviedo lies on a hill surrounded by mountains and a fertile plain. Founded as a monastery in AD 757, it became the capital of the kingdom of Asturias in 810. It was one of the few Spanish towns never conquered by the MOORS and contains many medieval landmarks, including a 14th-century cathedral. The cathedral was badly damaged during the SPANISH CIVIL WAR. Oviedo is the centre of a mining region that produces coal and iron.

Ovimbundu \ō-vim-'bůn-dü\ Bantu-speaking people of central Angola. Numbering about 4 million, the Ovimbundu provided the major popular support for JONAS M. SAVIMBI and the National Union for the Total Independence of Angola (UNITA). They were formerly traders; today they farm, hunt, and raise livestock. About half the 22 Ovimbundu chiefdoms were tributary to a larger chiefdom before Portuguese intervention in the 20th century.

ovum See EGG

Owen, Robert (b. May 14, 1771, Newtown, Montgomeryshire, Wales—d. Nov. 17, 1858, Newtown) Welsh manufacturer and philanthropist. At his New Lanark cotton mills (Lanarkshire, Scot.), in partnership with JEREMY BENTHAM, he set up innovative social and industrial welfare programs, including improved housing and schools for young children. In *A New View of Society* (1813) he contended that character is wholly formed by one's environment. By 1817 his work had evolved into ideas presaging socialism and the cooperative movement, ideas he would spend much of his life preaching. He sponsored several experimental utopian communities of "Owenites" in Britain and the U.S., including one at New Harmony, Ind. (1825–28)—where Owen lost some 80% of his fortune—all of which proved short-lived. He strongly supported early labour unions, but opposition and repression swiftly dissolved them, and it was two generations before socialism again influenced unionism. He was the father of ROBERT DALE OWEN.

Owen, Robert Dale (b. Nov. 9, 1801, Glasgow, Scot.—d. June 24, 1877, Lake George, N.Y., U.S.) U.S. social reformer. In 1825 he emigrated with his father, ROBERT OWEN, to establish a community at New Harmony, Ind. He edited the local newspaper, the *New Harmony Gazette*, until 1827, when he became associated with FANNY WRIGHT. The two eventually settled in New York City, where Owen edited the *Free Enquirer*, and both were active in the WORKINGMEN'S PARTY. Owen returned to New Harmony in 1832. After serving in the Indiana legislature, he was elected to the U.S. House of Representatives (1843–47), where he introduced a bill establishing the SMITHSONIAN INSTITUTION. He later served as U.S. minister to Italy (1855–58). A strong advocate of emancipation, he urged an end to slavery in an 1861 letter to ABRAHAM LINCOLN that was said to have influenced the president greatly.

Owen, Wilfred (b. March 18, 1893, Oswetry, Shropshire, Eng.—d. Nov. 4, 1918, France) British poet. Owen was already writing verse before he enlisted in the army in 1915, but the experience of trench warfare brought him to rapid maturity; the poignant poems he wrote after January 1917 are full of anger at the cruelty and waste of war and pity for its victims. A week before the armistice, he died in action at age 25. His single volume of poems, published posthumously, is noted for its experiments in assonance. BENJAMIN BRITTEN's celebrated *War Requiem* (1962) is a setting of Owen's poems.

Owens, Jesse *orig.* **James Cleveland Owens** (b. Sept. 12, 1913, Oakville, Ala., U.S.—d. March 31, 1980, Phoenix, Ariz.) U.S. track-and-field athlete. At Ohio State University in 1935, he broke or equaled four world track records in one day, setting a new long-jump record that would stand for 25 years. In the 1936 Olympics in Berlin he won four gold medals, tying the Olympic record in the 100-m run, breaking the Olympic record in the 200-m run, running the final segment for the world-record-breaking U.S. 400-m relay team, and breaking the listed world record for the long jump. This performance by an African American dramatically foiled ADOLF HITLER's intention to use the games to show Aryan racial superiority. For a time, Owens held alone or shared the world records for all sprint distances recognized by the International Amateur Athletic Federation.

Jesse Owens, 1936.
AP/WIDE WORLD PHOTOS

owl Any BIRD OF PREY in the mostly nocturnal order Strigiformes, including typical owls (family Strigidae) and BARN, bay, and grass owls (Tytonidae). Their virtually silent flight and protective (usually brown) coloration aid in capturing insects, birds, and small mammals. Owls have round, forward-looking eyes, a sharply hooked beak, and acute hearing and vision. They are 5–28 in. (13–70 cm) long. The feathers of some species form a disk framing the face or ear tufts that help locate prey by reflecting sound to the ears. Owls can turn their heads 180°; some species can turn as much as 270°. They nest in buildings, in trees, or on the ground. Typical owls occur worldwide except in Antarctica. See also HORNED OWL; SCREECH OWL; SNOWY OWL.

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owlet moth See MILLER

ox Domesticated form of large BOVID (species *Bos taurus*) that once moved in herds across North America and Europe (where they have disappeared) and Asia and Africa (where some still exist in the wild). The docile castrated male is used as a draft animal in many countries. Oxen are used for food in some areas. The term is also applied to a castrated male of any CATTLE breed. See also AUROCHS, YAK.

oxalic \äk-'sa-lik\ **acid** Colourless, crystalline, toxic CARBOXYLIC ACID found in many plants, especially rhubarb, wood sorrel, and spinach. Because it forms soluble CHELATES with iron, some of the iron in these plants is not available nutritionally. However, this property makes it useful for removing blood and rust stains, cleaning metals other than iron, and flushing car radiators. Oxalic acid and its SALTS (oxalates) are used in many chemical processes.

oxalis \äk-'sa-ləs\ Any of about 850 species of small herbaceous plants that make up the genus *Oxalis*, native mostly to southern Africa and tropical and South America. Most members are familiar garden ornamentals. The name (Greek for "acid") reflects the plant's sharp acidic taste. The common wood sorrel (*O. acetosella*) of eastern North America and Britain is a small, stemless plant with cloverlike three-part leaves, whose leaflets fold back and droop at night. The flowers have five white, purple-veined petals. After the fruit splits open, the fleshy coat of the seed curls back elastically, ejecting the true seed.

oxbow lake Small lake located in a former MEANDER loop of a river or stream channel. It is generally formed as a river cuts through a meander neck to shorten its course, blocks off the old channel, and then migrates away from the lake. If only one loop is cut off, the lake is crescent-shaped; if more than one loop is cut off, the lake is serpentine (winding). Eventually, oxbow lakes silt up to form marshes and finally meander scars.

Oxenstierna (af Södermöre) \'ůk-sen-ˌsher-nȧ**, Axel (Gustafsson), Count** (b. June 16, 1583, Fånö, near Uppsala, Swed.—d. Aug. 28, 1654, Stockholm) Swedish statesman. Born into a noble family, he became a member of the council of state and in 1612 was appointed chancellor by GUSTAV II ADOLF. He worked with the king to stabilize administrative reforms. As a diplomat, he negotiated peace treaties with Denmark (1613) and Poland (1622). In the THIRTY YEARS' WAR, he was appointed governor-general of Prussia (1626) and military commander in Germany (1631). He directed Swedish policy in Germany until 1636, when he returned to Sweden. As a regent during Queen CHRISTINA's minority (1636–44), he effectively ruled the country.

oxeye daisy Garden perennial plant (*Chrysanthemum leucanthemum*) in the COMPOSITE FAMILY. The compound flower has 15–30 white ray flowers surrounding a bright yellow disk flower, about 1–2 in. (2.5–5 cm) across. It grows about 2 ft (60 cm) high and has oblong, notched leaves and long petioles (leafstalks). Native to Europe and Asia, it has become a common wild plant in the U.S. See also DAISY.

Oxford *ancient* **Oxonia** City and administrative district (pop., 2001: 134,248), county seat of OXFORDSHIRE, England. Situated on the River THAMES, the town is best known for the University of OXFORD. First occupied in Saxon times as a fording point, it became a burg, built to defend the northern frontier of WESSEX from Danish attack; it was first mentioned in the Anglo-Saxon Chronicle of AD 912. Little remains of the town's NORMAN period of occupation. Oxford is generally known as the "City of Spires" because of its skyline of Gothic towers and steeples. Most of these 15th–17th-century buildings belong to the university. The city was the Royalist headquarters in the ENGLISH CIVIL WARS. Its modern economy is varied and includes, in addition to educational services, printing and publishing industries and automobile manufacturing.

Oxford, Earl of See Robert HARLEY

Oxford, Edward de Vere, 17th earl of *orig.* **Edward de Vere** (b. April 12, 1550, Castle Hedingham, Essex, Eng.—d. June 24, 1604, Newington, Middlesex) English lyric poet. A brilliantly gifted linguist and one of the most dashing figures of his time, Oxford was also reckless, hot-tempered, and disastrously spendthrift. He was the patron of an acting company, Oxford's Men, and possibly later of the Lord CHAMBERLAIN'S MEN (as hereditary Lord Great Chamberlain of England), as well as of such writers as JOHN LYLY and EDMUND SPENSER. He wrote highly praised poems and plays in his earlier years, though none of the plays are known to have survived. A 1920 book by J. Thomas Looney made Oxford the leading candidate, next to WILLIAM SHAKESPEARE himself, for the authorship of Shakespeare's plays, a theory supported by the coincidence that Oxford's literary output apparently ceased just before Shakespeare's work began to appear. A major difficulty in the Oxfordian theory, however, is his death date (1604), because, according to standard chronology, 14 of Shakespeare's plays, including many of the most important ones, were apparently written after that time. The debate, however, remained lively into the 21st century.

Oxford, Provisions of (1258) Plan of reform accepted by HENRY III of England. On the verge of bankruptcy, Henry asked Parliament for a grant of revenue and agreed in return to a program of reform drafted by a royal commission. Regarded as England's first written constitution, the Provisions placed the government under the direction of the king and a 15-member baronial council, provided for Parliament to meet three times a year, and reformed local administration. They were annulled by the Dictum of Kenilworth (1266).

Oxford, University of Autonomous university at Oxford, Oxfordshire, England. It was founded in the 12th century and modeled on the University of PARIS, with initial faculties of theology, law, medicine, and the liberal arts. Of the earliest colleges, University College was founded in 1249, Balliol c. 1263, and Merton in 1264. Early scholars of note include ROGER BACON, JOHN DUNS SCOTUS, William of OCKHAM, and JOHN WYCLIFFE. In the Renaissance, DESIDERIUS ERASMUS and ST. THOMAS MORE helped enhance its already considerable reputation. By then faculties of physical science, political science, and other fields had been added. The first women's college, Lady Margaret Hall, was established in 1878. There are 32 other colleges and collegial institutions. Oxford houses the BODLEIAN LIBRARY and the Ashmolean Museum of Art and Archaeology. Oxford University Press (1478) is the world's oldest, largest, and most famous university publisher. Oxford has been associated with many of the greatest names in British history.

Oxford English Dictionary, The (OED) Definitive historical DICTIONARY of the English language. It was conceived by London's Philological Society in 1857, and sustained editorial work began in 1879 under JAMES MURRAY. Published in 10 volumes between 1884 and 1928, it first appeared under its current name in 1933. Its definitions are arranged mostly in order of historical occurrence and illustrated with dated quotations from English-language literature and records. Its second edition was published in 20 volumes in 1989.

Oxford movement *or* **Tractarian movement** (1833–45) Movement within the Church of ENGLAND that aimed to emphasize the church's Catholic inheritance as a source of legitimacy and deeper spirituality. Its main intent was to defend the Church of England as a divine institution against the threats of liberal theology, rationalism, and government interference. Though some in the movement (notably JOHN HENRY NEWMAN and HENRY E. MANNING) ended up converting to Catholicism, most did not. Their concern for a higher standard of worship influenced not only the Church of England but also other British Protestant sects. The movement was also instrumental in the establishment of Anglican monasteries and convents.

Oxfordshire \'äks-fərd-ˌshir\ Administrative (pop., 2001: 605,492) and historic county, south-central England. It consists of two upland areas divided by a broad vale. Evidence of inhabitation dates from the PALEOLITHIC, MESOLITHIC, and NEOLITHIC periods. DORCHESTER was an important Roman settlement; subsequent Saxon settlement was concentrated along the THAMES RIVER valley. The county saw action during the ENGLISH CIVIL WARS. Oxfordshire's economy is basically agricultural, with sheep farming and wool production. Cowley, a suburb of the county seat of OXFORD, is the major industrial centre.

oxidation-reduction *or* **redox** Any CHEMICAL REACTION in which ELECTRONS are transferred. Addition of hydrogen or electrons is REDUCTION, and removal of hydrogen or electrons is oxidation (originally applied to combination with OXYGEN but now including transfer of HYDROGEN or electrons). The processes always occur simultaneously: one substance is oxidized by the other, which it reduces. The conditions of the substances before and after are called oxidation states, to which numbers are given and with which calculations can be made. (VALENCE is a similar but not identical concept.) The chemical equation that describes the electron transfer can be written as two separate half reactions that can in theory be carried out in separate compartments of an electrolytic cell (see ELECTROLYSIS), with electrons flowing through a wire connecting the two. Strong oxidizing

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agents include FLUORINE, OZONE, and oxygen itself; strong reducing agents include ALKALI METALS such as SODIUM and LITHIUM.

oxide Any of a large and important class of chemical compounds in which OXYGEN is combined with another ELEMENT. METAL oxides contain a metal CATION and the oxide ANION (O_2^-); they typically react with water to form BASES or with acids to form SALTS. Oxides of nonmetallic elements are volatile compounds in which a COVALENT BOND joins the oxygen and the nonmetal; they react with water to form acids or with bases to form salts. A few substances (e.g., ALUMINUM, ZINC) form amphoteric oxides, which form salts with both acids and bases. Certain organic compounds form oxides in which the oxygen is covalently bonded to an atom of nitrogen (amine oxides), phosphorus (phosphine oxides), or sulfur (sulfoxides) in the organic molecule.

oxide mineral Any naturally occurring inorganic compound with a structure based on close-packed oxygen atoms in which smaller, positively charged metal or other ions occur. Oxide minerals are common in all rock types, whether IGNEOUS, SEDIMENTARY, or METAMORPHIC.

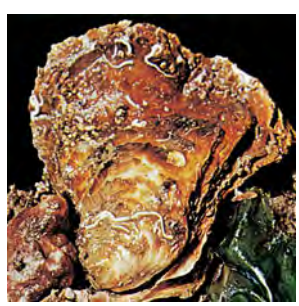
Oxus River See AMU DARYA

oxygen Gaseous chemical ELEMENT, chemical symbol O, atomic number 8. It constitutes 21% (by volume) of air and more than 46% (by weight) of Earth's crust, where it is the most plentiful element. It is a colourless, odourless, tasteless GAS, occurring as the diatomic molecule O_2. In RESPIRATION, it is taken up by animals and some bacteria (and by plants in the dark), which give off CARBON DIOXIDE (CO_2). In photosynthesis, green plants assimilate carbon dioxide in the presence of sunlight and give off oxygen. The small amount of oxygen that dissolves in water is essential for the respiration of fish and other aquatic life. Oxygen takes part in combustion and in corrosion but does not itself burn. It has VALENCE 2 in compounds; the most important is WATER. It forms OXIDES and is part of many other molecules and FUNCTIONAL GROUPS, including NITRATE, SULFATE, PHOSPHATE, and CARBONATE; ALCOHOLS, ALDEHYDES, CARBOXYLIC ACIDS, and KETONES; and PEROXIDES. Obtained for industrial use by DISTILLATION of liquefied air, oxygen is used in steelmaking and other metallurgical processes and in the chemical industry. Medical uses include RESPIRATORY THERAPY, incubators, and inhaled ANESTHETICS. Oxygen is part of all gas mixtures for manned spacecraft, scuba divers, workers in closed environments, and HYPERBARIC CHAMBERS. It is also used in rocket engines as an oxidizer (in liquefied form) and in water and waste treatment processes.

oxygen process, basic See BASIC OXYGEN PROCESS

Oxyrhynchus \ˌäk-si-ˈriŋ-kəs\ Archaeological site, Egypt, on the western bank of the NILE RIVER. Many ancient papyri dating from 250 BC to AD 700 were discovered there in the late 19th and early 20th centuries. The papyri, written mainly in Greek and Latin, contain both religious texts and masterpieces of Greek classical literature. Some of these texts, once considered lost, were by PINDAR and CALLIMACHUS. The modern village of Al-Bahnasā is located on the site.

Oyo empire YORUBA state in present-day southwestern Nigeria that dominated the land between the Volta and Niger rivers in 1650–1750. Two waves of immigrants probably entered the area c. AD 700–1000, and the second wave formed a state at Oyo. This state became preeminent among Yoruba states because of its good trading position, natural resources, and industrious inhabitants. Though at first less powerful than its neighbours, by the end of the 16th century its ruler, Orompoto, had used trade-derived wealth to maintain a trained army. In the 18th century Oyo subjugated the DAHOMEY KINGDOM and had begun trading with European merchants at Dahomey's ports. Oyo's wealth increased, but Abiodun (r. c. 1770–90) neglected the army and the possibilities for territorial expansion, thus weakening central authority for his successor. Soon after 1800 Oyo was captured by FULANI Muslims from Hausaland. See also HAUSA.



European flat oyster (*Ostrea edulis*)
G. TOMSICH—PHOTO RESEARCHERS

oyster Any BIVALVE of two families, Ostreidae (true oysters) or Aviculidae (pearl oysters), found in temperate and warm coastal waters worldwide. Both valves (halves) have a rough, often dirty-gray outer surface and a smooth white inner lining (nacre). The lower valve, which affixes to a surface, is nearly flat. The smaller upper valve is convex and has rougher edges. The oyster filters its food, minute organic particles, from the water. Cultivated as food, oysters are regarded as a delicacy. PEARLS are the accumulation of nacre around a piece of foreign matter.

oyster plant See SALSIFY

oystercatcher Any of about seven species (genus *Haematopus*, family Haematopodidae) of stout-bodied shorebirds inhabiting temperate and tropical seacoasts and inland waters in Europe, Asia, Africa, the Western Hemisphere, and Australia. Oystercatchers are 16–20 in. (40–50 cm) long, with thick pinkish legs; long pointed wings; and a long, flattened, wedge-shaped, orange-red bill. Their plumage varies from black-and-white, including a bold white wing patch, to entirely black. They attack mollusks as the tide ebbs, when the shells are exposed and still partially open.

Oz, Amos *orig.* **Amos Klausner** (b. May 4, 1939, Jerusalem, Israel) Israeli novelist, short-story writer, and essayist. A second-generation Israeli, Oz lived primarily on a kibbutz from the 1950s to the 1980s. He served in the Israeli Army (1957–60, 1967, and 1973) but later became a leading advocate of peace. His symbolic works—including *Where the Jackals Howl, and Other Stories* (1965); *My Michael* (1968), perhaps his best-known novel; and *Black Box* (1987)—reflect the conflicts in Israeli life.

Özal \ō-ˈzäl**, Turgut** (b. Oct. 13, 1927, Malatya, Tur.—d. April 17, 1993, Ankara) Prime minister (1983–89) and president (1989–93) of TURKEY. After studying electrical engineering, he oversaw Turkey's electrification program in the 1950s and '60s. After working as a World Bank economist for most of the 1970s, he was elected prime minister as head of his own Motherland Party in 1983 and was reelected in 1987. In 1989 he persuaded the parliament to make him president, a traditionally nonpolitical position, and used the office to claim for Turkey an important role in the PERSIAN GULF WAR (1990–91).

Ozark Mountains *or* **Ozark Plateau** Heavily forested highlands, south-central U.S. Extending southwest from ST. LOUIS to the ARKANSAS RIVER, they occupy an area of about 50,000 sq mi (130,000 sq km) in Missouri, Arkansas, Illinois, and Kansas. Many of the highest peaks exceed 2,000 ft (600 m). Tourism is one of the region's chief industries. Lake of the OZARKS provides power and recreational facilities. The name Ozark probably derives from the French trading post, Aux Arc, established in the area in the 1700s.

Ozarks, Lake of the Lake, south-central Missouri, U.S. One of the largest man-made lakes in the U.S., it is located in the scenic OZARK MOUNTAINS. It is about 125 mi (200 km) long, with an area of 93 sq mi (242 sq km). It is formed by the Bagnell Dam in the OSAGE RIVER. The area of Lake of the Ozarks State Park has recreational fishing and water sport facilities and is a popular resort destination. Nearby are several limestone caverns.

Ozawa \ō-ˈzä-wə**, Seiji** (b. Sept. 1, 1935, Hoten, Manchukuo) Manchurian-born Japanese-U.S. conductor. After initial conducting experience in Japan and study at Tanglewood in the U.S., he went to Europe to study with HERBERT VON KARAJAN. He became assistant to LEONARD BERNSTEIN at the New York Philharmonic (1961–65), then held posts in Chicago (1964–68), Toronto (1965–69), and San Francisco (1970–76) before becoming music director of the Boston Symphony Orchestra in 1973 (retired 2002). Noted for his energetic style and his sweeping performances of 19th-century Western symphonic works, he also had a distinguished opera-conducting career in Europe.

Ozick \ˈō-zik**, Cynthia** (b. April 17, 1928, New York, N.Y., U.S.) U.S. novelist and short-story writer. She graduated from New York University and received an M.A. from Ohio State University. She wrote often on Jewish themes, and much of her work presents a struggle with the notion that artistic creation can be a hubristic attempt to rival the Creator. Among these works are *Trust* (1966), *Leviathan* (1982), *The Messiah of Stockholm* (1987), *The Shawl* (1990), and *The Puttermesser Papers* (1997). Her essays have been collected in *Art & Ardor* (1983), *Metaphor & Memory* (1989), and *Fame & Folly* (1996).

Ozma, Project Attempt in 1960 to detect RADIO signals generated by hypothetical intelligent beings from planets of other stars. Frank D. Drake (born 1930), director of the search, named the project for the princess of L. FRANK BAUM's imaginary Oz. The search used a special receiver attached to a radio telescope at the U.S. National Radio Astronomy Observatory

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at Green Bank, W.V. Some 150 hours of occasional observation over four months detected no recognizable signals. See also DRAKE EQUATION, SETI.

ozone Pale blue GAS (O_3) that is irritating, explosive, and toxic. Like ordinary OXYGEN gas (O_2), it contains oxygen atoms, but the BONDING of three atoms per molecule gives it distinctive properties. It is formed in electrical discharges and accounts for the distinctive odour of the air after thunderstorms or near electrical equipment. Usually manufactured on the spot by passing an electric discharge through oxygen or air, it is used in water purification, deodorization, bleaching, and various CHEMICAL REACTIONS that require a strong oxidizing agent (see OXIDATION-REDUCTION). Small amounts that occur naturally in the stratospheric OZONE LAYER absorb ULTRAVIOLET (UV) RADIATION that otherwise could severely damage living organisms. Near Earth's surface, ozone contributes to AIR POLLUTION, ozone produced by auto emissions in the presence of sunlight being a deleterious component of SMOG, and also accelerates the deterioration of rubber.

ozone layer *or* **ozonosphere** Region in the upper ATMOSPHERE, about 6–30 mi (10–50 km) high, with significant concentrations of OZONE, formed by the effect of solar ULTRAVIOLET (UV) RADIATION on OXYGEN and also present in trace quantities elsewhere in earth's atmosphere. Ozone strongly absorbs solar UV radiation, causing atmospheric temperature to climb to about 30°F (0°C) at the top of the layer, and preventing much of this radiation from reaching earth's surface, where it would injure many living things. CHLOROFLUOROCARBONS, or CFCs, and some other air pollutants that diffuse into the ozone layer destroy ozone. In the mid-1980s, scientists discovered that a "hole"—an area where the ozone is up to 50% thinner than normal—develops periodically in the ozone layer above Antarctica. This severe regional depletion, explained as a natural seasonal depletion, appears to have been exacerbated by the effects of CFCs, and may have led to an increase in SKIN CANCER caused by UV exposure. Restrictions on the manufacture and use of CFCs and other ozone-destroying pollutants were imposed in 1978.

Ozu \'ō-zù\ **Yasujirō** (b. Dec. 15, 1903, Tokyo, Japan—d. Dec. 12, 1963, Tokyo) Japanese film director. He joined the Shochiku movie studio as a cameraman in 1923 and directed his first film three years later. He originated the genre known as *shomin-geki* ("common-people's drama"), which treated lower-middle-class Japanese family life, with films such as the silent comedies *I Graduated, But…* (1929) and *I Was Born, But…* (1932) and the sound drama *The Toda Brother and His Sisters* (1941). His later films, noted for their detailed character portrayals, pictorial beauty, and quiet, contemplative mood, include *Late Spring* (1949), *Tokyo Story* (1953), *Early Spring* (1956), *Late Autumn* (1960), *The End of Summer* (1961), and *An Autumn Afternoon* (1962). Ozu was considered the most typically Japanese of all directors and received more honours in his own country than did any other director.

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P-47 *or* **Thunderbolt** FIGHTER and fighter-bomber aircraft used by Allied air forces in World War II. A single-seat, single-engine monoplane, it was developed in the U.S. to meet the need for a high-speed long-range fighter. First flown in 1941, it carried eight .50-caliber machine guns, had a maximum bomb load of 2,500 lbs (1,100 kg), and could carry ten 5-in. (127-mm) rockets beneath its wings. It had a maximum speed of 440 mph (700 kph) and a ceiling of 40,000 ft (12,000 m). More P-47s (15,683) were built for the Allied air services than any other fighter.

P-51 *or* **Mustang** FIGHTER AIRCRAFT of World War II. A single seat, single-engine monoplane produced for Britain's RAF, it went into service in 1941 and later was adopted by the U.S. Army Air Force. The original P-51 had four .50-caliber and four .30-caliber machine guns and a camera for photoreconnaissance; its maximum speed was 390 mph (630 kph). The P-51D, a later model, had six .50-caliber machine guns and a maximum speed of 440 mph (700 kph). A superb long-range fighter, it played a significant part in defeating the German Luftwaffe.

p-n junction Electric contact in TRANSISTORS and related devices between two different types of material called *p*-type and *n*-type SEMICONDUCTORS. These materials are pure semiconductor materials, such as SILICON, to which impurities have been added. Materials of *p*-type contain "holes" (vacancies formerly occupied by ELECTRONS) that behave like positively charged particles, whereas *n*-type materials contain free electrons. ELECTRIC CURRENT flows more easily across a *p-n* junction in one direction than in the other. If the positive pole of a battery is connected to the *p*-side of the junction, and the negative pole to the *n*-side, charge flows across the junction. If the battery is connected in the opposite direction, very little charge can flow. The *p-n* junction forms the basis for COMPUTER CHIPS, SOLAR CELLS, and other electronic devices.

Paar, Jack (b. May 1, 1918, Canton, Ohio, U.S.—d. Jan. 27, 2004, Greenwich, Conn.) U.S. television talk-show host. He worked in radio in the late 1940s before hosting his first television show, *Up to Paar*, in 1952. As host of the late-night talk show *Tonight*, renamed *The Jack Paar Show* (1957–62), he established the now-standard format of celebrity interviews, monologues, and variety skits and was noted for his witty conversation, high-strung mannerisms, and mercurial temper. He later hosted the weekly *Jack Paar Program* (1962–65).

Paasikivi \'pä-si-ki-vē**, Juho Kusti** (b. Nov. 27, 1870, Tampere, Fin.—d. Dec. 14, 1956, Helsinki) Finnish statesman. He served in the Finnish parliament (1907–13), as minister of finance (1908–09), and as independent Finland's first prime minister in 1918. After World War I, he was prominent as a banker and businessman. As minister to Sweden (1936–39), he negotiated a treaty to end the RUSSO-FINNISH WAR (1940). After World War II, he served as Finland's prime minister (1944–46) and later president (1946–56). While accepting the necessity of friendly relations with the Soviet Union, he was uncompromising in his defense of Finnish independence and resisted the growth of communist influence in Finland.

Pabst \'päpst**, G(eorg) W(ilhelm)** (b. Aug. 27, 1885, Raudnice, Bohemia, Austria-Hungary—d. May 29, 1967, Vienna, Austria) German film director. He toured Europe as an actor from age 20 and was directing plays by 1912. He later directed films in Berlin, beginning with *The Treasure* (1923) and continuing with *The Joyless Street* (1925), *Secrets of a Soul* (1926), and *The Love of Jeanne Ney* (1927). His masterpieces, *Pandora's Box* (1929) and *Diary of a Lost Girl* (1929), both starred LOUISE BROOKS. Later films include *Kameradschaft* (1931) and *The Threepenny Opera* (1931). He moved to France in 1933 and to Austria after World War II. His films were among the most artistically successful of the 1920s, marked by social and political concerns and deep psychological insight.

PAC See POLITICAL ACTION COMMITTEE

pacemaker Source of rhythmic electrical impulses that trigger HEART contractions. In the heart's electrical system, impulses generated at a natural pacemaker are conducted to the atria and ventricles. Heart surgery or certain diseases can interrupt conduction (heart block), requiring use of a temporary or permanent artificial pacemaker. A small electrode attached to an electric generator outside the body is threaded through a vein into the heart. The generator, inserted beneath the skin, produces regular pulses of electric charge to maintain the heartbeat. Permanent pacemakers can also be implanted on the heart's surface.

Pachacamac \pä-'chä-kä-ˌmäk\ Site of a pre-Incan city, southeast of LIMA, Peru. It has remains of a temple to the god Pachacamac, a later Incan Temple of the Sun, and the ruins of the surrounding city. The earlier temple and terraced adobe pyramid date from c. 200 BC to AD 600. The city was sacked by Spanish soldiers under FRANCISCO PIZARRO c. 1523 and is now occupied by the village of La Mamacoma.

Pachelbel \päk̲-'el-ˌbel,\ *English* \'pä-kəl-ˌbel**, Johann** (baptized Sept. 1, 1653, Nürnberg—d. March 3, 1706, Nürnberg) German composer and organist. Conservative musically, he was friendly with DIETRICH BUXTEHUDE and was the teacher of Johann Christoph Bach, who later gave lessons to his younger brother JOHANN SEBASTIAN BACH. Though he wrote a huge amount of music, of which his organ chorale variations and Magnificat settings are especially remarkable, he is principally known today for a single piece, the extremely popular *Canon in D Major*, which he may not have written.

Pacher \'päk̲-ər**, Michael** (b. c. 1435, County of Tirol—d. August 1498, Salzburg?, Archbishopric of Salzburg) Austrian painter and sculptor. His colossal altarpiece for the Pilgrimage Church of St. Wolfgang in Upper Austria (1479–81) is a masterpiece of late Gothic painting, sculpture, and architecture. The painted panels, with their deep architectural perspective and dramatic foreshortening, indicate a knowledge of ANDREA MANTEGNA. The sculptural portions, with their intricate detail, bright polychrome, and sweeping draperies, show his attachment to northern traditions; and the architectural elements show an extravagant version of the late Gothic style. Pacher was one of the earliest artists to introduce the principles of Renaissance painting into German-speaking regions.

Pachuca *in full* **Pachuca de Soto** City (pop., 2000: 231,602), capital of HIDALGO state, central Mexico. Founded in 1534, it was one of the first settlements in the Viceroyalty of NEW SPAIN. It lies in a rich mining area in the Sierra Madre Oriental, roughly 8,000 ft (2,400 m) above sea level. Its silver mines date from the 16th century, when the Mexican process of separating silver from the ore by amalgamation with mercury was perfected there. Industries include smelting works and metallic-ore reduction plants.

Pacific, War of the (1879–83) Conflict involving Chile, Bolivia, and Peru over disputed territory on the mineral-rich Pacific coast. National boundaries in the region were not definitively established prior to the conflict, and in the 1870s Chile controlled nitrate fields claimed by Peru and Bolivia. When demand for nitrates rose, war broke out over the territory. Chile defeated both countries and took control of valuable mining areas in each; Bolivia lost its entire Pacific coast. A 1904 treaty gave Bolivia freedom of transit through Chilean territory, but Bolivia continued to try to escape its landlocked status (see CHACO WAR). Peru foundered economically for decades after the war. A final accord between Peru and Chile was reached only in 1929 through U.S. mediation.

Pacific Coast Ranges See COAST RANGES

Pacific Islands, Trust Territory of the Former UNITED NATIONS trusteeship, administered by the U.S. from 1947 to 1986. It consisted of more than 2,000 islands scattered over about 3,000,000 sq mi (7,770,000 sq km) of the tropical western Pacific Ocean, north of the Equator. It covered the region known as MICRONESIA and comprised three major island groups: the MARIANAS, the CAROLINES, and the MARSHALLS. The seat of government was SAIPAN in the NORTHERN MARIANA ISLANDS. In 1986 the U.S. declared the trust territory agreements no longer in effect. The Federated States of Micronesia and the Republic of the Marshall Islands became sovereign states, and the Northern Mariana Islands became a commonwealth of the U.S. The Republic of PALAU became a sovereign state in 1994.

Pacific Ocean Body of salt water extending from the Antarctic region in the south to the Arctic circle in the north and lying between the continents of Asia and Australia on the west and North and South America on the east. It occupies about one-third of the surface of the earth and is by far the largest of the world's OCEANS. Its area, excluding adjacent seas, is approximately 63,800,000 sq mi (165,250,000 sq km), twice that of the ATLANTIC OCEAN and more than the whole land area of the globe. Its mean depth is 14,040 ft (4,280 m). The western Pacific is noted for its many peripheral seas.

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Pacific Security Treaty See ANZUS PACT

Pacification of Ghent See Pacification of GHENT

pacifism \'pa-sə-ˌfi-zəm\ The doctrine that war and violence as a means of settling disputes is morally wrong. The first genuinely pacifist movement was BUDDHISM, whose founder demanded from his followers absolute abstention from any act of violence against their fellow creatures. The ancient Greek conception of pacifism applied to individual conduct rather than to the actions of peoples or kingdoms. The Romans conceived of *pax*, or peace, as a covenant between states or kingdoms that creates a "just" situation based on mutual recognition. This judicial approach was applicable only to the "civilized world," however. Though the spoken words of JESUS as recorded in the New Testament could be interpreted as a kind of pacifism (and in fact were so interpreted by many of his early followers), from the early 3rd century through the Middle Ages the Christian church itself held that armies were necessary to combat nonbelievers or demons. In the 17th and 18th centuries, much pacifist thinking was based on the idea that transferring power from sovereigns to the people would result in peace, because, it was claimed, wars were a product of sovereigns' ambitions and pride. In the 19th and 20th centuries, pacifism inspired widespread interest in general disarmament and in the creation of international organizations for the peaceful resolution of disputes, such as the LEAGUE OF NATIONS and the UNITED NATIONS. Pacifism as a national policy, rather than as a standard of individual conduct, has yet to satisfactorily address the problem of an aggressor that does not possess similar moral scruples. Individual pacifism may lead one to become a CONSCIENTIOUS OBJECTOR. Historically important pacifists include LEO TOLSTOY, MOHANDAS K. GANDHI, and MARTIN LUTHER KING, JR.

Pacino \pə-'chē-nō**, Al(fredo James)** (b. April 25, 1940, New York, N.Y., U.S.) U.S. actor. He began his career as a stage actor, winning Tony Awards for *Does a Tiger Wear a Necktie?* (1969) and later for *The Basic Training of Pavlo Hummel* (1977). He played Michael Corleone in *The Godfather* (1972) and its sequels (1974, 1990). Known for his intense, explosive acting style, he also starred in *Serpico* (1973), *Dog Day Afternoon* (1975), *And Justice for All* (1979), *Scarface* (1983), *Scent of a Woman* (1992, Academy Award), and *Insomnia* (2002).

pack rat See WOOD RAT

Pact of Paris See KELLOGG-BRIAND PACT

paddle tennis Game like tennis that is played with a rectangular paddle and a slow-bouncing rubber ball on a small court. Frank P. Beal introduced it on New York playgrounds in the early 1920s. National championship tournaments are still held in the U.S. See also PLATFORM TENNIS.

paddlefish Either of two species (family Polyodontidae) of archaic freshwater fishes with a paddlelike snout, wide mouth, smooth skin, and cartilaginous skeleton. It feeds with mouth gaping open, gill rakers straining plankton from the water. The American paddlefish, or spoonbill (*Polyodon spathula*), is greenish or gray and averages 40 lbs (18 kg); it lives in the open waters of the Mississippi basin. The other known species (*Psephurus gladius*), inhabits the Chang (Yangtze) River basin. The flesh of both species resembles CATFISH; the roe can be made into CAVIAR.

Paderewski \ˌpa-də-'ref-skē**, Ignacy (Jan)** (b. Nov. 18, 1860, Kuryłówka, Podolia province, Russian Poland—d. June 29, 1941, New York, N.Y., U.S.) Polish pianist, composer, and statesman. After teaching at the Warsaw Conservatory (1878–83), when he wrote most of the pieces for which he is remembered (including *Minuet in G*), he studied with THEODOR LESCHETIZKY in Vienna from 1884. His U.S. debut at Carnegie Hall (1891) was followed by a 117-concert North American tour, during which his pianism and dashingly Romantic image brought him a wild popularity. During World War I he worked for Polish independence; in 1919 he served briefly as the first premier of the new state, representing it at the Paris Peace Conference.

Padre \'pä-drē, 'pä-drā\ **Island** Barrier island, southern Texas, U.S. It is 113 mi (182 km) long and up to 3 mi (5 km) wide, lying along the Gulf Coast of Texas. It extends south from CORPUS CHRISTI to Port Isabel and is separated from the mainland by Laguna Madre. It contains a recreational preserve with a large variety of birdlife, excellent fishing, and a broad beach.

Padua \'pa-dyù-wə\ *Italian* **Padova** \'pä-dō-vä\ *ancient* **Patavium** City (pop., 2001 prelim.: 203,350), northern Italy. Legend holds that it was founded by the Trojan hero Antenor. First mentioned in 302 BC, it prospered as a Roman city and was under Lombard rule in the 7th–8th centuries. A leading Italian commune in the 11th–13th centuries, control of Padua then passed to VENICE from 1405 to 1797. Under Austrian rule (1815–66) the city was active in the RISORGIMENTO (movement for Italian independence). Padua was heavily bombed in World War II but was rebuilt. Its historic buildings contain works by many artists, including GIOTTO, TITIAN, DONATELLO, and MANTEGNA. The University of Padua (1222), the second oldest in Italy (after Bologna), had GALILEO among its teachers and DANTE, PETRARCH, and TASSO among its students. Padua's botanical garden (1545) is the oldest in Europe. The city is now a commercial and industrial centre.

Paekche \'pak-ˌchə\ One of three kingdoms into which Korea was divided before AD 660. It is traditionally said to have been founded in 18 BC by the legendary leader Onjo. In the 3rd century AD Paekche emerged as a fully developed kingdom, and by the 4th century it had extended its territory from the southwestern tip of the Korean peninsula to the whole Han River basin in central Korea. By then it was a centralized aristocratic state. Confucianism and Buddhism flourished, and Paekche's visual arts revealed technical maturity and warm human qualities. In the 5th century it was pushed back south by the northern Korean kingdom of KOGURYŎ, and in 660 it fell to an alliance of the southern Korean state of SILLA and the TANG-DYNASTY China.

Paeonia \pē-'ō-nē-ə\ Ancient land, in what is now northern Greece, the Republic of Macedonia, and western Bulgaria. Paeonia originally included the whole Vardar River valley. The Paeonians were weakened by the Persian invasion of 490 BC, and the tribes living along the Strymon River fell under Thracian control. The growth of ancient Macedonia forced the remaining tribes north, and they were defeated by PHILIP II in 358 BC. It became part of the Roman province of Macedonia; by AD 400 the Paeonians had lost their identity and Paeonia was merely a geographic term.

Paestum \'pes-təm, 'pēs-təm\ Ancient city, southern Italy. Located on the Gulf of Salerno (the ancient Bay of Paestum), the city was founded in the 6th century BC by Greek colonists from SYBARIS, who called it Poseidonia. It was taken by the Lucanians, an indigenous Italic people, in the 4th century BC. They ruled until 273 BC, when the city was captured by the Romans. Deserted after its sack by Muslim raiders in AD 871, the abandoned site's remains were discovered in the 18th century. It is known for its three Doric temples and its city walls of travertine blocks.

The Temple of Athena at Paestum
ALINARI/ART RESOURCE, NEW YORK

pagan Traditional designation of a practitioner of classical polytheisms. The early Christians often used the term to refer to non-Christians who worshiped multiple deities. Christian missionaries frequently sought to stamp out pagan practices by building churches on the sites of pagan shrines or by associating Christian holidays with pagan rituals (e.g., linking CHRISTMAS with the celebration of the winter solstice). The term *pagan* was also used to refer to non-Christian philosophers, and in the 20th century it was used to identify members of certain NEW RELIGIOUS MOVEMENTS. See NEO-PAGANISM.

The Ananda temple, Pagan; its top portion, a restoration, was broken off in an earthquake in 1975
VAN BUCHER—PHOTO RESEARCHERS

Pagan \pə-'gän\ Village, central Myanmar (Burma). Extending along the left bank of the IRRAWADDY RIVER, southwest of MANDALAY, it was founded c. AD 849 and was the capital of a powerful dynasty from the 11th to the 13th century. It was conquered by the MONGOLS in 1287. As a centre of Buddhist learning, it is a pilgrimage destination and contains Buddhist shrines that have been restored and redecorated and are in current use. Ruins of other shrines

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and pagodas cover a wide area. An earthquake in 1975 severely damaged more than half of the important structures and irreparably destroyed many of them. The village also has a school for lacquerware, for which the region is noted.

Paganini \ˌpa-gə-ˈnē-nē**, Niccolò** (b. Oct. 27, 1782, Genoa, Republic of Genoa—d. May 27, 1840, Nice, France) Italian violinist and composer. A prodigy, he joined an orchestra by age nine. He toured Italy (1810–28), renowned as its greatest violin virtuoso. His long-deferred international tour (1830–34) met with sensational success. Paganini's romantic personality and adventures created in his own day the legend of a Mephistophelean figure. He greatly extended violin technique, employing a wide use of harmonics, pizzicato effects, and new methods of fingering and even of tuning. His numerous compositions include *24 Caprices* (1801–07) for solo violin, displaying the novel features of his technique, and six violin concertos.

Paganini, etching by Luigi Calamatta after a drawing by J.-A.-D. Ingres, 1818
THE GRANGER COLLECTION, NEW YORK CITY

Page, Alan (Cedric) (b. Aug. 7, 1945, Canton, Ohio, U.S.) U.S. gridiron football player. He was an All-America defensive end for Notre Dame. Playing tackle for the Minnesota Vikings (1967–78), he became part of its legendary "Purple People Eaters" front line. In 1971 he became the first defensive player to win the NFL's Most Valuable Player award. He earned a law degree in 1978 and continued playing with the Chicago Bears (to 1981) while engaging in private practice. He never missed a game in his 15-year career. In 1993 he was named to the Minnesota Supreme Court.

Page, Geraldine (b. Nov. 22, 1924, Kirksville, Mo., U.S.—d. June 13, 1987, New York, N.Y.) U.S. actress. She studied drama in Chicago and New York and won fame on Broadway as Alma Winemiller in *Summer and Smoke* (1952; film, 1961). Noted for her intuitiveness and creativity in capturing her often vulnerable, eccentric characters, she starred in *The Rainmaker* (1954–55), *Separate Tables* (1957–58), *Strange Interlude* (1963), and *Agnes of God* (1982). Her films include *Hondo* (1953), *Sweet Bird of Youth* (1962), and *The Trip to Bountiful* (1985, Academy Award). She won Emmy Awards for *A Christmas Memory* (1966) and *The Thanksgiving Visitor* (1968).

pageant \ˈpa-jənt\ Large-scale, spectacular theatrical production or procession. In the Middle Ages, a pageant was the wagon on which religious plays such as MYSTERY PLAYS were performed. Because the plays were associated with ceremony and spectacle, the term came to refer to any extravagant dramatic event or colourful celebration. Pageants often serve to express the shared identity of a community or religious group. Secular pageants include coronations and royal weddings; other modern examples are seen in MARDI GRAS and other carnival processions.

Paget \ˈpa-jət**, Sir James** (b. Jan. 11, 1814, Great Yarmouth, Norfolk, Eng.—d. Dec. 30, 1899, London) British surgeon and physiologist. In 1834 he discovered the parasite that causes trichinosis. He gave excellent descriptions of breast cancer, Paget disease of breast (an inflammatory cancerous condition around the nipple), and PAGET DISEASE OF BONE (1877). He was one of the first to recommend surgical removal of bone marrow tumours instead of amputation of the limb.

Paget disease of bone *or* **osteitis** \ˌäs-tē-ˈīt-əs\ **deformans** Chronic bone disease of middle age. Named for JAMES PAGET, it is characterized by excessive BONE destruction alternating with disordered bone construction (with dense, brittle bones and deformity that can compress internal structures). The long bones, vertebrae, pelvis, and skull are most often affected, more often in men. The risk of cancer, usually osteosarcoma, is high. Increased blood supply to the area of bone destruction may lead to heart or circulatory problems. Calcitonin (which regulates bone growth) and bisphosphonates (which block excessive bone breakdown) are drugs of treatment.

Pago Pago \päŋ-ō-ˈpäŋ-ō, ˈpä-gō-ˈpä-gō\ Town and agglomeration of towns (pop., 2000: 4,278) that form the capital of AMERICAN SAMOA. Located on the shore of a deep inlet on the southern side of Tutuila Island in the South Pacific Ocean, it was selected in 1872 as the site of a U.S. Navy coaling station. An active naval base until 1951, it is now a regular port of call. Its airport, opened in 1964, has stimulated tourist traffic and modernization.

pagoda Towerlike, multistoried structure of stone, brick, or wood, usually associated with a Buddhist temple complex and enshrining sacred relics. The pagoda evolved from the Indian STUPA. The pagoda's crowning ornament is bottle-shaped in Tibet and pyramidal or conical in Myanmar, Thailand, Cambodia, and Laos. In China, Korea, and Japan, a pagoda is a tall tower repeating a basic story unit in diminishing proportions. The stories may be circular, square, or polygonal. The pagoda form is intended mainly as a monument and has very little usable interior space.

A square pagoda of the Daigo Temple, Kyōto, Japan.
MANLEY FEATURES/SHOSTAL ASSOCIATES

Pahang \pä-ˈhaŋ\ **River** River, Malaysia, the longest on the MALAY PENINSULA. It rises in the Main Range and flows south and east to the SOUTH CHINA SEA. It is 285 mi (459 km) long and navigable by boats for most of its length. Deforestation in the river's basin has led to heavy flooding during the monsoon season.

Pahari painting \pə-ˈhä-rē\ *or* **Hill painting** Style of miniature painting and book illustration that developed in the independent states of the Himalayan foothills in India c. 1690–1790. Combining the bold intensity of the Basohli school with the delicacy and lyricism of the Kangra school, Pahari painting is closely related to Rajasthani painting. It shares with the Rajput art of the northern Indian plains a preference for depicting legends of the cowherd god KRISHNA.

Pahlavi \ˈpa-lə-ˌvē**, Mohammad Reza Shah** (b. Oct. 26, 1919, Tehrān, Iran—d. July 27, 1980, Cairo, Egypt) Shah of Iran (1941–79), noted for his pro-Western orientation and autocratic rule. After an education in Switzerland, he replaced his father, REZA SHAH PAHLAVI, as ruler when the latter was forced into exile by the British. His rule was marked by a power struggle with his premier, MOHAMMAD MOSADDEQ, who briefly succeeded in deposing him in 1953; covert intervention by British and U.S. intelligence services returned him to the throne the next year. His program of rapid modernization and oil-field development initially brought him popular support, but his autocratic style and suppression of dissent, along with corruption and the unequal distribution of Iran's new oil wealth, increased opposition led by exiled cleric Ayatollah RUHOLLAH KHOMEINI. In 1979 Pahlavi was forced into exile.

Pahlavi, Reza Shah (b. March 16, 1878, Alasht, Qājār Iran—d. July 26, 1944, Johannesburg, S.Af.) Shah of Iran (1926–41). An army officer, he rose through the ranks and in 1921 led a coup that overthrew the QĀJĀR DYNASTY. He sought to bring order and end Iran's political chaos and its domination by Britain and Soviet Russia following World War I (1914–18). He constructed roads, schools, and hospitals, opened a university, and built the Trans-Iranian Railway. He emancipated women, nationalized several economic sectors, and reduced the clergy's power. He often used repressive methods, which eventually cost him his popularity. During World War II (1939–45), fearing that Pahlavi might side with Germany, the U.S. and Britain occupied Iran. The Allies forced him to abdicate (1941) in favour of his son, MOHAMMAD REZA SHAH PAHLAVI.

Pai River See BAI RIVER

Paige, Satchel *orig.* **Leroy Robert Paige** (b. July 7, 1906?, Mobile, Ala., U.S.—d. June 8, 1982, Kansas City, Mo.) U.S. baseball

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pitcher. Paige earned legendary fame during his many years pitching in the Negro leagues for a myriad of teams that included the Birmingham Black Barons, the Pittsburgh Crawfords, the Kansas City Monarchs, and the New York Black Yankees. He also barnstormed in exhibition games and played in the Caribbean during the off season. He was about 42 years old when he was finally allowed to enter the major leagues in 1948, shortly after Jackie Robinson broke baseball's race barrier. Joining the Cleveland Indians—the oldest player to make his debut in the major leagues—he helped that team win the World Series in his first season. He retired after the 1953 season. A right-handed, loose-jointed "beanpole," standing 6 ft 4 in. (1.93 m), Paige had considerable pitching speed and a comprehensive mastery of slow-breaking deliveries. He is reputed to have won 2,000 of a total of 2,500 games pitched during his nearly 30-year career. Among Paige's many oft-quoted comments is the admonition "Don't look back, something might be gaining on you."

Satchel Paige, 1942.
UPI

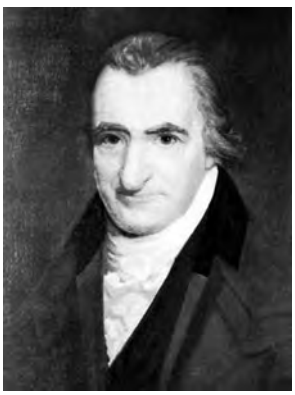
Päijänne \'pā-ˌya-ne**, Lake** Lake, southern Finland. It is 75 mi (121 km) long and 14 mi (23 km) wide. The lake contains thousands of islands. The lake system is drained southward to the Gulf of Finland by the Kymi River. The irregular shoreline is heavily forested and supports important timber operations that use the lake for transport. There are numerous villages along the lakeshore and many private villas at the southern end of the lake.

Paik \'pāk, 'pīk**, Nam June** (b. July 20, 1932, Seoul, Korea) Korean-born U.S. sculptor and video and performance artist. He studied music at the Universities of Tokyo and Munich and came to the U.S. in 1964. Inspired by Joseph Beuys and John Cage, he joined the Fluxus group. He is considered the father of video art. His sophisticated video displays, such as *TV Buddha* (1974), an installation with a Buddha contemplating himself on television, were seen as uniquely appropriate to the Information Age, in which fascination with electronic media has replaced spirituality. Prolific in many media, he was honoured with many major retrospectives in the late 20th century.

pain Physical suffering associated with a bodily disorder (such as a disease or injury) and accompanied by mental or emotional distress. Pain, in its simplest form, is a warning mechanism that helps protect an organism by influencing it to withdraw from harmful stimuli (such as a pinprick). In its more complex form, such as in the case of a chronic condition accompanied by depression or anxiety, it can be difficult to isolate and treat. Pain receptors, found in the skin and other tissues, are nerve fibres that react to mechanical, thermal, and chemical stimuli. Pain impulses enter the spinal cord and are transmitted to the brain stem and thalamus. The perception of pain is highly variable among individuals; it is influenced by previous experiences, cultural attitudes (including gender stereotypes), and genetic makeup. Medication, rest, and emotional support are the standard treatments. The most potent pain-relieving drugs are opium and morphine, followed by less-addictive substances and non-narcotic analgesics such as aspirin and ibuprofen.

Paine, Robert Treat (b. March 11, 1731, Boston, Mass.—d. May 11, 1814, Boston, Mass., U.S.) U.S. jurist. A lawyer in his native Boston from 1757, he gained recognition as a prosecuting attorney in the murder trial of the British soldiers involved in the Boston Massacre. He was a member of the Continental Congress and a signer of the Declaration of Independence. He also served as Massachusetts' first attorney general (1777–90) and as a judge in the state supreme court (1790–1804).

Paine, Thomas (b. Jan. 29, 1737, Thetford, Norfolk, Eng.—d. June 8, 1809, New York, N.Y., U.S.) English-American writer and political pamphleteer. After a series of professional failures in England, he met Benjamin Franklin, who advised him to immigrate to America. He arrived in Philadelphia in 1774 and helped edit the *Pennsylvania Magazine*. In January 1776 he wrote *Common Sense*, a 50-page pamphlet eloquently advocating independence; more than 500,000 copies were quickly sold, and it greatly strengthened the colonists' resolve. As a volunteer aide to Gen. Nathanael Greene during the American Revolution he wrote his 16 "Crisis" papers (1776–83), each signed "Common Sense"; the first, beginning "These are the times that try men's souls," was read to the troops at Valley Forge on George Washington's order. In 1787 Paine traveled to England and became involved in debate over the French Revolution; his *The Rights of Man* (1791–92) defended the revolution and espoused republicanism. Viewed as an attack on the monarchy, it was banned, and Paine was declared an outlaw in England. He then went to France, where he was elected to the National Convention (1792–93). After he criticized the Reign of Terror, he was imprisoned by Maximilien Robespierre (1793–94). His *The Age of Reason* (1794, 1796), the first part of which was published while he was still in prison, earned him a reputation as an atheist, though it in fact espouses Deism. He returned to the U.S. in 1802; criticized for his Deist writings and little remembered for his service to the Revolution, he died in poverty.



Thomas Paine, detail of a portrait by John Wesley Jarvis; in the Thomas Paine Memorial House, New Rochelle, N.Y.
COURTESY OF THE THOMAS PAINE NATIONAL HISTORICAL ASSOCIATION

paint Decorative and protective coating commonly applied to rigid surfaces as a liquid consisting of a pigment suspended in a vehicle, or binder. The vehicle, usually a resin dissolved in a solvent, dries to a tough film, binding the pigment to the surface. Paint was used for pictorial and decorative purposes in the caves of France and Spain as early as 15,000 BC.

paintbrush See Indian paintbrush

Painted Desert Region, north-central Arizona, U.S. It stretches about 150 mi (240 km) from the Grand Canyon to Petrified Forest National Park and has an area of about 7,500 sq mi (19,425 sq km). The name was first used in 1858 by a government explorer to describe the area's brilliantly coloured rock surfaces, exposed by erosion. A large part of the desert lies within Navajo and Hopi Indian reservations. The Navajo peoples use the various sands for their ceremonial sand paintings.

painted lady Either of two species of butterflies in the genus *Vanessa* (family Nymphalidae): *V. cardui* of Africa and Europe or *V. virginiensis* of North and Central America. They have broad, elaborately patterned wings of reddish orange, brown, white, and blue. In spring, vast numbers of *V. cardui* travel thousands of miles across the Mediterranean from Africa to Europe. A few members of the subsequent generation travel south in late summer, but most perish in the northern winter. North American painted ladies travel in spring from northwestern Mexico to the Mojave Desert and sometimes as far as Canada. Their larvae eat plants in the aster family; *V. cardui* larvae eat thistles and stinging nettles.

American painted lady (*Vanessa virginiensis*)
E.S. ROSS

painted turtle Species (*Chrysemys picta*, family Emydidae) of brightly marked North American turtle found from southern Canada to northern Mexico. It has a smooth shell, 4–7 in. (10–18 cm) long, with

Painted turtle (*Chrysemys picta*)
LEONARD LEE RUE III—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

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red and yellow markings on its relatively flat, black or greenish brown upper shell. It usually lives in quiet, shallow bodies of fresh water, especially those with thickly planted mud bottoms, feeding on plants, small animals, and some carrion. It often basks in large groups on logs and other objects. In many areas it hibernates.

Painter, Theophilus Shickel (b. Aug. 22, 1889, Salem, Va., U.S.—d. Oct. 5, 1969, Fort Stockton, Texas) U.S. zoologist and cell biologist. He received his Ph.D. from Yale in 1913. He was the first to show that the unusually large chromosomes in the salivary glands of *Drosophila* were particularly well suited for studies of genes and chromosomes. In the early 1930s he published a drawing of a section of a *Drosophila* chromosome showing more than 150 bands, which for the first time allowed the precise positions of genes to be determined.

painting Art consisting of representational, imaginative, or abstract designs produced by application of coloured paints to a two-dimensional, prepared, flat surface. The elements of design (i.e., line, colour, tone, texture) are used in various ways to produce sensations of volume, space, movement, and light. The range of media (e.g., tempera, FRESCO, oil, WATERCOLOUR, ink, GOUACHE, encaustic, casein) and the choice of a particular form (e.g., MURAL, easel, panel, MINIATURE, ILLUMINATED MANUSCRIPT, SCROLL, screen, FAN) combine to realize a unique visual image. Painting as an art form dates back to prehistoric cave paintings. The early cultural traditions of tribes, religions, guilds, royal courts, and states controlled the craft, form, imagery, and subject matter of painting and determined its function (e.g., ritualistic, devotional, decorative). Painters were considered skilled artisans rather than creative artists until eventually, in East Asia and Renaissance Europe, the fine artist emerged with the social status of a scholar and courtier. Fine artists signed their work and decided its design and often its subject and imagery. Over time painters have increasingly gained the freedom to invent their own visual language and to experiment with new forms and unconventional materials and techniques. In the early 20th century painters began to experiment with nonrepresentational art in which formal qualities such as line, colour, and form were explored rather than subject matter. Throughout the century styles vacillated between representational and nonrepresentational painting. In the late 20th century some critics forecast the "death of painting" in the face of new media such as video and intallation art, yet talented new artists repeatedly brought painting back to the centre of artistic production.

pair production Formation of an ELECTRON and a POSITRON from high-energy ELECTROMAGNETIC RADIATION traveling through matter, usually in the vicinity of an atomic NUCLEUS. It is a direct conversion of radiant energy into matter in accordance with the equation $E = mc^2$, where E is the amount of energy, m is the mass, and c is the speed of light. It is one of the principal ways in which high-energy GAMMA RAYS are absorbed in matter. The positrons quickly disappear by being reconverted into PHOTONS in the process of ANNIHILATION with other electrons. Pair production may sometimes refer to the formation of other particle/antiparticle pairs as well.

Paisiello \ˌpä-ēz-ˈye-lō**, Giovanni** (b. May 9, 1740, Taranto, Kingdom of Naples—d. June 5, 1816, Naples) Italian composer. Trained in Naples, he served the Russian empress CATHERINE II as chapel master in St. Petersburg (1776–84), where he wrote many short operas. He had his first operatic success in Vienna in 1784 then returned to Naples to become dramatic composer to Ferdinand IV. In 1802 Paisiello was invited by Napoleon to work in Paris, but after two years he returned to Naples, where, despite changes in regime, he retained his court post until 1815. He composed more than 80 operas, including a very popular *Barber of Seville* (1782).

Paisley, Ian (Richard Kyle) (b. April 6, 1926, Armagh, County Armagh, N.Ire.) Protestant leader in Northern Ireland. After being ordained in the Reformed Presbyterian church (1946), he cofounded a new sect, the Free Presbyterian Church of Ulster (1951), which soon grew to more than 30 churches. In the 1960s he became the voice of extreme Protestant opinion in the sectarian strife of Northern Ireland, opposed to any concessions to the Catholics. He led demonstrations throughout Northern Ireland and was repeatedly imprisoned for unlawful assembly. Elected to the House of Commons in 1970, he cofounded the Democratic Unionist Party in 1971 and also organized a paramilitary group of Protestant fighters called the Third Force. In 1998 he opposed the Good Friday Agreement, which called for power sharing between Roman Catholics and Protestants. He won a seat in the new Northern Ireland Assembly that the accord established, though he continued to refuse to participate in negotiations with Sinn Féin, the political wing of the Irish Republican Army.

Paiute \ˈpī-ˌyüt\ Either of two distinct American Indian groups living mostly in California, Nevada, Arizona, and Utah, U.S. Their languages belong to the Numic branch of the UTO-AZTECAN family. Their name for themselves is Numa. The Southern Paiute occupied southern Utah, northwestern Arizona, southern Nevada, and southwestern California. The Northern Paiute occupied east-central California, western Nevada, and eastern Oregon. Both groups were primarily food collectors who subsisted on wild plant foods supplemented by small game. They occupied temporary brush shelters, used rabbit-skin clothing, and made baskets for food gathering. They were organized in loosely knit BANDS. Most Paiute were directed onto reservations in the 19th century; they number some 13,500. See also UTE; WOVOKA.

Pakistan *officially* **Islamic Republic of Pakistan** Country, southern Asia. Area: 307,374 sq mi (796,096 sq km). Population (2005 est.): 153,960,000. Capital: ISLAMABAD. The population is a complex mix of

indigenous peoples who have been affected by successive waves of migrations of Aryans, Persians, Greeks, Pashtuns, Mughals, and Arabs. Languages: Urdu (official), Punjabi, Pashto, Sindhi, Balochi. Religions: Islam (official; predominantly Sunni); also Christianity, Hinduism. Currency: Pakistan rupee. Pakistan may be divided into four regions: the northern mountains, the Balochistan Plateau, the Indus Plain, and the desert areas. The Himalayan and Trans-Himalayan ranges form the great mountain areas of the northernmost part of the country; some of the highest peaks are K2 and NANGA PARBAT. The country has a developing mixed economy based largely on agriculture, light industries, and services. Remittances from Pakistanis working abroad are a major source of foreign exchange. Pakistan is a military-backed constitutional regime with two legislative houses; its chief of state is the president, assisted by the prime minister. The area has been inhabited since the 3rd millennium BC. From the 3rd century BC to the 2nd century AD, it was part of the Mauryan and Kushan kingdoms. The first Muslim conquests were in the 8th century AD. The British EAST INDIA CO. subdued the reigning MUGHAL DYNASTY in 1757. During the period of British colonial rule, what is now (Muslim) Pakistan was part of (Hindu) India. The new state of Pakistan came into existence in 1947 by act of the British Parliament. The KASHMIR region remained a disputed territory between Pakistan and India, with tensions resulting in military clashes and full-scale war in 1965. Civil war between East and West Pakistan in 1971 resulted in independence for Bangladesh (formerly East Pakistan) in 1972. Many Afghan refugees migrated to Pakistan during the Soviet-Afghan war in the 1980s and remained there during the TAL-

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IBAN and post-Taliban periods. Pakistan elected BENAZIR BHUTTO, the first woman to head a modern Islamic state, in 1988. She and her party were ousted in 1990, but she returned to power in 1993–97. Conditions became volatile during that period. Border flare-ups with India continued, and Pakistan conducted tests of nuclear weapons. Political conditions worsened, and the army carried out a coup in 1999.

Pala bronze See EASTERN INDIAN BRONZE

palace Royal residence, and sometimes a seat of government or a religious centre. The word derives from Rome's Palatine Hill, where the emperors built their residences. The earliest known palaces are those of the Egyptian kings at Thebes, with an outer wall enclosing a labyrinth of rooms and courtyards. Other ancient cultures also built vast palaces (e.g., the Assyrian palaces at Nimrūd, Khorsabad, and Nineveh; the Minoan palace at Knossos; and the Persian palaces at Persepolis and Susa). In Rome and Constantinople, palaces reached their peak as centres of power. In Western Europe after the Middle Ages, palaces tended to be single buildings. In Renaissance Italy every prince had his royal palace, usually with an internal court surrounded by an arcade. The court of the Pitti Palace in Florence (1560) is an important example of Mannerist architecture. French palaces include the LOUVRE and VERSAILLES; Spanish palaces include EL ESCORIAL and the ALHAMBRA. In contrast to the typical Western format, East Asian palaces, such as the imperial palaces of Japan and those in Beijing's FORBIDDEN CITY, consist of many buildings (in these cases, low pavilions mostly of highly decorated wood construction) within vast walled gardens.

Palacký \'pä-lats-kē\, **František** (b. June 14, 1798, Hodslavice, Moravia, Austrian Empire—d. May 26, 1876, Prague, Bohemia, Austria-Hungary) Czech historian and politician. His *History of Bohemia* (5 vol., 1836–67) made him the founder of modern Czech historiography. Supporting the concept of a federal Austria composed of nationalities with equal rights, he was chairman of the 1848 Prague Slavic congress to promote PAN-SLAVISM. He was a deputy in the Austrian assembly from 1861. His ideas of liberal nationalism later strongly influenced TOMÁŠ MASARYK.

Palamas \ˌpä-lä-'mäs\, **Saint Gregory** (b. Nov. 11/14, 1296, Constantinople—d. 1359, Thessalonica, Byzantine Empire) Eastern Orthodox priest. From 1332 he was the chief defender of the school of mysticism known as Hesychasm, which integrated repetitive prayer with bodily postures and controlled breathing. His *Apology for the Holy Hesychasts* (1338) is a justification for mystical experience that involves both soul and body; his *Book of Holiness* (1344) is the fundamental textbook of Byzantine mysticism. He was made bishop of Thessalonica in 1347, and in 1368 he was acclaimed a saint and named Father and Doctor of the Orthodox church.

palate \'pa-lət\ Roof of the MOUTH, separating the oral and nasal cavities. The front two-thirds, the hard palate, is a plate of bone covered by mucous membrane. It gives the tongue a surface against which to make speech sounds and shape food during chewing and keeps pressures in the mouth from closing off the nasal passage. The flexible soft palate behind it is made of muscle and connective tissue and ends in the uvula, a fleshy projection. It rises to block the nasal cavity (see NOSE) and upper PHARYNX off from the mouth and lower pharynx for swallowing or to create a vacuum for drinking. Cleft palate, a CONGENITAL DISORDER involving a gap in the palate, can be corrected surgically.

Palatinate \pə-'la-tᵊn-ət\ *German* **Pfalz** \'pfälts\ Historical region, now part of Germany. The region was once under the jurisdiction of the counts palatine (secular princes), who in the 14th century became ELECTORS of the HOLY ROMAN EMPIRE. In the 16th and 17th centuries the Palatinate was a stronghold of Protestantism. It was divided into two parts: the Lower, or Rhenish, Palatinate, on both sides of the RHINE RIVER in the area south of the MAIN RIVER; and the Upper Palatinate, in northern Bavaria around Amberg and Regensburg. The boundaries of the Palatinate varied with the political and dynastic fortunes of the counts palatine.

Palau \pə-'laů\ *officially* **Republic of Palau** Island country, western Pacific Ocean. Area: 188 sq mi (488 sq km). Population (2005 est.): 21,100. Capital: KOROR (acting); scheduled to move to the island of Babelthuap in 2006. The population is of mixed Malay, Melanesian, Filipino, and Polynesian ancestry. Languages: Palauan, Sonsorolese-Tobian, English (all official). Religion: Christianity (mostly Roman Catholic; also Protestant, other Christians). Currency: U.S. dollar. The islands of the Palau group are fertile, with mangrove swamps along the coasts, backed by savanna and palms rising to rainforests in the hills. The major source of employment is government service. Subsistence farming and fishing are the main occupations in the rural areas. Palau is a republic with two legislative houses; its head of state and government is the president. The islands had been under nominal Spanish ownership when they were sold to Germany in 1899. They were seized by Japan in 1914 and taken by Allied forces in 1944 during World War II. Palau became part of the U.S. Trust Territory of the PACIFIC ISLANDS in 1947 and became a sovereign state in 1994; the U.S. provides economic assistance and maintains a military presence in the islands.

Palawan \pä-'lä-wän\ Island (pop., 2000: 713,539), southwestern Philippines. It is long and narrow and extends northeast to southwest between the South CHINA SEA and the Sulu Sea. It has a mountainous backbone that runs its entire length, with the highest peak at Mount Mantalingajan (6,839 ft [2,085 m]). The capital is Puerto Princesa. The similarity of Palawan's vegetation with that of Borneo is explained by remnants of a Pleistocene Epoch land bridge that connected the two islands. A coastal plain supports most of the population and is the main agricultural area of Palawan. Scattered settlement and shifting agriculture predominate, with rice as the main food crop. Oil drilling off the northern coast began in 1992.

pale District separated from the surrounding country by defined boundaries or set apart by a distinctive administrative and legal system. In imperial Russia from the late 18th century, the Pale of Settlement was the area in which Jews were permitted to live. By the 19th century it included all of Russian Poland, Lithuania, Belarus, Crimea, Bessarabia, and most of Ukraine. It ceased to exist during World War I, when Jews in great numbers fled to the interior, and it was abolished in 1917. The English maintained a pale in Ireland until the entire island was subjugated under ELIZABETH I in the 16th century.

Palembang \ˌpä-lem-'bäŋ\ City (pop., 1995 est.: 1,283,100) and river port, Indonesia. It is located on both banks of the Musi River. It was the capital of a Buddhist kingdom from the 7th to the 14th century AD and was subsequently overthrown by the Hindu MAJAPAHIT EMPIRE. The Dutch EAST INDIA COMPANY established a trading post there and in 1659 built a fort. Palembang was occupied by the Japanese during World War II and was the capital of South Sumatra until that state was included in the Republic of Indonesia in 1950. The port is accessible to ocean traffic and conducts considerable trade with ports on the MALAY PENINSULA and in Thailand and China.

Palenque \pä-'leŋ-kā\ Ruined ancient Mayan city of the Late Classic period (c. AD 600–900) in what is now Chiapas state, Mexico. It is considered the most beautiful of Mayan sites. The Palenque builders designed temple pyramids and palaces with mansard-style roofs and walls embellished with delicate stucco reliefs of rulers, gods, and ceremonies. The principal structure is the palace, a labyrinth of galleries with interior courts and a four-story square tower. The great Temple of the Inscriptions is noted for its hieroglyphics and a vast funerary crypt, filled with jade, that was discovered in 1952.

Paleo-Asiatic languages See PALEO-SIBERIAN LANGUAGES

Paleo \ˌpā-lē-ō\ **-Siberian languages** *or* **Paleo-Asiatic languages** Group of four unrelated language families spoken in northeastern Asia. Believed to have covered much larger areas of Siberia and perhaps Manchuria in the past, they have lost ground to URALIC and ALTAIC languages and more recently to RUSSIAN (see SIBERIAN PEOPLES). Of the Yeniseian languages, the only survivors are Ket, spoken by fewer than 500 people, and the virtually extinct Yug. The two extant Yukaghir languages (which are believed by some specialists to belong to the URALIC LANGUAGES), North, or Tundra, Yukaghir and South, or Kolyma, Yukaghir, together have fewer than 100 speakers. The Chukotko-Kamchatkan (Luorawetlan) family includes Chukchi, with about 10,000 speakers in extreme northeastern Siberia; Koryak, with fewer than 5,000 speakers south of Chukchi; and Itelmen, spoken on the Kamchatka Peninsula by fewer than 100 people. The two Nivkh (Gilyak) varieties, Amur Nivkh and Sakhalin Nivkh, together have fewer than 1,000 speakers.

Paleocene \'pā-lē-ə-ˌsēn\ **Epoch** *or* **Palaeocene Epoch** Earliest division of the TERTIARY PERIOD, from 65 to 54.8 million years ago. It precedes the EOCENE EPOCH and follows the CRETACEOUS PERIOD. The Paleocene was characterized by a generally warming climate, with little or no frost; seasonal variation probably consisted of alternating dry and wet seasons. By the Paleocene the dinosaurs and other reptilian groups that were domi-

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nant during the Cretaceous had disappeared, and the epoch saw the rapid proliferation and evolution of mammals.

paleoclimatology *or* **palaeoclimatology** Scientific study of the extended climatic conditions of past geologic ages. Paleoclimatologists seek to explain climate variations for all parts of the Earth during any given geologic period, beginning with the time of the Earth's formation. The basic research data are drawn mainly from geology and paleobotany; speculative attempts at explanation have come largely from astronomy, atmospheric physics, meteorology, and geophysics.

paleogeography *or* **palaeogeography** Geography of selected portions of the Earth's surface at specific times in the geologic past. The simplest kind of paleogeography is a map showing the locations of ancient lands and seas, but paleogeographic maps may also show the occurrence and distribution of fossil, plant, and animal communities; environments of sedimentation (e.g., deltas, reefs, deserts, or deep-sea basins); areas undergoing uplift and erosion or subsidence and deposition; and major climatic zones.

paleogeology *or* **palaeogeology** Geology of a region at any given time in the distant past. Paleogeologic reconstructions in map form show not only the ancient topography of a region but also the distribution of rocks beneath the surface and such structural features as FAULTS and FOLDS. Maps of this kind help investigators determine deformation events in a region, stream-drainage patterns now buried under layers of sediment, and the extent of ancient oceans and seas. They also provide a useful tool for petroleum geologists, enabling them to identify geologic structures where oil or natural gas may be trapped.

paleohydrology *or* **palaeohydrology** Scientific discipline concerned with hydrologic systems as they existed during previous periods of Earth history. Changing hydrologic conditions are inferred from the evidence of the alteration, deposition, and erosion in rocks. Paleohydrology also deals with the changes in animals and plants through geologic time that have been greatly influenced by hydrologic change.

Paleolithic \ˌpā-lē-ə-'li-thik\ **Period** *or* **Old Stone Age** Ancient technological or cultural stage characterized by the use of rudimentary chipped stone tools. During the Lower Paleolithic (c. 2,500,000–200,000 years ago), simple pebble tools and crude stone choppers were made by the earliest humans. About 700,000 years ago, the first rough hand ax appeared; it was later refined and used with other tools in the ACHEULEAN INDUSTRY. A flake-tool tradition emerged in the Middle Paleolithic, as exemplified by implements of the MOUSTERIAN INDUSTRY. The Upper Paleolithic (40,000–10,000 BC) saw the emergence of more complex, specialized, and diverse regional stone-tool industries, such as the AURIGNACIAN, SOLUTREAN, and MAGDALENIAN. The two principal forms of Paleolithic art are small sculptures—such as the so-called Venus figurines and various carved or shaped animal and other figures—and monumental paintings, incised designs, and reliefs on the walls of caves such as ALTAMIRA (in Spain) and LASCAUX GROTTO (in France). The end of the Paleolithic is marked by the emergence of the settled agricultural villages of the NEOLITHIC PERIOD.

paleomagnetism *or* **palaeomagnetism** *or* **remanent magnetism** Permanent magnetism in rocks, resulting from the orientation of the Earth's magnetic field at the time of rock formation in a past geologic age. It is a source of information for the paleomagnetic studies of POLAR WANDERING and PLATE TECTONICS.

paleontology *or* **palaeontology** Scientific study of life of the geologic past, involving analysis of plant and animal fossils preserved in rocks. It is concerned with all aspects of the biology of ancient life forms: their shape and structure, evolutionary patterns, taxonomic relationships with each other and with modern species, geographic distribution, and interrelationships with the environment. Paleontology has played a key role in reconstructing the Earth's history and has provided evidence to support the theory of evolution. Data from paleontologic studies have also aided petroleum geologists in locating deposits of oil and natural gas, which are frequently associated with the remains of certain ancient life forms.

Paleozoic \ˌpā-lē-ə-'zō-ik\ **Era** *or* **Palaeozoic Era** Major interval of geologic time, c. 543–248 million years ago. From the Greek for "ancient life," it is the first era of the PHANEROZOIC EON and is followed by the MESOZOIC ERA. It is divided into six periods: (from oldest to youngest) the CAMBRIAN, ORDOVICIAN, SILURIAN, DEVONIAN, CARBONIFEROUS, and PERMIAN. During the early Paleozoic, much of North America was covered by a warm, shallow sea with many coral reefs. Fossils from this time include marine invertebrates and primitive fish; the plants were predominantly algae, with some mosses and ferns. During the late Paleozoic, huge, swampy forest regions covered much of the northern continents. Plant and animal life flourished. Amphibians left the oceans to live on land, reptiles evolved as fully terrestrial life forms, and insect life began. Ferns grew to tree size, and precursors of the conifers appeared.

Palermo *ancient* **Panormus** City (pop., 2001: 686,722), seaport, and capital of SICILY. Located on the Bay of Palermo, the city was founded by Phoenician traders in the 8th century BC; it was later a Carthaginian settlement. It was taken by the Romans in 254 BC. Conquered by the Arab troops of the AGHLABID DYNASTY in 831, it flourished as a centre of trade with North Africa. Palermo was thus quite prosperous when it fell to the Norman adventurers ROGER I and ROBERT GUISCARD in 1072. The ensuing era of Norman rule (1072–1194) was Palermo's golden age, particularly after the founding of the Norman kingdom of Sicily in 1130 by ROGER II. In 1194 Germany's Hohenstaufen ruler, FREDERICK II, took over. Palermo was conquered by the French under CHARLES OF ANJOU in 1266, but Angevin oppression was ended in 1282 by a popular uprising called the SICILIAN VESPERS. After 1412 the crown of Sicily was united with that of ARAGON and subsequently with that of Spain. Palermo declined during this long period of Spanish rule. The city was taken by Italian patriot Giuseppe de GARIBALDI in 1860 and made part of the kingdom of Italy. Heavily bombed during World War II, it was captured by Allied forces in 1943. Notable buildings from the Norman and later periods include the cathedral that contains the tombs of Roger II and Frederick II. Palermo is Sicily's chief port, and ship repair is an important industry.

Palestine *biblical* **Canaan** Region, at the eastern end of the MEDITERRANEAN SEA. It extends east to the JORDAN RIVER, north to the border between Israel and Lebanon, west to the Mediterranean, and south to the NEGEV desert, reaching the Gulf of AQABA. The political status and geographic area designated by the term have changed considerably over the course of three millennia. The eastern boundary has been particularly fluid, often understood as lying east of the Jordan and extending at times to the edge of the ARABIAN DESERT. A land of sharp contrasts, Palestine includes the DEAD SEA, the lowest natural point of elevation on Earth, and mountain peaks higher than 2,000 ft (610 m) above sea level. In the 20th and 21st centuries it has been the object of conflicting claims by Jewish and Arab national movements. The region is sacred to Judaism, Christianity, and Islam. Settled since early prehistoric times, mainly by Semitic groups, it was occupied in biblical times by the kingdoms of Israel, JUDAH, and JUDAEA. It was subsequently held by virtually every power of the Middle East, including the Assyrians, Persians, Romans, Byzantines, Crusaders, and Ottomans. It was governed by Britain under a League of Nations mandate from the end of World War I (1914–18) until 1948, when the State of Israel was proclaimed. Armies from Egypt, Transjordan, Syria, and Iraq attacked the next day. They were defeated by the Israeli army. See ISRAEL, JORDAN, WEST BANK, and GAZA STRIP for the later history of the region.

Palestine Liberation Organization (PLO) *Arabic* **Munaẓẓamat al-Taḥrīr al-Filasṭīniyyah** Umbrella political organization representing the Palestinian people in their drive for a Palestinian state. It was formed in 1964 to centralize the leadership of various groups. After the SIX-DAY WAR of 1967, the PLO promoted a distinctively Palestinian agenda. In 1969 YĀSIR ʿARAFĀT, leader of FATAH, the PLO's largest faction, became its chairman. From the late 1960s the PLO engaged in GUERRILLA attacks on Israel from bases in Jordan, from which it was expelled in 1971. PLO headquarters moved to Lebanon. In 1974 ʿArafāt advocated limiting PLO activity to direct attacks against ISRAEL, and the Arab community recognized the PLO as the sole legitimate representative of all Palestinians. It was admitted to the ARAB LEAGUE in 1976. In 1982 Israel invaded Lebanon and expelled PLO forces based there. In 1988 the PLO leadership, then based in Tunis, declared a Palestinian state and the following year elected ʿArafāt its president. It also recognized Israel's right to exist, though several militant factions dissented. In 1993 Israel recognized the PLO by signing an agreement with it granting Palestinian self-rule in parts of the WEST BANK and GAZA STRIP. The PLO became an integral part of the Palestinian National Authority. See also PALESTINE; LEBANESE CIVIL WAR; ḤAMĀS; *INTIFĀḌAH*.

Palestinian Talmud See TALMUD

Palestrina See PRAENESTE

Palestrina \ˌpa-lə-'strē-nə**, Giovanni Pierluigi da** (b. c. 1525, Palestrina, near Rome—d. Feb. 2, 1594, Rome) Italian composer. He sang

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in Rome as a choirboy, then worked as an organist in his nearby hometown of Palestrina. He was appointed director of the Vatican's Cappella Giulia by Pope Julius II in 1551, and he later worked at the other great Roman churches. He worked for the d'Este family in Tivoli for four years but returned to the Cappella Giulia in 1571 and remained there the rest of his life. Pope Gregory XIII commissioned Palestrina to restore the plainchant (a traditional liturgical chant sung in unison) to a more authentic form. The task proved too great, and his editorial work gave way to a flow of creative music, including volumes of masses, motets, and madrigals. After his death, his superbly balanced and serene music was proclaimed as a model for composers in the Roman Catholic church. The modern study of COUNTERPOINT dates from the codification of his practice in the 18th century.

Paley, Grace *orig.* **Grace Goodside** (b. Dec. 11, 1922, New York, N.Y., U.S.) U.S. short-story writer and poet. Paley's first languages were Russian and Yiddish, a circumstance that may have some bearing on her ability to vividly reproduce in her fiction a variety of accents and speech mannerisms. She was active in the opposition to the Vietnam War in the 1960s and continued her political activism after the war ended. Her stories, compassionate and often comic explorations of family and neighbourhood life and of individuals struggling against loneliness, are collected in *The Little Disturbances of Man* (1959), *Enormous Changes at the Last Minute* (1974), and *Later the Same Day* (1985). Her poetry appears in *Leaning Forward* (1985) and *Begin Again* (1992).

Paley, William S(amuel) (b. Sept. 28, 1901, Chicago, Ill., U.S.—d. Oct. 26, 1990, New York, N.Y.) U.S. broadcaster. He worked in his family's cigar business from 1922. His success at increasing sales through radio advertisements sparked his interest in the medium. He invested in a small radio network, Columbia Phonographic Broadcasting System, becoming its president in 1928 and rapidly adding member stations. He built CBS into one of the world's leading radio and television networks, serving as president (1928–46) and chairman of the board (1946–90). He launched CBS News in 1933 and built its outstanding staff, including EDWARD R. MURROW.

Palgrave, Francis Turner (b. Sept. 28, 1824, Great Yarmouth, Norfolk, Eng.—d. Oct. 24, 1897, London) English critic and poet. He spent many years in the civil service's education department and taught poetry at Oxford. His *Golden Treasury of English Songs and Lyrics* (1861), a comprehensive, well-chosen, and carefully arranged lyric anthology, influenced the poetic taste of several generations and was important in popularizing the works of WILLIAM WORDSWORTH.

Pali canon See TRIPITAKA

Pali \'pä-lē\ **language** Middle INDO-ARYAN LANGUAGE of the 5th century BC in which the most essential documents of THERAVADA Buddhism are written. Linguistically, Pali is a homogenization of the northern Middle Indo-Aryan dialects in which the BUDDHA's teachings were orally recorded and transmitted. According to the tradition of Sri Lankan chronicles, the Theravada canon was first written down in the 1st century BC, though its oral transmission continued long afterward. No single script was ever developed for Pali; scribes used scripts of their own languages to copy canonical texts and commentaries (see INDIC WRITING SYSTEMS), and most extant palm-leaf manuscripts of Pali are of relatively recent date.

Palikir \ˌpä-lē-'kir\ Capital (pop., 2000: 6,227) of the Federated States of MICRONESIA. It is located inland on the island of Pohnpei (or Ponape; pop., 2000: 34,486). Nearby is the coastal city of Kolonia (pop., 2000: 5,681), the island's other large town.

Palissy \pà-lē-'sē**, Bernard** (b. 1509, St. Avit, France—d. 1590, Paris) French potter and writer. Known for his decorated rustic ware, a type of EARTHENWARE covered with coloured lead glazes, he was appointed "inventor of rustic pottery to the king and the queen mother" in 1565. His public lectures on natural history, published in 1580, revealed him to be a writer and scientist and a pioneer of the scientific method. A Huguenot, he was imprisoned in 1588 in the Bastille, where he died.

Palladio \pä-'läd-yō**, Andrea** *orig.* **Andrea di Pietro della Gondola** (b. Nov. 30, 1508, Padua, Republic of Venice—d. August 1580, Vicenza) Italian architect. While a young mason, he was noticed by an Italian scholar and soon found himself studying mathematics, music, philosophy, and Classical authors. From 1541 he made several trips to Rome to study ancient ruins. His first palace design, the Palazzo Civena (1540–46), was innovative for its use of an arcaded area behind the main elevation, in imitation of a Roman forum. In his villas, Palladio tried to re-create the Roman villa based on ancient descriptions. His first, Villa Godi at Lonedo (c. 1540–42), contained elements for which he is famous, including symmetrical wings and a walled court. His most widely copied villa was the Villa Rotonda (1550–51), near Vicenza. Palladio was the first to systematize the plan of a house and to use the ancient Greco-Roman temple front as a portico. His reconstruction of the Basilica (town hall) in Vicenza (begun 1549) employs a two-story arcade with a motif that came to be known as Palladian: rounded arches flanked by rectangular openings. His facades for San Francesco della Vigna (c. 1565), San Giorgio Maggiore (begun 1566), and Il Redentore (begun 1576), all in Venice, became prototypes for attaching Classical temple fronts to basilican churches. Though Palladio absorbed contemporary Mannerist motifs, his plans and elevations always retained a repose and order not associated with Mannerist architecture. His *Four Books of Architecture* was possibly the most influential architectural pattern book ever printed. His influence climaxed during the 18th-century Classical Revival; the resulting Palladianism spread through Europe and the U.S.

palladium Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol Pd, atomic number 46. A precious, silver-white metal that resembles PLATINUM chemically, it is extremely ductile and easily worked and can be beaten into thin leaf. It is an excellent CATALYST for chemical reactions involving HYDROGEN and OXYGEN, such as the HYDROGENATION of unsaturated ORGANIC COMPOUNDS. Because it does not tarnish in air at ordinary temperatures, palladium and its alloys serve as substitutes for platinum in jewelry and in electrical contacts in telecommunications equipment. Small amounts of palladium alloyed with gold yield the best white gold. Palladium is used also in dental alloys. Because hydrogen passes rapidly through the metal at high temperatures, heated palladium tubes impervious to other gases function as semipermeable membranes and are used for hydrogen purification.

palm Any of about 2,800 species of flowering, subtropical trees, shrubs, and vines that make up the family Arecaceae (or Palmae). Many are economically important. Palms furnish food, shelter, clothing, timber, fuel, building materials, fibres, starch, oils, waxes, and wines for local populations in the tropics. Many species have very limited ranges; some grow only on single islands. The fast growth and many by-products of palms make exploitation of the rainforest appealing to agribusiness. The usually tall, unbranched, columnar trunk is crowned by a tuft of large, pleated, fan- or feather-shaped leaves, with often prickly petioles (leafstalks), the bases of which remain after leaves drop, often covering the trunk. Trunk height and diameter, leaf length, and seed size vary greatly. Small flowers are produced in large clusters. Among the most important palms are the sugar palm (*Arenga pinnata*, or *A. saccharifera*), COCONUT PALM, DATE PALM, and cabbage PALMETTO.

Royal palm (*Roystonea regia*).
E.R. DEGGINGER/EB INC.

palm PC Computer small enough to fit in a person's palm. Palm PCs (also called palmtops, handheld computers, or personal data assistants) typically use pens instead of keyboards for data input. They have limited memory and lack built-in peripheral devices (e.g., disk drives and modems), though such devices can be plugged in through peripheral slots. They run a limited set of application programs, such as calendars, address books, and memo pads.

Palm Springs Resort city (pop., 2000: 42,807), southern California, U.S. It is located in the COACHELLA VALLEY. Originally known as Agua Caliente for its hot springs, it was a stagecoach stop by 1872. In 1884 John G. McCallum established the Palm Valley Colony there. Incorporated as a city in 1938, it developed into a glamorous desert resort and residential area, frequented by celebrities, including Hollywood stars. Nearby is JOSHUA TREE NATIONAL PARK.

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Palm Sunday *or* **Passion Sunday** In Christianity, the first day of Holy Week and the Sunday before EASTER, commemorating JESUS' triumphal entry into Jerusalem. It usually includes a procession of members of the congregation carrying palms, representing the palm branches the crowd scattered in front of Jesus as he rode into the city. The liturgy also includes readings recounting the suffering and death of Jesus. Palm Sunday was celebrated in Jerusalem as early as the 4th century and in the West by the 8th century.

Palma (de Mallorca) City (pop., 2001: 333,801), capital of the BALEARIC ISLANDS and of MAJORCA island, Spain. Palma lies on the southwestern coast of Majorca on Palma Bay in the western Mediterranean Sea. Romans conquered Majorca in 123 BC, and it was later ruled by Byzantines and Arabs before being taken by JAMES I of Aragon in 1229. The city's old sections have many notable homes built in the 16th and 18th centuries. Historic buildings include the Gothic cathedral and Bellver Castle. The economy is varied and includes tourism and light manufacturing.

Palma, Arturo Alessandri See ARTURO ALESSANDRI PALMA

Palmas, Las See LAS PALMAS

Palme \'päl-mə**, (Sven) Olof (Joachim)** (b. Jan. 30, 1927, Stockholm, Swed.—d. Feb. 28, 1986, Stockholm) Swedish prime minister (1969–76, 1982–86). After studying in Sweden and the U.S., he was elected to the Swedish parliament (1958) and became a leader of the Swedish Social Democratic Workers' Party. He served in ministerial posts from 1963 and became prime minister in 1969. A strong pacifist, he attacked U.S. policy in the Vietnam War and later acted as a UN special envoy to mediate in the Iran-Iraq War. After his reelection in 1982, he tried to reinstate socialist economic policies in Sweden. He was shot to death by an assassin in 1986; his murder remains unsolved.

Palmer, A(lexander) Mitchell (b. May 4, 1872, Moosehead, Pa., U.S.—d. May 11, 1936, Washington, D.C.) U.S. politician. He served in the U.S. House of Representatives from 1909 to 1915 and helped secure the Democratic Party presidential nomination for WOODROW WILSON in 1912. Appointed U.S. attorney general (1919–21), Palmer used the espionage and sedition acts (1917, 1918) to attack political radicals, dissidents, and aliens in the "Red Scare" period following World War I. The government-led roundup of suspected communists became known as the "Palmer raids." In 1920 he ran unsuccessfully for the presidential nomination of the Democratic Party.

Palmer, Arnold (Daniel) (b. Sept. 10, 1929, Latrobe, Pa., U.S.) U.S. golfer. The son of a greenskeeper, Palmer turned professional in 1954 after winning the U.S. Amateur championship. He was the first player to win the MASTERS TOURNAMENT four times (1958, 1960, 1962, 1964); his other major titles include the U.S. Open (1960) and the British Open (1961–62). From 1954 through 1975 he won 61 tournaments. He won the PGA Senior Open in 1980 and 1981. He was the first golfer to earn $1,000,000 in tournament prize money. His exciting play and amiable personality won him wide popularity among fans, who became known as "Arnie's Army." Palmer was also the first athlete to parlay success on the playing field into lucrative off-the-field contracts, and thus he paved the way for athletes who followed to earn substantial sums from endorsement contracts.

Arnold Palmer, 1984
ARNOLD PALMER ENTERPRISES

Palmer, Samuel (b. Jan. 27, 1805, London, Eng.—d. May 24, 1881, Redhill, Surrey) British painter and etcher. He began exhibiting conventional landscapes at the Royal Academy by 14. After converting to a personal form of High Anglicanism and discovering medieval art, he developed a visionary style, displaying a mystical but precise depiction of nature and an overflowing religious intensity, united by a vivid re-creation of the pastoral conventions. In these works he was encouraged and influenced by WILLIAM BLAKE. As his religious fervour faded after 1830, the precarious balance between realism and vision was lost.

Palmerston (of Palmerston), Henry John Temple, 3rd Viscount *known as* **Lord Palmerston** (b. Oct. 20, 1784, Broadlands, Hampshire, Eng.—d. Oct. 18, 1865, Brocket Hall, Hertfordshire) English politician and prime minister (1855–58, 1859–65). He entered Parliament in 1807 as a TORY and served as secretary at war (1809–28). Associated with the WHIG Party from 1830, he served many years as foreign secretary (1830–34, 1835–41, 1846–51) and supported British interests and liberal causes abroad. He played a key role in establishing the independence of Belgium (1830–31) and Greece (1832) and secured Turkey's integrity against France (1840). Appointed prime minister in 1855, he brought an end to the Crimean War, approved the creation of the independent Kingdom of Italy, and supported a policy of neutrality in the American Civil War. Nicknamed "Pam," he was a symbol of British nationalism and one of Britain's most popular leaders.

palmetto \pal-'me-tō\ *or* **cabbage palmetto** Tree (*Sabal palmetto*) of the PALM family, occurring in the southeastern U.S. and the West Indies. Commonly grown for shade and as ornamentals along avenues, palmettos grow to about 80 ft (24 m) tall and have fan-shaped leaves. The water-resistant trunk is used as wharf piling. Mats and baskets are sometimes made from the leaves, and stiff brushes are made from the stems. The buds are edible. *S. texana*, a similar species, occurs in the southwestern U.S. and in Mexico.

palmistry Reading of an individual's character and DIVINATION of the future by interpreting lines on the palm of the hand. Palmistry may have originated in ancient India, and it was probably from their original Indian home that the traditional fortune-telling of the GYPSIES was derived. It was also practiced in China, Tibet, Persia, Mesopotamia, Egypt, and ancient Greece. In medieval Europe it was used to discover witches, who were thought to have pigmentation spots as signs of a pact with the devil. Though palmistry is still practiced, there is no known scientific basis for it.

Palmyra \pal-'mī-rə\ *biblical* **Tadmor** Ancient city, Syria, northeast of DAMASCUS, at the modern city of Tadmur. Said to have been built by King SOLOMON, it became prominent in the 3rd century BC, when the SELEUCID DYNASTY made the road through Palmyra one of the routes of east-west trade. Under Roman control by the reign of TIBERIUS, it briefly regained autonomy in the 3rd century AD under the Arab queen ZENOBIA. The main military station on the road that linked Damascus to the EUPHRATES RIVER, it was conquered by the Muslims in 634. Inscriptions in the ARAMAIC LANGUAGE supply information on the city's trade with India via the Persian Gulf and with Egypt, Rome, and Syria. Ancient ruins reveal the city's plan.

Temple of Bel, Palmyra, Syria.
H. ROGER-VIOLLET

Palomar Observatory Astronomical OBSERVATORY on Mount Palomar, near San Diego, California, U.S., site of the famous Hale TELESCOPE, a reflecting telescope with a 200-in. (5-m) aperture that has proved instrumental in cosmological research. Built in 1948 and named in honour of George Ellery Hale (1868–1938), it was the largest instrument of its kind for almost 30 years. Founded in 1948 by California Institute of Technology, the observatory was operated jointly with the MOUNT WILSON OBSERVATORY as the Hale Observatories until 1980.

Palomino \ˌpa-lə-'mē-nō\ Colour type of HORSE distinguished by its cream, yellow, or gold coat and a white or silver mane. It is popular in pleasure and parade classes. Palominos may conform to the breed types of several light breeds, including the ARABIAN HORSE and the American QUARTER HORSE.

palsy See CEREBRAL PALSY, PARALYSIS

Pamirs \pə-'mirz\ High mountain region, Central Asia. Located mostly in Tajikistan, it also borders parts of Afghanistan, Pakistan, China, and Kyrgyzstan. It includes many peaks that are higher than 20,000 ft (6,100

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m) in elevation, as well as many glaciers. Its highest point, Imeni Ismail Samani (Communism) Peak, rises in the northwestern part of the range to an elevation of 24,590 ft (7,495 m). The region is sparsely populated, and almost all the inhabitants are Tajiks. It is a central mountain knot from which extend several great ranges, including the Karakorams and Hindu Kush.

Pamlico \'pam-li-ˌkō\ **Sound** Shallow body of water, eastern shore of North Carolina, U.S. It is separated from the Atlantic Ocean by the Outer Banks. It extends 80 mi (130 km) south from Roanoke Island and is 8–30 mi (13–48 km) wide. Numerous waterfowl nest along the coastal waters; there is some commercial fishing, especially for oysters.

Pampas, the Vast, grass-covered plain in South America extending west from the Atlantic coast to the Andean foothills, primarily in Argentina. The Argentine Pampas covers 295,000 sq mi (764,000 sq km) and slopes gradually downward from northwest to southeast. The western portion is dry and largely barren; the humid eastern portion is the nation's economic heart. Herds of wild cattle and horses, introduced by the Spaniards and rounded up by Argentina's famed gauchos, roamed the Pampas until the later 19th century, when the land was fenced into huge *estancias* (ranches). The region is prominent in Argentina's gaucho literature and musical folklore.

pamphlet Unbound printed publication with a paper cover or no cover. Among the first printed materials, pamphlets were widely used in England, France, and Germany from the early 16th century, often for religious or political propaganda; they sometimes rose to the level of literature or philosophical discourse. In North America, pre-Revolutionary War agitation stimulated extensive pamphleteering; foremost among the writers of political pamphlets was Thomas Paine. By the 20th century, the pamphlet was more often used for information than for controversy.

Pamplona *Basque* **Iruña** *ancient* **Pompaelo** City (pop., 2001: 183,964), capital of Navarra, northern Spain. According to tradition, it was founded in 75 BC by Pompey the Great as a military settlement. It was left almost derelict after Moorish and Frankish invasions in the 5th century AD. It was captured from the Moors by Charlemagne in 778 and became the capital of the kingdom of Navarra under Sancho III. In 1512 the armies of King Ferdinand of Aragon-Castile entered Pamplona, and the portion of Navarra south of the Pyrenees was incorporated into Spain. The citadel built by King Philip II of Spain in 1571 made it the most strongly fortified town of the north. In 1841 it became the capital of the new Navarra province. The chief tourist attraction is the Fiesta de San Fermín (honouring its first bishop), which is celebrated with bullfights and the running of the bulls through the city streets. The fiesta is described in Ernest Hemingway's *The Sun Also Rises*.

Pan Greek fertility deity with a half-human, half-animal form. The Romans associated him with Faunus. Pan was usually said to be the son of Hermes. He was often represented as a vigorous and lustful figure with the horns, legs, and ears of a goat; in later art his human parts were more emphasized. Some Christian depictions of the Devil bear a striking resemblance to Pan. Pan haunted the high hills, where he was chiefly concerned with flocks and herds. Like a shepherd, Pan was a piper, and he rested at noon. He could inspire irrational terror in humans, and the word *panic* comes from his name.

pan See playa

Pan-African movement Movement dedicated to establishing independence for African nations and cultivating unity among black people throughout the world. It originated in conferences held in London (1900, 1919, 1921, 1923) and other cities. W.E.B. Du Bois was a principal early leader. The important sixth Pan-African conference (Manchester, 1945) included Jomo Kenyatta and Kwame Nkrumah. The first truly intergovernmental conference was held in Accra, Ghana, in 1958, where Patrice Lumumba was a key speaker. The Pan-Africanist Congress (PAC) was founded by Robert M. Sobukwe and others in South Africa in 1959 as a political alternative to the African National Congress, which was seen as contaminated by non-African influences. The founding of the Organization of African Unity (OAU; now the African Union) by Julius Nyerere and others in 1963 was a milestone, and the OAU soon became the most important Pan-Africanist organization.

Pan American (Sports) Games Quadrennial sports festival. The games, conceived in 1940 as an event for the nations of the Western Hemisphere, were first held in 1951. Patterned after the Olympic Games and sanctioned by the International Olympic Committee, the games are conducted by the Pan American Sports Organization (PASO), or Organización Deportiva Panamericana (ODEPA), headquartered in Mexico City. All major international sports and several more specialized events are included in the regular program. They are held the year preceding the Olympics, in various host cities.

Pan-American Highway International highway system connecting North and South America. Conceived in 1923 as a single route, the road grew to include a number of designated highways in participating countries, including the Inter-American Highway from Nuevo Laredo, Mex., to Panama City, Pan. The whole system, extending from Alaska and Canada to Chile, Argentina, and Brazil, totals nearly 30,000 mi (48,000 km). Only some 240 miles (400 km) in the Panama-Colombia border area remain uncompleted.

Pan-American Union Organization formed in 1890 to promote cooperation among the countries of Latin America and the U.S. It was established (as the International Union of American Republics) at the first Pan-American conference, which was called by U.S. secretary of state James Blaine in order to reach agreements on various common commercial and juridical problems among the countries of the Americas. In 1948 it was reconstituted as the Organization of American States.

Pan American World Airways, Inc. *known as* **Pan Am** Former U.S. airline. It was founded in 1927 by former World War I pilot Juan Trippe, who secured a contract to fly mail between Key West, Fla., and Havana. In 1929 Pan Am established passenger service to the Caribbean and Central America. It inaugurated the first transpacific flights (San Francisco to Manila) in 1936, the first transatlantic flights (New York City to Lisbon) in 1939, and the first round-the-world flights in 1947, and it pioneered commercial jet travel in the 1950s. Its business declined in the 1960s and '70s, and its acquisition of National Airlines in 1980 failed to improve its position. In 1988 a bomb planted aboard a Pan Am 747 caused the airliner to crash near Lockerbie, Scot., killing 270 people. Despite selling its Asian and South Pacific routes to United Airlines and its transatlantic, European, and Middle Eastern routes to Delta Air Lines, it was forced to declare bankruptcy in 1991. In the late 1990s another group bought the rights to the Pan Am name and began operating flights as Pan American Airways.

Pan-Arabism Nationalist notion of cultural and political unity among Arab countries. Its origins lie in the late 19th and early 20th centuries, when increased literacy led to a cultural and literary renaissance among Arabs of the Middle East. This contributed to political agitation and led to the independence of most Arab states from the Ottoman Empire (1918) and from the European powers (by the mid-20th century). An important event was the founding in 1943 of the Baʿth Party, which formed branches in several countries and became the ruling party in Syria and Iraq. Another was the founding of the Arab League in 1945. Pan-Arabism's most charismatic and effective proponent was Egypt's Gamal Abdel Nasser. After Nasser's death, Syria's Ḥāfiẓ al-Assad, Iraq's Ṣaddām Ḥussein, and Libya's Muammar al-Qaddafi tried to assume the mantle of Arab leadership.

Pan-Germanism Movement to politically unify all German-speaking people. The desire for German unification began in the early 19th century and was advanced by Ernst Arndt and other early nationalists. The Pan-German League was organized in 1894 by Ernst Hasse (1846–1908) to heighten German nationalist awareness, especially among German-speaking people outside Germany. The movement, which pressed for German expansion in Europe, gained support after World War I under the Weimar Republic and was actively promoted by Adolf Hitler and the Nazi Party. After Germany's defeat in 1945 and the expulsion of Germans from formerly German areas of eastern Europe, the movement declined.

Pan Gu *or* **P'an Ku** \'pän-'gü\ In Chinese Daoist legend, the first man. He came forth from Chaos (an egg) with two horns, two tusks, and a hairy body. He used his knowledge of yin-yang to separate heaven and earth, set the Sun, Moon, stars, and planets in place, and divide the four seas. He also shaped the earth by chiseling out valleys and stacking up mountains. Another legend says that the universe derived from Pan Gu's gigantic corpse. His eyes became the Sun and Moon, his blood formed rivers, his hair grew into trees and plants, and the human race sprang from parasites that infested his body. In art, he is often shown as a dwarf clothed with leaves.

Pan-p'o See Banpo

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Pan-Slavism Movement to unite Slav peoples of eastern and central Europe. It began in the early 19th century when Slav intellectuals studied their common cultures. Political goals for Slavic unity increased in 1848, when a Slav congress organized by FRANTIŠEK PALACKÝ met in Prague to press for equal rights under Austrian rule. In the 1860s the movement became popular in Russia, to which Pan-Slavs looked for protection from Turkish and Austro-Hungarian rule; this led Russia and Serbia into wars against the Ottoman Empire in 1876–77. In the 20th century, nationalist rivalries among the Slav peoples prevented their effective collaboration.

Pan-Turkism Political movement of the late 19th and early 20th centuries, which had as its goal the political union of all Turkic-speaking peoples in the OTTOMAN EMPIRE, Russia, China, Iran, and Afghanistan. The movement, which began among the Turks in the Crimea and on the Volga, initially sought to unite the Turks of the Ottoman and Russian empires against growing Russian domination. MUSTAFA KEMAL ATATÜRK, the father of the Republic of Turkey, later de-emphasized Pan-Turkism, encouraging Turkish nationalism only within Turkey. See also Ismail GASPRINSKI; ENVER PASHA; YOUNG TURKS.

Panaji \pä-'nä-jē\ *or* **New Goa** Town (pop., 2001 prelim.: 58,785), seaport, and capital of GOA, western India. It is on the Arabian Sea at the mouth of the Mandavi River. Panaji replaced Old Goa as the residence of the Portuguese viceroy in 1759 and as the capital of Portuguese India in 1843. It contains colonial houses and plazas and is a popular tourist attraction.

Panama *officially* **Republic of Panama** Country, CENTRAL AMERICA. It is bounded by the Caribbean Sea to the north and the Pacific Ocean to the south. Area: 28,973 sq mi (75,040 sq km). Population (2005 est.):

3,140,000. Capital: PANAMA CITY. Most of the people are of mixed heritage (primarily Indian-European and African-European). Languages: Spanish (official), English, indigenous Indian languages. Religion: Christianity (predominantly Roman Catholic; also other Christians). Currency: balboa. Panama consists of three distinct areas: the lowlands ("hot lands"; nearly nine-tenths of the country), the temperate lands, and the highlands ("cold lands"). It has a market economy based on services, mostly transportation, communications, and storage connected with the PANAMA CANAL as well as international banking and tourism. It is a republic with one legislative house; its head of state and government is the president, assisted by vice presidents. The land was inhabited by Indians when the Spanish arrived in 1501. The first successful Spanish settlement was founded by Vasco Núñez de BALBOA in 1511. Panama was part of the Viceroyalty of NEW GRANADA until it declared its independence from Spain in 1821 to join Colombia. In 1903 it revolted against Colombia and was recognized by the U.S., to whom it ceded the CANAL ZONE. The completed canal was opened in 1914; control of the canal passed to a joint U.S.-Panamanian commission in 1979. An invasion by U.S. troops in 1989 overthrew the de facto ruler, Gen. MANUEL NORIEGA. In 1999 the country elected its first female president, Mireya Moscoso, and later that year the canal came under the full control of Panama.

Panama Canal Lock-type canal, Panama. Extending across the Isthmus of Panama, it connects the Atlantic and Pacific oceans. It is about 50 mi (82 km) long from deepwater to deepwater, with an average depth of 43 ft (13 m). The width varies between 500 to 1,000 ft (150 to 300 m). In 1881 a French company began constructing the canal, but the enterprise collapsed in 1889. Under a 1903 treaty Panama granted the U.S. the Panama CANAL ZONE and the rights to build and operate a canal. Work began in 1904; facing enormous obstacles, GEORGE WASHINGTON GOETHALS directed the construction from 1907, and the canal opened on Aug. 15, 1914. The canal enabled ships traveling between the two oceans to avoid the lengthy circumnavigation of South America and was a boon to world commerce. After disputes over sovereignty, a 1977 treaty provided for Panama to take control of the canal by 2000; it did so in 1999. Except for small craft, no vessel can pass through the canal under its own power. Ships are towed by electric locomotives, and it generally takes 15–20 hours to complete the passage (including waiting time). Sets of double locks enable ships to pass in opposite directions simultaneously.

Panama Canal Zone See CANAL ZONE

Panama City City (pop., 2000: 415,964), capital of Panama. Near the Pacific Ocean entrance of the PANAMA CANAL, on the Bay of Panama, the site was originally an Indian fishing village. The old city was founded in 1519 but was completely destroyed by British buccaneer HENRY MORGAN in 1671. It was rebuilt in 1674 just west of the old site. In 1751 the area became part of the Viceroyalty of NEW GRANADA and later part of Colombia. It was the centre of the Panamanian revolt against Colombia in 1903, when it became the capital of Panama. After the canal opened in 1914, the city developed rapidly, becoming the commercial and transportation centre of the country. The economy depends largely on revenue from canal traffic and associated services.

Panathenaea \ˌpan-ˌa-thə-'nē-ə\ In GREEK RELIGION, an Athenian festival of great antiquity. Originally an annual event, it was eventually celebrated every fourth year, probably in deliberate rivalry to the OLYMPIC GAMES. It consisted of the sacrifices and rites proper to the season (mid-August) in the cult of ATHENA, the city's protectress. Representatives of all the dependencies of ATHENS came to the Panathenaea. The great procession, made up of the heroes of the Battle of MARATHON, is the subject of the frieze of the PARTHENON. The participants offered Athena an embroidered robe and sacrificed animals; there were also poetry recitations (later replaced by a musical contest) and athletic competitions.

Panay \pə-'nī\ Island (pop., 2000: 3,643,016), westernmost of the Visayan group, central Philippines. It is surrounded by the Sibuyan, Visayan, and Sulu seas, and the Guimaras Strait separates it from NEGROS island. Roughly triangular in shape, it has an area of 4,446 sq mi (11,515 sq km). A rugged, almost unpopulated mountain range parallels its western coastline. Between the range and a hilly eastern portion, a densely populated, intensely farmed fertile plain extends north to south. The island's chief city is ILOILO.

Panchatantra \ˌpən-chə-'tən-trə\ *Sanskrit* **"Five Treatises" or "Five Chapters"** Collection of Indian beast fables written in Sanskrit that has had extensive circulation throughout the world. The original work, now lost, may have been written down between 100 BC and AD 500. A textbook for instructing three sons of a king, it contained aphorisms that glorify shrewdness and cleverness over altruism. As early as the 11th century one version reached Europe, where it was known as *The Fables of Bidpai* (for the narrator, an Indian sage).

panchayat \pən-'chä-yət\ **raj** In India, government by the village council, or *panchayat*. When India gained its independence, it was stated that the government "should take steps to organize village *panchayat*s." The first *panchayat* was inaugurated in 1959 in Rajasthan, and in 1993 the *panchayat* institution was incorporated into the Indian Constitution. Their members are elected, and one-third of them are required to be women. Scheduled castes (formerly *UNTOUCHABLES*) and tribes are also guar-

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anteed representation in proportion to their population. Today the role and success of the *panchayat*s are still the topic of heated discussion. See also INDIAN NATIONAL CONGRESS.

Panchen Lama \'pän-chən-'lä-mə\ Any of the line of reincarnated LAMAS who head the Tashilhunpo Monastery in TIBET, traditionally second only to the DALAI LAMA in spiritual authority in the dominant sect of TIBETAN BUDDHISM. A Panchen Lama installed by the Chinese Nationalist government in 1949 later became an official under the Chinese communists. He remained in Tibet after the 14th Dalai Lama fled into exile in 1959 but was imprisoned in 1964 after criticizing the government. He was released in the late 1970s and died in 1989. The Dalai Lama and government subsequently chose different successors.

pancreas \'paŋ-krē-əs\ Compound GLAND functioning as both an exocrine (secreting through a duct) and an endocrine (ductless) gland. It continuously secretes pancreatic juice (containing water, bicarbonate, and enzymes needed to digest carbohydrates, fat, and protein) through the pancreatic duct to the DUODENUM. Scattered among the enzyme-producing cells are the ISLETS OF LANGERHANS, which secrete INSULIN and glucagon directly into the bloodstream. Disorders include inflammation (PANCREATITIS), INFECTIONS, TUMOURS, and CYSTS. If more than 80–90% of the pancreas must be removed, the patient will need to take insulin and pancreatic extracts. See also DIABETES MELLITUS; HYPOGLYCEMIA.

pancreatic cancer Malignant TUMOUR of the PANCREAS. Risk factors include smoking, a diet high in fat, exposure to certain industrial products, and diseases such as diabetes and chronic pancreatitis. Pancreatic cancer is more common in men. Symptoms often do not appear until pancreatic cancer is advanced; they include abdominal pain, unexplained weight loss, and difficulty digesting fatty foods. Surgery, radiation therapy, chemotherapy, or some combination of these may be used to treat the disease.

pancreatitis \ˌpaŋ-krē-ə-'tī-təs\ INFLAMMATION of the PANCREAS, associated with alcohol, trauma, or pancreatic-duct obstruction. Activated enzymes escaping into pancreatic tissues cause irritation and inflammation. If it does not subside, bleeding, tissue death and scarring, pus formation, and infection may occur. Symptoms include severe pain (worst when lying on the back), low fever, nausea, and HYPERTENSION. Acute cases are treated by controlling pain, preventing or relieving shock, inhibiting pancreatic-juice secretion (including eliminating oral intake of food), avoiding infection, and replacing lost fluids and salts. Chronic pancreatitis can destroy enough of the pancreas to cause pancreatic-juice deficiency and DIABETES MELLITUS. Treatment may include a low-fat diet, avoiding overeating and alcohol, pancreatic extracts, and INSULIN.

panda *or* **giant panda** Species (*Ailuropoda melanoleuca*, family Ursidae) of white-and-black forest-dwelling CARNIVORE, found in central China, that subsists almost exclusively on bamboo. Because they cannot digest cellulose, wild pandas (of which there are about 1,600) spend as much as 16 hours a day eating up to 40 lb (18 kg) of bamboo leaves, stems, and shoots to obtain needed nutrients. More than 120 individuals live in captivity, mostly in China. Large males may attain 6 ft (1.8 m) in length and weigh more than 220 lb (100 kg); females are usually smaller. Giant pandas live alone except when breeding. They have a slow reproductive cycle and are difficult to breed in captivity.

Giant panda (*Ailuropoda melanoleuca*)
TOM MCHUGH/PHOTO RESEARCHERS

panda, lesser *or* **cat bear** *or* **bear cat** Long-tailed nocturnal raccoonlike carnivore (*Ailurus fulgens*, family Procyonidae) that inhabits high mountain forests in the Himalayas and adjacent eastern Asia. It is 20–26 in. (50–65 cm) long, excluding the 12–20-in. (30–50-cm) bushy, faintly ringed tail. It weighs 6–10 lbs (3–4.5 kg) and has soft, thick, reddish brown fur. The face is white, with a red-brown stripe from the eyes to the mouth. It eats plants, especially bamboo, and fruits and insects. Though an agile climber, it mostly feeds while on the ground.

Pandora In GREEK MYTHOLOGY, the first woman. After PROMETHEUS stole fire from heaven and bestowed it on mortals, ZEUS decided to counteract this blessing and commissioned HEPHAESTUS to fashion a woman out of earth, upon whom the gods bestowed their choicest gifts. After marrying Prometheus's brother, Pandora opened a jar containing all kinds of misery and evil, which escaped and flew out over the earth. In one version, Hope alone remained inside, the lid having been shut before she could escape.

panegyric \ˌpa-nə-'jir-ik\ Eulogistic oration or laudatory discourse. The panegyric originally was a speech delivered at an ancient Greek general assembly (*panegyris*), such as the Olympic and Panathenaic festivals. Speakers frequently advocated Hellenic unity by expounding on the former glories of Greek cities; hence the elaborate and flowery connotations of the term. Later Roman speakers praised and flattered eminent persons, especially emperors, in panegyrics. The form was also used in the European Middle Ages, Renaissance, and Baroque era.

Pangea \pan-'jē-ə\ *or* **Pangaea** Hypothetical protocontinent proposed by ALFRED WEGENER in 1912 as part of his theory of CONTINENTAL DRIFT. Pangea (from Greek: *pangaia*, "all earth") supposedly covered about half the Earth and was completely surrounded by a world ocean called Panthalassa. Late in the TRIASSIC PERIOD (248–206 million years ago), Pangea began to break apart. Its segments, LAURASIA (composed of all the present-day northern continents) and GONDWANA (the present-day southern continents) gradually receded, resulting in the formation of the Atlantic Ocean.

Pangkor Engagement \'päŋ-ˌkȯr\ (1874) Treaty between the British government and Malay chiefs, named for the island where it was signed. In return for British backing in a complicated Perak succession dispute, Raja Abdullah accepted a British resident (adviser) with broad powers at his court, the first step in the establishment of British dominion over the Malay states.

pangolin \'paŋ-gə-lən\ *or* **scaly anteater** Any of about eight species of armoured placental MAMMALS (genus *Manis*, order Pholidota) of tropical Asia and Africa. Scales formed of cemented hairs cover the upper body, legs, and tail. Pangolins are 2–6 ft (60–180 cm) long and weigh 10–60 lb (5–27 kg). They have a conical head, no teeth, a long tongue, short legs, and a long prehensile tail. Some are arboreal; terrestrial species live in burrows. Nocturnal animals, pangolins locate prey, mainly termites, by smell and rip open nests with their front claws. When threatened, the pangolin (Malayan for "rolling over") curls up or emits an odoriferous secretion. See also ANTEATER; ECHIDNA.

panic In economics, a severe financial disturbance, such as widespread bank failures, feverish stock speculation followed by a market crash, or a climate of fear caused by economic crisis or anticipation of such a crisis. The term is applied only to the initial, violent stage of financial upheaval rather than the whole decline in the BUSINESS CYCLE (see DEPRESSION and RECESSION). Until the 19th century, economic fluctuations were largely connected with shortages of goods, market expansion, and speculation (as in the SOUTH SEA BUBBLE). Panics in the industrialized societies of the 19th–20th centuries have reflected the increasing complexity of advanced economies. The Panic of 1857 in the U.S. had its seeds in the railroads' defaulting on their BONDS and in the decline in the value of railroad SECURITIES; its effects were complex, including not only the closing of many banks but also severe unemployment in the U.S. and a money-market panic in Europe. The Panic of 1873, which began with financial crises in Vienna and New York, marked the start of a long-term contraction in the world economy. The most infamous panic began with the U.S. stock-market crash of 1929 (see GREAT DEPRESSION).

Emmeline Pankhurst in prison clothes, 1908
BBC HULTON PICTURE LIBRARY

Panjabi language See PUNJABI LANGUAGE

Pankhurst, Emmeline *orig.* **Emmeline Goulden** (b. July 14, 1858, Manchester, Eng.—d. June 14, 1928, London) British feminist. In 1879 she married Richard Pankhurst (1834–98), author of Britain's first

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women's-suffrage bill and the Married Women's Property Acts (1870, 1882). In 1889 she founded the Women's Franchise League, which in 1894 secured for married women the right to vote in local elections. In 1903, after holding municipal offices in Manchester, she founded the Women's Social and Political Union (WSPU). From 1912 she advocated extreme militancy, mainly in the form of arson, and was arrested 12 times in one year. Weeks before her death in 1928, Britain passed a bill to give voting rights to all women. Her daughter Christabel H. Pankhurst (1880–1958)—later Dame Christabel—organized the militant tactics of the WSPU and directed actions that included hunger strikes and huge outdoor rallies. She later became a religious evangelist and moved to the U.S.

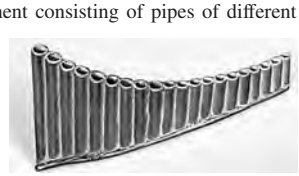
Pannini \pän-'nē-nē**, Giovanni Paolo** *or* **Giovanni Paolo Panini** (b. 1691, Piacenza, Duchy of Parma and Piacenza—d. 1765, Rome) Italian painter. After gaining fame for his fresco painting, he specialized in Roman topography and became the foremost artist in that field in the 18th century. His real and imaginary views of ancient Roman ruins embody precise observation and tender nostalgia and combine elements of late classical BAROQUE art with incipient ROMANTICISM. His work was popular both with tourists and his peers: he was admitted to the Académie Française in 1732 and became its professor of perspective.

Pannonia Province, Roman Empire, corresponding to modern western Hungary and parts of eastern Austria, Slovenia, and northern Serbia and Montenegro. The original inhabitants were mainly Illyrians, with some Celts in the western part. Conquered by Rome beginning in 35 BC, the people of Pannonia revolted in AD 6, posing the greatest threat to the empire since HANNIBAL's invasion. Pannonia was split in AD 106, and Pannonia Superior became a centre of the Roman wars under MARCUS AURELIUS. The Romans withdrew from the area after 395.

Panofsky \pə-'nōf-skē**, Erwin** (b. March 30, 1892, Hannover, Ger.—d. March 14, 1968, Princeton, N.J., U.S.) German-born U.S. art historian. A professor at the University of Hamburg (1926–33), he fled Nazi Germany for the U.S. and in 1935 began teaching at Princeton's Institute for Advanced Study. He gained prominence for his studies in iconography, the study of symbols and themes in works of art. His writings are distinguished by their variety of subjects, critical penetration, erudition, and rich allusions to literature, philosophy, and history. Among his major works are the groundbreaking *Studies in Iconology* (1939), *Albrecht Dürer* (1943), and *Early Netherlandish Painting* (1953).

panorama Narrative scene or landscape painted to conform to a curved or flat background, which surrounds or is unrolled before the viewer. Popular in the late 18th and 19th centuries, it was an antecedent of the stereopticon and motion pictures. The true panorama is exhibited on the walls of a large cylinder, and the viewer stands on a platform in the cylinder's centre and turns around to see all points of the horizon. The first panorama, a view of Edinburgh, was executed in 1788 by the Scottish painter Robert Barker (1739–1806). In the mid-19th century the rolled panorama became popular: a painting on canvas was wound between two poles and slowly unrolled behind a frame or revealed in sections.

panpipe *or* **syrinx** Wind instrument consisting of pipes of different lengths made of cane (less often wood, clay, or metal) arranged in a row. It is blown across the top, each pipe producing a different note. The panpipe dates from c. 2000 BC and is found worldwide, especially in eastern Africa, South America, and Melanesia.



Romanian panpipe; in the Horniman Museum, London
COURTESY OF THE HORNIMAN MUSEUM, LONDON

p'ansori *Korean* **"story singing"** A form of sung folk narrative. The form seems to have originated during the reign of Sukchong (1675–1720). Once a narrative performance that incorporated shamanistic chants, *p'ansori* became a vehicle for treating popular customs and everyday life. Six of the original 12 titles were revised by the master *p'ansori* writer Sin Chaehyo, of which five are still performed.

pansy Any of several popular cultivated VIOLETS (genus *Viola*). Pansies have been grown for so long under such diverse conditions with such striking variations in colour and form that their origin is uncertain. Probably the garden pansy (*V. wittrockiana*) is a cultivated form of *V. tricolor*, a weed of European grainfields. Annuals or short-lived perennials, pansies grow 6–12 in. (15–30 cm) tall and have heart-shaped leaves at the base and oblong leaves growing from the stems. Velvety flowers occur in combinations of blue, yellow, and white. The smaller, usually purple, wild pansy is also known as Johnny-jump-up, heartsease, and love-in-idleness.

Pansy (*Viola tricolor*)
KITTY KOHOUT/ROOT RESOURCES

pantheism Doctrine that the universe is God and, conversely, that there is no god apart from the substance, forces, and laws manifested in the universe. Pantheism characterizes many Buddhist and Hindu doctrines and can be seen in such Hindu works as the VEDAS and the BHAGAVADGITA. Numerous Greek philosophers contributed to the foundations of Western pantheism. In the Middle Ages and the Renaissance, the tradition was continued in NEOPLATONISM and Judeo-Christian MYSTICISM. In the 17th century BENEDICT DE SPINOZA formulated the most thoroughly pantheistic philosophical system, arguing that God and Nature are merely two names for one reality.

Pantheon Building in Rome begun 27 BC, probably as an ordinary rectangular Classical temple, and completely rebuilt by HADRIAN (c. AD 118–128). It is remarkable for its size and design; the exact method of construction has never been determined. A circular building of concrete faced with brick, it has a great concrete dome, 142 ft (43 m) in diameter, and a front porch of Corinthian columns with a triangular pediment. The vast space is lit solely by the 27-ft (8-m) oculus at the dome's centre. The interior is lined with coloured marble, and the walls are marked by seven deep recesses screened by pairs of columns.

Pantheon, Rome, begun by Agrippa in 27 BC, completely rebuilt by Hadrian c. AD 118–c. 128.
FREDERICO ARBORIO MELLA

panther See COUGAR, LEOPARD

pantomime See MIME AND PANTOMIME

pantothenic \ˌpan-tə-'the-nik, ˌpan-tə-'thē-nik\ **acid** Organic compound, essential in animal METABOLISM. The nature of the bound form was clarified through the discovery and synthesis (1947–50) of the compound pantetheine, which contains pantothenic acid combined with the compound thioethanolamine. Pantetheine is part of two larger compounds (COENZYME A and acyl-carrier protein) that promote a large number of metabolic reactions essential for the growth and well-being of animals. A dietary deficiency severe enough to lead to clear-cut disease has not been described in humans; however, when a person is severely malnourished, deficiency of the vitamin appears to contribute to the observed weakness and mental depression.

Pánuco River \'pä-nü-ˌkō\ River, central Mexico. Rising in HIDALGO state and flowing northeast into the Gulf of Mexico below TAMPICO, it is about 100 mi (160 km) long and has considerable economic importance. It has served to drain TEXCOCO and other interior lakes via a system of tunnels and channels. Its waters are used to irrigate the fertile La Huasteca lowlands, and its lower course is navigable.

panzer \'pan-zər, 'pänt-sər\ **division** (German *panzer*, "armoured") Self-contained MILITARY UNIT of the German army, built around the capabilities of ARMOURED VEHICLES. In World War II, it consisted of a tank brigade with four battalions; a motorized infantry brigade with four rifle battalions; an artillery regiment; and reconnaissance, antitank, and military-engineering battalions and service units. Germany had six panzer divisions in 1939 and 20 by 1941. It remains the principal offensive element of the German army.

pao-chia See BAOJIA

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Paoli \'paù-lē**, Pasquale** (b. April 26, 1725, Stretta di Morosaglia, Corsica—d. Feb. 5, 1807, London, Eng.) Corsican patriot. Son of Giacinto Paoli, who led the Corsicans against Genoa in 1735, he lived with his father in exile in Naples (1739–55). On his return, he overcame the Genoese faction and was elected to rule Corsica. He suppressed the vendetta system, substituted order and justice, and instituted national schools. He continued the fight for independence, but after France invaded Corsica in 1769 he fled to England, where he lived until 1790. Recalled to Corsica as military commandant, he expelled the French with British naval support (1794) and offered the island's sovereignty to England. He retired to England in 1795.

Paolo, Giovanni di See Giovanni di Paolo

Pap smear *or* **Papanicolaou** \ˌpäp-ə-'nē-kə-ˌlaù\ **smear** Sample of cells from the vagina and cervix of the uterus for laboratory staining and examination to detect genital herpes and early-stage cancer, especially of the cervix. Developed by the Greek-born U.S. physician George Nicolas Papanicolaou (1883–1962), this technique also can be applied to cells obtained from other surfaces.

papacy \'pā-pə-sē\ System of central government of the Roman Catholic church. Bishops led the early church, the bishop of Rome being accorded special respect by the end of the 1st century AD in part because of the belief that St. Peter was the first bishop of that city. St. Cyprian challenged that position of honour in the 3rd century, and in the 4th–5th century the power of the see of Constantinople rose to challenge that of Rome; the rivalry would culminate in the Schism of 1054 between the Eastern and Western churches. After the collapse of the Roman Empire, the papacy found protection under the wing of Charlemagne and his successors; in the 9th–10th century the German emperors controlled it. In 1059 Pope Nicholas II responded by vesting the right to name a new pope exclusively with the College of Cardinals. To establish the papacy's supremacy in Christian society, Gregory VII excommunicated Henry IV of Germany for disobedience to papal commands and decreed that civil rulers could not invest churchmen with temporal power (see Investiture Controversy). In the next centuries, the papacy developed into one of the most important and influential institutions in Europe, and Urban II, Innocent III, and Gregory IX were among the most significant popes of the period. The worldliness and corruption of the papal court that emerged at the same time and the "Babylonian Captivity" of the papacy at Avignon (see Avignon papacy) led to the Western Schism and eventually to the Reformation. The Council of Trent inaugurated the Counter-Reformation. In the 19th century the papacy lost its remaining temporal powers when the Papal States were incorporated into the new Kingdom of Italy. It maintained a conservative religious position, proclaiming infallibility in doctrinal matters and espousing the idea that the pope is the absolute ruler of the church. The Second Vatican Council gave the bishops, clergy, and laity more voice. See also Roman Catholicism.

Papago \'pä-pə-ˌgō\ *or* **Tohono O'odham** North American Indian people linving mostly in a region straddling the U.S.-Mexico border. Their language belongs to the Uto-Aztecan language stock. They rejected the name Papago, from a Piman word *papahvi-o-otam* meaning "bean eaters," in the 1980s; they call themselves Tohono O'odham, meaning "Desert People." Closely related to the Pima, they probably descend from ancient Hohokam peoples. On their traditional territory, vast stretches of desert regions of Arizona, U.S., and northern Sonora, Mex., the Papago practiced food gathering and flash-flood farming. Because of the wide dispersal of their fields, their largest viable political unit was a group of temporarily related villages. They had less contact with whites than other Indian groups and have retained elements of their traditional culture. They number some 15,000.

Papal Curia See Roman Curia

papal infallibility In Roman Catholicism, the doctrine that the pope, acting as supreme teacher and under certain conditions, as when he speaks *ex cathedra* ("from the chair"), cannot err when he teaches in matters of faith or morals. It is based on the belief that the church, entrusted with the teaching mission of Jesus, will be guided by the Holy Spirit in remaining faithful to that teaching. The First Vatican Council (1869–70) stated the conditions under which a pope may be said to have spoken infallibly: he must intend to demand irrevocable assent from the entire church in some aspect of faith or morals. The doctrine remains a major obstacle to ecumenical endeavours and is the subject of controversy even among Roman Catholic theologians.

Papal Inquisition See Inquisition

Papal States *Italian* **Stati Pontifici** \'stä-tē-pōn-'tē-fē-chē\ Territories of central Italy over which the pope had sovereignty from 756 to 1870. The extent of the territory and the degree of papal control varied over the centuries. As early as the 4th century, the popes had acquired considerable property around Rome (called the Patrimony of St. Peter). From the 5th century, with the breakdown of Roman imperial authority in the West, the popes' influence in central Italy increased as the people of the area relied on them for protection against the barbarian invasions. When the Lombards threatened to take over the whole peninsula in the 750s, Pope Stephen II (or III) appealed for aid to the Frankish ruler Pippin III (the Short). On intervening, Pippin "restored" the lands of central Italy to the Roman see, ignoring the claim of the Byzantine (Eastern Roman) Empire to sovereignty there. This Donation of Pippin (754) provided the basis for the papal claim to temporal power. More land was gained when the papacy acquired the duchy of Benevento in 1077, and Popes Innocent III and Julius II further expanded the papal domain. The rise of communes and rule by local families weakened papal authority in the towns, and by the 16th century the papal territory was one of a number of petty Italian states. They were an obstacle to Italian unity until 1870, when Rome was taken by Italian forces and became the capital of Italy. In 1929 the Lateran Treaty settled the pope's relation to the Italian state and set up an independent city-state (see Vatican City).

Papandreou \ˌpä-pän-'drā-ü**, Andreas (Georgios)** (b. Feb. 5, 1919, Chios, Greece—d. June 23, 1996, Ekáli, near Athens) Greek educator and prime minister (1981–89, 1993–96). Son of Georgios Papandreou, he taught at the University of California, Berkeley (1955–63), then returned to Greece when his father became premier (1963) and was elected to the Greek parliament. After the military coup in 1967 he went into exile. He returned in 1974 to form the left-wing Panhellenic Socialist Movement (Pasok). The party gained a majority in 1981, and Papandreou became premier. He promoted generous social-welfare programs, but his government was weakened by financial scandals and mounting budget deficits, and he resigned in 1989 but remained the leader of Pasok. He again became prime minister in 1993, but ill health forced him to retire in 1996.

Papandreou, Georgios (b. Feb. 13, 1888, Kaléntzi, Greece—d. Nov. 1, 1968, Athens) Greek prime minister (1944, 1963, 1964–65). He began his political career as a liberal in 1915 and served as minister of education (1929–33). In 1935 he founded the Democratic Socialist Party, then went into exile. He briefly headed a coalition government in 1944, then held ministerial posts (1946–52). He merged his party with the Liberal Party and formed the Centre Union in 1961. As prime minister in 1964 he introduced far-reaching social reforms, but he was dismissed by the king in 1965. After the military coup in 1967, he was jailed briefly with his son, Andreas Papandreou.

papaw *or* **pawpaw** \'pä-ˌpȯ\ Deciduous tree or shrub (*Asimina triloba*) of the custard apple family, native to the eastern and midwestern U.S. It can grow to 40 ft (12 m) tall and has pointed, broadly oblong, drooping leaves up to 12 in. (30 cm) long. The purple flowers bloom with a foul odour before the leaves emerge in spring. The edible fruit looks like a stubby banana; its skin turns black as it ripens. Handling papaw fruits produces a skin reaction in allergic individuals. The name is also sometimes applied to the papaya.

papaya \pə-'pī-ə\ Large palmlike plant (*Carica papaya*; family Caricaceae), cultivated throughout the tropics and warm subtropics, and its succulent juicy fruit. A popular breakfast fruit in many countries, it is also used in salads, pies, sherbets, juices, and confections. The juice of the unripe fruit contain an enzyme that is useful in various remedies for indigestion and in meat tenderizers.

Papeete \ˌpä-pā-'ā-tā\ Seaport (pop., 1996: 25,353), capital of French Polynesia. It is located on the northwestern coast of Tahiti. A tropical city with tall palms and exotic flowers, it is one of the largest urban and commercial centres in the South Pacific. By 1829 its excellent harbour made it a place of trade and a port of call for whalers. In 1880 it was annexed by the French, and it became a commune in 1890. It is a major tourist base and a centre for Pacific Rim trade.

Papen \'pä-pən**, Franz von** (b. Oct. 29, 1879, Werl, Ger.—d. May 2, 1969, Obersasbach, W.Ger.) German politician. He served as military attaché in Washington, D.C. (1913–15), but was recalled on espionage

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charges. A monarchist member of the German Reichstag (1921–32), he was chosen chancellor in 1932, but he was soon ousted by Kurt von Schleicher. In revenge, Papen persuaded Paul von Hindenburg to appoint Adolf Hitler as chancellor and himself as vice chancellor. Papen resigned in 1934 when he was unable to restrain the Nazis' push for power. As ambassador to Austria (1934–38), he worked for Austria's annexation to Germany. He was ambassador to Turkey (1939–44). Arrested in 1945, he was tried and acquitted at the Nürnberg trials; sentenced to prison by a German court as a Nazi, he was released on appeal in 1949.

Papen
CAMERA PRESS

paper Matted or felted sheet, usually made of cellulose fibres, formed on a wire screen from water suspension. Source materials include wood pulp, rags, and recycled paper. The fibres are separated (by processes that may be mechanical, chemical, or both) and wetted to produce paper pulp, or stock. The pulp is filtered on a woven screen to form a sheet of fibre, which is pressed and compacted to squeeze out most of the water. The remaining water is removed by evaporation, and the dry sheet is further compressed and often (depending on the intended use) coated or infused with other substances. Types of paper in common use include bond paper, book paper, bristol (or bristol board), groundwood and newsprint, kraft paper, paperboard, and sanitary paper (for towels, napkins, etc.). See also calendering; Fourdrinier machine; kraft process.

paper birch Ornamental, shade, and timber tree (*Betula papyrifera*) of the birch family, native to northern and central North America. Also called canoe birch, silver birch, or white birch, it is one of the best-known birches. The smooth, varicolored or white bark of young trees peels horizontally in thin sheets, which once were used as writing surfaces as well as for roofing, canoes, and shoes. The water-impervious bark, which burns even when wet, is a boon to campers and hikers.

paper chromatography (PC) Type of chromatography using filter paper or other special paper as the stationary phase. Spots of sample and reference materials are applied, usually as liquids, near one edge (or corner, for two-dimensional PC) of the paper. The edge of the paper is dipped in a solvent, which travels along it by capillarity, moving the components of the sample at rates depending on their relative solubilities in the solvent. In two-dimensional PC, the paper is then turned 90° and the new edge dipped in a different solvent. The components of the sample mixture, visible as separated spots, are identified by comparing the distances they have traveled with those of the known reference materials. PC is especially useful for complex mixtures of amino acids, peptides, carbohydrates, steroids, and many other organic compounds and inorganic ions.

paper folding *Japanese* **origami** Art of folding objects out of paper without cutting, pasting, or decorating. Its early history is unknown, but it seems to have developed from the older art of folding cloth. Origami has reached its greatest development in Japan, with hundreds of traditional folds and an extensive literature dealing with the art. There are two types of Japanese folds: figures used in ceremonial etiquette, and objects such as animals, flowers, furniture, and human figures. Some objects have amusing action features; best known is the bird that flaps its wings when its tail is pulled. Paper folding has also flourished in Spain, South America, and Germany.

Paphlagonia Ancient district, northern Anatolia, on the Black Sea. A mountainous country, one of the oldest in Anatolia, it submitted to Alexander the Great in 333 BC. In the 3rd–2nd century BC it was gradually absorbed by the Pontic kingdom on its eastern border. In 65 BC the coastal districts, including the capital, Sinope, were attached to Roman Bithynia. The area was incorporated into the Roman province of Galatia in c. 6 BC; the interior regions were left under native rulers. It was part of the Byzantine Empire, and all but its coastal regions were lost to invading Turkish peoples after the Battle of Manzikert (1071).

papillomavirus \ˌpa-pə-ˈlō-mə-ˌvī-rəs\ Any of a group of viruses that cause warts and other harmless tumours in humans. More than 100 distinct types are known. Different types are responsible for warts of the hands, plantar warts (of the feet), and throat warts. Genital warts are caused by other types, which are spread by sexual intercourse. Some types of papillomaviruses that cause genital infections have been linked with various cancerous tumours, especially cervical cancers; their presence can be detected through a Pap smear.

papillon \ˌpä-pē-ˈyōⁿ\ Breed of toy dog known from the 16th century, when it was called a dwarf spaniel. A favorite of Marie-Antoinette, it appeared in paintings by Old Masters. It acquired its name (French for "butterfly") in the late 19th century, when a variety with large, flaring ears became fashionable. Another variety has drooping ears. A slender, graceful dog with a plumed tail, it stands 11 in. (28 cm) or less and weighs up to 11 lbs (5 kg). The soft, full coat is usually white, with darker patches.

Papineau \pä-pē-ˈnō**, Louis Joseph** (b. Oct. 7, 1786, Montreal, Que.—d. Sept. 23, 1871, Montebello, Que., Can.) Canadian politician. He was elected to the legislative assembly of Lower Canada (now Quebec) in 1808 and became its speaker in 1815. A leader of the French-Canadian Party, he opposed the British-dominated government of Lower Canada. In 1834 he helped draft the 92 Resolutions, a statement of French-Canadian demands and grievances. When the British governor rejected the resolutions, hostilities broke out. Papineau escaped to the U.S. and then to France, where he lived from 1839 to 1844. He returned to Canada under an amnesty in 1844 and served in the Canadian House of Commons from 1848 to 1854, though he never regained his leadership of the French-Canadians.

Papp, Joseph *orig.* **Joseph Papirofsky** (b. June 22, 1921, Brooklyn, N.Y., U.S.—d. Oct. 31, 1991, New York, N.Y.) U.S. theatrical producer and director. He studied acting and directing and worked as a stage manager for CBS television. In 1954 he founded the New York Shakespeare Festival, which gave free performances of Shakespeare's plays in city parks. He produced and directed most of the plays; in 1962 the Delacorte Theatre in Central Park was built as the company's permanent home. In 1967 he founded the New York Shakespeare Festival Public Theatre, which concentrated on contemporary and experimental dramas. Several productions traveled to Broadway, including *Hair* (1967) and *A Chorus Line* (1975). Papp remained one of Off-Broadway's most active producers into the 1980s. He served as artistic director of the Shakespeare Festival and the Public Theatre until his death.

Papua *formerly* **Irian Jaya** Province (pop., 2000 prelim.: 2,220,934), Indonesia. It includes the western half of the island of New Guinea and its offshore islands and the Schouten and Raja Ampat island groups. The Maoke Mountains rise to 16,503 ft (5,030 m) at Puncak Jaya. First sighted by the Portuguese in 1511, Papua was claimed by the Dutch in 1828. It was transferred to Indonesia in 1963 and was made a province in 1969, with its capital at Jayapura. Rebels led a separatist movement there in the late 1990s, and Papua achieved greater autonomy in 2001.

Papua New Guinea \ˈpa-pyü-wə...ˈgi-nē\ *officially* **Independent State of Papua New Guinea** Island country, southwestern Pacific Ocean. Area: 178,704 sq mi (462,840 sq km). Population (2005 est.): 5,887,000. Capital: Port Moresby. Most of the people are Papuan (four-fifths) and Melanesian; ethnic minorities are Polynesian, Chinese, and European. Languages: English (official), Tok Pisin, Motu, indigenous languages. Religions: Christianity (Protestant, Roman Catholic); also traditional beliefs. Currency: kina. The island of New Guinea constitutes about seven-eighths of the total land area of Papua New Guinea; the country also includes Bougainville Island and the Bismarck Archipelago. The New Guinea terrain ranges from swampy lowland plains in the south and north to high central mountains (the highlands) in the northwest and southeast. Much of the land is covered with tropical rainforest. Some of the outlying islands are volcanic. The country has a developing mixed economy based largely on subsistence agriculture and the export of minerals. It is a constitutional monarchy with one legislative house; its chief of state is the British monarch represented by the governor-general, and the head of government is the prime minister. The area has been inhabited since prehistoric times, and farming has been practiced since c. 7000 BC. The Portuguese sighted the coast in 1511, and the first European landing was about 1526–27. The first European colony was founded in 1793 by the British. In 1828 the Dutch claimed the western half as part of the Dutch East Indies. In 1884 Britain annexed the southeastern part and Germany

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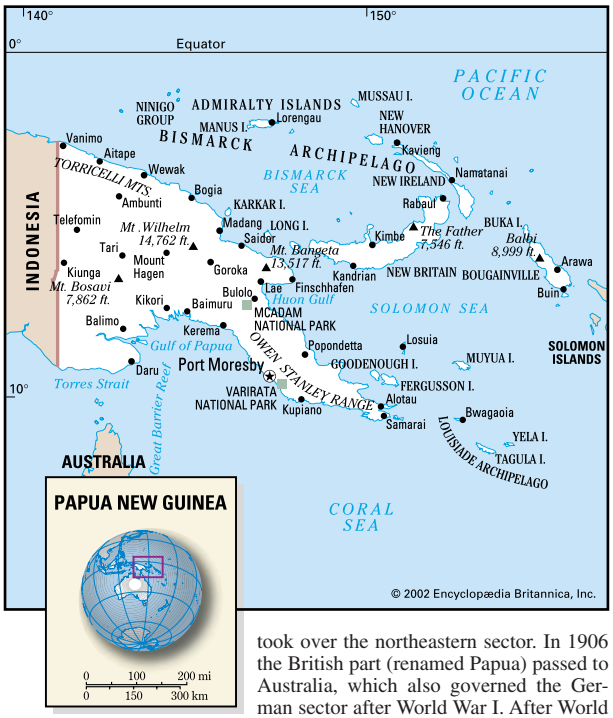

took over the northeastern sector. In 1906 the British part (renamed Papua) passed to Australia, which also governed the German sector after World War I. After World War II, Australia governed both sectors as the Territory of Papua and New Guinea. Dutch New Guinea was annexed to Indonesia in 1969. Papua New Guinea achieved independence in 1975 and joined the British COMMONWEALTH. By the mid-1990s the government of Papua New Guinea was seeking to resolve a long-standing conflict with Bougainville independence fighters, and in 2001 the two sides agreed on a peace treaty; Bougainville became an autonomous region in 2005.

Papuan \'pa-pyə-wən\ **languages** Group of about 750 languages spoken by indigenous peoples of New Guinea and parts of some neighbouring islands, including Alor, Bougainville, Halmahera, New Britain, New Ireland, and Timor. Spoken by perhaps five million people, Papuan languages belong to about 60 families, the higher genetic relationships of which are still uncertain. This diversity, conjoined with the numerous AUSTRONESIAN LANGUAGES spoken on smaller parts of New Guinea and on adjacent islands, makes the region the most linguistically heterogeneous area of the world. The vast majority of Papuan languages have fewer than 100,000 speakers; among those with more are Chimbu and Enga, spoken in the highlands of Papua New Guinea.

papyrus \pə-'pī-rəs\ Writing material of ancient times and the plant from which it comes, *Cyperus papyrus* (SEDGE FAMILY), also called paper plant. This grasslike aquatic plant has woody, bluntly triangular stems and grows to about 15 ft (4.6 m) high in quietly flowing water up to 3 ft (90 cm) deep. The ancient Egyptians used the stem of the plant to make sails, cloth, mats, cords, and principally paper. Paper made from papyrus was the chief writing material in ancient Egypt, Greece, and Rome. In the 8th–9th century AD, other plant fibres replaced papyrus in the manufacture of paper. The plant is now often used as a pool ornamental in warm areas or in conservatories.

Pará \pä-'rä\ **River** Channel of the AMAZON RIVER. It passes to the south and east of MARAJÓ ISLAND, in northeastern Pará state, northern Brazil, and is about 200 mi (320 km) long and 40 mi (64 km) wide at its mouth. It carries a small part of the discharge of the Amazon east and north to the Atlantic Ocean, and its entire length is navigable.

parabola \pə-'ra-bə-lə\ Open curve, one of the CONIC SECTIONS. It results when a right circular cone intersects a plane that is parallel to an edge of the cone. It is also the path of a point moving so that its distance from a fixed line (directrix) is always equal to its distance from a fixed point (focus). In ANALYTIC GEOMETRY its equation is $y = ax^2 + bx + c$ (a second-degree, or quadratic, POLYNOMIAL FUNCTION). Such a curve has the useful property that any line parallel to its axis of SYMMETRY reflects through its focus, and vice versa. Rotating a parabola about its axis produces a surface (paraboloid) with the same reflection property, making it an ideal shape for satellite dishes and reflectors in headlights. Parabolas occur naturally as the paths of projectiles. The shape is also seen in the design of bridges and arches.

Paracel \ˌpar-ə-'sel\ **Islands** *Chinese* **Xisha Qundao** *or* **Hsi-sha Ch'ün-tao** \'shē-ˌshä-'chün-'daù\ *Vietnamese* **Quan Dao Hoang Sa** \'kwän-'daù-'hwäŋ-'sä\ Group of about 130 small coral islands and reefs, South CHINA SEA, east of central Vietnam and southeast of HAINAN Island, China. The low, barren islands, none of which exceeds 1 sq mi (2.5 sq km) in area, lack fresh water, and there are no permanent human residents. In 1932 the islands were claimed by FRENCH INDOCHINA, and Japan occupied some of them during World War II. China, Taiwan, and Vietnam all claim them. In 1974 China assumed control, and they have remained a matter of contention.

Paracelsus \ˌpar-ə-'sel-səs\ *orig.* **Philippus Aureolus Theophrastus Bombastus von Hohenheim** (b. Nov. 11 or Dec. 17, 1493, Einsiedeln, Switz.—d. Sept. 24, 1541, Salzburg, Archbishopric of Salzburg) German-born Swiss physician and alchemist. He claimed to have received his doctoral degree at the University of Ferrara. He adopted the name "para-Celsus"—meaning "beyond CELSUS" (the Roman authority on medicine)—and wandered throughout Europe and the Middle East, studying with alchemists. He valued the common sense of common people more than the dry teachings of ARISTOTLE, GALEN, and AVICENNA and stressed nature's healing power. All were welcome at his lectures (which he gave in German, not Latin) at the University of Basel, but such broadmindedness scandalized the authorities, and eventually he was forced to flee the city. His written works include *Great Surgery Book* (1536). He anticipated by centuries the treatment of syphilis by mercury compounds, the realization that inhaled dust causes miners' SILICOSIS, and HOMEOPATHY, and he was the first to connect GOITRE with minerals in drinking water.

parachute Umbrella-like device for slowing the descent of a body falling through the atmosphere. Separate panels sewn together form a canopy attached by suspension lines to a harness worn by the user. Originally designed to provide a safe escape from a disabled aircraft, parachutes are also used for dropping supplies and for slowing returning space capsules. The parachute was conceived by the 14th century, but practical demonstrations began only in the 1780s in France, leading in 1797 to a 3,200-ft (1,000-m) exhibition jump from a balloon by André-Jacques Garnerin (1769–1823); in 1802 he made a jump of 8,000 ft (2,400 m). Early parachute material was canvas, which was later replaced by silk and then nylon. See also SKYDIVING.

Paraclete See HOLY SPIRIT

paradox Apparently self-contradictory statement whose underlying meaning is revealed only by careful scrutiny. Its purpose is to arrest attention and provoke fresh thought, as in the statement "Less is more." In poetry, paradox functions as a device encompassing the tensions of error and truth simultaneously, not necessarily by startling juxtapositions but by subtle and continuous qualifications of the ordinary meanings of words. When a paradox is compressed into two words, as in "living death," it is called an oxymoron.

paradoxes of Zeno \'zē-ˌnō\ Arguments by which ZENO OF ELEA upheld the doctrine of PARMENIDES that real Being is unique and unchanging. Zeno's arguments were aimed at discrediting the beliefs in plurality and motion that were inconsistent with Parmenides' doctrine. His best-known arguments are those against the reality of motion. One argument begins from the fact that a body in motion can reach a given point only after having traversed half the distance. But before traversing half, it must traverse half of this half, and so on ad infinitum; consequently, the goal can never be reached.

paraffin Paraffin WAX, a mixture of organic compounds traditionally derived from PETROLEUM but also obtained synthetically. It usually consists of alkane hydrocarbons (also called paraffins) and is used for coating and sealing, for candles, and in floor waxes, lubricants, waterproofing agents, and cosmetics. See also ALKANE.

Paragua See PALAWAN

Paraguaná Peninsula \ˌpä-rä-gwä-'nä\ Peninsula, northwestern Venezuela. Situated between the CARIBBEAN SEA and the Gulf of Venezu-

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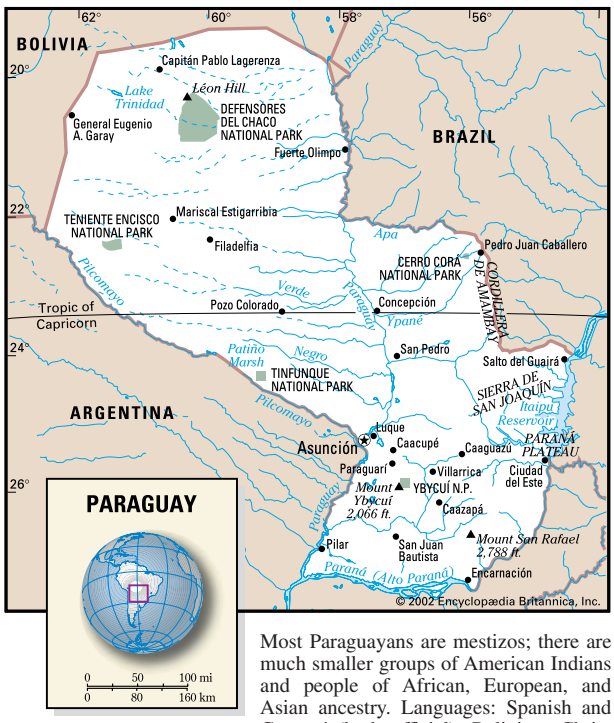
ela, it has a low elevation, infertile soil, and a sparse population. It became important in the 1950s and '60s with the development of the petroleum industry. Pipelines lead from the oil fields to the large refineries on the western side of the peninsula, which is accessible to deep-draft tankers.

Paraguay \ˌpä-rä-'gwī,\ *English* \'par-ə-ˌgwā\ *officially* **Republic of Paraguay** Country, south-central South America. Area: 157,048 sq mi (406,752 sq km). Population (2005 est.): 5,905,000. Capital: Asunción.



Most Paraguayans are mestizos; there are much smaller groups of American Indians and people of African, European, and Asian ancestry. Languages: Spanish and Guaraní (both official). Religion: Christianity (predominantly Roman Catholic; also Protestant). Currency: guaraní. Paraguay is a landlocked country of plains and swampland. The Paraguay River, flowing from north to south, divides the country into two geographic regions: the eastern region, which is an extension of the Brazilian Plateau; and the western region, which forms the northern part of the Gran Chaco plains. Paraguay has a developing market economy that is based largely on agriculture, trade, and light industries. It is a republic with two legislative houses; its head of state and government is the president. Seminomadic tribes speaking Guaraní were in the area long before it was settled by Spain in the 16th–17th century. Paraguay was part of the Viceroyalty of the Río de la Plata until it became independent in 1811. It suffered from dictatorial governments in the 19th century and was devastated by the War of the Triple Alliance (1864, 1865–70), which it fought against Brazil, Argentina, and Uruguay. The Chaco War (1932–35), with Bolivia over territorial rights in the Gran Chaco, was settled primarily in Paraguay's favour by the peace treaty of 1938. Military governments, including that of Alfredo Stroessner, predominated from the mid-20th century until a civilian president, Juan Carlos Wasmosy, was elected in 1993. The country suffered from a financial crisis beginning in the late 1990s.

Paraguay River River, South America. The fifth largest river in South America, it is 1,584 mi (2,550 km) long and the principal tributary of the Paraná River. Rising in the Mato Grosso region of Brazil about 980 ft (300 m) above sea level, it crosses Paraguay to its confluence with the Paraná near the Argentine border. The Gran Chaco plain extends west from the river.

Paraguayan War See War of the Triple Alliance

Paraíba do Sul \ˌpä-rä-'ē-bə-dü-'sül\ **River** River, eastern Brazil. It is formed by the confluence of the Paraitinga and Paraibuna rivers east of São Paulo; it flows east-northeastward and forms part of the border between Minas Gerais and Rio de Janeiro states before emptying into the Atlantic Ocean after a course of about 700 mi (1,100 km). Its lower course is navigable, and it plays a vital role in Brazil's social and economic life.

parakeet Any of 115 species in 30 genera (subfamily Psittacinae) of small, slender seed-eating parrots with a long, tapering tail. Parakeets are found worldwide in warm regions. They typically form large flocks. Most species lay four to eight eggs in a tree hole. The most popular caged parakeet is the budgerigar (*Melopsittacus undulatus*), mistakenly called lovebird; about 8 in. (19 cm) long, it may be any colour but usually has cheek spots and close barring on the upper parts.

Budgerigar (*Melopsittacus undulatus*), a popular parakeet.
BRUCE COLEMAN LTD.

parallax \'par-ə-laks\ Difference in the direction of a celestial object as seen by observers from two widely separated points, a measurement used to find a body's distance. The two positions of the observers and that of the object form a triangle; its apex angle (at the object) is twice the parallax, which becomes smaller with increasing distance. Observations for calculating the Sun's parallax can be made simultaneously from two different places on Earth's surface; that value reaches a maximum of 8.794 seconds of arc for observers at points separated by Earth's diameter. Observing the difference in an object's position as seen from Earth at points six months apart in its orbit (stellar, or annual, parallax) allows measurements of distances (e.g., of stars) too large to be made from two places on Earth's surface. The nearest star system, Alpha Centauri, has a stellar parallax of 0.76 second of arc. Highly precise parallaxes, and thus the positions, of more than 100,000 stars in the Sun's vicinity were determined from data collected by the European Space Agency's Hipparcos satellite (launched 1989).

parallel bars Event in men's gymnastics in which a pair of wooden bars supported horizontally above the floor at the same height is used to perform acrobatic feats. Competitors combine swings and vaults with stationary positions requiring strength and balance, though swings and vaults must predominate. It has been included as an Olympic gymnastics event since the modern games began in 1896. See also uneven parallel bars.

Paul Hamm (U.S.) competes on the parallel bars during the 2004 Olympic Games in Athens.
EZRA SHAW/GETTY IMAGES

parallel evolution Evolution of geographically separated groups in such a way that they show physical resemblances. A notable example is the similarity between the marsupial mammals of Australia and placental mammals elsewhere, which have arrived at remarkably similar forms through the separate courses of their evolution.

parallel postulate One of the five postulates, or axioms, of Euclid underpinning Euclidean geometry. It states that through any given point not on a line there passes exactly one line parallel to that line in the same plane. Unlike Euclid's other four postulates, it never seemed entirely self-evident, as attested by efforts to prove it through the centuries. The uniqueness of Euclidean geometry, and the absolute identification of mathematics with reality, was broken in the 19th century when Nikolay Lobachevsky and János Bolyai (1802–60) independently discovered that altering the parallel postulate resulted in perfectly consistent non-Euclidean geometries.

paralysis *or* **palsy** Loss or impairment of voluntary use of one or more muscles. It may be flaccid (with loss of muscle tone) or spastic (stiff). Hemiplegia (one-sided paralysis) is usually caused by stroke or brain tumour on the opposite side. Diplegia (two-sided paralysis, as in cerebral palsy) results from generalized brain disease. Spinal-cord damage (from

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bone or joint disease, FRACTURE, or tumour affecting the vertebrae; inflammatory and degenerative diseases; or PERNICIOUS ANEMIA) paralyzes the body at and below the level of the damage (paraplegia if the legs and lower body only; quadriplegia if arms and legs). POLIOMYELITIS and polyneuritis (NEURITIS of multiple nerves) result in paralysis with muscle wasting. Bell palsy (a type of neuritis) paralyzes the muscles of one side of the face. MUSCULAR DYSTROPHY causes paralysis by attacking muscle. Metabolic causes include MYASTHENIA GRAVIS. Paralysis may also have psychiatric causes (see HYSTERIA).

paramagnetism Kind of MAGNETISM that occurs in materials weakly attracted by a strong magnet. Compounds containing iron, palladium, platinum, and the rare-earth elements exhibit strong paramagnetism because they have atoms with some incomplete inner ELECTRON shells. Their unpaired electrons make the atoms behave like tiny permanent magnets that align with and strengthen an applied MAGNETIC FIELD. As the temperature rises, strong paramagnetism decreases because of the greater random motion of the atoms. Weak paramagnetism, found in many solid metallic elements, is independent of temperature.

Paramaribo \ˌpä-rä-ˈmä-rē-bō\ City (pop., 1999 est.: 233,000), seaport, and capital of Suriname. Located on the SURINAME RIVER near the Atlantic Ocean, it was originally an Indian village before becoming a French settlement (c. 1640). In 1651 it became a British colony but was ceded to the Dutch in 1667. It is built on a shingle reef that stands 16 ft (5 m) above the river at low tide. Much of the distinctive Dutch colonial architecture and a canal system remain. Since 1945 the city has grown considerably because of tourism and industries.

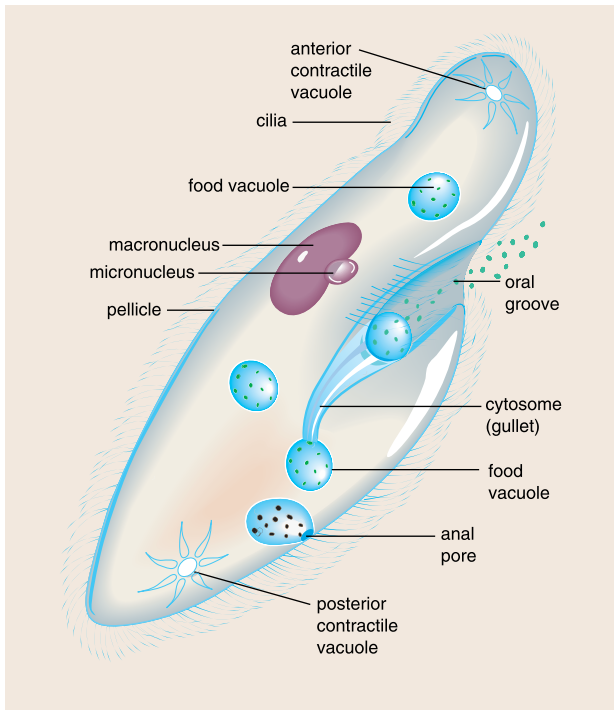
paramecium \ˌpar-ə-ˈmē-sē-əm\ Any of the free-living, single-celled PROTOZOANS that make up the genus *Paramecium*. Most are about the size of the period at the end of this sentence. They vary in shape and are surrounded by a rigid protein layer (pellicle) covered with hundreds of cilia that beat rhythmically to propel them and to direct bacteria and other food particles into their oral groove. Food particles are collected into food VACUOLES, where digestion takes place. Two (occasionally three) contractile vacuoles close to the surface near the ends of the cell expand and contract as they discharge metabolic wastes and excess fluid. Paramecia have two kinds of nuclei: a large macronucleus (the centre of all metabolic activities) and at least one small micronucleus (which stores the genetic material necessary for sexual reproduction). See illustration opposite.

Paramount Communications Media and communications corporation. It was founded (as Paramount Pictures Corp.) by W. W. Hodkinson in 1914 as a film distributor. It became a motion-picture company two years later and won attention with stars such as MARY PICKFORD, GLORIA SWANSON, and RUDOLPH VALENTINO. In the late 1920s and 1930s the studio added CLAUDETTE COLBERT, Gary COOPER, and MARLENE DIETRICH to its roster. Forced to declare bankruptcy after its chain of theaters suffered losses during the transition to sound, the company was reorganized two years later as Paramount Pictures, Inc. Among its successes of the 1940s and '50s were the films of PRESTON STURGES and BILLY WILDER. In 1966 Gulf & Western Industries took control of Paramount, and the new company later changed its name to Paramount Communications. In 1994 it was acquired by Viacom Inc., which in 2000 merged with CBS.

Paraná \ˌpä-rä-ˈnä\ **River** River, South America. It is the continent's second longest river (after the AMAZON RIVER) and rises on the plateau of southeast-central Brazil. It flows generally south 3,032 mi (4,880 km) to join the URUGUAY RIVER and form the Río de la PLATA estuary on the Atlantic Ocean. Its drainage basin includes most of southeastern Brazil, Paraguay, eastern Bolivia, and northern Argentina. From its origin at the confluence of the Grande and Paranaíba rivers to its junction with the PARAGUAY RIVER, it is known as the Alto (Upper) Paraná. Completion of the Itaipú Dam between Paraguay and Brazil in the 1980s submerged the massive Guaíra Falls and created a large reservoir.

paranoia Mental disorder characterized by delusions of persecution or grandeur, usually without HALLUCINATIONS. Paranoia was formerly classified as a distinct PSYCHOSIS but is now generally treated as one of several varieties of SCHIZOPHRENIA or, in milder cases, of PERSONALITY DISORDER. The paranoid person generally suffers from exaggerated self-reference, a tendency to construe independent events and acts as pertaining to him- or herself.

parapsychology \ˌpar-ə-ˌsī-ˈkä-lə-jē\ Discipline concerned with investigating events that cannot be accounted for by natural law and knowledge that cannot have been obtained through the usual sensory



General features of a paramecium.
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abilities. Parapsychology studies the cognitive phenomena often called EXTRASENSORY PERCEPTION, in which a person acquires knowledge of other people's thoughts or of future events through channels apparently beyond the five senses. It also examines physical phenomena such as the levitation of objects and the bending of metal through psychokinesis. Though belief in such phenomena may be traced to earliest times, parapsychology as a subject of serious research originated in the late 19th century, partly in reaction to the growth of the spiritualist movement. The Society of Psychical Research was established in London in 1882, and similar societies were later founded in the U.S. and in many European countries. In the 20th century research into parapsychology was also conducted at some universities, notably at Duke University under J. B. Rhine.

parasitism \ˈpar-ə-sə-ˌti-zəm\ Relationship between two species in which one benefits at the expense of the other. Ectoparasites live on the body surface of the host; endoparasites live in their hosts' organs, tissues, or cells and often rely on a third organism (the carrier, or vector) to transmit them to the host. The CUCKOO and COWBIRD practice brood parasitism, laying eggs in other birds' nests to be raised by the foster parents. In social parasitism, one type of animal parasitizes animals of the same type (e.g., one ant species on different ant species). Hyperparasitism occurs when parasites are parasitized (e.g., PROTOZOANS hyperparasitize a flea on a dog). See also PREDATION.

parathyroid gland Endocrine GLAND, two to eight of which are embedded in each side of the THYROID GLAND. It secretes parathyroid HORMONE, which regulates blood calcium and phosphorus levels. When calcium in body fluids drops, increased hormone secretion releases calcium from BONE into the bloodstream (see CALCIUM DEFICIENCY). The hormone also increases excretion of phosphate in the urine, lowering blood concentrations, and may play a role in magnesium metabolism. When thyroid removal is required, the parathyroid glands must be separated out and left in place. See also ENDOCRINE SYSTEM.

parchment Processed skins of certain animals (chiefly sheep, goats, and calves) that have been prepared for the purpose of writing on them. Parchment was probably invented in Greece in the 2nd century BC. Skins had been used for writing material even earlier (c. 2400 BC), but the new, more thorough method of cleaning, stretching, and scraping made possible the use of both sides of a manuscript leaf, leading to the replace-

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ment of the rolled manuscript by the bound book (CODEX). Especially fine parchment is known as vellum. In modern usage, the terms "parchment" and "vellum" are sometimes used for a type of high-quality paper.

pardo *Spanish* **"brown"** In Venezuela, a person of mixed African, European, and Indian ancestry. In the colonial period, *pardos*, like all nonwhites, were kept in a state of servitude, with no hope of gaining wealth or political power. Nevertheless, most *pardos* remained royalists during much of the war for independence because they relied on Spain for protection in their conflicts with the Venezuelan-born whites, toward whom the European Spaniards took a superior attitude. In Brazil a *pardo* is a person of mixed European and African descent.

pardon In law, release from guilt or remission of punishment. The power to pardon is generally exercised by the state's chief executive officer. A pardon may be full or conditional. A conditional pardon imposes a lesser punishment or some other obligation. Some states still bar pardoned offenders from holding public office or obtaining professional licenses.

Paré \pä-'rā**, Ambroise** (b. 1510, Bourg-Hersent, France—d. Dec. 20, 1590, Paris) French physician and surgeon. Employed as an army surgeon in 1537, Paré preferred measures less drastic than those of other surgeons at the time (whose techniques included castration in hernia surgery and searing large arteries with hot irons during amputation) and operated only when necessary. He introduced the implantation of gold and silver teeth, artificial limbs, and artificial eyes (see PROSTHESIS) and invented many instruments, popularized the truss for hernias, and first suggested that syphilis caused aneurysms. He published books on a wide variety of medical matters; his surgical works were especially influential.

Pareto \pä-'re-tō**, Vilfredo** (b. July 15, 1848, Paris, France—d. Aug. 19, 1923, Geneva, Switz.) Italian economist and sociologist. Educated at the University of Turin, he worked as an engineer and later served as a director of a large Italian railway. He taught at the University of Lausanne from 1893. His law of income distribution used a complex mathematical formula to trace historical patterns in the distribution of wealth. In 1906 he laid the foundation of modern WELFARE ECONOMICS with his Pareto Optimum, which stated that a society's resources are not optimally allocated as long as it is possible to make at least one person better off while keeping others as well off as before.

Parhae \'pò-'hī\ *Chinese* **Pohai** \'pò-'hī\ State established in the 8th century AD in northern Manchuria and northern Korea. Founded by a former Korean general, Tae Cho-yang, it was considered a successor state to KOGURYŎ, which had occupied much of the same territory before its conquest by SILLA in 668. Like Silla, Parhae was a tributary state of TANG-DYNASTY China. It traded with the nomadic tribes of the north and with China and Japan. Parhae was conquered in 926 by the Khitan tribes almost 20 years after their creation of the LIAO DYNASTY on China's northern borders.

pari-mutuel \ˌpar-i-'myü-chə-wəl\ Betting pool in which those who bet on competitors finishing in the first three places share the total amount bet minus a percentage for the management. First introduced in France c. 1870, it soon became one of the most popular methods of betting on horse races internationally. Today computers calculate betting pools and current odds on each horse and flash the figures to the public at regular intervals. The system is used largely for off-track betting. Pari-mutuel betting is also practiced in dog racing and JAI ALAI.

Paria \pə-'rē-ə**, Gulf of** Inlet of the Caribbean Sea, between Venezuela and Trinidad. Extending about 100 mi (160 km) from east to west and 40 mi (65 km) from north to south, it is linked with the Caribbean to the north and the Atlantic Ocean to the south. Its ports, including PORT-OF-SPAIN, Trinidad, handle shipments of petroleum, iron ore, and agricultural products. In 1498, on his third voyage to the Western Hemisphere, CHRISTOPHER COLUMBUS probably first sighted South America when he sailed into the gulf.

Parícutin \pä-'rē-kü-ˌtēn\ Volcano, western Michoacán state, west-central Mexico. It is about 9,210 ft (2,808 m) high and is one of the youngest volcanoes on Earth. It began to erupt in an open field in 1943 and buried the village of Parícutin. The eruption finally ceased in 1952.

Parilia \pə-'ri-lē-ə\ Ancient Roman festival celebrated annually on April 21 in honor of the goddess Pales, protector of flocks and herds. It was celebrated first by the early kings of Rome and later by the PONTIFEX MAXIMUS. The VESTAL VIRGINS opened the festival by distributing straw and the ashes and blood of sacrificed animals. Ritual cleaning, anointing, and adornment of herds and stalls followed. The celebrants jumped over a bonfire three times to complete the rite of purification.

Paris In GREEK MYTHOLOGY, a son of King PRIAM of TROY and his wife, HECUBA. An evil portent prompted his parents to abandon him as an infant. Unknown to them, he was raised as a shepherd, and as a young man he was received home again after winning a boxing contest against Priam's other sons. ZEUS chose him to determine which of three goddesses was most beautiful—HERA, ATHENA, or APHRODITE. In the famous "judgment of Paris," he chose Aphrodite because she offered to help him win the most beautiful woman alive. His seduction of HELEN was the cause of the TROJAN WAR. Near the end of the war, Paris shot the arrow that killed ACHILLES and soon afterward was himself killed.

Paris City (pop., 1999: 2,125,246; metro. area, 9,644,507), river port, capital of France. It is now located on both banks of the SEINE RIVER. The original settlement from which Paris evolved, Lutetia, was in existence by the late 3rd century BC on an island in the Seine. Lutetia was captured and fortified by the Romans in 52 BC. During the 1st century AD the city spread to the left bank of the Seine. By the early 4th century it was known as Paris. It withstood several Viking sieges (885–87) and became the capital of France in 987, when HUGH CAPET, the count of Paris, became king. The city was improved during the reign of PHILIP II, who formally recognized the University of PARIS c. 1200. In the 14th–15th centuries its development was hindered by the BLACK DEATH and the HUNDRED YEARS' WAR. In the 17th–18th centuries it was improved and beautified. Leading events of the FRENCH REVOLUTION took place in Paris (1789–99). NAPOLEON III commissioned GEORGES-EUGÈNE HAUSSMANN to modernize the city's infrastructure and add several new bridges over the Seine. The city was the site of the PARIS PEACE CONFERENCE, which ended WORLD WAR I. During World War II Paris was occupied by German troops. It is now the financial, commercial, transportation, artistic, and intellectual centre of France. The city's many attractions include the EIFFEL TOWER, NOTRE-DAME DE PARIS, the LOUVRE, the Panthéon, POMPIDOU CENTRE, and the PARIS OPERA, as well as boulevards, public parks, and gardens.

Paris, Congress of (1856) Conference in Paris to produce the treaty that ended the CRIMEAN WAR. The treaty was signed between Russia on one side and France, Britain, Sardinia-Piedmont, and Turkey on the other. It guaranteed the independence and territorial integrity of Turkey. Russia was forced to surrender Bessarabia to Moldavia, warships of all nations were barred from the Black Sea, and the Danube River was opened to shipping of all countries. The congress also adopted the first codified law of the sea, which banned privateering and defined a legal naval blockade.

Paris, Treaty of (1229) Treaty by which RAYMOND VII of Toulouse conceded defeat to LOUIS IX of France after the ALBIGENSIAN CRUSADE. It arranged the marriage of Raymond's daughter and Louis's brother and provided for the eventual return of LANGUEDOC to the crown, thus destroying the independence of the princes of the south.

Paris, Treaty of (1259) Peace treaty signed by HENRY III of England and LOUIS IX of France. It allowed the English to keep Aquitaine and nearby territories but obliged Henry to acknowledge himself the vassal of the French king. The agreement kept peace between England and France until the outbreak of the HUNDRED YEARS' WAR in 1337.

Paris, Treaty of (1763) Treaty concluding the SEVEN YEARS' WAR (including the FRENCH AND INDIAN WAR). It was signed by Britain and Hanover on one side and France and Spain on the other. France renounced to Britain the mainland of North America east of the Mississippi, its conquests in India since 1749, and four West Indian islands. Britain restored to France four other West Indian islands and the West African colony of Gorée (Senegal). In return for recovering Havana and Manila, Spain ceded Florida to Britain and received Louisiana from the French.

Paris, Treaty of (1814) Treaty signed in Paris that ended the NAPOLEONIC WARS between France and the Allies (Austria, Britain, Prussia, Russia, Spain, Sweden, and Portugal). The terms were generous to France, since NAPOLEON had abdicated and the Bourbon dynasty was restored. France was allowed to retain its boundaries of 1792 and ceded only several islands to Britain. Other terms were left to be discussed later.

Paris, Treaty of (1815) Second treaty between France and the Allies, following NAPOLEON's HUNDRED DAYS and final defeat. It was harsher than the first Treaty of PARIS (1814). France was required to return to its borders of 1790 and was stripped of the Saar and Savoy regions; it was also

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obliged to pay an indemnity of 700 million francs and to support a 150,000-man army of occupation for three to five years.

Paris, University of Second oldest European university (after the University of Bologna), founded c. 1170 in France. It grew out of the cathedral schools of Notre-Dame and, with papal support, soon became a great centre of Christian orthodox teaching. In the medieval period its professors included St. Bonaventure, Albertus Magnus, and Thomas Aquinas. Its most celebrated early college was the Sorbonne, founded c. 1257. The university declined somewhat under the impact of the Reformation and Counter-Reformation. With the French Revolution and Napoleon's reforms, teaching became more independent of religion and politics. By the mid-20th century the university had again become a preeminent scientific and intellectual centre. In May 1968 a Sorbonne student protest grew into a serious national crisis. This led to decentralizing reforms, the old university being replaced in 1970 by a system in Paris and its suburbs called the Universities of Paris I–XIII.

Paris Commune *or* **Commune of Paris** (March 18–May 28, 1871) Insurrection of Paris against the French government. After France's defeat in the Franco-Prussian War and the collapse of the Second Empire, the republican Parisians feared that the conservative majority in the National Assembly would restore the monarchy. On March 18 the National Guard in Paris resisted orders to disarm, and after municipal elections were won by the revolutionaries, they formed the Commune government. Factions included the so-called Jacobins, who wanted the Paris Commune to control the revolution (as its namesake had in the French Revolution); the Proudhonists, socialist followers of Pierre-Joseph Proudhon who supported a federation of communes; and the Blanquistes, socialist followers of Auguste Blanqui who demanded violent action. Government forces quickly suppressed communes elsewhere in France, then entered Paris on May 21. In a week of fierce fighting, they crushed the Communards, who had set up barricades in the streets and burned public buildings, including the Tuileries Palace. About 20,000 insurrectionists and 750 government troops were killed. In the aftermath, the government took harsh repressive action; 38,000 suspects were arrested and more than 7,000 were deported.

Paris-Match \pà-rē-'màch\ Weekly pictorial magazine published in France since 1949 as the successor to *L'Illustration* (1843–1944). A popular news and current-events magazine aimed at the middle class, it features picture-stories on such subjects as public affairs, entertainment, fashion, and consumer products. Its format resembles that of *Life*, and it is similarly noted for topicality and outstanding photography. Under the ownership of Jean Prouvost (d. 1978), it achieved prestige and financial success. It is now published by Hachette Filipacchi Médias, one of the world's largest magazine publishers.

Paris Opéra *or* **Opéra Garnier** \ō-per-'ä-gȧrn-'yā\ *also* **Théâtre Nationale de L'Opéra** Opera house in Paris designed by Charles Garnier (1825–98). The extraordinarily lavish building, considered one of the masterpieces of the Second Empire (Beaux-Arts style), was begun in 1861 and opened in 1875. The floor plan is as elaborate as the exterior. The interior features generous circulation space, including a grand staircase and numerous richly decorated galleries, foyers, and corridors. The designation also applies to the opera company in Paris that for more than two centuries was the chief performer of serious operas and musical dramas in the French language. One of the most venerable operatic institutions in the world, it occupied Garnier's building until 1990.

Paris Peace Conference (1919–20) Meeting that inaugurated the international settlement after World War I. It opened on Jan. 12, 1919, with representatives from more than 30 countries. The principal delegates were France's Georges Clemenceau, Britain's David Lloyd George, the U.S.'s Woodrow Wilson, and Italy's Vittorio Emanuele Orlando, who with their foreign ministers formed a Supreme Council. Commissions were appointed to study specific financial and territorial questions, including reparations. The major products of the conference were the League of Nations; the Treaty of Versailles, presented to Germany; the Treaty of Saint-Germain, presented to Austria; and the Treaty of Neuilly, presented to Bulgaria. The inauguration of the League of Nations on Jan. 16, 1920, brought the conference to a close. Treaties were subsequently concluded with Hungary (Treaty of Trianon, 1920) and Turkey (Treaties of Sèvres, 1920, and Lausanne, 1923).

parity In economics, equality in price, rate of exchange, purchasing power, or wages. In international exchange, parity exists when the exchange rate between two currencies makes the purchasing power of both currencies equal. Adjustments to maintain parity can occur in the marketplace as prices change in response to supply and demand, or through the intervention of national governments or international agencies such as the International Monetary Fund. In U.S. agricultural economics, the term parity is used for a system of regulating the prices of farm commodities, usually by government price supports and production quotas, to guarantee farmers the purchasing power they had in a past base period. Parity is also used in personnel administration to establish equitable wage rates for various classes of employees.

parity In physics, a property related to the symmetry of the wave function representing a system of fundamental particles. It plays an important role in quantum mechanics in the description of a physical system. Parity transformation replaces a system with a type of mirror image in which the spatial coordinates describing the system are inverted, so that the coordinates x, y, and z are replaced with $-x$, $-y$, and $-z$. If a system is identical to the original system after parity transformation, its parity is even. If the image is the negative of the original, its parity is odd. In either case, the physical observables of the system remain unchanged. In 1957 Chien-Shiung Wu (1912–1997) and coworkers made the surprising discovery that beta decay reactions do not conserve parity; in other words, the inverted image of the process does not exist in nature. This is a general property of the weak force.

park Large outdoor area set aside for recreation. The earliest parks were hunting grounds of the Persian kings; such reserves became shaped by riding paths and shelters. A second type of park derived from the open-air meeting places of Greece, where the functions of an area for exercise, social concourse, and athletes' training ground were combined with elements of a sculpture gallery and religious centre. Parks of post-Renaissance times featured extensive woods, raised galleries, and often elaborate aviaries and cages for wild animals. What often differentiates present-day parks from parks of the past is their accommodation for active recreation; facilities may include outdoor theatres, zoos, concert shells, concessions for dining and dancing, amusement areas, boating areas, and areas for sports. See also national park.

Park, Mungo (b. Sept. 10, 1771, Fowlshiels, Selkirk, Scot.—d. c. January 1806, near Bussa on the Niger River) Scottish explorer of the Niger River. A trained surgeon, Park had traveled to the East Indies before being chosen by the African Association to head an expedition to find the source of the Niger River (1795–97). He lost most of his crew and supplies, was imprisoned and tortured for four months by hostile Arabs, and suffered severe illness, reaching Ségou (now in Mali) but not the river's source. His *Travels in the Interior Districts of Africa* (1797) became a great popular success. On a second expedition (1805–06) he reached Bamako, but he was killed on the return trip.

Park, Robert E(zra) (b. Feb. 14, 1864, Harveyville, Pa., U.S.—d. Feb. 7, 1944, Nashville, Tenn.) U.S. sociologist. After 11 years as a newspaper reporter, Park attended various universities and studied with scholars such as John Dewey, William James, Josiah Royce, and Georg Simmel. He then worked for Booker T. Washington and later taught at the University of Chicago—where he was a leading figure in the "Chicago school" of sociology, characterized by empirical research and the use of human ecology models—and at Fisk University. He is noted for his work on ethnic groups, particularly African Americans, and on human ecology, a term he has been credited with coining. Park wrote *Introduction to the Science of Sociology* (1921) and *The City* (1925) with Ernest W. Burgess; *Race and Culture* (1950) and *Human Communities* (1952) were published posthumously.

Parker, Alton B(rooks) (b. May 14, 1852, Cortland, N.Y., U.S.—d. May 10, 1926, New York, N.Y.) U.S. jurist. He practiced law in Kingston, N.Y., and was elected surrogate of Ulster county in 1877 and 1883. He was appointed to the New York Supreme Court in 1885, the state Appeals Court in 1889, and the appellate division of the state Supreme Court in 1896. From 1898 to 1904 he was chief justice of the New York court of appeals. On the bench, he was noted for upholding the rights of labour. As the Democratic Party presidential candidate in 1904, he represented the eastern, pro-gold-standard wing of the party. Soundly defeated by Pres. Theodore Roosevelt, he resumed his law practice.

Parker, Charlie *orig.* **Charles Christopher Parker, Jr.** (b. Aug. 29, 1920, Kansas City, Kan., U.S.—d. March 12, 1955, New York, N.Y.) U.S. saxophonist and composer. He played with Jay McShann's big band (1940–42) and those of Earl Hines (1942–44) and Billy Eckstine (1944) before leading his own small groups in New York City. (A nickname

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acquired in the early 1940s, Yardbird, was shortened to Bird and used throughout his career.) Parker frequently worked with Dizzy Gillespie in the mid-1940s, making a series of small-group recordings that heralded the arrival of bebop as a mature outgrowth of the improvisation of the late swing era. His direct, cutting tone and unprecedented dexterity on the alto saxophone made rapid tempos and fast flurries of notes trademarks of bebop, and his complex, subtle harmonic understanding brought an altogether new sound to the music. Easily the most influential jazz musician of his generation, Parker suffered chronic drug addiction, and his early death contributed to making him a tragic legend.

Charlie Parker, 1949.
AP/WIDE WORLD PHOTOS

Parker, Dorothy *orig.* **Dorothy Rothschild** (b. Aug. 22, 1893, West End, near Long Beach, N.J., U.S.—d. June 7, 1967, New York, N.Y.) U.S. short-story writer and poet. She grew up in affluence in New York City. She was a drama critic for *Vanity Fair* and wrote book reviews for *The New Yorker* (1927–33). Her poetry volumes include *Enough Rope* (1926) and *Death and Taxes* (1931). Her short stories were collected in *Laments for the Living* (1930) and *After Such Pleasures* (1933). She also worked as a film writer, reported on the Spanish Civil War, and collaborated on several plays. A member of the Algonquin Round Table, she is chiefly remembered for her wit.

Dorothy Parker, 1939.
CULVER PICTURES

Parkinson, C(yril) Northcote (b. July 30, 1909, Barnard Castle, Durham, Eng.—d. March 9, 1993, Canterbury, Kent) British historian and writer. He received a Ph.D. from Kings College, London, and later taught at various schools in England and Malaya. He is most famous for his 1955 formulation of the satiric "Parkinson's Law," which stated that "Work expands to fill the time available for its completion." In *The Law and the Profits* (1960) he discussed a second law, "Expenditure rises to meet income."

parkinsonism Neurological disorder causing progressive loss of control of movement. It was first described in 1817 by British physician James Parkinson (1755–1824). The cause of primary parkinsonism, or Parkinson disease, is unknown. The mean age of onset is about 57, but juvenile parkinsonism is also known. Neurons in the brain that normally produce dopamine deteriorate. When 60–80% are destroyed, signals suppressing unintended movement are disrupted and symptoms appear, including tremor at rest, muscle rigidity, trouble in starting movements, and loss of balance. Known causes include sleeping sickness; certain poisons; repeated blows to the head, as in boxing; and the drug MPTP. Environmental toxins or genetic susceptibility may account for some cases. Drug therapy requires careful scheduling and combinations to delay development of tolerance and side effects. Surgical pallidotomy (destruction of the globus pallidus, a brain structure involved in motor control) and transplantation of fetal dopamine-producing tissue remain experimental.

Parkman, Francis (b. Sept. 16, 1823, Boston, Mass., U.S.—d. Nov. 8, 1893, Jamaica Plain, Mass.) U.S. historian. Parkman graduated from Harvard University before embarking in 1846 on a journey to the West that resulted in *The California and Oregon Trail* (1849). He is noted for his seven-part history *France and England in North America*, covering the colonial period from the beginnings to 1763; its volumes include *Pioneers of France in the New World* (1865); *Montcalm and Wolfe* (1884), which demonstrates how biography can penetrate the spirit of an age; and *A Half-Century of Conflict* (1892), which exemplifies his literary artistry.

Parks, Gordon (b. Nov. 30, 1912, Fort Scott, Kan., U.S.—d. March 7, 2006, New York, N.Y.) U.S. writer, photographer, and film director. As the first African American staff photographer for *Life* (1948–72), Parks became known for his portrayals of ghetto life, black nationalists, and the civil rights movement. His first work of fiction was *The Learning Tree* (1963), a novel about a black adolescent in Kansas in the 1920s. He combined poetry and photography in collections such as *A Poet and His Camera* (1968) and *Glimpses Toward Infinity* (1996). In 1968 he became the first African American to direct a major motion picture with his film adaptation of *The Learning Tree*. He later directed *Shaft* (1971), which helped give rise to the genre of African American action films known as "blaxploitation." Parks also composed music.

Parks, Rosa *orig.* **Rosa Louise McCauley** (b. Feb. 4, 1913, Tuskegee, Ala., U.S.—d. Oct. 24, 2005, Detroit, Mich.) U.S. civil rights activist. She worked as a seamstress in Montgomery, Ala., where she joined the NAACP in 1943. In 1955 she was arrested after refusing to give her seat on a public bus to a white man. The resultant boycott of the city's bus system, organized by Martin Luther King, Jr., and others, brought the civil rights movement to new prominence. In 1957 Parks moved to Detroit, where she was a staff assistant (1965–88) to U.S. Rep. John Conyers. She was awarded the Congressional Gold Medal in 1999.

Parlement \'pär-lə-mənt\ Supreme court under the ancien régime in France. It developed out of the *curia regis* ("king's court") in which the Capetian kings convened their chief vassals and prelates to consider feudal and political issues. By the mid-13th century this judicial institution was known as Parlement and served as a court of appeals against the judgments of royal officials. Later Parlements also reviewed the king's edicts to determine whether they were just and lawful. The chief Parlement was located in Paris, and others were established in the provinces. The Parlements were abolished in the French Revolution.

Parliament Legislative assembly of Britain and of other governments modeled after it. The British Parliament consists of the monarch, the House of Lords, and the House of Commons, and traces its roots to the union (c. 1300) of the Great Council and the King's Court, two bodies that treated with and advised the king. In the 14th century, Parliament was split into two houses, with the lords spiritual and temporal (i.e., not only the nobility but also high officials of the church) debating in one and the knights and burgesses in the other. In the 14th century Parliament also began to present petitions ("bills") to the king, which with his assent would become law. Robert Walpole was the first party leader to head the government as prime minister (1721–42). See also parliamentary democracy.

Parliament, Canadian Legislature of Canada, created by the British North America Act. The 301 members of its House of Commons are elected for maximum terms of five years from the provinces on the principle of representation by population. The 105 members of its Senate are appointed by Canada's governor-general from the regions of Canada and serve until age 75. The parliament has authority over the armed forces, regulates trade and commerce, levies taxes, and is in charge of banking, credit, currency and bankruptcy, criminal law, postal services, fisheries, patents and copyrights, the census, navigation and shipping, railways, canals, and telegraphs. It also retains powers not specifically assigned to provincial legislatures. The leader of the party winning the most seats in a general election becomes prime minister and is called on by the governor-general to form a government. He generally chooses elected party colleagues to form the cabinet. The party winning the second-largest number of seats in the House becomes the official opposition party.

Parliament Act of 1911 Act passed in the British Parliament that deprived the House of Lords of its absolute power of veto on legislation. Proposed by a Liberal majority in the House of Commons, the act stated that any bill passed unchanged by the Commons in three separate sessions over two years could be presented for the royal assent (necessary for a bill to become law) without the Lords' consent. By subordinating the Lords to the Commons, the act was seen as another step in making the British Constitution more democratic.

parliamentary democracy Democratic form of government in which the party (or a coalition of parties) with the greatest representation

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in the parliament (legislature) forms the government, its leader becoming PRIME MINISTER or CHANCELLOR. Executive functions are exercised by members of the parliament appointed by the prime minister to the CABINET. The parties in the minority serve in opposition to the majority and have the duty to challenge it regularly. The prime minister may be removed from power whenever he loses the confidence of a majority of the ruling party or of the parliament. Parliamentary democracy originated in Britain (see PARLIAMENT) and was adopted in several of its former colonies.

parliamentary procedure *or* **rules of order** Generally accepted rules, precedents, and practices used in the governance of deliberative assemblies. They are intended to maintain decorum, ascertain the will of the majority, preserve the rights of the minority, and facilitate the orderly transaction of business. Rules of parliamentary procedure originated in Britain in the 16th and 17th centuries and were subsequently adopted by legislatures around the world. *Robert's Rules of Order*, codified in 1876 by U.S. Gen. Henry M. Robert (1837–1923) and regularly refined and enlarged, is the standard set of rules used by legislatures in the U.S.

Parma City (pop, 2001 prelim.: 156,172), EMILIA-ROMAGNA region, northern Italy. Located on the Parma River, the site was founded by the Romans in 183 BC; it became an episcopal see in the 4th century AD. Parma was destroyed by the Ostrogoths under THEODORIC I but was rebuilt in the Middle Ages. Made part of the duchy of Parma and Piacenza in 1545, it was held by the FARNESE FAMILY and later passed to the Austrians. In 1815 Napoleon gave the city to his second consort, MARIE-LOUISE. In 1861 it became part of united Italy. It was badly damaged during World War II but was rebuilt. It is the commercial centre of an agricultural region and is famous for its Parmesan cheese. Sites of interest include the 12th-century Romanesque cathedral, the 13th-century baptistery, and the university (founded in the 11th century).

Parmenides \pär-ˈmen-ə-ˌdēz\ (b. c. 515 BC) Greek philosopher, leader of the ELEATICS. His general teaching has been reconstructed from the few surviving fragments of his lengthy verse composition *On Nature*. He held that the multiplicity of existing things, their changing forms and motion, are but an appearance of a single eternal reality, "Being." This doctrine, which was formulated as the principle that "all is one," entails that all claims of change or of non-Being are illogical. Because of his method of basing claims about appearances on a logical concept of Being, he is considered a founder of METAPHYSICS. PLATO's dialogue *Parmenides* discusses his thought.

Parmigianino \ˌpär-mi-jä-ˈnē-nō\ *orig.* **Girolamo Francesco Maria Mazzola** (b. Jan. 11, 1503, Parma, Duchy of Milan—d. Aug. 24, 1540, Casalmaggiore, Cremona) Italian painter and etcher. He painted some of his early frescoes for San Giovanni Evangelista; they were influenced by CORREGGIO, who had recently worked in the same church. His originality is seen in his *Self-Portrait in a Convex Mirror* (1524). His *Madonna of the Long Neck* (1534) is typical of his later work, which is characterized by ambiguity of spatial composition, elongation of the human figure, and the pursuit of a rhythmical, sensuous beauty beyond nature. Among the most remarkable portrait painters of his age, he was one of the first artists to develop the elegant and sophisticated version of MANNERISM that influenced the next generation of painters and was one of the first Italian artists to practice etching.

Parnaíba \ˌpär-nä-ˈē-bə\ **River** River, northeastern Brazil. It rises in the Tabatinga Mountains and flows northeast for 1,056 mi (1,700 km) to empty into the Atlantic Ocean, forming a delta at its mouth. The river has great economic importance. It is navigable by shallow-draft vessels from its mouth at least as far south as the junction of the Canindé River. The port of Parnaíba, located near the river's mouth, is a commercial centre.

Parnassian \pär-ˈna-sē-ən\ Members of a French school of poetry of the second half of the 19th century that was headed by Charles-Marie-Rene Leconte de Lisle (1818–94) and THÉOPHILE GAUTIER. The Parnassians stressed restraint, objectivity, technical perfection, and precise description as a reaction against the emotionalism and verbal excess of ROMANTICISM. Their name came from the anthology to which they contributed, *Le Parnasse contemporain* (1866, 1871, 1876). Their influence was evident in movements such as MODERNISMO and led to experimentation in metres and verse forms and the revival of the SONNET.

Parnassus \pär-ˈna-səs**, Mt.** Mountain in central Greece. Located in the Pindus range, it rises to a height of 8,061 ft (2,457 m). In the ancient world it was sacred to APOLLO and the Corycian nymphs, probably because of its proximity to DELPHI and its oracle. For Roman poets the Castalian spring on Parnassus was a source of inspiration, and the mountain was regarded as the home of the MUSES.

Parnell \pär-ˈnel**, Charles Stewart** (b. June 27, 1846, Avondale, County Wicklow, Ire.—d. Oct. 6, 1891, Brighton, Sussex, Eng.) Irish nationalist leader. After an education at the University of Cambridge, he returned to Ireland and served in the British Parliament (1875–91), introducing obstructionist legislative tactics to call attention to Ireland's needs. In 1877 he became president of the Home Rule Confederation. He was jailed for making violent speeches against the new land act (1881–82), then released to curb an increase in terrorist acts. Reaction against the PHOENIX PARK MURDERS enabled him to unite factions in Ireland to win support for parliamentary measures, such as WILLIAM E. GLADSTONE's HOME RULE proposals. He remained popular in Ireland until he was named in the divorce suit of his mistress, Katherine O'Shea (1890).

parochial education Education offered institutionally by a religious group. The curriculum usually includes both religious and general studies. In the U.S. and Canada, parochial education has referred primarily to elementary and secondary schools maintained by Roman Catholic parishes, but it can also apply to schools operated by Protestant, Jewish, Muslim, and Buddhist organizations, among others.

parody In literature, a work in which the style of an author is closely imitated for comic effect or in ridicule. Differing from both BURLESQUE (by the depth of its technical penetration) and travesty (which treats dignified subjects in a trivial manner), parody mercilessly exposes the tricks of manner and thought of its victim and therefore cannot be written without a thorough appreciation of the work it ridicules. Examples date from as early as ancient Greece and occur in nearly all literatures and all periods.

parole Supervised conditional liberty from prison granted prior to the expiration of a prisoner's sentence. Modern use of parole stems from a change in penal philosophy to emphasize rehabilitation rather than retribution. In some jurisdictions, those convicted of certain crimes (e.g., rape or murder) are not eligible for parole. Conditions of parole vary, but in all cases their violation may constitute grounds for reincarceration. Parole supervision ranges from little more than a periodic police check to intensive supervision by trained personnel. See also PROBATION.

Parr, Catherine See CATHERINE Parr

Parra, Nicanor (b. Sept. 5, 1914, San Fabian, Chile) Chilean poet. A student of mathematics and physics, Parra began teaching theoretical physics at the University of Chile in 1952. One of the most important Latin American poets of the 20th century, he is known for originating so-called antipoetry (poetry that opposes traditional poetic techniques or styles). In *Poems and Antipoems* (1954), he sought to make poetry accessible to the masses by treating everyday problems of a grotesque world in clear language with black humour and ironic vision. In later works he experimented with language, and he continued to use antipoetic techniques.

Parrhasius \pə-ˈrā-zhəs\ *or* **Parrhasios** (fl. 5th century BC, Athens, Greece) Greek painter. He was praised by ancient critics as a master of outline drawing. He apparently succeeded in portraying various psychological states in his depictions of the face. Many of his drawings on wood and parchment were preserved and highly valued by later painters for purposes of study. His picture of Theseus adorned the Capitol in Rome; other works were chiefly mythological groups. No works or copies survive.

Parrish \ˈpar-ish**, (Frederick) Maxfield** (b. July 25, 1870, Philadelphia, Pa., U.S.—d. March 10, 1966, Plainfield, N.H.) U.S. illustrator and painter. Trained at the Pennsylvania Academy of the Fine Arts and Drexel Institute of Art, he was the highest-paid commercial artist and muralist in the U.S. by the 1920s. He is best known for his depictions of fantasy landscapes populated by attractive young women. He used meticulously defined outlines and intricately detailed natural backgrounds; his unusual colours, especially the luminous "Parrish blue," give his pictures a dreamlike quality. Though his popularity declined in the late 1930s, appreciation of his work revived in the 1960s and '70s.

parrot Any of the 333 species of birds in the family Psittacidae. About 220 species of true parrots (subfamily Psittacinae) are found worldwide in warm regions (see PARAKEET). Many are brilliantly coloured. They have a blunt tongue and eat seeds, buds, and some fruit and insects. Their vocal

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apparatus permits many species to mimic human speech with great accuracy. The African gray parrot (*Psittacus erithacus*), intelligent and a particularly good talker, is about 13 in. (33 cm) long and is gray except for a red tail and white face; it lives up to 80 years. The 31 species of Amazon parrots (genus *Amazona*), also good mimics, are 10–16 in. (25–40 cm) long and predominantly green. Four other subfamilies are found chiefly around New Zealand and Australia, as are the COCKATOOS and COCKATIEL (family Cacatuidae); these are often considered parrots as well because they are classified with Psittacidae in the order Psittaciformes. See also KEA; LOVEBIRD; MACAW.

Rainbow lorikeet (*Trichoglossus haematodus*).
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parrot fish Any of about 80 species (family Scaridae) of slender, blunt-headed, deep-bodied fishes found on tropical reefs. They are often brightly coloured and have large scales. The fused teeth form a "beak" used to scrape algae and the soft part of coral from reefs. Platelike teeth in the throat grind the ingested food and bits of coral. Some species grow to 4 ft (1.2 m) long and weigh 45 lb (20 kg). The Indo-Pacific surf, or rivulated, parrot fish (*Callyodon fasciatus*) grows to 18 in. (46 cm) or more. The queen parrot fish (*Scarus vetula*) is an Atlantic species.

Parrot fish (*Calotomus*).
DOUGLAS FAULKNER

parsec Unit of measure used by astronomers to express distances to stars and galaxies. It is the distance at which the radius of Earth's orbit would subtend an angle of one second of arc, so an object one parsec away would have a PARALLAX of one second. An object's distance in parsecs is the reciprocal of its parallax in seconds of arc. For example, ALPHA CENTAURI, with a parallax of 0.76 second, is 1.33 parsecs from the Sun and Earth. One parsec equals 3.26 light-years, or 19.2 trillion mi (30.9 trillion km).

Parshvanatha \'pärsh-və-'nä-tə\ (fl. 8th century BC) In JAINISM, the 23rd TIRTHANKARA, or saint, of the present age. He founded a religious order and formulated four vows binding on its members (not to kill, steal, lie, or own property; a vow of celibacy was added later by MAHAVIRA). According to legend, Parshvanatha once saved a family of serpents trapped in a log in an ascetic's fire. One of the snakes, later reborn as Dharana, the lord of the underworld kingdom of NAGAS (snakes), sheltered Parshvanatha from a storm sent by an enemy demon. In sculpture and painting Parshvanatha is depicted with a canopy of snake hoods over his head.

Parsi *or* **Parsee** Zoroastrian of India. The Parsis, whose name means "Persians," are descended from Persian Zoroastrians who immigrated to India to escape persecution by Muslims. The migration occurred sometime between the 8th and 10th century. The Parsis settled in Gujarat and became a farming community. When the British EAST INDIA CO. took control of the region around Bombay (now Mumbai) in the late 17th century and established religious freedom, many Parsis moved there, and by the 19th century they had become a wealthy merchant class. The Parsis still live chiefly in the Mumbai area, though other Parsi communities exist in Bangalore, India, and Karachi, Pakistan. See also ZOROASTRIANISM AND PARSIISM.

Parsiism See ZOROASTRIANISM AND PARSIISM

parsley Hardy biennial herb (*Petroselinum crispum*) of the family Apiaceae, or Umbelliferae, native to Mediterranean lands. The compound leaves are used in cooking. The family Apiaceae, sometimes called the parsley family, contains 300–400 genera of plants found in a wide variety of habitats, mostly in northern temperate regions. Most are aromatic herbs with feathery leaves. The flowers are often arranged in a conspicuous umbel (a flat-topped cluster). Many species are poisonous, including POISON HEMLOCK. Popular members of the family include CARROT, CELERY, PARSNIP, and FENNEL. Species used as herbs and spices include ANISE, DILL, CORIANDER, CARAWAY, and cumin (*Cuminum cyminum*).

parsnip Plant (*Pastinaca sativa*) of the PARSLEY family, cultivated for its large, tapering, fleshy, edible white root, which has a distinctive, sweet flavour and is usually served as a cooked vegetable. At the end of summer the solids of the root consist largely of starch, but a period of low temperature changes much of the starch to sugar. The root is hardy and not damaged by hard freezing of the soil. Native to Britain, Europe, and temperate Asia, the parsnip has become extensively naturalized in North America.

Parsnip (*Pastinaca sativa*).
G.R. ROBERTS

Parsons, Sir Charles Algernon (b. June 13, 1854, London, Eng.—d. Feb. 11, 1931, Kingston Harbour, Jam.) British mechanical engineer. He began work at the Armstrong engineering works in Newcastle upon Tyne in 1877 and formed his own company to manufacture turbines and other heavy machinery in 1889. He developed the multiple-stage turbine in 1884 and had introduced it in power plants to generate electricity by 1891. Modern steam and nuclear power plants still use turbines of this type to turn their generators. He demonstrated his marine turbine in *Turbinia*, a vessel that attained a speed of over 34 knots in 1897; Parsons turbines made high-speed ocean liners possible.

Parsons, Elsie Clews *orig.* **Elsie Worthington Clews** (b. Nov. 27, 1875, New York, N.Y., U.S.—d. Dec. 19, 1941, New York City) U.S. sociologist, anthropologist, and folklorist. She was trained in sociology. Her early works, advocating women's rights, included *The Family* (1906) and *The Old-Fashioned Woman* (1913). She later turned to anthropology under the influence of FRANZ BOAS and ALFRED L. KROEBER. Her *Pueblo Indian Religion* (1936) and *Mitla* (1936) remain standard studies of Pueblo and Zapotec Indian cultures. She also produced notable collections of West Indian and African American folklore.

Parsons, Talcott (b. Dec. 13, 1902, Colorado Springs, Colo., U.S.—d. May 8, 1979, Munich, W.Ger.) U.S. sociologist. Parsons taught at Harvard University from 1927 to 1973. He advocated a structural-functional analysis, a study of the ways that interrelated and interacting units forming the structures of a social system contribute to the system's development and maintenance. He was largely responsible for introducing the work of ÉMILE DURKHEIM and MAX WEBER to American sociologists. His major work is *The Structure of Social Action* (1937). See also FUNCTIONALISM.

Parson's Cause Dispute involving English clergy in colonial Virginia over payment of salaries. When the British vetoed colonial laws that substituted currency for tobacco as payment for clerical salaries (1759), the clergy sued for back pay. In the most publicized case (1763), PATRICK HENRY defended a colonial parish against a suit by a clergyman, citing interference by the British and convincing a jury to return only one penny in damages. The clergy soon gave up their protest.

Pärt, Arvo (b. Sept. 11, 1935, Paide, Est.) Estonian composer. After years of experimentation, he began in the late 1970s to produce his own distinctive music. A devoutly Orthodox Christian, he developed a style based on the slow modulation of sounds such as those produced by bells and pure voice tones, a technique reminiscent of the medieval NOTRE-DAME SCHOOL and the sacred music of Eastern Orthodoxy. His major works include the violin concerto *Tabula Rasa* (1977), *Cantus in Memory of Benjamin Britten* (1977), *Magnificat-Antiphones* (1988), and *The Beatitudes* (1991).

Partch, Harry (b. June 24, 1901, Oakland, Calif., U.S.—d. Sept. 3, 1974, San Diego, Calif.) U.S. composer and instrument maker. He grew up in Arizona and was largely self-taught musically. During the Great Depression, he traveled as a hobo, conceiving many of his musical ideas while doing so. About 1930 he began building original percussion and string instruments, tunable to 43 divisions of the octave. His works often involve theatrical elements, reflecting his interest in African, Japanese, and Native American ritual. They include *Barstow—8 Hitchhiker Inscrip-*

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tions from a Highway Railing at Barstow, California (1941), *US Highball* (1943), and *And on the Seventh Day Petals Fell on Petaluma* (1966).

parterre \pär-'ter\ Division of garden beds in an ornamental pattern. The parterre grew out of the knot garden, a medieval form of bed in which various plant types were separated from each other by hedges. In the 16th century, the hedges were replaced by wooden or leaden shapes or by lines of shells or coal, and the areas between were filled with colored sand or stone chips. The naturalistic English garden of the 18th century displaced the elaborate parterre.

Parthenon \'pär-thə-ˌnän\ Chief temple of ATHENA on the ACROPOLIS at Athens. Built 447–432 BC by Ictinus and Callicrates under Pericles, it is considered the culmination of the Doric ORDER. Though the white marble temple has suffered damage over the centuries, including the loss of most of its sculpture, its basic structure remains intact. The colonnade supports an entablature consisting of a plain architrave, a frieze of alternating triglyphs (grooved blocks) and metopes (plain blocks with relief sculpture) and, at the two ends, a triangular pediment. The colonnade consists of eight columns on the ends and 17 on the sides, enclosing a cella; the interior originally held a great gold-and-ivory statue by PHIDIAS. Such architectural devices as entasis of the columns and an upward curvature of the base are used to correct optical illusions. Its sculpture rivaled its architecture. The pediment sculptures represent the birth of Athena and her battle with Poseidon; a continuous frieze shows the annual Panathenaic procession of citizens honoring Athena. The entire work is a marvel of harmony and clarity. See also ELGIN MARBLES.

Parthenon, on the Acropolis, Athens, by Ictinus and Callicrates, 447–432 BC
ALISON FRANTZ

Parthia Ancient land, southwestern Asia. Corresponding roughly to modern northeastern Iran, it formed a province of the Persian ACHAEMENIAN DYNASTY and later of the empire of ALEXANDER THE GREAT. After the dissolution of the SELEUCID DYNASTY c. 250 BC, a new Parthian kingdom was founded by Arsaces. The ARSACID DYNASTY ruled until it was overthrown by the SĀSĀNIAN DYNASTY c. AD 226. At its height in the early 1st century BC, it was known as the Parthian empire and included the area between the EUPHRATES and INDUS rivers and between the AMU DARYA and the Arabian Sea. It was weakened by internal disorder and by conflict with Rome in the 1st century BC. One of its later capitals was HECATOMPYLOS. The ruins of CTESIPHON, another major Parthian city, are in modern Iraq, near Baghdad. The Parthians were famous as horsemen and archers.

Parti Québécois \pär-tē-kā-be-'kwä\ Provincial Canadian political party founded in 1968 by RENÉ LÉVESQUE and other French-Canadian separatists in the province of Quebec. In the 1976 provincial election it won a majority in the Quebec assembly, which then decreed French as the province's only official language of government and business. After a separatist referendum on independence failed (1980), the party lost membership. The party revived in the 1990s, winning the provincial election in 1994. In 1995 the party held another referendum on secession, which was narrowly defeated.

partial derivative In DIFFERENTIAL CALCULUS, the DERIVATIVE of a function of several VARIABLES with respect to change in just one of its variables. Partial derivatives are useful in analyzing surfaces for MAXIMUM and MINIMUM points and give rise to PARTIAL DIFFERENTIAL EQUATIONS. As with ordinary derivatives, a first partial derivative represents a rate of change or a SLOPE of a TANGENT LINE. For a three-dimensional surface, two first partial derivatives represent the slope in each of two perpendicular directions. Second, third, and higher partial derivatives give more information about how the function changes at any point.

partial differential equation In mathematics, an equation that contains PARTIAL DERIVATIVES, expressing a process of change that depends on more than one independent variable. It can be read as a statement about how a process evolves without specifying the formula defining the process. Given the initial state of the process (such as its size at time zero) and a description of how it is changing (i.e., the partial differential equation), its defining formula can be found by various methods, most based on INTEGRATION. Important partial differential equations include the heat equation, the wave equation, and LAPLACE'S EQUATION, which are central to MATHEMATICAL PHYSICS.

particle accelerator Device that accelerates a beam of fast-moving, electrically charged atoms (IONS) or SUBATOMIC PARTICLES. Accelerators are used to study the structure of atomic nuclei (see ATOM) and the nature of subatomic particles and their FUNDAMENTAL INTERACTIONS. At speeds close to that of light, particles collide with and disrupt atomic nuclei and subatomic particles, allowing physicists to study nuclear components and to make new kinds of subatomic particles. The CYCLOTRON accelerates positively charged particles, while the betatron accelerates negatively charged ELECTRONS. SYNCHROTRONS and LINEAR ACCELERATORS are used either with positively charged particles or electrons. Accelerators are also used for radioisotope production, cancer therapy, biological sterilization, and one form of radiocarbon dating.

particle physics *or* **high-energy physics** Study of the fundamental SUBATOMIC PARTICLES, including both MATTER (and ANTIMATTER) and the carrier particles of the FUNDAMENTAL INTERACTIONS as described by QUANTUM FIELD THEORY. Particle physics is concerned with structure and forces at this level of existence and below. Fundamental particles possess properties such as ELECTRIC CHARGE, SPIN, MASS, MAGNETISM, and other complex characteristics, but are regarded as pointlike. All theories in particle physics involve QUANTUM MECHANICS, in which symmetry is of primary importance. See also ELECTROWEAK THEORY, LEPTON, MESON, QUANTUM CHROMODYNAMICS, QUARK.

parting In METALLURGY, the separation of GOLD and SILVER by chemical or electrochemical means. Gold and silver are often extracted together from the same ores or recovered as by-products from the extraction of other metals. A solid mixture of the two, known as bullion or doré, can be parted by boiling in nitric acid. The silver is dissolved as SILVER NITRATE, leaving a gold residue that is filtered off and washed; silver is precipitated out of solution by adding ferrous sulfate. This is the traditional method used in ASSAYING the content of gold and silver samples.

partnership Association of two or more persons or entities that conduct a business for profit as co-owners. Except in the case of the LIMITED LIABILITY partnership, which shares with the corporation the characteristic of being treated as a single entity whose members have limited personal liability, a partnership is traditionally viewed as an association of individuals rather than an entity with a separate and independent existence. A partnership cannot exist beyond the lives of the partners. The partners are taxed as individuals and are personally liable for TORTS and contractual obligations. Each is viewed as the agent of the others, and traditionally all are jointly and severally liable for the tortious acts of any partner.

partridge Any of certain species of Old World game bird in the family Phasianidae. The European gray partridge (*Perdix perdix*), introduced into North America, has a reddish face and tail, gray breast, barred sides, and a dark U shape on the belly. Males may be 12 in. (30 cm) long. The hen lays about 15 eggs in a grassy cup in grainfields or hedges. Family groups (coveys) forage for seeds and insects. The five Asian and 35 African species of francolins (genus *Francolinus*) have leg spurs and are 10–16 in. (25–40 cm) long. The snow partridge (*Lerwa lerwa*) inhabits high Asian mountains. Partridges are larger than QUAIL and have a stronger bill and feet. GROUSE and BOBWHITES are often erroneously called partridge.

parturition *or* **birth** *or* **childbirth** *or* **labour** *or* **delivery** Process of bringing forth a child from the UTERUS, ending PREGNANCY. It has three stages. In dilation, uterine contractions lasting about 40 seconds begin 20–30 minutes apart and progress to severe labour pains about every 3 minutes. The opening of the cervix widens as contractions push the FETUS. Dilation averages 13–14 hours in first-time mothers, less if a woman has

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had previous babies. When the cervix dilates fully, expulsion begins. The "water" (amniotic sac) breaks (if it has not already), and the woman may actively push. Expulsion lasts 1–2 hours or less. Normally, the baby's head emerges first; other positions make birth more difficult and risky. In the third stage, the PLACENTA is expelled, usually within 15 minutes. Within six to eight weeks, the mother's REPRODUCTIVE SYSTEM returns to nearly the prepregnancy state. See also CESAREAN SECTION; LACTATION; MIDWIFERY; MISCARRIAGE; NATURAL CHILDBIRTH; OBSTETRICS AND GYNECOLOGY; PREMATURE BIRTH.

Party of God See HEZBOLLAH

party system Political system in which individuals who share a common set of political beliefs organize themselves into parties to compete in elections for the right to govern. Single-party systems are found in countries that do not allow genuine political conflict. Multiparty and two-party systems represent means of organizing political conflict within pluralistic societies and are thus indicative of democracy. Multiparty systems allow for greater representation of minority viewpoints; since the coalitions that minority parties must often form with other minority parties to achieve a governing majority are often fragile, such systems may be marked by instability. See also ELECTORAL SYSTEM.

Parvati \'pär-və-ˌtē\ Wife of the Hindu god SHIVA. Parvati is the benevolent aspect of Shakti, the Hindu supreme goddess (see SHAKTISM). According to the traditional account of her marriage, she won Shiva's notice only after severe ascetic discipline. The couple had two children, the elephant-headed GANESHA and the six-headed Skanda. In sculpture Parvati is always depicted as a mature and beautiful woman. The sacred TANTRAS are framed as a discussion between Parvati and Shiva.

Parvati, bronze image, early Cola period, 10th century AD; in the Freer Gallery of Art, Washington, D.C.
COURTESY OF THE SMITHSONIAN INSTITUTION, FREER GALLERY OF ART, WASHINGTON, D.C.

Pas de Calais See Strait of DOVER

pas de deux \pä-də-'dœ\ *French* **"step for two"** Dance for two performers. A characteristic part of classical BALLET, it includes an adagio, or slow dance, by the ballerina and her partner; solo variations by the male dancer and then the ballerina; and a coda, or conclusion, with both partners dancing together to display their virtuosity. Celebrated pas de deux occur in *Sleeping Beauty*, *Swan Lake*, and *Giselle*.

Pasadena City (pop., 2000: 133,936), southwestern California, U.S., at the base of the SAN GABRIEL MOUNTAINS. Founded in 1874, it was incorporated as a city in 1886. It grew as a winter resort and citrus centre after the construction of the Santa Fe Railway and the freeway system that link it to LOS ANGELES to the southwest. It is a centre of scientific research, based on the CALIFORNIA INSTITUTE OF TECHNOLOGY and its Jet Propulsion Laboratory. It is the site of the annual college football ROSE BOWL and the New Year's Day Tournament of Roses, a flower festival begun in 1890.

Pasadena City (pop., 2000: 141,674), southeastern Texas, U.S., east of HOUSTON. Founded in 1895, it was incorporated in 1929. After World War II the city grew rapidly, stimulated by nearby industrial development, especially in petrochemicals and aerospace. Northeast of the city is the site of the 1836 capture of Mexican Gen. ANTONIO SANTA ANNA after the Battle of San Jacinto.

Pasargadae \pə-'sär-gə-ˌdē\ Ancient Persian city, near modern SHĪRĀZ, Iran. It was the capital of CYRUS II, founder of the ACHAEMENIAN DYNASTY. He was said to have founded the city on the site of his victory over the last king of the Medes (c. 550 BC). The city was surrendered to ALEXANDER THE GREAT in 330 BC. It was known for the majestic simplicity of its architecture; its ruins include the bases of several large buildings and the nearly intact tomb of Cyrus.

Pascal \pas-'kal\ Computer PROGRAMMING LANGUAGE named for BLAISE PASCAL and based partly on ALGOL. It was developed by Niklaus Wirth of Zurich's Federal Institute of Technology in the late 1960s as an educational tool for systematic teaching of programming, with fast, reliable COMPILERS. It was made available to the public in 1974 and was used by many universities for the next 15 years. Pascal strongly influenced languages developed later, such as ADA. Complex DATA STRUCTURES and ALGORITHMS can be described concisely by Pascal, and its programs are easy to read and debug.

pascal Unit of PRESSURE, abbreviated Pa, in the INTERNATIONAL SYSTEM of Units. Named for BLAISE PASCAL, the unit is a pressure of one NEWTON per square meter (1 N/m^2). It is inconveniently small for many purposes, and the kilopascal (kPa), 1,000 N/m^2, is more commonly used in engineering work (1 lb per sq in. equals 6.895 kPa).

Pascal \pas-'kal**, Blaise** (b. June 19, 1623, Clermont-Ferrand, France—d. Aug. 19, 1662, Paris) French mathematician, physicist, and religious philosopher. The son of a mathematician, he was a child prodigy, earning the envy of RENÉ DESCARTES with an essay he wrote on conic sections in 1640. In the 1640s and '50s he made contributions to physics (formulating PASCAL'S LAW) and mathematics (working on the arithmetic triangle, inventing a calculating machine, and contributing to the advance of differential calculus). For work done in his early years, he is regarded as the founder of the modern theory of probability. At the same time, he became increasingly involved with JANSENISM. *Les Provinciales* were a series of letters defending Jansenism and attacking the JESUITS. His great work of Christian apologetics, *Apologie de la religion chrétienne,* was never finished, but he put together most of his notes and fragments between 1657 and 1658; these were published posthumously as *Pensées* (1670). He returned to scientific work, contributing to the *Éléments de géométrie* and publishing his findings on cycloid curves, but he soon returned to devotional life and spent his last years helping the poor. The PASCAL was named in his honour. See also PASCAL'S WAGER.

Pascal's law *or* **Pascal's principle** In FLUID MECHANICS, the statement that in a fluid at rest in a closed container, a PRESSURE change in one part is transmitted without loss to every portion of the fluid and to the walls of the container. The principle was first stated by BLAISE PASCAL, who also discovered that the pressure at a point in a fluid at rest is the same in all directions, and that the pressure would be the same on all planes passing through a specific point.

Pascal's wager Practical argument for belief in God formulated by BLAISE PASCAL. In his *Pensées* (1657–58), Pascal posed the following argument to show that belief in the Christian religion is rational: If the Christian God does not exist, the agnostic loses little by believing in him and gains correspondingly little by not believing. If the Christian God does exist, the agnostic gains eternal life by believing in him and loses an infinite good by not believing. WILLIAM JAMES objected to the argument that it supported belief in any religion that promised an eternal afterlife. Others have objected that though the argument does give one a reason for believing in the Christian God, it does not make that belief "rational" in the proper sense.

Paschal \pas-'kal\ **II** *orig.* **Raniero** (b. Bieda di Galeata, near Ravenna—d. Jan. 21, 1118) Pope (1099–1118). He fostered the First CRUSADE and favoured Gregorian reforms, but his pontificate was dominated by the INVESTITURE CONTROVERSY. Paschal came to terms on the issue of lay investiture with HENRY I of England and Philip I of France (1107). His negotiations with Emperors HENRY IV and Henry V were unsuccessful, and he was imprisoned by Henry V (1111). While a prisoner, he agreed to royal investiture of bishops and crowned Henry emperor, but a church council declared his concessions invalid, and the archbishop of Vienne excommunicated the emperor.

Pascin \pȧs-'kaⁿ**, Jules** *orig.* **Julius Pincas** (b. March 31, 1885, Vidin, Bulg.—d. June 1, 1930, Paris, France) Bulgarian painter. He traveled widely and lived in Austria and Germany, producing drawings for satirical journals, before moving to Paris in 1905. He moved to New York City during World War I and became a U.S. citizen but returned to Paris in 1920 and became associated with other Jewish artists, including MARC CHAGALL, AMEDEO MODIGLIANI, and CHAIM SOUTINE. His most notable works

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are thinly painted, delicately toned, ironic studies of women; he also painted portraits and a series of large-scale biblical and mythological scenes. Though financially successful, he was emotionally unstable; he hanged himself at 45.

Pashtun \ˌpäsh-ˈtůn\ Any member of a Pashto-speaking people of southeastern Afghanistan and northwestern Pakistan. The Pashtun, who number about 7.5 million in Afghanistan and 14 million in Pakistan, constitute the majority of the population of Afghanistan. Their origins are unclear: Pashtun tradition asserts that they are descended from Afghana, grandson of King Saul of Israel, but most scholars believe that they arose from an intermingling of ancient Aryans from the north or west with subsequent invaders. Each Pashtun tribe is divided into clans, subclans, and patriarchal families. Disputes among the Pashtun over property, women, and personal injury often result in blood feuds between families and whole clans. Most tribal people are sedentary farmers; some are migratory herders and caravaners. Large numbers of the Pashtun have always been attracted to military service.

Pašić \ˈpä-shēchˌ\ *English* \ˈpä-shich**, Nikola** (b. Dec. 31, 1845, Zaječar, Serbia—d. Dec. 10, 1926, Belgrade) Serbian and Yugoslav statesman. The editor of a socialist newspaper in Serbia, he was elected in 1878 to the legislature, where he opposed the authoritarian monarchy and advocated a parliamentary democracy. In 1881 he helped found the Radical Party, but he was forced to flee to Bulgaria in 1883. Returning to Serbia in 1889 under a new king, he served as premier (1891–92) and as ambassador to Russia (1893–94). Forced into exile again because of his political radicalism (1899–1903), he returned to support the Karadjordjević dynasty and King Peter I. As leader of the Radical Party, he served as premier of Serbia during most of the period (1904–18), then helped create the new Kingdom of Serbs, Croats, and Slovenes (later Yugoslavia). As premier (1921–26), he pushed for a unitary constitution that confirmed Serbia's dominance despite opposition from the historically separate regions.

Pašić.
H. ROGER-VIOLLET

Pasionaria, La See Dolores Ibárruri

Pasolini \ˌpä-sō-ˈlē-nē**, Pier Paolo** (b. March 5, 1922, Bologna, Italy—d. Nov. 2, 1975, Ostia, near Rome) Italian film director, poet, and novelist. He wrote novels about Rome's slum life as well as a significant body of poetry. Pasolini became a screenwriter in the mid-1950s, collaborating most notably on Federico Fellini's *Nights of Cabiria* (1956). His directorial debut, *Accattone* (1961), was based on his novel *A Violent Life* (1959). His best-known film, stylistically unorthodox and implicitly radical, is perhaps *The Gospel According to Saint Matthew* (1964). Later films include *Oedipus Rex* (1967), *Teorema* (1968), *Medea* (1969), *The Canterbury Tales* (1972), and *The Arabian Nights* (1974), which won a special jury prize at Cannes. His use of eroticism, violence, and depravity were criticized by Italian religious authorities.

pasqueflower See anemone

passage, rite of Any of numerous ceremonial events, existing in all societies, that mark the passage of an individual from one social or religious status to another. The term was coined by the French anthropologist Arnold van Gennep (1873–1957) in 1909. Many of the most important rites are connected with the biological stages of life—birth, maturity, reproduction, and death. Other rites celebrate changes that are wholly cultural, such as initiation into special societies. In modern societies, graduation from school is a rite of passage. Scholars often interpret rites of passage as mechanisms by which society confronts and incorporates change without disrupting the equilibrium necessary to social order. See also secret society.

Passamaquoddy Bay Inlet of the Bay of Fundy, between southwestern New Brunswick, Canada, and southeastern Maine, U.S., at the mouth of the St. Croix River. Deer Island and Campobello Island are in its southern part. It has an immense tidal flow, with about 70 billion cu ft (2 billion cu m) entering and leaving twice daily on the turn of the tide.

passenger pigeon Extinct species (*Ectopistes migratorius*) of pigeon (subfamily Columbinae, family Columbidae). Passenger pigeons were about 13 in. (32 cm) long and had a long pointed tail; the male was pinkish, with a blue-gray head. Billions inhabited eastern North America in the early 19th century; migrating flocks darkened the skies for days at a time. Gunners began to slaughter them in huge numbers for shipping by railway carloads for sale in city meat markets. Martha, the last known passenger pigeon, died in 1914 in the Cincinnati Zoo. The bird's extinction was largely responsible for ending the marketing of game birds and gave major impetus to the conservation movement.

Passenger pigeon, mounted (*Ectopistes migratorius*)
BILL REASONS—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

passerine Any perching bird. All passerines belong to the largest order of birds, Passeriformes, and have feet specialized for holding onto a horizontal branch (perching). The passerine foot has three forward-directed toes and one backward-directed toe. Most passerines have moderately curved, sharp claws. Some ground-dwelling species (e.g., larks, pipits) have flatter, longer feet. Species that spend much time airborne (e.g., swallows) have small, weak feet. Species that cling and climb (e.g., nuthatches) have strong, sharp, curved claws. Passerines include about 4,000 species of oscines (songbirds; suborder Passere, or Oscines) and 1,100 species of suboscines (suborders Eurylaimi, called broadbills; Tyranni, including flycatchers; and Menurae, including lyrebirds). Suboscines lack the syrinx of the songbirds or have only a poorly developed one, but some can utter complex vocalizations. All passerines are land birds, abundant worldwide except in Antarctica. Most are insectivorous, solitary nesters that build a cup-shaped open nest.

Passion Musical setting of the suffering and crucifixion of Christ. The early Passion consisted entirely of plainchant. Liturgical enactments of Christ's Passion date from the early Middle Ages, the characters' parts being sung by individual celebrants and the crowd's role by the congregation. Polyphonic Passions began appearing in the 15th century. In the German tradition exemplified by Heinrich Schütz, the Passion closely resembles the dramatic oratorio, with solo arias and other ensembles contrasting with choral sections; the alternative motet-style Passion lacked solo sections and avoided dramatic oppositions. After the 18th century, Passions ceased to be widely composed.

Passion play Religious drama of medieval origin dealing with the suffering, death, and resurrection of Jesus. Early Passion plays were written in Latin and consisted of Gospel readings alternating with poetic descriptions of the events of Christ's Passion (i.e., his sufferings between the Last Supper and his death). Use of the vernacular for these poetic passages led to the development of independent vernacular plays. By the 16th century many of the plays had been overtaken by secular influences and had become mere popular entertainments. Some survived into the 21st century, most notably the one performed by local villagers every 10 years at Oberammergau, Ger. See also liturgical drama; miracle play; mystery play.

passionflower family Family Passifloraceae, composed of about 600 species of herbaceous or woody vines, shrubs, and trees in 20 genera. Members of this family grow mostly in warm regions. Many species produce edible fruits. Members of the largest genus, *Passiflora*, are highly prized for their showy, unusual flowers. A pedestal-like structure in the centre of the flower carries the reproductive parts of both sexes. The passionflower blossom is often used to symbolize events in the last hours (Passion) of Jesus, which accounts for the name of the group.

passive resistance See civil disobedience, satyagraha

Passover In Judaism, the holiday commemorating the liberation of the Hebrews from slavery in Egypt. Before sending a plague to destroy the firstborn of the Egyptians, God instructed Moses to tell the Israelites to place a special mark above their doors as a signal for the angel of death to pass over (i.e., spare the residents). The festival of Passover begins on the 15th and ends on the 22nd (in Israel, the 21st) day of the month of Nisan (March or April). During Passover only unleavened bread may be

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eaten, symbolizing the Hebrews' suffering in bondage and the haste with which they left Egypt. On the first night of Passover, a SEDER is held, and the HAGGADAH is read aloud.

passport Document issued by a national government identifying a traveler as a citizen with a right to protection while abroad and a right to return to the country of citizenship. It is normally a small booklet containing a description and photograph of the bearer. Most nations require entering travelers to obtain a visa, an endorsement on the passport showing that the proper authorities have examined it and permitting the bearer to enter the country and remain for a specified period.

pasta Any of several starchy food pastes (*pasta alimentaria*) made from semolina, the purified middlings (endosperm) of a hard WHEAT called durum. Pasta is traditionally associated with Italian cuisine, though it may have entered Europe from Asia during the Mongol invasions of the 13th century. In making pasta, semolina dough is rolled out and sliced or compacted and forced through perforated plates (dies) that form it into the desired shape. It is produced in the form of sheets, ribbons, cords, tubes, and other shapes, each with its own name (e.g., spaghetti, macaroni). The formed dough is then dried under controlled conditions. Pasta is boiled and topped with a sauce or combined with other foods before serving.

pastel Drawing medium consisting of fragile, finger-size crayons called pastels, made of powdered pigments combined with a minimum of nongreasy binder (usually gum tragacanth or, from the mid-20th century, methyl cellulose). Because pigment applied with pastel does not change in colour value, the final effect can be seen immediately. Pastel remains on the surface of the paper and thus can be easily obliterated unless protected by glass or a fixative spray of glue size or gum solution. When pastel is applied in short strokes or linearly, it is usually classed as drawing; when it is rubbed, smeared, and blended to achieve painterly effects, it is often regarded as a painting medium.

Pasternak, Boris (Leonidovich) (b. Feb. 10, 1890, Moscow, Russia—d. May 30, 1960, Peredelkino, near Moscow) Russian poet and prose writer. He studied music and philosophy and after the Russian Revolution of 1917 worked in the library of the Soviet commissariat of education. His early poetry, though avant-garde, was successful, but in the 1930s a gap widened between his work and officially approved literary modes, and he supported himself by doing translations. The novel *Doctor Zhivago* (1957; film, 1965), an epic of wandering, spiritual isolation, and love amid the harshness of the revolution and its aftermath, was a best-seller in the West but until 1987 circulated only in secrecy in the Soviet Union. Pasternak was awarded the Nobel Prize for Literature in 1958, but he was forced to decline it because of Soviet opposition to his work.

Pasteur \pas-'tər**, Louis** (b. Dec. 27, 1822, Dole, France—d. Sept. 28, 1895, Saint-Cloud, near Paris) French chemist and microbiologist. Early in his career, after studies at the École Normale Supérieure, he researched the effects of polarized light on chemical compounds. In 1857 he became director of scientific studies at the École. His studies of FERMENTATION of alcohol and milk (souring) showed that yeast could reproduce without free oxygen (the Pasteur effect); he deduced that fermentation and food spoilage were due to the activity of microorganisms and could be prevented by excluding or destroying them. His work overturned the concept of spontaneous generation (life arising from nonliving matter) and led to heat PASTEURIZATION, allowing vinegar, wine, and beer to be produced and transported without spoiling. He saved the French silk industry by his work on silkworm diseases. In 1881 he perfected a way to isolate and weaken germs, and he went on to develop VACCINES against anthrax in sheep and cholera in chickens, following EDWARD JENNER's example. He turned his attention to researching rabies, and in 1885 his inoculating with a weakened virus saved the life of a boy bitten by a rabid dog. In 1888 he founded the Pasteur Institute for rabies research, prevention, and treatment.

Pasteurella \ˌpas-chə-'rel-ə\ Genus (named after LOUIS PASTEUR) of rod-shaped BACTERIA that cause several serious diseases in domestic animals and milder infections in humans. Members are gram-negative (see GRAM STAIN), do not move, and do not require oxygen. The widespread infections they cause, referred to by the general term *pasteurelloses*, are transmitted by direct contact and, in some cases, by ticks and fleas. Control by vaccine is variable, as is treatment with penicillin and other antibiotics.

pasteurization Partial STERILIZATION of a substance, especially MILK or other beverages, by using heat to destroy microorganisms while leaving its chemical makeup unaltered. The process is named for LOUIS PASTEUR, its originator. Pasteurization of milk requires temperatures of about 145 °F (63 °C) for about 30 minutes, or higher temperatures for shorter periods. The treatment destroys any disease-causing organisms (principally *Mycobacterium tuberculosis*) as well as organisms that cause spoilage. See also FOOD PRESERVATION.

Pastor, Tony *orig.* **Antonio Pastor** (b. May 28, 1837, New York, N.Y., U.S.—d. Aug. 26, 1908, Elmhurst, N.Y.) U.S. impresario and comic singer. He appeared at P.T. BARNUM's American Museum as a child prodigy and first performed in a variety show in 1861. After managing a series of New York City theatres, he opened the Fourteenth Street Theatre in 1881. Though variety shows of the time featured coarse humour and were considered unsuitable for ladies, he advertised his theatre as "the first specialty and vaudeville theatre of America, catering to polite tastes." His unexpected success spurred other theatre managers to follow suit and led to the creation of VAUDEVILLE. See also MUSIC HALL AND VARIETY THEATRE.

Tony Pastor
CULVER PICTURES

pastoral \ˌpas-tə-'räl\ Literary work dealing in a usually artificial manner with shepherds or rural life, typically contrasting the innocence and serenity of the simple life with the misery and corruption of city or court life. The characters are often the vehicles for the author's moral, social, or literary views. The poet and his friends are often presented as shepherds and shepherdesses; two or more shepherds sometimes contend in "singing matches." The conventions of pastoral poetry were largely established by THEOCRITUS, whose bucolics are its earliest examples. VIRGIL's *Eclogues* were influential as well, as was EDMUND SPENSER's *Shepheardes Calender* in the Renaissance. The idea of pastoral as meaning a simpler world that somehow mirrors a more complex one also appears in novelists as different as FYODOR DOSTOYEVSKY, LEWIS CARROLL, and WILLIAM FAULKNER. See also ECLOGUE.

Pastoureaux \ˌpas-tȯr-'ō\ (French: "shepherds") Participants in two outbreaks of mob violence in medieval France. The first Pastoureaux were peasants in northeastern France aroused by news in 1251 of the reverses suffered by King LOUIS IX while on his CRUSADE. Accusing the nobles, clergy, and bourgeoisie of indifference to the king's fate, they began pillaging churches and towns and attacking clerics, the rich, and Jews. The second Pastoureaux converged on Paris in 1320 to punish Philip V for failing to undertake a Crusade he had called. They sacked the city, opened the prisons, and marched into the countryside, where they carried out pogroms against Jews and lepers before being suppressed.

Pasupata \'pä-shů-ˌpə-tə, ˌpä-shů-'pə-tə\ Early Hindu sect that worshiped SHIVA as the supreme deity. Numerous subsects flourished in northern and northwestern India until at least the 12th century and spread to Java and Cambodia. Pasupata teachings were believed to have originated with Shiva himself, reincarnated as the teacher Lakulin. The sect's rise is dated roughly between the 2nd century BC and the 2nd century AD. The ascetic practices adopted by the Pasupatas included smearing their bodies thrice-daily with ashes. Out of Pasupata doctrine developed two extreme schools, KAPALIKA AND KALAMUKHA, as well as one moderate sect, SHAIVISM.

Patagonia Semiarid scrub plateau, southern Argentina. It is the largest desert region in the Americas, with an area of about 260,000 sq mi (673,000 sq km). Its approximate boundaries are the COLORADO RIVER in the north, the Atlantic Ocean in the east, the Strait of Magellan in the south, and the ANDES MOUNTAINS in the west. A region of vast and virtually treeless plains, it has a variety of wildlife, including llamas, pumas, and eagles. Natural resources include petroleum, iron ore, copper, uranium, and manganese.

Patarine *or* **Patarene** \'pa-tə-rən\ Member of a group of craftsmen, tradesmen, and peasants, as well as some members of the clergy, that appeared in Milan c. 1058 to call for reform of the church. Named for the Pataria, the ragpickers' quarter of Milan where they assembled, the Patar-

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ines attacked SIMONY and clerical concubinage and marriage and opposed the clergy's moral corruption. They also encouraged greater participation by the laity in religious life and drew support from the Gregorian Reform popes, including Alexander II and GREGORY VII. The Patarines formed part of the broader movement for church reform in the 11th century, and the resignation of their rival, the archbishop of Milan, led to a schism in the city that would help bring about the INVESTITURE CONTROVERSY. In the later 12th century, the name Patarine was used as a general label for all heretics, particularly the CATHARI.

patch test Controlled application of biological or chemical substances to the skin to test for ALLERGY. Small amounts of diluted test substances applied under a patch of cloth or soft paper and an impermeable membrane are left in place for 48 hours, and the skin reaction is then examined and scored from 0 (none) to 4+ (severe blistering and redness).

Patel \pə-'tāl**, Vallabhbhai (Jhaverbhai)** *known as* **Sardar Patel** (b. Oct. 31, 1875, Nadiad, Gujarat, India—d. Dec. 15, 1950, Bombay) Indian statesman. Educated in India, he set up his own law office in 1900 and later studied law in Britain; he did not become involved in politics until 1917. Like MOHANDAS K. GANDHI (and unlike JAWAHARLAL NEHRU), he advocated dominion status within the British Commonwealth rather than independence for India. He opposed armed struggle on practical rather than moral grounds, and he was not interested in Hindu-Muslim unity. Patel was repeatedly a candidate for the presidency of the Indian National Congress, but his uncompromising attitude toward the Indian Muslims cost him Gandhi's support and, ultimately, the presidency. After Indian independence (1947), he held several cabinet positions. He is remembered for achieving the peaceful integration of the princely Indian states into the Indian union and the political unification of India.

Patenier, Joachim de See JOACHIM PATINIR

patent Government grant to an inventor of the exclusive right to make, use, or sell an invention, usually for a specified term. It may be granted for a process or method that is new, useful, and not obvious, or for a new use of a known process, machine, or composition of matter or material, including asexually reproduced plants and genetically engineered organisms. It may also be granted for any new, original, and ornamental design for an article of manufacture. The first recorded patent for an industrial invention was granted in 1421 in Florence to the architect and engineer FILIPPO BRUNELLESCHI. Until recently there were wide variations in the patent systems implemented by different countries. The duration of patents recognized generally ranged from 16 to 20 years. In some countries (e.g., France), some patents were given shorter terms because the inventions had an overall general usefulness. In communist countries (e.g., the Soviet Union), patents per se were not recognized; instead, certificates were issued to inventors to ensure that they received some form of compensation for their work. The agreement establishing the WORLD TRADE ORGANIZATION in the 1990s specifies a minimum set of exclusive rights that all patentees must be accorded and mandates a minimum patent term of 20 years from the date an application is filed. Patents are considered personal property and may be sold, assigned, or otherwise transferred.

Pater \'pā-tər**, Walter (Horatio)** (b. Aug. 4, 1839, Shadwell, London, Eng.—d. July 30, 1894, Oxford, Oxfordshire) English critic, essayist, and humanist. Elected a fellow at the University of Oxford in 1864, Pater made his reputation as a scholar and aesthete with essays collected in *Studies in the History of the Renaissance* (1873). Written in a delicate, fastidious style, the essays introduced his influential advocacy of "art for art's sake," which contrasted with the prevailing emphasis on art's moral or educational values and became a cardinal doctrine of AESTHETICISM. *Marius the Epicurean* (1885), a philosophical romance on the ideal life, is his most substantial work.

Paterson City (pop., 2000: 149,222), northeastern New Jersey, U.S. It is located on the Passaic River, north of NEWARK, N.J. It was founded in 1791 as an industrial settlement by advocates of U.S. industrial independence from Europe. The successful enterprise, begun by ALEXANDER HAMILTON, was known as the Society for Establishing Useful Manufactures. In the 19th century it was a centre of cotton textile production, the silk industry, and locomotive manufacturing. It received a city charter in 1851 and was the scene of many labour disputes. By the 20th century its industries were widely diversified.

Paterson, William (b. Dec. 24, 1745, County Antrim, Ire.—d. Sept. 9, 1806, Albany, N.Y., U.S.) Irish-born U.S. jurist. He immigrated with his family to New Jersey in 1747. He was the state's attorney general from 1776 to 1783. At the CONSTITUTIONAL CONVENTION he played a leading role in the opposition of the small states to representation according to population in the federal legislature, submitting the New Jersey (or small-state) Plan, which called for an equal vote for all states, to counter the Virginia (or large-state) Plan, which favoured larger states. He secured ratification of the CONSTITUTION OF THE UNITED STATES in New Jersey and was elected one of the state's first U.S. senators (1789–90). He served as governor of New Jersey from 1790 to 1793 and as a justice of the U.S. Supreme Court from 1793 to 1806.

Pathan See PASHTUN

Pathé \pà-'tā,\ *English* \pa-'thā**, Charles** (b. Dec. 25, 1863, Paris, France—d. Dec. 26, 1957, Monte-Carlo, Mon.) French film executive. In 1896 he and his brother Émile founded Pathé Frères, which distributed THOMAS ALVA EDISON's Kinetoscope viewing device to French theatres. The firm entered film production using the camera developed by the LUMIÈRE brothers. Pathé Frères filmed numerous short subjects, the majority of which are sensational criminal adventures, melodramatic love stories, and comic anecdotes. In 1909 Pathé produced his first "long film," *Les Misérables*, a four-reel screen version of the novel by Victor Hugo, and launched the *Pathé Gazette*, an internationally popular newsreel that ran until 1956. In 1914 Pathé Frères released the first episodes of *The Perils of Pauline*, one of the earliest screen SERIALS. With facilities throughout the world, Pathé Frères dominated the film market in the early 20th century, and it remained a film distributor after Charles's retirement in 1929.

pathology Medical specialty dealing with causes of disease and structural and functional changes in abnormal conditions. As AUTOPSIES, initially prohibited for religious reasons, became more accepted in the late Middle Ages, people learned more about the causes of death. In 1761 Giovanni Battista Morgagni (1682–1771) published the first book to locate disease in individual organs. In the mid-19th century the humoral theories of infection were replaced first by cell-based theories (see RUDOLF VIRCHOW) and then by the bacteriologic theories of ROBERT KOCH and LOUIS PASTEUR. Today pathologists work mostly in the laboratory and consult with a patient's physician after examining specimens including surgically removed body parts, blood and other fluids, urine, feces, and discharges. Culturing of infectious organisms, staining, fibre-optic endoscopy, and electron microscopy have greatly expanded the information available to the pathologist.

patina See DESERT VARNISH

Patinir \,pà-tə-'nir**, Joachim (de)** *or* **Joachim de Patinier** *or* **Joachim de Patenier** \,pà-tə-'nēr\ (b. c. 1485, Bouvignes, Namur—d. Oct. 5, 1524, Antwerp) Netherlandish painter. Nothing is known of his early life, but his work reflects knowledge of the paintings of GERARD DAVID. He is the first Western artist known to have specialized in landscape painting, though his work has a nominal religious subject and he never painted pure landscapes. His novelty lay in the fact that the religious motif in such works as *Flight into Egypt* (1515–20) was overshadowed by the phenomena of the natural world. He apparently made a practice of supplying landscape settings for figure compositions painted by other Flemish masters. His landscapes combine realistic detail with a sense of fantasy that suggests his familiarity with the works of HIËRONYMUS BOSCH.

patio In Spanish and Latin American architecture, a courtyard open to the sky within a building. A Spanish development of the Roman ATRIUM, it is comparable to the Italian *cortile* but provides more seclusion, possibly due to Moorish custom. The patio of the contemporary U.S. house is a paved outdoor area adjoining or partially enclosed by the building and often used for outdoor dining.

patio process *or* **Mexican process** Method of isolating SILVER from its ORE, apparently dating from pre-Columbian times. The ore was crushed and ground by mule power in ARRASTRAS, reducing it to a fine mud. This was then spread over a courtyard or patio, sprinkled with MERCURY, salt, and copper sulfate, and mixed by driving mules over it. Chemical reactions caused the silver to dissolve in the mercury. When the amalgamation was complete, the material was agitated with water in large tubs and the mud run off. The AMALGAM at the bottom was collected and heated to drive off the mercury. Used for much of the world's silver production for 350 years, the process was replaced by the CYANIDE PROCESS early in the 20th century.

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Patna \'pət-nə\ City (pop., 2001 prelim.: 1,376,950), capital of Bihar state, northeastern India, on the Ganges River. It was founded in the 5th century BC as Pataliputra and was the capital of Magadha until the 1st century BC. It was ruled later by the Mauryan empire. A centre of learning, it became the Gupta dynasty's capital in the 4th century AD but declined and was deserted by the 7th century. Revived as Patna in 1541 by an Afghan ruler, it became prosperous under the Mughal dynasty and passed to the British in 1765. Extensive archaeological excavations have been made in its vicinity.

Paton, Alan (Stewart) (b. Jan. 11, 1903, Pietermaritzburg, Natal, S.Af.—d. April 12, 1988, near Durban) South African writer and political activist. While principal of a reformatory housing black youths, Paton introduced controversial progressive reforms and wrote his best-known work, the novel *Cry, the Beloved Country* (1948), focusing international attention on the issue of apartheid. To offer a nonracial alternative to apartheid, he helped found the Liberal Party of South Africa in 1953 and led the organization until it was banned in 1968. His other works include the novel *Too Late the Phalarope* (1953) and the biographies *Hofmeyr* (1964) and *Apartheid and the Archbishop* (1973).

Paton, 1961
UPI

patria potestas \'pä-trē-ə-pō-'tes-ˌtäs\ *Latin* **"power of the father"** In Roman family law, the power that the male head of a family (*paterfamilias*) exercised over his descendants in the male line and over adopted children. Originally this power was absolute and included the power of life and death; a *paterfamilias* could acknowledge, banish, kill, or disown a child. He could free his male descendants from this obligation or turn over his daughter and all her inheritance to the power of her husband. By the end of the republic (from about the 1st century BC), a father could inflict only light punishment and his sons could keep what they earned.

patriarch Title applied to Old Testament leaders such as Methuselah, Abraham, Isaac, and Jacob. It was once given also to some Roman Catholic bishops who wielded great authority. It is still used in Eastern Orthodoxy, which now has nine patriarchates: Constantinople, Alexandria, Antioch, Jerusalem, Moscow, Georgia, Serbia, Romania, and Bulgaria.

patrician In ancient Rome, any member of a group of citizen families who, in contrast to the plebeians, formed a privileged nobility. They attempted to hold on to magistracies, priesthoods, and legal and religious knowledge, and the great civil struggle of the Roman republic was the effort of the plebeians to achieve equality and break the patrician monopoly. Gradually the patricians lost their monopoly—except in a few areas, such as selected priesthoods and the office of interrex—and in the late republic (1st century BC) the distinction lost political importance. After 27 BC, patrician rank was necessary for ascent to the imperial throne. After Constantine's reign (AD 337), the term became an honorary title with no particular power.

Patrick, Saint (fl. 5th century; feast day March 17) Patron saint of Ireland. Born in Britain of a Romanized family, he was captured at age 16 by Irish raiders and carried into slavery in Ireland. He spent six years as a herdsman before escaping from his master and being reunited with his family in Britain. Called in a dream to bring Christianity to the Irish, he returned to Ireland and journeyed far and wide, baptizing chiefs and kings and converting whole clans. One popular legend says that he explained the notion of the Holy Trinity using the shamrock, now the national flower of Ireland. He is also said to have rid Ireland of snakes.

patristic literature Body of literature that comprises those works (excluding the New Testament) written by Christians before the 8th century. It refers to the works of the Church Fathers. Most patristic literature is in Greek or Latin, but much survives in Syriac and other Middle Eastern languages. The works of the Apostolic Fathers contain the earliest patristic literature. By the mid-2nd century, Christians wrote to justify their faith to the Roman government and to refute Gnosticism. In the 4th and 5th centuries, Augustine of Hippo and others laid the foundation for much of medieval and modern Christian thought. Significant patristic authors include Justin Martyr, Origen, Tertullian, Eusebius of Caesarea, Athanasius, Basil the Great, St. Gregory of Nyssa, Gregory of Nazianzus, John Chrysostom, Ambrose, Ephraem Syrus (306?–373), St. Jerome, Theodore of Mopsuestia, St. Cyril of Alexandria (c. 375–444), St. Maximus the Confessor (c. 580–662), and Pope Gregory I.

patron saint Saint to whose protection and intercession a person, society, church, place, profession, or activity is dedicated. The choice is usually made on the basis of some real or presumed relationship (e.g., St. Patrick is the patron saint of Ireland because he is credited with introducing Christianity there).

patronage system See spoils system

pattern recognition In computer science, the imposition of identity on input data, such as speech, images, or a stream of text, by the recognition and delineation of patterns it contains and their relationships. Stages in pattern recognition may involve measurement of the object to identify distinguishing attributes, extraction of features for the defining attributes, and comparison with known patterns to determine a match or mismatch. Pattern recognition has extensive application in astronomy, medicine, robotics, and remote sensing by satellites. See also speech recognition.

patternmaking In materials processing, the first step in casting and molding processes, the making of an accurate model of the part, somewhat oversize to allow for shrinkage of the cast material as it cools. Foundry workers then make a mold from the pattern, introduce the liquid into the mold, and remove the hardened part from the mold. The processing of materials in liquid form is commonly known as casting when it involves metals, glass, and ceramics; it is called molding when it involves plastics and some other nonmetallic materials. Patternmaking is a highly skilled trade learned by apprenticeship.

Patterson, Floyd (b. Jan. 4, 1935, Waco, N.C., U.S.) U.S. boxer. Patterson grew up in Brooklyn, N.Y. As a middleweight amateur fighter, he won the N.Y. Golden Gloves championship in 1951 and '52 and won an Olympic gold medal in 1952. As a professional, he moved up to heavyweight and in 1956 succeeded Rocky Marciano as world heavyweight champion by knocking out Archie Moore. He lost the title to Ingemar Johansson in 1959, regained it in 1960 (becoming the first to hold the heavyweight championship twice), and lost it again in 1962 to Sonny Liston.

Patton, George S(mith) (b. Nov. 11, 1885, San Gabriel, Calif., U.S.—d. Dec. 21, 1945, Heidelberg, Ger.) U.S. army officer. He graduated from West Point and fought in World War I with the newly formed tank corps. He was later promoted to major general and given command of the 2nd Armored Division (1940). In World War II he led military operations in Morocco (1942) and Sicily (1943) and then commanded the 3rd Army in its sweep across northern France (1944) into Germany (1945). His strategy of bold and highly mobile operations in tank warfare, coupled with his strict, highly disciplined leadership, earned him his troops' respect and the nickname "Old Blood-and-Guts." Criticized for striking a hospitalized soldier he suspected of malingering, he later publicly apologized. He died in a car crash in Germany. See also Battle of the Bulge.

Paul *Russian* **Pavel Petrovich** (b. Oct. 1, 1754, St. Petersburg, Russia—d. March 23, 1801, St. Petersburg) Tsar of Russia (1796–1801). He was the son of Peter III and Catherine II, whom he succeeded as emperor in 1796. He reversed many of Catherine's policies, strengthened the autocracy, and established the law of succession within the male line of the Romanov dynasty. He provoked the hostility of the nobles and the army with his tyrannical rule and capricious foreign policy, which drew Russia into war with France. In a plot by the nobles to depose him and place his son Alexander (later Alexander I) on the throne, Paul was assassinated.

Paul III *orig.* **Alessandro Farnese** (b. Feb. 29, 1468, Canino, Papal States—d. Nov. 10, 1549, Rome) Pope (1534–49). The son of a noble Tuscan family, he was made a cardinal-deacon in 1493 and served as bishop in Parma and Ostia before being named dean of the College of Cardinals by Pope Leo X. Ordained a priest in 1519, he was unanimously elected pope in 1534. Though loose in morals in earlier years (he had three sons and a daughter), he became an efficient promoter of reform, convening the Council of Trent in 1545 and initiating the Counter-Reformation. He also supported the newly founded Jesuits and was a patron of the arts, the last in the tradition of the Renaissance popes.

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Paul VI *orig.* **Giovanni Battista Montini** (b. Sept. 26, 1897, Concesio, near Brescia, Italy—d. Aug. 6, 1978, Castel Gandolfo) Pope (1963–78). Educated at Brescia and ordained in 1920, he continued his studies in Rome, earning degrees in civil and canon law. He was a church diplomat for much of his career, until he was named archbishop of Milan in 1954. He became a cardinal in 1958, and in 1963 he was elected pope. Paul VI presided over the final sessions of the Second VATICAN COUNCIL and appointed commissions to carry out its reforms, including revisions in the MASS. He also relaxed rules on fasting, removed a number of questionable saints from the church's calendar, and enforced conservative positions on birth control and clerical celibacy. He promoted ECUMENISM and was the first pope to travel widely, visiting Israel, India, Asia, and Latin America.

Paul, Les *orig.* **Lester Polfus** (b. June 9, 1915, Waukesha, Wis., U.S.) U.S. guitarist and inventor. He played many styles of popular music, initially country but later jazz, and in the 1940s he was a sideman for NAT KING COLE and BING CROSBY. He invented the first solid-body electric guitar and was instrumental in developing modern multitrack recording. His overdubbed, sped-up recordings from the late 1940s and early 1950s—including "Brazil" (1948), "Nola" (1950), and "How High the Moon" (1951), often with his wife, Mary Ford (1924–77) singing multiple harmony parts—demonstrated the potential of tape. He continued to perform occasionally into his 80s.

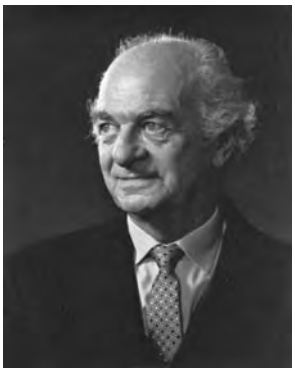
Paul, Lewis (d. April 1759, Kensington, Middlesex, Eng.) British inventor. Working with JOHN WYATT from about 1730, he developed the first power spinning machine (see DRAWING FRAME), which they patented in 1738. It operated by drawing cotton or wool through pairs of successively faster rollers. It was eventually replaced by RICHARD ARKWRIGHT's water frame. Paul also patented a CARDING MACHINE in 1748.

Paul, Saint *orig.* **Saul** (b. AD 10?, Tarsus in Cilicia—d. 67?, Rome) Early Christian missionary and theologian, known as the Apostle to the Gentiles. Born a Jew in TARSUS, Asia Minor, he was trained as a rabbi but earned his living as a tentmaker. A zealous PHARISEE, he persecuted the first Christians until a vision of JESUS, experienced while on the road to Damascus, converted him to Christianity. Three years later he met St. PETER and Jesus' brother James and was henceforth recognized as the 13th Apostle. From his base in Antioch, he traveled widely, preaching to the Gentiles. By asserting that non-Jewish disciples of Christ did not have to observe Jewish law, he helped to establish Christianity as a separate religion rather than a Jewish sect. On a journey to Jerusalem, he aroused such hostility among the Jews that a mob gathered, and he was arrested and imprisoned for two years. The circumstances of his death are unknown. Paul's ministry and religious views are known largely from his letters, or epistles, collected in the NEW TESTAMENT, which are the first Christian theological writing and the source of much Christian doctrine. It was due to Paul more than anyone else that Christianity became a world religion.

Pauli, Wolfgang (b. April 25, 1900, Vienna, Austria—d. Dec. 15, 1958, Zürich, Switz.) Austrian-born U.S. physicist. At the age of 20, he wrote a 200-page encyclopaedia article on the theory of relativity. He taught physics in Zürich (1928–40) and later at the Institute for Advanced Study in Princeton, N.J. In 1924 he proposed that a spin quantum number, +½ or –½, is necessary to specify electron energy states. In 1930 he proposed that the energy and momentum apparently lost when an electron is emitted from an atomic nucleus in beta decay is carried away by an almost massless, uncharged, and difficult-to-detect particle (the NEUTRINO). He was awarded a 1945 Nobel Prize for his 1925 discovery of the PAULI EXCLUSION PRINCIPLE.

Pauli exclusion principle Assertion proposed by WOLFGANG PAULI that no two ELECTRONS in an ATOM can be in the same state or configuration at the same time. It accounts for the observed patterns of light emission from atoms. The principle has since been generalized to include the whole class of particles called FERMIONS. The SPIN of such particles is always an odd whole-number multiple of ½. For example, electrons have spin ½, and can occupy two distinct states with opposite spin directions. The Pauli exclusion principle indicates, therefore, that only two electrons are allowed in each atomic energy state, leading to the successive buildup of ORBITALS around the NUCLEUS. This prevents matter from collapsing to an extremely dense state.

Pauling, Linus (Carl) (b. Feb. 28, 1901, Portland, Ore., U.S.—d. Aug. 19, 1994, Big Sur, Calif.) U.S. chemist. He received his doctorate from the California Institute of Technology and became a professor there in 1931. He was one of the first researchers to apply quantum mechanics to the study of molecular structures; to calculate interatomic distances and the angles between chemical bonds (see BONDING), he effectively used X-RAY DIFFRACTION, electron diffraction, magnetic effects, and the heat of REACTION. His book *The Nature of the Chemical Bond, and the Structure of Molecules and Crystals* (1939) became one of the century's most influential chemistry texts. He was the first recipient of the American Chemical Society's Langmuir Prize (1931) and later the first recipient of its Lewis medal (1951), and in 1954 he received the Nobel Prize for Chemistry. In 1962 his efforts on behalf of control of NUCLEAR WEAPONS and against nuclear testing brought him the Nobel Peace Prize, making him the first recipient of two unshared Nobel Prizes. In later years he devoted himself to the study of the prevention and treatment of illness by taking high doses of vitamins and minerals, particularly VITAMIN C.



Linus Pauling, photograph by Yousuf Karsh.
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Paulus \'paů-ləs**, Friedrich** (b. Sept. 23, 1890, Breitenau, Ger.—d. Feb. 1, 1957, Dresden, E.Ger.) German general in World War II. He became deputy chief of the German General Staff in World War II and commanded the German 6th Army in the Soviet Union. He was defeated in the Battle of STALINGRAD in 1943, and the surrender of his army of 300,000 men ended Germany's offensive in Russia. While a prisoner, Paulus agitated against ADOLF HITLER among the other German prisoners of war and later testified at the NÜRNBERG TRIALS. After his release from prison (1953), he settled in East Germany.

Pausanias \pȯ-'sā-nē-əs\ (fl. AD 143–176) Greek traveler and geographer. His *Description of Greece* is an invaluable guide to ancient ruins. He describes the religious art and architecture of OLYMPIA and DELPHI, the pictures and inscriptions at ATHENS, the statue of Athena on the ACROPOLIS, and (outside the city) the monuments of famous men and of Athenians fallen in battle. According to JAMES GEORGE FRAZER, without Pausanias the ruins of Greece would be "a labyrinth without a clue, a riddle without an answer."

pavane \pə-'vän\ Stately court dance introduced from southern Europe into England in the 16th century. The dance, consisting of forward and backward steps to music in duple time, was originally used to open ceremonial balls; later its steps became livelier and it came to be paired with the quick galliard in triple time.

Pavane, "The Dance in the Garden" illumination from the *Roman de la rose*, Toulouse, early 16th century; in the British Library (Harley MS 4425, fol. 14v)
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Pavarotti, Luciano (b. Oct. 12, 1935, Modena, Italy) Italian tenor. He started out as a schoolteacher, beginning his vocal training only in his 20s. He made his professional debut in 1961, then debuted at La Scala in 1965 and at the Metropolitan Opera in 1968. He retained the beautiful tone and thrilling high notes that his audiences loved into his 60s, nurturing his broad appeal by recording many light pieces in addition to the traditional Italian repertoire in which he specialized. The most famous male classical singer of the late 20th century, he came to personify the Italian tenor worldwide.

pavement Durable surfacing of a road, path, court, patio, plaza, airstrip, or other such area. The Romans, the greatest road builders of the ancient world, built their roads of stone and concrete. By AD 75 several methods of road construction were known in India, including brick and stone slab pavements, and street paving was common in towns. Smaller

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cobblestones began to be used for European paving in the late Middle Ages. The 18th–19th century saw the development of pavement systems (e.g., MACADAM) that used light road surfaces of broken or crushed stone. Modern flexible pavements contain sand and gravel or crushed stone compacted with a bituminous binder (e.g., asphalt or tar); such a pavement has enough plasticity to absorb shock. Rigid pavements are made of concrete, composed of coarse and fine aggregate and portland cement, and usually reinforced with steel rod or mesh.

Pavese \pä-'vā-sā**, Cesare** (b. Sept. 9, 1908, Santo Stefano Belbo, Italy—d. Aug. 27, 1950, Turin) Italian poet, critic, novelist, and translator. Pavese founded, and was long an editor with, the publishing house of Einaudi. Denied a creative outlet by fascist control of literature, he did translations in the 1930s and '40s that introduced many modern U.S. and English writers to Italy. Much of his own work appeared between the end of World War II and his death by suicide at age 41; some was published posthumously. His best works include *Dialogues with Leucò* (1947), poetic conversations on the human condition; the novel *The Moon and the Bonfire* (1950); and the journal *This Business of Living* (1952).

Pavia \pä-'vē-ə\ *ancient* **Ticinum** City (pop., 2001 prelim.: 71,074), LOMBARDY, northern Italy. Located on the TICINO RIVER, the site was originally a settlement of the Papiria tribe; it was conquered by Rome c. 220 BC. Pillaged by ATTILA and ODOACER in the 5th century AD, it became a centre of Gothic resistance against the Byzantine Empire. Ruled by the Visconti family (see GIAN GALEAZZO VISCONTI) from c. 1359, it became a leading Italian city-state. In 1525 it was the scene of a decisive victory by the Holy Roman emperor CHARLES V over the French under FRANCIS I, who was captured. It was active in the RISORGIMENTO and joined the Kingdom of Italy in 1859. It still retains the ancient plan of the Roman fortified town, and medieval structures remain. The University of Pavia (founded 1361) is linked with the ancient law school, which dates to 825. Pavia is a centre of communications, agriculture, and industry.

Pavlov \'päv-ˌlȯf**, Ivan (Petrovich)** (b. Sept. 26, 1849, Ryazan, Russia—d. Feb. 27, 1936, Leningrad) Russian physiologist. He is known chiefly for the concept of the conditioned reflex. In his classic experiment, he found that a hungry dog trained to associate the sound of a bell with food salivated at the sound even in the absence of food. He expanded on CHARLES SHERRINGTON's explanation of the spinal reflex. He also tried to apply his laws to human psychoses and language function. His ability to reduce a complex situation to a simple experiment and his pioneering studies relating human behaviour to the nervous system laid the basis for the scientific analysis of behaviour. After the Russian Revolution, he became an outspoken opponent of the communist government. He won a 1904 Nobel Prize for his work on digestive secretions.

Pavlova \'pav-lə-və**, Anna (Pavlovna)** (b. Feb. 12, 1881, St. Petersburg, Russia—d. Jan. 23, 1931, The Hague, Neth.) Russian ballet dancer. She studied at the Imperial Ballet School from 1891 and joined the MARIINSKY THEATRE company in 1899, becoming prima ballerina in 1906. In 1913 she left Russia to tour with her own company, which showcased her outstanding performances in classical ballets such as *Giselle*; the most famous numbers were a succession of short solos such as *The Dying Swan*, choreographed for her by MICHEL FOKINE. Her tours took ballet to audiences in many countries for the first time and did much to popularize ballet worldwide.

Anna Pavlova.
CULVER PICTURES

pawnbroking Business of advancing loans to customers who have pledged household goods or personal belongings as security. The pawnbroker's trade is one of the oldest known, having existed 2,000–3,000 years ago in China, as well as in ancient Greece and Rome. Pawnbroking was common in medieval Europe despite laws against USURY. Private pawnbrokers were usually those exempt from the laws, notably the Jews. In 1462 the FRANCISCANS set up the *montes pietatis*, which granted interest-free loans to the poor, though they were later forced to charge interest to prevent premature exhaustion of their funds. Public pawnshops existed briefly in the Middle Ages but were reestablished in the 18th century to free debtors from the high interest rates of private pawnshops. Most European countries now maintain public pawnshops; in the U.S. only private pawnshops exist. Social-welfare programs and increased access to easy CREDIT has led to a decline in pawnbroking's importance. See also INTEREST, CONSUMER CREDIT, CREDIT CARD.

Pawnee \pó-'nē\ North American PLAINS INDIAN people living mainly in Oklahoma, U.S. Their language belongs to the Caddoan language stock, and their name is derived from the Caddoan word meaning "horn," a reference to their unique hairstyle. They once lived along the Platte River in what is now Nebraska. The Pawnee tribe comprised four relatively independent BANDS, each divided into villages. They lived in large, dome-shaped, earth-covered lodges but used TEPEES on buffalo hunts. Women raised corn, squash, and beans, and they harvested a grain similar to WILD RICE. Chiefs, priests, and shamans constituted the dominant class. Pawnee religion centred on a variety of deities, including the supreme being Tirawa, the sun god, and morning and evening stars. The Pawnee had military societies, and many Pawnee served as scouts for the U.S. armies of the frontier. Pawnee lands were ceded to the U.S. in the mid-19th century, and most Pawnee were relocated to a reservation in Oklahoma. They number about 2,500.

pawpaw See PAPAW

Pax Romana \'paks-rō-'ma-nə, 'päks-rō-'mä-nə\ *Latin* **"Roman Peace"** State of comparative tranquility throughout the Mediterranean world from the reign of AUGUSTUS (27 BC–AD 14) to that of MARCUS AURELIUS (AD 161–180). The concord also included North Africa and Persia. The empire protected and governed provinces, each of which legislated and administered its own laws while accepting Roman taxation and military control. It was the Pax Romana that ensured the survival and eventual transmission of the classical Greek and Roman heritage.

Paxton Boys uprising (1763) Attack by Pennsylvania frontiersmen on an Indian settlement during the Pontiac Indian uprising. After 57 drunken rangers from Paxton, Pa., slaughtered 20 innocent and defenseless Conestoga Indians near Lancaster, Pa., the colonial governor ordered the arrest of those involved. Because local residents were sympathetic to the "Paxton Boys," no prosecutions were undertaken. Instead, angered by appropriations insufficient to defend the western frontier, more than 600 armed frontiersmen marched on Philadelphia in 1764. They were met by leading Philadelphians, including BENJAMIN FRANKLIN, who promised the men a hearing.

payments, balance of See BALANCE OF PAYMENTS

Payton, Walter (Jerry) (b. July 25, 1954, Columbia, Miss., U.S.—d. Nov. 1, 1999, Barrington, Ill.) U.S. football player. He played football at Jackson State University and from 1975 to 1987 was a member of the NFL Chicago Bears. He retired as the all-time leader for combined yardage (rushing, kick returning, and pass receiving; 21,803 yds), seasons with 1,000 or more yards rushing (10), and rushing yardage (16,726). In 2002 his career rushing record was broken by EMMITT SMITH and his combined yardage record was broken by JERRY RICE. Payton is considered among the greatest running backs in football history.

Paz \'päs**, Octavio** (b. March 31, 1914, Mexico City, Mex.—d. April 19, 1998, Mexico City) Mexican poet, writer, and diplomat. Educated at the University of Mexico, Paz published his first book of poetry, *Savage Moon*, in 1933. He later founded and edited several important literary reviews. Influenced in turn by Marxism, Surrealism, existentialism, Buddhism, and Hinduism, his poetry uses rich imagery in dealing with metaphysical questions, and his most prominent theme is the human ability to overcome existential solitude through erotic love and artistic creativity. His prose works include *The Labyrinth of Solitude* (1950), an influential essay on Mexican history and culture. He was Mexico's ambassador to India (1962–68). He was awarded the Nobel Prize for Literature in 1990.

Paz Estenssoro \'päs-ˌes-ten-'sȯr-ō**, Víctor** (b. Oct. 2, 1907, Tarija, Bol.—d. June 7, 2001, Tarija) President of Bolivia (1952–56, 1960–64, 1985–89). Originally an economics professor, he was elected to the Chamber of Deputies and then became president in 1952, when the National

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Revolutionary Movement (MNR), a left-wing organization that he helped found, seized power. He extended the vote to Indians, implemented agrarian reform, and expropriated three major tin companies. He was elected again in 1964 but was overthrown by a military coup the same year. He regained the presidency in 1985 and instituted a program of economic austerity that reduced the hyperinflation that had imperiled the Bolivian economy.

Pazzi conspiracy \'pät-sē\ (April 16, 1478) Unsuccessful plot to overthrow the MEDICI rulers of Florence. It was led by the rival Pazzi family, with the backing of Pope SIXTUS IV, who wanted to consolidate papal rule over northern central Italy. The conspirators tried to assassinate two Medici brothers during mass at the Cathedral of Florence; they killed Giuliano de' Medici, but Lorenzo de' MEDICI escaped. The people of Florence rallied to the Medici and killed many of the conspirators, leaving Lorenzo more powerful than before and setting off a two-year war with the papacy.

PBS *in full* **Public Broadcasting Service** Private, nonprofit U.S. corporation of public television stations. PBS provides its member stations, which are supported by public funds and private contributions rather than by commercials, with educational, cultural, news, and children's programs that are produced by its members and by independent producers worldwide. Its popular programs have included *Sesame Street*, *Masterpiece Theatre*, *Great Performances*, *NewsHour with Jim Lehrer*, and *Nova*. PBS was founded in 1969 to coordinate and provide services to its member stations, which now number about 350. Funding is provided mainly by viewers' contributions, state governments, and grants from businesses and private foundations; the U.S. government, through the Corporation for Public Broadcasting, supplies about 15%.

PC See PERSONAL COMPUTER

PCB *in full* **polychlorinated biphenyl** \bī-'fe-nᵊl, bī-'fē-nᵊl\ Any of a class of highly stable organic compounds prepared by the reaction of CHLORINE with biphenyl, a two-ring compound. The commercial product, a mix of several PCB ISOMERS, is a colourless, viscous liquid that is almost insoluble in water, does not degrade under high temperatures, and is a good electrical insulator (see DIELECTRIC). PCBs became widely used as lubricants, heat-transfer fluids, and fire-resistant dielectric fluids in transformers and capacitors in the 1930s and '40s. In the mid 1970s they were found to cause liver dysfunction in humans and came under suspicion as CARCINOGENS; their manufacture and use were consequently restricted in the U.S. and many other countries, though illegal dumping by manufacturers continued. They persist in the environment and have entered the FOOD CHAIN, causing great harm especially to invertebrates and fish.

pea Any of several species, comprising hundreds of varieties, of herbaceous annual plants belonging to the family Leguminosae (or Fabaceae, also known as the pea family; see LEGUME), grown virtually worldwide for their edible seeds. *Pisum sativum* is the common garden pea of the Western world, which GREGOR MENDEL used for his pioneering studies of HEREDITY. While their origins have not been definitely determined, it is known that peas are one of the oldest cultivated crops. Some varieties, called sugar peas, snow peas, or mange-touts, have edible pods and are popular in East Asian cuisines. See also SWEET PEA.

Pea (*Pisum sativum*)
WALTER CHANDOHA

Peabody \'pē-bə-dē**, Elizabeth (Palmer)** (b. May 16, 1804, Billerica, Mass., U.S.—d. Jan. 3, 1894, Jamaica Plain, Mass.) U.S. educator and leader in the kindergarten movement in America. She served as secretary to WILLIAM ELLERY CHANNING (1825–34) and worked with BRONSON ALCOTT in his Temple School. She opened a Boston bookshop in 1839, which became a centre for TRANSCENDENTALIST activities. She published works by MARGARET FULLER and NATHANIEL HAWTHORNE and also published and wrote articles for *The Dial*. Inspired by the work of FRIEDRICH FROEBEL, she opened the first English-language KINDERGARTEN in the U.S. in 1860 and thereafter devoted herself to organizing public and private kindergartens. Her sisters married HORACE MANN and NATHANIEL HAWTHORNE.

Peabody \'pē-ˌbä-dē**, George** (b. Feb. 18, 1795, South Danvers [now Peabody], Mass., U.S.—d. Nov. 4, 1869, London, Eng.) U.S. merchant and financier. Born in South Danvers, Mass. (renamed Peabody in his honour), he earned an early fortune as a partner in a wholesale dry-goods business and as president of the Eastern Railroad (from 1836). On a trip to England, he negotiated an $8 million loan for the near-bankrupt state of Maryland. In 1837 he moved to London permanently and founded a merchant banking house specializing in FOREIGN EXCHANGE; his banking operations helped establish U.S. CREDIT abroad. He spent most of his fortune on philanthropy to promote education and the arts; his gifts include a natural history museum at Yale University, an archaeology museum at Harvard University, and an Asian export art museum in Salem, Mass.

Peace Corps U.S. government agency of volunteers, formed in 1961 by Pres. JOHN F. KENNEDY. Its purpose is to assist other countries in their development efforts by providing skilled workers in the fields of education, agriculture, health, trade, technology, and community development. Volunteers are expected to serve for two years as good neighbours in the host country, to speak its language, and to live on a level comparable to that of the local residents. By the early 21st century, more than 165,000 volunteers had served in the corps.

Peace of God Movement within the medieval Roman Catholic church in response to the breakdown of public order. The movement began at a council at Le Puy in 975, but other, more important councils occured in southern and central France in the late 10th and early 11th centuries. Regional lay and religious authorities attended the councils to ensure God's peace, and they were often joined by large crowds who came to venerate the relics displayed at the meetings. The peace decrees forbade, under pain of excommunication, private warfare or violence against churches, clerics, pilgrims, merchants, women, peasants, and cattle. Participants at the councils took oaths on sacred relics to uphold the decisions made at those councils. The peace was also decreed at the councils of Charoux (c. 989), Limoges (994 and 1031), Poitiers (c. 1000), and Bourges (1038).

peace pipe See CALUMET

Peace River River, western Canada. Formed by the confluence of the Finlay and Parsnip rivers in the Canadian Rockies of British Columbia, it flows east across the border of Alberta to join the Slave River just north of its outlet from Lake ATHABASCA. It is 1,195 mi (1,923 km) long. It was explored by ALEXANDER MACKENZIE in 1792–93 and became a major fur-trading route. It is an important source of hydroelectric power.

Peace River River, west-central Florida, U.S. It rises in Polk county and flows south and southwest into Charlotte Harbor on the southwestern coast. It is about 85 mi (135 km) long.

peach Small to medium-sized fruit tree (*Prunus persica*) of the ROSE family, grown throughout the warmer temperate regions of both hemispheres, and the fruit it produces. It probably originated in China and spread westward. Peach trees are intolerant of severe cold but require winter chilling to induce spring growth. The long, pointed leaves are glossy green and lance-shaped. Pink or white flowers grow singly or clustered. The fleshy, juicy exterior of the fruit is edible; the hard interior is called the stone or pit. In freestone types, stones separate easily from ripe flesh; in clingstone types, the flesh adheres firmly to the stone. Thousands of varieties have been developed. Peach skin is downy or fuzzy; smooth-skinned peaches are NECTARINES. Peaches are widely eaten fresh and are baked in desserts. Canned peaches are a staple commodity in many regions. Related plants include ALMOND, PLUM, and CHERRY.

Peach (*Prunus persica*).
GRANT HEILMAN PHOTOGRAPHY

peacock Any of three species (family Phasianidae) of resplendent birds of open lowland forests. Blue, or Indian (*Pavo cristatus*), and green, or Javanese (*P. muticus*), peacock males are 35–50 in. (90–130 cm) long and have a 60-in. (150-cm) train of metallic green tail feathers tipped with an iridescent eyespot ringed with blue and bronze. The train is erected,

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fanned out, and vibrated during courtship. Females (peahens) are duller and have no train. The male forms a harem of two to five hens, which lay their eggs in a depression in the ground. The blue and green male Congo peacock (*Afropavo congensis*) has a short rounded tail; the reddish and brown hen has a topknot.

Peacock, Thomas Love (b. Oct. 18, 1785, Weymouth, Dorset, Eng.—d. Jan. 23, 1866, Lower Halliford, Middlesex) English novelist and poet. For most of his life Peacock worked for the East India Co. He was a close friend of Percy B. Shelley, who greatly inspired his writing. His best verse is interspersed in his novels, which are dominated by the conversations of their characters and satirize the intellectual currents of the day. His best-known work, *Nightmare Abbey* (1818), satirizes romantic melancholy and includes characters based on Shelley, Samuel Taylor Coleridge, and Lord Byron.

Peale, Charles Willson (b. April 15, 1741, Queen Anne's county, Md.—d. Feb. 22, 1827, Philadelphia, Pa., U.S.) U.S. painter, inventor, and naturalist. He began his career by exchanging a saddle for painting lessons. He later went to London to study with Benjamin West. On his return he became the preeminent portrait painter of the middle colonies. He damaged his professional career by entering enthusiastically into the revolutionary movement. In 1786 he founded an institution in Philadelphia for the study of natural law and display of natural history and technological objects; the Peale Museum, the first major U.S. museum, was widely imitated by other museums of the period and later by P.T. Barnum. Peale is best remembered for his portraits of the leading figures of the American Revolution.

Peale, Norman Vincent (b. May 31, 1898, Bowersville, Ohio, U.S.—d. Dec. 24, 1993, Pawling, N.Y.) U.S. Protestant clergyman. The son of a Methodist preacher, he attended Ohio Wesleyan University and was ordained a pastor in the Methodist Episcopal church. After leading congregations in Brooklyn and Syracuse, N.Y., in 1933 he became pastor of Marble Collegiate Church in New York City, where he remained for the rest of his career. In 1937 he cofounded the Religio-Psychiatric Clinic, which combined religion and psychiatry in the interests of mental health. He gained fame through radio and television sermons and through his books, including the best-selling *Power of Positive Thinking* (1952). In 1969 he was elected president of the Reformed Church in America.

Peale, Rembrandt (b. Feb. 22, 1778, Bucks county, Pennsylvania, U.S.—d. Oct. 3, 1860, Philadelphia, Penn.) U.S. painter and writer. A son of Charles Willson Peale, he studied with his father at the Royal Academy in London. In Paris 1808–10 he was offered the post of court painter to Napoleon I. His early portrait of Thomas Jefferson (1805) was his masterpiece. Following his father's example, he opened a museum and portrait gallery in Baltimore, where he established the first illuminating gasworks. When he resumed painting, he turned to formal subject pieces (e.g., *The Court of Death*, 1820) before returning to portraiture, continuing a series of portraits of George Washington.

peanut *or* **groundnut** Annual legume (*Arachis hypogaea*) and its edible seeds, which have the peculiar habit of ripening underground in pods. Native to tropical South America, peanuts were introduced early into the Old World tropics. Each pod contains one to three oblong seeds with whitish to dark-purple seed coats. Pound for pound, peanuts have more protein, minerals, and vitamins than beef liver, more fat than heavy cream, and more calories than sugar. They are pressed for edible oil, ground into peanut butter, eaten as snacks, and used in cooking. The plant is fed to livestock.

pear Any of several species of trees of the genus *Pyrus*, especially *P. communis*, of the rose family, which is one of the most important fruit trees in the world and is cultivated in all temperate-zone countries of both hemispheres. The thousands of varieties include Bartlett (by far the most widely grown), Beurre Bosc, and Beurre d'Anjou. In the U.S., much of the crop is canned; in Europe, pears are more commonly eaten fresh or used for perry (fermented pear juice). The tree is taller and more upright than the apple tree; pear fruits are sweeter and softer than apples. Hard cells (grit, or stone cells) dot the flesh.

Pear (*Pyrus communis*)
GRANT HEILMAN

pearl Concretion formed by a mollusk and consisting of the same material (called nacre, or mother-of-pearl) as the mollusk's shell. Long treasured as gemstones, pearls are valued for their translucence and lustre and for the delicate play of surface colour. The more perfect a pearl's shape and the deeper its lustre, the greater its value. The colour varies with the mollusk and its environment. Jewelers of the 16th–17th centuries often used irregularly shaped (baroque) pearls, formed from muscular tissue, to form the bodies of animals and other figures. In Europe and China, mother-of-pearl has been used as an inlay material for decorating furniture. The discovery that a pearl could be cultivated by insertion of a foreign object inside the mollusk's shell is said to have been made in 13th-century China.

Blister pearl attached to the shell of an Oriental pearl oyster (*Pinctada martensii Dunker*)
COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK

Pearl Harbor Inlet, southern coast of Oahu island, Hawaii, U.S. It lies 6 mi (10 km) west of Honolulu, forming a landlocked harbour connected with the Pacific Ocean. In 1887 Hawaii granted the U.S. the exclusive use of the harbour as a coaling and repair station, and in 1908 a naval station was established. In 1941 the harbour was attacked without warning by the Japanese air force, causing great loss of life and precipitating U.S. entry into World War II. It is now the headquarters of the U.S. Pacific Fleet.

Pearl Harbor attack (Dec. 7, 1941) Surprise aerial attack by the Japanese on the U.S. naval base at Pearl Harbor on Oahu island, Hawaii, that precipitated U.S. entry into World War II. In the decade preceding the attack, U.S.-Japanese relations steadily worsened, especially after Japan entered into an alliance with the Axis powers (Germany and Italy) in 1940, and by late 1941 the U.S. had severed practically all commercial and financial relations with Japan. On November 26 a Japanese fleet sailed to a point some 275 mi (440 km) north of Hawaii, and from there about 360 planes were launched. The first dive-bomber appeared over Pearl Harbor at 7:55 AM (local time) and was followed by waves of torpedo planes, bombers, and fighters. Due to lax reconnaissance and the fact that many vessels were undermanned since it was a Sunday morning, the base was unable to mount an effective defense. The *Arizona* was completely destroyed; the *Oklahoma* capsized; the *California*, *Nevada*, and *West Virginia* sank; more than 180 aircraft were destroyed; and numerous vessels were damaged. In addition, more than 2,300 military personnel were killed. The "date which will live in infamy," as U.S. Pres. Franklin Roosevelt termed it, unified the American public and swept away any earlier support of neutrality. On Dec. 8, 1941, Congress declared war on Japan.

Pearl River River, central Mississippi, U.S. It flows southwest through Jackson, then into Louisiana and the Gulf of Mexico. About 410 mi (660 km) long, it forms the boundary between Mississippi and Louisiana. Honey Island Swamp, lying in the mid-delta area southwest of Picayune, Miss., is noted for its wildlife and fishing.

pearlstone See perlite

Pearson, Drew *orig.* **Andrew Russell** (b. Dec. 3, 1897, Evanston, Ill., U.S.—d. Sept. 1, 1969, Rockville, Md.) U.S. newspaper columnist. Pearson taught industrial geography at the University of Pennsylvania before turning to journalism. He was fired from the *Baltimore Sun* for writing *Washington Merry-Go-Round* (1931, with Robert S. Allen), a gossipy book about the scene in the U.S. capital. From 1932 he wrote an influential syndicated column of the same name (with Allen until 1942; from 1965 with Jack Anderson, who inherited it on Pearson's death), which specialized in muckraking. Among the many world leaders he interviewed was Nikita Khrushchev. See muckraker.

Pearson, Lester B(owles) (b. April 23, 1897, Toronto, Ont., Can.—d. Dec. 27, 1972, Ottawa, Ont.) Prime minister of Canada (1963–

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68). He taught at the University of Toronto from 1924 until 1928, when he joined the Canadian foreign service. He was posted to Britain from 1935 to 1941 and to the U.S. from 1942 to 1945; he was ambassador to the U.S. from 1945 to 1946. He served in the Canadian House of Commons from 1948 to 1968 and as minister of external affairs from 1948 to 1956. During the latter period he also led the Canadian delegation to the UN; he was president of the UN General Assembly from 1952 to 1953. In 1957 he received the Nobel Prize for Peace for his role in resolving the Suez Crisis. He became head of the Liberal Party in 1958 and led it to victory in elections in 1963. His government introduced a national pension plan and a family assistance program, broadened old-age security benefits, and laid the groundwork for the National Free Medical Service. In 1967 he rebuked visiting French Pres. Charles de Gaulle for his support of separatism in Quebec. He retired in 1968.

Peary, Harold *orig.* **Harrold Jese Pereira de Faria** (b. July 25, 1908, San Leandro, Calif., U.S.—d. March 30, 1985, Torrance, Calif.) U.S. actor. He created the colourful, arrogant character Throckmorton F. Gildersleeve on the hit comedy series *Fibber McGee and Molly* in 1937. He starred in his own popular radio serial, *The Great Gildersleeve* (1941–50), considered the first spin-off created from another series. He later acted in television series such as *Blondie* (1957) and *Fibber McGee and Molly* (1959), and he appeared in the film *Clambake* (1967). Peary continued to perform on radio into the 1970s.

Peary, Robert E(dwin) (b. May 6, 1856, Cresson, Pa., U.S.—d. Feb. 20, 1920, Washington, D.C.) U.S. explorer. He joined the U.S. Navy in 1881 but was granted leaves of absence to pursue his Arctic expeditions. He explored Greenland by dog sled in 1886 and 1891, finding evidence that it was an island, and returned there in 1893–94, 1895, and 1896 to transport large meteorites to the U.S. After announcing his intention to reach the North Pole, he made several attempts between 1898 and 1905, sailing on a specially built ship and sledding to within 175 mi (280 km) of the pole. On April 6, 1909, accompanied by Matthew Henson (1866–1955) and four Eskimo, he reached what he thought was the pole, and he became widely acknowledged as the first explorer to attain that goal. (The claim of his former colleague Frederick A. Cook to have reached the pole in 1908 was later discredited.) In 1911 Peary retired from the navy with the rank of rear admiral. Examination of Peary's expedition diary and new documents in the 1980s suggested that the point he reached may have been 30–60 mi (50–100 km) short of the pole.

peasant Any member of a class that tills the soil as small landowners or agricultural labourers. The peasant economy generally has a simple technology and a division of labour by age and sex. The basic unit of production is the family or household. Peasant families traditionally consume what they produce, though a portion of their output may be sold in the market or paid to a landlord. Productivity per worker and yields per unit of land are usually low. Peasants as a class tend to disappear as a society industrializes, though peasantlike social structures may persist under new economic regimens. See also ejido; feudalism; hacienda; serfdom.

Peasants' Revolt *or* **Wat Tyler's Rebellion** (1381) First great popular rebellion in English history. It was triggered by the poll tax of 1381, which angered labourers and artisans already resentful of the limits on wages fixed by the Statute of Labourers (1351). Centred in southeastern England and East Anglia, the revolt was led by Wat Tyler (d. 1381), who marched into London with a band of Kentish rebels. They captured the Tower of London and beheaded officials responsible for the poll tax. Richard II promised reforms, but Tyler was killed in his presence by the mayor of London. The last of the rebels were subdued in East Anglia two weeks later.

Peasants' War (1524–25) Peasant uprising in Germany. Inspired by reforms brought by the Reformation, peasants in western and southern Germany invoked divine law to demand agrarian rights and freedom from oppression by nobles and landlords. As the uprising spread, some peasant groups organized armies. Although the revolt was supported by Huldrych Zwingli and Thomas Müntzer, its condemnation by Martin Luther contributed to its defeat, principally by the army of the Swabian League. Some 100,000 peasants were killed. Reprisals and increased restrictions discouraged further attempts to improve the peasants' plight.

peat Organic fuel consisting of a light, spongy material formed in temperate, humid environments by the accumulation and partial decomposition of vegetable remains under conditions of poor drainage. Peat deposition is the first step in the formation of coal. Dried peat burns readily, with a smoky flame and a characteristic odour. It is used for domestic heating and can be used to fire boilers. It is only a minor contributor to the world energy supply, but large deposits occur in Canada, China, Indonesia, Russia, Scandinavia, and the U.S. Major users include Finland, Ireland, Russia, and Sweden.

peat moss *or* **sphagnum moss** \'sfag-nəm\ Any of more than 160 species of plants that make up the bryophyte genus *Sphagnum*, which grow in dense clumps around ponds, in swamps and bogs, on moist, acid cliffs, and on lakeshores from tropical to subpolar regions. These pale-green to deep-red plants can hold 20 times their weight in water. As they die and are compressed, they form organic peat, which is harvested and dried as fuel, as seedbed cover, and as shipping packaging for plants and live aquatic animals. Gardeners stir peat into soil to increase soil moisture, porosity, and acidity and to reduce erosion.

pecan Nut and tree (*Carya illinoinensis*) of the walnut family, native to temperate North America. Occasionally reaching a height of about 160 ft (50 m), the tree has deeply furrowed bark and feather-shaped leaves. Pecan nut meat, rich and distinctive in flavour and texture, has one of the highest fat contents of any vegetable product and a caloric value close to that of butter. Pecan production is a considerable industry of the southeastern U.S., where pecan pie and pecan praline candy are traditional sweets.

Pecan (*Carya illinoinensis*)
GRANT HEILMAN

peccary \'pe-kə-rē\ *or* **javelin** \'ja-və-lən\ Any of three species (family Tayassuidae) of New World even-toed ungulates resembling pigs. Found in deserts and wet tropical forests from Texas to Patagonia, peccaries are gray with white markings and have small, erect ears and almost no tail. They grow to 30–35 in. (75–90 cm) long and weigh 37–66 lb (17–30 kg). A scent gland that opens on the back and emits a strong, musky odour inspired the belief that peccaries have two navels. Peccaries have spearlike upper canines and eat plants, small animals, and carrion. They live in groups of 5–25 or 50–100, depending on the species.

Collared peccary (*Tayassu tajacu*).
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Pechora River \pi-'chȯ-rə\ River, northeastern Russia. It rises in the northern Ural Mountains and flows south, then west and north to enter the Barents Sea after a course of 1,124 mi (1,809 km). It is frozen from early November to early May. Its basin contains large deposits of coal, petroleum, and natural gas.

Pechora Sea *Russian* **Pechorskoye More** \pi-'chȯr-skə-yə-'mȯr-yə\ Sea, southeastern extension of the Barents Sea, north of European Russia. It is located between Kolguyev Island and the Yugorsky Peninsula. Although it is blocked by floating ice from November to June, its cod, seals, and other marine life are exploited. The main port is Naryan-Mar on the Pechora River.

Peck, (Eldred) Gregory (b. April 5, 1916, La Jolla, Calif., U.S.—d. June 12, 2003, Los Angeles, Calif.) U.S. film actor. While a premed student at the University of California at Berkeley, he developed a taste for acting. He appeared on Broadway in *The Morning Star* (1942) and played several other stage roles before making his film debut in *Days of Glory* (1944). Known for playing likeable, honest men of high moral quality, he starred in movies such as *The Keys of the Kingdom* (1944), *Spellbound* (1945), *Gentleman's Agreement* (1947), *Twelve O'Clock High* (1949), *Roman Holiday* (1953), and *To Kill a Mockingbird* (1962, Academy Award). His later films include *MacArthur* (1977), *The Old Gringo* (1989), and *Cape Fear* (1991). He also served for three years as president of the Academy of Motion Picture Arts and Sciences.

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pecking order Basic pattern of social organization within a flock of poultry in which each bird pecks another lower in the scale without fear of retaliation and submits to pecking by one of higher rank. For groups of mammals (e.g., BABOON, WOLF) or other birds, the term "dominance hierarchy" is usually used, and the ranking often involves feeding or mating.

Peckinpah \'pe-kin-ˌpä**, (David) Sam(uel)** (b. Feb. 21, 1925, Fresno, Calif., U.S.—d. Dec. 28, 1984, Inglewood, Calif.) U.S. film director. He served in the U.S. Marines, studied drama at the University of Southern California, and began working in television in the mid-1950s, writing for and directing programs such as *Gunsmoke* and *The Rifleman*. He made his debut as a film director with *The Deadly Companions* (1961), which was followed by *Ride the High Country* (1962) and *Major Dundee* (1965). Among his later films are *The Wild Bunch* (1969), considered his finest, *Straw Dogs* (1971), *Pat Garrett and Billy the Kid* (1973), and *Cross of Iron* (1977). His films are noted for their magnificent landscapes, embittered characters, and brutal violence.

Pecos \'pā-kəs\ **River** River, eastern New Mexico and western Texas, U.S. It rises in the SANGRE DE CRISTO MOUNTAINS of New Mexico and flows southeast about 500 mi (800 km) across the Texas border. It empties into the RIO GRANDE at the Amistad National Recreation Area. There are many dams along the river, including the Alamogordo, Avalon, and Red Bluff dams.

pectin Any of a class of CARBOHYDRATES found in certain plant cell walls and tissues. They are principally composed of a GALACTOSE derivative, galacturonic acid. In fruits, pectin keeps the walls of adjacent cells joined together, helping them remain firm and hold their shape. As fruits become overripe, the pectin breaks down to simple sugars that dissolve more readily, so the fruits become soft and lose their shape. Because it forms a thick, gel-like solution when added in small amounts to fruit acids, sugar, and water, pectin is used to make jellies, jams, and marmalades. Its thickening properties also make it useful in the confectionery, pharmaceutical, and textile industries.

Pedersen \'pith-ər-sən**, Holger** (b. April 7, 1867, Gelballe, Den.—d. Oct. 25, 1953, Copenhagen) Danish linguist. He specialized in comparative Celtic grammar but made influential contributions to many other areas of linguistics. In addition to his *Comparative Grammar of the Celtic Languages*, 2 vol. (1909–13), he published works on Albanian, Armenian, Russian, and Indo-European dialects; on Lithuanian, Hittite, Tocharian, Czech, and Turkish PHONOLOGY; on the relationship of Indo-European languages to the Semitic and Finno-Ugric languages; and on the origin of runes.

pedestal In CLASSICAL ARCHITECTURE, a support or base for a column, statue, vase, or OBELISK. It may be square, octagonal, or circular. A single pedestal may also support a group of columns, or COLONNADE (see PODIUM). The pedestal, which was first employed by Roman architects, consists (from bottom to top) of three parts: the plinth, the DADO (or die), and the cornice (or cap).

pediatrics \ˌpē-dē-'a-triks\ Medical specialty dealing with the development, health, and diseases of children. It became a specialized area of study in the 18th century, when the first children's hospitals were founded. Early pediatricians studied childhood diseases (see THOMAS SYDENHAM) but could do little to cure them. By the mid-20th century, when ANTIBIOTICS and VACCINES had controlled most of these diseases in the developed world and infant and child mortality had fallen, pediatrics changed its focus to normal growth and child development. Recently, behavioral and social aspects of children's health have been incorporated.

pedigree Record of ancestry or purity of breed. Pedigrees of domesticated animals are maintained by governmental or private record associations or breed organizations in many countries. In human genetics, pedigree diagrams are used to trace the inheritance of a specific trait, abnormality, or disease. Standard symbols are used to represent males, females, mating (marriage), and offspring. The offspring symbols appear from left to right in the order of birth and are connected to the marriage line by a vertical line. Possession of the character under study is shown by a solid or blackened symbol, and absence is shown by an open or clear symbol.

pediment In CLASSICAL ARCHITECTURE, a triangular gable crowning a PORTICO or facade. The pediment was the crowning feature of the Greek temple front. The pediment's triangular wall surface, or tympanum, was often decorated with sculpture. The Romans adapted the pediment as a purely decorative form to finish doors, windows, and niches, sometimes using a series of alternating triangular and segmentally curved pediments, a motif revived in the Italian High Renaissance. Baroque-era designers developed many varieties of broken, scrolled, and reverse-curved pediments.

pediment In geology, any relatively flat surface of bedrock (exposed or lightly covered with soil or gravel) that occurs at the base of a mountain or as a plain having no associated mountain. Pediments are most conspicuous in basin-and-range-type desert areas throughout the world, but they also occur in humid areas. In the tropics, the surfaces tend to be covered with soil and obscured by vegetation. Many tropical river towns are situated on pediments, which offer easier building sites than the steep hillsides above or the river marshes below.

pedology \pi-'dä-lə-jē\ A branch of soil science focusing on the formation, morphology, and classification of soils as bodies within the natural landscape. Pedology seeks to understand how the properties and distribution patterns of soils worldwide (collectively called the pedosphere) have developed along with broader landforms, biogeochemical environments, and habitats of living organisms. Through their understanding of the causes and magnitudes of soil variations, pedologists help to broaden knowledge of the surface of the Earth.

Pedrell \pā-'threl**, Felipe** (b. Feb. 19, 1841, Tortosa, Spain—d. Aug. 19, 1922, Barcelona) Spanish musicologist and composer. He was largely self-taught as a musician. A scholarship for study in Rome exposed him to the great past of Spanish music preserved in archives there, and he set about reviving the tradition by bringing to light both folk and older art music and by promoting a national style of composition. His own works include operas and orchestral and choral works. He is regarded as the father of Spanish musical nationalism.

Pedro \'pā-drō, 'pā-drü\ **I** *known as* **Dom Pedro** (b. Oct. 12, 1798, Lisbon, Port.—d. Sept. 24, 1834, Lisbon) First emperor of Brazil (1822–31) and, briefly, king of Portugal. The son of John VI of Portugal, he became regent of Brazil in 1821, but in 1822 he broke with Lisbon and declared Brazil's independence. The former colony became a constitutional monarchy with Pedro its emperor. Strong opposition to his autocratic manner and impatience with parliamentary procedure induced him to abdicate in favour of his five-year-old son, PEDRO II. When John VI died, Pedro I became Portugal's King Pedro IV, but he quickly abdicated in favour of his daughter, the future Queen Maria II. See also JOSÉ BONIFÁCIO DE ANDRADA E SILVA.

Pedro II *orig.* **Dom Pedro de Alcântara** (b. Dec. 2, 1825, Rio de Janeiro, Braz.—d. Dec. 5, 1891, Paris, Fr.) Second and last emperor of Brazil (1831–89). He became emperor at age five when his father, PEDRO I, abdicated. After a period of regency, he was crowned in 1841. His concern for his subjects, skill at arbitrating political disputes, and leadership in economic matters brought stability to the country. He led Brazil into the PARAGUAYAN WAR, which brought Brazil prestige and territory. His support eroded primarily over the issue of the imperial prerogatives. Emancipation was proclaimed in 1888; in 1889 Pedro II was removed in a military coup, and a republic was established. See also JOSÉ BONIFÁCIO DE ANDRADA E SILVA.

Pee Dee River River, North and South Carolina, U.S. Rising as the Yadkin River in the BLUE RIDGE in northwestern North Carolina, it flows southeast into Winyah Bay near Georgetown, S.C. It is 233 mi (375 km) long. The lower Pee Dee is navigable for 90 mi (145 km).

Peel, Sir Robert, 2nd Baronet (b. Feb. 5, 1788, Bury, Lancashire, Eng.—d. July 2, 1850, London) British prime minister (1834–35, 1841–46) and principal founder of the CONSERVATIVE PARTY. A member of Parliament from 1809, Peel served as chief secretary for Ireland (1812–18) and resisted efforts to admit Catholics to Parliament. As home secretary (1822–27, 1828–30), he reorganized England's criminal code. He established London's first disciplined

Sir Robert Peel, detail of an oil painting by John Linnell, 1838; in the National Portrait Gallery, London.

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

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police force, whose members were nicknamed after him "bobbies" or "peelers." After a brief first term as prime minister, Peel led the newly formed Conservative Party to a strong victory in the 1841 elections and became prime minister again. He imposed an income tax, reorganized the Bank of England, and initiated reforms in Ireland. Favouring reduced tariffs on imports, he repealed the Corn Laws, which caused his government to fall, but he continued to support free-trade principles in Parliament. He was the chief architect of the mid-Victorian age of stability and prosperity that he did not live to see.

Peel River River, northwestern Canada. It rises in western Yukon Territory and flows east and then north into the Mackenzie River in the Northwest Territories, near Fort McPherson, a fur-trading post. It is 425 mi (684 km) long. Its upper course through Peel Plateau is characterized by canyons as deep as 1,000 ft (300 m). Its lower valley consists primarily of nature preserves and game sanctuaries.

peerage Body of peers or titled nobility in Britain. The five ranks, in descending order, are duke, marquess, earl (see count), viscount, and baron. Until 1999, peers were entitled to sit in the House of Lords and exempted from jury duty. Titles may be hereditary or granted for life.

Pegasus \'pe-gə-səs\ In Greek mythology, a winged horse. It sprang from the blood of Medusa as she was beheaded by Perseus. Bellerophon captured Pegasus and rode him in several of his exploits, including his fight with the Chimera, but when he tried to ride the winged horse to heaven he was unseated and killed, and Pegasus was placed in the sky as a constellation. The flight of Pegasus is often regarded as a symbol of poetic inspiration.

pegmatite \'peg-mə-ˌtīt\ Almost any wholly crystalline igneous rock that is at least in part very coarse-grained, the major constituents of which include minerals typically found in ordinary igneous rocks (such as granites) and in which extreme textural variations, especially in grain size, are characteristic. Usually found as irregular dikes, lenses, or veins, pegmatite deposits occur in all parts of the world and are the chief source of commercial feldspar, sheet mica, and beryllium, tantalum-niobium, and lithium minerals.

Pei \'pā**, I(eoh) M(ing)** (b. April 26, 1917, Canton, China) Chinese-born U.S. architect. He immigrated to the U.S. in 1935 and studied at the Massachusetts Institute of Technology and Harvard University. After working for the architectural firm of Webb & Knapp, he formed his own partnership in 1955. Early in his career he created the building for the National Center for Atmospheric Research, Boulder, Colo. (1968), which mimics the broken silhouettes of the surrounding peaks. His innovative East Building of the National Gallery of Art, Washington, D.C. (1978), was hailed as one of his finest achievements. Other works include Boston's John Hancock Tower (1973), Beijing's Fragrant Hill Hotel (1982), and a controversial glass pyramid for a courtyard at the Louvre Museum, Paris (1989). Pei's designs represent an elaboration on the rectangular forms and irregular silhouettes of the International Style but with a uniquely skillful arrangement of geometric shapes and a dramatic use of varied materials, spaces, and surfaces; in his Miho Museum of Art, Shiga, Japan (1997), for example, he achieved a harmony between the building, much of it underground, and its mountain environment. In 1983 Pei received the Pritzker Architecture Prize.

peine forte et dure \'pen-'fȯrt-ā-'dūr\ *French* **"strong and hard punishment"** Formerly in English law, punishment inflicted on those accused of a felony who refused to enter a plea. By a statute of 1275, the *peine* was usually to imprison and starve the prisoner until he submitted; in 1406 pressing by heavy weights was added to this. In one of the few instances of its use in the American colonies, during the Salem witch trials, 80-year-old Giles Corey, who had decided not to stand trial rather than forfeit his family's goods, was pressed to death by interrogators. The practice was abolished in 1772.

Peipsi \'pāp-sē**, Lake** *Estonian* **Peipsi Järv** Lake, north-central Europe, forming the boundary between Estonia and Russia. Lake Peipsi is 60 mi (97 km) long and 31 mi (50 km) wide, and it is frozen for half of the year. In 1242 the Russians, under Alexander Nevsky, defeated the Teutonic Knights (see Teutonic Order) on the frozen lake in the "Battle on the Ice," forcing the order to relinquish claims to Russian lands.

Peipus, Lake See Lake Peipsi

Peirce \'pərs, 'pirs**, Charles Sanders** (b. Sept. 10, 1839, Cambridge, Mass., U.S.—d. April 19, 1914, near Milford, Pa.) U.S. scientist, logician, and philosopher. He was the son of the mathematician and astronomer Benjamin Peirce (1809–80). After attending Harvard University he spent 30 years with the U.S. Coast Guard Survey (1861–91). As a scientist, he is noted for his contributions to the theory of probability, the study of gravity, and the logic of scientific methodology. He eventually abandoned the physical sciences to study logic, which in its widest sense he identified with semiotics. He lectured on logic at Johns Hopkins University from 1879 to 1894, then spent the rest of his life writing in seclusion. He is regarded as the founder of pragmatism. Though he made eminent contributions to deductive logic, he was a student primarily of "the logic of science"—i.e., of induction and of "retroduction," or "abduction," the forming and accepting on probation of a hypothesis in order to explain surprising facts. His lifelong ambition was to establish induction and abduction as permanent branches of logic.

Peisistratus \pi-'sis-trə-təs\ *or* **Pisistratus** (d. 527 BC) Tyrant of Athens (c. 560–559, 556–555, 546–527). Born an aristocrat, he gained military honours early. He first became tyrant in 560 after claiming an attempt had been made on his life and appealing to the people to grant him a bodyguard, which he used to help seize the Acropolis. His reign was short-lived, but he gained power again briefly in 556, before being ousted by Lycurgus and Megacles. After several years in exile, he returned with an army in 546, took control, and remained in power until his death. A patron of the arts, he executed many public works and tried to help small farmers. His unification of Attica and improvement of Athens's prosperity helped make the city preeminent in Greece.

Peking See Beijing

Peking man See Zhoukoudian

Peking opera See jingxi

Peking University *or* **Beijing University** One of the oldest and most important institutions of higher education in China. It was founded as Capital College in 1898 and became a university in 1911. By 1920 it had become a centre for progressive thought. During the Sino-Japanese War (1937–45) it was temporarily relocated to Yunnan province. The first disturbances of the Cultural Revolution began at Beijing University in 1966; education there ceased between 1966 and 1970. The university has since reasserted its position as China's foremost nontechnical university. It has more than three dozen colleges and academic departments and scores of research institutes.

Pekingese \ˌpē-kə-'nēz\ Breed of long-haired toy dog developed in ancient China, where it was held sacred and was kept in Peking's Imperial Palace. Looting English forces introduced the breed to the West in 1860. Known as the "lion dog" for its full mane but perhaps also for its courage, it stands 6–9 in. (15–23 cm) and weighs up to 14 lbs (6.5 kg). It has hanging ears, a short, wrinkled muzzle, and a black mask across the face. The coat may be solid or variegated. Chinese royalty carried very small Pekingese, called "sleeve dogs," in their sleeves.

Pekingese
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Peko \'pā-kȯ\ In Estonian religion, an agricultural deity who aided the growth of grain, especially barley. Peko was represented by a wax image that was kept buried in the grain in the granary and brought out in early spring for a ritual of agricultural fertility. At the end of a ceremonial feast, leftovers were distributed among the poor, and the men competed in wrestling or fence jumping to determine who had the right to keep Peko in his granary until the following year.

Pelagianism \pə-'lā-jē-ə-ˌni-zəm\ Christian heresy of the 5th century that emphasized free will and the goodness of human nature. Pelagius (354?–after 418), a British monk who settled in Africa in 410, was eager to raise moral standards among Christians. Rejecting the arguments of those who attributed their sins to human weakness, he argued that God made humans free to choose between good and evil and that sin is an entirely voluntary act. His disciple Celestius denied the church's doctrine of original sin and the necessity of infant baptism. Pelagius and Celestius were excommunicated in 418, but their views continued to find defenders until the Council of Ephesus condemned Pelagianism in 431.

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Pelé \'pā-ˌlā\ *orig.* **Edson Arantes do Nascimento** (b. Oct. 23, 1940, Três Corações, Braz.) Brazilian football (soccer) player, in his time perhaps the most celebrated athlete in the world. He joined the Santos Football Club in 1956 and helped lead that team to a world club championship in 1962. He was part of three Brazilian national teams that won World Cup championships (1958, 1962, 1970). In 1969, during his 909th match, he scored his 1,000th goal. He combined kicking power and accuracy with a remarkable ability to anticipate other players' moves. In 1975 he joined the New York Cosmos of the North American Soccer League (NASL); he retired after leading the team to the league championship in 1977. He was the 1978 recipient of the International Peace Award, and in 1980 he was named Athlete of the Century.

Pelé.
AFP/PICTORIAL PARADE

Pelée \pə-'lā**, Mount** Active volcanic mountain, northern Martinique, West Indies. It is northwest of Fort-de-France and is 4,583 ft (1,397 m) high. A gently sloping cone, it supports luxuriant forests. A violent eruption in 1902 destroyed the port of Saint-Pierre, killing about 30,000 people. A minor eruption occurred in 1929.

Pelew See Palau

Pelham, Henry (b. 1696—d. March 6, 1754, London, Eng.) British prime minister (1743–54). He was elected to Parliament in 1717 and, as a supporter of Robert Walpole, became secretary for war (1724) and paymaster of the forces (1730). He succeeded Walpole as prime minister and chancellor of the Exchequer in 1743 and led a stable Whig ministry with parliamentary assistance from his brother, Thomas Pelham-Holles, duke of Newcastle. Pelham resisted attempts to prolong the War of the Austrian Succession and signed the Treaty of Aix-la-Chapelle (1748). After the war, he introduced financial reforms, including lower military expenditures, a reduced land tax, and a consolidation of the national debt.

Pelham-Holles, Thomas See Duke of Newcastle

pelican Any of about eight species constituting the genus *Pelecanus* (family Pelecanidae), white or brown birds distinguished by a large, elastic throat pouch. Some species are 70 in. (180 cm) long, have a wingspan of 10 ft (3 m), and weigh up to 30 lbs (13 kg). Most species drive fish into shallow water and, using the pouch as a dip net, scoop them up and immediately swallow them. Pelicans inhabit freshwaters and seacoasts in many parts of the world; they breed in colonies on islands, laying one to four eggs in a stick nest. Chicks thrust their bills down the parent's gullet to obtain regurgitated food.

Brown pelican (*Pelecanus occidentalis*).
NORMAN TOMALIN—BRUCE COLEMAN INC.

Pella Ancient capital, Macedonia. Located in northern Greece, northwest of Thessaloníki, the city flourished at the end of the 5th century BC. Originally known as Bounomos, it developed rapidly under Philip II, but, after the Romans defeated the last Macedonian king, it became a small provincial town. Archaeological excavations began in 1957 and revealed large, well-built houses with rooms with mosaic floors dating from the late 4th century BC. Pella was the birthplace of Alexander the Great.

pellagra \pə-'la-grə\ Nutritional disorder caused largely by a deficiency of niacin, marked by skin lesions and digestive and neurological disturbances. Dermatitis usually appears first, with abnormal sensitivity to sunlight. It may look like a severe sunburn, later becoming reddish brown, rough, and scaly. Diarrhea usually alternates with constipation, along with mouth and tongue inflammation and cracking and dry scaling of the lips. Later, mental abnormalities may include nervousness, depression, and delirium. Mild cases of niacin deficiency respond to a well-balanced diet alone. Pellagra still occurs where diets consist mostly of corn, which is low in both niacin and tryptophan (converted to niacin in the body), with little or no protein-rich food. It can also be a side effect of chronic alcoholism.

Peloponnese \'pe-lə-pə-ˌnēz\ Peninsula, forming the southern part of mainland Greece. A large, mountainous body of land jutting south into the Mediterranean Sea, the peninsula has an area of 8,278 sq mi (21,439 sq km) and is joined to the rest of mainland Greece by the Isthmus of Corinth. The Mycenaean civilization flourished there in the 2nd millennium BC at Mycenae and Pylos. Its chief cities during the classical period were Corinth and Sparta. Under the Romans it was part of the province of Achaea from 146 BC to c. 4th century AD. It was part of the Byzantine Empire until it was taken by the Franks; they held it in the 13th–15th centuries, when it was often known as Morea. The modern city of Patras (pop., 2001: 163,446), in the north, is a commercial centre.

Peloponnesian League *or* **Spartan Alliance** Military coalition of Greek city-states led by Sparta, formed in the 6th century BC. League decisions about war, peace, or alliance were determined by congresses summoned by the Spartans. The league was a major force in Greek affairs, forming the core of resistance to the Persian invasions in 490 and 480 and fighting Athens in the Peloponnesian War. Its power declined after its defeat at Leuctra in 371, and the league disbanded in 366/365.

Peloponnesian War (431–404 BC) War fought between Athens and Sparta, the leading city-states of ancient Greece, along with their allies, which included nearly every other Greek city-state. Its principal cause was a fear of Athenian imperialism. The Athenian alliance relied on its strong navy, the Spartan alliance on its strong army. The war fell into two periods, separated by a six-year truce. Fighting broke out in 431, with Pericles commanding the Athenians. In the first 10 years, Archidamus led the Spartans to defeats. Plague struck Athens in 429, killing Pericles and much of the army. In 428 Cleon almost convinced Athens to massacre the rebellious citizens of Mytilene on Lesbos, but Athens rescinded the order. In 421 both states agreed to accept the Peace of Nicias. This lasted six years, until Athens launched its disastrous Sicilian expedition. By 413 Athens's forces were demolished. In 411 an oligarchy briefly took power. When democratic leaders were restored by the navy later that year, they refused Spartan peace offers, and the war continued until 405, when the Athenian navy was destroyed at the Battle of Aegospotami with Persian help. Under blockade, Athens surrendered in 404. Its empire was dismantled, and the Spartans installed the Thirty Tyrants.

Pelops \'pē-ˌläps, 'pe-ˌläps\ In Greek mythology, founder of the Pelopid dynasty at Mycenae. Pelops was a grandson of Zeus. His father, Tantalus, cooked and served Pelops to the gods at a banquet, and only Demeter, mourning the loss of her daughter, Persephone, was distracted enough to eat from the dish. The gods ordered the body restored, but the shoulder, Demeter's portion, was missing, and the boy was given a replacement of ivory. In another story, Poseidon, helped Pelops gain the hand of Hippodamia, daughter of King Oenomaus of Pisa.

pelota \pə-'lō-tə\ (Spanish: "little ball") Any of several games in which players take turns, using a glove or implement, hitting a rubber ball either directly at one another or off a wall. The latter version is related to handball and jai alai, which are played by two or four players on one-, two-, or three-walled courts using gloves, rackets, or bats. In Spain and elsewhere, pelota is a professional sport on which spectators wager.

Pelusium \pə-'lü-shē-əm\ Ancient Egyptian city. Located on what was once the easternmost mouth of the Nile River, its ruins lay southeast of modern Port Said. Beginning in the 26th dynasty (c. 7th century BC), it was the main frontier fortress facing Palestine and was a customs post for Asian goods. In 522 BC the Achaemenian Persians, under Cambyses II, defeated the pharaoh Psamtik III there. In Roman times it was a station on the trade route to the Red Sea; its ruins date from the Roman period.

pelvic inflammatory disease (PID) Acute inflammation of the pelvic cavity in women, caused by bacterial infection (usually gonorrhea or chlamydia) of the reproductive system. Usually a sexually transmitted disease, it occurs mainly in sexually active women under age 25, more often in those using intrauterine devices (IUDs). PID can resemble gonorrhea, with abdominal and lower pelvic pain, chills, nausea, fever, and thick, foul-smelling vaginal discharge. Fallopian tube scarring can cause infertility and ectopic pregnancy. Treatment requires antibiotics, bed rest, pain

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medication, and sexual abstinence until the infection disappears. Sexual partners must also be treated to prevent reinfection.

Pemex *officially* **Petróleos Mexicanos** Mexico's state-owned oil company. In 1938 Pres. Lázaro Cárdenas nationalized 17 foreign oil companies to create Pemex, the largest Latin American petroleum company and a major world exporter of fossil fuel. Pemex engages in exploration, production, refining, transportation, storage, distribution, and sales of oil and natural gas. In the 1970s promising oil discoveries gave rise to a national spending spree, led by the flamboyant Pres. José López Portillo and financed by massive borrowing. Crude-oil production tripled, but when the international price of oil collapsed in 1981, López Portillo raised Mexican oil prices. The country was virtually bankrupt within one year. Economic reforms have since contributed to greater stability. At the turn of the 21st century, Pemex accounted for nearly 40% of the Mexican government's income.

pen drawing Artwork executed wholly or in part with pen and ink, usually on paper. It is fundamentally a linear method of making images. Artists who wish to suggest three-dimensional forms use hatching and cross-hatching or washes of colour laid onto the drawing with a brush. The three most common types of ink are black carbon ink, the finest type being Chinese ink or the modern India ink; brown ink, which was popular with the Old Masters; and iron gall, a chemical ink. The three pen types are quill, reed, and metal. Quill pens were most popular for their flexibility and ability to be sharpened to extreme fineness. Steel became the predominant pen type by the 20th century.

penal colony Distant or overseas settlement established to punish criminals with forced labour and isolation from society. Such colonies were developed mostly by the English, French, and Russians. Britain sent criminals to its American colonies until the Revolutionary War; Australia was principally a penal colony from its colonization until the mid-19th century. French Guiana, site of a French penal colony, was infamous for its inhumanity; Devil's Island was still operating during World War II. Russian penal colonies were established in Siberia under the tsars but were most widely used during the Stalin era. Notorious for their harsh punishments and underfeeding, most penal colonies have now been abolished.

Penang \pə-ˈnaŋ\ *Malay* **Pinang** Island (pop., 2000 prelim.: 1,225,501), Malaysia, off the northwestern coast of the Malay Peninsula, part of the state of Pulau Pinang. The capital and chief port is George Town (pop., 2000 prelim.: 180,573), in the northeast. British colonization began in 1786. In 1826 Penang (known until 1867 as Prince of Wales Island) combined with Malacca and Singapore to form the Straits Settlements. From the mid-19th century it was a market for tin and rubber. In 1948 it became part of the Federation of Malaya, later Malaysia. In the late 20th century it became Malaysia's prime tourist centre, with resort hotels mainly on the northern coast at Batu Feringgi.

Penates \pə-ˈnā-tēz, pə-ˈnä-tēz\ Roman household gods. They were worshiped privately as protectors of the household and also publicly as protectors of the Roman state. They were sometimes associated with other deities of the house, such as Vesta, and their name was often used interchangeably with that of the Lares. Each house had a shrine with their images, which were worshiped at the family meal and on special occasions. Offerings were portions of the regular meal or of special cakes, wine, honey, and incense. The number and precise identities of the Penates were a puzzle even to the ancients.

pencil drawing Drawing executed with a pencil, an instrument made of graphite enclosed in a wood casing. Though graphite was mined in the 16th century, its use by artists is not known before the 17th century. In the 17th–18th century, graphite was used primarily to make preliminary sketches for more elaborate work in another medium, seldom for finished works. By the late 18th century, an ancestor of the modern pencil was constructed by inserting a rod of natural graphite into a hollow cylinder of wood. Pencil rods produced from mixtures of graphite and clays, true prototypes of the modern graphite pencil, were introduced in 1795. This improvement allowed for better control and encouraged wider use. The great masters of pencil drawing kept the elements of a simple linearism with limited shading, but many artists in the 18th–19th century created elaborate effects of light and shade by rubbing the soft graphite particles with a tightly rolled paper or chamois.

pendant *or* **pendent** In architecture, a sculpted ornament suspended from a vault or ceiling, especially an elongated boss (carved keystone) at the junction of the intersecting ribs of the fan vaulting associated with the English Perpendicular style. In stone ceilings, the use of pendant vaulting was a solution to the difficulty of adapting fan vaulting to very wide church naves. Strong transverse arches were made to span the area, and these in turn supported the elongated keystones. Intermediate rib and panel vaults sprang from these pendants.

pendant Ornament suspended from a bracelet, earring, or necklace and derived from the primitive practice of wearing amulets or talismans around the neck. The practice dates from the Stone Age, when pendants consisted of objects such as teeth, stones, and shells. Commemorative and decorative pendants were common in ancient Egypt, Greece, and Rome. In the Middle Ages reliquaries, or devotional pendants, and crosses were created with jewels. By the beginning of the 16th century, Renaissance artists were creating pendants for decorative rather than religious use. The late 19th-century Art Nouveau movement often featured women's figures, butterflies, or flowers on pendants.

Art Nouveau pendant by L. Gautrait, c. 1900; in the Schmuckmuseum, Pforzheim, Ger.
COURTESY OF THE SCHMUCKMUSEUM, PFORZHEIM, GER.

pendentive In architecture, a triangular segment of a spherical surface that forms the transition between the circular plan of a dome and the polygonal plan of its supporting structure. The problem of placing a round dome on a square base assumed growing importance to Roman builders, but it remained for Byzantine architects to recognize the possibilities of the pendentive and fully develop it (see Hagia Sophia). One of the great architectural inventions of all time, the pendentive became very important in the Renaissance and Baroque periods. As a result of Byzantine influence, pendentives are also frequent in Islamic architecture. The vaulting form in which the curve of the pendentive and dome is continuous is known as a pendentive dome.

Penderecki \ˌpen-də-ˈret-skē**, Krzysztof** (b. Nov. 23, 1933, Debica, Pol.) Polish composer and conductor. He studied composition at the Kraków Conservatory and would later serve as its director (1972–87). His early music (1960–74) involved dense note clusters and unorthodox sounds, and he developed his own musical notation to convey the desired effects, resulting in vivid works that attracted international attention, including *Threnody for the Victims of Hiroshima* (1960), *Stabat Mater* (1962), the *St. Luke Passion* (1963–65), and the opera *The Devils of Loudun* (1969). After 1975 he embraced a more traditional approach with works such as the opera *Paradise Lost* (1978), concertos for violin (1977), cello (1982), and viola (1983), and *Lux aeterna* (1983).

Pendergast, Thomas J(oseph) (b. July 22, 1872, St. Joseph, Mo., U.S.—d. Jan. 26, 1945, Kansas City, Mo.) U.S. politician. He was active in municipal politics in Kansas City, Mo., and became the political boss of the city's Democrats by 1916. His political machine dominated city and state politics for almost 25 years and influenced national Democratic conventions. He helped Harry S. Truman in his early political career. Attacked by opponents for allowing corrupt practices in Kansas City, he was convicted of income-tax evasion in 1939 and served one year in prison.

Pendleton, George (Hunt) (b. July 29, 1825, Cincinnati, Ohio, U.S.—d. Nov. 24, 1889, Brussels, Belg.) U.S. politician. He served in the U.S. House of Representatives from 1857 to 1865 and was the unsuccessful Democratic candidate for vice president (with George B. McClellan) in 1864. A member of the Greenback movement, he advocated the Ohio Idea for redeeming American Civil War bonds. From 1879 to 1885 he served in the U.S. Senate, where he sponsored the Pendleton Civil Service Act. He served as minister to Germany from 1885 to 1889.

Pendleton Civil Service Act (1883) U.S. legislation establishing the modern civil-service system of permanent federal employment based on merit. Public demand for civil-service reform to replace the system based on political party affiliation (the spoils system) resulted in a bill sponsored by Sen. George Pendleton, which provided for selection of government employees by competitive examination administered by a civil-service

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commission. Only 10% of government jobs were originally covered by the law, but successive Congresses expanded its scope to include more than 90% of federal employees.

pendulum Body suspended from a fixed point so that it can swing back and forth under the influence of gravity. A simple pendulum consists of a bob (weight) suspended at the end of a string. The PERIODIC MOTION of a pendulum is constant, but can be made longer or shorter by increasing or decreasing the length of the string. A change in the mass of the bob alone does not affect the period. Because of their constancy, pendulums were long used to regulate the movement of clocks. Other, special kinds of pendulums are used to measure the value of *g*, the acceleration due to gravity, and to show that the earth rotates on its axis (see FOUCAULT PENDULUM).

peneplain \'pē-nə-ˌplān\ Gently undulating, almost featureless plain near sea level. This would form, theoretically, by various erosional processes that reduce areas of initially high relief produced by active uplift to areas of virtually no relief. The lack of present-day peneplains tends to discredit the theory, but some geomorphologists propose that large areas of low relief at high altitude in some mountains are evidence of uplifted peneplains. Others question whether the dynamic relationship between erosion and rock type would ever allow the development of a peneplain, even over very long timespans.

Peneus River See PINIÓS RIVER

penguin Any of 17 species (order Sphenisciformes) of flightless seabirds that breed mainly on islands in subantarctic waters and on cool coasts of Africa, Australia, New Zealand, and South America. A few species inhabit temperate regions, and the Galápagos penguin (*Spheniscus mendiculus*) lives in the equatorial tropics off South America. Species differ mainly in size and head pattern; all have a dark back and a white belly. The smallest species, the little blue penguin (*Eudyptula minor*), is about 14 in. (35 cm) tall; the largest, the emperor penguin (*Aptenodytes forsteri*), is almost 4 ft (120 cm) tall. At sea for weeks at a time, flocks feed on fish, squid, and crustaceans.

penicillin ANTIBIOTIC derived from the *PENICILLIUM* mold. It was discovered in 1928 by ALEXANDER FLEMING; by 1940, HOWARD WALTER FLOREY, ERNST BORIS CHAIN, and others had produced commercial quantities that proved vital to the treatment of war casualties, making penicillin the first successful antibiotic for human bacterial infections. Many natural and semisynthetic (ampicillin, amoxicillin) variants have since been produced. All work by inhibiting the enzymes responsible for bacterial cell wall synthesis (and therefore do not work against microorganisms without cell walls or with certain variant cell walls; e.g., the tuberculosis bacillus). Among the bacteria susceptible to penicillin are those causing strep throat, spinal MENINGITIS, gas GANGRENE, and SYPHILIS. Overuse has led to DRUG RESISTANCE in some strains. Penicillin's chief side effect is ALLERGY, which can be life-threatening.

Penicillium \ˌpe-nə-'si-lē-əm\ Any blue or green MOLD in the genus *Penicillium* (kingdom Fungi; see FUNGUS). Common on foodstuffs, leather, and fabrics, they are economically important in producing ANTIBIOTICS (see PENICILLIN), organic acids, and cheeses such as English Stilton, Italian Gorgonzola, and French Roquefort.

Peninsular War (1808–14) Part of the NAPOLEONIC WARS, fought on the Iberian Peninsula. After French forces occupied Portugal (1807) and NAPOLEON installed his brother JOSEPH BONAPARTE as king of Spain (1808), a rebellion in Madrid began what was called in Spain "the War of Independence," and insurrections soon erupted in other cities. By 1810 the French overcame the Spanish rebels in Madrid and elsewhere in Spain. Meanwhile, the British under the future duke of WELLINGTON landed in Portugal (1808), where they fought the French in inconclusive campaigns until 1812. After Napoleon withdrew French forces to bolster his invasion of Russia, Wellington began his gradual advance into Spain. The British victory at the Battle of Vitoria (1813) and their march into southwestern France forced the French to withdraw from Spain and to reinstall FERDINAND VII as king (1814).

penis Male sex organ, which also provides the channel for urine to leave the body. Three long columns of tissue extend through its length, covered by elastic tissue and a thin layer of skin. One expands at the tip into a mushroom-shaped structure (glans penis) and contains the urethra (see URINARY SYSTEM), which ends in a slitlike opening. In sexual arousal, blood fills spaces in the tissue, and blood vessels constrict to hold it there, enlarging and hardening the penis in an erection. The foreskin, a circular fold of skin covering the glans, is often removed (see CIRCUMCISION). See also REPRODUCTIVE SYSTEM.

Penn, Irving (b. June 16, 1917, Plainfield, N.J., U.S.) U.S. photographer. He aspired to be a painter but at 26 took a job designing photographic covers for *Vogue* and soon was established as a fashion photographer. His austere fashion images communicated elegance and luxury through compositional refinement and clarity of line rather than through the use of elaborate props and backdrops. He branched out into portraiture after World War II and became much admired as a portraitist of celebrities. In his portraits the subject is usually posed before a bare backdrop and photographed in natural northern light. The resulting images combine simplicity and directness with great formal sophistication.

Penn, William (b. Oct. 14, 1644, London, Eng.—d. July 30, 1718, Buckinghamshire) English Quaker leader and founder of Pennsylvania. Expelled from Oxford for his Puritan beliefs, he was sent to manage the family estates in Ireland, where he joined the Society of FRIENDS in 1667. He was imprisoned four times for stating his Quaker beliefs in print and in speech; one of his trials resulted in the precedent-setting Bushell's Case, which established the independence of juries. In *The Great Case of Liberty of Conscience* (1670), Penn advocated religious toleration and envisioned a colony based on religious and political freedom. On his father's death, he inherited his estates and his influence with CHARLES II, who granted him a vast province on the Delaware River in payment for debts owed his father. In 1682 he drafted a Frame of Government that established freedom of worship in the settlement. Upon his arrival later that year, he negotiated a series of treaties with the local Indians. In 1684 he traveled to England to defend his interests against claims by neighbouring Maryland. With the accession of his friend the duke of York as JAMES II, he secured the release of imprisoned Quakers. He returned to Pennsylvania in 1699, where he wrote the Charter of Privileges, which allowed the assembly greater autonomy. The years after his return to England in 1701 were clouded by debt and illness.

Penney, J(ames) C(ash) (b. Sept. 16, 1875, Hamilton, Mo., U.S.—d. Feb. 12, 1971, New York, N.Y.) U.S. merchant. He became a partner in a dry-goods store in Wyoming in 1902 and five years later bought out his partners' shares to launch what became the J.C. Penney Co. His stores offered a wide variety of inexpensive merchandise, and he offered profit-sharing plans, first to managers and later to all employees. By 1929 the company had 1,392 stores across the U.S., and at the time of Penney's death it was the second largest merchandiser in the country, behind SEARS, ROEBUCK AND CO.

Pennines \'pe-ˌnīnz\ Upland mass, northern England. The Pennines extend south from NORTHUMBERLAND to DERBYSHIRE; the highest point is Cross Fell, at 2,930 ft (893 m). Water action has developed underground caverns in the uplands' limestone, which is extensively quarried. Sheep farming is also important. Archaeological remains in the area include the ancient Roman HADRIAN'S WALL.

Pennsylvania *officially* **Commonwealth of Pennsylvania** State (pop., 2000: 12,281,054), middle Atlantic region, U.S. It covers 45,333 sq mi (117,412 sq km); its capital is HARRISBURG. The state is bounded on the north by Lake Erie and New York; on the east by New York and New Jersey; on the south by Delaware, Maryland, and West Virginia; and on the west by the panhandle of West Virginia and by Ohio; the DELAWARE RIVER forms part of the eastern boundary. The MONONGAHELA RIVER unites with the ALLEGHENY RIVER at PITTSBURGH to form the OHIO RIVER. The area was inhabited by Indian peoples, including the SHAWNEE and DELAWARE, when Europeans arrived in the 17th century. In 1664 the English seized control of the region, and in 1681 the English king granted a charter to WILLIAM PENN, who established a Quaker colony based on religious tolerance in 1682. Much of the fighting of the FRENCH AND INDIAN WAR took place there. The first and second CONTINENTAL CONGRESSES met in PHILADELPHIA, and the DECLARATION OF INDEPENDENCE was signed there in 1776. One of the original states of the Union, it was the second state to ratify the U.S. Constitution in 1787. During the AMERICAN CIVIL WAR it was a centre of military activity (see Battle of GETTYSBURG). The postwar period brought great economic, industrial, and population growth, consolidating the state's position as a major commercial power. It is one of the most prosperous states, with an economy based on farming, mining, manufacturing, and high technology. The state continues to produce much of the

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nation's specialty steel and an abundance of coal. Philadelphia and Pittsburgh are major ports with fine educational, cultural, and musical institutions.

Pennsylvania, University of U.S. private university in Philadelphia, a traditional member of the IVY LEAGUE. Founded in 1740 as a charity school, it became an academy in 1753, with BENJAMIN FRANKLIN as president of the first board of trustees. With the founding of the first medical school in North America (1765), it became a university. Today, in addition to its college of arts and sciences and its medical school, it includes a college of general studies and schools of business (the Wharton School), communication (the Annenberg School), education, engineering, fine arts, law, nursing, dentistry, veterinary medicine, and social work. Its institutes include the Wistar Institute of Anatomy and Biology and the Phipps Institute of Genetics and Community Diseases. The University Museum (of archaeology and ethnology) is a teaching and research organization.

Pennsylvania Railroad Co. Former U.S. railroad. It was chartered in 1846 by the Pennsylvania legislature to build a line between Harrisburg and Pittsburgh, and its passenger service began two years later. By purchasing the Pittsburgh, Fort Wayne and Chicago Railway in 1856, the company extended its service to Chicago. After the Civil War it expanded to St. Louis, Mo., and Cincinnati, Ohio, in the west and Norfolk, Va., in the south, with 10,000 mi (16,000 km) of track at its greatest extent. It began to lose money in the mid 20th century, and in 1968 it merged with its competitor, the NEW YORK CENTRAL, to form the Penn Central Transportation Co. Penn Central declared bankruptcy in 1970; its passenger service was taken over by AMTRAK in 1971 and its assets by CONRAIL in 1976. See also J. EDGAR THOMSON.

Pennsylvania State University U.S. public state system of higher education with a main campus in University Park and numerous other campuses and locations, including the Milton S. Hershey Medical Center in Hershey and the Dickinson School of Law in Carlisle. The university originated with the charter of the Farmers' High School in 1855 and was designated the commonwealth's land-grant college in 1862. It took its current name only in 1953. Research facilities include the Biotechnology Institute, the Center for Applied Behavioral Science, and the Center for Particle Science and Engineering.

Pennsylvanian Period In North America, the interval of geologic time roughly equivalent to what is internationally designated the Late CARBONIFEROUS PERIOD (323–290 million years ago). Because the rocks that originated during this span of time are widespread in the state of Pennsylvania, some U.S. geologists favour the term over Late Carboniferous Period, which was first adopted in Europe.

Penobscot \pə-'näb-skət\ **River** River, central Maine, U.S. The Penobscot, which flows south into Penobscot Bay, is the state's longest river—about 350 mi (560 km). It is navigable for 60 mi (97 km) to Bangor. Once an important source of salmon, it has become economically important to the lumber, pulp, and paper industries because of its hydropower facilities. Navigated by French and English voyagers in the early 17th century, it was named for the Penobscot Indians.

penology \pē-'nä-lə-jē\ Branch of CRIMINOLOGY dealing with prison management and the treatment of offenders. Penological studies have sought to clarify the ethical bases of punishment, along with the motives and purposes of society in inflicting it; differences throughout history and between nations in penal laws and procedures; and the social consequences of the policies in force at a given time. Influential historical works have included Cesare Beccaria's *On Crimes and Punishments* (1764), JEREMY BENTHAM's "Panopticon" scheme (c. 1800), Cesare Lombroso's *Crime* (1876), and MICHEL FOUCAULT's *Discipline and Punish* (1975).

pension Series of periodic money payments made to a person who retires from employment because of age, disability, or the completion of an agreed span of service. The payments generally continue for the rest of the recipient's natural life, and they are sometimes extended to a widow or other survivor. Military pensions have existed for many centuries; private pension plans originated in Europe in the 19th century. There are two basic types of pension plans: defined contribution and defined benefit. A defined contribution plan invests a defined amount each pay period. The individual may have some discretion as to how the money is invested. The benefit, the amount of the pension, depends on the success of those investments. A defined benefit plan pays a known amount according to some formula, but the amount invested in the fund may vary. Pensions may be funded by making payments into a pension TRUST FUND or by the purchase of ANNUITIES from insurance companies. In plans known as multiemployer plans, various employers contribute to one central trust fund administered by a joint board of trustees.

Pentagon Huge five-sided building (1941–43) in Arlington, Va., that is the headquarters of the U.S. Department of Defense. Designed by George Edwin Bergstrom, it was, on its completion, the world's largest office building, covering 34 acres (14 hectares) and offering 3.7 million sq ft (about 344,000 sq m) of usable floor space for as many as 25,000 workers. Built of structural steel and reinforced concrete with some limestone facing at a cost of $83 million, the five-story structure actually consists of five concentric pentagons, with 10 spokelike corridors connecting the whole. In 2001 more than 180 people were killed and many more were injured when part of the Pentagon's southwest side was destroyed in the SEPTEMBER 11 ATTACKS.

Pentagon Papers Secret documents detailing the U.S. role in Indochina from World War II to 1968. The U.S. Defense Department commissioned the study; a project associate, Daniel Ellsberg, who was opposed to U.S. participation in the VIETNAM WAR, leaked details of the documents to the press. In June 1971 *The New York Times* began publishing articles based on the study. The U.S. Justice Department, citing national security, obtained a temporary court order halting publication. The U.S. Supreme Court ruled that the government had failed to justify restraint of publication, and the documents were published widely, fueling debate over the country's Vietnam policy.

Pentateuch See TORAH

pentathlon Athletic contest entailing five distinct types of competitions. In the ancient Olympic Games, the pentathlon included a sprint, the LONG JUMP, DISCUS THROW, JAVELIN THROW, and a WRESTLING match. A modified version (with a medium-distance race substituted for the wrestling match) was included in the revived Olympic Games (1912–24). The modern, or military, pentathlon, included in the Olympics from 1912 and made a team event in 1952, includes an equestrian STEEPLECHASE, FENCING, pistol SHOOTING, a freestyle swim, and a CROSS-COUNTRY RUN. Women's pentathlon competition (SHOT PUT, HIGH JUMP, HURDLING race, sprint, and long jump) was replaced in 1981 by the HEPTATHLON.

Pentecost (from Greek *pentecoste*, "fiftieth day") Christian festival commemorating the descent of the HOLY SPIRIT on the disciples of Jesus, occurring on the Jewish Pentecost, after Jesus' death, resurrection, and ascension. The disciples began to speak in the many languages of the people assembled there, a sign that the disciples should spread the Christian message throughout the world. Jewish Pentecost was a thanksgiving feast for the first fruits of the wheat harvest and was associated with remembrance of God's gift of the Law to Moses on Mount Sinai. Christian Pentecost is celebrated on the Sunday concluding the 50-day period following Easter. It is also the name of the Jewish celebration of Shavuot ("Festival of Weeks").

Pentecostalism Protestant religious movement that originated in the U.S. in the 19th–20th century. It is characterized by a belief that all Christians should seek a postconversion religious experience called BAPTISM with the HOLY SPIRIT. The experience corresponds to the descent of the Holy Spirit on the twelve APOSTLES (PENTECOST) and is evidenced by speaking in tongues, prophesying, and healing. Pentecostalism grew out of the 19th-century HOLINESS MOVEMENT and shares its emphasis on biblical literalism, conversion, and moral rigor. The charismatic movement in Roman Catholic and mainstream Protestant denominations represents the same spirit. Today there are many Pentecostalist denominations in the U.S. and around the world, including the ASSEMBLIES OF GOD. Penetcostalism has been especially successful in the Caribbean, Latin America, and Africa.

penthouse Enclosed area on top of a building. A penthouse can be an apartment on the roof or top floor of a building or a structure on the roof housing the top of an elevator shaft, air-conditioning equipment, or stairs leading to the roof. A penthouse is usually set back from the vertical face of a building, but as a real-estate term, penthouse may refer to any top floor, regardless of setbacks. Though the word now often suggests a luxurious apartment with a panoramic view, historically a penthouse was a lean-to, shed, or other small structure attached to a comparatively large building.

Pentium Family of MICROPROCESSORS developed by INTEL CORP. Introduced in 1993 as the successor to Intel's 80486 microprocessor, the Pentium

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contained two processors on a single chip and about 3.3 million TRANSISTORS. Using a CISC (complex instruction set computer) architecture, its main features were a 32-BIT address BUS, a 64-bit data bus, built-in floating-point and memory-management units, and two 8KB caches. It was available with processor speeds ranging from 60 megahertz (MHz) to 200 MHz. The Pentium quickly became the processor of choice for personal computers. It was superseded by ever faster and more powerful processors, the Pentium Pro (1995), the Pentium II (1997), the Pentium III (1999), and the Pentium 4 (2000).

Penutian languages \pə-'nü-tē-ən\ Hypothetical superfamily of North American Indian languages that unites a number of languages and language families mainly of the far western U.S. and Canada. The Penutian hypothesis was proposed by Roland B. Dixon and ALFRED L. KROEBER in 1913 and refined by EDWARD SAPIR in 1921. Like the Hokan hypothesis (see HOKAN LANGUAGES), it attempted to reduce the number of unrelated language families in one of the world's most linguistically diverse areas. At its core was a group of languages spoken along California's central coast and in the CENTRAL VALLEY, including Ohlone (Costanoan), Miwok, Wintuan, Maidu, and Yokuts. Sapir added Oregon Penutian (languages once spoken in eastern Oregon), Chinookan (spoken along the lower Columbia River), Plateau Penutian (languages of PLATEAU INDIAN peoples), Tsimshian (spoken in western British Columbia), and Mexican Penutian (spoken in southern Mexico). Aside from the Mexican group, all the languages are today either extinct or spoken almost exclusively by older adults. Though the hypothesis remains unproven, at least some languages of the group are probably related to each other.

Penzias \'pent-sē-əs**, Arno (Allan)** (b. April 26, 1933, Munich, Ger.) German-born U.S. astrophysicist. His family fled Nazi Germany, and he received his Ph.D. from Columbia University, after which he joined Bell Telephone Laboratories, where he worked with ROBERT W. WILSON monitoring radio emissions from a ring of gas around the Milky Way Galaxy. The two detected an unexpected uniform background static that suggested a thermal energy throughout the universe at a temperature of about –454 °F (–269 °C), which most scientists now agree is residual COSMIC BACKGROUND RADIATION stemming from the BIG BANG explosion billions of years ago, from which the universe was created. They shared a 1978 Nobel Prize with Pyotr Kapitsa (1894–1984) for their work. In 1981 Penzias became a vice president at Bell Laboratories, retiring in 1998.

peonage \'pē-ə-nij\ Form of involuntary servitude, the origins of which date to the Spanish conquest of Mexico, when the conquerors forced the poor, especially Indians, to work for Spanish planters and mine operators. In the U.S., the word *peon* referred to workers compelled by contract to pay their creditors in labour. Though prohibited under U.S. federal law, peonage persisted in some southern states through state laws that made labour compulsory. Another form of peonage exists when prisoners sentenced to hard labour are farmed out to labour camps.

peony \'pē-ə-nē\ Any of about 33 species of flowering plants in the genus *Paeonia*, sole genus of the family Paenoiaceae, found in Europe, Asia, and western North America and known for their large, showy blossoms. Herbaceous peonies are perennials that grow to about 3 ft (1 m). Their annual stems bear large, glossy, much-divided leaves and produce large single and double flowers of white, pink, rose, and deep crimson. Tree peonies are shrubs about 4–6 ft (1.2–1.8 m) high with permanent rootstocks and woody stems that bear flowers varying in colour from white to lilac, violet, and red.

People's Liberation Army Unified organization of China's land, sea, and air forces. With more than 2,000,000 troops, it is the largest military force of any country in the world. The People's Liberation Army traces its roots to the 1927 Nanchang Uprising of the communists against the Nationalists. Initially called the Red Army, it grew under ZHU DE from 5,000 troops in 1929 to 200,000 in 1933. Only a fraction of this force survived the LONG MARCH in retreat from the Nationalists. After rebuilding its strength, a large portion of it, the Eighth Route Army, fought with the Nationalists against the Japanese in northern China. After World War II the communist forces, renamed the People's Liberation Army, defeated the Nationalists, making possible the formation of the People's Republic of China in 1949. See also LIN BIAO; MAO ZEDONG.

Peoria City (pop., 2000: 112,936), central Illinois, U.S. The city is situated where the Illinois River widens to form Peoria Lake. The first settlement on the site was a French fort established in 1680 by the French explorer LA SALLE. Later settlements were by the French, Indians, and other colonists. It was incorporated as a city in 1845. It is a major port, trade, and shipping centre for a large agricultural area. It is highly industrialized, and its products include earth-moving equipment and chemicals.

Pepin III See PIPPIN III

Pepin, Donation of See DONATION OF PIPPIN

pepper *or* **garden pepper** Any of many plants in the genus *Capsicum* of the NIGHTSHADE FAMILY, notably *C. annuum*, *C. frutescens*, and *C. boccatum*, native to Central and South America and cultivated extensively throughout tropical Asia and the equatorial New World for their edible, pungent fruits. Red, green, and yellow mild bell or sweet peppers, rich in vitamins A and C, are used in seasoning and as a vegetable food. The pungency of hot peppers, including tabasco, chili, and cayenne peppers, comes from the compound capsaicin in the internal partitions of the fruit. The spice BLACK PEPPER comes from an unrelated plant.

Red peppers (*Capsicum annuum*) from which paprika is made
G.R. ROBERTS

pepper, black See BLACK PEPPER

Pepper, Claude (Denson) (b. Sept. 8, 1900, Dudleyville, Ala., U.S.—d. May 30, 1989, Washington, D.C.) U.S. politician. He practiced law in Florida before being elected to the U.S. Senate (1937–51), where he supported legislation that created SOCIAL SECURITY, a MINIMUM WAGE, and medical assistance for the elderly. Elected to the U.S. House of Representatives (1963–89), he chaired the committee on aging and sponsored legislation abolishing mandatory retirement in federal agencies and raising the retirement age to 70 in the private sector (1968). In 1989 he was awarded the Medal of Freedom.

peppermint Strongly aromatic perennial herb (*Mentha piperita*, MINT family), source of a widely used flavouring. Native to Europe and Asia, it has been naturalized in North America. The stalked, smooth, dark green leaves and blunt, oblong clusters of pinkish lavender flowers are dried for use as a flavouring agent. Oil of peppermint is widely used to flavour confectionery, chewing gum, toothpastes, and medicines. The oil also contains MENTHOL, long used medicinally as a soothing balm.

PepsiCo, Inc. U.S. conglomerate. The SOFT DRINK Pepsi-Cola was created by a pharmacist, Caleb D. Bradham, who gave his tonic its name (from Greek *pepsis*, "digestion") in 1898 and incorporated the Pepsi-Cola Co. in 1902. After two bankruptcies and several reincorporations, the Pepsi-Cola trademark and assets were bought in 1931 by Charles G. Guth, who improved the formula and marketed a 12-ounce bottle for five cents with huge success. Pepsi-Cola merged with the soda-fountain chain Loft, Inc., in 1941, and in 1965 it merged with Frito-Lay, Inc., adopting its current name, PepsiCo, Inc. In the 1970s and '80s PepsiCo bought restaurant chains such as Pizza Hut, Taco Bell, and Kentucky Fried Chicken, but in 1997 it spun off its restaurant business into a separate company, Tricon Global Restaurants. In 2001 the QUAKER OATS CO. merged with PepsiCo.

pepsin Powerful ENZYME in gastric juice (see STOMACH) that partially digests PROTEINS in food. Glands in the stomach lining make pepsinogen, a ZYMOGEN (enzyme precursor) converted to pepsin by the HYDROCHLORIC ACID in gastric juice. Pepsin is active only in the acid environment of the stomach (pH 1.5–2.5 or less); it is ineffective in the intestine (pH 7, neutral). It is used commercially in some cheese making, in the leather industry to remove hair and residual tissue from hides, and in the recovery of silver from discarded photographic films by digesting the gelatin layer that holds the silver.

peptic ulcer Sore that develops in the mucous membrane of the STOMACH (more frequent in women) or DUODENUM (accounting for 80% of ulcers and more frequent in men) when its ability to resist acid in gastric juice is reduced. It causes burning ache and hungerlike pain. Ulcers can bleed, perforate the abdominal wall, or block the gastrointestinal tract. Stress and

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diet were blamed until *Helicobacter pylori* bacteria and long-term use of ASPIRIN and similar drugs were shown to be the two major causes. The former is treated with combination drug therapy and the latter by stopping the causative drugs if possible or with drugs that reduce acid production. A rare cause is Zollinger-Ellison syndrome, in which a tumour causes increased acid secretion. Cigarette smoking slows healing and promotes recurrence.

peptide Organic compound composed of a series of AMINO ACIDS linked by peptide bonds (see COVALENT BOND) between a carbon atom of one and a nitrogen atom of the next. Peptide chains longer than a few dozen amino acids are called PROTEINS. Biosynthesis of peptides from a succession of amino acids carried by transfer RNA molecules takes place on RIBOSOMES and is catalyzed and controlled by ENZYMES. Many HORMONES, ANTIBIOTICS, and other compounds that participate in life processes are peptides.

Pepys \'pēps**, Samuel** (b. Feb. 23, 1633, London, Eng.—d. May 26, 1703, London) English diarist and public official. Born into a humble family, Pepys was appointed about 1659 as a clerk in the office of the Exchequer, where on Jan. 1, 1660, he began the diary for which he is chiefly known. He steadily improved his position, in time becoming secretary of the Admiralty, a member of Parliament, president of the Royal Society, trusted confidant of CHARLES II and JAMES II, and friend of the great scholars of his age. His diary (published 1825), which he kept through 1669, presents a fascinating picture of the official and upper-class life in Restoration London, with vivid, honest accounts of ordinary as well as great events, including the Plague and the GREAT FIRE OF LONDON.

Samuel Pepys, oil painting by John Hayls, 1666; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Pequot \'pē-ˌkwät\ North American Indian people now living in eastern Connecticut, U.S. Pequot is an Algonquian language, and the name is derived from an Algonquian word meaning "destroyers." Pequot subsistence was based on corn cultivation, hunting, and fishing. The people were at one time united with the MOHEGAN. For a brief period the Pequot lived amicably with the American colonists, but relations became strained as land pressures grew. Puritan clergymen encouraged violence against the Pequot as infidels, and in 1636 war broke out, resulting in large losses. Further destruction resulted when the remaining Pequot were placed under the control of other tribes. In 1655 the few remaining Pequot were resettled on the Mystic River. The two groups of Pequot number about 1,000.

Perahia \pə-'rī-ə**, Murray** (b. April 19, 1947, New York, N.Y., U.S.) U.S. pianist. He was trained at the Mannes College of Music in New York City. He won the Leeds International Piano Competition by unanimous vote in 1972, and in 1975 he shared the first Avery Fisher Prize. From 1982 he was music director of the Aldeburgh Festival and made his home in England. He is best known for his sensitive recordings of WOLFGANG AMADEUS MOZART's concertos, conducted from the keyboard.

Peranakan \ˌper-ə-'nä-kən\ Any native-born Indonesian of mixed Indonesian and foreign ancestry. The term often refers to the Peranakan Chinese, the largest and most important Peranakan group, who formed a stable community by the mid-19th century, partly adopting the indigenous way of life and generally speaking the native tongue. By contrast, in the early 20th century a large wave of Chinese immigration created a Totok (foreign-born) Chinese community. Unlike the Peranakans, the Totoks retained their own Chinese dialects and remained China-oriented.

perception Process of registering sensory stimuli as meaningful experience. The differences between SENSATION and perception have varied according to how the terms are defined. A common distinction is that sensations are simple sensory experiences, while percepts are complex constructions of simple elements joined through association. Another is that perception is more subject to the influence of learning. Though hearing, smell, touch, and taste perceptions have all been explored, vision has received the most attention. Structuralist researchers such as EDWARD BRADFORD TITCHENER focused on the constituent elements of visual perceptions, whereas GESTALT PSYCHOLOGY has stressed the need to examine organized wholes, believing humans are disposed to identifying patterns. Visual objects tend to appear stable despite continually changing stimulus features (such as ambient light, perspective, ground vs. figure arrangement), which enables an observer to match a perceived object with the object as it is understood to exist. Perceptions may be influenced by expectations, needs, unconscious ideas, values, and conflicts.

Perceval Hero of ARTHURIAN LEGEND. His childlike innocence protected him from worldly temptation. In CHRÉTIEN de Troyes's 12th-century *Le Conte du Graal*, Perceval visits the castle of the wounded Fisher King and sees the GRAIL, but he fails to ask about it and therefore fails to heal the Fisher King. He subsequently sets out in search of the Grail and grows spiritually. In later Grail legend he was displaced by GALAHAD as the hero of the Grail quest but continued to play an important role. His story was told in WOLFRAM von Eschenbach's 13th-century *Parzifal*, which provided the basis for RICHARD WAGNER's opera *Parsifal* (1882).

Perceval \'pər-sə-vəl**, Spencer** (b. Nov. 1, 1762, London, Eng.—d. May 11, 1812, London) British prime minister (1809–12). He entered Parliament in 1796 and supported WILLIAM PITT's policy of war with France. He served as attorney general (1802–06) and as chancellor of the Exchequer (1807–09). As premier from 1809, he was noted as an efficient administrator but also for his opposition to religious tolerance. He was assassinated by a deranged man who had applied to him for redress of a complaint against the government.

perch Either of two species (family Percidae, order Perciformes) of popular food and sport fishes: the Eurasian common perch (*Perca fluviatilis*) or the North American yellow perch (*P. flavescens*). Some consider the two a single species. Both have one spiny and one soft-rayed dorsal fin. Perches are carnivores of quiet ponds, lakes, streams, and rivers. The common perch is greenish, with dark vertical bars on the sides and reddish in the lower fins. It grows to 6 lbs (3 kg), rarely more. The yellow perch, similar but yellower, grows to about 15 in. (40 cm) and weighs up to 2 lbs (1 kg); it is a popular game fish. See also SAUGER, SEA BASS, WALLEYE.

Percheron \'pər-chə-ˌrän\ Heavy breed of draft HORSE that originated in France's Perche region. The breed probably stems from the medieval Flemish "great horse," which was modified by Oriental and draft-type blood to produce animals for heavy farm work. Percherons became popular in the U.S. in the 1850s and influenced U.S. agriculture more than any other draft breed. They average 16–17 hands (64–68 in. [163–173 cm]) high and weigh 1,900–2,100 lb (860–950 kg). Common colours are black and gray. Agile and energetic for their size, they have a mild disposition.

percussion instrument A musical instrument that is struck (or sometimes shaken or scraped) to produce sound. This category includes instruments whose own hard substance is made to vibrate (idiophones) and instruments that include a tight membrane that vibrates (membranophones). Percussion instruments may produce tones of definite or indefinite pitch. Their primary function is often rhythmic, but many are used as melody instruments. They include the BELL, CARILLON, CYMBAL, DRUM, DULCIMER, GAMELAN, GLOCKENSPIEL, MARIMBA, PIANO, STEEL DRUM, TABLA, TAMBOURINE, TIMPANI, VIBRAPHONE, and XYLOPHONE.

Percy, John (b. March 23, 1817, Nottingham, Nottinghamshire, Eng.—d. June 19, 1889, London) British metallurgist. He turned to metallurgy after obtaining a medical degree, and in 1848 he devised a process for extracting silver from its ores, which soon came into widespread use. He improved the BESSEMER PROCESS for making steel, and he was the first to survey British iron ores. At London's Metropolitan School of Sciences, he trained a generation of metallurgists. His multivolume *Treatise on Metallurgy* (1861–80), though unfinished, quickly attained classic status.

Percy, Walker (b. May 28, 1916, Birmingham, Ala., U.S.—d. May 10, 1990, Covington, La.) U.S. novelist. He was orphaned in late childhood and was raised by a cousin in Mississippi. While working as a pathologist he contracted tuberculosis; during his recuperation he decided on a writing career and converted to Roman Catholicism. His first and best-known novel, *The Moviegoer* (1961), introduced his concept of malaise, a sense of spiritual emptiness characteristic of the rootless modern world. His other works, often about the search for faith and love in a New South transformed by industry and technology, include *Love in the Ruins* (1971), *The Second Coming* (1980), and *The Thanatos Syndrome* (1987).

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peregrine falcon \'per-ə-grən\ *or* **duck hawk** FALCON species (*Falco peregrinus*) found worldwide but rare today because of bioaccumulation of pesticides. Peregrines are 13–19 in. (33–48 cm) long and gray above, with black-barred whitish underparts. They fly high and dive at tremendous speed (up to 175 mph, or 280 kph—the greatest speeds attained by any bird), striking with clenched talons and killing by impact. They usually nest in a scrape on a high cliff ledge near water, where bird prey is plentiful. Breeding programs have reintroduced the species into the wild and introduced it into urban areas, where it finds a cliff-like habitat among skyscrapers and preys chiefly on the rock dove (see PIGEON). Despite the programs' success, the species remains vulnerable.

Peregrine falcon (*Falco peregrinus*). KENNETH W. FINK—ROOT RESOURCES

Pereira \pə-'rā-rä\ City (pop., 1999 est.: 381,725), west-central Colombia. It is in the western foothills of the Cordillera Central of the Andes Mountains above the CAUCA RIVER valley. Founded in 1863 on the former site of Cartago, it is a centre for coffee production and cattle raising and has some light manufacturing.

Perelman \'per-əl-mən**, S(idney) J(oseph)** (b. Feb. 1, 1904, Brooklyn, N.Y., U.S.—d. Oct. 17, 1979, New York, N.Y.) U.S. humorist. Perelman attended Brown University and soon began writing screenplays for early Marx Brothers films such as *Monkey Business* (1931) and *Horse Feathers* (1932). A master of wordplay, he regularly contributed essays to *The New Yorker*; many were collected in books such as *Westward Ha!* (1948) and *The Road to Miltown* (1957). He collaborated with KURT WEILL on the musical *One Touch of Venus* (1943). His later screenplays include *Around the World in 80 Days* (1956, Academy Award).

perennial Any plant that persists for several years, usually with new herbaceous growth from a part that survives from season to season. Trees and shrubs are perennial, as are some herbaceous flowers and vegetative ground covers. Perennials have only a limited flowering period, but with maintenance throughout the growing season, they provide a leafy presence and shape to the garden landscape. Popular flowering perennials include BELLFLOWERS, CHRYSANTHEMUMS, COLUMBINES, LOCKSPURS, HOLLYHOCKS, PHLOX, PINKS, POPPIES, and PRIMROSES. See also ANNUAL, BIENNIAL.

Peres \'per-es**, Shimon** *orig.* **Shimon Perski** (b. Aug. 16, 1923, Wołożyn, Pol.) Polish-born Israeli statesman. He immigrated to Palestine with his family in 1934 and joined the HAGANAH organization in 1947. After Israel achieved independence, he held a number of positions in the defense establishment (1948–65). In 1968 he helped establish the ISRAEL LABOUR PARTY. The indecisive 1984 election led to a power-sharing arrangement with LIKUD candidate YITZHAK SHAMIR, the two men alternating as prime minister. During Peres's tenure (1984–86), Israel withdrew from most of Lebanon. He was foreign minister under YITZHAK RABIN (1992–95); Peres, Rabin, and Palestinian leader YĀSIR ʿARAFĀT shared the 1994 Nobel Prize for Peace. Peres became prime minister again upon Rabin's assassination in 1995 but was narrowly defeated in his bid for reelection by Likud leader Benjamin Netanyahu in 1996. Although Peres declined to seek reelection as leader of the Labour Party in 1997, he later served as foreign minister (2001–02), deputy prime minister (2001–02), and vice prime minister (2005) in the national unity government led by Likud's ARIEL SHARON. In 2003 Peres resumed the chair of the Labour Party but was unexpectedly defeated in the party's leadership election in 2005. He subsequently left the Labour Party.

perestroika \ˌper-ə-'strȯi-kə\ *Russian* **"restructuring"** Program instituted in the Soviet Union by MIKHAIL GORBACHEV in the mid-1980s to restructure Soviet political and economic policy. Gorbachev proposed reducing the direct involvement of the Communist Party leadership in the country's governance and increasing the local governments' authority. Seeking to bring the Soviet Union up to economic par with capitalist countries such as Germany, Japan, and the U.S., he decentralized economic controls and encouraged enterprises to become self-financing. The economic bureaucracy, fearing loss of its power and privileges, obstructed much of his program.

Peretz \'per-ets**, I(saac) L(eib)** *or* **Yitskhok Leybush Perets** (b. May 18, 1852, or May 20, 1851, Zamość, Pol., Russian Empire—d. April 3, 1915, Warsaw) Polish writer. Peretz wrote prolifically, mostly in Yiddish, bringing to the language both a new expressive force and modernizing influences from western European art and literature. His tales of Hasidic lore (e.g., the Silent Souls series) are elegiac meditations on traditional values that draw material from the lives of impoverished eastern European Jews. Among his works are story collections, including *Folktales* (1908), the drama *The Golden Chain* (1909), and articles on many subjects to encourage Jews toward wider secular knowledge.

Pérez (Rodríguez), Carlos (Andrés) (b. Oct. 27, 1922, Rubio, Venez.) President of Venezuela (1974–79, 1989–93). He began his political career at age 18. A founder of Democratic Action, he was elected president in 1973 with the support of the liberal RÓMULO BETANCOURT. He nationalized the oil industry while retaining experienced foreign personnel to ensure efficiency, slowed production to conserve resources, stimulated small business and agriculture, and channeled petroleum income into hydroelectric projects, education programs, and steel mills. Reelected in 1989, Pérez promoted free-market economic reforms. After surviving two attempted coups, he was imprisoned in 1993 on charges of embezzlement and misuse of public funds.

Pérez de Cuéllar \'per-es-thā-'kwā-yär**, Javier** (b. Jan. 19, 1920, Lima, Peru) Fifth secretary-general of the UNITED NATIONS (1982–91). He joined the Peruvian foreign ministry in 1940 and its foreign service in 1944, serving in France, Britain, Bolivia, and Brazil. After serving as ambassador to Switzerland and as Peru's first ambassador to the Soviet Union, he was appointed the country's ambassador to the UN, a post he held until he was appointed secretary-general. As secretary-general he advocated the use of the UNITED NATIONS SECURITY COUNCIL for keeping the peace and as a forum for negotiation. In his second term, he negotiated the cease-fire that ended the IRAN-IRAQ WAR (1988). Pérez de Cuéllar later served as prime minister of Peru (2000–01).

Pérez Galdós \'pā-rāth-gäl-'dōs**, Benito** (b. May 10, 1843, Las Palmas, Canary Islands, Spain—d. Jan. 4, 1920, Madrid) Spanish novelist. In the 1870s he began a cycle of 46 short historical novels, *Episodios nacionales* (1873–1912), that earned him comparison with Honoré de BALZAC and CHARLES DICKENS. Some of his finest works chronicle contemporary Spain, including *The Disinherited Lady* (1881) and his masterpiece, *Fortunata y Jacinta* (1886–87), a study of two unhappily married women. His earlier works show a reforming zeal and anticlericalism, but after the 1880s he displayed greater sympathy for Spain and its idiosyncrasies, as in *Nazarín* (1895), *Compassion* (1897), and a series featuring the character Torquemada. He also wrote plays, some very popular but of less artistic value. He was regarded as Spain's greatest novelist since Miguel de CERVANTES.

Pérez Jiménez \'per-ez-hē-'men-ez**, Marcos** (b. April 25, 1914, Michelena, Venez.—d. Sept. 20, 2001, Madrid, Spain) Soldier and president of Venezuela (1953–58). He graduated from the Venezuelan Military Academy and in 1945 and 1948 participated in coups d'état. Appointed to the presidency by the military and elected in 1953 by the constituent assembly, which he controlled, he embarked on a program of vast public works. He and his associates received commissions on every project. His regime was marked by extravagance, corruption, police oppression, unemployment, and high inflation. He was forced out of office in 1958 and later jailed for embezzling government funds. His repeated attempts to reenter political life were thwarted.

perfect gas *or* **ideal gas** Gas whose physical behaviour conforms to the general GAS LAW, which states that for a given quantity of gas, the product of the volume V and pressure P is proportional to the absolute temperature T, or $PV = kT$, where k is a constant. A perfect gas is assumed to consist of a large number of MOLECULES in random motion, which obey NEWTON'S LAWS OF MOTION. Their volume is assumed to be negligibly small, and no forces are presumed to act on the molecules except during momentary collisions. Though no gas has these properties, real gases at sufficiently high temperatures and low pressures can be described this way.

performance art Art form that arose in Europe and the U.S. in the 1960s. The term describes an art that is live but operates outside the traditional conventions of theatre or music. Early examples represented a challenge to orthodox art forms and cultural norms by creating an ephemeral art experience that could not be captured or purchased. By the 1970s performance art was used as a general term to describe a multitude of

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activities, including happenings, body art, actions, events, and non-matrix theatre. Prominent performance artists have included Joseph Beuys, John Cage, Dennis Oppenheim, Yoko Ono, Nam June Paik, Meredith Monk, and Laurie Anderson.

perfume Fluid preparation used for scenting, composed of natural essences or synthetics and a fixative. Perfumes are concocted by the artful blending of certain fragrant substances in appropriate proportions. The art of perfumery was apparently known to the ancient Chinese, Hindus, Egyptians, Israelites, Carthaginians, Arabs, Greeks, and Romans; references to perfumes are found in the Bible. Raw materials used in perfumery include natural products, of plant or animal origin, and synthetic materials. Fine perfumes may be blends of more than 100 ingredients.

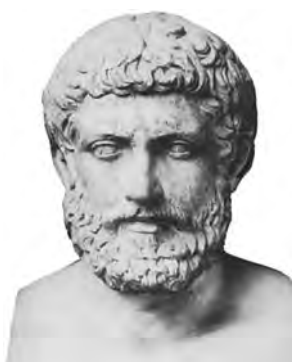
perfume bottle Vessel made to hold scent. The earliest example is Egyptian and dates to c. 1000 BC. The fashion for perfume later spread to Greece, where terra-cotta and glass containers were made in a variety of shapes such as animals and human heads. Romans made perfume bottles out of molded and blown glass. The spread of Christianity marked a decline in perfume production, as well as of glassmaking. The revival of perfume making in France in the 12th century and the popularity of Venetian glass in the 13th century revived the production of perfume bottles.

Pergamum \'pər-gə-məm\ *Greek* **Pergamon** \'pər-gə-məs\ Ancient Greek city, western Anatolia, near the modern town of Bergama, Turkey. It existed from at least the 5th century BC but became important in the Hellenistic period when it was the residence of the Attalid dynasty and reached its height (263–133 BC). Then it was bequeathed to Rome. After the fall of Rome, it was ruled by the Byzantine Empire until it passed into Ottoman hands in the early 14th century AD. It is one of the most outstanding examples of city planning in antiquity, and its library was excelled only by that at Alexandria, Egypt. Excavations begun in 1878 by the German archaeologists unearthed many artistic treasures, including the great altar of Zeus, which are now housed in Berlin's Pergamon Museum.

pergola \'pər-gə-lə\ Garden walk or terrace typically formed by two rows of columns or posts roofed with an open framework of beams and cross rafters over which plants are trained. Its purpose is to provide a foundation on which climbing plants can be viewed and to give shade. Known in ancient Egypt, pergolas were a common feature of early Renaissance gardens in Italy and subsequently throughout Europe. They had a marked revival during the Arts and Crafts Movement in Britain. See also arbor.

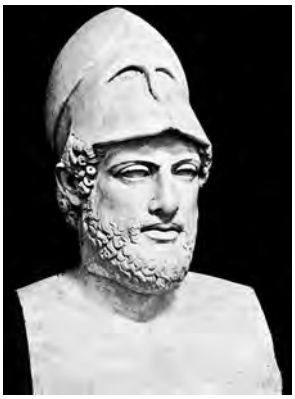
Pergolesi \ˌpər-gə-'lā-zē**, Giovanni Battista** (b. Jan. 4, 1710, Jesi, Italy—d. March 16, 1736, Pozzuoli) Italian composer. In 1732 he was appointed chapel master to a Neapolitan prince. His comic opera *Lo frate 'nnamorato* (1732) was followed in 1733 by an opera seria, which had a comic intermezzo that became his best-known work, *La serva padrona*. His health failing, he moved into a Franciscan monastery (1736), where he wrote his famous *Stabat Mater* and *Salve Regina* before dying at age 26. Traveling opera troupes took up *La serva padrona*, and in 1752 the success of a Paris production set off the controversy known as the *guerre des bouffons* ("war of the buffoons"), with musical forgers vying to produce spurious works of Pergolesi, leaving some uncertainty about the authenticity of works attributed to him.

Periander \ˌper-ē-'an-dər\ (d. c. 587 BC) Second tyrant of Corinth (c. 627–587). He was the son of Cypselus, founder of the Cypselid dynasty. One of the most violent of the early Greek tyrants, he killed his wife and avenged the death of his son in Corcyra by sending 300 Corcyran boys to be castrated (they managed to escape). He treated the nobility harshly but built a strong, prosperous Corinthian economy. His extensive building program included construction of the Diolkos, a portage used to transport ships across the Isthmus of Corinth.



Periander, marble bust in the Vatican Museum, Rome
THE MANSELL COLLECTION

Pericles \'per-ə-ˌklēz\ (b. c. 495, Athens—d. 429 BC, Athens) Athenian general and statesman largely responsible for the full development of Athenian democracy and the Athenian empire. Related to the influential Alcmaeonid family, he was elected to power sometime after 461, and he quickly helped adopt essential democratic reforms. He asserted Athenian control over the Delian League and used the league's treasury to rebuild the Acropolis, which had been sacked by the Persians. His influential consort Aspasia bore him a son, who was legitimated when his legitimate sons died. In 447–446 Athens lost Megara, giving Sparta direct access to Attica. Though Athens and Sparta agreed on a Thirty Years' Peace (446–445), Pericles had the Long Walls from Athens to the port at Piraeus strengthened for protection. When war broke out in 431, he relied on the navy to keep the city supplied. Attica's population was brought inside the Long Walls, leaving the countryside open to Spartan pillaging. When plague broke out, killing one-fourth of the population, he was deposed and fined. He was reelected, but he too died of the plague. His great funeral oration (c. 430) remains one of the greatest defenses of democracy, and his era is remembered as the Golden Age of Athens.



Pericles, detail of a marble herm; in the Vatican Museum
ANDERSON-ALINARI FROM ART RESOURCE/EB INC.

peridot \'per-ə-ˌdät, 'per-ə-ˌdō\ *or* **precious olivine** \'ä-lə-ˌvēn\ Gem-quality, transparent green olivine. Very large crystals are found in Myanmar; peridots from the U.S. are seldom larger than two carats. Yellow-green peridot has been called chrysolite (Greek for "golden stone"); this term, used for various unrelated minerals, is now less common for the gemstone.

peridotite \pə-'ri-də-ˌtīt\ Coarse-grained, heavy, igneous rock that contains at least 10% olivine, other iron- and magnesium-rich minerals (generally pyroxenes), and not more than 10% feldspar. Peridotite is the ultimate source of all chromium ore and naturally occurring diamonds, and of nearly all chrysotile asbestos. Nearly all peridotite is more or less altered to serpentine; in warm, humid climates peridotite and serpentine have weathered to soils and related deposits that, though now worked on a relatively small scale, are potential sources of iron, nickel, cobalt, and chromium.

Périer \pār-'yā**, Casimir (-Pierre)** (b. Oct. 21, 1777, Grenoble, France—d. May 16, 1832, Paris) French statesman. Son of a financier, he cofounded a bank in 1801 and by 1814 was a leading banker in Paris. He was elected to the French Chamber of Deputies (1817), where he opposed Charles X. After the July Revolution of 1830 made Louis-Philippe king, Périer became premier (1831) and quickly restored civic order in France. Active in foreign affairs, he sent an army to defend Belgium against the Dutch (1831) and ordered the occupation of Ancona to check Austrian predominance in the Papal States (1832). His authoritarian approach brought attacks from both left and right and sometimes alienated the king.

Périgord \ˌpā-rē-'gȯr\ Historic and cultural region, southern France. The counts of Périgord played a part in the troubled affairs of Aquitaine, and control of Périgord was disputed by the French and the English from 1259. The area was transferred to the house of Albret in 1470. After it was inherited by the crown of Navarra, Henry IV united it with the French crown in 1607.

period In geology, the basic unit of the geologic time scale. During these spans of time, specific systems of rocks were formed. Originally, the method for defining the sequence of periods was relative; it was based on stratigraphy and paleontology. Carbon-14 dating and similar methods are now used to determine absolute ages for various periods.

periodic motion Motion that is repeated in equal intervals of time. The time of each interval is the period. Examples of periodic motion include a rocking chair, a bouncing ball, a vibrating guitar string, a swinging pendulum, and a water wave. See also simple harmonic motion.

periodic table Organized array of all the chemical elements in approximately increasing order of their atomic weight. The elements show a periodic recurrence of certain properties, first discovered in 1869 by Dmitry I. Mendeleyev. Those in the same column (group) of the table as usually

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arranged have similar properties. In the 20th century, when the structure of ATOMS was understood, the table was seen to precisely reflect increasing order of ATOMIC NUMBER. Members of the same group in the table have the same number of ELECTRONS in the outermost shells of their atoms and form bonds of the same type, usually with the same VALENCE; the NOBLE GASES, with full outer shells, generally do not form bonds. The periodic table has thus greatly deepened understanding of BONDING and chemical behaviour. It also allowed the prediction of new elements, many of which were later discovered or synthesized. For an illustration of the periodic table, see chemical ELEMENT.

periodical Publication whose issues appear at fixed or regular intervals. Periodicals generally are considered to include NEWSPAPERS, which usually have large, unfastened pages and contents with considerable immediacy; and MAGAZINES, or journals, which have smaller pages, are usually fastened or bound, and often have more specialized, less time-dependent contents.

periodontitis \ˌper-ē-ə-ˌdän-ˈtī-təs\ INFLAMMATION of soft tissues around the teeth (see TOOTH). Poor dental hygiene leads to deposition of bacterial plaque on the teeth below the gum line, irritating and eroding nearby tissues. If it is not treated, the gum margin recedes, exposing the roots of the teeth. The process eventually involves the bone anchoring the teeth, which loosen and may fall out. Removal of all plaque deposits and affected soft tissues can arrest but not reverse bone deterioration.

periosteum \ˌper-ē-ˈäs-tē-əm\ Dense membrane over BONES. The outer layer contains nerve fibres and many blood vessels, which supply cells in the bone. The bone-producing cells of the inner layer are most prominent in fetal life and early childhood, when bone formation is at its peak. In adulthood they are less active but vital to continuous bone remodeling. When bone is injured, they multiply profusely to produce new bone.

periscope Optical instrument (see OPTICS) used in land and sea warfare, submarine NAVIGATION, and elsewhere to enable an observer to see the surroundings while remaining under cover, behind armour, or submerged. A periscope includes two mirrors or reflecting PRISMS to change the direction of the light coming from the scene observed: the first deflects it down through a vertical tube, the second diverts it horizontally so that the scene can be viewed conveniently.

peristalsis \ˌper-ə-ˈstȯl-səs\ Progressive wavelike MUSCLE contractions in the ESOPHAGUS, STOMACH, and intestines, and sometimes in the ureters and other hollow tubes. The waves can be short, local REFLEXES or long, continuous contractions along the length of the organ. In the esophagus, peristaltic waves push food into the stomach. In the stomach, they help mix stomach contents and propel food to the SMALL INTESTINE, where they expose food to the intestinal wall for absorption and move it forward. Peristalsis in the LARGE INTESTINE pushes waste toward the ANAL CANAL and is important in removing gas and dislodging potential bacterial colonies.

peritonitis \ˌper-ə-tᵊn-ˈī-təs\ INFLAMMATION of the peritoneum (see ABDOMINAL CAVITY), with pus accumulating between the parietal and the visceral peritoneum, abdominal pain and distension, vomiting, and fever. It may be acute or chronic, local or generalized. Acute peritonitis usually results from inflammation elsewhere (e.g., by spread of bacterial infection). Primary peritonitis often comes from a perforated gastrointestinal tract, as with rupture in appendicitis. Control of the source problem may be followed by remission, adhesions, or ABSCESSES (much rarer since the development of antibiotics).

periwinkle In botany, any of various plants of the genus *Vinca* of the DOGBANE FAMILY. The lesser periwinkle (*V. minor*), which has small lilac-blue flowers, is a dependable, trailing, evergreen perennial that is native to Europe and has become widespread over much of eastern North America. The greater periwinkle (*V. major*), with larger leaves and larger purplish-blue flowers, is native to continental Europe and has become naturalized in England. ALKALOIDS derived from the periwinkle plant have had some success in inhibiting cancer growth.

periwinkle In zoology, any of some 80 species (family Littorinidae) of widely distributed, chiefly herbivorous shore SNAILS. Periwinkles are usually found on rocks, stones, or pilings between high- and low-tide marks. The common periwinkle (*Littorina littorea*), the largest northern species, may grow to 1.5 in. (4 cm) long. It is usually dark gray and has a solid spiral shell. Introduced into North America c. 1857, it is now common on Atlantic coasts. All periwinkle species are a favourite food of many shorebirds. See photograph above.

Periwinkles (*Littorina*)
JANE BURTON—BRUCE COLEMAN LTD.

Periyar \ˌper-i-ˈyär\ **River** River, central KERALA state, southwestern India. It is 140 mi (225 km) long and rises in the Western GHATS range near the border with TAMIL NADU state. It flows north to Periyar Lake, an artificial reservoir created by damming the river. A tunnel carries water from the lake eastward through the mountains to the Vaigai River, where it is used for irrigation. From the lake it flows northwest and empties into the Arabian Sea.

perjury In law, act or crime of knowingly making a false statement while under oath. The statement must be material to the issue of inquiry. Perjuries that have the effect of obstructing the adjudication of a case may be given increased punishment for that reason. A person who makes a false statement and later corrects it is usually not considered to have committed perjury.

Perkins, Anthony (b. April 4, 1932, New York, N.Y., U.S.—d. Sept. 12, 1992, Hollywood, Calif.) U.S. film actor. He was the son of the actor Osgood Perkins, and he studied at Columbia University. After making his screen debut in *The Actress* (1953), he appeared in films such as *Friendly Persuasion* (1956) and *Fear Strikes Out* (1957), but he was best known as the murderous motel owner Norman Bates in ALFRED HITCHCOCK's *Psycho* (1960). He later appeared in several films in Europe, including *The Trial* (1963), *The Champagne Murders* (1967), and *Ten Days' Wonder* (1972), and in U.S. films such as *Pretty Poison* (1968), *Catch-22* (1970), and *WUSA* (1970). He reprised his role as Norman Bates in three sequels (1983, 1986, and 1990).

Perkins, Frances *orig.* **Fannie Coralie Perkins** (b. April 10, 1882, Boston, Mass., U.S.—d. May 14, 1965, New York, N.Y.) U.S. public official. She became a social worker in New York City and a leader in organizations aiming to improve working conditions for women. From 1929 to 1933 she served as state industrial commissioner under New York Gov. FRANKLIN D. ROOSEVELT. As president, Roosevelt appointed her U.S. secretary of labor; she thereby became the first woman to hold a U.S. cabinet post. In her long term of office (1933–45) she advocated reforms such as a MINIMUM WAGE, a maximum workweek, and unemployment compensation; she also helped draft the SOCIAL SECURITY ACT and supervised the Fair Labor Standards Act (1938). She was later a U.S. Civil Service commissioner (1945–53).

Perkins, Jacob (b. July 9, 1766, Newburyport, Mass., U.S.—d. July 30, 1849, London, Eng.) U.S. inventor. He built a machine to cut and head NAILS in one operation c. 1790. He developed a method of engraving paper money that made counterfeiting difficult; lack of interest in the U.S. led him to set up a bank-note factory in England (1819). He experimented with high-pressure steam BOILERS, built a horizontal STEAM ENGINE (1827), designed an improved paddle wheel (1829), and invented a means for the free circulation of water in boilers (1831) that led to the design of modern water-tube boilers.

Perkins, Maxwell (Evarts) (b. Sept. 20, 1884, New York, N.Y., U.S.—d. June 17, 1947, Stamford, Conn.) U.S. editor. He worked as a reporter for *The New York Times* before joining the publishing firm of Charles Scribner's Sons, of which he later became editorial director and vice president. He is best known for the intensive editorial work that shaped THOMAS WOLFE's sprawling manuscripts into publishable form, but he also assisted the early careers of F. SCOTT FITZGERALD, ERNEST HEMINGWAY, RING LARDNER, ERSKINE CALDWELL, EDMUND WILSON, and ALAN PATON.

Perl *in full* **Practical Extraction and Reporting Language.** High-level computer PROGRAMMING LANGUAGE, the most popular language for writing CGI scripts and the premier scripting (or interpreted) language of the WORLD WIDE WEB. Since it has roots in UNIX, its syntax is similar to C and it includes several UNIX utilities. Because of its excellent text-processing capability, it is widely used by system administrators (for writing administrative tasks) and is especially suited for developing prototype versions of programs. Because it is an interpreted language, its programs are highly portable across different operating systems. Originally developed by Larry Wall at NASA's Jet Propulsion Laboratory in 1986, it has since been improved by hundreds of volunteer developers. Like LINUX, it can be obtained free of charge.

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perlite *or* **pearlstone** Natural glass with concentric cracks such that the rock breaks into small, pearl-like bodies. It is formed by the rapid cooling of viscous LAVA or MAGMA. Perlite is porous and has a waxy to pearly lustre and is commonly gray or greenish but may be brown, blue, or red. Since c. 1950, large deposits have been worked in New Mexico, Nevada, California, and other western states. Heat-treated perlite is a substitute for sand in lightweight wall plaster and concrete aggregate. Perlite is used for heat and sound insulation, lightweight ceramic products, and filters.

Perlman, Itzhak (b. Aug. 31, 1945, Tel Aviv, Palestine) Israeli-born U.S. violinist. Despite a bout with polio at age four that left his legs paralyzed, he was a prodigy, and he made his U.S. television debut at age 13. He studied with Ivan Galamian and Dorothy DeLay at Juilliard. Recognition of his gifts led to a highly successful career as orchestral soloist and chamber-music player, with scores of recordings. Blessed with a popular touch, he appeared on television, played JAZZ and KLEZMER MUSIC, and involved himself in educating young musicians.

permafrost Perennially frozen earth, with a temperature below 32 °F (0 °C) continuously for two years or more. Permafrost is estimated to underlie 20% of the Earth's land surface and reaches depths of 5,000 ft (1,500 m) in northern Siberia. It occurs in 85% of Alaska, more than half of Russia and Canada, and probably all of Antarctica. Permafrost has a significant effect on plant and animal life, and it presents special problems in engineering projects. All land use in permafrost environments must take into account the terrain's special sensitivity; if the delicate natural balance is not maintained, extensive degradation and ecological damage may result.

permeability, magnetic See MAGNETIC PERMEABILITY

Permian Period Interval of geologic time, 290–248 million years ago. The last of the six periods of the PALEOZOIC ERA, it follows the CARBONIFEROUS PERIOD. During the Permian, the continents joined to form a single supercontinent, PANGEA. Hot, dry conditions prevailed almost everywhere, and deserts were widespread. Life evolved as a continuation of established lines. Marine invertebrates evolved into several lineages. Marine and freshwater fish and amphibians thrived. Reptiles evolved into three distinct groups: the cotylosaurs, the pelycosaurs, and the therapsids. Land plants evolved from ferns and seed ferns to conifers and adapted to drier and well-drained land conditions. Toward the close of the Permian, many forms of life suffered mass extinction, whose causes are unknown.

permutations and combinations Number of ways a subset of objects can be selected from a given set of objects. In a permutation, order is important; in a combination, it is not. Thus, there are six permutations of the letters A, B, C selected two at a time (AB, AC, BC, BA, CA, CB) yet only three combinations (AB, AC, BC). The number of permutations of r objects chosen from a set of n objects, expressed in FACTORIAL notation, is $n! \div (n - r)!$ The number of combinations is $n! \div [r!(n - r)!]$. The $(r + 1)$st coefficient in the binomial expansion of $(x + y)^n$ coincides with the combination of n objects chosen r at a time (see BINOMIAL THEOREM). PROBABILITY THEORY evolved from the study of gambling, including figuring out combinations of playing cards or permutations of win-place-show possibilities in a horse race, and such counting methods played an important role in its development in the 17th century.

Pernambuco See RECIFE

pernicious anemia Slow-developing disease in which vitamin B_{12} (see VITAMIN B COMPLEX) deficiency impairs red-blood-cell production. It can result from a diet lacking in vitamin B_{12} or when intrinsic factor, a substance needed for intestinal absorption of B_{12}, either is not produced by stomach cells or cannot bind to the vitamin. It causes weakness, waxy pallor, shiny tongue, and stomach, intestinal, and neurological problems. Its slow development can allow ANEMIA to become very severe by the time of diagnosis. Monthly B_{12} injections into muscle soon reverses the anemia, but the injections must be continued for life.

Perón \pā-'rōn**, Eva (Duarte de)** *known as* **Evita** *orig.* **María Eva Duarte** (b. May 7, 1919, Los Toldos, Arg.—d. July 26, 1952, Buenos Aires) Second wife of Argentine president JUAN PERÓN and a powerful though unofficial political leader. Born into poverty, she was an actress when she married Perón. She was instrumental in the success of his first presidential campaign and won the adulation of the masses. Evita acted as de facto minister of health and labour, awarding generous wage increases to workers. With "voluntary" contributions from businesses, labour unions, and the elite, she established thousands of hospitals, schools, and orphanages. After her death from cancer at age 33, her grief-stricken working-class followers sought to have her canonized.

Perón, Isabel (Martínez de) *orig.* **María Estela Martínez Cartas** (b. Feb. 4, 1931, La Rioja, Arg.) Third wife of JUAN PERÓN and president of Argentina (1974–76). Born into a lower-middle-class family, she was a dancer when she met Perón in 1955 or 1956. They married during his exile in 1961, and she became his running mate in the 1973 presidential election. She succeeded him when he died in 1974, inheriting problems of inflation and political violence, which she tried—ineffectively—to solve by printing money and imposing a state of siege. She was deposed in 1976; after five years of house arrest, she was convicted of corruption but permitted to go into exile in Spain.

Perón, Juan (Domingo) (b. Oct. 8, 1895, Buenos Aires province, Arg.—d. July 1, 1974, Buenos Aires) President of Argentina (1946–55, 1973–74). After attending military school, he served in the 1930s in Italy, where he observed the successes of the Fascists. In 1943 he helped overthrow Argentina's ineffective civilian government. As secretary of labour and social welfare, he built a loyal following among industrial workers, who helped elect him president in 1946. Perón's political views drew on both the far left and the far right: while he showered workers with much-needed benefits, he restricted civil liberties severely. The charisma of his second wife, EVA PERÓN, greatly increased the regime's standing with the populace. He was reelected in 1951, but a disastrous economic decline and increasing disaffection among many elements of Argentine society led to his overthrow in 1955 by democratically inspired military officers. He lived in exile in Spain for two decades but continued to influence Argentine affairs. When the PERONIST party was made legal, he was reelected president in absentia; he died less than a year after returning to Argentina and assuming the presidency. See also ISABEL PERÓN.

Peronist \pə-'rō-nist\ Member of Argentina's Justicialist Nationalist Movement, a supporter of JUAN PERÓN, or an adherent of his populist and nationalist policies. Perón's poorly defined political philosophy embraced elements of both left- and right-wing ideology, combining a commitment to the redistribution of wealth with authoritarian nationalism and disregard for civil rights. After his death in 1974, the Justicialist movement was weakened by factionalism, but it continued to play an important role in Argentine politics and had adherents elsewhere. See also CARLOS MENEM.

Perot \pə-'rō**, H(enry) Ross** (b. June 27, 1930, Texarkana, Texas, U.S.) U.S. businessman. After graduating from the U.S. Naval Academy, he served in the navy (1953–57). He worked for IBM from 1957 to 1962, when he formed his own company, Electronic Data Systems; he sold it in 1984 to General Motors for $2.5 billion. In 1992 he became an independent candidate for U.S. president. Appealing to voters dissatisfied with traditional party politics, he won 19% of the popular vote, the best third-party presidential showing since 1912. He ran again in 1996 but received only 8% of the vote. His Reform Party, which he founded in 1995, gradually established its autonomy from him.

peroxide Any of a class of chemical compounds in which two OXYGEN atoms are linked by a single COVALENT BOND. Several organic (see ORGANIC COMPOUND) and inorganic (see INORGANIC COMPOUND) peroxides are useful as bleaching and oxidizing agents (see OXIDATION-REDUCTION), as initiators of POLYMERIZATION reactions, and in the preparation of hydrogen peroxide (a mild bleach and antiseptic) and other oxygen compounds. The peroxide ANION (chemical formula O_2^{2-}) is present in peroxides of inorganic compounds.

Perpendicular style Phase of late GOTHIC ARCHITECTURE in England roughly parallel in time to the French FLAMBOYANT STYLE. The style, concerned with creating rich visual effects through decoration, was characterized by a predominance of vertical lines in stone window TRACERY, enlargement of windows to great proportions, and conversion of the interior stories into a single unified vertical expanse. Fan VAULTS, springing from slender columns or PENDANTS, became popular. The oldest surviving example of the style is probably the choir of Gloucester Cathedral (begun c. 1335). Other major monuments include King's College Chapel, Cambridge (1446–1515), and the chapel of Henry VII in WESTMINSTER ABBEY. In the 16th century, the grafting of Renaissance elements onto the Perpendicular style resulted in the TUDOR STYLE.

Perpignan \ˌper-pē-'nyäⁿ\ City (pop., 1999: 105,115), southern France. Located just north of the Spanish border, Perpignan was founded c. 10th

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century. It was the capital of Roussillon in the 12th century and of the kingdom of Majorca from 1276 to 1344. The city was heavily fortified during the struggle between France and Spain for the area; it became French in 1659. It is now a market centre for the surrounding agricultural area; its many medieval buildings have made tourism economically important.

Perrault \pe-'rō**, Charles** (b. Jan. 12, 1628, Paris, France—d. May 15/16, 1703, Paris) French poet, prose writer, and storyteller. Perrault began to win a literary reputation c. 1660 with light verse and love poetry. He is best remembered for his collection of charming fairy stories written to amuse his children, *Contes de ma mère l'oye,* or *Tales of Mother Goose* (1697; see Mother Goose). He spent the rest of his life promoting the study of literature and the arts. A leading member of the Académie Française, he was involved in a famous controversy with Nicholas Boileau on the relative merits of ancient and modern literature; his support for the modern was of landmark significance in the revolt against the constraints of prevailing tradition.

Perrot \pe-'rō**, Jules (-Joseph)** (b. Aug. 18, 1810, Lyon, Fr.—d. Aug. 24, 1892, Paramé) French dancer and choreographer. After studying with Auguste Vestris, he debuted at the Paris Opéra in 1830. He often partnered Marie Taglioni until 1835, when he left the company to tour in Europe. He choreographed several ballets for Carlotta Grisi, probably including the famous solos in *Giselle*. As dancer and ballet master in London (1842–48) and St. Petersburg (1848–58), he choreographed many important Romantic ballets with an expressive, dramatic style. In his later years he gave classes at the Paris Opéra.

Jules Perrot, engraving after a drawing.
COURTESY OF THE BIBLIOTHEQUE DE L'OPERA, PARIS; PHOTOGRAPH, PIC

Perry, Matthew C(albraith) (b. April 10, 1794, South Kingston, R.I., U.S.—d. March 4, 1858, New York, N.Y.) U.S. naval officer. He followed his brother Oliver Perry into the navy and commanded the first U.S. navy steamship, the *Fulton* (1837–40). He led naval forces in the Mexican War and assisted Winfield Scott at Veracruz. In 1852 Pres. Millard Fillmore sent Perry to head a naval expedition to induce Japan to establish diplomatic relations with the U.S. Concluding that the country's centuries-old policy of isolation would be ended only by a show of force, Perry led four ships into the fortified harbour of Uraga (1853) and convinced the Japanese to accept his message. In 1854 he entered Edo (now Tokyo) Bay with nine ships and concluded the first treaty between Japan and the U.S., which granted the U.S. trading privileges and opened the Far East to U.S. influence.

Perry, Oliver Hazard (b. Aug. 20, 1785, South Kingston, R.I., U.S.—d. Aug. 23, 1819, at sea) U.S. naval officer. The older brother of Matthew Perry, he entered the navy in 1799 and served in the West Indies and the Mediterranean. In 1813 he was ordered to Erie, Pa., to assemble a naval squadron to challenge British control of the Great Lakes in the War of 1812. With 10 small ships, he engaged six British warships in Lake Erie (Sept. 10, 1813). After his flagship was disabled, he was rowed to the *Niagara*, from which he won the battle by sailing directly into the British line, firing broadside. In reporting the British surrender he wrote, "We have met the enemy and they are ours."

Perse, Saint-John See Saint-John Perse

Persephone \pər-'se-fə-nē\ *Latin* **Proserpina** In Greek mythology, daughter of Zeus and Demeter. She was gathering flowers when she was seized by Hades, who carried her off to the underworld to make her his wife. On learning of the abduction, Demeter was so distraught that she allowed barrenness and famine to spread over the earth. Zeus commanded Hades to allow Persephone to return to her mother, but because she had eaten some (or, in some versions, just one) pomegranate seeds in the underworld, she had to remain one-third of the year with Hades, spending the other two-thirds with Demeter. This myth accounts for the change of the seasons and the annual cycle of growth and decay.

Persephone abducted by Hades, marble sculpture by Gian Lorenzo Bernini, 1621–22; in the Borghese Gallery, Rome
ANDERSON—ALINARI FROM ART RESOURCE/EB INC.

Persepolis \pər-'se-pə-ləs\ Ancient Persian city, northeast of modern Shīrāz, Iran. It was built in a remote and mountainous area during the reign of Darius I, who made it the capital of Persia, replacing Pasargadae. In 330 BC Alexander the Great plundered the city and burned the palace of Xerxes I. The city's ruins cover an extensive area and comprise a number of colossal buildings, including palaces of early Persian kings, a great staircase, an audience hall, and a treasury.

Perseus (b. c. 212—d. c. 165 BC, Alba Fucens, near Rome) Last king of Macedonia (r. 179–168). Son of Philip V, he fought against Rome (199) and Aetolia (189). He persuaded the king to execute his brother Demetrius. As king he extended his influence in neighbouring states and tried to gain the trust of the Greek world, but he alarmed Greece by visiting Delphi with an army. Eumenes II of Pergamum informed Rome of Perseus's allegedly aggressive designs, provoking the Third Macedonian War (171–168). The struggle ended in a final defeat of the Macedonians by the Romans, ending the monarchy, and Perseus spent the rest of his life in captivity.

Perseus In Greek mythology, the slayer of the Gorgon Medusa. He was the son of Zeus and Danaë. His grandfather had him thrown into the sea in a chest with his mother as an infant because of a prophecy that Perseus would kill him. Perseus and his mother survived, and as a young man Perseus set out to gain the head of Medusa. On his way home he rescued the Ethiopian princess Andromeda from a sea monster, and she became his wife. When he took his mother back to her native Argos, he threw a discus that accidentally killed his grandfather, thus fulfilling the prophecy.

Pershing \'pər-zhiŋ, 'pər-shiŋ**, John J(oseph)** (b. Sept. 13, 1860, Laclede, Mo., U.S.—d. July 15, 1948, Washington, D.C.) U.S. army officer. He graduated from West Point and served on the western frontier (1886–98), in the Spanish-American War, in the Philippines (1899–1903, 1906–13), and as commander of a punitive raid against Pancho Villa (1916). During World War I he was appointed commander in chief of the American Expeditionary Force (AEF). He maintained the AEF as an independent army of two million men and resisted Allied efforts to use U.S. forces as replacement units for French and British troops. He led the successful assault of the St. Mihiel salient in September 1918 and helped defeat German forces in the Meuse-Argonne offensive. He was promoted to general of the armies in 1919 and was army chief of staff from 1921 to 1924. His nickname, "Black Jack," derived from his service with an African American regiment early in his career (see buffalo soldier). His memoirs, *My Experiences in the World War* (1931), won a Pulitzer Prize.

John J. Pershing, 1917.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

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Persia Historical name for a region roughly coterminous with modern Iran. The term was used for centuries, chiefly in the West, and originally described a region of southern Iran formerly known as Persis or Parsa. Parsa was the name of an Indo-European nomadic people who migrated into the area c. 1000 BC; the use of the name was gradually extended by the ancient Greeks and other Western peoples to apply to the whole Iranian plateau. The people of Iran have always called their country Iran, and in 1935 the government requested that the name Iran be used instead of Persia.

Persian cat Breed of stocky, round-headed DOMESTIC CAT that has a long, silky coat (many colours possible), large round eyes, snub nose, and thick ruff. The breed is often referred to as the LONGHAIR.

Persian Gulf Arm of the ARABIAN SEA. It is about 615 mi (990 km) long and rarely exceeds a depth of 300 ft (90 m). It is connected with the Gulf of OMAN and the Arabian Sea through the Strait of HORMUZ. It contains the island kingdom of Bahrain and is bordered by Iran, the United Arab Emirates, Oman, Saudi Arabia, Qatar, Kuwait, and Iraq. It has long been a maritime trade route between the Middle East and South Asia; its modern economy is dominated by petroleum production.

Persian Gulf War, First *or* **Gulf War** (1990–91) International conflict triggered by Iraq's invasion of Kuwait in August 1990. Though justified by Iraqi leader ṢADDĀM ḤUSSEIN on grounds that Kuwait was historically part of Iraq, the invasion was presumed to be motivated by Iraq's desire to acquire Kuwait's rich oil fields and expand its power in the region. The United States, fearing Iraq's broader strategic intentions and acting under UN auspices, eventually formed a broad coalition, which included a number of Arab countries, and began massing troops in northern Saudi Arabia. When Iraq ignored a UN Security Council deadline for it to withdraw from Kuwait, the coalition began a large-scale air offensive (Jan. 16–17, 1991). Ṣaddām responded by launching ballistic missiles against neighbouring coalition states as well as Israel. A ground offensive by the coalition (February 24–28) quickly achieved victory. Estimates of Iraqi military deaths range up to 100,000; coalition forces lost about 300 troops. The war also caused extensive damage to the region's environment. The Iraqi regime subsequently faced widespread popular uprisings, which it brutally suppressed. A UN trade embargo remained in effect after the end of the conflict, pending Iraq's compliance with the terms of the armistice. The foremost term was that Iraq destroy its nuclear-, biological-, and chemical-weapons programs. The embargo continued into the 21st century and ceased only after the Second PERSIAN GULF WAR.

Persian Gulf War, Second (2003) International conflict that took place between Iraq and a combined force of troops from the United States and Great Britain, with smaller contingents from several other countries. The trade embargo and weapons-inspection process that the UN imposed on Iraq following the First PERSIAN GULF WAR (1990–91) had partly fallen into abeyance by 2001. U.S. Pres. George W. Bush argued that the SEPTEMBER 11 ATTACKS on the U.S. in that same year highlighted the threat to U.S. security posed by hostile countries such as Iraq. Encouraged by Bush and British Prime Minister Tony Blair, the UN issued Security Council Resolution 1441 in November 2002, demanding that Iraq readmit weapons inspectors and comply with all previous resolutions. Although Iraqi did readmit inspectors, Bush and Blair declared in early 2003 (despite objections by many world leaders) that Iraq was continuing to hinder UN inspections and that it still retained proscribed weapons. On March 20, seeking no further UN resolutions, the U.S. and Britain (with token representation from other countries) launched a series of air attacks on Iraq, and a ground invasion followed. Iraqi military and paramilitary forces were rapidly defeated; on April 9 U.S. forces took control of the capital, BAGHDAD, and British forces completed their occupation of the southern city of Al-BAṢRAH the same day. Within a few more days, all major cities had fallen, and by May 1 major combat operations had been completed. Guerrilla assaults on occupying forces continued thereafter, hindering Iraq's recovery.

Persian language *or* **Farsi language** IRANIAN LANGUAGE spoken by more than 25 million people in Iran as a first language, and by millions more as a second. Modern Persian is a KOINE developed from southwestern dialects in the 7th–9th centuries, after the introduction of Islam brought a massive infusion of loanwords from ARABIC. Its standardization and literary cultivation took place in northeastern Persia and Central Asia in the 11th–12th centuries. Polities outside Persia itself (e.g., Mughal India, Ottoman Turkey) have at times been major literary centres. Its status in those countries led to a very strong Persian influence on URDU and Ottoman TURKISH. Other TURKIC and INDO-ARYAN languages, CAUCASIAN LANGUAGES, and Iranian languages have also borrowed heavily from Persian. It is written in a slightly modified form of the ARABIC ALPHABET.

Persian Wars *or* **Greco-Persian Wars** (492–449 BC) Series of wars between Greek states and Persia, particularly two invasions of Greece by Persia (490, 480–479). When DARIUS I came to power in Persia in 522, the Ionian Greek city-states in Anatolia were under Persian control. They rose up unsuccessfully in the IONIAN REVOLT (499–494). The support lent by Athens provoked Darius to invade Greece (492). His fleet was destroyed in a storm. In 490 he assembled a huge army on a plain near Athens; his devastating defeat at the Battle of MARATHON sent him back to Persia. In 480 the Persians under XERXES I again invaded Greece, seeking to avenge the defeat. This time all Greece fought together, with Sparta in charge of the army and Athens of the navy. A band of Spartans under LEONIDAS was overcome at the Battle of THERMOPYLAE, allowing the Persian army to reach Athens, which they sacked (480). When the Persian navy was soundly defeated at the Battle of SALAMIS, Xerxes withdrew it to Persia. His army was defeated at the Battle of PLATAEA in 479 and driven from Greece, and the navy met a similar fate at Mycale on the Anatolian coast. Sporadic fighting went on for 30 more years, during which Athens formed the DELIAN LEAGUE to free the Ionians. The Peace of Callias (449) ended the hostilities.

persimmon Either of two trees of the genus *Diospyros* in the EBONY family, and their globular, edible fruits. The native American persimmon (*D. virginiana*), a small tree with dark-red to maroon fruits that contain several large, flattened seeds, grows from the Gulf states north to central Pennsylvania and central Illinois. The Oriental persimmon (*D. kaki*), grown extensively in China and Japan, has larger, more astringent, yellow to red fruit. Good sources of vitamins A and C, persimmons are eaten fresh or stewed or cooked as jam.

American persimmon (*Diospyros virginiana*).
H.R. HUNGERFORD

Perski, Shimon See SHIMON PERES

personal computer (PC) MICROCOMPUTER designed for use by one person at a time. A typical PC assemblage comprises a CPU; internal MEMORY consisting of RAM and ROM; data storage devices (including a HARD DISC, a FLOPPY DISC, or CD-ROM); and input/output devices (including a display screen, keyboard, MOUSE, and PRINTER). The PC industry began in 1977 when APPLE COMPUTER introduced the Apple II. Radio Shack and Commodore Business Machines also introduced PCs that year. IBM entered the PC market in 1981. The IBM PC, with increased memory capacity and backed by IBM's large sales organization, quickly became the industry standard. Apple's Macintosh (1984) was particularly useful for DESKTOP PUBLISHING. MICROSOFT CORP. introduced MS WINDOWS (1985), a GRAPHICAL USER INTERFACE that gave PCs many of the capabilities of the Macintosh, initially as an overlay of MS-DOS. Windows went on to replace MS-DOS as the dominant OPERATING SYSTEM for personal computers. Uses of PCs multiplied as the machines became more powerful and application SOFTWARE proliferated. Today, PCs are used for WORD PROCESSING, INTERNET access, and many other daily tasks.

personal-liberty laws Laws passed by U.S. states in the North to counter the FUGITIVE SLAVE ACTS. Such states as Indiana (1824) and Connecticut (1828) enacted laws giving escaped slaves the right to jury trials on appeal. Vermont and New York (1840) assured fugitives the right of jury trial and provided them with attorneys. Other states forbade state authorities to capture and return fugitives. After the COMPROMISE OF 1850, most Northern states enacted further guarantees of jury trials and punishment for illegal seizure. These laws were cited by proslavery interests as assaults on states' rights and as justification for SECESSION.

personal property See REAL AND PERSONAL PROPERTY

personalismo *Spanish* **"personalism"** In Latin America, the practice of glorifying a leader. It often involves sacrificing the interests of political parties, ideologies, and constitutional government out of loyalty

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to a leader. Political parties throughout Latin America have often consisted of the personal following of a single individual, a fact reflected in the popular terms for the partisans. Members of Argentina's Justicialist National Movement, for example, are called *peronistas* (PERONISTS), for its charismatic founder, Argentine president JUAN PERÓN, and the followers of Cuban leader FIDEL CASTRO are *fidelistas*. See also CAUDILLO.

personality Totality of an individual's behavioral and emotional characteristics. Personality embraces a person's moods, attitudes, opinions, motivations, and style of thinking, perceiving, speaking, and acting. It is part of what makes each individual distinct. Theories of personality have existed in most cultures and throughout most of recorded history. The ancient Greeks used their ideas about physiology to account for differences and similarities in TEMPERAMENT. In the 18th century IMMANUEL KANT, CHARLES-LOUIS MONTESQUIEU, and GIAMBATTISTA VICO proposed ways of understanding individual and group differences; in the early 20th century ERNST KRETSCHMER and the psychoanalysts SIGMUND FREUD, ALFRED ADLER, and CARL JUNG offered competing personality theories. Freud's model rested on the power of psychosexual drives as mediated by the structural components of the ID, EGO, and SUPEREGO and the interplay of conscious and unconscious motives. Particularly important was the array of DEFENSE MECHANISMS an individual employed. Jung, like Freud, emphasized unconscious motives but de-emphasized sexuality and advanced a typal theory that classified people as INTROVERTS AND EXTRAVERTS; he further claimed that an individual personality was a persona (i.e., social facade) drawn from the "collective unconscious," a pool of inherited memories. Later theories by ERIK H. ERIKSON, GORDON W. ALLPORT, and CARL R. ROGERS were also influential. Contemporary personality studies tend to be empirical (based on the administration of projective tests or personality inventories) and less theoretically sweeping and tend to emphasize personal identity and development. Personality traits are usually seen as the product of both genetic predisposition and experience. See also PERSONALITY DISORDER; PSYCHOLOGICAL TESTING.

personality disorder Mental disorder that is marked by deeply ingrained and lasting patterns of inflexible, maladaptive, or antisocial behaviour to the degree that an individual's social or occupational functioning is impaired. Rather than being illnesses, personality disorders are enduring and pervasive features of the personality that deviate markedly from the cultural norm. They include the dependent, histrionic, narcissistic, obsessive-compulsive, antisocial, avoidant, borderline (unstable), paranoid, and schizoid types. The causes appear to be both hereditary and environmental. The most effective treatment combines behavioral and psychotherapeutic therapies (see BEHAVIOUR THERAPY; PSYCHOTHERAPY).

personnel administration See INDUSTRIAL RELATIONS

perspective Depiction of three-dimensional objects and spatial relationships on a two-dimensional plane. In Western art, illusions of volume and space are generally created by use of the linear perspective system, based on the observation that objects appear to shrink and parallel lines to converge at an infinitely distant vanishing point as they recede in space from the viewer. The vanishing point may have been known to the Greeks and Romans but had been lost until FILIPPO BRUNELLESCHI rediscovered the principles of linear or "mathematical" perspective early in the 15th century. Linear perspective dominated Western painting until the late 19th century, when PAUL CÉZANNE flattened the conventional picture plane. The CUBISTS and other 20th-century painters abandoned depiction of three-dimensional space altogether. See also AERIAL PERSPECTIVE.

Perspex See LUCITE

perspiration Fluid given off by the SKIN as vapour by simple evaporation or as sweat actively secreted from SWEAT GLANDS to evaporate and cool the body. When the body temperature rises, the sympathetic nervous system stimulates eccrine sweat glands to secrete water to the skin surface, where it cools the body by evaporation. Human eccrine sweat is essentially a dilute solution of sodium chloride with trace amounts of other plasma electrolytes. In extreme conditions, human beings may excrete several litres of such sweat in an hour.

Perth City (pop., 2004 est.: 1,457,639), capital of WESTERN AUSTRALIA state, Australia. Located on the SWAN RIVER 10 mi (16 km) from its mouth, Perth was settled in 1829. It developed rapidly after the discovery of goldfields around Kalgoonie in the early 1890s and the opening of Fremantle Harbour in 1897. It is now a major industrial centre with a rapidly expanding economy. The site of the 1987 AMERICA'S CUP, it is the seat of the University of Western Australia and Murdoch University.

Perth City (pop., 1995 est.: 42,000), central Scotland. Located on the River TAY, northwest of EDINBURGH, Perth was a Roman settlement; it became a royal burgh in 1210. It was the capital of Scotland until 1437, when King JAMES I of Scotland was murdered there. At the Church of St. John the Baptist in 1559, JOHN KNOX denounced idolatry; the result was the plunder of Perth's monasteries and altars. It was a JACOBITE city during the Scottish uprisings of 1715 and 1745. The economy is based on whisky blending and distilling and on manufacturing. It is also an agricultural market centre.

pertussis See WHOOPING COUGH

Peru *officially* **Republic of Peru** Country, western South America. Area: 496,225 sq mi (1,285,216 sq km). Population (2005 est.): 27,968,000. Capital: LIMA. Almost half of the people are QUECHUA Indians,

nearly one-third are MESTIZOS, and most of the remainder are Aymara Indians and people of European ancestry. Languages: Spanish, Quechua, Aymara (all official). Religion: Christianity (predominantly Roman Catholic [official]; also Protestant). Currency: new sol. Peru is the third largest country in South America and may be divided into three geographic regions from west to east: the coast, which consists of a long, narrow belt of desert lowlands; the Sierra (highlands), which is the Peruvian portion of the ANDES MOUNTAINS; and the Montaña, the vast, forested eastern foothills and plains, consisting mainly of the tropical rainforests of the AMAZON RIVER basin. Peru has a developing mixed economy based largely on services, manufacturing, agriculture, and mining. Most industries, including the petroleum industry, were nationalized in the late 1960s and early '70s, but many were privatized again in the 1990s. Peru is a republic with one legislative house; its head of state and government is the president. Peru was the centre of the INCA empire, whose capital, CUZCO, was established in the 12th century. In 1533 the region was conquered by Spanish adventurer FRANCISCO PIZARRO and thereafter was dominated by Spain for almost 300 years as the Viceroyalty of PERU. It declared its independence in 1821, and freedom was achieved in 1824. Peru was defeated by Chile in the War of the PACIFIC (1879–83). In 1941 a boundary dispute with Ecuador erupted into war, which gave Peru control over a larger part of the Amazon basin; further disputes ensued until the border was demarcated again in 1998. The government was overthrown by a military junta in 1968; civilian rule was restored in 1980. The government of ALBERTO FUJIMORI dissolved the legislature in 1992 and promulgated a new constitution the following year. The government later successfully combated the SHINING PATH and TUPAC AMARU rebel movements. Fujimori won a second term in 1995, but charges of fraud accompanied his elec-

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tion to a third term in 2000; his government crumbled later that year. In 2001 Alejandro Toledo became Peru's first democratically elected president of Quechuan ethnicity.

Peru, Viceroyalty of Second of the four viceroyalties established by Spain to govern its domains in the Americas. Founded in 1543, it initially included most of South America, but it lost jurisdiction over much of its territory to other viceroyalties over time. Peru, with its wealth of silver, was considered Spain's most valuable possession in the Americas. By the late 18th century, Indian rebellions had destabilized the region, and the viceroyalty was unable to defend itself when the revolutionary forces of José de San Martín entered Lima in 1821. It became part of Peru and Chile in 1824. See also New Granada; New Spain; Viceroyalty of Río de la Plata.

Perugia \pā-'rü-jä\ City (pop., 2001 prelim.: 148,575), capital of Umbria region, central Italy. Perugia lies north of Rome between the Tiber River and Lake Trasimeno. Founded by the Umbrians, it became one of the 12 major cities of the Etruscans; it later was ruled by Rome (from 310 BC). It became a Lombard duchy in AD 592. It was the centre of the great Umbrian school of painting, which flourished in the 15th century (see Perugino; Pinturicchio). Perugia played an active role in the Italian Risorgimento and became part of Italy in 1860. It is an agricultural trade centre noted for its chocolate. There are notable remains of buildings and fortifications from Etruscan and medieval times.

Perugino \ˌper-ə-'jē-nō\ *orig.* **Pietro di Cristoforo Vannucci** (b. c. 1450, Città della Pieve, near Perugia, Romagna—d. February/March 1523, Fontignano, near Perugia) Italian painter. Born near Perugia (the source of his nickname), he was probably a pupil of Piero della Francesca and Andrea del Verrocchio. One of his most famous frescoes, *Giving of the Keys to St. Peter* (1481–82), in the Sistine Chapel, anticipated High Renaissance ideals in its compositional clarity and sense of spaciousness. He was at the height of his powers c. 1490–1500, when he painted the *Crucifixion* fresco for the convent of Santa Maria Maddalena dei Pazzi in Florence. Perugino's art declined in his later years, and c. 1505 he left the highly critical Florentine art scene to work in Umbria. In 1508 he made a brief comeback by painting roundels on the ceiling of the Stanza dell'Incendio in the Vatican. The commission for the wall frescoes went to his pupil Raphael, who had already proved himself the greater artist.

Vision of St. Bernard, wood panel by Perugino, c. 1491–94; in the Alte Pinakothek, Munich.
COURTESY OF THE ALTE PINAKOTHEK, MUNICH

Perun \pʸi-'rün\ In ancient Slavic religion, the thunder god. He purified the earth and made it fertile, and he was the overseer of right and order. His powers were believed to be evident in the thunderbolt, the rattle of stones, the bellow of a bull, the bleat of a goat, and the touch of an ax blade. In the Christian period the worship of Perun was gradually transferred to St. Elijah, but folk belief in his powers continued. Sacrifices and communal feasts on July 20 in his honor were celebrated in Russia until modern times.

Perutz \pə-'rüts**, Max Ferdinand** (b. May 19, 1914, Vienna, Austria—d. Feb. 6, 2002, Cambridge, Cambridgeshire, Eng.) Austrian-British biochemist. With John Cowdery Kendrew he founded the Medical Research Council Unit for Molecular Biology at the University of Cambridge. His discovery that hemoglobin's structure changes when it picks up or releases oxygen led to the full understanding of the molecular mechanism of respiratory oxygen transport by hemoglobin. For his X-ray diffraction analysis of hemoglobin's structure, Perutz and Kendrew shared the 1962 Nobel Prize for Chemistry. Perutz also used crystallography to study the flow of glaciers.

Pesaro \'pā-zä-ˌrō\ *ancient* **Pisorum** City (pop., 2001 prelim.: 90,311), Marche region, north-central Italy. A seaport on the Adriatic Sea, Pesaro was destroyed by the Ostrogoths in AD 536. Rebuilt and fortified by the Byzantine general Belisarius as one of the cities of the Pentapolis, it was sold to the Sforza family in 1445. It became part of the Papal States in 1631. It was the birthplace of composer Gioacchino Rossini in 1792. In World War II Pesaro suffered heavily in the Allied advance of 1944, but many of its old buildings escaped with minor damage. It is a seaside resort surrounded by an agricultural area. Its museum of majolica houses the richest collection in Italy.

Peshawar \pə-'shä-wər\ City (pop., 1998 est.: 988,055), capital of North-West Frontier province, Pakistan. It is located west of the Bara River near the Khyber Pass. Once the capital of the ancient Buddhist kingdom of Gandhara, it was a centre of the caravan trade with Afghanistan and Central Asia. It became the capital of the Indo-Scythian Kushān empire c. 1st century AD. It was captured by the Muslims in 988. By the 16th century Peshawar was ruled by the Afghans. It was under British control (1849–1947) and served as an important military base. The city is still militarily important; its ancient bazaar remains a meeting place for foreign merchants and traders.

Pessoa \pes-'sō-ə**, Fernando Antônio Nogueira** (b. June 13, 1888, Lisbon, Port.—d. Nov. 30, 1935, Lisbon) Portuguese poet. While living in South Africa, where his stepfather was Portugal's consul, Pessoa became fluent in English. On returning to Lisbon he worked as a translator while contributing to avant-garde reviews, especially *Orpheu* (1915), the organ of Brazilian-Portuguese Modernismo, of which he became a leading aesthetician. Only after his death did the rich dream world of his poetry, peopled with fictional alter egos called "heteronyms," become well known. His important volumes include *Poesias de Fernando Pessoa* (1942), *Poesias de Álvaro de Campos* (1944), *Poemas de Alberto Caeiro* (1946), and *Odes de Ricardo Reis* (1946).

pest Any organism, usually an animal, judged as a threat to humans. Most pests either compete with humans for natural resources or transmit disease to humans, their crops, or their livestock. Invertebrate pests include some protozoans, flatworms, nematodes, mollusks, arachnids, and especially insects. Mammals and birds can also be pests. Human activities, such as monocultural farming practices, use of broad-spectrum pesticides, and introduction of exotic species, often result in the proliferation of pest species. Certain fungi, bacteria, and viruses are also considered pests. Plant pests are usually called weeds.

Pestalozzi \ˌpes-tə-'lōt-sē**, Johann Heinrich** (b. Jan. 12, 1746, Zürich, Switz.—d. Feb. 17, 1827, Brugg) Swiss educational reformer. Between 1805 and 1825 he directed the Yverdon Institute (near Neuchâtel), which drew pupils and educators (including Friedrich Froebel) from all over Europe. His teaching method emphasized group rather than individual recitation and focused on such participatory activities as drawing, writing, singing, physical exercise, model making, collecting, mapmaking, and field trips. Among his ideas, considered radically innovative at the time, were making allowances for individual differences, grouping students by ability rather than age, and encouraging formal teacher training.

pesticide Any toxic substance used to kill animals or plants that damage crops or ornamental plants or that are hazardous to the health of domestic animals or humans. All pesticides act by interfering with the target species' normal metabolism. They are often classified by the type of organism they are intended to control (e.g., insecticide, herbicide, fungicide).

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Some inadvertently affect other organisms in the environment, either directly by their toxic effects or via elimination of the target organism.

pet Any animal kept by humans for companionship or pleasure rather than for utility. The main distinction between pets and domesticated livestock is the degree of contact between owner and animal. Another distinction is the owner's affection for the animal, which is often returned. Dogs are known to have been kept as pets since prehistoric times; cats, since the 16th century BC; and horses, since at least 2000 BC. Other common pets include birds, rabbits, rodents, raccoons, reptiles, amphibians, and even insects. The trend toward making pets of exotic animals (e.g., monkeys and ocelots) is worrisome because owners can rarely provide for their needs, and the animals' already precarious populations are further depleted when members are sold for pets.

PET See POSITRON EMISSION TOMOGRAPHY

Pétain \pā-'tan**, (Henri-) Philippe** (b. April 24, 1856, Cauchy-à-la-Tour, France—d. July 23, 1951, Île d'Yeu) French general. He served in the French army from 1876 and later taught at the war college. His successful defense in the Battle of VERDUN (1916) made him a national hero, and in 1918 he became commander in chief and a marshal of France. After the war he was appointed vice president of the Supreme War Council (1920–30) and minister of war (1934). After the German invasion of France (1940), Pétain was appointed premier at age 84. He concluded an armistice with Germany, and as head of VICHY FRANCE he attempted to obtain concessions by cooperating with the Germans. In 1942 the Germans forced him to accept PIERRE LAVAL as premier and he withdrew to a nominal role as head of state. After the Allied invasion of France, he fled to Germany. In 1945 he was tried and condemned to death; the sentence was commuted to life in prison, where he died at age 95.

Petén Itzá \pe-ˌten-ēt-'sä**, Lake** Lake, northern Guatemala. It is about 22 mi (35 km) long and covers an area of about 40 sq mi (100 sq km). The region was a stronghold of the Maya Itzá Indians, who were not conquered by the Spanish until 1697. The lakeshore is now dotted with towns such as Flores and San Benito. Much of the surrounding land is covered with dense rainforest, but there is some cultivation of cacao, sugarcane, and tropical fruits around Flores.

Peter I (b. c. 903—d. Jan. 30, 969) Tsar of Bulgaria (927–969). The second son of SIMEON I, he inherited the throne on his father's death in 927. Early in his reign, Peter faced revolts by his brothers, which were suppressed, and he also endured raids by the MAGYARS, who crossed Bulgaria on their way to the Byzantine Empire. His reign, however, was generally peaceful, and he made important gains against the Byzantines, receiving the title *emperor* from them. He also forced the Byzantines to recognize the independence of the Bulgarian church, and he married the granddaughter of the Byzantine emperor ROMANUS I LECAPENUS. In 965 war broke out with the Byzantines; Peter subsequently suffered a stroke and retired to a monastery, where he died two years later. Canonized by the Bulgarian Orthodox church, Peter was deeply religious and an active church builder. During his reign, the BOGOMIL heresy first appeared.

Peter I *Russian* **Pyotr Alekseyevich** *known as* **Peter the Great** (b. June 9, 1672, Moscow, Russia—d. Feb. 8, 1725, St. Petersburg) Tsar of Russia (1682–1725). Son of Tsar ALEXIS, he reigned jointly with his half brother IVAN V (1682–96) and alone from 1696. Interested in progressive influences from western Europe, he visited several countries there (1697–98). After returning to Russia, he introduced Western technology, modernized the government and military system, and transferred the capital to the new city of St. Petersburg (1703). He further increased the power of the monarchy at the expense of the nobles and the Orthodox church. Some of his reforms were implemented brutally, with considerable loss of life. Suspecting that his son Alexis was conspiring against him, he had Alexis tortured to death in 1718. He pursued foreign policies to give Russia access to the Baltic and Black seas, engaging in war with the Ottoman Empire (1695–96) and with Sweden in the Second NORTHERN WAR (1700–21). His campaign against Persia (1722–23) secured for Russia the southern and western shores of the Caspian Sea. In 1721 he was proclaimed emperor; his wife succeeded him as the empress CATHERINE I. For raising Russia to a recognized place among the great European powers, Peter is widely considered one of the outstanding rulers and reformers in Russian history, but he has also been decried by nationalists for discarding much of what was unique in Russian culture, and his legacy has been seen as a model for JOSEPH STALIN's brutal transformation of Russian life.

Peter I (b. July 11, 1844, Belgrade, Serbia—d. Aug. 16, 1921, Topčider, near Belgrade, Kingdom of Serbs, Croats, and Slovenes) King of Serbia (1903–18) and of the Kingdom of Serbs, Croats, and Slovenes (later Yugoslavia) from 1918. The son of Prince Alexander Karadjordjević, who was forced to abdicate in 1858, he lived with his family in exile. He fought with the French army in the FRANCO-PRUSSIAN WAR and with the Serbian revolt against the Turks (1875). After the assassination of Alexander Obrenović (1903), Peter was elected king of Serbia. He advocated a constitutional government and won recognition for his liberal policies. In World War I, he allied Serbia with France and Russia but was defeated by the Central Powers. In 1918 he returned to Belgrade and was proclaimed king of the Serbs, Croats, and Slovenes.

Peter II *Russian* **Pyotr Alekseyevich** (b. Oct. 23, 1715, St. Petersburg, Russia—d. Jan. 29, 1730, Moscow) Tsar of Russia (1727–30). The grandson of PETER I, he was named heir to the throne by CATHERINE I and on her death was crowned at age 11. Peter's regency was directed by ALEKSANDR MENSHIKOV. He fell under the influence of the aristocratic Dolgoruky family, which ousted Menshikov as regent, moved the capital to Moscow (1728), and arranged Peter's betrothal to one of its princesses. On the day set for the wedding, Peter died of smallpox at age 14.

Peter II (b. Sept. 6, 1923, Belgrade, Kingdom of Serbs, Croats, and Slovenes—d. Nov. 3, 1970, Los Angeles, Calif., U.S.) Last king of Yugoslavia. The son of ALEXANDER I, he became titular king on his father's assassination (1934), but he ruled under the regency of his uncle Prince Paul (1893–1976). After a coup deposed Paul (1941), Peter ruled for several weeks until the German invasion forced him to flee to London. He led a government-in-exile until the Yugoslav monarchy was abolished in 1945. He moved to the U.S., where he worked in public relations.

Peter III *Spanish* **Pedro** *known as* **Peter the Great** (b. 1239—d. Nov. 11, 1285, Villafrance del Panades, Catalonia) King of Aragon (1276–85) and of Sicily (as Pedro I, 1282–85). He married the Hohenstaufen heiress of Sicily (1262) and ended the Sicilian revolt (1282), becoming king despite Guelph and papal opposition (see SICILIAN VESPERS). Unhappy with his Sicilian venture, nobles and municipalities in Aragon forced Peter to confirm their legal rights and to diminish crown rights. In 1285 he defeated Philip III of France, who had invaded Aragon in an effort to dethrone him.

Peter III *Russian* **Pyotr Fyodorovich** *orig.* **Karl Peter Ulrich, duke von Holstein-Gottorp** (b. Feb. 21, 1728, Kiel, Holstein-Gottorp—d. July 18, 1762, Ropsha, near St. Petersburg, Russia) Tsar of Russia (1762). Grandson of PETER I, the young duke was brought to Russia by his aunt ELIZABETH when she became empress (1741). Proclaimed the heir to the Russian throne, he was unpopular at court for his pro-Prussian attitude. After he succeeded Elizabeth (1762), he reversed her foreign policy, making peace with Prussia and withdrawing from the SEVEN YEARS' WAR. He offended the Orthodox church by trying to force it to adopt Lutheran practices. After six months he was forced to abdicate by a group of nobles, in collusion with his own wife, Catherine (later CATHERINE II), and Count GRIGORY ORLOV, and was murdered while in the conspirators' custody.

Peter IV *Spanish* **Pedro** *known as* **Peter the Cruel** (b. Sept. 5, 1319, or Sept. 15, 1317, Balaguer, Catalonia—d. Jan. 5, 1387, Barcelona) King of Aragon (1336–87). He took the Balearic Islands and Roussillon from Majorca (1343–44), defeated the Aragonese nobles (1348), and became duke of Athens and Neopatras (1380). He waged war against Castile (1356–66) but failed to gain any territory; after 1369 France favoured Castile over Aragon. Peter tried to maintain neutrality in the HUNDRED YEARS' WAR, and he quarreled with his heir, the future John I, who became the tool of French intrigues.

Peter, Saint See Saint PETER THE APOSTLE

Peter Damian \'dā-mē-ən**, Saint** (b. 1007, Ravenna—d. Feb. 22, 1072, Faenze; feast day February 21) Italian cardinal and Doctor of the Church. He was prior of Fonte Avellana in the Apennines before being named a cardinal in 1057. A leading monastic reformer and ascetic, he played an important role in the promotion of apostolic poverty and in support of papal reformers who sought to enforce clerical celibacy and abolish SIMONY. He defended Pope Alexander II against the ANTIPOPE Honorius II and reconciled Alexander with the city of Ravenna. He was also sent as a papal legate to resolve disputes in Milan and Cluny, Burgundy, and he played a key role in the formulation of the papal election decree of 1059.

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Peter Lombard (b. c. 1100, Novara, Lombardy—d. Aug. 21/22, 1160, Paris) French bishop and theologian. He studied in Bologna and taught theology in the school of Notre-Dame, Paris. He was consecrated bishop of Paris in 1159. His *Four Books of Sentences* (1148–51), a systematic collection of teachings of the Church Fathers and opinions of medieval theologians, served as the standard theological text of the Middle Ages. In it Peter touched on every doctrinal issue, from God and the Trinity to the four "last things" (death, judgment, hell, and heaven). He asserted that sacraments are the cause and not merely the signal of grace and that human actions may be judged good or bad according to their cause and intention.

Peter the Apostle, Saint *orig.* **Simon** (d. c. AD 64, Rome) Disciple of JESUS, recognized as the leader of the Twelve APOSTLES. Jesus called him Cephas (Aramaic for "Rock"; rendered in Greek as "Petros") and said "Upon this rock I will build my church" (Matthew 16:18). When Jesus was arrested, according to the biblical account, Peter denied him three times, as Jesus had foretold. Accounts of Peter's life and ministry rely on the four GOSPELS, the Acts of the Apostles, the epistles of Peter, and the epistles of St. PAUL. Peter worked with Paul in Antioch and later carried on missionary work in Asia Minor. According to tradition, he eventually went to Rome, where he suffered martyrdom by being crucified upside down. SAINT PETER'S BASILICA is said to have been built on the site of his grave in Rome. In ROMAN CATHOLICISM he is regarded as the first in the unbroken succession of POPES. Jesus' promise to give him the "keys of the kingdom" led to the popular perception of Peter as the gatekeeper of heaven. The Roman Catholic church celebrates five feast days in honour of Peter, and in each the name of Paul is associated.

Peter the Cruel See PETER IV

Peter the Great See PETER I (Russia), PETER III (Aragon)

Peter the Great Bay Inlet, Sea of JAPAN (East Sea), northwestern Pacific Ocean, in extreme southeastern RUSSIA. It extends for 115 mi (185 km) from the mouth of the TUMEN RIVER northeast across to Cape Povorotny. The bay reaches inland for 55 mi (88 km) and contains the port of VLADIVOSTOK. The bay freezes from early December to mid-April.

Peter the Hermit (b. c. 1050, probably Amiens—d. July 8, 1115, Huy, Flanders) French ascetic and one of the most important preachers of the First CRUSADE. A charismatic ascetic, he preached widely in Europe in support of the First Crusade and led his enthusiastic followers to Constantinople in 1096. They advanced to Nicomedia, but Peter was unable to maintain discipline; he returned to Constantinople to ask for help from ALEXIUS I, and in his absence his army was annihilated by the Turks. Peter reached Jerusalem in 1099 and afterwards returned to France, where he became prior of an Augustinian monastery.

Peter the Venerable (b. c. 1092, Montboissier, Auvergne, Arles—d. Dec. 25, 1156, Cluny, Burgundy) French abbot of Cluny (from 1122). He joined BERNARD DE CLAIRVAUX in supporting Pope Innocent II and weakened the position of the antipope ANACLETUS II. He befriended PETER ABELARD and reconciled him to Bernard and the pope. Peter's reforms restored Cluny to its prominence among the religious establishments of Europe. He also wrote numerous letters and treatises against heresy, the Jews, and the Muslims and commissioned the first Latin translation of the QUR'ĀN.

Peterhof See PETRODVORETS

Peterloo Massacre (Aug. 16, 1819) Brutal dispersal of a meeting held on St. Peter's Fields in Manchester, Eng. Called to protest unemployment and high food prices and demand parliamentary reform, the meeting drew about 60,000 people, including many women and children. Alarmed by its size, city officials ordered the city's volunteer cavalry to arrest the speakers. The untrained cavalry also attacked the peaceable crowd with sabres, and professional soldiers were sent to join the attack. After a 10-minute rout, about 500 people lay injured and 11 were dead. The incident (likened to Waterloo) came to symbolize Tory tyranny.

Peters, Carl (b. Sept. 27, 1856, Neuhaus an der Elbe, Hanover—d. Sept. 10, 1918, Bad Harzburg, Ger.) German explorer and colonizer in East Africa. After studying British principles of colonization, he founded the Society for German Colonization (1884) and made treaties with chiefs in East Africa to cede their territories to him. He helped establish the German East African protectorate of Tanganyika and formed the German East Africa Company in 1885. He served as imperial high commissioner for Kilimanjaro (1891–97) and explored the Zambezi River (1899–1901), where he discovered relics of ancient cities and gold mines.

Peter's Pence In medieval England, an annual tax of a penny paid by landowners to the papal treasury in Rome. Peter's Pence was instituted during the 7th or 8th century and continued until the 16th century. It also existed in several northern European kingdoms.

Petersburg Campaign (1864–65) Series of military operations in southern Virginia at the end of the AMERICAN CIVIL WAR. The rail centre of Petersburg, Va., was a strategic defense point near the Confederate capital of Richmond. In June 1864 the Union army began a siege of both cities, and each side built fortifications 35 mi (56 km) long. Confederate troops under ROBERT E. LEE held the cities, but supplies were scarce and Lee's 50,000 troops were immobilized by lack of horses. In April 1865 the 120,000 Union troops under ULYSSES S. GRANT drove the Confederates behind Petersburg's inner defenses, forcing the evacuation of both cities. Soon thereafter the Confederates surrendered at APPOMATTOX COURT HOUSE.

Peterson, Oscar (Emmanuel) (b. Aug. 15, 1925, Montreal, Que., Can.) Canadian jazz pianist and composer. Peterson grew up in Montreal and studied classical piano. His jazz playing, influenced by ART TATUM and NAT KING COLE, is characterized by cascades of notes and an effervescent swing. After his Carnegie Hall debut in 1949 he became one of the busiest pianists in JAZZ, in demand as an accompanist, solo pianist, and leader of his own trio. An outstanding, extroverted improviser and sensitive accompanist, Peterson demonstrates in his performance his roots in SWING as well as BEBOP.

Peterson, Roger Tory (b. Aug. 28, 1908, Jamestown, N.Y., U.S.—d. July 28, 1996, Old Lyme, Conn.) U.S. ornithologist. He started drawing birds in high school. His *Field Guide to the Birds* (1934), illustrated with paintings that stressed the features that best identified a species in the field, greatly stimulated public interest in bird study in the U.S. and Europe. Many other guides followed. More responsible than any other person for fostering a widespread awareness of birds by the American public, he received such awards as the American Ornithologists' Union's Brewster Medal (1944) and the World Wildlife Fund's Gold Medal (1972).

Petipa \pā-tē-'pȧ**, Marius** (b. March 11, 1818, Marseille, Fr.—d. July 14, 1910, Gurzuf, Ukraine, Russian Empire) French-born Russian dancer and choreographer. He received his early training from his ballet-master father and was a principal dancer in France, Belgium, and Spain before joining the Imperial Theatre in St. Petersburg in 1847. There he also created several ballets, including *The Pharaoh's Daughter*, which led to his appointment as chief choreographer in 1869. By his retirement in 1903, he had produced more than 60 ballets for the imperial theatres in St. Petersburg and Moscow—including *Don Quixote* (1869), *La Camargo* (1872), *Sleeping Beauty* (1890), *Swan Lake* (1895), and *The Seasons* (1900)—which formed the core of the classical Russian repertoire.

Petit \pə-'tē**, Roland** (b. Jan. 13, 1924, Villemomble, Fr.) French dancer and choreographer. He danced with the Paris Opéra Ballet (1940–44) and then formed several companies, with which he toured Europe and the U.S. His dramatic ballets combined fantasy with elements of contemporary realism and included *The Strolling Players* (1945), *The Young Man and Death* (1946), and *Carmen* (1949). He choreographed dances for films in the 1950s, and he later staged revues featuring his wife, Zizi Jeanmaire. From 1973 to 1997 he was director of the Ballet de Marseille.

petit \'pe-tē\ **jury** *or* **trial jury** Group chosen from the citizens of a district to try a question of fact at issue in a trial. Though petit juries in England and the U.S. historically have contained 12 members, there is no uniform number. Numerical requirements for a valid verdict vary (e.g., unanimity in most courts in the U.S., a majority in Scotland and Italy, two-thirds in Portugal). The petit jury is the standard jury for civil and criminal trials. It has less discretion than is often imagined. The trial judge supervises it, rules on what EVIDENCE it may view and which laws are applicable, and sometimes directs or, at the end of the trial, sets aside its verdict. See also GRAND JURY.

petition Written instrument directed to an individual, government official, legislative body, or court in order to seek redress of grievances or to request a favour. In some jurisdictions, petitions brought by a sufficient number of people (represented by their signatures) are used to place a candidate on a ballot, to submit an issue to the electorate (see REFERENDUM AND INITIATIVE), or to exert pressure on legislators to vote in a certain way. In the U.S., the right to petition is guaranteed by the 1st Amendment to the Constitution.

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Petition of Right (1628) Petition sent by Parliament to King CHARLES I complaining of a series of breaches of law. The petition sought recognition of four principles: no taxation without the consent of Parliament, no imprisonment without cause, no quartering of soldiers on subjects, and no martial law in peacetime. To continue receiving subsidies for his policies, Charles was compelled to accept the petition, but he later ignored its principles.

Petőfi \'pet-ō̄-fē**, Sándor** (b. Jan. 1, 1823, Kiskőrös, Hung.—d. probably 1856, Siberia) Hungarian poet and revolutionary. He became famous with his first poetry volume, *Versek* (1844). Before the revolution of 1848 he wrote poems that glowed with political passion; one of them, "Talpra magyar" ("Rise, Hungarian"), became an anthem. He disappeared in battle and was assumed dead in 1849, but archives opened in the 1980s revealed that he was marched to Siberia and died there. His works are characterized by realism, humour, descriptive power, and a peculiar vigour and have a direct style adapted from national folk songs. *János vitéz* (1845), an entrancing fairy tale, is his most popular epic.

Petra \'pē-trə\ *Arabic* **Baṭrā** Ancient city, Middle East. Located in what is now southwestern JORDAN, it was the capital of the Nabataean kingdom until its defeat by the Romans in AD 106. It then became part of the Roman province of Arabia. After several centuries as a flourishing trade centre, it declined with the shifting of trade routes away from the city. It was captured by the Muslims in the 7th century. Its ruins were rediscovered in 1812 by the Swiss traveler Johann L. Burckhardt. Excavations since the mid-20th century have revealed many rock-cut monuments, including tombs with elaborate facades carved in the rose, crimson, and purple sandstone of the surrounding hills. Petra was designated a UNESCO WORLD HERITAGE SITE in 1985.

The Nabataean rock-cut monument of Ad-Dayr, Petra, Jordan.
BRIAN BRAKE FROM RAPHO/PHOTO RESEARCHERS—EB INC.

Petrarch \'pē-ˌträrk, 'pe-ˌträrk\ *Italian* **Francesco Petrarca** (b. July 20, 1304, Arezzo, Tuscany—d. July 18/19, 1374, Arquà, near Padua, Carrara) Italian scholar, poet, and humanist. After 1326 he abandoned the study of law for his true interests, literature and the religious life. He took minor ecclesiastical orders and moved to Avignon, where in 1327 he first saw Laura, the idealized subject of his chaste love and of his celebrated Italian love lyrics; mainly sonnets and odes written over some 20 years, most were included in his *Canzoniere* or *Rime* (1360). The greatest scholar of his age, especially of Classical Latin, he traveled widely, visiting learned men, searching out manuscripts, and undertaking diplomatic missions. He strongly advocated the continuity between Classical culture and the Christian message; in combining the two ideals he is considered the founder and a great representative of HUMANISM. His Latin works, reflecting his religious and philosophical interests, include *On Illustrious Men* (begun c. 1337), the epic poem *Africa* (begun c. 1338), the autobiographical treatise *Petrarch's Secret* (written 1342–58), *De vita solitaria* (1345–47; "The Life of Solitude"), and *Epistolae metricae* (begun c. 1345; "Metrical Letters"). After 1367 he lived in and near Padua. His influence on European literature was enormous and lasting, and his deep consciousness of the Classical past as a source of literary and philosophical meaning for the present was of great importance in paving the way for the RENAISSANCE.

petrel Any of numerous seabirds (order Procellariiformes, particularly family Procellariidae), including 24 species (genera *Pterodroma* and *Bulweria*) called gadfly petrels because of their fluttering flight. Most are dark above and light below, with long wings and a short, wedge-shaped tail. They nest in colonies on tropical and subtropical islands. Both parents tend the single chick until it is almost fully fledged. During the nonbreeding season, petrels roam the open ocean, eating squid and small fishes. Species in the family Pelecanoididae are called diving petrels. See also FULMAR, SHEARWATER, STORM PETREL.

Petrie \'pē-trē**, Sir (William Matthew) Flinders** (b. June 3, 1853, Charlton, near Greenwich, London, Eng.—d. July 28, 1942, Jerusalem) British archaeologist who made valuable contributions to the techniques of EXCAVATION and DATING. During excavations in Egypt in the mid 1880s Petrie developed a sequence dating method, based on a comparison of potsherds at various levels, that made possible the reconstruction of ancient history from material remains. His excavations, together with those of HEINRICH SCHLIEMANN at Troy, marked the beginning of the examination of successive levels of a site, rather than the previously haphazard digging. Petrie made many important discoveries in Egypt and Palestine. His *Methods and Aims in Archaeology* (1904) was the definitive work of its time. He taught at the University of London (1892–1933).

Petrified Forest National Park National park, eastern Arizona, U.S. Established as a national monument in 1906 and as a national park in 1962, it has an area of 146 sq mi (378 sq km). It features extensive exhibits of petrified wood in several "forest" areas, fossilized leaves, plants, and broken logs, and the PAINTED DESERT. Other features include petroglyphs and ancient PUEBLO INDIAN ruins.

petrified wood Fossil formed by the infiltration of minerals into cavities between and within cells of natural wood, usually by SILICA (silicon dioxide, SiO_2) or CALCITE (calcium carbonate, $CaCO_3$). Often this replacement of organic tissue by mineral deposits is so precise that the internal structure as well as the external shape is faithfully represented; sometimes even the cell structure may be determined.

Petrobrás \'pe-trō-ˌbräs\ *officially* **Petróleo Brasileiro SA** Brazilian oil and natural-gas company, the largest corporation in South America. It was founded in 1953 as a government-owned monopoly to prospect, extract, and refine domestic petroleum and to transport that oil and its derivatives. A government agency sets its policies and oversees its development. Although mainly devoted to developing petroleum sources in Brazil, Petrobrás also has interests in the Middle East, North Africa, and Colombia. In 1995, as part of a campaign to privatize state-owned industries, the Brazilian government ended the company's monopoly and allowed foreign competition. Petrobrás subsequently developed joint ventures with foreign businesses.

petrochemical Strictly, any of a large class of chemicals (as distinct from fuels) derived from PETROLEUM and NATURAL GAS. The category has been broadened to include a much larger range of organic compounds and a few inorganic compounds (including carbon black, SULFUR, and AMMONIA). Some materials cannot be classifed unequivocally because they have alternative sources (BENZENE from coal, ETHANOL from fermentation). Like crude oil and natural gas, most petrochemicals consist mainly of carbon and hydrogen and are called HYDROCARBONS. Petrochemicals used as raw materials (feedstocks) include ETHYLENE, propylene, butadiene, benzene, TOLUENE, xylene, and NAPHTHALENE. Among the myriad petrochemical products are PLASTICS (e.g., POLYETHYLENE, polypropylene, polystyrene), SOAPS and DETERGENTS, SOLVENTS, DRUGS, FERTILIZERS, PESTICIDES, EXPLOSIVES, synthetic fibres and RUBBERSS, paints, EPOXIES, flooring and insulating materials, luggage, and recording disks and tapes.

Petrodvorets \ˌpyi-trə-dvȧ-'ryets\ *formerly (until 1944)* **Peterhof** City (pop., 1995 est.: 82,000), northwestern Russia. Located near St. Petersburg, it was founded by PETER I THE GREAT as a country estate in 1709. After visiting France in 1717, he decided to create a residence that would rival the Palace of VERSAILLES. The Baroque Grand Palace (1714–28) was designed by Domenico Trezzini, and its gardens by Alexandre Le Blond (1679–1719). It became the most lavish and popular of the Russian royal summer residences. Today the Grand Palace (now a museum) and the vast park, with 39 mi (63 km) of canals that connect the intricate system of fountains, are part of the 2,500-acre (1,000-hectare) preserved area in the city of Petrodvorets.

Petrograd See SAINT PETERSBURG

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petrol See GASOLINE

Petróleos de Venezuela \,pe-trō-'lā-ōs-thā-,ve-nəz-'wā-lə\, SA (PDVSA) State-owned Venezuelan energy company with interests in oil, natural gas, coal, and petrochemicals. It was created in 1976 through the nationalization of Venezuela's petroleum industry, which had been controlled by foreign companies since the end of World War I. Petróleos de Venezuela engages in the exploration, refining, and marketing of oil, petrochemicals, and natural gas in many parts of the world. Through its acquisition of CITGO Petroleum in 1990, PDVSA became a leading supplier of gasoline and other petroleum products in the U.S. Given the scale of its operations, PDVSA usually earns the largest share of Venezuela's foreign currency.

petroleum *or* **crude oil** Complex mixture of HYDROCARBONS derived from the geologic transformation and decomposition of plants and animals that lived hundreds of millions of years ago. As a technical term, *petroleum* encompasses the liquid (crude oil), gaseous (NATURAL GAS), and viscous or solid (BITUMEN, ASPHALT) forms of hydrocarbons that occur in the Earth, but the meaning is often restricted to the liquid oil form. Crude oil and natural gas are the most important primary FOSSIL FUELS. Asphalt has been used since ancient times to caulk ships and pave roads. In the mid 1800s petroleum began to replace whale oil in lamps, and the first well specifically to extract it was drilled in 1859. The development of the automobile gave petroleum a new role as the source of GASOLINE. Petroleum and its products have since been used as fuels for heating, for land, air, and sea transport, and for electric power generation and as PETROCHEMICAL sources and lubricants. Crude oil and natural gas, produced mostly in Saudi Arabia, the U.S., and Russia, now account for about 60% of world energy consumption; the U.S. is by far the largest consumer. At present rates of consumption, the known supply will be exhausted by the mid 21st century. Petroleum is recovered from drilled wells, transported by pipeline or tanker ship to refineries, and there converted to fuels and petrochemicals.

petroleum trap Subsurface reservoir of petroleum. The oil is always accompanied by water and often by NATURAL GAS; all are confined in porous rock. The natural gas, being lightest, occupies the top of the trap and is underlain by the oil and then the water. A layer of impervious rock, called the roof rock, prevents the escape of the petroleum. The part of the trap that is actually occupied by the oil and gas is called the petroleum reservoir.

petrology Scientific study of rocks, including their composition, texture, and structure; occurrence and distribution; and conditions of origin. Petrology is concerned with all three major types of rocks: igneous, metamorphic, and sedimentary. The subdiscipline of experimental petrology involves synthesizing rocks in the laboratory to ascertain the physical and chemical conditions under which they form. The subdiscipline of petrography is concerned primarily with the systematic study and description of rocks using a petrographic microscope.

Petronas \pe-'trō-nəs\ Towers Twin stainless-steel-clad skyscrapers, linked by a skybridge, in Kuala Lumpur, Malaysia. Designed by Cesar Pelli (b. 1926) and completed in 1998, the circular, step-tapered towers house the headquarters of Malaysia's national petroleum company. Each tower is 88 stories high, has a structural frame of high-strength, steel-reinforced concrete, and reaches a height of 1,483 ft (451.9 m)—a figure that includes a pinnacle and steel spire atop each. In 1996, after achieving their full height, the towers were considered the world's tallest buildings, surpassing the then-tallest SEARS TOWER; they, in turn, were superseded in 2003 by the Taipei 101 (Taipei Financial Center) building in Taipei, Taiwan, that rose to 1,667 ft (508 m).

Petronius Arbiter, Gaius *orig.* **Titus Petronius Niger** (d. AD 66) Roman writer. Of a noble family, Petronius belonged to a class of idle pleasure-seekers, but he served ably as governor of the Asian province of Bithynia and as consul in Rome. After being appointed NERO's authority on taste (hence "Arbiter"), he was accused of plotting to kill the emperor and, though innocent, committed suicide. He is the reputed author of the *Satyricon*, a comic PICARESQUE NOVEL vividly portraying contemporary Roman society through the escapades of a disreputable trio of adventurers, with unrelated stories and the author's commentaries on Roman life interspersed.

Petty, Richard (b. July 2, 1937, Level Cross, N.C., U.S.) U.S. stock-car racer. He entered professional stock-car racing in 1958. In his long professional career he won 200 races. In 1975 he set the NASCAR record of 13 victories in one season. "King Richard" also won seven Daytona 500 races and seven NASCAR Grand National championships. His father, son, and grandson were all NASCAR racers.

Petty, Sir William (b. May 26, 1623, Romsey, Hampshire, Eng.—d. Dec. 16, 1687, London) British political economist and statistician. He gave up a life at sea to study medicine, and taught anatomy at the University of Oxford. He founded mines, ironworks, and fisheries in Ireland. He was also responsible for several inventions and was a founder of the ROYAL SOCIETY. Petty was an originator of political arithmetic, which he defined as the art of reasoning by figures upon things relating to government. In his best-known work, *Treatise of Taxes and Contributions* (1662), he favoured giving free rein to the forces of individual self-interest but declared the maintenance of a high level of employment to be a duty of the state. He also argued that the labour necessary for production was the main determinant of exchange value.

petunia Any of many species of flowering plants in the genus *Petunia*, in the NIGHTSHADE FAMILY, which originated in South America. The innumerable varieties of showy, trumpet-shaped flowers are immensely popular. There are two types: the compact, erect sort seen in summer garden beds, and the sprawling, long-stemmed sort seen in hanging baskets and window boxes. From early summer until frost, petunias bloom profusely with single or double blossoms; crisped, fringed, or ruffled flowers; and spectacular hues from pure white to deep crimson or purple, speckled or veined in contrasting colours. Leaves are soft, flabby, and covered with fine, sticky hairs. Technically perennials, petunias are most often grown as annuals.

Pevsner \'pevz-nər\, Antoine *orig.* **Natan Borisovich Pevzner** (b. Jan. 18, 1886, Oryol, Russia—d. April 12, 1962, Paris, France) Russian-born French sculptor and painter. After travels to Paris and Oslo, he returned to become a professor at Moscow's school of fine arts. He helped form the SUPREMATIST group, and in 1920 he and his brother, NAUM GABO, issued the *Realist Manifesto* of CONSTRUCTIVISM. He settled in Paris in 1923. He used zinc, brass, copper, and celluloid for his early sculptures; later he relied mainly on parallel arrays of bronze wire soldered together to form plates, which he joined to form intricate shapes.

Pevsner \'pefs-nər\, Sir Nikolaus (b. Jan. 30, 1902, Leipzig, Ger.—d. Aug. 18, 1983, London, Eng.) German-born British art historian. He studied at various German universities and taught at Göttingen University (1929–33) before moving to England to escape Nazism. There he taught at the Universities of London, Oxford, and Cambridge. He is best known for his writings on architecture, especially his 46-volume series of county-by-county guides, *The Buildings of England* (1951–74), one of the great achievements of 20th-century art scholarship. He conceived and edited the *Pelican History of Art* series (1953–); many of these individual volumes have become classics.

pewter Tin-based ALLOY used to make domestic utensils. Pewter dates back at least 2,000 years, to Roman times. Ancient pewter contained about 70% TIN and 30% LEAD. Such pewter, also called black metal, darkened greatly with age, and the lead readily leached out in contact with acidic foods. Pewter with little or no lead is of finer quality, and alloys that include ANTIMONY and BISMUTH are more durable and shinier. Modern pewter is about 91% tin, 7.5% antimony, and 1.5% copper; the absence of lead makes it safe to use for foods and beverages. The surface of modern pewter is bluish white with either a bright finish or a soft, satin sheen. It resists tarnish, retaining its colour and finish indefinitely.

peyote \pā-'ō-tē\ Either of two species of the genus *Lophophora* in the CACTUS family, native to North America, almost exclusively to Mexico. The body of the peyote cactus is spineless, soft, usually blue-green, and only 3 in. (8 cm) wide and 2 in. (5 cm) tall. The more common species, mescal (*L. williamsii*), has pink to white flowers. *L. diffusa*, more primitive, has white to yellow flowers and a yellow-green body. Well known for its hallucinogenic effects (primarily due to the alkaloid MESCALINE), peyote figures prominently in old and recent religious

Peyote (*Lophophora williamsii*)
DENNIS E. ANDERSON

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rituals of certain American Indian peoples. The sale, use, or possession of dried mescal buttons (flowering heads) or live plants is prohibited by law in many places.

peyotism See Native American Church

pH Quantitative measure of the strength of the acidity or alkalinity (see acid, base) of a solution. It is defined as the negative common logarithm of the concentration of hydrogen ions [H^+] in moles/litre: pH = $-\log_{10}$ [H^+]. The letters of its name are derived from the absolute value of the power (p) of the hydrogen ion concentration (H). The product of the concentrations in water of H^+ and OH^- (the hydroxide ion) is always about 10^{-14}. The strongest acid solution has about 1 mole/litre of H^+ (and about 10^{-14} of OH^-), for a pH of 1. The strongest basic solution has about 10^{-14} moles/litre of H^+ (and about 1 of OH^-), for a pH of 14. A neutral solution has about 10^{-7} moles/litre of both H^+ and OH^-, for a pH of 7. The pH value, measured by a pH meter, titration, or indicator (e.g., litmus) strips, helps inform chemists of the nature, composition, or extent of reaction of substances, biologists of the composition and environment of organisms or their parts or fluids, physicians of the functioning of bodily systems, and agronomists of the suitability of soils for crops and any treatments needed. The pH is now defined in electrochemical terms (see electrochemistry).

Phaedra \'fē-drə\ In Greek legend, the daughter of King Minos. She became the second wife of Theseus after he abandoned her sister Ariadne. She later fell in love with her stepson Hippolytus; rejected, she accused him of rape. He was killed, and she hanged herself.

Phaedrus \'fē-drəs\ (b. c. 15 BC, Thrace—d. c. AD 50, Italy) Roman fabulist. A slave by birth, Phaedrus became a freedman in Augustus's household. He was the first writer to Latinize whole books of fables, producing free versions in iambic metre of Greek prose fables that were then circulating under the name of Aesop. Phaedrus's renderings, noted for their charm, brevity, and didacticism, became very popular in medieval Europe; they include such favourites as "The Fox and the Sour Grapes" and "The Wolf and the Lamb."

Phaethon \'fā-ə-thən\ In Greek mythology, the son of Helios, the sun god, and a nymph. Taunted as illegitimate, Phaethon asked for permission to drive the chariot of the sun through the heavens for a single day in order to prove that Helios was his father. He proved unable to control the horses, and, after making a gash in the heavens that became the Milky Way, he rode too close to earth and began to scorch it. To prevent further damage, Zeus hurled a thunderbolt, killing him.

Phag-mo-gru family \'fäg-mō-grü\ Tibetan family that in the 14th century liberated Tibet from Mongol control. At that time Tibet was governed by lamas from the Sa-skya monastery who resided at the Mongol (Yuan) court in China. Under Byang-chub rgyal-mtshan (1302–1364), the Phag-mo-gru liberated central Tibet. For the next 100 years, a semblance of central authority was reestablished in the country.

phage See bacteriophage

phalanger See possum

phalanx \'fā-ˌlaŋks\ Tactical formation consisting of a block of heavily armed infantry standing shoulder to shoulder in files several ranks deep. First used by the Sumerians and fully developed by the ancient Greeks, it is viewed today as the beginning of European military development. The Greek city-states adopted a phalanx eight men deep during the 7th century BC. The spectacle of Greek hoplites marching forward in solid ranks was frightening to the enemy, but the phalanx was difficult to maneuver and easily thrown into confusion if its ranks were broken.

phalarope \'fa-lə-ˌrōp\ Any of three species (genus *Phalaropus*, family Scolopacidae) of slim-necked shorebirds, 6–10 in. (25–25 cm) long, with lobed toes and a straight, slender bill. In summer, their gray-and-white plumage has red markings. Females fight for nesting territory and court the males; males, smaller and duller, do all the nesting duties and lead the young south in autumn. Two species breed around the Arctic Circle and winter on tropical oceans, where they are known as sea snipe. Wilson's phalarope (*P. tricolor*) breeds in western North America and migrates to the Argentine pampas.

Phan Boi Chau \'pän-'bȯi-'chaù\ *or* **Phan Giai San** \'pän-'gyī-'sän\ *orig.* **Phan Van San** (b. 1867, Nghe An province, Viet.—d. Sept. 29, 1940, Hue) Vietnamese resistance figure. Son of a poor scholar, he received a doctorate in 1900, by which time he was already a firm nationalist. Opposed to French rule in Vietnam, he organized efforts to place the nationalist Prince Cuong De (1882–1951) on the throne. In 1905 he moved his resistance movement to Japan, where he met Sun Yat-sen and Phan Chau Trinh. His monarchist scheme failed, as did a plan to assassinate the governor-general of French Indochina, and Chau was imprisoned in 1914–17. Hundreds of Vietnamese protested when he was arrested again in 1925; subsequently released, he spent his remaining years in quiet retirement.

Phan Chau Trinh \'pän-'chü-'trin\ (b. 1872, Tay Loc, Quang Nam province, Viet.—d. March 24, 1926, Saigon) Vietnamese nationalist leader and reformer. Trinh, who fought in the resistance movement against the French even as a boy, came to believe that modernization was a prerequisite for developing an autonomous state, and he thus made modernization his primary goal. He urged replacing the civil service system with vocational schools and commercial firms, but his attempts to persuade the French to undertake major reforms failed, and he was twice imprisoned. He was mourned as a national hero after his death. See also Phan Boi Chau.

Phanerozoic \ˌfa-nə-rə-'zō-ik\ **Eon** Span of geologic time from c. 543 million years ago, the end of the Proterozoic Eon, to the present. The Phanerozoic, the eon of visible life, is divided into three major eras: the Paleozoic, Mesozoic, and Cenozoic. Although life originated in Precambrian time, it was in the Phanerozoic that many forms arose and evolved. The Earth gradually assumed its present configuration and physical features through such processes as plate tectonics, mountain building, and glaciation.

pharaoh \'fer-ō\ Epithet applied to Egyptian kings from c. 1500 to 343 BC. The term later evolved into a generic term for all ancient Egyptian kings. Pharaohs were regarded as gods, retaining their divine status even after death. A pharaoh's will was supreme, and he governed by royal decree, with the assistance of viziers. The common people nevertheless judged a pharaoh by his deeds; many were criticized, plotted against, and even deposed and killed. See also Akhenaton; Amenemhet I; Amenhotep II; Amenhotep III; Ramses II; Thutmose III; Tutankhamen.

Pharisee \'far-ə-ˌsē\ Member of a Jewish religious party in Palestine that emerged c. 160 BC in opposition to the Sadducees. The Pharisees held that the Jewish oral tradition was as valid as the Torah. They struggled to democratize the Jewish religion, arguing that the worship of God was not confined to the Temple of Jerusalem and fostering the synagogue as an institution of worship. Their belief that reason must be applied in the interpretation of the Torah and its application to contemporary problems is now basic to Jewish theology.

pharmaceutical industry Producers of pharmaceuticals, substances used in the diagnosis, treatment, and prevention of disease and the modification of organic functions. The earliest records of medicinal plants and minerals are those of the ancient Chinese, Hindu, and Mediterranean civilizations. Medicines were prepared first by physicians and later by apothecary shops. The modern pharmaceutical industry began in the 19th century with the discovery of highly active medicinal compounds that could be manufactured most efficiently on a large scale. As these drugs replaced the herbal medicines of earlier times, the occurrence and severity of such diseases as rheumatic fever, typhoid fever, pneumonia, poliomyelitis, syphilis, and tuberculosis were greatly reduced. Many drugs are extracted from plant substances; alkaloids such as quinine, cocaine, and morphine are among the best-known examples. Others are made from animal substances, such as the glandular extracts that are used to produce insulin. Pharmaceutical industry research has greatly aided medical progress, and many new drugs have been discovered and produced in industrial laboratories. Increasing health-care costs, government regulation, and research ethics are all issues of concern to the industry.

pharmacology \ˌfär-mə-'käl-ə-jē\ Branch of medicine dealing with the actions of drugs in the body—both therapeutic and toxic effects—and development and testing of new drugs and new uses of existing ones. Though the first Western pharmacological treatise (a listing of herbal plants) was compiled in the 1st century AD, scientific pharmacology was possible only from the 18th century on, when drugs could be purified and standardized. Pharmacologists develop drugs from plant and animal sources and create synthetic versions of these, along with new drugs based on them or their chemical structure. They also test drugs, first in vitro (in the laboratory) for biochemical activity and then in vivo (on animals, human volunteers, and patients) for safety, effectiveness, side effects, and

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interactions with other drugs and to find the best dose, timing, and route (mouth, injection, etc.). Drug products are constantly tested for potency and purity. See also DRUG POISONING; PHARMACY; PHARMACEUTICAL INDUSTRY.

pharmacy Science dealing with collection, preparation, and standardization of DRUGS. Pharmacists, who must earn a qualifying degree, prepare and dispense prescribed medications. They formerly mixed and measured drug products from raw materials according to doctors' prescriptions, and they are still responsible for formulating, storing, and providing correct dosages of medicines, now usually produced by pharmaceutical companies as premeasured tablets or capsules. They also advise patients on the use of both prescription and over-the-counter drugs. Laws regulating the pharmaceutical industry are based on the national pharmacopoeia, which outlines the purity and dosages of numerous medicinal products.

Pharsalus \fär-'sā-ləs**, Battle of** (48 BC) Decisive engagement in the Roman civil war between Julius CAESAR and POMPEY. Caesar had recently been defeated by Pompey when the two met again in Greece. Though Pompey had twice as many men, Caesar used unorthodox tactics to overwhelm him. Pompey fled and about half his men surrendered; the rest were killed or took flight.

pharyngitis \ˌfar-ən-'jī-təs\ INFLAMMATION and INFECTION (usually bacterial or viral) of the PHARYNX. Symptoms include pain (sore throat, worse on swallowing), redness, swollen lymph nodes, and fever. Throat culture may be the only way to distinguish infection with STREPTOCOCCUS bacteria (strep throat), which can cause RHEUMATIC FEVER if not treated in time with ANTIBIOTICS, from viral infections, which do not respond to antibiotics and require only symptom relief.

pharynx \'far-iŋks\ Inside of the throat, from the oral and nasal cavities (see MOUTH, NOSE) to the TRACHEA and ESOPHAGUS. It has three connected sections: the nasopharynx, at the back of the nasal cavity; the oropharynx, in the back of the oral cavity down to the epiglottis (a flap of tissue that closes off the LARYNX during swallowing); and the laryngopharynx, from the epiglottis to the esophagus. The oropharynx contains the palatine TONSILS. The eustachian tubes connect the middle EARS to the pharynx, allowing air pressure on the eardrum to be equalized. Disorders include PHARYNGITIS, TONSILLITIS, and cancer.

phase In THERMODYNAMICS, a chemically and physically uniform quantity of matter that can be separated mechanically from a nonhomogeneous mixture. It may consist of a single substance or of a mixture of substances. The three basic phases of matter are SOLID, LIQUID, and GAS; other phases that are considered to exist include crystalline (see CRYSTAL), colloidal (see COLLOID), GLASS, amorphous, and PLASMA. The different phases of a pure substance are related to each other in terms of TEMPERATURE and PRESSURE. For example, if the temperature of a solid is raised enough, or the pressure is reduced enough, it will become a liquid.

phase In wave motion, the fraction of the time required to complete a full cycle that a point completes after last passing through the reference position. Two PERIODIC MOTIONS are said to be in phase when corresponding points of each reach maximum or minimum displacements at the same time. If the crests of two waves pass the same point at the same time, they are in phase for that position. If the crest of one and the trough of the other pass the same point at the same time, the phase angles differ by 180° and the waves are said to be of opposite phase. Phase differences are important in alternating electric current technology (see ALTERNATING CURRENT).

Phazania See FEZZAN

pheasant Any of about 50 species of mostly long-tailed birds in the family Phasianidae (order Galliformes), chiefly Asian but naturalized elsewhere. Most species inhabit open woodlands and brushy fields. All have a hoarse call. The feet and lower legs are unfeathered. Females are inconspicuous. Most males are strikingly coloured and have one or more leg spurs, and some have a fleshy facial ornament. Males sometimes fight to the death for a harem of hens. Male ring-necked or common pheasants (*Phasianus colchicus*), 35 in. (90 cm) long, have a streaming tail, coppery breast, purplish green neck, and ear tufts; they are widespread in the northern U.S. Japanese green pheasants (*P. versicolor*) call in concert when an earthquake is imminent.

Common pheasant (*Phasianus colchicus*)
H. REINHARD—BRUCE COLEMAN INC./EB INC.

Pheidias See PHIDIAS

phenol \'fē-ˌnōl, 'fē-ˌnȯl\ Any of a class of organic compounds with a hydroxyl group (–OH; see FUNCTIONAL GROUP) attached to a carbon atom in a ring of an AROMATIC COMPOUND. The simplest one, CARBOLIC ACID (C_6H_5OH), is also called phenol; its most important reaction is with FORMALDEHYDE, with which it forms widely used polymers called phenol-formaldehyde (phenolic) resins. Phenols are similar to ALCOHOLS but form stronger hydrogen bonds (see BONDING), so they dissolve more readily in water and boil at higher temperatures. They may be colourless liquids or white solids; many have a sharp, spicy odour. Some are found in ESSENTIAL OILS. Phenols with higher MOLECULAR WEIGHTS and phenol derivatives have supplanted phenol itself as industrial ANTISEPTICS (germicidal cleaners). See also LEO BAEKELAND.

phenol See CARBOLIC ACID

phenomenalism View that statements about material objects are reducible to statements about actual and possible sensations, or SENSE-DATA. According to phenomenalists, a material object is not a mysterious something "behind" the appearances presented in sensation. If it were, the material world would be unknowable; indeed, the term *matter* is unintelligible unless it somehow can be defined by reference to sensations. In speaking about a material object, then, reference must be made to a very large system of possible sense-data, only some of which (if any) are ever actualized. Thus the statement "There is a fire in the next room" would be analyzed as a series of hypothetical statements such as "If one were to enter the next room with one's eyes open, one would see a bright light of a yellowish orange colour." Some philosophers have objected that it is difficult to remove all references to material objects from the hypothetical statements to which material-object talk is supposedly reducible. See also GEORGE BERKELEY.

phenomenology Philosophical discipline originated by EDMUND HUSSERL. Husserl developed the phenomenological method to make possible "a descriptive account of the essential structures of the directly given." Phenomenology emphasizes the immediacy of experience, the attempt to isolate it and set it off from all assumptions of existence or causal influence and lay bare its essential structure. Phenomenology restricts the philosopher's attention to the pure data of consciousness, uncontaminated by metaphysical theories or scientific assumptions. Husserl's concept of the life-world—as the individual's personal world as directly experienced—expressed this same idea of immediacy. With the appearance of the *Annual for Philosophical and Phenomenological Research* (1913–30), under Husserl's editorship, his personal philosophizing flowered into an international movement. Its most notable adherents were MAX SCHELER and MARTIN HEIDEGGER.

phenotype \'fē-nə-ˌtīp\ All the observable characteristics of an organism, such as shape, size, colour, and behaviour, that result from the interaction of its GENOTYPE (total genetic makeup) with the environment. The phenotype may change throughout the life of an individual because of environmental changes and the changes associated with aging. Different environments can influence the development of inherited traits (e.g., size is affected by available food supply) and can alter expression by similar genotypes (e.g., twins brought up in dissimilar families may mature differently). Furthermore, not all inherited possibilities in the genotype are expressed in the phenotype, because some are the result of inactive, recessive, or inhibited genes. See also VARIATION.

phenylalanine \ˌfe-nᵊl-'a-lə-ˌnēn, ˌfē-nᵊl-'a-lə-ˌnēn\ One of the essential AMINO ACIDS, present in many common PROTEINS, especially HEMOGLOBIN. It is used in medicine and nutrition and as one of the two amino acids making up ASPARTAME. Persons with PHENYLKETONURIA do not metabolize phenylalanine properly and must adhere to a diet free of it.

phenylketonuria \ˌfe-nᵊl-ˌkē-tᵊn-'ůr-ē-ə\ **(PKU)** *or* **phenylpyruvic oligophrenia** \ˌfe-nᵊl-pī-ˌrü-vik-ˌäl-i-gō-'frē-nē-ə\ Inability to normally metabolize PHENYLALANINE, the accumulation of which interferes with normal childhood development. Central NERVOUS SYSTEM effects include mental retardation and seizures (see EPILEPSY), with behavioral signs seen at four to six months of age. Abnormal metabolism also leads to low MELANIN levels, with light hair, eye, and skin colour. Tests detect this recessive genetic disorder (see CONGENITAL DISORDER; RECESSIVENESS) in two-thirds of the 1 in 10,000 newborns born with high levels of phenylalanine. Keeping

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phenylalanine out of the diet (by total avoidance of meat, dairy, and high-protein foods and ASPARTAME) until adolescence permits normal development. Protein is supplied in a phenylalanine-free formula. Pregnant women with PKU must resume the diet to prevent severe damage to the unborn child.

pheromone \'fer-ə-ˌmōn\ Any chemical compound secreted by an organism in minute amounts to elicit a particular reaction from other organisms of the same species. Pheromones are widespread among insects and vertebrates (except birds) and are present in some fungi, slime molds, and algae. The chemicals may be secreted by special GLANDS or incorporated into other substances (e.g., urine), shed freely, or deposited in selected locations. Pheromones are used to bring creatures together (e.g., in termite, bee, and ant colonies), lead them to food (e.g., in scent trails laid by ants), signal danger (e.g., when released by wounded fish to alert others), attract a mate and elicit sexual behaviour (numerous examples, possibly including humans), and influence sexual development (in many mammals and certain insects). Alarm pheromones often last a shorter time and travel a shorter distance than other types. In vertebrates, chemical stimuli often influence parent-young responses. Sex-attractant pheromones are used in certain products to lure and trap unwanted or harmful insects.

Phi Beta Kappa Leading academic honour society in the U.S., which draws its membership from college and university students. The oldest Greek-letter society in the U.S., it was founded in 1776 as a secret literary and philosophical society at the College of WILLIAM AND MARY. It became an honour society in the 19th century. Membership is now based on general scholarship, and new members are usually elected by Phi Beta Kappa faculty.

Phibunsongkhram \'pē-bùn-sòŋ-ˌkräm**, Luang** *orig.* **Plaek Khittasangkha** (b. July 14, 1897, near Bangkok, Siam—d. June 12, 1964, Tokyo, Japan) Field marshal and premier of Thailand (1938–44, 1948–57). After military training in France, he helped organize the PROMOTERS REVOLUTION of 1932, which ended absolute monarchy in what was then Siam; in 1939 he changed the country's name to Thailand. As premier during World War II, he allied himself with Japan, but, as the war turned against Japan, his government collapsed. The army seized power in 1947, and he was reinstalled as premier in 1948. Opposed to communism, he further allied Thailand to the West during the Cold War by helping establish the SOUTHEAST ASIA TREATY ORGANIZATION. He was ousted by his military colleagues in 1957 and fled to Japan.

Phidias \'fid-ē-əs\ *or* **Pheidias** \'fī-dē-əs\ (fl. c. 490–430 BC, Athens, Greece) Greek sculptor. Placed in charge of the great building program initiated by PERICLES in Athens, he supervised and probably designed the overall sculptural decoration of the PARTHENON. He also created its most important religious images, including the colossal statue of the Athena Parthenos (438–436 BC). Many of the Parthenon's sculptures (the ELGIN MARBLES) are now in the British Museum. Ancient writers considered his masterpiece to be the statue of Zeus (c. 430 BC) for the Temple of Zeus at Olympia. He initiated the idealistic Classical style that distinguishes Greek art in the later 5th and 4th centuries BC.

"Heracles," marble statue produced in the workshop of Phidias, from the eastern pediment of the Parthenon, the Acropolis, Athens, c. 5th century BC; in the British Museum

COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Philadelphia City (pop., 2000: 1,517,550) and port, southeastern Pennsylvania, U.S., at the confluence of the DELAWARE and Schuylkill rivers. The site was occupied by the DELAWARE Indians before WILLIAM PENN founded the city in 1682. It was the capital of Pennsylvania 1683–1799 and the capital of the U.S. between 1790 and 1800. It played a prominent role in opposing British policies and was the site of the first and second CONTINENTAL CONGRESSES, the signing of the DECLARATION OF INDEPENDENCE, and the CONSTITUTIONAL CONVENTION. The population grew in the 18th century, with many immigrants from Scotland, Ireland, and Germany. It was the largest and most important city of the U.S. in the 19th century and a centre of the anti-slavery movement. In 1876 it was the site of the U.S. Centennial Exposition. It is also the site of the U.S.'s oldest art museum (the Pennsylvania Academy of the Fine Arts, founded in 1805) and the first U.S. hospital (the Pennsylvania Hospital, founded in 1751). It is the largest city in the state and a centre of commerce, finance, industry, and culture. Its numerous educational institutions include the University of PENNSYLVANIA.

Philadelphia Inquirer Morning newspaper, long one of the most influential dailies in the eastern U.S. Founded in 1847 as the *Pennsylvania Inquirer*, it took its present name c. 1860. It was a strong supporter of the Union in the American Civil War. In the 19th and early 20th centuries it survived circulation wars by providing broad news coverage and by constantly modernizing its plant and equipment. Bought by Moses Annenberg in 1936, it stayed in his family's hands until 1969, when it was acquired by John S. Knight. In 1974 it became part of the merged Knight-Ridder Newspapers group.

Philae \'fī-lē\ Former island of the NILE RIVER in Upper Egypt. It was sacred to ISIS and contained many temples, the earliest dating from the 7th century BC. After the completion of the ASWAN HIGH DAM in 1970, the temples were moved to the nearby island of Agilkia before Philae was submerged by the waters of Lake NASSER.

philanthropy Voluntary, organized efforts intended for socially useful purposes. Philanthropic groups existed in the ancient civilizations of the Middle East, Greece, and Rome: an endowment supported Plato's Academy (c. 387 BC) for some 900 years; the Islamic *waqf* (religious endowment) dates to the 7th century AD; and the medieval Christian church administered trusts for benevolent purposes. Merchants in 17th- and 18th-century western Europe founded organizations for worthy causes. Starting in the late 19th century, large personal fortunes led to the creation of private foundations that bequeathed gifts totaling millions and then billions in support of the arts, education, medical research, public policy, social services, environmental causes, and other special interests. See ANDREW CARNEGIE; B'NAI B'RITH; BILL GATES; GEORGE PEABODY; ROCKEFELLER FOUNDATION; STRAUS FAMILY.

Philaretus See Arnold GEULINCX

philately \fə-'la-t°l-ē\ Collection and study of postage stamps. The first postage stamps were issued in England in 1840, and in the U.S. in 1842. Stamp collectors usually specialize, collecting stamps of one country, one period of time, or one subject (e.g., birds, flowers, art). Value depends on rarity and condition. An issue of stamps that includes a printer's error may have increased value.

Inverted airplane airmail stamp, U.S., 1918

LEE BOLTIN

Philby, Kim *orig.* **Harold Adrian Russell** (b. Jan. 1, 1912, Ambāla, India—d. May 11, 1988, Moscow, Russia, U.S.S.R.) British intelligence officer and Soviet spy. He became a communist at the University of Cambridge in the 1930s, and in 1933 he became a Soviet agent. Recruited into the MI-6 section of British intelligence by GUY BURGESS (1940), he became head of counterespionage operations. In 1949 he was sent to Washington, D.C., as top liaison officer between British and U.S. intelligence services. He revealed top-secret information to the Soviets and in 1951 warned Burgess and Donald Maclean (1913–83) that they were under suspicion, enabling them to escape. Philby himself came under suspicion and was dismissed from MI-6 in 1955. He worked as a journalist in Beirut, then in 1963 he fled to the Soviet Union, where he worked for the KGB and rose to the rank of colonel. The most successful Soviet double agent of the Cold War period, he was responsible for the deaths of many Western agents.

Philemon and Baucis \fi-'lē-mən...'bò-sis\ In GREEK MYTHOLOGY, a pious old couple in Phrygia. When ZEUS and HERMES, disguised as wayfarers, had been turned away by the couple's richer neighbors, Philemon and Baucis extended them hospitality. As a reward they were spared when a flood swept the countryside. Their cottage was turned into a temple, and they became priest and priestess of it. Years later they were granted their wish to die at the same moment, and they were turned into trees.

Philip (of Swabia) *German* **Philipp** (b. 1178—d. June 21, 1208, Bamberg, Ger.) German HOHENSTAUFEN king (1198–1208). The youngest son of FREDERICK I Barbarossa, he was elected German king on the death

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of Emperor Henry VI. The rival Welf dynasty elected Otto IV king, and a civil war broke out. A truce was finally called in 1207; Innocent III recognized Philip and promised to crown him emperor (1208), but Philip was murdered first.

Philip II *or* **Philip of Macedon** (b. 382—d. 336 BC, Asia Minor) Eighteenth king of Macedonia (359–336), father of Alexander the Great. Appointed regent for his nephew, he seized the throne. He initially promoted peace with his neighbours, using the time gained thereby to build his forces and introducing innovations in arms, tactics, and training and stabilizing his western frontier. His movements on the eastern frontier provoked the Greeks into forming a coalition against him. He intervened in the Sacred War to free Delphi from the Phocians, becoming the ally of Thebes and the Thessalian League, whose president he became. Demosthenes turned Athens against him with his *Philippics* (346–342), and Thebes also came to view Philip as a threat. He defeated both at the Battle of Chaeronea, becoming leader of all Greece. He formed the Greek states into the League of Corinth to attack Persia but was undone by family politics. After he took a second wife, his first wife, Olympias, left him, taking Alexander. Philip was assassinated by a Macedonian nobleman, possibly in collusion with Olympias and Alexander.

Philip II *French* **Philippe** *known as* **Philip the Bold** (b. Jan. 17, 1342, Pontoise, France—d. April 27, 1404, Halle, Brabant) Duke of Burgundy (1363–1404). He was granted the duchy of Burgundy by his father, John II, and by marriage and purchase he acquired additional lands in northern and central France, Flanders, and the Netherlands. He shared the government with his brothers during the minority of his nephew Charles VI, ensuring friendly relations with England and Germany. When Charles went insane (1392), Philip became virtual ruler of France. He formed an alliance with England (1396) and withdrew his support of the Avignon papacy (1398).

Philip II *French* **Philippe** *known as* **Philip Augustus** (b. Aug. 21, 1165, Paris—d. July 14, 1223, Mantes) French king (1179–1223). The first of the great Capetian kings, he gradually reconquered the French territories held by the kings of England. He joined with Richard I on the Third Crusade, but the two kings soon quarreled. Philip returned to France (1191) and attacked English possessions; imprisoned in Austria on his journey home, Richard was freed in 1194 and promptly went to war with the French. When Richard was killed (1199), his brother John signed a treaty with Philip (1200), but within two years France and England were again at war. Philip conquered Normandy (1204) and subdued Maine, Touraine, Anjou, and most of Poitou (1204–05). John later organized a coalition against France, but he was defeated by Philip at the Battle of Bouvines (1214). Philip also expanded his territory into Flanders and Languedoc.

Philip II *Spanish* **Felipe** \fā-'lē-pā\ (b. May 21, 1527, Valladolid, Spain—d. Sept. 13, 1598, El Escorial) King of Spain (1556–98) and of Portugal (as Philip I, 1580–98). The son of Emperor Charles V, Philip received from his father the duchy of Milan (1540), the kingdoms of Naples and Sicily (1554), the Netherlands (1555), and Spain and its overseas empire (1556). He ruled from the Netherlands from 1555 and waged a successful war against France in 1557. From 1559 he ruled from Spain, where he built the palace of El Escorial and encouraged Spain's literary golden age. He was a champion of the Counter-Reformation but failed to put down rebellions in the Netherlands (from 1568) and to conquer England, suffering the defeat of the Spanish Armada (1588). He gained a victory in the Mediterranean with the defeat of the Ottoman offensive at the Battle of Lepanto (1571) and unified the Iberian Peninsula as king of Portugal from 1580. During his reign the Spanish empire attained its greatest power, extent, and influence.

Philip II, detail of an oil painting by Titian; in the Corsini Gallery, Rome.
ALINARI/ART RESOURCE, NEW YORK

Philip III *French* **Philippe** *known as* **Philip the Good** (b. July 31, 1396, Dijon, Burgundy—d. June 15, 1467, Bruges) Duke of Burgundy (1419–67). The most important of the Valois dukes of Burgundy, he founded the Burgundian state that rivaled France in the 15th century. He confirmed his right to Burgundy by signing the Treaty of Troyes with Henry V of England (1420), and he maintained an alliance with England, breaking it only during his unsuccessful attempt to capture Calais (1435–39). Philip avoided conflict with France and instead attacked his smaller neighbors, conquering Hainaut, Brabant, Holland and Zeeland, and Luxembourg by 1443. A renowned patron of the arts, he presided over one of Europe's most extravagant courts.

Philip III *Spanish* **Felipe** (b. April 14, 1578, Madrid, Spain—d. March 31, 1621, Madrid) King of Spain and of Portugal (1598–1621). The son of Philip II, he was an indifferent ruler and allowed royal favourites to govern in his place. From 1609 his government continued the policy of expelling the Moriscos (Christians of Moorish ancestry), which caused serious economic problems. The huge sums he spent on court entertainments exacerbated Spain's growing economic problems.

Philip IV *French* **Philippe** *known as* **Philip the Fair** (b. 1268, Fontainebleau, France—d. Nov. 29, 1314, Fontainebleau) King of France (1285–1314). On inheriting the French throne, he modeled himself on his grandfather, Louis IX. He was also king of Navarre (as Philip I, 1284–1305), ruling jointly with his wife, Joan I of Navarre. War with England (1294–1303) ended with a peace treaty and the betrothal of his daughter to the future Edward II. Philip forced a harsh treaty on Flanders in 1305. He conducted a long struggle with Boniface VIII (1297–1303) that led to the breakdown of the medieval papacy. He was pacified by succeeding popes, including Clement V, who began the Avignon papacy. Philip expelled the Jews from France (1306), and his persecution of the Knights Templar in 1307 led to their suppression by the pope four years later.

Philip IV *Spanish* **Felipe** (b. April 8, 1605, Valladolid, Spain—d. Sept. 17, 1665, Madrid) King of Spain (1621–65) and of Portugal (as Philip II, 1621–40). He succeeded his father, Philip III, and left the administration of his rule to his chief ministers, the duke de Olivares (1621–43) and the duke's nephew Luis Méndez de Haro (1643–61). Spain's industry and commerce declined, and wars against Holland, France, and Germany further drained Spain's economy. Portugal regained its independence (1640), and Holland was lost by the Peace of Westphalia (1648). A poet and patron of the arts, Philip was the friend and frequent subject of Diego Velázquez.

Philip V (b. 238—d. 179 BC, Amphipolis, Macedonia) King of Macedonia (221–179). Son of Demetrius II, he succeeded Antigonus Doson. He supported the Hellenic League against Sparta, Aetolia, and Elis (220–217), allying himself with Hannibal in 215 and attacking Roman client states in Illyria. Rome responded in the First Macedonian War. Intrigue against Egypt and Philip's unsuccessful sea battle with Rhodes and Pergamum led Rome to initiate the Second Macedonian War, in which it prevailed at Cynoscephalae (197). Rome's harsh terms eased after Philip made common cause against its Greek foes. Fearing that Rome would turn on him again, he attempted to expand by attacking the Balkans (184, 183, 181); he died on a fourth attempt in 179.

Philip V *Spanish* **Felipe** *orig.* **Philippe, duke d'Anjou** (b. Dec. 19, 1683, Versailles, France—d. July 9, 1746, Madrid, Spain) King of Spain (1700–46). Grandson of Louis XIV of France and great-grandson of Philip IV of Spain, Philip was named to succeed the childless Charles II as king in 1700. Louis's refusal to exclude Philip from the line of succession to the French throne led to the War of the Spanish Succession. The resultant Peace of Utrecht (1713) deprived Philip of the Spanish Netherlands and parts of Italy, but it left him Spain and Spanish America. Initially influenced by his French advisers through his wife, Maria Luise of Savoy, after her death (1714) he was influenced by his second wife, Elizabeth Farnese, and her Italian advisers. Attempts to secure territories in Italy caused the formation of the Quadruple Alliance (1718) against Spain. Philip later brought Spain into the War of the Austrian Succession. His reign marked the beginning of the Bourbon dynasty in Spain (see house of Bourbon).

Philip VI *or* **Philip of Valois** \väl-'wä\ *French* **Philippe de Valois** (b. 1293—d. Aug. 22, 1350, near Paris) First French king of the Valois dynasty (1328–50). He continued Capetian efforts to centralize the state but made concessions to the nobility, clergy, and bourgeoisie. His knights killed thousands of rebellious Flemings at the Battle of Cassel (1328). His disputes with Edward III of England led to the outbreak of the Hundred Years' War (1337). French defeats at the Battles of Sluys (1340) and Crécy

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(1346) caused crises in France until the spread of the Black Death (from 1348) overshadowed other considerations.

Philip, duke of Edinburgh *known as* **Prince Philip** (b. June 10, 1921, Corfu, Greece) Husband of Queen Elizabeth II of Britain. Son of Prince Andrew of Greece and Denmark (1882–1944) and Princess Alice (1885–1969), a great-granddaughter of Queen Victoria, he was reared in Britain. In World War II he served in combat with the Royal Navy. In 1947 he became a British subject, taking his mother's surname, Mountbatten, and renouncing his right to the Greek and Danish thrones. He married Princess Elizabeth in 1947 and continued on active service in the navy until her accession to the throne in 1952. Charles, prince of Wales, is their son.

Philip, King See Metacom

Philip Augustus See Philip II (France)

Philip Morris tobacco companies Two of the world's largest tobacco companies, comprising Philip Morris International Inc. and Philip Morris USA Inc., both of which are owned by U.S. holding company Altria Group, Inc. Drawing on the name of Philip Morris, a London tobacconist who opened shop in the mid 1800s, the company was incorporated in New York in 1902 as a British-American venture; ownership shifted to American stockholders in 1919, when the company was renamed Philip Morris & Co. It became a principal maker of cigarettes in the 1930s and '40s, and the popularity of its Marlboro cigarettes grew with its use of cowboy imagery to advertise them in the mid 1950s. The company developed other American cigarette brands such as Parliament, Virginia Slims, and Merit. Overseas ventures in the manufacture and marketing of cigarettes led to the formation of Philip Morris International, which by 1972 had established sales in many parts of the world, including the former Soviet Union. Its global brands include Chesterfield and Lark.

Philip of Hesse (b. Nov. 13, 1504, Marburg, Hesse—d. March 31, 1567, Kassel, Ger.) German nobleman, landgrave of Hesse, and champion of the Reformation. His skillful management made Hesse a sovereign state. Won to the cause of Martin Luther, Philip became a Reformation leader in Germany. In 1529 he founded the first Protestant university at Marburg (1529), and in 1531 he united several princes and towns to form the Schmalkaldic League. However, his folly in contracting a bigamous second marriage damaged his reputation. After the emperor crushed the league, Philip was imprisoned (1547–52). Long imprisonment undermined his influence and his health, though he finally saw Lutheranism gain a position of legal equality with Catholicism in the Peace of Augsburg (1555). In the year of his death, he divided Hesse among his four sons.

Philip of Macedonia See Philip II

Philip of Valois See Philip VI (France)

Philip the Bold See Philip II (Burgundy)

Philip the Fair See Philip IV (France)

Philip the Good See Philip III (Burgundy)

Philipon \fē-lē-'pōⁿ**, Charles** (b. April 19, 1802, Lyon, France—d. Jan. 25, 1862, Paris) French caricaturist, lithographer, and journalist. An excellent draftsman with a fertile sense of satire and vigorous political opinions, he published a series of journals of political satire. *La Caricature*, which he introduced in 1830, was suppressed in 1835; *Le Charivari*, introduced in 1832, became the inspiration for *Punch*, subtitled *The London Charivari*. His drawing showing the transformation of Louis-Philippe into the shape of a pear established the pear as the common symbol for the king. He attracted and inspired the best caricaturists in France, including Honoré Daumier and Gustave Doré.

Philippe Égalité See duc d'Orléans

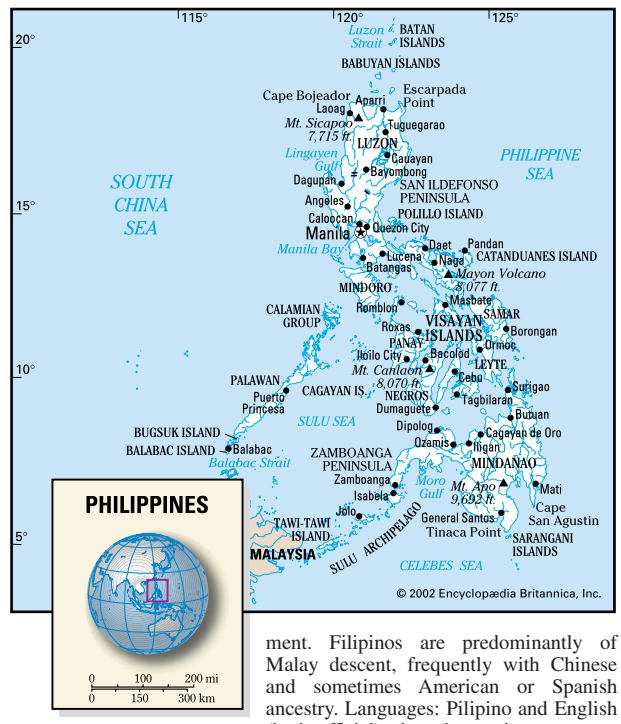
Philippi \'fi-lə-ˌpī\ Ruined hill town, northern central Macedonia, Greece. In c. 357 BC it was fortified by King Philip II to control nearby gold mines. In 42 BC it was the scene of the decisive Roman battle in which Mark Antony and Octavian (later Augustus) defeated Brutus and Cassius, the leading assassins of Julius Caesar. Many Christian ruins, especially of the 5th–6th century AD, are spread over the site. St. Paul preached the gospel to Christian converts there.

Philippine-American War *or* **Philippine Insurrection** (1899–1902) War between the U.S. and Filipino revolutionaries, which may be seen as a continuation of the Philippine Revolution against Spanish rule. The Treaty of Paris (1898), which concluded the Spanish-American War, transferred Philippine sovereignty from Spain to the U.S.; but it was not recognized by Filipino leaders, whose troops controlled the entire archipelago except the capital city of Manila. By 1902 U.S. troops had defeated the insurgency, though sporadic fighting continued until 1906. The U.S. retained possession of the islands (except for the Japanese occupation during World War II) until 1946.

Philippine Revolution (1896–98) Filipino independence struggle that failed to end Spanish colonial rule in the Philippines. There had been numerous quasi-religious uprisings during the more than 300 years of colonial rule, but the late 19th-century writings of Jose Rizal and others helped stimulate a more broad-based movement for Philippine independence. Spain was unwilling to reform its colonial government, and armed rebellion broke out in 1896. Rizal, who had advocated reform but not revolution, was shot for sedition; his martyrdom fueled the revolution. The rebel forces of Emilio Aguinaldo were unable to defeat the Spanish, but the Filipinos proclaimed their independence in the wake of Spain's defeat in the Spanish-American War (1898). The Treaty of Paris ceded the Philippines to the U.S., however, and Aguinaldo continued the revolutionary struggle, now against the U.S.; he gave up the struggle after being arrested in 1901. See also Philippine-American War.

Philippine Sea \'fil-ə-ˌpēn**, Battle of the** (June 19–20, 1944) Naval battle of World War II between the U.S. and Japan. On June 19, after the U.S. invaded Saipan, Japan sent 430 planes to destroy U.S. ships but suffered heavy losses from U.S. carrier aircraft before retiring the next day. Called the greatest carrier battle of the war, it ended with the loss of over 300 Japanese planes and two carriers, while U.S. aircraft losses totaled 130, with minor damage to ships.

Philippines *officially* **Republic of the Philippines** Island country, western Pacific Ocean, on an archipelago off the southeast coast of Asia. Area: 122,121 sq mi (316,294 sq km). Population (2005 est.): 84,191,000. Capital: Manila; Quezon City is the designated centre of national government. Filipinos are predominantly of Malay descent, frequently with Chinese and sometimes American or Spanish ancestry. Languages: Pilipino and English (both official); the other main groups are Cebuano, Ilocano, Hiligaynon, and Bicol. Religions: Christianity (predominantly Roman Catholic; also Protestant, other Christians); also Islam. Currency: Philippine peso. The Philippines consist of about 7,100 islands and islets. The two principal islands are Luzon in the north and Mindanao in the south. The Visayan group is in the central Philippines, Mindoro is directly south of Luzon, and Palawan is isolated in the west. The topog-



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raphy is varied; inactive volcanoes and mountain ranges are the main features of most of the larger islands. The country has a predominantly market economy based largely on agriculture, light industries, and services. The Philippines is a republic with two legislative houses; its chief of state and head of government is the president. First visited by Ferdinand Magellan in 1521, the islands were colonized by the Spanish, who retained control until the Philippines were ceded to the U.S. in 1898 following the Spanish-American War. The Commonwealth of the Philippines was established in 1935 to prepare the country for political and economic independence, which was delayed by World War II and the invasion of Japanese troops. The islands were liberated by U.S. forces in 1944–45, and the Republic of the Philippines was proclaimed in 1946, with a government patterned on that of the U.S. In 1965 Ferdinand Marcos was elected president. He declared martial law in 1972, which lasted until 1981. After 20 years of dictatorial rule, Marcos was driven from power in 1986. Corazon Aquino became president and instituted a period of democratic rule that continued with the elections of subsequent presidents. The government has tried to come to terms with Muslim independence fighters in the southern islands by establishing the Muslim Mindanao autonomous region in southwestern Mindanao and nearby islands.

Philips Electronics NV *in full* **Royal Philips Electronics NV** *Dutch* **Koninklijke Philips Electronics NV** Major Dutch manufacturer of consumer electronics, household appliances, lightbulbs, and imaging equipment. It was founded by Dutch engineer Gerard Philips in 1891 to make incandescent lamps and incorporated in 1912 under the name NV Philips Gloeilampenfabrieken (Dutch: Philips Incandescent Light Works). Its strong research efforts were consolidated in 1914 in a separate organization that became the Philips Research Laboratories. It began manufacturing radios in the 1920s, and after World War II it marketed stereo equipment, televisions, and other products under such brand names as Philips, Magnavox, and Norelco. Philips helped create the compact disc, the cassette tape, and the videocassette recorder, and it is a leading supplier of diagnostic medical equipment. Renamed Philips Electronics NV in 1991, the firm has manufacturing and marketing subsidiaries throughout the world.

Philistine Member of a group of Aegean origin that settled on the southern coast of Palestine. The Philistines first settled the region during the 12th century BC, about the time the Israelites arrived. They lived in five cities (the Pentapolis) that together made up Philistia, from which the Greeks derived the name Palestine. They first fought the Israelites in the 11th century BC. In the 10th century BC they were defeated by the Israelite king David. They were later ruled by Assyria, Egypt, Babylonia, Persia, Greece, and Rome. The group appears prominently in the Old Testament—from which much of the information about them is derived—though they left no written records of their own. It is from these many and coloured biblical references that the term assumes its modern significance in the English language.

Phillips, Irna (b. July 1, 1901, Chicago, Ill., U.S.—d. Dec. 22, 1973, Chicago) U.S. radio producer and director. She worked as a teacher before turning to writing for radio and creating the first soap opera, *Painted Dreams* (1930). Later known as "Queen of the Soaps," she introduced techniques such as the organ bridge to give a smooth flow between scenes and the cliff-hanger ending to each episode. Her daytime radio serials included *Today's Children* (1933–38, 1943–50); *The Guiding Light* (1937–56; television, 1952–); *Road of Life* (1937–59); and *Women in White* (1938–42, 1944–48), the first hospital soap opera. She also created the television serials *As the World Turns* (1956) and *Another World* (1964).

Phillips, Wendell (b. Nov. 29, 1811, Boston, Mass., U.S.—d. Feb. 2, 1884, Boston) U.S. reformer and abolitionist. A wealthy graduate of Harvard Law School, he sacrificed social status and a prospective political career in order to join the antislavery movement. His reputation as an inspirational orator was established with his address at an abolitionist meeting in 1837 to protest the murder of Elijah Lovejoy. He became an associate of William Lloyd Garrison and lectured widely at meetings of the American Anti-Slavery Society, serving as its president from 1865 to 1870. He also advocated prohibition, woman suffrage, prison reform, regulation of corporations, and labour reform.

Wendell Phillips
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Phillips curve Graphic representation of the inverse relationship between the rate of unemployment and the rate of change in money wages. In 1958 A. W. Phillips plotted British unemployment rates and rates of change in money wages and found that when unemployment rates were low, employers were more likely to bid wages up to lure good employees away from their competitors. He claimed that this was a stable relationship. In the 1960s macroeconomists substituted the rate of price inflation for the rate of change in money wages and promulgated the curve as a tool of economic policy, arguing that the simultaneous achievement of low unemployment and low inflation was problematic. Monetarists, including Milton Friedman, claimed the relationship was not stable.

Philo Judaeus \'fī-lō-jü-'dē-əs\ *or* **Philo of Alexandria** (b. 10–15 BC, Alexandria—d. AD 45–50, Alexandria) Greek-speaking Jewish philosopher. A leader of the Jewish community of Alexandria, he led a delegation to the emperor Caligula c. AD 40 to ask that Jews not be forced to worship him. His writings provide the clearest view of this development of Judaism in the Diaspora. His philosophy was influenced by Plato, Aristotle, the Neo-Pythagoreans, the Cynics, and Stoicism. In his view of God, Philo was original in insisting on an individual Providence able to suspend the laws of nature, in contrast to the prevailing Greek view of a universal Providence which is itself subject to the laws of nature. As the first to attempt to synthesize revealed faith and philosophic reason, he occupies a unique position in the history of philosophy. He is regarded as the most important representative of Hellenistic Judaism and a forerunner of Christian theology.

philodendron \ˌfi-lə-'den-drən\ Any of about 200 species of climbing herbaceous plants that make up the genus *Philodendron* in the arum family, native to the New World tropics. Some are popular indoor foliage plants in colder areas and landscape plants in warmer climates. The leaves are often large and smooth-edged to variously lobed and cut. The inflorescence is seldom produced indoors. Many forms are available in cultivation, foremost among them the common heart-leaf (*Philodendron scandens oxycardium*). Large varieties include the spade-leaf philodendron (*P. domesticum* or *P. hastatum*), with triangular leaves up to 2 ft (60 cm) long, and the selloum philodendron (*P. selloum*), with deeply cut leaves up to 3 ft (1 m) long.

Philopoemen \ˌfi-lə-'pē-mən\ (b. c. 253, Megalopolis, Arcadia—d. 182 BC, Messene, Messenia) General of the Achaean League. Elected federal cavalry commander (c. 210) and general of the league (208–207, 206–205, 201–200), he won victories against the Aetolians and the Spartans, using Macedonian armour and tactics. In his fourth generalship (193–192) he failed against the Spartans by sea but crushed their army on land. The Roman Flamininus stopped his capture of Sparta, but when the Spartan leader was assassinated Philopoemen added that state to the confederation. He was captured when Messene rebelled and given poison.

philosophe \ˌfē-lə-'zȯf\ Any of the literary men, scientists, and thinkers of 18th-century France who were united, in spite of divergent personal views, in their conviction of the supremacy and efficacy of human reason. Inspired by the philosophy of René Descartes, the skepticism of the libertines (or freethinkers), and the popularization of science by Bernard de Fontenelle (1657–1757), they were dedicated to the advancement of science and secular thought and to the open-mindedness of the Enlightenment. They included Voltaire, Montesquieu, Denis Diderot, Jean Le Rond d'Alembert, and Jean-Jacques Rousseau. The philosophes compiled the *Encyclopédie*, one of the great intellectual achievements of the century.

philosophical anthropology Study of human nature conducted by the methods of philosophy. It is concerned with questions such as the status of human beings in the universe, the purpose or meaning of human life, and whether humanity can be made an object of systematic study. Among the most important works in philosophical anthropology are *Man's Place in the Universe* (1928), by Max Scheler; *The Levels of the Organic and Man* (1928), by Helmuth Plessner; *Being and Time* (1929), by Martin Heidegger; *Der Mensch* (1940), by Arnold Gehlen; and *An Essay on Man* (1944), by Ernst Cassirer.

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philosophy Critical examination of the rational grounds of our most fundamental beliefs and logical analysis of the basic concepts employed in the expression of such beliefs. Philosophy may also be defined as reflection on the varieties of human experience, or as the rational, methodical, and systematic consideration of the topics that are of greatest concern to humanity. Philosophical inquiry is a central element in the intellectual history of many civilizations. Difficulty in achieving a consensus about the definition of the discipline partly reflects the fact that philosophers have frequently come to it from different fields and have preferred to reflect on different areas of experience. All the world's great religions have produced significant allied philosophical schools. Western philosophers such as THOMAS AQUINAS, GEORGE BERKELEY, and SØREN KIERKEGAARD regarded philosophy as a means of defending religion and dispelling the antireligious errors of MATERIALISM and RATIONALISM. PYTHAGORAS, RENÉ DESCARTES, and BERTRAND RUSSELL, among others, were primarily mathematicians whose views of reality and knowledge were influenced by mathematics. Figures such as THOMAS HOBBES, JEAN-JACQUES ROUSSEAU, and JOHN STUART MILL were mainly concerned with POLITICAL PHILOSOPHY, whereas SOCRATES and PLATO were occupied chiefly by questions in ETHICS. The PRE-SOCRATICS, FRANCIS BACON, and ALFRED NORTH WHITEHEAD, among many others, started from an interest in the physical composition of the natural world. Other philosophical fields include AESTHETICS, EPISTEMOLOGY, LOGIC, METAPHYSICS, philosophy of MIND, and PHILOSOPHICAL ANTHROPOLOGY. See also ANALYTIC PHILOSOPHY; CONTINENTAL PHILOSOPHY; FEMINIST PHILOSOPHY; philosophy of SCIENCE.

phlebitis \fli-'bī-təs\ INFLAMMATION of the wall of a VEIN. Causes include nearby infection, trauma, surgery, and childbirth. The area over the vein is painful, swollen, red, and hot. A tender, cordlike mass may be felt under the skin. It usually occurs in surface veins in the lower leg and can be treated with pain relievers and bed rest, with mild exercise after inflammation subsides. Phlebitis can last for years; in such cases, irritation of the vein's inner lining leads to blood-clot formation, a condition known as thrombophlebitis (see THROMBOSIS). In deeper veins, this requires anticoagulants to prevent EMBOLISMS.

phloem \'flō-ˌem\ *or* **bast** Plant tissues that conduct foods made in the leaves to all other parts of the plant. Phloem is composed of several types of specialized cells, including sieve-tube cells and phloem fibers. Sieve tubes (columns of sieve-tube cells), which have perforated areas in their walls, provide the main channels in which food substances travel. Phloem fibers are long, flexible cells that make up the soft fibers used commercially (e.g., FLAX and HEMP).

phlox Any of about 65 species of plants (genus *Phlox*), belonging to the family Polemoniaceae, admired both in gardens and in the wilds for their clustered heads of flowers. All species but one are native to North America. Phlox is herbaceous, usually with oval or linear leaves; it has heads of massed tubular flowers with five flaring lobes. A few species are woody, but most are herbaceous annuals or perennials. Sizes range from the 5-ft-high (1.5-m) summer phlox (*P. paniculata*) to the 18-in.-high (45-cm) woodland PERENNIAL blue phlox (*P. divaricata*) to the low-creeping, freely branching, evergreen moss pink, or creeping phlox (*P. subulata*).

Moss pink (*Phlox subulata*)
RUSS KINNE—PHOTO RESEARCHERS/EB INC.

Phnom Penh \pə-'nȯm-'pen\ City (pop., 1999 est.: 938,000), capital of Cambodia, at the junction of the Sab River (a tributary of the TONLE SAP) with the MEKONG RIVER. Founded in 1434 as the capital of the Khmer kingdom, it was abandoned several times before being reestablished in 1865. It was a cultural centre, with many institutions of higher learning. When the KHMER ROUGE came to power in Cambodia in 1975, they forced the city's population into the countryside to work in the fields. The city was repopulated beginning in 1979, and its educational institutions began a difficult period of recovery from the virtual extermination of Cambodia's educated class. Although the city is 180 mi (290 km) from the sea, it is a major port of the Mekong River valley; it is linked to the South CHINA SEA via a channel of the Mekong delta in Vietnam.

phobia Extreme and irrational fear of a particular object, class of objects, or situation. A phobia is classified as a type of ANXIETY disorder (a NEUROSIS), since anxiety is its chief symptom. Phobias are generally believed to result when fear produced by an original threatening situation (such as a near-drowning in childhood) is transferred to other similar situations (such as encounters with bodies of water), the original fear often being repressed or forgotten. BEHAVIOUR THERAPY can be helpful in overcoming phobias, the phobic person being gradually exposed to the anxiety-provoking object or situation in a way that demonstrates that no threat really exists.

Phocaea \fō-'sē-ə\ Ancient city on the Aegean Sea, northernmost of the IONIAN cities on the western coast of ASIA MINOR (now the Gulf of Izmir, Turkey). An important maritime state c. 1000–550 BC, it founded a number of colonies, including Massilia (MARSEILLE) in the western Mediterranean. It declined after the Persian conquest c. 545 BC. The modern town of Foça is located in an olive- and tobacco-growing region and attracts tourists to the ancient city's ruins.

Phocis \'fō-sis\ Ancient territory, central Greece. It extended north from the Gulf of Corinth over the range of Mount PARNASSUS to the Locrian Mountains, which formed the northern frontier. Its chief towns were Elateia, DELPHI, and Daulis. Mainly a pastoral region, its early history is obscure. Traditionally, the Phocians controlled the sanctuary and oracle at Delphi, but they lost control after a war with neighbouring Greek states c. 590 BC. Phocis was allied with SPARTA in the PELOPONNESIAN WAR (431–404 BC) and was conquered by PHILIP II of Macedon in 346 BC.

phoebe \'fē-bē\ Any of three species (family Tyrannidae, suborder Tyranni) of suboscine PASSERINES with a habit of twitching their tail when perching. The eastern phoebe (*Sayornis phoebe*) of North America is 7.5 in. (18 cm) long, plain brownish gray above, and paler below. Its call is a brisk "fee-bee" uttered over and over. It makes a mossy nest, strengthened with mud, on a ledge, often under a bridge. Say's phoebe (*S. saya*), a slightly larger bird with buff-hued underparts, occurs in open country in western North America. The black phoebe (*S. nigricans*), occurring from the southwestern U.S. to Argentina, is dark above with a white belly.

Phoenicia \fi-'nē-shə\ Ancient region, Middle East. Corresponding to modern Lebanon, with adjoining parts of Syria and Israel, its chief cities were Sidon, TYRE, and Berot (modern BEIRUT). The PHOENICIANS were notable merchants, traders, and colonizers (see CARTHAGE) of the Mediterranean region in the 1st millennium BC. The area was conquered successively by the Assyrians, Babylonians, Persians, and Macedonians under ALEXANDER THE GREAT. In 64 BC it was incorporated into the Roman province of Syria.

Phoenician \fi-'nē-shən\ One of a people of ancient PHOENICIA. They were merchants, traders, and colonizers who probably arrived from the Persian Gulf c. 3000 BC. By the 2nd millennium BC they had colonies in the Levant, North Africa, Anatolia, and Cyprus. They traded wood, cloth, dyes, embroideries, wine, and decorative objects; ivory and wood carving became their specialties, and the work of Phoenician goldsmiths and metalsmiths was well known. Their alphabet became the basis of the Greek alphabet.

Phoenix \'fē-niks\ City (pop., 2000: 1,321,045), capital of Arizona, U.S. It is located on the SALT RIVER. The river valley was occupied as early as AD 1300 by prehistoric Indians, now known as the HOHOKAM CULTURE, who disappeared in the early 15th century. A village was founded on the site in 1867 and incorporated as a city in 1881. It became the territorial capital in 1889 and state capital in 1912. There was widespread expansion after World War II, with the population quadrupling between 1950 and 1960. Phoenix occupies a semiarid valley surrounded by mountains and irrigated fields; its economy is based on farming, manufacturing, mining, and tourism.

phoenix In ancient Egypt and in classical antiquity, a fabulous bird associated with the worship of the sun. The Egyptian phoenix was said to be as large as an eagle, with brilliant scarlet and gold plumage and a melodious cry. Only one phoenix existed at a time, and it lived no less than 500 years. As its end approached, it built a nest of aromatic boughs and spices, set it on fire, and was consumed in the flames. From the pyre was born a new phoenix, which sealed its predecessor's ashes in an egg of myrrh and flew to HELIOPOLIS to deposit them on the altar of the sun god. The phoenix thus symbolized immortality. See also FENGHUANG.

Phoenix Islands Group of eight small coral atolls, KIRIBATI. Lying in the west-central Pacific Ocean 1,650 mi (2,650 km) southwest of Hawaii, the low, sandy atolls have a total land area of about 11 sq mi (28 sq km)

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and were discovered in the 19th century by U.S. whaling ships. Annexed by Britain in 1889, they were joined to the Gilbert and Ellice Islands in 1937. They became part of independent Kiribati in 1979. Kanton is the only inhabited atoll.

Phoenix Park murders (May 6, 1882) Assassination in Dublin of British officials. The newly arrived chief secretary of Ireland, Lord Frederick Cavendish, and his undersecretary, Thomas Burke, were walking in Dublin's Phoenix Park when they were stabbed to death by members of the Invincibles, a radical Irish nationalist secret society. The murders caused a revulsion against terrorism and enabled Charles Stewart Parnell to subordinate the Irish National League to the more moderate Home Rule Party in Parliament.

phoneme Smallest unit of speech distinguishing one word (or word element) from another (e.g., the sound *p* in *tap*, which differentiates that word from *tab* and *tag*). The term is usually restricted to vowels and consonants, but some linguists include differences of pitch, stress, and rhythm. A phoneme may have variants, called allophones, that differ phonetically without affecting meaning. Phonemes may be recorded with special symbols, such as those of the International Phonetic Alphabet. In transcription, linguists conventionally place symbols for phonemes between slash marks: /p/.

phonetics Study of speech sounds. It deals with their articulation (articulatory phonetics), their acoustic properties (acoustic phonetics), and how they combine to make syllables, words, and sentences (linguistic phonetics). The first phoneticians were Indian scholars (c. 300 BC) who tried to preserve the pronunciation of Sanskrit holy texts. The Classical Greeks are credited as the first to base a writing system on a phonetic alphabet. Modern phonetics began with Alexander Melville Bell (1819–1905), whose *Visible Speech* (1867) introduced a system of precise notation for writing down speech sounds. In the 20th century linguists focused on developing a classification system that can permit comparison of all human speech sounds. Another concern of modern phonetics is the mental processes of speech perception.

phonics \'fä-niks\ Method of reading instruction that breaks language down into its simplest components. Children learn the sounds of individual letters first, then the sounds of letters in combination and in simple words. Simple reading exercises with a controlled vocabulary reinforce the process. Phonics-based instruction was challenged by proponents of "whole-language" instruction, a process in which children are introduced to whole words at a time, are taught using real literature rather than reading exercises, and are encouraged to keep journals in which "creative" spelling is permitted. A strong backlash against whole-language teaching polarized these two approaches to reading instruction. Many schools have since come to use a combination of the two techniques.

phonograph *or* **record player** Instrument for reproducing sounds. A phonograph record stores a copy of sound waves as a series of undulations in a wavy groove inscribed on its rotating surface by the recording stylus. When the record is played back, another stylus (needle) responds to the undulations, and its motions are then reconverted into sound. Its invention is generally credited to Thomas Alva Edison (1877). Stereophonic systems, with two separate channels of information in a single groove, became a commercial reality in 1958. All modern phonograph systems had certain components in common: a turntable that rotated the record; a stylus that tracked a groove in the record; a pickup that converted the mechanical movements of the stylus into electrical impulses; an amplifier that intensified these electrical impulses; and a loudspeaker that converted the amplified signals back into sound. Phonographs and records were the chief means of reproducing recorded sound at home until the 1980s, when they were largely replaced by recorded cassettes (see tape recorder) and compact discs.

phonology \fə-'nä-lə-jē\ Study of sound patterns within languages. Diachronic (historical) phonology traces and analyzes changes in speech sounds and sound systems over time (e.g., the process by which *sea* and *see*, once pronounced with different vowel sounds, have come to be pronounced alike). Synchronic (descriptive) phonology investigates sound patterns at a single stage in a language's development, to identify which ones can occur and in what position (in English, for example, *nt* and *rk* appear within or at the end of words but not at the beginning).

phonon \'fō-ˌnän\ In solid-state physics, a quantum of lattice vibrational energy. In analogy to a photon (a quantum of light), a phonon is viewed as a wave packet with particlelike properties (see wave-particle duality). The way phonons behave determines or affects various properties of solids. Thermal conductivity, for instance, is explained by phonon interactions. Phonons also provide the basis for understanding superconductivity in certain metals.

Phony War (1939–40) Early months of World War II, marked by no major hostilities. The term was coined by journalists to derisively describe the six-month period (October 1939–March 1940) during which no land operations were undertaken by the Allies or the Germans after the German conquest of Poland in September 1939.

phosgene \'fäz-ˌjēn\ *or* **carbonyl chloride** \'kär-bə-ˌnil\ Colourless, highly toxic gas used in chemical warfare as well as in industrial processes including the making of dyestuffs and polyurethane resins. Either alone or in combination with chlorine, it was used against troops in World War I. It smells like musty hay. Inhalation causes severe lung injury several hours after exposure. First prepared in 1811, it is manufactured by the reaction of carbon monoxide and chlorine in the presence of a catalyst. Gaseous phosgene is usually stored and transported as a liquid under pressure in steel cylinders or as a solution in toluene. Mixed with water, it forms carbon dioxide and hydrochloric acid.

phosphate Any of numerous chemical compounds related to phosphoric acid (H_3PO_4). Phosphate salts are inorganic compounds containing the phosphate ion (PO_4^{3-}), the hydrogen phosphate ion (HPO_4^{2-}), or the dihydrogen phosphate ion ($H_2PO_4^-$), along with any cation. Phosphate esters are organic compounds in which the hydrogens of phosphoric acid are replaced by organic groups (e.g., methyl, ethyl, phenyl), with one of their carbon atoms bonding to an oxygen atom in the phosphate group. Nucleic acids and ATP both contain phosphate; bones and teeth contain calcium phosphate. Phosphate rock (mainly calcium phosphate) is one of the four most important basic chemical commodities. Phosphates were formerly used in detergents, which washed into rivers and lakes, causing water blooms of algae and bacteria (see eutrophication); such use is now generally outlawed or regulated. Phosphates are still used in fertilizers, baking powder, and toothpaste.

phospholipid \ˌfäs-fō-'li-pəd\ *or* **phosphatide** Any member of a large class of fatlike organic compounds that in their molecular structure resemble the triglycerides, except for the replacement of a fatty acid with a phosphate-containing polar group. The polar end of the molecule is soluble in water (hydrophilic) and water solutions (including cytoplasm); the other, fatty-acid end is soluble in fats (hydrophobic). In a watery environment phospholipids naturally combine to form a two-layer structure (lipid bilayer) with the fat-soluble ends sandwiched in the middle and the water-soluble ends sticking out. Such lipid bilayers are the structural basis of cell membranes. Phospholipids are the principal components of the myelin sheaths of neurons. Examples of phospholipids include lecithin, cephalins, phosphoinositides (in the brain), and cardiolipin (in the heart). See also detergent.

phosphorescence Emission of light from a substance exposed to radiation and persisting as an afterglow after the exciting radiation has been removed. Unlike fluorescence, in which the absorbed light is emitted about 10^{-8} second after excitation, in phosphorescence the extra energy absorbed is stored in metastable states and reemitted later. Phosphorescence may last from about 10^{-3} second to days or even years. The term phosphorescence is often applied to luminescence of living organisms, as well.

phosphorite \'fäs-fər-ˌit\ *or* **phosphate rock** Rock with a high concentration of phosphates in nodular or compact masses. The phosphates may be derived from a variety of sources, including marine invertebrates that secrete shells of calcium phosphate and the bones and excrement of vertebrates. Typical phosphorite beds contain about 30% phosphorus pentoxide (P_2O_5) and constitute the primary source of raw materials for phosphate fertilizers. Significant deposits in the U.S. include the Phosphoria Formation in Idaho and the Monterey Formation in California. Major deposits also occur in the Sechura Desert in Peru.

phosphorus Nonmetallic chemical element, chemical symbol P, atomic number 15. The ordinary allotrope, called white phosphorus, is a poisonous, colourless, semitransparent, soft, waxy solid that glows in the dark (see phosphorescence) and combusts spontaneously in air, producing dense white fumes of the oxide P_4O_{10}; it is used as a rodenticide and a military smokescreen. Heat or sunlight converts it to the red phosphorus allotrope,

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a violet-red powder that does not phosphoresce or ignite spontaneously. Much less reactive and soluble than white phosphorus, it is used in manufacturing other phosphorus compounds and in semiconductors, fertilizers, safety matches, and fireworks. Black phosphorus, made by heating the white form under pressure, is flaky like GRAPHITE. Phosphorus seldom occurs uncombined in nature. As the PHOSPHATE ion, it is abundant and widely distributed, in APATITE, PHOSPHORITE, and many other minerals. Phosphorus has VALENCE 3 or 5 in compounds, which have many uses in industry. Phosphine (PH_3) is a chemical raw material and a doping agent (deliberately added impurity) for solid-state electronics components. Organic phosphorus compounds are used as plasticizers, gasoline additives, insecticides (e.g., parathion), and nerve gases. In living organisms the role of phosphorus is essential; it is a component of DNA and RNA, ATP, and BONE.

Photian Schism See Photian SCHISM

Photius \'fō-shē-əs**, Saint** (b. c. 820, Constantinople—d. 10th century; feast day February 6) Patriarch of Constantinople (858–867, 877–886). A high-ranking civil servant, he was promoted swiftly through the ecclesiastical orders to become patriarch after the deposition of Ignatius, an action that offended Pope Nicholas I. Photius added to the conflict by refusing to restore dioceses earlier transferred from the Roman to the Byzantine church. Angry that Nicholas would not recognize him, Photius excommunicated the pope (867), thus beginning the PHOTIAN SCHISM. Photius was deposed the same year but restored in 877 after his successor died. He and Pope John VIII agreed to return Bulgaria to the Roman church but to allow Greek bishops to remain.

Photo-Realism Late 20th-century painting style based on photography, in which realistic scenes are rendered in meticulous detail. An offshoot of POP ART, it became a trend in U.S. painting in the 1970s among artists fascinated by camera images. Though photographs had been used by 19th-century painters such as EUGÈNE DELACROIX as substitutes for reality, the Photo-Realists relied on the photograph itself, replicating it in large-scale detail as the reality on which to base an ACRYLIC PAINTING. Its subjects often included reflecting surfaces (chrome-plated diners, motorcycles, glass-fronted buildings, etc.). Its awesome technical precision, brilliant colour schemes, and visual complexity earned the style wide popularity. Its most notable practitioners were CHUCK CLOSE, Don Eddy, Richard Estes, and Audrey Flack.

Photo-Secession Group of U.S. photographers influenced by the Pictorialist movement. Founded in 1902 by ALFRED STIEGLITZ, the Photo-Secession sought recognition of photography as an art to be judged on its own terms. It was akin to such groups as the Linked Ring in London, and its name reflected that of the SEZESSION movement in Austria and Germany. The group regularly showed its work at the Little Galleries of the Photo-Secession, also known as "291" (its address on Fifth Avenue in New York City), a gallery run by Stieglitz. While Stieglitz did not believe in retouching or manipulating negatives or prints, others of the group, such as EDWARD STEICHEN, were adherents of the impressionistic soft-focus school and the new techniques. By 1910 many members of the group left due to different aesthetic visions. The record of the Photo-Secession is contained in the quarterly *Camera Work* (1903–17).

photocell *or* **photoelectric cell** *or* **electric eye** SOLID-STATE DEVICE with a photosensitive CATHODE that emits ELECTRONS when illuminated and an ANODE for collecting the emitted electrons. Illumination excites electrons, which are attracted to the anode, producing current proportional to the intensity of the illumination. In a photovoltaic cell, light is used to produce voltage. In a photoconductive cell, light is used to regulate the flow of current. Photocells are used in control systems, where interrupting a beam of light opens a circuit, actuating a relay that supplies power to a mechanism to bring about a desired operation, such as opening a door or setting off a burglar alarm. Photocells are also used in PHOTOMETRY and SPECTROSCOPY.

photochemical reaction CHEMICAL REACTION initiated by absorption of ENERGY in the form of visible (LIGHT), ULTRAVIOLET, or INFRARED radiation. Primary photochemical processes occur as an immediate result, and secondary processes may follow. The most important example is PHOTOSYNTHESIS. Vision depends on photochemical reactions that occur in the eye (see RETINA; RHODOPSIN). In photographic film and paper, light activates their SILVER salts to a state that is easy to reduce to metallic silver grains during development. Bleaching of laundry, tanning of human skin, formation of Earth's OZONE LAYER, and many industrial reactions are also photochemical. Certain air pollutants (see SMOG) become more reactive and form noxious compounds in photochemical reactions.

photocopier Device for producing copies of text or graphic material by the use of light, heat, chemicals, or electrostatic charge. Most modern copiers use a method called XEROGRAPHY.

photoelectric effect Phenomenon in which charged particles are released from a material when it absorbs radiant energy (see RADIATION). It is often thought of as the ejection of ELECTRONS from the surface of a metal plate when visible light falls on it. It can also occur if the radiation is in the wavelength range of ULTRAVIOLET RADIATION, X RAYS, or GAMMA RAYS. The emitting surface may be a solid, liquid, or gas, and the emitted particles may be electrons or ions. The effect was discovered in 1887 by HEINRICH HERTZ and explained by ALBERT EINSTEIN in work for which he received the Nobel Prize.

photoengraving Any of several processes for producing PRINTING plates by photographic means (see PHOTOGRAPHY). In general, a plate coated with a photosensitive substance is exposed to an image, usually on film; the plate is then treated in various ways, depending on the printing process to be used. Photoengraving is particularly useful for reproducing photographs via the HALFTONE PROCESS. See also OFFSET PRINTING.

photography Method of recording permanent images by the action of light projected by a lens in a camera onto a film or other light-sensitive material. It was developed in the 19th century through the artistic aspirations of two Frenchmen, NICÉPHORE NIEPCE and LOUIS-JACQUES-MANDÉ DAGUERRE, whose combined discoveries led to the invention of the first commercially successful process, the DAGUERREOTYPE (1837). In addition, two Englishmen, Thomas Wedgwood and WILLIAM HENRY FOX TALBOT, patented the negative-positive calotype process (1839) that became the forerunner of modern photographic technique. Photography was initially used for portraiture and landscapes. In the 1850s and '60s, MATHEW B. BRADY and ROGER FENTON pioneered war photography and photojournalism. From its inception, two views of photography predominated: one approach held that the camera and its resulting images truthfully document the real world, while the other considered the camera simply to be a tool, much like a paintbrush, with which to create artistic statements. The latter notion, known as Pictorialism, held sway from the late 1860s through the first decade of the 20th century, as photographers manipulated their negatives and prints to create hazy, elaborately staged images that resembled paintings. By the 1920s and '30s, a new, more realistic style of photography gained prominence, as photographers such as PAUL STRAND, EDWARD WESTON, and ANSEL ADAMS began to pursue sharply focused, detailed images. The Great Depression and two world wars inspired many photographers, including WALKER EVANS and DOROTHEA LANGE, to pursue documentary, often socially conscious photography. Inspired by such work, many photojournalists, including ALFRED EISENSTAEDT and MARGARET BOURKE-WHITE, also emerged during this period. In the second half of the 20th century, the urban social scene became a subject of much interest to photographers, as did celebrity portraiture and fashion photography. At the turn of the 21st century, photographers took advantage of digital capabilities by experimenting with enormous formats and new manipulative techniques. As technological advances improve photographic equipment, materials, and techniques, the scope of photography continues to expand enormously. See also DIGITAL CAMERA.

photolysis \fō-'tä-lə-səs\ Breakdown of MOLECULES into smaller units via absorption of LIGHT. Flash photolysis, an experimental technique developed by MANFRED EIGEN, Ronald George Weyford Norrish, and George Porter, studies short-lived chemical intermediates formed in many PHOTOCHEMICAL REACTIONS. An intense, brief flash of light splits molecules into short-lived fragments, which are analyzed by SPECTROPHOTOMETRY in a second, less intense flash.

photometry \fō-'tä-mə-trē\ Precision measurement of the brightness, colour, and spectrum of STARS and other celestial objects to obtain data on their structure, temperature, and composition. About 130 BC HIPPARCHUS used a system that divided the stars into six MAGNITUDES, from brightest to faintest. Beginning in the 17th century, use of the TELESCOPE led to the discovery of many fainter stars, and the scale was extended. The use of photographic and, since the 1940s, photoelectric equipment has vastly extended the sensitivity and wavelength range of astronomical photometry. The main (UBVRI) classification system uses wave bands in the ultraviolet, blue, visual, red, and infrared ranges. More elaborate systems can distinguish giant and dwarf stars, detect metals in stars, and determine surface gravity.

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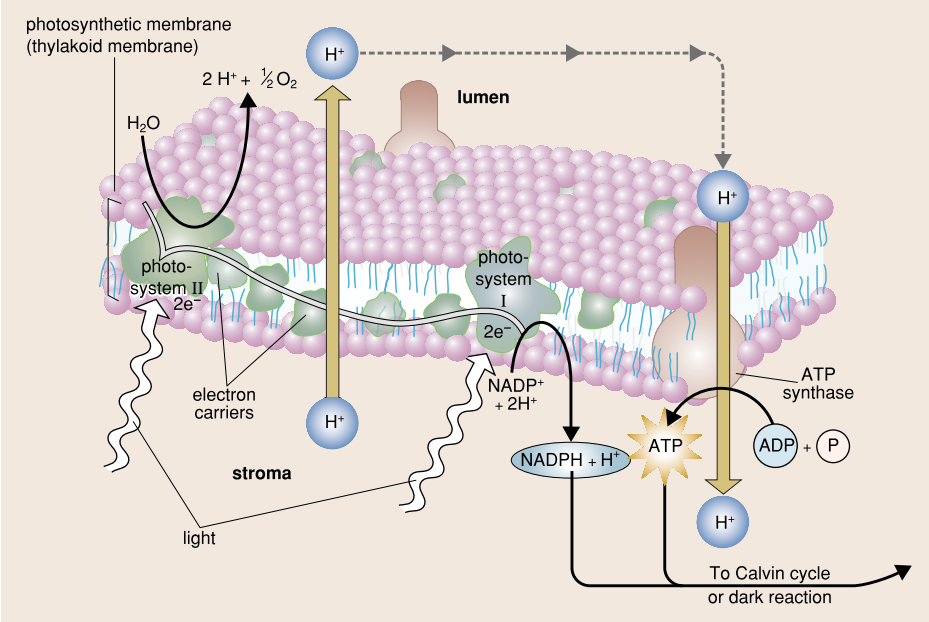

The light reaction of photosynthesis. The light reaction occurs in two photosystems (units of chlorophyll molecules). Light energy (indicated by wavy arrows) absorbed by photosystem II causes the formation of high-energy electrons, which are transferred along a series of acceptor molecules in an electron transport chain to photosystem I. Photosystem II obtains replacement electrons from water molecules, resulting in their split into hydrogen ions (H+) and oxygen atoms. The oxygen atoms combine to form molecular oxygen (O_2), which is released into the atmosphere. The hydrogen ions are released into the lumen. Additional hydrogen ions are pumped into the lumen by electron acceptor molecules. This creates a high concentration of ions inside the lumen. The flow of hydrogen ions back across the photosynthetic membrane provides the energy needed to drive the synthesis of the energy-rich molecule ATP. High-energy electrons released as photosystem I absorbs light energy are used to drive the synthesis of NADPH. Photosystem I obtains replacement electrons from the electron transport chain. ATP provides the energy and NADPH provides the hydrogen atoms needed to drive the subsequent photosynthetic dark reaction, or Calvin cycle.

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photon *or* **light quantum** Minute energy packet of ELECTROMAGNETIC RADIATION. In 1900 MAX PLANCK found that heat radiation is emitted and absorbed in distinct units, which he called quanta. In 1905 ALBERT EINSTEIN explained the PHOTOELECTRIC EFFECT, proposing the existence of discrete energy packets in light. The term photon came into use for these packets in 1926. The energies of photons range from high-energy gamma rays and X rays to low-energy infrared and radio waves, though all travel at the same speed, the speed of light. Photons have no ELECTRIC CHARGE or rest mass and are the carriers of the ELECTROMAGNETIC FIELD.

photoperiodism Response by an animal or plant to changes in daily, seasonal, or yearly cycles of light and darkness. Among animals, sleep, migration, reproduction, and the changing of coats or plumage are regulated to some extent by day length. In the poultry industry, photoperiodism is commonly induced by artificial lighing to maximize egg laying and body weight. Plant growth, seed setting, germination, flowering, and fruiting are also affected by day length. Other environmental factors that modify an organism's responses include temperature and nutrition.

photoreception Biological responses to stimulation by light, most often referring to the mechanism of vision. In one-celled organisms such as the amoeba, the whole cell may be sensitive to light. Earthworms have photoreceptive cells scattered over their bodies to help orient themselves by comparison of light intensities in different directions. Most animals have localized photoreceptors of varying complexity. In humans, photoreception relies on the chemical response of a light-sensitive pigment, RHODOPSIN, in photoreceptor cells in the RETINA of the EYE. Stimulation of those cells results in a stimulus being conducted toward the NERVOUS SYSTEM. Humans, like other vertebrates, have two types of photosensitive cells, rod cells and cone cells. Rod cells are responsible for vision when there is little light; cone cells mediate daylight vision and colour. Photoreception also refers to PHOTOSYNTHESIS in plants. See also SENSE.

photosphere Visible surface of the SUN, about 250 mi (400 km) thick. It emits most of the Sun's light that reaches Earth directly. Temperatures range from about 18,000 °F (10,000 °C) at the bottom to 8,000 °F (4,000 °C) at the top; its density is about 1/1,000 that of air at the surface of Earth. SUNSPOTS are photospheric phenomena. The photosphere has a granular structure. Each grain (cell), a mass of hot gas several hundred miles in diameter, rises from inside the Sun, radiates energy, and sinks back within minutes to be replaced by others in a constantly changing pattern.

photosynthesis Process by which green plants and certain other organisms transform light into chemical energy. In green plants, light energy is captured by CHLOROPHYLL in the CHLOROPLASTS of the leaves and used to convert water, carbon dioxide, and minerals into oxygen and energy-rich organic compounds (simple and complex sugars) that are the basis of both plant and animal life. Photosynthesis consists of a number of photochemical and enzymatic reactions. It occurs in two stages. During the light-dependent stage (light reaction), chlorophyll absorbs light energy, which excites some electrons in the pigment molecules to higher energy levels; these leave the chlorophyll and pass along a series of molecules, generating formation of NADPH (an enzyme) and high-energy ATP molecules. Oxygen, released as a by-product, passes into the atmosphere through pores in the leaves. NADPH and ATP drive the second stage, the dark reaction (or Calvin cycle, discovered by MELVIN CALVIN), which does not require light. During this stage glucose is generated using atmospheric carbon dioxide. Photosynthesis is crucial for maintaining life on Earth; if it ceased, there would soon be little food or other organic matter on the planet, and most types of organisms would disappear.

phototube See PHOTOCELL

photovoltaic effect Process in which two dissimilar materials in close contact act as an electric cell when struck by light or other radiant energy. In CRYSTALS of certain elements, such as SILICON and GERMANIUM, the ELECTRONS are usually not free to move from atom to atom. Light striking the crystal provides the energy needed to free electrons from their bound condition. These electrons can cross the junction between two dissimilar crystals more easily in one direction than another, so one side of the junction acquires a negative voltage with respect to the other. As long as light falls on the two materials, the photovoltaic BATTERY can continue to provide voltage and current. The current can be used to measure the brightness of the light or as a source of power, as in a SOLAR CELL.

Phrachomklao See MONGKUT

Phrachunlachomklao See CHULALONGKORN

Phramongkutklao See VAJIRAVUDH

phratry \'frā-trē\ In ancient Greece, tribal subdivisions of households or families claiming a common kin relation. At the apex of each phratry were aristocratic clans that had certain hereditary rights, such as the right to hold priestly offices. Both phratries and clans were patrilineal. The Athenian phratry is well known. Every native Athenian male belonged to a phratry; they were concerned with such matters as legitimacy of descent and inheritance.

Phraya Taksin See TAKSIN

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phrenology \fri-'nä-lə-jē\ Study of the shape of the SKULL as an indication of mental abilities and character traits. FRANZ JOSEPH GALL stated the principle that each of the innate mental faculties is based in a specific brain region ("organ"), whose size reflects the faculty's prominence in a person and is reflected by the skull's surface. He examined the skulls of persons with particular traits (including "criminal" traits) for a feature he could identify with it. His followers Johann Kaspar Spurzheim (1776–1832) and George Combe (1788–1858) divided the scalp into areas they labeled with traits such as combativeness, cautiousness, and form perception. Though popular well into the 20th century, phrenology has been wholly discredited.

Phrygia \'fri-jē-ə\ Ancient district, west-central ANATOLIA. It was named for a people whom the Greeks called Phryges and who dominated Anatolia between the HITTITE collapse (12th century BC) and ascent of LYDIA (7th century BC). The Phrygians were possibly of Thracian origin (see THRACE) and had their capital at Gordium. The kingdom of their legendary ruler, MIDAS, ended c. 700 BC with the invasion of the CIMMERIANS, who burned the capital. The Phrygians excelled in metalwork, wood carving, carpet making, and embroidery. Their religious cult of the GREAT MOTHER OF THE GODS was passed on to the Greeks. Excavations conducted since 1945 have uncovered carved stone tombs and shrines there.

Phumiphon Adunlayadet See BHUMIBOL ADULYADEJ

Phyfe \'fīf**, Duncan** *orig.* **Duncan Fife** (b. 1768, near Loch Fannich, Ross and Cromarty, Scot.—d. Aug. 16, 1854, New York, N.Y., U.S.) Scottish-born U.S. furniture designer. His family settled in Albany, N.Y., c. 1784; there he became an apprentice cabinetmaker and eventually opened his own shop. In 1792 he moved to New York City, where he changed the spelling of his name and became so successful that he employed 100 carvers and cabinetmakers. He was one of the first Americans to use the factory method of manufacturing furniture successfully. Though he did not originate a new furniture style, he interpreted fashionable European styles—SHERATON, REGENCY, DIRECTOIRE, EMPIRE—with such grace that he became a major exponent of NEOCLASSICISM. His furniture, decorated with typical period ornaments such as harps and acanthus leaves, was generally of high-quality mahogany.

Mahogany side chair designed by Phyfe, 1807; in The Henry Francis du Pont Winterthur Museum, Delaware
COURTESY OF THE HENRY FRANCIS DU PONT WINTERTHUR MUSEUM, DELAWARE

phyle \'fī-lē\ Any of several TRIBES that formed the largest political subgroups in all Dorian and most Ionian Greek city-states. Phylae were simultaneously kinship groups, corporations with their own officials and priests, and local units for administrative and military purposes. Athens's original four phylae were replaced by 10 under a reorganization (508/507 BC) initiated by CLEISTHENES; Sparta's original three were supplanted by five in the 8th century BC.

phyllite \'fi-ˌlīt\ Fine-grained METAMORPHIC ROCK formed by the recrystallization of fine-grained, parent SEDIMENTARY ROCKS, such as mudstones or shales. Phyllite has a marked tendency to split into sheets or slabs; it may have a sheen on its surfaces due to tiny plates of micas. Its grain size is larger than that of SLATE but smaller than that of SCHIST.

phylloxera \ˌfi-ˌläk-'sir-ə, fə-'läk-sə-rə\ Any of numerous, chiefly North American, INSECT species (genus *Phylloxera*, order Homoptera), many of which are serious pests of plants. Phylloxera form galls on and can defoliate trees, especially HICKORY and PECAN. See also GRAPE PHYLLOXERA.

phylogenetic tree \ˌfī-lō-jə-'ne-tik\ Diagram showing the evolutionary interrelations of a group of organisms that usually originated from a shared ancestral form. The ancestor is in the tree trunk; organisms that have arisen from it are placed at the ends of tree branches. The distance of one group from the other groups indicates the degree of relationship; that is, closely related groups are located on branches close to one another. Though phylogenetic trees are speculative, they provide a convenient method for studying phylogenetic relationships and EVOLUTION. See also PHYLOGENY.

phylogeny \fī-'lä-jə-nē\ History of the EVOLUTION of a species or group, especially lines of descent and relationships among broad groups. The fundamental proposition is that plants or animals of different species descended from common ancestors. Because the evidence for such relationships is almost always incomplete, most judgments of phylogenicity are based on indirect evidence and cautious speculation. Modern TAXONOMY, the science of classifying organisms, is based on phylogeny. Early taxonomic systems had no theoretical basis; organisms were grouped according to apparent similarity. Biologists who propose a phylogeny obtain evidence from the fields of paleontology, comparative anatomy, comparative embryology, biochemistry, and molecular biology. The data and conclusions of phylogeny indicate that today's living creatures are the product of a historical process of evolution and that degrees of resemblance within and between groups correspond to degrees of relationship by descent from common ancestors. See also PHYLOGENETIC TREE.

physiatry See PHYSICAL MEDICINE AND REHABILITATION

physical anthropology Branch of ANTHROPOLOGY concerned with the study of HUMAN EVOLUTION and human biological variation. Research on human evolution involves the discovery, analysis, and description of fossilized human remains. Two key goals are the identification of differences between humans and their human and nonhuman ancestors, and the clarification of the biological emergence of humankind. A variety of quantitative methods are used, including the comparative analysis of genetic codes. Research on biological variation among contemporary humans once relied heavily on the concept of RACE, but today principles of GENETICS and the analysis of such factors as BLOOD TYPE have largely eliminated race as a scientific category.

physical chemistry Branch of CHEMISTRY concerned with interactions and transformations of materials. Unlike other branches, it deals with the principles of physics underlying all chemical interactions (e.g., GAS LAWS), seeking to measure, correlate, and explain the quantitative aspects of reactions. QUANTUM MECHANICS has clarified much for physical chemistry by modeling the smallest particles ordinarily dealt with in the field, ATOMS and MOLECULES, enabling theoretical chemists to use computers and sophisticated mathematical techniques to understand the chemical behaviour of matter. Chemical thermodynamics deals with the relationship between heat and other forms of chemical energy, kinetics with CHEMICAL REACTION rates. Subdisciplines of physical chemistry include ELECTROCHEMISTRY, photochemistry (see PHOTOCHEMICAL REACTION), surface chemistry, and CATALYSIS.

physical education Training in physical fitness and in skills requiring or promoting it. In the U.S. it is required in most primary and secondary schools. It generally includes CALISTHENICS, GYMNASTICS, various sports, and some study of health. College majors in physical education have been available since the early 20th century. Most teaching is done in gymnasiums, though outdoor sports are also emphasized.

physical medicine and rehabilitation *or* **physiatry** \ˌfiz-ē-'a-trē\ *or* **physical therapy** *or* **rehabilitation medicine** Medical specialty treating chronic disabilities through physical means to help patients return to a comfortable, productive life despite a medical problem. Its objectives are pain relief, functional improvement or maintenance, training in essential activities, and functional testing of areas such as strength, mobility, breathing capacity, and coordination. Physical medicine may use DIATHERMY, HYDROTHERAPY, MASSAGE, exercise, and functional training. The last can mean learning to work with a guide dog or a PROSTHESIS or learning new ways to carry out everyday activities with a limb missing, sometimes by using assistive devices. Physician specialists head rehabilitation teams including a physical therapist, rehabilitation engineer, rehabilitation nurse, psychological counselor, and sometimes a respiratory or speech therapist. See also OCCUPATIONAL THERAPY; ORTHOPEDICS.

physics Science that deals with the structure of MATTER and the interactions between the fundamental constituents of the observable universe. Long called natural philosophy (from the Greek *physikos*), physics is concerned with all aspects of nature, covering the behaviour of objects under the action of given forces and the nature and origin of gravitational, electromagnetic, and nuclear force fields. The goal of physics is to formulate comprehensive principles that bring together and explain all discernible phenomena. See also AERODYNAMICS; ASTROPHYSICS; ATOMIC PHYSICS; BIOPHYSICS; MECHANICS; NUCLEAR PHYSICS; PARTICLE PHYSICS; QUANTUM MECHANICS; SOLID-STATE PHYSICS; STATISTICAL MECHANICS.

physics, mathematical See MATHEMATICAL PHYSICS

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physics, philosophy of Philosophical investigation of the concepts, problems, and methods of PHYSICS and related sciences. The philosophy of physics traditionally has been concerned with clarifying the logical structure, ontological commitments, and intertheoretic relations of fundamental physical theories, including RELATIVITY, QUANTUM MECHANICS, and STATISTICAL MECHANICS. The field also addresses various metaphysical and epistemological aspects of problems encountered in the foundations of theoretical physics. Examples include the apparent "directed" nature of time, the meaning of probabilistic descriptions of the initial state of the universe in statistical mechanics, the measurement problem in quantum mechanics (the problem of stating in precise terms the conditions in which probabilistic as opposed to deterministic laws apply to the motion of an elementary particle), and the problem of reconciling quantum mechanics with special, and ultimately general, relativity. See also UNCERTAINTY PRINCIPLE; UNIFIED FIELD THEORY.

physiocrat Member of a school of economics, founded in 18th-century France, that held that government should not interfere with the operation of natural economic laws. Generally regarded as the first scientific school of ECONOMICS, the physiocratic school (the name refers to the "rule of nature") was founded by FRANÇOIS QUESNAY, who demonstrated the economic relation between a workshop and a farm and asserted that the farm alone added to a nation's wealth. LAND and AGRICULTURE were therefore believed to be the source of all wealth. The physiocrats envisaged a society in which written law would be in harmony with NATURAL LAW. They pictured a predominantly agricultural society, attacking MERCANTILISM for its emphasis on manufacturing and foreign trade and its mass of economic regulations. Quesnay's disciples included Victor Riqueti, count de MIRABEAU, and Pierre Samuel du Pont de Nemours (1739–1817). The school was in decline by 1768, and after the dismissal of a sympathetic comptroller general in 1776 the leading physiocrats were exiled. Though many of their theories, notably their theory of wealth, were later demolished, their introduction of SCIENTIFIC METHOD to economics had a permanent effect on the discipline.

physiological psychology Study of the physiological basis of behaviour. Traditional specializations in the field cover PERCEPTION, MOTIVATION, EMOTION, LEARNING, MEMORY, COGNITION, or MENTAL DISORDERS. Also considered are other physical factors that affect the nervous system, including heredity, metabolism, hormones, disease, drug ingestion, and diet. An experimental science, physiological psychology relies heavily on laboratory research and quantitative data.

physiology \ˌfi-zē-ˈä-lə-jē\ Study of the functioning of living organisms or their constituent tissues or cells. Physiology was usually considered separately from ANATOMY until the development of high-powered microscopes made it clear that structure and function were inseparable at the cellular and molecular level. An understanding of BIOCHEMISTRY is fundamental to physiology. Physiological processes are dynamic; cells change their function in response to changes in the composition of their local environment, and the organism responds to alterations in both its internal and external environment. Many physiological reactions are aimed at preserving a constant physical and chemical internal environment (HOMEOSTASIS). See also CYTOLOGY.

phytoflagellate \ˌfī-tō-ˈfla-jə-lət\ Any of several PROTOZOANS that have flagella in addition to sharing many characteristics with typical ALGAE, especially the pigment CHLOROPHYLL and various other pigments. Some species, though similar in form, lack chlorophyll. Phytoflagellates may obtain nutrients by photosynthesis, by absorption through the body surface, or by ingestion of food particles. CRYPTOMONADS are among the more important phytoflagellates.

phytoplankton \ˌfī-tō-ˈplaŋk-tən\ FLORA of freely floating, often minute organisms that drift with water currents. Like land vegetation, phytoplankton uses carbon dioxide, releases oxygen, and converts minerals to a form animals can use. In fresh water, large numbers of green ALGAE often colour lakes and ponds, and CYANOBACTERIA may affect the taste of drinking water. Oceanic phytoplankton is the primary food source, directly or indirectly, of all sea organisms. Composed of groups with silica-containing skeletons, such as DIATOMS and DINOFLAGELLATES, phytoplankton varies seasonally in amount, increasing in spring and fall with favourable light, temperature, and minerals.

pi In mathematics, the RATIO of the circumference of a CIRCLE to its diameter. An IRRATIONAL NUMBER (see also TRANSCENDENTAL NUMBER), it has an approximate value of 3.14, but its exact value must be represented by a symbol, the Greek letter π. Pi is used in calculations involving lengths, areas, and volumes of circles, spheres, cylinders, and cones. It also arises frequently in problems dealing with certain periodic phenomena (e.g., motion of pendulums, alternating electric currents). By the end of the 20th century, computers had calculated pi to more than 200 billion decimal places.

Piaf, Edith \ˈpyȧf\ *English* \ˈpē-ˌaf\ *orig.* **Edith Giovanna Gassion** (b. Dec. 19, 1915, Paris, France—d. Oct. 11, 1963, Paris) French popular singer and actress. Her mother, a café singer, abandoned her at birth; Piaf became blind at age three as a result of meningitis but recovered her sight four years later. Her father, a circus acrobat, took her along on tours and encouraged her to sing. She sang for years in the streets of Paris until discovered by a cabaret owner who gave her her first nightclub job and suggested she change her name to Piaf, Parisian slang for "sparrow." She was soon singing her *chansons* (ballads) in the large music halls of Paris. During World War II she entertained French prisoners of war and aided several in their escapes. She spent the postwar years touring, gaining worldwide fame with her intense performances of songs such as "Non, je ne regrette rien" ("No, I regret nothing"). Her throaty, expressive voice, combined with her fragile appearance and a dramatic tight spotlight on her face and hands, made her concerts memorable.

Piaget \pyä-ˈzhā**, Jean** (b. Aug. 9, 1896, Neuchâtel, Switz.—d. Sept. 17, 1980, Geneva) Swiss psychologist. Trained in zoology and philosophy, Piaget later studied psychology in Zürich (from 1918) with CARL GUSTAV JUNG and EUGEN BLEULER, and he was subsequently affiliated with the University of Geneva from 1929 until his death. He developed a theory of "genetic epistemology," a natural timetable for the development of the child's ability to think in which he traced four stages—the sensorimotor (ages 0–2), preoperational or symbolic (2–7), concrete operational (7–12), and formal operational (through adulthood)—each marked by increased cognitive sophistication and ability to use symbols. In 1955 Piaget founded and became director (to 1980) of an international centre for genetic epistemology in Geneva. His numerous books include *The Language and Thought of the Child* (1923), *Judgment and Reasoning in the Child* (1924), *The Origin of Intelligence in Children* (1948), and *The Early Growth of Logic in the Child* (1964). He is regarded as the foremost developmental psychologist of the 20th century.

piano *or* **pianoforte** Keyboard instrument with wire strings that sound when struck by hammers operated by a keyboard. It was invented in Florence by BARTOLOMEO CRISTOFORI before 1720, with the particular aim of permitting note-to-note dynamic variation (lacking in the HARPSICHORD). It differs from the older CLAVICHORD in that its hammers (rather than tangents) are thrown at the strings and bounce back, permitting the struck string to vibrate loudly. A cast-iron frame is needed to withstand the strings' tremendous tension. Pianos have taken various shapes. The original harpsichord (or wing) shape has survived in the modern grand piano; the less-expensive square (actually rectangular) piano, standard in the early 19th century, was replaced by the upright piano, in which the strings are vertical. For at least 150 years the piano was the most important instrument in Western music. See illustration on following page.

piano nobile \ˌpyä-nō-ˈnō-bi-lā\ (Italian: "noble floor") In a Renaissance building, the first floor above ground level. In the typical palace erected by an Italian prince, the large, high-ceilinged reception rooms were in this upper, main story. Often a grand exterior staircase or pair of staircases led from ground level up to the piano nobile.

Piave River \ˈpyä-vā\ River, northeastern Italy. Rising in the Carnic Alps south of Lienz near the Austrian frontier, it flows south and southeast into the Adriatic Sea, east of VENICE. It is 137 mi (220 km) long. During World War I, its valley was the scene of several battles against the Austrians (see Battle of CAPORETTO). In 1966 the river burst its dikes in a major flood.

piazza \pē-ˈät-sə, pē-ˈa-zə\ Open square or marketplace, surrounded by buildings, in an Italian town or city. It was equivalent to the plaza of Spanish-speaking countries. The term became more widely used in the 16th–18th century, denoting any large open space with buildings around it. In 17th–18th-century Britain, long covered walks or galleries with roofs supported by columns were called piazzas; in the U.S. in the 19th century, piazza was another name for a veranda formed by projecting eaves.

Piazzetta \pyät-ˈtsät-tä**, Giovanni Battista** *or* **Giambattista Piazzetta** (b. Feb. 13, 1682, Venice—d. April 28, 1754, Venice) Italian painter, illustrator, and designer. Trained as a wood carver by his father, he turned to painting and became one of the outstanding Venetian artists

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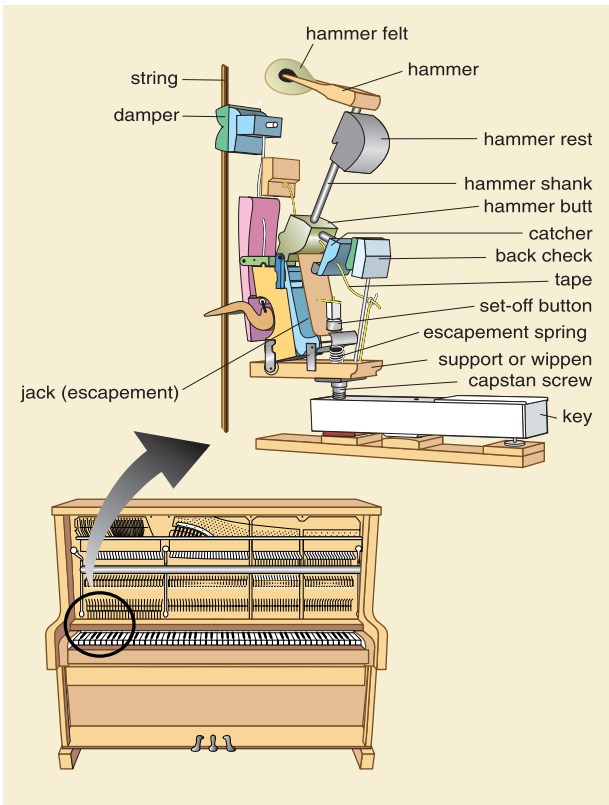

Each key of a piano actuates a complex mechanical system to strike a taut string and produce a musical tone. Depending on how the keys and pedals are operated, the mechanism may produce a variety of effects on the same note, from muffled to brilliant and from quick to sustained.

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of the 18th century. His art evolved from Italian Baroque traditions of the 17th century to the Rococo style. He had a strong influence on the young Giovanni Battista Tiepolo at the time he painted the finest of his early religious works, *St. James Led to Martyrdom* (1722). His most popular work is the celebrated *Fortune Teller* (1740). On the founding of the Venetian Academy in 1750, he was made its first director.

Piazzolla \pyät-'sō-lə**, Astor** (b. March 11, 1921, Mar del Plata, Arg.—d. July 5, 1992, Buenos Aires) Argentine composer. He lived in the Bronx, N.Y., until he was 15; he then returned to Argentina to play bandoneon (a type of accordion) in a tango band led by Anibal Troilo (1917–75). From 1944 he led his own groups. His interest in classical music led to study with Nadia Boulanger (1954–55) and the development of his own compositional style, infusing elements of jazz and modern music into tango. Not always initially popular with tango fans, his music is now recognized as having revived the genre and greatly expanded its artistic potential.

Picabia \pē-käb-'yä**, Francis** (b. Jan. 22, 1879, Paris, France—d. Nov. 30, 1953, Paris) French painter, illustrator, designer, writer, and editor. After studying at the École des Beaux-Arts and the École des Arts Décoratifs, he painted for a time in an Impressionist and then a Cubist style. Picabia went on to combine the Cubist style with Orphic elements in such paintings as *I See Again in Memory My Dear Udnie* (1913–14), to which he gave proto-Dadaist names. About 1916 he began to paint the satiric, machinelike contrivances that are his chief contribution to Dadaism. In 1915 in New York City, Picabia, Marcel Duchamp, and Man Ray together founded an American Dadaist movement. In 1917 Picabia returned to Europe and joined Dadaist movements in Barcelona, Paris, and Zürich. After Dadaism broke up about 1921, he followed the poet André Breton into the Surrealist movement. He subsequently painted in Surrealist, abstract, and figurative styles.

Picardy \'pi-kər-dē\ *French* **Picardie** \,pē-kär-'dē\ *Région* (pop., 2003 est.: 1,869,386), encompassing the northern French *départements* of Oise, Somme, and Aisne and roughly coextensive with the historical region of Picardy. In the 13th century the historical region included the countships of Amiénois and Vermandois, which were united with the French crown by Philip II from 1185. Picardy was joined to Burgundy in 1435 and attached to France in 1477. The province of Picardy from the 16th century to the end of the ancien régime in 1789 comprised the Somme River basin from Saint-Quentin to the English Channel, the basins of the Serre and upper Oise rivers, and Montreuil on the Canche beyond the Authie River. The region was the scene of heavy fighting in both world wars, especially in the First Battle of the Somme (1916). The capital of the French administrative region of Picardy is Amiens. Picardy has an area of 7,490 sq mi (19,399 sq km).

picaresque novel Early form of the novel, usually a first-person narrative, relating the episodic adventures of a rogue or lowborn adventurer (Spanish, *pícaro*). The hero drifts from place to place and from one social milieu to another in an effort to survive. The genre originated in Spain and had its prototype in Mateo Alemán's *Guzmán de Alfarache* (1599). It appeared in various European literatures until the mid-18th century, when the growth of the realistic novel led to its decline. Because of the opportunities for satire they present, picaresque elements enriched many later novels, such as Nikolay Gogol's *Dead Souls* (1842), Mark Twain's *Huckleberry Finn* (1884), and Thomas Mann's *Confessions of Felix Krull* (1954).

Picasso, Pablo (Ruiz y) (b. Oct. 25, 1881, Málaga, Spain—d. April 8, 1973, Mougins, France) Spanish-born French painter, sculptor, printmaker, ceramicist, and stage designer. Trained by his father, a professor of drawing, he exhibited his first works at 13. After moving permanently to Paris in 1904, he replaced the predominantly blue tones of his so-called Blue Period (1901–04) with those of pottery and flesh in his Rose Period (1904–06). His first masterpiece, *Les Demoiselles d'Avignon* (1907), was controversial for its violent treatment of the female body and the mask-like faces derived from his study of African art. From 1909 to 1912 Picasso worked closely with Georges Braque—the only time Picasso ever worked with another painter in this way—and they developed what came to be known as Cubism. The artists presented a new kind of reality that broke away from Renaissance tradition, especially from the use of perspective and illusion. Neither Braque nor Picasso desired to move into the realm of total abstraction in their Cubist works, although they implicitly accepted inconsistencies such as different points of view, different axes, and different light sources in the same picture. By 1912 they had taken Cubism further by gluing paper and other materials onto their canvases. Between 1917 and 1924 Picasso designed stage sets for five ballets for Sergey Diaghilev's Ballets Russes. In the 1920s and '30s, the Surrealists spurred him to explore new subject matter, particularly the image of the Minotaur. The Spanish Civil War inspired perhaps his greatest work, the enormous *Guernica* (1937), whose violent imagery condemned the useless destruction of life. After World War II he joined the Communist Party and devoted his time to sculpture, ceramics, and lithography as well as painting. In his late years he created variations on the works of earlier artists, the most famous being a series of 58 pictures based on *Las Meninas* of Diego Velázquez. For nearly 80 of his 91 years Picasso devoted himself to an artistic production that contributed significantly to and paralleled the whole development of modern art in the 20th century.

Piccard \pē-'kär**, Auguste** (b. Jan. 28, 1884, Basel, Switz.—d. March 24, 1962, Lausanne) Swiss-born Belgian physicist and balloon and undersea explorer. He studied and taught physics in Zürich and later at the University of Brussels (1922–54). In 1930 he designed a balloon with an airtight, pressurized cabin to ascend into the stratosphere to study cosmic rays. In 1932 he ascended over 55,500 ft (16,650 m). The undersea bathyscaphe he designed with his son, Jacques (b. 1922), descended in 1953 more than 10,000 ft (3,000 m). His grandson Bernard Piccard made the first round-the-world balloon flight in 1999.

Piccolomini \,pēk-kō-'lȯ-mē-nē\ **(-Pieri), Ottavio** (b. Nov. 11, 1599, Florence—d. Aug. 11, 1656, Vienna) Italian general. He entered the service of the Habsburgs in 1616 and became a trusted lieutenant to Albrecht Wenzel Eusebius von Wallenstein. Overlooked for advancement, he turned against his superior and conspired in his assassination (1634). He served Spain against the French in the Netherlands and won the Battle of Thionville (1639), for which he was created duke of Amalfi. In 1648 Emperor Ferdinand III named him commander in chief, and he conducted

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the last campaign of the THIRTY YEARS' WAR. He represented Austria at the Congress of Nürnberg (1649), which negotiated issues left unsettled by the Peace of WESTPHALIA.

picker Machine for harvesting a crop (e.g., corn, cotton) and preparing it for storage. The mechanical picker removes mainly the desired portion of the plant (e.g., grain and cobs of corn, bolls of cotton) rather than harvesting the entire plant.

pickerel Any of several North American PIKES (family Esocidae), distinguished from the northern pike and MUSKELLUNGE by their smaller size, completely scaled cheeks and gill covers, and banded or chainlike markings. The chain pickerel (*Esox niger*) grows to about 2 ft (0.6 m) and a weight of about 3 lbs (1.4 kg). The barred (*E. americanus*) and grass (*E. vermiculatus*) pickerels reach a maximum weight of about 1 lb (0.5 kg).

Pickering, Timothy (b. July 17, 1745, Salem, Mass.—d. Jan. 29, 1829, Salem, Mass., U.S.) U.S. politician. He joined the militia in 1766 and served in the AMERICAN REVOLUTION under GEORGE WASHINGTON, becoming adjutant general (1777–78) and quartermaster general (1780–85). He later served as U.S. postmaster general (1791–95), secretary of war (1795), and secretary of state (1795–1800). He served in the U.S. Senate from 1803 to 1811 and in the House of Representatives from 1813 to 1817. A leader of the FEDERALIST PARTY, he was a member of the ESSEX JUNTO, and he opposed the WAR OF 1812. After retiring from politics, he turned to experimental farming and education.

picketing Act by workers of standing in front of or near a workplace to call attention to their grievances, discourage patronage, and, during STRIKES, to discourage strikebreakers. Picketing is also used in non-work-related protests. The U.S. Norris-LaGuardia Act (1932) made it easier for workers to picket by restricting the use of court injunctions against strikes, but the TAFT-HARTLEY ACT (1947) outlawed mass picketing.

Pickett, George E(dward) (b. Jan. 25, 1825, Richmond, Va., U.S.—d. July 30, 1875, Norfolk, Va.) U.S. and Confederate army officer. He graduated from West Point and served in the MEXICAN WAR. In 1861 he resigned his commission to enter the Confederate army. He rose to major general and commanded a division at the Battle of Fredericksburg. At the Battle of GETTYSBURG, he led the climactic attack known as Pickett's Charge, in which 4,300 men of his division constituted almost half the attacking force under JAMES LONGSTREET. The attempt to breach the Union lines on Cemetery Ridge was repulsed with the loss of about 60% of his men. Though criticized for his leadership, he retained his command.

Pickford, Mary *orig.* **Gladys Mary Smith** (b. April 9, 1893, Toronto, Ont., Can.—d. May 28, 1979, Santa Monica, Calif., U.S.) Canadian-born U.S. film actress. She acted with a stock company from age 5, went on tour at 8, and was performing on Broadway by 18. She starred in D.W. GRIFFITH's *The Lonely Villa* (1909) and by 1913 was acting in movies exclusively. One of the first movie stars, she became a symbol of innocence and was known as "America's sweetheart." Her silent films include *Tess of the Storm Country* (1914), *Rebecca of Sunnybrook Farm* (1917), *Poor Little Rich Girl* (1917), and *Pollyanna* (1920). A shrewd businesswoman, she formed UNITED ARTISTS CORP. (1919) with her second husband, DOUGLAS FAIRBANKS, and others. She received an Academy Award for her first sound film, *Coquette* (1929). She retired from acting in 1933 and received a special Academy Award in 1975.

Pico Bolívar See BOLÍVAR PEAK

Pico della Mirandola \'pē-kō-ˌdāl-lä-mē-'rän-dō-ˌlä**, Giovanni, conte (count) di Concordia** (b. Feb. 24, 1463, Mirandola, duchy of Ferrara—d. Nov. 17, 1494, Florence) Italian scholar, philosopher, and humanist. He settled in Florence in 1484 as a protégé of LORENZO DE' MEDICI and MARSILIO FICINO. In 1486 he posted in Rome a list of 900 theses on logic, mathematics, physics, and other subjects that he proposed to defend against any opponent. His *Oration on the Dignity of Man* (1486), which accompanied the posting, epitomizes Renaissance HUMANISM. Accused of heresy by the pope, he was later cleared, and he was later reconverted to orthodoxy by GIROLAMO SAVONAROLA. Pico was the first Christian scholar to use Kabbalistic doctrine (see KABBALA) in support of Christian theology. His other works include *Heptaplus* (a seven-point exposition of the Book of Genesis) and a synoptic treatment of PLATO and ARISTOTLE, of which *Of Being and Unity* is a portion. He died at age 31.

picornavirus \pē-ˌkȯr-nə-'vī-rəs\ Any of a group of the smallest known animal VIRUSES. (*Pico* refers to their small size, *rna* to their core of RNA.) This group of spheroidal viruses includes viruses that attack the vertebrate intestinal tract and often invade the central nervous system as well (such as polioviruses), viruses that infect tissues in the vertebrate nose (RHINOVIRUSES), and the virus agent of FOOT-AND-MOUTH DISEASE.

Pict \'pikt\ Any member of an ancient people of what is now eastern and northeastern Scotland. The name (from Latin *picti*, "painted") referred to their body painting or tattooing. They were probably descended from pre-Celtic peoples. They attacked HADRIAN'S WALL in 297 and warred constantly with the Romans. They united their two kingdoms by the 7th century and converted to Christianity, and in 843 KENNETH I, king of the Scots, included them in the kingdom of Alba, later Scotland.

pictography \pik-'tä-grə-fē\ Expression of words and ideas through drawings (pictographs), considered a forerunner of true WRITING. Pictographs are drawn in a standardized way, omitting unnecessary details. A pictograph that stands for a specific idea or meaning is an ideogram; one that stands for an individual word is a logogram.

picturesque Artistic concept and style of the late 18th and early 19th century characterized by a preoccupation with architecture and landscape in pictorial combination with each other. In Britain, the picturesque was defined as an aesthetic quality marked by pleasing variety, irregularity, asymmetry, and interesting textures; medieval ruins in a natural landscape were thought to be picturesque. JOHN NASH produced some of the most exemplary works embodying the concept. See also FOLLY.

Picus \'pī-kəs\ In ROMAN MYTHOLOGY, a woodpecker sacred to MARS. A minor agricultural deity associated with the fertilization of the soil, Picus was widely worshiped in ancient Italy. Later versions of the myth made him an early king of Italy, whose bride, CIRCE, changed him into a woodpecker. In art he was shown as a woodpecker mounted on a pillar, and later as a youth with a woodpecker on his head. The woodpecker was also an important bird in augury.

pidgin \'pi-jən\ Language with a very limited vocabulary and a simplified grammar. Pidgins usually arise to permit communication between groups with no language in common; if a pidgin becomes established as the native language of a group, it is known as a CREOLE. Pidgins such as Chinese Pidgin English and Melanesian Pidgin English arose through contact between English-speaking traders and inhabitants of East Asia and the Pacific islands. Other pidgins appeared with the slave trade in Africa and with the importation of West African slaves to Caribbean plantations. Most of the small vocabulary of a pidgin language (Melanesian Pidgin has only 2,000 words, Chinese Pidgin English only 700) is usually drawn from a single language (Melanesian Pidgin, for example, has an English word stock of more than 90%).

Piedmont \'pēd-ˌmänt\ *Italian* **Piemonte** \pyā-'mȯn-tā\ Autonomous region (pop., 2001 prelim.: 4,166,442), northwestern Italy. With its capital at TURIN, Piedmont borders France and Switzerland; it has an area of 9,807 sq mi (25,399 sq km). In Roman times its passes connected Italy with the transalpine provinces of GAUL. In the Middle Ages the house of SAVOY was the region's most important power. It was a centre during the 19th-century RISORGIMENTO that united Italy. VICTOR EMMANUEL II, originally king of Piedmont and Sardinia, became modern Italy's first king in 1861. Surrounded by mountains, Piedmont is centred on the PO RIVER valley, which contains some of Italy's best farmland, producing wheat, rice, and wines. Its hydroelectric plants supply energy for much of northern Italy.

Piedmont Geographic region, eastern U.S. Lying between the APPALACHIAN MOUNTAINS and the Atlantic coastal plain, it is about 600 mi (950 km) long and stretches between the Hudson River and central Alabama. A relatively low, rolling plateau crossed by many rivers, it is a fertile agricultural region.

Pielinen \'pē-ə-ˌlē-nən**, Lake** Lake, southeastern Finland. Located near the border with Russia, Lake Pielinen is 56 mi (90 km) long and has an area of 422 sq mi (1,093 sq km). The lake has many islands and is drained southward into Lake SAIMAA by the Pielis River. It is surrounded by dense forests, especially on its western shore. The shore is capped by Koli hill, the centre of a winter sports area.

Pieman River \'pī-mən\ River, northwestern TASMANIA, Australia. It is formed near Tullah by the confluence of the Macintosh and MURCHISON rivers. Rising on the western edge of the central highlands, it is about 70 mi (115 km) long and flows west to the Indian Ocean. There was some gold and tin mining in the area during the 1870s and 1890s. It was named for an

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infamous convict, Alexander Pierce (Jimmy the Pieman), who was recaptured at its mouth after escaping from the Macquarie Harbour penal colony.

pier In building construction, a vertical load-bearing member such as an intermediate support for adjacent ends of two bays or spans. Bulkier than a column but smaller than a wall, a pier can support an arch or beam. The lower portion of a pier may be widened to better distribute the downward pressure of a massive overlying structure. In Romanesque and Gothic architecture, a feature of the nave arcade is the compound pier, which is cross-shaped in cross section, with shafts placed in the recesses.

Pierce, Franklin (b. Nov. 23, 1804, Hillsboro, N.H., U.S.—d. Oct. 8, 1869, Concord, N.H.) 14th president of the U.S. (1853–57). He served in the U.S. House of Representatives from 1833 to 1837 and in the Senate from 1837 to 1842. At the deadlocked Democratic Party convention of 1852, he was nominated as a compromise presidential candidate; though largely unknown nationally, he unexpectedly trounced Winfield Scott in the general election. For the sake of harmony and business prosperity, he was inclined to oppose antislavery agitation. His promotion of U.S. territorial expansion resulted in the diplomatic controversy of the Ostend Manifesto. He reorganized the diplomatic and consular service and created the U.S. Court of Claims. Pierce encouraged plans for a transcontinental railroad and approved the Gadsden Purchase. To promote northwestern migration and conciliate sectional demands, he approved the Kansas-Nebraska Act but was unable to settle the resultant problems. Defeated for renomination by James Buchanan in 1856, he retired from politics.

Franklin Pierce.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Piero della Francesca \fran-'ches-kə\ (b. c. 1420, Sansepolcro?, Republic of Florence—d. Oct. 12, 1492, Sansepolcro) Italian painter. Son of a prosperous tanner and wool merchant, he became known for his serene, disciplined exploration of perspective. His fresco cycle for San Francesco at Arezzo, *The Legend of the True Cross* (1450s), exemplifies his simplicity and clarity of structure, controlled use of perspective, and aura of serenity. His famous diptych portrait of his patrons, Count Federico da Montefeltro and his wife (c. 1470), is known for its unidealized depiction of their features and the use of landscape in the background. Though he had little influence on his contemporaries, Piero's important scientific and poetic contributions to Renaissance painting are now well recognized. Also a writer, he produced theoretical treatises on geometry and perspective.

The Baptism of Christ, panel painting by Piero della Francesca, c. 1440–45; in the National Gallery, London.
COURTESY OF THE TRUSTEES OF THE NATIONAL GALLERY, LONDON; PHOTOGRAPH, A.C. COOPER LTD.

Piero di Cosimo \kō-'sē-mō\ *orig.* **Piero di Lorenzo** (b. 1462, Florence, Republic of Florence—d. 1521, Florence) Italian painter. His name derives from that of his master, Cosimo Rosselli, whom he assisted on frescoes for the Sistine Chapel. His later mythological paintings exhibit a bizarre Romantic style. Many are filled with fantastic hybrid human-animal forms engaging in revels (*The Discovery of Honey*, c. 1500) or fights (*Battle of the Centaurs and the Lapiths*, c. 1500). His art reflects his eccentric personality. He belonged to no school of painting but borrowed from many artists, including Sandro Botticelli and Leonardo da Vinci.

Pierre \'pir\ City (pop., 2000: 13,876), capital of South Dakota, U.S. It is located on the Missouri River, in the geographic centre of the state. The area was originally inhabited by Arikara Indians. The city was founded in 1880 as the western terminus of the Chicago and North Western Railway, which spurred its growth as a mining and trade centre. It became the state capital in 1889. It is the hub of a large, diversified agricultural area with a significant tourist industry based on nearby lakes.

Pietà \pyā-'tä\ *Italian* **"Pity"** Depiction of the Virgin Mary supporting the body of the dead Christ. The theme grew out of that of the Lamentation, the moment between the Descent from the Cross and the Entombment. It first appeared in Germany in the early 14th century. It enjoyed greater popularity in northern Europe than in Italy through the 15th century, yet the supreme representation is Michelangelo's sculpture (1499) in St. Peter's Basilica. The Pietà was widely represented in both painting and sculpture. Michelangelo's conception of Mary bearing Jesus' body on her knees was standard until the 16th century, when artists began to place Jesus at Mary's feet. Though most religious art declined after the 17th century, the Pietà retained its popularity through the 19th century.

Pietà, marble sculpture by Michelangelo, 1499; in St. Peter's Basilica, Rome.
SCALA/ART RESOURCE, NEW YORK

Pietism \'pī-ə-ˌti-zəm\ Reform movement in German Lutheranism that arose in the 17th century. Philipp Jakob Spener (1635–1705), a Lutheran pastor, originated the movement when he organized an "assembly of piety," a regular meeting of Christians for devotional reading and spiritual exchange. Spener advocated greater involvement of the laity in worship, more extensive study of scripture, and ministerial training that emphasized piety and learning rather than disputation. Under Spener's successor, August Hermann Francke (1663–1727), the University of Halle became a centre of the movement. Pietism influenced the Moravian and Methodist churches (see Methodism).

Pietro da Cortona *orig.* **Pietro Berrettini** (b. Nov. 1, 1596, Cortona, Tuscany—d. May 16, 1669, Rome, Papal States) Italian painter, architect, and decorator. The son of a stonemason, he was apprenticed to a painter in Florence. His first major work, a series of frescoes in the small church of Santa Bibiana in Rome (1624–26), was commissioned by Pope Urban VIII, and the patronage of the pope's family, the Barberinis, advanced Pietro's career. The rich exuberance of those Baroque frescoes was a prelude to his best-known work, the large ceiling fresco *Allegory of Divine Providence and Barberini Power* (1632–39) in the Barberini Palace. Here he demonstrated his mastery of illusion, for the centre of the vault appears open to the sky and the figures seem to hover in space. He provided a series of frescoes for the Pitti Palace in Florence. Also a master architect, his greatest architectural accomplishment is the church of Santi Martina e Luca in Rome (1634), the first Baroque church built as a unitary whole.

piezoelectricity \pē-ˌā-zō-ə-ˌlek-'tri-sə-tē\ Appearance of an electric field in certain nonconducting crystals as a result of the application of mechanical pressure. Pressure polarizes some crystals, such as quartz, by slightly separating the centers of positive and negative charge. The resultant electric field is detectable as a voltage. The converse effect also occurs: an applied electric field produces mechanical deformation in the crystal. Using this effect, a high-frequency alternating electric current (see alternating current) can be converted to an ultrasonic wave of the same frequency, while a mechanical vibration, such as sound, can be converted into a corresponding electrical signal. Piezoelectricity is utilized in microphones, phonograph pickups, and telephone communications systems.

pig Any wild or domestic even-toed ungulate (family Suidae) that is a stout-bodied, short-legged omnivore, with thick, sparsely bristled skin, a long mobile snout, small tail, and hooves with two functional and two nonfunctional digits. Pigs are native to European, Asian, and North African forests. Wild pigs use their tusklike teeth to forage and for defense; the teeth of domestic pigs, which were developed from wild pigs in

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Europe c. 1500 BC, are less developed. Pigs are regarded as highly intelligent. Domestic pigs are classified as lard (thick fat, carcass weighing at least 220 lbs, or 100 kg), bacon (carcass about 150 lbs, or 70 kg), and PORK (carcass about 100 lbs, or 45 kg) pigs, depending on the principal product derived from them; they are also a source of leather. Today they are usually bred in almost complete confinement. See also BOAR, HOG.

pig iron Crude IRON obtained directly from the BLAST FURNACE and cast in molds (see CAST IRON). The crude ingots, called pigs, are then remelted along with scrap and alloying elements and recast into molds to produce various iron and STEEL products (see BESSEMER PROCESS, FINERY PROCESS, PUDDLING PROCESS).

Pigalle \pē-'gäl**, Jean-Baptiste** (b. Jan. 26, 1714, Paris, France—d. Aug. 21, 1785, Paris) French sculptor. Born into a family of master carpenters, he began training as a sculptor in Paris at 18 and then studied in Rome (1736–40). Returning to France, he modeled the first version of his famous *Mercury Fastening His Sandals*, which in a later version won him admission to the Royal Academy (1744). The statue became so popular that in 1748 LOUIS XV commissioned a life-size marble version to present to FREDERICK II of Prussia. He was also noted for his portrait sculptures. His *Nude Voltaire* (1776), an anatomically realistic rendering of the aged philosopher, caused a furor when it was first shown.

pigeon Plump, small-billed, monogamous birds of the family Columbidae, found almost worldwide and recognizable by their head-bobbing strut. Unlike other birds, pigeons suck liquids and provide the young with regurgitated "pigeon's milk." The 175 species of true pigeons include the Old and New World *Columba* species and the Old World *Streptopelia* species; all eat seeds and fruit. Common street pigeons, or rock doves, are descendants of the Eurasian rock dove (*Columba livia*). From antiquity pigeons were trained to carry messages over long distances. About 115 species of fruit pigeons occur in Africa, southern Asia, Australia, and the Pacific islands. The three species of crowned pigeons (genus *Goura*), of New Guinea, are nearly the size of a turkey. See also DOVE; MOURNING DOVE; PASSENGER PIGEON; TURTLEDOVE.

pigeon hawk See MERLIN

pigment Any intensely coloured compound used to colour other materials. Unlike DYES, pigments do not dissolve; they are applied as fine solid particles mixed with a liquid. In general, the same ones are used in oil- and water-based PAINTS, printing INKS, and PLASTICS. They may be inorganic compounds (usually brighter and longer-lasting) or organic compounds. Natural organic pigments have been used for centuries, but today most are synthetic or inorganic. The primary white pigment is TITANIUM dioxide. CARBON black is the most usual black pigment. IRON oxides give browns, ranging from yellowish through orange to dark brown. CHROMIUM compounds yield chrome yellows, oranges, and greens; CADMIUM compounds brilliant yellows, oranges, and reds. The most common blues, Prussian blue and ultramarine, are also inorganic. Organic pigments, usually synthesized from aromatic HYDROCARBONS, include the nitrogen-containing azo pigments (red, orange, and yellow; see AZO DYES) and the COPPER phthalocyanines (brilliant, strong blues and greens). CHLOROPHYLL, CAROTENE, RHODOPSIN, and MELANIN are pigments produced by plants and animals for specialized purposes.

pika \'pē-kə, 'pī-kə\ Any of numerous round-eared, tailless members (genus *Ochotona*, family Ochotonidae) of the RABBIT order (Lagomorpha), found in Asia, eastern Europe, and parts of western North America. Though not HARES, they are sometimes called mouse hares. The hind legs are less developed than a rabbit's; pikas scamper rather than bound. Their brownish or reddish fur is soft, long, and thick. Most pikas weigh between 4.5 and 7.1 oz. (125 and 200 g) and are about 6 in. (15 cm) long. Many species live in rocky, mountainous areas, but some Asian species inhabit burrows. Pikas do not hibernate, but in summer and autumn they "harvest" vegetation and store it in protected places (e.g., under rocks) to be eaten in winter.

American pika (*Ochotona princeps*).
KENNETH W. FINK/ROOT RESOURCES

pike Ancient and medieval INFANTRY weapon consisting of a long, metal-pointed spear with a heavy wooden shaft 10–20 ft (3–6 m) in length. Its use by Swiss foot soldiers in the 14th century contributed to the decline of the feudal knights. A variation is used by the picador in BULLFIGHTING.

pike Any of several voracious freshwater fishes (family Esocidae, order Salmoniformes) with a slender body, small scales, long head, shovel-like snout, large mouth, and strong teeth, and with dorsal and anal fins far back on the tail. The northern pike (*Esox lucius*) of North America, Europe, and northern Asia may grow to 4.5 ft (1.4 m) long and weigh 45 lbs (20 kg). A solitary hunter, it lies motionless or lurks among weeds, then suddenly lunges, seizing an approaching fish or invertebrate. Large species also take waterfowl and small mammals. See also MUSKELLUNGE, PICKEREL.

Northern pike (*Esox lucius*).
RUSS KINNE—PHOTO RESEARCHERS

Pike, Kenneth L(ee) (b. June 9, 1912, Woodstock, Conn., U.S.—d. Dec. 31, 2000, Dallas, Tex.) U.S. linguist and anthropologist. Pike was associated throughout his career with the Summer Institute of Linguistics (now SIL International), an organization dedicated to linguistic study of little-known, unwritten languages, as an ancillary to Bible translation. He originated the linguistic theory known as tagmemics. The tagmeme, a unit comprising a function (e.g., a subject) and a class of items fulfilling that function (e.g., nouns), is identified by semantic as well as syntactic function.

Pike, Zebulon Montgomery (b. Jan. 5, 1779, Lamberton, N.J., U.S.—d. April 27, 1813, York, Ont.) U.S. explorer. He joined the army at age 15. In 1805 he led an expedition to find the headwaters of the Mississippi River, traveling 2,000 mi (3,200 km) from St. Louis to northern Minnesota, where he erroneously identified Leech Lake as the river's source. In 1806 he was sent to the Southwest to explore the Arkansas and Red rivers. Passing through Colorado, he tried unsuccessfully to climb the 14,110-ft (4,301-m) mountain later named PIKES PEAK. His party continued into northern New Mexico (1807); his report on the Santa Fe region encouraged later expansion into the Southwest. In the WAR OF 1812 he was killed in the attack on York (Toronto).

Pikes Peak Mountain peak, eastern Colorado, U.S. It is located in the Front Range of the ROCKY MOUNTAINS, near COLORADO SPRINGS. At 14,110 ft (4,301 m) in height, it is known for the panoramic view from its summit. It was discovered in 1806 by U.S. explorer ZEBULON PIKE. The view from it is said to have inspired Katharine Lee Bates to write "America the Beautiful" in 1893.

pilaster \pi-'las-tər\ In CLASSICAL ARCHITECTURE, a shallow rectangular column built into a wall and projecting slightly beyond it. It has a capital and base and conforms to one of the ORDERS. In Roman architecture the pilaster gradually became more decorative than structural, and it served to break up otherwise empty expanses of wall.

Pilate \'pī-lət**, Pontius** (d. AD 36) Roman prefect of JUDAEA (AD 26–36) who presided at the trial of JESUS and gave the order for his CRUCIFIXION. The NEW TESTAMENT represents Pilate as a weak and vacillating man who found no fault with Jesus but ordered his execution to please the mob calling for his death. Known for his severity toward the Jews, he was eventually ordered back to Rome to stand trial for cruelty and oppression. A tradition of uncertain accuracy holds that he killed himself on orders from CALIGULA in AD 39; another legend relates that both Pilate and his wife converted to Christianity.

pilchard \'pil-chərd\ Local name in Britain and elsewhere for the European SARDINE (*Sardina pilchardus*). It is found in the Mediterranean and off the Atlantic coasts of Spain, Portugal, France, and Britain.

Pilcomayo \ˌpēl-kō-'mä-yō\ **River** River, south-central South America. The chief western tributary of the PARAGUAY RIVER, it rises in the eastern ANDES MOUNTAINS in west-central Bolivia. It flows southeast through the

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Gran Chaco of Paraguay to join the Paraguay River opposite Asunción, after about 1,000 mi (1,600 km). It forms part of the border between Argentina and Paraguay.

pile In building construction, a postlike foundation member used from prehistoric times. Piles transfer building loads down to a suitable bearing stratum when the soil mass immediately below a construction is unsuitable for the direct bearing of footings (see foundation). Piles support loads either by bearing directly on rock or suitable soil or by developing friction along their very ample length. In modern civil engineering, piles of timber, steel, or concrete are driven into the ground to support a structure; bridge piers and building foundations may be supported on groups of piles.

pile See hemorrhoid

pileworm See shipworm

pilgrimage Journey to a shrine or other sacred place undertaken to gain divine aid, as an act of thanksgiving or penance, or to demonstrate devotion. Medieval Christian pilgrims stayed at hospices set up specifically for pilgrims, and on their return trip they wore on their hats the badge of the shrine visited. The chief attractions for pilgrims in the Middle Ages were the Holy Land, Santiago de Compostela in Spain, and Rome, but there were hundreds of local pilgrimage sites, including the tomb of St. Francis of Assisi and that of St. Thomas Becket in Canterbury. More recent pilgrimage sites include the shrine of Our Lady of Guadalupe in Mexico (1531), Lourdes in France (1858), and Fátima in Portugal (1917). The tradition of pilgrimage is also important in Buddhism, with sites including Bodh Gaya, where the Buddha received enlightenment, and Varanasi, where he delivered his first sermon. In Islam all members of the faith are enjoined to perform the hajj, the pilgrimage to Mecca, at least once in their lifetime.

Pilgrimage of Grace (1536) Uprising in the northern counties of England against the Reformation legislation of Henry VIII. Royal mandates to dissolve the monasteries in the north triggered riots in Lincolnshire and Yorkshire, where 30,000 armed rebels under Robert Aske occupied York, demanding a return to papal obedience and a parliament free from royal influence. Playing for time to assemble enough royal forces to oust the rebels, the 3rd duke of Norfolk made vague promises, and the rebels dispersed, believing they had won, only to be arrested later; about 220 were executed, including Aske.

Pilgrims First settlers of Plymouth (Massachusetts), the first permanent colony in New England (1620). The members of the English Separatist Church, a radical faction of Puritanism, composed a third of the 102 colonists who sailed aboard the *Mayflower* to North America, and they became the dominant group in the colony. The settlers were later collectively referred to as the Forefathers; the term Pilgrim Fathers was applied to them by Daniel Webster at the bicentennial celebration (1820). See also Mayflower Compact; Plymouth Co.

pill bug Any species of terrestrial crustacean in the genera *Armadillidium* and *Armadillo* (both in the order Isopoda), native to Europe and introduced worldwide. Pill bugs (sometimes called wood lice) resemble tiny armadillos in appearance and behaviour; they have a gray, oval body covered with plate-like armour and, when disturbed, roll into a ball. They are about 0.75 in. (19 mm) long. Pill bugs live in dry, sunny places, in dry leaf litter, and on forest edges. See also sow bug.

Pill bugs (*Armadillidium vulgare*)
E.S. ROSS

pillar Relatively slender isolated vertical structural member such as a pier or (usually squat) column. It may be constructed of a single piece of stone or wood or built up of units, such as bricks. A pillar commonly has a load-bearing or stabilizing function, but it may also stand alone, as do commemorative pillars.

Pillars of Hercules Two promontories at the eastern end of the Strait of Gibraltar. They include the Rock of Gibraltar (at Gibraltar) in Europe and Jebel Musa (at Ceuta) in northern Africa. They are fabled to have been set there by Heracles as a memorial in his labour of seizing the cattle of the three-bodied giant Geryon.

Pillars of Islam See Pillars of Islam

Pillsbury Co. U.S. food-products company. It was established in Minneapolis in 1871 as C.A. Pillsbury & Co. Its founder, Charles Alfred Pillsbury (1842–99), built the company into one of the world's largest milling concerns in the 1880s, expanding the business by obtaining favourable freight rates and building his own grain elevators throughout the Northwest. He sold the firm to an English syndicate but remained its managing director until his death. Pillsbury later became a successful manufacturer of food products, acquiring subsidiaries such as Burger King, Häagen-Dazs, and Green Giant. It was acquired by Grand Metropolitan PLC (now Diageo PLC) in a hostile takeover in 1989, and in 2001 it was sold to former rival General Mills, Inc.

Pilon \pē-'lō^{n}**, Germain** (b. 1535, Paris, France—d. Feb. 3, 1590, Paris) French sculptor. His decoration of the tomb of Francis I (1558), a relatively early work, shows an Italian influence, but he later developed a distinctively French expression by fusing elements of Classical and Gothic art with the Fontainebleau adaptation of Mannerism. His best-known works are funerary sculptures for Henry II and Catherine de Médicis at St.-Denis (1561–70). His work represents a transitional link between the Gothic tradition and Baroque sculpture.

pilot fish Widely distributed species (*Naucrates ductor*, family Carangidae) of carnivorous fish that inhabits warm and tropical open seas. It is slender and has a forked tail, a lengthwise keel on each side of the tail base, and a few small spines in front of the dorsal and anal fins. It may grow to 2 ft (60 cm) but is usually about 14 in. (35 cm) long. Five to seven distinctive vertical dark bands mark the bluish body. Pilot fishes follow sharks and ships, apparently to feed on parasites and leftover scraps. It was formerly thought that they were leading, or "piloting," the larger fishes to food.

pilot whale Any of one to three species (genus *Globicephala*, family Delphinidae) of toothed whale found in all oceans except the Arctic and Antarctic, also called caa'ing whale for a roaring sound it makes when stranded. It is black, usually with a lighter splash on the throat and chest, and has a round, bulging forehead, a short beaklike snout, and slender, pointed flippers, and grows to 13–20 ft (4–6 m) long. Pilot whales live in large schools, sometimes hundreds or thousands, feeding mainly on squid. They have been kept in oceanariums and trained to perform.

Piłsudski \pil-'süt-skē, pil-'züt-skē**, Józef (Klemens)** (b. Dec. 5, 1867, Żułów, Pol., Russian Empire—d. May 12, 1935, Warsaw, Pol.) Polish revolutionary leader. Reared with a hatred for Russian oppression, he was politically active and was banished to Siberia for his socialist agitation (1887–92), and he became a leader of the Polish Socialist Party on his return. In 1908 he organized the secret Union of Military Action, which fought in World War I under Austro-Hungarian command against the Russians. In 1916 he demanded recognition of Poland's independence, which was granted in 1918. He served as Poland's first head of state until the constitution was established in 1922. After staging a coup in 1926, he served as premier (1926–28) and minister of defense (1926–35) under handpicked premiers, enabling him to rule as the dictator of Poland.

Piltdown hoax Forgery of human fossil remains that impeded early 20th-century progress in the study of human evolution. The apparently fossilized skull found at Piltdown Common near Lewes, Eng., was first proposed as a new species of prehistoric man ("Piltdown man") in 1912. Only in 1954 was the skull shown to consist of a human cranium skillfully joined to the jaw of an orangutan. The hoax may have been perpetrated by the skull's discoverer, Charles Dawson, though evidence discovered in the 1970s suggests a British Museum staff member, Martin A.C. Hinton.

Pima \'pē-mə\ North American Indian people living mainly in Arizona, U.S. The Pima language is of Uto-Aztecan language stock, and the name Pima was given by the Spanish, who may have derived it from the phrase *pi-nyi-match*, meaning "I don't know." They call themselves Akimel O'odham, meaning "River People." Their traditional lands are located in the core area of the prehistoric Hohokam culture, from which they probably descend. The Pima originally were sedentary corn farmers who lived in one-room houses and used the Gila and Salt rivers for irrigation. Some hunting and gathering were also done. Their villages were larger than those of the related Papago Indians, and they possessed a stronger tribal

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unity. The Pima were long friendly with whites but enemies of the Apache. At the turn of the 21st century they numbered some 15,000.

pimiento *or* **pimento** Any of various mild peppers of the genus *Capsicum* that have distinctive flavour but lack pungency, including the European paprikas. A common flavouring in Hungarian dishes, paprika is made by grinding dried peppers. The term *pimento* sometimes refers to allspice because early Spanish explorers of the West Indies and Central America mistook the highly aromatic berries of the tropical allspice tree for a type of pepper and called it *pimenta*.

pin (fastener) In mechanical and civil engineering, a peg or bar designed to fasten machine and structural components together or to keep them aligned. Dowel pins are used to keep machine components aligned, sometimes without making a rigid joint (as in a pin-connected truss). Taper pins are used to fix the hub of a gear or a pulley to a shaft. Split cotter pins prevent nuts from turning on bolts and keep loosely fitting pins in place. The clevis pin has a ridge at one end and is kept in place by a cotter pin inserted through a hole in the other end. Many other types of pins are used in various machines.

Pinatubo \ˌpē-nä-ˈtü-bō**, Mount** Volcano, western Luzon, Philippines. Located about 55 mi (90 km) northwest of Manila, it rose to a height of about 4,800 ft (1,460 m) before its eruption in 1991 (for the first time in 600 years). Its explosions produced a column of smoke and ash more than 19 mi (30 km) high and left some 100,000 people homeless. The ashfalls forced the evacuation and eventual closing of a nearby U.S. Air Force base. The eruption was one of the largest of the 20th century.

Pinchback, Pinckney (Benton Stewart) (b. May 10, 1837, Macon, Ga., U.S.—d. Dec. 21, 1921, Washington, D.C.) U.S. politician. Born to a former slave and a white planter, he became a steward on river steamboats. At the outbreak of the American Civil War, he reached Union-held New Orleans, where he raised and led a company of black Union volunteers called the Corps d'Afrique (1862–63). After the war he was elected to the Louisiana senate (1868) and served as lieutenant governor (1871). Elected to the U.S. House of Representatives (1872) and Senate (1873), he was denied his seat in each body on unproved charges of election fraud. He subsequently became a lawyer and moved to Washington, D.C.

Pinchot \ˈpin-shō**, Gifford** (b. Aug. 11, 1865, Simsbury, Conn., U.S.—d. Oct. 4, 1946, New York, N.Y.) U.S. forestry and conservation pioneer. He graduated from Yale University and studied forestry in Europe. In 1892 he became the first professional U.S. forester. In 1896 he joined the national forest commission of the National Academy of Sciences and helped plan the U.S. system of forest reserves (later national forests). As chief of the U.S. Forest Service (1898–1910), he established the nation's forest-service system. He founded the Yale School of Forestry and taught there from 1903 to 1936. He served as governor of Pennsylvania from 1923 to 1927 and from 1931 to 1935.

Pinckney, Charles (b. Oct. 26, 1757, Charleston, S.C.—d. Oct. 29, 1824, Charleston, S.C., U.S.) U.S. statesman. A cousin of Charles C. Pinckney and Thomas Pinckney, he fought in the American Revolution. From 1784 to 1787 he served in the Continental Congress, where he was instrumental in calling for the Constitutional Convention. As a delegate to the convention from South Carolina, he proposed numerous provisions that were incorporated in the final draft of the Constitution of the United States. He helped write the South Carolina constitution and was also governor of the state (1789–92, 1796–98, 1806–08). He served in the U.S. Senate from 1798 to 1801 and as minister to Spain from 1801 to 1805.

Pinckney, Charles Cotesworth (b. Feb. 25, 1746, Charleston, S.C.—d. Aug. 16, 1825, Charleston, S.C., U.S.) U.S. soldier, statesman, and diplomat. A cousin of Charles Pinckney and the brother of Thomas Pinckney, he was an aide to George Washington in the American Revolution, commanded at Savannah, Ga., and was promoted to brigadier general in 1783. He was a delegate to the Constitutional Convention. Appointed minister to France (1796), he was involved in negotiations that ended in the XYZ Affair; when one of the group of French negotiators suggested that the U.S. representatives offer a gift in order to gain a peace treaty, Pinckney is said to have replied, "No! No! Not a sixpence!" He was the unsuccessful Federalist candidate for vice president in 1800 and for president in 1804 and 1808.

Pinckney, Eliza *orig.* **Elizabeth Lucas** (b. c. Dec. 28, 1722, Antigua, West Indies—d. May 26, 1793, Philadelphia, Pa., U.S.) British-American planter. The daughter of a British landowner in South Carolina, she managed his plantations from 1739. Experimenting with various crops, she succeeded in marketing the first American crop of indigo. After her marriage to the lawyer Charles Pinckney (1744), she revived the cultivation of silkworms and manufacture of silk on his plantation. She continued to manage their extensive landholdings after his death (1758). Charles C. Pinckney and Thomas Pinckney were her sons.

Pinckney, Thomas (b. Oct. 23, 1750, Charleston, S.C.—d. Nov. 2, 1828, Charleston, S.C., U.S.) U.S. soldier, politician, and diplomat. The brother of Charles C. Pinckney and a cousin of Charles Pinckney, he served as governor of South Carolina (1787–89) and as minister to Britain (1792–96). As special envoy to Spain (1795), he negotiated the Treaty of San Lorenzo, also called Pinckney's Treaty, which fixed the southern border of the U.S. and granted the U.S. navigation rights on the Mississippi River and the right of deposit (storage of goods) at New Orleans. He was a major general in the War of 1812.

Pindar (b. 518/522, Cynoscephalae—d. c. 438 BC, Argos) Greek poet. A Boeotian of aristocratic birth, Pindar was educated in neighbouring Athens and lived much of his life in Thebes. Almost all his early poems have been lost, but his reputation was probably established by his later hymns in honour of the gods. He developed into the greatest lyric poet of ancient Greece, respected throughout the Greek world. Of his 17 volumes, comprising almost every genre of choral lyric, only four have survived complete, and those lack his musical settings. The extant poems, probably representing his masterpieces, are odes (see Pindaric ode) commissioned to celebrate triumphs in various Hellenic athletic games. Lofty and religious in tone, they are noted for their complexity, rich metaphors, and intensely emotive language.

Pindaric ode Ceremonious poem in the manner of Pindar, who employed a triadic, or three-part, structure consisting of a strophe (two or more lines repeated as a unit) followed by a metrically harmonious antistrophe and an epode (summary line) in a different metre. The three parts correspond to movements onstage by the chorus in Greek drama. After the 16th-century publication of Pindar's choral odes in the epinicion (celebratory) form, poets writing in various vernaculars created irregular rhymed odes that suggest his style. Such odes in English are among the greatest poems in the language, including John Dryden's "Alexander's Feast," William Wordsworth's "Ode: Intimations of Immortality," and John Keats's "Ode on a Grecian Urn."

pine Any of 10 genera of coniferous trees (rarely shrubs) of the family Pinaceae (see conifer), native to northern temperate regions, especially about 90 species of ornamental and timber evergreen conifers of the genus *Pinus*. Needlelike leaves and cones are solitary or in bunches. Shallow root systems make pines susceptible to wind and surface disturbance. The family includes fir, Douglas fir, hemlock, spruce, larch, and cedar. Many species are sources of softwood timber, paper pulp, oils, and resins. Some are cultivated as ornamentals.

Cluster of pollen-bearing male cones of Austrian (black) pine (*Pinus nigra*).
GRANT HEILMAN/EB INC.

pineal \ˈpī-nē-əl, pī-ˈnē-əl\ **gland** *or* **pineal body** Endocrine gland in the brain that produces melatonin. It is large in children and begins to shrink at puberty. The gland may play a significant role in sexual maturation, circadian rhythm and sleep induction, and seasonal affective disorder and depression. In animals it is known to play a major role in sexual development, hibernation, and seasonal breeding.

Pineapple (*Ananas comosus*).
COURTESY OF DOLE COMPANY

pineapple Fruit-bearing plant (*Ananas comosus*) of the family Bromeliaceae, native to the New World tropics and subtropics but introduced elsewhere. Pineapple is served fresh where available and in canned form worldwide. It is a key ingredient in

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Polynesian cuisine. Like AGAVE and some YUCCAS, the plant has a rosette of 30–40 stiff, succulent leaves on a thick, fleshy stem. A determinate inflorescence forms 15–20 months after planting. After fertilization, the many lavender flowers fuse and become fleshy to form the 2–4 lb (1–2 kg) fruit. Ripening takes 5–6 months.

Pinero \pi-'nir-ō**, Sir Arthur Wing** (b. May 24, 1855, London, Eng.—d. Nov. 23, 1934, London) British playwright. He entered the theatrical world as an actor with HENRY IRVING's theatre company. His first play, *£200 a Year*, was produced in 1877. He wrote a series of successful farces such as *The Magistrate* (1885) before turning to dramas of social issues. *The Second Mrs. Tanqueray* (1893), the first of his plays depicting women confronting their situation in society, established his reputation, and he followed it with works such as *The Notorious Mrs. Ebbsmith* (1895) and *Trelawny of the "Wells"* (1898), becoming the most successful playwright of his time.

Ping Pong See TABLE TENNIS

Pinilla, Gustavo Rojas See Gustavo ROJAS PINILLA

pinion See GEAR, RACK AND PINION

Piniós River \,pē-nē-'ōs\ *or* **Peneus River** \pi-'nē-əs\ River, THESSALY, north-central Greece. It rises in the Pindus Mountains and flows about 125 mi (200 km) southeast and northeast through the plain of Thessaly and the Vale of TEMPE into the Gulf of Salonika (see Thessaloníki). In prehistoric times it formed a great lake before it broke through the Vale of Tempe. It is navigable in its lower course.

pink family Family Caryophyllaceae, composed of 2,070 species of flowering plants in 89 genera found mainly in northern temperate regions. The approximately 300 species of true pinks belong to the genus *Dianthus*; relatively easy to grow, these are popular in rock gardens for their fragrant, showy flowers. Though members of the pink family are diverse in appearance and habitat, most have swollen leaf and stem joints. The family includes CARNATIONS, BABY'S BREATH, SWEET WILLIAM, CAMPION, and CHICKWEED.

pink salmon Food fish (*Oncorhynchus gorbuscha*, family Salmonidae) of the North Pacific that constitutes half of the commercial fishery of Pacific SALMON. It weighs about 4.5 lbs (2 kg) and is marked with large, irregular spots. Pink salmon often spawn on tidal flats. The young enter the sea immediately after hatching.

Pinkerton National Detective Agency U.S. independent police force. The agency was founded in 1850 by Allan Pinkerton (1819–84), former deputy sheriff of Cook county, Ill. It originally specialized in railway theft cases, protecting trains and apprehending train robbers. It solved the $700,000 Adams Express Co. theft in 1856, and in 1861 it thwarted an assassination plot against president-elect ABRAHAM LINCOLN. It later participated in anti-labour union activities (see HOMESTEAD STRIKE). It was instrumental in breaking up the MOLLY MAGUIRES.

Pinkham \'piŋk-əm**, Lydia E(stes)** (b. Feb. 9, 1819, Lynn, Mass., U.S.—d. May 17, 1883, Lynn) U.S. patent-medicine proprietor. Pinkham began making Vegetable Compound as a home remedy, sharing it with her neighbours. Her compound, a blend of ground herbs, was 18% alcohol by content. In 1875 the Pinkham family decided to go into business selling the medicine, which Pinkham claimed could cure any "female complaint" from nervous prostration to a prolapsed uterus. It quickly gained acceptance, and the business was soon grossing close to $300,000 a year. Not until the 1920s, when federal regulation of drugs and advertising increased, did the Lydia E. Pinkham Medicine Co. reduce both the alcohol content of the medicine and the claims for its efficacy.

pinniped \'pi-nə-,ped\ Any member of the three existing families of aquatic, fin-footed mammals that constitute the suborder Pinnipedia (order Carnivora; see CARNIVORE). They include the Odobenidae (see WALRUS) and the Phocidae and Otariidae (see SEAL).

Pinochet (Ugarte) \,pē-nə-'shā,\ *Spanish* \,pē-nō-'che**, Augusto** (b. Nov. 25, 1915, Valparaiso, Chile) Head of Chile's military government (1974–90). A career military officer, he planned and led the coup d'état in which Pres. SALVADOR ALLENDE died. He immediately moved to crush liberal opposition and in the next three years arrested about 130,000 Chileans and foreigners, many of whom were tortured and some of whom were killed. He led a rapid transition to a free-market economy, which slowed inflation but led to acute hardship for the lower classes. A new constitution in 1981 granted him eight more years as president. Rejected in a plebiscite in 1989, he stepped down after free elections installed Patricio Aylwin in 1990. In 1998 he was arrested in England at the request of Spain and held for trial for crimes against Spanish citizens in Chile during his tenure; he was released 16 months later. He was then indicted in Chile for the murder of dissidents but was declared mentally unfit for trial.

pinochle \'pē-,nə-kəl\ Card game. In one popular version of pinochle three players use two packs of 24 cards ranking ace, 10, king, queen, jack, and 9 of each suit. Each player is dealt 15 cards, 3 at a time. Bidding is based on certain combinations of cards within the player's hand and an estimation of tricks, or hands, the player can win. The name derives from *Binokel*, a German game resembling bezique.

Pinsky, Robert (b. Oct. 20, 1940, Long Branch, N.J., U.S.) American poet and critic. Pinsky was poetry editor of *The New Republic* from 1979 to 1986. His own poems, many of which are to be found in *The Figured Wheel: New and Collected Poems* (1996), often explore the meaning of ordinary acts. He also did a notable verse translation of Dante's *Inferno* (1994). Pinsky was poet laureate consultant from 1997 to 2000.

pintail Any of four species (genus *Anas*, family Anatidae) of sleek, long-tailed, long-necked DABBLING DUCKS that are swift fliers and popular game birds. The common, or northern, pintail (*A. acuta*), widespread in the Northern Hemisphere, is a long-distance flier; some Alaskan birds winter in Hawaii. It is 26–30 in. (66–75 cm) long. The male has a white breast, gray back, and black tail; the female is mottled brown. The preferred diet is seeds. The brown, or yellow-billed, and the Bahama, or white-cheeked, pintails are primarily found in South America. The red-billed pintail is a grayish African species.

Pinter, Harold (b. Oct. 10, 1930, London, Eng.) British playwright. Born into a working-class family, he acted with touring companies until 1959. His early one-act plays were followed by the full-length *The Birthday Party* (1958). His next major plays, *The Caretaker* (1960) and *The Homecoming* (1965), established his reputation as an innovative and complex dramatist, sometimes considered as belonging to the THEATRE OF THE ABSURD. He often used disjointed small talk and lengthy pauses in dialogue to convey a character's thought, which often contradicts his speech. Pinter's later plays include *Old Times* (1971), *No Man's Land* (1975), *Betrayal* (1978; film, 1983), *Mountain Language* (1988), and *Moonlight* (1993). He also wrote radio and television plays as well as screenplays for *The Go-Between* (1970), *The French Lieutenant's Woman* (1981), and *The Handmaid's Tale* (1990). In 2005 he won the Nobel Prize for Literature.

pinto Spotted HORSE, also called paint, piebald, skewbald, and other terms to describe variations in colour and markings. The American Indian ponies of the western U.S. were often pintos. Most pure-breed associations refuse to register horses with pinto colouring. Pintos have colour patterns called overo (white spreading irregularly up from the belly, mixed with a darker colour) and tobiano (white spreading down from the back in smooth, clean-cut patterns).

Pinturicchio \,pēn-tü-'rēk-kyō\ *or* **Pintoricchio** \,pēn-tó-'rēk-kyō\ *orig.* **Bernardino di Betto di Biago** (b. c. 1454, Perugia, Romagna—d. Dec. 11, 1513, Siena, Republic of Siena) Italian painter. He assisted PERUGINO on the frescoes in the Vatican's SISTINE CHAPEL (1481–82). Painting in the early Renaissance style, he was more interested in decorative effects than in clarity of design; his most important work, the fresco decoration of six rooms in the Borgia Apartments for Pope ALEXANDER VI (1492–94), features brilliant colours, gilding, and ancient Roman ornamental motifs. His last major works were 10 scenes from the life of PIUS II in the Piccolomini Library of Siena Cathedral. He was also a prolific panel painter.

Pinworm (*Enterobius vermicularis*)
WALTER DAWN

pinworm Common species (*Enterobius vermicularis*) of NEMATODE parasitic to humans, especially children. Female pinworms may be 0.5 in. (13 mm) long; males are much smaller. Pinworms have a very long tail that gives them a pinlike appearance. They mate in the upper gastrointestinal tract, usually in the

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large intestine; the females travel to the anus, deposit their fertilized eggs on the skin near the anal opening, and die. The worms' movements cause itching; eggs transferred to the fingernails when the victim scratches may be passed to the mouth. Eggs can also be inhaled with air dust. The eggs or larvae make their way to the intestine, and the cycle begins again.

Pio, Padre *orig.* **Francesco Forgione** (b. May 25, 1887, Pietreclina, Italy—d. Sept. 23, 1968, San Giovanni Rotondo) Italian priest. Born into a devout Catholic family, he consecrated himself to Jesus at 5. At 15 he joined the Capuchins and took the name Pio; in 1910 he became a priest. That same year he received the stigmata for the first time. They were healed, but he received them again in 1918; this time they remained with him until his death. This and other signs of his holiness (perfume and, reportedly, the ability to be in two places at once), drew growing numbers of pilgrims to him. He was canonized in 2002.

Piombo, Sebastiano del See SEBASTIANO DEL PIOMBO

Pioneer First series of unmanned U.S. deep-space probes. Pioneers 0–4 were all intended to be lunar missions, but only Pioneer 4 succeeded in escaping Earth's gravity (1964). Pioneer 1 was the first spacecraft launched by NASA (1958). Pioneers 6–9 were successfully launched into solar orbits (1965–68) to study the SOLAR WIND, solar magnetic field, and COSMIC RAYS. Pioneer 10, launched in 1972, was the first space probe to traverse the ASTEROID belt and the first to fly by JUPITER (1973), where it discovered Jupiter's huge magnetic tail. It then became the first man-made object to exit the solar system. Pioneer 11's data and photographs (1979) enabled scientists to identify two previously undiscovered moons and an additional ring around SATURN and radiation belts in its magnetosphere. Two Pioneer Venus spacecraft, the Orbiter and the Multiprobe (Pioneer 12 and 13, respectively), reached VENUS in 1978. The Orbiter observed the planet's clouds and atmosphere and mapped its surface by radar; the Multiprobe released four instrument packages into the atmosphere at different locations.

pipa \'pē-'pä\ *or* **p'i-p'a** Short-necked Chinese lute. It has a pear-shaped body and a fretted fingerboard, and the silk strings are plucked with the fingernails. It is prominent in the opera orchestra and as an ensemble, solo, and accompanying instrument. The Japanese *biwa* is a similar instrument.

pipe, sacred See CALUMET

Pipestone National Monument National monument, southwestern Minnesota, U.S. Established in 1937, it has an area of 282 acres (114 hectares) and contains quarries of a reddish-coloured stone that was used by the PLAINS INDIANS to make ceremonial peace pipes. The stone is reserved for use by the Indians, who quarry it under special permits from the National Park Service. HENRY WADSWORTH LONGFELLOW popularized the quarries in "The Song of Hiawatha."

pipit *or* **fieldlark** Any of about 50 species (especially in the genus *Anthus*) of small, slender-bodied, ground-dwelling songbirds belonging to the family Motacillidae. Found worldwide except in polar regions and on some islands, they are brownish-streaked and 5–9 in. (12–23 cm) long. They have a thin, pointed bill, pointed wings, and elongated hind toes and claws. Named for their twittering sounds, they walk and run rapidly (but never hop), searching the ground for insects. Their flight is strongly undulating. Their white outer tail feathers show best in flight. See also WAGTAIL.

Pippin \'pe-pən\ **III** *or* **Pepin** *or* **Pippin the Short** (b. c. 714—d. Sept. 24, 768, Saint-Denix, Neustria) King of the Franks (751–768), the first king of the CAROLINGIAN DYNASTY and the father of CHARLEMAGNE. A son of CHARLES Martel, he became mayor of Neustria, Burgundy, and Provence in 741 and de facto ruler of the Franks when his brother entered a monastery in 747. With the backing of the pope, he deposed the last MEROVINGIAN ruler, Childeric III, in 751 and was crowned king by the bishops of his realm and, possibly, by the papal legate St. BONIFACE. Pippin was crowned king in 754 by Pope STEPHEN II. The king bestowed on the pope the Donation of Pippin and invaded Italy twice (754, 756) to protect the pope from the Lombards. He also put down revolts in Saxony and Bavaria and struggled to subdue rebellious Aquitaine. Pippin called several church councils and promoted religious reform in the kingdom.

Pippin, Horace (b. Feb. 22, 1888, West Chester, Pa., U.S.—d. July 6, 1946, West Chester) U.S. folk painter. Pippin served in the infantry in World War I, but he was wounded in 1918 and discharged with a partially paralyzed right arm. His first large canvas was an eloquent protest against war, *End of the War: Starting Home* (1931–34). His primary theme became the African American experience, as seen in his series entitled *Cabin in the Cotton* (mid 1930s) and his paintings of episodes in the lives of the antislavery leader John Brown and Pres. Abraham Lincoln. After the art world discovered Pippin in 1937, he received wide acclaim as the greatest black painter of his time.

piracy Illegal act of violence, detention, or plunder committed for private ends by the crew of a private ship (usually) against another ship on the HIGH SEAS. Air piracy (i.e., the HIJACKING of an aircraft) is a more recent phenomenon. Piracy has occurred in all stages of history: the Phoenicians, Greeks, and Romans engaged in it, as did the Vikings, Moors, and other Europeans. It also occurred among Asian peoples. During the wars between England and Spain in the late 16th century, treasure-laden Spanish galleons proceeding from Mexico into the Caribbean were a natural target for pirates. In the 16th–18th centuries pirates from North Africa's BARBARY COAST threatened commerce in the Mediterranean. The increased size of merchant vessels, improved naval patrolling, and recognition by governments of piracy as an international offense led to its decline in the late 19th century. In the late 20th century incidents of piracy occurred with increasing frequency in the seas of East and Southeast Asia. See also BLACKBEARD; FRANCIS DRAKE; JEAN LAFFITE; HENRY MORGAN.

Piraeus \pī-'rē-əs\ City (pop., 2001: 175,697), port of ATHENS, Greece. The port and its "long walls," fortified barriers connecting it with Athens, were completed in the mid-5th century BC. The walls were destroyed by SPARTA at the end of the PELOPONNESIAN WAR. Rebuilt under the Athenian leader Conon in 393 BC, Piraeus was burned in 86 BC by the Roman commander LUCIUS CORNELIUS SULLA. The city regained importance after AD 1834, when Athens became capital of the newly independent Greece. The largest port in Greece, it is the centre for all sea communication with the Greek islands.

Pirandello, Luigi (b. June 28, 1867, Agrigento, Sicily, Italy—d. Dec. 10, 1936, Rome) Italian playwright and novelist. He earned a doctorate in philology at the University of Bonn but turned to writing poetry, short stories, and several novels, including the successful *The Late Mattia Pascal* (1904). His first major play, *Right You Are (if You Think You Are)* (1917), explored the relativity of truth, a lifelong subject for Pirandello. *Six Characters in Search of an Author* (1921) contrasted art and life; it was followed by the tragedy *Henry IV* (1922). His other plays include *Each in His Own Way* (1924) and *Tonight We Improvise* (1930). He established the Teatro d'Arte in Rome and toured the world with his company (1925–27). Recognized as a major figure in 20th-century theatre, he was awarded the Nobel Prize for Literature in 1934.

Luigi Pirandello.
COURTESY OF THE ITALIAN INSTITUTE, LONDON

Piranesi \ˌpē-rä-'nā-sē**, Giovanni Battista** *or* **Giambattista Piranesi** (b. Oct. 4, 1720, Mestre, near Venice—d. Nov. 9, 1778, Rome, Papal States) Italian draftsman, printmaker, architect, and art theorist. He went to Rome at 20 as a draftsman for the Venetian ambassador. After settling there in 1747, he developed a highly original etching technique that produced rich textures and bold contrasts of light and shadow. His many prints of Classical and post-Classical Roman structures contributed to the growth of Classical archaeology and the NEOCLASSICAL art movement. He is best known today for his extraordinary series of imaginary prisons (*Carceri d'invenzione*, 1745). His prints are among the most impressive architectural representations in Western art.

piranha \pə-'rä-nə, pə-'rän-yə\ *or* **caribe** \kə-'rē-bē\ Any of several species of deep-bodied, carnivorous fishes in the genus *Serrasalmus* (family Characidae), abundant in rivers of eastern and central South America and noted for voracity. The red-bellied piranha (*S. nattereri*) grows to 2 ft (60 cm) long, but most species are smaller. Some species are silvery with an orange belly and throat; others are almost completely black. All have sharp, saw-edged teeth that close in a scissorlike bite. Traveling in groups, they usually prey on other fishes, but red-bellied piranhas occasionally converge on larger animals. Though generally scavengers, they are attracted to the scent of blood and can quickly reduce even a large animal to a skeleton.

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Pirquet \pir-'kā**, Clemens, baron von** (b. May 12, 1874, Vienna, Austria—d. Feb. 28, 1929, Vienna) Austrian physician. In 1906 he noticed that patients who received two injections of horse serum or smallpox vaccine usually had quicker, more severe reactions (which he called "allergies") to the second injection. While studying cowpox vaccination symptoms, he also developed a new theory about infectious diseases' incubation times and about antibody formation. In the Pirquet test, a drop of tuberculin is scratched into the skin; a red, raised area developing at the site (Pirquet reaction) indicates tuberculosis.

Pisa \'pē-zə,\ *Italian* \'pē-sä\ *ancient* **Pisae** City (pop., 2001 prelim.: 85,379), central Italy. Located on the Arno River, Pisa probably began as an Etruscan town. It became a Roman colony c. 180 BC. A Christian bishopric by AD 313, it flourished during the Middle Ages as the principal urban centre of Tuscany. Pisa's participation in the Crusades made it a rival of Genoa and Venice. It became part of the Kingdom of Italy in 1860. The city was the scene of heavy fighting during World War II. It is now an important railway junction. Its cathedral, the Leaning Tower of Pisa, and other attractions, make it a tourist destination. It is the site of the University of Pisa (founded 1343) and the birthplace of Galileo.

Pisano \pi-'sä-nō, pi-'zä-nō**, Andrea** *or* **Andrea da Pontedera** (b. c. 1270–90, Pontedera, near Pisa—d. c. 1348/49, Orvieto, Papal States) Italian sculptor and architect. He created the earliest of three bronze doors for the Baptistery of the cathedral of Florence (1330–36). On Giotto's death in 1337, Andrea succeeded him as chief architect of the cathedral's bell tower, to which he added two stories adorned with panel reliefs. In 1347 he was appointed superintending architect of the cathedral of Orvieto. One of the most important Italian sculptors of the 14th century, he is known for his restrained style and skillful arrangement of figures.

Pisano, Giovanni (b. c. 1250, Pisa—d. after 1314, Siena?) Italian sculptor and architect. His early work is similar to that of Nicola Pisano, his father and teacher. About 1285 he began work on the facade of Siena's cathedral, whose lavish and ordered design and ornamentation became the model for future Gothic facade decoration in central Italy. His other great achievement, the Pistoia pulpit (c. 1298–1301), is characterized by extreme agitation, its figures, animals, drapery, and landscape being wrenched into physically impossible configurations. His pulpit for the Pisa cathedral (1302–10) is much more Classical, perhaps to accord with Giotto's monumental style, then in the ascendancy. Though regarded as Italy's only true Gothic sculptor, he never lost sight of the heritage of Classical Rome.

Pisano, Nicola (b. c. 1220, Apulia?—d. 1278/84, Pisa?) Italian sculptor. His work, along with that of his son, Giovanni Pisano, created a new sculptural style for the late 13th and 14th centuries in Italy. His greatest work, the pulpit in the Baptistery of Pisa Cathedral (1260), is extraordinary in its assertion of a new style, distinct from all its predecessors though indebted to them. The work draws on many motifs, including Roman reliefs, early Christian frescoes and mosaics, and French Gothic architecture and sculpture, but assimilates them, creating a unified whole that gave a new sense of direction to Tuscan art.

Adoration of the Magi (detail) by Nicola Pisano, c. 1259–60; part of the marble pulpit in the Baptistery at Pisa.
ALINARI/ART RESOURCE, NEW YORK

Pisces \'pī-ˌsēz\ (Latin: "Fishes") In astronomy, the constellation lying between Aries and Aquarius; in astrology, the twelfth sign of the zodiac, governing approximately the period February 19–March 20. Its symbol is two fish tied together. These are a reference to the Greek myth of Aphrodite and Eros, who jumped into a river to escape the monster Typhon and were changed into fish. In another version of the myth, two fish carried them to safety.

Pishpek See Bishkek

Pisidia \pi-'si-dē-ə\ Ancient region, southern Anatolia. Most of it was composed of the Taurus Mountains, which provided refuge for a lawless population that resisted successive conquerors. It was incorporated into the Roman province of Galatia in the early 1st century AD and became part of Lycia and Pamphylia under the emperor Vespasian in AD 74. Diocletian included Pisidia in the diocese of Asia c. 297. During Byzantine times it continued to be a region of revolt. By 1204 the Byzantine Empire had lost control of the region to Turkish invaders.

Pissarro \pə-'sär-ō**, (Jacob-Abraham-) Camille** (b. July 10, 1830, St. Thomas, Danish West Indies—d. Nov. 13, 1903, Paris, France) West Indian-born French painter. The son of a prosperous Jewish merchant, he moved to Paris in 1855. His earliest canvases are broadly painted figure paintings and landscapes; these show the careful observation of nature that was to remain a characteristic of his art. In 1871 he took a house in Pontoise, in the countryside outside Paris. These surroundings formed the theme of his art for some 30 years. Pissarro's leading motifs during the 1870s and 1880s were houses, factories, trees, haystacks, fields, labouring peasants, and river scenes. In these works, forms do not dissolve but remain firm, and colours are strong; during the latter part of the 1870s his comma-like brushstrokes frequently recorded the sparkling scintillation of light. These works were admired by the Impressionist artists; Pissarro was the only Impressionist painter who participated in all eight of the group's exhibitions. Despite acute eye trouble, his later years were his most prolific.

Self-portrait by Camille Pissarro, oil on canvas, 1903; in the Tate Gallery, London.
COURTESY OF THE TRUSTEES OF THE TATE GALLERY, LONDON

pistachio \pə-'sta-shē-ˌō\ Any of nine species of aromatic trees and shrubs, some ornamental, that make up the genus *Pistacia* of the sumac (or cashew) family, native to Eurasia, with one species in southwestern North America and another in the Canary Islands. Commercial pistachio nuts are seeds from the fruit of *P. vera*. They have a pleasing, mild, resinous flavour and are used extensively as food and for yellowish green colouring in confections. The tree bears leaves with thick, wide, leathery, featherlike leaflets and small fruit in clusters.

pistil Female reproductive part of a flower. Centrally located, the pistil typically has a swollen base called the ovary, which contains the potential seeds (ovules). The stalk (style) arises from the ovary and has a pollen-receptive tip, the stigma, which is variously shaped and often sticky. There may be a single pistil, as in the lily, or several to many pistils, as in the buttercup. Each pistil is constructed of one to many rolled leaflike structures, or carpels. Differences in the composition and form of the pistil are useful in classifying flowering plants. See also stamen.

pistol Small firearm designed to be operated with one hand. The name may derive from the city of Pistoia, Italy, where handguns were made as early as the 15th century. It was originally a cavalry weapon. However, because the firepower of pistols must be kept low in order to reduce them to manageable weight, and because only skilled soldiers can shoot them accurately beyond 10 yards, they have never been satisfactory military weapons. In legal use, pistols are most frequently carried by police and other security personnel and serve mainly as a defensive weapon of last resort. Their compact size, low cost, and ease of operation make them a common weapon in violent crime, so that pistols are a common object of laws regulating the ownership of firearms. The two classes of pistol are revolvers and automatics. Automatics have a mechanism, actuated by the energy of recoil, that feeds cartridges from a magazine in the grip. See illustration on opposite page.

piston and cylinder In mechanical engineering, a sliding cylinder with a closed head (the piston) that moves up and down (or back and forth) in a slightly larger cylindrical chamber (the cylinder) by or against pressure of a fluid, as in an engine or pump. The cylinder of a steam engine is closed by plates at both ends, with provision for the piston rod, which is rigidly attached to the piston, to pass through one of the end cover plates. The cylinder of an internal-combustion engine is closed at one end by a plate called the head and open at the other end to permit free oscillation of the connecting rod, which joins the piston to the crankshaft.

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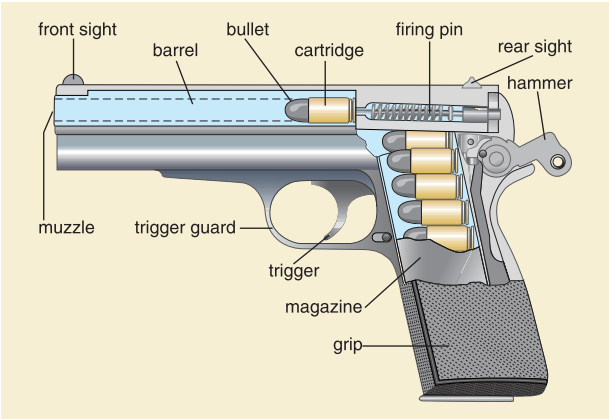

Parts of a semiautomatic pistol.
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pit bull terrier *or* **Staffordshire terrier** Dog breed developed in 19th-century Britain for fighting other dogs in pits. It was created by crossing the BULLDOG (which at the time was longer-legged and more agile) with a terrier, possibly the FOX TERRIER. Once known by such names as bull-and-terrier and half-and-half, the pit bull is a stocky, muscular, unusually strong dog with powerful jaws, standing 17–19 in. (43–48 cm) tall and weighing 30–50 lb (14–23 kg). Its stiff, short coat may be any colour, solid or variegated. See also BULL TERRIER.

pit viper Any species of VIPER (subfamily Crotalinae) that has, in addition to two movable fangs, a heat-sensitive pit organ between each eye and nostril which together help it accurately aim its strike at its warm-blooded prey. Pit vipers are found from deserts to rain forests, primarily in the New World. They may be terrestrial, arboreal, or aquatic. Some species lay eggs; others produce live young. See also BUSHMASTER, COPPERHEAD, FER-DE-LANCE, MOCCASIN, RATTLESNAKE.

Pitcairn Island Island (pop., 2003 est.: 47) and British overseas territory, south-central PACIFIC OCEAN. It is the only inhabited island of the Pitcairn island group, which also includes Henderson, Ducie, and Oeno islands. It has an area of about 2 sq mi (5 sq km). Discovered in 1767 by the British, it was uninhabited until 1790, when it was settled by mutineers from HMS *BOUNTY*, led by Fletcher Christian. Pitcairn was annexed by Britain in 1838. The inhabitants were removed to NORFOLK ISLAND in 1856 because of overpopulation. Some returned to Pitcairn, and it is their descendants who make up the present population, subsisting on fishing and farming. In 1970 the British High Commissioner in NEW ZEALAND was appointed Pitcairn's governor.

pitch In music, position of a single sound in the complete range of sound; this quality varies with the number of vibrations per second (hertz, Hz) of the sounding body and is perceived as highness or lowness. A higher pitch has a higher number of vibrations. In Western music, standard pitches have long been used to facilitate tuning. A confusing variety of pitches prevailed until the 19th century, when the continual rise in pitch made some international agreement a matter of practical necessity. In 1939 the A above middle C was standardized as 440 Hz. See also INTERVAL; TUNING AND TEMPERAMENT.

pitchblende Amorphous, dense, black, pitchy form of the crystalline uranium oxide mineral URANINITE; it is one of the primary mineral ores of URANIUM. Pitchblende is found in granular masses and has a greasy lustre. Three chemical elements were first discovered in pitchblende: uranium, polonium, and RADIUM. Deposits, frequently in association with uraninite or with secondary uranium minerals, are known in the Czech Republic, Britain, the Northwest Territories and Saskatchewan in Canada, and Arizona, Colorado, Montana, New Mexico, and Utah in the U.S.

Pitcher, Molly (b. c. 1753—d. Jan. 22, 1832, Carlisle, Pa., U.S.) U.S. patriot. Little is known of her early life, though she is thought to have been Irish. In the AMERICAN REVOLUTION she accompanied her husband, William Hays, a gunner, at the Battle of Monmouth (1778), where she carried pitchers of water to wounded American soldiers, earning the nickname "Molly Pitcher." According to legend, after her husband collapsed from the heat, she took his place at the cannon and served heroically through the battle. In 1822 she was recognized for her heroism with a state pension. Some historians attribute the act of replacing her husband at the cannon to Margaret Corbin (1751–1800) in the attack on Fort Washington in 1776.

pitcher plant Any CARNIVOROUS PLANT with pitcher-, trumpet-, or urn-shaped leaves. Several families include pitcher plants: Nepenthaceae (Old World pitcher plants), Cephalotaceae, Asclepiadaceae (MILKWEED FAMILY), and especially Sarraceniaceae (New World pitcher plants, particularly those in the eastern North American genus *Sarracenia*). Pitcher plants inhabit bogs, swamps, wet or sandy meadows, or savannas where the soils are water-saturated, acidic, and deficient in nitrates or phosphates. Their unusual tubular leaves have a series of nectar-secreting glands that extend from the lip down into the interior and attract insects. Once in the plant, the prey tumbles down into a liquid pool and drowns, after which an enzyme secreted within the leaf digests it, releasing nitrates and other nutrients, which supplement the meager nutrient supply of bogs. Most pitcher plants produce pitcher-shaped, insect-catching leaves in the spring and tubeless leaves in the fall. Their flowers are showy and have an agreeable scent.

Yellow pitcher plant (*Sarracenia flava*).
JEFF LEPORE/PHOTO RESEACHERS

pitot tube \'pē-ˌtō\ Instrument for measuring the velocity (speed) of a flowing FLUID. Invented by Henri Pitot (1695–1771), it consists of a tube with a short, right-angled bend, which is placed vertically in a moving fluid with the mouth of the bent part directed upstream; the PRESSURE, measured with an attached device, depends on the fluid flow and can be used to calculate the velocity. Pitot tubes are used to measure airspeed in WIND TUNNELS and aboard aircraft in flight; they are also used to measure the flow of liquids (see FLOW METER).

Pitt, William, the Elder *later* **1st earl of Chatham** (b. Nov. 15, 1708, London, Eng.—d. May 11, 1778, Hayes, Kent) British statesman and orator, twice virtual prime minister (1756–61, 1766–68). He entered Parliament in 1735 and provoked controversy with his maiden speech, which criticized the ministry of ROBERT WALPOLE. With the outbreak of the SEVEN YEARS' WAR, he was named secretary of state and became virtual prime minister. His leadership brought many British victories that greatly extended the British Empire. His wide popular appeal led to the nickname "the Great Commoner," though he was disliked by many in government for his high-handedness. He resigned in 1761 when the cabinet refused to declare war on Spain. He became a champion of liberty and spoke in favour of American colonial resistance to the STAMP ACT. He formed another government in 1766, in which he served as lord privy seal, but he resigned in 1768 because of ill health. Widely mourned on his death in 1778, he was buried in Westminster Abbey.

Pitt, William, the Younger (b. May 28, 1759, Hayes, Kent, Eng.—d. Jan. 23, 1806, London) British statesman and prime minister (1783–1801, 1804–06). The son of WILLIAM PITT, he entered Parliament in 1781 and served as chancellor of the Exchequer (1782–83). He was appointed prime minister in 1783 and undertook reforms that reduced the large national debt incurred by the AMERICAN REVOLUTION, reduced tariffs, placed the EAST INDIA CO. under government control, and restructured the government in India. Forced into conflict with France by the FRENCH REVOLUTIONARY WARS, he formed a series of coalitions with European states against France (1793, 1798, 1805). Pitt responded to demands by radicals for parliamentary reform

William Pitt the Younger, detail of an oil painting by John Hoppner; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

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with repressive measures. In 1800 he secured the Act of Union with Ireland but resigned in 1801 when his proposal for Catholic emancipation was denied. His second term as premier (1804–06) was marked by the collapse of the Third Coalition after the Battles of Ulm and Austerlitz, the news of which weakened his already fragile health.

pittosporum \pə-'täs-pə-rəm\ Any of various evergreen shrubs or trees, mainly from Australia and New Zealand, that make up the genus *Pittosporum* (family Pittosporaceae), commonly known as Australian laurel. They are planted especially as ornamentals in warm regions. The most popular and hardiest species, called tobira, or house-blooming mock orange (*P. tobira*), is native to China and Japan; it is a popular fragrant hedge plant in warm climates and a handsome indoor plant elsewhere.

Pittsburgh City (pop., 2000: 334,563), southwestern Pennsylvania, U.S. It is situated at the confluence of the Allegheny and Monongahela rivers where they form the Ohio River. In 1758 the French Fort Duquesne was captured there by the British, and the site was renamed Pitt. It was incorporated as a borough in 1794 and as a city in 1816. In the 19th century it developed rapidly as a steel-manufacturing centre. The American Federation of Labor began there in 1881 (see AFL-CIO). The second-largest city in the state, it is the centre of an urban industrial complex that includes several neighbouring cities. There are more than 150 industrial research laboratories in the area. It is home to the University of Pittsburgh, Carnegie Mellon University, and other educational institutions.

Pittsburgh Platform Manifesto of Reform Judaism, drawn up in 1885 by a conference of rabbis chaired by Isaac Mayer Wise in Pittsburgh, Pa. It declared that Judaism taught the highest conception of God, but it recognized the efforts of other religions to grasp the truth. The Bible was understood as the primary instrument of moral and religious instruction even though it reflected the primitive ideas of the time of its composition. It rejected the Mosaic and rabbinic laws regulating diet and dress, accepting only those laws that elevate the spirit. The Pittsburgh Platform looked forward to the messianic kingdom and accepted the immortality of the soul but not resurrection of the body. It advocated social justice and universal moral reform and maintained that Judaism was an evolving religion. It remained the official philosophy of the U.S. Reform movement until 1937, when the Columbus Platform moved Reform Judaism back to a more traditional position.

pituitary \pə-'tü-ə-ˌter-ē\ **gland** *or* **hypophysis** \hī-'päf-ə-səs\ Endocrine gland lying on the underside of the brain. It plays a major part in regulating the endocrine system. Its anterior lobe secretes most of the pituitary hormones, which stimulate growth (see growth hormone); egg and sperm development; milk secretion; release of other hormones by the thyroid gland, adrenal glands, and reproductive system; and pigment production. The posterior lobe stores and releases hormones from the hypothalamus that control pituitary function, uterine contraction and milk release, and blood pressure and fluid balance.

Pius \'pī-əs\ **II** *orig.* **Enea Silvio Piccolomini** (b. Oct. 18, 1405, Corsignano, Republic of Siena—d. Aug. 14/15. 1464, Ancona, Papal States) Pope (1458–64). An Italian diplomat who became bishop of Trieste (1447) and Siena (1449), he mediated between the German princes and the papacy, arranged the coronation of Frederick III as Holy Roman emperor (1452), and made peace with Aragon and Naples. As pope he tried to unite Europe in a Crusade against the Turks, but he was unable to win the support of the Christian princes. Pius was also a noted humanist and a prolific writer on the events of his day.

Pius V, Saint *orig.* **Antonio or Michele Ghislieri** (b. Jan. 17, 1504, Bosco, duchy of Milan—d. May 1, 1572, Rome, Papal States; canonized May 22, 1712; feast day April 30) Pope (1566–72). He joined the Dominican order at age 14 and was ordained in 1528. A relentless pursuer of heretics, he was named commissary general of the Inquisition in 1551. By 1556 he was a cardinal, and in 1566 he was elected pope. He zealously carried out church reforms and succeeded in keeping Protestantism out of Italy. In 1570 he excommunicated Elizabeth I, thus worsening the position of Catholics in England. He organized the campaign that led to the victory of the Spanish, Venetian, and papal fleets over the Turks in the Battle of Lepanto in 1571.

Pius IX *orig.* **Giovanni Maria Mastai-Ferretti** (b. May 13, 1792, Senigallia, Papal States—d. Feb. 7, 1878, Rome; beatified Sept. 3, 2000; feast day February 7) Pope (1846–78). He became an archbishop in 1827, a cardinal in 1840, and pope on the death of Gregory XVI (1831–46). He set out to make liberal reforms, but the revolutionary fervour of 1848 frightened him into extreme conservatism. He proclaimed the dogma of the Immaculate Conception (1854) and convened the First Vatican Council (1869–70), which promulgated the doctrine of papal infallibility. After losing temporal power to Victor Emmanuel II upon Italian unification, he regarded himself as a "prisoner in the Vatican" and refused any contact with the Italian government. Pius's pontificate was the longest in history. He was beatified in 2000 by Pope John Paul II (1978–2005).

Pius IX.
FELICI

Pius X, Saint *orig.* **Giuseppe Melchiorre Sarto** (b. June 2, 1835, Riese, Venetia, Austrian Empire—d. Aug. 20, 1914, Rome, Italy; canonized May 29, 1954; feast day August 21) Pope (1903–14). Born in the Italian region of Venetia, he became bishop of Mantua in 1884 and patriarch of Venice in 1893. He was elected pope in 1903 and soon became known both for his piety and for his staunch religious and political conservatism. Pius suppressed the Catholic intellectual movement known as Modernism and opposed the political movement for social reform known as Christian Democracy. He worked to organize the laity for collaboration in the church's apostolic work, and he reformed the Catholic liturgy. His decision to systematize canon law led to the publication of the new code in 1917, which became effective in 1918.

Pius XII *orig.* **Eugenio Maria Giuseppe Giovanni Pacelli** (b. March 2, 1876, Rome, Italy—d. Oct. 9, 1958, Castel Gandolfo) Pope (1939–58). Before succeeding Pius XI in 1939, he served in the papal diplomatic service and as secretary of state to the Holy See. He was active in humanitarian work with prisoners and refugees during World War II but has been criticized by some for not having done more to prevent or battle the Holocaust. In the postwar era he was a defender of persecuted Catholics in communist countries. Known for his austere conservatism, he in 1950 defined the dogma of the bodily Assumption of the Virgin.

Pius XII, photograph by Yousuf Karsh.
© KARSH FROM RAPHO/PHOTO RESEARCHERS

Pius, Sextus Pompeius Magnus See Sextus Pompeius Magnus Pius

pixel *in full* **picture element** Smallest resolved unit of a video image that has specific luminescence and colour. Its proportions are determined by the number of lines making up the scanning raster (the pattern of dots that form the image) and the resolution along each line. In the most common form of computer graphics, the thousands of tiny pixels that make up an individual image are projected onto a display screen as illuminated dots that from a distance appear as a continuous image. An electron beam creates the grid of pixels by tracing each horizontal line from left to right, one pixel at a time, from the top line to the bottom line. A pixel may also be the smallest element of a light-sensitive device, such as cameras that use charge-coupled devices (see CCD).

Pizarro, Francisco (b. c. 1475, Trujillo, Extremadura, Castile—d. June 26, 1541, Lima) Conquistador who seized the Inca empire for Spain. In 1510 he enrolled in an expedition of exploration in the New World, and three years later he joined Vasco Núñez de Balboa on the expedition that discovered the Pacific. He made two voyages of discovery down the Colombian coast (1524–25, 1526–28) and continued his explorations southward, naming the new territory Peru. In 1531 he set sail for Peru with his 4 brothers, 180 men, and 37 horses. He soon encountered emissaries of the Inca emperor, Atahuallpa, and arranged a meeting. There his men slaughtered the emperor's unarmed retainers and took him hostage. After

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accepting a rich ransom for Atahuallpa's release, Pizarro had him garroted. He spent the rest of his life consolidating Spain's hold on Peru. He founded Lima (1535), where he was killed by fellow Spaniards he had betrayed.

Pizarro, Gonzalo (b. 1502?, Trujillo, Spain—d. April 10, 1548, Cuzco, Peru) Spanish explorer and conqueror. With his half brother Francisco Pizarro, he took part in the conquest of Peru (1531–33), for which he received extensive land grants and was made governor of Quito (1539). In 1541–42 he led a disastrous expedition into the unexplored region east of Quito that cost the lives of almost 200 Spaniards and 4,000 Indians. He returned to find that Spain had restricted the conquerors' privileges; the conquistadores revolted against the viceroy, and Pizarro led the anti-royalist forces to victory at the Battle of Anaquito (1546), but they were defeated in 1548, and he was executed.

pizza Food of Neapolitan origin. It consists of a flattened disk of bread dough, typically topped with olive oil, tomatoes, and mozzarella cheese, baked quickly, and served hot. Pizza is eaten throughout Italy, with regional variations in toppings. Pizza came to the U.S. with Italian immigrants; the first U.S. pizzeria opened in 1905, and pizza became one of the nation's favourite foods after World War II. It is now popular worldwide.

PKK See Kurdistan Workers Party

PKU See phenylketonuria

PL Kyodan \'pē-'el-'kyō-dän\ *in full* **Perfect Liberty Kyodan** Religious group founded in Japan by Miki Tokuchika in 1946 as a revival of his father's group, Hito-no-michi. Unaffiliated with any of the major religious traditions of Japan, it teaches that the goal of human life is joyful self-expression. Misfortune and suffering come from forgetting God, but the believer may pray that his troubles be transferred to the patriarch, who is strengthened for vicarious suffering by the group's collective prayers. Today PL Kyodan claims more than 2.5 million adherents worldwide. The sect's headquarters are at Habikino, near Osaka.

placenta \plə-'sen-tə\ Organ in most mammals that develops in the uterus along with a fetus to mediate metabolic exchange. The umbilical cord attaches it to the fetus at the navel. Nutrients and oxygen in the mother's blood pass across the placenta to the fetus, and metabolic wastes and carbon dioxide from the fetus cross in the other direction; the two blood supplies do not mix. Other substances (e.g., alcohol or drugs) in the mother's blood can also cross the placenta, with effects including congenital disorders and drug addiction in the newborn (see fetal alcohol syndrome); some microorganisms can cross it to infect the fetus, but so do the mother's antibodies. The placenta, weighing a pound or more at the end of pregnancy, is expelled at parturition. Some animals eat it as a source of nutrients; in some species this stimulates lactation.

placer deposit Natural concentration of heavy minerals caused by the effect of gravity on moving particles. When heavy, stable minerals are freed from their matrix by weathering processes, they are slowly washed downslope into streams that quickly winnow the lighter matrix. Thus the heavy minerals become concentrated in stream, beach, and lag (residual) gravels and constitute workable ore deposits. Minerals that form placer deposits include gold, platinum, cassiterite, magnetite, chromite, ilmenite, rutile, native copper, zircon, monazite, and various gemstones.

placer mining Oldest method of recovering gold from alluvial deposits. It takes advantage of gold's high density, which causes it to sink more rapidly from moving water than the lighter siliceous materials with which it is found. Panning, used by 19th-century miners, employed a pan in which a few handfuls of the gold-bearing soil or gravel and a large amount of water were placed; by swirling the pan's contents, the miner washed the siliceous material over the side, leaving the gold and heavy materials behind. Dredging is the most important placer-mining method today. Used worldwide is the bucket-ladder dredge, with its continuous chain of buckets rotating around a rigid adjustable frame called the ladder. In sluicing, a slightly sloping wooden trough called a box sluice, or a ditch cut in hard gravel or rock called a ground sluice, is used as a channel along which gold-bearing gravel is carried by a stream of water. Riffles placed transversely along the bottom of the sluice cause the water to eddy into small basins, retarding the current so that gold may settle.

Placid, Lake See Lake Placid

plagioclase \'plā-jē-ə-ˌklās\ Any member of the series of abundant feldspar minerals that usually occur as light- to medium-grey-coloured, transparent to translucent grains or crystals. Plagioclase ranges in composition from albite to anorthite. It is used in the manufacture of glass and ceramics; iridescent varieties are valued as gemstones. The primary importance of plagioclase, however, derives from its role as a rock-forming mineral.

plague \'plāg\ Infectious fever caused by the bacterium *Yersinia pestis*, carried by the rat flea. It usually spreads to humans only when the flea runs out of rodent hosts. It takes three forms. Bubonic, the mildest, has characteristic swollen lymph nodes (buboes) and is spread only by the flea. It accounts for three-fourths of plague cases. Pneumonic plague has extensive lung involvement and is spread in droplets from the lungs; it is often fatal in three or four days without treatment. In septicemic plague, bacteria overwhelm the bloodstream and often cause death within 24 hours, before other symptoms have a chance to develop. In the 14th century, plague ravaged Europe and Asia and was called the Black Death. Plague does not respond to penicillin, but other antibiotics are effective. Sanitary measures against fleas and rodents, quarantine, and extreme caution in handling infectious materials help to suppress epidemics. A vaccine can prevent plague.

plaice Commercially valuable European flatfish (*Pleuronectes platessa*). At most 36 in. (90 cm) long, the plaice normally has both eyes on the right side of the head and four to seven bony bumps near its eyes. It is brown with red or orange spots. The American plaice (*Hippoglossoides platessoides*) is found in both Europe (where it is called the rough dab) and the U.S. It is reddish or brownish and grows to about 24 in. (60 cm) long.

Plaice (*Pleuronectes platessa*)
JACQUES SIX

plain Any relatively level area of the Earth's surface that exhibits gentle slopes and small local relief (differences in elevation). Occupying slightly more than one-third of the terrestrial surface, plains are found on all continents except Antarctica. Some are tree-covered, and others are grassy. Still others support scrub brush and bunch grass, and a few are nearly waterless deserts. With certain exceptions, plains have become the sites of major centres of population, industry, commerce, and transportation.

Plain, the *French* **la Plaine** In the French Revolution, the centrist deputies in the National Convention. They formed the majority of the assembly's members and were essential to the passage of any measures. Their name derived from their place on the floor of the assembly; above them sat the members of the Mountain, or Montagnard. Led by Emmanuel-Joseph Sieyès, the Plain initially voted with the moderate Girondins but later joined the Montagnards in voting for the execution of Louis XVI. In 1794 they helped overthrow Maximilien de Robespierre and other extreme Jacobins (see Jacobin Club).

Plain of Esdraelon See Plain of Esdraelon

Plain of Reeds See Plain of Reeds

Plain of Sharon See Plain of Sharon

Plains Indian Any member of various Native American tribes that formerly inhabited the Great Plains of the U.S. and southern Canada. Plains Indians are popularly regarded as the typical American Indians. They were essentially big-game hunters, the buffalo being a primary source of food and equally important as a source of materials for clothing, shelter, and tools. Until supplanted by the white settlers from the 16th century onward, the Plains Indians occupied the area between the Mississippi River and the Rocky Mountains, which includes portions of both the United States and Canada. It is a vast grassland stretching from northern Alberta and Saskatchewan in Canada to the Rio Grande border of Texas. The Arapaho, Assiniboin, Blackfoot, Cheyenne, Comanche, Plains Cree, Crow, Hidatsa, Kiowa, Mandan, Osage, Pawnee, and Sioux are Plains Indians.

Plains of Abraham See Plains of Abraham

planarian \plə-'nar-ē-ən\ Any of about 3,000 species of widely distributed, mostly free-living flatworms of the family Planariidae and related families (class Turbellaria), usually found in freshwater but also in marine and terrestrial environments. The soft, ciliated body is leaf-shaped when elongated. The spade-shaped head has two eyes and sometimes tentacles. The tail is pointed. The mouth is on the lower side, often more than halfway

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toward the tail. Most species are 0.1–0.6 in. (3–15 mm) long; some grow to about 1 ft (30 cm). Planarians swim with an undulating motion or creep like slugs. Most feed at night on protozoans, snails, and other worms.

Planck \'plänk**, Max (Karl Ernst Ludwig)** (b. April 23, 1858, Kiel, Schleswig—d. Oct. 4, 1947, Göttingen, W.Ger.) German physicist. He studied at the Universities of Munich and Kiel, then became professor of theoretical physics at the University of Berlin (1889–1928). His work on the second law of thermodynamics and blackbody radiation led him to formulate the revolutionary quantum theory of radiation, for which he received a Nobel Prize in 1918. He also discovered the quantum of action, now known as Planck's constant, *h*. He championed ALBERT EINSTEIN's special theory of RELATIVITY, but he opposed the indeterministic, statistical worldview introduced by NIELS BOHR, MAX BORN, and WERNER HEISENBERG after the advent of QUANTUM MECHANICS. As the influential president of the Kaiser Wilhelm Society (later the Max Planck Society) until his resignation in 1937, he appealed to ADOLF HITLER to reverse his devastating racial policies. His son was later implicated in the JULY PLOT against Hitler and was executed.

plane tree Any of ten species of large trees that make up the genus *Platanus*, sole genus of the family Platanaceae, native to North America, eastern Europe, and Asia. Plane trees are planted widely in cities for their resistance to diseases and to air pollution and because they grow rapidly and furnish quick shade. They are characterized by scaling bark; large, deciduous, usually lobed leaves; and globular heads of flower and seed. Ball-shaped smooth or bristly seed clusters, which dangle singly and often persist after leaf fall, are key identifiers. Winter bark is patchy and picturesque; as the outer bark flakes off, inner bark shows shades of white, gray, green, and yellow.

planer Metal-cutting MACHINE TOOL in which the workpiece is firmly attached to a horizontal table that moves back and forth under a single-point cutting tool. The tool-holding device is mounted on a crossrail so that the tool can be moved across the table in small sideward movements. Since the cutting tool can be moved at almost any angle, a wide variety of grooves and surfaces can be generated. Mechanical planers, or surfacers, are also used to smooth wood to an even thickness. Planers perform the same operations as SHAPERS but can machine workpieces up to 50 ft (15 m) long.

planet Any large body orbiting the SUN or another STAR (see PLANETS OF OTHER STARS); COMETS, ASTEROIDS, meteoroids (see METEOR), and natural SATELLITES are excluded. The word comes from the Greek for "wanderer," because their positions change relative to those of the stars. The nine major planets known to revolve around the Sun, in order of increasing distance, are MERCURY, VENUS, EARTH, MARS, JUPITER, SATURN, URANUS, NEPTUNE, and PLUTO. The first four are called terrestrial planets and the next four Jovian planets. Pluto, distinct from either group, resembles a giant comet or one of the icy satellites of the Jovian planets. The terrestrial planets are less than 8,000 mi (13,000 km) in diameter and rocky, with comparatively thin or negligible atmospheres. The Sun's heat is thought to have prevented the abundant gases in the original SOLAR NEBULA from condensing in them. The Jovian planets formed farther out, where the gases were cool enough to condense, so the planets grew very massive and accumulated huge atmospheres of light gases, mainly hydrogen and helium. Called gas giants, the Jovian planets appear to be similar in structure; none has an accessible surface. Pluto is by far the smallest body traditionally called a major planet, although many astronomers now consider it the largest known member of the KUIPER BELT. Additional bodies rivaling Pluto in size may exist in this region of the solar system; one about half its size was discovered in 2002. The term *minor planet* is sometimes used (less now than formerly) to refer to any of the asteroids that lie between the terrestrial and Jovian planets. In ASTROLOGY great importance is placed on the planets' positions in the 12 constellations of the ZODIAC. See also PLANETESIMAL; SOLAR SYSTEM.

Planet X Supposed distant PLANET of the SOLAR SYSTEM, hypothesized on the basis of calculations of effects on the orbits of Uranus and Neptune. The term was first used by PERCIVAL LOWELL c. 1905, and though his prediction eventually resulted in the discovery of PLUTO (1930), Pluto's mass was insufficient to explain the apparent perturbations of Uranus and Neptune. Proposals and searches for other planets beyond Neptune or Pluto continued sporadically during the remainder of the 20th century. However, VOYAGER spacecraft data gathered about the masses of the outer planets indicate that no additional large bodies are needed to explain the planets' observed orbits. See also KUIPER BELT.

planetarium Institution devoted to popular education in ASTRONOMY and related fields, especially space science, whose main teaching tool is a hemispheric screen onto which images of celestial objects as seen from Earth are projected from an instrument also known as a planetarium, or planetarium projector. Major planetariums have extensive exhibit space, museum collections, sizable staffs, projection domes 80 ft (25 m) or more across, and seating capacities of over 600.

planetary nebula Any of a class of bright NEBULAe that may somewhat resemble PLANETS when viewed through a small telescope but are, in fact, expanding shells of luminous gas around dying stars. A planetary nebula is the outer envelope shed by a red GIANT STAR not massive enough to become a SUPERNOVA. Instead, the star's intensely hot core becomes exposed (see WHITE DWARF STAR) and ionizes the surrounding shell of gas, which is expanding at tens of miles per second.

planetesimal \ˌpla-nə-'te-sə-məl\ One of a class of hypothetical bodies that joined to form the PLANETS after condensing from dust and gas early in the history of the SOLAR SYSTEM. According to the nebular hypothesis, a rotating cloud of interstellar dust and gas underwent gravitational contraction, eventually forming a SOLAR NEBULA comprising a disk of matter with a central hub. As the disk contracted further, clumps of dust left behind in its midplane coalesced successively into bodies the size of pebbles and boulders and then into planetesimals up to several hundred miles across. These then combined under the force of gravity to form protoplanets, precursors of the current planets.

planets of other stars *or* **extrasolar planets** Planets that orbit stars other than the Sun. The existence of extrasolar planets, many light-years from Earth, was confirmed in the early 1990s with the detection of three bodies circling a PULSAR. The first planet revolving around a more sunlike star, 51 Pegasi, was reported in 1995. Within a decade over 100 stars with one or more planets were known. Current detection methods, based on the planets' gravitational effects on the stars they orbit, have revealed only planets much more massive than Earth; some are several times the size of JUPITER. A number of them have highly elliptical orbits, and many are closer to their stars than MERCURY is to the Sun. These findings have raised questions regarding astronomers' ideas of how Earth's SOLAR SYSTEM formed and how typical it is.

plankton Marine and freshwater organisms that, because they are unable to move or are too small or too weak to swim against water currents, exist in a drifting, floating state. Plankton is the productive base of both marine and freshwater ecosystems, providing food for larger animals and indirectly for humans, whose fisheries depend on plankton. As a human resource, plankton has only begun to be developed and used. The plantlike community of plankton is called PHYTOPLANKTON, and the animal-like community is called ZOOPLANKTON, but many planktonic organisms are better described as PROTISTS. Most phytoplankton serves as food for zooplankton, but some of it is carried below the light zone. Zooplankton is used directly as food by fish (including herring) or mammals (including whales), but several links on the food chain usually have been passed before plankton is available for human consumption.

plant Any organism in the kingdom Plantae, consisting of multicellular, eukaryotic life forms (see EUKARYOTE) with six fundamental characteristics: PHOTOSYNTHESIS as the almost exclusive mode of nutrition, essentially unlimited growth at MERISTEMS, cells that contain CELLULOSE in their walls and are therefore somewhat rigid, the absence of organs of movement, the absence of sensory and nervous systems, and life histories that show ALTERNATION OF GENERATIONS. No definition of the kingdom completely excludes all nonplant organisms or even includes all plants. Many plants, for example, are not green and thus do not produce their own food by photosynthesis, being instead parasitic on other living plants (see PARASITISM). Others obtain their food from dead organic matter. Many animals possess plantlike characteristics, such as a lack of mobility (e.g., SPONGES) or the presence of a plantlike growth form (e.g., some CORALS and BRYOZOANS), but in general such animals lack other plant characteristics. Some past classification systems (see TAXONOMY) placed difficult groups such as PROTOZOANS, BACTERIA, ALGAE, SLIME MOLDS, and fungi (see FUNGUS) in the plant kingdom, but structural and functional differences between these organisms and plants have convinced most scientists to classify them elsewhere.

plant virus Any of various VIRUSes that can cause plant disease (e.g., the tobacco mosaic virus). Plant viruses are economically important because many of them infect crop and ornamental plants. Numerous plant viruses are rodlike and can be extracted readily from plant tissue and crystallized.

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Most lack the fatty membrane found in many animal viruses, and all contain RNA. Plant viruses are transmitted in various ways, most importantly through insect bites, mainly by aphids and plant hoppers. Symptoms of virus infection include colour changes, dwarfing, and tissue distortion. The appearance of streaks of colour in certain tulips is caused by a virus. See also REOVIRUS.

Plantagenet \plan-'ta-jə-nət**, House of** *or* **House of Anjou** \'an-jü\ Royal house of England (1154–1485) that provided 14 kings, including six from the cadet houses of LANCASTER and YORK. The line descended from Geoffrey, count of Anjou (died 1151), and the empress MATILDA, daughter of the English king HENRY I. Some historians apply the name House of Anjou, or ANGEVIN DYNASTY, to only HENRY II, RICHARD I, and JOHN, and label their successors, including EDWARD I, EDWARD II, and EDWARD III, as Plantagenets. The name may have originated as a nickname (Plantegeneste) for Count Geoffrey, who planted broom shrubs (Latin *Genista*) to improve his hunting covers. The Wars of the ROSES saw the defeat of the last Plantagenet king, RICHARD III, in 1485. The legitimate line ended with Edward of Warwick (died 1499).

plantain Tall plant (*Musa paradisiaca*) of the BANANA family that is closely related to the common banana (*M. sapientum*). Believed to have originated in Southeast Asia, the plantain grows 10–33 ft (3–10 m) tall and has a conical false "trunk" formed by the leaf sheaths of its spirally arranged, long, thin leaves. The green-coloured fruit is larger than that of the banana and contains more starch. Because the starch is maximal before the fruit ripens, the fruit is not eaten raw but is boiled or fried, often with coconut juice or sugar as flavouring. It may also be dried for later use in cooking or ground for use as meal, which can be further refined to a flour. The plantain is a staple food and beer-making crop for East African peoples and is also eaten in the Caribbean and Latin America.

plantain \'plan-tᵊn\ Any of about 265 species of familiar garden, lawn, and roadside WEEDS in the genus *Plantago* of the family Plantaginaceae. Distinctively, the leaves lack a proper blade. What appears to be a blade is an expanded petiole (leafstalk), with several parallel main veins, emerging at the base of the stalk. Small flowers are borne in spikes or heads atop long leafless stalks. The greater plantain (*P. major*) provides seed spikes for bird food. Ribwort, or English, plantain (*P. lanceolata*) and hoary plantain (*P. media*) are troublesome weeds. Some species have been useful in medicine (e.g., as an ingredient in laxatives).

plantation walking horse See TENNESSEE WALKING HORSE

Plante, (Joseph) Jacques (Omer) (b. Jan. 17, 1929, Shawinigan Falls, Que., Can.—d. Feb. 26, 1986, Geneva, Switz.) Canadian ice-hockey player. A goalie, he recorded a shutout in his first NHL game. He was an integral member of the powerful Montreal Canadiens team that won a record five successive STANLEY CUPS (1956–60). He was the first goalie to wear a protective face mask (1959). Honoured throughout his 18-year NHL career, he was one of the most successful of all NHL goaltenders.

Planudes \plā-'nü-dēz**, Maximus** *orig.* **Manuel Planudes** (b. 1260, Nicomedia, Byzantine Empire—d. c. 1310, Constantinople) Greek Orthodox scholar, anthologist, and polemicist. He established a school in Constantinople that gained a strong reputation for its humanities curriculum. His Greek translations of Latin philosophy and literature and of Arabic mathematics publicized these areas of learning throughout the Greek Byzantine cultural world. Though chiefly known for his theological writings, he made a distinctive contribution to the history of Greek literature with his revision of the *Greek Anthology*, a collection of Greek prose and poetry c. 700 BC–AD 1000.

plasma \'plaz-mə\ Liquid part of blood (including dissolved chemicals but not the cells and PLATELETS). This straw-coloured fluid serves as the blood's transport medium, helps maintain BLOOD PRESSURE, distributes body heat, and maintains the PH balance in the bloodstream and body. More than 90% consists of water, about 7% proteins, and the rest other substances, including waste products of METABOLISM. Important plasma proteins include ALBUMIN, COAGULATION factors, and GLOBULINS, including GAMMA GLOBULIN and a hormone that stimulates ERYTHROCYTE formation. Serum is the liquid part of the blood that remains after clotting.

plasma Electrically conducting medium in which there are roughly equal numbers of positively and negatively charged particles, produced when the atoms in a gas become ionized (see IONIZATION). Plasma is sometimes called the fourth state of MATTER (the first three being solid, liquid, and gas). A plasma is unique in the way it interacts with itself, with ELECTRIC and MAGNETIC fields, and with its environment. It can be thought of as a collection of ions, electrons, neutral atoms and molecules, and photons in which some atoms are being ionized at the same time as electrons are recombining with other ions to form neutral particles, while photons are continuously being produced and absorbed. It is estimated that more than 99% of the matter in the universe exists in the plasma state.

plasmid \'plaz-məd\ Genetic element not contained within a CHROMOSOME. It occurs in many bacterial strains. Plasmids are circular DNA molecules that replicate independently of the bacterial chromosome. They are not essential for the bacterium but may give it a selective advantage. Some plasmids determine the production of proteins that can kill other bacteria; others make bacteria resistant to antibiotics. Plasmids are extremely valuable tools in the fields of molecular biology and genetics, specifically in the area of GENETIC ENGINEERING.

plasmodium \plaz-'mō-dē-əm\ Any of the parasitic PROTOZOANS that make up the genus *Plasmodium*, the cause of MALARIA. Infecting red blood cells in mammals, birds, and reptiles, plasmodia occur worldwide, especially in tropical and temperate zones. They are transmitted to humans by the bite of the *Anopheles* mosquito. From the bloodstream, young plasmodia enter liver cells, where they divide and form an adult stage that is then released back into the bloodstream and infects red blood cells. Rapid division of the parasites results in the destruction of the red blood cells, which release toxins that cause the periodic chill and fever cycles typical of malaria.

plaster of paris Quick-setting GYPSUM plaster consisting of a fine white powder, calcium sulfate hemihydrate, which hardens when moistened and allowed to dry. It is made by heating gypsum to 250–360°F (120–180°C). Used since ancient times, plaster of paris is so called because of its preparation from the abundant gypsum found in Paris. It is used to make molds and casts for ceramics and sculptures, to precast and hold ornamental plasterwork on ceilings and cornices, and for orthopedic bandages (casts). In medieval and Renaissance times, gesso (plaster of paris mixed with glue) was applied to wood panels, plaster, stone, or canvas to provide the ground for tempera and oil painting.

plastic surgery SURGERY to correct disfigurement, restore function, or improve appearance. It may involve reshaping or moving tissues to fill a depression, cover a wound, or improve appearance. Cosmetic surgery solely to improve appearance is not the main focus of plastic surgery. It is utilized after disfigurement by burns or tumour removal or for reconstructive work, and it may involve hiding incisions in skin folds or using buried sutures to hold wounds closed. Reconstructive plastic surgery corrects severe functional impairments, fixes physical abnormalities, and compensates for tissue lost to trauma or surgery. MICROSURGERY and computerized DIAGNOSTIC IMAGING techniques have revolutionized the field.

plasticity Ability of certain SOLIDS to flow or to change shape permanently when subjected to STRESSES between those that produce temporary deformation, or elastic behaviour, and those that cause failure of the material, or rupture (see FRACTURE). Plasticity allows a solid under the action of outside forces to become permanently deformed without rupturing; ELASTICITY enables a solid to return to its original shape after the load is removed. Plastic deformation occurs in many metal-forming processes (ROLLING, pressing, FORGING, WIRE DRAWING) and in geologic processes (rock folding and rock flow within the Earth under extremely high pressures and at elevated temperatures).

plastics POLYMERS that can be molded or shaped, usually by heat and pressure. Most are lightweight, transparent, tough organic compounds that do not conduct electricity well. They fall into two classes: Thermoplastics (e.g., POLYETHYLENE, polystyrene) can be melted and formed again and again; thermosetting plastics, or thermosets (e.g., POLYURETHANE, EPOXY), once formed, are destroyed rather than melted by heating. Few plastics contain only the polymer RESIN; many also contain plasticizers (to change the melting point and make them softer), colorants, reinforcements, and fillers (to improve mechanical properties such as stiffness), and stabilizers and antioxidants (to protect against aging, light, or biological agents). Traditional plastics are not biodegradable (see BIODEGRADABILITY); RECYCLING of plastics, especially thermoplastics, has become an important industry, and the development of low-cost biodegradable plastics and plastic substitutes is a significant pursuit of industrial research. Major commercial uses of plastics include cars, buildings, packaging, textiles, paints, adhesives, pipes, electrical and electronic components, prostheses, toys, brushes, and furniture. Common plastics include polyethylene terephtha-

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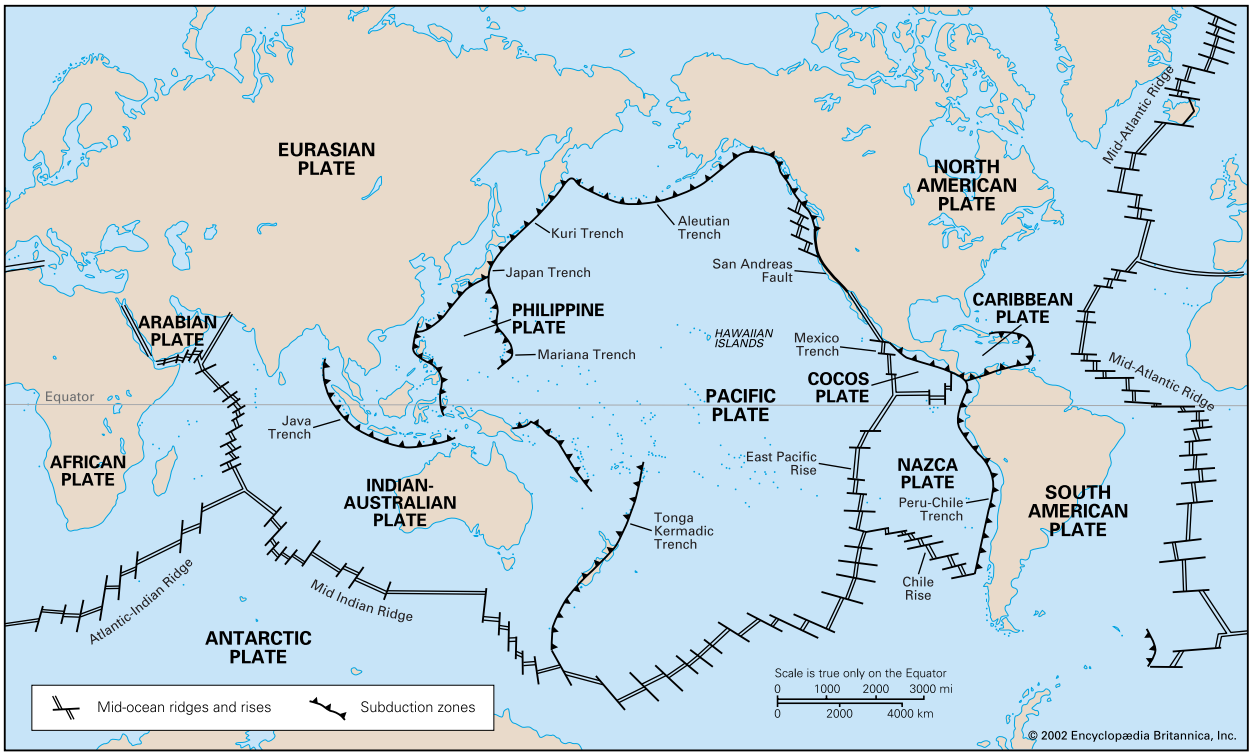

Major tectonic plates of the earth's lithosphere. New lithosphere is created by upwelling magma at certain plate boundaries, called spreading centers or oceanic ridges, where the plates diverge. At other boundaries, called subduction zones, plates converge until one is forced under the other (subducted) into the earth. The continents are rigidly connected to their respective plates and move as the plates move, a few inches a year.

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late, or PET (beverage bottles), PVC (pipes and hoses), foamed polystyrene, or Styrofoam (insulated food containers), and LUCITE (shatterproof windows). See also LEO BAEKELAND.

Plata, Río de la Estuary of the PARANÁ and URUGUAY rivers, between Uruguay and Argentina. It is about 180 mi (290 km) long, with a maximum width of 136 mi (219 km) at its mouth, but it narrows gradually to the northwest as it approaches BUENOS AIRES. Discovered by the Spanish in 1516, it was explored by FERDINAND MAGELLAN in 1520 and by SEBASTIAN CABOT (1526–29). The first permanent settlement in the area was at Asunción in 1537.

Plata, Viceroyalty of the Río de la See Viceroyalty of the RÍO DE LA PLATA

Plataea \plə-'tē-ə\ Ancient city, BOEOTIA, east-central Greece, south of THEBES. Plataea was settled by Boeotians who expelled the earlier Bronze Age inhabitants. The Plataeans fought along with the Athenians against the Persians at the Battle of MARATHON (490 BC). Plataea was the scene of the Greek victory over the invading Persians in the Battle of PLATAEA (479 BC). It was destroyed by the Spartans in 427 BC but was rebuilt under the Macedonian kings PHILIP II and ALEXANDER THE GREAT as a symbol of Greek courage in resisting Persia.

Plataea, Battle of (479 BC) Battle between Greek and Persian forces near Plataea (modern Plataiaí) in Boeotia on the slopes of Mount Cithaeron. A largely Spartan force, including HELOTS, defeated the Persian army of XERXES I, led by Mardonius; the victory marked this battle as the final Persian attempt to invade mainland Greece.

plate tectonics Theory that the Earth's LITHOSPHERE (the crust and upper portion of the mantle) is divided into about 12 large plates and several small ones that float on and travel independently over the ASTHENOSPHERE. The theory revolutionized the geological sciences in the 1960s by combining the earlier idea of CONTINENTAL DRIFT and the new concept of SEAFLOOR SPREADING into a coherent whole. Each plate consists of rigid rock created by upwelling magma at OCEANIC RIDGES, where plates diverge. Where two plates converge, a SUBDUCTION ZONE forms, in which one plate is forced under another and into the Earth's mantle. The majority of the earthquakes and volcanoes on the Earth's surface occur along the margins of tectonic plates. The interior of a plate moves as a rigid body, with only minor flexing, few earthquakes, and relatively little volcanic activity.

plateau Extensive area of flat upland, usually bounded by an escarpment on all sides but sometimes enclosed by mountains. Plateaus are extensive, and together with enclosed basins they cover about 45% of the Earth's land surface. The essential criteria for a plateau are low relative relief and some altitude. Low relief distinguishes plateaus from MOUNTAINS, although their origin may be similar. Plateaus, being high, often create their own local climate; the topography of plateaus and their surroundings often produce arid and semiarid conditions.

Plateau Indian Any member of various North American Indian peoples that inhabited the high plateau between the Rocky Mountains on the east and the Cascade Range on the west. The Plateau culture was not stable. By AD 1200–1300 the "classic" phase had emerged, characterized by permanent winter villages with semi-subterranean earth lodges along the main rivers and by summer camps with mat-covered conical lodges in the meadows. During the centuries that followed, the Plateau area was influenced by cultural elements from the highly specialized Northwest Coast culture. Part of this diffusion was possibly brought about by a Chinook group, the Wishram, who migrated from the coast into the Cascade Mountains. During the 18th century there were influences from the east. The SHOSHONE had acquired horses by that time and furnished their closest neighbours on the Plains and the Plateau with horses. Other elements of Plains culture, such as beaded dresses, warbonnets, and tepees, came with the horse. Among this group were the Coeur d'Alene, FLATHEAD, KLAMATH, Kutenai, MODOC, NEZ PERCÉ, Spokan, Thompson, and Salish.

platelet *or* **thrombocyte** Small, colourless, irregular blood cell crucial in COAGULATION. Produced in BONE MARROW and stored in the SPLEEN, platelets accumulate to block a cut in a blood vessel and provide a surface for fibrin strands to adhere to, contract to pull the strands together,

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and take part in the conversion sequence of coagulation factors. They also store and transport several chemicals.

Plateresque \ˌpla-tə-ˈresk\ Main architectural style in Spain and its New World colonies in the late 15th and 16th centuries. The name (which comes from a comparison to the intricate work of silversmiths) came to be generally applied to late Gothic and early Renaissance Spanish architecture, which was characterized by minutely detailed relief ornament derived from Moorish, Gothic, and Italian Renaissance sources and applied without regard for structure. Favourite motifs for this ornament included twisted columns, heraldic escutcheons, and sinuous scrolls; clusters of ornament often contrasted with broad expanses of flat wall surface. Over time, the style evolved so that ornamentation became purer and more unified with the overall structure. Outstanding examples of the style include Diego de Siloé's Granada Cathedral (1528–43), Diego de Riaño's work on the Seville Cathedral (c. 1530), and Rodrigo Gil de Hontañón's facade of the University of Alcalá de Henares (1541–53).

platform tennis Variation of PADDLE TENNIS, played on a platform enclosed by a wire fence. It was devised in 1928 in Scarsdale, N.Y., U.S. The short-handled oval paddles are made of perforated plywood; the balls are made of sponge rubber. The rules are the same as for TENNIS, except that balls may be played off back or side walls after first striking inside the court.

Plath, Sylvia (b. Oct. 27, 1932, Boston, Mass., U.S.—d. Feb. 11, 1963, London, Eng.) U.S. poet. The daughter of an entomologist, Plath was driven to excel as a writer from an early age and published her first poem at age eight. At Smith College she made an early suicide attempt and submitted to electroshock treatment. While attending Cambridge University on a Fulbright grant, she married the poet TED HUGHES. After their separation, she committed suicide at age 30. Though she was not widely recognized in her lifetime, her reputation grew rapidly afterward; by the 1970s she was considered a major contemporary poet. Her works, often confessional and preoccupied with alienation, death, and self-destruction, include the volumes *The Colossus* (1960), *Ariel* (1965), and *The Collected Poems* (1981, Pulitzer Prize) and a semiautobiographical novel, *The Bell Jar* (1963).

plating Coating a METAL or other material, such as plastic or china, with a hard, nonporous metallic surface to improve durability and beauty. Early plated goods ("old SHEFFIELD PLATE") are made by the process invented by THOMAS BOULSOVER, and consist of a sandwich of copper between two layers of silver. Today surfaces such as gold, silver, stainless steel, palladium, copper, and nickel are applied by dipping an object into a solution containing the desired surface material, which is deposited by chemical or electrochemical action (see ELECTROPLATING). Much plating is done for decorative purposes, but still more is done to increase the durability and CORROSION resistance of softer materials. Most automotive parts, appliances, housewares and flatware, hardware, plumbing and electronic equipment, wire goods, aircraft and aerospace products, and machine tools are plated for durability. See also GALVANIZING, TERNEPLATE, TINPLATING.

platinum Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol Pt, atomic number 78. A very heavy, silvery white precious METAL, it is soft and ductile, with a high melting point (3,216 °F [1,769 °C]) and good resistance to corrosion and chemical attack. Small amounts of IRIDIUM are commonly added for a harder, stronger ALLOY that retains platinum's advantages. Platinum is found usually as alloys of 80–90% purity in PLACER DEPOSITS or more rarely combined with arsenic or sulfur. It is indispensable in high-temperature laboratory work for electrodes, dishes, and electrical contacts that resist chemical attack even when very hot. Platinum is used in dental alloys and surgical pins; alloys typically containing 90–95% platinum are used in expensive jewelry. The international primary standard for the kilogram is made of 90% platinum, 10% iridium. Platinum has VALENCE 2 or 4 in its compounds, which include many coordination complexes. It and some compounds are useful CATALYSTS, particularly for HYDROGENATION and in catalytic converters for reducing automobile emissions.

Plato \ˈplā-tō\ *orig.* **Aristocles** (b. 428/427, Athens, or Aegina, Greece—d. 348/347 BC, Athens) Greek philosopher, who with his teacher SOCRATES and his student ARISTOTLE laid the philosophical foundations of Western culture. His family was highly distinguished; his father claimed descent from the last king of Athens, and his mother was related to Critias and Charmides, extremist leaders of the oligarchic terror of 404. Plato (whose acquired name refers to his broad forehead, and thus his range of knowledge) must have known Socrates from boyhood. After Socrates was put to death in 401, Plato fled Athens for Megara, then spent the next 12 years in travel. Upon his return, he founded the Academy, an institute of scientific and philosophical research, where Aristotle was one of his students. Building on but also departing from Socrates' thought, he developed a profound and wide-ranging philosophical system, subsequently known as PLATONISM. His thought has logical, epistemological, and metaphysical aspects, but much of its underlying motivation is ethical. It is presented in his many dialogues, in most of which Socrates plays a leading role. See also NEOPLATONISM.

Platonic solid *also known as* **regular polyhedron** Geometric solid all of whose faces are identical regular POLYGONS and all of whose angles are equal. There are only five such POLYHEDRONS. The cube is constructed from the square, the dodecahedron from the regular pentagon, and the tetrahedron, octahedron, and icosahedron (with 20 faces) from the equilateral triangle. They are known as the Platonic solids because of PLATO's attempt to relate each to one of the five elements that he believed formed the world.

Platonism \ˈplā-tə-ˌni-zəm\ Any philosophy that embodies some major idea of Plato's, especially in taking abstract forms as metaphysically more basic than material things. Though there was in antiquity a tradition about Plato's "unwritten doctrines," Platonism then and later was based primarily on a reading of the dialogues. It is characterized by an intense concern for the quality of human life—always ethical, often religious, and sometimes political, based on a belief in unchanging and eternal realities (the Platonic Forms), independent of the changing things of the physical world perceived by the senses. This belief in absolute values rooted in an eternal world distinguishes Platonism from the philosophies of Plato's immediate predecessors and successors and from later philosophies inspired by them. See also NEOPLATONISM.

platoon Principal subdivision of a military company, battery, or troop. Usually commanded by a lieutenant, it consists of 25–50 soldiers organized into two or more squads led by noncommissioned officers. The term was first used in the 17th century to refer to a small body of musketeers who fired together in a volley alternately with another platoon. It has been used in U.S. military manuals since 1779, and throughout the 19th century it meant half a company. It was reintroduced into the British army in 1913. See also MILITARY UNIT.

Platt, Orville Hitchcock (b. July 19, 1827, Washington, Conn., U.S.—d. April 21, 1905, Washington) U.S. politician. He served in the Connecticut legislature (1861–62, 1864, 1869) and later in the U.S. Senate (1879–1905), where he sponsored legislation concerning patents and copyrights. He was chairman of the committee on territories (1887–93), which recommended admission of six new western states. He is remembered for sponsoring the PLATT AMENDMENT (1901), which became the basis for the withdrawal of U.S. troops from Cuba following the SPANISH-AMERICAN WAR of 1898.

Platt Amendment (1901) Rider appended to a U.S. Army appropriations bill stipulating conditions for withdrawing of U.S. troops remaining in Cuba after the SPANISH-AMERICAN WAR. The amendment, which was added to the Cuban constitution of 1901, affected Cuba's rights to negotiate treaties and permitted the U.S. to maintain its naval base at GUANTÁNAMO BAY and to intervene in Cuban affairs "for the preservation of Cuban independence." In 1934 Pres. FRANKLIN ROOSEVELT supported abrogation of the amendment's provisions except for U.S. rights to the naval base. See also GOOD NEIGHBOR POLICY.

Platte River River, central Nebraska, U.S. Formed by the confluence of the NORTH PLATTE and SOUTH PLATTE rivers, it is 310 mi (500 km) long. It flows southeast into a big bend at Kearney, Neb., then empties into the MISSOURI RIVER at Plattsmouth, south of OMAHA. It is too shallow for navigation and is almost dry for much of the year. Its waters are used for irrigation and municipal water systems.

Plattsburgh City (pop., 2000: 18,816), northeastern New York, U.S. Situated on the western shore of Lake CHAMPLAIN, south of the Canadian border, Plattsburgh was founded by Zephaniah Platt in 1784. It was the scene of an important U.S. victory during the WAR OF 1812 on Lake Champlain that saved New York from British invasion via the HUDSON RIVER valley. Incorporated as a city in 1902, it became the centre of the Lake Champlain resort area.

platyhelminth See FLATWORM

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platypus *or* **duckbill** Monotreme amphibious mammal (*Ornithorhynchus anatinus*) of lakes and streams in eastern Australia and Tasmania. About 23 in. (60 cm) long, the squat-bodied platypus has a ducklike snout, short legs, webbed feet, and a beaverlike tail. Each day it eats nearly its own weight in crustaceans, fishes, frogs, mollusks, tadpoles, and earthworms; lacking teeth, it crushes its food with ridges in the bill. The female lays one to three eggs in a nest in a long twisting passage above the waterline. The young are weaned about four months after hatching. The male's heel bears a spur connected to a poison-secreting gland. Large fishes and perhaps snakes prey on platypuses. Formerly trapped for their dense, soft fur, they are now protected by law.

Plautus \'plȯ-təs\ (b. c. 254, Sarsina, Umbria?—d. 184 BC) Roman comic playwright. Little is known for certain about his life, but tradition holds that he was associated with the theatre from an early age. Like other Roman playwrights, he borrowed plots and dramatic techniques from Greek authors, especially New Comedy playwrights such as Menander. His plays, written in verse, were often farces marked by cases of mistaken identity and opportunities for slapstick, and he popularized character types such as the braggart soldier and the sly servant. Twenty-one of his comedies—among the earliest surviving works in Latin—are extant, including *The Pot of Gold*, *The Captives*, *The Two Menaechmuses*, *The Braggart Warrior*, and *Pseudolus*. His work influenced European comedy from the Renaissance onward, notably William Shakespeare's *Comedy of Errors* (1592–93) and Molière's *The Miser* (1669).

play See theatre

play In zoology, actions that have all the elements of purposeful behaviour but are performed for no apparent reason. Play has been documented only among mammals and birds. It is most common among immature animals, but adult animals also play. Horses, cattle, and other ungulates run and kick up their heels even when not fleeing from predators or defending themselves. Dogs adopt an aggressive posture to entice others to join in mock combat. Otters are well known for their mud sliding. Male birds may spontaneously perform their territorial songs when there is no intruding rival.

playa \'plī-ə\ *or* **pan** *or* **flat** *or* **dry lake** Flat-bottomed depression that is periodically covered by water. Playas occur in interior desert basins and adjacent to coasts in arid and semiarid regions. The water that periodically covers the playa slowly filters into the groundwater system or evaporates into the atmosphere, causing the deposition of salt, sand, and mud along the bottom and around the edges of the depression.

Player, Gary (Jim) (b. Nov. 1, 1935, Johannesburg, S.Af.) South African golfer. Player entered the U.S. PGA circuit in 1957. He won the British Open three times (1959, 1968, 1974), the Masters three times (1961, 1974, 1978), the PGA twice (1962, 1972), and the U.S. Open once (1965). Player was the third man (after Gene Sarazen and Ben Hogan) to win the four tournaments composing the modern grand slam of golf (the Masters, the U.S. Open, the British Open, and the PGA Championship).

player piano Piano that mechanically plays music encoded as perforations on a paper roll. An early version, patented in 1897 by the American engineer E.S. Votey, was a cabinet placed in front of an ordinary piano, with wooden "fingers" projecting over the keyboard. A paper roll with perforations corresponding to the notes passed over a tracker bar to activate the release of air by pneumatic devices that set the fingers in motion; the user could control tempo and loudness by levers and pedals. Soon this mechanism was built into the piano itself. The later "reproducing piano" could reproduce the nuances of tempo and dynamics in great performances, the roll having been produced by the performance itself. After the 1920s the phonograph led to the instrument's quick decline. Modern versions, such as the Yamaha Disklavier, are operated by digital memory on a computer disk.

Steinway-Welte player piano, 1910; in the British Piano and Musical Museum, Brentford, Middlesex, Eng.
COURTESY OF THE BRITISH PIANO AND MUSICAL MUSEUM, BRENTFORD, MIDDLESEX, ENG.

playing cards Small rectangular cards used for playing games and sometimes for divination and conjuring. Modern cards are divided into four suits: spades, hearts, diamonds, and clubs. A complete pack, or deck, of cards includes 13 cards in each suit (10 numbered cards and 3 court cards—king, queen, and jack, or knave); 2 extra cards, called jokers (many times portraying a medieval jester), are often included as well. The origin of playing cards is obscure—China and India being the two most likely sources—as is the meaning of their symbols. The earliest reference to cards in Europe occurs in Italy in 1299. The 52-card French deck is now standard throughout the world, but decks with fewer cards evolved in Germany and Spain. Other suit emblems were also used (e.g., bells in Germany, cups in Spain and Italy). See also tarot.

plea bargaining Negotiation of an agreement between the prosecution and the defense whereby the defendant pleads guilty to a lesser offense or (in the case of multiple offenses) to one or more of the offenses charged, in exchange for more lenient sentencing, recommendations, a specific sentence, or a dismissal of other charges. Supporters claim plea bargaining speeds court proceedings and guarantees a conviction; opponents believe it prevents justice from being served.

plebeian \ple-'bē-ən\ (Latin, *plebs*) Member of the general citizenry, as opposed to the patrician class, in the ancient Roman republic. Plebeians were originally excluded from the Senate and from all public offices except military tribune, and they were forbidden to marry patricians. Seeking to acquire equal rights, they carried on a campaign called Conflict of the Orders, developing a separate political organization and seceding in protest from the state at least five times. The campaign ceased when a plebeian dictator (appointed 287 BC) made measures passed in the plebeian assembly binding on the whole community.

plebiscite \'ple-bə-ˌsīt\ Vote by the people of an entire country or district to decide an issue. Voters are asked to accept or reject a given proposal rather than choose between alternative proposals. By means of plebiscites, intermediaries such as political parties can be bypassed. Because plebiscites offer a way to claim a popular mandate without permitting an opposition party, totalitarian regimes have used them to legitimize their power. See also referendum and initiative.

Plehve \'plā-vyi**, Vyacheslav (Konstantinovich)** (b. April 20, 1846, Kaluga province, Russia—d. July 28, 1904, St. Petersburg) Russian government administrator. In 1881 he was appointed director of the secret police in the ministry of the interior. He became head of the imperial chancellery (1894), state secretary for Finland (1899), and minister of the interior (1902). Concerned with upholding autocratic principles, he suppressed revolutionary and liberal movements, harshly pursued Russification policies against minority nationality groups, and backed police-controlled labour unions. He was assassinated by a member of the Socialist Revolutionary Party.

Pleiades \'plē-ə-ˌdēz\ Open cluster of stars in the constellation Taurus, about 400 light-years from Earth. It contains a large amount of bright nebulous material and several hundred stars, of which six or seven can be seen by the unaided eye and have figured prominently in the myths and literature of many cultures. In the Northern Hemisphere, the rising of the Pleiades near dawn in spring has from ancient times marked the opening, and their morning setting in autumn the end, of seafaring and farming seasons.

Pleistocene \'plīs-tə-ˌsēn\ **Epoch** Earlier and longer of the two epochs that constitute the Quaternary Period. The Pleistocene began c. 1.8 million years ago and ended c. 10,000 years ago. It was preceded by the Pliocene Epoch of the Tertiary Period and followed by the Holocene Epoch. At the height of the Pleistocene glacial ages, more than 30% of the land area of the Earth was covered by glacial ice; during the interglacial stages, probably only about 10% was covered. The animals of the Pleistocene began to resemble those of today, and new groups of land mammals, including humans, appeared. At the end of the epoch, mass extinctions occurred: in North America more than 30 genera of large mammals became extinct within a span of roughly 2,000 years. Of the many causes that have been proposed for these extinctions, the two most likely are changing environment with changing climate and disruption of the ecological pattern by early humans.

Plekhanov \pli-'ka̲-nȯf**, Georgy (Valentinovich)** (b. Dec. 11, 1856, Gudalovka, Russia—d. May 30, 1918, Terioki, Fin.) Russian Marxist theorist. From 1874 he was active in the Populist movement and

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became a leader of the Land and Freedom group (1877–80). To avoid arrest, he went into a long exile in Geneva (1880–1917). In 1883 he founded the first Russian Marxian revolutionary organization, Liberation of Labour, which became the Russian Social-Democratic Workers' Party (1898). In *Socialism and Political Struggle* (1883) and *Our Differences* (1885), he described a two-phase revolutionary scheme that influenced Russian Marxist thought. Followers in the 1890s included Vladimir Ilich Lenin. After the party split (1903), Plekhanov joined the Mensheviks but spent years trying to reunite the party. He supported the Allies in World War I and opposed the Bolshevik seizure of power. After returning briefly to Russia in 1917, he died in exile in Finland.

Plessy v. Ferguson (1896) U.S. Supreme Court decision that established the legality of racial segregation so long as facilities were "separate but equal." The case involved a challenge to Louisiana laws requiring separate railcars for African Americans and whites. Though the laws were upheld by a majority of 8 to 1, a famous dissent by John Marshall Harlan advanced the idea that the U.S. Constitution is "color-blind." The *Plessy* decision was overturned in 1954 by *Brown v. Board of Education*.

Pleven \plā-'ven**, René** (b. April 13 or 15, 1901, Rennes, France—d. Jan. 13, 1993, Paris) French politician and premier (1950–51, 1951–52). A lawyer and industrial executive, he served in Charles de Gaulle's wartime government (1940–45). Elected to the National Assembly in 1945, he cofounded with François Mitterrand the Democratic and Socialist Union of the Resistance, serving as its president (1946–53). He held several postwar cabinet posts, including minister of defense (1949–50, 1952–54). He sponsored the Pleven Plan for a unified European army, but the European Defense Community, based on his plan, collapsed in 1954. He served as minister of justice (1969–73).

Plexiglas See Lucite

Pleyel \ple-'yel,\ *English* \'plī-əl**, Ignace Joseph** *or* **Ignaz Josef Pleyel** (b. June 18, 1757, Ruppersthal, Austria—d. Nov. 14, 1831, Paris, France) Austrian-French music publisher, piano maker, and composer. He studied with Joseph Haydn (c. 1772–77), then held posts in Vienna and Strasbourg and traveled in Italy before settling in Paris. His publishing house, Maison Pleyel, published Haydn's complete string quartets (1801), and in 1802 it published the first miniature scores for study. It ceased publishing in 1834, but the piano-manufacturing company he founded in 1807 lasted until the 1960s. Pleyel's music, including 45 symphonies and more than 70 string quartets, was once very popular.

Plimsoll \'plim-səl**, Samuel** (b. Feb. 10, 1824, Bristol, Gloucestershire, Eng.—d. June 3, 1898, Folkestone, Kent) British reformer. A London coal merchant, he served in Parliament (1868–80). With his book *Our Seamen* (1873), he helped overcome resistance to the Merchant Shipping Act, which instituted such reforms as the loading limit for cargo ships. A load line (the Plimsoll mark or line) was marked on the hull of every cargo ship, indicating the maximum depth to which the ship could be safely loaded.

Pliny \'plin-ē\ **the Elder** *Latin* **Gaius Plinius Secundus** (b. AD 23, Novum Comum, Transpadane Gaul—d. Aug. 24, 79, Stabiae, near Mt. Vesuvius) Roman scholar. Descended from a prosperous family, Pliny pursued a military career, held official positions (including procurator of Spain), and later spent years in semiretirement, studying and writing. His fame rests on his *Natural History* (AD 77), an encyclopaedic work of uneven accuracy that was the European authority on scientific matters up to the Middle Ages. Six other works ascribed to him were probably lost in antiquity. He died while observing the great eruption of Vesuvius.

Pliny the Younger *Latin* **Gaius Plinius Caecilius Secundus** (b. AD 61/62, Comum—d. c. 113, Bithynia, Asia Minor) Roman author and administrator. The nephew of Pliny the Elder, he practiced law and held official posts, including consul and head of the military and senatorial treasuries. He is known for the nine books of private letters he published in AD 100–109. The carefully composed letter, at that time a fashion among the wealthy, was transformed by Pliny into an art. His are charming and meticulous occasional pieces on diverse literary, social, and domestic themes that intimately illustrate public and private life in the heyday of the Roman Empire.

Pliocene \'plī-ə-ˌsēn\ **Epoch** Last and shortest epoch of the Tertiary Period, from c. 5.3 to c. 1.8 million years ago. It follows the Miocene Epoch and precedes the Pleistocene Epoch of the Quaternary Period. Pliocene environments were generally cooler and drier than those of preceding Tertiary epochs. In general, Pliocene mammals grew larger than those of earlier epochs. The more advanced primates continued to evolve, and it is possible that the australopithecines (see Australopithecus), the first creatures that can be termed human, developed late in the Pliocene.

Plisetskaya \pli-'set-skə-yə**, Maya (Mikhaylovna)** (b. Nov. 20, 1925, Moscow, Russia, U.S.S.R.) Russian prima ballerina. She studied at the Bolshoi Ballet's school in Moscow and joined the company as a soloist in 1943. Noted for her technical virtuosity and ability to integrate acting with dancing, she toured worldwide with the Bolshoi Ballet and appeared as a guest artist with several companies, including the Paris Opéra. She also danced in several films, including *Swan Lake* (1957). In the 1980s she was a guest ballet director in Rome and then in Madrid.

Maya Plisetskaya in *Swan Lake,* 1961.
PARIS MATCH-PICTORIAL PARADE

PLO See Palestine Liberation Organization

ploidy \'plȯi-dē\ Number of sets of chromosomes in the nucleus of a cell. In normal human body cells, chromosomes exist in pairs, a condition called diploidy. During meiosis the cell produces sex cells (gametes), each containing half the normal number of chromosomes, a condition called haploidy. When an egg and a sperm unite in fertilization, the diploid condition is restored. Polyploid cells have three or more times the number of chromosomes found in haploid cells; polyploid organisms usually cannot reproduce. Aneuploid cells have an abnormal number of chromosomes that is not a multiple of the haploid number. Aneuploidy is most often caused by an error leading to an unequal distribution of chromosomes during division.

Plotinus \plō-'tī-nəs\ (b. AD 205, Lyco, or Lycopolis, Egypt?—d. 270, Campania) Egyptian-Roman philosopher. At age 27 he traveled to Alexandria, where he studied philosophy for 11 years. In about 242 he joined the expedition of the Roman emperor Gordian III against Persia in order to learn about the philosophies of the Persians and Indians. He went to Antioch and then to Rome, where he settled at age 40, becoming the centre of an influential circle of intellectuals. His attempt to form a Platonic republic in Campania c. 265 was halted by the emperor Gallienus. He was the founder of the school of philosophy known as Neoplatonism; his collected works, the *Enneads* (from Greek, *enneas*: "set of nine"), arranged by his disciple Porphyry (232?–c. 305), are the first and greatest collection of Neoplatonic writings. For Plotinus, philosophy was not only a matter of abstract speculation but also a way of life and a religion. His works strongly influenced early Christian theology, and his philosophy was widely studied and emulated for many centuries.

Plovdiv \'plȯv-ˌdif\ City (pop., 2001: 340,638), south-central Bulgaria. It is situated on the Maritsa River, north of the Rhodope Mountains. In 341 BC it fell to Philip II and was renamed Philippopolis. From AD 46 it was called Trimontium and was the capital of the Roman province of Thrace. It changed hands repeatedly during the Middle Ages until 1364, when it was captured by the Turks. After the Russo-Turkish Wars (1877–78), it became the capital of Turkish Eastern Rumelia, which united with Bulgaria in 1885. It officially assumed its present name after World War I. It is a major railroad junction and a food-processing centre with diversified industries.

plover \'plə-vər, 'plō-vər\ Any of about 36 species (family Charadriidae, order Charadriiformes) of plump-breasted shorebirds found almost worldwide. Plovers are 6–12 in. (15–30 cm) long and have long wings, long-

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ish legs, a short neck, and a straight, short bill. Many species are plain brown, gray, or sandy above and whitish below. Others, including the golden and black-bellied plovers, are finely patterned above and black below in breeding season. Many species run along the shoreline, snapping up small aquatic invertebrates. They have a melodious whistled call. Both parents incubate the two to five eggs and care for the young. See also KILLDEER.

Golden plover (*Pluvialis apricaria*).
KENNETH W. FINK—ROOT RESOURCES

plow *or* **plough** Most important agricultural implement since the beginning of history, used to turn and break up SOIL, to bury CROP residues, and to help control WEEDS. The forerunner of the plow is the prehistoric digging stick. The earliest plows were undoubtedly digging sticks with handles for pulling or pushing. By Roman times, plows were pulled by oxen or horses, and today they are drawn by TRACTORS.

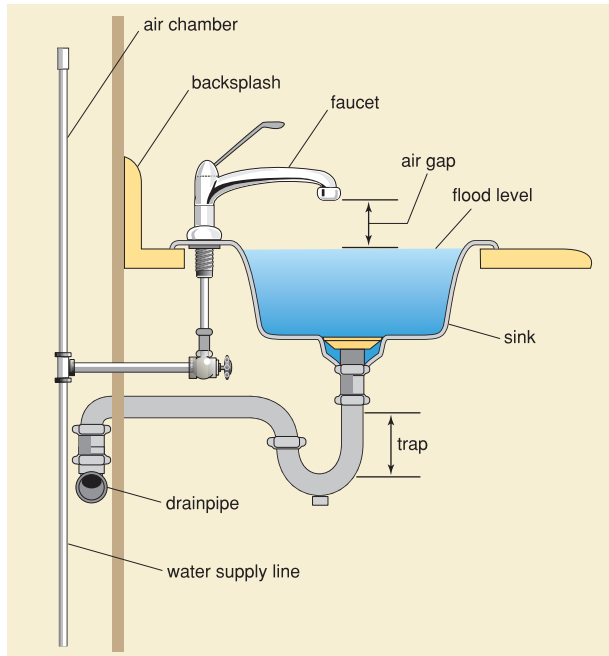
plum Any of various trees in the genus *Prunus* of the ROSE family, and their edible fruits. In the U.S. and Europe, plums are the most extensively distributed of the stone (drupe) fruits, most varied in native and cultivated kinds, and most adapted to a wide range of soils and climatic conditions. The fruits show a wide range of size, flavour, colour, and texture. They are widely eaten fresh, cooked, or baked in pastries. In full bloom, plum trees are covered with densely packed, showy flower clusters. The smooth-skinned fruit has a fleshy, juicy exterior and a hard interior stone or pit. Plum varieties that can be or have been dried without resulting in fermentation are called prunes.

plumbago See GRAPHITE

plumbing System of pipes and fixtures installed in a building for the distribution of potable water and the removal of waterborne wastes. Plumbing is usually distinguished from water and sewage systems, which serve a group of buildings or a city. Improvement in plumbing systems was very slow, with virtually no progress made from the time of the Roman system of AQUEDUCTS and lead pipes until the 19th century. Eventually the development of separate, underground water and sewage systems eliminated open sewage ditches. Present-day water pipes are usually made of steel, copper, brass, plastic, or other nontoxic material. A building's waste-disposal system has two parts: the drainage system and the venting system. The drainage portion comprises pipes leading from various fixture drains to the central main, which is connected to the sewage system. The venting system consists of pipes leading from an air inlet (usually on the roof) to various points within the drainage system; by providing the circulation of air within the system, it protects the trap seals of fixtures from siphonage and back pressure. See also SEWAGE SYSTEM, WATER POLLUTION, WATER-SUPPLY SYSTEM. See illustration opposite.

Plunket, Saint Oliver (b. 1629, Loughcrew, County Meath, Ire.—d. July 1, 1681, London, Eng.; canonized 1975; feast day July 11) Irish prelate, the last man to suffer martyrdom for the Catholic faith in England. He was ordained in Rome, where he taught theology and represented the Irish bishops at the Holy See. In 1669 he was appointed archbishop of Armagh and primate of Ireland, and he worked to restore the disorganized church in Ireland. Renewed persecution forced him into hiding in 1673. In the anti-Catholic hysteria caused by the TITUS OATES plot (1678), he was betrayed and imprisoned in Dublin in 1679. After a farcical trial in London, he was convicted of treason and was hanged, drawn, and quartered. His head, originally sent to Rome, is preserved at Drogheda, and his body is at Downside Abbey, near Bath.

pluralism In political science, the view that in liberal democracies power is (or should be) dispersed among a variety of economic and ideological pressure groups and is not (or should not be) held by a single elite or group of elites. Pluralism assumes that diversity is beneficial to society and that the disparate functional or cultural groups of which society is composed—including religious groups, trade unions, professional organizations, and ethnic minorities—should be autonomous. Pluralism was stressed most vigorously during the early 20th century by a group of English writers that included FREDERIC W. MAITLAND and HAROLD J. LASKI; it was defended in the later 20th century by the American scholars Robert Dahl and David B. Truman.



The basic components of a plumbing fixture include the water-supply pipes, a valve or faucet for controlling the flow of water, and a drainpipe to carry wastewater away. An air chamber may be added to the supply line to cushion the effects of water hammer. A trap in the drain line leaves a plug of water in the pipe to prevent unwanted sewer gases from entering the room via the drain.
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pluralism In METAPHYSICS, the doctrine opposed to MONISM. Whereas monists such as PARMENIDES, BENEDICT DE SPINOZA, and G.W.F. HEGEL maintain that reality consists of only one ultimate substance, pluralists assert that reality consists of manifold entities of many different types and that the diversity of things is more striking and important than their unity. In *A Pluralistic Universe* (1909), WILLIAM JAMES held that it is characteristic of empirically minded thinkers to note the changeability of things, the multiplicity of their being and their relations with one another, and the unfinished character of the world.

plurality system Electoral process in which the candidate who polls more votes than any other candidate is elected. It is distinguished from the majority system, in which, to win, a candidate must receive more votes than all other candidates combined. It is the most common method of selecting candidates for public office. Its chief advantage is that it avoids the need for runoffs to produce a winner. Its chief disadvantage is that it may result in a winner who has received a minority of the votes cast. It operates best in a two-party system, where the small vote for any third party will rarely result in an outcome seriously at odds with the voters' will.

Plutarch \'plü-ˌtärk\ *Greek* **Plutarchos** *Latin* **Plutarchus** (b. AD 46, Chaeronea, Boeotia—d. after 119) Greek biographer and author. The son of a biographer and philosopher, Plutarch studied in Athens, taught in Rome, traveled widely, and made many important friends before returning to his native town in Boeotia. His literary output was immense, but his popularity rests primarily on his *Parallel Lives*, a series of pairs of biographies of famous Greeks and Romans. Displaying impressive learning and research, the *Lives* exhibit noble deeds and characters and provide model patterns of behaviour. The *Moralia*, or *Ethica*, contains his surviving writings on ethical, religious, physical, political, and literary topics. His works profoundly influenced the evolution of the essay, biography, and historical writing in 16th–19th-century Europe, especially through translations such as Sir Thomas North's *Lives of the Noble Grecians and Romanes* (1579), WILLIAM SHAKESPEARE's source for his Roman history plays.

Pluto Ninth planet from the Sun. It was discovered in 1930 by Clyde W. Tombaugh (1906–97) and named after the Greek god of the underworld. It is usually the outermost of the known planets, averaging about 3.7 billion

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mi (5.9 billion km) from the Sun (within the KUIPER BELT), but its eccentric orbit brings it closer to the Sun than NEPTUNE for 22 years during its 248-year orbit. Its axis is tipped 120°, so it rotates nearly on its side and "backward" (see RETROGRADE MOTION) once every 6.39 days, locked synchronously with the orbit of its largest moon, Charon, discovered in 1978. Two additional, small moons were discovered in 2005. Pluto has a diameter of about 1,455 mi (2,340 km), roughly two-thirds that of the Moon, and has less than 1% of Earth's mass and only about 6% of its surface gravity. Its estimated average surface temperature is near –390 °F (–235 °C). Its thin atmosphere contains nitrogen, methane, and perhaps other heavier gases. Pluto is thought to be made of frozen gases with a significant fraction of rocky material. Its size, composition, and orbital location in the Kuiper belt have sparked debate over its classification as a major planet.

plutonium Radioactive (see RADIOACTIVITY) metallic chemical ELEMENT, chemical symbol Pu, atomic number 94. A member of the ACTINIDE series of TRANSITION ELEMENTS, it is the most important TRANSURANIUM ELEMENT because of its use in certain types of nuclear reactors (see NUCLEAR POWER) and in NUCLEAR WEAPONS. It is found in nature only in traces produced by natural NEUTRON irradiation in URANIUM ores. It is produced artificially by neutron irradiation of uranium-238. Plutonium is a silvery METAL that tarnishes in air; it is warm because of energy released in ALPHA DECAY. Its ISOTOPES, all radioactive, are highly toxic radiological poisons (see RADIATION INJURY) because they give off alpha particles and are specifically absorbed by bone marrow.

Plymouth City (pop., 1999 est.: 255,800) in DEVON, southwestern England. Located on Plymouth Sound southwest of London, the city was named Sudstone in DOMESDAY BOOK (1086); its harbour is called Sutton Harbour. It was the port from which the English fleet sailed against the Spanish ARMADA in 1588. In 1690 its dockyard was built on the western bank of the River Tamar. During World War II Plymouth suffered bomb damage from air raids. The rebuilt city has some of the finest commercial, shopping, and civic centres in Britain and new bridges over the Rivers Plym and Tamar.

Plymouth City (pop., 2000: 51,701), southeastern Massachusetts, U.S. Located on Plymouth Bay, it was the site of the first permanent European settlement in New England, the Colony of New Plymouth, founded by the PILGRIMS in 1620 and governed under the MAYFLOWER COMPACT until 1691, when it became part of MASSACHUSETTS BAY COLONY. Its seaside location and historic associations make Plymouth an outstanding summer resort. A tourist-based economy is supplemented by light industry, fishing, and cranberry growing. Historical attractions include Plimoth Plantation (a recreation of the original Pilgrim village) and many restored early colonial houses.

Plymouth Company (1606–09) Commercial trading company chartered by the English crown to colonize the eastern coast of North America in present-day New England. Also called the Virginia Colony of Plymouth, its shareholders were merchants of Plymouth, Bristol, and Exeter. Its twin company was the more successful LONDON COMPANY. The Plymouth Company established a colony on the coast of Maine in 1607 but soon abandoned it. Inactive after 1609, it was reorganized under a new charter in 1620 as the Council for New England. See also CHARTERED COMPANY.

plywood Manufactured panel made up of three or more thin plies (layers) of wood. Each ply is laid down with its grain running perpendicular to the one before it. Like other glued-wood products, plywood provides a strong, inexpensive alternative to solid wood. It is widely used both in cabinetmaking (for chests, dressers, wardrobes, and tables) and in house construction (for walls, ceilings, subfloors, doors, and in forms for casting concrete).

PMS See PREMENSTRUAL SYNDROME

pneumatic device \nü-'ma-tik\ Any of various TOOLS and instruments that generate and use COMPRESSED AIR. Examples include rock drills, pavement breakers, riveters, forging presses, paint sprayers, blast cleaners, and atomizers. Compressed-air power is flexible, economical, and safe. In general, pneumatic systems have relatively few moving parts, contributing to high reliability and low maintenance costs.

pneumatic structure MEMBRANE STRUCTURE that is stabilized by the pressure of compressed air. Air-supported structures are supported by internal air pressure. A network of cables stiffens the fabric, and the assembly is supported by a rigid ring at the edge. The air pressure within this bubble is increased slightly above normal atmospheric pressure and maintained by compressors or fans. Air locks are required at entrances to prevent loss of internal air pressure. Air-supported membranes were first devised by Walter Bird in the late 1940s and were soon put to use as covers for swimming pools, temporary warehouses, and exhibition buildings. Air-inflated structures are supported by pressurized air within inflated building elements that are shaped to carry loads in a traditional manner. Pneumatic structures are perhaps the most cost-effective type of building for very long spans.

pneumococcus \ˌnü-mə-'kä-kəs\ Spheroidal bacterium (*Streptococcus pneumoniae*) that causes human diseases including pneumonia, sinusitis, ear infection, and meningitis. Usually occurring in the upper respiratory tract, this gram-positive (see GRAM STAIN) COCCUS is often found in a chain configuration and surrounded by a POLYSACCHARIDE capsule. Pneumococci are separated into types depending on the specific capsular polysaccharide formed. Their disease-causing ability resides in the capsule, which delays or prevents their destruction by cells in the bloodstream that normally engulf foreign material.

pneumoconiosis \ˌnü-mə-ˌkō-nē-'ō-səs\ Any LUNG disease caused by inhalation of organic or inorganic dusts or chemical irritants, usually over time. Some dusts (e.g., SILICA MINERALS, ASBESTOS) produce grave reactions in small quantities. Dust collects in the PULMONARY ALVEOLI, causing inflammation that scars lung tissue, reducing its elasticity. Chest tightness and shortness of breath may progress to chronic BRONCHITIS and EMPHYSEMA. Cigarette smoking worsens many types. The most common cause of severe disease is silica (see SILICOSIS). Asbestos (see ASBESTOSIS), beryllium, and aluminum dusts can cause worse disease, often on brief exposure. Organic causes include mold spores (see ALLERGY) and textile fibres. Chemical irritants such as ammonia, acid, and sulfur dioxide are soon absorbed by the lung lining; their irritant effect can cause pulmonary EDEMA, and they can lead to chronic bronchitis.

pneumonia \nü-'mōn-yə\ INFLAMMATION and solidification of LUNG tissue caused by infection, foreign particle inhalation, or irradiation but usually by BACTERIA. *Mycoplasma pneumoniae* is the most common cause in healthy individuals. The bronchi and alveoli may be inflamed. Coughing becomes severe and may bring up flecks of blood. It can be serious but is rarely fatal. *Streptococcus pneumoniae* is more common and generally more severe but usually affects only those with low resistance, especially in hospitals. A highly lethal form caused by *Klebsiella pneumoniae* is almost always confined to hospitalized patients with low immunity. Other bacterial pneumonias include *Pneumocystis carinii* pneumonia (rare except in AIDS) and LEGIONNAIRE DISEASE. Most respond to ANTIBIOTIC treatment. VIRUSES set the stage for bacterial pneumonia by weakening the individual's immune system more often than they cause pneumonia directly. Fungal pneumonia usually occurs in hospitalized persons with low resistance, but contaminated dusts can cause it in healthy individuals. It can develop rapidly and may be fatal. X-RAY treatment (see RADIATION THERAPY) of structures in the chest may cause temporary lung inflammation.

pneumothorax Condition in which air accumulates in the pleural sac, causing it to expand and thus compress the underlying LUNG, which may then collapse. (The pleural sac is a cavity formed by the two pleural membranes that line the thoracic cavity and cover the lungs.) Traumatic pneumothorax is the accumulation of air caused by penetrating wounds (knife stabbing, gunshot) or other injuries to the chest wall, after which air is sucked through the opening and into the pleural sac. Spontaneous pneumothorax is the passage of air into the pleural sac from an abnormal connection created between the pleura and the bronchial system as a result of tuberculosis or some other lung disease. The symptoms of spontaneous pneumothorax are a sharp pain in one side of the chest and shortness of breath.

Po Chü-i See BO JUYI

Po Hai See BO HAI

Po River *ancient* **Padus** River, northern Italy. The country's longest river, it is about 405 mi (652 km) long. It rises in the Cottian Alps on the western frontier and flows northeast to TURIN, then east across PIEDMONT and LOMBARDY into the ADRIATIC SEA. Its delta is one of the most complex of any European river, with at least 14 mouths. It is navigable from its mouth to PAVIA. Industrial cities in its valley include MILAN, PADUA, and VERONA. It has suffered devastating autumn floods, including those in 589, 1438, 1951, and 1966.

Pobedonostsev \pə-byi-də-'nôst-syif**, Konstantin (Petrovich)** (b. May 21, 1827, Moscow, Russia—d. March 23, 1907, St. Petersburg)

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Russian government administrator. He wrote and lectured on civil law at Moscow University (1859–65), tutored the sons of Tsar Alexander II, and later became a close adviser to Alexander III, influencing him to adopt reactionary policies. As director general of the Holy Synod of the Russian Orthodox church (1880–1905), he assumed great power over domestic policy in education, religion, and censorship. Nicknamed "the Grand Inquisitor," he became the symbol of Russian monarchical absolutism.

Pocahontas \ˌpō-kə-ˈhän-təs\ (b. c. 1596, near present-day Jamestown, Va. [U.S.]—d. March 1617, Gravesend, Kent, Eng.) Powhatan Indian woman. Daughter of the powerful chief Powhatan, Pocahontas helped maintain peace between English colonists and Native Americans by befriending the settlers at Jamestown, Va. By the account of colonial leader John Smith, Pocahontas intervened to save his life after he had been taken prisoner by her father's men. She subsequently converted to Christianity and wedded the colonist John Rolfe, which furthered efforts toward peace. She traveled to England, where she was received at court, but soon afterward she died, probably of lung disease.

Pocahontas, detail of a portrait by an unknown artist, 1616.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

pocket billiards See pool

pocket gopher See gopher

pocket mouse Any of about 30 species of nocturnal North American rodents constituting the genus *Perognathus* (family Heteromyidae), having fur-lined, external cheek pouches that open alongside the mouth. Pocket mice are yellowish brown to dark gray and are 2.5–5 in. (6–13 cm) long, excluding a tail of about the same length. They are usually solitary and inhabit dry and desert regions. They carry food (mainly seeds) in their pouches and store it in their burrows. Spiny pocket mice (most in the genera *Liomys* and *Heteromys*; family Heteromyidae), found from Mexico through Central America, are gray, brown, or black nocturnal burrowers that inhabit wet, forested regions as well as dry country.

podesta \ˌpō-də-ˈstä\ (Italian: "power") In medieval Italian communes, the highest judicial and military magistrate. The office was instituted by Frederick I Barbarossa in an attempt to govern rebellious Lombard cities. From the late 12th century the communes usually elected their own podesta, often a nobleman with legal training. Serving for six months or a year, the podesta summoned councils, led the communal army, and administered civil and criminal jurisdiction.

Podgorica \ˈpȯd-ˌgȯr-ēt-sä\ *formerly (1946–92)* **Titograd** City (pop., 1999 est.: 130,875), capital of Montenegro, southern Serbia and Montenegro. As a feudal state capital in the early Middle Ages, it was known as Ribnica; it was called Podgorica from 1326. It fell to the Turks in 1474 but was restored to Montenegro in 1878. It was occupied in 1916 by Austria, in 1941 by Italy, and in 1943 by Germany. In 1946 it became Titograd in honour of Marshal Tito, but its former name was restored in 1992 after the collapse of communism. It is the site of a university (founded 1974).

Podgorny \pȯd-ˈgȯr-nē**, Nikolay (Viktorovich)** (b. Feb. 18, 1903, Karlovka, Ukraine, Russian Empire—d. Jan. 12, 1983, Moscow, Russia, U.S.S.R.) Soviet politician. He worked in engineering jobs in the sugar industry, then was appointed deputy commissar of the Soviet food-processing industry in 1940. He rose through the Communist Party hierarchy to become chair of the Ukraine party committee (1957–63), a full member of the Politburo (1960), and head of the party's Central Committee (1963–65). In a power struggle with Leonid Brezhnev, Podgorny was demoted to the ceremonial post of chairman of the Presidium of the Supreme Soviet (1965–77).

podiatry \pə-ˈdī-ə-trē\ *or* **chiropody** \ˌkə-ˈräp-əd-ē\ Medical specialty dealing with the foot. Podiatrists diagnose and treat foot diseases, disabilities, and deformities by means of physical medicine and rehabilitation, special shoes and other mechanical devices, drugs, and minor surgery.

podium In architecture, a pedestal on a large scale. It may be any of various elements that form the base of a structure, such as the platform forming the floor and substructure of a Classical temple, a low wall supporting columns, or the structurally or decoratively emphasized lowest portion of a wall. The term is also applied to other types of raised platform, such as an orchestra conductor's dais.

Poe, Edgar Allan (b. Jan. 19, 1809, Boston, Mass., U.S.—d. Oct. 7, 1849, Baltimore, Md.) U.S. poet, critic, and short-story writer. Poe was raised by foster parents in Richmond, Va., following his mother's death in 1811. He briefly attended the University of Virginia and then returned to Boston, where in 1827 he published a pamphlet of youthful, Byronic poems. By 1835 he was in Richmond as editor of the *Southern Literary Messenger*, the first of several periodicals he was to edit or write for. There he married a 13-year-old cousin, who died in 1847. At various times he lived in Baltimore, New York, and Philadelphia. Alcohol, the bane of his irregular and eccentric life, caused his death at age 40. His works are famous for his cultivation of mystery and the macabre. Among his tales are "The Fall of the House of Usher," "The Masque of the Red Death," "The Black Cat," "The Tell-Tale Heart," and "The Pit and the Pendulum." "The Murders in the Rue Morgue" and "The Purloined Letter" initiated the modern detective story. His poems (less highly regarded now than formerly) are musical and sensuous, as in "The Bells," a showcase of sound effects; they include touching lyrics inspired by women (e.g., "Annabel Lee") and the uncanny (e.g., "The Raven").

poet laureate Title first granted in England for poetic excellence. Begun in 1616, the office was formally established in 1668 and has been continuous since then. Its holder, a salaried member of the British royal household, was formerly expected to compose poems for court or national occasions, but since the appointment of William Wordsworth in 1843 the office has been a reward for eminence in poetry and has carried no specific duties. In 1985 the U.S. government created the title of poet laureate, to be held by the consultant in poetry to the Library of Congress.

poetry Writing that formulates a concentrated imaginative awareness of experience in language chosen and arranged to create a specific emotional response through its meaning, sound, and rhythm. It may be distinguished from prose by its compression, frequent use of conventions of metre and rhyme, use of the line as a formal unit, heightened vocabulary, and freedom of syntax. Its emotional content is expressed through a variety of techniques, from direct description to symbolism, including the use of metaphor and simile. See also prose poem; prosody.

Poetry U.S. poetry magazine founded in Chicago in 1912 by Harriet Monroe, who became its longtime editor. It became the principal organ for modern poetry of the English-speaking world and survived through World War II. Because its inception coincided with the Chicago literary renaissance, it is often associated with the raw, local-colour poetry of Carl Sandburg, Edgar Lee Masters, Vachel Lindsay, and Sherwood Anderson, but it also championed new formalistic movements, including Imagism. Ezra Pound was its European correspondent; among the authors it published were T.S. Eliot, Wallace Stevens, Marianne Moore, D.H. Lawrence, and William Carlos Williams.

Poggio Bracciolini \ˈpȯd-jō-ˌbrät-chō-ˈlē-nē**, Gian Francesco** (b. Feb. 11, 1380, Terranuova, Tuscany—d. Oct. 30, 1459, Florence) Italian humanist and calligrapher. While working as a copyist of manuscripts, Poggio invented the humanist script, which later became the prototype for Roman fonts in printing. He traveled to various monasteries in Europe, uncovering lost, forgotten, or neglected classical Latin manuscripts, including works by Cicero and Lucretius. He also translated works by Lucian, Xenophon, and others into Latin. His own writings include moral dialogues and *Facetiae* (1438–52), a collection of humorous tales containing satires of his contemporaries.

pogrom \pə-ˈgräm\ *Russian* **"devastation" or "riot"** Mob attack, condoned by authorities, against persons and property of a religious, racial, or national minority. The term is usually applied to attacks on Jews in Russia in the late 19th and early 20th centuries. After the assassination of Tsar Alexander II (1881), false rumours associating Jews with the murder aroused Russian mobs in more than 200 cities and towns to attack Jews and destroy their property. Mob attacks diminished in the 1890s, but they again became common in 1903–06. Although the government did not organize pogroms, its anti-Semitic policy (1881–1917) and reluctance to stop the attacks led many anti-Semites to believe that their violence was legitimate. Pogroms also occurred in Poland and in Germany during Adolf Hitler's regime.

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pogy See MENHADEN

Poincaré \pwa^{n}-kä-'rā**, (Jules-) Henri** (b. April 29, 1854, Nancy, France—d. July 17, 1912, Paris) French mathematician, theoretical astronomer, and philosopher of science. Born into a distinguished family of civil servants (see RAYMOND POINCARE), he excelled at mental calculation and possessed an unusually retentive memory. He wrote a doctoral dissertation on DIFFERENTIAL EQUATIONS (1879), then joined the University of Paris (1881), where he remained the rest of his life. Working in celestial mechanics and mathematical analysis, he independently obtained many of ALBERT EINSTEIN's results relating to the special theory of relativity and published them in a paper on the dynamics of the electron (1906). He later wrote books for the general public on the meaning and importance of science and mathematics.

Henri Poincaré, 1909.
H. ROGER-VIOLLET

Poincaré \pwa^{n}-kä-'rā**, Raymond** (b. Aug. 20, 1860, Bar-le-Duc, France—d. Oct. 15, 1934, Paris) French politician. A lawyer, he served in the Chamber of Deputies (1887–1903) and the Senate (1903–12) and as minister of education (1893, 1895) and finance minister (1894, 1906). As prime minister and foreign minister (1912–13), he strengthened France's ties with Russia and Britain. As president of the THIRD REPUBLIC (1913–20), he vigorously supported national unity. As prime minister again in 1922–24 and 1926–29, he was credited with solving France's financial crisis by stabilizing the franc, enabling a period of new prosperity.

poinsettia \pȯin-'se-tē-ə\ Popular flowering plant (*Euphorbia pulcherrima*), best-known member of the diverse SPURGE family. Native to Mexico and Central America, it grows in moist, wet, wooded ravines and on rocky hillsides. What appear to be flower petals are actually coloured leaflike BRACTS that surround a central cluster of tiny yellow flowers. Cultivated varieties are available with white, pink, mottled, and striped bracts, but the solid red varieties are in greatest demand during the Christmas season. Milky latex in the stems and leaves can be irritating to sensitized persons or animals, but the claim that poinsettias are deadly poisonous is greatly exaggerated.

Poinsettia (*Euphorbia pulcherrima*).
GRANT HEILMAN-EB INC.

Point Four Program U.S. policy of technical assistance and economic aid to less-developed countries. Pres. HARRY S. TRUMAN proposed the plan as the fourth point of his 1949 inaugural address. It was approved by Congress and administered by a special State Department agency until it was merged with other foreign-aid programs in 1953. Technical assistance, mainly in agriculture, public health, and education, was provided through contracts with U.S. business and educational organizations. Organizations such as the INTER-AMERICAN DEVELOPMENT BANK were created to help develop the program.

Pointe-Noire \ˌpwa^{n}t-'nwär\ City (pop., 1992 est.: 576,206) and port, southwestern Republic of the Congo. It was the capital (1950–58) of the Middle Congo region of FRENCH EQUATORIAL AFRICA. With independence in 1958, it was replaced by BRAZZAVILLE as the national capital, but it remained important for trade. Its port facilities were completed in 1939 and expanded during World War II. The country's second largest city, it is a principal port and commercial centre, especially for the oil industry.

pointer Dog breed, of HOUND, SPANIEL, and SETTER ancestry, first recorded c. 1650 in Great Britain and named for the dog's rigid posture in the direction of quarry. Pointers were originally used to point out hares and were later trained as bird dogs. The pointer stands 23–28 in. (58–71 cm) tall and weighs 50–75 lb (23–34 kg); it has a long muzzle, hanging ears, tapered tail, and a short, smooth coat, usually white with dark markings. The German short-haired pointer, another sporting breed, tracks, points, and retrieves; it is about the size of a pointer and has a short coat of solid liver colour or liver and gray-white.

German short-haired pointer
SALLY ANNE THOMPSON

pointillism \'pwa^{n}-tē-ˌyi-zəm, 'pȯin-tᵊl-ˌi-zəm\ In painting, the practice of applying small strokes or dots of contrasting colour to a surface so that from a distance they blend together. The term (and its synonym, divisionism) was first used to describe the paintings of GEORGES SEURAT. See also CAMILLE PISSARRO; PAUL SIGNAC.

Poiret \pwȧ-'re**, Paul** (b. April 20, 1879, Paris, Fr.—d. April 30, 1944, Paris) French fashion designer. After working in the Parisian fashion house of CHARLES FREDERICK WORTH, he opened his own shop in 1902. In 1908 he revived the Empire style, popular in France during the reign of Napoleon I. Seeking to restore naturalness to female garb, he was principally responsible for the decline of the corset. He is best known for the hobble skirt, to which he later added draped and belted knee-length tunics. Fringed and tasseled capes, multicoloured feathers, and fox stoles imparted a theatrical look to his designs. His flowing Greek costumes were extremely popular in the prewar era, but his popularity faded in the 1920s and he died in poverty.

poison Any substance (natural or synthetic) that, at a certain dosage, damages living tissues and injures or kills. Poisons spontaneously produced by living organisms are often called TOXINS, VENOMS if produced by animals. Poisons may be ingested, inhaled, injected, or absorbed through the skin. They do not always have an all-or-none effect; degrees of poisoning may occur, and at a given dose some substances are far more toxic than others (e.g., a pinch of potassium CYANIDE can kill, whereas a single dose of ordinary table salt must be massive to kill). Poisoning may be acute (a single dose does significant damage) or chronic (repeated or continuous doses produce an eventual effect, as with chemical CARCINOGENS). The effects produced by poisons may be local (hives, blisters, inflammation) or systemic (hemorrhage, convulsions, vomiting, diarrhea, clouding of the senses, paralysis, respiratory or cardiac arrest). Agricultural PESTICIDES are often poisonous to humans. Some industrial chemicals can be very toxic or carcinogenic. Most therapeutic drugs and health-care products can be poisons if taken inappropriately or in excess. Most forms of RADIATION can be toxic (see RADIATION INJURY). See also ANTIDOTE; ARSENIC POISONING; FISH POISONING; FOOD POISONING; LEAD POISONING; MEDICINAL POISONING; MERCURY POISONING; MUSHROOM POISONING.

poison hemlock Any of several poisonous herbaceous plants of the PARSLEY family, especially *Conium maculatum*, believed to be the plant that killed SOCRATES. It is now common in the U.S. as well as in Europe. A tall biennial, this plant has green stems spotted with red or purple, large compound leaves, and white flowers. Though the poison is concentrated in the seeds, the entire plant is dangerous to livestock when fresh. Despite their common name, poison hemlocks are not CONIFERS (see HEMLOCK). Water hemlocks (*Cicuta* species) are similar and also dangerous.

poison ivy Either of two North American species of white-fruited woody vines or shrubs of the SUMAC, or cashew, family. The species found

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in eastern North America (*Toxicodendron radicans*) is abundant; a western species, known as POISON OAK, is less common. Both species are sometimes classified as genus *Rhus*. A key identifier is leaves with three mitten-shaped leaflets. Contact with urushiol, an oil produced by the plant, can cause severe inflammation and blistering of human skin. Urushiol may be carried from the plant on clothing, shoes, tools, or soil; by animals; or by smoke from burning plants. Because urushiol is nonvolatile, a reaction may result from wearing clothing a year or more after its contact with the plant.

Poison ivy (*Toxicodendron radicans*)
WALTER CHANDOHA

poison oak Species of POISON IVY (*Toxicodendron diversilobum*) native to western North America and classified in the SUMAC (or cashew) family. Like many other lobe-leafed plants commonly called oak, poison oak is not an OAK tree (genus *Quercus*).

poison sumac *also called* **poison elder** Attractive, narrow shrub or small tree (*Rhus vernix* or *Toxicodendron vernix*) of the SUMAC, or cashew, family. It is native to swampy acidic soils of eastern North America. Unlike the upright reddish, fuzzy fruit clusters of other sumacs, whitish waxy berries droop loosely from its stalks. The clear sap, which blackens on exposure to air, is extremely irritating to the skin for many people.

Poitier \'pwä-tē-ˌā**, Sidney** (b. Feb. 20, 1927?, Miami, Fla., U.S.) U.S. actor. He was raised in The Bahamas, then studied and acted with the American Negro Theatre in New York City. He made his film debut in *No Way Out* (1950) and gave notable performances in *Blackboard Jungle* (1955) and *The Defiant Ones* (1958). He won acclaim on Broadway for his role in *A Raisin in the Sun* (1959). He became the first African American actor to win an Academy Award, for his role in *Lilies of the Field* (1963). He used his critical and commercial success to push for integrated film crews. He went on to star in notable films such as *In the Heat of the Night* (1967), *To Sir with Love* (1967), and *Guess Who's Coming to Dinner* (1967). He also directed several films, including *Buck and the Preacher* (1972), *Let's Do It Again* (1975), and *Stir Crazy* (1980). In 1997 he was appointed The Bahamian ambassador to Japan.

Poitiers, Battle of (732) See Battle of TOURS/POITIERS

Poitiers \pwä-'tyā**, Battle of** (September 19, 1356) Catastrophic defeat of the French king JOHN II in the HUNDRED YEARS' WAR between France and England. English troops under EDWARD THE BLACK PRINCE were under pursuit from the probably superior French forces. South of Poitiers the English secured themselves in thickets and marshes, where the French knights became bogged down and made easy targets for the English archers. John II was taken prisoner and for his freedom had to consent to the disadvantageous Treaties of BRETIGNY and Calais.

Poitou \pwä-'tü\ Historical region, western central France. It was bounded by BRITTANY, ANJOU, TOURAINE, Marche, and the Atlantic Ocean. It was inhabited by the ancient Gallic tribe of Pictones and became part of Roman Aquitania. A meeting place of northern and southern cultures, its golden age (11th–12th century) was characterized by great ROMANESQUE ART and architecture. The counts of Poitiers were succeeded by the Angevin kings of England, but by 1375 the French had won the region back. It was a province of France until the FRENCH REVOLUTION, when it was divided into three departments. It is predominantly a rural area; regional specialties include seafood and white wine.

poker Any of several card games in which a player bets that the value of his or her hand is greater than that of the hands held by others. Each subsequent player must either equal or raise the bet or drop out. The pot is eventually won by either the player showing the best hand when it comes to a showdown or the only player left when everyone else has dropped out, or "folded." In this case the winner need not show his hand and could conceivably have won the pot with a lower hand than any other at the table. It is for this reason that poker is described as a game of bluff. Three principal forms of the game have developed: straight poker, in which all cards of the standard five-card hand are dealt facedown; stud poker, in which some but not all of a player's cards are dealt faceup; and community-card poker, in which some cards are exposed and used by all the players to form their best hand. In draw poker, the main variant of straight poker, cards may be discarded and additional cards drawn. The traditional ranking of hands is (1) straight flush (five cards of the same suit in sequence, the highest sequence—ace, king, queen, jack, ten—being called a royal flush), (2) four of a kind, (3) full house (three of a kind, plus a pair), (4) flush (five of a single suit), (5) straight (five in sequence), (6) three of a kind, (7) two pair, (8) one pair.

pokeweed *also called* **pokeberry** *or* **poke** Strong-smelling shrublike plant (*Phytolacca americana*) with a poisonous root resembling the shape of horseradish, native to wet or sandy areas of eastern North America. It has white flowers, reddish black berries, and dark green leaves that often are red-veined or borne on red leafstalks. The berries contain a red dye used to colour wine, candies, cloth, and paper. Like the roots, the red or purplish mature stalks are poisonous. Very young green shoots (up to about 6 in. [15 cm]), however, are edible.

Pokrovsky Cathedral See SAINT BASIL THE BLESSED

Pol Pot *orig.* **Saloth Sar** (b. May 19, 1925/28, Kompong Thom province, Cambodia—d. April 15, 1998, near Anlong Veng) Prime minister of Cambodia. He joined the anti-French resistance under HO CHI MINH in the 1940s and became a member of the Cambodian Communist Party in 1946. After studying radio technology in Paris, he returned to Cambodia in 1953 and taught French until he fell under police suspicion in 1963. For the next 12 years he built up the Communist Party. U.S. anticommunist activity in Cambodia in the early 1970s, including helping to depose NORODOM SIHANOUK and a bombing campaign in the countryside, drove many to join him. In 1975 his KHMER ROUGE forces captured Phnom Penh, which he ordered entirely evacuated. Even the sick were wheeled out in hospital beds, and in the first weeks it is estimated that tens of thousands died. The ruthlessness with which he pursued his intention to return to "year zero" and create an ethnically pure, agrarian, communist state resulted in the deaths of one to two million people. Overthrown by the Vietnamese in 1979, he led an anti-Vietnamese guerrilla war until he was repudiated by the Khmer Rouge and sentenced to life imprisonment (1997); he died the next year.

Poland *officially* **Republic of Poland** Country, central Europe. Area: 120,728 sq mi (312,685 sq km). Population (2005 est.): 38,164,000. Capital: WARSAW. Most of the people are Polish; there are minorities of Ukrainians, Germans, and Belarusians. Language: Polish (official). Religion: Christianity (predominantly Roman Catholic; also Eastern Orthodox). Currency: zloty. Poland consists almost entirely of lowlands in the northern and central regions; the southern border is largely formed by the Sudeten

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and the Carpathian Mountains. The Vistula and Oder, the principal river systems, both drain into the Baltic Sea. Industries include mining, manufacturing, and public utilities. Poland is a republic with two legislative houses; its chief of state is the president, and its head of government is the prime minister. Established as a kingdom in 922 under Mieszko I, Poland was united with Lithuania in 1386 under the Jagiellon dynasty (1386–1572) to become the dominant power in east-central Europe, enjoying a prosperous golden age. In 1466 it wrested western and eastern Prussia from the Teutonic Order, and its lands eventually stretched to the Black Sea. Wars with Sweden (see First Northern War; Second Northern War) and Russia beginning in the late 17th century led to the loss of considerable territory. In 1697 the electors of Saxony became kings of Poland, virtually ending Polish independence. In the late 18th century Poland was divided between Prussia, Russia, and Austria (see partitions of Poland) and ceased to exist. After 1815 the former Polish lands came under Russian domination, and from 1863 Poland was a Russian province, subjected to intensive Russification. After World War I an independent Poland was established by the Allies. The invasion of Poland in 1939 by the U.S.S.R. and Germany precipitated World War II, during which the Nazis sought to purge Poland's culture and its large Jewish population in the Holocaust. Reoccupied by Soviet forces in 1945, Poland was controlled by a Soviet-dominated government from 1947. In the 1980s the Solidarity labour movement led by Lech Wałęsa achieved major political reforms, and free elections were held in 1989. An economic austerity program instituted in 1990 sped the transition to a market economy. Poland became a member of NATO in 1999 and the European Union in 2004.

Poland, partitions of (1772, 1793, 1795) Territorial divisions of Poland by Russia, Prussia, and Austria that progressively reduced its territory until it ceased to exist as a state. In the First Partition (1772), a Poland weakened by civil war and Russian intervention agreed to a treaty signed by Russia, Prussia, and Austria that deprived it of half its population and almost one-third of its land area. In the Second Partition (1793), Poland was forced to cede additional lands to Prussia and Russia. To quell a nationalist uprising led by Tadeusz Kościuszko, Russia and Prussia invaded Poland and divided the remnants of the state among themselves and Austria in the Third Partition (1795). Only with the establishment of the Polish Republic in 1918 were the results of the partitions reversed.

Polanski \pə-'lan-skē**, Roman** (b. Aug. 18, 1933, Paris, France) Polish-French film director. He grew up in Poland and survived a traumatic wartime childhood under the Nazis. His first feature film, *Knife in the Water* (1962), brought him international fame. He left Poland that year for Britain, where he made *Repulsion* (1965), and later the U.S., where his *Rosemary's Baby* (1968) was highly successful. In 1969 his new wife, the actress Sharon Tate, was murdered by followers of Charles Manson. He directed a graphic adaptation of *Macbeth* (1971) and the acclaimed film noir *Chinatown* (1974). In 1977 Polanski was arrested and eventually pleaded guilty to a charge of statutory rape. He subsequently jumped bail and fled to France, where he remained active in both the theatre and motion pictures. His subsequent films include *Tess* (1979), *Frantic* (1988), *Bitter Moon* (1992), *Death and the Maiden* (1994), and *The Pianist* (2002), which won the Gold Palm for best film at the Cannes International Film Festival and earned a best director Academy Award for Polanski.

polar bear White semiaquatic bear (*Ursus maritimus*) found throughout Arctic regions, generally on drifting oceanic ice floes. A swift, wide-ranging traveler and a good swimmer, it stalks and captures its prey. It primarily eats seal but also fish, seaweed, grass, birds, and caribou. The male weighs 900–1,600 lbs (410–720 kg) and is about 5.3 ft (1.6 m) tall at the shoulder and 7–8 ft (2.2–2.5 m) long. It has a short tail. The hairy soles of its broad feet protect it from the cold and help it move across the ice. Though shy, it is dangerous when confronted.

Polar bear (*Ursus maritimus*)
FRANCOIS GOHIER/ARDEA LONDON

polar wandering Migration of the magnetic poles of the Earth through geologic time. Scientific evidence indicates that the magnetic poles have slowly and erratically wandered across the surface of the Earth. Pole locations calculated from measurements on rocks younger than about 20 million years do not depart from the present pole locations by very much, but successively greater "virtual pole" distances are revealed for rocks older than 30 million years, indicating that substantial deviations occurred. Calculations of polar wandering formed one of the first important pieces of evidence for continental drift.

Polaris \pə-'lar-əs\ *or* **North Star** Earth's present northern polestar (the star visible from the Northern Hemisphere toward which Earth's axis points), at the end of the "handle" of the Little Dipper in the constellation Ursa Minor. Polaris is actually a triple star, composed of a binary star and a Cepheid variable. Precession of Earth's axis made the star Thuban, in the constellation Draco, the North Star in ancient Egyptian times; it will cause the North Pole to point toward Vega, in the constellation Lyra, 12,000 years from now.

polarization Property of certain types of electromagnetic radiation in which the direction and magnitude of the vibrating electric field are related in a specified way. The electric vector representing the magnitude and direction of the electric field in a wave of light is perpendicular to the direction in which the wave is moving. Unpolarized light consists of waves moving in the same direction with their electric vectors pointing in random orientations about the axis of propagation. Plane-polarized light consists only of waves that vibrate in one direction. In circular polarization the electric vector rotates about the propagation direction. Light may be polarized by reflection or by passing it through polarizing filters, such as certain crystals, that transmit vibrations in one plane but not in others. Polarized light has useful applications in crystallography, liquid-crystal displays, optical filters, and the identification of optically active chemical compounds.

Polaroid Corp. Major U.S. manufacturer of photographic equipment and supplies. The company was established as Land-Wheelwright Laboratories in 1932 by Edwin Land and George Wheelwright to produce Land's first invention, an inexpensive plastic-sheet light polarizer (see polarization). By 1936 Land was using polarized material in sunglasses and other optical devices, and in 1937 the company was incorporated under the Polaroid name. After World War II Land invented the first instant camera, marketed in 1947 as the Polaroid Land camera, which delivered a finished sepia-toned print 60 seconds after exposure. The company introduced colour film for its Polaroid cameras in the 1960s and instant motion pictures in 1977. Other Polaroid products include film, digital cameras, and identification systems.

Pole, Reginald (b. March 3, 1500, Stourton Castle, Staffordshire, Eng.—d. Nov. 17, 1558, London) English Catholic prelate. A cousin of Henry VII, Pole was sent by Henry VIII to study in Italy (1521–27) and given minor offices in the church. Critical of Henry's antipapal policies, he wrote *In Defense of Ecclesiastical Unity* (1536) to defend the pope's spiritual authority. As cardinal, he was sent by Pope Paul III on missions to persuade Catholic monarchs to depose Henry. These efforts angered Henry, who executed Pole's brother, Lord Montague (1538), and his mother, Margaret, countess of Salisbury (1541). Pole was named papal governor of the Patrimony of St. Peter and later was presiding legate at the Council of Trent. When the Catholic Mary Tudor became queen as Mary I in 1553, he was appointed legate for England; there he instituted church reforms and was a strong influence on the queen. He was appointed archbishop of Canterbury (1556), but a conflict between the papacy and England's ally Spain caused the pope to cancel Pole's authority and declare him a heretic. Demoralized, he died 12 hours after the death of Queen Mary.

pole construction Method of building that dates back to the Stone Age. Excavations in Europe show rings of stones that may have braced huts made of wooden poles or weighted down the walls of tents made of animal skins supported by central poles. Two types of Native American pole structures were the wigwam and longhouse. Pole-and-thatch dwellings are common in the Caribbean, Mesoamerica, and the Pacific Islands; bamboo-pole dwellings constructed on piles are found in many wet areas of Asia. A southern African method utilizes a ring of poles that is inserted into the ground, brought together in a crest, and expertly thatched. Today, pole construction employs a vertical structure of pressure-treated wood poles firmly embedded in the ground as a pier foundation. See also tent structure.

pole vault Track-and-field event consisting of a vault for height over a crossbar with the aid of a long pole. It became a competitive sport in the mid-19th century and was included in the first modern Olympic Games.

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In competition, each vaulter is given three chances to clear a specific height. The bar is raised progressively until a winner emerges.

polecat Any of several CARNIVORES of the WEASEL family (Mustelidae), found in Eurasia and Africa. The polecat hunts at night, principally on the ground, feeding on small mammals, birds, reptiles, frogs, fishes, and eggs. Species differ in size and colour. The European, or common, polecat (*Mustela putorius*), also called foul MARTEN for its odour, weighs 1–3 lb (0.5–1.4 kg) and is 14–21 in. (35–53 cm) long, excluding the 5–8-in. (13–20-cm) bushy tail. Its long, coarse fur is brown above, black below. In the U.S., SKUNKS are often called polecats. See also FERRET.

European polecat (*Mustela putorius*)
RUSS KINNE—PHOTO RESEARCHERS

police Body of agents organized to maintain civil order and public safety, enforce the law, and investigate crime. Characteristics common to most police forces include a quasi-military organization, a uniformed patrol and traffic-control force, plainclothes divisions for criminal investigations, and a set of enforcement priorities that reflects the community's way of life. Administration may be centralized at the national level downward, or decentralized, with local police forces largely autonomous. Recruits usually receive specialized training and take an exam. The modern metropolitan police force began with SIR ROBERT PEEL in Britain c. 1829. SECRET POLICE are often separate, clandestine organizations established by national governments to maintain political and social orthodoxy, which typically operate with little or no restraint.

police power Power of a government to exercise reasonable control over people and property within its jurisdiction in the interest of general security, health, safety, morals, and welfare. It is generally regarded as one of the powers reserved to the states under the U.S. Constitution. In considering cases involving the exercise of police power, the courts have applied a doctrine called "balance of interests" to determine when the public's right to health and well-being outweighs private or individual concerns. Of equal concern is that DUE PROCESS of law be observed.

poliomyelitis \ˌpō-lē-ō-ˌmī-ə-ˈlī-təs\ *or* **polio** *or* **infantile paralysis** Acute infectious viral disease that can cause flaccid PARALYSIS of MUSCLES. Severe epidemics killed or paralyzed many people, mostly children and young adults, until the 1960s, when JONAS SALK's injectable killed VACCINE and ALBERT B. SABIN's oral attenuated live vaccine controlled polio in the developed world. Flulike symptoms with diarrhea may progress to back and limb pain, muscle tenderness, and stiff neck. Destruction of SPINAL CORD motor cells causes paralysis, ranging from transient weakness to complete, permanent paralysis, in fewer than 20% of patients. Patients may lose the ability to use their limbs, to breathe, or to swallow and speak. They may need PHYSICAL MEDICINE AND REHABILITATION, mechanical breathing assistance, or tracheal suction to remove secretions. A "postpolio syndrome" occurs decades later in some cases, with weakness of muscles that had recovered.

polis \ˈpä-ləs\ In ancient Greece, an independent city and its surrounding region under a unified government. A polis might originate from the natural divisions of mountains and sea and from local tribal and cult divisions. Usually the town was walled and contained a citadel on raised ground (ACROPOLIS) and a marketplace (AGORA). Government was centred in the town; usually there was an assembly of citizens, a council, and magistrates. Ideally, all citizens participated in the government and in the cults, as well as in defense and economy. Women, minors, METICS, and slaves were not citizens. Hellenism spread many of the institutions into the Middle East. See also ATHENS; CITY-STATE; SPARTA; THEBES.

Polisario \ˌpō-li-ˈsä-rē-ō\ *officially* **Popular Front for the Liberation of Saguia el Hamra and Río de Oro** Sahrawi political and military group. Initially an insurgent against Spanish control of WESTERN SAHARA, it turned to agitation against Morocco and Mauritania when the Spanish withdrew in 1976 and those two countries partitioned the country. Mauritania made peace with the group in 1979, whereupon Morocco annexed the whole territory. Polisario continued its resistance, mostly from bases in Algeria. In 1991 it agreed to a ceasefire and a referendum, which has been repeatedly postponed by Morocco, to determine the state's fate. See also SAHARAN ARAB DEMOCRATIC REPUBLIC.

Polish Corridor Strip of land that gave Poland access to the Baltic Sea. Transferred to the newly constituted state of Poland as part of the Treaty of VERSAILLES (1919), the corridor, 20 to 70 mi (30 to 110 km) wide, separated eastern Prussia from the main part of Germany. The Germans resented the transfer, though the region had been historically Polish before the partitions of POLAND and was inhabited by a Polish majority. When Poland refused to accede to ADOLF HITLER's demands for extraterritorial highways across the corridor and cession of the free port city of Danzig (Gdańsk), Germany seized the pretext to invade Poland (1939), beginning World War II.

Polish language West SLAVIC LANGUAGE of Poland, spoken by more than 41 million people, including 2–3 million in North America and perhaps 1.5 million in the former Soviet Union. The earliest continuous text in Polish dates from the 14th century. The standard language, formulated in the 16th century, combines features of western and southeastern dialects. Polish is written in the LATIN ALPHABET and utilizes both digraphs (combinations of letters) and diacritics to distinguish its fairly elaborate repertory of consonants. Stress is fixed on the next-to-last syllable.

Polish Succession, War of the (1733–38) European conflict waged ostensibly to determine the successor to AUGUSTUS II. Austria and Russia supported his son AUGUSTUS III, while most Poles, France, and Spain supported STANISŁAW I, a former Polish king (1704–09) and father-in-law of France's LOUIS XV. Stanisław was elected king in 1733, but a Russian threat forced him to flee, and Augustus was elected in his place. France, with Sardinia and Spain, declared war on Austria (1733), seeking to reclaim territory in Italy held by Austria. An inconclusive campaign ended in the preliminary Peace of Vienna (1735), which redistributed the disputed Italian territory and recognized Augustus as king. A final treaty was signed in 1738.

Politburo \ˈpä-lət-ˌbyůr-ō\ Supreme policy-making body of the COMMUNIST PARTY OF THE SOVIET UNION, the model for the politburos in other countries. The first Politburo, created in 1917 to provide leadership during the BOLSHEVIK uprising, was dissolved when the coup was accomplished. The party congress of 1919 instructed the Central Committee to elect a new Politburo, which soon overshadowed the Central Committee in power. In 1952 it was replaced by a larger Presidium of the Central Committee; after JOSEPH STALIN's death, stress was placed on "collective leadership" to correct for his abuses. The name Politburo was revived in 1966. Its members included the general secretary of the Communist Party, the minister of defense, the head of the KGB, and the heads of the most important republics or urban party branches. It was dissolved with the breakup of the Soviet Union in 1991.

Politian \pō-ˈli-shən\ *orig.* **Angelo Poliziano** *or* **Angelo Ambrogini** (b. July 14, 1454, Montepulciano, Tuscany—d. Sept. 28/29, 1494, Florence) Italian poet and humanist. He demonstrated his poetic abilities early and became a friend and protégé of Lorenzo de' MEDICI. One of the foremost classical scholars of the Renaissance, he produced between 1473 and 1478 Latin and Greek verses that are among the best examples of humanist poetry. He was also, with Lorenzo, a leader in the revaluation of literature in Italian. His vernacular works include *Stanzas Begun for the Tournament of the Magnificent Giuliano de' Medici* (1475–78), a masterpiece in OTTAVA RIMA, and the drama *Orfeo* (1480).

political action committee (PAC) In U.S. politics, an organization whose purpose is to raise and distribute campaign funds to candidates seeking political office. PACs rose to prominence after the Federal Election Campaign Act (1971) limited the amount of money any corporation, union, or private individual could give to a candidate. PACs were able to circumvent these limits by soliciting smaller contributions from a much

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larger number of individuals. During the late 20th and early 21st centuries the vast amounts of money raised by PACs greatly increased the cost of running for office and led to efforts to reform this method of financing campaigns.

political convention *or* **party conference** In politics, a meeting of members of a POLITICAL PARTY at the local, state, or national level to select party leaders and candidates for office and to determine party policy. During presidential election years in the U.S., the main parties hold conventions that serve to showcase their presidential and vice presidential candidates and to boost the morale of party members for the campaigns that follow. Conventions were instituted in the U.S. in the 1830s to replace the often exclusive and secretive caucus system; it was hoped that the conventions' openness would make them less vulnerable to control by party bosses. Most candidates for political office at all levels in the U.S. are now nominated through PRIMARY ELECTIONS, and the conventions merely ratify the candidates already selected by the voters. Political parties in other countries (e.g., Great Britain) often hold annual party conferences.

political economy Academic discipline that explores the relationship between individuals and society and between markets and the state, using methods drawn from economics, political science, and sociology. The term is derived from the Greek terms *polis* (city or state) and *oikonomos* (one who manages a household). Political economy is thus concerned with how countries are managed, taking into account both political and economic factors. The field today encompasses several areas of inquiry, including the politics of economic relations, domestic political and economic issues, the comparative study of political and economic systems, and the study of international political economy.

political machine In U.S. politics, a political organization that controls enough votes to maintain political and administrative control of its community. The rapid growth of cities in the 19th century created huge problems for city governments, which were often poorly organized and unable to provide services. Enterprising politicians were able to win support by offering favours, including patronage jobs and housing, in exchange for votes. Though machines often helped to restructure city governments to the benefit of their constituents, they just as often resulted in poorer service (when jobs were doled out as political rewards), corruption (when contracts or concessions were awarded in return for kickbacks), and aggravation of racial or ethnic hostilities (when the machine did not reflect the city's diversity). Reforms, suburban flight, and a more mobile population with fewer ties to city neighbourhoods have weakened machine politics. Famous machines include those of WILLIAM MARCY TWEED (New York), JAMES MICHAEL CURLEY (Boston), THOMAS PENDERGAST (Kansas City, Mo.), and RICHARD J. DALEY (Chicago). See also CIVIL SERVICE.

political party Group of persons organized to acquire and exercise political power. Formal political parties originated in their modern form in Europe and the U.S. in the 19th century. Whereas mass-based parties appeal for support to the whole electorate, cadre parties aim at attracting only an active elite; most parties have features of both types. All parties develop a political program that defines their ideology and sets out the agenda they would pursue should they win elective office or gain power through extraparliamentary means. Most countries have single-party, two-party, or multiparty systems (see PARTY SYSTEM). In the U.S., party candidates are usually selected through PRIMARY ELECTIONS at the state level.

political philosophy Branch of philosophy that analyzes the state and related concepts such as political obligation, law, social justice, and constitution. The first major work of political philosophy in the Western tradition was PLATO's *Republic*. ARISTOTLE's *Politics* is a detailed empirical study of political institutions. The Roman tradition is best exemplified by CICERO and POLYBIUS. St. AUGUSTINE's *City of God* began the tradition of Christian political thinking, which was developed by THOMAS AQUINAS. NICCOLÒ MACHIAVELLI studied the nature and limits of political power. THOMAS HOBBES's *Leviathan* (1651) raised the problem of political obligation in its modern form. Hobbes was followed by BENEDICT DE SPINOZA, JOHN LOCKE, and JEAN-JACQUES ROUSSEAU in the exposition of a SOCIAL-CONTRACT theory. This was rejected by DAVID HUME and also by G.W.F. HEGEL, whose *Philosophy of Right* (1821) was fundamental for 19th-century political thought. Hegel's defense of private property stimulated KARL MARX's critique of it. JOHN STUART MILL developed JEREMY BENTHAM's utilitarian theory of law and political institutions, so as to reconcile them with individual liberty. In the 20th century JOHN DEWEY sought to counteract the dehumanizing aspects of modern capitalist society through a freer form of education. Until the end of the Cold War, the field of political philosophy was characterized by a division between Marxists and more traditional liberal thinkers, as well as by disagreements between left- and right-leaning liberals, such as JOHN RAWLS and Robert Nozick (1938–2002), respectively. From the 1970s, feminist political philosophy drew attention to the apparent gendered nature of many concepts and problems in Western political philosophy, especially autonomy, rights, liberty, and the public-private distinction.

political science Academic discipline concerned with the empirical study of government and politics. Political scientists have investigated the nature of states, the functions performed by governments, voter behaviour, political parties, political culture, POLITICAL ECONOMY, and public opinion, among other topics. Though it has roots in the political philosophies of PLATO and ARISTOTLE, political science in the modern sense did not begin until the 19th century, when many of the SOCIAL SCIENCES were established. Its empirical and generally scientific orientation is traceable to the work of HENRI DE SAINT-SIMON and AUGUSTE COMTE. The first institution dedicated to its study, the Free School of Political Science, was founded in Paris in 1871.

Polk, James K(nox) (b. Nov. 2, 1795, Mecklenburg county, N.C., U.S.—d. June 15, 1849, Nashville, Tenn.) 11th president of the U.S. (1845–49). He was a friend and supporter of ANDREW JACKSON, who helped Polk win election to the U.S. House of Representatives in 1825. He left the House in 1839 to become governor of Tennessee. At the deadlocked 1844 Democratic Party convention Polk was nominated as the compromise candidate; he is considered the first dark-horse presidential candidate. A proponent of western expansion, he openly laid claim to the whole territory that extended as far north as latitude 54° 40' with the slogan "Fifty-four Forty or Fight" (see OREGON QUESTION). Elected at the age of 49, the youngest president to that time, he successfully concluded the Oregon border dispute with Britain (1846) and secured passage of the Walker Tariff Act (1846), which lowered import duties and helped foreign trade. He led the prosecution of the MEXICAN WAR, which resulted in large territorial gains but reopened debate over the extension of slavery. His administration also established the Department of the Interior, the U.S. NAVAL ACADEMY, and the SMITHSONIAN INSTITUTION; oversaw revision of the treasury system; and proclaimed the validity of the MONROE DOCTRINE. Though an efficient and competent president and deft in his handling of Congress, he was exhausted by his efforts and did not seek reelection; he died three months after leaving office.

James K. Polk, daguerreotype by Mathew Brady, 1849.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

polka Lively couple dance of Bohemian folk origin. The polka (Czech for "Polish woman") is characterized by three quick steps and a hop and is danced to music in ¾, or duple, time. It originated in the early 19th century and became popular in ballrooms across Europe and in North and South America. It has remained popular into the 21st century as both a folk dance and a ballroom dance.

poll tax Tax of a uniform amount levied on each individual. The most famous British poll tax was the one levied in 1380, a main cause of the 1381 PEASANTS' REVOLT. In the U.S., poll taxes were used as a voting prerequisite in the southern states; when payment was made a prerequisite to voting, impoverished blacks (and often poor whites) were effectively denied the vote. In 1966 the U.S. Supreme Court ruled that states could not levy a poll tax as a prerequisite for voting in state and local elections.

pollack *or* **pollock** \'pä-lək\ Either of two commercially important North Atlantic species of food fish in the COD family (Gadidae). *Pollachius* (or *Gadus*) *virens*, called saithe or coalfish in Europe, is deep green with a pale belly. It has a small chin barbel (fleshy protuberance) and three dorsal and two anal fins. A carnivorous, lively, usually schooling fish, it grows to about 3.5 ft (1.1 m) long and weighs up to 35 lbs (16 kg). The other species, *Theragra chalcogramma*, or walleye pollack, closely resembles *P. virens*.

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Pollaiuolo \ˌpōl-lī-ˈwò-lō**, Antonio and Piero del** *orig.* **Antonio and Piero di Jacopo d'Antonio Benci** (respectively b. Jan. 17, 1432/33, Florence, Republic of Florence—d. Feb. 4, 1498, Rome; b. 1443, Florence—d. 1496, Rome) Italian sculptors, painters, engravers, and goldsmiths. Antonio probably trained in goldsmithing and metalworking with Lorenzo Ghiberti, while Piero may have studied painting with Andrea del Castagno. The brothers collaborated consistently after 1460, producing their works under a combined signature, and their individual contributions are hard to determine. Antonio is recognized as a superb draftsman and was among the first to practice anatomical dissection in the study of the human form; Piero's individual work is less artistically significant. In Florence they created an altarpiece in San Miniato al Monte and *The Martyrdom of St. Sebastian* (1475) in the Pucci Chapel of the Church of the Santissima Annunziata. In Rome their works included the tombs of Popes Sixtus IV and Innocent VIII. Antonio's famous *Battle of Nudes* is one of the largest and most important Italian engravings of the 15th century.

pollen Mass of microscopic spores in a seed plant that appears usually as a fine dust. Each pollen grain is tiny, varies in shape and structure, is formed in the stamens in seed plants, and is transported by various means (see pollination) to the pistil, where fertilization occurs. The outer layer of a pollen grain is very resistant to disintegration; treatment with intense heat, strong acids, or strong bases has little effect on it. Because the grains often are very distinctive, some plant species may be identified by their pollen grains alone. Common components of both recent and ancient geologic sediments, pollen grains have provided much information on the origin and geologic history of plant life on land. Pollen is produced in such quantities that it is a significant part of the airborne components of earth's atmosphere. The protein-containing substance in many pollen grains (e.g., ragweed and many grasses) causes the allergic reaction commonly known as hay fever.

pollination Transfer of pollen grains in seed plants from the stamens, where they form, to the pistil. Pollination is required for fertilization and the production of seeds. On the surface of the pistil the pollen grains germinate (see germination) and form pollen tubes that grow downward toward the ovules. During fertilization, a sperm cell in a pollen tube fuses with the egg cell of an ovule, giving rise to the plant embryo. The ovule then grows into a seed. Since the pollen-bearing parts of the stamens are rarely in direct contact with the pistil, plants commonly rely on external agents for pollen transport. Insects (especially bees) and wind are the most important pollinators; other agents include birds and a few mammals (notably certain bats). Water transport of pollen is rare. An egg may be fertilized by self-pollination (when the sperm comes from pollen produced by the same flower or by another flower on the same plant) or by cross-pollination (when the sperm comes from the pollen of a different plant).

Pollini, Maurizio (b. Jan. 5, 1942, Milan, Italy) Italian pianist. He made his debut at age nine and won the Warsaw Chopin Competition in 1960. He first played in the U.S. in 1968. His recordings and performances range from works by Johann Sebastian Bach to Ludwig van Beethoven to Karlheinz Stockhausen. His combination of intellectual seriousness and extraordinary technical brilliance have given him a unique standing in the concert world.

polliwog See tadpole

pollock See pollack

Pollock, Sir Frederick, 3rd Baronet (b. Dec. 10, 1845, London, Eng.—d. Jan. 18, 1937, London) British legal scholar. He taught at the University of Oxford (1883–1903) and was made a king's counsel in 1920. He was noted for his *History of English Law Before the Time of Edward I* (1895; written with Frederic W. Maitland) and several standard textbooks. He maintained a 60-year correspondence with Oliver Wendell Holmes, Jr.; the *Holmes-Pollock Letters* were published in 1941.

Pollock \ˈpä-lək**, (Paul) Jackson** (b. Jan. 28, 1912, Cody, Wyo., U.S.—d. Aug. 11, 1956, East Hampton, N.Y.) U.S. painter. He grew up in California and Arizona. In the early 1930s he studied in New York City under Thomas Hart Benton, and later he was employed on the WPA Federal Art Project. In 1945 he married the artist Lee Krasner. Two years later, after several years of semiabstract work stimulated by psychotherapy, Pollock began to lay his canvas on the floor and pour or drip paint onto it in stages. This process permitted him to record the force and scope of his gestures in trajectories of enamel or aluminum paint that "veiled" the figurative elements found in his earlier work. The results were huge areas covered with complex and dynamic linear patterns that fuse image and form and engulf the vision of the spectator in their scale and intricacy. Pollock believed that art derived from the unconscious and judged his work and that of others on its inherent authenticity of personal expression. He became known as a leading practitioner of Abstract Expressionism, particularly the form known as action painting. Championed by critic Clement Greenberg and others, he became a celebrity. When he died in a car crash at 44, he was one of the few American painters to be recognized during his lifetime and afterward as the peer of 20th-century European masters of modern art.

Jackson Pollock painting in his studio on Long Island, New York, 1950.
© HANS NAMUTH

Pollock v. Farmers' Loan and Trust Company (1895) U.S. Supreme Court ruling that declared the federal income tax unconstitutional, thus voiding portions of an 1894 act that imposed a direct tax on the incomes of U.S. citizens and corporations. The decision was mooted in 1913 when ratification of the 16th Amendment to the U.S. Constitution gave Congress the power "to lay and collect taxes on incomes."

pollution See air pollution, water pollution

Pollux, Castor and See Dioscuri

polo Game played by teams of players on horseback. Players use mallets with long flexible handles to drive a wooden ball through goalposts. It was first played in Persia in the 6th century BC; from there it spread to Arabia, Tibet (*polo* is Balti for "ball"), South Asia, and the Far East. The first British polo clubs were formed in India in the mid-19th century; the game came to the U.S. a few decades later. Polo has long been primarily played by the wealthy, because of the expense of acquiring and maintaining a stable of polo "ponies" (actually full-sized adult horses, bred for docility, speed, endurance, and intelligence). The standard team is made up of four players whose positions are numbered 1–4. A game consists of six 7.5-minute periods called chukkers or chukkas. The field is 300 yards (274.3 m) long by 160 yards (146.3 m) wide; an indoor version of the game is played on a smaller field.

Polo, Marco (b. c. 1254, Venice or Curzola, Venetian Dalmatia—d. Jan. 8, 1324, Venice) Venetian merchant and traveler who journeyed from Europe to Asia (1271–95). Born into a Venetian merchant family, he joined his father and uncle on a journey to China, traveling along the Silk Road and reaching the court of Kublai Khan c. 1274. The Polos remained in China for about 17 years, and the Mongol emperor sent Marco on several fact-finding missions to distant lands. Marco may also have governed the city of Yangzhou (1282–87). The Polos returned to Venice in 1295, after sailing from eastern China to Persia and then journeying overland through Turkey. Captured by the Genoese soon after his return, Marco was imprisoned along with a writer, Rustichello, who helped him to write the tale of his travels. The book, *Il milione*, was an instant success, though most medieval readers considered it an extravagant romance rather than a true story.

Marco Polo, title page of the first printed edition of *The Travels of Marco Polo*, 1477.
COURTESY OF THE COLUMBIA UNIVERSITY LIBRARIES, NEW YORK

polonaise \ˌpä-lə-ˈnāz\ Dignified ceremonial dance in ¾ time, frequently employing dotted rhythms, that often opened court balls in the 17th–19th century. It likely began as a

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warrior's triumphal dance and had been adopted by the Polish court as a formal march as early as 1573. The dancers promenaded with gliding steps accented by bending the knee slightly on every third step. It often appeared in ballets, and it was used as a musical form by composers such as George Frideric Handel, Ludwig van Beethoven, and especially Frédéric Chopin, whose piano polonaises were martial and heroic.

Poltava \pəl-'tä-və**, Battle of** (June 1709) Decisive victory of Russia over Sweden in the Second Northern War. The battle was fought near Poltava, Ukr., between 80,000 Russian troops under Peter I the Great and Aleksandr Menshikov and 17,000 Swedish troops under Charles XII. Despite the lack of reinforcements for his depleted forces, Charles besieged Poltava in May 1709. The Russians set up a countersiege line and forced the Swedes to attack. Charles planned a daring charge through the Russian line, but he had been injured, and his commanders failed to execute the attack. The Russian counterattack killed or captured the entire Swedish army except for Charles and 1,500 followers. Sweden's defeat ended its status as a major power and marked the beginning of Russian supremacy in eastern Europe.

Polybius \pə-'lib-ē-əs\ (b. c. 200, Megalopolis, Arcadia, Greece—d. c. 118 BC) Greek statesman and historian. Son of an Achaean statesman, Polybius was one of 1,000 eminent Achaeans deported to Rome in 168 BC for supposed disloyalty to the Romans. There he became mentor to Scipio Africanus the Younger, with whom he witnessed the destruction of Carthage soon after his political detention had ended. When hostilities broke out between Achaea and Rome, he negotiated for his countrymen and sought to reestablish order. His reputation rests on his history of the rise of Rome; of its 40 volumes, only 5 survive in their entirety.

polychaete \'pä-lē-ˌkēt\ Any of about 5,400 species of marine worms of the annelid class Polychaeta, having a segmented body with many setae (bristles) on each segment. Species, often brightly coloured, range from less than 1 in. (2.5 cm) to about 10 ft (3 m) long. Most body segments bear two bristly parapodia (lobelike outgrowths). The head has short sensory projections and tentacles. Adults may be free-swimming or sedentary; larvae are free-swimming. Found worldwide, polychaetes are important for turning over sediment on the ocean bottom. One species, the bloodworm, is a popular saltwater fish bait. See also tube worm.

Polyclitus *or* **Polycleitos** *or* **Polykleitos** \ˌpä-li-'klī-təs\ (fl. 5th century BC, Greece) Greek sculptor. His *Spear Bearer* (c. 440 BC) was known as "the Canon" because it illustrated his book of that name, which set forth his theory of the ideal mathematical proportions of the human body and proposed that the sculptor strive for a dramatic counterbalance between the relaxed and tense body parts and the directions in which they move. His balanced and rhythmical bronze statues of young athletes, such as *Man Tying on a Fillet* (c. 420 BC), demonstrated his principles and freed Greek sculpture from its tradition of rigid frontal poses. With Phidias, Polyclitus was the most important Greek sculptor of his age.

Polycrates \pə-'lik-rə-ˌtēz\ (fl. 6th century BC) Tyrant of the Aegean island of Samos c. 535–522 BC. He seized sole control during a festival of Hera, eliminating his two brothers, who shared his power. He quickly became notorious for piracy, as he sought to dominate nearby islands and Ionia. Initially a supporter of Egypt, he joined the Persians against Egypt in 525. Attempts by his opponents to remove him were unsuccessful until the Persian governor of Sardis lured him to the mainland and had him crucified. Polycrates brought wealth and prominence to Samos and was a patron of writers, including Anacreon.

polycystic ovary syndrome *or* **Stein-Leventhal syndrome** Endocrine disorder in women, characterized by high androgen levels and infrequent or absent ovulation (see reproductive system). It causes a high proportion of female infertility cases. Symptoms vary but often include hirsutism, acne, and obesity. Menstruation may be irregular, absent, or excessive. The ovaries are usually enlarged and contain cysts. The disease may remain undiagnosed until a woman tries to conceive. The underlying cause is not fully understood. Treatment attempts to reduce androgen production. Infertility may be treated with clomiphene citrate or gonadotropins to induce ovulation or with laparoscopy.

polyester Organic compound, any of a class of polymers formed by ester linkages between monomers. They are usually prepared from equivalent amounts of glycols and dibasic carboxylic acids, which undergo condensation polymerization to produce the polyester and water. Polyesters are strong, colourfast, and resistant to corrosion and chemical attack but tend to build up a static electric charge. In addition to the familiar fibres and films (e.g., Dacron, Mylar), polyesters are used to make reinforced plastics, automotive parts, boat hulls, foams, laminates, tapes, piping, bottles, disposable filters, encapsulations, and coatings.

polyethylene (PE) Any of the polymers of ethylene, the largest class of plastics. Its simple basic structure, of ethylene monomers, can be linear (high-density and ultrahigh-molecular-weight polyethylene; HDPE and UHMWPE, respectively) or branched to a greater or lesser degree (low-density and linear low-density polyethylene; LDPE and LLDPE, respectively). The branched polyethylenes have similar structural characteristics (e.g., low crystalline content), properties (high flexibility), and uses (packaging film, plastic bags, mulch, insulation, squeeze bottles, toys, and housewares). HDPE has a dense, highly crystalline structure of high strength and moderate stiffness; uses include beverage bottles, liquid detergent jugs, crates, barrels, and luggage. UHMWPE is made with molecular weights 6–12 times that of HDPE; it can be spun and stretched into stiff, highly crystalline fibres with a tensile strength many times that of steel; uses include bulletproof vests.

polygamy \pə-'li-gə-mē\ Marriage to more than one spouse at a time. Although the term may also refer to polyandry (marriage to more than one man) it is often used as a synonym for polygyny (marriage to more than one woman), which appears to have once been common in most of the world and is still found widely in some cultures. Polygyny seems to offer the husband increased prestige, economic stability, and sexual companionship in cultures where pregnancy and lactation dictate abstinence, while offering the wives a shared labour burden and an institutionalized role where a surplus of unmarried women might otherwise exist. The polygynous family is often fraught with bickering and sexual jealousy; to preserve harmony, one wife may be accorded seniority, and each wife and her children may have separate living quarters. Polyandry is relatively rare; in Tibet and Nepal, where brothers may marry a single woman, the practice serves to limit the number of descendants and keep limited land within the household.

Polygnotus *or* **Polygnotos** \ˌpä-lig-'nō-təs\ (b. c. 500, Thasos, Thrace—d. c. 440 BC, Athens, Greece) Greek painter. None of his works are extant, but accounts exist of monumental wall paintings in a severely Classical style at the hall of the Cnidians at Delphi: *Sack of Troy* and *Ulysses Visiting Hades*. His compositions were noted for the expression of emotion on faces and for the distribution of figures throughout the composition rather than on a single base line, as was the convention of the day.

polygon In geometry, any closed curve consisting of a set of line segments (sides) connected such that no two segments cross. The simplest polygons are triangles (three sides), quadrilaterals (four sides), and pentagons (five sides). If none of the sides, when extended, intersects the polygon, it is a convex polygon; otherwise it is concave. A polygon with all sides equal is equilateral. One with all interior angles equal is equiangular. Any polygon that is both equilateral and equiangular is a regular polygon (e.g., equilateral triangle, square).

polygraph See lie detector

polyhedron \ˌpä-lē-'hē-drən\ In Euclidean geometry, a three-dimensional object composed of a finite number of polygonal surfaces (faces). Technically, a polyhedron is the boundary between the interior and exterior of a solid. In general, polyhedrons are named according to number of faces. A tetrahedron has four faces, a pentahedron five, and so on; a cube is a six-sided regular polyhedron (hexahedron) whose faces are squares. The faces meet at line segments called edges, which meet at points called vertices. See also Platonic solid; Euler's formula.

Polykleitos See Polyclitus

polymer \'pä-lə-mər\ Any of a class of natural or synthetic substances composed of macromolecules that are multiples of monomers. The monomers need not all be the same or have the same structure. Polymers may consist of long chains of unbranched or branched monomers or may be cross-linked networks of monomers in two or three dimensions. Their backbones may be flexible or rigid. Some natural inorganic materials (e.g., the minerals diamond, graphite, and feldspar) and certain man-made inorganic materials (e.g., glass) have polymer-like structures. Many important natural materials are organic polymers, including cellulose (from sugar monomers; see polysaccharide), lignin, rubber, proteins (from amino acids), and nucleic acids (from nucleotides). Synthetic organic polymers

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include many PLASTICS, including POLYETHYLENE, the NYLONS, POLYURETHANES, POLYESTERS, vinyls (e.g., PVC), and synthetic RUBBERS. The SILICONE polymers, with an inorganic backbone of silicon and oxygen atoms and organic side groups, are among the most important mixed organic-inorganic compounds.

polymerase \pä-'lə-mə-ˌrās\ **chain reaction (PCR)** Laboratory technique used to make numerous copies of specific DNA segments quickly and accurately. These are needed for various experiments and procedures in MOLECULAR BIOLOGY, forensic analysis (DNA FINGERPRINTING), evolutionary biology (to amplify DNA fragments found in ancient specimens), and medicine (to diagnose genetic disease or detect low viral counts). Invented by KARY MULLIS, PCR requires a DNA template (as little as one molecule) to copy, NUCLEOTIDES to build the copies, and the ENZYME DNA polymerase to catalyze the formation of bonds between the nucleotide monomers. Each three-step cycle (separating the two strands of the DNA double helix, marking the ends of the segment to be copied, and catalyzing the formation of bonds), which takes only minutes to complete, doubles the number of DNA strands present in the reaction medium. Repetition of this cycle many times results in an exponential increase in the amount of DNA.

polymerization \pə-ˌli-mə-rə-'zā-shən\ Any process in which MONOMERS combine chemically to produce a POLYMER. The monomer molecules—which in the polymer usually number from at least 100 to many thousands—may or may not all be the same. In nature, ENZYMES carry out polymerization under ordinary conditions to form PROTEINS, NUCLEIC ACIDS, and CARBOHYDRATE polymers; in industry, the reaction is usually done with a CATALYST, often under high pressure or heat. In addition polymerization, monomers are added successively to the reactive ends of a growing polymer molecule, similar to adding links to a chain; during the reactions, no by-products are formed. In condensation polymerization, growth of the polymer advances stepwise—monomers having reactive FUNCTIONAL GROUPS combine into larger molecules with their own functional groups; each reaction splits off a small molecule, often water, as a by-product.

polymorphism Discontinuous genetic VARIATION that results in the occurrence of several different forms or types of individuals among the members of a single species. The most obvious example of polymorphism is the separation of most higher organisms into male and female sexes. Another example is the different blood types in humans. A polymorphism that persists over many generations is usually maintained because no one form has an overall advantage or disadvantage over the others in terms of NATURAL SELECTION. Some polymorphisms have no visible manifestations. The CASTES that occur in social insects are a special form of polymorphism that results from differences in nutrition rather than from genetic variation.

Polynesia \ˌpä-lə-'nē-zhə\ Island group, scattered across a huge triangular area of the east-central Pacific Ocean. A subdivision of OCEANIA, Polynesia includes NEW ZEALAND, HAWAII, SAMOA, the LINE ISLANDS, FRENCH POLYNESIA, the COOK ISLANDS, the PHOENIX ISLANDS, TUVALU, TONGA, and EASTER ISLAND. FIJI is sometimes included because of its Polynesian population. The islands are mostly small coral atolls; some are of volcanic origin. Most of the inhabitants are Polynesians, some of whom might be related to the Malay. Their languages belong to a subfamily of the AUSTRONESIAN LANGUAGES. Contact with European culture began in the late 1700s with the arrival of Spanish explorers and radically altered life in Polynesia. Colonizers, imposing Western belief systems and cultural ways, effectively wiped out local traditions and customs. Samoa and Tonga retain more of the traditional culture than the other islands.

polynomial In algebra, an expression consisting of numbers and variables grouped according to certain patterns. Specifically, polynomials are sums of monomials of the form ax^n, where a (the coefficient) can be any real number and n (the degree) must be a whole number. A polynomial's degree is that of its monomial of highest degree. Like whole numbers, polynomials may be prime or factorable into products of primes. They may contain any number of VARIABLES, provided that the power of each variable is a nonnegative integer. They are the basis of algebraic equation solving. Setting a polynomial equal to zero results in a polynomial EQUATION; equating it to a variable results in a polynomial FUNCTION, a particularly useful tool in modeling physical situations. Polynomial equations and functions can be analyzed completely by methods of ALGEBRA and CALCULUS. See also ORTHOGANAL POLYNOMIAL.

polynomial, orthogonal See ORTHOGANAL POLYNOMIAL

polyoma \ˌpä-lē-'ō-mə\ **virus** Minute infectious agent normally present in extremely small amounts in wild mice without causing obvious ill effects. It may induce cancerous tumours if grown in tissue culture and injected in large quantities into newborn mice or young hamsters, guinea pigs, and rabbits. It belongs to the Papovaviridae family of VIRUSES.

polyp \'pä-ləp\ Growth projecting from the wall of a cavity lined with a mucous membrane. Shape varies widely; it may have a stalk or many lobes. Polyps most often occur in the nose, urinary bladder, and digestive tract, especially in the rectum and colon. Symptoms, if any, depend on location and size; they may result from pressure or from blockage of a passage. Polyps occasionally bleed. Because a small percentage are precursors to cancers or actually contain cancers, it is advisable to have them removed and examined microscopically and to undergo routine colonoscopy after age 50.

polyp In zoology, one of two principal CNIDARIAN body forms and, sometimes, an individual in a BRYOZOAN colony. The cnidarian polyp body is a hollow cylindrical structure. The lower end attaches to another body or surface. The upper, or free, end is directed upward and has a mouth surrounded by extensible tentacles that bear stinging structures called nematocysts. The tentacles capture prey, which is then drawn into the mouth. The polyp may be solitary (see SEA ANEMONE) or colonial (see CORAL). The body wall consists of three dermal layers. The other cnidarian body form is the MEDUSA.

Polyphemus \ˌpä-lə-'fē-məs\ In GREEK MYTHOLOGY, a CYCLOPS. He was the son of POSEIDON and the nymph Thoösa. When ODYSSEUS and his companions were cast ashore on the coast of Sicily, Polyphemus imprisoned them in his cave with the intention of eating them. Odysseus got the giant drunk and then blinded him by plunging a burning stake into his single eye. When Polyphemus opened his cave in the morning, Odysseus and the six men the giant had not yet devoured made their escape by clinging to the bellies of sheep let out to pasture.

polyphony See COUNTERPOINT

polyploidy See PLOIDY

polysaccharide \ˌpä-lē-'sa-kə-ˌrīd\ Any of a large class of long-chain SUGARS composed of MONOSACCHARIDES. Because the chains may be unbranched or branched and the monosaccharides may be of one, two, or occasionally more kinds, polysaccharides can be categorized in various ways. CELLULOSE, STARCH, GLYCOGEN, and dextran are all polysaccharides of GLUCOSE, with different CONFIGURATIONS. PECTINS are composed of a GALACTOSE derivative, CHITIN of a glucose derivative. Connective tissues, joint fluid, and cartilage contain two-component polysaccharides, including HEPARIN. See also OLIGOSACCHARIDE.

polysiloxane See SILICONE

polytheism Belief in many gods. Though Judaism, Christianity, and Islam are monotheistic (see MONOTHEISM), most other religions throughout history have been polytheistic. The numerous gods may be dominated by a supreme god or by a small group of powerful gods. The gods originated as abstractions of the forces of nature such as the sky or the sea and of human and social functions such as love, war, marriage, or the arts. In many religions the sky god is powerful and all-knowing (e.g., DIEVS), and the earth goddess is maternal and associated with fertility. Gods of death and the underworld (e.g., OSIRIS and HEL) are also important. In addition to many gods, polytheistic religions generally also include malevolent or benevolent spiritual forces or powers. See also GOD AND GODDESS.

polyurethane Any of a class of very versatile POLYMERS that are made into flexible and rigid foams, fibres, elastomers (elastic polymers), surface coatings, and adhesives. They are produced by reacting a diisocyanate (a compound with two FUNCTIONAL GROUPS of the type —NCO) with a diol (a compound with two hydroxyl, or —OH, groups). Foamed polyurethanes, used for insulation and mattress and upholstery filler, are made with organic compounds containing carboxyl groups, causing a reaction that liberates carbon dioxide bubbles throughout the product. Spandex fibres are highly elastic and have replaced natural and synthetic rubber fibres for many textile purposes. Polyurethane elastomers are made into auto parts, rollers, flexible molds, medical equipment, and shoe soles. Polyurethane surface coatings are applied as sealants to wood, concrete, and machine parts and as linings for tanks and pipes; moisture-curing polyurethane resin is used as a general-purpose waterproof glue.

polyvinyl chloride See PVC

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Pombal \pə-'bäl**, Sebastião de Carvalho, marquess de** (b. May 13, 1699, Lisbon, Port.—d. May 8, 1782, Pombal) Portuguese reformer. After serving as ambassador to England and Vienna, he became chief minister to King Joseph and came to dominate Portuguese politics (1750–77). He encouraged industry and commerce and stimulated trade with Brazil. After the 1755 earthquake that devastated Lisbon, he organized aid and reconstruction efforts. He restricted the power of the nobility, had the Jesuits imprisoned or deported to Rome (1759), reorganized Portugal's army, and reformed the university educational system. After Joseph's death (1777), Pombal's power disappeared; under Queen Maria I, he was accused of abuse of power and banished from Lisbon to his estates.

pomegranate \'pä-mə-ˌgra-nət\ Fruit of *Punica granatum*, a bush or small tree of Asia, which with a little-known species from the island of Socotra constitutes the family Punicaceae. Native to Iran and long cultivated around the Mediterranean and in India, it also grows in the warmer parts of the New World. The orange-sized and obscurely six-sided fruit has smooth, leathery, brownish yellow to red skin. Several chambers contain many thin, transparent vesicles of reddish, juicy pulp, each containing an angular, elongated seed. The fruit is eaten fresh, and the juice is the source of the grenadine syrup used in flavourings and liqueurs. The plant grows 16–23 ft (5–7 m) tall and has elliptical, bright green leaves and handsome orange-red flowers. Throughout the Orient, the pomegranate has since earliest times occupied a position of importance alongside the grape and the fig. It is mentioned in the Bible, by the Prophet Muhammad, and in Greek mythology.

Pomerania \ˌpä-mə-'rā-nē-ə\ Historical region, northeastern Europe, on the Baltic Sea between the Oder and Vistula rivers. Occupied by Slavs and other peoples, it was ruled by Polish princes in the 10th century. German immigration into western and central Pomerania began in the late 12th century, and Polish dukes ruled this area under the suzerainty of the Holy Roman Empire until the 17th century. Eastern Pomerania was held by the Knights of the Teutonic Order from 1308 until it was reconquered by Poland in 1454. The elector of Brandenburg acquired the duchies in 1637. Prussia united western and central Pomerania in 1815 as the province of Pommern. Most of the area is now in Poland; its westernmost section is in eastern Germany.

Pomeranian \ˌpä-mə-'rā-nē-ən\ Breed of toy dog developed from the same sled-dog ancestors as the Keeshond, Samoyed, and Norwegian elkhound. It is said to have been bred down in size from a 30-lb (14-kg) dog in the duchy of Pomerania in the early 19th century. Spirited but docile, it has a foxlike head and small, erect ears. Its long coat, especially full on the neck and chest, is white, black, brown, or reddish brown. It stands about 6–7 in. (14–18 cm) and weighs about 3–7 lbs (1.5–3 kg).

Pomeranian.
SALLY ANNE THOMPSON-EB INC.

pommel horse *or* **side horse** Gymnastics event for men. It uses a padded rectangular apparatus supported by legs and with two pommels (U-shaped handles) on the top. The gymnast performs various swinging and balancing feats, holding himself over the horse by means of the pommels or by grasping the front (neck), centre (saddle), or rear (croup) of the horse. The apparatus stems from a wooden horse used by the Romans to teach mounting and dismounting.

Pomo North American Indian people living in northern California, U.S. The name Pomo, which may have been derived from the name of a village, was given to seven distinct Hokan-speaking peoples who inhabited the Russian River valley. Fish, waterfowl, deer, and wild plant foods were plentiful in this region. Coastal Pomo constructed dwellings of heavy timber and bark; inland Pomo used poles, brush, and grass. Pomo religion involved secret societies, dances, rituals, and impersonations of spirits. Pomo basketry is often considered among the finest in the world. About 3,000 Pomo live in some 20 communities within their original territory.

Pomona \pə-'mō-nə\ Ancient Roman goddess of fruit. Vertumnus, god of the seasons, fell in love with her, but she rejected him and all other suitors, preferring to cultivate her orchards. Refusing to give up, Vertumnus came to her in the form of an old woman and pleaded his case so effectively that Pomona changed her mind and agreed to be his.

Pompadour \'päm-pə-ˌdōr**, Jeanne-Antoinette Poisson, marchioness de** *known as* **Madame de Pompadour** (b. Dec. 29, 1721, Paris, France—d. April 15, 1764, Versailles) French mistress of Louis XV. Educated in art and literature, she married Charles-Guillaume Le Normant d'Étoiles in 1741 and became admired by Parisian society and by the king, who installed her at Versailles as his mistress in 1745. She obtained a separation from her husband and was created marchioness de Pompadour. She, the king, and her brother, appointed director of the king's buildings, planned and built the École Militaire and the Place de la Concorde in Paris, the Petit Trianon Palace at Versailles, and many other buildings. She and Louis also encouraged painters, sculptors, and craftsmen, making her 20 years in power the height of artistic taste. Her political influence was less astute; the alliance with Austria against the German Protestant princes that she urged led to the disastrous Seven Years' War.

Madame de Pompadour, detail of a portrait by François Boucher; in the National Gallery of Scotland, Edinburgh.
COURTESY OF THE NATIONAL GALLERIES OF SCOTLAND, EDINBURGH

pompano \'päm-pə-ˌnō\ Any of several species of deep-bodied, toothless, silvery fishes in the order Perciformes (especially in the genus *Trachinotus*, family Carangidae) inhabiting warm coastal waters worldwide. Some are highly prized as food. Pompanos have small scales, a narrow tail base, and a forked tail. The Florida, or common, pompano (*T. carolinus*), of the U.S. Atlantic and Gulf coasts, is about 18 in. (45 cm) long and weighs about 2 lbs (1 kg). The African pompano, or threadfish (*Alectis crinitis*), of the Atlantic and eastern Pacific, is 35 in. (90 cm) long and has long, threadlike rays extending from the dorsal and anal fins. The Pacific pompano (*Peprilus simillimus*) is in the family Stromateidae.

Florida pompano (*Trachinotus carolinus*).
ROBERT REDDEN-ANIMALS ANIMALS

Pompeii \päm-'pā\ Ancient city, southern Italy, southeast of Naples. Founded in the 6th century BC (or earlier) by Oscan-speaking descendants of the Neolithic inhabitants of Campania, Pompeii came under Greek and Etruscan influence and then was occupied by the Samnites, an Italic tribe, in the late 5th century BC. The city was allied with Rome and colonized by 80 BC. It was damaged by an earthquake in AD 63 and was completely destroyed by the eruption of Mount Vesuvius in 79. Volcanic debris buried the town and protected the ruins for years. Archaeological excavations, begun in 1748, have uncovered much of the city, including forums, temples, baths, theatres, and hundreds of private homes. See also Herculaneum.

Temple of Apollo, Pompeii, Italy, with Mount Vesuvius in the background.
EDWIN SMITH

Pompeius Magnus Pius \päm-'pē-əs-'mag-nəs-'pī-əs**, Sextus** *or* **Pompey the Younger** (b. c. 67—d. 35 BC, Miletus) Son of Pompey the Great and an opponent of Pompey's rivals. After his father was killed

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fighting Julius Caesar in 48, Pompeius fled to Spain to continue the struggle. Mark Antony gave him a naval command after Caesar's assassination (44), but he was outlawed in 43 under a law targeting those complicit in Caesar's death. He ravaged the coast of Italy, helped Antony against Octavian (later Augustus), and tried in vain to force both to make him governor of Sicily (39). Finally defeated by Octavian's forces, he fled to Asia Minor but was caught and executed.

Pompey \'päm-pē\ **the Great** *in full* **Gnaeus Pompeius Magnus** (b. Sept. 29, 106, Rome—d. Sept. 28, 48 BC, Pelusium, Egypt) Statesman and general of the Roman republic. His early military career was illustrious. He fought effectively for Sulla against Marius in the Social War, reconquered Spain (76–71), destroyed utterly the army of Spartacus (71), destroyed the pirates of the eastern Mediterranean (from 67), defeated Mithradates (63), and consolidated and extended the eastern provinces and frontier kingdoms. In 61 he formed the First Triumvirate with Julius Caesar and Marcus Licinius Crassus. After Crassus's death in 53, Pompey and Caesar fell out. By 52, with Rome in a state of anarchy, Pompey was named sole consul. In 49 Caesar defied the Senate and provoked the civil war by crossing the Rubicon in pursuit of Pompey, who fled east with his navy. Defeated at the Battle of Pharsalus (48), Pompey fled with his fleet to Egypt, not realizing the Egyptians would take Caesar's side, and was killed as he prepared to step on land from the boat they had sent to bring him ashore.

Pompidou \'päm-pi-ˌdü**, Georges (-Jean-Raymond)** (b. July 5, 1911, Montboudif, France—d. April 2, 1974, Paris) French premier (1962–68) and president (1969–74). He taught school before serving in World War II and was an aide to Charles de Gaulle (1944–46). After joining the Rothschild bank in Paris, he rose rapidly to become director general (1959). As de Gaulle's chief aide (1958–59), he helped draft the constitution of the Fifth Republic. He secretly negotiated a cease-fire in the Algerian War in 1961 and was appointed premier the following year. In 1968 he skillfully negotiated an end to the French student-worker strikes. Elected president of France in 1969, he continued de Gaulle's policies. The Pompidou Centre is named for him.

Pompidou
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Pompidou \'päm-pi-ˌdü\ **Centre** *or* **Beaubourg** \bō-'bür\ **Centre** French national cultural centre, on the rue Beaubourg in the Marais section of Paris. Its full name, the Georges Pompidou National Art and Cultural Centre, recognizes the president of the Republic under whose administration it was commissioned. When formally opened in 1977, the building attracted notoriety for its brightly coloured exterior pipes, ducts, and other exposed architectural elements, and it soon became one of the most visited cultural sites in the world. Though primarily a museum for 20th-century visual arts, it also houses temporary exhibitions, a library, a centre for industrial design, a film museum, and a Centre for Musical and Acoustical Research.

Ponce de León \ˌpän-sə-ˌdā-lē-'ōn**, Juan** (b. 1460, Tierra de Campos Palencia, Leon—d. 1521, Havana, Cuba) Spanish explorer. He may have accompanied Christopher Columbus's expedition in 1493 and later fought in the West Indies (1502), becoming governor of eastern Hispaniola. He colonized Puerto Rico (1508–09) and founded a settlement near modern San Juan. Rumours of a fountain of youth in the Bahamas inspired him to lead an expedition in 1513, but he landed instead on the northern coast of Florida near modern St. Augustine. He sailed along Florida's southern and western coasts, then returned to Spain to secure the title of military governor (1514). He sailed again to colonize Florida in 1521 but was wounded in an Indian attack and died in Cuba.

Pondicherry Union territory (pop., 2001: 974,345), India. It was formed in 1962 from the four former French colonies of Pondicherry, Karikal, and Yanam, on the eastern seaboard, and Mahe, on the western seaboard. With a total area of 190 sq mi (492 sq km), it is united by little other than its colonial past and focus on tourism. The city of Pondicherry is the administrative capital.

Pondicherry City (pop., 2001: 220,865), seaport, and capital of Pondicherry union territory, southeastern India. Lying on the Coromandel Coast, it originated as a French trade centre in 1674, when it was purchased from a local ruler. The scene of fighting between the French and Dutch, it was occupied by the British several times from 1761 before becoming a French possession (1816–1954). A seaside tourist resort, it contains an international study centre at a Hindu religious retreat, or ashram.

Pondoland Region, Eastern Cape province, southern Republic of South Africa, on the coast of the Indian Ocean. It was settled at the end of the 16th century by the Pondo (Mpondo), a Bantu-speaking people. It was annexed to Cape Colony in 1894. It occupies a narrow strip from the coast to the interior plateaus in the west. The interior is rich cattle country with fertile farmlands.

Pont-Aven \ˌpōⁿ-tə-'ven\ **school** Group of young painters who espoused a style known as Synthetism and united under the tutelage of Paul Gauguin at Pont-Aven, Brittany, France, in the late 1880s and early 1890s. The artists included Émile Bernard, Charles Laval, Maxime Maufra, Paul Sérusier, Charles Filiger, Jacob Meyer de Haan, Armand Séguin, and Henri de Chamaillard. Their paintings showed an overall simplification, a highly expressive use of colour, and an intensely spiritual subject matter. When Gauguin left for Tahiti, members of the school became increasingly involved in developing the theories and techniques of Symbolism.

Pontchartrain \'pän-chər-ˌtrān**, Lake** Lake, southeastern Louisiana, U.S. It is 40 mi (64 km) long and 25 mi (40 km) wide, with an area of 630 sq mi (1,631 sq km). More a tidal lagoon than a lake, it is brackish and teems with game fish. It is connected through Lake Borgne with the Gulf of Mexico and by canal with the Mississippi River. It is spanned by the Pontchartrain Causeway, two parallel road bridges which cross the lake north of New Orleans and, at nearly 24 mi (39 km) in length, are the longest overwater bridges in the world.

Pontecorvo \ˌpän-tə-'kȯr-vō**, Guido** (b. Nov. 29, 1907, Pisa, Italy—d. Sept. 24, 1999, near Zermatt, Switz.) Italian-born British geneticist. In 1938, influenced by Hermann Joseph Muller, he designed a method for studying genetic differences among species that usually produce sterile hybrids when interbred. His technique permitted him to study evolutionary divergence in the fruit fly. His conviction that research in microbial genetics could lead to increased production of penicillin, much needed in World War II, led him to the genetics of fungi, and in 1950 he found that recombination of genes can occur in the fungus *Aspergillus nidulans* without sexual reproduction. Nonsexual gene recombination became a useful technique in exploring the nature of gene action.

Pontiac (b. c. 1720, on the Maumee River in present-day Ohio, U.S.—d. April 20, 1769, near the Mississippi River at present-day Cahokia, Ill.) Ottawa Indian chief. At first friendly with whites, Pontiac realized that his people would lose their ancestral lands in the Great Lakes area if white encroachment were not stopped. With a series of actions that came to be known as Pontiac's War (1763–64), he coordinated the attack on 12 fortified British posts by a confederacy of tribes, winning a great victory. He himself led the attack on the fort at Detroit, in what is now Michigan, U.S. Continuing British action took its toll, however, and in 1766 Pontiac finally agreed to a peace treaty. His murder in 1769 by an Illinois Indian provoked the vengeance of several northern Algonquian tribes, resulting in the virtual destruction of the Illinois.

Pontifex See Quintus Mucius Scaevola

pontifex Member of a council of priests in ancient Rome. The pontifices were responsible for administration of the *jus divinum* (laws concerning religious practices). There were 3 pontifices under the monarchy, but by the time of Julius Caesar the number had grown to 16, of which 1 was designated chief priest, or *pontifex maximus*. Also included in the *collegium* (college) of pontifices were the Vestal Virgins. Among the duties of the pontifices were regulation of the calendar and of expiatory rituals, consecration of temples and sacred objects, superintendence of marriage and the family, and administration of the laws of adoption and succession.

Pontoppidan \pȯn-'tȯp-ē-dan**, Henrik** (b. July 24, 1857, Fredericia, Den.—d. Aug. 21, 1943, Ordrup, near Copenhagen) Danish realist writer of novels and short stories. He studied engineering and worked as a

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teacher before taking up writing. His works, typically written in a cold, aloof, epic style, present a comprehensive picture of his country and his epoch. His earlier works are informed with a desire for social progress; his later ones despair of its realization. His major novels include the semiautobiographical *Lucky Peter* (1898–1904) and the five-volume cycle *The Realm of the Dead* (1912–16). He shared the 1917 Nobel Prize for Literature with Karl Gjellerup.

Pontormo \pōn-'tȯr-mō**, Jacopo da** *orig.* **Jacopo Carrucci** (b. May 24, 1494, Pontormo, Republic of Florence—buried Jan. 2, 1557, Florence) Florentine painter. The son of a painter, he was apprenticed to Leonardo da Vinci and later to Piero di Cosimo and Andrea del Sarto (who exerted the greatest influence on him). The agitated, almost neurotic emotionalism of his work reflects a departure from the balance and tranquillity of the High Renaissance. His expressive style is sometimes considered an early manifestation of Mannerism. Primarily a religious painter, he also did sensitive portraits and was employed by the Medici family to decorate their villa at Poggio a Caiano with mythological subjects.

Pontus Ancient district, northeastern Anatolia adjoining the Black Sea. An independent kingdom with its capital at Amasia, it was established in the 4th century BC. It continued expanding its borders until 66 BC, when its last king, Mithradates VI Eupator, was defeated by the Roman general Pompey the Great. It was incorporated into the Roman Empire in 63 BC.

pony Any of several breeds of small horses standing less than 14.2 hands (57 in., 144 cm) high and noted for gentleness and endurance. Among the common pony breeds are the Shetland; the stylish and hardy Welsh; the high-stepping Welsh Cob; the Exmoor and Dartmoor, natives of the English moors that are used to breed polo ponies; and the Highland, a thick, gray saddle animal.

Pony Express (1860–61) U.S. system of mail delivery by horse and rider relays. The 1,800-mi (2,900-km) route between St. Joseph, Mo., and Sacramento, Calif., included 157 stations. Riders changed horses every 10 to 15 miles, and it took about 10 days to complete the route. The sponsoring company of Russell, Majors, Wadell employed riders such as William F. Cody and Pony Bob Haslam. The system provided an important mail link with the West, but it was a financial failure and became obsolete after 18 months with the completion of the transcontinental telegraph system.

poodle German water retriever. Poodles have a long muzzle, hanging ears, and docked tail. The dense, solid-coloured, wiry topcoat covers a woolly undercoat. Poodles' hair was traditionally clipped to permit them to swim efficiently when retrieving; today they are usually clipped in ornamental patterns. A dog with unclipped hair, which forms ropelike cords, is called a corded poodle. The standard poodle is more than 15 in. (38 cm) tall and weighs up to 70 lb (32 kg); the miniature stands 10–15 in. (25.5–38 cm); the toy is under 10 in. (25.5 cm) and weighs about 7 lb (3 kg). The poodle is the national dog of France, where it was once trained to scent and dig up truffles. Poodles are regarded as the most intelligent of all domestic dog breeds.

Standard poodle
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pool *or* **pocket billiards** Billiards game played on an oblong table having six pockets with 15 object balls and a white cue ball. At the beginning of play, the balls are arranged (racked) in a pyramid formation with its apex on a spot near the foot of the table. The first player breaks the formation by driving the cue ball into it; to continue play, he or she must hit a ball into a pocket. In the popular "8-ball" game, the first player (or team) to sink either the seven solid-coloured balls (numbered 1–7) or the seven banded (striped) balls (9–15), finishing with the black 8-ball, wins. In "9-ball," only the balls numbered 1–9 are used, and they must be sunk sequentially; the player who sinks the 9-ball wins. Pool probably reached its present form in England and France by c. 1800; today it is most popular in North America.

Poona See Pune

Poor Law In British history, a body of laws undertaking to provide relief for the poor, developed in 16th-century England and maintained, with various changes, until after World War II. The original laws provided relief, including care for the elderly, sick, and infant poor as well as work for the able-bodied through local parishes. Their scope was curtailed in the 1830s, when poverty among the able-bodied was considered a moral failing. The new law provided no relief for the able-bodied poor except employment in the workhouse, with the object of stimulating workers to seek regular employment rather than charity. In the 1930s and '40s the Poor Laws were replaced by a comprehensive system of public welfare services.

Pop art Art in which commonplace objects (such as comic strips, soup cans, road signs, and hamburgers) were used as subject matter. The Pop art movement was largely a British and American cultural phenomenon of the late 1950s and '60s. Works by such Pop artists as the Americans Roy Lichtenstein, Andy Warhol, Claes Oldenburg, Tom Wesselman, James Rosenquist, and Robert Indiana and the Britons David Hockney and Peter Blake, among others, were characterized by their portrayal of any and all aspects of popular culture that had a powerful impact on contemporary life; their iconography—taken from television, comic books, movie magazines, and all forms of advertising—was presented emphatically and objectively and by means of the precise commercial techniques used by the media from which the iconography itself was borrowed. Some of the more striking forms that Pop art took were Lichtenstein's stylized reproductions of comic strips and Warhol's meticulously literal paintings and silk-screen prints of soup-can labels and Marilyn Monroe. Pop art represented an attempt to return to a more objective, universally acceptable form of art after the dominance in both the United States and Europe of the highly personal Abstract Expressionist movement. Its effects—including its decisive destruction of the boundary between "high" and "low" art—have continued to be powerfully felt throughout the visual arts to the present day.

Popé \pō-'pā\ (d. 1692, San Juan Pueblo, New Spain) Tewa Pueblo medicine man. Believing he was guided by tribal ancestral spirits (kachinas), Popé led an Indian revolt in 1680 against the Spanish invaders in what is now the southwestern U.S. The rebellion, known as the Pueblo Revolt, drove the Spanish out of Santa Fe and temporarily restored the old Pueblo way of life. Popé was accorded great honours, but success made him despotic. Although he was eventually deposed, he was reelected Pueblo leader in 1688.

pope Ecclesiastical title of the bishop of Rome, head of the Roman Catholic church. In the early church, especially in the 3rd–5th century, it was a title of affectionate respect for any bishop. It is still used for the Eastern Orthodox patriarch of Alexandria and for Orthodox priests, but around the 9th century it came to be reserved in the West exclusively for the bishop of Rome. Catholic doctrine regards the pope as the successor of St. Peter the Apostle and accords him supreme jurisdiction over the church in matters of faith and morals, as well as in church discipline and government. Papal infallibility in matters of doctrine was asserted by the First Vatican Council in 1870. See also papacy, Roman Catholicism. See tables on following pages.

Pope, Alexander (b. May 21, 1688, London, Eng.—d. May 30, 1744, Twickenham, near London) English poet and satirist. A precocious boy precluded from formal education by his Roman Catholicism, Pope was mainly self-educated. A deformity of the spine and other health problems limited his growth and physical activities, leading him to devote himself to reading and writing. His first major work was *An Essay on Criticism* (1711), a poem on the art of writing that contains several brilliant epigrams (e.g., "To err is human, to forgive, divine"). His witty mock-epic *The Rape of the Lock* (1712, 1714) ridicules fashionable society. The great labour of his life was his verse translation of Homer's *Iliad* (1720) and *Odyssey* (1726), whose success made him financially secure. He became involved in many literary battles, prompting him to write poems such as the scathing mock-

Alexander Pope, portrait by Thomas Hudson; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

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Popes and Antipopes[1] (antipopes in italics)

Peter	?–c.64	Sabinian	604–6	Leo VIII[4]	963–65	Nicholas III	1277–80
Linus	c.67–76/79	Boniface III	607	Benedict V[4]	964–66?	Martin IV[6]	1281–85
Anacletus	76–88 or 79–91	Boniface IV	608–15	John XIII	965–72	Honorius IV	1285–87
		Deusdedit (also called Adeodatus I)	615–18	Benedict VI	973–74	Nicholas IV	1288–92
Clement I	88–97 or 92–101	Boniface V	619–25	*Boniface VII (1st time)*	*974*	Celestine V	1294
Evaristus	c.97–c.107	Honorius I	625–38	Benedict VII	974–83	Boniface VIII	1294–1303
Alexander I	105–115 or 109–119	Severinus	640	John XIV	983–84	Benedict XI	1303–4
Sixtus I	c.115–c.125	John IV	640–42	*Boniface VII (2nd time)*	*984–85*	Clement V (at Avignon, from 1309)	1305–14
Telesphorus	c.125–c.136	Theodore I	642–49	John XV (or XVI)[5]	985–96	John XXII 5 (at Avignon)	1316–34
Hyginus	c.136–c.140	Martin I	649–55	Gregory V	996–99	*Nicholas (V) (at Rome)*	*1328–30*
Pius I	c.140–55	Eugenius I	654–57	*John XVI (or XVII)*[5]	*997–98*	Benedict XII (at Avignon)	1334–42
Anicetus	c.155–c.166	Vitalian	657–72	Sylvester II	999–1003	Clement VI (at Avignon)	1342–52
Soter	c.166–c.175	Adeodatus II	672–76	John XVII (or XVIII)[5]	1003	Innocent VI (at Avignon)	1352–62
Eleutherius	c.175–89	Donus	676–78	John XVIII (or XIX)[5]	1004–9	Urban V (at Avignon)	1362–70
Victor I	c.189–99	Agatho	678–81	Sergius IV	1009–12	Gregory XI (at Avignon, then Rome from 1377)	1370–78
Zephyrinus	c.199–217	Leo II	682–83	*Gregory (VI)*	*1012*	Urban VI	1378–89
Calixtus I (Callistus)	217?–22	Benedict II	684–85	Benedict VIII	1012–24	*Clement (VII) (at Avignon)*	*1378–94*
Hippolytus	*217, 18–235*	John V	685–86	John XIX (or XX)[5]	1024–32	Boniface IX	1389–1404
Urban I	222–30	Conon	686–87	Benedict IX *(1st time)*	1032–44	*Benedict (XIII) (at Avignon)*	*1394–1423*
Pontian	230–35	Sergius I	687–701	Sylvester III	1045	Innocent VII	1404–6
Anterus	235–36	*Theodore*	*687*	Benedict IX *(2nd time)*	1045	Gregory XII	1406–15
Fabian	236–50	*Paschal*	*687*	Gregory VI	1045–46	*Alexander (V) (at Bologna)*	*1409–10*
Cornelius	251–53	John VI	701–5	Clement II	1046–47	*John (XXIII) (at Bologna)*	*1410–15*
Novatian	*251*	John VII	705–7	Benedict IX *(3rd time)*	1047–48	Martin V[6]	1417–31
Lucius I	253–54	Sisinnius	708	Damasus II	1048	*Clement (VIII)*	*1423–29*
Stephen I	254–57	Constantine	708–15	Leo IX	1049–54	Eugenius IV	1431–47
Sixtus II	257–58	Gregory II	715–31	Victor II	1055–57	*Felix (V) (also called Amadeus VIII of Savoy)*	*1439–49*
Dionysius	259–68	Gregory III	731–41	Stephen IX (or X)[3]	1057–58	Nicholas V	1447–55
Felix I	269–74	Zacharias (Zachary)	741–52	*Benedict X*	*1058–59*	Calixtus III (Callistus)	1455–58
Eutychian	275–83	Stephen (II)[3]	752	Nicholas II	1059–61	Pius II	1458–64
Gaius	283–96	Stephen II (or III)[3]	*752–57*	Alexander II	1061–73	Paul II	1464–71
Marcellinus	291/96–304	Paul I	*757–67*	*Honorius (II)*	*1061–72*	Sixtus IV	1471–84
Marcellus I	308–9	*Constantine (II)*	*767–68*	Gregory VII	1073–85	Innocent VIII	1484–92
Eusebius	309/10	*Philip*	*768*	*Clement (III)*	*1080–1100*	Alexander VI	1492–1503
Miltiades (Melchiades)	311–14	Stephen III (or IV)[3]	768–72	Victor III	1086–87	Pius III	1503
Sylvester I	314–35	Adrian I	772–95	Urban II	1088–99	Julius II	1503–13
Mark	336	Leo III	795–816	Paschal II	1099–1118	Leo X	1513–21
Julius I	337–52	Stephen IV (or V)[3]	816–17	*Theodoric*	*1100–2*	Adrian VI	1522–23
Liberius	352–66	Paschal I	817–24	*Albert (Aleric)*	*1102*	Clement VII	1523–34
Felix (II)	*355–58*	Eugenius II	824–27	*Sylvester (IV)*	*1105–11*	Paul III	1534–49
Damasus I	366–84	Valentine	827	Gelasius II	1118–19	Julius III	1550–55
Ursinus	*366–67*	Gregory IV	827–44	*Gregory (VIII)*	*1118–21*	Marcellus II	1555
Siricius	384–99	*John*	*844*	Calixtus II (Callistus)	1119–24	Paul IV	1555–59
Anastasius I	399–401	Sergius II	844–47	Honorius II	1124–30	Pius IV	1559–65
Innocent I	401–17	Leo IV	847–55	*Celestine (II)*	*1124*	Pius V	1566–72
Zosimus	417–18	Benedict III	855–58	Innocent II	1130–43	Gregory XIII	1572–85
Boniface I	418–22	*Anastasius (the Librarian)*	*855*	*Anacletus (II)*	*1130–38*	Sixtus V	1585–90
Eulalius	*418–19*	Nicholas I	858–67	*Victor (IV)*	*1138*	Urban VII	1590
Celestine I	422–32	Adrian II	867–72	Celestine II	1143–44	Gregory XIV	1590–91
Sixtus III	432–40	John VIII	872–82	Lucius II	1144–45	Innocent IX	1591
Leo I	440–61	Marinus I	882–84	Eugenius III	1145–53	Clement VIII	1592–1605
Hilary	461–68	Adrian III	884–85	Anastasius IV	1153–54	Leo XI	1605
Simplicius	468–83	Stephen V (or VI)[3]	885–91	Adrian IV	1154–59	Paul V	1605–21
Felix III (or II)[2]	483–92	Formosus	891–96	Alexander III	1159–81	Gregory XV	1621–23
Gelasius I	492–96	Boniface VI	896	*Victor (IV)*	*1159–64*	Urban VIII	1623–44
Anastasius II	496–98	Stephen VI (or VII)[3]	896	*Paschal (III)*	*1164–68*	Innocent X	1644–55
Symmachus	498–514	Romanus	897	*Calixtus (III)*	*1168–78*	Alexander VII	1655–67
Laurentius	*498, 501–c. 505/507*	Theodore II	897	*Innocent (III)*	*1179–80*	Clement IX	1667–69
Hormisdas	514–23	John IX	898–900	Lucius III	1181–85	Clement X	1670–76
John I	523–26	Benedict IV	900–903	Urban III	1185–87	Innocent XI	1676–89
Felix IV (or III)[2]	526–30	Leo V	903	Gregory VIII	1187	Alexander VIII	1689–91
Dioscorus	*530*	*Christopher*	*903–4*	Clement III	1187–91	Innocent XII	1691–1700
Boniface II	530–32	Sergius III	904–11	Celestine III	1191–98	Clement XI	1700–21
John II	533–35	Anastasius III	911–13	Innocent III	1198–1216	Innocent XIII	1721–24
Agapetus I	535–36	Lando	913–14	Honorius III	1216–27	Benedict XIII	1724–30
Silverius	536–37	John X	914–28	Gregory IX	1227–41	Clement XII	1730–40
Vigilius	537–55	Leo VI	928	Celestine IV	1241	Benedict XIV	1740–58
Pelagius I	556–61	Stephen VII (or VIII)[3]	929–31	Innocent IV	1243–54	Clement XIII	1758–69
John III	561–74	John XI	931–35	Alexander IV	1254–61	Clement XIV	1769–74
Benedict I	575–79	Leo VII	936–39	Urban IV	1261–64	Pius VI	1775–99
Pelagius II	579–90	Stephen VIII (or IX)[3]	939–42	Clement IV	1265–68	Pius VII	1800–23
Gregory I	590–604	Marinus II	942–46	Gregory X	1271–76	Leo XII	1823–29
		Agapetus II	946–55	Innocent V	1276		
		John XII	955–64	Adrian V	1276		
				John XXI[5]	1276–77		

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Popes and Antipopes[1] (antipopes in italics) (continued)

Pius VIII	1829–30	Pius XII	1939–58
Gregory XVI	1831–46	John XXIII	1958–63
Pius IX	1846–78	Paul VI	1963–78
Leo XIII	1878–1903	John Paul I	1978
Pius X	1903–14	John Paul II	1978–2005
Benedict XV	1914–22	Benedict XVI	2005–
Pius XI	1922–39		

[1]Until the 4th cent., the popes were usually known only as bishops of Rome.
[2]The higher number is used if Felix (II), who reigned 355–58 and is ordinarily classed as an antipope, is counted as a pope.
[3]Though elected on March 23, 752, Stephen (II) died two days later before he could be consecrated and thus is ordinarily not counted. The issue has made the numbering of subsequent Stephens somewhat irregular.
[4]Either Leo VIII or Benedict V may be considered an antipope.
[5]A confusion in the numbering of popes named John after John XIV (r.983–84) resulted because some 11th-cent. historians mistakenly believed that there had been a pope named John between antipope Boniface VII and the true John XV (r.985–86). Therefore they mistakenly numbered the real popes John XV to XIX as John XVI to XX. These popes have since customarily been renumbered XV to XIX, but John XXI and John XXII continue to bear numbers that they themselves formally adopted on the assumption that there had indeed been 20 Johns before them. In current numbering, there thus exists no pope by the name of John XX.
[6]In the 13th cent. the papal chancery misread the names of the two popes Marinus as Martin, and as a result of this error Simon de Brie in 1281 assumed the name of Pope Martin IV instead of Martin II. The enumeration has not been corrected, and thus there exist no Martin II and Martin III.

epic *The Dunciad* (1728) and *An Epistle to Dr. Arbuthnot* (1735). The philosophical *An Essay on Man* (1733–34) was intended as part of a larger work that he never completed.

Pope, John (b. March 16, 1822, Louisville, Ky., U.S.—d. Sept. 23, 1892, Sandusky, Ohio) U.S. army officer. A graduate of West Point, he served in the Mexican War. At the outbreak of the American Civil War, he was appointed brigadier general of volunteers, and he commanded operations that secured Union navigation of the Mississippi River almost to Memphis. In 1862 he was given command of the Army of Virginia. At the Second Battle of Bull Run, his forces were defeated. Though he tried to blame the rout on his subordinates, including Fitz-John Porter, he was relieved of his command and sent to Minnesota to quell a Sioux uprising. After the war he commanded the Department of the Missouri (1870–83).

John Pope
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Popish Plot (1678) In English history, a fictitious but widely believed rumour that Jesuits planned to assassinate Charles II and replace him with his brother, the Catholic duke of York (later James II). The rumour was fabricated by Titus Oates, who gave a sworn deposition of his "evidence" to a London justice of the peace. When the latter was found murdered, a panic among the people was followed by accusations and trials, leading to the execution of about 35 innocent people. When Oates was finally discredited, the panic subsided.

poplar Any of at least 35 species and many natural hybrids of trees that make up the genus *Populus* (willow family). Poplars grow throughout northern temperate regions, some even beyond the Arctic Circle. They are rapid-growing but relatively short-lived. Their leaves flutter in the slightest breeze because of their laterally compressed petioles (leafstalks). The relatively soft wood is used to make cardboard boxes, crates, paper, and veneer. North America has three groups of native poplars: cottonwoods, aspens, and balsam poplars.

poplar, yellow See tulip tree

Popocatépetl \ˌpō-pə-ˈka-tə-ˌpe-tᵊl\ Volcano, Puebla state, southeast-central Mexico, west of the city of Puebla. The perpetually snowcapped, symmetrical cone reaches 17,930 ft (5,465 m). The first Spanish ascent is thought to have been made in 1519. After being inactive for more than 50 years, Popocatépetl erupted in 1994, with frequent recurrences in the years that followed.

Popol Vuh \ˈpō-pōl-ˈvü\ Mayan document that provides valuable information on ancient Maya mythology and culture. It was written between 1554 and 1558 in the Quiche language using Spanish letters. It tells of the creation of man, the acts of the gods, and the origin and history of the Quiche people and also gives a chronology of their kings. The book was discovered early in the 18th century by Francisco Jiménez, a parish priest in the Guatemalan highlands, who copied out the original, now lost, and translated it into Spanish.

popolo \ˈpō-pō-lō\ (Italian: "people") In the communes (city-states) of 13th-century Italy, a pressure group instituted to protect the interests of the commoners against the nobility. Until then noblemen had exclusively controlled the commune governments, and the popolo was the means by which wealthy merchants sought to extend their power. The popolo in Florence controlled the government 1250–60 and again after 1282. By the beginning of the 14th century, its elders formed the supreme executive of the commune.

Popper, Sir Karl (Raimund) (b. July 28, 1902, Vienna, Austria—d. Sept. 17, 1994, Croydon, Greater London, Eng.) Austrian-British philosopher of natural and social science. In *The Logic of Scientific Discovery* (1934), he rejected the traditional conception of induction, which held that a scientific hypothesis may be verified through the accumulation of confirming observations, arguing instead that scientific hypotheses can at best only be falsified. His later works include *The Open Society and Its Enemies* (1945), *The Poverty of Historicism* (1957), and *Postscript to the Logic of Scientific Discovery* (3 vol., 1981–82).

poppy family Family Papaveraceae, containing about 200 species of mostly herbaceous plants and some woody small trees and shrubs. Most species of this family, which is outstanding for its many garden ornamentals (largely of the genus *Papaver*) and for pharmaceutically important plants, are found in the Northern Hemisphere. All have cup-shaped flowers, a capsule fruit, leaves that are usually deeply cut or divided into leaflets, and coloured sap. Members include the opium poppy and the corn, or Flanders, poppy (*P. rhoeas*), the seeds of which may lie dormant for years. The latter became a symbol of World War I because it bloomed in fields that had been disturbed by battle. See also California poppy.

popular front In European politics, any coalition of working-class and middle-class political parties united to defend democracy against an expected fascist assault. The policy of a "united front" against fascism was announced at the communist Third International (1935); it was to include not only communists and socialists but also liberals, moderates, and even conservatives. Popular-front governments were formed in France and Spain in 1936, but the financial consequences of the reforms undertaken by the French government, under Léon Blum, proved its undoing, and the Spanish government was brought down by Francisco Franco in the Spanish Civil War.

Popular Front for the Liberation of Oman (PFLO) *orig.* **Dhofar Liberation Front** Resistance group founded in 1963 by Arab nationalists and religious conservatives to depose Sultan Saʿīd ibn Taymūr (r. 1932–70). In 1968 its leadership was taken over by Marxists. In 1970 the sultan was deposed by his son, Qābūs ibn Saʿīd, who softened the resistance with a combination of military pressure and economic development.

Popular Front for the Liberation of Saguia el Hamra and Rio de Oro See Polisario

popular music Any music intended to be received and appreciated by ordinary people in a literate, technologically advanced society dominated by urban culture. Unlike traditional folk music, popular music is written by known individuals, usually professionals, and does not evolve through the process of oral transmission. Historically, popular music was any nonfolk form that acquired mass popularity—from the songs of the medieval minstrels and troubadours to those elements of fine art music originally intended for a small, elite audience but that became widely popular. After the Industrial Revolution, true folk music began to disappear, and the popular music of the Victorian era and the early 20th century was that of the music hall and vaudeville, with its upper reaches dominated by waltz music and operettas. In the U.S., minstrel shows performed the composi-

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tions of songwriters such as Stephen Foster. In the 1890s Tin Pan Alley emerged as the first popular song-publishing industry, and over the next half century its lyricism was combined with European operetta in a new kind of play known as the musical. Beginning with ragtime in the 1890s, African Americans had begun combining complex African rhythms with European harmonic structures, a synthesis that would eventually create jazz. The music audience greatly expanded, partly because of technology. By 1930, phonograph records had replaced sheet music as the chief source of music in the home. The microphone enabled more intimate vocal techniques to be commercially adapted. The ability of radio broadcasting to reach rural communities aided the dissemination of new styles, notably country music. U.S. popular music achieved international dominance in the decades after World War II. By the 1950s, the migration of African Americans to cities in the North had resulted in the cross-fertilization of elements of blues with the uptempo rhythms of jazz to create rhythm and blues. Rock and roll, with figures such as Elvis Presley, soon developed as an amalgam of rhythm and blues with country music and other influences (see rock music). In the 1960s, British rock groups, including the Beatles, became internationally influential. Rock quickly attracted the allegiance of Western teenagers, who replaced young adults as the chief audience for popular music. From the late 1960s black pop (see Motown) achieved greater sophistication and a wide audience. The history of pop through the 1990s was basically that of rock and its variants, including disco, heavy metal, punk rock, and rap, which spread throughout the world and became the standard musical idiom for young people in many countries.

Popular Party (Italy) See Italian Popular Party

Popular Republican Movement (MRP) French social reform party. Founded in 1944, the MRP was a strong centre party of the Fourth Republic and the French expression of Christian Democracy. After winning about 25% of the vote, it declined in the 1950s, losing strength to both right and left factions. In 1966 it was merged with other right-centre parties to become the Centre Démocrate, which won only 13% of the vote. By 1968 it had become little more than a political club.

popular sovereignty Political doctrine that allowed the settlers of U.S. federal territories to decide whether to enter the Union as free or slave states. It was applied by Sen. Stephen A. Douglas as a means to reach a compromise through passage of the Kansas-Nebraska Act. Critics of the doctrine called it "squatter sovereignty." The resulting violence between pro- and antislavery factions (see Bleeding Kansas) showed its failure as a workable compromise. See also Dred Scott decision.

Populares See Optimates and Populares

Populations I and II Two broad classes of stars and stellar groupings, whose members differ primarily in age, chemical composition, and location in galaxies. They were distinguished and named by Walter Baade (1893–1960). Population I consists of younger stars, clusters, and associations. These occur in and near the arms of the Milky Way Galaxy and other spiral galaxies and have been detected in irregular galaxies (such as the Magellanic Clouds). Population I objects are thought to have originated from interstellar gas that underwent various processes, including supernova explosions, which enriched their constituent matter with heavier elements. Population II consists of older (generally 1 billion–15 billion years old) stars and clusters, presumably formed from interstellar gas clouds that emerged very early in a galaxy's history. Consisting almost entirely of hydrogen and helium, they are found in the galactic halos of spiral galaxies, in globular clusters, and, in large numbers, in elliptical galaxies. Astronomers sometimes refer to a Population III as the very first generation of stars to emerge after the big bang.

populism Political program or movement that champions the common person, usually by favourable contrast with an elite. Populism usually combines elements of the left and right, opposing large business and financial interests but also frequently being hostile to established socialist and labour parties. In the U.S. the term was applied to the program of the Populist movement of the 1890s.

Populist See Narodnik

Populist Movement Coalition of U.S. agrarian reformers in the Midwest and South in the 1890s. The movement developed from farmers' alliances formed in the 1880s in reaction to falling crop prices and poor credit facilities. The leaders organized the Populist, or People's, Party (1892), which advocated a variety of measures to help farmers. They also demanded an increase in the circulating currency (to be achieved by the unlimited coinage of silver), a graduated income tax, government ownership of the railroads, a tariff for revenue only, and the direct election of U.S. senators. The party's presidential candidate in 1892, James B. Weaver (1833–1912), received more than one million votes. Many state and local Populist candidates were elected in the Midwest. In 1896 the Populists joined with the Democratic Party to support the Free Silver Movement and the unsuccessful presidential candidacy of William Jennings Bryan. The movement declined thereafter, though some of its causes were later embraced by the Progressive Party.

Populonia *ancient* **Pupluna** Ancient Roman city, western coast of central Italy. It was originally Etruscan. Silver and iron ores from the nearby island of Elba supplied its metal-manufacturing industry. During the 5th century BC it became wealthy as the first city in Etruria to coin silver. It was conquered by Romans and suffered during the wars between Sulla and Marius in the 1st century BC.

porcelain Vitrified pottery with a white, fine-grained body that is usually translucent. It was first made in China during the Tang dynasty (618–907) and in its advanced form during the Yuan dynasty (1279–1368). The three main types are true (or hard-paste) porcelain, artificial (or soft-paste) porcelain, and bone china. Attempts by medieval European potters to imitate true porcelain led to the discovery of soft-paste porcelain, which can be cut with a file. The secret of true porcelain was discovered c. 1707 in Saxony. Standard English bone china was produced c. 1800 when Josiah Spode II (1754–1827) added calcined bones to the hard-paste porcelain formula. Hard-paste porcelain, though strong, chips more readily than bone china. See also Bow porcelain; Chantilly porcelain; Chelsea porcelain; Meissen porcelain; Nymphenburg porcelain; Saint-Cloud porcelain; Sèvres porcelain; stoneware.

porch Roofed structure, usually open at front and sides, projecting from the face of a building and used to protect an entrance. If colonnaded, it may be called a portico. A veranda is typically a long porch surrounded by a railing, often extending along more than one side of a building. Simple porches were exceedingly common in the domestic architecture of Britain and the U.S. from the late 18th century. In Gothic cathedrals the porch was often a small gabled structure projecting from the northern or southern walls of the nave. See also loggia, narthex.

porcupine Heavy-bodied, solitary, slow-moving, nocturnal rodent with quills (modified hairs) along the back, tail, and, on certain crested species, the neck and shoulders. The quills are easily detached when touched. The New World species (four genera in family Erethizontidae) are arboreal and have barbed quills; the Old World species (four genera in family Hystricidae) are terrestrial and have unbarbed quills. The North American porcupine (*Erethizon dorsatum*), about 31 in. (80 cm) long with a tail about 12 in. (30 cm) long and quills about 3 in. (8 cm) long, drives its powerful tail against an assailant. For food, it favours the tender tissue beneath tree bark. Crested porcupines, the typical Old World porcupines, run backward, quills erect, into the enemy. They eat roots, fruit, and other vegetation. The African crested porcupine, the largest terrestrial rodent in Europe and Africa, may weigh 60 lb (27 kg) and have quills 14 in. (35 cm) long.

porgy \'pȯr-jē\ Any of about 100 species (family Sparidae) of generally shallow-water fishes found throughout tropical and temperate seas. Porgies, sometimes called sea breams, are typically high-backed, with a single dorsal fin, a small mouth, and teeth strong enough to handle fishes and hard-shelled invertebrates. Most species do not exceed 1 ft (30 cm) long, but some may grow to 4 ft (120 cm). The South African musselcrackers, popular sport fishes, grow to 100 lbs (45 kg). In Australia and Japan, several species of *Chrysophrys* are important food fish (called snappers in Australia). The red sea bream inhabits deep European waters. See also sheepshead.

Northern porgy (*Stenotomus chrysops*).
RUNK/SCHOENBERGER FROM GRANT HEILMAN

pork Flesh of hogs, usually slaughtered between the ages of six months and one year. The world's most popular meat, it is consumed fresh in various cuts or preparations, including chops and sausage, or cured or smoked for ham, bacon, dry sausage, or other products. Because pigs may be infected by the parasitic disease trichinosis, fresh pork must be cooked

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to an internal temperature of 160 °F (71 °C) to destroy the parasite. Pork is proscribed by the dietary laws of Islam and Judaism.

pornography Depiction of erotic behaviour intended to cause sexual excitement. The word originally signified any work of art or literature depicting the life of prostitutes. Though pornography is clearly ancient in origin, its early history is obscure because it was customarily not thought worthy of transmission or preservation. Nevertheless, in the artwork of many historic societies, including ancient India, ancient Greece, and Rome, erotic imagery was commonplace and often appeared in religious contexts. *The Art of Love*, by OVID, is a treatise on seduction and sensual arousal. The invention of printing led to the production of ambitious works of pornographic writing intended to entertain as well as to arouse. In 18th-century Europe, pornography became a vehicle for social and political protest through its depiction of the misdeeds of royalty and other aristocrats, as well as those of clerics, a traditional target. The development of photography and motion pictures in the 19th and 20th centuries contributed greatly to the proliferation of pornography, as did the advent of the INTERNET in the late 20th century. During the 20th century, restrictions on pornography were relaxed throughout much of Europe and North America, though regulations remained strict in Asia, the Middle East, and Africa. Child pornography is almost universally prohibited.

porphyrin \'pȯr-fə-rən\ Any of a class of biologically important HETEROCYCLIC COMPOUNDS of a characteristic chemical structure that includes four pyrrole groups (five-membered organic rings each containing a nitrogen atom) linked by additional carbon atoms to form a large flat ring. As biological PIGMENTS, they and closely related molecules are responsible for many of the vivid colours in living organisms, where they often occur combined with METAL IONS and various substituents as coordination complexes (see COMPOUND). These include the magnesium-containing CHLOROPHYLLS and the iron-containing heme group, a constituent (along with protein) of, e.g., HEMOGLOBIN, the CYTOCHROMES, and the ENZYME catalase. In medicine, porphyrins are used in conjunction with light, often a LASER beam, to induce reactions in the body against cancer and other diseases.

porphyry copper deposit \'pȯr-fə-rē\ A large body of igneous rock, having distinct crystals in a relatively fine-grained base, that contains CHALCOPYRITE and other sulfide minerals. These deposits contain vast amounts of ore that averages a fraction of 1% copper by weight; although low-grade, the deposits are important because they can be worked on a large scale at low cost. Large porphyry copper deposits are worked in the southwestern U.S. (where molybdenum may be produced as a by-product), the Solomon Islands, Canada, Peru, Chile, Mexico, and elsewhere.

porpoise Any TOOTHED WHALE in the family Phocoenidae (or, by some authorities, part of the DOLPHIN family Delphinidae). The four species (genus *Phocoena*) of the common, or harbour, porpoise are primarily fish eaters that travel in pairs or large groups. They are gray or black above and white below. The shy *P. phocoena,* found throughout the Northern Hemisphere, rarely leaps. The other species of *Phocoena* are found along Californian and South American coasts. The active, gregarious Dall porpoise (*Phocoenoides dalli*) of the North Pacific and the True porpoise (*P. truei*) of Japan often swim with ships, usually in groups of 2 to 20. Both eat cephalopods and fishes and are black with a large white patch on each side. The black finless porpoise (*Neomeris phocoenoides*), a small, slow animal, inhabits the Pacific and Indian oceans. At most 7 ft (2 m) long, porpoises are shorter and chubbier than dolphins and have a blunt snout. Like the dolphins, they are known for their high intelligence.

port Input/output conduit for PERSONAL COMPUTERS. The serial port was created as an interface between data terminal equipment and data-communications equipment. It processes data sequentially, as a series of BITS, and is used to connect equipment (e.g., a MODEM or MOUSE) to the computer. The parallel port processes several data bits in parallel and is used to connect peripherals such as computer PRINTERS and optical SCANNERS to the computer. The parallel port is faster, but the serial port is cheaper and requires less power. See also USB.

port Sweet, fortified WINE of rich taste and aroma made in Portugal. The name derives from PORTO, the town where it is traditionally aged and bottled. Most port is red, but lesser amounts of tawny and white are produced. Peculiar to the manufacture of port is a large dose of BRANDY given to the still-fermenting liquid (called must). Much time, often decades, is needed for the maturing of fine ports.

Port Arthur See LÜSHUN

Port-au-Prince \ˌpōr-tō-'prins\ City (metro. area pop., 1997: 1,556,000), seaport, and capital of Haiti, West Indies, on the southeastern shore of the Golfe de la Gonâve. Founded by the French in 1749, it was destroyed by earthquakes in 1751 and 1770 and has frequently suffered from fires and civil strife. In 1807 the port was opened to foreign commerce. It is the country's principal port and commercial centre, producing sugar, flour, cottonseed oil, and textiles.

Port Blair City (pop., 2001 prelim.: 100,186), capital of ANDAMAN AND NICOBAR ISLANDS union territory, India, in the Bay of BENGAL. It was occupied by the British in 1789 but soon abandoned. The town was made a penal colony in 1858. It was occupied by the Japanese in 1942–45. The penal colony was abolished in 1945. Port Blair is a market town with several local museums and an airport.

Port-de-France See NOUMÉA

Port Jackson Inlet of the South Pacific Ocean, NEW SOUTH WALES, southeastern Australia. It is one of the world's finest natural harbours. It was sighted in 1770 by Capt. JAMES COOK. Its entrance is between North and South Heads, where naval and military stations are located. SYDNEY is on its southern shore and the northern suburbs of Sydney are on its northern shore; the shores are joined by the Sydney Harbour Bridge, which was built in 1932.

Port Louis City (pop., 2000: 148,506), capital, and main port of Mauritius. It was founded c. 1736 by the French as a port for ships rounding the Cape of GOOD HOPE to and from Asia and Europe. With the completion of the SUEZ CANAL in 1869, the city's importance declined. It is the principal commercial centre of the island; its primary export is sugar.

Port Moresby City (pop., 1997: 271,813), capital of Papua New Guinea, on the southeastern coast of the Gulf of Papua. Its large, sheltered harbour was explored by British Capt. John Moresby in 1873. The British annexed the area in 1883–84. The town became a main Allied base in World War II. The National Capital District, established in 1974, includes all of Port Moresby; it became the capital when Papua New Guinea became independent in 1975. A commercial centre, the city is also the site of a university.

Port of Spain City (pop., 1996 est.: 43,396), seaport, and capital of Trinidad and Tobago. Formerly the capital of the West Indies Federation, it is located in the northwestern part of the island of Trinidad on the Gulf of PARIA. It is an air transport centre for the Caribbean and has a diversified economy, producing rum, beer, and lumber. It is also a principal port and shipping centre; exports include oil, sugar, citrus, and asphalt.

Port Said \sä-'ēd, 'sīd\ Seaport city (pop., 1996 est.: 470,000), northeastern Egypt. It is on the Mediterranean Sea at the northern end of the SUEZ CANAL. Founded in 1859 on a narrow, sandy strip separating the Mediterranean from Lake Manzilah, it became the world's most important coaling station. It was the landing point of French and British troops during the SUEZ CRISIS (1956) that followed Egypt's nationalization of the Suez Canal. In the SIX-DAY WAR of 1967, Israeli forces occupied the eastern bank of the canal, which was closed until 1975. The city was revitalized after 1975, and its industries include textiles, clothing, cosmetics, and glass.

Port-Vila See VILA

porte cochere \ˌpōrt-kō-'sher\ (French: "coach door") Passageway through a building, or gateway in an outer wall, designed to let vehicles pass from the street to an interior courtyard. Such gateways are common features of homes and palaces built in the grand style of Louis XIV and Louis XV. The term also applies to a roofed structure extending from the entrance of a building over an adjacent driveway.

Porter, Cole (Albert) (b. June 9, 1891, Peru, Ind., U.S.—d. Oct. 15, 1964, Santa Monica, Calif.) U.S. composer and lyricist. Porter was born to an affluent family and studied violin and piano as a child and composed an operetta at age 10. As a student at Yale University he composed about 300 songs, including "Bulldog"; he went on to study law and then music at Harvard. He made his Broadway debut with the musical comedy *See America First* (1916). In 1917 he went to France and became an itinerant playboy; though rather openly homosexual, he married a wealthy divorcée. He wrote songs for the Broadway success *Paris* (1928), and this led to a series of his own hit musicals, including *Anything Goes* (1934), *Red, Hot and Blue* (1934), *Kiss Me, Kate* (1948), *Can-Can* (1953), and *Silk Stockings* (1955). Porter also worked on a number of films, such as *High Society* (1956). His witty, sophisticated songs, for which he wrote

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both words and music, include "Night and Day," "I Get a Kick Out of You," "Begin the Beguine," and "I've Got You Under My Skin." Porter's large output might have been even more vast had not a riding accident in 1937 necessitated 30 operations and eventually the amputation of a leg.

Porter, David (b. Feb. 1, 1780, Boston, Mass., U.S.—d. March 3, 1843, Pera, Tur.) U.S. naval officer. He joined the navy (1798) and served in the Tripolitan War. In the War of 1812 he commanded the *Essex*, the first U.S. warship to operate in the Pacific Ocean; he captured several British whaling vessels and took possession of Nuku Hiva, the largest of the Marquesas Islands (1813). He was blockaded by British frigates in Valparaíso, Chile, where he surrendered (1814). He served on the board of naval commissioners (1815–23) and commanded a squadron to suppress piracy in the West Indies (1823–25). For unauthorized action against Spanish authorities in Puerto Rico, he was court-martialed and suspended from duty. He resigned in 1826 and became commander of the Mexican navy (1826–29).

Porter, David Dixon (b. June 8, 1813, Chester, Pa., U.S.—d. Feb. 13, 1891, Washington, D.C.) U.S. naval officer. He served under his father, David Porter, in the West Indies and in the Mexican navy before joining the U.S. Navy in 1829. Promoted to commander in the American Civil War, he served under his foster brother, David Farragut, to help win the Battle of New Orleans. In 1863 he succeeded in running his fleet past the Confederate fort at Vicksburg to meet Ulysses S. Grant's troops and complete the effort to open the Mississippi River to Union forces. After the war he served as superintendent of the U.S. Naval Academy (1865–69) and was promoted to admiral (1870).

David Dixon Porter, photograph; in the Mathew Brady collection
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Porter, Fitz-John (b. Aug. 31, 1822, Portsmouth, N.H., U.S.—d. May 21, 1901, Morristown, N.J.) U.S. army officer. He graduated from West Point and later taught there (1849–55). In the American Civil War he was made a brigadier general of volunteers. In the Second Battle of Bull Run he served under Gen. John Pope, who blamed Porter for the Union's defeat. At his court-martial, Porter claimed that Pope's orders were confusing and impossible to execute, but he was found guilty and cashiered. In 1879 he won a review of his case, which supported his claim of innocence. In 1886 he was reappointed an army officer and placed, at his own request, on the retired list.

Porter, Katherine Anne (b. May 15, 1890, Indian Creek, Texas, U.S.—d. Sept. 18, 1980, Silver Spring, Md.) U.S. writer. She worked as a journalist in Chicago and Denver, Colo., before leaving in 1920 for Mexico, the setting of several of her stories. Her collections include *Flowering Judas* (1930), her first and most popular; *Pale Horse, Pale Rider* (1939), a set of three novellas; and *Collected Short Stories* (1965, Pulitzer Prize, National Book Award). Her stories have a richness of texture and complexity of character delineation usually achieved only in the novel. *Ship of Fools* (1962) is her only novel.

portico Colonnaded porch or entrance to a structure, or a covered walkway supported by regularly spaced columns. The portico is a principal feature of Greek temple architecture and thus a prominent element in Roman and all subsequent Classically inspired structures.

Portillo, José López See José López Portillo

Portland Seaport city (pop., 2000: 64,249), southwestern Maine, U.S. First settled in 1633, it was raided by Indians in 1676 and by French and Indians in 1690. It was incorporated as a town in 1786 and was the state capital 1820–31. A fire destroyed much of the city centre in 1866, but Portland was again rebuilt. The state's largest city, it is the hub of a metropolitan area that includes the cities of South Portland and Westbrook and many towns. It is built largely on two hilly peninsulas overlooking Casco Bay. The city's diversified manufactures include semiconductors, food products, stainless steel, and printed materials. Ship modernization and commercial fishing also are important. It was the birthplace of Henry Wadsworth Longfellow.

Portland City (pop., 2000: 529,121) and port, northwestern Oregon, U.S. Situated on the Willamette River, southeast of its confluence with the Columbia River, Portland was settled in 1829 on the site of an early Indian campground. It was laid out in 1844 and incorporated in 1851. Early growth was stimulated by gold rushes and the flow of immigrants along the Oregon Trail. It is the state's largest city and principal port. Exports include lumber, aluminum, and wheat. Shipbuilding and meat-packing are important industries. It is the site of many educational institutions, including Lewis and Clark College (1867) and Reed College.

portland cement Binding agent of present-day concrete. It is a finely ground powder made by burning and grinding a limestone mixed with clay or shale. Its inventor, Joseph Aspdin (1799–1855), patented the process in 1824, naming the material for its resemblance to the limestone of the Isle of Portland, England. The cement combines chemically with the water it is mixed with, then hardens and strengthens.

Portland Vase Roman vase (1st century AD) of dark-blue glass decorated with white figures, the finest surviving Roman example of cameo glass. It came into the possession of the duke of Portland in the 18th century. The vase has been extensively copied, particularly in the Victorian period. The most accurate copies were made in jasperware with white figures in relief (by Josiah Wedgwood, 1790) and in glass (1876). In 1845, while in the British Museum (where it still resides), the original vase was smashed, necessitating painstaking restoration.

Portland Vase, Roman cameo glass, 1st century AD; in the British Museum
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Porto \'pōr-tü\ *Portuguese* **Oporto** Seaport city (pop., 2001 prelim.: 262,928), northwestern Portugal. On the right (north) bank of the Douro River, Porto was called Portus Cale in Roman times and was earlier a flourishing settlement on the Douro's south bank. Held successively by the Alani, Visigoths, Moors, and Christians, it became an important port in the 14th century. Henry the Navigator was born there in 1394. It was the site of a British victory over the French in the 1809 Peninsular War. World-famous for its port wine, Porto is Portugal's second largest city and the region's commercial and industrial centre.

Pôrto Alegre \'pōr-tü-ä-'lā-grē\ Port and city (pop., 2002: city, 1,342,900; metro. area, 3,765,500), southern Brazil. Located along the Guaíba River near the Atlantic Ocean coast, it was founded c. 1742 by immigrants from the Azores. It was first known as Pôrto dos Casais. It received many German and Italian settlers in the 19th century. It is a centre of inland navigation and is the most important Brazilian commercial city south of São Paulo; exports include rice, tobacco, and hides. Industries include shipbuilding and the manufacture of textiles, pharmaceuticals, and chemicals. It is also an educational centre.

Porto-Novo \ˌpōr-tō-'nō-vō\ City (pop. 2004 est.: 234,300), seaport, and capital of Benin, on the Gulf of Guinea, western Africa. Situated on a coastal lagoon in the southeastern part of the country, it was probably founded in the late 16th century as the centre of the kingdom of Porto-Novo. The Portuguese established a trading post in the 17th century, and it became a centre of the Atlantic slave trade. It became a short-lived French protectorate in 1863 and attained that status again in 1882. The ruins of old African palaces remain, and there are many colonial-style buildings, including the old Portuguese cathedral. Porto-Novo was established as the official capital of the country by the constitution, but only the legislature is found there; the president, most government ministers, and the judiciary reside in Cotonou.

Portsmouth \'pōrt-smәth\ City and unitary authority (pop., 2001: 186,704), geographic and historic county of Hampshire, southern England. The seaport city is a major naval base and, with Southsea, a popular holiday resort. Located on the island of Portsea in the English Channel, Portsmouth was founded and received its first charter in 1194. A naval dockyard was established in 1496 and greatly expanded after 1698. Covering more

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than 300 acres (120 hectares), the dockyard is the city's main source of employment. Portsmouth suffered extensive damage from German bombing in World War II. Important industries are shipbuilding and aircraft engineering. The city was the birthplace of Charles Dickens.

Portsmouth City (pop., 2000: 100,565) and seaport, southeastern Virginia, U.S. Located on the Elizabeth River opposite Norfolk, with Norfolk and Newport News, Portsmouth makes up the Port of Hampton Roads. Founded in 1752 and named after Portsmouth, Eng., it was occupied by both British and American troops during the American Revolution. It was incorporated as a city in 1858. During the American Civil War the U.S. Navy Yard was evacuated by Union troops, allowing Southern troops access to stores of equipment; Portsmouth was recaptured in 1862. It is part of the U.S. military complex at Hampton Roads. Shipbuilding and ship repair are the main economic activities, augmented by various manufactures.

Portsmouth, Treaty of (1905) Peace settlement that ended the Russo-Japanese War. It was mediated by Pres. Theodore Roosevelt and signed at the U.S. naval base near Portsmouth, N.H. By its terms, Russia recognized Japan as the dominant power in Korea and ceded its leases to Port Arthur (now Lüshun) and the Liaodong Peninsula, as well as the southern half of Sakhalin, to Japan. Both powers agreed to restore Manchuria to China.

Portugal *officially* **Portuguese Republic** Country, on the west coast of the Iberian Peninsula, southwestern Europe. Area: 35,580 sq mi (92,152 sq km). Population (2005 est.): 10,513,000. Capital: Lisbon. Most of the

people are Portuguese. Language: Portuguese (official). Religion: Christianity (predominantly Roman Catholic). Currency: euro. Administratively, the Atlantic islands of the Azores and Madeira are part of Portugal. Portugal is divided roughly in half by the Tagus River; the highlands rise mostly north of the Tagus and stretch northeast into Spain. Portugal has an industrialized economy in which both public and private sectors participate. Major industries were nationalized after a military coup in 1974, but many were returned to the private sector beginning in the late 1980s. Although motor vehicle manufacture is significant, light industries predominate; important products include textiles and clothing, paper and wood products, and chemicals. Portugal is a republic with a unicameral legislature; the chief of state is the president, and the head of government is the prime minister. In the 1st millennium BC, Celtic peoples settled the Iberian Peninsula. They were conquered c. 140 BC by the Romans, who ruled until the 5th century AD, when the area was invaded by Germanic tribes. A Muslim invasion in 711 left only the northern part of Portugal in Christian hands. In 1179 it became the kingdom of Portugal and expanded as it reconquered the Muslim-held sectors. The boundaries of modern continental Portugal were completed under King Afonso III (reigned 1248–79). From 1580 to 1640 Portugal was united with Spain. In the 15th and 16th centuries the monarchy encouraged exploration that took Portuguese navigators to Africa, India, Indonesia, China, the Middle East, and South America. Although Portugal established several colonies, they achieved independence over the years (see Brazil; Goa; Cape Verde; East Timor; Angola; Guinea-Bissau; Mozambique; Macau). António de Oliveira Salazar ruled Portugal as a dictator from 1932 to 1968. The country's dictatorship was overthrown in the April 25, 1974, Revolution of the Carnations. A new constitution was adopted in 1976, and civilian rule resumed. Portugal was a charter member of NATO and is a member of the European Union (EU). In 1999 the government adopted the euro as the country's official monetary unit and returned Macau, its last overseas territory, to Chinese rule.

Portuguese East Africa See Mozambique

Portuguese Guinea See Guinea-Bissau

Portuguese language Romance language spoken by about 170 million people in Portugal, Brazil, and other former Portuguese colonies. The first literary works in Portuguese date from the 13th–14th century. Standard Portuguese is based on the dialect of Lisbon. Dialectal variation in Portugal is limited, but the differences between Brazilian and European Portuguese are more extensive, including changes in phonology, verb conjugation, and syntax. The four major dialect groups are Northern (Galician, spoken in northwestern Spain), Central, Southern (including the Lisbon dialect), and Insular (including Brazilian and Madeiran) Portuguese.

Portuguese man-of-war Any of various floating, warm-water marine cnidarians (genus *Physalia*, class Hydrozoa) found worldwide but mostly in the Gulf Stream and the Indian and Pacific oceans. The medusa-form body consists of a translucent, jellylike, gas-filled float, which may be 3–12 in. (9–30 cm) long. Polyps beneath the float bear hanging tentacles up to 165 ft (50 m) long. Nematocysts on some polyps paralyze fish and other prey. Other polyps then attach to, spread over, and digest the victim. A third type of polyp is involved in reproduction. The painful sting of *Physalia* can cause fever, shock, or disruption of heart and lung function.

Portuguese West Africa See Angola

Poseidon \pə-'sī-dən\ Greek god of water and the sea, son of Cronus and Rhea. His brothers were Zeus and Hades. When the three brothers deposed their father, the kingdom of the sea fell by lot to Poseidon. Unpredictable and sometimes violent, he was also god of earthquakes, and he was closely associated with horses. Most of his offspring were giants and savage creatures. By Medusa he was the father of the winged horse Pegasus. The Isthmian Games were held in his honor. In art he was often shown holding a trident and accompanied by a dolphin and tuna. The Romans identified him with Neptune.

Poseidon, marble statue from Melos, 2nd century BC; in the National Archaeological Museum, Athens.
ALINARI-ART RESOURCE/EB INC.

Posen See Poznań

positivism Any philosophical system that confines itself to the data of experience, excludes a priori or metaphysical speculations, and emphasizes the achievements of science. Positivism is closely connected with empiricism, pragmatism, and logical positivism. More narrowly, the term designates the philosophy of Auguste Comte, who held that human thought had passed inevitably through a theological stage into a metaphysical stage and was passing into a positive, or scientific, stage. Believing that the religious impulse would survive the decay of revealed religion, he projected a worship of mankind, with churches, calendar, and hierarchy.

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positron \'pä-zə-ˌträn\ SUBATOMIC PARTICLE having the same MASS as an ELECTRON but with an electric charge of +1 (an electron has a charge of −1). It constitutes the antiparticle (see ANTIMATTER) of an electron. The existence of the positron was a consequence of the electron theory of P. A. M. DIRAC (1928), and the particle was discovered in COSMIC RAYS by Carl D. Anderson (1905–1991) in 1932. Though they are stable in a vacuum, positrons react quickly with the electrons of ordinary matter, producing GAMMA RAYS by the process of ANNIHILATION. They are emitted in positive BETA DECAY of proton-rich radioactive nuclei and are formed in PAIR PRODUCTION.

positron emission tomography (PET) Imaging technique used in diagnosis and biomedical research. A chemical compound labeled with a radioactive ISOTOPE (see RADIOACTIVITY) that emits POSITRONS is injected into the body, and detectors measure their activity in the tissues as they combine with ELECTRONS and are annihilated. Computers analyze, integrate, and reconstruct the data to produce images of the organs scanned. PET is particularly useful for studying BRAIN and HEART functions.

possession, adverse See ADVERSE POSSESSION

possible world Conception of a total way the universe might have been. It is often contrasted with the way things actually are. In his *Theodicy* (1710), G.W. LEIBNIZ used the concept of a possible world in his proposed solution to the theological problem of the existence of evil, arguing that an all-perfect God would actualize the best of all possible worlds; this idea was later satirized by VOLTAIRE in his comic novel *Candide* (1759). Philosophers have since constructed several different formalizations of the concept of a possible world.

possum *or* **phalanger** \fə-'lan-jər, 'fā-ˌlan-jər\ Any of several species (family Phalangeridae) of nocturnal, arboreal MARSUPIALS of Australia and New Guinea. They are 22–50 in. (55–125 cm) long, including the long prehensile tail, and have woolly fur. All species eat fruits, leaves, and blossoms; some also eat insects and small vertebrates. Possums grasp branches with their hind feet. Most species bear their young in tree hollows and unused birds' nests; a few build leafy nests. Several species are endangered because of predation, fur trapping, or habitat loss, but the common brush-tailed possum is considered a pest. See also OPOSSUM.

Post, C(harles) W(illiam) (b. Oct. 26, 1854, Springfield, Ill., U.S.—d. May 9, 1914, Santa Barbara, Calif.) U.S. manufacturer of breakfast CEREALS. In the 1880s Post became a patient of JOHN H. KELLOGG at a health sanitarium in Battle Creek, Mich., where he became interested in producing healthful foods like those Kellogg served. In 1895 he founded Postum Cereal Co., the precursor to GENERAL FOODS CORP. His first product, the cereal beverage Postum, was followed by Grape Nuts and Post Toasties.

Post, Emily *orig.* **Emily Price** (b. Oct. 27, 1872 or Oct. 3, 1873, Baltimore, Md., U.S.—d. Sept. 25, 1960, New York, N.Y.) U.S. authority on etiquette. She was educated in private schools in New York City. At the turn of the century her straitened circumstances compelled her to begin writing light fiction and magazine articles. At her publisher's suggestion, she undertook her major work, *Etiquette: The Blue Book of Social Usage* (originally *Etiquette in Society, in Business, in Politics and at Home*), in 1922; unlike earlier writers on the subject, she directed her commonsense views to the ordinary person of moderate means. The book appeared in 10 editions and 90 printings in her lifetime. The outpouring of letters it provoked inspired her newspaper column, which became widely syndicated.

Emily Post.
BROWN BROTHERS

post-and-beam system In building construction, a system in which two upright members, the posts, hold up a third member, the beam, laid horizontally across their top surfaces. In Britain it is called post-and-lintel system, but in the U.S. "lintel" is usually reserved for a short beam that spans a window or door opening. The post and beam formed the basis of architecture from prehistoric to Roman times, and is illustrated by such ancient structures as STONEHENGE. All structural openings evolved from this system, which is seen in pure form only in COLONNADES and in FRAMED STRUCTURES, the posts of doors, windows, ceilings, and roofs usually being hidden in walls. The beam must bear loads that rest on it as well as its own load without deforming or breaking. Post-and-beam construction has largely been supplanted by the modern steel frame.

Post-Impressionism Movement in Western painting that represented both an extension of IMPRESSIONISM and a rejection of its limitations. The term was coined by ROGER FRY for the works of PAUL CÉZANNE, GEORGES SEURAT, VINCENT VAN GOGH, PAUL GAUGUIN, HENRI DE TOULOUSE-LAUTREC, and others. Most of these painters first pursued Impressionism, a style based, in its strictest sense, on the objective recording of nature in terms of the fugitive effects of colour and light. The Post-Impressionists rejected this aim in favour of more ambitious expression, admitting their debt, however, to the pure, brilliant colours of Impressionism, its freedom from traditional subject matter, and its technique of defining form with short brushstrokes of broken colour. Each painter in the movement pursued unique, personal subject matter and, while sharing stylistic goals with the other Post-Impressionists, had a personal form of expression. For example, Cézanne abandoned the Impressionists' virtuoso depiction of evanescent light effects in order to pursue his preoccupation with the underlying structures of natural forms and the problem of unifying surface patterns with spatial depth. Both Gauguin and van Gogh rejected the indifferent objectivity of Impressionism in favour of a more personal, spiritual expression. The Post-Impressionists often exhibited together but, unlike the Impressionists, who were a close-knit and convivial group, they painted mainly alone. In general, Post-Impressionism led away from a naturalistic approach and toward the two major movements of early 20th-century art that followed it: CUBISM and FAUVISM. See also NEO-IMPRESSIONISM.

post-traumatic stress disorder (PTSD) Psychological reaction occurring after a highly stressful event and typically characterized by flashbacks, recurrent nightmares, and avoidance of reminders of the event; DEPRESSION and ANXIETY are often present. Traumatic events that can lead to PTSD include automobile accidents, rape or assault, military combat, torture, and such natural disasters as floods, fires, or earthquakes. Long-term effects can include marital and family problems, difficulties at work, and abuse of alcohol and other drugs. Antidepressant medication and PSYCHOTHERAPY, including GROUP THERAPY, are used in treating the disorder.

postal system System that allows persons to send letters, parcels, or packages to addressees in the same country or abroad. Postal systems are usually government-run and paid for by a combination of user charges and government subsidies. There are early references to postal services in Egypt c. 2000 BC and in Zhou-dynasty China c. 1000 BC. The Roman Empire developed various centralized methods of relaying messages. In the Middle Ages there were no centralized postal services. Private postal systems developed with the rise of nation-states during the Renaissance; subsequently, postal services became government monopolies. Charges based on weight rather than distance and the use of prepaid stamps were first proposed in 1837. The General Postal Union (1875; later Universal Postal Union) improved international mail delivery by allowing member countries to retain the postage they collected on outgoing international mail and requiring them to treat incoming international mail as they did domestic mail. Airmail and automated mail handling were developed in the 20th century. See also E-MAIL.

poster Eye-catching printed paper announcement or advertisement that is exhibited to promote a product, event, or idea. Posters were popularized by the mid-19th-century invention of LITHOGRAPHY, which allowed coloured posters to be produced cheaply and easily. HENRI DE TOULOUSE-LAUTREC was noted for his poster art, which often advertised Parisian cabaret performers. Poster art flourished with the rise of the ART NOUVEAU style, as seen in the work of ALPHONSE MUCHA. During World War I posters were used for recruiting and propaganda, and the industrial boom of the early 20th century gave rise to advertising posters for every conceivable product and event. The later rise of film and television advertising led to an eclipse in poster art.

postmodernism Any of several artistic movements since about the 1960s that have challenged the philosophy and practices of modern arts or literature. In literature this has amounted to a reaction against an ordered view of the world and therefore against fixed ideas about the form and meaning of texts. In its reaction against Modernist ideals (see MODERNISM) such as autotelic art and the original masterpiece, postmodern writing and art emphasize devices such as pastiche and parody and the stylized tech-

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nique of the antinovel and magic realism. Postmodernism has also led to a proliferation of critical theories, most notably DECONSTRUCTION and its offshoots, and the breaking down of the distinction between "high" and "low" culture.

postmortem See AUTOPSY

poststructuralism Movement in LITERARY CRITICISM and philosophy begun in France in the late 1960s. Drawing upon the linguistic theories of FERDINAND DE SAUSSURE, the anthropology of CLAUDE LÉVI-STRAUSS (see STRUCTURALISM), and the deconstructionist theories of JACQUES DERRIDA (see DECONSTRUCTION), it held that language is not a transparent medium that connects one directly with a "truth" or "reality" outside it but rather a structure or code, whose parts derive their meaning from their contrast with one another and not from any connection with an outside world. Writers associated with the movement include ROLAND BARTHES, JACQUES LACAN, JULIA KRISTEVA, and MICHEL FOUCAULT.

Potala Palace \pō-tə-lə\ Religious and administrative complex, near LHASA, Tibet, China. It covers 5 sq mi (13 sq km) atop a hill 425 ft (130 m) above the Lhasa River valley. Potrang Karpo (the White Palace, completed 1648) once served as the seat of the Tibetan government and the main residence of the DALAI LAMA; from the mid-18th century it was used as a winter palace. Potrang Marpo (the Red Palace, 1694) houses several chapels, sacred statues, and the tombs of eight Dalai Lamas; it remains a major pilgrimage site for Tibetan Buddhists. The complex, which has a total of 1,000 rooms, was declared a WORLD HERITAGE SITE in 1994.

potash \'pät-ˌash\ Name used for various inorganic compounds of POTASSIUM, chiefly the CARBONATE (K_2CO_3), a white crystalline material formerly obtained from wood ashes. They are used to make special types of glass, potassium silicate (a dehydrating agent), pigments, printing inks, and soft soaps; for washing raw wool; and as a lab reagent and general-purpose food additive. Potassium hydroxide is frequently called caustic potash, and in the fertilizer industry, potassium oxide is called potash.

potash mica See MUSCOVITE

potassium Chemical ELEMENT, one of the ALKALI METALS, chemical symbol K, atomic number 19. It is a soft, silvery white METAL, not found free in nature and rarely used as the metal (except as a chemical reagent) because of its extreme reactivity. Potassium is essential for life and is present in all soils. Potassium IONS (K^+) and SODIUM ions act at cell membranes in electrochemical impulse transmission and in TRANSPORT. Potassium in compounds has VALENCE 1. The chloride is used as a fertilizer and a raw material for producing other compounds, and the HYDROXIDE for making liquid soaps and detergents and in preparing various SALTS. The iodide is added to table salt to protect against IODINE DEFICIENCY. The NITRATE is also called SALTPETRE, and the CARBONATE is called POTASH.

potassium-argon dating Method for determining the age of igneous rocks based on the amount of argon-40 in the rock. Radioactive potassium-40 decays to argon-40 with a half-life of about 1.3 billion years, making this method useful for dating rocks that are billions of years old. A more sophisticated method, called argon-argon dating, provides a more accurate estimate of the original potassium-40 content by means of the ratio of argon-40 to argon-39 in the rock, thus yielding a more accurate age determination. See also DATING.

potato Herbaceous annual (*Solanum tuberosum*) in the NIGHTSHADE FAMILY. One of the world's main food crops, the potato differs from other food crops in that the edible portion is a TUBER. Highly digestible, potatoes are prepared for eating in many ways and are a major source of starch as well as amino acids, protein, vitamin C, and B vitamins. The stem grows 20–40 in. (50–100 cm) tall, sprouting spirally arranged compound leaves. Underground, stems extend as STOLONS, the ends of which enlarge into 1–20 tubers of variable shape and size. The tubers have spirally arranged buds (eyes) that may remain dormant after the tuber is fully grown for up to 10 weeks or more; they grow into plants identical to the parent plant. A native of the Andes, the potato (also known as the common potato, white potato, or Irish potato) was carried by Spaniards into Europe during the 16th century. A century later, it had become the major food crop in Ireland; disastrous damage to the crop by a fungal blight caused the IRISH POTATO FAMINE in the mid-1800s. See also SWEET POTATO.

Potato (*Solanum tuberosum*).
GRANT HEILMAN

potato beetle Destructive species (*Lema trilineata*) of leaf BEETLE (family Chrysomelidae). Less than 0.25 in. (6 mm) long, it is yellow and has three black stripes on its wing covers. Eggs are laid on the underside of a potato leaf, on which both larvae and adults feed. The larvae are camouflaged by excrement the beetles pile on their back. Two generations are produced each year; the second overwinters in the ground in the pupal stage. See also COLORADO POTATO BEETLE.

potato bug See COLORADO POTATO BEETLE

Potemkin \pə-'tyem-kin**, Grigory (Aleksandrovich)** (b. Sept. 24, 1739, Chizovo, Russia—d. Oct. 16, 1791, near Iaşi, Moldavia) Russian army officer. He entered the horseguards (1755) and helped bring CATHERINE II to power (1762). He fought with distinction in the RUSSO-TURKISH WAR (1768–74), then became Catherine's lover (1774–76) and was made governor-general of "New Russia" (southern Ukraine). In 1783 she made him prince of Tauris. As a field marshal from 1784, he introduced reforms in the army, built the harbour of Sevastopol, and constructed a fleet in the Black Sea. He attempted to colonize the Ukrainian steppes, but he underestimated the costs, leaving many projects half-complete; his successful disguising of the weak points of his administration led to the claim that he erected mere facades—"Potemkin villages"—to show Catherine on her tour of the region. He commanded the Russian army in the second Russo-Turkish War.

Grigory Potemkin, engraving by James Walker, 1789, after a portrait by Johann Baptist Lampi.
REPRODUCED BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO., LTD.

potential, electric See ELECTRIC POTENTIAL

potential energy Energy stored by an object by virtue of its position. For example, an object raised above the ground acquires potential energy equal to the WORK done against the force of gravity; the energy is released as KINETIC ENERGY when it falls back to the ground. Similarly, a stretched spring has stored potential energy that is released when the spring is returned to its unstretched state. Other forms of potential energy include electrical potential energy, CHEMICAL ENERGY, and NUCLEAR ENERGY.

Potenza \pō-'tent-sä\ *ancient* **Potentia** City (pop., 2001 prelim.: 69,295), capital of the BASILICATA region, southern Italy. Located at 2,684 ft (819 m) above sea level in the APENNINES, the Roman city Potentia was founded in the 2nd century BC and became an important road junction and flourishing community. In medieval times it had a succession of feudal overlords. In 1860 it was the first town in southern Italy to expel the Bourbon rulers of the Kingdom of the TWO SICILIES. The town has been rebuilt several times after earthquake damage. It is an agricultural centre and ships fruit and vegetables.

potestas patria See PATRIA POTESTAS

potlatch Ceremonial distribution of property and gifts practiced among the American Indians of the Northwest Pacific coast, particularly the KWAKIUTL. A potlatch is given by an heir or successor to assert and validate his newly assumed social position. Ceremonial formalities are observed in inviting guests, in speech making, and in distributing goods according to the social rank of the recipients. Great feasts and generous hospitality accompany the potlatch. The ceremony has been much studied by anthropologists for the light it sheds on the nature of property, wealth, prestige, and SOCIAL STATUS. See also GIFT EXCHANGE.

Potok \'pō-täk**, Chaim** *orig.* **Herman Harold Potok** (b. Feb. 17, 1929, New York, N.Y., U.S.—d. July 23, 2002, Merion, Pa.) U.S. rabbi and novelist. The son of Polish immigrants, he was reared in an Ortho-

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dox Jewish home and was ordained a Conservative rabbi. He taught until he began a career as an editor and writer of scholarly and popular articles and reviews in the 1960s. His novels, which have introduced to American fiction the spiritual and cultural life of Orthodox Jews, include *The Chosen* (1967; film, 1981), *The Promise* (1969), and *My Name Is Asher Lev* (1972). Three connected novellas, *Old Men at Midnight*, appeared in 2001. Notable among Potok's nonfiction writings are *Wanderings: Chaim Potok's History of the Jews* (1978), in which the author combines impressive scholarship with dramatic narrative, and *The Gates of November* (1996), a chronicle of a Soviet Jewish family and the rise and fall of the Soviet Union.

Potomac \pə-'tō-mək\ **River** River, east-central U.S. Rising in the Appalachian Mountains of West Virginia, it is about 287 mi (462 km) long. It flows southeast through the District of Columbia into Chesapeake Bay. It is navigable by large vessels to Washington, D.C., above which it descends in a series of rapids and falls, including Great Falls. Noted for its beauty, the Potomac is also rich in history. Mount Vernon, home of George Washington, is on its banks below Washington, D.C. The Chesapeake and Ohio Canal National Historical Park parallels the river.

Potosí \ˌpō-tō-'sē\ City (pop., 2001: 132,966), southwestern Bolivia. Founded in 1545 after the discovery of silver in a neighbouring mountain, it grew to be the most populous city in Latin America. After the mid-17th century, its population declined drastically when silver production waned but expanded in the 19th–20th century with the introduction of other industries, including tin mining. One of the highest cities in the world, at an elevation of about 13,700 ft (4,200 m), it is a major Bolivian industrial centre. The historic city was designated a UNESCO World Heritage site in 1987.

Potsdam City (pop., 2002 est.:130,435), capital of Brandenburg state, Germany. It is located on the Havel River southwest of Berlin. First mentioned in 993 as a Slav settlement, it was chartered in 1317. It became the electoral residence of the margrave of Brandenburg in 1640 under Frederick William, the Great Elector. It was the Prussian royal residence under Frederick II, during whose reign it was a military and intellectual centre. It was severely damaged during World War II, but many monuments survived and others have been restored. In 1945 it was the site of the Potsdam Conference. Its large, beautifully landscaped parks were named a World Heritage site by UNESCO in 1990. Industries include administration, retailing, education, film production, and tourism. It is the site of several scientific and technical institutions.

Potsdam Conference (July 17–Aug. 2, 1945) Allied conference held in the Berlin suburb of Potsdam after Germany's surrender in World War II. Harry Truman, Joseph Stalin, and Winston Churchill (later replaced by Clement R. Attlee) met to discuss European peace settlements, the administration of defeated Germany, the demarcation of the boundaries of Poland, the occupation of Austria, the definition of the Soviet Union's role in eastern Europe, the determination of reparations, and the further prosecution of the war against Japan. The four occupation zones of Germany conceived at the Yalta Conference were set up, each to be administered by the commander-in-chief of the Soviet, British, U.S., or French army of occupation. Poland's boundary became the Oder and Neisse rivers in the west, and the country received part of former East Prussia. Stalin refused to let the Western powers interfere with his control of eastern Europe.

Potter, (Helen) Beatrix (b. July 28, 1866, South Kensington, Middlesex, Eng.—d. Dec. 22, 1943, Sawrey, Lancashire) English author and illustrator of children's books. In her childhood Potter spent holidays in Scotland and the English Lake District, which inspired her love of animals and stimulated her imaginative and technically superb watercolour drawings. The illustrated animal stories she sent to a sick child when she was 27 were published as *The Tale of Peter Rabbit* (1902), which became one of the best-selling children's books of all time. More than 20 sequels followed, featuring such original characters as Jeremy Fisher, Squirrel Nutkin, Jemima Puddle-Duck, and Mrs. Tiggy-Winkle.

Beatrix Potter, 1913
PICTORIAL PARADE/*LONDON DAILY EXPRESS*, REPRODUCED BY PERMISSION OF FREDERICK WARNE & CO.

Potter, Dennis (Christopher George) (b. May 17, 1935, Berry Hill, Gloucestershire, Eng.—d. June 7, 1994, Ross-on-Wye, Herefordshire) British dramatist. Educated at Oxford, he thereafter devoted himself to writing, especially of television plays. His innovative serial *Pennies from Heaven* (1978) combined fantasy sequences and musical interludes in which actors lip-synched to old recordings of period songs. His best-known teleplay, the eight-part *The Singing Detective* (1986), an autobiographical account of his crippling bouts of psoriatic arthropathy, combined humour, pathos, and fantastic musical numbers. His other teleplays include the allegedly sacrilegious *Brimstone and Treacle* (1976, televised 1987) and *Lipstick on Your Collar* (1993). His movie screenplays include *Gorky Park* (1983) and *Dreamchild* (1985).

pottery One of the oldest and most widespread of the decorative arts, consisting of objects (mostly useful ones, such as vessels, plates, and bowls) made of clay and hardened with heat. Earthenware is the oldest and simplest form; stoneware is fired at a high temperature to cause it to vitrify and harden; and porcelain is a fine, generally translucent form of pottery. The Chinese began their sophisticated production of pottery in the Neolithic period and produced porcelain as early as the 7th century AD. Chinese porcelain, or "china," was widely exported to Europe and had a profound influence on European manufacturers and on taste. Classical Greece and Islamic cultures are also known for their artistic and technical innovations in pottery.

Poujade \pü-'zhäd**, Pierre (-Marie)** (b. Dec. 1, 1920, Saint-Céré, France—d. Aug. 27, 2003, La Bastide-l'Évêque) French political leader. The owner of a bookstore in Saint-Céré, in 1953 he organized a local shopkeepers' strike to protest high taxation. Expanding his activities to other towns, he enrolled 800,000 members in his Union for the Defense of Tradesmen and Artisans. His right-wing movement, known as Poujadism, attracted discontented farmers and merchants; in 1956 it won 52 seats in the National Assembly. Poujade's influence soon waned, but in the 1970s he founded an organization for nonunion workers.

Poulenc \'pü-ˌlaŋk**, Francis (Jean Marcel)** (b. Jan. 7, 1899, Paris, Fr.—d. Jan. 30, 1963, Paris) French composer. In his teens he studied piano with Ricardo Viñes (1875–1943). Influenced by Erik Satie, Poulenc and five other like-minded young composers became known as Les Six. Poulenc wrote piano compositions, orchestral music, and chamber music, but he is best known for his vocal music, including many admired songs, the operas *The Breasts of Tiresias* (1944), *Dialogues of the Carmelites* (1956), and *La voix humaine* (1958), and such sacred choral works as *Mass in G Major* (1937), the *Stabat Mater* (1950), and the *Gloria* (1959), reflecting his devout Catholicism.

poultry farming Raising birds commercially or domestically for meat, eggs, and feathers. Chickens, ducks, turkeys, and geese are the birds of primary commercial importance. Guinea fowl and squabs are chiefly of local interest. Though chickens have been domesticated for at least 4,000 years, their meat and eggs have been mass-production commodities only since c. 1800.

pound Unit of weight in the avoirdupois system, the traditional European system of weight (incorporated into the British Imperial system and the U.S. system of weights and measures), equal to 16 oz, 7,000 grains, or 0.4536 kg. It is also a unit of weight in the troy and apothecaries' systems (two other traditional systems of weight), equal to 12 troy or apothecaries' oz, 5,760 grains, or 0.37 kg. Its Roman ancestor, the *libra*, is the source of the abbreviation lb. The troy pound is used for precious metals, the apothecaries' pound for drugs. The British monetary pound is linked historically with the minting of silver coins (sterlings). Large payments were reckoned in "pounds of sterlings," later shortened to "pounds sterling." See also gram; International System of Units; measurement; metric system; ounce.

Pound, Ezra (Loomis) (b. Oct. 30, 1885, Hailey, Idaho, U.S.—d. Nov. 1, 1972, Venice, Italy) U.S. poet and critic. Pound attended Hamilton College and the University of Pennsylvania, where he studied various languages. In 1908 he sailed for Europe, where he would spend most of his life. He soon became a leader of Imagism and a dominant influence in Anglo-American verse, helping promote writers such as William Butler Yeats, James Joyce, Hilda Doolittle, Ernest Hemingway, Robert Frost, D.H. Lawrence, and T.S. Eliot, whose *The Waste Land* he brilliantly edited. After

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World War I he published two of his most important poems, "Homage to Sextus Propertius" (1919) and "Hugh Selwyn Mauberley" (1920). He also began publishing *The Cantos*, an attempt at an epic sequence of poems, which would remain his major poetic occupation throughout his life. With the onset of the Great Depression, he increasingly pursued his interest in history and economics, became obsessed with monetary reform, and declared his admiration for Benito Mussolini. In World War II he made pro-fascist radio broadcasts; detained by U.S. forces for treason in 1945, he was initially held at Pisa; *The Pisan Cantos* (1948, Bollingen Prize), written there, are notably moving. He was subsequently held in an American mental hospital until 1958, when he returned to Italy. *The Cantos* (1970) collects his 117 completed cantos.

Pound, Roscoe (b. Oct. 27, 1870, Lincoln, Neb., U.S.—d. July 1, 1964, Cambridge, Mass.) U.S. legal educator and botanist. After studying botany at the University of Nebraska and law at Harvard University (1889–90), he was admitted to the Nebraska bar, and he practiced law while also teaching at the state university (1890–1903). At the University of Nebraska he directed the state botanical survey (1892–1903) and discovered a rare fungus (*Roscopoundia*). He later taught at several law schools, most notably Harvard (1910–37), where he also served as dean (1916–36), instituting many reforms. He was perhaps the chief U.S. advocate of sociological jurisprudence, which holds that statutes and court decisions are affected by social conditions; his ideas apparently influenced the New Deal programs of Pres. Franklin D. Roosevelt. After World War II he helped reorganize the judicial system of Taiwan.

Roscoe Pound.
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Poussin \pü-'sa^{n}**, Nicolas** (b. 1594, Villers, France—d. Nov. 19, 1665, Rome, Papal States) French painter. Except for two years as court painter to Louis XIII, he spent his entire career in Rome, where he became an admirer of ancient Roman civilization. In early works, he depicted themes from Classical mythology in a painterly style reminiscent of such Venetian masters as Titian. Turning to Raphael for inspiration, he began in the mid 1630s to develop a style marked by Classical clarity and monumentality. His late masterworks, such as *Holy Family on the Steps* (1648), employ a style calculated to express virtue and rectitude, featuring only a few figures painted in harsh colours against a severe background. In his landscapes, such as *Landscape with Polyphemus* (1649), the disorder of nature is reduced to the order of geometry. His austere and highly ordered compositions influenced generations of French painters, including Jacques-Louis David, J.-A.-D. Ingres, and Paul Cézanne.

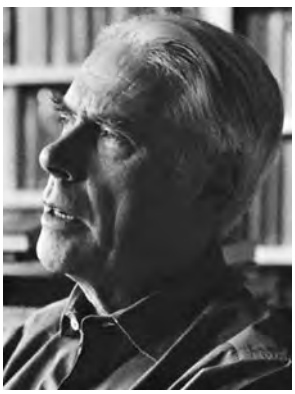
powder metallurgy Fabrication of metal objects from a powder rather than casting from molten metal or forging at softening temperatures. In some cases the powder method is more economical, as in making metal parts such as gears for small machines, in which casting would involve considerable scrap loss. In other cases, melting is impractical (e.g., because the melting point of the metal is too high). Powder metallurgy is also used to produce a porous product that will allow a liquid or gas to pass through it. See also metallurgy, sintering.

Powder River River, northern Wyoming and southeastern Montana, U.S. It rises in the foothills of the Bighorn Mountains in Wyoming and flows north 486 mi (782 km) to join the Yellowstone River near Terry, Mont. Tributaries include the Little Powder River and Crazy Woman Creek.

Powderly, Terence V(incent) (b. Jan. 22, 1849, Carbondale, Pa., U.S.—d. June 24, 1924, Washington, D.C.) U.S. labour leader. The son of Irish immigrants, he became a railroad worker at age 13 and a machinist's apprentice at 17. He joined the Machinists' and Blacksmiths' Union in 1871. Three years later he joined the secret order of the Knights of Labor, and in 1879 he was chosen for its highest post, grand master workman. He presided over the union in its period of greatest membership, but attacks by opponents such as Jay Gould caused membership to decline. Powderly became absorbed in internal disputes and finally resigned in 1893. See also labour union; Uriah Smith Stephens.

Powell, Adam Clayton, Jr. (b. Nov. 29, 1908, New Haven, Conn., U.S.—d. April 4, 1972, Miami, Fla.) U.S. politician. In 1937 he succeeded his father as pastor of the Abyssinian Baptist Church in Harlem, New York City, and built its membership to 13,000. Elected to the New York City Council in 1941, he became the first African American to serve on that body. In the U.S. House of Representatives (1945–67, 1969–71), he sponsored much social-welfare legislation, including a minimum wage act, antipoverty acts, and bills providing federal aid to education. Known for his flamboyance and his lack of concern for House decorum, he was the target of a libel suit and was investigated for financial misconduct. In 1967 the House voted to exclude him, but the U.S. Supreme Court later ruled that the House's action was unconstitutional.

Powell \'pō-əl, 'paù(-ə)l**, Anthony (Dymoke)** (b. Dec. 21, 1905, London, Eng.—d. March 28, 2000, near Frome, Somerset) British novelist. He published his first novel, *Afternoon Men* (1931), while working in a London publishing house. He worked in journalism and served in World War II before publishing the first of 12 novels in the autobiographical and satiric series *A Dance to the Music of Time* (1951–75). His best-known work, it reflects his outlook and experiences of English society in the decades before and after the war. His later novels include *The Fisher King* (1986).



Anthony Powell, 1974
FAY GODWIN

Powell, Bud *orig.* **Earl Powell** (b. Sept. 27, 1924, New York, N.Y., U.S.—d. Aug. 1, 1966, New York City) U.S. jazz pianist and composer. Powell played in Cootie Williams's big band (1942–44) before becoming part of the burgeoning activity of bebop in the late 1940s. His style became the predominant approach for post-swing era pianists: he did away with most accepted functions of the left hand, reducing it to playing brief, syncopated chords supporting long melody lines by the right hand. He moved to Paris in 1959 and returned to the U.S. in 1964. His career was interrupted several times due to nervous breakdowns thought to derive from head injuries sustained in a racially motivated attack in 1945.

Powell, Colin (Luther) (b. April 5, 1937, New York, N.Y., U.S.) U.S. general and statesman. The son of Jamaican immigrants, he entered the U.S. Army after college and served in the Vietnam War (1962–63, 1968–69). After holding various posts in the Pentagon and elsewhere, he was appointed senior military assistant to the secretary of defense in 1983. In 1987 he joined the staff of the National Security Council; in that same year Pres. Ronald Reagan appointed him assistant to the president for national security affairs. In 1989 Powell was promoted to four-star general and, appointed by Pres. George Bush, became the first African American to serve as chairman of the Joint Chiefs of Staff. He helped plan the invasion of Panama (1989) and the military operations of the First Persian Gulf War. Under Pres. George W. Bush he served as secretary of state (2001–05), the first African American to hold that post.

Powell, John Wesley (b. March 24, 1834, Mount Morris, N.Y., U.S.—d. Sept. 23, 1902, Haven, Maine) U.S. geologist and ethnologist. Powell took many expeditions (1871–79) down the Colorado River, describing the earliest of these in *Exploration of the Colorado River of the West and Its Tributaries* (1875). He developed the first comprehensive classification of American Indian languages (1877) and was the first director of the Smithsonian Institution's Bureau of American Ethnology (1879–1902). In 1881 he became director of the U.S. Geological Survey, where he worked extensively on mapping water sources and advancing irrigation projects.

Powell, Lewis F(ranklin), Jr. (b. Sept. 19, 1907, Suffolk, Va., U.S.—d. Aug. 25, 1998, Richmond, Va.) U.S. jurist. After studying law at Washington and Lee University and Harvard University, he returned to practice law in Virginia. As chairman of the Richmond school board, he oversaw peaceful school integration in 1959; he later chaired the state

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board of education and served as president of the American Bar Association. Widely respected in legal circles, he was nominated to the Supreme Court of the United States by Pres. Richard Nixon in 1971; he took his seat in 1972 and served until 1987. He adopted moderate-to-liberal positions on civil rights, affirmative action, and separation of church and state, though his views on law enforcement were conservative.

Powell, Michael (Latham) (b. Sept. 30, 1905, Bekesbourne, Kent, Eng.—d. Feb. 19, 1990, Avening, Gloucestershire) British film director. He directed his first movie, *Two Crowded Hours*, in 1931 and made over 20 low-budget films before Alexander Korda teamed him with screenwriter Emeric Pressburger (1902–88) to make the successful *U-Boat 29* (1939). Forming their own production company, they made movies such as *The Thief of Bagdad* (1940), *The Life and Death of Colonel Blimp* (1943), *Stairway to Heaven* (1946), *Black Narcissus* (1947), *The Red Shoes* (1948), and *The Tales of Hoffmann* (1951). Powell made the controversial *Peeping Tom* (1960) without Pressburger. Powell's films were notable for their use of brilliant colour, fantasy, and experimental cinematography.

Powell, Robert Baden- See Robert S. Baden-Powell

Powell, William (b. July 29, 1892, Pittsburgh, Pa., U.S.—d. March 5, 1984, Palm Springs, Calif.) U.S. film actor. He acted on Broadway from 1912 and made his screen debut in *Sherlock Holmes* (1922). Powell played villains in the silent movies, and with the coming of sound he moved into light mysteries, playing his first detective in *The Canary Murder Case* (1929). An intelligent, debonair leading man, he became a top star as the sophisticated, bemused detective Nick Charles, opposite Myrna Loy, in the hit *The Thin Man* (1934) and its successful sequels. His later notable films include *The Great Ziegfeld* (1936), *My Man Godfrey* (1936), and *Life with Father* (1947).

power In science and engineering, the time rate of doing work or delivering energy. Power (P) can be expressed as the amount of work done (W), or energy transferred, divided by the time interval (t): $P = W/t$. A given amount of work can be done by a low-powered motor in a long time or by a high-powered motor in a short time. Units of power are those of work (or energy) per unit time, such as foot-pounds per minute, joules per second (called watts), or ergs per second. Power can also be expressed as the product of the force (F) applied to move an object and the speed (v) of the object in the direction of the force: $P = Fv$. See also horsepower.

Power, Charles Gavan (1888–1968) Canadian politician. Born in Sillery, Quebec, he was seriously wounded in World War I. He served in the Canadian House of Commons 1917–55. In W.L. Mackenzie King's government he served as minister for pensions and national health (1935–39) and postmaster general (1939–40). As minister for national defense for air (1940–44), he promoted the interests of Canadian air forces serving under British command and created Canadian squadrons in Europe.

Power, Tyrone (Edmund) (b. May 5, 1914, Cincinnati, Ohio, U.S.—d. Nov. 15, 1958, Madrid, Spain) U.S. actor. The descendant of a long line of actors, he toured with a Shakespearean repertory company before making his Broadway debut in *Romeo and Juliet* (1935). His first film hit was *Lloyds of London* (1936). He became noted for his action-adventure roles in movies such as *The Rains Came* (1939), *The Mark of Zorro* (1940), *Blood and Sand* (1941), *Nightmare Alley* (1947), and *The Mississippi Gambler* (1953), while continuing to act on stage in plays such as *Saint Joan* (1936), *Mister Roberts* (1950), and *Back to Methuselah* (1958).

power of attorney See power of attorney

Powers, Hiram (b. June 29, 1805, Woodstock, Vt., U.S.—d. June 27, 1873, Florence, Italy) U.S.-born Italian sculptor. He worked as an artist-assistant in a waxworks museum in Cincinnati, Ohio, then moved to Washington, D.C., where he modeled busts of such figures as Andrew Jackson (1834). In 1837 he settled permanently in Florence. He attracted international notoriety with his marble *Greek Slave* (1843), an image of a nude young woman in chains, which caused a sensation at London's Crystal Palace Exposition in 1851. An artist of outstanding technical ability, he was one of the most popular sculptors of his time. See photograph opposite.

Powhatan \ˌpau̇-ə-ˈtan, pau̇-ˈha-tᵊn\ (d. April 1618, Virginia) American Indian leader, father of Pocahontas. At the peak of his power, he ruled the 13,000 to 34,000 people of the Powhatan empire. He initially acted ambivalently toward the English settlement at Jamestown, Va., and sometimes permitted attacks against the colonists. After Pocahontas married an English settler in 1614, however, Powhatan maintained peaceful relations with the colonists until the end of his life.

Powhatan Confederacy of more than 30 North American Indian tribes living in Oklahoma, New Jersey, and Virginia, U.S., and in Canada. Powhatan languages belong to the Algonquian language family. They once occupied most of Tidewater Virginia and the eastern shore of Chesapeake Bay. The confederacy was named for its powerful chief, Powhatan, to whom the tribes provided military support and paid taxes in the form of goods. Many of the villages, consisting of long dwellings covered with bark or reed mats, were palisaded. Powhatan women cultivated corn, beans, and squash; the men hunted and waged war, chiefly against the Iroquois. The intermittent hostilities with the English settlers, often called the Powhatan War (1622–44), ended with the breaking of the confederacy.

powwow American Indian ceremony or gathering of various kinds. Powwows originally were healing ceremonies, but the word could also refer to exuberant celebrations, with dancing and singing, of success in hunting or victory in battle. Meetings of tribal councils were also called powwows. Today the word is used for large-scale Indian social gatherings, often representing more than one tribe, with traditional drumming, singing, and dancing. Modern powwows draw tourists as well as participants, and craft items and souvenirs are offered for sale.

Powys \ˈpō-əs\ County (pop., 2001: 126,344), east-central Wales. The county seat is at Llandridod Wells. It is named after the Welsh princedom of Powys, located in the border country between Wales and England. At its most powerful in the 12th century, the princedom was unable to gain ascendancy in Wales because it was so close to the border area where the cultures of Wales and England intermingled. Main elements in the landscape are the valley lowlands leading to Shrewsbury and Hereford. There are remains of Iron Age and Roman settlements.

"Greek Slave," marble statue by Hiram Powers, 1843; in the Corcoran Gallery of Art, Washington, D.C.
COURTESY OF THE CORCORAN GALLERY OF ART, WASHINGTON, D.C.

poxvirus Any of a group of viruses responsible for a wide range of pox diseases in humans and other animals. Poxvirus was the cause of smallpox. (Human chickenpox is caused by varicella-zoster virus.) The virus particle is somewhat brick-shaped, and its surface is studded with hollow spikes. It contains DNA. Unlike other DNA viruses, poxviruses appear to develop entirely within the cytoplasm of affected cells. The virus of rabbitpox has been used with mixed success in Australia to control the wild rabbit population.

Poynings \ˈpȯi-ˌniŋz**, Sir Edward** (b. 1459, Southwark?, near London, Eng.—d. October 1521, Westenhanger, Kent) English soldier and administrator. A supporter of Henry Tudor (later Henry VII), he served as the king's lord deputy of Ireland (1494–95), where he enacted legislative measures ("Poynings' Laws") that applied all English public laws to Ireland and required every act of the Irish parliament to be approved by the king and privy council.

Poznań \ˈpȯz-ˌnän\ *German* **Posen** \ˈpōz-ᵊn\ City (pop., 2000 est.: 574,896), west-central Poland. Located on the Warta River, Poznań is one of the oldest cities in Poland,

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dating from the 9th century AD. It reached the height of prosperity as a trade centre from the 15th to the 17th century but declined after the Second Northern War. In 1793 Poznań was annexed to Prussia, intensifying a Germanization that had begun in the 13th century. In 1918 it reverted to Poland. During World War II it was occupied by the Germans and suffered extensive damage. Rebuilt after the war, it has become the administrative, industrial, and cultural centre of western Poland. It is also an academic centre with scientific and literary institutes. Its varied industries include textile mills, metallurgical works, and chemical plants.

Practical Learning School *or* **Silhak** School of thought that arose in 18th-century Korea, dedicated to a practical approach to statecraft. It attacked Neo-Confucianism, particularly its formalism and concern with ritual. Members of the school originated many ideas for social reform and the development of farming. Notable contributors include Yi Ik (1681–1763), who wrote on land reform and the abolition of class barriers, and Pak Chi-won (1737–1805), who advocated the development of commerce and technology. The school contributed to the wave of modernization that occurred after the introduction of Western culture into Korea in the late 19th century.

practical reason Rational capacity by which (rational) agents guide their conduct. In Immanuel Kant's moral philosophy, it is defined as the capacity of a rational being to act according to principles (i.e., according to the conception of laws). Unlike the ethical intuitionists (see intuitionism), Kant never held that practical reason intuits the rightness of particular actions or moral principles. For him, practical reason was basically formal rather than material, a framework of formative principles rather than a source of specific rules. This is why he put such stress on his first formulation of the categorical imperative. Lacking any insight into the moral realm, humans can only ask themselves if what they are proposing to do has the formal character of law, namely, the character of being the same for all persons similarly circumstanced.

Prado \'prä-dō\ **Museum** Spain's national art museum, housing the world's greatest collection of Spanish painting as well as other European works. Founded in Madrid in 1818 by Ferdinand VII, it was opened to the public in 1819 as the Royal Museum of Painting. Its holdings were formed over three centuries from the various royal collections of the Habsburg and Bourbon monarchs in Spain. In 1868 it became the National Museum of the Prado after the exile of Isabella II. In 1872 it acquired many notable paintings formerly owned by Spanish convents and monasteries. It owns the outstanding collections of the works of El Greco, Diego Velázquez, and Francisco de Goya and numerous works by other Spanish masters such as José de Ribera and Francisco Zurbarán. Among its other holdings are collections of Greco-Roman statuary and many Flemish and Italian masterpieces.

Praeneste \prē-'nes-tē\ *modern* **Palestrina** Ancient city, Latium, central Italy. Praeneste was located on a spur of the Apennines. Founded before the 8th century BC, it saw many battles with Rome before becoming part of the Roman Empire. It was a major centre for the cult of the goddess Fortuna, whose sanctuary and temple oracle were surrounded by an immense complex of buildings. It became a favourite summer resort of wealthy Romans, including Augustus, Hadrian, and Pliny the Younger. The modern town is the birthplace of composer Giovanni Pierluigi da Palestrina.

praetor \'prē-tər\ In ancient Rome, a judicial officer who had broad authority in cases of equity, was responsible for producing public games, and, in the absence of a consul, exercised extensive authority in the government. After a one-year term, a praetor typically went on to govern a province. Originally only a patrician magistrate could be a praetor, but from c. 337 BC, the position was also open to plebeians. The number of praetors increased to eight by the 1st century BC, two for civil matters and six for specific courts. It continued to vary under different government leaders and emperors; by the late empire, only the city praetor for public games remained.

Praetorian \prē-'tōr-ē-ən\ **Guard** (Latin, *cohors praetoria*) Household troops of the Roman emperors. In the 2nd century BC they were bodyguards for Roman generals, their name taken from the general's tent (*praetorium*). During the civil wars military leaders had personal bodyguards, but in 27 BC Augustus created a permanent corps to guard the emperor and stationed its members around Rome. In AD 23, with Sejanus as commander, they gained political influence; from then on, they usually had an important voice in the appointment of emperors. They were responsible for the accession of Claudius (41), the disorders of 68–69, the lynching of Domitian's murderers (97), and the murder of Elagabalus (222). Constantine I disbanded the Praetorian Guard in 312.

Pragmatic Sanction (1713) Decree by Emperor Charles VI requiring the undivided descent of his Habsburg domains. It stipulated that his heritage go to his eldest son or, in the absence of a son, to his eldest daughter. It became law in 1720 within the Habsburg states, and much of Charles's later reign was directed toward securing acceptance of the sanction from the other European powers. Since his son died soon after birth (1716), his daughter Maria Theresa became his heir. On Charles's death (1740), the sanction was contested by Prussia and Bavaria, which led to the War of the Austrian Succession.

Pragmatic Sanction of Bourges \'bürzh\ (July 7, 1438) Decree issued by King Charles VII of France after the Council of Basel, confirming the supremacy of a council over the pope. The decree also confirmed the Council's assertion of the "liberties" of the Gallican Church, restricting the rights of the pope and in many cases making his jurisdiction subject to the king's. Revoked by Louis XI in 1461, the Pragmatic Sanction was reasserted periodically until the 16th century.

pragmatics In linguistics and philosophy, the study of the use of natural language in communication; more generally, the study of the relations between languages and their users. It is sometimes defined in contrast with linguistic semantics, which can be described as the study of the rule systems that determine the literal meanings of linguistic expressions. Pragmatics is then the study of how both literal and nonliteral aspects of communicated linguistic meaning are determined by principles that refer to the physical or social context (broadly construed) in which language is used. Among these aspects are conversational and conventional "implicatures" (e.g., "John has three sons" conversationally implicates that John has no more than three sons; "He was poor but honest" conventionally implicates an unspecified contrast between poverty and honesty). Other aspects include metaphor and other tropes and speech acts.

pragmatism Philosophical movement first given systematic expression by Charles Sanders Peirce and William James and later taken up and transformed by John Dewey. Pragmatists emphasize the practical function of knowledge as an instrument for adapting to reality and controlling it. Pragmatism agrees with empiricism in its emphasis on the priority of experience over a priori reasoning. Whereas truth had traditionally been explained in terms of correspondence with reality or in terms of coherence (see coherentism), pragmatism holds that truth is to be found in the process of verification. Pragmatists interpret ideas as instruments and plans of action rather than as images of reality; more specifically, they are suggestions and anticipations of possible conduct, hypotheses or forecasts of what will result from a given action, or ways of organizing behaviour. See also W.V.O. Quine; Richard Rorty.

Prague \'präg\ City (pop., 2001 est.: 1,178,576), capital of the Czech Republic. Situated on both sides of the Vltava River, the site was settled as early as the 9th century AD. By the 14th century it was one of Europe's leading cultural and trade centres. It was the focal point of opposition to the Habsburgs in the early 17th century (see Defenestration of Prague). The treaty ending the Austro-Prussian War was signed there in 1866. It became the capital of an independent Czechoslovakia in 1918. Prague was occupied by Germany during World War II and by the U.S.S.R. and other Warsaw Pact military forces in 1968 (see Prague Spring). In 1989 it was the centre of a movement that led to the peaceful overthrow of the communist government. Prague is the country's major economic and cultural centre, famous for its music, literature, and architecture.

Prague, Defenestration of (May 23, 1618) Incident of Bohemian resistance to Habsburg authority. In 1617 Catholic officials in Bohemia closed Protestant chapels in violation of the religious-liberty guarantee of 1609. At an assembly called by the Protestants, the imperial regents were found guilty of violating the guarantee and were thrown from the windows of the council room of Prague Castle. Though the victims were not seriously hurt, the incident sparked the Bohemian revolt against Emperor Ferdinand II and led to the Thirty Years' War.

Prague Spring (1968) Brief period of liberalization in Czechoslovakia under Alexander Dubček. In April 1968 he instituted agricultural and industrial reforms, a revised constitution to guarantee civil rights, autonomy for Slovakia, and democratization of the government and the Communist Party. By June, many Czechs were calling for more rapid

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progress toward real democracy. Although Dubček believed he could control the situation, the Soviet Union and the WARSAW PACT countries, alarmed by the threat of a social-democratic Czechoslovakia, invaded the country in August, deposed Dubček, and gradually restored control by reinstalling hard-line communists as leaders.

Praia \'prī-ə\ City (pop., 2000: 94,757), port, and capital of Cape Verde. It is located on the southern shore of São Tiago (Santiago) Island, in the Atlantic Ocean, about 400 mi (640 km) off the western African bulge. It ships agricultural products, including bananas, coffee, and sugarcane, and it is a submarine cable station.

prairie Level or rolling grassland, especially that found in central North America. Decreasing amounts of rainfall, from 40 in. (100 cm) at the forested eastern edge to less than 12 in. (30 cm) at the desertlike western edge, affect the species composition of the prairie grassland. The vegetation is composed primarily of perennial grasses, with many species of flowering plants of the pea and composite families. The three main types of prairie are the tallgrass prairie; midgrass, or mixed-grass, prairie; and shortgrass prairie, or shortgrass plains. Coastal prairie, Pacific or California prairie, Palouse prairie, and desert plains grassland are covered primarily with combinations of mixed-grass and shortgrass species.

prairie chicken Either of two species of North American GROUSE (genus *Tympanuchus*) noted for lek displays (group courtship displays). The greater prairie chicken is about 18 in. (45 cm) long and may weigh almost 2 lbs (1 kg). Its brown plumage is strongly barred below, and it has a short, rounded, dark tail. It occurs locally from Saskatchewan to coastal Texas and Louisiana; northernmost birds are somewhat migratory. The eastern subspecies, the heath hen, is extinct. The lesser prairie chicken, smaller and paler, inhabits the arid western central Great Plains. The sharp-tailed grouse (*Pedioecetes*) is locally called prairie chicken.

prairie dog Any of five species (genus *Cynomys*) of short-legged, terrestrial SQUIRRELS, named for their barklike call. Once abundant throughout the plains of the western U.S., part of southern Canada, and northern Mexico, they are now found mostly in isolated or protected areas. They are 12–17 in. (30–43 cm) long, including a 1–5-in. (3–12-cm) tail. Their main diet is grass. Colonies consist of well-defined territories defended by a male, several females, and young. The burrows of the black-tailed prairie dog have carefully tended funnel-shaped entry mounds that prevent flooding and serve as lookout posts. The white-tailed prairie dog inhabits higher altitudes, hibernates, and is less colonial.

Prairie school Group of architects, including FRANK LLOYD WRIGHT, who created low-lying "prairie houses" in the U.S. Midwest c. 1900–17. Prairie houses were generally built of brick, wood, and plaster, with stucco walls and bands of casement windows. The Prairie architects emphasized horizontal lines by using low roofs with wide, projecting eaves. They discarded elaborate floor plans and detailing for flowing internal spaces organized around a central fireplace or hearth. The resulting low, spreading structures are characterized by light, crossing volumes and spaces; they reach out to nature, not to other buildings. Other architects working in the style included George Grant Elmslie (1871–1952) and Barry Byrne (1883–1967).

Prajapati \prə-'jä-pə-tē\ Creator figure in the Vedic period of India. In early Vedic literature (see VEDA), the name was applied to various primal figures. Later it signified one deity, the "lord of all creatures," who was said to have produced the universe and all its beings after preparing himself through ascetic practices. Other stories allude to his own creation from the primal waters. His female emanation was Vac, the personification of the sacred word; Usas, the dawn, was identified as his female partner or his daughter. In the post-Vedic age, Prajapati came to be identified with BRAHMA.

Prajnaparamita \'prəg-ˌnyä-'pär-ə-mē-ˌtä\ Body of SUTRAS and their commentaries in MAHAYANA Buddhism. The main texts, written 100 BCE–150 CE, represent *prajna* (wisdom) as the supreme perfection and the primary avenue to NIRVANA. The content of this wisdom is the realization that all phenomena are illusory. The name Prajnaparamita also refers to the personification of the literature or of wisdom, often depicted as a woman with her hands in the teaching gesture or holding a lotus and sacred book. See photograph opposite.

prakriti and purusha \'prə-kri-tē...'pù-rù-shə\ In the SAMKHYA school of Indian philosophy, material nature and the soul. Prakriti is material nature in its germinal state, eternal and beyond perception. When it comes into contact with the soul or self (purusha), it starts a process of evolution that leads through several stages to the creation of the existing material world. In the Samkhya view, only prakriti is active; the self, trapped in materiality, does nothing but observe and experience. The self escapes from prakriti by recognizing its total difference from and noninvolvement in the material world.

Pramoedya Ananta Toer *or* **Pramudya Ananta Tur** \prä-'müd-yä-ä-'nän-tä-'tür\ (b. Feb. 20, 1925, Blora, Java, Indon.) Javanese novelist and short-story writer. While imprisoned by the Dutch (1947–49) for his role in the Indonesian revolt against renewed colonial rule, Pramoedya wrote his first published novel, *The Fugitive* (1950). After Indonesia gained independence in 1949, he began to produce works written in a rich style that incorporates everyday speech and images from classical Javanese culture. Imprisoned (1965–79) for his role in an attempted communist coup, he wrote a series of four novels —*This Earth of Mankind* (1980), *Child of All Nations* (1980), *Footsteps* (1985), and *House of Glass* (1988)—that depict Javanese society under Dutch rule. He is the preeminent prose writer of postindependence Indonesia.

Prandtl \'prän-tᵊl**, Ludwig** (b. Feb. 4, 1875, Freising, Ger.—d. Aug. 15, 1953, Göttingen, W.Ger.) German physicist, considered the father of AERODYNAMICS. He taught at the University of Göttingen (1904–53). His 1904 discovery of the BOUNDARY LAYER at the surface of a body moving in air or water led to an understanding of skin friction DRAG and of the way streamlining (see STREAMLINE) reduces the drag of airplane wings and other moving bodies. His work on wing theory explained the process of airflow over airplane wings.

prasada \prə-'sä-də\ In HINDUISM, consecrated food offered to the deity and then distributed to worshipers, who consume it as a sign of the god's favour. *Prasada* is used both in temple ceremonies, where it may be offered to a god such as KRISHNA and then distributed by the priests, and at household shrines, where it is offered to the god and then handed out to household members. See also PUJA.

pratitya-samutpada \prə-'tēt-yə-ˌsə-mùt-'pä-də\ In BUDDHISM, the chain of causation that leads from rebirth to death. Existence is seen as an interrelated flux of transient events that occur in a series, one producing another, usually described as a chain of 12 links: (1) ignorance, which leads to (2) faulty perceptions of reality, which provide the structure of (3) knowledge, which addresses (4) name and form, or the principle of individual identity and the sensory perception of an object, experienced through (5) the six domains (the five senses and their object, along with the mind), whose presence leads to (6) contact (between objects and the senses), followed by (7) sensation, which, being pleasant, leads to (8) thirst and then (9) grasping (as of sex partners), which leads to (10) the process of becoming, culminating in (11) birth, and at last (12) old age and death.

Pratt, E(dwin) J(ohn) (b. Feb. 4, 1883, Western Bay, Nfd., Can.—d. April 26, 1964, Toronto, Ont.) Canadian poet. He trained for the ministry and later taught for many years at the University of Toronto. The early collection *The Titans* (1926) contains his widely read "The Cachalot," an account of a whale hunt. *Brébeuf and His Brethren* (1940), perhaps his best work, chronicles the martyrdom of Jesuit missionaries. Later collections include *Dunkirk* (1941), *They Are Returning* (1945), *Behind the Log* (1947), and *Towards the Last Spike* (1952).

Prajnaparamita, 13th-century stone sculpture from Singosari, East Java; in the Museum Pusat, Jakarta, Indonesia
COURTESY OF THE RIJKSMUSEUM VOOR VOLKENKUNDE, LEIDEN, NETH.

Pratt, Francis Ashbury (b. Feb. 15, 1827, Woodstock, Vt., U.S.—d. Feb. 10, 1902, Hartford, Conn.) U.S. inventor. With AMOS WHITNEY he founded the Pratt & Whitney Co. in Hartford to manufacture MACHINE TOOLS. He was instrumental in bringing about adoption of a standard system of GAUGES. He also invented a metal-planing machine (1869), a gear cutter (1884), and a milling machine (1885).

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Pratt Institute Private institution of higher learning in Brooklyn, New York, New York, U.S. It was founded as a trade school in 1887 by the industrialist Charles Pratt (1830–91). It comprises schools of architecture, art and design (for which it is especially renowned), liberal arts and sciences, professional studies, and information and library science. It has both bachelor's and master's degree programs.

pratyaya \prət-'yä-yə\ In BUDDHISM, an auxiliary, indirect cause, as distinguished from a direct cause (*hetu*). A seed, for example, is the direct cause of a plant, whereas sunlight, water, and earth are the auxiliary causes. Sometimes *pratyaya* is used to refer to cause in general. The idea of causation is important in the Buddhist concept of the cycle of death and rebirth (see PRATITYA-SAMUTPADA).

pratyeka-buddha \prət-'yā-kə\ In BUDDHISM, one who attains enlightenment through his own efforts rather than by listening to the teachings of a buddha. The way of the self-enlightened buddha was retained only in the THERAVADA tradition. MAHAYANA Buddhism rejects the path of self-enlightenment as too limiting and embraces the ideal of the BODHISATTVA, who postpones final enlightenment to work for the salvation of others.

Pravda \'präv-də\ *Russian* **"Truth"** Former daily newspaper published in Moscow and distributed nationwide, the official organ of the Communist Party of the Soviet Union (1918–91). It was founded in St. Petersburg as an underground paper by VLADIMIR ILICH LENIN and two colleagues in 1912. As a Soviet state newspaper and central source of information and education, it offered well-written articles and analyses on science, economics, cultural topics, and literature as well as materials to indoctrinate and inform readers on communist theory and programs. Topics concerning international relations were largely left to the government paper *IZVESTIYA*. After communist power ended in 1991, most of its readership evaporated; it became the voice of the conservative-nationalist opposition and ceased publication in 1996.

Praxiteles \prak-'si-tə'l-ˌēz\ (fl. c. 370–330 BC, Greece) Greek sculptor. His only known surviving work, the marble *Hermes Carrying the Infant Dionysus*, displays delicate modeling and exquisite surface finish. A few other works survive in Roman copies. His most celebrated work was the *Aphrodite of Cnidus*, which PLINY THE ELDER considered the best statue in the world. Through Praxiteles' influence, figures were increasingly shown standing in graceful, sinuous poses, leaning lightly on some support, a pose further developed by sculptors of the HELLENISTIC AGE. Greatest and most original of the 4th-century Attic sculptors, he profoundly influenced the later course of Greek sculpture.

Prayag Raj See ALLAHABAD

prayer Silent or spoken petition made to God or a god. Prayer has been practiced in all religions throughout history. Its characteristic postures (bowing the head, kneeling, prostration) and position of the hands (raised, outstretched, clasped) signify an attitude of submission and devotion. Prayer may involve confessions of SIN, requests, thanks, praise, offerings of SACRIFICE, or promises of future acts of devotion. In addition to spontaneous private prayer, most religions have fixed formulas of prayer (e.g., the LORD'S PRAYER), often recited in group worship. The four prophetic religions (JUDAISM, CHRISTIANITY, ISLAM, and ZOROASTRIANISM) prescribe a daily set form of individual prayer, such as the Shema, to be recited twice a day by every male Jew, and the Islamic salat, performed five times a day.

Tibetan prayer wheel, gilt silver, 18th–19th century; in the Seattle (Washington) Art Museum.
COURTESY OF THE SEATTLE ART MUSEUM, WASHINGTON, EUGENE FULLER MEMORIAL COLLECTION

prayer wheel In TIBETAN BUDDHISM, a mechanical device used as an equivalent to the recitation of a MANTRA. The prayer wheel consists of a hollow metal cylinder, often beautifully embossed, mounted on a rod and containing a consecrated paper bearing a mantra. Each turn of the wheel by hand is considered equivalent to orally reciting the prayer. Variants to the handheld prayer wheel are large cylinders that can be set in motion by hand or attached to windmills or waterwheels and thus kept in continuous motion.

praying mantis See MANTIS

Pre-Raphaelites \ˌprē-'rä-fē-ə-ˌlīts\ Group of young British painters, led by DANTE GABRIEL ROSSETTI, WILLIAM HOLMAN HUNT, and JOHN EVERETT MILLAIS, who banded together in 1848 in reaction against what they considered the unimaginative and artificial historical painting of the 18th and early 19th centuries, seeking to express a new moral seriousness and sincerity in their works. Their name, the Pre-Raphaelite Brotherhood, honoured the simple depiction of nature in Italian art before RAPHAEL; the symbolism, imagery, and mannered style of their paintings often suggest a faux-medieval world. Later members included EDWARD BURNE-JONES and George Frederic Watts (1817–1904). The group also functioned as a school of writers who often used medieval settings, sometimes with shocking effect, as in WILLIAM MORRIS's *The Defence of Guenevere* (1858), which deals with issues of love and sex. Though active less than 10 years, the group had a profound influence on the arts.

pre-Socratics Earliest Greek philosophers (those who preceded SOCRATES) whose attention to questions about the origin and nature of the physical world has led to their being called cosmologists or naturalists. Among the most significant were the Milesians THALES, ANAXIMANDER, and ANAXIMENES, XENOPHANES OF COLOPHON, PARMENIDES, HERACLEITUS of Ephesus, EMPEDOCLES, ANAXAGORAS, DEMOCRITUS, ZENO OF ELEA, and PYTHAGORAS.

Preakness Stakes One of the three classic U.S. horse races making up the TRIPLE CROWN. It is held annually in mid-May at Baltimore's Pimlico Race Course. The course distance is 1 3/16 mi (1.9 km). The field is limited to 3-year-old Thoroughbreds.

Prebisch \'prā-bish\, **Raúl** (b. April 17, 1901, Tucumán, Arg.—d. April 29, 1986, Las Vertientes, near Santiago, Chile) Argentine economist and statesman. Serving in various positions in Argentine government and academia, he advised developing countries to stimulate domestic manufacturing to reduce their reliance on imports and thus their dependence on the industrialized nations. He also advocated the economic integration of Latin America to achieve economies of scale and LAND REFORM to reduce the income inequalities that impeded the growth of the domestic market. As the influential head of the UN's Economic Commission for Latin America, he addressed inequities in the trade relationships between wealthy and poor nations.

Precambrian time Interval of geologic time from c. 3.8 billion years ago, the age of the oldest known rocks, to 544 million years ago, the beginning of the CAMBRIAN PERIOD. This interval represents more than 80% of the geologic record and thus provides important evidence of how the continents evolved. The Precambrian is divided into the ARCHEAN and PROTEROZOIC eons, with the boundary between them at 2.5 billion years ago. It was originally defined as the era that predated the emergence of life in the Cambrian Period. It is now known, however, that life on Earth had begun by the early Archean. Soft-bodied organisms without skeletons began to appear toward the end of the Precambrian.

precast concrete Concrete cast into structural members under factory conditions and then brought to the building site. A 20th-century development, precasting increases the strength and finish durability of the member and decreases time and construction costs. Concrete cures slowly; the design strength is usually reached 28 days after initial setting. Using precast concrete eliminates the lag between the time on-site concrete is placed and the time it can carry loads. Precast concrete components include slabs, beams, columns, walls, stairways, modular boxes, and even kitchens and bathrooms with precast fixtures. See also PREFABRICATION.

precession Phenomenon associated with the action of a GYROSCOPE or a spinning top and consisting of a comparatively slow rotation of the axis of rotation of a spinning body about a line intersecting the spin axis. It arises as a result of external TORQUE acting on the body. One example of precession is the smooth, slow circling of a spinning top (the uneven wobbling is called nutation). Precession of the earth's axis of rotation is the reason that the positions of celestial bodies appear to drift systematically with the passage of time. See also precession of the EQUINOXES.

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precipitation All liquid and solid water particles that fall from clouds and reach the ground, including drizzle, RAIN, SNOW, ice crystals, and HAIL. The essential difference between a precipitation particle and a cloud particle is size; an average raindrop has a mass equivalent to that of about one million cloud droplets. Precipitation elements (ice crystals or droplets that form around soluble particles such as salt) form directly from the vapour state and get larger through collision and coalescence. Eventually they become large enough to respond to gravity, and they fall to the ground.

Precisionism Smooth, precise technique used primarily in the 1920s by several U.S. painters in representational canvases depicting sharply defined forms, such as urban skylines; the industrial landscape of factories and smokestacks, buildings, and machinery; and country landscapes with grain elevators and barns or empty desert and sky. The scenes are always devoid of people or signs of human activity. Precisionism is a "cool" art, which keeps the viewer at a distance. It had its origins in CUBISM, FUTURISM, and ORPHISM; in turn it influenced POP ART. Though it was not a school or movement with a formal program, the Precisionist artists, including CHARLES DEMUTH and GEORGIA O'KEEFFE, often exhibited together.

predation Form of food getting in which one animal, the predator, eats an animal of another species, the prey, immediately after killing it or, in some cases, while it is still alive. Most predators are generalists; they eat a variety of prey species. Specialist predators, such as ANTEATERS, eat only one or a few prey species. Cannibalism is a type of predation in which an animal eats another of its own species. Seed consumption is also considered predation because the entire living embryo of a plant is destroyed.

predestination In CHRISTIANITY, the doctrine that God has long ago determined who will be saved and who will be damned. Three types of predestination doctrine have developed. One doctrine holds that God singled out the saved because he foresaw their future merits. A second doctrine (often identified with JOHN CALVIN) states that from eternity God has determined the saved and the damned, regardless of their merit or lack thereof. A third doctrine, set forth by THOMAS AQUINAS and MARTIN LUTHER, ascribes salvation to the unmerited GRACE of God but links the lack of grace to SIN. In ISLAM, issues of predestination and free will were argued extensively. The MUTAZILA held that God would be unjust if he predestined all human actions; the ASHARIYA advocated a strict predestination that became the mainstream Islamic view.

predicate calculus Part of modern symbolic logic which systematically exhibits the logical relations between propositions involving quantifiers such as "all" and "some." The predicate calculus usually builds on some form of the PROPOSITIONAL CALCULUS and introduces quantifiers, individual variables, and predicate letters. A sentence of the form "All F's are either G's or H's" is symbolically rendered as $(\forall x)[Fx \supset (Gx \vee Hx)]$, and "Some F's are both G's and H's" is symbolically rendered as $(\exists x)[Fx \wedge (Gx \wedge Hx)]$. Once conditions of truth and falsity for the basic types of propositions have been determined, the propositions formulable within the calculus are grouped into three mutually exclusive classes: (1) those that are true on every possible specification of the meaning of their predicate signs, such as "Everything is F or is not F"; (2) those false on every such specification, such as "Something is F and not F"; and (3) those true on some specifications and false on others, such as "Something is F and is G." These are called, respectively, the valid, inconsistent, and contingent propositions. Certain valid proposition types may be selected as axioms or as the basis for rules of inference. There exist multiple complete axiomatizations of first-order (or lower) predicate calculus ("first-order" meaning that quantifiers bind individual variables but not variables ranging over predicates of individuals). See also LOGIC.

preeclampsia \ˌprē-i-'klamp-sē-ə\ **and eclampsia** Hypertensive conditions unique to PREGNANCY. Preeclampsia is marked by HYPERTENSION, PROTEIN in the urine, and hand and face EDEMA, which develop late in pregnancy or soon after. Persistent hypertension compromises the fetus's blood supply and damages the mother's kidneys. Monitoring of blood pressure and weight gain may detect it before symptoms (headaches, visual disturbances, stomach pain) begin. Eclampsia follows in about 5% of cases, with convulsions that pose a serious threat to mother and child. It can usually be prevented by special diets, drugs, and limited activity or early delivery.

preemption \prē-'emp-shən\ U.S. policy that allowed the first settlers, or squatters, on public land to buy the land they had improved. Since improved land, coveted by speculators, was often priced too high for squatters to buy at auction, temporary preemptive laws allowed them to acquire it without bidding. The Pre-Emption Act (1841) gave squatters the right to buy 160 acres at $1.25 per acre before the land was auctioned. The Homestead Act (1862) made preemption an accepted part of U.S. land policy. See also HOMESTEAD MOVEMENT.

prefabrication Assembly of standardized building components at a location other than the building site. Units may include doors, stairs, window walls, wall panels, floor panels, roof trusses, room-sized components, and even entire buildings. Prefabrication requires the cooperation of architects, suppliers, and builders regarding the size of basic modular units. In the U.S. building industry, the 4-by-8-ft (1.2-by-2.4-m) panel is a standard unit; the architect's drafted building plans and the supplier's prefabricated wall units are based on multiples of that MODULE. Advantages of prefabrication include the cost savings of mass production, the opportunity to use specialized equipment to produce components, and standardization of parts for quick assembly and erection. The major drawback is in assigning responsibility for quality control. See also PRECAST CONCRETE.

prefect In ancient Rome, any of various high officials with primarily judicial and administrative responsibilities. In the early republic, a prefect of the city (*praefectus urbi*) took over the CONSUL's duties during their absence from Rome. The office lost some importance after the introduction of PRAETORS (mid 4th century BC). AUGUSTUS revitalized the office when he appointed five prefects to supervise the city government, the fire brigade, the grain supply, and the PRAETORIAN GUARD. The praetorian prefects acquired great power and often became virtual prime ministers.

pregnancy Process of human gestation that takes place in the female's body as a FETUS develops, from FERTILIZATION to birth (see PARTURITION). It begins when a viable SPERM from the male and EGG from the OVARY merge in the fallopian tube (see FERTILITY; FERTILIZATION). The fertilized egg (zygote) grows by cell division as it moves toward the UTERUS, where it implants in the lining and grows into an EMBRYO and then a fetus. A PLACENTA and umbilical cord develop for nutrient and waste exchange between the circulations of mother and fetus. A protective fluid-filled amniotic sac encloses and cushions the fetus. Early in pregnancy, higher ESTROGEN and PROGESTERONE levels halt MENSTRUATION, cause nausea, often with vomiting (morning sickness), and enlarge the breasts and prepare them for LACTATION. As the fetus grows, so does the uterus, displacing other organs. Normal weight gain in pregnancy is 20–25 lbs (9–11.5 kg). The fetus's nutritional needs require the mother to take in more calories and especially protein, water, calcium, and iron. FOLIC-ACID supplements are recommended during early pregnancy to prevent NEURAL TUBE DEFECTS. Smoking, alcohol, and many legal and illegal drugs can cause CONGENITAL DISORDERS and should be avoided during pregnancy. ULTRASOUND imaging is often used to monitor structural and functional progress of the growing fetus. The due date is estimated as 280 days from the time of last menstruation; 90% of babies are born within two weeks of the estimated date. See also AMNIOCENTESIS; PREECLAMPSIA AND ECLAMPSIA; PREMATURE BIRTH. See illustration on opposite page.

prehistoric religion Religious practices and beliefs of prehistoric peoples, as inferred from archaeological findings. The oldest burials that attest to a belief in life after death date from 50,000–30,000 BC. Corpses were buried with goods such as stone tools and parts of animals, suggesting an attempt to placate the dead or equip them for the next world. The Middle PALEOLITHIC PERIOD provides the first evidence of animal SACRIFICES, which may have been offerings to the dead, to a higher power, or to the fertility of the animal species. Prehistoric human sacrifices have also been found, usually of women and children. From the BRONZE AGE on, weapons and jewelry were often thrown into springs, wells, and other bodies of water as sacrifices (probably of war booty). Animals such as bears were important in prehistoric religion from the Upper Paleolithic Period on, probably seen as guardian spirits and associated with magical powers. Fertility rites were also practiced, as evidenced by small, corpulent female figures, known as Venus statuettes, with highly emphasized breasts and buttocks.

prelude Musical composition, usually brief, generally played as an introduction to another piece. The prelude originated as short pieces that were improvised by an organist to establish the key of a following piece or to fill brief interludes in a church service. Their improvisatory origins were often reflected in rhythmic freedom and virtuosic runs. A section in this style would often lead to a closing fugal section; in time this turned into a separate movement, and preludes came to be paired with FUGUES.

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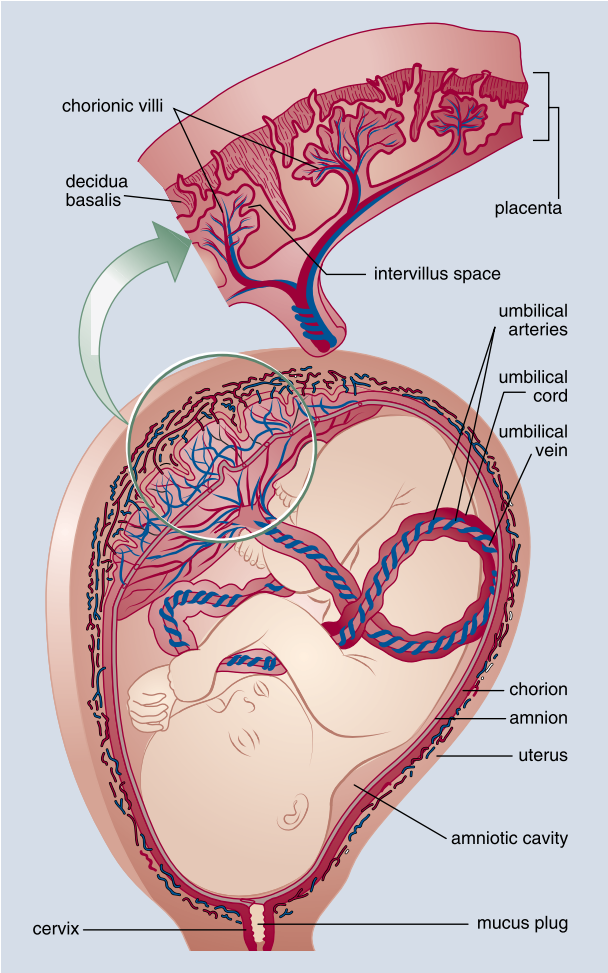

Full-term fetus in the uterus. The amnion, formed from the inner embryonic membrane, encloses the fetus. The space between the amnion and fetus (amniotic cavity) is filled with the watery amniotic fluid. The outermost embryonic membrane, the chorion, has developed fingerlike projections (villi) on its outer surface, which have enlarged and penetrated the decidua basalis layer of the uterus. The chorionic villi and the decidua basalis form the placenta. Maternal blood fills the spaces around the villi (intervillous spaces); oxygen and nutrients diffuse into the villi and pass on to the fetus via the umbilical vein. Waste materials that leave the fetus via the umbilical arteries diffuse out of the villi into the mother's blood.
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In the 17th century, preludes began to be frequently written for lute or harpsichord. In later years the term came to be used for short piano pieces, often in sets, by composers such as Frédéric Chopin, Aleksandr Scriabin, and Claude Debussy.

premature birth Birth less than 37 weeks after conception. Infants born as early as 23–24 weeks may survive but many face lifelong disabilities (e.g., cerebral palsy, blindness, deafness). Premature infants account for 8–9% of live births but two-thirds of infant deaths. 40–50% of cases have no explanation; other cases can be attributed to such causes as maternal hypertension or diabetes, multiple pregnancy, or placental separation. With good care, about 85% of live-born premature infants should survive. Infants born very early (before 32–34 weeks) lack fully developed lungs and often develop respiratory distress syndrome. They also have problems maintaining body temperature and fighting infection. Most deaths result from breathing problems, infections, and brain or lung hemorrhages. Premature infants are characterized by low birth weight, small size, irregular breathing, absence of subcutaneous fat, and thin skin.

premenstrual syndrome (PMS) Variable group of symptoms occurring before menstruation in 40% of women, severe in about 10% of those. Physical symptoms may include headache, cramps, bloating, and constipation or diarrhea. Emotional symptoms range from irritability, lethargy, and mood swings to hostility, confusion, and depression. Theories as to the cause centre on hormones, nutrition, and stress (known to affect severity). Depending on the symptoms, treatment may involve exercise, stress management, nutritional therapy, or drugs. Dietary measures include low sodium and high protein and complex carbohydrate intake and avoidance of xanthines (including caffeine). Increasing calcium intake has been shown to prevent or reduce cramps, which are best treated with ibuprofen.

premier See prime minister

Preminger \'pre-min-jər**, Otto (Ludwig)** (b. Dec. 5, 1906, Vienna, Austria—d. April 23, 1986, New York, N.Y., U.S.) Austrian-born U.S. film director. While studying law in his native Vienna, he worked with Max Reinhardt's theatre and soon became its director. In 1935 he went to the U.S. to direct *Libel* on Broadway. Invited to Hollywood, he made the successful thriller *Laura* (1944), which helped establish film noir. Forming his own production company, he defied Hollywood's Production Code with a series of controversial films and brought about the relaxation of censorship regulations. His landmark films include *The Moon Is Blue* (1953); the all-African American *Carmen Jones* (1954); and *The Man with the Golden Arm* (1955), a tale of drug addiction. His later films include *Anatomy of a Murder* (1959), *Exodus* (1960), *The Cardinal* (1963), and *Hurry Sundown* (1967). He also worked as a character actor, most notably in Billy Wilder's *Stalag 17* (1953).

Prendergast, Maurice (Brazil) (b. Oct. 10, 1859, St. John's, Nfd., Can.—d. Feb. 1, 1924, New York, N.Y., U.S.) Canadian-born U.S. painter. He moved with his family to Boston in 1868. After study in Paris (1891–94), he spent much of his career traveling and painting abroad. He was the first U.S. artist to fully absorb French Impressionism and Post-Impressionism. His lively street scenes feature floating geometric areas of brilliant decorative colour with a mosaiclike effect. He produced his most outstanding works in watercolour. In his later years he lived in New York City and exhibited with The Eight and in the 1913 Armory Show.

Prensa \'pren-sä**, La** *Spanish* **"The Press"** Argentine daily newspaper, widely regarded as the finest Spanish-language newspaper in the world. Founded in Buenos Aires in 1869, it soon broke with the traditional emphasis on propaganda to stress professional, accurate news reporting and independence in editorial opinion. It displayed a concern for human welfare that persisted in the face of government harassment, notably in the 1940s under the regime of Juan Perón. In 1951 it was seized and became a Peronist propaganda organ; after Perón's overthrow, it reappeared as an independent daily in 1956.

Preobrajenska, Olga *orig.* **Olga Yosifovna Preobrazhenskaya** (b. Feb. 2, 1871, St. Petersburg, Russia—d. Dec. 27, 1962, Saint-Mandé, Fr.) Russian ballerina and teacher. She joined the Mariinsky Ballet (see Mariinsky Theatre) in 1889 and earned the title of prima ballerina in 1900. Her lyrical creativity and love of improvisation were praised by audiences and critics. She also taught at the Imperial Theatre School (1901–02 and 1914–21, during which time the school was renamed the Petrograd State Ballet School). As an instructor, she helped to form the next generation of Russian dancers. In 1922 she emigrated from Russia and taught at her own ballet school in Paris (1923–60).

preparatory school School that prepares students for entrance to a higher school. In Europe, where secondary education has been selective, preparatory schools have been those that catered to pupils wishing to enter the academic secondary schools. In North America, where access to secondary education has been less competitive, the term usually refers to private secondary schools that prepare students for college.

Preparedness Movement Pre-World War I campaign to increase U.S. military capabilities and convince the public of the need for U.S. involvement in a future European conflict. Leaders such as Theodore Roosevelt and Gen. Leonard Wood sought to persuade Pres. Woodrow Wilson to strengthen U.S. national defenses, and various organizations sponsored preparedness parades to build public awareness and support. The campaign resulted in passage of the National Defense Act (1916); the U.S. entered World War I the following year.

prerogative court \pri-'rä-gə-tiv\ In English law, a court through which the powers, privileges, and immunities reserved to the sovereign

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were exercised. Such courts were originally formed during the period when the sovereign's power was greater than the Parliament's. The STAR CHAMBER, the High Commission, and the Court of CHANCERY all achieved importance in the 16th century. By the 17th century they were being challenged by the COMMON LAW courts and competing political interests, and they were soon put out of business. See also PRIVY COUNCIL.

Presbyterianism Form of church government based on rule by elders, or presbyters. The presbyters who govern the church are grouped in a hierarchy of courts, the highest of which is the general assembly. They are elected by the members of the congregation for fixed terms, in a system intended to affirm the equality of all Christians. The term Presbyterianism also refers to a denomination, the Presbyterian Church. The modern Presbyterian churches trace their origins to the Calvinist churches of the British Isles; in continental Europe such congregations were known as REFORMED CHURCHES. The Presbyterian Church is strongest in Scotland, where it was founded by JOHN KNOX in 1557, but it is also well established in England, Wales, and the U.S. See also CALVINISM.

preschool education Childhood education during the period from infancy to age five or six. Institutions for preschool education vary widely around the world, as do their names (e.g., infant school, day care, maternal school, nursery school, crèche, kindergarten). The first systematic theory of early childhood pedagogy was propounded by FRIEDRICH FROEBEL, the founder of the KINDERGARTEN. Other influential theorists include MARIA MONTESSORI and JEAN PIAGET. Of major concern in preschool education is language development; teachers often conduct listening and language games. See also ELEMENTARY EDUCATION.

Prescott, Edward C. (b. Dec. 26, 1940, Glens Falls, N.Y., U.S.) U.S. economist. Prescott studied at Swarthmore College (B.A., 1962), Case Western Reserve University (M.S., 1963), and Carnegie Mellon University (Ph.D., 1967), where he later taught and advised FINN E. KYDLAND on his doctorate. Working with Kydland, he demonstrated how a declared commitment to a low inflation rate by policy makers might create expectations of low inflation and unemployment rates. The two men also established the microeconomic foundation for business cycle analyses, demonstrating that technology changes or supply shocks, such as oil price hikes, could be reflected in investment and relative price movements and thereby create short-term fluctuations around the long-term economic growth path. In 2004 Prescott shared the Nobel Prize for Economics with Kydland.

Prescott, William H(ickling) (b. May 4, 1796, Salem, Mass., U.S.—d. Jan. 28, 1859, Boston, Mass.) U.S. historian. Born to a prosperous family, Prescott graduated from Harvard University in 1814 but was prevented by poor health and eyesight from a career in law or business. His friends, including WASHINGTON IRVING, led him to his life's work: recounting the history of 16th-century Spain and its colonies. He is best known for his *History of the Conquest of Mexico* (1843) and *History of the Conquest of Peru* (1847), for which he made rigorous use of original sources, and which earned him a reputation as the first scientific U.S. historian.

prescription In property law, the effect of the lapse of time in creating and destroying rights. Acquisitive prescription allows an individual, after unequivocal possession for a specific period, to acquire an interest in REAL PROPERTY, such as an easement, but not the property itself. See also ADVERSE POSSESSION.

prescriptivism In metaethics, the view that moral judgments are prescriptions and therefore have the logical form of imperatives. Prescriptivism was first advocated by Richard M. Hare (born 1919) in *The Language of Morals* (1952). Hare argued that it is impossible to derive any prescription from a set of descriptive sentences, but tried nevertheless to provide a foothold for moral reasoning in the constraint that moral judgments must be "universalizable": that is, that if one judges a particular action to be wrong, one must also judge any relevantly similar action to be wrong. Universalizability is not a substantive moral principle but a logical feature of the moral terms: anyone who uses such terms as "right" and "ought" is logically committed to universalizability.

preservation, food See FOOD PRESERVATION

preservative Any of numerous chemical additives used to prevent or slow food spoilage caused by chemical changes (e.g., oxidation, mold growth) and maintain a fresh appearance and consistency. Antimycotics (e.g., sodium and calcium propionate, sorbic acid) inhibit mold growth; ANTIOXIDANTS (e.g., butylated hydroxytoluene or BHT) delay rancidity in foods containing fats and oils; ANTIBIOTICS (e.g., tetracyclines) prevent bacterial growth; humectants retain moisture in products like shredded coconut; and antistaling agents (e.g., glyceryl monostearate) maintain moisture and softness in baked goods. Some preservatives also improve the appearance of the product (e.g., sodium nitrate and NITRITE in meats).

president In government, the officer who serves as head of state and sometimes also as chief executive. In countries where the president is chief of state but not of government, the role is largely ceremonial, with few or no political powers. Presidents may be elected directly or indirectly, for a limited or unlimited number of terms. In the U.S., the president's chief duty is to ensure that the laws are faithfully executed, which he does through various executive agencies and with the aid of his CABINET. He also serves as commander in chief of the armed forces, nominates judges to the SUPREME COURT, and makes treaties with foreign governments (contingent on Senate approval). The office of president is used in governments in South and Central America, Africa, and elsewhere. In western Europe executive power is generally vested in a PRIME MINISTER and his cabinet, and the president, where the office exists, has few responsibilities (though France is a significant exception).

Presley, Elvis (Aaron) (b. Jan. 8, 1935, Tupelo, Miss., U.S.—d. Aug. 16, 1977, Memphis, Tenn.) U.S. popular singer, the "King of Rock and Roll." Presley was raised in Memphis, where he sang Pentecostal church music and listened to black bluesmen and Grand Ole Opry broadcasts. In 1954 he began to record for the producer Sam Phillips, who had been searching for a white singer who sounded like a black man. In 1956, under his new manager, "Colonel" Tom Parker, he released "Heartbreak Hotel," the first of numerous million-selling hits that included "Hound Dog" and "All Shook Up." In the same year, he appeared in *Love Me Tender*, the first of 33 mediocre films, and on several TV shows, notably the *Ed Sullivan Show*. Presley's intensely charismatic style—including his sexy hip shaking, ducktail haircut, and characteristic sneer—excited young fans, especially females, to wild adulation. After a stint in the army (1958–60) he resumed recording and acting, but his earlier raucous style was moderated. In 1968 he introduced a Las Vegas-based touring act with orchestra and gospel-type choir. Battling public pressures, weight gain, and drug dependence, he underwent a personal decline. His death at age 42, attributed to natural causes, was mourned by hundreds of thousands of fans at Graceland, his Memphis estate, which remains a place of international pilgrimage.

Prespa, Lake Lake on the boundary between Macedonia, Albania, and Greece. It is 14 mi (23 km) long, 8 mi (13 km) wide, 2,800 ft (853 m) above sea level, and it drains northwest into Lake Ohrid through a subterranean channel. South of it is Little Prespa Lake, which contains the island of St. Achilius; the island was an early capital of Bulgarian Tsar SAMUEL in the 10th century. It became a tourist and fishing centre in the 1970s.

Pressburg See BRATISLAVA

Pressburg, Treaty of (Dec. 26, 1805) Agreement signed by Austria and France at Pressburg (now Bratislava, Slvk.) after NAPOLEON's victories at the Battles of ULM and AUSTERLITZ. Austria gave up Venetia to Napoleon's kingdom of Italy and the Tirol and Vorarlberg to Bavaria. Austria agreed to admit the electors of Bavaria and Württemberg, allied with Napoleon, to the rank of kings, which further reduced Austrian influence in Germany. Austria's influence was also excluded from Italy. The treaty enabled Napoleon to create a ring of French client states beyond France.

pressure Perpendicular force per unit area, or STRESS at a point within a confined fluid. A solid object exerts pressure on a floor equal to its WEIGHT divided by the area of contact. The weight of the Earth's atmosphere on the surface constitutes ATMOSPHERIC PRESSURE, which varies from place to place but always decreases with altitude. The pressure exerted by a confined gas results from the average effect of the forces produced on the walls of the container by the continual, numerous collisions by gas molecules. Hydrostatic pressure is the stress, or pressure, exerted equally in all directions at points within a confined fluid. Lithostatic pressure is the stress exerted on a body of rock in the Earth's crust by surrounding rock, which increases with depth below the surface. The SI unit of pressure is the pascal (Pa), which is equal to one newton of force per square metre.

pressure gauge Instrument for measuring the condition of a fluid (liquid or gas) that is specified by the FORCE the fluid would apply, when

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at rest, to a unit area, such as pounds per square inch (psi) or PASCALS (Pa). The reading on the gauge, called the gauge pressure, is always the difference between two PRESSURES. When the lower of the pressures is that of the atmosphere, the total (or absolute) pressure is the sum of the gauge and atmospheric pressures.

Prester John Legendary Christian ruler of the East. He was believed to be a NESTORIAN and a king-priest (prester being short for presbyter, "elder" or "priest") reigning in an unspecified part of the Far East. The legend arose during the CRUSADES in the 12th century, among European Christians who hoped that Prester John would prove an ally in the effort to regain the Holy Land from the SARACENS. In the 13th–14th century various missionaries and travelers, including Marco POLO, searched for his kingdom in Asia. After the mid-14th century, Ethiopia was the centre of the quest, as Prester John became identified with the emperor of that African Christian nation.

Prestes \'prās-tās**, Luís Carlos** (b. Jan. 3, 1898, Pôrto Alegre, Rio Grande do Sul, Braz.—d. March 7, 1990, Rio de Janeiro) Brazilian revolutionary. Beginning in 1924, he led a rebel force on a three-year trek through Brazil's interior in an effort to spark a rebellion in the countryside. Although the effort failed, he became a romantic hero. He went on to lead the Brazilian Communist Party, which advocated ending payments on the national debt, nationalization of foreign-owned companies, and LAND REFORM. Imprisoned after a violent uprising in 1935, he was released after World War II and later served briefly as a senator.

Preston City and borough (pop., 2001: 129,642), county seat of LANCASHIRE, England. On the River RIBBLE, Preston grew near the site of a Roman fort and received its first charter in 1179. As a market centre, it became known for its wool and linen weaving and its cotton mills. It was the site of the Lancashire Royalist headquarters during the ENGLISH CIVIL WARS. The Royalists were defeated there by OLIVER CROMWELL in 1648. Despite the decline of the cotton textile industry, the economy has remained strong through diversification, and it produces aircraft and motor vehicles.

prestressed concrete Concrete reinforced by either pretensioning or posttensioning, allowing it to carry a greater load or span a greater distance than ordinary REINFORCED CONCRETE. In pretensioning, lengths of steel wire or cables are laid in the empty mold and stretched. The concrete is placed and allowed to set, and the cables are released, placing the concrete into compression as the steel shrinks back to its original length. In posttensioning, the steel in the concrete is stretched after the curing process. Prestressing places a concrete member in compression; these compressive stresses counteract the tensile bending stresses of an applied load. The process was developed by the French engineer Eugène Fressinet in the early 20th century.

Pretoria \pri-'tōr-ē-ə\ City (pop., 2005 est.: metro. area, 1,282,000), administrative capital of the Republic of South Africa. Founded in 1855, it became the capital of the TRANSVAAL in 1860, the administrative capital of South Africa in 1910, and a city in 1931. In 1899, during the SOUTH AFRICAN WAR (1899–1902), WINSTON CHURCHILL was imprisoned there until his escape. Pretoria is primarily a seat of government, and most people are employed in the service sector. It is also an important rail centre, with an industrial economy based on iron and steel. Its educational institutions include the University of South Africa (1873) and the University of Pretoria (1908). Pretoria became part of the Tshwane Metropolitan Municipality in 2000. See also BLOEMFONTEIN; CAPE TOWN.

Pretorius \prə-'tü-rē-ūs**, Andries (Wilhelmus Jacobus)** (b. Nov. 27, 1798, near Graaff-Reinet, Cape Colony—d. July 23, 1853, Magaliesberg, Transvaal) Boer leader in the GREAT TREK. Pretorius's forces defeated the ZULU at Blood River in 1838 and at Magono in 1840. In 1842 he led an unsuccessful fight with the British over the annexation of Natal. Following British annexation of Transvaal in 1848, his forces again attacked and were again defeated. In 1852 he participated in the Sand River Convention, where Transvaal independence was recognized. He led negotiations for independence of the Orange River Sovereignty, finally guaranteed by the Bloemfontein Convention of 1854. His son Marthinus Wessel Pretorius (1819–1901) was the first president of the South African Republic (1857, 1864, 1869) and president of the Orange Free State (1859–63). After British annexation of the Transvaal, Marthinus joined insurgent Boer leaders and helped win recognition of its independence. He was a member of the ruling triumvirate until the election of PAUL KRUGER as president in 1883.

preventive medicine Efforts toward disease prevention in the community and the individual. It covers patient interviews and testing to detect risk factors; sanitary measures in homes, communities, and medical facilities; patient education; and diet and exercise programs as well as preventive drugs and surgery. It has three levels: primary (e.g., prevention of coronary heart disease in a healthy person), secondary (e.g., prevention of heart attack in a person with heart disease), and tertiary (e.g., prevention of disability and death after a heart attack). The first is by far the most economical. Important advances in preventive medicine include vaccination (see VACCINE), ANTIBIOTICS, DIAGNOSTIC IMAGING, and recognition of psychological factors. See also EPIDEMIOLOGY, IMMUNOLOGY, INDUSTRIAL MEDICINE, QUARANTINE.

Prévert \prā-'ver**, Jacques (-Henri-Marie)** (b. Feb. 4, 1900, Neuilly-sur-Seine, France—d. April 11, 1977, Omonville-la-Petite) French poet and screenwriter. A shop worker, he began writing after his military service. Influenced by the SYMBOLIST MOVEMENT, he renewed the ancient tradition of oral poetry, creating "song poems" about Paris street life, collected in the anthology *Words* (1945). Many were put to music and became extremely popular. His excellent screenplays for MARCEL CARNÉ include *The Children of Paradise* (1945), *Spectacle* (1951), and *Things and Other Things* (1972). He also worked for French television and on animated films for children.

Previn \'pre-vin**, André (George)** *orig.* **Andreas Ludwig Priwin** (b. April 6, 1929, Berlin, Ger.) German-born U.S. pianist, composer, and conductor. He fled Nazi persecution with his family and moved to Los Angeles in 1939. He orchestrated and arranged music for MGM in the 1940s and '50s and thereafter scored films for several studios. Meanwhile he had become a noted classical and jazz pianist and started conducting. He served as principal conductor of the Houston Symphony, London Symphony, Pittsburgh Symphony, Los Angeles Philharmonic, and Royal Philharmonic orchestras. He also composed a symphony, concertos, and the opera *A Streetcar Named Desire* (1998), as well as popular songs. He was knighted in 1996.

Prévost d'Exiles \prā-ˌvō-dāg-'zēl**, Antoine-François, Abbé** *known as* **Abbé Prévost** (b. April 1, 1697, Hesdin, France—d. Nov. 25, 1763, Chantilly) French novelist. From an early age Prévost alternated between enlistments in the army and entries into the religious life, which he eventually fled in 1728. Subsequent years were marked by numerous love affairs and debt. His fame rests entirely on one work—*Manon Lescaut* (1731), a sentimental novel about a young man of good family who ruins his life for a courtesan, which became the basis of two famous operas, Jules Massenet's *Manon* and GIACOMO PUCCINI's *Manon Lescaut*.

PRI See INSTITUTIONAL REVOLUTIONARY PARTY

Priam \'prī-əm\ In GREEK MYTHOLOGY, the last king of TROY. He succeeded his father Laomedon as king and gradually expanded Troy's control over the Hellespont. By his wife, HECUBA, he had many children, including HECTOR and PARIS. He reigned during the TROJAN WAR; in its final year he lost 13 sons, three of whom were killed by ACHILLES in a single day. Hector's death broke his spirit, and he went humbly to Achilles to ask for the corpse. When Troy fell, Achilles' son Neoptolemus killed the elderly Priam on an altar.

Priapus \prī-'ā-pəs\ Greek god of animal and vegetable fertility. He was represented in a caricature of the human form, grotesquely misshapen, with an enormous phallus. The ass was sacrificed in his honor, probably because it symbolized lecherousness and was associated with the god's sexual potency. His father was DIONYSUS and his mother was either a local nymph or APHRODITE. In Hellenistic times the worship of Priapus spread throughout the ancient world, and he was adopted as the god of gardens.

Pribilof \'pri-bə-ˌlȯf\ **Islands** Group of islands, southeastern BERING SEA, Alaska, U.S. It includes St. Paul, St. George, and three islets, and it lies about 300 mi (500 km) west of the mainland. Control of the islands was transferred from Russia to the U.S. with the ALASKA PURCHASE (1867). The islands are hilly and treeless with no harbours. They are breeding grounds from April to November for most of the world's fur seals. Commercial harvesting of seals was discontinued in 1986. The islands are also home to enormous numbers of birds and both blue and white phases of Arctic foxes. The indigenous population is made up of ALEUTS.

price Amount of MONEY that has to be paid to acquire a given good, service, or resource. Operating as a measure of value, prices perform a significant economic function, distributing the scarce supply of goods,

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services, and resources to those who most want them through the adjustments of SUPPLY AND DEMAND. Prices of resources are called wages, interest, and rent. This system, known as the price mechanism, is based on the principle that only by allowing prices to move freely will the supply of any given commodity match demand. If supply is excessive, prices will be low and production will be reduced; this will cause prices to rise until there is a balance of demand and supply. If supply is inadequate, prices will be high, prompting an increase in production that in turn will lead to a reduction in prices until supply and demand are in equilibrium. A totally free price mechanism does not exist in practice; even in free-market economies, MONOPOLIES or government regulation may limit the efficiency of price as a determinant of supply and demand. In centrally planned economies, the price mechanism may be supplanted by centralized government control. Attempts to operate an economy without a price mechanism usually result in surpluses of unwanted goods, shortages of desired products, BLACK MARKETS, and stunted economic growth.

Price, (Mary Violet) Leontyne (b. Feb. 10, 1927, Laurel, Miss., U.S.) U.S. soprano. She was trained at the Juilliard School. After her debut in a revival of *Four Saints in Three Acts* in 1952, she made her name in the international tour of *Porgy and Bess* (1953–55). She sang in *Aïda* at Milan's La Scala in 1960 and made her Metropolitan Opera debut in 1961. Price was one of the Met's most popular stars for more than two decades and was the first African American singer to achieve an international reputation in opera. She gave her farewell performance of *Aïda* at the Met in 1985 but continued to give recitals.

Price, Vincent (Leonard) (b. May 27, 1911, St. Louis, Mo., U.S.—d. Oct. 25, 1993, Los Angeles, Calif.) U.S. actor. He first appeared onstage in a London production of the play *Chicago* and then played the leading role as Prince Albert in *Victoria Regina* (1935), which he reprised on Broadway. In 1938 he went to Hollywood, where he became known for his cultivated manner and silken voice. He played historical roles in *The Private Lives of Elizabeth and Essex* (1939), *Hudson's Bay* (1941), and *The Three Musketeers* (1948). He was the menacing villain in horror movies such as *House of Wax* (1953) and *The Abominable Dr. Phibes* (1971) as well as a series of ROGER CORMAN movies adapted from EDGAR ALLAN POE stories, including *The Masque of the Red Death* (1964). He accepted occasional film and television roles throughout his later years; his performances in *The Whales of August* (1987) and *Edward Scissorhands* (1990) were particularly memorable.

price discrimination Practice of selling goods or services at different prices to different buyers, even though sales costs are the same for all the transactions. Buyers may be discriminated against on the basis of income, ethnicity, age, or geographic location. For price discrimination to succeed, other entrepreneurs must be unable to purchase goods at the lower price and resell them at a higher one.

price index Measure of change in a set of PRICES, consisting of a series of numbers arranged so that a comparison of the values for any two periods or places will show the change in prices between periods or the difference in prices between places. Price indexes were first developed to measure changes in the cost of living in order to determine the wage increases necessary to maintain a constant STANDARD OF LIVING. There are two basic types. Laspeyres-type indexes define a market basket of goods in a base period, then use the prices for those goods to examine change over space and time. In its simplest form, this is simply the ratio of what those goods cost today to what they cost in the base period. The two most familiar indexes of this type are the CONSUMER PRICE INDEX (CPI) and the producer price index (PPI). The CPI measures changes in retail prices in such component parts as food, clothing, and shelter. The PPI (formerly called the wholesale price index) measures changes in the prices charged by manufacturers and wholesalers. Paasche-type indexes define a market basket of goods in the current period, then use the prices of those goods from past periods. The most familiar index of this type is the GDP deflator, used in the U.S. in the NATIONAL INCOME ACCOUNTING to differentiate amounts in constant dollars from those in current dollars.

prickly pear Any of a group of flat-stemmed, spiny OPUNTIA cacti (see CACTUS), native to the Western Hemisphere, or the edible fruit of certain species. Engelmann prickly pear (*Opuntia engelmannii*) and beaver tail cactus (*O. basilaris*) commonly occur in the southwestern U.S. The Indian fig (*O. ficus-indica*) is an important food in tropical and subtropical countries. Because their stems have a high water content, prickly pears can be used as forage crops and emergency stock feed during drought. Some species are cultivated as ornamentals and valued for their large flowers.

Engelmann prickly pear (*Opuntia engelmannii*)
GRANT HEILMAN PHOTOGRAPHY

Pride, Sir Thomas (b. Somerset?, Eng.—d. Oct. 23, 1658, Worcester House, Surrey) English soldier. Joining the Parliamentary army in the ENGLISH CIVIL WARS, he commanded a regiment in the Battle of NASEBY (1645), then served with OLIVER CROMWELL and helped rout the invading Scots at Preston (1648). When the army, dominated by the Independents, occupied London later that year, Pride arrested or expelled about 140 Presbyterian members from the House of Commons ("Pride's Purge"). He was a member of the commission that tried King CHARLES I.

Pridi Phanomyong \'prē-dē-'pä-nōm-ˌyōŋ\ *or* **Luang Pradist Manudharm** \lü-'äŋ-prä-'dist-ˌmä-nù-'därm\ (b. May 11, 1900, Ayutthaya, Siam—d. May 2, 1983, Paris, France) Thai political leader and prime minister. He earned a doctorate in law in France, where he was influenced by socialism and where, with LUANG PHIBUNSONGKHRAM and others, he plotted to overthrow the absolute monarchy in Siam (Thailand). Pridi participated in the PROMOTERS REVOLUTION and helped write the constitution of December 1932. He engineered the downfall of Phibunsongkhram's pro-Japanese government (1944) and in 1946 became Thailand's first popularly elected prime minister. Unjustly held responsible for the assassination of King Ananda that year, he was forced to resign and flee the country in 1947. He lived in China until 1970, when he moved to France.

Priene \prī-'ē-nē\ Ancient city of IONIA, north of the MENDERES (Maeander) River, southwestern Anatolia. According to STRABO, it was founded by Ionians and Thebans. It was sacked in the 7th century BC but regained its position in the 6th century BC. It prospered under the Romans and Byzantines but gradually declined. After passing into Turkish hands in the 13th century AD, it was abandoned. Archaeological excavations revealed a Greek town built on terraces; atop a nearby hill is a temple of Athena Polias that was dedicated by ALEXANDER THE GREAT in 334 BC.

priesthood Office of a spiritual leader expert in the ceremonies of worship and the performance of religious rituals. Though chieftains, kings, and heads of households have sometimes performed priestly functions, in most civilizations the priesthood is a specialized office. The priest's duties are concerned less with magic than with the right performance of ritual acts required by the divine powers. Many African societies, for example, differentiated between SHAMANS and the priests responsible for the worship of tribal ancestors. SACRIFICE is often one of the most important duties of the priesthood. Not every highly developed religion possesses a priesthood, the most notable exception being ISLAM. The idea of the "priesthood of all believers" was also a cardinal doctrine of the REFORMATION, and the Protestant belief that priests are not needed as intermediaries between church members and the HOLY SPIRIT is seen most clearly in sects such as the Society of FRIENDS.

Priestley, Joseph (b. March 13, 1733, Birstall Fieldhead, near Leeds, Yorkshire, Eng.—d. Feb. 6, 1804, Northumberland, Pa., U.S.) English theologian, political theorist, and physical scientist. He worked as a teacher and lecturer in various subjects before joining the ministry in 1767. His early scientific studies resulted in his *History and Present State of Electricity* (1767), which became a fundamental text in the field. His *Essay on Government* (1768) influenced later UTILITARIANISM. He did important work in the field of chemical reactions and change. He is considered the discoverer of nitrogen, carbon monoxide, ammonia, and several other gases, and in 1774 he became the first to identify oxygen; his report led ANTOINE LAVOISIER to repeat the experiment, deduce oxygen's nature and role, and name it. His theological works include *History of the Corruptions of the Christian Church* (1782), burned as sacrilegious in 1785, and *A General History of the Christian Church*, 6 vol. (1790–1802). His nonconformist religious views and his political activities, particularly in sup-

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port of the French Revolution, made him increasingly controversial in England, and he immigrated to the U.S. in 1794.

primary education See ELEMENTARY EDUCATION

primary election Electoral device for choosing a party's candidates for public office. The formal primary system is peculiar to the U.S., where it came into widespread use in the early 20th century. Most U.S. states use it for elections to statewide offices and to the national presidency; in presidential elections, delegates are selected to attend a national convention, where they vote for the candidate to whom they are pledged. A closed-vote primary is restricted to party members; an open-vote primary is open to all voters in the district. Names can be placed on a ballot by an eligible citizen's declaration of candidacy, by nomination at a pre-primary convention, or by a petition signed by a required number of voters. In the late 20th and early 21st centuries political parties in some countries (e.g., the United Kingdom and Israel) adopted similar procedures for the election of the national party leader. See also ELECTORAL SYSTEM; PARTY SYSTEM.

primate Any of more than 300 species of the order Primates, including monkeys, apes, humans, and others. Primates are distinguished from other MAMMALS by one or more of the following traits: unspecialized structure, specialized behaviour, a short muzzle, comparatively poor sense of smell, prehensile five-digit hands and feet possessing flat nails instead of claws, acute vision with depth perception due to forward-facing eyes, a large brain, and prolonged pre- and postnatal development. Most species bear a single young and live in troops headed by a male. The primates are one of the most diverse orders of mammals on Earth. They include the LEMURS (more than 70 species in six families), the LORISES (three or more species in one subfamily), the TARSIERS (six or more species in one family), the NEW WORLD MONKEYS (almost 100 species in five families), the OLD WORLD MONKEYS (more than 100 species in one family), and the APES and humans (about 20 species in two families). The oldest known fossil remains of primates are about 60 million years old.

Primaticcio \ˌprē-mə-'tēt-chō**, Francesco** (b. April 30, 1504, Bologna, Emilia—d. 1570, Paris, France) Italian-born French painter, sculptor, and architect. In 1532 FRANCIS I invited him to help redecorate the FONTAINEBLEAU Palace, and Primaticcio became one of the principal artists in France; he remained there the rest of his life, making only brief trips to Italy. His decorative style in painting and stucco sculpture stressed the human figure; the exaggerated musculature and active, elongated forms of his figures greatly influenced 16th-century French art. One of the first artists in France to replace religious themes with those of Classical mythology, he brought a quiet French elegance to Italian MANNERISM.

prime minister *or* **premier** \pri-'mir, pri-'myir\ Head of the executive branch of government in states with a parliamentary system (see PARLIAMENTARY DEMOCRACY). The prime minister is the leader of the POLITICAL PARTY or coalition with a governing majority, and is formally appointed by the head of state. The office was developed in Britain by ROBERT WALPOLE; its powers were consolidated by WILLIAM PITT the Younger. The British prime ministry has served as a model for the heads of government in many Commonwealth countries, Europe, and Japan. The prime minister has appointive powers and is responsible for the government's legislative program, budget, and other policies. His term of office lasts until the next scheduled election or until he loses legislative support. In France, which has both a PRESIDENT and a prime minister, the president wields greater power but the prime minister controls the domestic legislative agenda. See also CHANCELLOR.

prime number Any positive INTEGER greater than 1 and exactly divisible only by 1 and itself. The sequence of prime numbers begins 2, 3, 5, 7, 11, 13, 17, 19, 23, 29… but follows no discernible pattern. The issues of the regularities and irregularities in the distribution of primes are among the most important questions in NUMBER THEORY. Primes have been recognized at least since PYTHAGORAS. It has been known that there are infinitely many of them at least since EUCLID. The prime-number FACTORS of an integer are the prime numbers whose product is that integer (see FUNDAMENTAL THEOREM OF ARITHMETIC).

Primo de Rivera \'prē-mō-thā-ri-'ver-ə**, José Antonio** (b. April 24, 1903, Madrid, Spain—d. Nov. 20, 1936, Alicante) Spanish politician. Son of the dictator Miguel PRIMO DE RIVERA, he began a legal career in 1925. In 1933 he founded the Spanish fascist party, the FALANGE, and was elected to the Cortes (parliament). He expounded his views in his periodicals *F.E.* (1934) and *Arriba* (1935) and made speeches across Spain. After the leftist Popular Front came to power (1936), he was arrested, given a summary trial, and executed at age 33. He was treated as a martyr by FRANCISCO FRANCO's Nationalist movement.

Primo de Rivera, Miguel (b. Jan. 8, 1870, Cádiz, Spain—d. March 16, 1930, Paris, France) Spanish general and dictator of Spain (1923–30). A military officer from 1888, he served as military governor of Cádiz (1915–19), Valencia (1919–22), and Barcelona (1922–23), where he firmly suppressed disorder. Believing the parliamentary system to be corrupt, he took power in a coup in 1923, dissolved the Cortes (parliament), and suspended constitutional guarantees. He successfully ended the Moroccan War (1927), settled labour disputes, and undertook public works, but he failed to implement agrarian reforms. Increasing discontent with his repressive government and lack of support from the army forced him to resign in 1930. José Antonio PRIMO DE RIVERA was his son.

primogeniture \ˌprī-mō-'je-nə-ˌchůr\ Preference in INHERITANCE that is given by law or custom to the eldest son and his issue. The motivation for such a practice has usually been to keep the estate of the deceased, or some part of it, whole and intact, and to acknowledge the importance of age-seniority within the social hierarchy. It is no longer a recognized principle of inheritance in most jurisdictions.

primrose Any flowering plant of the genus *Primula*, one of 28 genera of the family Primulaceae. *Primula* includes more than 500 species, which occur chiefly in the Northern Hemisphere in cool or mountainous regions. The plants are low-growing, usually perennial herbs; a few are biennials. Most species grow 25–50 cm (10–20 inches) tall, but some are as short as 5 cm and others as tall as 120 cm. Many species are cultivated for their attractive, five-petaled flowers, which may be red, pink, purple, blue, white, or yellow. Other plants in the primrose family include CYCLAMENS and pimpernels. The EVENING PRIMROSE (family Onagraceae) is not a true primrose.

Primus \'prī-məs**, Pearl** (b. Nov. 29, 1919, Port of Spain, Trin.—d. Oct. 29, 1994, New Rochelle, N.Y., U.S.) U.S. dancer, choreographer, and anthropologist. Her family moved to New York City when she was two years old. She made her dance debut as the first black member of the New Dance Group in 1943 and formed her own company the next year. Her anthropological research in Africa and the Caribbean led her to choreograph works such as *African Ceremonial* (1944) and *The Wedding* (1961), and she obtained a Ph.D. from Columbia University.

Prince *orig.* **Prince Rogers Nelson** (b. June 7, 1958, Minneapolis, Minn., U.S.) U.S. singer and songwriter. The son of a jazz pianist, he taught himself several instruments and formed his own bands as a teenager. At age 19 he released his first album, on which he played all the instruments. His second album, *Prince* (1979), was followed by many others, including the best-selling *1999* (1982), the soundtrack of the film *Purple Rain* (1983), in which he also starred, and *Diamonds and Pearls* (1991). In 1993 he changed his name to an unpronounceable symbol and became known as "the artist formerly known as Prince," but in 2000 he resumed his previous name. In 2004 he was inducted into the Rock and Roll Hall of Fame.

prince European title of rank, usually denoting a person exercising complete or almost complete sovereignty or a member of a royal family. The wife of a prince is a princess. In Britain, the title was not used until 1301, when EDWARD I invested his son, the future EDWARD II, as prince of Wales. From EDWARD III's time, the king's (or queen's) eldest son and heir has usually been so invested.

Prince, Hal *orig.* **Harold Smith Prince** (b. Jan. 30, 1928, New York, N.Y., U.S.) U.S. theatrical producer and director. He worked for the producer GEORGE ABBOTT before coproducing the successful musical *The Pajama Game* (1954). He went on to produce or coproduce over 30 hit musicals, including *Damn Yankees* (1955), *West Side Story* (1957), *A Funny Thing Happened on the Way to the Forum* (1962), and *Fiddler on the Roof* (1964). Frequently working with STEPHEN SONDHEIM, he won Tony Awards for his direction of the musicals *Cabaret* (1966), *Company* (1970), *Follies* (1971), *Candide* (1974), *Sweeney Todd* (1979), *Evita* (1979), *The Phantom of the Opera* (1986), and *Show Boat* (1995).

Prince Albert National Park Park, central Saskatchewan, Canada. Its main entrance is northwest of the city of Prince Albert. Established in 1927, it has an area of 1,496 sq mi (3,875 sq km) and is mostly woodland and lakes, interlaced with streams and nature trails. It is a sanctuary for birds, moose, elk, caribou, and bears.

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Prince Edward Island Province (pop., 2000 est.: 138,900), Canada. One of the Maritime Provinces and Canada's smallest province, it is an island in the southern Gulf of St. Lawrence, separated from Nova Scotia and New Brunswick by the Northumberland Strait. Its capital is Charlottetown. Discovered by Jacques Cartier in 1534, it was used by Micmac Indians for fishing and hunting. It was colonized by the French in 1720, then ceded to the British in 1763. Known as the "Cradle of Confederation," it was the site of the Charlottetown Conference of 1864, which led to the federation of Canada. It became a province in 1873. It has good natural harbours on its eastern and southern sides. There has been little industrial development, and more than half of the island is used for agriculture. Fishing and tourism are also of economic importance. In 1997 a bridge opened between Prince Edward Island and the mainland.

Prince of Wales Strait Narrow channel between Banks Island and northwestern Victoria Island in the southwestern Arctic Archipelago of the Northwest Territories, Canada. It is about 170 mi (274 km) long and forms part of the Northwest Passage between the Atlantic and Pacific oceans. It was discovered in 1850 by the Irish explorer Robert McClure.

Prince Rupert's Land See Rupert's Land

Prince William Sound Inlet of the Gulf of Alaska, southern Alaska, U.S. It lies east of the Kenai Peninsula and spans 90–100 mi (145–160 km). It was named by the British captain George Vancouver in 1778 to honour a son of George III. In 1989 one of the most disastrous oil spills in history occurred when the tanker *Exxon Valdez* ran aground on Bligh Reef and lost 10.9 million gallons of crude oil into the sound.

princeps *Latin* **"first one," "leader"** Unofficial title used by Roman emperors from Augustus (r. 27 BC–AD 14) to Diocletian (r. 284–305), a period called the principate. The title originated during the Roman republic, when it was held by the leading member of the Senate. Its use by Augustus strengthened his claim to be the restorer of republican institutions and virtues, though he and his successors were in fact autocrats. See also prince.

Princeton, Battles of Trenton and See Battles of Trenton and Princeton

Princeton University Private university in Princeton, New Jersey, U.S., a traditional member of the Ivy League. Founded as the College of New Jersey in 1746, it is the fourth oldest university in the U.S. and one of the most prestigious. Woodrow Wilson served as university president (1902–10). In addition to an undergraduate college and a graduate school, Princeton has a school of engineering and applied science and a school of architecture and urban planning. Its Woodrow Wilson School of Public and International Affairs continues a long Princeton tradition of training government officials. The university has admitted women since 1969.

Princip \'prēnt-sēp**, Gavrilo** (b. July 25, 1894, Obljaj, Bosnia—d. April 28, 1918, Theresienstadt, Austria) Serbian nationalist and assassin of Archduke Francis Ferdinand. A Bosnian Serb, he sought to unite the southern Slavic peoples and destroy Austro-Hungarian rule in the Balkans and was trained in terrorism by the Black Hand society. When the Austro-Hungarian archduke made an official visit to Sarajevo in June 1914, Princip shot him and his wife, Sophie. The assassinations precipitated World War I. Princip was sentenced to 20 years in prison, where he died after the amputation of his arm.

Príncipe See São Tomé and Príncipe

Pringle, Sir John (b. April 10, 1707, Stitchel, Roxburgh, Scot.—d. Jan. 18, 1782, London, Eng.) British physician. As physician general to the British armed forces (1740–48), he applied his knowledge to hospitals and army camps. In *Observations on the Diseases of the Army* (1752), he outlined procedures for hospital ventilation and camp sanitation. He recognized the various forms of dysentery as one, equated hospital and jail fevers, and coined the term *influenza*. His suggestion that military hospitals be respected as sanctuaries by both sides in a conflict led to the establishment of the Red Cross.

printed circuit Electrical device in which the wiring and certain components consist of a thin coat of electrically conductive material applied in a pattern on an insulating substrate. Printed circuits replaced conventional wiring after World War II in much electronic equipment, greatly reducing size and weight while improving reliability and uniformity over the hand-soldered circuits formerly used. They are commonly used to mount integrated circuits on boards for use as plug-in units in computers, televisions, and other electronic devices. Mass-produced printed circuit boards allow automated assembly of electronic components, considerably reducing their cost.

printer, computer Electronic device that accepts text files or images from a computer and transfers them to a medium such as paper or film. It can be connected directly to the computer or indirectly via a network. Printers are classified as impact printers (in which the print medium is physically struck) and non-impact printers. Most impact printers are dot-matrix printers, which have a number of pins on the print head that emerge to form a character. Non-impact printers fall into three main categories: laser printers use a laser beam to attract toner to an area of the paper; ink-jet printers spray a jet of liquid ink; and thermal printers transfer wax-based ink or use heated pins to directly imprint an image on specially treated paper. Important printer characteristics include resolution (in dots per inch), speed (in sheets of paper printed per minute), colour (full-colour or black-and-white), and cache memory (which affects the speed at which a file can be printed).

printing Process for reproducing text and illustrations, traditionally by applying ink to paper under pressure, but today including various other methods. In modern commercial printing, three basic techniques are used. Letterpress printing relies on mechanical pressure to transfer a raised inked image to the surface to be printed. Gravure printing transfers ink from recessed cells of varying depths. In offset printing the printing and non-printing areas of the plate differ not in height but in wettability.

printmaking Art form consisting of the production of images, usually on paper but occasionally on fabric, parchment, plastic, or other support, by various techniques of multiplication, under the direct supervision of or by the hand of the artist. Such fine prints are considered original works of art, even though they can exist in multiple copies. The major techniques are relief printing, where the background is cut away, leaving a raised image; intaglio printing, where the image is incised directly into the plate; surface printing such as lithography, where the image is painted or drawn onto a stone; and stencil printing, where the design is cut out and printed by spraying paint or ink through the stencil. The history of printmaking parallels the history of art and is one of the oldest art forms. Though he had several predecessors, the first important engraver was a 15th-century German, Martin Schongauer. In the 16th century Albrecht Dürer created prints of the highest quality, and in the 17th century the etchings of Rembrandt were especially fine. Japanese printmaking originated in the 17th century with the ukiyo-e school of woodcuts; the best-known artists were Hokusai and Hiroshige. Important 18th-century Western artists who made prints include William Hogarth, Francisco Goya, and Giambattista Piranesi. Among the works of 19th-century printmakers, those of Honoré Daumier and of many of the French Impressionists are notable. Experimentation in new styles and new directions proliferated in the 20th century, with artists from the century's major movements—including Expressionism, Surrealism, Pop art, Minimalism, and Neo-Expressionism—all pursuing printmaking. See also engraving; etching; mezzotint; woodcut.

prion \'prē-ˌän\ Disease-causing agent, discovered by Stanley Prusiner, responsible for various fatal neurodegenerative diseases called transmissible spongiform encephalopathies. An abnormal form of a normally harmless protein found in mammals and birds, the disease-causing prion can enter the brain through infection, or it can arise from a mutation in the gene that encodes the protein. Once present in the brain it causes normal proteins to refold into the abnormal shape. As prion proteins multiply, they accumulate within nerve cells, destroying them and eventually causing brain tissue to become riddled with holes. Diseases caused by prions include Creutzfeldt-Jakob disease, mad cow disease, and scrapie. Prions are unlike all other known disease-causing organisms in that they appear to lack nucleic acid (DNA or RNA).

Pripet \'pri-ˌpet\ **Marshes** Vast marsh region, southern Belarus and northwestern Ukraine. The largest swamp of the European continent, the marshes lie in the thickly forested basin of the Pripet River. They cover an area of about 104,000 sq mi (270,000 sq km). Densely wooded and largely uninhabited, the region has supported a diversified lumber industry. A vast amount of land reclamation took place during the 20th century, including the regulation of water drainage, permitting the development of agricultural areas.

Pripet \'pri-ˌpet\ **River** *Belarusian* **Prypyats' River** *Ukrainian* **Pryp'yat River** River, northwestern Ukraine and southern Belarus. Rising in northwestern Ukraine near the Polish border, it flows east

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through the Pripet Marshes to Mazyr, then joins the Dnieper River in the Kiev Reservoir after a course of 480 mi (775 km). It is navigable for 300 mi (483 km) and is connected by canals with the Bug and Neman rivers.

Priscian \'pri-shən\ *Latin* **Priscianus Caesariensis** (b. c. 500, Caesarea, Mauretania) Latin grammarian. He used the writings of Apollonius Dyscolus on Greek grammar as a guide in producing his own classic works on Latin grammar. His *Institutiones grammaticae* ("Grammatical Foundations"), with citations from Latin authors, became the standard work for teaching grammar in the Middle Ages. His other writings include treatises on weights and measures and on the metres of Terence.

prism Piece of glass or other transparent material cut with precise angles and plane faces. Prisms are useful for analyzing and refracting light (see refraction). A triangular prism can separate white light into its constituent colours by refracting each different wavelength of light by a different amount. The longer wavelengths (those at the red end of the spectrum) are bent the least, the shorter ones (those at the violet end) the most. The result is the spectrum of visible light, or the rainbow. Prisms are used in certain kinds of spectroscopy and in various optical systems.

prison Institution for the confinement of people convicted of crimes. Prisons are administered by state, provincial, or national governments and house inmates for relatively long terms. They thus differ from jails, which usually are under local jurisidiction and house inmates serving short sentences. Until the late 18th century, prisons were used mainly for the confinement of debtors who could not meet their obligations, of accused persons waiting to be tried, and of convicts who were waiting for their sentences of death or banishment to be put into effect. Later, imprisonment itself came to be accepted as a means of punishing convicted criminals. In early U.S. prisons, prisoners were kept in isolation; in the 19th century, they were permitted to work together, but only in silence. At the end of the 19th century, prison reformers successfully advocated segregation of criminals by type of crime, age, and sex; rewards for good behaviour; indeterminate sentencing; vocational training; and parole. In the late 20th century, prison populations in many countries began to explode as arrests for violent offenses and for possession of small amounts of illegal drugs increased.

prisoner's dilemma Imaginary situation employed in game theory. One version is as follows. Two prisoners are accused of a crime. If one confesses and the other does not, the one who confesses will be released immediately and the other will spend 20 years in prison. If neither confesses, each will be held only a few months. If both confess, they will each be jailed 15 years. They cannot communicate with one another. Given that neither prisoner knows whether the other has confessed, it is in the self-interest of each to confess himself. Paradoxically, when each prisoner pursues his self-interest, both end up worse off than they would have been had they acted otherwise. See egoism.

Priština \'prēsh-tē-ˌnä\ City (pop., 2000 est.: 186,611), Kosovo region, Serbia, Serbia and Montenegro. It is the capital of the Kosovo region (administered by the UN from mid-1999). Priština was the capital of the Serbian state before the Turks defeated the Balkan Christian armies in 1389 at the Battle of Kosovo. It is also a cultural centre for Kosovar Albanians, though it lost many of its ethnic Albanian inhabitants in 1999 when they were driven out by the Serbian campaign of "ethnic cleansing" (see Kosovo conflict). Many returned after a peace accord was signed in June 1999, however.

Pritchett, Sir V(ictor) S(awdon) (b. Dec. 16, 1900, Ipswich, Suffolk, Eng.—d. March 20, 1997, London) British novelist, short-story writer, and critic. A full-time journalist from 1922 and a literary critic for the *New Statesman* (1928–65), Pritchett became known for his perceptive essays and reviews and for his penetrating and finely crafted short stories. His collections, which offer lively, ironic portraits of middle-class life, include *You Make Your Own Life* (1938), *Blind Love* (1969), and *A Careless Widow* (1989). He also wrote novels, travel books, and the admired memoirs *A Cab at the Door* (1968) and *Midnight Oil* (1971).

Prithvi Narayan \'prit-vē-'nä-rä-yän\ **Shah** (b. 1723?—d. 1775) Founder of the modern state of Nepal. A member of the ruling Shah family of Gurkha (Gorkha) principality, he conquered the three Malla kingdoms (see Malla era) and consolidated them. After unifying Nepal, he annexed territory in northern India, as well as large portions of the Plateau of Tibet and of the valleys of the Inner Himalayas. He sealed Nepal's border and maintained peaceful but distant relations with the British.

Pritzker Architecture Prize World's most prestigious honour in the field of architecture. Established through the philanthropic efforts of the Pritzkers, a prominent Chicago business family, the prize, first awarded in 1979, bestows an annual award of $100,000 on an architect whose built contributions to the field and to society are judged worthiest. The international jury has included architects, artists, historians, academicians, critics, and business executives.

privacy, right of Right of a person to be free from intrusion into matters of a personal nature. Although not explicitly mentioned in the U.S. Constitution, a right to privacy has been held to be implicit in the Bill of Rights, providing protection from unwarranted government intrusion into areas such as marriage and contraception. A person's right to privacy may be overcome by a compelling state interest. In tort law, privacy is a right not to have one's intimate life and affairs exposed to public view or otherwise invaded. Less broad protections of privacy are afforded public officials and others defined by law as "public figures" (e.g., movie stars).

privateer Privately owned vessel commissioned by a state at war to attack enemy ships, usually merchant vessels. All nations engaged in privateering from the earliest times until the 19th century. Crews were not paid by the government but were entitled to receive portions of the value of any cargo they seized. Limiting privateers to the activities laid down in their commissions was difficult, and the line between privateering and piracy was often blurred. In 1856, by the Declaration of Paris, Britain and other major European countries (except Spain) declared privateering illegal; the U.S. finally repudiated it at the end of the 19th century, and Spain agreed to the ban in 1908. See also buccaneer, Francis Drake, William Kidd, Jean Laffite.

privatization Transfer of government services or assets to the private sector. State-owned assets may be sold to private owners, or statutory restrictions on competition between privately and publicly owned enterprises may be lifted. Services formerly provided by government may be contracted out. The objective is often to increase government efficiency; implementation may affect government revenue either positively or negatively. Privatization is the opposite of nationalization, a policy resorted to by governments that want to keep the revenues from major industries, especially those that might otherwise be controlled by foreign interests.

privet \'pri-vət\ Any of about 40–50 species of shrubs and small trees in the genus *Ligustrum* of the olive family that are widely used for hedges, screens, and ornamental plantings. Native to Europe, Asia, Australia, and the Mediterranean, these evergreen or deciduous plants have usually oval, smooth-edged leaves; creamy-white, often odorous clusters of flowers; and black berries. The hardy common privet (*L. vulgare*), native to northeastern Europe and Britain and naturalized in northeastern North America, is used widely as a hedge plant. Mock privets belong to the genus *Phillyrea* (same family) and bear small, bright-red fruits that turn purple-black as they mature.

privileged communication *or* **confidential communication** In law, communication between parties to a confidential relation such that the communication's recipient is exempted from disclosing it as a witness. Communications between attorney and client are privileged and do not have to be disclosed to the court. The right to privileged communication also exists between husbands and wives, as neither is required to testify against the other in court, and between physicians and patients, though doctors may be required to disclose such information if the right of the defendant to receive a fair trial outweighs the patient's right to confidentiality. Members of the clergy have limited rights to refuse to testify in court, and reporters have been accorded a limited right to privileged communication concerning the sources of their information, though they can be ordered to divulge information in certain circumstances.

Privy \'pri-vē\ **Council** Historically, the British sovereign's private council. Once powerful, the Privy Council has long ceased to be an active body, having lost most of its judicial and political functions since the middle of the 17th century. It grew out of the medieval curia (*curia regis*), which comprised the king's tenants in chief, household officials, and other advisers. The curia performed all the functions of government in either small groups, which became the king's council, or large groups, which grew into the great council and Parliament. It now is chiefly concerned with issuing royal charters, conducting government research, and serving as an appeals body for ecclesiastical and other lesser courts. See also prerogative court.

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Prix de Rome \'prē-də-'rȯm\ *in full* **Grand Prix de Rome** Art scholarship awarded by the French government. First established in 1666 by Louis XIV and Charles Le Brun, it enables young French painters, sculptors, architects, engravers, and musicians to study in Rome. Grand-prize winners in each artistic category study at the Académie de France in Rome for four years. Many of the greatest French artists and musicians of past centuries have been prizewinners, including Jean-Honoré Fragonard, Jacques-Louis David, Hector Berlioz, and Claude Debussy. The prizes are still being awarded, though their prestige has diminished.

prize cases (1863) Legal dispute in which the U.S. Supreme Court upheld Pres. Abraham Lincoln's seizure of ships (prizes). In April 1861, three months before Congress declared a state of war, Lincoln authorized a blockade of Confederate ports. In that three-month period, several merchant ships ran the blockade and were captured by the Union navy. The legality of the seizures was challenged in court; on appeal, the Supreme Court ruled that the president had acted legally to resist insurrection, sanctioning presidential use of emergency powers.

probability theory Branch of mathematics that deals with analysis of random events. Probability is the numerical assessment of likelihood on a scale from 0 (impossibility) to 1 (absolute certainty). Probability is usually expressed as the ratio between the number of ways an event can happen and the total number of things that can happen (e.g., there are 13 ways of picking a diamond from a deck of 52 cards, so the probability of picking a diamond is 13⁄52, or ¼). Probability theory grew out of attempts to understand card games and gambling. As science became more rigorous, analogies between certain biological, physical, and social phenomena and games of chance became more evident (e.g., the sexes of newborn infants follow sequences similar to those of coin tosses). As a result, probability became a fundamental tool of modern genetics and many other disciplines. Probability theory is also the basis of the insurance industry, in the form of actuarial statistics.

probate In law, the process of proving in a court (probate court) that an instrument is the valid last will and testament of a deceased person. The term also refers broadly to the process of administering an estate. Unless it is contested or shown to contain obvious anomalies, a document purporting to be a will requires little authenticating proof for certification (admission to probate). Probate courts also often supervise the administration of estates by executors and oversee the guardianship of minors and others lacking capacity under the law.

probation Conditional suspension of an offender's sentence upon the promise of good behaviour and agreement to accept supervision and abide by specified requirements. It differs from parole in that the offender is not required to serve any of his sentence. Those convicted of serious offenses and those previously convicted of other offenses are usually not considered for probation. Studies in several countries show that 70 to 80% of probationers successfully complete their probation; additional limited evidence suggests that recidivism may be less than 30%.

problem play *or* **thesis play** Type of drama that developed in the 19th century to deal with controversial social issues in a realistic manner, expose social ills, and stimulate thought and discussion. It is exemplified by the works of Henrik Ibsen, who exposed hypocrisy, greed, and hidden corruption of society in a number of masterly plays. His influence encouraged others to use the form. George Bernard Shaw brought it to an intellectual peak with his plays and their long, witty prefaces. More recent examples include works of Sean O'Casey, Athol Fugard, Arthur Miller, and August Wilson.

problem solving Process involved in finding a solution to a problem. Many animals routinely solve problems of locomotion, food finding, and shelter through trial and error. Some higher animals, such as apes and cetaceans, have demonstrated more complex problem-solving abilities, including discrimination of abstract stimuli, rule learning, and application of language or languagelike operations. Humans use not only trial and error but also insight based on an understanding of principles, inductive and deductive reasoning (see deduction; induction; and logic), and divergent or creative thinking (see creativity). Problem-solving abilities and styles may vary considerably by individual.

proboscis monkey \prə-'bä-səs, prə-'bäs-kəs\ Species (*Nasalis larvatus*, family Cercopithecidae) of long-tailed arboreal Old World monkey of swampy mangrove forests on Borneo. Diurnal vegetarians, they live in groups of about 20. They are red-brown with pale underparts; the young monkey has a blue face. The male's nose is long and pendulous, the female's is smaller, and the young's is upturned. Males are 22–28 in. (56–72 cm) long, have a 26–29-in. (66–75-cm) tail, and weigh 26–53 lbs (12–24 kg); females are smaller and much lighter.

procedural law Law that prescribes the procedures and methods for enforcing rights and duties and for obtaining redress (e.g., in a suit). It is distinguished from substantive law (i.e., law that creates, defines, or regulates rights and duties). Procedural law is a set of established forms for conducting a trial and regulating the events that precede and follow it. It prescribes rules relative to jurisdiction, pleading and practice, jury selection, evidence, appeal, execution of judgments, representation of counsel, costs, registration (e.g., of a stock offer), prosecution of crime, and conveyancing (transference of deeds, leases, etc.), among other matters.

process philosophy 20th-century school of philosophy that emphasizes the elements of becoming, change, and novelty in experienced reality and opposes the traditional Western philosophical stress on being, permanence, and uniformity. Reality, including both the natural world and the human sphere, is essentially historical in this view, emerging from (and bearing) a past and advancing into a novel future. Hence, it cannot be grasped by old static spatial concepts that ignore the temporal and novel aspects of the universe given in human experience. The foremost contributors to process philosophy have been Henri Bergson and Alfred North Whitehead.

Proclamation of 1763 Proclamation by Britain at the end of the French and Indian War that prohibited settlement by whites on Indian territory. It established a British-administered reservation from west of the Appalachians and south of Hudson Bay to the Floridas and ordered white settlers to withdraw. It formalized Indian land titles and forbade land patents without a purchase from, or treaty agreement with, the title-holding tribe. After American colonists and pioneers objected, the proclamation was replaced by the Treaties of Fort Stanwix.

proconsul In the ancient Roman republic, a consul whose powers had been extended for a definite period beyond his regular one-year term. These extensions were necessitated by such events as long periods of war. The extension of a chief magistrate's term was originally voted by the people, but the power was soon assumed by the Senate. Provincial governors were usually magistrates whose terms had been extended. Under the empire (after 27 BC), governors of senatorial provinces were called proconsuls.

Procopius \prə-'kō-pē-əs\ (b. probably between 490 and 507, Caesarea, Palestine) Byzantine historian. He advised Belisarius on his first Persian campaign (527–531) and fought the Vandals in Africa until 536. He was in Sicily with Belisarius and fought the Goths in Italy until 540, and he described the plague in Constantinople in 542. His books *Polemon* ("Wars"), *Peri Ktismaton* ("Buildings"), and *Anecdota* ("Secret History") are valuable sources for his period's history.

Procter, William (Cooper) (b. Aug. 25, 1862, Glendale, near Cincinnati, Ohio, U.S.—d. May 2, 1934, Cincinnati) U.S. manufacturer. A grandson of the founder of Procter & Gamble Co., he started working at the company in 1883. He served as president from 1907 to 1930, during which time sales rose from $20 million to over $200 million. Under his leadership the company pioneered in labour relations: he introduced a profit-sharing plan for employees (1887), guaranteed them 48 weeks of work a year (1920), and introduced a disability pension plan, a life-insurance plan, and employee representation on the board of directors.

Procter & Gamble Co. Major U.S. manufacturer of soaps, cleansers, and other household products. It was formed in 1837 when William C. Procter, a British candlemaker, and James Gamble, an Irish soapmaker, merged their businesses in Cincinnati. The company supplied soap and candles to the Union Army in the Civil War and continued to prosper when the war was over. Among its products were Ivory soap (1879), Crisco shortening (1911), Tide, the first synthetic laundry detergent (1946), and Joy, the first liquid synthetic detergent (1949). In 1932 Procter & Gamble also sponsored the first radio soap opera. The company later began to make personal-care items such as toothpaste, shampoo, and deodorant; food products such as cake mixes and coffee; and miscellaneous products such as cellulose pulp and chemicals.

proctoscope \'präk-tə-ˌskōp\ Lighted tube used to inspect the rectum and lower colon. It is 10 in. (25 cm) long, allowing the entire rectal lining to be examined for evidence of disease. It is inserted into the anal

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CANAL and advanced as far as is comfortable for the patient. Modern fibre-optic proctoscopes allow more extensive observation with less discomfort. Proctoscopy is standard in physical examinations of older persons. See also ENDOSCOPY.

Prodi, Romano (b. Aug. 9, 1939, Scandiano, Italy) Italian prime minister (1996–98) and president of the European Commission (1999–2004), one of the governing bodies of the EUROPEAN UNION (EU). Prodi graduated from Catholic University in Milan in 1961 and did postdoctoral work at the London School of Economics. After serving as a professor of economics at the University of Bologna, he entered government as minister of industry in 1978. In 1996, after two productive stints as chairman of the Institute for Industrial Reconstruction (1982–89 and 1993–94), he was narrowly elected prime minister as head of the centre-left Olive Tree coalition. During his 28 months in office, Prodi privatized telecommunications and reformed the government's employment and pension policies. Budget disputes with members of his own party led to his resignation in October 1998. During his five-year term as president of the European Commission, the EU expanded beyond its western European roots to include Malta, Cyprus, and eight eastern and central European members.

producer goods *or* **capital goods** *or* **intermediate goods** Goods manufactured and used in further manufacturing, processing, or resale. Intermediate goods either become part of the final product or lose their distinct identity in the manufacturing stream, while capital goods are the plant, equipment, and inventories used to produce final products. The contribution of intermediate goods to a country's GROSS DOMESTIC PRODUCT may be determined through the value-added method, which calculates the amount of value added to the final CONSUMER GOOD at each stage of production. This series of values is summed to estimate the total value of the final product.

product rule Rule for finding the DERIVATIVE of a product of two FUNCTIONS. If both f and g are differentiable, then $(fg)' = fg' + f'g$.

production function Equation that expresses the relationship between the quantities of productive factors (such as LABOUR and CAPITAL) used and the amount of product obtained. It states the amount of product that can be obtained from every combination of factors, assuming that the most efficient available methods of production are used. The production function can thus measure the MARGINAL PRODUCTIVITY of a particular factor of production and determine the cheapest combination of productive factors that can be used to produce a given output.

production management *or* **operations management** Planning, implementation, and control of industrial production processes to ensure smooth and efficient operation. Production management techniques are used in both manufacturing and SERVICE industries. Production management responsibilities include the traditional "five M's": men and women, machines, methods, materials, and money. Managers are expected to maintain an efficient production process with a workforce that can readily adapt to new equipment and schedules. They may use INDUSTRIAL ENGINEERING methods, such as TIME-AND-MOTION studies, to design efficient work methods. They are responsible for managing both physical (raw) materials and information materials (paperwork or electronic documentation). Of their duties involving money, INVENTORY control is the most important. This involves tracking all component parts, work in process, finished goods, packaging materials, and general supplies. The production cycle requires that sales, financial, engineering, and planning departments exchange information—such as sales forecasts, inventory levels, and budgets—until detailed production orders are dispatched by a production-control division. Managers must also monitor operations to ensure that planned output levels, cost levels, and quality objectives are met. See also PRODUCTIVITY.

productivity In economics, a measure of productive EFFICIENCY calculated as the ratio of what is produced to what is required to produce it. Any of the traditional factors of production—LAND, LABOUR, or CAPITAL—can be used as the denominator of the ratio, though productivity calculations are actually seldom made for land or capital since their capacity is difficult to measure. Labour is in most cases easily quantified—for example, by counting workers engaged on a particular product. In industrialized nations, the effects of increasing productivity are most apparent in the use of labour. Productivity can be seen not only as a measure of efficiency but also as an indicator of ECONOMIC DEVELOPMENT. Productivity increases as a primitive extractive economy develops into a technologically sophisticated one. The pattern of increase typically exhibits long-term stability interrupted by sudden leaps that represent major technological advances. Productivity in Europe and the U.S. made great strides following the development of such technologies as steam power, the railroad, and the gasoline motor. Later in the 20th century, advances in productivity stemmed from a number of innovations, including ASSEMBLY LINES and AUTOMATION, COMPUTER-INTEGRATED MANUFACTURING, DATABASE MANAGEMENT SYSTEMS, JUST-IN-TIME MANUFACTURING, and just-in-time INVENTORY management. Increases in productivity have tended to lead to long-term increases in real wages.

proenzyme See ZYMOGEN

profiler Machine tool for cutting complex, irregular shapes, invented by Frederick W. Howe. A rapidly rotating cutter is guided by a finger that traces around the outline of a pattern. The profiler was an important component of the AMERICAN SYSTEM OF MANUFACTURE that made mass production possible.

profit In business usage, the excess of total revenue over total COST during a specific period of time. In economics, profit is the excess over the returns to CAPITAL, LAND, and LABOUR. Since these resources are measured by their OPPORTUNITY COSTS, economic profit can be negative. There are various sources of profit: an innovator who introduces a new production technique can earn entrepreneurial profits; changes in consumer tastes may bring some firms windfall profits; or a firm may restrict output to prevent prices from falling to the level of costs (monopoly profit).

profit sharing System by which employees are paid a share of the PROFITS of the business enterprise in which they are employed, in keeping with a plan outlined in advance. These payments, which may vary according to salary or wage, are in addition to regular earnings. Profit-sharing plans were probably first developed in France in the early 19th century as worker incentives. Today such plans are used by businesses in Western Europe, the U.S., and parts of Latin America. Profit shares may be distributed on a current or deferred basis or through some combination of the two. Under current distribution, profits are paid out to employees immediately in the form of cash or company stock. In deferred-payment plans, profit shares may be paid into a TRUST FUND from which employees can draw ANNUITIES in later years.

progeria \prō-'jir-ē-ə\ Disorder with characteristics of premature aging. Affected persons have thin skin, go bald or gray early, and develop diseases of aging decades earlier than normal individuals. Not all systems are affected; there is no senility, no aging in the central nervous system. There are two major types. In the extremely rare Hutchinson-Gilford syndrome, children look 60 years old by age 10 and die at an average age of 13. The unrelated Werner syndrome is a recessive hereditary disease that begins in young adulthood and makes patients look 30 years older than they are; their average life span is 47 years.

progesterone \prō-'jes-tə-ˌrōn\ STEROID HORMONE secreted by the female REPRODUCTIVE SYSTEM that functions mainly to regulate the condition of the endometrium (see UTERUS), preparing it to accept a fertilized egg. If the egg is not fertilized, the level of progesterone drops, the uterine lining breaks down, and MENSTRUATION ensues. If the egg is fertilized (see PREGNANCY), the placenta produces progesterone, whose effects include preparing the MAMMARY GLANDS for LACTATION. Many forms of oral CONTRACEPTION use a synthetic progesterone.

program, computer Set of ordered instructions that enable a computer to carry out a specific task. A program is prepared by first formulating the task and then expressing it in an appropriate PROGRAMMING LANGUAGE. Programmers may work in MACHINE LANGUAGE or in ASSEMBLY LANGUAGES. But most applications programmers use one of the high-level languages (such as BASIC or C++) or FOURTH-GENERATION LANGUAGES that more closely resemble human communication. Other programs then translate the instructions into machine language for the computer to use. Programs are stored on permanent media (such as a HARD DISK), and loaded into RAM to be executed by the computer's processor, which executes each instruction in the program, one at a time. Programs are often divided into applications and system programs. Applications perform tasks such as WORD PROCESSING, DATABASE functions, or accessing the INTERNET. System programs control the functioning of the computer itself; an OPERATING SYSTEM is a very large program that controls the operations of the computer, the transfer of files, and the processing of other programs.

programming language Language in which a computer programmer writes instructions for a computer to execute. Some languages, such

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as COBOL, FORTRAN, PASCAL, and C, are known as procedural languages because they use a sequence of commands to specify how the machine is to solve a problem. Others, such as LISP, are functional, in that programming is done by invoking procedures (sections of CODE executed within a program). Languages that support OBJECT-ORIENTED PROGRAMMING take the data to be manipulated as their point of departure. Programming languages can also be classified as high-level or low-level. Low-level languages address the computer in a way that it can understand directly, but they are very far from human language. High-level languages deal in concepts that humans devise and can understand, but they must be translated by means of a COMPILER into language the computer understands.

Progressive Conservative Party of Canada Former Canadian political party. It was formed as the Liberal-Conservative Party in 1854 from a union of conservative and moderate-liberal political factions; except for a period during and after World War I, the party kept this name until 1942, when it adopted the name Progressive Conservative Party of Canada. Its first leader was JOHN MACDONALD. The party led the government from 1854 to 1873 and again from 1878 to 1896. It regained power in coalition with the Quebec nationalists in 1911 but went down to severe defeat in 1921. From then until 1957 the party held power only twice, briefly in 1926 and from 1930 to 1935. The party held power from 1958 to 1963 under JOHN G. DIEFENBAKER, from 1979 to 1980 under Joe Clark, and from 1984 to 1989 under BRIAN MULRONEY. In 1993 it was reduced to only two seats in the Canadian House of Commons. In 2003 the Progressive Conservative Party merged with the Canadian Alliance to form the Conservative Party of Canada. The party favoured reducing government intervention in both the economy and social affairs; strongly federalist, it also was less accommodating than other parties to Quebec separatism.

progressive education Movement that took form in Europe and North America during the late 19th century as a reaction to the alleged narrowness and formalism of traditional education. A main objective was to educate the "whole child"—that is, to attend to physical and emotional as well as intellectual growth. Creative and manual arts gained importance in the curriculum, and children were encouraged toward experimentation and independent thinking. Progressive educational ideas and practices were most powerfully advanced in the U.S. by JOHN DEWEY. See also SUMMERHILL SCHOOL.

Progressive Party U.S. independent political party. The first Progressive Party, known as the BULL MOOSE PARTY, was organized in 1911. The second was assembled in 1924; it nominated as its presidential candidate ROBERT LA FOLLETTE, who received 17% of the national vote on a platform calling for a "housecleaning" of executive departments, public control of natural resources, public ownership of the railways, and tax reduction. The party dissolved upon La Follette's death in 1925. The third Progressive Party, founded in 1947 by HENRY WALLACE, differed from the previous groups in its focus on foreign affairs; it favoured a conciliatory policy toward the Soviet Union. Though Wallace received more than one million votes in the 1948 election, the party was never again influential.

progressive tax Tax levied at a rate that increases as the quantity subject to taxation increases. Designed to collect a greater proportion of tax revenue from wealthy people, progressive taxes reflect the view that those who are able to pay more should carry a heavier share of the tax burden. Progressive INCOME TAXES may provide for exemption from tax liability for incomes under a specified amount, or they may establish progressively greater rates for larger and larger incomes. The presence of deductions can also make a tax progressive. Progressive taxes are a stabilizing force in periods of INFLATION or RECESSION because the amount of tax revenue changes more than proportionately with an increase or decrease in income. For example, in an inflationary economy, as prices and incomes rise, a greater percentage of taxpayers' income goes toward taxes. Government revenues increase, and the government has more leverage over the economy. A side effect of this system is that lower-income taxpayers have an especially difficult time making ends meet when inflation is high. To compensate, many economists advocate INDEXATION; several countries adjust their tax rates annually in times of inflation, usually in line with the CONSUMER PRICE INDEX. See also REGRESSIVE TAX.

Prohibition Legal prevention of the manufacture, sale, or transportation of alcoholic beverages. In the U.S., the Prohibition movement arose out of the religious revivalism of the 1820s. Maine passed the first state Prohibition law in 1846, ushering in a wave of such state legislation. The drive toward national Prohibition was fueled by the Anti-Saloon League, founded in 1893. With Prohibition already adopted in 33 states, the 18th Amendment to the U.S. Constitution went into effect in 1920. Prohibition was embraced with varying degrees of enthusiasm in different parts of the country, and enforced accordingly. In urban areas, BOOTLEGGING gave rise to ORGANIZED CRIME, with such gangsters as AL CAPONE. In part because of the rise in crime, its supporters gradually became disenchanted with it. The 21st Amendment repealed the 18th in 1933, and by 1966 all states had also abandoned Prohibition.

Prohibition Party Oldest minor U.S. political party still in existence. It was founded in 1869 to campaign for legislation to prohibit the manufacture and sale of liquor. The party was strong in rural regions and among small-town voters affiliated with Protestant evangelical churches. It nominated candidates for state and local offices and attained national strength in the 1888 and 1892 presidential elections, when its candidates polled 2.2% of the vote. Since 1900 it has been active mainly on local levels.

projective geometry Branch of mathematics that deals with the relationships between geometric figures and the images (mappings) of them that result from projection. Examples of projections include motion pictures, maps of the Earth's surface, and shadows cast by objects. One stimulus for the subject's development was the need to understand PERSPECTIVE in drawing and painting. Every point of the projected object and the corresponding point of its image must lie on the projection ray, a line that passes through the centre of projection. Modern projective geometry emphasizes the mathematical properties (such as straightness of lines and points of intersection) preserved in projections despite the distortion of lengths, angles, and shapes.

prokaryote \prō-ˈkar-ē-ˌōt\ Any cellular organism that lacks a distinct NUCLEUS. BACTERIA (including blue-green algae, or CYANOBACTERIA) are prokaryotes; all other organisms are EUKARYOTES. Prokaryotic cells lack a nuclear membrane and most of the components of eukaryotic cells. The cytoplasm includes ribosomes that carry out protein synthesis and a double-stranded DNA chromosome, usually circular. Many prokaryotes also contain additional circular DNA molecules called plasmids. The flagella are distinct from those of eukaryotes in design and movement.

Prokofiev \prə-ˈkō-fyif**, Sergey (Sergeyevich)** (b. April 23, 1891, Sontsovka, Ukraine, Russian Empire—d. March 5, 1953, Moscow, Russia, U.S.S.R.) Russian composer and pianist. Son of a pianist, he began writing piano pieces at age five and wrote an opera at nine. He studied at the St. Petersburg Conservatory (1904–14) with NIKOLAY RIMSKY-KORSAKOV and others. Prolific and arrogant, from 1910 he made a living by performing as a virtuoso. He played his own first concerto at his graduation recital. During World War I he wrote his *Scythian Suite* (1915) and *First* ("Classical") *Symphony* (1917). His opera *The Love for Three Oranges* premiered in 1921 in Chicago. Paris was his base from 1922, and during the 1920s he produced three new symphonies and the operas *The Fiery Angel* (1927) and *The Gambler* (1928). In the 1930s he was drawn back to his homeland; there he wrote the score for the ballet *Romeo and Juliet* (1936), the symphonic children's tale *Peter and the Wolf* (1936), and striking national music for SERGEY EISENSTEIN's film *Alexander Nevsky* (1938). World War II inspired the score to Eisenstein's *Ivan the Terrible* (1942–45) and the opera *War and Peace* (1943). The government's denunciation of his work in 1948 was a harsh blow; his health failed, and he died on the same day as JOSEPH STALIN.

prolapse Protrusion of an internal organ out of its normal place, usually of the RECTUM or UTERUS outside the body when supporting muscles weaken. The membrane lining the rectum can push out through the anus, most often in old people with constipation who strain during defecation. Chronic rectal prolapse requires surgical repair. The uterus may prolapse into the vagina after gravity adds to weakness from childbirth injuries. Temporary supports and pelvic exercises can relieve mild uterine prolapse, but severe prolapse may require HYSTERECTOMY.

proletariat \ˌprō-lə-ˈter-ē-ət\ The lowest, or one among the lowest, economic and social classes in a society. In ancient Rome, the proletariat were poor landless freemen who, crowded out of the labour market by the extension of slavery, became parasites on the economy. KARL MARX used the term to refer to the class of wage earners engaged in industrial production only (the broader term *working class* included all those obliged to work for a living). Another of Marx's categories, the *lumpenproletariat* (*lumpen* meaning "rags"), comprised marginal and unemployable workers, paupers, beggars, and criminals. Marxian theory predicted a transitional phase between the abolition of capitalism and the establish-

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ment of communism during which a "dictatorship of the proletariat" would suppress resistance to the socialist revolution by the bourgeoisie, destroy the social relations of production underlying the class system, and create a new, classless society.

proline \'prō-ˌlēn\ One of the nonessential AMINO ACIDS, found in many PROTEINS, especially COLLAGEN. Because the nitrogen atom of its amino group is part of a ring structure (making it a HETEROCYCLIC COMPOUND), its chemical properties differ from those of the other amino acids in proteins. It is used in biochemical, nutritional, and microbiological research and as a dietary supplement.

promenade \ˌprä-mə-'nād, ˌprä-mə-'näd\ Public place where people walk (or, in the past, rode) at leisure for pleasure, exercise, or display. Promenades are pedestrian avenues pleasingly landscaped or commanding a view, often located along waterfronts and in parks. Vehicular traffic may or may not be restricted.

Prometheus \prə-'mē-thē-əs\ In GREEK RELIGION, one of the TITANS and a god of fire. He was a master craftsman and a supreme trickster, and he was sometimes associated with the creation of humans. According to legend, Prometheus stole fire from the gods and gave it to humans. In vengeance, ZEUS created PANDORA, who married Prometheus's brother and set loose all the evils of the world. Another tale held that ZEUS had Prometheus chained to a mountain and sent an eagle to devour his liver, which regenerated every night so that he could suffer the same torment the next day.

promissory note Short-term credit instrument consisting of a written promise by one person to pay a specified amount of money to another on demand or at a given future date. Promissory notes were in use in Europe as early as the Renaissance. They are often negotiable and may be secured by the pledge of collateral. The instrument changed substantially during the 20th century, when various clauses were added regarding payment and other provisions—for example, authorizing the sale of collateral, permitting extensions of time, and allowing acceleration of payment in the event of default. See also BILL OF EXCHANGE.

Promoters Revolution (1932) Bloodless coup that put an end to absolute monarchy in Siam (Thailand) and initiated the Constitutional Era. The coup was headed by the Promoters, a group that included members of the Thai elite, noted intellectuals, and disaffected army officers. Their first constitution, the Temporary Constitution, stripped the king of power and put it in the hands of the Promoters themselves. The Permanent, or December, Constitution restored some of the royal prestige and dignity and introduced some liberal, Western-style reforms. None of Thailand's subsequent constitutions effectively limited political power or provided a means by which political contests could be decided. See also LUANG PHIBUNSONGKHRAM; PRIDI PHANOMYONG.

pronghorn RUMINANT (*Antilocapra americana*) of North American plains and semideserts, the only living member of the family Antilocapridae. The pronghorn stands 30–40 in. (80–100 cm) tall. It is reddish brown with a short, dark-brown mane, white underparts, two white bands on the throat, and a circular white patch on the rump. Both sexes bear erect, two-pronged horns; the longer prong curves backward, the shorter prong forward. Pronghorns live alone or in small bands in summer, and in large herds in winter. The fastest mammal of North America, the pronghorn can run 45 mph (70 kph) and can bound up to 20 ft (6 m). Though tens of millions once roamed the West, they were nearly exterminated by hunters in the early 20th century; conservation efforts have since allowed their populations to increase.

Pronghorn (*Antilocapra americana*). LEONARD LEE RUE III

proof In logic and mathematics, an argument that establishes a proposition's validity. Formally, it is a finite sequence of formulas generated according to accepted rules. Each formula either is an AXIOM or is derived from a previously established THEOREM, and the last formula is the statement that is to be proven. The essence of deductive reasoning (see DEDUCTION), this is the basis of EUCLIDEAN GEOMETRY and all scientific methods inspired by it. An alternative form of proof, called mathematical INDUCTION, applies to propositions defined through processes based on the counting numbers. If the proposition holds for $n = 1$ and can be shown to hold for $n = k + 1$ whenever $n = k$ (a constant) is also true, then it holds for all values of n. An example is the assertion that the sum of the first n counting numbers is $n(n + 1)/2$.

propaganda Manipulation of information to influence public opinion. The term comes from Congregatio de Propaganda Fide (Congregation for the Propagation of the Faith), a missionary organization established by the pope in 1622. Propagandists emphasize the elements of information that support their position and deemphasize or exclude those that do not. Misleading statements and even lies may be used to create the desired effect in the public audience. LOBBYING, advertising, and missionary activity are all forms of propaganda, but the term is most commonly used in the political arena. Prior to the 20th century, pictures and the written media were the principal instruments of propaganda; radio, television, motion pictures, and the Internet later joined their ranks. Authoritarian and totalitarian regimes use propaganda to win and keep the support of the populace. In wartime, propaganda directed by a country at its own civilian population and military forces can boost morale; propaganda aimed at the enemy is an element of PSYCHOLOGICAL WARFARE.

propane Colourless, easily liquefied HYDROCARBON GAS (C_3H_8 or, more fully, $CH_3CH_2CH_3$). Separated in large quantities from natural gas, light crude oil, and oil-refinery gases, it is available as liquefied propane or as a major constituent of liquefied petroleum gas (LPG). It is an important raw material for the manufacture of ETHYLENE and for the PETROCHEMICAL industry. It is also used as a refrigerant, extractant, solvent, AEROSOL propellant, and fuel for portable cooking appliances, torches, and lighters.

propeller Device with a central hub and radiating blades placed so that each forms part of a helical (spiral) surface, used to propel a vehicle such as a SHIP or AIRPLANE. By its rotation in water or air, the propeller produces thrust on the blades, which gives forward motion to the vehicle.

proper motion Apparent motion of a star across the CELESTIAL SPHERE at right angles to the observer's line of sight, generally measured in seconds of arc per year. Any radial motion (toward or away from the observer) is not included. EDMOND HALLEY was the first to detect proper motions; the largest known is that of BARNARD'S STAR, about 10 seconds yearly.

Propertius \prō-'pər-shəs, prō-'pər-shē-əs**, Sextus** (b. 55/43, Assisi, Umbria—d. after 16 BC, Rome) Roman poet. Very few details of his life are known. The first and best known of his four books of elegies (see ELEGY), *Cynthia*, was published in 29 BC, the year he met its heroine (his mistress, whose real name was Hostia). She emerges from his poems as beautiful, uninhibited, jealous, and irresistible. In Book II his main theme is still love, but he also contemplates writing an epic, is preoccupied with thoughts of death, and attacks the materialism of his time. Books III and IV demonstrate a bold command of language and various literary forms; among the subjects are Roman mythology and history.

property In law, something that is owned or possessed. Concepts of property vary widely among cultures. In the West, property is generally regarded as either tangible (e.g., land or goods) or intangible (e.g., STOCKS and BONDS or a PATENT). Individual ownership of property is emphasized in Western societies, whereas in many non-Western societies property ownership is deemphasized or conceived on a more strictly communal basis. The use of property is extensively regulated throughout the West. Landowners injured by adjoining land uses may sue in NUISANCE in Anglo-American countries; similar actions exist in CIVIL-LAW countries. Throughout the West, landowners may agree to allow others to use their land in ways that would otherwise be actionable, and such agreements may be made to bind those to whom the land is conveyed. Anglo-American law tends to divide these grants of use rights into categories that reflect their common-law origins: EASEMENTS (such as rights of way), PROFITS (such as the right to take minerals or timber), real covenants (such as a promise to pay a homeowners' association fee), and equitable SERVITUDES (such as a promise to use the property for residential purposes only). The civil law has fewer categories, the general category "servitudes" tending to cover for them all, and is a bit more restrictive. A common means of acquiring property is by transfer from the previous owner or owners. Such transfers include sales, donations, and INHERITANCE. See also ADVERSE POSSESSION; COMMUNITY PROPERTY; INTELLECTUAL PROPERTY; PRESCRIPTION; REAL AND PERSONAL PROPERTY.

property tax Levy imposed on real estate (land and buildings) and in some jurisdictions on personal property such as automobiles, jewelry, and

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furniture. Some countries also levy property taxes on farm equipment, business equipment, and inventories as well as intangibles such as stocks and bonds. Property taxes are usually levied by local or state governments rather than national governments, and they are a major source of tax revenue. Property taxes existed in the ancient world first as land taxes and later as taxes on farmhouses, livestock, and so on. The administration of a property tax involves identifying the property to be taxed, assessing its value, determining the appropriate tax rate, and collecting the requisite sum of money. Though sometimes burdensome to the poor, property taxes generally tend to redistribute the benefits of wealth from higher to lower income groups, since they often pay for schools and other services used by low-income groups. See also CAPITAL-GAINS TAX; CONSUMPTION TAX; INCOME TAX; PROGRESSIVE TAX; REGRESSIVE TAX.

prophet Person who speaks by divine inspiration, revealing or interpreting the will of a god. Prophets have appeared in many religions throughout history. The most familiar in the West are such OLD TESTAMENT leaders as MOSES, ISAIAH, and DANIEL, along with the Prophet MUHAMMAD. In contrast to the diviner or interpreter of omens (see DIVINATION), who may answer private questions, prophets often address the destiny and moral life of a whole people. Some prophets seek to create a new society that will realize their message and thus found new religions. Others may look only to reform or purify an existing society and religion. The tone of prophecy ranges widely, from ecstasy, inspired utterance, and ethical fervor to passionate social criticism, prediction of the future, and expectation of APOCALYPSE.

Prophet, The *orig.* **Tenskwatawa** (b. c. March 1768, Old Chillicothe, Ohio—d. 1834, Argentine, Kan., U.S.) North American Indian leader. The brother of TECUMSEH, he maintained a strong following among the SHAWNEE on the strength of his 1805 declaration that he had received a message from the "Master of Life" and had contact with the supernatural. Advocating a return to traditional ways of life, he rejected the white man's introduction of alcohol, textile clothing, and individual ownership of property, and he worked with Tecumseh for an Indian confederacy to resist U.S. encroachment on Indian land. In Tecumseh's absence he allowed the Shawnee to be drawn into and defeated at the Battle of TIPPECANOE (1811).

Prophet's Mosque House of worship built on the site of MUHAMMAD's house in MEDINA, considered one of the three holiest places of ISLAM. It was originally a simple brick structure surrounding an enclosed courtyard where people gathered to hear Muhammad. Muhammad later built roofed galleries to shelter his visitors, and in 628 a pulpit was added to raise him above the crowd. In 706 Caliph al-Walīd I pulled down the original building and built a MOSQUE on the site, which contains Muhammad's tomb. The mosque served as the model for later Islamic architecture.

proportion/proportionality In algebra, equality between two RATIOS. In the expression $a/b = c/d$, a and b are in the same proportion as c and d. A proportion is typically set up to solve a word problem in which one of its four quantities is unknown. It is solved by multiplying one numerator by the opposite denominator and equating the product to that of the other numerator and denominator. The term *proportionality* describes any relationship that is always in the same ratio. The number of apples in a crop, for example, is proportional to the number of trees in the orchard, the ratio of proportionality being the average number of apples per tree.

proportional representation ELECTORAL SYSTEM in which the share of seats held by a POLITICAL PARTY in the LEGISLATURE closely matches the share of popular votes it received. It was devised in Europe in the mid-19th century to guarantee minority groups more representation than was possible under the majority or PLURALITY SYSTEMS. Its supporters claim that it creates a more accurate reflection of public opinion; its opponents argue that by allowing more parties in a legislature, it may result in weaker, less stable governments. Two methods for apportioning seats are the single-transferable-vote method, under which voters rank candidates by preference, and the list system, under which voters select a party's list of candidates rather than individuals. Some countries (e.g., Germany and Russia) use a combination of plurality and proportional methods for allocating seats in the lower house of the national legislature. See also LEGISLATIVE APPORTIONMENT.

propositional attitude Psychological state expressed by a verb that may take a subordinate clause beginning with "that" as its complement. Verbs such as "believe," "hope," "fear," "desire," "intend," and "know" all express propositional attitudes. The linguistic contexts created by their use are typically referentially opaque (see INTENTIONALITY) in the sense that the substitution of co-referential expressions within them may change the "truth value" (true or false) of the containing sentence. Thus, to use BERTRAND RUSSELL's example, though it is true that Peter believes that WALTER SCOTT was a Scotsman, it may be false that he believes that the author of *Waverley* (who is Scott) was a Scotsman.

propositional calculus FORMAL SYSTEM of propositions and their logical relationships. As opposed to the PREDICATE CALCULUS, the propositional calculus employs simple, unanalyzed propositions rather than predicates as its atomic units. Simple (atomic) propositions are denoted by lowercase Roman letters (e.g., p, q), and compound (molecular) propositions are formed using the standard symbols $\wedge$ for "and," $\vee$ for "or," $\supset$ for "if . . . then," and $\neg$ for "not." As a formal system, the propositional calculus is concerned with determining which formulas (compound proposition forms) are provable from the axioms. Valid inferences among propositions are reflected by the provable formulas, because (for any formulas A and B) $A \supset B$ is provable if and only if B is a logical consequence of A. The propositional calculus is consistent in that there exists no formula A in it such that both A and $\neg$ A are provable. It is also complete in the sense that the addition of any unprovable formula as a new axiom would introduce a contradiction. Further, there exists an effective procedure for deciding whether a given formula is provable in the system. See also LOGIC, PREDICATE CALCULUS, laws of THOUGHT.

propositional function Sentencelike expression that may be thought of as obtained from a sentence by substituting variables for constants occurring in the sentence. For example, "x was a parent of y" may be thought of as obtained from "Adam was a parent of Abel." A propositional function therefore has no truth-value, becoming true or false only when its free variables are replaced by constants of appropriate syntactic categories (e.g., "Abraham was a parent of Isaac").

proprietary colony Type of settlement in British North America (1660–90). To repay political and financial debts, the British crown, beginning with CHARLES II, awarded supporters vast tracts of land in colonial New York, New Jersey, Pennsylvania, Maryland, and the Carolinas. The proprietors were to supervise and develop the colonies, which became successful enterprises. By 1690 concern about the colonies' growing independence from control by British officials led to the end of proprietary grants.

proprioception \ˌprō-prē-ō-'sep-shən\ Perception of stimuli relating to position, posture, equilibrium, or internal condition. Receptors (nerve endings) in skeletal MUSCLES and on TENDONS provide constant information on limb position and muscle action for coordination of limb movements. Awareness of equilibrium changes usually involves perception of gravity. In humans, gravity, position, and orientation are registered by tiny grains called otoliths moving within two fluid-filled sacs in the INNER EAR in response to any change in position or orientation. Their motion is detected by sense hairs. Rotation is detected by the inertial lag of fluid in the semicircular canals acting on the sense hairs. The central NERVOUS SYSTEM integrates signals from the canals to perceive rotation in three dimensions. See also SENSE.

propylaeum \ˌprä-pə-'lē-əm, ˌprō-pə-'lē-əm\ In ancient Greek architecture, a structure forming an entrance or gateway to a sacred enclosure, usually consisting, at the least, of a porch supported by columns both outside and within the actual gate. The term is often used in the plural (propylaea). The most famous example is the great Propylaea designed by Mnesicles for the Athenian ACROPOLIS. The name propylaea was also applied to various 18th–19th-century Neoclassical and Romantic monumental gateways.

proscenium \prō-'sē-nē-əm\ In a THEATRE, the frame or arch separating the stage from the AUDITORIUM, through which the action of a play is viewed. In ancient Greek theatres, the *proskenion* was an area in front of the SKENE that eventually functioned as the stage. The first permanent proscenium in the modern sense was built in 1618 at the Farnese Theatre in Parma. Though the arch contained a stage curtain, its main purpose was to provide a sense of spectacle and illusion; scene changes were carried out in view of the audience. Not until the 18th century was the curtain commonly used to hide scene changes. The proscenium opening was of particular importance to 19th-century realist playwrights, for whom it served as a picture frame or an invisible wall through which the audience experienced the illusion of spying on the characters.

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prose Literary medium distinguished from POETRY especially by its greater irregularity and variety of rhythm and its closer correspondence to the patterns of everyday speech. Though it is readily distinguishable from poetry in that it does not treat a line as a formal unit, the significant differences between prose and poetry are of tone, pace, and sometimes subject matter.

prose poem Work in prose that has some of the technical or literary qualities of POETRY (such as regular rhythm, definitely patterned structure, or emotional or imaginative heightening) but that is set on a page as PROSE. The form took its name from CHARLES BAUDELAIRE's *Little Poems in Prose* (1869). Other writers of prose poems include, in the 19th century, STÉPHANE MALLARMÉ, ARTHUR RIMBAUD, FRIEDRICH HÖLDERLIN, NOVALIS, and RAINER MARIA RILKE, and in the 20th, AMY LOWELL (in her "polyphonic prose") and such contemporary poets as JOHN ASHBERY.

prosecutor Government attorney who presents the state's case against the defendant in a criminal prosecution. In some countries (France, Japan), public prosecution is carried out by a single office. In the U.S., states and counties have their own prosecutors. Only at the federal level is the system unitary; the U.S. attorney general's office appoints a U.S. attorney for each federal district. In most state and local jurisdictions, prosecutors are elected to office. Whether elected or appointed, prosecutors are often subject to political pressures. A prosecutor takes charge of the investigation once a crime has been committed, presents evidence at a hearing before a grand jury, and questions witnesses during the trial. See also INDEPENDENT COUNSEL.

Proserpina See PERSEPHONE

prosody \'prä-sə-dē, 'prä-zə-dē\ Study of the elements of language, especially METRE, that contribute to rhythmic and acoustic effects in poetry. The basis of "traditional" prosody in English is the classification of verse according to the syllable stress of its lines. Effects such as RHYME scheme, ALLITERATION, and assonance further influence a poem's "sound meaning." Nonmetrical prosodic study is sometimes applied to modern poetry, and visual prosody is used when verse is "shaped" by its typographical arrangement. Prosody also involves examining the subtleties of a poem's rhythm, its "flow," the historical period to which it belongs, the poetic genre, and the poet's individual style.

Prosser, Gabriel See GABRIEL

prostaglandin \ˌpräs-tə-'glan-dən\ Any of a class of organic compounds that occur in many animal tissues and have diverse hormonelike effects in animals (see HORMONE). Their common chemical structure is derived from a FATTY ACID with 20 carbon atoms. They have important effects on BLOOD PRESSURE, blood clotting, pain sensation, and reproduction mechanisms, but one prostaglandin may have different and even opposite effects in different tissues. They hold promise for treating HEART DISEASE and VIRAL DISEASES and may be useful in CONTRACEPTION. Some substances that inhibit prostaglandin synthesis (see ASPIRIN) are useful in controlling pain, asthma attacks, or anaphylactic shock or as ANTICOAGULANTS.

prostate cancer Malignant TUMOUR of the PROSTATE GLAND. Prostate cancer commonly occurs in men over age 50. Symptoms include frequent or painful urination, blood in the urine, sexual dysfunction, swollen lymph nodes in the groin, and pain in the pelvis, hips, back, or ribs. The likelihood of developing prostate cancer doubles if there is a family history. Treatment may include surgery, radiation therapy, hormone therapy, chemotherapy, or a combination of two or more of these approaches.

prostate gland \'präs-ˌtāt\ Chestnut-shaped male reproductive organ, located under the bladder, which adds secretions to the SPERM during ejaculation of SEMEN. It surrounds the urethra (see URINARY SYSTEM) and is rounded at the top, narrowing to a blunt point. The prostate consists of 30–50 GLANDS, supported by CONNECTIVE TISSUE, that discharge fluids into the urethra and two ejaculatory ducts. Those ducts, which also carry sperm and fluid discharged by the seminal vesicles, join the urethra inside the prostate. The prostate contributes 15–30% of the seminal fluid. It reaches its mature size at PUBERTY. Around age 50, it commonly shrinks and decreases its secretions; an increase in size after midlife may be due to INFLAMMATION or malignancy. See also PROSTATIC DISORDER.

prostatic disorder \prä-'sta-tik\ Abnormality or disease of the PROSTATE GLAND. About half of all men over 60 have some nonmalignant enlargement, or benign prostatic hyperplasia (BPH). The gland may eventually compress the urethra, causing problems urinating. Severe cases can lead to infection, bladder stones, obstruction, and kidney failure. Prostate cancer, also found mainly in older men, can be deadly but usually grows so slowly that most patients die of something else before the cancer spreads. Since surgery and radiation therapy often lead to incontinence and impotence, many cases are monitored (through prostate-specific antigen, or PSA, tests) and treated only if necessary. Gonorrhea and other bacterial infections involving the prostate are treated with antibiotics.

prosthesis \präs-'thē-səs\ Artificial substitute for a missing part of the body, usually an arm or leg. Prostheses have evolved from wooden legs and hooks that replaced hands to sophisticated plastic, fibreglass, and metal devices designed to fit limbs amputated at different points. They may have working joints and allow motion either by amplification of electric current generated by muscle contractions or by actual attachment to the muscles. Arm prostheses usually allow some degree of grasping and manipulation. External or implanted breast prostheses are used after mastectomy.

prostitution Practice of engaging in sexual activity, usually with individuals other than a spouse or friend, in exchange for immediate payment in money or other valuables. Prostitutes may be of either sex and may engage in either heterosexual or homosexual activity, but historically most prostitution has been by females with males as clients. Prostitution is a very old and universal phenomenon; also universal is condemnation of the prostitute but relative indifference toward the client. Prostitutes are often set apart in some way. In ancient Rome they were required to wear distinctive dress; under Hebrew law only foreign women could be prostitutes; in prewar Japan they were required to live in special sections of the city. In medieval Europe prostitution was licensed and regulated by law, but by the 16th century an epidemic of venereal disease and post-Reformation morality led to the closure of brothels. International cooperation to end the traffic in women for the purpose of prostitution began in 1899. In 1921 the League of Nations established the Committee on the Traffic in Women and Children, and in 1949 the UN General Assembly adopted a convention for the suppression of prostitution. In the U.S. prostitution was first curtailed by the Mann Act (1910), and by 1915 most states had banned brothels (Nevada being a notable exception). Prostitution is nevertheless tolerated in most U.S. and European cities. In The Netherlands many prostitutes have become members of a professional service union, and in Scandinavia government regulations emphasize hygienic aspects, requiring frequent medical examination and providing free mandatory hospitalization for anyone found to be infected with venereal disease. Prostitutes are very often poor and lack skills to support themselves; in many traditional societies there are few other available money-earning occupations for women without family support. In developing African and Asian countries, prostitution has been largely responsible for the spread of AIDS and the orphaning of hundreds of thousands of children.

Protagoras \prō-'tag-ə-rəs\ (b. 485, Abdera, Greece—d. c. 410 BC) Greek philosopher, first and most famous of the SOPHISTS. He spent most of his life at Athens, where he considerably influenced contemporary thought on moral and political questions. PLATO named one of his dialogues after him. Protagoras claimed to teach men "virtue" in the conduct of their daily lives. He is best known for his dictum, "Man is the measure of all things" (see RELATIVISM; ETHICAL RELATIVISM). Though he adopted conventional moral ideas, his work *Concerning the Gods* advocated AGNOSTICISM regarding religious belief. He was accused of impiety, his books were publicly burned, and he was exiled from Athens c. 415 BC.

protectionism Policy of protecting domestic industries against foreign competition by means of TARIFFS, SUBSIDIES, import QUOTAS, or other handicaps placed on imports. The chief protectionist measures, government-levied tariffs, raise the price of imported articles, making them less attractive to consumers than cheaper domestic products. Import quotas, which limit the quantities of goods that can be imported, are another protectionist device. Wars and economic depressions historically have resulted in increases in protectionism, while peace and prosperity have tended to encourage FREE TRADE. Protectionist policies were common in Europe in the 17th–18th centuries under MERCANTILISM. Britain abandoned many of its protectionist laws in the 19th century, and by World War I tariffs were low throughout the Western world. Economic and political dislocation led to rising customs barriers in Europe in the 1920s, and the GREAT DEPRESSION produced a spate of protectionist measures; world trade shrank drastically as a result. The U.S. had a long history of protectionism, with tariffs reaching high points in the 1820s and the Great Depres-

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sion, but in 1947 it became one of 23 nations to sign the General Agreement on Tariffs and Trade (GATT), which substantially reduced customs tariffs while reducing or eliminating quotas. Despite trade agreements such as GATT and NAFTA, calls for protectionism are still heard in many countries when industries suffer severely from foreign competition. See also trade agreement; World Trade Organization.

protectorate Relationship in which one country exercises some decisive control over another country or region. The degree of control may vary from one in which the protecting state guarantees the safety of the other to one that is a disguised form of annexation. Though the relationship is an ancient one, the use of the term dates only from the 19th century. In modern times most protectorates have been established by treaties requiring the weaker state to surrender management of its international relations, thus losing part of its sovereignty.

protein Any of numerous organic compounds, complex polymers of amino acids that are involved in nearly every aspect of the physiology and biochemistry of living organisms. Twenty different amino acids are common to proteins, linked in chains of hundreds to thousands of units. An active protein molecule has three important levels of structure: primary (the amino acid sequence), determined by the genes; secondary (the geometric shape, often a helix), determined by the angles of the covalent bonds between and within amino acids; and tertiary (the looped and folded overall shape), determined largely by attraction between oppositely charged groups (and repulsion between like charged groups) on amino-acid side chains and especially by hydrogen bonding. The tertiary structure, which can be globular or sheetlike with ridges, crevices, or pockets, often holds the key to a protein's biological activity. Proteins can serve, e.g., as structural material (as in connective tissue and hair; see collagen; keratin), as enzymes and hormones, as transporters of essential substances such as oxygen (see hemoglobin), as antibodies, or as regulators of gene expression. Some proteins are simple (amino acids only), some conjugated (see conjugation) to other groups, often vitamins or metal atoms needed in tiny amounts in the diet (see coenzyme; cofactor). Rhodopsin and hemoglobin are conjugated proteins. Proteins may be covalently linked to other atoms or molecules, as to sugars (glycoproteins), phosphate groups (phosphoproteins), or sulfur (sulfoproteins). Proteins are an essential human nutrient, obtained from both plant and animal foods. Their greatest commercial use is in food products; they are also employed in adhesives, plastics, and fibres.

proteolysis \ˌprō-tē-ˈä-lə-səs\ Process in which a protein is broken down partially, into peptides, or completely, into amino acids, by proteolytic enzymes, present in bacteria and in plants but most abundant in animals. Proteins in food are attacked in the stomach by pepsin and in the small intestine mainly by trypsin and chymotrypsin from the pancreas. Proteolytic enzymes are secreted as zymogens, which are themselves converted by proteolysis to their active forms. Many other zymogens or precursors undergo proteolysis to form active enzymes or proteins (e.g., fibrinogen to fibrin). In cells, proteolytic degradation of old proteins is part of cellular maintenance.

Proterozoic \ˌprä-tə-rə-ˈzō-ik, ˌprō-tə-rə-ˈzō-ik\ **Eon** Younger of the two divisions of Precambrian time, from 2.5 billion to 543 million years ago. Proterozoic rocks have been identified on all the continents and often constitute important sources of metallic ores, notably of iron, gold, copper, uranium, and nickel. The many small protocontinents that had formed during early Precambrian time had coalesced into one or several large landmasses by the beginning of the Proterozoic. Rocks of the Proterozoic contain many traces of primitive life forms, such as the fossil remains of bacteria and blue-green algae (see cyanobacteria).

Protestant ethic Value attached to hard work, thrift, and self-discipline under certain Protestant doctrines, particularly those of Calvinism. Max Weber, in *The Protestant Ethic and the Spirit of Capitalism* (1904–05), held that the Protestant ethic was an important factor in the economic success of Protestant groups in the early stages of European capitalism, in that worldly success came to be interpreted as a sign of the individual's election to eternal salvation. Weber's thesis was variously criticized and expanded throughout the 20th century. See also Protestantism; Richard H. Tawney.

Protestantism One of the three major branches of Christianity, originating in the 16th-century Reformation. The term applies to the beliefs of Christians who do not adhere to Roman Catholicism or Eastern Orthodoxy. A variety of Protestant denominations grew out of the Reformation. The followers of Martin Luther established the evangelical churches of Germany and Scandinavia; John Calvin and more radical reformers such as Huldrych Zwingli founded Reformed churches in Switzerland, and Calvin's disciple John Knox established a church in Scotland (Presbyterianism). Another important branch of Protestantism, represented by the Church of England and Episcopal Church, had its origins in 16th-century England and is now the Protestant denomination closest to Roman Catholicism in theology and worship. The doctrines of the various Protestant denominations vary considerably, but all emphasize the supremacy of the Bible in matters of faith and order, justification by grace through faith and not through works, and the priesthood of all believers. In the early 21st century there were nearly 350 million Protestants in the world. See also Adventist, Baptist, Society of Friends, Mennonite, Methodism.

Proteus \ˈprō-tē-əs\ In Greek mythology, the prophetic old man of the sea and the shepherd of sea animals such as seals. He was subject to Poseidon. He knew all things—past, present, and future—but disliked telling what he knew. Those who wanted information from him had to catch him sleeping and bind him. He would try to escape by changing his form, but if a captor held him fast he gave the wished-for answer and plunged into the sea.

prothrombin \prō-ˈthräm-bin\ Carbohydrate-protein compound in plasma essential to coagulation. In response to bleeding, a complex series of clotting-factor interactions leads to its conversion by thromboplastin to thrombin, which transforms fibrinogen in plasma into fibrin. Fibrin and platelets combine to form a clot. Hemophilia is caused by a hereditary lack of one of the clotting factors. Vitamin K is needed to synthesize prothrombin, so conditions that impair the vitamin's absorption result in prothrombin deficiency and a tendency to prolonged bleeding.

protist \ˈprō-təst\ Any member of a kingdom (Protista) of diverse eukaryotes, including algae, protozoans, and lower fungi (see fungus). Most are single-celled organisms, though the algae tend to be multicellular. Many can move, mainly by using flagella (see flagellum), cilia (see cilium), or footlike extensions (pseudopodia). The kingdom was developed to accommodate intermediate organisms that, even though they possessed some plant or animal characteristics, did not exhibit the specialized features indicative of those groups. Some protists are considered the ancestors of multicellular plants, animals, and fungi. The term was first suggested in 1866 by Ernst Haeckel. With the development of advanced biochemical, genetic, and imaging techniques, previously established relationships have come under scrutiny, and it is now thought that some groups are less closely related to one another than once believed. As a result, the classification of protists, while convenient, is no longer entirely satisfactory.

Proto-Geometric style Visual art style of ancient Greece that signaled the reawakening of technical proficiency and conscious creative spirit after the collapse of the Minoan and Mycenaean civilizations, around the 12th century BC. The vocabulary of the style was limited to circles, arcs, triangles, and wavy lines, all derived from Minoan-Mycenaean representations of aquatic and plant life. On pottery, these design elements were carefully placed in horizontal bands, mainly at a vase's shoulder or belly. Its lower portion was usually either left plain or painted in a solid glossy black pigment inherited from Bronze Age artists.

Proto-Geometric amphora from Athens, early 10th century BC; in the Kerameikos Museum, Athens.
HIRMER FOTOARCHIV, MUNICH

protoceratops \ˌprō-tə-ˈser-ə-ˌtäps\ Any member of a genus of quadrupedal dinosaurs found as fossils in Gobi deposits of the Cretaceous period (144–65 million years ago). The hind limbs were more strongly developed than the forelimbs; the back was arched. Adults were about 7 ft (2 m) long and probably weighed about 400 lbs (180 kg). The skull was about one-fifth the body length. Bones in the skull grew backward into a perforated frill. The jaws were beaklike and toothed. There may have been a hornlike structure on top of the snout. Long spines on the well-developed tail suggest that protoceratops was semiaquatic.

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Protococcus \ˌprō-tə-'kä-kəs\ *or* **Pleurococcus** Genus of green ALGAE. Popularly called MOSS though not actually classified as such, it is found as a thin, green covering on the moist, shaded side of trees, rocks, and soil. The spherical cells, either solitary or clumped together forming short false filaments, have heavy cell walls that protect them against excessive water loss. Each cell contains a large dense CHLOROPLAST. The position of *Protococcus* in classification systems is uncertain.

protocol In computer science, a set of rules or procedures for transmitting data between electronic devices, such as computers. In order for computers to exchange information, there must be a preexisting agreement as to how the information will be structured and how each side will send and receive it. Without a protocol, a transmitting computer, for example, could be sending its data in 8-BIT packets while the receiving computer might expect the data in 16-bit packets. Protocols are established by international or industrywide organizations. Perhaps the most important computer protocol is OSI (Open Systems Interconnection), a set of guidelines for implementing networking communications between computers. The most important sets of Internet protocols are TCP/IP, HTTP, and FTP.

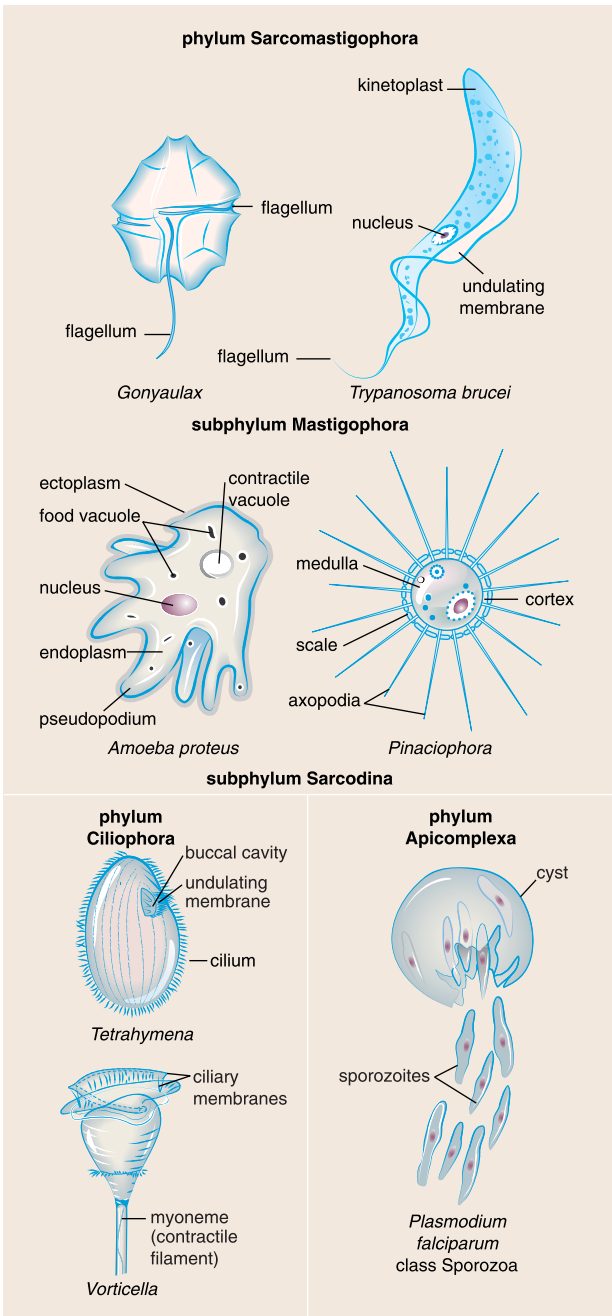
proton Stable SUBATOMIC PARTICLE (one of the BARYONS) with a unit of positive ELECTRIC CHARGE and a mass 1,836 times that of the ELECTRON. Protons are found in the atomic nucleus along with NEUTRONS. For every nucleus of a given ELEMENT, the number of protons is always the same; this number is the element's ATOMIC NUMBER. A single proton is the nucleus of an atom of ordinary hydrogen; as such, it is identical to the hydrogen ion (H^+). Protons have ANTIMATTER counterparts (antiprotons), with the same mass but a negative charge. Protons are used as projectiles in PARTICLE ACCELERATORS to produce and study nuclear reactions. They are the chief constituent of primary COSMIC RAYS and are among the products of radioactive decay (see RADIOACTIVITY) and nuclear reactions.

protozoal \ˌprō-tə-'zō-əl\ **diseases** Diseases caused by PROTOZOANS. These organisms may remain in the human host for their entire life cycle, but many carry out part of their reproductive cycle in insects or other hosts. For example, mosquitoes are vectors of PLASMODIUM, the cause of MALARIA. See also ENTAMOEBA; GIARDIA LAMBLIA; SLEEPING SICKNESS.

protozoan \ˌprō-tə-'zō-ən\ Any of a group of small (usually microscopic) single-celled PROTISTS. They are found in most soils, fresh water, and oceans. While most are solitary individuals, various colonial forms exist. The taxonomic relationships of protozoans to one another and to other protists continue to be revised. The smallest known protozoans are tiny blood parasites less than 2 microns long; the largest may be 16 mm long and visible to the naked eye. Protozoan shapes vary, but all share such eukaryotic features as lipid-protein membranes and membrane-enclosed vacuoles and organelles (see EUKARYOTE). They show wide variation in modes of movement, nutrition, and reproduction. Various classification systems exist to group the protozoans. The major phyla include Sarcomastigophora (flagellated forms and forms possessing cytoplasmic extensions called pseudopodia), Ciliophora (ciliated forms), and Apicomplexa, Microspora, and Myxozoa (spore-producing forms). Apicomplexa and Microspora are sometimes included in the single phylum Sporozoa. Commonly known protozoans include DINOFLAGELLATES, AMOEBAS, and paramecia (see PARAMECIUM). See illustration opposite.

protractor Instrument for constructing and measuring plane ANGLES. The simplest protractor is a semicircular disk marked in degrees from 0° to 180°. A more complex protractor, for plotting position on NAVIGATION charts, is called a three-arm protractor, or station pointer, and consists of a circular scale connected to three arms. The centre arm is fixed, while the outer two can be rotated to any desired angle relative to the centre one. A related instrument is the course protractor, which allows navigators to measure the angular distance between north and the course plotted on a navigation chart.

Proudhon \prü-'dōⁿ**, Pierre-Joseph** (b. Jan. 15, 1809, Besançon, France—d. Jan. 19, 1865, Paris) French journalist and socialist. After working as a printer, he moved to Paris in 1838 and joined the socialist movement. His *What Is Property?* (1840) created a sensation with such phrases as "property is theft." While working in Lyon (1843–48), he encountered the Mutualists, a weavers' anarchist society whose name he later adopted for his form of ANARCHISM. His *System of Economic Contradictions* (1846) was attacked by KARL MARX and initiated the split between anarchists and Marxists. In Paris in 1848, Proudhon published radical newspapers; imprisoned (1849–52), he was harassed by the police after



Representative protozoans. The zooflagellate *Trypanosoma brucei* is the causative agent of African sleeping sickness. The phytoflagellate *Gonyaulax* is one of the dinoflagellates responsible for the occurrence of red tides. The amoeba is one of the most common sarcodines. Other members of the subphylum Sarcodina, such as the radiolarians, heliozoans, and foraminiferans, usually possess protective coverings. The heliozoan *Pinaciophora* is shown covered with scales. The subphylum Ciliophora, which includes the ciliated *Tetrahymena* and *Vorticella*, contains the greatest number of protozoan species but is the most homogeneous group. The malaria-causing *Plasmodium* is spread by the bite of a mosquito that injects infective spores (sporozoites) into the bloodstream.

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his release and fled to Belgium in 1858. On his return in 1862, he gained influence among the workers, including some of the founders of the First International.

Proulx \'prü**, (Edna) Annie** (b. Aug. 22, 1935, Norwich, Conn., U.S.) U.S. writer. She studied at the University of Vermont. She began professional writing with commissioned nonfiction books on cooking, gardening, and country living. She founded and edited (1984–86) *Behind the Times*, a rural Vermont newspaper, and published stories in men's outdoor magazines. Her first novel, *Postcards* (1992), depicting the decline of the small farm, received the PEN/Faulkner Award. It was followed by *The Shipping News* (1993, Pulitzer Prize, National Book Award) and *Accordion Crimes* (1996). Her story collections *Heart Songs* (1988) and *Close Range* (1999) also won high praise.

Proust \'prüst**, Marcel** (b. July 10, 1871, Auteuil, near Paris, France—d. Nov. 18, 1922, Paris) French novelist. Born to a wealthy family, he studied law and literature. His social connections allowed him to become an observant habitué of the most exclusive drawing rooms of the nobility, and he wrote social pieces for Parisian journals. He published essays and stories, including the story collection *Pleasures and Days* (1896). He had suffered from asthma since childhood, and c. 1897 he began to disengage from social life as his health declined. Half-Jewish himself, he became a major supporter of Alfred Dreyfus in the affair that made French anti-Semitism into a national issue. Deeply affected by his mother's death in 1905, he withdrew further from society. An incident of involuntary revival of childhood memory in 1909 led him to retire almost totally into an eccentric seclusion in his cork-lined bedroom to write *À la recherche du temps perdu* (1913–27; *In Search of Lost Time*, or *Remembrance of Things Past*). The vast seven-part novel is at once a kind of autobiography, a vast social panorama of France in the years just before and during World War I, and an immense meditation on love and jealousy and on art and its relation to reality. One of the supreme achievements in fiction of all time, it brought him worldwide fame and affected the entire climate of the 20th-century novel.

Marcel Proust, oil painting by Jacques-Émile Blanche; in a private collection.
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Provençal language See Occitan language

Provence \prō-'vä^{n}s\ Historical, cultural, and governmental region, southeast-coastal France. Provence was part of Roman Gallia Transalpina. With the breakdown of the Roman Empire in the late 5th century, Provence was invaded successively by the Visigoths, Burgundians, and Ostrogoths. It came under the rule of the Franks c. 536. During the 13th century it was involved in the Albigensian Crusade. It was united with the French crown in 1481. The language of Provence, Provençal, was important in medieval literature, and Provence's Romanesque architecture was an outstanding cultural achievement of the Middle Ages. The region suffered in the 16th-century Wars of Religion. In 1790, during the French Revolution, it lost its political institutions and was divided into several *département*s. The historical region of Provence is roughly coextensive with the present-day *région* of Provence-Alpes-Côte d'Azur (pop., 2003 est.: 4,665,051), which has an area of 12,124 sq mi (31,400 sq km); its capital is Marseille.

proverb Succinct and pithy saying that is in general use and expresses commonly held ideas and beliefs. Proverbs are part of every spoken language and folk literature, originating in oral tradition. Often a proverb is found with variations in many different parts of the world. Literate societies dating to the ancient Egyptians have collected proverbs. One of the earliest English proverb collections, *The Proverbs of Alfred*, dates from c. 1150–80. In North America the best-known collection is probably *Poor Richard's*, an almanac published 1732–57 by Benjamin Franklin.

Providence City (pop., 2000: 173,618), capital of Rhode Island, U.S. It is located at the head of Narragansett Bay on the Providence River. Founded in 1636 by Roger Williams as a refuge for religious dissenters, it was partly destroyed in King Philip's War in 1676. It played an important role in the American Revolution and was a major port in trade with the West Indies in the 18th century. Incorporated as a city in 1831, it became the sole capital of the state in 1900. Previously it had shared that honour with Newport since 1854. A seaport and an industrial and commercial centre, it is the focus of a metropolitan area that includes Pawtucket and East Providence. Educational institutions include Brown University and the Rhode Island School of Design.

Provincetown Town (pop., 2000: 3,431), eastern Massachusetts, U.S. At the northern tip of Cape Cod, Provincetown was the first landing place of the Pilgrims in 1620, and the Mayflower Compact was drawn up in its harbour. Incorporated as a town in 1727, it was a whaling and fishing port in the 19th century. Bounded by the Cape Cod National Seashore, it is a popular summer resort and noted artists' colony. The Provincetown Players theatre group originated there.

Provincetown Players U.S. theatrical company. It was founded in 1915 by a group of writers and artists in Provincetown, Mass., to encourage new and experimental works. Among their first productions, which were often staged in members' homes, was the first play by Eugene O'Neill, a founding member whose career was launched by the Players. In 1916 the players moved to New York's Greenwich Village. There they introduced several more of O'Neill's plays as well as works by Edna St. Vincent Millay, Susan Glaspell, Paul Green, and dozens of other playwrights. The company disbanded after the stock-market crash of 1929, though the Provincetown Playhouse has continued to serve intermittently as a theatre into the 21st century.

Provisions of Oxford See Provisions of Oxford

Provisors, Statute of (1351) Law passed by the English Parliament during the reign of Edward III. It set up procedures to increase royal control over the papal practice of making appointments to church benefices in England, and damaged English relations with the church.

Provo City (pop., 2000: 105,166), north-central Utah, U.S. Situated on the Provo River between Utah Lake and the Wasatch Mountains, it was founded in 1849 by Mormon colonists. Construction of railroads in the 1870s spurred the city's development as a centre for the mining of silver, lead, copper, and gold. The founding in 1875 of Brigham Young Academy (now Brigham Young University) also contributed to Provo's growth. The city's industries include steel, canning, electronics, and textiles. Nearby is Timpanogos Cave National Monument.

Proxima Centauri See Alpha Centauri

Prozac First of the class of antidepressant drugs called selective serotonin reuptake inhibitors (SSRIs), generic name fluoxetine hydrochloride. Introduced in 1986 as a treatment for clinical depression, Prozac is also used to treat a variety of other psychiatric disorders, including obsessive-compulsive disorder and bulimia nervosa. The drug, taken as a pill, apparently achieves its therapeutic effect by interfering with the reabsorption of the neurotransmitter serotonin within the brain.

Prudhoe \'prü-dō\ **Bay** Small inlet of the Beaufort Sea, northern Alaska, U.S. It has been the centre of oil-drilling activities since the discovery in 1968 of vast petroleum deposits on Alaska's North Slope. The Trans-Alaska Pipeline links the area to Valdez on Prince William Sound.

Prudhomme, Sully See Sully Prudhomme

Prud'hon \prǖ-'dō^{n}**, Pierre-Paul** (b. April 4, 1758, Cluny, France—d. Feb. 16, 1823, Paris) French painter. During his years in Rome (1784–88), the works of Correggio inspired him to introduce a softer effect into French painting, then dominated by the austere style of Jacques-Louis David. He made drawings for engravers before he came to the attention of Napoleon. His portrait of the empress Joséphine (1805) exhibits the seductive and mysterious quality with which he invested his portraits of women. He achieved fame and received the Legion of Honor for his allegorical *Crime Pursued by Divine Vengeance and Justice* (1808). His elegant style served as a bridge from late 18th-century Neoclassicism to 19th-century Romanticism.

Prusiner, Stanley (Ben) (b. May 28, 1942, Des Moines, Iowa, U.S.) U.S. neurologist. He earned his M.D. from the University of Pennsylvania and subsequently taught at UC–San Francisco (1974–84) and UC–Berkeley (from 1984). As a medical resident, he was intrigued by spongiform encephalopathies when a patient died of Creutzfeldt-Jakob dis-

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EASE; he later studied the related sheep disorder scrapie and in 1982 reported isolation of its causative agent, which he called a prion. Initially criticized, his prion theory was eventually generally accepted, and his research received world attention when MAD COW DISEASE emerged in Britain. The theory may also shed light on disorders such as ALZHEIMER DISEASE and PARKINSONISM, which share traits with prion-based diseases. His work won him a 1997 Nobel Prize.

Prussia *German* **Preussen** \'prȯis-ᵊn\ In European history, any of three areas of eastern and central Europe. The first was the land of the Prussians on the southeastern coast of the Baltic Sea, which came under Polish and German rule in the Middle Ages. The second was the kingdom ruled from 1701 by the German HOHENZOLLERN DYNASTY, including Prussia and BRANDENBURG, with BERLIN as its capital. It seized much of northern Germany and western Poland in the 18th–19th century and united Germany under its leadership in 1871. The third was the state created after the fall of the Hohenzollerns in 1918, which included most of their former kingdom and which was abolished by the Allies in 1947 as part of the political reorganization of Germany after its defeat in World War II.

Prynne \'prin**, William** (b. 1600, Swainswick, Somerset, Eng.—d. Oct. 24, 1669, London) English Puritan pamphleteer. Trained as a lawyer, he published Puritan tracts from 1627 and assailed Anglican ceremonialism. He attacked popular amusements, especially plays, in his book *Histrio Mastix: The Players Scourge* (1633). Archbishop WILLIAM LAUD had him imprisoned; after he wrote more pamphlets attacking Laud and other Anglicans, his ears were cut off. Released in 1640, Prynne brought about Laud's conviction and execution (1645). Elected to Parliament in 1648, he was expelled for attacks on radical Puritans and later imprisoned for refusing to pay taxes (1650–53). Disaffected with OLIVER CROMWELL's Commonwealth, he became a supporter of CHARLES II.

Pryp'yat River See PRIPET RIVER

Prypyats' River See PRIPET RIVER

Przewalski's horse \pshə-'väl-skēz, ˌpər-zhə-'väl-skēz\ Last wild EQUINE subspecies (*Equus caballus przewalskii*) surviving into the 20th century. It is yellowish or light red (dun) and stands 12–14 hands (48–56 in., 122–142 cm) high. It has a dark mane and tail and usually a stripe on the back. The mane is short and erect with no forelock. It was discovered in western Mongolia in the 1870s. The horse disappeared in the wild in the 1960s, but the descendants of specimens that had earlier been taken to European zoos began to be reintroduced into the Mongolian steppe in the 1990s.

Przewalski's horse (*Equus caballus przewalskii*).
KENNETH W. FINK FROM ROOT RESOURCES

psalm \'säm\ Sacred song or poem. The term is most widely known from the book of Psalms in the Bible. Its 150 psalms, ranging in subject from songs of joyous faith and thanksgiving to songs of bitter protest and lamentation, rank among the immortal poems of all time. They have had a profound influence on the liturgies of Judaism and Christianity. Their dating and authorship are highly problematic, and the tradition of assigning them to King DAVID is no longer accepted. In the original Hebrew text the book had no name. When the Hebrew Bible was translated into Greek (the SEPTUAGINT), it was titled Psalterion, referring to a stringed instrument that would accompany such songs.

Pseudo-Demetrius See False DMITRY

Pseudo-Dionysius the Areopagite (fl. c. 500) Probably a Syrian monk. Under the pseudonym DIONYSIUS THE AREOPAGITE, he wrote a series of treatises that united Neoplatonic philosophy (see NEOPLATONISM), Christian theology, and mystical experience. Their doctrinal content covers the Trinity, the angelic world, and the Incarnation and redemption and provides an explanation of all that is. His treatise "On Divine Names" discusses the nature and effects of contemplative prayer. The Dionysian corpus was absorbed into Greek and Eastern Christian theologies and also influenced mystics in the Western church. THOMAS AQUINAS was among those who wrote commentaries on the works.

pseudomonad \ˌsü-də-'mō-ˌnad\ Any of a large and varied group of rod-shaped, often curved BACTERIA. Many can move, propelled by one or more flagella. Some aquatic species are attached to surfaces by long strands or stalks. Most are found in soil or water; some cause diseases in plants, and a few cause serious diseases in humans and other mammals. One very common and widespread species, *Pseudomonas aeruginosa*, is a serious cause of disease in humans, causing antibiotic-resistant infections in individuals with weakened resistance. Pseudomonads have been implicated in hospital-acquired infections of surgical wounds and severely burned tissue and in fatal infections of cancer patients treated with immunosuppressive drugs.

psilomelane \ˌsī-lō-'me-ˌlān\ Barium and manganese hydrous oxide, $BaMnMn_8O_{16}(OH)_4$, an important ore mineral of MANGANESE. What was formerly called psilomelane is now known to be a mixture of several manganese oxides of which romanechite is a major constituent. Such manganese oxide mixtures may form large deposits and may occur in lake or swamp bedded deposits and clays; it has been found in Germany, France, Belgium, Scotland, Sweden, India, and the U.S. The name *psilomelane* (from the Greek words for "smooth" and "black") refers to its typical black, smooth-surfaced, grape-bunch-shaped or stalactitic masses.

psoriasis \sə-'rī-ə-səs\ Chronic, recurrent skin disorder with reddish, slightly elevated patches or bumps covered with silvery-white scales. Spots may coalesce into large patches around a normal area. If the nails are involved, they may become pitted, thick, and separated from the nail bed. Skin injury, infection, stress, and certain drugs may trigger psoriasis. Skin cells move at an accelerated rate from the dermis into the epidermis, where they slough off, causing inflammation. In some cases, patients also have arthritis. Psoriasis often becomes less severe in the summer and during pregnancy. There is no cure, but treatment with drugs and ultraviolet light may help.

Psyche \'sī-kē\ In Greek and Roman mythology, a beautiful princess who won CUPID's love. Her beauty was such that worshipers began to turn away from VENUS, and the envious goddess commanded her son Cupid to make Psyche fall in love with the most despicable of men. But Cupid himself fell in love with Psyche and hid her in a remote place, where he visited her secretly under cover of darkness. One night she lit a lamp and discovered her lover's identity. He left angrily, and Psyche wandered the earth searching for him and was captured by Venus. After Cupid rescued Psyche, JUPITER made her immortal and gave her in marriage to Cupid.

Psyche, depicted with wings, classical sculpture; in the Louvre, Paris
ALINARI-ART RESOURCE/EB INC.

psychiatry Branch of medicine concerned with mental disorders. Until the 18th century, mental health problems were considered forms of demonic possession; gradually they came to be seen as illnesses requiring treatment. In the 19th century, research into and classification and treatment of mental illnesses advanced. SIGMUND FREUD's psychoanalytic theory dominated the field for many years before it was challenged by behavioral and cognitive therapy and humanistic PSYCHOLOGY in the mid-20th century. Psychiatrists hold medical degrees and can prescribe drugs and other medical treatments in addition to conducting psychotherapy. The psychiatrist often works as a member of a mental health team that includes clinical psychologists and social workers.

psychoanalysis Method of treating MENTAL DISORDERS that emphasizes the probing of unconscious mental processes. It is based on the psychoanalytic theory devised by SIGMUND FREUD in Vienna in the late 19th and early 20th century. It calls for patients to engage in free ASSOCIATION of ideas, speaking to therapists about anything that comes to mind. DREAMS and slips of the tongue are examined as a key to the workings of the unconscious mind, and the "work" of therapy is to uncover the tensions existing between the instinctual drive of the ID, the perceptions and actions

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of the EGO, and the censorship imposed by the morality of the SUPEREGO. Careful attention is paid to early childhood experiences (especially those with a sexual dimension), the memory of which may have been repressed because of guilt or trauma; recalling and analyzing these experiences is thought to help free patients from the ANXIETY and neuroses caused by REPRESSION as well as from more serious illnesses known as psychoses (see NEUROSIS, PSYCHOSIS). Some of Freud's early associates, notably CARL GUSTAV JUNG and ALFRED ADLER, rejected his theories on many points and devised alternative methods of analysis. Other important figures in psychoanalysis, including ERIK ERIKSON, KAREN HORNEY, and ERICH FROMM, accepted the basic Freudian framework but contributed their own additions or modifications.

psycholinguistics Study of the mental processes involved in the comprehension, production, and acquisition of LANGUAGE. Much psycholinguistic work has been devoted to the learning of language by children and on speech processing and comprehension by both children and adults. Traditional areas of research include language production, language comprehension, language acquisition, language disorders, language and thought, and neurocognition. See also LINGUISTICS.

psychological development Development of cognitive, emotional, intellectual, and social capabilities and functioning over the course of one's life. It is the subject matter of the discipline of DEVELOPMENTAL PSYCHOLOGY. In INFANCY, language is acquired, PERCEPTION, EMOTION, and MEMORY take shape, and learning and motor skills develop. In childhood, SPEECH emerges, cognitive abilities advance from concrete to abstract operations, emotional responses become more sophisticated, and EMPATHY and moral reasoning begin to be employed. ADOLESCENCE is a time of rapid emotional and intellectual growth, while ADULTHOOD is characterized by the maturing of all developmental processes.

psychological testing Use of tests to measure skill, knowledge, intelligence, capacities, or aptitudes and to make predictions about performance. Best known is the IQ test; other tests include achievement tests—designed to evaluate a student's grade or performance level—and PERSONALITY tests. The latter include both inventory-type (question-and-response) tests and projective tests such as the Rorschach (inkblot) and thematic apperception (picture-theme) tests, which are used by clinical psychologists and psychiatrists to help diagnose mental disorders and by psychotherapists and counselors to help assess their clients. Experimental psychologists routinely devise tests to obtain data on PERCEPTION, LEARNING, and MOTIVATION. Clinical neuropsychologists often use tests to assess cognitive functioning of people with brain injuries. See also EXPERIMENTAL PSYCHOLOGY; PSYCHOMETRICS.

psychological warfare Use of propaganda against an enemy, supported by whatever military, economic, or political measures are required, and usually intended to demoralize an enemy or to win it over to a different point of view. It has been carried on since ancient times. The conquests of GENGHIS KHAN were aided by expertly planted rumours about large numbers of ferocious MONGOL horsemen in his army. Specialized units were a major part of the German and Allied forces in World War II and the U.S. armed forces in the Korean and Vietnam wars. Strategic psychological warfare is mass communications directed to a very large audience or over a considerable expanse of territory; tactical psychological warfare implies a direct connection with combat operations (e.g., the surrender demand). Consolidation psychological warfare consists of messages distributed to the rear of one's own advancing forces for the sake of protecting the line of communications, establishing military government, and carrying out administrative tasks within such a government.

psychology Scientific discipline that studies mental processes and behaviour in humans and other animals. Literally meaning "the study of the mind," psychology focuses on both individual and group behaviour. CLINICAL PSYCHOLOGY is concerned with the diagnosis and treatment of MENTAL DISORDERS. Other specialized fields of psychology include CHILD PSYCHOLOGY, EDUCATIONAL PSYCHOLOGY, sports psychology, SOCIAL PSYCHOLOGY, and COMPARATIVE PSYCHOLOGY. The issues studied by psychologists cover a wide spectrum, including LEARNING, COGNITION, INTELLIGENCE, motivation, EMOTION, PERCEPTION, PERSONALITY, and the extent to which individual differences are shaped by genetics or environment. The methods used in psychological research include observation, interviews, PSYCHOLOGICAL TESTING, laboratory experimentation, and statistical analysis.

psychometrics Science of psychological measurement. Psychometricians design and administer psychological tests (see PSYCHOLOGICAL TESTING), both to generate empirical data on mental processes and to refine their understanding of measurement techniques and the statistical analysis of results. Major concerns include test reliability and validity and the norming or standardization of results.

psychoneurosis See NEUROSIS

psychopathology See ABNORMAL PSYCHOLOGY

psychopharmacology Study of the effect of drugs on the mind and behaviour, particularly in the context of developing treatments for mental disorders. Major psychopharmacological advances in the 20th century include the development of TRANQUILIZERS, ANTIDEPRESSANTS, lithium carbonate (for BIPOLAR DISORDER), certain stimulants (including AMPHETAMINES), and antipsychotic agents such as chlorpromazine (Thorazine), fluphenazine (Prolixin), and haloperidol (Haldol).

psychophysics Branch of psychology concerned with the effect of physical stimuli (such as sound waves) on mental processes. Psychophysics was established by GUSTAV THEODOR FECHNER in the mid-19th century, and since then its central inquiry has remained the quantitative relation between stimulus and SENSATION. A key tenet has been WEBER'S LAW. Psychophysical methods are used today in vision research and audiology, PSYCHOLOGICAL TESTING, and commercial product comparisons (e.g., tobacco, perfume, and liquor).

psychosis \sī-ˈkō-səs\ Serious mental derangement characterized by defective or lost contact with reality. The primary psychoses are SCHIZOPHRENIA and the delusional disorders (e.g., megalomania), but extreme cases of DEPRESSION and BIPOLAR DISORDER, substance-induced DELIRIUM, and certain varieties of DEMENTIA are also understood to share important features with the psychoses. The major symptoms, aside from delusions and HALLUCINATIONS, are disorganized speech and behaviour and, often, mood disturbances. Treatment usually consists of medication and counseling in an institutional setting. Compare NEUROSIS.

psychosomatic disorder Bodily ailment or symptom, caused by mental or emotional disturbance, in which psychological stresses adversely affect physiological (somatic) functioning to the point of distress. Psychosomatic disorders may include HYPERTENSION, respiratory ailments, gastrointestinal disturbances, migraine and tension HEADACHES, SEXUAL DYSFUNCTIONS, and DERMATITIS. Many patients with psychosomatic conditions respond to a combination of drug therapy and PSYCHOTHERAPY. See also HYPOCHONDRIASIS.

psychosurgery Treatment of PSYCHOSIS or other MENTAL DISORDERS by means of brain surgery. The first such technique was the prefrontal LOBOTOMY. Fairly common from the 1930s through the 1950s, lobotomy reduced neurotic symptoms such as agitation and aggressiveness but also left patients apathetic and with a limited range of emotions; it has since been largely replaced by the use of tranquilizing and antipsychotic drugs (see PSYCHOPHARMACOLOGY). A form of psychosurgery developed more recently involves the placement of tiny lesions in specific areas of the brain and has little effect on intellectual function or quality of life; it has been used to treat OBSESSIVE-COMPULSIVE DISORDER and occasionally cases of severe psychosis.

psychotherapy Treatment of psychological, emotional, or behaviour disorders through interpersonal communications between the patient and a trained counselor or therapist. The goal of many modern individual and GROUP THERAPIES is to establish a central relationship of trust in which the client or patient can feel free to express personal thoughts and emotions and thus gain insight into his condition and generally share in the healing power of words. Such therapies include PSYCHOANALYSIS and its variants (see ALFRED ADLER; CARL GUSTAV JUNG), client-centred or NONDIRECTIVE PSYCHOTHERAPY, Gestalt therapy (see GESTALT PSYCHOLOGY), play and art therapy, and general COUNSELING. In contrast, BEHAVIOUR THERAPY focuses on modifying behaviour by reinforcement techniques without concerning itself with internal states.

Ptah \ˈptä\ In EGYPTIAN RELIGION, the creator god. The patron of craftsmen, especially sculptors, Ptah was identified by the Greeks with HEPHAESTUS, the divine blacksmith. He was represented as a man in mummy form, wearing a skullcap and a short, straight false beard. He was originally the local deity of MEMPHIS, capital of Egypt from the 1st dynasty onward; the political importance of Memphis caused Ptah's cult to spread across Egypt. With Sekhmet and Nefertem, he was one of the Memphite Triad of deities. See photograph on opposite page.

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ptarmigan \'tär-mi-gən\ Any of three or four species of GROUSE (genus *Lagopus*) of cold regions. Ptarmigan plumage changes from white in winter to gray or brown, with barring, in spring and summer. The toes are covered with stiff feathers above and below. The common ptarmigan (*L. mutus*) occurs throughout the British Isles, Europe, and North America, where it is called rock ptarmigan. Ptarmigans survive winter in the Arctic and on mountaintops by browsing shrubs and scratching up lichens and leaves; they burrow in snow to sleep. Males begin group displays in early spring and then separate and display singly in adjoining territories.

Pteranodon \tə-'ra-nə-ˌdän\ Genus of extinct flying REPTILES, descendants of the PTERODACTYL. Fossils are known from Late Cretaceous (99–65 million years ago) deposits of Europe, Asia, and North America. *Pteranodon* had a wingspan of 23 ft (7 m) or more. The largest specimen had a wingspan of 50 ft (15.5 m). The body was about the size of a modern turkey. *Pteranodon* had a crest at the back of the skull and long, pelican-like, toothless jaws. They probably made nests and spent much time gliding over the ocean searching for fish. They probably depended on air currents for liftoff rather than on flapping their wings.

pterodactyl \ˌter-ə-'dak-tᵊl\ Any member of the PTEROSAUR suborder Pterodactyloidea, known from Late Jurassic and Cretaceous fossils (159–65 million years ago) in eastern Africa and Europe. Members of the typical genus, *Pterodactylus*, ranged from the size of a sparrow to that of an albatross. Pterodactyls had slender, delicate teeth that were angled forward (possibly for use as straining devices), long metacarpal bones, and a short tail. They were probably able gliders but not efficient as active fliers, and they apparently lacked feathers. Unlike the ARCHAEOPTERYX, the pterodactyl was not an ancestor of the birds.

pterosaur \'ter-ə-ˌsȯr\ Any of several extinct flying REPTILES (order Pterosauria) that flourished during the Jurassic and Cretaceous periods (206–65 million years ago). Pterosaurs hung by their long, slender hind limbs when at rest. They soared and glided on fragile, membranous wings that were attached to the long fourth finger of each forelimb and extended along the flank. The first three fingers were slender, clawed, clutching structures. Pterosaurs had a long, slender beak and a large brain. *Ramphorhynchus* had strong, sharply pointed teeth, a long tail, and a wingspread of about 3 ft (1 m). It probably obtained food by diving for fish. See also PTERODACTYL.

Ptolemais \ˌtä-lə-'mā-əs\ Ancient coastal city, CYRENAICA. Located in modern Libya, it received its name in the 3rd century BC from Ptolemy III, who united Cyrenaica with Egypt. Its economy was based on trade with the interior, and it flourished in Hellenistic times, in the early period of the Roman Empire, and again from the late 3rd century AD, when DIOCLETIAN made it the metropolis of the Roman province of Upper Libya.

Ptah, holding the emblems of life and power, bronze statuette, Memphis, *c.* 600–100 BC; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Ptolemy \'tä-lə-mē\ *Latin* **Claudius Ptolemaeus** (b. c. AD 100—d. c. AD 170) Greek astronomer and mathematician. He worked principally in Alexandria. It is often difficult to determine which findings in his great astronomical book, the *ALMAGEST*, are Ptolemy's and which are HIPPARCHUS's. The Sun, Moon, planets, and stars, he believed, were attached to crystalline spheres, centred on Earth, which turned to create the cycles of day and night, the lunar month, and so on. In order to explain RETROGRADE MOTION of the planets, he refined a complex geometric model of cycles within cycles that was highly successful at predicting the planets' positions in the sky. The Earth-centred Ptolemaic system became dogmatically asserted in Western Christendom until the Sun-centred COPERNICAN SYSTEM replaced it. His *Geography* contained an estimate of the size of Earth, a description of its surface, and a list of places located by latitude and longitude. Ptolemy also dabbled in mechanics, optics, and music theory.

Ptolemy I Soter \'tä-lə-mē...'sō-tər\ (b. 367/366, Macedonia—d. 283/282 BC, Egypt) Ruler of Egypt (323–285) and founder of the Ptolemaic dynasty. A Macedonian general of ALEXANDER THE GREAT, he and the other generals divided the empire after Alexander's death, Ptolemy becoming SATRAP of Egypt. Alexander's successors were soon at war. Ptolemy was defeated in 306 by ANTIGONUS I MONOPHTHALMUS, though he and the others rebuffed Antigonus's attack on Egypt. He earned the name Soter ("Saviour") after defeating Antigonus on Rhodes (304), but Antigonus was not finally crushed until 301 at the Battle of IPSUS. Ptolemy secured and expanded his empire through alliances and marriages. He and his fellow kings won a final war (288–286) against DEMETRIUS of Macedonia, freeing Athens from Macedonian occupation. He obtained control of the League of Islanders (including most of the Aegean islands), which formed the basis of Egypt's maritime supremacy. As king he respected Egyptian culture, blended Greek and Egyptian peoples and religions, and founded the Library and Museum of ALEXANDRIA. After his death the Egyptians raised him to the level of a god. He was succeeded by his son, PTOLEMY II PHILADELPHUS.

Ptolemy II Philadelphus (b. 308, Cos—d. 246 BC) King of Egypt (285–246 BC), second king of the Ptolemaic dynasty. He reigned as coruler (285–282) with his father, PTOLEMY I SOTER, then purged his family of rivals, including his first wife, and married his sister, ARSINOE II. Wars with the rulers of the SELEUCID and ANTIGONID dynasties weakened his influence in the Aegean and brought near-disaster to his allies Athens and Sparta. He concluded these wars by diplomacy and marriage alliances and managed to regain his influence in the Aegean. He devised a buffer zone of possessions to protect Egypt from attack, and he dealt with reverses through diplomacy. A prudent and enlightened ruler, he promoted economic development and made Alexandria into a centre for poets and scholars.

Ptolemy III–XV (r. 246–30 BC) Macedonian kings of the Ptolemaic dynasty in Egypt. Ptolemy III Euergetes ("Benefactor") (fl. 246–221) defeated the ruler of the SELEUCID DYNASTY in the Third Syrian War (245–241). Ptolemy IV Philopator ("Father-loving") (r. 221–205) allowed Egypt to decline under his debauched rule. Ptolemy IX Soter II ruled with his mother (116–110, 109–107), until she expelled him and installed his brother Ptolemy X Alexander (r. 107–88). Alexander's unpopularity resulted in his expulsion, and he died at sea in 88. Soter II assumed sole rule (88–81), installing his brother's widow, his own daughter, with him. Ptolemy XI Alexander II (r. 80) was the last fully legitimate Ptolemaic king of Egypt. On the orders of SULLA, whose hostage he had been, he took Ptolemy IX Soter II's widow as wife and attempted to rule with her. This being unacceptable to the queen, Ptolemy murdered her and took sole power, for which the people of Alexandria killed him; his rule lasted 19 days. Of the remaining Ptolemies, Ptolemy XIV Theos Philopator II shared power (47–44) with his sister CLEOPATRA; it was probably she who had him assassinated, to make way for her son by Julius CAESAR. Ptolemy XV Caesar, or Caesarion, shared power with his mother from 44; he was killed by Octavian (later AUGUSTUS) after Cleopatra's suicide in 30. His death marked the Roman conquest of Egypt and the dynasty's end.

puberty In human physiology, the period of first becoming capable of reproducing sexually. Occurring at about age 12 in girls and age 14 in boys, puberty is characterized by the maturing of the genital organs, development of secondary sex characteristics, and, in girls, onset of MENSTRUATION. Both sexes experience a swift increase in body size and changes in body shape and composition. Puberty marks the beginning of ADOLESCENCE.

pubic louse See human LOUSE

Public Broadcasting Service See PBS

public debt See NATIONAL DEBT

public health Science and art of preventing disease, prolonging life, and promoting health through organized community efforts. These include sanitation, control of contagious infections, hygiene education, early diagnosis and preventive treatment, and adequate living standards. It requires understanding not only of epidemiology, nutrition, and antiseptic practices but also of social science. Historical public health measures included quarantine of leprosy victims in the Middle Ages and efforts to improve sanitation following the 14th-century plague epidemics. Population increases in Europe brought with them increased awareness of infant

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deaths and a proliferation of hospitals. Britain's Public Health Act of 1848 established a special public health ministry. In the U.S., public health is studied and coordinated on a national level by the Centers for Disease Control and Prevention; internationally, the World Health Organization plays an equivalent role.

public house *or* **pub** Establishment that serves alcoholic beverages for consumption on the premises, especially in Britain. Under English common law, inns and taverns were declared public houses responsible for the well-being of travelers. They were expected to receive all travelers in reasonable condition who were willing to pay for food, drink, and lodging. In Tudor England, certain innkeepers were obliged by royal act to maintain stables; others served as unofficial postmasters. The early public houses were identified by simple signs that featured creatures such as lions, dolphins, or swans. In the 18th century, the word Arms was added to many pub names to indicate that the establishment was under the protection of a noble family. Though British public houses were traditionally owned and operated by independent licensed proprietors, by the early 20th century many were owned or associated with brewery companies.

public relations (PR) Aspect of communications that involves promoting a desirable image for a person or group seeking public attention. It originated in the U.S. in the early 20th century with pioneers such as Edward L. Bernays and Ivy Ledbetter Lee. Government agencies in Britain and the U.S. soon began hiring publicists to engineer support for their policies and programs, and the public-relations business boomed after World War II. Clients may include individuals such as politicians, performers, and authors, and groups such as business corporations, government agencies, charities, and religious bodies. The audience addressed may be as narrow as male alternative-music fans between the ages of 21 and 30 or as broad as the world at large. A publicist's functions include generating favourable publicity and knowing what kind of story is likely to be printed or broadcast. The task is complicated by the variety of existing media: besides newspapers, magazines, radio, and television, there are publications of professional associations, direct-mail lists, on-site promotional events, and so on. It consists largely of optimizing good news and forestalling bad news; if disaster strikes, the publicist must assess the situation, organize the client's response so as to minimize damage, and marshal and present information to the media.

Public Safety, Committee of See Committee of Public Safety

public school *or* **independent school** In the United Kingdom, any of a small group of tuition-charging secondary schools that specialize in preparing students for university and for public service. The name *public school* dates from the 18th century, when the schools began attracting students from beyond their immediate environs and thus became "public" as opposed to local. Such schools are thus in fact private schools independent of the state system. Although many schools have become coeducational, only boys attend the historically important schools Winchester (1394), Eton (1440–41), Westminster (1560), and Harrow (1571); well-known girls' schools include Cheltenham (1853), Roedean (1885), and Wycomb Abbey (1896). Public schools cultivated a class-conscious code of behaviour, speech, and appearance that set the standard for British officialdom from the early 19th century. See also secondary education.

public television See PBS

public transportation See mass transit

public utility Enterprise that provides certain classes of services to the public, including common-carrier transportation (buses, airlines, railroads); telephone and telegraph services; power, heat and light; and community facilities for water and sanitation. In most countries such enterprises are state-owned and state-operated; in the U.S. they are mainly privately owned, but they operate under close regulation. Given the technology of production and distribution, they are considered natural monopolies, since the capital costs for such enterprises are large and the existence of competing or parallel systems would be inordinately expensive and wasteful. Government regulation in the U.S., particularly at the state level, aims to ensure safe operation, reasonable rates, and service on equal terms to all customers. Some states have experimented with deregulation of electricity and natural-gas operations to stimulate price reductions and improved service through competition, but the results have not been universally promising.

Public Works Administration U.S. government agency (1933–39). It was established as part of the New Deal to reduce unemployment through the construction of highways and public buildings. Authorized by the National Industrial Recovery Act (1933) and administered by Harold Ickes, it spent about $4 billion to build schools, courthouses, city halls, public-health facilities, and roads, bridges, dams, and subways. It was gradually dismantled as the country moved to a military-industrial economy during World War II.

Public Works of Art Project (PWAP) First of the U.S. federal art programs conceived as part of the New Deal during the Great Depression. Organized in 1933, it provided work to thousands of unemployed artists. PWAP projects (many of which were left unfinished) included some 7,000 easel paintings and watercolours, 1,400 murals and sculptures, 2,500 works of graphic art, and numerous other works designated to embellish nonfederal public buildings and parks. Prominent works include the murals in San Francisco's Coit Memorial Tower, Grant Wood's mural at Iowa State College, and Ben Shahn's mural designs on the theme of Prohibition. Many projects left incomplete when the PWAP ended in 1934 were finished under the WPA Federal Art Project.

publishing Traditionally, the selection, preparation, and distribution of printed matter—including books, newspapers, magazines, and pamphlets. Contemporary publishing includes the production of materials in digital formats such as CD-ROMs, as well as materials created or adapted for electronic distribution. Publishing has evolved from small, ancient, and law- or religion-bound origins into a vast industry that disseminates every kind of information imaginable. In the modern sense of a copying industry supplying a lay readership, publishing began in Hellenistic Greece, in Rome, and in China. After paper reached the West from China in the 11th century, the central innovation in Western publishing was Johannes Gutenberg's invention of movable type. In the 19th and 20th centuries, technological advances, the rise of literacy and leisure, and ever-increasing information needs contributed to an unprecedented expansion of publishing. Contemporary challenges in publishing include attempts at censorship, copyright laws and plagiarism, royalties for authors and commissions for literary agents, competitive marketing techniques, pressures from advertisers affecting editorial independence, acquisition of independent publishing concerns by conglomerates, and the loss of readers to other media such as television and the Internet.

Pucci \'pü-chē**, Emilio, marquess di Barsento** (b. Nov. 20, 1914, Naples, Italy—d. Nov. 29, 1992, Florence) Italian fashion designer and politician. He became a designer when a fashion photographer for *Vogue* noticed his original ski outfit and asked him to design women's ski clothes. He is best known for his tight shantung "Pucci pants" and vividly printed silk dresses and blouses. His colourful, less formal uniforms for Braniff flight attendants were the first of their kind. Later he branched into men's fashions, perfume, and ceramics. He was a member of the Italian Parliament (1963–72).

Puccini \pü-'chē-nē**, Giacomo (Antonio Domenico Michele Secondo Maria)** (b. Dec. 22, 1858, Lucca, Tuscany—d. Nov. 29, 1924, Brussels, Belg.) Italian composer. Born into a family of organists and choirmasters, he was inspired to write operas after hearing Giuseppe Verdi's *Aïda* in 1876. At the Milan Conservatory he studied with Amilcare Ponchielli (1834–86). Puccini entered his first opera, *Le villi* (1883), in a competition; though it lost, a group of his friends subsidized its production, and its premiere took place with immense success. His second, *Edgar* (1889), was a failure, but *Manon Lescaut* (1893) brought him international recognition. His mature operas included *La Bohème* (1896), *Tosca* (1900), *Madam Butterfly* (1904), and *The Girl of the Golden West* (1910). All four are tragic love stories; his use of the orchestra was refined, and he established a dramatic structure that balanced action and conflict with moments of repose, contemplation, and lyricism. They remained exceedingly popular into the 21st century. He was the most popular opera composer in the world at the time of his death; his unfinished *Turandot* was completed by Franco Alfano (1875–1954).

Pucelle \pü̇-'sel**, Jean** (b. 1300?—d. 1355?) French manuscript illuminator. Little is known of his background, but his large workshop dominated Parisian painting in the early 14th century, when he enjoyed court patronage and his work commanded high prices. His most celebrated work, the *Hours of Jeanne d'Evreux* (c. 1325–28), a tiny private prayer book commissioned by the queen, featured numerous drolleries (marginal designs), a style he popularized, and reveals his genius for using sources from Italian and French art to give a playful tone to an essentially religious work.

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puddling process Method of converting PIG IRON into WROUGHT iron by subjecting it to heat and frequent stirring in a furnace in the presence of oxidizing substances (see OXIDATION-REDUCTION). Invented by HENRY CORT in 1784 (superseding the FINERY PROCESS), it was the first method that allowed wrought iron to be produced on a large scale.

Puebla State (pop., 2000: 5,076,686), southeast-central Mexico. It covers an area of 13,090 sq mi (33,902 sq km), and its capital is PUEBLA city. It occupies part of the Anáhuac Plateau and varies in elevation from 5,000 to 8,000 ft (1,500 to 2,400 m), with fertile valleys formed by the SIERRA MADRE Oriental. The region has long been densely populated. Pre-Columbian peoples had a highly developed civilization in the area, and there are many archaeological sites. The Spanish made Puebla an economic and religious centre, and since the 19th century it has been an important agricultural and industrial centre.

Puebla *in full* **Puebla de Zaragoza** City (pop., 2000: 1,271,673), capital of PUEBLA state, southeastern Mexico. Founded in 1532, it lies on a plain about 7,100 ft (2,165 m) above sea level in the SIERRA MADRE Oriental foothills. Located between MEXICO CITY and VERACRUZ, it was occupied by U.S. forces during the MEXICAN WAR. Its Spanish colonial architecture is similar to that of the city of TOLEDO, Spain. The centre of an important agricultural and industrial region, it is also known for its glazed ceramic tiles, glass, and pottery. In 1973 the city was shaken by a severe earthquake.

pueblo (Spanish: "town") Community of the PUEBLO INDIANS of the southwestern U.S., consisting of multistoried apartment houses constructed of large ADOBE blocks beginning c. AD 1000. Freestanding structures up to five stories tall were built around a central court. Each floor is set back from the floor under it; the whole structure resembles a zigzag pyramid, with terraces formed by the rooftops of the level below. Though rooms often have connecting doorways, movement between levels is by means of ladders through holes in the ceilings. Ground-floor rooms, used for storage, have no outside doors. Each pueblo has at least two KIVAS. Many of the pueblos are still occupied; ACOMA pueblo is believed to be the oldest continuously inhabited place in the U.S. Some of the largest pueblos are at Taos, Isleta, Laguna, and Zuni. See also CLIFF DWELLING.

Pueblo Incident (1968) Capture of the USS *Pueblo*, a Navy intelligence ship, by North Korea off its coast on Jan. 23, 1968. The U.S. initiated negotiations with North Korea to secure the release of its 83 crewmen. The resulting agreement allowed the U.S. to publicly disavow the confession the crew had signed while privately admitting its truth; the U.S. also acknowledged the ship's intrusion into North Korean waters and agreed not to undertake similar intelligence gathering activities in the future. An inquiry into the crew's confession and the conduct of the ship's commander produced no apparent disciplinary action.

Pueblo Indian Any of the historic descendants of the prehistoric ANASAZI peoples who have for centuries lived in settled PUEBLOS in what is now northeastern Arizona and northwestern New Mexico. The contemporary pueblos are divided into eastern and western. The eastern group includes settlements along the Rio Grande in New Mexico (most notably TAOS Pueblo), while the western group includes the HOPI villages of northeastern Arizona and the ZUNI, ACOMA, and Laguna villages of northwestern New Mexico. The original Pueblo culture was characterized by both agriculture and the hunting of deer and antelope. Today agriculture predominates. Modern Pueblo social life centres on the village. Pueblo Indians have retained their pre-Spanish way of life to a surprising degree. Even though they have added to their inventory of material goods, the basic fabric of the Pueblo social system, community of organization and native religion, with modifications only of detail, has survived.

Pueblo pottery One of the most highly developed of the Native American arts. Pueblo pots, made only by women of the tribe, are constructed of long "sausages" of clay that are coiled upward and then smoothed out. Designs include geometric, floral, and animal patterns. The method was developed during the Classical Pueblo period (c. 1050–1300) and is still being used today. See photograph above.

Puente \'pwen-tā**, Tito** *orig.* **Ernesto Antonio Puente, Jr.** (b. April 20, 1923, New York, N.Y., U.S.—d. May 31, 2000, New York City) U.S. bandleader, percussionist, and composer. Born to Puerto Rican parents, Puente served in the Navy during World War II and later studied at Juilliard. In the late 1940s he formed his own band and rose to prominence with the SALSA, mambo, MERENGUE, and cha-cha-cha fads of the 1950s.

Pottery made by the Pueblo Indians (Left) Acoma waterjar, 1890, (centre) Santa Clara vase, c. 1880, (right) San Ildefonso waterjar, 1906; in the Denver Art Museum, Colo.
COURTESY OF THE DENVER ART MUSEUM, DENVER, COLO.

Always experimenting, he became a pioneer of Latin-jazz fusion. His compositions include "Pare Cochero" and "Oye Como Va." He performed with many artists, especially CELIA CRUZ, and he recorded more than 100 albums. He also performed in several films, including *Radio Days* (1987) and *The Mambo Kings* (1992).

puerperal \pyü-'ər-pə-rəl\ **fever** *or* **childbed fever** Infection of the female REPRODUCTIVE SYSTEM after childbirth or abortion, with fever over 100 °F (38 °C) in the first 10 days. The inner surface of the uterus is most often infected, but lacerations of any part of the genital tract can give BACTERIA (often *Streptococcus pyogenes*) access to the bloodstream and lymphatic system to cause SEPTICEMIA, cellulitis (cellular inflammation), and pelvic or generalized PERITONITIS. Severity varies. Puerperal fever has become very rare in developed countries but is still seen after abortions performed in unhygienic surroundings.

Puerto Rico *officially* **Commonwealth of Puerto Rico** Self-governing island commonwealth of the WEST INDIES, in the northeastern Caribbean Sea; it is associated with the U.S. Area: 3,515 sq mi (9,104 sq km). Population (2005 est.): 3,912,000. Capital: SAN JUAN. Most of the population is of Spanish descent, with significant minorities of people of African and mixed (African-European) descent. Languages: Spanish, English (both official). Religion: Christianity (predominantly Roman Catholic; also Protestant). Currency: U.S. dollar. The island of Puerto Rico may be divided into three geographic regions: the mountainous interior, the northern plateau, and the coastal plains. It has a developing free-market economy, of which manufacturing, financial services, and trade (mostly with the U.S.) are the main components. Tourism is also an important source of income. Puerto Rico's chief of state is the U.S. president, and its head of government is the commonwealth governor. The island was inhabited by ARAWAK Indians when it was settled by the Spanish in the early 16th century. It remained largely undeveloped economically until the late 18th century. After 1830 it gradually developed a plantation economy based on the export crops of sugarcane, coffee, and tobacco. The independence movement began in the late 19th century, and Spain ceded the island to the U.S. in 1898 after the SPANISH-AMERICAN WAR. In 1917 Puerto Ricans were granted U.S. citizenship, and in 1952 the island became a commonwealth with autonomy in internal affairs. Voters reaffirmed the island's commonwealth status in plebiscites in 1967, 1993, and (tacitly) 1998, but Puerto Rican statehood remained a political issue into the 21st century.

Puerto Vallarta \'pwer-tō-bä-'yär-tä\ City (pop., 2000: 151,432), west-central Mexico. It is situated on Banderas Bay, in the Pacific coastal lowland, south of the mouth of the Ameca River. The major port of JALISCO state, it exports bananas, coconut oil, hides, and fine woods. It is also an international tourist resort, known for aquatic sports, fishing (especially for sharks), and hunting.

Pufendorf \'pü-fən-ˌdȯrf**, Samuel, baron von** (b. Jan. 8, 1632, Dorfchemnitz, near Thalheim, Saxony—d. Oct. 13, 1694, Berlin) German jurist and historian. The son of a pastor, he left the study of theology for jurisprudence, philosophy, and history. He taught at the Universities of Heidelberg (1661–68) and Lund (1670–77). His *Elements of Universal Jurisprudence* (1660) and *Of the Law and Nature of Nations* (1672), which were influenced by HUGO GROTIUS and THOMAS HOBBES, departed from the traditional approach of the medieval theologians to NATURAL LAW in arguing that there is no such creature as a natural slave—that all men have a right to equality and freedom. His views were attacked by conservative Protestant theologians in Sweden and Germany, and GOTTFRIED WILHELM

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Leibniz dismissed him as "a man not a lawyer and scarcely a philosopher at all." Nevertheless, he was protected by the Swedish government, and he became the official historiographer to Charles XI of Sweden (1677–88) and to the elector of Brandenburg (1688–94).

puffball Any of various fungi (see fungus) in the order Lycoperdales of the class Basidiomycetes, found in soil or on decaying wood in grassy areas and woods. Puffballs are named for the fact that puffs of spores are released when the dry and powdery tissues of the mature spherical fruiting body (basidiocarp) are disturbed. Many are edible before maturity.

puffer *or* **blowfish** Any of about 90 species (family Tetraodontidae) of fishes that, when disturbed, inflate themselves into a globular shape with air or water. Most species occur in warm and temperate seas worldwide; some occur in brackish or fresh water. Puffers have tough, usually prickly, skin; their fused teeth form a beaklike structure, split in the center of each jaw. The largest grow to 3 ft (90 cm) long, but most are considerably smaller. Though they contain a lethal toxin, they are sometimes eaten, especially in Japan, where puffers (called fugu) are prepared by a specially trained chef.

Puffer (*Arothron stellatus*).
DOUGLAS FAULKNER

puffin *or* **sea parrot** Any of three species (family Alcidae) of diving birds with a large, brightly coloured, triangular beak. Puffins nest in large colonies on seaside and island cliffs. Both parents carry up to 10 fish crosswise in the bill to the nest (a deep burrow); they feed the single chick for about six weeks. They then leave, and the chick waits alone for its flight feathers to grow, living on stored fat, and then flies out to sea by itself. The common, or Atlantic, puffin (*Fratercula arctica*) is about 12 in. (30 cm) long. The Pacific species are the horned puffin (*F. corniculata*) and the tufted puffin (*Lunda cirrhata*).

Common puffin (*Fratercula arctica*)
BEN GOLDSTEIN—ROOT RESOURCES

pug Breed of toy dog that probably originated in China. Dutch traders brought it to England in the late 17th century. Squarely built and muscular, the pug has a short muzzle, tightly curled tail, large head, prominent eyes, and small, drooping ears. It stands 10–11 in. (26–28 cm) and weighs about 13–18 lbs (6–8 kg). Its short, glossy coat can be black, silver, or apricot fawn; there is a black mask on the face. Loyal and alert, pugs are valued as companions.

Pug.
SALLY ANNE THOMPSON/EB INC.

Pugachov \ˌpü-gə-'chȯf**, Yemelyan (Ivanovich)** (b. c. 1742, Zimoveyskaya-na-Donu, Russia—d. Jan. 21, 1775, Moscow) Russian Cossack leader. He fought in the Russian army (1763–70), then wandered among settlements of the dissident Old Believers. Learning of Cossack discontent after their unsuccessful rebellion in 1772, he claimed to be Tsar Peter III and decreed the abolition of serfdom. Vowing to depose Catherine II, he gathered a large following of Cossacks and peasants in the Ural region. After initial victories against the Russian army, he was defeated, captured, and executed.

Puget \pyē-'zhe**, Pierre** (b. Oct. 16, 1620, at or near Marseille, France—d. Dec. 2, 1694, Marseille) French sculptor, painter, and architect. As a young man he was employed by Pietro da Cortona to work on the ceiling decorations of the Pitti Palace in Florence. Thereafter he worked chiefly in France as a painter and sculptor. While his work is in the tradition of Roman Baroque, such sculptures as *Milo of Crotona* (c. 1671–82), in which the athlete is attacked by a lion while his hand is caught in a tree stump, show a strain and anguish that suggest the works of Michelangelo.

Puget \'pyü-jət\ **Sound** Arm of the Pacific Ocean indenting northwestern Washington, U.S. It was explored by the British navigator George Vancouver in 1792 and named by him for Peter Puget, a second lieutenant in his expedition, who probed the main channel. It has many deepwater harbours, including Seattle, Tacoma, Everett, and Port Townsend, which are shipping ports for the rich farmlands along the river estuaries. It provides a sheltered area for recreational boating and salmon fishing.

Puglia \'pü-lyä\ *or* **Apulia** \ä-'pü-lyä\ Autonomous *regione*, southeastern Italy. It is located between the Adriatic Sea, the Apennines, and the Gulf of Taranto. It was ruled in the early Middle Ages by Goths, Lombards, and Byzantines and achieved its greatest glory under the Hohenstaufen emperors, especially the 13th-century Holy Roman emperor Frederick II. In 1861 it became part of the Italian kingdom. The region is predominantly agricultural. Wheat, barley, and oats are grown on the plain and in the more fertile parts of the plateaus, while olives, grapes, almonds, figs, and vegetables predominate farther south; tobacco is a specialty of the Lecce Plain. The wines of Puglia are the strongest in Italy and are used to fortify other, lighter varieties. There are chemical and petrochemical industries in Bari and iron and steel plants in Taranto. The capital of Puglia (pop., 2001 prelim.: 3,983,487) is Bari; the region has an area of 7,470 sq mi (19,348 sq km).

Pugwash Conferences Series of international meetings of eminent scientists to discuss problems of nuclear weapons and world security. The first meeting was held in 1957 at the estate of Cyrus Eaton in Pugwash, Nova Scotia. The Pugwash organization was established to convene subsequent conferences to discuss arms control and disarmament; these were held in the Soviet Union, Britain, India, and the U.S., among other countries. The organization and its president and founding member, Joseph Rotblat (born 1908), received the 1995 Nobel Prize for Peace.

puja \'pü-jä\ In Hinduism, a form of ceremonial worship. It may range from brief daily rites in the home to an elaborate temple ritual. A typical *puja* offers the image of a deity the honours accorded to a royal guest. The god is gently roused from sleep, ritually bathed and dressed, served three meals during the day, and ceremonially put to bed. Rituals may also include a sacrifice and oblation to the sacred fire. Some *puja*s are performed by the worshiper alone; others require a ritually pure person. A *puja* may be performed for a specific purpose or simply as an act of devotion.

Pukaskwa \pü-'kas-kwə\ **National Park** National park, central Ontario, Canada. Established in 1971, it is Ontario's largest national park, covering 725 sq mi (1,878 sq km). It includes areas of rugged Canadian Shield wilderness as well as 50 mi (80 km) of the shoreline of northeastern Lake Superior, with rocky islets and coves and spectacular cliffs. Excavations of prehistoric Indian remains have been made. Wildlife includes timber wolf, black bear, mink, lynx, white-tailed deer, moose, and woodland caribou. The park has vast forests of white and black spruce, jack pine, poplar, and birch.

Pulcher, Publius Clodius See Publius Clodius Pulcher

Pulitzer \'pù-lət-sər**, Joseph** (b. April 10, 1847, Makó, Hung.—d. Oct. 29, 1911, Charleston, S.C., U.S.) Hungarian-born U.S. newspaper editor and publisher. He immigrated to the U.S. in 1864 to serve in the American Civil War. After the war he became a reporter and then proprietor at German-language newspapers in St. Louis and entered Missouri politics. In 1878 he merged the *St. Louis Dispatch* (founded 1864) and the *Post* (founded 1875) into the *Post-Dispatch*, which soon became the city's dominant evening newspaper. Shifting his interests to New York City, he purchased the *World* (1883) and founded the *Evening World* (1887). He helped establish the pattern of the modern newspaper by combining exposés of political corruption and crusading investigative reporting with publicity stunts, self-advertising, and sensationalism. In his will he endowed the Columbia University School of Journalism and established the Pulitzer Prizes.

Pulitzer Prize \'pù-lət-sər, 'pyü-lət-sər\ Any of a series of annual prizes awarded by Columbia University for outstanding public service and achievement in American journalism, letters, and music. Fellowships are

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also awarded. The prizes, originally endowed with a gift of $500,000 from Joseph Pulitzer, are highly esteemed and have been awarded each May since 1917 on the recommendation of the Pulitzer Prize Board, composed of judges appointed by the university. The numbers and categories of prizes have varied over the years. Today they include 14 awards in journalism, six in letters, one in music, and four fellowships.

pulley In mechanics, a wheel that carries a flexible rope, cord, cable, chain, or belt on its rim. Pulleys are used singly or in combination to transmit energy and motion. In belt drives, pulleys are attached to shafts at their axes, and power is transmitted between the shafts by means of endless belts running over the pulleys. One or more independently rotating pulleys can be used to gain mechanical advantage, especially for lifting weights. The shafts around which the pulleys turn may attach them to frames or blocks, and a combination of pulleys, blocks, and rope is called a block and tackle. The pulley is considered one of the five simple machines.

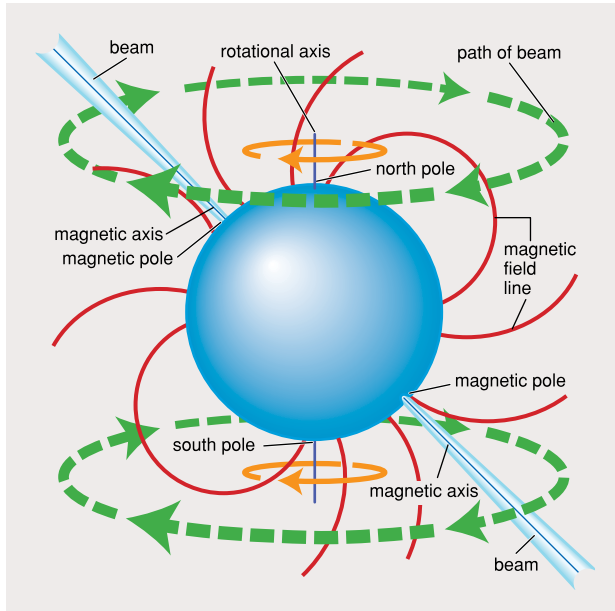
Pullman, George M(ortimer) (b. March 3, 1831, Brocton, N.Y., U.S.—d. Oct. 19, 1897, Chicago, Ill.) U.S. industrialist. He moved to Chicago as a young man and worked as a cabinetmaker for his brother. In 1858 he remodeled two day coaches for a local railroad company into sleeping coaches; eventually he set up his own firm, and the first true Pullman sleeping car appeared in 1865. Becoming wealthy from his invention, in 1867 he founded the Pullman Palace Car Company; the next year he created the first dining car. In 1880 he built the town of Pullman (now incorporated into Chicago) for its workers; a much-discussed social experiment, the town was also the scene of the famous Pullman Strike of 1894.

Pullman Strike (May 11–c. July 20, 1894) Massive railroad strike in the U.S. After financial reversals caused the Pullman Palace Car Co. to cut wages by 25%, local union members called a strike. The company's president, George Pullman, refused arbitration, and union president Eugene V. Debs called for a nationwide boycott of Pullman cars. Sympathy strikes followed in 27 states. Violence broke out in Chicago, Ill., but Gov. John Peter Altgeld refused to intervene. The U.S. attorney general, Richard Olney, obtained an injunction against the strikers for impeding the mail service, and federal troops were called in. Debs's conviction for conspiring against interstate commerce established that the Sherman Antitrust Act could be enforced against labour-unions.

pulmonary alveolus \'půl-mə-ˌner-ē-al-'vē-ə-ləs\ Any of the 300 million or so small air spaces in the lungs where carbon dioxide leaves the blood and oxygen enters it. Alveoli form clusters (alveolar sacs) connected by alveolar ducts to the bronchioles. Their thin walls contain numerous capillaries, supported by a mesh of elastic and collagenous fibres; gas exchange between them occurs by diffusion. A film of fatty substances (surfactant) over the walls reduces surface tension, keeping the alveoli from collapsing and making it easier to expand the lungs. Alveolar macrophages (see leukocyte; lymphoid tissue) act as mobile scavengers, engulfing foreign particles in the lungs.

pulmonary heart disease *or* **cor pulmonale** \ˌkȯr-půl-mə-'näl-ē\ Enlargement and eventual failure of the right ventricle of the heart due to disorders of the lungs or their blood vessels or chest wall abnormalities. Chronic disease is most often caused by chronic bronchitis or emphysema. Symptoms include chronic cough, trouble in breathing after exertion, wheezing, weakness, leg edema, right upper abdominal pain, and neck vein distension. Pressure in the pulmonary artery rises and the right ventricle enlarges in response, leading, if uncorrected, to heart failure. Treatment includes a respirator, low-sodium diet, diuretics, digitalis, and antibiotics for respiratory infection. Acute disease due to pulmonary embolism is often treated by removal of the blockage.

pulsar *in full* **pulsating radio star** Any of a class of cosmic objects that appear to emit extremely regular pulses of radio waves. A few give off short rhythmic bursts of visible light, X rays, and gamma radiation as well. Thought to be rapidly spinning neutron stars, they were discovered by Antony Hewish and Jocelyn Bell Burnell in 1967 with a specially designed radio telescope. More than 550 have been detected since. All behave similarly, but the intervals between pulses (and thus their rotation periods) range from one-thousandth of a second to four seconds. Charged particles from the surface enter the star's magnetic field, which accelerates them so that they give off radiation, released as intense beams from the magnetic poles. These do not coincide with the pulsar's own axis of rotation, so as the star spins, the radiation beams swing around like lighthouse beams and are seen as pulses. Pulsars have been shown to be slowing down, typically by a millionth of a second per year. It has been calculated that pulsars "switch off" after about 10 million years, when their magnetic fields weaken enough.



A pulsar emits two beams of electromagnetic radiation along its magnetic axis. If the magnetic axis is offset from the rotational axis, the beams will sweep out circular paths as the star rotates, instead of remaining in one position. An observer in the path of such a beam will thus detect a periodic pulse of radiation as the beam sweeps by.

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pulse Pressure wave in the arteries from contraction of the heart. It can be felt where arteries are near the skin's surface; it is usually read at the carotid artery in the neck or at the wrist. Its rate, strength, and rhythm and the contour of the wave provide valuable information but must be viewed in context (e.g., rapid pulse occurs with serious heart disease, simple fever, or vigorous exercise). The average adult pulse rate is 70–80 beats per minute; the rate decreases with age and is generally faster in women.

puma See cougar

pumice \'pə-məs\ Very porous, frothlike volcanic glass that has long been used as an abrasive in cleaning, polishing, and scouring compounds. It is also used in precast masonry units, poured concrete, insulation and acoustic tile, and plaster. Pumice is igneous rock that cooled so rapidly there was no time for it to crystallize. When it solidified, the vapours dissolved in it were suddenly released, and the whole mass swelled up into a froth that immediately consolidated. Any type of lava may become pumiceous under favourable conditions.

pump Machine that uses energy to raise, transport, or compress fluids. Pumps are classified by how they transfer energy to the fluid. The basic methods are volume displacement, addition of kinetic energy, and use of electromagnetic force. Pumps in which displacement is accomplished mechanically are called positive displacement pumps. Kinetic pumps pass kinetic energy to the fluid by means of a rapidly rotating impeller (blade). To use electromagnetic force, the fluid being pumped must be a good electrical conductor. Pumps used to transport or pressurize gases are called compressors, blowers, or fans.

pumpkin Fruit of certain varieties of *Cucurbita pepo* or *C. moschata*, of the gourd family. In the U.S., the thick-growing, small-fruited bush, or nontrailing, varieties of *C. pepo* are called squash, and the long-season, long-trailing, large-fruited varieties are called pumpkin. Pumpkins produce very long vines and large (9–18 lb [4–8 kg]), globe-shaped, orange fruits. Giant and miniature varieties are available. The usually lightly furrowed or ribbed rind is smooth, and the fruit stem is hard and woody. Pumpkins mature in early autumn and can be stored for a few months in

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a dry, warm place. They are commonly grown in North America, Britain, and Europe for human food and livestock feed. In Europe pumpkin is served mainly as a vegetable; in the U.S. and Canada pumpkin pie is a traditional Thanksgiving and Christmas dessert. Pumpkins are used in the U.S. for HALLOWEEN decorations.

Punch Hooknosed, humpbacked character in MARIONETTE and puppet shows (see PUPPETRY). Adapted from a stock character of the COMMEDIA DELL'ARTE, the puppet character was taken to France and England by Italian puppeteers in the 1660s. By 1700 every English puppet show featured Punch (from Punchinello) and his wife, Judy. As marionettes became less popular in the 1790s, smaller glove puppets were used in the popular Punch-and-Judy play. The hooked nose and the brutal, vindictive, and deceitful behaviour of the English Punch were established characteristics by the 19th century. In France his popularity declined during the 19th and 20th centuries, and he disappeared there as a comic figure. Puppeteers in England have carried on the tradition of Punch-and-Judy shows.

Punch English illustrated periodical published 1841–1992 and revived in 1996 with a revised format. Initially a weekly radical paper, it became famous for its satiric humour, caricatures, and cartoons. Among its famous early staff members were WILLIAM THACKERAY and JOHN TENNIEL. A cover drawing by Richard Doyle was used continuously from 1849 to 1956, when each issue's cover was made different, though the traditional figures of Punch and his dog Toby usually appeared somewhere.

punch press MACHINE TOOL that changes the size or shape of a piece of material, usually sheet metal, by applying PRESSURE to a DIE in which the workpiece is held. The form and construction of the die determine the shape produced on the workpiece. A punch press has two components: the punch, which is attached to the reciprocating (back and forth, or up and down) ram (plunger) of the machine; and the die, which is clamped onto a bed or anvil whose flat surface is perpendicular to the path of the ram. The punch pushes against the workpiece, which is held in the die. Punch presses are usually driven by electric motors. See also HYDRAULIC PRESS.

punctuation Standard set of marks used in written and printed texts to clarify meaning and to separate sentences, words, and parts of words. It often marks discourse features such as intonational contours and pauses. It may also convey information about a word (e.g., hyphens in compound words) unrelated to speech patterns. In English, the period (.) marks the end of a sentence or an abbreviation. The comma (,) usually separates clauses, phrases, or items in a series. The colon (:) often introduces an explanation or series of examples. The semicolon (;) usually separates independent clauses. The em-dash (—) marks an abrupt transition. The exclamation point (!) signals surprise. The question mark (?) signals a question. The apostrophe (') marks the possessive case or the omission of letters. Quotation marks (" ") set off either quoted words or words used with special significance. Interpolations in a sentence are marked by brackets ([ ]) or parentheses ( ).

Punctation of Olmütz See OLMÜTZ, PUNCTATION OF

Pune \'pü-nə\ *formerly* **Poona** City (pop., 2001 prelim.: city, 2,540,069; metro. area, 3,755,525), western India. Called "Queen of the DECCAN," it is the cultural capital of the Maratha peoples (see MARATHA CONFEDERACY). It first gained importance as the capital of the Bhonsle Marathas in the 17th century. Temporarily captured by the Mughals, it again became the Maratha capital from 1714 until 1817, when it fell to the British. It served as the seasonal capital of the Bombay presidency, and its mild weather has made it a popular tourist resort. It is a major educational centre and headquarters of the Indian army's southern command; it is ringed by a sprawling complex of industrial suburbs.

Punic Wars \'pyü-nik\ *or* **Carthaginian Wars** Three wars (264–241 BC, 218–201, 149–146) between Rome and CARTHAGE. The first concerned control of Sicily and of the sea lanes in the western Mediterranean; it ended with Rome victorious but with great loss of ships and men on both sides. In 218 HANNIBAL attacked Roman territory, starting from Spain and marching overland into Italy with troops and elephants. After an initial Carthaginian victory, FABIUS MAXIMUS CUNCTATOR harassed him wherever he went without offering battle. Abandoning this tactic resulted in a major Roman loss at the Battle of CANNAE (216); that defeat drew the Romans together and, though worn down, they managed to rally, eventually defeating Hannibal and driving him out of Italy (203). The Third Punic War was essentially the siege of Carthage; it led to the destruction of Carthage, the enslavement of its people, and Roman hegemony in the western Mediterranean. The Carthaginian territory became the Roman province of Africa.

Punjab \ˌpən-'jäb\ State (pop., 2001 prelim.: 24,289,296), northwestern India. Bordered by PAKISTAN and the states of JAMMU AND KASHMIR, HIMACHAL PRADESH, HARYANA, and RAJASTHAN, it occupies an area of 19,445 sq mi (50,362 sq km). The city of CHANDIGARH is the joint administrative capital of Punjab and Haryana. In the 18th century the Sikhs (see SIKHISM) built a powerful kingdom in the Punjab, which came under British rule in 1849. In 1947 the area was split between the new nations of India and Pakistan, the smaller eastern portion going to India. It is the only Indian state with a majority of Sikhs. Hindus make up about one-third of the population, and there are smaller minorities of Christians, Jains, and Muslims. The economy is based on agriculture and small- and medium-scale industry.

Punjabi \ˌpən-jä-bē\ **language** *or* **Panjabi language** Indo-Aryan language of the Punjab in India and Pakistan. Punjabi has about 26 million speakers in India and more than 60 million in Pakistan—nearly half the population of the latter—but linguists have sometimes considered the dialects of southwestern, western, and northern Punjab province in Pakistan a different language. Inhabitants of southern Punjab province have agitated for consideration of their speech, Siraiki (with more than 12 million speakers), as a distinct language, though Siraiki and Punjabi are mutually intelligible.

punk Aggressive form of ROCK MUSIC that coalesced into an international (though predominantly Anglo-American) movement in 1975–80. Originating in the countercultural rock of artists such as the Velvet Underground and Iggy (Pop) and the Stooges, punk rock evolved in New York City in the mid-1970s with artists such as Patti Smith and the Ramones. It soon took root in London—where distinctly "punk" fashions, including spiked hair and ripped clothing, were popularized—with bands such as the Sex Pistols and the Clash, and later in California, with X, Black Flag, and the Dead Kennedys. It is often marked by a fast, aggressive beat, loud guitar with abrupt chord changes, and nihilistic lyrics. Variants include new wave (more pop-oriented and accessible) and hardcore (characterized by brief, harsh songs played at breakneck speed); the latter continued to thrive through the 1990s.

Punnett \'pən-ət**, Reginald Crundall** (b. June 20, 1875, Tonbridge, Kent, Eng.—d. Jan. 3, 1967, Bilbrook, Somerset) British geneticist. Through contact with WILLIAM BATESON he came to support the theories of GREGOR MENDEL, and in 1905 he published the first textbook on Mendelian genetics. Using poultry and sweet peas, Punnett and Bateson discovered some of the fundamental processes of Mendelian genetics, including linkage, sex determination, sex linkage, and the first example of nonsexual chromosome linkage. Punnett demonstrated the value of using sex-linked plumage-colour factors to distinguish male from female chickens, making possible early identification of the less valuable males, a process now known as autosexing.

Punt \'pünt\ In ancient Egyptian and Greek geography, the southern coast of the RED SEA and adjacent coasts of the Gulf of ADEN, corresponding to modern coastal Ethiopia and Djibouti. Visited by Egyptian expeditions as early as 2200 BC, it was a place of ancient legend and fable and Egypt's source for incense, ivory, and ostrich feathers. During the reign of Queen HATSHEPSUT, an expedition was sent to Punt, and the queen had the details of the journey recorded on the walls of the Deir el-Bahri temple near THEBES. Only in the late 4th century BC were the trade routes to Punt opened to the Greeks.

pupa \'pyü-pə\ Inactive, nonfeeding stage in the life of insects that undergo complete METAMORPHOSIS. In a protective covering (cocoon or chrysalis), the LARVA is transformed into an adult. During pupation, a process controlled by hormones, larval structures break down and adult structures form; wings appear for the first time. The adult emerges either by splitting the pupal skin and chewing its way out or by secreting a fluid that softens the cocoon.

puppetry Art of creating and manipulating puppets in a theatrical show. Puppets are figures that are moved by human rather than mechanical aid. They may be controlled by one or several puppeteers, who are screened from the spectators. Varieties include glove (or hand) puppets, rod puppets, shadow puppets, and MARIONETTES (or string puppets). Puppetry had its beginnings in tribal society and has been part of every civilization. By the 18th century it was so popular in Europe that permanent theatres were

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built for the usually itinerant puppeteers. Companies presented favourite stories of the French Guignol, the Italian Arlecchino, the German Kasperle, and the English Punch and Judy. By the mid 20th century puppetry had reached television with Jim Henson's Muppets. See also bunraku; Sergey Obraztsov.

Puracé \ˌpü-rä-ˈsā\ **National Park** National park, southwestern Colombia. Established in 1961, its main feature is the active Puracé Volcano, which is located just southeast of the city of Popayán and reaches an elevation of 15,603 ft (4,756 m). The park covers 320 sq mi (830 sq km) and is home to the spectacled bear and the pudu, a small deer that is about 12 inches (30 cm) tall.

Purana \pù-ˈrä-nə\ In Hinduism, an encyclopaedic collection of myth, legend, and genealogy. A *Purana* traditionally treats five subjects: primary creation of the universe, secondary creation after periodic annihilation, genealogy of gods and saints, grand epochs, and histories of the royal dynasties. Written in narrative couplets, the *Purana*s date from c. 400 to c. 1000. The 18 principal surviving *Purana*s are grouped according to whether they exalt Vishnu, Shiva, or Brahma. Most popular is the *Bhagavata Purana*, which treats the early life of Krishna.

Purari River River, eastern central New Guinea. Rising in the central highlands of Papua New Guinea, it flows about 290 mi (470 km) to the Gulf of Papua of the Coral Sea. Its lower course divides into five main channels that lace through a well-settled swampy delta. It is navigable for about 120 mi (190 km). Although found and partially charted in 1887, the river system was not fully traced until the 1930s.

Purcell \ˈpər-səl**, Henry** (b. c. 1659, London, Eng.—d. Nov. 21, 1695, London) British composer. Little is known of his origins, but he was in the Chapel Royal choir from boyhood, and he probably studied with Pelham Humfrey (1647–74) and John Blow (1649–1708). His first known composition was written at age eight. When his voice changed, he assisted in keeping the royal instruments in repair and tuning the Westminster Abbey organ. He became organist there in 1679 and at the Chapel Royal in 1682. He wrote music in a number of genres. His opera *Dido and Aeneas* (1689) is notable for achieving a high degree of dramatic intensity within a narrow framework. This he followed with the "semi-operas" *King Arthur* (1691), *The Fairy Queen* (1692), and *The Indian Queen* (1695). He also wrote much incidental music, some 250 songs, 12 fantasias for viol consort, and many anthems and services. He is regarded as the greatest English composer after William Byrd and before the 20th century.

purdah Seclusion of women from public observation by means of concealing clothing (including the veil) and walled enclosures as well as screens and curtains within the home. The custom seems to have originated in Persia and was adopted by Muslims during the Arab conquest of what is now Iraq in the 7th century. The Muslim domination of northern India led to its adoption by the Hindu upper classes, but it was discarded by Hindus after the end of British rule in India. The custom of purdah still continues in many Islamic countries.

pure culture In microbiology, laboratory culture containing a single species of organism. A pure culture is usually derived from a mixed culture (containing many species) by methods that separate the individual cells so that, when they multiply, each will form an individually distinct colony, which may then be used to establish new cultures with the assurance that only one type of organism will be present. Pure cultures may be more easily isolated if the growth medium of the original mixed culture favours the growth of one organism to the exclusion of others.

Pure Land Buddhism Devotional cult of the buddha Amitabha. It is one of the most popular forms of Mahayana Buddhism in East Asia today. Pure Land schools believe that rebirth in the Western Paradise (the Pure Land) is given to all those who invoke Amitabha's name with sincere devotion. In China the Pure Land cult can be traced back to the 4th century, when the scholar Huiyuan (333–416) formed a society of monks and laymen who meditated on the name of Amitabha. His successors systematized and spread the doctrine in the 6th–7th century. The Pure Land teaching was transmitted to Japan by monks of the Tiantai school.

purgatory In Roman Catholic doctrine, the condition of those who have died in a state of grace but have not been purged of sin. These remaining sins include unforgiven venial sins or forgiven mortal sins. Souls burdened by such sins must be purified before entering heaven. The church also teaches that souls in purgatory may be aided by efforts of the living faithful through prayers, almsgiving, indulgences, and other works. The existence of purgatory has been denied as unbiblical by Protestant churches and most Eastern Orthodox churches.

purge trials Soviet trials of critics of Joseph Stalin. After the assassination of Sergey Kirov, prominent Bolsheviks were accused of conspiracy to remove Stalin from power. In three widely publicized show trials (1936–38), which presented confessions obtained under torture or fabricated by the secret police, the accused were found guilty and executed or sent to prison. Numerous closed, unpublicized trials of Soviet military leaders were also held and resulted in a massive purge throughout the armed forces. The trials eliminated such potential rivals and critics of Stalin as Nikolay Bukharin, Lev Kamenev, Aleksey Rykov, Mikhayl Tukhachevsky, Genrikh Yagoda, and Grigory Zinovyev but earned worldwide condemnation.

Purim \ˈpůr-im, pů-ˈrēm\ Jewish festival celebrating the survival of the Jews marked for death in Persia in the 5th cent BC. According to the Book of Esther, Haman, chief minister of King Ahasuerus, planned a general massacre of the Jews and set the date by casting lots. Ahasuerus' wife Esther interceded for the Jews, and they were allowed to attack their enemies. The ritual observance begins with a day of fasting on the 13th of Adar (in February or March), the day before the actual holiday. The Book of Esther is read in the synagogue, and Jews are enjoined to exchange gifts and make donations to the poor. Purim is a day of merrymaking and feasting.

purine \ˈpyůr-ˌēn\ Any of a class of heterocyclic compounds with a two-ring structure composed of carbon and nitrogen atoms. The simplest member, purine itself ($C_5H_4N_4$), is not common, but its derivatives with the structure are. Examples are uric acid, caffeine, and two of the nucleotides in nucleic acids, guanine and adenine.

Puritan Revolution See English Civil Wars

Puritanism Movement in the late 16th and 17th century that sought to "purify" the Church of England, leading to civil war in England and to the founding of colonies in North America. Many Puritans joined the Parliamentary party during the English Civil War and gained considerable power, but after the Restoration they were once again a dissenting minority. Believing themselves chosen by God to revolutionize history, some Puritans founded settlements in America (see Pilgrims), notably the Massachusetts Bay Colony. The Puritans of Massachusetts emphasized the conversion experience, by which the elect experienced the descent of grace. In their theocracy only the elect were allowed to vote and rule, though the privileges of church membership were extended to all baptized and orthodox persons.

Purkinje \pər-ˈkin-jē**, Jan Evangelista** (b. Dec. 17, 1787, Libochovice, Bohemia—d. July 28, 1869, Prague, Czech.) Czech experimental physiologist. He discovered the Purkinje effect (as light decreases, red objects appear to fade faster than blue ones), Purkinje cells (large branching neurons in the cerebellum), and Purkinje fibres (which conduct impulses from the natural pacemaker throughout the heart). At Breslau he created the world's first independent physiology department and first official physiology laboratory. He introduced the term *protoplasm*, devised new methods for preparing microscope samples, discovered the skin's sweat glands and the nucleus of the unripe ovum, recognized the uniqueness of fingerprints, and noted that pancreatic extracts digest protein.

Purkinje
CTK/CZECHOSLOVAK NEWS AGENCY

purpura \ˈpər-pə-rə\ Presence of hemorrhages in the skin, often associated with bleeding from natural cavities and in tissues. Major causes include damage to small artery walls (as in vitamin deficiency or allergic reaction) and platelet deficiency (in association with such disorders as lupus erythematosus and as a complication of leukemia or chemotherapy).

Purus \pü-ˈrüs\ **River** River, northwest-central South America. It rises in Peru and flows generally northeast through the rainforests of Peru and Brazil in one of the world's most meandering courses. In Brazil it joins

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the stretch of the Amazon River upstream from Manaus known as the Solimões River. At its mouth it divides into numerous branches. Most of its 1,995-mi (3,211-km) course is navigable, as are the many lakes formed near its shores. Rubber is gathered from forests along its course.

purusha See prakriti and purusha

Pusan \'pü-ˌsän\ *or* **Busan** City (pop., 2003 est.: 3,747,369) and port, South Korea, at the southeastern tip of the Korean peninsula. Pusan was opened to Japanese trade in 1876 and to general foreign trade in 1883. It developed into a major port under Japanese rule (1910–45). It served as the country's temporary capital during the Korean War. Pusan is South Korea's largest port and second largest city. Administratively, it has the status of a metropolitan city equal to that of a province. Industries include shipbuilding and manufacturing. Hot springs are located in the northeastern suburbs.

Pushkin, Aleksandr (Sergeyevich) (b. June 6, 1799, Moscow, Russia—d. Feb. 10, 1837, St. Petersburg) Russian writer. Born into an aristocratic family, Pushkin began his literary career while still a student at the Imperial Lyceum at Tsarskoye Selo (later renamed Pushkin). His first major work was the romantic poem *Ruslan and Ludmila* (1820). With his political verses and epigrams, he became associated with a revolutionary movement that culminated in the unsuccessful Decembrist revolt of 1825. Banished to several provincial locations, he produced a cycle of romantic narrative poems that confirmed him as the leading Russian poet of the day and the leader of the Romantic generation of the 1820s. He also worked on his important historical tragedy, *Boris Godunov* (1831), and his central masterpiece, the novel in verse *Eugene Onegin* (1833). After Nicholas I allowed him to return to Moscow in 1826, Pushkin abandoned his revolutionary sentiments, turning to the figure of Peter the Great in poems such as *The Bronze Horseman* (1837). Other works from this period include the classic short story "The Queen of Spades" (1834) and the drama *The Stone Guest* (1839). In his late works the motif of peasant rebellion is prominent. The object of suspicion in court circles, he died at age 37 after being forced into a duel. He is often considered his country's greatest poet and the founder of modern Russian literature.

Putin \'pü-tyin**, Vladimir (Vladimirovich)** (b. Oct. 7, 1952, Leningrad, U.S.S.R.) Russian president (from 1999). Putin served 15 years with the KGB, including six years in Dresden, East Ger. In 1990 he retired from active KGB service and returned to Russia to become prorector of Leningrad State University, and by 1994 he had risen to the post of first deputy mayor of the city. In 1996 he moved to Moscow, where he joined the presidential staff as deputy to Pavel Borodin, the Kremlin's chief administrator. In July 1998 President Boris Yeltsin made Putin director of the Federal Security Service (the KGB's domestic successor). In 1999 Yeltsin appointed Putin prime minister, and on December 31 of that year Yeltsin stepped down as president in Putin's favour. Three months later Putin won a resounding electoral victory, partly the result of his success in the battle to keep Chechnya from seceding. In his first term he asserted central control over Russia's 89 regions and republics and moved to reduce the power of Russia's unpopular financiers and media tycoons. The period was also marked by frequent terrorist attacks by Chechen separatists. Putin easily won reelection in 2004.

Putnam, Hilary (b. July 31, 1926, Chicago, Ill., U.S.) U.S. philosopher. After receiving his Ph.D. in 1951 he taught at Northwestern University, Princeton University, the Massachusetts Institute of Technology, and Harvard. Early in his career he was a defender of scientific realism. In the 1960s he extended the causal theory of reference to natural-kind and other scientific terms. He is known as the originator of functionalism in the philosophy of mind, though he later rejected that approach (see philosophy of language). Beginning in the mid-1970s he gradually abandoned his earlier scientific realism in favour of a pragmatically oriented view he called "internal realism." According to this view, scientific theories are not true absolutely but only relative to large-scale conceptual schemes. Among his many works are *Philosophical Papers* (3 vol., 1975–83), *Reason, Truth, and History* (1981), and *Pragmatism* (1995).

Putnam, Israel (b. Jan. 7, 1718, Salem Village, Mass.—d. May 29, 1790, Pomfret, Conn., U.S.) American Revolutionary army officer. He was a prosperous farmer in Connecticut from 1740. He served throughout the French and Indian War and rose to the rank of lieutenant colonel in 1759. Appointed a major general in the Continental Army in 1775, he fought with distinction at Bunker Hill, but his troops were defeated at the Battle of Long Island. He was charged with the defense of the Hudson highlands but abandoned Fort Montgomery and Fort Clinton to the British. He served in lesser commands until suffering a stroke in 1779.

Putnam, Rufus (b. April 9, 1738, Sutton, Mass.—d. May 4, 1824, Marietta, Ohio, U.S.) American Revolutionary army officer. A cousin of Israel Putnam, he fought in the French and Indian War. Entering the Continental Army in 1775, he organized fortifications in Boston and New York (1776–77) and at West Point (1778), and he fought at the Battle of Saratoga. In 1783 he was promoted to brigadier general. After the war he helped found the Ohio Company of Associates to obtain a land grant for settlement by war veterans; he led the group that founded Marietta, Ohio (1788). From 1796 to 1803 he was U.S. surveyor general.

putting-out system See domestic system

Putumayo \ˌpü-tü-'mä-yō\ **River** River, northwestern South America. Rising in southwestern Colombia, it is about 980 mi (1,575 km) long and flows southeast through tropical rainforests, where it forms a large section of the border between Peru and Colombia. It crosses the border into Brazil, where it is known as the Içá and empties into the Amazon River. It is navigable for almost its entire length and is a major transport route, especially for the rubber produced in the region.

Puvis de Chavannes \pyē-'vē-də-shå-'vän**, Pierre (-Cécile)** (b. Dec. 14, 1824, Lyon, France—d. Oct. 24, 1898, Paris) French painter. He studied briefly with Eugène Delacroix in Paris and exhibited regularly at the Paris Salons. He is best known for his large canvas paintings for the walls of public buildings in Paris, including the Pantheon (1874–78, 1893–98), the Sorbonne (1889–91), and the Hôtel de Ville (1891–94), as well as the museum in Amiens (1880–82). He also decorated the staircase of the Boston Public Library (1895–96). His works are usually idealized depictions of antiquity or allegorical representations of abstract themes, in simplified forms and pale, flat, frescolike colours. The leading French mural painter of the later 19th century, he exerted a strong influence on the Post-Impressionists.

The Poor Fisherman, oil on canvas by Pierre Puvis de Chavannes, 1881; in the Louvre, Paris.
COURTESY OF THE MUSEE DU LOUVRE, PARIS; PHOTOGRAPH, MARC GARANGER

PVC *in full* **polyvinyl chloride** Synthetic resin, an organic polymer made by treating vinyl chloride monomers with a peroxide. It may be blended with more rubbery polymers or copolymerized with other vinyls to obtain products with desired properties. PVC resin mixed with plasticizers (see Waldo Semon), stabilizers, and pigments is made into flexible articles (e.g., raincoats, toys, containers). Nonplasticized resin has been used for rigid products (e.g., water pipes, plumbing fittings, phonograph records). Concern over leaching of vinyl chloride into foods has resulted in restrictions on its use in food containers; its decomposition into hydrogen chloride when burned has also raised concerns. Today it is produced in larger quantities than any other plastic except polyethylene.

Pydna \'pid-nə**, Battle of** (June 22, 168 BC) Decisive confrontation in the Roman victory over Perseus and Macedonia in the Third Macedonian

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War. It took place on a plain near Pydna (present-day Kítros, Greece). The Roman general Lucius Paullus (b. c. 229–d. 160 BC) adroitly outmaneuvered the Macedonians; their phalanx was penetrated by the Roman legions, whose short swords were more effective than the Macedonian pikes. When defeat was imminent, Perseus fled. The Romans ended the Macedonian monarchy and divided the country into four republics.

pyelonephritis \ˌpī-ə-lō-ni-ˈfrī-təs\ Infection (usually bacterial) and inflammation of kidney tissue and the renal pelvis. Acute pyelonephritis is usually localized and may have no apparent cause. Symptoms include fever, chills, lower-back pain, and bacteria and white blood cells in the urine. Treatment with antibiotics requires one to three weeks. Scar tissue forms, but kidney function is usually not impaired. Chronic pyelonephritis results from repeated bacterial infections, which may have no symptoms but destroy more and more tissue over years. If it is diagnosed before too much function is lost, surgery may help, but uremia, severe infections, and heart and blood-vessel disorders can lead to death. Dialysis or kidney transplant sometimes prolongs life.

Pygmalion In Greek mythology, a king of Cyprus who fell in love with a statue of Aphrodite. The goddess took pity on him and brought the statue to life, and he married her. In some versions of the myth Pygmalion was a sculptor who carved the statue himself because he was disgusted with the faults of ordinary women, and when it was brought to life he gave it the name Galatea.

Pygmy Member of any human group whose adult males grow to less than 59 in. (150 cm) in average height. The name is also sometimes loosely applied to the San of southern Africa and the so-called Negrito peoples of Asia (such as the Philippine Ilongot). Besides their short stature, Pygmies are notable in having the highest basal-metabolism rate in the world and a high incidence of sickle-cell anemia. The Bambuti of the Ituri Forest are a well-studied example. See also race.

Pyle \ˈpīl**, Ernie** *orig.* **Ernest Taylor Pyle** (b. Aug. 3, 1900, near Dana, Ind., U.S.—d. April 18, 1945, le Shima, Ryukyu Islands) U.S. journalist. Pyle left Indiana University to become a reporter for a small-town newspaper. Later he acquired a roving assignment for the Scripps-Howard newspaper chain; his experiences provided material for a column that appeared in as many as 200 newspapers before World War II. His reporting of the campaigns in North Africa, Sicily, Italy, and France won a Pulitzer Prize in 1944. He was killed by Japanese machine-gun fire during the Okinawa campaign. Compilations of his columns include *Ernie Pyle in England* (1941), *Brave Men* (1944), and *Last Chapter* (1946).

pylon \ˈpī-ˌlän\ (Greek: "gateway") In modern construction, a tower that gives support, such as the steel towers between which electrical wires are strung or the piers of a bridge. Originally, pylons were monumental gateways to ancient Egyptian temples, either a pair of tall truncated pyramids with a doorway between them or a masonry mass pierced by a doorway.

Pym \ˈpim**, John** (b. 1583/84, Brymore, Somerset, Eng.—d. Dec. 8, 1643, London) English politician. As a member of Parliament (1621–43), he soon became an expert on finances and colonial affairs. He was an architect of Parliament's victory over Charles I in the first phase of the English Civil Wars. He helped form the system of taxation that survived in England until the 19th century. His skill as a parliamentary tactician preserved the unity of Parliament and led to close relations between the government and the city of London.

Pynchon \ˈpin-chən**, Thomas** (b. May 8, 1937, Glen Cove, Long Island, N.Y., U.S.) U.S. writer. He studied physics at Cornell University and worked briefly as a technical writer before devoting himself to fiction. Beginning with his first novel, *V* (1963), a complex, cynically absurd tale that juxtaposes scenes of 1950s hipster life with symbolic images of the entire century, his works have combined black humour and fantasy to depict human alienation in the chaos of modern society. The idea of conspiracy is central to *The Crying of Lot 49* (1966) and to his masterpiece, *Gravity's Rainbow* (1973), an extraordinary novel about the end of World War II, full of paranoid fantasy, grotesque imagery, and esoteric scientific and anthropological material. Later works include the novels *Vineland* (1990) and *Mason & Dixon* (1997) and the story collection *Slow Learner* (1984). He has lived in hiding or incognito for decades, refusing to grant interviews or be photographed.

P'yŏngyang \ˌpyəŋ-ˈyaŋ\ City (pop., 2003 est.: 3,164,000), capital of North Korea, on the Taedong River. Founded in 1122 BC according to legend, it is said to be the oldest city in Korea. In 108 BC the Chinese established a trading colony there. It was the capital of the Koguryŏ kingdom (AD 427–668), then was captured by Chinese invaders. It fell to the Japanese in 1592 and was devastated by the Manchus in the early 17th century. Much of it was destroyed during the Sino-Japanese War (1894–95). During the Japanese occupation of Korea (1910–45), it was built up as an industrial city. Captured by UN forces during the Korean War in 1950, it was retaken by Chinese communist troops. After 1953 it was rebuilt with Soviet and Chinese aid. It is a centre of heavy industry and transportation.

pyramid Ancient monumental structure constructed of or faced with stone or brick and having a rectangular base and four sloping triangular sides meeting at an apex. Pyramids have been built at various times and places; the best-known are those of Egypt and of Central and South America. The pyramids of ancient Egypt were royal tombs. Each contained an inner sepulchral chamber that housed the deceased (usually mummified) ruler, members of his entourage, and artifacts. The rest of the pyramid complex consisted of a large enclosure, an adjacent mortuary temple, and a causeway leading down to a pavilion. About 80 royal pyramids survive in Egypt, the greatest being those at Giza. American pyramids include the pyramids of the Sun and Moon at Teotihuacán, the Castillo at Chichén Itzá, and various Inca and Chimú structures in Andean settlements. These pyramids were generally built of earth and faced with stone; they are typically stepped pyramids and are topped by a platform or temple structure used for rituals, including human sacrifice.

Pyramus and Thisbe \ˈpir-ə-məs...ˈthiz-bē\ Hero and heroine of a Babylonian love story related in Ovid's *Metamorphoses*. Their parents forbade them to meet, so they communicated through a hole in the wall between their two houses before at last deciding to run away together. They agreed to meet at a mulberry tree. Arriving first, Thisbe was scared away by a lion, which shredded the veil she dropped when she fled. Pyramus, finding the veil, believed her dead and stabbed himself; she returned and, finding Pyramus dying, killed herself. The fruit of the mulberry tree, white until then, was stained dark purple by the lovers' blood.

Pyrenees \ˈpir-ə-ˌnēz\ Mountain range, southwestern Europe. It extends 270 mi (430 km) from the Mediterranean Sea to the Bay of Biscay on the Atlantic Ocean. The Pyrenees form a high wall between France and Spain; generally, the crest of the range marks the boundary between the two countries. The tiny, autonomous principality of Andorra lies among the range's peaks. The highest point is Aneto Peak, elevation 11,169 ft (3,404 m). There are few passes through the mountains. The pass at Roncesvalles was made famous in the 12th-century *La* Chanson de Roland, based on the 778 Battle of Roncesvalles (Roncevaux).

Pyrenees, Treaty of the (November 7, 1659) Peace treaty between France and Spain. From the end of the Thirty Years' War (1648) until 1659, Spain and France fought almost continuously. When Philip IV of Spain did not receive the expected Habsburg support against France, he concluded a peace settlement that ceded border regions to France. The treaty also involved a marriage compact between Louis XIV and the Spanish infanta Maria Teresa, which established Louis as the most powerful monarch in Europe.

pyrethrum \pī-ˈrē-thrəm\ Any of certain plant species of the genus *Chrysanthemum* (see chrysanthemum) native to South Asia, whose aromatic flower heads, when powdered, constitute the active ingredient in the insecticide pyrethrin (or pyrethrum). The concentrations of pyrethrum powder used in insecticides are nontoxic to plants and higher animals; these insecticides therefore find wide use in household and livestock sprays as well as in dusts for edible plants. The typical species, the perennial *C. coccineum*, also is the florists' pyrethrum, or painted lady. Large petals of a deep rose colour surrounding the yellow centre, or disk, are borne on long simple stems above the crown of finely cut leaves.

pyridine \ˈpir-ə-ˌdēn\ Any of a class of aromatic compounds with a six-member aromatic ring composed of five carbon atoms and one nitrogen atom, making it a heterocyclic compound. The simplest one is pyridine itself (C_5H_5N). Natural compounds with pyridine rings include niacin and pyridoxine (see vitamin B complex), the tuberculosis drug isoniazid, and several plant products (e.g., nicotine). Pyridine is used as a raw material for various drugs, vitamins, and fungicides and as a solvent. Because it has a nauseating odour and a burning taste, it is added to ethanol and antifreezes to make them undrinkable (see denaturation).

pyrimidine \pə-ˈrim-ə-ˌdēn\ Any of a class of heterocyclic compounds with a ring structure of four carbon and two nitrogen atoms. The simplest

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member, pyrimidine itself ($C_4H_4N_2$), is not common, but derivatives with the structure are. Examples include THIAMINE (vitamin B_1), several SULFA DRUGS, BARBITURATES, and three of the bases in NUCLEIC ACIDS (CYTOSINE, THYMINE, and URACIL).

pyrite \'pī-ˌrīt\ *or* **iron pyrite** *or* **fool's gold** Naturally occurring, gold-coloured iron disulfide mineral. Pyrite has frequently fooled prospectors into thinking they had discovered gold. Pure pyrite (FeS_2) contains 47% iron and 53% sulfur, by weight. Pyrite is used commercially as a source of SULFUR, particularly for the production of sulfuric acid. Because there are much better sources of iron, it is not generally used as an iron ore. For many years Spain was the largest producer; other countries include Japan, the U.S., Canada, Italy, Norway, Portugal, and Slovakia.

pyrometer \pī-'rä-mə-tər\ Instrument for measuring relatively high TEMPERATURES, as in furnaces. Most pyrometers work by measuring RADIATION from the body whose temperature is to be measured (radiation devices have the advantage of not having to touch the material being measured). Optical pyrometers measure the temperature of glowing bodies by comparing them visually with an incandescent filament of known temperature whose temperature can be adjusted. In resistance pyrometers, a fine wire is put in contact with the object; the instrument converts the change in electrical resistance caused by heat to a reading of the temperature of the object.

pyroxene \pī-'räk-ˌsēn\ A group of important rock-forming SILICATE MINERALS of variable composition, among which calcium-, magnesium-, and iron-rich varieties predominate. Common pyroxenes belong to either the low-calcium enstatite-(ortho)ferrosilite series, $(Mg,Fe)SiO_3$, or the high-calcium diopside-hedenbergite series, $Ca(Mg,Fe)Si_2O_6$. Rare pyroxenes include JADEITE, AEGIRINE, and johannsenite. See also ENSTATITE.

pyroxenite \pī-'räk-sə-ˌnīt\ Dark medium- to coarse-grained igneous rock that consists chiefly of PYROXENE. Accessory minerals include HORNBLENDE, BIOTITE, or OLIVINE. Pyroxenites are not abundant.

pyrrhotite \'pir-ə-ˌtīt\ Iron SULFIDE MINERAL in which the ratio of iron to sulfur atoms is somewhat variable but is always slightly less than 1. It commonly is found in association with other sulfides. The variety troilite, with a composition near that of iron sulfide (FeS), is an important constituent of some meteorites.

Pyrrhus \'pir-əs\ (b. 319—d. 272 BC, Argos, Argolis) King of Hellenistic EPIRUS. After being allied to DEMETRIUS and taken hostage, he was befriended by PTOLEMY I SOTER and restored to his kingdom. In 281 he was asked for help against Rome by the Greek enclave of Tarentum (TARANTO) and won costly victories at Heraclea and Ausculum. Crossing to Sicily, he conquered most of the Punic territory, but the Greek Sicilians revolted against his despotism. He suffered serious losses on his return to Italy (275) but defeated ANTIGONUS II GONATAS in Macedonia (274) and became king there. He died in a skirmish in Argos trying to help Sparta. His costly victories gave rise to the term "Pyrrhic victory."

Pythagoras \pə-'tha-gə-rəs\ (b. c. 580 BC, Samos, Ionia—d. c. 500, Metapontum, Lucania) Greek philosopher and mathematician. He established a community of followers in Croton who adhered to a way of life he prescribed. His school of philosophy reduced all meaning to numerical relationships and proposed that all existing objects are fundamentally composed of form and not material substance. The principles of PYTHAGOREANISM, including belief in the immortality and reincarnation of the soul and in the liberating power of abstinence and asceticism, influenced the thought of PLATO and ARISTOTLE and contributed to the development of mathematics and Western rational philosophy. The proportions of musical intervals and SCALES were first studied by Pythagoras, and he was the first influential Western practitioner of VEGETARIANISM. None of his writings survive, and it is difficult to distinguish the ideas he originated from those of his disciples. His memory is kept alive partly by the PYTHAGOREAN THEOREM, probably developed by his school after he died.

Pythagorean \pə-ˌtha-gə-'rē-ən\ **theorem** Rule relating the lengths of the sides of a right triangle. It says that the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse (the side opposite the right angle). That is, $a^2 + b^2 = c^2$, where c is the length of the hypotenuse. Triads of whole numbers that satisfy it (e.g., 3, 4, and 5) are called Pythagorean triples. See also LAW OF COSINES; LAW OF SINES.

Pythagoreanism \pə-ˌtha-gə-'rē-ə-ˌni-zəm\ Philosophical school, probably founded by PYTHAGORAS c. 525 BC. It originated as a religious brotherhood or an association for the moral reformation of society; brothers were sworn to strict loyalty and secrecy. The brotherhood had much in common with the Orphic communities (see ORPHISM), which sought by rites and abstinence to purify the believer's soul and enable it to escape from the "wheel of birth." Pythagoreanism held that reality, at its deepest level, is mathematical, that philosophy can be used for spiritual purification, that the soul can rise to union with the divine, and that certain symbols have mystical significance. It was the first important Western system of thought to advocate vegetarianism. The school became extinct in the mid-4th century.

Pythian \'pi-thē-ən\ **Games** In ancient Greece, various athletic and musical competitions held in honour of APOLLO, chiefly those at DELPHI. The games were held from before the 5th century BC to the 4th century AD. They took place in August of the third year of each Olympiad (the four-year period between OLYMPIC GAMES). Events were similar to those of the ancient Olympics.

python \'pī-ˌthän\ Any of 28 species (family Pythonidae, sometimes a subfamily of Boidae) of sluggish, docile, nonvenomous SNAKES found in tropical and temperate regions. Except for one Central American species (*Loxocemus bicolor*), pythons are found from western Africa to China, Australia, and the Pacific islands. Pythons feed on birds and mammals, killing them by constriction. Most are found near water; some are arboreal. Unlike BOAS, pythons lay eggs (15–100, depending on body size). The Asian reticulated python (*Python reticulatus*) may be the world's longest snake (the ANACONDA is heavier); specimens over 30 ft (9 m) long have been recorded.

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Qadariya \ˌkä-də-'rē-ə\ In ISLAM, adherents of the doctrine of free will. The name was also applied to the MUTAZILA. The issue of free will was a major point of controversy in Islamic theology, and the Qadariya took the most extreme stand in its defense. They based their argument on the necessity of divine justice, maintaining that without responsibility and freedom one cannot fairly be held accountable for one's actions. See FREE WILL PROBLEM.

Qaddafi \kə-'dä-fē**, Muammar al-** *or* **Muʿammar al-Qadhdhāfī** (b. 1942, Surt, Libya) Ruler of Libya from 1969. Son of a BEDOUIN farmer, he was born in a tent in the desert. He graduated from the University of Libya and Libya's military academy and was a devout Muslim and ardent nationalist. As a captain in the army, he led the 1969 coup that deposed King IDRĪS I. He espoused his own form of Islamic socialism, and his foreign policy was anti-Western and anti-Israel. In 1970 he closed U.S. and British military bases and expelled Italians and Jews. He banned alcoholic beverages and gambling and in 1973 nationalized the oil industry. He made unsuccessful attempts to unify Libya with other countries. His government was repeatedly linked with terrorist incidents in Europe and elsewhere, and he supported groups trying to overthrow neighbouring governments. He narrowly escaped death in 1986 when U.S. planes bombed sites in Libya, including his own residence.

qāḍī \'kä-ˌdē\ Muslim judge who renders decisions according to the SHARĪʿAH, the canon law of ISLAM. The *qāḍī* hears only religious cases, such as those involving inheritance, pious bequests, marriage, and divorce, though theoretically his jurisdiction extends to civil and criminal matters. The second caliph, ʿUMAR IBN AL-KHAṬṬĀB, was the first to appoint a *qāḍī* to eliminate the necessity of his personally judging every dispute that arose in the community.

Qādisiyyah \ˌkä-di-'sē-ə**, Battle of** (636?) Battle fought near Al-Ḥīrah (in present-day Iraq) between forces of the SĀSĀNIAN DYNASTY and an invading Arab army. The Arab victory over the army of Yazdegerd (r. 632–651) marked the end of his dynasty and the beginning of Arab and Islamic rule in Persia.

Qaeda, al- *also* **al-Qāʿidah** *Arabic* **"the Base"** Broad-based Islamic militant organization founded in Afghanistan by OSAMA BIN LADEN. Its members supported Muslim fighters during the AFGHAN WAR of 1979–89; afterward the organization dispersed but continued to oppose secularized Muslim regimes and foreign (notably U.S.) presence in Islamic lands. It staged numerous terrorist attacks, including the bombing of the WORLD TRADE CENTER in 1993, the destruction of two U.S. embassies in Africa in 1998, and a suicide bomb attack against the U.S. warship *Cole* in 2000. During that time it merged with other Islamic extremist organizations and eventually reestablished its headquarters in TALIBAN-controlled Afghanistan, where it trained thousands of Muslim militants. In 2001, 19 such militants staged the SEPTEMBER 11 ATTACKS. The U.S. and allied forces responded by attacking Taliban and al-Qaeda forces in Afghanistan, killing and capturing thousands and driving the remainder into hiding.

Qājār \kä-'jär\ **dynasty** (1794–1925) Ruling dynasty of Iran. It was founded by Āghā Muḥammad Khan, who brutally reunified Iran and reasserted Iranian rule over territories in Georgia and the Caucasus by defeating his rivals, including the last ruler of the Zand dynasty. His successor, Fatḥ ʿAlī Shah (r. 1797–1834), lost land to Russia and increased contacts with the West. NĀṢIR AL-DĪN SHAH's (r. 1848–96) successful manipulation of Russia and Britain preserved Persia's independence, but his successors could not cope with subsequent European meddling, and the dynasty was overthrown by REZA SHAH PAHLAVI in 1925.

Qantas Airways Limited Australian airline, the oldest in the English-speaking world, founded in 1920 as Queensland and Northern Territory Aerial Services Ltd. (later abbreviated as Qantas). By 2002 it had more than 140 destinations in over 30 countries.

Qara Qoyunlu See KARA KOYUNLU

Qaraghandy *or* **Karaganda** \ˌkä-rə-'gän-də\ City (pop., 1999.: 436,900), central Kazakhstan. The first settlement appeared in 1856, and small-scale coal mining began the next year. Mining expanded rapidly in the early 1930s, and the town was made a city in 1934. Kazakhstan's second largest city, it consists of the old town, which grew up haphazardly around more than 20 mining settlements, and the new town, the region's cultural and administrative centre, which includes a university and medical and polytechnic institutes.

Qaraism See KARAISM

Qarqar See KARKAR

Qāsimī \kä-'sē-mē**, Sheikh Sulṭān ibn Muḥammad al-** (b. July 1, 1939) Ruler of the emirate of Al-Shariqah (Sharjah) in the United Arab Emirates (UAE) from 1972. He succeeded his brother, who was assassinated. A political moderate, he favoured strengthening the federal government of the UAE. In the wake of a failed coup attempt by another brother, he agreed to implement financial and administrative reforms and to make his brother crown prince, with the right to succeed him, but he changed his mind and exiled his brother in 1990.

Qatar \'kä-tər\ *officially* **State of Qatar** Country, Middle East, southwestern Asia. It juts out from the east coast of the ARABIAN PENINSULA into the Persian Gulf. Area: 4,412 sq mi (11,427 sq km). Population (2005 est.): 773,000. Capital: DOHA. Most of the population is Arab, with South Asian and Iranian minorities who are often migrant workers. Languages: Arabic (official), English. Religions: Islam (official; predominantly Sunni); also Christianity, Hinduism. Currency: Qatar rial. Qatar is mostly stony, sandy, and barren and consists of salt flats, dune desert, and arid plains. Largely because of petroleum and natural gas exports, its gross national product per capita is one of the highest in the world. The government owns all of the agricultural land and generates most of the economic activity; the private sector participates in trade and contracting on a limited scale. Qatar is a constitutional emirate, and its basis of legislation is Islamic law. The head of state and government is the emir, assisted by the prime minister. It was partly controlled

by Bahrain from the mid-18th to the mid-19th century and then was nominally part of the OTTOMAN EMPIRE until World War I (1914–18). In 1916 it became a British protectorate. Oil was discovered in 1939, and Qatar rapidly modernized. It declared independence in 1971, when the British protectorate ended. In 1991 Qatar served as a base for air strikes against Iraq in the First PERSIAN GULF WAR.

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Qayrawān, Al- See KAIROUAN

Qazvīn *or* **Kazvīn** \kaz-'vēn\ City (pop., 1996: 291,117), northwestern Iran. Founded as Shad Shāhpūr in AD 250, it flourished under Muslim rule in the 7th century. GENGHIS KHAN laid waste to the city, but it later revived and was made the capital of Persia (1548–98) under the ṢAFAVID DYNASTY. In the late 18th century it became a base for foreign trade with areas of the Caspian Sea, Persian Gulf, and Anatolia. A coup was launched from Qazvīn in 1921 that led to Iran's consolidation under Reza Shah PAHLAVI. It is a regional communications centre, with some manufacturing.

qedesha \'kä-de-shȧ\ One of a class of sacred prostitutes found throughout the ancient Middle East and associated especially with the worship of the fertility goddess ASTARTE. Prostitutes, who often played an important part in official temple worship, could be either male or female. The early Israelites adopted Canaanite rites of sacred prostitution, and despite the denunciations of Israelite PROPHETS, the practice continued until the reforms of JOSIAH in the 7th century BC.

Qi *or* **Ch'i** One of the largest and most powerful of the many states into which early China was divided (771?–221 BC). During the Eastern ZHOU DYNASTY, Qi was the first state to fully institute a uniform tax system, a central army, and a centralized bureaucracy based on talent rather than hereditary rank. It formed a league of states in 651 BC to stave off invasions from the north and south, but its hegemony was short-lived. In 221 BC it was absorbed into the QIN DYNASTY.

qi *or* **ch'i** \'chē\ In Chinese philosophy, the ethereal substance of which everything is composed. Early Daoist philosophers and alchemists regarded it as a vital force associated with breath and bodily fluids and sought to control its movement within the body in order to achieve longevity and spiritual power. Manipulation of *qi* is central to Chinese meditation, medicine, and MARTIAL ARTS. In the 10th–13th centuries NEO-CONFUCIANISM regarded *qi* as emanating from the Great Ultimate by way of *li*, the ordering principle of the universe, transformed into the elements through yin and yang (see YIN-YANG).

Qianlong emperor *or* **Ch'ien-lung** \chē-'en-'lůŋ\ **emperor** *orig.* **Hongli** (b. Sept. 25, 1711, China—d. Feb. 7, 1799, Beijing) Fourth emperor of the QING DYNASTY in China. His reign (1735–96) was one of the longest in Chinese history. China's boundaries reached their greatest extent, encompassing Mongolia, Tibet, Nepal, Taiwan, and portions of Central Asia. Qianlong sponsored a compilation of the Confucian Classics (see FIVE CLASSICS); the compilation's descriptive catalog is still used today. At the same time, he ordered that all books containing anti-Manchu sentiments be expurgated or destroyed; some 2,600 titles were lost. He enjoyed excellent personal relationships with JESUIT missionaries in Beijing, though Roman Catholic preaching remained officially forbidden. In the first half of his reign, agriculture made great strides and was superior to that in much of Europe. Taxes were light and education was widespread, even among the peasantry. Subsequently, military expeditions and increasing governmental corruption permanently harmed the dynasty, sowing the seeds for its decline in the 19th century. See also HESHEN; KANGXI EMPEROR; MANCHU.

qilin *or* **ch'i-lin** \chē-'lin\ In Chinese mythology, a kind of UNICORN whose rare appearance often coincides with the imminent birth or death of a sage or illustrious ruler. Appearances could also indicate the benevolence of living emperors. A *qilin* has a single horn on its forehead, a yellow belly, a multicoloured back, a horse's hooves, a deer's body, and an ox's tail. Legend has it that a *qilin* appeared to the pregnant mother of CONFUCIUS.

Qin dynasty *or* **Ch'in** \'chin\ **dynasty** (221–207 BC) Dynasty that established the first great Chinese empire. The Qin (from which the name China is derived) established the approximate boundaries and basic administrative system that all subsequent dynasties were to follow. Qin accomplishments include standardizing the CHINESE WRITING SYSTEM and building the GREAT WALL; the dynasty is also notorious for the "Qin bibliocaust," in which all nonutilitarian books were ordered burned. Due to its harshness, the dynasty outlasted its first emperor, SHIHUANGDI, by only three years; it was beset by rebellion and succeeded by the HAN DYNASTY.

Qin Hui *or* **Ch'in Kuei** \'chin-kü-'ā\ (b. 1090, Jiangning, Jiangsu province, China—d. 1155, Hangzhou, Zhejiang province) Chief counselor to the Southern SONG emperor Gaozong. He maintained external security by signing a peace treaty with the Juchen in the north and internal security by undermining the power of leading generals, notably YUE FEI, who had argued for war with the Juchen and whom Qin Hui executed. For relinquishing northern China to the Juchen, Qin Hui is remembered as a traitor.

Qin Jiushao (b. c. 1202, Puzhou, China—d. c. 1261, Meizhou) Chinese mathematician who developed a method of solving simultaneous linear congruences. In 1219 he joined the army as captain of a territorial volunteer unit and helped quash a local rebellion. In 1233 he began his official government service. In his only mathematical book, now known as *Shushu jiuzhang* (1247; "Mathematical Writings in Nine Sections"), he introduced a method of solving systems of linear equations that was rediscovered in Europe about 1802, where it became known as the Ruffini-Horner method. He later became provincial governor of Qiongzhou, but charges of corruption and bribery brought his dismissal in 1258.

Qin tomb *or* **Ch'in** \'chin\ **tomb** Major Chinese archaeological site near the ancient capital city of Chang'an (now Xi'an), a 20-sq-mi (50-sq-km) funerary compound built by the first sovereign emperor, Qin SHIHUANGDI. In 1974 workers drilling a well discovered a subterranean chamber that contained an army of some 6,000 life-size terra-cotta soldiers with individually detailed faces, as well as horses, weapons, and other objects. Three nearby chambers containing more than 1,400 figures have also been unearthed; the tomb itself has not yet been excavated. Archaeologists anticipate that it will take many years to unearth the rest of the complex. The mausoleum is a UNESCO World Heritage site.

Qing dynasty *or* **Ch'ing** \'chiŋ\ **dynasty** *or* **Manchu dynasty** (1644–1911/12) Last of the imperial dynasties in China. The name Qing was first applied to the dynasty established by the MANCHU in 1636 in Manchuria and then applied by extension to their rule in China. During the Qing dynasty, China's territory and population expanded tremendously. Cultural attitudes were strongly conservative and NEO-CONFUCIANISM was the dominant philosophy. The arts flourished: LITERATI painting was popular, novels in the vernacular developed substantially, and *JINGXI* (Peking opera) developed. Qing porcelain, textiles, tea, paper, sugar, and steel were exported to all parts of the world. Military campaigns in the latter part of the 18th century depleted government finances, and corruption grew. These conditions, combined with population pressures and natural disasters, led to the OPIUM WARS and the TAIPING and NIAN rebellions, which in turn so weakened the dynasty that it was unable to rebuff the demands of foreign powers. The dynasty ended with the republican revolution of 1911 and the abdication of the last emperor in 1912.

Qinghai *or* **Ch'ing-hai** *conventional* **Tsinghai** Province (pop., 2000 est.: 5,180,000), west-central China. It is bordered by GANSU and SICHUAN provinces and the TIBET and XINJIANG autonomous regions.With an area of 278,400 sq mi (721,000 sq km), it is the largest Chinese province. The capital is XINING. Located in a remote region west of the historic provinces of China proper, it forms the northeastern part of the Plateau of Tibet, mostly above 10,000 ft (3,048 m) in elevation. The source of the HUANG HE (Yellow River) is in one of its mountain ranges. Parts of Qinghai came under Chinese control in the 3rd century BC. For centuries it was sparsely occupied by nomadic herdsmen, chiefly Tibetans and Mongols, and a few Chinese farmers. The Chinese population increased over the years. Qinghai was made a Chinese province in 1928. Economic activities today include farming, herding, mining, lumbering, and manufacturing. It possesses some of China's best pasturelands and is noted for its horse breeding.

Qinghai Hu See KOKO NOR

Qishon River *or* **Kishon** \'kī-ˌshän\ **River** River, northern Israel. It rises near Mount Gilboa and flows northwest for about 25 mi (40 km) through the Plain of Esdraelon to the Mediterranean Sea just north of HAIFA. It was the scene of biblical events, including the Israelite victory of DEBORAH over the Canaanite general Sisera and of ELIJAH's slaying of the prophets of BAAL. In modern times, the river's mouth has been developed as part of Haifa's port complex. It is the main base of Israel's fishing fleet.

Qiu Chuji *or* **Ch'iu Ch'u-chi** \'jyü-'jü-'jē\ *orig.* **Changchun** \'chäŋ-'chůn\ (b. 1148, Qixia, Dengzhou, China—d. 1227, Beijing) Daoist monk and alchemist. His disciple Li Zhichang chronicled Qiu's journey to meet GENGHIS KHAN (who wished to learn from Qiu) in *The Travels of an Alchemist*, which describes the land and people between the GREAT WALL and Kabul and between the Yellow and Aral seas. Qiu Chuji was a member of a sect known for its extreme asceticism and for the doctrine of *xingming*, which held that humanity's lost natural state could be recovered through prescribed practices.

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Qizilqum See KYZYLKUM

Qo‘qon \kə-'kȯn\ *or* **Qŭqon** *or* **Kokand** \kə-'känt\ Region, eastern UZBEKISTAN. A powerful khanate by the 18th century, it was conquered by Russia in 1876 and was made a province of Turkistan under its ancient name, Fergana. It became part of the new Uzbek S.S.R. in 1924 and of independent Uzbekistan in 1991. Its chief city, also called Qo‘qon (pop., 1999 est.: 192,500), was founded in 1732, though its settlement dates to the 10th century.

Qu Yuan *or* **Ch‘ü Yüan** \'chē-'ywen\ (b. c. 339, Quyi, China—d. 278 BC, Hunan) Chinese poet. Born into the ruling house of Chu, in youth Qu Yuan was a favourite of the region’s ruler. Later he was banished and wandered in despair, writing and observing folk customs, which would influence his works. He eventually drowned himself. His most famous poem is the melancholy *Lisao* (“On Encountering Sorrow”). One of the greatest poets of ancient China, he exerted enormous influence on later poets with his highly original verse.

quack grass See COUCH GRASS

quadrangle Rectangular open space completely or partially enclosed by buildings of an academic or civic character. The grounds of a quadrangle are often grassy or landscaped. Such an area, intended as an environment for contemplation, study, or relaxation, was a feature of monastic establishments and the colleges that evolved from them. The quadrangular layout at New College in Oxford University (completed 1386), with its partially connected buildings, was enormously influential in subsequent collegiate building.

quadratic equation Algebraic equation of particular importance in OPTIMIZATION. A more descriptive name is second-degree POLYNOMIAL equation. Its standard form is $ax^2 + bx + c = 0$, and its solution is given by the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{(2a)}$$

which guarantees two REAL-NUMBER solutions, one real-number solution, or two COMPLEX-NUMBER solutions, depending on whether the discriminate, $b^2 - 4ac$, is greater than, equal to, or less than 0.

quadrille \kwä-'dril\ Dance for four couples in square formation, fashionable from the late 18th through the 19th century. Imported to England from Parisian ballrooms in 1815, it consisted of four or five contredanses (see COUNTRY DANCE), each danced with prescribed combinations of intertwining figures rather than depending on intricate individual steps. It was often danced to opera melodies. See also American SQUARE DANCE.

Quadros, Jânio da Silva (b. Jan. 25, 1917, Campo Grande, Mato Grosso, Braz.—d. Feb. 16, 1992, São Paulo) President of Brazil (1961). A colourful and eccentric populist, he campaigned with a broom to dramatize his pledge to “sweep out corruption.” In his seven months as president, he banned bikini swimsuits and cockfights, reestablished relations with the Soviet Union, decorated CHE GUEVARA, and refused to support the U.S. in the BAY OF PIGS INVASION of Cuba. He attributed his sudden resignation to “terrible forces” conspiring against him. Stripped of political rights and exiled in 1968, he was granted amnesty in 1980 and returned to serve two terms as mayor of São Paulo.

Quadruple Alliance (1718) Alliance between Austria, Britain, the Dutch Republic, and France, formed to prevent Spain from altering the terms of the Peace of UTRECHT (1713). When PHILIP V of Spain seized Sardinia and Sicily, the British fleet brought Austrian troops to Sicily and the French occupied northern Spain, and Philip was forced to renounce his claims in Italy.

Quadruple Alliance (1815) Alliance between Britain, Russia, Austria, and Prussia first formed in 1813 to oppose France in the final phase of the NAPOLEONIC WARS. It was officially renewed in 1815 to enforce the peace settlement concluded at the Congress of VIENNA. The allies agreed to meet occasionally to keep European political development within terms of the 1815 settlement. This program was partially carried out by the Congresses of AIX-LA-CHAPELLE (1818), TROPPAU (1820), LAIBACH (1821), and VERONA (1822).

quaestor \'kwe-stər, 'kwē-stər\ *Latin* **“investigator”** In ancient Rome, the lowest ranking regular magistrate, whose traditional responsibility was the treasury. Quaestors functioned as deputies to consuls. Like CONSULS, PRAETORS, and PREFECTS they were of the magistrate class, high-level government administrators. Quaestors were the lowest level of this class and were elected by the people. Initially they were appointed by the consuls, but later they were elected. After 421 BC there were four quaestors, two public treasurers and two who assisted the consuls, serving as quartermasters. From the time of AUGUSTUS, the number of quaestors increased to 20, many of whom acted as financial officers and assistants to provincial governors.

quahog \'kō-ˌhȯg, 'kwȯ-ˌhȯg\ Thick-shelled edible CLAM of the U.S. The northern quahog (*Mercenaria mercenaria*), also known as the cherrystone, littleneck, or hard-shell clam, is 3–5 in. (8–13 cm) long. The dingy white shell is thick and rounded and has prominent concentric lines. It is found in the intertidal zone from the Gulf of St. Lawrence to the Gulf of Mexico. It is the most important food clam of the Atlantic coast. The southern quahog (*M. campechiensis*), found in the intertidal zone from Chesapeake Bay to the West Indies, is about 3–6 in. (8–15 cm) long and has a heavy, white, plump shell.

quail Any of several species of short-tailed game birds (family Phasianidae), some with a head plume that is straight or curled forward. Species range from 5 to 13 in. (13–33 cm) long. Some of the 95 Old World species have leg spurs, but the 36 New World species never do. Quails prefer open country and brushy borders. The male may help incubate the 12 eggs. Quails mainly eat seeds and berries but also leaves, roots, and insects. The common quail (*Coturnix coturnix*) of Eurasia and Africa is the only migratory bird in the order Galliformes. Quails are generally smaller than PARTRIDGES. See also BOBWHITE.

California quail (*Callipepla californica*).
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Quaker Oats Co. International manufacturer of grocery products. It was formed in 1901 by the merging of three milling companies from Ohio and Iowa, including the country’s largest cereal mill. The company initially produced oat and wheat cereals, cornmeal, and baby food. By the late 20th century, hundreds of food products had been added. In the 1960s and ’70s, the company diversified into chemical products, restaurants, and toys. Quaker purchased Gatorade in 1983 and sold most of its nonfood assets in the 1990s. The company merged with PEPSICO, INC., in 2001.

Quakers See Society of FRIENDS

quality In philosophy, a property that applies to things taken singly, in contrast to a RELATION, which applies to things taken in pairs, triples, etc. The distinction drawn by GALILEO and JOHN LOCKE between primary and secondary qualities is motivated by the fact that modern science seems to reveal that unaided sensory perception gives false or incomplete information about the intrinsic qualities of physical objects. In this view, primary qualities, such as shape, quantity, and motion, are genuine properties of things that are describable by mathematics, whereas secondary qualities, such as odour, taste, sound, and colour, exist only in human consciousness.

Quant, Mary (b. Feb. 11, 1934, London, Eng.) English fashion designer. Specializing in youth-oriented fashions, she was responsible in the 1960s for the “Chelsea look” of England and the widespread popularity of the miniskirt and “hot pants.” After opening a successful boutique called Bazaar in 1957, she went on to mass-produce her designs on a multimillion-dollar annual scale.

Quantrill \'kwän-trəl**, William C(larke)** (b. July 31, 1837, Canal Dover, Ohio, U.S.—d. June 6, 1865, Louisville, Ky.) U.S. outlaw and Confederate guerrilla. After working as an itinerant schoolteacher, he moved to Kansas, where he failed at farming. By 1860 he was a horse thief and murderer. In the AMERICAN CIVIL WAR he joined the Confederate army and later gathered a gang of guerrillas to raid and rob Union towns

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and farms. Quantrill's Raiders were made an official troop by the Confederates in 1862. In 1863 Quantrill and his group of about 450 men sacked the free-state town of Lawrence, Kan., killing 150 people. They later defeated a Union detachment, killing 90 soldiers. Quantrill was mortally wounded in a raid into Kentucky.

quantum In physics, a discrete natural unit, or packet, of energy, charge, angular momentum, or other physical property. Light, for example, which appears in some respects as a continuous electromagnetic wave, on the submicroscopic level is emitted and absorbed in discrete amounts, or quanta; for light of a given wavelength, the magnitude of all the quanta emitted or absorbed is the same in both energy and momentum. These particlelike packets of light are called PHOTONS, a term also applicable to quanta of other forms of electromagnetic energy such as X RAYS and GAMMA RAYS. Submicroscopic mechanical vibrations in the layers of atoms comprising CRYSTALS also give up or take on energy and momentum in quanta called PHONONS. See also QUANTUM MECHANICS.

quantum chromodynamics (QCD) Theory that describes the action of the STRONG FORCE. The strong force acts only on certain particles, principally QUARKS that are bound together in the PROTONS and NEUTRONS of the atomic NUCLEUS, as well as in less stable, more exotic forms of matter. Quantum chromodynamics has been built on the concept that QUARKS interact via the strong force because they carry a form of "strong charge," which has been given the name "colour." The three types of charge are called red, green, and blue, in analogy to the primary colours of light, though there is no connection with the usual sense of colour.

quantum computing Experimental method of computing that makes use of quantum-mechanical phenomena. It incorporates quantum theory and the UNCERTAINTY PRINCIPLE. Quantum computers would allow a BIT to store a value of 0 and 1 simultaneously. They could pursue multiple lines of inquiry simultaneously, with the final output dependent on the interference pattern generated by the various calculations. See also DNA COMPUTING, QUANTUM MECHANICS.

quantum electrodynamics (QED) Quantum theory of the interactions of charged particles with the ELECTROMAGNETIC FIELD. It describes the interactions of light with matter as well as those of charged particles with each other. Its foundations were laid by P. A. M. DIRAC when he discovered an equation describing the motion and spin of electrons that incorporated both QUANTUM MECHANICS and the theory of special RELATIVITY. The theory, as refined and developed in the late 1940s, rests on the idea that charged particles interact by emitting and absorbing PHOTONS. It has become a model for other QUANTUM FIELD THEORIES.

quantum field theory Theory that brings QUANTUM MECHANICS and special RELATIVITY together to account for subatomic phenomena. In particular, the interactions of SUBATOMIC PARTICLES are described in terms of their interactions with fields, such as the ELECTROMAGNETIC FIELD. However, the fields are quantized and represented by particles, such as PHOTONS for the electromagnetic field. QUANTUM ELECTRODYNAMICS is the quantum field theory that describes the interaction of electrically charged particles via electromagnetic fields. QUANTUM CHROMODYNAMICS describes the action of the STRONG FORCE. The ELECTROWEAK THEORY, a unified theory of electromagnetic and WEAK FORCES, has considerable experimental support, and can likely be extended to include the strong force. Theories that include the gravitational force (see GRAVITATION) are more speculative. See also GRAND UNIFIED THEORY, UNIFIED FIELD THEORY.

quantum mechanics Branch of mathematical physics that deals with atomic and subatomic systems. It is concerned with phenomena that are so small-scale that they cannot be described in classical terms, and it is formulated entirely in terms of statistical probabilities. Considered one of the great ideas of the 20th century, quantum mechanics was developed mainly by NIELS BOHR, ERWIN SCHRÖDINGER, WERNER HEISENBERG, and MAX BORN and led to a drastic reappraisal of the concept of objective reality. It explained the structure of ATOMS, atomic nuclei (see NUCLEUS), and MOLECULES; the behaviour of SUBATOMIC PARTICLES; the nature of chemical bonds (see BONDING); the properties of crystalline solids (see CRYSTAL); NUCLEAR ENERGY; and the forces that stabilize collapsed STARS. It also led directly to the development of the LASER, the ELECTRON MICROSCOPE, and the TRANSISTOR.

Qu'Appelle \kwä-'pel\ **River** River, southern Saskatchewan, Canada. It is about 270 mi (435 km) long and flows east through several lakes and Indian reservations and across the Manitoba border into the ASSINIBOINE RIVER. Its French name, meaning "who calls," derived from its CREE Indian name Kah-tep-was ("River That Calls"), referring to the cries of a legendary spirit supposedly haunting its waters. Once a fur-trapping region, its basin is now farmed for wheat.

quarantine Detention of humans or animals suspected to have communicable disease until they are proved free of infection. The term is often used interchangeably with *isolation* (separation of a known infected individual from healthy ones until the danger of transmission passes). It derives from the 40-day (*quarantina*) isolation period instituted in an attempt to prevent spread of plague in the Middle Ages. Though appropriate in some cases (e.g., DIPHTHERIA), it is ineffective for diseases that are spread by other means (e.g., PLAGUE) or are contagious before symptoms appear. In some cases, contacts (e.g., the family of a hepatitis patient) are notified, educated on precautions, and monitored for development of illness. Quarantine is more often applied to animals (e.g., for RABIES).

quark Any of a group of SUBATOMIC PARTICLES thought to be among the fundamental constituents of matter—more specifically, of PROTONS and NEUTRONS. The concept of the quark was first proposed by MURRAY GELL-MANN and George Zweig (b. 1937); its name was taken from JAMES JOYCE's novel *Finnegans Wake*. Quarks include all particles that interact by means of the STRONG FORCE. They have MASS and SPIN, and they obey the PAULI EXCLUSION PRINCIPLE. They have never been resolved into smaller components, and they never occur alone. Their behaviour is explained by the theory of QUANTUM CHROMODYNAMICS, which provides a means of calculating their basic properties. There are six types of quarks, called up, down, strange, charm, bottom, and top. Only the up and down quarks are needed to make protons and neutrons; the others occur in heavier, unstable particles.

Quarles, Francis (baptized May 8, 1592, Romford, Essex, Eng.—d. Sept. 8, 1644, London) English religious poet. Quarles is remembered for his *Emblemes* (1635), the most notable of English-language emblem books (collections of symbolic pictures, usually with verse and prose). Its success led him to produce another, *Hieroglyphikes of the Life of Man* (1638). Printed together in 1639, they formed perhaps the most popular volume of verse of the 17th century. He also wrote *Enchiridion* (1640), a highly popular book of aphorisms.

quarter horse Breed of light HORSE developed in the U.S. from THOROUGHBRED, MORGAN, AMERICAN SADDLEBRED, and other stock as a quarter-mile racer. Though overshadowed by the Thoroughbred, it found a place in the western and southwestern U.S. as a stock horse (see CUTTING HORSE). Modern quarter horses are short and stocky, with a muscular build and a deep, broad chest. They are noted for fast starting, turning, and stopping ability, short-distance speed, and intelligence. They stand 14.3–16 hands (57–64 in., 145–163 cm) high, weigh 950–1,200 lbs (431–544 kg), and have a calm, cooperative temperament.

quarter-horse racing Racing of QUARTER HORSES. It originated among British settlers in Virginia shortly after Jamestown was established in 1607. The course was traditionally a quarter-mile (400 m); today there are 11 officially sanctioned races, ranging from 220 to 870 yd (201 to 796 m). Timing is to the nearest .01 second.

quartermaster Officer who oversees arrangements for the quartering and movement of troops. The office dates at least to the 15th century in Europe. The French minister of war under LOUIS XIV created a quartermaster general's department that dotted the countryside with strategically located stockpiles of food, forage, ammunition, and equipment. By the 18th century his duties in some European countries included coordinating marches and deployments and drafting operational orders; in the U.S. he remained a specialized administrative and logistical functionary until 1962, when the Quartermaster Corps was absorbed by other agencies.

quartz Second most abundant mineral (after FELDSPAR) in the Earth's crust, present in many rocks. Quartz, which consists of silica, or silicon dioxide (SiO_2), has great economic importance. Many varieties are gemstones, including AMETHYST, CITRINE, SMOKY QUARTZ, and rose quartz. SANDSTONE, composed mainly of quartz, is an important building stone. Large amounts of quartz sand (or silica sand) are used in the manufacture of glass and ceramics and for molds in metal casting. Crushed quartz is used as an abrasive in sandpaper; silica sand is employed in sandblasting; and sandstone is used whole to make whetstones, millstones, and grindstones. Silica glass (or fused quartz) is used in optics to transmit ultraviolet light. Tubing and various vessels of fused quartz have important laboratory applications, and quartz fibres are employed in extremely sensitive weighing devices.

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quartzite SANDSTONE that has been converted into a solid QUARTZ rock. Quartzites are usually white; they fracture smoothly and break up into rubble under frost action. Sandstone may be converted to quartzite by precipitation of silica from waters below the Earth's surface; such rocks are called orthoquartzites, whereas those produced by recrystallization (METAMORPHISM) are metaquartzites. Because they weather slowly, they tend to project as hills or mountain masses. Many prominent ridges in the Appalachian Mountains are composed of quartzite. Pure quartzites are a source of silica for metallurgical purposes and for the manufacture of silica brick. Quartzite is also quarried for paving and roofing materials.

quasar \'kwā-ˌzär\ *in full* **quasi-stellar radio source** Any of a class of enigmatic cosmic objects of high luminosity and strong radio emission observed at extremely great distances; also, a closely related object that has the same optical appearance but does not emit radio waves, i.e., a so-called quasi-stellar object (QSO). Most quasars exhibit very large REDSHIFTS, suggesting that they are moving away from Earth at tremendous speeds (approaching the speed of light); they thus are some of the most distant known objects in the universe. Quasars are no more than a light-year or two across but as much as 1,000 times more luminous than a giant galaxy having a diameter of 100,000 light-years; their extreme brightness allows them to be observed at distances of more than 10 billion light-years. Many investigators attribute such energy generation to matter spiraling at high velocity into a supermassive BLACK HOLE (millions or billions of times as much mass as the Sun) at the centre of a distant GALAXY. See also ACTIVE GALACTIC NUCLEUS.

Quasimodo \ˌkwä-zē-'mō-dō**, Salvatore** (b. Aug. 20, 1901, Modica, Italy—d. June 14, 1968, Naples) Italian poet, critic, and translator. He spent 10 years as an engineer for the Italian government while writing poetry in his spare time. He gradually became a leader of HERMETICISM after the publication of his first poetry collection, *Waters and Land* (1930). After World War II his social convictions shaped his work, beginning with *Day After Day* (1947). He published an astonishing range of translations, edited anthologies, and wrote essays, including those in *The Poet and the Politician* (1960). He received the Nobel Prize for Literature in 1959.

Quaternary \'kwä-tər-ˌner-ē, kwə-'tər-nə-rē\ **Period** Interval of geologic time, 1.8 million years ago to the present. The Quaternary follows the TERTIARY PERIOD and is the more recent of the two periods of the CENOZOIC ERA. The Quaternary is subdivided into the PLEISTOCENE EPOCH and the HOLOCENE EPOCH and is characterized by major cyclical changes of climate on a global scale. These led to repeated invasions of vast areas by ice sheets. Its major biologic feature is the evolution and dispersion of humans. The dramatic changes of climate and environment in the Quaternary led to high rates of evolution and extinction, particularly among the mammals. The extinction of many large mammals toward the end of the last ice age may also be related to the rapid territorial expansion of humans.

Quayle, (James) Dan(forth) (b. Feb. 4, 1947, Indianapolis, Ind., U.S.) U.S. politician. After earning a law degree, he served as associate publisher of his family's *Huntington Herald-Press* (1974–76). He served two terms in the U.S. House of Representatives (1977–81) and two in the Senate (1981–89). Chosen as the Republican Party candidate for vice president in 1988, he was elected with GEORGE H.W. BUSH. During his term, Quayle traveled abroad on goodwill missions but was criticized for various verbal gaffes. He and Bush ran for reelection in 1992 but were defeated. He briefly campaigned for the Republican nomination for president in 2000.

Quds, Al- See JERUSALEM

Quebec Province (pop., 2001: 7,410,500), eastern Canada. It is bounded on the north by HUDSON STRAIT and UNGAVA BAY, on the east by LABRADOR, on the southeast by the GULF OF ST. LAWRENCE and NEW BRUNSWICK, on the south by the U.S. (MAINE, NEW HAMPSHIRE, VERMONT, and NEW YORK), and on the west by ONTARIO and by HUDSON BAY. Its capital is QUEBEC city. The original inhabitants were Inuit (see ESKIMO) and members of Algonquin, Cree, and other Indian tribes. Settled by the French in the early 17th century, the area was lost to the British in the FRENCH AND INDIAN WAR, but the struggle for authority between the French and British groups led to a rebellion by French Canadians in 1837. The rebellion was quelled and in 1867 Quebec (formerly CANADA EAST) united with New Brunswick and Nova Scotia to form the Dominion of Canada. Most of the population of Quebec is of French descent. Various movements calling for Quebec's independence from the rest of Canada continued throughout the 20th century; the PARTI QUÉBÉCOIS won provincial elections in 1976, but its independence referendum was defeated in 1980. A second independence referendum was defeated in 1995 by a close margin. Principal industries include mining, hydroelectric power, and forestry.

Quebec *or* **Quebec City** City (pop., 2001: metro. area, 682,757), port and capital of QUEBEC province, Canada. It lies at the confluence of the ST. LAWRENCE and St. Charles rivers, about 150 mi (240 km) northeast of MONTREAL, on a rocky promontory above the rivers. Canada's oldest city, it was settled by the French in 1608 as a trading post. It was the capital of NEW FRANCE from 1663 to 1763, when it was lost to the British. It was the capital of Lower Canada 1791–1841 and CANADA EAST 1841–67. It became the provincial capital in 1867. Most of the population is French speaking and Roman Catholic. It is the site of LAVAL UNIVERSITY and other colleges and cultural institutions. Manufactures include newsprint, milled grain, cigarettes, and clothing. Shipbuilding and tourism are important industries.

Quebec, Battle of (Sept. 13, 1759) Decisive battle of the FRENCH AND INDIAN WAR. In June 1759, JAMES WOLFE led a British force of 250 ships with 8,500 soldiers to take up positions in the St. Lawrence River around Quebec. French forces under the marquis de MONTCALM withstood a two-month siege of the city. In September the British secretly landed 4,000 men near the city and forced a confrontation with French troops on the Plains of ABRAHAM. The defending French were routed in the battle, in which both Wolfe and Montcalm were mortally wounded.

Quebec Act (1774) British statute establishing Quebec's government and extending its borders. It provided for a governor and appointed council, religious freedom for Roman Catholics, and use of the French civil code. The act attempted to resolve the problem of making the colony a province of British North America and tried to build French-Canadian loyalty to the British. It also extended the borders of Quebec to include the land between the Ohio and Mississippi rivers, a region claimed by American colonists. It was considered one of the INTOLERABLE ACTS, which led to the AMERICAN REVOLUTION.

Québécois, Parti See PARTI QUÉBÉCOIS

Quechua \'ke-chə-wə\ South American Indian population of the ANDES MOUNTAINS from Ecuador to Bolivia. In the early 15th century the Quechua were conquered by the Chanca, who in turn were subdued by the INCA. Much of the traditional Quechua way of life endured under the Inca, but it was drastically altered by the 16th-century Spanish conquest. Traditional Quechua now lead isolated lives as marginal farmers in the high Andes. Their religion combines Roman Catholicism with folk beliefs. See also QUECHUAN LANGUAGES.

Quechuan \'ke-chə-wən\ **languages** Family of closely related South American Indian languages still spoken by some 12 million people in southern Colombia and Ecuador, Bolivia, and northern Argentina. Southern Peruvian Quechua, one language of the family, was a KOINE and administrative language within the INCA empire and was spread by Inca colonization.

Queen, Ellery *pseudonym of* **Frederic Dannay** *orig.* **Daniel Nathan** *and* **Manfred Bennington Lee** *orig.* **Manford Lepofsky** (respectively b. Oct. 20, 1905, Brooklyn, N.Y., U.S.—d. Sept. 3, 1982, White Plains, N.Y.; b. Jan. 11, 1905, Brooklyn, N.Y., U.S.—d. April 3, 1971, near Waterbury, Conn.) U.S. writers. The two cousins collaborated on more than 35 best-selling DETECTIVE NOVELS featuring the detective Ellery Queen. They took turns writing stories about Queen after winning a detective-story contest with *The Roman Hat Mystery* (1929). The pair used the pseudonym Barnaby Ross to write about a second detective, Drury Lane. They also cofounded *Ellery Queen's Mystery Magazine* (1941), edited numerous anthologies, and cofounded Mystery Writers of America.

Queen Anne style Style of English decorative arts that reached its apex during the reign (1702–14) of Queen ANNE. The most distinctive feature of Queen Anne furniture is the cabriole leg, shaped in a double curve (the upper part convex, the lower concave) and ending in either a claw-and-ball or paw foot. The Queen Anne chair is identifiable by a splat back curved to fit the hollow of the spine. The wood used was almost exclusively walnut, often embellished with marquetry, inlay, veneering, and lacquerwork. Ornamentation motifs include scallop shells, scrolls, Asian figures, and animals.

Queen Anne's lace *or* **wild carrot** Bristly biennial (*Daucus carota*) of the PARSLEY family, native to Eurasia but now found almost worldwide.

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An ancestor of the cultivated CARROT, it grows 5 ft (1.5 m) tall and has divided, long, feathery leaves. Flat-topped clusters (umbels) of white or pink flowers have a single dark-purple flower in the center and resemble lace. The enlarged root is edible but very bitter, and the ribbed fruits have sharp spines.

Queen Anne's War (1702–13) Second in a series of wars between Britain and France for control of North America. It was the American phase of the War of the SPANISH SUCCESSION. American colonial settlements along the New York and New England borders with Canada were raided by French forces and their Indian allies. The British capture of Port Royal (1710) resulted in French-held Acadia's becoming the British province of Nova Scotia. Under the Treaty of Utrecht (1713), Britain also acquired Newfoundland and the Hudson Bay region from France.

Queen Charlotte Islands Group of about 150 islands (pop., 2001: 4,935) off western British Columbia, Canada. They have an area of 3,705 sq mi (9,596 sq km). The two largest islands, Graham and Moresby, are irregular in shape and rise to nearly 4,000 ft (1,200 m). The inhabitants, including HAIDA Indians, engage in fishing and ranching.

Queen Charlotte Sound Broad, deep inlet of the Pacific Ocean indenting western British Columbia, Canada. Bounded on the north by the QUEEN CHARLOTTE ISLANDS and on the south by VANCOUVER ISLAND, the sound feeds into a series of straits that once were the paths followed by the continental GLACIERS as they pushed out to sea. Its eastern border is a complex of islands, inlets, and fjords.

Queen Elizabeth Islands Island group, northern Canada. Part of the Canadian Arctic archipelago, it comprises all the islands north of latitude 74°30' N, including the Parry and Sverdrup island groups. The islands, the largest of which are ELLESMERE, MELVILLE, Devon, and Axel Heiberg, have a total land area of over 150,000 sq mi (390,000 sq km). Probably first visited by the Vikings c. AD 1000, they were partially explored (1615–16) by English navigators William Baffin and Robert Bylot. The islands, which are administratively split between the NORTHWEST TERRITORIES and NUNAVUT, were named in 1953 to honour Queen ELIZABETH II.

Queen Elizabeth National Park *or* **Ruwenzori National Park** National park, southwestern Uganda. Established in 1952, it has an area of 764 sq mi (1,978 sq km) and lies east of Lake EDWARD. One of the largest parks in Uganda, it has areas of rainforest and savanna grassland. It is within the western branch of the GREAT RIFT VALLEY and is dotted with PLEISTOCENE volcanic craters. Wildlife includes chimpanzees, leopards, lions, and elephants.

Queens Borough (pop., 2000: 2,229,379) of NEW YORK CITY, coextensive with Queens county, southeastern New York, U.S. The largest of the five boroughs, it lies on western LONG ISLAND and extends across the width of the island from the junction of the EAST RIVER and LONG ISLAND SOUND to the Atlantic Ocean. The first settlements, made by the Dutch 1636–56, came under English control in 1664. It became a county in 1683 and a borough in 1898. Queens was primarily rural during the 19th century, but some of its shore communities began attracting summer vacationers. Development was spurred by the construction of the Queensboro Bridge and the Long Island Railroad tunnel. It is mostly residential, though it has extensive manufacturing around Long Island City and storage and shipping facilities lining the East River. It is the site of New York City's major airports, Kennedy and La Guardia.

Queen's University at Kingston Privately endowed university in Kingston, Ontario, Canada. It was founded in 1841 and modeled after the University of EDINBURGH. It is a comprehensive research institution, offering undergraduate, graduate, and professional degrees in most major fields. Research facilities include centres for the study of international relations, industrial relations, and natural resources.

Queensberry rules Code of BOXING rules. It was written by John Graham Chambers (1843–1883) and published in 1867 under the sponsorship of John Sholto Douglas, marquess of Queensberry (1844–1900), who was known also for precipitating the downfall of OSCAR WILDE. Besides calling for the wearing of gloves, the rules forbade wrestling holds, required a fallen man to be given a free count of 10 to recover, established the three-minute round with a one-minute rest period, and disallowed seconds from entering the ring during the round.

Queensland State (pop., 2001: 3,635,121), northeastern Australia. Bounded on the north by the Pacific Ocean and the GREAT BARRIER REEF, it has an area of 668,210 sq mi (1,730,650 sq km); the capital is BRISBANE. Its coastal region, the most tropical part of Australia, attracts many tourists. Inland from the GREAT DIVIDING RANGE, which runs the entire length of the state, mining and cattle ranching are important. Capt. JAMES COOK charted the coast in 1770. In the 19th century the state housed several penal colonies and drew settlers to mine its gold. It became a constituent state in 1901 when the Commonwealth of Australia was proclaimed.

quenching Rapid cooling, as by immersion in oil or water, of a METAL object from the high temperature at which it is shaped. Quenching is usually done to maintain mechanical properties that would be lost with slow cooling. It is commonly applied to STEEL objects, to which it gives HARDNESS. The quenching media and the type of agitation during quenching are selected to obtain specified physical properties with minimum internal stresses and distortions. Oil is the mildest medium, and salt brine has the strongest quenching effect. In special cases, steel is cooled and held for some time in a molten salt bath, which is kept at a temperature either just above or just below the temperature where martensite begins to form. These two heat treatments, called martempering and austempering, both result in even less distortion of the metal. Copper objects hardened by hammering or other deformation at ordinary temperatures can be restored to malleability by heating and quenching. See also TEMPERING.

Queneau \kə-'nō**, Raymond** (b. Feb. 21, 1903, Le Havre, France—d. Oct. 25, 1976, Paris) French author. After working as a reporter, he became a reader for the prestigious *Encyclopédie de la Pléiade*, a scholarly edition of past and present classical authors; by 1955 he was its director. Verbal play, black humour, pessimism, and a derisive posture toward authority appear often in his more than 30 works of prose and poetry, which include the novels *Zazie dans le métro* (1959; film, 1960), perhaps his best-known work, and *The Blue Flowers* (1965).

Quercia, Jacopo della See JACOPO DELLA QUERCIA

Quercy \ker-'sē\ Historical and cultural region, southwestern France. The district was organized in Gallo-Roman times and was occupied by the FRANKS in the 6th century. It was contested by England and France throughout the Middle Ages. United with the French crown in 1472, it suffered severely during the Wars of RELIGION of the 16th century. It is well forested with oaks of the genus *Quercus* that give the region its name. There are vineyards around Cahors that produce rich red wines.

Querétaro City (pop., 2000: 536,463), capital of QUERÉTARO state, Mexico. Situated on the Mexican Plateau about 6,100 ft (1,860 m) above sea level, it is an excellent example of a Spanish colonial city. Founded by the OTOMI Indians, it was incorporated into the AZTEC empire in 1446. Brought under Spanish control in 1531, it became an important supply centre for the rich mining districts of GUANAJUATO and ZACATECAS. Emperor MAXIMILIAN was executed there in 1867 after his defeat by the forces of BENITO JUÁREZ. The Mexican Constitution of 1917 was written in Querétaro. It is the site of one of Mexico's oldest and largest cotton factories; textiles and pottery are also produced there.

Querétaro \kā-'rā-tä-ˌrō\ State (pop., 2000: 1,404,306), central Mexico. It has an area of 4,420 sq mi (11,449 sq km), and its capital is QUERÉTARO city. Situated on the central plateau, it is almost evenly divided between mountainous areas in the north and plains and valleys in the south that form part of Mexico's Bajío region. In 1531 the area was conquered by Spain, which began colonization in the 1550s. It was administered with Guanajuato before it became a state in 1824. Chief mineral products are opals and mercury. Medicinal plants, sweet potatoes, fruits, and grains are among the many crops cultivated.

Quesada, Gonzalo Jiménez de See GONZALO JIMÉNEZ DE QUESADA

Quesnay \kā-'nā**, François** (b. June 4, 1694, near Paris, France—d. Dec. 16, 1774, Versailles) French physician and economist. He served as consulting physician to LOUIS XV at Versailles, where he developed an interest in economics. In his *Tableau économique* (1758), he described the relationship between the different economic classes of society and the flow of payments among them, and he developed the concept of economic equilibrium used by many later economic analysts. An advocate of LAISSEZ-FAIRE economic policy, he became the intellectual leader of the PHYSIOCRAT, the first systematic school of POLITICAL ECONOMY.

Quetelet \ket-'le**, (Lambert) Adolphe (Jacques)** (b. Feb. 22, 1796, Ghent, Belg.—d. Feb. 17, 1874, Brussels) Belgian statistician, sociologist, and astronomer. He is known for his application of STATISTICS and

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the theory of probability to social phenomena. He collected and analyzed government statistics on crime, mortality, and other subjects and devised improvements in census taking. In *Sur l'homme* (1835) and *L'Anthropométrie* (1871) he developed the notion of the *homme moyen*, the statistically "average man." A founder of quantitative social science, he was nonetheless widely criticized for the crudeness of his methodology.

quetzal \ket-'säl\ Any of several tropical arboreal, short-billed, fruit-eating birds (genus *Pharomachrus*) in the trogon family (Trogonidae), whose weak feet have, uniquely, the second toe directed backward. It was the sacred bird of the ancient MAYAS and AZTECS. Today the quetzal, found in remote parts of cloud forests from southern Mexico to Bolivia, is the national emblem of Guatemala (whose monetary unit is the quetzal). The resplendent, or Guatemalan, quetzal is about 50 in. (125 cm) long. Long blue-green plumes cover the tail; the breast and head, with a rounded hairlike crest, are gold-green; the blue back has a curly gold-tinged mantle; and the belly is red. The quetzal is now listed as endangered.

Quetzalcóatl \ˌkāt-säl-'kō-ä-təl, ˌkāt-säl-kō-'ä-təl\ Feathered Serpent, a major deity of ancient Mexico. Quetzalcóatl began as a god of vegetation in the TEOTIHUACÁN civilization. For the TOLTECS he was the god of the morning and evening star. The AZTECS revered him as the patron of priests, the inventor of the calendar and of books, and the protector of goldsmiths and other craftsmen. He was also identified with the planet Venus and was a symbol of death and resurrection. One myth held that he was a white priest-king who sailed away on a raft made of snakes. The belief that he would someday return from the east led MONTEZUMA II to regard HERNAN CORTES as the fulfillment of the prophecy.

Quetzalcóatl, limestone figure of the Huastec culture, Mexico, AD 900–1250; in The Brooklyn Museum, New York.
COURTESY OF THE BROOKLYN MUSEUM, NEW YORK, HENRY L. BATTERMAN AND FRANK S. BENSON FUNDS

queuing \'kyü-iŋ\ **theory** Study of the behaviour of queues (waiting lines) and their elements. Queuing theory is a tool for studying several performance parameters of computer systems and is particularly useful in locating the reasons for "bottlenecks," compromised computer performance caused by too much data waiting to be acted on at a particular phase. Queue size and waiting time can be looked at, or items within queues can be studied and manipulated according to factors such as priority, size, or time of arrival.

Quezon \'kā-sȯn\ **(y Molina), Manuel (Luis)** (b. Aug. 19, 1878, Baler, Phil.—d. Aug. 1, 1944, Saranac Lake, N.Y., U.S.) Filipino statesman. Quezon fought in the PHILIPPINE-AMERICAN WAR but became convinced after the Philippines' defeat that the only way to independence was through cooperation with the U.S. He served in the Philippine Assembly (1907–09). As the Philippines' representative in the U.S. House of Representatives (1909–16), he played a major role in obtaining Congress's pledge of independence for the Philippines (1916) and fought for passage of the Tydings-McDuffie Act (1934), which laid out a timetable for independence. He became president of the Commonwealth (a precursor to the independent republic) in 1935 and was reelected in 1941; when Japan occupied the Philippines in 1942, he formed a government-in-exile in the U.S. He did not live to see full independence for the Philippines. Quezon City is named in his honour.

Quezon \'kā-ˌsȯn\ **City** City (pop., 2000: 2,173,831), Luzon Island, Philippines, northeast of MANILA. Named for Pres. MANUEL QUEZON, who selected the site in 1939, it replaced Manila as the capital in 1948. Considered part of metropolitan Manila, it began to grow after World War II with the construction of many government buildings. The seat of government moved back to Manila in 1976. The city is home to two major universities.

Quiché *or* **K'iche** *or* **Kiche** \kē-'chā\ Indian group of the Guatemalan highlands, largest of all ethnic groups speaking a MAYA LANGUAGE. The Quiché Maya had an advanced civilization in pre-Columbian times. Records of their history and mythology are preserved in the *POPOL VUH*. Traditional Quiché are agricultural. Their homes are thatched huts, and they practice weaving and pottery. Nominally Roman Catholic, they conduct traditional rituals as well. Many were killed or displaced during the Guatemalan military's counterinsurgency campaign of the early 1980s.

quicklime See LIME

quicksand State in which water-saturated sand loses its supporting capacity and acquires the characteristics of a liquid. Quicksand is usually found in a hollow at the mouth of a large river or along a flat stretch of stream or beach where pools of water become partly filled with sand and an underlying layer of stiff clay or other dense material prevents drainage. Mixtures of sand, mud, and vegetation in bogs often act like true quicksands. Any sand may become "quick" if its effective weight is being carried by water between the grains. In that case, even a footstep may collapse the loose structure. The sand-water suspension is denser than an animal or human body, so the body cannot sink below the surface, but struggling may lead to loss of balance and drowning.

quicksilver See MERCURY

Quiller-Couch, Sir Arthur (Thomas) (b. Nov. 21, 1863, Bodmin, Cornwall, Eng.—d. May 12, 1944, Fowey, Cornwall) English poet, novelist, and anthologist. Educated at Oxford, he worked as a journalist and editor in London before settling in his native Cornwall. He taught at Cambridge from 1912. He is noted for compiling *The Oxford Book of English Verse 1250–1900* (1900; revised 1939) and *The Oxford Book of Ballads* (1910). His works, written in a clear and apparently effortless style, include many novels and short stories, verse, and criticism, including *On the Art of Writing* (1916) and *On the Art of Reading* (1920).

quilombo \kē-'lȯm-bō\ *ormocambo* In colonial Brazil, a community organized by fugitive slaves. *Quilombos* were located in inaccessible areas and usually consisted of fewer than 100 people who survived by farming and raiding. The largest and most famous was Palmares, which grew into an autonomous republic and by the 1690s had 20,000 inhabitants. It owed its prosperity to abundant irrigated land and the abduction of slaves from Portuguese plantations. The abducted slaves were kept in bondage by the runaways. Several Portuguese and Dutch slave-hunting expeditions (*BANDEIRA*) attempted to destroy Palmares; one of these finally succeeded in 1694.

quilting Process of stitching together two layers of fabric, usually with a soft, thick substance placed between them. The layer of wool, cotton, or other stuffing provides insulation; the stitching keeps the stuffing evenly distributed and also provides opportunity for artistic expression. Quilting has long been used for clothing in many parts of the world, especially in the Far and Middle East and the Muslim regions of Africa. It reached its fullest development in the U.S., where it was at first popularly used for petticoats and comforters. By the end of the 18th century the U.S. quilt had distinctive features, such as coloured fabric sewn on the outer layers (appliqué) and stitching that echoed the appliqué pattern. Patchwork patterns proliferated in the 19th and 20th centuries.

quince Any of the fruit shrubs and small trees that make up the genus *Cydonia*, in the ROSE family. Common quince (*C. oblonga*) is native to Iran, Turkey, and perhaps Greece and the Crimea. The raw golden-yellow fruit has a strong fragrant aroma and astringent taste; it takes on a pink colour when cooked and makes an excellent preserve. The Japanese quince (*Chaenomeles* species) is an ornamental shrub widely used for its flowers, which appear on the tightly branched stems before the leaves open fully in late winter and early spring.

Quince (*Cydonia oblonga*).
WALTER CHANDOHA

Quincey, Thomas De See THOMAS DE QUINCEY

Quine, W(illard) V(an) O(rman) (b. June 25, 1908, Akron, Ohio, U.S.—d. Dec. 25, 2000, Boston, Mass.) U.S. logician and philosopher. He completed his Ph.D. at Harvard University in 1932 and joined the faculty there in 1936. From 1942 to 1945 he served as a naval intelligence

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officer in Washington, D.C. Promoted to full professor at Harvard in 1948, he remained there until 1978, when he retired. He produced highly original and important work in several areas of philosophy, including epistemology, logic, ontology, and the philosophy of language. He was known for rejecting epistemological foundationalism in favour of what he called "naturalized epistemology," whose modest task is merely to give a psychological account of how scientific knowledge is obtained. Though influenced by the LOGICAL POSITIVISM of RUDOLF CARNAP and other members of the VIENNA CIRCLE, he famously rejected one of their cardinal doctrines, the ANALYTIC-SYNTHETIC DISTINCTION. In ontology he rejected the existence of properties, propositions, and meanings as ill-defined or scientifically useless. He was also known for his behaviourist account of language learning and for his thesis of the "indeterminacy of translation," according to which there can be no "fact of the matter" about which of indefinitely many possible translations of one language into another is correct. His many books include *Word and Object* (1960), *The Roots of Reference* (1974), and an autobiography, *The Time of My Life* (1985).

quinine \'kwī-ˌnīn\ ALKALOID found in the bark of CINCHONA trees and shrubs. The chemical structure of this HETEROCYCLIC COMPOUND is large and complex, with several rings. For the 300 years preceding the 1940s, when newer antimalarials were developed, quinine was the only drug known to Western medicine for the prevention and treatment of MALARIA. The first chemical compound ever used successfully against an infectious disease, it has benefited more people than any other such drug in history and is still used to treat malaria, often in combination with other drugs. Quinine is also a flavouring agent in some carbonated beverages, including tonic water.

Quinn, Anthony (Rudolph Oaxaca) (b. April 21, 1915, Chihuahua, Mex.—d. June 3, 2001, Boston, Mass., U.S.) Mexican-born U.S. film actor. He began appearing in movies in 1936, initially playing bit parts as American Indians or ethnic characters. After appearing on Broadway in *A Streetcar Named Desire*, he returned to Hollywood, where he won Academy Awards for his supporting roles in *Viva Zapata!* (1952) and *Lust for Life* (1956). He was noted for his earthy masculinity and acted in over 100 other films, notably FEDERICO FELLINI's *La strada* (1954), *Requiem for a Heavyweight* (1962), and *Zorba the Greek* (1964). Quinn was also a successful artist and sculptor.

quinone \kwi-'nōn\ Any member of a class of cyclic organic compounds comprising a six-membered unsaturated ring (see SATURATION) to which two oxygen atoms are bonded as carbonyl groups (—C═O; see FUNCTIONAL GROUP). This structure plays an important role in theories of chemical structure and colour, since quinones occur as PIGMENTS in bacteria, fungi, and certain higher plants; animals containing quinones obtain them from plants they eat. The K vitamins (see VITAMIN K) are naphthoquinones. The term *quinone* often specifically denotes *para*-benzoquinone ($C_6H_4O_2$), a bright yellow solid with a sharp odour used in manufacturing dyes and fungicides and in photography.

Quintana Roo \kē-'tä-nä-'rō\ State (pop., 2000: 874,963), eastern YUCATÁN PENINSULA, southeastern Mexico. It has an area of 19,397 sq mi (50,212 sq km), and its capital is CHETUMAL. The region was used as a place of exile for political prisoners for many years. Originally created as a territory from parts of YUCATÁN and CAMPECHE states, it became a state in 1974. It is the site of many MAYA ruins. Its main products are chicle (for chewing gum) and a small amount of copra (for producing coconut oil); the latter is produced on the coast near the island of Cozumel (where HERNÁN CORTÉS landed in 1519), which is now a popular tourist destination.

Quinte \'kwin-tē**, Bay of** Arm of Lake ONTARIO, southeastern Ontario, Canada. It extends for 75 mi (121 km) from its entrance near Amherst Island to Murray Canal at the western end. A resort area, it is a scenic, narrow bay with many small inlets. Among the major settlements around the bay are Trenton, Belleville, Deseronto, and Picton. The bay's name was derived from Kenté, an Indian village on the bay's western shore.

Quintero \kēn-'ter-ō**, José (Benjamín)** (b. Oct. 15, 1924, Panama City, Pan.—d. Feb. 26, 1999, New York, N.Y., U.S.) Panamanian-born U.S. theatrical director. After studying theatre at theUniversity of Southern California, he directed his first play in 1949. He was a founder of the Off-Broadway theatre Circle in the Square, where he directed regularly from 1950, establishing the house as a major centre for serious theatre. His direction of TENNESSEE WILLIAMS's *Summer and Smoke* (1952) confirmed his reputation and made a star of GERALDINE PAGE. He was best known for his productions of 20th-century plays, especially those of Williams and EUGENE O'NEILL, including *The Iceman Cometh* (1956), *Long Day's Journey into Night* (1956), and *A Moon for the Misbegotten* (1973, Tony Award).

Quintilian *Latin* **Marcus Fabius Quintilianus** (b. AD 35, Calagurris Nassica, Hispania Tarraconensis—d. after 96, Rome) Latin teacher and writer. Quintilian was probably educated and trained in oratory in Rome. From about 68 to 88 he taught rhetoric, becoming Rome's leading teacher, and was an eminent advocate in the law courts. His *Institutio oratoria* is a practical survey of rhetoric in 12 books and a major contribution to educational theory and literary criticism. His dual emphasis on intellectual and moral training appealed to humanists of the 15th–16th centuries and through them influenced the modern view of education as all-around character training to equip a student for life.

Quirino \kē-'rē-nō**, Elpidio** (b. Nov. 16, 1890, Vigan, Phil.—d. Feb. 28, 1956, Novaliches) Second president of the independent Republic of the Philippines. Quirino served in numerous elected and appointed posts in the Philippines prior to independence. In 1934 he accompanied MANUEL QUEZON to the U.S. to secure passage of the Tydings-McDuffie Act, which set a date for Philippine independence. He became vice president to MANUEL ROXAS after independence, succeeding to the presidency on Roxas's death in 1948. Quirino's presidency (1948–53) was one of notable postwar reconstruction and economic gains, but social problems remained unsolved (leading to the HUKBALAHAP REBELLION), and government corruption was widespread.

Quirinus \kwə-'rī-nəs\ Major Roman deity ranking close to JUPITER and MARS. The *flamines* (see FLAMEN) of these three gods were the three major priests of Rome. Despite his importance, little is known about Quirinus, who was originally a god of the SABINES. He may have been another form of Mars. By the late republic he was identified with ROMULUS. His festival, the Quirinalia, was celebrated on February 17, and his temple was one of the oldest in Rome.

Quisling, Vidkun (Abraham Lauritz Jonsson) (b. July 18, 1887, Fyresdal, Nor.—d. Oct. 24, 1945, Akershus Fortress, Oslo) Norwegian politician and collaborator with the Germans in World War II. After serving as military attaché in Petrograd and Helsinki, he became Norway's minister of defense in 1931. He resigned in 1933 to form the fascist National Union party. He actively collaborated in the German conquest of Norway (1940) and served in the occupation government. His attempts to convert Norwegians to NATIONAL SOCIALISM aroused strong opposition. After Norway's liberation, he was found guilty of treason and executed. His name became a synonym for "traitor."

Quito \'kē-tō\ City (pop., 2001: 1,399,378), capital of Ecuador. The city lies at an elevation of 9,350 ft (2,850 m) on the lower slopes of Pichincha, an active volcano, in a narrow valley of the Andes Mountains. A pre-Columbian town, it was captured by the INCA in 1487 and taken by the Spanish in 1534. It is the oldest of all South American capitals, and its old town preserves much of its colonial atmosphere. In 1552 the Franciscans established an art school there, the first of its kind in South America. One of Ecuador's two major industrial centres, it produces textiles and light consumer goods. It is the site of several institutions of higher learning. The old town was designated a UNESCO WORLD HERITAGE SITE in 1978.

quiz show See GAME SHOW

Qumrān \kům-'rän\ Site on the northwestern shore of the DEAD SEA where the DEAD SEA SCROLLS were discovered in 1947. Excavations less than a mile from the sea have revealed the ruins of buildings believed by some scholars to have been occupied by ESSENES, the probable authors of the scrolls. The buildings include a scriptorium, a potter's workshop, and a flour mill; water was supplied through an aqueduct. The Essenes are thought to have founded a monastic community at Qumrān in the mid-2nd century BC. They temporarily abandoned the settlement after an earthquake and fire in 31 BC but later returned and lived there until Roman legions destroyed the community in AD 68.

quoin \'kȯin, 'kwȯin\ In architecture, both the external corner of a building and, more often, one of the stones used to form that corner. These stones are both structural and decorative in that they often differ in jointing, colour, texture, or size from the masonry of the adjoining walls. Usually quoins are toothed (i.e., set in short courses in a regular pattern of alternating lengths). Such construction dates back to ancient Rome.

quoits \'kȯits, 'kwȯits\ Game in which flattened rings of iron or circles of rope (both called quoits) are thrown at an upright pin (hob) in an

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attempt to ring it or come as near to it as possible. Quoits may have been played in Roman-occupied Britain (1st–5th century AD), and it may have given rise to HORSESHOE PITCHING.

quota In international trade, a government-imposed limit on the quantity of goods and services that may be exported or imported over a specified period of time. Quotas are more effective than TARIFFS in restricting trade, since they limit the availability of goods rather than simply increasing their price. By limiting foreign goods, a quota aims to allow domestic goods to compete more successfully, though the PRICE of the goods may also rise. Quotas restricting trade were first imposed on a large scale during World War I. In the 1920s, quotas were progressively abolished and replaced by tariffs, but their use was revived in the wave of PROTECTIONISM set off by the GREAT DEPRESSION. After World War II, the western European countries began a gradual dismantling of quantitative import restrictions, but the U.S. was slower to discard them. See also FREE TRADE; GATT.

quotient rule Rule for finding the DERIVATIVE of a quotient of two functions. If both f and g are differentiable, then so is the quotient $f(x)/g(x)$. In abbreviated notation, it says $(f/g)' = (gf' - fg')/g^2$.

Qŭqon See QO'QON

Qur'ān \kù-'rän\ *or* **Koran** \kə-'ran, kə'rän\ Sacred SCRIPTURE of ISLAM, regarded by Muslims as the infallible word of God, revealed to the Prophet MUHAMMAD. The book, first compiled in its authoritative form in the 7th century, consists of 114 chapters (SŪRAHS) of varying length, written in Arabic. The earliest *sūrahs* call for moral and religious obedience in light of the coming Day of Judgment; the ones written later provide directives for the creation of a social structure that will support the moral life called for by God. The Qur'ān also provides detailed accounts of the joys of paradise and the terrors of hell. Muslims believe that the God who spoke to Muhammad is the God worshiped by Jews and Christians but that the revelations received by those religions are incomplete. Emphasis on the stern justice of God is tempered by frequent references to his mercy and compassion. The Qur'ān demands absolute submission (*islam*) to God and his word, and it serves as the primary source of Islamic law. It is regarded as immutable in both form and content; traditionally translation was forbidden. The translations available today are regarded as paraphrases to facilitate understanding of the actual scripture.

qurra \kù-'rä\ Professional class of reciters of the QUR'ĀN. MUHAMMAD's early disciples often memorized his divine revelations, and even after the Qur'ān was assembled in written form, it was common for pious Muslims to memorize it in its entirety. Such reciters were often called on by scholars to elucidate points of pronunciation and meaning, and by the 9th century they formed an established class. Religious men employed in mosques still memorize the Qur'ān to aid them in interpreting its revelations to the faithful. In some Arab countries the professional duties of reciting the Qur'ān are usually reserved for blind men.

Quṭb \'kù-tùb**, Sayyid** *in full* **Ibrāhīm Ḥusayn Shādhilī Sayyid Quṭb** (b. Oct. 9, 1906, near Asyūṭ, Egypt—d. Aug. 29, 1966, Cairo) Egyptian writer who was one of the foremost figures in modern Sunnite Islamic revivalism. He was from a family of impoverished rural notables. For most of his early life he was a schoolteacher. Originally an ardent secularist, he came, over time, to adopt many Islamist views. Following a brief period studying in the U.S. (1948–50), he became convinced of the corruption of Western secularism and on his return to Egypt joined the MUSLIM BROTHERHOOD. He was at first on good terms with the revolutionary regime of GAMAL ABDEL NASSER but was imprisoned (1954–64) along with other Brotherhood leaders on charges of sedition. His prison years were his most productive. The brutal treatment he received convinced him that Egypt, like the West, was corrupt, and, drawing (often freely) on the work of early Muslim scholars such as IBN TAYMIYYAH, he argued that much of modern Muslim society had fallen in apostasy and was, therefore, a legitimate target of JIHAD. He penned these ideas in several books, including *Signposts in the Road* (1964), which became a template for modern Sunnite militancy. Released from prison in 1964, he was soon rearrested, tried for treason, and executed.

Qwaqwa \'kwä-ˌkwä\ Former black enclave, South Africa. It bordered Lesotho and the province of NATAL. With an area of 253 sq mi (655 sq km), it was the smallest of South Africa's black states. Established in 1974, it had industries that included brickworks, gravel quarries, and furniture making. In 1994 it was incorporated into ORANGE FREE STATE province, which was called Free State province after 1995.

Qyzylqum See KYZYLKUM

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Ra See Re

Rabanus Maurus *or* **Hrabanus Maurus** \rä-'bä-nůs-'maů-růs\ (b. c. 780, Mainz, Franconia—d. Feb. 4, 856, Winkel) Frankish abbot, archbishop, and theologian whose encyclopaedic knowledge and numerous writings brought him the title Praeceptor Germaniae ("Teacher of Germany"). A Benedictine monk, he became director of the school at the Fulda monastery near Frankfurt am Main in 803, and he built Fulda into a leading European centre of learning. He was elected abbot in 822 and used the monastery as a base for Christian missions throughout Europe. He was named archbishop of Mainz in 847. His many writings include *On the Nature of Things* (842–847), an encyclopaedia synthesizing intellectual history until the 9th century. He also wrote treatises on education and grammar and commentaries on the Bible. As abbot and archbishop, he was involved in the disciplinary and theological controversies associated with Gottschalk of Orbais.

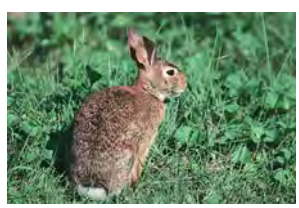
Rabat \rə-'bät\ *Arabic* **Ribāṭ** \ri-'bät\ City (pop., 1994: city, 623,457; Rabat-Salé metro. area, 1,385,872), capital of Morocco. It is situated on the Atlantic coast at the mouth of the Bou Regreg River, opposite Salé. One of Morocco's four imperial cities, it was founded in the 12th century by a ruler of the Almohad dynasty, ʿAbd al-Muʾmin, as a *ribāṭ* (camp) quartering troops for his holy war against Spain. After 1609 the unified community of Rabat-Salé became the home of large numbers of Andalusian Moors who had been driven from Spain and, later, of the Sallee Corsairs, the most dreaded of Barbary Coast pirates. Under the French, it was made the administrative capital of a French protectorate after 1912. Now a centre of the textile industry, it is noted for its carpets, blankets, and leather handicrafts.

Rabban Gamaliel See Gamaliel I

rabbi \'ra-ˌbī\ *or* **rebbe** \'re-bə\ In Judaism, a person qualified by study of the Hebrew scriptures and the Talmud to serve as spiritual leader of a Jewish community or congregation. Ordination can be conferred by any rabbi, but it usually depends on a written statement issued by the candidate's teacher. Though rabbis are considered teachers rather than priests, they conduct religious services, assist at Bar Mitzvahs, perform marriages, and are present at funerals. In questions of divorce, a rabbi's role depends on an appointment to a special court of Jewish law. The rabbi also counsels and consoles members of his congregation and oversees the religious education of the young.

rabbinic Judaism \rə-'bi-nik\ Principal form of Judaism that developed after the fall of the Second Temple of Jerusalem (AD 70). It originated in the teachings of the Pharisees, who emphasized the need for critical interpretation of the Torah. Rabbinic Judaism is centered on study of the Talmud and debate about the legal and theological issues it raises. Its mode of worship and life discipline continue to be practiced by Jews worldwide.

rabbit Any small, bounding, gnawing mammal of the family Leporidae. Rabbits have long ears, a short tail, long hind legs, and continuously growing incisors. Most species are gray or brown and range in size from 10 to 18 in. (25 to 45 cm) long and 1 to 4 lb (0.5 to 2 kg). They feed primarily on grasses. Their reproductive rate is very high; unlike hares, rabbits are born blind, hairless, and helpless. Most species are nocturnal and live alone in burrows. However, the European, or Old World, rabbit (*Oryctolagus cuniculus*; of Europe and Asia) lives in warrens consisting of many burrows; this species is the ancestor to all domestic breeds. The 13 North American species called cottontails (genus *Sylvilagus*) have white on the underside of the tail.



Eastern cottontail rabbit (*Sylvilagus floridanus*).
STEVE AND DAVE MASLOWSKI

Rabéarivelo \rä-bā-ä-rē-'vä-lō**, Jean-Joseph** (b. March 4, 1901, Tananarive, Madag.—d. June 22, 1937, Tananarive) Malagasy writer. Largely self-educated, he earned his living as a proofreader for a publishing concern. He wrote seven volumes of poetry in French, of which *Near-Dreams* (1934) and *Translation of the Night* (1935) are considered the most important. The mythical and surrealistic world created in his poems is intensely personal and dominated by visions of death, catastrophe, and alienation. Harassed by French authorities and addicted to drugs, he committed suicide. He is regarded as the father of modern literature in his native land.

Rabelais \rä-'ble,\ *English* \'ra-bə-ˌlā**, François** (b. c. 1494, Poitou, France—d. probably April 9, 1553, Paris) French writer and priest. After apparently studying law, he took holy orders as a Franciscan but later, because of a dispute, removed to a Benedictine house. In 1530 he left the Benedictines to study medicine, a profession he would follow the rest of his life. He became a significant humanist scholar, publishing translations of Hippocrates and Galen. His fame rests on the five comic novels (one of doubtful authenticity) known collectively as *Gargantua and Pantagruel*, including the masterpieces *Pantagruel* (1532) and *Gargantua* (1534) as well as *Le Tiers Livre* (1546; "The Third Book"), his most profound work. These works display a delight in words, a mastery of storytelling, and deep humanist learning in a mosaic of scholarly, literary, and scientific parody that is unlike any previous work in French. The books were banned by civil and church authorities for their satirical content and earthy humour, but they were nevertheless read throughout Europe. Throughout his career, Rabelais owed his freedom to the protection of powerful patrons.

Rabi \'rä-bē**, I(sidor) I(saac)** (b. July 29, 1898, Rymanów, Austria-Hungary—d. Jan. 11, 1988, New York, N.Y., U.S.) Polish-born U.S. physicist. He earned his Ph.D. at Columbia University, where he later taught physics (from 1929). In 1940–45 at the Massachusetts Institute of Technology he led a group of scientists who helped develop radar, and he succeeded J. Robert Oppenheimer as chairman of the Atomic Energy Commission's General Advisory Committee (1952–56). He was the first to propose the joint European laboratory CERN, and he helped found New York's Brookhaven National Laboratory. His method for measuring the magnetic properties of atoms, atomic nuclei, and molecules (1937) led to the atomic clock, the maser, the laser, magnetic resonance imaging, and the central technique for molecular and atomic beam experimentation; it also won him a 1944 Nobel Prize.

rabies \'rā-ˌbēz\ Acute, usually fatal infectious disease of warm-blooded animals that attacks the central nervous system. It is spread by contact with an infected animal's saliva, usually from a bite. The rhabdovirus that causes it spreads along nerve tissue from the wound to the brain. Symptoms usually appear four to six weeks later, often beginning with irritability and aggressiveness. Wild animals lose their fear of humans and are easily provoked to bite, as are pets. Depression and paralysis soon follow. Death usually comes three to five days after symptoms begin. In humans, death can result from a seizure in the early phase even before symptoms of central nervous system depression develop. One name for rabies, hydrophobia ("fear of water"), comes from painful throat contraction on trying to swallow. If not treated in time (within a day or two) with a serum containing antibodies and then a series of vaccinations, rabies in humans is almost always fatal. Immediate cleansing of animal bites with soap and water can remove much of the virus.

Rabin \rə-'bēn**, Yitzhak** (b. March 1, 1922, Jerusalem—d. Nov. 4, 1995, Tel Aviv–Yafo, Israel) First native-born prime minister of Israel. He fought in the first Arab-Israeli War and became chief of staff in 1964. His strategies helped win the Six-Day War in 1967. After retiring from the army (1968), he served as ambassador to the U.S. (1968–73). As head of the Israel Labour Party, he twice served as prime minister (1974–77, 1992–95). During his first tenure, he secured a cease-fire with Syria in the Golan Heights and ordered the raid at Entebbe, Ugan. (see Entebbe raid). As defense minister (1984–90) he responded forcefully to the Palestinian first *intifādah*. In 1993 secret negotiations with the Palestinians yielded a political settlement that called for limited Palestinian self-rule in the Gaza Strip and the West Bank, for which he shared the 1994 Nobel Prize for Peace with Shimon Peres and Yāsir ʿArafāt. He was assassinated by a right-wing Jewish extremist.

raccoon *or* **ringtail** Any of seven species of omnivorous, nocturnal carnivores (genus *Procyon*, family Procyonidae) characterized by a bushy,

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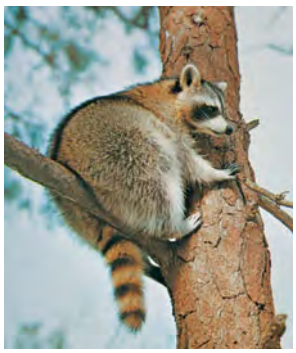
ringed tail and a black mask on the face. The North American raccoon (*P. lotor*) has a stout body, short legs, pointed muzzle, and small erect ears. It is 30–36 in. (75–90 cm) long, including the 10-in. (25-cm) tail, and weighs over 22 lb (10 kg). The shaggy, coarse fur is iron-gray to blackish. The feet resemble slender human hands. Raccoons eat arthropods, rodents, frogs, berries, fruit, and plants; in towns and cities they thrive on garbage. They prefer woods near water and usually live in hollow trees. The crab-eating raccoon (*P. cancrivorus*) of South America is similar but has coarser fur.



North American raccoon (*Procyon lotor*).
LEONARD LEE RUE III

race Term once commonly used in PHYSICAL ANTHROPOLOGY to denote a division of humankind possessing traits that are transmissible by descent and sufficient to characterize it as a distinct human type (e.g., Caucasoid, Mongoloid, Negroid). Today the term has little scientific standing, as older methods of differentiation, including hair form and body measurement, have given way to the comparative analysis of DNA and gene frequencies relating to such factors as BLOOD TYPING, the excretion of AMINO ACIDS, and inherited ENZYME deficiencies. Because all human populations today are extremely similar genetically, most researchers have abandoned the concept of race for the concept of the cline, a graded series of differences occurring along a line of environmental or geographical transition. This reflects the recognition that human populations have always been in a state of flux, with genes constantly flowing from one gene pool to another, impeded only by physical or ecological boundaries. While relative isolation does preserve genetic differences and allow populations to maximally adapt to climatic and disease factors over long periods of time, all groups currently existing are thoroughly "mixed" genetically, and such differences as still exist do not lend themselves to simple typologizing. "Race" is today primarily a sociological designation, identifying a class sharing some outward physical characteristics and some commonalities of culture and history. See also CLIMATIC ADAPTATION, ETHNIC GROUP, RACISM.

racemate \rā-'sē-ˌmāt\ Mixture of equal quantities of two enantiomers, substances whose molecular structures are mirror images of one another (see ISOMER). The two enantiomers rotate polarized light through opposite angles, canceling each other out so that the racemic mixture has no OPTICAL ACTIVITY. Racemization is the conversion of an optically active form of a compound into a racemic mixture; reversing this process is called resolution.

racer Any of several slender, swift SNAKES (subspecies of *Coluber constrictor*, family Colubridae) of North and Central America and Asia. Racers have a long tail, big eyes, and smooth scales. Colour and pattern vary among subspecies, some of which grow to 6 ft (1.8 m) long. Among the fastest of snakes, racers can move at 3.5 mph (5.6 km/hr). They hold down their prey, usually a small warm-blooded animal, by the weight of their coils and then swallow it. If cornered, they vibrate the tail and strike repeatedly with a sideways motion that tears a victim's skin. See also BLACK SNAKE.

Racer (*Coluber constrictor*)
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Rachel In the book of GENESIS, one of JACOB's two wives. Jacob was forced to serve her father, Laban, for seven years to win her, but at the end of that time he was tricked into marrying her sister, Leah. He was then allowed to marry Rachel as well, in return for seven more years of labour. At first childless, Rachel eventually gave birth to JOSEPH, and she died giving birth to Benjamin.

Rachmaninoff \räk-'mä-nə-ˌnȯf**, Sergey (Vassilyevich)** (b. April 1, 1873, Oneg, near Semyonovo, Russia—d. March 28, 1943, Beverly Hills, Calif., U.S.) Russian-born U.S. composer and pianist. He studied at the St. Petersburg and Moscow conservatories. After playing his first concerto for his graduation as a piano student (1891), he stayed on to earn a composition degree, writing his first opera, *Aleko* (1892). His first symphony (1897) was such a disaster that he could not compose for three years. Known for his titanic virtuosity as a pianist, he toured widely while returning to composing prolifically. He moved to the U.S. after the 1917 revolution. His works, most of them in a lush late-Romantic style, include three symphonies, four piano concertos, the tone poem *From the Isle of the Dead* (1909), and *Symphonic Dances* (1940).

Racine \rà-'sēn**, Jean (-Baptiste)** (baptized Dec. 22, 1639, La Ferté-Milon, France—d. April 21, 1699, Paris) French playwright. Orphaned at an early age, he was educated in a Jansenist convent, and he chose drama in defiance of his upbringing. His first play was produced by MOLIÈRE in 1664. Their friendship ended when Racine took his next play, *Alexander the Great* (1665), to a competing theatre and seduced Molière's mistress and leading actress, Thérèse du Parc. She starred in Racine's successful *Andromaque* (1667), which explored his theme of the tragic folly of passionate love. His only comedy, *The Litigants* (1668), was followed by his great tragedies *Britannicus* (1669), *Bérénice* (1670), and *Bajazet* (1672). After writing his masterpiece, *Phèdre* (1677), a tragedy drawn from Greek mythology, he retired to become official historian to LOUIS XIV. His final plays, *Esther* (1689) and *Athalie* (1691), were commissioned by the king's wife, Mme. de MAINTENON.

racism Any action, practice, or belief that reflects the racial worldview—the ideology that humans are divided into separate and exclusive biological entities called "races," that there is a causal link between inherited physical traits and traits of personality, intellect, morality, and other cultural behavioral features, and that some "races" are innately superior to others. Racism was at the heart of North American SLAVERY and the overseas colonization and empire-building activities of some western Europeans, especially in the 18th century. The idea of RACE was invented to magnify the differences between people of European origin in the U.S. and those of African descent whose ancestors had been brought against their will to function as slaves in the American South. By viewing Africans and their descendants as lesser human beings, the proponents of slavery attempted to justify and maintain this system of exploitation while at the same time portraying the U.S. as a bastion and champion of human freedom, with human rights, democratic institutions, unlimited opportunities, and equality. The contradiction between slavery and the ideology of human equality, accompanying a philosophy of human freedom and dignity, seemed to demand the dehumanization of those enslaved. By the 19th century racism had matured and the idea spread around the world. Racism differs from ethnocentrism in that it is linked to physical and therefore immutable differences among people. Ethnic identity is acquired, and ethnic features are learned forms of behaviour. Race, on the other hand, is a form of identity that is perceived as innate and unalterable. In the last half of the 20th century several conflicts around the world were interpreted in racial terms even though their origins were in the ethnic hostilities that have long characterized many human societies (e.g., Arabs and Jews, English and Irish). Racism reflects an acceptance of the deepest forms and degrees of divisiveness and carries the implication that differences among groups are so great that they cannot be transcended. See also ETHNIC GROUP; SOCIOCULTURAL EVOLUTION.

rack and pinion Mechanical device consisting of a bar of rectangular cross section (the rack), having teeth on one side that mesh with teeth on a small GEAR (the pinion). If the pinion rotates about a fixed axis, the rack will move in a straight path. Some AUTOMOBILE steering mechanisms have rack-and-pinion drives that use this principle. If the rack is fixed and the pinion is carried in bearings on a table guided on tracks parallel to the rack, rotation of the pinion shaft will move the table parallel to the rack. On MACHINE TOOLS, this principle is used to obtain rapid movements of worktables.

racketeering See ORGANIZED CRIME

rackets Game for two or four players with ball and racket on a four-walled court. Rackets is played with a hard ball in a relatively large court (approximately 9 × 18 m), unlike the related games of SQUASH and RACQUETBALL. As in these other games, the object of rackets is to bounce, or rebound, the ball off the front and other walls in such a way as to defeat an opponent's attempt to reach and return it. It appears to have developed in England in the early 19th century.

Rackham, Arthur (b. Sept. 19, 1867, London, Eng.—d. Sept. 6, 1939, Limpsfield, Surrey) British artist and illustrator. While a staff artist for a

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London newspaper, he also began illustrating books. He became skillful using the new halftone process, and his highly detailed drawings revealed a unique imagination. He achieved renown with a 1900 edition of *Grimm's Fairy Tales*, and his illustrations for *Rip Van Winkle* (1905) brought him recognition in America as well. Altogether he illustrated more than 60 books, including classics of children's literature as well as works by William Shakespeare, Charles Dickens, John Milton, Richard Wagner, and Edgar Allan Poe.

racquetball Game similar to handball but played with racquets. The game is played on a four-walled court with a short-handled racket and a ball larger than that used in handball. It was invented in 1950 by Joseph G. Sobek (1918–98), who was unhappy with the indoor racquet sports then available. By the late 1990s there were 8.5 million racquetball players in 91 countries.

radar System that uses electromagnetic echoes to detect and locate objects. It can also measure precisely the distance (range) to an object and the speed at which the object is moving toward or away from the observing unit. Radar (the name is derived from *ra*dio *d*etecting *a*nd *r*anging) originated in the experimental work of Heinrich Hertz in the late 1880s. During World War II British and U.S. researchers developed a high-powered microwave radar system for military use. Radar is used today in identification and monitoring of artificial satellites in Earth orbit, as a navigational aid for airplanes and marine vessels, for air traffic control around major airports, for monitoring local weather systems, and for spotting "speeders."

radar astronomy See radio and radar astronomy

Radcliffe, Ann *orig.* **Ann Ward** (b. July 9, 1764, London, Eng.—d. Feb. 7, 1823, London) English gothic novelist. Brought up in a well-to-do family, in 1787 she married a journalist who encouraged her literary pursuits. Her first two novels were published anonymously. She achieved fame with her third novel, *The Romance of the Forest* (1791). With her fourth, *The Mysteries of Udolpho* (1794), she became the most popular novelist in England. *The Italian* (1797), which displays rare psychological insight, reveals her full powers. In her tales, scenes of terror and suspense are infused with an aura of romantic sensibility. See also gothic novel.

Radcliffe-Brown, A(lfred) R(eginald) (b. Jan. 17, 1881, Birmingham, Warwick, Eng.—d. Oct. 24, 1955, London) British social anthropologist. He taught at the universities of Cape Town, Sydney, Chicago, and Oxford. In his version of functionalism, he viewed the component parts of society (e.g., the kinship system, the legal system) as having an indispensable function for one another, the continued existence of one component being dependent on that of the other, and he developed a systematic framework of concepts relating to the social structures of small-scale societies. He had a profound impact on British and American social anthropology. Among his major works are *The Andaman Islanders* (1922) and *Structure and Function in Primitive Society* (1952).

Radek \'rä-dyik**, Karl (Bernhardovich)** *orig.* **Karl Sobelsohn** (b. 1885, Lemberg, Galicia, Austria-Hungary—d. 1939?) Russian communist politician. He took part in the Russian Revolution of 1905, then wrote for leftist newspapers in Poland and Germany (1906–14). After meeting Vladimir Lenin in 1915, he helped reorganize the German Communist Party in 1918. He returned to Russia in 1919 and rose to leadership in the Comintern but was ousted in 1924 for his support of Leon Trotsky. After recanting in 1929, he became a fervent Stalinist and editorial board member of *Izvestiya* (1931–36). Despite his conversion, he was arrested and tried in the purge trials and sentenced to 10 years in prison, where he died.

Radetzky \rä-'det-skē**, Joseph, Count** (b. Nov. 2, 1766, Trebnice, Bohemia—d. Jan. 5, 1858, Milan) Austrian army officer. He fought with distinction against the French in the Napoleonic Wars. As army chief of staff, he attempted to modernize the Austrian army. As commander in chief of the Austrian army in northern Italy (1831–57), he suppressed the revolt in the Austrian-ruled provinces of Lombardy and Venetia in 1848. He served as governor-general of these provinces (1849–57). His status among conservatives as a national hero inspired Johann Strauss the Elder to compose the *Radetzky March*.

Radha \'rä-dä\ In Hindu mythology, mistress of the god Krishna when he lived among the cowherds of Vrndavana. Though Radha was the wife of another cowherd, she was the most beloved of Krishna's consorts and his constant companion. In the bhakti movement of Vaishnavism, Radha symbolizes the human soul and Krishna the divine. The allegorical love of Radha and Krishna has been celebrated in the poetry of many Indian languages, and Radha is often worshiped along with Krishna, especially in northern and eastern India.

radial engine Type of internal-combustion engine used mainly in small airplanes, in which the cylinders (ranging from five to as many as 28, depending on engine size) are mounted in a circle around the crankshaft, sometimes in banks of two or more. Once the dominant piston-engine type, radials are now in only limited production; most new requirements are met by remanufacturing existing stock.

radiant heating Heating system in which heat is transmitted by radiation from a heated surface. Radiant heating systems usually employ either electric-resistance wiring or hot-water heating pipes, which may embedded in the floor, ceiling, or walls. Panel heating is a form of radiant heating characterized by very large surfaces (typically an entire ceiling or floor) containing electrical conductors, hot-water pipes, or hot-air ducts. With many such systems there is no visible heating equipment in the room.

radiation Process by which energy is emitted from a source and propagated through the surrounding medium, or the energy involved in this process. Radiation consists of a flow of atomic or subatomic particles or of waves. Familiar examples are light (a form of electromagnetic radiation) and sound (a form of acoustic radiation). Both electromagnetic and acoustic radiation can be described as waves with a range of frequencies and intensities. Electromagnetic radiation is also often treated as discrete packets of energy, called photons. All matter is constantly bombarded by radiation from cosmic and terrestrial sources, and radioactive elements emit several types of radiation (see radioactivity). See also Cherenkov radiation, Hawking radiation, infrared radiation, synchrotron radiation, thermal radiation, ultraviolet radiation.

radiation injury Tissue damage caused by exposure to ionizing radiation. Structures with rapid cell turnover (e.g., skin, stomach or intestinal lining, and bone marrow) are most susceptible. High-dose irradiation of the last two causes radiation sickness. Nausea and vomiting subside in a few hours. They are followed in intestinal cases by abdominal pain, fever, and diarrhea leading to dehydration and a fatal shocklike state, and in bone-marrow cases (two to three weeks later) by fever, weakness, hair loss, infection, and hemorrhage. In severe cases, death occurs from infection and uncontrollable bleeding. Lower radiation doses can cause cancer (notably leukemia and breast cancer), sometimes years later. Radiation exposure in early pregnancy can produce abnormalities in the embryo, whose cells are multiplying rapidly.

radiation pressure Pressure on a surface resulting from electromagnetic radiation that impinges on it. The pressure is a result of the momentum carried by the radiation. When radiation is reflected rather than absorbed, the radiation pressure is doubled. Radiation pressure can sometimes be great enough to produce a force that is useful.

radiation therapy *or* **radiotherapy** *or* **therapeutic radiology** Use of radiation sources to treat or relieve diseases, usually cancer (including leukemia). The ionizing radiation primarily used to destroy diseased cells works best on fast-growing cancers. However, radiation can also cause cancer (see radiation injury) and is no longer used for benign conditions. Other complications include nausea, hair loss, weight loss, and weakness. Radioactive substances may be implanted in tumours (see nuclear medicine). External radiation involves 10–20 sessions over several months, either after surgical removal of the growth or when surgery is impossible; it can deliver higher doses to deep tumours than implantation. Infrared radiation and ultraviolet radiation is applied with lamps to relieve inflammation.

radical Term used in chemistry with one predominant and two subsidiary, looser meanings. It most often refers to a free radical. It can also mean an ion or a functional group.

radical In politics, one who desires extreme change of part or all of the social order. The term (which derives from the Latin word for "root," and thus implies change beginning at a system's roots) was given this sense by Charles James Fox in 1797 when he demanded "radical reform" consisting of universal manhood suffrage. In France before 1848, republicans and advocates of universal male suffrage were called radicals. The term was later applied to Marxists (see Marxism) who called for fundamental

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social change to eradicate divisions among social classes. In popular usage, it is applied to political extremism, not necessarily violent, of both the left and the right.

Radical Republican Member of the Republican Party in the 1860s committed to the emancipation of slaves and the equal treatment and enfranchisement of blacks. Zealous antislavery advocates in the Congress pressed Pres. Abraham Lincoln to include emancipation as a war aim. They later opposed his policy of lenient Reconstruction of the South under presidential control and passed harsher measures in the Wade-Davis Bill. After Lincoln's death the Radicals supported Pres. Andrew Johnson but soon demanded congressional control of Reconstruction. Johnson's attempt to break the Radicals' power led them to pass the Tenure of Office Act; his challenge of the act led to his impeachment. Radical Republican leaders included Henry Winter Davis (1817–65), Thaddeus Stevens, Charles Sumner, and Benjamin Butler. Their influence waned as white control over Southern governments gradually returned in the 1870s.

Radical-Socialist Party French political party. The oldest of France's political parties, it was founded in 1901 but originated in the 1870s in the reformist wing of the French Republican Party, known as the Radicals, led by Georges Clemenceau. Traditionally a centrist party, it was most prominent in the Third Republic and Fourth Republic. In the 1920s and '30s it joined coalition governments with the French Socialist Party. After 1945 it led other centrist groups to form politically important coalitions. By the late 20th century, however, it was only a minor party. In 1998 it renamed itself the Radical Party of the Left.

radio Electromagnetic radiation of lower frequency (hence longer wavelength) than visible light or infrared radiation, and consisting of the range of frequencies used for navigation signals, AM and FM broadcasting, television transmissions, cell-phone communications, and various forms of radar. For radio transmission, information is imparted to a carrier wave by varying (modulating) its amplitude, frequency, or duration. The technology of radio arose from the work of Michael Faraday, James Clerk Maxwell, Heinrich Hertz, Guglielmo Marconi, and others, and improvement followed the development of the vacuum tube, the electronic-tube oscillator, the tuned circuit, and other components. Later innovations have included the replacement of tubes by transistors and of wires by printed circuits. See also radio and radar astronomy.

radio and radar astronomy Study of celestial bodies by measuring the energy they emit or reflect at radio wavelengths. It began in 1931 with Karl Jansky's discovery of radio waves from an extraterrestrial source. After 1945, huge dish antennas, improved receivers and data-processing methods, and radio interferometers let astronomers study fainter sources and obtain greater detail. Radio waves penetrate much of the gas and dust in space, giving a much clearer picture of the centre and structure of the Milky Way Galaxy than optical observation can. This has allowed detailed studies of the interstellar medium in the Galaxy and the discovery of previously unknown cosmic objects (e.g., pulsars, quasars). In radar astronomy, radio signals are sent to near-Earth bodies or phenomena (e.g., meteor trails, the Moon, asteroids, nearby planets) and the reflections detected, providing precise measurement of the objects' distances and surface structure. Because radar waves can penetrate even dense clouds, they have provided astronomers' only maps of the surface of Venus. Radio and radar studies of the Moon revealed its sandlike surface before landings were made. Radio observations have also contributed greatly to knowledge about the Sun. See also radio telescope.

radio broadcasting See broadcasting

radio telescope Combination of radio receiver and antenna, used for observation in radio and radar astronomy. Radio telescopes vary widely, but all have two basic components: a large radio antenna or an antenna array and a radiometer or radio receiver. Because some astronomical radio sources are extremely weak, radio telescopes are usually very large, and only the most sensitive radio receivers are used. The first large fully steerable radio telescope was completed in 1957 at Jodrell Bank, Eng. The world's largest fully steerable radio telescope is the 360 × 330-ft (110 × 100-m) off-axis antenna operated by the National Radio Astronomy Observatory in Green Bank, W.Va. The largest single radio telescope is the 1,000-ft (305-m) fixed spherical reflector at the Arecibo Observatory in Puerto Rico. The world's most powerful radio telescope is the Very Large Array in New Mexico, made up of 27 separate mobile parabolic antennas that together provide the angular resolution of a single antenna 22 mi (35 km) in diameter. See photograph above.

Lovell Telescope, a fully steerable radio telescope at Jodrell Bank, Macclesfield, Cheshire, Eng.
JODRELL BANK SCIENCE CENTRE

radio wave Wave from the portion of the electromagnetic spectrum at lower frequencies than microwaves. The wavelengths of radio waves range from thousands of metres to around 30 cm. These correspond to frequencies as low as 3 Hz and as high as 1 gigahertz (10^9 Hz). Radio-wave communications signals travel through the air in a straight line, reflect off of clouds or layers of the ionosphere, or are relayed by satellites in space. They are used in standard broadcast radio and television, short-wave radio, navigation and air-traffic control, cellular telephony, and even remote-controlled toys. See illustration on following page.

radioactive series Any of four sets of unstable heavy atomic nuclei that undergo a series of alpha decay and beta decay until a stable nucleus is achieved. The natural series are the thorium series, the uranium series, and the actinium series. These are headed by naturally occurring species of unstable nuclei that have half-lives comparable to the age of the earth. The fourth set, the neptunium series, is headed by neptunium-237, which has a half-life of 2 million years. Its members do not occur naturally but are artificially produced by nuclear reactions and have short half-lives.

radioactivity Property exhibited by certain types of matter of emitting radiation spontaneously. The phenomenon was first reported in 1896 by Henri Becquerel for a uranium salt, and it was soon found that all uranium compounds are radioactive due to the uranium's radioactivity. In 1898 Marie Curie and her husband discovered two other naturally occurring, strongly radioactive elements, radium and polonium. The radiation is emitted by unstable atomic nuclei (see nucleus) as they attempt to become more stable. The main processes of radioactivity are alpha decay, beta decay, and gamma decay. In 1934 it was discovered that radioactivity could be induced in ordinary matter by artificial transmutation.

radiocarbon dating See carbon-14 dating

radiology Branch of medicine that uses radiation for diagnosis (diagnostic imaging) and treatment (radiation therapy) of disease. Originally, it involved X rays for diagnosis and X rays, gamma rays, and other ionizing radiation for treatment. Diagnostic methods now include isotope scanning (see nuclear medicine), use of nonionizing radiation, as in ultrasound and magnetic resonance imaging, and radioimmunoassay (in which radioactive isotopes in antibodies against hormones detect minute amounts of hormones for diagnosis of endocrine disorders). Radiotherapy now includes, in cancer treatment, radioactive hormones and chemotherapeutic drugs.

radiotherapy See radiation therapy

radish Annual or biennial plant (*Raphanus sativus*) of the mustard family, probably of Oriental origin,

Radish (*Raphanus sativus* variety *radicula*)
INGMAR HOLMASEN

O | P | Q | R

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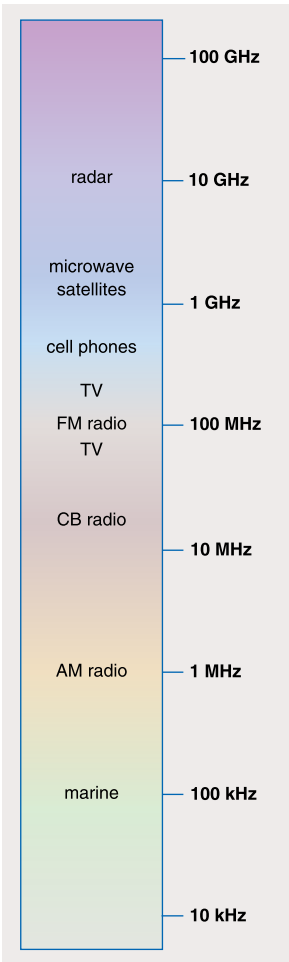

Radio waves lie at the low-frequency end of the electromagnetic spectrum. They are primarily used in various types of communications signals. Also of importance is the detection of natural radio sources in radio and radar astronomy. A few applications are shown at their approximate positions in the spectrum (on a logarithmic scale). Microwaves are a subset of the radio spectrum, ranging from about 1 to 1000 mm in wavelength, or a frequency between about 1 and 100 GHz. The microwave region is used especially in various forms of radar, in communications with spacecraft and satellites (as in the Global Positioning System), and in microwave ovens. Amateur communications, such as CB (citizens' band) and short-wave radio, occur around 10 MHz. Marine navigation and communications systems operate especially below 1 MHz. Other devices or systems using radio waves include metal detectors, loran, and magnetic resonance imaging.

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grown for its large, succulent root. Low in calories and high in bulk, radishes have a sharp taste and are usually eaten raw. The shape of the edible portion of the root varies greatly, as does the color (from white through pink to red, purple, and black). Radishes may weigh only a few ounces (U.S. and European varieties) or, in the case of the Japanese daikon, more than 2 lbs (1 kg).

Radishchev \rə-'dyēsh-chif**, Aleksandr (Nikolayevich)** (b. Aug. 31, 1749, Moscow, Russia—d. Sept. 24, 1802, St. Petersburg) Russian political writer. Although from the nobility, he pursued a career as a civil servant, in which he met people from all social classes. Influenced by such writers as Jean-Jacques Rousseau, he wrote *A Journey from St. Petersburg to Moscow* (1790), in which he described examples of social injustice, hoping that his criticism of serfdom, autocracy, and censorship would enlighten Catherine II. Instead, he was arrested and exiled to Siberia. He was pardoned by Alexander I in 1801 but committed suicide a year later. He inspired later revolutionaries, including those who instigated the Decembrist revolt.

radium Chemical element, heaviest alkaline earth metal, chemical symbol Ra, atomic number 88. It was discovered by Marie Curie and her husband, Pierre Curie, in 1898 and isolated by 1910. All its isotopes are radioactive (see radioactivity). Radium does not occur free in nature but occurs in natural ores such as pitchblende as a disintegration product of radioactive decay of heavier elements, including uranium. Chemically it is highly reactive and has valence 2 in all of its compounds. Its use in medicine (see radiation therapy; radiology; nuclear medicine) has declined because of its cost, and its use in consumer goods (to illuminate watch and clock hands and numbers, as well as instrument dials) was halted because it can cause radiation injury. It is still used for some radiography and as a source of neutrons.

radon \'rā-ˌdän\ Chemical element, chemical symbol Rn, atomic number 86. The heaviest noble gas, it is colourless, odourless, tasteless, radioactive (see radioactivity), and almost completely unreactive (forming compounds only with fluorine). It is rare in nature because all its isotopes are short-lived and because radium, its source, is scarce. Radon seeps from certain soils and rocks (such as granite) into the atmosphere and can accumulate in poorly ventilated spaces near ground level, including house basements; in some regions of the world the use of such spaces is believed to increase the risk of lung cancer more than any other common factor except smoking. Radon is used in radiotherapy, radiography, and research.

Raeburn, Sir Henry (b. March 4, 1756, Stockbridge, Scot.—d. July 8, 1823, Edinburgh) Scottish portrait painter. Though apprenticed early to a goldsmith, he lacked formal training as a painter. He worked principally as a miniaturist and evolved a distinctive style of oil portraiture, painting directly on the canvas without preliminary drawings. His portraits are characterized by a vigorous handling of paint and vivid and experimental lighting effects, usually from behind the sitters' heads. He was elected president of the Edinburgh Society of Artists (1812) and Royal Academician (1815), knighted in 1822, and appointed His Majesty's Limner for Scotland (1822).

Raeder \'rā-dər**, Erich** (b. April 24, 1876, Wandsbek, Ger.—d. Nov. 6, 1960, Kiel, W.Ger.) German naval officer. After serving as chief of staff to an admiral in World War I, he himself rose to the rank of admiral. As naval commander in chief from 1928, he urged the construction of submarines (forbidden by the Treaty of Versailles) and fast cruisers. Appointed grand admiral in 1939, he supervised the invasion of Denmark and Norway in 1940. Differences with Adolf Hitler led to his dismissal from supreme command in 1943. He was sentenced to life in prison at the Nürnberg trials, but he was released because of ill health in 1955.

Raetia *or* **Rhaetia** \'rē-shē-ə\ Ancient Roman province south of the Danube River. It comprised parts of present-day Austria, Switzerland, and Germany. Its native inhabitants were probably of mixed Illyrian and Celtic descent. Conquered by Rome in 15 BC, it became an important part of the empire for its position on the highways between Italy and the Danube and between Gaul and the Balkans. Because it was a frontier province, its boundaries shifted when German tribes encroached; in the 1st century AD, the northern boundary extended to the Neckar River, but in the 3rd century the western and northern boundaries were pulled back. By 450, Rome controlled only the alpine regions.

RAF See Royal Air Force

Raffles, Sir (Thomas) Stamford (b. July 6, 1781, at sea off Port Morant, Jam.—d. July 5, 1826, London, Eng.) Administrator in the British East India Company and founder of Singapore. He joined the British East India Company at age 14, and his hard work won him an appointment as assistant secretary to the government of Penang (in present-day Malaysia). There he undertook an intensive study of the Malayan peoples, and his knowledge allowed him to play a key role in 1811, when the British defeated Dutch-French forces in Java. He subsequently became lieutenant governor there and inaugurated a mass of reforms aimed at transforming the Dutch colonial system and improving the condition of the native population. He was recalled by the company, which deemed his reforms too costly; though he was popular in London (he was knighted in 1816), his authority when he resumed his service in Southeast Asia was severely restricted. Undeterred, he founded the port city of Singapore in 1819 in order to to ensure British access to the China seas; in 1824 the Dutch relinquished all claims to Singapore. Raffles is credited with creating Britain's Far Eastern empire.

raga In the classical music of India and Pakistan, a melodic framework for improvisation based on a given set of notes (usually five to seven) and characteristic rhythmic patterns. A raga can be regarded as a vocabulary of melodic figures that tend, as a group, to emphasize certain tones of a scale, giving the raga a specific emotional character and implying the kind of music to be improvised. The emphasis on certain pitches effectively divides the scale into primary and secondary tones; the secondary tones serve to ornament the primary tones, thus reinforcing the emphasis. Each scale can have several different ragas, depending on which tones of the scale are made primary. Two additional factors contribute to the artistic potential of the raga: the division of tones between primary and secondary is not always hard and fast; moreover, a tertiary level (ornaments of the ornaments) is often made available to the performer. The concept of raga, introduced sometime before the 9th century, became influential throughout South and East Asia. See also South Asian arts.

Ragae See Rhagae

Raglan (of Raglan), FitzRoy James Henry Somerset, 1st Baron (b. Sept. 30, 1788, Badminton, Gloucestershire, Eng.—d. June 28, 1855, near Sevastopol, Crimea, Russia) English army officer. He served as aide and, later, military secretary to the duke of Wellington. Appointed commander in chief of British forces in the Crimean War

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(1854), he gave an ambiguous order in the Battle of Balaklava that led to the disastrous charge of the Light Cavalry Brigade under the earl of Cardigan. Raglan became the scapegoat for the campaign's lack of progress and the inadequate supplies to the troops in the winter of 1854–55. His name was applied to the raglan sleeve, probably designed to adapt his coat to the arm he had amputated after the Battle of Waterloo.

Ragnarök \'räg-nə-ˌrœk, 'räg-nə-ˌräk\ In Scandinavian mythology, the end of the divine and human worlds. As described in the 10th-century Icelandic poem *Völuspá* and other sources, Ragnarök will be preceded by cruel winters and moral chaos. Giants and demons will attack the gods, who will face death like heroes. The sun will be darkened, the stars will vanish, and the earth will sink into the sea. Afterward the earth will rise again, the innocent Balder will return from the dead, and the hosts of the just will live in a hall roofed with gold. The title of Richard Wagner's opera *Götterdämmerung* (*The Twilight of the Gods*) is a German equivalent of Ragnarök.

ragtime U.S. popular music of the late 19th and early 20th centuries distinguished by its heavily syncopated rhythm. Ragtime found its characteristic expression in formally structured piano compositions, the accented left-hand beat opposed in the right hand by a fast, bouncing melody that gave the music its powerful forward impetus. (The term probably derives from "ragged time," a description of syncopation.) Ragtime compositions typically featured three or four discrete 16-bar strains performed at a moderate tempo. The most celebrated ragtime composer was Scott Joplin. The rhythm and structure of ragtime were important influences on the development of jazz.

ragweed Any of about 15 species of weedy plants (see weed) that make up the genus *Ambrosia* in the composite family, most of which are native to North America. They have rough hairy stems, mostly lobed or divided leaves, and inconspicuous greenish flowers borne in small heads. Common ragweed (*A. artemisiifolia*) is found across North America. Pollen shed by ragweeds in great abundance in late summer is the principal cause of hay fever in eastern and middle North America. Since ragweeds are annuals, mowing before pollination season eradicates them.

rail Any of about 100 species (family Rallidae) of slender marsh birds found almost worldwide. Rails have short rounded wings, a short tail, large feet, and long toes. Their loud call, especially at night, reveals their presence in dense vegetation. They are mostly dull grays and browns, often with barred patterns. Species vary from 4 to 18 in. (11–45 cm) long. Short-billed species are often called crakes. The king (*Rallus elegans*), clapper (*R. longirostris*), and Virginia (*R. limicola*) rails and the sora, or Carolina rail (*Porzana carolina*), have been hunted in the U.S.; several of the rails are now endangered, and some species have been exterminated.

Virginia rail (*Rallus limicola*)
JOHN H. GERARD FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

railroad Mode of land transportation in which flange-wheeled vehicles move over two parallel steel rails or tracks, drawn by a locomotive or propelled by self-contained motors. The earliest railroads were built in European mines in the 16th century, using cars pulled on tracks by men or horses. With the advent of the steam locomotive and construction of the first railway in 1825, the modern railroad developed quickly. The first U.S. railroad, the Baltimore and Ohio, began operation in 1827. Specialized railroad cars were built to transport freight and passengers, including the sleeping cars developed by George Pullman in 1859. In the 19th century the railroad had an important influence on every country's economic and social development. In the U.S. the transcontinental railroad, completed in 1869, began an era of railroad expansion and consolidation that involved such financial empire builders as Cornelius Vanderbilt, Jay Gould, Edward H. Harriman, James J. Hill, and Leland Stanford. The railroad's importance in the U.S. began to diminish from the early 20th century, but in Europe, Asia, and Africa it continues to provide vital transportation links within and between countries. See also Orient Express, Trans-Siberian Railroad.

Railway Express Agency U.S. company that once operated the nation's largest ground and air express services. It was founded by the U.S. government as the American Railway Express Co. in 1918, when the nation's major express carriers—Adams & Co., American Express Co., Wells, Fargo & Co., and Southern Express Co.—were merged into a public corporation. An association of railroads bought out the business in 1929 and began to operate it as the Railway Express Agency. Its name was changed to REA Express in 1970. Poor management, strikes, and competition led to heavy losses, and REA filed for bankruptcy in 1975.

Raimondi \rī-'män-dē, rī-'mōn-dē**, Marcantonio** (b. c. 1480, near Bologna—d. c. 1534, Bologna) Italian engraver. He trained in Bologna under Francesco Francia, but his energetic lines and use of cross-hatching in modeling were influenced by Albrecht Dürer. After he moved to Rome c. 1510, he specialized in reproducing works by other artists, particularly Raphael. He retained Raphael's idealized figures but provided his own background and landscapes. His engravings sold in large numbers and did much to spread High Renaissance style throughout Europe during his lifetime.

rain Precipitation of liquid water drops with diameters greater than 0.02 in. (0.5 mm). When the drops are smaller, the precipitation is usually called drizzle. Raindrops may form by the coalescence of colliding small water droplets or from the melting of snowflakes and other ice particles as they fall into warm air near the ground. Hawaii's Mount Waialeale, with a 20-year annual average of 460 in. (11,700 mm), is the Earth's wettest known point; the driest areas are in parts of deserts where no appreciable rain has ever been observed. Less than 10 in. (250 mm) and more than 60 in. (1,500 mm) per year represent approximate extremes of rainfall for all the continents.

rain dance Ceremonial dance performed to bring rain needed to water crops. Rain dances have been customary in many cultures, from the ancient Egyptians to the civilization of the Mayas and the people of the 20th-century Balkans. Rain dances often include dancing in a circle, the participation of young girls, decoration with green vegetation, nudity, the pouring of water, and whirling, meant to act as a wind charm. They may also include phallic and fertility rites.

rainbow Series of concentric, coloured arcs that may be seen when light from a distant source—usually the Sun—falls on a collection of water drops such as in rain, spray, or fog. The coloured rays of the rainbow are caused by the refraction and internal reflection of light rays that enter the drop, each colour being bent through a slightly different angle. Hence, the combined colours are separated upon emerging from the drop. The most brilliant and most common rainbow is the so-called primary bow, which results from light that emerges from the drop after one internal reflection. The colours of the arc (from outside to inside) are red, orange, yellow, green, blue, indigo, and violet. Occasionally a less-intense secondary bow may be observed; it has its colour sequence reversed.

Rainbow Bridge National Monument Natural area, southern Utah, U.S. Located on the Navajo Indian Reservation near the Utah-Arizona border, the monument was established in 1910 and occupies 160 acres (65 hectares). It centres on a rainbow-shaped bridge of pink sandstone 290 ft (88 m) above a creek that winds toward the Colorado River. The bridge is 275 ft (84 m) long and is one of the world's largest natural bridges. Embedded among canyons, the area is accessible only on foot, by horseback, or by boat on Lake Powell.

rainbow trout Species (*Oncorhynchus mykiss*) of fish in the salmon family (Salmonidae) noted for spectacular leaps and hard fighting when hooked. It has been introduced from western North America to many other countries. A brightly coloured fish of lakes and swift streams, it is covered with small black spots and has a reddish band along either side. The steelhead, a large, bluish, oceangoing form, is also a prized game fish. Rainbow trout may weigh 6 lb (2.8 kg); steelheads (and rainbows in large lakes) may weigh 10–20 lb (4.5–9 kg) or more. Another form of rainbow, the Kamloops, or Kootenay, trout of Idaho, may exceed 30 lb (14 kg).

Rainer \'rī-nər**, Luise** (b. Jan. 12, 1910, Vienna, Austria) Austrian film actress. She grew up in Munich, in Switzerland, and in Vienna and was a distinguished stage actress with Max Reinhardt's company (from 1927) before making films in Europe. Moving to Hollywood, she starred in *The Great Ziegfeld* (1936) and *The Good Earth* (1936), winning Academy Awards for both pictures. After a brief career and a stormy marriage to Clifford Odets, she retired to Europe, returning to the screen many years later in *Dancer* (1988) and *The Gambler* (1997).

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Rainey, Ma *orig.* **Gertrude Malissa Nix Pridgett** (b. April 26, 1886, Columbus, Ga., U.S.—d. Dec. 22, 1939, Rome, Ga.) U.S. singer. Rainey began touring Southern tent shows, levee camps, and cabarets at age 17 in a song-and-dance team with her husband, the minstrel comic William ("Pa") Rainey. She performed through the 1920s, leading her own troupes, including at times Bessie Smith and Thomas A. Dorsey. An earthy stage presence, known for her flamboyant dress and her deep, powerful contralto voice, Rainey recorded more than 90 songs (including "See See Rider" and "Ma Rainey's Black Bottom") from 1923 to 1928 with country blues musicians and black jazz players. She retired in 1933. The first great professional blues vocalist, she earned the sobriquet "mother of the blues."

rainforest Lush forest, generally composed of tall, broad-leaved trees and usually found in wet tropical regions around the Equator. Despite increased awareness of the rainforests' importance during the late 20th century, they continue to be cleared. Rainforests grow mainly in South and Central America, West and Central Africa, Indonesia, parts of Southeast Asia, and tropical Australia, where the climate is relatively humid with no marked seasonal variation. Depending on the amount of annual rainfall, the trees may be evergreen or mainly deciduous. The former require more water. Temperatures are high, usually about 86 °F (30 °C) during the day and 68 °F (20 °C) at night. Soil conditions vary with location and climate, though most rainforest soils tend to be permanently moist and not very fertile, because the hot, humid weather causes organic matter to decompose rapidly and to be absorbed quickly by tree roots and fungi. Rainforests have several layers. The highest continuous layer, called the canopy, extends across the treetops at a height of 100–165 ft (30–50 m). Most animals live among the leaves and branches. Below the canopy is a thick understory filled with small trees, lianas, and epiphytes. The space directly above the ground can be occupied by tree branches, twigs, and foliage, but, contrary to popular belief, the rainforest floor is not impassable. Rather, it is bare except for a thin layer of humus and fallen leaves. Animals inhabiting this layer (e.g., gorillas, elephants, jaguars, and bears) are adapted to walking or climbing for only short distances. Burrowing animals, such as armadillos and caecilians, are found in the soil, as are microorganisms that help decompose and recycle the organic litter accumulated by other plants and animals from all layers. The climate of the ground layer is unusually stable because the upper stories of tree canopies and the lower branches filter out sunlight, retain heat, and reduce wind speeds, keeping the temperature fairly even.

Rainier \ren-'yā,\ *English* \rā-'nir\ **III** *orig.* **Rainier-Louis-Henri-Maxence-Bertrand de Grimaldi** (b. May 31, 1923, Monaco—d. April 6, 2005, Monaco) Prince of Monaco (1949–2005), 31st in a line of hereditary rulers. He intensified, expanded, and diversified Monaco's enterprises, including its industry. Through land reclamation from the sea, he expanded the principality's territory by one-fifth. His most significant political reform was the promulgation of a new constitution, based on modern principles without repudiating tradition. His wedding to Grace Kelly in 1956 attracted worldwide attention.

Rainier \rə-'nir**, Mount** Mountain, west-central Washington state, U.S. At 14,410 ft (4,392 m), Mount Rainier is the highest point in the Cascade Range and in the state. The mountain is actually a dormant volcano that last erupted some 150–175 years ago; it covers 100 sq mi (260 sq km) and is surrounded by the largest single-mountain glacier system in the continental U.S., with 41 glaciers radiating from the broad summit. It forms the centre of Mount Rainier National Park, which was established in 1899 and comprises 368 sq mi (953 sq km). It is a popular tourist and recreation area.

Rainy Lake Narrow lake astride the Canadian-U.S. border, between Minnesota and southwestern Ontario. Rainy Lake is about 50 mi (80 km) long and has an area of 360 sq mi (932 sq km). Its shores are irregular and deeply indented, and it contains more than 500 islands. The region is the site of several Indian reservations and is popular for hunting, fishing, and canoeing.

Rajang \'rä-,jäŋ\ **River** *or* **Rejang** \'rā-,jäŋ\ **River** Chief river, central Sarawak, Malaysia, on the island of Borneo. It flows southwest and west into the South China Sea and is about 350 mi (565 km) long. It is navigable for about 80 mi (130 km) to Sibu by oceangoing vessels and has a wide, swampy delta. Several market towns are along its banks.

Rajasthan \'rä-jə-,stän\ State (pop., 2001 prelim.: 56,473,122), northwestern India. Bordered by Pakistan and the states of Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, and Gujarat, it covers an area of 132,139 sq mi (342,239 sq km); its capital is Jaipur. Archaeological evidence shows continuous human habitation for about 100,000 years. In the 7th–11th centuries AD, several Rajput dynasties arose, reaching their height in the 16th century. The emperor Akbar brought the Rajput states into the Mughal Empire. In the 19th century, the British came into control of the region. After Indian independence (1947), the area was organized as the Union of Rajasthan, then reorganized in 1956. It is dominated by the Aravalli Range and the Thar Desert. Predominantly an agricultural and pastoral state, it is the largest producer of wool in India.

Rajneesh \'rəj-,nēsh, räj-'nēsh**, Bhagwan Shree** *orig.* **Chandra Mohan Jain** (b. Dec. 11, 1931, central India—d. Jan. 19, 1990, Pune) Indian spiritual leader. A teacher of philosophy, he lectured throughout India and established an ashram in Pune (Poona). He preached an eclectic doctrine of Eastern mysticism, individual devotion, and sexual freedom while amassing vast personal wealth. By the early 1970s he had attracted 200,000 devotees, many from Europe and the U.S. He lived with a community of followers in Oregon from 1981 to 1985, when he was deported from the U.S. for immigration fraud. He spent his last years in Pune, where he reestablished his ashram.

Rajput \'räj-,půt\ Any member of a caste of landowners located mainly in central and northern India. The Rajputs are organized in patrilineal clans and number about 12 million. They regard themselves as descendants or members of the Kshattriya (warrior ruling) class, though in fact they vary greatly in status. After the fall of the Gupta dynasty, invaders and indigenous peoples in northwestern India were probably integrated, the leaders in both groups becoming Kshattriyas. The Rajputs became important politically in the 9th–10th centuries, and for centuries they prevented complete Muslim domination of Hindu India. They eventually accepted Mughal overlordship and, in 1818, British suzerainty.

Rajputana \,räj-pə-'tä-nə\ Region of northwestern India that now comprises Rajasthan state and small sections of Madhya Pradesh and Gujarat. The Aravalli Range crosses the southern part of the region from northeast to southwest. The northwestern part is largely the Thar desert, but to the southeast the country is very fertile. The Rajput states came under British protection by treaties in 1818; most of the area was formed into Rajasthan state in 1948.

Rakaia River \rə-'kī-ə\ River, eastern central South Island, New Zealand. Rising in the glaciers of the Southern Alps, it flows east and southeast for 90 mi (145 km) before entering Canterbury Bight of the Pacific Ocean through a delta west of Banks Peninsula.

Rákóczi family \'rä-kōt-sē\ Noble Magyar family prominent in 17th-century Hungary. Its members included György I (1593–1648), who as prince of Transylvania (1630–48) allied himself with Sweden against the Habsburgs and won religious freedom for Protestants in Hungary. His son György II (1621–1660), prince of Transylvania (1648–60), joined Sweden in attacking Poland (1656) but was forced to retreat; he was killed in battle by the invading Turks, who restored Turkish control over Transylvania. György's son Ferenc I (1645–1676) became a Catholic and joined Croatia in an unsuccessful revolt against Habsburg rule in Hungary. His son Ferenc II (1676–1735), prince of Transylvania (1704–11), led a Hungarian uprising for independence from the Habsburg empire (1703) that was initially successful, but his forces were defeated by the Austrians in 1711.

Raleigh \'rô-lē, 'rä-lē\ City (pop., 2000: 276,093), capital of North Carolina, U.S. It was selected as the state capital in 1788 and was laid out in 1792. It is a major retail shipping point for eastern North Carolina and a wholesale distributing point for food stores. Manufactures include textiles, electronic equipment and computers, and processed foods. Along with Durham and Chapel Hill, Raleigh is part of North Carolina's Research Triangle—an area of cultural, scientific, and educational institutions that includes Duke University and the University of North Carolina.

Raleigh, Sir Walter (b. 1554?, Hayes Barton, near Budleigh Salterton, Devon, Eng.—d. Oct. 29, 1618, London) English adventurer and favourite of Elizabeth I. He joined his half brother Humphrey Gilbert on a piratical expedition against the Spanish (1578) then fought against the Irish rebels in Munster (1580). His outspoken views on English policy in Ireland caught the attention of Elizabeth I, who made him her favourite at court. In 1584 he sent an expedition to explore the coast north of Florida, which he named Virginia, and to establish an unsuccessful colony at Roanoke Island. He was knighted by Elizabeth in 1585. Out of favour

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at court from c. 1592, he led an unsuccessful expedition up the Orinoco River in search of gold, which he described in *The Discoverie of Guiana* (1596). When Elizabeth died (1603), he was accused of plotting to depose James I and was imprisoned in the Tower of London. Released in 1616, he led another unsuccessful expedition to search for gold in Guyana. When his men burned a Spanish settlement, he was rearrested by James and executed, at the demand of the Spanish ambassador, under Raleigh's original sentence for treason.

rally *or* **rallye** Automobile competition using public roads and ordinary traffic rules. The object is to maintain a specified average speed between checkpoints; the route is unknown to the driver and navigator until the start of the event. Such competition began in 1907 with a Beijing-to-Paris event (12,000 km [7,500 mi]). The Monte-Carlo rally began in 1911. The Paris-Dakar (Senegal) Rally (15,000 km (9,300 mi]) is considered one of the most grueling rally events.

Rally for the Republic (RPR) *or* **Gaullists** Former French political party. It was founded by Jacques Chirac in 1976 as the successor to the various Gaullist coalitions that dominated the political life of the Fifth Republic under Charles de Gaulle and Georges Pompidou. The party had its antecedents in the group Rally of the French People, organized by de Gaulle in 1947. It evolved into the Union for the New Republic (1958–62) and then the Union of Democrats for the New Republic (1968–76) before assuming the name Rally for the Republic. In 2002 the party merged with the Liberal Democratic party and much of the Union for the French Democracy to form the Union for a Popular Movement.

ram Projection fixed to the front end of a fighting vessel and designed to damage enemy ships struck by it. It may have been developed by the Egyptians as early as 1200 BC, but it was most commonly used on Phoenician, Greek, and Roman galleys. It was briefly revived in the mid-19th century, notably in the American Civil War, when rams mounted on armored, steam-driven warships were used effectively against wooden sailing ships. Improvements in naval weaponry and the spread of metal-hulled ships soon made it obsolete again. See also battering ram.

RAM \'ram\ *in full* **random-access memory** Computer main memory in which specific contents can be accessed (read or written) directly by the CPU in a very short time regardless of the sequence (and hence location) in which they were recorded. Two types of memory are possible with random-access circuits, static RAM (SRAM) and dynamic RAM (DRAM). A single memory chip is made up of several million memory cells. In a SRAM chip, each memory cell stores a binary digit (1 or 0) for as long as power is supplied. In a DRAM chip, the charge on individual memory cells must be refreshed periodically in order to retain data. Because it has fewer components, DRAM requires less chip area than SRAM; hence a DRAM chip can hold more memory, though its access time is slower.

Rama Major Hindu deity. The name became associated with Ramacandra, the seventh incarnation of Vishnu, whose story is told in the Ramayana. Conceived as a model of reason, virtue, and right action, Rama was one of the chief objects of the bhakti cults. He is often depicted as a standing figure, holding an arrow in his right hand and a bow in his left. In temples his image is attended by the figures of his wife, Sita, his half brother, Laksmana, and the monkey general, Hanuman.

Rama IV See Mongkut

Rama V See Chulalongkorn

Rama VI See Vajiravudh

Rama IX See Bhumibol Adulyadej

Ramadan \rä-mä-'dän\ In Islam, a holy month of fasting, the ninth month of the Muslim year, commemorating the revelation of the Qur'ān to Muhammad. As an act of atonement, Muslims are required to fast and abstain from sexual activity during the daylight hours of Ramadan. Determined according to the lunar calendar, Ramadan can fall in any season of the year. The Ramadan fast is considered one of the Five Pillars of Islam, and the end of the fast is celebrated as one of the important religious holidays of Islam.

Ramakrishna (Paramahamsa) *orig.* **Gadadhar Chattopadhyaya** (b. Feb. 18, 1836, Hooghly, Bengal state, India—d. Aug. 16, 1886, Calcutta) Indian mystic. Born into a poor Brahman family, he worked as a priest in a temple of Kali in Calcutta (now Kolkata), where he had a vision and commenced spiritual practices in a number of different religious traditions. He denounced sexual desire and money as the twin evils that put spiritual enlightenment beyond reach, rejected the caste system, and held that all religions are in essence the same and that all are true. His teachings were spread by his disciples, notably Vivekananda. A religious order bearing his name, with headquarters in Kolkata, sends missionaries throughout the world.

Raman \'rä-mən**, Sir Chandrasekhara Venkata** (b. Nov. 7, 1888, Trichinopoly, India—d. Nov. 21, 1970, Bangalore) Indian physicist influential in the growth of science in India. He received a Nobel Prize in 1930 for discovering that when light passes through a transparent material, some of the light that emerges at a right angle to the original beam is of other frequencies (Raman frequencies) characteristic of the material. He contributed to the building up of nearly every Indian research institution in his time, founded a scholarly physics journal and an academy of sciences, and trained hundreds of students.

Ramana Maharshi \'rə-mə-nə-mə-'hər-shē\ *orig.* **Venkataraman Aiyer** (b. Dec. 30, 1879, Madurai, Madras state, India—d. April 14, 1950, Tiruvannamalai) Hindu spiritual leader. Born into a Brahman family, he left his village at age 17 to become a hermit on Mount Arunachala, where Shiva was said to have entered the world at creation. One of India's youngest gurus, he held that evil and death were an illusion, which could be dissipated through his technique of *vicara* (self-pondering inquiry), and that to achieve liberation from rebirth it was necessary to practice bhakti (devotional surrender) either to Shiva or to Ramana Maharshi himself.

Ramananda \ˌrä-mə-'nən-də\ (b. c. 1400—d. c. 1470) Indian spiritual leader. He lived as an ascetic before settling in Varanasi (Benares) to study Vedic texts and the philosophy of Ramanuja. He was fifth in succession in the lineage of Ramanuja, but his determination to ignore caste distinctions led to a break with the philosopher's other followers. With 12 disciples he founded his own sect, the Ramanandis, who practiced devotion to Rama. His teachings were similar to Ramanuja's, but he dropped the ban on intercaste dining and the strict rule that all teaching and all texts must be in Sanskrit, himself teaching in the vernacular Hindi in order to reach the masses who did not know Sanskrit.

Ramanuja \rä-'mä-nù-jə\ (b. c. 1017, Shriperumbudur, India—d. 1137, Shrirangam) Indian theologian and philosopher, the most influential thinker of devotional Hinduism. After a long pilgrimage through India, he founded centres to spread devotion to Vishnu and Lakshmi. He provided an intellectual basis for the practice of bhakti in major commentaries on the Vedas, the *Brahma-sutras*, and the *Bhagavadgita*. He was a major figure in the school of Visistadvaita, which emphasized the need for the soul to be united with a personal god. His chief philosophical contributions follow from his conviction that the phenomenal world is real and provides real knowledge and that the exigencies of daily life are not contrary to the life of the spirit.

Ramanuja, bronze sculpture, 12th century; from a Visnu temple in Tanjore district, India
COURTESY OF THE INSTITUT FRANCAIS D'INDOLOGIE, PONDICHERRY

Ramanujan \rä-'män-ù-jə^{n}**, Srinivasa (Aaiyangar)** (b. Dec. 22, 1887, Erode, India—d. April 26, 1920, Kumbakonam) Indian mathematician. Extremely poor, he was largely self-taught from age 15. In 1913 he began a correspondence with Godfrey H. Hardy (1877–1947) that took him to England, where he made advances, especially in the theory of numbers, the partition of numbers, and the theory of continued fractions. He published papers in English and European journals, and in 1918 he became the first Indian elected to the Royal Society of London. He died of tuberculosis at age 32, generally unknown but recognized by mathematicians as a phenomenal genius.

Ramatirtha \ˌrä-mə-'tir-tə\ *orig.* **Tirath Rama** (b. 1873, Miraliwala, Punjab province, India—d. Oct. 17, 1906, Tehri, United Provinces of Agra and Oudh) Hindu religious leader. He was a professor of mathematics before a meeting with Vivekananda strengthened his desire to pursue a

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religious life. In 1901 he left his wife and children and went into seclusion in the Himalayas, and he later traveled to Japan and the U.S. He became known for his poetic manner of interpreting VEDANTA and for his joyful approach to religious learning as a means to the liberation of the individual. He died by drowning in the Ganges.

Ramayana \rä-'mä-yə-nə\ Indian epic poem, composed in Sanskrit c. 300 BCE. With the MAHABHARATA, it is one of the two great epic poems of India. Consisting of 24,000 couplets in seven books, it describes the royal birth of RAMA and the loss of his throne. Banished to the forest with his wife, SITA, and his half brother, Laksmana, he spends 14 years in exile. When a demon king carries off Sita, Rama enters into an alliance with Sugriva, king of the monkeys, and HANUMAN, the monkey general, who help him rescue her. Rama regains his kingdom, but Sita is banished when her chastity is questioned, and she is swallowed by the earth after proving her innocence.

Rambert \räm-'ber**, Dame Marie** *orig.* **Cyvia Rambam** (b. Feb. 20, 1888, Warsaw, Pol., Russian Empire—d. June 12, 1982, London, Eng.) Polish-born English ballet producer and director. She studied with the musician ÉMILE JAQUES-DALCROZE and taught his technique, eurythmics, to the Paris-based BALLETS RUSSES, influencing VASLAV NIJINSKY's avant-garde choreography. At the outbreak of World War I, she moved to London, where she studied ballet with Enrico Cecchetti (1850–1928); in 1920 she founded a ballet school that used his methods. In 1930 she helped found the Camargo Society and established the Ballet Club (later Ballet Rambert). As director of Ballet Rambert, she favoured experimentation, encouraging young choreographers such as FREDERICK ASHTON and supporting new dancers and stage designers. Her troupe, renamed the Rambert Dance Company in 1987, has continued to perform.

Rameau \rä-'mō**, Jean-Philippe** (baptized Sept. 25, 1683, Dijon, France—d. Sept. 12, 1764, Paris) French composer and music theorist. Son of an organist, he held organist posts until he was 49. His *Treatise on Harmony* (1722) established him as a major music theorist. In it he asserted that HARMONY is the basis of music, and that chords, which had been understood principally as collections of intervals above a bass, should instead be seen as representing inversions of more fundamental harmonic entities. From 1733 he wrote a series of highly successful operas, including *Hippolyte et Aricie* (1733) and *The Gallant Indies* (1735), assuring his place as the most important French opera composer since JEAN-BAPTISTE LULLY. In the *querelles des bouffons* ("war of the buffoons," 1752–53), a famous artistic controversy about the relative merits of French and Italian opera, Rameau's music exemplified the French style. He also won renown for his many keyboard pieces, mostly composed for harpsichord.

ramjet Air-breathing JET ENGINE that operates with no major moving parts. It relies on the craft's forward motion to draw in air and on a specially shaped intake passage to compress the air for combustion. After fuel sprayed into the engine has been ignited, combustion is self-sustaining. As in other jet engines, forward thrust is obtained as a reaction to the rearward rush of hot exhaust gases. Ramjets work best at speeds of Mach 2 (twice the speed of sound) and higher. See also TURBOJET.

Ramkhamhaeng \ˌräm-ˌkäm-'haŋ\ (b. 1239?—d. 1298) Third king of Sukhothai (in modern north-central Thailand) who created the first major TAI state in Southeast Asia. He united a region that shared a common religion (THERAVADA Buddhism). Under him, the arts developed distinctively Tai expressions, and accomplished bronze sculptures were created. He is also credited with inventing the Thai alphabet, a modification of Khmer script. He was remembered only in legend until 1834 when King MONGKUT of Siam (then a Buddhist monk) rediscovered an inscription Ramkhamhaeng had made in 1292. As a result, he came to be regarded as a national hero, a just and liberal ruler who imparted a sense of cultural unity to the region.

rammed earth *or* **pisé de terre** \ˌpē-ˌzā-də-'ter\ Building material made by compacting and drying a stiff mixture of clay, sand or other aggregate, and water. It has been used by many civilizations. The most durable of the earth-building forms, it is formed into building blocks (see ADOBE) or rammed within removable wooden forms in layers or lifts to construct walls. China's Erligang (c. 1600 BC) is an example of a rammed-earth fortification; it covers an area of 1.2 sq mi (3.2 sq km) and may have taken 10,000 people more than 12 years to build.

Rampal \räm-'päl**, Jean-Pierre (-Louis)** (b. Jan. 7, 1922, Marseille, France—d. May 20, 2000, Paris) French flutist. From 1947 he appeared widely in chamber music and solo recitals. In the 1950s he founded his own chamber groups, while also playing in the pit at the Paris Opéra (1956–62). Works were written for him by FRANCIS POULENC and others. His sweetness of tone and virtuosity in a largely Baroque repertoire, as evidenced on many admired recordings, made him the first flutist to attain international stardom.

Ramses \'ram-ˌsēz\ **II** *known as* **Ramses the Great** (fl. 13th century BC) King of ancient Egypt, 1279–13 BC. His family came to power some decades after the reign of AKHENATON. Ramses set about restoring Egypt's power by quelling rebellions in southern Syria and fighting the HITTITES inconclusively at the Battle of KADESH. He captured towns in Galilee and Amor, but, unable to defeat the Hittites, he assented to a peace treaty in 1258 BC. He married one and perhaps two of the Hittite king's daughters, and the later part of his reign was free from war. Its prosperity may be measured by the amount of construction he undertook. Early on he built himself a residence city in the Nile delta as a base for military campaigns and resumed construction of the temple of Osiris, begun by his father. He added to the temple at KARNAK and completed a funerary temple for his father at LUXOR. In Nubia he built six temples, most famously those at ABU SIMBEL.

Ramses II, upper portion of a granite figure from Thebes, 1250 BC; in the British Museum.
REPRODUCED BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Ramses III (d. 1156 BC) King of ancient Egypt, 1187–56 BC. Son of Setnakht, the founder of Egypt's 20th dynasty, he fought off Libyan invaders in the fifth year of his reign and the SEA PEOPLES (a conglomeration of migrating peoples from Anatolia and the Mediterranean Sea region) two years later. After another conflict with the Libyans, he achieved a lasting peace. He then reorganized society into classes grouped by occupation and resumed temple building. He encouraged trade and industry, and the country prospered. A delay in sending monthly rations to temple builders in Thebes c. 1158 BC resulted in the world's first recorded labour dispute.

Ramses III, detail of the lid of a granite sarcophagus, about 1187–56 BC; in the Fitzwilliam Museum, Cambridge
COURTESY OF THE FITZWILLIAM MUSEUM, CAMBRIDGE

Ramu River \'rä-mü\ River, Papua New Guinea. One of the country's longest rivers, it is about 400 mi (645 km) long. It rises in the southeast and flows northwest through the great Central Depression, where it receives numerous streams draining the mountainous region. During World War II its valley was taken from the Japanese by Allied forces (1943). It was the scene of an earthquake in 1993.

Rana era (1846–1951) In Nepal, the period during which control of the government lay in the hands of the Rana family. Jung Bahadur (1817–77) seized power in 1846 and made himself permanent prime minister. He was given the hereditary title of Rana. Under the Ranas, Nepal maintained relations with the British, who provided it with support. When the British withdrew from India in 1947, the Rana family was exposed to new dangers. They faced a revolution in 1950, and in 1951, under pressure from India, Nepal's King Tribhuvan took the throne with restored sovereignty.

ranch Large farm for breeding and raising cattle, sheep, or horses. Ranching originated in South America and Mexico in early colonial times, when Spanish settlers introduced cattle and horses and tended them on the pampas. It was an itinerant form of LIVESTOCK farming: herds were tended on open range, and biannual roundups were held for branding calves and driving mature animals to market. Itinerant ranching reached

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its peak in the 1880s. By the early 20th century, overstocking, quarantine laws, railroad competition, and barbed-wire fences had put an end to cattle drives and open-range farming. Ranching today is nearly all sedentary, but huge ranches still exist.

Rand, Ayn *orig.* **Alice Rosenbaum** *or* **Alissa Rosenbaum** (b. Feb. 2, 1905, St. Petersburg, Russia—d. March 6, 1982, New York, N.Y., U.S.) Russian-born U.S. writer. She immigrated to the U.S. in 1926 after graduating from the University of Petrograd and worked as a screenwriter in Hollywood. She won a cult following with two best-selling novels presenting her belief that all real achievement comes from individual ability and effort, that laissez-faire capitalism is most congenial to the exercise of talent, and that selfishness is a virtue, altruism a vice. In *The Fountainhead* (1943), a superior individual transcends traditionalism and conformism. The allegorical *Atlas Shrugged* (1957) combines SCIENCE FICTION with her political message. She expounded her philosophy, which she called objectivism, in nonfiction works and as editor of two journals and became an icon of radical LIBERTARIANISM.

RAND Corp. Nonpartisan think tank whose original focus was national security. It grew out of a research-and-development project (its name is a contraction of "research and development") by Douglas Aircraft Co. for the Army Air Force in 1945. In 1948 it became a private nonprofit corporation. In the 1960s it expanded its focus to address domestic public-policy issues. Its mission today is to improve policy and decision making through research and analysis. It employs several hundred scholars in many disciplines. Its funding comes from government contracts, charitable foundations, private corporations, and earnings on its endowment. Its headquarters are in Santa Monica, Cal., and it has offices in Washington, D.C., New York, and overseas.

Randolph, A(sa) Philip (b. April 15, 1889, Crescent City, Fla., U.S.—d. May 16, 1979, New York, N.Y.) U.S. civil-rights leader. He was the son of a Methodist minister. In 1911 he moved to New York, where he cofounded the journal *The Messenger* (later *Black Worker*), in which he called for more positions for African Americans in the war industry and the armed forces. In 1925 he founded the Brotherhood of Sleeping Car Porters, the first successful African American trade union, and he served as its president until 1968. In 1941 he lobbied Pres. FRANKLIN D. ROOSEVELT to ban racial discrimination in defense industries and federal bureaus. In 1948 he influenced Pres. HARRY TRUMAN to bar racial segregation in the armed forces. In 1955 he was made a vice president of the newly combined AFL-CIO. In order to combat discrimination in that union, he formed the Negro American Labor Council in 1960.

Randolph, Edmund Jennings (b. Aug. 10, 1753, Willliamsburg, Va.—d. Sept. 12, 1813, Clark county, Va., U.S.) U.S. politician. He helped draft Virginia's constitution (1776) and served in the Continental Congress (1779–82). He was a delegate to the ANNAPOLIS CONVENTION and the CONSTITUTIONAL CONVENTION, where he presented the Virginia (or large-state) Plan, which influenced the final draft of the CONSTITUTION OF THE UNITED STATES. As governor of Virginia (1786–88), he effected the state's ratification of the Constitution. He served as U.S. attorney general (1789–94) and secretary of state (1794–95) but resigned after he was falsely accused of accepting a bribe from the French to influence the U.S. government against Britain. He returned to his law practice and served as chief counsel for AARON BURR in his 1807 trial.

Randolph, John (b. June 2, 1773, Prince George county, Va.—d. May 24, 1833, Philadelphia, Pa., U.S.) U.S. politician. In 1799 he was elected to the U.S. House of Representatives, where he served almost continuously until 1829. A noted orator, he was a staunch advocate of STATES' RIGHTS and opposed a national bank and federal protective tariffs. A supporter of slavery, he led the resistance to the MISSOURI COMPROMISE. His denunciation of HENRY CLAY for his support of the presidential candidacy of JOHN QUINCY ADAMS led to a harmless duel with Clay (1826).

random-access memory See RAM

Random House U.S. publishing company. It was founded by BENNETT CERF and Donald S. Klopfer in 1925. As it grew it published many successful and prestigious writers and gathered under its corporate roof many other firms, including Alfred A. Knopf, Inc. (acquired 1960), Pantheon Books (1961), Ballantine Books (1973), Fawcett Books (1982), and the Crown Publishing Group (1988). It was itself bought several times before becoming in 1998 a part of one of the world's largest media companies, Bertelsmann AG.

random variable In statistics, a FUNCTION that can take on either a finite number of values, each with an associated probability, or an infinite number of values, whose probabilities are summarized by a DENSITY FUNCTION. Used in studying chance events, it is defined so as to account for all possible outcomes of the event. When these are finite (e.g., the number of heads in a three-coin toss), the random variable is called discrete and the probabilities of the outcomes sum to 1. If the possible outcomes are infinite (e.g., the life expectancy of a light bulb), the random variable is called continuous and corresponds to a density function whose INTEGRAL over the entire range of outcomes equals 1. Probabilities for specific outcomes are determined by summing probabilities (in the discrete case) or by integrating the density function over an interval corresponding to that outcome (in the continuous case).

range finder Instrument used to measure the distance from the instrument to a selected point or object. The optical range finder, used chiefly in CAMERAS, consists of an arrangement of LENSES and PRISMS set at each end of a tube. The object's range is determined by measuring the ANGLES formed by a line of sight at each end of the tube; the smaller the angles, the greater the distance, and vice versa. Since the mid-1940s, radar has replaced optical range finders for most military targeting, and the laser range finder, developed in 1965, has largely replaced optical range finders for SURVEYING and radar in certain military applications.

Rangeley \'rānj-lē\ **Lakes** Chain of lakes, western Maine, U.S. It includes Rangeley, Mooselookmeguntic, Richardson, and Umbagog lakes. The lakes extend more than 50 mi (80 km) and cover an area of 80 sq mi (207 sq km), with elevations between 1,200 and 1,500 ft (365 and 460 m).

Ranger Any of a series of unmanned probes launched from 1961 to 1965 by NASA. The project was NASA's earliest attempt to explore the MOON's surface. Ranger 4 (1962) became the first U.S. spacecraft to hit the Moon, crash-landing on its surface as planned. The last three probes in the series (1964–65) sent more than 17,000 high-resolution photographs of the Moon before crashing. See also LUNA; PIONEER; SURVEYOR.

Rangoon See YANGÔN

Ranjit Singh \'rən-jit-'si^{n}-hə\ (b. Nov. 13, 1780, Budrukhan or Gujranwala, India—d. June 27, 1839, Lahore) Founder and maharaja (1801–39) of the Sikh kingdom of the Punjab. He became chief of the Shukerchakias (a Sikh group located in what is now Pakistan) on the death of his father in 1792. In 1799 he seized Lahore, the capital of the Punjab (and now in Pakistan), and in 1801 he proclaimed himself maharaja of the Punjab. In 1802 he captured Amritsar, a city sacred to the Sikhs, and by 1820 he had consolidated his rule over the whole of Punjab between the Sutlej and the Indus rivers. The Sikh state he created, which had included Sikhs, Muslims, and Hindus in both the army and the cabinet, collapsed soon after his death.

Rank, J(oseph) Arthur, Baron Rank (of Sutton Scotney) (b. Dec. 22/23, 1888, Hull, Yorkshire, Eng.—d. March 29, 1972, Winchester, Hampshire) British motion-picture distributor and producer. His British National Film Co. made its first commercial picture in 1935. That year he and Charles Woolf established General Film Distributors to distribute UNIVERSAL PICTURES films in Britain. By 1941 Rank controlled two of the three largest movie theatre chains in Britain. The J. Arthur Rank Organisation (incorporated 1946) dominated British film production in the late 1940s and '50s. Rank served as chairman (1946–62) and president (1962–72) of the Rank Organisation, which shifted from filmmaking to hotel ownership and other more profitable enterprises in the late 1960s.

Rank \'räŋk**, Otto** *orig.* **Otto Rosenfeld** (b. April 22, 1884, Vienna, Austria—d. Oct. 31, 1939, New York, N.Y., U.S.) Austrian psychologist. A protégé of SIGMUND FREUD, Rank's early books, including *The Artist* (1907) and *The Myth of the Birth of the Hero* (1909), extended psychoanalytic theory to explain the significance of myths. He edited the *International Journal of Psychoanalysis* (1912–24). The publication of *The Trauma of Birth* (1924), which was seen to undermine the principles of psychoanalysis by arguing that the basis of anxiety neurosis is psychological trauma occurring during birth, led to his expulsion from the Vienna Psychoanalytic Society. Rank settled in New York City in 1936, and his later work focused on the will as the guiding force in personality development.

Ranke \'räŋ-kə**, Leopold von** *orig.* **Leopold Ranke** (b. Dec. 21, 1795, Wiehe, Thuringia, Saxony—d. May 23, 1886, Berlin) German his-

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torian. Ranke taught at the University of Berlin (1825–71). Inspired by the scientific method of historical study used by Barthold Georg Niebuhr, he championed objective writing based on philological and textual criticism of source materials. His scholarly technique and way of teaching (he was the first to establish a historical seminar) had great influence on Western historiography. His many works covering a wide variety of topics typically are subtle accounts of particular limited periods in European state and political history that, like his source materials, take comparatively little notice of social and economic forces.

Rankin, Jeannette (b. June 11, 1880, near Missoula, Mont., U.S.—d. May 18, 1973, Carmel, Calif.) U.S. reformer, first woman member of the U.S. Congress (1917–19, 1941–43). She was a social worker and an active member of the woman suffrage movement. Elected to the U.S. House of Representatives in 1916, she introduced the first bill to give women the vote. A pacifist, she voted against declaring war on Germany (1917). After losing her bid for a U.S. Senate seat (1918), she returned to social work. In 1940 she was again elected to the House, where she became the only legislator to vote against the declaration of war on Japan. Declining to seek reelection, she continued to lecture on social reform. In 1968, at age 87, she led 5,000 women, the "Jeannette Rankin Brigade," in protest of the Vietnam War.

Jeannette Rankin, 1918.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Rankine \'raŋ-kən**, William J(ohn) M(acquorn)** (b. July 5, 1820, Edinburgh, Scot.—d. Dec. 24, 1872, Glasgow) Scottish engineer and physicist, one of the founders of thermodynamics. His classic *Manual of the Steam Engine and Other Prime Movers* (1859) was the first attempt at a systematic treatment of the theory of steam engines. He worked out a thermodynamic cycle of events (the Rankine cycle) that was used as a standard for the performance of steam-power installations in which a condensable vapour provides the working fluid.

Rankine cycle Ideal cyclical sequence of changes of pressure and temperature of a fluid, such as water, used in an engine, such as a steam engine. Described in 1859 by William Rankine, it is used as a standard for rating the performance of steam power plants. In the Rankine cycle, the working substance of the engine undergoes four successive changes: (1) heating at constant volume (as in a boiler), (2) evaporation and superheating (if any) at constant pressure, (3) isentropic expansion in the engine, and (4) condensation at constant pressure with return of the fluid to the boiler. See also Carnot cycle.

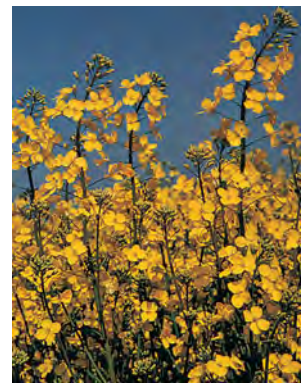
Ransom, John Crowe (b. April 30, 1888, Pulaski, Tenn., U.S.—d. July 4, 1974, Gambier, Ohio) U.S. poet and critic. Ransom attended and later taught at Vanderbilt University, where he became the leader of the Fugitives, a group of poets who shared a belief in the South and its agrarian traditions and published the influential journal *The Fugitive* (1922–25); he was among those Fugitives called Agrarian who contributed to *I'll Take My Stand* (1930). At Kenyon College, he founded and edited (1939–59) the *Kenyon Review*. His literary studies include *The New Criticism* (1941), which gave its name to an important critical movement (see New Criticism), and he became recognized as a leading theorist of the post-World War I Southern literary renaissance. His *Selected Poems* (1945; rev. ed., 1969) won the National Book Award.

rap Musical style in which rhythmic and/or rhyming speech is chanted ("rapped") to musical accompaniment. This backing music, which can include digital sampling (music and sounds extracted from other recordings), is also called hip-hop, the name used to refer to a broader cultural movement that includes rap, deejaying (turntable manipulation), graffiti painting, and breakdancing. Rap, which originated in African American communities in New York City, came to national prominence with the Sugar Hill Gang's "Rapper's Delight" (1979). Rap's early stars included Grandmaster Flash and the Furious Five, Run-D.M.C., LL Cool J, Public Enemy (who espoused a radical political message), and the Beastie Boys. The late 1980s saw the advent of "gangsta rap," with lyrics that were often misogynistic or that glamorized violence and drug dealing. More recent stars have included Sean "Puffy" Combs, Jay-Z, OutKast, and Eminem.

Rapa Nui See Easter Island

Rapallo \rä-'pä-lō**, Treaty of** (April 16, 1922) Treaty between Germany and the Soviet Union, signed at Rapallo, Italy. Negotiated by Germany's Walther Rathenau and the Soviet Union's Georgy V. Chicherin, it reestablished normal relations between the two nations. The nations agreed to cancel all financial claims against each other, and the treaty strengthened their economic and military ties. As the first agreement concluded by Germany as an independent agent since World War I, it angered the Western Allies.

rape Annual plant (*Brassica napus*) of the mustard family, native to Europe. This 1-ft-tall (30-cm) plant has a long, thin taproot; smooth, bluish-green, deeply scalloped leaves; and clusters of yellow flowers. Each round, elongated seedpod has a short beak and contains many seeds. The seeds yield an oil (rapeseed oil, or canola) that is the lowest in saturated fat of any edible oil, making it popular for use in cooking. It is also used as an ingredient in soap and margarine and as a lamp fuel.



Rape (*Brassica napus*)
INGMAR HOLMASEN

rape Unlawful sexual activity, usually sexual intercourse, carried out forcibly or under threat of injury and against the will of the victim. Though traditionally limited to attacks on women by men, the definition of rape has been broadened to cover same-sex attacks and attacks against those who, because of mental illness, intoxication, or other reasons, are incapable of valid consent. Statutory rape, or intercourse with a person younger than a certain age (generally from 12 to 18 years), has long been a serious crime in most jurisdictions. Rape is widely considered an expression of anger or aggression and a pathological assertion of power by the rapist. The psychological responses of victims vary but usually include feelings of shame, humiliation, confusion, fear, and rage. Many rape victims fail to report the crime, deterred by the prospect of a distressing cross-examination in court and the difficulty of proving a crime for which there usually are no witnesses. In the late 20th century there was a notable increase in the use of rape as a weapon of war, and in the 1990s the tribunal investigating crimes stemming from genocide in Rwanda ruled that rape and sexual violence constituted a form of genocide. See also assault and battery.

Raphael \'ra-fē-əl, 'rā-fē-əl\ *orig.* **Raffaello Sanzio** (b. April 6, 1483, Urbino, Duchy of Urbino—d. April 6, 1520, Rome, Papal States) Italian painter and architect. As a member of Perugino's workshop, he established his mastery by 17 and began receiving important commissions. In 1504 he moved to Florence, where he executed many of his famous Madonnas; his unity of composition and suppression of inessentials is evident in *The Madonna of the Goldfinch* (c. 1506). Though influenced by Leonardo da Vinci's chiaroscuro and sfumato, his figure types were his own creation, with round, gentle faces that reveal human sentiments raised to a sublime serenity. In 1508 he was summoned to Rome to decorate a suite of papal chambers in the Vatican. The frescoes in the Stanza della Segnatura are probably his greatest work; the most famous, *The School of Athens* (1510–11), is a complex and magnificently ordered allegory of secular knowledge showing Greek philosophers in an architectural setting. The Madonnas he painted in Rome show him turning away from his earlier work's serenity to emphasize movement and grandeur, partly under Michelangelo's High Renaissance influence. The *Sistine Madonna* (1513) shows the richness of colour and new boldness of compositional invention typical of his Roman period. He became the most important portraitist in Rome, designed 10 large tapestries to hang in the Sistine Chapel, designed a church and a chapel, assumed the direction of work on St. Peter's Basilica at the death of Donato Bramante, and took charge of virtually all the papacy's projects in architecture, painting, and the preservation of antiquities. When he died on his 37th birthday, his last masterpiece, the *Transfiguration* altarpiece, was placed at the head of his bier.

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Raphael In the BIBLE and the QUR'ĀN, one of the archangels. In the apocryphal book of Tobit he appears in human disguise and conquers the demon Asmodeus. His name in Hebrew means "God has healed," and in Tobit his business is to heal the earth. Raphael is reckoned among the saints in both Eastern and Western churches, and his feast day is October 24.

Rapier \'rāp-yər**, James T(homas)** (b. Nov. 13, 1837, Florence, Ala., U.S.—d. May 31, 1883, Montgomery, Ala.) U.S. politician. The son of a slave and a wealthy planter, he was educated in Canada and Scotland. After the AMERICAN CIVIL WAR he returned to Alabama, where he became a successful cotton planter and a delegate to the state's first Republican convention. Serving in the U.S. House of Representatives (1873–75) during RECONSTRUCTION, he worked for passage of the Civil Rights Act of 1875. He was later collector of internal revenue in Alabama's second district, and he remained active as a labour organizer and publisher of the *Montgomery Sentinel*.

raptor \'rap-tər\ In general, any BIRD OF PREY, including OWLS. The raptors are sometimes restricted to EAGLES, FALCONS, HAWKS, and VULTURES (birds of the order Falconiformes), all diurnal predators that "seize and carry off" (Latin *raptare*) their prey.

rare earth metal Any of a large class of chemical ELEMENTS including scandium (atomic number 21), yttrium (39), and the 15 elements from 57 (lanthanum) to 71 (see LANTHANIDES). The rare earths themselves are pure or mixed OXIDES of these METALS, originally thought to be quite scarce; however, CERIUM, the most plentiful, is three times as abundant as lead in the Earth's crust. The metals never occur free, and the pure oxides never occur in minerals. These metals are similar chemically because their atomic structures are generally similar; all form compounds in which they have VALENCE 3, including stable oxides, CARBIDES, and borides.

Ra's Naṣrānī See Cape NAṢRĀNĪ

Rashi \'rä-shē\ *in full* **Rabbi Shlomo Yitzhaqi** (b. 1040, Troyes, Champagne—d. July 13, 1105, Troyes) Medieval French commentator on the Bible and the Talmud. He studied in the schools of Worms and Mainz and became a local Jewish leader in the valley of the Seine c. 1065. His influential writings on the Bible examined the literal meaning of the text and used allegory, parable, and symbolism to analyze its nonliteral meaning. His landmark commentary on the Talmud is a classic introduction to biblical and postbiblical Judaism.

Rashīd Riḍā \rä-'shēd-rē-'dä**, Muḥammad** (b. 1865, Syria—d. 1935, Syria) Syrian Islamic scholar. As founder (1898) and publisher of the newspaper *Al-Manār*, he helped Muslims formulate an intellectual response to the problem of reconciling their religious heritage with the modern world. He was concerned with the backwardness of the Muslim countries, which he proposed to remedy by reviving the original principles of Islam. He advocated that rulers consult with religious leaders in formulating government policies. He also urged Arabs and Muslims to emulate the scientific and technological progress of the West.

Rashīdūn \ˌrä-shi-'dün\ *Arabic* **"Rightly Guided"** First four CALIPHS of the Islamic community: ABŪ BAKR, ʿUMAR IBN AL-KHAṬṬĀB, ʿUTHMĀN IBN ʿAFFĀN, and ʿALĪ. As ISLAM's first rulers after MUHAMMAD, they assumed all his duties except prophecy: they led the congregation in prayer, delivered the Friday sermons, and commanded the army. The caliphate of the Rashīdūn expanded the Islamic state beyond Arabia into Iraq, Syria, Palestine, Egypt, Iran, and Armenia. They were also responsible for the adoption of the Islamic calendar and the establishment of an authoritative reading of the QUR'ĀN.

Rashnu \'räsh-nü\ In ZOROASTRIANISM, the god of justice, who determines the fates of the dead. Assisted by MITHRA and SRAOSHA, Rashnu stands at the Bridge of the Requiter and weighs on his golden scales the deeds of the souls that wish to pass. The divine triad sometimes attempts to intercede for souls and obtain forgiveness for their sins. The 18th day of the month is sacred to Rashnu.

Rasht City (pop., 1996: 417,748), north-central Iran. It is situated on a branch of the Safīd River south of the Caspian Sea. Its importance as the main city of the Gīlān region dates from Russia's expansion southward in the 17th century. In the 20th century, it was severely damaged by Russian occupation during both world wars. Surrounded by rice fields and areas of half-cleared forests, it is a market and processing centre for rice, tea, peanuts, and silk.

Rask \'räsk**, Rasmus (Kristian)** (b. Nov. 22, 1787, Braendekilde, Den.—d. Nov. 14, 1832, Copenhagen) Danish linguist. A scholar of INDO-EUROPEAN LANGUAGES, he was a principal founder of the science of comparative linguistics. His observation that sound shifts between corresponding words in GERMANIC and other Indo-European languages followed predictable patterns was the basis of a fundamental law of linguistics later enunciated by JACOB GRIMM (Grimm's law). Rask also carried out extensive research on OLD NORSE, publishing his *Investigation of the Origin of the Old Norse or Icelandic Language* in 1818. By the end of his life he had mastered 25 languages and dialects.

Raskob \'ras-kəb**, John Jakob** (b. March 19, 1879, Lockport, N.Y., U.S.—d. Oct. 15, 1950, Centreville, Md.) U.S. financier. He went to work for E.I. du Pont de Nemours & Co. in 1902 and played a major role in DU PONT's expansion in the early 20th century. He joined the board of GENERAL MOTORS in 1915; as chairman of its finance committee from 1918, he greatly increased sales and earnings, establishing the General Motors Acceptance Corp. (GMAC) to allow dealers to finance their inventory and offer credit and long-term financing to their customers. He left in 1928 to head the Democratic National Committee and run ALFRED E. SMITH's unsuccessful presidential campaign; later he and Smith helped direct the construction of the EMPIRE STATE BUILDING.

raspberry Any of many species of fruit-bearing bushes of the genus *Rubus* in the ROSE family. When picked, the juicy red, purple, or black BERRY separates from a core, whereas in the related BLACKBERRY the core is part of the fruit. Both so-called berries are actually aggregate fruits. Red raspberries are propagated by suckers (see SUCKERING) from the roots of the parent plant or from root CUTTINGS. Black and purple varieties have arched canes and are propagated by LAYERING of the shoot tips. Raspberries contain iron and vitamin C. They are eaten fresh and are also very popular in jams, as a pastry filling, and as a flavouring for liqueurs.

Black raspberry (*Rubus occidentalis*). GRANT HEILMAN

Rasputin \ra-'spyü-tᵊn**, Grigory (Yefimovich)** *orig.* **Grigory (Yefimovich) Novykh** (b. 1872?, Pokrovskoye, near Tyumen, Siberia, Russian Empire—d. Dec. 30, 1916, Petrograd) Russian mystic influential at the court of Tsar NICHOLAS II and ALEXANDRA. An illiterate peasant, he earned the name *rasputin* ("debauched one") for his early licentious behaviour. After undergoing a religious experience, he gained a reputation among the peasants as a holy man, able to heal the sick. He became known to Nicholas and the susceptible Alexandra, and he proved capable of stopping the bleeding of their hemophiliac son, probably by means of hypnotism. He became a favourite at court, despite reports of his continuing and flagrant debauchery. When Nicholas left Alexandra in charge of Russia's internal affairs in 1915, Rasputin influenced her appointment of church officials and incompetent cabinet ministers. After several attempts to remove his harmful influence, a group of noblemen including Prince Felix Yusupov assassinated him by successively poisoning him, shooting him, and finally throwing him into the ice-filled Neva River. The RUSSIAN REVOLUTION OF 1917 followed weeks later.

Rastafarian \ˌras-tə-'fer-ē-ən\ Member of a political and religious movement among blacks in Jamaica and several other countries. Rastafarians worship HAILE SELASSIE, considering him the MESSIAH. They believe that blacks are the Israelites reincarnated, who have been subjected to the evil and inferior white race in divine punishment for their sins; they will eventually be redeemed by repatriation to Africa and will compel the whites to serve them. These beliefs, first enunciated in 1953, can be traced to several independent prophets, particularly MARCUS GARVEY. As the movement grew, ideas of repatriation tended to give way to either black militancy or mysticism. The Rastafarian life usually includes vegetarianism, the wearing of dreadlocks, and the smoking of marijuana.

Rastatt and Baden \'rä-ˌshtät...'bäd-ᵊn**, treaties of** (March 6 and Sept. 7, 1714) Two peace treaties between CHARLES VI, the Holy Roman emperor, and France that ended Charles's attempt to continue the War of the SPANISH SUCCESSION. In these treaties, Charles renounced his claims to the Spanish throne but did not actually make peace with Spain.

Rastenburg Assassination Plot See JULY PLOT

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rat Any of more than 500 forms of Asian RODENT (genus *Rattus*, family Muridae) that have been introduced worldwide. The black rat (*Rattus rattus*) and the Norway rat (*R. norvegicus*) are the aggressive, omnivorous animals commonly associated with the name. They prefer areas of human habitation, where they can easily find food. They have keen senses and can climb, jump, burrow, or gnaw their way into seemingly inaccessible places. They reproduce extremely rapidly (up to 150 offspring a year) and have few natural predators. Rats transmit numerous human diseases and have often destroyed grain supplies. The black rat is about 8 in. (20 cm) long, excluding the slightly longer tail. The Norway rat (also called the brown, barn, sewer, or wharf rat) has proportionately smaller ears and a shorter tail. Laboratory rats are strains of the Norway rat. The name rat is applied, without scientific basis, to other rodents (e.g., KANGAROO RAT, WOOD RAT).

Norway rat (*Rattus norvegicus*).
JOHN H. GERARD

rat snake Any of 40–55 SNAKE species in the genus *Elaphe* (family Colubridae) and similar forms, found in woodlands and barnyards in North America, Europe, and Asia. Nonvenomous, they kill rats and mice by constriction, and also eat eggs and poultry. Some hunt birds in trees. These egg-laying snakes are normally slow and docile, but in self-defense they vibrate the tail, discharge a foul liquid, and strike from an upreared position. The black rat, or pilot black, snake (*E. obsoleta obsoleta*) of the eastern U.S. may exceed 8 ft (2.5 m).

Aesculapian snake (*Elaphe longissima*).
ANTON THAU-BAVARIA VERLAG

ratchet Mechanical device that transmits intermittent MOTION or permits a shaft to rotate in one direction but not in the opposite one. Reversible ratchets are used on socket WRENCH handles and are convenient for tightening or loosening bolts in positions where a complete revolution of a wrench handle is impossible. They are used in mechanical jacks to lock the jack rod after each successive lift.

Rathbone, (Philip St. John) Basil (b. June 13, 1892, Johannesburg, S.Af.—d. July 21, 1967, New York, N.Y., U.S.) British actor. He made his stage debut in 1911 and later played classical roles in London and New York City. From 1924 he appeared in Hollywood movies, often in romantic roles. With his distinctive voice and gaunt appearance, he was cast as a villain in several swashbuckling movies starring TYRONE POWER and ERROL FLYNN. He won praise for his roles in *Romeo and Juliet* (1936) and *If I Were King* (1938), but he became best known for portraying Sherlock Holmes in a series of films that began with *The Hound of the Baskervilles* (1939).

Rathenau \'rä-tᵊn-ˌaù,\ *English* \'ra-thən-ˌaù**, Walther** (b. Sept. 29, 1867, Berlin, Prussia—d. June 24, 1922, Berlin, Ger.) German industrialist and statesman. From 1915 he headed the AEG conglomerate developed by his father, Emil Rathenau (1838–1915). In World War I he organized the conservation and distribution of raw materials for the War Ministry. In 1918 he cofounded the liberal German Democratic Party and supported cooperation with the Social Democratic Party. After serving as minister of reconstruction (1921–22), he was appointed foreign minister and negotiated the Treaty of RAPALLO with the Soviet Union. Reviled by extreme nationalists as a Jew and a promoter of "creeping Communism," he was assassinated.

Rathke \'rät-kə**, Martin H(einrich)** (b. Aug. 25, 1793, Danzig, Prussia—d. Sept. 3, 1860, Königsberg) German anatomist and embryologist. He was the first to describe gill slits and gill arches in mammal and bird embryos. He thought they were vestigial gills but recognized their significance in development of the associated blood vessels. He first described the Rathke pouch (1839), an embryonic structure that develops into the pituitary gland's anterior lobe. He also did pioneering marine zoology research.

ratio Quotient of two values. The ratio of *a* to *b* can be written *a*:*b* or as the fraction *a*/*b*. In either case, *a* is the antecedent and *b* the consequent. Ratios arise whenever comparisons are made. They are usually reduced to lowest terms for simplicity. Thus, a school with 1,000 students and 50 teachers has a student/teacher ratio of 20 to 1. The ratio of the width to the height of a rectangle is called an aspect ratio, an example of which is the GOLDEN RATIO of classical architecture. When two ratios are set equal to each other, the resulting equation is called a PROPORTION.

rational number Any number that can be represented as the quotient of two INTEGERS (i.e., the denominator cannot equal zero). The set of rational numbers includes all integers as well as all FRACTIONS. In decimal form, rational numbers are either terminating or repeating decimals.

rational psychology Metaphysical discipline that attempted to determine the nature of the human soul by A PRIORI reasoning. In CHRISTIAN WOLFF's division of metaphysics, rational psychology was one of three disciplines included under the heading of "special metaphysics" (the others being rational cosmology and rational theology). IMMANUEL KANT, in his *Critique of Pure Reason*, criticized the pretensions of rational psychology.

rationalism Philosophical view that regards reason as the chief source and test of knowledge. Rationalism has long been the rival of EMPIRICISM, the doctrine that all knowledge of matters of fact ultimately derives from, and must be tested by, sense experience. As against this doctrine, rationalism holds reason to be a faculty that can lay hold of truths beyond the reach of sense perception, both in certainty and in generality. In stressing the existence of a "natural light," rationalism also has been the rival of systems claiming esoteric knowledge, whether from mystical experience, revelation, or intuition, and has been opposed to various irrationalisms that tend to stress the biological, the emotional or volitional, the unconscious, or the existential at the expense of the rational.

rationing Government allocation of scarce resources and consumer goods, usually adopted during wars, famines, or other national emergencies. Rationing according to use prohibits the less important uses of a commodity (e.g., the use of gasoline for pleasure trips as opposed to work-related travel). Rationing by quantity limits the amounts of a commodity available to each claimant (e.g., a pound of butter per month). Rationing by value limits the amount of money consumers can spend on commodities that are difficult to standardize (e.g., clothing). Point rationing assigns a point value to each commodity and allocates a certain number of points to each consumer. These can be tracked through coupons, which are issued to consumers and must be exchanged for the approved amounts of rationed goods. Consumers in a rationed economy are usually encouraged to save their money or invest in government BONDS so that unspent money will not be used for unrationed items or purchases on the BLACK MARKET.

ratite \'ra-ˌtīt\ Any bird species that cannot fly because its smooth, or raftlike, sternum (breastbone) lacks a keel to which flight muscles can be anchored. The group includes some of the largest birds of all time. Two extinct types, the slow-moving, heavy-bodied elephant bird of Madagascar and the MOAS of New Zealand, grew to 10 ft (3 m) tall. Extant ratites include the CASSOWARY, EMU, KIWI, OSTRICH, and RHEA.

Rattigan, Sir Terence (Mervyn) (b. June 10, 1911, London, Eng.—d. Nov. 30, 1977, Hamilton, Bermuda) British playwright. After writing two comedies, he won acclaim for the drama *The Winslow Boy* (1946; film, 1948). His best-known work, *Separate Tables* (1955; film, 1958), explores the isolation created by rigidly imposed social conventions. His other plays include *The Browning Version* (1948), *Ross* (1960), and *A Bequest to the Nation* (1970). He wrote screenplays for the film adaptations of his plays and for *The Yellow Rolls-Royce* (1965) and *Goodbye Mr. Chips* (1969).

rattlesnake Any of about 30 species in two genera of New World PIT VIPERS having a tail rattle that produces a buzzing sound when vibrated. The rattle is composed of horny, loosely connected segments added one at a time with each molt. *Sistrurus* species have large scales on the top of the head. *Crotalus* species have mostly small scales on the head. Species range from 1 to 8 ft (30 to 250 cm) long. Most eat small animals, primarily rodents, birds, and lizards. All bear live young. In hot

Timber rattlesnake (*Crotalus horridus*).
JACK DERMID

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areas rattlesnakes become nocturnal; in cold areas they hibernate in groups. Heat-sensitive organs on the sides of the head help them locate and strike their prey. A rattlesnake bite is painful and can be fatal if not treated. See also SIDEWINDER.

Ratzenhofer, Gustav (b. July 4, 1842, Vienna—d. Oct. 8, 1904, at sea) Austrian general, philosopher, and sociologist. After a successful military career in which he attained the rank of field marshal, he developed an interest in the social sciences, particularly SOCIAL DARWINISM. He believed human interaction was characterized by "absolute hostility" between ethnic groups but that the species could evolve higher forms of association through sociology. His works included *The Essence and Objective of Politics*, 3 vol. (1893), and *Sociological Perception* (1898).

Rauschenberg \'raù-shən-ˌberg**, Robert** *orig.* **Milton Rauschenberg** (b. Oct. 22, 1925, Port Arthur, Texas, U.S.) U.S. painter and graphic artist. He studied under JOSEF ALBERS. His "combine" paintings of the 1950s, incorporating objects such as soda bottles, traffic barricades, and stuffed birds, anticipated the POP ART movement. In later work, he used silkscreen and other techniques to transfer images from commercial print media and his own photographs to canvas, reinforcing the images and unifying them compositionally with bold strokes of paint. His work has roots in DADA and the ready-mades of MARCEL DUCHAMP.

Ravana \'rä-və-nə\ In Hinduism, king of the demons. Ravana is depicted with 10 heads and 20 hands and flying a magic chariot. He ruled in the kingdom of Lanka, from which he had expelled his brother Kubera. His abduction of SITA and defeat by her husband, RAMA, are the central events of the epic *RAMAYANA*. The demon king is also remembered for shaking Mount Kailasa until SHIVA intervened and imprisoned him beneath it for 1,000 years. The popular annual Ram Lila festival climaxes with the defeat of Ravana and the burning of huge effigies of demons.

Ravana, the 10-headed demon-king, detail from a Guler painting of the *Ramayana*, c. 1720; in the Cleveland Museum of Art.
COURTESY OF THE CLEVELAND MUSEUM OF ART, OHIO, GIFT OF GEORGE P. BICKFORD

Ravel \rà-'vel**, (Joseph-) Maurice** (b. March 7, 1875, Ciboure, France—d. Dec. 28, 1937, Paris) French composer. At age 14 he was admitted to the Paris Conservatoire. Completing his piano studies, he returned to study composition with GABRIEL FAURÉ, writing the important piano piece *Jeux d'eau* (completed 1901) and a string quartet. In the next decade he produced some of his best-known music, including *Pavane pour une infante défunte* (1899), the *String Quartet* (1903), and the *Sonatine* for piano (1905). His great ballet *Daphnis et Chloé* (1912) was commissioned by the impresario SERGEY DIAGHILEV. Other works include the opera *L'Enfant et les sortileges* (1925), the suite *Le Tombeau de Couperin* (1917), and the orchestral works *La Valse* (1920) and *Boléro* (1928). Careful and precise, Ravel possessed great gifts as an orchestrator, and his works are universally admired for their superb craftsmanship; he has remained the most widely popular of all French composers.

raven Any of several species (genus *Corvus*, CROW family Corvidae) of heavy-billed, usually solitary, songbirds, once abundant throughout the Northern Hemisphere but now restricted to undisturbed areas. The common raven (*C. corax*), the biggest PASSERINE, grows to 26 in. (66 cm) long and has a wingspan of more than 4 ft (1.3 m). The dark, iridescent plumage is shaggy, especially around the throat. Ravens eat rodents, insects, grain, birds' eggs, and, in winter, carrion and refuse. Captive nestlings may learn to mimic a few words. The large nest, a crude structure of sticks, is built high on a cliff or treetop.

Ravenna \rə-'ve-nə\ City (pop., 2001 prelim.: 138,204), northeastern Italy. It is located inland from the Adriatic Sea, with which it is connected by a canal. It was the capital of the Western Roman Empire in the 5th century AD and of the Ostrogothic kingdom and Byzantine Italy in the 6th–8th centuries. Ravenna's art and architecture reflect a fusion of Roman forms with Byzantine mosaics and other decoration; sites include the 6th-century basilica of Sant'Apollinare Nuovo and the octagonal church of San Vitale. It became part of the Kingdom of Italy in 1861 and today is an agricultural and industrial city, with industries that include petroleum and natural-gas refining.

Ravi \'rä-vē\ **River** River, northwestern India and northeastern Pakistan, one of the five main rivers of the PUNJAB. It rises in the HIMALAYAS in HIMACHAL PRADESH state, India, and flows past Chamba, turning southwest at the boundary of JAMMU AND KASHMIR state. It then flows to the Pakistani border and along it before entering Pakistani Punjab. In Pakistan it runs past LAHORE and turns west near Kamalia, emptying into the CHENAB RIVER after a course of about 450 mi (725 km).

Rawalpindi \ˌrä-wəl-'pin-dē\ City (pop., 1998: 1,406,214), PUNJAB province, northern Pakistan, southwest of ISLAMABAD. In ancient times, the locality was included in the Achaemenian Persian Empire. The ancient city of TAXILA has been identified with nearby ruins. Strategically located, it controls the routes to the Kashmir region and was the site of an important British military station. The former capital of Pakistan (1959–69), Rawalpindi is the headquarters of Pakistan's army and an administrative, commercial, and industrial centre. Wheat, barley, corn, and millet are the chief crops grown in the area. Mankial, south of the city, is the site of a Buddhist STUPA dating to the 3rd century BC.

Rawlings, Jerry J(ohn) (b. June 22, 1947, Accra, Ghana) Ruler of Ghana (1981–2001). Of Scottish and Ghanaian descent, Rawlings, then a junior air force officer, first overthrew the government in 1979, but he yielded power to a freely elected civilian president, Hilla Limann. Two years later he ousted Limann. As Ghana's ruler, he created workers' councils and established production and price controls but later abandoned these measures. His policies afforded GHANA relative political and economic stability. He was returned to office by election in 1996 and stepped down from the presidency in 2001.

Rawlings, Marjorie Kinnan *orig.* **Marjorie Kinnan** (b. Aug. 8, 1896, Washington, D.C., U.S.—d. Dec. 14, 1953, St. Augustine, Fla.) U.S. short-story writer and novelist. Rawlings worked as a journalist before moving to backwoods Florida and devoting herself to fiction. Taking her material from the people and land around her, she wrote richly atmospheric works that resemble vivid factual reporting and are noted for their magical descriptions of landscape. Her best-known novel is *The Yearling* (1938, Pulitzer Prize), about a boy from a hardscrabble family and the fawn he adopts. Her later works include *Cross Creek* (1942) and *The Sojourner* (1953).

Rawls, John (b. Feb. 21, 1921, Baltimore, Md., U.S.—d. Nov. 24, 2002, Lexington, Mass.) U.S. political philosopher. He taught at Cornell University (1962–79) and later at Harvard University. He wrote primarily on political philosophy and ethics. His *Theory of Justice* (1971) is widely recognized as the major work in 20th-century political philosophy. In that work and others Rawls sought to develop a conception of justice appropriate to a democratic society. He believes that UTILITARIANISM, which enjoins maximizing overall happiness, inadequately protects freedom and equality, the core liberal and democratic values. Following JEAN-JACQUES ROUSSEAU and IMMANUEL KANT, he appealed to the idea of a SOCIAL CONTRACT: he depicted justice as the result of a hypothetical agreement among free persons acting from a position of equal right. To insure a fair, impartial agreement, Rawls situated parties to it equally by imposing a "veil of ignorance": parties do not know any particular facts about themselves and others (e.g., their talents, social class, wealth, or religious and other values) or even facts about history or their society. From this "original position" Rawls contends that free persons would agree to a liberal egalitarian conception of justice, or "justice as fairness." This conception comprises two principles: (1) certain basic liberties, such as freedom of thought and association, are so important that they take precedence over other social values, such as economic efficiency and improving the welfare of the poor; (2) offices and positions of authority are to be open to all under conditions of equality of opportunity.

Cow-nosed ray (*Rhinoptera bonasus*), a stingray
PAINTING BY RICHARD ELLIS

ray Any of 300–350 mostly marine species of cartilaginous fish (order Batoidei) found worldwide and classified as ELECTRIC RAYS, SAWFISHES, SKATES, and STINGRAYS. Many species

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are slow-moving bottom-dwellers. The gill openings and mouth are on the underside of the flattened body. Winglike pectoral fins extend along the sides of the head. All but electric rays have a long, slender tail, often with saw-edged, venomous spines, and rough, often spiny, skin. See also MANTA RAY.

Ray, James Earl (b. March 10, 1928, Alton, Ill., U.S.—d. April 23, 1998, Nashville, Tenn.) Assassin of MARTIN LUTHER KING, JR. Ray was a petty criminal who had been sentenced several times to prison; he escaped from the Missouri state prison in 1967. In Memphis, Tenn., on April 4, 1968, he shot King from the window of a rooming house as King emerged from his motel room across the street. Ray fled to Toronto, London, Lisbon, and back to London, where he was arrested on June 8. In Memphis he pleaded guilty and was sentenced to 99 years in prison. Months later, he recanted his confession, without effect. Later in life, his unsuccessful pleas to have his case reopened were supported by some civil rights leaders, notably the King family.

Ray, John (b. Nov. 29, 1627, Black Notley, Essex, Eng.—d. Jan. 17, 1705, Black Notley) British naturalist and botanist. He attended Cambridge University and spent many years there as a fellow. With Francis Willughby (1635–1672) he undertook a complete catalog of living things, of which he published numerous volumes. His enduring legacy to botany was the establishment of species as the ultimate unit of taxonomy. He attempted to base his systems of classification on all the structural characteristics of organisms, including internal anatomy, rather than on a single feature. By insisting on the importance of lungs and heart structure, he effectively established the class of mammals, and he divided insects according to the presence or absence of multiple metamorphoses. Coming closer to a truly natural system of taxonomy than had any of his contemporaries, Ray helped make possible CAROLUS LINNAEUS's later contributions.

Ray, Man See MAN RAY

Ray, Nicholas *orig.* **Raymond Nicholas Kienzle** (b. Aug. 7, 1911, Galesville, Wis., U.S.—d. June 16, 1979, New York, N.Y.) U.S. film director. He studied architecture and drama and began directing plays in the mid-1930s. After working in New York with JOHN HOUSEMAN and ELIA KAZAN, he followed them to Hollywood, where he directed *They Live by Night* (1948). Ray was praised for demonstrating a personal style in movies such as *In a Lonely Place* (1950), *The Lusty Men* (1952), *Johnny Guitar* (1954), and the landmark film of youthful rebellion, *Rebel Without a Cause* (1955). He also directed *Bigger Than Life* (1956), *Bitter Victory* (1958), and *55 Days at Peking* (1963). He later tried directing in Yugoslavia and taught at the State University of New York.

Ray, Satyajit (b. May 2, 1921, Calcutta, India—d. April 23, 1992, Calcutta) Bengali-Indian film director. After studying with RABINDRANATH TAGORE, he became art director of an ad agency and a book illustrator. He sold all his possessions to make his first film, *Pather Panchali* (1955), a story of village life. With *Aparajito* (1956) and *The World of Apu* (1959), he completed the brilliant Apu Trilogy and brought Indian cinema to world attention. He later won acclaim for *Devi* (1960), *Two Daughters* (1961), *The Big City* (1964), *The Lonely Wife* (1964), *The Chess Players* (1977), *The Home and the World* (1984), and *The Visitor* (1990). He wrote all his own screenplays, noted for their humanism and poetry, and often composed the music for his films, though his short stories and novellas became his main source of income.

Satyajit Ray.
CAMERA PRESS

ray flower See COMPOSITE FAMILY

Rayburn, Sam(uel) (Taliaferro) (b. Jan. 6, 1882, Roane county, Tenn., U.S.—d. Nov. 16, 1961, Bonham, Texas) U.S. politician. He taught school in Texas before becoming a lawyer. He served in the state legislature from 1907 to 1913. In 1912 he was elected as a Democrat to the U.S. House of Representatives, where he served for the next 48 years, including 17 years as speaker (1940–46, 1949–53, 1955–61). A skillful tactician, he influenced the passage of much NEW DEAL legislation and cowrote the bill enacting rural electrification. He was the long-time political mentor of LYNDON B. JOHNSON and a trusted adviser to presidents from FRANKLIN D. ROOSEVELT to JOHN F. KENNEDY.

Rayleigh \'rā-lē\ **(of Terling Place), John William Strutt, 3rd Baron** (b. Nov. 12, 1842, Langford Grove, Essex, Eng.—d. June 30, 1919, Terling Place, Witham, Essex) English physicist. In 1873 he succeeded to his father's title and built a research laboratory on his estate. He taught physics at Cambridge University (1879–84) and was secretary of the Royal Society (1884–95). His research included work on electromagnetism, colour, acoustics, and diffraction gratings, and his theory explaining the blue colour of the sky evolved into the RAYLEIGH SCATTERING law. In 1904 he was awarded the Nobel Prize for Physics for his isolation of ARGON. In 1908 he became chancellor of Cambridge University. His influential *Theory of Sound* (1877, 1878) examines questions of vibrations and resonance of media.

Rayleigh scattering Dispersion of ELECTROMAGNETIC RADIATION by particles with radii less than ⅒ the WAVELENGTH of the radiation. It is named for Baron RAYLEIGH, who described it in 1871. Since blue light is at the short wavelength end of the visible SPECTRUM, it is scattered in the atmosphere much more than the longer-wavelength red light. This causes the blue colour of the sky, since the observer sees only the scattered light. The Rayleigh laws predict the variation of the intensity and the POLARIZATION of scattered light.

Raymond IV *French* **Raimond** *known as* **Raymond of Saint-Gilles** \sa^{n}-'zhēl\ (b. 1041 or 1042, Toulouse, county of Toulouse—d. Feb. 28, 1105, near Tripoli) Count of Toulouse (1093–1105) and marquis of Provence (1066–1105). The first western European ruler to join the First CRUSADE, he helped capture Antioch (1098) and Jerusalem (1099) but refused the Crusaders' crown of Jerusalem. He also conquered and ruled Tripoli (1102–05).

Raymond VI *French* **Raimond** (b. Oct. 27, 1156—d. Aug. 1222, Toulouse, France) Count of TOULOUSE (1194–1222). He at first tolerated the heretical CATHARI but later joined the ALBIGENSIAN CRUSADE against them. Raymond fought the Crusaders to save his own dominions. Though he lost his title by decree of the fourth LATERAN COUNCIL (1215), despite the effort of Pope INNOCENT III to arrange a compromise, he regained most of his lands by conquest. Twice excommunicated, he was refused Christian burial.

Raymond VII *French* **Raimond** (b. July 1197, Beaucaire, France—d. Sept. 27, 1249, Millau) Count of Toulouse (1222–49). He helped recover lands taken from his father, RAYMOND VI, and negotiated a truce (1223) with land-hungry Crusaders from northern France. For failing to suppress the heretical CATHARI, he was excommunicated (1226) and subjected to a French invasion. He ceded territory to France by treaty and agreed to permit the ALBIGENSIAN CRUSADE to continue in Languedoc (1229). Allied with HENRY III of England, he rebelled unsuccessfully against Louis VIII of France (1242) and was forced to accept greater French authority over Toulouse.

Raymond, Antonin (b. May 10, 1888, Kladno, Bohemia—d. Nov. 21, 1976, Langhorne, Pa., U.S.) Czech-born U.S. architect. He immigrated to the U.S. in 1910. He assisted FRANK LLOYD WRIGHT in building the Imperial Hotel, Tokyo (1916). Remaining in Japan, he and his partner, Ladislav Rado, built numerous structures, mostly for Americans. One of the few Modernist architects working in Japan at the time, he influenced such Japanese architects as Yoshimura Junzo and MAEKAWA KUNIO. Among his works were the Reader's Digest Building, Tokyo (1951; since destroyed), and the Nagoya International School (opened 1967), a circular structure serving a flexible, progressive educational program.

Raymond of Peñafort \ˌpān-yə-'fȯrt**, Saint** *Spanish* **Raimundo** (b. c. 1185, Peñafort, near Barcelona—d. Jan. 6, 1275, Barcelona; canonized 1601; feast day January 7) Catalan Dominican friar influential in defining church law. He studied and taught CANON LAW at Bologna, then returned to Barcelona, where he joined the Dominicans and wrote a manual for confessors widely used in the late Middle Ages. Appointed papal chaplain by Pope GREGORY IX (1230), he was commissioned to codify the papal statues and rulings on canon law; these *Decretals* (1234) remained part of church law until 1917. He later organized schools of Arabic and Hebrew studies in Tunis and Murcia.

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Rayonism \'rā-ə-ˌni-zəm\ (from Russian, *Luchizm*: "ray-ism") Russian art movement founded 1912–13 by Mikhail Larionov (1881–1964) and his wife, Natalia Goncharova (1881–1962), which represented one of the first steps toward the development of abstract art in Russia. A synthesis of CUBISM, FUTURISM, and ORPHISM, Rayonism was described by Larionov as "concerned with spatial forms that are obtained through the crossing of reflected rays from various objects." It apparently ended after 1914, when its founders departed for Paris.

Rayonnant style \re-yən-'äⁿ\ French style (13th century) that represents the height of GOTHIC ARCHITECTURE. During this period architects became less interested in achieving great size than in decoration, which took such forms as pinnacles, moldings, and especially window TRACERY. The style's name reflects the radiating character of the ROSE WINDOW. Other features include the thinning of vertical supporting members, the enlargement of windows, and the combination of the triforium gallery and CLERESTORY into one large glazed area, until walls became largely undifferentiated screens of tracery, mullions, and glass. Amiens Cathedral (1220–70) is cited as its earliest manifestation. Especially fine achievements include NOTRE-DAME DE PARIS, the church of Saint-Urbain in Troyes (founded 1262), and the extraordinary Sainte-Chapelle, Paris (consecrated 1248), Louis IX's palace chapel. See also CATHEDRAL.

Rāzī \'rä-zē**, al-** *in full* **Abū Bakr Muḥammad ibn Zakariyyā' al-Rāzī** *Latin* **Rhazes** (b. c. 865, Rayy, Persia—d. 925 or 935, Rayy) Persian alchemist and philosopher. He saw himself as the Islamic heir of SOCRATES in philosophy and of HIPPOCRATES in medicine. In *The Comprehensive Book*, he surveyed Greek, Syrian, early Arabic, and some Indian medical knowledge, adding his own comments. A number of his works were translated into Latin and other languages. One such, *The Spiritual Physick of Rhazes*, is a popular ethical treatise and major alchemical study. He called himself a follower of PLATO but disagreed with Arabic interpreters of Plato. His theory of the composition of matter is similar to that of DEMOCRITUS. He was considered one of the greatest physicians of the early Islamic world.

Razin \'rä-zyin**, Stenka** *orig.* **Stepan Timofeyevich Razin** (b. c. 1630, Zimoveyskaya-na-Donu, Russia—d. June 16, 1671, Moscow) Russian COSSACK rebel. Born in the prosperous Don Cossack area, he supported the runaway serfs from Poland and Russia who escaped into the region to find land. In 1667 he led a band of newcomers to establish an outpost on the upper Don River. They raided Russian and Persian settlements on the Caspian Sea (1667–70), acquiring great fame and wealth. He then led his Cossack anarchists on a campaign into the Volga River region, where he was joined by disaffected peasants. After seizing Tsaritsyn (now Volgograd), Astrakhan, and Saratov, his force of 20,000 undisciplined rebels was defeated by the Russian army at Simbirsk. Razin was captured, tortured, and executed. He became a popular Russian folk hero and was immortalized in songs and legends.

razor clam Any of several species of marine CLAMS (family Solenidae) common in intertidal sands and muds, particularly of temperate seas. Razor clams have narrow and elongated shells (shaped like straight razors) up to 8 in. (20 cm) long. A large active foot enables them to move rapidly up and down within their burrow and retreat quickly when disturbed. With their short siphons (tubes) they feed on particulate material in seawater. Some species can swim short distances by jetting water through their siphons.

razorback whale See FIN WHALE

RCA Corp. Major U.S. electronics and broadcasting conglomerate that was purchased by the GENERAL ELECTRIC CO. (GE) in 1986. RCA's subsidiaries at the time of the acquisition included NBC, which is managed as a separate division within GE. RCA was founded as the Radio Corp. of America by General Electric in 1919 to acquire Marconi Wireless Telegraph Co. of America, at that time the only company capable of handling commercial transatlantic radio communications. RCA founded NBC in 1926 to manage radio broadcasting operations for GE, AT&T, and WESTINGHOUSE. An ANTITRUST suit against the three latter companies in 1932 caused RCA and its NBC unit to become independent. In 1939 RCA developed the first experimental TELEVISION set, and its black-and-white sets went on the market seven years later. After consolidating most of RCA's operations into GE's businesses, in 1987 General Electric sold RCA's consumer-electronics division to the French corporation Thomson-Brandt, SA (later Thomson SA). Within GE, RCA's core products are in military and space electronics and satellite communications.

Re \'rā\ *or* **Ra** \'rä\ In ancient EGYPTIAN RELIGION, the creator god and god of the sun. He was believed to sail across the sky in his solar bark and at night to travel in another bark through the underworld, where he had to vanquish a serpent before he could be born again. As the creator, he rose from the ocean of chaos, creating himself and then engendering eight other gods. From the 4th dynasty, kings held the title Son of Re, and Re later became part of the throne name they adopted at accession and was appended to the names of such gods as AMON and SEBEK.

reactance Measure of the opposition that an electrical CIRCUIT or a part of a circuit presents to ELECTRIC CURRENT (see ELECTRICAL IMPEDANCE) insofar as the current is varying or alternating. Steady electric currents flowing along conductors in one direction undergo opposition called electrical RESISTANCE, but no reactance. Reactance is present in addition to resistance when conductors carry ALTERNATING CURRENT. Reactance also occurs for short intervals when DIRECT CURRENT is changing as it approaches or departs from steady flow (e.g., when switches are closed or opened). Reactance is of two types, inductive and capacitive. Inductive reactance is associated with the varying magnetic field that surrounds a wire or a coil carrying a current. Capacitive reactance is associated with the changing electric field between two conducting surfaces (plates) separated from each other by an insulating medium. The ohm is the unit of reactance.

reaction, heat of Amount of HEAT that must be added or removed during a CHEMICAL REACTION to keep all substances involved at the same temperature. If it is positive (heat must be added), the reaction is endothermic; if it is negative (heat is given off), the reaction is exothermic. Accurate heat of reaction values are needed for proper design of equipment used in chemical processes; they are usually estimated from compiled tables of THERMODYNAMICS data (heats of formation and heats of combustion of many known materials). The ACTIVATION ENERGY is unrelated to the heat of reaction.

reaction rate Speed at which a CHEMICAL REACTION proceeds, in terms of amount of product formed or amount of reactant consumed per unit of time. The reaction rate depends on the nature of the reacting substances and the type of chemical change, as well as temperature and pressure, especially if GASES are involved. In general, the reactions of IONS occur very rapidly, but those in which COVALENT BONDS are formed or broken are slower. CATALYSTS usually accelerate reaction rates. The prediction, measurement, and interpretation of reaction rates are subjects of the branch of chemistry known as chemical kinetics. See also MASS ACTION, LAW OF.

read-only memory See ROM

Reade, Charles (b. June 8, 1814, near Ipsden, Oxfordshire, Eng.—d. April 11, 1884, London) English novelist and dramatist. Though trained in law and an administrator at Oxford University, he put much of his time and resources into writing and staging his melodramatic plays. His novels expose, with passionate indignation, the social injustices of his times. He is best remembered for the historical romance *The Cloister and the Hearth* (1861). His other novels include *It Is Never Too Late to Mend* (1856), attacking prison conditions; *Hard Cash* (1863), on the abuse of mental patients; and *Put Yourself in His Place* (1870), about terrorism by trade unionists.

Reader's Digest U.S.-based monthly magazine. Founded by DEWITT AND LILA WALLACE, it was first published in 1922 as a digest of articles of topical interest and entertainment value condensed from other periodicals. From 1934 it published condensed versions of current books; later it began publishing books containing original material. Though initially conceived as an impartial journal, the *Digest* has tended to reflect its publishers' generally conservative outlook. It probably has the largest circulation of any periodical in the world, appearing in dozens of editions and a wide variety of languages worldwide.

Reading \'re-diŋ\ Town and unitary authority (pop., 2001: 143,124), county seat of BERKSHIRE, England, west of LONDON. Reading was a Danish encampment as early as AD 871. It was given a town charter by King HENRY III in 1253; that charter was confirmed by succeeding sovereigns. Between the 12th and 16th centuries Reading was dominated by a struggle for privileges between the Benedictine abbey founded in 1121 and the emergent merchants' guild. By the 17th century the town's trade, notably in clothing, had begun to decline. In the 18th century the chief trade was in malt. In the city's public gardens are the ruins of the abbey, which was dissolved by Henry VIII. The structure was destroyed during the English Civil Wars, during which time the town in general also suffered severely.

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In Reading Gaol, adjoining the ruins, Oscar Wilde was imprisoned, and it was there that he wrote *The Ballad of Reading Gaol*. The city is now an agricultural centre noted for the bulbs produced in its nurseries. It is the site of a university, and its industries include computer production and malting and brewing.

ready-made Everyday object selected and designated as art. The name was coined by Marcel Duchamp, whose first ready-mades included a snow shovel that he picked up on a snowy day in New York, and a wheel mounted on a stool (1913). They represented a protest against the excessive importance attached to works of art. Duchamp's anti-aesthetic gestures made him one of the leading Dadaists of his day, and his ready-made concept, though widely regarded for decades as an insult to art, was adapted by such later artists as Robert Rauschenberg, Andy Warhol, and Jasper Johns.

Reagan \'rā-gən**, Ronald W(ilson)** (b. Feb. 6, 1911, Tampico, Ill., U.S.—d. June 5, 2004, Los Angeles, Calif.) 40th president of the U.S. (1981–89). He attended Eureka College and worked as a radio sports announcer before going to Hollywood in 1937. In his career as a movie actor, he appeared in more than 50 films and was twice president of the Screen Actors Guild (1947–52, 1959–60). In the mid-1950s he became a spokesman for the General Electric Co.; he hosted its television theatre program from 1954 to 1962. Having gradually changed his political affiliation from liberal Democrat to conservative Republican, he was elected governor of California in 1966 and served two terms. In 1980 he defeated incumbent Pres. Jimmy Carter to become president. Shortly after taking office, he was wounded in an assassination attempt. His administration adopted policies based on supply-side economics in an effort to promote rapid economic growth and reduce the federal deficit. Congress approved many of his proposals (1981), which succeeded in lowering inflation but doubled the national debt by 1986. He began the largest peacetime military buildup in U.S. history; in 1983 he proposed construction of the Strategic Defense Initiative. His administration concluded a treaty with the Soviet Union to restrict intermediate-range nuclear weapons, conducted a proxy war against Nicaragua through its support of the Contras, and invaded Grenada ostensibly to prevent the island nation from becoming a Soviet outpost. He was reelected by a large margin in 1984. Beginning in 1986, the Iran-Contra Affair temporarily weakened his presidency. Though his intellectual capacity for governing was often disparaged by his critics, his affability and artful communication skills enabled him to pursue numerous conservative policies with conspicuous success, and his tough stance toward the Soviet Union is often credited with contributing to the demise of Soviet communism. In 1994 he revealed that he had Alzheimer disease.

real and personal property Basic types of property in English common law, roughly corresponding to the division between immovables and movables in civil law. Real property consists of land, buildings, crops, and other resources, improvements, or fixtures still attached to the land. Personal property is essentially all property other than real property, including goods, animals, money, and vehicles.

real number In mathematics, a quantity that can be expressed as a finite or infinite decimal expansion. The counting numbers, integers, rational numbers, and irrational numbers are all real numbers. Real numbers are used in measuring continuously varying quantities (e.g., size, time), in contrast to measurements that result from counting. The word *real* distinguishes them from the imaginary numbers.

realism In the visual arts, an aesthetic that promotes accurate, detailed, unembellished depiction of nature or of contemporary life. Realism rejects imaginative idealization in favour of close observation of outward appearances. It was a dominant current in French art between 1850 and 1880. In the early 1830s the painters of the Barbizon school espoused realism in their faithful reproduction of the landscape near their village. Gustave Courbet was the first artist to proclaim and practice the realist aesthetic; his *Burial at Ornans* and *The Stone Breakers* (1849) shocked the public and critics with their frank depiction of peasants and labourers. In his satirical caricatures, Honoré Daumier used an energetic linear style and bold detail to criticize the immorality he saw in French society. Realism emerged in the U.S. in the work of Winslow Homer and Thomas Eakins. In the 20th century German artists associated with the Neue Sachlichkeit worked in a realist style to express their disillusionment after World War I. The Depression-era movement known as Social Realism adopted a similarly harsh realism to depict the injustices of U.S. society. See also naturalism.

realism In literature, the theory or practice of fidelity to nature or to real life and to accurate representation without idealization of everyday life. The 18th-century works of Daniel Defoe, Henry Fielding, and Tobias Smollett are among the earliest examples of realism in English literature. It was consciously adopted as an aesthetic program in France in the mid-19th century, when interest arose in recording previously ignored aspects of contemporary life and society; Gustave Flaubert's *Madame Bovary* (1857) established the movement in European literature. The realist emphasis on detachment and objectivity, along with lucid but restrained social criticism, became integral to the novel in the late 19th century. The word has also been used critically to denote excessive minuteness of detail or preoccupation with trivial, sordid, or squalid subjects. See also naturalism.

realism In philosophy, any viewpoint that accords to the objects of human knowledge an existence that is independent of whether they are being perceived or thought about. In the metaphysical debate concerning universals, realism is opposed to nominalism, which denies that universals have any reality at all (except as words), and to conceptualism, which grants universals reality but only as concepts in the mind. Against idealism and phenomenalism, realism asserts the independent existence of material objects and their qualities. Similarly, moral realism holds that the moral qualities of things and actions (such as being good or bad, right or wrong) belong to the things or actions themselves and are not to be explained in terms of the subject's feelings of approval or disapproval. In opposition to conventionalism, realism holds that scientific theories are objectively true (or false) based on their correspondence (or lack of it) to an independently existing reality.

realpolitik Politics based on practical objectives rather than on ideals. The word does not mean "real" in the English sense but rather connotes "things"—hence a politics of adaptation to things as they are. Realpolitik thus suggests a pragmatic, no-nonsense view and a disregard for ethical considerations. In diplomacy it is often associated with relentless, though realistic, pursuit of the national interest.

reamer Rotary cutting tool of cylindrical or conical shape, used for enlarging and finishing to accurate dimensions holes that have been drilled, bored, or cored. A reamer cannot be used to start a hole. All reamers have lengthwise flutes or grooves; either the sides of the tool or the tip may be used for cutting. Reamers are made from high-carbon steel, high-speed steel, or cemented carbides.

reaper Any farm machine that cuts grain (cereal). Early reapers simply cut the crop and dropped it unbound. Modern machines include harvesters, combines (see combine harvester), and binders, which also perform other harvesting operations. See also Cyrus H. McCormick.

reason, practical See practical reason

Réaumur \rā-ō-'mūr,\ *English* \,rā-ō-'myůr**, René-Antoine Ferchault de** (b. Feb. 28, 1683, La Rochelle, France—d. Oct. 17, 1757, Saint-Julien-du-Terroux) French physicist and entomologist. He invented the thermometric scale that bears his name (see thermometry); on the Réaumur scale, 0° marks the freezing point of water and 80° marks the boiling point. He invented the opaque white glass known as Réaumur porcelain, improved techniques for making iron and steel, discovered that crayfish can regenerate lost appendages, and isolated gastric juice. His *Memoirs Serving as a Natural History of Insects* (1734–42), though unfinished, was a milestone in entomological history.

rebate Retroactive refund or credit given to a buyer who has purchased a product or service. Fair and equitable rebates are used simply as incentives available to all customers. So-called deferred (or exclusive-patronage) rebates are used by large vendors of perishables and consumer durable goods. To receive such a rebate, the purchaser must agree to buy certain goods or services exclusively from a particular vendor for a fixed period of time. Rebating was a common pricing tactic in the 19th century, often used by large companies to undercut competition from smaller firms. The U.S. railroad industry practiced price discrimination by granting secret rebates to important customers; the rebates granted to Standard Oil Co. helped it acquire a monopoly over the oil industry. Governments occasionally sponsor rebates on previously paid taxes such as property, income, or sales taxes. Tax rebates can be used to stimulate the economy, to return excess revenue to taxpayers, or to encourage specific actions such as energy conservation.

rebbe See rabbi

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Récamier \rā-kȧm-'yā**, Madame de** *orig.* **Jeanne-Françoise-Julie-Adélaïde Bernard** *in full* **Jeanne-Françoise-Julie-Adélaïde, dame de Récamier** (b. Dec. 4, 1777, Lyon, France—d. May 11, 1849, Paris) French hostess. Daughter of a prosperous banker, she married a wealthy banker and began to entertain widely. Her great charm and wit attracted to her salon most of the important political and literary figures of early 19th-century Paris, including many opponents of NAPOLEON, who exiled her in 1805. After Napoleon's defeat in 1815 she returned to Paris, where in her later years RENÉ, VISCOUNT DE CHATEAUBRIAND became her companion and the central figure in her salon. Her friend GERMAINE DE STAËL created her literary portrait in the novel *Corinne*.

receivership In law, state of being in the hands of a receiver, a person appointed by the court to administer, conserve, rehabilitate, or liquidate the assets of an insolvent corporation for the protection or relief of creditors. It is a legal solution to a financial difficulty; it does not necessarily entail the termination of the corporate charter. See also BANKRUPTCY, INSOLVENCY.

Recent epoch See HOLOCENE EPOCH

recession Downward trend in the BUSINESS CYCLE characterized by a decline in production and employment, which in turn lowers household income and spending. Even though not all households and businesses experience actual declines in income, they become less certain about the future and consequently delay making large purchases or investments. Consumers buy fewer durable household goods, and businesses are less likely to purchase machinery and equipment and more likely to use up existing inventory instead of adding goods to their stock. This drop in demand leads to a corresponding fall in output and thus worsens the economic situation. Whether a recession develops into a severe and prolonged DEPRESSION depends on a number of circumstances. Among them are the extent and quality of CREDIT extended during the previous period of prosperity, the amount of speculation permitted, the ability of government MONETARY and FISCAL policies to reverse (or minimize) the downward trend, and the amount of excess productive capacity. Compare DEPRESSION.

recessiveness Failure of one of a pair of genes (ALLELES) present in an individual to express itself in an observable manner because of the greater influence, or DOMINANCE, of its opposite-acting partner. Both alleles affect the same inherited characteristic, but the presence of the recessive gene cannot be determined by observation of the organism; that is, though present in the organism's GENOTYPE (gene makeup), the recessive trait is not evident in its PHENOTYPE (observable characteristics). The term *recessive* is applied both to the trait in the organism having the alleles of a gene pair in the recessive condition and to the allele whose effect can be masked by another allele of the same gene.

Recife \ri-'sē-fē\ Port and city (pop., 2003: city, 1,461,300; metro. area, 3,466,214), northeastern Brazil. Founded by the Portuguese in the first half of the 16th century, it was raided and sacked by British privateers in 1595. It was later occupied by the Dutch (1630–54). It has been called the Venice of Brazil because it is crossed by waterways, and areas of the city are linked by numerous bridges. Situated at the confluence of the Capibaribe and Beberibe rivers, it is one of the leading ports of Brazil, with extensive modern port facilities. It is an educational and cultural centre, with several universities and theatres.

reciprocity \ˌre-sə-'prä-sə-tē\ In international trade, the granting of mutual concessions on TARIFFS, QUOTAS, or other commercial restrictions. Reciprocity implies that these concessions are neither intended nor expected to be generalized to other countries with which the contracting parties have commercial treaties. Reciprocity agreements may be made between individual countries or groups of countries. Membership in the WORLD TRADE ORGANIZATION to some extent precludes the signing of reciprocity treaties because WTO nations are obliged to grant MOST-FAVORED-NATION TREATMENT to all other members.

recitative \ˌre-sə-tə-'tēv\ Style of accompanied solo singing that imitates the rhythms and tones of speech. Representing an attempt at an ideally expressive musical text setting, which the ancient Greeks were thought to have mastered, it came into existence in tandem with OPERA c. 1600, the first operas being largely written in recitative. Recitative style gradually began to separate from lyrical ARIA style. Regular alternation of recitative with aria became the rule for both opera and CANTATA, and recitative became essential to the dramatic ORATORIO as well. It remains basic to operatic composition; the presence of recitative (as opposed to spoken dialogue) most clearly distinguishes opera from the MUSICAL and related genres.

recognizance \ri-'käg-nə-zənts\ In law, obligation entered into before a court or magistrate requiring the performance of an act (e.g., appearance in court), usually under penalty of a money forfeiture. The most common use of recognizance is in connection with BAIL in criminal cases. The accused may also be released on his "own recognizance" when no bail is required.

recombination In genetics, regrouping of the maternal and paternal GENES during the formation of sex cells (gametes). Recombination occurs randomly in nature as a normal event of MEIOSIS. It is enhanced by crossing-over (see LINKAGE GROUP). Recombination acts to ensure that no two daughter cells are identical, nor are any identical in genetic content to the parent cell. Laboratory study of recombination has contributed significantly to the understanding of genetic mechanisms, allowing scientists to map CHROMOSOMES, identify linkage groups, isolate the causes of certain genetic mistakes, and manipulate recombination itself by transplanting genes from one chromosome to another. See also GENETIC ENGINEERING, MOLECULAR BIOLOGY.

recompression chamber See HYPERBARIC CHAMBER

Reconstruction (1865–77) Period after the AMERICAN CIVIL WAR in which attempts were made to solve the political, social, and economic problems arising from the readmission to the Union of the 11 Confederate states that had seceded at or before the outbreak of war. Pres. ABRAHAM LINCOLN planned to readmit states in which at least 10% of the voters had pledged loyalty to the Union. This lenient approach was opposed by the RADICAL REPUBLICANS, who favoured the harsher measures passed in the WADE-DAVIS BILL. Pres. ANDREW JOHNSON continued Lincoln's moderate policies, but enactment in the South of the BLACK CODES and demand in the North for stricter legislation resulted in victories for Radical Republicans in the congressional elections of 1866. Congress then passed the Reconstruction Acts of 1867, which established military districts in the South and required the Southern states to accept the 14th and 15th Amendments to the Constitution. Southern resentment of the imposed state governments, which included Republicans, CARPETBAGGERS, and SCALAWAGS, and of the activities of the FREEDMEN'S BUREAU led to the formation of terrorist groups such as the KU KLUX KLAN and the Knights of the White Camelia. By the 1870s conservative Democrats again controlled most state governments in the South. Though Reconstruction has been seen as a period of corruption, many constructive legal and educational reforms were introduced. The Reconstruction era led to an increase in sectional bitterness, dissension regarding the rights of blacks, and the development of one-party politics in the South.

Reconstruction Finance Corporation (RFC) U.S. government agency established (1932) to provide loans to railroads, banks, and businesses. The RFC was an attempt by Pres. HERBERT HOOVER to counter the early effects of the GREAT DEPRESSION by rescuing institutions from default. It was widely used by Pres. FRANKLIN ROOSEVELT in the NEW DEAL and to finance defense plants in World War II. After the war, the RFC's powers and functions were gradually transferred to other agencies.

Reconstructionism Movement that originated in U.S. Judaism in the 1920s. It regards Judaism only as a specific human culture, rejects the tradition of a transcendent deity who made a COVENANT with his chosen people, and does not accept the BIBLE as the inspired word of God. Its principles, as enunciated by MORDECAI MENAHEM KAPLAN, are based on the belief that Jews can live a distinctively Jewish cultural life without being religiously observant. Reconstructionists today number about 60,000.

record player See PHONOGRAPH

recorder In music, a cylindrical, usually wooden, wind instrument with fingerholes. As a fipple (duct) flute, its rather soft tones are produced by air blown against the sharp edge of an opening in the tube. The large recorder family includes instruments ranging from the sopranino to the contrabass. The recorder emerged in the 14th century and was widely used in ensembles and orchestras in the late Renaissance and throughout the Baroque era. Displaced by the transverse FLUTE after the mid-18th century, it was revived in the 20th century.

rectum End segment of the LARGE INTESTINE (see DIGESTION) in which FECES accumulate just prior to discharge. It is 5–6 in. (13–15 cm) long and lined with mucous membrane. One set of muscles separates it from the ANAL CANAL; another shortens it to expel feces. The rectal walls distend as feces enter, which stimulates the urge for DEFECATION.

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recycling *or* **materials salvage** Recovery and reuse of materials from consumed products. The main motives for recycling have been the increasing scarcity and cost of natural resources (including oil, gas, coal, mineral ores, and trees) and the pollution of air (see AIR POLLUTION), water (see WATER POLLUTION), and land by waste materials. There are two types of recycling, internal and external. Internal recycling is the reuse in a manufacturing process of materials that are a waste product of that process, and is common in the metals industry (see SCRAP METAL). External recycling is the reclaiming of materials from a product that is worn out or no longer useful; an example is the collection of old newspapers and magazines for the manufacture of newsprint or other paper products.

Red Army Army of the Soviet Union. Formed in the aftermath of the RUSSIAN REVOLUTION OF 1917, its first civilian leader was LEON TROTSKY, who proved a brilliant strategist and administrator. Formed of workers and peasants, it initially lacked an officers' corps, and Trotsky was forced to mobilize officers of the former imperial army until a new, politically reliable corps could be trained. The COMMUNIST PARTY placed commissars in all army units to ensure political orthodoxy. JOSEPH STALIN purged the military leadership in 1937, leaving the army demoralized and unprepared for the German surprise attack in 1941. It recovered sufficiently by 1945 to have forces numbering more than 11 million, surpassed in strength only by the U.S. Army. In 1946 it was renamed the Soviet Army. In 1960 the commissars' duties were transferred to army officers. See also UNION OF SOVIET SOCIALIST REPUBLICS.

Red Army Faction See BAADER-MEINHOF GANG

red blood cell See ERYTHROCYTE

Red Brigades *Italian* **Brigate Rosse** Extreme left-wing terrorist organization in Italy. Its self-proclaimed aim was to undermine the Italian state and pave the way for a Marxist upheaval led by a "revolutionary proletariat." Reputedly founded by Renato Curcio (b. 1945), it began carrying out violent acts with firebombings (1970), escalating to kidnappings (1971) and murders (1974), most notably that of ALDO MORO (1978). At its height, it probably had 400 to 500 full-time members, perhaps 1,000 sporadic members, and a few thousand supporters. Arrest and imprisonment of many leaders and ordinary members greatly weakened the organization in the 1980s. However, a group calling itself the Red Brigades claimed responsibility for several violent attacks in the 1990s and into the 21st century.

Red Cloud *orig.* **Mahpiua Luta** (b. 1822, on the Platte River, Nebraska Territory, U.S.—d. Dec. 10, 1909, Pine Ridge Agency, S.D.) American Indian leader. The principal chief of the Oglala Teton Dakota (SIOUX), he led the opposition of both the Sioux and the Cheyenne to the U.S. government's development of the Bozeman Trail to goldfields in the Montana Territory (1865–67). Relentlessly attacking workers along the route from Fort Laramie (in modern Wyoming) to Montana, he refused offers to negotiate until the U.S. agreed to halt the project, whereupon he laid down his arms and allowed himself to be settled on the Red Cloud Agency in Nebraska.

Red Cross *officially* **International Movement of the Red Cross and Red Crescent** *formerly* **International Red Cross** Humanitarian agency with national affiliates worldwide. Established for the care of victims of battle, it now aids in the general prevention and relief of human suffering. It arose out of the work of JEAN-HENRI DUNANT, who proposed the formation of voluntary relief societies in all countries, the first of which came into being in 1864. The name Red Crescent, adopted in 1906 at the insistence of the Ottoman Empire, is used in Muslim countries. In peacetime, the Red Cross aids victims of natural disasters, maintains blood banks, and provides supplementary health care services. In wartime, it serves as an intermediary between belligerents and visits prisoner-of-war camps to provide relief supplies, deliver mail, and transmit information between prisoners and their relatives. Its operating principles are humanity, impartiality, and neutrality. Its headquarters are in Geneva. Individual national organizations run community programs and coordinate natural-disaster relief efforts. The American Red Cross was founded by CLARA BARTON in 1881 and first chartered by Congress in 1900; it runs the world's largest blood-donor service. In 1901 Dunant received the first Nobel Prize for Peace; the Red Cross itself received the prize in 1917, 1944, and 1963.

red deer Species of DEER (*Cervus elaphus*), sometimes called ELK, native to Europe, Asia, and North Africa. It is found in woodlands and hunted for sport and food. Red deer live in sexually segregated herds except in the breeding season, when males (harts) fight for harems of females (hinds). Red deer stand about 4 ft (1.2 m) high at the shoulder. The coat is reddish brown, with lighter underparts and a light rump. The hart has long, regularly branched antlers bearing 10 or more tines. There are several endangered subspecies. See also WAPITI.

red elm See SLIPPERY ELM

Red Eyebrows Chinese peasant band that formed in response to the unrest and civil war following the floods and famines that accompanied disastrous changes in the course of the HUANG HE (Yellow River) between AD 2 and 11. They painted their faces to look like demons, and their leader spoke through mediums. In AD 23 their forces were involved in the overthrow of WANG MANG, the usurper whose reign had interrupted the HAN DYNASTY.

red-figure pottery Type of Greek POTTERY that flourished from the late 6th to the late 4th century BC. Developed in Athens c. 530 BC, the red-figure pottery quickly overtook the older BLACK-FIGURE POTTERY as the preferred style of vase painting. In red-figure technique, the background was painted black, and the outline details on the figures were also painted (rather than incised) in black, but the rest of each figure was unpainted and so retained the orange-red colour of the natural vase. By comparison with incising, the painting of the details allowed more flexibility in rendering human form, movements, expressions, and perspective. Since most of the ornamentation was narrative, such technical advantages were of utmost importance.

Athenian red-figure cup, detail of a bearded reveler by the Brygos Painter, c. 490 BC; in the Louvre, Paris
J.E. BULLOZ

red fox *or* **common fox** Either of two FOX species: *Vulpes vulpes*, found throughout Europe, temperate Asia, and northern Africa, and *V. fulva* of North America. It has a reddish brown coat; the tail is white-tipped, and the ears and legs are black. Red foxes are 36–42 in. (90–105 cm) long, including the 15-in. (38-cm) tail; they stand about 16 in. (40 cm) tall and weigh about 15 lb (7 kg). They eat small mammals, eggs, fruit, and birds. They are hunted for sport and for their fur and are raised commercially for pelts. North American red foxes exhibit black and silver colour phases.

Red Guards Paramilitary units of radical university and high-school students formed during the Chinese CULTURAL REVOLUTION. Responding in 1966 to MAO ZEDONG's call to revitalize the revolutionary spirit of the CHINESE COMMUNIST PARTY, they went so far as to attempt to purge the country of its pre-Communist culture. With a membership in the millions, they attacked and persecuted local party leaders, schoolteachers, and other intellectuals. By early 1967 they had overthrown party authorities in many localities. Internal strife ensued as different units argued over which among them best represented MAOISM. In 1968 their disruption of industrial production and urban life led the government to redirect them to the countryside, where the movement gradually subsided.

Red River *Chinese* **Yuan Chiang** \'ywän-'jyäŋ\ *Vietnamese* **Song Hong** \'sòŋ-'hòŋ\ River, Southeast Asia. It rises in central YUNNAN province, southern China, and flows southeast across northern Vietnam, past HANOI, into the Gulf of TONKIN. The principal river of northern Vietnam, it is about 500 mi (805 km) long and has a wide, fertile delta east of Hanoi.

Red River River, south-central U.S. It rises in the high plains of eastern New Mexico and flows southeast across Texas and Louisiana to a point northwest of Baton Rouge, where it enters the ATCHAFALAYA RIVER. It is 1,290 mi (2,080 km) long and forms a part of Texas's borders with Oklahoma and Arkansas. In Texas it was the site of the RED RIVER INDIAN WAR (1874).

Red River Indian War (1874–75) Uprising of Indian warriors from reservation tribes (ARAPAHO, CHEYENNE, COMANCHE, KIOWA, and Kataka). After settlement of southwestern tribes on reservations in Oklahoma and

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Texas (1867), discontented braves broke out repeatedly to raid white travelers and settlers. An attack in 1874 killed 60 Texans. Federal troops under William T. Sherman converged on Indians concentrated in the Red River valley of Texas. Indian resistance forced 14 pitched battles with U.S. troops before the Indians' eventual surrender and return to the reservations.

Red River of the North River, northern U.S. and southern Canada. It flows north, forming the Minnesota–North Dakota boundary, before entering Manitoba and emptying into Lake Winnipeg after a course of 545 mi (877 km). It was explored in 1732–33 by the French voyageur Pierre Gaultier de Varennes et de La Vérendrye. The river, named after the reddish brown silt it carries, was a transportation link between Lake Winnipeg and the Mississippi River system. The Red River Settlement, an agricultural colony, was founded in 1811 near Winnipeg. Its fertile valley produces cereals, potatoes, and sugar beets and supports cattle raising.

red salmon See sockeye salmon

Red Sea Narrow inland sea between the Arabian Peninsula and Africa. It extends southeast from Suez, Egypt, for about 1,200 mi (1,930 km) to the Strait of Mandeb, which connects with the Gulf of Aden and then with the Arabian Sea. It separates the coasts of Egypt, The Sudan, and Eritrea from those of Saudi Arabia and Yemen. It contains some of the world's warmest and saltiest seawater. With its connection to the Mediterranean Sea via the Suez Canal, it is one of the most heavily traveled waterways in the world, carrying traffic between Europe and Asia. Its name is derived from the colour changes observed in its waters.

red soil Any of a group of soils that develop in a warm, temperate, moist climate under deciduous or mixed forests and that have thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an illuvial (see illuviation) red layer. Red soils generally form from iron-rich sedimentary rock. They are usually poor growing soils, low in nutrients and humus and difficult to cultivate.

red spider See spider mite

Red Square Large public square, central Moscow. It lies north of the Moskva River, adjacent to the Kremlin, and covers some 18 acres (7.3 hectares). Dating from the late 15th century, it has long been a busy market area as well as a focal point in Russian history as the scene of executions, demonstrations, riots, and parades. Located around it are the State Historical Museum (1875–81), the nine-towered Cathedral of St. Basil the Blessed (1554–60), the former state department store GUM, and the tomb of Vladimir Ilich Lenin. The square and Kremlin were designated a UNESCO World Heritage site in 1990.

red tide Discoloration of seawater caused by dinoflagellates during periodic blooms (population increases). Toxic substances released by these organisms into the water may be lethal to fish and other marine life, and they irritate the human respiratory system. Coastal resorts sometimes close when breaking waves release the toxic substances into the air. The causes of red tide are uncertain; it may require the confluence of several natural phenomena, in which human influence may or may not play a part.

Red Turbans Peasant rebel movement of the mid-14th century that flourished in northern China at the end of the Yuan dynasty (1206–1368). The Red Turbans, whose leader was regarded as an incarnation of the bodhisattva Maitreya, were opposed to alien Mongol rule; their movement gained momentum from the famine that resulted from crop failures and floods in the 1330s. Their marauding, which began in the 1350s, took them as far as Korea, where their incursions contributed to the downfall of the Koryŏ dynasty. Though their rebellion was put down, rival rebel forces under Zhu Yuanzhang (1328–98) toppled the Yuan dynasty and founded the Ming. See also Hongwu emperor.

Eastern redbud (*Cercis canadensis*)
KENNETH AND BRENDA FORMANEK/EB INC.

redbird See cardinal

redbud Any of the shrubs or small trees that make up the genus *Cercis* (family Leguminosae), native to North America, southern Europe, and Asia, and widely planted for their showy early-spring flowers and interesting branch patterns. Clusters of small, purplish-pink flowers appear on old stems and branches before the leaves unfurl. The heart-shaped to roundish leaves quickly turn from bronzy to bright green, then to yellow in fall. The eastern redbud (*C. canadensis*) is the hardiest species.

redfish *or* **rosefish** *or* **ocean perch** Commercially important food fish (*Sebastes marinus*) of the scorpion fish family (Scorpaenidae), found in the Atlantic along European and North American coasts. It has a large mouth, large eyes, and spines on its head and cheeks. It grows to about 40 in. (1 m) long. Related species include *S. owstoni*, a food fish of the Orient, and the Norway haddock (*S. viviparus*) of Europe. Both are red and grow to about 10 in. (25 cm) long.

Redford (Jr.), (Charles) Robert (b. Aug. 18, 1937, Santa Monica, Calif., U.S.) U.S. film actor and director. He made his Broadway debut in 1959 and won acclaim in *Barefoot in the Park* (1963; film, 1967). The blond, appealing Redford began acting in films in the mid-1960s. He appeared with Paul Newman in the hits *Butch Cassidy and the Sundance Kid* (1969) and *The Sting* (1973) and also starred in *The Candidate* (1972), *Jeremiah Johnson* (1972), *All the President's Men* (1976), *The Natural* (1984), *Out of Africa* (1985), and *Indecent Proposal* (1993). His directorial debut, *Ordinary People* (1980, Academy Award), was followed by *The Milagro Beanfield War* (1988), *A River Runs Through It* (1992), *Quiz Show* (1994), *The Horse Whisperer* (1998), and *The Legend of Bagger Vance* (2000). He received an honorary Academy Award in 2001. In 1980 he founded the Sundance Institute to sponsor young filmmakers' works, and by the 1990s its film festival was the major showcase for U.S. independent films.

Redgrave, Sir Michael (Scudamore) (b. March 20, 1908, Bristol, Gloucestershire, Eng.—d. March 21, 1985, Denham, Buckinghamshire) British actor. He made his stage debut in 1934 and acted with the Old Vic and the National Theatre in classic roles from William Shakespeare, Henrik Ibsen, and Anton Chekhov and in modern works such as *Family Reunion* (1939) and *Tiger at the Gate* (1955). Noted for his refined good looks and expressive voice, he began his film career in *The Lady Vanishes* (1938) and continued with roles in *Dead of Night* (1945), *Mourning Becomes Electra* (1947), and *The Browning Version* (1951).

Redgrave, Vanessa (b. Jan. 30, 1937, London, Eng.) British actress. The daughter of actor Michael Redgrave, she made her London stage debut in 1958 and won praise as Rosalind in *As You Like It* (1961). Her performances in such movies as *Blow-Up* (1966), *Camelot* (1967), *Mary, Queen of Scots* (1971), and *Julia* (1977, Academy Award) won her critical adulation. Though criticized by some for her left-wing political activism, especially on behalf of Palestinians, she continued to win acclaim for her work on stage and screen. Her later films included *The Bostonians* (1984), *Howards End* (1992), and *Mrs. Dalloway* (1998).

Redi \'re-dē**, Francesco** (b. Feb. 19, 1626, Arezzo, Italy—d. March 1, 1697, Pisa) Italian physician and poet. While working as physician to the dukes of Tuscany, he demonstrated in 1668, in one of the first biological experiments with proper controls, that the presence of maggots in rotting meat does not result from spontaneous generation. Redi set up a series of flasks containing different meats; half were sealed, half open. He repeated the experiment, replacing the sealed flasks with gauze-covered flasks. Though the meat in all the flasks rotted, Redi found that only in the uncovered flasks, which flies had entered freely, did the meat contain maggots. As a poet, he is known chiefly for his "Bacco in Toscana" (1685).

Odilon Redon, self-portrait, 1904; in a private collection.
ARCHIVES PHOTOGRAPHIQUES, PARIS

Redon \rə-'dōⁿ**, Odilon** (b. April 20, 1840, Bordeaux, Fr.—d. July 6, 1916, Paris) French painter, lithographer, and etcher. He studied under Jean-Léon Gérome and learned lithography under Henri Fantin-Latour. He came to be associated with the Symbolist painters. His oils and pastels, chiefly still lifes with flowers, won him admiration as a colourist from

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Henri Matisse and other painters. His prints (nearly 200 in all), which explore fantastic, often macabre themes, foreshadowed Surrealism and Dada.

Redouté \rə-dü-'tā**, Pierre Joseph** (b. July 10, 1759, Saint-Hubert, Luxembourg—d. June 20, 1840, Paris, France) French botanical painter. He became a favoured artist at the court of France, patronized by kings from Louis XVI to Louis-Philippe. His delicate botanical prints were not only framed as pictures but also used for china patterns. His *Les Liliacées* (1802–15) contained 500 plates of lilies. However, roses became his specialty; *Les Roses* (1817–21) is considered his finest series, and its classic images are still widely reproduced.

redox See oxidation-reduction

redshift Displacement of the spectrum of an astronomical object toward longer wavelengths (visible light shifts toward the red end of the spectrum). In 1929 Edwin Hubble reported that distant galaxies had redshifts proportionate to their distances (see Hubble's constant). Since redshifts can be caused by motion of an object away from the observer (the Doppler effect), Hubble concluded that all galaxies are receding from each other. This became the cornerstone of theories of an expanding universe.

redstart Any of about 11 species of Old World chat-thrushes (see chat) in the genus *Phoenicurus* (family Turdidae) or about 12 New World species of wood warblers (family Parulidae) of similar appearance and behaviour. Old World redstarts have a red tail, which they constantly flit or shiver. They are about 6 in. (14 cm) long. The male common redstart (*P. phoenicurus*) is gray, with a black face and throat and reddish breast. New World redstarts (genera *Setophaga* and *Myioborus*) are usually strikingly marked with black, white, and red.

Common, or American, redstart (*Setophaga ruticilla*)
HAL H. HARRISON FROM GRANT HEILMAN

reduction Any of a class of chemical reactions in which the number of electrons associated with an atom or group of atoms is increased. The electrons taken up by the substance reduced are supplied by another substance, often hydrogen (H_2), which is thereby oxidized. See also oxidation-reduction.

redwood *or* **sequoia** Coniferous evergreen timber tree (*Sequoia sempervirens*) of the family Taxodiaceae, found in the fog belt of west-coastal North America. It grows in the coastal range from southwestern Oregon to central California at elevations up to 3,300 ft (1,000 m). The genus name commemorates the Cherokee Indian Sequoyah. The redwood is sometimes called coast redwood to distinguish it from the Sierra redwood (or big tree) and the Japanese redwood (or Japanese cedar). Redwoods are the tallest living trees, often exceeding 300 ft (90 m) in height; one has reached 368 ft (112 m). Typical trunk diameters are 10–20 ft (3–6 m) or more. The redwood tree takes 400–500 years to reach maturity; some are known to be more than 1,500 years old. As the tree ages, the lower limbs fall away, leaving a columnar trunk. Redwood timber has been used for furniture, shingles, fence posts, paneling, and fine wood objects. Today many of the remaining redwood stands are protected (see Redwood National Park; Sequoia National Park). See also dawn redwood.

Redwood National Park National park, northwestern corner of California, U.S. It was established in 1968, expanded in 1978, and designated a World Heritage site in 1980. It preserves virgin groves of ancient redwood trees, including the world's tallest, 367.8 ft (112.1 m) high. It also includes 40 mi (65 km) of scenic Pacific coastline. It covers an area of 172 sq mi (445 sq km), including land in three state parks.

reed In botany, any of several species of large aquatic grasses, especially the four species in the genus *Phragmites* (family Poaceae, or Gramineae). The common, or water, reed (*P. australis*) occurs along the margins of lakes, fens, marshes, and streams from the Arctic to the tropics. It is a broad-leaved grass, about 5–15 ft (1.5–5 m) tall, with feathery flower clusters and stiff, smooth stems. Bur reed (genus *Sparganium*) and reed mace (genus *Typha*) are plants of other families. Dried reed stems have been used for millennia as thatching and construction material, in basketry, for arrows and pens, and in musical instruments (see reed instruments).

Reed, Sir Carol (b. Dec. 30, 1906, London, Eng.—d. April 25, 1976, London) British film director. He made his stage debut as an actor in 1924 and as a director in 1927, staging Edgar Wallace's detective thrillers. He began directing films in 1935, winning praise for *The Stars Look Down* (1939), *Night Train* (1940), and the wartime semidocumentary *The True Glory* (1945). Noted for his technical mastery of the suspense-thriller genre, he had great success with *Odd Man Out* (1947), *The Fallen Idol* (1948), and the classic *The Third Man* (1949). His later films include *The Key* (1958), *Our Man in Havana* (1959), and *Oliver!* (1968, Academy Award). He was the first British film director to be knighted.

Reed, John (b. Oct. 22, 1887, Portland, Ore., U.S.—d. Oct. 19, 1920, Moscow, Russia) U.S. journalist. He attended Harvard University and began writing for the radical socialist journal *The Masses* in 1913. He covered the revolutionary fighting in Mexico (1914) and was frequently arrested for leading labour strikes. A war correspondent during World War I, he became a close friend of Vladimir Lenin and witnessed the Russian Revolution of 1917, described in his book *Ten Days That Shook the World* (1919). He became head of the U.S. Communist Labor Party; indicted for sedition, he escaped to the Soviet Union, where he died of typhus and was buried beside the Kremlin wall.

Reed, Thomas B(ackett) (b. Oct. 18, 1839, Portland, Maine, U.S.—d. Dec. 7, 1902, Washington, D.C.) U.S. politician. He served in the Maine legislature and was elected to the U.S. House of Representatives (1877–99). As speaker of the House (1889–91, 1895–99) he introduced procedural changes that strengthened legislative control by the majority party and increased the power of the speaker and the Rules Committee. The Reed Rules were attacked by opponents, who called Reed "Czar Reed" for his vigorous promotion of their passage. Ten years later the speaker's powers were reduced.

Reed, Walter (b. Sept. 13, 1851, Belroi, Va., U.S.—d. Nov. 22, 1902, Washington, D.C.) U.S. pathologist and bacteriologist. He received a medical degree at age 18 from the University of Virginia and entered the Army Medical Corps in 1875. He investigated the spread of typhoid fever in military camps during the Spanish-American War and was later curator of the Army Medical Museum in Washington, D.C. Yellow fever was believed to be spread by bedding and other articles, but Carlos Finlay had theorized in 1886 that it was carried by insects, and Reed's team ruled out a bacterium suspected as the cause and found patterns of spread that supported the insect theory. Controlled experiments proved transmission by mosquito bite, and in 1901 efforts to combat an outbreak in Havana succeeded within 90 days.

Walter Reed
BETTMANN ARCHIVE

Reed, Willis (b. June 25, 1942, Hico, La., U.S.) U.S. basketball player. Drafted by the New York Knicks in 1964, he averaged 19.5 points in his first season and was named Rookie of the Year. He led the Knicks to the NBA title in 1970 and that year became the only player ever to win the Most Valuable Player award for the regular season, the championships, and the All-Star game. After retiring in 1974 he coached the Knicks (1977–79) and other teams.

reed instrument Any musical wind instrument that sounds when the player's breath or air from a wind chamber causes a reed (a thin blade of cane or metal) to vibrate, thereby setting up a sound wave in an enclosed air column or in the open air. Reed pipes have single or double reeds. A double reed, as in the oboe or bassoon, consists of two cane blades tied together that beat against each other. A single reed may hit against a frame (beating reeds), as in the clarinet or saxophone, or it may vibrate freely through a closely fitting frame (free reeds), as in a harmonica or accordion. Beating reeds in woodwind instruments depend on the pipe's sounding length (as determined by the fingering) to determine the pitch. Free reeds have their own single pitch, determined by their thickness and length. See also English horn; shawm.

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reed organ See HARMONIUM

Reeds, Plain of *Vietnamese* **Dong Thap Muoi** \'dȯŋ-'täp-'mwȯi\ Low, swampy region, a northwestern extension of the MEKONG RIVER delta, southern Vietnam and eastern Cambodia. It has been partially reclaimed by a levee and drainage system.

reef, coral See CORAL REEF

Refah \re-'fä\ **Party** *or* **Welfare Party** Turkish political party noted for its Islamic orientation. It was founded in 1983 by NECMETTIN ERBAKAN. After doing well in local elections in the early 1990s, it won nearly one-third of the seats (the largest single bloc) in the 1995 national legislative elections, becoming the first religious party in Turkey to win a general election. It took office in 1996 at the head of a new coalition after a centre-right coalition formed to oppose it collapsed after a few months. The party's pro-Islamist policies brought it into conflict with the army and other secular elements in the country, and it left power in 1997. It was subsequently banned.

reference frame *or* **frame of reference** Coordinate system that allows description of time and position of points relative to a body. The axes, or lines, emanate from a position called the origin. As a point moves, its VELOCITY can be described in terms of changes in displacement and direction. Reference frames are chosen arbitrarily. For example, if a person is sitting in a moving train, the description of the person's motion depends on the chosen frame of reference. If the frame of reference is the train, the person is considered to be not moving relative to the train; if the frame of reference is the Earth, the person is moving relative to the Earth.

referendum and initiative Electoral devices by which voters express their wishes regarding government policy or proposed legislation. Obligatory referenda are those required by law. Optional referenda are put on the ballot when a sufficient number of voters sign a PETITION demanding that a law passed by the legislature be ratified by the people. Obligatory and optional referenda should be distinguished from the voluntary referenda that legislatures submit to voters to decide an issue or to test public opinion. Initiatives are used to invoke a popular vote on a proposed law or constitutional amendment. Direct initiatives are submitted directly to the public after approval by a required number of voters; indirect initiatives are submitted to the legislature. Switzerland has held about half the world's national referenda. Referenda also are common at the local and state level in the U.S. In the late 20th century, referenda were employed more frequently, particularly in Europe, to decide public policy on voting systems, treaties and peace agreements (e.g., the MAASTRICHT TREATY), and social issues. See also PLEBISCITE.

referential opacity See INTENTIONALITY

reflection Change in the direction of propagation of a WAVE that strikes a boundary between different media through which it cannot pass. When a wave strikes such a boundary it bounces back, or is reflected, just as a ball bounces off the floor. The angle of incidence is the angle between the path of the wave and a line perpendicular to the boundary. The angle of reflection is the angle between the same line and the path of the reflected wave. All reflected waves obey the law of reflection, which states that the angle of reflection is equal to the angle of incidence. The reflectivity of a material is the fraction of energy of the oncoming wave that is reflected by it.

reflex In biology, an automatic and inborn response to a stimulus that involves a nerve impulse passing from a sensory nerve cell to a muscle or gland without reaching the level of consciousness. Simple reflexes include sucking, swallowing, blinking, scratching, and the knee jerk. Most reflexes consist of complex patterns of many unconsciously coordinated muscular actions that form the basis of much instinctive behavior in animals. Examples include walking, standing, the cat's righting reflex, and basic sexual acts.

Reform Bill of 1832 British parliamentary act that expanded the electorate. It transferred voting privileges from the small rural boroughs controlled by the nobility and gentry to the heavily populated but underrepresented industrial towns. Conceived by Prime Minister EARL GREY and introduced by EARL RUSSELL, it passed in the House of Commons three times but was opposed by the House of Lords until Grey's threat to create 50 new liberal peers (enough to carry the bill) finally brought their agreement. The act redistributed seats in the Commons and lowered the electoral qualifications to allow voting by small property owners (much of the middle class).

Reform Bill of 1867 British parliamentary act that extended the vote to many workingmen in the towns and cities, creating a major working-class constituency for the first time. It was largely conceived by BENJAMIN DISRAELI, who hoped to expand his base of potential supporters.

Reform Bill of 1884–85 British parliamentary act that gave the vote to agricultural workers. In 1885 the Redistribution Act equalized representation on the basis of 50,000 voters for each member of parliament. Together the two acts tripled the electorate and prepared the way for universal male suffrage.

Reform Judaism Religious movement that has modified or abandoned many traditional Jewish beliefs and practices in an effort to adapt Judaism to the modern world. It originated in Germany in 1809 and spread to the U.S. in the 1840s under the leadership of Rabbi ISAAC MAYER WISE. Reform Judaism permits men and women to sit together in the synagogue, incorporates choir and organ music in the service, holds a confirmation ceremony for girls parallel to the boys' BAR MITZVAH, and does not observe daily public worship, strict dietary laws, or the restriction of normal activities on the SABBATH. Its principles, initially enunciated in the PITTSBURGH PLATFORM (1885), were revised in the COLUMBUS PLATFORM (1937) to support traditional customs and ceremonies and the liturgical use of Hebrew. The Reform movement continues to move toward ORTHODOX JUDAISM without embracing all its strictures.

Reform Party Political movement in Canada in the 1830s and '40s. Reformers in Upper Canada (later Ontario) led by ROBERT BALDWIN urged that provincial governments be made accountable to elected legislative assemblies ("responsible government"). An extremist group led by WILLIAM L. MACKENZIE opposed the government in the rebellion of 1837. Reformers in Lower Canada (later Quebec) joined LOUIS PAPINEAU and his Patriote Party. Reform Party candidates were elected premier (1842–43, 1848–54) in the province of Canada (union of Upper and Lower Canada). In the 1850s the party split between a moderate group, which allied with JOHN MACDONALD's PROGRESSIVE CONSERVATIVE PARTY, and a radical faction, the CLEAR GRITS, from which the LIBERAL PARTY emerged.

Reforma, La (1854–76) Liberal political and social revolution in Mexico under the principal leadership of BENITO JUÁREZ. It began with the removal of the dictator ANTONIO SANTA ANNA and went on to abolish special privileges of the church and the military, confiscate church lands, suppress monasteries, institute civil marriage, establish a liberal federalist constitution, and place the army under civilian control. Confiscated church property was to be allocated to the landless, but this policy proved to be La Reforma's outstanding failure; in fact, the number and wealth of large landholders increased. La Reforma came to a close when PORFIRIO DÍAZ seized power in 1876.

Reformation *or* **Protestant Reformation** Break with ROMAN CATHOLICISM and the establishment of Protestant churches in the 16th century. Though reformers such as JAN HUS and JOHN WYCLIFFE attacked abuses in the Roman Catholic church in the late medieval period, the Reformation is usually dated from 1517, when, according to tradition, MARTIN LUTHER posted his NINETY-FIVE THESES on the church door in Wittenberg. Various Protestant denominations were soon founded by more radical reformers, such as HULDRYCH ZWINGLI and the ANABAPTISTS. JOHN CALVIN established a theocracy in Geneva after his conversion to the Protestant cause. The Reformation spread to other European countries and soon dominated northern Europe. Spain and Italy remained resistant to Protestantism and became centres of the COUNTER-REFORMATION. In England, where HENRY VIII founded the Church of ENGLAND in 1534, the Reformation's roots were primarily political rather than religious, motivated by the pope's refusal to grant Henry a divorce. In Scotland the Calvinist JOHN KNOX led in the establishment of the Presbyterian church (see PRESBYTERIANISM).

Reformed church Any of several Protestant groups strongly influenced by CALVINISM. They are often called by national names (Swiss Reformed, Dutch Reformed, etc.). The name was originally used by all the Protestant churches that arose out of the 16th-century REFORMATION but was later confined to the Calvinistic churches of continental Europe, most of which use a Presbyterian form of church government. The Calvinistic churches of the British Isles became known as Presbyterian churches (see PRESBYTERIANISM).

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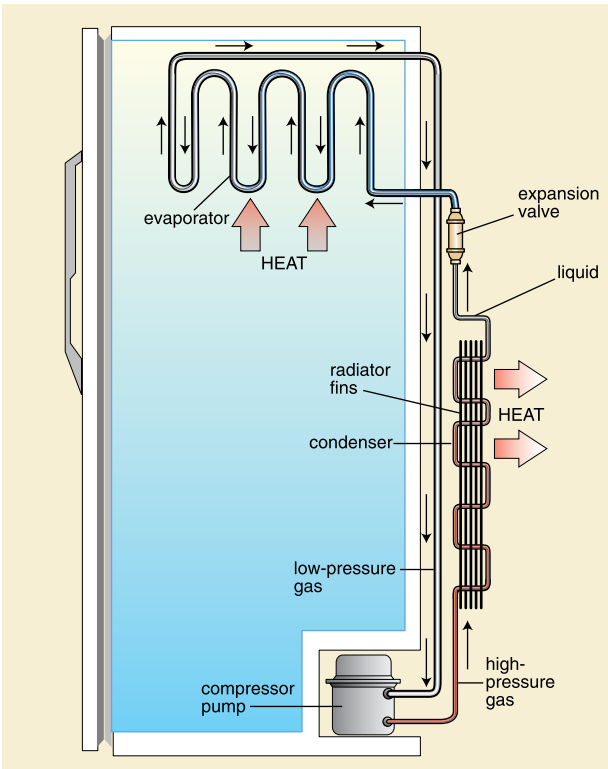
refraction Change in direction of a WAVE as it leaves one medium and enters another. Waves, such as sound and light waves, travel at different speeds in different media. When a wave enters a new medium at an angle of less than 90°, the change in speed occurs sooner on one side of the wave than on the other, causing the wave to bend, or refract. When water waves approach shallower water at an angle, they bend and become parallel to the shore. Refraction explains the apparent bending of a pencil when it is partly immersed in water and viewed from above the surface. It also causes the optical illusion of the MIRAGE.

refractory Material that is not deformed or damaged by high temperatures, used to make CRUCIBLES, incinerators, insulation, and furnaces, particularly metallurgical furnaces. Refractories are produced in several forms: molded bricks of various shapes, bulk granular materials, plastic mixtures consisting of moistened aggregates that are rammed into place, castables composed of dry aggregates and a binder that can be mixed with water and poured like concrete, and mortars and cements for laying brickwork.

refrigeration Process of removing HEAT from an enclosed space or from a substance in order to lower the temperature. In industrialized nations and prosperous regions in the developing world, refrigeration is used chiefly to store foodstuffs at low temperatures, thus inhibiting the destructive action of bacteria, yeasts, and molds. Many perishable products can be frozen, permitting them to be kept for months and even years with little loss in nutrition or flavour or change in appearance. See also AIR-CONDITIONING; COOLING SYSTEM; HEAT EXCHANGER.



Components of a refrigerator. A compressor pressurizes the refrigerant gas, heating it and forcing it through the system. The gas cools and liquefies in the condenser, giving up its heat to the outside air. The liquid's pressure is lowered when it passes through an expansion valve, and there is an associated further drop in temperature. The cold liquid then passes into the evaporator coils, where heat drawn from the warmer refrigerator compartment causes it to vaporize. The gas is then returned to the compressor to repeat the cycle.

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refugee Person involuntarily displaced from his or her homeland. Until the late 19th century and the emergence of fixed and closed national boundaries, refugees were always absorbed by neighbouring countries. Later, immigration restrictions and increasing numbers of refugees necessitated special action to aid them. In 1921 FRIDTJOF NANSEN created a League of Nations Passport to allow refugees to move freely across national boundaries. Refugee status at that time was accorded only if the migrant's departure was involuntary and asylum was sought in another country. In 1938 the definition of refugee was expanded to include persons with a well-founded fear of persecution because of ethnicity, religion, nationality, group membership, or political opinion. Later the definition was expanded again to include persons who have fled from their homes to other places in their own countries. Refugee status ceases to apply when the migrant either is resettled or returns home. At the beginning of the 21st century there were some 16 million refugees, including nearly 4 million Palestinians; much of the rest of the world's refugees were in Asia (particularly Afghanistan) and Africa, though conflict in the former Yugoslavia and elsewhere in post-Cold War Europe significantly increased the number of refugees in those regions. See also INTERNATIONAL REFUGEE ORGANIZATION; Office of the UNITED NATIONS HIGH COMMISSIONER FOR REFUGEES; UNITED NATIONS RELIEF AND REHABILITATION ADMINISTRATION.

Refusés, Salon des See SALON DES REFUSÉS

Régence style \rā-'zhäⁿs\ French style in the decorative arts that developed c. 1710–1730, when Philippe II, duc d'Orléans, was regent of France. It marks the transition from the massive rectilinear forms of furniture in the LOUIS XIV STYLE to the ROCOCO forms of LOUIS XV STYLE. In reaction against the pomposity of Louis XIV's court, smaller, more intimate rooms replaced formal state apartments and called for a more graceful style. The delicately styled Régence furniture replaced heavy, carved ornamentation with flat, curving motifs, often foliage and bouquets framed by flowing ribbons and bows. Walnut, rosewood, and mahogany supplied rich but tasteful contrasts in veneering. Intricate tracery in brass and tortoiseshell marquetry on ebony was adapted to the new taste. The commode and writing table were introduced during this period.

Regency style Style in the decorative arts and architecture produced in England during the regency (1811–20) and reign (1820–30) of GEORGE IV. Designers borrowed both structural and ornamental elements from Greek and Roman antiquity. Egyptian motifs, inspired by Napoleon's Egyptian campaign of 1798, became part of the Regency fashion. A resurgence of a taste for CHINOISERIE is seen in imitation bamboo and in "japanned" lacquerwork. The prince's taste for French furniture popularized pieces ornamented with brass marquetry in the French style. Ornamentation relied on rich contrasts of exotic wood veneers and application of metal or painting rather than extensive carving.

Reger \'rā-gər**, (Johann Baptist Joseph) Max(imilian)** (b. March 19, 1873, Brand, Bavaria, Ger.—d. May 11, 1916, Leipzig) German composer and organist. From 1890 to 1893 he studied at Sondershausen and Wiesbaden and taught piano, organ, and theory. By 1901, despite opposition to his traditional methods, he had established himself in Munich as a composer, pianist, and teacher. He became a prolific composer of songs, piano pieces, and especially organ music. His music, combining progressive and conservative elements and often highly chromatic, has always been more popular in Germany than elsewhere.

reggae \'re-gā\ Jamaican popular music and dance style. It originated in the mid-1960s as a music of the Jamaican poor, reflecting social discontent and the RASTAFARIAN movement. Its instrumentation features an electric bass played at high volume as a lead instrument, around which an ensemble of organ, piano, drums, and lead and rhythm electric guitars plays short ostinato phrases with regular accents on the offbeats. Reggae was popularized in the U.S. by the film *The Harder They Come* (1973), starring the singer Jimmy Cliff, and through tours by BOB MARLEY and the Wailers and by Toots (Hibbert) and the Maytals, whose influence was felt among white rock musicians.

Reggio di Calabria \'red-jō-dē-kä-'lä-brē-ə\ *ancient* **Rhegium** City (pop., 2001 prelim.: 179,384), capital of Reggio di Calabria province and former capital (until 1971) of Calabria region, southern Italy. A Greek colony founded on the Strait of MESSINA at the end of the 8th century BC, it was allied with Athens in the 5th century BC and with Rome c. 280 BC. From the 5th century AD it was ruled successively by the Visigoths, Ostrogoths, Byzantines, and Arabs. It was conquered by the Normans under ROBERT GUISCARD c. 1060 and became part of the Kingdom of the TWO SICILIES. Destroyed many times by Muslim invaders and by earthquakes, it has repeatedly been rebuilt. It is a tourist resort and seaport that exports dried herbs and essential oils for the perfume and pharmaceutical industries.

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regiment In most armies, a body of troops headed by a colonel and divided into companies, BATTALIONS, or squadrons. French CAVALRY units were called regiments as early as 1558. In early U.S. service, as in European armies up to that time, the usual number of companies in a regiment was 10. Early in the 19th century, NAPOLEON divided the regiments of the French army into three battalions each, and in 1901 the U.S. Army adopted the three-battalion INFANTRY regimental system.

Regina \ri-ˈjī-nə\ City (pop., 2001: 178,225), capital of Saskatchewan, Canada. It is located on the Wascana Creek in the south-central part of the province. Regina originated as a hunting camp and was known as Pile O'Bones for the heaps of bones left there after skinning and cutting buffalo. It was the administrative headquarters of the Northwest Territories 1882–1905, then it became the provincial capital. It was the headquarters of the ROYAL CANADIAN MOUNTED POLICE until 1920. After World War II the city expanded rapidly to become an important transportation, manufacturing, and distributing centre for a vast agricultural area. Local mineral resources and fertile prairies support an economy based largely on oil, natural gas, potash refining, and food processing.

regional development program Any government program designed to encourage the industrial and economic development of regions beset by joblessness or other economic hardship. Most industrialized countries have adopted some type of regional development program since World War II. The most common method of encouraging development is to offer grants, loans, and loan guarantees to companies relocating or expanding in the region. France, for example, has offered SUBSIDIES related to the amount of investment and the number of new jobs created, as well as loans, interest subsidies, and free land sites. Tax incentives are also used to encourage companies to invest in depressed areas. In other programs, the government may offer low-cost housing for workers and assistance in developing power, light, transportation, and sanitation facilities. See also DEVELOPMENT BANK.

regression In statistics, a process for determining a line or curve that best represents the general trend of a data set. Linear regression results in a line of best fit, for which the sum of the squares of the vertical distances between the proposed line and the points of the data set are minimized (see LEAST SQUARES METHOD). Other types of regression may be based on higher-degree POLYNOMIAL functions or EXPONENTIAL FUNCTIONS. A quadratic regression, for example, uses a quadratic function (second-degree polynomial function) to produce a PARABOLA of best fit.

regressive tax Tax levied at a rate that decreases as its base increases. Regressivity is considered undesirable because poorer people pay a greater percentage of their income in tax than wealthier people. CONSUMPTION TAXES and SALES TAXES are usually considered regressive because of their set rate structures. Tobacco, gasoline, and liquor sales taxes, all major sources of tax revenue, are the most regressive taxes. In an effort to limit regressivity, a number of U.S. states have exempted medicine and grocery items from sales tax. Although the PROPERTY TAX is sometimes judged regressive because poorer people spend a larger percentage of their income on housing than wealthier people, property taxes are nonetheless effective in redistributing wealth from higher to lower income groups. See also PROGRESSIVE TAX.

Regulators of North Carolina (1764–71) Vigilance group formed in the western frontier counties of North Carolina. Opposed to the high taxes and corruption of the colonial government, the group sought vainly to obtain reforms; it then refused to pay taxes, agitated against public officials, and committed acts of violence. Gov. William Tryon sent troops to crush the insurrection at the Battle of Alamance (1771). The leaders were hanged for treason, and many followers fled to Tennessee, where they sided with the LOYALISTS in the AMERICAN REVOLUTION.

regulatory agency Independent government commission charged by the legislature with setting and enforcing standards for specific industries in the private sector. The concept was invented by the U.S. government in 1887, and regulatory agencies exist almost exclusively in the U.S. The theory is that a commission of experts on the industry being regulated is better equipped to regulate it than the legislature or executive departments. Designed to operate with a minimum of executive or legislative supervision, agencies have executive, legislative, and judicial functions, and their regulations have the force of law. Important regulatory agencies include the FOOD AND DRUG ADMINISTRATION, OSHA, the Federal Communications Commission, and the SECURITIES AND EXCHANGE COMMISSION.

Rehnquist \ˈren-ˌkwist**, William H(ubbs)** (b. Oct. 1, 1924, Milwaukee, Wis., U.S.—d. Sept. 3, 2005, Arlington, Va.) U.S. jurist who served as chief justice of the United States (1986–2005). He received his law degree from Stanford University and served as clerk to Supreme Court justice ROBERT JACKSON. He later practiced law in Phoenix, Ariz. (1953–69), where he became active in the conservative wing of the Republican Party. At the U.S. Justice Department (1969–71), he opposed civil rights legislation and advocated greatly enlarged police powers. He was nominated for the Supreme Court by Pres. RICHARD NIXON in 1972. During the 1970s and into the '80s, Rehnquist formed the anchor of the court's conservative minority bloc. His polished legal opinions and consistently conservative stance on almost all legal issues led Pres. RONALD REAGAN to appoint him chief justice in 1986. Rehnquist dramatically reduced the court's caseload and improved its efficiency. With the support of other conservatives, he led the court in curbing the ability of Congress to expand federal authority and in curtailing AFFIRMATIVE ACTION programs. He presided over the U.S. Senate during the impeachment trial of Pres. BILL CLINTON (1999).

Reich \ˈrīk**, Steve** *orig.* **Stephen Michael Reich** (b. Oct. 3, 1936, New York, N.Y., U.S.) U.S. composer. He majored in philosophy at Cornell University. After musical study with DARIUS MILHAUD and LUCIANO BERIO, he pursued interests in Balinese and African music, learning drumming in Ghana. His early music explored the process of simultaneous repeated patterns gradually slipping out of phase ("process music"). With Terry Riley (b. 1935) and PHILIP GLASS, he was among the most prominent of the early "minimalists" of the 1970s. His early works include *Drumming* (1971) and *Music for 18 Musicians* (1976); later works such as *The Desert Music* (1983) and *Different Trains* (1988) show a considerably expanded compositional vocabulary.

Reich \ˈrīk**, Wilhelm** (b. March 24, 1897, Dobrzcynica, Galicia, Austria-Hungary—d. Nov. 3, 1957, Lewisburg, Pa., U.S.) Austrian-U.S. psychologist. Trained at the Berlin Psychoanalytic Institute, he joined the faculty of the Vienna Psychoanalytic Institute in 1924. In *The Function of the Orgasm* (1927), he argued that the failure to achieve orgasm could produce neurosis. An advocate of sexual education and freedom as well as of radical left-wing politics, he left Germany in 1933 and settled in the U.S. in 1939. After breaking with the psychoanalytic movement in 1934, he developed a pseudoscientific system called orgonomy. He conceived of mental illness and some physical illnesses as deficiency of cosmic energy (measured in units called "orgones"), which he treated by placing the patient in a cabinet with reflective inner surfaces known as the orgone box. Reich's views brought him into conflict with U.S. authorities in the early 1950s; he was convicted of contempt of court and died in prison.

Reichstag \ˈrīks-ˌtäk\ **fire** (Feb. 27, 1933) Burning of the German parliament building (Reichstag) in Berlin. Allegedly set by a Dutch communist, the fire was used by ADOLF HITLER to turn public opinion against his opponents, especially the communists. He enacted a decree suspending constitutional protection of personal rights, which effectively began the NAZI PARTY dictatorship. The fire was widely believed to have been set by the Nazis themselves, while others have argued there was no proof of Nazi complicity; it remains the subject of debate and research.

Reid, Thomas (b. April 26, 1710, Kincardineshire, Scot.—d. Oct. 7, 1796, Glasgow) Scottish philosopher. He served as a Presbyterian pastor from 1737 to 1751. His lengthy studies of DAVID HUME convinced him that Hume's SKEPTICISM was false, because it was incompatible with common sense. According to Reid, both human behaviour and ordinary language provide overwhelming evidence to support the reality of a material world and the existence of an enduring self as the subject of continuously changing mental experience. His works include *An Inquiry into the Human Mind* (1764), *Essays on the Intellectual Powers of Man* (1785), and *Essays on the Active Power of Man* (1788).

Reign of Terror *French* **La Terreur** (1793–94) Period in the FRENCH REVOLUTION. It was established by the government on Sept. 5, 1793, to take harsh measures against those suspected of being enemies of the Revolution (including nobles, priests, and hoarders). Controlled by the radical COMMITTEE OF PUBLIC SAFETY and MAXIMILIEN ROBESPIERRE, the Terror eliminated enemies on the left (JACQUES HÉBERT and his followers) and the right (GEORGES DANTON and the Indulgents). A law passed in June 1794 that suspended a suspect's right to public trial or legal defense caused the THERMIDORIAN REACTION, and the Terror ended on July 27, 1794, with Robespierre's overthrow. About 300,000 suspects were arrested during the period; about 17,000 were executed, and many others died in prison.

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Reims *or* **Rheims** \ˈrēmz,\ *French* \ˈrⁿs\ City (pop., 1999: 187,206), northeastern France. The ancient capital of the Gallic tribe of the Remi, it was conquered by the Romans. In the 5th century the Frankish king Clovis was baptized there, and in honour of this occasion most later French kings were crowned in Reims. The city was badly damaged in World Wars I and II and was the scene of Germany's unconditional surrender in May 1945. It is a major wine-producing centre noted especially for champagne. Other industries include aircraft and automobile equipment manufacturing. The 13th-century cathedral of Notre-Dame is one of the most notable Gothic cathedrals in France.

The cathedral of Notre-Dame, Reims, Fr.
PAUL ALMASY

reincarnation *or* **transmigration of souls** *or* **metempsychosis** Doctrine of the rebirth of the soul in one or more successive existences, which may be human, animal, or vegetable. Belief in reincarnation is characteristic of Asian religions, especially Hinduism, Jainism, Buddhism, and Sikhism. All hold to the doctrine of karma, the belief that actions in this life will have their effect in the next. In Hinduism, a person may be freed from the cycle of birth and rebirth only by reaching a state of enlightenment. Likewise in Buddhism, discipline and meditation may enable a seeker to reach nirvana and escape the wheel of birth and rebirth. Manichaeism and Gnosticism accepted the concept of reincarnation, as do such modern spiritual movements as Theosophy.

reindeer Any species of Arctic deer in the genus *Rangifer* (family Cervidae), especially Old World species, some of which are domesticated. New World species are usually called caribou. The reindeer herded by the Sami (Lapps) are used as draft and pack animals and as a source of meat and milk; their skins are used for tents, boots, and other clothing. In Siberia they are used as pack animals and as mounts.

Reiner, Carl (b. March 20, 1922, Bronx, New York, N.Y., U.S.) U.S. actor, writer, director, and producer. He acted on the stage before appearing with Sid Caesar in the television comedy series *Your Show of Shows* (1950–54). He created and produced *The Dick Van Dyke Show* (1961–66), for which he won several Emmy Awards. His novel *Enter Laughing* (1958) was adapted as a play (1963) and a movie (1967). He directed film comedies such as *Where's Poppa* (1970), *Oh, God!* (1977), and *Fatal Instinct* (1993). His son Rob Reiner (b. 1945) acted in various television series, including *All in the Family* (1971–78), and became a director of note.

Reiner \ˈrī-nər**, Fritz** (b. Dec. 19, 1888, Budapest, Austria-Hungary—d. Nov. 15, 1963, New York, N.Y., U.S.) Hungarian-born U.S. conductor. After piano studies with Béla Bartók, he conducted opera in Budapest (1911–14) and Dresden (1914–22). In 1922 he immigrated to the U.S., where he conducted orchestras in Cincinnati (1922–31) and Pittsburgh (1938–48). From 1953 to 1962 he led the Chicago Symphony Orchestra, which under Reiner first won international acclaim. He also taught conducting at the Curtis Institute (Leonard Bernstein was among his students). A stern taskmaster, he inspired devotion on the part of many players.

reinforced concrete Concrete in which steel is embedded in such a manner that the two materials act together in resisting forces. The reinforcing steel—rods, bars, or mesh—absorbs the tensile, shear, and sometimes the compressive stresses in a concrete structure. Plain concrete does not easily withstand tensile and shear stresses caused by wind, earthquakes, vibrations, and other forces and is therefore unsuitable in most structural applications. In reinforced concrete, the tensile strength of steel and the compressive strength of concrete work together to allow the member to sustain these stresses over considerable spans. The invention of reinforced concrete in the 19th century revolutionized the construction industry, and concrete became one of the world's most common building materials.

Reinhardt, Ad(olf Frederick) (b. Dec. 24, 1913, Buffalo, N.Y., U.S.—d. Aug. 30, 1967, New York, N.Y.) U.S. painter. He studied art after graduating from Columbia University. He employed several abstract styles in the 1930s and '40s, but by the early 1950s he had restricted his works to monochrome paintings incorporating symmetrically placed squares and oblong shapes against backgrounds of similar colour, in which drawing, line, brushwork, texture, light, and most other visual elements were suppressed. He explained his style as a conscious search for an art that would be entirely separate from life. He influenced the Minimalist movement of the 1960s, more as a polemicist than as a painter.

Reinhardt, Django *orig.* **Jean-Baptiste Reinhardt** (b. Jan. 23, 1910, Liberchies, Belg.—d. May 16, 1953, Fontainebleau, France) Belgian-French guitarist. Of Roma (Gypsy) parentage, Reinhardt learned guitar at an early age, adapting his technique to accommodate the loss of the use of two fingers burned in a caravan fire in 1928. With jazz violinist Stéphane Grappelli (1908–97), he formed the Quintette du Hot Club de France in 1934. He toured the U.S. with Duke Ellington in 1946. Reinhardt was one of the first important guitar soloists in jazz; his blend of swing and the Roma musical tradition as well as his unconventional technique made him a unique and legendary figure.

Django Reinhardt, 1947
COURTESY OF *DOWN BEAT* MAGAZINE

Reinhardt, Max *orig.* **Max Goldmann** (b. Sept. 9, 1873, Baden, near Vienna, Austria—d. Oct. 31, 1943, New York, N.Y., U.S.) German theatrical director. After studying drama in Vienna and acting in Salzburg, he joined Otto Brahm's company in Berlin in 1894. Reinhardt directed his first play in 1902 and managed a small theatre from 1903. He had directed more than 40 plays by 1905, when he became famous for his creative staging of Shakespeare's *A Midsummer Night's Dream*. He bought Berlin's Deutsches Theater and remodeled it with the latest innovations in scenic design and lighting. Known for the extravagant theatricality and stunning visual effects of his productions, he won much praise for his staging of the religious spectacle *The Miracle* (1911). In 1920 he cofounded the Salzburg Festival, where he staged *Jedermann* (an adaptation of *Everyman*) in the cathedral square. He left Germany in 1933 and eventually settled in the U.S. A major influence on 20th-century drama, he helped increase the creative authority of the director.

Reinsurance Treaty (June 18, 1887) Secret agreement between Germany and Russia. Arranged by Otto von Bismarck after the collapse of the Three Emperors' League, it provided that each party would remain neutral if either became involved in a war with a third nation, and that this would not apply if Germany attacked France or if Russia attacked Austria. Germany acknowledged the Russian sphere of influence in Bulgaria. After the treaty was not renewed in 1890, a Franco-Russian alliance began to take shape.

Rejang River See Rajang River

relapsing fever Infectious disease with recurring fever, caused by several spirochetes of the genus *Borrelia*, transmitted by lice, ticks, and bedbugs. Onset is sudden, with high fever, which breaks within a week with profuse sweating. Symptoms return about a week later. There may be 2 to 10 relapses, usually decreasing in severity. Mortality usually ranges from 0 to 6%, up to 30% in rare epidemics. Central nervous system involvement causes various (usually mild) neurological symptoms. The first microscopic organisms clearly associated with serious human disease (1867–68), the spirochetes mutate repeatedly, changing their antigens so that the host's immunity no longer is effective, which produces the relapses. Antibiotics can be effective, but inadequate therapy may leave spirochetes alive in the brain, and they may reinvade the bloodstream.

relation In logic, a relation R is defined as a set of ordered pairs, triples, quadruples, and so on. A set of ordered pairs is called a two-place (or dyadic) relation; a set of ordered triples is a three-place (or triadic) relation; and so on. In general, a relation is any set of ordered n-tuples of objects. Important properties of relations include symmetry, transitivity, and reflexivity. Consider a two-place (or dyadic) relation R. R can be said to be symmetrical if, whenever R holds between x and y, it also holds

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between y and x (symbolically, (∀x) (∀y) [Rxy ⊃ Ryx]); an example of a symmetrical relation is "x is parallel to y." R is transitive if, whenever it holds between one object and a second and also between that second object and a third, it holds between the first and the third (symbolically, (∀x) (∀y) (∀z) [(Rxy ∧ Ryz) ⊃ Rxz]); an example is "x is greater than y." R is reflexive if it always holds between any object and itself (symbolically, (∀x) Rxx); an example is "x is at least as tall as y" since x is always also "at least as tall" as itself.

relational database DATABASE in which all data are represented in tabular form. The description of a particular entity is provided by the set of its attribute values, stored as one row or record of the table, called a tuple. Similar items from different records can appear in a table column. The relational approach supports queries that involve several tables by providing automatic links across tables. Payroll data, for example, can be stored in one table and personnel benefits data in another; complete information on an employee can be obtained by joining the tables on employee identification number. In more powerful relational data models, entries can be programs, text, unstructured data in the form of binary large objects (BLOBs), or any other format the user requires. The relational approach is currently the most popular model for DATABASE MANAGEMENT SYSTEM. See also OBJECT-ORIENTED PROGRAMMING.

relative density See SPECIFIC GRAVITY

relativism Any view that maintains that the truth or falsity of statements of a certain class depends on the person making the statement or upon his circumstances or society. Historically the most prevalent form of relativism has been See also ETHICAL RELATIVISM.

relativity Concept in physics that measurements change when considered by observers in various states of motion. In classical physics, it was assumed that all observers anywhere in the universe would obtain identical measurements of space and time intervals. According to relativity theory, this is not so; all measurements depend on the relative motions of the observer and the observed. There are two distinct theories of relativity, both proposed by ALBERT EINSTEIN. The special theory of relativity (1905) developed from Einstein's acceptance that the speed of LIGHT is the same in all REFERENCE FRAMES, irrespective of their relative motion. It deals with nonaccelerating reference frames, and is concerned primarily with electric and magnetic phenomena and their propagation in space and time. The general theory (1916) was developed primarily to deal with GRAVITATION and involves accelerating reference frames. Both theories are major milestones in the history of modern physics. See also EQUIVALENCE PRINCIPLE, SPACE-TIME.

relay race Race between teams in which each team member successively covers a specified portion of the course. In track events, such as the 4 × 100-m and 4 × 400-m relays, the runner finishing one leg passes a baton to the next runner while both are running within a marked exchange zone. In swimming competitions, such as the 4 × 100-m and 4 × 200-m freestyle races and the 4 × 100-m medley, the swimmer completing one leg touches the edge of the pool to signal the start of the next teammate's leg.

relief *or* **rilievo** \ril-'ye-vō\ (from Italian, *rilievare*: "to raise") In sculpture, any work in which the figures project from a supporting background, usually a plane surface. Basreliefs ("low reliefs"), in which the design projects only slightly, were common on the walls of stone buildings in ancient Egypt, Assyria, and elsewhere in the Middle East. High reliefs, in which the forms project at least half or more of their natural circumference, were first employed by the ancient Greeks. Italian Renaissance sculptors combined high and low relief in strikingly illusionistic compositions, as in LORENZO GHIBERTI's bronze doors in Florence. Baroque sculptors continued these experiments, often on a larger scale (e.g., ALESSANDRO ALGARDI's *Meeting of Attila and Pope Leo*, 1646–53). The dramatic possibilities of the Renaissance concept of relief were later notably employed by FRANÇOIS RUDE (*The Marseillaise*, 1833–36) and AUGUSTE RODIN (*The Gates of Hell*).

Athena mourning, mezzo-relievo from the Acropolis, 5th century BC, in the Acropolis Museum, Athens
ALINARI--ART RESOURCE/EB INC.

relief Public or private aid to people in economic need because of natural disasters, wars, economic upheaval, chronic unemployment, or other conditions that prevent self-sufficiency. A distinction may be drawn between relief targeting upheavals and natural disasters and relief of chronic social conditions, now usually referred to as WELFARE. In 17th-century China the government maintained EVER-NORMAL GRANARIES for use in the event of famine. Through the 19th century, disaster relief in Europe consisted largely of emergency grants of food, clothing, and medical care through hastily organized local committees. In the 20th century, disaster relief became one of the chief activities of the International RED CROSS and other international agencies. Assistance to the needy from public funds has traditionally been strictly limited; in England, the Poor Law Reform Act of 1834 required people able to work to enter a workhouse in order to receive public assistance. The U.S. government responded to the Great Depression with the NEW DEAL, which emphasized work relief programs such as the WORKS PROGRESS ADMINISTRATION. In the later 20th century, the work requirement was abandoned in most countries, and the needy received direct cash payments, though in the U.S. the movement for welfare reform resulted in the passage in 1996 of "workfare" laws cutting off relief for most able-bodied welfare recipients who failed to find a job or perform community service.

relief printing See LETTERPRESS PRINTING

religion Relation of human beings to God or the gods or to whatever they consider sacred or, in some cases, merely supernatural. Archaeological evidence suggests that religious beliefs have existed since the first human communities. They are generally shared by a community, and they express the communal culture and values through myth, doctrine, and ritual. Worship is probably the most basic element of religion, but moral conduct, right belief, and participation in religious institutions also constitute elements of the religious life. Religions attempt to answer basic questions intrinsic to the human condition (Why do we suffer? Why is there evil in the world? What happens to us when we die?) through the relationship to the sacred or supernatural or (e.g., in the case of BUDDHISM) through perception of the true nature of reality. Broadly speaking, some religions (e.g., JUDAISM, CHRISTIANITY, and ISLAM) are outwardly focused, and others (e.g., JAINISM, Buddhism) are inwardly focused.

religion, philosophy of Branch of philosophy that studies key metaphysical and epistemological concepts, principles, and problems of religion. Topics considered include the existence and nature of God, the possibility of knowledge of God, human freedom (the FREE WILL PROBLEM), immortality, and the problems of moral and natural evil and suffering. Natural THEOLOGY is the attempt to establish knowledge of God without dependence on revelation. Traditional arguments for the existence of God include the ONTOLOGICAL ARGUMENT, the COSMOLOGICAL ARGUMENT, and the ARGUMENT FROM DESIGN.

Religion, Wars of (1562–98) Conflicts in France between Protestants and Catholics. The spread of French CALVINISM persuaded the French ruler CATHERINE de Médicis to show more tolerance for the HUGUENOTS, which angered the powerful Catholic de GUISE family. Its partisans massacred a Huguenot congregation at Vassy (1562), causing an uprising in the provinces. Many inconclusive skirmishes followed, and compromises were reached in 1563, 1568, and 1570. After the murder of the Huguenot leader GASPARD II DE COLIGNY in the Massacre of SAINT BARTHOLOMEW'S DAY (1572), the civil war resumed. A peace compromise in 1576 allowed the Huguenots freedom of worship. An uneasy peace existed until 1584, when the Huguenot leader Henry of Navarra (later HENRY IV) became heir to the French throne. This led to the War of the THREE HENRYS and later brought Spain to the aid the Catholics. The wars ended with Henry's embrace of Catholicism and the religious toleration of the Huguenots guaranteed by the Edict of NANTES (1598).

Religious Science Movement founded in the U.S. by Ernest Holmes (1887–1960). After publishing his major work, *The Science of the Mind* (1926), Holmes established the Institute of Religious Science and Philosophy (1927). In 1949 Religious Science was established as a denomination; it soon split into two groups. It teaches that the individual mind and the Universal Mind are one and that the universe is the material manifestation of the Universal Mind. Like NEW THOUGHT, it teaches that evil stems from

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ignorance of humanity's true higher identity and that prayer can bring about healing not only of spiritual but of physical ailments.

Remagen \'rā-ˌmäg-ᵊn\ Town (pop., 2002 est.: 16,134), western Germany. Located on the left bank of the Rhine River, southeast of Bonn, it originated as a Roman fortress and still has Roman remains. During World War II its railroad bridge was the site where Allied troops forced a crossing of the Rhine (1945) for the first time in the war.

Remak \'rā-ˌmäk**, Robert** (b. July 26, 1815, Posen, Prussia—d. Aug. 29, 1865, Kissingen, Bavaria) German embryologist and neurologist. He discovered and named the three germ layers of cells that develop in the early embryo: the ectoderm, mesoderm, and endoderm. He also discovered Remak fibres (nerve fibres with no myelin sheath) and Remak ganglia (neurons in the heart) and was a pioneer in electrotherapy for nervous diseases. He achieved enough eminence to obtain a lectureship at the University of Berlin despite Prussian laws barring Jews from teaching.

remanent magnetism See PALEOMAGNETISM

Remarque \rə-'märk**, Erich Maria** *orig.* **Erich Paul Kramer** (b. June 22, 1898, Osnabrück, Ger.—d. Sept. 25, 1970, Locarno, Switz.) German-born U.S.-Swiss novelist. Drafted into the German army at age 18, he served in World War I and was wounded several times. He is chiefly remembered for *All Quiet on the Western Front* (1929), a brutally realistic account of the daily routine of ordinary soldiers and perhaps the best-known and most representative novel about that war. He moved to the U.S. in 1939 and became a U.S. citizen but settled in Switzerland after World War II. His other works include *The Road Back* (1931), *Arc de Triomphe* (1946; film, 1948), and *The Black Obelisk* (1956).

Rembrandt (Harmenszoon) van Rijn \rīn\ (b. July 15, 1606, Leiden, Neth.—d. Oct. 4, 1669, Amsterdam) Dutch painter and etcher. The son of a prosperous miller in Leiden, he was apprenticed to masters there and in Amsterdam. His early works show the spotlight effects of light and shadow that were to dominate his later works. After moving to Amsterdam in 1631, he quickly became the city's most fashionable portrait painter, and in 1632 he was commissioned to paint the celebrated *Anatomy Lesson of Dr. Nicolaes Tulp*. Yearning for recognition as a biblical and mythological painter, in 1635 he produced his *Sacrifice of Isaac* and in 1636 the unconventional masterpiece *Danaë*. In 1634 he married Saskia van Uylenburgh, a woman of property, and he painted many tender pictures of her until 1642, when Saskia died. That same year he completed his largest painting, the extraordinary but controversial *The Militia Company of Captain Frans Banning Cocq* (known as *The Night Watch*), which was a watershed in his life and art. His portrait commissions thereafter declined and he turned increasingly to etchings and biblical subjects. His *Christ at Emmaus* (1648) exemplifies the quiet dignity and vulnerability of his later spirituality. In 1656, after transferring most of his property to his son, he applied for bankruptcy. In his last decade he treated biblical subjects like portraits, and also did a wealth of self-portraits; many of these paintings evoke a timeless world of quiet, deep emotion. His paintings are characterized by luxuriant brushwork, rich colour, and a mastery of chiaroscuro. The silent human figure, Rembrandt's central subject, contributes to the sense of a shared dialogue between viewer and picture, the foundation of Rembrandt's greatness and of his popularity today.

Remington, Eliphalet (b. Oct. 28, 1793, Suffield, Conn., U.S.—d. Aug. 12, 1861, Ilion, N.Y.) U.S. firearms manufacturer and inventor. The son of a blacksmith, he grew up on his father's farm near Utica, N.Y., where he made his first FLINTLOCK rifle (1816). In 1828 he built a large arms factory at present-day Ilion, N.Y. He and his son Philo improved arms manufacture with the reflection method of straightening gun barrels and the first successful cast-steel, drilled rifle barrel made in the U.S. In 1847 he supplied the U.S. Navy with its first breech-loading rifle. His Remington Arms Co. made small arms for the U.S. government during the American Civil War and World Wars I and II.

Remington, Frederic (b. Oct. 4, 1861, Canton, N.Y., U.S.—d. Dec. 26, 1909, near Ridgefield, Conn.) U.S. painter, illustrator, sculptor, and war correspondent. He studied at Yale University and New York's Art Students League. He traveled widely and specialized in depicting Native Americans, cowboys, soldiers, horses, and other aspects of life in the American West. His work is notable for its rendering of swift action and its accuracy of detail. He covered the Spanish-American War (1898) as a correspondent. The countless reproductions of his works as newspaper engravings brought him wealth and fame.

remora \'re-mə-rə\ *or* **sharksucker** *or* **suckerfish** Any of 8–10 species of marine fishes (family Echeneidae) noted for attaching themselves to, and riding about on, SHARKS, other marine animals, and oceangoing ships. Remoras adhere by means of a flat, oval sucking disk on top of the head. They are thin and dark, 1–3 ft (30–90 cm) long. They live in warm waters worldwide, feeding on the leavings or the external parasites of their hosts.

A remora (*Echeneis naucrates*) and its host, a leopard shark.
DOUGLAS FAULKNER

ren *or* **jen** \'rən\ In CONFUCIANISM, the most basic of all virtues, variously translated as "humaneness" or "benevolence." It originally denoted the kindness of rulers to subjects. CONFUCIUS identified ren as perfect virtue, and MENCIUS made it the distinguishing characteristic of humanity. In NEO-CONFUCIANISM it was a moral quality imparted by Heaven.

Renaissance \'re-nə-ˌsäns\ *French* **"Rebirth"** Late medieval cultural movement in Europe. The Renaissance brought renewed interest in Classical learning and values to Italy and subsequently the rest of western and central Europe from the late 13th to the early 17th century. Attracted by the values and rhetorical eloquence of ancient writers, figures such as PETRARCH, GIOVANNI BOCCACCIO, and LORENZO VALLA rejected medieval SCHOLASTICISM in favour of human-centred forms of philosophy and literature. In northern Europe, DESIDERIUS ERASMUS cultivated Christian HUMANISM, and writers such as FRANÇOIS RABELAIS and WILLIAM SHAKESPEARE produced works that emphasized the intricacies of human character. Inspired by ancient Greece and Rome, Renaissance painters and sculptors took the visible world for their subject and practiced according to mathematical principles of balance, harmony, and perspective. The new aesthetic found expression in the works of Italian artists such as LEONARDO DA VINCI, SANDRO BOTTICELLI, RAPHAEL, TITIAN, and MICHELANGELO, and the Italian city of Florence became the centre of Renaissance art. The term has also been applied to cultural revivals in England in the 8th century, the Frankish kingdoms in the 9th century, and Europe in the 12th century. See also RENAISSANCE ARCHITECTURE.

Renaissance architecture Style of architecture, reflecting the rebirth of Classical culture, that originated in Florence in the early 15th century and spread throughout Europe, replacing the medieval Gothic style. There was a revival of ancient Roman forms, including the column and round arch, the tunnel VAULT, and the dome. The basic design element was the ORDER. Knowledge of CLASSICAL ARCHITECTURE came from the ruins of ancient buildings and the writings of VITRUVIUS. As in the Classical period, proportion was the most important factor of beauty; Renaissance architects found a harmony between human proportions and buildings. This concern for proportion resulted in clear, easily comprehended space and mass, which distinguishes the Renaissance style from the more complex Gothic. FILIPPO BRUNELLESCHI is considered the first Renaissance architect. LEON BATTISTA ALBERTI's *Ten Books on Architecture*, inspired by Vitruvius, became a bible of Renaissance architecture. From Florence the early Renaissance style spread through Italy. DONATO BRAMANTE's move to Rome ushered in the High Renaissance (c. 1500–20). Mannerism, the style of the Late Renaissance (1520–1600), was characterized by sophistication, complexity, and novelty rather than the harmony, clarity, and repose of the High Renaissance. The Late Renaissance also saw much architectural theorizing, with Sebastiano Serlio (1475–1554), Giacomo da Vignola (1507–1573), and ANDREA PALLADIO publishing influential books.

renal cell carcinoma *or* **hypernephroma** Malignant TUMOUR of the cells that cover and line the KIDNEY. It usually affects persons over age 50 who have vascular disorders of the kidneys. It seldom causes pain, unless it is advanced. It may metastasize to other organs (e.g., lungs, liver, brain, bone) and go unrecognized until these secondary tumours cause symptoms. Blood can appear in the urine early on but is painless and usually disregarded. Even when the cancer is in the early stages, X-ray films can show deformity in kidney structures.

renal cyst Any of several types of CYSTS in the KIDNEYS. Some are present at birth; others are caused by tubular obstruction. Large cysts can cause backaches and a dragging sensation. Multiple cysts occur as a result of various disorders, including kidney vascular diseases, lymphatic vessel

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blockage, congenital diseases, and tapeworm infestation. The most serious is medullary cystic disease, which has no warning symptoms but causes ANEMIA, low blood sodium levels, and UREMIA. The kidneys become shrunken, grainy, and scarred. Cysts should usually be checked surgically to rule out cancer. See also UROGENITAL MALFORMATION.

renal failure See KIDNEY FAILURE

renal system See URINARY SYSTEM

Renan \rə-'nä[n]**, (Joseph-) Ernest** (b. Feb. 28, 1823, Tréguier, France—d. Oct. 2, 1892, Paris) French philosopher, historian, and scholar of religion. He trained for the priesthood but left the Catholic church in 1845, feeling that its teachings were incompatible with the findings of historical criticism, though he retained a quasi-Christian faith in God. His five-volume *History of the Origins of Christianity* (1863–80) includes his *Life of Jesus* (1863); an attempt to reconstruct the mind of Jesus as a wholly human person, it was virulently denounced by the church but widely read by the general public. His later works include the series *History of the People of Israel* (1888–96).

Renan, detail of an oil painting by Léon Bonnat, 1892; in the Musée Renan, Tréguier, Fr.
ARCHIVES PHOTOGRAPHIQUES

renga \'reŋ-ˌgä\ Japanese linked-verse poetry in which two or more poets supply alternating sections of a poem. The form began with the composition of a traditional five-line poem (tanka) by two people. A popular pastime from ancient times, even in remote rural areas, it developed fully in the 15th century. Composition spread to court poets, who drew up "codes" to establish renga as an art. An example of renga is the melancholy *Minase sangin hyakuin* (1488), composed by Iio SŌGI, Shōhaku, and Sōchō. Later the initial verse (*hokku*) of a renga developed into the HAIKU form.

Reni \'rā-nē**, Guido** (b. Nov. 4, 1575, Bologna, Papal States—d. Aug. 18, 1642, Bologna) Italian painter. Apprenticed to the Flemish painter Denis Calvaert at 10, he was later influenced by the novel naturalism of the CARRACCI FAMILY of his native Bologna, the frescoes of RAPHAEL, and ancient Greco-Roman sculpture. He executed many important commissions in Rome, including the celebrated ceiling fresco *Aurora* (1613–14). In his religious and mythological works, he tempered BAROQUE exuberance and complexity with Classical restraint, tender emotion, and delicate colouring. Until JOHN RUSKIN scorned him in the 19th century, he was highly regarded; his status as one of the great painters of the 17th century has since been reestablished.

Renner, Karl (b. Dec. 14, 1870, Unter-Tannowitz, Bohemia, Austria-Hungary—d. Dec. 31, 1950, Doebling, Austria) Austrian chancellor (1918–20, 1945) and president (1945–50). A lawyer, he served in the Reichsrat (lower house) from 1907. He became the first chancellor of the new Austrian republic in 1918 but was unable to prevent territorial losses at the end of World War I. In the 1920s he led the right wing of the Social Democratic Party and in 1938 favoured the ANSCHLUSS with Germany. In 1945 he worked to reestablish Austrian home rule and was elected president of the republic. He wrote numerous works on government and law.

Rennes \'ren\ City (pop., 1999: 206,229), western France. Located at the confluence of the Ille and Vilaine rivers, Rennes was once under Roman occupation. It was the capital of BRITTANY in the Middle Ages and a rival of NANTES. It was the seat of the Brittany parliament from 1561 to 1675. Rennes was almost completely destroyed by fire in 1720 and was rebuilt. It was bombed and partly destroyed in World War II. It is a commercial and industrial city, producing railway equipment, automobiles, and chemicals. It is also the cultural centre of Brittany.

Rennie, John (b. June 7, 1761, Phantassie, East Lothian, Scot.—d. Oct. 4, 1821, London, Eng.) Scottish civil engineer. He built three bridges across the Thames at London: Waterloo Bridge (since replaced), the old Southwark Bridge (1814–19), and the New London Bridge (completed 1831 and since replaced). He worked on extensive drainage projects in the Lincolnshire fens; built the London and East India docks on the Thames; improved naval dockyards at Plymouth, Portsmouth, Chatham, and Sheerness; and began the great breakwater that shelters Plymouth Sound.

Reno \'rē-nō\ City (pop., 2000: 180,480), western Nevada, U.S. It is located on the Truckee River, near the California border, Lake TAHOE, and the SIERRA NEVADA foothills. Until 1900 it was primarily a distribution point, but, after several well-known people were granted divorces or were quickly married there under liberal state laws, it became famous as a busy divorce and marriage centre. It is also a year-round vacation centre. When gambling was legalized in Nevada in 1931, Reno began to attract tourists to its many casinos.

Renoir, Jean (b. Sept. 15, 1894, Paris, France—d. Feb. 12, 1979, Los Angeles, Calif., U.S.) French film director. The son of PIERRE-AUGUSTE RENOIR, he discovered a passion for the cinema while recovering from wounds suffered in World War I. He directed his first film, *La Fille de l'eau*, in 1924. His films, in both silent and later eras, were noted for their deep appreciation for the unpredictability of human character. He cowrote the screenplays for many of his films, including *Boudu Saved from Drowning* (1932), *Madame Bovary* (1934), *The Crime of Monsieur Lange* (1936), and *La Bête humaine* (1938) as well as his two masterpieces, *Grand Illusion* (1937) and *The Rules of the Game* (1939). He lived in the U.S. (1940–51), where he directed *The Southerner* (1945), *The Diary of a Chambermaid* (1946), and *The River* (1951).

Jean Renoir
GLOBE PHOTOS

Renoir \rən-'wär**, Pierre-Auguste** (b. Feb. 25, 1841, Limoges, France—d. Dec. 3, 1919, Cagnes) French painter. His father, a tailor in Limoges, moved with his large family to Paris in 1844. Renoir began working as a decorator of porcelain at 13 and studied painting at night. He formed a close friendship with his fellow student CLAUDE MONET and became a leading member of the Paris IMPRESSIONISTS. His early works were typically Impressionist snapshots of real life, full of sparkling colour and light. By using small, multicoloured strokes, Renoir evoked the vibration of the atmosphere, the sparkling effect of foliage, and especially the luminosity of a young woman's skin in the outdoors. Because of his fascination with the human figure, he was distinctive among the others, who were more interested in landscape. Among his early masterpieces are *Le Moulin de la Galette* (1876) and *The Luncheon of the Boating Party* (1881). A visit to Italy (1881–82) introduced him to RAPHAEL and the expressive force of clear line and smooth painting, and by the mid 1880s he had broken with Impressionism to employ a more disciplined, formal technique. In works such as *Bathers* (1884–87), he emphasized volume, form, contours, and line. In his later works, he departed from the strict rules of Classicism to paint colourful still lifes, portraits, nudes, and landscapes of southern France, where he settled in 1907. Rheumatism confined him to a wheelchair by 1912 but he never ceased to paint, even though often with his brush attached to his hand. The filmmaker JEAN RENOIR was his son.

rent In common usage, payment made in return for the right to use property belonging to another. In CLASSICAL ECONOMICS, rent was the income gained from cultivated or improved land after the deduction of all production costs. In modern economic usage, rent is the difference between the total return to a factor of production (LAND, LABOUR, CAPITAL) and its supply PRICE, the minimum amount necessary to attain its services. Rent plus OPPORTUNITY COST make up the total income paid to a productive resource. Efforts made by a resource owner to obtain MONOPOLY profit is considered rent-seeking behaviour.

Renta, Oscar de la See Oscar DE LA RENTA

Reorganized Church of Jesus Christ of Latter Day Saints See COMMUNITY OF CHRIST

reovirus \ˌrē-ō-'vī-rəs\ Any of a small group of animal and plant VIRUSES that appear spheroidal and contain a core of RNA. Among the best-known

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genera are *Orthoreovirus*, *Orbivirus*, *Rotavirus*, and *Phytoreovirus*. The first three infect animals; the last can destroy rice, corn, and other crops.

reparations Payment in money or materials by a nation defeated in war. After World War I, reparations to the Allied Powers were required of Germany by the Treaty of Versailles. The original amount of $33 billion was later reduced by the Dawes Plan and the Young Plan and was canceled after 1933. In the 1920s German resentment over reparations was used by ultranationalists to foment political unrest.

repertory theatre Production of several different plays in a single season by a resident acting company. The plays chosen may be classic works by famous dramatists or new works by emerging playwrights, and the companies that perform them often serve as a training ground for young actors. In Britain the practice, intended to make high-quality theatre available throughout the country, began in the early 20th century. Repertory companies, or stock companies, originally presented a different play each night of the week while preparing and rehearsing new plays. The system evolved to the current practice of presenting a series of short, continuous runs of each play.

Repin \'ryā-pyin,\ *English* \'rā-pin**, Ilya (Yefimovich)** (b. Aug. 5, 1844, Chuguyev, Russia—d. Sept. 29, 1930, Kuokkala, Fin.) Russian painter. After training with a provincial icon painter and at the St. Petersburg Academy of Fine Arts, he visited France and Italy on an academy scholarship. On his return he began painting subjects from Russian history. In 1873 he achieved international fame with *Volga Boatmen*, a grim, powerful image that became the model for Soviet Socialist Realism. Among his best-known works is *Ivan the Terrible and His Son Ivan* (1895), depicting Ivan's murder of his son. He also painted vigorous portraits (including Leo Tolstoy and Modest Mussorgsky). In 1894 he became professor of historical painting at the St. Petersburg Academy.

replacement deposit In geology, a mineral deposit formed by chemical processes that dissolve the original rock and deposit a new assemblage of minerals in its place. See also metasomatic replacement.

representation In politics, a method or process of enabling a constituency to influence legislation and government policy through deputies chosen by it. The rationale of representative government is that in large modern countries the people cannot all assemble, as they did in the marketplace of democratic Athens. If the public is to participate in government, citizens must select a small number from among themselves to act for them. Political parties have come to act as intermediaries between citizens and their representatives by helping to formulate systematically citizens' demands. Arguments persist about the proper role of representatives; some theories suggest that they should act as delegates carrying out the instructions of the public, whereas others argue that they should serve as free agents, acting in accordance with their best ability and understanding. See also proportional representation.

Representation of the People Acts (1918, 1928) Parliamentary acts that expanded suffrage in Britain. The act of 1918 gave the vote to all men over 21 and all women over 30, which tripled the electorate. The act of 1928 extended the franchise to women aged 21–30. The acts continued the voting reforms begun by the Reform Bills (see Reform Bill of 1832, Reform Bill of 1867, Reform Bill of 1884–85).

representationalism Theory of knowledge based on the assertion that the mind perceives only mental representations of material objects outside the mind, not the objects themselves. The validity of human knowledge is thus called into question because of the need to show that such images accurately correspond to the external objects. The doctrine, still current in certain philosophical circles, has roots in Cartesianism, the empiricism of John Locke and David Hume, and the idealism of Immanuel Kant.

repression In metabolism, a control mechanism by which a protein molecule, called a repressor, prevents the synthesis of an enzyme by binding to (and thus hindering the action of) the DNA that controls the enzyme's synthesis. Though the process has been studied mainly in microorganisms, it is believed to occur in a similar way in higher organisms. See also inhibition.

repression In psychoanalytic theory, the exclusion of distressing memories, thoughts, or feelings from the conscious mind. Often involving sexual or aggressive urges or painful childhood memories, these unwanted mental contents are pushed into the unconscious mind. Repression is thought to give rise to anxiety and to neurotic symptoms, which begin when a forbidden drive or impulse threatens to enter the conscious mind. Psychoanalysis seeks to uncover repressed memories and feelings through free association as well as to examine the repressed wishes released in dreams. See also unconscious.

reproduction Process by which organisms replicate themselves, assuring continuation of their species. The two basic forms are asexual and sexual. Asexual reproduction (e.g., fission, spore formation, regeneration, and vegetative reproduction) produces an offspring genetically identical to its single parent. Sexual reproduction produces a new individual through the union of special sex cells (gametes), usually from different parents. Gametes result from meiosis. Gamete union results in a zygote, the first cell of a new organism. Sexual reproduction ensures that each offspring is genetically unique (except in cases of multiple offspring derived from divisions of one zygote). Most animals, including all vertebrates, reproduce sexually.

reproductive behaviour In animals, any activity directed toward perpetuation of a species. Sexual reproduction, the most common mode, occurs when a female's egg is fertilized by a male's sperm. The resulting unique combination of genes produces genetic variety that contributes to a species' adaptability. The stages of approach, identification, and copulation are well developed to avoid predators and the wastage of eggs and sperm. Most one-celled and some more-complex organisms reproduce asexually. See also courtship behaviour.

reproductive system, human Organ system by which humans reproduce. In females, the ovaries sit near the openings of the fallopian tubes, which carry eggs from the ovaries to the uterus. The cervix extends from the lower end of the uterus into the vagina, whose opening, as well as that of the urethra (see urinary system), is covered by four folds of skin (the labia); the clitoris, a small erectile organ, is located where the labia join in front. The activity of the ovaries and uterus goes through a monthly cycle of changes (see menstruation) throughout the reproductive years except during pregnancy and nursing. In males, the testes lie in a sac of skin (the scrotum). A long duct (the vas deferens) leads from each testis and carries sperm to the ejaculatory ducts in the prostate gland; these join the urethra, which continues through the penis. In the urethra, sperm mixes with secretions from the seminal vesicles, prostate gland, and Cowper gland to form semen. In early embryos, the reproductive systems are undetermined. By birth the organs appropriate to each sex have typically developed but are not functioning. They continue to grow, and at puberty their activity increases and maturation occurs, enabling sexual reproduction. See illustration on opposite page.

reptile Any of the approximately 6,000 species of the class Reptilia, air-breathing vertebrates that have internal fertilization and a scaly body and are cold-blooded. Most species have short legs (or none) and have long tails, and most lay eggs. Living reptiles include the scaly reptiles (snakes and lizards; order Squamata), the crocodiles (Crocodilia), the turtles (Chelonia), and the unique tuatara (Rhynchocephalia). Being cold-blooded, reptiles are not found in very cold regions, and in regions with cold winters they usually hibernate. They range in size from geckos that measure about 1 in. (3 cm) long to the python, which grows to 30 ft (9 m); the largest turtle, the marine leatherback, weighs about 1,500 lbs (680 kg). Extinct reptiles include the dinosaurs, the pterosaurs, and the dolphinlike ichthyosaurs.

republic Form of government in which a state is ruled by representatives elected by its populace. The term was originally applied to a form of government in which the leader is periodically appointed under a constitution; it was contrasted with governments in which leadership is hereditary. A republic may also be distinguished from direct democracy, though modern representative democracies are by and large republics.

Republican, Radical See Radical Republican

Republican Party *or* **GOP (Grand Old Party)** One of two major U.S. political parties. It was formed in 1854 by former members of the Whig, Democratic, and Free Soil parties who chose the party's name to recall the Jeffersonian Republicans' concern with the national interest above sectional interests and states' rights. The new party opposed slavery and its extension into the territories, as provided by the Kansas-Nebraska Act. Its first presidential candidate, John C. Frémont, won 11 states in 1856; its second, Abraham Lincoln, won the 1860 election by carrying 18 states. Its association with the Union victory in the American Civil War allowed it a long period of dominance nationally, though it was uncom-

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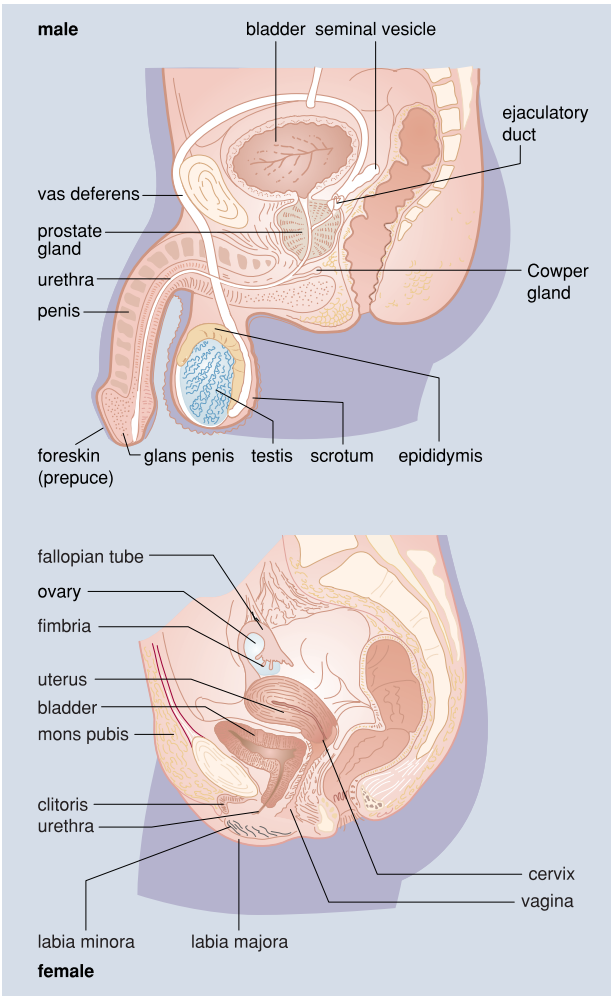

Organs of the human reproductive system. In a male, the scrotum, a pouch of skin, is divided into two sacs, each containing a testis and its associated epididymis. Tubules within the testes contain sperm cells at different stages of development. As sperm leaves the testes, it passes into the epididymis, a highly coiled tube that serves as a reservoir for sperm. The vas deferens, a duct leading out from the epididymis, joins with the duct of the seminal vesicles as it passes through the prostate gland to form a single tube (ejaculatory duct) that opens into the urethra, the tube that conveys both sperm and urine out through the penis. In a menstruating woman, a follicle containing an egg matures each month in either of two ovaries. Ovulation occurs as the mature follicle ruptures and releases an egg, which is drawn into the ovary's associated fallopian (uterine) tube, which contains a fringe of fingerlike projections (fimbriae). Fertilization usually occurs in the fallopian tube as the egg travels to the uterus. Successful implantation of a fertilized egg in the uterus results in development of an embryo. The vagina, a muscular tube that leads to the uterus, allows sperm to pass into the uterus and serves as a passageway for the fetus during childbirth.

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petitive in the South for more than a century after the war. Republican candidates won 14 of 18 presidential elections between 1860 and 1932, through support from an alliance of Northern and Midwestern farmers and big-business interests. In 1912 the party split between a progressive wing led by Theodore Roosevelt and a conservative wing led by Pres. William Howard Taft; the rift enabled the Democratic candidate, Woodrow Wilson, to win that year's election. The Republican Party's inability to counter the impact of the Great Depression led to its ouster from power in 1933; in 1953 the presidency of Dwight D. Eisenhower brought a moderate wing of the party to prominence. The party's platform remained conservative, emphasizing anticommunism, reduced government regulation of the economy, and lower taxes; many members also opposed civil rights legislation. In the 1950s the GOP gained new support from middle-class suburbanites and white Southerners disturbed by the integrationist policies of the national Democratic Party. Richard Nixon, who narrowly lost the 1960 presidential race, won narrowly in 1968 and by a landslide in 1972, but he was forced to resign in 1974 as a result of the Watergate scandal. Ronald Reagan, who had assumed the leadership of the conservative wing of the Republican Party after Barry Goldwater's defeat in the presidential election of 1964, won the presidency in 1980 and 1984; he introduced deep tax cuts and launched a massive buildup of U.S. military forces. Reagan's vice president, George Bush, was elected in 1988 and enjoyed enormous popularity after success in the First Persian Gulf War, but an anemic economy led to his defeat in 1992 by Democrat Bill Clinton. The defeat was offset in 1994, when the Republicans regained control of the House of Representatives for the first time in 40 years. In 2000 George W. Bush narrowly won the presidency in one of the closest and most controversial elections in U.S. history. In 2004 he won reelection. The party continues to emphasize tax cuts, traditional social values, and strong national defense.

Republican Party, National See National Republican Party

Republican River River, central U.S. Rising in eastern Colorado, it is 422 mi (679 km) long. It flows northeast and east through southern Nebraska, then southeast through northeastern central Kansas to unite with the Smoky Hill River at Junction City and form the Kansas River. It is part of the Missouri River Basin flood-control and land-reclamation project.

requiem mass Musical setting of the mass for the dead. (*Requiem*, Latin for "rest," is the first word of the mass.) The requiem's text differs from the standard mass Ordinary in omitting its joyous sections and keeping only the Kyrie, Sanctus, and Agnus Dei, which are combined with other sections, including the sequence *Dies irae* ("Day of Wrath"). The first surviving polyphonic setting is by Johannes Ockeghem; celebrated later requiems include those of Wolfgang Amadeus Mozart, Hector Berlioz, Giuseppe Verdi, Gabriel Fauré, Johannes Brahms, and Benjamin Britten.

resale price maintenance Measures taken by manufacturers or distributors to control the resale prices of their products (i.e., the prices charged by businesses that resell them). Such measures have been applied to a limited array of goods, including pharmaceuticals, books, photographic supplies, and liquor. Resale price maintenance first began to be employed in the 1880s, reflecting the success of brand promotion and the resulting increase in competition among retailers. It became especially common in the U.S. but declined after World War II. It is prohibited in some countries. The complexity of marketing channels in industrialized countries makes it increasingly difficult for manufacturers to establish and enforce a single price or even a minimum price for their goods. See also fair trade law.

research and development (R&D) In industry, two closely related processes by which new products and new forms of old products are created through technological innovation. The work generally focuses on two types of research, basic and applied. Basic research is directed toward a generalized goal (e.g., genetic research in a pharmaceutical laboratory). Applied research directs the results of basic research toward the needs of a specific industry and results in the development of new or modified products or processes. In addition to carrying out basic and applied research and developing models, R&D staff may evaluate the efficiency and cost of the product.

resin \'re-z^{ə}n\ Any natural or synthetic organic compound consisting of a noncrystalline (amorphous) solid or viscous liquid substance or mixture. Natural resins are usually transparent or translucent yellow to brown and can melt and burn. Most are exuded from trees, especially pines and firs (see conifer), when the bark is injured or stripped. The fluid secretion usually dries out and hardens into a material that can be worked. Natural resins have been used in perfumes and medicines (e.g., balsams), in paints and varnishes (e.g., turpentine and shellac, the latter derived from the secretion of an insect), and in decorative ware (e.g., amber, Oriental lacquer). Synthetic resins are all plastics; the term *resin*, though still used in the modern industry, dates from the years when synthetics began to replace natural resins. Thermoplastic resins are plastics such as polyethylene that can be shaped repeatedly on reheating, whereas thermosetting resins are plastics such as epoxy that set permanently and cannot be reshaped.

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resistance Opposition that a material or electrical CIRCUIT offers to the flow of ELECTRIC CURRENT. It is the property of a circuit that transforms electrical energy into heat energy as it opposes the flow of current. The resistance *R*, the ELECTROMOTIVE FORCE or voltage *V*, and the current *I* are related by OHM'S LAW. The resistance of an electrical CONDUCTOR generally increases with increasing temperature and is utilized in devices such as lamps and heaters. The ohm (Ω) is the common unit of electrical resistance; one ohm is equal to one volt (see ELECTROMOTIVE FORCE) per ampere.

Resistance *or* **Underground** Clandestine groups opposed to Nazi rule in German-occupied Europe in World War II. The groups included civilians who worked secretly against the occupation and armed bands of partisans or guerrilla fighters. Resistance activities ranged from assisting the escape of Jews and Allied airmen shot down over enemy territory to committing sabotage, ambushing German patrols, and sending intelligence information to the Allies. Resistance groups were not always unified; in some countries, rival groups divided along communist and noncommunist lines. However, in France the clandestine National Council of the Resistance coordinated all French groups, which gave support to the NORMANDY CAMPAIGN and participated in the August 1944 uprising that helped liberate Paris. Resistance groups in other northern European countries also undertook military actions to help the Allied forces in 1944–45.

resistivity Electrical RESISTANCE of a CONDUCTOR of unit cross-sectional area and unit length. The resistivity of a conductor depends on its composition and its temperature. As a characteristic property of each material, resistivity is useful in comparing various materials on the basis of their ability to conduct ELECTRIC CURRENT. As temperature increases, the resistivity of a metallic conductor usually increases and that of a SEMICONDUCTOR usually decreases.

Resnais \rə-'nā**, Alain** (b. June 3, 1922, Vannes, France) French film director. After studying at the French cinema school IDHEC, he made short films on the visual arts (*Van Gogh* [1948]) and documentaries (*Night and Fog* [1956]). His first feature film, *Hiroshima mon amour* (1959), created a sensation with its alternation between past and present and is considered one of the earliest and best films of the NEW WAVE. He continued his exploration of the complex themes of time and memory in *Last Year at Marienbad* (1961). His later films include *Muriel* (1963), *Stavisky* (1974), *My American Uncle* (1980), *Love unto Death* (1984), *I Want to Go Home* (1989), *Smoking/No Smoking* (1993), and *Same Old Song* (1997).

Resnais
COURTESY OF THE FRENCH FILM OFFICE, NEW YORK

resonance In physics, the relatively large selective response of an object or a system that vibrates in step with an externally applied VIBRATION. Acoustical resonance is the vibration induced in a string of a given pitch when a note of the same pitch is produced nearby, in the sound box of an instrument such as a guitar, or in the mouth or nasal cavity when speaking. Mechanical resonance, such as that produced in a bridge by wind or by marching soldiers, can eventually produce wide swings great enough to cause the bridge's destruction. Resonance in frequency-sensitive electrical CIRCUITS makes it possible for certain communication devices to accept signals of some frequencies while rejecting others. MAGNETIC RESONANCE occurs when electrons or atomic nuclei respond to the application of MAGNETIC FIELDS by emitting or absorbing ELECTROMAGNETIC RADIATION. See also NUCLEAR MAGNETIC RESONANCE.

Respighi \re-'spē-gē**, Ottorino** (b. July 9, 1879, Bologna, Italy—d. April 18, 1936, Rome) Italian composer. After musical studies in Bologna (1891–1901), he played viola in a Russian orchestra and studied with NIKOLAY RIMSKY-KORSAKOV, from whom he learned much about orchestration. His best-known works are the colourful tone poems *The Fountains of Rome* (1916) and *The Pines of Rome* (1924). Interested in early music, he also produced works such as *Gli uccelli* (1927), based on works by JEAN-PHILIPPE RAMEAU, and *La Boutique fantasque*, based on works by GIOACCHINO ROSSINI.

respiration Process of taking in air for oxygen and releasing it to dispose of carbon dioxide. The amount of air inhaled and exhaled in an average human breath (tidal volume) is about one-eighth the amount that can be inhaled after exhaling as much as possible (vital capacity). Nerve centres in the brain regulate the movements of muscles of respiration (DIAPHRAGM and chest wall muscles). Blood in the pulmonary circulation brings carbon dioxide from the tissues to be exhaled and takes up oxygen from the air in the PULMONARY ALVEOLI to carry it to the heart and the rest of the body. Because the body stores almost no oxygen, interruption of respiration—by asphyxiation, drowning, or chest muscle PARALYSIS—for more than a few minutes can cause death. Disorders affecting respiration include ALLERGY, ASTHMA, BRONCHITIS, EMPHYSEMA, PNEUMONIA, and TUBERCULOSIS. See also RESPIRATORY SYSTEM; RESPIRATORY THERAPY.

respiratory distress syndrome *or* **hyaline membrane disease** Common complication in newborns, especially after PREMATURE BIRTH. Symptoms include very laboured breathing, bluish skin tinge, and low blood oxygen levels. Insufficient surfactant in the PULMONARY ALVEOLI raises surface tension, hampering lung expansion. The alveoli collapse (see ATELECTASIS), and a "glassy" (hyaline) membrane develops in the alveolar ducts. Once the leading cause of death in premature infants, the syndrome is now usually treated for a few days with a mechanical ventilator (see RESPIRATORY THERAPY), with no aftereffects. An adult respiratory distress syndrome (ARDS) can follow lung injury.

respiratory system Organ system involved in RESPIRATION. In humans, the DIAPHRAGM and, to a lesser extent, the muscles between the ribs generate a pumping action, moving air in and out of the lungs through a system of pipes (conducting airways), divided into upper and lower airway systems. The upper airway system comprises the nasal cavity (see NOSE), SINUSES, and PHARYNX; the lower airway system consists of the LARYNX, TRACHEA, bronchi, bronchioles, and alveolar ducts (see PULMONARY ALVEOLUS). The blood and CARDIOVASCULAR SYSTEM can be considered elements of a working respiratory system. See also THORACIC CAVITY. See illustration on opposite page.

respiratory therapy Medical profession concerned with assisting the respiratory function of individuals who have severe lung disorders. Practices include suctioning to clear secretions from the airway, use of aerosol mists (sometimes medicated) or gases to ease breathing, and tilting the body and chest percussion to promote drainage. A respiratory therapist also manages mechanical ventilation, a process in which a machine generates a controlled flow of a gas mixture into the airway of a patient who cannot breathe efficiently.

restaurant Establishment where refreshments or meals are served to paying guests. Though inns and taverns served simple fare to travelers for centuries, the first modern restaurant where guests could order from a varied menu is thought to have belonged to A. Boulanger, a soup vendor who opened his business in Paris in 1765. The sign above his door advertised restoratives, or *restaurants*, referring to his soups and broths. By 1804 Paris had more than 500 restaurants, and France soon became internationally famous for its cuisine. Other European restaurants include the Italian *trattorie*, taverns featuring local specialties; the German *Weinstuben,* informal restaurants with a large wine selection; the Spanish tapas bars, which serve a wide variety of appetizers; and the PUBLIC HOUSES of England. Asian restaurants include the Japanese sushi bars and teahouses serving formal Kaiseki cuisine as well as the noodle shops of China. Most U.S. restaurant innovations have revolved around speed. The cafeteria originated in San Francisco during the 1849 gold rush; cafeterias feature self-service and offer a variety of foods displayed on counters. The U.S. also pioneered fast-food restaurants such as White Castle (founded 1921) and McDonald's (see RAY KROC), usually operated as chains and offering limited menus.

Reston, James (Barrett) (b. Nov. 3, 1909, Clydebank, Dumbartonshire, Scot.—d. Dec. 6, 1995, Washington, D.C., U.S.) Scottish-born U.S. columnist and editor. His family moved to the U.S. when he was 10 years old. He was a sportswriter before joining *The New York Times* in 1939, where he worked as a reporter, a nationally syndicated columnist, Washington bureau chief (1953–64), executive editor (1968–69), and vice president (1969–74) before retiring in 1989. One of the most influential U.S. journalists, he had unrivaled personal access to U.S. presidents and world leaders and was often the first to break major stories. He won two Pulitzer Prizes (1945, 1957), helped create the first Op-Ed page (1970; a forum for columnists' opinion pieces), and recruited and trained many talented young journalists.

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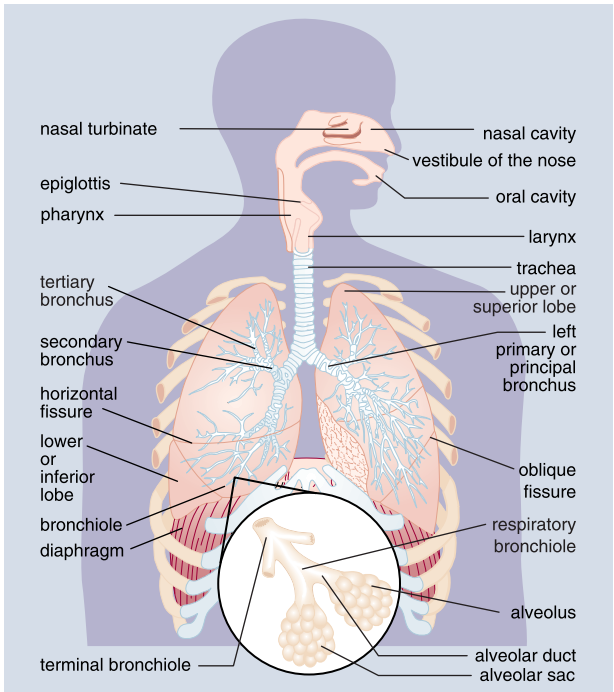

As air enters the nasal cavity through the nostrils, it is warmed and moistened by mucous membranes of the nasal turbinates before entering the pharynx. Stiff hairs lining the vestibule inside the nostrils help filter the entering air. The air-filled sinuses adjacent to the nasal cavity produce mucus. The larynx connects the pharynx with the trachea or windpipe. The cartilaginous epiglottis prevents food from entering the larynx during swallowing. A left and right primary bronchus supply each lung with air from the trachea. They divide into smaller secondary and tertiary bronchi; the smallest divisions, bronchioles, lead to the cup-shaped, thin-walled alveoli, which occur in clusters (alveolar sacs). Oxygen and carbon dioxide are exchanged between the alveoli and surrounding capillaries. Oblique fissures or grooves of each lung separate the upper lobe from the lower lobe. The horizontal, or transverse, fissure of the right lung forms a middle lobe. Movement of the diaphragm along with the ribs and rib muscles causes expansion and contraction of the lungs during breathing.

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Restoration Restoration of the monarchy in England in 1660. It marked the return of CHARLES II as king (1660–85) following the period of OLIVER CROMWELL's Commonwealth. The bishops were restored to Parliament, which established a strict Anglican orthodoxy. The period, which also included the reign of JAMES II (1685–88), was marked by an expansion in colonial trade, the ANGLO-DUTCH WARS, and a revival of drama and literature (see RESTORATION LITERATURE).

Restoration literature English literature written after the RESTORATION of the monarchy in 1660 following the period of the Commonwealth. Some literary historians equate its era with the reign of CHARLES II (1660–85), while others add the reign of JAMES II (1685–88). Many typical modern literary forms (e.g., the novel, biography, history, travel writing, and journalism) began to develop with sureness during the Restoration period. Pamphlets and poetry (notably that of JOHN DRYDEN) flourished, but the age is chiefly remembered for its glittering, critical, and often bawdy comedies of manners by such playwrights as GEORGE ETHEREGE, THOMAS SHADWELL, WILLIAM WYCHERLY, JOHN VANBRUGH, WILLIAM CONGREVE, and GEORGE FARQUHAR.

restraint of trade Preventing of free competition in business by some action or condition such as price-fixing or the creation of a MONOPOLY. The U.S. has a long-standing policy of maintaining competition among business enterprises through ANTITRUST LAWS, the best-known of which, the SHERMAN ANTITRUST ACT of 1890, declared illegal "every contract, combination…or conspiracy in restraint of trade or commerce."

restriction enzyme PROTEIN (more specifically, an endonuclease) produced by BACTERIA that cleaves DNA at specific sites along its length. Thousands have been found, from many different bacteria; each recognizes a specific NUCLEOTIDE sequence. In the living bacterial cell, these ENZYMES destroy the DNA of certain invading VIRUSES (BACTERIOPHAGES), thus placing a "restriction" on the number of viral strains that can cause infection; the bacterium's own DNA is protected from cleavage by methyl ($-CH_3$) groups, which are added by enzymes at the recognition sites to mask them. In the laboratory, restriction enzymes allow researchers to isolate DNA fragments of interest, such as those that contain GENES, and to recombine them with other DNA molecules; for this reason they have become very powerful tools of recombinant DNA BIOTECHNOLOGY (see DNA RECOMBINATION).

restrictive covenant In property law, an agreement acknowledged in a deed or lease that restricts the free use or occupancy of property, such as by forbidding commercial use or certain types of structures. The restrictive covenant is as old as the law of property, being well-established in Roman law. The term is also used in business law to refer to an agreement whereby one party promises not to engage in the same business or a similar business in a particular area for a period of time.

retailing Selling of merchandise directly to the consumer. Retailing began several thousand years ago with peddlers hawking their wares at the earliest marketplaces. It is extremely competitive, and the failure rate of retail establishments is relatively high. Price is the most important arena of competition, but other factors include convenience of location, selection and display of merchandise, attractiveness of the establishment, and reputation. The diversity of retailing is evident in the many forms it now takes, including VENDING MACHINES, door-to-door and telephone sales, DIRECT-MAIL MARKETING, the Internet, discount houses, specialty stores, DEPARTMENT STORES, supermarkets, and consumer COOPERATIVES.

retaining wall *or* **revetment** Wall constructed to hold in place a mass of earth or prevent the erosion of an embankment. It may also be battered, with the face inclined toward the load it is bearing. The most basic type of reinforced retaining wall is the massive concrete gravity wall, which is prevented from falling over by the sheer weight and volume of its mass. A CANTILEVER (L-shaped) retaining wall resists overturning by means of cantilever footings, spread footings (see FOUNDATION) shaped to resist overturning and sliding.

reticuloendothelial \re-ˌtik-yə-lō-ˌen-də-ˈthē-lē-əl\ **system** *or* **macrophage** \ˈmak-rə-ˌfāj\ **system** *or* **mononuclear phagocyte system** Part of the body's defenses, consisting of a class of cells widely distributed in the body. Reticuloendothelial cells filter out and destroy BACTERIA, VIRUSES, and foreign substances and destroy worn-out or abnormal cells and tissues. Precursor cells in bone marrow develop into monocytes (see LEUKOCYTE), which are released into the bloodstream. Most enter body tissues, developing into much larger cells called macrophages, with different appearances in various locations. Some roam through the circulation and between cells and can coalesce into a single cell around a foreign object to engulf it. Reticuloendothelial cells also interact with LYMPHOCYTES in immune reactions. Cells in the SPLEEN destroy old red blood cells and recycle their HEMOGLOBIN; uncontrolled, this process causes ANEMIA. TUMOURS of the reticuloendothelial system can be localized or widespread throughout the body. See also LYMPHATIC SYSTEM.

retina \ˈre-tᵊn-ə\ Layer of nerve tissue covering the back two-thirds of the eyeball. Light focused onto the retina by the lens of the EYE stimulates two types of light-sensitive cells: rods, which are sensitive to low light levels, and cones, which provide detailed vision and colour perception. Chemical changes in these cells trigger nerve impulses, which are assembled by complex connections among retinal nerves into a pattern to be carried through the optic nerve to the visual centres of the brain. Disorders affecting the retina or the macula in its centre decrease vision and can cause BLINDNESS. See also DETACHED RETINA; MACULAR DEGENERATION.

retriever Any of several dog breeds, bred to retrieve game, that have a thick, water-resistant coat, keen sense of smell, and "soft" mouth that does not damage game. Retrievers are 22–24 in. (55–62 cm) tall and weigh 55–75 lbs (25–34 kg). The golden retriever has a golden-brown coat that is long on the neck,

Golden retriever.
SALLY ANNE THOMPSON

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legs, and tail. The Labrador retriever has a short black or brown coat. Both are often used as guide dogs, and both are highly popular as pets. Other retriever breeds include the Chesapeake Bay, curly-coated, and flat-coated retrievers.

retrograde motion In astronomy, the actual or apparent motion of a body in a direction opposite to that of the predominant (direct or prograde) motions of similar bodies. Observationally and historically, retrograde motion refers to the apparent reversal of the planets' motion through the stars for several months in each SYNODIC PERIOD. This required a complex explanation in Earth-centred models of the universe (see PTOLEMY) but was naturally explained in heliocentric models (see COPERNICAN SYSTEM) by the apparent motion as Earth passed by a planet in its orbit. It is now known that nearly all bodies in the SOLAR SYSTEM revolve and rotate in the same counterclockwise direction as viewed from a position in space above Earth's North Pole. This common direction probably arose during the formation of the SOLAR NEBULA. The relatively few objects with clockwise motions (e.g., the rotation of Venus, Uranus, and Pluto) are also described as retrograde.

retrovirus \ˌre-trō-ˈvī-rəs\ Any of a group of VIRUSES that, unlike most other viruses and all cellular organisms, carry their genetic blueprint in the form of RNA. Retroviruses are responsible for some cancers and viral infections of animals, and they cause at least one type of human cancer. The retrovirus HIV is the cause of AIDS in humans. The name signifies that they use RNA to synthesize DNA, the reverse of the usual cell process. This process makes it possible for genetic material from a retrovirus to enter and become a permanent part of the GENES of an infected cell.

Retton, Mary Lou (b. Jan. 24, 1968, Fairmont, W.Va., U.S.) U.S. gymnast. Retton began studying dance and acrobatics at age 4. At the 1984 Olympic Games she received perfect scores in her final two events to win a dramatic victory in the combined exercises, becoming the first American woman gymnast to win an individual Olympic gold medal. Her style, exhibiting speed, accuracy, and power, served to transform women's gymnastics. She was the first gymnast inducted into the U.S. Olympics Hall of Fame (1985).

Reuchlin \ˈrȯiⱪ-lin**, Johannes** (b. Feb. 22, 1455, Pforzheim, Württemberg—d. June 6, 1522, Bad Liebnzell) German humanist. After obtaining his law degree in 1481, he held court and judicial posts in Württemberg and its capital, Stuttgart, from the 1480s until 1512. Second only to DESIDERIUS ERASMUS among the German humanists, Reuchlin was a pioneer in the scientific study of Classical Greek and translated many Classical texts. His grammar and lexicon, *On the Fundamentals of Hebrew* (1506), revolutionized Hebrew studies and advanced Old Testament research. His opposition to the Dominicans' plan to destroy all Hebrew literature was one of the great controversies prior to the outbreak of the REFORMATION, and in 1516 he was acquitted of heresy by a papal commission. PHILIPP MELANCHTHON was his nephew.

Réunion \rē-ˈyün-yən\ Island (pop., 2005 est.: 780,000) and French overseas department, Mascarene Islands, western Indian Ocean. Located 425 mi (684 km) east of MADAGASCAR, Réunion is about 40 mi (65 km) long and 30 mi (50 km) wide and has an area of 968 sq mi (2,507 sq km). Its capital is SAINT-DENIS. It consists mainly of rugged mountains dissected by torrential rivers. Most of the population is of mixed ancestry, with African descent predominant. Réunion was settled in the 17th century by the French, who brought slaves from eastern Africa to work on coffee and sugar plantations. It was a French colony until 1946, when it became an overseas department of France. Its economy is based largely on the export of sugar. Other products include meat and milk products, rum, molasses, tobacco, geranium essence, and vanilla.

Reuter \ˈrȯi-tər**, Paul Julius, Baron von Reuter** *orig.* **Israel Beer Josaphat** (b. July 21, 1816, Kassel, Electorate of Hesse—d. Feb. 25, 1899, Nice, France) German founder of the news agency REUTERS. He was a bank clerk and partner in a small publishing concern before initiating a prototype news service in Paris in 1849, using electric telegraphy and carrier pigeons in his network. He moved to England in 1851 and opened a telegraph office serving banks, brokerage houses, and leading business firms. He steadily extended his commercial news service, acquiring his first subscribing newspaper client in 1858. Undersea cables enabled him to expand the service to other continents.

Reuters \ˈrȯi-tərz\ British cooperative NEWS AGENCY. Founded in 1851 by PAUL JULIUS REUTER, it was initially concerned with commercial news but began to serve a growing newspaper clientele after the London *Morning Advertiser* subscribed in 1858. After a period of competition, Reuters and two rival agencies agreed on a division of territory and for many years held a virtual monopoly on world press services. The company remained in private hands until 1925, when its structure began moving toward a cooperative of British and Australasian press interests. By the late 20th century Reuters was a world leader in business and financial market coverage. In 1984 it became a public company under the name Reuters Group PLC.

Reuther \ˈrü-thər**, Walter (Philip)** (b. Sept. 1, 1907, Wheeling, W.Va., U.S.—d. May 9, 1970, Pellston, Mich.) U.S. labour leader. He became an apprentice tool- and diemaker at age 16. He traveled around the world in the 1930s, developing a lifelong distaste for communism after spending two years in a Soviet auto factory. He became a local union leader in Detroit, Mich., and helped organize sit-down strikes—during which he suffered brutal physical attacks—that made the UNITED AUTOMOBILE WORKERS (UAW) a power in the auto industry. As president of the UAW from 1946 until his death, he was an effective negotiator of wages-and-hours gains. He became president of the Congress of Industrial Organizations (CIO) in 1952 and was an architect of the AFL-CIO merger in 1955. He was second in power to GEORGE MEANY at the AFL-CIO; however, their repeated clashes, partly stemming from Reuther's strong support for civil rights and opposition to the Vietnam War, resulted in Reuther's leading the UAW out of the AFL-CIO in 1968 and forming a short-lived federation with the TEAMSTERS UNION. He died in a plane crash.

revelation Transmission of knowledge from a god or gods to humans. In the Western monotheistic religions of Judaism, Christianity, and Islam, revelation is the basis of religious knowledge. Humans know God and his will because God has chosen to reveal himself to them. He may communicate with his chosen servants through dreams, visions, or physical manifestations and may inspire PROPHETS who relay his message to the people. His will may also be translated directly into writing through the handing down of divine law (e.g., the TEN COMMANDMENTS) or SCRIPTURE (e.g., the BIBLE and the QUR'ĀN). Other religions emphasize "cosmic" revelation, in which any and all aspects of the world may reveal the nature of a single underlying divine power (e.g., BRAHMAN in the VEDAS).

Revelation, Book of *or* **Revelations** *or* **Apocalypse of John** Last book of the NEW TESTAMENT. It consists of two main parts, the first containing moral admonitions to several Christian churches in Asia Minor, and the second composed of extraordinary visions, allegories, and symbols that have been the subject of varying interpretations throughout history. A popular interpretation is that Revelation deals with a contemporary crisis of faith, possibly the result of Roman persecutions. It exhorts Christians to remain steadfast in their faith and hold firm to the hope that God will ultimately vanquish their enemies. References to "a thousand years" have led some to expect that the final victory over evil will come after the completion of a millennium (see MILLENNIALISM). Modern scholarship accepts that the book was written not by St. JOHN THE APOSTLE but by various unknown authors in the late 1st century AD. See also APOCALYPSE.

Revels, Hiram R(hoades) (b. Sept. 1, 1822, Fayetteville, N.C., U.S.—d. Jan. 16, 1901, Aberdeen, Miss.) U.S. clergyman and politician. The son of free blacks, he traveled to Indiana and Illinois to receive the education that was denied him in the South. Ordained a minister, he became a pastor and principal of a Baltimore school for African Americans. In the AMERICAN CIVIL WAR he helped organize African American volunteer regiments for the Union army. After the war he moved to Natchez, Miss., and was elected state senator in 1869. In 1870 he was elected to the U.S. Senate to fill the unexpired term of JEFFERSON DAVIS, becoming the first African American elected to that body. He later served as president of Alcorn A&M College (1871–74, 1876–83).

revenue bond *or* **limited obligation bond** BOND issued by a municipality, state, or public agency authorized to build, acquire, or improve a revenue-producing property such as a waterworks, electric generating plant, or railroad. Unlike general-obligation bonds, which are repaid through a variety of tax sources, revenue bonds are payable from specified revenues only, usually the revenues from the facility for which the bond was originally issued. Revenue bonds typically pay interest rates higher than those of general-obligation bonds. The separation of the revenue bond obligation from a municipality's other bond obligations allows the municipality to circumvent legislated debt limits.

revenue sharing Funding arrangement in which one government unit grants a portion of its tax income to another government unit. For example, provinces or states may share revenue with local governments,

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or national governments may share revenue with provinces or states. Laws determine the formulas by which revenue is shared, limiting the controls that the unit supplying the money can exercise over the receiver and specifying whether matching funds must be supplied by the receiver. Forms of revenue sharing have been used in several countries, including Canada, India, and Switzerland. From 1972 to 1986 the U.S. pursued a revenue-sharing program in which state and local governments received federal funds to spend as they saw fit.

reverberatory furnace Furnace used for SMELTING, refining, or melting in which the fuel is not in direct contact with the contents but heats it by a flame blown over it from another chamber. Such furnaces are used in COPPER, TIN, and NICKEL production, in the production of certain CONCRETES and CEMENTS, and in ALUMINUM recycling. In steelmaking, this process (now largely obsolete) is called the OPEN-HEARTH PROCESS. The heat passes over the hearth and then radiates back (reverberates) onto the contents. The roof is arched, with the highest point over the firebox. It slopes downward toward a bridge of flues that deflects the flame so that it reverberates.

Revere, Paul (b. Jan. 1, 1735, Boston, Mass.—d. May 10, 1818, Boston) American patriot and silversmith. He entered his father's trade as a silversmith and engraver. An ardent supporter of the colonists' cause, he took part in the BOSTON TEA PARTY. As the principal rider for Boston's Committee of Safety, he arranged to signal the British approach by having lanterns placed in Boston's Old North Church steeple: "One if by land and two if by sea." On April 18, 1775, he set off to ride to Lexington to alert colonists that British troops were on the march and to warn SAMUEL ADAMS and JOHN HANCOCK to flee. Though he was stopped by a British patrol, he was able to alert the patriot leaders; because of his warning, the MINUTEMEN were prepared for the Battle of LEXINGTON and the start of the AMERICAN REVOLUTION. His ride was celebrated in a famous poem by HENRY W. LONGFELLOW (1863). During the war, Revere constructed a powder mill to supply colonial arms. After the war he discovered a process for rolling sheet copper and opened a rolling mill that produced sheathing for ships such as the USS *CONSTITUTION*. He continued to design handsome silver bowls, flatware, and utensils that are museum pieces today.

revetment See RETAINING WALL

Revillagigedo \rā-ˈvē-yä-hē-ˈhā-thō\ Group of islands, Mexico, in the Pacific Ocean. The islands are located about 300 mi (500 km) south of the BAJA CALIFORNIA peninsula and about 370 mi (600 km) west of mainland Mexico. Covering a total land area of 320 sq mi (830 sq km), it consists of numerous volcanic islands. The largest, Socorro, reaches an elevation of 3,707 ft (1,130 m). The islands are rich in sulfur, fish, and guano and are administered by COLIMA state.

revivalism Reawakening of Christian values and commitment. The spiritual fervour of revival-style preaching, typically performed by itinerant, charismatic preachers before large gatherings, is thought to have a restorative effect on those who have been led away from the right path. Various Protestant sects have experienced periods of revivalism at different times since the 17th century, and many, notably METHODISM, came into being during revivalist periods. Common themes are strict interpretation of the BIBLE, rejection of literary or historical study of the Bible, emphasis on the conversion experience, and a call to live devoutly. Revivalism can be interpreted as a precursor of 20th-century Christian FUNDAMENTALISM. See also GREAT AWAKENING; DWIGHT MOODY.

revolution In politics, fundamental, rapid, and often irreversible change in the established order. Revolution involves a radical change in government, usually accomplished through violence, that may also result in changes to the economic system, social structure, and cultural values. The ancient Greeks viewed revolution as the undesirable result of societal breakdown; a strong value system, firmly adhered to, was thought to protect against it. During the Middle Ages, much attention was given to finding means of combating revolution and stifling societal change. With the advent of Renaissance humanism, there arose the belief that radical changes of government are sometimes necessary and good, and the idea of revolution took on more positive connotations. JOHN MILTON regarded it as a means of achieving freedom, IMMANUEL KANT believed it was a force for the advancement of mankind, and G.W.F. HEGEL held it to be the fulfillment of human destiny. Hegel's philosophy in turn influenced KARL MARX. See also COUP D'ÉTAT.

Revolution of 1688 See GLORIOUS REVOLUTION

Revolutionary War See AMERICAN REVOLUTION

Revolutions of 1848 Series of republican revolts against European monarchies. The revolutions began in Sicily and spread to France, the German and Italian states, and the Austrian Empire. In France the revolution established the SECOND REPUBLIC, and in central Europe liberal political reform and national unification appeared likely. However, the armies loyal to the monarchies soon reestablished their power and rescinded most of the promised reforms. The revolts eventually ended in failure and repression, and they were followed by widespread disillusionment among liberals.

revolver PISTOL with a revolving cylinder that provides multishot action. Some early versions, known as pepperboxes, had several barrels, but as early as the 17th century pistols were being made with a revolving chamber to load cartridges into a single barrel. The first practical revolver was not designed until 1835, when SAMUEL COLT patented his version. He established the standard of a cylinder with multiple chambers, each of which successively locked in position behind the barrel and was discharged by pressure on the trigger. In Colt's early single-action revolvers, the cylinder revolved as the hammer was cocked manually. Double-action revolvers, in which the hammer is cocked and the cylinder revolves as the trigger is pulled, were developed soon afterward, along with metal cartridges.

revue Theatrical production of brief, loosely connected, often satirical skits, songs, and dances. Originally derived from the medieval French street fair, the modern revue dates from the early 19th century with the Parisian *Folies Marigny* and later at the FOLIES-BERGÈRE. The English revue developed in two forms: one as the costume display and spectacle of the Court Theatre productions in the 1890s and another as the *André Charlot Revues* of the 1920s and the London Hippodrome shows, which emphasized clever repartee and topicality. In the U.S. the *Ziegfeld Follies* began in 1907 and usually featured a star personality. Revues appeared periodically on Broadway and West End stages until competition from movies and television moved the form to small nightclubs and improvisational theatres.

Rexroth, Kenneth (b. Dec. 22, 1905, South Bend, Ind., U.S.—d. June 6, 1982, Santa Barbara, Calif.) U.S. painter, essayist, poet, and translator. The largely self-educated Rexroth spent much of his youth traveling in the West, organizing and speaking for unions. His early poems were experimental, influenced by SURREALISM; his later work was praised for its tight form and its wit and humanistic passion. He was an early champion of the BEAT MOVEMENT. His works include essays in *Assays* (1962) and *With Eye and Ear* (1970); and many translations of Japanese, Chinese, Greek, Latin, and Spanish poetry.

Rey See RHAGAE

Reye syndrome Acute neurological illness in children, following INFLUENZA, CHICKENPOX, or other viral infections. Vomiting, lethargy, and confusion begin as the child appears to be recovering. These symptoms are followed hours or days later by drowsiness, disorientation, seizures, respiratory arrest, and coma. At worst, the syndrome includes fatty liver degeneration and potentially fatal brain swelling. There is no specific cure, but treatment of imbalances helps over 70% of patients survive (some with brain damage). The incidence has decreased since the recognition that it often follows use of ASPIRIN or other SALICYLIC ACID derivatives in children during a viral illness. It can also result from AFLATOXIN or WARFARIN poisoning.

Reykjavík \ˈrā-kyä-ˌvēk\ City (pop., 1999 est.: 109,152), capital of Iceland. According to tradition, it was founded in 874 by the Norseman Ingólfur Arnarson. Until the 20th century it was a small fishing village at the southeastern corner of FAXA BAY, ruled and largely inhabited by Danes. It became the capital of a self-governing Iceland under the Danish king in 1918 and of the independent Republic of Iceland in 1944. During World War II it was a U.S. naval and air base. In 1986 arms-control talks between the U.S. and U.S.S.R. were held there. It is the commercial, industrial, and cultural centre of the island, its major fishing port, and the site of nearly half of the nation's industries.

Reymont \ˈrā-ˌmȯnt**, Władysław (Stanisław)** *or* **Władysław Stanisław Rejment** (b. May 7, 1867, Kobiele Wielkie, Pol., Russian Empire—d. Dec. 5, 1925, Warsaw, Pol.) Polish novelist. He never finished his schooling and worked in his youth as a shop apprentice, a lay brother in a monastery, a railway official, and an actor. His short stories and novels are written in a naturalistic, factual style with short sentences. His best work, *The Peasants* (1904–09), is a four-volume chronicle of peasant life over the

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course of a year, written in peasant dialect. Translated into many languages, it won Reymont the 1924 Nobel Prize for Literature.

Reynaud \rā-'nō**, Paul** (b. Oct. 15, 1878, Barcelonnette, France—d. Sept. 21, 1966, Paris) French politician and premier (1940). After serving in World War I, he served in the Chamber of Deputies (1919–24, 1928–40) and in cabinet positions (1930–32). As minister of finance (1938–40) and premier (1940), he called on France to resist Nazi Germany. After the German invasion, Reynaud resigned rather than conclude an armistice; he was arrested and kept in captivity (1940–45). He returned to the Chamber of Deputies (1946–62) and helped draft the constitution of the FIFTH REPUBLIC.

Reynolds, Sir Joshua (b. July 16, 1723, Plympton, Devon, Eng.—d. Feb. 23, 1792, London) British portrait painter. Son of a clergyman-schoolmaster, he was apprenticed to a London portraitist in 1740. His large group portrait *The Eliot Family* (c. 1746) reveals the influence of ANTHONY VAN DYCK. The impressions he gained during two years in Italy (1750–52), particularly in Venice, inspired his painting for the rest of his life. He established a portrait studio in London in 1753 and was immediately successful. His early London portraits introduced new vigour into English portraiture. After 1760, with the increasing vogue for Greco-Roman antiquity, his style became increasingly Classical and self-conscious. He was elected the first president of the Royal Academy in 1768. Through his art and teaching, Reynolds led British painting away from the anecdotal pictures of the early 18th century toward the formal rhetoric of continental academic painting. His *Discourses Delivered at the Royal Academy* (1769–90), advocating rigorous academic training and study of the Old Masters, ranks among the most important art criticism of the time.

Reynolds, Osborne (b. Aug. 23, 1842, Belfast, Ire.—d. Feb. 21, 1912, Watchet, Somerset, Eng.) British engineer and physicist. Educated at Cambridge University, he became the first professor of engineering at the University of Manchester (1868). Best known for his work in HYDRAULICS and hydrodynamics, he formulated the law of resistance in parallel channels (1883), the theory of LUBRICATION (1886), and the standard mathematical framework used in TURBULENCE work (1889). He studied wave engineering and tidal motions in rivers and made pioneering contributions to the concept of group velocity. The Reynolds stress in fluids with turbulent motion and the REYNOLDS NUMBER are named for him.

Reynolds American Inc. *formerly* **R.J. Reynolds Tobacco Holdings, Inc.** U.S.-based tobacco company. Its origins date to the establishment of Richard Joshua Reynolds's tobacco-plug factory in Winston, N.C., in 1875, producing plug tobacco (compressed cakes). The Reynolds Tobacco Co. became a major manufacturer of tobacco products, notably Camel, Winston, and Salem cigarettes. After embarking on a program of diversification in the 1960s, the firm adopted the name R.J. Reynolds Industries, Inc., in 1970 and purchased Nabisco Brands in 1985. The new company, named RJR Nabisco in 1986, was acquired in 1989 by Kohlberg Kravis Roberts & Co. (KKR) for $25 billion, the largest corporate transaction of its time. KKR divested its ownership in 1995. R.J. Reynolds returned to its primary business of tobacco marketing and merged with British-owned rival Brown & Williamson Tobacco Corp. in 2004 to create Reynolds American.

Reynolds number In FLUID MECHANICS, a number that indicates whether the flow of a fluid (liquid or gas) is absolutely steady (in streamlined, or LAMINAR FLOW) or on the average steady with small, unsteady changes (in turbulent flow; see TURBULENCE). The Reynolds number, abbreviated N_{Re} or Re, has no dimensions (see DIMENSIONAL ANALYSIS) and is defined as the size of the flow—as, for example, the diameter of a tube (D) times the average speed of flow (v) times the mass density of the fluid (ρ)—divided by its absolute VISCOSITY (μ). OSBORNE REYNOLDS demonstrated in 1883 that the change from laminar to turbulent flow in a pipe occurs when the value of the Reynolds number exceeds 2,100.

Rg Veda See RIG VEDA

Rh blood-group system System for classifying BLOOD according to presence or absence of the Rh ANTIGEN (factor) in ERYTHROCYTES. Rh-negative persons who receive Rh-positive BLOOD TRANSFUSIONS produce ANTIBODIES to Rh factor, which attack red blood cells with the factor if they are ever received again, causing serious illness and sometimes death. The antibodies also attack the red cells of an Rh-positive fetus carried by an Rh-negative woman if she has had a previous Rh-positive transfusion or pregnancy (see ERYTHROBLASTOSIS FETALIS). The Rh-negative trait is rare worldwide but more common in some ethnic groups. See also BLOOD TYPING.

rhabdovirus \ˌrab-dō-'vī-rəs\ Any of a group of VIRUSES responsible for RABIES and vesicular stomatitis (an acute disease of cattle and horses, characterized by blisters in and about the mouth, that resembles foot-and-mouth disease). The bullet-shaped virus particle is encased in a fatty membrane and contains RNA.

Rhaetia See RAETIA

Rhaetian \'rē-tēən\ **Alps** Segment of the central ALPS located mainly in Switzerland but also extending along the Italian-Swiss and Austrian-Swiss borders. Bernina Peak, on the Italian border, is the highest point, at elevation 13,284 ft (4,049 m). In the eastern section is the Swiss National Park, founded in 1914, with an area of 65 sq mi (169 sq km); it is known for its rugged Alpine scenery and its wildlife.

Rhagae *or* **Ragae** \'rā-jē\ *Persian* **Rey** Ancient city, MEDIA. It was formerly one of the great cities of Iran; its ruins are at modern Rey, near TEHRĀN. Settlement there dates from the 3rd millennium BC. Under the SĀSĀNIAN DYNASTY (3rd–7th centuries AD), it was a centre of ZOROASTRIANISM. It was captured by the Muslims in AD 641. It grew in importance until the 12th century, when it was weakened by religious conflicts. In 1220 it was destroyed by the MONGOLS, and its inhabitants were massacred. It was famous for its decorated silks and for ceramics. The ʿAbbāsid caliph HĀRŪN AL-RASHĪD, memorialized in *THE THOUSAND AND ONE NIGHTS*, was born there c. 765. The only remaining architectural features are two towers.

Rhazes See al-RĀZĪ

Rhea \'rē-ə\ Greek goddess, one of the TITANS. Daughter of URANUS and GAEA, she married her brother CRONUS, who swallowed all their children except ZEUS, whom Rhea concealed. Zeus then overcame Cronus and restored his siblings.

rhea \'rē-ə\ Either of two ostrich-like species of South American three-toed RATITE birds (family Rheidae). The common rhea (*Rhea americana*) is about 4 ft (120 cm) tall and weighs about 50 lbs (20 kg). It has luxuriant plumage, brown or gray above and whitish below. Darwin's rhea (*Pterocnemia pennata*) is smaller and has white-tipped brownish plumage. Rheas live in open country, often among grazing animals, and run from predators. They eat a wide variety of plants and animals. Both species are listed as endangered.

Rhee, Syngman (b. March 26, 1875, Whang-hae, Korea—d. July 19, 1965, Honolulu, Hawaii, U.S.) First president of the Republic of KOREA (South Korea). The first Korean to earn a Ph.D. at a U.S. university (Princeton), he returned to Korea in 1910, the year Japan annexed Korea. Unable to hide his hostility toward Japanese rule, he left again for the U.S. in 1912. For the next 30 years he spoke out for Korean independence; in 1919 he was elected president of a provisional government in exile. As the only Korean leader well known to the U.S., Rhee was returned to Korea ahead of his rivals at the end of World War II; he was elected president of the Republic of Korea in 1948. He held that post until 1960, when opposition to his authoritarian policies (which included outlawing the opposition Progressive Party) forced his resignation. He died in exile.

Rheims See REIMS

rhesus \'rē-səs\ **monkey** Sand-coloured MACAQUE (*Macaca mulatta*), widespread in South and Southeast Asian forests. Rhesus monkeys are 17–25 in. (43–64 cm) long, excluding the furry 8–12-in. (20–30-cm) tail, and weigh 10–24 lb (4.5–11 kg). They eat fruits, seeds, roots, herbs, and insects. They are held sacred in some parts of India. Hardy in captivity, highly intelligent, and lively, they make good pets when young but may become bad-tempered as adults. They have been used frequently in medical research. The determination of the Rh (from rhesus) factor in human blood involves reaction with the blood of this species. See also RH BLOOD-GROUP SYSTEM.

Rhesus monkeys (*Macaca mulatta*).
YLLA—RAPHO/PHOTO RESEARCHERS

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rhetoric Art of speaking or writing effectively. It may entail the study of principles and rules of composition formulated by critics of ancient times, and it can also involve the study of writing or speaking as a means of communication or persuasion. Classical rhetoric probably developed along with democracy in Syracuse (Sicily) in the 5th century BC, when dispossessed landowners argued claims before their fellow citizens. Shrewd speakers sought help from teachers of oratory, called *rhetor*s. This use of language was of interest to philosophers such as PLATO and ARISTOTLE because the oratorical arguments called into question the relationships among language, truth, and morality. The Romans recognized separate aspects of the process of composing speeches, a compartmentalization that grew more pronounced with time. Renaissance scholars and poets studied rhetoric closely, and it was a central concern of humanism. In all times and places where rhetoric has been significant, listening and reading and speaking and writing have been the critical skills necessary for effective communication.

rheumatic \rü-ˈma-tik\ **fever** Generalized disease caused by certain types of STREPTOCOCCUS bacteria. It occurs mostly in children and young adults. Symptoms may be mild or severe. Sudden fever, joint pain, and inflammation may begin days to weeks after a streptococcal infection, usually of the throat (see PHARYNGITIS). Other symptoms may include skin nodules and rashes, CHOREA, abdominal pain, nosebleeds, and weight loss. HEART inflammation, with accompanying rapid heartbeat, murmurs, and enlargement, can lead to valve scarring, markedly shortening life. After recovery, survivors are prone to future attacks. PENICILLIN given when the initial infection is diagnosed can prevent it. Otherwise, SALICYLIC ACID derivatives or corticosteroids help the symptoms.

rheumatoid \ˈrü-mə-ˌtȯid\ **arthritis** Chronic, progressive AUTOIMMUNE DISEASE causing CONNECTIVE-TISSUE INFLAMMATION, mostly in synovial JOINTS. It can occur at any age, is more common in women, and has an unpredictable course. It usually starts gradually, with pain and stiffness in one or more joints, then swelling and heat. Muscle pain may persist, worsen, or subside. Membrane inflammation and thickening scars joint structures and destroys CARTILAGE. In severe cases, adhesions immobilize and deform the joints, and adjacent skin, bones, and muscles atrophy. If high-dose aspirin, ibuprofen, and other NSAIDs do not relieve pain and disability, low-dose corticosteroids may be tried. Physical medicine and rehabilitation with heat and then range-of-motion exercises reduce pain and swelling. Orthopedic appliances correct or prevent gross deformity and malfunction. Surgery can replace destroyed hip, knee, or finger joints with prostheses. There is also a juvenile form of the disease.

Rhiannon \hrē-ˈä-nōn\ Welsh manifestation of the Gaulish horse goddess EPONA and the Irish goddess Macha. She is best known from the MABINOGION, in which she makes her appearance on a pale, mysterious steed and meets King Pwyll, whom she marries. Unjustly accused of killing her infant son, she was forced to carry people on her back like a horse until she was vindicated by her son's return.

Rhine, Confederation of the See CONFEDERATION OF THE RHINE

Rhine River *German* **Rhein** River, western Europe. Rising in the Swiss ALPS, it flows north and west through western Germany to drain through the delta region of The Netherlands into the North Sea. It is 820 mi (1,319 km) long and navigable for 540 mi (870 km). Its many canals connect it with the RHÔNE, MARNE, and DANUBE river systems. It has been an international waterway since 1815 (see Congress of VIENNA). It has played a prominent part in German history and legend. During World War II its course was a major line of defense. Major cities along its banks include BASEL, MANNHEIM, KOBLENZ, COLOGNE, DUISBURG, and ROTTERDAM.

Rhineland *German* **Rheinland** Region of Germany. It is located west of the RHINE RIVER and encompasses the states of Saarland and Rhineland-Palantinate and portions of Baden-Württemberg, Hesse, and North Rhine–Westphalia. The chief city of the Rhineland is COLOGNE. In the 19th century the Rhineland became the most prosperous area of Germany. After World War I, Allied troops occupied portions of the area on the border with France, and it was the scene of recurrent crises and controversies during the 1920s. In 1936 ADOLF HITLER ordered German troops to enter the demilitarized zone of the Rhineland; weak objections by the Allies foreshadowed Hitler's later annexation of the SUDETENLAND.

rhinoceros Any of five extant African and Asian species (family Rhinocerotidae) of three-toed horned UNGULATES. One of the largest of all land animals (the white rhinoceros is second only to the elephant), the rhinoceros is particularly distinguished by one or two horns—growths of keratin, a fibrous hair protein—on its upper snout. All have thick, virtually hairless skin that, in the three Asian species, forms platelike folds at the shoulders and thighs. Rhinos grow to 8–14 ft (2.5–4.3 m) long and 3–6.5 ft (1.5–2 m) tall; adults weigh 3–5 tons. Most are solitary inhabitants of open grassland, scrub forest, or marsh, but the Sumatran rhino lives in deep forest. The African black rhino browses on succulent plants, the white and great Indian rhinos graze on short grasses, and the Sumatran and Javan rhinos browse on bushes and bamboo. In the second half of the 20th century, the rhinoceroses were brought to the brink of extinction by hunters, mostly seeking the horn, which is valued in Asia as an aphrodisiac. The white rhinoceros of Africa is no longer endangered, but the population of the other four species combined is only a few thousand, almost all of which live on reserves.

African black rhino (*Diceros bicornis*). CAMERA PRESS/PICTORIAL PARADE

rhinovirus \ˌrī-nō-ˈvī-rəs\ Any of a group of PICORNAVIRUSES capable of causing common COLDS in humans. The virus is thought to be transmitted to the upper respiratory tract by airborne droplets. Because of the great number of cold viruses, VACCINES against them are virtually impossible to develop. See also ADENOVIRUS.

rhizome Horizontal underground plant stem capable of producing the upward shoot and downward root systems of a new plant. This capability allows vegetative (asexual) propagation and enables plants to survive an annual unfavourable season underground. In some plants (e.g., WATER LILIES, many FERNS, and forest herbs), the rhizome is the only stem of the plant. In such cases, only the leaves and flowers are readily visible.

Rhode Island *officially* **Rhode Island and Providence Plantations** State (pop., 2000: 1,048,319), northeastern U.S. One of the NEW ENGLAND states and the smallest U.S. state, it covers 1,212 sq mi (3,139 sq km); its capital is PROVIDENCE. Rhode Island is bordered by Massachusetts on the north and east, and Connecticut on the west. The Rhode Island Sound on the south is the basis of the state's fishing industry. The original inhabitants of the area were Narragansett Indians. The first European settlement was in 1636 by ROGER WILLIAMS and his followers, who were banished from Massachusetts; in 1663 King CHARLES II granted a charter to Williams. Though it never officially joined the New England colonies in KING PHILIP'S WAR, it suffered greatly when many settlements were burned. It was at the forefront of the fight against British customs laws that led to the AMERICAN REVOLUTION. An original state of the Union, in 1790 it was the 13th state to ratify the Constitution, agreeing only after the BILL OF RIGHTS was included. The state's original charter remained in effect until Dorr's Rebellion (see THOMAS W. DORR) in 1842 led to extension of suffrage. The cotton-textile mill built by Samuel Slater in Pawtucket in 1790 initiated the Industrial Revolution in the U.S. Manufacturing is still important to the economy, and products include jewelry and silverware, textiles and clothing, and electrical machinery and electronics.

Rhode Island School of Design (RISD) One of the most eminent fine arts colleges in the U.S., located in Providence, R.I. It was founded in 1877 but did not offer college-level instruction until 1932. It combines professional arts training with a broad liberal arts curriculum, offering bachelor's and master's degrees in the design, fine arts, and other fields. Its art museum has extensive collections of American painting and decorative arts.

Rhodes *Greek* **Ródhos** \ˈrȯ-ˌthȯs\ Island of Greece. It is the largest island of the Dodecanese group and the most easterly in the Aegean Sea. Its main city, Rhodes (pop., 2001: 53,709), lies at the northern tip of the island. The earliest known settlers were the Dorians c. 1000 BC. During the Classical period the island's affiliations vacillated between Athens, Sparta, and Persia in attempts to preserve a balance of power. A devastating earthquake c. 225 BC destroyed the Colossus of RHODES, one of the SEVEN WONDERS OF THE WORLD. In the medieval period Rhodes was occu-

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pied by the Byzantines, Muslims, and Knights of St. John (see KNIGHTS OF MALTA). The knights converted the island into a fortress and held it for two centuries until 1523, when the Turks took control. In 1912 it was taken from Turkey by Italy, and in 1947 it was awarded by treaty to Greece. A year-round tourist industry has brought prosperity to the island.

Rhodes, Alexandre de (b. March 15, 1591, Avignon, France—d. March 5, 1660, Eṣfahān, Iran) French missionary, the first Frenchman to visit Vietnam. He established a Jesuit mission in the region in 1619 and later estimated that he had converted some 6,700 Vietnamese to Roman Catholicism. Expelled in 1630, he spent 10 years teaching philosophy in Macau before returning, only to be exiled again in 1646. The Vatican sponsored a Vietnamese missionary program in 1658 based on de Rhodes's ideas, but he himself was sent to Iran (Persia), where he died. He wrote a Vietnamese-Latin-Portuguese dictionary and perfected the romanized script Quoc-ngu (developed by earlier missionaries), which facilitated communicating Christian doctrines to the Vietnamese and increased the literacy rate among the population.

Rhodes, Cecil (John) (b. July 5, 1853, Bishop's Stortford, Hertfordshire, Eng.—d. March 26, 1902, Muizenberg, Cape Colony) Financier, statesman, and empire builder of British South Africa. Rhodes grew up in the English countryside and in 1871 was sent to assist his brother in business in South Africa, where he became interested in diamond mining. He founded DE BEERS CONSOLIDATED MINES (1888), and by 1891 his company was mining 90% of the world's diamonds. Seeking expansion to the north and dreaming of building a Cape-to-Cairo railway, he persuaded Britain to establish a protectorate over Bechuanaland (1884), clashing with Boer president PAUL KRUGER. He obtained digging concessions from LOBENGULA (1889), but in 1893 Rhodes overran him militarily. At his instigation Britain chartered the British South Africa Co. (1889) and put Rhodes in charge. He extended the company's control to two northern provinces, which were eventually named after him as Southern Rhodesia (now Zimbabwe) and Northern Rhodesia (now Zambia). Interested in the mineral-rich TRANSVAAL, he plotted to overthrow Kruger (1895); the attempt was botched by LEANDER STARR JAMESON, and Rhodes was forced to resign as prime minister of Cape Colony and head of the British South Africa Co. His last years were marked by disappointment and scandal brought about by the scheming of Princess Radziwiłł. His will bequeathed most of his fortune to establishing the RHODES SCHOLARSHIP.

Rhodes, Colossus of Enormous bronze statue of the sun god Helios that towered more than 100 ft (30 m) over the harbour at the city of Rhodes in Greece. The work of Chares of Lindos, the statue commemorated the raising of Demetrios Poliorcetes' long siege of Rhodes (305–304 BC). One of the SEVEN WONDERS OF THE WORLD, it was toppled by an earthquake c. 225 BC. The fallen Colossus was left in place until AD 653, when raiding Arabs broke up its remains and sold the bronze for scrap.

Colossus of Rhodes, constructed c. 292–280 BC, wood engraving reconstruction by Sidney Barclay, c. 1875.
HISTORICAL PICTURES SERVICE, CHICAGO

Rhodes scholarship Grant to attend the University of OXFORD. The program was established in 1902 by the will of CECIL RHODES. Until 1976, candidates had to be unmarried male residents in a Commonwealth country, the U.S., or South Africa. In 1976 women were accepted. Two candidates each year are also chosen from Germany. The scholarships, which are highly competitive, are usually for two years.

Rhodesia Region, south-central Africa, now divided into ZIMBABWE in the south and ZAMBIA in the north. Named after British colonial administrator CECIL RHODES, it was administered by the British South Africa Company in the 19th century and exploited mostly for its gold, copper, and coal deposits. In 1911 it was divided into Northern and Southern Rhodesia; Southern Rhodesia became a self-governing British colony (1923) and Northern Rhodesia a British protectorate (1924). They joined with Nyasaland to become the Federation of Rhodesia and Nyasaland (1953–63). See also MALAWI.

Rhodesia See ZIMBABWE

Rhodesian ridgeback *or* **African lion dog** South African hound breed characterized by a narrow band of hair growing forward along its back, against the direction of the rest of the coat. The ridge is inherited from a half-wild local hunting dog that was crossbred with European dogs. Strong, active, and of great endurance, it is trim and short-haired, with hanging ears and a glossy brown coat. It stands 24–27 in. (61–69 cm) and weighs 65–75 lbs (30–34 kg). It is an able guard and hunter (especially of lions) and a good companion.

Rhodesian ridgeback.
WALTER CHANDOHA

Rhodian Sea Law \'rō-dē-ən\ Regulations governing trade and navigation in the Byzantine Empire. Based on a statute in the Code of JUSTINIAN and on ancient maritime law in Rhodes, the Rhodian Sea Law focused on liability for lost or damaged cargo. It divided the cost of the losses among the shipowner, the owners of the cargo, and the passengers, thus serving as a form of insurance against storms and piracy. It was effective from the 7th through the 12th century.

rhodium Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol Rh, atomic number 45. Chemically related to PLATINUM, it is a precious, silver-white metal mainly used as an alloying agent for the latter element. Rhodium added to platinum in small amounts yields alloys that are harder and that lose mass at high temperatures more slowly than pure platinum. Such alloys are used for laboratory furnace crucibles, spark-plug electrodes, CATALYSTS in very hot chemical environments (including automobile CATALYTIC CONVERTERS), and high-temperature THERMOCOUPLES. Because rhodium resists tarnishing at ordinary temperatures and is highly reflective, it is in demand as a surface electroplating for jewelry and other decorative articles. The plated metal is also used for reflecting surfaces in optical instruments.

rhodochrosite \ˌrō-də-'krō-ˌsīt\ CARBONATE MINERAL composed of manganese carbonate ($MnCO_3$), a source of MANGANESE for the ferromanganese alloys used in steel production. It is commonly found in ore veins formed at moderate temperatures, in high-temperature metamorphic deposits, and in sedimentary deposits.

rhododendron \ˌrō-də-'den-drən\ Any of about 800 diverse species of woody plants that make up the genus *Rhododendron* in the HEATH FAMILY, notable for their attractive flowers and handsome foliage. They are native chiefly in the northern temperate zone, especially in South Asia and Malaysia. Some are evergreens, others deciduous. Some are low-growing ground covers; others are tall trees. Flowers are usually tubular to funnel-shaped and occur in a wide range of colours: white, yellow, pink, scarlet, purple, and blue. See also AZALEA.

rhodonite \'rō-də-ˌnīt\ SILICATE MINERAL that occurs in various MANGANESE ores, often with RHODOCHROSITE. A manganese silicate, $MnSiO_3$, with small amounts of iron and calcium, it is found in the Ural Mountains, Sweden, Australia, California, New Jersey, and elsewhere. Rhodonite is the primary source of some important manganese oxide deposits, such as the manganese ores of India. Fine-grained rhodonite of clean, pink colour is a desirable gem and ornamental stone.

Rhodonite from Pajsberg, Swed.
COURTESY OF THE FIELD MUSEUM OF NATURAL HISTORY, CHICAGO; PHOTOGRAPH, JOHN H. GERARD

Rhodope \'rä-də-pē\ **Mountains** Mountain range, BALKAN PENINSULA, southeastern Europe. Extending southeast from Bulgaria through Macedonia and Greece, the range is drained by tributaries of the MARITSA RIVER. It forms an important climatic barrier, protecting the Aegean low-

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lands from cold northerly winds. The mountains were a refuge for Slavic peoples during the period of Turkish rule (15th–19th century), and ancient customs survive. The lakes, river valleys, and extensive forests form the basis of a tourist industry.

rhodopsin \rō-'däp-sən\ *or* **visual purple** Light-sensitive, purple-red organic pigment contained in the rod cells of the RETINA that allows the EYE to see in black and white in dim light. It is composed of opsin, a PROTEIN, linked to retinal, a conjugated molecule (see CONJUGATION) formed from VITAMIN A. PHOTONS of light that enter the eye are absorbed by retinal and cause it to change its CONFIGURATION, starting a biochemical chain of events that ends with impulses being sent along the optic nerve to the brain. In bright light, to protect rod cells from overstimulation, rhodopsin breaks down into retinal and opsin, both of which are colourless. In dim light or darkness the process is reversed (dark adaptation), and purple-red rhodopsin is reformed. Similar light-sensitive compounds made of retinal and other opsin proteins are the pigments in the retina's cone cells responsible for colour vision in bright light.

Rhône River River, Switzerland and France. A historic southern gateway, as well as the only major European river flowing directly to the Mediterranean Sea, the Rhône is 505 mi (813 km) long and navigable for about 300 mi (485 km). It is Alpine in character, and its course has been shaped by neighbouring mountain systems. Rising in the Swiss ALPS, it flows into Lake GENEVA, then crosses into France through the JURA Mountains. It continues south through LYON, AVIGNON, and Tarascon to ARLES and enters the Mediterranean west of MARSEILLE.

rhubarb Any of several species of the genus *Rheum* (family Polygonaceae), especially *R. rhaponticum* (or *R. rhabarbarum*), a hardy perennial grown for its large, succulent, edible leafstalks. Rhubarb is best adapted to the cooler parts of the temperate zones. The fleshy, tart, and highly acid leafstalks are used in pies, compotes and preserves, and sometimes as the base of a wine or an aperitif. The roots withstand cold well. The huge leaves that unfold in early spring are toxic to cattle and humans; later in the season a large central flower stalk may bear numerous small, greenish-white flowers and angular, winged fruits. Rhubarb root has long been considered to have cathartic and purgative properties.

Rhubarb (*Rheum rhaponticum*)
DEREK FELL

rhyme Type of echoing produced by the close placement of two or more words with similarly sounding final syllables. Rhyme is used in poetry (and occasionally in prose) to produce sounds that appeal to the ear and to unify and establish a poem's stanzaic form. End rhyme (i.e., rhyme used at the end of a line to echo the end of another line) is most common, but internal rhyme (occurring before the end of a line) is frequently used as an embellishment. Types of "true rhyme" include masculine rhyme, in which the two words end with the same vowel-consonant combination (stand/land); feminine rhyme (or double rhyme), in which two syllables rhyme (profession/discretion); and trisyllabic rhyme, in which three syllables rhyme (patinate/latinate).

rhyolite \'rī-ə-ˌlīt\ IGNEOUS ROCK that is the volcanic equivalent of GRANITE, whose chemical composition is similar. Rhyolites are known from all parts of the Earth and from all geologic ages; they are found mostly on the continents or their immediate margins, but small quantities have been described from remote islands.

Rhys \'rēs**, Jean** *orig.* **Ella Gwendolen Rees William** (b. Aug. 24, 1890, Roseau, Dominica, Windward Islands, West Indies—d. May 14, 1979, Exeter, Devon, Eng.) Dominican-born British novelist. Rhys left the West Indies for London to study acting at age 16. She later moved to Paris, where she was encouraged to write by FORD MADOX FORD. She earned acclaim for short stories and novels set in the bohemian world of Europe in the 1920s and '30s, including *Good Morning, Midnight* (1939). After settling in Cornwall, she published nothing for nearly three decades before producing *Wide Sargasso Sea* (1966), a memorable novel about Mr. Rochester's mad first wife in Charlotte Brontë's *Jane Eyre* (see BRONTË SISTERS); and two story collections.

rhythm and blues (R&B) Any of several closely related musical styles developed by African American artists. The various styles were based on a mingling of European influences with JAZZ rhythms and tonal inflections, particularly syncopation and the flatted blues chords. They grew out of the BLUES of the rural South, which blended work chants with songs of deep emotion, and were greatly influenced by GOSPEL MUSIC. Three major forms were distinguishable. The earliest, called *race*, was the style of the "jump" band, which emphasized strong rhythm, solo work (especially by saxophones), and vocals in a shout-blues manner. A second form, often called *Chicago blues*, was exemplified by performers such as MUDDY WATERS and was typically played by a small group with amplified instruments. The third major form was primarily vocal, featuring close, gospel-influenced harmonies often backed by an orchestra. In the mid-1950s the term *rhythm and blues* was adopted by the music industry for music intended for the African American audience; with the gradual disappearance of racial barriers, the Chicago blues style began to seem less a vital form than a folk tradition, while the gospel style was transformed into the SOUL MUSIC of vast appeal. Rhythm and blues was the chief antecedent of ROCK MUSIC.

rhythm and metre Two aspects of the organization of time in music. Rhythm is the placement of musical sounds in time. Metre, like poetical METRE, is usually a regular pattern of beats and provides the context in which rhythm is understood. In Western notated music, metre is indicated by means of a time signature—in which the lower number specifies the basic unit or subunit of the beat (e.g., 8 usually indicates that eighth-notes are the basic subunit) and the upper number specifies the number of beats in a measure—at the beginning of a piece or movement, and by the vertical bar lines that divide the piece into measures.

rhythmic sportive gymnastics Athletic competition related to GYMNASTICS and dance in which participants, individually or in groups, perform exercise routines with the aid of hand apparatuses such as ropes, hoops, balls, clubs, and ribbons. In scoring points, artistry counts more than acrobatics. The sport dates from the 18th century. Though some gymnasts participated at the Olympic Games from 1948 to 1956, not until 1984 did it become an official Olympic competitive event.

Ribalta \rē-'bäl-tä**, Francisco** (b. 1565, Castellón de la Plana, Spain—d. Jan. 12, 1628, Valencia) Spanish painter. His early works are MANNERIST. After settling in Valencia in 1598, he developed a darker and more naturalistic style (e.g., his *Santiago* altarpiece, 1603) under the influence of CARAVAGGIO. After 1612 he achieved originality and grandeur in such paintings as *Christ Embracing St. Bernard.* His later paintings, marked by powerfully modeled forms, simplicity of composition, and naturalistic lighting, anticipate the work of DIEGO VELÁZQUEZ, FRANCISCO ZURBARÁN, and JOSÉ DE RIBERA.

Ribāṭ See RABAT

Ribaut \rē-'bō**, Jean** (b. c. 1520, Dieppe, France—d. Oct. 12, 1565, Florida) French naval officer and colonizer. He served in the French navy under Gaspard II de COLIGNY, who in 1562 sent him to found a French Huguenot colony in Florida. He landed at the mouth of the St. Johns River (Florida), then sailed north to establish Charlesfort (now in South Carolina). He returned to France, then was sent back to Florida (1565) to reinforce the French colony of Fort Caroline on the St. Johns River. Spanish claims to the region led to the attack and destruction of the colony by PEDRO MENÉNDEZ DE AVILÉS, who massacred the French, including Ribaut.

Ribbentrop \'ri-bən-ˌträp**, Joachim von** (b. April 30, 1893, Wesel, Ger.—d. Oct. 16, 1946, Nürnberg) German diplomat and foreign minister under the Nazi regime. After serving in World War I, he became a wine merchant. He met ADOLF HITLER in 1932 and became his chief adviser on foreign affairs. He negotiated the ANGLO-GERMAN NAVAL AGREEMENT and served as ambassador to Britain (1936–38), advising Hitler that Britain could not aid Poland effectively. As foreign minister (1938–45), he negotiated the Pact of Steel with Italy, the GERMAN-SOVIET NONAGGRESSION PACT, and the Tripartite Pact with Japan and Italy. His influence waned in World War II, after which he was found guilty at the NÜRNBERG TRIALS and hanged.

Ribble, River River, northwestern England. It is 75 mi (120 km) long. It rises in North Yorkshire and flows south and west through Lancashire into the Irish Sea through an estuary extending from PRESTON. The channel to the Irish Sea coast has been straightened to provide a shipping lane to Preston.

Ribera \rē-'ber-ə**, José de** *or* **Jusepe de Ribera** (baptized Feb. 17, 1591, Játiva, Spain—d. Sept. 2, 1652, Naples) Spanish painter and

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printmaker. Though born in Spain, where he is said to have trained under Francisco Ribalta, he spent most of his life in Naples (then a Spanish possession). Most of his works are of religious subjects. Dramatic light and shadow and sometimes horrific detail emphasize the mental and physical suffering of penitent or martyred saints, as in *The Martyrdom of St. Bartholomew* (c. 1630). In later works his modeling is softer, his colours are richer, and he demonstrates strong human sympathy, as in *The Clubfooted Boy* (1642). His etchings are among the finest produced in Italy and Spain in the Baroque period.

riboflavin \ˌrī-bə-ˈflā-vən\ *or* **vitamin B_2** Yellow, water-soluble organic compound, abundant in whey and egg white. It has a complex structure incorporating three rings. Green plants and most microorganisms can synthesize it; animals need to acquire it in their diet. It exists in combined forms as coenzymes and functions in the metabolism of carbohydrates and amino acids. A syndrome resembling pellagra is thought to result from riboflavin deficiency. See also flavin.

ribose \ˈrī-ˌbōs\ Five-carbon sugar found in RNA. (In DNA the corresponding sugar is the closely related deoxyribose.) A ribose molecule combined with adenine, guanine, cytosine, or uracil forms a nucleoside; adding a phosphate group forms a nucleotide. The ribose of one nucleotide joins with the phosphate of the next to form the RNA backbone. Ribose phosphates are components of various coenzymes and are used by microorganisms in synthesizing histidine.

ribosome \ˈrī-bə-ˌsōm\ Tiny particle, the site of protein synthesis, that is present in large numbers in living cells. They occur both as free particles within cells and, in eukaryotes, as particles attached to the membranes of the endoplasmic reticulum. They are 40% protein and 60% RNA. Ribosomes account for a large proportion of the total RNA of a cell. Proteins newly formed on ribosomes detach and migrate to other parts of the cell to be used.

Ricardo, David (b. April 18/19, 1772, London, Eng.—d. Sept. 11, 1823, Gatcombe Park, Gloucestershire) British economist. The son of a Dutch Jew, he followed his father into the London stock exchange, where he made a fortune before turning to the study of political economy, in which he was influenced by the writings of Adam Smith. His writings in support of a metal currency standard were influential. In his major work, *The Principles of Political Economy and Taxation* (1817), he examined the movement of wages and the determination of value, asserting that the domestic values of commodities were largely determined by the labour required for their production. His *Iron Law of Wages* stated that attempts to improve the real income of workers were futile and that wages tended to stabilize at subsistence level. Though many of his ideas are obsolete, he was a major figure in the development of classical economics and is credited as the first person to systematize economics.

Ricci \ˈrēt-chē**, Matteo** (b. Oct. 6, 1552, Macerata, Papal States—d. May 11, 1610, China) Italian Jesuit missionary who introduced Christianity to China. From a noble family, he was educated by the Jesuits, whose order he joined after studying law in Rome. He volunteered for missionary work overseas, arrived in Goa in 1578, and proceeded to China in 1582. China's interior was closed to foreigners when he arrived, but his willingness to adopt the Chinese language and culture gave him entry. In 1597 he was appointed director of Jesuit activities in China. In 1599 he settled in Nanjing, where he studied astronomy and geography. In 1601 he was finally admitted to Beijing, where he preached the Gospel, taught science to scholars, and translated Christian works into Chinese.

Riccio \ˈrēt-chō,\ *English* \ˈrich-ē-ˌō**, David** *orig.* **Davide Rizzio** (b. c. 1533, Pancalieri, near Turin, Piedmont—d. March 9, 1566, Edinburgh, Scot.) Secretary to Mary, Queen of Scots. The son of a musician, he accompanied the duke of Savoy's ambassador to Scotland and entered Mary's service as a musician (1561). He became her close adviser and helped arrange her marriage to Lord Darnley (1565). Disliked because of his arrogance, Riccio was an impediment to the Scottish nobles' plan to remove Mary. While at dinner in Mary's palace, he was seized by an armed band of nobles, including Lord Ruthven, and stabbed to death.

rice Edible starchy cereal grain and the annual grass (*Oryza sativa*, family Poaceae, or Gramineae) that produces it. Roughly one-half of the world's population, including almost all of East and Southeast Asia, depends on rice as its principal staple food. First cultivated in India more than 4,000 years ago, rice was planted gradually westward and is now cultivated widely in flooded fields (paddies) and river deltas of tropical, semitropical, and temperate regions. Growing to about 4 ft (1.2 m) in height, rice has long, flat leaves and an inflorescence made up of spikelets bearing flowers that produce the fruit, or grain. Removal of just the husk produces brown rice, containing 8% protein and a source of iron, calcium, and B vitamins. Removal of the bran layer leaves white rice, greatly diminished in nutrients. Enriched white rice has added B vitamins and minerals. So-called wild rice (*Zizania aquatica*) is a coarse annual grass of the same family whose cereal grain, now often considered a delicacy, has long been an important food of North American Indians.

Rice (*Oryza sativa*).
GRANT HEILMAN

Rice, Jerry (Lee) (b. Oct. 13, 1962, Starkville, Miss., U.S.) U.S. gridiron football player. He won All-America honours at Mississippi Valley State University. As a wide receiver for the San Francisco 49ers (1985–2000), he was part of three Super Bowl championship teams (1988, 1989, and 1994). Standing 6 ft 2 in. (1.9 m), Rice was larger than the typical NFL wide receiver of his era, and he used his size and strength to overmatch defenders; he was also an exceptional runner. He completed his career in 2005 as the all-time NFL leader in touchdowns (207), receptions (1,549), receiving yards (22,895), and combined yardage (23,546).

Rice University Private university in Houston, Texas, U.S. It was founded in 1891 and endowed by William Marsh Rice. It has schools of humanities, social sciences, architecture, music, natural sciences, and engineering and a graduate school of administration. It offers both undergraduate and graduate degrees in numerous fields.

Rich, Adrienne (Cecile) (b. May 16, 1929, Baltimore, Md., U.S.) U.S. poet, scholar, and critic. She was a student at Radcliffe College when her poems were chosen for publication in the Yale Younger Poets series; the resulting volume, *A Change of World* (1951), reflected her formal mastery. Her subsequent work traces a transformation from well-crafted but imitative poetry to a highly personal and powerful style. Her increasing commitment to the women's movement and a lesbian/feminist aesthetic influenced much of her work. Among her collections are *Diving into the Wreck* (1973, National Book Award) and *The Dream of a Common Language* (1978). She also wrote compelling books of nonfiction, including *Of Woman Born* (1976; National Book Award), *On Lies, Secrets, and Silence* (1979), and *What Is Found There* (1993).

Rich, Buddy *orig.* **Bernard Rich** (b. June 30/Sept. 30, 1917, Brooklyn, N.Y., U.S.—d. April 2, 1987, Los Angeles, Calif.) U.S. bandleader and drummer. Rich was a child-prodigy vaudeville performer known as "Baby Traps, the Drum Wonder." He played with several of the great swing bands, notably those of Artie Shaw (1939) and Tommy Dorsey (1939–42, 1944–46), before forming his own big band. In small ensembles, he worked with many of the greatest jazz musicians in concerts and recordings during the 1950s. The clarity and speed of his drumming made him legendary.

Richard I *known as* **Richard the Lionheart(ed)** *French* **Richard Coeur de Lion** (b. Sept. 8, 1157, Oxford, Eng.—d. April 6, 1199, Châlus, Duchy of Aquitaine) Duke of Aquitaine (1168–99) and Poitiers (1172–99) and king of England, duke of Normandy, and count of Anjou (1189–99). He inherited Aquitaine from his mother, Eleanor of Aquitaine. Denied real authority there, he rebelled against his father, Henry II (1173–74) and later enlisted Philip II of France in a successful campaign against Henry (1189). Crowned king of England on Henry's death that year, Richard embarked on the Third Crusade (1190), stopping in Sicily to name Tancred king and conquering Cyprus. He won victories in the Holy Land, but, after failing to gain Jerusalem, he signed a truce (1192) with Saladin. On his way home Richard was captured by Leopold of Austria and turned over to Henry VI of Germany, who imprisoned him until a ransom was paid (1194). Richard returned to England and reclaimed the throne from his brother John, then spent the rest of his life in Normandy fighting against Philip II.

Richard II (b. Jan. 6, 1367, Bordeaux—d. February 1400, Pontefract, Yorkshire, Eng.) King of England (1377–99). The grandson of Edward III,

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he inherited the throne during his boyhood, and his uncle John of Gaunt and other nobles dominated the government. The Black Death brought on economic problems, leading to the Peasants' Revolt (1381), which Richard quelled with false promises. His enemies among the nobility placed limits on his royal power (1386–89), but he later took revenge on them. He banished John of Gaunt's son, Henry, and confiscated his vast Lancastrian estates. While Richard was absent in Ireland, Henry invaded England (1399) and seized power as Henry IV. Richard was then forced to abdicate the throne. He was then imprisoned, and sometime in February 1400 he was executed; by means unknown.

Richard III (b. Oct. 2, 1452, Fotheringhay Castle, Northamptonshire, Eng.—d. Aug. 22, 1485, Bosworth, Leicestershire) Last Yorkist king of England. He was made duke of Gloucester in 1461 after his brother Edward of York had deposed the weak Lancastrian king Henry VI and assumed power as Edward IV. Richard and Edward were driven into exile in 1470 but returned and defeated the Lancastrians in 1471. On Edward's death (1483), Richard became protector for Edward's son, the 12-year-old King Edward V, but he usurped the throne and confined Edward and his little brother to the Tower of London, where they were murdered. Henry Tudor (later Henry VII) raised an army against Richard, who was defeated and killed at the Battle of Bosworth Field. Later Tudor histories and William Shakespeare's play *Richard III* painted Richard as a monster and were gross caricatures motivated by the new dynasty's need to denigrate its predecessor.

Richard, (Joseph Henri) Maurice (b. Aug. 4, 1921, Montreal, Que., Can.—d. May 27, 2000, Montreal) Canadian ice-hockey player. He played right wing for the Montreal Canadiens (1942–60) and became the first National Hockey League player to score 50 goals in a regular (50-game) season (1943–44). His nickname, "Rocket," reflected his speed and aggressive play. He was also noted for his clutch scoring and fiery temper.

Richards, I(vor) A(rmstrong) (b. Feb. 26, 1893, Sandbach, Cheshire, Eng.—d. Sept. 7, 1979, Cambridge, Cambridgeshire) English critic and poet. While a lecturer at Cambridge, Richards wrote influential works, including *Principles of Literary Criticism* (1924), in which he introduced a new way of reading poetry that led to the New Criticism. A student of psychology, he concluded that poetry performs a therapeutic function by coordinating various human impulses into an aesthetic whole. In the 1930s he spent much of his time developing Basic English, a language system of 850 basic words that he believed would promote international understanding. He taught at Harvard University from 1944.

Richards, (Isaac) Vivian (Alexander) (b. March 7, 1952, St. John's, Antigua) West Indian professional cricket player. Born into a sporting family, Richards appeared in his first Test match for the West Indies against India in 1974, but he came to prominence with a score of 192 while batting against India in his second Test that year. In 1976 Richards scored a record 1,710 runs. His 56-ball century (scoring 100 points on 56 balls bowled) in 1985 is a record in Test cricket. Richards played a vital role in the West Indies' two World Cup triumphs. He captained the West Indies in 50 Tests with 27 victories and holds the record for never having lost a series as captain. He was selected Wisden Cricketer of the Year in 1977 and was also one of the five cricketers of the century selected by Wisden in 2000. He began coaching the West Indies team upon his retirement as a player in 1991.

Richardson, Dorothy M(iller) (b. May 17, 1873, Abingdon, Berkshire, Eng.—d. June 17, 1957, Beckenham, Kent) English novelist. From age 17 she engaged in teaching, clerical work, and journalism. For much of her life she worked on her sequence novel *Pilgrimage*, comprising 13 volumes beginning with *Pointed Roofs* (1915). The final volume, *March Moonlight*, was published a decade after her death. A sensitive autobiographical account of a woman's developing consciousness, it was a pioneering work in stream-of-consciousness fiction.

Richardson, Henry Handel *orig.* **Ethel Florence Lindesay Richardson** (b. Jan. 3, 1870, Melbourne, Austl.—d. March 20, 1946, Fairlight, Sussex, Eng.) Australian-born English novelist. In 1888 she left Australia to study music in Germany, and she spent the rest of her life abroad, settling in England in 1904 with her husband, J.G. Robertson. *Maurice Guest* (1908), her antiromantic first novel, concerns a music student's disastrous love affair. Her masterpiece, *The Fortunes of Richard Mahony*, 3 vol. (1917–29), combining description of an Australian immigrant's life and work in the goldfields with a powerful character study, is considered the crowning achievement of modern Australian fiction to that time.

Richardson, Henry Hobson (b. Sept. 29, 1838, Priestley Plantation, La., U.S.—d. April 27, 1886, Brookline, Mass.) U.S. architect. He studied at Harvard University in Cambridge, Mass., and the École des Beaux-Arts in Paris. His designs for Boston's Brattle Square (1870–72) and Trinity (1872–77) churches won him a national reputation. He designed houses, libraries, suburban railroad stations, educational buildings, and commercial and civic structures. Instead of the narrow vertical proportions and Gothic features used by his contemporaries, he favoured horizontal lines, simple silhouettes, and large-scale Romanesque or Byzantine-inspired details. The Crane Memorial Library in Quincy, Mass. (1880–82), with its granite base, clerestory windows, tiled gable roof, and cavernous entrance arch, stands among his finest mature works. His Romanesque style had an integrity seldom achieved by his many imitators, and the functionalism of his designs presaged the work of Louis H. Sullivan.

Richardson, John (b. Oct. 4, 1796, probably Fort George, Upper Canada—d. May 12, 1852, New York, N.Y., U.S.) Canadian writer. His experience in the British army in the War of 1812 and later abroad provided material for some of his writings. The first Canadian novelist to write in English, he won acclaim with his third novel and only enduring work, *Wacousta* (1832), a gothic story about the Indian uprising led by Pontiac. His nonfiction includes *Personal Memoirs of Major Richardson* (1838) and *War of 1812* (1842).

Richardson, Sir Ralph (David) (b. Dec. 19, 1902, Cheltenham, Gloucestershire, Eng.—d. Oct. 10, 1983, London) British actor. He began his acting career at age 18 and gained prominence in the 1930s and '40s at the Old Vic in roles such as Peer Gynt, Petruchio, Falstaff, and Volpone, gaining a reputation as one of the greatest actors of his time. He made his screen debut in 1933 and became known for playing urbane, witty characters and later for eccentric old men. His many films included *The Fallen Idol* (1948), *Doctor Zhivago* (1965), and *Greystoke* (1984).

Richardson, Samuel (baptized Aug. 19, 1689, Mackworth, near Derby, Derbyshire, Eng.—d. July 4, 1761, Parson's Green, near London) English novelist. After moving with his family to London at age 10, Richardson was apprenticed to a printer before setting up in business for himself in 1721. He soon became quite prosperous. In the 1730s he began to edit and write pamphlets, and he eventually hit on the idea of writing a book using a series of letters on the same subject. His major novels were the epistolary novel *Pamela* (1740), about a servant who avoids seduction and is rewarded by marriage; and his huge masterpiece, *Clarissa*, 7 vol. (1747–48), a tragedy with multiple narrators that develops a profoundly suggestive interplay of opposed voices. *The History of Sir Charles Grandison* (1753–54), which blends moral discussion and a comic ending, influenced later writers, especially Jane Austen.

Richardson, Tony *orig.* **Cecil Antonio Richardson** (b. June 5, 1928, Shipley, Yorkshire, Eng.—d. Nov. 14, 1991, Los Angeles, Calif., U.S.) British director. With the English Stage Co. he won acclaim with John Osborne's *Look Back in Anger* (1956), and he led the company in reinterpreting classic plays and in productions of Eugène Ionesco and Samuel Beckett. His experimental productions stimulated a renewal of creative vitality on the British stage during the 1950s. He directed *The Entertainer* (1958) and *A Taste of Honey* (1960) on Broadway. He and Osborne formed a film company (1958), which produced screen versions of Osborne's plays as well as *The Loneliness of the Long Distance Runner* (1962) and *Tom Jones* (1963, Academy Award). His later films include *The Charge of the Light Brigade* (1968), *Ned Kelly* (1970), and *Blue Sky* (1993). He was married to Vanessa Redgrave; their daughters, Miranda and Joely Richardson, are both film actresses.

Richelieu \'ri-shə-ˌlü,\ *French* \rē-shə-'lyœ\, **Armand-Jean du Plessis, cardinal and duke de** (b. Sept. 9, 1585, Richelieu, Poitou, France—d. Dec. 4, 1642, Paris) French statesman and chief minister to Louis XIII. Born to a minor noble family, he was ordained a priest in 1607 and became bishop of Luçon.

Cardinal de Richelieu, detail of a portrait by Philippe de Champaigne; in the Louvre, Paris.
GIRAUDON/ART RESOURCE, NEW YORK

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As the first bishop in France to implement reforms decreed by the Council of Trent, he brought order to a diocese ruined by the Wars of Religion. In 1614 he was elected a deputy of the clergy in the Estates-General, where he was noted as a conciliatory force. He became an adviser to Marie de Médicis in 1616 and later councillor to her son, Louis XIII. Named a cardinal in 1622, he served as chief minister from 1624 and became the controlling influence in France's policies. He established royal absolutism in France by suppressing the political power of the Huguenots and reducing the influence of the nobles. In foreign policy, he sought to weaken Habsburg control of Europe and involved France in the Thirty Years' War. Devious and brilliant, he increased the power of the Bourbon dynasty and established orderly government in France. He also founded the Académie Française and rebuilt the Sorbonne.

Richelieu River \'ri-shə-ˌlü\ River, southern Quebec. It is 210 mi (338 km) long and flows north from Lake Champlain to join the St. Lawrence River at Sorel. Explored in 1609 by Samuel de Champlain, it was used by the warring French and English colonists and later by commercial loggers and fishermen. A canal enables shallow-draft vessels to navigate between Montreal and New York City via the St. Lawrence and Richelieu rivers, Lake Champlain, and the Hudson River.

Richler, Mordecai (b. Jan. 27, 1931, Montreal, Que., Can.—d. July 3, 2001, Montreal) Canadian novelist. He grew up in a Jewish working-class neighbourhood in which many of his novels are set. In 1951–52 he lived in Paris, where he was influenced by existentialism; he later lived in England. *The Apprenticeship of Duddy Kravitz* (1959) is a bawdy account of a Jewish boy in Montreal and his transformation into a ruthless businessman. His later novels include *Joshua Then and Now* (1980) and *Solomon Gursky Was Here* (1989). He also wrote children's books featuring the character Jacob Two-Two.

Richmond City (pop., 2000: 197,790), capital of Virginia, U.S. Located in the east-central part of the state, on the James River, Richmond was established as a trading post in 1637 and incorporated as a town in 1742. It became the state capital in 1779 and played an important role in the American Revolution. During the American Civil War it was the capital of the Confederate States of America. It was taken by Gen. Ulysses S. Grant in 1865, and much of the business district was burned. It is now a major tobacco market and commercial and government centre; its universities include the University of Richmond (founded 1830) and Virginia Commonwealth University (1838).

Richter \'rik-tər**, Conrad (Michael)** (b. Oct. 13, 1890, Pine Grove, Pa., U.S.—d. Oct. 30, 1968, Pottsville, Pa.) U.S. short-story writer and novelist. He began as an editor and reporter and founded a juvenile magazine before moving to New Mexico in 1928. He became fascinated with U.S. history and spent years researching frontier life. He is best known for *The Sea of Grass* (1936), an epic on the settling of the Southwest, and for his trilogy of pioneer life, *The Trees* (1940), *The Fields* (1946), and *The Town* (1950, Pulitzer Prize). *The Waters of Kronos* (1960, National Book Award) is an autobiographical novel.

Richter \'rik-tər**, Curt Paul** (b. Feb. 20, 1894, Denver, Colo., U.S.—d. Dec. 21, 1988, Baltimore, Md.) U.S. biologist. He received a Ph.D. from Johns Hopkins University. He introduced the concept of the biological clock in a 1927 paper on animals' internal cycles (see biological rhythm). He theorized that ancient peoples' discovery of fire changed their habits, resulting in brain-structure changes that increased their ability to learn and communicate. He helped discover relationships between behaviour and biochemistry governing sleep, stress, and disease onset.

Richter, Gerhard (b. Feb. 9, 1932, Dresden, Ger.) German painter. Beginning in the early 1960s, Richter created paintings that were faithful enlargements of black-and-white photographs, often family snapshots and landscapes; he would continue this pursuit throughout his career. In the 1970s he also created monochromatic paintings, which explored the act of painting at its purest, while by the 1980s he experimented with an expressionistic, gestural style. Notably, Richter never allied himself to one movement—he has been alternatively described as a Pop artist, Minimalist, and postmodernist. Instead, he has consistently carried out a rigorous, personal exploration of the process of painting.

Richter, Sviatoslav (Teofilovich) (b. March 20, 1915, Zhitomir, Ukraine, Russian Empire—d. Aug. 1, 1997, Moscow, Russia) Ukrainian pianist of German descent. He became accompanist to the Odessa Opera at age 15 and began conducting there at 18. In 1949, two years after he graduated from the Moscow Conservatory, he won the Stalin Prize. He toured Europe, China, Japan, and the U.S., becoming legendary for the powerful technique and fiery energy in his solo performances. Highly regarded as an accompanist and chamber player as well, he made celebrated trio recordings with Mstislav Rostropovich and David Oistrakh.

Richter scale \'rik-tər\ Widely used measure of the magnitude of an earthquake, introduced in 1935 by U.S. seismologists Beno Gutenberg (1889–1960) and Charles F. Richter (1900–1985). The scale is logarithmic, so that each increase of one unit represents a 10-fold increase in magnitude (amplitude of seismic waves). The magnitude is then translated into energy released. Earthquakes that are fainter than the ones originally chosen to define magnitude zero are accommodated by using negative numbers. Though the scale has no theoretical upper limit, the most severe earthquakes have not exceeded a scale value of 9. The moment magnitude scale, in use since 1993, is more accurate for large earthquakes; it takes into account the amount of fault slippage, the size of the area ruptured, and the nature of the materials that faulted.

Richthofen \'rikt-ˌhō-fən**, Manfred, baron von** *known as* **the Red Baron** (b. May 2, 1892, Breslau, Ger.—d. April 21, 1918, Vaux-sur-Somme, France) German World War I ace. Born to a famous and wealthy family, he began his military career in 1912 as a cavalry officer. In 1915 he transferred to the air force and in 1916 took command of a fighter group that came to be known as "Richthofen's Flying Circus" for its decorated scarlet planes. He had been acclaimed Germany's greatest aviation ace, credited with shooting down 80 enemy airplanes, before he himself was shot down at age 25.

Manfred, Freiherr (baron) von Richthofen.
PICTORIAL PARADE

Ricimer \'ri-sə-mər\ *orig.* **Flavius Ricimer** (d. Aug. 18, 472) Roman general. The son of a Visigothic princess and a Germanic chieftain, he rose high in the Roman army, but he was barred from the imperial throne as a barbarian and instead became a kingmaker in the empire. He defeated the Vandals in Sicily and deposed the emperor Avitus for Majorian (457), who elevated him to consul. In 461 Ricimer deposed and executed Majorian and appointed Libius Severus as Western emperor. The Eastern emperor later made Anthemius ruler in the West, but Ricimer elevated Olybrius (472) and killed Anthemius.

Rickenbacker, Eddie *orig.* **Edward Rickenbacher** (b. Oct. 8, 1890, Columbus, Ohio, U.S.—d. July 23, 1973, Zürich, Switz.) U.S. World War I ace and industrialist. He developed an early interest in automobiles, and by the time the U.S. entered the war in 1917 he was one of the country's top racing drivers. He began army service as a driver and soon became a fighter pilot. For shooting down 26 enemy airplanes in World War I, he was awarded the Medal of Honor. He later founded and directed his own automobile company, and from 1932 he was an executive with several airlines. As president of Eastern Air Lines from 1938 to 1959, he oversaw its growth into a major corporation.

rickets *or* **vitamin D deficiency** Disease of infancy and childhood characterized by defective bone growth due to lack of vitamin D. Calcium phosphate is not properly deposited in the bones, which become soft, curved, and stunted. Early symptoms include restlessness, profuse sweating, lack of limb and abdominal-muscle tone, soft skull bones, and developmental delays. Muscles may cramp and twitch. Without early treatment, effects may include bowlegs, knock-knees, and beadiness where the ribs meet the breastbone. A narrow chest and pelvis can later increase susceptibility to lung diseases and impede childbirth. Treatment is with high-dose vitamin D supplementation, sunlight, and a balanced diet. Adding vitamin D to milk has reduced rickets in high-latitude areas where the skin cannot produce enough.

Ricketts, Howard T(aylor) (b. Feb. 9, 1871, Findlay, Ohio, U.S.—d. May 3, 1910, Mexico City, Mex.) U.S. pathologist. He received his medical degree from Northwestern University. He discovered the bacterium

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(named RICKETTSIA) that causes ROCKY MOUNTAIN SPOTTED FEVER and epidemic TYPHUS. He demonstrated in 1906 that the former could be transmitted by the bite of a certain tick and identified a bacterium in the blood of infected animals, in the ticks, and in their eggs. He found that epidemic typhus in Mexico was transmitted by a louse and found a related bacterium in the victim's blood and in the lice. He transmitted the disease to monkeys, which developed immunity. He died of typhus later that year.

rickettsia \ri-'ket-sē-ə\ Any of the rod-shaped BACTERIA that make up the family Rickettsiaceae (named for HOWARD RICKETTS). They are rod-shaped or variably spherical, and most are gram-negative (see GRAM STAIN). Natural parasites of certain ARTHROPODS, they can cause serious diseases in humans and other animals, to which they are usually transmitted by a bite from an arthropod carrier. Because certain species can survive considerable drying, rickettsias can also be transmitted when arthropod feces are inhaled or enter the skin through abrasion. TYPHUS, trench fever, and ROCKY MOUNTAIN SPOTTED FEVER are rickettsial infections. The most effective treatment includes timely and prolonged administration of broad-spectrum antibiotics.

Rickey, Branch (Wesley) (b. Dec. 20, 1881, Stockdale, Ohio, U.S.—d. Dec. 9, 1965, Columbia, Mo.) U.S. baseball executive. Rickey began playing professional baseball while a student at Ohio Wesleyan University. In 1917 he began a long association with the St. Louis Cardinals (president, 1917–19; field manager, 1919–25; general manager, 1925–42). In 1919 he devised the farm system of training ballplayers. He later became president and general manager of the Brooklyn Dodgers (1943–50). Defying strong resistance, in 1945 he broke a long-standing race barrier by hiring the first black player in major league baseball. JACKIE ROBINSON played for the Dodgers' farm teams for two years before he was brought up to play as an infielder for Brooklyn in 1947. Rickey was later associated with the Pittsburgh Pirates (1950–59).

Rickover, Hyman G(eorge) (b. Jan. 27, 1900, Makov, Russia—d. July 8, 1986, Arlington, Va., U.S.) U.S. naval nuclear engineer. His family immigrated to the U.S. in 1906, and he grew up in Chicago. After graduating from the U.S. Naval Academy, he served on submarines and other ships, then headed the electrical section of the Navy's Bureau of Ships in World War II. From 1947 he led the Navy's nuclear-propulsion program; his team developed the first atomic-powered submarine, the USS *Nautilus*, launched in 1954. He headed research on reactor development for the Atomic Energy Commission and helped develop the country's first full-scale, civilian-use nuclear power plant, at Shippingport, Pa. (1956–57). Promoted to admiral in 1973, he was noted for his outspoken views and his singleminded advocacy of nuclear power.

Riḍā, Muḥammad Rashīd See Muḥammad RASHĪD RIḌĀ

riddle Deliberately enigmatic or ambiguous question requiring a thoughtful and often witty answer. The riddle is a form of guessing game that has been a part of the folklore of most cultures from ancient times. Western scholars generally recognize two main kinds of riddle: the descriptive riddle, usually describing an animal, person, plant, or object in an intentionally enigmatic manner (thus an egg is "a little white house without door or window"); and the shrewd or witty question. A classical Greek example of the latter type is "What is the strongest of all things?"—"Love: iron is strong, but the blacksmith is stronger, and love can subdue the blacksmith."

Ride, Sally (Kristen) (b. May 26, 1951, Encino, Calif., U.S.) U.S. astronaut. She received a Ph.D. in physics from Stanford University in 1977 and joined NASA the same year. In 1983 she participated in the seventh space-shuttle mission, aboard the *Challenger*, as flight engineer, becoming the first American woman and the third woman internationally (after the Russians VALENTINA TERESHKOVA [1963], and Svetlana Savitskaya [1982]) to fly into outer space. She went on to become director of the California Space Institute at UC–San Diego in 1989. From 1999 Ride worked on Internet-based projects related to space and pursued her longtime interest in encouraging young women to study science and mathematics.

Ridgway, Matthew B(unker) (b. March 3, 1895, Fort Monroe, Va., U.S.—d. July 26, 1993, Fox Chapel, near Pittsburgh, Pa.) U.S. army officer. He graduated from West Point and served in staff positions until World War II. In 1942 he commanded an airborne division in the invasion of Sicily (1943), the first airborne assault in U.S. military history. He led his paratroopers in the NORMANDY CAMPAIGN and commanded airborne operations across Europe. In the KOREAN WAR he led the U.S. 8th Army, rallying UN forces and forcing the Chinese out of South Korea. Promoted to general, he succeeded DOUGLAS MACARTHUR as Allied commander in the Far East (1951). He later served as supreme commander of NATO forces (1952) and army chief of staff (1953–55).

Riefenstahl \'rē-fən-ˌshtäl**, Leni** *orig.* **Berta Helene Amalie Riefenstahl** (b. Aug. 22, 1902, Berlin, Ger.—d. Sept. 8, 2003, Pöcking) German film director and photographer. In the 1920s she was a dancer and actress in German nature films. After forming a production company, she made and starred in the mystical *The Blue Light* (1932). For ADOLF HITLER she directed the propaganda film *Triumph of the Will* (1935), a documentary glorifying the 1934 NÜRNBERG RALLY. She was praised for the technical brilliance of *Olympia* (1938), her documentary on the 1936 Berlin Olympic Games. Detained by Allied forces after World War II, she was eventually cleared of complicity in Nazi war crimes, but her film career never recovered, and she worked principally as a photographer thereafter.

Riel \rē-'el**, Louis** (b. Oct. 23, 1844, St. Boniface, Assiniboia, Can.—d. Nov. 16, 1885, Regina, District of Assinibois, Can.) Canadian leader of the MÉTIS people in western Canada. In 1869 Riel headed a revolt against Canadian expansion in the west that resulted in the establishment of the province of MANITOBA (1870). Intermittent hostilities continued for several years thereafter, and Riel was officially outlawed. In 1885 he led a Métis uprising in Saskatchewan that was crushed by the Canadians. Riel was found guilty of treason and hanged. His death led to ethnic conflicts in Quebec and Ontario and marked the beginning of the nationalist movement.

Riemann \'rē-ˌmän**, (Georg Friedrich) Bernhard** (b. Sept. 17, 1826, Breselenz, Hanover—d. July 20, 1866, Selasca, Italy) German mathematician. He studied at the Universities of Berlin and Göttingen and later taught principally at Göttingen. His dissertation (1851) was on function theory. He became convinced that mathematical theory could link magnetism, light, gravitation, and electricity and suggested field theories, in which the space surrounding electrical charges may be mathematically described. While continuing to develop unifying mathematical themes in the laws of physics, he created Riemannian geometry (or ELLIPTIC GEOMETRY), which proved essential to ALBERT EINSTEIN's model of SPACE-TIME in RELATIVITY theory. Riemann surfaces, Riemann integrals, and Riemann curvature, among other concepts, contributed to the understanding of curves and surfaces, as well as of CALCULUS. With CARL FRIEDRICH GAUSS, Riemann helped establish Göttingen's reputation as a world leader in mathematical research. His work widely influenced geometry and ANALYSIS.

Riemannian geometry See ELLIPTIC GEOMETRY

Riemenschneider \'rē-mən-ˌshnī-dər**, Tilman** (b. c. 1460, Heilgenstadt or Osterode, Domain of the Teutonic Order—d. July 7, 1531, Würzburg) German sculptor. Son of a mint master, he settled in Würzburg in 1483 and opened a highly successful workshop. He was a city councillor (1504–20) and burgomaster (1520–25), but his sympathies with the revolutionaries in the PEASANTS' WAR led to a brief imprisonment. His wood and stone sculpture, characterized by sharply folded, flowing drapery, included monumental tombs and altarpieces as well as independent statues and reliefs, and made him one of the major masters of late Gothic art in Germany.

Jewel casket on a stand, veneered with mahogany, sycamore, and purplewood, by Riesener, *c.* 1780; in the Victoria and Albert Museum, London.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

Rienzo, Cola di See COLA DI RIENZO

Riesener \rēz-'ner**, Jean-Henri** (b. July 4, 1734, Gladbeck, Münster—d. Jan. 6, 1806, Paris, Fr.) French cabinetmaker. Son of an usher in the law courts of the elector of Cologne, he joined a workshop in Paris and became its head when his master died. In 1774 he was made royal cabinetmaker and from then on

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was the regular supplier of furniture to Marie-Antoinette. His preferred wood was mahogany; occasionally he used lacquer and mother-of-pearl to enrich his surfaces. His furniture exemplified the Louis XVI style.

Riesman, David (b. Sept. 22, 1909, Philadelphia, Pa., U.S.—d. May 10, 2002, Binghamton, N.Y.) U.S. sociologist. Riesman taught at the universities of Buffalo and Chicago before returning to Harvard, his alma mater, to teach (1958–80). He studied primarily the social character of the urban middle class and is noted for *The Lonely Crowd* (1950), the title of which became a catchphrase for the alienation of the individual in modern urban society.

Rietveld \'rēt-ˌvelt**, Gerrit (Thomas)** (b. June 24, 1888, Utrecht, Neth.—d. June 25, 1964, Utrecht) Dutch architect and furniture designer. He was an apprentice in his father's cabinetmaking business (1899–1906) and later studied architecture in Utrecht. In 1918 he created his famous red-and-blue armchair, which, with its emphasis on geometry and use of primary colours, became a symbol of De Stijl. His masterpiece is the Schroeder House in Utrecht (1924), remarkable for its interplay of right-angle forms, planes, and lines, and for its use of primary colours.

Rif Muslim Berber people who live in El-Rif in northern Morocco. Their culture is based on cultivation, herding, and fish processing. They speak a dialect of Berber, but Arabic and Spanish are also widely used. They have traditionally flouted central-government control and have often instigated uprisings and attempted coups. Led by Abd el-Krim, they declared a short-lived independent republic, the Republic of the Rif (1921–26), which was quashed by a French-Spanish alliance.

Rif, El- \er-'rif\ *or* **Rif** Hilly coastal region, northern Morocco. Constituting the central and eastern parts of former Spanish Morocco, the hills extend from east of Melilla to Ceuta, both Spanish enclaves. For the greater part of its length, the mountains hug the Mediterranean Sea, leaving only a few narrow coastal valleys suitable for agriculture or urban settlement. The loftier peaks are snowcapped in winter. In the 1920s Berber tribes inhabiting the region rose in revolt under Abd al-Krim to resist Franco-Spanish occupation.

rifle Firearm whose barrel is rifled (i.e., has spiral grooves cut inside it to give a spin to the projectile). Though usually applied to a weapon fired from the shoulder, the name can also refer to a rifled cannon. Rifled firearms date to at least the 15th century, when it was discovered that imparting a spin to the bullet improved its range and accuracy. The earliest muzzle-loading rifles were more difficult to load than smoothbore muskets, but the invention of metallic cartridges made possible the development of breech-loading mechanisms. Bolt-action rifles, which use a manually operated cylinder to drive the cartridge into the rifle's chamber, are the most common type for hunting. See also assault rifle.

rift valley Elongated trough formed by the subsidence of a segment of the Earth's crust between dip-slip, or normal, faults. Rift valleys are usually narrow and long and have a relatively flat floor. The sides drop away steeply in steps and terraces. Rift valleys are found on the continents and along the crests of oceanic ridges. They occur where two plates that make up the Earth's surface are separating (see plate tectonics). Submarine rift valleys are usually centres of seafloor spreading, where magma wells up from the mantle. The most extensive continental rift valleys are those of the East African Rift System; other notable examples include Russia's Baikal Rift Valley and Germany's Rhine Rift Valley.

Rift Valley See Great Rift Valley

Riga \'rē-gə\ City (pop., 2000 prelim.: 764,328), capital of Latvia. Riga is situated on both banks of the Western Dvina River, above its mouth on the Gulf of Riga. It was founded as a trading post in 1201 on the site of an ancient Liv settlement and joined the Hanseatic League in 1282. In the Middle Ages it was dominated by the Teutonic Order, and it was fought over by the Poles and Russians in the 16th century. Riga was captured by Sweden in 1621 and granted self-government, but it was ceded to Russia in 1721. The city became the capital of an independent Latvia from 1918 to 1940 but was thereafter incorporated into the U.S.S.R. Riga again became the capital of an independent Latvia in 1991. It is a principal Baltic port and a major administrative, cultural, and industrial centre. Its medieval remains include a 13th-century church and a 14th-century castle.

Riga, Gulf of Large gulf of the Baltic Sea. Bounded by Latvia and Estonia, it covers about 7,000 sq mi (18,000 sq km). The gulf, icebound from December to April, has a maximum depth of 177 ft (54 m). The coasts are mostly low and sandy, and several important rivers, including the Western Dvina, reach the sea there. Several ports and resorts, including Riga, line its shores.

Riga, Treaty of (1921) Treaty between Poland and Russia signed in Riga, Latvia, that ended the Russo-Polish War of 1919–20 and set their mutual border. The treaty, which gave Poland parts of Byelorussia (Belarus) and Ukraine, lasted until World War II, after which a new treaty established a new border.

right Portion of the political spectrum associated with conservative political thought. The term derives from the seating arrangement of the French revolutionary parliament (c. 1790s) in which the conservative representatives sat to the presiding officer's right. In the 19th century, the term applied to conservatives who supported authority, tradition, and property. In the 20th century a divergent, radical form developed that was associated with fascism. See also left.

right-to-work law In the U.S., any state law forbidding various union-security measures, particularly the union shop, under which workers are required to join a union within a specified time after they begin employment. Supporters of such laws maintain that they are more equitable because they allow a person to choose whether or not to join a labour union. Opponents contend that the name *right-to-work law* is misleading because such laws do not guarantee employment to anyone. On the contrary, they maintain that such laws tend to reduce workers' job security by weakening the bargaining power of unions.

right whale Any of five species (genera *Balaena*, *Eubalaena*, and *Caperea*) of baleen whales (family Balaenidae) with a stout body and an enormous head. (The name refers to two species considered the "right" whales to hunt because of their value, slowness, and buoyancy after death.) The upper jaw is strongly arched, and the lower lip curves upward along the side, giving the lower jaw a scooplike form. There is no dorsal fin except in the pygmy right whale (*Caperea marginata*), a small, seldom-seen whale of the Southern Hemisphere. The bowhead whale (*Balaena mysticetus*), inhabiting Arctic and northern temperate waters, is black, with a white chin, throat, and sometimes underparts. It grows to about 65 ft (20 m). The northern right whale (*E. glacialis*) grows to 60 ft (18 m). Similar to the bowhead but with a smaller, less strongly arched head, it may also have a "bonnet," a horny growth infested with parasites, on its snout. Both species have been protected since 1946.

Southern right whale (*Eubalaena australis*).
ILLUSTRATION BY LARRY FOSTER

rights of the accused See rights of the accused

Rigveda *or* **Rgveda** \rig-'vā-də\ Oldest religious scripture in the world and most revered of the Vedas, completed by the 12th century BC. Consisting of more than 1,000 hymns addressed to devas (gods), it reflects a polytheism that is mainly concerned with the propitiation of divinities associated with the sky and the atmosphere. It makes reference to such rituals as marriage and funeral rites, which differ little from those practiced today in Hinduism. It is the source of much Indian thought, and many consider its study essential to understanding India.

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Riis \'rēs**, Jacob A(ugust)** (b. May 3, 1849, Ribe, Den.—d. May 26, 1914, Barre, Mass., U.S.) U.S. journalist and social reformer. He immigrated to the U.S. at 21 and became a police reporter for the *New York Tribune* (1877–88) and the *New York Evening Sun* (1888–99). He publicized the deplorable living conditions in the slums of New York's Lower East Side, photographing the rooms and hallways of tenements. He compiled his findings in *How the Other Half Lives* (1890), a book that stirred the nation's conscience and spurred the state's first significant legislation to improve tenements.

Rijn, Rembrandt van See REMBRANDT VAN RIJN

Rikken Seiyūkai \'rik-ˌen-'sā-yü-ˌkī\ *English* **"Friends of Constitutional Government"** Dominant Japanese political party from its inception in 1900 until 1940. Founded by ITŌ HIROBUMI, it initially stood for increased parliamentary participation in government. It was supported by the landlord class and ZAIBATSU business interests, and was generally more conservative than its chief rival, the Democratic Party (Minseitō).

Riley, James Whitcomb (b. Oct. 7, 1849, Greenfield, Ind., U.S.—d. July 22, 1916, Indianapolis, Ind.) U.S. poet. He came into touch with the populace of rural Indiana through his early work experiences. His verse contributions to the *Indianapolis Daily Journal*, written in Hoosier dialect ostensibly by a farmer, established his reputation as "the poet of the common people." His best-known poems include "When the Frost Is on the Punkin" and "The Raggedy Man." Among his many collections are *The Old Swimmin' Hole* (1883), *Pipes o' Pan at Zekesbury* (1888), and *Home Folks* (1900).

rilievo See RELIEF

Rilke \'ril-kə**, Rainer Maria** *orig.* **René Maria Rilke** (b. Dec. 4, 1875, Prague, Bohemia, Austria-Hungary—d. Dec. 29, 1926, Valmont, Switz.) Austro-German poet. After an unhappy childhood and an ill-planned preparatory education, Rilke began a life of wandering that took him across Europe. His visits to Russia inspired his first serious work, the long poem cycle *The Book of Hours* (1905). For 12 years beginning in 1902 his geographic centre was Paris, where he researched a book on AUGUSTE RODIN, associated with the great sculptor, and developed a new style of lyrical poetry that attempted to capture the plastic essence of a physical object; the results were *New Poems* (1907–08) and its prose counterpart, the novel *The Notebook of Malte Laurids Brigge* (1910). After 13 years of writing very little because of writer's block and depression, in 1922 he finally completed the 10 poems of the *Duino Elegies* (1923), a profound meditation on the paradoxes of human existence and one of the century's poetic masterpieces. Unexpectedly and with astonishing speed, he then composed *Sonnets to Orpheus* (1923), a superb 55-poem cycle inspired by the death of a young girl, which continues the *Elegies*' meditations on death, transcendence, and poetry. The two works brought him international fame.

Rimbaud \ra^{n}-'bō**, (Jean-Nicolas-) Arthur** (b. Oct. 20, 1854, Charleville, France—d. Nov. 10, 1891, Marseille) French poet and adventurer. The provincial son of an army captain, he had begun by age 16 to write violent, blasphemous poems, and he formulated an aesthetic doctrine stating that a poet must become a seer, break down the restraints and controls on personality, and thus become the instrument for the voice of the eternal. He was invited to Paris by PAUL VERLAINE, with whom he had a homosexual relationship and engaged in a wild and dissipated life. *The Drunken Boat* (written 1871), perhaps his finest poem, displays his astonishing verbal virtuosity and a daring choice of images and metaphors. In *Les Illuminations* (written 1872–74), a collection of mainly PROSE POEMS, he tried to abolish the distinction between reality and hallucination. *A Season in Hell* (1873), which alternates prose passages with dazzling lyrics, became his farewell to poetry at age 19. After they had a falling-out, Verlaine shot and wounded Rimbaud; afterward their final meeting ended in a violent quarrel. Rimbaud abandoned literature and from 1875 led an international vagabond life as a merchant and trader, mainly in Ethiopia; he died at age 37 after his leg was amputated. The Dionysian power of his verse and his liberation of language from the constraints of form greatly influenced the SYMBOLIST MOVEMENT and 20th-century poetry.

Rimbaud, detail from "Un Coin de table," oil painting by Henri Fantin-Latour, 1872; in the Louvre, Paris
GIRAUDON—ART RESOURCE

Rimsky-Korsakov, Nikolay (Andreyevich) (b. March 18, 1844, Tikhvin, near Novgorod, Russia—d. June 21, 1908, Lyubensk) Russian composer. While at St. Petersburg's College of Naval Cadets, he met other composers; MILY BALAKIREV took a special interest in him, and from 1867 he was included among the group of nationalist composers known as THE FIVE. Returning from his first cruise as a midshipman in 1865, he completed his first symphony. In 1873 he left the naval service and assumed charge of military bands as inspector and conductor. As the de facto editor and head of an enterprise dedicated to publishing music by Russian composers, he edited several posthumous works of ALEKSANDR BORODIN and MODEST MUSSORGSKY. He wrote many colourful operas, much loved in Russia, including *Sadko* (1896), *Mozart and Salieri* (1897), *The Legend of the Invisible City of Kitezh* (1905), and *Le Coq d'or* (1908); the subjects of most of these are from Russian or Slavic fairy tales, literature, and history. Other works include the suite *Scheherazade* (1888) and the *Russian Easter Festival* overture. All his works are distinguished by brilliant orchestration. His many students included ALEKSANDR GLAZUNOV, SERGEY PROKOFIEV, and IGOR STRAVINSKY.

rinderpest Acute, highly contagious viral disease of RUMINANTS (including wild cloven-hoofed ones), common in Africa, the Indian subcontinent, and the Middle East. The virus spreads by close direct or indirect contact. It is the most severe infectious disease of cattle, with sudden onset and high mortality; fever and loss of appetite are followed by symptoms including eye and nasal discharge, laboured breathing, and diarrhea; prostration, coma, and death follow within 6–12 days. Local eradication depends on controlling it in wild animals and eliminating infected domestic animals; vaccination combined with quarantine is effective.

ring Circular band of gold, silver, or other precious or decorative material usually worn on the finger, but sometimes on the toes, the ears, or the nose. The earliest examples were found in the tombs of ancient Egypt. In addition to being worn as adornment, rings have functioned as symbols of authority, fidelity, or social status. In the early Roman republic, most were made of iron, gold being reserved for persons of high status; but by the 3rd century BC anyone except a slave could wear a gold ring. The Romans are thought to have originated engagement rings, symbolizing a promise of marriage. In the Middle Ages, signet rings were important in religious, legal, and commercial transactions; memorial, posy, and keepsake rings served sentimental purposes; occult rings supposedly had magical powers; and poison rings had hollow bezels that could be filled with poison for the purpose of suicide or homicide.

ring In modern ALGEBRA, a set of elements with two operations, referred to as "addition" and "multiplication," that conform to certain conditions. These specify that the set is closed under both operations, the ASSOCIATIVE LAW holds for both operations, the COMMUTATIVE LAW holds for addition, the DISTRIBUTIVE LAW holds, there is an additive identity (known as zero), and every element has an additive inverse (see INVERSE FUNCTION). The set of INTEGERS is a ring. See also FIELD THEORY.

Ring of Fire Name given to a belt of seismic and volcanic activity roughly surrounding the Pacific Ocean. It includes the ANDES MOUNTAINS of South America, the coastal regions of western Central America and North America, the ALEUTIAN and KURIL islands, the KAMCHATKA PENINSULA, Japan, Taiwan, eastern Indonesia, the Philippines, New Zealand, and the island arcs of the western Pacific. About three-fourths of all historically recorded active volcanoes have occurred in this belt. See also PLATE TECTONICS.

Ringgold, Faith (b. Oct. 8, 1930, New York, N.Y., U.S.) U.S. artist, author, and political activist. She began teaching art in New York's public schools in the 1950s. In 1963 she began her "American People" series of paintings, which dealt with the civil-rights movement from a female perspective. In the 1970s she became active in promoting feminist art and the racial integration of the New York art world. Her famous "story quilts," inspired by Tibetan *tankas*, depict stories set in the context of African American history. She adapted one of her quilts, *Tar Beach*, as a children's book and went on to publish other books for children.

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Ringling Brothers Family of U.S. circus owners. After five of the seven brothers formed a song-and-dance troupe (1882), they began to add CIRCUS acts to their show. In 1884 they organized their first small circus in their hometown, Baraboo, Wis., and toured the Midwest in circus wagons. In 1890 they began moving their wagons by railway. They acquired smaller circuses from 1900, and in 1907 they bought the Barnum & Bailey Circus, thus becoming the leading U.S. circus. The guiding managers were Charles Ringling (1863–1926) and later John Ringling (1866–1936), whose acquisition of American Circus Corp. in 1929 brought 11 major circuses under Ringling control. The Ringling Brothers and Barnum & Bailey Circus continues to perform, though it passed out of Ringling family hands in 1967.

John Ringling
KEYSTONE—EB INC.

rings Event in men's GYMNASTICS in which a pair of rubber-coated metal rings suspended from a ceiling or crossbar are used to perform hanging, swinging, and balancing feats. The rings themselves must remain essentially stationary. There must be at least two handstands in an exercise, one attained by strength and the other utilizing body swing. Strength movements on the rings include the iron cross (holding the body vertical with the arms fully stretched sideways) and the lever (hanging with straight arms with the body stretched out horizontally).

ringworm Superficial skin changes caused by certain fungi (see FUNGUS) that live on the skin, feeding on KERATIN. Skin responses vary from slight scaling to blistering and marked disruption of the keratin layer (depending on body area and type of fungus), usually in a ring shape. It includes ATHLETE'S FOOT, jock itch, and fungal infections of the body, hands, nails, and scalp. While the last is very contagious, spread of other types depends on susceptibility and predisposing factors (e.g., excessive perspiration). Ringworm is treated with medications applied to the skin or taken orally.

Rio de Janeiro City (pop., 2002 est.: city, 5,937,300; metro. area, 11,121,300) and port, southeastern Brazil. The site was founded by the Portuguese in the early 16th century and became important in the 18th century as an outlet for mineral exports from gold and diamond mines. Located on one of the largest harbours in the world and known for its scenic views, it was the capital of Brazil from 1822 to 1960, when the national capital was moved to BRASÍLIA. It is the country's second largest manufacturing centre after SÃO PAULO. Major industries include metallurgy and food processing. Noted for its wide streets, public buildings, beaches (see COPACABANA), and public parks and gardens, it is a leading tourist and resort centre.

Río de la Plata See Río de la PLATA

Río de la Plata, Viceroyalty of the Last of the four viceroyalties that Spain created to govern its New World colonies. Established in 1776 as means of decentralizing rule in the Spanish empire, it controlled an area previously administered by the Viceroyalty of PERU and included what is now Argentina, Uruguay, Paraguay, and Bolivia. Successive viceroys defended the territory against encroachment by Portugal and Britain and helped BUENOS AIRES become a flourishing outpost of the Spanish empire. Salted meat from the cattle ranches of the interior, exported to meet the demand for cheap food for slaves, brought unprecedented wealth to the colony. In 1810 the Creoles created a provisional junta and sent the viceroy into exile. See also NEW GRANADA;NEW SPAIN.

Río de Oro Southern region, WESTERN SAHARA. Its principal town, Al-Dakhla (formerly Villa Cisneros), has a small port and must rely on imported drinking water. The narrow inlet of the Atlantic Ocean at Al-Dakhla was called Río de Oro ("River of Gold") by the Portuguese because of the trade in gold dust from western Africa that they engaged in there. From the 1880s until 1976 it was ruled by Spain. In 1979 it was occupied by Morocco. The indigenous inhabitants are Muslim and largely nomadic BERBERS.

Rio Grande \'rē-ō-'grand\ *in Mexico* **Río Bravo** River, North America. One of the longest rivers of North America, it flows 1,900 mi (3,000 km) from its sources in the ROCKY MOUNTAINS of southwestern Colorado, U.S., to the Gulf of MEXICO. It rises high in the SAN JUAN MOUNTAINS and flows generally south, passing southeast and forming the entire border between Texas and Mexico. The earliest European settlements were along the lower course of the river in the 16th century, but many of the PUEBLO INDIAN settlements of New Mexico date from before the Spanish conquest. During the Spanish period, the middle and upper portions were called the Río del Norte, and the lower course was called the Río Bravo. It is a major source of irrigation. At the U.S.-Mexican border, it defines the edge of BIG BEND NATIONAL PARK, Texas.

Rio Treaty *officially* **Convention on Biological Diversity** International environmental agreement approved at the 1992 EARTH SUMMIT in Rio de Janeiro. Negotiations began in 1988 under the auspices of the United Nations Environment Program. Its goals are the conservation of the planet's biodiversity and the fair use of its resources. By the early 21st century, more than 185 governments were party to the agreement.

Riopelle \rē-ō-'pel**, Jean-Paul** (b. Oct. 7, 1923, Montreal, Que., Can.—d. March 12, 2002, Ile-aux-Grues, near Quebec City) Canadian painter and sculptor. He moved to Paris in 1947 and, with PAUL-ÉMILE BORDUAS, became associated with the group of Canadian painters known as Les Automatistes, who practiced AUTOMATISM. His early lyrical, abstract paintings evolved into a denser, more powerful impasto style. He is renowned for his use of various media (including watercolour, ink, oils, crayon, and chalk), and he also produced large collage murals. He achieved international acclaim with the huge triptych *Pavane* (1954) and is the leading Canadian abstract painter of his generation.

rip current *or* **riptide** Narrow, jetlike stream of water that flows sporadically seaward for several minutes, in a direction perpendicular to a beach. The term *riptide* is a misnomer because the currents are in no way related to tides. Rip currents form at long coasts that are approached by wave trains that are nearly parallel to the shoreline. In shallow water, normal wave motion displaces the water small distances shoreward with each passing wave. During periods of large waves, water builds up at the beach and cannot escape as longshore currents, which require oblique wave approach. The buildup continues until water can escape by surging for several minutes through a low point in a breaker, creating an undertow that can be dangerous for swimmers.

riparian right \ri-'par-ē-ən\ In law, the right of one who owns riparian land (land abutting or including a stream or river) to have access to and use of the shore and water. These rights are a form of real property (see REAL AND PERSONAL PROPERTY) and are inherited with the land. A landowner whose property abuts an ocean, sea, lake, or pond is said to possess littoral rights. Specific water-use laws vary from state to state.

Ripken, Cal(vin Edwin), Jr. (b. Aug. 24, 1960, Havre de Grace, Md., U.S.) U.S. baseball player. Ripken was born into a baseball family; his father and brother both played professionally. He played for the Baltimore Orioles from 1981. In 1990 he set single-season records for highest fielding percentage by a shortstop (.996) and fewest errors by a shortstop (3), and in 1993 he broke the home-run record for a shortstop. On Sept. 6, 1995, he broke LOU GEHRIG's long-standing record of consecutive games played (2,130), eventually running his streak to 2,632 games before taking a day off in 1998. Ripken retired at the end of the 2001 season.

Ripley, George (b. Oct. 3, 1802, Greenfield, Mass., U.S.—d. July 4, 1880, New York, N.Y.) U.S. journalist and reformer. He became a Unitarian minister after graduating from Harvard Divinity School. A member of the Transcendental Club and an editor of *The Dial*, its literary magazine, he founded the utopian community BROOK FARM in 1841 and served as its director and leading promoter. When it closed in 1847, he took a job with the *New York Tribune* to pay off its debts. His own financial position did not become secure until he published *The Cyclopedia* (1862), a popular reference book.

ripple mark One of a series of small marine, lake, or riverine features, consisting of repeating wavelike forms with symmetric slopes, sharp peaks, and rounded troughs. Ripple marks are formed in sandy bottoms by oscillation waves, in which only the wave form advances rapidly, the actual water-particle motion consisting of almost closed vertical orbits. The presence of the bottom restricts the lowermost orbits into nearly flat ellipses, and the bottom water moves back and forth rhythmically. If the maximum horizontal velocity of this motion is capable of moving the grains composing the bed, ripple marks develop. See also WAVE.

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RISC \'risk\ *in full* **Reduced Instruction Set Computing** COMPUTER ARCHITECTURE that uses a limited number of instructions. RISC became popular in microprocessors in the 1980s. The traditional CISC (Complex Instruction Set Computing) architecture uses many instructions that do long, complex operations. Each RISC instruction is executed much more quickly than a CISC instruction, and most computational tasks can be processed faster. Modern instruction sets combine attributes of CISC and RISC.

risk In economics and finance, an allowance for the hazard (risk) in an investment or loan. Default risk refers to the chance that a borrower will not repay a loan. If a banker believes that a borrower may not repay a loan, the banker will charge the true INTEREST plus a premium for the default risk, the premium depending on the degree of presumed risk. All stock investment carries an implicit risk since there is no guarantee of return on investment. Trading or variability risk is the amount that the return may vary, up or down, from the expected return on investment.

Risorgimento \rē-ˌzȯr-ji-'men-tō\ *Italian* **"Rising Again"** Nineteenth-century movement for Italian unification. Reforms introduced by France into its Italian states in the Napoleonic period remained after the states were restored to their former rulers in 1815 and provided an impetus for the movement. Secret groups such as YOUNG ITALY advocated Italian unity, and leaders such as CAMILLO CAVOUR, who founded the journal *Il Risorgimento* (1847), GIUSEPPE GARIBALDI, and GIUSEPPE MAZZINI called for liberal reforms and a united Italy. After the failure of the REVOLUTIONS OF 1848, leadership passed to Cavour and Piedmont, which formed an alliance with France against Austria (1859). The unification of most of Italy in 1861, followed by the annexation of Venetia (1866) and papal Rome (1870), marked the end of the Risorgimento.

Ritalin A mild form of AMPHETAMINE used in the treatment of ATTENTION-DEFICIT HYPERACTIVITY DISORDER (ADHD), generic name methylphenidate. Ritalin, taken as a pill, also has been effective for the treatment of other conditions such as NARCOLEPSY. Although the drug acts as a stimulant in most people, Ritalin calms and focuses those with ADHD. Ritalin's mode of action is unknown, but it is thought that the drug reduces symptoms by increasing the amount and activity of a neurotransmitter in the brain.

rite of passage See rite of PASSAGE

Ritsos \'rēt-sȯs**, Yannis** (b. May 1, 1909, Monemvasia, Greece—d. Nov. 11, 1990, Athens) Greek poet. He joined the Greek Communist Party in 1934, the year his first collection of poems, *Tractors*, appeared. It and a second collection mixed socialist philosophy with images of his personal suffering. His third collection, *Funeral Procession* (1936), provided the words for the anthem of the Greek Left. He fought as a communist during the Nazi occupation and Greek civil war, and he spent four years in prison camps. Arrested and exiled in 1967, he was prohibited from publishing until 1972. Despite those obstacles, he wrote a total of 117 books, including plays and essays.

Rittenhouse, David (b. April 8, 1732, Germantown, Pa.—d. June 26, 1796, Philadelphia, Pa., U.S.) U.S. astronomer and inventor. He was a clockmaker by trade but also built mathematical instruments and, it is believed, the first TELESCOPE in the U.S. In 1769 he observed VENUS moving across the face of the Sun and noted that Venus has an atmosphere. Rittenhouse served as treasurer of Pennsylvania (1777–89), first director of the U.S. Mint in Philadelphia (1792–95), and president of the American Philosophical Society (1791–96).

Rivadavia \ˌrē-vä-thä-vē-ə**, Bernardino** (b. May 20, 1780, Buenos Aires, Arg.—d. Sept. 2, 1845, Cádiz, Spain) First president of the Argentine republic (1826–27). Active in the 1810 movement for independence from Spain, he came to dominate the ruling revolutionary triumvirate in 1811. He disbanded the Spanish courts, abolished censorship, and ended the slave trade. Elected president of the United Provinces in 1826, he continued to advance reforms but was unable to extricate his country from a fruitless war with Brazil and was constantly embroiled with provincial CAUDILLOS. Unable to win acceptance for a centralist constitution, he resigned. His cultural initiatives, including the founding of the University of Buenos Aires, were among his greatest achievements. Most of his later years were spent in exile.

river Natural stream of water that flows in a channel with more or less defined banks. Rivers are a fundamental link in the HYDROLOGIC CYCLE, and they play a major role in shaping the surface features of the Earth. Even apparently arid desert regions are greatly influenced by river action when periodic floodwaters surge down usually dry watercourses. River flow is sustained by the difference between water input and output. Rivers are fed by overland runoff, groundwater seepage, and meltwater released along the edges of snowfields and glaciers. Direct precipitation contributes only very small amounts of water. Losses of river water result from percolation into porous and permeable rock, gravel, or sand; evaporation; and ultimately outflow into the ocean.

river blindness *or* **onchocerciasis** \ˌäŋ-kō-ˌsər-'kī-ə-səs\ Human disease caused by a filarial worm native to Africa but also found in parts of tropical America and transmitted by several BLACKFLIES. It is so called because the flies that transmit the disease breed on rivers and mostly affect riverine populations. Blindness is caused by dead microfilariae—the larvae that can be produced for some 15–18 years by adult worms—inside the eye. River blindness is common in savannah areas of Africa and in Guatemala and Mexico. In 1987 the World Health Organization began to distribute the drug ivermectin (originally developed for use against livestock parasites), which eliminates the microfilariae, though it does not kill the adult parasite.

Rivera, Diego (b. Dec. 8, 1886, Guanajuato, Mex.—d. Nov. 25, 1957, Mexico City) Mexican muralist. After study in Mexico City and Spain, he settled in Paris from 1909 to 1919. He briefly espoused CUBISM but abandoned it c. 1917 for a visual language of simplified forms and bold areas of colour. Returning to Mexico in 1921, he sought to create a new national art on revolutionary themes in the wake of the MEXICAN REVOLUTION. He painted many public murals, the most ambitious of which is in the National Palace (1929–57). From 1930 to 1934 he worked in the U.S. His mural for New York's Rockefeller Center aroused a storm of controversy and was ultimately destroyed because it contained the figure of VLADIMIR ILICH LENIN; he later reproduced it at the Palace of Fine Arts in Mexico City. With JOSÉ CLEMENTE OROZCO and DAVID ALFARO SIQUEIROS, Rivera created a revival of FRESCO PAINTING that became Mexico's most significant contribution to 20th-century art. His large-scale, didactic murals contain scenes of Mexican history, culture, and industry, with Indians, peasants, conquistadores, and factory workers drawn as simplified figures in crowded, shallow spaces. Rivera was married to FRIDA KAHLO almost uninterruptedly from 1929 to 1954.

Rivera, José Antonio Primo de See José Antonio PRIMO DE RIVERA

Rivera, Luis Muñoz See Luis MUÑOZ RIVERA

Rivers, Larry *orig.* **Yitzroch Loiza Grossberg** (b. Aug. 17, 1923, New York, N.Y., U.S.—d. Aug. 14, 2002, Southampton, N.Y.) U.S. painter associated with ABSTRACT EXPRESSIONISM and POP ART. He studied at the Juilliard School in New York City and was a professional jazz saxophonist before turning to painting and studying with HANS HOFMANN. His early works are characterized by frequent use of complex, fragmentary, and multiple views; perhaps the best-known is the harshly realistic *Double Portrait of Berdie* (1955). From the 1960s he introduced commercial images into his work, as well as elements of collage, construction, and sculpture; an elaborate example of his mixed-media works is *The History of the Russian Revolution* (1965).

Riverside City (pop., 2000: 255,166), southern California, U.S. It lies on the Santa Ana River. Along with SAN BERNARDINO and Ontario, Riverside forms a metropolitan complex east of LOS ANGELES. Settled in the 1870s, it was incorporated as a city in 1883 and became known for its citrus industry. Its economy now includes manufacturing and educational activities.

Riviera \ˌri-vē-'er-ə\ Coastal region bordering the Mediterranean Sea in southeastern France, Monaco, and northwestern Italy. It extends from CANNES, France, to La Spezia, Italy. The Italian Riviera is divided into the Riviera di Ponente, west of GENOA, and the Riviera di Levante, east of Genoa. The French Riviera is also called the CÔTE D'AZUR. Noted for its scenery and pleasant climate, it is one of the major tourist centres of Europe. Because of its mild winters, many delicate plants flourish there, and flowers are grown out of season for export to northern markets. See also Cannes; NICE; MONTE CARLO.

Riyadh \rē-'yäd\ City (pop., 2004: 4,087,152), capital of SAUDI ARABIA. Located in the east-central part of the country, it was chosen as the capital of the SAʿŪD DYNASTY in 1824. It remained the centre of Saʿūdī rule until 1881, when the Rashīd family took control of the region. In 1902 IBN SAʿŪD regained control, and it became the centre for his conquest of the ARABIAN PENINSULA. When the kingdom of Saudi Arabia was proclaimed in 1932, Riyadh became the capital. Discovery of immense petroleum depos-

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its in the kingdom in the 1930s transformed the old provincial town into a showplace of sophisticated technology, modern architecture, and highways. In addition to its administrative role, Riyadh is the kingdom's commercial, education, and transportation centre.

Rizal (y Alonso) \rē-'säl**, José** *in full* **José Protasio Rizal Mercado y Alonso Realonda** (b. June 19, 1861, Calamba, Phil.—d. Dec. 30, 1896, Manila) Filipino patriot, physician, and man of letters. Beginning in his youth, Rizal committed himself to the reform of Spanish rule in his home country. He lived in Europe (1882–92), where he published novels exposing the evils of Spanish rule and became the leader of the Propaganda movement, which produced reform-oriented articles, magazines, and poetry. He returned to the Philippines to found a nonviolent-reform society and was deported to Mindanao, where he spent four years. When the Katipunan nationalist secret society revolted in 1896, the Spanish arrested and executed Rizal, though he had no connection with the group and had taken no part in the insurrection. His martyrdom convinced Filipinos that there was no alternative to independence from Spain.

RKO Radio Pictures, Inc. U.S. film studio. It was created in 1928 as Radio-Keith-Orpheum when the Radio Corp. of America (RCA Corp.) acquired the Keith-Albee-Orpheum theatre chain and a production firm. In the 1930s RKO was noted for producing a series of musicals starring Fred Astaire and Ginger Rogers and Katharine Hepburn's early movies, as well as films such as *Cimarron* (1931), *The Informer* (1935), and *Citizen Kane* (1941). It was bought by Howard R. Hughes in 1948; his inattention doomed the company, and it ceased production in 1953 and was sold to Desilu Productions (1957). After numerous reorganizations, it continued as RKO General, operating radio and television stations and theatres.

RNA *in full* **ribonucleic** \ˌrī-bō-nü-'klē-ik, ˌrī-bō-nü-'klā-ik\ **acid** One of the two main types of nucleic acid (the other being DNA), which functions in cellular protein synthesis in all living cells and replaces DNA as the carrier of genetic information in some viruses. Like DNA, it consists of strands of repeating nucleotides joined in chainlike fashion, but the strands are single (except in certain viruses), and it has the nucleotide uracil (U) where DNA has thymine (T). Messenger RNA (mRNA), a single strand copied from a DNA strand that acts as its template, carries the message of the genetic code from DNA (in chromosomes) to the site of protein synthesis (on ribosomes). Ribosomal RNA (rRNA), part of the building blocks of ribosomes, participates in protein synthesis. Transfer RNA (tRNA), the smallest type, has fewer than 100 nucleotide units (mRNA and rRNA contain thousands). Each nucleotide triplet on mRNA specifies which amino acid comes next on the protein being synthesized, and a tRNA molecule with that triplet's complement on its protruding end brings the specified amino acid to the site of synthesis to be linked into the protein. Various minor types of RNA also exist; at least some act as catalysts (ribozymes), a function long ascribed only to proteins.

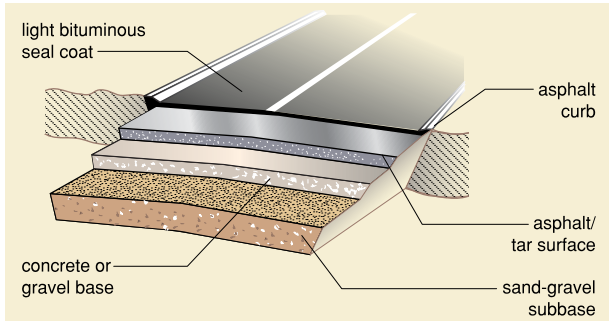
roach See cockroach

roach Common European sport fish (*Rutilus rutilus*) of the carp family (Cyprinidae), found in lakes and slow rivers. A high-backed, yellowish green fish with red eyes and reddish fins, the roach is 6–16 in. (15–40 cm) long and weighs up to 4.5 lbs (2 kg). It lives in small schools and eats plants, insects, and small animals. It is sometimes eaten or used as bait. In North America, other fishes are called roach, including the rudd, the golden shiner (both cyprinids), and several members of the sunfish family (Centrarchidae).

Roach, Hal *orig.* **Harold Eugene Roach** (b. Jan. 14, 1892, Elmira, N.Y., U.S.—d. Nov. 2, 1992, Bel Air, Calif.) U.S. film producer. He tried gold prospecting before becoming a bit player in Hollywood (1912). He befriended Harold Lloyd and directed and produced *Just Nuts* (1915), in which Lloyd starred, then formed the Hal Roach Studio (1919) and went on to produce other Lloyd comedies such as *Safety Last* (1923). In the 1920s and '30s he produced thousands of comedy shorts, winning Academy Awards for *The Music Box* (1932) and *Bored of Education* (1936). In addition to producing the Will Rogers films and the "Our Gang" shorts, he teamed Laurel and Hardy (see Stan Laurel; and Oliver Hardy) in their first film together in 1927 and produced a series of their films, including *Leave 'em Laughing* (1928) and *Way Out West* (1937), as well as other successes such as *Topper* (1937) and *Of Mice and Men* (1939). He ranks with Mack Sennett as a creator of inspired chaos in the early Hollywood comic style.

Roach, Max(well) (b. Jan. 10, 1924, New Land, N.C., U.S.) U.S. jazz bandleader, composer, and drummer. Roach performed with many of the key bebop players of the mid-1940s, including Dizzy Gillespie and Charlie Parker. He developed a light, flexible manner of keeping time with the ride cymbal rather than the bass drum, updating the role of the drum set for the new music and exploring the melodic possibilities of the drums in his solos. He formed a quintet with trumpeter Clifford Brown in 1954 and continued as leader of his own group following Brown's death in 1956.

road Traveled way on which people, animals, or wheeled vehicles move. The earliest roads developed from paths and trails and appeared with the invention of wheeled vehicles, around 3000 BC. Road systems developed to facilitate trade in early civilizations; the first major road extended 1,775 mi (2,857 km) from the Persian Gulf to the Aegean Sea and was used c. 3500–300 BC. The Romans used roads to maintain control of their empire, with over 53,000 mi (85,000 km) of roadways extending across its lands; Roman construction techniques and design remained the most advanced until the late 1700s. In the early 19th century invention of macadam road construction provided a quick and durable method for building roads, and asphalt and concrete also began to be used. Motorized traffic in the 20th century led to the limited-access highway, the first of which was a parkway in New York City (1925). Superhighways also appeared in Italy and Germany in the 1930s. In the 1950s the U.S. interstate highway system was inaugurated to link the country's major cities.



Elements of a modern asphalt road.
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roadrunner *or* **chaparral cock** \ˌsha-pə-'ral\ Either of two species of terrestrial cuckoo, especially *Geococcyx californianus* (family Cuculidae), of Mexican and southwestern U.S. deserts. About 22 in. (56 cm) long, they have streaked brown-and-white plumage, a short shaggy crest, bare blue and red skin behind the eyes, stout bluish legs, and a long tail carried at an angle. Clumsy, weak fliers, they prefer to run. Using their stout bill, they pound insects, lizards, and snakes to death, then swallow the victim head first. The lesser roadrunner (*G. velox*), of Mexico and Central America, is smaller, buffier, and less streaked.

Roadrunner (*Geococcyx californianus*)
RUSS KINNE—PHOTO RESEARCHERS/EB INC.

Roanoke \'rō-ə-ˌnōk\ City (pop., 2000: 94,911), western Virginia, U.S. It is located on the Roanoke River at the southern end of the Shenandoah Valley. Settled in 1740, it developed after 1882 when it became a rail junction and outlet for Virginia and West Virginia coal. Chartered in 1874 as the town of Big Lick, it was renamed Roanoke (1882) after either the Indian term for shell money or a nearby salt marsh. Manufactures now include metal and steel products, clothing, chemicals, and furniture.

Roanoke Island Island, off the North Carolina coast, U.S. Situated near the southern entrance to Albemarle Sound, the island is about 12 mi (19 km) long and 3 mi (5 km) wide. It was the site of the first English settlement in North America; its original colonists, sent by Walter Raleigh, arrived in mid-1585 but stayed only until 1586. A second group arrived in 1587; Virginia Dare, the first English child born in the Americas, was born on the island. When a supply ship arrived in 1590, all the colonists, including Virginia, had vanished; their fate is unknown. During the Ameri-

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can Civil War the island was captured in 1862 by Union forces under Gen. Ambrose E. Burnside. It is now a resort and residential area.

Roanoke River River, southern Virginia and northeastern North Carolina, U.S. Formed by the confluence of forks in West Virginia, it flows southeast for 380 mi (612 km) into Albemarle Sound on the Atlantic coast of North Carolina. Just north of the Virginia–North Carolina boundary, it joins the Dan River, its principal tributary. It is navigable by small craft from its mouth to Weldon, N.C.

roasting In metallurgy, usually the first step in smelting ore to extract metal. The ore is heated in the presence of an abundant flow of air to drive off moisture and, if the metal-bearing mineral is a sulfide, convert it to an oxide. Sulfur fumes from ore roasting have been a major source of environmental pollution in the past.

Rob Roy *orig.* **Robert MacGregor** (baptized March 7, 1671, Buchanan, Stirlingshire, Scot.—d. Dec. 28, 1734, Balquhidder, Perthshire) Scottish Highland outlaw. Nephew of the chief of the MacGregor clan, he became a freebooter and apparently engaged in the time-honoured Border practices of cattle stealing and blackmail. After the penal laws against the MacGregors were reintroduced (1693), he took the surname Campbell and frequently signed himself Rob Roy ("Red Rob"), in reference to his red hair. He became a brigand after his financial ruin in 1712 and exacted tribute for protection against thieves. Arrested in 1722, he was pardoned in 1727. He was glamorously portrayed as a Scottish Robin Hood in Walter Scott's novel *Rob Roy*.

Robbe-Grillet \rôb-grē-'yā**, Alain** (b. Aug. 18, 1922, Brest, France) French writer. Trained as a statistician and agronomist, he became a writer and leading theoretician of the *nouveau roman* ("new novel"), the French antinovel that emerged in the 1950s. His narratives lack conventional elements such as chronological plot and are composed largely of recurring images and repeated fragments of dialogue. Among his works are fiction, including *The Erasers* (1953), *Jealousy* (1957), and *Djinn* (1981); the essay "Towards a New Novel" (1963); and the memoir *Ghosts in the Mirror* (1984). He is also a screenwriter and film director; his best-known screenplay is that for *Last Year at Marienbad* (1961).

robber fly *or* **assassin fly** Any of about 4,000 species of predatory dipterans in the family Asilidae, found worldwide. Robber flies are the largest of all dipterans; some species are 3 in. (8 cm) long. Most have a dull-coloured, stout body resembling that of a bumblebee and a moustache of bristles between the large-faceted eyes. They use their long legs to capture insects in flight and hold them while eating; a fluid injected into the victim breaks down muscle tissue. A few species are serious pests of apiaries.

Robber fly (Asilidae)
WILLIAM E. FERGUSON

robbery See theft

Robbia family, Della See Della Robbia family

Robbins, Jerome *orig.* **Jerome Rabinowitz** (b. Oct. 11, 1918, New York, N.Y., U.S.—d. July 29, 1998, New York City) U.S. dancer, choreographer, and director. He joined Ballet Theatre (later American Ballet Theatre) as a dancer in 1940. His first choreographic success was *Fancy Free* (set to a musical score by Leonard Bernstein), which was expanded into the musical *On the Town* (1944). He joined the New York City Ballet in 1948 and soon became associate director (1950–59), creating many works for the company. For the Broadway stage he choreographed successful musicals such as *The King and I* (1951; film, 1956), *West Side Story* (1957; film, 1961), *Gypsy* (1959; television, 1993), and *Fiddler on the Roof* (1964). Returning to the New York City Ballet, he was resident choreographer and ballet master (1969–83) and then codirector with Peter Martins until retiring in 1990. His choreography is marked by a blend of modern, academic, and popular dance styles in a variety of American idioms. See photograph above.

Robert Guiscard \gēs-'kär\ (b. c. 1015, Normandy—d. July 17, 1085, near Cephalonia, Greece, Byzantine Empire) Norman adventurer and duke of Apulia (1059–85). Born into a family of Norman knights, he joined his brothers and half brothers in southern Italy, defeating the Byzantines, Lombards, and papacy (1053) and taking over Apulia. He allied with the papacy (1059), agreeing to oppose the Byzantines and expel the Arabs from Sicily. His brother Roger (later Roger I) helped him to conquer Sicily and Calabria, and he gained control of Salerno in 1076, making it the capital of his duchy. Robert made an abortive attempt to gain the Byzantine throne (1083) but returned to Italy to defend Pope Gregory VII from his enemies.

Jerome Robbins in *Fancy Free*, 1944.
FRED FEHL

Robert I *known as* **Robert the Bruce** (b. July 11, 1274—d. June 7, 1329, Cardross, Dumbartonshire, Scot.) King of Scotland (1306–29). Though Robert was of Anglo-Norman ancestry and held lands in both England and Scotland, he sided with the Scots against England and supported the rebel William Wallace. He gained the Scottish throne in 1306 after stabbing a rival to death in a quarrel. Twice defeated by Edward I (1306), he became a fugitive, hiding on a remote island off the Irish coast. Within a year, Robert returned to Scotland and began gathering supporters, and in 1314 he defeated Edward II at the Battle of Bannockburn. Edward III finally recognized him and confirmed Scottish independence in 1328.

Robert II *known as* **Robert Curthose** \'kůr-tōz\ (b. c. 1054—d. February 1134, Cardiff, Wales) Duke of Normandy (1087–1106). The eldest son of William I, he was named heir to Normandy but rebelled twice (c. 1077, c. 1082). Robert was exiled to Italy but returned as duke on his father's death. He pawned Normandy to his brother William II and joined the First Crusade, in which he fought bravely and helped capture Jerusalem (1099). He led an unsuccessful invasion of England after Henry I became king (1100); Henry then invaded Normandy (1105–06) and captured Robert, who spent the rest of his life as a prisoner.

Robert II (b. March 2, 1316—d. April 19, 1390, Dundonald, Ayrshire, Scot.) King of Scotland (1371–90). Grandson of Robert I, he served as regent during the periods of exile and of imprisonment by the English of his uncle, David II, and took the throne on David's death in 1371 as the first Stuart king and thus was the founder of the house of Stuart. His reign proved anticlimactic; he had little effect on political and military affairs, taking no active part in the renewed war with England (1378–88). Succession after his death was disputed by his numerous children (legitimate and illegitimate) and their descendants.

Robert III *orig.* **John Stewart, earl of Carrick** (b. c. 1337—d. April 4, 1406, Rothesay, Bute, Scot.) King of Scotland (1390–1406). After having ruled in the name of his father, Robert II, from 1384 to 1388, he assumed the throne in his own right on his father's death. Physically disabled by a kick from a horse in 1388, he was never the real ruler of Scotland. His brother Robert, earl of Fife, later duke of Albany, governed during Robert II's last years and continued to govern throughout Robert III's reign, except for three years when Robert III's eldest son, David, duke of Rothesay, took his place. Robert III's other son became James I.

Robert-Houdin \rô-ber-ü-'da^{n}**, Jean-Eugène** *orig.* **Jean-Eugène Robert** (b. Dec. 6, 1805, Blois, France—d. June 13, 1871, St. Gervais, near Blois) French magician, considered the father of modern conjuring. Trained as a watchmaker, he became a magician at the Palais-Royal (1845–55), performing on a bare stage in evening dress rather than the usual wizardlike costume. He used familiar objects to create his illusions, then gave a plausible explanation of the technical procedures involved. Robert-Houdin was the first magician to use electricity, and he exposed magicians who relied on supernatural explanations for their feats. In 1856 he was sent to Algeria by the French government to counter the influence of the dervishes, who were encouraging rebellion against French forces, by duplicating their feats.

Roberts, Sir Charles G(eorge) D(ouglas) (b. Jan. 10, 1860, Douglas, N.B.—d. Nov. 26, 1943, Toronto, Ont., Can.) Canadian poet. At first a teacher and editor, he became a journalist in New York City and lived

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in London before settling in Toronto. His best-known poems are simple descriptive lyrics about the scenery and rural life of Nova Scotia and his native New Brunswick. He published some 12 verse volumes, including *In Divers Tones* (1887) and *The Vagrant of Time* (1927). His prose includes short stories that display his intimate knowledge of the Canadian woods, including *Earth's Enigmas* (1896) and *Red Fox* (1905). He is remembered as the first writer to express national feeling after the confederation of 1867.

Roberts, John G(lover), Jr. (b. Jan. 27, 1955, Buffalo, N.Y., U.S.) 17th chief justice of the United States (2005–). He earned a law degree (1979) from Harvard University, where he was the managing editor of the *Harvard Law Review*, and served as a law clerk (1980–81) to Supreme Court Justice William H. Rehnquist, who later became chief justice. He held several positions in the administrations of Presidents Ronald Reagan and George H.W. Bush, during which time he became noted for his apparent advocacy of strongly conservative legal viewpoints. In 2003 Pres. George W. Bush nominated Roberts to the U.S. Court of Appeals for the District of Columbia Circuit; he was confirmed later that year. He held that post until 2005, when Bush nominated him to fill the vacancy left by the retiring justice Sandra Day O'Connor. Shortly before Roberts's confirmation hearings began, Rehnquist died, prompting Bush to appoint Roberts chief justice. Quickly confirmed by the Senate (78–22), he was sworn in on Sept. 29, 2005.

Roberts, Oral (b. Jan. 24, 1918, near Ada, Okla., U.S.) U.S. evangelist. The son of a Pentecostal preacher, he underwent a conversion experience in 1935. He spent 12 years as a pastor in several towns in the South and built up his own organization, the Pentecostal Holiness Church. He studied at Oklahoma Baptist College (1943–45), emerging as a Methodist. Claiming direct communications from God, he began an itinerant ministry of faith healing in the late 1940s. The Oral Roberts Evangelistic Association, based in Tulsa, Okla., became the parent organization for other endeavors, including a publishing firm, and Roberts became known for his luxurious way of life. From the 1950s he reached wide audiences through radio and television. In 1963 he founded Oral Roberts University in Tulsa, and in the early 21st century he continued his association with the university, holding the office of chancellor.

Roberts, Richard (b. April 22, 1789, Carreghova, Montgomeryshire, Wales—d. March 16, 1864, Manchester, Eng.) British inventor. He was an uneducated Welsh quarryman before he took a position with Henry Maudslay and then established his own machine-tool factory. He was one of the inventors of the metal planer, and he made important improvements to the lathe. His automatic spinning mule marked an important advance in spinning technology. He developed a screw-cutting lathe and built gear-cutting and slotting machines, railway locomotives with interchangeable parts, automatic machinery for punching holes in plate, and the first successful gas meter. Though he was said to have improved everything he touched, he was not a shrewd businessman, and he died in poverty.

Robertson, Oscar (Palmer) (b. Nov. 24, 1938, Charlotte, Tenn., U.S.) U.S. basketball player. He was the first African American to play for the University of Cincinnati. Drafted by the Cincinnati Royals of the NBA in 1960, he averaged double figures in points (30.8), rebounds (12.5), and assists (11.4) per game in 1961–62, a feat unmatched by any other player. He played for the Milwaukee Bucks (1970–74) and helped the team win a championship in 1970. He ended his career with 26,710 points, 7,804 rebounds, and 9,887 assists.

Robertson, Pat *orig.* **Marion Gordon Robertson** (b. March 23, 1930, Lexington, Va., U.S.) U.S. evangelist. He attended Washington and Lee University, served in the Marine Corps, and earned a law degree from Yale University. After undergoing a religious conversion, he studied at New York Theological Seminary and was ordained a Southern Baptist minister in 1959. In 1960 he started the nation's first Christian television station, at Portsmouth, Va., and he built it into the Christian Broadcasting Network. Its mainstay was his talk show, *The 700 Club*. In 1988 he campaigned for the Republican presidential nomination. In 1989 he founded the Christian Coalition, a conservative political organization that went on to exercise wide influence.

Roberval \rô-ber-'vàl**, Jean-François de la Rocque, lord de** (b. c. 1500, Carcassonne, France—d. 1560/61, Paris) French colonizer in Canada. He was a member of the court of Francis I. Appointed lieutenant general of the North American territory discovered earlier by Jacques Cartier, he was sent to colonize the region. In 1542 he reached Cartier's former headquarters at Cap Rouge, near present-day Quebec. Cartier was to have served as his guide, but he had left in 1541. The settlement was short-lived, breaking up in 1543 after a harsh winter. Mineral wealth that Roberval brought back turned out to be fool's gold and mica.

Robeson \'rōb-sən**, Paul (Bustill)** (b. April 9, 1898, Princeton, N.J., U.S.—d. Jan. 23, 1976, Philadelphia, Pa.) U.S. singer, actor, and activist. Born to a former slave turned preacher and a Quaker mother, Robeson attended Rutgers University, where he was an All-America football player. Graduating at the head of his class, he went on to earn a law degree at Columbia University. Because of a lack of opportunity for African Americans in law, he turned to theatre, joining a group that included Eugene O'Neill and appearing in his *All God's Chillun Got Wings* (1924) and *The Emperor Jones* (1924), a huge success in New York City and London. He also starred in the film version of *The Emperor Jones* (1933). Robeson's superb bass-baritone brought him worldwide renown with his performance of "Ol' Man River" in *Show Boat* (1928). His lead role in *Othello* won high praise in London (1930) and on Broadway (1943). He visited the Soviet Union in 1934 and became identified with leftist politics. In 1950 his passport was withdrawn because he refused to disclaim membership in the Communist Party. Viciously harassed and ostracized, Robeson left the U.S. to live in Europe and travel in Soviet-bloc countries, but he returned in 1963 because of ill health.

Robeson \'rōb-sən\ **Channel** Northernmost part of the sea passage connecting Baffin Bay with the Arctic Ocean. Located between Ellesmere Island, Can., and northwestern Greenland, it extends north for 50 mi (80 km) from the Hall Basin to the Lincoln Sea. For brief periods during the summer, the channel is open to navigation.

Robespierre \ˌrō-bes-'pyer**, Maximilien (François-Marie-Isidore) de** (b. May 6, 1758, Arras, France—d. July 28, 1794, Paris) French revolutionary. A successful lawyer in Arras (1781–89), he was elected to the National Assembly (1789), where he became notorious as an outspoken radical in favour of individual rights. He became a leading member of the Montagnards in the National Convention. After calling for the death of Louis XVI, he led the Jacobins (see Jacobin Club) and the Committee of Public Safety (1793) in establishing the Reign of Terror, during which, as virtual dictator of France, he had former friends such as Georges Danton executed. Despite earlier support from the people of Paris, who called him "the Incorruptible," he lost his dominating authority and was overthrown and guillotined in the Thermidorian Reaction. Often regarded as a bloodthirsty dictator, he was later valued for his social ideals of reducing inequality and ensuring work for all.

robin Either of two thrush species (family Turdidae). The American robin (*Turdus migratorius*), 10 in. (25 cm) long, with gray-brown upper parts and a rusty breast, lives in deciduous forests and sometimes towns. It eats earthworms, insects, and berries. The European robin, or robin redbreast (*Erithacus rubecula*), breeds throughout Europe, western Asia, and part of North Africa. It is 5.5 in. (14 cm) long, with olive-brown upper parts, white belly, and rusty-orange face and breast.

Robin Hood Legendary English outlaw. The hero of ballads dating from as early as the 14th century, Robin Hood was a rebel who robbed and killed landowners and government officials and gave his gains to the poor. He treated women and common people with courtesy, and he ignored the laws of the forest that restricted hunting rights. His greatest enemy was the sheriff of Nottingham. The ballads emerged during a time of agrarian unrest that culminated in the Peasants' Revolt of 1381. There is no evidence of Robin Hood's historical existence, though later tradition places him in the reign of King John. In postmedieval ballads and stories he was a nobleman who took refuge in Sherwood Forest after losing his lands. His men included Little John and Friar Tuck; his beloved was Maid Marion.

Robinson, Bill *orig.* **Luther Robinson** *known as* **Bojangles** (b. May 25, 1878, Richmond, Va., U.S.—d. Nov. 25, 1949, New York, N.Y.) U.S. tap dancer. He developed extraordinary tap-dancing skills as a child, became the first black performer to appear in white vaudeville shows, and was later the first black in Florenz Ziegfeld's Follies. He is best known for his starring roles in films, notably the four he made with Shirley Temple and the all-black musical *Stormy Weather* (1943). His soft-shoe and tap routines were widely copied by other dancers, but he was unmatched for ingenuity in creating new steps, especially his famous "stair dance." He also was famed for a unique ability to run backward. See also tap dance.

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Robinson, Edward G. *orig.* **Emmanuel Goldenberg** (b. Dec. 12, 1893, Bucharest, Rom.—d. Jan. 26, 1973, Hollywood, Calif., U.S.) Romanian-born U.S. film actor. He was raised in New York City's Lower East Side and won a scholarship to the American Academy of Dramatic Art. He was largely a stage actor until the advent of sound movies. He won fame playing a gangster boss in *Little Caesar* (1931). Short and chubby, with heavy features and a gruff voice, Robinson was content that his career would consist of rough-and-tumble roles and character parts. His later films include *Barbary Coast* (1935), *Double Indemnity* (1944), *The Woman in the Window* (1944), *Scarlet Street* (1945), *All My Sons* (1948), *Key Largo* (1948), and *The Cincinnati Kid* (1965). In 1973 he was posthumously awarded an honorary Academy Award.

Robinson, Edwin Arlington (b. Dec. 22, 1869, Head Tide, Maine, U.S.—d. April 6, 1935, New York, N.Y.) U.S. poet. He attended Harvard briefly, then he endured years of poverty and obscurity before his poetry began to attract attention. He is best known for short dramatic lyrics about the lives (mostly tragic) of the people in a small New England village; these include "Richard Cory" and "Miniver Cheevy." Among his collections are *The Children of the Night* (1897), *The Man Against the Sky* (1916), and *Collected Poems* (1921, Pulitzer Prize). He also wrote long narrative poems, including *Merlin* (1917), *Lancelot* (1920), *The Man Who Died Twice* (1924, Pulitzer Prize), *Tristram* (1927, Pulitzer Prize), and *Amaranth* (1934).

Robinson, Frank (b. Aug. 31, 1935, Beaumont, Tex., U.S.) U.S. baseball player and the first black manager in major league baseball. Robinson played principally for the Cincinnati Reds (1956–65) and Baltimore Orioles (1966–71). In 1966 he won the triple crown, leading the league in home runs (49), runs batted in (122), and batting average (.316). He later managed the Cleveland Indians (1975–77), San Francisco Giants (1981–84), Baltimore Orioles (1988–91), and Montreal Expos (since 2002; the franchise moved to Washington, D.C. in 2005 and was renamed the Nationals).

Robinson, Henry Peach (b. July 9, 1830, Ludlow, Shropshire, Eng.—d. Feb. 21, 1901, Tunbridge Wells) British photographer. Tiring of doing portraits, he turned to "high art" photographs, which imitated the anecdotal genre paintings popular at the time, creating them by pasting together parts of several negatives ("combination printing"). His photograph *Fading Away* (1858), depicting the peaceful death of a young girl surrounded by her grieving family, skillfully combines five different negatives. He used costumed models to shoot bucolic scenes in his studio. His *Pictorial Effect in Photography* (1869) was for decades the most influential book in English on photographic practice.

Robinson, Jackie *in full* **Jack Roosevelt Robinson** (b. Jan. 31, 1919, Cairo, Ga., U.S.—d. Oct. 24, 1972, Stamford, Conn.) U.S. baseball player, the first black player in the major leagues. Robinson became an outstanding performer in several sports at Pasadena Junior College and UCLA before leaving college to help his mother care for the family. He served as a second lieutenant in the U.S. Army in World War II. He played baseball with the Kansas City Monarchs of the Negro leagues before being signed by Branch Rickey to a Brooklyn Dodgers farm team (1945–46). On being advanced to the majors in 1947, he endured with notable dignity the early opposition to his presence, opposition quickly silenced by Robinson's immediate success as he led the league in stolen bases and was chosen Rookie of the Year. In 1949 he won the batting championship with a .342 average and was voted the league's most valuable player. He retired from the Dodgers team in 1956 with a career batting average of .311. In his later years he strongly supported the cause of civil rights for African Americans.

Jackie Robinson, 1946.
UPI

Robinson, James Harvey (b. June 29, 1863, Bloomington, Ill., U.S.—d. Feb. 16, 1936, New York, N.Y.) U.S. historian. Robinson received his doctorate from the University of Freiburg and returned to the U.S. to teach European history, principally at Columbia University (1895–1919). In *The New History* (1912), he called for the use of the social sciences in historical scholarship and put forth his controversial contention that the study of the past should serve primarily to improve the present. Among his other works are *The Mind in the Making* (1921) and several influential textbooks, including *The Development of Modern Europe* (1907–08; with Charles Beard).

Robinson, Joan (Violet) *orig.* **Joan (Violet) Maurice** (b. Oct. 31, 1903, Camberley, Surrey, Eng.—d. Aug. 5, 1983, Cambridge, Cambridgeshire) British economist. A professor at the University of Cambridge (1931–71), she helped develop Keynesian theory, establishing her reputation in 1933 with *The Economics of Imperfect Competition*, in which she analyzed distribution and allocation, dealing particularly with the concept of exploitation (see monopolistic competition). In the 1940s she began to incorporate aspects of Marxism into her work. Her unorthodox views and sympathy with noncapitalist systems—including China's, on which she wrote three books—involved her in controversy throughout her career.

Robinson, Mary *orig.* **Mary Bourke** (b. May 21, 1944, Ballina, County Mayo, Ire.) Irish politician, first woman president of Ireland (1990–97). She earned a law degree at the University of Dublin, where she became a professor of law (1969–75). She served in the Irish senate (1969–89) as a Labour Party member. Nominated by the Labour Party and supported by the Green Party and the Workers' Party, she became Ireland's first woman president in 1990 by mobilizing a liberal constituency and merging it with a more conservative constituency opposed to the Fianna Fáil party. In 1997 she left office a few months before her term expired to take up the post of UN high commissioner for human rights.

Robinson, Smokey *orig.* **William Robinson** (b. Feb. 19, 1940, Detroit, Mich., U.S.) U.S. singer and songwriter. Robinson formed a group while still in high school. As the Miracles, they released their first single, produced by Berry Gordy, Jr., who shortly thereafter founded the Motown label. Their first Motown hit, "Shop Around" (1961), was followed by "You Really Got a Hold on Me," "I Second That Emotion," and "The Tracks of My Tears"; Robinson also wrote other Motown hits such as the Temptations' "My Girl" and Mary Wells's "My Guy." He became president of Motown in 1972, by which time he was performing as a solo artist. He was inducted into the Rock and Roll Hall of Fame in 1987.

Robinson, Sugar Ray *orig.* **Walker Smith, Jr.** (b. May 3, 1921, Detroit, Mich., U.S.—d. April 12, 1989, Culver City, Calif.) U.S. boxer. Robinson began boxing in high school in New York City and won all of his 89 amateur fights. He was six times a world champion, once (1946–51) as a welterweight (147 lbs) and five times (1951–60) as a middleweight (160 lbs). In 201 professional bouts, he made 109 knockouts. He suffered only 19 defeats, most when he was past 40. His outstanding ability and flamboyant personality made him a hero of boxing fans throughout the world, and he is sometimes considered the best fighter in history.

robot Any automatically operated machine that replaces human effort, though it may not look much like a human being or function in a human-like manner. The term comes from the play *R.U.R.* by Karel Čapek (1920). Major developments in microelectronics and computer technology since the 1960s have led to significant advances in robotics. Advanced, high-performance robots are used today in automobile manufacturing and aircraft assembly, and electronics firms use robotic devices together with other computerized instruments to sort or test finished products.

robotics Design, construction, and use of machines (robots) to perform tasks done traditionally by human beings. Robots are widely used in such industries as automobile manufacture to perform simple repetitive tasks, and in industries where work must be performed in environments hazardous to humans. Many aspects of robotics involve artificial intelligence; robots may be equipped with the equivalent of human senses such as vision, touch, and the ability to sense temperature. Some are even capable of simple decision making, and current robotics research is geared toward devising robots with a degree of self-sufficiency that will permit mobility and decision-making in an unstructured environment. Today's industrial robots do not resemble human beings; a robot in human form is called an android.

Roca \'rō-kə**, Cape** Promontory in Portugal. The westernmost point of continental Europe, Cape Roca lies on the Atlantic coast northwest of Lis-

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BON. Known to the Romans as Promontorium Magnum, the cape is a narrow granite cliff, 472 ft (144 m) high, forming the western end of the Sintra Mountains.

rocaille \rō-'kī\ *French* **rock work** In Western architecture and decorative arts, an 18th-century style featuring elaborately stylized shell-like, rocklike, flower, fern, and scroll motifs. Originally designating the fanciful shellwork of artificial grottoes, rocaille came to be synonymous with LOUIS XV STYLE. It is most often found in small pieces of furniture and such personal articles as snuffboxes. The term "Rococo" combines "rocaille" and "barocco" (Baroque).

Rochambeau \ˌrō-ˌsham-'bō**, Jean-Baptiste-Donatien de Vimeur, count de** (b. July 1, 1725, Vendôme, France—d. May 10, 1807, Thoré) French army officer. He served in the War of the AUSTRIAN SUCCESSION and became a brigadier general in 1761. He was put in command of a French army of 6,000 sent to join the Continental Army in the AMERICAN REVOLUTION (1780). After waiting in vain for French naval support, he joined forces with GEORGE WASHINGTON at White Plains, N.Y., in 1781. They marched to YORKTOWN, where they besieged British troops and forced their surrender. He returned to France (1783), where he commanded the Army of the North in the FRENCH REVOLUTION and was made a marshal of France.

Roche \'rōsh**, (Eamonn) Kevin** (b. June 14, 1922, Dublin, Ire.) Irish-born U.S. architect. After studying under Ludwig MIES VAN DER ROHE, he became EERO SAARINEN's principal design associate. After Saarinen's death in 1961, Roche and John Dinkeloo (1918–81) completed Saarinen's unfinished projects, including the Dulles International Airport Terminal Building, near Washington, D.C. (1962), and St. Louis's Gateway Arch (1965). The two launched their own firm in 1966; their approach, though similar to Saarinen's, resulted in simpler geometric forms. Well-known works by Roche and Dinkeloo include the Ford Foundation headquarters in New York City (1968), General Foods headquarters in Rye, N.Y. (1977), and the Bouygues world headquarters outside Paris (1983). Roche received the Pritzker Architecture Prize in 1982.

Roche, Mazo de la See MAZO DE LA ROCHE

Roche \'rōsh\ **limit** Minimum distance at which a large natural SATELLITE can orbit its primary body without being torn apart by tidal forces. If satellite and primary are of similar composition, the theoretical limit is about 2.5 times the radius of the larger body. The rings of SATURN, for example, lie inside Saturn's Roche limit and may be the debris of a demolished moon. The limit was first calculated by the French astronomer Édouard Roche (1820–53) in 1850.

Rochefoucauld, duke de La See François VI, duke de LA ROCHEFOUCAULD

Rochester City (pop., 2000: 219,773) and port, northwestern New York, U.S. Founded in 1811 and incorporated as a city in 1834, it became a boomtown with construction of the ERIE CANAL and rail connections. It was the home of Margaret and Kate Fox, spiritualists who attracted world attention in the 1840s with their seances known as the "Rochester rappings." FREDERICK DOUGLASS published his antislavery newspaper there in 1847, and the city was a terminus of the UNDERGROUND RAILROAD. SUSAN B. ANTHONY lived there (1866–1906). In the 1890s GEORGE EASTMAN developed photographic equipment there; the city's manufacturing still includes cameras and photographic equipment. It is a cultural and educational centre and the home of the University of Rochester, the Eastman School of Music, and the Rochester Institute of Technology.

Rochester, John Wilmot, 2nd earl of (b. April 10, 1647, Ditchley Manor House, Oxfordshire, Eng.—d. July 26, 1680, Woodstock, Oxfordshire) English poet and wit. The most notorious debauchee of the RESTORATION court, Rochester was also its best poet and one of the most original and powerful English satirists. *A Satyr Against Mankind* (1675) is a scathing denunciation of rationalism and optimism that contrasts human perfidy with animal wisdom, and "History of Insipids" (1676) is a devastating attack on the government of CHARLES II. In 1680 he became ill, experienced a religious conversion, and recanted his past, ordering "all his profane and lewd writings" burned. His single dramatic work is *Valentinian* (1685).

rock In geology, a naturally occurring and coherent aggregate of MINERALS. The three major classes of rock—IGNEOUS, SEDIMENTARY, and METAMORPHIC—are based on the processes that formed them. These three classes are further subdivided on the basis of various factors, especially chemical, mineralogical, and textural attributes (see e.g., ACID AND BASIC ROCKS; CRYSTALLINE ROCK; EXTRUSIVE ROCK). See also FELSIC ROCK; INTRUSIVE ROCK; MAFIC ROCK.

rock See ROCK MUSIC

rock art Ancient or prehistoric drawing, painting, or similar work on or of stone. Rock art includes pictographs (drawings or paintings), petroglyphs (carvings or inscriptions), engravings (incised motifs), petroforms (rocks laid out in patterns), and geoglyphs (ground drawings). The ancient animals, tools, and human activities depicted often help shed light on daily life in the distant past, though the images are frequently symbolic. Sometimes a single site may have art that dates from several centuries. Rock art may have played a role in PREHISTORIC RELIGION, possibly in connection with ancient MYTHS or the activities of SHAMANS. Important sites occur in southern Africa, Europe, North America, and Australia.

rock crystal Transparent variety of the SILICA MINERAL QUARTZ that is valued for its clarity and total lack of colour or flaws. Rock crystal formerly was used extensively as a gemstone, but it has been replaced by glass and plastic; rhinestones originally were quartz pebbles found in the Rhine River. The optical properties of rock crystal led to its use in lenses and prisms; its piezoelectric properties (see PIEZOELECTRICITY) are used to control the oscillation of electrical circuits.

Rock crystal from the Dauphiné region of France.
EMIL JAVORSKY-EB INC.

rock glacier Tonguelike body of coarse rock fragments, found above the timberline on mountains, that moves slowly down a valley. The rock material usually has fallen from the valley walls and may contain large boulders; it resembles the material left at the end (terminus) of a true GLACIER. A rock glacier may be 100 ft (30 m) deep and nearly a mile (1.5 km) long.

rock music *or* **rock and roll** Musical style that arose in the U.S. in the mid-1950s and became the dominant form of popular music in the world. Though rock has used a wide variety of instruments, its basic elements are one or several vocalists, heavily amplified electric guitars (including bass, rhythm, and lead), and drums. It began as a simple style, relying on heavy, dance-oriented rhythms, uncomplicated melodies and harmonies, and lyrics sympathetic to its teenage audience's concerns—young love, the stresses of adolescence, and automobiles. Its roots lay principally in RHYTHM AND BLUES (R&B) and COUNTRY MUSIC. Both R&B and country existed outside the mainstream of popular music in the early 1950s, when the Cleveland disc jockey Alan Freed (1921–65) and others began programming R&B, which until then had been played only to black audiences. Freed's success gave currency to the term *rock and roll*. The highly rhythmic, sensual music of CHUCK BERRY, BILL HALEY and the Comets, and particularly ELVIS PRESLEY in 1955–56 struck a responsive chord in the newly affluent postwar teenagers. In the 1960s several influences combined to lift rock out of what had already declined into a bland and mechanical format. In England, where rock's development had been slow, the BEATLES and the ROLLING STONES were found to have retained the freshness of its very early years and achieved enormous success in the U.S., where a new generation had grown up unaware of the musical influences of the new stars. At the same time, BOB DYLAN, JONI MITCHELL, the Byrds, and others were blending the traditional ballads and verse forms of FOLK MUSIC with rock, and musicians began to explore social and political themes. Performers such as the GRATEFUL DEAD, JIM MORRISON of the Doors, and Frank Zappa of the Mothers of Invention combined imaginative lyrics with instrumental virtuosity, typically featuring lengthy solo improvisation. JANIS JOPLIN and JIMI HENDRIX won large followings with their exotic elaborations on R&B. The 1970s saw the rise of singer-songwriters such as PAUL SIMON, NEIL YOUNG, ELTON JOHN, DAVID BOWIE, and BRUCE SPRINGSTEEN, and rock assimilated other forms to produce JAZZ-rock, HEAVY METAL, and PUNK ROCK. In the 1980s the DISCO-influenced rock of MADONNA, MICHAEL JACKSON, and PRINCE was balanced by the post-punk "new wave" music of performers such as LAURIE ANDERSON, Talking Heads (led by DAVID BYRNE), and the Eurythmics—all of whom illustrated their songs with music videos. By the 1990s rock music had incorporated grunge, RAP, TECHNO, and other forms.

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Rock River River, north-central U.S. It rises in southeastern Wisconsin and flows across the northwestern corner of Illinois, emptying into the Mississippi River at Rock Island, Ill.; it is 300 mi (480 km) long. The bottomlands along the lower course are subject to spring floods and require levee protection.

Rockefeller, David (b. June 12, 1915, New York, N.Y., U.S.) U.S. banker and philanthropist. He was the grandson of JOHN D. ROCKEFELLER and brother of NELSON ROCKEFELLER. After earning a Ph.D. in economics at the University of Chicago (1940) and serving in World War II (1942–45), he joined the staff of the Chase National Bank of New York in 1946. He became senior vice president in 1952 and effected the merger with the Bank of Manhattan Co. that resulted in the CHASE MANHATTAN BANK (1955); he served as the bank's chairman of the board from 1969 to 1981. His speciality was international banking, and he was a familiar figure to ministers and heads of state of various countries around the world.

Rockefeller, John D(avison) (b. July 8, 1839, Richford, N.Y., U.S.—d. May 23, 1937, Ormond Beach, Fla.) U.S. industrialist and philanthropist. He moved with his family to Cleveland, Ohio, in 1853, and in 1859 he established a commission business dealing in hay, grain, meats, and other goods. In 1863 he built an oil refinery that soon was the largest in the area. With a few associates he incorporated STANDARD OIL CO. (Ohio) in 1870. He bought out competitors to control the oil-refinery business in Cleveland (1872) and in the U.S. (1882). He placed the stock of the company and its affiliates in other states under control of a board of trustees, establishing the first major U.S. business trust company. As a result of antitrust proceedings, he later converted the trust into a holding company. In the 1890s he turned his attention to philanthropy. He founded the University of CHICAGO in 1892, the Rockefeller Institute for Medical Research (later Rockefeller University) in 1901, and the ROCKEFELLER FOUNDATION in 1913. He donated over $500 million in his lifetime, and his philanthropy continued through donations by his son, John D. Rockefeller, Jr. (1874–1960), and other descendants.

Rockefeller, Nelson (Aldrich) (b. July 8, 1908, Bar Harbor, Maine, U.S.—d. Jan. 26, 1979, New York, N.Y.) U.S. politician. A grandson of JOHN D. ROCKEFELLER, he worked for several family enterprises, including Creole Petroleum in Venezuela (1935–40). He became coordinator of inter-American affairs at the U.S. State Department (1940–44), assistant secretary of state (1944–45), and undersecretary of health, education, and welfare (1953–55). As governor of New York (1959–73), he oversaw expansion of the state's fiscal, cultural, and educational systems. He sought the Republican Party presidential nomination in 1964 and 1968. He served as U.S. vice president (1974–77) under GERALD FORD. A major art patron, he founded the Museum of Primitive Art (later incorporated into the METROPOLITAN MUSEUM OF ART).

Rockefeller Center Complex of 14 limestone skyscrapers set amid a series of outdoor spaces on a 12-acre (5-hectare) site, built between 1929 and 1940 in midtown Manhattan. It was designed by a team of architects headed by Henry Hofmeister, H. W. Corbett, RAYMOND HOOD, and Wallace K. Harrison. Wood veneering, mural painting, mosaics, sculpture, metalwork, and other allied arts were integrated with the architecture. Radio City Music Hall (1932) is noted for its ART DECO interior.

Rockefeller Foundation U.S. philanthropic organization. It was endowed by JOHN D. ROCKEFELLER and chartered in 1913 to alleviate human suffering worldwide. Rockefeller was assisted in its management by his son John D. Rockefeller, Jr. Among its many activities, the foundation supports medical research and education. It also provides grant and fellowship programs in the social sciences, agricultural sciences, and global environmental studies, and in building democracy and international philanthropy.

rocket Type of jet-propulsion device that uses either solid or liquid propellants to provide the fuel and oxidizer needed for combustion. The hot gases provided by combustion are ejected in a jet through a nozzle at the rear of the rocket. The term is also commonly applied to any of various vehicles, including fireworks, skyrockets, GUIDED MISSILES, and LAUNCH VEHICLES for SPACECRAFT, that are driven by such a propulsive device. Typically, thrust (force causing forward motion) is produced by reaction to a rearward expulsion of hot gases at extremely high speed (see NEWTON'S LAWS OF MOTION).

rocket See ARUGULA

rockfish *or* **stonefish** Name applied to species in the SCORPION-FISH family (Scorpaenidae), including the LIONFISH, REDFISH, and ZEBRA FISH. In North America the name is also applied to the eastern mudminnow (*Umbra pygmaea*, family Umbridae), one of several hardy fishes of cool, mud-bottomed ponds, lakes, and streams. Eastern mudminnows frequently bury themselves, tail first, in the mud. They are often used as bait.

Rockford City (pop., 2000: 150,111), northern Illinois, U.S. Located on the ROCK RIVER, it is the state's second largest city and was founded by New Englanders in 1834. Originally called Midway, it was renamed for the ford across the river and incorporated as a city in 1852. Waterpower supplied by a dam built in 1844 led to its development as a manufacturing centre in the middle of an agricultural area. Principal products include machine tools and hardware, farm implements, furniture, and seeds.

Rockingham, Charles Watson-Wentworth, 2nd marquess of (b. May 13, 1730—d. July 1, 1782, London, Eng.) British politician. From 1751 to 1762 he served as gentleman of the bedchamber for GEORGE II and then GEORGE III, who appointed him prime minister in 1765. He obtained repeal of the unpopular STAMP ACT but agreed to the passage of the DECLARATORY ACT. His ministry collapsed through internal dissension in 1766. He and EDMUND BURKE led the parliamentary opposition to the ministries in power and spoke in favour of independence for the American colonies. In his brief second ministry (1782), he began peace negotiations with the U.S. and obtained legislative independence for the Irish parliament.

Rockne \'räk-nē**, Knute (Kenneth)** (b. March 4, 1888, Voss, Nor.—d. March 31, 1931, Chase county, Kan., U.S.) U.S. football coach. He immigrated with his family to Chicago in 1893. He ran track and played end on the University of Notre Dame football team, combining with quarterback Gus Dorias to popularize the forward pass as a major offensive tactic. In 1919 he was named head coach at Notre Dame. In Rockne's 13 seasons, his "Fighting Irish" posted an impressive record (105–12–5) that included 5 undefeated seasons and 3 national championships. He coached players such as George "The Gipper" Gipp and the members of the FOUR HORSEMEN, and his colourful personality captured the public's imagination.

Rockwell, Norman (b. Feb. 3, 1894, New York, N.Y., U.S.—d. Nov. 8, 1978, Stockbridge, Mass.) U.S. illustrator. He studied at the Art Students League and received his first freelance assignment at 17. From 1916 to 1963 he produced 317 covers for *The Saturday Evening Post*. Most of his works are humorous treatments of idealized small-town and family life. During World War II, posters of his *Four Freedoms* were distributed by the Office of War Information. Though loved by the public, Rockwell's work was often dismissed by critics. Late in his career, he turned to more serious subjects (e.g., a series on racism for *Look* magazine) and began to receive more serious attention, and in the 1990s his critical reputation enjoyed a positive reassessment.

Rocky Mountain goat See MOUNTAIN GOAT

Rocky Mountain National Park National park, north-central Colorado, U.S. Established in 1915 and enclosing part of the Front Range of the ROCKY MOUNTAINS, the park has an area of 262,191 acres (106,105 hectares). It contains many peaks exceeding 10,000 ft (3,000 m), including Longs Peak (14,255 ft [4,345 m]), as well as broad valleys and alpine lakes. The tundra in the park's high country is an island of Arctic vegetation surrounded by plants of lower latitudes. Animal life includes bighorn sheep, deer, mountain lions, and a variety of birds.

Rocky Mountain spotted fever TYPHUS-like disease first seen in the Rocky Mountain region, caused by the bacterium *Rickettsia rickettsii* (see RICKETTSIA) and transmitted by various TICKS. In severe cases the rash bleeds more and is especially prominent on the wrists and ankles. Central nervous system involvement causes restlessness, insomnia, and delirium. Prostration may progress to coma, with death possible in a week or more. Mortality increases with age. Recovery is slow but usually complete as visual disturbances, deafness, and mental confusion pass. Prompt antibiotic treatment hastens it and reduces mortality. Prevention depends on avoiding tick bites, by wearing long, light-coloured clothing and insect repellent and inspecting for ticks. A vaccine reduces the risk of infection somewhat and of death greatly.

Rocky Mountains *or* **Rockies** Mountain system, western North America. It extends some 3,000 mi (4,800 km) from the Mexican frontier to the Arctic Ocean, through the western U.S. and Canada. The highest peak in the U.S. Rockies is Mount Elbert in Colorado, at 14,433 ft (4,399 m); in the Canadian Rockies it is Mount Robson in British Colum-

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bia, at 12,972 ft (3,954 m). The Continental Divide, located in the mountains, separates rivers flowing to the east and to the west. Wildlife includes grizzly bear, brown bear, elk, bighorn sheep, and cougar. The area is rich in deposits of copper, iron ore, silver, gold, lead, zinc, phosphate, potash, and gypsum. Rocky Mountain, Yellowstone, and Grand Teton national parks in the U.S. are major recreational facilities.

Rococo \rə-'kō-ˌkō, rō-kə-'kō\ **style** *or* **Late Baroque** Style in interior design, the decorative arts, painting, architecture, and sculpture that originated in Paris in the early 18th century. The word Rococo is derived from French *rocaille*, denoting the shell-covered rockwork used to decorate artificial grottoes. Reacting against the ponderous Baroque that had become the official style of Louis XIV's reign, the Rococo was light, elegant, and elaborately ornamented. Several interior designers, painters, and engravers—among them Pierre Le Pautre, Juste-Aurèle Meissonier, Jean Berain, and Nicolas Pineau—developed a lighter and more intimate style of decoration for the new residences of nobles in Paris, and the style was disseminated throughout France by means of engravings. In these designers' work, walls, ceilings, and moldings feature interlacings of curves and countercurves based on S and C shapes as well as on shell forms and other natural shapes. Chinese motifs were also employed (see chinoiserie). Rococo painting was characterized by easygoing treatments of mythological and courtship themes, delicate brushwork, and sensuous colouring; notable practitioners included Antoine Watteau, François Boucher, and Jean-Honoré Fragonard. The Rococo style spread throughout France and other countries, principally Germany and Austria. Among the finest German examples of Rococo architecture is the church designed by Balthasar Neumann at Vierzehnheiligen, near Lichtenfels, in Bavaria. In Italy the Rococo style was concentrated primarily in Venice, where it was epitomized by the large-scale decorative paintings of Giovanni Battista Tiepolo.

Rodchenko \räd-'cheŋ-kō**, Aleksandr (Mikhailovich)** (b. Dec. 5, 1891, St. Petersburg, Russia—d. Dec. 3, 1956, Moscow, Russia, U.S.S.R.) Russian painter, sculptor, designer, and photographer. He initially embraced a completely abstract, highly geometric style, using a ruler and compass. His series of black-on-black geometric paintings (1918) was a direct response to Kazimir Malevich's painting *White on White*. In 1919, influenced by Vladimir Tatlin, he began to make hanging three-dimensional constructions that were, in effect, mobiles. As leader of a wing of Constructivism that sought to produce works appropriate to workers' daily lives, he renounced easel painting and took up photography and book, furniture, and set design. His innovations in lighting in his photography influenced Sergei Eisenstein. He returned to easel painting in the 1930s.

Roddenberry, Gene *in full* **Eugene Wesley Roddenberry** (b. Aug. 19, 1921, El Paso, Texas, U.S.—d. Oct. 24, 1991, Santa Monica, Calif.) U.S. television and film producer. He worked as a pilot (1945–49) and police officer (1949–53) before becoming a writer for television series such as *Dragnet* and *Dr. Kildare*. He created the idea for the *Star Trek* series and produced the show from 1966 until it ended in 1969; later rerun in syndication, it developed a durable cult following among fans known as "Trekkies." He produced six *Star Trek* movies, and from 1987 to 1991 he produced the television series *Star Trek: The Next Generation*.

rodent Any member of the order Rodentia, which contains 50% of all living mammal species. Rodents are gnawing, mostly herbivorous, placental mammals. They have one pair of upper and one pair of lower, continuously growing, incisors. When the lower jaw is pulled back, the cheek teeth connect for grinding; when it is pulled forward and down, the incisors meet at the tips for gnawing. Rodent families include squirrels (Sciuridae); Old World mice (see mouse) and rats (Muridae); deer mice (see deer mouse), gerbils, hamsters, lemmings, muskrats, wood rats, and voles (Cricetidae); beaver (Castoridae); gophers (Geomyidae); guinea pigs (Caviidae); pocket mice (see pocket mouse) and kangaroo rats and mice (Heteromyidae); New and Old World porcupines (Erethizontidae and Hystricidae); and hutia (Capromyidae).

rodeo Sport involving a series of contests derived from North American cowboy skills. Rodeos typically feature competitive or exhibition bronco riding, calf roping, steer wrestling, and Brahma bull riding. The sport developed from informal competitions among cowboys held from the mid-19th century. Denver is traditionally accepted as the birthplace of paid spectator rodeo, in 1887. The oldest surviving annual show is the Frontier Days celebration in Cheyenne, Wyo. (established 1897). The Calgary Stampede has been held annually in Alberta, Can., since 1923. In calf roping and steer wrestling, the contestant seeks to bring down the animal in the shortest possible time. In riding events, contestants seek to stay on their mounts as long as possible and are awarded points for style, control, and other factors.

Rodgers, Jimmie *orig.* **James Charles Rodgers** (b. Sept. 8, 1897, Meridian, Miss., U.S.—d. May 26, 1933, New York, N.Y.) U.S. country music singer and guitarist. He left school at age 14 to work on the railroad, and he would be known throughout his career as the "Singing Brakeman." While working on the trains he learned guitar and banjo, absorbed blues techniques from African American railroad workers, and eventually created his characteristic sound—a blend of traditional work, blues, hobo, and cowboy songs and his trademark "blue yodel." By c. 1924 tuberculosis had made his railroad work impossible; he began instead to perform and soon became a best-selling recording artist, the first solo star of country music. His more than 110 recordings include "Blue Yodel No. 1" and "Mississippi River Blues." He died at age 35. He was one of the first three inductees into the Country Music Hall of Fame.

Rodgers, Richard (b. June 28, 1902, New York, N.Y., U.S.—d. Dec. 30, 1979, New York City) U.S. composer. Rodgers studied at Columbia University, where he met his future collaborator Lorenz Hart, and he later studied composition at the Institute of Musical Art. His first success with Hart (who wrote lyrics) was a revue, *The Garrick Gaieties* (1925). Their comedy *On Your Toes* (1936), with the jazz ballet *Slaughter on Tenth Avenue*, established serious dance as a permanent part of musical comedy. Among their other collaborations were *Babes in Arms* (1937), *The Boys from Syracuse* (1938), and *Pal Joey* (1940), which was revived in 1952 with great success. After Hart's death, Rodgers worked with librettist Oscar Hammerstein. Their *Oklahoma!* (1943, Pulitzer Prize) enjoyed a then-unprecedented Broadway run of 2,248 performances; their 17-year partnership produced successes such as *South Pacific* (1949), *The King and I* (1951), and *The Sound of Music* (1959) and made them the foremost team in the history of the American musical.

Rodin \rō-'daⁿ**, (François-) Auguste (René)** (b. Nov. 12, 1840, Paris, France—d. Nov. 17, 1917, Meudon) French sculptor. Insolvent and repeatedly rejected by the École des Beaux-Arts, he earned his living by doing decorative stonework. Not until his late 30s, after a trip to Italy, did he develop a personal style free of academic restraints and establish his reputation as a sculptor with *The Age of Bronze* (exhibited 1878), whose realism was so great that he was accused of forming its mold on a living person. His *Gates of Hell*, a bronze door commissioned in 1880 for a proposed Musée des Arts Décoratifs, remained unfinished at his death, but two of its many figures were the bases of his most famous images, *The Thinker* (1880) and *The Kiss* (1886). His portraits include monumental figures of Victor Hugo and Honoré de Balzac. Though these and many other works caused controversy for their unconventionality, he was successful enough that he could establish a workshop where he executed only molds, leaving the casting of bronze and the carving of marble to assistants. To his sculpture he added book illustrations, etchings, and numerous drawings, mostly of female nudes. He revitalized sculpture as an art of personal expression and has been considered one of its greatest portraitists.

Rodney, Caesar (b. Oct. 7, 1728, Dover, Del.—d. June 26, 1784, Dover, Del., U.S.) American Revolutionary leader. He was a delegate to the Stamp Act Congress (1765) and the Continental Congress (1774–76, 1777–78). He cast the tie-breaking vote in the Delaware delegation that decided the Congress's resolution for independence. A signer of the Declaration of Independence, he became commander of the Delaware militia (1777) and served as "president" of Delaware (1778–81).

Rodrigo, Joaquín (b. Nov. 22, 1901, Sagunto, Spain—d. July 6, 1999, Madrid) Spanish composer. Rodrigo, who was blind from age three, studied music from an early age. Best known for his music for the guitar, especially his highly successful *Concierto de Aranjuez* for guitar and orchestra (1939), Rodrigo also wrote concertos for other instruments, a ballet, an opera, and some 60 songs.

Roe deer buck (*Capreolus capreolus*). PHILIP WAYRE/EB INC.

roe deer Almost tailless Eurasian deer (*Capreolus capreolus*), found in

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small family groups in lightly forested regions. It stands 26–34 in. (66–86 cm) at the shoulder. Its coat is reddish brown in summer and grayish brown, with a conspicuous white rump patch, in winter. The male has short, usually three-tined antlers roughened at the base. When alarmed, the deer barks like a dog.

Roe v. Wade (1973) Decision of the Supreme Court of the United States that established a woman's right to have an abortion without undue interference from the government. A Texas law prohibiting abortions was challenged by an unmarried pregnant woman (pseudonymously named Jane Roe), and the court ruled in her favour, finding that the state had violated her right to privacy (see rights of privacy). Harry Blackmun, writing for the seven-member majority, argued that the state's legitimate concern for the protection of prenatal life increased as a pregnancy advanced. While allowing that the state might forbid abortions during a pregnancy's third trimester, he held that a woman was entitled to obtain an abortion freely, after medical consultation, during the first trimester and in an authorized clinic during the second trimester. The *Roe* decision, perhaps the most controversial in the Supreme Court's history, remains at the centre of the issue of abortion rights. Repeated challenges since 1973, such as *Planned Parenthood of Southeastern Pennsylvania* v. *Casey*, have narrowed the scope of *Roe* but have not overturned it.

Roebling \'rœb-liŋ,\ *English* \'rō-bliŋ**, John Augustus** (b. June 12, 1806, Mühlhausen, Prussia—d. July 22, 1869, Brooklyn Heights, N.Y., U.S.) German-U.S. civil engineer, a pioneer in the design of suspension bridges. He immigrated to the U.S. in 1831. His best-known work is New York's Brooklyn Bridge. In the 1850s and '60s Roebling and his son Washington (1837–1926) built four suspension bridges: two at Pittsburgh, one at Niagara Falls (1855), and one at Cincinnati (1866). When his design for a bridge connecting Brooklyn and Manhattan was accepted, he was appointed chief engineer. He died from an injury he received as construction began. Washington completed the project in 1883; himself incapacitated from 1872 by decompression sickness, his completion of the work depended heavily on his wife, Emily Warren Roebling.

Roentgen \'rœnt-gən**, Abraham** (b. 1711, Mühlheim, Cologne—d. 1793, Neuwied?, Trier) German furniture designer and cabinetmaker. In 1750 he established a shop in Neuwied, near Cologne. The Rococo-style furniture he produced there was of outstanding quality and was often decorated with inlay work of ivory and other semiprecious materials. Much of his work was created for various German courts. His son David Roentgen (1743–1807), who succeeded him as head of the firm in 1772, was appointed cabinetmaker to Marie-Antoinette of France. The Roentgens' shop was perhaps the most successful firm of furniture production in the 18th century.

Roentgen, Wilhelm Conrad See Wilhelm Conrad Röntgen

Roethke \'ret-kē**, Theodore** (b. May 25, 1908, Saginaw, Mich., U.S.—d. Aug. 1, 1963, Bainbridge Island, Wash.) U.S. poet. He was educated at the University of Michigan and Harvard University. He later taught at several colleges and universities, notably the University of Washington (1947–63). His verse, characterized by introspection and intense lyricism, is collected in volumes such as *Open House* (1941), *The Waking* (1953, Pulitzer Prize), *Words for the Wind* (1957, Bollingen Prize, National Book Award), and *The Far Field* (1964, National Book Award). His later career was interrupted by hospitalizations for manic depression.

Roger I *known as* **Roger Guiscard** \gēs-'kȧr\ (b. 1031, Normandy, France—d. June 22, 1101, Mileto, Calabria) Count of Sicily (1072–1101). A Norman knight, he went to Italy (1057) to help his brother Robert Guiscard take Calabria from the Byzantines (1060). They launched a campaign to conquer Sicily from the Muslims (1061). When they captured Palermo (1072), Roger was granted a limited right to govern Sicily and Calabria. After Robert's death, he gained full right to govern and created an efficient centralized government.

Roger II (b. Dec. 22, 1095—d. Feb. 26, 1154, Palermo) Grand count of Sicily (1105–30) and king of Sicily (1130–54). The son of Roger I, he was a capable and energetic ruler who incorporated the mainland territories of Calabria (1122) and Apulia (1127). He was crowned king by the antipope Anacletus II, and he forced Innocent II to confirm him in 1139. He built a powerful navy but refused to join the Second Crusade, preferring as the ruler of a largely Arab population to show tolerance toward Muslims. He promulgated a law code (1140), and his court was an intellectual center for both Arab and Western scholars.

Rogers, Carl R(ansom) (b. Jan. 8, 1902, Oak Park, Ill., U.S.—d. Feb. 4, 1987, La Jolla, Calif.) U.S. psychologist. He trained at Teachers College, Columbia University (Ph.D., 1931), and directed a children's agency in New York before taking teaching positions at various universities. In 1963 he helped found an institute for the study of the person in La Jolla, Calif. He is known as the originator of client-centred, or nondirective, psychotherapy, and he helped establish humanistic psychology. His writings include *Counseling and Psychotherapy* (1942), *Client-Centered Therapy* (1951), *Psychotherapy and Personality Change* (1954), and *On Becoming a Person* (1961).

Rogers, Fred (McFeely) *known as* **Mr. Rogers** (b. March 20, 1928, La Trobe, Pa., U.S.—d. Feb. 27, 2003, Pittsburgh, Pa.) U.S. television host and producer. He produced the local public-television show *The Children's Corner* (1954–61) and later created a similar program, *Mister Rogers*, for Canadian television (1963–64). In 1968 he developed it into *Mister Rogers' Neighborhood*. Known for his gentleness and his desire to educate, Rogers, who was ordained a Presbyterian minister in 1962, used puppets, music, and guests to teach his viewers about various subjects and emotions. His show, the longest-running U.S. children's television program, garnered many honours. In 2002 he was awarded the Presidential Medal of Freedom, the highest U.S. civilian honour.

Rogers, Ginger *orig.* **Virginia Katherine McMath** (b. July 16, 1911, Independence, Mo., U.S.—d. April 25, 1995, Rancho Mirage, Calif.) U.S. film actress. She began her career as a dancer in vaudeville and made her Broadway debut in 1929. After starring in *Girl Crazy* (1930–31), she moved to Hollywood. Her first performance with Fred Astaire, in *Flying Down to Rio* (1933), was so popular that they continued the partnership in nine more movies, including *The Gay Divorcee* (1934), *Top Hat* (1935), and *Swing Time* (1936). She also acted in the drama *Kitty Foyle* (1940, Academy Award) and in light comedies such as *Tom, Dick, and Harry* (1941) and *The Major and the Minor* (1942). Rogers returned to the Broadway stage in 1965, taking the lead in *Hello Dolly!*, and she followed that in 1969 with a star performance as *Mame* in London.

Rogers, Robert (b. Nov. 7, 1731, Methuen, Mass.—d. May 18, 1795, London, Eng.) American frontier soldier. He raised and commanded a militia called Rogers's Rangers, which earned fame in the French and Indian War and in Pontiac's War. He led the first English exploration of the upper Mississippi River and Great Lakes region (1766) but failed to reach the Pacific Ocean, his intended goal. In the American Revolution he was regarded as a loyalist spy; imprisoned by George Washington, he escaped to organize the Queen's Rangers, which he led in operations around New York. Defeated in 1780, he fled to England.

Rogers, Roy *orig.* **Leonard Franklin Slye Rogers** (b. Nov. 5, 1911/12, Cincinnati, Ohio, U.S.—d. July 6, 1998, Apple Valley, Calif.) U.S. actor and singer. During his childhood Rogers took up singing, guitar playing, and square-dance calling. He made radio and personal appearances with a succession of groups before helping form the singing group Sons of the Pioneers. He acted in westerns with Gene Autry, whom he replaced as "King of the Cowboys" when Autry went to war. His films include *Tumbling Tumbleweeds* (1935), *Red River Valley* (1941), and *Yellow Rose of Texas* (1944). He acted in several with his wife, Dale Evans, usually riding his famous horse, Trigger. He also starred on radio in *The Roy Rogers Show* (1944–55) as well as on television in a series of the same name (1951–57).

Will Rogers.
CULVER PICTURES

Rogers, Will(iam Penn Adair) (b. Nov. 4, 1879, Indian Territory, U.S. [near present-day Claremore, Okla.]—d. Aug. 15, 1935,

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near Point Barrow, Alaska) U.S. humorist and actor. Raised in Indian Territory, he demonstrated his rope-twirling skills in Wild West shows and vaudeville and gradually wove bits of homespun wit into his act. He was popular in New York City from 1905 and starred in Florenz Ziegfeld's *Midnight Frolic* (1915). Noted for his good-natured but sharp criticism of current affairs, he wrote a newspaper column in the *New York Times* (from 1922) as well as several books. He performed on radio and in movies such as *State Fair* (1933) and *Steamboat Round the Bend* (1935). His death in a plane crash in Alaska with the aviator Wiley Post (1899–1935) was widely mourned.

Roget \rō-'zhā**, Peter Mark** (b. Jan. 18, 1779, London, Eng.—d. Sept. 12, 1869, West Malvern, Worcestershire) English physician and philologist. In 1814 he invented a slide rule for calculating the roots and powers of numbers. He was instrumental in founding the University of London (1828). He is best known for his *Thesaurus of English Words and Phrases* (1852), a comprehensive classification of synonyms or verbal equivalents which he assembled during his retirement. He was a fellow (from 1815) and secretary (from 1827) of the Royal Society.

Roh Moo Hyun (b. Aug. 6, 1946, Gimhae, near Pusan, Korea [now in South Korea]) South Korean president (from 2003). Born into a poor family, Roh did not attend college but was able to pass the bar exam in 1975 and later became a highly respected human rights lawyer. He was a member of the National Assembly (1988–92) and served in the cabinet (1998–2002) of Pres. Kim Dae Jung. Roh, who favoured negotiations with North Korea and criticized U.S. policy toward the Korean peninsula, won the 2002 presidential elections. In March 2004 Roh was impeached over charges of electoral law violations, economic mismanagement, and illegal campaign donations. Forced to temporarily step down, he was reinstated as president in May after the Constitutional Court overturned the impeachment.

Rohan \rō-'äⁿ**, Henri, duke de** (b. 1579, Château of Blain, Brittany, France—d. April 13, 1638, Königsfeld, Switz.) French Huguenot leader. At age 16 he entered the army of Henry IV, who made him a peer of France in 1603. After Henry's death (1610), Rohan led the Huguenots in revolt against the government of Marie de Médicis (1615–16) and became the Huguenots' foremost general in the civil wars of the 1620s. He recounted the events of the War of La Rochelle (1627–29) in his celebrated *Mémoires*. He then went to Venice. After his return to France (1635), he successfully commanded a French expedition against the Habsburgs in Lombardy. In 1637 he went to Switzerland, where he died in the Thirty Years' War battle at Rheinfelden.

Rohan, Louis-René-Édouard, prince de (b. Sept. 25, 1734, Paris, France—d. Feb. 17, 1803, Ettenheim, Baden) French clergyman. A cardinal and bishop of Strasbourg (1779–1801), he spent much of his time at the French court. He was involved in the Affair of the Diamond Necklace (1785) when he was duped into purchasing a necklace for Marie-Antoinette without her authority. Tried for fraud, he was acquitted but was exiled from the court in disgrace, and he became a martyr to the queen's enemies and the critics of royal absolutism.

Rohe, Ludwig Mies van der
See Ludwig Mies van der Rohe

Röhm \'rœm**, Ernst** (b. Nov. 28, 1887, Munich, Ger.—d. July 1, 1934, Munich-Stadelheim) German leader of the SA. He rose to the rank of major in World War I. Soon thereafter, he helped found the Nazi Party. A supporter of Adolf Hitler, he offered Hitler the use of his private strong-arm force (later the SA). After brief imprisonment for his part in the Beer Hall Putsch (1923), Röhm went to Bolivia as a military instructor (1925–30), but he was recalled by Hitler to reorganize and command the SA. Röhm's ambition that the SA supplant or absorb the regular army came to be opposed by Hitler and his advisers. On the pretext that he and the SA were preparing to overthrow Hitler, Röhm was murdered during the Night of the Long Knives.

Röhm, 1933.
HEINRICH HOFFMANN, MUNICH

Rohmer \'rō-mər**, Eric** *orig.* **Jean-Marie-Maurice Scherer** (b. April 4, 1920, Nancy, France) French film director. After working as a schoolteacher, he became a founding editor of *La Gazette du Cinéma* in 1950 and later editor of the influential New Wave periodical *Cahiers du Cinéma* (1957–63). After directing several short films, he made a series of *contes moraux* ("moral tales") that included the successful films *My Night at Maud's* (1968), *Claire's Knee* (1970), and *Chloe in the Afternoon* (1972), sensitively observed studies of romantic love. His later films include *The Marquise of O* (1976), *Full Moon in Paris* (1984), and *Autumn Tale* (1999).

Rojas Pinilla \'rō-häs-pē-'nē-yä**, Gustavo** (b. March 12, 1900, Tunja, Colom.—d. Jan. 17, 1975, Bogotá) Soldier and dictator of Colombia (1953–57). He rose through the ranks of the army to seize power from the brutal regime of Laureano Gómez (b. 1889—d. 1965). Though he promised peace, justice, and liberty, he instead ruled by decree, silencing the opposition press, stirring up violence against Protestants, and embezzling government money. He was exiled and impeached but returned to form an opposition party and run for president. In 1970 he was narrowly defeated in elections he claimed were fraudulent; his supporters rioted and martial law was declared. His daughter sought the presidency in 1974 but was soundly defeated.

Rokitansky \ˌrō-kē-'tän-skē**, Karl, baron von** (b. Feb. 19, 1804, Königgrätz, Austria—d. July 23, 1878, Vienna) Austrian pathologist. He inspired Ignaz Semmelweis to study medicine and supported his use of antiseptic procedures to eliminate puerperal fever. Rokitansky was the first to detect bacteria in malignant endocarditis and to describe spondylolisthesis (forward displacement of one vertebra over another). He differentiated pneumonias originating in lobes of the lung and in bronchioles, made a fundamental study of acute yellow atrophy of the liver, and established the micropathology of emphysema. His *Treatise of Pathological Anatomy* (3 vol., 1842–46) elevated pathology to an established science. During his career he performed more than 30,000 autopsies.

Rokossovsky \rə-kə-'sȯf-skē**, Konstantin (Konstantinovich)** (b. Dec. 21, 1896, Velikiye Luki, Russia—d. Aug. 3, 1968, Moscow, Russia, U.S.S.R.) Russian army officer. He joined the Red Army in 1917 and rose through the ranks. Imprisoned in 1938 during the Stalinist purges, he was released when Germany invaded the Soviet Union in 1941. He became a noted commander in World War II, especially at the Battle of Stalingrad. After the war he was minister of defense in Soviet-dominated Poland (1949–56) and deputy minister of defense in the Soviet Union (1956–62).

Roland, Chanson de
See Chanson de Roland

Rolfe \'rälf**, John** (baptized May 6, 1585, Norfolk, Eng.—d. 1622?, Virginia) English colonial official. He arrived in Virginia (1610), where his experiments with tobacco cultivation produced the first export crop and built the colony's economy. In 1614 he married Pocahontas, which helped assure peaceful relations with local tribes. In 1617 the couple and their infant son traveled to England; they were enthusiastically received, but Pocahontas became ill and died. Rolfe returned to Virginia and was appointed to the colony's council. He was apparently killed in a massacre.

Rolland \rō-'läⁿ**, Romain** (b. Jan. 29, 1866, Clamecy, France—d. Dec. 30, 1944, Vézelay) French novelist, dramatist, and essayist. At age 14 he went to Paris to study and found a society in spiritual disarray, and his life and writings came to reflect his concern with major social, political, and spiritual events. From 1910 he taught music history at the Sorbonne. His best-known novel is *Jean-Christophe* (1904–12), a 10-volume epic whose protagonist is modeled half on Ludwig van Beethoven and half on himself. His pamphlet *Above the Battle* (1915) calls on France and Germany to respect truth and humanity during World War I. In the 1920s he turned to interpreting the mystical philosophy of Asia, especially India, in works such as *Mahatma Gandhi* (1924). He wrote several other major biographies, including *Beethoven* (1910). He was awarded the Nobel Prize for Literature in 1915.

Rolle \'rōl**, Richard (de Hampole)** (b. c. 1300, Thornton, Yorkshire, Eng.—d. Sept. 29, 1394, Hampole, Yorkshire) English mystic. He left the University of Oxford without a degree, dissatisfied with the subjects of study, and became a hermit. Writing in the vernacular for the sake of women readers, he exalted the contemplative life and emphasized a rapturous mystical union with God. He may have been spiritual adviser to the nuns of Hampole in his late years.

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roller bearing One of the two types of rolling, or antifriction, BEARINGS, the other being the BALL BEARING. Like a ball bearing, a roller bearing has two grooved tracks, but the balls are replaced by rollers. The rollers may be cylinders or shortened cones. If the rollers are cylindrical, only radial loads (perpendicular to the axis of rotation) can be carried, but with conical rollers both radial and thrust, or axial, loads (parallel to the axis of rotation) can be carried. In a given space, a roller bearing can carry a greater radial load than a ball bearing can.

roller-skating Recreation and sport in which the participants use roller skates (shoes with sets of wheels attached) to move about on special rinks or paved surfaces. The invention of roller skates is traditionally credited to the Belgian Joseph Merlin in the 1760s, but the first practical four-wheel skate was designed in 1863 by James Plimpton of Medford, Mass. Roller-skating speed events became popular in the early 20th century. Later, team competitions in "roller derbies" on banked tracks became a spectator sport. Other roller-skate contests, such as acrobatics and hockey, followed. In the late 20th century, roller skates gave way to in-line (Rollerblade) skates, in which a single row of wheels is used in place of the standard rectangular configuration.

Rolle's theorem \'rōlz\ Special case of the MEAN-VALUE THEOREM of differential calculus. It states that if a continuous curve passes through the *x*-axis twice within a given interval and has a unique TANGENT LINE at every point of that interval, then somewhere between the two points of interception it has a tangent parallel to the *x*-axis.

rolling In technology, the main method of forming molten METALS, GLASS, or other substances into shapes that are small in cross-section in comparison with their length, such as bars, sheets, rods, rails, and girders. Rolling is the most widely used method of shaping metals and is particularly important in the manufacture of STEEL. The process consists of passing the metal between pairs of rollers revolving at the same speed but in opposite directions and spaced so that the distance between them is slightly less than the thickness of the metal.

Rolling Stones British musical group. Its original members were Mick Jagger (b. 1943), Keith Richards (b. 1943), Brian Jones (1944–69), Bill Wyman (b. 1936), and Charlie Watts (b. 1941). The band was formed in 1962 when Jagger, Richards, and Jones, who had been performing sporadically in a blues band, recruited Wyman and formed their own group. Watts joined the band in 1963. Jagger was the lead vocalist, while Jones and Richards played guitars, Wyman played bass, and Watts played drums. The band's name was adopted from a MUDDY WATERS song. By 1966 a series of outstanding songs had made the band second in popularity only to the BEATLES. Jagger and Richards wrote most of its songs, which are marked by a driving backbeat, biting and satirical lyrics, and simple but expressive instrumental accompaniments. The group reached the height of its popularity with albums such as *Beggar's Banquet* (1968) and *Exile on Main Street* (1972). Jones was succeeded by Mick Taylor (b. 1948) in 1969, who was replaced in turn by Ron Wood (b. 1947) in 1976. They continued to perform long after the other classic rock bands of the 1960s disbanded.

Rollins, Sonny *orig.* **Theodore Walter Rollins** (b. Sept. 7, 1930, New York, N.Y., U.S.) U.S. JAZZ saxophonist and composer. Rollins was inspired by COLEMAN HAWKINS and CHARLIE PARKER and performed with many musicians in the late 1940s, including MILES DAVIS. A member of the CLIFFORD BROWN–MAX ROACH quintet in 1955–57, he later formed his own groups. Rollins's robust tone and technical dexterity are matched with athletic endurance in the service of the logical evolution of ideas in his solos.

Rollo (b. c. 860—d. c. 932) Scandinavian rover who founded the duchy of NORMANDY. After raiding Scotland, England, Flanders, and France on pirating expeditions, he took lands along the Seine River as his base (c. 911). He battled CHARLES III of France, who gave him, in return for Rollo's promise to stop pillaging, the part of Neustria that came to be called Normandy.

Rolls-Royce PLC British manufacturer of aircraft engines and propulsion and power systems and, for much of the 20th century, a maker of luxury automobiles. Charles S. Rolls, a pioneer motorist and aviator, and Henry Royce, an engineer and carmaker, incorporated Rolls-Royce Ltd. in 1906. The firm's handsome, immaculately engineered cars included the Silver Ghost (introduced 1906 as "40/50 hp" model), a series of Phantoms (1925), the Silver Dawn (1949), Silver Cloud (1955), Silver Shadow (1965), and Silver Seraph (1998). In 1931 Rolls-Royce acquired Bentley Motors Ltd., another maker of fine cars. Rolls-Royce also developed a series of notable piston and jet aircraft engines, beginning with the Eagle (1914); eventually its turbine-engine operations accounted for the largest part of its sales. A fixed-price contract with Lockheed Aircraft (see LOCKHEED MARTIN CORP.) to produce an engine for its L-1011 TriStar jetliner drove Rolls-Royce into bankruptcy in 1971. It was split into two companies: its jet-engine division was taken over by the British government and later privatized as Rolls-Royce PLC, while its automobile operations were restructured into Rolls-Royce Motor Holdings Ltd. and privatized. The latter was acquired in 1980 by Vickers Ltd., which sold it to VOLKSWAGEN AG in 1998 as part of a novel agreement in which BMW AG would take over the manufacture of cars with the Rolls-Royce name in 2003, while Volkswagen retained the Bentley line.

Rølvaag \'rōl-ˌväg**, Ole (Edvart)** (b. April 22, 1876, Dönna Island, Helgeland, Nor.—d. Nov. 5, 1931, Northfield, Minn., U.S.) Norwegian-born U.S. novelist and educator. He immigrated to the U.S. in 1896 and spent most of his life at St. Olaf College (Northfield, Minn.), teaching Norwegian language and literature and the history of Norwegian immigration. His works, written in Norwegian, are noted for their realistic portrayals of Norwegian settlers on the Dakota prairies and of the clash between transplanted and native cultures in the U.S. His best-known work is *Giants in the Earth* (1927), a translation of two of his novels.

ROM \'räm\ *in full* **read-only memory** Form of computer MEMORY that does not lose its contents when the power supply is cut off and that is not rewritable once it is manufactured or written. It is generally employed for programs designed for repeated use without modification, such as the start-up procedures of a PERSONAL COMPUTER; the ROM is used for storing the program used in the control unit of the computer. See also CD-ROM, COMPACT DISC.

Rom *or* **Gypsy** *plural* **Roma** Any member of a people originating in northern India but now living worldwide, principally in Europe. Most speak ROMANY in addition to the local language. It is thought that Roma groups left India in successive migrations, reaching western Europe by the 15th century. In the 20th century they spread to North and South America and Australia. Because of their often nomadic and marginalized lives, population figures are largely guesswork; estimates in the early 21st century range from two to three million. They have often been persecuted and harassed; the Nazis killed about 400,000 Roma in extermination camps. How many Roma retain a nomadic lifestyle is unclear, but those that migrate do so at least seasonally along patterned routes that ignore national boundaries. They pursue occupations compatible with a nomadic life. In the past they were often livestock traders, tinkers, fortune-tellers, and entertainers; today they are often car mechanics, auto-body repairmen, and workers in traveling circuses and amusement parks. Confederations of 10–100 families elect chieftains for life, but their title is not heritable. Women are organized as a group within the confederation and represented by a senior woman. Modern Roma culture faces erosion from urban influences; integrated housing, economic independence, and intermarriage with non-Roma have weakened Roma law.

Romains \rô-'ma^{n}**, Jules** *orig.* **Louis-Henri-Jean Farigoule** (b. Aug. 26, 1885, Saint-Julien-Chapteuil, France—d. Aug. 14, 1972, Paris) French novelist, dramatist, and poet. A teacher of philosophy, Romains first became known as a poet and as founder (c. 1908–11), with Georges Chennevière, of the literary movement Unanimisme, which combined belief in universal brotherhood with the psychological concept of group consciousness. His most popular work was the comedy *Knock* (1923), a satire on doctors. His masterpiece, *Men of Good Will*, 27 vol. (1932–46), is a vast novel cycle attempting to recreate the spirit of French society from 1908 to 1933 and exemplifying the Unanimiste interest in collective life.

roman Typeface used most widely in Western TYPOGRAPHY, the general term for the type of this book's text. Characterized by simple, unembellished shapes, roman was developed by 15th-century printers as an alternative to the heavy-bodied, spiky BLACK LETTER SCRIPT. Models for a new type that was easier to cut and read were found in the scriptoria, where scribes, probably at the urging of humanist scholars, were experimenting with a letter face they believed had been used in ancient Rome. Historians now trace its ancestry instead to the letter forms developed for Charlemagne's decrees by ALCUIN in the 9th century. Within a century, roman had superseded all other typefaces throughout Europe; the sole exception was Germany, where black letter continued to hold sway into the 20th century.

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roman à clef \rō-män-ä-'klā\ *French* **"novel with a key"** Novel that has the extraliterary interest of portraying identifiable people more or less thinly disguised as fictional characters. The tradition dates to 17th-century France, when members of aristocratic literary coteries included in their historical romances representations of well-known figures in the court of Louis XIV. A more recent example is W. Somerset Maugham's *Cakes and Ale* (1930), widely held to portray Thomas Hardy and Hugh Walpole. A more common type of roman à clef is one in which the disguised characters are easily recognized only by a few insiders, as in Simone de Beauvoir's *The Mandarins* (1954).

Roman Africa See Roman Africa

Roman alphabet See Latin alphabet

Roman Catholicism Largest denomination of Christianity, with more than one billion members. The Roman Catholic Church has had a profound effect on the development of Western civilization and has been responsible for introducing Christianity in many parts of the world. It regards itself as the only legitimate inheritor of the ministry of Jesus, by virtue of an unbroken succession of leaders beginning with St. Peter the Apostle and continuing to the present day. It holds that the pope is the infallible interpreter of divine revelation. Church organization is strictly hierarchical. The pope appoints and presides over the cardinals, whose numbers grew dramatically in the late 20th century, reaching 182 under John Paul II (1978–2005). Each of the church's 500 archbishops is the head of an archdiocese. These in turn are divided into about 1,800 dioceses, each headed by a bishop. Within dioceses are parishes, each served by a church and a priest. Only men can enter the priesthood, but women who wish to enter holy orders can become nuns, who are organized into orders and convents. The basic form of worship is the mass, which celebrates the sacrament of the Eucharist. Theologically, Roman Catholicism differs from Protestantism with regard to its understanding of the sources of revelation and the channels of grace. With Eastern Orthodoxy it asserts that both scripture and church tradition are revelatory of the basis of Christian belief and church polity. It sets the number of sacraments at seven (baptism, reconciliation [formerly known as penance], the Eucharist, matrimony, ordination, confirmation, and anointing of the sick); its rich sacramental life is supplemented by other devotions, chiefly eucharistic services and devotions to the saints. The Second Vatican Council (1962–65) promoted the role of the laity in the church, approved the use of the vernacular in the mass, and strove to improve relations with other religions. Pope John Paul II actively pursued better relations with other faiths, especially Judaism, and remained popular despite various controversies. Although faced with many challenges, the church remained one of the largest and most significant religious bodies in the world at the start of its third millennium.

Roman Curia Group of Vatican bureaus that assist the pope in exercising his jurisdiction over the Roman Catholic Church. The work of the Curia is traditionally associated with the College of Cardinals. A cardinal named as secretary of state coordinates the activities of the Curia, and various sacred congregations handle administrative matters—for example, the Sacred Congregation for the Causes of Saints is concerned with beatification and canonization and with the preservation of relics. The judicial branch of the Curia consists of three tribunals, of which the highest is the Apostolic Signatura.

Roman de la Rose \rō-'mä[n]-də-lä-'rōs\ *French* **"Romance of the Rose"** One of the most popular French poems of the late medieval period. Modeled on Ovid's *Art of Love*, it survives in more than 300 manuscripts. Its first 4,058 lines were written c. 1225–30 by Guillaume de Lorris; they form a charming dream allegory drawing on traditions of courtly love. About 1280 Jean de Meun wrote the rest of the more than 21,000 lines, incorporating a vast mass of encyclopaedic information and opinions on many contemporary topics, which secured the poem's fame. The *Roman* was translated by Geoffrey Chaucer and was one of the most important literary influences on his writings.

Roman law Law of the Roman Republic and Empire. Roman law has influenced the development of law in most of Western civilization. It dealt with matters of succession (or inheritance), obligations (including contracts), property (including slaves), and persons. Most laws were passed by assemblies dominated by the patrician families, though the rulings of magistrates were also important. Later emperors bypassed these forms and issued their own decrees. The interpretations of jurists also came to have the weight of law. Though various attempts were made to gather and simplify existing laws (beginning with the Law of the Twelve Tables), by far the most successful effort was that of Justinian I, whose code superseded all previous laws and formed the Roman Empire's legal legacy (see Code of Justinian). Roman legal procedure is the basis for modern procedure in civil-law countries. In the early Republic, the plaintiff was required to call the defendant to court or to bring him by force. A magistrate then decided whether the case should go before a *judex*, or prominent layman. The *judex* heard arguments from advocates and questioned witnesses; he made a decision but had no power to execute it. In the later Republic, much greater power was placed in the hands of the magistrates and courts: the summons was issued by the court, the trial was held only before a magistrate, and the court became responsible for the execution of the sentence.

Roman mythology Oral and literary traditions of the ancient Romans concerning their gods and heroes and the nature and history of the cosmos. Much of what became Roman mythology was borrowed from Greek mythology at a later date, as Greek gods were associated with their Roman counterparts. As in Greek mythology, legendary Roman heroes (such as Romulus and Remus and Aeneas) were given semidivine status. See also Roman religion.

Roman numerals System of representing numbers devised by the ancient Romans. The numbers are formed by combinations of the symbols I, V, X, L, C, D, and M, standing, respectively, for 1, 5, 10, 50, 100, 500, and 1,000 in the Hindu-Arabic numeral system. A symbol placed after another of equal or greater value adds its value; for example, II = 2 and LX = 60. A symbol placed before one of greater value subtracts its value; for example, IV = 4 and XL = 40. A bar over a symbol indicates that its value should be multiplied by 1,000.

1	I	8	VIII	40	XL	900	CM
2	II	9	IX	50	L	1,000	M
3	III	10	X	60	LX	5,000	$\overline{V}$
4	IV	11	XI	90	XC	10,000	$\overline{X}$
5	V	19	XIX	100	C	50,000	$\overline{L}$
6	VI	20	XX	200	CC	100,000	$\overline{C}$
7	VII	30	XXX	500	D	500,000	$\overline{D}$

Roman question Dispute between church and state in Italy. With the completed unification of Italy in 1870, the papacy objected to the Italian seizure of Rome and the Papal States. The conflict was ended in 1929 by the Lateran Treaty, which created Vatican City and resolved the dispute.

Roman religion Religious beliefs of the Romans from ancient times until official acceptance of Christianity in the 4th century AD. The Romans believed that everything was subordinate to the rule of the gods, and the object of their religion was to secure divine cooperation and benevolence. Prayer and sacrifice were used to propitiate the gods and were often carried out at temples dedicated to particular divinities and presided over by priests (see flamen). The chief Roman priest, head of the state religion, was known as the pontifex *maximus*; notable among the other groups of priests were the augurs, who practiced divination to determine whether the

Roman Gods and Goddesses

Apollo	god of sunlight, music, poetry, and, prophecy	Mars	god of war
Aurora	goddess of the dawn	Mercury	messenger god and god of commerce
Bacchus	god of wine	Minerva	goddess of wisdom, the arts, and trades
Bellona	goddess of war	Mithra	god of light
Ceres	goddess of agriculture	Neptune	god of the sea
Cupid	god of love	Ops	goddess of abundance
Diana	goddess of fertility, hunting, and the moon	Pales	goddess of flocks and shepherds
Dis or Orcus	god of the underworld	Pomona	goddess of fruit trees and fruit
Faunus	god of pastures, forests, and herds	Proserpine	goddess of the underworld
Flora	goddess of flowers	Saturn	god of seed time and harvest
Janus	god of gates and doors	Venus	goddess of beauty and love
Juno	goddess of marriage and women	Vertumnus	god of the seasons
Jupiter	supreme god and god of the sky and weather	Vesta	goddess of the hearth
Libitina	goddess of funerals	Vulcan	god of fire
Maia	goddess of growth and increase		

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gods approved of an action. The earliest Roman gods were the sky god Jupiter, the war god Mars, and Quirinus; other important early gods were Janus and Vesta. Many other deities were borrowed from Greek religion or associated with Greek gods, and the stories woven into Roman mythology were often taken directly from Greek mythology. Domestic shrines were devoted to divine ancestors or protectors, the Lares and Penates. Dead Roman emperors were also raised to the status of divinities and were regarded with veneration and gratitude.

Roman Republic and Empire Ancient state that once ruled the Western world. It centred on the city of Rome from the founding of the republic (509 BC) through the establishment of the empire (27 BC) to the final eclipse of the empire in the west (5th century AD). The republic's government consisted of two consuls, the Senate, and magistrates, originally all patricians, and two popular plebeian assemblies: the military centuriate assembly and the civilian tribal assembly. A written code, the Law of the Twelve Tables (451 BC), became the basis of Roman private law. By the end of the 3rd century BC, Roman territory included all of Italy; by the late republican period it encompassed most of western Europe, northern Africa, and the Near East, organized into provinces. After a period of civil war, Julius Caesar took power as dictator. Following his assassination (44 BC), conflict among the triumvirs—Mark Antony, Lepidus, and Octavian—ultimately resulted in Octavian's victory (31) and his accession as Emperor Augustus (r. 27 BC–AD 14). The imperial government, a principate, combined aspects of the republic and a monarchy. In AD 395 the empire split into eastern and western halves, with the west under severe pressure from the barbarians. Rome was sacked in 410 by the Visigoths, and the western empire fell to German invaders in 476; the east continued as the Byzantine Empire until 1453. See table opposite.

Roman Emperors*

Augustus	27 BC–AD 14	Carus	282–83
Tiberius	14–37	Carinus	283–85
Caligula	37–41	Numerian	283–84
Claudius	41–54	Constantine I	312–37
Nero	54–68	Constantine II	337–40
Galba	68–69	Constans I	337–50
Otho	69	Constantius II	337–61
Vitellius	69	Magnentius	350–53
Vespasian	69–79	Julian	361–63
Titus	79–81	Jovian	363–64
Domitian	81–96	Theodosius I	379–95
Nerva	96–98	**East only**	
Trajan	98–117	Diocletian	284–305
Hadrian	117–38	Galerius	305–11
Antoninus Pius	138–61	Licinius	308–24
Marcus Aurelius	161–80	Valens	364–78
Lucius Verus	161–69	Procopius	365–66
Commodus	177–92	Arcadius	395–408
Pertinax	193	Theodosius II	408–50
Didius Julianus	193	Marcian	450–57
Septimius Severus	193–211	Leo I	457–74
Caracalla	198–217	Leo II	474
Geta	209–12	Zeno	474–91
Macrinus	217–18	**West only**	
Elagabalus	218–22	Maximian	286–305
Severus Alexander	222–35	??	306–8
Maximin	235–38	Constantius I Chlorus	305–6
Gordian I	238	Severus	306–7
Gordian II	238	Maxentius	306–12
Maximus	238	Valentinian I	364–75
Balbinus	238	Gratian	375–83
Gordian III	238–44	Valentinian II	375–92
Philip	244–49	Honorius	395–423
Decius	249–51	Constantius III	421
Hostilian	251	Valentinian III	425–55
Gallus	251–53	Petronius Maximus	455
Aemilian	253	Avitus	455–56
Valerian	253–60	Majorian	457–61
Gallienus	253–68	Libius Severus	461–67
Claudius II Gothicus	268–70	Anthemius	467–72
Quintillus	269–70	Olybrius	472
Aurelian	270–75	Glycerius	473–74
Tacitus	275–76	Julius Nepos	474–75
Florian	276	Romulus Augustulus	475–76
Probus	276–82		

*For Eastern emperors after the fall of Rome, see Byzantine Empire.

romance Literary form that developed in the aristocratic courts of mid-12th-century France and had its heyday in France and Germany between the mid-12th and mid-13th century in the works of such masters as Chrétien de Troyes and Gottfried von Strassburg. The staple subject matter is chivalric adventure (see chivalry), though love stories and religious allegories are sometimes interwoven. Most romances draw their plots from classical history and legend, Arthurian legend, and the adventures of Charlemagne and his knights. Written in the vernacular, they share a taste for the exotic, the remote, and the miraculous. Lingering echoes of the form can be found in later centuries, as in the Romanticism of the 18th–19th century and today's popular romantic novels.

Romance languages Group of related languages derived from Latin, with nearly 920 million native speakers. The major Romance languages—French, Spanish, Portuguese, Italian, and Romanian—are national languages. French is probably the most internationally significant, but Spanish, the official language of 19 American countries and Spain and Equatorial Guinea, has the most speakers. Languages spoken in smaller areas include Catalan, Occitan, Sardinian, and Rhaeto-Romance. The Romance languages began as dialects of Vulgar Latin, which spread during the Roman occupation of Italy, the Iberian Peninsula, Gaul, and the Balkans and developed into separate languages in the 5th–9th centuries. Later, European colonial and commercial contacts spread them to the Americas, Africa, and Asia.

Romanesque architecture Architecture current in Europe from about the mid-11th century to the advent of Gothic architecture. A fusion of Roman, Carolingian and Ottonian, Byzantine, and local Germanic traditions, it was a product of the great expansion of monasticism in the 10th–11th century. Larger churches were needed to accommodate the numerous monks and priests, as well as the pilgrims who came to view saints' relics. For the sake of fire resistance, masonry vaulting began to replace timber construction. Romanesque churches characteristically incorporated semicircular arches for windows, doors, and arcades; barrel or groin vaults to support the roof of the nave; massive piers and walls, with few windows, to contain the outward thrust of the vaults; side aisles with galleries above them; a large tower over the crossing of nave and transept; and smaller towers at the church's western end. French churches commonly expanded on the early Christian basilica plan, incorporating radiating chapels to accommodate more priests, ambulatories around the sanctuary apse for visiting pilgrims, and large transepts between the sanctuary and nave.

Romanesque art Sculpture and painting that reached its height in western Europe c. 1075–1125, a fusion of Roman, Carolingian and Ottonian, and Byzantine art with local Germanic traditions. The expansion of monasticism in the 10th–11th centuries revived the art of monumental sculpture after almost 600 years of dormancy. Relief sculpture depicted biblical history and church doctrine on column capitals and around the massive doors of churches. Natural objects were freely transformed into visionary images that derive their power from abstract linear design and expressive distortion. Linear stylization is seen also in the capital letters and marginal decoration of illuminated manuscripts. Romanesque art was concerned with transcendental values, in sharp contrast to the naturalism and humanism of the earlier Classical and later Gothic art traditions. Monumental painting that imitated the sculptural style covered the interior walls of churches. Both sculpture and painting incorporated a broad range of subject matter, including theological works, reflecting the revival of learning. See also Romanesque architecture.

Romania *or* **Rumania** Country, northeastern Balkan Peninsula, southeastern Europe. Area: 92,043 sq mi (238,391 sq km). Population (2005 est.): 21,602,000. Capital: Bucharest. Most of the people are Romanian; a minority are Hungarian. Language: Romanian (official). Religion: Christianity (predominantly Eastern Orthodox; also Protestant, Roman Catholic). Currency: leu. The land is dominated by the great arc of the Carpathian Mountains, whose highest peak, Moldoveanu, reaches an elevation of 8,346 ft (2,544 m). The Danube River forms most of the southern boundary with Bulgaria. Under communist rule (1948–89), Romania had a centrally planned economy that was transformed from an agricultural into an industrial economy. From 1991 the postcommunist government began returning industrial and commercial enterprises to the private sector. Romania is a republic with two legislative houses; its chief of state is the president, and

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the head of government is the prime minister. Romania was formed in 1859 by the de facto unification of Moldavia and Walachia (for earlier history, see Dacia). During World War I it sided with the Allies and doubled its territory in 1918 with the addition of Transylvania, Bukovina, and Bessarabia. Allied with Germany in World War II, Romania was occupied by Soviet troops in 1944 and became a satellite of the U.S.S.R. in 1948. During the 1960s Romania's foreign policy was frequently independent of the Soviet Union's. The communist regime of Nicolae Ceauşescu was overthrown in 1989, and free elections were held in 1990. In the 1990s Romania struggled with rampant corruption, but it entered the 21st century with a stabilizing economy. In 2004 it joined NATO.

Romanian language \rü-'mā-nē-ən, rō-'mā-nē-ən\ Romance language spoken mainly in Romania and Moldova. The name Romanian is usually identified with Daco-Romanian, one of the four major dialects of Balkan Romance. Other dialects are Aromanian (Macedo-Romanian), spoken in scattered communities in Greece, Macedonia, Albania, and Bulgaria; the nearly extinct Megleno-Romanian, spoken in northern Greece; and Istro-Romanian, spoken on Croatia's Istrian Peninsula. The earliest known continuous text in Romanian dates from 1521. Romanian's phonology, grammar, and vocabulary reflect its relative isolation from other Romance languages and its close contact with the Slavic languages. Written in the Cyrillic alphabet until the 19th century, Romanian now uses the Latin alphabet.

Romano, Giulio See Giulio Romano

Romanov, Michael See Michael

Romanov \rō-'mä-nȯf, 'rō-mə-ˌnȯf\ **dynasty** Rulers of Russia from 1613 to 1917. The name derived from Roman Yurev (d. 1543), whose daughter Anastasiya Romanovna was the first wife of Ivan IV the Terrible. Her nephews assumed the surname Romanov, and the dynasty began with the election of Michael Romanov as tsar in 1613. He was succeeded by his son Alexis (r. 1645–76), followed by Alexis's sons Fyodor III and joint rulers Ivan V and Peter I. When Peter was sole ruler, he decreed in 1722 that the monarch could choose his successor, but he was unable to effect the law, so the crown passed to his wife Catherine I, his grandson Peter II, and Ivan V's daughter Anna. The line of descent returned to Peter's daughter Elizabeth (r. 1741–62), her nephew Peter III and his wife Catherine II the Great, and their son Paul I. Paul established a definite order of succession and was followed by his sons Alexander I (r. 1801–25) and Nicholas I (r. 1825–55). Nicholas was succeeded by his son Alexander II, grandson Alexander III, and great-grandson Nicholas II (r. 1894–1917), the last ruler of the Russian monarchy.

Romanticism Literary, artistic, and philosophical movement that began in Europe in the 18th century and lasted roughly until the mid-19th century. In its intense focus on the individual consciousness, it was both a continuation of and a reaction against the Enlightenment. Romanticism emphasized the individual, the subjective, the irrational, the imaginative, the personal, the spontaneous, the emotional, the visionary, and the transcendental. Among its attitudes were a deepened appreciation of the beauties of nature; a general exaltation of emotion over reason and of the senses over intellect; a turning in upon the self and a heightened examination of human personality; a preoccupation with the genius, the hero, and the exceptional figure; a new view of the artist as a supremely individual creator; an emphasis on imagination as a gateway to transcendent experience and spiritual truth; a consuming interest in folk culture, national and ethnic cultural origins, and the medieval era; and a predilection for the exotic, the remote, the mysterious, the weird, the occult, the monstrous, the diseased, and even the satanic. See also classicism and Transcendentalism.

Romanus I Lecapenus \rō-'mā-nəs..ˌle-kə-'pē-nəs\ (b. c. 872—d. 948) Byzantine emperor (920–944). He was admiral of the Byzantine fleet on the Danube before being chosen to share the throne with his son-in-law Constantine VII. He exercised all the real power of the imperial throne until 944. His reign was ended by his own sons, who compelled him to become a monk.

Romanus III Argyrus \'är-jə-rəs\ (b. c. 968—d. April 11, 1034) Byzantine emperor (1028–34). An undistinguished Byzantine patrician, he was compelled by the dying emperor Constantine VIII to marry his daughter Zoe and become his successor. Romanus proved inept in military and financial matters, and his effort to repel Muslim invaders was unsuccessful (1030). He is believed to have been poisoned by his wife.

Romanus IV Diogenes \dī-'ä-jə-ˌnēz\ (d. 1072) Byzantine emperor (1067–71). A member of the military aristocracy, he married the widow of the emperor Constantine X Ducas in 1067. He led military expeditions against the Seljuq Turks, who defeated and captured him at the Battle of Manzikert (1071). During his imprisonment Constantine's son was crowned as Michael VII Ducas. On his release the new emperor blinded Romanus and exiled him to an island in the Sea of Marmara.

Romany \'rō-mə-nē\ **language** Indo-Aryan language of the Roma (see Rom), spoken in many countries of the world, with its greatest concentration of speakers in eastern Europe. Romany is believed to have separated from the northern Indian languages c. AD 1000. Its dialects, which include many loanwords from languages where the Roma have lived, are classified according to the languages that influenced them: Greek, Romanian, Hungarian, Czecho-Slovak, German, Polish, Russian, Finnish, Scandinavian, Italian, Serbo-Croatian, Welsh, and Spanish. Romany has no tradition of writing but a rich oral tradition. In the 20th century some collections of Romany poems and folktales were published in eastern Europe.

Romberg, Sigmund (b. July 29, 1887, Nagykanizsa, Austria-Hungary—d. Nov. 9, 1951, New York, N.Y., U.S.) Hungarian-born U.S. composer. Romberg studied engineering and composition in Vienna, becoming a skilled violinist and organist. In 1909 he went to New York City, where he conducted a restaurant orchestra and played piano in cafés. As staff composer for the impresario Jacob Shubert (see Shubert Brothers), Romberg prepared scores for about 40 musical shows. His first notable operetta, *Maytime* (1917), was followed in the 1920s by *Blossom Time* (1921), *The Student Prince* (1924), *The Desert Song* (1926), and *The New Moon* (1928). His last success was *Up in Central Park* (1945). In all he wrote almost 80 stage shows.

Rome *Italian* **Roma** City (pop., 2001 prelim: 2,459,776), capital of Italy. It is situated on the Tiber River in the central part of the country. The historical site of Rome on its seven hills was occupied as early as the Bronze Age (c. 1500 BC), and the city was politically unified by the early 6th century BC. It became the capital of the Roman Empire (see Roman Republic and Empire). The Romans gradually conquered the Italian peninsula (see Etruscan), extended their dominion over the entire Mediterranean basin (see Punic Wars), and expanded their empire into continental Europe. Under Pompey the Great and Julius Caesar, Rome's influence was extended over Syria, Jerusalem, Cyprus, and Gaul. After the Battle of Actium, all Roman lands were controlled by Octavian (Augustus), the first Roman emperor. As the imperial capital, Rome became the site of magnificent public buildings, including palaces, temples, public baths, theatres, and stadiums. It reached the peak of its grandeur and ancient population during the late 1st and early

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2nd centuries AD. It remained the capital of the Roman Empire until Emperor CONSTANTINE the Great dedicated Constantinople (now ISTANBUL) in 330. By the end of the 6th century the protection of the city was in the hands of the Roman Catholic church (see HOLY ROMAN EMPIRE), which achieved absolute rule only in the 15th century. The city flourished during the RENAISSANCE and was the seat of the PAPACY and the PAPAL STATES. In 1870 it became the capital of a united Italy. It was transformed into a modern capital in the 1920s and '30s and is Italy's administrative, cultural, and transportation centre. See also VATICAN CITY.

Rome, March on (October 1922) Insurrection that brought BENITO MUSSOLINI to power in Italy. Social discontent gave Fascist Party leaders the opportunity to take control of the Italian government. Assisted by the armed squads known as BLACKSHIRTS, they planned to march on Rome and force King VICTOR EMMANUEL III to call on Mussolini to form a government. Since the king was unwilling to use the Italian army to defend Rome, the government capitulated to the Fascists' demands. The March on Rome turned into a parade to show the Fascist Party's support for Mussolini as the new prime minister.

Rome, Treaties of Two international agreements signed in Rome in 1957 by Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands. One established the EUROPEAN ECONOMIC COMMUNITY; the other created the EUROPEAN ATOMIC ENERGY COMMUNITY.

Rommel \'rô-məl**, Erwin (Johannes Eugen)** (b. Nov. 15, 1891, Heidenheim an der Brentz, Württemberg, Ger.—d. Oct. 14, 1944, Herrlingen, near Ulm) German army commander in WORLD WAR II. A teacher at military academies, he wrote the acclaimed textbook *Infantry Attacks* (1937). He commanded a PANZER DIVISION in the invasion of France (1940), then led his Afrika Korps troops in early successes against the Allies in the NORTH AFRICA CAMPAIGN. He became known as the "Desert Fox" for his audacious surprise attacks, and he was promoted to field marshal. In 1942 he was ordered to attack Cairo and the Suez Canal, despite his request to withdraw his exhausted troops. After his defeat in the Battles of EL ALAMEIN and retreat into Tunisia, he returned to Germany and in 1944 was given command of the defense of the northwestern French coast. His tactical suggestions were ignored, and after the Allied NORMANDY CAMPAIGN began, he became convinced that the war could not be won. Implicated in the JULY PLOT to kill ADOLF HITLER, he was ordered to take poison so that Hitler could avoid a trial of the esteemed "people's marshal."

Erwin Rommel, 1941.
ULLSTEIN BILDERDIENST, BERLIN

Romney, George (b. Dec. 15, 1734, Dalton-in-Furness, Lancashire, Eng.—d. Nov. 15, 1802, Kendal, Westmorland) British portrait painter. Son of a Lancashire cabinetmaker, he began his career by touring the northern counties, painting portraits for a few guineas each. In 1762 he established himself as a portraitist in London and quickly won favour among society patrons. His success depended on the flattery of his likenesses; he avoided any suggestion of the sitter's character or sensibilities. Infatuated with Emma Hart (later Lady HAMILTON) c. 1781–82, he went on to paint more than 50 images of her. Line, rather than colour, dominates his work, and the flowing rhythms and easy poses of Roman Classical sculpture underlie the smooth patterns of his compositions.

George Romney, "Self Portrait," oil painting, 1782; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Romulus and Remus Twins of Roman legend who were the legendary founders of ROME. They were the offspring of MARS and Rhea Silvia, a VESTAL VIRGIN and princess in Alba Longa. As infants they were thrown into the TIBER RIVER by their great-uncle Amulius, who feared they would lay claim to his title. Suckled by a she-wolf and raised by a shepherd, the twins later deposed Amulius, restored their grandfather Numitor to the throne, and founded a city on the site where they had been saved from the river. When Romulus built a city wall, Remus jumped over it and was killed by his brother. The city was named for Romulus, who ruled until his disappearance in a storm. Believing that he had become a deity, the Romans worshiped him as QUIRINUS.

Romulus and Remus with their wolf foster-mother, bronze sculpture; in the Museo Nuovo in the Palazzo dei Conservatori, Rome
ALINARI/ART RESOURCE

Roncesvalles \ˌrȯn-thās-'bäl-ˌyās**, Battle of** *or* **Battle of Roncevaux** \rōü-sə-'vō\ (August 15, 778) Basque attack on CHARLEMAGNE's army at a pass in the Pyrenees in northern Spain. It occurred when Charlemagne was returning to Aquitaine after a campaign against the Muslims in Spain, and his rear guard was ambushed and massacred by Basque soldiers. The battle is treated in the 11th-century *Chanson de Roland*, in which the attackers are Moors and the rear guard is led by Charlemagne's nephew Roland.

Rondane \'rôn-dä-nə\ **National Park** Park, south-central Norway. Established as a national park in 1970, it covers an area of 221 sq mi (572 sq km) of mountainous terrain. The highest peak is Rondeslottet at 7,146 ft (2,178 m). Vegetation is sparse, and the few trees are mostly dwarf birch and conifers.

rondeau \'rän-dō,\ *French* \rō^{n}-'dō\ One of several FORMES FIXES (fixed forms) in French lyric poetry and song of the 14th–15th century, later popular with many English poets. The rondeau has only two rhymes (allowing no repetition of rhyme words) and consists of 13 or 15 lines of 8 or 10 syllables divided into three stanzas. The beginning of the first line of the first stanza serves as the refrain of the second and third stanzas.

rondo Musical form characterized by the initial statement and periodic restatement of a melody alternately with contrasting material. It originated in the French Baroque harpsichord RONDEAU, where a refrain of 8 or 16 measures is played in alternation with a succession of couplets (episodes) so as to form a chainlike structure of variable length. Most rondos fall into either a five-part (*abaca*) or a seven-part (*abacaba*) form. The rondo was very popular in the late 18th and the early 19th centuries, frequently providing the form for the final movements of sonatas, quartets, symphonies, and concertos.

Rondon \rōn-'dōn**, Cândido (Mariano da Silva)** (b. May 5, 1865, Mimoso, near Cuiabá, Mato Grosso, Braz.—d. Jan. 19, 1958, Rio de Janeiro) Brazilian explorer and protector of Indians. As a young soldier, he was assigned to extend telegraph lines into the Brazilian backlands. In 1913–14 he and U.S. Pres. THEODORE ROOSEVELT headed an expedition that explored a tributary of the Madeira River. In both these undertakings, Rondon came into close contact with the Indians of the interior. Appalled at their mistreatment by developers and settlers, he helped create a govern-

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ment agency for their protection. The state of Rondônia, created in 1982 from the former Guaporé territory, was named for him.

rōnin \'rō-nin\ Japanese masterless SAMURAI. Because samurai received their livelihood from their lord in return for service, a masterless samurai was essentially a vagabond unless he could enter the service of another lord. *Rōnin* could be disruptive to society; at the beginning of the TOKUGAWA PERIOD (the early 17th century), *rōnin* led unsuccessful revolts against the shogunate. The most famous *rōnin* were the 47 whose actions were celebrated in the kabuki play *Chūshingura*. By avenging their lord's death in defiance of a shogunal order forbidding the vendetta, the 47 *rōnin*, who were subsequently forced to commit SEPPUKU (ritual suicide), came to be seen as embodiments of the ideals of *BUSHIDŌ*, the warrior's code.

Ronsard \rōn-'sȧr**, Pierre de** (b. Sept. 11, 1524, La Possonnière, near Couture, France—d. Dec. 27, 1585, Saint-Cosme, near Tours) French poet. Of a noble family, Ronsard turned to scholarship and literature after an illness left him partially deaf. He was the foremost poet of La Pléiade, a literary group that used Classical and Italian models to elevate the French language as a medium for literary expression. He was recognized in his lifetime as a prince of poets; among his diverse works were *Odes* (1550), inspired by HORACE; *Les Amours* (1552); the unfinished *La Franciade* (1572), in imitation of VIRGIL's *Aeneid*, meant to be the national epic; and *Sonnets pour Hélène,* now perhaps his most famous collection. He perfected and established the ALEXANDRINE as the classic form in French for scathing satire, elegiac tenderness, and tragic passion.

Röntgen \'rent-gən, 'rənt-jən**, Wilhelm Conrad** *or* **Wilhelm Conrad Roentgen** (b. March 27, 1845, Lennep, Prussia—d. Feb. 10, 1923, Munich, Ger.) German physicist. He taught at the Universities of Giessen (1879–88), Würzburg (1888–1900), and Munich (1900–20). In 1895 he discovered rays that did not exhibit properties such as reflection or refraction and mistakenly thought they were unrelated to light. Because of their mysterious nature, he called them X-RAYS. He later produced the first X-ray photographs, showing the interiors of metal objects and the bones in his wife's hand. He also did important research in a wide variety of other fields. In 1901 he was awarded the first Nobel Prize for Physics.

Röntgen
HISTORIA-PHOTO

roof Covering of the top of a building. Roofs have been constructed in a wide variety of forms—flat, pitched, vaulted, domed, or in combinations—as dictated by regional, technical, and aesthetic considerations. Thatched roofs, usually sloping, were the earliest type and are still used in rural Africa and elsewhere. Flat roofs have historically been used in arid climates where drainage of water off the roof is not important, as in the Middle East and the southwestern U.S. They came into more widespread use in the 19th century, when new waterproof roofing materials and the use of structural steel and concrete made them more practical. Sloping roofs come in many different varieties. The simplest is the lean-to (or shed) roof, which has only one slope. A roof with two slopes that form a triangle at each end is called a gable roof. A hipped (or hip) roof has sloping sides and ends meeting at inclined projecting angles called hips. The gambrel roof has two slopes on each of its two sides, the upper being less steep than the lower. The mansard roof has two slopes on all four sides, a shallower upper part and a steeper lower part. See also HAMMER-BEAM ROOF.

roof pendant Downward extension of the surrounding rock that protrudes into the upper surface of intrusive rocks. Most intrusions that contain roof pendants are relatively shallow; the roof pendants occur as isolated pieces of the surrounding rock within the intrusive mass. Because roof pendants are exposed by erosion of the overlying rock, their presence indicates that the igneous body is being observed near its upper surface. Roof pendants can be studied to determine some of the conditions that existed at the time of intrusion, such as the temperature and composition of the MAGMA.

rook Most abundant Eurasian bird (*Corvus frugilegus*) of the CROW family (Corvidae). Rooks, 18 in. (45 cm) long, are black and have shaggy thigh feathers and bare white skin at the base of the sharp bill. They are migratory and range discontinuously from Britain to Iran and Manchuria. They dig for larvae and worms in meadows and plowed fields. They nest in large colonies (rookeries) in tall trees, sometimes within towns; the nest, solidly constructed of twigs and soil, is used year after year.

Roon \'rōn**, Albrecht Theodor Emil, count von** (b. April 30, 1803, Pleushagen, near Kolberg, Pomerania—d. Feb. 23, 1879, Berlin, Ger.) Prussian army officer. He aided Prince William (later Emperor WILLIAM I) in suppressing the insurrection in Baden (1848). As minister of war (1859–73), he improved the Prussian army by requiring universal military service and a permanent reserve. His reforms contributed to the army's decisive victories in the SEVEN WEEKS' WAR (1866) and the FRANCO-PRUSSIAN WAR (1870–71), which helped make Germany the leading power on the European continent.

Rooney, Mickey *orig.* **Joe Yule, Jr.** (b. Sept. 23, 1920, Brooklyn, N.Y., U.S.) U.S. film actor. He joined his family in their vaudeville act from the age of 17 months and made his film debut playing a cigar-smoking midget con man in 1926. He starred in 50 RKO short comedies as Mickey McGuire (1927–33) and won praise for his roles in *A Midsummer Night's Dream* (1935) and *Boys Town* (1938). From 1937 he played the cocky, energetic Andy Hardy in a series of popular films, often teamed with JUDY GARLAND. His later film successes include *The Human Comedy* (1943), *National Velvet* (1944), *Baby Face Nelson* (1957), and *The Black Stallion* (1979). He made a successful Broadway debut in *Sugar Babies* in 1979, and he continued to perform in popular musical theatre productions, appearing in the title role of *The Wizard of Oz* in 1998.

Roosevelt \'rō-zə-ˌvelt, 'rō-zə-vəlt**, (Anna) Eleanor** (b. Oct. 11, 1884, New York, N.Y., U.S.—d. Nov. 7, 1962, New York City) U.S. FIRST LADY and diplomat. The niece of THEODORE ROOSEVELT, she married her distant cousin, FRANKLIN D. ROOSEVELT, in 1905. She raised their five children and became active in politics after her husband's polio attack (1921). As first lady (1933–45), she traveled around the U.S. to report on living conditions and public opinion for her husband, and she supported humanitarian causes such as child welfare, equal rights, and social reforms. During World War II, she traveled in Britain and the South Pacific as well as to U.S. military bases to help raise morale. She wrote the syndicated column "My Day," as well as several books. After her husband's death, she was appointed a delegate to the UN (1945, 1949–52, 1961), whose founding she had strongly advocated. As chair of its Commission on Human Rights (1946–51), she helped draft the UNIVERSAL DECLARATION OF HUMAN RIGHTS (1948). In the 1950s she traveled around the world for the UN and remained active in the Democratic Party.

Eleanor Roosevelt, 1950.
BROWN BROTHERS

Roosevelt, Franklin D(elano) (b. Jan. 30, 1882, Hyde Park, N.Y., U.S.—d. April 12, 1945, Warm Springs, Ga.) 32nd president of the U.S. (1933–45). Attracted to politics by the example of his cousin THEODORE ROOSEVELT, he became active in the Democratic Party. In 1905 he married ELEANOR ROOSEVELT, who would become a valued adviser in future years. He served in the New York senate (1910–13) and as U.S. assistant secretary of the navy (1913–20). In 1920 he was nominated by the Democrats as their vice presidential candidate. The next year he was stricken with polio; though unable to walk, he remained active in politics. As governor of New York (1929–33), he set up the first state relief agency in the U.S. In 1932 he won the Democratic presidential nomination with the help of JAMES FARLEY and easily defeated Pres. HERBERT HOOVER. In his inaugural address to a nation of more than 13 million unemployed, he pronounced that "the only thing we have to fear is fear itself." Congress passed most of the changes he sought in his NEW DEAL program in the first hundred days of his term. He was overwhelmingly reelected in 1936 over ALF LANDON. To solve legal challenges to the New Deal, he proposed enlarging the Supreme Court, but his "court-packing" plan aroused strong oppo-

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sition and had to be abandoned. By the late 1930s economic recovery had slowed, but Roosevelt was increasingly concerned with the growing threat of war. In 1940 he was reelected to an unprecedented third term, defeating Wendell Willkie. He developed the lend-lease program to aid U.S. allies, especially Britain, in the early years of World War II. In 1941 he met with Winston Churchill to draft the Atlantic Charter. With U.S. entry into war, Roosevelt mobilized industry for military production and formed an alliance with Britain and the Soviet Union; he met with Churchill and Joseph Stalin to form war policy at Tehrān (1943) and Yalta (1945). Despite declining health, he won reelection for a fourth term against Thomas Dewey (1944) but served only briefly before his death.

Roosevelt, Theodore *known as* **Teddy Roosevelt** (b. Oct. 27, 1858, New York, N.Y., U.S.—d. Jan. 6, 1919, Oyster Bay, N.Y.) 26th president of the U.S. (1901–09). He was elected to the New York legislature (1882), where he became a Republican leader opposed to the Democratic political machine. After political defeats and the death of his wife, he went to the Dakota Territory to ranch. He returned to New York to serve on the U.S. Civil Service Commission (1889–95) and as head of the city's board of police commissioners (1895–97). A supporter of William McKinley, he served as assistant secretary of the navy (1897–98). When the Spanish-American War was declared, he resigned to organize a cavalry unit, the Rough Riders. He returned to New York a hero and was elected governor in 1899. As the Republican vice-presidential nominee, he took office when McKinley was reelected, and he became president on McKinley's assassination in 1901. One of his early initiatives was to urge enforcement of the Sherman Antitrust Act against business monopolies. He won election in his own right in 1904, defeating Alton Parker. At his urging, Congress regulated railroad rates and passed the Pure Food and Drug Act and Meat Inspection Act (1906) to protect public health. He created national forests and set aside mineral, oil, and coal deposits for conservation. He and secretary of state Elihu Root announced the Roosevelt corollary to the Monroe Doctrine, which reasserted the U.S.'s position as protector of the Western Hemisphere. For mediating an end to the Russo-Japanese War, he received the 1906 Nobel Prize for Peace. He secured a treaty with Panama for construction of a trans-isthmus canal. Declining to seek reelection, he secured the nomination for William H. Taft. After traveling in Africa and Europe, he tried to win the Republican presidential nomination in 1912; when he was rejected, he organized the Bull Moose Party and ran on a policy of New Nationalism. Though he lost the election, he secured 88 electoral votes—the most successful third-party candidacy in the 20th century. Throughout his life he continued to write, publishing extensively on history, politics, travel, and nature. See also Big Stick policy; Theodore Roosevelt National Park.

Roosevelt Island *formerly (until 1921)* **Blackwell's Island** *and (1921–73)* **Welfare Island** Island in the East River, between the boroughs of Manhattan and Queens, New York, New York, U.S. Administratively part of Manhattan, it has an area of 139 acres (56 hectares). In 1637 the Dutch bought the island from the Indians. In 1828 the city acquired it and built a penitentiary there. It was renamed in 1973 to honour Pres. Franklin Roosevelt. Now the site of moderate-income housing and shopping complexes, it is connected to Manhattan by aerial tramway and to Queens by bridge.

root In botany, the underground anchoring part of a plant. It grows downward in response to gravity, absorbs water and dissolved minerals, and stores reserve food. Primary root systems have a deep sturdy taproot (in gymnosperms and dicots; see cotyledon) plus secondary or lateral smaller roots, and root hairs. Grasses and other monocots produce a shallow diffuse mass of fibrous secondary roots. Additional support (e.g., in corn and orchids) comes from stem offshoots called adventitious, or prop, roots. Fleshy roots that store food may be modified taproots (e.g., carrots, turnips, and beets) or modified adventitious roots (e.g. cassava). Tubers such as the potato are modified, fleshy, underground stems, or rhizomes. Aerial roots arise from the stem and either pass for some distance through the air before reaching the soil or remain hanging in the air. See illustration opposite.

Root, Elihu (b. Feb. 15, 1845, Clinton, N.Y., U.S.—d. Feb. 7, 1937, New York, N.Y.) U.S. lawyer and diplomat. He became a U.S. attorney for the southern district of New York in 1883. He served as secretary of war from 1899 to 1904. After the Spanish-American War, he set up a civil government in Puerto Rico and organized U.S. control of the Philippines. As secretary of state (1905–09) under Theodore Roosevelt, he concluded treaties with Japan and persuaded Latin American states to participate in the second Hague conference in 1907 (see Hague Conventions). He was awarded the Nobel Prize for Peace in 1912. He served in the U.S. Senate from 1909 to 1915. A supporter of the League of Nations, he helped frame the statute that established the International Court of Justice.

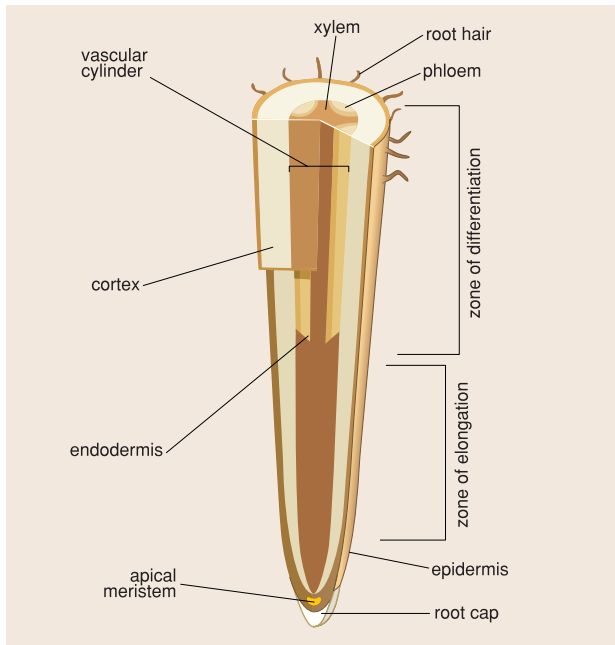
rope Assemblage of fibres, filaments, or wires compacted by twisting or braiding into a long, flexible line. Wire rope is often referred to as cable. The basic requirement for service is that the rope remain firmly compacted and structurally stable, even while being bent, twisted, and pulled. The most important property of a rope is its tensile strength. Because even short fibres can be spun into long flexible yarns, practically any fibre can be made into a rope. Braided ropes deteriorate more slowly than twisted ropes.

Roper River River, Northern Territory, Australia. It flows east to Limmen Bight on the Gulf of Carpentaria; it is about 325 mi (525 km) long and is navigable for about 90 mi (145 km). It marks the southern limit of the region known as Arnhem Land. North of the river's mouth is the "Ruined City of Arnhem Land," a region of sandstone whose weathered shapes suggest ruined buildings.

Rorik See Rurik

rorqual \'rȯr-kwəl\ Any of five species of baleen whales in the genus *Balaenoptera* (family Balaenopteridae), namely, the blue, fin, sei, Bryde's, and minke whales. The term often includes the humpback whale, the only other member of the family.

Rorschach \'rōr-ˌshäk**, Hermann** (b. Nov. 8, 1884, Zürich, Switz.—d. April 2, 1922, Herisau) Swiss psychiatrist. The eldest son of an art teacher, he was given the nickname Kleck, meaning "inkblot," as a schoolboy because of his interest in sketching. After receiving his M.D. from the University of Zürich in 1912, he became a practitioner of psychoanalysis and became vice president of the Swiss Psychoanalytic Society in 1919. He devised the Rorschach test to gauge the perceptions, intelligence, and emotional traits of his patients and used it to gather the data that he summarized in *Psychodiagnostics* (1921).



Structure of a root. The apical meristem is an area of actively dividing cells that forms all the root's cells. The root cap provides a protective covering that facilitates passage of the root through soil. Cells become specialized for specific functions in the zone of differentiation, or maturation zone. The epidermal layer allows passage of water and dissolved materials into the interior. Cells of the cortex store food and transport water and substances to the endodermis, which regulates their entry into the vascular cylinder, containing the xylem (for transporting water and dissolved minerals to the rest of the plant) and phloem (for transporting nutrients made in the leaves).

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Rorty, Richard (McKay) (b. Oct. 4, 1931, New York, N.Y., U.S.) U.S. philosopher. After receiving his Ph.D. at Yale University in 1956, he taught at Wellesley College, Princeton University, the University of Virginia, and Stanford University. An opponent of epistemological FOUNDATIONALISM, Rorty holds that no statement is epistemologically more basic than any other and no statement is ever justified finally or absolutely. He also rejects the idea that sentences or beliefs are true or false in any interesting sense other than being useful or successful within a broad social practice (see PRAGMATISM). Because there is no such thing as certainty or absolute truth, according to Rorty, it is not the purpose of philosophy to pursue such things; its role instead should be to conduct a "conversation" between contrasting but equally valid forms of intellectual inquiry. His publications include *Philosophy and the Mirror of Nature* (1979), *Consequences of Pragmatism* (1982), and *Contingency, Irony and Solidarity* (1989).

Rosa, Salvator (b. June 20, 1615, Arenella, Sicily, Spanish Habsburg—d. March 15, 1673, Rome, Papal States) Italian painter and etcher. He studied in Naples, where he came under the influence of JOSÉ DE RIBERA, but most of his career was spent in Rome, with an interlude in Florence under the patronage of a Medici cardinal. His landscapes, marine paintings, and battle scenes are known for their picturesquely wild, romantic qualities. A flamboyant personality, he was also an accomplished poet, satirist, actor, and musician.

Rosario City (metro. area pop., 1999 est.: 1,000,000) and river port, east-central Argentina, on the PARANÁ RIVER. Founded in 1725, it began to develop into a major city in the late 19th century. In 1819 the city was burned by revolutionaries. In 1860 it welcomed domestic and foreign oceangoing ships to its natural harbour, which became a major port. One of Argentina's largest cities, it exports grain, meat, and lumber. It is also an industrial city, producing steel, automobiles, and agricultural machinery, and it is an educational centre.

rosary Religious exercise in which prayers are recited and counted on a string of beads or knotted cord, which is also called a rosary. Many of these devices are highly ornamental and incorporate jewels. The practice of using a rosary or "counting beads" occurs widely in world religions, including Christianity, Hinduism, Buddhism, and Islam. In Christianity, the most common rosary is that of the Virgin MARY. Its origin is uncertain, but it is associated with St. DOMINIC and reached its definitive form in the 15th century.

rosary pea *or* **Indian licorice** Tropical plant (*Abrus precatorius*; family Leguminosae). Its hard, red and black seeds, though highly poisonous, are strung into necklaces and rosaries in India and other tropical areas. In India the seeds are also used as a unit of weight (*ratti*).

Rosas \'rō-säs**, Juan Manuel de** (b. March 30, 1793, Buenos Aires, Viceroyalty of the Río de la Plata—d. March 14, 1877, Southampton, Hampshire, Eng.) Argentinian military and political leader. Born to a wealthy family, Rosas emerged a federalist hero from the country's long civil war and was made governor of Buenos Aires in 1829. He left office in 1833 to pursue a war against the Indians, and in 1835 he again became governor of Buenos Aires, this time with dictatorial powers. He was the quintessential CAUDILLO, a tyrant who cultivated a fiercely loyal personal following and ruled by intimidation and patronage. Despite his professed allegiance to federalism, he established central control over all of Argentina until he was finally overthrown in 1852 and forced to flee to England.

rose Any of about 100 species in the genus *Rosa* (family Rosaceae) characterized by their beautiful, fragrant flowers. *Rosa* species are probably the most widely recognized and universally favoured of ornamental flowering plants. Hundreds of varieties are cultivated in all types of settings, and there are many hybrids. Roses are susceptible to numerous diseases, most caused by fungi. The rose family contains about 3,000 species and accounts for 45% of the species in the rose order (Rosales).

Prairie rose (*Rosa setigera*).
JOHN H. GERARD

Other popular garden plants and ornamentals in the rose family include SPIREA, CINQUEFOIL, HAWTHORN, MOUNTAIN ASH, and flowering CHERRY. The family also contains many important fruits, including the APPLE, PEACH, STRAWBERRY, PEAR, PLUM, APRICOT, ALMOND, QUINCE, BLACKBERRY, and RASPBERRY. Plants of some species contain dangerous CYANIDE compounds. Many members have thorns or prickles.

Rose, Fred (b. Aug. 24, 1897, Evansville, Ind., U.S.—d. Dec. 1, 1954, Nashville, Tenn.) U.S. singer and songwriter, a pioneer of COUNTRY MUSIC. He grew up in St. Louis, and he performed at Chicago nightclubs as a teenager. He wrote and recorded popular music in the 1920s, including "Honest and Truly." As country music emerged, Rose became one of its foremost songwriters. He had his own Nashville radio show and later wrote songs for GENE AUTRY's films. Many of his songs have become classics, including "Tears on My Pillow" (1941) and "A Mansion on the Hill" (1948), cowritten with HANK WILLIAMS, whose career he helped foster. In 1942 he and ROY ACUFF cofounded the Acuff-Rose Publishing Co. Rose was one of the first three musicians elected to the Country Music Hall of Fame.

Rose, Pete(r Edward) (b. April 14, 1941, Cincinnati, Ohio, U.S.) U.S. baseball player. Rose began playing organized baseball at age eight. He played for the Cincinnati Reds (1963–78, 1984–86), the Philadelphia Phillies (1979–83), and the Montreal Expos (1984). His 4,256 career hits and 3,562 games played both remain all-time records, and his career mark for runs (2,165) is exceeded only by TY COBB, BABE RUTH, and HANK AARON. In 1989, after being investigated for allegedly betting on baseball games, including those of his own Reds, Rose was banned from the sport for life by the commissioner of baseball.

Rose Bowl *formally* **Pasadena Tournament of Roses** Oldest U.S. postseason college gridiron football contest. It is held annually in Pasadena, Calif., usually on New Year's Day. Each Rose Bowl game is preceded by a "Rose Parade" featuring floats of elaborate floral design. The first festival was held in 1890 and the first football game in 1902. The Rose Bowl stadium opened in 1922. From 1947 to 2001 participation was limited to teams from the Big Ten and Pacific Ten conferences. Starting in 2002, this arrangement was suspended every fourth year to allow the Rose Bowl to host a national championship game.

Rose of Lima, Saint *orig.* **Isabel de Flores** (b. April 20/30, 1586, Lima, Viceroyalty of Peru—d. Aug. 24, 1617, Lima; canonized April 12, 1671; feast day August 23, formerly August 30) Patron saint of Peru and all of South America, the first person born in the Western Hemisphere to be canonized by the Roman Catholic church. Born to a wealthy family, she joined a Dominican order in 1606, overcoming her mother's objections. She went into seclusion in a hut in the family garden, where she lived with great austerity, fasting, wearing a crown of thorns, and sleeping on a bed of broken glass. She experienced many visions, particularly of the Devil. Only in her last three years did she leave her seclusion. Many miracles were reported after her death.

rose of Sharon Shrub or small tree (*Hibiscus syriacus*, or *Althaea syriaca*) in the MALLOW FAMILY, native to eastern Asia but widely planted as an ornamental for its showy flowers. It can grow to 10 ft (3 m) and generally assumes a low-branching pyramid shape. The mallowlike flowers range from white and pinkish-lavender to purple, generally with a crimson base; some varieties have double flowers. The name also sometimes refers to the unrelated Aaron's-beard (*Hypericum calycinum*), a shrubby relative of ST.-JOHN'S-WORT.

rose quartz Translucent, coarse-grained variety of the SILICA MINERAL QUARTZ found in PEGMATITES. Rose quartz is valued for its pale to rich pink colour, which is due to very small amounts of TITANIUM. It has been carved since early times and has been faceted to provide gems of good brilliance. Its milky aspect is attributed to tiny, needlelike inclusions of RUTILE, which, when oriented, give the polished stone an asterism (optical phenomenon of a star-shaped figure) like that found in sapphire, but not as sharp or intense. Rose quartz occurs in Brazil, Madagascar, Sweden, Namibia, California, and Maine, among other sites.

rose window In GOTHIC ARCHITECTURE, a decorated circular window, often glazed with stained glass, that first appeared in mid-12th-century cathedrals. It was used mainly at the western end of the NAVE and the ends of the TRANSEPT. The bar TRACERY of a High Gothic rose window consisted of a series of radiating forms, each tipped by a pointed arch at the outside of the circle. The rose windows of NOTRE-DAME DE PARIS are particu-

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larly noteworthy. In later Flamboyant-style tracery, the radiating elements consisted of an intricate network of wavy, double-curved bars.

Roseau \rō-'zō\ Town (pop., 1991:15,853), capital of Dominica, an island nation of the Lesser Antilles in the Caribbean Sea. Roseau lies on the island's southwestern coast, at the mouth of the Roseau River. Its port exports limes, tropical vegetables, and spices. There are botanical gardens, nearby waterfalls, and thermal springs. The town was burned by the French in 1805 and suffered nearly total destruction by a hurricane in 1979.

Rosebery \'rōz-bə-rē**, Archibald Philip Primrose, 5th earl of** *orig.* **Archibald Philip Primrose** (b. May 7, 1847, London, Eng.—d. May 21, 1929, Epsom, Surrey) British politician. He served in William E. Gladstone's governments as undersecretary for Scottish affairs (1881–83) and foreign secretary (1886, 1892–94). He succeeded Gladstone as prime minister (1894–95) but was ineffective in resolving conflicts within the Liberal Party and in passing legislation through the Conservative-dominated House of Lords. He broke with the Liberal Party by opposing Irish Home Rule (1905) and retired from public life.

Rosecrans \'rō-zə-ˌkranz**, William S(tarke)** (b. Sept. 6, 1819, Kingston Township, Ohio, U.S.—d. March 11, 1898, Redondo Junction, Calif.) U.S. general. He served in the army before resigning to become an architect and civil engineer. In the American Civil War he led Union forces to victory at Iuka and Corinth, Miss., and at Murfreesboro, Tenn. In 1863 he advanced on Confederate troops under Braxton Bragg at Chattanooga, Tenn., forcing them out of the city. An ill-planned move precipitated the Battle of Chickamauga and forced his troops to retreat into Chattanooga, where they were besieged; Rosecrans's error led to his removal from command. He later served in the U.S. House of Representatives (1881–85).

rosefish See redfish

rosemary Small perennial evergreen shrub (*Rosmarinus officinalis*) of the mint family whose leaves are used to flavour a wide variety of food. The bush grows 3–7.5 ft (1–2.3 m) tall and has short linear leaves that resemble curved pine needles, dark green and shiny above, white beneath. Bluish flowers grow in small clusters. Bees are particularly fond of rosemary. In ancient times rosemary was believed to strengthen memory; in literature and folklore it is an emblem of remembrance and fidelity. Native to the Mediterranean, it has been naturalized throughout Europe and temperate America.

Rosenberg, Alfred (b. Jan. 12, 1893, Reval, Estonia—d. Oct. 16, 1946, Nürnberg, Ger.) German Nazi ideologue. As editor of the Nazi Party newspaper from 1921, he drew on the ideas of the English racist Houston Stewart Chamberlain for his books espousing German racial purity and anti-Semitism, which reinforced Adolf Hitler's own extreme prejudices. In World War II he oversaw the transport of stolen art into Germany and was a government official in the occupied eastern territories. After the war he was tried at the Nürnberg trials and hanged as a war criminal.

Rosenberg, Ethel and Julius *orig.* **Ethel Greenglass** (respectively b. Sept. 28, 1915, New York, N.Y., U.S.—d. June 19, 1953, Ossining, N.Y.; b. May 12, 1918, New York, N.Y., U.S.—d. June 19, 1953, Ossining, N.Y.) U.S. spies. They were married in 1939, by which time they were already active in the Communist Party. In 1940 Julius became an engineer with the U.S. Army Signal Corps. He and his wife, Ethel, apparently gave military secrets to the Soviet military in a conspiracy with Ethel's brother, Sgt. David Greenglass, a machinist on the atomic-bomb project at Los Alamos, N.M., and Harry Gold, a courier for the U.S. espionage ring. They were all arrested in mid-1950. Greenglass and Gold received prison terms, but the Rosenbergs were sentenced to death. Despite several appeals and a worldwide campaign for mercy, they were executed at Sing Sing Prison in 1953, the only U.S. civilians ever executed for espionage. Despite considerable controversy in subsequent years, the question of their guilt was largely resolved in the early 1990s, when the release of Soviet intelligence information confirmed the Rosenbergs' involvement in espionage.

Rosenquist, James (b. Nov. 29, 1933, Grand Forks, N.D., U.S.) U.S. painter. His youthful employment as a billboard painter influenced the enlarged imagery and cool, impersonal style of painting that he developed by the early 1960s. In a typical painting, he juxtaposed imagery from pop culture, advertising, and other mass media using bright colours and a large canvas. This interest in popular culture has led many to define him as a precursor to Pop art. He has also created large works combining lithography, screenprinting, etching, and collage.

Rosenzweig \'rō-zən-ˌtsvīk**, Franz** (b. Dec. 25, 1886, Kassel, Ger.—d. Dec. 10, 1929, Frankfurt am Main) German existentialist and religious philosopher. As a student at Berlin and Freiburg, he rejected the idealism of Georg Wilhelm Friedrich Hegel. He briefly thought of converting to Christianity from Judaism but turned instead to an intensive reading of the Hebrew classics. While serving in World War I, he began to formulate the existentialist understanding of faith and belief that would eventuate in his major work, *The Star of Redemption* (1921). He collaborated with Martin Buber on a translation of the Hebrew scriptures in which he tried to restore what he thought was the existentialist tone of the original.

Roses, Wars of the (1455–85) Series of dynastic civil wars between the houses of Lancaster and York for the English throne. The wars were named for the emblems of the two houses, the white rose of York and the red of Lancaster. Both claimed the throne through descent from Edward III. Lancastrians held the throne from 1399, but the country fell into a state of near anarchy during the reign of Henry VI, and during one of Henry's bouts with madness in 1453 the duke of York was declared protector of the realm. Henry reestablished his authority in 1455, and the battle was joined. The Yorkists succeeded in putting Edward IV on the throne in 1461, but the wars continued, and in 1471 they murdered Henry VI in the Tower of London. In 1483 Richard III overrode the claims of his nephew Edward V to seize the throne, alienating many Yorkists. The Lancastrian Henry Tudor (Henry VII) defeated and killed Richard at the Battle of Bosworth Field, ending the wars. He united the houses by marriage and defeated a Yorkist rising in 1487. See also earl of Warwick.

Rosetta \rō-'ze-tə\ **Stone** Inscribed stone slab, now in the British Museum, that provided an important key to the decipherment of Egyptian hieroglyphs. An irregularly shaped block of black basalt with inscriptions in hieroglyphs, Demotic Egyptian, and Greek, it was discovered by Napoleon's troops near the town of Rosetta (Rashid), northeast of Alexandria, in 1799. The text concerns the deeds of Ptolemy V Epiphanes (205–180 BC) and dates from the ninth year of his reign. Its decipherment was begun by Thomas Young, who isolated the proper names in the Demotic version, and decisively completed by J.-F. Champollion, who grasped that some hieroglyphs were phonetic.

The Rosetta Stone, with Egyptian hieroglyphs in the top section, demotic characters in the middle, and Greek at the bottom; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Rosewall, Ken(neth Ronald) (b. Nov. 2, 1934, Sydney, Austl.) Australian tennis player. He won his first major titles, the Wimbledon men's doubles and the French singles, in 1956. He remained a top competitor for 25 years, winning 18 grand-slam titles. His last major victory came in 1973 when he was part of the Australian Davis Cup team.

Rosh Hashanah \ˌräsh-hə-'shä-nə\ Jewish New Year. Sometimes called the Day of Judgment, Rosh Hashanah falls on Tishri 1 (in September or October) and ushers in a 10-day period of self-examination and penitence that ends with Yom Kippur. The liturgy includes the blowing of the ram's horn, or shofar, a call for spiritual awakening associated with the giving of the Law to Moses on Mount Sinai. It is also called the Day of Remembrance, since it celebrates the creation of the world and the responsibilities of the Jews as God's chosen people. It is a solemn but hopeful holiday; bread and fruit dipped in honey are eaten as omens of sweetness for the year ahead.

Rosicrucian \ˌrō-zə-'krü-shən\ Member of a secret worldwide brotherhood claiming to possess esoteric wisdom handed down from ancient times. The name derives from the order's symbol, a combination of a rose and a cross. Its origins are obscure. Its earliest known document, *Account of the Brotherhood* (1614), tells the story of the supposed founder, Christian Rosenkreuz ("Rose Cross"), allegedly born in 1378, who is said to

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have acquired his wisdom on trips to the Middle East and imparted it to his followers on his return to Germany. He is now generally considered a symbolic rather than a real character. Some regard PARACELSUS as the true founder; others say Rosicrucianism is only the accumulated wisdom passed down from PLATO, JESUS, PHILO Judaeus, PLOTINUS, and others. No reliable evidence dates the order's history earlier than the 17th century. The international Ancient Mystical Order Rosae Crucis was founded in 1915; it and other Rosicrucian groups continue to operate today.

Ross, Betsy *orig.* **Elizabeth Griscom** (b. Jan. 1, 1752, Philadelphia, Pa.—d. Jan. 30, 1836, Philadelphia, Pa., U.S.) American patriot. She worked as a seamstress and upholsterer, carrying on her husband's upholstery business after he was killed in the American Revolution. According to legend, in 1776 she was visited by GEORGE WASHINGTON, ROBERT MORRIS, and her husband's uncle George Ross, who asked her to make a flag for the new nation based on a sketch by Washington. She is supposed also to have suggested the use of the five-pointed star rather than the six-pointed one chosen by Washington. Though Ross did make flags for the navy, no firm evidence supports the legend of the national flag. In 1777 the Continental Congress adopted the Stars and Stripes as the U.S. flag.

Ross, Diana See SUPREMES

Ross, Harold W(allace) (b. Nov. 6, 1892, Aspen, Colo., U.S.—d. Dec. 6, 1951, Boston, Mass.) U.S. editor. He worked as a reporter and editor before launching *The* NEW YORKER in 1925 with the financial backing of a wealthy friend. The new magazine soon attracted established writers and artists as well as young talent drawn by its innovative style and Ross's encouragement. His famously unvarnished speech and bluster, which seemed at odds with his magazine's sophistication, masked extraordinary editorial instincts and capacities. Ross remained the guiding force behind *The New Yorker* until his death, though he relinquished many of his duties in his later years.

Ross, John *Indian name* **Tsan-Usdi ("Little John")** (b. Oct. 3, 1790, near Lookout Mountain, western district of N.C., U.S.—d. Aug. 1, 1866, Washington, D.C.) American Indian chief. The son of a Scottish father and part-Cherokee mother, he grew up as a CHEROKEE. He fought in the Creek War under ANDREW JACKSON (1813–14). He later became president of the National Council of Cherokees (1819–26). As principal chief of the Cherokee Nation (1828–39), he resisted government attempts to seize Cherokee farms and lands in Georgia and unsuccessfully petitioned Jackson to defend the Indians' rights. In 1838 he was forced to lead his people on the infamous TRAIL OF TEARS to the Oklahoma Territory. There he became chief of the new United Cherokee Nation (1839–66).

Ross, Martin See SOMERVILLE AND ROSS

Ross, Sir Ronald (b. May 13, 1857, Almora, India—d. Sept. 16, 1932, Putney Heath, London, Eng.) British bacteriologist. After earning a medical degree, he entered the Indian Medical Service and served in the third Anglo-Burmese War (1885). He studied bacteriology in London, then returned to India, where he discovered the PLASMODIUM parasite (cause of MALARIA) in the gastrointestinal tract of the *Anopheles* mosquito in 1897. He used infected and healthy birds to learn its entire life cycle, including its presence in the mosquito's salivary glands, showing how it is transmitted by a bite. He received a 1902 Nobel Prize.

Ross, Sir William David (b. April 15, 1877, Thurso, Caithness, Scot.—d. May 5, 1971, Oxford, Oxfordshire, Eng.) Scottish moral philosopher. He served many years as provost at Oriel College, University of Oxford (1902–47), and later as Oxford's vice chancellor. A critic of UTILITARIANISM, he maintained a form of ethical INTUITIONISM. He held that the terms "good" (which pertains to motives) and "right" (which pertains to acts) are indefinable and irreducible (see NATURALISTIC FALLACY) and that certain commonsensical moral principles (e.g., those requiring promise-keeping, truth-telling, and justice) are knowable by mature reflection. His writings include *Aristotle* (1923), *The Right and the Good* (1930), *Foundations of Ethics* (1939), *Plato's Theory of Ideas* (1951), and *Kant's Ethical Theory* (1954).

Ross Ice Shelf World's largest body of floating ice. It lies at the head of the Ross Sea, which forms an enormous indentation in Antarctica. Its area is estimated to be about the size of France. The great white barrier wall of the shelf's front, first seen in 1841 by British explorer Capt. James C. Ross, rises in places to 200 ft (60 m). The ice shelf has been an important gateway for explorations of the Antarctic interior, including expeditions (1911–12) to the South Pole by ROALD AMUNDSEN and ROBERT FALCON SCOTT and RICHARD E. BYRD's expeditions (1928–41). It is the site of several permanent research stations.

Rosse, William Parsons, 3rd earl of (b. June 17, 1800, York, Eng.—d. Oct. 31, 1867, Monkstown, County Cork, Ire.) Irish astronomer. His "Leviathan," 54 ft (16.5 m) long, was the largest reflecting TELESCOPE of the 19th century, and its mirror had a diameter of 72 in. (183 cm). With it Rosse discovered the spiral shape of many objects then classed as nebulae, now recognized as GALAXIES, and he studied and named the CRAB NEBULA. He was also the first to discover binary and triple stars. As Lord Oxmantown, he sat in the House of Commons (1821–34); on inheriting his father's earldom in 1841, he joined the House of Lords.

Rossellini \ˌrōs-sāl-'lē-nē**, Roberto** (b. May 8, 1906, Rome, Italy—d. June 3, 1977, Rome) Italian film director. He directed his first feature film, *White Ship*, in 1941. During World War II he made Fascist propaganda films but also secretly filmed anti-Fascist activities. He used the documentary footage in *Open City* (1945), acclaimed as one of the first examples of Italian NEOREALISM. The screenplay was written with FEDERICO FELLINI, who also collaborated with him on *Paisan* (1946). He made several films starring INGRID BERGMAN, beginning with *Stromboli* (1949), but the scandal of their adulterous affair and marriage damaged their careers. He later directed *General della Rovere* (1959) and works for the stage and television, including a series of didactic historical works. His daughter Isabella Rossellini (b. 1952) appeared in films such as *Blue Velvet* (1986) and *Big Night* (1996).

Rossellino \ˌrōs-sāl-'lē-nō**, Bernardo** (b. 1409, Settignano, Republic of Florence—d. Sept. 23, 1464, Florence) Italian architect and sculptor. Influenced by DONATELLO, FILIPPO BRUNELLESCHI, and Luca DELLA ROBBIA, he developed a moderately Classical style. His tomb for Leonardo Bruni (1444–50) in Santa Croce, Florence, was one of the greatest achievements of early Renaissance sculpture and inaugurated a new type of sepulchral monument. Its fine balance between sculpture and architecture, figure and decoration, made it the prototypical niche tomb of its time. He also designed the apse of ST. PETER'S BASILICA and the cathedral and Piccolomini Palace in Pienza (1460–64). He presumably trained his brother Antonio (1427–79), who regularly assisted him.

Rossetti \rō-'ze-tē**, Christina (Georgina)** (b. Dec. 5, 1830, London, Eng.—d. Dec. 29, 1894, London) English poet. The youngest child of GABRIELE ROSSETTI and the sister of DANTE GABRIEL ROSSETTI, she found her highest inspiration in her deep religious faith. The collections *Goblin Market* (1862) and *The Prince's Progress* (1866) contain most of her finest work. Her best poetry is strong, personal, and unforced; her success arises from her ability to unite the devotional and the passionate sides of her nature. Her *Sing-Song* (1872; enlarged 1893), a collection of nursery rhymes, is among the most outstanding children's books of the 19th century. After the onset of a thyroid disorder in 1871, she wrote mainly devotional verse.

Christina Rossetti, chalk drawing by Dante Gabriel Rossetti, 1866; in a private collection

REPRODUCED WITH PERMISSION FROM HAROLD ROSSETTI; PHOTOGRAPH, J.M. COTTERELL

Rossetti \rō-'zet-ē, rō-'set-ē**, Dante Gabriel** *orig.* **Gabriel Charles Dante Rossetti** (b. May 12, 1828, London, Eng.—d. April 9, 1882, Birchington-on-Sea, Kent) British painter and poet. Son of GABRIELE ROSSETTI and brother of CHRISTINA ROSSETTI, he trained at the Royal Academy but vacillated between painting and poetry. As an informal pupil of FORD MADOX BROWN, he absorbed Brown's admiration for the German NAZARENES. In 1848, with several friends, he formed the PRE-RAPHAELITE Brotherhood, a group of painters treating religious, moral, and medieval subjects in a naturalistic style. Rossetti expanded the Brotherhood's aims by linking poetry, painting, and Social Idealism and by treating "Pre-Raphaelite" as synonymous with a romanticized medieval past. When his oil paintings were severely criticized, he turned to watercolours based on literary works, which he could

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more easily sell to acquaintances, and became very successful. The group broke up in 1852, but Rossetti revived it in 1856 with Edward Burne-Jones and William Morris. After the death of his long-ailing wife in 1862, possibly by suicide, literary themes gave way to pictures of women, particularly Morris's wife, Jane. His poetry, including the sonnet sequence "The House of Life," was widely admired. He broke with Morris in 1875 over his love for Jane and spent his later years as an alcoholic recluse.

Dante Gabriel Rossetti, photograph by Lewis Carroll, 1863
THE BETTMANN ARCHIVE

Rossetti, Gabriele (Pasquale Giuseppe) (b. Feb. 28, 1783, Vasto, Kingdom of Naples—d. April 24, 1854, London, Eng.) Italian poet, revolutionary, and scholar. A librettist and later curator of a museum in Naples, he was condemned for his spirited verse on contemporary politics and for membership in a revolutionary group. In 1824 he fled to England, where in 1831 he published an eccentric interpretation of Dante, claiming a chiefly political and antipapal meaning in the *Divine Comedy*. The work led to a post as professor of Italian at King's College, London, from 1831 to 1847. He is best known as the father of four talented children, including Christina Rossetti and Dante Gabriel Rossetti.

Rossini, Gioacchino (Antonio) (b. Feb. 29, 1792, Pesaro, Papal States—d. Nov. 13, 1868, Passy, France) Italian composer. He sang in church and in minor opera roles as a child, began composing at age 12, and at 14 entered Bologna's conservatory, where he wrote mostly sacred music. From 1812 he produced theatre works at a terrific rate, and for 15 years he was the dominant voice of Italian opera; his major successes included *The Italian Girl in Algiers* (1813), *The Barber of Seville* (1816), *La cenerentola* (1817), and *Semiramide* (1823). Into the genteel atmosphere of lingering 18th-century operatic manners, Rossini brought genuine originality marked by rude wit and humour and a willingness to sacrifice all "rules" of musical and operatic decorum. His career marked the zenith of the bel canto style, a singer-dominated manner of composition that emphasized vocal agility and long, florid phrasing. From 1824 he spent much time in Paris, where he wrote his masterpiece, *William Tell* (1829). After 1832 his health was poor, and he composed little until the series of piano pieces and songs collected as *Sins of My Old Age* (1868).

Rosso \'rōs-sō**, Giovanni Battista (di Jacopo)** *known as* **Rosso Fiorentino** *or* **Il Rosso** (b. March 8, 1495, Florence, Republic of Florence—d. Nov. 14, 1540, Paris, Fr.) Italian painter and decorator. He trained under Andrea del Sarto, alongside Jacopo da Pontormo, with whom he became a leading figure in the development of Mannerism. In his later work, the highly charged emotionalism of his early works (e.g., the *Assumption* fresco, 1513–14, in Florence's Santissima Annunziata) is more subdued; his new style is seen in his *Dead Christ with Angels* (1525–26). In 1530 he went to France at the invitation of Francis I; there he became a founder of the Fontainebleau school, and the ornamental style he developed influenced decorative arts across northern Europe. He remained in the royal service until his death.

Rostand \rȯs-'tä^{n}**, Edmond (-Eugène)** (b. April 1, 1868, Marseille, France—d. Dec. 2, 1918, Paris) French playwright. He wrote poetry, essays, and plays for puppet theatre before his first stage play, *The Red Glove*, was performed in 1888. His most popular work is the heroic comedy *Cyrano de Bergerac* (1898), the story of an ugly, long-nosed soldier who despairs of winning the woman he loves and helps a friend woo her instead. A final, belated example of French Romantic drama, it was enormously successful internationally. He also wrote *The Eaglet* (1900) for Sarah Bernhardt.

Rostock \'rō-ˌstȯk\ City (pop., 2002 est.: 198,964) and seaport, northeastern Germany. Located on the Warnow River, 8 mi (13 km) from the Baltic Sea, Rostock was founded in 1218 and was a powerful member of the Hanseatic League in the 14th century. Sailing ships were built in its shipyards from the medieval period until 1851, when the first German steam-propelled vessel was built there. The city was heavily damaged by Allied bombing in World War II. After the war the town centre was rebuilt, and it was developed as East Germany's principal ocean port. It is an important fishing and shipbuilding centre; diesel engines and chemical products are manufactured there.

Rostov \rə-'stȯf\ City (pop., 2002: 34,141), western Russia. First mentioned in chronicles in AD 862, Rostov was an outstanding centre of early medieval Russia. It was the capital of the Rostov-Suzdal principality, which came under the control of Moscow in 1474. In the late 16th century it became an important trade centre on the route between Moscow and the White Sea. The traditional handicraft of enamel on metal continues in present-day Rostov.

Rostov-na-Donu \rə-'stȯf-nä-'dȯ-nü\ *English* **Rostov-on-Don** City (pop., 2002: 1,070,200), southwestern Russia. Located on the Don River about 30 mi (50 km) from the Sea of Azov, it was founded as a customs post in 1749. It was fortified soon after, and, because of its key position as a transport centre and port, it grew steadily with 19th-century Russian colonization. Occupied by the Germans in World War II, it suffered extensive damage but was rebuilt after the war. It is a transportation and industrial centre. The city's nodal location and the proximity of the Donets Basin have led to major industrial development, especially in engineering.

Rostropovich \ˌrȯs-trə-'pō-vich**, Mstislav (Leopoldovich)** (b. March 27, 1927, Baku, Azerbaijan S.S.R., U.S.S.R.) Russian cellist and conductor. He studied composition (with Dmitry Shostakovich), piano, and cello at the Moscow Conservatory from 1943 to 1948. He had works written for him by such composers as Shostakovich, Sergey Prokofiev, and Benjamin Britten. A political dissident, he left the Soviet Union in 1974 and made his career in the West. Settling in the U.S., he served as music director of the National Symphony Orchestra (1977–94) while continuing to make many solo appearances, becoming perhaps the world's most famous cellist. As a pianist, he accompanied his wife, the soprano Galina Vishnevskaya.

Roswitha See Hrosvitha

Rota, Nino (b. Dec. 31, 1911, Milan, Italy—d. April 10, 1979, Rome) Italian composer of film scores. Rota had composed an oratorio and an opera by age 13. After studies at Philadelphia's Curtis Institute he began writing film scores. From 1950 to 1978 he served as director of the Liceo Musicale, a conservatory in Bari. In 1950 he also began his long association with Federico Fellini, for whom he would score films such as *La strada* (1955), *La dolce vita* (1960), *8½* (1963), and *Amarcord* (1973). He provided scores for many other films including Francis Ford Coppola's *The Godfather* (1972) and *The Godfather: Part II* (1974).

rotary engine Internal-combustion engine in which the combustion chambers and cylinders rotate with the driven shaft around a fixed control shaft to which pistons are attached. The gas pressures of combustion are used to rotate the shaft. In the Wankel engine, the most fully developed and widely used rotary engine, a triangular rotor rotates with an orbital motion in a specially shaped casing, and forms rotating crescent-shaped combustion chambers between its sides and the curved wall of the casing.

rotary press Printing press that prints on paper passing between a supporting cylinder and a cylinder containing the printing plates. In contrast, the flatbed press has a flat printing surface. The rotary press is used mainly in high-speed, web-fed operations in which the press takes paper from a roll, as in newspaper printing. Many of these large presses not only print as many as four colours but also cut and fold and bind in a cover, all in one continuous automatic process. Paper passes through some presses at nearly 20 mph (30 kph); large presses can print up to 60,000 copies of 128 standard-size pages in an hour. See also R. Hoe.

Roth, Philip (Milton) (b. March 19, 1933, Newark, N.J.,U.S.) U.S. writer. Roth attended the University of Chicago and first achieved fame with *Goodbye Columbus* (1959), whose title story concerns the boorish materialism of a suburban family. His works are characterized by an acute ear for dialogue, a concern with Jewish middle-class life, and the painful entanglements of sexual and familial love. Among his subsequent novels are the comic and scandalous *Portnoy's Complaint* (1969) and an admired series centring on a writer named Nathan Zuckerman, including *The Ghost Writer* (1979) and *Zuckerman Unbound* (1981). His later works include *Sabbath's Theater* (1995, National Book Award) and *American Pastoral* (1997, Pulitzer Prize).

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Rothko, Mark *orig.* **Marcus Rothkowitz** (b. Sept. 25, 1903, Dvinsk, Russia—d. Feb. 25, 1970, New York, N.Y., U.S.) Russian-born U.S. painter. His family settled in Portland, Ore., in 1913, and he took up painting (largely self-taught) after moving to New York City in 1925. His early realistic style culminated in the *Subway* series (late 1930s). The semi-abstract forms of his work in the early 1940s developed into a highly personal, contemplative form of Abstract Expressionism by 1948. Unlike many of his fellow Abstract Expressionists, Rothko never relied on such dramatic techniques as violent brush strokes or the dripping and splattering of paint. Instead, his virtually gestureless paintings achieved their effects by juxtaposing large areas of melting colours that seemingly float parallel to the picture plane in an indeterminate, atmospheric space. Rothko spent the rest of his life refining this basic style through continuous simplification. In 1965–66 he completed 14 immense canvases, whose sombre intensity reveals his deepening mysticism; they are now housed in a chapel in Houston, which was named the Rothko Chapel after his suicide.

Rothschild family European banking dynasty. It was founded by Mayer Amschel Rothschild (1744–1812), who started out in a Frankfurt banking house. The family name derived from the red shield (*rote Schild*) on the house in the Jewish ghetto where Mayer's ancestors lived. The financial transactions of the Napoleonic Wars of 1792–1815 were the foundation of the Rothschild fortune. Mayer and his oldest son, Amschel (1773–1855), supervised the growing business from Frankfurt, while his other sons established offices elsewhere: Nathan (1777–1836) established a branch in London in 1804, James (or Jakob, 1792–1868) settled in Paris in 1811, and Salomon (1774–1855) and Karl (1788–1855) opened offices in Vienna and Naples, respectively, in the 1820s. The Rothschild business later focused on government securities and industrial companies, including railway, coal, ironworking, oil, and metallurgical investments. Their powerful position was eventually threatened by the new commercial banks, and by the late 19th century the Rothschild group was no longer the first banking consortium. The Rothschilds received many honours: Mayer's five sons were made barons of the Austrian Empire, a Rothschild was the first Jew to enter the British Parliament, and another was the first to be elevated to the British peerage. Members of the British and French families—the only ones still engaged in banking after the seizure of the Austrian house by the Nazis—distinguished themselves as scientists and philanthropists. Baron Philippe de Rothschild (1902–88) became a premier winemaker of the vineyard Mouton-Rothschild.

rotifer \'rō-tə-fər\ Any of about 2,000 species of microscopic, multicellular, water-dwelling invertebrates constituting the class Rotifera, or Rotaria (phylum Aschelminthes; see worm). Currents created by the rotifer's corona (moving cilia arranged in a circle at the head) sweep bacteria, protozoans, and detritus into the mouth. Rotifers also eat larger items (other rotifers, crustaceans, algae). The muscular pharynx contains hard jaws. Body shape varies greatly among species. Rotifers are common in freshwater on all continents, but some live in saltwater. The species vary widely in mode of living: they may be free-living or parasitic, solitary or colonial, and free-swimming, crawling, or sedentary.

Rotifer (*Platyias quadricornis*)
RUNK/SCHOENBERGER FROM GRANT HEILMAN

Rotterdam City (pop., 2001 est.: 593,000) and seaport, western Netherlands. It is situated on both sides of the Nieuwe Maas River (a distributary of the Rhine), near the North Sea. Founded in the 13th century, it developed into a major port and commercial city. From 1795 to 1813 it was occupied by the French. Heavily damaged by the Germans during World War II, it was extensively rebuilt on a new plan. One of the world's busiest cargo-handling ports, it is a major transshipment port for inland Europe, with tens of thousands of Rhine River barges using its facilities. The second largest city in The Netherlands, it has several large oil refineries and produces chemicals, paper, and clothing. It is also a cultural and educational centre.

Rottluff, Karl Schmidt- See Karl Schmidt-Rottluff

Rottweiler \'rät-ˌwī-lər, 'rōt-ˌvī-lər\ Breed of dog descended from a breed of cattle dog left by the Roman legions in Rottweil, Germany. From the Middle Ages to c. 1900, it accompanied butchers on buying expeditions, carrying money in a neck pouch. It has also served as a guard dog, drover's dog, draft dog, and police dog. Stocky and muscular, it stands 22–27 in. (56–69 cm) and weighs 90–110 lbs (41–50 kg). It has a short, black coat, with tan markings on the head, chest, and legs.

Rottweiler
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rotunda In Classical and Neoclassical architecture, a building or room that is circular in plan and covered with a dome. The Pantheon is a Classical Roman rotunda. The Villa Rotonda at Vicenza, designed by Andrea Palladio, is an Italian Renaissance example. The central hall of the U.S. Capitol is an example of the rotunda in its familiar role as part of a monumental public building.

Rouault \rü-'ō**, Georges (-Henri)** (b. May 27, 1871, Paris, Fr.—d. Feb. 13, 1958, Paris) French painter. His apprenticeship in a glazier's shop restoring medieval stained glass (1885–90) influenced his mature style as a painter. After an early academic period, his style evolved toward Fauvism before he established a highly personal form of Expressionism. An ardent Roman Catholic, he painted subjects apparently fallen from grace—prostitutes, tragic clowns, and pitiless judges. After 1914 his subject matter became more specifically religious, with greater emphasis on redemption, and he shifted from watercolour to oil. His layers of paint became thick and rich, his forms simplified, and his colours and black lines reminiscent of stained glass. In the 1930s he produced a splendid series on Christ's Passion, while reworking many earlier paintings. His series of clowns in the 1940s are virtual self-portraits. He also produced many engravings as well as ceramics, tapestry designs, and stained glass.

Rouen \rü-'äⁿ\ City (pop., 1999: city, 106,592; metro. area, 389,862), northwestern France. Situated on the Seine River, Rouen became important in the 3rd century AD after the arrival of Christianity with St. Mellon. Sacked by the Normans in 876, it became the medieval capital of Normandy. It came under English rule in 1066 and again in 1419. Joan of Arc was imprisoned and executed there in 1431. Rouen was recaptured by the French in 1449. Historic buildings include the 14th-century abbey of Saint Ouen and the great Gothic cathedral, whose oldest parts date to the 11th century. The city was the birthplace of Pierre Corneille and Gustave Flaubert.

Rough Rider Member of the 1st Volunteer Cavalry regiment in the Spanish-American War. The group, organized and led by Theodore Roosevelt and Leonard Wood, included cowboys, miners, policemen, and college athletes. The most famous of its exploits in the fighting in Cuba was an uphill charge in the Battle of Santiago (July 1, 1898) in which the group helped capture Kettle Hill and then charged across a valley to assist in the seizure of San Juan Ridge and its high point, San Juan Hill. Wide coverage of the regiment in the U.S. press helped establish Roosevelt's reputation.

roulette \rü-'let\ Gambling game. After a small ball is released in the opposite direction of a revolving wheel, players make bets concerning which red or black numbered compartment the ball will enter as it comes to rest. Bets are placed on a table marked to correspond with the compartments of the wheel. Roulette (French: "small wheel") emerged in the late 18th century in the casinos of Europe. All bets are placed against the "house," or casino bank. Bets may be made until the ball slows down and is about to drop from its track into a compartment. Bets may be on a single number or various combinations of numbers that pay off at lesser odds if the winner is among them. Betting that red or black or that an odd or even number will come up are other options.

roundworm See nematode

Rousseau \rü-'sō**, Henri** *known as* **Le Douanier Rousseau** (b. May 21, 1844, Laval, Fr.—d. Sept. 2, 1910, Paris) French painter. After service in the army, he began working as a toll collector (not as a *douanier*, or customs officer, the epithet his friends later used) but found time to paint and draw. Completely self-taught, he exhibited some early paintings, including *Carnival Evening*, at the Salon des Indépendants in 1886. Like his later works, it is typical of naive art: everything is drawn literally, the clouds look solid, and the costumes receive more attention than the figures themselves. It nonetheless achieves a striking mood and mys-

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tery. In 1893 he retired to devote himself to painting, and in 1894 his *War* won him his first recognition by the avant-garde. His best-known works are richly coloured images of lush jungles, wild beasts, and exotic figures. He exhibited *The Hungry Lion* with the Fauves in 1905. He died a pauper; only after his death was his greatness recognized.

Rousseau, Jean-Jacques (b. June 28, 1712, Geneva, Switz.—d. July 2, 1778, Ermenonville, France) Swiss-French philosopher. At age 16 he fled Geneva to Savoy, where he became the steward and later the lover of the baronne de Warens. At age 30, having furthered his education and social position under her influence, he moved to Paris, where he joined Denis Diderot at the centre of the philosophes; he wrote on music and economics for Diderot's *Encyclopédie*. His first major work, the *Discourse on the Arts and Sciences* (1750), argued that man is good by nature but has been corrupted by society and civilization; Rousseau's belief in the natural goodness of man set him apart from Roman Catholic writers who, like him, were hostile to the idea of progress. He also wrote music; his light opera *The Cunning-Man* (1752) was widely admired. In 1752 he became involved in an influential dispute with Jean-Philippe Rameau over the relative merits of French and Italian music; Rousseau championed the latter. In the *Discourse on the Origin and Foundations of Inequality Among Men* (1754), he argued against Thomas Hobbes that human life before the formation of societies was healthy, happy, and free and that vice arose as the result of social organization and especially the introduction of private property. Civil society, he held, comes into being only to ensure peace and to protect property, which not everyone has; it thus represents a fraudulent social contract that reinforces inequality. In the *Social Contract* (1762), which begins with the memorable line, "Man was born free, but he is everywhere in chains," Rousseau argues that a civil society based on a genuine social contract rather than a fraudulent one would provide people with a better kind of freedom in exchange for their natural independence, namely, political liberty, which he understands as obedience to a self-imposed law created by the "general will." In 1762 the publication of *Émile*, a treatise on education, produced outrage, and Rousseau was forced to flee to Switzerland. He began showing signs of mental instability c. 1767, and he died insane. His *Confessions* (1781–88), which he modeled on the work of the same title by St. Augustine, is among the most famous autobiographies.

Rousseau \rü-'sō**, (Pierre-Etienne-) Théodore** (b. April 15, 1812, Paris, Fr.—d. Dec. 22, 1867, Barbizon) French painter. A tailor's son, he began to paint at 14 and soon was painting outdoors directly from nature, a novel practice at the time. Because he strayed from the academic path, his work was consistently rejected by the Salon. From the 1830s he painted regularly in the village of Barbizon, where he became a leader of the Barbizon school of landscape painters. His paintings, which show nature as a wild, undisciplined force, counter the calmly idealized landscapes of Neoclassicism, and his small, highly textured brushstrokes presage those of the Impressionists.

Roussel \rü-'sel**, Albert (-Charles-Paul-Marie)** (b. April 5, 1869, Tourcoing, France—d. Aug. 23, 1937, Royan) French composer. He served as a midshipman for seven years before making music his career, and he studied for 10 years at Paris's Schola Cantorum. His early music was much influenced by his teacher Vincent d'Indy. His opera-ballet *Padmavati* (1918), with its Indian scales, won enthusiasm from younger composers; his other important works include the ballets *The Spider's Feast* (1913) and *Bacchus et Ariane* (1930) and the *Third Symphony* (1930). His music is notable for its lyrical fervour, austerity of technique, and harmonic audacity.

Roussillon \ˌrü-sē-'yōⁿ\ Historical and cultural region, southern France. Originally inhabited by Iberians, the region was conquered by Rome in the 2nd century BC. It was held by the Visigoths in the 5th century AD, and successively by Arabs and Carolingian Franks. It was acquired by the counts of Barcelona in the 9th century. Monasticism flourished from the 10th century on, and the area is rich in Romanesque architectural remains. It became part of the kingdom of Aragon in the 12th century. It was acquired from Spain by treaty in 1659. The chief city is Perpignan. There are numerous families of Catalan gypsies, and Catalan is widely spoken.

router Portable electric power tool used in carpentry and furniture making that consists of an electric motor, a base, two handle knobs, and bits (cutting tools). A router can cut fancy edges for shelving, grooves for storm windows and weather stripping, circles and ovals with smooth edges, and round corners on work of all types.

Rowe \'rō**, Nicholas** (b. June 20, 1674, Little Barford, Bedfordshire, Eng.—d. Dec. 6, 1718, London) English writer. His plays, which did much to assist the rise of domestic tragedy (in which the protagonists are middle-class rather than aristocratic), include *The Ambitious Step-Mother* (1700), *Tamerlane* (1702), *The Fair Penitent* (1703), *The Tragedy of Jane Shore* (1714), and *The Tragedy of the Lady Jane Grey* (1715). He is also remembered as the first to attempt a critical edition of William Shakespeare (*The Works of Mr. William Shakespear*, 1709, 1714). His own poetry includes odes and translations. He became poet laureate in 1715. Rowe is regarded as the foremost 18th-century English tragic dramatist.

rowing Propulsion of a boat by means of oars. As a sport, it involves one of two kinds of boat: (1) the shell, a narrow, light racing boat propelled by eight rowers pulling single oars under the direction of a coxswain; and (2) the scull, a racing shell propelled by one or two rowers using sculls (pairs of oars). Organized racing began at the Universities of Oxford and Cambridge in the 1820s, culminating in 1839 in the Henley Regatta (from 1851 the Henley Royal Regatta). In the U.S., Harvard and Yale universities first raced in 1851. Rowing events in the Olympic Games have been held for men since 1900 and for women since 1976.

Rowlandson \'rō-lənd-sən**, Mary** *orig.* **Mary White** (b. c. 1637, England—d. Jan. 5, 1710/11, Wethersfield, Conn.) British-American colonial author. She was the daughter of the original proprietor of Lancaster, Mass., where she lived with her minister husband and their four children. When Indians razed the settlement in 1676, she was captured and held hostage for 11 weeks. Ransomed, she moved to Connecticut with her husband and two surviving children. Her narrative of captivity, titled *The Soveraignty & Goodness of God, Together with the Faithfulness of His Promises Displayed; Being a Narrative of the Captivity and Restauration of Mrs. Mary Rowlandson* and published in 1682, became popular in the colonies and in London.

Rowlandson, Thomas (b. July 1756, London, Eng.—d. April 22, 1827, London) British caricaturist. The son of a merchant, he studied at the Royal Academy and in Paris. After establishing a portrait studio, he began to draw caricatures to supplement his income, and found such success with them that caricature became his major occupation. The comic images he created lampooned familiar social types of his day—the antiquarian, the blowsy barmaid, the hack writer. He also illustrated editions of the novels of Tobias Smollett, Oliver Goldsmith, and Laurence Sterne.

Rowling, J(oanne) K(athleen) (b. July 31, 1965, Chipping Sodbury, near Bristol, Eng.) British author, creator of the popular and critically acclaimed Harry Potter series. The first book in the proposed seven-volume series, *Harry Potter and the Philosopher's Stone* (U.S. title *Harry Potter and the Sorcerer's Stone*), was published in 1997. Featuring vivid descriptions and an imaginative story line, the book followed the unlikely hero Harry Potter, a lonely orphan who discovers that he is actually a wizard. The book was an immediate success, appealing to both children (its intended audience) and adults. Succeeding volumes—*Harry Potter and the Chamber of Secrets* (1998), *Harry Potter and the Prisoner of Azkaban* (1999), *Harry Potter and the Goblet of Fire* (2000), *Harry Potter and the Order of the Phoenix* (2003), and *Harry Potter and the Half-Blood Prince* (2005)—were also best sellers. Rowling was credited with renewing children's interest in reading, and in 2001 she was appointed OBE (Officer of the British Empire). That year also marked the release of the film adaptation of the first Harry Potter book. It became one of the top-grossing movies in the world, and subsequent volumes were also made into highly successful films.

Roxas \'rō-käs**, (y Acuna), Manuel** (b. Jan. 1, 1892, Capiz, Phil.—d. April 15, 1948, Clark Field, Pampanga) First president (1946–48) of the Republic of the Philippines. A lawyer, he began his political career in 1917. An advocate for Philippine independence from the U.S., he was a member of the convention that drew up a constitution under the revised Philippine Independence and Commonwealth Act (Tydings-McDuffie Act; 1934). He collaborated with the pro-Japanese administration during World War II but was defended in postwar trials by Gen. Douglas MacArthur. He became president of the Philippines when independence was achieved (1946). Roxas obtained rehabilitation funds from the U.S. but was forced to allow the U.S. to maintain military bases and make other major concessions. His government was marred by corruption and police brutality, setting the stage for the Hukbalahap Rebellion.

Roy, Jamini (b. April 15, 1887, Baliatore, India—d. April 24, 1972, Calcutta) Indian artist. In the late 1920s and early '30s he rejected his

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academic training and instead developed a linear, decorative, colourful style based on Bengali folk traditions. During the 1930s and '40s the popularity of his paintings represented the passage of modern Indian art from its earlier academic leanings to new nativist predilections. Roy's subject matter ranged from the *Ramayana* to Christ to portraits of contemporary figures such as Mahatma Gandhi. He is one of the best-known Indian artists of the 20th century.

Roy, Ram Mohun (b. May 22, 1772, Radhanagar, Bengal, India—d. Sept. 27, 1833, Bristol, Gloucestershire, Eng.) Indian religious, social, and political reformer. Born to a prosperous Brahman family, he traveled widely in his youth, exposing himself to various cultures and developing unorthodox views of Hinduism. In 1803 he composed a tract denouncing India's religious divisions and superstitions and advocating a monotheistic Hinduism that would worship one supreme God. He provided modern translations of the Vedas and Upanishads to provide a philosophical basis for his beliefs, advocated freedom of speech and of religion, and denounced the caste system and suttee. In 1826 he founded the Vedanta College, and in 1828 he formed the Brahmo Samaj.

Royal Academy of Arts Britain's national academy of art. It was founded in 1768 by George III. Its first president (1768–92) was Joshua Reynolds. The number of its members, who are selected by members and associates, is fixed at 40; members' names are frequently followed by the initials R.A. ("Royal Academician"). Its galleries contain works by such former members as Thomas Gainsborough and J.M.W. Turner. The academy opened a new wing, the Sackler Galleries, in 1991.

Royal Air Force (RAF) Armed service charged with the air defense of Britain and other international defense obligations. It originated in 1911, when an air battalion of the Royal Engineers was formed with one balloon and one airplane company. The air battalion was assumed into the Royal Flying Corps (RFC) in 1912, and in 1918 the RFC and Royal Naval Air Services were merged into the RAF. (The Fleet Air Arm was returned to the Royal Navy in 1937.) The Royal Air Force College was established at Cranwell, Lincolnshire, in 1920 and the RAF Staff College at Andover, Hampshire, in 1922. During World War II, pilots of the RAF Fighter Command distinguished themselves in the Battle of Britain, and Bomber Command conducted massive bombing raids on the German homeland. All front-line units are now combined under the RAF Strike Command; Personnel and Training Command handles recruiting, training, pensions, and other personnel issues. Uniformed RAF personnel numbered some 48,000 at the start of the 21st century.

Royal Ballet English ballet company and school. In 1931 Ninette de Valois and Lilian Baylis organized the Vic-Wells Ballet, naming it for the two theatres (Old Vic and Sadler's Wells) where it performed. In the 1940s the group was called the Sadler's Wells Ballet, after its theatre; it moved to Covent Garden in 1946. Alicia Markova, Margot Fonteyn, and Robert Helpmann were among the company's early members. By the 1950s the Sadler's Wells Ballet had expanded to include its own school and a separate touring company; in 1956 it received a royal charter and was renamed the Royal Ballet. Dancers such as Rudolf Nureyev and choreographers such as Frederick Ashton, Kenneth MacMillan, and Bronislava Nijinska were associated with the company.

Royal Botanic Gardens, Kew See Kew Gardens

Royal Canadian Mounted Police *or* **Mounties** Federal police force of Canada. It is also the criminal and provincial force in all provinces except Ontario and Quebec and the only force in the Yukon, Northwest, and Nunavut territories. It was founded as the North West Mounted Police (1873) with a force of 300 men to bring order to western Canada, where U.S. traders were creating havoc by trading whiskey to the Indians for furs. That success was followed by peacekeeping in the Klondike gold rush (1898) and later settlement of the west. The group assumed its current name in 1920, when it became a federal force and its headquarters were moved to Ottawa.

Royal Dutch Shell PLC *formerly* **Royal Dutch/Shell Group** Multinational corporation comprising two founding companies, Royal Dutch Petroleum Co. of The Hague, Neth., and Shell Transport and Trading Co., PLC, of London, Eng. The two companies began as rivals. In London in 1878, Marcus Samuel took over his father's import-export business (which included Oriental shells) and started selling kerosene; he later entered the oil business in East Asia, and in 1897 he founded Shell Transport and Trading Co., Ltd. Meanwhile, in 1890 a group of Dutch businessmen founded the Royal Dutch Co. for the Exploitation of Oil Wells in the Dutch Indies, which built its first refinery in Sumatra in 1892. In 1907 the two companies merged into the Royal Dutch/Shell Group, which acquired producing concerns in Egypt, Iraq, Romania, Russia, Mexico, Venezuela, California, and Oklahoma. The group, commonly referred to as Shell, has used the scallop shell as its logo since the early 1900s. With interests in liquefied natural gas and petrochemicals as well as aviation, shipping, and automotive fuels, Royal Dutch Shell ranks among the largest oil companies in the world.

Royal Greenwich \'gre-nich\ **Observatory** Astronomical observatory, oldest scientific institution in Britain, founded for navigational purposes in 1675 by Charles II at Greenwich, England. Its main contributions have been in navigation, timekeeping, determination of star positions, and almanac publication. In 1767 it began publishing *The Nautical Almanac*, based on the time at the longitude of Greenwich; its popularity among navigators led in part to the Greenwich meridian's being made Earth's prime meridian and the starting point for international time zones in 1884 (see Greenwich Mean Time).

Royal National Theatre British theatre company. It was formed in 1962 as the National Theatre with Laurence Olivier as director (1963–73) and included many actors from the Old Vic company. In 1976 the company moved from London's Old Vic Theatre to a newly constructed three-theatre complex on the southern bank of the Thames. In 1988 Queen Elizabeth II gave the company permission to add "Royal" to its name. Partly subsidized by the state, the theatre presents a mixed classic and modern repertoire. Its directors have included Peter Hall (1973–88), Richard Eyre (1988–97), Trevor Nunn (1997–2003), and Nicholas Hytner (from 2003).

Royal Navy Naval branch of the armed forces of the United Kingdom. Organized sea power was first used in England by Alfred the Great, who launched ships to repel a Viking invasion. In the 16th century Henry VIII built a fleet of fighting ships armed with large guns and created a naval administration. Under Elizabeth I the navy developed into Britain's major defense and became the means for extending the British Empire around the globe. The maritime forces were given the name Royal Navy by Charles II. In the 18th century it engaged in a long struggle with the French for maritime supremacy, and it later played a key role in Britain's stand against Napoleon. For the rest of the 19th century, it helped enforce what became known as the Pax Britannica, the long period of relative peace in Europe that depended on British maritime supremacy. It remained the world's most powerful navy until the mid-20th century, and it was active in protecting shipping from submarine attack in World Wars I and II. Today it maintains four fighting forces: conventional and nuclear-armed submarines, various surface vessels, naval aircraft, and the Royal Marines. Officers are trained at the Britannia Royal Naval College, Dartmouth, Devon. At the start of the 21st century some 42,000 personnel were in service.

Royal Shakespeare Company (RSC) Major British theatrical company. It was originally attached to the Shakespeare Memorial Theatre in Stratford-upon-Avon, which opened in 1879 as the site of an annual festival of William Shakespeare's plays. The resident company was called the Shakespeare Memorial Company until 1961, when it was renamed and reorganized into two units, one to play at Stratford and the other to be based in London. The Stratford unit performs plays by Shakespeare and other Elizabethan and Jacobean playwrights, while the London unit also performs modern plays and classics of other eras. Plays are produced in Newcastle as well.

Royal Society (of London for Improving Natural Knowledge) Leading scientific society in Britain and the oldest national scientific society in the world. Founded in 1660, its early members included Robert Hooke, Christopher Wren, Isaac Newton, and Edmond Halley. It has long provided an impetus to scientific thought and research in the U.K., and its achievements have become internationally famous. The society's *Philosophical Transactions*, the oldest scientific periodical in continuous publication, has published papers since 1665. The society awards several prizes, the most prestigious being the Copley Medal. At the beginning of the 21st century, the society had some 1,300 fellows and 130 foreign members.

Royall \'rȯi-əl**, Anne Newport** *orig.* **Anne Newport** (b. June 11, 1769, New Baltimore, Md.—d. Oct. 1, 1854, Washington, D.C., U.S.) U.S. writer, generally considered the nation's first newspaperwoman. Royall

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journeyed across the country and during 1826–31 published 10 accounts of her travels, which remain valuable sources of social history. An eccentric and acerbic woman, she was convicted in Washington, D.C., in 1829 of being a "common scold," the result of her antagonism to a local Presbyterian church. In 1831 she began to publish her outspoken and controversial views on various subjects in her Washington newspaper, *Paul Pry* (1831–36), which was succeeded by *The Huntress* (1836–54).

Royce, Josiah (b. Nov. 20, 1855, Grass Valley, Calif., U.S.—d. Sept. 14, 1916, Cambridge, Mass.) U.S. philosopher. He studied under William James and Charles Sanders Peirce at Johns Hopkins University. After teaching English at the University of California for four years, he accepted a position at Harvard University (1882), where he remained until his death. An absolute idealist in the Hegelian tradition, he stressed the unity of human thought with the external world. His IDEALISM also extended to religion, the basis of which he conceived to be human loyalty. In his words, the highest good would be achieved by "the willing and practical and thoroughgoing devotion of a person to a cause." A diverse thinker, he also made contributions to psychology, social ethics, literary criticism, history, and metaphysics. His many books include *The Religious Aspect of Philosophy* (1885), *The Spirit of Modern Philosophy* (1892), *Studies of Good and Evil* (1898), *The World and the Individual* (1900–01), and *The Philosophy of Loyalty* (1908). His emphasis on individuality and will over intellect strongly influenced 20th-century American philosophy.

Royko, Mike *orig.* **Michael Royko** (b. Sept. 19, 1932, Chicago, Ill., U.S.—d. April 29, 1997, Chicago) U.S. columnist. Royko cut short his college education to serve in the air force during the Korean War. In 1959 he joined the *Chicago Daily News*, becoming a full-time columnist in 1964. His irreverent, acerbic, and insightful political and social essays reflected his working-class ethnic origins, often exposing injustices visited on ordinary people. He later moved to the *Chicago Sun-Times* and then to the *Chicago Tribune*. His widely syndicated column earned him a Pulitzer Prize in 1972. He published collections of his columns and the best-selling *Boss* (1971), on RICHARD J. DALEY.

Royster, Vermont (Connecticut) (b. April 30, 1914, Raleigh, N.C., U.S.—d. July 22, 1996, Raleigh) U.S. journalist. Royster joined *The Wall Street Journal* as a Washington correspondent in 1936. After serving in the navy during World War II he returned to the *Journal*, becoming editor (1958–71) and senior vice president (1960–71) of its publishing company, Dow Jones & Co., before retiring in 1971. As editor emeritus, he wrote a weekly column, "Thinking Things Over" until 1986. He was awarded two Pulitzer Prizes (1953, 1984) and the Presidential Medal of Freedom (1986).

Rozelle, Pete *orig.* **Alvin Ray Rozelle** (b. March 1, 1926, South Gate, Calif., U.S.—d. Dec. 6, 1996, Rancho Santa Fe, Calif.) U.S. sports executive and commissioner of the NATIONAL FOOTBALL LEAGUE (NFL). He graduated from the University of San Francisco and initially worked in public relations. Named commissioner in 1960, he doubled the league's size, helped create the SUPER BOWL, and negotiated lucrative television deals with the networks. In 1966 Rozelle secured an agreement to merge the NFL with the rival American Football League. In 1970 he persuaded ABC to broadcast *Monday Night Football*, which proved a huge success. NFL attendance more than tripled during his tenure, which lasted until 1989.

RU-486 Common name for mifepristone, a drug used in the first several weeks of pregnancy for inducing abortion. RU-486 blocks the receptors for progesterone, a hormone necessary for the maintenance of pregnancy. The drug causes the breakdown of the uterine lining, which, along with the embryo, is shed through the vagina. It has been available in France for the termination of early pregnancy since 1988 and was approved for use in the U.S. in 2000. The name RU-486 is derived from the manufacturer Roussel-Uclaf and a serial number.

Ruanda-Urundi \rü-'än-dä-ü-'rün-dē\ Former territory, east-central Africa. It was administered by Belgium from 1922 to 1962, during which time it was reconstituted (1946) as a UN trust territory. It was part of the Belgian Congo from 1925 to 1960. In 1962 it was divided into the independent states of RWANDA and BURUNDI.

Rubʿ al-Khali \'rüb-ål-'ḵå-lē\ Vast desert, south-central ARABIAN PENINSULA. It covers about 250,000 sq mi (650,000 sq km), mainly in southeastern Saudi Arabia, and has lesser portions in Yemen, Oman, and the United Arab Emirates. It is the largest area of continuous sand in the world and occupies more than one-fourth of Saudi Arabia. It is virtually uninhabited and largely unexplored. In 1948 Al-Ghawār, the world's largest oil field, was discovered there.

rubber Flexible material that can recover its shape after considerable deformation.The best-known rubber is natural rubber, made from the milky LATEX of the RUBBER TREE (*Hevea brasiliensis*). Natural rubber is still important industrially, but it now competes with synthetic alternatives (e.g., NEOPRENE, SILICONE) derived from petroleum, natural gas, and other source materials. Rubber's usefulness is based on the unique elasticity of its constituent POLYMER molecules (built of thousands of isoprene MONOMERS; see ISOPRENOID), which are capable of returning to their original coiled shape after being stretched to great extents; it is made more durable by VULCANIZATION with SULFUR or another agent that establishes chemical cross-links between the polymers. Fillers and other additives allow tailoring of properties to the desired use (e.g., by foaming, shaping, and curing). More than half of all rubber goes into making tires; the rest is used principally in belts, hoses, gaskets, shoes, clothing, furniture, and toys.

rubber plant *or* **India rubber plant** Tropical tree (*Ficus elastica*) of the MULBERRY FAMILY. The rubber plant is large in its native Southeast Asia and other warm areas; elsewhere it is commonly grown indoors as a potted plant. The plant has large, thick, oblong leaves and pairs of figlike fruits along its branches. The milky sap, or LATEX, was once an important source of an inferior natural RUBBER. Young plants available in the florist's trade are durable and grow well under less-than-ideal indoor conditions. Some cultivated varieties have broader, darker green leaves; others are variegated. See also RUBBER TREE.

rubber tree South American tropical tree (*Hevea brasiliensis*) of the SPURGE family. Cultivated on plantations in the tropics and subtropics, especially in Southeast Asia and western Africa, it replaced the RUBBER PLANT in the early 20th century as the chief source of natural RUBBER. It has soft wood, high, branching limbs, and a large area of bark. The milky liquid (LATEX) that oozes from any wound to the tree bark contains about 30% rubber, which can be coagulated and processed into solid products such as tires. Latex can also be concentrated for producing dipped goods such as surgical gloves.

rubella \rü-'be-lə\ *or* **German measles** Viral disease with a usually mild course, except in women in the first 20 weeks of pregnancy, in whom it can cause fetal birth defects (of eyes, heart, brain, and large arteries) or death. Sore throat and fever are followed by swollen glands and a rash. Up to 30% of infections may have no symptoms. Lifelong immunity follows infection. ENCEPHALITIS is a rare complication. Rubella was not distinguished from MEASLES (rubeola) until the early 19th century and was not known to be dangerous until 1941. The virus was isolated in 1962, and a vaccine became available in 1969.

Rubens, Peter Paul (b. June 28, 1577, Siegen, Westphalia—d. May 30, 1640, Antwerp, Spanish Neth.) Flemish painter and diplomat. After apprenticeships in Antwerp, he was admitted to its painters' guild in 1598. He went to Italy in 1600 and until 1608 worked for the duke of Mantua, who in 1603 sent him to Spain to present paintings and other gifts to PHILIP III, the first of many diplomatic missions he would perform for various courts over three decades. The enormous fame he would achieve made him welcome at royal courts, and sovereigns often discussed affairs of state while they sat for portraits. Returning to the Spanish Netherlands (now Belgium) in 1608, he was appointed court painter to the Spanish Habsburg regents, and over the next decade produced numerous altarpieces. A devout Catholic, he became the Counter-Reformation's chief artistic proponent in northern Europe. In 1620 he contracted to design 39 ceiling paintings for the Jesuit church, to be completed by assistants, including the young ANTHONY VAN DYCK. In France he did 21 large canvases for MARIE DE MÉDICIS and a tapestry cycle for LOUIS XIII; for Britain his *Allegory of Peace and War* (1629–30) commemorated the success of his own diplomatic efforts to end hostilities between Britain and Spain, and he decorated the royal Banqueting House for CHARLES I; in Spain he did more than 60 oil sketches for PHILIP IV's hunting lodge. Both Charles and Philip knighted him. His output was prodigious. He was the greatest exponent of BAROQUE painting's dynamism, vitality, and sensual exuberance. His profound stylistic influence extended over three centuries.

rubeola See MEASLES

Rubicon \'rü-bi-ˌkän\ Small stream that separated Cisalpine GAUL from Italy in the era of the Roman republic. The movement of Julius CAESAR's

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forces over the Rubicon into Italy in 49 BC violated the law that forbade a general to lead an army out of the province to which he was assigned. Caesar's act thus amounted to a declaration of war against the Roman Senate and resulted in the three-year civil war that left Caesar ruler of the Roman world. "Crossing the Rubicon" became a popular phrase describing a step that irrevocably commits a person to a given course of action.

rubidium-strontium \rü-'bi-dē-əm-'strän-shē-əm\ **dating** Method of estimating the age of rocks, minerals, and meteorites from measurements of the amount of the stable isotope strontium-87 formed by the decay of the unstable isotope rubidium-87 that was present in the rock at the time of its formation. The method is applicable to very old rocks because the transformation is extremely slow: the half-life, or time required for half the initial quantity of rubidium-87 to disappear, is approximately 48.8 billion years. See also DATING.

Rubinstein, Anton (Grigoryevich) (b. Nov. 28, 1829, Vykhvatinets, Podolia province, Russia—d. Nov. 20, 1894, Peterhof) Russian composer and pianist. Touring as a piano virtuoso, he met FRÉDÉRIC CHOPIN and FRANZ LISZT in Paris and GIACOMO MEYERBEER in Berlin. After several years of study, in 1848 he settled in St. Petersburg, where in 1862 he founded the St. Petersburg Conservatory and thereafter devoted much energy to improving the quality of Russian musical education. His once popular compositions, including six symphonies, five piano concertos, and many chamber works and piano pieces (including "Melody in F") have largely disappeared from the repertoire. His brother Nicolay (1835–81), also a famous pianist and teacher, founded the Moscow Conservatory in the 1860s.

Anton Rubinstein
COURTESY OF THE ROYAL COLLEGE OF MUSIC, LONDON

Rubinstein, Artur (b. Jan. 28, 1887, Łodz, Pol.—d. Dec. 20, 1982, Geneva, Switz.) Polish-U.S. pianist. His studies with JOSEPH JOACHIM led to a debut in Berlin in 1900. He later studied with IGNACY JAN PADEREWSKI as well and performed with moderate success. After some years accompanying the violinist Eugène Ysaye (1858–1931), he stopped performing for five years (1932–37) to improve his technique and reemerged as a giant of 20th-century music. Moving to the U.S., he became equally noted as soloist and chamber musician, with such partners as JASCHA HEIFETZ and Gregor Piatigorsky (1903–76). Active through his 80s, his repertoire ranged from JOHANN SEBASTIAN BACH to 20th-century Spanish composers; his playing of FRÉDÉRIC CHOPIN and JOHANNES BRAHMS was particularly admired.

Rubinstein, Helena (b. Dec. 25, 1870, Kraków, Pol., Austria-Hungary—d. April 1, 1965, New York, N.Y., U.S.) Polish-U.S. cosmetician, business executive, and philanthropist. She went to Australia in 1902, where she opened a beauty salon in which she offered free consultation along with a special cream brought from Poland. Experiencing an immediate success there, she returned to Europe, opening a salon in London in 1908 and another in Paris in 1912. In 1914 she immigrated to the U.S. to open salons in New York and other cities. She began wholesale distribution of her products in 1917. After World War II she built factories on five continents. In 1953 she established the Helena Rubinstein Foundation to coordinate her gifts to museums, colleges, and institutions for the needy.

Rublev \rəb-'lyôf**, Andrei** *or* **Andrei Rublyov** (b. c. 1360, Russia—d. 1430) Russian painter. He was trained wholly in the stylized tradition of Byzantine art, but to the more humanistic approach it had adopted by the 14th century he added a truly Russian element, a complete unworldliness that distinguishes his work from that of his predecessors and successors. He assisted Theophanes the Greek in decorating the Cathedral of the Annunciation in Moscow. The greatest of medieval Russian ICON painters, he is best known for *The Old Testament Trinity* (c. 1410). He became a monk fairly late in life.

rubrication \ˌrü-bri-'kā-shən\ In calligraphy and typography, the use of handwriting or type of a different colour on a page, derived from the practice of setting off liturgical directions, headings of statutes, and the like in red. Specifically, it applied to the rules prescribed for the conduct of religious services as set forth in breviaries, prayer books, and missals. Though red is the traditional colour for rubrication (from Latin, *rubricare*: "to colour red"), the term is now extended to include inks of other colours either applied by hand or printed.

Detail showing the use of rubrication from the *Gellone Sacramentary,* 8th century (Paris, Bibliothèque Nationale, MS. lat. 12048, fol. 40)
COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS

ruby Gemstone composed of transparent red CORUNDUM. Its colour varies from deep to pale red, in some cases with a tinge of purple, depending on chromium and iron content; the most valued is a pigeon-blood red. When it is cut and polished, ruby is a brilliant (light-deflecting) stone, but it lacks fire (flashes of colour). Ruby is a mineral of very limited distribution. Its best-known source is in Myanmar, and rubies have also been found in Thailand, Sri Lanka, and elsewhere. Rubies have been produced synthetically with much success; those containing 2.5% chromic oxide have the prized pigeon-blood red colour.

Rude \'rüd**, François** (b. Jan. 4, 1784, Dijon, Fr.—d. Nov. 3, 1855, Paris) French sculptor. He won the Prix de Rome in 1812 but was prevented from going to Rome by the Napoleonic Wars. His early work was in the Neoclassical tradition, but he was uncomfortable within its restrictions and soon adopted a dynamic, emotional style that might be called Romantic-Realist. An ardent Bonapartist, he is best known for *Departure of the Volunteers of 1792* (1833–36) on the ARC DE TRIOMPHE; popularly called *La Marseillaise*, it catches the martial spirit of the Napoleonic era.

Rudolf (b. Aug. 21, 1858, Schloss Laxenburg, near Vienna, Austria—d. Jan. 30, 1889, Schloss Mayerling, near Vienna) Archduke and crown prince of Austria. The son of Emperor FRANCIS JOSEPH, he received a broad education and traveled widely. As heir to the throne of Austria-Hungary, he hoped to bring reform to the empire, but his liberal views alienated his father, and he was excluded from the business of government. From 1881 he considered having himself crowned king of Hungary and reviving a kingdom of Poland. He then became despondent and allegedly formed a suicide pact with his mistress, Maria Vetsera; the two were found shot dead in the hunting lodge at Mayerling. Efforts to disguise the facts provoked many rumours, while romantic writers found inspiration in the story.

Rudolf I *or* **Rudolf of Habsburg** (b. May 1, 1218, Limburg-im-Breisgau—d. July 15, 1291, Speyer) First German king (1273–91) of the HABSBURG DYNASTY. He inherited lands in Alsace, the Aargau, and Breisgau and extended his territory by marriage and through negotiation. Crowned king in 1273, he was recognized by Pope GREGORY X only after promising to lead a new Crusade and to renounce imperial rights in Rome, the papal territories, and Italy. Rudolf defeated his rival Otakar II (1276, 1278) and gained lands in Austria, which he granted to his sons. He worked to combat the expansionist policies of France, but French influence at the papal court kept him from being crowned Holy Roman emperor. Although he created the core of later Habsburg territorial power, Rudolf was unable to make the throne a hereditary possession of his family, because the German electors would not raise his son to the kingship.

Rudolf, Lake *or* **Lake Turkana** Lake, mainly in northern Kenya. The fourth largest of the eastern African lakes, it lies 1,230 ft (375 m) above sea level in the GREAT RIFT VALLEY and covers an area of 2,473 sq mi (6,405 sq km). The three main islands in the lake are volcanic. The lake is relatively shallow; its greatest recorded depth is 240 ft (73 m). Having no outlet, the lake's waters are brackish. Sudden storms are frequent, rendering navigation treacherous. It is a rich reservoir of fish.

Rudolph, Wilma (Glodean) (b. June 23, 1940, St. Bethlehem, Tenn., U.S.—d. Nov. 12, 1994, Brentwood, Tenn.) U.S. sprinter. She was a sickly child who wore an orthopedic shoe until she was 11. She matured into an excellent basketball player and sprinter in high school and at Tennessee State University. At the 1960 Olympics in Rome she won the 100-m and 200-m dashes and was a member of the winning 4 × 100-m

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relay team. She became the first American woman to win three track-and-field gold medals in a single Olympics.

Wilma Rudolph, 1961.
AP/WIDE WORLD PHOTOS

Rudolphi's rorqual See SEI WHALE

rue family *or* **citrus family** Family Rutaceae, made up of about 1,700 species of woody shrubs and trees (and a few herbaceous perennials) in 160 genera. Valuable for timber, edible fruits, and as ornamentals, members are found worldwide in warm temperate and tropical regions. The flowers are conspicuous for their colour, fragrance, and nectar. Economically important fruits in the family include the LEMON, LIME, ORANGE, GRAPEFRUIT, CITRON, and KUMQUAT. Among the ornamentals are common rue (*Ruta graveolens*) and the unusual burning bush, or gas plant, (*Dictamnus albus*), whose aromatic leaves contain oil glands that, when squeezed, release a gas ignitable by a match.

ruffed grouse North American species (*Bonasa umbellus*) of GROUSE, sometimes incorrectly called a PARTRIDGE. Ruffed grouse live mainly on berries, fruits, seeds, and buds but also eat much animal food. They are 16–20 in. (40–50 cm) long and have feathered lower legs and a black band on the fan-shaped tail. The male's ruff consists of erectile black feathers on the sides of the neck. Males beat their wings rapidly against the air (called drumming) to proclaim their territory.

Ruffin, Edmund (b. Jan. 5, 1794, Prince George county, Va., U.S.—d. June 18, 1865, Amelia county, Va.) U.S. agriculturist and secessionist. Educated largely at home, he managed his father's tobacco plantation from 1813. He found that overuse and poor farming methods produced an acid soil unable to retain fertilizers; in 1832 he published an influential book advocating the use of marl to reduce soil acidity, which helped restore Southern plantations to productivity. He also published the *Farmer's Register* (1833–42) and lectured widely on agriculture. In the 1850s he defended slavery and advocated secession. He fired one of the first shots at FORT SUMTER (1861). Unable to accept the South's defeat, he killed himself.

rug and carpet Any decorative textile normally made of a thick material and intended as a floor covering. Floor coverings made of plaited rushes date from the 5th or 4th millennium BC. Carpets were first made in central and western Asia as coverings for earthen floors; they were also used for blankets, saddle covers, storage bags, tent doorways, and tomb covers. Oriental carpets imported into Europe in the 16th–17th century were considered too valuable to be put on the floor and were often used as wall decoration. They are still popular wall decorations in Russia. Carpet weaving reached its peak of artistry in 16th-century Persia. In the West, outstanding carpets were produced at factories in 17th-century France and 18th-century England. Most handmade carpets are made from sheep's wool. Natural dyes were used until the 19th century, when chemical dyes were introduced. See also AUBUSSON CARPET; AXMINSTER CARPET.

rugby Football sport made up of two variant codes—rugby union and rugby league. The sport was first developed in the 1820s at Rugby School in England. In 1895 a dispute over professionalism between the Rugby Football Union and several clubs in northern England led to the creation of rugby league (always a professional sport). Rugby union became fully professional in 1995. The game is played by teams of 15 (union) or 13 (league) members each, using an inflated oval ball. The ball may be kicked, carried, or passed laterally or backward (but not forward). The object is to score goals (worth three points) by kicking the ball between the uprights of the opponent's goal, or tries (worth five points in union play, four in league), by grounding the ball behind the opponent's goal line. A conversion kick (worth two points) is attempted after scoring a try. Both rugby union and rugby league have international play and world cup tournaments. Rugby is most popular in the United Kingdom, South Africa, Australia, and New Zealand.

Ruhr occupation (1923–25) Occupation of the industrial RUHR RIVER valley region in Germany by French and Belgian troops. The action was provoked by German deficiencies in the coal and coke deliveries to France required by the reparations agreement after World War I. French occupation of Düsseldorf, Duisburg, and Ruhrort in 1921 was followed by French-Belgian occupation of the entire region in 1923. Passive resistance by German workers paralyzed the Ruhr's economy and precipitated the collapse of the German currency. The dispute was settled by the DAWES PLAN, and the occupation ended in 1925.

Ruhr \'rür\ **River** River, western Germany. An important tributary of the lower RHINE RIVER, it rises on the northern side of Winterberg and flows 146 mi (235 km) west. The Ruhr valley is a major industrial and mining region; it includes the industrial cities of ESSEN, DÜSSELDORF, and DORTMUND. The Ruhr coalfield is one of the world's largest and produces the bulk of Germany's bituminous coal. Industries begun by the Krupp and Thyssen families flourished in the 19th–20th centuries (see THYSSEN-KRUPP Stahl). The river was militarily important in World War I, and the river valley was occupied from 1923 to 1925 by France and Belgium (see RUHR OCCUPATION). As the industrial heart of Nazi Germany, it was heavily bombed in World War II and occupied by Allied troops in 1945; full control was returned to West Germany in 1954. It is now a centre of steel production and diversified chemical manufacturing.

Ruisdael \'rȯis-ˌdȧl**, Jacob (Isaakszoon) van** *also spelled* **Ruysdael** (b. 1628/29, Haarlem, Neth.—buried March 14, 1682, Amsterdam) Dutch landscape painter. He was probably trained by his father, a framemaker and artist. He was enrolled in the Haarlem painters' guild in 1648 and settled in Amsterdam c. 1656. He was a remarkably versatile artist, and some 700 paintings have been attributed to him. Whereas earlier Dutch artists used trees merely as decorative devices, Ruisdael made them the subject of his paintings and imbued them with forceful personalities through vigorous brushwork and strong colours in the BAROQUE style. The emotional force of his work is evident in the famous *Jewish Cemetery* (c. 1660), where three tombstones crumble to ruin amid an ever-renewing nature. His late works include numerous panoramas of the flat Dutch countryside, in which a low, distant horizon is dominated by a vast, clouded sky. He is often considered the greatest Dutch landscape painter of all time.

Ruisdael, Salomon van See Salomon van RUYSDAEL

Ruiz \rü-'ēth**, Juan** (b. c. 1283, Alcalá, Spain—d. c. 1350) Spanish poet and cleric. Educated at Toledo, Ruiz was serving as a village archpriest when he finished his masterpiece, *The Book of Good Love* (1330, expanded 1343). Perhaps the most important long poem in medieval Spanish literature, it contains 12 narrative poems, each describing a different love affair. Its title refers to the distinction the author makes between the (good) love of God and carnal love. Drawing on material from an impressive range of literary and other sources, it presents a vigorous, high-spirited, satirical glimpse of medieval life.

Rukwa \'rü-kwä**, Lake** Shallow lake, southwestern Tanzania, eastern Africa. It covers an area of about 1,000 sq mi (2,600 sq km) and lies midway between Lake TANGANYIKA and Lake MALAWI (Nyasa) at an elevation of about 2,600 ft (800 m). It has no outlet, and at times it is completely dry. Its water is brackish, and there are salt pans near its southwestern end. Crocodiles and hippopotamuses inhabit the lake, and fish abound.

Rule of the Community See MANUAL OF DISCIPLINE

rules of order See PARLIAMENTARY PROCEDURE

rum DISTILLED LIQUOR made from SUGARCANE products, primarily molasses. It is first mentioned in records from Barbados c. 1650. Rum figured in the slave trade: slaves from Africa were traded in the West Indies for molasses, the molasses was made into rum in New England, and the rum was then traded to Africa for more slaves. British sailors received regular rum rations from the 18th century until the 1970s. Two major types are marketed. The light-bodied rums, traditionally of Puerto Rico and Cuba, employ cultivated yeast and are distilled in continuous-operation stills before being blended and aged one to four years. The heavier dark rums, traditionally of Jamaica, employ yeast spores from the air and are distilled in simple pot stills before being blended and aged five to seven years. Rum is drunk straight or mixed and is used in dessert sauces and other dishes.

Rumania See ROMANIA

Rūmī \'rü-ˌmē\ *in full* **Jalāl al-Dīn al-Rūmī** *byname* **Mawlānā (Arabic: "Our Master")** (b. c. Sept. 30, 1207, Balkh, Ghūrid

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empire—d. Dec. 17, 1273, Konya, Anatolia) The greatest Sufi mystic and among the most renowned Persian poets. He was a teacher at a *madrasah* in Anatolia when he met Shams al-Dīn ("Sun of Religion"), a wandering dervish who revealed to him the inner mysteries of divine majesty; their intimate relationship scandalized Rūmī's followers, who likely had Shams al-Dīn murdered. The disappearance of his companion turned Rūmī to poetry, and his *Dīvān-e Shams* ("Collected Poetry of the Sun") contains verses on his love and longing for Shams al-Dīn. His main work, the didactic epic *Masnavī-ye Ma'navī* ("Spiritual Couplets"), widely influenced Muslim mystical thought and literature. He is believed to have composed poetry while in a state of ecstasy and often accompanied his verses by a whirling dance. After his death, his disciples were organized as the Mawlawiyyah (Mevlevī), a Sufi order called in the West the "whirling dervishes," and his influence on Turkish culture is inestimable. His poems, originally in Persian, have been translated into a number of languages, including English, and have enjoyed a worldwide following into the modern period.

ruminant \'rü-mə-nənt\ Any cud-chewing UNGULATE, including ANTELOPE, CAMELS, CATTLE, DEER, GIRAFFES, GOATS, OKAPIS, PRONGHORN, and SHEEP. Most ruminants have a four-chambered stomach, two-toed feet, and small or absent upper incisors. Camels and CHEVROTAINS have three-chambered stomachs. Ruminants eat quickly, storing masses of grass (grazers) or foliage (browsers) in the first stomach chamber, the rumen, where it softens. They later regurgitate the material, called cud, and chew it again to break down the undigestible cellulose. The chewed cud goes directly to the other chambers, where various microorganisms help in its digestion.

rummy Family of card games. The many variants of rummy make it one of the world's best-known and most widely played card games. The basic principle of rummy (also spelled rum, rhum, or romme) is to form sets of three or four cards of the same rank (as four 8s, three 6s) or sequences of three or more cards of the same suit (6–5–4–3, all of diamonds, e.g.). CANASTA is an unusual type of rummy, in that sequences are not permitted. See also GIN RUMMY.

Rundstedt \'rünt-ˌshtet**, (Karl Rudolf) Gerd von** (b. Dec. 12, 1875, Aschersleben, near Magdeburg, Prussia—d. Feb. 24, 1953, Hannover, W.Ger.) German general in World War II. Chief of staff of an army corps in World War I, he was active after the war in Germany's secret rearmament. In World War II he was promoted to field marshal (1940) and commanded armies in the invasions of Poland, France, and the Soviet Union. As commander in chief on the Western Front (1942–45), he fortified France against the expected Allied invasion. Removed briefly from command (1944), he returned to direct the Battle of the BULGE. He was captured in 1945 but released because of ill health.

rune Any of the characters within an early Germanic writing system. The runic alphabet, also called futhark, is attested in northern Europe, Britain, Scandinavia, and Iceland from about the 3rd century to the 16th or 17th century AD. The Goths may have developed it from the Etruscan alphabet of northern Italy. More than 4,000 runic inscriptions and several runic manuscripts are extant. Approximately 2,500 of these come from Sweden, the remainder being from Norway, Denmark, Britain, Iceland, and various islands off the coast of Britain and Scandinavia, as well as France, Germany, Ukraine, and Russia.

Runeberg \'rü-nə-ˌber^{y}**, Johan Ludvig** (b. Feb. 5, 1804, Jakobstad, Swedish Finland—d. May 6, 1877, Borgå, Russian Finland) Finnish poet who wrote in Swedish. During an interruption in his academic career, he became a tutor at a country estate, where he encountered Finland's landscape and tales of the heroic past. His works, combining classicism with Romantic feeling and an understanding of peasant life and character, include the epic poems *The Moose Hunters* (1832) and *Hanna* (1836), which won him a place in Swedish letters; and *Kung Fjalar*, a cycle of romances derived from old legends. His patriotic poem "Our Country," from *Tales of Ensign Stål* (1848, 1860), became the Finnish national anthem. Runeberg is considered Finland's national poet.

runic writing *or* **futhark** \'fü-ˌthärk\ Writing system used by Germanic peoples of northern Europe, Britain, Scandinavia, and Iceland from roughly the 3rd to the 16th or 17th century AD. Of uncertain origins, it is clearly derived from one of the alphabets of the Mediterranean area. Three main varieties were used in different regions and time periods: Early, or Common Germanic (Teutonic); Anglo-Saxon, or Anglian; and Nordic, or Scandinavian. More than 4,000 runic inscriptions and several runic manuscripts are extant, of which about 2,500 come from Sweden.

runner See STOLON

Runyon, (Alfred) Damon (b. Oct. 4, 1884, Manhattan, Kan., U.S.—d. Dec. 10, 1946, New York, N.Y.) U.S. journalist and short-story writer. He served in the Spanish-American War as a teenager. After returning to the U.S. he wrote for newspapers in the West. In 1911 he moved to New York, where he developed a style focusing on the underside of city life and began to write stories. He is best known for *Guys and Dolls* (1931), a collection of stories about a racy section of Broadway written in the uniquely rendered slang that became his trademark and gave rise to the term *Runyonesque*; the book was adapted as a musical by FRANK LOESSER (1950).

rupa-loka \'rü-pə-'lō-kə\ In BUDDHISM, any of the 16 planes of existence into which those beings who have renounced sense desires are reborn. It is intermediate between the *kama-loka*, where material beings are born, and the ARUPA-LOKA, where only the mind exists. Its upper levels are called the Pure Abodes, the birthplace of those beings who do not return to lower planes in subsequent births. The *rupa-loka*, free from sensuous desire but still conditioned by form, is inhabited by gods. See also KARMA.

Rupert, Prince (b. Dec. 17, 1619, Prague, Bohemia—d. Nov. 29, 1682, London, Eng.) Royalist commander in the ENGLISH CIVIL WARS. Son of the Palatine elector FREDERICK V and Elizabeth, daughter of JAMES I of England, Rupert became a favourite of his uncle, CHARLES I, whom he joined in England in 1642. In the English Civil Wars, he was given command of the cavalry and became known for his daring tactics in winning victories at Bristol (1643) and in Lancashire (1644). He met defeat at the Battle of MARSTON MOOR but was appointed commander of the king's army. When he surrendered Bristol (1645), he was dismissed and then banished from England. He commanded a small Royalist fleet that preyed on English shipping (1648–50), then retired to Germany (1653–60). With the RESTORATION (1660), he was given naval commands in the ANGLO-DUTCH WARS. He was a founder and first governor of the HUDSON'S BAY CO.

Rupert's Land *or* **Prince Rupert's Land** Historical region, northern and western Canada, comprising the drainage basin of HUDSON BAY. In 1670 it was granted by King CHARLES II to the HUDSON'S BAY CO. It was named after Prince RUPERT, the king's cousin and the company's first governor. In 1869 the land became part of the Dominion of Canada.

Rupnarayan River \'rüp-nä-ˌrä-yən\ River, West Bengal state, northeastern India. It rises as the Dhaleshwari in the Chota Nagpur plateau foothills northeast of Purulia and follows a tortuous southeasterly course past the town of Bankura, where it is known as the Dwarkeswar. It flows 150 mi (240 km) to join the HUGLI RIVER. It originally formed a western exit of the GANGES RIVER and is important for its irrigation potential.

rural electrification Project of the U.S. government in the 1930s. As part of the NEW DEAL, the Rural Electrification Administration (REA) was established (1935) to bring electric power to farms, thereby raising the standard of rural living and slowing the migration of farm workers to cities. Providing low-interest loans to construct power plants and power lines to rural areas, the project eventually equipped over 98% of U.S. farms with electricity.

Rurik *or* **Rorik** (d. 879) Semilegendary founder of the Rurik dynasty of KIEVAN RUS. He was a Viking (Varangian) prince. According to one 12th-century Russian chronicle, the people of Novgorod invited him to take over their strife-ridden government (c. 862). Other historians think that he conquered Novgorod or that he and his army were rebellious mercenaries. Igor, probably his son, is held to be the real founder of the Russian princely house.

Rus See KIEVAN RUS

rusalka \rü-'säl-kə\ *plural* **rusalki** In Slavic folklore and mythology, a water NYMPH who embodies the soul of either a drowned virgin or a child that died unbaptized. Details of *rusalki*s' appearance and behaviour vary widely, but a common feature is that the nymphs attempt to entice men. In some areas, they are the subject of a festival in the early summer, when they are thought to emerge from the water and dance by night. In ANTONÍN DVOŘÁK's opera *Rusalka*, a *rusalka* attempts to marry a human prince but is reclaimed by her element.

rush Any of several flowering plants distinguished by cylindrical stalks or hollow, stemlike leaves. They are found in temperate regions, particularly in moist or shady locations. The rush family (Juncaceae) includes the genera *Juncus*, the common rushes, and *Luzula*, the wood rushes. In

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many parts of the world, common rushes are woven into chair bottoms, mats, and basketwork, while rush pith serves as wicks in open oil lamps and tallow candles (rushlights). Other rushes include the BULRUSH (family Typhaceae), the HORSETAIL (or scouring rush), the flowering rush (*Butomus umbellatus*, family Butomaceae), and the sweet rush, or sweet flag (*Acorus calamus*, ARUM FAMILY).

Rush, Benjamin (b. Jan. 4, 1746, Byberry, near Philadelphia, Pa.—d. April 19, 1813, Philadelphia, Pa., U.S.) U.S. physician and political leader. He attended the College of New Jersey at Princeton. As a doctor, he was a dogmatic theorist who proposed that all diseases are fevers caused by overstimulation of blood vessels, with a simple remedy—bloodletting and purges. He advocated humane treatment for insane patients; his idea that insanity often had physical causes marked a significant advance. He wrote the first chemistry textbook and the first psychiatry treatise in the U.S. An early and active American patriot and a member of the Continental Congress, Rush drafted a resolution urging independence and signed the Declaration of Independence.

Rush, Richard (b. Aug. 29, 1780, Philadelphia, Pa., U.S.—d. July 30, 1859, Philadelphia) U.S. diplomat. The son of BENJAMIN RUSH, he served as U.S. attorney general (1814–17) and secretary of the treasury (1825–29). As acting secretary of state (1817), he negotiated the Rush-Bagot Agreement with Britain, which limited naval forces on the Great Lakes after the War of 1812. As U.S. minister to Britain (1817–25), he negotiated an agreement fixing the border between Canada and the U.S. at the 49th parallel. In conferences on Latin America, he helped formulate the MONROE DOCTRINE. In 1836, as the U.S. agent in London, he received the bequest by which James Smithson founded the SMITHSONIAN INSTITUTION; Rush considered his role in founding the museum his most important public service.

Rushdie \'růsh-dē,\ *commonly* \'rəsh-dē**, (Ahmed) Salman** (b. June 19, 1947, Bombay, India) Indian-British novelist. Educated at the University of Cambridge, he worked as an advertising copywriter in London in the 1970s before winning unexpected success with *Midnight's Children* (1981, Booker Prize), an allegorical novel about modern India. His second novel, *Shame* (1983), is a scathing portrait of politics and sexual morality in Pakistan. *The Satanic Verses* (1988), which includes among its bizarre happenings some episodes based on the life of MUḤAMMAD, was denounced as blasphemous by outraged Muslim leaders, and in 1989 Rushdie was condemned to death by Iran's RUHOLLAH KHOMEINI. He became the focus of enormous international attention and was compelled to remain in hiding for years. His later novels include *The Moor's Last Sigh* (1995) and *Fury* (2001).

Rushing, Jimmy *orig.* **James Andrew Rushing** (b. Aug. 26, 1903, Oklahoma City, Okla., U.S.—d. June 8, 1972, New York, N.Y.) U.S. BLUES and JAZZ singer. Rushing joined COUNT BASIE's first group in 1935, gaining exposure through many recordings, and remained until 1950. He thereafter led his own small groups or worked with the bands of BENNY GOODMAN, Buck Clayton, and occasionally Basie. Rushing's full tenor voice, although associated with the blues-based repertoire of the Basie period, was also well suited to popular songs and ballads.

Rusk, (David) Dean (b. Feb. 9, 1909, Cherokee county, Ga., U.S.—d. Dec. 20, 1994, Athens, Ga.) U.S. secretary of state (1961–69) and educator. He earned a master's degree as a Rhodes scholar at St. John's College, Oxford, and then taught (1934–40) at Mills College in Oakland, Calif. He served in World War II on Gen. JOSEPH STILWELL's staff. He later held positions in the U.S. State Department and War Department, helping prosecute the Korean War as an assistant secretary of state (1950). After serving as president of the ROCKEFELLER FOUNDATION (1952–60), he became U.S. secretary of state under JOHN F. KENNEDY and LYNDON B. JOHNSON. A consistent defender of U.S. participation in the Vietnam War, he became a target of antiwar protests. He also opposed diplomatic recognition of China. After retiring from public life, he taught at the University of Georgia until 1984.

Ruskin, John (b. Feb. 8, 1819, London, Eng.—d. Jan. 20, 1900, Coniston, Lancashire) English art critic. Born into a wealthy family, Ruskin was largely educated at home. He was a gifted painter, but the best of his talent went into his writing. His multivolume *Modern Painters* (1843–60), planned as a defense of painter J.M.W. TURNER, expanded to become a general survey of art. In Turner he saw "truth to nature" in landscape painting, and he went on to find the same truthfulness in GOTHIC ARCHITECTURE. His other writings include *The Seven Lamps of Architecture* (1849) and *The Stones of Venice* (1851–53). He was also a defender of the PRE-RAPHAELITES. In 1869 he was elected Oxford's first Slade professor of fine art; he resigned in 1879 after JAMES MCNEILL WHISTLER won a libel suit against him. In later years he used his inherited wealth to promote idealistic social causes, but his powerful rhetoric, which still contained striking insights, became marred by bigotry and occasional incoherence. Ruskin remains the preeminent art critic of 19th-century Britain.

Russell, Bertrand (Arthur William), 3rd Earl Russell (b. May 18, 1872, Trelleck, Monmouthshire, Eng.—d. Feb. 2, 1970, near Penrhyndeudraeth, Merioneth, Wales) British logician and philosopher. He is best known for his work in mathematical logic and for his advocacy on behalf of a variety of social and political causes, especially pacifism and nuclear disarmament. He was born into the British nobility as the grandson of Earl RUSSELL, who was twice prime minister of Britain in the mid-19th century. He studied mathematics and philosophy at Cambridge University, where he came under the influence of the idealist philosopher J.M.E. McTaggart, though he soon rejected IDEALISM in favour of an extreme Platonic realism. In an early paper, "On Denoting" (1905), he solved a notorious puzzle in the philosophy of language by showing how phrases such as "The present king of France," which have no referents, function logically as general statements rather than as proper names. Russell later regarded this discovery, which came to be known as the "theory of descriptions," as one of his most important contributions to philosophy. In *The Principles of Mathematics* (1903) and the epochal *Principia Mathematica* (3 vol., 1910–13), which he wrote with ALFRED NORTH WHITEHEAD, he sought to demonstrate that the whole of mathematics derives from logic. For his pacifism in World War I he lost his lectureship at Cambridge and was later imprisoned. (He would abandon pacifism in 1939 in the face of Nazi aggression.) Russell's best-developed metaphysical doctrine, logical atomism, strongly influenced the school of LOGICAL POSITIVISM. His later philosophical works include *The Analysis of Mind* (1921), *The Analysis of Matter* (1927), and *Human Knowledge: Its Scope and Limits* (1948). His *A History of Western Philosophy* (1945), which he wrote for a popular audience, became a best-seller and was for many years the main source of his income. Among his many works on social and political topics are *Roads to Freedom* (1918); *The Practice and Theory of Bolshevism* (1920), a scathing critique of Soviet communism; *On Education* (1926); and *Marriage and Morals* (1929). In part because of the controversial views he espoused in the latter work, he was prevented from accepting a teaching position at the City College of New York in 1940. After World War II he became a leader in the worldwide campaign for nuclear disarmament, serving as first president of the international PUGWASH CONFERENCES on nuclear weapons and world security and of the Campaign for Nuclear Disarmament. In 1961, at the age of 89, he was imprisoned for a second time for inciting civil disobedience. He received the Nobel Prize for Literature in 1950.

Bertrand Russell, 1960
COURTESY OF THE BRITISH BROADCASTING CORPORATION, LONDON

Russell, Bill *in full* **William Felton Russell** (b. Feb. 12, 1934, Monroe, La., U.S.) U.S. basketball player. The 6-ft 10-in. (2.08-m) centre led the University of San Francisco to two NCAA championships (1955–56). Playing for the Boston Celtics (1956–69), Russell led his team to 11 NBA championships in 13 seasons—the last 2 as coach, having become in 1967 the first black coach of a major professional sports team. Russell's career mark for rebounds (21,620) is second only to that of his great rival WILT CHAMBERLAIN, and he is regarded as one of the finest defensive centres of all time. He was voted most valuable player in the NBA five times. He later coached the Seattle SuperSonics (1973–77) and the Sacramento Kings (1987–88).

Russell, Charles Taze (b. Feb. 16, 1852, Pittsburgh, Pa., U.S.—d. Oct. 31, 1916, Pampa, Texas) U.S. religious leader who founded the International Bible Students Association, the forerunner of the JEHOVAH'S WITNESSES. He was raised in the Congregational church but rejected its teachings, unable to reconcile God's mercy with the idea of hell. Influenced by the ADVENTISTS, he adopted a doctrine of MILLENNIALISM. He founded

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the International Bible Students Association in 1872 (renamed Jehovah's Witnesses in 1931) and taught that the final days would come in 1914 and that Christ's kingdom on earth would begin after a war between capitalism and socialism. In 1884 he founded the Watch Tower Bible and Tract Society, today one of the world's largest publishers. His books, pamphlets, and periodicals were widely circulated, and he won many converts despite the apparent failure of his apocalyptic prediction.

Russell (of Kingston Russell), John Russell, 1st Earl (b. Aug. 18, 1792, London, Eng.—d. May 28, 1878, Pembroke Lodge, Richmond Park, Surrey) British politician and prime minister (1846–52, 1865–66). A member of the prominent Russell family, he entered Parliament in 1813. He was a strong advocate of reform and made it a cause of the Whig Party, leading the effort to pass the Reform Bill of 1832. He served in Viscount Melbourne's government as home secretary (1835), reducing the number of crimes liable to capital punishment and beginning state support of public education. In the 1840s he advocated free trade and forced Robert Peel out of office. Russell became prime minister in 1846 and established the 10-hour day in factories (1847) and a board of public health (1848), but party disunity defeated his attempts at wider social and economic reform.

Russell, Lillian *orig.* **Helen Louise Leonard** (b. Dec. 4, 1861, Clinton, Iowa, U.S.—d. June 6, 1922, Pittsburgh, Pa.) U.S. singer and actress. She made her stage debut while still in her teens. She achieved stardom in *Grand Mogul* (1881) and later won acclaim in *The Grand Duchess* (1890). From 1899 to 1904 she appeared in England and the U.S. with a burlesque company. Representing the feminine ideal of her generation, she was as famous for her flamboyant personal life as for her hourglass figure, her beauty, and her voice. After her fourth marriage in 1912, she wrote a syndicated column on health, beauty, and love and lectured on these topics before vaudeville audiences.

Russell, William Russell, Lord (b. Sept. 29, 1639—d. July 21, 1683, London, Eng.) English Whig politician. A member of the House of Commons, he joined the opposition to the pro-French policies of Charles II. In 1678 he was convinced by Titus Oates's fabricated Popish Plot, and by 1680 he led the fight in the Commons to exclude Charles's brother James (later James II) from the succession. After Charles dissolved Parliament (1681), Russell continued to associate with Whig dissidents. In 1683 he was accused of participating in the Rye House Plot to murder Charles. The charges were never proved, but Russell was found guilty of treason and beheaded.

Russell Cave National Monument National Monument, northeastern Alabama, U.S. Located south of the Alabama-Tennessee border, the monument constitutes part of a cavern that was discovered c. 1953. The cave is about 210 ft (64 m) long, 107 ft (33 m) wide, and 26 ft (8 m) high. It contains an almost continuous record of human habitation dating to at least 7000 BC. The national monument was established in 1961.

Russell family English Whig family. It first became prominent under the Tudors, when John Russell (died 1555) was created earl of Bedford (1549) for helping suppress a rebellion against the Protestant reforms of Edward VI. The family was connected with the Parliamentary party in the English Civil Wars. Its first notable Whig member was William, Lord Russell. Later members included John, Earl Russell, and his grandson, the philosopher Bertrand Russell.

Russia *officially* **Russian Federation** Country, eastern Europe and northern Asia, formerly the preeminent republic of the Union of Soviet Socialist Republics. Area: 6,592,800 sq mi (17,075,400 sq km). Population (2005 est.): 143,420,000. Capital: Moscow. The population is primarily Russian; minorities include Tatars and Ukrainians. Languages: Russian (official), various Turkic and Uralic languages. Religions: Christianity (mostly Eastern Orthodox, also Protestant); also Islam. However, about one-third of the people are nonreligious or atheist. Currency: ruble. The land and its environments are varied, including the Ural Mountains and ranges in eastern Siberia, the highest peaks being on the Kamchatka Peninsula. The Russian Plain contains the great Volga and Northern Dvina rivers, and in Siberia are the valleys of the Ob, Yenisey, Lena, and Amur rivers. Tundra covers extensive portions in the north, and in the south there are forests, steppes, and fertile areas. The economy was industrialized from 1917 to 1945 but was in serious decline by the 1980s. In 1992 the government decreed radical reforms to convert the centrally planned economy into a market economy based on private enterprise. Russia is a federal republic with a bicameral legislative body; its head of state is the president, and the head of government is the prime minister. What is now the territory of Russia was inhabited from ancient times by various peoples, including the Slavs. The area was overrun in the 8th century BC–6th century AD by successive nomadic peoples, including the Sythians, Sarmatians, Goths, Huns, and Avars. Kievan Rus, a confederation of principalities ruling from Kiev, emerged c. the 10th century; it lost supremacy in the 11th–12th century to independent principalities, including Novgorod and Vladimir. Novgorod ascended in the north and was the only Russian principality to escape the domination of the Mongol Golden Horde in the 13th century. In the 14th–15th century the princes of Moscow gradually overthrew the Mongols. Under Ivan IV (the Terrible), Russia began to expand. The Romanov dynasty arose in 1613. Expansion continued under Peter I (the Great) and Catherine II (the Great). The area was invaded by Napoleon in 1812; after his defeat, Russia received most of the Grand Duchy of Warsaw (1815). Russia annexed Georgia, Armenia, and Caucasus territories in the 19th century. The Russian southward advance against the Ottoman Empire was of key importance to Europe (see Crimea). Russia was defeated in the Crimean War (1853–56). Chinese cession of the Amur River's left bank in 1858 marked Russia's expansion in East Asia. Russia sold Alaska to the U.S. in 1867 (see Alaska Purchase). Defeat in the Russo-Japanese War led to an unsuccessful uprising in 1905 (see Russian Revolution of 1905). In World War I Russia fought against the Central Powers. The popular overthrow of the tsarist regime in 1917 marked the beginning of a government of soviets (see Russian Revolution of 1917). The Bolsheviks brought the main part of the former empire under communist control and organized it as the Russian Soviet Federated Socialist Republic (coextensive with present-day Russia). The Russian S.F.S.R. joined other soviet republics in 1922 to form the U.S.S.R. Upon the dissolution of the U.S.S.R. in 1991, the Russian S.F.S.R. was renamed and became the leading member of the Commonwealth of Independent States. It adopted a new constitution in 1993. During the 1990s and into the early 21st century, it struggled on several fronts, beset with economic difficulties, political corruption, and independence movements (see Chechnya). See map on opposite page.

Leaders of Muscovy, Russia, and the Russian Empire

Princes of Muscovy:		**Interregnum**	1610–12
Danilovich dynasty*		**Czars and Empresses of Russia: Romanov dynasty****	
Daniel (son of Alexander Nevsky)	c.1276–1303	Michael III	1613–45
Yury	1303–25	Alexis	1645–76
Ivan I	1325–40	Fyodor III	1676–82
Semyon (Simeon)	1340–53	Peter I (Ivan V coruler 1682–96)	1682–1725
Ivan II	1353–59	Catherine I	1725–27
Dmitry Donskoy	1359–89	Peter II	1727–30
Vasily I	1389–1425	Anna	1730–40
Vasily II	1425–62	Ivan VI	1740–41
Ivan III	1462–1505	Elizabeth	1741–61 (O.S.)
Vasily III	1505–33	Peter III***	1761–62 (O.S.)
Ivan IV	1533–47	Catherine II	1762–96
Czars of Russia: Danilovich dynasty		Paul	1796–1801
Ivan IV	1547–84	Alexander I	1801–25
Fyodor I	1584–98	Nicholas I	1825–55
Czars of Russia: Time of Troubles		Alexander II	1855–81
Boris Godunov	1598–1605	Alexander III	1881–94
Fyodor II	1605	Nicholas II	1894–1917
False Dmitry	1605–6		
Vasily (IV)	1606–10		

*The Danilovich dynasty is a late branch of the Rurik dynasty, named after its progenitor, Daniel.
**In 1721 Peter I the Great took the title of "emperor" (Russian: *imperator*), considering it a larger, more European title than the Russian "czar." However, every male sovereign continued usually to be called czar (and his consort czarina, or czaritsa), though every female sovereign was conventionally called empress (*imperatritsa*).
***The direct line of the Romanov dynasty came to an end in 1761 with the death of Elizabeth, daughter of Peter I, but subsequent rulers of the "Holstein–Gottorp dynasty" (the first, Peter III, was son of Charles Frederick, duke of Holstein–Gottorp, and Anna, daughter of Peter I) took the family name of Romanov.

Russian Civil War (1918–20) Conflict between the newly formed Bolshevik government and its Red Army against the anti-Bolshevik forces in Russia. The unfavourable Treaty of Brest-Litovsk concluded with Ger-

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many caused socialists opposed to VLADIMIR LENIN to break with the Bolsheviks and join the right-wing Whites and their volunteer army under ANTON DENIKIN. In an attempt to create another front in WORLD WAR I, the Allies gave limited support to the Whites. The Moscow government responded to the growing anti-Bolshevik movement by expelling MENSHEVIK and Social Revolutionary deputies from the government, and it began a campaign of "Red terror" that gave increased powers to the secret police (Cheka) to arrest and execute suspects. The Bolsheviks maintained control over the heart of the country, but the anti-Bolsheviks gained power in Ukraine and Omsk, where ALEKSANDR KOLCHAK and other dissident groups joined together to fight the Red Army. Confused by the struggles between communists, Russian Whites, and Ukrainian nationalists, the Allies withdrew their support by 1919. After early military successes against the Red Army, the White forces under Kolchak were defeated by early 1920. Other White troops under NIKOLAY YUDENICH failed to take St. Petersburg. The last White stronghold in the Crimea under PYOTR WRANGEL, Denikin's successor, was defeated in November 1920, ending the Russian Civil War.

Russian Formalism See FORMALISM

Russian language East SLAVIC LANGUAGE spoken by about 170 million people in Russia, former republics of the Soviet Union, and émigré communities. For many non-Russian ethnic groups both within and outside contemporary Russia, it is a common second language and LINGUA FRANCA. Since the Middle Ages, Russian has gradually expanded its speech area from its historical locus in the upper Volga and Dnieper River drainages northward and eastward. Russian speakers penetrated Siberia in the 16th century and reached the Pacific in the 17th century. Russian became a full-fledged literary language in the 18th century, when it finally displaced Church Slavonic (see OLD CHURCH SLAVONIC LANGUAGE). Dialect differences in Russian are not great, considering the enormous territory over which it is spoken, and the upheavals of the 20th century eroded such distinctions as exist. See table opposite.

Russian Orthodox Church Eastern Orthodox church of Russia, its de facto national church. In 988 Prince Vladimir of Kiev (later St. VLADIMIR) embraced Byzantine Orthodoxy and ordered the baptism of his population. By the 14th century, the metropolitan of Kiev and all Russia (head of the Russian church) was residing in Moscow; dissatisfied western Russian principalities obtained temporary separate metropolitans, but authority was later recentralized under Moscow. In the 15th century the church, rejecting Metropolitan Isidore's acceptance of union with the Western church (see Council of FERRARA-FLORENCE), appointed their own independent metropolitan. Moscow saw itself as the "third Rome" and the last bulwark of true Orthodoxy; in 1589 the head of the Russian church obtained the title patriarch, putting him on a level with the patriarchs of Constantinople, Alexandria, Antioch, and Jerusalem. The reforms of NIKON caused a schism within the church (see OLD BELIEVERS), and PETER I

Russian Alphabet

Letters	English sound	Letters	English sound	Letters	English sound
А а	a	К к	k	Х х	kh
Б б	b	Л л	l	Ц ц	ts
В в	v	М м	m	Ч ч	ch
Г г	g	Н н	n	Ш ш	sh
Д д	d	О о	o	Щ щ	shch
Е е	e or ye	П п	p	Ъ ъ	(the hard sign)
Ё ё	o or yo	Р р	r	Ы ы	y
Ж ж	zh	С с	s	Ь ь	(the soft sign)
З з	z	Т т	t	Э э	e
И и	i	У у	u	Ю ю	yu
Й й	y	Ф ф	f	Я я	ya

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abolished the patriarchate in 1721, making church administration a department of the state. The patriarchate was reestablished in 1917, two months before the Bolshevik revolution, but under the soviets the church was deprived of its legal rights and practically suppressed. It saw a great resurgence following the collapse of the Soviet Union (1991). The Russian Orthodox Church in the U.S. became independent from Moscow in 1970.

Russian Revolution of 1905 Unsuccessful uprising in Russia against the tsarist regime. After several years of mounting discontent, a peaceful demonstration was crushed by Tsar Nicholas II's troops in the Bloody Sunday massacre. General strikes followed in St. Petersburg and other industrial cities. The revolt spread to non-Russian parts of the empire, including Poland, Finland, and Georgia. Antirevolutionary groups, including the Black Hundreds, opposed the rebellion with violent attacks on socialists and pogroms against Jews. By October 1905, general strikes had spread to all the large cities, and the workers' councils or soviets, often led by the Mensheviks, became revolutionary governments. The strikes' magnitude convinced Nicholas II, advised by Sergey Witte, to issue the October Manifesto, promising an elected legislature. The concessions satisfied most moderates, though the more ardent revolutionaries refused to yield, and pockets of resistance in Poland, Georgia, and elsewhere were harshly suppressed as the regime restored its authority. While most of the revolutionary leaders, including Leon Trotsky, were arrested, the revolution forced the tsar to institute reforms such as a new constitution and a Duma, though he failed to adequately implement various promised reforms.

Russian Revolution of 1917 Revolution that overthrew the imperial government and placed the Bolsheviks in power. Increasing governmental corruption, the reactionary policies of Tsar Nicholas II, and catastrophic Russian losses in World War I contributed to widespread dissatisfaction and economic hardship. In February 1917 riots over food scarcity broke out in Petrograd (St. Petersburg). When the army joined the rebels, Nicholas was forced to abdicate. A provisional government, headed by Georgy Lvov, was appointed in March and tried to continue Russia's participation in World War I, but it was opposed by the powerful Petrograd workers' soviet, which favoured Russian withdrawal from the war. Other soviets were formed in major cities and towns, choosing members from factories and military units. The soviet movement was dominated by the Socialist Revolutionary Party, followed by the Mensheviks and the Bolsheviks. Between March and October, the provisional government was reorganized four times; Aleksandr Kerensky became its head in July; he survived a coup attempt by Lavr Kornilov but was unable to halt Russia's slide into political and military chaos. By September the Bolsheviks, led by Vladimir Lenin, had achieved majorities in the Petrograd and Moscow soviets and won increasing support among the hungry urban workers and soldiers. In October they staged a nearly bloodless coup (the "October Revolution"), occupying government buildings and strategic points. Kerensky tried unsuccessfully to organize resistance, then fled the country. The congress of soviets approved the formation of a new government composed mainly of Bolsheviks. See also April Theses; Aleksandr Guchkov; July Days; Russian Civil War.

Russian Social-Democratic Workers' Party Marxist revolutionary party that preceded the Communist Party of the Soviet Union. Founded in Minsk in 1898, it held that Russia could achieve socialism only after developing a bourgeois society with an urban proletariat. The party split in 1903 because of the argument between the Bolshevik wing, led by Vladimir Ilich Lenin, and the Menshevik wing, led by L. Martov, over Lenin's proposals for a party composed of professional revolutionaries. Party members were active in the Russian Revolution of 1905. In the turmoil of the Russian Revolution of 1917, the Bolsheviks broke completely with the Mensheviks and changed their name to "Russian Communist Party (Bolshevik)."

Russo-Finnish War *or* **Winter War** (1939–40) War waged by the Soviet Union against Finland at the start of World War II, following the signing of the German-Soviet Nonaggression Pact. When Finland refused to grant the Soviets a naval base and other concessions, Soviet troops attacked on several fronts in November 1939. The heavily outnumbered Finns under Carl Gustav Emil Mannerheim put up a skillful defense until February 1940, when heavy Russian bombardments breached the Finns' southern defenses. A peace treaty in March 1940 ceded western Karelia to Russia and allowed construction of a Soviet naval base on the Hanko peninsula.

Russo-Japanese War (1904–5) Conflict between Russia and Japan over territorial expansion in East Asia. After Russia leased the strategically important Port Arthur (now Lüshun, China) and expanded into Manchuria, it faced the increasing power of Japan. When Russia reneged on its agreement with Japan to withdraw troops from Manchuria, the Japanese fleet attacked the Russia naval squadron at Port Arthur and began a siege of the city in February 1904. Japanese land forces cut the Russian army off from coming to aid Port Arthur and pushed it back to Mukden (now Shenyang). The reinforced Russian army took the offensive in October, but poor military leadership blunted its effectiveness. After the long Japanese siege of Port Arthur, in January 1905 the corrupt Russian commander surrendered the garrison without consulting his officers, despite adequate stores and ammunition for its continued defense. Heavy fighting around Mukden ended in March 1905 with the withdrawal of Russian troops under Aleksey Kuropatkin. The decisive naval Battle of Tsushima gave the Japanese the upper hand and brought Russia to the peace table. With the signing of the Treaty of Portsmouth, Russia abandoned its expansionist policy in eastern Asia and Japan gained effective control of Korea and much of Manchuria.

Russo-Turkish Wars Series of wars fought between Russia and the Ottoman Empire from the 17th to the 19th century. Russia waged the early wars (1676–81, 1686, 1689) in a fruitless attempt to establish a warm-water port on the Black Sea. In the war of 1695–96, however, Peter I captured the fortress of Azov, but subsequent attempts (1710–12, 1735–39) by the Russians to seize the Balkans failed, leading to the Treaty of Belgrade. In Catherine II's reign the first major Russo-Turkish war (1768–74) pushed Russian borders south and gave Russia a vague right of protection over the Ottoman sultan's Christian subjects. (See also Treaty of Küçük Kaynarca.) Catherine annexed the Crimean Peninsula in 1783. Russia gained the entire western Ukrainian Black Sea coast in the Treaty of Jassy (1792). A subsequent war (1806–12) led to the Treaty of Bucharest. In the 19th century wars were fought over the Dardanelles and Bosporus straits, the Caucasus, and Crimea. The war of 1828–29 ended in the Treaty of Edirne (1829), which ceded large tracts to Russia. The Crimean War (1853–56), however, was a major diplomatic setback for Russia. The 1877–78 Russo-Turkish War pitted Russia and Serbia against Turkey over autonomy for Bosnia and Herzegovina. Russia was victorious, but the gains it achieved under the Treaty of San Stefano (1878) were restricted by the Congress of Berlin (1878), imposed by Britain and Austria-Hungary.

rust, blister See blister rust

rustication In architecture, decorative masonry achieved by cutting back the edges of stones to a plane surface while leaving the central portion of the face either rough or projecting markedly. Rustication provides a rich, bold surface for exterior walls. It was used as early as the 6th century BC in the tomb of Cyrus the Great. Italian early Renaissance architects used rustication to decorate palaces. In the Mannerist (late Renaissance) and Baroque periods, rustication assumed great importance in garden and villa design. Fantastic surfaces were achieved, as in vermiculated work, in which the surface is covered with wavy, serpentine patterns or vertical, dribbled forms.

Rustin, Bayard (b. March 17, 1910, West Chester, Pa., U.S.—d. Aug. 24, 1987, New York, N.Y.) U.S. civil rights leader. He organized the New York branch of the Congress of Racial Equality in 1941 and worked for the Fellowship of Reconciliation from 1941 to 1953. In the 1950s he was an adviser to Martin Luther King, Jr., and helped organize the Southern Christian Leadership Conference. He was the chief organizer of the 1963 March on Washington to rally support for pending civil rights legislation. He later served as president (1966–79) of the A. Philip Randolph Institute, a civil rights organization.

rutabaga \ˌrü-tə-'bā-gə\ Swedish turnip (*Brassica napus*) in the mustard family. A hardy biennial, the rutabaga is a cool-season plant cultivated for its fleshy roots and tender leaves. Related to the turnip, it requires a longer growing season but is more tolerant of cold; in addition, its flesh is firmer and more nutritious and its roots keep much better during winter. White-fleshed varieties have a rough, green skin and bright canary-coloured flowers. Yellow-fleshed varieties have a smooth green, purple, or bronze skin and buff-yellow or pale orange flowers. Rutabagas are extensively cultivated as a vegetable and as a cattle fodder crop in Canada, Britain, and northern Europe, and to a lesser extent in the U.S.

Ruth, Babe *orig.* **George Herman Ruth** (b. Feb. 6, 1895, Baltimore, Md., U.S.—d. Aug. 16, 1948, New York, N.Y.) U.S. baseball player,

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one of the greatest hitters and most popular figures in the sport's history. He began his career in 1914 as a member of Baltimore's minor league team and joined the Boston Red Sox later that season. He started as a pitcher, compiling an outstanding record (94 wins, 46 losses), but switched to the outfield because of his powerful hitting. Sold to the New York Yankees in 1920, he remained with the team until 1934; he played his last year with the Boston Braves (1935). He coached the Brooklyn Dodgers in 1938, but his reputation for irresponsibility prevented his obtaining a permanent coaching or manager's job. His prodigious slugging earned him the nickname "Sultan of Swat." In 1927 he set the most famous of all baseball records when he hit 60 home runs in a single season, a mark that stood until 1961, when broken by Roger Maris. Ruth hit at least 50 home runs in four separate seasons and at least 40 in each of 11 seasons. His career slugging percentage (.690) remains an all-time record; he ranks second in career home runs (714, behind Hank Aaron), second in runs batted in (2,213, again behind Aaron), and third in runs (2,174, behind Rickey Henderson and Ty Cobb and tied with Aaron).

Babe Ruth.
UPI

Ruthenian language See Ukrainian language

Rutherford of Nelson, Ernest Rutherford, Baron (b. Aug. 30, 1871, Spring Grove, N.Z.—d. Oct. 19, 1937, Cambridge, Cambridgeshire, Eng.) New Zealand-born British physicist. After studies at Canterbury College, he moved to Britain to attend Cambridge University, where he worked with J.J. Thomson at the Cavendish Laboratory. He would later teach at McGill University in Montreal (1898–1907) and Victoria University in Manchester (1907–19) before becoming chair of the Cavendish Laboratory (from 1919). At the laboratory in the years 1895–97 he discovered and named two types of radioactivity, alpha decay and beta decay. He later identified the alpha particle as a helium atom and used it in postulating the existence of the atomic nucleus. With Frederick Soddy he formulated the transformation theory of radioactivity (1902). In 1919 he became the first person to disintegrate an element artificially, and in 1920 he hypothesized the existence of the neutron. His work contributed greatly to understanding the disintegration and transmutation of radioactive elements and became fundamental to much of 20th-century physics. In 1908 he was awarded the Nobel Prize. He was knighted in 1914 and ennobled in 1931. Element 104, rutherfordium, is named in his honour.

Ruthven family \'ri-vən, 'rüth-vən\ Noble Scottish family prominent in the 16th century. Its members included Lord Patrick Ruthven (c. 1520–1566), provost of Perth (1553–66) and Protestant privy councillor to Mary, Queen of Scots. He helped arrange her marriage to Lord Darnley (1565) and led the plot to murder her secretary, David Riccio, after which he fled to England. His son William Ruthven (1541?–1584) also took part in the plot against Riccio and became lord high treasurer (1571). He was the chief conspirator in the "raid of Ruthven" that in 1582 captured the boy king James VI (later James I of England), after which Ruthven was pardoned but later beheaded for treason. His son John Ruthven, earl of Gowrie (1577?–1600), continued the family tradition of intrigue by offering to serve Queen Elizabeth I, then leading the opposition to James VI. In the so-called Gowrie conspiracy, Ruthven was killed in his house in Perth, possibly in an abortive attempt to take James VI prisoner.

Rutile on pyrophyllite from Mono County, Calif.
B.M. SHAUB

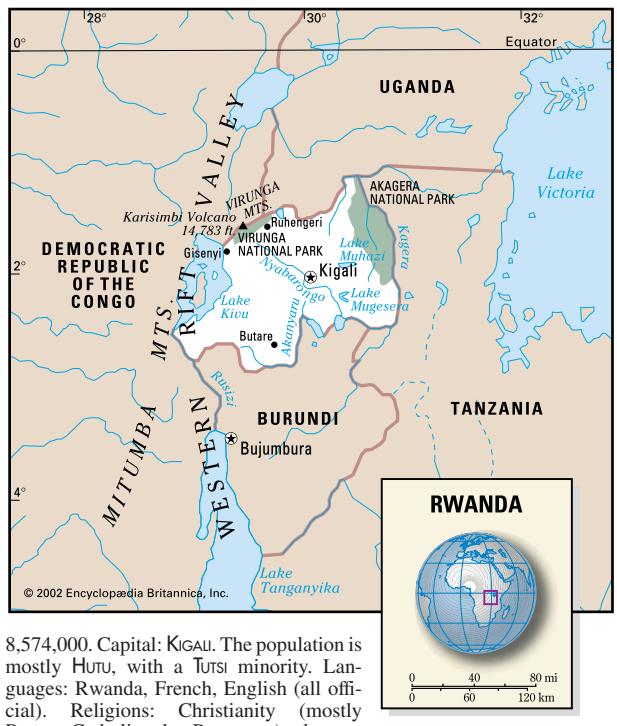
rutile \'rü-ˌtīl\ Commercially important titanium mineral (titanium dioxide, TiO_2). It forms red to reddish brown, hard, brilliant metallic, slender crystals. Rutile has minor uses in porcelain and glass manufacture as a colouring agent and in making some steels and copper alloys. It is also used as a gem, but synthetic rutile is actually superior to natural crystals for gem use; it has fire (flashes of colour) and brilliance (light deflection) like those of diamond. Rutile is mined in Norway and is widespread in the Alps, the southern U.S., Mexico, and elsewhere.

Ruwenzori National Park See Queen Elizabeth National Park

Ruysdael, Jacob van See Jacob van Ruisdael

Ruysdael \'rōis-ˌdāl**, Salomon van** *orig.* **Salomon de Goyer** (b. c. 1600, Naarden, United Provinces—buried Nov. 1, 1670, Haarlem, Neth.) Dutch landscape painter. Uncle of Jacob van Ruisdael, he entered the Haarlem painters' guild in 1623 and became its head in 1648. Unlike other Baroque landscape painters of the period, including his nephew, Ruysdael generally painted actual landscapes, sometimes combining motifs from several places in one picture. His powerful later work exhibits a command of landscape elements and an increasing use of colour for effect.

Rwanda \rə-'wän-də\ *officially* **Republic of Rwanda** Country, east-central Africa. Area: 10,169 sq mi (26,338 sq km). Population (2005 est.): 8,574,000. Capital: Kigali. The population is mostly Hutu, with a Tutsi minority. Languages: Rwanda, French, English (all official). Religions: Christianity (mostly Roman Catholic; also Protestant); also traditional beliefs, Islam. Currency: Rwanda franc. Rwanda is a landlocked mountainous country, most of it at an elevation above 4,000 ft (1,200 m). There are bamboo forests, wooded regions, and grassy savannas with rich and varied wildlife. The developing economy is mainly free-enterprise, based on agriculture. Rwanda is a republic with two legislative bodies; its head of state and government is the president, assisted by the prime minister. Originally inhabited by the Twa, a Pygmy people, it became home to the Hutu, who were well established there when the Tutsi appeared in the 14th century. The Tutsi conquered the Hutu and in the 15th century founded a kingdom near Kigali. The kingdom expanded steadily, but from 1894 to 1918 Rwanda was part of German East Africa. The Belgians occupied Rwanda in 1916, and the League of Nations created Ruanda-Urundi as a Belgian mandate in 1923. The Tutsi retained their dominance until shortly before Rwanda reached independence in 1962, when the Hutu took control of the government and stripped the Tutsi of much of their land. Many Tutsi fled Rwanda, and the Hutu dominated the country's political system, waging sporadic civil wars until mid-1994, when the death of the country's leader in a plane crash triggered massive violence. The Tutsi-led Rwandan Patriotic Front (RPF) took over the country by force after the massacre of almost one million Tutsi and Tutsi sympathizers by the Hutu. Two million



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refugees, mostly Hutu, fled to neighboring Congo (Kinshasa) after the RPF's victory. A transitional government was replaced in 2003 following the country's first multiparty elections.

Ryan, (Lynn) Nolan, Jr. (b. Jan. 31, 1947, Refugio, Tex., U.S.) U.S. baseball pitcher. Ryan was signed to a New York Mets minor league team in 1965. He played for the Mets (1968–71), California Angels (1972–79), Houston Astros (1980–88), and Texas Rangers (1989–93). In 1983 he became the first pitcher to surpass Walter Johnson's 1927 record of 3,508 career strikeouts, and he retired in 1993 at the advanced age of 46 with an astonishing 5,714. He also set records for most strikeouts in a season (383 in 1973) and most no-hit games (7).

Ryan, Robert (b. Nov. 11, 1909, Chicago, Ill., U.S.—d. July 11, 1973, New York, N.Y.) U.S. film actor. He trained for the stage at Max Reinhardt's workshop in Hollywood, and after World War II he became a successful character actor. Often playing tough guys and bullies, he earned acclaim for his roles in *The Woman on the Beach* (1947), *Crossfire* (1947), *The Set-Up* (1949), and *Act of Violence* (1949). His later films include *Bad Day at Black Rock* (1955), *Men in War* (1957), *Odds Against Tomorrow* (1959), *Billy Budd* (1962), and *The Wild Bunch* (1969).

Rybinsk Reservoir \'ri-bənsk\ Lake, on the upper Volga River, northwestern Russia. It was created by two dams on the Volga and its tributary, the Sheksna. When the project was completed in 1947, a lake of 1,768 sq mi (4,580 sq km) in area was formed; it was the world's largest artificial body of water. It regulates the flow of the Volga, provides power for Moscow and other cities, and is part of the Volga-Baltic Waterway.

Ryder, Albert Pinkham (b. March 19, 1847, New Bedford, Mass., U.S.—d. March 28, 1917, Elmhurst, N.Y.) U.S. painter. Born in a fishing port, he never lost his obsession with the sea. He settled in New York City c. 1870 and briefly studied painting. His highly personal seascapes, including *Toilers of the Sea*, reflect his feeling of human helplessness against the forces of nature. Thick yellow light (usually moonlight) heightens the mood of mystery in such paintings as *The Race Track* and *Death on a Pale Horse.* He was a strikingly imaginative painter, and though he was a solitary one, his works became well known in his lifetime.

"Toilers of the Sea," oil on wood panel by Ryder, before 1884; in the Metropolitan Museum of Art, New York City
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK, GEORGE A. HEARN FUND, 1915

Ryder Cup Biennial team golf event first held in 1927. It was originally played between teams of golfers from the U.S. and Britain; since 1979 players opposing the U.S. have been chosen from all of Europe. The trophy was donated by the British seed merchant Samuel Ryder.

rye Cereal grass (*Secale cereale*) and its edible grain, used to make rye bread and rye whiskey, as livestock feed, and as a pasture plant. Native to South Asia, today it is grown extensively in Europe, Asia, and North America. It is planted mainly where climate and soil are relatively unfavourable for other cereals and as a winter crop where temperatures are too cold for winter wheat. Rye thrives at high altitudes and is the most winter-hardy of all small grains. It is high in carbohydrates and provides small quantities of protein, potassium, and B vitamins. Only rye and wheat have the necessary qualities to make a loaf of bread, but rye lacks the elasticity of wheat and thus is frequently blended with wheat flour. The tough fibrous straw of rye is used for animal bedding, thatching, mattresses, hats, and paper. Rye may be grown as a green manure crop.

Rye House Plot (1683) In English history, an alleged Whig conspiracy to assassinate Charles II because of his pro-Catholic policies. The plot drew its name from Rye House at Hoddeston, Hertfordshire, near the road where Charles was supposed to be killed as he traveled from a horse meet. The king's unexpected early departure supposedly foiled the plot, which was later revealed by an informer. The facts remained cloudy, but the main plotters included the duke of Monmouth, William, Lord Russell, Algernon Sidney (1622–1683), and Sir Thomas Armstrong. The last three were tried, convicted of treason, and beheaded.

Ryerson Polytechnic University Privately endowed institution of higher learning in Toronto, Ontario, Canada. It was founded in 1948 and named after the educator Egerton Ryerson (1803–82). It has faculties of engineering and applied science, arts (including the humanities and social sciences), applied arts, business, community services, and continuing education. It is primarily a four-year baccalaureate institution.

Rykov \'rik-əf**, Aleksey (Ivanovich)** (b. Feb. 25, 1881, Saratov, Russia—d. March 14, 1938, Moscow, Russia, U.S.S.R.) Soviet official. Active in Bolshevik revolutionary activities from age 18, he became a party leader and, after Vladimir Lenin's death, chairman of the Council of People's Commissars (1924–29). A strong supporter of the New Economic Policy, he was joined by Joseph Stalin to defeat the economic radicals (and Stalin's rivals) Leon Trotsky, Grigory Zinovyev, and Lev Kamenev. When Stalin then adopted his rivals' radical ideas, Rykov was stripped of his posts and forced to recant his "Right Opposition" views (1929). In 1936 he was implicated in fabricated conspiracies, tried in Stalin's purge trials, and executed for treason.

Ryle, Gilbert (b. Aug. 19, 1900, Brighton, Sussex, Eng.—d. Oct. 6, 1976, Whitby, North Yorkshire) British philosopher, leading figure in the "ordinary language," or "Oxford" school of analytic philosophy. He became a lecturer in philosophy at Christ Church College in 1924. He was Waynflete professor of metaphysical philosophy at Oxford from 1945 to 1968 and editor of *Mind* from 1948 to 1971. His major work, *The Concept of Mind* (1949), rejects Cartesian dualism as the logically incoherent doctrine of the "ghost in the machine" and argues for a "logical behaviourism" according to which attributions of mental states need refer only to the behaviour of bodies and not to any mysterious entity hidden inside them. His other works include *Philosophical Arguments* (1945), *Dilemmas* (1954), *A Rational Animal* (1962), *Plato's Progress* (1966), and *The Thinking of Thoughts* (1968).

Ryle, Sir Martin (b. Sept. 27, 1918, Brighton, Sussex, Eng.—d. Oct. 14, 1984, Cambridge, Cambridgeshire) British radio astronomer. After receiving a Ph.D. in physics from the University of Oxford, he helped design radar equipment during World War II. He was an early investigator of extraterrestrial radio signals. Ryle guided the Cambridge radio astronomy group in the production of radio source catalogs. The *Third Cambridge Catalogue* (1959) helped lead to the discovery of the first quasar. To map distant radio sources, he developed a technique called aperture synthesis, which provided tremendously increased resolving power for radio telescopes and was used to locate the first pulsar. In 1974 he and Antony Hewish shared a Nobel Prize.

Rymer \'rī-mər**, Thomas** (b. 1643?, near Northallerton, Yorkshire, Eng.—d. Dec. 14, 1713, London) English critic. Though called to the bar in 1673, Rymer almost immediately turned to literary criticism. He is known for introducing into England the principles of French formalist Neoclassical criticism. Among his works are *The Tragedies of the Last Age* (1678) and *A Short View of Tragedy* (1693), both highly critical of modern drama and favouring classical tragedy. His views were very influential until the 19th century. Appointed historiographer royal in 1692, he compiled most of the *Foedera*, a collection of treaties entered into by England that is of considerable value to the medievalist.

Ryōan \ˌrē-ō-'än\ **Temple** *Japanese* **Ryōan-ji** \rē-ō-'än-ˌjē\ Japanese Buddhist temple in Kyōto, famous for its abstract meditation garden (c. 1500). An area approximately 30 by 70 ft (10 by 20 m) is covered with raked gravel and set with 15 stones divided into five unequal groups. The pattern of the design may be interpreted as rocky islets in a sea, but the garden's appeal lies essentially in the charm of its relationships and the arrangement of rocks such that all 15 are not visible from any single vantage point.

Ryukyu \rē-'yü-ˌkyü\ **Islands** Island chain, extreme southern Japan. It extends in an arc 700 mi (1,100 km) long from the southern Japanese island of Kyushu to the northern tip of Taiwan island. The 55 islands and islets have a total land area of 1,193 sq mi (3,090 sq km). In ancient times it was an independent kingdom, but Chinese and Japanese sovereignty were successively imposed on the archipelago from the 14th to the 19th century. In 1879 the Ryukyus became an integral part of Japan. After Japan's defeat in World War II, the U.S. took control of the islands; it returned them all by 1972. The U.S. maintains military bases on Okinawa. The islands are primarily rural, and agriculture is the dominant occupation; tourism has grown in importance.

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SA *in full* **Sturmabteilung (German: "Assault Division")** *known as* **Storm Troopers** *or* **Brownshirts** Nazi paramilitary organization that played a key role in Adolf Hitler's rise to power. The SA was founded by Hitler in Munich in 1921 and drew its early membership from the Freikorps. Outfitted in brown uniforms after the fashion of the Italian Fascist Blackshirts, the SA protected Nazi Party meetings and assaulted political opponents. From 1931 it was headed by Ernst Röhm, and by 1932 it had grown to a force of more than 400,000. Röhm wanted to merge the regular army with the SA under his leadership, but Hitler had become wary of the organization's growing power. In 1934 he ordered a "blood purge" of the SA, which became known as the Night of the Long Knives. Thereafter the SA was reduced to a minor political role.

Ṣā al-Ḥajar See Sais

Sa-skya pa \'sás-kyə-'pä\ Tibetan Buddhist sect granted sovereignty over Tibet by Kublai Khan and noted also for contributions to philosophy and linguistics. The Sa-skya pandita Kun-dga'-rgyal-mtshan (1182–1251) wrote a major treatise developing Buddhist logic.

Saadia ben Joseph \'sä-dē-ä-ben-'jō-zəf\ *Arabic* **Saʿīd ibn Yūsuf al-Fayyūmī** (b. 882, Dilaz, in al-Fayyūm, Egypt—d. September 942, Sura, Babylonia) Egyptian-Babylonian Jewish philosopher and polemicist. He left Egypt c. 905 and eventually settled in Babylonia, where he headed the rabbinic Academy of Sura. He wrote a Hebrew-Arabic dictionary and translated much of the Old Testament into Arabic. In 935 he produced his greatest work, *The Book of Beliefs and Opinions*, the objective of which was the harmonization of revelation and reason. The introduction refutes skepticism and establishes the foundations of human knowledge. The first chapter seeks to establish creation ex nihilo (out of nothing) in order to ascertain the existence of a Creator-God. Saadia then discusses God's uniqueness, justice, revelation, free will, and other doctrines accepted both by Judaism and by the Muʿtazilī sect of Islam (see Muʿtazilah). The second part of the book deals with the essence of the soul and eschatological problems and presents guidelines for ethical living.

Saale \'zä-lə,\ *English* \'sä-lə\ **River** River, east-central Germany. A tributary of the Elbe River, it rises in the Bavarian highlands and flows north to join the Elbe just above Barby. As it crosses Thuringia, it enters a deep valley dominated by picturesque castles. The Saale is 265 mi (426 km) long.

Saar, Betye *orig.* **Betye Irene Brown** (b. July 30, 1926, Los Angeles, Calif., U.S.) U.S. artist and educator. She studied design, education, and printmaking. By 1968 she developed an interest in three-dimensional objects and began working in assemblage. Her works incorporate found objects of all sorts—from those suggesting ritual folk art to traditional Christianity. Many also challenge racist myths and stereotypes. Saar's *The Liberation of Aunt Jemima* (1972), for example, is a "mammy" doll placed in front of the eponymous pancake syrup labels; the doll carries a broom in one hand and a shotgun in the other. Saar's works expanded in size and scope from the late 1970s. Her room-size installations often featured mystical themes and sometimes included shrines.

Saar \'sär, 'zär\ **River** *French* **Sarre** \'sär\ River, France and Germany. A tributary of the Moselle River, it flows 153 mi (246 km) across northeastern France into Germany and enters the Moselle above Trier. The northern part of the valley is a wine-growing district. The middle stretch between Saarbrücken and Dillingen is a centre of heavy industry.

Saarbrücken \zär-'brē-kən\ City (pop., 2002 est.: city, 182,858; urban agglom., 959,084), capital of Saarland state, southwestern Germany. Located on the Saar River, Saarbrücken was chartered in 1321 and belonged to the counts of Nassau-Saarbrücken until it was occupied by the French in 1793. It passed to Prussia in 1815 and became the capital of the Saar region in 1919. The present city was formed in 1909 by the union of the former Saarbrücken with Burbach-Malstatt, Sankt Johann, and Sankt Arnual. In 1959 it was made capital of Saarland. Historic buildings include the 18th-century Baroque Ludwigskirche, the Gothic abbey church of St. Arnual (c. 1270–1330), and the Old Bridge over the Saar (1546).

Saaremaa *or* **Sarema** \'sär-ə-ˌmä\ Island, Estonia. The largest of the islands in the Muhu archipelago, which divides the Baltic Sea from the Gulf of Riga, Saaremaa has an area of 1,031 sq mi (2,671 sq km). It was occupied in the 13th century by the Livonian Knights and was ruled successively by Denmark, Sweden, and Russia before becoming part of Estonia in 1918. In 1940 Estonia was incorporated into the U.S.S.R., and the island passed into the Soviet sphere. Saaremaa was occupied by German troops during World War II. In 1991 Estonia became an independent nation, and Saaremaa was once again an Estonian possession. Economic activities include agriculture, livestock raising, and fishing.

Saarinen \'sär-ə-nən\, **Eero** (b. Aug. 20, 1910, Kirkkonummi, Fin.—d. Sept. 1, 1961, Ann Arbor, Mich., U.S.) Finnish-born U.S. architect. His father, Eliel Saarinen (1873–1950), was the foremost Finnish architect of his time; his major works include the Helsinki railway station (1904–14) and—after immigrating to the U.S. in 1923—the buildings of the Cranbrook Foundation, Bloomfield Hills, Mich. (1925–41). Eero joined his father's practice after studying at Yale. His vast General Motors Technical Center in Warren, Mich. (1948–56), was followed in 1948 by his design for the Gateway Arch in St. Louis, Mo. (completed 1965). In the Kresge Auditorium and chapel at MIT (1955), Cambridge, Mass., he used a "handkerchief" dome resting on three points for the auditorium and a stark red-brick cylinder for the chapel. His TWA terminal at Kennedy International Airport (1956–62), New York City, employs two cantilevered concrete shells that extend dramatically outward, suggesting wings. Like many contemporary architects, Saarinen was challenged by furniture design, especially the chair. He is remembered in particular for a chair in molded plywood he designed with Charles Eames; a womblike chair using a glass-fibre shell upholstered in foam rubber and fabric; and a series of pedestal-based chairs and tables that combined a sculptural aluminum base with plastic shells for the chairs and disks of marble or plastic for the table tops.

Saarland \'zär-ˌlänt,\ *English* \'sär-ˌland\ *or* **Saargebiet** \'zär-gə-ˌbēt\ State (pop., 2002 est.: 1,066,470), southwestern Germany. It has an area of 992 sq mi (2,569 sq km). The capital, Saarbrücken, lies along the Saar River. The region was contested by France and Germany from the 17th century until 1815, when France ceded most of it to Prussia by the Treaty of Paris. When Alsace-Lorraine was added to the German Empire in 1871, the Saar ceased to be a boundary state and developed rapidly as a coal-mining and industrial area, producing iron and steel. French military forces occupied it after World War II, but it was restored to West Germany and became a state in 1957.

Saba Island (pop., 1994 est.: 1,180) of the Netherlands Antilles in the Caribbean Sea. It lies 16 mi (26 km) northwest of St. Eustatius, with which it forms the Lesser Antilles. It has an area of 5 sq mi (13 sq km) and is the peak of an extinct volcano, Mount Scenery. It was settled by the Dutch in 1632, but its inaccessibility and ruggedness prevented it from achieving economic importance and it was often a buccaneers' stronghold. The economy depends heavily on tourism.

Ṣabāḥ dynasty *or* **Āl Ṣabāḥ ("Ṣabāḥ family")** Ruling family of Kuwait since 1756. In that year the Banū ʿUtūb, a group of families of the ʿAnizah tribe living in what is now Kuwait, appointed a member of the Ṣabāḥ family, Ṣabāḥ ibn Jābir (r. c. 1752–64), to be their ruler. The dynasty frequently depended politically or militarily on outsiders but maintained its autonomy. Its dependence on the Ottoman Empire in the late 19th century was subsequently a cause for Iraq to claim hegemony over Kuwait. It later enjoyed the patronage of the United Kingdom and, more recently, the support of the U.S. Despite the existence of deliberative institutions in modern Kuwait, the dynasty retains absolute power.

Sabbath Day of the week set aside for worship and observance of religious duties in Judaism and Christianity. The Jewish Sabbath begins at sunset on Friday and lasts until sunset the next day, during which time no ordinary work or act of labor is performed. For most Christian denominations, the Sabbath is on Sunday; prescribed conduct varies considerably, but attendance at worship services is a feature common to all. In Islam, Friday is the day of worship.

Sabi River See Save River

Sabin \'sā-bin\, **Albert B(ruce)** (b. Aug. 26, 1906, Białystok, Poland, Russian Empire—d. March 3, 1993, Washington, D.C., U.S.) Polish-born

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U.S. physician and microbiologist. He immigrated to the U.S. with his parents in 1921 and received an M.D. from New York University. He grew poliovirus in human nerve tissue outside the body, showed that it does not enter the body through the respiratory system, and proved that POLIOMYELITIS is primarily an infection of the digestive tract. He postulated that an oral vaccine would work longer than JONAS SALK's injections of killed virus, and he isolated weakened strains of each of the three types of poliovirus that would stimulate antibody production but not produce disease. The Sabin oral polio vaccine, approved for use in the U.S. in 1960, became the main defense against polio throughout the world.

Sabine \'sā-ˌbīnz\ Any member of an ancient Italic tribe located east of the Tiber River. According to legend, ROMULUS invited them to a festival and then carried off ("raped") their women to provide wives for his men. The second king of Rome, Numa Pompilius, probably a Sabine, is credited with creating a great number of the early Roman religious institutions and practices. Later groups displaced the Sabines from Rome. The Romans conquered them and granted them partial citizenship in 290 BC; they became full citizens in 268.

Sabine \'sab-in**, Sir Edward** (b. Oct. 14, 1788, Dublin, Ire.—d. June 26, 1883, East Sheen, Surrey, Eng.) British astronomer and geodesist. He accompanied the expeditions of John Ross (1818) and William Parry (1819) in search of the Northwest Passage. In 1821 he began experiments to determine the Earth's shape more precisely by observing the motion of a pendulum. He thereafter devoted most of his efforts to researches on terrestrial magnetism, overseeing the establishment of magnetic observatories throughout the world. In 1852 he discovered that the periodic variation of sunspots is correlated with certain changes in magnetic disturbances. He was president of London's Royal Society (1861–71). Knighted in 1869, he was promoted to the rank of general in 1870.

Sabine \sə-'bēn\ **River** River, eastern Texas and western Louisiana, U.S. Rising in northeastern Texas, it flows southeast and south, broadens near its mouth to form Sabine Lake, and continues from Port Arthur, Texas, through Sabine Pass to enter the Gulf of Mexico after a course of 578 mi (930 km). The river forms the southern section of the Texas-Louisiana boundary and is a link in the GULF INTRACOASTAL WATERWAY.

sable CARNIVORE (*Martes zibellina*, family Mustelidae) that inhabits forests of northern Asia and is highly valued for its fur. The name is sometimes applied to related European and Asian species and to the American MARTEN. The sable is 13–20 in. (32–51 cm) long, excluding the 5–7-in. (13–18-cm) tail, and weighs 2–4 lbs (0.9–1.8 kg). The coat varies from brown to almost black. The solitary, arboreal sable eats small animals and eggs.

Sabra and Shatila \'säb-rə...shä-'tē-lə\ **massacres** (1982) Massacre of Palestinian civilians by Christian militiamen in two Beirut refugee camps during the Israeli invasion of Lebanon. The goal of Israel's action was to expel Palestinian guerrillas from Lebanon. To achieve this objective, Israel allied itself with several Lebanese Christian groups, including the Phalange party, who fought the Palestinians during the protracted LEBANESE CIVIL WAR (1975–90). Following the U.S.-brokered evacuation of PALESTINE LIBERATION ORGANIZATION (PLO) fighters from Beirut, Israeli forces under Defense Minister ARIEL SHARON allowed Phalange militiamen into the camps, ostensibly to root out further PLO fighters. Estimates of the number of women, children, and elderly who were killed over the next several days ranged from 800 to several thousand. Although no militiamen were ever prosecuted for their participation, Sharon—who an Israeli commission of inquiry later found indirectly responsible through negligence—was condemned in Arab popular opinion as the culprit of the massacre.

Sabratha \'sa-brə-thə\ *or* **Sabrata** Ancient city, Roman AFRICA. Founded by the Carthaginians as a trading post, it was first permanently settled in the 4th century BC. It was the westernmost of the three cities of TRIPOLITANIA; the site is located near the modern town of Ṣabrātah, northwestern LIBYA. Archaeological excavations have uncovered more than half the area of the city, including Roman and Byzantine fortifications, temples, fountains, the forum, theatre, basilica, and several churches. It was designated a UNESCO WORLD HERITAGE SITE in 1982.

Sabre See F-86

sabre-toothed tiger *or* **sabre-toothed cat** Any of the extinct CAT species forming the subfamily Machairodontinae. They had two long, bladelike canine teeth in the upper jaw. They lived from 36.6 million years ago to about 10,000 years ago, arising in North America and Europe and spreading to Asia, Africa, and South America. The best-known, the short-limbed *Smilodon* of the Americas, was bigger than the modern lion. Its "sabres," which grew to 8 in. (20 cm) long, were used to stab and slash prey, including the MASTODON, whose pattern of extinction paralleled their own.

Sabzevārī \'sab-zə-ˌvä-rē**, Hājjī Hādī** (b. 1797/98, Sabzevār, Iran—d. 1878, Sabzevār) Iranian philosopher and religious scholar. In his native city he founded a school that attracted students of philosophy from all over the Muslim world. His two main philosophical works, *The Secrets of Wisdom* and *A Treatise on Logic in Verse*, in which he advanced the *ḥikmah* (wisdom) school of thought, are still studied in Iran. He lived a devoutly religious and ascetic life and is said to have performed miracles.

Sac See SAUK

Sacagawea \ˌsa-kə-jə-'wē-ə\ SHOSHONE Indian guide who led the LEWIS AND CLARK EXPEDITION (1804–06). Having been captured by Hidatsa Indians, she had been separated from her people for nearly 10 years when the expedition began. Carrying her infant son on her back, she traveled thousands of wilderness miles with the expedition. At one point in the journey, Sacagawea was instrumental in obtaining horses and guides from a band of Shoshone (led by her brother Cameahwait); without them the expedition might well have ended. Her fortitude in the face of hazards and deprivations became legendary.

saccharin \'sa-kə-rən\ Synthetic organic compound, $C_7H_5NSO_3$, that is 200–700 times as sweet as cane sugar. The sodium or calcium salt of saccharin is widely used as a diet sweetener. Though approved by the U.S. Food and Drug Administration and other regulatory bodies around the world, its safety is controversial because it appears to be a weak CARCINOGEN. See also ASPARTAME.

Sacchi \'säk-kē**, Andrea** (b. 1599, Nettuno, Papal States—d. June 21, 1661, Rome) Italian painter. He studied with FRANCESCO ALBANI in Bologna and in Rome, where he would work all his life. He was employed, with PIETRO DA CORTONA, to decorate the Sacchetti family villa (1628) and the Barberini Palace, for which he produced the ceiling fresco *Allegory of Divine Wisdom* (1629–31). His two altarpieces in the church of Santa Maria della Concezione (1631–38) are distinguished by their Classicism. Other notable works include eight canvases in the cupola of the Baptistery of St. John in Rome (1639–45). He was a skilled draftsman and the leading exponent of the Classical tradition in 17th-century Roman painting.

Sacco-Vanzetti case Murder trial in Massachusetts (1920–27). After the robbery and murder of a paymaster and a guard at a shoe factory (1920), police arrested the Italian immigrant anarchists Nicola Sacco (1891–1927), a shoemaker, and Bartolomeo Vanzetti (1888–1927), a fish peddler. They were tried and found guilty. Radicals and socialists protested the men's innocence, and many others felt they had been convicted for their anarchist beliefs. In 1925 a convicted murderer confessed to participating in the crime, but attempts to obtain a retrial failed and Sacco and Vanzetti were sentenced to death in 1927. Protest meetings were held throughout the U.S. Gov. Alvin Fuller appointed an advisory panel, which agreed with his refusal to grant clemency, and the men were executed. They became martyrs to radicals' belief that the legal system was biased. Though opinion remained divided on the men's guilt, most agreed that a retrial was warranted. In 1977 Massachusetts governor Michael Dukakis issued a proclamation stating that Sacco and Vanzetti had not been treated justly and that no stigma should be associated with their names.

Sachs \'zäks,\ *English* \'saks**, Curt** (b. June 29, 1881, Berlin, Ger.—d. Feb. 5, 1959, New York, N.Y., U.S.) German-born U.S. musicologist. He studied clarinet and composition as a teenager but earned a doctorate in art history. After working as an art critic, he returned to musicology, becoming one of the most significant scholars of that field, especially in the systematic study of musical instruments (working with ERICH VON HORNBOSTEL). After immigrating to the U.S. in 1937, he wrote important textbooks and surveys and supervised the growth of the discipline, lecturing at such institutions as Columbia University and New York University.

Sachs, Nelly (Leonie) (b. Dec. 10, 1891, Berlin, Ger.—d. May 12, 1970, Stockholm, Swed.) German poet and dramatist. Born to a prosperous family, Sachs wrote poems mainly for her own entertainment until the advent of Nazism darkened her work and forced her to flee to Swe-

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den. Her lyrics from those years combine lean simplicity with imagery variously tender, searing, or mystical. In the famous title poem of her collection *O the Chimneys* (1967), Israel's body drifts upward as smoke from the Nazi death camps. Her best-known play is *Eli* (1951). She shared the 1966 Nobel Prize with S.Y. Agnon.

Nelly Sachs, 1966
UPI

Sachsen See Saxony

Sachsenhausen \'zäk-sən-ˌhaůzən\ German Nazi concentration camp. Located near the village of Sachsenhausen in northern Germany, it was established in 1936 as part of a system of camps that included Buchenwald (for central Germany) and Dachau (for southern Germany). The camp's early prisoners included 10,000 Jews rounded up from Berlin and Hamburg after the Kristallnacht raids. Of the 200,000 prisoners who went through Sachsenhausen during World War II, 100,000 died there from disease, execution, and overwork in the local armaments factories; many of the rest were transferred to other camps. See also Holocaust.

Sackler, Arthur M(itchell) (b. Aug. 22, 1913, New York, N.Y., U.S.—d. May 26, 1987, New York City) U.S. physician, medical publisher, and art collector. He earned an M.D. from New York University. In 1949 he founded the Creedmore Institute of Psychobiological Studies in New York and did pioneering research in the field of psychobiology. He edited the *Journal of Clinical and Experimental Psychopathology* and founded the biweekly *Medical Tribune* newspaper. He funded research at several universities and endowed art galleries at universities and museums, donating art from his own vast collection, including the world's largest collection of ancient Chinese art, to the Metropolitan Museum of Art.

Sacks, Oliver (Wolf) (b. July 9, 1933, London, Eng.) British-U.S. neurologist and writer. He immigrated to the U.S. in 1960 to study neurology at the University of California, and in 1965 he joined the faculty at New York's Albert Einstein College of Medicine. Many of his books relate case histories of neurologically damaged people. His empathy with those afflicted with strange conditions, including Tourette syndrome, amnesia, and autism, has been the hallmark of his writings. His book *Awakenings* (1973), about the long-term effects of sleeping sickness, was filmed in 1990; other books include *The Man Who Mistook His Wife for a Hat* (1986) and *An Anthropologist on Mars* (1995).

Sackville, Thomas, 1st earl of Dorset (b. 1536, Buckhurst, Sussex, Eng.—d. April 19, 1608, London) English politician and poet. A London barrister, he entered Parliament in 1558. He was a member of the Privy Council (1585) and conveyed the death sentence to Mary, Queen of Scots, in 1586. He later served on diplomatic missions to The Hague and served as lord high treasurer (1599–1608). He was also noted as the coauthor of *The Tragedie of Gorboduc* (1561), the earliest English drama in blank verse, and for his "Induction," the most famous part of the verse collection *A Myrrour for Magistrates* (1563).

Sackville-West, Vita *orig.* **Victoria Mary Sackville-West** (b. March 9, 1892, Knole, Kent, Eng.—d. June 2, 1962, Sissinghurst Castle, Kent) British novelist and poet. The daughter of a baron, she married the diplomat and author Harold Nicolson (1886–1968) in 1913; her journal was the basis of *Portrait of a Marriage* (1973) by their son Nigel, which described a happy marriage in which both partners were principally homosexual. Her gift for evoking the beauty of the Kentish countryside was evident in her long poem *The Land* (1926). Her best-known novels are *The Edwardians* (1930) and *All Passion Spent* (1931). She also wrote biographies and gardening books. She was the inspiration for the title character in her friend Virginia Woolf's novel *Orlando*.

sacrament Religious action or symbol in which spiritual power is believed to be transmitted through material elements or the performance of ritual. The concept is ancient; prehistoric people believed that they could advantageously influence events in the natural world, such as weather patterns, through the performance of ritual. The word *sacramentum* was used in Roman law and later became an oath of allegiance soldiers swore in a sacred place. The sacrament is primarily associated with Christianity, and Christian theologians as early as St. Augustine focused on the proper definition of sacrament. Among Christians, sacraments are said to derive from practices instituted by Jesus, such as baptism, the washing of the feet, and the casting out of demons. There are seven sacraments of Roman Catholicism, as codified by St. Thomas Aquinas and promulgated by the Council of Trent: baptism, confirmation, the Eucharist, penance, anointing of the sick, ordination, and matrimony. The Eastern Orthodox church generally accepts seven sacraments, even though no council accepted by the Orthodox church ever defined the number of sacraments. In most Protestant churches, however, only baptism and the Lord's Supper are recognized as sacraments, as the understanding of sacrament differs from that of the Roman Catholic church. See also samskara.

Sacramento City (pop., 2000: 407,018), capital of California, U.S. It is located in the Central Valley, where the Sacramento and American rivers meet. First settled in 1839 as New Helvetia by John Sutter, it became an important trading centre during the gold rush. The present city was laid out in 1848 and named for the river. It became the state capital in 1854 and prospered as a transportation and agricultural centre. It was the terminus of the first California railroad in 1856 and the western terminus of the Pony Express in 1860. A ship canal completed in 1963 made the city a deepwater port. The city's main industries, in addition to government services, include food processing, printing, and aerospace products. It is the site of several institutions of higher learning.

Sacramento River River, northern California, U.S. Rising near Mount Shasta, it flows 382 mi (615 km) southwest between the Cascade and Sierra Nevada ranges, through the northern Central Valley. It forms a common delta with the San Joaquin River before entering the northern arm of San Francisco Bay. California's largest river, it is navigable for 180 mi (290 km) and accommodates oceangoing vessels as far as Sacramento. Scene of the gold rush of 1849, the river flows through one of the world's richest agricultural regions.

sacrifice Act of offering objects to a divinity, thereby making them holy. The motivation for sacrifice is to perpetuate, intensify, or reestablish a connection between the human and the divine. It is often intended to gain the favour of the god or to placate divine wrath. The term has come to be applied specifically to blood sacrifice, which entails the death or destruction of the thing sacrificed (see human sacrifice). The sacrifice of fruits, flowers, or crops (bloodless sacrifice) is more often referred to as an offering.

sacrifice, human See human sacrifice

Sādāt \sə-'dat**, (Muḥammad) Anwar el-** (b. Dec. 25, 1918, Mit Abū al-Kum, Egypt—d. Oct. 6, 1981, Cairo) President of Egypt (1970–81). A graduate of the Cairo Military Academy, he joined Gamal Abdel Nasser's coup that deposed the monarchy in 1950 and later served as vice president (1964–66, 1969–70). He became president when Nasser died in 1970. He led Egypt during the Yom Kippur War (1973) against Israel. A military loss, the war was a political success for Sādāt, bolstering his popularity through the Arab world. At home, he reversed many of Nasser's socialist policies and attempted to garner the support of the country's Islamists. In 1977 he went to Jerusalem to offer peace to Israel, and in 1979 he concluded a peace treaty, the Camp David Accords, with Israeli prime minister Menachem Begin. The two men shared the 1978 Nobel Prize for Peace. His popularity in the Arab world plummeted, and domestic support for his treaty with the Jewish state—especially among Islamists—evaporated. He was killed by a group of Muslim extremists led by Khālid al-Islāmbūlī and associated with the Islamic Jihad Group. See also Arab-Israeli Wars; Ḥosnī Mubārak.

Ṣaddām Ḥussein (b. April 28, 1937, Tikrīt, Iraq) President of Iraq (1979–2003). He joined the Baʿth Party in 1957. Following participation in a failed attempt to assassinate Iraqi Pres. ʿAbd al-Karīm Qāsim in 1959, Ṣaddām fled to Cairo, where he briefly attended law school. He returned to Iraq when the Baʿthists gained power in 1963. Jailed when the Baʿthists were overthrown, he escaped and helped reinstall the party to power in 1968. He led the nationalization of the oil industry in 1972. He took over the presidency with the aims of replacing Egypt as leader of the Arab world and of gaining hegemony over the Persian Gulf, and he launched wars against Iran (Iran-Iraq War, 1980–90) and Kuwait (First Persian Gulf

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War, 1990–91), both of which he lost. He instituted a brutal dictatorship and directed intensive campaigns against minorities within Iraq, particularly the Kurds. U.S. fears regarding his development of weapons of mass destruction led to Western sanctions against Iraq. Sanctions were followed by an Anglo-American invasion in 2003 (Second Persian Gulf War) that drove him from power. After several months in hiding, he was captured by U.S. forces. See also Pan-Arabism.

saddle Seat for a rider on the back of an animal, usually a horse. The leather saddle was developed between the 3rd century BC and the 1st century AD, probably by peoples of the Asian steppes, where the stirrup and the horse collar also originated. The saddle greatly improved a rider's ability to control a moving horse, especially in combat. Improvements made in medieval Europe were related to feudal battles among knights. Modern saddles are mainly divided into two types: the light, flat English or Hungarian style used for sport and recreation, and the sturdy Western style used originally for cattle roping and now also for recreation.

Sadducee \'sa-jə-ˌsē\ Member of a Jewish priestly sect that flourished for about two centuries, until the destruction (AD 70) of the Second Temple of Jerusalem. Sadducees were generally wealthier, more conservative, and better connected politically than their rivals, the Pharisees. They believed in strict interpretation of the Torah and thus rejected such ideas as immortality of the soul, bodily resurrection after death, and the existence of angels. They viewed Jesus' ministry with mistrust and are believed to have played some part in his death. Their wealth and complicity with Roman rulers made them unpopular with the common people.

Sade \'sȧd**, Marquis de** *orig.* **Donatien-Alphonse-François, count de Sade** (b. June 2, 1740, Paris, France—d. Dec. 2, 1814, Charenton, near Paris) French novelist and philosopher. After abandoning a military career at the end of the Seven Years' War, he married and became involved in a life of debauchery and outrageous scandal with prostitutes and with local young people he abducted, for which he was repeatedly imprisoned, once narrowly escaping execution. Despite his noble birth, he supported the French Revolution, which he saw as representing political liberation on a level parallel to the sexual liberation he himself represented. He was twice sent to the insane asylum at Charenton (1789–90, 1801–14), where he would eventually die. He overcame boredom and anger in prison and the asylum by writing sexually graphic novels and plays. *The 120 Days of Sodom* (written 1785) was a tale of four libertines who kidnap victims for a nonstop orgy of perversion. In his most famous novel, *Justine* (1791), the heroine suffers because she fails to perceive that there is no moral God and that desire is the only reality. His other works include *Philosophy in the Bedroom* (1793) and *Crimes of Passion* (1800). His reputation and writings gave rise to the term *sadism*.

sadhu and swami In India, a religious ascetic or holy person. Sadhus are typically wandering ascetics who subsist on alms. They may follow the tenets of a particular belief system, such as Hinduism or Jainism, but are more typically regarded as saintly in their own right. The term swami refers to a sadhu ordained in a specific order and is associated particularly with Vedanta. Sadhus and swamis may live either in communities or in solitude; they typically possess little, eschew conventional and modern dress, and have shaven heads or matted, unkempt hair.

sadism \'sā-ˌdi-zəm, 'sa-ˌdi-zəm\ Psychosexual disorder in which sexual urges are gratified by inflicting pain on another person. The term was coined in reference to the marquis de Sade, who chronicled his own such practices. Sadism is often linked to masochism, and many individuals who have one tendency also have the other.

Sadowa, Battle of See Battle of Königgrätz

Ṣadr, Mūsā al- \'mü-sȧ-ȧl-'sädrª\ (b. 1928, Qom, Iran—disappeared Aug. 31, 1978, Libya?) Iranian-born Lebanese Shīʿite cleric. The son of an ayatollah, he received a traditional Islamic education in Qom and in Al-Najaf, Iraq, and also briefly studied political economy and law at Tehrān University. In 1960 he moved to Lebanon, where he became involved in social work among the country's largely disfranchised Shīʿite community. In 1968–69 he formed the Higher Shīʿite Islamic Council to promote the community's interests, and in 1975 he formed a militia, Amal, to defend the Shīʿite community in the Lebanese Civil War. He and a small entourage disappeared while on an official trip in Libya. The Libyan government disavowed any knowledge of what became of the cleric and his companions; his disappearance has remained a highly controversial mystery.

Saenredam \'sȧn-re-ˌdäm**, Pieter Jansz(oon)** (b. June 9, 1597, Assendelft, Neth.—buried May 31, 1665, Haarlem) Dutch painter. Son of an engraver, he became a friend of the architect Jacob van Campen (1595–1657), which may have influenced him to specialize in architectural painting. A pioneer of the "church portrait," he was the first Dutch artist to abandon the Mannerist tradition of fanciful invention in architectural painting in favour of a new realism in rendering specific buildings. His paintings of church interiors show a scrupulous precision and convey a majestic spaciousness and serenity.

Ṣafāqis See Sfax

Ṣafavid \sȧ-'fȧ-vəd\ **dynasty** (1502–1736) Persian dynasty. It was founded by Ismāʿīl I, who, by converting his people from Sunnite to Shīʿite Islam and adopting the trappings of Persian monarchy, planted the seeds of a unique national and religious identity. He captured Tabrīz from the Ak Koyunlu and became shah of Azerbaijan (1501) and Persia (1502). ʿAbbās I (r. 1588–1629) brought the dynasty to its peak; his capital, Eṣfahān, was the centre of Ṣafavid architectural achievement. The dynasty declined in the century following his reign, pressed by the Ottoman Empire and the Mughal dynasty, and fell when a weak shah, Ṭahmāsp II, was deposed by his general, Nādir Shah.

Safdie \'sȧf-dē**, Moshe** (b. July 14, 1938, Haifa, Palestine) Israeli-Canadian architect. Educated at McGill University School of Architecture, Montreal, he began his career in the offices of Louis Kahn. His Habitat '67 was a bold experiment in prefabricated housing using modular units; the design was for a prefabricated concrete housing complex of individual apartment units stacked irregularly along a zigzagged framework that was evocative of an Italian hill town or a pueblo. This aroused intense international interest but failed to catch on as a low-cost housing construction method. Later works include Yeshivat Porat Joseph Rabbinical College in Jerusalem (1971–79) and Coldspring New Town near Baltimore (1971). He served as director of urban design at Harvard University, 1978–84.

safety Activities that seek to minimize or to eliminate hazardous conditions that can cause bodily injury. Occupational safety is concerned with risks in areas where people work: offices, manufacturing plants, farms, construction sites, and commercial and retail facilities. Public safety is concerned with hazards in the home, in travel and recreation, and in other situations that do not fall within the scope of occupational safety.

safflower Flowering annual plant (*Carthamus tinctorius*) of the composite family. Native to parts of Asia and Africa, it is now widely grown as an oil crop in the U.S., Canada, Australia, Israel, and Turkey. Oil obtained from the seeds, an ingredient of soft margarines, salad oil, and cooking oil, is valued for its high proportion of polyunsaturated fats. Since the oil does not yellow with age, it is also a useful base for varnish and paint. The plant, which grows 1–4 ft (0.3–1.2 m) high, has flowers in red, orange, yellow, or white, which were formerly a source of textile dyes.

Safflower (*Carthamus tinctorius*)
J.C. ALLEN AND SON

saffron Golden-coloured, pungent seasoning and dye obtained from the dried stigmas of flowers of the saffron crocus (*Crocus sativus*), a bulbous perennial of the iris family. Because 1 lb (0.45 kg) of saffron represents 75,000 blossoms, it is the world's most expensive spice. The colour and flavour are essential ingredients for certain Mediterranean and Asian dishes, as well as for special English, Scandinavian, and Balkan baked goods. Since ancient times, saffron has been the official colour for the robes of Buddhist priests and for royal garments in several cultures. Greeks and Romans scattered saffron as a perfume in halls, courts, theatres, and baths.

Saffron (*Crocus sativus*)
EMIL MUENCH—OSTMAN AGENCY

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Ṣafī al-Dīn \sä-'fē-ål-'dēn\ (b. 1253, Ardabīl, Iran—d. Sept. 12, 1334, Ardabīl) Iranian founder of the Ṣafavid Sufi order, which in time developed into the ṢAFAVID DYNASTY. He was influenced by mystics of the Sufi order and by Sheikh Zāhid, a religious leader whose daughter he eventually married. On Sheikh Zāhid's death, Ṣafī al-Dīn assumed leadership and gradually attracted many more adherents, largely through his policy of hospitality to all who sought refuge. He is commemorated by a shrine in Ardabīl.

Safire \'sa-ˌfīr**, William** (b. Dec. 17, 1929, New York, N.Y., U.S.) U.S. journalist. Educated at Syracuse University, he worked as a newspaper reporter and at radio and television stations before entering the public-relations field, eventually founding his own firm. He was a speechwriter for SPIRO AGNEW and then for RICHARD NIXON. In 1973 he began his conservative and vigorously written "Essay" column for *The New York Times*, which earned him a Pulitzer Prize in 1978. He also writes on linguistic issues in *The New York Times Magazine*. Among his books are the novels *Full Disclosure* (1977) and *Sleeper Spy* (1995) and works of lexicographical interest.

saga Genre of prose narrative typically dealing with prominent figures and events of the heroic age in Norway and Iceland, especially as recorded in Icelandic manuscripts of the late 12th and 13th century. Once thought to be orally transmitted history that had finally been written down, sagas are now usually regarded as reconstructions of the past, imaginative in varying degrees and created according to aesthetic principles. Important ideals in sagas are heroism and loyalty; revenge often plays a part. Action is preferred to reflection, and description of the inner motives and point of view of protagonists is minimized. Subdivisions of the genre include kings' sagas, recounting the lives of Scandinavian rulers; legendary sagas, treating themes from myth and legend; and ICELANDERS' SAGAS. See also GRETTIS SAGA, NJÁLS SAGA.

Sagan \'sā-gən**, Carl (Edward)** (b. Nov. 9, 1934, Brooklyn, N.Y., N.Y., U.S.—d. Dec. 20, 1996, Seattle, Wash.) U.S. astronomer and science writer. He received his Ph.D. from the University of Chicago. At the Smithsonian Astrophysical Observatory (1962–68), he focused on planetary astronomy and on SETI efforts to find extraterrestrial life. He gained prominence as a popular science writer and commentator noted for his clear writing and enthusiasm; his *Dragons of Eden* (1977) won a Pulitzer Prize. He coproduced and narrated the television series *Cosmos* (1980); its companion book became the best-selling English-language science book of all time. In the 1980s he studied the environmental effects of nuclear war and helped popularize the term *nuclear winter*.

Sagan \sä-'gäⁿ**, Françoise** *orig.* **Françoise Quoirez** (b. June 21, 1935, Carjac, France—d. Sept. 24, 2004, Honfleur) French novelist and dramatist. While attending the Sorbonne, she published her best-known novel, the poignant *Bonjour Tristesse* (1954), when she was 19 years old. It became an international best-seller and was followed by *A Certain Smile* (1956). Her later novels often feature aimless people in tangled relationships. Her plays, including *Opposite Extremes* (1987), resemble her novels in their subject matter.

sage Aromatic perennial herb (*Salvia officinalis*) of the MINT family, native to the Mediterranean. Its leaves are used fresh or dried as a flavouring in many foods. The stems, 2 ft (60 cm) tall, have rough or wrinkled, downy, gray-green or whitish green oval leaves. The flowers may be purple, pink, white, or red. Since the Middle Ages, sage tea has been brewed as a spring tonic and a stimulant believed to strengthen the memory and promote wisdom. See also SALVIA.

Sage (*Salvia officinalis*)
INGMAR HOLMASEN

Sage, Russell (b. Aug. 4, 1816, Shenandoah, N.Y., U.S.—d. July 22, 1906, Lawrence Beach, N.Y.) U.S. financier. He worked as an errand boy, studying arithmetic and bookkeeping in his spare time, and in 1839 he started a wholesale grocery business, which earned him enough money to start a Hudson River shipping trade. He served in Congress (1853–57). Sage invested successfully in the La Crosse Railroad in Wisconsin, and he eventually acquired an interest in more than 40 railroads, serving as director or president of 20. He helped organize the Atlantic & Pacific Telegraph Co. In 1872 he originated stock-market *puts* and *calls* (options to buy or sell a set amount of stock at a set price and within a given time limit), but he stopped dealing in them after losing $7 million in the panic of 1884. His wife, Margaret Olivia Sage, established the Russell Sage Foundation and Russell Sage College (Troy, N.Y.) after his death.

sagebrush Any of various shrubby species of ARTEMISIA of the COMPOSITE FAMILY. Native to semiarid plains and mountain slopes in western North America, these shrubs are adapted both to dry, hot summers and to moist, mild winters with intermittent polar Pacific winds. Common sagebrush (*Artemisia tridentata*) is a many-branched shrub, usually about 3–6.5 ft (1–2 m) high, with silvery gray, bitter-aromatic foliage.

Sager \'sā-jər**, Ruth** (b. Feb. 7, 1918, Chicago, Ill., U.S.—d. March 29, 1997, Brookline, Mass.) U.S. geneticist. She received her Ph.D. from Columbia and later taught at Hunter College and Harvard University. Questioning the traditional belief that chromosomal genes are the only apparatus for transmitting genetic information to a cell, she discovered (1953) in the alga *Chlamydomonas* the existence of a second genetic transmitting system, a gene not located on the alga's chromosomes that controls the cell's sensitivity to the antibiotic streptomycin, and she observed that both male and female *Chlamydomonas* can transmit the nonchromosomal gene.

Sagittarius \ˌsa-jə-'ter-ē-əs\ *Latin* **"Archer"** In astronomy, the constellation lying between Capricorn and Scorpio; in ASTROLOGY, the ninth sign of the ZODIAC, governing approximately the period November 22–December 21. Its symbol is either a CENTAUR shooting a bow and arrow or an arrow drawn across a bow. The association of this constellation with a mounted archer originated in Babylonia as early as the 11th century BC.

Sagittarius A Strongest source of cosmic RADIO WAVES, lying in the direction of the constellation Sagittarius. Discovered by KARL JANSKY in 1932, it has been identified as the nucleus of the MILKY WAY GALAXY. The region is relatively small and constitutes an intense source of INFRARED RADIATION thought to be emitted partly by stars and partly by dust around them. Within the region is a much smaller radio source, Sagittarius (Sgr) A*, which appears to mark the centre of the Galaxy. Observations indicate that the galactic nucleus contains a BLACK HOLE with a mass of one million to several million times that of the Sun; they also provide a strong case that Sgr A* is the black hole. The activity at the Galaxy's centre resembles that of an ACTIVE GALACTIC NUCLEUS but on a much smaller scale.

sago \'sā-gō\ Food STARCH prepared from CARBOHYDRATE material stored in the trunks of several PALMS, chiefly *Metroxylon rumphii* and *M. sagu*, sago palms native to Indonesia. Composed of 88% carbohydrate, sago is a basic food of the South Pacific, where it is used in meal form to prepare soups, cakes, and puddings. Elsewhere its use in cookery is mainly as a pudding and sauce thickener. In industry it is used as a textile stiffener. The thick trunk grows to 30 ft (9 m) tall in low marshy areas. At 15 years the core of the mature trunk is engorged with starchy material. If allowed to form and ripen, the fruit absorbs the starch, leaving the stem hollow and dying. Cultivated plants thus are cut down when the flower spike appears, and the starchy pith is extracted from the stems.

saguaro \sə-'wär-ə, sə-'gwär-ō\ Large, candelabra-shaped, branched CACTUS (*Cereus giganteus*, or *Carnegiea gigantea*) native to Mexico, Arizona, and California. Slow-growing at first, mature saguaros may eventually reach 50 ft (15 m) in height. They bloom for the first time when 50–75 years old. They may die at 150–200 years (at a weight of up to 10 tons, or 9,000 kg), most commonly by being uprooted by wind or washouts. Shallow, wide-ranging roots gather moisture from a large area of desert to support the weighty top growth. The white, night-blooming flowers, which remain open into the next day, are the Arizona state flower. The red fruits have been an important food of American Indians.

Saguaro National Park Mountain and desert region, southern Arizona, U.S. Established as a national monument in 1933, it became a national park in 1994. It has a total area of 143 sq mi (370 sq km). Its two districts, separated by the city of TUCSON, contain forests of SAGUARO cactus. Plant life also includes paloverde, mesquite, and ocotillo.

Saguenay \ˌsa-gə-'nā\ **River** River, southern central Quebec, Canada. It drains Lac-SAINT-JEAN into the SAINT LAWRENCE RIVER at Tadoussac, northeast of QUEBEC city. Flowing east, it descends about 300 ft (90 m) in a turbulent stream in the first third of its 105-mi (169-km) course. Its fall is a

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source of hydroelectric power; its shores are in many places cliffs 1,000–1,800 ft (300–550 m) high. Noted for its scenery, it is a recreational area.

Sahara Largest desert in the world, encompassing almost all of northern Africa. Covering an area of about 3,500,000 sq mi (9,065,000 sq km), it is bounded by the Atlantic Ocean, the Atlas Mountains, the Mediterranean Sea, the Red Sea, and the Sahel region. It includes portions of several countries, including Morocco, Algeria, Tunisia, Libya, Egypt, Mauritania, Mali, Niger, Chad, and The Sudan. Principal topographic features include large oasis depressions, extensive stony plains, rock-strewn plateaus, abrupt mountains, sand sheets and dunes, and sand seas. Huge areas of it are empty, but scattered clusters of inhabitants survive in fragile ecological balance wherever water sources occur. Sedentary living is restricted to oasis areas. See also Libyan Desert.

Saharan Arab Democratic Republic Disputed territory of Western Sahara occupied by Morocco. It was a Spanish colony from c. 1884 to 1976. After Spain left, native Saharawi guerrillas (see Polisario) based in Algeria declared a government-in-exile and fought Morocco and Mauritania for control. Mauritania made peace in 1979, whereupon Morocco claimed the whole territory. A referendum on whether the territory will remain part of Morocco or become independent has been repeatedly postponed. See also Ḥassan II.

Sahel \sä-'hel\ *Arabic* **Sāḥil** Semiarid zone, western and north-central Africa. Extending from Senegal eastward to The Sudan, it forms a narrow transitional band between the arid Sahara to the north and the humid savannas to the south. Beginning in the late 20th century, it was subjected to increased desertification and soil erosion caused by natural climate changes as well as overgrazing and overfarming. The countries of the zone suffered a devastating drought and famine in the early 1970s, and by 1973 sections of the Sahara had advanced southward as much as 60 mi (100 km). Severe drought and famine again struck the region in 1983–85. Efforts by local governments to combat desertification in the Sahel have met with limited success.

Sahibdin (fl. 17th century, India) Indian miniature painter. His work dominated the Mewar school of Rajasthani painting. Though he was a Muslim, Sahibdin was fully at ease with Hindu themes. He produced abstract compositions that are full of brilliant colour and endowed with religious fervour. Among the important surviving examples of his paintings are a *ragamala* (musical modes) series (1628); a series on the *Bhagavata-Purana*, a scriptural text (1648); and the sixth book (*Yuddhakanda*) of the Hindu epic the *Ramayana* (1652).

Saichō \'sī-ˌchō\ *or* **Dengyō Daishi** (b. 767, Ōmi province, Japan—d. 822, Hiei-zan) Monk who established the Tendai (Chinese Tiantai) sect of Buddhism in Japan. Ordained at age 13, he studied in China and returned with the teachings of Tendai Buddhism, which embraced the Lotus Sutra. Unlike other Buddhist sects in Japan, it asserted that the material world could hold meaning and value and that the teachings of the Buddha are accessible to all, not just a select few. Saichō enjoyed favour with the government but often incurred the enmity of the leaders of other Japanese Buddhist sects. The monastery he built on Mount Hiei became one of the great centres of Buddhist learning.

Said \sä-'ēd**, Edward W(adie)** (b. Nov. 1, 1935, Jerusalem—d. Sept. 25, 2003, New York, N.Y., U.S.) Palestinian-born U.S. literary critic. Said was educated in Western schools in Jerusalem and Cairo before moving to the United States to attend Princeton and Harvard universities. He taught at Columbia University beginning in 1963. In *Orientalism* (1978), his best-known work, he examines Western stereotypes of the Islamic world and argues that Orientalist scholarship is based on Western imperialism. An outspoken proponent of Palestinian issues, he wrote on the Middle East in such works as *The Question of Palestine* (1979) and *The Politics of Dispossession* (1994). His more general concern was the complex interaction of literature and politics, which he treated in *Beginnings* (1975), *The World, the Text, and the Critic* (1983), and *Culture and Imperialism* (1993). *Out of Place* (1999) is a memoir.

Saʿīd ibn Sulṭān \sä-'ēd-ˌib-ən-sůl-'tän\ *or* **Saʿīd Sayyid** \sä-'ēd-'sī-əd\ (b. 1791, Oman—d. Oct. 19, 1856, at sea) Ruler of Muscat and Oman and of Zanzibar (1806–56). He made Zanzibar the principal power in East Africa and the commercial capital of the western Indian Ocean. Under Saʿīd, Zanzibar caravans were sent into central Africa to extract ivory, slaves, and other products. In 1822 he forbade his subjects to sell slaves to European traders. From 1828 he developed the islands of Zanzibar and Pemba into the world's largest clove producers, and he built up a large navy that helped expand his commercial interests.

Saigō Takamori \'sī-gō-ˌtä-kä-'mȯ-rē\ (b. Dec. 7, 1827, Kagoshima, Kyushu, Japan—d. Sept. 24, 1877, Kagoshima) Japanese military and political leader of the late Tokugawa and early Meiji periods. A samurai from the domain of Satsuma, Saigō joined Ōkubo Toshimichi and Kido Takayoshi in working to overthrow the Tokugawa shogunate (military government) and restore rule by the emperor. He commanded the troops that seized control of the imperial palace from the shogunate, and went on to lead a campaign against the shogunate's supporters. After the Meiji Restoration (1868), he was given command of the new Imperial Guard. In 1873 he supported a war with Korea; when this plan was cancelled, he resigned from government. He opened a military school in his native Kagoshima that drew to it disaffected former samurai (class distinctions had been abolished in 1871). In 1877 some of his disciples attacked a government arsenal, and he found himself the unwilling head of a rebellion. It lasted for six months and resulted in some 12,000 dead on both sides, including Saigō himself. He is regarded as a tragic hero by the Japanese.

Saigon See Ho Chi Minh City

Saikaku See Ihara Saikaku

sailfish Valued food and game fish in the genus *Istiophorus* (family Istiophoridae) of warm and temperate waters worldwide. It has a long, rounded spear extending from its snout but is distinguished from marlins and related species by its slimmer form, long pelvic fins, and especially its large, sail-like dorsal fin, which is bright blue and spotted. Deep blue above and silvery below, they grow to about 11 ft (3.4 m) long and 200 lbs (90 kg) or more. They feed mainly on other fishes. Its classification is uncertain, and one (*I. platypterus*) to several species may be recognized.

Sailfish (*Istiophorus platypterus*)
D. CORSON—SHOSTAL

sailing *or* **yachting** Sport or pastime of racing or cruising a sailboat or yacht. A modern yacht (from a Dutch word meaning "ship for chasing") is a sailboat used for racing. In the 17th century Dutch royalty sailed early yachts for pleasure; Charles II brought the sport to England. Organized yacht racing on the Thames began in the mid-18th century. In North America yachting began with the Dutch in New York in the 17th century. The first U.S. yacht clubs were founded in the mid-19th century. Sailboat races are held over two kinds of courses, point-to-point and closed. Yacht racing has been part of the Olympic Games since 1900. The America's Cup is the preeminent prize in yachting. See illustration on opposite page.

sailplane See glider

Saimaa \'sī-ˌmä**, Lake** Lake, southeastern Finland. Located northeast of Helsinki, Lake Saimaa has an area of 443 sq mi (1,147 sq km) and is the primary lake in the Great Saimaa lake system, the largest in Finland. About 120 lakes and numerous rivers and streams in the system drain most of southeastern Finland through Lake Saimaa, the Vuoksi River, and the Saimaa Canal to the Gulf of Finland. The lake system provides essential transportation links and hydroelectric power among the major towns of the region, and its scenic forests attract many tourists.

saint Holy person. In the New Testament, St. Paul used the term to mean a member of the Christian community, but the term more commonly refers to those noted for their holiness and venerated during their lifetimes or after death. In Roman Catholicism and Eastern Orthodoxy, saints are publicly recognized by the church and are considered intercessors with God for the living. They are honoured on special feast days, and their remains and personal effects are venerated as relics. Often Christian saints perform miracles in their lifetime, or miracles occur in their names after their death. In Islam, *wali* ("friend of God") is often translated as saint; in Buddhism, arhats and bodhisattvas are roughly equivalent to saints. Hindu sadhus are somewhat similar. See also canonization.

Saint Albans Raid (Oct. 19, 1864) Raid by Confederates in the American Civil War. About 25 Confederate soldiers based in Canada raided the Union town of St. Albans, Vt., where they killed one man and robbed

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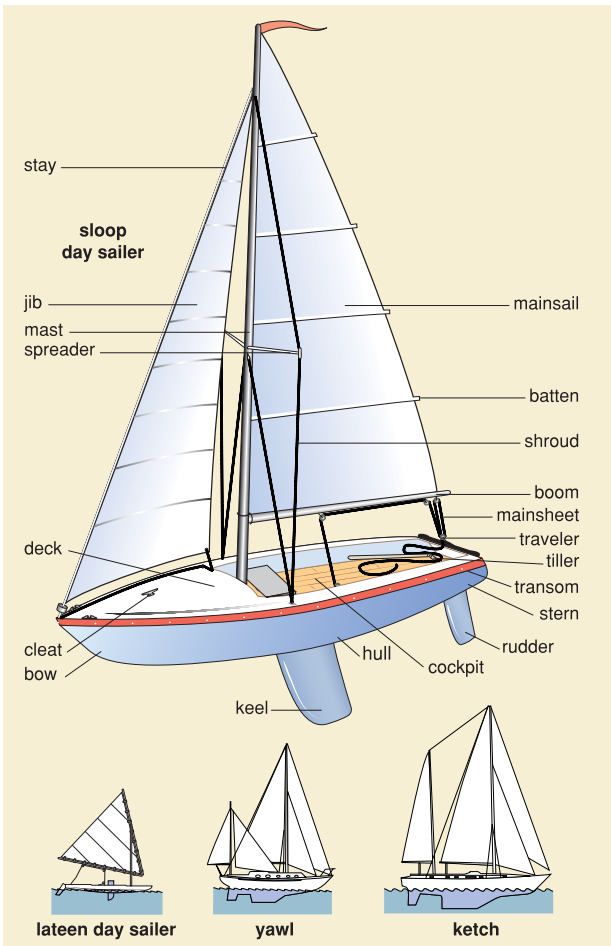

Principal parts of a sloop-rigged sailboat. A single mast is mounted forward of the keel and supported by stays and shrouds. Wind power is harnessed by the mainsail, which is fastened to the mast and a swinging boom, is stiffened by battens, and is kept in trim by crew members using the mainsheet. A jib funnels wind past the mainsail and also adds more sail area. A weighted keel translates most of the lateral thrust of the wind into forward motion and also counteracts the tendency of the boat to roll in its hull. The boat is steered from the stern by a rudder, which is turned from the cockpit by a tiller. Another single-mast boat design is the lateen, which has a triangular sail affixed to a long yard that is fastened at an angle to the top of a short mast. A yawl is a two-masted design with the mizzenmast mounted aft of the rudder post. On a ketch the mizzenmast is forward of the rudder.

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three banks. They retreated to Canada, where a pursuing U.S. posse captured several of them, though the posse was forced to surrender them to Canadian authorities. The Canadians returned the stolen money but later released the soldiers, causing strained relations between the two countries.

Saint Andrews City (pop., 1995 est.: 15,000) and seaport, Fife council area, eastern Scotland. It was formerly the ecclesiastical capital of Scotland; its religious traditions began in the 6th century AD, when St. Kenneth is believed to have formed a Celtic religious community there. It received a charter in 1160 and was one of the principal towns in Scotland in the Middle Ages. In 1472 its archbishop was recognized as the primate of Scotland, and it took part in the important events of the Scottish Reformation. A popular seaside resort, it is noted for its golf courses and for the University of St. Andrews.

Saint Andrews, University of Oldest university in Scotland, founded in 1411 on the outskirts of St. Andrews. The university buildings include St. Salvator's College (1450), St. Leonard's College (1512; merged with St. Salvator's in 1747), and the University Library (1612). A third college, St. Mary's (1537), has always taught theology exclusively. The medical and dental school became independent as the University of Dundee in 1967.

Saint Augustine \'ȯ-gə-ˌstēn\ City (pop., 2000: 11,592), northeastern Florida, U.S. It is the oldest continuously settled U.S. city. In 1513 Juan Ponce de León landed there in search of the Fountain of Youth and claimed the territory for Spain. It became part of the U.S. in 1821. The Castillo de San Marcos, now a national monument, is a symbol of the era of Spanish control. During the American Revolution the city was a refuge for loyalists, and during the Indian Wars it was the place of imprisonment for Osceola and other Seminoles. It is a winter and summer resort and a port on the Atlantic Intracoastal Waterway. The economy is based on tourism and fishing.

Saint Bartholomew's Day, Massacre of (Aug. 24–25, 1572) Murder of French Huguenots in Paris by Catholics. As part of the ongoing Wars of Religion, Catherine de Médicis agreed to a plot by the Guise family (see house of Guise) to assassinate the Huguenot Gaspard II de Coligny. When he was only wounded, Catherine feared discovery of her complicity and secretly urged faithful nobles to murder all the Huguenot leaders, who were in Paris for the wedding of the future Henry IV. The massacre began on August 24 and spread rapidly; after the leaders had been murdered, Huguenot homes and shops were pillaged and their occupants murdered and thrown into the Seine. Even after the royal order on August 25 to stop the killing, it continued and spread to Rouen, Lyon, Bourges, Orléans, and Bordeaux. By October, about 3,000 Huguenots had been murdered in Paris and probably tens of thousands more in the provinces.

Saint Basil the Blessed *or* **Pokrovsky** \pə-'krȯf-skē\ **Cathedral** Church constructed at the southern end of Red Square in Moscow (1554–60) by Ivan IV as a votive offering for his military victories over the Tatars. The brick-and-stone church was designed by the architects Postnik and Barma (who may in fact have been one person). It is a unique and magnificent architectural fantasy exhibiting Byzantine influences. Eight chapels topped by onion domes surround a central church with a tower topped by a tent-shaped roof and a small golden cupola. Each of the painted domes differs in design and colour.

Saint Bernard Breed of rescue dog that saved about 2,500 people over 300 years of service at a hospice in Great St. Bernard pass in the Pennine Alps. Probably descended from mastiff-like dogs, it was brought to the hospice in the late 17th century. A powerful dog with a massive head and drooping ears, it stands at least 25 in. (65 cm) and weighs 110–200 lbs (50–90 kg). Its dense coat is red-brown and white or brindle and white and may be short or medium-long. The long-haired variety was produced by crosses with the Newfoundland in the early 19th century.

Saint Bernard Pass See Great St. Bernard Pass

Saint Bernard Pass, Little See Little St. Bernard Pass

Saint Christopher and Nevis See Saint Kitts-Nevis

Saint Clair, Lake Lake, west-central Tasmania, Australia. It is located at the southern boundary of Cradle Mountain–Lake Saint Clair National Park. It has an area of 11 sq mi (28 sq km) and an elevation of 2,417 ft (737 m) on Tasmania's central plateau. Its maximum depth approaches 700 ft (215 m), making it Australia's deepest lake.

Saint Clair, Lake Lake, forming part of the boundary between Michigan, U.S., and Ontario, Canada. Roughly circular, with an area of 467 sq mi (1,210 sq km), it connects with the St. Clair River and Lake Huron to the north and with the Detroit River and Lake Erie to the south. It is in a popular summer recreation area. Suburbs of Detroit lie on its western shore.

Saint-Cloud \sen-'klü\ **porcelain** Soft-paste porcelain made in Saint-Cloud, France, from the last quarter of the 17th century until 1766. Much of the yellowish or creamy off-white porcelain was influenced by late Ming Chinese white porcelain—hence the plum-blossom decoration molded in low relief and figures in the Chinese manner.

Saint Croix \'krȯi\ Largest island (pop., 1990: 50,000) of the U.S. Virgin Islands. Located south of Saint Thomas, it has an area of 84 sq mi (218 sq km). Its capital is Christiansted; the town of Frederiksted is the commercial centre. In 1493 it was visited by Christopher Columbus, who named

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it Santa Cruz. In the mid-17th century it was colonized in turn by the Dutch, English, Spanish, and French. It was purchased by Denmark in 1733 and sold to the U.S. in 1917. In 1989 it was devastated by a hurricane but recovered with U.S. aid. Tourism is the main industry; rum is distilled and exported.

Saint-Denis \ˌsen-də-ˈnē\ City (pop., 1999: 85,832), northern France. Now a suburb of Paris, until the mid-19th century it was only a small township centred on its famous abbey church, which had been the burial place of French kings. King Dagobert I founded the abbey in the 7th century and built it over the tomb of St. Denis, patron saint of France. Abbot Suger built there a new basilica which later transformed Western architecture from the Romanesque to the Gothic; most late-12th-century French cathedrals, including Chartres, are based on that of Saint-Denis. Remarkable tombs found there include those of Louis XII, Anne of Brittany, Henry II, and Catherine de Médicis. The city is now an industrial centre.

Saint-Denis \ˌsan-də-ˈnē\ City (pop., 1999: 131,557), capital of the French overseas department of Réunion, in the western Indian Ocean. It lies in a basin at the mouth of the St.-Denis River on the northern coast of the island, wedged between the ocean and a mountain rising abruptly behind it. It was originally the main port of Réunion, but an artificial harbour at Le Port, on the northwestern coast, replaced it in the 1880s. It is primarily an administrative town.

Saint Elias \ˌə-ˈlī-əs\ **Mountains** Segment of the Pacific Coast Ranges in the southwestern Yukon Territory of Canada and eastern Alaska, U.S. The mountains extend southeast about 250 mi (400 km) from the Wrangell Mountains to Cross Sound along the Canada-U.S. border. Many peaks exceed 17,000 ft (5,200 km), including Mount St. Elias (18,008 ft [5,489 km]) and Mount Logan. In 1741 Vitus Bering sighted Mount St. Elias from his ship and became the first official European discoverer of northwestern America. The mountains contain the world's most extensive ice fields outside the polar ice caps. The southern end of the range forms part of Glacier Bay National Park.

Saint Elmo's fire Glow accompanying the brushlike discharges of atmospheric electricity that usually appears as a tip of light on the extremities of such pointed objects as church towers or the masts of ships during stormy weather. It is commonly accompanied by a crackling or fizzing noise. It is commonly observed on the periphery of propellers and along the wing tips, windshield, and nose of aircraft flying in dry snow, in ice crystals, or near thunderstorms. St. Elmo is an Italian corruption of St. Erasmus, patron saint of Mediterranean sailors, who traditionally regarded St. Elmo's fire as a sign of his guardianship over them.

Saint-Exupéry \san-tāg-zü-pā-ˈrē**, Antoine (-Marie-Roger) de** (b. June 29, 1900, Lyon, France—d. July 31, 1944, in flight over the Mediterranean) French aviator and writer. He flew as a commercial, test, and military reconnaissance pilot and was a publicity attaché for Air France and a reporter. He died when he was shot down on a wartime Air Force mission over the Mediterranean. His writings exalt perilous adventure and aviation, as in the novels *Southern Mail* (1929) and *Night Flight* (1931). *Wind, Sand, and Stars* (1939) is a lyrical memoir with philosophical musings and meditations. *The Little Prince* (1943) is a child's fable for adults.

Saint Francis River River, southeastern Missouri and eastern Arkansas, U.S. Rising in southeastern Missouri and flowing south, it enters the Mississippi River just above Helena, Ark., after a course of 425 mi (684 km). Part of its course forms a portion of the Missouri-Arkansas boundary. It is navigable for 125 mi (201 km).

Saint-Gaudens \sānt-ˈgȯ-dᵊnz**, Augustus** (b. March 1, 1848, Dublin, Ire.—d. Aug. 3, 1907, Cornish, N.H., U.S.) Irish-born U.S. sculptor. Son of an Irish mother and a French father, he was brought to the U.S. in infancy and at 13 was apprenticed to a cameo cutter. He studied sculpture in New York and at the École des Beaux-Arts in Paris (1867–70), then settled in New York City in 1872. Between 1880 and 1897 he executed most of the works that earned him his reputation as the foremost American sculptor of the late 19th century. His first important commission was the monument to David Farragut (1878–81) in New York's Madison Square Park. For Boston he produced his great relief monument to Col. Robert G. Shaw and his African American Civil War regiment (1884–97). The memorial to the wife of Henry Adams (1886–91) in Washington, D.C., a mysterious draped figure with a shadowed face, is often considered his greatest work.

Saint George's Town (pop., 1991 est.: 5,000), capital of Grenada, in the West Indies. It lies on the island's southwestern coast, on a small peninsula. Founded by the French in 1650, it became the capital of the Windward Islands (1885–1958). Now a port, it exports cacao, nutmeg, mace, and bananas. It was the scene of fighting in 1983 during the military intervention in Grenada by U.S. and Caribbean forces.

Saint George's Channel Wide passage between the Irish Sea and the northern Atlantic Ocean. It extends for 100 mi (160 km) and has a minimum width of 47 mi (76 km) between Carnsore Point, Ireland, and St. David's Head, Wales. The name derives from the legend of St. George, in which he traveled to England by sea.

Saint-Germain \ˌsan-zher-ˈman**, Treaty of** (1919) Treaty ending World War I between Austria and the Allied Powers. Signed at Saint-Germain-en-Laye, near Paris, on Sept. 10, 1919, it came into force on July 16, 1920. It registered the breakup of the Habsburg empire and recognized the independence of Czechoslovakia, Poland, Hungary, and the Kingdom of the Serbs, Croats, and Slovenes (later Yugoslavia). Eastern Galicia, southern Tirol, and Trieste were also ceded by Austria. The treaty limited Austria's army to 30,000 men, dismantled the Austro-Hungarian navy, and barred the union of Austria with Germany.

Saint Gotthard \ˈgä-tərd\ **Pass** Mountain pass, Lepontine Alps, southern Switzerland. An important motor and railway route between central Europe and Italy, the pass lies at an elevation of 6,916 ft (2,108 m) and is 16 mi (26 km) long. Though the pass was known to the Romans, it was not generally used until the early 13th century. A long, winding motorway leads across the pass, and the St. Gotthard Tunnel extends for more than 9 mi (14 km) beneath it. The railway through the tunnel connects Lucerne with Milan.

Saint Helena \ˈhe-lə-nə, hə-ˈlē-nə\ Island (pop., 2003 est.: 3,800), eastern South Atlantic Ocean. Located 1,200 mi (1,950 km) west of Africa, Saint Helena has an area of 47 sq mi (122 sq km). The capital and port is Jamestown. With Ascension Island and Tristan da Cunha, it constitutes a British overseas territory (area: 119 sq mi [308 sq km]; pop., 2003 est.: 5,104). Discovered in 1502, it became a port of call for ships sailing between Europe and the East Indies. It was owned by the English East India Co. in the 17th century; because of its remoteness, it was used as the final place of exile for Napoleon (1815–21). It declined in importance after the Suez Canal was opened in 1869.

Saint Helens, Mount Volcanic peak in the Cascade Range, southwestern Washington, U.S. Dormant since 1857, it erupted in May 1980 in one of the greatest volcanic explosions ever recorded in North America. Sixty people and thousands of animals were killed in the May 18 event, and 10 million trees were blown down by the lateral air blast. At the event's end Mount St. Helens's volcanic cone had been completely blasted away; in place of its 9,680-ft (2,950-m) peak was a horseshoe-shaped crater with a rim reaching elevations of about 8,000 ft (2,400 m). Further eruptions have occurred since 1980, and a dome of lava has grown in the crater. Mount St. Helens National Volcanic Monument was established in 1982.

Saint-Jean \san-ˈzhän**, Lac** Lake, south-central Quebec, Canada. A shallow lake, it has an area of 387 sq mi (1,003 sq km) and discharges into the Saguenay River. In the 20th century logging operations on its feeder streams led to the establishment of large paper mills on the lake. Since 1926 the lake's seasonal fluctuations have been controlled by two hydroelectric dams. It is a tourist resort centre famous for its salmon fishing.

Saint John City (pop., 2001: 69,661), southern New Brunswick, Canada. It is situated on the Bay of Fundy, at the mouth of the Saint John River. The site, visited by Samuel de Champlain in 1604 and fortified in the 1630s, was occupied by the British in 1758. It was chartered as the first city in Canada in 1785. The city recovered from a disastrous fire in 1877. Its year-round ice-free harbour fostered shipping, shipbuilding, and fishing. It is the province's largest city and principal port. Industries include lumbering and pulp and paper products.

Saint John, Henry See Viscount Bolingbroke

Saint-John Perse \san-dzhȯn-ˈpers\ *orig.* **Marie-René-Auguste-Aléxis Saint-Léger Léger** (b. May 31, 1887, Saint-Léger-les Feuilles, Guad.—d. Sept. 20, 1975, Presqu'ile-de-Giens, France) French poet and diplomat. He served in various diplomatic posts from 1914 until his dismissal by the collaborationist Vichy government in 1940. He spent

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the years 1940–57 in exile in the U.S. The language of his poetry, admired especially by poets for its precision and purity, is difficult, and he made little appeal to the general public. His works include *Anabasis* (1924; translated by T.S. Eliot), *Exile* (1942), *Winds* (1946), *Seamarks* (1957), and *Birds* (1962). He was awarded the Nobel Prize for Literature in 1960.

Saint John River River, northeastern U.S. and southeastern Canada. Rising in northwestern Maine, it flows northeast to the Canadian border, then southeast to form that international boundary; in Canada, it flows through New Brunswick into the Bay of Fundy at Saint John. It is 418 mi (673 km) long. At Grand Falls, the river drops 75 ft (23 m), and at its mouth are the "reversing falls" rapids, caused by the strong tides of the bay, which at high tide force the river to reverse its flow.

Saint John's City (pop., 1991 est.: 22,000), capital of Antigua and Barbuda, West Indies. It lies on Antigua's northwestern coast. It is a resort and the island's main port, handling sugar, cotton, machinery, and lumber. Nearby Fort St. John's was damaged over the centuries (1690–1847) by earthquakes, fire and a hurricane.

Saint John's City (pop., 2001: 172,918), port, and capital of Newfoundland and Labrador, Canada. Located on the southeastern Atlantic coast, St. John's was a small fishing base from the early 16th century; it was colonized by the British in 1583. Attacked several times by the French, it was securely British from 1762 and prospered as a fishing port, despite several disastrous fires in the 19th century. It is a commercial and industrial centre, a major ocean port, and the base for the province's fishing fleet. Industries include shipbuilding and fish processing. The annual regatta is one of the oldest sports events in North America. Signal Hill Historic Park memorializes several events, including Guglielmo Marconi's reception of the first transatlantic wireless message from Europe (1901).

Saint Johns River River, northeastern Florida, U.S. It rises in the east-central part of the state and flows north parallel to the coast until it turns at Jacksonville to empty into the Atlantic Ocean, after a course of 285 mi (459 km). It is important for both shipping and recreation.

Saint-John's-wort Common name for plants in the family Hypericaceae, which contains 350 species of herbs or low shrubs in eight genera. The family is sometimes considered part of the family Guttiferae. The majority of species (about 300) belong to the genus *Hypericum*. Their leaves are opposite or whorled, dotted with glands, and usually have smooth margins. Several species are cultivated in temperate regions for their handsome flowers. *H. perforatum*, a showy golden flower grown in both the Old and New Worlds whose buds contain a red oil, has long been credited with magical and medicinal powers; today it is being widely used and studied for its possible efficacy against depression.

Saint-Just \sa^{n}-'zhüst**, Louis (-Antoine-Léon) de** (b. Aug. 25, 1767, Decize, France—d. July 28, 1794, Paris) French Revolutionary leader. In support of the French Revolution, he wrote the radical *Esprit de la révolution et de la constitution de France* (1791) and was elected to the National Convention in 1792. A close associate of Maximilien Robespierre and a member of the Committee of Public Safety, he was elected president of the Convention in 1793 and sponsored the Ventôse (March) Decrees, which confiscated property of the Revolution's enemies and redistributed it to the poor. He led the victorious attack against the Austrians at Fleurus (in modern Belgium). A fanatical leader of the Reign of Terror, he was arrested in the Thermidorian Reaction and guillotined.

Louis de Saint-Just, portrait after a red chalk drawing by Christophe Guérin, 1793.
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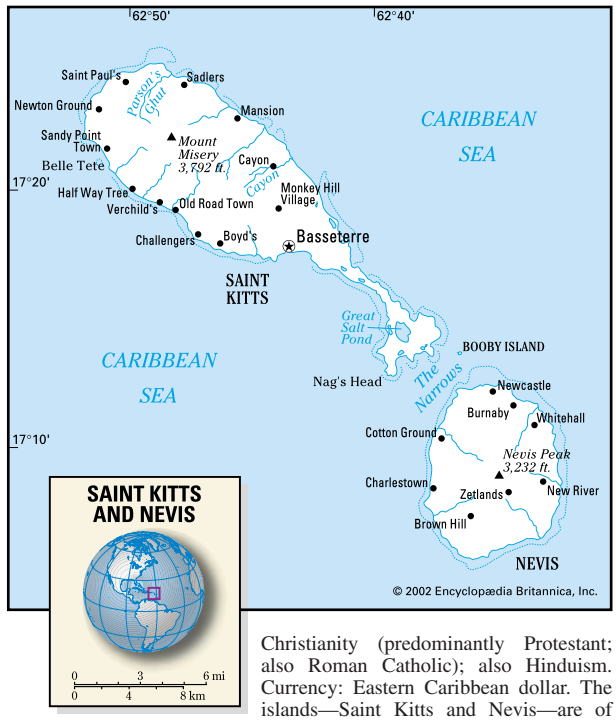
Saint Kitts and Nevis *officially* **Federation of Saint Kitts and Nevis** Island country, Leeward Islands, in the eastern Caribbean Sea. Area: 104 sq mi (269 sq km). Population (2005 est.): 46,600. Capital: Basseterre (on Saint Kitts). Most of the population is of African descent. Language: English (official). Religions:



Christianity (predominantly Protestant; also Roman Catholic); also Hinduism. Currency: Eastern Caribbean dollar. The islands—Saint Kitts and Nevis—are of volcanic origin, with mountain ranges rising to 3,792 ft (1,156 m). The climate is tropical, and heavy vegetation covers most of the mountainous interior. The economy is based on agriculture; sugar has long been the mainstay, and tourism is also important. Saint Kitts and Nevis is a constitutional monarchy with one legislative house; its chief of state is the British monarch represented by the governor-general, and the head of government is the prime minister. Saint Kitts became the first British colony in the West Indies in 1623. Anglo-French rivalry grew in the 17th century and lasted more than a century. In 1783, by the Treaty of Versailles, the islands became wholly British possessions. They were united with Anguilla from 1882 to 1980 but became an independent federation within the British Commonwealth in 1983.

Saint Laurent \'sa^{n}-lȯ-'rä^{n}**, Louis (Stephen)** (b. Feb. 1, 1882, Compton, Que., Can.—d. July 25, 1973, Quebec, Que.) Prime minister of Canada (1948–57). One of Canada's most prominent lawyers, he served in the Canadian House of Commons (1942–58) and in W.L. Mackenzie King's cabinet as minister of justice and attorney general (1942–46) and minister of external affairs (1945–48). As leader of the Liberal Party (1948), he succeeded King as prime minister. He promoted Canadian unity by equalizing provincial revenues and expanded social security and university education. He supported Canadian membership in NATO and helped establish the St. Lawrence Seaway.

Saint Laurent \sa^{n}-lȯ-'rä^{n}**, Yves (-Henri-Donat-Mathieu)** (b. Aug. 1, 1936, Oran, Alg.) Algerian-born French fashion designer. He left for Paris after secondary school to pursue a fashion career and at 17 was hired as Christian Dior's assistant. When Dior died four years later, he was named head of the House of Dior. In 1962 he opened his own fashion house and quickly emerged as one of the world's most influential designers. He popularized trousers for women for both city and country wear. Metallic and transparent fabrics were prominent in his late '60s collections; in the 1970s, inspired by ethnic costume, he introduced the haute peasant look. During the 1960s and '70s his enterprises expanded to include ready-to-wear licenses, accessories, household linens, fragrances, and men's clothes in addition to his couture business. He retired in 2002.

Saint Lawrence, Gulf of Deep gulf of the Atlantic Ocean off eastern Canada. It has an area of about 60,000 sq mi (155,000 sq km). It touches the shores of half of the provinces of Canada, providing a gateway to the interior of the entire North American continent. Its boundaries are the maritime estuary at the mouth of the Saint Lawrence River, the Strait of Belle Isle

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between Newfoundland and the mainland, and Cabot Strait. It has many islands, including Prince Edward Island and the Magdalen Islands.

Saint Lawrence River River, southern Quebec and southeastern Ontario, Canada. It flows northeast out of Lake Ontario into the Gulf of Saint Lawrence and is about 760 mi (1,225 km) long. It passes through the Thousand Islands and for about 120 mi (195 km) forms the boundary between New York and Ontario. Entering Quebec, it widens into Lake St. Francis, then flows past Montreal island. Below Quebec city it widens to 90 mi (145 km) at its mouth in the Gulf of St. Lawrence. Major tributaries include the Ottawa, Saguenay, Richelieu, and Manicouagan rivers, all in Canada. It links the Atlantic Ocean with the Great Lakes through the Saint Lawrence Seaway.

Saint Lawrence Seaway U.S.-Canadian waterway and lock system. Located along the upper St. Lawrence River, it links the Atlantic Ocean with the Great Lakes. Its construction, carried out in 1954–59, involved clearing a 186-mi (299-km) stretch of the St. Lawrence River between Montreal and Lake Ontario. It included lakes, rivers, locks, and canals that extended for 2,340 mi (3,766 km) to connect Duluth, Minn., with the head of the Gulf of St. Lawrence. With the Great Lakes, it provides 9,500 mi (15,285 km) of navigable waterways. It allows deep-draft ocean vessels access to the Great Lakes' rich industrial and agricultural regions. It is navigable from April to mid-December.

Saint-Léon \sa^{n}-lā-'ō^{n}**, (Charles-Victor-) Arthur (-Michel)** (b. Sept. 17, 1821, Paris, Fr.—d. Sept. 2, 1870, Paris) French dancer, choreographer, and violinist. He trained with his ballet-master father and toured extensively throughout Europe (1838–59), often playing the violin as he danced. He was ballet master at the Imperial Theatre in St. Petersburg (1859–69); his *The Humpbacked Horse* (1864) was the first ballet based on Russian folk themes. In 1870 he became ballet master at the Paris Opéra, where he choreographed his most famous ballet, *Coppélia*. He developed an early system of dance notation, which he published in 1852.

Saint Louis City (pop., 2000: 348,189), east-central Missouri, U.S. Located on the Mississippi River below its confluence with the Missouri River, it was founded by Auguste Chouteau in 1764 as a trading post and was named for King Louis IX of France. It became the crossroads of westward expansion for exploring parties, fur-trading expeditions, and pioneers traveling the Santa Fe and Oregon trails. Since the 19th-century steamboat era and the arrival of the railroads in the 1850s, it has been a major transportation hub. Its diversified industries include brewing, food processing, and the manufacture of aircraft. The largest city in the state, it is home to many educational institutions, including Washington University and St. Louis University. The emblem of the city is its Gateway Arch, designed by Eero Saarinen.

Saint Lucia \'lü-shə\ Island country, Windward Islands, in the eastern Caribbean Sea. Area: 238 sq mi (617 sq km). Population (2005 est.): 161,000. Capital: Castries. Most of the population is of African descent. Languages: English (official), French patois. Religions: Christianity (Roman Catholic, Protestant); also Rastafarianism. Currency: Eastern Caribbean dollar. Saint Lucia is of volcanic origin; within the Qualibou Caldera is Sulphur Springs, which continues to emit steam and gases and is a prime tourist attraction. Wooded mountains run north-south, culminating in Mount Gimie (3,145 ft [958.6 m]). The economy is based on agriculture and tourism. Saint Lucia is a constitutional monarchy with a parliament of two legislative houses; its chief of state is the British monarch represented by the governor-general, and the head of government is the prime minister. Caribs replaced early Arawak inhabitants c. AD 800–1300. Settled by the French in 1650, Saint Lucia was ceded to Great Britain in 1814 and became one of the Windward Islands in 1871. It became fully independent in 1979. See map above.

Saint-Malo \sa^{n}-mä-'lō**, Gulf of** Gulf of the English Channel, France. Indenting the northern coast of Brittany, the gulf extends from the island of Bréhat to the peninsula of Cotentin, Normandy. It includes the rocky islet of Mont-Saint-Michel. At low tide in spring and fall a huge tract of land is uncovered at the gulf's main port, Saint-Malo. The shore is lined with numerous small resorts.

Saint Mark's Basilica *or* **San Marco Basilica** Church in Venice built to house the remains of St. Mark. The basilica originally built for this purpose, begun in 829, was burned during a revolt in 976; the present structure, one of the most beautiful buildings in Europe, was completed

in 1071. The plan is an Eastern symmetrical Greek cross (see church) surmounted by five domes. The design is distinctly Byzantine, and both Byzantine and Italian architects and craftsmen probably worked on it. The interior is decorated with mosaics on a gold background; the floor is of inlaid marble and glass. In the restricted light their colours glow fantastically. Over the centuries, the church has benefited richly from the addition of sculptures, mosaics, and ceremonial objects.

Saint Martin *Dutch* **Sint Maarten** Island, Leeward Islands, eastern West Indies. Located northwest of Saint Kitts and Nevis, it covers an area of 33 sq mi (85 sq km). Discovered by Christopher Columbus, it was divided in 1648 between the French and the Dutch. The northern section of the island (20 sq mi [52 sq km]) is a dependency of the French overseas department of Guadeloupe; its chief town is Marigot (pop., 1990: 26,000). The island's southern section (13 sq mi [34 sq km]) is administratively part of the Netherlands Antilles; its main town is the island's capital, Philipsburg (pop., 1990: 32,000). The island's economy is based on tourism.

Saint-Maurice \sa^{n}-mō-'rēs\ **River** River, southern Quebec, Canada. It is 325 mi (523 km) long and a major tributary of the Saint Lawrence River, flowing south from Gouin Reservoir into the St. Lawrence at Trois Rivières. It is a major logging river, serving large pulp and paper factories at La Tuque, Grand-Mère, Shawinigan, and Trois Rivières. Since 1900 it has also been a major source of hydroelectric power.

Saint Paul City (pop., 2000: 287,151), capital of Minnesota, U.S. It is in the eastern part of the state, on the Mississippi River just east of Minneapolis, with which it forms the Twin Cities. In 1805 Zebulon Pike made an unofficial treaty there with the Dakota (Sioux) for possession of the region. First settled in 1838, it was known as Pig's Eye until 1841, when a log chapel dedicated to St. Paul was built there. It became the capital of the Minnesota Territory in 1849 and of the state in 1858. It was important in the development of the upper Midwest because of its location on the Mississippi and its rail links, which promoted its livestock market. It is a major transportation, commercial, and industrial centre with diversified manufactures, including automobiles, electronic equipment, and food products. Educational institutions include Macalester and Concordia colleges.

Saint Paul River River, western Africa. Rising in southeastern Guinea, its upper reach forms part of the border between Guinea and Liberia. It enters Liberia north of Gbarnga and discharges into the Atlantic Ocean after a southwesterly course of about 280 mi (450 km). Navigable for 18 mi (29 km) upstream, the river and its major tributaries drain much of Liberia and Guinea. Two arms of the river enclose Bushrod Island, site of the port of Monrovia.

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Saint Paul's Cathedral Cathedral of the Church of England in London. The present building is a domed church of great openness designed in a restrained style that combines elements of Neoclassical, Gothic, and Baroque architecture. It was designed by Christopher Wren and constructed (1675–1710) of Portland stone. The building replaced Old St. Paul's, destroyed in the Great Fire of 1666. The interior is characterized by ironwork and woodcarving by master craftsworkers. The majestic dome, set on a colonnaded drum, rises 365 ft (111 m). The superbly detailed cathedral that Wren built bears only a slight resemblance to the Classical-Gothic design that had been accepted; why this is so remains a mystery.

Saint Peter's Basilica Present church of St. Peter's in Rome, begun by Pope Julius II in 1506 and completed in 1615. It is the church of the popes and one of the world's largest churches. It was built to replace Old St. Peter's, erected by Constantine over Peter's traditional burial place. According to the original plan of Donato Bramante, it was to take the form of a Greek cross around a central dome. Successive architects, including Raphael, drew fresh plans after Bramante's death, modifying the original Greek-cross plan to a Latin cross. Antonio da Sangallo the Younger returned to Bramante's symmetrical plan. Michelangelo, who followed Sangallo, nearly completed the drum for the massive dome before his death. Pope Paul V (r. 1605–21) then insisted on a longitudinal plan for liturgical reasons and adopted the plan of Carlo Maderno (1556–1629), which extended the nave to the east. Gian Lorenzo Bernini added the elliptical piazza, lined by colonnades, that serves as the approach to the basilica. The interior is filled with Renaissance and Baroque masterpieces, including Michelangelo's *Pietà*, Bernini's baldachin, a statue of St. Longinus, the tomb of Urban VIII, and a bronze throne of St. Peter.

Saint Petersburg *Russian* **Sankt-Peterburg** \'sånkt-ˌpʸə-tʸər-'bůrk\ *formerly (1914–24)* **Petrograd** *or (1924–91)* **Leningrad** City (pop., 2002: 4,669,400) and port, northwestern Russia. Located on the delta of the Neva River where it enters the Gulf of Finland, it is Russia's second largest city after Moscow. Founded by Peter I (the Great) in 1703, it was the capital of the Russian Empire from 1712 to 1917. It was the scene of the Decembrist revolt in 1825 and the Bloody Sunday attack on workers in the Russian Revolution of 1905. The original centre of the Bolshevik revolution (see Russian Revolution of 1917), it lost its capital status to Moscow in 1918. In World War II it underwent a siege by German forces (September 1941–January 1944), during which hundreds of thousands of people died (see Siege of Leningrad). From 1990 a reformist city council and mayor helped swing the country from the control of the Communist Party of the Soviet Union. St. Petersburg is a cultural, educational, and industrial centre and Russia's largest seaport. Industries include engineering, printing, manufacturing, and shipbuilding. One of Europe's most beautiful cities, it is strewn with canals and several hundred bridges; its many palaces, cathedrals, museums (including the Hermitage), and historical monuments were designated a UNESCO World Heritage site in 1990.

Saint Petersburg City (pop., 2000: 248,232), west-central Florida, U.S. It lies near the tip of Pinellas Peninsula, adjacent to Tampa Bay. Settled in 1876, it became in the late 1940s one of the first Florida cities to encourage tourists to spend their retirement years there. It is a winter resort and a centre for yachting and sport fishing. The city is connected by several bridges with a string of sandy islands (west) between the Gulf of Mexico and Boca Ciega Bay; seaside communities such as St. Pete Beach are located there. To the south, the Sunshine Skyway Bridge across the lower bay links the city to Bradenton and Sarasota.

Saint-Pierre and Miquelon \'sānt-'pir...'mi-kə-ˌlän\ *French* \sⁿ-'pyer-ā-mē-'klôⁿ\ French overseas territorial collectivity (pop., 1993 est.: 6,000). It consists of an archipelago in the Atlantic Ocean off the southern coast of Newfoundland, Can. The largest island, Miquelon, has an area of 83 sq mi (215 sq km). St.-Pierre, with an area of 10 sq mi (26 sq km), is the administrative and commercial centre; almost 90% of the population live there. First settled by seafarers from western France early in the 17th century, the islands changed hands several times between France and Britain until an 1814 treaty made French possession final. They were classified as a French territory in 1946, a department in 1976, and a territorial collectivity in 1985. The economy is based on fishing.

Saint-Saëns \saⁿ-'säⁿs**, (Charles) Camille** (b. Oct. 9, 1835, Paris, France—d. Dec. 16, 1921, Algiers) French composer. Astonishingly gifted from childhood, with a phenomenal memory (at his debut piano recital at age 11, he offered to play any Beethoven sonata without music), he became a darling of the salons and a celebrated improviser. To promote new music by French composers, he founded the Société Nationale de Musique in 1871. His compositions are often brilliant in their effects but not always profound. Of his 13 operas, *Samson et Dalila* (1877) had the greatest success. He wrote piano, cello, and violin concertos and three symphonies (including the *"Organ" Symphony*, 1886); his tone poem *Danse macabre* (1874) and the suite *Carnival of the Animals* (1886) are widely known.

Saint-Simon \saⁿ-sē-'mōⁿ**, (Claude-) Henri (de Rouvroy, comte) de** (b. Oct. 17, 1760, Paris, France—d. May 19, 1825, Paris) French social theorist. He joined the French army at age 17 and was sent to aid the colonists in the American Revolution. After his return to France (1783), he made a fortune in land speculation but gradually dissipated it. He turned to the study of science and technology as the solution to society's problems and wrote "On the Reorganization of European Society" (1814) and (with Auguste Comte) "Industry" (1816–18), in which he envisioned an industrialized state directed by modern science. In *New Christianity* (1825), he stated that religion should guide society toward improving life for the poor. His disciples helped influence the rise of Christian socialism.

Henri de Saint-Simon, lithograph by L. Deymaru, 19th century
BBC HULTON PICTURE LIBRARY

Saint Thomas Chief island (pop., 1990: 48,000), U.S. Virgin Islands. Located east of Puerto Rico, it covers an area of 32 sq mi (83 sq km). The capital, Charlotte Amalie, has a well-sheltered harbour. Sighted in 1493 by Christopher Columbus, St. Thomas was colonized first by the Dutch (1657) and then by the Danish (1666). After 1673, when slavery was introduced, the island became one of the chief Caribbean sugar producers and a major slaving centre. Falling sugar prices after 1820 and the abolition of slavery in 1848 led to a decrease in profits. The U.S. bought St. Thomas for use as a naval base in 1917. The chief industry is tourism.

Saint Vincent, Cape Cape, Portugal. Located at the southwesternmost point of Portugal, the cape was known to the Greeks and Romans as Promontorium Sacrum ("Sacred Point") because of a shrine there. Pastoralism and fishing are the economic mainstays of the region. Near Sagres, the main settlement, was the town of Vila do Infante, where c. 1420 Prince Henry the Navigator established a naval observatory and school for navigators. Many naval battles have taken place off the cape.

Saint Vincent, Gulf Triangular inlet of the Indian Ocean, southeastern Australia. It is on the coast of South Australia between Yorke Peninsula (west) and the mainland (east and southeast). About 90 mi (145 km) long and 45 mi (73 km) wide, it is linked to the ocean by Investigator Strait and Backstairs Passage. Kangaroo Island lies across the gulf's entrance. Adelaide and Port Adelaide Enfield (pop., 2004 est.: 103,830), South Australia's leading port, are on its eastern side.

Saint Vincent and the Grenadines \'gre-nə-ˌdēnz\ Island country, Windward Islands, in the eastern Caribbean Sea. It is composed of Saint Vincent island and the northern Grenadines. Area: 150 sq mi (389 sq km). Pop. (2005 est.): 119,000. Capital: Kingstown. Most of the population is of African descent. Languages: English (official), French patois. Religions: Christianity (mostly Protestant; also other Christians, Roman Catholic); also Hinduism, Islam. Currency: Eastern Caribbean dollar. The islands are composed of volcanic rock. Thickly wooded volcanic mountains run north-south and are cut by many swift streams. Soufrière (4,048 ft [1,234 m]), the highest of the mountains, has had devastating volcanic eruptions. Agriculture is the mainstay of the economy, and export crops include bananas and arrowroot. Tourism is also important. The country is a constitutional monarchy with one legislative house; its chief of state is the British monarch represented by the governor-general, and the head of government is the prime minister. The French and the British contested for control of Saint Vincent until 1763, when it was ceded to England by the Treaty of Paris.

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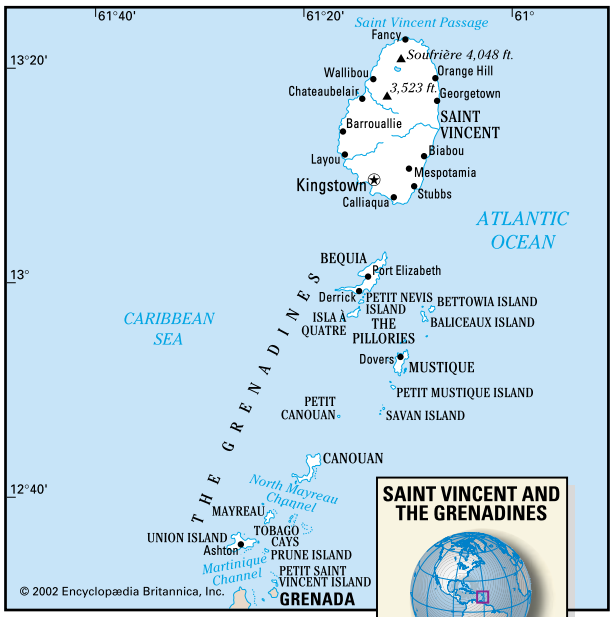

The original inhabitants, the Caribs, recognized British sovereignty but revolted in 1795. Most of the Caribs were deported; many who remained were killed in volcanic eruptions in 1812 and 1902. In 1969 Saint Vincent became a self-governing state in association with the United Kingdom, and in 1979 it achieved full independence.

Sainte-Beuve \sa^{n}t-'bœv**, Charles-Augustin** (b. Dec. 23, 1804, Boulogne, France—d. Oct. 13, 1869, Paris) French literary historian and critic. In 1825 he began contributing critical articles to periodicals. In essays collected in *Critiques et portraits littéraires*, 5 vol. (1832–39) and *Portraits contemporains* (1846), he developed a new approach to critiquing living writers that involved extensive biographical research to understand their mental attitudes. His famous "Monday Chats," published in newspapers from 1849 to 1869, were detailed, well-rounded literary studies in which he applied historical frames of reference to contemporary writing. His methods revolutionized French criticism by freeing it from personal prejudice and partisan passions. His *Port-Royal* (1840–48) is a scholarly history of an abbey and of 17th-century France.

Saintsbury, George (Edward Bateman) (b. Oct. 23, 1845, Southampton, Hampshire, Eng.—d. Jan. 28, 1933, Bath, Somerset) English literary historian and critic. When the school at which he was teaching failed in 1876, he decided to write for a living. He produced several successful volumes of criticism of French literature and extensive writings on English literature. Though he formulated no philosophy of criticism, his works were influential because they combined authoritative scholarship with the popular appeal of entertaining prose. They include *A History of Criticism and Literary Taste in Europe from the Earliest Texts to the Present Day* (1900–04), one of the first surveys of critical literary theory and practice.

Saipan \sī-'pan, sī-'pän\ Island (pop., 2000: 62,392), Northern Mariana Islands, in the western Pacific Ocean. It has an area of 42 sq mi (109 sq km). Its chief settlement, Chalan Kanoa, is the Northern Marianas' commonwealth centre. Ruled by Spain (1565–1899), it then passed to Germany (1899–1914). It was a Japanese mandate from 1920, but in 1944 during World War II it was captured by U.S. forces after fierce fighting. It subsequently was the headquarters of the U.S.-administered UN Trust Territory of the Pacific Islands (terminated 1990). Copra is the island's chief product.

Sais \'sā-is\ *Arabic* **Ṣā al-Ḥajar** Ancient Egyptian city. Located in the delta on the Canopic, or Rosetta, branch of the Nile River, it was from prehistoric times the site of the chief shrine of Neith, goddess of war and the loom. It became the capital of Egypt under Psamtik I (r. 664–609 BC). His successors of the 26th dynasty also had their capital there. Enriched by trade from the Mediterranean region and Africa, the Saite kings built fine temples, palaces, and tombs. Inscribed stones found on the site and in nearby villages are all that remain of the once-great city.

Saivism See Shaivism

saivo \'sī-ˌvü\ One of the Sami regions of the dead, where the deceased lead happy lives with their families and ancestors, acting in every way as they did on earth. In Norway the *saivo* world was thought to exist in the mountains, whereas in Finland it was usually believed to be under special double-bottomed lakes. These localities were regarded as sacred and as sources of power that could be used by the shaman, or noaide. When the *noaide* wished to go into a trance, he would ask his guardian spirits from the *saivo* to aid him.

Sakakura \ˌsä-kä-'kù-rä\ **Junzō** (b. May 29, 1904, Gifu prefecture, Japan—d. Sept. 1, 1969, Tokyo) Japanese architect. He was one of the first to combine 20th-century European architecture with traditional Japanese elements. His first outstanding East-West blend was the Japanese pavilion at the 1937 World Exposition in Paris. He worked in the Paris office of Le Corbusier (1931–36) and was known as Le Corbusier's leading advocate in Japan. His major works include the Museum of Modern Art in Kamakura (1951) and Shinjuku Station Square and Odakyū Department Store in Tokyo (1964–67).

sake \'sä-kē\ Japanese alcoholic beverage made from fermented rice. It dates to at least the 3rd century AD. Sake is light in colour and noncarbonated, with a sweet flavour; its alcohol content is about 18% by volume. Often mistakenly called a wine, sake is closer in its method of manufacture to beer. Steamed rice is combined with a mold that converts the rice starch to fermentable sugars; the mix is kneaded into a paste, twice fermented (with fresh rice and water added), filtered, and bottled. In Japan, where it is the national beverage and the traditional drink of the Shinto gods, sake is warmed in a small earthenware or porcelain vessel before being blessed and served in small porcelain cups.

Sakha *or* **Yakut** Siberian people who speak a Turkic language. Most were formerly seminomadic, raising cattle and horses. They lived in winter settlements of earth-covered log huts and summer camps of conical birch-bark tents near pasturage and sources of hay for winter fodder. Through assimilation, many southern Sakha turned to farming while northern Sakha adopted reindeer breeding from the Evenk. The Sakha were noted for their ironwork (supernatural power was attributed to blacksmiths) and also made pottery; traditional arts such as ivory and wood carving are still practiced. Filmmaking has become popular more recently. The Sakha number about 380,000. See also Siberian peoples.

Sakhalin \ˌsä-kä-'lēn\ **Island** Island, extreme eastern Russia. Together with the Kuril Islands, it forms an administrative region of Russia. It is 589 mi (948 km) long and a maximum of 100 mi (160 km) wide; it covers 29,500 sq mi (76,400 sq km). Sakhalin was first settled by Russians in 1853, and it came under Russian control in 1875 when Japan ceded it in exchange for the Kuril Islands. Japan held the southern part from 1905 to 1945, then ceded it and the Kurils to the U.S.S.R. The economy is dominated by fishing, lumbering, coal mining, and the extraction of oil and natural gas in the north.

Sakharov \'sä-kə-ˌrȯf**, Andrey (Dmitriyevich)** (b. May 21, 1921, Moscow, Russia—d. Dec. 14, 1989, Moscow) Russian nuclear physicist and human rights advocate. He worked with I.Y. Tamm (1895–1971) to develop the Soviet Union's first hydrogen bomb, but in 1961 he opposed Nikita Khrushchev's plan to test a 100-megaton hydrogen bomb in the atmosphere. In 1968 he published in the West "Progress, Coexistence, and Intellectual Freedom," which called for nuclear arms reduction and criticized Soviet repression of dissidents. He and his wife, Yelena G. Bonner, continued to advocate civil liberties and reform in the Soviet Union. In 1975 Sakharov received the Nobel Prize for Peace but was forbidden to travel to Oslo to receive it. In 1980 he was exiled to the closed city Gorky (now Nizhny Novgorod); his wife was exiled there in 1984. They were released in 1986 and returned to Moscow. Elected to the Congress of People's Deputies in April 1989, Sakharov had his honours restored and saw many of the causes for which he had fought and suffered become official policy under Mikhail Gorbachev.

Saki \'sä-kē\ *orig.* **H(ector) H(ugh) Munro** (b. Dec. 18, 1870, Akyab, Burma—d. Nov. 14, 1916, near Beaumont-Hamel, France) Scottish writer. A journalist early in his career, he wrote political satires and

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worked as a foreign correspondent before settling in London in 1908. His comic short stories and sketches, which satirize the Edwardian social scene, were published in *Reginald* (1904), *Reginald in Russia* (1910), *The Chronicles of Clovis* (1911), and *Beasts and Super-Beasts* (1914); the best-known include "Tobermory" and "The Open Window." Studded with epigrams and with well-contrived plots, his stories reveal a vein of cruelty and a self-identification with the enfant terrible. He was killed in action in World War I.

Sakkara See ṢAQQĀRAH

sakti See SHAKTI

Saktism See SHAKTISM

Sakyamuni \'säk-yə-ˌmü-nē\ Epithet of the BUDDHA Gautama meaning "sage of the Sakyas." The Sakyas were a clan into which the Buddha was born a prince; their kingdom covered an area that is today in southern Nepal and part of what is now northern UTTAR PRADESH, India.

Saladin \'sa-lə-dᵊn\ *byname of* **Ṣalāḥ al-Dīn Yūsuf ibn Ayyūb** (b. 1137/38, Tikrīt, Mesopotamia—d. March 4, 1193, Damascus, Syria) Kurdish sultan of Egypt, Syria, Yemen, and Palestine and founder of the AYYŪBID DYNASTY. Though as a youth he preferred religious to military studies, he began his military career under his uncle, a military commander of the Zangid dynasty. On his uncle's death, Saladin became vizier of the FĀṬIMID DYNASTY of Egypt. In 1171 he abolished the Shīʿite Fāṭimid caliphate and announced a return to Sunnite Islam in Egypt. From 1174, as sultan of Egypt and Syria, he succeeded in uniting Egypt, Syria, northern Mesopotamia, and Palestine. His reputation as a generous and virtuous but firm ruler rekindled Muslim resistance to the CRUSADES. In 1187, turning his full strength against the Latin CRUSADER STATES, he captured JERUSALEM, which had been in Christian hands for 88 years. Whereas the Christian conquest had been marked by slaughter, Saladin's troops demonstrated courteous and civilized behaviour. His victory deeply shocked the West and led to the call for the Third Crusade (1189–92), which matched him against RICHARD I (the Lionheart); their stalemate resulted in a peace that gave the Crusaders only a small strip of land from Tyre to Yafo (Jaffa). Many Muslims consider Saladin the paradigm of the pious and virtuous ruler.

Salado \sä-'lä-thō\ **River** River, eastern Argentina. It flows through the PAMPAS, generally southeast for about 400 mi (640 km) to the Atlantic Ocean, where it empties southeast of BUENOS AIRES. Before 1800 it marked the frontier between areas colonized by Spain to the northeast and regions inhabited by indigenous Indians to the southwest.

Ṣalāḥ al-Dīn Yūsuf ibn Ayyūb See SALADIN

Salamanca *ancient* **Salmantica** *or* **Helmantica** City (pop., 2001: 156,368), western Spain. An important Iberian settlement, it was sacked by HANNIBAL in 217 BC. It later became a Roman station. Captured by Moors in the 8th century, it was reconquered by Christians from 1087 to 1102. It was occupied by the French in the PENINSULAR WAR (1808–14). It is a cultural centre as well as the commercial centre of an agricultural district. Its many landmarks include the 12th-century Romanesque cathedral, the Gothic-style cathedral (begun 1513), and the University of Salamanca (founded 1218).

salamander Any member of about 400 species in 10 AMPHIBIAN families (order Caudata), commonly found in fresh water and damp woodlands, principally in temperate regions of the Northern Hemisphere. Salamanders are generally nocturnal, short-bodied, 4–6 in. (10–15 cm) long, and brightly coloured. They have a tail, two pairs of limbs of roughly the same size, moist, smooth skin, teeth on the jaws and roof of the mouth, and, usually, internal fertilization. The largest species, the Chinese giant salamander (*Andrias davidianus*), is 5 ft (1.5 m) long. Salamanders eat insects, worms, snails, and other small animals, including members of their own species. See also HELLBENDER; NEWT.

Salamander (*Salamandra terrestris*)
JACQUES SIX

Salamis \'sa-lə-məs\ Ancient city, Cyprus. Located on Cyprus's eastern coast, it had an active trade with PHOENICIA, EGYPT, and CILICIA. According to tradition, it was founded by Teucer, a hero of the TROJAN WAR. A major Hellenic centre during the struggles between Greece and Persia, it was the scene of a Greek naval victory in 449 BC; in 306 BC the Macedonian king DEMETRIUS I (POLIORCETES) defeated PTOLEMY I (SOTER) of Egypt near there. The city was visited later by SS PAUL and Barnabas. It was known as Constantia after the Byzantine emperor Constantius II rebuilt it (AD 337–61). It was abandoned after its destruction by the Arabs in 647–48.

Salamis, Battle of (480 BC) Significant naval battle of the PERSIAN WARS, the first ever recorded. (AESCHYLUS served in the battle and wrote *The Persians*, which is the earliest of his works to survive.) The Greek fleet of some 370 TRIREMES, under the command of THEMISTOCLES, lured the Persian fleet of about 800 GALLEYS into the narrow strait between the island of Salamis and the Athenian port of Piraeus. There the highly maneuverable triremes sank about 300 Persian vessels while losing only about 40 of their own. As a result of this battle, XERXES had to postpone his planned land offensive, giving the Greek city-states time to unite against him.

Salan \sȧ-'läⁿ**, Raoul (-Albin-Louis)** (b. June 10, 1899, Roquecourbe, France—d. July 3, 1984, Paris) French military officer who sought to prevent Algerian independence. During a military career in which he became the French army's most decorated soldier, he served in France during World War I (1914–18), French West Africa (1941–44), French Indochina (1945–53), and Algeria (1956–62). Rebelling against CHARLES DE GAULLE's decision to free Algeria, in 1961 he formed a right-wing extremist group, the Secret Army Organization, which terrorized France and Algeria. He was captured in 1962 and tried for treason.

Salazar \ˌsa-lə-'zär**, António de Oliveira** (b. April 28, 1889, Vimierio, Port.—d. July 27, 1970, Lisbon) Portuguese prime minister (1932–68). A professor of economics, he was appointed by Pres. António Óscar de Fragoso CARMONA as finance minister (1928) and later prime minister (1932). His new constitution established the authoritarian New State, curtailing political freedom and concentrating on economic recovery, and he thenceforth ruled as a virtual dictator. Sympathetic to FRANCISCO FRANCO and the Axis Powers, he maintained Portugal's neutrality in World War II, and after the war he led Portugal into NATO. He greatly improved the country's transportation, utilities, and education systems. He fought to preserve Portugal's African colonies after the general decolonization. Incapacitated by a stroke in 1968 after 36 years in power, he was not told when he was replaced as prime minister.

Salé \sa-'lā\ *Arabic* **Sla** \'slä\ City (pop., 1994: city, 504,420; Rabat-Salé metro. area, 1,385,872), northwestern Morocco. Located at the mouth of the Bou Regreg River, opposite RABAT, it was founded in the 10th century and reached its peak as a merchant port. After 1627 Salé, with Rabat as its vassal, became the corsair republic of Bou Regreg and the base for the Sallee Corsairs, the most dreaded of the BARBARY COAST pirates. The two cities grew together until the Bou Regreg silted up and Salé port was closed. It has many mosques and mausoleums; its greatest shrine is the tomb of Sīdī ʿAbd Allāh ibn Ḥasan, the city's patron saint.

Salem City (pop., 2000: 136,924), capital of Oregon, U.S. It lies along the WILLAMETTE RIVER, southwest of PORTLAND. Founded in 1840, the town prospered as migration increased over the OREGON TRAIL. It became the state capital in 1859. It was an early river port whose growth was stimulated by rail connections in the 1870s. It is a food-processing centre for a fruit-growing and dairy area and has wood and light manufacturing industries.

Salem witch trials (May–October 1692) American colonial persecutions for witchcraft. In the town of Salem, Massachusetts Bay Colony, several young girls, stimulated by supernatural tales told by a West Indian slave, claimed to be possessed by the devil and accused three women of witchcraft. Under pressure, the accused women named others in false confessions. Encouraged by the clergy, a special civil court was convened with three judges, including SAMUEL SEWALL, to conduct the trials. They resulted in the conviction and hanging of 19 "witches" and the imprisonment of nearly 150 others. As public zeal abated, the trials were stopped and then condemned. The colonial legislature later annulled the convictions.

Salerno City (pop., 2001 prelim.: 144,078), southern Italy. Located on the Gulf of Salerno, it was founded by the Romans in 197 BC on the site of an earlier town. Part of a Lombard duchy from AD 646, it was the capital of an independent Lombard principality from 839 to c. 1076. It was then conquered by the Norman ROBERT GUISCARD and became his capital. It was later incorporated into the Kingdom of NAPLES. During World War II, Salerno's

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coast was the scene of a major battle (September 1943) between Allied landing forces and German troops. It is an active seaport in an industrial area; its landmarks include a medical school (the earliest in Europe, probably founded in the 9th century) and the cathedral (845, rebuilt 1076–85) that contains the tombs of St. Matthew and Pope Gregory VII.

sales tax Levy imposed on the sale of goods and services. A sales tax on the manufacture, purchase, sale, or consumption of a specific commodity is known as an excise tax. Though excise taxes have been used since ancient times, the general sales tax is a comparatively recent innovation. Sales taxes are ad valorem taxes, imposed "according to the value" (i.e., monetary value) of the taxable commodity. They are classified according to the levels of business activity at which they are imposed—production, wholesale, or retail. They account for significant portions of the revenue of most U.S. states and Canadian provinces. A variation of the sales tax, the VALUE-ADDED TAX, became popular in western European countries and is widely used. Most sales taxes are borne by the consumer, since even where they are levied on production or wholesale goods, part or all of the cost is shifted to the consumer in the form of higher prices. Because the retail sales tax is considered a REGRESSIVE TAX, essential goods such as food, clothing, or drugs are sometimes exempted or taxed at a lower level. See also INCOME TAX; PROGRESSIVE TAX.

Salesbury \'sālz-ˌber-ē**, William** (b. c. 1520, Cae Du, Llansannan, Denbighshire, Wales—d. c. 1584, Llanrwst) Welsh lexicographer and translator. He spent most of his life at Llanrwst, Wales, following antiquarian, botanical, and literary pursuits. His collection of Welsh proverbs, *The Whole Sense of a Welshman's Head* (1546), may be the first book printed in Welsh. Salesbury compiled the first Welsh-English dictionary (1547) and, with Richard Davies, translated the New Testament into Welsh (1567).

Salgado, Sebastião (b. Feb. 8, 1944, Aimorés, Braz.) Brazilian photojournalist. He briefly pursued a career as an economist before switching his focus to photography in 1971. Over the next decade he photographed stories such as the famine in Niger and the civil war in Mozambique. In 1979 he joined the prestigious Magnum Photos cooperative for photojournalists, and two years later he gained prominence as a result of his photograph of John Hinckley's attempt to assassinate U.S. Pres. Ronald Reagan. By the mid 1980s Salgado devoted himself almost entirely to long-term projects that told a story through a series of images, often focusing on the homeless and downtrodden. Among his critically acclaimed books of photographs are *Other Americas* (1986), *Workers* (1993), and *Migrations: Humanity in Transition* (2000).

salicylic \ˌsa-lə-'si-lik\ **acid** White, crystalline solid ORGANIC COMPOUND used chiefly to make ASPIRIN and other pharmaceutical products, including methyl salicylate (oil of WINTERGREEN, for medicines and flavourings), phenyl salicylate (for sunburn creams and pill coatings), and salicylanilide (a cutaneous FUNGICIDE). Its molecular structure, with the formula $C_6H_4(OH)COOH$, consists of a six-membered aromatic ring (see AROMATIC COMPOUND) having a hydroxyl group (—OH) and a carboxyl group (—COOH) bonded to adjacent carbon atoms; as such, it is both a PHENOL and a CARBOXYLIC ACID. It and certain derivatives occur naturally in some plants, particularly species of *Spiraea* and *Salix* (WILLOW). Large amounts are used in producing certain dyes.

Salieri \säl-'yer-ē**, Antonio** (b. Aug. 18, 1750, Legnago, Republic of Venice—d. May 7, 1825, Vienna, Austria) Italian composer. He moved to Vienna in 1766 with the imperial court composer Florian Gassmann (1729–74), and he remained there most of his career. On Gassmann's death, Salieri became composer and conductor of the Italian opera at the imperial court, and later court kapellmeister (1788). Vienna's most popular opera composer for much of the last quarter of the 18th century, he had many important students, including Ludwig van Beethoven, Franz Schubert, and Franz Liszt. In addition to his more than 40 operas, he wrote much other secular and sacred music. Though he and Wolfgang Amadeus Mozart were rivals, there is no basis to the story that he poisoned Mozart, and it is unlikely that he claimed to have done so.

Salinas \sə-'lē-nəs\ City (pop., 2000: 151,060), western California, U.S. Located in the Salinas valley east of Monterey, it was a crossroads on El Camino Real, the old Spanish trail between San Diego and San Francisco. It was settled in 1856 and became a cattle centre. The arrival of the Southern Pacific Railroad in 1868 stimulated agricultural development. Salinas was the birthplace of John Steinbeck, who often referred to it in his books, especially in *East of Eden*.

Salinas \sä-'lē-näs\ **(de Gortari), Carlos** (b. April 3, 1948, Mexico City, Mex.) President of Mexico (1988–94). Son of a Mexican senator, Salinas earned a Ph.D. in economics at Harvard University and held various governmental posts until he was elected president in 1988 by a slim margin; vote fraud was widely charged. He pursued a program of economic retrenchment and privatization, selling off hundreds of inefficient state-owned corporations and spending part of the proceeds on infrastructure and social services. In 1991–92 his government co-negotiated the North American Free Trade Agreement. The economic collapse immediately following his term made him the target of bitter criticism. The assassination of his party's nominee as his successor was linked to Salinas's associates, and Salinas fled to the U.S. and eventually Ireland. His brother Raúl, widely suspected of extensive corruption, was convicted in 1999 of complicity in another assassination.

Salinger \'sa-lin-jər**, J(erome) D(avid)** (b. Jan. 1, 1919, New York, N.Y., U.S.) U.S. writer. He began to publish short stories in periodicals in 1940. After World War II his stories, some based on his army experiences, appeared increasingly in *The New Yorker*. His entire literary output comprises 13 stories and novellas— collected in *Nine Stories* (1953), *Franny and Zooey* (1961), and *Raise High the Roof Beam, Carpenters, and Seymour: An Introduction* (1963)—and *The Catcher in the Rye* (1951), a novel of adolescent anguish that won great critical and popular admiration, especially among college students. He retreated into a mysterious seclusion in New Hampshire and ceased to publish.

Salisbury See Harare

Salisbury, Earl of See Robert Cecil

Salisbury \'sȯlz-bə-rē**, Harrison E(vans)** (b. Nov. 14, 1908, Minneapolis, Minn., U.S.—d. July 5, 1993, near Providence, R.I.) U.S. author and journalist. He was a reporter with United Press (1930–48) before joining *The New York Times*, where he won a 1955 Pulitzer Prize. He later held editorial positions with the *Times*, rising to associate editor (1972–74). The first Western journalist to visit Hanoi during the Vietnam War, he wrote eyewitness accounts that contributed to skepticism in the U.S. about the war's purpose. His 29 books include 10 on Russia and 6 on China.

Salisbury, Robert Arthur Talbot Gascoyne-Cecil, 3rd marquess of (b. Feb. 3, 1830, Hatfield, Hertfordshire, Eng.—d. Aug. 22, 1903, Hatfield) British prime minister (1885–86, 1886–92, 1895–1902). He served in Benjamin Disraeli's government as secretary for India (1874–78) and foreign secretary (1878–80), helping to convene the Congress of Berlin. He led the Conservative Party opposition in the House of Lords, then became prime minister on three occasions beginning in 1885, usually serving concurrently as foreign secretary. He opposed alliances, maintained strong national interests, and presided over an expansion of Britain's colonial empire, especially in Africa. He retired in 1902 in favour of his nephew, Arthur James Balfour.

Salishan \'sā-li-shən\ **languages** Family of about 23 North American Indian languages, spoken or formerly spoken in the Pacific Northwest and adjoining areas of Idaho, Montana, and southern British Columbia. Today Salishan languages are spoken almost exclusively by older adults. They are remarkable for their elaborate consonant inventories and small number of vowels.

saliva Thick, colourless fluid constantly present in the mouth, composed of water, mucus, proteins, mineral salts, and amylase, an enzyme that breaks down starches. One to two litres are produced daily by the SALIVARY GLANDS. Small amounts are continually discharged into the mouth, but the presence, smell, or even thought of food increases flow. Saliva's main function is to keep the inside of the mouth moist, making speech more fluid, dissolving food molecules for taste, and easing swallowing. It also helps control the body's water balance, since lack of it stimulates thirst when water intake has been low. Saliva reduces dental CARIES and infection by removing food debris, dead cells, bacteria, and white blood cells.

salivary gland \'sal-ə-ˌver-ē\ Any of the organs that secrete SALIVA. Three pairs of major glands secrete saliva into the mouth through distinct ducts: the parotid glands (the largest), between the ear and the back of the lower JAW; the submaxillary glands, along the side of the lower jaw; and the sublingual glands, in the floor of the mouth near the chin. There are also numerous small glands in the tongue, palate, lips, and cheeks. The presence, smell, or thought of food normally increases secretion.

Saljūq dynasty See Seljūq dynasty

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Salk \'sȯk**, Jonas (Edward)** (b. Oct. 28, 1914, New York, N.Y., U.S.—d. June 23, 1995, La Jolla, Calif.) U.S. physician and researcher. He received his M.D. from New York University. Working with other scientists to classify poliovirus, he confirmed earlier studies that identified three strains. He showed that killed virus of each strain could induce antibody formation without producing disease. Salk's vaccine was released for use in the U.S. in 1955. From 1963 he directed the Salk Institute in La Jolla, Calif. He was awarded the Presidential Medal of Freedom in 1977.

Sallé \sȧ-'lā**, Marie** (b. 1707—d. July 27, 1756, Paris, Fr.) French dancer and choreographer. She made her debut at the Paris Opéra in 1721. In London and Paris she performed in a new expressive, dramatic style that later was championed as the *ballet d'action* by JEAN-GEORGES NOVERRE. With *Pygmalion* (1734) she became the first woman to choreograph a ballet in which she danced and also the first to discard the traditional restrictive costume for a muslin dress. Her rivalry with MARIE CAMARGO led her to appear more frequently in London, where she danced in several of GEORGE FRIDERIC HANDEL's opera ballets. She retired from the Opéra in 1740.

Sallust \'sa-ləst\ *Latin* **Gaius Sallustius Crispus** (b. c. 86 BC, Amiternum, Samnium—d. 35/34 BC) Roman historian. Sallust probably had military experience before taking political office during the strife of the 50s. He began to write after his political career ended c. 45 BC, becoming one of the great Latin literary stylists, noted for his narrative writings about political personalities, corruption, and party rivalry. His works, whose influence pervades later Roman historiography, are *Catiline's War* (43–42 BC), dealing with corruption in Roman politics; *The Jugurthine War* (41–40), exploring party struggles in Rome in the late 2nd century BC; and *Histories*, of which only fragments remain.

salmon Name that originally referred to the ATLANTIC SALMON (*Salmo salar*) and now also refers to six species of Pacific salmon (genus *Oncorhynchus*, family Salmonidae): CHUM, CHINOOK, PINK, and SOCKEYE salmon; COHO; and the cherry salmon (*O. masu*) of Japan. Adult salmon live at sea, then migrate, fighting rapids and leaping high falls, to the stream where they hatched to spawn. Pacific salmon die soon after spawning; many Atlantic salmon live to spawn again. See also TROUT.

Salmon River River, central Idaho, U.S. It flows northeast past the town of Salmon, where it is joined by the Lemhi River, and then northwest to join the SNAKE RIVER south of the Idaho-Oregon-Washington border. It is about 420 mi (676 km) long. It is the largest tributary of the Snake and flows through an extensive wildlife area of national forests.

salmon trout See LAKE TROUT

salmonella \ˌsal-mə-'ne-lə\ Any of the rod-shaped, gram-negative, non-oxygen-requiring BACTERIA that make up the genus *Salmonella*. Their main habitat is the intestinal tract of humans and other animals. Some of the 2,200 species exist in animals without causing disease; others are serious pathogens. Any of a wide range of mild to serious infections caused by salmonellae are called salmonellosis, including TYPHOID and paratyphoid fever in humans. Refrigeration prevents their reproduction but does not kill them; as a result, many salmonellae can develop in foods, which, when eaten, can cause GASTROENTERITIS. Chickens are major reservoirs of salmonella, and chicken and eggs are the principal source of human poisoning, whose symptoms include diarrhea, vomiting, chills, and painful headaches. Other food sources include unpasteurized milk, ground meat, and fish.

salmonellosis \ˌsal-mə-ˌne-'lō-səs\ Any of several bacterial infections caused by SALMONELLA, including TYPHOID and similar fevers and GASTROENTERITIS (see FOOD POISONING). Meat from diseased animals carries the BACTERIA, and any food can pick it up from infected feces in the field or during storage or from contaminated food or utensils during food preparation. The source is often hard to trace. Eggs from infected hens can carry it within, not just on the shells. Onset is sudden and sometimes severe, with nausea, vomiting, diarrhea, fatigue, and low fever. Most patients recover within days, with some degree of immunity. Prevention requires care in food handling, especially thorough cooking.

Salome \sə-'lō-mē, 'sa-lə-(ˌ)mā\ Stepdaughter of HEROD ANTIPAS, who caused the death of JOHN THE BAPTIST. The event is recounted in the gospels of Matthew and Mark, though her name is given only by the historian JOSEPHUS. John had been imprisoned for denouncing Herod's adulterous marriage to Herodias, but Herod was afraid to kill him. When Salome, daughter of Herodias, danced before the king, he promised to give her anything she asked as a reward, and she requested John's head on a platter. The scene was a popular subject in Christian art.

Salomon \'zä-lō-mȯn**, Erich** (b. April 28, 1886, Berlin, Ger.—d. July 7, 1944, Auschwitz, Pol.) German photographer. He studied law at the University of Munich but soon abandoned his practice to pioneer in photojournalism. He specialized in photographing heads of state in unguarded moments at international conferences and social gatherings. His purpose was to show the human qualities of world leaders, who up to that time had been stereotyped in stiff formal portraits. In May 1944 he was sent to the concentration camp at Auschwitz, where he died.

Salomon \'sa-lə-mən**, Haym** (b. 1740, Lissa, Pol.—d. Jan. 6, 1785, Philadelphia, Pa., U.S.) American patriot and financier. Forced to flee Poland for his revolutionary activities, he arrived in New York in 1772 and soon became a successful merchant and financier. A supporter of the patriot cause in the American Revolution, he was arrested and imprisoned by the British. In 1778 he escaped to Philadelphia, where he opened a brokerage office. He made loans in excess of $600,000 to help finance the new government, extended interest-free private loans to JAMES MADISON, THOMAS JEFFERSON, JAMES MONROE, and others, and obtained French loans to the American government.

Salon \sȧ-'lōü\ Official exhibition of art sponsored by the French government. It originated in 1667 when LOUIS XIV sponsored an exhibit of the works of the members of the Royal Academy of Painting and Sculpture. The Salon derives its name from the exhibition's location in the Salon d'Apollon of the Louvre Palace. After 1737 it became an annual event, and in 1748 the jury system of selection was introduced. During the French Revolution, the Salon was opened to all French artists, though academicians continued to maintain near-total control over the teaching and exhibition of art through most of the 19th century. In 1881 the new Société des Artistes Français began to oversee the Salon, and with the growing importance of independent exhibitions of the works of avant-garde artists, it gradually lost its influence and prestige.

Salon des Indépendants \sȧ-'lōⁿ-dā-zaⁿ-dā-päⁿ-'däⁿ\ Annual unjuried exhibition of the Société des Artistes Indépendants, held in Paris since 1884. Organized as a second SALON DES REFUSÉS, it was established in response to the rigid traditionalism of the official government-sponsored SALON. Its first show exhibited works by PAUL CÉZANNE, PAUL GAUGUIN, HENRI DE TOULOUSE-LAUTREC, Vincent van GOGH, and GEORGES SEURAT. By 1905 HENRI ROUSSEAU, PIERRE BONNARD, HENRI MATISSE, and the Fauves had all exhibited there.

Salon des Refusés \sȧ-'lōⁿ-dā-rə-fyē-'zā\ Art exhibition held in 1863 in Paris by command of NAPOLEON III for those artists whose works had been refused by the jury of the official SALON. Among the exhibitors were CAMILLE PISSARRO, HENRI FANTIN-LATOUR, JAMES M. WHISTLER, and ÉDOUARD MANET, whose scandalous *Le Déjeuner sur l'herbe* was officially regarded as an affront to taste.

Salonika See THESSALONÍKI

salsa *Spanish* **"sauce"** Contemporary Latin American dance music. Salsa developed in Cuba in the 1940s. It drew upon local musical styles, such as *charanga* (featuring primarily strings and flute) and the dance music of the *conjuntos* (bands), and blended them with elements of jazz. In the 1950s salsa began to flourish in New York City, where it incorporated traditional Puerto Rican rhythms, and later, elements from Venezuelan and Colombian music and RHYTHM AND BLUES. Its stars have included CELIA CRUZ, TITO PUENTE, and Willie Colon.

Flower of goatsbeard (*Tragopogon pratensis*)
LOUISE K. BROMAN/ROOT RESOURCES

salsify \'sal-sə-fē, 'sal-sə-ˌfī\ *or* **oyster plant** *or* **vegetable oyster** Biennial herbaceous plant (*Tragopogon porrifolius*) of the COMPOSITE FAMILY, native to the Mediterranean. The thick white taproot is cooked as a vegetable and tastes somewhat like oysters. The plant has purple flowers and narrow leaves

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whose bases usually clasp the stem. Goatsbeard, or meadow salsify (*T. pratensis*), is a weedy European species, naturalized in North America, that has a large yellow flower head. It is occasionally cultivated as an ornamental, and its leaves, flowers, and roots are sometimes eaten in salads.

salt Chemical COMPOUND formed when the hydrogen of an ACID is replaced by a METAL or its equivalent, such as ammonium (NH_4). Typically, an acid and a BASE react to form a salt and water. Most inorganic salts ionize (see ION) in water solution. SODIUM CHLORIDE—common table salt—is the most familiar salt; sodium bicarbonate (BICARBONATE OF SODA), SILVER NITRATE, and calcium carbonate are others.

SALT See STRATETIC ARMS LIMITATION TALKS

salt dome Largely subsurface geologic structure that consists of a vertical cylinder of SALT embedded in horizontal or inclined strata. In the broadest sense, the term includes both the core of salt and the strata that surround and are "domed" by the core. Major accumulations of oil and NATURAL GAS are associated with salt domes in the U.S., Mexico, the North Sea, Germany, and Romania; domes along the Gulf Coast contain large quantities of SULFUR. Salt domes are also major sources of salt and potash on the Gulf Coast and in Germany, and they have been used for underground storage of liquefied propane gas. Storage "bottles," made by drilling into the salt and then forming a cavity by subsequent solution, have been considered as sites for disposal of radioactive wastes.

Salt Lake City City (pop., 2000: 181,743), capital of Utah, U.S. Located on the Jordan River, near the southeastern end of GREAT SALT LAKE, it was founded in 1847 by BRIGHAM YOUNG and a group of 148 MORMONS as a refuge from religious persecution. It was known as Great Salt Lake City until 1868. It prospered from rail connections to become a hub of western commerce and became the state capital in 1896. The largest city in the state, it lies at an altitude of 4,390 ft (1,338 m). It is a commercial centre for nearby mining operations and has diversified manufacturing industries. It is the headquarters of the Mormon Church of Jesus Christ of Latter-day Saints, which influences the social, economic, political, and cultural life of the state and region. It is the site of the Mormon Temple and Tabernacle. It was the host city of the 2002 Winter Olympic Games.

Salt River River, east-central Arizona, U.S. A tributary of the GILA RIVER, it is formed at the confluence of the Black and White rivers. It flows west 200 mi (320 km) and empties into the Gila River southwest of PHOENIX. It is part of the COLORADO RIVER drainage basin. A system of dams forms a chain of lakes that provides hydroelectric power. In pre-Columbian times the river valley was cultivated by HOHOKAM Indians who constructed systems of irrigation canals.

Salta City (pop., 1999 est.: 457,223), northwestern Argentina. It lies in the irrigated Lerma valley in the Andes Mountains on a headstream of the SALADO RIVER. Founded in 1582 as San Felipe de Lerma, it was the scene of the defeat of the Spanish royal forces in 1813 during the Argentine war of independence. The economy is based on farming, lumbering, stock raising, and mining. Its nearby thermal springs are popular with tourists, and it has grown in importance as a centre of archaeological investigations of pre-Columbian Indian cultures, including the INCA.

saltbox CLAPBOARD house of the original New England settlers having two stories in front, a single story in the rear, and a double-sloped roof that is longer over the rear section. It arose from the tradition of locating the kitchen in a lean-to behind the house; the roof was simply extended over the lean-to, creating the characteristic long-in-back silhouette.

Saltillo \säl-'tē-yō\ City (pop., 2000: 562,587), capital of COAHUILA state, northeastern Mexico. Founded in 1575, it was the first Spanish settlement in the area. In 1824–36 it was the capital of a vast province that included what is now Texas and other areas of the American Southwest. It is now a commercial, communications, and manufacturing centre; its products include woolen fabrics, knitted goods, and flour. Gold, silver, lead, and coal are mined in the nearby mountains. Located at an elevation of about 5,250 ft (1,600 m), it has a cool, dry climate that has made it a summer resort.

Salton Sea Saline lake, southeastern California, U.S. The area that is now the lake was a salt-covered sink or depression about 280 ft (85 m) below sea level until 1905–06, when diversion controls on the COLORADO RIVER broke below the California-Mexico border and floodwaters rushed north, filling the depression. In 1907 a line of protective levees was built to prevent further deepening of the depression. The lake has an area of 344 sq mi (890 sq km). Its surface is now about 235 ft (72 m) below sea level, and its salinity is similar to that of seawater. Part of a state recreation area, it has swimming, boating, and camping facilities.

saltpetre *or* **nitre** *also spelled* **saltpeter** *or* **niter** Transparent, colourless, or white powder or crystals of POTASSIUM NITRATE (KNO_3), found native in deposits. It is a strong oxidizing agent (see OXIDATION-REDUCTION), used in fireworks, EXPLOSIVES, matches, fertilizers, glassmaking, steel TEMPERING, and food curing; as a reagent; and as an oxidizer in solid rocket propellants. The term is also used for sodium nitrate (Chile saltpetre) and calcium nitrate (lime saltpetre), both of which are used in the NITRIC ACID industry and as fertilizers, and for ammonium nitrate (Norway saltpetre), a high explosive and fertilizer.

Saluda \sə-'lü-də\ **River** River, west-central South Carolina, U.S. Rising in the BLUE RIDGE Mountains, in northern and southern forks that join northwest of Greenville, the main stream flows southeast past Pelzer. After a course of about 145 mi (233 km), it joins the Broad River at COLUMBIA to form the Congaree River. The name Saluda is of Indian origin, probably meaning "river of corn."

saluki \sə-'lü-kē\ Breed of HOUND whose ancestors may date to 7000 BC. It was sacred to the Egyptians, who called it the "royal dog of Egypt" and used it to hunt gazelle. Keen-sighted and hardy, it resembles a GREYHOUND, with long ears and silky coat. Colours can be solid white, tan, or reddish brown or a combination of black, tan, and white. It stands 18–28 in. (46–71 cm) tall and weighs 45–60 lb (20–27 kg).

Salvador *or* **Bahia** City (pop., 2002 est.: 2,519,500), port, and capital of BAHIA state, northeastern Brazil. Located at the southern tip of a peninsula that separates All Saints Bay from the Atlantic Ocean, it is one of Brazil's oldest cities, founded in 1549 as the Portuguese colonial capital. At the centre of the sugar trade along the bay, it became a prize for privateers, and the Dutch captured it briefly in 1624. Retaken by the Portuguese, it became a major centre for the African slave trade. It has grown continuously since 1940, and its port is one of the country's finest. Important industries include food and tobacco processing, ceramics, and shipbuilding.

salvation In religion, deliverance from fundamentally negative conditions, such as suffering, evil, death, or SAMSARA, or the restoration or elevation of the natural world to a higher, better state. Eastern religions tend to stress self-help through individual discipline and practice, sometimes over the course of many lifetimes, though in MAHAYANA Buddhism BODHISATTVAS and certain buddhas may act as intervening divine agents. In Christianity, JESUS is the source of salvation and faith in his saving power is stressed. Islam emphasizes submission to God. Judaism posits collective salvation for the people of Israel.

Salvation Army International Christian charitable movement. It was founded in 1865 by WILLIAM BOOTH, with the aim of feeding and housing the poor of London. He adopted the name Salvation Army in 1878 and established the organization on a military pattern. Members are called soldiers, and officers earn ranks that range from lieutenant to brigadier. Converts are required to sign Articles of War and to volunteer their services. Doctrines are similar to those of other evangelical Protestant denominations, though Booth saw no need for SACRAMENTS. The meetings are characterized by singing and hand clapping, instrumental music, personal testimony, free prayer, and an open invitation to repentance. Headquartered in London, the Salvation Army now provides a wide variety of social services in more than 100 countries.

salvia \'sal-vē-ə\ Any of about 700 species of herbaceous and woody plants that make up the genus *Salvia*, in the MINT family. Some members (e.g., SAGE) are important as sources of flavouring. Easy to propagate, transplant, and grow in poor soil and drought conditions, salvias are a garden staple. Best-known is the 1–3-ft (30–90-cm) annual scarlet sage (*S. splendens*) from Brazil, whose blazing spikes contrast with dark green, oval leaves from midsummer to frost. Blue sage (*S. farinacea*), of southwestern North America, is a favourite in dried winter bouquets.

Salween River \'sal-ˌwēn\ *Chinese* **Nu Jiang** River, Southeast Asia. Rising in eastern Tibet, it flows generally south for about 1,500 mi (2,400 km) through YUNNAN province, China, and eastern Myanmar (Burma), emptying into the Gulf of Martaban of the ANDAMAN SEA at Moulmein. In its lower course, it forms the frontier between Myanmar and Thailand for about 80 mi (130 km). It is the longest river in Myanmar and is navigable by small craft in certain sections, but dangerous rapids hinder its use as a major waterway.

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Salyut \sȧl-'yüt\ Any of a series of seven Soviet SPACE STATIONS (of two designs) placed into Earth orbit in the 1970s and early '80s that served as living quarters and scientific laboratories or military reconnaissance platforms. Manned SOYUZ spacecraft and robotic Progress cargo ferries routinely rendezvoused and docked with the Salyuts to transfer cosmonauts and supplies. Salyut 1 (launched 1971) was the world's first space station; after staying aboard 23 days, the inaugural crew died while returning to Earth. Salyut 6 (1977), the first with an improved design, was a highly successful scientific station that hosted a series of international visitors. Salyut 7 (1982) was succeeded by MIR.

Salzburg *ancient* **Juvavum** City (pop., 2001: city, 142,662; urban agglom., 210,276), north-central Austria. Located on the Salzach River, it began as a Celtic settlement and later became the site of a Roman town. It was made a bishopric by St. BONIFACE in 739 and was raised to an archbishopric in 798. Its archbishops became princes of the HOLY ROMAN EMPIRE in 1278; Salzburg became the seat of their powerful ecclesiastical principality. A music centre for centuries, it is the birthplace of Wolfgang Amadeus MOZART; the annual Salzburg Festival is held there. Notable buildings include Renaissance and Baroque houses, archiepiscopal palaces, and a 17th-century cathedral.

sama \sȧ-'ma\ In SUFISM, the practice of listening to music, chanting, and dancing as a means of producing a state of religious ecstasy and mystical trance. Practitioners hold that music prepares the soul for a deeper comprehension of divine realities and a better appreciation of divine music. God, as the source of beauty, is taken to be approachable through these activities because they contain or exemplify beauty. It is stressed that music is only a means to approach the spiritual realm, and strong ascetic training is required to ensure that music so employed does not arouse base instincts.

samadhi \sə-'mä-dē\ State of intense concentration or absorption of consciousness, the product of meditation. In Hinduism, it is achieved through YOGA, in which the consciousness is absorbed in the object of meditation. In Buddhism, samadhi is the result of mind-development as distinct from insight-development (see VIPASSANA), and is attainable by non-Buddhists as well as Buddhists. In ZEN Buddhism, samadhi allows the meditator to overcome dualistic subject-object awareness through unity with the object of meditation.

Samar \'sä-ˌmär\ Island (pop., 2000: 1,517,585), east-central Philippines. The third largest Philippine island after LUZON and MINDANAO, it has an area of 5,050 sq mi (13,080 sq km) and is one of the VISAYAN group. In World War II it was occupied by the Japanese in 1942 and was retaken by the U.S. in 1944. The rugged interior is sparsely settled; permanent settlements are generally coastal. Coconuts and abaca are the main cash crops. The island is well forested, and there are logging and sawmill operations on the eastern coast.

Samara \sə-'mä-rə\ *formerly (1935–91)* **Kuybyshev** \'kü-ē-bə-shəf\ City (pop., 2002: 1,158,100) and river port, western RUSSIA. Located on the left bank of the VOLGA RIVER at its confluence with the Samara River, it was founded in 1586 as a fortress protecting the Volga trade route. It was the scene of the rebellion of YEMELYAN PUGACHOV against CATHERINE II in 1773–74. Samara later became a major trade centre. Its growth was stimulated during World War II by the relocation there of numerous government functions when MOSCOW was threatened by German attack. It is highly industrialized and is the centre of a network of pipelines. Oil and petrochemicals are the major industries.

Samaria \sə-'mar-ē-ə\ Central region, ancient Palestine. Extending about 40 mi (65 km) north-south and 35 mi (55 km) east-west, it was bounded by GALILEE to the north, JUDAEA to the south, the Mediterranean Sea to the west, and the JORDAN RIVER to the east. It corresponds roughly to the northern portion of the modern WEST BANK territory. Ancient Shechem (near modern Nābulus) was the region's crossroads and political centre until the Assyrian conquest of Israel in the 8th century BC. The town of Samaria, its capital, was built by King Omri c. 880 BC. It was taken by SARGON II in c. 724–721 BC, and its inhabitants were transported into captivity. It was rebuilt by HEROD the Great, who renamed it Sebaste in honour of the Roman emperor AUGUSTUS (Greek, Sebastos). In AD 6 the region became part of the Roman province of Judaea.

Samaritan Member of a now nearly extinct Jewish community. Calling themselves Bene-Yisrael ("Children of Israel"), or Shamerim ("Observant Ones"), they claim to be related to those Jews of ancient Samaria who were not deported from Israel by the Assyrians in 722 BC. The Pentateuch (first five books of the Old Testament) is their sole norm of religious observance. Jews who returned to their homeland after the BABYLONIAN EXILE would not accept their help in building the Second Temple of JERUSALEM. Consequently, in the 4th century BC the Samaritans built their own temple in Nābulus, at the base of Mount Gerizim, in the present-day WEST BANK. The modern population (about 500 persons) is distributed between Nābulus and the city of Ḥolon in ISRAEL. All live in semi-isolation, marrying only within their own community. They pray in Hebrew but have adopted Arabic as their vernacular.

Samarkand \ˌsä-mər-'känd\ *or* **Samarqand** City (pop., 1999 est.: 362,300), east-central UZBEKISTAN. One of the oldest cities in Central Asia, it was known as Maracanda in the 4th century BC and was captured by ALEXANDER THE GREAT in 329. From the 6th century AD it was ruled by various Turkish, Arab, and Persian groups and was an important point on the SILK ROAD from China to Europe until its destruction by GENGHIS Khan in 1220. It became the capital of the empire of TIMUR (Tamerlane) c. 1370; he made it the most important economic and cultural centre in the region. The old city contains many fine examples of Central Asian architecture, some dating to the 14th century; this area was designated a UNESCO WORLD HERITAGE SITE in 2001. It became a provincial capital of the Russian Empire in 1887, and it grew considerably during the Soviet period.

samba Ballroom dance of Brazilian origin, popularized in the U.S. and Europe in the 1940s. Danced to music in ¼ time with a syncopated rhythm, the dance is characterized by simple forward and backward steps and tilting, rocking body movements. In Brazil an older African type of samba is also danced in circles or double lines as a group dance. For decades the samba has dominated Brazilian popular music.

Sambhar \'säm-bər\ **Lake** Salt lake, east-central RAJASTHAN state, India. Located west of JAIPUR, it is about 90 sq mi (230 sq km) in area and is India's largest lake. The soluble sodium compounds stored in the lake's underlying silt have accumulated by the evaporation of water brought down by annual river flooding. The lake's bed, usually dry in the hot months, becomes covered by salt sheets, which from a distance resemble snow.

Samhain See HALLOWEEN

Sami \'sä-mē\ *or* **Lapp** Any of the descendants of ancient nomadic peoples who inhabited northern Scandinavia. They may be Paleo-Siberian or alpine peoples from central Europe. Reindeer hunting was the basis of their life from earliest times; herding was the basis of their economy until recently. They became nomadic a few centuries ago. The three Sami languages, mutually unintelligible, are sometimes considered dialects of one language of the FINNO-UGRIC branch of the Uralic family. They number about 70,000.

samizdat \'sä-mēz-ˌdät\ System whereby literature suppressed by the Soviet government was clandestinely written, printed, and distributed; also, the literature itself. Samizdat began appearing in the 1950s, first in Moscow and Leningrad, then throughout the Soviet Union. It typically took the form of carbon copies of typewritten sheets that were passed from reader to reader. The subjects included dissident activities, protests addressed to the regime, transcripts of political trials, analyses of socioeconomic and cultural themes, and even pornography. Samizdat disappeared when media outlets independent of the government emerged in the early 1990s.

Samkara See SANKARA

Samkhya \'səŋ-kyä, 'səm-kyä\ One of the six orthodox systems (DARSHANS) of Indian philosophy. It adopts a consistent DUALISM between matter and soul (see PRAKRITI AND PURUSHA), which are sufficient to account for the existence of the universe; it does not hypothesize the existence of a god. Samkhya also makes a thoroughgoing distinction between psychological and physical functions on the one hand and pure "personhood" on the other.

Samnite Any member of an ancient warlike tribe of the mountainous centre of southern Italy. The Samnites were probably related to the SABINES. Originally allies of Rome against the Gauls (354 BC), they later fought three wars against the Romans (343–341, 316–304, 298–290). Though defeated, the Samnites later helped PYRRHUS and HANNIBAL in their wars against Rome. They also fought in the SOCIAL WAR and unsuccessfully took part in the civil war against SULLA (82 BC).

Samoa *officially* **Independent State of Samoa** *formerly* **Western Samoa** Island country, central South Pacific Ocean, among the westernmost of the island nations of Polynesia. Area: 1,093 sq mi (2,831 sq

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km). Population (2005 est.): 185,000. Capital: Apia (on Upolu Island). The people are mainly Polynesian, closely akin to Tongans and to New Zealand's Maori. Languages: Samoan, English (both official). Religion: Christianity (mostly Protestant; also Roman Catholic, other Christians). Currency: tala. Samoa is part of the Samoan archipelago and consists of two major islands, Upolu and Savai'i, both of which are volcanic. There are also seven small islands, two of which, Apolima and Manono, are inhabited. Samoa has a developing economy based mainly on agriculture, with some light manufacturing, fishing, lumbering, and tourism. It is a constitutional monarchy with one legislative house; the paramount chief is the head of state, and the head of government is the prime minister. Polynesians inhabited the islands for thousands of years before Europeans arrived there in the 18th century. The islands were contested by the U.S., Britain, and Germany until 1899, when they were divided between the U.S. and Germany. In 1914 Western Samoa was occupied by New Zealand, which received it as a League of Nations mandate in 1920. After World War II it became a UN trust territory administered by New Zealand. It achieved independence in 1962. In 1997 the word Western was dropped from the country's name.

Samoa, American See American Samoa

Samory *in full* **Samory Touré** \sä-'mȯr-ē-tü-'rā\ (b. c. 1830, near Sarranko, Upper Guinea—d. June 2, 1900, Gabon, French Congo) Muslim reformer and military adventurer. A member of the Malinke people, Samory in 1868 proclaimed himself a religious chief and led a band of warriors in establishing a chiefdom in the Kankan region of Guinea. He fought the French in 1883, 1886, and 1891, managing to expand into the Sudan, but he was ultimately forced to transfer his kingdom to the upper Ivory Coast. Captured in 1898, he died two years later.

Sámos \'sä-ˌmōs\ Island (pop., 1991: 42,000), Greece. In the Aegean Sea, Sámos is located off the western coast of Turkey, from which it is separated by the Sámos Strait. Wooded and mountainous, the island has an area of 184 sq mi (476 sq km). Settled by the Ionians in the 11th century BC, it was a leading commercial centre of Greece by the 7th century BC. It was noted for its cultural achievements, especially in sculpture, during the 6th-century-BC reign of Polycrates. Ruled successively by Persia, Athens, Sparta, Rome, Byzantium, and Turkey, it was annexed to Greece in 1912. The island is fertile and produces wine, olives, fruit, cotton, and tobacco.

Samoyed *or* **Samoyede** \'sa-mə-ˌyed\ Breed of sturdily built, husky-like dog developed in Siberia, where Siberian peoples kept it as a sled dog, companion, and herd dog for their reindeer. It has erect ears, dark, almond-shaped eyes, and a characteristic "smile." Its long, heavy coat is white, cream-coloured, grayish yellow (biscuit), or white-and-biscuit. It stands 19–24 in. (48–60 cm) tall and weighs 50–65 lb (23–30 kg). Gentle, loyal, and intelligent, it makes a capable guard and a good companion.

Samoyed
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sampo \'säm-pō\ In Finnish mythology, a mysterious object that has been variously identified but is typically believed to be a cosmological pillar that supports the vault of heaven. Because it is the axis around which the heavens revolve, all life depends on it as the source of all good. In one legend, the creator-smith Ilmarinen forged the *sampo* for Louhi, the hag-goddess of the underworld, and then stole it back, resulting in its near-destruction. In the Kalevala, *sampo* is a magic mill that grinds out an endless supply of salt, gold, and meal for its possessor.

Sampras, Pete (b. Aug. 12, 1971, Washington, D.C., U.S.) U.S. tennis player. He learned tennis after moving to southern California in 1978. He was a five-time U.S. Open champion (1990, 1993, 1995–96, 2002), seven-time Wimbledon champion (1993–95, 1997–2000), and two-time Australian Open champion (1994, 1997). In 2000 he won his 7th Wimbledon men's singles trophy, setting a world record of 13 grand-slam victories; he claimed his 14th grand-slam title at the 2002 U.S. Open. He was known for his high-powered serves, accurate volleys, and unassuming demeanour. In 2003 Sampras retired from professional tennis.

Sampson, William T(homas) (b. Feb. 9, 1840, Palmyra, N.Y., U.S.—d. May 6, 1902, Washington, D.C.) U.S. naval officer. After graduating from Annapolis, he served in the American Civil War. He was superintendent of the U.S. Naval Academy (1886–90) and chief of the ordnance bureau (1893–97). In the Spanish-American War he commanded the Atlantic squadron in its blockade of the Spanish fleet at Santiago de Cuba (1898). When the Spanish tried to escape from the harbour, his squadron destroyed the fleet. Though he had outlined the plans for the battle, he was absent on shore when it took place. Credited with the victory, he was promoted to rear admiral.

samsara \səm-'sär-ə, səŋ-'sär-ə\ In Buddhism and Hinduism, the endless round of birth, death, and rebirth to which all conditioned beings are subject. Samsara is conceived as having no perceptible beginning or end. The particulars of an individual's wanderings in samsara are determined by karma. In Hinduism, moksha is release from samsara. In Buddhism, samsara is transcended by the attainment of nirvana. The range of samsara stretches from the lowliest insect (sometimes the vegetable and mineral kingdoms are included) to Brahma, the highest of the gods.

samskara \səm-'skär-ə, səŋ-'skär-ə\ In Hinduism, any of the personal sacraments traditionally observed at every stage of life, from the moment of conception to the scattering of one's funeral ashes. The observance of the samskaras is based on custom and on such texts as the Puranas, and differs considerably according to region, caste, or family. The most generally accepted list of 16 traditional samskaras includes ceremonies for conception, a male birth, name-giving, the upanayana, and marriage. There is also a body of noncanonical samskaras performed by and for the benefit of women.

Samson Israelite warrior hero of the Old Testament Book of Judges. His mother had been told by an angel that she would bear a son whose life would be dedicated to God and whose hair must never be cut. Samson performed many powerful acts, including slaying a lion and moving the gates of Gaza. When he revealed to a Philistine woman, Delilah, that his hair was the source of his strength, she shaved his head while he was sleeping, leaving him powerless. He was blinded and enslaved by the Philistines, but later his strength was restored and he pulled down the pillars of a temple where 3,000 Philistines had gathered, killing them and himself.

Samuel (c. 11th century BC) Old Testament prophet, the first after Moses and the last of the judges of ancient Israel. His story is told in two biblical books (1 and 2 Samuel) that relate the history of Israel in the 11th–10th century BC. During this period, the first monarchy of Israel was established and the tribes of Israel united under a single kingdom with its capital at Jerusalem. Samuel received a revelation that led to the installation of Saul as king, but later announced an oracle rejecting Saul and secretly anointed David as king. Scholars dispute whether the historical Samuel was the author of the two books that bear his name.

Samuel (d. Oct. 6, 1014) Tsar of Western Bulgaria (980–1014). Ruling originally in Macedonia, he conquered Serbia, northern Bulgaria, Albania, and northern Greece. He revived the Bulgarian patriarchate and in the 980s defeated Basil II. However, his struggle with the Byzantines continued until 1014, when Basil defeated Samuel's army at the Battle of Belasitsa. At Basil's order, the 15,000 Bulgarian prisoners were blinded and then returned to Samuel, who is said to have died of shock.

Samuel (of Mount Carmel and of Toxeth), Herbert Louis Samuel, 1st Viscount (b. Nov. 6, 1870, Liverpool, Eng.—d. Feb. 5, 1963, London) British politician. A social worker in the London slums, he entered the House of Commons in 1902, where he effected legislation that established juvenile courts and the Borstal system for youthful offenders. As postmaster general (1910–14, 1915–16), he nationalized the telephone system. Appointed the first British high commissioner for Palestine (1920–25), he improved the region's economy and promoted harmony among its religious communities. He presided (1925–26) over the royal commission on the coal industry and helped to settle the general strike of May 1926. He led the Liberal Party in the House of Commons (1931–35), and after being made viscount (1937), he was leader of the party in the House of Lords (1944–55). As president of the British (later Royal) Institute of Philosophy (1931–59), he wrote popular works such as *Practical Ethics* (1935) and *Belief and Action* (1937).

Samuelson, Paul (Anthony) (b. May 15, 1915, Gary, Ind., U.S.) U.S. economist. He received his Ph.D. from Harvard and taught at Massachusetts Institute of Technology from 1940, becoming an emeritus pro-

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fessor in 1986. His *Foundations of Economic Analysis* (1947) outlines a basic theme of his work, the universal nature of consumer behaviour as the key to economic theory. His studies included the dynamics of economic systems, analyses of public goods, welfare economics, and public expenditure. His most influential work was perhaps his mathematical formulation of multiplier and accelerator effects and, in consumption analysis, his development of the theory of revealed preference. His classic *Economics* (1948) is the best-selling U.S. economics textbook of all time. For his fundamental contributions to nearly all branches of economics, he became in 1970 the third person to be awarded the Nobel Prize in Economic Sciences.

samurai Member of the Japanese warrior class. In early Japanese history, culture was associated with the imperial court, and warriors were accorded low status. The samurai became important with the rise in private estates (*shōen*), which needed military protection. Their power increased, and when Minamoto Yoritomo became the first shogun (military ruler) of the Kamakura period (1192–1333), they became the ruling class. They came to be characterized by the ethic of bushidō, which stressed discipline, stoicism, and service. Samurai culture developed further under the Ashikaga shoguns of the Muromachi period (1338–1573). During the long interval of peace of the Tokugawa period (1603–1867), they were largely transformed into civil bureaucrats. As government employees, they received a stipend that was worth less and less in the flourishing merchant economy of the 18th–19th centuries in Edo (Tokyo) and Ōsaka. By the mid-19th century, lower-ranking samurai, eager for societal change and anxious to create a strong Japan in the face of Western encroachment, overthrew the shogunal government in the Meiji Restoration of 1868. Feudal distinctions were abolished in 1871. Some samurai rebelled (see Saigō Takamori), but most threw themselves into the task of modernizing Japan. See also daimyo; han.

San *formerly* **Bushmen** Group of peoples now living mainly in and around the Kalahari Desert region of southern Africa, chiefly Botswana, Namibia, and northwestern South Africa. They are closely related to the Khoekhoe. San languages belong to the Khoisan family. Two well-known San groups are the !Kung (Ju) and the |Gui. The San are, for the most part, physically indistinguishable from the Khoekhoe or from their Bantu-speaking neighbours. Traditional San society centres on the nomadic band of related families. San shelters are semicircular structures of branches, twigs, and grass; their equipment is portable, their possessions few and light. They have traditionally hunted, using bows and snares, and gathered wild vegetables, fruits, and nuts. Numbering in the tens of thousands, most San have been restricted, because of historical and political factors, to harsh, semiarid areas, and they work for wages on European farms or serve other Africans, notably the Tswana.

San \'sän**, Saya** *orig.* **Ya Gyaw** (b. Oct. 24, 1876, East Thayetkan, Shewbo district, Burma—d. Nov. 16, 1931, Tharrawaddy) Political leader of Burma (Myanmar). A Buddhist monk, physician, and astrologer in Siam (Thailand) and Burma, he joined an extreme nationalist group dedicated to organizing peasant discontent. Claiming the throne of Burma, he had himself crowned in 1930 and initiated an anti-British revolt in the Tharrawaddy district. Within two years the rebels, armed only with spears and swords and protected by charms they believed would make them invulnerable to bullets, were defeated by British troops with machine guns; Saya San was captured, tried, and hanged. The revolt exposed the precarious and unpopular position of the British in Burma.

San Andreas \ˌsan-an-'drā-əs\ **Fault** Zone of transform faults at the boundary between two tectonic plates in the western U.S. The fault runs along the coast of northern California for more than 800 mi (1,300 km) and passes seaward in the vicinity of San Francisco. Movement along the fault is characterized by frequent earthquakes, including the major San Francisco quake of 1906, when parts of the fault line moved as much as 21 ft (6.4 m); the less serious earthquake of 1989; and a destructive quake centred in the Los Angeles suburb of Northridge in 1994.

San Antonio City (pop., 2000: 1,144,646), south-central Texas, U.S. It is situated at the headwaters of the San Antonio River. Founded in 1718 by the Spanish as a mission on the site of a Coahuiltecan Indian village, it was laid out as a town in 1731. The mission, called the Alamo, became a military post in 1794; it was the site of a historic siege in 1836. In the late 19th century, as the starting point of the Chisholm Trail, the town became a major cattle centre. Military installations, especially for aviation and aerospace, spurred the city's rapid growth after 1940. The economy is now diversified—government, business, manufacturing, education, and tourism are all important aspects of San Antonio's growth.

San Bernardino City (pop., 2000: 185,410), southern California, U.S. Located east of Los Angeles, it was laid out as a town by Mormons in 1852 and developed as a trade centre chiefly for the surrounding citrus groves and vineyards. Other industries, including aerospace and electronics, are now the economic mainstays. It is part of the San Bernardino–Riverside–Ontario metropolitan complex.

San Bernardino Pass Mountain pass, Lepontine Alps, southeastern Switzerland. Its altitude is 6,775 ft (2,065 m). The village of San Bernardino, just south of the pass, is a popular year-round resort. A tunnel beneath the pass was opened in 1967, improving travel through the region. The pass was named for St. Bernardine of Siena, who preached in the area in the early 15th century.

San Cristóbal \ˌsän-krēs-'tō-bäl\ **Island** One of the Galapagos Islands, eastern Pacific Ocean, Ecuador. It is the most populated and fertile island of the archipelago, producing sugar, coffee, cassava, and limes. Volcanic in origin and with an area of 195 sq mi (505 sq km), it is the only island of the group that has a regular supply of fresh water. Charles Darwin landed there at the settlement of San Cristóbal in 1835 and compiled data that he later used in his book *On the Origin of Species* (1859).

San Diego City (pop., 2000: 1,223,400) and port, southern California, U.S. It is located on San Diego Bay, the site of major naval and military bases. Sighted by the Spanish in 1542 and named San Miguel, the area was renamed San Diego in 1602. In 1769 the Spanish established a military post on the site, and Junípero Serra dedicated the first California mission there. The U.S. acquired it from Mexico in 1846, and a new city was laid out in 1867. The arrival of the Santa Fe railroad in 1885 stimulated the city's growth. Industrial development is dominated by aerospace, electronics, and shipbuilding, and the city is the main commercial outlet for the farm produce of southern California. Balboa Park and its San Diego Zoo are renowned, as are the area universities.

San Diego Zoo One of the world's largest collections of mammals, birds, and reptiles, located in San Diego, Calif., and administered by the Zoological Society of San Diego. The 100-acre (40.5-hectare) zoo, founded in 1916, has more than 800 animal species and more than 6,500 plant species. The 1,800-acre (730-hectare) San Diego Wild Animal Park opened in 1972 some 30 mi (50 km) northeast, in the San Pasqual Valley; there some 400 species of animals roam through simulated Asian and African habitats. The research department Conservation and Research for Endangered Species has contributed to the zoo's success in managing and breeding endangered species.

San Fernando Valley Valley, southern California, U.S. Northwest of central Los Angeles, the valley is bounded by the San Gabriel, Santa Susana, and Santa Monica mountains and the Simi Hills. Originally an agricultural area, it occupies 260 sq mi (670 sq km) and now contains several residential suburbs of Los Angeles, including Encino, North Hollywood, Studio City, and Van Nuys.

San Francisco City (pop., 2000: 776,733) and port, northern California, U.S. San Francisco lies on the northern end of a peninsula between the Pacific Ocean and San Francisco Bay. The Golden Gate Bridge spans the strait to the north that separates San Francisco from Marin county. Founded in the 18th century by the Spanish, it came under Mexican control after Mexican independence in 1821. Occupied by U.S. forces in 1846, it grew rapidly after the discovery of gold in nearby areas (see gold rush). San Francisco suffered extensive damage from the earthquake and fire of 1906 and from an earthquake in 1989. The city was prominent in the American cultural revolution of the 1960s. It is a commercial, cultural, educational, and financial centre and one of the country's most cosmopolitan cities.

San Francisco Bay Large, nearly landlocked bay indenting west-central California, U.S. A drowned river valley paralleling the coastline, it is connected with the Pacific Ocean by the Golden Gate Strait, which is spanned by the Golden Gate Bridge. The bay is one of the world's finest natural harbours. Treasure, Yerba Buena, Angel, and Alcatraz islands are there; the cities of San Francisco, Oakland, and Berkeley are nearby.

San Gabriel Mountains Segment of the Pacific Coast Ranges, southern California, U.S. Many peaks exceed 9,000 ft (2,700 m); the highest is San Antonio Peak, or Old Baldy, at 10,080 ft (3,072 m). The range also

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includes Mount Wilson Observatory, northeast of Pasadena. The mountains are largely within the Angeles National Forest.

San Jacinto \ˌsan-jə-'sin-tō\ **Mountains** Segment of the Pacific Coast Ranges, southwestern California, U.S. San Jacinto Peak is the highest point in these mountains, at 10,804 ft (3,293 m); the city of Palm Springs lies at its eastern base. The range is largely within conservation areas, including the Mount San Jacinto State Park and a division of the San Bernardino National Forest. The mountains attract tourists, provide outdoor recreation, and are an important watershed for the surrounding area.

San Joaquin \ˌsan-wä-'kēn\ **River** River, central California, U.S. Formed by forks rising in the Sierra Nevada, it flows past Stockton, Calif., to join the Sacramento River above Suisun Bay. It is 350 mi (560 km) long and is dammed for hydroelectric power. Its valley is the southern part of the Central Valley, one of the most productive agricultural regions in the U.S.

San José \ˌsäŋ-hō-'sā\ City (pop., 2000: 309,672), capital of Costa Rica. Founded c. 1736 as Villa Nueva in a broad, fertile valley about 3,800 ft (1,160 m) above sea level, it developed slowly as a tobacco centre in the Spanish colonial era. In 1823 it became the capital and in the 1840s the centre of coffee production, which remained the chief source of the country's income through the 19th century. The political, social, and economic centre of Costa Rica, it grew rapidly throughout the 20th century in both population and area.

San Jose \ˌsan-hō-'zā\ City (pop., 2000: 894,943), west-central California, U.S. Located southeast of San Francisco, San Jose was the first civic settlement in California. Founded in 1777 as a farming community, it became a Spanish military supply base and was the state's first capital (1849–52). In 1850 it became the first chartered city in California. It was a trade depot for the California gold fields. The railroad from San Francisco improved trade connections for the produce of nearby farms. San Jose is a processing and distribution centre for a rich agricultural area producing fruit and wine. It is part of Silicon Valley, and its industries include the manufacture of electronic, computer, and aerospace components, auto parts, and consumer goods.

San Jose scale Species (*Aspidiotus perniciosus*) of scale insect first discovered in North America at San Jose, Cal., in 1880 but probably a native of China. A waxy gray secretion (the scale) covers the yellow females, which are about 0.06 in. (1.5 mm) in diameter. The scale is elevated in the center and is surrounded by a yellow ring. The female produces several generations of living young each year. San Jose scales can completely cover tree branches and may eventually kill the tree.

San Juan \sän-'hwän\ City (pop., 2000: metro. area, 421,958), seaport, and capital of Puerto Rico. It was visited in 1508 by Juan Ponce de León and founded in the early 16th century by the Spanish. It became heavily fortified and was a starting point for expeditions to unknown parts of the New World. Several times it was attacked by the British, including Francis Drake in 1595. In 1898, during the Spanish-American War, San Juan fell to the U.S. The city expanded rapidly in the 20th century and is one of the major ports and tourist resorts of the West Indies. Industries include petroleum and sugar refining, brewing, and distilling. San Juan is the commonwealth's financial capital and many U.S. banks and corporations maintain offices there. El Morro and San Cristóbal fortifications are among the city's historic remnants.

San Juan Island National Historical Park Historical park, San Juan Islands, northwestern Washington, U.S. Established in 1966, it covers 1,752 ac (710 ha). The San Juan Islands archipelago consists of 172 islands and makes up a county of Washington state.

San Juan Mountains Segment of the southern Rocky Mountains, southwestern Colorado and northern New Mexico, U.S. The mountains extend from southwestern Colorado along the course of the Rio Grande to the Chama River in northern New Mexico. Many peaks in the northern section exceed 14,000 ft (4,300 m), including Mounts Eolus, Sneffels, and Redcloud. Uncompahgre Peak is the highest, at 14,309 ft (4,361 m). Composed mainly of volcanic rocks, the mountains have a rugged, well-forested terrain.

San Juan River River and outlet of Lake Nicaragua, southern Nicaragua. It flows from the lake's southeastern end, forms the border of Nicaragua and Costa Rica, and empties into the Caribbean Sea; it is 124 mi (199 km) long. Near its mouth it divides and forms the Juanillo Menor, Colorado, and San Juan rivers.

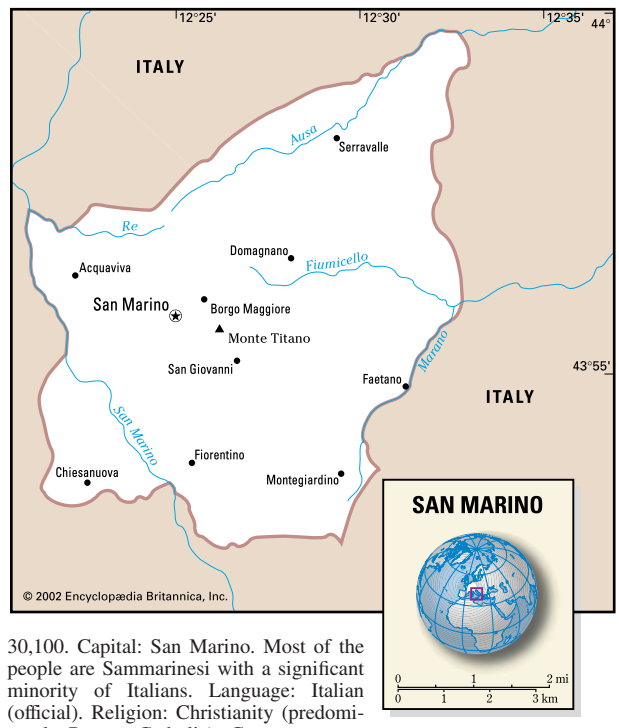
San Juan River River, southwestern U.S. It rises in the San Juan Mountains of southern Colorado, on the western side of the Continental Divide. It flows southwest into New Mexico, northwest into Utah, and west to the Colorado River. It is 360 mi (580 km) long and not navigable. The section of the river where the boundaries of New Mexico, Utah, Arizona, and Colorado meet, where the San Juan has carved numerous S-shaped canyons more than 1,000 ft (300 m) deep, is known as the Goosenecks.

San Luis Potosí City (pop., 2000: 629,208), capital of San Luis Potosí state, Mexico. Situated on the central plateau, it is about 6,100 ft (1,850 m) above sea level. Founded as a Franciscan mission in 1583 and made a city in 1658, it was the centre of the region's colonial administration. It was the site of Benito Juárez's government in 1863. In 1910 Francisco Madero drew up the basic social and political program of the Mexican Revolution in the city. It is the hub of a rich silver mining and agricultural region and is a leading manufacturing, metal smelting, and refining centre.

San Luis Potosí \sän-'lwēs-pō-tō-'sē\ State (pop., 2000: 2,299,360), northeastern Mexico. It has an area of 24,351 sq mi (63,068 sq km), and its capital is San Luis Potosí. It is a fertile area, and crops are cultivated in the uplands and in the lower tropical valleys. Livestock raising is important, and hides, tallow, and wool are exported. Some of the richest silver mines in Mexico are located in the state.

San Marco Basilica See Saint Mark's Basilica

San Marino *officially* **Republic of San Marino** Country, central Italian peninsula, southern Europe. It is located near the Adriatic Sea but is surrounded by Italy. Area: 24 sq mi (61 sq km). Population (2005 est.):



30,100. Capital: San Marino. Most of the people are Sammarinesi with a significant minority of Italians. Language: Italian (official). Religion: Christianity (predominantly Roman Catholic). Currency: euro.

San Marino has an irregular rectangular form with a maximum length of 8 mi (13 km). It is crossed by streams that flow into the Adriatic Sea and is dominated by Mount Titano (2,424 ft [739 m]), on which the capital, the town of San Marino, is located, surrounded by triple walls. The economy is based on private enterprise and includes tourism, commerce, agriculture, crafts, and fine printing, particularly of postage stamps. San Marino is a republic with one legislative house; its heads of state and government are two captains-regent. According to tradition, it was founded in the early 4th century AD by St. Marinus. By the 12th century it had developed into a commune and remained independent despite challenges from neighbouring rulers, including the Malatesta family in nearby Rimini. San Marino survived the Renaissance as a relic of the self-governing Italian city-state and remained an independent republic after the

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unification of Italy in 1861–70. It is one of the smallest republics in the world and may be the oldest one in Europe. At the beginning of the 21st century, its citizens enjoyed a high standard of living.

San Marino City (pop., 2000: 12,945), southwestern California, U.S. It is east of Los Angeles and south of Pasadena. In 1903 railroad magnate Henry E. Huntington (1850–1927) purchased the San Marino Ranch and founded the community, which was incorporated in 1913. His estate, deeded to the public, includes the Huntington Library (with rare English and American books and manuscripts), Art Gallery (where Thomas Gainsborough's *Blue Boy* is displayed), and Botanical Gardens.

San Martín \ˌsän-mär-ˈtēn**, José de** (b. Feb. 25, 1778, Yapeyú, Viceroyalty of Río de la Plata—d. Aug. 17, 1850, Boulogne-sur-Mer, Fr.) National hero of Argentina who helped lead the revolutions against Spanish rule in Argentina (1812), Chile (1818), and Peru (1821). Son of a professional soldier and colonial administrator, he was educated in Spain. Initially he fought loyally for Spain against the Moors (1791), the British (1798), and the Portuguese (1801), but in 1812 he returned to the New World to help the revolutionaries. His greatest campaign was the liberation of Lima, without which the independence of the Argentine provinces could not have been secured. His bold strategy was to lead an army over the Andes, a daunting undertaking. In 1817 he liberated Chile, which he turned over to Bernardo O'Higgins, and proceeded to Peru by ship, where he blockaded the chief port until the royalists withdrew. He then entered Lima and declared the independence of Peru, though he lacked adequate forces to subdue the royalists in the interior. The following year he met with Simón Bolívar; what passed between them is unknown, but San Martín soon afterward went into exile in France, leaving Bolívar to complete the liberation of Peru.

San Pedro Sula \sän-ˈpā-thrō-ˈsü-lä\ City (pop., 2001: 439,086), northwestern Honduras. It is located about 100 mi (160 km) northwest of Tegucigalpa. Founded by the Spanish in 1536, the city has been almost completely rebuilt. It is the country's chief industrial centre and second largest city; it produces a wide variety of items, including textiles, foodstuffs, clothing, beverages, and furniture.

San Salvador City (pop., 1992: city, 415,346; metro. area 1,522,126), capital of El Salvador. Founded near Suchitoto by the Spanish in 1525, it was moved to its present site in 1528 and declared a city in 1546. It became the capital of the country in 1839. During the late 1970s it became the focus of violence between the government and left-wing political groups. It is the country's financial, commercial, and industrial centre, producing textiles and clothing, leather goods, and wood products. It is also the site of the University of El Salvador. Devasted by earthquakes in 1854, 1873, 1917, and 1986 and by heavy floods in 1934, it has been reconstructed frequently.

San Salvador See Bahamas

San Sebastián See Donostia-San Sebastián

San Simeon Former estate of William Randolph Hearst in southern California. It was built on a vast private estate of 245,000 acres (99,000 hectares), developed in the 1860s by Hearst's father. In 1919–20, with the architect Julia Morgan, Hearst began construction of a complex of luxurious buildings and gardens to serve as a country house. The main residence, later called Hearst Castle, is a Spanish Renaissance building with 150 rooms, a cathedral-like facade, and two bell towers. Lavish interior decorations were obtained from European churches and palaces. The site's embellishment continued (1919–48) with numerous subsidiary buildings, Mediterranean gardens, statuary, pools, fountains, a pergola, and priceless art treasures collected from all over the world. The complex is now a state historical monument.

San Stefano \sän-ˈste-fä-ˌnō**, Treaty of** (1878) Peace settlement imposed on the Ottoman government by Russia at the end of the Russo-Turkish War. It established an independent Bulgarian principality that included most of Macedonia, realigned other European provinces of the Ottoman Empire, and ceded parts of Asian Turkey to Russia. Opposed by Austria-Hungary and Britain, it was modified at the Congress of Berlin.

Sanaa \sä-ˈnä\ *Arabic* **Ṣanaʿā'** City (pop., 2004: 1,747,627), capital of Yemen. Located in the western part of the country, it was built on the site of an ancient pre-Islamic stronghold that has been traditionally dated to the 1st or 2nd century BC. Its people converted to Islam in 632. Nominally under Ottoman sovereignty from the mid-16th century, it was effectively controlled from the early 17th century until 1872 by the imams (leaders) of the Zaydī Shīʿite sect. It became the capital of an independent Yemen after the Ottoman defeat in World War I (1914–18). In 1990 it became the capital of the unified country. For many centuries it has been the chief economic, political, and religious centre of the Yemen highlands. The old walled city centre was designated a UNESCO World Heritage site in 1986.

Sanaga River \ˌsä-nä-ˈgä\ River, central Cameroon. It flows southwest into the Bight of Biafra opposite the island of Bioko. It is about 325 mi (525 km) long. Falls and rapids are found along much of its upper course. Dams and reservoirs regulate water flow and harness the river's hydroelectric power.

Sánchez Cotán \ˈsän-chāth-kō-ˈtän**, Juan** (b. 1561, Orgaz, Spain—d. Sept. 8, 1627, Granada) Spanish painter. Profoundly religious, he was influenced early by the spirit of Catholic mysticism that dominated the intellectual life of Toledo, where he was a still-life painter. He entered a monastery in 1603 and remained a Carthusian lay brother until his death. Though his religious paintings are not exceptional, his still lifes are considered among the best produced in Europe; their detailed realism, visual harmony, and illusion of depth convey humility and mystic spirituality. His concern with the relationships among objects and with achieving the illusion of reality through the use of light and shadow was a major influence on the work of Francisco de Zurbarán and other later Spanish painters.

"Quince, Cabbage, Melon, and Cucumber," oil on canvas by Juan Sánchez Cotán, *c.* 1602; in the San Diego Museum of Art, Calif.
SAN DIEGO MUSEUM OF ART, GIFT OF ANNE R. AND AMY PUTNAM

Sanchi sculpture \ˈsän-chē\ Early Indian sculpture that embellished the gateways of the Buddhist relic mound called the Great Stupa at Sanchi, in Madhya Pradesh, a magnificent monument of the 1st century BC. The two square posts of each gateway are topped by capitals of sculptured animals or dwarfs, surmounted by three crossbars that end in spirals and are covered with crowded relief sculptures depicting events of the Buddha's life. In the angle between the lowest crossbar and the pillar are sensuous figures of female earthly spirits.

Architraves of the north gateway (toran) to the Great Stupa (stupa No. 1) at Sānchi, Madhya Pradesh, India
ART RESOURCE—EB INC.

Sancho I *known as* **Sancho the Founder** (b. 1154, Coimbra, Port.—d. March 26, 1211) Second king of Portugal (1185–1211). The son of Afonso I, he resettled depopulated areas of Portugal, established new towns, and rebuilt frontier strongholds and castles. He encouraged foreign settlers and granted large tracts to military orders. When Portugal was invaded by the Almohad Moors, he sent a Crusader fleet against them (1189), but he lost control of Portuguese lands south of the Tagus River (1191).

Sancho II *known as* **Sancho the Cowled** (b. 1207, Coimbra, Port.—d. Jan. 4, 1248, Toledo, Castile) Fourth king of Portugal (1223–45). His reign was marked by a series of vain attempts to bring political stability to his strife-ridden realm. He renewed the war against the Moors and gained control over most of the Algarve (1238–39). He was deposed (1245) in favour of his brother Afonso III.

Sancho III Garcés \ˈsän-chō...gär-ˈthās\ *known as* **Sancho the Great** (b. c. 992—d. Oct. 18, 1035) King of Navarra (1000–35). Son of García III, he proved to be a skilled politician and succeeded in extending control over all the Christian states of Spain. In 1010 he married Munia, daughter of the count of Castile, and he elevated Castile to a kingdom in 1029. By dividing his kingdom between his four sons, he made fratricidal wars inevitable after his death.

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Sancho IV *known as* **Sancho the Brave** (b. 1257—d. April 25, 1295, Toledo, Castile) King of Castile and Leon (1284–95). The second son of Afonso X, he won the backing of nobles and military orders in his effort to gain recognition as heir, and he usurped the throne on his father's death. Sancho defeated an invasion of Andalusia by the king of Fès (1290) and won the support of Aragon by marrying his son to the daughter of James II. He depended greatly on his warrior-queen, María de Molina (d. 1321).

sand Mineral, rock, or soil particles that are 0.0008–0.08 in. (0.02–2 mm) in diameter. Most rock-forming minerals are found in sand, but QUARTZ is by far the most common. Most sands also contain a small quantity of FELDSPAR, as well as white MICA. All sands contain small quantities of heavy rock-forming minerals, including garnet, tourmaline, zircon, rutile, topaz, pyroxenes, and amphiboles. In the pottery and glassmaking industries very pure quartz sands are used as a source of silica. Similar sands are used for lining the hearths of steel furnaces. Molds used in foundries for casting metal are made of sand with a clay binder. Quartz and garnet sands are used extensively as abrasives. Among ordinary sand's many uses, it is a basic ingredient of mortar, cement, and concrete. See also TAR SAND.

Sand, \'sä^{n}d,\ *English* \'sand\ **George** *orig.* **Amandine-Aurore-Lucile Dupin** (b. July 1, 1804, Paris, France—d. June 8, 1876, Nohant) French writer. During childhood she gained a love of the countryside that would inform most of her works. Married in 1822, she soon tired of her husband, Casimir Dudevant, and began a series of liaisons; her lovers included PROSPER MÉRIMÉE, ALFRED DE MUSSET, and, most importantly, FRÉDÉRIC CHOPIN. She became famous (under her pseudonym) with her novel *Indiana* (1832), a protest against conventions that bind an unhappy wife to her husband. *Lélia* (1833) extended her iconoclastic views on social and class associations. Similar themes, along with her sympathy for the poor, are evident in her finest works, the so-called rustic novels, including *The Devil's Pool* (1846), *The Country Waif* (1848), and *Little Fadette* (1849).

George Sand
COURTESY OF THE MUSÉE CARNAVALET, PARIS

Sand Creek Massacre *or* **Chivington Massacre** (Nov. 29, 1864) Surprise attack by U.S. troops on a Cheyenne camp. A force of 1,200 men, mostly Colorado volunteers under Col. John M. Chivington, attacked several hundred Cheyenne camped on Sand Creek near Fort Lyon in southeastern Colorado Territory. The Indians had been conducting peace negotiations with the fort's commander; when the attack began, they raised a white flag, but the troops continued to attack, massacring more than 200 of them. The slayings led to the PLAINS INDIAN wars.

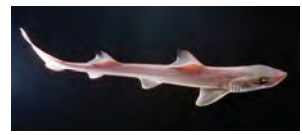
sand dollar Any ECHINODERM (order Clypeastroida, class Echinoidea) that has a coinlike, thin-edged body. Five "petals" spread out from the center of the upper body. It burrows in sand, feeding on organic particles wafted to the mouth, located in the center of the body's underside. Small spines covering the body are used for digging and crawling. Tests (external skeletons) of the common sand dollar (*Echinarachnius parma*), which often wash up on beaches in North America and Japan, are 2–4 in. (5–10 cm) in diameter.

sand dune Hill, mound, or ridge of windblown sand or other loose material such as clay particles. Dunes are commonly associated with desert regions and seacoasts, and there are large areas of dunes in nonglacial parts of Antarctica.

sand flea *or* **beach flea** Hopping terrestrial CRUSTACEAN (family Talitridae). The European sand flea (*Talitrus saltator*) is about 0.6 in. (1.5 cm) long. The long-horned sand flea (*T. longicornis*), found on the North American Atlantic coast, has antennae the same length as the waxy white body, up to 1 in. (2.5 cm) long. During the day, sand fleas lie buried near the high-tide mark; at night, they forage for organic debris. The common sand flea (*Orchestia agilis*, or *platensis*) lives along Atlantic coasts of Europe and the Americas.

sand fly Any of several species in the DIPTERAN family Phlebotomidae (sometimes considered part of the family Psychodidae) with aquatic larvae that live in the intertidal zone of coastal beaches, in mud, or in wet organic debris. The genus *Phlebotomus* transmits the pappataci fever virus, and in parts of South America, Africa, and Asia it carries the protozoan parasites that cause kala azar, Oriental sore, espundia, and bartonellosis. The name is also used for species of the BLACKFLY and biting MIDGE families.

sand shark Any of about six species of shallow-water, bottom-dwelling SHARKS in the genus *Odontaspis* (family Odontaspididae), found along tropical and temperate coastlines of all oceans. They are 10–20 ft (3–6 m) long and are brown or gray above, paler below. Voracious but generally sluggish, they have long, slim, pointed teeth and prey on fishes and INVERTEBRATES. Two species, the sand tiger (*O. taurus*) of the Atlantic and the gray nurse (*O. arenarius*) of Australia, are potentially dangerous.

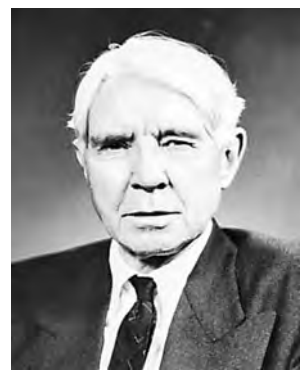

Sand shark (*Odontaspis*).
GRANT HEILMAN—EB INC.

sandalwood Any semiparasitic plant of the genus *Santalum* (family Santalaceae; the sandalwood family), or its wood, especially the wood of the true, or white, sandalwood, *Santalum album*, which is used in making furniture and from which oil used in making perfumes, soaps, candles, and incense is derived. The approximately 10 species of *Santalum* are distributed throughout South Asia and the islands of the South Pacific. The sandalwood family contains more than 400 species of semiparasitic shrubs, herbs, and trees in about 36 genera, found in tropical and temperate regions. In some genera the leaves are reduced to scalelike structures. The green leaves contain some chlorophyll, which allows the plants to make food, but all sandalwoods are parasites to a certain extent, obtaining water and nutrients from their hosts. Most, including *S. album*, are root parasites, but some are stem parasites.

Sandalwood Island See SUMBA

sandbar *or* **offshore bar** Submerged or partly exposed ridge of sand or coarse sediment that is built by waves offshore from a beach. The swirling turbulence of waves breaking off a beach excavates a trough in the sandy bottom. Some of this sand is carried forward onto the beach and the rest is deposited on the offshore flank of the trough. Sand suspended in the backwash and in rip currents adds to the bar, as does some sand moving shoreward from deeper water. The bar's top is kept below still-water level by the plunge of the waves breaking over it.

Sandburg, Carl (b. Jan. 6, 1878, Galesburg, Ill., U.S.—d. July 22, 1967, Flat Rock, N.C.) U.S. poet, historian, novelist, and folklorist. Sandburg tried many occupations and fought in the Spanish-American War before moving to Chicago in 1913, where he worked in journalism. He won recognition in 1914 with poems, including "Chicago," perhaps his best-known, published in POETRY magazine. His Whitmanesque free verse eulogizing American workers appeared in such volumes as *Smoke and Steel* (1920) and *The People, Yes* (1936). *The American Songbag* (1927) and *New American Songbag* (1950) collect folk songs he performed. His other works include *Abraham Lincoln: The Prairie Years* (1926), *Abraham Lincoln: The War Years* (1939, Pulitzer Prize), *Remembrance Rock* (1948), and four children's books, including *Rootabaga Stories* (1922).


Carl Sandburg, 1949.
COURTESY OF THE ILLINOIS STATE HISTORICAL LIBRARY, SPRINGFIELD

Sanders, Barry (b. July 16, 1968, Wichita, Kan., U.S.) U.S. football player. He attended Oklahoma State University, where he won the HEISMAN TROPHY (1988) and set 34 college rushing records. As a running back for the Detroit Lions (1989–99), he rushed for 15,269 yd, placing him third behind EMMITT SMITH and WALTER PAYTON in all-time career rushing

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yardage. He holds records for the most games with 150 yd or more rushing (25), the most 100-yd games in a season (14), and the most touchdown runs of 50 or more yards (15). A runner with exceptional speed and balance, Sanders was known for his array of jukes and spins that left defenders grasping at air.

Sanders, Otto Liman von See Otto Liman von Sanders

sandhill crane Crane species (*Grus canadensis* family Gruidae), 35–43 in. (90–110 cm) long, with a red crown, a bluish or brownish gray body tinged with sandy yellow, and a long, harsh, penetrating call. It is one of the oldest of all existing bird species. It breeds from Alaska to Hudson Bay; it formerly bred in south-central Canada and the Great Lakes region of the U.S. but is now uncommon in those regions. A smaller, nonmigratory subspecies breeds in Florida and southern Georgia. Sandhill cranes have been used as surrogate parents in efforts to save the whooping crane from extinction.

Sandinista Any member of Nicaragua's Sandinista National Liberation Front (FSLN). Named for César Augusto Sandino, a hero of Nicaraguan resistance to U.S. occupation (1927–33), the group was founded in 1962 to oppose the Somoza family's dictatorship. They organized support among students, workers, and peasants. From bases in Honduras and Costa Rica, they attacked the Nicaraguan National Guard. They split into factions in the mid-1970s but reunited during the revolution of 1978–79 that finally succeeded in overthrowing Pres. Anastasio Somoza. A junta headed by Daniel Ortega led the Sandinista government (1979–90), which implemented literacy and community health programs. In an effort to topple the government, the U.S. imposed a trade embargo, pressured international lending institutions to withhold aid, and trained and supported the contras. The FSLN lost support over time and was voted out of power in 1990. See also Violeta Chamorro.

sandpainting Type of art practiced among the Navajo and Pueblo Indians and among Tibetan Buddhists. Sandpaintings are stylized, symbolic pictures (in Tibet, mandalas) prepared by trickling small quantities of crushed, coloured sandstone, charcoal, or pollen on a background of clean smoothed sand. The pictures may include representations of deities, cosmic worlds, animals, lightning, rainbows, plants, and other symbols described in chants that accompany various religious and healing rites.

sandpiper Any of numerous shorebirds (family Scolopacidae) found either breeding or wintering nearly worldwide. Sandpipers, 6–12 in. (15–30 cm) long, have a moderately long bill and legs, long, narrow wings, and a fairly short tail. Their plumage has a complicated "dead-grass" pattern of browns, buffs, and blacks above, white or cream below. They run along ocean and inland beaches and mudflats, picking up insects, crustaceans, and worms and uttering thin, piping cries. Many species migrate in great flocks, from the Arctic to South America and New Zealand.

White-rumped sandpiper (*Calidris fuscicollis*)
HELEN CRUICKSHANK FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

sandstone Sedimentary rock formed from sand-sized grains (0.0025–0.08 in., or 0.06–2 mm, in diameter). The spaces between grains may be empty or filled with either a chemical cement of silica or calcium carbonate or a fine-grained matrix of silt and clay particles. The principal mineral constituents of the grain framework are quartz, feldspar, and rock fragments. Sandstones are quarried for use as building stone. Because of their abundance, diversity, and mineralogy, sandstones are also important to geologists as indicators of erosional and depositional processes. See also graywacke.

Sandwich, John Montagu, 4th earl of (b. Nov. 13, 1718—d. April 30, 1792, London, Eng.) British first lord of the Admiralty (1748–51, 1771–82). He served as secretary of state for the north (1763–65, 1770–71) and led the prosecution of John Wilkes. Appointed first lord of the Admiralty during the American Revolution, he was criticized for keeping much of the British fleet in European waters to avoid French attack. His promotion of exploration led Capt. James Cook to name the Sandwich Islands (later Hawaii) after him in 1778. The sandwich was named after him in 1762 when he spent 24 hours at a gaming table without other food.

Sangallo the Younger, Antonio da See Antonio da Sangallo the Younger

Sanger, Frederick (b. Aug. 13, 1918, Rendcombe, Gloucestershire, Eng.) British biochemist. Educated at the University of Cambridge, he thereafter worked principally at the Medical Research Council in Cambridge (1951–83). He spent 10 years elucidating the structure of the insulin molecule, determining the exact order of all its amino acids by 1955. His techniques for determining the order in which amino acids are linked in proteins made it possible to discover the structure of many other complex proteins. In 1958 he won a Nobel Prize for his work. In 1980 Sanger became the fourth person ever to be awarded a second Nobel Prize, which he shared with Paul Berg and Walter Gilbert (b. 1932), for determining the sequences of nucleotides in the DNA molecule of a small virus.

Sanger, Margaret *orig.* **Margaret Higgins** (b. Sept. 14, 1879, Corning, N.Y., U.S.—d. Sept. 6, 1966, Tucson, Ariz.) U.S. birth-control pioneer. She practiced obstetrical nursing on New York's Lower East Side, where she noticed a relationship between poverty, uncontrolled fertility, and high rates of infant and maternal deaths. In 1914 she published *The Woman Rebel* (later *Birth Control Reviews*), which was banned as obscene. She was arrested in 1916 for mailing birth-control literature and again when she opened the country's first birth-control clinic. Her legal appeals brought publicity and support to her cause, and the federal courts soon granted physicians the right to prescribe contraceptives. In 1921 she founded the American Birth Control League. She soon took her campaign worldwide, organizing the first World Population Conference (1927) and becoming the founding president of the International Planned Parenthood Federation (1953).

Margaret Sanger.
COURTESY OF PLANNED PARENTHOOD FEDERATION OF AMERICA, INC.

sangha \'seŋ-gə\ Buddhist monastic order, traditionally composed of four groups: monks, nuns, laymen, and laywomen. Established by the Buddha, it is the world's oldest body of celibate clerics. Together with the Buddha and the dharma, it makes up the Threefold Refuge, a basic creed of Buddhism. Buddha established the bhiksu sangha for men and later the bhiksuni sangha for women. Members depend on alms from the community, since they are discouraged from engaging in commerce or agriculture. They live according to the Vinaya Pitaka.

Sangre de Cristo \'saŋ-grē-də-'kris-tō\ **Mountains** Segment of the southern Rocky Mountains. The mountains extend southeast for about 250 mi (400 km) from south-central Colorado to north-central New Mexico. Many of the peaks exceed 14,000 ft (4,300 m); Blanca Peak, at 14,345 ft (4,372 m), is the highest. Tourism and mining are the main economic activities.

Sanhedrin \san-'hē-drən, san-'he-drən\ Jewish council that operated in Roman Palestine from the time of the Maccabees (c. 165 BC) to the end of the patriarchate (AD 425). While the term refers to the supreme Jewish court, the Sanhedrin's exact composition and powers—religious, judicial, and legislative—are reported variously in different sources. It is mentioned in various books of the Bible (Mark, Luke, Acts) as having taken part in or adjudicated the trials of Jesus, St. Peter the Apostle, and St. John the Baptist. According to Talmudic sources, the Great Sanhedrin was a court of 71 sages that met on fixed occasions in the Temple of Jerusalem, acting as a religious legislative body, trial court, and administrator of rituals.

sankin kōtai \'san-ˌkin-kō-'tī\ In Japanese history, a system of alternating residency practiced during the Tokugawa period (1603–1867). The daimyo (domain lords) were required to reside alternately in their *han* (feudal domains) and in Edo (modern Tokyo), the capital of the Tokugawa shogunate. The system, inaugurated in 1635, lasted until 1862. It kept the daimyo from building up power bases in their domains that could threaten the shogunate, and, because of the expense of maintaining two residences, prevented them from building up wealth. It also contributed to the flow-

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ering of an urban culture and a commercial economy and encouraged improvements to roads and communications.

sannyasi \ˌsən-ˈyä-sē\ In HINDUISM, one who renounces all ties with family and society and pursues spiritual liberation. Sannyasis are a class of SADHU that do not live in communities, instead leading a mendicant, itinerant life. Those recognized as having achieved full self-knowledge are considered free of all worldly rules and duties, including those pertaining to CASTE, and are not required to carry out image worship or offerings. After death, their bodies, rather than being cremated, are buried in a seated, meditative posture.

sansculotte \ˌsäⁿ-kyœ-ˈlȯt,\ *English* \ˌsanz-kù-ˈlät\ (French *sans-culotte*, "without breeches") In the FRENCH REVOLUTION, one of the ill-clad and ill-equipped volunteers of the Revolutionary army; also a Parisian ultrademocrat of the Revolution. The working-class sansculottes wore long trousers to distinguish themselves from the upper classes, who wore knee-breeches (*culotte*). Allied with the Jacobins (see JACOBIN CLUB) in the REIGN OF TERROR, sansculottes included ultrademocrats of all classes. Their influence waned after the fall of MAXIMILIEN ROBESPIERRE in 1794. See also JACQUES HÉBERT.

Sanskrit language Old INDO-ARYAN LANGUAGE, the classical literary language of HINDUISM. The most ancient form is Vedic, attested in its earliest form in parts of the RIG VEDA, dating from the late 2nd millennium BC. Late Vedic Sanskrit was described and codified in a grammar by Panini, dating from about the 5th century BC. Literary activity in so-called Classical Sanskrit, in many respects similar to the language described by Panini, flourished c. 500 BC–c. AD 1000. Today Sanskrit (now usually written in the Devanagari script) serves as a learned language and LINGUA FRANCA for Brahman scholars. It is an archaic INDO-EUROPEAN LANGUAGE with an elaborate system of nominal and verbal inflection.

Sansovino \ˌsän-sō-ˈvē-nō**, Andrea** *orig.* **Andrea Contucci** (b. c. 1467, Monte San Savino, Republic of Florence—d. 1529, Monte San Savino) Italian sculptor. The fine detail and high emotional pitch of his marble *Altar of the Sacrament* in Florence's Santo Spirito (1485–90) typify his early work; his marble *Baptism of Christ* (1502), above one of the Baptistery doors in Florence, marks a shift to High Renaissance style with its dignified poses and strong but controlled emotion. His tombs for two cardinals in Rome's Santa Maria del Popolo (completed 1509) were his most influential innovation, with their triumphal-arch form and the novel sleeping attitude of the deceased cardinals. His works display the transition from early to High Renaissance, and his graceful style acted as a counterbalance to MICHELANGELO's titanic, muscular sculpture throughout the 16th century.

Sansovino \ˌsän-sō-ˈvē-nō**, Jacopo** *orig.* **Jacopo Tatti** (b. July 2, 1486, Florence, Republic of Florence—d. Nov. 27, 1570, Venice, Republic of Venice) Italian sculptor and architect. He trained in Florence under ANDREA SANSOVINO, whose name he adopted. In 1505–06 he moved to Rome to study architecture and work on the restoration of ancient sculpture. After the sack of Rome in 1527 he fled to Venice, where he was appointed state architect (1529). His Library of St. Mark's (begun 1537) is one of the major architectural works of the 16th century. His vivid sculptures were often important decorative elements of his buildings. His best-known statues are the colossal figures of Mars and Neptune on the staircase of the Doges' Palace (1554–66). He was more successful than any other RENAISSANCE ARCHITECT in fusing architecture and sculpture.

Santa Ana City (pop., 2000: 337,977), southwestern California, U.S. Located east of LONG BEACH, the site was laid out in 1869. The community developed as a centre for the farm produce of the Santa Ana valley after the Southern Pacific Railroad connected it to LOS ANGELES in 1878. Nearby military installations and freeway construction spurred residential and industrial growth after World War II.

Santa Ana \ˌsän-tä-ˈä-nä\ City (pop., 1992: 139,389), northwestern El Salvador. It is one of the country's largest cities and a major coffee-producing centre with one of the world's largest coffee mills. Other industries include the manufacture of cotton textiles, furniture, and leather goods. There are summer resorts at nearby Lake Coatepeque, and the ruined Indian city of Chalchuapa is 9 mi (14 km) west. Santa Ana Volcano, which reaches 7,755 ft (2,365 m), is also nearby.

Santa Anna, Antonio (López de) (b. Feb. 21, 1794, Jalapa, Mex.—d. June 21, 1876, Mexico City) Soldier and several times president of Mexico (1833–36, 1844–45, 1847, 1853–55). He fought on both sides of nearly every issue of the day. He is famous for his glorious victories, including his thwarting of Spain's attempt to reconquer Mexico (1829), and for his ignominious failures, including his defeat and capture by SAM HOUSTON at San Jacinto in the Texas revolt (1836). When the MEXICAN WAR broke out, he contacted Pres. JAMES K. POLK to broker a peace, but on arriving in Mexico he led Mexican forces against the U.S. (1846–47) and was driven into exile. When MAXIMILIAN was made emperor of Mexico, Santa Anna offered his services both to Maximilian and to his opponents; neither side accepted. He lived abroad 1855–74, finally returning to Mexico to die in poverty. See also ALAMO; CAUDILLO; La REFORMA.

Antonio López de Santa Anna, daguerreotype by F.W. Seiders.
COURTESY OF THE SAN JACINTO MUSEUM OF HISTORY ASSOCIATION, SAN JACINTO MONUMENT, TEXAS

Santa Barbara City (pop., 2000: 92,325), southern California, U.S. Located on the Pacific coast, Santa Barbara was named for the patron saint of mariners in 1602, and it became the site of a Spanish military post in 1782. The mission of Santa Barbara was built in 1786; it is the western headquarters of the FRANCISCAN Order and has been in continuous use since its founding. The city developed into a busy port and was incorporated as a city in 1850. After the arrival (1887) of the Southern Pacific Railroad, Santa Barbara became a popular seaside resort. Its economy is bolstered by livestock farms and petroleum production. Its educational institutions include the University of California at Santa Barbara (1891).

Santa Barbara Islands See CHANNEL ISLANDS (California)

Santa Claus See Saint NICHOLAS

Santa Cruz \ˌsän-tä-ˈkrüs\ City (pop., 2001: 1,116,059), east-central Bolivia. Founded by Spaniards from Paraguay in 1561 at what is now San José de Chiquitos, it was attacked repeatedly by Indians until 1595. It then was moved to its present location and renamed Santa Cruz de la Sierra. In 1811 its inhabitants declared their independence from Spain. Bolivia's largest city, it is a trade centre for crops, including sugarcane and rice, grown in the surrounding area. It has an oil refinery and is the seat of a university.

Santa Cruz de Tenerife \ˌsän-tä-ˈkrüth-ˌthā-ˌtā-nē-ˈrē-fā\ Port city (pop., 2001: 188,477), capital of the island of Tenerife in the CANARY ISLANDS, Spain. Founded in 1494, it occupies a small plain between two usually waterless ravines. It was attacked by the British in 1657 and 1797; the latter assault was led by HORATIO NELSON. After 1877 growth was spurred by the banana and tomato trade and, later, by harbour improvements and tourism. In 1936 FRANCISCO FRANCO, then captain general of the Canary Islands, organized from Santa Cruz the national uprising that led to the SPANISH CIVIL WAR. Industries include oil refining.

Santa Fe City (pop., 2000: 62,203), capital of New Mexico, U.S. It lies at the foot of the SANGRE DE CRISTO MOUNTAINS. Founded by the Spanish in 1610, it was the administrative, military, and missionary headquarters of a vast, sparsely populated Spanish colonial province during the 18th century. In the MEXICAN WAR in 1846, the city was occupied by U.S. forces under Gen. STEPHEN KEARNY. After New Mexico was ceded to the U.S., Santa Fe became the capital of the territory in 1851. In 1912 it became the state capital. It was the western terminus of the SANTA FE TRAIL. It is a major tourist centre noted for Indian and Mexican handicrafts, and its large Spanish-American population has made it the cultural capital of the southwest. A popular summer resort, it also attracts winter skiers.

Santa Fe Railway See ATCHISON, TOPEKA AND SANTA FE RAILROAD CO.

Santa Fe Trail Historic wagon trail from INDEPENDENCE, Missouri, to SANTA FE, New Mexico, U.S. An important commercial route from 1821 to 1880, it was opened by WILLIAM BECKNELL and used by merchant wagon caravans. From the MISSOURI RIVER the trail followed the divide between the tributaries of the Arkansas and Kansas rivers to the site of modern Great Bend, Kan., then proceeded along the Arkansas River. At the western end three routes turned south to Santa Fe, the shortest being the

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Cimarron Cutoff through the valley of the Cimarron River. When the Santa Fe railroad was completed in 1880, use of the trail ceased.

Santa Gertrudis Heaviest breed of beef cattle, developed in the 20th century by the King Ranch in Texas by crossing Brahman bulls with shorthorn cows. It is usually solid red with occasional small white markings on the forehead or the flanks. It has a long, deep body and much loose skin about the neck, brisket, and navel.

Santa Isabel *or* **Ysabel** Island, central Solomon Islands, western South Pacific Ocean. Located 50 mi (80 km) northwest of Guadalcanal, Santa Isabel is about 130 mi (209 km) long and 20 mi (32 km) wide at its widest point. Mount Marescot, rising 4,000 ft (1,219 m), is the highest peak. The island was under German control from 1886 to 1899; Rekata Bay on the northwestern coast was a Japanese military base during World War II. Coconut plantations and timber development are important to the economy.

Santa Isabel See Malabo

Santa River River, west-central Peru. Rising in the Cordillera Blanca branch of the Andes Mountains, it descends to the northwest to form the Huaylas Valley, a densely populated agricultural region. Below Huallanca, it veers west and plunges through a spectacular gorge, the Pato Canyon, to enter the Pacific Ocean after a course of 200 mi (300 km). It is harnessed by hydroelectric stations to provide power.

Santa Rosa City (pop., 2000: 147,595), western California, U.S. Santa Rosa lies at the foot of the Sonoma Mountains, northwest of San Francisco. Founded in 1833 and incorporated in 1868, it developed as a processing and shipping centre for the agricultural produce of the Sonoma valley. The economy relies on retail services catering to an increasing residential population. The city was the site of the home and gardens of plant breeder Luther Burbank. Nearby is the Jack London Memorial.

Santander \ˌsän-ˌtän-ˈder\ Port city (pop., 2001: 180,717), capital of the autonomous community (*comunidad autónoma*) of Cantabria, northern Spain. A major seaport and summer resort, it is situated on the southern shore of Cape Mayor, a rocky peninsula extending east and sheltering Santander Bay, an inlet of the Bay of Biscay. The city was rebuilt after a disastrous fire in 1941. In addition to tourism, the economy is based on fishing, iron refining, and shipbuilding. The caves of Altamira and Castillo are nearby.

Santayana \ˌsän-tä-ˈyä-nä**, George** *orig.* **Jorge Augustín Nicolás Ruiz de Santillana** (b. Dec. 16, 1863, Madrid, Spain—d. Sept. 26, 1952, Rome, Italy) Spanish-born U.S. philosopher, poet, and humanist. Santayana moved to the U.S. as a boy in 1872. After graduating from Harvard, he taught philosophy there (with William James and Josiah Royce) from 1889 to 1912, and he began producing important contributions to aesthetics, speculative philosophy, and literary criticism, including *The Sense of Beauty* (1896), *Interpretations of Poetry and Religion* (1900), and *The Life of Reason* (1905–06). He returned to Europe in 1912. *Scepticism and Animal Faith* (1923) best conveys his theory of immediately apprehended essences and describes the role played by "animal faith" in various forms of knowledge. He also wrote a novel, *The Last Puritan* (1935), and an autobiography, *Persons and Places*, 3 vol. (1944–53).

Santee \san-ˈtē\ **River** River, southeast-central South Carolina, U.S. The Santee flows southeast into the Atlantic Ocean after a course of 143 mi (230 km). It has been dammed to form the reservoir Lake Marion, which is connected by a navigable waterway, Lake Moultrie, and the Cooper River to Charleston. The entire river system is the most important waterway and source of hydroelectric power in South Carolina.

Santería \ˌsän-te-ˈrē-ə\ Religious movement that originated in Cuba. It combines West African Yoruba beliefs and practices with elements of Roman Catholicism. It includes belief in one supreme being, but worship and rituals centre on *orisha*s, deities or patron saints (with parallels among the Roman Catholic saints) that combine a force of nature and humanlike characteristics. Practices may include trance dancing, rhythmic drumming, spirit possession, and animal sacrifice. Santería has a considerable following in the U.S., particularly in Florida and in other areas with large African and Hispanic populations. See also Candomblé; Macumba; Vodou.

Santiago \ˌsan-tē-ˈä-gō\ City (pop., 2002 prelim.: 4,630,000), capital of Chile. It is located in central Chile, on the Mapocho River at an elevation of about 1,700 ft (520 m). Founded in 1541 by the Spanish, the city has suffered repeatedly from earthquakes, floods, and civil disorder. It was only slightly damaged during the War of Independence (1810–18) and became the capital of an independent Chile at the war's end. It is the country's economic and cultural centre and principal industrial city, producing textiles, footwear, and foodstuffs. The city boasts a cosmopolitan cultural life and is the home of the University of Chile.

Santiago (de los Caballeros) City (pop., 1993: 365,463), north-central Dominican Republic. Founded c. 1500, it was destroyed by an earthquake in 1562 and rebuilt a few miles away. Ruins of the old city are still visible in the district of San Francisco de Jacagua. It is the country's second largest city; its economy depends mainly on the production of pharmaceuticals, cigarettes, rum, and coffee.

Santiago de Compostela City (pop., 2001: 90,188), capital of Galicia autonomous community (*comunidad autonóma*), northwestern Spain. Santiago de Compostela contains a Romanesque cathedral completed in 1211 that was built on what was said to be the tomb of Jesus' apostle St. James. This tomb, discovered in the 9th century, became the most important Christian pilgrimage site in Europe after Rome. The town that grew up around the tomb was destroyed in 997 by the Moors and was rebuilt in the Middle Ages. Chief economic activities include agriculture, silverwork, wood engraving, and the manufacture of linen and paper. The city is home to several colleges and a university.

Santiago de Cuba Seaport city (pop., 1994 est.: 440,000), eastern Cuba. The second largest city in Cuba, it was founded in 1514 and moved to its present site in 1522. It commanded a strategic location on the northern Caribbean Sea in the early colonial period and was the capital of Cuba until 1589. It was a focal point of the Spanish-American War, and in 1898 the entire Spanish fleet was destroyed near its coast. In 1953 it was the scene of Fidel Castro's attack against the Moncada army barracks. It is the centre of an agricultural and mining region and exports copper, iron, manganese, sugar, and fruit.

Santo Domingo City (pop., 1993: metro. area, 1,556,000), capital of the Dominican Republic. It is situated on the southeastern coast of the island of Hispaniola, at the mouth of the Ozama River. Founded in 1496 by Christopher Columbus's brother Bartolomeo as the capital of the first Spanish colony in the New World, it became the oldest permanent city established by Europeans in the Western Hemisphere. It was under French control (1795–1809), and it was annexed to Spain (1861–65). It became the capital of the Dominican Republic when the country gained independence from Spain in 1865. The city was renamed Ciudad Trujillo in 1936 for Pres. Rafael Trujillo, but it reverted to its original name after his assassination in 1961. It is the commercial and cultural centre of the republic and its principal seaport. Important industries include metallurgy and petrochemicals. It is the reputed site of the tomb of Christopher Columbus.

Santo Tomé de Guayana See Ciudad Guayana

Santorini See Thíra

Santorio, Santorio *Latin* **Sanctorius** (b. March 29, 1561, Capodistria—d. Feb. 22, 1636, Venice) Italian physician. He adapted several of Galileo's inventions to develop a medical thermometer and a pulse clock. To test Galen's assertion that respiration also occurs through the skin as "insensible perspiration," Santorio built a large scale on which he frequently ate, worked, and slept, so he could study his body-weight changes in relation to his solid and liquid intake and output. After 30 years, he found the total of visible excreta was less than the amount ingested; his study marked the introduction of quantitative procedure into medical research. His *On Medical Measurement* (1614) was the first systematic study of basal metabolism.

Sanūsī \sä-ˈnü-sē**, al-** *in full* **Sīdī Muḥammad ibn ʿAlī al-Sanūsī al-Mujāhirī al-Ḥasanī al-Idrīsī** (b. c. 1787, Tursh, near Mostaganem, North Africa—d. Sept. 7, 1859, Jaghbūb, Cyrenaica) North African Muslim theologian. He received his religious training in Fès, Mor., which was under strong French influence at the time. He became convinced that the Islamic community needed to revitalize itself in order to shake off foreign domination. Using tactics he had developed preaching among Bedouin in the Hejaz, he organized tribes in Cyrenaica to resist Italian domination, founding a militant mystical movement, the Sanūsiyyah (1837), which helped Libya win its independence in the 20th century. Libya's first king, Idrīs I, was his grandson.

São Francisco \ˌsaùⁿm-frāⁿ-ˈsēs-kü\ **River** River, eastern Brazil. The largest river wholly within Brazil, it flows north and east across the great

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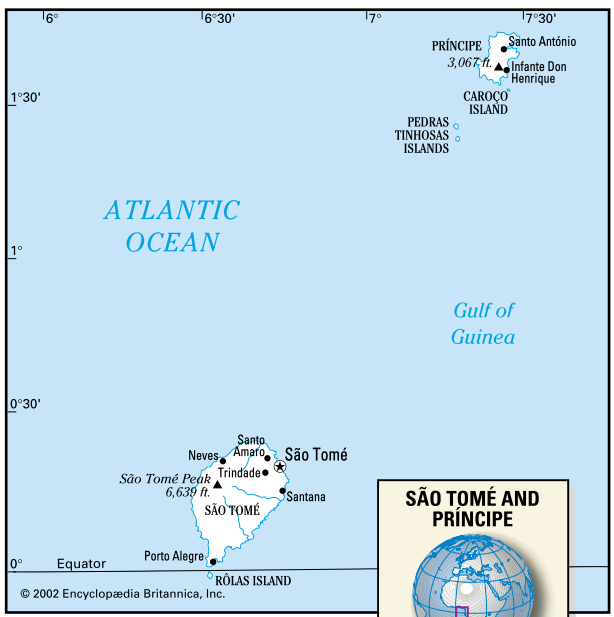
Central Plateau for about 1,811 mi (2,914 km) to its mouth on the Atlantic Ocean. The upper river valley is an area of thorny forest vegetation; the climate of the river basin is dry and hot. The fish of the river are an important food source. Hydroelectric dams harness the river and provide power throughout northeastern Brazil.

São Paulo \saù^{n}m-'paù-lü\ City (pop., 2002 est.: city, 9,969,100; metro. area, 18,390,800), southeastern Brazil. It is located 30 mi (48 km) from its Atlantic Ocean port of Santos. Founded by Portuguese Jesuits in 1554, it became a base for exploration in the 17th century and a city in 1711. In 1822 it was the scene of the declaration of Brazilian independence by Emperor Pedro I. It developed rapidly from the late 19th century. It is the foremost industrial centre in Latin America, producing steel, motor vehicles, machine tools, and a wide range of consumer goods, including textiles and appliances. It is also Brazil's largest city, an important cultural and publishing centre, and one of the most populous cities in the world.

São Tomé \saù^{n}-tü-'mā\ City (pop., 1991 est.: 43,420), capital of São Tomé and Príncipe. It is on the northeastern coast of the island of São Tomé, located on the Equator in the Gulf of Guinea. It is the country's largest city and its major port.

São Tomé and Príncipe \saù^{n}-tü-'mā...'prēn-sē-pē\ *officially* **Democratic Republic of São Tomé and Príncipe** Island country, central Africa. It is situated on the Equator in the Gulf of Guinea, west of the African mainland. Area: 386 sq mi (1,001 sq km). Population (2005 est.):



157,000. Capital: São Tomé. Most of the people are a mixture of African and European ancestry or are Fang or Angolares (descendants of former Angolan slaves). Languages: Portuguese (official), Creole. Religion: Christianity (predominantly Roman Catholic; also Protestant). Currency: dobra. The country consists of the two main islands, São Tomé and Príncipe, which are separated by about 90 mi (145 km), and a number of islets. The two main islands each have northeastern lowlands, central volcanic highlands, and swift-flowing streams. The economy, partly government-controlled and partly private, is based on agriculture and fishing; it has long depended heavily on international assistance. The country is a republic with one legislative house; its chief of state is the president, and the head of government is the prime minister. First visited by European navigators in the 1470s, the islands were soon colonized by the Portuguese and were used in the trade and transshipment of slaves. Sugar and cocoa were the main cash crops. The islands became an overseas province of Portugal in 1951 and achieved independence in 1975.

Saône \'sōn\ **River** *ancient* **Arar** River, eastern France. It flows generally south to join the Rhône River at Lyon. It is navigable upstream from Lyon for 233 mi (375 km) and has 30 locks along its course, which is almost completely canalized. Barge traffic is heavy along its lower course, and it is connected by canal to both the Rhine and Seine rivers.

Saoshyant \saùsh-'yänt\ In Zoroastrianism and Parsiism, the final saviour of the world. He is the foremost of the three saviours who are posthumous sons of Zoroaster. He is expected to appear at the end of the last millennium of the world, miraculously conceived by a virgin who has swum in a lake where Zoroaster's seed is preserved. He will vanquish demonic power and resurrect the bodies of the dead, bestowing eternal perfection on them after all souls have been cleansed.

Sapir \sə-'pir**, Edward** (b. Jan. 26, 1884, Lauenburg, Pomerania, Ger.—d. Feb. 4, 1939, New Haven, Conn., U.S.) Polish-born U.S. linguist and anthropologist. He was a founder of ethnolinguistics, which considers the relationship of culture to language, and a principal developer of the American (descriptive) school of structural linguistics. He became widely known for his contributions to the study of American Indian languages. His best-known work is *Language* (1921).

sapodilla \ˌsa-pə-'di-lə\ Tropical evergreen tree (*Manilkara zapota*) of the family Sapotaceae, native to southern Mexico and northern Central America, and its distinctive fruit. The rusty-brown fruit is eaten fresh in many tropical and subtropical areas. Its sweet flavour has been compared to a combination of pears and brown sugar. When the fruit is ripe, its shiny black seeds are surrounded by clear, yellowish brown, juicy flesh; when immature, its flesh contains both tannin and milky latex and is distasteful. The latex is the chief source of gum chicle, once important in the chewing-gum industry.

Sapodilla (*Manilkara*, or *Achras*, *zapota*)
WALTER DAWN

sapper Military engineer. The name is derived from the French word *sappe* ("trench"), which became connected with military engineering in the 17th century, when attackers dug covered trenches to approach the walls of a besieged fort and also undermined the walls by tunneling beneath them. In modern armies, sappers provide tactical support by carrying out construction, including earthworks, portable bridges, and tank traps; build major facilities such as airports, supply roads, fuel depots, and barracks; and handle additional tasks, including disarming and disposing of land mines and unexploded bombs and preparing and distributing maps.

sapphire Transparent to translucent natural or synthetic variety of corundum that is highly prized as a gemstone. Its colour is due mainly to the presence of small amounts of iron and titanium and normally ranges from very pale blue to deep indigo. Colourless, gray, yellow, pale pink, orange, green, violet, and brown varieties also are known as sapphire; red varieties are called ruby. Synthetic sapphire has been produced commercially since 1902. Much is used in jewelry, but most is used in the manufacture of jewel bearings, gauges, dies, and other specialized components; some also is used as a high-grade abrasive. It is found in Sri Lanka, Myanmar, India, and Montana in the U.S.

Sappho \'sa-fō\ (fl. 610–c. 570 BC, Lesbos, Asia Minor) Greek lyric poet. Although legends about her abound, little is known of her life. She was born on the island of Lesbos and became the leader of a *thiasos*, an informal female community, whose purpose was the education of young women, especially for marriage. The principal themes of her poetry are personal and reflect the activities and atmosphere of the *thiasos*. Her writing, mostly vernacular and not formally literary, is concise, direct, picturesque, and various. It includes nuptial songs and an expression of her love for other women, which produced the word *lesbian* (from the island's name). Though she was much admired in antiquity, most of her work was lost by the early Middle Ages; only an ode to Aphrodite—28 lines long—is complete.

Sapporo \sä-'pō-rō\ City (pop., 2000 prelim.: 1,822,300), Hokkaido, Japan. Located on the Ishikari River, the city was laid out in 1871 with wide, tree-lined streets; it became the capital in 1886. It is a major com-

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mercial centre, with Otaru, on the Sea of Japan (East Sea), as its port. Chief industries are lumbering, printing, and publishing. A popular centre for skiing and winter sports, it was the site of the 1972 Winter Olympic Games. The annual Snow Festival features giant sculptures carved from packed snow. It is the site of two universities.

sapsucker Either of two species of North American woodpeckers that drill holes in neat, close rows to obtain sap and insects. The yellow-bellied sapsucker (*Sphyrapicus varius*), about 8 in. (20 cm) long, is one of the few migratory species of woodpecker, breeding in northern regions and southern mountains and migrating as far as the West Indies and Central America. Both sexes have bold head markings. Williamson's sapsucker (*S. thyroideus*), which lives in high pine forests of the western U.S., is uncommon throughout its range.

Yellow-bellied sapsucker (*Sphyrapicus varius*)
KENNETH W. FINK FROM ROOT RESOURCES

Ṣaqqārah *or* **Sakkara** \sə-'kär-ə\ Site of ancient ruins, Lower Egypt. Part of the necropolis of the ancient city of Memphis, it is located southwest of Cairo and west of the modern village of Ṣaqqārah. The earliest remains are from the Archaic Period, in a cemetery at the northern end of the site, where large mud-brick tombs, or mastabas, have been found dating to the beginning of Egyptian history. South of the Archaic cemetery lies the Step Pyramid, the oldest pyramid in Egypt. It was built by Djoser, second king of the 3rd dynasty, who ruled c. 2650–c. 2575 BC.

sarabande \'sar-ə-ˌband\ Stately processional dance in triple metre popular in the French court and throughout Europe in the 17th–18th century. Of Spanish or Mexican origin, it began as a vigorous dance, set to lively music and castanets, for a double line of couples. At first considered improper, it was forbidden in Spain in 1583. In the early 17th century it was modified to its slow, dignified court version in France and Italy. The slow sarabande, usually with an accented dotted note on the second beat, became a standard movement of the baroque suite.

Saracen \'sar-ə-sən\ In the Middle Ages, any person—Arab, Turk, or other—who professed the religion of Islam. The name spread into western Europe through the Byzantines and the Crusaders. It was also applied to nomadic people of the deserts between Syria and Arabia.

Saragossa See Zaragoza

Sarah (fl. early 2nd millennium BC) In the Hebrew scriptures, the wife of Abraham and mother of Isaac. She was childless until age 90. In Genesis, God promised Abraham that she would be "a mother of nations," but Sarah refused to believe and had already given her maidservant Hagar to Abraham, with whom he fathered Ishmael. Nevertheless, Sarah did conceive in her old age and give birth to Abraham's son Isaac.

Sarajevo \'sä-rä-ye-ˌvȯ,\ *English* \ˌsar-ə-'yā-vō\ City (pop., 1997 est.: 360,000), capital of Bosnia and Herzegovina. After the Turks invaded in the late 15th century, it developed as a trading centre and stronghold of Muslim culture. From 1878 it was part of the Austro-Hungarian Empire (see Austria-Hungary). In 1914 Archduke Francis Ferdinand was assassinated by a Serbian nationalist, which action precipitated World War I. After Bosnia and Herzegovina declared independence from Yugoslavia in 1992, it became a focal point of fierce civil war as Serb militias drove thousands of Bosnian Muslims from the countryside to take refuge in the city (see Bosnian conflict). Its pre-civil war industries included a brewery, furniture factory, tobacco factory, and automobile plant. It was the host of the 1984 Winter Olympic Games and is the centre of a road network. A rail connection to the Adriatic Sea was damaged during fighting in the 1990s but is now operational. Sarajevo retains a Muslim character, with many mosques and an ancient marketplace.

Saramago \ˌsä-rä-'mä-gü**, José** (b. Nov. 16, 1922, Azinhaga, Port.) Portuguese novelist. From a poor family, Saramago studied part-time while working in a welder's shop. Later he began working as a journalist and translator. He published his first novel, *Country of Sin*, in 1947. His breakthrough work, *Baltasar and Blimunda* (1982), alternates allegorical fantasy with grimly realistic descriptions of the construction of a convent by thousands of labourers pressed into service. Saramago's later novels, in which magic realism is mixed with outspoken political commentary, include *The Stone Raft* (1986), perhaps his best-known work, and *Blindness* (1995). He received the Nobel Prize for Literature in 1998.

Saranac \'sar-ə-ˌnak\ **Lakes** Three lakes, northeastern New York, U.S. Located in the Adirondack Mountains region, they are Upper, Middle, and Lower Saranac Lakes. Their elevation is 1,540 ft (469 m) above sea level. The village of Saranac Lake (pop., 2000: 5,041) is a summer and winter sports resort. Tourism and wood-based industries are the chief sources of income.

Sarandon \sə-'ran-dən**, Susan** *orig.* **Susan Abigail Tomalin** (b. Oct. 4, 1946, New York, N.Y., U.S.) U.S. film actress. After reading with her husband, Chris Sarandon (divorced 1979), at one of his auditions, she was cast as the female lead in *Joe* (1970). After winning fans in the campy *Rocky Horror Picture Show* (1975), she proved her talent in films such as *Pretty Baby* (1978), *Atlantic City* (1981), and *The Witches of Eastwick* (1987). Her later films include *Bull Durham* (1988), *Thelma and Louise* (1991), *Lorenzo's Oil* (1992), *Dead Man Walking* (1995, Academy Award), *Cradle Will Rock* (1999), and *Igby Goes Down* (2002).

Sarapeum \ˌser-ə-'pē-əm\ Either of two temples of ancient Egypt that were dedicated to the worship of the Greco-Egyptian god Sarapis. The original temple was built on the western bank of the Nile, near Saqqara, during the reign of Ramses II on a site originally dedicated to the worship of Osiris. The other Sarapeum was at Alexandria and was built during the reign of Ptolemy I Soter. In Roman times, other Sarapeums were constructed throughout the empire.

Sarasate \ˌsä-rä-'sä-tā\ **(y Navascuéz), Pablo (Martín Melitón) de** (b. March 10, 1844, Pamplona, Spain—d. Sept. 20, 1908, Biarritz, France) Spanish violinist. After his debut at age eight, he was sent to study in Madrid, where the queen gave him the Stradivarius that he would play his whole life. After finishing his studies in Paris, he toured the world. He had many pieces written for him (by Max Bruch, Camille Saint-Saëns, etc.) and wrote scores of brilliant virtuoso works himself, including *Zigeunerweisen* (1878) and the *Carmen Fantasy* (1883).

Saratoga, Battles of (1777) Engagements in the American Revolution. British troops under John Burgoyne marched from Canada to join with other British troops, and, after camping at Saratoga, N.Y., engaged the Continental Army under Horatio Gates at the First Battle of Saratoga (September 19), also known as the Battle of Freeman's Farm. Failing to break the American lines, the British faced a counterattack led by Benedict Arnold at the Second Battle of Saratoga (October 7), or the Battle of Bemis Heights. With his forces reduced to 5,000 men, Burgoyne began to retreat, but Gates, with 20,000 men, surrounded the British at Saratoga and forced their surrender (October 17). The American victory induced the French to offer open recognition and military aid.

Saratov \sə-'rä-təf\ City (pop., 2001: 864,400), western Russia. Located on the Volga River, it was founded in 1590 as a fortress to protect the trade route along the Volga. It was moved to a new site in 1616 and again in 1674 after the fortress was destroyed in a revolt. Linked to Moscow by railroad in the 1870s, Saratov became a major commercial centre. Its road bridge across the Volga (opened 1965) is one of the longest in Europe. A major industrial centre, it produces electric and petrochemical equipment and machine tools. Its educational institutions include a university (founded 1909) and a music conservatory.

Sarazen \'sar-ə-zən**, Gene** *orig.* **Eugene Saraceni** (b. Feb. 27, 1902, Harrison, N.Y., U.S.—d. May 13, 1999, Naples, Fla.) U.S. golfer, prominent in the 1920s and '30s. Born to a poor Italian immigrant family, Sarazen began caddying when he was eight. He became a professional golfer in 1920. Sarazen was the first to win the four tournaments that comprise golf's grand slam in modern times. Sarazen won the U.S. Open (1922, 1932), the British Open (1932), and the PGA Championship (1922–23, 1933) and completed the grand slam with his Masters victory in 1935. That Masters victory was highlighted by his famous double eagle, two strokes (three under par) on the par-five 15th hole.

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sardine Any of certain species of small (6–12 in., or 15–30 cm, long) food fishes of the HERRING family (Clupeidae), especially in the genera *Sardina*, *Sardinops*, and *Sardinella*. The common herring (*Clupea harengus*) is found throughout the North Atlantic. The five species of *Sardinops* live in the Pacific and Indian oceans. Sardines are small, silvery, slender fishes with a single short dorsal fin and no scales on the head. They live in dense schools, migrating along the coast. They are usually fished with an encircling net, particularly the purse seine, and mainly at night, when they surface to feed on plankton. See also PILCHARD, SPRAT.

Sardinia *Italian* **Sardegna** \sär-'dān-yä\ Island and autonomous region (pop., 2001 prelim.: 1,599,511), Italy. Off the southern Italian coast, Sardinia is the second largest island in the western Mediterranean Sea. It measures 9,194 sq mi (23,813 sq km); its capital is CAGLIARI. Thousands of structures made of basalt blocks, called *nuraghi*, are a dominating feature of the island. These truncated conic structures of blocks taken from extinct volcanoes were built in prehistoric times without any mortar. Some date to c. 1500–400 BC. Phoenicians were Sardinia's first recorded settlers c. 800 BC. Greeks and Carthaginians followed; Roman rule began in 238 BC. In the early Middle Ages PISA and GENOA struggled over its domination. The kingdom of Sardinia, centred on the lands of Piedmont in northwestern Italy and the island of Sardinia, was ruled by the house of SAVOY from 1720 until the unification of Italy in 1861. Agriculture, fishing, and mining are economic mainstays of the island.

Sardinian language ROMANCE LANGUAGE spoken in SARDINIA, the most similar to Vulgar LATIN of the modern Romance languages. Its only standard form is the *sardo illustre*, a literary language used mostly for folk verse. Italian is the island's official language, and few literary works exist in Sardinian. The earliest written materials date from c. 1080.

Sardis \'sär-dəs\ *or* **Sardes** \'sär-dēz\ Ancient city, Anatolia. Located east of Smyrna (modern İZMIR), it was the chief city and capital of the kingdom of LYDIA from the 7th century BC and the first city where gold and silver coins were minted. It fell to the Persians c. 546 BC and passed to the Romans in 133 BC. Destroyed by an earthquake in AD 17, it was rebuilt and remained one of the great cities of Anatolia until the later Byzantine period. It was obliterated by TIMUR in 1402. Its ruins include the ancient Lydian citadel, but excavations have uncovered more remains of the Hellenistic and Byzantine city than of the ancient Lydian town.

Sardou \sär-'dü**, Victorien** (b. Sept. 5, 1831, Paris, France—d. Nov. 8, 1908, Paris) French playwright. He owed his initial success to the actress Pauline Déjazet, for whom he wrote several of his 70 works, including *A Scrap of Paper* (1860). Several later works, including *Fédora* (1882), were written for SARAH BERNHARDT. His *La Tosca* (1887) was adapted by GIACOMO PUCCINI as an opera. His last success was *Madame Sans-Gêne* (1893). In 1877 he was elected to the Académie Française. His plays rely heavily on theatrical devices and plot contrivances, and he is remembered as a craftsman of the bourgeois drama that GEORGE BERNARD SHAW belittled as "Sardoodledom."

Sarekat \'sär-ə-kät\ **Islam** First nationalist political party in Indonesia to gain wide popular support. Founded in 1912 to promote the interests of Muslim merchants, it soon began working for the self-government of the Dutch East Indies. Its religious appeal helped it grow rapidly, and by 1916 it claimed 350,000 members. As it became increasingly involved in revolutionary activities, communist elements entered the organization. A struggle for power ensued between religious leaders and communists, which culminated in the party dividing in 1921. Sarekat Islam declined after the departure of its left wing.

Sarema See SAAREMAA

Sargasso Sea Body of still water in the North Atlantic Ocean. Elliptical in shape and strewn with a brown floating seaweed of the genus *Sargassum*, it lies between the parallels 20° and 35° N and the meridians 30° and 70° W and encompasses the BERMUDA islands. It was first mentioned by CHRISTOPHER COLUMBUS, who crossed it in 1492. The presence of the seaweed suggested the proximity of land and encouraged him to continue, but many early navigators feared becoming entangled in the floating vegetation and turned back.

sargassum \sär-'ga-süm\ Any of the brown ALGAE that make up the genus *Sargassum.* They are adapted for a free-floating tropical environment, even though many species grow attached to rocks along the coast. The SARGASSO SEA, a free-floating mass of seaweed (mostly *S. natans*), occurs in the Atlantic Ocean. Sargassums are also known as sea holly because of their highly branched stems with hollow, berrylike floats and many leaflike, sawtooth-edged blades. They are used as fertilizer in New Zealand and as a component of soups and soy sauce in Japan.

Sargent, John Singer (b. Jan. 12, 1856, Florence, Italy—d. April 15, 1925, London, Eng.) U.S.-British painter. Son of wealthy American parents, he was born in Italy and grew up in Europe, not seeing the U.S. until 1876. Having studied painting in Paris, in 1879 he traveled to Madrid and Haarlem to study the works of DIEGO VELÁZQUEZ and FRANS HALS; his finest works were painted soon afterward. Best known is his portrait *Madame X*, which created a scandal at the 1884 Salon; critics found it eccentric and erotic, and the sitter's mother claimed it made her daughter a laughingstock. Discouraged, he moved permanently to London, though he often visited the U.S. Not until about 1887 did he achieve the acclaim he was to enjoy in the U.S. and England the rest of his life. His elegant portraits created an enduring image of high society of the Edwardian age; the best, painted with his slashing brushstrokes, capture his subjects in revealing, off-guard moments. He largely gave up portraiture in 1907 and devoted the rest of his life to murals and landscapes.

Sargon \'sär-gän\ (fl. 23rd century BC) Ancient Mesopotamian ruler (r. 2334–2279 BC). What is known of him comes from legends and tales; his capital city, Agade, has never been located. Perhaps originally a royal cupbearer, he came to prominence by defeating a Sumerian king, thereby attaining an empire in southern Mesopotamia and becoming the first emperor whose native tongue was Akkadian rather than Sumerian. He enlarged the empire from Iraq to Anatolia, and trade flourished with the Indus valley, Oman, the Persian Gulf coast, Cappadocia, and perhaps Greece.

Sargon II (d. 705 BC) Assyrian king (r. 721–705 BC). He continued the empire-building work of his presumed father, TIGLATH-PILESER III. One of his aims was to prove the might of the Assyrian god Ashur by enlarging the empire he had inherited. His conquests ranged from southern Babylonia to Armenia and the Mediterranean. He probably died in battle in northwestern Persia. His son, SENNACHERIB, succeeded him.

Sargon II, detail of a relief from the palace at Khorsabad; in the Louvre, Paris

COURTESY OF THE MUSEE DU LOUVRE, PARIS; PHOTOGRAPH, MAURICE CHUZEVILLE

Sarmatian \sär-'mā-shən\ Any member of a people originally of Iranian stock who migrated from Central Asia to the Ural Mountains in the 6th–4th centuries BC and settled in southern European Russia and the eastern Balkans. Closely related to the SCYTHIANS, they were expert horsemen and warriors and gained wide influence through administrative and political astuteness. Women fought alongside men and may have inspired Greek tales of AMAZONS. By the 5th century BC they controlled the land between the Urals and the Don, and by the 2nd century they had conquered the Scythians to rule almost all southern Russia. Allied with Germanic tribes, they continued to pose a threat to the West until the 1st century AD. After invading Dacia and the lower Danube, they were overrun by the GOTHS. Many joined the Gothic invasion of western Europe. Sarmatia was destroyed by HUNS after AD 370. Their descendants cannot be traced after the 5th century.

Sarmiento \särm-'yān-tō**, Domingo Faustino** (b. Feb. 14, 1811, San Juan, Viceroyalty of Río de la Plata—d. Sept. 11, 1888, Asunción, Para.) Educator, statesman, writer, and president of Argentina (1868–74). A rural schoolteacher, he entered provincial politics and was exiled to Chile by JUAN MANUEL DE ROSAS for his outspokenness. There he became an important figure in journalism and education. In his important book *Facundo* (1845), he denounced the Rosas dictatorship and the culture of the GAUCHOS. He returned to Argentina to help overthrow Rosas in 1852. Elected president in 1868, he ended the PARAGUAYAN WAR, developed the public school system, established technical and professional schools, and upheld civil liberties.

Sarnoff, David (b. Feb. 27, 1891, Minsk, Russia—d. Dec. 12, 1971, New York, N.Y., U.S.) Russian-born U.S. communications executive.

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Sarnoff, 1971
AP/WIDE WORLD PHOTOS

After immigrating with his family to New York in 1900, he left school to work for the Marconi telegraph company. In 1912 he heard the distress signal from the sinking *Titanic* and remained at his instrument for 72 hours relaying news. In 1921 he became general manager of the newly formed Radio Corp. of America (RCA Corp.). He had proposed the first commercially marketed radio receiver in 1916, and by 1924 it had earned $80 million in sales. He formed the radio network NBC in 1926. Perceiving television's potential, he set up an experimental television station (1928) and demonstrated the new medium at the New York World's Fair (1939). During World War II he was a communications consultant to Gen. Dwight D. Eisenhower and was made a brigadier general. President of RCA (1930–47), he served as chairman of the board until 1970.

Saro-Wiwa \ˌsä-rō-ˈwē-wə**, Ken** *orig.* **Kenule Beeson Saro-Wiwa** (b. Oct. 10, 1941, Bori, near Port Harcourt, Nigeria—d. Nov. 10, 1995, Port Harcourt) Nigerian writer and activist. He taught at the University of Lagos and held government office before turning to writing. His first novels were *Songs in a Time of War* and *Sozaboy* (both 1985); his television series *Basi and Company* satirized the Nigerian desire to get rich with little effort. He also wrote poetry, children's stories, and a newspaper column. His support of the Ogoni people against the oil industry put him at odds with the government; he was spuriously charged with four murders and executed despite worldwide protest.

Saronic \sə-ˈrä-nik\ **Gulf** Gulf of the Aegean Sea, southeastern coast of Greece. Some 50 mi (80 km) long and 30 mi (50 km) wide, it separates Attica and the Peloponnese and is linked to the Gulf of Corinth by the Corinth Canal. It was the site of a major Athenian victory over the Persians in 480 BC (see Battle of Salamis). Its ports include Piraeus and Mégara.

Saroyan \sə-ˈrȯi-ən**, William** (b. Aug. 31, 1908, Fresno, Calif., U.S.—d. May 18, 1981, Fresno) U.S. writer. Saroyan was the largely self-educated son of an Armenian immigrant. He made his initial impact during the Depression with brash, original, and irreverent stories celebrating the joy of living in spite of poverty, hunger, and insecurity. Much of his fiction is based on his childhood and family. His story collections include *The Daring Young Man on the Flying Trapeze* (1934), *Inhale and Exhale* (1936), and *My Name is Aram* (1940). His other works include the play *The Time of Your Life* (1939, Pulitzer Prize) and *The Human Comedy* (1943), a sentimental novel of life in a small California town.

Sarpi \ˈsär-pē**, Paolo** (b. Aug. 14, 1552, Venice—d. Jan. 14, 1623, Venice) Italian patriot, scholar, and state theologian. At age 20 Sarpi became court theologian to the duke of Mantua, a post that gave him leisure to study Greek, Hebrew, mathematics, anatomy, and botany. Later, as consultor to the government, he incurred the wrath of Pope Paul V by supporting Venice's right to restrict church construction in the city and to try priests accused of crimes unrelated to religion (e.g., murder) in the state's courts. His *History of the Council of Trent* (1619), an important work decrying papal absolutism, was published under a pseudonym; though placed on the Index librorum prohibitorum, it went through several editions and five translations in 10 years.

Sarraute \sä-ˈrōt**, Nathalie** *orig.* **Nathalie Ilyanova Tcherniak** (b. July 18, 1900, Ivanova, Russia—d. Oct. 19, 1999, Paris, France) French novelist and essayist. She practiced law until c. 1940, when she became a full-time writer. *Tropismes* (1939), a collection of sketches, introduced her idea of tropisms, the "things that are not said and the movements that cross our consciousness very rapidly." An early practitioner and leading theorist of the *nouveau roman* ("new novel"), the French antinovel, she discarded conventions of plot, chronology, characterization, and point of view. Her novels—including *Portrait of a Man Unknown* (1948), *Martereau* (1953), *Le planétarium* (1959), and *Here* (1997)—and her plays focus on the unspoken "subconversations" in human interactions.

SARS *in full* **severe acute respiratory syndrome** Highly contagious respiratory illness characterized by a persistent fever, headache, and bodily discomfort, followed by a dry cough that may progress to great difficulty in breathing. SARS appeared in November 2002 in Guangdong province, China, and was brought to Hong Kong in February 2003. As it spread from there to other countries of East Asia and the world, health authorities instituted an unprecedented series of control measures, including quarantines and prohibitions on travel, and in June 2003 the global outbreak was declared to be contained. By that time more than 8,000 cases had been reported, and some 800 people had died. SARS is believed to be caused by a mutant coronavirus, a type usually associated with pneumonia and the common cold. A specific vaccine has not been developed. Treatment is usually restricted to easing the patient's symptoms—providing mechanical ventilation if necessary—until the illness has run its course.

sarsaparilla \ˌsas-pə-ˈri-lə\ Aromatic flavouring agent originally made from the dried roots of several tropical smilax vines. Native to the southern and western coasts of Mexico to Peru, the plants are large, perennial, climbing or trailing vines with short, thick, underground stems that produce many prickly, angular, aboveground stems supported by tendrils. Once a popular tonic, sarsaparilla now is blended with wintergreen and other flavours and used in root beer and other carbonated beverages, or to flavour and mask the taste of medicines. In North America, the strongly aromatic roots of the wild sarsaparilla (*Aralia nudicaulis*) and false, or bristly, sarsaparilla (*A. hispida*), of the ginseng family, are sometimes substituted for true sarsaparilla.

Sarto, Andrea del See Andrea del Sarto

Sartre \ˈsärtrᵊ**, Jean-Paul** (b. June 21, 1905, Paris, France—d. April 15, 1980, Paris) French philosopher, novelist, and playwright, the foremost exponent of existentialism. He studied at the Sorbonne, where he met Simone de Beauvoir, who became his lifelong companion and intellectual collaborator. His first novel, *Nausea* (1938), narrates the feeling of revulsion that a young man experiences when confronted with the contingency of existence. Sartre used the phenomenological method of Edmund Husserl (see phenomenology) with great skill in three successive publications: *Imagination: A Psychological Critique* (1936), *Sketch for a Theory of the Emotions* (1939), and *The Psychology of Imagination* (1940). In *Being and Nothingness* (1943), he places human consciousness, or nothingness (*néant*), in opposition to being, or thingness (*être*); consciousness is nonmatter and thus escapes all determinism. In his postwar treatise *Existentialism and Humanism* (1946) he depicts this radical freedom as carrying with it a responsibility for the welfare of others. In the 1940s and '50s he wrote many critically acclaimed plays—including *The Flies* (1943), *No Exit* (1946), and *The Condemned of Altona* (1959)—the study Jean Genet (1952), and numerous articles for *Les Temps Modernes*, the monthly review that he and de Beauvoir founded and edited. A central figure of the French left after the war, he was an outspoken admirer of the Soviet Union—though not a member of the French Communist Party—until the crushing of the Hungarian uprising by Soviet tanks in 1956, which he condemned. His *Critique of Dialectical Reason* (1960) faults Marxism for failing to adapt itself to the concrete circumstances of particular societies and for not respecting individual freedom. His final works include an autobiography, *The Words* (1963), and *Flaubert* (4 vol., 1971–72), a lengthy study of the author. He declined the 1964 Nobel Prize for Literature.

Jean-Paul Sartre, photograph by Gisèle Freund, 1968.
GISÈLE FREUND

Sarvastivada \sər-ˌväs-ti-ˈvä-də\ One of the 18 schools of Hinayana Buddhism that developed during the first four or five centuries after the Buddha's death. The name literally means the teaching that everything exists, which relates to the notion that the past, present, and future all exist. The Sarvastivada school was particularly influential in northwestern India and portions of Southeast Asia.

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Sāsānian dynasty *or* **Sāssānian** \sa-'sā-nē-ən\ **dynasty** Persian dynasty (AD 224–651). Founded by Ardashīr I (r. AD 224–241) and named for his ancestor Sāsān (c. 1st century AD), it replaced the Parthian empire (see PARTHIA). Its capital was CTESIPHON. The dynasty battled the ROMAN REPUBLIC AND EMPIRE and its successor the BYZANTINE EMPIRE in the west and the Kushāns and Hephthalites in the east throughout much of its existence. In the 3rd century its empire stretched from SOGDIANA and Georgia to northern Arabia, and from the Indus River to the Tigris and Euphrates rivers. Traditions of the ACHAEMENIAN DYNASTY were revived, Zoroastrianism was reestablished as the state religion, and art and architecture experienced a renaissance. Its important rulers included Shāpūr I (d. 272), Shāpūr II (309–379), KHOSROW I, and KHOSROW II. The Sāsānids were the last native Persian dynasty before the Arab conquest of the region in the late 7th century.

Saskatchewan \sas-'ka-chə-ˌwän\ Province (pop., 2000: 978,933), western Canada. It is bounded to the north by the Northwest Territories, to the east by Manitoba, to the south by the U.S. state of Montana, and to the west by Alberta. The capital of Saskatchewan is REGINA. A plains region, with prairie to the south and wooded country to the north, it supports rich and varied wildlife. The Cree Indians inhabited the region for some 5,000 years before it was claimed by the HUDSON'S BAY CO., which controlled the area from 1670 until it surrendered the land to the British in 1868. It was part of Rupert's Land (the territories granted to the Hudson's Bay Co.) until 1869, and in 1870 it became part of the Dominion of Canada. From 1882 the extension of the railroad brought large numbers of European settlers. The province was created in 1905. Its economy is based on oil, gas, and potash production, grains, and livestock. The largest city is SASKATOON.

Saskatchewan, University of Canadian public university in Saskatoon, founded in 1907. It has colleges of arts and sciences, graduate studies, agriculture, veterinary medicine, engineering, law, medicine, dentistry, nursing, pharmacy, commerce, education, and physical education.

Saskatchewan River River, southwestern and southern central Canada. The largest river system of Alberta and Saskatchewan, it rises in the Canadian Rockies as the North and South Saskatchewan rivers, which are 800 mi (1,287 km) and 865 mi (1,392 km) long, respectively. The combined streams continue east 340 mi (550 km) to enter Lake WINNIPEG. Once important as a fur-trading route, it now provides hydroelectric power and irrigation.

Saskatoon \ˌsas-kə-'tün\ City (pop., 2001: 196,811), south-central Saskatchewan, Canada. It was founded on the SASKATCHEWAN RIVER in 1883 as the proposed capital of a temperance colony. It grew rapidly following the arrival of the railroad in 1890 and the town's amalgamation with two adjoining settlements in 1906. Saskatchewan's largest city, it is a cultural and educational centre and a major transportation hub and distribution centre. Its educational institutions include the University of Saskatchewan (founded 1907).

Sasquatch See BIGFOOT

sassafras \'sa-sə-ˌfras\ North American tree (*Sassafras albidum*) of the LAUREL FAMILY. The aromatic leaf, bark, and root are used as a flavouring, as a traditional home medicine, and as a tea. The aromatic roots yield about 2% oil of sassafras, once the characteristic ingredient of root beer. The tree is native to sandy soils from Maine to Ontario and Iowa and south to Florida and Texas. It is usually small but may attain a height of 65 ft (20 m) or more. It has furrowed bark, bright green twigs, small clusters of yellow flowers followed by dark blue berries, and three distinctive forms of leaves, often on the same twig: three-lobed, two-lobed (mitten-shaped), and entire.

Sassandra River \sə-'san-drə\ River, western Côte d'Ivoire. It rises as the Tienba in the northwestern highlands and becomes the Sassandra at its confluence with the Férédougouba. It courses southeast 400 mi (650 km) to empty into the Gulf of GUINEA at the seaport of Sassandra. Its upper reaches have been panned for diamonds; its lower course marks the eastern boundary of the Taï Reserve, known for its pygmy hippopotamus.

Sāssānian dynasty See SĀSĀNIAN DYNASTY

Sassetta *orig.* **Stefano di Giovanni** (d. c. 1450, Siena, Republic of Siena) Italian painter. His interest in Florentine art is evident in his monumental *Madonna of the Snow* altarpiece for Siena Cathedral (1430–32) and in his most ambitious work, an altarpiece for San Francesco at Sansepolcro (1437–44). His fusion of traditional and contemporary elements transformed Sienese painting from the Gothic to the Renaissance style, and he is considered one of the greatest Sienese painters of the 15th century.

SAT *in full* **Scholastic Aptitude Test** Standardized test taken by U.S. high school students applying to colleges. It is divided into two principal sections, verbal and mathematical. Promulgated largely through the efforts of JAMES B. CONANT as a means of promoting merit-based (rather than class-based) college admissions, it was administered to few students before the end of World War II but by the end of the 20th century was taken by millions each year. Scores declined as the test came to be more widely administered, and in 1995 the score of 500 for each section (midway between the extremes of 200 and 800) was reestablished as the actual mean score of those tested. The test, which most colleges use as one measure of an applicant's ability, has been denounced as biased in favour of men and the white middle class. Other critics claim that the SAT is inadequate for testing various important capacities.

satanism Worship of Satan, or the DEVIL, the personality or principle regarded in the Judeo-Christian tradition as embodying absolute evil, in complete antithesis to God. Cults associated with satanism have been documented, however sketchily, back to the 17th century. Their central feature is the black MASS, a corrupted and inverted rendition of the Christian EUCHARIST. Practices are said to include animal SACRIFICE and deviant sexual activity. Worship is motivated by the belief that Satan is more powerful than the forces of good, and so is more capable of bringing about the results sought by his adherents.

satellite Natural object (moon) or SPACECRAFT (artificial satellite) orbiting a larger astronomical body. Most known natural satellites orbit PLANETS; the Earth's MOON is the most obvious example and was the only one known until the discovery of the GALILEAN SATELLITES of Jupiter in 1610. All the SOLAR SYSTEM's planets except Mercury and Venus have moons, which vary greatly in size, composition (from rock to mostly ice), and activity (from cold and inert to volcanic). Some ASTEROIDS are also known to have their own moons. The first artificial satellite, SPUTNIK 1, was launched into orbit around Earth in 1957. Since then, thousands have been sent into orbit around Earth as well as the Moon, Venus, Mars, Jupiter, and other bodies. Artificial satellites are used for scientific research and other purposes, such as communication (see COMMUNICATIONS SATELLITE), weather forecasting, Earth resources management, and military intelligence. See also LANDSAT.

satellite, communications See COMMUNICATIONS SATELLITE

sati See SUTTEE

Satie \sà-'tē**, Erik** *orig.* **Eric Alfred Leslie Satie** (b. May 17, 1866, Honfleur, Calvados, France—d. July 1, 1925, Paris) French composer. He studied at the Paris Conservatoire (1879–82) but dropped out. From 1888 he played piano at the café Le Chat Noir; he became associated with the ROSICRUCIAN movement in about 1890 and wrote several works under its influence. Living in austere poverty in a working-class district, he began to gain prominence in 1911, when he was lauded as a forerunner of modern music; his admirers included CLAUDE DEBUSSY, JEAN COCTEAU, and the group of composers known as LES SIX. Satie's music represents the first definite break with 19th-century French Romanticism; it also stands in opposition to Impressionism (a movement he frequently mocked). His mostly short piano works are spare and unconventional, and they characteristically take the form of parody, with flippant titles such as *Three Pieces in the Form of a Pear* (1903).

satin Fabric constructed by the satin WEAVING method, one of the three basic TEXTILE weaves. Satin weave superficially resembles TWILL but does not have the regular step in each successive weft that characterizes twills. Thus, there is no strong diagonal line, and the fabric is smooth-faced, with an unbroken surface made up of long floating warp yarns. Because satins are susceptible to the wear caused by rubbing and snagging, they are considered luxury fabrics. Satin is made in different weights for various uses, including dresses (particularly evening wear), linings, bedspreads, and upholstery. Though originally of SILK, it may be made of yarns of other fibres.

satire Artistic form in which human or individual vices, folly, abuses, or shortcomings are held up to censure by means of ridicule, derision, burlesque, irony, or other methods, sometimes with an intent to bring

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about improvement. Literature and drama are its chief vehicles, but it is also found in such mediums as film, the visual arts (e.g., caricatures), and political cartoons. Though present in Greek literature, notably in the works of ARISTOPHANES, satire generally follows the example of either of two Romans, HORACE or JUVENAL. To Horace the satirist is an urbane man of the world who sees folly everywhere but is moved to gentle laughter rather than to rage. Juvenal's satirist is an upright man who is horrified and angered by corruption. Their different perspectives produced the subgenres of satire identified by JOHN DRYDEN as comic satire and tragic satire.

Satnami sect \ˌsət-'nä-mē\ Religious community in India that challenges political and religious authority by worshiping the supreme god Satnam. Combining practices from ISLAM and HINDUISM, Satnamis typically reject both the worship of images and the CASTE system, while retaining an underlying orthodox VEDANTA philosophy. Modern Satnamis are confined almost entirely to the low-status Camar caste, and they advocate social equality as well as ethical and dietary self-restraint.

Satō \'sä-tō**, Eisaku** (b. March 1, 1901, Tabuse, Yamaguchi prefecture, Japan—d. June 3, 1975, Tokyo) Prime minister of Japan (1964–72) who presided over Japan's post-World War II reemergence as a major world power. For his policies on nuclear weapons, which led to Japan signing the nuclear nonproliferation treaty, he shared the 1974 Nobel Prize for Peace. As prime minister Satō improved relations with other Asian countries and oversaw the return of the Ryukyu Islands from U.S. to Japanese jurisdiction.

satrap Provincial governor in the ACHAEMENIAN empire. DARIUS I (r. 522–486 BC) established 20 satrapies with an annual tribute. Appointed by the king, satraps were usually of the royal family or Persian nobility and held office indefinitely. They collected taxes, were the highest judicial authority, and were responsible for internal security and for raising and maintaining an army. Controls guarded against the abuse of power, but after the mid 5th century BC, with central authority weakened, satrapies became virtually independent. ALEXANDER THE GREAT and his successors retained the satraps.

Satsuma \'sät-sü-ˌmä\ Japanese feudal domain (*HAN*) in southern Kyushu noted for its role in Japan's modernization. Satsuma (part of modern-day Kagoshima prefecture) was ruled by the Shimazu family from the end of the 12th century to the MEIJI RESTORATION in 1868. In 1609 the family had conquered the RYUKYU ISLANDS, and trade with the Ryukyus continued during the TOKUGAWA PERIOD, when the rest of the country was forbidden contact with the outside world. This trade both enriched Satsuma and provided experience with foreign affairs that would prove useful in the 19th century when Western powers started pressuring Japan to end its isolation. The domain also developed expertise in Western learning: Shimazu Shigehide (1745–1833) founded schools of medicine, mathematics, and astronomy; Shimazu Nariakira (1809–58) adopted Western-style military techniques and armaments. These advantages, along with a traditional enmity toward the Tokugawa family, put the men of Satsuma in a prime position to become leaders in the movement to overthrow the shogunal government. See also ŌKUBO TOSHIMICHI; SAIGŌ TAKAMORI.

Satsuma Rebellion See SAIGO TAKAMORI

saturation State of an ORGANIC COMPOUND in which all its CARBON atoms are linked by single COVALENT BONDS. Saturation also means the state of a SOLUTION or vapour (see VAPORIZATION) in which it has the highest possible concentration of the dissolved or vaporized material at a given pressure and temperature. Though it is sometimes possible to bring about supersaturation (a concentration exceeding the equilibrium value), such solutions or vapours are unstable and spontaneously revert to the saturated state, accompanied by the transformation of the excess material to the solid or liquid form (precipitation). See also FATTY ACID; HYDROGENATION.

Saturn Roman god of agriculture, equated with the Greek deity CRONUS. His wife was Ops, the goddess of plenty, and his children included JUNO, NEPTUNE, and CERES. His festival, Saturnalia (beginning December 17), became the most popular Roman festival; its influence is still felt in the celebration of CHRISTMAS and the Western New Year. During Saturnalia, all business transactions were suspended, presents were exchanged, and slaves were given token freedom. The remains of Saturn's temple are located in the Forum in Rome. Saturday is named for Saturn.

Saturn Sixth PLANET from the Sun, named for the Roman god of sowing and seed. The second largest nonstellar object in the SOLAR SYSTEM after Jupiter, it is about 95 times as massive as Earth and has more than 700 times its volume. Saturn's outer layers are gaseous, mainly hydrogen. Models of its interior suggest a rock-and-ice core surrounded by a shallow layer of liquid metallic hydrogen encased by an envelope of molecular hydrogen. Its mean density, about 70% that of water, is the lowest of any known object in the solar system. Saturn has at least 47 moons (including TITAN, the largest) and an extensive ring system, with several main sections visible from Earth with a telescope. Saturn's rings, first observed in 1610 by GALILEO, are made up of countless separate particles ranging mainly from inches to many feet in size but also including dust in some regions. Water ice probably constitutes most of the ring material. Saturn's day is about 10.6 hours; its year is 29.4 Earth years. Its rapid rotation, acting on electric currents in the core, generates a strong magnetic field and large magnetosphere. Saturn's fast spin also makes it the most flattened (oblate) of the planets; its polar diameter of 67,560 mi (108,728 km) is 10% smaller than its equatorial diameter. Its average distance from the Sun is 887 million mi (1.43 billion km).

Saturn Any of a series of large two- and three-stage LAUNCH VEHICLES for spacecraft, developed by the U.S. beginning in 1958 and first flight-tested in 1961. Saturn I, the first U.S. rocket specifically developed for spaceflight, was a two-stage vehicle; it and its Saturn IB derivative placed unmanned and manned versions of APOLLO spacecraft into Earth orbit and launched unmanned satellites. Saturn V was the largest launch vehicle ever built by the U.S. and was used for the lunar missions of Apollo and to launch the SKYLAB SPACE STATION.

saturniid \sə-'tər-nē-əd\ **moth** *or* **giant silkworm moth** Any of some 800 MOTH species of the principally tropical family Saturniidae. Adults have a stout, hairy body and broad wings, often vividly coloured and patterned. Most species have a central eyespot on each wing. Among the saturniids are the io moth (*Automeris io*); the giant cecropia moth (*Hyalophora cecropia*), the largest moth native to North America, with a wingspan of 6 in. (15 cm); several species of *Antheraea* that are used as a source of commercial silk; the emperor moth (*Saturnia pavonia*); and the LUNA MOTH.

Polyphemus moth (*Antheraea polyphemus*)
WILLIAM E. FERGUSON

Saturninus \ˌsa-tər-'nī-nəs**, Lucius Appuleius** (d. 100 BC) Roman politician. From 104 he opposed the Senate, which objected to his extremist liberal positions. As TRIBUNE (103) he supported Rome's proletariat by reducing the price of grain, assigning land grants to veterans, and setting up a court to try cases of treason. The consul, MARIUS, initially supported him but later withdrew his backing. When Saturninus and his followers seized the Capitoline Hill, Marius restored order, locking the leaders of the action in the Senate house. Their enemies tore off the roof and stoned them to death. The Senate then rescinded most of Saturninus's legislation, but his land grants seem to have been recognized.

satyagraha \ˌsət-'yä-grə-hə\ Philosophy of nonviolent protest, or passive resistance. MOHANDAS K. GANDHI introduced it in South Africa (1906) and, from 1917, developed it in India in the period leading up to independence from Britain. Satyagraha seeks to conquer through submission. It involves refusing to submit to or cooperate with anything perceived as wrong, while adhering to the principle of nonviolence in order to maintain the tranquillity of mind required for insight and understanding. The principle played a significant role in the U.S. CIVIL RIGHTS MOVEMENT led by MARTIN LUTHER KING. See also CIVIL DISOBRDIENCE.

satyr and silenus \'sā-tər...sī-'lē-nəs\ In GREEK MYTHOLOGY, wild woodland creatures that are part man and part beast, the bestial part being represented as the legs of a goat or horse. From the 5th century BC, the name Silenus was applied to the foster father and tutor of DIONYSUS. Satyrs and sileni are depicted in art and literature in the company of NYMPHS, whom they constantly pursue. PRAXITELES' sculptures represented a new artistic type in which the satyr was young and handsome.

Sa'ūd \sȧ-'üd\ *in full* **Sa'ūd ibn 'Abd al-'Azīz al-Fayṣal Āl Sa'ūd** (b. Jan. 15, 1902, Kuwait—d. Feb. 23, 1969, Athens, Greece) King of SAUDI ARABIA (1953–64). Son and successor of IBN SA'ŪD, he continued his father's program of modernization, emphasizing the construction of

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medical and educational facilities, based on revenues from the oil industry. His financial mismanagement led to increasing opposition within the family to his rule. He was deposed in favour of his more financially competent brother, Fayṣal ibn ʿAbd al-ʿAzīz (1905–75).

Saʿūd \sä-'üd\ **dynasty** *or* **Āl Saʿūd ("Saʿūd family")** Rulers of Saudi Arabia. In the 18th century Muḥammad ibn Saʿūd (d. 1765), chief of an Arabian village that had never fallen under control of the Ottoman Empire, rose to power together with the Wahhābī religious movement. He and his son ʿAbd al-ʿAzīz I (r. 1764–1803) conquered much of Arabia; Saʿūd I (r. 1803–14) conquered Medina in 1804 and Mecca in 1806. The Ottoman sultan induced the viceroy of Egypt to crush the Saʿūdīs and Wahhābīs, which was accomplished by 1818. A second Saʿūdī state was formed in 1824 by Muḥammad ibn Saʿūd's grandson Turkī (r. 1823–34), who made Riyadh his capital. When Turkī's son Fayṣal (r. 1843–65) died, succession disputes led to civil war. Power did not return to Saʿūdī hands until 1902, when Ibn Saʿūd recaptured Riyadh. He established the kingdom of Saudi Arabia by royal decree in 1932. A number of his sons later ruled the country, including Abdullah (b. 1924), who assumed the throne in 2005.

Saudi \'saù-dē, 'sò-dē\ **Arabia** *officially* **Kingdom of Saudi Arabia** Country, Middle East, southwestern Asia. It occupies four-fifths of the Arabian Peninsula and is bounded by the Red Sea and the Persian Gulf.

Area: 830,000 sq mi (2,149,690 sq km). Population (2005 est.): 23,230,000. Capital: Riyadh. The people are predominantly Arab. Language: Arabic (official). Religion: Islam (official; predominantly Sunni). Currency: Saudi rial. The country is a plateau region, with bands of imposing highlands rising from the narrow Red Sea coast. More than nine-tenths is desert, including the world's largest continuous sand area, the Rubʿ al-Khali ("Empty Quarter"). The largest petroleum producer of the Organization of Petroleum Exporting Countries (OPEC) and one of the leading oil exporters in the world, Saudi Arabia has reserves that represent one-fourth of the world total. Its other products include natural gas, gypsum, dates, wheat, and desalinated water. It is a monarchy; its head of state and government is the king, assisted by the crown prince. Saudi Arabia is the historical home of Islam. During premodern times, local and foreign rulers fought for control of the region; in 1517 the Ottoman Empire attained nominal control of most of the peninsula. In the 18th–19th century an Islamic reform group known as the Wahhābī joined with the Saʿūd dynasty to take control of most of central Arabia; they suffered political setbacks but regained most of their territory by 1904. The British held Saudi lands as a protectorate (1915–27), after which they acknowledged the sovereignty of the Kingdom of the Hejaz and Nejd. The two kingdoms were unified as the Kingdom of Saudi Arabia in 1932. Since World War II (1939–45), the kingdom's rulers have supported the Palestinian cause in the Middle East and maintained close ties with the U.S. In 2000 Saudi Arabia and Yemen settled a long-standing border dispute.

sauger \'sò-gər\ Species (*Stizostedion canadense*) of pikeperch (family Percidae), carnivorous food and game fishes found in lakes and silty rivers of eastern North America. Saugers are slender and darkly mottled. They have two dorsal fins and rarely exceed a length of 12 in. (30 cm) or a weight of about 2 lbs (1 kg).

Saugus Iron Works First successful ironworks in colonial America. It was established in 1646 in Saugus, Mass., just north of Boston, by Robert Bridges and Joseph Jenks, after large quantities of bog iron were discovered there. It principally cast utensils and rolled and slit nail rods for the settlers. It closed c. 1688. Parts have been restored as a national historic site.

Sauk \'sòk\ *or* **Sac** Algonquian-speaking North American Indian people closely related to the Fox and Kickapoo who traditionally inhabited the region of what is now Green Bay, Wis., U.S. In summer the Sauk lived in bark-house villages near fields where women raised corn and other crops. In winter the village separated into patrilineal family groups that erected pole-and-thatch houses. In spring they gathered on the Iowa prairie to hunt bison. By c. 1800 the Sauk had settled along the Mississippi River in central Illinois, but they were forced to cede these lands to the U.S. In 1832 a group of Sauk and Fox led by Black Hawk made a tragically unsuccessful attempt to return to their Illinois lands. Today some 6,600 people claim Sauk and Fox ancestry.

Saul *Hebrew* **Shaul** (fl. 11th century BC, Israel) First king of Israel (r. 1021–1000 BC). All that is known of Saul comes from the biblical books of Samuel I and II. He was anointed king by the prophet Samuel, as a concession to popular pressure, after delivering the town of Jabesh-Gilead from Ammonite oppression. Samuel's rejection of Saul and Saul's jealousy of David led to Saul's decline. He died battling the Philistines at Mount Gilboa; David delivered the Israelites and paid tribute to the fallen Saul.

Saule \'saù-le\ In Baltic mythology, the sun goddess who determines the well-being and regeneration of all life on earth. She is said to ride each day through the sky on a chariot with copper wheels, drawn by horses that never tire or sweat. Toward evening, she washes the horses in the sea before retreating into her castle at the end of the sea. The major event in her honour was the midsummer Ligo feast, during which great fires were lit on hills to ward off evil spirits.

Sault Sainte Marie \ˌsü-ˌsānt-mə-'rē\ City (pop., 2000: 16,542), eastern Upper Peninsula, Michigan, U.S. Located on the rapids of the St. Marys River between Lakes Superior and Huron, it is linked to its Canadian twin city, Sault Sainte Marie, Ont. (pop., 2001: 74,566), by road and rail bridges. The U.S. and Canada each operate a part of the Sault Sainte Marie Canals, or Soo Canals, a hub of the Saint Lawrence Seaway. The first U.S. canal went into operation in 1855; it has since been replaced and is now divided into the northern canal (completed 1919) and the southern canal (completed 1896). The Canadian canal, which has one lock, was completed in 1895.

sauna Bath in steam from water thrown on heated stones. Known in ancient times in various places, saunas are most closely identified with the Finnish people, who made saunas a national tradition. Typically, a wooden hut containing rows of flat stones is built near the edge of a lake. Wood is burned to heat the stones, and, when the stones are hot, cold water is thrown on them to create steam. The unclothed bathers sit on wooden benches in the steam-filled hut, then beat themselves with branches until their skin is red and tingling, and dive into the cold water or (in winter) roll in the snow. These extreme temperature changes are thought to have a beneficial effect on the circulation. In an adapted form, saunas are popular today in gymnasiums and health clubs.

Saura \'saù-rä\ **(Atarés), Carlos** (b. Jan. 4, 1932, Huesca, Spain) Spanish film director. He won notice as a director with *The Hunt* (1965), the first of his allegorical films criticizing Spanish society under Francisco Franco. He wrote or cowrote the screenplays for and directed *The Garden of Delights* (1970), which was delayed then mutilated by Spanish censors; *Anna and the Wolves* (1972); and *Cousin Angelica* (1973), which was the first Spanish film to present the Spanish Civil War from the viewpoint of the losing Republican cause. He collaborated with the

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choreographer-dancer Antonio Gades on the flamenco dramas *Blood Wedding* (1981), *Carmen* (1983), and *Love the Magician* (1986). His later films include *Flamenco* (1997) and *Tango* (1998).

saurischian \sò-'ris-kē-ən\ Any "lizard-hipped" DINOSAUR species (order Saurischia), with hip bones arranged like those of modern REPTILES, the pubis bone pointed forward and down. The order includes all carnivorous and some giant herbivorous dinosaurs. Saurischians evolved from small bipedal dinosaurs called thecodonts; they first appeared in the Late TRIASSIC epoch (227–206 million years ago). The order consists of three suborders: THEROPODS, SAUROPODS, and staurikosaurs (suborder Staurikosauria). Staurikosaurs, known only from the incomplete remains of a few species, seem to have been medium-sized flesh-eaters similar to the theropods. See also ORNITHISCHIAN.

sauropod \'sór-ə-ˌpäd\ Any species of four-legged, herbivorous, SAURISCHIAN dinosaur in the suborder Sauropoda. The sauropods include the largest of all dinosaurs and the largest land animals that ever lived. They existed from the Late Triassic Epoch into the Cretaceous Period (227–65 million years ago). All species had a small head, extremely long neck, massive body, thick, pillarlike legs, and a very long, tapering, whiplike tail. With their weak, sparse teeth, they cropped vegetation from even the tallest trees, apparently depending on swallowed stones or bacteria in the gut to digest plant matter. Species ranged from 50 ft (15 m) long to the 98-ft (30-m) *Brachiosaurus*, which weighed 80 metric tons. See also BRONTOSAURUS; DIPLODOCUS; THEROPOD.

sausage Highly seasoned minced meat, usually PORK or BEEF, traditionally stuffed in casings of prepared animal intestine. Sausage has been known since ancient times. Some varieties came to be known by their city of origin: the frankfurter from Frankfurt am Main, bologna from Bologna, the wiener from Vienna (Wien). Sausage meat may be eaten fresh, smoked, dried, or pickled. It may be mixed with other meats and additives such as cereals, vegetable starch, soy flour, preservatives, artificial colourings, salt, and various herbs and spices. Casings may be intestine, paraffin-treated fabric bags, or synthetic sleeves of plastic or reconstituted COLLAGEN. All but dry (cured) sausages require refrigerated storage. Cooked and dry sausages are ready to eat; fresh (and frozen) sausages must be cooked.

Saussure \sō-'sʉ̈r**, Ferdinand de** (b. Nov. 26, 1857, Geneva, Switz.—d. Feb. 22, 1913, Geneva) Swiss linguist. Though his only written work appeared while he was still a university student, Saussure became very influential as a teacher, principally at the University of Geneva (1901–13). Two of his students reconstructed lecture notes and other materials as *Course in General Linguistics* (1916), often considered the starting point of 20th-century LINGUISTICS. He saw language as a structured system that may be approached both as it exists at a particular time and as it changes over time, and he formalized principles and methods of study for each approach. His concepts may be regarded as the beginning of STRUCTURALISM.

Sauveur \sō-'vœr**, Albert** (b. June 21, 1863, Louvain, Belg.—d. Jan. 26, 1939, Boston, Mass., U.S.) Belgian-born U.S. metallurgist. He immigrated to the U.S. in 1887 and taught at Harvard University (1899–1939). His microscopic and photomicroscopic studies of metal structures make him one of the founders of physical METALLURGY. His work in HEAT-TREATING of metals is regarded as a scientific landmark. He wrote the influential treatise *Metallography and Heat Treatment of Iron and Steel* (1912).

Sava River \'sä-vä\ River, western Balkans, southern Europe. It flows for 584 mi (940 km), and its basin covers much of Slovenia, Croatia, Bosnia, and northern Serbia. It rises in the JULIAN ALPS as two rivers, which join at Radovlijica. It then flows through Slovenia and Croatia, forming the border between Croatia and Bosnia before entering Serbia and joining the DANUBE RIVER at BELGRADE.

Savannah City (pop., 2000: 131,510), southeastern Georgia, U.S. Located at the mouth of the SAVANNAH RIVER, it is the oldest city in Georgia and its principal seaport. It was established in 1733 by JAMES OGLETHORPE and was the birthplace of the Georgia colony, the seat of the colonial government, and capital of the state until 1786. A major Confederate supply port during the AMERICAN CIVIL WAR, the city was the objective of Union Gen. WILLIAM T. SHERMAN's march to the sea in 1864. Noted for its beautiful historic buildings built around a system of small parks, it is a leading tourist centre. It is the site of several institutions of higher learning.

Savannah River River, eastern Georgia, U.S. Formed by the confluence of the Tugaloo and Seneca rivers at Hartwell Dam, it flows southeast to form the boundary between Georgia and South Carolina. It empties into the Atlantic Ocean at SAVANNAH after a course of 314 mi (505 km). It is navigable for ocean vessels to 5 mi (8 km) above Savannah and for barge traffic to Augusta.

savant syndrome Rare condition wherein a person of subnormal intelligence or severely limited emotional range has prodigious intellectual gifts in a specific area. Mathematical, musical, artistic, and mechanical abilities have been among the talents demonstrated by savants. Examples include performing rapid mental calculations of huge sums, playing lengthy compositions from memory after a single hearing, and repairing complex mechanisms without training. About 10% of autistic people are savants; mentally retarded people may also be savants, though the incidence is much lower. See also AUTISM.

Save \'sä-vē\ **River** *or* **Sabi** \'sä-bē\ **River** River, southeastern Africa. It rises in Zimbabwe and flows east-southeast across the border into Mozambique, continuing east into the MOZAMBIQUE CHANNEL. It is about 400 mi (645 km) long and is navigable by light craft for 100 mi (160 km) above its mouth.

Savigny \'zä-vin-yē**, Friedrich Karl von** (b. Feb. 21, 1779, Frankfurt am Main—d. Oct. 25, 1861, Berlin, Prussia) German jurist and legal historian. He was nobly born, and his privileged position enabled him to devote his life to scholarship. Teaching at the University of Berlin (1810–42), he helped found the influential "historical school" of jurisprudence. His six-volume *History of Roman Law in the Middle Ages* (1815–31) laid the foundation of the modern study of medieval law. He founded a system for establishing a modern German CIVIL LAW with his eight-volume *System of Modern Roman Law* (1840–49), which also contained his system of international private law. A product of Romanticism, he regarded law as a reflection of a people's customs and spirit that could not be imposed artificially by means of rational, formal legislation.

Savimbi \sə-'vim-bē**, Jonas (Malheiro)** (b. Aug. 3, 1934, Portuguese Angola—d. Feb. 22, 2002, near Lucusse, Angola) Angolan guerrilla leader and politician. After obtaining a doctorate abroad, Savimbi returned to found the National Union for the Total Independence of Angola (UNITA) in 1966. With aid from China, South Africa, and the U.S., UNITA developed a large guerrilla army and embarked on an extended war against the Soviet-backed Angolan government. In 1991 Savimbi agreed to participate in free multiparty elections, but after losing he resumed his military campaign. A peace accord (1994) and later agreements (1996) permitted UNITA to join a coalition government; many of the agreements' measures were carried out under UN auspices, but Savimbi declined to become vice president, and violence continued until his death. UNITA signed a peace agreement in April 2002.

saving Process of setting aside a portion of current income for future use, or the resources accumulated in this way over a given period of time. Savings may take the form of bank deposits and cash holdings or securities. How much individuals save is affected by their preferences for future over present consumption and their expectations of future income. If individuals consume more than the value of their income, then their saving is negative and they are said to be dissaving. Individual saving may be measured by estimating disposable income and subtracting current CONSUMPTION expenditures. A measure of business saving is the increase in net worth shown on a BALANCE SHEET. Total national saving is measured as the excess of national income over consumption and taxes. Saving is important to economic progress because of its relation to INVESTMENT: an increase in productive wealth requires that some individuals abstain from consuming their entire income and make their savings available for investment.

savings and loan association Financial institution that accepts savings from depositors and uses those funds primarily to make loans to home buyers. Savings and loan associations (S&Ls) originated with 18th-century British building societies, in which workmen banded together to finance the building of their homes. The first U.S. savings and loan was established in Philadelphia in 1831. S&Ls were initially cooperative institutions in which savers were shareholders in the association and received dividends in proportion to profits, but today are mutual organizations that offer a variety of savings plans. They are not obliged to rely on individual deposits for funds but are permitted to borrow from other financial institutions and to market mortgage-backed SECURITIES, money-market certificates, and STOCK. Because high INFLATION and rising interest rates in the 1970s made fixed-rate mortgages unprofitable, regulations were altered to

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permit S&Ls to renegotiate mortgages. In the late 1980s, a growing number of S&Ls failed because inadequate regulation had allowed risky investments and fraud to flourish. The government was obliged to cover vast losses in excess of $200 billion, and the Federal Savings and Loan Insurance Corp. (FSLIC) became insolvent in 1989. Its insurance functions were taken over by a new organization supervised by the Federal Deposit Insurance Corp., and the Resolution Trust Corp. was established to handle the bailout of the failed S&Ls.

savings bank Financial institution that gathers savings and pays interest or dividends to savers. It channels the savings of individuals who wish to consume less than their incomes to borrowers who wish to spend more. This function is performed by mutual savings banks, savings and loan associations, credit unions, postal savings systems, and municipal savings banks. Unlike a commercial bank, a savings bank does not accept demand deposits. Many savings banks originated as part of a philanthropic effort to encourage saving among people of modest means. The earliest municipal savings banks developed from the municipal pawnshops of Italy (see pawnbroking). Other early savings banks were founded in Germany in 1778 and The Netherlands in 1817. The first U.S. savings banks were nonprofit institutions established in the early 1800s for charitable purposes.

Savonarola \ˌsa-və-nə-ˈrō-lə,\ *Italian* \ˌsä-vō-nä-ˈrô-lä**, Girolamo** (b. Sept. 21, 1452, Ferrara, duchy of Ferrara—d. May 23, 1498, Florence) Italian preacher, religious reformer, and martyr. He joined the Dominican order in 1475 and was sent to Florence to lecture at the convent of San Marco, where he became known for his learning and asceticism. His apocalyptic preaching maintained that the church needed reforming, that it would be scourged and then renewed. After the overthrow of the Medici family (1494), Savonarola became leader of Florence, setting up a democratic but severely puritanical government, notable for its "bonfire of the vanities," in which frivolous materials were burned. He also sought to establish a Christian republic as a base for reforming Italy and the church. He was opposed by the Arrabiati, supporters of the Medici, and by Pope Alexander VI, who attempted to restrain his unusual interpretations of scripture and his claim of prophecy. Savonarola was tried, convicted of heresy (1498), and hanged and burned. Despite popular veneration, attempts to bring about his canonization have been unsuccessful.

Savonarola, painting by Fra Bartolomeo; in the Museo di S. Marco, Florence
ALINARI—ART RESOURCE/EB INC.

savory Aromatic annual herb (*Satureja hortensis*) of the mint family, native to southern Europe. The dried leaves and flowering tops are used as a flavouring and in herb bouquets. Winter, or dwarf, savory (*S. montana*) is smaller and flowers in winter. It is used for culinary purposes almost interchangeably with the summer species.

Savoy *French* **Savoie** \sȧ-ˈvwȧ\ *Italian* **Savoia** \sä-ˈvȯ-yä\ Historical region, southeastern France and northwestern Italy. From the 11th century the counts of Savoy ruled it as part of the kingdom of Arles under the suzerainty of what would become the Holy Roman Empire. It became virtually independent and expanded across the Alps to include the plain of Piedmont in Italy. In the 18th century Piedmont and Savoy were incorporated into the kingdom of Sardinia, and the dukes of Savoy became kings of Sardinia. Savoy and Piedmont were ceded to France in 1792, but Savoy was restored to its traditional rulers in 1815, with the addition of Genoa. In 1860 Sardinia, Genoa, and Piedmont joined other Italian states to form the Kingdom of Italy. The house of Savoy was the ruling house of Italy until 1946, when the Italian Republic was established.

Savoy, house of Historic dynasty of Europe and the ruling house of Italy (1861–1946). Its founder was Umberto I the Whitehanded (d. 1048?), who held the county of Savoy and areas east of the Rhône River and south of Lake Geneva. His medieval successors, including Amadeus VI, added territory in the western Alps where France, Italy, and Switzerland converge. In 1416 the house was raised to ducal status in the Holy Roman Empire, after which it declined until the late 16th century. Although under French domination in the 17th century, the house under Victor Amadeus II acquired territory in northeastern Italy and attained the royal title, first of the kingdom of Sicily (1713), which he exchanged for Sardinia (1720). The house was powerful in the Risorgimento, and under the kings Victor Emmanuel I, Victor Emmanuel II, and Charles Albert it contributed to the 19th-century unification of Italy. It then lost its prominence, and the monarchs Umberto I and Victor Emmanuel III served mainly as figureheads until the vote for a republic in 1946 ended Savoy rule.

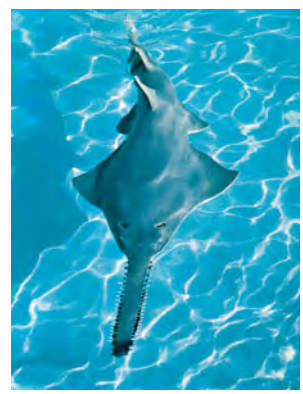
saw Tool for cutting solid materials to prescribed lengths or shapes. Most saws take the form of a thin metal strip with teeth on one edge or a thin metal disk with teeth on the edge. The teeth are usually set to alternate sides so that the kerf (groove) cut by the saw is wider than the thickness of the saw; the saw blade can thus move freely in the groove without binding. Thin-strip saws are used in various ways in both hand and machine operations; circular, or disk, saws are always machine powered (see sawing machine, machine tool).

saw palmetto Any of several shrubby palms chiefly of the southern U.S. and West Indies that have spiny-toothed petioles (leafstalks), especially a common palm (*Serenoa repens*) of the southeastern U.S., with a usually creeping stem. Saw palmettos make up part of the vegetation found in the Florida Everglades. When undisturbed, they grow into great masses of foliage. The saw palmetto has recently drawn attention as the source of a possible treatment for prostate cancer.

Sawatch \sə-ˈwäch\ **Range** Range of the Rocky Mountains, central Colorado, U.S. It is 100 mi (160 km) long and is bounded by the Arkansas River and the Elk Mountains. Its middle portion, with Mounts Yale, Harvard, and Princeton, is usually called the Collegiate Range. Many summits exceed 14,000 ft (4,300 m), including Mount Elbert (14,433 ft [4,399 m]), the highest point in the Rockies. The discovery of gold in 1860 attracted settlers to the region. Ranching, dairying, and tourism are the main industries today.

Sawchuk \ˈsȯw-chək**, Terry** *in full* **Terrence Gordon Sawchuck** (b. Dec. 28, 1929, Winnipeg, Man., Can.—d. May 31, 1970, New York, N.Y., U.S.) Canadian-U.S. hockey goalie. He played two seasons in other leagues before going to the National Hockey League (1949), in which he played for the Detroit Red Wings (1949–54, 1957–64), Boston Bruins (1955–56), Toronto Maple Leafs (1964–67), and other teams. His career record of 103 shutouts still stands; he is second in career wins (447).

sawfish Any of about six species (genus *Pristis*, family Pristidae) of sharklike ray. Sawfishes have a long head, long body, and a long, toothed, bladelike snout. The largest attain lengths of 23 ft (7 m) or more. These bottom-dwellers inhabit shallow waters of subtropical and tropical bays and estuaries and sometimes swim up rivers. Some live in the freshwaters of Lake Nicaragua. They are not generally dangerous. Their saws are used either to dig out bottom animals or, when lashed about, to kill or maim schooling fishes. Sawfishes are good to eat when small; they are fished in some areas for food, oil, skins, and other products.



Sawfish (*Pristis*).
KARL H. MASLOWSKI

sawfly Any of numerous, widely distributed insect species in five families (superfamily Tenthredinoidea, order Hymenoptera). Typical sawflies (family Tenthredinidae) are often brightly coloured and are commonly found on flowers; the North American pear slug eats pear, cherry, and plum leaves. The larvae of many species in the other four families also damage trees. Argid sawflies (family Argidae) feed on rose bushes and willow, oak, and birch trees. The North American elm sawfly (family Cimbicidae) feeds on elm and willow. The North American conifer sawflies

Sawfly (*Cimbex*)
WILLIAM E. FERGUSON

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(family Diprionidae) are common, sometimes serious pests of coniferous trees. The pergid sawflies (family Pergidae) consist of a single genus in South America and Australia.

sawing machine MACHINE TOOL for cutting up bars of material or for cutting out shapes in plates of raw material. The cutting tools (SAWS) may be thin metallic disks with teeth on their edges, thin metal blades or flexible bands with teeth on one edge, or thin grinding wheels. The tools may use any of three actions: true cutting, grinding, or friction-created melting.

sawmill Machine or plant with power-driven machines for sawing logs into rough-squared sections or into planks and boards. A sawmill may be equipped with planing, molding, tenoning, and other machines for finishing processes. Cutting is performed on various large machines; reciprocating saws, band saws, or circular saws cut the log into various thicknesses as it moves past the saw on a feeder table. The biggest mills are usually located where timber can be brought by river or rail, and mill design is affected by the mode of transportation.

Sax, Adolphe *orig.* **Antoine-Joseph Sax** (b. Nov. 6, 1814, Dinant, Belg.—d. Feb. 7, 1894, Paris, France) Belgian instrument maker. Son of an accomplished instrument maker, he worked for his father until 1842, making improvements on the clarinet and bass clarinet. He then set up shop in Paris, supported by musicians such as HECTOR BERLIOZ and Fromental Halévy (1799–1862) but opposed by French instrument makers; he invented several new families of instruments, including the saxhorns, the saxtrombas, and most successfully, the SAXOPHONES. A fine woodwind player, he taught saxophone at the Paris Conservatoire (1857–71).

Saxe, (Hermann-) Maurice, count de (b. Oct. 28, 1696, Goslar, Saxony—d. Nov. 30, 1750, Chambord, France) German-born French general. The illegitimate son of Frederick Augustus I of Saxony, he served under EUGENE OF SAVOY in Flanders and was made count of Saxony (Saxe) in 1711. He commanded a German regiment in the French service (1719) and made innovations in military training, especially in musketry. He served with distinction in the French army against his half brother AUGUSTUS III in the War of the POLISH SUCCESSION and was made a general (1734). He successfully led French forces in the War of the AUSTRIAN SUCCESSION, capturing Prague (1741) and invading the Austrian Netherlands. There he won the Battle of Fontenoy (1745) and captured Brussels and Antwerp (1746). Appointed marshal general of France by LOUIS XV, Saxe led the successful invasion of Holland in 1747.

Saxe-Coburg-Gotha, House of See House of WINDSOR

saxifrage \'sak-sə-frij\ Any of about 300 species of the genus *Saxifraga*, of the family Saxifragaceae, which is composed of 36 genera of mostly perennial herbaceous plants. Members of the saxifrage family are known for their ability to grow and thrive on exposed rocky crags and in fissures of rocks. They are adapted to the full range of moisture conditions, but most grow in moist, shaded woodlands in northern cold and temperate regions. Leaves characteristically alternate along the stem and sometimes are deeply lobed or form rosettes. Flowers generally are borne in branched clusters and range in colour from greenish to white or yellow and from pink or red to purple. The fruit is a CAPSULE. *Saxifraga* species are planted in rock gardens or as border ornamentals, prized for their small, bright flowers, fine-textured foliage, and early spring flowering. Other well-known genera in the saxifrage family are *Astilbe*, *Heuchera*, and *Mitella*.

Saxo Grammaticus \'sak-sō-grə-'ma-ti-kəs\ (fl. 12th century–early 13th century) Danish historian. Little is known of Saxo's life except that he was from Sjælland, born to a family of warriors, and probably served as clerk to the archbishop of Lund. His 16-volume *Gesta Danorum* ("Story of the Danes") is the first important work on the history of Denmark and the first Danish contribution to world literature. A panorama of his country's antiquity and traditions, it inspired many 19th-century Danish Romantic poets and was the original source of the story of WILLIAM SHAKESPEARE's *Hamlet*. Saxo's brilliant, ornate Latin earned him the name "Grammaticus" in the 14th century.

Saxon Any member of a Germanic people who lived along the Baltic coast in ancient times and later migrated west as far as the British Isles. The Saxons became pirates in the North Sea during the decline of the Roman empire, and in the early 5th century they spread through northern Germany and along the coasts of Gaul and Britain. They fought CHARLEMAGNE (772–804) before being incorporated into the Frankish kingdom, and they settled Britain along with other Germanic invaders, including the ANGLES and the Jutes.

Saxony *German* **Sachsen** \'zäk-sən\ Historical region, former state, and recreated state, Germany. Before 1180 the name was applied to the territory conquered c. AD 200–700 by the Germanic Saxon tribe. They were conquered and Christianized by CHARLEMAGNE in the late 8th century. In the mid-9th century Saxony became part of the German kingdom of the FRANKS. The territory was broken up in 1180 and divided into two smaller and widely separated areas, Saxe-Lauenburg on the lower ELBE RIVER and Saxe-Wittenberg on the middle Elbe. From 1422 the name Saxony was applied to a large region, including the country from THURINGIA to Lusatia, bordering Bohemia. It was part of the German Empire (1871–1918) and a free state in the WEIMAR REPUBLIC (1919–33). The state was abolished in 1952 and divided among East German districts. Upon German reunification in 1990, a new state of Saxony was recreated. The current territory of Saxony *Land* (pop., 2001 est.: 4,384,192) occupies the southeastern portion of what was formerly East Germany and covers an area of 7,080 sq mi (18,337 sq km). The capital is Dresden.

saxophone Single-reed wind instrument with a conical metal tube and finger keys. Though made of brass, it is classified as a WOODWIND INSTRUMENT. Its mouthpiece resembles that of the CLARINET. The saxophone family includes instruments with at least eight different ranges, the tenor and alto instruments being the most common. The smallest (highest-range) saxophones are straight; the rest have curved necks and their bells are bent up and out. Transposing instruments (producing a higher or lower pitch than indicated in music written for it) in B-flat and E-flat, all have the same written 3½-octave range. The saxophone was patented in 1846 by ADOLPHE SAX, who created two separate instrument families, for military and orchestral use respectively. Though few composers included saxophones in their orchestral scores, they became centrally important in military, dance, and jazz bands.

Say \'se,\ *English* \'sā**, J(ean)-B(aptiste)** (b. Jan. 5, 1767, Lyon, France—d. Nov. 15, 1832, Paris) French economist. He edited a magazine and started a spinning mill before joining the faculty of the Conservatory of Arts and Crafts (1817–30) and the Collège de France (1830–32). In his major work, *A Treatise on Political Economy* (1803), he advanced his law of markets, which claims that supply creates its own demand. He attributed economic DEPRESSION not to a general deficiency in demand but rather to temporary overproduction for some markets and underproduction for others, an imbalance that must automatically adjust itself as overproducers redirect their production to conform with consumers' preferences. Say's law remained a central tenet of orthodox economics until the GREAT DEPRESSION.

Sayan \sə-'yän\ **Mountains** Large upland region on the frontiers of east-central Russia and Mongolia. The mountains form a rough arc stretching from the ALTAI MOUNTAINS to Lake BAIKAL and connecting with the Khamar-Daban mountain system of the Transbaikalia. The western and eastern ranges, each with a different geologic history, meet in a central knot where elevations exceed 10,000 ft (3,000 m). The range's highest peak is Munku-Sardyk, in Mongolia, which reaches an elevation of 11,453 ft (3,491 m).

Sayers, Dorothy L(eigh) (b. June 13, 1893, Oxford, Oxfordshire, Eng.—d. Dec. 17, 1957, Witham, Essex) English scholar and writer. In 1915 Sayers became one of the first women to graduate from Oxford University. Her first major work was *Whose Body?* (1923), in which she created the detective Lord Peter Wimsey, a witty, dashing young gentleman-scholar who would be featured in such later short-story collections and novels as *Strong Poison* (1930), *The Nine Tailors* (1934), and *Busman's Honeymoon* (1937). After the 1930s she concentrated on theological dramas and books, radio plays, and scholarly translations, notably of DANTE's *Divine Comedy*.

Sayles, John (b. Sept. 28, 1950, Schenectady, N.Y., U.S.) U.S. film director. He graduated from Williams College and wrote short stories and novels, including *Union Dues* (1977), before becoming a screenwriter for ROGER CORMAN. He made his directorial debut with the acclaimed *Return of the Secaucus Seven* (1980). He explored social and political issues in other thoughtful films such as *Lianna* (1982), *Matewan* (1987), *Eight Men Out* (1988), *City of Hope* (1991), *Lone Star* (1996), and *Sunshine State* (2002), and he usually wrote his own screenplays. He also directed the

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children's movie *The Secret of Roan Inish* (1994). Sayles was one of America's most successful independent filmmakers.

Sayyid Quṭb See Sayyid Quṭb

Sazonov \sə-'zȯ-nəf**, Sergey (Dmitriyevich)** (b. Aug. 10, 1860, Ryazan province, Russia—d. Dec. 25, 1927, Nice, Fr.) Russian diplomat. After he became minister of foreign affairs in 1910, Sazonov promoted close relations with Britain and France and supported the Balkan League against Turkey. He contributed to the precipitating events of World War I by affirming Russia's support for Serbia against Austria and insisting that Nicholas II order the mobilization of the Russian army (July 30, 1914); two days later, Germany declared war on Russia. He set Russia's war aim as the annexation of Constantinople and the Turkish straits but was dismissed when he urged the tsar to grant Poland autonomy. After the Russian Revolution of 1917, Sazonov moved to France.

scabious \'skā-bē-əs\ Any of about 100 species of annual and perennial herbaceous plants that make up the genus *Scabiosa* (family Dipsaceae), native to temperate Eurasia, the Mediterranean, and mountains of eastern Africa. Some are important garden plants, including the southern European annual pincushion flower (*S. atropurpurea*), also called sweet scabious, mourning bride, or garden scabious. All species have leaf rosettes at the base of the plant, and leafy stems. Flower heads have an outer ring of female flowers and a circle of leaflike bracts below. Devil's bit scabious belongs to the genus *Succisa* (see bluebonnet).

Perennial scabious (*Scabiosa caucasica*)
VALERIE FINNIS

Scaevola \'sē-və-lə**, Quintus Mucius** *or* **Pontifex** (d. 82 BC) Roman lawgiver. He served successively as consul, as governor of the province of Asia, and from c. 89 as *pontifex maximus*. About 95 he obtained the passage of the *lex Licinia Mucia*, removing certain groups from the citizen rolls, which led to the Social War of 90–88. His major work was an 80-volume systematic treatise on civil law, which was frequently quoted and followed by subsequent writers. His handbook *Horoi* consisted of short rules of law and explanations of legal terms; it was the oldest work excerpted in Justinian I's Digest.

scaffold Temporary platform used to elevate and support workers and materials during work on a structure or machine. It consists of one or more wooden planks and is supported by either a timber or a tubular steel or aluminum frame; bamboo is used in parts of Asia. Scaffolding may be raised and lowered by means of cables controlled by a ratchet or electric motor.

scalawag U.S. Southerner who supported Reconstruction. Opponents also applied the pejorative term to those who joined with carpetbaggers and freedmen to support Republican Party policies. The term, of unknown origin, was used from the 1840s to denote a worthless farm animal and later a worthless person. Scalawags included former Whigs and hill-country farmers with Unionist sympathies and constituted nearly 20% of the white electorate after the American Civil War. Many held government positions in the South and advocated moderate reforms.

scale In music, primary pitches of a key or mode arranged within an octave. Scales are distinguished by the pattern of the intervals between adjacent notes. A scale can be seen as an abstraction from melody—that is, the pitches of a melody arranged in stepwise order.

Examples of the chromatic, major, and minor scales.
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scale insect Any member of several families of sap-sucking insects (order Homoptera) whose bodies are covered by a waxy shell (the scale). The eggs are protected by the female's body or scale or a waxy filamentous mass. Scale insects may attack any part of a plant, but each species is host-specific. Many species are serious plant pests; others have commercial value. The lac insect is used in a red dye and in shellac. Cochineal, a red dyestuff, consists of the dried, pulverized bodies of females of the species *Dactylopius coccus*. See also cottony-cushion scale, San Jose scale.

Scalia \skə-'lē-ə**, Antonin** (b. March 11, 1936, Trenton, N.J., U.S.) U.S. jurist. He studied at Georgetown University and Harvard Law School, where he edited its law review. Successively, he worked for a Cleveland law firm (1961–67), taught at the University of Virginia (1967–74), served as an assistant U.S. attorney general (1974–77), and taught at the University of Chicago (1977–82). He was appointed by Pres. Ronald Reagan to the U.S. Court of Appeals (1982) and then to the Supreme Court of the United States (1986). Among the court's most outspoken justices, he quickly earned a reputation for aggressive oral argument and scathingly critical written opinions, especially when expressing dissenting views. An opponent of "judicial activism," he favoured a restrained judiciary, deference to the original intent of the framers in constitutional interpretation, and a limited role for the federal government.

Scaliger \'ska-lə-jər**, Julius Caesar, and Scaliger, Joseph Justus** (respectively b. April 23, 1484, Riva, Republic of Venice—d. Oct. 21, 1558, Agen, France; b. Aug. 5, 1540, Agen, France—d. Jan. 21, 1609, Leiden, Holland) Classical scholars. Julius worked in botany, zoology, and grammar but was chiefly interested in developing an understanding and critical evaluation of the ancients. His most widely read book was his *Poetics* (1561), in which Greco-Roman rhetoric and poetics are used as a foundation for literary criticism. His son Joseph, a precocious student of language, studied in France, Germany, and Italy and taught in France before he was called to the University of Leiden, where he became known as the most erudite scholar of his time. His major works are the *Study on the Improvement of Time* (1583) and *Thesaurus of Time* (1609), which brought order to ancient chronology.

scallop Any of more than 400 species (family Pectinidae) of marine bivalves found worldwide, from the intertidal zone to deep waters. The two halves of the shell (valves) are usually fan-shaped, except for a winglike projection at either side of the straight hinge. The shells are 1–6 in. (2.5–15 cm) long. They may be smooth or ribbed and red, purple, orange, yellow, or white. Cilia filter microscopic plants and animals from the water and move them toward the mouth. Scallops swim by clapping the valves, propelling themselves forward. The muscle that closes the valves is a popular food item.

scalping Removal of all or part of the scalp, with hair attached, from an enemy's head. It is best known as a practice of North American Indian warfare. At first confined to eastern tribes, it spread as a result of bounties offered by the French, English, Dutch, and Spanish for the scalps of enemy Indians and sometimes of enemy whites. Many American frontiersmen and soldiers adopted the custom. Among Plains Indians, scalps were taken for war honours, usually from dead enemies, although some warriors preferred a live victim. The operation was not necessarily fatal, and some victims were released alive.

scaly anteater See pangolin

Scamander River See Menderes River

scampi *or* **Dublin Bay prawn** *or* **Norway lobster** Edible lobster (*Nephrops norvegicus*), widespread in the Mediterranean and northeastern Atlantic. It is sold as a delicacy over much of its range. Scampi live in burrows on soft sea bottoms at depths of 33 to 820 ft (10–250 m). They grow to about 8 in. (200 mm) long and weigh about 7 oz (200 g). The slender claws may be almost as long as the body. Most scampi are trawled, but some are caught in baited lobster pots.

Scandinavia Region of northern Europe, usually defined as comprising Norway, Sweden, and Denmark. It is sometimes used more broadly to include Finland and Iceland. Norway and Sweden occupy the Scandinavian Peninsula, though Denmark is part of the North European Plain. The Scandinavian peoples are linked by cultural similarities, and they speak a closely related group of Germanic languages.

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Scandinavian Peninsula Large promontory, northern Europe. Occupied by Norway and Sweden, it is about 1,150 mi (1,850 km) long, with an area of 290,000 sq mi (750,000 sq km), and it extends south from the Barents Sea. It is largely mountainous; its eastern side slopes gently to the Baltic Sea, while the western side has mountains reaching the coast and is deeply dissected by fjords.

scanner, optical Computer input device that uses a light beam to scan codes, text, or graphic images directly into a computer or computer system. Bar-code scanners are used widely at point-of-sale terminals in retail stores. A handheld scanner or bar-code pen is moved across the code, or the code itself is moved by hand across a scanner built into a checkout counter or other surface, and the computer stores or immediately processes the data in the bar code. After identifying the product through its bar code, the computer determines its price and feeds that information into the cash register. Optical scanners are also used in fax machines and to input graphic material directly into personal computers. See also OCR.

Scapa Flow Sea basin, Orkney Islands, Scotland. Located off of Scotland's northern tip, the basin is about 15 mi (24 km) long and 8 mi (13 km) wide. Its extensive sheltered waters served as a major British naval base during World Wars I and II. The Germans scuttled their fleet there after World War I. The base was fortified in World War II following German attacks and the sinking of the battleship *Royal Oak* in 1939. The base closed in 1956.

scapegoat In the Old Testament, a goat that was symbolically burdened with the sins of the people and then killed on Yom Kippur to rid Jerusalem of its iniquities. Similar rituals were held elsewhere in the ancient world to transfer guilt or blame. In ancient Greece, human scapegoats were beaten and driven out of cities to mitigate calamities. In early Roman law, an innocent person was allowed to assume the penalty of another; Christianity reflects this notion in its belief that Jesus died to atone for the sins of mankind.

scar Mark left on the skin after a wound heals. Cells called fibroblasts produce collagen fibres, which form bundles that make up the bulk of scar tissue. Scars have a blood supply but no oil glands or elastic tissue, so they can be slightly painful or itchy. Hypertrophic scars grow overly thick and fibrous but remain within the original wound site. Scars can also develop into tumourlike growths called keloids, which extend beyond the wound's limits. Both can inhibit movement when they result from serious burns over large areas, especially around a joint. Scars, especially those from unaided healing of third-degree burns, can become malignant. Treatment of serious scars is one of the most important problems in plastic surgery.

scarab \'skar-əb\ In Egyptian religion, a symbol of immortality much used in funerary art. It was inspired by the life cycle of the scarab beetle; the dung balls that the beetles consume, lay their eggs in, and use to feed their young represented a cycle of rebirth and were associated with immortality and with the passage of the sun across the heavens. Many scarabs were made of precious metals and were worn as amulets or used as seals. First appearing c. 2575–c. 2130 BC, they were fashioned in great numbers during the Middle Kingdom and New Kingdom.

Scarab commemorating the marriage of Amenhotep III and Queen Tiy, 18th dynasty; in the Oriental Institute, Chicago

COURTESY OF THE ORIENTAL INSTITUTE, THE UNIVERSITY OF CHICAGO

scarab beetle Any of about 30,000 beetle species (family Scarabaeidae), found worldwide, that are compact, heavy-bodied, and oval. Each antenna terminates in three flattened plates that fit together to form a club. The outer edges of the front legs may be toothed or scalloped. Species range from about 0.2 to 4.8 in. (5 to 120 mm) long and include one of the heaviest known insects. One species of dung beetle, *Scarabaeus sacer*, was sacred to the ancient Egyptians. Many species are agricultural pests (e.g., chafer, Japanese beetle, June beetle); many are popular with insect collectors because they are large and have beautifully coloured, hard, highly polished forewings.

Scarborough Town and borough (pop., 2001: 106,233), North Yorkshire, England. Located on the North Sea coast, Scarborough originated as a 10th-century Viking fishing settlement at the site of a 4th-century Roman signal station. In the 12th century a Norman castle was built on the headland. After 1626, spa development made it a fashionable resort. It remains the most popular seaside resort in northeastern England. The borough of Scarborough extends far beyond old Scarborough town.

Scarborough Former city (pop., 2001: 593,297), southeastern Ontario, Canada. In 1998 it joined the cities of Etobicoke, York, North York, and Toronto and the borough of East York to become the City of Toronto. First called Glasgow, Scarborough was renamed in 1793 because its coastal bluffs reminded settlers of Scarborough, Eng. Originally a farming community, it later became an industrial and residential urban area.

Scarborough Town (pop., 1990: 4,000) and deepwater harbour of Tobago island, Trinidad and Tobago. First named Port Louis, Scarborough is laid out on the steep slopes of a hill overlooking the harbour. It succeeded Georgetown as Tobago's capital in 1796. It is located in a coconut-growing area.

Scarlatti, (Pietro) Alessandro (Gaspare) (b. May 2, 1660, Palermo, Sicily, Kingdom of the Two Sicilies—d. Oct. 24, 1725, Naples) Italian composer. He may have studied with Giacomo Carissimi in Rome. His first known opera (1679) was a success, and by 1680 he was chapel master in Rome for Queen Christina of Sweden. He left this secure position to become chapel master of the viceroy of Naples (1684–1702). Most of the operas produced in the city during this period were his own, and they were increasingly heard in other cities as well, including Leipzig and London. Most of his instrumental music comes from his late period, as do his comic operas. He wrote at least 70 and perhaps more than 100 operas, as well as some 600 secular cantatas; his opera overtures (*sinfonie*) were important forerunners of the symphony. Domenico Scarlatti was his son.

Scarlatti \skär-'lät-ē**, (Giuseppe) Domenico** (b. Oct. 26, 1685, Naples—d. July 23, 1757, Madrid, Spain) Italian composer and keyboard player. Son of the composer Alessandro Scarlatti, he worked as his father's assistant in Naples. By 1705 he was living in Rome. His father subsequently sent him to Venice, where he stayed until about 1708. There he probably met George Frideric Handel and Antonio Vivaldi; he is said to have had a contest with Handel in which the German won at organ playing but Scarlatti won at the harpsichord. By 1723 he was tutor to the Spanish infanta (later crown princess) Maria Bárbara, in whose service he remained for much of his life. Though he wrote operas, oratorios, cantatas, and other works, his reputation rests on the 555 brilliant one-movement keyboard sonatas he wrote for the princess, one of the greatest bodies of work by any Baroque composer.

Domenico Scarlatti, engraving.

COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS; PHOTOGRAPH, J.P. ZIOLO

scarlet fever *or* **scarlatina** Acute infectious disease caused by some types of streptococcus bacteria. Fever, sore throat, headache, and, in children, vomiting are followed in two to three days by a rash. The skin peels in about one-third of cases. After a coating disappears, the tongue is swollen, red, and bumpy (strawberry tongue). Glands are usually swollen. Complications frequently involve the sinuses, ears (sometimes with mastoiditis), and neck. Abscesses are common. Nephritis, arthritis, or rheumatic fever may occur later. Treatment involves penicillin, bed rest, and adequate fluid intake. Scarlet fever has become uncommon and much milder since the mid-20th century, independent of the use of antibiotics.

Scarron \skä-'rō^{n}**, Paul** (baptized July 4, 1610, Paris, France—d. Oct. 7, 1660, Paris) French writer. With his first works, Scarron helped make the burlesque a characteristic literary form of his time. *Virgile travesty*, 7 vol. (1648–53) was a very successful parody of Virgil's *Aeneid*. Scarron's plays, often based on Spanish originals, were important in the theatrical life of Paris. He is now remembered for a single novel, *Le Roman comique*, 3 vol. (1651–57; "The Comic Novel"), which recounts the comical adventures of a company of strolling players; its realism makes it an

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invaluable source of information about conditions in the French provinces in the 17th century. His widow, Madame de Maintenon, was later married to Louis XIV.

scattering In physics, the change in direction of MOTION of a particle because of a collision with another particle. The collision can occur between two charged particles; it need not involve direct physical contact. Experiments show that the trajectory of the scattered particle is a hyperbola and that, as the bombarding particle is aimed more closely toward the scattering centre, the angle of deflection decreases. The term *scattering* is also used for the diffusion of electromagnetic waves by the atmosphere, resulting, for example, in long-range radio reception on the ground. See also RAYLEIGH SCATTERING.

scaup Any of three species (genus *Aythya*, family Anatidae) of DIVING DUCKS. The greater scaup, or big bluebill (*A. marila*), breeds across Eurasia and most of the Nearctic region. The lesser scaup, or little bluebill (*A. affinis*), breeds in northwestern North America. Both are popular game birds, 15–20 in. (38–51 cm) long, that winter along the U.S. coasts. Males have a dark breast and grayish back but differ in head colour and wing markings; females are brown with white patches around the blue bill. Scaups eat mainly clams. The third species is the New Zealand scaup (*A. novaeseelandiae*).

Schacht \'shäkt**, (Horace Greeley) Hjalmar** (b. Jan. 22, 1877, Tinglev, Ger.—d. June 4, 1970, Munich, W.Ger.) German financier. He served as vice director of the Dresdner Bank and director of the German National Bank before becoming a commissioner in the finance ministry (1923), where he developed a rigorous monetary program that halted German inflation and stabilized the mark. He became president of the Reichsbank (1923–30, 1933–39) and minister of economics (1934–37), but he was dismissed when he opposed ADOLF HITLER's rearmament expenditure. Imprisoned after the JULY PLOT against Hitler's life (1944), he was later captured by the Allies and acquitted at the NÜRNBERG TRIALS. He later founded a bank in Düsseldorf and served as an international financial consultant.

Schally \'sha-lē**, Andrew V(ictor)** (b. Nov. 20, 1926, Wilno, Pol.) Polish-born U.S. endocrinologist. His family fled Poland in 1939, and he received his Ph.D. in biochemistry from McGill University in 1957. He shared a 1977 Nobel Prize for his work with ROGER C.L. GUILLEMIN and ROSALYN YALOW in isolating and synthesizing HORMONES produced by the HYPOTHALAMUS.

Scharnhorst \'shärn-ˌhȯrst**, Gerhard Johann David von** (b. Nov. 12, 1755, Bordenau, Hanover—d. June 28, 1813, Prague, Bohemia) Prussian general. He joined the Hanoverian army in 1778 and served with distinction in Belgium against the French in the 1790s. An officer in the Prussian army from 1801, he taught at the war academy and became chief of staff in the war against Napoleon (1806). As head of the army reform commission (from 1807), he developed the modern general staff system and reorganized the Prussian army; with AUGUST VON GNEISENAU he devised the system of rapid military training and use of army reserves. After a forced retirement, he became chief of staff to GEBHARD VON BLÜCHER (1813) and died of a wound received in the Battle of Lützen.

Schaumburg-Lippe \'shaům-ˌbůrk-'li-pə\ Former German state. Schaumburg was the ancestral seat of a line of counts recorded from the early 12th century. The line died out in 1640 and the lands were partitioned. It joined the GERMAN CONFEDERATION in 1815 and the German empire in 1871. It joined the WEIMAR REPUBLIC in 1918 as a free state; in 1946 it was merged into the state of Lower Saxony.

Schechter \'shek-tər\ **Poultry Corporation v. United States** (1935) Decision of the Supreme Court of the United States that abolished the National Industrial Recovery Act (NIRA; see NATIONAL RECOVERY ADMINISTRATION), a cornerstone of the NEW DEAL. By unanimous vote, the court held that Congress had exceeded its authority by delegating too much legislative power to the president and industrial groups. It also found that NIRA's "codes of fair practice" went beyond the regulation of interstate commerce in attempting to control intrastate activity. NIRA's successor, the National Labor Relations Act (1935), proved acceptable to the court.

Scheherazade *or* **Sheherazade** \shə-ˌher-ə-'zäd\ Fictional sultan's wife who narrated *The* THOUSAND AND ONE NIGHTS. According to the story that serves as the collection's framework, the Sultan Shahryar found his first wife unfaithful, and, after deciding that he hated all women, he married and killed a new wife each day. Scheherazade, daughter of his vizier, in an effort to avoid his previous wives' fate, related to him a fascinating story every night, promising to finish it on the following night. The sultan enjoyed the stories so much that he put off her execution indefinitely and finally abandoned the idea altogether.

Scheidt \'shīt**, Samuel** (b. 1587, Halle, Saxony—d. March 30, 1654, Halle) German composer. After study in Amsterdam with JAN PIETERSZOON SWEELINCK, he returned to his native Halle and spent his entire life there in various musical offices, including court organist and later kapellmeister to the Margrave of Brandenburg. He wrote much sacred vocal music in both German and Latin, including *Geistliche Concerte* (1631–40). His chief work for keyboard (mostly organ) was *Tabulatura nova* (1624), written in open score rather than traditional organ tablature. The collection contains fantasias, toccatas, "echo pieces," organ responses for liturgical use, and, most important, variations on chorale melodies.

Schein \'shīn**, Johann Hermann** (b. Jan. 20, 1586, Grünhain, Saxony—d. Nov. 19, 1630, Leipzig) German composer. After singing as a boy in the chapel of the elector of Saxony, he studied music at the University of Leipzig. In 1616 he became cantor of St. Thomas Church in Leipzig, the post later held by JOHANN SEBASTIAN BACH. In this capacity, he was an important teacher, became friends with SAMUEL SCHEIDT and HEINRICH SCHÜTZ, and wrote sacred works that combined the vocal lyricism of Italian music with the Northern contrapuntal style. His *Banchetto musicale* (1617) is a collection of dances, perhaps the first in which dances are gathered into unified suites, with common thematic motifs. His sacred vocal works include *Opella nova* (1618–26) and the hymn collection *Cantional* (1627).

Schelde \'skel-də\ **River** *or* **Scheldt** \'skelt\ **River** *French* **Escaut** \es-'kō\ River, western Europe. The Schelde rises in northern France, flows through western Belgium to the city of ANTWERP, turns northwest, and empties into the NORTH SEA in Dutch territory after a course of 270 mi (435 km). Along with the lower RHINE and the MEUSE rivers, it drains one of the world's most densely populated areas. A channel in the western Schelde allows oceangoing vessels to reach Antwerp at full tide.

Scheler \'shā-lər**, Max** (b. Aug. 22, 1874, Munich, Ger.—d. May 19, 1928, Frankfurt am Main) German philosopher. He is remembered primarily for his contributions to PHENOMENOLOGY. His *Formalism in Ethics and Non-Formal Ethics of Values* (1913–16) contains a detailed critique of the ethics of IMMANUEL KANT. In *Man's Place in the Universe* (1928), he advanced a rather grandiose metaphysical doctrine with affinities to American PRAGMATISM: humanity, God, and world are one cosmic process, with two "poles," spirit and "life-urge"; the ideas of spirit become real through human life and history.

Schelling \'shel-iŋ**, Friedrich Wilhelm Joseph von** (b. Jan. 27, 1775, Leonberg, Württemberg—d. Aug. 20, 1854, Bad Ragaz, Switz.) German philosopher and educator. Inspired by IMMANUEL KANT, in his *System of Transcendental Idealism* (1800) he attempted to unite his concept of nature with the philosophy of JOHANN GOTTLIEB FICHTE. He held that art mediates between the natural and physical spheres when the natural (or unconscious) and spiritual (or conscious) productions are united in artistic creation. His view that the Absolute expresses itself in all beings as the unity of the subjective and the objective was criticized by G.W.F. HEGEL. In *Of Human Freedom* (1809), he declared that mankind's freedom is real only if it is freedom for both good and evil, a position that forms the basis of his later philosophy. A major figure of post-Kantian IDEALISM, Schelling had an important influence on Romanticism. See also IMMANUEL KANT; KANTIANISM.

Schenker \'sheŋ-kər**, Heinrich** (b. June 19, 1868, Wisniowczyk, Galicia, Russia—d. Jan. 14, 1935, Vienna, Austria) Austrian music theorist. Schenker studied law and composition in Vienna before settling there as a private teacher and occasional performer. He proposed that JEAN-PHILIPPE RAMEAU's harmonic theory had erred in making HARMONY fundamental at the expense of COUNTERPOINT. His own study of C.P.E. BACH led him to posit counterpoint as equally fundamental and to recognize the subtle integration of the two. Schenker's most influential perception was that tonal music consists of layers of ornamentation of simpler musical statements. His controversial theories and graphic notation—presented in texts such as *Harmony* (1906), *Counterpoint* (1910–22), and *Free Composition* (1935)—were widely disseminated in the 1970s and by the end of the 20th century had become the basis of the most widely employed analytical techniques for tonal music.

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scherzo \'skert-ˌsō\ *Italian* **"joke"** Musical movement in rapid triple time; it replaced the MINUET in genres such as the SYMPHONY, SONATA, and STRING QUARTET in the 19th century. The name was first used for light vocal and instrumental pieces of the Baroque era. It formally often resembles the minuet, being in rounded binary form and having a contrasting trio section between two statements of the scherzo proper, but its tempo is often much faster and its style may range from playful to vehement or grotesque.

Schiaparelli \ˌskyä-pä-'rel-lē**, Elsa** (b. Sept. 10, 1890, Rome, Italy—d. Nov. 13, 1973, Paris, Fr.) Italian-born French fashion designer. After working in the U.S. as a film scriptwriter and translator, she settled in Paris and opened her first shop in the 1920s. By 1935 she was a leader in haute couture and was expanding into perfume, cosmetics, lingerie, jewelry, and swimsuits. Her designs combined eccentricity with simplicity and a trim neatness with flamboyant colour. She introduced the padded shoulder in 1932; designed fur bed jackets and rhinestone-trimmed lingerie in the 1940s; and in the 1950s popularized "shortie" coats in vivid reds, golds, and chartreuses. Her use of "shocking pink," the sensation of the 1947 season, is still regularly revived. With CHRISTIAN DIOR, she was instrumental in the worldwide commercialization of Parisian fashion.

Schickard \'shi-ˌkärd**, Wilhelm** (b. April 22, 1592, Herrenberg, Württemberg—d. Oct. 24, 1635, Tübingen) German astronomer, mathematician, and cartographer. In 1623 he invented one of the first calculating machines. He proposed to JOHANNES KEPLER the development of a mechanical means of calculating ephemerides (predicted positions of celestial bodies at regular intervals of time), and he contributed to the improvement of accuracy in mapmaking.

Schiele \'shē-lə**, Egon** (b. June 12, 1890, Tulln, Austria—d. Oct. 31, 1918, Vienna) Austrian painter, draftsman, and printmaker. He was strongly influenced by the JUGENDSTIL movement, and the linearity and subtlety of his work owe much to GUSTAV KLIMT's decorative elegance. Still, he always emphasized expression over decoration, heightening the emotive power of line with a feverish intensity. His candid, agitated, erotic images—often portraits of women— caused a sensation, and in 1912 he was briefly imprisoned for indecency. His landscapes exhibit the same febrile quality of colour and line. A special room was reserved for his work at a Viennese exhibition in 1918, just before he died in the influenza epidemic of that year. He has since been recognized as one of the great artists of EXPRESSIONISM.

Schiff \'shif**, Dorothy** (b. March 11, 1903, New York, N.Y., U.S.—d. Aug. 30, 1989, New York City) U.S. newspaper publisher. Schiff was a wealthy socialite who in 1939 used family money to buy majority control of the *New York Post.* In 1943 she took the title of owner and president, and in 1962 she became editor in chief. Under her direction the *Post* became a crusading liberal paper, staunchly supporting unions and social-welfare legislation. She converted it to a tabloid format and included popular features and columnists, with the result that in the 1960s it became the city's only surviving afternoon daily. In 1976 she sold the *Post* to RUPERT MURDOCH.

Schiff, Jacob H(enry) (b. Jan. 10, 1847, Frankfurt am Main—d. Sept. 25, 1920, New York, N.Y., U.S.) German-born U.S. financier and philanthropist. He immigrated to the U.S. in 1865 and in 1875 joined the investment-banking firm of Kuhn, Loeb & Co. He succeeded his father-in-law as head of the firm in 1885 and became one of the leading railroad bankers in the U.S. He played a pivotal role in the reorganization of several transcontinental lines, notably the UNION PACIFIC Railroad and the NORTHERN PACIFIC RAILWAY. During the Russo-Japanese War he sold Japanese bonds in the U.S., for which he was decorated by the emperor of Japan. His extensive philanthropies included large contributions to Barnard College and the Jewish Theological Seminary.

Schiller \'shil-ər**, (Johann Christoph) Friedrich (von)** (b. Nov. 10, 1759, Marbach, Württemberg—d. May 9, 1805, Weimar, Saxe-Weimar) German dramatist, poet, and literary theorist, one of the greatest figures in German literature. Schiller was educated at the direction of a domineering duke, whose tyranny he eventually fled to write. With his successful first play, *The Robbers* (1781), he took up the exploration of freedom, a central theme throughout his works. *Don Carlos* (1787), his first major poetic drama, helped establish BLANK VERSE as the recognized medium of German poetic drama. His jubilant "Ode to Joy" was later used in LUDWIG VAN BEETHOVEN's *Symphony No. 9.* Appointed professor of history at the University of Jena in 1789, he developed his epic masterpiece, the historical drama *Wallenstein* (1800). During a period spent formulating his views on aesthetic activity, he produced philosophical essays, exquisite reflective poems, and some of his most popular ballads. He spent his last years in ill health in Weimar, near his friend JOHANN WOLFGANG VON GOETHE. His mature plays, including *Maria Stuart* (performed 1800) and *Wilhelm Tell* (1804), examine the inward freedom of the soul that enables the individual to rise above physical frailties and the pressure of material conditions.

Schinkel \'shiŋ-kəl**, Karl Friedrich** (b. March 13, 1781, near Brandenburg, Brandenburg—d. Oct. 9, 1841, Berlin) German architect and painter. As state architect of Prussia (from 1815), he executed many commissions for FREDERICK WILLIAM III and other royal family members. He based his work on the revival of various historical styles. His mausoleum for Queen Louise (1810) and the brick and terra-cotta Werdersche Kirche, Berlin (1821–30), are among the earliest GOTHIC REVIVAL designs in Europe. Other works include the GREEK REVIVAL Schauspielhaus (1818) and Altes Museum (1822–30), both in Berlin. In 1830 Schinkel became director of the Prussian Office of Public Works; his work as a city planner resulted in new boulevards and squares in Berlin. His Romantic-Classical creations in architecture, landscape painting, and other related arts such as stage sets and ironwork made him the leading arbiter of national aesthetic taste in his lifetime.

schipperke \'ski-pər-kē, 'shi-pər-kē\ Dog breed that originated in Flanders and was used as a guard on barges. The schipperke ("little captain") is descended from the Leauvenaar, which also gave rise to the Belgian SHEEPDOG. A short, thickset, tailless dog with a dense black coat and a foxlike head, it stands 12–13 in. (31–33 cm) and weighs up to 18 lbs (8 kg). It has a lively, inquisitive expression and is generally hardy and energetic, an able vermin hunter, and a good watchdog.

Schism \'si-zəm**, Photian** Controversy between Eastern and Western Christianity in the 9th century, triggered by the opposition of the Roman pope to the appointment of PHOTIUS as patriarch of Constantinople. Ecclesiastical rights of jurisdiction in the Bulgarian church and a doctrinal dispute over the insertion of the *Filioque* ("and from the Son") clause in the NICENE CREED were also at issue. Photius withdrew from communion with Rome in 867; he himself was finally exiled in 886.

Schism, Western *or* **Great Schism** (1378–1417) In Roman Catholic history, a period when there were two, and later three, rival popes, each with his own College of CARDINALS. The schism began soon after the papal residence was returned to Rome from Avignon (see AVIGNON PAPACY). URBAN VI was elected amid local demands for an Italian pope, but a group of cardinals with French sympathies elected an antipope, Clement VII, who took up residence at Avignon. Cardinals from both sides met at Pisa in 1409 and elected a third pope in an effort to end the schism. The rift was not healed until the Council of Constance vacated all three seats and elected MARTIN V as pope in 1417.

Schism of 1054 *or* **East-West Schism** Event that separated the Byzantine and Roman churches. The Eastern and Western churches had long been estranged over doctrinal issues such as the relationship of the Holy Spirit to the Father and the Son. The Eastern church resented the Roman enforcement of clerical celibacy and the limitation of the right of confirmation to the bishop. There were also jurisdictional disputes between Rome and Constantinople, including Rome's assertion of papal primacy. In 1054 Pope LEO IX, through his representative Humbert of Silva Candida, and the patriarch of Constantinople, MICHAEL CERULARIUS, excommunicated each other, an event that marked the final break between the two churches. The rift widened in subsequent centuries, and the churches have remained separate, though the excommunications were lifted by the papacy and the patriarch in the 20th century. See also EASTERN ORTHODOXY; ROMAN CATHOLICISM.

schist \'shist\ Crystalline METAMORPHIC ROCK that has a highly developed tendency to split into layers. Most schists are composed largely of platy minerals such as MUSCOVITE, CHLORITE, TALC, BIOTITE, and GRAPHITE. The green colour of many schists and their formation under a certain range of temperature and pressure conditions have led to distinction of the GREENSCHIST FACIES in the mineral facies classification of metamorphic rocks. Schists are usually classified on the basis of their mineralogy, with varietal names that indicate the characteristic mineral present.

schistosomiasis \ˌshis-tə-sə-'mī-ə-səs\ *or* **bilharziasis** \ˌbil-ˌhär-'zī-ə-səs\ Group of chronic disorders caused by parasitic FLATWORMS of the

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genus *Schistosoma* (blood FLUKES). Depending on the infecting species, thousands of eggs released by the females reach either the intestine or the bladder, are excreted in feces or urine, and hatch on contact with fresh water. The larvae invade snails, develop to the next stage, emerge into the water, and invade mammals to feed and breed in the bloodstream. An initial allergic reaction (inflammation, cough, late-afternoon fever, hives, liver tenderness) and blood in the stools and urine give way to a chronic stage, in which eggs impacted in the walls of organs cause fibrous thickening (fibrosis). This condition can lead to serious liver damage in the intestinal types and to bladder stones, fibrosis of other pelvic organs, and urinary-tract bacterial infection. In most cases, early diagnosis and persistent treatment to kill the adult worms ensure recovery.

schizophrenia \ˌskit-sə-'frē-nē-ə\ Any of a group of severe mental disorders that have in common symptoms such as HALLUCINATIONS, delusions, blunted emotions, disorganized thinking, and withdrawal from reality. Five main types are recognized: the paranoid, characterized by delusions of persecution or grandeur combined with unrealistic, illogical thinking and frequent auditory hallucinations; the disorganized (hebephrenic), characterized by disordered speech and behaviour and shallow or inappropriate emotional responses; the catatonic, characterized by motor inflexibility or stupor along with mutism, echolalia, or other speech abnormalities; the simple or undifferentiated type, which conforms to basic definitions of schizophrenia but does not exhibit particular behaviours in the aforementioned types; and the residual type, which is a chronic stage indicating advancement toward later-stage schizophrenia. Schizophrenia seems to occur in 0.5–1% of the general population, and more than half of those so diagnosed will eventually recover. There is strong evidence that genetic inheritance plays a role, but no single cause of schizophrenia has been identified. Stressful life experiences may help trigger its onset. Treatment consists of drug therapy and counseling.

Schlegel \'shlā-gəl**, August Wilhelm von** (b. Sept. 8, 1767, Hannover, Hanover—d. May 12, 1845, Bonn) German scholar and critic. He worked as a tutor and wrote for FRIEDRICH SCHILLER's short-lived periodical *Die Horen* before cofounding with his brother FRIEDRICH VON SCHLEGEL the periodical *Athenäum* (1798–1800), which became the organ of German ROMANTICISM. While a professor at the University of Jena, he undertook translations of the works of WILLIAM SHAKESPEARE (1797–1810) that became standard editions and are among the finest of all German literary translations. His *Lectures on Dramatic Art and Literature* (1809–11) was widely translated and helped spread fundamental Romantic ideas throughout Europe. From 1818 until his death he taught at the University of Bonn.

Schlegel, Friedrich von (b. March 10, 1772, Hannover, Hanover—d. Jan. 12, 1829, Dresden, Saxony) German writer and critic. He contributed many of his projects and theories to journals such as *Athenäum* (1798–1800), the quarterly he and his brother AUGUST WILHELM VON SCHLEGEL founded at Jena. His study of Sanskrit led him to publish *Concerning the Language and Wisdom of India* (1808), a pioneering attempt at comparative Indo-European linguistics and the starting point of the study of Indo-Aryan languages and comparative philology. His conception of a universal, historical, and comparative literary scholarship has been profoundly influential, and he is regarded as the originator of many of the philosophical ideas that inspired early German ROMANTICISM.

Schleicher \'shlī-k̲ər**, August** (b. Feb. 19, 1821, Meiningen, Saxe-Meiningen—d. Dec. 6, 1868, Jena, Prussia) German linguist. He began his career studying classical and Slavic languages. Influenced by G.W.F. HEGEL and CHARLES DARWIN, he formed the theory that a language is an organism, with periods of development, maturity, and decline. He invented a system of language classification that resembled a botanical taxonomy, tracing groups of related languages and arranging them in a genealogical tree. His model, the *Stammbaumtheorie* ("family-tree theory"), was a major development in the study of INDO-EUROPEAN LANGUAGES. His great work was *A Compendium of the Comparative Grammar of the Indo-European, Sanskrit, Greek and Latin Languages* (1874–77), in which he attempted to reconstruct Proto-Indo-European.

Schleicher, Kurt von (b. April 7, 1882, Brandenburg, Ger.—d. June 30, 1934, Berlin) German army officer and last chancellor of the WEIMAR REPUBLIC. A career army officer, he rose to major general by 1929 and became a key figure in the Weimar Republic. His political intrigues helped secure for him the posts of defense minister (1932) and chancellor (1932–33). Seeking to keep the Nazis under the army's control, he offered to participate in a government with ADOLF HITLER, but Hitler refused him and thereafter regarded Schleicher as his chief enemy. Dismissed by PAUL VON HINDENBURG in favour of Hitler, Schleicher was murdered during the NIGHT OF THE LONG KNIVES.

Kurt von Schleicher, 1932
ARCHIV FUR KUNST UND GESCHICHTE, BERLIN

Schleiden \'shlī-dən**, Mathias Jacob** (b. April 5, 1804, Hamburg, Ger.—d. June 23, 1881, Frankfurt am Main) German botanist. Trained as a lawyer, he soon left the profession to study natural science. He and THEODOR SCHWANN developed the cell theory, which states that organisms are composed of cells or substances made by cells; they were thus the first to formulate what was then an informal belief as a principle of biology equal in importance to the atomic theory of chemistry. He also recognized the importance of the cell nucleus and sensed its connection with cell division. He was one of the first German biologists to accept CHARLES DARWIN's theory of evolution.

Schleiden
BY COURTESY BILDARCHIV PREUSSISCHER KULTURBESITZ BPK, WEST BERLIN

Schleiermacher \'shlī-ər-ˌmäk̲-ər**, Friedrich (Ernst Daniel)** (b. Nov. 21, 1768, Breslau, Silesia, Prussia—d. Feb. 12, 1834, Berlin) German theologian, preacher, and classical philologist. A member of the clergy from 1796, he taught at the University of Berlin from 1810 to his death. In *On Religion* (1799), he contended that the Romantics were not as far from religion as they thought. In 1817 he helped unite Prussia's Lutheran and Reformed churches. His major work, *The Christian Faith* (1821–22), is a systematic interpretation of Christian dogmatics. His work influenced theology through the 19th and early 20th centuries; he is generally recognized as the founder of modern Protestant theology.

Schlesinger \'shlā-ziŋ-ər, 'shle-sin-jər**, Arthur M(eier), and Schlesinger, Arthur M(eier), Jr.** (respectively b. Feb. 27, 1888, Xenia, Ohio, U.S.—d. Oct. 30, 1965, Boston, Mass.; b. Oct. 15, 1917, Columbus, Ohio) U.S. historians. The elder Schlesinger taught at Harvard University for three decades beginning in 1924. He helped to broaden the study of U.S. history by emphasizing social and urban developments. His books include *The Colonial Merchants and the American Revolution, 1763–1776* (1917) and *Rise of the City, 1878–1898* (1933), and he coedited (with Dixon Ryan Fox) the series *A History of American Life* (1928–43). His son taught at Harvard (1946–61) and the City University of New York (1966–95). Long active in liberal politics, he was an adviser to ADLAI STEVENSON and JOHN F. KENNEDY during their presidential campaigns and served as Kennedy's special assistant. His books include *The Age of Jackson* (1946, Pulitzer Prize), *The Age of Roosevelt*, 3 vol. (1957–60), *A Thousand Days* (1965, National Book Award, Pulitzer Prize), *The Imperial Presidency* (1973), and *The Cycles of American History* (1986).

Schlesinger, John (Richard) (b. Feb. 16, 1926, London, Eng.—d. July 25, 2003, Palm Springs, Calif., U.S.) British film and theatre director. He worked as an actor before becoming a documentary director for BBC television, where he won praise for his *Terminus* (1960). His feature films *A Kind of Loving* (1962) and *Billy Liar* (1963) were caustic depictions of English urban life. The successful *Darling* (1965) mocked the shallowness of the jet set, and he followed it with *Far from the Madding Crowd* (1967). His first American film, *Midnight Cowboy* (1969), won him an Academy Award. His later films include *Sunday Bloody Sunday* (1971), *Marathon Man* (1976), *Madame Sousatzka* (1988), *Cold Comfort Farm* (1995), and *The Next Best Thing* (2000).

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Schleswig-Holstein \'shlās-ˌviⱪ-'hōl-ˌshtīn\ Historical area and state (pop., 2002 est.: 2,804,249), northwestern Germany. With an area of 6,073 sq mi (15,729 sq km), the state occupies the southern half of the Jutland Peninsula and includes Fehmarn Island in the Baltic Sea and various islands in the Frisian Islands group. Its capital is Kiel. From the 15th century the former duchies of Schleswig and Holstein were subject to the claims and counterclaims of Denmark, Sweden, the Holy Roman Empire, Prussia, and Austria. The Danes ceded them to Prussia and Austria in 1864, and in 1866 both areas became part of Prussia (see Schleswig-Holstein Question). The northern part of Schleswig was awarded to Denmark in 1920. The German part of Schleswig-Holstein was organized as a state of West Germany after World War II. Industries include shipbuilding, electrical engineering, paper, textiles, clothing, and tourism.

Schleswig-Holstein Question \'shles-ˌwig-'hōl-ˌstīn\ Conflict between Denmark and Prussia over Schleswig-Holstein. In the 1840s the Danish-speaking population of northern Schleswig, supported by the Danish government, wanted to detach Schleswig from Holstein and incorporate it with Denmark, whereas the German-speaking majority of the two duchies wanted to combine them as a state within the German Confederation. An 1848 uprising by Germans in the region was aided by the Prussian army in a war that ousted Denmark's troops (1848–51). The agreements of 1851–52 restored the region's status quo. In 1863 a renewed attempt by Denmark to annex Schleswig caused Prussia and Austria to declare war in 1864. After the Danish defeat at Dybbøl and the occupation of Jutland, Denmark was forced to surrender all of Schleswig-Holstein to Prussia and Austria.

Schlieffen Plan \'shlē-fən\ Plan of attack used by the German armies at the outbreak of World War I. It was named after its developer, Count Alfred von Schlieffen (1833–1913), former chief of the German general staff. To meet the possibility of Germany's facing a war against France in the west and Russia in the east, Schlieffen proposed that, instead of aiming the first strike against Russia, Germany should aim a rapid, decisive blow with a large force at France's flank through Belgium, then sweep around and crush the French armies against a smaller German force in the south. The plan used at the beginning of World War I had been modified by Helmuth von Moltke, who reduced the size of the attacking army and was blamed for Germany's failure to win a quick victory.

Schliemann \'shlē-män**, Heinrich** (b. Jan. 6, 1822, Neubukow, Mecklenburg-Schwerin—d. Dec. 26, 1890, Naples, Italy) German archaeologist and excavator of Troy, Mycenae, and Tiryns. As a boy he loved the Homeric poems, and he eventually learned ancient and modern Greek and many other languages. As a military contractor in the Crimean War he made a sufficient fortune to retire at 36 and devote himself to archaeology. In 1873, at Hisarlık, Tur., he discovered the remains of ancient Troy (verifying the historical event of the Trojan War) and a treasure of gold jewelry ("Priam's Treasure"), which he smuggled out of the country. Because the Ottoman government prevented his return, he began excavating Mycenae in Greece, where he found more invaluable remains and treasures. He and Wilhelm Dörpfeld (1853–1940) resumed work at Hisarlık in 1878, exposing the stratigraphy more clearly and advancing archaeological technique. In 1884 they excavated the great fortified site at Tiryns. Schliemann's excavations helped to lengthen considerably the perspective of history and to popularize archaeology. His contributions were genuine, though his written accounts contain many self-serving fabrications.

Schliemann, detail of an engraving by A. Weger, after a photograph.
COURTESY OF THE DEUTSCHE STAATSBIBLIOTHEK, EAST BERLIN

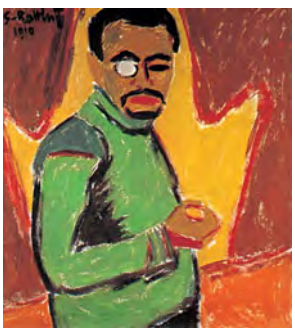
Schlöndorff \'shlœn-ˌdȯrf**, Volker** (b. March 31, 1939, Wiesbaden, Ger.) German-U.S. film director. He studied filmmaking in Paris and worked for Louis Malle and Alain Resnais. He returned to Germany to make his first feature film, *Young Torless* (1968). He displayed a cool directorial style that distinguished him from others in the New German cinema movement. Forming his own production company, he made movies such as *The Lost Honor of Katharina Blum* (1975) and *Coup de Grace* (1976). *The Tin Drum* (1979) won the Golden Palm at the Cannes Film Festival and an Academy Award for best foreign language film. His later films include *Swann in Love* (1984), *Voyager* (1991), and *The Ogre* (1998).

Schmalkaldic Articles \shmäl-'käl-dik\ One of the confessions of faith of Lutheranism, written by Martin Luther in 1536 and considered by heads of state of the Schmalkaldic League in 1537. A response to a bull issued by Pope Paul III calling for a general council of the Roman Catholic church to deal with the Reformation, the articles were prepared in order to determine which issues could be negotiated with Roman Catholicism and which could not be compromised. The first section discusses the unity of God, the Holy Trinity, the Incarnation, and Jesus; on these subjects there was no disagreement with the Catholics. The second discusses justification by faith, the chief point of contention. The third deals with such matters as sin, repentance, the sacraments, and confession.

Schmalkaldic League \'shmäl-ˌkäl-dik\ Defensive alliance by Protestant states of the Holy Roman Empire. It was established in 1531 at Schmalkalden, Germany, to defend the newly formed Lutheran churches from attack by the Catholic emperor Charles V. Fearing that the league would ally itself with his enemy, Francis I of France, Charles gave it de facto recognition until 1544, when he made peace with Francis. Charles then moved against the league militarily and by 1547 had effectively destroyed it. See also Schmalkaldic Articles.

Schmidt \'shmit**, Helmut** (b. Dec. 23, 1918, Hamburg, Ger.) German politician, chancellor of West Germany (1974–82). A member of the Social Democratic Party, he served in the Bundestag (1953–61, 1965–87). He was minister of defense (1969–72) and minister of finance (1972–74) before succeeding Willy Brandt as chancellor in 1974. A popular and capable chancellor, he continued the policy of Ostpolitik while maintaining West Germany's key position in NATO and the European Community. His refusal to cut West Germany's social welfare programs prompted the centrist Free Democrats to defect from his governing coalition. Losing his majority in the Bundestag, Schmidt resigned the chancellorship after a vote of no confidence in the Bundestag in October 1982. He was succeeded as chancellor by Helmut Kohl. Schmidt has written numerous books on German politics and international relations.

Schmidt-Rottluff \'shmit-'rôt-lůf**, Karl** *orig.* **Karl Schmidt** (b. Dec. 1, 1884, Rottluff, Ger.—d. Aug. 9, 1976, West Berlin, W.Ger.) German painter and printmaker. As an architecture student in Dresden, he helped form Die Brücke in 1905. He soon realized the expressive potential of flat, patterned design; his mature style, seen in *Self-Portrait with Monocle* (1910), is characterized by boldly dissonant colours and jagged forms. After 1911, when he moved to Berlin, his paintings and woodcuts showed an interest in Cubism and African sculpture. Though his works had become more conventional by the 1930s, the Nazis officially declared them "degenerate." After World War II he taught art and resumed painting, but his work never regained its former power.



Self-Portrait with Monocle, oil on canvas by Karl Schmidt-Rottluff, 1910; in the National Gallery, Berlin.
COURTESY OF THE NATIONALGALERIE, STAATLICHE MUSEEN PREUSSISCHER KULTURBESITZ, BERLIN

Schnabel \'shnä-bəl**, Artur** (b. April 17, 1882, Lipnik, Austria—d. Aug. 15, 1951, Axenstein, Switz.) Austrian pianist and composer. When he was seven years old, his family moved to Vienna. There he studied with Theodor Leschetizky and also met Johannes Brahms and others. He made his debut in 1890. Based in Berlin from 1900 to 1933, he composed, taught, and gave legendary performances of the complete sonatas of Ludwig van Beethoven and Franz Schubert for centenary celebrations. In the 1930s he became the first to record the complete Beethoven cycle. During the Nazi period, he moved to London, then to the U.S. Though he mostly played works of the past, his own compositions were ultramodern. Today he is uniquely revered by serious pianists.

Schnabel \'shnä-bəl**, Julian** (b. Oct. 26, 1951, New York, N.Y., U.S.) U.S. painter. He studied at the University of Houston and the Whitney

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Museum of American Art. In the 1980s he was a leading exponent of NEO-EXPRESSIONISM. His works exhibit an ambivalent emotional tone, jarring colour harmonies, and a rough-hewn style; his best-known works incorporate shards of broken plates. Though he has enjoyed considerable success, there has been controversy regarding both the quality of his art and his aggressive self-promotion. Starting in the 1990s, Schnabel began to pursue film. He received widespread critical acclaim for his direction of *Before Night Falls* (2000), a film about Cuban poet Reinaldo Arenas.

schnauzer \'shnaůt-sər, 'shnaů-zər\ Any of three German dog breeds having a wiry black, salt-and-pepper, or black-and-tan coat. The standard, 17–20 in. (43–51 cm) high and weighing 26–37 lbs (12–17 kg), dates to the 15th century; it has a blunt, heavily whiskered muzzle and a squared body. The miniature, 12–14 in. (30–36 cm) high and weighing 13–15 lbs (6–7 kg), was developed in the 19th century from standard schnauzers and AFFENPINSCHERS. The giant schnauzer, a cross between the standard and various working dogs, stands 21–26 in. (53–66 cm) and weighs 66–77 lbs (30–35 kg).

Schnittke \'shnit-kə**, Alfred (Garriyevich)** (b. Nov. 24, 1934, Engels, Volga German Autonomous S.S.R.—d. Aug. 3, 1998, Hamburg, Ger.) Russian composer. He began musical training in Vienna and continued in Moscow, then taught at the Moscow Conservatory (1962–72). He scored more than 60 films and was one of the first Soviet composers to experiment with SERIALISM. After the death of DMITRY SHOSTAKOVICH, Schnittke became the Soviet Union's leading composer and gained a major international reputation as he evolved a highly eclectic style ("polystylistics"). He suffered the first of several serious strokes in 1985 but continued to compose. He wrote nine symphonies, six concerti grossi, many concertos, four string quartets, and the operas *Life with an Idiot* (1992), *Gesualdo* (1995), and *Historia von D. Johann Fausten* (1995).

Schnitzler \'shnits-lər**, Arthur** (b. May 15, 1862, Vienna, Austria—d. Oct. 21, 1931, Vienna) Austrian playwright and novelist. Schnitzler practiced medicine in Vienna most of his life, and he also studied psychiatry. He became known for his psychological dramas and for his fearlessness in depicting the erotic lives of his characters, beginning with the early play *Anatol* (1893). His best-known play, *Reigen* (*Merry-Go-Round*, 1897), was a cycle of 10 dramatic dialogues that traced the links connecting the partners in a series of sexual encounters; considered scandalous when first performed in 1920, it was filmed as *La Ronde* by MAX OPHÜLS in 1950. His drama *Playing with Love* (1896) and his most successful novel, *None but the Brave* (1901), revealed the hollowness of the Austrian military code of honour.

Schoenberg \'shœn-ˌberk,\ *English* \'shərn-ˌbərg**, Arnold (Franz Walter)** (b. Sept. 13, 1874, Vienna, Austro-Hungarian Empire—d. July 13, 1951, Los Angeles, Calif., U.S.) Austrian-born U.S. composer. He was raised as a Catholic by his Jewish-born parents. He began studying violin at age eight and later taught himself cello. While working as a bank clerk, he studied composition with Alexander Zemlinsky (1871–1942); Schoenberg soon wrote his first string quartet (1897), which was acclaimed. With RICHARD STRAUSS's help he obtained a teaching post in Berlin, but he soon returned to Vienna, having composed his gigantic cantata *Gurrelieder* (1901, orchestrated 1913). In 1904 ALBAN BERG and ANTON WEBERN began their studies with him, which would profoundly shape their later artistic careers. About 1906 Schoenberg came to believe that tonality had to be abandoned. During his subsequent period of "free ATONALITY" (1907–16) he created remarkable works such as the monodrama *Erwartung* (1909), *Five Orchestral Pieces* (1909), and *Pierrot lunaire* (1912). From 1916 to 1923 he issued almost nothing, being occupied with teaching and conducting but also seeking a way to organize atonality. He eventually developed the 12-tone method (see SERIALISM), in which each composition is formed from a special row or series of 12 different tones. In 1930 he began work on a three-act opera based on a single tone row; *Moses und Aron* remained unfinished at his death. The rise of Nazism moved him to reassert his Jewish faith and forced him to flee to the U.S., where he remained, teaching at the University of California at Los Angeles (1936–44). Though never embraced by a broad public, he may have exercised a greater influence on 20th-century music than any other composer.

Arnold Schoenberg.
PICTORIAL PARADE

Scholasticism Theological and philosophical movement, beginning in the 11th century, that sought to integrate the secular understanding of the ancient world, as exemplified by ARISTOTLE, with the dogma implicit in the revelations of Christianity. Its aim was a synthesis of learning in which theology surmounted the hierarchy of knowledge. Principal figures in early Scholasticism were PETER ABELARD, ST. ANSELM OF CANTERBURY, ST. ALBERTUS MAGNUS, and ROGER BACON. The movement flourished in the 13th century, drawing on the writings and doctrines of ST. THOMAS AQUINAS. By the 14th century Scholasticism was in decline, but it had laid the foundations for many revivals and revisitations in later centuries, particularly under Pope LEO XIII (1879), who sought to modernize the insights of the medieval scholastics. Modern philosophers influenced by Scholasticism include JACQUES MARITAIN and Étienne Gilson (1884–1978).

Schönerer \'shœ-nə-rər**, Georg, knight von** (b. July 17, 1842, Vienna, Austria—d. Aug. 14, 1921, Rosenau bei Zwettl) Austrian political extremist. In 1873 he was elected to the federal parliament as a left-wing liberal. He became an ardent German nationalist and outspoken anti-Semite and in 1885 founded the Pan-German Party. Reelected to the parliament in 1897, he opposed the pro-Czech language ordinances and was credited with driving the prime minister from office. He helped 21 Pan-German candidates win election to the parliament in 1901. His violent temperament so disrupted the party that by 1907 it had virtually disappeared from Austrian politics, but his ideological influence continued undiminished.

Schongauer \'shōn-ˌgaů-ər**, Martin** (b. 1445/50, Colmar, Alsace—d. Feb. 2, 1491, Breisach, Baden) German painter and printmaker. Though a prolific painter whose panels were sought in many countries, it was as an engraver that he was unrivaled in northern Europe. His engravings, consisting of about 115 plates, represent a highly refined manifestation of the late GOTHIC spirit. He brought engraving to maturity by expanding its range of contrasts and textures, bringing an artist's sensibility to an art hitherto the domain of goldsmiths. The grace of his work became proverbial in his lifetime, giving rise to such nicknames as Hübsch ("Charming") Martin and Schön ("Beautiful") Martin.

school psychology Branch of APPLIED PSYCHOLOGY that deals largely with educational assessment, PSYCHOLOGICAL TESTING, and student consultation in elementary and secondary schools. School psychologists train in EDUCATIONAL and DEVELOPMENTAL psychology as well as in general psychology, COUNSELING, and other fields. The school psychologist usually must be certified to practice in a particular school district.

Schoolcraft, Henry Rowe (b. March 28, 1793, Albany county, N.Y., U.S.—d. Dec. 10, 1864, Washington, D.C.) U.S. explorer and ethnologist. He served as topographer on an expedition to the Lake Superior region (1820), then married a woman who was part OJIBWA and became an Indian agent. In 1832 he discovered the source of the MISSISSIPPI RIVER at Lake Itaska, Minn. A treaty he concluded with the Ojibwa in 1836 ceded much of their land in northern Michigan to the U.S. Schoolcraft's six-volume *Indian Tribes of the United States* (1851–57) was a pioneering, though flawed, work.

schooling behaviour Activity characteristic of clupeiform fish (HERRINGS, ANCHOVIES, and allies) in which many fish swim together, appearing to act as a single organism. A school of herring may contain many millions of individuals of roughly similar size. Fishes above or below the size limit break away and form schools among themselves. The primary advantage to the fish seems to be safety for the individual. When threatened, a school of thousands of anchovies, spread over several hundred metres, will contract to a writhing sphere only a few metres across, thereby thwarting the attempt of a natural predator to catch a single individual.

schooner \'skü-nər\ Sailing ship rigged with fore-and-aft sails on its two or more masts. Though apparently developed from a 17th-century Dutch design, the first genuine schooner was built in the American colonies, probably at Gloucester, Mass., in 1713, by Andrew Robinson. Compared to square-rigged ships, they were ideal for coastal sailing; they

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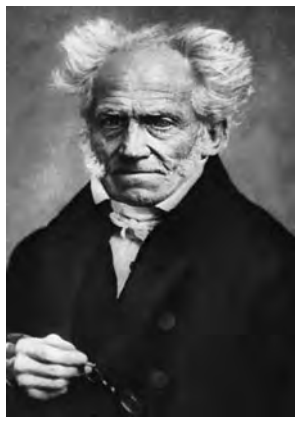
handled better in the varying coastal winds, had shallower drafts for shallow waters, and required a smaller crew in proportion to their size. By the end of the century, they were the most important North American ship, used for the coastal trade and for fishing. After 1800 they became popular in Europe and around the world. CLIPPER SHIPS married the schooner design to that of the old three-masted merchantman.

Schopenhauer \'shō-pən-ˌhaù-ər**, Arthur** (b. Feb. 22, 1788, Danzig, Prussia—d. Sept. 21, 1860, Frankfurt am Main) German philosopher. His father was a banker and his mother a novelist. He studied in several fields before earning his doctorate in philosophy. He regarded the UPANISHADS, together with the works of PLATO and IMMANUEL KANT, as the foundation of his philosophical system, a metaphysical doctrine of the will developed in reaction to the IDEALISM of G.W.F. HEGEL. His magnum opus, *The World as Will and Representation* (1819), consists of two comprehensive series of reflections on the theory of knowledge and the philosophy of nature, aesthetics, and ethics. By turning away from spirit and reason to the powers of intuition, creativity, and the irrational, he influenced (partly via FRIEDRICH NIETZSCHE) the ideas and methods of vitalism, life philosophy, EXISTENTIALISM, and ANTHROPOLOGY. His other works include *On the Will in Nature* (1836), *The Two Main Problems of Ethics* (1841), and *Parerga and Paralipomena* (1851). An unhappy and solitary man, his works earned him the sobriquet "the philosopher of pessimism."



Arthur Schopenhauer, 1855.
ARCHIV FUR KUNST UND GESCHICHTE, WEST BERLIN

Schouten \'skaù-tᵊn\ **Islands** Archipelago, across the entrance to Cenderawasih Bay of the Pacific Ocean, off the northern coast of PAPUA (Irian Jaya), Indonesia. The islands cover an area of 1,231 sq mi (3,188 sq km). The chief islands, Biak, Supiori, and Numfoor, are among the most densely populated areas of Papua. Another island group of the same name is located off the northeastern coast of New Guinea island; it is part of Papua New Guinea.

Schreiner \'shrī-nər**, Olive (Emilie Albertina)** (b. March 24, 1855, Wittebergen, Cape Colony—d. Dec. 11, 1920, Cape Town, S.Af.) South African writer. She had no formal education but read widely, developing a powerful intellect and militantly feminist and liberal views. After working as a governess she published (as Ralph Iron) the semiautobiographical *The Story of an African Farm* (1883). The first great South African novel, it concerns a girl living on an isolated farm in the veld who struggles to attain independence in the face of rigid Boer social conventions. Her later works include *Trooper Peter Halkett of Mashonaland* (1897), attacking CECIL RHODES, and *Woman and Labour* (1911), an acclaimed bible of the women's movement.

Schröder \'shrœ-dər**, Gerhard** (b. April 7, 1944, Mossenberg, near Detmold, Ger.) Chancellor of Germany (1998–2005). In his youth he joined the Social Democratic Party (SPD) and the Young Socialists, and, as a law student at Göttingen, he participated in the student protests of 1968. A member of the SPD, he served in the Bundestag (1980–86) and in 1990 succeeded to the premiership of the state of Lower Saxony. His election as federal chancellor in 1998 ended 16 years of conservative rule under HELMUT KOHL. Despite continuing high unemployment in Germany, Schröder led his Social Democratic–Green coalition to victory in 2002, and he was reelected chancellor. As the country's economy worsened, he introduced in 2003 a major reform program that proved highly unpopular, and the following year he stepped down as SDP leader. In 2005 the SDP lost the general election, and Schröder was succeeded by Angela Merkel of the Christian Democratic Union.

Schröder-Devrient \'shrœ-dər-dəv-rē-'aⁿ, -dev-'rēnt**, Wilhelmine** (b. Dec. 6, 1804, Hamburg—d. Jan. 26, 1860, Coburg, Saxe-Coburg-Gotha) German soprano. Daughter of a baritone, she achieved international renown with her 1822 performance as LUDWIG VAN BEETHOVEN's Leonora. Though her voice showed signs of wear by her 30s, she was known for her dramatic prowess—she genuinely cried onstage and was called the "Queen of Tears"—and she created three early Wagnerian (see RICHARD WAGNER) roles: Adriano (*Rienzi*, 1842), Senta (*The Flying Dutchman*, 1843), and Venus (*Tannhäuser*, 1845).

Schrödinger \'shrœ-diŋ-ər**, Erwin** (b. Aug. 12, 1887, Vienna, Austria—d. Jan. 4, 1961, Vienna) Austrian physicist. He taught physics in Zürich (1921–27) and Berlin (1927–33), then left Germany, objecting to the persecution of Jews. He settled in Ireland, where he joined the Dublin Institute for Advanced Studies (1940–56). He made fundamental contributions to quantum mechanics, and he shared a 1933 Nobel Prize with P.A.M. DIRAC for his development in 1926 of the wave equation now called the SCHRÖDINGER EQUATION. In addition to his scientific research, he made contributions to philosophy and the history of science; his books include *What Is Life?* (1944), *Nature and the Greeks* (1954), and *My View of the World* (1961).

Schrödinger \'shrœ-diŋ-ər\ **equation** Fundamental equation developed in 1926 by ERWIN SCHRÖDINGER that established the mathematics of QUANTUM MECHANICS. The equation determines the behaviour of the WAVE FUNCTION that describes the wavelike properties of a subatomic system. It relates KINETIC ENERGY and POTENTIAL ENERGY to the total energy, and it is solved to find the different energy levels of the system. Schrödinger applied the equation to the hydrogen atom and predicted many of its properties with remarkable accuracy. The equation is used extensively in atomic, nuclear, and solid-state physics. See also WAVE-PARTICLE DUALITY.

Schubert \'shü-ˌbert**, Franz (Peter)** (b. Jan. 31, 1797, Himmelpfortgrund, near Vienna—d. Nov. 19, 1828, Vienna) Austrian composer. He learned violin from his schoolteacher father and piano from his brother. He joined the precursor of the Vienna Boys Choir (1808), making such quick progress that ANTONIO SALIERI undertook to guide his training (1810–16). At his family's insistence, he was trained as a schoolteacher. In 1815 he wrote 2 symphonies, more than 100 songs, and 4 stage works. In 1818, seeking independence, he quit teaching at his father's school to tutor Johann Esterházy's daughters. In 1819–20 he wrote the celebrated *Trout Quintet* and a mass. In 1821, 20 of his most popular songs were published with great success, and he wrote the three-act opera *Alfonso und Estrella*. Despite his first awareness of the disease (possibly syphilis) that would kill him, his amazing production continued in 1822, with the *Unfinished Symphony* and the *Wanderer Fantasy*. He was often ill during his last five years but continued his production of music, including the song cycles *The Miller's Beautiful Daughter* and *Winter Journey*, the last three piano sonatas, and the *Great Symphony*. His last years were made miserable by illness, not poverty; in fact, his greatness was widely recognized. He died at 31, having produced more masterpieces by that age than almost any other composer in history. His 600 songs made the LIED a serious genre and sparked its great development in subsequent decades.

Schuller \'shùl-ər**, Gunther (Alexander)** (b. Nov. 22, 1925, New York, N.Y., U.S.) U.S. composer, conductor, and educator. Son of a violinist, he trained at the Manhattan School of Music. He played French horn with the Cincinnati Orchestra from age 18 and with the Metropolitan Opera orchestra (1945–59), as well as with JAZZ musicians such as MILES DAVIS and the MODERN JAZZ QUARTET. His "third stream" music (combining classical and jazz styles) includes compositions such as *Seven Studies on Themes of Paul Klee* (1959). He was president of the New England Conservatory of Music (1967–77) and directed the Berkshire Music Center (1974–84). A preeminent authority on jazz, he wrote the acclaimed *Early Jazz* (1968) and *The Swing Era* (1988).

Schultz \'shùlts**, Dutch** *orig.* **Arthur Flegenheimer** (b. Aug. 6, 1902, Bronx, N.Y., U.S.—d. Oct. 23, 1935, Newark, N.J.) U.S. gangster. Schultz advanced from burglaries to bootlegging, ownership of breweries and speakeasies, and policy rackets in the Bronx and Manhattan. His gang engaged in a number of bloody wars with rival gangs. When the murderous "Dutchman" made plans to assassinate THOMAS DEWEY, who had made him the target of an investigation, he himself was murdered by New York's crime bosses, who feared his plan would result in a crackdown on their operations.

Schulz \'shùlts**, Charles** (b. Nov. 26, 1922, Minneapolis, Minn., U.S.—d. Feb. 12, 2000, Santa Rosa, Calif.) U.S. cartoonist. Son of a Minneapolis barber, he took a correspondence course in cartooning and worked as a freelance cartoonist before creating *Peanuts* (originally *Li'l Folks,* 1950), which would become the most widely syndicated comic strip of all time. The strip, whose characters are boys and girls ranging

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in age from three to five and a beagle with a grandiose imagination, deals with the frustrations of everyday life and the cruelty that exists among children, often with philosophical and psychological overtones. Just before his death, after 50 years of continuous production, Schulz announced the end of his strip.

Schumacher \'shü-ˌmäk-ər,\ *English* \'shü-ˌmāk-ər\, **E(rnst) F(riedrich)** (b. Aug. 16, 1911, Bonn, Ger.—d. Sept. 4, 1977, Romont, Switz.) German-born British economist. After studying in England and the U.S., he settled in England in 1937. During World War II he worked on theories for full-employment policies and, under William H. Beveridge, plans for Britain's postwar welfare state. Between 1950 and 1970 he was an adviser to Britain's nationalized coal industry. After a visit to Burma in 1955, he came to believe that poor countries needed an "intermediate technology" adapted to the unique needs of each in order to develop. In the influential *Small Is Beautiful* (1973) he argued that capitalism brought higher living standards at the cost of deteriorating culture and that bigness—especially large industries and large cities—was unaffordable.

Schuman \'shü-ˌmän\, **Robert** (b. June 29, 1886, Luxembourg—d. Sept. 4, 1963, Metz, France) French statesman. He was a member of the French National Assembly from 1919. After working in the French Resistance in World War II, he helped found the Popular Republican Movement. He served as finance minister (1946), premier (1947–48), foreign minister (1948–52), and minister of justice (1955–56). In 1950 he proposed the Schuman Plan to promote European economic and military unity, which led to the European Coal and Steel Community and the European Economic Community (EEC). He served as president of the EEC's consultative assembly (1958–60).

Schuman \'shü-mən\, **William (Howard)** (b. Aug. 4, 1910, New York, N.Y., U.S.—d. Feb. 15, 1992, New York City) U.S. composer and administrator. He wrote songs in high school with his friend Frank Loesser. In 1930 he began studying composition with Roy Harris. He achieved success with his *American Festival Overture* (1939), and his *Secular Cantata No. 2: A Free Song* won the first Pulitzer Prize for music (1943). His other works include ballets for Martha Graham, the popular *New England Triptych* (1956), and 10 symphonies. As president of the Juilliard School (1945–62), he modernized its curriculum. As the first president of Lincoln Center (1962–68), he brought together several music organizations and established its Chamber Music Society and Mostly Mozart program.

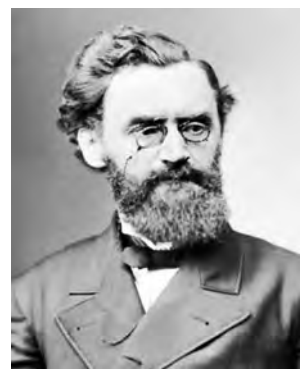
Schumann \'shü-ˌmän\, **Clara** *orig.* **Clara Josephine Wieck** (b. Sept. 13, 1819, Leipzig, Saxony—d. May 20, 1896, Frankfurt am Main, Ger.) German pianist. Trained by her father, the noted piano teacher Friedrich Wieck (1785–1873), she debuted as a prodigy with Leipzig's Gewandhaus Orchestra in 1830, and then she toured for two years. By 1835 she had fallen in love with Robert Schumann, the Wiecks' boarder since 1830. When Clara turned 21 years old, they eloped against her father's wishes. Her artistic stature had already been established by her tours, but the birth of eight children limited her career, and she stopped writing music in 1853 after showing considerable promise as a composer. Robert's mental deterioration led to her resuming touring full-time; she retired from performing and teaching in the 1890s because of ill health. From 1853 she had a close lifelong relationship with Johannes Brahms.

Robert and Clara Schumann, lithograph by J. Hofelich
THE BETTMANN ARCHIVE

Schumann, Robert (Alexander) (b. June 8, 1810, Zwickau, Saxony—d. July 29, 1856, Endenich, near Bonn, Prussia) German composer. Son of a bookseller, he considered becoming a novelist. Under family pressure he reluctantly entered law school, but he devoted his time to song composition and piano lessons. An injury to one of his fingers put an end to his hopes of a career as a virtuoso and confined him to composition. He embarked upon a prolific period, writing piano pieces and founding, in 1834, the *New Journal for Music*. His works from this fertile period include *Papillons*, *Carnaval* (both 1833–35), and *Davidsbündlertänze* (1837). He married the pianist Clara Wieck in 1840. That year he returned to the field of the solo song; in the span of 11 months he composed nearly all the songs on which much of his reputation rests, such as the song cycles *Dichterliebe* and *Frauenliebe und Leben*. The next year he widened his scope to orchestral music, producing *Symphony No. 1*, *Symphony No. 4*, and his piano concerto; in 1842 he concentrated on chamber music. In his last productive years, he turned to dramatic or semidramatic works. His mental deterioration (probably associated with both syphilis and a family history of mental illness) accelerated; in 1854 he was placed in a sanatorium, where he died two years later.

Schumpeter \'shům-ˌpā-tər\, **Joseph A(lois)** (b. Feb. 8, 1883, Triesch, Moravia—d. Jan. 8, 1950, Taconic, Conn., U.S.) Moravian-U.S. economist and sociologist. Educated in Austria, he taught at several European universities before joining the faculty of Harvard University (1932–50). He became known for his theories of capitalist development and the business cycle. His popular book *Capitalism, Socialism, and Democracy* (1942) argued that capitalism would eventually perish of its own success. His posthumous *History of Economic Analysis* (1954) is an exhaustive study of the development of analytic methods in economics.

Schurz \'shůrts, 'shərts\, **Carl** (b. March 2, 1829, Liblar, near Cologne, Prussia—d. May 14, 1906, New York, N.Y., U.S.) German-U.S. politician and journalist. After participating in the abortive German revolution of 1848, he fled to the U.S. in 1852. He settled in Wisconsin, where he became active in the antislavery movement and the Republican Party. In the American Civil War he was appointed brigadier general of volunteers and saw action in several battles. After the war he became a newspaper editor in St. Louis (1867–69), where he won election to the U.S. Senate (1869–75). As U.S. secretary of the interior (1877–81), he promoted civil-service reform and an improved Indian policy. He later edited the *New York Evening Post* and the *Nation* (1881–83) and wrote editorials for *Harper's Weekly* (1892–98). Pursuing his reform interests, he joined the Mugwumps (1884) and headed the National Civil Service Reform League (1892–1901).



Schurz
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Schuschnigg \'shůsh-nik\, **Kurt von** (b. Dec. 14, 1897, Riva del Garda, Trento, Austria-Hungary—d. Nov. 18, 1977, Mutters, near Innsbruck, Austria) Austrian politician and chancellor (1934–38). Elected to the Austrian parliament in 1927, he served in the government of Engelbert Dollfuss as minister of justice (1932) and education (1933–34). After Dollfuss was assassinated, Schuschnigg was named chancellor. He disbanded the paramilitary Heimwehr in 1936 and tried to prevent the German takeover of Austria. After making concessions to Adolf Hitler in February 1938, he sought to reassert national independence through a plebiscite to be held on March 13. However, on March 11 Germany invaded Austria and carried out the Anschluss, and Schuschnigg was imprisoned until the war ended. He later lived and taught in the U.S. (1948–67).

Schutz \'shůts\, **Alfred** (b. April 13, 1899, Vienna, Austria—d. May 20, 1959, New York, N.Y., U.S.) Austrian-born U.S. sociologist and philosopher who developed a social science based on phenomenology. He emigrated to the U.S. in 1939, teaching at the New School for Social Research in New York (1943–59). He drew attention to the social presuppositions underlying everyday life and to the creation of social reality through symbols and human action. His work laid the basis for the field of ethnomethodology, the study of people's commonsense understandings of the structure of social interaction. His principal work is *The Phenomenology of the Social World* (1932). See also interactionism.

Schütz \'shütz\, **Heinrich** (b. Oct. 8, 1585, Köstritz, Saxony—d. Nov. 6, 1672, Dresden) German composer. An innkeeper's son, he was heard singing by a nobleman staying at the inn, who underwrote his education; in 1608 he entered the University of Marburg to study law, but in 1609 he began to study music with Giovanni Gabrieli in Venice. The elector of

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Saxony in Dresden "borrowed" Schütz for a "few months" in 1614, then refused to let him return. As kapellmeister in Dresden from 1619, he published his first collection of sacred music, *Psalms of David* (1619). In 1628 he traveled to Italy, where Claudio Monteverdi acquainted him with new musical developments, and he adopted aspects of the Italian style in his great *Symphoniae sacrae* (1629) for chorus and instruments; he later published a second and third collection of *Symphoniae sacrae* (1647, 1650). He spent much time in Denmark and elsewhere over the next 15 years. Economic conditions deteriorated, and in the early 1650s he was no longer even being paid; he was released by the elector's death in 1656.

Schuyler \'skī-lər**, Philip John** (b. Nov. 11, 1733, Albany, N.Y.—d. Nov. 18, 1804, Albany, N.Y., U.S.) American Revolutionary officer. He served in the French and Indian War and helped settle colonial war claims with Britain (1761–63). He served in the New York legislature (1768–75) and in the Continental Congress (1775–77, 1778–80). In the American Revolution he was commissioned one of four major generals in the Continental Army. As commander of the northern department, he was unable, because of illness, to undertake his planned invasion of Canada. His later defeat at the Battle of Ticonderoga led to his replacement by Horatio Gates. He subsequently served as one of New York's first U.S. senators (1789–91, 1797–98).

Schwab, Charles M(ichael) (b. Feb. 18, 1862, Williamsburg, Pa., U.S.—d. Sept. 18, 1939, New York, N.Y.) U.S. entrepreneur and steel-industry pioneer. He joined Andrew Carnegie's steelworks at Braddock, Pa., as a labourer and rose swiftly in the Carnegie empire. In 1892 Carnegie delegated to Schwab the task of returning the plant in Homestead, Pa., to normal production after the bloody Homestead Strike. His success in improving labour relations and increasing production led to his appointment as president of Carnegie Steel Co. in 1897 at the age of 35. Schwab proposed the merger of the competing steel companies that would create the U.S. Steel Corp., and he became its first president in 1901. He resigned in 1903 to devote himself to the Bethlehem Steel Corp., which he built into one of the nation's largest steel producers of its time.

Schwann \'shvän**, Theodor** (b. Dec. 7, 1810, Neuss, Prussia—d. Jan. 11, 1882, Cologne, Ger.) German physiologist. He founded modern histology by recognizing the cell as the basic unit of animal structure. A year after Mathias Jacob Schleiden, a colleague Schwann knew well, advanced the cell theory for plants, Schwann extended it to animals. While investigating digestive processes, he isolated a substance responsible for digestion in the stomach, the first enzyme prepared from animal tissue, and named it pepsin. He studied muscle contraction and nerve structure, discovering the striated muscle in the upper esophagus and the myelin sheath covering nerve cells. He coined the term *metabolism*, identified the role played by microorganisms in the decomposition of organic matter, and formulated the basic principles of embryology by observing that the egg is a single cell that eventually develops into a complete organism.

Schwartz, Arthur See Howard Dietz

Schwartz \'shwȯrts**, Delmore** (b. Dec. 8, 1913, Brooklyn, N.Y., U.S.—d. July 11, 1966, New York, N.Y.) U.S. poet, short-story writer, and critic. He taught at Harvard and other schools and was an editor of *Partisan Review* (1943–55). His works include *In Dreams Begin Responsibilities* (1939), consisting of a short story and poetry; *Shenandoah* (1941), a verse play; and *The World Is a Wedding* (1948) and *Successful Love* (1961), collections of short stories dealing primarily with middle-class Jewish family life. His work is noted for its lyrical descriptions of cultural alienation and the search for identity. Brilliant but unstable, he became alcoholic and declined into insanity.

Schwarzenberg \'shvärt-sən-ˌberk**, Felix, prince zu** (b. Oct. 2, 1800, Krummau, Bohemia, Austrian Habsburg domain—d. April 5, 1852, Vienna, Austria) Austrian statesman who restored the Habsburg empire as a European power. Entering the diplomatic service, he became a protégé of Prince Klemens von Metternich and served in several Austrian embassies. In the Revolutions of 1848, he helped Joseph Radetzky defeat rebel forces in Italy. As prime minister and foreign minister of Austria (1848–52), he secured the replacement of Emperor Ferdinand by Francis Joseph. He reestablished order in Austria with a new constitution that transformed the Habsburg empire into a unitary, centralized state. He also imposed the Punctation of Olmütz on Prussia.

Schwarzenegger \'swȯrts-ə-ˌneg-ər**, Arnold** (b. July 30, 1947, Graz, Austria) Austrian-born U.S. film actor and politician. A bodybuilder in Austria, he moved to the U.S. in 1968 and won the title of Mr. Universe five times and Mr. Olympia seven times before retiring undefeated in 1980. After appearing in the documentary *Pumping Iron* (1977), he starred in *Conan the Barbarian* (1982) and its sequel *Conan the Destroyer* (1984). Noted for his extraordinary physique and heavy accent, he became an international star with *The Terminator* (1984) and its sequels (1991, 2003). His other films include *Kindergarten Cop* (1990), *Total Recall* (1990), *True Lies* (1994), and *The 6th Day* (2000). In 2003 Schwarzenegger was elected governor of California in a recall election.

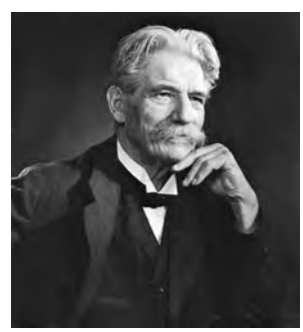
Schwarzkopf \'shwȯrts-ˌkȯf**, Dame (Olga Maria) Elisabeth (Fredericke)** (b. Dec. 9, 1915, Jarotschin, near Posen, Ger.) German-born British soprano. After studies at the Berlin High School for Music, she debuted in 1938 as a flower maiden in the opera *Parsifal*. A 1942 recital in Berlin caused Karl Böhm to invite her to the Vienna State Opera. She made her Covent Garden debut in 1947 with that company and remained there for five years. Her voice bloomed, and she began her long associations with the Salzburg Festival (1949–64) and La Scala (1949–63). Her annual lieder recitals were legendary. Her opera farewell (1972) was in her famous role as the Marschallin in *Der Rosenkavalier*, and she retired in 1975.

Schwarzkopf, H. Norman (b. Aug. 22, 1934, Trenton, N.J., U.S.) U.S. army commander. The son of a brigadier general, he graduated from West Point and fought in the Vietnam War (1965–66, 1969–70). After various other assignments, he was promoted to major general (1983) and commanded forces in the invasion of Grenada. In 1988 he became a four-star general and commander of the U.S. Central Command, which included operations in the Middle East. Following Iraq's invasion of Kuwait in 1990, he directed the buildup of 700,000 U.S. and allied troops in Saudi Arabia and commanded the successful Desert Storm operations in the Persian Gulf War (1991), after which he retired from active service.

Schwarzschild \'shwȯrt-ˌshilt**, Karl** (b. Oct. 9, 1873, Frankfurt am Main, Ger.—d. May 11, 1916, Potsdam) German astronomer. He published his first paper (on celestial orbits) at age 16. In 1901 he became professor and director of the observatory at the University of Göttingen. He gave the first exact solution of Albert Einstein's general equations of gravitation, which led to a description of how mass curves space. He also laid the foundation of the theory of black holes, using the gravitational equations to show that a body of sufficient mass would have an escape velocity greater than the speed of light and therefore would not be directly observable, since even light rays from it could not escape into space. See also Schwarzschild radius.

Schwarzschild radius *or* **gravitational radius** Radius inside which the gravitational attraction between a body's particles must cause its irreversible gravitational collapse, named for Karl Schwarzschild. This is thought to be the final fate of the most massive stars (see black hole). The gravitational radius (R_g) of an object of mass M is given by $R_g = 2GM/c^2$, where G is the universal gravitational constant and c the speed of light. For a star like the Sun, the Schwarzschild radius would be about 1.8 mi (3 km).

Schweitzer \'shwīt-sər**, Albert** (b. Jan. 14, 1875, Kaysersberg, Upper Alsace, Ger.—d. Sept. 4, 1965, Lambaréné, Gabon) Alsatian-born German theologian, philosopher, organist, and mission doctor. In his early years he obtained a degree in philosophy (1899) and became an accomplished organist. In his biography of Johann Sebastian Bach (2 vol., 1905), he viewed Bach as a religious mystic. He also wrote on organ construction and produced an edition of Bach's organ works. His books on religion include several on St. Paul; his *Quest of the Historical Jesus* (1910) became widely influential. In 1905 he announced he would become a mission doctor and devote himself to philanthropic work. He and his wife moved in 1913 to Lambaréné in French Equatorial Africa (now Gabon) and with locals built a hospital on the banks of the Ogooué River, to which they later added a



Albert Schweitzer, photograph by Yousuf Karsh.
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leper colony. In 1952 he received the Nobel Peace Prize for his efforts on behalf of "the Brotherhood of Nations." Two years before his death, his hospital and leper colony were serving 500 patients. His philosophical books discuss his famous principle of "reverence for life."

Schwitters \'shvit-ərz**, Kurt** (b. June 20, 1887, Hannover, Ger.—d. Jan. 8, 1948, Little Langdale, Westmorland, Eng.) German DADA artist and poet. Associated with the Berlin Dadaists from 1918, he moved back to Hannover in 1924. He assembled collages and other constructions from everyday objects (train tickets, wooden spools, newspapers, postage stamps); his poems were composites of newspaper headlines, advertising slogans, and other printed ephemera. He referred to all his artistic activities—and later to all his daily activities and even to himself—as *Merz*, the syllable left when he snipped letters from *Kommerzbank* ("Commercial Bank"). When the Nazis declared his art "degenerate" in 1937, he moved to Norway and later to England.

Picture with Light Centre, collage of paper with oil on cardboard by Kurt Schwitters, 1919; in the Museum of Modern Art, New York City.
COURTESY OF THE MUSEUM OF MODERN ART, NEW YORK

sciatica \sī-'a-ti-kə\ Pain along the course of the sciatic nerve, from the lower back down each leg. It often begins after lower back strain and is associated with spinal disk herniation. Pain is increased by coughing, sneezing, or bending the neck forward. Muscle relaxants, painkillers, and nerve stimulation are among the treatments, but surgery to relieve pressure on the nerve is needed if pain is disabling or nerve function is progressively disturbed (with leg weakness and loss of feeling). Rarely, sciatica arises from other causes of nerve compression (e.g., tumour) or disorders involving the peripheral nervous system.

science, philosophy of Branch of philosophy that attempts to elucidate the nature of scientific inquiry—observational procedures, patterns of argument, methods of representation and calculation, metaphysical presuppositions—and evaluate the grounds of their validity from the points of view of EPISTEMOLOGY, formal LOGIC, SCIENTIFIC METHOD, and METAPHYSICS. Historically, it has had two main preoccupations, ontological and epistemological. The ontological preoccupations (which frequently overlap with the sciences themselves) ask what kinds of entities can properly figure in scientific theories and what sort of existence such entities possess. Epistemologically, philosophers of science have analyzed and evaluated the concepts and methods employed in studying natural phenomena, both the general concepts and methods common to all scientific inquiries and the specific ones that distinguish special sciences.

science fiction Fiction dealing principally with the impact of actual or imagined science on society or individuals, or more generally, literary fantasy including a scientific factor as an essential orienting component. Precursors of the genre include MARY SHELLEY's *Frankenstein* (1818), ROBERT LOUIS STEVENSON's *The Strange Case of Dr. Jekyll and Mr. Hyde* (1886), and JONATHAN SWIFT's *Gulliver's Travels* (1726). From its beginnings in the works of JULES VERNE and H.G. WELLS, it emerged as a self-conscious genre in the pulp magazine *Amazing Stories*, founded in 1926. It came into its own as serious fiction in the magazine *Astounding Science Fiction* in the late 1930s and in works by such writers as ISAAC ASIMOV, ARTHUR C. CLARKE, and ROBERT HEINLEIN. A great boom in popularity followed World War II, when numerous writers' approaches included predictions of future societies on Earth, analyses of the consequences of interstellar travel, and imaginative explorations of intelligent life in other worlds. Much recent fiction has been written in the "cyberpunk" genre, which deals with the effects of computers and artificial intelligence on anarchic future societies. Radio, film, and television have reinforced the popularity of the genre.

Scientific American U.S. monthly magazine interpreting scientific developments to lay readers. It was founded in 1845 as a newspaper describing new inventions. By 1853 its circulation had reached 30,000 and it was reporting on various sciences, such as astronomy and medicine, apart from inventions. In 1921 it became a monthly. From its founding it used woodcut illustrations, and it was one of the first papers to use halftone illustrations. Its articles—solidly based on scholarly research, well written, carefully edited, and accompanied by definitions of scientific terms and by illustrations—have made it the most highly regarded magazine of its genre.

scientific method Mathematical and experimental techniques employed in the natural sciences. Many empirical sciences, especially the social sciences, use mathematical tools borrowed from PROBABILITY THEORY and STATISTICS, together with such outgrowths of these as DECISION THEORY, GAME THEORY, utility theory, and OPERATIONS RESEARCH. Philosophers of science have addressed general methodological problems, such as the nature of scientific EXPLANATION and the justification of INDUCTION. See also MILL'S METHODS.

scientific visualization Process of graphically displaying real or simulated scientific data. It is a vital procedure in the creative realization of scientific ideas, particularly in COMPUTER SCIENCE. Basic visualization techniques include surface rendering, volume rendering, and animation. High-performance workstations or SUPERCOMPUTERS are used to show SIMULATIONS, and high-level PROGRAMMING LANGUAGES are being developed to support visualization programming. Scientific visualization has applications in biology, business, chemistry, computer science, education, engineering, and medicine.

Scientology, Church of International movement established in the U.S. by L. Ron Hubbard in 1954. He introduced his ideas to the general public in *Dianetics: The Modern Science of Mental Health* (1950). Dianetics sought to free subjects from the destructive imprints of past experiences, called engrams. Later Hubbard moved toward a structured system of belief involving the human soul, or thetan (each person's spiritual self), and the origins of life and the universe. The organization has often been the subject of controversy.

Scilly \'si-lē**, Isles of** *or* **Scilly Isles** Group of about 50 small islands and many more islets, southwestern England. Located off LAND'S END, with an area of about 6 sq mi (16 sq km), the islands are a continuation of the granite masses of the Cornish mainland. During the ENGLISH CIVIL WARS, Prince CHARLES sheltered there until his escape to JERSEY in 1646. The islands were a haunt of pirates and notorious for smuggling activities. Administratively, they are a distinct unit within England, though they form part of the county of CORNWALL.

Scipio Africanus (the Elder) \'si-pē-ō, 'ski-pē-ō\ *in full* **Publius Cornelius Scipio Africanus** (b. 236—d. 184/183 BC, Liternum, Campania) Roman general in the Second PUNIC WAR. He was born into a patrician family that had produced several consuls. As a military TRIBUNE, he fought at the Battle of CANNAE (216), managing to escape from the defeat. While still young, he secured Spain for Rome by 206, driving the Carthaginians out and avenging his father's death. As CONSUL in 205 he was granted permission to attack the Carthaginians in Africa. In 202 he was victorious over HANNIBAL at the Battle of ZAMA, ending the Second Punic War and winning the name Africanus. His political opponents, led by CATO, accused Scipio and his brother Lucius of offering too lenient terms to Macedonia after their engagement there and of not being able to account for money supposedly received in those terms. Though there was no evidence of his guilt, Scipio withdrew from public life and died a virtual exile.

Scipio Africanus (the Younger) *or* **Scipio Aemilianus** \i-ˌmil-ē-'ā-nəs\ *in full* **Publius Cornelius Scipio Aemilianus Africanus Numantinus** (b. 185/184—d. 129 BC, Rome) Roman general credited with the final subjugation of CARTHAGE. He was the natural son of Paullus and the adoptive son of Publius Scipio, son of SCIPIO AFRICANUS THE ELDER. POLYBIUS instilled in him the ideals of honour, glory, and military success. He first distinguished himself in the Third MACEDONIAN WAR (168). He then campaigned in Spain and went on to Africa (150), where he displayed great military skill against Carthage while serving as military TRIBUNE, and demand arose that he take the command against Carthage. Though under age, he was elected CONSUL in 147 and returned to Africa. He besieged and destroyed Carthage (146), ending the Third PUNIC WAR and establishing the province of Africa. Again made consul in 134, he was given command of the Celtiberian War (see CELTIBERIA), and he secured Spain by besieging and destroying Numantia (133). Back in Rome, he took an unpopular position on a bill supported by his friend Tiberius GRACCHUS; he was due to speak on the question when he died unexpectedly.

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scirocco See SIROCCO

scissors Cutting instrument or tool consisting of a pair of opposed metal blades that meet and cut when the handles at their ends are brought together. Modern scissors are of two types: the more usual pivoted blades have a rivet or screw connection between the cutting ends and the handle ends; spring shears have a C-shaped spring connection at the handle ends.

SCLC See SOUTHERN CHRISTIAN LEADERSHIP CONFERENCE

scleroderma \ˌskler-ə-ˈdər-mə\ *or* **progressive systemic sclerosis** \sis-ˈtem-ik-sklə-ˈrō-səs\ Chronic disease that hardens the SKIN and fixes it to underlying structures. Swelling and COLLAGEN buildup lead to loss of elasticity. The cause is unknown. It usually begins at age 25–55, more often in women, with severe inflammation of underlying tissue and stiffness, pain, and skin tautness and thickening. Systemic problems that may arise years later include fever, trouble in breathing, fibrous tissue in the lungs, inflammation of heart muscle or membranes, gastrointestinal disorders, and kidney malfunction. Calcium deposits build up under the skin. The disease may finally stabilize or gradually regress. STEROIDS may help, and physical medicine and rehabilitation with heat, massage, and passive exercise (movement of the limbs by the therapist) help prevent limb fixation and deformity.

Scofield, (David) Paul (b. Jan. 21, 1922, Hurstpierpoint, Sussex, Eng.) British actor. After entertaining the troops in World War II, he joined the theatre company at Stratford-upon-Avon (later the ROYAL SHAKESPEARE COMPANY) in 1946, winning acclaim as Henry V and Hamlet. He had his greatest success in *A Man for All Seasons* in London (1960) and New York City (1961–62) and reprised the role on film (1966, Academy Award). He continued to excel in stage productions, notably *Uncle Vanya* (1970) and *Amadeus* (1979). He appeared in the film versions of *King Lear* (1971), *A Delicate Balance* (1973), and *Henry V* (1989), and he later acted in the films *Quiz Show* (1994) and *The Crucible* (1996).

Scone \ˈskün**, Stone of** Rectangular block of yellow sandstone decorated with a Celtic cross, which has been associated with the crowning of Scottish kings since medieval times. Legend says it was Jacob's pillow in the Holy Land, and it was taken to Ireland and then carried off by invading Scots. KENNETH I MACALPIN brought it to the Scottish village of Scone c. 840. EDWARD I took it to England (1296), where it was later placed under the Coronation Chair in Westminster Abbey as a symbol of the authority of English kings over Scotland. It was finally returned to Scotland in 1996.

Scopas *or* **Skopas** \ˈskō-pəs\ (fl. 4th century BC, Greece) Greek sculptor and architect. Ancient writers ranked him with PRAXITELES and LYSIPPUS as one of the major sculptors of the late Classical period. He helped establish the expression of powerful emotions as an artistic theme. He apparently worked on three monuments: the temple of Athena Alea at Tegea, the temple of Artemis at Ephesus, and the Mausoleum at Halicarnassus. Of many freestanding sculptures attributed to him, the *Maenad* in Dresden and the *Pothos* in Rome are the most noteworthy.

Scopes Trial (July 10–21, 1925) Widely publicized trial (called the "Monkey Trial") in Dayton, Tenn. John T. Scopes (1900–70), a high-school teacher, was charged with teaching CHARLES DARWIN's theory of EVOLUTION, which violated a state law prohibiting the teaching of any doctrine that denied the divine creation of humans. The trial was broadcast live on radio and attracted worldwide interest. The prosecutor was WILLIAM JENNINGS BRYAN; the defense attorney was CLARENCE DARROW. The judge limited arguments to the basic charge to avoid a test of the law's constitutionality and a discussion of Darwin's theory. Scopes was found guilty and fined $100; he was later acquitted on the technicality that he had been fined excessively. The law was repealed in 1967.

score In music, the parts of all the instruments or singers of an ensemble notated with simultaneous sounds aligned vertically, on a system of parallel staffs arranged one above another. Polyphonic (multivoiced) music was being composed for some 600 years before the score came into regular use in the 16th–17th centuries. Early examples of scores exist for works of the NOTRE-DAME SCHOOL, and early composers may have used temporary scores during composition, perhaps on chalkboards, from which the parts for individual singers were then copied.

Scorel \ˈskȯr-əl**, Jan van** (b. August 1495, Schoorel, Habsburg Netherlands—d. Dec. 6, 1562, Utrecht) Dutch humanist, architect, engineer, and painter. He studied briefly with JAN GOSSART, who encouraged him to travel. Five years of work and study in Europe eventually took him to Rome. Returning to Holland in 1524, he introduced such Italian Renaissance elements as nudes, Classical draperies and architecture, and spacious imaginary landscapes. His greatest works are his portraits, which show his gift for characterization. He successfully combined the idealism of Renaissance Italy with the naturalism of northern European art in his paintings, and he bequeathed the style to successive generations of Dutch artists.

Scoresby Sound \ˈskōrz-bē\ Deep inlet, Norwegian Sea, eastern central coast of Greenland. It runs inland for 70 mi (110 km) and has numerous fjords (the longest is 280 mi, or 451 km) and two large islands. It was charted by William Scoresby in 1822.

scoria \ˈskōr-ē-ə\ Heavy, dark, glassy IGNEOUS ROCK that contains many bubblelike cavities. Foamlike scoria, in which the bubbles are very thin shells of solidified basaltic magma, occurs as a product of explosive eruptions (as on Hawaii) and as frothy crusts on some lavas. Other scoria, sometimes called volcanic cinder, resembles clinkers, or cinders from a coal furnace.

Scorpio *or* **Scorpius** *Latin* **"Scorpion"** In astronomy, the constellation lying between Libra and Sagittarius; in ASTROLOGY, the eighth sign of the ZODIAC, governing approximately the period October 24–November 21. Its symbol, a scorpion, refers to the Greek myth of the scorpion that stung ORION. The story explains why the constellation of Orion sets as Scorpius rises in the sky. Another Greek myth says that a scorpion caused the horses of the sun to bolt when they were being driven by the inexperienced PHAETHON.

scorpion Any of some 1,300 nocturnal ARACHNID species (order Scorpionida, subphylum Chelicerata) having a slender body, a segmented tail tipped with a venomous stinger, and six pairs of appendages. The small first pair tear apart insect and spider prey. Strong, clawlike pincers on the large second pair, held horizontally in front, are used as feelers and for grasping prey while sucking the tissue fluids. The last four pairs, each with a pincer, are walking legs. The venom is either a hemotoxin that, in humans, causes swelling, redness, and pain or a neurotoxin that may cause convulsions, paralysis, cardiac irregularities, and death. Most scorpions will sting a human only if provoked. Nocturnal hunters, most species are tropical or subtropical.

scorpion fish Any of the numerous species of carnivorous marine fish of the family Scorpaenidae, especially those in the genus *Scorpaena*, widely distributed in temperate and tropical waters. They have large, spiny heads and strong, sometimes venomous, fin spines. Many species blend with their surroundings by virtue of their dull colour, but some are brightly coloured, often red. The largest species grow to about 40 in. (1 m) long. Scorpion fish lie quietly on the bottom, often among rocks. See also LIONFISH; REDFISH; ROCKFISH; ZEBRA FISH.

California scorpion fish (*Scorpaena guttata*)
BUD MEESE FROM ROOT RESOURCES—EB INC.

Scorsese \skȯr-ˈsā-zē**, Martin** (b. Nov. 17, 1942, Flushing, N.Y., U.S.) U.S. film director. Scorsese earned a graduate degree in filmmaking at New York University. After directing several short films, he won critical attention for his feature film *Mean Streets* (1973) and was widely praised for *Taxi Driver* (1976); both films starred his frequent lead actor, ROBERT DE NIRO. Noted for his realistic, violent portrayals of New York street life, innovative camera work, classic film knowledge, and a spirited cynicism, he rose to the top rank of American directors with such films as *Raging Bull* (1980), *The King of Comedy* (1983), *GoodFellas* (1990), *The Age of Innocence* (1993), and *Gangs of New York* (2002).

scotch See WHISKEY

scoter *or* **sea coot** Any of three species (genus *Melanitta*) of DIVING DUCK that are mainly marine except during the breeding season. The males are shiny black. The surf scoter (*Melanitta perspicillata*) breeds in the forests and tundra of Canada and Alaska and winters on seacoasts as far south as Florida and southern California. The white-winged, or velvet,

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scoter (*M. deglandi*, or *fusca*) and the black, or common, scoter (*M. nigra*) occur north of the equator nearly worldwide. All three feed mainly on marine animals such as clams.

Scotland Northernmost country of the United Kingdom. Area: 30,421 sq mi (78,789 sq km). Population (2001): 5,062,011. Capital: Edinburgh. The population is a blend of Celtic, Angle, and Norman ancestry. Languages: English (official), Scottish Gaelic, and Scots. Religion: Church of Scotland (Presbyterian; official). Currency: pound sterling. Scotland has three major geographic regions. The Highlands, in the north, are occupied by a series of lakes and the Grampian Mountains. The Lowlands, which include some of Scotland's best farmland, comprise the other two major regions: the Midland Valley (Central Lowlands) and the Southern Uplands; the Southern Uplands feature narrow, flat valleys separating table mountains. Scotland has a temperate oceanic climate. Important industries are coal and oil production, electronics, forestry, and marine fishing. Picts inhabited the region when it was invaded by the Romans c. AD 80. In the 5th century it split into four kingdoms under the Picts, Scots, Britons, and Angles. Scottish unification began in the 9th century. It came under a heavy Anglicizing influence from the 11th century, and its ruler was forced to pay homage to the English crown in 1174, leading to numerous future disputes. The Scottish and English kingdoms were united in 1603 when James VI, son of Mary, Queen of Scots, ascended the English throne as James I. Scotland became part of the United Kingdom of Great Britain in 1707, when the parliaments of both governments passed the Act of Union. The English prevailed in two Scottish rebellions in the 18th century, and after 1745 the history of Scotland became part of the history of Great Britain. Scotland has no sovereign executive but retains vestiges of ancient sovereignty in its own legal and educational systems. In 1997 the Scots passed a referendum that allowed them to establish their own parliament in Edinburgh to vote on wide-ranging political issues while remaining part of the United Kingdom. The Scottish Parliament first convened in 1999.

Scotland Yard *officially* **New Scotland Yard** Headquarters of the London Metropolitan Police, and, by extension, the force itself. The London police force was created in 1829 by Sir Robert Peel and housed at 4 Whitehall Place, which had an entrance in Great Scotland Yard. In 1890 it moved to a new building; that location became New Scotland Yard, a name that was kept when it moved again in 1967. In addition to duties common to all metropolitan police forces (including crime detection and prevention and traffic management), it is entrusted with civil defense in times of emergency, and it maintains a special branch for guarding visiting dignitaries, royalty, and political dignitaries. It keeps records on all known criminals in Britain, and other British police forces often seek its assistance. It also helps train the police of Commonwealth nations.

Scott, George C(ampbell) (b. Oct. 18, 1927, Wise, Va., U.S.—d. Sept. 22, 1999, Westlake Village, Calif.) U.S. actor. He served in the U.S. Marines before studying drama and journalism at the University of Missouri. He took numerous roles in television and repertory theatre productions before winning praise for his early film roles in *Anatomy of a Murder* (1959), *The Hustler* (1961), and *Petulia* (1968). He was noted for his strong screen presence and barking voice. He won an Academy Award for *Patton* (1970) but refused to accept it, calling the competition a "meat parade." Among his later films were *The Hospital* (1972), *Hardcore* (1979), *Taps* (1981), and *Malice* (1993). His television work included *The Price* (1970, Emmy Award, also refused) and the role of Scrooge in *A Christmas Carol* (1984).

Scott, Paul (Mark) (b. March 25, 1920, Palmers Green, Eng.—d. March 1, 1978, London) British novelist. Scott entered military service in India in the 1940s and later was a director of a London literary agency; he resigned in 1960 to write full-time. He is known for works chronicling the decline of the British occupation of India, notably *The Raj Quartet*—consisting of *The Jewel in the Crown* (1966), *The Day of the Scorpion* (1968), *The Towers of Silence* (1971), and *A Division of the Spoils* (1975)—and *Staying On* (1977, Booker Prize). All his works, including those set outside India, employ Indian themes or characters.

Scott, Sir Peter Markham (b. Sept. 14, 1909, London, Eng.—d. Aug. 29, 1989, Bristol) British conservationist and artist. Son of Robert Falcon Scott, he graduated from Cambridge University and soon gained renown as a wildlife painter. In 1946 he founded the Severn Wildfowl Trust (later renamed the Wildfowl and Wetlands Trust). Through a captive breeding program at his sanctuary, he saved the nene from extinction in the 1950s. In 1961 he founded the World Wildlife Fund (World Wide Fund for Nature). As a member of the Species Survival Commission of the International Union for Conservation of Nature and Natural Resources (1962–81), he created the *Red Data Book* (see endangered species). He was knighted in 1973.

Scott, Ridley (b. Nov. 30, 1937, South Shields, Durham, Eng.) British film director. He studied art and worked as a set designer and director in British television, then formed his own production company in 1967 to make television commercials. His first feature film was *The Duellists* (1977). It was followed by the science-fiction thrillers *Alien* (1979) and *Blade Runner* (1982), a box-office hit that became a cult classic for its vividly dark images. His later films include *Someone to Watch over Me* (1987), *Thelma & Louise* (1991), and *Gladiator* (2000), which won the Academy Award for best picture.

Scott, Robert Falcon (b. June 6, 1868, Devonport, Devon, Eng.—d. c. March 29, 1912, Antarctica) British explorer. He joined the Royal Navy in 1880, proved his competence leading an Antarctic expedition (1901–04), and was promoted to captain. In 1910 he embarked on a second expedition, and in October 1911 he and 11 others started overland for the South Pole. After their motor sledges broke down and seven men returned to base camp, Scott and four others trekked for 81 days to reach the pole in January 1912, only to find that Roald Amundsen had preceded them by about a month. Exhausted and beset by bad weather and insufficient supplies, the men died on the return trip, Scott and the last two survivors only 11 miles from their base camp. In England Scott was celebrated as a national hero for his courage, though his judgment has been questioned.

Scott, Sir Walter, 1st Baronet (b. Aug. 15, 1771, Edinburgh, Scot.—d. Sept. 21, 1832, Abbotsford, Roxburgh) Scottish writer, often considered both the inventor and the greatest practitioner of the historical novel. From childhood Scott was familiar with stories of the Border region of Scotland. Apprenticed to his father, a lawyer, in 1786, he later became sheriff depute of Selkirk and clerk to the Court of Session in Edinburgh. His interest in border ballads led to the collection *Minstrelsy of the Scottish Border* (1802–03). His first original poetic romance, *The Lay of the Last Minstrel* (1805), established his reputation; *The Lady of the Lake* (1810) was his most successful contribution to the genre. He produced editions of the works of John Dryden, 18 vol. (1808), and Jonathan Swift, 19 vol. (1814). Troubled with debt, from 1813 he wrote in part to make money. He tired of narrative poetry and turned to prose romances. The extremely popular series now known as the Waverley novels consists of more than two dozen works dealing with Scottish history, including the masterpieces *Old Mortality* (1816), *Rob Roy* (1817), and *The Heart of Midlothian* (1818). He drew on English history and other themes for *Ivanhoe* (1819), *Kenilworth* (1821), and *Quentin Durward* (1823). All his novels were published anonymously until 1827.

Sir Walter Scott, detail of an oil painting by Sir Edwin Henry Landseer, 1824; in the National Portrait Gallery, London

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Scott, Winfield (b. June 13, 1786, Petersburg, Va., U.S.—d. May 29, 1866, West Point, N.Y.) U.S. army officer. He fought in the War of 1812 at the battles of Chippewa and Lundy's Lane (1814). Promoted to major general, he traveled to Europe to study military tactics. He advocated a well-trained and disciplined army, earning the nickname "Old Fuss and Feathers" for his emphasis on military formalities. In 1841 he became commanding general of the U.S. Army. He directed operations during the Mexican War and led the U.S. invasion at Veracruz and the victory at the Battle of Cerro Gordo. He was the Whig Party's nominee in the 1852 presidential election but lost to Franklin Pierce. In 1855 he was promoted to lieutenant general, becoming the first man since George Washington to hold that rank. Scott was still commander in chief of the U.S. Army when the American Civil War broke out in April 1861, but his proposed strategy of splitting the Confederacy—the plan eventually adopted—was ridiculed. Age forced his retirement the following November.

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Scott v. Stanford See Dred Scott decision

Scottish fold cat Breed of domestic cat with ears that fold forward and down. A Scottish shepherd discovered the foundation cat—Susie, a white barn cat—in 1961. Scottish folds may be longhaired or shorthaired and of various colours and patterns. Susie's fold was caused by a genetic mutation that does not appear in every kitten. The folded ear and a pedigree that leads back to Susie are required for show. Scottish folds are gentle and quiet.

Scottish Gaelic language Celtic language of northern Scotland, a descendant of the Irish speech introduced into northern Britain by invaders in the 4th–5th centuries. Gaelic gradually supplanted Pictish (see Picts) as well as the British Celtic Lowlands dialects, and by the Middle Ages it was the language of all of the Scottish Highlands and part of the Lowlands. Until the 17th century, Classical Modern Irish (see Irish language) was the literary medium of Gaeldom, and only after its collapse did writers regularly begin to use features that distinguish Scottish Gaelic dialects from Irish dialects. Increasing Anglicization, suppression of traditional culture after the Battle of Culloden, and the 19th-century land clearances precipitated a marked decline; today it is probably a true community language for fewer than 80,000 people, most of whom live on the northwestern coast and the Hebrides.

Scottish law Legal practices and institutions of Scotland. When the English and Scottish parliaments were joined in 1707, the legal systems of the two countries were very dissimilar. Scotland had supplemented its customary law with civil-law principles adapted from the systems of France and Holland. Its assimilation of English law following the union was significant, particularly in the area of mercantile law. The supreme Scottish civil court is the Court of Sessions, composed of 18 judges and divided into Outer and Inner houses. The supreme criminal court is the High Court of Justiciary. Below these two bodies are six sheriffdoms, each with its own sheriff court, an institution of great antiquity. Lesser cases are heard by district courts.

Scottish terrier *or* **Scottie** Short-legged terrier breed, perhaps the oldest of the Highland terriers. A strong and plucky dog, the Scottie is squat and bewhiskered, with alert-looking eyes and a distinctive rolling gait. It stands about 10 in. (25.5 cm) tall and weighs 18–22 lb (8–10 kg). Its hard, wiry coat may be of various colours.

Scotts Bluff National Monument National monument, western Nebraska, U.S. Established in 1919, it has an area of 5 sq mi (13 sq km). Its focus is a large bluff that rises 800 ft (244 m) above the North Platte River and was a prominent landmark on the Oregon Trail. A museum at the base of the bluff highlights the history of the pioneer travelers.

Scottsboro case U.S. civil-rights controversy. In April 1931, in Scottsboro, Ala., nine African American youths were charged with the rape of two white women. Despite testimony by doctors that no rape had occurred, the all-white jury convicted them and sentenced all but the youngest to death. In 1932, following public outcry, the U.S. Supreme Court overturned the convictions on the grounds that the defendants had not received adequate legal counsel. Alabama retried and convicted one of the youths; this conviction too was overturned by the Supreme Court on the grounds that African Americans had been systematically excluded from the state's juries. Alabama retried and reconvicted the defendants individually, but the state yielded to public pressure and freed or paroled all but one, who later escaped.

Scotus, John Duns See John Duns Scotus

scouting Activities of various national and worldwide organizations for youth aimed at developing character, citizenship, and individual skills. Scouting began when Robert S. Baden-Powell published *Scouting for Boys* (1908), in which he described the games and contests he used to train cavalry troops in scouting, envisioning small groups of boys who would learn tracking, reconnaissance, mapping, and other outdoor skills under a peer leader. The Boy Scouts, as established by Baden-Powell, was for boys 11–15 years old. The concept became so popular that separate organizations for girls (Girl Guides, or Girl Scouts, 1910) and for younger boys (Wolf Cubs, or Cub Scouts, 1916) and older boys (Explorers) were also formed.

Scrabble Game in which two to four players compete in forming words with lettered wooden tiles on a 225-square board. Words spelled out by letters on the tiles interlock like words in a crossword puzzle. Words are scored by adding up the point values of their letters. The game (originally called Lexico) was developed by Alfred Butts, an unemployed architect, in 1931. It was redesigned and renamed Scrabble by Butts and James Brunot in 1948. Tens of millions of sets have been sold in many languages worldwide.

scrap metal Used metals that are an important source of industrial metals and alloys, particularly in the production of steel, copper, lead, aluminum, and zinc. Smaller amounts of tin, nickel, magnesium, and precious metals are also recovered from scrap. Impurities consisting of such organic materials as wood, plastic, paint, and fabric can be burned off. Scrap is usually blended and remelted to produce alloys similar to or more complex than those from which the scrap was derived. See also recycling.

screech owl Any of numerous owls of the genus *Otus* (family Strigidae). Both New World species and Old World species (called scops owls) have a facial disk and ear tufts. In spite of their name, they do not in fact screech. Their colouring resembles tree bark, and they are 8–12 in. (20–30 cm) long. They eat mostly small mammals, birds, and insects. Notable species are the common screech owl (*O. asio*) of North America, the flammulated owl (*O. flammeolus*) of western North America, and the common scops owl (*O. scops*) of southern Europe, Asia, and Africa.

screenplay Written text that provides the basis for a film production. Screenplays usually include not only the dialogue spoken by the characters but also a shot-by-shot outline of the film's action. Screenplays may be adapted from novels or stage plays or developed from original ideas suggested by the screenwriters or their collaborators. They generally pass through multiple revisions, and screenwriters are called on to incorporate suggestions from directors, producers, and others involved in the filmmaking process. Early drafts often include only brief suggestions for planned shots, but by the date of production a screenplay may evolve into a detailed shooting script, in which action and gestures are explicitly stated.

screw In machine construction, a usually circular cylindrical member with a continuous spiral rib or thread, used either as a fastener or as a force and motion modifier. Various types of screws are used to clamp machine parts together. Wood screws are made in a wide variety of diameters and lengths; when using wood screws, small starting holes called pilot holes are often drilled first to avoid splitting the wood. Screws that modify force and motion are known as power screws. The screw is considered one of the five simple machines. See also wedge.

screwworm Any of several North and South American blowfly species named for the screwlike appearance of the larva's body, which is ringed with small spines. Screwworms attack livestock and other animals, including humans. The true screwworm (*Cochliomyia hominivorax*) and the secondary screwworm (*Callitroga macellaria*) develop in decaying flesh; they may also attack healthy tissue. Each female deposits 200–400 eggs near an open wound. The larvae burrow into the tissue and, when mature, drop to the ground to pupate. Severe infestations (myiasis) may kill the affected animal.

Scriabin \'skryä-bin**, Aleksandr (Nikolayevich)** (b. Jan. 6, 1872, Moscow, Russia—d. April 27, 1915, Moscow) Russian composer and pianist. He studied piano and composition at the Moscow Conservatory and then launched a successful concert career. His early music was mostly for piano (including études, preludes, and sonatas) but also included two symphonies and a piano concerto. After 1900 he was much preoccupied with mystical philosophy and began using unusual harmonies, producing a third symphony and the *Divine Poem* (1904). He became involved in theosophy, which provided the basis for the orchestral *Poem of Ecstasy* (1908) and *Prometheus* (1910); the latter called for the projection of colours onto a screen during the performance. No longer thinking in terms of music alone, he made sketches for a huge operatic ritual, *Mysterium*, which was never composed.

Aleksandr Scriabin.
Novosti Press Agency

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Scribe \'skrēb**, (Augustin) Eugène** (b. Dec. 24, 1791, Paris, France—d. Feb. 20, 1861, Paris) French playwright and librettist. He wrote some 350 dramas, most of which proved extremely successful, and he became the most popular opera librettist of his time. His librettos include Gioacchino Rossini's *Count Ory* (1828), Vincenzo Bellini's *The Sleepwalker* (1831), Gaetano Donizetti's *The Elixir of Love* (1832), Giacomo Meyerbeer's *Les Huguenots* (1836), and Giuseppe Verdi's *The Sicilian Vespers* (1855).

Scribner, Charles *orig.* **Charles Scrivener** (b. Feb. 21, 1821, New York, N.Y., U.S.—d. Aug. 26, 1871, Lucerne, Switz.) U.S. publisher. In 1846, in partnership with Isaac D. Baker (d. 1850), Scribner established the publishing firm of Baker & Scribner in his native New York City. In 1878 the firm was renamed Charles Scribner's Sons. Its list initially consisted of philosophical and theological (mainly Presbyterian) books, but it later included reprints and translations of British and continental European literature. Among the firm's periodicals was *Scribner's Monthly* (1870–81). After his death other members of the Scribner family continued the business.

Scribner family Family of U.S. publishers whose firm, named Charles Scribner's Sons from 1878, issued books and periodicals. After the death of its founder, Charles Scribner, the company was headed successively by his sons John Blair (1850–1879), Charles (1854–1930), and Arthur Hawley (1859–1932). During the long presidency (1879–1928) of the second Charles Scribner, the firm published such authors as Henry James, Theodore Roosevelt, Edith Wharton, Ernest Hemingway, George Meredith, and Rudyard Kipling. Later presidents were Charles Scribner (1890–1952), son of the second Charles; and his son Charles, Jr. (1921–1995), who also served as president of Princeton University Press, founded in 1905 by his grandfather. Charles Scribner's Sons was purchased in 1984 by Macmillan Inc.

scrimshaw Decoration of bone or ivory objects, such as whale's teeth and walrus tusks, with fanciful designs, traditionally carved by Anglo-American and Native American whale fishermen with a jackknife or sail needle and emphasized with black pigments (e.g., lampblack). Among the traditional subjects are whaling scenes, ships, naval battles, flower bouquets, Masonic emblems, coats of arms, and the Irish harp. The earliest surviving examples date from the late 17th century, but the craft reached its peak in 1830–50. It is still practiced by whalers in Siberia and Alaska.

Scripps, Edward Willis (b. June 18, 1854, near Rushville, Ill., U.S.—d. March 12, 1926, at sea off Monrovia, Liberia) U.S. newspaper publisher. He was first employed by his half brother, James Edmund Scripps (1835–1906), on newspapers in Detroit. He began publishing his own papers in 1878 and eventually owned 34 in 15 states. He was a partner in forming the first major U.S. newspaper chain, the Scripps-McRae League of Newspapers (1894). In 1907 he consolidated regional Scripps news services as United Press (after 1958, United Press International). In 1922 he transferred his interests to his son, Robert Paine Scripps (1895–1938), who with Roy W. Howard formed the Scripps-Howard chain. The E.W. Scripps Co. now operates the latter chain and includes varied media holdings in addition to newspapers.

scripture Sacred writings of religions, comprising a large portion of the literature of the world. Scriptures vary in form, volume, age, and degree of sacredness. Nearly all scriptures were originally oral and were passed down as memorized texts through several generations before being put in writing. In some religions, notably Islam, Hinduism, and Buddhism, there is still strong emphasis on the value of reciting or chanting the scriptures aloud. The Hebrew Bible (Old Testament) is the scripture of Judaism; the Bible (Old and New Testaments together) is the scripture of Christianity; and the Qu'rān is the scripture of Islam. Scriptures of Hinduism include the Vedas and Upanishads. See also Adi Granth; Avesta; *Book of* Mormon; sutra; Tripitaka.

scrod Young fish (as a cod or haddock), especially one split and boned for cooking. The origin of the term is not known for certain, but it is thought to come from an Old Dutch word meaning "to shred." It seems to have first been used around 1841.

scroll painting Art form practiced primarily in the Far East. The two dominant types are the Chinese landscape scroll and the Japanese narrative scroll. China's greatest contribution to the history of painting, the landscape hand scroll, reached its greatest period in the 10th–11th century with such masters as Xu Daoning and Fan Kuan. The Japanese scroll paintings of the 12th–13th century developed the storytelling potential of painting to its greatest extent. In the earliest, Murasaki Shikibu's literary masterpiece *The Tale of Genji*, the narrative is told in pictures alternating with text. Eventually the illustration stood nearly alone. Typical subjects were the stories and biographies popular during Japan's Middle Ages.

SCSI \'skə-zē\ *in full* **Small Computer System Interface** Once common standard for connecting peripheral devices (disks, modems, printers, etc.) to small and medium-sized computers. SCSI has given way to faster standards, such as Firewire and USB.

scuba diving Swimming done underwater with a self-contained underwater-breathing apparatus (scuba), as opposed to skin diving, which requires only a snorkel, goggles, and flippers. Scuba gear was invented by Jacques-Yves Cousteau and Émile Gagnan in 1943. Diving clubs formed quickly as the technology became widely available. Scuba diving is used in oceanography, in underwater exploration and salvage work, in the study of water pollution, and for recreation.

sculpin *or* **bullhead** *or* **sea scorpion** Any of about 300 species (family Cottidae) of inactive, bottom-dwelling fishes found principally in northern regions. Sculpins are slender and tapered and have one or more spines on the gill covers, large fanlike pectoral fins, and smooth or spiny skin. The head is usually wide and heavy. Most species live in shallow seawaters, some live in deeper waters, and others inhabit fresh water. The largest species grow to 2 ft (60 cm) long; the miller's-thumb (*Cottus gobio*), common in European lakes and rivers, is only about 4 in. (10 cm) long. Other species of *Cottus* are found in Asia and North America.

sculpture Three-dimensional art produced especially by forming hard or plastic materials into three-dimensional objects, usually by carving or modeling. The designs may be produced in freestanding objects (i.e., in the round), in relief, or in environments, and a variety of media may be used, including clay, wax, stone, metal, fabric, wood, plaster, rubber, and found objects. Materials may be carved, modeled, molded, cast, wrought, welded, sewn, or assembled and combined. Various forms of sculpture have been found in virtually every culture throughout history. Until the 20th century, sculpture was considered a representational art, but, beginning in the early 1900, nonrepresentational works were increasingly produced. The scope of the term became much wider in the second half of the 20th century. Present-day sculptors use any materials and methods of manufacture that will serve their purposes, and so the art of sculpture can no longer be identified with any special materials or techniques. See also environmental sculpture; kinetic sculpture.

scurvy *or* **vitamin C deficiency** Nutritional disorder caused by deficiency of vitamin C. Deficiency interferes with tissue synthesis, causing swollen, bleeding gums; loose teeth; sore, stiff joints and legs; bleeding under the skin and in deep tissues; slow wound healing; and anemia. The scourge of sailors on long sea voyages, scurvy was recognized as diet-related in 1753, when James Lind showed that drinking citrus juice could cure and prevent it, leading to the concept of deficiency diseases. Full-blown scurvy is now rare, and adequate vitamin C usually cures even severe cases in days.

Scutari \'skü-tä-rē**, Lake** Largest lake in the Balkan Peninsula. Located on the frontier between Montenegro (see Serbia and Montenegro) and Albania, it has an area of 150 sq mi (390 sq km). It was formerly an arm of the Adriatic Sea. Steep mountains, plains, and marshland border the lake, as do many small villages that are noted for their old monasteries and fortresses.

Scylla and Charybdis \'si-lə...kə-'rib-dis\ In Greek mythology, two monsters that guarded the narrow passage through which Odysseus had to sail in his wanderings. These waters are now identified with the Strait of Messina. On one shore was Scylla, a monster with six snaky heads, who reached out of her cave to seize and devour six of Odysseus' companions. On the opposite shore was Charybdis, the personification of a whirlpool, who drank down and belched forth the waters three times a day. The shipwrecked Odysseus saved himself by clinging to a tree on the shore until his raft floated to the surface.

Scythian \'si-thē-ən\ Any member of a nomadic people of Iranian stock who migrated from Central Asia to southern Russia in the 8th–7th century BC. Fierce warriors, they were among the first expert horsemen, which enabled them to establish an empire from western Persia through Syria and Judaea to Egypt and to expel the Cimmerians from their territory in the Caucasus and north of the Black Sea. Although driven out of Anatolia by the Medes (see Media), they held territory from the Persian border into southern Russia; they repelled an invasion by the Persian Darius I c. 513 BC. Their civilization produced wealthy aristocrats ("Royal Scyths"),

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whose graves held richly worked articles of gold and other precious materials. The army consisted of freemen; on presentation of an enemy's head, a soldier could share in the booty. They fought with double-curved bows, trefoil-shaped arrows, and Persian swords. Burial called for the sacrifice of the dead man's wife and servants. In the 5th century BC the royal family intermarried with Greeks. The community fell to the SARMATIANS in the 2nd century BC. See also SCYTHIAN ART.

Scythian art \'si-thē-ən\ Decorative objects, mainly jewelry and trappings for horses, tents, and wagons, produced by nomadic SCYTHIAN tribes that roamed Central Asia and eastern Europe between the 7th century BC and the 2nd century AD. Also known as Steppes art, it largely features representations of real or mythical beasts worked in a wide variety of materials, including wood, leather, bone, appliqué felt, bronze, iron, silver, gold, and electrum. Outstanding are gold stags about 12 in. (30 cm) long, their legs tucked under them, probably used as central ornaments on round shields.

Scythian gold belt buckle with turquoise inlay, from Siberia; in the Hermitage, St. Petersburg
NOVOSTI PRESS AGENCY

SDI See STRATEGIC DEFENSE INITIATIVE

SDS See STUDENTS FOR A DEMOCRATIC SOCIETY

Sea, Law of the International law codified in a treaty signed in 1982 covering the status and use of TERRITORIAL WATERS, sea lanes, and ocean resources. Originally signed by 117 countries, the treaty had some 140 state parties by the early 21st century. The treaty defines territorial waters as those extending 12 nautical mi (22 km) beyond a country's coast and gives to each country exclusive fishing and mining rights in waters extending to 200 nautical mi (370 km) from its coast. See also HIGH SEAS.

sea anemone \ə-ˌne-mə-ˌnē\ Any of more than 1,000 CNIDARIAN species in the order Actiniaria, found from the tidal zone of all oceans to depths of more than 30,000 ft (10,000 m) and occasionally in brackish water. Species vary from less than 1 in. (3 cm) to about 5 ft (1.5 m) in diameter. The mouth, at the upper end of the cylindrical body, is surrounded by petal-like, usually colourful tentacles that bear stinging nematocysts for paralyzing prey such as fishes. Some species eat only microorganisms. Most species remain permanently attached to a hard surface such as a rock or the back of a crab.

Sea anemone, *Tealia*
M. WOODBRIDGE WILLIAMS

sea bass Any of about 400 species (family Serranidae) of carnivorous fishes, most of which inhabit shallow regions of warm and tropical seas. Sea bass have a slender body, small scales, large mouth, and straight-edged or rounded tail. The spiny frontal section and the soft-rayed rear section of the dorsal fin are usually joined but may be separated by a notch. Species range from about 1 in. (3 cm) to 6 ft (1.8 m) long and may weigh 500 lbs (225 kg). About 12 species in the family Moronidae (sometimes considered a subfamily of Serranidae) inhabit temperate waters. See also BASS.

sea coot See SCOTER

sea cow *or* **Steller's sea cow** Extinct aquatic mammal (*Hydrodamalis gigas*) that lived around islands in the Bering Sea. It was discovered in 1741 and described by a member of VITUS BERING's expedition. At least 24 ft (7.5 m) long, it had no teeth, a small head, and a broad, horizontal, forked tail fluke; its dark brown skin was sometimes streaked or spotted with white. It browsed on seaweed. Russian sealers hunted it for food and fur; by 1768 the entire population, estimated at about 5,000, had been exterminated. The term also refers to DUGONGS and MANATEES.

sea cucumber Any of 1,100 species of ECHINODERMS constituting the class Holothurioidea, found in all oceans, mostly in shallow water. The soft, cylindrical body is 0.75 in. (2 cm) to 6.5 ft (2 m) long and 0.4–8 in. (1–20 cm) thick. It is usually dull, dark, and often warty. The internal skeleton consists merely of numerous tiny bits in the skin. Most species have five rows of tube feet extending from mouth to anus. The 10 or more retractile tentacles surrounding the mouth are used for taking food (mud containing nutrients or small aquatic animals) or burrowing. Locomotion is sluglike. See also SHELLFISH.

sea eagle Any of various large fish-eating EAGLES (especially in the genus *Haliaeetus*), of which the best known is the BALD EAGLE. Sea eagles live along rivers, big lakes, and tidewater worldwide except in South America. Some reach over 3 ft (1 m) long. All have an exceptionally large, high-arched beak and bare lower legs. The toes' undersurfaces are roughened for grasping slippery prey. They eat mostly carrion but sometimes kill, snatching fish from the water surface and often robbing their chief competitor, the OSPREY. Asian species include the gray-headed, or greater, fishing eagle and the lesser fishing eagle.

sea fan Any of about 500 CORAL species (genus *Gorgonia*) especially abundant in shallow waters along the Atlantic coasts of Florida, Bermuda, and the West Indies. POLYPS grow colonially in a flat, fanlike pattern. Each polyp has some multiple of six tentacles, which it spreads out to form a plankton-catching net. An internal skeleton supports all branches of the colony. The living tissues (often red, yellow, or orange) entirely cover the skeleton. The fan-shaped colonies usually grow across the current, increasing their ability to ensnare prey. All species grow to about 2 ft (60 cm) high.

Sea fan
DOUGLAS FAULKNER

sea horse Any of about 24 species (family Syngnathidae) of fishes that usually live along warm seashores, clinging to plants with their forward-curled, prehensile tail. Species range from 1.5 to 12 in. (4–30 cm) long. Sea horses have bony rings instead of scales, and their eyes can move independently. They swim upright, propelling themselves horizontally with their fins and vertically with their swim bladder. They catch small organisms by sucking them quickly into their small mouths. The female deposits her eggs into a brood pouch beneath the male's tail, and the male expels the newly hatched young.

Sea horse (*Hippocampus erectus*).
DES BARTLETT—BRUCE COLEMAN LTD.

sea ice Ice formed from frozen seawater in polar regions. Most sea ice occurs as pack ice, which drifts across the ocean surface; other types of sea ice include fast ice, which is attached to coasts and sometimes the seafloor or between grounded icebergs, and marine ice, which forms at the bottom of ice shelves in Antarctica. The sea ice of the Northern Hemisphere covers about 3 million sq mi (8 million sq km) in September and about 6 million sq mi (15 million sq km) in March. Sea ice in the Southern Hemisphere ranges from about 1.5 million sq mi (4 million sq km) in February to about 8 million sq mi (20 million sq km) in September.

sea lavender Any of about 300 species of chiefly perennial herbaceous plants that make up the genus *Limonium* of the family Plumbaginaceae, especially *L. vulgare*. Bearing small flowers in dense spikes, *L. vulgare* grows in large tracts that sometimes turn acres lilac-coloured in late summer. The flower spikes of this and other sea lavenders are often used in dry-flower arrangements for their lasting qualities and permanent colours.

sea leopard See LEOPARD SEAL

sea level Position of the air-sea boundary, to which all terrestrial elevations and submarine depths are referred. The sea level at any location changes constantly with changes in tides, atmospheric pressure, and wind

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conditions. Longer-term changes are influenced by changes in the Earth's climates. Consequently, the level is better defined as mean sea level, the height of the sea surface averaged over all stages of the tide over a long period of time.

sea lion Any of five species (family Otariidae) of eared SEALS found along coasts on both sides of the Pacific, from Alaska to Australia. Sea lions have short, coarse hair that lacks a distinct undercoat. The males of all but the California sea lion have a mane. Sea lions feed principally on fish, squid, and octopus. They breed in large herds; males establish a harem of 3–20 females. The California sea lion (*Zalophus californianus*) is the trained seal of circuses and zoos. Males of the various species range from 8 to 11 ft (2.5–3.3 m) long and weigh 600–2,200 lbs (270–1,000 kg).

sea otter *or* **great sea otter** Rare, completely marine OTTER (*Enhydra lutris*) of the northern Pacific, usually found in kelp beds. Floating on its back, it opens mollusks by smashing them on a stone balanced on its chest. The large hind feet are broad and flipperlike. It is 40–65 in. (100–160 cm) long and weighs 35–90 lbs (16–40 kg). The thick lustrous coat is reddish to dark brown. By 1910 it had been hunted almost to extinction for its fur; now fully protected, it is gradually increasing in numbers.

sea parrot See PUFFIN

Sea People Any of the groups of aggressive seafarers who invaded eastern Anatolia, Syria, Palestine, Cyprus, and Egypt toward the end of the BRONZE AGE. They were especially active in the 13th century BC. Though the extent and origin of the upheavals remain uncertain, Sea Peoples are believed responsible for the destruction of old powers such as the HITTITE empire. The Egyptians waged two wars against them (1236–23 BC and c. 1198–66). The only major tribe to settle permanently in Palestine were the Peleset (i.e., PHILISTINES).

sea power Means by which a nation extends its military power onto the seas. Measured in terms of a nation's capacity to use the seas in defiance of rivals, it consists of combat vessels and weapons, auxiliary craft, commercial shipping, bases, and trained personnel. It includes aircraft based on carriers or used in support of shipping. Its main purpose is to protect friendly shipping from enemy attack and to destroy or hinder the enemy's shipping. It may also be used to enforce a BLOCKADE. Finally, naval forces have been used to bombard land targets from the sea. The AIRCRAFT CARRIER added a new dimension to this capability, as did the missile-firing nuclear SUBMARINE. The classic exposition of the role of sea power as the basis of national greatness is ALFRED THAYER MAHAN's *The Influence of Sea Power upon History* (1890).

sea scorpion See SCULPIN

sea slug See NUDIBRANCH

sea snake Any of some 50 species (family Hydrophiidae) of venomous, marine SNAKES with an oarlike tail and flattened body. Most are found along coasts and in estuaries of Australia and Asia, sometimes basking on the surface in a large group, though the yellow-bellied, or pelagic, sea snake ranges throughout the Pacific. The nostrils, usually on top of the snout, have valvelike closings. The body of several species is much thicker than the head and neck. Most species are 3–4 ft (1–1.2 m) long; *Laticauda semifasciata*, a Japanese delicacy, may be twice as long. Though generally slow to strike, their venom may be lethal.

sea squirt Any TUNICATE in the class Ascidiacea; found in seas worldwide. Resembling potatoes more than animals, they are permanently fixed to a surface. A forceful contraction of the adult's vaselike body shoots a jet of seawater when it is disturbed. They filter-feed near the shore on debris from dead plants and animals and, in deeper water, on plankton. Adults, from less than 1 in. to 1 ft (2–30 cm) long, have functional male and female reproductive organs. The free-swimming, tadpolelike larvae hatch from eggs shed by one individual and fertilized by another. Some species live individually, others in colonies.

sea star See STARFISH

sea trout See WEAKFISH

sea urchin Any of about 700 species (class Echinoidea) of ECHINODERMS found worldwide. Sea urchins have a globular body covered with movable, sometimes poisonous, spines up to 12 in. (30 cm) long. Pores along the internal skeleton accommodate slender, extensible, often sucker-tipped tube feet. Sea urchins live on the seafloor and use their tube feet or spines to move about. The mouth is on the body's underside; teeth are extruded to scrape algae and other food from rocks. Some species excavate hiding places in coral, rock, or even steel. Roe of some species is eaten in certain countries.

Slate-pencil urchin (*Heterocentrotus mammillatus*)
DOUGLAS FAULKNER

Seaborg \'sē-ˌbȯrg**, Glenn (Theodore)** (b. April 19, 1912, Ishpeming, Mich., U.S.—d. Feb. 25, 1999, Lafayette, Calif.) U.S. nuclear chemist. Seaborg pursued graduate study at the University of California at Berkeley. Working with John Livingood, Emilio Segré, and others, he discovered some 100 isotopes, including many that would prove to be of major importance, such as iodine-131 and technetium-99. However, his best-known work involved the isolation and identification of TRANSURANIUM ELEMENTS. In 1941 he and his colleagues discovered PLUTONIUM. He went on to discover and isolate the elements americum, curium, berkelium, californium, einsteinium, fermium, mendelevium, and nobelium (atomic numbers 95–102). He joined the MANHATTAN PROJECT in 1942 and was instrumental in the development of the ATOMIC BOMB, although he pleaded, unsuccessfully, with Pres. Truman not to use the bomb on civilian targets. He shared a 1951 Nobel Prize with Edwin Mattison McMillan (1907–91). Prediction of new elements' chemical properties and placement in the PERIODIC TABLE was helped greatly by an important organizing principle enunciated by Seaborg, the actinide concept. He served as head of the Atomic Energy Commission (1961–71). A strong advocate of nuclear disarmament, he led the negotiations that eventuated in the Limited Nuclear Test-Ban Treaty (1963) and later played a leading role in the passage of the NUCLEAR NONPROLIFERATION TREATY. In 1997 his name was given to the new element seaborgium, the first time a living person had been so honoured.

seafloor spreading Theory that oceanic crust forms along submarine mountain zones, known collectively as the OCEANIC RIDGE system, and spreads out laterally away from them. This idea, proposed by U.S. geophysicist Harry H. Hess (1906–1969) in 1960, was pivotal in the development of the theory of PLATE TECTONICS.

seafood Edible aquatic animals excluding mammals, but including both freshwater and ocean creatures. Seafood includes bony and cartilaginous FISHES, CRUSTACEANS, MOLLUSKS, edible JELLYFISH, sea TURTLES, FROGS, SEA URCHINS, and SEA CUCUMBERS. The roe, or eggs, of some species are eaten as CAVIAR. After cereals, seafood may be mankind's most important food, furnishing about 15% of the world's protein intake. Lean fish is equivalent to beef or poultry in its protein yield (18–25% by weight), but it is much lower in calories. Much seafood is eaten uncooked, either raw, dried, smoked, salted, pickled, or fermented. Otherwise it is cooked whole or cut into steaks, filets, or chunks. It is often used in stews or soups.

Seagram Building High-rise office building in New York City (1958). Designed by Ludwig MIES VAN DER ROHE and PHILIP JOHNSON, this sleek Park Avenue skyscraper is a pure example of a rectilinear prism sheathed in glass and bronze; it took the INTERNATIONAL STYLE to its zenith. Despite its austere and forthright use of the most modern materials, it demonstrates Mies's exceptional sense of proportion and concern for detail.

Seagram Company Ltd. Formerly the world's largest producer and marketer of distilled spirits. The company began when Distillers Corp., Ltd., a Montreal distillery owned by Samuel Bronfman, acquired Joseph E. Seagram & Sons in 1928. The new company, Distillers Corp.-Seagrams Ltd., grew rapidly. Originally a maker of blended whiskies, the firm diversified in the 1950s and '60s into scotch, bourbon, rum, vodka, gin, and wines, which were sold around the world. In the 1990s it entered the field of music and entertainment, purchasing Universal Studios, media firm MCA, and the Dutch music giant Polygram NV. The company was acquired by French media conglomerate Vivendi in 2000 to form Vivendi Universal. The beverage businesses were later sold to Diageo and Pernod Ricard. See also SEAGRAM BUILDING.

seal Aquatic carnivore with webbed flippers and a streamlined body. Earless (true, or hair) seals (of the family Phocidae, with 18 species) lack external ears. In water, they propel themselves by side-to-side strokes of the hind limbs and maneuver with their forelimbs. On land, they wriggle on their belly or pull themselves with their forelimbs. Earless species include the

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ELEPHANT SEAL, HARBOUR SEAL, HARP SEAL, and LEOPARD SEAL. The eared seals (family Otariidae, with five species of SEA LION and nine of fur seal) have external ears and longer flippers. In water, they propel themselves by a rowing motion of their forelimbs; on land, they use all four limbs to move about.

Sealyham terrier Breed of TERRIER developed in the late 19th century by Capt. John Edwardes for hunting foxes, otters, and badgers on his Welsh estate, Sealyham. A small, short-legged, sturdy dog, it was bred for courage, stamina, and hunting ability. It has a double coat, soft underneath and wiry on top, and may be solid white or white with darker markings on its head and drooping ears. It stands about 10 in. (25.5 cm) and weighs about 20 lbs (9 kg).

Seami See ZEAMI

seamount Large submarine volcanic mountain rising at least 3,000 ft (1,000 m) above the surrounding seafloor; smaller submarine volcanoes are called sea knolls, and flat-topped seamounts are called guyots. Seamounts are abundant and occur in all major ocean basins. By the late 1970s more than 10,000 seamounts had been reported in the Pacific Ocean basin alone. Virtually every oceanographic expedition discovers new seamounts, and it is estimated that about 20,000 exist worldwide.

seaplane Aircraft that can land, float, and take off on water. The first practical seaplanes were built and flown in 1911–12 by GLENN H. CURTISS, who developed both the float seaplane, essentially a land plane with pontoons instead of landing wheels, and the flying boat, a boatlike plane that combined a main float and fuselage in a single body. A retractable landing wheel was later added to create an amphibian aircraft. By the late 1920s seaplanes held the speed and range records for aircraft. During the 1940s their utility diminished with the building of long-range land-based airplanes, new airports, and aircraft carriers.

search and seizure In law enforcement, an exploratory investigation of a premises or a person and the taking into custody of property or an individual in the interest of gaining evidence of unlawful activity or guilt. The latitude allowed police in carrying out searches and seizures varies greatly from country to country. In the U.S., the 4th Amendment to the Constitution prohibits unreasonable searches and seizures and requires that a warrant be issued following a finding of probable cause. The warrant must specify the place to be searched and the persons and things to be seized.

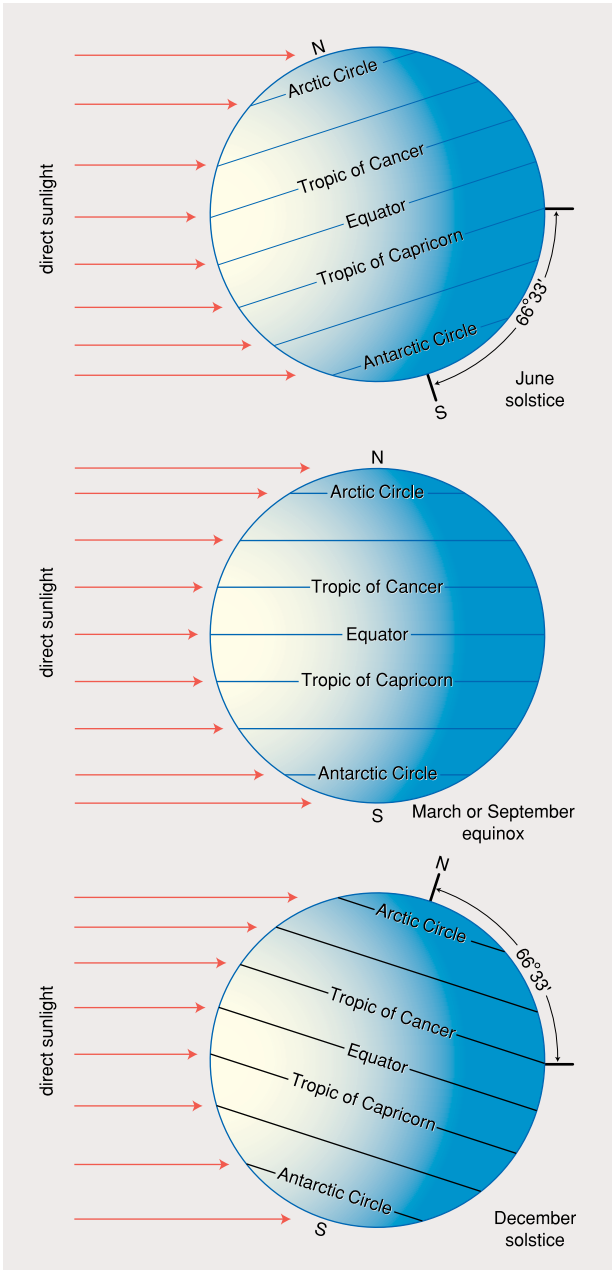
search engine Tool for finding information, especially on the INTERNET or WORLD WIDE WEB. Search engines are essentially massive DATABASES that cover wide swaths of the Internet. Most consist of three parts: at least one program, called a spider, crawler, or bot, which "crawls" through the Internet gathering information; a database, which stores the gathered information; and a search tool, with which users search through the database by typing in keywords describing the information desired (usually at a Web site dedicated to the search engine). Increasingly, metasearch engines, which search a subset (usually 10 or so) of the huge number of search engines and then compile and index the results, are being used.

Sears, Isaac (b. July 1?, 1730, West Brewster, Mass.—d. Oct. 28, 1786, Canton, China) American patriot. A merchant in New York City, he supported the patriots' cause in the STAMP ACT riots. As a member of the radical Sons of Liberty, he headed a boycott of British goods to protest the Townshend Acts. He led the ouster of LOYALIST officials from New York City and seized control of the municipal government until GEORGE WASHINGTON's troops arrived (1775). From Boston he organized privateers to prey on British ships. He died while on a trading venture in China.

Sears, Roebuck and Company U.S. merchandising company, historically one of the world's largest retailers. It was founded in 1893 by Richard W. Sears (1863–1914) and Alvah C. Roebuck (1864–1948). The company grew rapidly, selling mail-order merchandise at low prices to rural dwellers who lacked access to competitive retail outlets. Under Robert E. Wood (president 1928–54), Sears built stores across the U.S., and by 1931 its retail sales had topped its mail-order sales. It diversified into financial services in the 1980s and introduced the Discover credit card in 1985, but in 1992 it began shedding its financial-services subsidiaries. It discontinued its famous catalog in 1993 and spun off insurance subsidiary Allstate (founded by Sears in 1931) in 1995. A merger with KMART in 2005 brought the two retail chains under the leadership of Sears Holdings Corporation.

Sears Tower Skyscraper office building in Chicago. With 110 floors and a height of 1,450 ft (442 m), it became the world's tallest building at its completion in 1974. Its architect, Fazlur Khan (1928–1982), designed it as a bundled-tube (see SKYSCRAPER) structure to resist lateral forces. It is modular in plan, with nine 75-ft- (23-m-) square, column-free units. The exterior is sheathed in black aluminum and bronze-tinted glass. Louvers clad the four floors devoted to the building's mechanical operations. It was the world's tallest building until 1996, when it was surpassed by the PETRONAS TOWERS (1,483 ft [452 m]) in Kuala Lumpur, Malaysia.

season Any of four divisions of the year according to consistent annual changes in the weather. In the Northern Hemisphere, winter formally



The primary cause of Earth's seasons is the change in the amount of sunlight reaching the surface at various latitudes over the course of a year. Because Earth is tilted on its axis with respect to the plane of its orbit around the Sun, different parts of its surface are in direct (overhead) sunlight at different times of the year.

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begins on the winter SOLSTICE, December 21 or 22; spring on the vernal EQUINOX, March 20 or 21; summer on the summer solstice, June 21 or 22; and fall (autumn) on the autumnal equinox, September 22 or 23. In the Southern Hemisphere, the dates of onset of summer and winter are reversed, as are those of spring and fall.

seasonal affective disorder (SAD) Cyclical DEPRESSION occurring in winter, apparently caused by insufficient sunlight. It is most common in places at high latitudes and therefore with long winters and very short daylight hours. Symptoms can include all those of major depression, and there is a risk of suicide. The cause may be related to regulation of the body's temperature and hormones and may involve the PINEAL GLAND and MELATONIN. Exposure to intense full-spectrum light from a set of fluorescent bulbs in a light box with a diffusing screen has proved effective as treatment. Dawn simulation (exposure to low light levels in the final sleep period) and negative-ion therapy can also help.

Seastrom, Victor See Victor SJÖSTRÖM

SEATO See SOUTHEAST ASIA TREATY ORGANIZATION

Seattle City (pop., 2000: 563,374) and seaport, Washington, U.S. It is the largest city in the state and the commercial, industrial, and financial centre of the Pacific Northwest. Situated between Elliott Bay (PUGET SOUND) and Lake Washington, it is flanked by the OLYMPIC MOUNTAINS and the CASCADE RANGE. Laid out in 1853, it withstood an Indian attack (1856), anti-Chinese riots (1880s), and a disastrous fire (1889) to emerge as the gateway to the Orient and Alaska. It was the main supply depot for the Yukon and Alaskan gold rushes (see GOLD RUSH) in the 1890s. World War II brought a great boom to the city, with shipyards and the aircraft industry playing important roles. Seattle Center, site of the 1962 World's Fair, contains the 607-ft (185-m) Space Needle. Seattle's educational institutions include the University of Washington (1861).

Seattle Slew (foaled 1974) U.S. Thoroughbred racehorse. He was the first unbeaten racer ever to win the TRIPLE CROWN (1977). In his racing career of 17 races, he won 14, was second twice, and fourth once. He was retired to stud in 1978.

seawater Water that makes up the oceans and seas. Seawater is a complex mixture of 96.5% water, 2.5% salts, and small amounts of other substances. Much of the world's magnesium is recovered from seawater, as are large quantities of bromine. In certain parts of the world, sodium chloride (table salt) is obtained by evaporating seawater. In addition, desalted seawater can theoretically furnish a limitless supply of drinking water, but the high processing costs are prohibitive. Large desalination plants have been built in dry areas along seacoasts in the Middle East and elsewhere to relieve shortages of fresh water.

seaweed Any of certain species of red, green, and brown marine ALGAE that generally are anchored to the sea bottom or to a solid structure by rootlike holdfasts that perform the sole function of attachment and do not extract nutrients as do the roots of higher plants. The most obvious seaweeds are brown algae; mosslike carpets of red algae are seen at low tides. Seaweeds are often dense in shallow water. Brown algae commonly found as seaweeds include KELP, which include the largest algae, and SARGASSUM. Some seaweeds have hollow, gas-filled floats that keep their fronds at the surface of the water. *Ulva* species, commonly called sea lettuce, are among the relatively few green algae that are seaweeds. Seaweeds are used as food, and brown algae are used in FERTILIZERS. The red alga *Gelidium* is used to make the gelatin-like product called agar.

sebaceous gland \si-'bā-shəs\ Small OIL-producing gland in the SKIN, usually connected to a HAIR follicle by a duct into which it releases sebum, a component of the slightly greasy film on the skin that helps keep it flexible and prevents too much water loss or absorption. The glands are distributed over the entire body except the palms and soles, most abundantly on the scalp and face. Large and well developed at birth, they shrink during childhood but enlarge again and increase their sebum output at puberty (apparently in response to male hormones), often leading to ACNE.

Sebastian, Saint (d. c. 288, Rome; feast day January 20) Christian martyr who died during the persecutions of DIOCLETIAN. According to legend, he was born in Gaul and went to Rome to serve in the army. When officials learned that he was a Christian seeking converts, they ordered his execution by archers. Left for dead, he was nursed back to health by a Christian widow. He presented himself before the emperor, who condemned him to death by beating. His body was thrown into a sewer but was afterward found and buried. In Renaissance art he was often depicted as a handsome youth pierced by arrows.

Sebastiano del Piombo \se-bäs-'tyä-nō-del-'pyȯm-bō\ *orig.* **Sebastiano Luciani** (b. c. 1485, Venice, Republic of Venice—d. July 21, 1547, Rome, Papal States) Italian painter. While in Venice, he was highly influenced by his teacher, GIORGIONE. In 1511 he moved to Rome and became a member of MICHELANGELO's circle of Renaissance artists. Michelangelo thought so highly of him that he provided sketches for him to execute. In Sebastiano's *Pietà* (1513), *Flagellation* (1516–24), and *Raising of Lazarus* (1516–18), all based on Michelangelo's sketches, he combined the warm colouring of the Venetian school with Michelangelo's anatomical clarity and firm sculptural drawing. After Raphael's death, Sebastiano's reputation as a portraitist was unparalleled. In 1531 Pope Clement VII, the subject of one of his finest portraits (1526), appointed him keeper of the papal seal; his nickname derives from the fact that the seal was of lead (Italian, *piombo*). The lucrative post gave him financial security, and his output declined.

Sebastopol See SEVASTOPOL

Sebek \'se-ˌbek\ In ancient EGYPTIAN RELIGION, a crocodile god. His chief sanctuary in Fayyūm province included a sacred crocodile, which was believed to be an incarnation of the god. Sebek may have been associated with fertility or death and burial before becoming a major deity and patron of kings in the Middle Kingdom (c. 1938–c. 1600? BC). He was merged with RE, the sun god, to constitute a crocodile form of that deity known as Sebek-Re. The worship of Sebek continued in Ptolemaic and Roman times.

Sebek, wearing horns, solar disk with uraeus, and plumes, bronze figurine, c. 600–300 BC; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Sebou \sə-'bü\ **River** River, northern Morocco. From its source as the Wadi Guigou, it flows north to FÈS and then east to the Atlantic Ocean at Mehdiya, a distance of 280 mi (450 km). Its basin is a major region for cultivating olives, rice, wheat, sugar beets, and grapes. Kenitra (pop., 1994: 292,627), 10 mi (16 km) from its mouth, is a busy port at the head of navigation for oceangoing vessels.

secession (1860–61) Withdrawal of 11 Southern states from the U.S. The precipitating event was the election of ABRAHAM LINCOLN as president (1860). Since the Republican Party strongly opposed slavery and its extension into the new territories, most slaveholding states had vowed to secede if the Republican candidate won. Secession had been proclaimed by states'-rights advocates as a corollary to the compact that united the states, permitting them to withdraw as easily as they had joined. Earlier threats of secession were made at the HARTFORD CONVENTION (1814), in the NULLIFICATION crisis (1832), and in the 1850s before the MISSOURI COMPROMISE. Secession was first approved by South Carolina (1860); six other states followed in the period before Lincoln was inaugurated in March 1861. After Lincoln resisted the South's attack on FORT SUMTER, four other slaveholding states voted to secede, joining the newly formed CONFEDERATE STATES OF AMERICA.

Second Empire (1852–70) Period in France under the rule of Emperor NAPOLEON III (the original empire having been that of NAPOLEON). In its early years (1852–59), the empire was authoritarian but enjoyed economic growth and pursued a favourable foreign policy. Liberal reforms were gradually introduced after 1859, but measures such as a low-tariff treaty with Britain alienated French businessmen, and political liberalization led

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to increased opposition to the government. In 1870 a new constitution establishing a quasi-parliamentary regime was widely approved, but France's defeat at the Battle of Sedan in the Franco-Prussian War was followed by an uprising in Paris on Sept. 4, 1870. This resulted in the overthrow of the government, the abdication of Napoleon III, and the end of the Second Empire.

Second Empire style See Beaux-Arts style

Second International *or* **Socialist International** (1889–1914) Federation of socialist political parties and trade unions that greatly influenced the European labour movement while supporting parliamentary democracy and opposing anarchism. Unlike the centralized First International, it was a loose federation that met in a number of cities at various intervals. By 1912 it represented the socialist parties of all European countries, the U.S., Canada, and Japan, with a membership of about nine million. It reaffirmed Marxist doctrine, but its main concern became the prevention of a general European war. When that failed, the International ended in 1914.

Second Republic (1848–52) French republic established after the Revolutions of 1848 (following the original republic during the French Revolution). The liberal republicans' hopes of establishing an enduring democratic regime were soon frustrated. In 1848 Louis-Napoléon (later Napoleon III) was elected president, and a monarchist majority was elected to the legislative assembly, which passed conservative measures restricting voting rights and freedom of the press and giving the church increased control over education. Soon realizing that his power and future reelection were limited by the assembly's actions, Louis-Napoléon organized a coup d'état in 1851. A new constitution reduced the assembly's power, and a plebiscite to approve the change was accompanied by officially inspired petitions for the empire's restoration. In 1852 Louis-Napoléon was proclaimed emperor, and the Second Empire was born.

secondary education Traditional second stage in formal education, typically beginning at ages 11–13 and ending usually at ages 15–18. The distinction between elementary education and secondary education has gradually become less marked, because of the proliferation of middle schools, junior high schools, and other divisions.

secret police Police established by national governments to maintain political and social control. Generally clandestine, secret police have operated independently of the civil police. Particularly notorious examples were the Nazi Gestapo, the Russian KGB, and the East German Stasi. Secret-police tactics include arrest, imprisonment, torture, and execution of political enemies and intimidation of potential opposition members.

secret society Any of various oath-bound societies devoted to brotherhood (or sisterhood), moral discipline, and mutual assistance. Such societies usually conduct rituals of initiation to instruct new members in the rules of the group (see rite of passage). Greek and Roman mystery religions had their secular counterparts in clandestine social clubs, some of which served as platforms for political dissent. In West Africa secret societies such as Poro (for men) and Sande (for women) serve to translate slight advantages of wealth and prestige into political authority. In parts of New Guinea secret men's societies serve as repositories of tribal knowledge. Fraternal orders such as the Freemasons (see Freemasonry) may be considered secret societies, as may criminal groups such as the Mafia and the Chinese Triads and hate groups such as the Ku Klux Klan.

Secretariat (foaled 1970) U.S. Thoroughbred racehorse. In 1973 he became the first Triple Crown winner since Citation in 1948. At the Belmont Stakes he won by an unprecedented 31 lengths. In his two-year career he came in first 16 times, second 3 times, and third once. He is often regarded as the greatest Thoroughbred in history.

secretary bird African raptor (*Sagittarius serpentarius*, family Sagittaridae), the only living bird of prey that hunts on foot. It has long scaly legs, a light-gray body that is 4 ft (1.2 m) long, and a 7-ft (2.1-m) wingspread. It weighs about 8 lbs (3.5 kg). Twenty black crest feathers make it appear to be carrying quill pens behind its ears. Secretary birds kill snakes (their main prey) by stamping on them, flailing them against the ground, or dropping them from aloft. They make their large stick-built nests in thorn trees. Both parents feed the offspring by regurgitation. Secretary birds are protected in most African nations. See photograph opposite.

Secular Games *Latin* **Ludi saeculares** Celebrations held in ancient Rome at the beginning of a new *saeculum*, or generation. Similar games were originally held by the Etruscans as offerings to the underworld gods. The Romans initially worshiped the underworld gods but later introduced Apollo, Diana, and Leto in a festival that lasted three days and nights. More days were added later. The first known Roman games were held in 249 BC, the second in 146, and the third in 17 under Caesar Augustus. Later games, held in AD 47, 88, 147, 204, 248, and 262, included sports, music, theatre, and circuses. The games ceased in the 4th century AD under Constantine I, who converted to Christianity.

Securities and Exchange Commission (SEC) U.S. regulatory commission established by Congress in 1934. Its purpose was to restore investor confidence by ending the misleading sales practices and stock manipulations that had led to the stock market's 1929 collapse (see Stock Market Crash of 1929). It also prohibited the purchase of stock shares without adequate funds to pay for them, initiated registration and supervision of securities markets and stockbrokers, established rules regarding proxies, and prohibited unfair use of nonpublic information in stock trading (see insider trading). It also required that companies offering securities make full public disclosure of all relevant information. The discovery of fraudulent accounting practices among several large U.S. corporations brought demands for greater SEC oversight in the early 21st century.

security In finance, written evidence of ownership conferring the right to receive property not currently in the holder's possession. The most common securities are stocks and bonds. Governments, companies, and financial institutions use securities to raise money. Stocks are securities issued in the form of equity ownership. Bonds are securities that take the form of debt. They constitute promises to pay a specified amount at a specified date and to pay interest at a specified rate in the interim. Most government securities are bonds that pay a fixed amount of interest per year; unlike commercial securities, their repayment is guaranteed. Both stocks and bonds are traded publicly on organized exchanges such as the New York Stock Exchange, the London Stock Exchange, and the Tokyo Stock Exchange. External forces such as international troubles, changes in government policies, and trends in foreign stock markets all have an effect on security prices. For individual stocks, the company's current and prospective financial performance play an important role, as do overall trends within its business sector. See also investment; saving.

Security Council, United Nations See United Nations Security Council

Sedan \sə-'dä^{n},\ *English* \sə-'dan**, Battle of** (Sept. 1, 1870) Defeat of the French army in the Franco-Prussian War that led to the fall of the Second Empire. At the French border fortress of Sedan on the Meuse River, 120,000 French troops under Maurice, count de Mac-Mahon, were attacked by more than 200,000 German troops under Helmuth von Moltke. After Mac-Mahon was wounded, the confused French command tried unsuccessfully to break through the encircling German lines with massive cavalry charges. Emperor Napoleon III, who had accompanied Mac-Mahon, realized the French position was hopeless and surrendered with 83,000 troops.

Seder \'sā-dər\ Ritual meal served on the first night of Passover, commemorating the flight of the Jews from Egypt. Presided over by the head

Secretary bird (*Sagittarius serpentarius*).
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of the family, the Seder follows a liturgy, the HAGGADAH, that reminds participants of the story of the EXODUS. The ritual includes blessings, the pouring of wine, and ritual questions about the meaning of the event ("Why does this night differ from all other nights?") asked by the youngest child present. The meal includes unleavened bread and bitter herbs, the bread symbolizing the haste with which the Israelites left Egypt and the herbs symbolizing the bitterness of slavery. A cup of wine is poured for ELIJAH, the precursor of the MESSIAH.

sedge family Family Cyperaceae, one of the 10 largest families of flowering plants, composed of about 5,000 species of grasslike herbs that inhabit wet regions worldwide. Sedges are monocots (see COTYLEDON) of extraordinary ecological importance; forming the base of food webs, they provide food and shelter for aquatic and wetland animals. They are also important as ornamentals and weeds, and are used in woven products such as mats, baskets, screens, and sandals. Key identifying characteristics that distinguish sedges from GRASSES are solid stems that are often triangular in cross section; leaves, when present, that clasp the stem with a sheath; and small spikes of minute flowers that are not enclosed in bracts. They range in height from about 1 in. to 13 ft (2 cm–4 m). The genus *Carex* represents the true sedges. PAPYRUS and BULRUSHES are also included in this family.

Sedgwick, Adam (b. March 22, 1785, Dent, Yorkshire, Eng.—d. Jan. 27, 1873, Cambridge, Cambridgeshire) English geologist. A pioneer in the establishment of geology as a university discipline (Trinity College, Oxford), he named the CAMBRIAN PERIOD and (with Roderick Murchison) the DEVONIAN PERIOD. His grandnephew, the zoologist Adam Sedgwick (1854–1913), first established the evolutionary link between the annelids and the arthropods.

sedimentary facies \'fā-shēz\ Different, but contemporaneous and juxtaposed, SEDIMENTARY ROCKS. Terrigenous facies are accumulations of particles eroded from older rocks and transported to the depositional site. Biogenic facies are accumulations of whole or fragmented shells and other hard parts of animals. Chemical facies result from precipitation of inorganic material from solution. The shapes and characteristics of facies may change as conditions change over time.

sedimentary rock Rock formed at or near the Earth's surface by the accumulation and LITHIFICATION of fragments of preexisting rocks or by precipitation from solution at normal surface temperatures. Sedimentary rocks can be formed only where sediments are deposited long enough to become compacted and cemented into hard beds or strata. They are the most common rocks exposed on the Earth's surface but are only a minor constituent of the entire crust. Their defining characteristic is that they are formed in layers. Each layer has features that reflect the conditions during deposition, the nature of the source material (and, often, the organisms present), and the means of transport. See also SEDIMENTARY FACIES.

sedimentation In geology, the process of deposition of a solid material from a state of suspension or solution in a fluid (usually air or water). Broadly defined it also includes deposits from glacial ice and materials collected under the effect of gravity alone, as in talus deposits, or accumulations of rock debris at the base of cliffs.

sedimentology Scientific discipline concerned with the physical and chemical properties of SEDIMENTARY ROCKS and the processes involved in their formation, including transportation, deposition, and LITHIFICATION of sediments. The aim of much sedimentological research is to interpret ancient environmental conditions by studying the constituents, textures, structures, and fossil content of the deposits.

sedition Crime of creating a revolt, disturbance, or violence against lawful civil authority with the intent to cause its overthrow or destruction. Because it is limited to organizing and encouraging opposition to government rather than directly participating in its overthrow, sedition is regarded as falling one step short of the more serious crime of TREASON. In the U.S. the display of a certain flag or the advocacy of a particular movement, such as SYNDICALISM, ANARCHISM, or COMMUNISM, has periodically been declared seditious. More recently, the courts have applied a more stringent test of sedition to ensure that constitutional guarantees regarding FREEDOM OF SPEECH are not abridged. See also ALIEN AND SEDITION ACTS.

sedum \'sē-dəm\ Any of about 600 species of succulent plants that make up the genus *Sedum*, in the stonecrop, or orpine, family (Crassulaceae), native to temperate zones and to mountains in the tropics. Some species are grown in greenhouses for their unusual foliage and sometimes showy flowers of white, yellow, pink, or red. Low-growing varieties are popular in rock gardens and rock walls, and as edging in garden borders. Some species form mosslike mats on rocks and walls.

Seeckt \'zākt**, Hans von** (b. April 22, 1866, Schleswig, Prussia—d. Dec. 27, 1936, Berlin, Ger.) German general. A career army officer, in World War I he was chief of staff of the 11th Army and then chief of staff of the Turkish army. After the war he became head of the German Reichswehr (1919–26) and secretly built a small but efficient army, circumventing the Treaty of VERSAILLES prohibition. He supported cooperation with Russia and encouraged the Treaty of RAPALLO. He later served as an adviser to the Chinese Nationalist Army (1934–35).

seed Reproductive structure in plants that consists of a plant embryo, usually accompanied by a supply of food (endosperm, which is produced during fertilization) and enclosed in a protective coat. Seed embryos contain one or more COTYLEDONS. In typical FLOWERING PLANTS, seed production follows POLLINATION and fertilization. As seeds mature, the ovary that enclosed the ovules develops into a fruit containing the seeds. Most seeds are small, weighing less than a gram; the smallest contain no food reserve. At the opposite extreme, the seed of the double coconut palm may weigh up to about 60 lb (27 kg). Seeds are highly adapted to transportation by animals, wind, and water. When circumstances are favorable, water and oxygen penetrate the seed coat, and the new plant begins to grow (see GERMINATION). The longevity of seeds varies widely: some remain viable for only about a week; others have been known to germinate after hundreds or even thousands of years.

seed plant *or* **spermatophyte** \spər-'ma-tə-ˌfīt\ Any of the FLOWERING PLANTS (angiosperms) and the CONIFERS and related plants (GYMNOSPERMS). Seed plants share many features with FERNS, including the presence of vascular tissue (see XYLEM and PHLOEM), but unlike ferns, they have stems that branch sideways and vascular tissue that is arranged in strands (bundles) around the core. Seed plants have generally more complex plant bodies and reproduce via SEEDS. As the main dispersal unit of seed plants, the seed represents a significant improvement over the SPORE, with its limited capacity for survival. Seed plants also differ from ferns in having GAMETOPHYTES that are reduced in size and are embedded in the SPOROPHYTES (and thus are less vulnerable to environmental stress). Another land-based adaptation of seed plants is POLLEN dispersed by wind or animals. The dispersal of pollen, in addition to dispersal of seeds, promotes genetic RECOMBINATION and distribution of the species over a wide geographic area.

Seeger, Pete(r) (b. May 3, 1919, New York, N.Y., U.S.) U.S. folk singer and songwriter. He was the son of the pioneering ethnomusicologist Charles Seeger (1886–1979) and stepson of the composer RUTH CRAWFORD SEEGER. Leaving Harvard after two years in 1938, he hitchhiked and rode freight trains around the country, gathering folk songs and developing a virtuosity on the banjo. In 1940 he organized the Almanac Singers with WOODY GUTHRIE and performed widely at union halls and farm meetings. In 1948, with Lee Hays (1926–95), Ronnie Gilbert (b. 1927?), and Fred Hellerman (b. 1927), he formed the Weavers. Shortly after the group became successful, it was blacklisted because of Seeger's previous activities in left-wing and labour politics. He fostered the growth of the hootenanny (a gathering of performers playing and singing for each other, with audience participation), and he wrote folk standards such as "Where Have All the Flowers Gone" and "If I Had a Hammer." He is also known as a prominent supporter of antiwar, civil rights, and environmental causes.

Pete Seeger, 1971.
DAVID GAHR

Seeger, Ruth Crawford See RUTH CRAWFORD SEEGER

Seeing Eye dog See GUIDE DOG

Sefarim, Mendele Moykher See MENDELE MOYKHER SFORIM

Sefer ha-bahir \'se-fer-ˌhä-bä-'hir\ *Hebrew* **"Book of Brightness"** Hebrew commentary on the OLD TESTAMENT that had a major influ-

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ence on the development of the KABBALA. It also influenced the symbology of JUDAISM in general by calling attention to the mystical significance of the shapes and sounds of the HEBREW ALPHABET. The *Bahir* first appeared in France in the 12th century, though Kabbalists consider it much older. It introduced the concept of the transmigration of souls and the notion of a cosmic or spiritual tree that symbolizes the flow of divine creative power. Though Kabbalists view it as authoritative, mainstream Judaism rejects it as heretical.

Sefer ha-zohar \'se-fer-hä-'zō-ˌhär\ *Hebrew* **"Book of Splendour"** Classical text central to KABBALA that has influenced all mystical movements within JUDAISM. Many Kabbalists invest it with a sanctity normally accorded only to the TORAH and the TALMUD. Written mostly in Aramaic, it is believed to be mainly the work of MOSES de León. The main part of the *Zohar* provides a mystical and symbolic interpretation of biblical texts, especially the Torah, the book of Ruth, and the Song of SOLOMON. Other sections deal with the mystery of creation, the problem of evil, and the cosmic significance of prayer and good deeds.

Sefer Torah \'se-fer-tō-'rä\ *Hebrew* **"Book of the Law"** In JUDAISM, the Pentateuch (see TORAH), when written in Hebrew by a qualified calligrapher on vellum or parchment and enshrined in the Ark of the Law in a synagogue. It is used for public readings during services on the Sabbath, Mondays, Thursdays, and religious festivals. Sephardic Jews often enclose it in a wooden or metal case; Ashkenazi Jews cover it with an ornate mantle of cloth decorated with ritual ornaments. Its scrolls are handled according to prescribed ritual that reflects the esteem in which the scrolls are held.

Seferis \se-'fer-ēs**, George** *orig.* **Giōrgios Stylianou Seferiadēs** *or* **Yeoryios Stilianou Sepheriades** (b. March 13, 1900, Smyrna, Anatolia, Ottoman Empire—d. Sept. 20, 1971, Athens, Greece) Greek poet, essayist, and diplomat. He studied law in Paris and held various diplomatic posts from 1926 to 1962. His poetry appeared in a number of collections beginning with *I strofí* (1931; "The Turning Point"). He is considered the leading Greek poet of "the generation of the '30s," which introduced SYMBOLISM to modern Greek literature. He was awarded the Nobel Prize for Literature in 1963.

Segal \'sē-gəl**, George** (b. Nov. 26, 1924, New York, N.Y., U.S.—d. June 9, 2000, South Brunswick, N.J.) U.S. sculptor. Segal began his artistic career as an abstract painter. In 1958 he started creating sculptures from chicken wire and plaster and two years later turned to plaster casts, often using family members and friends as models. Though he was associated with members of the burgeoning POP ART movement in the late 1950s, Segal's sculptures, which were frequently outfitted with the bland commercial props of the Pop idiom, are distinguished from that characteristically ironic movement by a mute, ghostly anguish. His casting technique, in which the live model is wrapped in strips of plaster-soaked cheesecloth, imparts a rough texture and a minimum of surface detail to the figures, thus heightening the sense of anonymity and isolation.

Segesta \sē-'jes-tə\ Ancient city, northwestern Sicily. Located near modern Calatafimi, it was the chief city of the Elymi, a people of supposedly Trojan origin (see TROY). Culturally, the city was Greek, but it generally took the Carthaginian side against its Greek neighbours, and boundary disputes with SELINUS were frequent. Early in the First PUNIC WAR, Segesta was allied with Rome. Its ruins include a well-preserved 3rd-century-BC theatre and a 5th-century-BC temple to Artemis.

segoni-kun \se-'gō-nē-'kůn\ Highly sculptural mask of the Tyiwara society of the western African BAMBARA tribe. Derived from the antelope's form and emphasizing its head, neck, and horns, the masks were worn at cultivation ceremonies by dancers imitating the antelope's graceful movements. It was believed that the spirit of the *tyi-wara* (work animal), which held great power over agricultural fertility, was embodied in the masks.

Segovia, Andrés (b. Feb. 21, 1893, Linares, Spain—d. June 2, 1987, Madrid) Spanish guitarist. Almost entirely self-taught, he made his debut in Grenada in 1909 and by the 1920s was touring internationally; he continued to perform into his 90s. He was by far the most important force in making the guitar a concert instrument. He commissioned works by MANUEL DE FALLA, ALBERT ROUSSEL, and HEITOR VILLA-LOBOS, and he arranged music ranging from the Renaissance to the 19th century for solo guitar. See photograph opposite.

Segrè \sə-'grā**, Emilio (Gino)** (b. Feb. 1, 1905, Tivoli, Italy—d. April 22, 1989, Lafayette, Calif., U.S.) Italian-born U.S. physicist. He worked under ENRICO FERMI before becoming director of the physics laboratory at the University of Palermo in 1936. In 1937 he discovered TECHNETIUM, the first man-made element not found in nature. While visiting California in 1938, he was dismissed from the university by the fascist government. He continued his research at the University of California at Berkeley, where he and his associates discovered the element astatine and the isotope plutonium-239, which he found to be fissionable. In 1955, using the new Bevatron particle accelerator, Segrè and Owen Chamberlain (b. 1920) produced and identified antiprotons, antiparticles having the same mass as protons but opposite electrical charge, setting the stage for the discovery of many additional antiparticles. The two men shared a 1959 Nobel Prize.

segregation, racial Practice of restricting people to certain circumscribed areas of residence or to separate institutions and facilities on the basis of race or alleged race. Racial segregation provides a means of maintaining the economic advantages and higher social status of politically dominant races. Historically, various conquerors—among them Asian Mongols, African Bantu, and American Aztecs—have practiced discrimination involving the segregation of subject races. Racial segregation has appeared in all multiracial communities, except where racial amalgamation has occurred on a large scale, as in Hawaii and Brazil. In such places there has been occasional social discrimination but not legal segregation. In the Southern states of the U.S., public facilities were segregated from the late 19th century into the 1950s (see JIM CROW LAW), and in South Africa a system of APARTHEID sanctioned discrimination against nonwhites until it was abolished in the 1990s. The U.S. CIVIL RIGHTS MOVEMENT and CIVIL RIGHTS ACT OF 1964 helped end racial segregation in education and public facilities, though other forms of racial discrimination continued.

sei whale \'sā\ *or* **Rudolphi's rorqual** \'rȯr-kwəl\ Swift species (*Balaenoptera borealis*) of BALEEN WHALE in the RORQUAL family. It is 40–50 ft (13–15 m) long and is bluish gray or blackish above and paler below. It has small flippers, about 50 short lengthwise grooves on its chest, and dark baleen with pale, silky, inner fringes. It inhabits oceans from the Arctic to the Antarctic, migrating between cold and temperate summer waters and winter breeding grounds in warmer regions.

Seifert \'sā-fert**, Jaroslav** (b. Sept. 23, 1901, Prague, Bohemia, Austria-Hungary—d. Jan. 10, 1986, Prague, Czech.) Czech poet. He made a living as a journalist until 1950. Though his early works reflect youthful expectations for the future of communism in the Soviet Union, he broke with the Communist Party in 1929. More lyrical elements were evident in his later poems, and the history and current events of Czechoslovakia were the most common subjects in his approximately 30 volumes. In the 1980s and '90s many of his works were translated, including *Honeymoon Ride* (1938), *Bozena Nemcova's Fan* (1940), and *Halley's Comet* (1967). He also contributed to journals and wrote children's literature and memoirs. In 1984 he became the first Czech to win the Nobel Prize for Literature.

seigniorage \'sān-yə-rij\ Charge over and above the expenses of COINAGE that is deducted from the bullion brought to a MINT to be coined. From early times, coinage was the prerogative of kings, who prescribed the amount they were to receive as seigniorage. This was sometimes compensated for by replacing part of the gold or silver with base metal, resulting in debased coinage. In England all such charges were abolished in 1666. Because coins are now issued only as token MONEY, they no longer need to possess a high intrinsic value, and low-standard silver or base-metal ALLOYS are sufficient. The margin between the cost of producing a coin and its CURRENCY value is known as seigniorage.

Andrés Segovia.
AP/WIDE WORLD PHOTOS

seignorialism See MANORIALISM

Seine \'sen\ **River** *ancient* **Sequana** Second longest river in France. It rises on the Langres plateau, 18 mi (30 km) northwest of DIJON, and flows through PARIS before emptying into the ENGLISH CHANNEL at LE HAVRE after a course of 485 mi (780

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km). Its tributaries include the Marne and Oise rivers. It drains an area of about 30,400 sq mi (78,700 sq km) in northern France; its network carries most of France's inland waterway traffic.

Seinfeld, Jerry (b. April 29, 1954, Brooklyn, N.Y., U.S.) U.S. comedian and television actor. He initially worked as a stand-up comic in nightclubs and on television. He cocreated and starred in the hit television series *Seinfeld* (1990–98), which was inspired by his stand-up routines about life in New York City. One of the most successful situation comedies, it featured a collection of selfish and neurotic characters obsessed with the fear of commitment and the minutiae of everyday life. He also starred in and was executive producer of *Comedian* (2002), a documentary about his return to the comedy circuit.

seismic sea wave See tsunami

seismic \'sīz-mik\ **wave** Vibration generated by an earthquake, explosion, or similar phenomenon and propagated within the Earth or along its surface. Earthquakes generate two principal types of waves: body waves, which travel within the Earth, and surface waves, which travel along the surface. Seismograms (recorded traces of the amplitude and frequency of seismic waves) yield information about the Earth and its subsurface structure; artificially generated seismic waves are used in oil and gas prospecting.

seismology \sīz-'mä-lə-jē\ Scientific discipline concerned with the study of earthquakes and of the propagation of seismic waves. A branch of geophysics, it has provided much information about the composition and state of the planet's interior. Recent work has focused on predicting earthquakes in hopes of minimizing the risk to humans. Seismologists have also studied quakes induced by human activities—such as impounding water behind high dams, injecting fluids into deep wells, and detonating underground nuclear explosions—in an effort to find ways of controlling natural earthquakes.

Seistan See Sīstān

Seiyukai See Rikken Seiyukai

Sejanus \si-'jā-nəs**, Lucius Aelius** (d. ad 31) Administrator of the Roman empire for Tiberius. In ad 14 he became prefect of the Praetorian Guard and gained the emperor's confidence. After the suspicious death of Tiberius's son Drusus in 23, Sejanus sought to discredit Agrippina the Elder, mother of Tiberius's probable heirs. Forbidden to marry Drusus's widow, Sejanus moved the emperor to Capri (27) and had Agrippina and her son Nero exiled (29). The emperor suspected Sejanus of plotting a coup and had him executed, to widespread relief.

Sejong \'se-'jȯŋ\ (b. 1397—d. 1450) Monarch of the Chosŏn dynasty in Korea during whose reign (1419–50) Korean cultural achievements reached a high point. Sejong oversaw the creation of hangul, the Korean alphabet (see Korean language), and banned Buddhist monks from Seoul, thereby reducing the power and wealth of the Buddhist hierarchy.

Seki Takakazu *also called* **Seki Kōwa** (b. c. 1640, Fujioka, Japan—d. Oct. 24, 1708, Edo) The most important figure of the *wasan* ("Japanese calculation") tradition that flourished from the early 17th century until the opening of Japan to the West in the mid-19th century. He was adopted at an early age by Seki Gorōzaemon, a samurai official with the Bureau of Supply in Edo, to carry on the Seki family name. He assumed various positions as an examiner of accounts for the lord of Kōfu, Tokugawa Tsunashige (until 1678), and then his son, the future shogun Tokugawa Ienobu (see Tokugawa period). Seki's most productive research was in algebra, a field in which he created powerful new tools and provided many definitive solutions. He was instrumental in recovering mathematical knowledge from ancient Chinese sources. He substituted a tabular notational system for the cumbersome Chinese method of counting rods, thereby simplifying the handling of equations with more than one unknown.

Seku, Ahmadu See Ahmadu Seku

Selassie, Haile See Haile Selassie

Seldes \'sel-dəs**, George** (b. Nov. 16, 1890, Alliance, N.J., U.S.—d. July 2, 1995, Hartland Four Corners, Vt.) U.S. journalist. He became a reporter in 1909. From 1918 to 1928 he worked for the *Chicago Tribune*, then quit to pursue independent journalism. In *You Can't Print That* (1928) he criticized censorship and strictures on journalists, a continuing theme in his career. He reported on the rise of fascism in Italy and Spain in the 1930s, and he and his wife published *In Fact*, a journal devoted to press criticism, in the years 1940–50. His other targets included the tobacco industry and J. Edgar Hoover. He published his memoirs, *Witness to a Century*, in 1987. His brother, the critic Gilbert Seldes (1893–1970), was managing editor of *The Dial* during the 1920s. George Seldes's best-known book was *The Seven Lively Arts* (1924). He was a columnist for the *New York Evening Journal* and the *Saturday Evening Post*, film critic for *The New Republic*, first director of television for *CBS News*, and first dean of the University of Pennsylvania's Annenberg School for Communication.

selection In biology, the preferential survival and reproduction or preferential elimination of individuals with certain genotypes, by means of natural or artificial controlling factors. The theory of evolution by natural selection was proposed by Charles Darwin and Alfred Russel Wallace in 1858. Artificial selection differs from natural selection in that inherited variations in a species are manipulated by humans through controlled breeding in order to create qualities economically or aesthetically desirable to humans, rather than useful to the organism in its natural environment.

Selene \sə-'lē-nē\ *Latin* **Luna** In Greek and Roman religion, the goddess that personified the Moon. Her parents were the Titans Hyperion and Theia; her siblings were Helios and Eos, the goddess of dawn. Selene fell in love with Endymion, a handsome young shepherd; Zeus cast Endymion into eternal sleep, but Selene visited him in the cave where he slept, and he fathered her 50 daughters (one for each lunar month between Olympiads) and, according to some accounts, Narcissus. In art Selene is often represented as a woman with the crescent moon on her head. As Luna she had temples in Rome on the Aventine and Palatine hills.

Selenga \ˌsi-liŋ-'gä\ **River** River, Mongolia and east-central Russia. It is formed by the confluence of the Ider and Delger rivers and receives the Orhon River at Sühbaatar. It continues north into Russia, eventually flowing into Lake Baikal after a course of 920 mi (1,480 km). It is navigable from its mouth to beyond Sühbaatar from May to October, when it is free of ice.

selenium \sə-'lē-nē-əm\ Semimetallic chemical element, chemical symbol Se, atomic number 34. It is widely distributed, usually in small amounts, occasionally uncombined but more often as selenides of iron, lead, silver, or copper. Selenium has several allotropes; the gray metallic crystalline form is the most stable at room temperature. Its electrical conductivity increases when light strikes it, and it can convert light directly into electricity, so selenium is used in photocells (e.g., in light meters and security alarms), solar cells, and photocopiers. It also has been used in rectifiers to convert alternating to direct electric current. It serves as a red colorant for glass and glazes. Selenium has valence 2, 4, and 6 in its compounds, many of which are toxic though the element is not. Selenium dioxide is an important reagent in organic chemistry. Vital to living cells, it works as an antioxidant in the body and is being studied for a variety of possible beneficial health effects; it is used in nutritional supplements and animal feeds.

Seles \'se-ləs**, Monica** (b. Dec. 2, 1973, Novi Sad, Yugos.) Yugoslav-U.S. tennis player. She went to the U.S. to train in 1985. She developed quickly and became one of the dominant women stars of the 1990s, achieving multiple wins in all grand-slam tournaments (French Open, 1990–92; Australian Open, 1991–93, 1996; U.S. Open, 1991–92) except Wimbledon, which she lost in 1991 and 1992 to her rival Steffi Graf. In 1993 she stopped competing temporarily after being stabbed by a Graf fan on a court in Hamburg, Ger.

Seleucia \sə-'lü-shə\ **on the Tigris** Ancient city, on the Tigris River, central Iraq. Founded by Seleucus I Nicator in the late 4th century bc as his eastern capital, it replaced Babylon as Mesopotamia's leading city. The population, which Pliny the Elder estimated at 600,000, was composed largely of Macedonians and Greeks and also included Jews and Syrians. During the Parthian domination of the Tigris-Euphrates valley that began in the 2nd century bc, it maintained its position and trade despite its Greek sympathies. In ad 165 the Romans burned the city, marking the end of Hellenism in Mesopotamia. See also Seleucid dynasty.

Seleucid dynasty \sə-'lü-səd\ Macedonian Greek dynasty (312–64 bc) founded by Seleucus I Nicator. Carved from the empire of Alexander the Great, the Seleucid domain stretched from Thrace to the border of India and included Babylonia, Syria, and Anatolia. Seleucus was succeeded in 281 by Antiochus I Soter, who reigned until 261. He was followed by Antiochus II (r. 261–246), Seleucus II Callinicus (r. 246–225), Seleucus III (r. 225–223), and Antiochus III (the Great; r. 223–187). Under

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the last, the empire was at its height. Resistance to the power and spread of Hellenistic culture soon began to manifest itself in the Asian lands. Antiochus III's encounter with the Romans signaled decline, especially after the defeat of 190. The decline accelerated after the death of Antiochus IV (r. 175–164), who lost JUDAEA to the MACCABEES. The efforts of Demetrius I and Antiochus VII could not forestall the dynasty's inevitable end at the hands of the Roman POMPEY THE GREAT in 64 BC.

Seleucus I Nicator \sə-'lü-kəs...ni-'kā-tər\ (b. c. 358, Europus, Macedonia—d. August/September 281 BC, near Lysimachia, Thrace) Macedonian army officer, founder of the SELEUCID DYNASTY. After the death of ALEXANDER THE GREAT, under whom he had served, Seleucus won an empire centred on Syria and Iran. Having been ousted by ANTIGONUS I MONOPHTHALMUS and serving PTOLEMY, Seleucus reconquered Babylon in 312. He declared himself king in 305. By 303 he had extended his empire to India. In 301 he helped defeat Antigonus at the Battle of IPSUS and received Syria, later taking southern Syria from Ptolemy. A marriage alliance with DEMETRIUS I POLIORCETES's daughter soured, and in 294, when his son became sick with love for Seleucus's wife (the son's stepmother), he gave her to him and made the son coregent. Hoping to reestablish Alexander's empire, Seleucus captured Demetrius (285) and defeated Lysimachus (281), another of Alexander's former generals who had become a satrap in Asia Minor. Later while attempting to enter Macedonia, he was murdered.

Seleucus II Callinicus \ˌka-lə-'nī-kəs\ *Latin* **"Gloriously Victorious"** (b. c. 265—d. 225 BC) Fourth king (r. 246–225) of the SELEUCID DYNASTY. He became ruler when his mother poisoned his father, Antiochus II, and proclaimed him king. Her supporters made away with his Egyptian stepmother, Bernice, daughter of PTOLEMY II, whom Antiochus had briefly married. Ptolemy III, Bernice's brother, responded by invading Seleucus's kingdom and taking the eastern provinces. Seleucus managed to regain northern Syria and part of Iran but was defeated by his brother (c. 235), now supported by their mother, and ceded territory beyond the Taurus River. He died in a fall from his horse.

self-defense In CRIMINAL LAW, an affirmative defense (e.g., to a murder charge) alleging that the defendant used serious force necessarily for self-protection. The claim of self-defense must normally rely on a reasonable belief that the other party intended to inflict great bodily harm or death and that avoidance by retreating was impossible. See also HOMICIDE.

Self-Defense Force Japan's military after World War II. In Article 9 of Japan's postwar constitution, the Japanese renounced war and pledged never to maintain land, sea, or air forces. The rearming of Japan in the 1950s was therefore cast in terms of self-defense. In 1950 a small military force called the National Police Reserve was created; this became the National Safety Force in 1952 and the Self-Defense Force in 1954. Ostensibly it was never to be used outside Japan or its waters; consequently, Self-Defense Force participation in UN peacekeeping missions or relief work has sparked vigorous debate in Japan and abroad, especially among nations that were victims of Japanese aggression in World War II.

self-determination Process by which a group of people, usually possessing a degree of political consciousness, form their own state and government. The idea evolved as a byproduct of NATIONALISM. According to the UN charter, a people has the right to form itself into a state or to otherwise determine the form of its association with another state, and every state has the right to choose its own political, economic, social, and cultural systems. Moreover, the administering authorities of dependent territories are enjoined to ensure political advancement and the development of self-government in those territories.

self-esteem Sense of personal worth and ability that is fundamental to an individual's identity. Family relationships during childhood are believed to play a crucial role in its development. Parents may foster self-esteem by expressing affection and support for the child as well as by helping the child set realistic goals for achievement instead of imposing unreachably high standards. KAREN HORNEY asserted that low self-esteem leads to the development of a personality that excessively craves approval and affection and exhibits an extreme desire for personal achievement. According to ALFRED ADLER's theory of personality, low self-esteem leads people to strive to overcome their perceived inferiorities and to develop strengths or talents in compensation.

self-fertilization Fusion of male and female sex cells (gametes) produced by the same individual. This type of FERTILIZATION occurs in bisexual organisms, including most flowering plants, numerous protozoans, and many invertebrates. Many organisms capable of self-fertilization can also reproduce by means of CROSS-FERTILIZATION. As an evolutionary mechanism, self-fertilization allows an isolated individual to create a local population and stabilizes desirable genetic strains, but it fails to provide a significant degree of variability within a population and thereby limits the possibilities for adaptation to environmental change.

self-heal Perennial weed (*Prunella vulgaris*) in the MINT family, native to North America and widespread throughout the continent. Growing 6–14 in. (14–36 cm) tall, self-heal is often a low weed in lawns. The often-prostrate branches root readily wherever they touch soil. Tiny, two-lipped, lilac-coloured or white flowers are clustered into noticeable dense, spikes. Leaves have sparsely toothed or smooth margins. Regarded in medieval times as a cure-all, the dried leaves and flowers are still brewed for soothing sore throats.

self-incrimination In CRIMINAL LAW, the giving of evidence that might tend to expose the witness to punishment for a crime. The term is generally used in relation to the privilege of refusing to give such evidence. In some continental European countries (e.g., Germany), a person fearing self-incrimination may make his own decision as to whether or not he will testify. In Anglo-American practice, a person other than an accused cannot refuse to testify; he may only cite his privilege against self-incrimination, and the judge then decides whether he must testify. If required to testify, he must answer all questions except those he considers to be self-incriminating. The Fifth Amendment to the U.S. Constitution contains a provision that protects a person from being compelled to make self-incriminating statements, one intention being to prevent coercion of testimony. See also rights of the ACCUSED; EXCLUSIONARY RULE.

Selim \se-'lēm\ **III** (b. Dec. 24, 1761, Constantinople, Ottoman Empire—d. July 29, 1808, Constantinople) Ottoman sultan (r. 1789–1807). He inherited the throne during a losing war with Austria and Russia (1787–92), with whom he later signed treaties. NAPOLEON I's invasion of Egypt in 1798 drove him into an alliance with Britain and Russia, but, impressed with Napoleon's successes, he switched sides in 1806. At home he attempted tax and land reform and established a European-style military corps, but, unable to enforce his reforms in the face of mutinies among the JANISSARIES and other units, he rescinded them. He was promptly overthrown and was strangled on the orders of his successor, Mustafa IV.

Selim III, detail of a portrait by H. Berteaux, early 19th century; in the Topkapı Palace Museum, Istanbul
SONIA HALLIDAY

Selinus \si-'lī-nəs\ Ancient Greek city, southern coast of Sicily. Founded by Greek colonists in the 7th century BC, Selinus achieved great prosperity in the 5th century BC, the time when its Doric temples were being built. In 409 BC it was destroyed by a Carthaginian army aiding the inhabitants of the rival city of SEGESTA. It never truly recovered, and in 250 BC the Carthaginians finally demolished it. Its extensive ruins include the remains of eight temples.

Seljūq \'sel-jük\ **dynasty** *or* **Saljūq** \'sal-jük\ **dynasty** (c. 11th–13th centuries) Muslim TURKMEN dynasty that ruled Persia, Iraq, Syria, and Anatolia. Seljūq was the chief of a nomadic Turkish tribe. His grandsons Chaghri Beg and TOGHRĪL BEG conquered realms in Iran. Under ALP-ARSLAN and Malik-Shah, the empire came to include all of Iran, Mesopotamia, Syria, and Palestine; Alp-Arslan's victory over the BYZANTINE EMPIRE at the Battle of MANZIKERT led to several CRUSADES. Adherents of Sunnite Islam, the Seljūqs adopted Persian culture, and under them the Persian language partly displaced Arabic as a literary language in Iran. By 1200 Seljūq power remained only in their sultanate of Rūm in Anatolia, which collapsed in a war against the KHWĀREZM-SHAH DYNASTY in 1230 and was overrun by MONGOLS in 1243. See also NIẒĀM AL-MULK.

Selkirk \'sel-ˌkərk\ **Mountains** Mountain range, southeastern British Columbia, Canada, and northern Idaho and Montana, U.S. The Selkirks extend some 200 mi (320 km) and in many places rise abruptly more than

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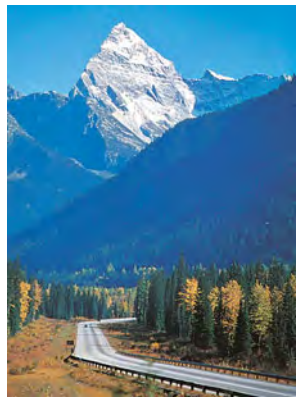
8,000 ft (2,400 m). The highest summit is Mount Sir Sanford at 11,555 ft (3,522 m). Crossed by the Canadian Pacific Railway, the range contains parts of Glacier and Mount Revelstoke national parks.



Mount Sir Donald in the Selkirk Mountains, British Columbia, Can.
BOB AND IRA SPRING/EB INC.

Sellars, Peter (b. Sept. 27, 1957, Pittsburgh, Pa., U.S.) U.S. stage director. He attended Harvard University, where he began developing his innovative and often controversial style of directing. He is best known for staging plays and operas for numerous international theatres in settings far different than those suggested by the text. His controversial production of *Ajax* (1986) took the form of a post-Vietnam military trial, and among his many striking opera productions, Wolfgang Amadeus Mozart's *Don Giovanni* was staged in an urban ghetto, his *Così fan tutte* in a diner, and his *Marriage of Figaro* in a corporate high-rise.

Sellers, Peter *orig.* **Richard Henry Sellers** (b. Sept. 8, 1925, Southsea, Hampshire, Eng.—d. July 24, 1980, London) British film actor. The son of vaudeville performers, he acted from childhood in his parents' comedy act. In the early 1950s he performed on radio in the popular comedy series *The Goon Show*. He began appearing in the movies in the mid-1950s; his performances in *The Mouse That Roared* (1959), *I'm All Right, Jack* (1959), *Lolita* (1962), and *Dr. Strangelove* (1964), in which he played three characters, were especially well received. He was enormously popular as the bumbling Inspector Clouseau in the comedy *The Pink Panther* (1964) and its sequels, and he later won acclaim for his role as a simpleminded gardener in *Being There* (1979). His large range of characters earned him international stardom at a time when rigid typecasting was usual.

Selye \'zel-yə**, Hans (Hugo Bruno)** (b. Jan. 26, 1907, Vienna, Austria-Hungary—d. Oct. 16, 1982, Montreal, Que., Can.) Austrian-born Canadian endocrinologist. In early work on the effects of stress, he injected ovarian hormones into rats; this stimulated the adrenal glands, causing deterioration of the thymus gland, ulcers, and finally death. He later showed that physical injury, environmental stress, and toxins could have similar effects. Extending his theory to humans, he proved that a stress-induced hormonal system breakdown could lead to so-called "diseases of adaptation," including heart disease and hypertension. He was president of the International Institute of Stress and wrote 33 books, including *Stress Without Distress* (1974).

Selznick, David O(liver) (b. May 10, 1902, Pittsburgh, Pa., U.S.—d. June 22, 1965, Hollywood, Calif.) U.S. film producer. He trained with his father, a movie executive, before moving to Hollywood in 1926. Working for MGM, RKO, and other studios, he produced films such as *Dinner at Eight* (1933), *King Kong* (1933), *David Copperfield* (1935), and *A Tale of Two Cities* (1935). He formed his own company, Selznick International, in 1936 and produced hits such as *A Star Is Born* (1937). He was essential to the enormous success of *Gone with the Wind* (1939), overseeing its entire production with detailed memos about every aspect of the movie. He brought Alfred Hitchcock to the U.S. and produced *Rebecca* (1940) and *Spellbound* (1945). He also produced *Duel in the Sun* (1946), *The Third Man* (1949), and *A Farewell to Arms* (1957), which starred his second wife, Jennifer Jones.

semantics Study of meaning, one of the major areas of linguistic study (see linguistics). Linguists have approached it in a variety of ways. Members of the school of interpretive semantics study the structures of language independent of their conditions of use. In contrast, the advocates of generative semantics insist that the meaning of sentences is a function of their use. Still another group maintains that semantics will not advance until theorists take into account the psychological questions of how people form concepts and how these relate to word meanings.

semaphore \'se-mə-ˌfōr\ Method of visual signaling, usually with flags or lights. Before radio, a semaphore system was widely used to send messages between ships. A person would stand with arms extended, moving two flags to specific angles to indicate letters or numbers. Before the invention of the telegraph, semaphore signaling with lights on high towers was used to transmit messages between distant points; messages were read by telescope. Modern semaphores have included movable arms or rows of light simulating arms, displayed from towers and used to signal railroad trains.

Semarang \sə-'mär-ˌaŋ\ City (pop., 1995 est.: 1,104,405), Java, Indonesia. It is located on Java's northern coast on the banks of the Semarang River, which is canalized for traffic to and from the sea. Despite being one of the largest ports in Java, its harbour is unprotected against monsoons, which can cause suspension of port operations. Semarang is the seat of a university.

Sembène \sem-'ben**, Ousmane** (b. Jan. 1, 1923, Ziguinchor-Casamance, Seneg.) Senegalese writer and film director. He fought with the Free French in World War II. After the war he worked as a docker in Marseille and taught himself French. His writings, often on historical-political themes, include *The Black Docker* (1956), *God's Bits of Wood* (1960), and *Niiwam and Taaw* (1987). About 1960 he became interested in film; after studying in Moscow, he made films reflecting a strong social commitment, including *Black Girl* (1966), the first feature produced in sub-Saharan Africa. With *Mandabi* (1968), he began to film in the Wolof language; his later films have included *Xala* (1974), *Ceddo* (1977), *Camp de Thiaroye* (1987), and *Guelwaar* (1994).

Semele \'se-mə-ˌlē\ In Greek mythology, a daughter of Cadmus and Harmonia, and the mother of Dionysus. When Semele became the lover of Zeus, Hera was enraged, and she coaxed Semele into asking to see the god in all his splendour. Having promised to grant Semele's every wish, Zeus was forced to comply. The thunderbolts emanating from him destroyed Semele, but Zeus rescued the unborn Dionysus from the ashes. Some stories hold that Dionysus later descended into Hades and brought Semele back to take her place among the immortals.

semen \'sē-mən\ *or* **seminal fluid** Whitish viscous fluid emitted from the male reproductive tract that contains sperm and liquids (seminal plasma) that help keep them viable. Sperm cells, produced by the testes in humans, represent 2–5% of semen volume; fluids from tubules, glands, and storage areas of the reproductive system bathe them as they travel down, nourishing them, keeping them motile, or participating in certain chemical reactions. During ejaculation, liquids from the prostate gland and seminal vesicles dilute the sperm and provide a suitable, slightly alkaline environment. An average ejaculation of a human male expels 0.1–0.3 cu inches (2–5 ml), containing 200–300 million sperm.

Semey \ˌse-mā'\ *formerly (until 1991)* **Semipalatinsk** \ˌse-mē-pə-'lä-tinsk\ Port city (pop., 1999: 269,600) on the Irtysh (Ertis) River, eastern Kazakhstan. It was founded as a Russian fort in 1718 and was moved to its present site in 1778, at the junction of caravan trails; before 1917 more than 11,000 camels passed through the city annually. In the early 20th century it was connected by rail to Siberia and other parts of Central Asia. It has one of the largest meat-packing plants in Kazakhstan. Its name was changed after Kazakhstan attained independence in 1991.

semi-Pelagianism \ˌse-mē-pə-'lā-jē-ə-ˌni-zəm\ Religious movement that flourished AD 429–529 in southern France, considered a heresy by the Roman Catholic church. Unlike their near-contemporaries, the Pelagians (see Pelagianism), the semi-Pelagians believed in the universality of original sin as a corruptive force in mankind and held that it could not be overcome without the grace of God. They endorsed baptism, but contrary to Augustine, they taught that the innate corruption of mankind was not so great that it was beyond the will of mankind to subdue through asceticism. Its principal exponents were Sts. John Cassian (360–435), Vincent of Lérins (died c. 450), and Faustus of Riez (c. 400–c. 490).

semiconductor Class of crystalline solids with electrical conductivity between that of a conductor and an insulator. Such materials can be treated chemically to allow transmission and control of an electric current. Semiconductors are used in the manufacture of electronic devices such as diodes, transistors, and integrated circuits. Intrinsic semiconductors have a high degree of chemical purity, but their conductivity is poor. Extrinsic semiconductors contain impurities that produce much greater conductivity. Some common intrinsic semiconductors are single crystals of silicon, germanium, and gallium arsenide; such materials can be converted into the technologically more important extrinsic semiconductors by addition of

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small amounts of impurities, a process called doping (see DOPANT). Advances in semiconductor technology in recent years have gone hand in hand with increased operational speed in COMPUTERS.

seminary Educational institution, usually for training in theology. In the U.S. the term was formerly also used to refer to institutions of higher learning for women, often teachers' colleges. Since at least the 4th century there have been seminaries for the training of clergy. The first known group of seminarians was gathered by St. Basil of Ancyra. The term dropped out of general use in the Middle Ages, when most theological training was in monasteries, and later, in the universities. After the REFORMATION and the emergence of new denominations, seminaries again came into use, especially in the U.S. The 16th-century Council of TRENT ordered seminaries to be opened in every diocese.

Seminole \'se-mə-ˌnōl\ North American Indian people living mainly in Florida and Oklahoma, U.S. Their language belongs to the Muskogean language stock. The name Seminole is a Creek derivation of the Spanish word *cimarrón*, meaning "wild." The Seminoles split off from the Creek in the later 18th century and settled in northern Florida, where they were joined by runaway slaves, Indian and black, from Georgia. They lived more by hunting and fishing than by agriculture, constructed shelters of thatched roofs supported by poles, and wore tailored hide clothing decorated in bright-coloured strips. In an effort to stem white encroachment, they fought a succession of wars (see SEMINOLE WARS). Together the Seminole number about 15,000.

Seminole Wars (1817–18, 1835–42, 1855–58) Three conflicts between the U.S. and the SEMINOLE Indians of Florida. The first began when U.S. authorities tried to recapture runaway slaves living among Seminole bands. After U.S. forces seized Spanish-held Pensacola and St. Marks, Spain ceded its Florida territory under the Transcontinental Treaty (1819). The second conflict followed the refusal of most Seminoles to relocate under the INDIAN REMOVAL ACT. Led by OSCEOLA, the Seminole warriors hid in the Everglades and used guerrilla tactics to defend their land; about 2,000 U.S. soldiers were killed in the prolonged fighting. After Osceola was captured, resistance declined and most Seminoles agreed to emigrate west. The third conflict arose from efforts to oust the remaining Seminoles from Florida.

semiotics \ˌsē-mē-'ä-tiks, ˌse-mē-'ä-tiks\ *or* **semiology** Study of signs and sign-using behaviour, especially in language. In the late 19th and early 20th century the work of Ferdinand de SAUSSURE and Charles Sanders PEIRCE led to the emergence of semiotics as a method for examining phenomena in different fields, including aesthetics, anthropology, communications, psychology, and semantics. Interest in the structure behind the use of particular signs links semiotics with the methods of STRUCTURALISM. Saussure's theories are also fundamental to POSTSTRUCTURALISM.

Semipalatinsk See SEMEY

Semite Person speaking one of a group of related languages, presumably derived from a common language, Semitic (see SEMITIC LANGUAGES). The term came to include ARABS, Akkadians, Canaanites, some Ethiopians, and ARAMAEAN tribes including Hebrews. Semitic tribes migrated from the ARABIAN PENINSULA, beginning c. 2500 BC, to the Mediterranean coast, MESOPOTAMIA, and the Nile River delta. In PHOENICIA, they became seafarers. In Mesopotamia, they blended with the civilization of SUMER. The Hebrews settled at last with other Semites in PALESTINE.

Semitic \sə-'mi-tik\ **languages** Family of AFRO-ASIATIC LANGUAGES spoken in northern Africa and South Asia. No other language family has been attested in writing over a greater time span—from the late 3rd millennium BC to the present. Both traditional and some recent classifications divide the family into an eastern and western group. Until recently the sole known East Semitic language was AKKADIAN; now some scholars add Eblaite, the language of a CUNEIFORM archive found at the ancient city of EBLA, with documents dating from c. 2300–2250 BC. West Semitic contains as one major subgroup Northwest Semitic, which includes Ugaritic, known from alphabetic cuneiform texts of c. 1400–1190 BC; the closely related Canaanite languages (including Moabite, Phoenician, and Ancient HEBREW); and ARAMAIC. Further subgrouping is controversial; traditionally, ARABIC was placed in a distinct South Semitic subgroup of West Semitic, though a more recent classification puts it together with Northwest Semitic. The South Semitic languages include Epigraphic South Arabian; Modern South Arabian (or Modern South Arabic), a group of six languages spoken in eastern Yemen, southwestern Oman, and the island of Socotra; and ETHIOPIC.

Semliki \'sem-lē-kē\ **River** River, east-central Africa. It connects Lake EDWARD and Lake ALBERT and is 143 mi (230 km) long. The latter part of its course forms part of the border between Congo (Kinshasa) and Uganda. Wildlife, including elephants, hippopotamuses, crocodiles, and antelope, is abundant. The river's delta, choked with ambatch (a fast-growing thorny tree) and papyrus, is steadily encroaching on Lake Albert.

Semmelweis \'ze-məl-ˌvīs**, Ignaz (Philipp)** *Hungarian* **Ignác Fülöp Semmelweis** (b. July 1, 1818, Buda, Hung., Austrian Empire—d. August 13, 1865, Vienna, Austria) Hungarian-born Austrian physician. As an assistant at Vienna's obstetric clinic at a time when death rates from puerperal fever were as high as 30% in European maternity hospitals, Semmelweis noticed that far fewer women died in the midwives' division of the clinic than in the division where students (often coming from the dissecting room) were taught. Concluding that students carried the infection, he had them wash their hands in chlorinated lime before each exam, and mortality dropped from 18% to 1%. Though his ideas were accepted in Hungary, his *Etiology, Understanding, and Preventing of Childbed Fever* (1861) was widely rejected abroad, including by RUDOLF VIRCHOW.

Semmes \'semz**, Raphael** (b. Sept. 27, 1809, Charles county, Md., U.S.—d. Aug. 30, 1877, Mobile, Ala.) U.S. naval officer. He joined the U.S. Navy in 1826, and in the Mexican War he commanded the naval landing at Veracruz. A resident of Alabama, he resigned his commission in 1861 and was appointed a commander in the Confederate navy. He captured 17 Union merchant ships before assuming command of the English-made *Alabama* in 1862. On numerous raids he captured, sank, or burned 82 Union ships, disrupting Union commerce. In 1864 he was defeated in a battle with the Union ship *Kearsarge* in the English Channel, but he escaped capture. After the war he practiced law. See also ALABAMA CLAIMS.

Semon \'sē-mən**, Waldo Lonsbury** (b. Sept. 10, 1898, Demopolis, Ala., U.S.—d. May 26, 1999, Hudson, Ohio) U.S. chemist. He obtained his doctorate from the University of Washington and subsequently worked for the B.F. Goodrich Co. He is known principally for his discovery of plasticized PVC, which, in combinations of up to 50% with plasticizer, is now familiar as floor tile, garden hose, imitation leather, shower curtains, and coatings. He also made pioneering contributions in polymer science, including new rubber antioxidants, and his technical leadership led to discovery of three major new polymer families: thermoplastic polyurethane, synthetic "natural" rubber, and oil-resistant synthetic rubbers.

Semyonov \sə-'myô-nəf**, Nikolay (Nikolayevich) Semyonov** *also spelled* **Semënov** (b. April 15, 1896, Saratov, Russia—d. Sept. 25, 1986, Moscow, U.S.S.R.) Russian physical chemist. His specialty was the mechanisms of chain and branched-chain CHEMICAL REACTIONS, which he showed were the norm in chemical transformations. He shared a 1956 Nobel Prize with Cyril Hinshelwood (1897–1967).

Sen, Amartya (b. Nov. 3, 1933, Santiniketan, India) Indian economist who was awarded the 1998 NOBEL PRIZE in Economic Sciences for his work in WELFARE ECONOMICS and social choice. Sen is best known for his work on the causes of FAMINE, and his research led to the development of solutions for limiting the effects of food shortages. After attending Presidency College in Calcutta (now Kolkata), Sen studied at Trinity College, University of Cambridge (B.A., 1955; M.A. and Ph.D., 1959). He taught economics at the Universities of Jadavpur (1956–58) and Delhi (1963–71), the London School of Economics, the University of London (1971–77), the University of Oxford (1977–88), and Harvard University (1988–98). In 1998 he was appointed master of Trinity College. His *Poverty and Famines: An Essay on Entitlement and Deprivation* (1981) showed that declining wages, unemployment, rising food prices, and inefficient food distribution could lead to starvation. His views encouraged policy makers to maintain stable prices for food.

Senate In ancient Rome, the governing and advisory council that was the most permanent element in the Roman constitution. Under the monarchy it served as an advisory council, with undefined powers. During the republic it advised the CONSULS and supposedly stood second to them in power. Senators were appointed by the consuls, but since they served for life, by the late republic the Senate became independent of the consuls, with extensive powers. About 312 BC the selection of senators was transferred from the consuls to the CENSORS. In 81 BC SULLA made selection automatic, routinely admitting all former QUAESTORS. It became the chief governing body and controlled the republic's finances. Julius CAESAR

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increased the number of senators to 900. Augustus dropped the number to 300 and reduced the Senate's power, while giving it new judicial and legislative functions. The number later increased to about 2,000; many were provincials, the most important being the great landowners. The Senate's power faded until it disappeared from the historical record in the 6th century AD.

Sendak, Maurice (Bernard) (b. June 10, 1928, New York, N.Y., U.S.) U.S. artist and writer. Sendak studied at the Art Students League. He illustrated more than 80 children's books by other writers before writing one himself. His *Kenny's Window* (1956) was followed by the innovative trilogy *Where the Wild Things Are* (1963), *In the Night Kitchen* (1970), and *Outside over There* (1981). He collaborated with Carole King on the musical *Really Rosie* (1978) and designed stage productions of *The Magic Flute* (1980) and *The Nutcracker* (1983).

Sendero Luminoso See Shining Path

Seneca \'se-ni-kə\ North American Indian people living mainly in western New York, U.S. Their language belongs to the Iroquoian linguistic group, and their traditional homeland is western New York and eastern Ohio. They were the largest nation of the Iroquois Confederacy and were known as the "Keepers of the Western Door." They call themselves Onondowahgah, meaning "People of the Great Hill." The Seneca have eight clans, and a person's clan is the same as his mother's. Historically, families linked by maternal kinship lived together in longhouses. Each community had a council of adult males, which guided the village chief. In the autumn small parties would leave the villages for the annual hunt, returning about midwinter; spring was the fishing season. Seneca women cultivated corn and other vegetables. Warfare with other Indian nations was frequent. In the American Revolution the Seneca were British allies, resulting in the destruction of their villages by Gen. John Sullivan in 1779. In 1797 they secured land for 12 reservations in western New York, four of which still exist. Today the Seneca number about 5,500. See also Cornplanter; Ganioda'yo.

Seneca \'se-ni-kə**, Lucius Annaeus** (b. c. 4 BC, Corduba, Spain—d. AD 65, Rome) Roman philosopher, statesman, and playwright. He was trained as an orator and began a career in politics and law in Rome c. AD 31. While banished to Corsica for adultery (41–49), he wrote the philosophical treatises *Consolationes*. He later became tutor to the future emperor Nero and from 54 to 62 was a leading intellectual figure in Rome. An adherent of Stoicism, he wrote other philosophical works, including *Moral Letters*, a collection of essays on moral problems. He also left a series of verse tragedies marked by violence and bloodshed, including *Thyestes*, *Hercules*, and *Medea*. His plays influenced the development of Elizabethan drama during the Renaissance, notably William Shakespeare's *Titus Andronicus* (1593–94) and John Webster's *The Duchess of Malfi* (c. 1613).

Seneca, marble bust, 3rd century, after an original bust of the 1st century; in the Staatliche Museen zu Berlin, Germany
COURTESY OF THE STAATLICHE MUSEEN ZU BERLIN, GERMANY

Seneca Falls Convention (July 19–20, 1848) Assembly held at Seneca Falls, N.Y., that launched the U.S. woman suffrage movement. Initiated by Elizabeth Cady Stanton (who lived in Seneca Falls) and Lucretia Mott, the meeting was attended by more than 200 people, including 40 men. The group passed the Declaration of Sentiments, a list of grievances and demands modeled on the Declaration of Independence that called on women to organize and petition for their rights. A controversial demand for the right to vote passed by a narrow margin.

Senegal \ˌse-ni-'gȯl\ *officially* **Republic of Senegal** Country, western Africa. Area: 75,955 sq mi (196,722 sq km). Population (2005 est.): 11,706,000. Capital: Dakar. There are seven major ethnic groups in Senegal—including the Wolof, Fulani, and Malinke, each speaking a separate language—and a number of smaller groups. Language: French (official). Religions: Islam; also traditional beliefs, Christianity. Currency: CFA franc. The climate varies from dry desert to moist tropics. Forests

cover about one-third of the total area, and nearly one-third is pasture or rangeland; much of the rest is arable. Agriculture is the main industry; peanuts are the most important cash and export crop. Other important industries are fishing, mining, manufacturing, and tourism. Senegal has large reserves of phosphates and iron ore. It is a republic with one legislative house; its head of state and government is the president, assisted by the prime minister. Links between the peoples of Senegal and North Africa were established in the early centuries AD. Islam was introduced in the 11th century, although animism retained a hold on the country into the 19th century. The Portuguese explored the coast about 1444, and in 1638 the French established a trading post at the mouth of the Sénégal River. Throughout the 17th and 18th centuries, Europeans exported slaves, ivory, and gold from Senegal. The French gained control over the coast in the early 19th century and moved inland, checking the expansion of the Tukulor empire; in 1895 Senegal became part of French West Africa. Its inhabitants were made French citizens in 1946, and it became an overseas territory of France. It voted for a degree of autonomy in 1958, was federated with Mali in 1959–60, and became an independent state in 1960. In 1982 it entered a confederation with Gambia, called Senegambia, which was dissolved in 1989. Separatists fighting in the southern part of the country since the early 1980s signed a peace accord with the government in 2003.

Sénégal River River, western Africa. It rises in Guinea and flows northwest across Mali, then west to the Atlantic Ocean, forming the border between Mauritania and Senegal. It is 1,020 mi (1,641 km) long. Its two major headstreams, the Bafing and Bakoye, meet in Mali to form the Sénégal proper. Dams control floodwaters and prevent the encroachment of saltwater during the dry season.

Senegambia Confederation of Senegal and Gambia, 1982–89. The two countries agreed to integrate their military and security forces, form an economic and monetary union, coordinate their foreign policies and communications, and establish confederal institutions controlled by Senegal. Each country maintained its independence. The confederation was dissolved in 1989. The name Senegambia also refers to the region around the Sénégal and Gambia rivers.

Senghor \seŋ-'gȯr**, Léopold (Sédar)** (b. Oct. 9, 1906, Joal, Senegal, French West Africa—d. Dec. 20, 2001, Verson, Fr.) Poet, president of Senegal (1960–80), and cofounder of the Negritude movement in African art and literature. He completed his studies in Paris and became a teacher there. Drafted in 1939, he was captured and spent two years in Nazi concentration camps, where he wrote some of his finest poems. He was elected to the French National Assembly in 1945. In 1948 he edited

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Hosties noires, an anthology of French-language African poetry that became a seminal Negritude text. That same year he founded the Senegalese Progressive Union, which, as the Socialist Party (since 1976), remains Senegal's governing party. When Senegal gained independence in 1960, he was unanimously elected president. Advocating a moderate "African socialism," free of atheism and excessive materialism, he became an internationally respected spokesman for Africa and the Third World. In 1984 he became the first black inducted into the French Academy.

senna Any of several plants, especially of the genus *Cassia*, in the pea family (see LEGUME), mostly of subtropical and tropical regions. Many are used medicinally; some yield tanbark used in preparing leather. Some sennas are among the showiest flowering trees. In the eastern U.S., wild sennas (*C. hebecarpa* and *C. marilandica*) grow up to 4 ft (1.25 m) high and have showy spikes of yellow flowers. Some species are Old World shrubs or small trees.

Senna (*Cassia didymobotrya*).
GERALD CUBITT

Sennacherib \sə-'na-kə-rəb\ (d. January 681 BC) King of Assyria (r. 705/704–681 BC), son and successor of SARGON II. Between 703 and 689 he undertook six campaigns against ELAM (southwestern Iran), which was stirring up Chaldean and Aramaean tribes in Babylonia; BABYLON was sacked during the last campaign. He dealt firmly with an Egyptian-backed rebellion in PALESTINE in 701, sparing JERUSALEM after receiving payment of a heavy indemnity. He rebuilt the city of NINEVEH, around which he planted fruit trees and exotic plants, including cotton, building extensive canals to bring water to the plantations. He devised less laborious methods of bronze casting and improved methods of raising water from wells. He was assassinated by a son during a rebellion.

Sennett, Mack *orig.* **Michael Sinnott** (b. Jan. 17, 1880, Richmond, Que., Can.—d. Nov. 5, 1960, Hollywood, Calif., U.S.) Canadian-born U.S. film director. He performed in burlesque and vaudeville before joining the Biograph studio in 1908, and he soon was directing comedies under D.W. GRIFFITH's tutelage. He left to form his own Keystone Co. in 1912. Considered the father of slapstick comedy in motion pictures, he produced the first U.S. feature-length comedy, *Tillie's Punctured Romance* (1914), and made over 1,000 comedy shorts, often featuring the wild antics of the Keystone Kops. He hired stars such as Mabel Normand, Fatty Arbuckle, and CHARLIE CHAPLIN. Important directors such as FRANK CAPRA and GEORGE STEVENS also received experience under Sennett. Sennett excelled in comic timing, improvisation, and effective editing, and he used trick camera work and high-speed and slow-motion photography to produce his famous comic chase scenes. In 1937 he received a special Academy Award.

Mack Sennett.
COURTESY OF THE MUSEUM OF MODERN ART FILM STILLS ARCHIVE, NEW YORK

sensation Mental process (such as seeing, hearing, or smelling) due to immediate bodily stimulation, usually as distinguished from PERCEPTION. When a stimulus impinges on a SENSE organ and the organism responds, it is said that the stimulus has been sensed. See also PSYCHOPHYSICS, SENSE-DATA.

sense *or* **sensory reception** *or* **sense perception** Mechanism by which information is received about one's external or internal environment. Stimuli received by nerves, in some cases through specialized organs with receptor cells sensitive to one type of stimulus, are converted into impulses that travel to specialized areas of the brain, where they are analyzed. In addition to the "five senses"—sight, hearing, smell, taste, and touch—humans have senses of motion (kinesthetic sense), heat, cold, pressure, pain, and balance. Temperature, pressure, and pain are cutaneous (skin) senses; different points on the skin are particularly sensitive to each. See also CHEMORECEPTION, EAR, EYE, INNER EAR, MECHANORECEPTION, NOSE, PHOTORECEPTION, PROPRIOCEPTION, TASTE, THERMORECEPTION, TONGUE.

sense-data Entities that are the direct objects of sensation. Examples of sense-data are the circular image one sees when viewing the face of a penny and the oblong image one sees when viewing the penny from an angle. Other examples are the image one sees with one's eyes closed after staring at a bright light (an afterimage) and the dagger Macbeth sees floating before him (a hallucination). In each case, according to sense-data theorists, there is something of which one is directly aware, and that something is the sense-datum.

sensitive plant Either of two plants in the pea family (see LEGUME) that close up their leaves and droop when touched. This unusually quick response is due to rapid water release from specialized cells at the bases of leaftsalks. The more common plant is *Mimosa pudica* (see MIMOSA). Spiny and shrubby, with fernlike leaves and small, globular, mauve flower puffs, it grows about 1 ft (30 cm) high as a widespread tropical weed and a greenhouse curiosity. Wild sensitive plant (*Cassia nictitans*) is less sensitive to touch; a larger plant, 20 in. (50 cm) high, it is native to the eastern U.S. and the West Indies.

sentence In CRIMINAL LAW, a judgment formally pronouncing the punishment to be inflicted on a person convicted of a crime. Among the major types are the concurrent sentence, which runs at the same time as another; the consecutive sentence, which runs before or after another; the mandatory sentence, which is specifically required by statute as punishment for an offense; and the suspended sentence, the imposition or execution of which is suspended by the court. See also CAPITAL PUNISHMENT, PAROLE.

Seoul \'sōl\ City (pop., 2000: 9,853,972), capital of South Korea since 1946, with the administrative status of a province. Located on the HAN RIVER near the centre of the Korean peninsula, Seoul was the capital of the CHOSŎN DYNASTY (1394–1910) and the centre of Japanese rule of Korea (1910–45). During the KOREAN WAR it was the capital of the U.S. military government and suffered extensive damage; it has been largely rebuilt since 1953. In 1988 it was the site of the Summer OLYMPIC GAMES. The commercial, cultural, and industrial heart of South Korea, it is a centre of higher education, with several universities, including Seoul National University (1946).

separation of powers Division of the legislative, executive, and judicial functions of government among separate and independent bodies. Such a separation limits the possibility of arbitrary excesses by government, since the sanction of all three branches is required for the making, executing, and administering of laws. The concept received its first modern formulation in the work of CHARLES-LOUIS DE SECONDAT, BARON DE LA BRÈDE ET DE MONTESQUIEU, who declared it the best way to safeguard liberty; he influenced the framers of the CONSTITUTION OF THE UNITED STATES, who in turn influenced the writers of 19th- and 20th-century constitutions. See also CHECKS AND BALANCES.

Sephardi \sə-'fär-dē\ Any member of the Jewish community, or their descendants, who lived in Spain and Portugal from the Middle Ages until their expulsion in the late 15th century. They fled first to North Africa and other parts of the OTTOMAN EMPIRE and eventually settled in countries such as France, Holland, England, Italy, and the Balkan states. They differ from the ASHKENAZI Jews in their traditional language, LADINO, and in their preservation of Babylonian rather than Palestinian Jewish ritual traditions. Many now live in ISRAEL.

Sephardic language See LADINO LANGUAGE

Sepik \'sā-pik\ **River** River, northeastern New Guinea. It enters the Bismarck Sea through a delta about 700 mi (1,100 km) from its source in the central highlands. Because of the amount of sediment it carries, it discolours the waters for 20 mi (32 km) beyond its mouth, which is more than 1 mi (1.6 km) wide. It is navigable by shallow-draft vessels for more than 300 mi (483 km). The river's small tribal groups have extensive artistic traditions, known as the Sepik River style.

Sepoy Mutiny See INDIAN MUTINY

seppuku \'se-pə-ˌkü\ *or* **hara-kiri** Japanese ritual suicide by disembowelment, practiced by members of the SAMURAI class. Suicide by dis-

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embowelment was favoured because it was slow and painful and therefore demonstrated courage, self-control, and strong resolve. Voluntary seppuku was performed to avoid the dishonour of capture, show loyalty to one's lord by following him into death, protest against some policy of a superior, or atone for failure. Obligatory seppuku was a method of capital punishment for a samurai, who would be beheaded by a second once he had made an initial stab wound himself. Obligatory seppuku was abolished in 1873, but voluntary seppuku continued to occur. Notable 20th-century examples included those of army officer Nogi Maresuke and writer Yukio Mishima. See also *bushidō*.

September 11 attacks Series of airline hijackings and suicide bombings against U.S. targets perpetrated by 19 militants associated with the Islamic extremist group al-Qaeda. The attacks were planned well in advance; the militants—most of whom were from Saudi Arabia—traveled to the U.S. beforehand, where a number received commercial flight training. Working in small groups, the hijackers boarded 4 domestic airliners in groups of 5 (a 20th participant was alleged) on Sept. 11, 2001, and took control of the planes soon after takeoff. At 8:46 AM (local time), the terrorists piloted the first plane into the north tower of the World Trade Center in New York City. A second plane struck the south tower some 15 minutes later. Both structures erupted in flames and, badly damaged, soon collapsed. A third plane struck the southwest side of the Pentagon near Washington, D.C., at 9:40, and within the next hour the fourth crashed in Pennsylvania after its passengers—aware of events via cellular telephone—attempted to overpower their assailants. Some 2,750 people were killed in New York, 184 at the Pentagon, and 40 in Pennsylvania. All 19 terrorists died.

septic arthritis Acute inflammation of one or more joints caused by infection. Suppurative arthritis may follow certain bacterial infections; joints become swollen, hot, sore, and filled with pus, which erodes their cartilage, causing permanent damage if not promptly treated by giving antibiotics, draining the pus, and resting the joint. Nonsuppurative arthritis can accompany several diseases caused by bacteria, viruses, or fungi; joints become stiff, swollen, and painful to move. Treatment includes rest, drugs, and, in the case of tuberculosis, orthopedic care to prevent skeletal deformity.

septicemia \ˌsep-ti-'sē-mē-ə\ *or* **blood poisoning** Invasion of the bloodstream, after surgery or infectious disease, by microorganisms—typically gram-negative (see gram stain) bacteria—and the toxins they release. The latter trigger immune responses and widespread coagulation in blood vessels. High fever, chills, weakness, and sweating are followed by a drop in blood pressure. Multiple infections are often present, requiring broad-spectrum antibiotics as well as drainage of foci of infection. Without immediate treatment, septic shock follows, with a mortality rate over 50%. Invasive technology and antibiotic-resistant bacteria in hospitals have made septicemia more severe and more common. See also bacteremia.

Septimania \ˌsep-tə-'mā-nē-ə\ Ancient territory, southwestern France. Located between the Garonne and Rhône rivers and the Pyrenees and Cévennes mountains, Septimania was settled during the reign of the Roman emperor Augustus by veterans of the Seventh Legion (Septimani). It was the last Gallic holding of the Visigoths of Spain. The region was occupied by the Franks (732–768), was then part of the kingdom of Aquitaine under the Carolingians, and became a separate duchy in 817. Later in the 9th century it was subsumed under the counts of Toulouse.

Septuagint \sep-'tü-ə-jənt\ Earliest extant Greek translation of the Hebrew scriptures from the original Hebrew, presumably made for the use of the Jewish community in Egypt when Greek was the lingua franca. The Pentateuch was translated near the middle of the 3rd century BC; the rest of the Hebrew scriptures were translated in the 2nd century BC. The name Septuagint was derived from a legend that 72 translators worked on the project. Its influence was far-reaching. The Septuagint rather than the original Hebrew Bible was the main basis for the Old Latin, Coptic, Ethiopic, Armenian, Georgian, Slavonic, and some Arabic translations of the Bible.

sequencing Determining of the order of amino acids in a protein or of nucleotides in a nucleic acid or gene. The results have increased understanding of the mechanisms of life processes and have numerous applications. Whereas Frederick Sanger required 10 years to determine the structure and sequence of amino acids in insulin and about as long to determine the sequence of nucleotides in the DNA of a small virus, automated laboratory instruments and techniques can now do either task in days or hours. See also genetic code; polymerase chain reaction.

sequestration In law, a writ authorizing a law-enforcement official to take into custody the property of a defendant in order to enforce a judgment or to preserve the property until a judgment is rendered. In some civil-law jurisdictions, contested property may be deposited with a third party until it is determined to whom it properly belongs.

sequoia See redwood

sequoia, giant See big tree

Sequoia National Park National park, Sierra Nevada range, California, U.S. The park, with an area of 629 sq mi (1,629 sq km), was set aside in 1890 to protect groves of big trees (*Sequoiadendron giganteum*) that are among the world's largest and oldest living things. The largest tree in the park is thought to be 2,300–2,700 years old. Kings Canyon National Park adjoins Sequoia park to the north; Mount Whitney is on the eastern boundary.

Sequoyah *or* **Sequoya** *or* **Sequoia** \si-'kwȯi-ə\ (b. c. 1760/1770, Taskigi, North Carolina colony—d. August 1843, near San Fernando, Mex.) Creator of the Cherokee writing system. Sequoyah was probably the son of a British trader. Convinced that the secret of the white people's power was written language, Sequoyah set about developing a Cherokee system. Adapting letters from English, Greek, and Hebrew, he created a system of 86 symbols representing all the syllables of the Cherokee language. Most Cherokee quickly became literate as a result. Sequoyah never learned to speak, read, or write English.

Seram See Ceram

seraph \'ser-əf\ In Jewish, Christian, and Islamic literature, a celestial being with two or three pairs of wings who guards the throne of God. In Christian angelology, seraphim are the highest-ranking in the hierarchy of angels. In art they are often painted red, symbolizing fire. They appear in the Old Testament in a vision of Isaiah as six-winged creatures praising God. See also cherub.

Serbia \'sər-bē-ˌyä\ Constituent republic of Serbia and Montenegro, constituting about 80% of its area. The formerly autonomous provinces of Kosovo (administered by the UN since 1999) and the Vojvodina are within its borders. Area: 34,116 sq mi (88,361 sq km). Population (2001 est.): 9,993,000. The capital is Belgrade. Serbia is mountainous, with forests in the central area and low-lying plains in the north. Serbs settled the region in the 6th–7th centuries AD. In the 9th century the Serbs, nominally under Byzantine suzerainty, converted to Eastern Orthodox Christianity. The Ottoman Empire triumphed at the Battle of Kosovo in 1389; after a long period of resistance, Serbia became part of the empire in 1459. After the Russo-Turkish War of 1828–29, Serbia became an autonomous principality under Ottoman suzerainty and Russian protection. It became completely independent of the Ottoman Empire in 1878. After World War I, Serbia became part of the Kingdom of Serbs, Croats, and Slovenes, which was renamed Yugoslavia in 1929. In 1946 Serbia was made one of six federated republics of Yugoslavia. As the Yugoslav economy faltered in the 1980s, the country began to break apart. After an unsuccessful attempt to prevent Slovenia's secession in 1991, Serbian elements of the Yugoslav armed forces began assisting Bosnian Serbs in sweeping Bosniacs (formerly designated Muslims) and Croats from eastern and northern Bosnia and Herzegovina. In 1992, after Yugoslavia's breakup, Serbia joined with Montenegro to form a new Yugoslav federation. The area remained in turmoil (see Bosnian conflict). The signing of the Dayton peace accords in 1995 ultimately brought little relief. Slobodan Milošević retained power in Serbia through the end of the century, and the push for more autonomy by Albanian Kosovars provoked another round of fighting in 1998–99 (see Kosovo conflict). As the violence escalated, NATO responded with a bombing campaign, which led to a peace accord in June 1999. A change in the Yugoslav government late in 2000 brought reinstatement in the UN, and in 2003, after the Montenegrin government threatened to declare independence, the governments of the two constituent states agreed to remain united under the name Serbia and Montenegro.

Serbia and Montenegro Federated country, west-central Balkans region, southern Europe. It consists of two republics: Serbia and Montenegro. Area: 39,449 sq mi (102,173 sq km). Population (2005 est.): 9,960,000. Administrative centre: Belgrade. The population comprises Serbian, Albanian, Montenegrin, Hungarian, and other ethnic groups. Languages: Serbian (Serbo-Croatian), Albanian. Religions: Christianity (mostly Eastern Orthodox; also Roman Catholic), Islam. Currencies: Serbian dinar (Serbia); euro (Montenegro). The southern two-thirds of Serbia

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and Montenegro is mountainous, with the Dinaric Alps in the west and the Balkan Mountains in the east. Rivers include the Danube, Ibar, Morava, Timiş, and Tisza. The country has oil, gas, coal, copper, lead, zinc, and gold deposits. Its industries include machine building, metallurgy, mining, electronics, and petroleum products, while its agricultural products include corn, wheat, potatoes, and fruit. The country is a federation with a president and a unicameral legislature, but most power resides with the governments of the two republics. The Kingdom of Serbs, Croats, and Slovenes was created after the collapse of Austria-Hungary at the end of World War I. The country signed treaties with Czechoslovakia and Romania in 1920–21, marking the beginning of the Little Entente. In 1929 an absolute monarchy was established, the country's name was changed to Yugoslavia, and it was divided without regard to ethnic boundaries. Axis powers invaded Yugoslavia in 1941, and German, Italian, Hungarian, and Bulgarian troops occupied it for the rest of World War II. In 1945 the Federal People's Republic of Yugoslavia was established; it included the republics of Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia, and Slovenia. Its independent form of communism under the leadership of Josip Broz Tito provoked the Soviet Union and led to its expulsion from the Cominform in 1948. Internal ethnic tensions flared up in the 1980s, causing Yugoslavia to collapse. In 1991–92 independence was declared by Croatia, Slovenia, Macedonia, and Bosnia and Herzegovina; the new Federal Republic of Yugoslavia (containing roughly 45% of the population and 40% of the area of its predecessor) was proclaimed by Serbia and Montenegro. Still fueled by long-standing ethnic tensions, hostilities continued into the 1990s (see Bosnian conflict; Kosovo conflict). In 2003, after ratification of an accord by the governments of Serbia, Montenegro, and Yugoslavia, the country was renamed Serbia and Montenegro.

Serbo-Croatian language South Slavic language spoken by some 21 million people in Croatia, Bosnia and Herzegovina, and Serbia and Montenegro. As the dominant language of pre-1991 Yugoslavia, it was used or understood by most ethnic groups of the federation. The Central Neo-Shtokavian dialect forms the basis for both Standard Serbian and Standard Croatian. Historically, Serbia's literary language was the Serbian recension of Church Slavonic (see Old Church Slavonic language). In the 19th century a new literary language based on colloquial Serbian was successfully promulgated by Vuk Stefanović Karadžić. Croatian written in the Latin alphabet first appears in the mid-14th century. In the 19th century the Zagreb-based Illyrian political movement, which aimed at a union of all South Slavs, turned to the Central Neo-Shtokavian dialect as the basis for a literary language that would unite Croatians and bring them closer to their Slavic compatriots. The move toward a unified "Serbo-Croatian" was supported by the politically unified Yugoslav kingdom (1918–41) and communist Yugoslavia (1945–91). With the independence of Bosnia and Herzegovina in 1992, a Bosnian form of the language was recognized of necessity. Vocabulary and pronunciation differences exist among the three but form no real barrier to communication. The Croats and Bosnians use the Roman, or Latin, alphabet; the Serbs and Montenegrins of present-day Serbia and Montenegro use Cyrillic. Most Bosnians, Serbs, and Croats insist that their language is distinct from the others, and, perhaps, from a political perspective this is understandable; but most linguists consider Serbian, Croatian, and Bosnian a single language, which has historically been called Serbo-Croatian.

Serbs, Croats \'krō-,äts**, and Slovenes, Kingdom of** Balkan state formed in 1918 after World War I. It included the previously independent kingdoms of Serbia and Montenegro and the southern Slavic territories formerly subject to the Austro-Hungarian Empire, including Dalmatia, Croatia-Slavonia, Slovenia, and Bosnia and Herzegovina. The kingdom was ruled by the Serbian Karadjordjević dynasty. In 1929 King Alexander I sought to combat local nationalisms by proclaiming a royal dictatorship and renaming the state Yugoslavia. See also Serbia and Montenegro.

Serengeti \ˌser-ən-'ge-tē\ **National Park** Wildlife refuge, north-central Tanzania. Established in 1951, the park covers 5,700 sq mi (14,763 sq km). An international tourist attraction, it is the only place in Africa where vast land-animal migrations still take place. More than 35 species of plains animals, more than 350 species of birds, and lions, leopards, elephants, rhinoceroses, hippopotamuses, giraffes, and baboons inhabit the park. Poaching is a major problem.

serfdom In medieval Europe, condition of a tenant farmer who was bound to a hereditary plot of land and to the will of his landlord. Serfs differed from slaves in that slaves could be bought and sold without reference to land, whereas serfs changed lords only when the land they worked changed hands. From about the 2nd century AD, large privately owned estates in the Roman Empire that had been worked by slaves were broken up and given to peasant farmers. These farmers came to depend on larger landowners for protection in turbulent times, and swearing fealty to a proprietor became common practice. In 332 Constantine I established serfdom legally by requiring tenant farmers to pay labour services to their lords. As serfs, they could not marry, change occupations, or move without the permission of their lords, to whom they were required to give a major portion of their harvest. The development of centralized political power, the labour shortage caused by the Black Death, and endemic peasant uprisings in the 14th and 15th centuries led to the gradual emancipation of serfs in western Europe. In eastern Europe serfdom became more entrenched during that period; the peasants of the Austro-Hungarian Empire were freed in the late 18th century, and Russia's serfs were freed in 1861. See also feudalism.

serial Film presented in a series of episodes over several months. The serials, usually adventure melodramas, probably developed from the adventure stories published in monthly installments in magazines. The first internationally popular serial, *The Perils of Pauline* (1914), starring Pearl White, was followed by other serials such as *The Hazards of Helen*, which ran for 119 episodes (1914–17). Serials focused on action sequences, with cliff-hanging endings for each episode. They remained popular with movie audiences, especially children, into the 1940s.

serial murder Unlawful homicide of at least two people, carried out in a series over a period of time. Serial murder differs from mass murder, in which several victims are murdered at the same time and place. Criminologists have distinguished between two types of serial murder: classic serial murder, which usually involves stalking and is often sexually motivated, and spree serial murder, which is usually motivated by thrill-seeking. Cases of serial murder have been documented since ancient times. The incidence of serial murder increased dramatically in the early 19th century, particularly in Europe, though this development has been attributed to advances in crime detection and increased news coverage rather than to an actual rise in the number of occurrences. From the late 19th century serial murderers received considerable attention in the press, and their cases inspired numerous books and films. These accounts, however, tended to mislead the public by suggesting that serial murder is a common phenomenon, when in fact it represented less than 2% of all murders in the late 20th century.

serialism Use of an ordered set of pitches as the basis of a musical composition. The terms *12-tone music* and *serialism*, though not entirely

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synonymous, are often used interchangeably. The serial method was worked out by Arnold Schoenberg in the years 1916–23, though another serial method was being devised simultaneously by Josef Matthias Hauer. To Schoenberg, it represented the culmination of the growth of chromaticism in the late 19th and early 20th century. In an attempt to erase the system of tonality, which he regarded as outworn but which frequently asserted itself even in the music of composers who desired to transcend it, Schoenberg's original method stipulated (among several other requirements) that no note could be repeated before all 11 other notes of the chromatic scale had been used. *Serialism*, a broader term than *12-tone music*, can be applied to the use of fewer than 12 tones. "Total serialism," a concept that arose in the late 1940s, attempts to organize not only the 12 pitches but also other elements such as rhythm, dynamics, register, and instrumentation into ordered sets.

serigraphy See silkscreen

serine \'ser-ˌēn\ One of the nonessential amino acids, found in substantial concentrations (sometimes 5–10%) in many common proteins. It is also an important component of phospholipids. It is used in biochemical and microbiological research and as a dietary supplement and feed additive.

Serkin, Rudolf (b. March 28, 1903, Eger, Bohemia, Austria-Hungary—d. May 8, 1991, Guilford, Vt., U.S.) Austrian-born U.S. pianist. He made his debut at age 12 in Vienna, and from 1920 he was a close associate of the conductor Adolf Busch, whose daughter he married in 1935. He immigrated to the U.S. in 1939 and began teaching at the Curtis Institute, of which he served as director (1968–75). In 1950 he and Busch cofounded the Marlboro Music Festival in Vermont, which under Serkin's direction became the preeminent locus for chamber music in the U.S. He was known for his highly intelligent and expressive but self-effacing playing of the German-Austrian classics. His son, Peter (b. 1947), is a well-known pianist, with a wide repertoire.

Serling, (Edward) Rod(man) (b. Dec. 25, 1924, Syracuse, N.Y., U.S.—d. June 28, 1975, Rochester, N.Y.) U.S. television writer and producer. He began his career in radio but soon shifted to television, becoming a freelance screenwriter in 1953. He wrote teleplays for series such as *Kraft Television Theater, Studio One,* and *Playhouse 90*, including *Requiem for a Heavyweight* (1956, Emmy Award). He created, narrated, and was the main writer of the famous supernatural series *The Twilight Zone* (1959–65) and narrated the similar series *Night Gallery* (1970–73). He also wrote screenplays, often based on his television scripts, such as *Patterns* (1956) and *The Rack* (1956). He was coauthor of *The Planet of the Apes* (1968).

Sermon on the Mount Biblical collection of religious teachings and ethical sayings attributed to Jesus, as reported in the Gospel of St. Matthew. The sermon was addressed to disciples and a large crowd of listeners to guide them in a life of discipline based on a new law of love, even of enemies, as opposed to the old law of retribution. It is the source of many familiar Christian homilies and oft-quoted passages from the Bible, including the Beatitudes and the Lord's Prayer. The sermon is often regarded as a blueprint for Christian life.

serotonin \ˌser-ə-'tō-nən\ Chemical (5-hydroxytryptamine, or 5-HT) derived from the amino acid tryptophan. It occurs in brain and intestinal tissue, platelets, and certain connective-tissue cells and is a component of many animal venoms (e.g., wasp, toad). A strong stimulator of blood-vessel constriction and a neurotransmitter, serotonin concentrates in certain brain areas, especially the midbrain and hypothalamus. Some cases of depression are apparently caused by reduced amounts or activity of serotonin in the brain; many antidepressants counteract that condition. Excessive brain serotonin activity may cause migraine headaches and nausea. LSD may act by inhibiting the action of serotonin.

serpentine \'sər-pən-ˌtēn\ Any of a group of magnesium-rich silicate minerals whose composition resembles $Mg_3Si_2O_5(OH)_4$. Serpentine generally occurs in three forms: as chrysotile, the most common variety of asbestos; and as antigorite or lizardite, both of which are commonly massive and fine-grained. Named in allusion to its resemblance to a snake's skin, serpentine is usually grayish, white, or green but may be yellow or green-blue. It takes a high polish and is sometimes used as an ornamental stone.

Serra \'ser-ə**, Junípero** (b. Nov. 24, 1713, Petra, Majorca, Spain—d. Aug. 28, 1784, Carmel, Calif., New Spain) Spanish missionary. He was ordained a Franciscan priest in 1730 and worked as a missionary in Mexico (1750–67). When Spain began its occupation of Alta California (now California), he joined the expedition and in 1769 founded Mission San Diego. From 1770 to 1782 he founded eight more missions in California, thereby strengthening Spain's control of the area. His work earned him the title Apostle of California, and he was beatified in 1988.

Serra, Richard (b. Nov. 2, 1939, San Francisco, Calif., U.S.) U.S. sculptor. He paid for his education at the University of California by working in steel factories. From 1961 he studied with Josef Albers at Yale University. He settled in New York City c. 1966 and began to experiment with new materials. In 1967–68 he displayed a series of works entitled *Splashes*, which were pieces of molten lead thrown against a wall in a gallery; the resulting solidified lead could be seen as sculpture, although Serra himself viewed the process of creation as more important than the end result. In 1969–70 gravity became a major element of his work; the *Prop* series consisted of huge plates of lead or steel leaning against each other, supported only by their opposing weights. He is best known for his enormous, sometimes controversial, outdoor pieces that interact with the environment, particularly *Tilted Arc*, installed in New York's Federal Plaza in 1981 but removed in 1989. His work has been defined as Minimalist.

Sert, José Luis *Catalan* **Josep Lluís Sert i Lopéz** (b. July 1, 1902, Barcelona, Spain—d. March 15, 1983, Barcelona) Spanish-born U.S. architect. After graduating from Barcelona's School of Architecture, he worked with Le Corbusier in Paris. On his own, he designed the Spanish pavilion at the Paris World's Fair (1937). After moving to the U.S. in 1939, he worked in urban development for Bogotá and Havana, among other cities. He served as dean of the Graduate School of Design at Harvard University (1953–59), Cambridge, Mass. His work is best exemplified by his Peabody Terrace married-students' housing at Harvard (1963–65), in which high-rise and low-rise apartment buildings are harmoniously interconnected. His outstanding museum designs include the Maeght Foundation in Saint-Paul-de-Vence, France (1968), and the Joan Miró Foundation in Barcelona (1975).

Sertorius \sər-'tōr-ē-əs**, Quintus** (b. c. 126, Nursia, Sabini—d. 73 BC) Roman statesman and military commander. He commanded an army in the Social War, and he helped Marius take Rome (87–86) in his struggle against Sulla. As praetor in 83 he was sent to Spain; he fled to Mauretania when Sulla pursued him but later overthrew Sulla's governor in Farther Spain and by 77 was ruler of most of Spain. When Pompey the Great and Metellus Pius finally arrived to put down the rebellion, he skillfully kept them at bay until the tide turned in his favour. When troop morale sank, he was murdered by a conspiracy of officers.

serval \'sər-vəl\ Long-limbed cat (*Felis serval*) of sub-Saharan Africa found in grass- and bush-covered country near water. It has a long neck and large, cupped ears. It is 32–40 in. (80–100 cm) long, has an 8–12-in. (20–30-cm) tail, stands about 20 in. (50 cm), and may weigh over 30 lbs (15 kg). Its long coat is yellowish to reddish brown above and whitish below, with black spots or stripes; there are some all-black servals in Kenya.

Serval (*Felis serval*)
CHRISTINA LOKE—PHOTO RESEARCHERS

server Network computer, computer program, or device that processes requests from a client (see client-server architecture). On the World Wide Web, for example, a Web server is a computer that uses the HTTP protocol to send Web pages to a client's computer when the client requests them. On a local area network, a print server manages one or more printers, and prints files sent to it by client computers. Network servers (which manage network traffic) and file servers (which store and retrieve files for clients) are two more examples of servers.

Servetus \sər-'vē-təs**, Michael** *orig.* **Miguel Servet** (b. 1511?, Villanueva or Tudela, Spain—d. Oct. 27, 1553, Champel, Switz.) Spanish physician and theologian. His views alienated both Roman Catholics and Protestants, beginning with the publication of his first book, *De Trinitatis erroribus* (1531), in which he denied the Holy Trinity. His most important work, *Biblia sacra ex Santis Pagnini translatione* (1542), was notable

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for its theory of prophecy. Elsewhere he questioned the usefulness of baptism and criticized the promulgation of the NICENE CREED. Persecuted by JOHN CALVIN, he was convicted of heresy in Geneva and burned at the stake. His notable contribution to medicine was the first accurate description of cardiopulmonary circulation of the blood (1553).

Service, Robert (William) (b. Jan. 16, 1874, Preston, Lancashire, Eng.—d. Sept. 11, 1958, Lancieux, France) English-born Canadian popular verse writer. He immigrated to Canada in 1894 and lived eight years in the Yukon. His *Songs of a Sourdough* (1907) and *Ballads of a Cheechako* (1909), about life in the "frozen North," were enormously popular. He became known as "the Canadian Kipling" with such rollicking ballads as "The Shooting of Dan McGrew" and "The Cremation of Sam McGee". His other works include the novel *The Trail of '98* (1910) and *Rhymes of a Red Cross Man* (1916).

service industry Industry that provides services rather than goods. Economists divide the products of all economic activity into two broad categories, goods and services. Industries that produce goods (tangible objects) include agriculture, mining, manufacturing, and construction. Service industries include everything else: banking, communications, wholesale and retail trade, all professional services such as engineering and medicine, all consumer services, and all government services. The proportion of the world economy devoted to services rose rapidly in the 20th century. In the U.S., the service sector accounted for more than half the gross domestic product in 1929, two-thirds in 1978, and more than three-quarters in 1993. As increases in AUTOMATION facilitate productivity, a smaller workforce is able to produce more goods, and the service functions of distribution, management, FINANCE, and sales become relatively more important.

servitude In property law, a right by which property owned by one person is subject to a specified use or enjoyment by another. Servitudes allow people to create stable long-term arrangements for a wide variety of purposes, including shared land uses; maintaining the character of a residential neighbourhood, commercial development, or historic property; and financing infrastructure and common facilities. Modern European CIVIL LAW is derived from ROMAN LAW, which divides real servitudes into rural (those owed by one estate to another) and urban (those established for convenience). Rural servitudes include various rights of way; urban servitudes include building rights in neighbouring properties, such as drainage and encroachment rights, and rights to light, support, and view. See also EASEMENT.

servomechanism Device used to correct the performance of a mechanism automatically, by means of error-sensing feedback. The term properly applies only to systems in which the feedback and error-correction signals control mechanical position or velocity. Servomechanisms were first used in military and marine navigation equipment. Today they are used in automatic machine tools, satellite-tracking antennas, celestial-tracking systems on telescopes, automatic navigation systems, and antiaircraft-gun control systems. The design of servomechanisms is considered to be a branch of both ROBOTICS and CYBERNETICS.

sesame Erect, annual plant (*Sesamum indicum*) of numerous types and varieties in the family Pedaliaceae. It has been cultivated since antiquity for its seeds, which are used as food and flavouring and yield a prized oil. The hulled seeds, creamy or pearly white and tiny, have a mild, nutlike aroma and taste. The whole seed is used extensively in the cuisines of the Middle East and Asia. Sesame oil, noted for its stability and its resistance to becoming rancid, is used as a salad or cooking oil, in shortening and margarine, in the manufacture of soaps, pharmaceuticals, and lubricants, and as an ingredient in cosmetics.

Sessions, Roger (Huntington) (b. Dec. 28, 1896, Brooklyn, N.Y., U.S.—d. March 16, 1985, Princeton, N.J.) U.S. composer. He attended Harvard and Yale, lived in Italy and Germany (1925–33), and later taught principally at Princeton University (1935–45, 1953–65). His early interest in Neoclassicism was replaced c. 1953 by his adoption of SERIALISM. His works include the operas *The Trial of Lucullus* (1947) and *Montezuma* (1963), incidental music to *The Black Maskers* (1923), eight symphonies, a *Concerto for Orchestra* (1982, Pulitzer Prize), and the cantata *When Lilacs Last in the Door-yard Bloom'd* (1970), as well as several widely read books on music.

set In mathematics and logic, any collection of objects (elements), which may be mathematical (e.g., numbers, FUNCTIONS) or not. The intuitive idea of a set is probably even older than that of NUMBER. Members of a herd of animals, for example, could be matched with stones in a sack without members of either set actually being counted. The notion extends into the infinite. For example, the set of integers from 1 to 100 is finite, whereas the set of all integers is infinite. A set is commonly represented as a list of all its members enclosed in braces. A set with no members is called an empty, or null, set, and is denoted ∅. Because an infinite set cannot be listed, it is usually represented by a formula that generates its elements when applied to the elements of the set of counting numbers. Thus, $\{2x \mid x = 1,2,3,...\}$ represents the set of positive even numbers (the vertical bar means "such that").

set theory Branch of mathematics that deals with the properties of SETS. It is most valuable as applied to other areas of mathematics, which borrow from and adapt its terminology and concepts. These include the operations of union (∪), and intersection (∩). The union of two sets is a set containing all the elements of both sets, each listed once. The intersection is the set of all elements common to both original sets. Set theory is useful in analyzing difficult concepts in mathematics and LOGIC. It was placed on a firm theoretical footing by GEORG CANTOR, who discovered the value of clearly formulated sets in the analysis of problems in symbolic logic and NUMBER THEORY.

setback In architecture, a steplike recession in the profile of a high-rise building. Usually dictated by BUILDING CODES to allow sunlight to reach streets and lower floors, the building must take another step back from the street for every specified added height interval. Without building setbacks, many of New York City's streets would be in constant shadow. In the 1920s architects drew attention to their setbacks with decorative devices—mosaics; Chinese, Mayan, or Greek motifs; or geometric blocks—but later architects deemphasized them. The INTERNATIONAL STYLE glass-wall skyscraper was typically built without intermittent setbacks, but architects met zoning requirements by creating one huge setback at ground level that created a plaza. The late 20th century saw a return to decorative setbacks.

Seth *or* **Set** Ancient Egyptian god and patron of the 11th nome, or province, of Upper Egypt. A trickster, he was a sky god, lord of the desert, and master of storms, disorder, and warfare. He was the brother of OSIRIS, whom he killed, and he was antagonistic to HORUS, the child of Osiris's sister, ISIS. Seth's cult largely died out in the 1st millennium BC, and he was gradually ousted from the Egyptian pantheon. He was later regarded as entirely evil and identified as a god of the Persians and other invaders of Egypt.

SETI *in full* **search for extraterrestrial intelligence** Ongoing effort to seek intelligent extraterrestrial life. SETI focuses on receiving and analyzing signals from space, particularly in the RADIO and visible-LIGHT regions of the ELECTROMAGNETIC SPECTRUM, looking for nonrandom patterns likely to have been sent either deliberately or inadvertently by technologically advanced beings. The first modern SETI search was Project OZMA (1960), which made use of a RADIO TELESCOPE in Green Bank, W.Va. SETI approaches include targeted searches, which typically concentrate on groups of nearby sunlike stars, and systematic surveys covering all directions. The value of SETI efforts has been controversial; programs initiated by NASA in the 1970s were terminated by congressional action in 1993. Subsequently, SETI researchers organized privately funded programs—e.g., the targeted-search Project Phoenix in the U.S. and the survey-type SERENDIP projects in the U.S. and Australia. See also DRAKE EQUATION.

Seti I (d. 1279 BC) Egyptian king of the 19th dynasty (r. 1290–79 BC). His father, Ramses I, had reigned only two years, and it was Seti who was the real founder of the greatness of the Ramessids. Seti did much to promote Egypt's prosperity. He fortified the frontier, opened mines and quarries, dug wells, and rebuilt temples and shrines; he continued work on the great hall at KARNAK and built a temple at ABYDOS decorated with reliefs of great delicacy.

Seton \sē-tᵊn**, Saint Elizabeth Ann** *orig.* **Elizabeth Ann Bayley** *known as* **Mother Seton** (b. Aug. 28, 1774, New York, N.Y.—d. Jan. 4, 1821, Emmitsburg, Md., U.S.; canonized Sept. 14, 1975; feast day January 4) U.S. religious leader and educator, the first native-born U.S. citizen canonized by the Roman Catholic church. Born into an upper-class family, she married William Magee Seton in 1794. In 1797 she founded the Society for the Relief of Poor Widows with Small Children, and in 1803 she was herself left a widow with five children. After converting

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from Episcopalianism to Roman Catholicism in 1805, she opened a free Catholic elementary school in Baltimore, Md., in 1809. In 1813 she founded the Sisters of Charity, the first U.S. religious order, and she served as its superior until her death. She is often considered the mother of the parochial school system in the U.S.

Seton \'sē-tᵊn**, Ernest Thompson** *orig.* **Ernest Evan Thompson** *also called* **Ernest E.T. Seton** *or* **Ernest Seton-Thompson** (b. Aug. 14, 1860, South Shields, Durham, Eng.—d. Oct. 23, 1946, Seton Village, Santa Fe, N.M., U.S.) British-born U.S. naturalist and animal fiction writer. Seton's family emigrated to Canada from England in 1866. He earned a living for a time as a wild-animal artist, and in 1898 he published his most popular book, the story collection *Wild Animals I Have Known*. Deeply concerned for the future of the North American prairie, he fought to establish reservations for American Indians and parks for endangered animals. In 1902 he founded the Woodcraft Indians to give children opportunities for nature study. He chaired the committee that established the Boy Scouts of America.

setter Any of three breeds derived from a medieval hunting dog that would set (lie down) when it found birds so that it and the birds could be covered with a net. Setters have long hair on the ears, chest, legs, and tail. They weigh 44–70 lbs (20–32 kg) and stand 23–27 in. (58–69 cm). The English setter, developed in the 15th century, may be all white, black and white-and-tan, or white with dark flecks. The Gordon setter originated in 17th-century Scotland; its soft, wavy coat is black with tan markings. The Irish setter, bred in Ireland in the 18th-cent, has a straight red coat.

Irish setter
SALLY ANNE THOMPSON/EB INC.

Settignano, Desiderio da See Desiderio da Settignano

settlement In law, a compromise or agreement between litigants to settle the matters in dispute between them in order to dispose of and conclude their litigation. Generally, as a result of the settlement, prosecution of the action is withdrawn or dismissed without any judgment being entered. The parties may, however, incorporate the terms of the settlement into a consent decree, recorded by the court. Most suits brought today are either withdrawn or settled.

Settlement, Act of (June 12, 1701) Act of Parliament that thereafter regulated the succession to the English throne. It decreed that if King William III or Princess (later Queen) Anne died without issue, the crown was to pass to James I's granddaughter Sophie of Hanover (1630–1714) and her Protestant heirs. The act resulted in the accession of the house of Hanover in 1714. It also decreed that future monarchs must belong to the Church of England, that judges were to hold office on the basis of good behaviour rather than at the sovereign's pleasure, and that impeachment by the House of Commons was not subject to pardon by the sovereign.

settlement house *or* **social settlement** *or* **community centre** Neighbourhood social-welfare agency. The staff of a settlement house may sponsor clubs, classes, athletic teams, and interest groups; they may employ such specialists as vocational counselors and caseworkers. The settlement movement began with the founding of Toynbee Hall in London in 1884 by Samuel Augustus Barnett (1844–1913). It spread to the U.S. in the late 19th century with the establishment of such institutions as Chicago's Hull House (founded by Jane Addams). Many countries now have similar institutions. In the late 19th and early 20th centuries, U.S. settlement houses were active among the masses of new immigrants and worked for reform legislation such as workers' compensation and child-labour laws.

settling In building construction, the gradual subsiding of a structure as the soil beneath its foundation consolidates under loading. This may continue for several years after the structure's completion. Primary consolidation occurs as water is squeezed out from the voids within the soil mass. Secondary consolidation results from adjustments in the internal structure of the soil mass under a sustained load. Whenever the possibility of settlement exists, care must be taken to choose a structural system and foundation capable of adapting. Fixed-end beams present a problem as they are incapable of rotating under uneven settlement loads and bend in response to the stress; simply supported beams, the ends of which act as hinges, will rotate slightly and remain straight. Special columns with jacking devices may then be used to level the beams. Floating foundations and piles are often used to overcome the problems of building on yielding soils. See also soil mechanics.

Seurat \sœ-'rä**, Georges (-Pierre)** (b. Dec. 2, 1859, Paris, Fr.—d. March 29, 1891, Paris) French painter. He entered the École des Beaux-Arts in 1878 and exhibited at the 1883 Salon, though he had already lost sympathy with its conservative policies. He studied scientific works in an effort to achieve scientifically the colour effects that the Impressionists had pursued, and developed Pointillism, the technique of juxtaposing tiny brushstrokes of contrasting colours to portray the play of light. Employing this method, he created huge compositions, including his masterpiece, *Sunday Afternoon on the Island of La Grande Jatte* (1884–86). He and other artists working in this style became known as Neo-Impressionists. As an aesthetic theorist, he explored the effects that could be achieved with the three primary colours and their complements.

Seuss, Doctor See Theodor Geisel

Sevan \sə-'vän**, Lake** Lake, northern Armenia. It has an area of some 525 sq mi (1,360 sq km). Lying at 6,250 ft (1,905 m) above sea level in a mountain-enclosed basin, it is Armenia's largest lake and is in two connected parts: the smaller Maly Sevan and the Bolshoy Sevan. It is rich in fish. Several ancient Armenian churches lie along the shore.

Sevastopol *formerly* **Sebastopol** \sə-'vas-tə-ˌpōl\ Seaport city (pop., 2001: 342,000) in the Crimea, southern Ukraine. In 1783 the Russians annexed the Crimea, and, near the ancient Greek colony of Chersonesus, they began construction of a naval base on Sevastopol Bay, an inlet of the Black Sea. It became a commercial port in the early 19th century. It was besieged by Anglo-French forces for 11 months (1854–55) during the Crimean War, an ordeal chronicled by Leo Tolstoy in his *Sevastopol Sketches*. The devastated town was later rebuilt, and it was the anti-Bolshevik White Army headquarters in the Russian Civil War (1918–20). In World War II it was destroyed after a months-long siege by the Germans, but again it was reconstructed. The chief base of the Russian Black Sea fleet since the early 19th century, it has extensive dockyard facilities and arsenals. The Ukrainian naval forces are also now based in Sevastopol.

Seven, Group of Toronto-centred group of Canadian painters devoted to landscape painting (especially of northern Ontario subjects) and the creation of a national style. A number of future members met in 1913 while working as commercial artists in Toronto. The group adopted its name on the occasion of a group exhibition held in 1920. The original members included J.E.H. MacDonald, Lawren S. Harris, Arthur Lismer, F.H. Varley, Franklin Carmichael, Frank H. Johnston, and Alexander Young Jackson. The group was particularly influential in the 1920s and '30s. In 1933 the name was changed to the Canadian Group of Painters.

Seven Cities of Cíbola See Seven Cities of Cíbola

Seven Days' Battles (June 25–July 1, 1862) American Civil War battles that prevented Union capture of Richmond, Va. In a series of attacks and counterattacks by both sides, the Confederate army under Robert E. Lee forced Union troops under George B. McClellan to retreat from a position 4 mi (6 km) east of the Confederate capital to a new base on the James River. The Union failure to take Richmond and the withdrawal of the Army of the Potomac ended the Peninsular Campaign. Casualties were estimated at 16,000 for the Union and 20,000 for the Confederates.

Seven Oaks Massacre (1816) Destruction of a Canadian fur-trading settlement. Sixty Métis, directed by an agent of the North West Co., attempted to run provisions past the rival Hudson's Bay Co. settlement on the Red River. They were intercepted by the colony's governor and 25 soldiers at Seven Oaks, near the settlement. An argument grew into a fight in which the Métis killed 20 men, including the governor. They then threatened the remaining settlers with massacre, forcing them to abandon the colony. The settlement was restored the next year.

Seven Weeks' War *or* **Austro-Prussian War** (June–August 1866) Conflict between Prussia on one side and Austria, Bavaria, Saxony, Hanover, and minor German states on the other. A contrived dispute by Prussia's Otto von Bismarck over the Schleswig-Holstein Question resulted

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in the June 1866 Prussian attack on Austrian forces in Bohemia. The Prussian army, modernized and reorganized by Albrecht Theodor Emil, count von Roon, and Helmuth von Moltke, decisively defeated Austria at the Battle of Königgrätz and elsewhere. By August the war was formally concluded by the Treaty of Prague, which assigned Schleswig-Holstein and other territories to Prussia. The effect of the war was to exclude Austria from Germany.

Seven Wonders of the World Preeminent architectural and sculptural achievements of antiquity, as listed by various Greco-Roman observers. Included on the best known list were the Pyramids of Giza (the oldest of the wonders and the only one substantially in existence today), the Hanging Gardens of Babylon (a series of landscaped rooftop terraces on a ziggurat, ascribed to either Nebuchadnezzar II or the semilegendary Queen Sammu-ramat), the Statue of Zeus at Olympia (a large gold-and-ivory figure of the god on his throne by Phidias), the Temple of Artemis at Ephesus (a temple, built in 356 BC, famous for its imposing size and the works of art that adorned it), the Mausoleum of Halicarnassus, the Colossus of Rhodes, and the Pharos of Alexandria (a lighthouse built c. 280 BC on the island of Pharos off Alexandria, said to have been more than 350 ft, or 110 m, high). These wonders inspired the compilation of many other lists of seven attractions, or "wonders," by later generations.

Seven Years' War (1756–63) Major European conflict between Austria and its allies France, Saxony, Sweden, and Russia on one side against Prussia and its allies Hanover and Britain on the other. The war arose out of Austria's attempt to win back the rich province of Silesia, taken by Prussia in the War of the Austrian Succession. Early victories by Frederick II the Great in Saxony and Bohemia (1756–58) were offset by a decisive Prussian defeat by Austria and Russia near Frankfurt (1759). After inconclusive fighting in 1760–61, Frederick concluded a peace with Russia (1762) and drove the Austrians from Silesia. The war also involved the overseas colonial struggles between Britain and France in North America (see French and Indian War) and in India. The European conflict was settled with the Treaty of Hubertusburg, by which Frederick confirmed Prussia's stature as a major European power.

Seventh-day Adventist See Adventist

Severn \'se-vərn**, River** *Welsh* **Hafren** \'hä-vren\ *ancient* **Sabrina** River, eastern Wales and western England. Britain's longest river, it is 180 mi (290 km) long from its source to tidal waters. It rises in east-central Wales and crosses the English border near Shrewsbury, continuing south to the Bristol Channel and the Atlantic Ocean.

Severus \sə-'vir-əs**, Septimius** *in full* **Lucius Septimius Severus Pertinax** (b. AD 145, Leptis Magna, Tripolitania—d. Feb. 4, 211, Eboracum, Britain) Roman emperor (193–211). He was in Europe in command of Rome's largest army when the emperor Publius Helvius Pertinax was murdered. Named emperor by his troops, he marched on Rome, entering the city without resistance. He effectively made Rome a military monarchy, giving the army a dominant role in government, ignoring the Senate, choosing officials from among the *equites* (see eques) and granting control of the courts to the Praetorian prefect. He annexed Mesopotamia, and he died attempting to subdue non-Roman Britain. He named his son Caracalla his successor.

Severus Alexander *in full* **Marcus Aurelius Severus Alexander** *orig.* **Gessius Bassianus Alexianus** (b. c. AD 209, Phoenicia—d. 235, Gaul) Roman emperor (222–235). At age 14 he succeeded Elagabalus, who had been murdered by the Praetorian Guard. Severus's mother and grandmother both held real power during his reign. A council of senators gave nominal ruling power to the Senate. Civil lawlessness reigned, and Severus's military incompetence led to defeat by the Persians, though their heavy losses forced them to withdraw from Mesopotamia. When he bought peace from the invading Germanic Alemanni, his indignant soldiers murdered him and his mother.

Sevier \sə-'vir**, John** (b. Sept. 23, 1745, New Market, Va.—d. Sept. 24, 1815, Fort Decatur, Mississippi Territory) American frontiersman and politician. He moved to what is now eastern Tennessee in 1773, where he fought in Lord Dunmore's War. In the American Revolution he helped win the Battle of King's Mountain (1780). He participated in a settlers' revolt against North Carolina that formed the temporary state of Franklin (1784) and was elected its governor (1785–88). He served in the U.S. House of Representatives from North Carolina (1789–91). When Tennessee joined the Union, he served as its governor (1796–1801, 1803–09).

Sévigné \sā-vēn-'yā**, Marquise de** *orig.* **Marie de Rabutin-Chantal** (b. Feb. 5, 1626, Paris, France—d. April 17, 1696, Grignan) French writer. Of old Burgundian nobility, she was well educated and moved in court society in Paris after her marriage in 1644. She was devoted to her children, and, after her daughter married and moved to Provence, she began writing letters to her, without literary intention, that recounted events, described people and details of daily life, and commented on many topics. The stories and gossip in the 1,700 letters of this correspondence, related in a natural, spontaneous tone, provide a vivid picture of the 17th-century French aristocracy.

Sevilla \sā-'vē-yä\ *English* **Seville** \sə-'vil\ *ancient* **Hispalis** City (pop., 2005 est.: city, 704,154; 2001: urban agglom., 1,180,197), capital of Sevilla province and Andalusia autonomous community (*comunidad autónoma*), Spain. Located on the Guadalquivir River, it is Spain's leading inland port and fourth largest city. Originally an Iberian town, Sevilla prospered under the Romans in the 2nd century BC. In the 5th–8th centuries AD it was the chief city in southern Spain under the Vandals and the Visigoths. In 711 it fell to the Moors, and under Muslim rule it was a cultural and commercial centre until the 13th century, when Spanish Christians under Ferdinand III captured it. About 1500 Sevilla became the centre of the Spanish colonial trade with the Americas. The French occupied the city (1808–12), and during the Spanish Civil War (1936–39) it was held by the Nationalists. It is one of Spain's main tourist centres, with historic mosques, cathedrals, and the 12th-century Alcázar Palace. It was the site of the Iberoamerican Exposition in 1929 and the Universal Exposition in 1992. The University of Sevilla was founded in 1502.

Sèvres \'sevrᵊ**, Treaty of** (Aug. 10, 1920) Pact at the end of World War I between the Allied Powers and the government of Ottoman Turkey, signed at Sèvres, France. It abolished the Ottoman Empire, obliged Turkey to renounce rights over Arab Asia and North Africa, and provided for an independent Armenia, an autonomous Kurdistan, and Greek control over the Aegean islands commanding the Dardanelles. These provisions were rejected by the new Republic of Turkey, and the treaty was replaced in 1923 by the Treaty of Lausanne.

Sèvres \'sev-rə\ **porcelain** French hard-paste, or true, porcelain, as well as soft-paste porcelain, made at the royal (now national) factory of Sèvres from 1756 until the present. After the decline of Meissen porcelain after 1756, Sèvres became the leading porcelain factory in Europe, thanks in large part to the patronage of Louis XV's mistress, Madame de Pompadour, who involved the foremost artists of the day (e.g., François Boucher and Étienne-Maurice Falconet) in the enterprise. Sèvres porcelain is famous for many styles and techniques, including white figures representing cupids, shepherdesses, or nymphs and the embellishment of grounds with minute patterns in gold.

Sèvres soft-paste porcelain jardiniere decorated with flowers and cupids painted in reserves on *rose Pompadour* ground, 1761; in the Victoria and Albert Museum, London

COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, WILFRID WALTER—EB INC.

Sewa \'sē-wə\ **River** River, Sierra Leone. Formed by the junction of the Bagbe and Bafi rivers, it flows 150 mi (240 km) to join the Waanje River and form the Kittam, which empties into the Atlantic Ocean. The country's most important commercial river, it is extensively panned for diamonds.

sewage system Collection of pipes and mains, treatment works, and discharge lines (sewers) for the wastewater of a community. Early civilizations often built drainage systems in urban areas to handle storm runoff. The Romans constructed elaborate systems that also drained wastewater from the public baths. In the Middle Ages these systems fell into disrepair. As the populations of cities grew, disastrous epidemics of cholera and typhoid fever broke out, the result of ineffective separation of sewage and drinking water. In the mid-19th century the first steps were taken to treat wastewater. The concentration of population and the addition to sewage of manufacturing waste that occurred during the Industrial

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Revolution increased the need for effective sewage treatment. Sewer pipe is laid following street patterns, and access holes with metal covers allow periodic inspection and cleaning. Catch basins at street corners and along street gutters collect surface runoff of storm water and direct it to the storm sewers. Civil engineers determine the volume of sewage likely, the route of the system, and the slope of the pipe to ensure an even flow by gravity that will not leave solids behind. In flat regions, pumping stations are sometimes needed. Modern sewage systems include domestic and industrial sewers and storm sewers. Sewage treatment plants remove organic matter from waste water through a series of steps. As sewage enters the plant, large objects (such as wood and gravel) are screened out; grit and sand are then removed by settling or screening with finer mesh. The remaining sewage passes into primary sedimentation tanks where suspended solids (sludge) settle out. The remaining sewage is aerated and mixed with microorganisms to decompose organic matter. A secondary sedimentation tank allows any remaining solids to settle out; the remaining liquid effluent is discharged into a body of water. Sludge from the sedimentation tanks may be disposed of in landfills, dumped at sea, used as fertilizer, or decomposed further in heated tanks (digestion tanks) to produce methane gas to power the treatment plant.

Sewall \'sü-əl**, Samuel** (b. March 28, 1652, Bishopstoke, Hampshire, Eng.—d. Jan. 1, 1730, Boston, Mass.) British-American colonial merchant and jurist. He immigrated to America as a boy and became manager of the New England colonial printing press (1681–84) and a member of the governor's council (1684–1725). In 1692 he was appointed to preside at the Salem witch trials, in which 19 people were executed. Later admitting the error of the court's decision, he stood silently in the Old South Church in Boston in 1697 while his confession of error and guilt was read aloud. His three-volume *Diary* (published 1878–82) provides a view of New England Puritan life.

Seward \'sü-ərd**, William H(enry)** (b. May 16, 1801, Florida, N.Y., U.S.—d. Oct. 10, 1872, Auburn, N.Y.) U.S. politician. He served in the New York state senate (1830–34) and as governor (1839–43). In the U.S. Senate (1849–61), he was an antislavery leader in the Whig and Republican parties. A close adviser to Pres. Abraham Lincoln, he served as U.S. secretary of state (1861–69). He helped prevent foreign recognition of the Confederacy and obtained settlement in the Trent Affair. In 1865 he was stabbed by a conspirator of John Wilkes Booth but recovered. He is best remembered for successfully negotiating the Alaska Purchase (1867), which critics called Seward's Folly.

Seward \'sü-ərd\ **Peninsula** Peninsula, western Alaska, U.S. Its tip, Cape Prince of Wales, on the Bering Strait, is the most westerly point of North America. The peninsula is about 180 mi (290 km) long and 130 mi (209 km) wide; its highest peak is 4,720 ft (1,439 m), in the Kigluaik Mountains. The city of Nome is on its southern coast.

Sewell \'sü-əl**, Anna** (b. March 30, 1820, Yarmouth, Norfolk, Eng.—d. April 25, 1878, Old Catton, Norfolk) British writer. She was introduced to writing by her mother, an author of juvenile best-sellers, and her concern for the humane treatment of horses began early in life. Confined to her house as an invalid, she spent her last years writing the children's classic *Black Beauty* (1877), a fictional autobiography of a gentle, highbred horse. It had a strong moral purpose and is said to have been instrumental in abolishing the cruel practice of using the checkrein (a short rein used to prevent a horse from lowering its head).

sewing machine Machine for stitching material (such as cloth or leather), usually having a needle and shuttle to carry thread and powered by treadle or electricity. Invented by Elias Howe in 1846 and successfully manufactured by Howe and Isaac Merritt Singer, it became the first widely distributed mechanical home appliance and has also been an important industrial machine. Modern sewing machines are usually powered by an electric motor, but the foot-treadle machine is still in wide use in much of the world.

sex Sum of features by which a member of a plant or animal species can be placed into one of two complementary reproductive groups, male or female. In both plants and animals, sex is determined by the reproductive cells (gametes) produced by the organism. The male produces sperm cells, and the female produces egg cells. Males and females may or may not have apparent structural differences, but they always have functional, hormonal, and chromosomal differences. Patterns of behaviour, sometimes elaborate, may also distinguish the sexes in some species. See also reproductive behaviour.

sex chromosome Either of a pair of chromosomes that determine whether an individual is male or female. The sex chromosomes of mammals are designated X and Y; in humans, they constitute one pair of the total 23 pairs of chromosomes. Individuals possessing two X chromosomes (XX) are female; those having one X and one Y chromosome (XY) are male. The X chromosome is larger and carries more genetic information than the Y. Traits controlled only by genes found on the X chromosome (e.g., hemophilia, red-green colour blindness) are said to be sex-linked. Sex-linked traits occur far more frequently in males than in females, since a male inheriting an allele for a recessive (see recessiveness) trait on the X chromosome lacks a corresponding allele on the Y chromosome that might counteract its effects. Several disorders are associated with an abnormal number of sex chromosomes, including Turner syndrome and Klinefelter syndrome.

sex linkage See linkage group

sextant Instrument for determining the angle between the horizon and a celestial body—such as the Sun, the Moon, or a star—used in celestial navigation to determine latitude and longitude. It consists of a metal arc, marked in degrees, and a movable radial arm pivoted at the centre of the arc's circle. A telescope, mounted rigidly to the framework, is lined up with the horizon. The radial arm, on which a mirror is mounted, is moved until the star is reflected into a half-silvered mirror in line with the telescope and appears, through the telescope, to coincide with the horizon. The angular distance of the star above the horizon is then read from the graduated arc of the sextant. From this angle, the latitude can be determined (within a few hundred metres) by means of published tables, and by consulting an accurate chronometer the longitude can be established. Invented in 1731, the sextant replaced the octant and became an essential tool of navigation.

Sexton, Anne *orig.* **Anne Gray Harvey** (b. Nov. 9, 1928, Newton, Mass., U.S.—d. Oct. 4, 1974, Weston, Mass.) U.S. poet. She worked as a model, librarian, and teacher. Her first book of poetry, *To Bedlam and Part Way Back* (1960), examines her mental breakdowns and subsequent recoveries with confessional intensity. She continued probing her personal life in *All My Pretty Ones* (1962) and *Live or Die* (1966, Pulitzer Prize). Her other works include the nonfiction collection *No Evil Star* (1985). She died a suicide. Several volumes of poetry were published posthumously.

sexual dysfunction Inability to experience arousal or achieve sexual satisfaction under ordinary circumstances, as a result of psychological or physiological problems. The most common sexual dysfunctions have traditionally been referred to as impotence (applied to males) and frigidity (females), but these terms have gradually been replaced by more specific terms. Most sexual dysfunctions can be overcome through use of counseling, psychotherapy, or drug therapy.

sexual harassment Unsolicited verbal or physical behaviour of a sexual nature. Sexual harassment may embrace any sexually motivated behaviour considered offensive by the recipient. Legal recourse is available in cases that occur in the workplace, though it is very difficult to obtain convictions. In 1994 the Supreme Court of the United States ruled that behaviour can be considered sexual harassment and an abridgment of an individual's civil rights if it creates a hostile and abusive working environment.

sexual intercourse *or* **coitus** *or* **copulation** Act in which the male reproductive organ enters the female reproductive tract (see reproductive system). Various sexual activities (foreplay) lead to physiological changes that progress to orgasm (climax) and resolution (see sexual response). If it is completed, semen passes from the male into the female's body. If conditions favour fertilization, a sperm joins with an egg, and pregnancy begins (see fertility; reproduction); contraception can prevent this. Intercourse with an unwilling female is rape. See also reproductive behaviour; sexuality, human; sexually transmitted disease.

sexual response Four-stage series of physiological reactions to sexual stimulation. Persons do not necessarily progress through all four stages, nor need two persons pass through them simultaneously. If the two partners are of opposite sex, sexual response may lead to sexual intercourse. In excitement, muscles tense and heart rate increases; in males, the penis becomes erect; in females, the inner vagina widens, its walls become moist, and the clitoris enlarges. In the plateau stage, breathing accelerates and muscles continue tensing; the testes and glans of the penis

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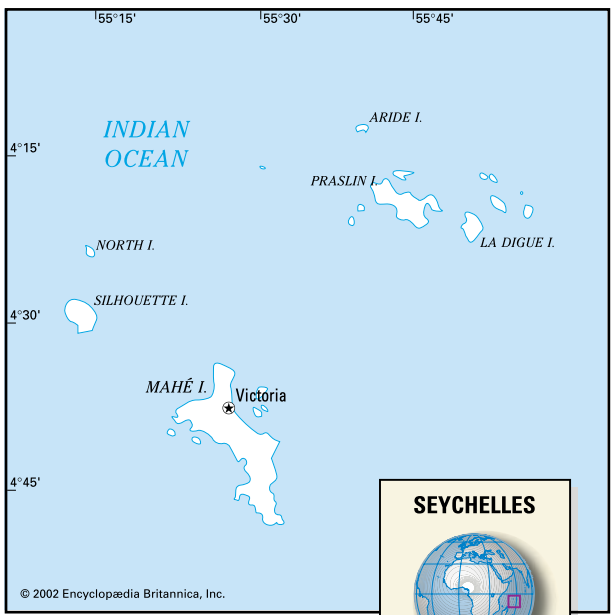
enlarge; the outer vagina contracts and the clitoris retracts. At orgasm the muscle tension is quickly released; the penis contracts repeatedly, ejaculating SEMEN; the vagina contracts regularly. In resolution, the genitals of both return to their pre-arousal condition; men cannot become aroused for some minutes or hours; women can quickly become aroused again.

sexuality, human Tendencies and behaviour of human beings with regard to any activity that causes or is otherwise associated with sexual arousal. It is strongly influenced by the genetically inherited SEXUAL RESPONSE patterns that ensure reproduction (see REPRODUCTIVE BEHAVIOUR), societal attitudes toward sex, and each individual's upbringing. Physiology sets only very broad limits on human sexuality; most of the enormous variation found among humans results from learning and conditioning. What is deviant in one society may be normal in another. Sexuality covers gender identity, sexual orientation, and actual practices, as well as one's acceptance of these aspects of one's personality, which may be more important than their specifics. See also HOMOSEXUALITY; TRANSSEXUALISM.

sexually transmitted disease (STD) Disease transmitted primarily by direct sexual contact. STDs usually affect the REPRODUCTIVE SYSTEM and URINARY system but can be spread to the mouth or rectum by oral or anal sex. In later stages they may attack other organs and systems. The best-known are SYPHILIS, GONORRHEA, AIDS, and HERPES SIMPLEX. Yeast infections (see CANDIDA) produce a thick, whitish vaginal discharge and genital irritation and itch in women and sometimes irritation of the penis in men. Crab louse infestation (see LOUSE, HUMAN) can also be considered an STD. The incidence of STDs has been affected by such factors as ANTIBIOTICS, BIRTH-CONTROL methods, and changes in sexual behaviour. See also CHLAMYDIA; HEPATITIS; PELVIC INFLAMMATORY DISEASE; WART.

Seybouse River \sā-'büz\ River, northeastern Algeria. It rises at the eastern edge of the Sétif plains, rushes through a narrow gorge in Mount Nador, and flows through a tree-lined valley to the Mediterranean Sea south of ANNABA. Unnavigable except for its estuary, it is 145 mi (232 km) long.

Seychelles \sā-'shel, sā-'shelz\ *officially* **Republic of Seychelles** Island country, western Indian Ocean. Area: 176 sq mi (455 sq km). Population (2005 est.): 82,800. Capital: VICTORIA. The mixed population is



of French, African, and Asian ancestry. Languages: Creole, English, French. Religion: Christianity (predominantly Roman Catholic; also Protestant). Currency: Seychelles rupee. Located east of northeastern Tanzania, Seychelles is composed of two main island groups: the Mahé group of 40 central, mountainous, granitic islands and a second group of more than 70 outlying, flat, coralline islands. The country has a developing economy that depends heavily on tourism. Exports include fish, copra, and cinnamon. It is a republic with one legislative house; its head of state and government is the president. The first recorded landing on uninhabited Seychelles was made in 1609 by an expedition of the British EAST INDIA COMPANY. The archipelago was claimed by the French in 1756 and surrendered to the British in 1810. It became a British crown colony in 1903 and a republic within the COMMONWEALTH in 1976. A one-party socialist state since 1979, it held multiparty elections in 1992 and adopted a new constitution in 1993.

Seymour, Jane See JANE Seymour

Seyss-Inquart \'zīs-'iŋk-ˌvärt**, Arthur** (b. July 22, 1892, Stannern, near Iglau, Bohemia, Austria-Hungary—d. Oct. 16, 1946, Nürnberg, Ger.) Austrian Nazi leader. He served in the Austro-Hungarian army during World War I and was seriously wounded. Later a lawyer in Vienna, he became a leader of the moderate faction of the Austrian Nazis and served on the federal council of state (1937–38). In response to German pressure, he was named minister of interior and security and then replaced KURT VON SCHUSCHNIGG as chancellor (1938). He welcomed the ANSCHLUSS by Germany and became governor of the Austrian administration (1938–39). In World War II he was German high commissioner of The Netherlands (1940–45) and carried out the Nazi policy against Dutch Jews. He was tried at the NÜRNBERG TRIALS and executed as a war criminal.

Sezession \zā-tses-'yōn\ Name for several groups of progressive artists that broke away from established and conservative artists' organizations in Austria and Germany. The first secession group was formed in Munich in 1892. It was followed by the Berlin Sezession movement, formed by Max Liebermann in 1892, which included such artists as LOVIS CORINTH. The most famous of the groups, formed in Vienna in 1897 by GUSTAV KLIMT, favoured a highly ornamental ART NOUVEAU style over the prevailing academicism. Shortly thereafter, murals created by Klimt for the ceiling of the University of Vienna auditorium were rejected as scandalous because of their erotic symbolism. The Sezession movement influenced such artists and architects as EGON SCHIELE and JOSEF HOFFMANN. See also PHOTO-SECESSION.

Sfax \'sfaks\ *or* **Ṣafāqis** \sə-'fä-kis\ Port city (pop., 1994: 230,900), east-central Tunisia. Built on the site of two ancient settlements, the city grew as an Islamic trading centre. It was occupied by the Normans in the 12th century and by the Spanish in the 16th century, and later served as a stronghold of the BARBARY COAST pirates. The town was bombarded by the French in 1881 prior to their occupation of Tunisia and again in World War II (1939–45), when it was a base for German forces until taken by the British in 1943. Tunisia's second-largest city, it is a transportation hub and a major fishing port.

Sforim, Mendele Moykher See MENDELE MOYKHER SFORIM

Sforza \'sfȯrt-sä**, Carlo, Count** (b. Sept. 25, 1873, Montignoso di Lunigiana, Italy—d. Sept. 4, 1952, Rome) Italian diplomat. He entered the diplomatic service in 1896 and served in embassies worldwide. He served as minister for foreign affairs (1920–21) and as Italy's ambassador to France (1922), but he resigned after refusing to serve under BENITO MUSSOLINI. A strong antifascist, he lived in voluntary exile in Belgium until 1939 and in the U.S. (1940–43). He returned to Italy after World War II to serve in various government posts, including minister of foreign affairs (1947–51).

Sforza, Francesco (b. July 23, 1401, San Miniato, Tuscany—d. March 8, 1466, Milan) Italian mercenary and duke of Milan (1450–66). He became condottiere of Florence in 1434 and defeated Milan twice (1438, 1440), then was hired by the Milanese to serve as captain general in their struggle to found a republic (1447). He later blockaded the city and seized control, becoming duke of Milan in 1450, and he allied with Florence to secure the Peace of LODI (1454). See also SFORZA FAMILY.

Sforza, Ludovico (b. July 27, 1452, Vigevano, Pavia, duchy of Milan—d. May 27, 1508, Loches, Toubrenne, France) Regent (1480–94) and duke of Milan (1494–98). The second son of FRANCESCO SFORZA, he was known as "the Moor" because of his dark complexion and black hair. He plotted to take over as regent for his young nephew. He made Milan supreme among the Italian states, and his patronage of scholars and artists such as LEONARDO DA VINCI made his court renowned in Europe. He bribed MAXIMILIAN I to declare him duke of Milan and fought to expel the French from Italy. After LOUIS XII conquered Milan (1498), Ludovico tried unsuccessfully to retake it (1500); he was captured and died in prison.

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Sforza family Italian family that ruled Milan (1450–1535). The family began with the prosperous farmer and later condottiere leader Muzio Attendolo (1369–1424), who was given the nickname Sforza ("Force"). His illegitimate son Francesco Sforza became duke of Milan in 1450. Galeazzo Maria Sforza (1444–76) succeeded his father in 1466, and, though a despotic ruler, he introduced the cultivation of rice, built canals and encouraged commerce, and was a patron of the arts; he was assassinated by conspirators who vainly hoped to provoke a popular uprising. Gian Galeazzo Sforza (1469–94) succeeded his father in 1476 under the regency of his mother and uncle, Ludovico Sforza, who usurped the government in 1481 and established Milan's supremacy. After Ludovico was driven from power by Louis XII of France in 1499, his son Massimiliano Sforza (1493–1530) returned to rule briefly (1513–16) before yielding the duchy to France. Another son, Francesco Maria Sforza (1495–1535), returned after the French defeat to rule from 1522, until his death without heirs ended the ducal line in 1535. The duchy then passed to Charles V and the Habsburgs. Descendants of Sforza Secondo (an illegitimate son of Francesco Sforza) became the Counts Sforza and included the diplomat Carlo, Count Sforza.

SGML *in full* **Standard Generalized Markup Language** Markup language for organizing and tagging elements of a document, including headings, paragraphs, tables, and graphics. The elements are marked according to their meaning and relationship to other elements rather than to the format of their presentation. The tagged elements can then be formatted in different ways according to the unique rules for different applications. Readable by both humans and computer programs, SGML is usable in a wide range of applications, including print publishing, CD-ROMs, and database systems. Generic coding of electronic manuscripts was first proposed in the late 1960s; in 1969 an IBM team developed GML, which was adopted by the U.S. Internal Revenue Service and Department of Defense. In the late 1970s the American National Standards Institute (ANSI) established a committee to create SGML from GML; it was accepted by the International Organization for Standards in 1986. See also HTML, XML.

Shaanxi \'shän-'shē\ *or* **Shen-hsi** *conventional* **Shensi** \'shen-'sē\ Province (pop., 2002 est.: 36,740,000), north-central China. It is bordered by Shanxi, Henan, Hubei, Sichuan, and Gansu provinces, Chongqing municipality, and Ningxia and Inner Mongolia autonomous regions. It has an area of 75,600 sq mi (195,800 sq km). Its capital is Xi′an. Shaanxi has three distinct natural regions: the mountainous southern region, the central Wei River valley, and the northern upland plateau. The valley is especially vulnerable to earthquakes. Its northern parts were some of the earliest settled in China, and the remains of ancient construction projects found there include part of the Great Wall. From 221 BC until the Tang dynasty, it was wealthy and the centre of much political activity. As its irrigation system deteriorated, the area declined. In the 13th century, under the Mongols, it assumed its present form as a province. Mao Zedong's Long March ended here in 1935. Its ancient irrigation system has been rehabilitated in modern times, and the region is again a rich agricultural area. Crops include corn, winter wheat, fruits, tobacco, and cotton.

Shabbetai Tzevi \'shä-bə-ˌtī-tsə-'vē\ (b. July 23, 1626, Smyrna, Ottoman Tur.—d. 1676, Dulcingo, Alb.) False Jewish messiah. He studied the mystical learning of the Kabbala and at age 22 proclaimed himself the messiah. He traveled around the Levant, gaining both followers and enemies. With the support of powerful religious and political figures, his movement spread to parts of Europe and North Africa. In 1666, the year he was prophesied to bring about the restoration of Israel, he was imprisoned by the Ottoman sultan and, under threat of torture, converted to Islam. His following largely fell away, though some remained faithful to him and strove to reconcile his claims with his seeming betrayal of Judaism.

Shackleton, Sir Ernest Henry (b. Feb. 15, 1874, Kilkea, County Kildare, Ire.—d. Jan. 5, 1922, Grytviken, South Georgia) British explorer. In 1901 he joined Robert Falcon Scott's expedition to the Antarctic. He returned to Antarctica in 1908 and led a sledging party to within 97 mi (156 km) of the pole. In 1914 he led the British Trans-Antarctic Expedition, which planned to cross Antarctica via the South Pole. His expedition ship *Endurance* was caught in pack ice and drifted for 10 months before being crushed. Shackleton and his crew drifted on ice floes for another five months until they reached Elephant Island. He and five others sailed 800 mi (1,300 km) to South Georgia Island to get help, then he led four relief expeditions to rescue his men. Shackleton died on South Georgia at the outset of another Antarctic expedition.

shad Any of several saltwater food fishes of the herring family (Clupeidae) that swim up rivers to spawn. Shad eggs (roe) are a delicacy in the U.S. Adult shad are toothless. The lower jaw of shad in the genus *Alosa* fits into a notch at the tip of the upper jaw. The American shad (*A. sapidissima*), an Atlantic fish introduced into the Pacific, is a migratory plankton eater and a good game fish. The Allis (or Allice) shad (*A. alosa*) of Europe is about 30 in. (75 cm) long and weighs about 8 lbs (3.6 kg). See also whitefish.

Shadwell, Thomas (b. 1642?, Norfolk, Eng.—d. Nov. 19, 1692, London) English dramatist. One of the court wits after the Restoration (1660), he wrote 18 plays, of which his broad comedies of manners are the best remembered. *Epsom-Wells* (1672), his greatest success, played for nearly half a century. After his friendship with John Dryden ended over differences in politics and dramatic techniques, both men produced satires attacking the other, Dryden's (including the devastating *MacFlecknoe*), being the more memorable. In 1688 Shadwell succeeded Dryden as poet laureate and historiographer royal.

Shaffer, Peter (Levin) (b. May 15, 1926, London, Eng.) British playwright. He first won notice for his comedy *Five Finger Exercise* (1958) and his epic tragedy *The Royal Hunt of the Sun* (1964). His *Equus* (1973, Tony Award; film, 1977) was a hit in London and New York City. He was also acclaimed for *Amadeus* (1979), which treated Antonio Salieri's one-sided rivalry with Wolfgang Amadeus Mozart; Shaffer adapted the play for film (1984, Academy Award). His later plays include *Lettice and Lovage* (1988).

Shāfiʿī \'sha-fi-ˌē**, Abū ʿAbd Allāh (Muḥammad ibn Idrīs) al-** (b. 767, Arabia—d. Jan. 20, 820, Al-Fusṭāṭ, Egypt) Muslim legal scholar and founder of the Shāfiʿiyyah school of law. A distant relative of Muhammad, he was brought up in poverty in Mecca and studied with Islamic scholars across Arabia and the Levant. His great contribution was the creation of a synthesis of Islamic legal thought that put into coherent form many familiar but unsystematized ideas. He dealt primarily with the identification of the sources of Islamic law and their application to contemporary events. His book, the *Risālah* (c. 817), earned him the title "father of Muslim jurisprudence."

shaft seal See oil seal

Shaftesbury, Anthony Ashley Cooper, 1st earl of (b. July 22, 1621, Wimborne St. Giles, Dorset, Eng.—d. Jan. 21, 1683, Amsterdam, Neth.) English politician. He served in the English Civil Wars, fighting first for the king (1643) and then for Parliament (1644). He was appointed by Oliver Cromwell to the council of state (1653–54, 1659) and also served in Parliament (1654–60). One of 12 commissioners sent to invite Charles II to return to England, he was appointed to Charles's privy council (1660) and served as chancellor of the Exchequer (1661–72) and lord chancellor (1672–73). As head of the Council of Trade and Foreign Plantations (1672–74), he drew up a constitution for the North American province of Carolina, aided by his protégé John Locke. Dismissed by Charles for supporting the anti-Catholic Test Act and opposing the marriage of Charles's brother James (later James II) to another Catholic, Shaftesbury became a leader of the Whig opposition. He exploited the political chaos caused by Titus Oates to consolidate his parliamentary power and tried unsuccessfully to pass the Exclusion Bill, to keep James from the throne. In 1681 Charles dissolved the Parliament; Shaftesbury was arrested and tried for treason but was acquitted. In 1682 he fled to Holland, where he died.

Shaftesbury, Anthony Ashley Cooper, 3rd earl of (b. Feb. 26, 1671, London, Eng.—d. Feb. 15, 1713, Naples) English politician and philosopher. Grandson of the 1st earl of Shaftesbury, he received his early education from John Locke. He entered Parliament in 1695; succeeding to his title in 1699, he served three years in the House of Lords. His numerous philosophical essays were influenced by Neoplatonism; published as *Characteristicks of Men, Manners, Opinions, Times* (1711), they became the chief source of English Deism and influenced writers such as Alexander Pope, Samuel Taylor Coleridge, and Immanuel Kant.

Shaftesbury, Anthony Ashley Cooper, 7th earl of (b. April 28, 1801, London, Eng.—d. Oct. 1, 1885, Folkestone, Kent) English politician and social reformer. When his father succeeded to the earldom in 1811, Cooper became Lord Ashley. As a member of Parliament (1826–51), he opposed the Reform Bill of 1832 but supported Catholic emancipation and repeal of the Corn Laws. From 1833 he led the factory reform movement in Parliament and effected passage of the Mines Act (1842)

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and the Ten Hours Act (1847), known as Lord Ashley's Act, which shortened the working day in textile mills. As president of the Ragged Schools Union (1843–83), he promoted the free education of destitute children. Succeeding to his father's title in 1851, he continued his work as one of the most effective social reformers of 19th-century England. He also led the Evangelical movement within the Church of England and financially supported several missionary societies.

Shah Jahān \'shä-jə-'hän\ (b. Jan. 5, 1592, Lahore, India—d. Jan. 22, 1666, Agra) Mughal emperor of India (1628–58). During the reign of his father, Jahāngīr, he was part of the clique that dominated Mughal-dynasty politics. After Jāhangīr's death, he garnered enough support to proclaim himself emperor. His reign was notable for its successes against the Deccan states. Though attempts to reconquer lost territory almost bankrupted the empire, his reign marked the zenith of Mughal court splendour. Of his great architectural undertakings (including a fortress-palace built when he transferred the capital from Agra to Delhi), the most famous is the Taj Mahal. Though a more orthodox Muslim than his father, he was less orthodox than his son and successor, Aurangzeb, and he was relatively tolerant of his Hindu subjects.

shah of Iran See Mohammad Reza Shah Pahlavi; Reza Shah Pahlavi

Shahn, Ben(jamin) (b. Sept. 12, 1898, Kaunas, Russia—d. March 14, 1969, New York, N.Y., U.S.) Lithuanian-born U.S. painter and graphic artist. His family immigrated to New York City in 1906. As a youth he worked as a lithographer's apprentice; he later attended New York University and the National Academy of Design. In 1931–33 he achieved fame with a series of gouache paintings inspired by the Sacco-Vanzetti case, combining realism and abstraction in the service of sharp sociopolitical comment. In 1933 he assisted Diego Rivera with his Rockefeller Center mural and worked for the Public Works of Art Project. In 1935–38 he depicted rural poverty while working as an artist and photographer for the Farm Security Administration. After World War II he concentrated on easel painting, poster design, and book illustration.

Ben Shahn, 1966.
© KARSH FROM RAPHO/PHOTO RESEARCHERS—EB INC.

Shaivism *or* **Saivism** \'shī-ˌvi-zəm\ One of three main forms of modern Hinduism, centred on the worship of Shiva. The earliest of the cults devoted to Shiva date from the 4th century BC. Texts written by devotees of Shiva in the 3rd century AD are the basis of Tantra in Hinduism and other Indian religions. Today Shaivism includes diverse movements, both religious and secular, all of which take Shiva as the supreme and all-powerful deity and teacher and view gaining the nature of Shiva as the ultimate goal of existence. This is believed to be brought about by the performance of complex rituals. See also Shaktism; Vaishnavism.

Shaka \'shä-kə\ (b. c. 1787—d. Sept. 22, 1828) Zulu chief (1816–28), founder of southern Africa's Zulu kingdom. His life is the subject of numerous colourful and exaggerated stories, many of which are debated by historians. It is generally accepted that Shaka was a highly skilled warrior who established himself as head of the Zulu about 1816. Under his autocratic rule, the Zulu kingdom experienced significant expansion, quickly becoming the dominant power in southeastern Africa. Shaka was murdered by his half-brother.

Shaka, lithograph by W. Bagg, 1836.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Shaker Member of the United Society of Believers in Christ's Second Appearing, a celibate millenarian sect. Derived from a branch of the radical English Quakers (see Society of Friends), the movement was brought to the U.S. in 1774 by Ann Lee, an illiterate textile worker whose followers accepted her as the second incarnation of Christ. The Shakers spread throughout New England from their base near Albany, N.Y., and later into Kentucky, Ohio, and Indiana, eventually establishing 19 communities. Communities held property in common, observed celibacy, and pursued a life of productive labour. Although sometimes persecuted for their pacifism and for bizarre beliefs falsely attributed to them, Shakers won admiration for their model farms and orderly, prosperous communities. Their talent for simple, functional design led to numerous inventions and innovations (see Shaker furniture). The movement reached its height in the 1840s and thereafter gradually declined. In the early 21st century only one working Shaker village remained: Sabbathday Lake, near New Gloucester, Maine.

Shaker furniture Furniture designed for the religious colonies of Shakers founded in the U.S. in the last quarter of the 18th century. The Shakers' designs reflected their beliefs that good craftsmanship was in itself an act of prayer and that form should follow function, an attitude that anticipated the concept of Functionalism a century later. Constructed of pine or other inexpensive wood, each item was fashioned solely to serve its intended use and was devoid of decoration. Interest in Shaker furniture and other Shaker crafts revived in the 20th century, after most Shaker colonies had dissolved, and imitations are now widely produced.

Shakespeare, William (baptized April 26, 1564, Stratford-upon-Avon, Warwickshire, Eng.—d. April 23, 1616, Stratford-upon-Avon) British poet and playwright, often considered the greatest writer in world literature. He spent his early life in Stratford-upon-Avon, receiving at most a grammar-school education, and at age 18 he married a local woman, Anne Hathaway. By 1594 he was apparently a rising playwright in London and an actor in a leading theatre company, the Lord Chamberlain's Men (later King's Men); the company performed at the Globe Theatre from 1599. The order in which his plays were written and performed is highly uncertain. His earliest plays seem to date from the late 1580s to the mid-1590s and include the comedies *Love's Labour's Lost*, *The Comedy of Errors*, *The Taming of the Shrew*, and *A Midsummer Night's Dream*; history plays based on the lives of the English kings, including *Henry VI* (parts 1, 2, and 3), *Richard III*, and *Richard II*; and the tragedy *Romeo and Juliet*. The plays apparently written between 1596 and 1600 are mostly comedies, including *The Merchant of Venice*, *The Merry Wives of Windsor*, *Much Ado About Nothing*, and *As You Like It*, and histories, including *Henry IV* (parts 1 and 2), *Henry V*, and *Julius Caesar*. Approximately between 1600 and 1607 he wrote the comedies *Twelfth Night*, *All's Well That Ends Well*, and *Measure for Measure*, as well as the great tragedies *Hamlet* (probably begun in 1599), *Othello*, *Macbeth*, and *King Lear*, which mark the summit of his art. Among his later works (about 1607 to 1614) are the tragedies *Antony and Cleopatra*, *Coriolanus*, and *Timon of Athens*, as well as the fantastical romances *The Winter's Tale* and *The Tempest*. He probably also is responsible for some sections of the plays *Edward III* and *The Two Noble Kinsmen*.

Shakespeare's plays, all of them written largely in iambic pentameter verse, are marked by extraordinary poetry; vivid, subtle, and complex characterizations; and a highly inventive use of English. His 154 sonnets, published in 1609 but apparently written mostly in the 1590s, often express strong feeling within an exquisitely controlled form. Shakespeare retired to Stratford before 1610 and lived as a country gentleman until his death. The first collected edition of his plays, or First Folio, was published in 1623. As with most writers of the time, little is known about his life and work, and other writers, particularly the 17th earl of Oxford, have frequently been proposed as the actual authors of his plays and poems.

shakti *or* **sakti** \'shək-tē\ In Hinduism, the "creative energy" inherent in and proceeding from God. It is exemplified by the female principle, the female reproductive organs, or the goddess Shakti, wife of Shiva. As energy, shakti is viewed as the merging of powers emanating from male gods, and it is possessed by each person. In Tantric Hinduism, the goddess Shakti is associated with the lowest of the chakras, lying dormant within the body as a coiled serpent (Kundalini) that must be aroused to reach spiritual liberation by uniting with Shiva at the top of the head. See also Shaktism.

Shaktism *or* **Saktism** \'shək-ˌti-zəm\ Worship of the supreme Hindu goddess Shakti. Together with Vaishnavism and Shaivism, it is one of the major forms of Hinduism practiced today. Particularly prominent in Bengal and Assam, Shaktism takes various forms depending on conceptions

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of Shakti. In popular worship she has many names, and some scholars consider most female deities in Hinduism to be various manifestations of her. Shakti is worshiped and cultivated as a power that can lead to spiritual liberation. Shaktism is inseparably related to the system of practices for the purification of mind and body that are grouped under Tantric Hinduism.

shakuhachi \ˌshä-kü-ˈhä-chē\ Japanese end-blown bamboo flute. Its notes are produced by blowing across the open upper end, resulting in a distinctively breathy tone. It has five fingerholes. The *shakuhachi* is of great antiquity; it has been widely played as a solo instrument and in small ensembles, especially with the KOTO and samisen (a fretless lute).

shale Any of a group of fine-grained, laminated SEDIMENTARY ROCKS consisting of silt- and clay-sized particles. Shale constitutes roughly 60% of the sedimentary rock in the Earth's crust. Shales are commercially important, particularly in the ceramics industry. They are a valuable raw material for tile, brick, and pottery and constitute a major source of alumina for portland cement. In addition, advances in recovery methods may one day make OIL SHALE a practical source for liquid petroleum.

shale oil Synthetic crude oil that is extracted from OIL SHALE by pyrolysis, or destructive distillation. The oil obtained from oil shale cannot be refined by the methods that have been developed for crude oil, however, because shale oil is low in hydrogen and contains large amounts of nitrogen and sulfur compounds. To be made usable, shale oil must be hydrogenated and then chemically treated to remove the nitrogen and sulfur, a process too expensive to make shale oil commercially competitive with crude oil. See also KEROGEN, PETROLEUM.

shallot Mildly aromatic herbaceous plant (*Allium ascalonicum*) of the LILY FAMILY, probably of Asiatic origin, used to flavour foods. Closely related to the ONION and GARLIC, the shallot is a hardy perennial with short, small, cylindrical, and hollow leaves; lavender to red flowers in a compact umbel; and small, elongated, angular BULBS. Much like garlic, the bulbs develop in clusters on a common base. The leaves are sometimes eaten when green. The so-called shallot marketed extensively as green spring onions is in fact a form of onion.

shaman \ˈshä-mən\ Person who uses MAGIC to cure the sick, divine the unknown, or control events. Both men and women can be shamans. Shamanism is classically associated with certain Arctic and Central Asian peoples, but today the term is applied to analogous religious and quasi-religious systems throughout the world. As MEDICINE MAN and priest, the shaman cures illnesses, directs communal sacrifices, and escorts the SOULS of the dead to the other world. He operates by using techniques of ecstasy, the power to leave his body at will during a trancelike state. In cultures where shamanism occurs, sickness is usually thought of as soul loss; it is thus the shaman's task to enter the spirit world, capture the soul, and reintegrate it in the body. A person becomes a shaman either by inheritance or by self-election. See also ANIMISM.

Shamash \ˈshä-ˌmäsh\ In MESOPOTAMIAN RELIGION, the god of the sun, who, with his father, SIN, and the goddess ISHTAR, was part of an astral triad of divinities. As the solar god, Shamash was the heroic conqueror of night and death, and he became known as the god of justice and equity. He was said to have presented the Code of HAMMURABI to the Babylonian king. At night he served as judge of the underworld. The chief centres of his cult were at LARSA and SIPPAR.

Shāmil *or* **Shāmyl** \ˈshä-ˌmēl\ (b. 1797?, Gimry, Dagestan—d. March 1871, Medina?, Arabia) Leader of Muslim Dagestan and Chechen mountaineers. In 1830 he joined a Sufi sect that had become involved in a holy war against the Russians for Dagestan, formerly part of northern Iran but occupied by the Russians from 1813. He eventually became IMAM of Dagestan and established an independent republic (1834), then led successive raids against the Russians in the Caucasus for 25 years. Determined to suppress him, the Russians attacked from all sides, compelling his surrender in 1859 and effectively ending Caucasian resistance to Russian subjugation.

Shamir \shə-ˈmēr**, Yitzhak** *orig.* **Yitzhak Jazernicki** (b. Oct. 15, 1915, Ruzinoy, Pol., Russian Empire) Polish-born Israeli statesman. He immigrated in 1935 to Palestine, where he helped found the Israel Freedom Fighters, later known as the Stern Gang. Twice arrested by British authorities (1941, 1946), he twice escaped and eventually found asylum in France. After Israel achieved independence, he served as a secret-service operative until 1965. He was speaker of the Knesset (1977–80) and later foreign minister under MENACHEM BEGIN (1980–83). He became prime minister in 1983; in 1984 an indecisive election led to his sharing power with the Labour Party leader SHIMON PERES, and Shamir acted as prime minister for the six years beginning in 1986, which included another indecisive election in 1988 and the formation of a coalition government in 1990, but lost power in 1992. He retired from the Knesset in 1996.

Sham'ūn, Kamīl See CAMILLE CHAMOUN

Shan *Shan* **Tai** Any member of a Southeast Asian people who live primarily in eastern and northwestern Myanmar (Burma) and also in Yunnan province, China. The Shan are the largest minority group in Myanmar, numbering more than four million. They live mainly in the valleys and plains on the Shan Plateau, where they grow rice or practice shifting agriculture. They are THERAVADA Buddhists and have their own written language and literature. They dominated much of Myanmar from the 13th to the 16th century; since the 1970s they have been at odds with the national government over the issue of local autonomy. See also TAI.

Shan-hsi See SHANXI

Shandong \ˈshän-ˈdůŋ\ *or* **Shan-tung** *conventional* **Shantung** Coastal province (pop., 2002 est.: 90,820,000), eastern China. It lies on the YELLOW SEA and is bordered by JIANGSU, ANHUI, HENAN, and HEBEI provinces. It has an area of 59,200 sq mi (153,300 sq km), and its capital is JINAN. It contains the Shandong Peninsula and an inland zone that includes a fertile, intensely cultivated area that forms part of the HUANG HE (Yellow River) basin. The peninsula has been occupied since the 3rd millennium BC, and by the 8th century BC it had become a centre of political and military activity. It became northern China's leading maritime centre in the 3rd century AD and retained that position for centuries. In the 19th century devastating floods resulted in substantial emigration. It came under German, British, and Japanese influence in the late 19th century. The Japanese occupied it in 1937–45; it came under communist control in 1948. Its products include wheat, corn, iron ore, gold, fish, and silk. CONFUCIUS and MENCIUS were born in Shandong.

Shandong Peninsula *or* **Shan-tung Peninsula** *conventional* **Shantung Peninsula** Peninsula, eastern China. Occupying the eastern section of Shandong province, it extends northeastward between the BO HAI (Gulf of Chihli) and the YELLOW SEA. The terrain is hilly, with elevations around 600 ft (180 m), rising to 3,707 ft (1,130 m) in the Lao Mountains. Fishing is important along the coast, and fruit is grown in the hills. Iron ore, magnesite, and gold are abundant. Some of China's best ports are located along the peninsula's rocky, indented coast.

Shang dynasty *or* **Yin dynasty** Traditionally, the second of China's dynasties, following the XIA DYNASTY. Until excavations in the 20th century provided archaeological evidence for the Xia, the Shang was the first verifiable Chinese dynasty. Dates for its founding vary; traditionally its rule was said to have spanned 1766–1122 BC, but more recently the range has been given as c. 1600–1046 BC. Shang society was stratified: it included a king, local governors, nobles, and the masses, who engaged in agriculture. The Shang developed a 12-month, 360-day calendar with intercalary months added as necessary. The CHINESE WRITING SYSTEM began to develop; numerous records and ceremonial inscriptions survive. Surviving artifacts include musical instruments, superb bronze vessels, pottery for ceremonial and daily use, and jade and ivory ornaments. Cowrie shells were used as currency. See also ERLITOU CULTURE; ZHOU DYNASTY.

Shanghai \ˈshaŋ-ˈhī\ *or* **Shang-hai** Municipality with provincial status (pop., 2003 est.: city, 10,030,800; 2002 est.: municipality, 16,250,000), east-central CHINA. The municipality, on the East CHINA SEA, is bordered by JIANGSU and ZHEJIANG provinces and has an area of 2,400 sq mi (6,200 sq km). The city is located on the Huangpu River, which gives oceangoing vessels access to it. The site was settled during the Bei (Northern) SONG period (AD 960–1127), and later under the MING DYNASTY it was an area of intense cotton production. This changed when it became the first Chinese port opened to trade with the West after China's defeat by Britain in the OPIUM WARS (1842); it came to dominate the nation's commerce. The site of the CHINESE COMMUNIST PARTY's founding in 1921, it saw severe fighting in the Sino-Japanese War of 1937–45 and was occupied by Japan during World War II. Since 1949, it has become China's chief industrial and commercial centre and one of its leading centres of higher education and scientific research.

Shankar \ˈshäŋ-ˌkär**, Ravi** (b. April 7, 1920, Benares, India) Indian SITAR player. He studied music and dance, toured as a member of his

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brother Uday's dance troupe, and spent years learning the sitar. After serving as music director of All-India Radio (1948–56), he began a series of European and U.S. tours. He wrote the score for Satyajit Ray's *Apu* film trilogy (1955–59). He was a founder of the National Orchestra of India, and in 1962 he founded the Kinnara School of Music in Bombay (now Mumbai) and later in Los Angeles. His performances with Yehudi Menuhin and his association with George Harrison of the Beatles were primarily responsible for bringing Indian music to a broad Western audience.

Shankara \'shən-kə-rə\ *or* **Samkara** \'shəm-kə-rə\ (b. c. 700, Kaladi village?, India—d. c. 750, Kedarnath) Indian philosopher and theologian. According to tradition, he was born into a pious Brahman family and became a sannyasi after his father's death. He is said to have traveled all over India, holding discussions with philosophers of different creeds, and is believed to have founded four monasteries. He is the reputed author of more than 300 Sanskrit works, most of them commentaries on and expositions of Vedic literature, but most are not regarded as authentic. The most renowned exponent of the Advaita school of Vedanta philosophy, he is credited with laying the foundation for Hindu orthodoxy in India after centuries of challenge from Jainism and Buddhism.

Shannon, Claude (Elwood) (b. April 30, 1916, Petoskey, Mich., U.S.—d. Feb. 24, 2001, Medford, Mass.) U.S. electrical engineer. Shannon earned a Ph.D. in mathematics from MIT in 1940. He had a long career as a research mathematician at Bell Laboratories (1941–72) and as a professor at MIT (1957–78). On the basis of his 1948 paper "The Mathematical Theory of Communication," he is considered the founder of communication theory. He was awarded the National Medal of Science in 1966 and the Kyoto Prize in 1985.

Shannon, River River, Ireland. The country's longest river, it rises in northwestern County Cavan and flows for about 230 mi (370 km) to enter the Atlantic Ocean below Limerick. It is surrounded by marshes and bogs for much of its course and widens at various points into lakes, many with islands. In the early 19th century it was a vital link in the waterways of Ireland; today it is used by pleasure craft.

Shantung See Shandong

Shanxi \'shän-'shē\ *or* **Shan-hsi** *conventional* **Shansi** \'shän-'sē\ Province (pop., 2000 est.: 32,970,000), northern China. It is bordered by Hebei, Henan, and Shaanxi provinces and Inner Mongolia. It has an area of 60,700 sq mi (157,100 sq km). The capital is Taiyuan. Largely a vast plateau covered by great loess deposits, it was the home of early Chinese agriculture. Most of the people are Han Chinese; other ethnic groups include Hui (Chinese Muslims), Mongols, and Manchus. Since ancient times it has been an integral part of the various northern kingdoms of China, serving as a buffer against invaders from the north and as a key trade route. It was one of the major avenues by which Buddhism came to China from India. After the overthrow of the Qing dynasty in 1911–12, the warlord Yan Xishan ruled as absolute dictator until the end of World War II. Japan occupied part of the province during the Sino-Japanese War. Communist forces assumed control of Shanxi in 1949. It has vast reserves of coal and iron and the largest titanium and vanadium deposits in China, and it is China's largest provincial producer of cotton.

Shao Yong *or* **Shao Yung** \'shaù-'yůŋ\ (b. 1011, Kung-ch'eng, China—d. 1077, Henan) Chinese philosopher who greatly influenced the development of the idealist school of Neo-Confucianism. Originally a Daoist, he refused all offers of government office and lived in a hermitage outside Henan. He became interested in Confucianism by studying the *Yi jing*, from which he developed his theory that numbers are the basis of all existence. He believed that the key to the world hinged on the number four; thus the universe is divided into four sections (sun, moon, stars, zodiac), the body into four sense organs (eye, ear, nose, mouth), and the earth into four substances (fire, water, earth, stone). He also introduced to Confucianism the Buddhist concept of the universe's repeating cycles.

shape-note singing U.S. a cappella singing style incorporating many folk hymns and utilizing a special musical notation. The seven-note scale used by some singers is sung not to the syllables *do-re-mi-fa-sol-la-ti* but to a four-syllable system brought to America by early English colonists: *fa-sol-la-fa-sol-la-mi*. The system reflects the fact that a series of three intervals repeats itself in the major scale. A differently shaped note head is used for each of the four syllables. The singer reads the music by following the shapes; singers unfamiliar with the system can read the notes according to their placement on the staff. The tradition started in New England and moved South and West as more sophisticated forms of music reached the U.S. Shape-note singing had largely died out except in rural areas by the 1880s, but it has experienced a revival in recent years. The traditional shape-note hymnal, *The Sacred Harp*, first published in 1844, remains in use today.

shaper Metal-cutting machine tool in which the workpiece is usually held in a vise or similar device that is clamped to a table and can be manually operated or power-driven at right angles to the path of a chisel-like cutting tool with only one cutting edge. A moving table feeds the workpiece in small, individual steps at the end of each stroke of the tool. The adjustable mounting of the tool permits the cutting of grooves and generating of surfaces at almost any angle to one another. The largest shapers have a 36-in. (0.9-m) cutting stroke and can machine parts up to 36 in. (0.9 m) long. See also planer.

Shapley, Harlow (b. Nov. 2, 1885, Nashville, Mo., U.S.—d. Oct. 20, 1972, Boulder, Colo.) U.S. astronomer. In 1911 he began a determination of the dimensions of the components of numerous binary stars from measurements of their light variation when they eclipse one another; he also proposed (correctly) that Cepheid variables are pulsating variable stars, not eclipsing binaries (see eclipsing variable star). In 1914 he joined the staff of Mount Wilson Observatory. His study of the distribution of globular clusters in the Milky Way Galaxy led him to deduce that the Sun, previously thought to lie near the centre of the Galaxy, was 50,000 light-years from the centre (now estimated at about 27,000), leading to the first realistic estimate of the Galaxy's size. Shapley also studied neighbouring galaxies, especially the Magellanic Clouds, and found that galaxies tend to occur in clusters.

shar-pei \'shär-'pā\ Ancient breed of dog that originated in China. Sharpeis are notable for their loose, wrinkled skin, especially when young. They have a short bristly coat, wide blunt muzzle, blue-black tongue, and unusual black gums.

Sha'rānī \ˌsha-rä-'nē**, al-** *orig.* **'Abd al-Wahhāb ibn Aḥmad** (b. 1492, Cairo—d. 1565, Cairo) Egyptian scholar and mystic, founder of the Sufi order known as the Sha'rawiyyah. Throughout his career he sought to avoid the extremism he saw in the various theological sects of Islam, as well as in other Sufi orders; his aim was to take the best from each, ignoring conflicts between them. Since his thoughts and writings were unsystematic and confused, the appeal of his teachings depended largely on his personal presence. The order gradually declined after his death, though it remained popular until the 19th century.

Sharansky, Natan See Anatoly Shcharansky

sharecropping See tenant farming

Shari River See Chari River

Sharī'ah \'shä-'rē-ä\ Legal and moral code of Islam, systematized in the early centuries of the Muslim era (8th–9th century AD). It rests on four bases: the Qur'ān; the sunna, as recorded in the Ḥadīth; *ijma*, or agreement among scholars; and *qiya*, or analogical reasoning. Sharī'ah differs fundamentally from Western law in that it purports to be grounded in divine revelation. Among modern Muslim countries, Saudi Arabia and Iran retain Sharī'ah as the law of the land, in both civil and criminal proceedings, but the legal codes of most other Muslim countries combine elements of Islamic and Western law where necessary. Most Islamic fundamentalist groups insist that Muslim countries should be governed by Sharī'ah.

Sharīk Peninsula *or* **Cape Bon** \'bōⁿ\ **Peninsula** Peninsula, northeastern Tunisia. Extending northeast into the Mediterranean Sea, it is about 50 mi (80 km) long. During World War II (1939–45), it was occupied by German troops in retreat from Egypt and Libya (1943); they soon surrendered to the Allied Powers there.

shark Any of more than 300 species of predatory cartilaginous fish (order Selachii). An ancient animal, it has changed little in 100 million years. The skin typically is dull gray and tough and has toothlike scales. Most sharks have a muscular, asymmetrical, upturned tail; pointed fins; a pointed snout; and sharp triangular teeth. Sharks have no swim bladder and must swim perpetually to keep from sinking. Most species bear living young. Several species can be dangerous to humans (e.g., great white shark, hammerhead shark, sand shark, tiger shark); smaller ones, called topes, hounds, and dogfishes, are fished commercially. See also basking shark, mackerel shark, mako shark, thresher shark, whale shark.

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sharksucker See REMORA

Sharm al-Sheikh See Cape NAṢRĀNĪ

Sharon \shə-'rōn**, Ariel** (b. Feb. 26, 1928, Kefar Malal, Palestine) Israeli soldier and politician. He received military training early in life and did intelligence and reconnaissance work after Israel achieved independence. During the SUEZ CRISIS (1956) and again during the SIX-DAY WAR (1967), a unit under his command captured the strategic Mitla Pass. In the Yom Kippur War (1973), he led an Israeli counterattack. Appointed minister of agriculture in charge of settlements in 1977, he actively promoted Jewish settlement in the WEST BANK and GAZA STRIP. As minister of defense (1981–83), he oversaw Israel's invasion of Lebanon (see LEBANESE CIVIL WAR). An Israeli court of inquiry held Sharon indirectly responsible for the SABRA AND SHATILA MASSACRES, and he was forced to resign in 1983. He held several further cabinet positions throughout the 1980s and '90s and in 1999 became head of the LIKUD party. Elected prime minister in 2001, Sharon faced increased fighting between Israelis and Palestinians. In an effort to stem the violence, he initiated a plan to withdraw Israeli settlers and soldiers from the Gaza Strip and parts of the West Bank in 2005. In November 2005 Sharon quit Likud to form Kadima ("Forward"), a centrist party. In January 2006 he suffered a massive stroke, and power was transferred to an acting prime minister.

Sharon, Plain of Mediterranean coastal plain, western Israel. Extending about 55 mi (90 km) from Mount Carmel to TEL AVIV–YAFO and roughly triangular in shape, it has been inhabited since remote antiquity. Its name occurs in the Bible and is mentioned in Egyptian pharaonic inscriptions. Modern settlement was undertaken as part of the ZIONIST movement to settle the agricultural lands of Palestine in the late 19th century, and by the early 1930s it had become the most densely settled area of Jewish Palestine. It produces citrus fruits, vegetables, and cotton and is a popular tourist destination.

Shasta, Mount Peak, CASCADE RANGE, northern California, U.S. A double-peaked extinct volcano 14,162 ft (4,317 m) high, Mount Shasta dominates the landscape for a hundred miles. The several glaciers on its slopes are popular with skiers and climbers. The first ascent was made in 1854.

shaṭḥ \'shath\ In SUFISM, a divinely inspired statement that a practitioner utters in a mystical state. The Sufis claim that there are moments of ecstatic fervour when they are overwhelmed by the divine presence to such a degree that they lose touch with worldly realities. In such moments they utter statements that may seem incoherent or blasphemous if taken literally, so the statements must be interpreted symbolically. Since the state of mystical trance is normally brief, the statements rarely exceed six or seven words, but the Sufis regard all their writings, particularly their poetry, as possessing an element of *shaṭḥ*.

Shatila See SABRA AND SHATILA MASSACRES

Shatt al-Arab \'shät-ål-'är-əb\ River, southeastern Iraq, formed by the confluence of the TIGRIS and EUPHRATES rivers. It flows southeastward for 120 mi (193 km) and passes the Iraqi port of Al-BAṢRAH and the Iranian port of Ābādān before emptying into the Persian Gulf. With dredging, the river is navigable by shallow-draft oceangoing vessels. For about the last half of its course, the river forms the border between Iraq and Iran. In the 1980s it was the scene of prolonged fighting during the IRAN-IRAQ WAR.

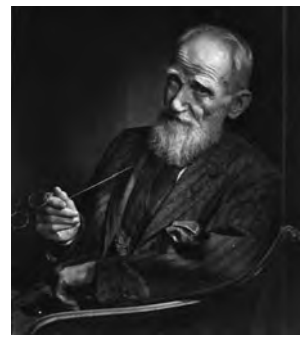
Shatuo Turk *or* **Sha-t'o** \'shä-'tō\ **Turk** Any member of a nomadic people who came to the aid of the TANG DYNASTY (618–907) after the rebel Huang Zhao captured the capitals of Luoyang and Chang'an in 880 and 881. Their leader, Li Keyong (856–908), became one of the aspirants to imperial power during the collapse of the Tang dynasty.

Shaughnessy \'shò-nə-sē\ **(of Montreal and Ashford), Thomas George Shaughnessy, 1st Baron** (b. Oct. 6, 1853, Milwaukee, Wis., U.S.—d. Dec. 10, 1923, Montreal, Que., Can.) Canadian railway executive. After working as a clerk for the Chicago, Milwaukee & St. Paul Railway, he joined the CANADIAN PACIFIC RAILWAY as general purchasing agent (1882), becoming vice president (1891–99), president (1899–1918), and chairman of the board (from 1918). He oversaw the greatest expansion in the railroad's history and added shipping and mining industries to its holdings.

Shaw, Anna Howard (b. Feb. 14, 1847, Newcastle upon Tyne, Northumberland, Eng.—d. July 2, 1919, Moylan, Pa., U.S.) U.S. minister and suffragist. She arrived in the U.S. with her family in 1851. By age 15 she was a frontier schoolteacher, and in 1880 she became the first woman minister of the Methodist Protestant Church. She took up the causes of temperance and woman suffrage in 1885 and became an important spokesperson for both. She earned a medical degree the next year and later served as president of the National American Woman Suffrage Association (1904–15). She performed home-front war work during World War I, for which she received the Distinguished Service Medal in 1919. She died shortly before women gained the right to vote.

Shaw, Artie *orig.* **Arthur Jacob Arshawsky** (b. May 23, 1910, New York, N.Y., U.S.—d. Dec. 30, 2004, Newbury Park, Calif.) U.S. clarinetist and leader of one of the most popular big bands of the SWING era. Shaw was a technically brilliant clarinetist and worked freelance before leading his own groups. In 1935 he performed with a string quartet, later expanding the group into a more conventional dance band. He led a U.S. Navy band during World War II and afterward led various ensembles until his retirement in 1954. His best-known recordings are "Begin the Beguine" and "Frenesi."

Shaw, George Bernard (b. July 26, 1856, Dublin, Ire.—d. Nov. 2, 1950, Ayot St. Lawrence, Hertfordshire, Eng.) Irish playwright and critic. After moving to London in 1876, he worked for years as a music and art critic, wrote book and theatre reviews, and was an active member of the socialist FABIAN SOCIETY. In his first play, *Widowers' Houses* (1892), he emphasized social and economic issues instead of romance, adopting the ironic comedic tone that would characterize all his work. He described his first plays as "unpleasant" because they forced the spectator to face unpleasant facts; these plays include *Mrs. Warren's Profession* (1893), which concerns prostitution and was barred from performance until 1902. He then wrote four "pleasant" plays, including the comedies *Arms and the Man* (1894) and *Candida* (1895). His next plays include *Caesar and Cleopatra* (1899) and *Man and Superman* (1905). He used high comedy to explore society's foibles in *Major Barbara* (1905), *The Doctor's Dilemma* (1911), and *Pygmalion* (1913), his comedic masterpiece. Other notable plays include *Androcles and the Lion* (1912), *Heartbreak House* (1919), and *Saint Joan* (1923). His other writings and speeches made him a controversial public figure for much of his life. He received the Nobel Prize in 1925.



George Bernard Shaw, photograph by Yousuf Karsh.
KARSH/WOODFIN CAMP AND ASSOCIATES

Shaw, Lemuel (b. Jan. 9, 1781, Barnstable, Mass., U.S.—d. March 30, 1861, Boston, Mass.) U.S. jurist. He was educated at Harvard University. In 1822 he drafted the first municipal charter for Boston virtually without precedents to guide him; it remained in effect until 1913. In 1830 he was appointed chief justice of the Supreme Judicial Court of Massachusetts, where he served for 30 years. His rulings were formative in the development of both Massachusetts and national jurisprudence. In particular, his ruling in favour of a striking labour union (1842) provided the first major precedent for removing unions from the province of the law of conspiracy, and his decision upholding the city's segregated schools (1849) was later reflected in the "separate but equal" doctrine propounded by the SUPREME COURT OF THE UNITED STATES in *PLESSY V. FERGUSON* (1896), though it also led Massachusetts to pass the only 19th-century American desegregation law. His daughter married HERMAN MELVILLE.

shawm Double-reed Renaissance WOODWIND INSTRUMENT, ancestor of the OBOE. Its conical bore and bell are wider than the oboe's. A disk called a pirouette usually supports the player's lips. Shawms were constructed in many sizes, from treble to great bass. They were in use in the Middle East perhaps 2,000 years ago, and they were introduced into Europe during the Crusades. With their powerful tone, shawms were classed with the "loud" or "outdoor" instruments and were used in dance and ceremonial music.

Shawn, Ted *orig.* **Edwin Myers Shawn** (b. Oct. 21, 1891, Kansas City, Mo., U.S.—d. Jan. 9, 1972, Orlando, Fla.) U.S. modern dancer, teacher, and choreographer. He married RUTH ST. DENIS in 1914, soon after beginning his dance career. In 1915 they cofounded the Denishawn school

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and company to promote nonballetic dance movement; their tours brought modern dance to many parts of the U.S. for the first time. After the couple separated in 1931, the company disbanded, and Shawn established a company of male dancers for which he choreographed works that embodied a vigorous, masculine style. In 1933 he founded the Jacob's Pillow Dance Festival in Becket, Mass., as a summer residence and theatre for his dancers. He continued to dance and choreograph into the 1960s.

Shawn in *Frohsinn*
PICTORIAL PARADE

Shawnee \shȯ-'nē\ Algonquian-speaking North American Indian people from the central Ohio River valley. (See ALGONQUIAN LANGUAGES.) Closely related in language and culture to the FOX, KICKAPOO, and SAUK, the Shawnee were also influenced by the SENECA and DELAWARE. In the summer the Shawnee lived in bark-covered houses grouped into large villages near cornfields. Women farmed, and the primary male occupation was hunting. In winter the village broke into small patrilineal family groups, which moved to hunting camps. In the 17th century the Shawnee were driven from their home by the IROQUOIS, scattering into widely separated areas. After 1725 the Shawnee reunited in Ohio. Following their defeat by Gen. ANTHONY WAYNE (1794), they broke into three independent branches that eventually settled in Oklahoma. Today some 11,000 people claim Shawnee ancestry. See also TECUMSEH.

shaykh See SHEIKH

Shays's Rebellion (1786–87) Uprising in western Massachusetts. In a period of economic depression and land seizures for debt collection, several hundred farmers led by Daniel Shays (1747?–1825), who had served as a captain in the Revolutionary army, marched on the state supreme court in Springfield, preventing it from carrying out foreclosures and debt collection. Shays then led about 1,200 men in an attack on the nearby federal arsenal, but they were repulsed by troops under BENJAMIN LINCOLN. As a result of the uprising, the state enacted laws easing the economic condition of debtors.

Shcharansky \shə-'ran-skē**, Anatoly (Borisovich)** *or* **Natan Sharansky** (b. Jan. 20, 1948, Stalino, Ukraine, U.S.S.R.) Soviet dissident and Israeli politician. He studied mathematics and computer programming at the Moscow Physical-Technical Institute (1966–72) and then worked in Moscow as a computer specialist for the Institute of Oil and Gas. A Jew, he applied for permission to emigrate to Israel in 1973 but was refused and discharged from his job. With an excellent command of English, he became a spokesperson for the dissidents and refuseniks in contacting Western correspondents to publicize their cause. In 1977 he was arrested by the KGB for treason and espionage, sentenced to 13 years in prison, and sent to the Siberian GULAG. His wife, Avital, who had emigrated to Israel in 1974, championed his cause. Released in 1986, he settled in Israel, where he founded a party stressing the concerns of Russian immigrants, and he was appointed to the cabinet as minister of industry and trade in 1996. He later served as interior minister in Ehud Barak's government and as housing and construction minister in Ariel Sharon's government.

She-Chi See SHE-JI

She-Ji \'shə-'jē\ *or* **She-Chi** Ancient Chinese compound deity of the soil and harvests. China's earliest legendary emperors worshiped She (earth), for they alone had responsibility for the entire earth and country. Since ordinary people had no part in this courtly worship, they came to focus their worship on the god of grain (Ji). Local shrines held two images, one of She and one of Ji, and eventually the two images were considered man and wife.

shear legs Device, often temporary, for lifting heavy weights. It consisted of three poles lashed together at the top with a block and tackle attached. Shear legs were often used for placing masts in sailing ships.

shear wall In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. Examples are the reinforced-concrete wall or vertical TRUSS. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure and occupants, create powerful twisting (torsional) forces. These forces can literally tear (shear) a building apart. Reinforcing a frame by attaching or placing a rigid wall inside it maintains the shape of the frame and prevents rotation at the joints. Shear walls are especially important in high-rise buildings subject to lateral wind and seismic forces.

shearing In TEXTILE manufacturing, the cutting of the raised nap of a pile fabric to a uniform height to enhance appearance. Shearing machines operate much like rotary lawn mowers, and the amount of shearing depends on the desired height of the nap or pile. Shearing may also be applied to create stripes and other patterns by varying surface height. In animal husbandry, shearing is the cutting off of the fleece of SHEEP and other wool-bearing animals, using special shears.

shearwater Any of numerous species (family Procellariidae) of long-winged seabirds named for their habit of gliding on stiff wings along wave troughs. Typical shearwaters are the 12–17 drab, slender-billed species of *Puffinus*, 14–26 in. (35–65 cm) long. Shearwaters nest in a burrow on offshore islands and coastal hills in the Atlantic and Mediterranean and throughout most of the Pacific. A colony may consist of hundreds of thousands of pairs; at night, when the calling adults move in and out of the burrows, the din is deafening. See also FULMAR, PETREL.

sheathed bacteria Group of BACTERIA found widely in nature in slow-running water. Many species are attached to underwater surfaces. They are characterized by a threadlike, branching arrangement of cells enclosed in a sheath. The sheaths of some are variously encrusted with iron or manganese oxides, depending on the water. One of the best-known is a common species, *Sphaerotilus natans*; in polluted water it has thin, colourless sheaths, and in unpolluted water containing iron it has yellow-brown, iron-encrusted sheaths that often grow into long slimy tassels.

Sheba, Queen of (fl. 10th century BC) In Jewish and Islamic traditions, ruler of the Kingdom of Saba' (Sheba) in southwestern Arabia. In an Old Testament story, she visited King SOLOMON to test his wisdom. In Islamic tradition she is known as Bilqīs and is converted from worship of the sun to worship of God, marrying either Solomon himself or a Hamdānī tribesman. In Persian folklore she is considered the daughter of a Chinese king and a peri (a type of supernatural being). Ethiopian tradition names her Makeda; her son by Solomon is seen as the founder of the Ethiopian royal dynasty.

Shebele River See SHABEELLE RIVER

Shebeli \shə-bā'-lē\ **River** *Somali* **Shabeelle** \sha-'be-lē\ **River** River, eastern Africa. It rises in the Ethiopian Highlands and flows southeast through the arid OGADEN Plateau. After crossing into Somalia, it approaches the coast near MOGADISHU, then turns southwest to flow parallel with the coast. Its total length is about 1,130 mi (1,820 km). During rainy periods in Ethiopia, it joins the JUBBA RIVER, and the combined waters then flow to the Indian Ocean. In drier years it disappears in a series of marshes and sand flats northeast of the Jubba confluence.

Sheeler, Charles (b. July 16, 1883, Philadelphia, Pa., U.S.—d. May 7, 1965, Dobbs Ferry, N.Y.) U.S. painter and photographer. Educated at the Pennsylvania Academy of the Fine Arts, he initially earned a living as a photographer. His acclaimed series of photographs of the Ford automobile plant at River Rouge, Mich. (1927), was followed by a series on Chartres Cathedral (1929). In his paintings, early CUBIST influences led to the PRECISIONISM of his maturity. He treated industrial and architectural subjects in an abstract-realist style, emphasizing their formal qualities, as in his painting *Rolling Power* (1939), which revealed the abstract power of a locomotive's driving wheels.

Sheen, Fulton J(ohn) (b. May 8, 1895, El Paso, Il. U.S.—d. Dec. 9, 1979, New York, N.Y.) U.S. religious leader. He attended parochial school and St. Viator College before being ordained to the priesthood in 1919. He pursued further studies in the U.S. and Belgium. He taught at Catholic University (Washington, D.C.) from 1926 to 1950. In 1930 he began his 22-year radio career on the program *The Catholic Hour*, with which he reached an estimated 4 million listeners. In 1951 he became a titular bishop, and he served as bishop of Rochester, N.Y. from 1966 to 1969. In the 1950s he began a weekly television series, *Life Is Worth Living*; it was followed by two more series. He was also the author of numerous books. At his death he was one of the best-known clerics in the U.S.

sheep RUMINANTS (BOVID genus *Ovis*) that have scent glands in the face and hind feet. Horns, if present, are more divergent than those of GOATS.

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Species range from 80 to 400 lb (35 to 180 kg). The coat of wild species consists of outer hair underlain by WOOL. Sheep graze in flocks, preferably on short, fine grasses and legumes. They have been domesticated from at least 5000 BC in the Middle East, Europe, and Central Asia. Most domesticated breeds produce fine wool; the few that produce only hair or coarse or long wool are generally raised for meat. The flesh of mature sheep is called mutton; that of immature sheep is called LAMB.

sheep laurel *or* **lambkill** Open upright woody shrub (*Kalmia angustifolia*) of the HEATH FAMILY. Growing 1–4 ft (0.3–1.2 m) high, it has glossy, leathery, evergreen leaves and showy pink to rose flowers. Like other *Kalmia* species (including MOUNTAIN LAUREL) and other members of the heath family, it contains a poison (andromedotoxin). In northwestern North America, where these plants occur, livestock (especially sheep) that graze on nonfertile soils of abandoned pastures and meadows may ingest enough of the plant to become poisoned, potentially fatally.

sheepdog In general, any dog breed developed to herd sheep; specifically, the BORDER COLLIE. Most sheepdog breeds stand about 2 ft (60 cm) and weigh over 50 lbs (23 kg). The French briard has bushy brows and a long, waterproof coat. The Belgian sheepdog has long black hair and erect ears. The Hungarian puli has a coat of long ropelike cords. It stands 16–19 in. (41–48 cm) and weighs about 30 lbs (14 kg). See also OLD ENGLISH SHEEPDOG, SHETLAND SHEEPDOG.

sheepshead Species (*Archosargus probatocephalus*) of popular edible sport fish in the PORGY family, common along southern North American Atlantic and Gulf of Mexico coasts. The species has inexplicably become very rare from New England to the Chesapeake Bay area, where it was once prevalent. Sheepsheads have a high forehead and a compressed silver body with wide, dark, vertical bands, most distinct in juveniles. The large flat teeth crush and grind crustaceans and hard-shelled mollusks. Adults are typically 2–2.5 ft (60–75 cm) long and weigh about 20 lbs (9 kg).

sheet See SILL

sheet erosion Detachment of soil particles by raindrop impact and their removal downslope by water flowing overland as a sheet instead of in definite channels or rills. A more or less uniform layer of fine particles is removed from the entire surface of an area, sometimes resulting in an extensive loss of rich topsoil. Sheet erosion commonly occurs on recently plowed fields or on other sites having poorly consolidated soil material with scant vegetative cover.

Sheffield City and metropolitan borough (pop., 2001: 513,234), SOUTH YORKSHIRE, England. It is situated at the foot of the PENNINES. An Anglo-Saxon village that became the site of a castle and parish church early in the 12th century, it has been known for its cutlery since medieval times. By 1700 it had a monopoly of the English cutlery trade, and it remains the centre of the industry today. It developed a steel industry from the mid-19th century, and several metallurgical innovations, including the process for making STAINLESS STEEL, originated there. In 1568 MARY, QUEEN OF SCOTS, was imprisoned in its Norman castle (now in ruins).

Sheffield plate Articles made of copper coated with silver by fusion. The technique was discovered c. 1742 by the Sheffield (Yorkshire, Eng.) cutler THOMAS BOULSOVER, who noted that the combination of fused silver and copper retained the ductility of both metals and acted as one when manipulated. Other workshops in Britain, continental Europe, and North America also produced cooking and eating utensils of Sheffield plate. After the introduction of ELECTROPLATING in 1840, production of Sheffield plate declined; by the 1870s it had all but disappeared. Admired for its soft, glowing gray lustre, Sheffield-plate ware soon came to be prized and collected.

Sheffield plate chamber candlestick by Matthew Boulton, *c.* 1820; in the Sheffield City Museum, Sheffield, South Yorkshire

COURTESY OF SHEFFIELD CITY MUSEUM; MOTTERSHAW PHOTOGRAPHY

Sheherazade See SCHEHERAZADE

sheikh \'shēk, 'shāk\ *or* **shaykh** Among Arabic-speaking tribes, especially BEDOUIN, the male head of the family, as well as of each successively larger social unit making up the tribal structure. The sheikh is generally assisted by an informal tribal council of male elders. Within the broader Arabic-speaking community, the word may also be used as a title or form of respectful address or to designate a religious authority. Its significance may vary from region to region.

Shekhina \shə-kē-'nä, shə-'kē-nə\ In JUDAISM, the worldly presence of God, sometimes conceived of as a divine light. It is said that the Shekhina descended on the TABERNACLE and on SOLOMON'S Temple, though it was one of the five things lacking in the Second Temple of JERUSALEM. There is an affinity between the Shekhina and the HOLY SPIRIT; though the two are not identical, both signify divine immanence, are associated with prophecy, can be lost due to sin, and are connected with the study of the TORAH.

shelduck *or* **sheldrake** Any of several short-billed, somewhat goose-like, Old World DUCKS with long legs and an upright stance. They are smaller members of the duck tribe Tadornini (family Anatidae). The common shelduck (*Tadorna tadorna*), of Europe and Asia, is black and white with a reddish chest band; the drake has a knob on his red bill. The ruddy shelduck (*Casarca ferruginea*), ranging from northern Africa and Spain to Mongolia, is orangish, with a pale head and white wing patches. Drakes usually have melodious whistling calls and are aggressive. In North America, MERGANSERS are sometimes called sheldrakes.

shelf fungus See BRACKET FUNGUS

Shelikhov \'she-li-ˌkȯf**, Gulf of** *Russian* **Zaliv Shelikhova** \zə-'lʲif-'she-li-kə-və\ Gulf, eastern Russia. Lying between the Siberian mainland and the KAMCHATKA PENINSULA, it is an extension of the Sea of OKHOTSK. It extends northward 420 mi (670 km) and has a maximum width of 185 mi (300 km). The tidal ranges in its northern bays are among the greatest in the world. It is closed by ice from December to May.

shell ARTILLERY projectile, cartridge case, or shotgun cartridge. It originated in the 15th century as a container for metal or stone shot, dispersed when the container burst after leaving the GUN. Explosive shells, in use by the 16th century, were hollow cast-iron balls filled with GUNPOWDER and lit by a fuse. Until the 18th century, such shells were used only in high-angle fire (including MORTARS). In the 19th century, shells were adopted for direct-fire artillery, notably in the form of SHRAPNEL. Modern artillery shells consist of a casing (usually steel), a propelling charge, and a bursting charge; the propelling charge is ignited by a primer at the base of the shell and the bursting charge by a fuse in the nose. In RIFLE, PISTOL, and MACHINE-GUN ammunition, the word usually signifies the brass casing that contains the propulsive charge. In shotgun ammunition, the shell is the entire cartridge, including shot, powder, primer, and case.

Shell See ROYAL DUTCH SHELL PLC

shell structure In building construction, a thin, curved plate structure shaped to transmit applied forces by compressive, tensile, and shear stresses that act in the plane of the surface. They are usually constructed of concrete reinforced with steel mesh (see SHOTCRETE). Shell construction began in the 1920s; the shell emerged as a major long-span concrete structure after World War II. Thin parabolic shell vaults stiffened with ribs have been built with spans up to about 300 ft (90 m). More complex forms of concrete shells have been made, including hyperbolic paraboloids, or saddle shapes, and intersecting parabolic vaults less than 0.5 in. (1.25 cm) thick. Pioneering thin-shell designers include FELIX CANDELA and PIER LUIGI NERVI.

Shelley, Mary Wollstonecraft *orig.* **Mary Wollstonecraft Godwin** (b. Aug. 30, 1797, London, Eng.—d. Feb. 1, 1851, London) English Romantic novelist. The only daughter of WILLIAM GODWIN and MARY WOLLSTONECRAFT, she met and eloped with PERCY B. SHELLEY in 1814. They married in 1816 after his first wife committed suicide. Mary Shelley's best-known work is *Frankenstein* (1818), a narrative of the dreadful consequences of a scientist's artificially creating a human

Mary Wollstonecraft Shelley, detail of an oil painting by Richard Rothwell, first exhibited 1840; in the National Portrait Gallery, London.

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

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being. After her husband's death in 1822, she devoted herself to publicizing his writings and educating their son. Of her several other novels, the best, *The Last Man* (1826), is an account of the future destruction of the human race by a plague.

Shelley, Percy Bysshe (b. Aug. 4, 1792, Field Place, near Horsham, Sussex, Eng.—d. July 8, 1822, at sea off Livorno, Tuscany) English Romantic poet. The heir to rich estates, Shelley was a rebellious youth who was expelled from Oxford in 1811 for refusing to admit authorship of *The Necessity of Atheism*. Later that year he eloped with Harriet Westbrook, the daughter of a tavern owner. He gradually channeled his passionate pursuit of personal love and social justice into poetry. His first major poem, *Queen Mab* (1813), is a utopian political epic revealing his progressive social ideals. In 1814 he eloped to France with Mary Wollstonecraft Godwin (see MARY SHELLEY); in 1816, after Harriet drowned herself, they were married. In 1818 the Shelleys moved to Italy. Away from British politics, he became less intent on social reform and more devoted to expressing his ideals in poetry. He composed the verse tragedy *The Cenci* (1819) and his masterpiece, the lyric drama *Prometheus Unbound* (1820), which was published with some of his finest shorter poems, including "Ode to the West Wind" and "To a Skylark." *Epipsychidion* (1821) is a Dantean fable about the relationship of sexual desire to spiritual love and artistic creation. *Adonais* (1821) commemorates the death of JOHN KEATS. Shelley drowned at age 29 while sailing in a storm off the Italian coast, leaving unfinished his last and possibly greatest visionary poem, *The Triumph of Life*.

Percy Bysshe Shelley, oil painting by Amelia Curran, 1819; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

shellfish Any aquatic MOLLUSK, CRUSTACEAN, or ECHINODERM that has a shell. OYSTERS, MUSSELS, SCALLOPS, and CLAMS rank among the most commercially important. Certain gastropod mollusks, such as ABALONE, WHELK, and CONCH, are also marketed. The main crustaceans are SHRIMP, LOBSTER, and CRAB. Among echinoderms, SEA URCHINS and SEA CUCUMBERS are locally popular. After being harvested, all shellfish are highly perishable. Many types are cooked live to protect the consumer against the effects of spoilage.

sheltie See SHETLAND SHEEPDOG

Shen-hsi See SHAANXI

Shenandoah National Park National park, BLUE RIDGE Mountains, northern Virginia, U.S. Formed in 1935, the park consists of 193,537 ac (78,322 ha) and is noted for its scenery, which affords some of the widest views in the eastern states. It is heavily forested with hardwoods and conifers; wildlife includes deer, foxes, and numerous birds.

Shenandoah Valley Valley, chiefly in Virginia, U.S. The valley is about 150 mi (241 km) long and 25 mi (40 km) wide, extending southwest from Harpers Ferry, W.Va., and lying between the BLUE RIDGE and ALLEGHENY MOUNTAINS. It is drained by the Shenandoah River. The route of the famous 19th-century Valley Turnpike (now an interstate highway) was used earlier by Native Americans and later became a main artery for westward expansion. The Shenandoah Valley was the scene of military operations throughout the AMERICAN CIVIL WAR. Today its many parks, limestone caverns, and scenic drives are tourist attractions. In 2005 the Museum of the Shenandoah Valley opened in Winchester, Va.

sheng \'shəŋ\ *Chinese* **"sage" or "saint"** In Chinese belief, a mortal who attains extraordinary or supernatural powers by self-cultivation and serves as a model for others. CONFUCIUS used the term to refer to exemplary rulers of the past.

Shensi See SHAANXI

Shenyang \'shən-'yäŋ\ *or* **Shen-yang** *formerly* **Mukden** \'mùk-dən\ City (pop., 2003 est.: 3,995,500), capital of LIAONING province, northeastern China. An ancient city, it was the MANCHU capital (1625–44) before the establishment of the QING (Manchu) dynasty. After 1895 it was fought over by Russia and Japan in the struggle for MANCHURIA. It was occupied by the Japanese (1931–45). Taken by the communist forces in 1948, it was a base for their conquest of the Chinese mainland. It is one of China's leading industrial cities; its manufactures include machinery, wires and cables, textiles, and chemicals. It is also a cultural and educational centre.

Shepard, Alan B(artlett), Jr. (b. Nov. 18, 1923, East Derry, N.H., U.S.—d. July 21, 1998, Monterey, Calif.) U.S. astronaut. He graduated from the U.S. Naval Academy and served in the Pacific during World War II. In 1959 he became one of the original seven MERCURY program astronauts. In May 1961, 23 days after YURY A. GAGARIN became the first human to orbit Earth, Shepard made a 15-minute suborbital flight that reached an altitude of 115 mi (185 km). He later commanded the APOLLO 14 flight (1971), the first to land in the lunar highlands. Retiring from NASA and the navy in 1974, he entered private business.

Shepard, Roger N(ewland) (b. Jan. 30, 1929, Palo Alto, Calif., U.S.) U.S. psychologist and cognitive scientist. He received a Ph.D. from Yale University and later worked at Bell Laboratories (1958–66) and taught at Stanford University (from 1968). He is known for his work in multidimensional scaling, the use of spatial models to show similarities and dissimilarities among data. He has also examined the phenomena of "mental rotation," a form of image transformation. He received the National Medal of Science in 1995.

Shepard, Sam *orig.* **Samuel Shepard Rogers** (b. Nov. 5, 1943, Fort Sheridan, Ill., U.S.) U.S. playwright and actor. He worked as an actor and rock musician before turning to playwriting; his early one-act dramas and experimental plays were performed Off-Broadway in the 1960s, winning several Obie Awards. His successful full-length plays, noted for their often surreal images drawn from the American West, science fiction, and popular culture, include *The Tooth of Crime* (1972), *Curse of the Starving Class* (1976), *Buried Child* (1979, Pulitzer Prize), *True West* (1980), *Fool for Love* (1983; film, 1985), and *Simpatico* (1996). He wrote the screenplay for *Paris, Texas* (1984) and acted in numerous movies, including *Days of Heaven* (1978) and *The Right Stuff* (1983).

shepherd's purse Widespread lawn and roadside weed (*Capsella bursa-pastoris*) of the MUSTARD FAMILY, native to the Mediterranean and now found worldwide. Growing as high as 18 in. (45 cm), it is easily recognized by its flat, heart-shaped, green fruits, borne along the branching flower stalks, which arise from a dandelion-like rosette of deeply cut or almost entire leaves at the base and bear clusters of tiny white flowers. Shepherd's purse has been much studied to understand embryogenesis (development from zygote to seedling) in flowering plants.

Shepp, Archie (Vernon) (b. May 24, 1937, Fort Lauderdale, Fla., U.S.) U.S. JAZZ saxophonist and composer. Shepp was originally inspired by JOHN COLTRANE. His playing increasingly demonstrated the influence of BEN WEBSTER, with a wide vibrato and gruff tone; his occasional eruptions of harsh screams and multiphonics (two notes played simultaneously) became trademarks of avant-garde saxophone technique. His first recordings were with free-jazz pianist Cecil Taylor (b. 1933) in the early 1960s; thereafter he worked as leader of his own groups. Also a playwright and educator, Shepp became an eloquent spokesman for the new music and its social significance.

Sheraton, Thomas (b. 1751, Stockton-on-Tees, Durham, Eng.—d. Oct. 22, 1806, London) British cabinetmaker. A leading exponent of NEOCLASSICISM, he gave his name to a style of furniture characterized by a firm, feminine refinement of late Georgian and became probably the most powerful source of inspiration behind the furniture of the late 18th century. His four-part *Cabinet-Maker and Upholsterers' Drawing Book* (1791) greatly influenced British and U.S. design. At his best, Sheraton had a natural approach to contemporary design: he used wood for its own sake, rather than covering it with such disguises as gilt or modulating it excessively with ormolu mounts.

Sheridan, Philip H(enry) (b. March 6, 1831, Albany, N.Y., U.S.—d. Aug. 5, 1888, Nonquitt, Mass.) U.S. army officer. He graduated from West Point and served at frontier posts. In the American Civil War he led a Union division in Tennessee and helped win the Battle of CHATTANOOGA with his cavalry charge up Missionary Ridge. In the East he became commander of the cavalry (1864) and led raids on Confederate forces around Richmond, Va. As commander of the Army of the Shenandoah, he drove Confederate forces under JUBAL EARLY from the Shenandoah Valley. He

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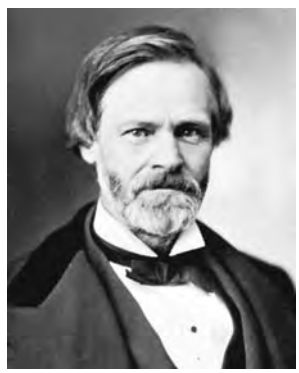
joined Ulysses S. Grant to help secure Union victories in the Petersburg Campaign. After the war he became general of the army (1883).

Sheridan, Richard Brinsley (Butler) (baptized Nov. 4, 1751, Dublin, Ire.—d. July 7, 1816, London, Eng.) British playwright, orator, and politician. His family moved to England, and he was educated at Harrow School in London. He rejected a legal career for the theatre. His comedy *The Rivals* (1775) introduced the popular character Mrs. Malaprop and established him as a leading dramatist. He became manager and later owner of the Drury Lane Theatre (1776–1809), where his plays were produced. He won wide acclaim for his comedy of manners *The School for Scandal* (1777) and showed his flair for satirical wit again in *The Critic* (1779). His plays formed a link in the history of the comedy of manners between the Restoration drama and the later plays of Oscar Wilde. In 1780 Sheridan became a member of Parliament, where he was a noted orator for the minority Whig party.

sheriff In the U.S., the chief law-enforcement officer for the courts in a county. He is ordinarily elected, and he may appoint a deputy. The sheriff and his deputy have the power of police officers to enforce criminal law and may summon private citizens (the *posse comitatus*, or "force of the county") to help maintain the peace. The main judicial duty of the sheriff is to execute processes and writs of the courts. Officers of this name also exist in England, Wales, Scotland, and Northern Ireland. In England the office of sheriff existed before the Norman Conquest (1066).

Sherman, Cindy (b. Jan. 19, 1954, Glen Ridge, N.J., U.S.) U.S. photographer. After graduating from the State University of New York at Buffalo, Sherman began work on *Untitled Film Stills* (1977–80), one of her best-known projects. The series of 8 x 10-inch black-and-white photographs features Sherman in a variety of roles reminiscent of film noir. Throughout her career she would continue to be the model in her photographs, donning wigs and costumes that evoke images from the realms of advertising, television, film, and fashion and that, in turn, challenge the cultural stereotypes about women supported by these media. During the 1980s Sherman's work featured mutilated bodies and reflected concerns such as eating disorders, insanity, and death. She returned to ironic commentary upon female identities in the 1990s, introducing mannequins and dolls to some of her photographs.

Sherman, John (b. May 10, 1823, Lancaster, Ohio, U.S.—d. Oct. 22, 1900, Washington, D.C.) U.S. politician. A brother of William T. Sherman, he served in the U.S. House of Representatives (1855–61). A fiscal expert, he helped establish the national banking system (1863) and supported legislation that returned the U.S. to the gold standard. He served as U.S. secretary of the treasury (1877–81). In the U.S. Senate (1861–77, 1881–97), he proposed the Sherman Antitrust Act and the Sherman Silver Purchase Act (1890). He later served briefly as secretary of state (1897–98), resigning the day Congress declared war against Spain.



John Sherman
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Sherman, Roger (b. April 19, 1721, Newton, Mass.—d. July 23, 1793, New Haven, Conn., U.S.) American jurist and politician. Active in trade and law in Connecticut, he served as judge of the superior court (1766–85) and mayor of New Haven (1784–93). A delegate to the Continental Congress, he signed the Declaration of Independence and helped draft the Articles of Confederation. At the Constitutional Convention, he proposed a compromise on congressional representation that combined facets of the two opposing plans by the large and small states. The result, called the Connecticut (or Great) Compromise, which was incorporated into the Constitution, provided for a bicameral legislature with representation based on population in one house (House of Representatives) and on the principle of equality in the other (Senate).

Sherman, William Tecumseh (b. Feb. 8, 1820, Lancaster, Ohio, U.S.—d. Feb. 14, 1891, New York, N.Y.) U.S. army general. A brother of John Sherman, he graduated from West Point, served in Florida and California, then resigned his commission in 1853 to pursue a banking career. He rejoined the Union army when the American Civil War broke out. He fought in the Battle of Bull Run, then served under Ulysses S. Grant at Shiloh and was promoted to major general. With Grant he helped win the Vicksburg Campaign and the Battle of Chattanooga. As commander of the division of the Mississippi, he assembled 100,000 troops for the invasion of Georgia (1864). After engagements with Confederate troops under Joseph Johnston, he captured and burned Atlanta and began his devastating March to the Sea to capture Savannah, leaving a trail of near-total destruction. In 1865 he marched north, destroying Confederate railroads and sources of supply in North and South Carolina. He accepted the surrender of Johnston's army on April 26. Promoted to general, he succeeded Grant as commander of the army (1869–84). Often credited with the saying "War is hell," he was a major architect of modern total war.

Sherman Antitrust Act (1890) First U.S. legislation enacted to curb concentrations of power that restrict trade and reduce economic competition. Proposed by Sen. John Sherman, it made illegal all attempts to monopolize any part of trade or commerce in the U.S. Initially used against trade unions, it was more widely enforced under Pres. Theodore Roosevelt. In 1914 Congress strengthened the act with the Clayton Antitrust Act and the formation of the Federal Trade Commission. In 1920 the U.S. Supreme Court relaxed antitrust regulations so that only "unreasonable" restraint of trade through acquisitions, mergers, and predatory pricing constituted a violation. Later cases reinforced the prohibition against monopoly control, including the 1984 break-up of AT&T. See also antitrust law.

Sherpa Any member of a mountain-dwelling people of Nepal and of Sikkim state, India. Sherpas are of Tibetan culture and descent and speak a Tibetan dialect. They make a living spinning and weaving wool, along with farming and cattle breeding. They have won international renown as porters in the high Himalayas. They number about 120,000.

Sherrington, Sir Charles Scott (b. Nov. 27, 1857, London, Eng.—d. March 4, 1952, Eastbourne, Sussex) English physiologist. By studying animals whose cerebral cortexes had been removed, he showed that reflexes are integrated activities of the total organism, not based on isolated "reflex arcs." Sherrington's law states that when one set of muscles is stimulated, muscles opposing their action are inhibited. He showed that the role of proprioception in reflexes that maintain upright posture against gravity is independent of cerebral function and skin sensation. His work influenced the development of brain surgery and treatment of nervous disorders, and he coined the terms *neuron* and *synapse*. His classic work is *The Integrative Action of the Nervous System* (1906). In 1932 he shared a Nobel Prize with Edgar Adrian (1889–1977).

sherry Fortified wine of Spanish origin. It takes its name from the province of Jerez de la Frontera in Spain. Essential to its taste is the action of *flor*, a mildewlike growth encouraged by a slight exposure to air after fermentation. Also unique is the *solera* system of blending wines of many vintage years. Sherry is fortified after fermentation with high-proof brandy to 16–18% alcohol. It is served primarily as an aperitif, though sweeter, heavier sherries are used as dessert wines.

Sherwood, Robert E(mmet) (b. April 4, 1896, New Rochelle, N.Y., U.S.—d. Nov. 14, 1955, New York, N.Y.) U.S. playwright. Sherwood was a magazine editor in New York City and a member of the Algonquin Round Table, the centre of a New York literary coterie. He examined the pointlessness of war in his first play, *The Road to Rome* (1927). *Idiot's Delight* (1936), *Abe Lincoln in Illinois* (1938), and *There Shall Be No Night* (1940) won Pulitzer prizes. In 1938 he cofounded the Playwrights' Company, which became a major producing company. During World War II he wrote speeches for Pres. Franklin D. Roosevelt and headed the overseas branch of the Office of War Information (1941–44). His book *Roosevelt and Hopkins* (1948) won a Pulitzer Prize. Many of his plays were adapted for film; his original screenplays include *The Best Years of Our Lives* (1946, Academy Award).

Sherwood Forest Woodland, Nottinghamshire, England. A former royal hunting ground that is known for its association with the legendary Robin Hood, Sherwood Forest formerly occupied almost all of western Nottinghamshire and extended into Derbyshire. Today a reduced area of woodland remains between Nottingham and Worksop.

Shetland Islands *or* **Zetland Islands** Island group (pop., 2001: 21,988), Scotland. The Shetlands comprise some 100 islands located 130

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mi (210 km) north of the Scottish mainland and about 400 mi (640 km) south of the Arctic Circle. They form the Shetland administrative region; the region's capital is Lerwick. Fewer than 20 of the islands are inhabited. The northernmost part of Britain, the islands have fjordlike coasts and a climate warmed by the North Atlantic Current. The Norse ruled the Shetlands from the 8th to the 15th century. In 1472 the islands, with Orkney, were annexed to the Scottish crown. They are famous for their livestock, which includes the Shetland pony and the Shetland sheep. The latter's fine wool is used in the distinctive Shetland and Fair Isle knitted patterns. The North Sea oil industry has contributed to the economy.

Shetland pony Breed of pony that originated in Scotland's Shetland Islands. Well adapted to the islands' harsh climate and scant food supply, Shetlands were used as pack horses. Around 1850 they were taken to England to work in coal mines and to the U.S., where a more refined pony suitable for children was developed. Except for certain dwarf ponies, the Shetland is the smallest breed of horse. Its average height is about 40 in. (102 cm; Shetlands are not measured in hands). Shetlands are long-lived and need little care; they are gentle and even-tempered if properly trained.

Shetland sheepdog *or* **sheltie** Breed of sheepdog developed from a Scottish working dog to herd the small sheep of the Shetland Islands. The sheltie resembles the rough-coated collie but in miniature; it stands 13–16 in. (33–41 cm). Sturdy and agile, it is noted for its herding ability, intelligence, and affectionate nature. Its long, straight coat is generally black, brown, or blue-gray with black mottling.

Shetland sheepdog
SALLY ANNE THOMPSON/EB INC.

Shevardnadze \ˌshe-vərd-ˈnäd-zə**, Eduard (Amvrosiyevich)** (b. Jan. 25, 1928, Mamati, Georgia, U.S.S.R.) Soviet foreign minister (1985–90, 1991) and head of state of Georgia (1992–2003). He rose in the Komsomol hierarchy to become first secretary of its central committee in Georgia (1957–61). He later served as a member of the Soviet Union's Central Committee (1976) and a full member of the Politburo (1985). As foreign minister under Mikhail Gorbachev, he implemented the Soviet withdrawal from Afghanistan in 1988, new arms treaties with the U.S., and the Soviet Union's tacit acquiescence in the fall of the communist regimes of eastern Europe (1989–90), while promoting the reform policies of glasnost and perestroika. After the Soviet Union's collapse, he returned to the newly independent republic of Georgia, where he was elected chairman of the State Council (an office then equivalent to president) in 1992 and later that year chairman of parliament. He fought organized crime and tried to find solutions for separatist violence in the Georgian provinces of South Ossetia and Abkhazia. After surviving an assassination attempt in August 1995, he was elected president of Georgia in November. His government faced numerous problems, including a failing economy and charges of corruption and cronyism. In addition, several elections were marred by allegations of irregularities and fraud. Faced with growing unrest, Shevardnadze resigned in November 2003.

Shīʿa See Shiʿite

shiatsu See acupressure

Shibusawa Eiichi \ˌshə-bü-ˈsä-wä-ˈā-i-chē\ (b. March 16, 1840, Musashi province, Japan—d. Nov. 11, 1931, Tokyo) Japanese industrialist and government official. The son of wealthy peasants, he received samurai status from the shogun Tokugawa Yoshinobu (1837–1913). Following the Meiji Restoration in 1868, he worked in the finance ministry of the new government. In 1873 he left to become the first president of Dai-ichi Bank (now Dai-ichi Kangyo Bank). In 1880 he organized the Ōsaka Spinning Mill, a major industrial success. He also created a cotton-spinners' *zaibatsu*, or cartel, to help the industry and make mutually advantageous arrangements with shippers and merchandisers, a practice common in industrializing Japan. He helped create and manage many other companies, founded the Tokyo Chamber of Commerce and Bankers Assn., and, after retiring, was active in social welfare causes.

shigella \shi-ˈgel-ə\ Any of the rod-shaped bacteria that make up the genus *Shigella*, which are normal inhabitants of the human intestinal tract and can cause dysentery, or shigellosis. Shigellae are gram-negative (see gram stain), non-spore-forming, stationary bacteria. *S. dysenteriae*, spread by contaminated water and food, causes the most severe dysentery because of its potent toxin, but other species may also be dysentery agents.

Shih-chia-chuang See Shijiazhuang

shih tzu \ˈshē-ˈdzü\ Breed of toy dog developed in Tibet from the Pekingese and the Lhasa apso. Sturdily built and short-legged, it stands about 10 in. (26 cm) tall and weighs 18 lb (8 kg) or less. It is longer than it is tall and has a short muzzle, hanging ears, and heavily haired tail, which it carries over its back. Its long, dense coat may be any of several colours and falls over the eyes, forming a beard.

Shihuangdi *or* **Shih Huang-ti** \ˈshir-ˈhwäŋ-ˈdē\ *orig.* **Zhao Zheng** (b. c. 259 bc, Qin state, northwestern China—d. 210 bc, Hebei province) Founder of the Qin dynasty (221–207 bc). His father was king of Qin, which was regarded as barbarous by the central states of China but had developed a strong bureaucratic government under the philosophy of legalism (see Hanfeizi). Aided by Li Si, Zheng eliminated the other Chinese states until in 221 bc Qin ruled supreme. He proclaimed himself Shihuangdi ("First Sovereign Emperor") and initiated reforms designed to create a fully centralized administration. He was interested in magic and alchemy, hoping for an elixir of immortality; his reliance on magicians was strongly condemned by Confucian scholars, many of whom he executed. The scholars also advocated a return to old feudal ways; their obstinacy led him to order the burning of all nonutilitarian books. Traditional histories regarded him as the ultimate villain, cruel, uncultivated, and superstitious. Modern historians stress the endurance of his bureaucratic and administrative structure. Though the Qin dynasty collapsed after his death, future dynasties adopted his structures. He was buried in a massive tomb with an army of more than 6,000 terra-cotta soldiers and horses. See also Qin tomb.

Shiʿite \ˈshē-ˌīt\ Member of the Shiʿite branch of Islam, which resulted from the first *fitnah*, or split, within the religion over leadership. Members of the political faction that supported ʿAlī, Muhammad's son-in-law, as the Prophet's heir after the murder of the third caliph, ʿUthmān, the Shiʿites gradually became a religious movement after the murder of ʿAlī. ʿAlī's followers insisted that a caliph, or imam, be a lineal descendant of ʿAlī and his wife, Fāṭimah. Shiʿite legal tradition is distinct from the four major schools of thought in Sunnite Islam and is generally regarded as the most conservative. Though Shiʿites represent only about 10% of Muslims in the world, they are a majority in Iran and Iraq, and there are sizable populations in Yemen, Syria, Lebanon, East Africa, Pakistan, and northern India. The largest subdivision is the Ithnā ʿAshariyyah, or Twelvers, who recognized 12 historical imams (including ʿAlī); other subsects include the Ismāʿīliyyah and the Zaydiyyah.

Shijiazhuang \ˈshi-ˈjyä-ˈjwäŋ\ *or* **Shih-chia-chuang** City (pop., 1999 est.: 1,338,796), capital of Hebei province, northeastern China. Located on the edge of the North China Plain at the foot of the Taihang Mountains, the site dates to pre-Han times (c. 206 bc). After it came under the Tang dynasty (7th–10th century ad), it was only a local market town. Its growth into one of China's major cities began in 1905, when the railway reached the area, stimulating trade and agriculture. Other rail connections and an extensive road network established it as a communications centre. It developed into an industrial city with administrative functions at the end of World War II. It is now one of China's major industrial, cultural, and economic centres.

shikhara See sikhara

Shikoku \shē-ˈkō-kü\ Smallest main island (pop., 2000 prelim.: 4,148,000) of Japan. It is located south of Honshu and east of Kyushu. Much of its 7,063 sq mi (18,292 sq km) is mountainous, and the population is concentrated in urban areas along the coast. Rice, barley, wheat, and mandarin oranges are among the island's major crops. Industries include petroleum, textiles, paper, and fishing.

Shillong \shi-ˈlȯŋ\ City (pop., 2001 prelim.: 132,876), northeastern India. It has been an administrative centre since 1864, first as a district headquarters, later as the capital of Assam, and since 1972 as the capital of Meghalaya state. It was destroyed by an earthquake in 1897; completely rebuilt, it is now a resort area and an important agricultural trade centre.

Shilluk \shi-ˈlük\ People living on the western bank of the Nile in The Sudan. They speak an Eastern Sudanic language of the Nilo-Saharan family and are sedentary agriculturalists who keep cattle, sheep, and goats.

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Historically, they were united in a single tribal state headed by a divine king whose physical and ritual well-being was held to ensure the state's prosperity. In addition to several classes of royalty, the Shilluk traditionally were divided into royal retainers, commoners, and slaves. See also NILOT.

Shiloh \'shī-lō**, Battle of** (April 6–7, 1862) Second major engagement of the AMERICAN CIVIL WAR. Union forces under ULYSSES S. GRANT, including WILLIAM T. SHERMAN, camped on the Tennessee River at Pittsburg Landing, Tenn. (near Shiloh Church), in preparation for an offensive. Confederate forces under A.S. Johnston and P.G.T. BEAUREGARD attacked, surprising the Union troops and forcing their retreat, though Johnston was mortally wounded. A Union counterattack the next day regained the lost ground, and the Confederates withdrew to Corinth, Miss. Both sides claimed victory, but the battle was considered a Confederate defeat. Each side suffered about 10,000 casualties.

Shimabara \shē-'mä-bä-rä\ **Rebellion** (1637–38) In Japanese history, last major uprising against Tokugawa rule until the 1860s. A large contingent of peasants, supported by *RŌNIN* (masterless samurai), rebelled in protest of heavy taxation. After initial success, the uprising was crushed, and an estimated 37,000 rebels were killed. Because many of the peasants were converts to Christianity, their rebellion strengthened government determination to isolate Japan from foreign influence and vigorously enforce its proscription of all Christian beliefs and activities.

Shimla *formerly* **Simla** City (pop., 2001 prelim.: 142,161), capital of HIMACHAL PRADESH state, northwestern India. The city was built by the British after the Gurkha War (1814–16), on a ridge of the Himalayan foothills some 7,100 ft (2,200 m) high. It served as the British summer capital (1865–1939), and as the headquarters of PUNJAB (1947–53). Because of its cool climate and scenic setting, it is one of India's most popular hill resorts.

shimmy See CHEMIN DE FER

Shinano \shē-'nä-nō\ **River** River, HONSHU, Japan. The country's longest river, at 228 mi (367 km), it rises at the foot of Mount Kobushi and flows north-northeast to enter the Sea of JAPAN (East Sea) at Niigata. It has long served as an inland waterway and has numerous river ports.

Shinbutsu shūgō \'shēn-ˌbůt-sů-'shü-ˌgō\ Japanese amalgamation of BUDDHISM and SHINTŌ. The hybridization began on Buddhism's appearance in Japan (mid-6th century AD), and the practice of building Shintō and Buddhist shrines near each other developed in the 8th century. To separate the two religions, the government issued an edict in 1868 ordering Buddhist priests connected with Shintō shrines either to be reordained as Shintō priests or to return to lay life. Because the state religion was Shintō, the government abolished Buddhist ceremonies in the imperial household. Nevertheless, most Japanese incorporate elements of both religions in their lives, celebrating life-related events (birth, coming of age, marriage) at Shintō shrines but holding Buddhist funeral rites and memorial services.

shinden-zukuri \'shēn-ˌden-zů-'ků-rē\ Japanese architectural style of mansion-estates constructed in the HEIAN PERIOD (794–1185). The form consisted of a *shinden* (central building) to which subsidiary structures were connected by corridors. The *shinden* faced south on an open court, across which was a pond garden. The eastern and western *tainoya*, or subsidiary living quarters, were attached by *watadono* (corridors), from which narrow corridors extended south, ending in small pavilions. This layout resulted in a U-shaped arrangement around the court. See also SHOIN-ZUKURI.

shiner Any of several small freshwater fishes (genera *Notemigonus* and *Notropis*, family Cyprinidae). The common shiner (*Notropis cornutus*) is a blue and silver MINNOW up to 8 in. (20 cm) long. The golden shiner (*Notemigonus cryseleucas*), sometimes called the American ROACH, is a greenish and golden minnow, about 12 in. (30 cm) long and weighing 1.5 lbs (0.7 kg). It is edible and valuable as bait.

shingle Thin piece of building material made of wood, asphaltic material, slate, metal, or concrete, laid in overlapping rows to shed water. Shingles are widely used as roof covering on residential buildings and sometimes also for SIDING (see SHINGLE STYLE). Wood shingles in the U.S. are usually made of cypress, redwood, or Western red cedar.

Shingle style In the U.S., a style of wood-shingle-covered domestic architecture of the 1870s and '80s. Among the finest examples are HENRY HOBSON RICHARDSON's Sherman House (1874–75), Newport, R.I., and Stoughton House (1882–83), Cambridge, Mass. The style grew out of the QUEEN ANNE and STICK STYLES and was stimulated by a revived interest in colonial American architecture. The small size of the shingle made it easy to cover a variety of shapes. Like the Stick style, the Shingle style is characterized by a free-flowing, open plan; open porches and irregular roof lines contribute to the picturesque or rustic effect. The style had a significant influence on FRANK LLOYD WRIGHT.

shingles *or* **herpes zoster** \'hər-ˌpēz-'zäs-tər\ Acute viral skin and nerve infection. Groups of small blisters appear along certain nerve segments, most often on the back, sometimes after a dull ache at the site; pain becomes more severe when the blisters break out. Caused by the same virus as CHICKENPOX, it probably results from reactivation of seemingly inactive virus in a partially immune person. Spontaneous recovery from the infection usually occurs within two weeks, but NEURALGIA may last months or even years longer.

Shingon \'shēŋ-ˌgȯŋ,\ *English* \'shin-ˌgän\ Esoteric Japanese sect based on an interpretation of 9th-century Chinese BUDDHISM. It holds that the BUDDHA's secret wisdom can be developed through special ritual means (see YOGA) employing body, speech, and mind, including the use of symbolic gestures, mystical syllables, and mental concentration. The whole is intended to arouse a realization of the spiritual presence of the Buddha inherent in all living things. Shingon's main scripture, the *Mahavairocana Sutra* ("Great Sun Sutra"), is not canonical in other Buddhist schools. Shingon is properly considered a form of VAJRAYANA, though it was much modified and systematized by KŪKAI.

Shining Path *Spanish* **Sendero Luminoso** Maoist movement in Peru dedicated to violent revolution. It was founded in 1970 by a philosophy professor, Abimael Guzmán Reynoso (b. 1934), as a result of a split in the Peruvian Communist Party. The *senderistas* began their campaign among the impoverished Indians of the high Andes, attracting sympathizers by their emphasis on the empowerment of Indians at the expense of Peru's traditional elite. They gained control of large areas of Peru through violence and intimidation. By 1992, when Guzmán was captured and their influence began to wane, they had caused an estimated 25,000 deaths and seriously disrupted the Peruvian economy. Their new leader, Oscar Ramirez Durand, was sentenced to life imprisonment in 1999.

Shinran \'shēn-ˌrän\ *orig.* **Matsuwaka-Maru** (b. 1173, near Kyōto, Japan—d. Jan. 9, 1263, Kyōto) Japanese philosopher and religious reformer. He entered the priesthood at age nine and studied for 20 years at the centre founded by SAICHŌ on Mount Hiei. He later met HŌNEN, founder of the Jōdo sect (see PURE LAND BUDDHISM). When Hōnen's movement was suppressed, he and Shinran were exiled. For more than 20 years, Shinran lived an academic and missionary life, compiling the six volumes of his teachings. In 1224 he established Jōdo Shinshū ("True Pure Land sect"). He refined the Pure Land teaching that salvation could be attained through chanting the name of the Buddha Amida (AMITĀBHA) by saying that even one such utterance, if made with true faith, was sufficient for salvation. He advocated marriage for his priests to minimize the distance between clergy and laity. Jōdo Shinshū is the largest Buddhist denomination in modern Japan.

Shintō Indigenous religion of Japan. Based on the worship of spirits known as *kami*, Shintō has no founder and no official SCRIPTURE, though its mythology is collected in the *Kojiki* ("Records of Ancient Matters") and *Nihon shoki* ("Chronicles of Japan"), written in the 8th century. The term Shintō ("Way of the *Kami*") came into use to distinguish indigenous Japanese beliefs from BUDDHISM, which had been introduced into Japan in the 6th century. At Shintō's core are beliefs in the *kami*'s mysterious creating and harmonizing power. According to Shintō myths, in the beginning a certain number of *kami* simply emerged, and a pair of *kami*, IZANAGI AND IZANAMI, gave birth to the Japanese islands, as well as to the *kami* who became ancestors of the various clans. The Japanese imperial family claims descent from Izanagi's daughter, the sun goddess AMATERASU. All *kami* are said to cooperate with one another, and life lived in accordance with their will is believed to produce a mystical power that gains their protection, cooperation, and approval. Through veneration and observation of prescribed rituals at shrines (e.g., ritual purity), practitioners of Shintō can come to understand and live in accordance with divine will. In the early 21st century, Shintō had nearly 2.8 million followers. See also SHINBUTSU SHŪGŌ.

shinty *or* **shinny** Game similar to HURLING and FIELD HOCKEY. Players (12 per team) use curved sticks to hit a small, hard ball into the opposing team's goal (*hail*). It is considered the national game of Scotland, where it originated before the 17th century.

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ship Large floating vessel capable of crossing open waters. The term formerly was applied to sailing vessels with three or more masts; today it usually denotes a vessel of more than 500 tons' (450 metric tons') displacement. The largest ships today are enormous oil tankers, some of which are 500,000 tons (450,000 metric tons) deadweight. Other specialized ships (CONTAINERSHIPS) carry general freight in standardized containers that can be easily loaded, unloaded, and transferred. See also BATTLESHIP, BRIG, CLIPPER SHIP, CORVETTE, DHOW, FRIGATE, JUNK, LONGSHIP, OCEAN LINER, SCHOONER, YACHT.

ship money English tax levied by the crown on coastal cities for naval defense in time of war. First levied in medieval times, the tax required payment in the form of a number of warships or their equivalent in money. It was revived in 1634 by CHARLES I to raise extra revenue. He issued six annual writs (1634–39) that extended the imposition to inland towns and sought to establish it as a permanent tax. Its enforcement aroused widespread opposition and added to the discontent leading to the ENGLISH CIVIL WARS. In 1641 the tax was declared illegal by Parliament.

ship of the line Type of sailing warship, the principal vessel of the West's great navies from the mid-17th to the mid-19th century. It evolved from a tactic in naval warfare known as the line of battle, in which two opposing columns of ships maneuvered to fire their guns broadside against each other. Since the largest ships carrying the biggest guns usually won these battles, this led to the construction of more big line-of-battle ships, or ships of the line. These three-masted ships were often 200 ft (60 m) long, displaced 1,200–2,000 tons (1,100–1,800 metric tons), and had crews of 600–800 men; they usually had 60–110 cannons and other guns arranged along three decks. They eventually gave way to the steam-powered BATTLESHIP.

Shipka Pass Pass in the BALKAN MOUNTAINS, central Bulgaria. The pass is 4,376 ft (1,334 m) high. A main route between Bulgaria and Turkey, it was the site of fierce fighting during the RUSSO-TURKISH WARS; in one battle (1878), the Turks lost so many soldiers that their leader, Süleyman, earned the name "Shipka butcher."

Shippen, William, Jr. (b. Oct. 21, 1736, Philadelphia, Pa.—d. July 11, 1808, Philadelphia, Pa., U.S.) U.S. physician. He earned his M.D. in Edinburgh. In 1762 he established the first American maternity hospital, and in 1765, with JOHN MORGAN, he organized the first medical school in the American colonies, where he became the first systematic teacher of anatomy, surgery, and obstetrics. He was one of the first to use dissected human bodies to teach anatomy. He succeeded Morgan as head medical officer of the Continental Army in 1777. He was a founder and president of the College of Physicians of Philadelphia, the first American medical school.

shipping Transporting of goods and passengers by water. Early civilizations, which arose by waterways, depended on watercraft for transport. The Egyptians were probably the first to use seagoing vessels (c. 1500 BC); the Phoenicians, Cretans, Greeks, and Romans also all relied on waterways. In Asia, Chinese ships equipped with multiple masts and a rudder were making sea voyages by c. AD 200; from as early as the 4th century BC the Chinese also relied heavily on internal waterways to transport food to their large cities (see GRAND CANAL). Japan, too mountainous to rely on roads for mass transport, also relied on internal and coastal waterways for shipping from early in its history. The spice trade was a great stimulus to shipping trade; Arabians were sailing to the spice islands before the Christian era and European merchant marines grew up largely because of it. The tea trade had a similar effect, as did the discovery of gold in the New World. From the 17th to the 19th century, the slave trade was a major feature of Atlantic shipping. The U.S. and England were the ascendant shipping nations in the 19th century; Germany, Norway, Japan, The Netherlands, and France joined them in the early 20th century, with Greece dominating the industry by the century's end. Transoceanic shipping remains a vital part of the world economy. Many U.S. merchant ships are registered in a third nation to avoid heavy taxes. See also British EAST INDIA CO.; Dutch EAST INDIA CO.; French EAST INDIA CO.

shipworm *or* **pileworm** Any of approximately 65 species (family Teredidae) of common marine BIVALVES that can severely damage wooden structures, including ship hulls and wharves. Its anterior end is covered by a shell; the rest is a tubelike structure, sometimes up to 6 ft (1.8 m) long. File-like ridges on its white shell cut into wood at 8–12 rasping motions a minute. It secretes lime to line its burrow, and its tubelike portion extends back to the burrow opening. It ingests food particles and oxygen from the water; some wood is also ingested as food.

Shirakawa Hideki (b. Aug. 20, 1936, Tokyo, Japan) Japanese chemist. He earned a Ph.D. from the Tokyo Institute of Technology in 1966. After graduation he began teaching at the University of Tsukuba. In 1977 he started collaborating with ALAN J. HEEGER and ALAN G. MACDIARMID, conducting experiments on the polymer polyacetylene. Their work demonstrated that certain plastics can be chemically changed to conduct electricity almost as readily as metals. Other conductive polymers were later discovered, and the finding was expected to play a significant role in the emerging field of molecular electronics. With Heeger and MacDiarmid, Shirakawa was awarded the Nobel Prize for Chemistry in 2000.

Shīrāz \shē-'räz\ Industrial and commercial city (pop., 1996: 1,053,025), south-central Iran. It was important during the Seleucid (312–175 BC), Parthian (247 BC–AD 224), and Sāsānian (c. AD 224–651) periods but reached its economic and cultural peak in the 10th–11th centuries, during the Islamic period. In the 14th century, TIMUR occupied Shīrāz, which had by that time become a Muslim centre rivaling BAGHDAD. In 1724 it was sacked by Afghan invaders and later became the capital of the Persian Zand dynasty (1750–94). Famous for its wine, gardens, shrines, and mosques, it was the birthplace of the Persian poets Saʿdī and Ḥāfeẓ, who remain local icons and whose tombs are located there.

Shire River \'shir-ā\ River, southern Malawi and central Mozambique. The most important river in Malawi, it flows 250 mi (402 km) from the southern shore of Lake MALAWI into the ZAMBEZI RIVER. In Malawi it drops 1,260 ft (384 m) in a spectacular 50-mi (80-km) stretch of gorges and cataracts. A dam at Liwonde regulates flow from Lake Malawi and provides flood control.

Shirer \'shīr-ər\, William L(awrence) (b. Feb. 23, 1904, Chicago, Ill., U.S.—d. Dec. 28, 1993, Boston, Mass.) U.S. journalist, historian, and novelist. He served as a foreign correspondent and radio broadcaster in Europe and India in the 1920s, '30s, and '40s. *Berlin Diary* (1941) collects his impressions of European political events. He was blacklisted in the McCarthy era as a leftist sympathizer. He is best known for *The Rise and Fall of the Third Reich* (1969, National Book Award), a massive study of Nazi Germany. His other major historical work is *The Collapse of the Third Republic* (1969), a study of France. *Gandhi* (1979) recalls interviews conducted in the 1930s.

shirk In Islam, idolatry and POLYTHEISM, both of which are regarded as heretical. The QUʾRĀN stresses that God does not share his powers with any partner (*sharik*) and warns that those who believe in idols will be harshly dealt with on the Day of Judgment. The concept of *shirk* has broadened considerably throughout the dogmatic development of Islam, and it has come to be used as the opposite of *tawḥīd* (the oneness of God). Different grades of *shirk* have been distinguished by Islamic law; they include the belief in superstition, belief in the power of created things (e.g., reverencing saints), and belief in those who profess to know the future—all of which pale beside polytheism in seriousness.

Shirley, William (b. Dec. 2, 1694, Preston, Sussex, Eng.—d. March 24, 1771, Roxbury, Mass.) American colonial governor. A lawyer in England, he moved to Boston in 1731. He was appointed admiralty judge (1733), king's advocate general (1734), and governor of Massachusetts (1741–49, 1753–56). In KING GEORGE'S WAR he planned the British capture of Louisbourg (1745). He became commander of British forces in North America (1755) but was dismissed after the failure of his expedition against Fort Niagara. He served as governor of the Bahamas (1761–67).

Shiva \'shi-və, 'shē-və\ *or* **Siva** Major deity of HINDUISM, believed to have many manifestations. Like VISHNU, he is the subject of an elaborate and sometimes contradictory

Shiva, bronze statue, Madras, c. AD 900.

COURTESY OF THE GOVERNMENT MUSEUM, CHENNAI; PHOTOGRAPH, ROYAL ACADEMY OF ARTS, LONDON

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mythology. He is both the destroyer and the restorer, the great ascetic and the symbol of sensuality, the benevolent herdsman of souls and the wrathful avenger. His female consort is known under various manifestations, including PARVATI, DURGA, and KALI. In SHAIVISM he is worshiped as the paramount lord.

Shivaji \'shi-vä-jē\ *or* **Sivaji** (b. Feb. 19, 1630, or April 1627, Shivner, Pune, India—d. April 3, 1680, Rajgarh) Indian king (r. 1674–80), founder of the Maratha kingdom of India. A devout Hindu, he grew up at a time when India was ruled by Muslims, and he found their religious persecution intolerable. Collecting a band of followers, he began in c. 1655 to seize weak outposts of the sultan of Bijapur. In 1659 he lured the sultan's army to its destruction and, possessed of its horses and armaments, became overnight a formidable warlord. The Mughal emperor AURANGZEB sent out his most prominent general and an army of 100,000 to capture him, but Shivaji made a daring escape. Gaining even more strength, he added a naval force to his military might. In 1674 he proclaimed himself an independent sovereign. He forged an alliance with the sultans in the south, thereby blocking the spread of Mughal rule. His rule was noted for its religious tolerance. See also MARATHA CONFEDERACY.

Shklovsky \'shklȯf-skē**, Viktor (Borisovich)** (b. Jan. 24, 1893, St. Petersburg, Russia—d. Dec. 8, 1984, Moscow) Russian critic and novelist. From 1914 he was a major voice in the critical movement called Russian FORMALISM, to which he contributed the concept of *ostranenie*, or "making it strange." He argued that literature is a collection of devices that force readers to view the world afresh by presenting old ideas or mundane experiences in new, unusual ways. His earlier works include the acclaimed memoir *A Sentimental Journey* (1923) and *The Technique of the Writer's Craft* (1928). Official Soviet displeasure with Formalism later obliged him to write within the constraints of SOCIALIST REALISM, and he published historical novels, film criticism, and highly praised literary studies.

shock State in which the circulatory system fails to supply enough blood to peripheral tissues to meet basic requirements. Symptoms—weak, rapid PULSE; low BLOOD PRESSURE; and cold, sweaty skin—are not all present in every case. Causes include low blood volume, caused by bleeding or fluid loss from BURNS or DEHYDRATION; inability of the heart to pump enough blood, due to HEART ATTACK, pulmonary EMBOLISM, or cardiac tamponade (compression of the heart by fluid in the membrane around it); and blood-vessel dilation as a result of SEPTICEMIA, allergy (including ANAPHYLAXIS), or drugs. All result in reduced capillary blood flow; reflexes increase heart rate and constrict small blood vessels to protect the blood supply to essential organs. Without treatment of the underlying cause, these mechanisms fail; since the cause is not always clear, cases tend to require different and occasionally contradictory treatment (e.g., intravenous fluids can save the life of a patient with massive blood loss but can overload a weakened heart).

shock absorber Device for controlling unwanted motion of a spring-mounted vehicle. On an automobile, the SPRINGS act as a cushion between the axles and the body and reduce the shocks produced by a rough road surface. Since some combinations of road surface and car speed may result in excessive up-and-down motion of the car body, shock absorbers—which today are hydraulic devices that oppose both compression and stretching of the springs—slow down and reduce the magnitude of these vibratory motions. See also DAMPING.

shock therapy See ELECTROCONVULSIVE THERAPY

Shockley, William B(radford) (b. Feb. 13, 1910, London, Eng.—d. Aug. 12, 1989, Palo Alto, Calif., U.S.) U.S. engineer and teacher. He received a Ph.D. from Harvard University. He joined Bell Labs in 1936, where he began experiments that led to the development of the TRANSISTOR. During World War II he was director of research for the U.S. Navy's Antisubmarine Warfare Operations Research Group; later (1954–55) he was deputy director of the Defense Department's Weapons Systems Evaluation Group. He established the Shockley Semiconductor Laboratory at Beckman Instruments in 1955. In 1956 he shared a Nobel Prize with JOHN BARDEEN and WALTER H. BRATTAIN for their work at Bell Labs on the transistor. He taught at Stanford University (1958–74). From the late 1960s he earned notoriety for his outspoken and critical views on the intellectual capacity of blacks.

shoe Outer covering for the foot, usually of leather, with a stiff or thick sole and heel, and generally reaching no higher than the ankle (unlike a boot). Early examples from Mesopotamia were moccasinlike wrap-arounds of leather; not until the Hellenistic Age did shoes become luxurious. The Romans developed shoes fitted for the left and right feet, and differentiated according to sex and rank. In the 14th–15th century, shoes became extremely long and pointed, the points attaining a length of 18 in. (45 cm) or more. In the 16th century, the toes became extremely broad, like a duck's bill. In the 17th century, shoes had moderately high heels and were often decorated with large rosettes of lace and ribbons, which gave way to gold or silver buckles in the 18th century. The first shoe factory opened in 1760, in Massachusetts, but not until the development of modern machinery in the 19th century were shoes made quickly and inexpensively.

Shoemaker, Bill *or* **Willie Shoemaker** *in full* **William Lee Shoemaker** (b. Aug. 19, 1931, Fabens, Texas, U.S.—d. Oct. 12, 2003, San Marino, Calif.) U.S. jockey. He began his racing career in 1949. He rode in 24 Kentucky Derbies and won four; he also won the Belmont Stakes five times and the Preakness twice. He rode more than 8,800 winners in his 41-year career, which ended in 1989, and he is considered the greatest American jockey of the second half of the 20th century.

Shoemaker-Levy 9 COMET that collided with t he planet JUPITER in July 1994, discovered by Carolyn and Eugene Shoemaker and David Levy 16 months earlier. The comet was torn apart into more than 20 fragments during a close encounter with Jupiter in July 1992, resulting in a "string of pearls" that collided sequentially with Jupiter two years later over a period of a week, leaving dark spots larger than Earth at their impact sites in Jupiter's atmosphere.

shōen \'shō-'en\ In Japan (c. 8th–15th century), a private, tax-free, often autonomous estate. As the *shōen* increased in numbers, they undermined the political and economic power of the central government and contributed to the growth of powerful local clans. Landowners would commend their parcels of land to powerful families or religious institutions with tax-free status, thereby obtaining that status for themselves. All people connected with the land—the powerful patron, the owner, and the estate manager—had rights to part of the income from the land. During the KAMAKURA PERIOD (1192–1333), the shogunate (military government) asserted authority over the *shōen* by inserting its own stewards (*jitō*) into each estate to collect taxes. During Japan's WARRING STATES PERIOD, the *shōen* gave way to consolidated landholdings controlled by DAIMYO (domain lords). See also SAMURAI.

shogi \'shō-gē\ Strategic board game for two players that evolved in Japan from the 8th to the 12th century. Although often called Japanese chess in the West, shogi is played with a board (9 × 9), pieces (flat, wedge-shaped tiles, all of one colour, with rank given by text on each side), and rules that are completely unlike those of CHESS. Its most unique feature is known as the drop, whereby a captured piece can be placed on an empty square, subject to certain restrictions. Most pieces are promoted to another piece, indicated by flipping its tile, after reaching particular regions of the board. Ownership of each piece is indicated by the direction of the wedge.

shogun \'shō-gən\ *Japanese* **"barbarian-quelling generalissimo"** In Japanese history, a military ruler. The title was first used during the HEIAN PERIOD, when it was occasionally bestowed on a general after a successful campaign. In 1185 MINAMOTO Yoritomo gained military control of Japan; seven years later he assumed the title of shogun and formed the first *bakufu*, or shogunate (see KAMAKURA PERIOD). Later Kamakura shoguns lost real power to the HŌJŌ FAMILY while remaining rulers in name. Ashikaga Takauji received the title of shogun in 1338 and established the Ashikaga shogunate (see MUROMACHI PERIOD), but his successors enjoyed even less control over Japan than had the Kamakura shoguns, and the country gradually fell into civil war (see ŌNIN WAR). TOKUGAWA Ieyasu's shogunate (see TOKUGAWA PERIOD) proved the most durable, but the Japanese penchant for titular rulers prevailed, and in time a council of elders from the main branches of the Tokugawa clan ruled from behind the scenes. Since the title of shogun ultimately came from the emperor, he became a rallying point for those who brought down the shogunate in the MEIJI RESTORATION.

shoin-zukuri \'shō-ēn-zù-'kù-rē\ Style of Japanese domestic architecture. The name is taken from a feature called the *shoin*, a study alcove with a built-in desk. Other common features included the TOKONOMA and *chigai-dana* (built-in shelves). The style, derived from Zen Buddhist monastic dwellings, gradually replaced the SHINDEN-ZUKURI style during the Muromachi period (1338–1573). It is characterized by a new modesty of

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scale (forced on the aristocracy by loss of income); asymmetry and an irregular flowing together of masses; and the use of solid-wall construction and sliding *SHŌJI*, rather than the movable partitions that divided the main living space in the *shinden*.

shōji \'shō-jē\ In Japanese architecture, sliding partition doors and windows made of a latticework wooden frame and covered with a tough, translucent white paper. When closed, they softly diffuse light throughout the house. In summer they can be slid back or removed, opening the house to the outside—a desirable arrangement in Japan because of the extreme humidity. *Shōji* are a feature of the SHOIN-ZUKURI style.

Shoin-zukuri interior in the Ginkaku Temple, Kyōto, showing a *chigai-dana* (left background) and a *shoin* with *shōji* (right background), late 15th century
OGURO PLANNING CO.—FPG

Sholem Aleichem \'shō-ləm-ə-'lā-ḵəm\ *orig.* **Sholem Yakov Rabinowitz** (b. Feb. 18, 1859, Pereyaslav, Russia—d. May 13, 1916, New York, N.Y., U.S.) Russian writer. Drawn to writing as a youth, he became a private tutor at age 17 and later served as a government rabbi. Beginning in 1883 he published more than 40 widely translated volumes of novels, stories, and plays in Yiddish. English translations from his 14-volume collected works include *Jewish Children* and *The Old Country*. His best-known character, Tevye the dairyman, was the subject of a volume of short stories that later was the basis for the musical *Fiddler on the Roof* (1964).

Sholes, Christopher Latham (b. Feb. 14, 1819, near Mooresburg, Pa., U.S.—d. Feb. 17, 1890, Milwaukee, Wis.) U.S. inventor. His first experiments were with numbering and letter-writing machines. In 1868 he was granted a patent for a TYPEWRITER with Carlos Glidden and Samuel W. Soulé; later improvements brought him two more patents. In 1873 he sold his rights for $12,000 to the Remington Arms Co., which developed the machine that was marketed as the Remington Typewriter.

Sholokhov \'shō-lə-ḵəf**, Mikhail (Aleksandrovich)** (b. May 24, 1905, Veshenskaya, Russia—d. Feb. 21, 1984, Veshenskaya, U.S.S.R.) Russian novelist. A native of the Don River region, he served in the Red Army and joined the Communist Party in 1932. He is best known for the huge novel *The Quiet Don*, translated in two parts as *And Quiet Flows the Don* (1934) and *The Don Flows Home to the Sea* (1940). A portrayal of the struggle between the Cossacks and Bolsheviks, it was heralded in the Soviet Union as a powerful example of SOCIALIST REALISM and became the most widely read novel in Russia. It became controversial when ALEKSANDR SOLZHENITSYN and others alleged that it was plagiarized from the Cossack writer Fyodor Kryukov (d. 1920). Sholokhov's later novels include *Virgin Soil Upturned* (1932–60). He received the Nobel Prize for Literature in 1965.

Shona Cluster of Bantu-speaking peoples living in eastern Zimbabwe, west-central Mozambique, and southern Zambia. Numbering about nine million, they cultivate corn, millet, and sorghum and keep cattle. Their villages consist of mud-and-wattle huts, granaries, and common cattle kraals. Shona traditional culture, now fast declining under Christianizing and urbanizing influences, was noted for its ironwork, pottery, and music. Magic, witchcraft, and sorcery remain important. The Shona are believed to have built Great Zimbabwe.

shooting Sport of gun marksmanship. It typically involves firing at targets with RIFLES, PISTOLS, and SHOTGUNS. World championship competitions are held for the small-bore rifle, free rifle, centre-fire pistol, free pistol, rapid-fire pistol, air rifle, air pistol, and shotgun. Shooting has been an Olympic sport since the modern games began in 1896; women's events were established in 1984. See also SKEET SHOOTING; TRAPSHOOTING.

shooting star See METEOR

shopping mall *or* **shopping centre** Collection of independent retail stores, services, and parking areas constructed and maintained by a management firm as a unit. It is a 20th-century adaptation of the historical marketplace. In the U.S., postwar migration from cities to suburbs and increased automobile use created a perceived need for centralized shopping facilities. The urban shopping arcade developed out of the need for shelter from the weather; Buffalo, N.Y., and Cleveland, Ohio, have charming trussed and glass-roofed examples. The next generation of shopping malls, the large regional centre sited in a vast sea of parking lots, bears little resemblance to its small, arcaded ancestors. Two of the world's largest malls are the West Edmonton Mall in Alberta, Canada, and the Mall of America in Bloomington, Minn. In recent years large shopping malls have attempted to revive an arcadelike atmosphere, often featuring atriums and balconies.

shore See COAST

Shore Temple Complex of elegant shrines (c. 700), one among a number of Hindu monuments at Mahabalipuram, on the coast of Tamil Nadu state, India. It is considered the finest early example of medieval southern Indian temple architecture. Unlike most of its neighbours at the site, it is built of cut stones rather than carved out of caves. It has two shrines, one dedicated to SHIVA and the other to VISHNU. Its style is characterized by a pyramidal *kutina*-type tower that consists of stepped stories topped by a cupola and finial, a form quite different from the northern Indian *SIKHARA*.

Short Parliament See LONG PARLIAMENT

short story Brief fictional prose narrative. It usually presents a single significant episode or scene involving a limited number of characters. The form encourages economy of setting and concise narration; character is disclosed in action and dramatic encounter but seldom fully developed. A short story may concentrate on the creation of mood rather than the telling of a story. Despite numerous precedents, it emerged only in the 19th century as a distinct literary genre in the works of writers such as E.T.A. HOFFMANN, HEINRICH KLEIST, EDGAR ALLAN POE, PROSPER MÉRIMÉE, GUY DE MAUPASSANT, and ANTON CHEKHOV.

Shorter, Wayne (b. Aug. 25, 1933, Newark, N.J., U.S.) U.S. saxophonist and composer. After studying at New York University and serving in the U.S. Army, he played with ART BLAKEY's group (1959–64), acting as its music director. Shorter then joined MILES DAVIS's remarkable mid-1960s group, which included HERBIE HANCOCK, bassist Ron Carter (b. 1937), and drummer Tony Williams (b. 1945). In 1970 Shorter and Joe Zawinul (b. 1932) formed Weather Report, the most significant jazz-rock "fusion" band of the 1970s, with bassist Jaco Pastorius (1951–87). Shorter wrote many distinctive jazz standards.

shorthair cat Breed of DOMESTIC CAT. Show standards call for a sturdily built cat with strong-boned legs, a round head, round eyes, and ears that are rounded at the tips. The coat must be short and may be of almost any colour or pattern. Some colours, such as blue cream, are infrequently found in shorthairs; others, such as tabby (stripes and mottled patterns in silver, brown, blue, and red), are common.

shorthand *or* **stenography** \stə-'nä-grə-fē\ System for rapid WRITING that uses symbols or abbreviations for letters, words, or phrases. Employed since Greek and Roman times, shorthand has been used in England since the 16th century. Popular modern systems include Pitman, Gregg, and Speedwriting. Many are phonetic and call for writing words as they sound (e.g., in the Pitman system, *deal*, *may*, and *knife* are written *del*, *ma*, and *nif*). Shorthand has been used in reporting proceedings of legislative bodies and courts and in taking dictated business correspondence.

Shorthorn *or* **Durham** Blocky, short-horned breed of beef CATTLE developed in the late 18th century by crossbreeding of local cattle in the county of Durham, Eng. Colour can be white, solid or white-marked red, or roan. The Shorthorn is the only roan-coloured modern cattle breed. It is popular throughout the world. Special strains include the Milking, or Dairy, Shorthorn, raised for milk and beef, and the Polled Shorthorn, a hornless variety.

Shoshone \shə-'shō-nē\ Group of closely related North American Indian peoples living in the Great Basin region of the U.S. Their language belongs to the Numic group of the UTO-AZTECAN family. The Shoshone are usually divided into four groups: Western (unmounted) Shoshone, centred in eastern Nevada; Northern (mounted) Shoshone of northwestern Utah and southern Idaho; Wind River Shoshone in western Wyoming; and COMANCHE in western Texas. The Western Shoshone subsisted through hunting and gathering. The Northern Shoshone and Wind River Shoshone

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probably acquired horses by 1680 and adopted much of Plains Indian culture; they hunted buffalo, used tepees and skin clothing, and warred with other tribes. The Shoshone are closely related to the Ute, Paiute, Gosiute, and Bannock. After splitting from the Wind River group, the Comanche moved south. The Shoshone number about 10,000.

Shoshone \shə-'shō-nē, shə-'shōn\ **River** River, northwestern Wyoming, U.S. Formed by the uniting of two headstreams in the Absaroka Range in Yellowstone National Park, it flows northeast 100 mi (160 km) to join the Bighorn River near the Montana border. The river was named for the Shoshone Indians.

Shostakovich \ˌshäs-tə-'kō-vich**, Dmitry (Dmitriyevich)** (b. Sept. 25, 1906, St. Petersburg, Russia—d. Aug. 9, 1975, Moscow, Russia, U.S.S.R.) Russian composer. Shaped by his intellectual parents and the political turmoil of his youth, he was admitted to the St. Petersburg Conservatory at age 13. His *Symphony No. 1* (1924–25) attracted international attention for its convincing command of a large scale and its expressive palette ranging from unaffected lyricism to bitter satire to grand heroics. He experimented with avant-garde trends in his next symphonies and theatre works, such as the opera *Lady Macbeth of Mtsensk* (1932; revised as *Katerina Izmaylova*). The denunciation of *Lady Macbeth* by the Soviet authorities in 1936 led to his adopting a very different style that was serious and elegiac, with a directness that appealed to the public. His wartime *Symphony No. 7* (1941), thought to portray the German invasion, became a symbol of patriotism. After his music was denounced by the government in 1948, he was again devastated and began putting his most personal feelings into chamber works, particularly the remarkable 15 string quartets. With the Cold War "thaw" of the late 1950s, he composed two outspokenly personal late symphonies, including the 13th (1962). He is remembered as the greatest Russian composer to follow Igor Stravinsky.

shot put Field event in which a metal ball is heaved for distance. It derives from the ancient event of "putting the stone"; later a shot (cannonball) was substituted. A 16-lb (7.3-kg) shot was adopted for men in the first modern Olympic Games (1896); an 8.8-lb (4-kg) weight is used by women.

shotcrete *or* **gunite** Concrete applied by spraying. Shotcrete is a mixture of portland cement, aggregate, and water conveyed by compressed air to a spray gun. For structural uses, shotcrete is usually sprayed over a framework of reinforcing bars and steel mesh. Because it can take any shape, is easily coloured, and can be sculpted after application, it is used for a variety of specialized structures, including artificial rock walls, zoo enclosures, canopies, shell structures, pools, and dams. It is sometimes used to bind the walls of tunnels.

shotgun Smoothbore shoulder firearm designed to fire a number of pellets, or shot, that cover a large target area after they leave the muzzle. It is used mainly against small game such as birds. The earliest examples were the fowling pieces that appeared in 16th-century Europe. Repeating shotguns, in which several cartridges could be loaded at once, became available in the 1880s. The range of a modern shotgun is about 50 yards (45 m).

Shōtoku *in full* **Shōtoku Taishi** \shō-'tō-kù-'tä-ē-shē\ *English* **Crown Prince Shōtoku** (b. 574, Yamato, Japan—d. April 8, 622, Yamato) Important Japanese regent and scholar of the Asuka period who promoted Buddhism and Confucianism, reinstituted embassies to China, and adopted the Chinese calendar and court ranks. He built the Hōryū Temple and is sometimes credited with writing the Seventeen-Article Constitution, which describes Confucian ethical concepts and the Chinese bureaucratic system. Since his death he has been regarded as a Buddhist saint.

shoveler Any of four species (genus *Anas*, family Anatidae) of dabbling ducks having a long, spoon-shaped bill. The migratory northern shoveler (*A. clypeata*) inhabits shallow marshes and lagoons in the Americas, Europe, Africa, and Asia. The male has a green head, white breast, chestnut belly and sides, and a blue patch on the forewing. It uses its bill to sift small organisms and seeds from the mud; in deeper waters, it skims the surface for plankton. The other species are the South American red shoveler (*A. platalea*); the Cape, or Smith's, shoveler (*A. smithii*) of South Africa; and the Australasian, or blue-winged, shoveler (*A. rhynchotis*).

show jumping Competitive riding of horses through an obstacle course. Horses run the course one at a time, and the winner is judged according to jumping ability and speed. Individual and team jumping events have been part of the Olympic Games since 1912. The President's Cup is the world team championship.

Shōwa emperor See Hirohito

Shōwa \'shō-ə\ **period** (1926–89) Period of Japanese history corresponding to the reign of Hirohito, the Shōwa emperor. The first decades of the period were marked by the rise of militarism in the 1930s and by Japan's disastrous participation in World War II, resulting in the country's complete collapse and ultimate surrender. The postwar era was one of rehabilitation, during which it joined the UN (1956), hosted the 1964 Summer Olympics, and held the Ōsaka World Exposition in 1970. Japan experienced a so-called "economic miracle," with annual growth averaging 10% in 1955–60 and higher in the years following. In the 1980s the Japanese economy became one of the world's largest and most sophisticated, with per capita income surpassing that of the U.S. Japanese society became increasingly urban, with one-tenth of the population living in Tokyo by mid-decade. U.S. influence on popular culture was strong, and young Japanese emulated their U.S. counterparts in numerous ways. Other societal changes during the Shōwa period included more people living in nuclear families than in extended families, love marriages rather than arranged marriages, fewer children per family, and more opportunities for women. See also Heisei period; Occupation (of Japan).

shrapnel \'shrap-nᵊl\ Originally, a type of projectile invented by the British artillery officer Henry Shrapnel (1761–1842), containing small spherical bullets and an explosive charge to scatter the shot and fragments of the shell casing. A time fuse set off the explosive charge late in the shell's flight, when it was near opposing troops. The resulting hail of high-velocity debris was often lethal; it caused most of the artillery-inflicted wounds in World War I. In World War II a high-explosive bursting charge that fragmented the shell's iron casing made shrapnel balls unnecessary; the term shrapnel came to be used for the shell-casing fragments.

Shreve, Henry Miller (b. Oct. 21, 1785, Burlington county, N.J., U.S.—d. March 6, 1851, St. Louis, Mo.) U.S. inventor and explorer. He grew up on the western Pennsylvania frontier and began making trading voyages after his father's death in 1799. In the War of 1812 he was skipper of the *Enterprise*, the second steamboat on the Mississippi, carrying supplies for Andrew Jackson's army. Though it was the first steamboat to reach Louisville, Ky. (1815), the trip convinced Shreve of the need for a new design for river steamers. His design for the *Washington*—with a flat shallow hull, a steam engine on the main deck, and a second deck—established the Mississippi steamboat type. To clear rivers of debris, he later designed the first snag boat. His camp on the Red River in Louisiana grew into a permanent settlement as Shreveport.

Shreveport City (pop., 2000: 200,145), northwestern Louisiana, U.S. It is located on the banks of the Red River. In 1837 Shreveport was founded on land bought from the Caddo Indians. The city became a Confederate state capital and army headquarters during the American Civil War. It developed rapidly after oil was discovered in 1906 and is now a commercial and industrial centre for a three-state region. Barksdale Air Force Base is near the city.

shrew Any of more than 300 species of small insectivores constituting the family Soricidae. About 40% of these species live in Africa, but shrews are also found throughout the Northern Hemisphere. Shrews are absent from Australia and most of South America. They have tiny eyes and ears, a movable snout, and long, hook-tipped incisors. Typically 2 to 3 in. (6 to 8 cm) long, with a shorter tail, many shrews weigh only about 0.5 oz (14 g). Some are considered the smallest mammals, weighing only a few grams, with bodies less than 2 in. long. Most species live in ground litter, but some live in burrows or trees and a few are semiaquatic. Because they are so small, shrews have the highest metabolic rates of any mammals (with pulses as high as 800 beats per minute). They spend most of their time searching for food, as they can survive only a few hours without eating. Their normal prey is invertebrates such as worms, though some will eat other small animals as well. Some species have toxic saliva (painful to humans). Raptors and snakes eat shrews, but mammals avoid them. Tree shrews (family Tupaiidae) belong to a separate mammalian order (Scandentia) unrelated to true shrews.

Shrewsbury Town (pop., 1995 est.: 63,000), borough of Shrewsbury and Atcham, administrative and historic county of Shropshire, England. It is the county seat of Shropshire. Located on the English-Welsh border, Shrewsbury is encircled by the River Severn. Founded in the 5th century

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AD by the Welsh kingdom of POWYS, it became part of the Anglo-Saxon kingdom of MERCIA at the end of the 8th century. An 11th-century grant to Roger de Montgomery, who founded its abbey, made it one of the first English earldoms. Prosperity came to the area in the late Middle Ages after centuries of fighting with the Welsh ended and trading in Welsh wool and flax began. The town was the birthplace of CHARLES DARWIN.

Shrewsbury, Charles Talbot, duke and 12th earl of (b. July 24, 1660—d. Feb. 1, 1718, London, Eng.) English statesman. He inherited his father's title at age seven and was raised as a Catholic. He became a Protestant in 1679 and in 1688 was one of seven men who invited William of Orange to seize power from JAMES II. After aiding the successful rebellion, Shrewsbury served WILLIAM III as secretary of state (1689–90, 1694–99) and was created a duke in 1694. Shifting his allegiance from the Whigs, he served in a Tory administration as lord lieutenant of Ireland (1710–14) and was appointed by Queen ANNE as lord high treasurer (1714). He obtained recognition of GEORGE I as the legitimate royal heir and assured the peaceful succession of the house of HANOVER.

Shridhara (fl. c. 750, India) Highly esteemed Hindu mathematician who wrote several treatises on Indian mathematics. His extant works are the partially preserved *Patiganita* ("Mathematics of Procedures"), *Ganitasara* ("Essence of Mathematics"), and *Ganitapanchavimashi* ("Mathematics in 25 Verses"). *Patiganita* consists of versified mathematical rules, without proofs. The first part treats arithmetic operations (including the calculation of squares, square roots, cubes, and cubic roots) for both integers and fractions, reductions of fractions, and proportions. The second part presents mixture problems and various series before it breaks off in the midst of rules for plane figures. He composed *Ganitasara* and *Ganitapanchavimashi* as epitomes of a larger work, which may or may not have been *Patiganita*. He gave the first correct formulas in India for the volume of a sphere and of a truncated cone.

shrike Any of about 64 species of solitary, predatory songbirds (family Laniidae), especially any of the 25 species of the genus *Lanius*. Shrikes kill insects, lizards, mice, and birds with their bill or may impale their prey on a thorn (earning them the name butcher bird). Most species are gray or brownish and have a harsh call; several Eurasian species have reddish or brown markings. The great gray shrike (*L. excubitor*), called northern shrike in Canada and the U.S., is about 10 in. (25 cm) long and has a black mask. The only other New World species is the similar but smaller loggerhead shrike (*L. ludovicianus*) of North America.

shrimp Any of approximately 2,000 DECAPOD species (suborder Natantia) having a semitransparent body flattened from side to side and a flexible abdomen terminating in a fanlike tail. The appendages are modified for swimming, and the antennae are long and whiplike. Shrimps occur in shallow and deep ocean waters and in lakes and streams. Species range from less than an inch (a few millimeters) to about 8 in. (20 cm) long. Larger species are often called prawns. Shrimps swim backward by rapidly flexing the abdomen and tail. They eat small plants and animals; some species eat carrion. Many species are commercially important as food. See also FAIRY SHRIMP.

Peneus setiferus, an edible shrimp
MARINELAND OF FLORIDA

Shripati (fl. c. 1045, Rohinikhanda, India) Indian astronomer-astrologer and mathematician. He wrote *Ganitatilaka* ("The Ornament of Mathematics") and the astronomical works *Siddhantashekhara* ("The Crest of Established Doctrines"), *Dhikotidakarana* ("Procedure Giving Intellectual Climax"), and *Dhruvamanasa* ("Permanent Mind"). *Siddhantashekhara* includes two chapters on mathematics; as one of the few surviving documents from this period, it sheds important light on the state of Indian algebra between BRAHMAGUPTA and BHASKARA II. For horoscopic astrology, Shripati wrote *Jatakakarmapaddhati* ("Way to the Computation of Nativity") and *Jyotisharatnamala* ("A Jewel Necklace of Astral Science"), which were highly influential on the development of astrology in India.

Shropshire \'shräp-shir\ Administrative (pop., 2001: 283,240), geographic, and historic county, western England. It is divided by the River SEVERN; its county seat is SHREWSBURY. Remnants left by Neolithic, Bronze Age, and early Iron Age inhabitants have been found in the region. In the 1st century AD the Romans built a fortress at Viroconium, one of the largest towns in Roman Britain. The SAXON conquest brought the construction of OFFA'S DYKE, marking the England-Wales border. After the NORMAN CONQUEST of 1066, a double line of castles was established as fortification against the Welsh. In the 13th century the high quality of Shropshire wool brought prosperity to the region. In the early 18th century it became the greatest iron-producing area in England. Iron founding and agriculture remain important. The administrative county of Shropshire comprises five districts: Bridgnorth, North Shropshire, South Shropshire, and the boroughs of Oswestry and Shrewsbury and Atcham.

Shroud of Turin See Shroud of TURIN

shrub Any woody plant that has several stems, none of which is dominant, and is usually less than 10 ft (3 m) tall. When much-branched and dense, it may be called a bush. Intermediate between shrubs and trees are arborescences, or treelike shrubs (10–20 ft, or 3–6 m, tall). TREES are generally defined as woody plants more than 20 ft (6 m) tall, having a dominant stem, or trunk, and a definite crown shape. These distinctions are not reliable, however; for example, under especially favourable environmental conditions, some shrubs may grow to the size of an arborescence or even a small tree.

Shu \'shü\ In EGYPTIAN RELIGION, the god of the air and supporter of the sky, created by the god Atum. Shu and his sister Tefnut (goddess of moisture) were the first couple of the group of nine gods called the Ennead of HELIOPOLIS. Of their union were born GEB and NUT. Shu was portrayed in human form with an ostrich feather on his head. He was often represented supporting with uplifted arms the body of Nut arched above him. Later he was frequently termed the son of RE, and he was also identified with Onuris, a warrior god.

Shu (907–65) Ancient name for Sichuan and the name of two of the 10 kingdoms included in China's Ten Kingdoms period (907–c. 980), specifically the Qian (Former) Shu (907–25) and the Hou (Later) Shu (934–65). The kingdom of Shu was located in present-day Sichuan. Aside from 10 years of instability that occurred between the two Shu regimes, the area experienced peace and prosperity. Poetry flourished, as did Buddhism and Taoism. See also FIVE DYNASTIES, THREE KINGDOMS.

Shu ching See SHU JING

Shu Maung See U NE WIN

Shubert Brothers U.S. theatrical managers and producers. After emigrating from Russia with their parents in 1882, the two oldest brothers, Lee (1872–1953) and Sam (c. 1875–1905), leased theatres and presented plays in Syracuse, N.Y., in the 1890s. By 1900 Jacob (1880–1963) had joined the business, and the brothers leased their first theatres in New York City. Coming into conflict with the Theatrical Syndicate, which controlled U.S. theatrical bookings, they led an independent movement to fight the syndicate and prevailed after a long legal battle. After Sam's death, Lee and Jacob built theatres across the U.S. and came to own more than 60 legitimate houses and many vaudeville and movie theatres. They produced more than 1,000 different shows, including 600 plays, revues, and musicals. Theatrical unions such as Actors' Equity were formed in response to their often sharp business practices. Charged with monopoly practices in 1950, they sold a number of theatres in 1956 but retained prestigious houses in many cities.

Shubrā al-Khaymah \shù-'brä-el-'kā-mə\ City (pop., 1996: 870,716), Egypt. It is a northern suburb of CAIRO, on the eastern bank of the NILE RIVER. It was formerly a marketplace supplying Cairo with agricultural produce from the rich delta area. In the 1820s the Ottoman viceroy of Egypt built the country's first European-style factories and schools there, and it developed as an industrial centre. The city lies west of the southern terminus of the Ismāʿīliyyah Canal, which links the SUEZ CANAL with the Nile.

Shudra \'sü-drə, 'shü-drə\ *or* **Sudra** Fourth and lowest of the VARNAS, or social classes, of Hindu India. Traditionally composed of artisans and labourers, it probably originally included all conquered peoples of the INDUS CIVILIZATION as they were assimilated into the CASTE system. Members are not permitted to participate in the UPANAYANA and thus cannot study the VEDAS. The high end of the Shudra includes some landowners; at the low end are UNTOUCHABLES. See also BRAHMAN; KSHATRIYA; VAISHYA.

shuffleboard Game in which two or four players use long-handled cues to shove disks into scoring areas of a diagram marked on a flat,

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smooth surface (6 × 52 ft [1.8 × 15.8 m]). It was popular in England as early as the 15th century, especially with the aristocracy; it later became popular as a deck game among travelers on ocean liners and cruise ships. The current form of the game was defined at St. Petersburg, Fla., U.S., in 1924.

Shugen-dō \shü-'gen-'dō\ Japanese religious tradition combining folk beliefs with Shintō, Buddhism, and elements of Daoism. The practitioner engages in spiritual and physical disciplines to attain power against evil spirits. Shugen-dō flourished in the Heian period and allied itself with the esoteric schools of Buddhism, Tendai (Chinese Tiantai), and Shingon. Many Buddhist priests belonging to esoteric traditions regularly developed Shugen-dō techniques, and Shugen-dō practitioners often served as Shintō priests. The government abolished Shugen-dō in 1872. After 1945, with the establishment of religious freedom, some Shugen-dō groups attempted a revival, but the tradition's membership and influence remain greatly diminished.

Shujing *or* **Shu-ching** \'shü-'jiŋ\ One of the Five Classics of Chinese antiquity. Documenting China's ancient history, the *Shujing* contains the oldest Chinese writing of its kind. It consists of 58 chapters, of which 33 are generally considered authentic works of the 4th century BC or earlier. The first 5 chapters purport to preserve the sayings and recall the deeds of emperors who reigned during China's legendary golden age; the next 4 are devoted to the Xia dynasty; the next 17 chapters deal with the Shang dynasty; and the final 32 chapters cover the Western Zhou dynasty.

Shula, Don(ald Francis) (b. Jan. 4, 1930, Grand River, Ohio, U.S.) U.S. football coach. He played football for John Carroll University and the Baltimore Colts and other NFL clubs. After coaching collegiate football, he became head coach of the Colts (1963–69); under Shula the team won 71 games, lost 23, and tied 4. As coach of the Miami Dolphins (1970–96), he became the first NFL coach to win 100 games in 10 seasons; in 1972–73 the Dolphins became the first team to go undefeated through an entire season and the play-offs, culminating in a Super Bowl victory. Shula holds the all-time NFL record for victories, with 347.

Shull, George Harrison (b. April 15, 1874, Clark county, Ohio, U.S.—d. Sept. 28, 1954, Princeton, N.J.) U.S. botanist and geneticist. He acquired his doctorate in 1904 and worked thereafter primarily for the Carnegie Institute at Cold Spring Harbor, N.Y., and at Princeton University. He developed a method of breeding corn that made the seed capable of thriving under various soil and climatic conditions, as a result of which corn yields per acre were increased 25–50%. Shull developed his first hybrids before 1910, though commercial production did not begin until 1922. He founded the journal *Genetics* in 1916. See also Edward Murray East.

Shun \'shün\ In Chinese mythology, one of the three legendary emperors, along with Yao and Da Yu, of the golden age of antiquity (c. 23rd century BC), singled out by Confucius as models of integrity and virtue. Though his father repeatedly tried to murder him, Shun remained loyal to him. Because heaven and earth knew of Shun's virtue, animals assisted him in all his labours. The emperor Yao bypassed his own son to select Shun as his successor, and he gave Shun his two daughters in marriage. Shun is credited with standardizing weights and measures, regulating waterways, and organizing the kingdom into provinces.

Shute, Nevil *orig.* **Nevil Shute Norway** (b. Jan. 17, 1899, Ealing, Middlesex, Eng.—d. Jan. 12, 1960, Melbourne, Vic., Australia) English-born Australian novelist. Trained as an aeronautical engineer, Shute drew on technical detail in his fiction. His early works include *So Disdained* (1928) and *What Happened to the Corbetts* (1939), a foretaste of the bombing of civilians in World War II. After the war he settled in Australia, where he set his later novels. Reflecting a growing despair about the future of humanity, they include *A Town Like Alice* (1950; film, 1956) and his best-known work, *On The Beach* (1957; film, 1959), a vivid picture of the nuclear annihilation of the human race.

shuttle In the weaving of cloth, a spindle-shaped device used to carry the crosswise threads (weft) through the lengthwise threads (warp). Not all modern looms use a shuttle; shuttleless looms draw the weft from a nonmoving supply. Shuttle looms fall into two groups according to whether the shuttle is moved by hand or automatically. The second kind is often described as an automatic loom, but except for shuttle movement it is no more automatic in its operation than the hand-moved or so-called nonautomatic loom. See also flying shuttle.

Shwe Dagon \'shwā-ˌdä-gün\ Pagoda in Yangôn (Rangoon) that is the centre of Burmese religious life. A Buddhist temple complex begun in the 15th century, the cone-shaped Shwe Dagon is constructed of brick and is completely covered with gold. Raised over a relic chamber, it was rebuilt several times and was brought to its present height of 326 ft (99 m) in 1841 by King Tharrawaddy. The pagoda sits atop a hill that rises 168 ft (51 m) above the city.

Shymkent \shim-'kent\ *or* **Chimkent** City (pop., 1999 est.: 360,100), south-central Kazakhstan. It lies at an elevation of 1,680 ft (512 m) in the foothills of the Ugam Range, north of Tashkent. Originally a settlement on the caravan route from Central Asia to China, it dates to at least the 12th century AD. Destroyed by nomad attacks several times, it became part of the khanate of Qo'qon in the early 19th century and was annexed by the Russian Empire in 1864. It lies on the Turkistan-Siberian Railroad, and its population grew dramatically in the 20th century. It is now an industrial and cultural centre.

SI system See International System of Units

Sia See Hu, Sia, and Heh

Siad Barre \'sē-ˌäd-'bär-ā**, Mohamed** (b. c. 1919, Ganane, Italian Somaliland—d. Jan. 2, 1995, Lagos, Nigeria) President of Somalia, 1969–91. He attended military school in Italy, and when Somalia achieved independence in 1960 he was made a colonel in its army. He seized power in a bloodless coup after the president's assassination in 1969. Under Siad Barre, Somali forces invaded a disputed area in southeastern Ethiopia in 1977, but they were eventually repelled. His government was charged with widespread human rights abuses, and from 1988 government forces repeatedly clashed with rebels. With Somalia in a state of civil war and on the brink of mass starvation, he fled into exile in Nigeria in 1991.

Siam See Thailand

Siamese cat Breed of slender, short-haired domestic cat that originated in Thailand (Siam). The Siamese has a pale fawn or gray body with dark points on the ears, face, legs, and tail. The points may be dark brown (seal point), blue-gray (blue point), milk-chocolate brown (chocolate point), pinkish gray (lilac point), or reddish orange (red point). The head is wedge-shaped. The blue eyes are slanted and may be crossed, though crossed eyes and kinked tail are discouraged by breeders of show animals. Siamese are considered highly intelligent and are very vocal, with a distinctive yowling mew.

Siamese fighting fish Freshwater tropical fish *(Betta splendens*; family Belontiidae or Anabantidae), noted for the males' pugnacity toward one another. A native of Thailand, it was domesticated there for use in contests. Combat consists mainly of fin nipping and is accompanied by a display of extended gill covers, spread fins, and intensified colouring. This slender fish grows to about 2.5 in. (6.5 cm) long. In the wild it is predominantly greenish or brown, with red fins; domesticated, it has been bred with long, flowing fins and in a variety of colours, such as red, green, blue, and lavender.

Siamese fighting fish (*Betta splendens*). DOUGLAS FAULKNER

Siamese twins See conjoined twins

Sian See Xi'an

Siang River See Xiang River

Sibelius \si-'bāl-yəs**, Jean** *orig.* **Johan Julius Christian Sibelius** (b. Dec. 8, 1865, Hämeenlinna, Fin.—d. Sept. 20, 1957, Järvenpää) Finnish composer. He played violin and composed as a child, and later he studied composition with Karl Goldmark (1830–1915). After initially concentrating on chamber music, he rapidly developed into an orchestral composer. He became involved with the movement for national independence from Russia, and his nationalism resulted in works based on Finnish folklore, such as *Kullervo* (1892), the *Karelia* suite (1893), *Legends from the Kalevala* (1893), and *Finlandia* (1900). His major achievements were his seven symphonies (1899–1924), the *Violin Concerto in D Minor*

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(1903), and *Tapiola* (1926). His works, marked by a sweeping but melancholy Romanticism, achieved international popularity. He wrote nothing in his last 30 years.

Siberia Region, north-central Asia, largely in Russia. It extends from the Ural Mountains to the Pacific Ocean and from the Arctic Ocean to central Kazakhstan and the boundaries of China and Mongolia; it covers more than 5,000,000 sq mi (13,000,000 sq km). It is notorious for the length and severity of its almost snowless winters. Temperatures of –90 °F (–68 °C) have been recorded. The first settlers probably arrived in southern Siberia in the Paleolithic Period. The area was under Chinese influence from c. 1000 BC, followed by the Turkic-Mongols in the 3rd century BC. Russian trappers and Cossack explorers (see Cossacks) colonized it in the late 16th century, and by the mid-18th century most of Siberia was under Russian rule. It was connected to other parts of Russia by the Trans-Siberian Railroad. Eastern Siberia was the scene of the anti-Bolshevik government of Aleksandr Kolchak (1918–20). It was made part of the Russian S.F.S.R. in 1922. Russia exiled criminals and political prisoners there, and in the 1930s Joseph Stalin set up forced-labour camps that fueled industrial growth. When Russian factories were relocated there during World War II, it played an important role in the war effort. It has deposits of coal, petroleum, natural gas, diamonds, iron ore, and gold; its chief industrial products include steel, aluminum, and machinery. Southern Siberia produces wheat, rye, oats, and sunflowers. Its main cities include Novosibirsk, Omsk, Krasnoyarsk, and Irkutsk.

Siberian husky Breed of dog developed in Siberia by the Chukchi people, who used it as a sled dog, companion, and guard. It was brought to Alaska in 1909 for sled-dog races and became established as a consistent winner. A graceful dog with erect ears and a dense, soft coat, it stands 20–24 in. (51–60 cm) and weighs 35–60 lbs (16–27 kg). It is usually gray, tan, or black and white; head markings may resemble a cap, mask, or spectacles. The breed, kept pure for hundreds of years in Siberia, is noted for intelligence and a gentle temperament.

Siberian peoples Any of a large number of small ethnic groups living in Siberia. Most engage either in reindeer herding or fishing, while some also hunt furbearing animals or farm and raise horses or cattle. In the past, many had both summer and winter dwellings, their winter homes sometimes being partially or entirely underground and their summer homes being various styles of tent. Shamanism was common, and the family was the basic societal unit. The Soviet government attempted to settle Siberian peoples on collective farms and to introduce new occupations, but some groups, such as the Koryak and the Nenets, still engage in their traditional pursuits. Other Siberian peoples include the Chukchi, Evenk, Ket, Khanty, Mansi, Sakha, and Yukaghir. See also Paleo-Siberian languages.

Siberut \ˌsē-bə-ˈrüt\ Island, Indonesia. The largest island in the Mentawai group, it lies off the western coast of Sumatra, Indonesia. It is 25 mi (40 km) wide and 70 mi (110 km) long. The coast is low and swampy; the inland is savanna. Agriculture is the chief occupation.

Sibyl Prophetess of Greek legend. She was a figure of the mythical past whose prophecies, phrased in Greek hexameters, were handed down in writing. In the late 4th century BC, the number of Sibyls multiplied, and the term *sibyl* was treated as a title. Sibyls were associated with various oracles, especially those of Apollo, who was said to be their inspiration. They were typically depicted as extremely old women who lived in caves and delivered their prophecies in an ecstatic frenzy. A famous collection of prophecies, the *Sibylline Books*, was traditionally kept in the temple of Jupiter, to be consulted only in emergencies.

Sichuan \ˈse-ˈchwän, ˈsē-ˈchwän\ *or* **Ssu-ch'uan** *conventional* **Szechwan** Province (pop., 2002 est.: 86,730,000), upper Yangtze River (Chang Jiang) valley, southwestern China. It is bordered by Qinghai, Gansu, Shaanxi, Guizhou, and Yunnan provinces, Chongqing municipality, and Tibet. It has an area of 188,000 sq mi (487,000 sq km) and encompasses the central depression called the Sichuan (or Red) Basin; its capital is Chengdu. Sichuan is one of China's most densely populated and ethnically diverse provinces. It was among the first areas to be settled by the Chinese (5th century BC). From the Zhou dynasty (1046–256 BC) until the Song dynasty (AD 960–1279), it was administered through various political subdivisions. It was established as a province during the Qing dynasty (1644–1911/12). During the Sino-Japanese War (1937–45), it served as the seat (at Chongqing) of the Nationalist government; the Japanese never penetrated the area. It is China's leading producer of rice, corn (maize), sweet potatoes, cattle, and pigs. The most industrialized province of southwestern China, it is a centre for coal mining, petroleum refining, and chemical production. Sichuan's spicy cuisine is renowned worldwide.

Sicilian school Group of Sicilian, southern Italian, and Tuscan poets centred in the courts of Frederick II (r. 1194–1250) and his son Manfred of Sicily (d. 1266). They established the vernacular, as opposed to Provençal, as the standard language for Italian love poetry and are also credited with inventing two major Italian poetic forms, the canzone and the sonnet. Some 125 of their poems are extant, many by Giacomo Da Lentini (fl. 13th century), the school's senior poet. The Sicilian-school sonnet became, with variations, the dominant poetic form in Renaissance Italy and Elizabethan England, where it was modified to form the English, or Shakespearean, sonnet.

Sicilian Vespers (1282) Massacre of the French that began a Sicilian revolt against the Angevin king Charles I. Backed by Peter III of Aragon, the rising broke out when Sicilians killed some insulting French soldiers at vespers in the church of Santo Spirito in Palermo. The people of the city followed suit and massacred 2,000 of its French inhabitants. All of Sicily soon revolted and sought help from the Aragonese, and the war became a French-Aragonese struggle for possession of Sicily. The conflict was finally resolved when the Sicilians chose Frederick III, brother of the king of Aragon, as their ruler in 1302.

Sicily \ˈsi-sə-lē\ *Italian* **Sicilia** \si-ˈsil-yə\ Island, Italy. Sicily is separated from the mainland by the Strait of Messina. The largest island (9,830 sq mi [25,460 sq km]) in the Mediterranean Sea, it is also the site of Europe's highest active volcano, Mount Etna. The capital is Palermo. Sicily's strategic location at the centre of the Mediterranean has made the island a crossroads of history. The Greeks colonized it in the 8th–6th centuries BC, and in the 3rd century BC it became the first Roman province. It came under Byzantine rule in the 6th century AD and fell in 965 to Arabs from North Africa. It was taken in 1060 by the Normans. In the 12th–13th centuries and again in the 18th century it formed part of the Kingdom of the Two Sicilies. During the 19th century it was a major centre of revolutionary movements; in 1860 it was liberated from the Bourbons, and in 1861 it was incorporated into the Kingdom of Italy. Agriculture is its economic mainstay; industries include oil refining, food processing, wine making, and shipbuilding. Together with the islands of Egadi, Lipari, Pelagie, and Panteleria, Sicily forms an autonomous region of Italy (pop., 2001 prelim.: 4,866,202).

sickle-cell anemia Blood disorder (see hemoglobinopathy) seen mainly in persons of Sub-Saharan African ancestry and their descendants and in those from the Middle East, the Mediterranean area, and India. About 1 in 400 blacks worldwide has the disease, caused by inheriting two copies of a recessive gene that makes those with one copy (about 1 in 12 blacks worldwide) resistant to malaria. The gene specifies a variant hemoglobin (hemoglobin S or Hb S) that distorts red blood cells (erythrocytes) into a rigid sickle shape. The cells become clogged in capillaries, damaging or destroying various tissues. Symptoms include chronic anemia, shortness of breath, fever, and episodic "crises" (severe pain in the abdomen, bones, or muscles). Hydroxyurea treatment triggers production of fetal hemoglobin (Hb F), which does not sickle, greatly lessening severity of crises and increasing life expectancy, previously about 45 years.

Sicyon \ˈsi-sē-ən\ Ancient city, northern Peloponnese, southern Greece. Located 11 mi (18 km) northwest of Corinth, Sicyon was influential in Greek history, attaining its greatest power in the 6th century BC under Cleisthenes, grandfather of Cleisthenes of Athens. During the 4th century BC it was celebrated for its school of painters and sculptors, which included Lysippus. In the 3rd century BC it gained prominence under Aratus, who brought it into the Achaean League.

Sarah Siddons, chalk drawing by J. Downman, 1787; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Siddons, Sarah *orig.* **Sarah Kemble** (b. July 5, 1755, Brecon, Brecknockshire, Wales—d. June 8, 1831, London, Eng.) British actress.

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She acted with her father's traveling company and married actor William Siddons in 1773. Her performance as Isabella in *Fatal Marriage* at the Drury Lane Theatre in 1782 was highly successful; she was instantly acclaimed as the leading tragedienne of the time. Siddons played Shakespearean parts, notably Lady Macbeth, from 1785 until she retired in 1812. She was the subject of well-known portraits by Thomas Gainsborough and Joshua Reynolds.

Side \'sē-də\ Ancient city, southwestern Anatolia. The most important port of ancient Pamphylia, it originally was situated on the Mediterranean Sea coast; it now lies inland. Though it was founded by Aeolian Greeks, a peculiar non-Greek language was spoken there. Alexander the Great occupied it (333 BC); the Seleucid king Antiochus III was defeated there by a Roman army in 190 BC. In the 1st century BC, Cilician pirates made it their chief slave market. The ruins include the remains of a colossal theatre, built on arches and considered one of the finest in Anatolia.

side horse See pommel horse

sidereal \sī-'dir-ē-əl\ **period** Time required for a celestial body in the solar system to complete one revolution with respect to the fixed stars (as observed from a fixed point outside the system). A planet's sidereal period can be calculated from its synodic period. The sidereal period of the Moon or an artificial satellite of Earth is the time it takes to return to the same position against the background of stars. See also day.

siderite \'sī-də-ˌrīt\ *or* **chalybite** \'ka-lə-ˌbīt\ Iron carbonate ($FeCO_3$), a widespread carbonate mineral that can be an ore of iron. The mineral commonly occurs in thin beds with shales, clay, or coal seams (as sedimentary deposits) and in hydrothermal metallic veins (as gangue, or waste rock).

sidewinder Species (*Crotalus cerastes*) of small, nocturnal rattlesnake, found in sandy deserts of Mexico and the southwestern U.S. It is 18–30 in. (45–75 cm) long. It has hornlike scales above its eyes and is pale tan, pinkish, or gray, with an inconspicuous spotted pattern on the back and sides. It moves by looping itself obliquely across the sand, leaving a characteristic J-shaped trail. Its venomous bite is usually not fatal to humans.

Sidgwick, Henry (b. May 31, 1838, Skipton, Yorkshire, Eng.—d. Aug. 29, 1900, Cambridge, Cambridgeshire) British philosopher. Educated at Cambridge, he remained there as a fellow (from 1859) and professor (from 1883). His *Methods of Ethics* (1874) is considered by some the most significant 19th-century ethical work in English. Drawing on the utilitarianism of John Stuart Mill and the categorical imperative of Immanuel Kant, he proposed a system of "universalistic hedonism" that would reconcile the apparent conflict between the pleasure of self and the pleasure of others. His other writings include *Principles of Political Economy* (1883) and *Elements of Politics* (1891). He also cofounded the Society for Psychical Research (1882) and helped found Cambridge's first women's college.

Sīdī Muḥammad ibn Yūsuf See Muḥammad V

Sīdī Muḥammad Idrīs al-Mahdī al-Sanūsī See Idrīs I

siding Material used to surface the exterior of a building to protect against exposure to the elements, prevent heat loss, and visually unify the facade. The word siding implies wood units, or products imitative of wood, used on houses. There are many different types of siding, including clapboard, horizontal lap siding, vertical board siding, and shingles. Board and batten siding, sometimes found in Carpenter Gothic houses and very modest structures, differs from the common clapboard in that it consists of vertical wood boards with their butt joints covered by battens (narrow strips), imparting a seamed appearance. Both aluminum and polyvinyl-fluoride-coated siding (commonly called vinyl siding) were developed as maintenance-free alternatives to wood clapboard; they mimic its horizontal boards. Fiberboard, a pressed-wood-pulp product, is sometimes used, though its long-term durability is limited. In larger buildings, the exterior covering is called cladding, and may be of brick, glass in a metal framework, or stone, concrete, or metal panels.

Sidney, Sir Philip (b. Nov. 30, 1554, Penshurst, Kent, Eng.—d. Oct. 17, 1586, Arnhem, Neth.) English courtier, statesman, soldier, and poet. Born into an aristocratic family and educated to be a statesman and soldier, Sidney served in minor official posts and turned to literature as an outlet for his energies. *Astrophel and Stella* (1591), inspired by Sidney's passion for his aunt's married ward, is considered the finest Elizabethan sonnet cycle after William Shakespeare's sonnets. *The Defence of Poesie* (1595), an urbane and eloquent plea for imaginative literature, introduced the critical ideas of Renaissance theorists to England. His heroic romance *Arcadia*, though unfinished, is the most important work of English prose fiction of the 16th century. None of his works was published in his lifetime. Wounded in action while soldiering in the Netherlands, he died from an infection, and he was widely mourned as the ideal gentleman of his day.

Sidon \'sīd-ᵊn\ *Arabic* **Ṣaydā** Seaport (pop., latest est.: 140,000), southwestern Lebanon. Located on the site of a city founded in the 3rd millennium BC, it was a principal city of Phoenicia from the 2nd millennium BC and a parent city of Tyre. Ruled successively in ancient times by the Assyrians, Babylonians, and Persians, it was conquered by Alexander the Great (c. 330 BC). Under Roman rule by the 1st century BC, it was an important centre for the manufacture of glass and purple dyes. It changed hands several times during the Crusades and fell to the Muslims in 1291. It flourished for a while under Ottoman rule after 1517.

Sidra \'si-drə**, Gulf of** *or* **Gulf of Sirte** \'sir-ˌtā\ Inlet of the Mediterranean Sea, north-central coast, Libya. It extends 275 mi (443 km). In August the gulf's water temperature reaches 88 °F (31 °C), the warmest in the Mediterranean. It was the scene of the Battle of Sirte in World War II (1939–45), during which a British naval convoy thwarted attacks by Italian warships and German bombers. In the early 1980s Libya laid claim to the entire gulf, prompting minor clashes with U.S. naval forces in the area.

SIDS See sudden infant death syndrome

Siegel \'sē-gəl**, Bugsy** *orig.* **Benjamin Siegel** (b. Feb. 28, 1906, Brooklyn, N.Y., U.S.—d. June 20, 1947, Beverly Hills, Calif.) U.S. gangster. He began his career extorting money from Jewish peddlers on New York's Lower East Side. He joined with Meyer Lansky and began operating bootlegging and gambling rackets; they later formed the forerunner of Murder, Inc. In 1937 he was sent to develop rackets on the West Coast, and he soon set up gambling dens and ships, as well as narcotics smuggling and blackmail operations. In 1945 he built the Flamingo Hotel and Casino in Las Vegas, Nev. Originally budgeted at $1.5 million, its cost was driven to $6 million through his skimming. This angered Lansky and other bosses, and Siegel was murdered in his home.

Siegfried \'sig-ˌfrēd,\ *German* \'zēk-ˌfrēt\ *or* **Sigurd** Hero of German and Old Norse mythology noted for his outstanding strength and courage. He is one of the heroes of the *Poetic* Edda and the Nibelungenlied, and he figures in many different, sometimes inconsistent, legends. In the earliest stories, Siegfried is presented as a boy of noble lineage who grew up without parental care, but other accounts provide elaborate detail of a courtly upbringing. One legend tells of his battle with a dragon, and another of his acquiring treasure. He also plays a part in the story of Brunhild, in which he meets his death. He is the hero of Richard Wagner's operatic tetralogy *The Ring of the Nibelung*. See also Kriemhild.

Siemens \'sē-mənz**, Sir (Charles) William** *orig.* **Karl Wilhelm Siemens** (b. April 4, 1823, Lenthe, Prussia—d. Nov. 19, 1883, London, Eng.) German-born British engineer and inventor. He immigrated to Britain in 1844. In 1861 he patented the open-hearth furnace (see open-hearth process), which was soon being widely used in steelmaking and eventually replaced the earlier Bessemer process. He also made a reputation and a fortune in the steel cable and telegraph industries and was a principal in the company that laid the first successful transatlantic telegraph cable (1866). His three brothers were also eminent engineers and industrialists (see Siemens AG).

Siemens \'sē-mənz\ **AG** German electrical-equipment manufacturer. The first Siemens company, Siemens & Halske, was founded in Berlin in 1847 to build telegraph installations. Under Werner Siemens (1816–92) and his three brothers (including William Siemens), it expanded to produce dynamos, cables, telephones, electric power, and electric lighting. In 1903 Siemens & Halske transferred its power-engineering activities to the new Siemens-Schuckertwerke GmbH, and in 1932 Siemens-Reiniger-Werke AG was established to produce medical equipment. The companies expanded greatly during the Third Reich; after World War II, Siemens officials were charged with using slave labour and participating in the construction and operation of the Auschwitz and Buchenwald camps. The Siemens companies flourished again in the 1950s, and by 1966, when the three separate companies merged to form Siemens AG, were among the world's largest electrical suppliers. Siemens products include electrical components, computer systems, microwave devices, and medical equipment.

Siemens-Martin process See open-hearth process

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Siena \sē-'e-nä\ *ancient* **Saena Julia** City (pop., 2001: 54,366), western Italy. It is located south of Florence. Founded by the Etruscans, Siena later passed to the Romans and the Lombards; in the 12th century it became a self-governing commune. Rivalry with Florence made Siena the center of pro-imperial Ghibellinism in Tuscany. It was conquered by Charles I (Charles of Anjou), king of Naples and Sicily, in 1270 and joined the Guelph confederation (see Guelphs and Ghibellines). It was an important banking and commercial centre until surpassed by Florence in the 13th–14th centuries. Conquered by the Holy Roman emperor Charles V in 1555, it was ceded to Florence in 1557. Modern Siena is a market town and tourist centre; historic sites there include the Gothic-Romanesque cathedral, the University of Siena (founded 1240), and the Piazza del Campo, where the Corsa del Palio, a horse race originating in medieval times, is still held.

Sienkiewicz \shʸen-'kʸe-vʸēch**, Henryk (Adam Alexander Pius)** (b. May 5, 1846, Wola Okrzejska, Pol.—d. Nov. 15, 1916, Vevey, Switz.) Polish novelist. In 1869 he began to publish critical works showing the influence of positivism. He worked as a newspaperman and published successful short stories before producing the great trilogy consisting of *With Fire and Sword* (1884), *The Deluge* (1886), and *Pan Michael* (1887–88). Describing Poland's struggles against Cossacks, Tatars, Swedes, and Turks, the novels stress Polish heroism in a vivid style of epic clarity and simplicity. The widely translated *Quo Vadis?* (1896), set in Rome under Nero, established his international reputation. He received the Nobel Prize for Literature in 1905.

Sierra Club U.S. organization for the conservation of natural resources, headquartered in San Francisco. It was founded in 1892 by a group of Californians, including John Muir, who wanted to sponsor wilderness outings in Pacific Coast mountain regions. As its first president, Muir initiated the club's involvement in political action on behalf of nature conservation. With branches in all 50 states, it works to educate the public on environmental issues and lobbies local, state, and federal agencies for environmental legislation.

Sierra Leone \sē-ˌer-ə-lē-'ōn\ *officially* **Republic of Sierra Leone** Country, western Africa. Area: 27,699 sq mi (71,740 sq km). Population (2005 est.): 5,018,000. Capital: Freetown. The Mende and Temne are the largest of about 18 ethnic groups. Languages: English (official), Krio (derived from English and a variety of African languages). Religions: Islam (predominantly Sunni), traditional beliefs, Christianity. Currency: leone. Sierra Leone has four physical regions: the coastal swamp; the Sierra Leone Peninsula, with thickly wooded mountains that rise from the swamps; the interior plains, consisting of grasslands and rolling wooded country; and the eastern plateau region, encompassing several mountains. About one-eighth of the country is forest. Wildlife includes chimpanzees, tigers, crocodiles, and many species of birds. The economy is based largely on agriculture and mining; rice, cassava, coffee, cacao, and oil palm are major crops, and diamonds and bauxite are mined. Sierra Leone is a republic with one legislative house; the head of state and government is the president. The earliest inhabitants were probably the Bulom and Temne; Mande-speaking peoples began arriving in the 15th century. The coastal region was visited by the Portuguese in the 15th century, who built a fort near the site of modern Freetown. European ships visited the coast regularly to trade for slaves and ivory, and the English built trading posts on offshore islands in the 17th century. British abolitionists and philanthropists founded Freetown in 1787 as a private venture for freed and runaway slaves. In 1808 the coastal settlement became a British colony. The region became a British protectorate in 1896. It achieved independence in 1961 and became a republic in 1971. Since independence Sierra Leone has experienced a series of military coups. An 11-year civil war that was marked by horrific atrocities and further devastated the country ended in 2002.

Sierra Madre Principal mountain system, Mexico. It includes the ranges of the Sierra Madre Occidental (to the west), the Sierra Madre Oriental (to the east), and the Sierra Madre del Sur (to the south)—all running roughly northwest-southeast. The Sierra Madre Occidental extends for about 700 mi (1,100 km) parallel with the Gulf of California and the Pacific Ocean; summits reach elevations above 6,000 ft (1,800 m), with some exceeding 10,000 ft (3,000 m). The Sierra Madre Oriental originates near the Rio Grande to the north and extends roughly parallel with the Gulf of Mexico for about 700 mi; it has an average elevation of about 7,000 ft (2,150 m), but some peaks rise above 10,000 ft (Mount Peña Nevada). The Sierra Madre del Sur stretches through the southern Mexican states of Guerrero and Oaxaca, reaching elevations of about 6,500 ft (2,000 m), with a few peaks above 10,000 ft.

Sierra Nevada Mountain range, eastern California, U.S. The Sierra Nevada range extends more than 250 mi (400 km) from the Mojave Desert to the Cascade Range, and it averages about 50 mi (80 km) in width. The peaks of the range are 11,000–14,000 ft (3,350–4,270 m) high; Mount Whitney is the highest mountain. It is a year-round recreation centre and is easily accessed from the state's large urban areas.

Sierra redwood See big tree

Sieyès \syā-'yes**, Emmanuel-Joseph** (b. May 3, 1748, Fréjus, France—d. June 20, 1836, Paris) French political theorist. A Catholic priest, he rose to become chancellor of the diocese of Chartres in 1788. In sympathy with the reform movement before the French Revolution, he won great popularity with his pamphlet *What Is the Third Estate?* (1789) and was elected to represent the Third Estate in the Estates-General. He led the movement to establish the National Assembly, then served in the National Convention until the radical Jacobins seized control (1793). During the Directory, he served on the Council of Five Hundred (1795–99) and on the Directory itself (1799). He helped organize the military Coup of 18–19 Brumaire, which overthrew the Directory and brought Napoleon to power. After the monarchy's restoration (1815), he lived in exile in Belgium until 1830.

Sigebert \sēzh-'ber\ **I** (b. 535—d. November? 575, Vitry, near Arras) Frankish king of the Merovingian dynasty. On the death of his father, Chlotar I, he became king of Austrasia, and he gained further territory on the death of his brother Charibert I (c. 567). He repelled attacks by the Avars (562, c. 568) and married Brunhild, the daughter of the Visigothic king. Brunhild's sister had married Sigebert's brother Chilperic I and was murdered by him. To avenge his sister-in-law's murder, Sigebert waged civil war against Chilperic, defeating him and taking most of his land. Acclaimed king by his brother's subjects, he was immediately killed by assassins in the service of Fredegund, Chilperic's second wife.

Siger de Brabant \sē-'zhā...bra-'bäⁿ\ (b. 1240, duchy of Brabant—d. between 1281 and 1284, Orvieto, Tuscany) French philosopher. He taught at the University of Paris and was a leader of the school of radical Aristotelianism. From c. 1260 he and others gave lectures on the works of Greek, Arabic, and medieval philosophers without regard for church teaching, which had blended Aristotelianism with the Christian faith. Some of his teachings were condemned in 1270 by the bishop of Paris,

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and in 1277 many more were condemned by the bishop. When summoned by the Inquisition (1276), he fled to Italy. Dante, in *The Divine Comedy*, put Siger in the Heaven of Light.

Sigismund \'si-jəs-mənd\ (b. Feb. 15, 1368, probably Nürnberg—d. Dec. 9, 1437, Znojmo, Bohemia) Holy Roman emperor (1433–37), king of Hungary (from 1387), German king (from 1411), king of Bohemia (from 1419), and Lombard king (from 1431). He became king of Hungary by marriage and pawned his German lands to raise funds for defense (1388). He pursued an expansionist policy that brought him into conflict with his brother Wenceslas, whom he imprisoned (1402–03) in an abortive effort to seize Bohemia. As German king, Sigismund helped to end the Western Schism. He was twice defeated by the Turks (1396, 1428). Although he inherited the Bohemian crown in 1419, wars against the Hussites delayed his coronation until 1436. He gained the imperial crown in 1433, becoming the last emperor of the house of Luxembourg.

Sigismund I *Polish* **Zygmunt Stary ("Sigismund the Old")** (b. Jan. 1, 1467—d. April 1, 1548, Kraków, Pol.) King of Poland (1506–48). Son of Casimir IV, he became grand prince of Lithuania and king of Poland in 1506. After his army subdued the Teutonic Order in East Prussia, he established Polish suzerainty over the area, known as Ducal Prussia (1525). He added the duchy of Mazovia (now the province of Warsaw) to the Polish state in 1529. He established judicial and administrative reforms and encouraged a reform of the currency. A lover of the fine arts, he brought Italian artists to Poland and promoted the development of the Renaissance.

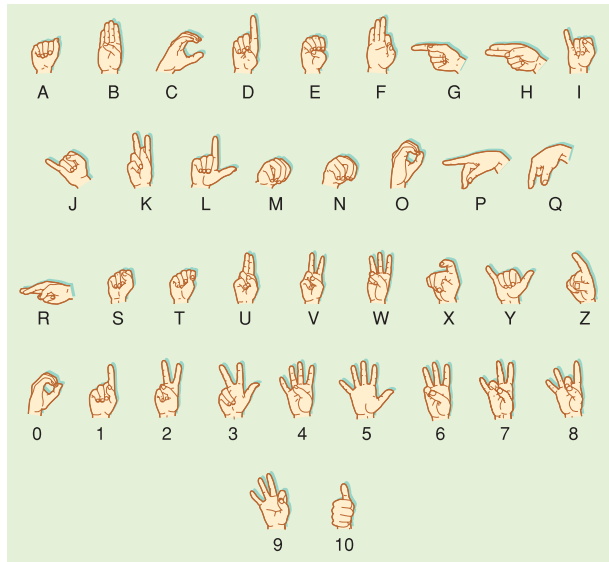
Sigismund II Augustus *Polish* **Zygmunt August** (b. Aug. 1, 1520, Kraków, Pol.—d. July 7, 1572, Knyszyn) King of Poland (1548–72). Son of Sigismund I, he was crowned coruler with his father in 1530 and ruled the duchy of Lithuania from 1544. After becoming king of Poland (1548), he supported the Teutonic Order in Livonia against Russia (1559) and by treaty incorporated Livonia into Lithuania (1561). Continued threats by Russia compelled Sigismund to unite the lands attached to the Polish crown, and by the Union of Lublin (1569) he united Poland and Lithuania and their respective dependencies. He died childless, which brought the end of the direct Jagiellon dynasty.

Sigismund III Vasa *Polish* **Zygmunt Waza** (b. June 20, 1566, Gripsholm, Swed.—d. April 30, 1632, Warsaw, Pol.) King of Poland (1587–1632) and of Sweden (1592–99). Son of King John III of Sweden (1537–1592) and Catherine, daughter of Sigismund I of Poland, he was elected king of Poland in 1587. On his father's death (1592), he accepted the Swedish throne and was crowned in 1594. He left his paternal uncle Charles (later Charles IX) as regent in Sweden and returned to Poland, but Charles later rose in rebellion, defeated Sigismund's army (1598), and deposed Sigismund (1599). Poland and Sweden fought intermittently from 1600 as Sigismund tried to regain the Swedish throne. He invaded Russia in the Time of Troubles and held Moscow (1610–12). In a renewal of the Polish-Swedish conflict in 1621, King Gustav II Adolf seized most of Polish Livonia, which Sweden retained under the terms of a 1629 truce.

Sigismund III, detail of a painting, school of Rubens; in the Bayerische Staatsgemäldesammlungen, Munich
COURTESY OF THE BAYERISCHE STAATSGEMALDESAMMLUNGEN, MUNICH

sign In marketing and advertising, a device placed on or before a premises to identify its occupant and the nature of the business done there or, placed at a distance, to advertise a business or its products. The ancient Egyptians and Greeks used signs for advertising purposes, as did the Romans, who also, in effect, created signboards by whitewashing convenient sections of walls for suitable inscriptions. Early shop signs were developed when tradesmen, dealing with a largely illiterate public, devised certain easily recognizable emblems to represent their trades. Modern sign designers use various forms of animation and light.

sign language Any means of communication through bodily movements, especially of the hands and arms, rather than through speech. It has long been used by speakers of mutually unintelligible languages—for example, various Plains Indian tribes in 19th-century North America communicated via a sign language—and is widely used for communication by the deaf. Charles-Michel, abbé de l'Épée (1712–89), developed the first sign language for the deaf in the mid-18th century; his system developed into French Sign Language (FSL), still used in France. Transported to the U.S. in 1816 by Thomas Gallaudet (1787–1851), it evolved into American Sign Language (ASL, or Ameslan), now used by more than half a million people. These and other national sign languages generally express concepts rather than elements of words and thus have more in common with each other than with their countries' spoken languages.



The alphabet and the numbers 0–10 in Amer. Sign Language.
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Signac \sē-'nyȧk**, Paul** (b. Nov. 11, 1863, Paris, Fr.—d. Aug. 15, 1935, Paris) French painter. At 18 he gave up architecture to pursue painting in the Impressionist manner. In 1884 he became a founder of the Salon des Indépendants. With Georges Seurat he developed an exact mathematical system of applying dots of colour, which they called Pointillism (see Neo-Impressionism). He traveled extensively along the European coast painting landscapes and seascapes; in his later years he painted street scenes of Paris and other cities. He was a master of watercolour, in which he achieved great brilliance of colour and a free, spontaneous style. His work had a great influence on Henri Matisse.

Signorelli \ˌsēn-yō-'rel-lē**, Luca (d'Egidio di Ventura de')** *or* **Luca da Cortona** (b. 1445/50, Cortona, Republic of Florence—d. Oct. 16, 1523, Cortona) Italian painter. Highly influenced by the Florentine artists, he was probably a student of Piero della Francesca. He went to Rome c. 1483, where he produced the *Testament of Moses* fresco in the Sistine Chapel. The dramatic action and depiction of great muscular effort in this and similar Renaissance works mark him as essentially a Florentine naturalist. His masterpiece, the *End of the World* and *Last Judgment* frescoes in Orvieto Cathedral, with their many muscular nudes, greatly influenced Michelangelo.

Sigurd See Siegfried

Sihanouk, Norodom See Norodom Sihanouk

Sikh Wars \'sēk\ (1845–46, 1848–49) Two wars fought between the Sikhs and the British. In the first war Sikhs invaded British India under the pretext of forestalling a British attack on the Sikh state in the Punjab (see Ranjit Singh). They were defeated, the British annexed some of their lands, and British troops and a British resident were stationed in Lahore. The second war was a Sikh national revolt that ended in a British victory and annexation of the Punjab.

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sikhara *or* **shikhara** \'shi-kə-rə\ Tower characteristic of Hindu temples of northern India. The *sikhara* over the sanctuary of a temple is usually tapered convexly, consisting of piled-up roof slabs of diminishing size. The surface is covered with vinelike *candrashala* (ogee arch) tracery; at the top is a cushion-shaped grooved disk (*amalaka*), and above that a pot with a crowning finial. The *sikhara* developed during the Gupta period (4th–6th century AD) and steadily grew taller and more elaborate, as in the soaring tower of the 11th-century Lingaraja Temple in BHUBANESWAR. In a variation of the basic form, half spires are added on either side of the *sikhara*; excellent examples are the 10th-century Laksmana and 11th-century Kandarya Mahadeva temples at Khajuraho, Madhya Pradesh. In addition to the curved *sikhara*, there is a smaller, rectilinear type frequently used above the temple *mandapa*s (halls).

A *sikhara* of the *bhumija* type, Udayesvara temple, Udayapur, Madhya Pradesh, India, 1059–82.
P. CHANDRA

Sikhism \'sē-ˌkiz-əm\ Indian religion founded in the late 15th century by NANAK, the first of the Sikh leaders titled GURU. Most of the religion's 25 million members, called Sikhs, live in the PUNJAB—the site of their holiest shrine, the GOLDEN TEMPLE, and the principal seat of Sikh religious authority, the AKAL TAKHT. The ADI GRANTH is the canonical SCRIPTURE of Sikhism. Its theology is based on a supreme God who governs with justice and grace. Every human being, irrespective of CASTE or gender, has the opportunity to become one with God. The basic human flaw of self-centredness can be overcome through proper reverence for God, commitment to hard work, service to humanity, and sharing the fruits of one's labour. Sikhs consider themselves disciples of the 10 human Gurus; the *Adi Granth* assumed the position of Guru after the death of the last human Guru, GOBIND SINGH (1666–1708). Sikhs accept the Hindu ideas of SAMSARA and KARMA. The dominant order of Sikhism, into which most Sikh boys and girls are initiated at puberty, is the Khalsa. The emblems of the Khalsa, called the five Ks, are *kes* (uncut hair), *kangha* (a comb), *kachha* (long shorts), *kirpan* (a sword), and *karka* (a steel bracelet).

Sikkim \'si-kəm\ State (pop., 2001 prelim.: 540,773), northeastern India. In the eastern HIMALAYAS, Mount KANCHENJUNGA, third highest peak in the world, forms its western border with NEPAL. It is also bordered by BHUTAN and WEST BENGAL state and has an area of 2,740 sq mi (7,096 sq km); the capital, GANGTOK, is the only urban centre. As an independent country, it fought prolonged wars in the 18th and 19th centuries with Bhutan and Nepal. It first came under British influence in 1817, though it remained an independent buffer between British India and Tibet. In 1950 it became an Indian protectorate and, in 1975, a state of India. One of India's smallest states, it exports agricultural products and is one of the world's main producers of cardamom. Its mineral resources include copper, lead, zinc, coal, iron ore, and garnets.

Sikorski, Władysław (Eugeniusz) (b. May 20, 1881, Tuszów Narodowy, Pol., Austria-Hungary—d. July 4, 1943, Gibraltar) Polish general and politician. He served in the Austrian army and in World War I was head of the Polish Legion, which joined with Austria against Russia. He served as prime minister of Poland (1923–24) and as minister of military affairs (1924–25). From 1928 he joined the opposition to the government controlled by JÓZEF PILSUDSKI. After the German invasion of Poland (1939), he became prime minister of the Polish government-in-exile. When he asked JOSEPH STALIN to allow the Red Cross to investigate the KATYN MASSACRE, Stalin broke off Soviet-Polish diplomatic contact. Sikorski died in an airplane crash several months later.

Sikorsky, Igor (Ivan) (b. May 25, 1889, Kiev, Russian Empire—d. Oct. 26, 1972, Easton, Conn., U.S.) Russian-U.S. pioneer in aircraft design. After studying engineering in Kiev, he set up his own shop to develop the HELICOPTER. In 1910, after failing to build a workable model, he turned to fixed-wing airplane design, and in 1913 he built the first four-engine airplane, with an innovative enclosed cabin. He immigrated to the U.S. in 1919. In 1931 he produced the twin-engine amphibian aircraft that became the model for PAN AMERICAN WORLD AIRWAYS' "Clipper." In 1939 Sikorsky finally realized a viable helicopter design. He directed his company, a division of United Aircraft Corporation, from 1929 to 1957.

Igor Sikorsky, Russian-born American aircraft designer.
COURTESY OF SIKORSKY AIRCRAFT

silage \'sī-lij\ *or* **ensilage** \'en-sə-lij\ FORAGE plants such as corn, legumes, and grasses that have been harvested at early maturity, finely chopped, packed tightly to exclude air, and stored in tower silos, pits, or trenches. Properly stored silage ferments slightly and keeps for several months. It is used as animal feed.

silane \'si-ˌlān, 'sī-ˌlān\ *or* **silicon hydride** Any of a series of inorganic compounds of SILICON and hydrogen with COVALENT BONDS and the general chemical formula $Si_nH_{(2n + 2)}$. Silanes are structural analogs of saturated hydrocarbons (see SATURATION; ALKANE) but are much less stable. All burn or explode when exposed to air and react readily with HALOGENS or hydrogen halides to form halogenated silanes and with OLEFINS to form alkylsilanes, products used as water repellents and as starting materials for SILICONES.

silenus See SATYR AND SILENUS

Silesia \si-'lē-zhə\ *Polish* **Śląsk** \'shläsk\ *German* **Schlesien** \'shlā-zē-ən\ Historic region, east-central Europe. It now lies mainly in southwestern Poland, with parts in Germany and the Czech Republic. It was originally a Polish province that became a possession of the Bohemian crown, and thus part of the HOLY ROMAN EMPIRE, in 1335. Because of succession disputes and the region's prosperity, there were at least 16 Silesian principalities by the end of the 15th century. It passed to the Austrian HABSBURGS in 1526; it was taken by Prussia in 1742. After World War I it was divided between Poland, Czechoslovakia, and Germany. During World War II Polish Silesia was occupied by Germany and was the site of atrocities against the population by Nazi and, later, Soviet forces. In 1945 the Allied powers assigned virtually all of Silesia to Poland; today its nine Polish provinces contain almost one-fourth of Poland's population.

Silhak See PRACTICAL LEARNING SCHOOL

silhouette \ˌsi-lü-'et\ Outline image or design in a single solid, flat colour, giving the appearance of a shadow cast by a solid figure. The term is usually applied to profile portraits in black against white (or vice versa), either painted or cut from paper, especially popular c. 1750–1850 as the least expensive method of portraiture. The name derives from Étienne de Silhouette, Louis XV's finance minister, notorious for his frugality and his hobby of making cut-paper shadow portraits. In 17th-century Europe, shadow portraits and scenes were produced by drawing the outline cast by candlelight or lamplight; when paper became widely available, they were often cut out freehand directly from life. Photography rendered silhouettes nearly obsolete, and they became a type of folk art practiced by itinerant artists and caricaturists.

Silhouette portrait by Charles Willson Peale; in the Library of Congress, Washington, D.C.
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

silica mineral \'si-li-kə\ Any of the forms of silicon dioxide (SiO_2),

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including QUARTZ, tridymite, cristobalite, coesite, stishovite, melanophlogite, lechatelierite, and chalcedony. Various kinds of silica minerals have been produced synthetically.

silicate mineral Any of a large group of silicon-oxygen compounds that are widely distributed throughout much of the solar system. The silicates make up about 95% of the Earth's crust and upper mantle, occurring as the major constituents of most IGNEOUS ROCKS and in appreciable quantities in SEDIMENTARY and METAMORPHIC rocks. They also are important constituents of lunar samples, meteorites, and most asteroids. In addition, planetary probes have detected them on the surfaces of Mercury, Venus, and Mars. Of the approximately 600 known silicate minerals, only the FELDSPARS, AMPHIBOLES, PYROXENES, MICAS, OLIVINES, FELDSPATHOIDS, and ZEOLITES are significant in rock formation.

siliceous rock \sə-'li-shəs\ Any of a group of SEDIMENTARY ROCKS that consist largely or almost entirely of silicon dioxide (SiO_2), either as QUARTZ or as CHERT, the most common siliceous rock. It occurs in beds and in nodules. Bedded cherts may be an original organic or inorganic precipitate. Nodular cherts appear to be produced by the alteration of preexisting sedimentary rock. In this process silica distributed throughout the rock dissolves and reprecipitates to form nodules.

silicon Nonmetallic to semimetallic chemical ELEMENT, chemical symbol Si, atomic number 14. Second only to oxygen in abundance in Earth's crust, it never occurs free but is found in almost all rocks and in sand, clay, and soils, combined with oxygen as silica (silicon dioxide, SiO_2) or with oxygen and metals as SILICATE MINERALS. It occurs in many plants and some animals. Pure silicon is a hard, dark gray solid with a metallic lustre and the same CRYSTAL structure as DIAMOND. It is an extremely important SEMICONDUCTOR; doped (see DOPANT) with boron, phosphorus, or arsenic, it is used in various electronic circuit and switching devices, including COMPUTER CHIPS, TRANSISTORS, and DIODES. Silicon is also used in metallurgy as a reducing (see REDUCTION) agent and in steel, brass, and bronze. Its usual VALENCE in compounds is 4. Silica is used in the form of sand and clay for many purposes; as QUARTZ, it may be heated to form special GLASSES. Silicates are used in making glass, enamels, and ceramics; sodium silicates (water glass) are used in soaps, wood treatment, cements, and dyeing. See also SILANE; SILICONE.

silicon hydride See SILANE

Silicon Valley Industrial region, west-central California. Roughly bounded by San Francisco Bay on the north, the Santa Cruz Mountains on the west, and the Diablo Range on the east, it takes its (unofficial) name from the extensive use of SILICON in the region's electronics industries. The U.S. government invested heavily in the region's industry following World War II. A second economic surge occurred with the proliferation of PERSONAL COMPUTERS in the 1980s, and a third surge followed the growth of the INTERNET in the 1990s.

silicone *or* **polysiloxane** Any of a diverse class of POLYMERS manufactured as fluids, RESINS, or elastomers. They are partially organic compounds, but, unlike most polymers, they have a backbone containing no carbon, composed instead of alternating SILICON and OXYGEN atoms. In most silicones, two organic groups (see FUNCTIONAL GROUP), usually methyl or phenyl, are attached to each silicon atom. Silicones in general are exceptionally stable and inert. Silicone fluids are used in hydraulic fluids, emulsion-breaking compositions, and breast implants and as adhesives, lubricants, water repellents, and protective coatings. Silicone rubbers are used as electrical insulators in encapsulations, coatings, and varnishes; as gaskets and caulking material; in specialized tubing; as automobile engine components; as flexible windows in face masks and air locks; for laminating glass cloth; and as surgical membranes and implants.

silicosis \ˌsi-lə-'kō-səs\ Common PNEUMOCONIOSIS caused by long-term inhalation of SILICA MINERAL dust. Known since the 18th century, it usually occurs after 10–20 years of exposure in jobs such as mining, stonecutting, grinding, or polishing. The smallest particles do the most damage, killing macrophages (see RETICULOENDOTHELIAL SYSTEM) that engulf them in the pulmonary alveoli. Dead cells accumulate, forming fibrous masses that reduce LUNG elasticity. Decreased lung volume and poor gas exchange lead to shortness of breath and then to coughing, difficulty in breathing, and weakness. Patients are vulnerable to TUBERCULOSIS, EMPHYSEMA, and PNEUMONIA. In the absence of effective treatment, control of silicosis depends on prevention with face masks, proper ventilation, and X-ray monitoring of workers' lungs.

Siljan \'sil-ˌyän**, Lake** Lake, central Sweden. Covering 112 sq mi (290 sq km), it is Sweden's third largest lake. It is fed by the Österdal River and extends into two bays. Its wooded shores are interspersed with meadows and quaint villages, making it an attractive tourist destination.

silk Animal fibre produced by certain insects as building material for cocoons and webs. In commercial use it refers almost entirely to filament from cocoons produced by the caterpillars of several moth species of the genus *Bombyx*, commonly called SILKWORMS. Silk is a continuous filament around each cocoon. It is freed by softening the cocoon in water and then locating the filament end; the filaments from several cocoons are unwound at the same time, sometimes with a slight twist, to form a single strand. In the process called throwing, several very thin strands are twisted together to make thicker, stronger YARN. Silk was discovered in China sometime before 2700 BC, and the secret of its production was closely guarded for millennia. Along with jade and spices, silk was the primary commodity traded along the SILK ROAD beginning about 100 BC. Since World War II, NYLON and other synthetic fibres have replaced silk in many applications (e.g., parachutes, hosiery, dental floss), but silk remains an important luxury material for clothing and home furnishings. More than 50% of the world's silk is still produced in China.

Silk Road Ancient trade route that linked China with Europe. Originally a CARAVAN route and used from c. 100 BC, the 4,000-mi (6,400-km) road started in XI'AN, China, followed the GREAT WALL to the northwest, climbed the Pamir Mtns., crossed Afghanistan, and went on to the eastern Mediterranean Sea, where goods were taken by boat to Rome. Silk was carried westward, while wool, gold, and silver were carried eastward. With the fall of Rome, the route became unsafe; it was revived under the Mongols, and MARCO POLO used it in the 13th century.

silkscreen *or* **serigraphy** \sə-'ri-grə-fē\ Sophisticated stenciling technique for surface printing, in which a design is cut out of paper or another thin, strong material and then printed by rubbing, rolling, or spraying paint or ink through the cutout areas. It was developed c. 1900 and originally used in advertising and display work. In the 1950s fine artists began to use the process. It got its name from the fine-mesh silk that, when tacked to a wooden frame, serves as a support for the cut-paper stencil, which is glued to it. To make a silkscreen print, the wooden frame holding the screen is hinged to a slightly larger wooden board, the printing paper is placed on the board under the screen, and the paint is pressed through the screen with a squeegee (rubber blade) the same width as the screen. Many colours can be used, with a separate screen for each colour.

silkworm moth Any MOTH in the genus *Bombyx* (family Bombycidae). The Chinese silkworm (*B. mori*) has been used in commercial SILK production for centuries. The adult, which has a wingspan of about 2 in. (50 mm) and a thick, hairy body, lives only two or three days. The female lays 300–500 eggs. The pale, naked larvae are fed mulberry leaves until pupation begins, when they are about 3 in. (75 mm) long. They spin a cocoon of one continuous white or yellow silken thread, about 1,000 yards (900 m) long. The pupa is killed with hot air or steam to preserve the thread intact. See also SATURNIID MOTH.

Silkworm larvae (*Bombyx*) feeding on mulberry leaves
UPI

sill *or* **sheet** In geology, a tabular igneous intrusion emplaced parallel to the bedding of the enclosing rock. Although they may have inclined orientations, nearly horizontal sills are most common. Sills may range from a few inches to hundreds of feet thick and up to hundreds of miles long. They include rock compositions of all types.

Silla Kingdom of ancient Korea that in AD 668 consolidated other polities on the Korean peninsula under the Unified Silla dynasty (668–935). Traditionally believed to have been founded by Hyŏkkŏse in 57 BC, Silla emerged as a full-fledged kingdom in the 6th century. In the reign of King Chinhŭng (540–576), a unique military corps, the *hwarang* (see HWARANGDO), was organized; allied with TANG-DYNASTY China, it defeated the Korean state of PAEKCHE in 660 and KOGURYŎ in 668, then expelled the Tang forces to create a unified and independent Korean state. It adopted a Chinese bureaucratic structure, but its aristocracy was never replaced by a

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bureaucratic class based on merit. Silla art before unification shows a tendency toward abstraction; postunification art reflects Tang naturalism.

Sillanpää \'sēl-län-ˌpä**, Frans Eemil** (b. Sept. 16, 1888, Hämeenkyrö, Fin., Russian Empire—d. June 3, 1964, Helsinki, Fin.) Finnish novelist. The son of a farmer, he studied natural science but returned to the country to write. Shocked by the Finnish civil war of 1918, he produced his most substantial novel, *Meek Heritage* (1919), relating how a humble cottager becomes involved with the Red Guards. After several collections of short stories in the late 1920s, he published his best-known work, *The Maid Silja* (1931), about an old peasant family. *People in the Summer Night* (1934) is his most polished and poetic novel. In 1939 he became the first Finnish writer to win the Nobel Prize for Literature.

sillimanite \'si-lə-mə-ˌnīt\ *or* **fibrolite** \'fī-brə-ˌlīt\ Brown, pale green, or white glassy SILICATE MINERAL that often occurs in long, slender, needlelike crystals frequently found in fibrous aggregates. An aluminum silicate, Al_2OSiO_4, it occurs in high-temperature regionally metamorphosed clay-rich rocks (e.g., SCHISTS and GNEISSES). Sillimanite is found at many localities in France, Madagascar, and the eastern U.S.; a pale sapphire-blue gem variety occurs in the gravels of Sri Lanka.

Sillitoe \'si-li-ˌtō**, Alan** (b. March 4, 1928, Nottingham, Nottinghamshire, Eng.) English writer. The son of a tannery worker, he worked in factories from age 14. Many of his later novels and stories are brash and angry accounts of working-class life, beginning with his successful first novel, *Saturday Night and Sunday Morning* (1958; film, 1960). Perhaps his best-known work is the title story in the collection *The Loneliness of the Long-Distance Runner* (1959; film, 1962). His other works include the novels *The Death of William Posters* (1965), *The Widower's Son* (1976), and *The Open Door* (1989) and the story collections *The Ragman's Daughter* (1963; film, 1974) and *Second Chance* (1981).

Sills, Beverly *orig.* **Belle Silverman** (b. May 25, 1929, New York, N.Y., U.S.) U.S. soprano. She sang on radio as a child and made her operatic debut in 1946. From 1955 she sang with the New York City Opera. After gaining attention for her coloratura performance in *Julius Caesar* (1966), she became one of the most celebrated opera stars in the world. After 25 years of singing with the company, she served as its director (1979–89). She sang with the Metropolitan Opera as well (1975–80), though after her prime. An effervescent personality, she hosted broadcast concerts and opera performances, becoming popular among a wide public.

Siloé \sē-lō-'ā**, Diego de** (b. c. 1495, Burgos, Spain—d. Oct. 22, 1563, Granada) Spanish sculptor and architect. Son of the sculptor Gil de Siloé (d. 1501?), he probably studied sculpture in Italy. His works are considered among the finest of the Spanish Renaissance. His sculptural style is Plateresque, a mixture of Italian Renaissance, Gothic, and Mudéjar styles. His principal architectural work, the Granada Cathedral (begun 1528), combines the best features of those styles.

Silone \sē-'lō-nā**, Ignazio** *orig.* **Secondo Tranquilli** (b. May 1, 1900, Pescina dei Marsi, Italy—d. Aug. 22, 1978, Geneva, Switz.) Italian novelist, short-story writer, and political leader. A founder of the Italian Communist party in 1921, he was active in the party until the fascists drove him into exile. In 1930 he settled in Switzerland, became disillusioned with communism, and began to write antifascist works. He became internationally famous with his first novel, *Fontamara* (1930), which was followed by the novels *Bread and Wine* (1937) and *The Seed Beneath the Snow* (1940) and the satire *The School for Dictators* (1938). After World War II he returned to Italian politics before retiring to write such works as *A Handful of Blackberries* (1952).

silt Sediment particles 0.00016–0.0024 in. (0.004–0.06 mm) in diameter, regardless of mineral type. Silt is easily transported by moving currents but settles in still water. An unconsolidated aggregate of silt particles is also called silt, whereas a consolidated aggregate is called SILTSTONE. Silt deposits formed by wind are known as LOESS. Sediments are seldom composed entirely of silt but rather are a mixture of clay, silt, and sand. Clay-rich silt, upon consolidation, frequently develops parting along bedding surfaces and is then called SHALE. If parting does not develop, the massive rock is called mudstone.

siltstone Hardened sedimentary rock that is composed primarily of angular silt-sized particles (see SILT) and that is not laminated or easily split into thin layers. Siltstones, which are hard and durable, occur in thin layers rarely thick enough to be classified as formations. They are intermediate between sandstones and shales but are not as common as either.

Silurian \sī-'lůr-ē-ən\ **Period** Interval of geologic time, 443–417 million years ago. The third period of the PALEOZOIC ERA, the Silurian follows the ORDOVICIAN PERIOD and precedes the DEVONIAN. It marks the first appearance of land plants and jawed fishes. The continents were distributed as follows: Arctic Canada, Scandinavia, and Australia were probably in the tropics; Japan and the Philippines may have been inside the Arctic Circle; South America and Africa were likely near the South Pole, with either present-day Brazil or western Africa as the locus of the pole. The land surface was buried by an ice sheet, possibly as deep as that covering Antarctica today.

Silvassa \ˌsil-vä-'sä\ Town (pop., 2001 prelim.: 21,890), capital of DADRA AND NAGAR HAVELI union territory, western India. Located on the Daman Ganga River some 15 mi (25 km) from the Arabian Sea, it is the economic centre of the territory, which produces rice, pulses, and fruit crops.

silver Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol Ag, atomic number 47. It is a white, lustrous precious METAL, valued for its beauty. It is also valued for its electrical conductivity, which is the highest of any metal. Between COPPER and GOLD in their common group of the PERIODIC TABLE, it is intermediate between them in many properties. Widely distributed in nature in small amounts, as the native metal and in ORES, it is usually recovered as a by-product of copper and lead production. Its use in bullion and coins was overtaken in the 1960s by demand for industrial purposes, especially photography. It is also used in printed electrical circuits, electronic conductors, and contacts. It is the CATALYST for converting ethylene to ethylene oxide, the precursor of many organic chemicals. Its use in ALLOYS in sterling (92.5% silver, 7.5% copper) and plated silverware, ornaments, and jewelry remains important; yellow gold used in jewelry is typically 25% silver, and gold dental alloys are about 10% silver. Silver dental fillings are an AMALGAM of silver and MERCURY. Silver in compounds, the most important of which is SILVER NITRATE, has VALENCE 1. Its chloride, bromide, and iodide are used in photography and its iodide in cloud seeding.

Dendritic (branching) silver from Ontario

COURTESY OF JOSEPH AND HELEN GUETTERMAN COLLECTION; PHOTOGRAPH, JOHN H. GERARD

Silver, Horace (b. Sept. 2, 1928, Norwalk, Conn., U.S.) U.S. JAZZ pianist, composer, and bandleader. Silver performed with STAN GETZ in 1950–51 before leading his own trio in 1952. With ART BLAKEY he led the Jazz Messengers from 1954, then formed his own quintet in 1956, performing his own compositions in arrangements that provided the template for much of the hard bop (see BEBOP) of the 1950s and '60s. Influenced by BUD POWELL and THELONIOUS MONK, Silver combined the sophistication of bebop with the earthiness of the BLUES in compositions such as "The Preacher," "Opus de Funk," and "Sister Sadie."

Silver Age In Latin literature, the period from c. AD 18 to 133, second only to the preceding Golden Age in literary achievement. SATIRE was the most vigorous literary form, exemplified by JUVENAL, MARTIAL, and PETRONIUS. Other figures included TACITUS and SUETONIUS in history, PLINY THE ELDER and PLINY THE YOUNGER in letter writing, and QUINTILIAN in literary criticism. Prose was characteristically elaborate and poetical in style, and many of the best works of the period were psychologically perceptive and humanist in tone. See also AUGUSTAN AGE.

silver nitrate Inorganic compound ($AgNO_3$), colourless, transparent crystals with a bitter, caustic, metallic taste. The most important SILVER compound, it is used to prepare other silver salts, to silver mirrors, and as a reagent in ANALYSIS. It is very soluble in water; dilute solutions are effective against gonococcal bacteria and may be applied to newborns' eyes to prevent blindness from GONORRHEA. Ingesting silver nitrate causes violent abdominal pain and GASTROENTERITIS.

silver salmon See COHO

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silver standard Monetary standard under which the basic unit of CURRENCY is defined as a stated quantity of silver. It is usually characterized by the coinage and circulation of silver, unrestricted convertibility of other MONEY into silver, and the free import and export of silver for the settlement of international obligations. No country now operates under a silver standard. In the 1870s most European countries adopted the GOLD STANDARD, and by the early 1900s only China, Mexico, and a few small countries still used the silver standard. In 1873 the U.S. Treasury stopped coining silver, which led to the FREE SILVER MOVEMENT, but the defeat of WILLIAM JENNINGS BRYAN ended agitation for free silver in the U.S. See also BIMETALLISM.

silverfish Species (*Lepisma saccharina*) of quick-moving, slender, flat, wingless insect having three tail bristles and silvery scales. Silverfish are found worldwide. Females deposit fertilized eggs in cracks and hidden places. The hatched young are scaleless and have short appendages. Silverfish normally live indoors and, because they eat starchy materials (e.g., paste, bookbindings, and wallpaper), can cause much damage. They live two to three years and molt throughout life.

silverpoint See METAL POINT

Silvers, Phil *orig.* **Philip Silversmith** (b. May 11, 1912, Brooklyn, N.Y., U.S.—d. Nov. 1, 1985, Los Angeles, Calif.) U.S. actor and comedian. He began his career as a boy singer in vaudeville and a comedian in burlesque. After making his film debut in 1940, he appeared as comic relief in many feature films. He acted on Broadway in *High Button Shoes* (1947–50) and starred in *Top Banana* (1951–52, Tony Award; film, 1954). He is best remembered for his role as Sgt. Bilko in the television series *The Phil Silvers Show* (1955–59; originally known as *You'll Never Get Rich*), for which he won several Emmy Awards. He appeared in the film version of *A Funny Thing Happened on the Way to the Forum* (1966) and its Broadway revival (1972, Tony Award). His popularity stemmed in part from his highly recognizable grin, horn-rimmed glasses, and catchphrases.

Silverstein, Shel(by) (b. Sept. 25, 1932, Chicago, Ill., U.S.—d. May 10, 1999, Key West, Fla.) U.S. cartoonist, children's author, poet, songwriter, and playwright. Often compared to Dr. Seuss (see THEODOR GEISEL), Silverstein is best known for his children's stories and poems. Among his memorable characters are the protagonist in *Uncle Shelby's Story of Lafcadio, the Lion Who Shot Back* (1963), the boy-man and tree in *The Giving Tree* (1964), and the partial circle in *The Missing Piece*. Silverstein was credited with helping young readers develop an appreciation of poetry, and his serious verse reveals an understanding of common childhood anxieties and wishes.

Simcoe, John Graves (b. Feb. 25, 1752, Cotterstock, Northamptonshire, Eng.—d. Oct. 26, 1806, Exeter, Devonshire) British soldier and colonial administrator in Canada. He served in the American Revolution as commander of the Queen's Rangers (1777–79). He was taken prisoner (1779) but later released (1781) and invalided back to England. After the Constitutional Act was passed, he served as the first lieutenant-governor of Upper Canada (now Ontario) from 1792 to 1796. He encouraged immigration and agriculture and supported defense and road building.

Simcoe, Lake Lake, southeastern Ontario, Canada. Located between GEORGIAN BAY and Lake ONTARIO north of TORONTO, Lake Simcoe is 287 sq mi (743 sq km) in area. Numerous small streams and the Trent Canal feed the lake, which is 30 mi (48 km) long and contains several islands; the largest, Georgina, is an Indian reserve. The lake is a popular summer vacation area.

Simenon \sē-mə-'nō^{n}**, Georges (-Joseph-Christian)** (b. Feb. 13, 1903, Liège, Belg.—d. Sept. 4, 1989, Lausanne, Switz.) Belgian-born French novelist. During 1923–33 he wrote more than 200 pseudonymous books of pulp fiction. His first novel under his own name was *The Case of Peter the Lett* (1931), in which he introduced one of the best-known characters in detective fiction, the Parisian police official Inspector Maigret. He wrote some 80 more Maigret novels, as well as about 130 psychological novels, numerous short stories, and autobiographical works, and was one of the most prolific and widely published authors of the 20th century. Simenon's central theme is the essential humanity of even the isolated, abnormal individual and the sorrow at the root of the human condition. Employing a style of rigorous simplicity, he evokes a prevailing atmosphere of neurotic tensions with sharp economy.

Georges Simenon.
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Simeon \'si-mē-ən\ **I** *known as* **Simeon the Great** (b. 864/865—d. May 27, 927) Tsar of the first Bulgarian empire (925–927). The son of BORIS I, he succeeded his father in 893 after the short intervening reign (889–893) of his dissolute elder brother, Vladimir. Hoping to gain the imperial throne, he fought five wars with the Byzantine Empire between 894 and 923. He adopted the title "Tsar of All the Bulgarians" in 925. He extended his power over southern Macedonia, southern Albania, and Serbia but probably lost Bulgaria's dominion north of the Danube.

Simeon Stylites \stī-'līt-ˌēz**, Saint** *or* **Simeon the Elder** (b. c. 390, Sisan, Cilicia—d. 459, Telanissus, Syria) Syrian ascetic. A shepherd, he entered a monastic community but was expelled for excessive austerity and became a hermit. His reputed miracle working drew such crowds that he took to living atop a 6-ft (2-m) pillar (Greek *stylos*) c. 420, becoming the first of the stylites (pillar hermits). He remained atop a second, 50-ft (15-m) pillar until his death; a railing prevented his falling, and food was brought by disciples. He inspired other ascetics and is called Simeon the Elder to distinguish him from a 6th-century stylite of the same name. Stylites were documented as late as the 19th century in Russia.

Simic \'sim-ik**, Charles** (b. May 9, 1938, Belgrade, Yugos.) Yugoslavian-born U.S. poet. When he was 15 years old, he and his mother moved to Paris; a year later they joined his father in the U.S. After graduating from New York University, he translated Yugoslavian poetry into English. His first volume of poetry, *What the Grass Says* (1967) was recognized for its lively, surrealistic imagery; the collection *The World Doesn't End* (1989) won a Pulitzer Prize. He held a MacArthur Fellowship 1984–89. Since 1973 he has taught at the University of New Hampshire.

simile \'si-mə-lē\ FIGURE OF SPEECH involving a comparison between two unlike entities. In a simile, unlike a METAPHOR, the resemblance is indicated by the words "like" or "as." Similes in everyday speech reflect simple comparisons, as in "He eats like a bird" or "She is slow as molasses." Similes in literature may be specific and direct or more lengthy and complex. The Homeric, or epic, simile, which is typically used in epic poetry, often extends to several lines.

Simla See Shimla

Simmel \'zim-əl**, Georg** (b. March 1, 1858, Berlin, Ger.—d. Sept. 26, 1918, Strassburg) German sociologist and philosopher. From teaching posts at the universities of Berlin (1885–1914) and Strassburg (1914–18), Simmel did much to establish sociology as a basic social science in Germany. He sought to isolate the general forms or recurrent regularities of social interaction from the specific content of definite kinds of activity, such as political, economic, or aesthetic. He gave special attention to the problem of authority and obedience. His ideas became influential in the U.S. through the works of ROBERT E. PARK, Albion Small, and Ernest Burgess. See also INTERACTIONISM.

Simms, Willie (b. Jan. 16, 1870, near Augusta, Ga., U.S.—d. Feb. 26, 1927, Asbury, N.J.) U.S. jockey. Simms began racing in 1887 and was one of the most successful early adopters of the short stirrup. In 1895 Simms became the first American jockey to win in England, where English sportswriters soon referred to the short stirrup and crouching posture as the "American seat." Simms won the Belmont Stakes in 1893 and 1894, the Kentucky Derby in 1896 and 1898, and the Preakness Stakes in 1898; he is the only African American to win all of the Triple Crown classics. He was one of the first jockeys to be elected to the National Museum of Racing's Hall of Fame.

Simon \sē-'mō^{n}**, Claude (Eugène Henri)** (b. Oct. 10, 1913, Tananarive [now Antananarivo], Madag.—d. July 6, 2005, Paris, France) French writer. Captured by the Nazis while fighting in World War II, he escaped to join the French Resistance. He completed his first novel during the war. His works, mixing narration and STREAM OF CONSCIOUSNESS in densely constructed prose, are representative of the *nouveau roman* ("new novel"), or French ANTINOVEL, that emerged in the 1950s. Perhaps most important is the cycle

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comprising *The Grass* (1958), *The Flanders Road* (1960), *The Palace* (1962), and *History* (1967), with its recurring characters and events. His other novels include *The Wind* (1957), *Triptych* (1973), *The Acacia* (1989), and *The Trolley* (2001). He received the Nobel Prize for Literature in 1985.

Simon \'sī-mən**, Herbert (Alexander)** (b. June 15, 1916, Milwaukee, Wis., U.S.—d. Feb. 9, 2001, Pittsburgh, Pa.) U.S. social scientist. He received his Ph.D. from the University of Chicago in 1943. At Carnegie-Mellon University (from 1949), he taught psychology and later computer science. In *Administrative Behavior* (1947) Simon argued for recognizing a multiplicity of factors (including psychological ones) in corporate decision making rather than emphasizing the achievement of maximum profits as the primary motivation. He was awarded the Nobel Prize in Economics in 1978. He subsequently worked in the field of ARTIFICIAL INTELLIGENCE using computer technology.

Simon (of Stackpole Elidor), John Allsebrook Simon, 1st Viscount (b. Feb. 28, 1873, Manchester, Eng.—d. Jan. 11, 1954, London) British politician. A successful lawyer, he served in the House of Commons (1906–18, 1922–40). In the 1930s he led the Liberal National Party and served successively as foreign secretary (1931–35), home secretary (1935–37), and chancellor of the Exchequer (1937–40). Favouring rapprochement with Germany, he supported the appeasement policy of NEVILLE CHAMBERLAIN and the MUNICH AGREEMENT. In 1940 Simon was appointed lord chancellor in WINSTON CHURCHILL's wartime coalition ministry and was created a viscount.

Simon, (Marvin) Neil (b. July 4, 1927, New York, N.Y., U.S.) U.S. playwright. After studying at New York University, he worked as a comedy writer for SID CAESAR in the 1950s. His autobiographical play *Come Blow Your Horn* (1961) was the first of a long series of hit comedies that includes *Barefoot in the Park* (1963; film, 1967), *The Odd Couple* (1965; film, 1968), and *Plaza Suite* (1968; film, 1971). His later plays include the autobiographical trilogy of *Brighton Beach Memoirs* (1983), *Biloxi Blues* (1985, Tony Award), and *Broadway Bound* (1986). His plays deal humorously with the everyday conflicts of ordinary middle-class people, often in New York City. For *Lost in Yonkers* (1991), he received a Tony Award and a Pulitzer Prize.

Simon, Paul (Frederic) (b. Oct. 13, 1941, Newark, N.J., U.S.) U.S. pop singer and songwriter. Simon began performing with Art Garfunkel (b. 1941) in the 1950s, using the name Tom and Jerry. After a break, the two reunited in 1964 as Simon and Garfunkel. Their first hit single was "Sounds of Silence" (1966); others over the next six years included "Mrs. Robinson" (for the film *The Graduate*) and "Bridge over Troubled Water." After the two parted company, Simon released several hit albums, including *Still Crazy After All These Years* (1975). His *Graceland* (1986) album, recorded with African musicians, became the most successful and influential of the new genre of WORLD MUSIC. Both African music and Brazilian music informed his album *The Rhythm of the Saints* (1990). With the West Indian poet DEREK WALCOTT he wrote the Broadway musical *The Capeman* (1998).

Simon & Schuster \'shü-stər\ U.S. publishing company. It was founded in 1924 by Richard L. Simon (1899–1960) and M. Lincoln Schuster (1897–1970), whose initial project, the original crossword-puzzle book, was a best-seller. Among their other innovations was Pocket Books, the first U.S. paperback line, launched in 1939. The company came to publish a wide variety of books, including many best-sellers and prize-winners. In 1975 it was sold to GULF & WESTERN INC., which, renamed Paramount Communications in 1989, was acquired by Viacom Inc. in 1994. With the 1998 sale of its educational, professional, international, and reference divisions, Simon & Schuster concentrated again on fiction and nonfiction for the general reader.

Simon de Montfort See Simon de MONTFORT

Simon Fraser University Privately endowed university in Burnaby, British Columbia, Canada, with a branch campus in Vancouver. It was established in 1963 and named after the explorer SIMON FRASER. It has faculties of arts, science, applied sciences, graduate studies, business administration, education, and continuing studies and a school for the contemporary arts.

Simonde de Sismondi, J.-C.-L. See J.-C.-L. Simonde de SISMONDI

simony \'si-mə-nē, 'sī-mə-nē\ Buying or selling of church offices or powers. The name is taken from Simon Magus (Acts 8:18), who tried to buy the power of conferring the gifts of the HOLY SPIRIT. Simony was said to have become widespread in Europe in the 10th–11th century, as promotions to the priesthood or episcopate were bestowed by monarchs and nobles, often in exchange for oaths of loyalty. Changes in the understanding of the nature of simony and the relationship between lay and religious orders contributed to the perception of the growth of simony, even though corrupt practices did exist. Rigorously attacked by Pope GREGORY VII and the reform movement associated with him, the practice recurred in the 15th century, but after the 16th century its more flagrant forms disappeared.

simple harmonic motion Repetitive back-and-forth movement through a central, or EQUILIBRIUM, position in which the maximum displacement on one side is equal to the maximum displacement on the other. Each complete vibration takes the same time, the period; the reciprocal of the period is the FREQUENCY of vibration. The force that causes the motion is always directed toward the equilibrium position and is directly proportional to the distance from it. A PENDULUM displays simple harmonic motion; other examples include the electrons in a wire carrying ALTERNATING CURRENT and the vibrating particles of a medium carrying sound waves.

simplex method Standard technique in LINEAR PROGRAMMING for solving an OPTIMIZATION problem, typically one involving a FUNCTION and several constraints expressed as inequalities. The inequalities define a polygonal region (see POLYGON), and the solution is typically at one of the vertices. The simplex method is a systematic procedure for testing the vertices as possible solutions.

Simplon \'sim-ˌplän\ **Pass** Alpine pass and tunnel, southern Switzerland. It is situated between the Pennine and LEPONTINE ALPS at 6,581 ft (2,006 m). An important Alpine route since the mid-13th century, the pass became a major link between central and southern Europe when NAPOLEON had a road built there (1800–07). A hospice, occupied by the AUGUSTINIANS and dating from 1235, is near the summit. When the pass is closed to road traffic in the winter, cars are transported by train through a 12.5-mi (20-km) tunnel below the pass that connects Brig, Switz., with Iselle, Italy.

Simpson, George Gaylord (b. June 16, 1902, Chicago, Ill., U.S.—d. Oct. 6, 1984, Tucson, Ariz.) U.S. paleontologist. He earned a doctorate at Yale University. His contributions to evolutionary theory include a detailed classification of mammals, based on his studies of mammalian evolution, which is still the standard. He also is known for his studies of intercontinental migrations of animal species, especially South American mammals, in past geologic times. His books include *Tempo and Mode in Evolution* (1944; 1984), *The Meaning of Evolution* (1949), *The Major Features of Evolution* (1953), and *The Principles of Animal Taxonomy* (1961).

Simpson, Sir James Young (b. June 7, 1811, Bathgate, Linlithgowshire, Scot.—d. May 6, 1870, London, Eng.) Scottish obstetrician. He received his M.D. from the University of Edinburgh, where he became professor of obstetrics. After news of the use of ether in surgery in Boston reached Scotland, Simpson employed it in obstetrics to relieve labour pains (1847) and later substituted chloroform, which he continued to use despite opposition from obstetricians and the clergy. He also introduced iron-wire sutures, the use of pressure to stop bleeding, and Simpson forceps (long obstetrical forceps).

Simpson, O(renthal) J(ames) (b. July 9, 1947, San Francisco, Calif., U.S.) U.S. football player. At the University of Southern California as a running back (1965–68), he set rushing records, was named All-American, and won the HEISMAN TROPHY (1968). He joined the Buffalo Bills in 1969, with whom he continued to set records, and he became a great box-office draw. Knee injuries led to his being traded in 1978 to the San Francisco 49ers; he retired after the 1979 season. Handsome and genial, he became a popular film and television actor. In 1994 he was charged with the murder of his estranged wife and her friend. The resulting trial and acquittal generated unprecedented media coverage and public debate. A separate civil trial in 1997 found Simpson guilty in a wrongful-death suit.

Sims, William Sowden (b. Oct. 15, 1858, Port Hope, Ont., Can.—d. Sept. 28, 1936, Boston, Mass., U.S.) U.S. naval officer. He graduated from the U.S. Naval Academy and later wrote a navigation textbook that became widely used. As naval attaché to U.S. embassies in Paris and St. Petersburg, he observed the superiority of foreign navies. As inspector of naval target practice (1902–09), he revolutionized U.S. naval gunnery. In World War I he commanded the U.S. fleet in Europe and helped develop the convoy system to protect Allied ships from German submarine attack. He was president of the Naval War College (1917–18, 1919–22).

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simulation, computer Use of a computer-generated system to represent the dynamic responses and behaviour of a real or proposed system. A mathematical description of a system is developed as a computer program that uses equations to represent the functional relationships within the system. When the program is run, the resulting mathematical dynamics form an analog, usually represented graphically, of the behaviour of the modeled system. Variables in the program can be adjusted to simulate varying conditions in the system. Computer simulations are used to study the behaviour of objects or systems that cannot be easily or safely tested in real life, such as weather patterns or a nuclear blast. Simpler simulations performed by PERSONAL COMPUTERS are business models and geometric models. See also SCIENTIFIC VISUALIZATION.

simultaneous equations See SYSTEM OF EQUATIONS

Sin \'sēn\ *Sumerian* **Nanna** In MESOPOTAMIAN RELIGION, the god of the moon. He was the father of SHAMASH and, in some myths, of ISHTAR. Sin was thought to confer fertility and prosperity on cowherds by governing the rise of waters and the growth of reeds, particularly in the marshes along the lower EUPHRATES RIVER, where his worship originated. In the 6th century BC, attempts were made to elevate Sin to a supreme position in the Babylonian pantheon.

sin Wrongdoing, particularly the breaking of moral or religious rules. In the Hebrew scriptures, sin is viewed as a hatred of God or defiance of his commandments. The NEW TESTAMENT regards sinfulness as the inherent state of humanity, which JESUS came into the world to heal. Christian theologians divide sin into actual and ORIGINAL SIN. Actual sin, consisting of evil acts, words, and deeds, is in turn divided into mortal sin, in which the perpetrator deliberately turns away from God, and venial sin, a less serious transgression committed without full awareness of wrongdoing. In Islam, sin is a straying from God's path; the prophets were sent to guide people back to the true path. In Hinduism and Buddhism, the good and evil deeds one commits in this life affect one's rebirth in the next.

Sinai, Mount *or* **Mount Horeb** Peak, south-central SINAI Peninsula, Egypt. It rises to 7,497 ft (2,285 m) in elevation and is especially renowned in the Jewish, Christian, and Islamic traditions as the site where MOSES received the TEN COMMANDMENTS. Though not positively identified as the place referred to in biblical texts, it is an important pilgrimage site. St. Catherine's, founded in 527 and thought to be the world's oldest continuously inhabited Christian monastery, is at its northern base.

Sinai \'sī-ˌnī\ **Peninsula** Peninsula, northeastern EGYPT. Located between the Gulfs of SUEZ and AQABA at the northern end of the Red Sea, it covers some 23,500 sq mi (61,000 sq km). Its southern region is mountainous and includes Mount SINAI, while its northern two-thirds is an arid plateau known as the Sinai Desert. Inhabited since prehistoric times, it is famous as the purported route of the Israelite EXODUS from Egypt. For centuries, its northern coast was the main trade route between Egypt and PALESTINE. From the 1st century AD until the rise of Islam in the 7th century, it was part of the Roman Empire and its successor, the Byzantine Empire. It was ruled by various Islamic dynasties until the 16th century, when it became part of the Ottoman Empire. Turned over to Egypt at the end of World War I in 1918, it was the scene of heavy fighting during the SUEZ CRISIS (1956), the SIX-DAY WAR, (1967), and the Yom Kippur War (1973) and was occupied by Israel from 1967 until 1982, when it was then returned to Egypt. See ARAB-ISRAELI WARS.

Sinaloa \ˌsē-nä-'lō-ä\ State (pop., 2000: 2,536,844), northwestern Mexico. It has an area of 22,521 sq mi (58,328 sq km), and its capital is CULIACÁN. It was made a state in 1830 and consists of a tropical coastal plain along the Gulf of CALIFORNIA that rises inland to the SIERRA MADRE Occidental. The popular resort city of MAZATLÁN is on its coast. It is primarily an agricultural area, producing wheat, cotton, tobacco, and sugarcane. Salt, graphite, manganese, and gold are mined.

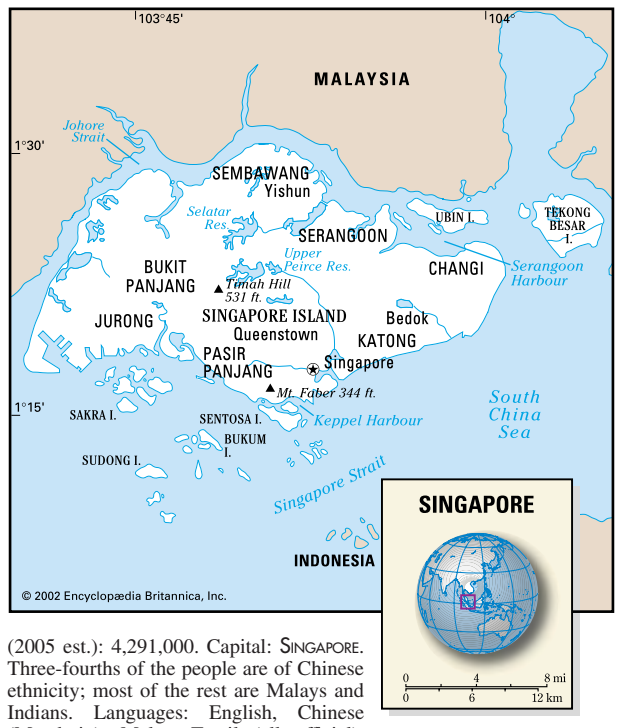
Sinatra, Frank *orig.* **Francis Albert Sinatra** (b. Dec. 12, 1915, Hoboken, N.J., U.S.—d. May 14, 1998, Los Angeles, Calif.) U.S. singer and actor. Sinatra began his singing career in the mid-1930s and was "discovered" by trumpeter HARRY JAMES, who immediately recruited him. Sinatra achieved sweeping national popularity in 1940–42 while singing with the TOMMY DORSEY Orchestra. He sang on the radio program *Your Hit Parade* (1943–45), while becoming a favourite performer in theatres and nightclubs. In the 1940s he co-starred in a number of musical films with dancer Gene Kelly. His popularity suddenly declined about 1948, but his performance in *From Here to Eternity* (1953, Academy Award) revived his flagging career, and he later starred in many acclaimed films, including musicals such as *Guys and Dolls* (1955) and dramas such as *The Manchurian Candidate* (1962). After 1953 he performed and recorded using arrangements by Nelson Riddle, Billy May, and Gordon Jenkins, reaching his peak in albums such as *Only the Lonely* (1958). In 1961 he founded Reprise Records. His masterly performances, alternately swinging and affectingly melancholic, brought him a success unparalleled in the history of American popular music.

Sinclair, Upton (Beall) (b. Sept. 20, 1878, Baltimore, Md., U.S.—d. Nov. 25, 1968, Bound Brook, N.J.) U.S. novelist. He was supporting himself as a journalist when an assignment led him to write *The Jungle* (1906), a best-selling muckraking exposé of conditions in the Chicago stockyards. A landmark among naturalistic, proletarian novels, it aroused great public indignation and resulted in the passage of the U.S. Pure Food and Drug Act. Many other topical novels followed, as well as the successful Lanny Budd series of 11 contemporary historical novels featuring an antifascist hero, beginning with *World's End* (1940) and including *Dragon's Teeth* (1942, Pulitzer Prize). In the 1930s Sinclair organized a socialist reform movement and won the Democratic nomination for governor of California.

Sind *or* **Sindh** Province (pop., 1998: 29,991,000), southeastern Pakistan. It is bordered by the Arabian Sea to the south. The capital is KARACHI. The centre of the ancient INDUS CIVILIZATION, it was annexed to the Persian Achaemenian Empire in the 6th century BC. Conquered by ALEXANDER THE GREAT in 325 BC, it was part of the MAURYAN EMPIRE in the 3rd century BC. It fell to the Arabs c. AD 711. In the 16th–17th centuries it was ruled by the MUGHALS. It came under British control in 1843. After Pakistan's independence, Sind was integrated into the province of West Pakistan but in 1970 was reestablished as a separate province. It is arid except in the irrigated INDUS RIVER valley, where cotton, wheat, and rice are grown and where the population is concentrated.

sine See TRIGONOMETRIC FUNCTION

Singapore *officially* **Republic of Singapore** Island country, Southeast Asia. Situated off the southern tip of the MALAY PENINSULA, it comprises Singapore island and 60 islets. Area: 269 sq mi (697 sq km). Population



(2005 est.): 4,291,000. Capital: SINGAPORE. Three-fourths of the people are of Chinese ethnicity; most of the rest are Malays and Indians. Languages: English, Chinese (Mandarin), Malay, Tamil (all official). Religions: Buddhism, Islam, Christianity, Daoism, Hinduism. Currency: Singapore dollar. Nearly two-thirds of the island's hilly landscape lies below 50 ft (15 m) above sea level. It has a hot, humid climate. Although only about 2% of its land is arable, it is highly productive cropland. The

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economy is based largely on international trade and finance; there are more than 100 commercial banks, most of which are foreign, and the headquarters of the Asian Dollar Market is located there. The port is one of the largest in the world, and the country is one of the world's leading petroleum refiners. Manufacturing (notably electronic equipment) is also important. Singapore is a republic with one legislative house; its chief of state is the president, and the head of government is the prime minister. Long inhabited by fishermen and pirates, it was an outpost of the Sumatran empire of Shrivijaya until the 14th century, when it passed to Java and then Ayutthaya (Siam). It became part of the Malacca empire in the 15th century. In the 16th century the Portuguese controlled the area; they were followed by the Dutch in the 17th century. In 1819 it was ceded to the British East India Company, becoming part of the Straits Settlements and the centre of British colonial activity in Southeast Asia. During World War II the Japanese occupied the island (1942–45). In 1946 it became a crown colony. It achieved full internal self-government in 1959, became part of Malaysia in 1963, and gained independence in 1965. Singapore is influential in the affairs of the Association of Southeast Asian Nations (ASEAN). The country's dominant voice in politics for 30 years after independence was Lee Kuan Yew. Singapore has become a regional economic powerhouse.

Singapore City (2002 est.: 4,204,000), capital of the Republic of Singapore. A free port centred on the southern part of Singapore island, it so dominates the island that the republic is now commonly considered a city-state. Known as the Garden City for its many parks and tree-lined streets, it offers glimpses into the cultures brought to it by immigrants from all parts of Asia. Traditionally founded by a Shrivijayan prince, it was an important Malay city in the 13th century. Destroyed by the Javanese in the 14th century, it was refounded by Stamford Raffles of the British East India Company in 1819. It became the capital of the Straits Settlements in 1833 and developed as a port and naval base; today it is one of the world's great commercial centres. Its thriving banking, insurance, and brokerage firms make it the chief trading and financial centre of Southeast Asia. It is home to the National University of Singapore (1980).

Singer, Isaac Bashevis *Yiddish* **Yitskhok Bashevis Zinger** (b. July 14?, 1904, Radzymin, Pol., Russian Empire—d. July 24, 1991, Surfside, Fla., U.S.) Polish-born U.S. writer of novels, short stories, and essays. He received a traditional Jewish education at the Warsaw Rabbinical Seminary. After publishing his first novel, *Satan in Goray* (1932), he immigrated to the U.S. in 1935 and wrote for the *Jewish Daily Forward*, a Yiddish newspaper in New York. Though he continued to write mostly in Yiddish, he personally supervised the English translations. Depicting Jewish life in Poland and the U.S., his works are a rich blend of irony, wit, and wisdom, flavoured distinctively with the occult and the grotesque. His works include the novels *The Family Moskat* (1950), *The Magician of Lublin* (1960), and *Enemies: A Love Story* (1972; film, 1989); the story collections *Gimpel the Fool* (1957), *The Spinoza of Market Street* (1961), and *A Crown of Feathers* (1973, National Book Award); and the play *Yentl the Yeshiva Boy* (1974; film, 1983). He was awarded the Nobel Prize for Literature in 1978.

Singer, Isaac Merritt (b. Oct. 27, 1811, Pittstown, N.Y., U.S.—d. July 23, 1875, Torquay, Devon, Eng.) U.S. inventor and manufacturer. He became an apprentice machinist at 19. He patented a rock-drilling machine (1839) and a metal- and wood-carving machine (1849) before producing an improved version of Elias Howe's sewing machine in 1851 and soon thereafter founding I.M. Singer & Co. (see Singer Co.) to manufacture it. Howe's successful patent-infringement suit against him in 1854 did not prevent Singer from manufacturing his machine, and his company was soon the world's largest sewing-machine producer. He patented numerous further improvements in the technology; he also pioneered the use of installment credit plans.

Singer NV U.S. sewing-machine manufacturer. The company began in 1851, when Isaac Merritt Singer (1811–75) patented the first practical sewing machine for domestic use. By 1860 I.M. Singer & Co. was the largest maker of sewing machines in the world. In 1863 its business was taken over by the newly incorporated Singer Manufacturing Co. The company began mass-producing domestic electric machines in 1910 and pioneered marketing innovations such as the installment plan. It later expanded into power tools, floor-care products, furniture, and electronics; it adopted the name Singer Co. in 1963. Its sewing-machine and furniture operations were spun off into a separate company, SSMC Inc., in 1986. Two years later it was the subject of a hostile takeover by investor Paul Bilzerian, who in 1989 sold Singer's assets to Semi-Tech, a Hong Kong company controlled by investor James Henry Ting. Still one of the world's largest sewing-machine manufacturers, the company declared bankruptcy in 1999 and was reorganized as Singer NV in 2000.

Singitic \sin-'ji-tik\ **Gulf** Inlet of the Aegean Sea, northeastern Greece. It is the larger and deeper of two gulfs (the other being Ierisoú Gulf) that extend into the peninsula of the historical region in Greece known as Macedonia. The silted-up remains of a canal completed by Xerxes in 480 BC link the two gulfs. The main community on the gulf is Ouranópolis, a stop for tourists exploring Mount Athos.

single tax Tax on land values intended as the sole source of government revenues, replacing all existing taxes. Henry George proposed the single tax in his book *Progress and Poverty* (1879). The plan gained considerable support in subsequent decades but was never implemented. Advocates argued that since land is a fixed resource, the income it yields is a product of the economy's growth and not individual effort, and that it therefore can fairly be taxed to support the government. Critics protested that the single tax would take no account of an individual's ability to pay, since there is no correlation between land ownership and total wealth or income.

Singspiel \'siŋ-ˌspēl, 'ziŋ-ˌshpēl\ *German* **"song-play"** Eighteenth-century opera in the German language, containing spoken dialogue and usually comic in tone. The earliest Singspiels were light plays in which the dialogue was interspersed with popular songs. In Vienna the form had a brief but intense flowering that resulted in Wolfgang Amadeus Mozart's enduring *Abduction from the Seraglio* (1782) and *The Magic Flute* (1791). Singspiel evolved into transitional works such as Ludwig van Beethoven's *Fidelio* (1805) and ultimately gave rise to German Romantic opera. See also musical; operetta; zarzuela.

Sinhalese \ˌsiŋ-gə-'lēz\ Any member of the largest ethnic group of Sri Lanka. Their ancestors are believed to have come from northern India. Most Sinhalese are agriculturalists, and most adhere to Theravada Buddhism. Like other peoples of Sri Lanka, the Sinhalese have a caste society with a complex structure based largely on occupation. Today the Sinhalese number more than 12 million.

Sinitic languages See Chinese languages

sinkhole *or* **sink** *or* **doline** \də-'lē-nə\ Depression formed as underlying limestone bedrock is dissolved by groundwater. Sinkholes vary greatly in area and depth and may be very large. The two main varieties are those caused by the collapse of a cavern roof, and those caused by the gradual dissolving of rock under a soil mantle. Collapsed sinkholes generally have steep rock sides and may receive streams that then flow underground. Soil-mantled sinkholes are generally shallower; they may become clogged with clay and hold a small lake.

Sinkiang See Xinjiang

sinking fund Fund set aside by a corporation or government agency for the purpose of periodically redeeming bonds, debentures, and preferred stocks. The fund is accumulated from earnings, and payments into the fund may be based on either a fixed percentage of the outstanding debt or a fixed percentage of profits. Sinking funds are administered separately from the corporation's working funds by a trust company or trustee. The purpose of a sinking fund is to assure investors that provision has been made for the repayment of bonds at maturity.

Sinn Féin \'shin-'fān\ *Irish* **"We Alone"** Nationalist political party in Ireland. It was founded by Arthur Griffith and others in 1902, and its policy involved passive resistance to the British, withholding of taxes, and establishing an Irish ruling council. The party had little impact until after the Easter Rising, when the demand of its leader Eamon de Valera for a united, republican Ireland won the party 73 out of 105 seats in the 1918 election. Its power diminished after 1926, when de Valera founded Fianna Fáil, which absorbed most of Sinn Féin's membership. The party continued as the political arm of the Irish Republican Army, actively supporting Irish unification. Under the leadership of Gerry Adams in the late 20th and early 21st centuries, Sinn Féin participated in the peace talks on Northern Ireland and became one of the leading Roman Catholic parties in Northern Ireland.

Sino-French War (1883–85) Conflict between China and France over Vietnam. It revealed the inadequacy of China's modernization efforts and aroused nationalistic sentiment in southern China. In 1880, when France began to extend its presence in Vietnam northward from the three south-

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ern provinces it controlled, China sent in troops and engaged in limited battles. The governor-general, Li Hongzhang, negotiated an agreement whereby northern Vietnam would be a joint protectorate, but a hard-line government faction in China rejected it. The French defeated Chinese reinforcements in 1883, and the new settlement was more strongly in France's favour. This, too, was rejected in China; after further hostilities, the new Chinese fleet of 11 steamers was destroyed, as was a large shipyard at Fuzhou. In 1885 China signed a peace treaty accepting the settlement of 1883.

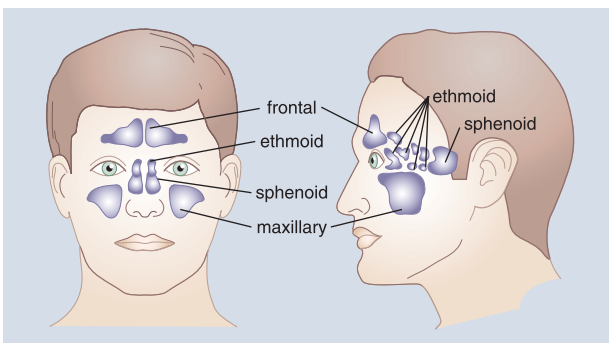
Sino-Japanese War Either of two conflicts between China and Japan in the 19th and 20th centuries. The first (1894–95), over Korea, marked the emergence of Japan as a world power and demonstrated the weakness of China. Though Korea had long been China's most important client state, Japan became interested in it for its natural resources and its strategic location. After Japan opened Korea to foreign trade in 1875, tensions between radical, pro-Japanese Koreans, who favoured modernization, and conservative Korean government officials, who were supported by China, brought China and Japan into conflict. Foreign observers predicted an easy victory for the more massive Chinese forces, but Japan scored overwhelming victories on both land and sea. In the Treaty of Shimonoseki, China recognized the independence of Korea and ceded Taiwan, the Pescadores, and the Liaodong Peninsula (the last of which Japan was later forced to return) to Japan. The second conflict (1937–45) denotes the period of China's resistance to Japan's aggression in Chinese territory after Japan had established itself in Manchuria; it ended with Japan's defeat in World War II. See also Manchukuo; Marco Polo Bridge Incident; Nanjing Massacre; Tonghak Uprising.

Sino-Tibetan \ˌsī-nō-tə-'be-tən\ **languages** Superfamily of languages whose two branches are the Sinitic, or Chinese, languages and the Tibeto-Burman family, an assemblage of several hundred very diverse languages spoken by some 65 million people from northern Pakistan east to Vietnam and from the Tibetan Plateau south to the Malay Peninsula. They include Tibetan, Burmese, Karen, and many other languages of Nepal, India, Myanmar (Burma), Bangladesh, China, and Thailand. Tibetan and Burmese are the only Tibeto-Burman languages with long literary traditions. Burmese is written in an adaptation of the Mon script (see Mon-Khmer languages).

sinter Mineral deposit with a porous or vesicular texture (having small cavities). Siliceous sinter is a deposit of opaline or amorphous silica that occurs as an incrustation around hot springs and geysers and sometimes forms conical mounds (geyser cones) or terraces. Calcareous sinter, sometimes called tufa, calcareous tufa, or calc-tufa, is a deposit of calcium carbonate.

sintering Welding together of small particles of metal by applying heat at temperatures below the melting point. The process is used to form complex shapes, to produce alloys, and to allow work on metals with very high melting points. Sintering is also used in the preliminary molding of ceramic or glass powders into forms that can then be permanently fixed by firing. See also powder metallurgy.

sinus Body cavity or hollow. The paranasal sinuses, which are known commonly simply as the sinuses, are any of four sets of cavities in the bones adjoining the nose: maxillary, the largest, between the eye socket and the palate and upper jaw; frontal, just above and between the eye sockets; ethmoid, consisting of 3–18 thin-walled cavities between the nasal cavities and the eye sockets; and sphenoid, behind the nasal cavity. All are absent or small at birth, enlarge gradually until puberty, and then grow rapidly. They affect the sound of the voice and may help to warm inhaled air. Their lining produces mucus, which drains into the nasal cavity. Blockage of their outlets by swelling (from allergy or infection; see sinusitis), polyps, or structural problems hampers breathing through the nose and can lead to serious infection. Severe obstruction may require surgery, which must be done with extreme care to avoid harm to nearby brain structures or the eyes.



The paranasal sinuses.
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sinusitis \ˌsī-nə-'sī-təs\ Inflammation of the sinuses. Acute sinusitis, usually due to infections such as the common cold, causes localized pain and tenderness, nasal obstruction and discharge, and malaise. Nose drops or inhalations containing drugs that contract blood vessels help drain the sinuses. Antibiotics may be used for bacterial infections. Chronic sinusitis, with frequent colds, pus, obstructed breathing, loss of sense of smell, and sometimes headache, may follow repeated or untreated acute attacks, particularly with impaired breathing or drainage. If antibiotic therapy or repeated lavage (rinsing out) does not help, surgery to open passages for drainage may be needed.

Siouan \'sü-ən\ **languages** Family of North American Indian languages, spoken mainly west of the Mississippi River in the 17th and 18th centuries. The principal languages and language groups at this time were Winnebago in Wisconsin, Chiwere (Iowa, Oto, and Missouri) in Iowa and northern Missouri, Dhegiha (Ponca, Omaha, Kansa, Osage, Quapaw) in an area extending from eastern Nebraska to Arkansas, Sioux or Dakota (a range of dialects including Santee or Dakota proper in Minnesota, Teton or Lakota in North and South Dakota, and Assiniboine in Canada), Hidatsa and Mandan on the middle Missouri River, and Crow in Wyoming and Montana. Separated from the main body of Siouan languages were the now-extinct languages Tufelo and Biloxi, near the Gulf of Mexico, and the distantly related Catawba, once spoken in South Carolina. The extant Siouan languages are now spoken mainly or solely by older adults.

Sioux \'sü\ *or* **Dakota** *or* **Lakota** Any of a number of North American Plains Indian peoples living mostly in North Dakota, South Dakota, Montana, and Nebraska, U.S. They comprise the Santee (Eastern Sioux), Yankton, and Teton (Western Sioux), each of which in turn has lesser divisions (e.g., Blackfoot, Oglala). Their languages belong to the Siouan language stock. The name Sioux is a French derivation of an Ojibwa name for "enemy" or "snake." They call themselves Dakota, meaning "Friend." In the 17th century the Sioux lived in the area around Lake Superior, but attacks from the Ojibwa drove them west into Minnesota. They adopted a Plains way of life, hunting buffalo, living in tepees, emphasizing valour in warfare, and practicing the sun dance. Sioux women were skilled at porcupine-quill and bead embroidery. The Sioux were resolute in resisting white incursions. In 1862, white treaty violations led the Santee to mount a bloody uprising under Little Crow; after their defeat, they were forced onto reservations in South Dakota and Nebraska. Serious fighting between U.S. troops and the Yankton and Teton Sioux in the 1860s and '70s culminated in the Battle of the Little Bighorn in 1876, a great Indian victory. Eventually, however, the Sioux surrendered and were forced onto reservations. In 1890 the Ghost Dance religion inspired many Sioux to take up arms, leading to the massacre at Wounded Knee. The Sioux number about 75,000. See also Sitting Bull.

Sioux Falls City (pop., 2000: 123,975), southeastern South Dakota, U.S. Founded in 1857, the area was abandoned in 1862 following an Indian uprising. With the establishment of Fort Dakota on the site in 1865 the settlers gradually returned. Sioux Falls is the state's largest city, and it is a commercial and financial centre in a livestock-farming region, with one of the largest livestock markets in the U.S. Nearby was one of the world's first commercial nuclear power plants, decommissioned in 1967. The Earth Resource Observation Systems (EROS) Data Center is located in the city.

Sippar \si-'pär\ Ancient city, Babylonia. It is located southwest of modern Baghdad on the Euphrates River. From the 3rd millennium BC, it was a centre of worship of the Sumerian sun-god Shamash. It was subject to the 1st dynasty of Babylon, but little else is known about the city before 1174 BC, when it was sacked by the Elamites. It recovered from its defeat but was later captured by the Assyrians. Excavations, begun in 1882, have uncovered the remains of a large temple and thousands of religious and historic clay tablets.

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Siqueiros \sē-'kā-rōs**, David Alfaro** (b. Dec. 29, 1896, Chihuahua, Mex.—d. Jan. 6, 1974, Cuernavaca) Mexican painter. A Marxist activist from his youth, he fought in the Mexican Revolution alongside Venustiano Carranza, who rewarded him by sponsoring his studies in Europe. Back in Mexico (1922), he began his lifework of decorating public buildings with murals and organizing unions of artists and workers. With Diego Rivera and José Clemente Orozco, he cofounded the renowned school of Mexican mural painting. His activism interrupted his career several times when he was imprisoned, chose self-imposed exile, and fought in the Spanish Civil War. His murals are marked by great dynamism, monumental size and vigour, and a limited colour range subordinated to dramatic effects of light and shadow. His easel paintings (e.g., *Echo of a Scream*, 1937) helped establish his international reputation. In 1968 he became the first president of the Mexican Academy of Arts.

Siracusa See Syracuse

Siren In Greek mythology, a creature, half bird and half woman, who lures sailors to their doom with her sweet singing. Homer placed Sirens near the rocks of Scylla; in the *Odyssey*, Odysseus has his men plug their ears with wax and has himself tied to his ship's mast so he can hear the Sirens' singing without endangering the ship. In one tale of Jason and the Argonauts, Orpheus sings so sweetly that the crew do not listen to the Sirens. According to later legend, the Sirens committed suicide after one or the other of those failures.

Sirius \'sir-ē-əs\ *or* **Dog Star** Brightest star in the night sky (apparent magnitude −1.44), a binary star about 8.6 light-years from the Sun in the constellation Canis Major. The bright component of the binary is a blue-white star 23 times as luminous as the Sun, about twice the size, and considerably hotter; its companion was the first white dwarf star discovered. Its name probably comes from a Greek word meaning "sparkling" or "scorching." The ancient Egyptians used its predawn rising to predict the annual flooding of the Nile. The ancient Romans associated the rising of the Dog Star at dawn with the hottest part of the year, called the "dog days."

Sirk, Douglas *orig.* **Claus Detlef Sierck** (b. April 26, 1900, Hamburg, Ger.—d. Jan. 14, 1987, Lugano, Switz.) German-U.S. film director. He was artistic director of theatres in Bremen (1923–29) and Leipzig (1929–36), Ger., and made several films before fleeing the country in 1937. He arrived in Hollywood in 1939, and in 1943 he directed his first American film, *Hitler's Madman*. He joined Universal Pictures in 1950, where he directed comedy, western, and war movies but was best known for popular melodramas such as *Magnificent Obsession* (1954), *There's Always Tomorrow* (1956), *Written on the Wind* (1956), and *The Tarnished Angels* (1957), in which frightful emotional warfare lurks beneath the facade of upper-middle-class life. After directing his greatest success, *Imitation of Life* (1959), he retired to Europe.

sirocco \sə-'rä-kō, shi-'rä-kō\ *or* **scirocco** Warm, humid wind over the Mediterranean Sea and southern Europe, where it blows from the south or southeast and brings rain and fog. It is produced on the front sides of low-pressure centres that travel eastward over the southern Mediterranean. It originates over North Africa as a dry wind and picks up moisture as it crosses the Mediterranean.

Sirte, Gulf of See Gulf of Sidra

sisal \'sī-səl\ Plant (*Agave sisalana*) of the agave family, and the fibre from its leaves. The fibre is made into ropes and twines for marine, agricultural, shipping, and general industrial use, as well as into matting, rugs, hats, and brushes. Though sometimes referred to as sisal hemp, it is not related to true hemp. Growing to a height of about 3 ft (1 m) and a diameter of about 15 in. (38 cm), the stalk bears fleshy, rigid, gray to dark green, lance-shaped leaves in a dense rosette. Tanzania and Brazil are the main producers of sisal.

Siskind \'sis-kind**, Aaron** (b. Dec. 4, 1903, New York, N.Y., U.S.—d. Feb. 8, 1991, Providence, R.I.) U.S. photographer, teacher, and editor. He began to photograph in 1932 while teaching English in a public school. While documenting the Great Depression, he attended as closely to pure design as to his subjects. In the 1940s he began to photograph patterns and textures of subjects such as coiled ropes, footprints in sand, and weathered pavement and billboards. Though not immediately accepted by photographers, his abstract work was admired by painters Willem de Kooning and Franz Kline, with whom he later exhibited. He was most influential as a professor of photography and as coeditor of the magazine *Choice*.

Sisley \'siz-lē, sēs-'lā**, Alfred** (b. Oct. 30, 1839, Paris, Fr.—d. Jan. 29, 1899, Moret-sur-Loing) British-French landscape painter. Born in Paris to English parents, he began painting as an amateur. His early style was much influenced by Camille Corot. He became associated with Claude Monet and Pierre-Auguste Renoir and with them became one of the founders of Impressionism. His works, mostly landscapes, are distinguished from those of his colleagues by their softly harmonious values. His family was ruined by the Franco-Prussian War, and his life was a constant struggle against poverty. Not until after his death did his talent begin to be widely recognized.

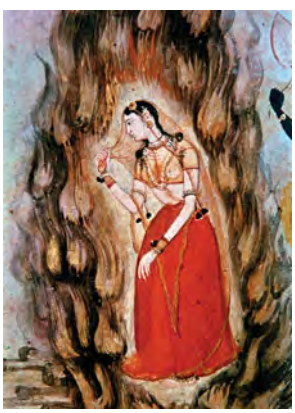
Sismondi \sēs-mō^{n}-'dē,\ *English* \sis-'män-dē**, J(ean-) C(harles-) L(éonard) Simonde de** (b. May 9, 1773, Geneva, Switz.—d. June 25, 1842, Chêne, near Geneva) Swiss economist and historian. He worked in a French bank from 1789, then moved to Tuscany in 1794 with his family to farm. Living in his native Geneva from 1800, he wrote his *History of the Italian Republics in the Middle Ages* (1809–18), which inspired the leaders of the Risorgimento. In his influential *New Principles of Political Economy* (1819), he criticized capitalism and argued for regulation of economic competition and for a balance between production and consumption. He urged social reforms to improve working-class living conditions. His theories influenced later economists such as Karl Marx and John Maynard Keynes.

Sissle, Noble See Edward Blake

Sīstān *or* **Seistan** \sē-'stän\ Extensive border region, eastern Iran and southwestern Afghanistan. Most of its sparse population and about two-fifths of its area lie in Iran. It comprises a large marshland depression with a true desert climate. It is the reputed homeland of the legendary Kayānian dynasty of Persia and played an important part in Persian history, especially under the Ṣafavid dynasty (1502–1736). In the 19th century it was the centre of a dispute between Persia and Afghanistan that led to the establishment of their modern frontier.

Sistine Chapel \'sis-ˌtēn\ Papal chapel in the Vatican Palace, Rome, constructed 1473–81 by Giovanni dei Dolci for Pope Sixtus IV (for whom it is named). It is the site of the principal papal ceremonies. Its exterior is drab and unadorned, but its interior walls and ceiling are decorated with frescoes by Florentine Renaissance masters, including Perugino, Pinturicchio, Sandro Botticelli, Domenico Ghirlandaio, and Luca Signorelli. Portions of the walls were once covered with tapestries designed by Raphael (1515–19). The most important works are the frescoes by Michelangelo on the ceiling and the western wall behind the altar, considered among the greatest achievements of Western painting. The ceiling frescoes, depicting Old Testament scenes, were commissioned by Pope Julius II and painted 1508–12; the *Last Judgment* fresco on the western wall was painted 1536–41 for Pope Paul III. A controversial 10-year cleaning and restoration of the ceiling was completed in 1989, and of the western wall in 1994.

Sisyphus \'si-sə-fəs\ In Greek mythology, the king of Corinth who was punished in Hades by having to roll a huge stone up a hill over and over again. He was the son of Aeolus and the father of Glaucus. When Death came to fetch him, Sisyphus had him chained up so that no one died until Ares came to free Death. Before being taken to the underworld, Sisyphus asked his wife to leave his body unburied. When he reached Hades he was permitted to go back to earth to punish his wife, and he lived to a ripe old age before dying a second time. His trickery resulted in his punishment in Hades.



Sītā, Mughal painting, *c.* 1600; in the collection of Bharat Kala Bhavan, Vārānasi, India
PRAMOD CHANDRA

Sita \'sē-ˌtä\ In Hindu mythology, the consort of Rama. She sprang from a furrow when King Janaka was plowing his field, and Rama won her as his bride by bending Shiva's bow. Her abduction by the demon king Ravana and subsequent rescue are described in the Ramayana. She kept herself chaste during her long imprisonment, and on her return she proved her purity by undergoing an

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ordeal by fire. A symbol of the sufferings and strengths of women, she is one of the most revered figures in the Hindu pantheon.

sitar \si-'tär, 'si-ˌtär\ Long-necked STRINGED INSTRUMENT of northern India, the dominant instrument in Hindustani music. It is used in ensembles and as a solo instrument with the *tamboura* (drone-lute) and TABLA. The sitar developed from the Middle Eastern *tanbur*. It has a deep pear-shaped gourd body, metal strings, front and side tuning pegs, a wide neck, and movable frets. It normally has four or five melody strings, which are plucked with a plectrum worn on the forefinger; several drone strings; and numerous sympathetic strings (strings caused to vibrate by the other strings' vibrations). A gourd resonator is attached to the top of the neck.

sitcom See SITUATION COMEDY

Sitka National Historical Park Park, southeastern Alaska, U.S. Located on Baranof Island in the Gulf of ALASKA, it was established in 1910 as a national monument; a national park since 1972, it covers 107 ac (43 ha). It contains the ruins of the Indian fortress in which the TLINGIT Indians made their last stand against Russian settlers in 1804. It also has a collection of old HAIDA Indian totem poles and the oldest intact Russian-American building in the U.S.

Sittang \'si-ˌtäŋ\ **River** River, east-central Myanmar (Burma). It rises on the edge of the Shan Plateau and flows south 260 mi (420 km) to empty into the Gulf of Martaban of the ANDAMAN SEA. Though navigable for only a short distance, it is used to float timber (particularly teak) south for export. It was the scene of severe fighting during World War II.

Sitting Bull (b. c. 1831, near Grand River, Dakota Territory, U.S.—d. Dec. 15, 1890, on the Grand River in South Dakota) Teton SIOUX chief under whom the Sioux peoples united in their struggle for survival. Frequent skirmishes between the U.S. Army and Sitting Bull's warriors occurred in 1863–68, at the end of which the Sioux agreed to accept a reservation in southwestern Dakota Territory. When gold was discovered in the Black Hills in the mid-1870s, further outbreaks occurred. At the Battle of the Rosebud, troops under Gen. George Crook were forced to retreat; and at the Battle of LITTLE BIGHORN, Lt. Col. GEORGE ARMSTRONG CUSTER and his men were killed. In 1877 Sitting Bull led his followers into Canada, but, with the buffalo reduced to near extinction, starvation eventually drove the Sioux to surrender. From 1883 Sitting Bull lived on Indian Agency lands, at one point (1885) traveling with Buffalo Bill's Wild West Show. During the GHOST DANCE movement, Sitting Bull was arrested. He was killed when his warriors tried to rescue him.

situation comedy *or* **sitcom** Radio or television comedy series that involves a continuing cast of characters in a succession of episodes. Often the characters are markedly different types thrown together by circumstance and occupying a shared environment such as an apartment building or workplace. Typically half an hour in length and either taped in front of a studio audience or employing canned applause, they are marked by verbal sparring and rapidly resolved conflicts.

Sitwell family British family of writers. Edith Sitwell (1887–1964) attracted attention when she joined her brothers in a revolt against GEORGIAN POETRY. Her early work, which emphasizes the value of sound, includes *Clowns' Houses* (1918) and *Façade* (1923), set to music by WILLIAM WALTON. Beginning with *Gold Coast Customs* (1929), her style became less artificial and experimental, and during World War II she emerged as a poet of some emotional depth. Her later poetry is informed by religious symbolism, as in *Gardeners and Astronomers* (1953) and *The Outcasts* (1962). She was famous for her formidable personality, Elizabethan dress, and eccentric opinions. Her brother Osbert (1892–1969) became famous, with his siblings, as a tilter at establishment windmills in literature and the arts. His best-known books are his memoirs, including *Left Hand! Right Hand!* (1944) and *Noble Essences* (1950), which create with conscious nostalgia the portrait of a vanished aristocratic age. Their brother Sacheverell (1897–1988) is best known for his books on art, architecture, and travel. His *Southern Baroque Art* (1924) was the forerunner of much academic research. His poetry, including *The People's Palace* (1918) and *The Rio Grande*, was written mostly in traditional metres and reveals in its mannered style his interest in the arts and music.

Siva See SHIVA

Sivaji See SHIVAJI

Siwa \'sē-wə\ **Oasis** *ancient* **Ammonium** Oasis (pop., latest est.: 7,000), western Egypt. Located near the modern border with Libya, it is 6 mi (10 km) long and 4–5 mi (6–8 km) wide, with about 200 springs. Extremely fertile, it supports thousands of date palms and olive trees. It was the seat of the oracle temple of AMON; its fragmentary remains survive, with inscriptions dating from the 4th century BC, along with many Roman remains.

Six \'sēs**, Les** *French* **"The Six"** Group of young French composers in the 1920s. Named by the critic Henri Collet (1885–1951), the group was made up of ARTHUR HONEGGER, DARIUS MILHAUD, FRANCIS POULENC, Georges Auric (1899–1983), Louis Durey (1888–1979), and Germaine Tailleferre (1892–1983). Their music represents a strong reaction against German Romanticism, as well as against the lush style sometimes termed Impressionism, exemplified by the work of CLAUDE DEBUSSY. Most of Les Six were inspired by the iconoclastic music of ERIK SATIE, and they benefited from the promotion of JEAN COCTEAU. They were only active as a group for a few years.

Six-Day War *or* **Arab-Israeli War of 1967** War between Israel and the Arab countries of Egypt, Syria, and Jordan. Palestinian GUERRILLA attacks on Israel from bases in Syria led to increased hostility between the two countries. A series of miscalculations by both sides followed. Syria feared that an invasion by Israel was forthcoming and appealed to Egypt for support. Egypt answered by ordering the withdrawal of UN peacekeeping forces from the SINAI PENINSULA and by moving troops into the area. Amid increasingly belligerent language from both sides, Egypt signed a mutual defense treaty with Jordan. Israel, surrounded and fearing an Arab attack was imminent, launched what it felt was a preemptive strike against the three Arab states on June 5, 1967. Israeli forces captured the Sinai Peninsula, GAZA STRIP, WEST BANK of the JORDAN RIVER, Old City of JERUSALEM, and the GOLAN HEIGHTS. The status of these occupied territories subsequently became a major point of contention between the two sides.

Six Dynasties (AD 220–589) In China, the period between the end of the HAN DYNASTY and the foundation of the SUI. The name is derived from the six successive dynasties that had their capital at NANJING: the Wu (222–280), the Eastern JIN (317–420), the Liusong (420–479), the Southern Qi (479–502), the Southern Liang (502–557), and the Southern Chen (557–589). During this period northern China was ruled by a succession of kingdoms established by Central Asian invaders. Important among these were the NORTHERN WEI, Eastern Wei, Western Wei, Northern Qi, and Northern Zhou. Despite the chaos of the age, great advances were made in medicine, astronomy, botany, and chemistry. Buddhism and Daoism became great popular religions, and the translation of Buddhist texts focused Chinese attention on literature and calligraphy. Architecture and the visual arts also bloomed during the period.

Sixtus IV *orig.* **Francesco della Rovere** (b. July 21, 1414, Cella Ligure, near Savona, Republic of Genoa—d. Aug. 12, 1484, Rome) Pope (1471–84). A FRANCISCAN from Genoa, he enriched his family and the Papal States through SIMONY and heavy taxation. The PRAGMATIC SANCTION OF BOURGES caused strain with France, and Sixtus failed in his effort to unite the Russian and Roman churches. He endorsed the PAZZI CONSPIRACY, though not the attempt to kill LORENZO DE' MEDICI. He also incited Venice to attack Ferrara; then, in a turnabout, he placed Venice under interdict (1483) as a rival to the Papal States. A patron of arts and letters, he built the SISTINE CHAPEL, which takes its name from him.

Sixtus V *orig.* **Felice Peretti** (b. Dec. 13, 1520, Grottammare, Ancona, Papal States—d. Aug. 27, 1590, Rome) Pope (1585–90). A dedicated FRANCISCAN and two-time inquisitor general of Venice, Sixtus was elected pope at a time when the Papal States were in chaos. He suppressed brigandage and restored order using harsh measures that won him many enemies. He raised vast sums through loans, taxes, and the sale of offices and carried out an extensive building program in Rome. He defined the Sacred College of Cardinals (1586), limiting the number of CARDINALS to 70, and his reforms of the ROMAN CURIA (1588) lasted until the Second VATICAN COUNCIL. An energetic supporter of the COUNCIL OF TRENT, whose decisions he implemented, Sixtus is recognized as one of the founders of the COUNTER-REFORMATION. His foreign policy was aimed at combatting Protestantism; he excommunicated the Protestant Henry of Navarre (later HENRY IV of France) and promised subsidies in return for a Spanish invasion of England. He supported other Catholic rulers in Europe and moderated his position toward Henry when it became apparent the future king would convert to Catholicism.

Sjælland \'she-ˌlän\ *English* **Zealand** Island, Denmark. Located between the Kattegat strait and the BALTIC SEA, Sjælland is the largest (2,715

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sq mi [7,031 sq km]) and most populous island (pop., 1990 est.: 1,972,711) of Denmark. COPENHAGEN is its major city. Two fjords break the irregular coastline of the island, and fine beaches line its northern shore. It has many Stone Age and Viking relics, including the Viking fortress of Trælleborg (c. 1000), as well as medieval churches, castles, and manor houses. Grain and livestock farming, fishing, and tourism are major industries.

Sjahrir \'syä-ˌrir**, Sutan** (b. March 5, 1909, Padangpandjang, Sumatra, Dutch East Indies—d. April 9, 1966, Zürich, Switz.) Indonesian nationalist and prime minister. He received a Dutch education and returned to Indonesia, where he helped found a nationalist party in the 1930s. His party, which favoured adopting Western constitutional democracy, opposed that of SUKARNO. He became prime minister after World War II, stripping power from then-president Sukarno, whose collaboration with the Japanese he feared would hurt the republic's image internationally. Sjahrir negotiated an agreement with the Dutch that established Indonesia's authority in Sumatra and Java. Twice forced to resign (1946, 1947), he then formed a socialist party (1948) that failed to win popular support. Sukarno banned it in 1960, and Sjahrir was arrested and imprisoned; He was allowed to travel to Switzerland shortly before his death.

Sjöström \'shœ-strœm**, Victor** *or* **Victor Seastrom** (b. Sept. 20, 1879, Silbodal, Swed.—d. Jan. 3, 1960, Stockholm) Swedish film actor and director. Trained as a stage actor, he directed and starred in his first movie, *The Gardener*, in 1912. With notable films such as *Ingeborg Holm* (1913), *The Outlaw and His Wife* (1918), and *The Phantom Carriage* (1921), he established the artistic excellence of the Swedish silent film in the post-World War I era. In 1923 he moved to Hollywood, where he directed movies such as *The Scarlet Letter* (1926) and *The Wind* (1928). He returned to Sweden in 1930 and acted in numerous films, notably INGMAR BERGMAN's *Wild Strawberries* (1957). Sjöström's films are lyrically beautiful expressions of humanity's relationship to nature and to society.

Sjöström in *Wild Strawberries*, 1957
COURTESY OF THE MUSEUM OF MODERN ART/FILM STILLS ARCHIVE, NEW YORK CITY

skaldic \'skȯl-dik\ **poetry** Oral court poetry originating in Norway but developed chiefly by Icelandic poets (skalds) from the 9th to the 13th century. Skaldic poetry was contemporary with Eddic poetry (see EDDA) but differed from it in metre, diction, and style. Eddic poetry is anonymous, simple, and terse, often taking the form of an objective dramatic dialogue. Skalds were identified by name. Their poems were descriptive, occasional, and subjective, their metres strictly syllabic instead of free and variable, and their language ornamented with similes and metaphors. Formal subjects were the mythical stories engraved on shields, praise of kings, epitaphs, and genealogies.

Skanderbeg \'skän-dər-ˌbeg\ *orig.* **George Kastrioti** (b. 1405, northern Albania—d. Jan. 17, 1468, Lezhë) Albanian leader. Son of the prince of Emathia, he was given early as a hostage to the Turkish sultan. He converted to Islam, served in the Turkish army, and was given the name Iskander and the rank of bey. In 1443 he abandoned the Turkish service, joining his Albanian countrymen in opposition to the Turks and returning to the Christian faith. He then organized a league of Albanian princes and was elected commander in chief. In 1444–66 he repulsed 13 Turkish invasions; his defeat of Murad II's armies in 1450 made him a hero in the Western world. After his death, however, Albania soon became part of the OTTOMAN EMPIRE. Skanderbeg is regarded as the national hero of Albania.

skandha \'skən-də\ *Pali* **khandha** In BUDDHISM, any of the five elements that constitute an individual's mental and physical existence. They are *rupa* (physical matter), *vedana* (feeling), *samjna* (perception; Pali *sanna*), *samskara* (mental formations; Pali *sankhara*), and *vijnana* (consciousness; Pali *vinnana*). The four mental aggregates are perceived to be the personality or ego but are in fact only processes in a state of continuous change, subject to the effects of KARMA. At death the mental *skandha*s dissociate from the *rupa* and find a new physical base, resulting in a new birth.

Skara Brae \'skä-rä-'brā\ *or* **Skerrabra** Late Neolithic village on the shore of the Bay of Skaill in Scotland's Orkney Islands. Skara Brae was built c. 3200–2200 BC. Covered by a sand dune, it is one of the most perfectly preserved ancient villages of Europe. Its excavation, begun in the 1860s, revealed huts of undressed, mortarless stone slabs containing stone furniture. They were linked by paved alleys; some had been covered by banking them with mixed sand, peat ash, and refuse, becoming stone-roofed tunnels. A sewer drained the whole. Inhabitants lived on the flesh and milk of their cattle and on shellfish; they probably wore skins. For tools they used local stone, beach pebbles, and animal bones. They wore pendants and coloured beads of sheep marrow, cows' teeth, killer-whale teeth, and boars' tusks. Lozenges and similar rectilinear patterns were scratched on hut walls and along alleys. Pottery vessels show incised and relief designs, including the only example of a true spiral known from prehistoric Britain.

skarn In geology, a metamorphic zone developed in the contact area around IGNEOUS ROCK intrusions when carbonate SEDIMENTARY ROCKS are invaded by and replaced with chemical elements that originate from the igneous rock mass nearby. Many skarns also include ore minerals; productive deposits of copper or other base metals have been found in and adjacent to skarns. The typical rock of a skarn is hornfels, a fine-grained, flinty rock produced by the heat and solutions given off by the intruding magma.

skate Any of nine genera (suborder Rajoidea) of rounded to diamond-shaped RAYS. These bottom-dwellers are found from tropical to near-Arctic waters and from the shallows to depths of more than 9,000 ft (2,700 m). Most have spines on the upper surface, and some have weak electrical organs in their long, slender tails. Skates lay oblong, leathery eggs (called mermaid's purses), which are often found on beaches. Species vary from 20 in. (50 cm) to 8 ft (2.5 m) long. They swim with an undulating movement of their pectoral fins. They trap active mollusk, crustacean, and fish prey by dropping down on them from above. Skates' "wings" are edible.

skateboarding Form of recreation, popular among youths, in which a person rides standing balanced on a small board mounted on wheels. The skateboard first appeared in the early 1960s on paved areas along California beaches as a makeshift diversion for surfers when the ocean was flat. In the 1970s a faster, polyurethane wheel was developed. Eventually skateboard parks were built, providing a variety of slopes and banked surfaces for sudden turns and flamboyant stunts. The skateboarding craze contributed to the emergence of SNOWBOARDING as a winter youth sport.

skating Sport in which bladelike runners or sets of wheels attached to shoes are used for gliding on ice or on surfaces other than ice. See FIGURE SKATING, ICE DANCING, ICE HOCKEY, ROLLER-SKATING, SPEED SKATING.

Skeena River River, western British Columbia, Canada. It rises in the northern part of the province and flows about 360 mi (580 km) before emptying into Chatham Sound on the Pacific Ocean. An important salmon-fishing stream, it has several canneries near its mouth.

skeet shooting Shooting sport using moving targets. Marksmen use shotguns to shoot at clay targets (pigeons) hurled into the air by spring devices called traps. It differs from TRAPSHOOTING in that skeet traps are set at two points on the field and targets may be thrown diagonally across the shooter's field of vision. Skeet shooting has been an Olympic event since 1968.

skeleton Bony framework of the body. It includes the SKULL, VERTEBRAL COLUMN, collarbone, shoulder blades, rib cage, pelvic girdle and the BONES of the hands, arms, feet, and legs. The skeleton supports the body and protects its internal organs. It is held together by LIGAMENTS and moved at the JOINTS by the MUSCLES, which are attached to it. The skeletal system includes both bones and CARTILAGE. See illustration on following page.

skeleton dance See DANCE OF DEATH

skeleton sledding Winter sport similar to LUGEING in which a small sled is ridden downhill in a headfirst, prone position. The sport of skeleton sledding developed in the 1880s on the famed Cresta Run at Saint Moritz, Switz. The "bony" look of the early sleds gave the sport its name. Riders attain speeds of more than 80 miles (129 km) per hour. It was first contested at the OLYMPIC GAMES in 1928.

Skelton, John (b. c. 1460—d. June 21, 1529, London, Eng.) English poet. Appointed court poet to Henry VII in 1489, Skelton became a tutor and eventually an adviser to Henry VIII. In 1498 he took holy orders. He wrote political and religious satires in an individual poetic style of short

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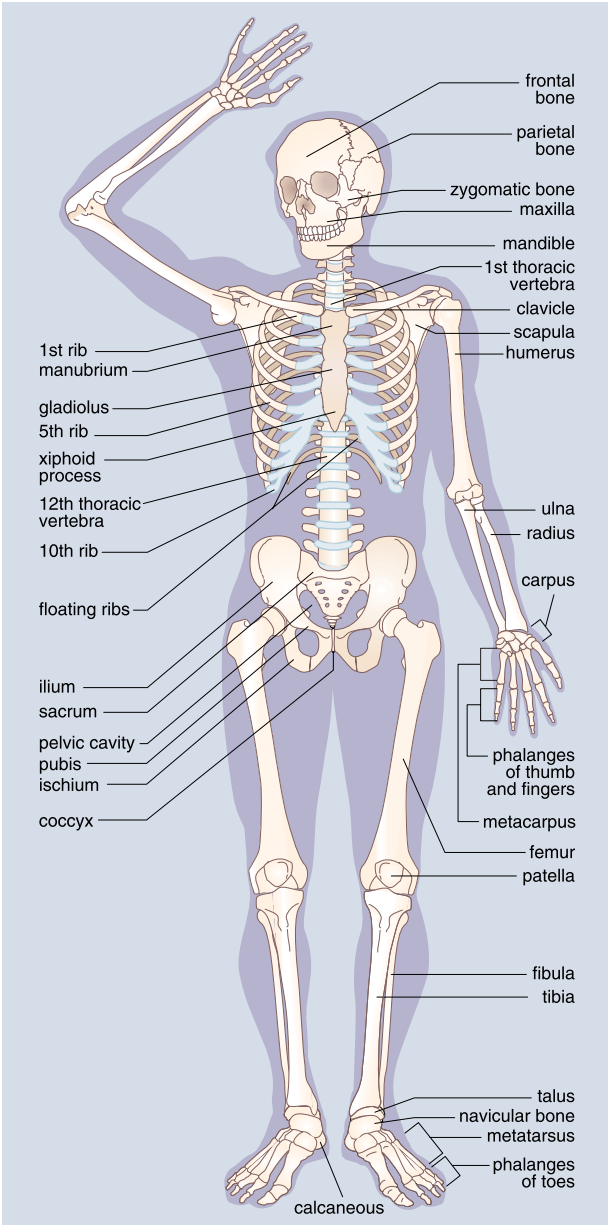

Major bones of the human skeleton.
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rhyming lines, called Skeltonics. Among his poems are *Bowge of Courte*, satirizing life at court; *Phyllyp Sparowe*, lampooning the liturgical office for the dead; and *Ware the Hawke*, attacking an irreverent priest. In 1516 he wrote the first secular MORALITY PLAY in English, *Magnyfycence*. The satires *Speke, Parrot* (written 1521), *Collyn Clout* (1522), and *Why Come Ye Nat to Courte?* (1522) were directed against Cardinal WOLSEY and humanist learning.

Skelton, Red *orig.* **Richard Bernard Skelton** (b. July 18, 1913, Vincennes, Ind., U.S.—d. Sept. 17, 1997, Rancho Mirage, Calif.) U.S. comic actor. He joined a touring medicine show at age 10, performed in minstrel shows, burlesque, and vaudeville, and was a hit on Broadway in 1937 with his trademark doughnut-dunking pantomime. His 1938 screen debut was followed by appearances in more than 35 film comedies. He starred in the popular *The Red Skelton Show* on radio (1941–44, 1945–53) and television (1951–71). Noted for his broad humour and warm personality, Skelton developed characters such as the Mean Widdle Kid, Clem Kadiddlehopper, and Freddie the Freeloader.

skene \'skē-nē\ In ancient Greek theatre, a building behind the playing area that was originally a hut in which actors changed masks and costumes. It eventually became the scenic backdrop for the drama. First used c. 465 BC, the skene was a small wooden structure facing the circle of spectators. It developed into a two-story edifice decorated with columns, with three doors used for entrances and exits. It was flanked by wings (*paraskēnia*). By the end of the 5th century BC, the wooden skene was replaced by a permanent stone structure. In the Roman theatre it was an elaborate building facade.

skepticism Philosophical doubting of knowledge claims in various areas. From ancient to modern times, skeptics have challenged accepted views in metaphysics, science, morals, and religion. Pyrrhon of Elis (c. 360–272 BC) sought mental peace by avoiding commitment to any particular view; his approach gave rise in the lst century BC to Pyrrhonism, proponents of which sought to achieve suspension of judgment by systematically opposing various knowledge claims. One of its later leaders, Sextus Empiricus (2nd or 3rd century AD), strove for a state of imperturbability. Modern skeptical philosophers include MICHEL DE MONTAIGNE, PIERRE BAYLE, and DAVID HUME.

ski jumping Skiing event in which contestants ski down a steep ramp curved upward at the end and launch themselves into the air for distance. Using a crouch position, skiers can achieve ramp speeds of 75 mi (120 km) per hour. After takeoff, they lean far forward from the ankles with knees straight and skis held open at the tips to form a V, a position that minimizes wind resistance and maximizes lift. Scoring is based partly on distance and partly on form.

skiing Sport and mode of transportation involving moving over snow on a pair of long flat runners (skis) attached to shoes or boots. Skiing was born in northern Europe; the oldest skis, found in Russia, are some 6,000 years old. The earliest skis were often short and broad. The first written references to skiing come from the HAN DYNASTY (206 BC–AD 220) and describe skiing in northern China. Skiing was used in warfare in Scandinavia from the 13th century or earlier to the 20th century. The earliest mode of skiing developed into the sport now called CROSS-COUNTRY SKIING. Competitive cross-country skiing began in Norway in the 1840s and had reached California by the 1860s. Improvements on primitive bindings c. 1860 led to greater popularity of recreational skiing. SKI-JUMPING competitions date from the 1870s. Downhill skiing was limited by the need to climb the hill before or after skiing down; the building of ski lifts began in the 1930s. Skis were originally made of a single piece of wood, usually hickory; laminated construction began in the 1930s, plastic running surfaces were introduced in the 1950s, and no wood has been used in the construction of downhill skis for several decades. The business of skiing began its serious growth in the 1930s and became explosive in the 1950s and ’60s; huge resorts now dot the Austrian, Swiss, and Italian Alps, the Rocky Mountains, and other mountainous regions. See also ALPINE SKIING.

skimmer Any of three species (family Rynchopidae) of waterbirds having a red bladelike bill, with the lower mandible longer than the upper. Skimmers live chiefly in estuaries and along wide rivers in warm regions. At twilight, they skim calm, shallow water with the open bill tip submerged; when a fish or crustacean is hit, the upper mandible snaps down. Skimmers are dark above with white underparts, face, and forehead, red legs, and black wings. The American black skimmer (*Rynchops nigra*) grows to 20 in. (50 cm) long.

skin Surface covering of the body that protects it and receives external sensory stimuli, consisting of an epidermis over a thicker dermis. The epidermis contains cells involved in immune defenses, sensory receptors, pigment cells, and KERATIN-producing cells. The last harden and migrate to the surface to form a dead, relatively dry outer layer of horny tissue that constantly sloughs away. The dermis contains sensory nerves and blood vessels within CONNECTIVE TISSUE. COLLAGEN and elastin fibres give skin its tough, elastic quality. Cells scattered through it produce its components and take part in immune and other skin responses. A FAT layer under the dermis provides nutritional storage, cushioning, and insulation. Skin disorders range from DERMATITIS and ACNE to SKIN CANCER. Changes in skin colour (e.g., JAUNDICE) or texture may be clues to systemic disorders. See also DERMATOLOGY; HAIR; INTEGUMENT; NAIL; PERSPIRATION; SEBACEOUS GLAND; SWEAT GLAND. See illustration on opposite page.

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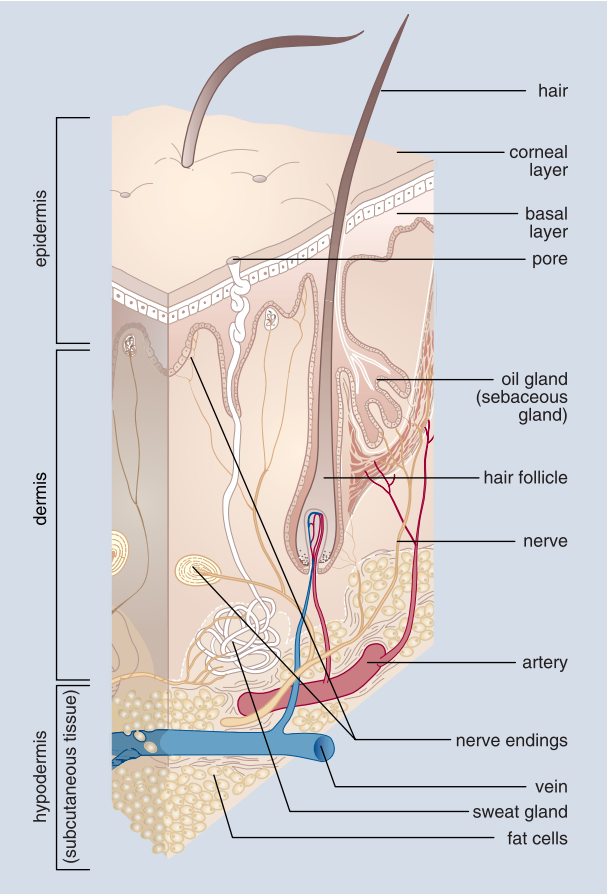

A section through the skin. The tough, dead cells of the outer epidermal surface (corneal layer) serve as a physical barrier and are continually replaced by cells produced in the basal layer. The thick supportive layer of dermis contains nerve endings, blood vessels, sweat glands, hair follicles, and oil glands. The hair follicle encloses the root of the hair. Oil glands associated with hair follicles secrete an oily substance (sebum) which lubricates the skin surface. The watery secretions of the tubular sweat glands are released onto the skin's surface through small pores. A layer of fat cells lies below the dermis.
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skin cancer Malignant tumour of the skin, including some of the most common human cancers. Though recognizable at an early stage, it has a significant death rate. Light-skinned people have the highest risk but can reduce it by limiting exposure to sunlight and to ionizing radiation. The most common types arise in the epidermis (outer skin layer) and have become more frequent with the thinning of the atmosphere's OZONE LAYER. The most serious form is MELANOMA, which is frequently fatal if not treated early with surgery. Cancers arising from the dermis are rare; the best-known is KAPOSI SARCOMA.

skinhead Member of an international youth subculture characterized by hair and dress styles evoking aggression and physical toughness. Typical skinhead style includes shaved heads, combat boots, tattoos, and prominent body piercings. Skinheads first appeared in working-class areas of London in the 1960s; during the 1970s and '80s the skinhead phenomenon spread to Australia, North America, and western Europe. In many countries, skinheads are regarded as extreme right-wing nationalists who espouse anti-Semitic and other racist views and engage in violent attacks on immigrants and racial minorities. This characterization, however, does not apply to all members of the subculture.

skink Any of about 1,275 species (family Scincidae) of LIZARDS found throughout the tropics and in temperate regions of North America. Skinks have a cylindrical body, a conical head, and a long, tapering tail. Some species are 26 in. (66 cm) long, but most are under 8 in. (20 cm). Some have small or no limbs and sunken eardrums. Most are ground-dwellers or burrowers; some are arboreal or semiaquatic. Skinks eat insects and other small invertebrates; large species are herbivorous. Some species lay eggs; others bear live young.

Striped broad-headed skink (*Eumeces laticeps*)
JOHN H. GERARD FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Skinner, B(urrhus) F(rederic) (b. March 20, 1904, Susquehanna, Pa., U.S.—d. Aug. 18, 1990, Cambridge, Mass.) U.S. psychologist and influential theorist of BEHAVIOURISM. He received his Ph.D. from Harvard University and first achieved notice with *The Behavior of Organisms* (1938). In the mid-1940s he presented his "Air-Crib," a soundproof, germ-free, air-conditioned box meant to serve as an optimal environment for the first two years of childhood. In *Walden Two* (1948), a controversial but popular work, he described a utopia based on behavioral engineering. He spent most of his teaching career at Harvard (1948–74). His other works include *Science and Human Behavior* (1953), *Verbal Behavior* (1957), *Beyond Freedom and Dignity* (1971), and an autobiography (3 vol., 1976–83). He received the National Medal of Science in 1968.

Skinner, Cornelia Otis (b. May 30, 1901, Chicago, Ill., U.S.—d. July 9, 1979, New York, N.Y.) U.S. actress and writer. She made her stage debut in *Blood and Sand* (1921) with her actor-father, Otis Skinner, who also collaborated on her first play, *Captain Fury* (1925). In the 1930s she wrote and staged monodramas, including *The Wives of Henry VIII* and *The Loves of Charles II*. She won acclaim in such plays as *Candida* (1939), *Lady Windermere's Fan* (1946), and *The Pleasure of His Company* (1958), which she wrote with Samuel Taylor. She also cowrote the best-seller *Our Hearts Were Young and Gay* (1942).

skip rope See JUMP ROPE

skipper Any of some 3,000 LEPIDOPTERAN species (family Hesperiidae) named for their fast (up to 20 mph, or 30 kph), darting flight. The head and stout body of the adult skipper resemble a MOTH's, but most skippers hold the first pair of wings vertically at rest, as BUTTERFLIES do. Most skippers are diurnal and lack the wing-coupling structures typical of moths. Larvae feed mostly on legumes and grasses, usually living inside folded or rolled leaves that may be woven together. They pupate in a thin cocoon of silk or silk and leaves.

skittles English ninepin bowling game played with a wooden disk or ball. The pins are set in a diamond formation; the player who knocks down all the pins in the fewest throws wins. Skittles has been played for centuries in public houses and clubs.

Skopas See SCOPAS

Skopje \'skȯp-ye\ *Serbian* **Skoplje** \'skȯp-lye\ City (pop., 1994: 444,299), capital of the Republic of Macedonia. The old city is located on a terraced riverbank dominated by an ancient fortress, north of which is a Roman aqueduct. Skopje was an important city in the Roman province of Moesia Superior and was a capital of medieval Serbia. It was under Turkish rule from 1392 to 1913, then was incorporated into Serbia. After an earthquake destroyed 80% of the city in 1963, aid was sent by 78 countries and it was rebuilt. Today it is an industrial, commercial, educational, and administrative centre.

skua \'skü-ə\ Species (*Catharacta skua*, family Stercorariidae) of predatory seabird, called great skua in Britain (where the JAEGERS are also called skua). It is about 24 in. (60 cm) long. It resembles a heavily built gull, with brownish body and large white wing patches. It is the only bird that breeds in both the Arctic and the Antarctic. The agile, swift skuas force

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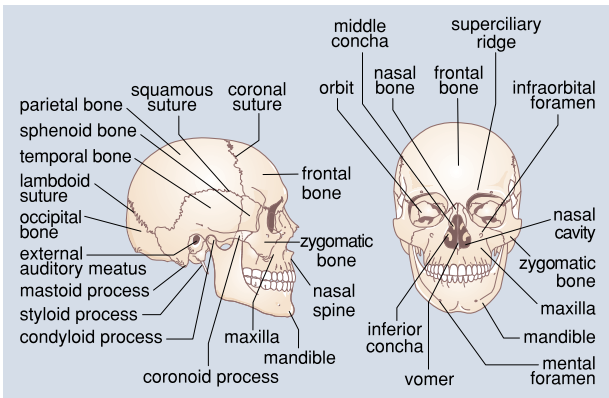
other birds to disgorge food; they nest near penguins, petrels, murres, and terns, stealing their eggs and young. They also eat lemmings and carrion.

skull Skeletal framework of the head. With the exception of the lower JAW, its bones meet in immovable joints (sutures) to form a unit that encloses and protects the BRAIN and SENSE organs and gives shape to the FACE. The cranium, the upper part enclosing the brain, comprising the frontal, parietal, occipital, temporal, sphenoid, and ethmoid bones, is globular and relatively large compared to the facial portion. Its base has an opening through which the SPINAL CORD connects to the brain. The skull sits on the top vertebra (atlas), which permits back-and-forth motion. For side-to-side motion, the atlas turns on the next vertebra (axis). See also CRANIOSYNOSTOSIS, FONTANEL.



Front and side views of the human skull.
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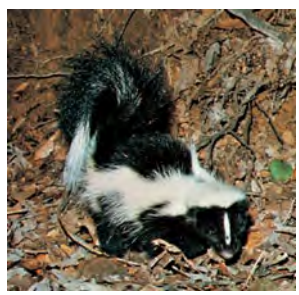
skunk Any of several black-and-white New World species in the CARNIVORE family Mephitidae that eject an odoriferous liquid (as far as 12 ft [3.7 m]) when threatened. The liquid becomes a fine mist that causes tearing of the eyes and choking. Some scent-gland secretions are used in perfume. Species vary in colour pattern and size. Most are 18–37 in. (46–93 cm) long, including the bushy tail, and weigh 2–13 lb (1–6 kg); the two species of spotted skunk (genus *Spilogale*) are much smaller. Skunks eat rodents, insects, eggs, birds, and plants. The striped, or common, skunk (*Mephitis mephitis*) is a nocturnal feeder that occurs in most of North America. With its scent glands removed, it is sometimes kept as a pet. The common skunk is a major carrier of RABIES, which is fatal to skunks. The seven species of hog-nosed skunk (genus *Conepatus*) have a long, bald snout. The hooded skunk (*Mephitis macroura*) has a neck ruff.



Striped skunk (*Mephitis mephitis*).
E.R. DEGGINGER

skunk bear See WOLVERINE

skunk cabbage Any of three species of plants that grow in temperate bogs and meadows, emitting unpleasant odours as they grow. The eastern North American skunk cabbage (*Symplocarpus foetidus*, of the ARUM FAMILY) has large fleshy leaves, purple-brown spathes, and a skunklike odour. The western, or yellow, skunk cabbage (*Lysichiton americanum*), also an arum, bears a large yellow spathe and is found from California to Alaska and eastward to Montana. The third species, *Veratrum californicum*, is the poisonous corn lily, or false HELLEBORE, of the LILY FAMILY, which grows from New Mexico and Baja California northward to Washington State.

skydiving Sport of jumping from an airplane at a moderate altitude (e.g., 6,000 ft [1,800 m]) and executing various body maneuvers before pulling the rip cord of a PARACHUTE. Competitive events include jumping for style, landing with accuracy, and performing in teams (e.g., making free-fall formations). The sport parachute is designed to be more maneuverable than the safety parachute. See photograph above.

Seven-man freefall hookup.
GUY SAUVAGE—AGENCE VANDYSTADT/PHOTO RESEARCHERS

Skylab First U.S. SPACE STATION. Launched into Earth orbit in 1973 on a SATURN V rocket, it used as its main habitat the vehicle's third stage, which had been outfitted as a workshop. Its apparatus included a powerful solar telescope and equipment for Earth- and materials-sciences research and for studies of the human body's adaptation to weightlessness. Three successive astronaut crews conducted research aboard Skylab for a total of 171 days in 1973–74. Because its thermal shielding was damaged during launch, its first crew took up and installed an improvised sunshade to prevent the station from seriously overheating. Although plans called for Skylab to be reused, increased solar activity caused its orbit to degrade faster than expected. In 1979 it entered Earth's atmosphere and broke up, with debris spreading over the southeastern Indian Ocean and a sparsely populated section of Western Australia.

skylark Species (*Alauda arvensis*) of Old World LARK particularly noted for its rich, sustained song and for singing in the air. It is about 7 in. (18 cm) long, with brown upper parts streaked with black and buffish white underparts. It breeds across Europe and has been introduced into Australia, New Zealand, Hawaii, and British Columbia.

skylight Roof opening covered with translucent or transparent glass or plastic designed to admit daylight. Skylights have found wide application admitting steady, even light in industrial, commercial, and residential buildings, especially those with a northern orientation. Installations range from purely functional daylighting to elaborate aesthetic forms. Flat-roofed buildings may have domed skylights; in others the skylight follows the slope of the roof. Often the skylight, or a portion of it, functions as an operating window to admit air.

skyscraper Very tall multistoried building. The term originally applied to buildings of 10–20 stories, but now generally describes HIGH-RISES of more than 40–50 stories. James Bogardus (1800–1874) built the pioneering Cast Iron Building, New York (1848), with a rigid iron frame providing the main support for upper-floor and roof loads. The refinement of the BESSEMER PROCESS for making steel (lighter and stronger than iron) made extremely tall buildings possible. Chicago's Home Insurance Co. Building (1884–85), by William Le Baron Jenney (1832–1907), was the first tall building to use a steel skeleton. Structurally, skyscrapers consist of a substructure supported by a deep foundation of PILES or CAISSONS beneath the ground, an aboveground superstructure of columns and girders, and a CURTAIN WALL hung on the structural framework. Tube structures, braced tubes, and trussed tubes were developed to give skyscrapers the ability to resist lateral wind and seismic forces. The bundled-tube system, developed by Fazlur Khan (1928–1982), uses narrow steel tubes clustered together to form exceptionally rigid columns, and has been used to build some of the world's tallest skyscrapers (e.g., SEARS TOWER). Skyscraper design and decoration have passed through several stages: LOUIS SULLIVAN emphasized verticality; the firm of McKim, Mead, & White (see CHARLES F. MCKIM, STANFORD WHITE) stressed Neoclassicism. The INTERNATIONAL STYLE was ideally suited to skyscraper design. Originally a form of commercial architecture, skyscrapers have increasingly been used for residential purposes as well. See also SETBACK.

slag By-product formed in SMELTING, WELDING, and other metallurgical and combustion processes from impurities in the metals or ores being treated.

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Slag consists mostly of mixed OXIDES of elements such as silicon, sulfur, phosphorus, and aluminum; ash; and products formed in their reactions with furnace linings and fluxing substances such as limestone. During smelting or refining, slag floats on the surface of the molten metal, protecting it from oxidation (see OXIDATION-REDUCTION) by the atmosphere and keeping it clean. Slag cools into a coarse aggregate used in certain concretes; it is used as a road-building material, as ballast, and as a source of available phosphate fertilizer.

slalom \'slä-ləm\ ALPINE SKIING event in which competitors race one at a time down a zigzag or wavy course past a series of flags or markers called gates. The course is carefully designed to test the skier's skill, timing, and judgment. A skier who misses a gate is disqualified unless he or she returns and passes through it from the proper side. Men's events use 55–75 gates, women's 45–65. The giant slalom has characteristics of both slalom and downhill skiing; giant-slalom gates are wider and set farther apart, and the course is longer than in the slalom. The supergiant slalom ("super-G") is closer to downhill; its course is steeper and straighter than that of the other slalom events and features longer, more sweeping turns taken at higher speed.

Skier competing in the slalom.
FABRICE COFFRINI—AFP/GETTY IMAGES

slander See DEFAMATION

slang Nonstandard vocabulary of extreme informality, usually not limited to any region. It includes newly coined words, shortened forms, and standard words used playfully out of their usual context. Slang is drawn from the vocabularies of limited groups: cant, the words or expressions coined or adopted by an age, ethnic, occupational, or other group (e.g., college students, jazz musicians); jargon, the shoptalk or technical terminology specific to an occupation; and argot, the cant and jargon used as a secret language by thieves or other criminals. Occupying a middle ground between standard and informal words accepted by the general public and the special words or expressions of these subgroups, slang often serves as a testing ground for words in the latter category. Many prove either useful enough to become accepted as standard or informal words or too faddish for standard use. *Blizzard* and *okay* have become standard, while *conbobberation* ("disturbance") and *tomato* ("girl") have been discarded. Some words and expressions have a lasting place in slang; for instance, *beat it* ("go away"), first used in the 16th century, has neither become standard English nor vanished.

slapstick Comedy characterized by broad humour, absurd situations, and vigorous, often violent action. It took its name from a paddlelike device, probably introduced by 16th-century COMMEDIA DELL'ARTE troupes, that produced a resounding whack when one comic actor used it to strike another. Slapstick comedy became popular in 19th-century music halls and vaudeville theatres and was carried into the 20th century by silent-movie comedians such as CHARLIE CHAPLIN, HAROLD LLOYD, and MACK SENNETT's Keystone Kops and later by LAUREL AND HARDY, the MARX BROTHERS, and the THREE STOOGES.

slate Fine-grained, clayey METAMORPHIC ROCK that splits readily into thin slabs that have great tensile strength and durability. Some other rocks that occur in thin beds are improperly called slate because they can be used for roofing and similar purposes. True slates generally split not along the bedding plane but along planes of CLEAVAGE that may intersect the bedding plane at high angles. Slates may be black, blue, purple, red, green, or gray. Slate may be marketed either as dimension slate, used mainly for electrical panels, laboratory tabletops, roofing, and flooring, or as crushed slate, used on composition roofing, in aggregates, and as a filler.

Slater, Samuel (b. June 9, 1768, Belper, Derbyshire, Eng.—d. April 21, 1835, Webster, Mass., U.S.) British-born U.S. industrialist. Initially apprenticed to a partner of RICHARD ARKWRIGHT, he immigrated to the U.S. in 1789, where he reproduced versions of Arkwright's spinning and CARDING MACHINES from memory and in 1793 established the first successful American COTTON mill at Pawtucket, R.I., the first of several plants. He founded the town of Slatersville, R.I. He is regarded as the founder of the U.S. cotton textile industry.

Slav \'släv\ Any member of the most numerous ethnic and linguistic body of peoples in Europe. They live chiefly in eastern and southeastern Europe but also extend across northern Asia to the Pacific. Slavs are customarily subdivided into eastern Slavs (Russians, Ukrainians, and Belarusians), western Slavs (Poles, Czechs, Slovaks, and Wends, or Sorbs), and southern Slavs (Serbs, Croats, Bulgarians, Slovenes, and Macedonians). Historically, western Slavs were integrated into western Europe; their societies developed along the lines of other western European nations. Eastern and southern Slavs suffered Mongol and Turkish invasions and evolved more autocratic, state-centred forms of government. Religion (mainly Eastern Orthodoxy and Roman Catholicism) divides Slavs, as does the use of the CYRILLIC and LATIN alphabets. In the Middle Ages, Slavic polities that left a rich cultural heritage developed in Bohemia, Poland, Croatia, Bosnia, Serbia, and Bulgaria, but, by the end of the 18th century, all these states had been absorbed by powerful neighbours (the Ottoman Empire, Austria, Hungary, Prussia, Russia). Eastern Slavic history often was marked by unsuccessful attempts to repel Asian invaders. In the 16th century, Muscovy (later Russia) embarked on a course of expansion across northern and central Asia that eventually made it the most powerful Slavic state. PAN-SLAVISM in the 19th century had some influence on the formation of the new Slavic states after World War I, though Czechoslovakia and Yugoslavia—the two attempts to integrate different Slavic peoples into single polities—had both disintegrated by the end of the 20th century, one peacefully and the other violently.

Slave Acts, Fugitive See FUGITIVE SLAVE ACTS

slave code In U.S. history, law governing the status of slaves, enacted by those colonies or states that permitted SLAVERY. Slaves were considered property rather than persons. They had few legal rights: in court, their testimony was inadmissible in cases involving whites; they could make no contract nor own any property; they could not strike a white person, even if attacked by one; they could not be away from their owner's premises without permission; they could not assemble unless a white person was present; they could not be taught to read or write; and they were not permitted to marry. Offenders were subject to severe punishment, including whipping, branding, imprisonment, and death. See also BLACK CODE.

Slave Lake, Lesser See LESSER SLAVE LAKE

slave narrative Account of the life, or a major portion of the life, of a fugitive or former slave, either written or orally related by the slave himself or herself. *A Narrative of the Uncommon Sufferings and Surprising Deliverance of Briton Hammon, a Negro Man* (1760) is often considered the first example. The first slave narrative to become an international best-seller was the two-volume *Interesting Narrative of the Life of Olaudah Equiano, or Gustavus Vassa, the African* (1789), but evidence turned up at the outset of the 21st century suggests that the author was born in South Carolina rather than Africa—i.e., that at least part of the work is not autobiographical. The major period of slave narratives was 1830–60. Some were factual autobiographies, while others were influenced or sensationalized by the writer's desire to arouse sympathy for the abolitionist cause. The genre reached its height with the autobiography of FREDERICK DOUGLASS (1845). In the 20th century, documentary narratives were compiled from recorded interviews with former slaves.

Slave River River, northern Alberta and southern Northwest Territories, Canada. Forming an integral part of the MACKENZIE RIVER waterway, the river flows northward 258 mi (415 km) from Lake ATHABASCA before emptying into GREAT SLAVE LAKE near Fort Resolution. The PEACE RIVER and several small streams enter it along its course.

slave trade Capturing, selling, and buying of slaves. SLAVERY has existed throughout the world from ancient times, and trading in slaves has been equally universal. Slaves were taken from the Slavs and Iranians from antiquity to the 19th century, from the sub-Saharan Africans from the 1st century AD to the mid-20th century, and from the Germanic, Celtic, and Romance peoples during the Viking era. Elaborate trade networks developed: for example, in the 9th and 10th centuries, Vikings might sell East Slavic slaves to Arab and Jewish traders, who would take them to Verdun and León, whence they might be sold throughout Moorish Spain and North Africa. The transatlantic slave trade is perhaps the best-known. In Africa, women and children but not men were wanted as slaves for labour and for lineage incorporation; from c. 1500, captive men were taken to the coast and sold to Europeans. They were then transported to the Caribbean or Brazil, where they were sold at auction and taken throughout the New World. In the 17th and 18th centuries, African slaves

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were traded in the Caribbean for molasses, which was made into rum in the American colonies and traded back to Africa for more slaves.

slavery Forced labour for little or no pay under the threat of violence. Slavery has existed on nearly every continent, including Asia, Europe, Africa, and the Americas, and throughout most of recorded history. The ancient Greeks and Romans accepted the institution of slavery, as did the Mayas, Incas, Aztecs, and Chinese. Until European involvement in the trade, however, slavery was a private and domestic institution. Beginning in the 16th century, a more public and "racially" based type of slavery was established when Europeans began importing slaves from Africa to the New World (see SLAVE TRADE). An estimated 11 million people were taken from Africa during the transatlantic slave trade. By the mid-19th century the slave population in the U.S. had risen to more than four million, although slave imports had been banned from 1809. Most of the Africans sent to the United States worked on cotton or rice plantations in the South, their status governed by SLAVE CODES. Almost 40 percent of captives transported from Africa to the Americas were taken to Brazil, where harsh conditions required the constant replenishing of slaves. Following the rise of ABOLITIONISM, Britain outlawed slavery in its colonies in 1833, and France did the same in 1848. During the American Civil War, slavery was abolished in the Confederacy by the EMANCIPATION PROCLAMATION (1863), which was decreed by Pres. Abraham Lincoln. Brazil was the last to abolish slavery, doing so in 1888. Official policy notwithstanding, slavery continues to exist in many parts of the world. Many contemporary slaves are women and children forced into prostitution or working at hard labour or in sweatshops. Debt bondage is common, affecting millions of people, and slaves are often traded for material goods. See also DRED SCOTT DECISION; FUGITIVE SLAVE ACTS; SERFDOM; UNDERGROUND RAILROAD.

Slavic \'slä-vik, 'sla-vik\ **languages** *or* **Slavonic languages** Branch of the INDO-EUROPEAN LANGUAGE family spoken by more than 315 million people in central and eastern Europe and northern Asia. The Slavic family is usually divided into three subgroups: West Slavic, comprising POLISH, SLOVAK, CZECH, and Sorbian; East Slavic, comprising RUSSIAN, UKRAINIAN, and BELARUSIAN; and South Slavic, comprising SLOVENE, SERBO-CROATIAN, BULGARIAN, and Macedonian. Polish belongs to the Lekhitic subgroup of West Slavic languages, which also includes Kashubian—now spoken in western Poland by fewer than 150,000 people and regarded in Poland as a Polish dialect—and several now-extinct languages. A distinctive feature of this subgroup is its preservation of the Proto-Slavic nasal vowels. Another remnant language is Sorbian, spoken by 60,000–70,000 people in eastern Germany. Western Lekhitic and Sorbian are all that remains of what was once a much greater Slavic speech area in central Europe; that area was gradually Germanized from about the 9th century. Among Indo-European languages, Slavic is closest to the family of BALTIC LANGUAGES.

Slavic religion Beliefs and religious practices of the ancient Slavic peoples of East Europe, including the Russians, Ukrainians, Poles, Czechs, Slovaks, Serbs, Croats, and Slovenes. Most Slavic mythologies hold that God ordered the DEVIL to bring up a handful of sand from the bottom of the sea and created the land from it. Slavic religion was often characterized by DUALISM, with a Black God named in curses and a White God invoked to obtain protection or mercy. Lightning and fire gods were also common. The ancient Russians appear to have erected their idols outdoors, but the Baltic Slavs built temples and enclosed sacred places, where festivals were held and animal and human sacrifices occurred. Such festivals also often included communal banquets at which the flesh of sacrificial animals was consumed.

Slavonia Historical region, CROATIA. It lay between the SAVA RIVER on the south and the DRAVA and DANUBE rivers on the north and east. It was included in the kingdom of Croatia in the 10th century. As Slavonia-Crotia, it joins DALMATIA and ISTRIA as one of the three traditional regions of Croatia.

Slavophiles and Westernizers Opposing groups of intellectuals in 19th-century Russia. Prominent in the 1840s and '50s, the Slavophiles believed in the uniqueness of Russian culture and contended that Russia should rely on its own character and history to determine its future development. They hoped to restore the autocracy and the church to their ideal forms before PETER I (the Great) introduced Western reforms, and they also favoured emancipation of the serfs and freedom of speech and the press. The Slavophile movement declined in the 1860s, but its principles were adapted and simplified by extreme nationalists, advocates of PAN-SLAVISM, and revolutionary NARODNIKS (Populists). It was opposed by the Westernizers, who viewed western Europe as a model for Russian modernization.

sled dog Any WORKING DOG used to pull a sled carrying people and supplies across snow and ice. The breeds most commonly used are the ALASKAN MALAMUTE, Laika, SAMOYED, and SIBERIAN HUSKY. All are powerful dogs with a thick coat and high endurance. See also ESKIMO DOG.

sleep Natural periodic suspension of CONSCIOUSNESS during which the powers of the body are restored. Humans normally sleep at night, whereas nocturnal species sleep during the day. The average human sleep requirement is about 7.5 hours. Sleep is divided into two main types, REM (rapid-eye-movement) and NREM (non-REM); each recurs cyclically several times during a normal period of sleep. REM sleep is characterized by increased neuronal activity of the forebrain and midbrain, by depressed muscle tone, and by dreaming (see DREAM), rapid eye movements, and vascular congestion of the sex organs. NREM sleep is divided into four stages, the last of which is the deep, restorative, quiet sleep commonly associated with "a good night's rest." See also INSOMNIA, NARCOLEPSY.

sleeping sickness PROTOZOAL DISEASE transmitted by the bite of the TSETSE FLY. Two forms, caused by different species of the genus *Trypanosoma*, occur in separate regions in Africa. The parasite enters the bloodstream and invades the LYMPH NODES and SPLEEN, which become swollen, soft, and tender. Irregular fever and delayed pain sensation develop. In the Rhodesian form, the patient soon dies of massive toxemia. The Gambian type progresses to brain and spinal cord invasion, causing severe headache, mental and physical fatigue, spastic or flaccid PARALYSIS, CHOREA, and profound sleepiness, followed over two or three years by emaciation, coma, and death. Some patients develop a tolerance but still carry the trypanosomes. The earlier drug treatment begins, the greater the chance of recovery. Sleeping sickness is still prevalent in parts of Africa despite efforts to control it.

Slidell \slī-'del**, John** (b. 1793, New York, N.Y., U.S.—d. July 29, 1871, London, Eng.) U.S. and Confederate diplomat. He practiced law in New Orleans from 1819, then served in the U.S. House of Representatives (1843–45) and Senate (1853–61). In the American Civil War he joined the Confederate foreign service. En route to France to seek support for the Confederacy, he and JAMES MURRAY MASON were seized from the British steamer *Trent* by a Union vessel (see TRENT AFFAIR).

Slim, William (Joseph), 1st Viscount Slim (of Yarralumla and Bishopston) (b. Aug. 6, 1891, Bristol, Gloucestershire, Eng.—d. Dec. 14, 1970, London) British general. He served with the British army in World War I and with the Indian army from 1920. In World War II he commanded Indian troops in East Africa and the Middle East (1940–41). As commander of the 1st Burma Corps (1942), he led a 900-mi (1,450-km) retreat from superior Japanese forces in Burma to India. In 1944 he led forces to repel a Japanese invasion of northern India; in 1945 he retook Burma from the Japanese. Promoted to field marshal (1948), he served as chief of the Imperial General Staff (1948–52) and later as governor-general of Australia (1953–60).

slime mold Any of about 500 species of primitive organisms that contain true nuclei and resemble both PROTISTS and fungi (see FUNGUS). Originally grouped within the kingdom Fungi, some classification systems consider slime molds to be in the kingdom Protista. They typically thrive in dark, cool, moist conditions such as on forest floors. BACTERIA, YEAST, MOLDS, and fungi provide the main source of slime-mold nutrition. The complex life cycle of slime molds, exhibiting complete ALTERNATION OF GENERATIONS, may clarify the early evolution of both plant and animal cells. In the presence of water a tiny SPORE releases a mass of cytoplasm called a swarm cell, which later develops into an amoebalike creeping cell called a myxamoeba. Both swarm cells and myxamoebas can fuse in sexual union; the resulting fertilized cell, or plasmodium, grows through nuclear division and forms a spore case, which, when it dries, disintegrates and releases spores to begin the cycle again.

slippery elm *or* **red elm** Large-leaved ELM (*Ulmus rubra* or *U. fulva*) of eastern North America that has hard wood and fragrant inner bark. A gluelike substance in the inner bark has long been steeped in water as a remedy for throat ailments, powdered for use in poultices, and chewed as a thirst quencher, among other uses. It has received renewed attention in recent years as part of ALTERNATIVE MEDICINE's herbal pharmacopoeia, prescribed for a wide variety of ailments.

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slipware POTTERY that has been treated with semiliquid clay, or slip. The technique was originally used to cover defects in body colour, but later evolved into decorative techniques such as sgraffito, carving, painting, trailing, marbling, and inlay. In sgraffito a pattern is incised through the slip to reveal the different body colour underneath. The Staffordshire potters in 17th-century Britain were famous for the decorative figures, flowers, and patterns they created by using dotted and trailed slip.

English slipware dish by Thomas Toft of northern Staffordshire, c. 1680; in the Victoria and Albert Museum, London
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

Sloan, Alfred P(ritchard), Jr. (b. May 23, 1875, New Haven, Conn., U.S.—d. Feb. 17, 1966, New York, N.Y.) U.S. corporate executive. He began his career at the Hyatt Roller Bearing Co. in New Jersey and became its president at age 26. Hyatt was later acquired by GENERAL MOTORS CORP. (GM), and Sloan rose to become president and chief executive officer of GM in 1923. Under his leadership it surpassed FORD MOTOR CO. in sales and became the largest corporation in the world. He served as chairman of the board from 1937 to his retirement in 1956. A noted philanthropist, he endowed the Alfred P. Sloan Foundation and contributed to the Sloan-Kettering Cancer Center in New York and to the school of management at the Massachusetts Institute of Technology.

Sloan, John (French) (b. Aug. 2, 1871, Lock Haven, Pa., U.S.—d. Sept. 7, 1951, Hanover, N.H.) U.S. artist. He worked as a commercial newspaper artist in Philadelphia, where he studied with ROBERT HENRI. He followed Henri to New York City, where in 1908 with six others they exhibited as The EIGHT. Sloan's realistic urban paintings gave rise to the epithet ASH CAN SCHOOL. Works such as *Sunday, Women Drying Their Hair* (1912) and *Backyards, Greenwich Village* (1914) are sympathetic portrayals of working men and women; occasionally he evoked a mood of romantic melancholy.

Slocum, Joshua (b. Feb. 20, 1844, Wilmot, Nova Scotia, Can.—disappeared 1909/10, at sea) Canadian seaman and adventurer. He worked his way up from ship's cook to captain of a trading vessel by 1869. Wrecked with his family on the Brazilian coast in 1886, he built a canoe from the wreckage and paddled back to New York. He set sail from Boston in 1895 in a 36-ft, 9-in. (11.2-m) fishing boat. In three years, two months, and two days, he sailed 46,000 mi (74,000 km) in a circuitous route ending in Newport, R.I, becoming the first man in recorded history to sail around the world singlehandedly. He wrote several books, including the classic *Sailing Alone Around the World*. In 1909 he set sail for Grand Cayman from New England and was lost at sea.

Slonimsky, Nicolas (b. April 27, 1894, St. Petersburg, Russia—d. Dec. 25, 1995, Los Angeles, Calif., U.S.) Russian-born U.S. musicologist, conductor, and composer. He left the Soviet Union after studies at the St. Petersburg Conservatory and settled in the U.S. in 1923. In the 1930s he conducted premieres of works by CHARLES IVES, EDGARD VARÈSE, and others. In *Music Since 1900* (1937) he chronicled the century's musical life day by day. His *Lexicon of Musical Invective* (1952) collected wrongheaded musical criticism. His *Thesaurus of Scales and Melodic Patterns* (1947) was an inspiration to numerous composers. He edited four editions of *Baker's Dictionary of Music and Musicians* (1958–92). His commodious scholarship was undertaken with zest and humour, and near the end of his long life he was lionized by Frank Zappa and other musicians.

slope Numerical measure of a line's inclination relative to the horizontal. In ANALYTIC GEOMETRY, the slope of any line, ray, or line segment is the ratio of the vertical to the horizontal distance between any two points on it ("slope equals rise over run"). In DIFFERENTIAL CALCULUS, the slope of a line tangent to the graph of a function is given by that function's DERIVATIVE and represents the instantaneous rate of change of the function with respect to change in the independent variable. In the graph of a position FUNCTION (representing the distance traveled by an object plotted against elapsed time), the slope of a TANGENT LINE represents the object's instantaneous velocity.

sloth Nocturnal, solitary, tree-dwelling MAMMAL (family Bradypodidae), found in South and Central America. About 2 ft (60 cm) long, sloths have a tiny tail, peglike teeth, long curved claws, and long forelimbs. A green alga grows in the shaggy fur. The four species of three-toed sloths, or ais (*Bradypus*), eat only leaves of the trumpet tree. The two species of two-toed sloths, or unaus (*Choloepus*), have two toes on the forelimbs; they eat fruits, stems, and leaves of various plants. Sloths cannot walk. They cling upright to trunks, hang upside down (in which position they sleep some 15 hours a day), or move, extremely slowly (hence their name), by pulling hand over hand. Their natural camouflage is their chief protection from predators.

Three-toed sloth (*Bradypus tridactylus*)
DES BARTLETT—BRUCE COLEMAN LTD.

Slovak \'slō-ˌväk\ **language** West SLAVIC LANGUAGE of Slovakia, spoken by about 5.6 million people there and in enclaves in the Czech Republic, Hungary, northern Serbia, and North America. Slovak was virtually an unwritten language until the late 18th century, largely because of the long political domination of Slovakia by Hungary and the much earlier literary cultivation of CZECH, Slovak's western linguistic neighbour. Present-day literary Slovak was effectively consolidated by the 1850s on the basis of Central Slovak dialects.

Slovakia *officially* **Slovak Republic** Country, central Europe. Area: 18,933 sq mi (49,035 sq km). Population (2005 est.): 5,384,000. Capital: BRATISLAVA. About nine-tenths of the population are Slovak; Hungarians

form the largest minority. Language: SLOVAK (official). Religion: Christianity (mostly Roman Catholic; also Protestant, other Christians). Currency: Slovak koruna. The CARPATHIAN MOUNTAINS dominate Slovakia, with lowlands in the southwestern and southeastern regions. The MORAVA and DANUBE rivers form parts of the southern and western borders. Grain, sugar beets, and vegetable crops are grown and pigs, sheep, and cattle are raised, but the economy is based on mining and manufacturing; there are substantial deposits of iron ore, copper, magnesite, lead, and zinc. Slovakia is a republic with one legislative house; its chief of state is the president, and the head of government is the prime minister. Slovakia was inhabited in the first centuries AD by Illyrian, Celtic, and Germanic tribes.

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Slovaks settled there around the 6th century. It became part of Great Moravia in the 9th century but was conquered by the Magyars c. 907. It remained in the kingdom of Hungary until the end of World War I, when the Slovaks joined the Czechs to form the new state of Czechoslovakia in 1918. In 1938 Slovakia was declared an autonomous unit within Czechoslovakia; it was nominally independent under German protection from 1939 to 1945. After the expulsion of the Germans, Slovakia joined a reconstituted Czechoslovakia, which came under Soviet domination in 1948. The fall of the communist regime in 1989 led to a revival of interest in autonomy, and Slovakia became an independent nation in 1993. It joined both NATO and the European Union in 2004.

Slovene \'slō-ˌvēn\ **language** *or* **Slovenian language** South Slavic language spoken by more than 2.2 million people in Slovenia, in adjacent parts of Italy, Austria, and Hungary, and in small enclaves outside Europe. The oldest Slavic text in the Latin alphabet, the Freising Fragments (c. 1000), are written in a very early form of Slovene; the language is not attested again until the 16th century, when Lutheran reformers translated the Bible into Slovene. The language has a remarkable degree of dialect diversity considering the size of its speech area, probably enhanced by the country's Alpine geography and long period of domination by non-Slovene-speaking rulers.

Slovenia *officially* **Republic of Slovenia** Country, northwestern Balkans region, southern Europe. Area: 7,827 sq mi (20,273 sq km). Population (2005 est.): 1,999,000. Capital: Ljubljana. The vast majority of

the population is Slovene. Language: Slovene (official). Religion: Christianity (predominantly Roman Catholic; also other Christians). Currency: Slovene tolar. Slovenia is predominantly mountainous and wooded, with deep, fertile valleys and numerous rivers. It is one of the more prosperous regions of the Balkans. Its economy is based largely on manufacturing; coal, lead, and zinc are mined, but forestry, livestock, and crops, including potatoes, grains, and fruits, are also important. Slovenia is a republic with two legislative houses; its head of state is the president, and the head of government is the prime minister. The Slovenes settled the region in the 6th century AD. In the 8th century it was incorporated into the Frankish empire of Charlemagne, and in the 10th century it came under Germany as part of the medieval empire (later the Holy Roman Empire). Except for the period from 1809 to 1813, when Napoleon ruled the area, most of the lands belonged to Austria until the formation of the Kingdom of Serbs, Croats, and Slovenes in 1918. Slovenia became a constituent republic of Yugoslavia in 1946 and received a section of the former Italian Adriatic coastline in 1947. In 1990 Slovenia held the first contested multiparty elections in Yugoslavia since before World War II. In 1991 Slovenia seceded from Yugoslavia; its independence was internationally recognized in 1992.

slug Any species of gastropod that glides along on a broad tapered foot and has no shell or one that is merely an internal plate or a series of granules. Most slugs use the mantle cavity (see mollusk) as a lung. Slugs have a soft, slimy body and live in moist habitats on land (except for one freshwater species). All are hermaphroditic. In temperate regions, the common slugs eat fungi and decaying leaves. Some tropical species eat plants, and some European species eat other snails and earthworms. See also nudibranch.

slum Densely populated area of substandard housing, usually in a city, characterized by unsanitary conditions and social disorganization. Rapid industrialization in 19th-century Europe was accompanied by rapid population growth and the concentration of working-class people in overcrowded, poorly built housing. England passed the first legislation for building low-income housing to certain minimum standards in 1851; laws for slum clearance were first enacted in 1868. In the U.S., slum development coincided with the arrival of large numbers of immigrants in the late 19th and early 20th centuries; laws concerning adequate ventilation, fire protection, and sanitation in urban housing were passed in the late 1800s. In the 20th century government and private organizations built low-income housing and appropriated funds for urban renewal and offered low-interest home loans. Shantytowns, which often grow up around urban centres in developing countries as rural populations migrate to the cities in search of employment, are one type of slum for which alleviating measures have yet to be successfully introduced. See also urban planning.

slump, submarine See submarine slump

Sluter \'slüt-ər**, Claus** (b. c. 1340/50, Haarlem?, Holland—d. between Sept. 24, 1405, and Jan. 30, 1406, Dijon, Burgundy) Early Netherlandish sculptor. He entered the service of Philip II the Bold in 1385 and became his chief sculptor in 1389. All his surviving sculptures were made for the Carthusian monastery of Champmol at Dijon, which Philip founded. Sluter moved beyond the prevailing French taste for graceful figures, delicate movement, and fluid falls of drapery and toward highly individual naturalistic forms. His works infuse realism with spirituality and monumental grandeur. His influence was extensive among both painters and sculptors of 15th-century northern Europe.

(From left) Zechariah, Daniel, and Isaiah from the "Well of Moses," marble sculpture by Sluter, 1395–1404/05; in the cloister of the Chartreuse de Champmol, Dijon, Fr.
FOTO MARBURG/ART RESOURCE, NEW YORK CITY

Small Computer System Interface See SCSI

small intestine Long, narrow, convoluted tube in which most digestion takes place. It extends 22–25 ft (6.7–7.6 m), from the stomach to the large intestine. The mesentery, a membrane structure, supports it and contains its blood supply, lymphatics, and insulating fat. The autonomic nervous system supplies it with parasympathetic nerves that initiate peristalsis and sympathetic nerves that suppress it. It is lined with minute fingerlike projections (villi) that greatly increase its surface area for enzyme secretion and food absorption. Its three sections, the duodenum, jejunum, and ileum, have distinct characteristics. Food takes three to six hours to pass through the small intestine unless a disorder such as gastroenteritis, diverticulosis, or obstruction impedes it.

smallpox *or* **variola** \və-'rī-ə-lə\ One of the world's most dreaded plagues before 1980, when it was declared eradicated. It was known in ancient China, India, and Egypt. It came to the Western Hemisphere with Europeans in the 16th century and devastated the native population, which lacked resistance. An infectious viral disease only of humans, it causes fever and then a rash of variable severity that blisters and dries up, leaving scars. It is not spread easily, but the virus can survive for long peri-

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ods outside the body (e.g., in bedding). EDWARD JENNER developed a VACCINE from cowpox. The World Health Organization's eradication project reduced smallpox deaths from two million in 1967 to zero in 1977–80. The virus now exists only in laboratories; in some countries it may be under development for purposes of BIOLOGICAL WARFARE.

Smalls, Robert (b. April 5, 1839, Beaufort, S.C., U.S.—d. Feb. 22, 1915, Beaufort) U.S. naval hero. Born to plantation slaves, he was taken to Charleston, S.C., where he worked as a hotel waiter. In the American Civil War he was impressed into the Confederate navy to serve on the armed frigate *Planter*. In 1862 he and 12 other slaves seized control of the ship in Charleston harbour and turned it over to the Union navy. He served as the ship's pilot and became its captain in 1863. After the war he served in the U.S. House of Representatives (1875–79, 1881–87).

Smalls
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Smallwood, Joey *orig.* **Joseph Roberts Smallwood** (b. Dec. 24, 1900, Gambo, Nfd.—d. Dec. 17, 1991, St. Johns, Nfd., Can.) Canadian politician. He worked for socialist publications in New York City (1921–25), then returned to Newfoundland to become a union organizer and radio broadcaster. An advocate of confederation with Canada, he was elected to a convention to decide Newfoundland's future (1946); his vigorous campaign helped effect its admission as a province (1948). He was elected Newfoundland's first premier in 1949 and retained leadership of the government and the ruling Liberal Party until 1971.

smart bomb Bomb with a guidance system that directs its path toward a target. It is steered by fins or wings on the bomb that move in response to guidance commands. Guidance systems may be electro-optical, laser, infrared, or inertial. Electro-optical systems send pictures of the area so that the bomb can be guided onto the target. Laser-guided bombs follow the reflections of a laser beam trained onto the target by an aircraft or a spotter on the ground. Infrared guidance responds to radiation generated by warm areas of the target. Inertial navigation is based on inputting coordinates derived from radar systems or from Global Positioning System satellites into the bomb's gyroscopes. Smart bombs, initially used in the Vietnam War, offer far greater accuracy than traditional gravity, or "dumb," bombs.

Smarta Orthodox Hindu sect consisting of members of higher CASTES who worship all the gods of the Hindu pantheon and adhere to rules of ritual and conduct laid down in ancient SUTRAS. The sect was founded by SHANKARA. The head of the monastery he established at Sringeri is the spiritual authority of the Smartas and one of the chief religious personages of India. The Smartas regard five gods as primary: SHIVA, VISHNU, SHAKTI, SURYA, and GANESHA. Active in all branches of learning, they have earned the honorary title *sastri* (Sanskrit: "men of learning").

Smeaton, John (b. June 8, 1724, Austhorpe, Yorkshire, Eng.—d. Oct. 28, 1792, Austhorpe) British civil engineer. In 1756–59 he rebuilt the Eddystone Lighthouse (off Plymouth), during which he rediscovered hydraulic cement (lost since the fall of Rome) as the best mortar for underwater construction. He constructed the great Forth and Clyde Canal in Scotland; built bridges at Perth, Banff, and Coldstream; and completed the harbour at Ramsgate, Kent. He was a leader in the transition from wind-and-water to steam power; with his improvements, THOMAS NEWCOMEN's atmospheric STEAM ENGINE achieved its maximum performance. He designed atmospheric pumping engines for collieries, mines, and docks. In 1771 he founded the British Society of Civil Engineers (now the Smeatonian Society). He is regarded as the founder of the CIVIL ENGINEERING profession in Britain.

smelt Any of certain slender, silvery, carnivorous, food fishes (family Osmeridae) having a small fleshy fin. Smelts live in cold northern seas, and most species spawn a short distance upstream. The American smelt (*Osmerus mordax*), introduced from the Atlantic to the Great Lakes, is the largest smelt, about 15 in. (38 cm) long. The European smelt (*O. eperlanus*) is similar. Among Pacific species are the rainbow herring, capelin, and eulachon, or candlefish, which is so oily at spawning time that it can be dried and burned as a candle. Silversides (see GRUNION) and other unrelated fishes are sometimes called smelts.

smelting Process by which a METAL is obtained from its ORE, either as the element or as a simple compound, usually by heating beyond the melting point, ordinarily in the presence of reducing agents such as COKE or oxidizing agents such as air (see OXIDATION-REDUCTION). A metal whose ore is an oxygen compound (e.g., iron, zinc, or lead OXIDE) is heated (reduction smelting) in a BLAST FURNACE to a high temperature; the oxide combines with the carbon in the coke, escaping as carbon monoxide or carbon dioxide. Other impurities are removed by adding FLUX, with which they combine to form SLAG. If the ore is a SULFIDE MINERAL (e.g., copper, nickel, lead, or cobalt), air or oxygen is blasted through (matte smelting) to oxidize the sulfide to sulfur dioxide and any iron to oxide slag, leaving the metal. See also METALLURGY; MINERAL PROCESSING.

Smetana \'sme-tᵊn-ə**, Bedřich** (b. March 2, 1824, Leitomischl, Bohemia, Austrian Empire—d. May 12, 1884, Prague) Czech (Bohemian) composer. He was determined to become a pianist, but his first concert (1847) ended his hopes, and he thereafter taught music, opening two schools of music. In the 1860s he turned to opera, becoming conductor of the national theatre in 1866. His second opera was *The Bartered Bride* (1866), which gained lasting success after many revisions. *Dalibor* (1868) followed and also became popular; he would complete five more operas. Though rendered deaf by syphilis in 1874, in his last decade he wrote some of his most beloved music, including the cycle *My Country* (1874–79), which included the famous symphonic poem *The Moldau*, and the quartet *From My Life* (1876). He became insane in 1883 and died in an asylum. The strongly Czech character of his music made Smetana the preeminent Czech nationalist composer.

smew See MERGANSER

smilax \'smī-ˌlaks\ Any of about 300 species of woody or herbaceous vines, variously known as catbriers and greenbriers, that make up the genus *Smilax* (family Smilacaceae), native to tropical and temperate regions. The stems of many species are covered with prickles, the lower leaves are scalelike, and the leathery upper leaves have untoothed blades with three to nine large veins. White or yellow-green flowers are followed by clusters of red or bluish-black berries. Common catbrier (*S. rotundifolia*) and carrion flower (*S. herbacea*) of eastern North America are sometimes cultivated to form impenetrable thickets. See also SARSAPARILLA.

Smith, Adam (baptized June 5, 1723, Kirkcaldy, Fife, Scot.—d. July 17, 1790, Edinburgh) Scottish social philosopher and political economist. The son of a customs official, he studied at the Universities of Glasgow and Oxford. A series of public lectures in Edinburgh (from 1748) led to a lifelong friendship with DAVID HUME and to Smith's appointment to the Glasgow faculty in 1751. After publishing *The Theory of Moral Sentiments* (1759), he became the tutor of the future Duke of Buccleuch (1763–66); with him he traveled to France, where Smith consorted with other eminent thinkers. In 1776, after nine years of work, Smith published *An Inquiry into the Nature and Causes of the Wealth of Nations*, the first comprehensive system of political economy. In it he argued in favour of an economic system based on individual self-interest that would be led, as if by an "invisible hand," to achieve the greatest good for all, and posited the DIVISION OF LABOUR as the chief factor in economic growth. A reaction to the system of MERCANTILISM then current, it stands as the beginning of CLASSICAL ECONOMICS. *The Wealth of Nations* in time won him an enormous reputation and would become virtually the most influential work on economics ever published. Though often regarded as the bible of CAPITALISM, it is harshly critical of the shortcomings of unrestrained free enterprise and monopoly. In 1777 Smith was appointed commissioner of customs for Scotland, and in 1787 rector of the University of Glasgow.

Smith, Alfred E(manuel) (b. Dec. 30, 1873, New York, N.Y., U.S.—d. Oct. 4, 1944, New York City) U.S. politician. After working in the Fulton fish market to help support his family, he began his political career with a job from TAMMANY HALL (1895). In the state assembly (1903–15), he rose to speaker, then served in city political posts. As governor of New York (1919–20, 1923–28) he worked for improved housing, child welfare, and efficient government. In 1928 he won the presidential nomination of the Democratic Party, the first Roman Catholic to do so, but he was easily defeated by HERBERT HOOVER. He later opposed the NEW DEAL

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programs of Franklin D. Roosevelt and supported Republican presidential candidates for president in 1936 and 1940.

Smith, Bessie *orig.* **Elizabeth Smith** (b. April 15, 1898?, Chattanooga, Tenn., U.S.—d. Sept. 26, 1937, Clarksdale, Miss.) U.S. blues and jazz singer. Smith sang popular songs as well as blues on the minstrel and vaudeville stage. She began recording in 1923 and appeared in the film *St. Louis Blues* (1929). Her interpretations represent the fully realized transition of the rural folk tradition of the blues to its urbane structure and expressiveness. A bold, supremely confident artist with a powerful voice and precise diction, she became known as "Empress of the Blues." Smith was the most successful African American entertainer of her time. She died from injuries sustained in a car crash, and it was said that, had she been white, she would have received earlier medical treatment and her life might have been saved; the actual circumstances of her treatment remain obscure.

Smith, Cyril Stanley (b. Oct. 4, 1903, Birmingham, Warwickshire, Eng.—d. Aug. 25, 1992, Cambridge, Mass., U.S.) British-born U.S. metallurgist. He worked as a researcher at the Massachusetts Institute of Technology (MIT) and the American Brass Co. before joining the Manhattan Project, where he determined the properties and technology of plutonium and uranium, the essential materials of the atomic bomb. He later taught at the University of Chicago (1946–61) and MIT (1961–69). He published many books on the history of metallurgy, including *A History of Metallography* (1960).

Smith, David (Roland) (b. March 9, 1906, Decatur, Ind., U.S.—d. May 23, 1965, Albany, N.Y.) U.S. sculptor. He learned to work with metal while employed at an automobile plant. In 1926 he went to New York City and took various jobs while studying painting at the Art Students League. His sculptures grew out of his abstract paintings, to which he attached so many bits of wood, metal, and found objects that they became virtual bases for sculptural superstructures. He became the first U.S. artist to make welded metal sculpture. In 1940 he moved to Bolton Landing, N.Y., and there made his large yet seemingly weightless metal sculptures until his death in a car crash. His abstract biomorphic and geometric forms are remarkable for their erratic inventiveness, stylistic diversity, and high aesthetic quality. His work greatly influenced Minimalist sculpture in the 1960s.

Smith, Emmitt (b. May 15, 1969, Pensacola, Fla., U.S.) U.S. football player. He set 58 school football records at the University of Florida, and as a running back for the Dallas Cowboys of the NFL (1990–2002), he helped his team win three Super Bowl games. In 1995 he set the all-time NFL record for touchdowns in a single season (25), and he holds the record for most career rushing touchdowns (164). In 2002 he surpassed Walter Payton to become the NFL's all-time leading rusher. He played two seasons with the Arizona Cardinals and retired in 2004 with 18,355 career rushing yards.

Smith, Frederick Edwin See Earl of Birkenhead

Smith, George (b. March 19, 1824, London, Eng.—d. April 6, 1901, Byfleet, near Weybridge, Surrey) British publisher. He took over his father's bookselling and publishing business in 1846. Under his leadership the firm issued works by such noted Victorian writers as John Ruskin, the Brontë sisters, Charles Darwin, William Thackeray, Elizabeth Barrett Browning, Wilkie Collins, Matthew Arnold, Harriet Martineau, and Anthony Trollope. His most important publication was the first edition of the *Dictionary of National Biography*, 66 vol. (1885–1901), later continued by Oxford University Press. He also began the illustrated literary journal *Cornhill Magazine* (1860) and the *Pall Mall Gazette* (1865), a literary newspaper.

Smith, Gerrit (b. March 6, 1797, Utica, N.Y., U.S.—d. Dec. 28, 1874, New York, N.Y.) U.S. reformer and philanthropist. Born into a wealthy family, he became active in the temperance movement (1828) and built one of the first U.S. temperance hotels at Peterboro, N.Y. From 1835 he was an active abolitionist, and he made his hotel a stop on the Underground Railroad. He helped form the Liberty Party and was its unsuccessful presidential candidate in 1848 and 1852. He paid the legal expenses of many slaves arrested under the Fugitive Slave Acts. He gave a farm to his friend John Brown and financed some of Brown's activities.

Smith, Hamilton O(thanel) (b. Aug. 23, 1931, New York, N.Y., U.S.) U.S. microbiologist. He received his M.D. from Johns Hopkins University. While studying the mechanism whereby the bacterium *Haemophilus influenzae* takes up DNA from a particular bacteriophage, Smith, Werner Arber, and Daniel Nathans discovered the first of what came to be called type II restriction enzymes. Whereas previously studied restriction enzymes cut DNA at unpredictable points, the type II enzymes' predictability allowed the scientists to cut DNA at a particular point. The enzymes have become valuable tools in the study of DNA structure and in recombinant DNA technology. The three shared a 1978 Nobel Prize.

Smith, Hoke (b. Sept. 2, 1855, Newton, N.C., U.S.—d. Nov. 27, 1931, Atlanta, Ga.) U.S. politician. He was publisher of the *Atlanta Journal* (1887–1900), which he used to promote progressive measures (except civil rights for African Americans). He served as U.S. secretary of the interior (1893–96). As governor of Georgia (1907–09, 1911), he improved education, transportation, and prison conditions. Elected to the U.S. Senate (1911–21), he supported progressive legislation but opposed U.S. participation in the League of Nations.

Smith, Ian (Douglas) (b. April 8, 1919, Selukwe, Rhodesia) First native-born prime minister of the British colony of Southern Rhodesia (1964–65). An ardent advocate of white rule, in 1965 he declared Rhodesia's independence and withdrew it from the Commonwealth. He faced guerrilla attacks from Robert Mugabe and Joshua Nkomo through most of the 1970s. In 1977 he was finally compelled to negotiate a transfer of power to the black majority, a process completed two years later. He continued to serve in Parliament until 1987.

Smith, John (baptized Jan. 6, 1580, Willoughby, Lincolnshire, Eng.—d. June 21, 1631, London) English explorer. After a period as a military adventurer, he joined an English group preparing to establish a colony in North America. The Virginia Company of London sailed three ships to Chesapeake Bay, arriving in 1607 to establish the first permanent English settlement in North America at Jamestown, of which Smith later became the leader. On a river voyage to explore the surrounding region, he was captured by Indians of the Powhatan empire; according to his own account, Smith was saved from death by Pocahontas, daughter of the Indian chief. While president of the Jamestown Colony, Smith oversaw its expansion. An injury forced his return to England in 1609. Eager for further exploration, he made contact with the Plymouth Company and sailed in 1614 to the area he named New England. He also mapped its coast and wrote descriptions of Virginia and New England that encouraged others to colonize the New World.

John Smith, engraving by Simon van de Passe, 1616

COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, J.R. FREEMAN & CO. LTD.

Smith, Joseph (b. Dec. 23, 1805, Sharon, Vt., U.S.—d. June 27, 1844, Carthage, Ill.) Founder of the Church of Jesus Christ of Latter-day Saints (Mormon church). He began experiencing visions as a teenager in Palmyra, N.Y. In 1827 he claimed that an angel had directed him to buried golden plates containing God's revelation; these he translated into the *Book of Mormon* (1830). He led converts to Ohio, Missouri, and Illinois, where he established the town of Nauvoo (1839), which soon became the state's largest town. Imprisoned for treason after his efforts to silence Mormon dissenters led to mob violence, he was murdered by a lynch mob that stormed the jail where he was held. His work was continued by Brigham Young.

Joseph Smith, detail from an oil painting by an unknown artist; in the Community of Christ Temple and Auditorium complex, Independence, Missouri.

COURTESY OF THE COMMUNITY OF CHRIST, INDEPENDENCE, MISSOURI

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Smith, Kate *orig.* **Kathryn Elizabeth Smith** (b. May 1, 1909, Greenville, Va., U.S.—d. June 17, 1986, Raleigh, N.C.) U.S. singer, long known as the "First Lady of Radio." Smith studied nursing before moving to New York City, where she won a Broadway role as an overweight girl who was the butt of jokes. In 1931 she began her immensely popular radio show *Kate Smith Sings*, which ran for 16 years; her theme song, "When the Moon Comes over the Mountain," became familiar to millions. In 1938 she created the news and gossip program *Kate Smith Speaks* and introduced Irving Berlin's song "God Bless America." She hosted several television shows in the 1950s. In 1982 she was awarded the U.S. Medal of Freedom.

Smith, Dame Maggie *orig.* **Margaret Natalie Smith** (b. Dec. 28, 1934, Ilford, Essex, Eng.) British actress. She first gained recognition on Broadway in *New Faces of 1956*, and, after winning praise for her roles in *The Rehearsal* (1961) and *Mary, Mary* (1963), she joined Britain's National Theatre Company, where she starred opposite Laurence Olivier in *Othello* (1964; film, 1965). Her later films include *The Prime of Miss Jean Brodie* (1969, Academy Award), *Travels with My Aunt* (1972), *California Suite* (1978, Academy Award), and *The Lonely Passion of Judith Hearne* (1987). Known for her nervous intensity, acid wit, and flawless timing, she has many great stage performances to her credit, notably in *The Way of the World* (1985) and *Lettice and Lovage* (1990, Tony Award).

Smith, Margaret Chase *orig.* **Margaret Madeline Chase** (b. Dec. 14, 1897, Skowhegan, Maine, U.S.—d. May 29, 1995, Skowhegan) U.S. politician. She served as secretary to her husband, Clyde Smith, after he was elected to the U.S. House of Representatives as a Republican in 1936. When he suffered a heart attack in 1940, he urged voters to elect her to the office. She became the first woman to win election to both the House (1940–49) and the Senate (1949–73). Though a staunch anticommunist, she was the first Republican senator to condemn the tactics of Joseph McCarthy, delivering a memorable "Declaration of Conscience" speech on the Senate floor in 1950. Her opinion that Pres. John F. Kennedy should use nuclear weapons against the Soviet Union prompted Soviet leader Nikita Khrushchev to dub her "the devil in disguise of a woman." She retired from politics after her defeat in 1972. She received the Presidential Medal of Freedom in 1989.

Smith, Red *orig.* **Walter Wellesley Smith** (b. Sept. 25, 1905, Green Bay, Wis., U.S.—d. Jan. 15, 1982, Stamford, Conn.) U.S. sports columnist. Smith worked for various newspapers before his column, "Views of Sport," began appearing in the *New York Herald Tribune* in 1945; it was syndicated soon thereafter. He joined *The New York Times* in 1971. His writing, mostly about major spectator sports, shunned jargon and displayed literary craftsmanship, wry humour, and deep knowledge. He won a Pulitzer Prize in 1976. His columns were collected in five books, including *Out of the Red* (1950) and *Strawberries in the Wintertime* (1974).

Smith, Samuel (b. July 27, 1752, Carlisle, Pa.—d. April 22, 1839, Baltimore, Md., U.S.) U.S. politician. He was a merchant in Baltimore and fought in the American Revolution. He served in the U.S. House of Representatives (1793–1803, 1816–22) and Senate (1803–15, 1822–33). As brigadier general of the Maryland militia, he commanded U.S. troops that defended Baltimore from the British in the War of 1812. After leading the militia against rioters, he was elected mayor of Baltimore (1835–38) at age 83.

Smith, Stevie *orig.* **Florence Margaret Smith** (b. Sept. 20, 1902, Hull, Yorkshire, Eng.—d. March 7, 1971, London) British poet. She lived most of her life with an aunt in a London suburb and worked many years as a secretary. Her poetry, an unsentimental combination of the ludicrous and the pathetic, expresses an original and visionary personality. In the 1960s her poetry readings became popular, and she made radio broadcasts and recordings. Her *Collected Poems* (1975) is illustrated with her James Thurber-like sketches; it includes her first book, *A Good Time Was Had by All* (1937), and *Not Waving but Drowning* (1957), whose title poem appears in many anthologies.

Smith, Theobald (b. July 31, 1859, Albany, N.Y., U.S.—d. Dec. 10, 1934, New York, N.Y., U.S.) U.S. microbiologist and pathologist. He received his M.D. from Cornell University. He discovered that injected heat-killed cultures of the causative microorganisms can immunize animals against disease. His discovery that Texas cattle fever is caused by a parasite transmitted by ticks—the first definite proof of arthropods' role in spreading disease—helped the scientific community accept mosquitoes' role in malaria and yellow fever. Smith was the first to differentiate the bacteria that cause tuberculosis in cattle and in humans, and he was one of the first to notice anaphylaxis. He also improved laboratory production of vaccines.

Smith, Vernon L. (b. Jan. 1, 1927, Wichita, Kan., U.S.) U.S. economist. Smith studied economics at the University of Kansas (M.A., 1952) and at Harvard (Ph.D., 1955). He later taught at a number of institutions and in 2001 became a professor at George Mason University. His extensive laboratory experiments in economic analysis laid the foundation for the field of experimental economics. Through such work he was able to determine the theoretical equilibrium, or acceptable market price. He also focused on the outcome of public auctions, showing that the way in which the bidding was organized affected the selling price, and he devised "wind-tunnel tests," where trials of new alternative market designs, such as those for a deregulated industry, could be tested. In 2002 he shared the Nobel Prize for Economics with Daniel Kahneman.

Smith, W(illiam) Eugene (b. Dec. 20, 1918, Wichita, Kan., U.S.—d. Oct. 15, 1978, Tucson, Ariz.) U.S. photojournalist. He worked as a photographer for local papers then went to New York City and worked for several magazines. In 1943–44, as a war correspondent for *Life* magazine, he covered many of the important battles of the Pacific theatre. He produced a number of photoessays for *Life*, such as *Spanish Village* (1951), a study of villagers' daily struggle to draw life from exhausted soil. His most famous picture, *The Walk to Paradise Garden* (1947), showing his own children entering a forest clearing, concluded the landmark photographic exhibition *The Family of Man*.

Smith, William (b. March 23, 1769, Churchill, Oxfordshire, Eng.—d. Aug. 28, 1839, Northampton, Northamptonshire) English engineer and geologist, known as the founder of the science of stratigraphy. The son of a blacksmith, he was largely self-educated. He produced the first geologic map of England and Wales (1815), setting the style for modern geologic maps, and subsequently a series of geologic maps of the English counties. He introduced many techniques still used, including the use of fossils for the dating of layers. Current geologic maps of England differ from his primarily in detail, and many of the colourful names he applied to the strata are also used today.

Smith & Wesson U.S. gun manufacturer. The company has its roots in an 1852 partnership between Horace Smith (1808–93) and Daniel B. Wesson (1825–1906), who designed and marketed a lever-action, repeating magazine handgun that held a self-contained cartridge. Their venture ran into financial difficulties and they were forced to sell it, but a second partnership in 1856, manufacturing their new revolving-cylinder handgun (now known as the .22 rimfire) proved more successful. The Civil War made Smith & Wesson a leading firearms manufacturer. In 1867 it began selling in Europe. It supplied the British in World War I and the Allies in World War II. In 1965 the Wesson family sold the company, which has since changed hands several times.

Smith College Private liberal arts college for women in Northampton, Mass. It was founded in 1871 through the bequest of Sophia Smith (1796–1870). Bachelor's degrees are granted in most major academic fields, and master's degrees are granted in biology, dance, education, music, religion, social work, and theatre. Smith's school of social work also grants doctoral degrees. The college belongs to a five-college cooperative with Amherst, Hampshire, and Mount Holyoke colleges and the University of Massachusetts at Amherst.

Smith Sound Channel between Ellesmere Island, Canada, and northwestern Greenland. About 30–45 mi (48–72 km) wide, the sound extends northward for 55 mi (88 km) from Baffin Bay to the Kane Basin. It was discovered by William Baffin in 1616 and named for Thomas Smythe (Smith), who had promoted a number of voyages searching for a Northwest Passage.

smithing Fabrication and repair of metal objects by hot and cold forging on an anvil or with a power hammer or by welding and other means. Blacksmiths traditionally worked with iron (anciently known as "black metal"), making agricultural and other tools, fashioning hardware (e.g., hooks, hinges, handles) for the farm, the home, and industry, and shoeing horses. The term *smithing* is also applied to work with precious metals (gold, silver) as well as other metals (e.g., tin, including tinplate, and steel).

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Smithsonian Institution U.S. research institution. Enabled by the bequest of the English chemist James Smithson (1765–1829), it was established in Washington, D.C., by an 1846 act of Congress. The Smithsonian administers numerous bureaus, including the Freer Gallery of Art, the John F. Kennedy Center for the Performing Arts, the National Air and Space Museum, the National Gallery of Art, the National Museum of History and Technology, the National Museum of Natural History, the National Zoological Park, and the Smithsonian Astrophysical Observatory.

smog Polluted air over a community. The term, a combination of "smoke" and "fog," was popularized in the early 20th century and now commonly refers to the pall of automotive or industrial origin that lies over many cities. Sulfurous smog results from the use of sulfur-bearing fossil fuels, particularly coal, and is aggravated by dampness. Photochemical smog requires neither smoke nor fog. Nitrogen oxides and hydrocarbon vapours emitted from automobiles and other sources undergo reactions in the presence of sunlight that produce a light brownish coloration of the atmosphere, reduced visibility, plant damage, irritation of the eyes, and respiratory distress.

smoking Breathing the fumes of burning plant material, especially tobacco, from a cigarette, cigar, or pipe. Despite social and medical arguments against tobacco use, smoking is widely practiced around the world. NICOTINE is an ALKALOID in tobacco that is addictive and can have both stimulating and tranquilizing psychoactive effects. The tar (residue) and gases produced by burning tobacco have many negative health effects. They include LUNG CANCER, PANCREATIC CANCER, and LARYNGEAL CANCER; HEART DISEASE and STROKE; and EMPHYSEMA and chronic BRONCHITIS. Smoking also increases other health-related risk factors (see ASBESTOSIS). A nonsmoker who breathes secondhand smoke (such as the smoke from a lit cigarette) is at an increased risk of the same diseases that affect smokers. Secondhand smoke also increases the risk of SUDDEN INFANT DEATH SYNDROME. Doctor-run programs, along with nicotine patches and gums that provide diminishing doses of nicotine, are among the aids available to help those who wish to quit smoking. Hypnosis, acupuncture, herbal remedies, and other approaches are also widely advertised as ways to quit smoking. Smoking has been greatly reduced in the health-conscious West even as it rises in many less-developed countries.

Smoky Mountains See GREAT SMOKY MTNS.

smoky quartz Common, coarse-grained variety of QUARTZ that ranges in colour from nearly black through smoky brown. No distinct boundary exists between smoky and colourless quartz. Its abundance causes it to be worth considerably less than either AMETHYST or CITRINE. Heating bleaches the stone, the colour sometimes passing through yellow; these yellow pieces are often sold as citrine.

Smolensk \smō-'lensk\ City (pop., 1999 est.: 355,700), western Russia. One of the oldest and most historic of Russian cities, it was a key stronghold on the DNIEPER RIVER by the 9th century and became a commercial centre on the trade route between the BALTIC SEA and the BYZANTINE EMPIRE. Sacked by the TATARS c. 1240, it subsequently fell to Lithuania. Sieges led to its capture by Moscow in 1340 and recapture by Lithuania in 1408. It was fought over several times, then was finally taken by Russia in 1654. It was burned during NAPOLEON's invasion of Russia in 1812. The scene of heavy fighting in World War II, it was occupied by the Germans from 1941 to 1943. It is a light-industry and educational centre.

Smollett, detail of an oil painting by an unknown artist, about 1770; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Smollett \'smä-lət**, Tobias (George)** (baptized March 19, 1721, Cardross, Dumbartonshire, Scot.—d. Sept. 17, 1771, near Livorno, Tuscany) English satirical novelist. Throughout his life Smollett combined the roles of medical man and writer. He is best known for his novels, including the PICARESQUE NOVELS *Roderick Random* (1748), a graphic account of British naval life, and *Peregrine Pickle* (1751), a comic, savage portrayal of 18th-century society. In an active publishing career, he translated, wrote a *Complete History of England* (1757–58), edited periodicals, including *The Critical Review*, and compiled a 58-volume *Universal History*. In the mid-1760s, seriously ill with tuberculosis, he retired to France. In 1766 he published the irascible *Travels Through France and Italy*, his one nonfiction work that is still read. His finest work, *Humphry Clinker* (1771), is a humorous EPISTOLARY NOVEL.

Smoot-Hawley Tariff Act (1930) U.S. legislation that raised import duties by as much as 50%, adding considerable strain to the worldwide economic climate of the GREAT DEPRESSION. Despite a petition from 1,000 economists urging Pres. HERBERT HOOVER to veto the act, it was passed as a protective measure for domestic industries. It contributed to the early loss of confidence on Wall Street and signaled U.S. isolationism. Other countries retaliated with similarly high protective tariffs, and overseas banks began to collapse. In 1934 Pres. FRANKLIN D. ROOSEVELT signed the Trade Agreements Act, which reduced such tariffs.

Smrti \'smri-tē, 'smər-tē\ Class of Hindu sacred literature that is based on human memory, as distinct from the VEDAS, which are considered to be divinely revealed. Smrti serves to elaborate, interpret, and codify Vedic literature. It is considered less authoritative than Vedic literature but tends to be more widely known. The term has come to refer particularly to texts pertaining to law and social conduct, including the *Kalpa-sutra*s, the PURANAS, the BHAGAVADGITA, the RAMAYANA, and the MAHABHARATA.

smuggling Act of importing and exporting secretly and illegally to avoid paying duties or to evade enforcement of laws (e.g., drug- or firearms-control laws). Smuggling is probably as old as the first tax or regulation on trade. Two main methods exist: the undetected running of cargoes across frontiers, and the concealment of goods in unlikely places on ships or cars, in baggage or cargo, or on the person.

smut Disease of CEREALS, CORN, GRASSES, ONION, and SORGHUM, caused by many species of fungi (see FUNGUS). SPORES accumulate in sootlike masses (sori) that form within blisters in seeds, leaves, stems, flower parts, and bulbs. The sori usually break up into a black powder that is readily dispersed by wind. Many smut fungi enter embryos or seedling plants, develop throughout the plant, and appear externally only as the plants near maturity. Other smuts are localized, infecting actively growing tissues. Control includes growing resistant varieties in noninfested soil, treating seeds with fungicide, using disease-free transplants, and destroying infected plants or plant parts before the spores are released.

Smuts \'smu̇ts**, Jan (Christian)** (b. May 24, 1870, Bovenplaats, near Riebeeck West, Cape Colony—d. Sept. 11, 1950, Irene, near Pretoria, S.Af.) South African statesman, soldier, and prime minister (1919–24, 1939–48). An AFRIKANER, Smuts studied law at Cambridge University. Returning to South Africa, he was appointed state attorney in Pretoria by Pres. PAUL KRUGER in 1897. He fought the British in the SOUTH AFRICAN WAR and joined with LOUIS BOTHA to oppose ALFRED MILNER's implementation of the peace terms. By 1905 Smuts was reconciled to British control and sought to keep South Africa within the Commonwealth. In World War I he joined again with Botha to suppress rebellion, conquer South West Africa, and launch a campaign in East Africa. He attended the Versailles peace conference and helped promote the LEAGUE OF NATIONS. When Botha died, Smuts became prime minister. He was defeated in 1924 by a NATIONAL PARTY coalition. In 1933 he helped J.B.M. HERTZOG force out the extreme nationalists, and in 1939 he replaced Hertzog as prime minister. Under his leadership South Africa helped prevent Germany and Italy from conquering North Africa. In 1948 he was defeated by DANIEL F. MALAN's Nationalists. He ended his life as chancellor of Cambridge University.

Smyrna See İZMIR

Smyth, Dame Ethel (Mary) (b. April 22, 1858, London, Eng.—d. May 9, 1944, Woking, Surrey) British composer. Born into a military family, she studied at the Leipzig Conservatory and was encouraged by JOHANNES BRAHMS and ANTONÍN DVOŘÁK. She first gained notice with her sweeping *Mass in D* (1893). Her best-known work is *The Wreckers* (1906), the most admired English opera of its time. Her *March of the Women* (1911) reflected her strong involvement in the WOMAN SUFFRAGE movement. Her comic opera *The Boatswain's Mate* (1916) enjoyed considerable success. Her work is notably eclectic, ranging from conventional to experimental. She wrote a multivolume autobiography, *Impressions That Remained* (1919–40).

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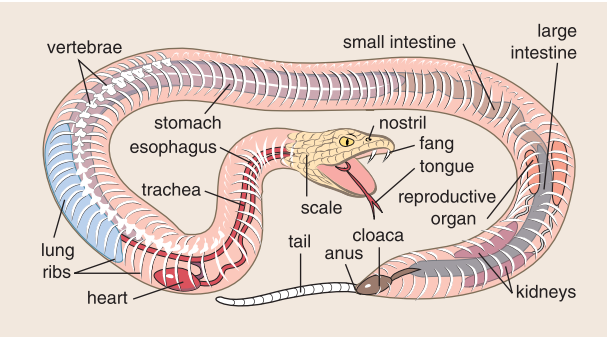
Smythe \'smīth**, Conn** *in full* **Constantine Falkland Cary Smythe** (b. Feb. 1, 1895, Toronto, Ont., Can.—d. Nov. 18, 1980, Caledon, Ont.) Canadian ice-hockey player, coach, and executive. He founded the Toronto Maple Leafs in 1927 and made them into a leading hockey club. In 1928 he coached the Canadian hockey team to an Olympic gold medal. Since 1965 the Conn Smythe Trophy has been given annually to the best player in the STANLEY CUP play-offs.

snail Any species of GASTROPOD that glides along on a broad tapered foot and has a high coiled shell into which it can withdraw. Snails are found in the ocean, in fresh waters, and on land. Most marine snails have gills in the mantle cavity (see MOLLUSK). Most land and freshwater snails have no gills; they use the mantle cavity itself as a lung. Snails may be either scavengers (of dead plant or animal matter) or predators. Some species are used as food, and the shells of some are used as ornaments. See also LIMPET, PERIWINKLE, SLUG, WHELK.

snail darter Rare species (*Percina tanasi*) of DARTER that originally was found only in the Little Tennessee River in the southeastern U.S. It became the subject of a legal controversy in 1978, when its status as an endangered species delayed for two years the construction of Tellico Dam. The situation was resolved when the fish was successfully introduced into the Hiwassee River.

snake Any member of about 19 REPTILE families (suborder Serpentes, order Squamata) that has no limbs, voice, external ears, or eyelids, only one functional lung, and a long, slender body. About 2,900 snake species are known to exist, most living in the tropics. Their skin is covered with scales. They have good eyesight, and they continually taste the surrounding air with their tongues. Though they lack any voice, they are capable of hissing. Most live on the ground, but some are arboreal or aquatic, and some are burrowers. They move by muscular contraction, aided by elongated scales on their abdomen. They focus 70% of their mostly solitary existence on tracking, capturing, and digesting their living prey. The construction of their jaws and bodies enables them to swallow large prey whole. Because they are ectotherms (cold-blooded), a single meal can often sustain them for weeks. Mating and laying eggs or bearing live young are brief seasonal activities. About one-tenth of snake species are venomous; some can kill humans with their bite. Others kill their prey by constriction or simply ingesting. Species range from less than 5 in. (12 cm) to over 30 ft (9 m) long. Snakes grow continuously throughout their lives, shedding their outgrown skin at each growth increment. They are found worldwide, but few species are found on islands or in regions with long winters.



Internal and external features of a snake.
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Snake River River, northwestern U.S. It is the largest tributary of the COLUMBIA RIVER and one of the most important streams in the Pacific Northwest. It rises in the mountains of YELLOWSTONE NATIONAL PARK in Wyoming and flows south and west through Idaho, turning north at the Oregon border to enter the Columbia in southeastern Washington after a course of 1,040 mi (1,670 km). The lower Snake flows through HELLS CANYON, the deepest river gorge in North America. See photograph above.

snakebird See ANHINGA

snakebite Wound from the bite of a SNAKE, especially a venomous one. Nonvenomous snakes leave skin tears that may be treated like scratches. A person bitten by a venomous snake needs medical care as soon as possible. Antivenin must be specific to the type of VENOM, so the snake should be identified or accurately described. Different kinds of venom break down red blood cells or attack the nervous system, causing PARALYSIS. Local tissue destruction may lead to GANGRENE. First aid for snakebite seeks to keep the venom from spreading to the rest of the body. The bitten limb should be kept still below heart level with a broad, firm (not tight) bandage around it above the bite. Exertion and excitement should be avoided. Cutting, suction, tourniquets, and applying ice are not advised.

The lower Snake River in Hells Canyon National Recreation Area, between Oregon and Idaho.
GREG VAUGHN/TOM STACK & ASSOCIATES

snapdragon family Family Scrophulariaceae, containing about 4,000 species of flowering plants in 190 genera, found worldwide. The family is notable for its many ornamental garden plants, including snapdragon (*Antirrhinum* species) and FOXGLOVE. *Antirrhinum* contains about 40 species native to western North America and the western Mediterranean. Other members of the family, including BUTTER-AND-EGGS, are wildflowers. Flowers of the family are tubular and bilaterally symmetrical (two-lipped).

snapper Any of about 250 species of valuable food fishes (family Lutjanidae), found throughout the tropics. These active schooling fishes have slender bodies, large mouths, sharp canine teeth, and blunt or forked tails. Many species grow to 2–3 ft (60–90 cm) long. Snappers eat crustaceans and other fishes. Some species, such as the Atlantic dog snapper, contain a toxin. The red snapper, a bright red fish, inhabits deep Atlantic waters. The emperor snapper is a red-and-white Indo-Pacific fish. The Atlantic yellowtail snapper has a broad yellow stripe from the nose to the wholly yellow tail.

Red spot snapper (*Lethrinus variegatus*)
DOUGLAS FAULKNER

snapping turtle Either of two species (family Chelydridae) of edible, omnivorous, freshwater TURTLES found in North and Central America. They are tan to black and have a rough upper shell, a small cross-shaped lower shell, a long tail, and a large head with hooked jaws. Known for their fierceness, they lunge at aggressors and prey and bite them with their powerful jaws. The common snapping turtle (*Chelydra serpentina*) has a shell 8–12 in. (20–30 cm) long and weighs 10–35 lbs (4.5–16 kg). The alligator snapping turtle (*Macroclemys temmincki*), the largest freshwater turtle in the U.S., has a shell 16–28 in. (40–70 cm) long and weighs 40–155 lbs (18–70 kg). It lies quietly on the bottom of slow moving bodies of water, luring fishes by means of a wormlike appendage on the floor of its open mouth.

Snapping turtle (*Chelydra serpentina*)
WALTER DAWN

Snead, Sam(uel Jackson) (b. May 27, 1912, near Hot Springs, Va., U.S.—d. May 23, 2002, Hot Springs) U.S. golfer. Snead reportedly never took a golf lesson. Known for his straw hat and his flowing, powerful swing, "Slammin' Sam" won the PGA Championship (1942, 1949, 1951), the British Open (1946), and the Masters (1949, 1952, 1954) and was a member of the U.S. RYDER CUP team (eight times—including 1969, when

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he captained the squad but did not play). Snead won more PGA tournaments (82) than any other player in history, and his total number of world tournament wins is estimated at 135.

Snell's law Relationship between the path taken by a ray of light as it moves from one medium to another and the refractive indices of the two media. Discovered in 1621 by Willebrord Snell (1580–1626), the law went unpublished until its mention by CHRISTIAAN HUYGENS. If n_1 and n_2 represent the indices of refraction of two media, and θ_1 and θ_2 are the angles of incidence and REFRACTION that a ray of light makes with the line perpendicular to the boundary (the normal), Snell's law states that $n_1/n_2 = \sin \theta_2/\sin \theta_1$. Because the ratio n_1/n_2 is a constant for any given wavelength of light, the ratio of the two sines is also a constant for any angle.

snipe Any of about 20 species of birds (family Scolopacidae) that frequent wet meadows and marshes in temperate and warm regions worldwide. They are short-legged and chunky, with brown, black, and white stripes and bars. The wings are pointed and angular. The long, flexible bill is used to probe mud for worms. The common snipe (*Gallinago gallinago*) is about 12 in. (30 cm) long, including the bill.

Common snipe (*Gallinago gallinago*).
INGMAR HOLMASEN

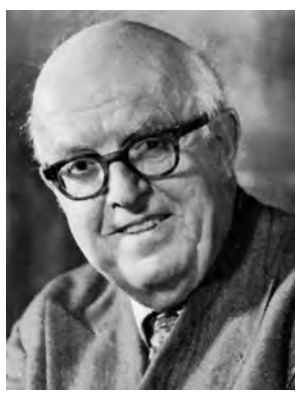
snook Any of about eight species (genus *Centropomus*) of tropical marine fishes that are long and silvery and have two dorsal fins, a long head, and a large mouth with a projecting lower jaw. They are found along the North and South American Atlantic and Pacific coasts, often in estuaries and among mangroves and sometimes in fresh water. They range from 1.5 to 5 ft (0.5–1.5 m) long and are valued for food and sport.

snooker Variation of English BILLIARDS. It is played with 15 red balls and 6 variously coloured balls. Snooker arose, probably in India, as a game for soldiers in the 1870s. Players try to pocket first the red and then the nonred balls, scoring one point for each red ball and the number value of the others. "Snooker" refers to the position of the cue ball when it cannot hit a required ball.

Snorri Sturluson \'snōr-ē-'stu̇r-lu̇-sən\ (b. 1179, Iceland—d. Sept. 22, 1241, Reykjaholt) Icelandic poet, historian, and chieftain. Of an influential family, Snorri became the "lawspeaker," or president, of the Icelandic high court and a vassal of King HAAKON IV of Norway. He was the author of the *Prose* EDDA and the *Heimskringla*, a history of Norwegian kings. His writings are remarkable for their scope and formal assurance; his genius lay in his power to present all that he perceived as a historian with the immediacy of drama. His relations with Haakon deteriorated, and he was assassinated on the king's order.

snout beetle See WEEVIL

snow Solid form of water that crystallizes in the atmosphere and falls to the Earth, covering about 23% of the Earth's surface either permanently or temporarily. Snowflakes are formed by crystals of ice that generally have a hexagonal pattern. Snow cover has a significant effect on climate and on plant, animal, and human life. By increasing the reflection of solar radiation and interfering with the conduction of heat from the ground, it induces a cold climate. The low heat conduction protects small plants from the effects of the lowest winter temperatures; on the other hand, late disappearance of snow in the spring delays the growth of plants.



C.P. Snow
CAMERA PRESS—PICTORIAL PARADE/EB INC.

Snow, C(harles) P(ercy) *later* **Baron Snow (of the City of Leicester)** (b. Oct. 15, 1905, Leicester, Leicestershire, Eng.—d. July 1, 1980, London) British novelist, scientist, and government administrator. Snow was a molecular physicist at the University of Cambridge for some 20 years and served as a scientific adviser to the British government. His 11-novel sequence *Strangers and Brothers* (1940–70), which analyzes bureaucratic man and the corrupting influence of power, includes *The Masters* (1951), *The New Men* (1954), and *Corridors of Power* (1964). *The Two Cultures and the Scientific Revolution* (1959) and later nonfiction works deal with the cultural separation between practitioners of science and literature.

snow leopard *or* **ounce** Endangered species (*Uncia uncia*;) of nocturnal long-haired CAT that inhabits the high mountains of Central Asia and India. It is about 6 ft (1.8 m) long, including the 3-ft (1-m) tail, stands about 2 ft (0.5 m) tall, and weighs 60–120 lb (27–55 kg). Its dense, soft coat, consisting of an insulating undercoat and outer coat of 2-in. (5-cm) hairs, is pale grayish with dark rosettes and a dark streak along the spine. The whitish fur of the underparts may be 4 in. (10 cm) long. It preys on marmots, wild sheep and goats, birds, and other animals. It is hunted principally for the market in goods used in Asian traditional medicine.

snowberry Any of about 18 species of low shrubs that belong to the genus *Symphoricarpos* of the HONEYSUCKLE FAMILY. All are native to North America, except for one species in central China. All have bell-shaped, pinkish or white flowers and snow-white berries. The best-known ornamental species are *S. albus*, a shrub 3 ft (1 m) high, with delicate stems, oval leaves, and large, pulpy, white berries, and *S. rivularis*, slightly larger, with elliptical leaves and a profusion of berries. Creeping snowberry is a plant of the genus *Gaultheria* (HEATH FAMILY).

Snowberry (*Symphoricarpos rivularis*)
SVEN SAMELIUS

snowboarding Sport of sliding downhill over snow on a snowboard, a wide ski ridden in a surfing position. Derived from SURFING and influenced also by SKATEBOARDING as well as skiing, snowboarding began to burgeon among young people in the U.S. in the mid-1980s. The first Olympic snowboarding competition was held in the 1998 Winter Games. The two main events are giant slalom (similar to Alpine giant SLALOM) and halfpipe, in which riders use a large, snow-covered trench (halfpipe) to repeatedly launch themselves into the air and perform various acrobatic feats.

Snowden (of Ickornshaw), Philip Snowden, Viscount (b. July 18, 1864, Ickornshaw, Yorkshire, Eng.—d. May 15, 1937, Tilford, Surrey) British politician. From 1893 he was a lecturer and writer for the socialist Independent Labour Party (ILP), then became its leader (1903–06). In the House of Commons (1906–18, 1922–31), he excelled in debates on social and economic questions. He served as chancellor of the Exchequer in JAMES RAMSAY MACDONALD's governments (1924, 1929–31) and in 1931 secured Britain's abandonment of the gold standard.

Snowdonia National Park Park, northern Wales. Established in 1951, it has an area of 838 sq mi (2,171 sq km). It is best known for its mountains, composed largely of volcanic rock and cut by valleys that show the influence of Ice Age glaciers. Mount Snowdon, 3,560 ft (1,085 m) high, is the highest peak in England and Wales.

snowdrop Any of about 12 species and many variations of white-flowered, spring-blooming, bulbous Eurasian plants that make up the genus *Galanthus* of the AMARYLLIS FAMILY. Several species, including common snowdrop (*G. nivalis*) and giant snowdrop (*G. elwesii*), are cultivated as ornamentals for their nodding, sometimes fragrant flowers. They are among the earliest garden flowers to blossom in the spring. Similarly named but very different, the snowdrop tree, or silver bells (*Halesia carolina*, family Styracaceae), is a tall tree with clustered, bell-shaped

Snowdrop (*Galanthus*)
DEREK FELL

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flowers that grows in the southern U.S. The snowdrop bush (*Styrax officinalis*) of eastern Europe and Asia Minor, also unrelated, grows to about 18 ft (6 m).

snowshoe hare *or* **snowshoe rabbit** *or* **varying hare** Northern North American species (*Lepus americanus*) of HARE that undergoes an annual colour change from brownish or grayish in summer to pure white in winter. The hind feet are heavily furred, and all four feet are large in proportion to body size, a snowshoe-like adaptation that enables the hare to travel over snow.

snowy egret White New World EGRET (*Egretta thula*; family Ardeidae). It is about 24 in. (60 cm) long and has filmy recurved plumes on the back and head. Formerly hunted for its plumes, it ranges from the U.S. to Chile and Argentina.

snowy owl White or barred brown-and-white typical OWL (*Nyctea scandiaca*, family Strigidae) of the Arctic tundra, sometimes found in Europe, Asia, and North America. Snowy owls are about 2 ft (60 cm) long and have broad wings and a round head without ear tufts. They are diurnal and eat small mammals, such as hares and lemmings, and birds. They nest on the ground in the open.

Snowy owl (*Nyctea scandiaca*)
W. SUSCHITZKY

Snyder, Gary (Sherman) (b. May 8, 1930, San Francisco, Calif., U.S.) U.S. poet. Snyder worked as a forest ranger, logger, and seaman and studied Zen Buddhism in Japan (1958–66). His poetry, early identified with the BEAT MOVEMENT, is rooted in ancient, natural, and mythic experience. It initially contained images drawn from his outdoor work in the Pacific Northwest and later reflected his interest in Eastern philosophies. His volumes include *Turtle Island* (1974, Pulitzer Prize) and *Mountains and Rivers Without End* (1996). From the late 1960s he has been an important spokesman for communal living and ecological activism.

Soane, Sir John (b. Sept. 10, 1753, Goring, Oxfordshire, Eng.—d. Jan. 20, 1837, London) British architect. He was appointed architect to the Bank of England in 1788. Various government appointments followed, and in 1806 he succeeded his mentor, George Dance (1741–1837), as professor of architecture at the Royal Academy. His work is characterized by a tendency to reduce Classical elements to their structural essentials, to use linear instead of modeled ornamentation, to favour shallow domes and top lighting, and to handle interior spaces in an ingenious manner.

soap Any of a group of organic compounds that are SALTS of FATTY ACIDS, usually stearic acid (with 18 carbon atoms) or palmitic acid (with 16 carbon atoms). The source may be any vegetable oil or animal fat. Soaps are emulsifying agents commonly used for cleaning; they have long been made from LYE and FAT. DETERGENTS are entirely synthetic and may or may not be soaps. Soaps of METALS heavier than sodium are not very soluble; the curdy precipitate made by soap in HARD WATER is the calcium or magnesium salt of the fatty acid in the soap. Heavy-metal soaps are used in lubricating greases, as gel thickeners, and in paints. NAPALM is an aluminum soap.

soap opera Broadcast serial drama, characterized by a permanent cast of actors, a continuing story, tangled interpersonal situations, and a melodramatic or sentimental style. Its name derived from the soap and detergent manufacturers who originally often sponsored such programs on radio. Soap operas began in the early 1930s as 15-minute radio episodes and continued on television from the early 1950s as 30-minute and later hour-long episodes. Usually broadcast during the day and aimed at housewives, they initially focused on middle-class family life, but by the 1970s their content had expanded to include a wider variety of characters and situations and a greater degree of sexual explicitness. In the 1980s similar series began to be aired in prime-time evening hours (e.g., *Dallas* and *Dynasty*). See also CARLTON E. MORSE; IRNA PHILLIPS.

soaring *or* **gliding** Sport of flying a GLIDER or sailplane. The craft is towed behind a powered airplane to an altitude of about 2,000 ft (600 m) and then released. The glider pilot makes use of rising currents of warm air, such as those above a sunlit field, to maintain or gain altitude. Instruments used include the altimeter, airspeed indicator, compass, and turn-and-bank indicator. National soaring contests, which include events for altitude, speed, distance, and accuracy in returning to a starting point, are held annually.

Sobat \'sō-ˌbat\ **River** River, east-central Africa. Formed by the confluence of the Baro and Pibor rivers on the Ethiopian border, it merges with the JABAL RIVER in Sudan to form the White Nile. A major tributary of the NILE RIVER, it is 220 mi (354 km) long.

Sobukwe \sō-'bük-wā**, Robert (Mangaliso)** (b. Dec. 5, 1924, Graaff-Reinet, Cape Colony—d. Feb. 27, 1978, Kimberley, S.Af.) South African black nationalist leader. Sobukwe insisted that South Africa be returned to its indigenous inhabitants ("Africa for the Africans"). Charging the AFRICAN NATIONAL CONGRESS with being contaminated by non-African influences, he founded the Pan-Africanist Congress in 1959 and became a leader in the PAN-AFRICAN MOVEMENT. Arrested in 1960, he spent the rest of his life in prison or under house arrest.

soccer See FOOTBALL

social class See social CLASS

social contract Actual or hypothetical compact between the ruled and their rulers. The original inspiration for the notion may derive from the biblical covenant between God and ABRAHAM, but it is most closely associated with the writings of THOMAS HOBBES, JOHN LOCKE, and JEAN-JACQUES ROUSSEAU. Hobbes argued that the absolute power of the sovereign is justified by a hypothetical social contract in which the people agree to obey him in all matters in return for a guarantee of peace and security, which they lack in the warlike "state of nature" posited to exist before the contract is made. Locke believed that rulers also were obliged to protect private property and the right to freedom of thought, speech, and worship. Rousseau held that in the state of nature people are unwarlike but also undeveloped in reasoning and morality; in surrendering their individual freedom, they acquire political liberty and civil rights within a system of laws based on the "general will" of the governed. The idea of the social contract influenced the shapers of the AMERICAN REVOLUTION and the FRENCH REVOLUTION and the CONSTITUTIONS that followed them.

Social Credit Party Canadian political party. Founded in 1935 by WILLIAM ABERHART, it was based on the social-credit theory of the British economist Clifford Douglas (1879–1952). By the late 1930s the party advocated employee profit sharing and shareholding. It led the provincial governments in Alberta (1935–71) and British Columbia (1952–71, 1976–1991), and it won several seats in the parliament in Ottawa between 1935 and 1980. The party suffered from internal conflicts, and at the end of the 20th century it had failed to win seats in any provincial assembly.

social Darwinism Theory that persons, groups, and "races" are subject to the same laws of NATURAL SELECTION as CHARLES DARWIN had proposed for plants and animals in nature. Social Darwinists, such as HERBERT SPENCER and WALTER BAGEHOT in England and William Graham Sumner in the U.S., held that the life of humans in society was a struggle for existence ruled by "survival of the fittest," in Spencer's words. Wealth was said to be a sign of natural superiority, its absence a sign of unfitness. The theory was used from the late 19th century to support LAISSEZ-FAIRE capitalism and political conservatism. Social Darwinism declined as scientific knowledge expanded.

social democracy Political ideology that advocates a peaceful, evolutionary transition of society from CAPITALISM to SOCIALISM, using established political processes. It rejects MARXISM's advocacy of social revolution. Social democracy began as a political movement in Germany in the 1870s. EDUARD BERNSTEIN argued (1899) that capitalism was overcoming many of the weaknesses KARL MARX had seen in it (including unemployment and overproduction) and that universal suffrage would lead peacefully to a socialist government. After 1945, social-democratic governments came to power in West Germany (see SOCIAL DEMOCRATIC PARTY), Sweden, and Britain (under the LABOUR PARTY). Social-democratic thought gradually came to regard state regulation (without state ownership) as sufficient to ensure economic growth and a fair distribution of income.

Social Democratic Party of Germany (SPD) German political party. Formed in 1875 as the Socialist Workers' Party and renamed in 1890, it is Germany's oldest and largest single party. Its influence grew

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until World War I, when centrists led by KARL KAUTSKY formed the Independent Social Democrats and leftists led by ROSA LUXEMBURG and KARL LIEBKNECHT formed the SPARTACISTS. The SPD's right wing under FRIEDRICH EBERT helped crush the Soviet-style uprisings in Germany in 1918, and the party won 37% of the vote in the 1919 elections. The government's acceptance of the Treaty of VERSAILLES and Germany's severe economic problems caused a drop in support in the 1920s. Outlawed by the Nazis in 1933, the party revived after World War II in West Germany and grew steadily, receiving almost 46% of the vote in the 1972 elections. It formed coalition governments with the CHRISTIAN DEMOCRATIC UNION (1966–69) and the FREE DEMOCRATIC PARTY (1969–82). In 1990 it reunited with a newly independent SPD from the former East Germany. The party returned to power in 1998 under GERHARD SCHRÖDER, who served as chancellor of Germany until 2005.

Social Gospel Religious social-reform movement in the U.S., prominent from c. 1870 to 1920 among liberal Protestant groups. The movement focused on applying moral principles to the improvement of industrialized society and particularly to reforms such as the abolition of child labour, a shorter workweek, and factory regulation. Many of its aims were realized through the rise of organized labour and through legislation of the NEW DEAL.

social history Branch of history that emphasizes social structures and the interaction of different groups in society rather than affairs of state. An outgrowth of economic history, it expanded as a discipline in the 1960s. It initially focused on disenfranchised social groups but later began to focus more attention on the middle and upper classes. As a field, it often borders on economic history on the one hand and on sociology and ethnology on the other.

social insurance Compulsory public-insurance program that protects against various economic risks (e.g., loss of income due to sickness, old age, or unemployment). Social insurance is considered one type of SOCIAL SECURITY, though the two terms are sometimes used interchangeably. The first compulsory national social-insurance programs were established in Germany under OTTO VON BISMARCK: HEALTH INSURANCE in 1883, WORKERS' COMPENSATION in 1884, and old-age and disability PENSIONS in 1889. Austria and Hungary soon followed Germany's example. After 1920, social insurance was rapidly adopted throughout Europe and the Western Hemisphere. The U.S. lagged behind until the passage of the SOCIAL SECURITY ACT in 1935. Social Security in the U.S. now provides retirement benefits, health care for persons over a specific minimum age, and disability insurance. Social-insurance contributions are normally compulsory and may be made by the insured person's employer and the state as well as by the individual. Social insurance is usually self-financing, with contributions being placed in specific funds for that purpose. See also UNEMPLOYMENT INSURANCE; WELFARE.

social learning In psychological theory, a change in behaviour that is controlled by environmental influences rather than by innate or internal forces. In zoology, social learning is exhibited by innumerable species of birds and mammals, who modify their behaviour by observing and imitating the adults around them. BIRDSONG is a socially learned behaviour.

social psychology Branch of PSYCHOLOGY concerned with the PERSONALITY, ATTITUDES, MOTIVATIONS, and behaviour of the individual or group in the context of social interaction. The field emerged in the U.S. in the 1920s. Topics include the attribution of SOCIAL STATUS based on perceptual cues, the influence of social factors (such as peers) on a person's attitudes and beliefs, the functioning of small groups and large organizations, and the dynamics of face-to-face interactions.

Social Realism Trend in U.S. art, originating c. 1930, toward treating themes of social protest—poverty, political corruption, labour-management conflict—in a naturalistic manner. The movement was stimulated in part by the ASH CAN SCHOOL, the GREAT DEPRESSION, and the NEW DEAL's arts patronage programs, including the WPA FEDERAL ART PROJECT. Works in this vein include BEN SHAHN's *Passion of Sacco and Vanzetti* (1931–32) and William Gropper's *The Senate* (1935).

social science Any discipline or branch of science that deals with the sociocultural aspects of human behaviour. The social sciences generally include CULTURAL ANTHROPOLOGY, ECONOMICS, POLITICAL SCIENCE, SOCIOLOGY, CRIMINOLOGY, and SOCIAL PSYCHOLOGY. Comparative law and comparative religion (the comparative study of the legal systems and religions of different nations and cultures) are also sometimes regarded as social sciences.

social security Public provision for the economic security and social welfare of all individuals and their families, especially in the case of income losses due to unemployment, work injury, maternity, sickness, old age, and death. The term encompasses not only SOCIAL INSURANCE but also health and welfare services and various income maintenance programs designed to improve the recipient's welfare through public services. Some of the first organized cooperative efforts to provide for the economic security of individuals were instituted by workingmen's associations, mutual-benefit societies, and LABOUR UNIONS; social security was not widely established by law until the 19th and 20th centuries, with the first modern program appearing in Germany in 1883. Almost all developed nations now have social security programs that provide benefits or services through several major approaches such as social insurance and social assistance, a needs-based program that pays benefits only to the poor. See also SOCIAL SECURITY ACT; UNEMPLOYMENT INSURANCE; WELFARE; WORKERS' COMPENSATION.

Social Security Act (Aug. 14, 1935) Legislation that established a national old-age pension system in the U.S. Dissatisfied with the government response to the GREAT DEPRESSION, about five million people joined "Townsend clubs" to support the plan of Francis E. Townsend (1867–1960) to demand a $200 monthly pension for everyone over the age of 60. Pres. FRANKLIN D. ROOSEVELT established a committee on economic security (1934), which recommended legislative action to the U.S. Congress. The act provided old-age benefits to be financed by a payroll tax on employers and employees. The system was later expanded to include dependents, the disabled, and others.

social settlement See SETTLEMENT HOUSE

social status Relative rank that an individual holds, with attendant rights, duties, and lifestyle, in a social hierarchy based on honour and prestige. Status is often ascribed on the basis of sex, age, family relationships, and birth, placing one into a particular social group irrespective of ability or accomplishments. Achieved status, on the other hand, is based on educational attainment, occupational choice, marital status, and other factors involving personal effort. Status groups differ from social CLASSES in being based on considerations of honour and prestige rather than purely economic position. Relative status is a major determinant of people's behaviour toward one another, and competition for status seems to be a prime human motivator.

Social War *or* **Italic War** *or* **Marsic War** (90–89 BC) Rebellion waged by ancient Rome's Italian allies (Latin, *socii*). The allies in central and southern Italy had aided Rome in its wars, but they were denied the privileges of Roman citizenship. The people of central Italy's hills—the Marsi in the north and the Samnites in the south—organized a confederacy and began an uprising for independence, winning victories over Roman armies in the north and south. After Rome granted citizenship to those who had not revolted and those who would immediately lay down their arms, Italian interest in the struggle declined. SULLA defeated the weakened rebels in the south, and legislation was passed to unify Italy south of the Po River.

social welfare See WELFARE

social work Any of various professional activities or methods concerned with providing social services (such as investigatory and treatment services or material aid) to disadvantaged, distressed, or vulnerable persons or groups. The field originated in the charity organizations in Europe and the U.S. in the late 19th century. The training of volunteer workers by these organizations led directly to the founding of the first schools of social work and indirectly to increased government responsibility for the welfare of the disadvantaged. Social workers may serve the needs of children and families, the poor or homeless, immigrants, veterans, the mentally ill, the handicapped, victims of rape or domestic violence, and persons dependent on alcohol or drugs. See also WELFARE.

socialism System of social organization in which private property and the distribution of income are subject to social control; also, the political movements aimed at putting that system into practice. Because "social control" may be interpreted in widely diverging ways, socialism ranges from statist to libertarian, from Marxist to liberal. The term was first used to describe the doctrines of CHARLES FOURIER, HENRI DE SAINT-SIMON, and ROBERT OWEN, who emphasized noncoercive communities of people working noncompetitively for the spiritual and physical well-being of all (see UTOPIAN SOCIALISM). KARL MARX and FRIEDRICH ENGELS, seeing socialism as a tran-

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sition state between CAPITALISM and COMMUNISM, appropriated what they found useful in socialist movements to develop their "scientific socialism." In the 20th century, the Soviet Union was the principal model of strictly centralized socialism, while Sweden and Denmark were well-known for their noncommunist socialism. See also COLLECTIVISM, COMMUNITARIANISM, SOCIAL DEMOCRACY.

Socialist International See SECOND INTERNATIONAL

Socialist Realism Officially sanctioned theory and method of artistic and literary composition in the Soviet Union from 1932 to the mid-1980s. Following the tradition of 19th-century Russian REALISM, Socialist Realism purported to serve as an objective mirror of life. Instead of critiquing society, however, it took as its primary theme the struggle to build socialism and a classless society and called for the didactic use of art to develop social consciousness. Artists were expected to take a positive view of socialist society and to keep in mind its historical relevance, requisites that seldom coincided with their real experiences and frequently undermined the artistic credibility of their works.

Socialist Revolutionary Party (SR) Russian political party. The ideological heir to the 19th-century NARODNIKS (Populists), it was founded in 1901 by agrarian socialists and appealed mainly to the peasantry. It was the principal alternative to the RUSSIAN SOCIAL-DEMOCRATIC WORKERS' PARTY in the early 20th century. It relied on terrorist tactics and carried out hundreds of political assassinations. By 1917 it was Russia's largest socialist group; its members included ALEKSANDR KERENSKY, VIKTOR CHERNOV, and CATHERINE BRESHKOVSKY. The party split after the RUSSIAN REVOLUTION OF 1917, and its radical wing joined the BOLSHEVIK government. It was suppressed by VLADIMIR LENIN after the RUSSIAN CIVIL WAR.

Société Générale \sȯs-ye-'tā-zhā-nā-'ral\ Major French commercial bank, with headquarters in Paris. It was established in 1864 to offer banking and investment services, and was nationalized in 1946 along with several other large French banks. With subsidiaries and branches throughout the world, Société Générale provides general banking, investment advising, securities underwriting, foreign-currency exchange, and computer services.

Society Islands Archipelago (pop., 1996: 189,522), western FRENCH POLYNESIA. Its chief island is TAHITI. The Society Islands comprise two groups, the Windward Islands and the Leeward Islands. They are volcanic in origin and mountainous. Claimed for Britain in 1767, the islands were visited in 1769 by Capt. JAMES COOK with a scientific expedition of the Royal Society (hence their name). They were claimed by France in 1768 and became a French protectorate in 1842, a French colony in 1881, and a part of French Oceania in 1903. Their chief products are copra and pearls.

sociobiology Systematic study of the biological basis of social behaviour. The concept was popularized by EDWARD O. WILSON in his *Sociobiology* (1975) and by Richard Dawkins (b. 1941) in *The Selfish Gene* (1976). Sociobiology attempts to understand and explain animal (and human) social behaviour in the light of NATURAL SELECTION and other biological processes. A central tenet is that the transmission of GENES through successful reproduction is the central motivator in animals' struggle for survival, and that animals will behave in ways that maximize their chances of transmitting their genes to succeeding generations. Though sociobiology has contributed insights into animal behaviour (such as altruism in social insects and male-female differences in certain species), it remains controversial when applied to human social behaviour. See also ETHOLOGY.

sociocultural evolution Development of culture and society from simple to complex forms. Europeans had sought to explain the existence of various "primitive" societies, some believing that such societies represented the lost tribes of Israel, others speculating that primitive peoples had degenerated since the time of Adam from an originally "barbarous" to an even lowlier "savage" state. European society was taken to epitomize the highest state of existence, "civilization." In the late 19th century, EDWARD BURNETT TYLOR and LEWIS HENRY MORGAN elaborated the theory of unilinear evolution, specifying criteria for categorizing cultures according to their standing within a fixed system of growth of humanity as a whole and examining the modes and mechanisms of this growth. A widespread reaction followed; FRANZ BOAS introduced the "culture history" approach, which concentrated on fieldwork among native peoples to identify actual cultural and historical processes rather than speculative stages of growth. Leslie White, Julian Steward, and others sought to revive aspects of sociocultural evolutionism, positing a progression ranging from BANDS and TRIBES at one end to CHIEFDOMS and STATES at the other. More recently some anthropologists have adopted a general systems approach, examining cultures as emergent systems. Others continue to reject evolutionary thinking and look instead at historical contingencies, contacts with other cultures, and the operation of cultural SYMBOL systems. See also SOCIAL DARWINISM.

sociolinguistics Study of the sociological aspects of language. Sociolinguists attempt to isolate the linguistic features used in particular situations that mark the various social relationships among the participants and the significant elements of the situation. Factors influencing the choice of sounds, grammatical elements, and vocabulary may include age, gender, education, ethnic identity, occupation, and peer-group identification. See also INTERACTIONISM, LINGUISTICS, PRAGMATICS, SEMIOTICS.

sociology Science of society, social institutions, and social relationships, and specifically the systematic study of the development, structure, interaction, and collective behaviour of organized human groups. It emerged at the end of the 19th century through the work of ÉMILE DURKHEIM in France, MAX WEBER and GEORG SIMMEL in Germany, and ROBERT E. PARK and Albion Small in the U.S. Sociologists use observational techniques, surveys and interviews, statistical analysis, controlled experiments, and other methods to study subjects such as the FAMILY, ethnic relations, schooling, SOCIAL STATUS and CLASS, BUREAUCRACY, religious movements, deviance, the elderly, and social change.

sockeye salmon *or* **red salmon** Food fish (*Oncorhynchus nerka*) of the North Pacific that constitutes almost 20% of the commercial fishery of Pacific SALMON. It weighs about 6 lbs (3 kg) and lacks distinct spots on the body. It ranges from the northern Bering Sea to Japan and from Alaska to California. Sockeyes may migrate more than 1,000 miles (1,600 km) upriver to spawn in lakes or tributary streams. The young remain in freshwater one to five years. The kokanee is a small, nonmigratory, freshwater subspecies.

Male sockeye salmon (*Oncorhynchus nerka*) in spawning phase
JEFF FOOTT—BRUCE COLEMAN INC.

Socotra \sə-'kō-trə\ Island, Yemen, in the Indian Ocean. Located about 210 mi (340 km) southeast of the ARABIAN PENINSULA, it has an area of about 1,400 sq mi (3,600 sq km). Its interior is mountainous, with flora that includes myrrh, frankincense, and the dragon's blood tree. The island, mentioned in various legends, was long ruled by the Mahra sultans of southeastern Yemen, except for a brief Portuguese occupation (1507–11). In 1886 it came under British control and in 1967 became part of independent Yemen. Its chief town is Hadīboh.

Socrates (b. c. 470, Athens—d. 399 BC, Athens) Greek philosopher whose way of life, character, and thought exerted a profound influence on ancient and modern philosophy. Because he wrote nothing, information about his personality and doctrine is derived chiefly from depictions of his conversations and other information in the dialogues of PLATO, in the *Memorabilia* of XENOPHON, and in various writings of ARISTOTLE. He fought bravely in the PELOPONNESIAN WAR and later served in the Athenian *boule* (assembly). Socrates considered it his religious duty to call his fellow citizens to the examined life by engaging them in philosophical conversation. His contribution to these exchanges typically consisted of a series of probing questions that cumulatively revealed his interlocutor's complete ignorance of the subject under discussion; such cross-examination used as a pedagogical technique has been called the "Socratic method." Though Socrates characteristically professed his own ignorance regarding many of the (mainly ethical) subjects he investigated (e.g., the nature of piety), he did hold certain convictions with confidence, including that: (1) human wisdom begins with the recognition of one's own ignorance; (2) the unexamined life is not worth living; (3) ethical virtue is the only thing that matters; and (4) a good person can never be harmed, because whatever misfortune he may suffer, his virtue will remain intact. His students and admirers included, in addition to Plato, ALCIBIADES, who betrayed Athens in the Peloponnesian War, and Critias (c. 480–403 BC), who was one of the THIRTY TYRANTS imposed on Athens after its defeat by Sparta. Because he was connected with these two men, but also because his habit of exposing the

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ignorance of his fellow citizens had made him widely hated and feared, Socrates was tried on charges of impiety and corrupting the youth and condemned to death by poisoning (the poison probably being HEMLOCK) in 399 BC; he submitted to the sentence willingly. Plato's *Apology* purports to be the speech that Socrates gave in his own defense. As depicted in the *Apology*, Socrates' trial and death raise vital questions about the nature of democracy, the value of free speech, and the potential conflict between moral and religious obligation and the laws of the state.

soda, caustic See CAUSTIC SODA

Soddy, Frederick (b. Sept. 2, 1877, Eastbourne, Sussex, Eng.—d. Sept. 22, 1956, Brighton, Sussex) British chemist. He worked with ERNEST RUTHERFORD to develop a theory of the disintegration of radioactive elements. In 1912 he was among the first to conclude that elements might exist in forms (isotopes) of different ATOMIC WEIGHTS but indistinguishable chemically. In *Science and Life* (1920) he pointed out the value of isotopes in determining geologic age (see CARBON-14 DATING). For his investigations of radioactivity and isotopes, he received a 1921 Nobel Prize.

sodium Chemical ELEMENT, one of the ALKALI METALS, chemical symbol Na, atomic number 11. A very soft, silvery white METAL, the sixth most abundant element on Earth, it occurs mainly as HALITE, never free. Extremely reactive, it is used as a chemical reagent and raw material, in metallurgy, as a heat exchanger (in NUCLEAR POWER generators and certain types of engines), and in sodium-vapour lamps (see ELECTRIC DISCHARGE LAMP). Sodium is essential for life but rarely deficient in diets; high intake is linked to HYPERTENSION. Sodium in compounds, many of great industrial importance (including BICARBONATE OF SODA, CAUSTIC SODA, sodium NITRATE [Chile SALTPETRE], and SODIUM CHLORIDE), has VALENCE 1. Sodium CARBONATE, one of the four most important basic chemical commodities, is used in making glass, detergents, and cleansers. Sodium hypochlorite, familiar as household BLEACH, is also used to bleach paper pulp and textiles, to chlorinate water, and in some medicines. The SULFATE is used in the KRAFT PROCESS and also used to make paperboard, glass, and detergents. The thiosulfate (hyposulfite, or "hypo") is used to developed photographs.

sodium bicarbonate See BICARBONATE OF SODA

sodium chloride *or* **table salt** Inorganic compound of SODIUM and CHLORINE, a SALT in which IONIC BONDS hold the two components in the familiar white crystals. Salt is essential to health as a source of sodium; blood and all other physiological fluids are dilute salt solutions. One of the most widely employed materials of the chemical industry, it is used in manufacturing CHLORINE, CAUSTIC SODA, sodium CARBONATE, BICARBONATE OF SODA, SOAP, and chlorine BLEACH, as well as in ceramic glazes, metallurgy, food preservation, curing of hides, road de-icing, water softening, photography, and many consumer products, including mineral waters, mouthwashes, and table salt itself. It is mined, extracted from SEAWATER, and obtained from dry salt lakes called pans. See also HALITE.

Sodom and Gomorrah \'sä-dəm...gə-'mȯr-ə\ Legendary cities of ancient Palestine. According to the Old Testament book of Genesis, the notorious cities were destroyed by "brimstone and fire" because of their wickedness. The site of the cities is unknown but may have beeen in an area now beneath the waters of the DEAD SEA. Archaeological evidence shows that the area may once have been fertile and could have drawn the biblical LOT to graze his flock. The cities' legendary wickedness has inspired many writers, including JEAN GIRAUDOUX and NIKOS KAZANTZAKIS.

sodomy Noncoital carnal copulation. Sodomy is a crime in some jurisdictions. Some sodomy laws, particularly in Middle Eastern countries and those jurisdictions observing SHARĪʿAH law, provide penalties as severe as life imprisonment for homosexual intercourse, even if the relations are between legally consenting adults. Other sodomy laws proscribe a variety of other forms of sexual contact and apply even to married couples. No such regulations are found in the law codes of Denmark, France, Italy, Sweden, The Netherlands, or Switzerland, among other countries.The Wolfenden committee in Britain and the American Law Institute recommended abolition of criminal penalties for sodomy, except in cases involving violence, children, or public solicitation. This position was adopted in England in 1967 and has been adopted in many U.S. states as well.

sofer *or* **sopher** \sō-'fer, 'sō-fər\ In JUDAISM, a scholar-teacher of the 5th–2nd centuries BC who transcribed, edited, and interpreted the BIBLE. The first *sofer* was EZRA, who, with his disciples, initiated a tradition of rabbinical scholarship that is still central in Judaism. This tradition of scholarship arose to meet the specific need of applying the idealistic aspirations of the TORAH and oral tradition to everyday life, thus in effect codifying Mosaic law. The *soferim* were important historically for having fixed the canon of the Hebrew scriptures. Later the term *sofer* came to refer to one who taught the Bible to children or who was qualified to write Torah scrolls.

Sofia \'sō-fē-ə, sō-'fē-ə,\ *ancient* **Serdica** City (pop., 2001: 1,096,389), capital of Bulgaria. Established as a Thracian settlement c. 8th century BC, it flourished under the Romans. Plundered by the Huns in the 5th century AD, it was rebuilt under the Byzantine Empire. In 809 it became a Bulgarian town but reverted to Byzantine rule from 1018 to 1185, when the second Bulgarian empire was established. The Turks held it from 1382 until it was liberated by the Russians in 1878. In 1879 it was made the Bulgarian capital. It is the country's principal transportation and cultural centre and the site of many industries. Among its educational institutions is the University of Sofia (1888), Bulgaria's oldest university. Its historical monuments include the 6th-century church of St. Sofia.

soft coal See BITUMINOUS COAL

soft drink Nonalcoholic beverage, usually carbonated, consisting of water (soda water), flavouring, and a sweet syrup or artificial sweetener. Attempts to reproduce the natural effervescence of certain spring waters for presumed health benefits began before 1700. JOSEPH PRIESTLEY's experiments with "fixed air" (carbon dioxide) led in the late 1790s to the successful preparation of carbonated "mineral water" by Jacob Schweppe of Geneva; by the early 1800s it was being bottled and sold commercially. Today there are hundreds of varieties of flavoured soft drinks. Some of the world's largest corporations (including COCA-COLA CO. and PEPSICO) founded their businesses on soft-drink manufacturing.

soft money In the U.S., paper money as contrasted with coins, or hard money; also, unregulated monetary donations to political parties or candidates. In the 19th and early 20th centuries, advocates of soft money favoured governmental deficit spending to stimulate consumption and employment. Fiscal conservatives, who put their trust in hard money, maintained that government should not spend beyond its resources. In the late 20th century, strict regulations governed the source, amount, and use of donations to particular candidates (hard money), but few such laws applied to contributions for the general promotion of a political party's message (soft money). In 2002 the U.S. Congress passed legislation that prohibited soft money contributions to the national political parties and strictly limited such contributions to state and local parties.

softball Game resembling BASEBALL but played on a smaller diamond with a larger ball (12 in. [30.5 cm] in circumference), which is pitched underhand. Since the first standard set of rules was published in the 1920s, the game has been popular as an amateur sport in the U.S., and since the 1960s it has grown considerably in popularity outside of North America. In U.S. high schools and colleges it is a popular women's sport; a women's softball competition was added to the Olympic Games in 1996.

softshell turtle Any of more than 20 species (family Trionychidae) of swift-moving, carnivorous TURTLES found in North American, African, and Asian freshwaters with soft, muddy bottoms. They have a pancakelike, leathery shell; webbed feet; a long neck; and an elongated snout. They often lie buried in mud or sand and occasionally emerge to bask in the sun. Aggressive when captured, they can deliver rapid, vicious bites. The two North American species have a grayish or brown shell, 14–18 in. (35–45 cm) long. Two Old World species grow to 24 in. (60 cm) or more.

Softshell turtle (*Trionyx*)
E.R. DEGGINGER

software Instructions that tell a COMPUTER what to do. Software is the entire set of programs, procedures, and routines associated with the operation of a computer system, including the OPERATING SYSTEM. The term differentiates these features from HARDWARE, the physical components of a computer system. Two main types of software are system software, which controls a computer's internal functioning, and application software, which directs the computer to execute commands that solve practical problems. A third category is network software, which coordinates communication between computers linked in a network. Software is written

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by programmers in any number of PROGRAMMING LANGUAGES. This information, the source code, must then be translated by means of a COMPILER into MACHINE LANGUAGE, which the computer can understand and act on.

softwood Timber obtained from coniferous trees (mainly of the PINE and FIR families). With the exception of BALD CYPRESS, tamarack, and LARCH, softwood trees are EVERGREENS. Softwood is mostly obtained from the Baltic, Scandinavia, and North America and is the source of about 80% of the world's production of timber. The term sometimes imprecisely means all soft and hard woods used as construction wood in temperate regions. Softwoods of longleaf pine, DOUGLAS FIR, and YEW are much harder in the mechanical sense than several HARDWOODS.

Soga family Japanese aristocratic family preeminent in the 7th century and instrumental in introducing Buddhism to Japan. Soga Umako (d. 626) overcame the powerful Mononobe and Nakatomi clans, who supported the native Shintō religion over Buddhism, and contrived to have his niece proclaimed empress, selecting one of his nephews to be her regent (see SHŌTOKU). The next generation alienated other aristocratic families with their high-handed ways, and after many intrigues and assassinations Soga power was crushed in 645 by Prince Nakano Ōe, who was to become the emperor Tenji, aided by Fujiwara Kamatari, founder of the FUJIWARA FAMILY. See also NARA PERIOD.

Sogdiana \ˌsäg-dē-'a-nə\ Ancient country of Central Asia. It was centred in the fertile valley of the Zeravshan River, in present-day UZBEKISTAN. It became a satrapy of the ACHAEMENIAN DYNASTY under DARIUS I in the 6th century BC and was conquered by ALEXANDER THE GREAT in the 4th century. It asserted its independence from the SELEUCID DYNASTY c. 250 BC as part of the kingdom of BACTRIA and fell to invading northern tribes in the 2nd century BC. It prospered as a centre of Islamic civilization, especially under the Sāmānid dynasty (9th–10th centuries AD), until the Mongol invasion of the 13th century. See also BUKHARA.

Sogne Fjord \'sȯŋ-nə\ *or* **Sognefjorden** \'sȯŋ-nə-ˌfyȯr-dən\ Longest and deepest fjord in Norway. It extends 127 mi (204 km) inland from the Norwegian Sea and has a maximum depth of 4,291 ft (1,308 m). The fjord and its branches provide some of the most picturesque scenery in Norway.

soil The biologically active, porous medium that has developed in the uppermost layer of the Earth's crust. Soil serves as a natural reservoir of water and nutrients, as a medium for the filtration and breakdown of injurious wastes, and as a participant in the cycling of carbon and other elements through the global ecosystem. It has evolved through the WEATHERING of solid materials such as consolidated rocks, sediments, glacial tills, volcanic ash, and organic matter. The bulk of soil consists of mineral particles composed of silicate ions combined with various metal ions. Organic soil content consists of undecomposed or partially decomposed biomass as well as humus, an array of organic compounds derived from broken down biomass.

soil mechanics Study of soils and their utilization, especially in planning foundations for structures and highways. How the soil of a given site will support the weight of structures or respond to movement in the course of construction depends on a number of properties (e.g., compressibility, elasticity, and permeability). Examination techniques include trench-digging, boring, and pumping samples to the surface with water. Seismic testing and measurement of electrical resistance also yield helpful information. In road construction, soil mechanics helps determine which type of pavement (rigid or flexible) will last longer. The study of soil characteristics is also used to choose the most suitable method for excavating underground tunnels. See also FOUNDATION, SETTLING.

soil science Scientific discipline that investigates SOILS as primary natural resources at the surface of the Earth. It includes the subdisciplines of PEDOLOGY (study of soil formation and classification), soil biology (study of soil organisms), soil chemistry, and soil physics.

Soka-gakkai \'sō-kä-'gäk-kī\ Lay religious and political group associated with the Buddhist sect Nichiren-sho-shu (see NICHIREN BUDDHISM). The most successful of Japan's new religious movements of the 20th century, it draws on the 13th-century teachings of NICHIREN. Like other movements in Nichiren Buddhism, it takes the LOTUS SUTRA as its chief scripture. Founded in 1930, Soka-gakkai came to prominence in the later 20th century, eventually developing a membership of over 6 million. In 1964 it established the Komeito (Clean Government Party), which by the 1980s was Japan's third-largest political party. It also conducts educational and cultural activities.

Sokhumi *formerly* **Sukhumi** \sù-'kü-mē\ *ancient* **Dioscurias.** Seaport (pop., 1991 est.: 120,000), Republic of Georgia. Located on the BLACK SEA, it was the site of an ancient Greek colony that was later held successively by the Romans, Byzantines, Ottomans, and Russians. It became a popular resort. After Georgia's independence (1991), it was the centre of a rebellion for Abkhazian independence. It is the capital of the autonomous republic of Abkhazia.

Sokolow \'sȯ-kȯ-lȯv**, Anna** (b. Feb. 9, 1910, Hartford, Conn., U.S.—d. March 29, 2000, New York, N.Y.) U.S. modern dancer, choreographer, and teacher. She studied with MARTHA GRAHAM and danced with Graham's company (1930–38). In the early 1930s she also formed her own dance group, the Dance Unit. From 1939 to 1949 she spent part of each year as a teacher and choreographer in Mexico City, where she formed Mexico's first modern-dance group. Throughout her career and into the 1990s, she continued to form various companies and for them she often choreographed works on subjects of social concern.

Sokoto \sō-'kō-tō\ City (pop., 1996 est.: 204,900), northwestern Nigeria. It lies along the Sokoto River on a traditional caravan route that leads north across the SAHARA. It was the capital of the FULANI empire. Modern Sokoto is a major trade centre for agriculture and leather crafts. A pilgrimage centre, it is the site of mosques, a sultan's palace, and USMAN DAN FODIO's tomb and other holy shrines. Usman dan Fodio University was founded in 1975.

Sol \'säl\ In ROMAN RELIGION, the name of two distinct sun gods at Rome. The original Sol, or Sol Indiges, had an annual sacrifice and shrines on the Quirinal and in the Circus Maximus. After the importation of various Syrian sun cults, ELAGABALUS built a temple to Sol Invictus on the Palatine and attempted to make his worship the principal religion at Rome. AURELIAN later reestablished the worship and erected a temple to Sol in the Campus Agrippae. The worship of Sol remained the chief imperial cult until the rise of CHRISTIANITY.

solar cell Any device that directly converts the ENERGY in LIGHT into electrical energy through the process of photovoltaics (see PHOTOVOLTAIC EFFECT). Solar cells do not use chemical reactions to produce electric power, and they have no moving parts. Most solar cells are designed for converting sunlight into ELECTRICITY. In large arrays, which may contain many thousands of individual cells, they can function as central electric power stations analogous to nuclear, coal-, or oil-fired power plants. Much smaller assemblies of solar cells are used to provide electric power in remote locations including space satellites; because they have no moving parts that could require service or fuels that would require replenishment, solar cells are ideal for providing power in space. See illustration on following page.

solar cycle Period in which several important kinds of solar activity repeat, discovered in 1843 by Samuel Heinrich Schwabe (1789–1875). Lasting about 22 years on average, it includes two 11-year cycles of SUNSPOTS, whose magnetic polarities alternate between the SUN's northern and southern hemispheres, and two peaks and two declines in the phenomena (e.g., SOLAR PROMINENCES, AURORAS) that vary in the same period. Attempts have been made to connect the solar cycle to various other phenomena, including possible slight variations in the diameter of the Sun, sequences of annual growth rings in trees, and even the stock market's rise and fall.

solar energy Radiation from the Sun that can produce heat, generate electricity, or cause chemical reactions. Solar collectors collect solar radiation and transfer it as heat to a carrier fluid. It can then be used for heating. SOLAR CELLS convert solar radiation directly into electricity by means of the PHOTOVOLTAIC EFFECT. Solar energy is inexhaustible and nonpolluting, but converting solar radiation to electricity is not yet commercially competitive, because of the high cost of producing large-scale solar cell arrays and the inherent inefficiency in converting light to electricity.

solar flare Sudden intense brightening of a small part of the SUN's surface, often near a SUNSPOT group. Flares develop in a few minutes and may last several hours, releasing intense X rays and streams of energetic particles. They appear to be connected with changes in the Sun's magnetic fields during the SOLAR CYCLE. The ejected particles take a day or two to reach the vicinity of Earth, where they can disrupt radio communications and cause AURORAS, and may pose a radiation hazard to astronauts.

solar heating Use of solar radiation to heat water or air in buildings. There are two types: passive and active. Passive heating relies on architectural design; the building's siting, orientation, layout, materials, and construction are utilized to maximize the heating effect of sunlight fall-

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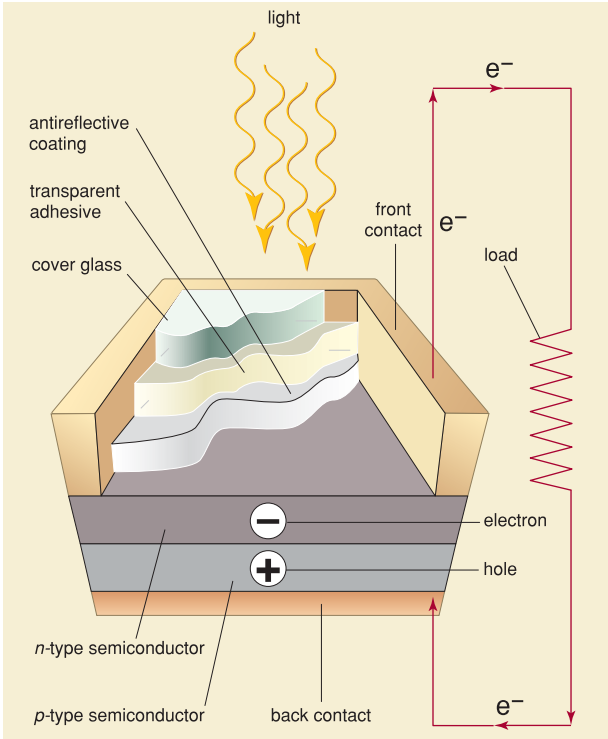

When sunlight strikes a solar cell, an electron is freed by the photoelectric effect. The two dissimilar semiconductors possess a natural difference in electric potential (voltage), which causes the electrons to flow through the external circuit, supplying power to the load. The flow of electricity results from the characteristics of the semiconductors, and is powered entirely by light striking the cell.

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ing on it. A well-insulated building with a large south-facing window, for instance, can trap heat on sunny days and reduce reliance on gas, oil, or electricity. Brick, stone, or tile capacity walls are often incorporated to absorb the sun's energy and radiate it into the interior, usually after a time lag of several hours. In active solar heating, mechanical means are used to collect, store, and distribute solar energy. In liquid-based systems, a blackened metal plate on the exterior absorbs sunlight and traps heat, which is transferred to a carrier fluid. Alternatively, fluid may be pumped through a glass tube or volume of space onto which sunlight has been focused by mirrors. After picking up heat from the collector, the warm fluid is pumped to an insulated storage tank. The system can supply a home with hot water from the tank or provide space heating with the warmed water flowing through tubes in floors and ceilings.

solar nebula Gaseous cloud from which, in the nebular hypothesis of the origin of the SOLAR SYSTEM, the Sun and planets formed by condensation. In 1755 IMMANUEL KANT suggested that a NEBULA gradually pulled together by its own gravity developed into the Sun and planets. Pierre-Simon, marquis de LAPLACE, in 1796 proposed a similar model, in which a rotating and contracting cloud of gas—the young Sun—shed concentric rings of matter that condensed into the planets. But JAMES CLERK MAXWELL showed that, if all the matter in the known planets had once been distributed this way, shearing forces would have prevented such condensation. Another objection was that the Sun has less ANGULAR MOMENTUM than the theory seems to require. In the early 20th century most astronomers preferred the collision theory: that the planets formed as a result of a close approach to the Sun by another star. Eventually, however, stronger objections were mounted to the collision theory than to the nebular hypothesis, and a modified version of the latter—in which a rotating disk of matter gave rise to the planets through successively larger agglomerations, from dust grains through PLANETESIMALS and protoplanets—became the prevailing theory of the solar system's origin.

solar neutrino problem See NEUTRINO PROBLEM, SOLAR

solar prominence Arched stream of hot gas projecting from the SUN's surface into the CHROMOSPHERE or CORONA. Prominences can be hundreds of thousands of miles long and can be seen with the unaided eye during a total eclipse. They appear to lie along and are supported by loops in the Sun's magnetic field, where they may remain for days to months.

solar system The SUN, its PLANETS, and the small bodies (see ASTEROID, CENTAUR OBJECT, COMET, KUIPER BELT, METEORITE, and OORT CLOUD) interplanetary dust and gas under the Sun's gravitational control. Another component of the solar system is the SOLAR WIND. The Sun contains more than 99% of the mass of the solar system; most of the rest is distributed among the nine planets, with JUPITER containing about 70%. According to the prevailing theory, the solar system originated from the SOLAR NEBULA. See also EARTH, MARS, MERCURY, NEPTUNE, PLUTO, SATURN, URANUS, VENUS.

solar wind Flux of particles, chiefly PROTONS, ELECTRONS, and HELIUM nuclei accelerated by the hot solar CORONA's high temperatures to speeds high enough to allow them to escape the Sun. SOLAR FLARES increase its intensity. The solar wind deflects planets' MAGNETOSPHERES and the ion tails of COMETS away from the Sun. The uninterrupted portion of the solar wind continues to travel to a distance of about 20 ASTRONOMICAL UNITS, where it cools and eventually diffuses into interstellar space. See also HELIOPAUSE.

soldering \'sä-dər-iŋ\ Process that uses METAL ALLOYS with low melting points to join metallic surfaces without melting them. Tin-lead solders, once widely used in the electrical and plumbing industries, are now replaced by lead-free alloys. Such alloys are also used to solder brass and copper automobile radiators. Solders are supplied in wire, bar, or premixed-paste form, depending on the application. Soldering can be carried out using a torch, a soldering iron, a flame heater, or an induction heater. See also BRAZING, FLUX.

sole Any of several FLATFISHES, especially about 100 species in the family Soleidae. Those found from Europe to Australia and Japan are marine; some New World species live in freshwater. The eyes are on the right side of the head. The Dover sole (*Solea solea*), found from estuaries to offshore waters in the eastern Atlantic and Mediterranean, grows to 20 in. (50 cm) long. The hogchoker (*Trinectes maculatus*), seldom over 10 in. (25 cm) long, is found in shallow coastal waters from New England to Central America and far inland in habitats associated with large rivers.

Dover sole (*Solea solea*)
JACQUES SIX

Solemn League and Covenant (1643) Agreement between the English and Scots in which the Scots agreed to support the English Parliamentarians in their disputes with the Royalists, and both countries agreed to work for a civil and religious union of England, Scotland, and Ireland under a presbyterian-parliamentary system. The Scots sent an army to England in 1644, and CHARLES I surrendered to them in 1646. He later agreed to the covenant and received Scottish military assistance (1647). Neither OLIVER CROMWELL's Commonwealth nor CHARLES II (after the 1660 RESTORATION) honoured the covenant, and it was not renewed. See also COVENANTER.

Solent \'sō-lənt**, The** Strait of the ENGLISH CHANNEL. It extends 15 mi (24 km) between mainland England and the Isle of WIGHT and varies in width from 2 to 5 mi (3 to 8 km). The submerged valley of a former eastward-flowing river, it is the scene of yacht races and is famous for the naval reviews off Spithead.

Soleri \sō-'ler-ē**, Paolo** (b. June 21, 1919, Turin, Italy) Italian-born U.S. architect. After receiving a doctorate from Turin Polytechnic, he worked under FRANK LLOYD WRIGHT in Arizona (1947–49). In 1959 he began to draw up plans for a series of compact urban centres that would extend vertically into space rather than horizontally along the ground. These megastructures were designed to conserve energy and resources (partly through reliance on solar energy and elimination of automobile use within the city), preserve natural surroundings, and condense human activities within integrated total environments. Soleri coined the term *arcology* (from "architecture" and "ecology") to describe his utopian constructions, which he delineated in drawings of great beauty and imagination. In 1970 he began constructing a prototype town called Arcosanti, for a population of 5,000, between Phoenix and Flagstaff, Ariz. The work, by students and volunteers, is still in progress.

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solfeggio See SOLMIZATION

Solferino \ˌsäl-fə-ˈrē-nō**, Battle of** (June 24, 1859) Engagement fought in Lombardy between Austria and an allied French and Piedmontese army. After its defeat at the Battle of MAGENTA, the Austrian army retreated eastward, where it unexpectedly met the allied army commanded by NAPOLEON III and VICTOR EMMANUEL II. The battle developed in a confused fashion until the French eventually broke the Austrian centre line, but vigorous delaying actions left the allied army too exhausted to pursue the defeated Austrians. The battle left 14,000 Austrians and 15,000 French and Piedmontese killed or wounded. The costly battle influenced Napoleon III to seek a truce (the Peace of VILLAFRANCA), which contributed to the unification of Italy.

Soli \ˈsō-ˌlī\ Ancient seaport, Anatolia. Located in what is now south-central Turkey, it was founded by Greek colonists from RHODES and was a principle city of CILICIA. It was later conquered by ALEXANDER THE GREAT (333 BC). Destroyed in the 1st century BC by Tigranes II of Armenia, it was rebuilt by the Roman general POMPEY THE GREAT. Traces of the port's artificial harbour and a portion of a long colonnade remain.

solicitation In CRIMINAL LAW, the act of asking, inducing, or directing someone to commit a crime. The person soliciting another becomes an accomplice to the crime. The term also refers to the act of obtaining bribes, as well as to the crime of a prostitute who offers sexual relations in exchange for money.

solicitor British lawyer who advises clients, represents them in the lower courts, and prepares cases for BARRISTERS to try in higher courts. The education required of a solicitor includes a law school course and five years of apprenticeship with a practicing solicitor. In the U.S. the solicitor general represents the federal government in court, especially the SUPREME COURT OF THE UNITED STATES.

solid One of the three basic states of MATTER. A solid forms from either a LIQUID or a GAS (the other two states of matter) because, as the energy of the atoms decreases, they coalesce in the relatively ordered, three-dimensional structure of a solid. All solids have the ability to support loads applied either perpendicular (normal) or parallel (shear) to a surface. Solids can be crystalline (as in metals), amorphous (as in glass), or quasi-crystalline (as in certain metal alloys), depending on the degree of order in the arrangement of the atoms.

solid solution Solid form of a liquid SOLUTION. As with liquids, a tendency for mutual solubility exists between any two coexisting solids (i.e., each can mix with the other); depending on the chemical similarities of the solids, mutual solubility of two substances may be 100% (as between silver and gold), or it may be near 0 (as between copper and bismuth).

solid-state device Electronic device that operates on the basis of the electric, magnetic, or optical properties of a solid material, especially one that uses a solid CRYSTAL in which an orderly three-dimensional arrangement of atoms, ions, or molecules is repeated throughout the entire crystal. Synthetic crystals of elements such as SILICON, gallium arsenide, and GERMANIUM are used in TRANSISTORS, rectifiers, and INTEGRATED CIRCUITS. The first solid-state device was the "cat's whisker" (1906), in which a fine wire was moved across a solid crystal to detect a radio signal. See also SEMICONDUCTOR.

solid-state physics Branch of physics concerned with the physical properties of solid materials. It deals with the properties of CRYSTAL-LATTICE arrangements of ATOMS, and dislocations and defects in the arrangements. These structures are especially important in the study of the conductance of heat and electricity through solid materials.

Solidarity *Polish* **Solidarność** Polish trade union. A workers' strike in 1980 at the Lenin Shipyards in Gdańsk inspired other labour strikes in Poland and compelled the government to agree to the workers' demands for independent unions. Solidarity was founded to unite the regional trade unions, and LECH WAŁĘSA was elected chairman. The movement won economic reforms and free elections before pressure from the Soviet Union forced the Polish government to suppress the union in 1981. The focus of worldwide attention, it continued as an underground organization until 1989, when the government recognized its legality. In the free elections of 1989, Solidarity candidates won most of the contested seats in the assembly and formed a coalition government. In the 1990s the union's role diminished as new political parties emerged in a free Poland.

soliloquy \sə-ˈli-lə-ˌkwē\ Dramatic monologue that gives the illusion of being a series of unspoken reflections. An accepted dramatic convention in the 16th–17th centuries, it was used artfully by WILLIAM SHAKESPEARE to reveal the minds of his characters. PIERRE CORNEILLE emphasized its lyricism, while JEAN RACINE favoured it for dramatic effect. Overused in English Restoration plays (1660–85), it fell into disfavour. Rejected by prose dramatists such as HENRIK IBSEN, it was seldom used in late 19th-century naturalist drama. Many 20th-century dramatists also avoided the soliloquy as artificial, though TENNESSEE WILLIAMS and ARTHUR MILLER, among others, adapted it by introducing narrators who alternately mused on the action and took part in it. It has been used by contemporary playwrights such as JOHN GUARE and BRIAN FRIEL, and the illusion that the characters are confiding in the audience has proved acceptable to a culture accustomed to the interview and the documentary film.

solmization \ˌsäl-mə-ˈzā-shən\ *or* **solfeggio** \säl-ˈfe-jē-ō\ System of designating musical notes by syllable names. It may have been invented by the 11th-century Italian monk GUIDO d'Arezzo when training his cathedral singers. The syllables—*ut*, *re*, *mi*, *fa*, *sol*, *la*—were derived from the first syllables of the lines of a hymn, each phrase of which began one note higher than the previous phrase. This six-note series, or HEXACHORD, facilitated the sight-reading of music by allowing the singer always to associate a given musical INTERVAL with any two syllables. The syllables are still in use, though *ut* is usually replaced by the more singable *do*, and *ti* or *si* has been added for the seventh scale degree. Compare SHAPE-NOTE SINGING.

Solo River Longest river in JAVA, Indonesia. It rises on the slope of Mount Lawu volcano and flows 335 mi (539 km) north and east to discharge into the Java Sea. It is navigable for small craft in much of its upper course; its marshy delta is used for fish ponds.

Solomon (fl. 10th century BC) Son and successor of DAVID. Nearly all that is known about him comes from the BIBLE (1 Kings 1–11 and 2 Chronicles 1–9). Through the efforts of his mother, Bathsheba, and the prophet NATHAN, Solomon was anointed king while David was still alive. On accession to the throne, he liquidated his opponents ruthlessly and installed friends in key posts. He established Israelite colonies outside his kingdom's borders, cooperating with such friendly rulers as the QUEEN OF SHEBA to increase commerce. Fortification of his far-flung empire necessitated a vast building program, the crowning achievement of which was the TEMPLE OF JERUSALEM. He reorganized the nation into 12 tribes with 12 administrative districts. He is said to have had a harem of 700 wives and 300 concubines. After the ascension to the throne of his son Rehoboam, the northern tribes seceded and formed their own kingdom of Israel, bringing an end to Solomon's empire. His legendary wisdom is recorded in the Book of Proverbs, and he is traditionally named as the author of the biblical Song of Solomon. He was regarded as the greatest king of Israel.

Solomon Islands Island country, southwestern South Pacific Ocean. (Another island group named Solomon Islands, which includes BOUGAINVILLE, is part of Papua New Guinea.) The country includes the islands of GUADALCANAL, MALAITA, San Cristobal, Choiseul, Santa Isabel, and Rennell; the Russell, Florida, Shortland, Santa Cruz, and New Georgia island groups; and small islands and reefs. Area: 10,954 sq mi (28,370 sq km). Population (2005 est.): 471,000. Capital: HONIARA. The population is largely Melanesian. Languages: English (official), Pijin (an English-based pidgin), and more than 60 indigenous Melanesian languages. Religions: Christianity (predominantly Protestant; also Roman Catholic); also traditional beliefs. Currency: Solomon Islands dollar. The Solomons group comprises numerous volcanic islands arranged in two parallel chains that converge in the southeast. They consist mostly of heavily wooded, mountainous terrain drained by short, swift-flowing rivers. The climate is tropical. The economy is based on agriculture, fishing, and lumbering. Tourism is increasing as cruise ships and visitors to World War II battlefields stop at the islands. The country is a constitutional monarchy with one legislative house; its chief of state is the British monarch represented by the governor-general, and the head of government is the prime minister. The Solomon Islands were probably settled c. 2000 BC by Austronesian people. Visited by the Spanish in 1568, they were subsequently explored and charted by the Dutch, French, and British. They were under British protection from 1893 as the British Solomon Islands. The Japanese invasion of 1942 ignited some of the most bitter fighting in the Pacific during the war, particularly on Guadalcanal. The protectorate became self-governing in 1976 and fully independent in 1978. From 1999 ethnic fighting broke out in the Solomons; New Zealand and Australian armed forces helped restore order.

Solomon's seal Any of about 25 species of herbaceous perennials that make up the genus *Polygonatum* (LILY FAMILY), found throughout the North-

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ern Hemisphere. Particularly common in the eastern U.S. and Canada, Solomon's seals flourish in damp, wooded areas and thicks. They have thick, creeping rhizomes and tall, drooping stems, and they bear clusters of white or greenish-white flowers in the axils of leaves, followed by drooping red berries. Similar plants of the genus *Smilacina*, known as false Solomon's seal, bear their flower clusters at the tips of the stems.

Solon \'sō-lən\ (b. c. 630—d. c. 560 BC) Athenian statesman, reformer, and poet, known as one of the Seven Wise Men of Greece. He was of noble descent but of moderate means. Though he held the office of ARCHON c. 594, he did not gain full power as a reformer and legislator until some 20 years later. He ended aristocratic rule and permitted participation by all citizens who had achieved a measure of wealth, eliminating any bloodline requirement. He replaced DRACO's code with more humane laws, freed citizens enslaved for debt and redeemed their land, encouraged professions, and reformed coinage and weights and measures. Despite complaints from all sides, the people abided by the changes. He apparently left Athens for 10 years on a series of travels; on his return, he warned Athens about his relative PEISISTRATUS, who would become TYRANT.

Solow \'sō-lō**, Robert M(erton)** (b. Aug. 23, 1924, Brooklyn, N.Y., U.S.) U.S. economist. He received his Ph.D. from Harvard University and began teaching at the Massachusetts Institute of Technology in 1949. Solow developed a mathematical model that could show the relative contributions of various factors to sustained national economic growth. He demonstrated that, contrary to traditional economic thinking, the rate of technological progress is more important to growth than capital accumulation or increases in labour. From the 1960s on, his studies were influential in persuading governments to invest in technological RESEARCH AND DEVELOPMENT. In 1987 he was awarded the Nobel Prize in Economic Sciences.

solstice \'sōl-stis\ Either of the two moments in the year when the Sun's apparent path is farthest north or south from Earth's Equator; also, either of the two points along the ECLIPTIC that the Sun passes through at these times. In the Northern Hemisphere the summer solstice occurs on June 21 or 22; the winter solstice on December 21 or 22. In the Southern Hemisphere the seasons are reversed. See also EQUINOX.

Solti \'shōl-tē**, Sir Georg** *orig.* **György Stern Solti** (b. Oct. 21, 1912, Budapest, Hung.—d. Sept. 5, 1997, Antibes, France) Hungarian-born British conductor. After making his piano debut at age 12, he studied piano with BÉLA BARTÓK and composition with ZOLTÁN KODÁLY. He was ARTURO TOSCANINI's assistant at Salzburg (1936–37). In Switzerland when World War II broke out, he returned to piano, winning the 1942 Geneva International Competition. He led the Bavarian State Opera in Munich (1945–52), and then he moved to Frankfurt (1952–61). As director of Covent Garden (1961–71), he made the first complete recording of RICHARD WAGNER's *Ring* cycle (1958–65), which remains one of the celebrated recordings of all time. Under Solti (1969–91), the Chicago Symphony Orchestra won extraordinary praise and success.

solubility Degree to which a substance dissolves in a SOLVENT to make a SOLUTION (usually expressed as grams of solute per litre of solvent). Solubility of one fluid (liquid or gas) in another may be complete (totally miscible; e.g., methanol and water) or partial (oil and water dissolve only slightly). In general, "like dissolves like" (e.g., aromatic hydrocarbons dissolve in each other but not in water). Some separation methods (ABSORPTION, extraction) rely on differences in solubility, expressed as the distribution coefficient (ratio of a material's solubilities in two solvents). Generally, solubilities of solids in liquids increase with temperature and those of gases decrease with temperature and increase with pressure. A solution in which no more solute can be dissolved at a given temperature and pressure is said to be saturated (see SATURATION). See also JOEL HILDEBRAND.

solution In chemistry, a homogeneous mixture of two or more substances in relative amounts that can vary continuously up to the limit of solubility (SATURATION), if any, of one in the other. Most solutions are LIQUIDS, but solutions also can be of GASES or SOLIDS—for example, AIR (composed primarily of oxygen and nitrogen) or BRASS (composed chiefly of copper and zinc; see ALLOY). In solutions comprising a solid dissolved in a liquid, the liquid is the SOLVENT, and the solid is the solute; if both components are liquids, the one present in a smaller amount is usually considered the solute. If the saturation point is passed, excess solute separates out. Substances with IONIC BONDS (e.g., SALTS) and many with COVALENT BONDS (e.g., ACIDS, BASES, ALCOHOLS) undergo DISSOCIATION into IONS on dissolving and are called ELECTROLYTES. Their solutions can conduct ELECTRICITY and have other properties that differ from those of nonelectrolytes. Solutions are involved in most chemical reactions, refining and purification, industrial processing, and biological processes.

Solutrean \sə-'lü-trē-ən\ **industry** Short-lived STONE-TOOL INDUSTRY that flourished 17,000–21,000 years ago in southwestern France (e.g., at La Solutré and Laugerie-Haute) and in nearby areas. The industry is of special interest because of its particularly fine workmanship. In addition to burins (chisel-like tools), scrapers, and borers, the Solutrean industry exhibits blades formed in the shape of laurel or willow leaves and various shouldered points. Some implements are so fine as to be useless as tools and may instead have been luxury items.

Solvay process \'säl-ˌvā\ *or* **ammonia-soda process** Modern method of manufacturing sodium carbonate (soda ash), devised and commercialized in Belgium by Ernest Solvay (1838–1922). Common salt (sodium chloride) is treated with ammonia and then carbon dioxide, under carefully controlled conditions, to form sodium bicarbonate and ammonium chloride. When heated, the bicarbonate yields sodium carbonate, the desired product; the ammonium chloride is treated with lime to produce ammonia (for reuse) and calcium chloride. The process proved of great commercial value, since large quantities of soda ash are used in making glass, detergents, and cleansers. See also CAUSTIC SODA.

solvent Substance, ordinarily a LIQUID, in which other materials dissolve to form a SOLUTION. Polar solvents (e.g., WATER) favour formation of IONS; nonpolar ones (e.g., HYDROCARBONS) do not. Solvents may be predominantly acidic, predominantly basic, amphoteric (both), or aprotic (neither). Organic compounds used as solvents include AROMATIC COMPOUNDS and other hydrocarbons, ALCOHOLS, ESTERS, ETHERS, KETONES, AMINES, and nitrated and halogenated hydrocarbons. Their chief uses are as media for chemical syntheses, as industrial cleaners, in extractive processes, in pharmaceuticals, in inks, and in paints, varnishes, and lacquers.

Solway Firth Inlet of the IRISH SEA. On the border between northwestern England and southwestern Scotland, it extends inland for 38 mi (61 km). It is a traditional boundary between the two countries. HADRIAN'S WALL terminates on its southern shore.

Solzhenitsyn \ˌsōl-zhə-'nēt-sin**, Aleksandr (Isayevich)** (b. Dec. 11, 1918, Kislovodsk, Russia) Russian novelist and historian. He fought in World War II but was arrested in 1945 for criticizing JOSEPH STALIN. He spent eight years in prisons and labour camps and three more in enforced exile. With *One Day in the Life of Ivan Denisovich* (1962), based on his labour-camp experiences, he emerged as an eloquent opponent of government repression. He was forced to publish later works abroad, including *The First Circle* (1968), *Cancer Ward* (1968), and *August 1914* (1971). Publication of the first volume of *The Gulag Archipelago* (1973), one of the greatest works in Russian prose, resulted in his being charged with treason. Expelled from the Soviet Union in 1974, he lived in the U.S., enjoying worldwide fame, until 1994, when he returned home. In the late 1980s glasnost brought renewed access to his work in Russia but also a loss of interest in it and in the prophetic role he claimed for himself in Russian history. He was awarded the Nobel Prize for Literature in 1970.

soma In ancient Indian religion, an unidentified plant, the juice of which was an offering of the Vedic sacrifices. Its stalks were pressed, and its juice, filtered through wool, was mixed with water and milk. After being offered as a libation to the gods, the remainder of the soma was consumed by the priests and the sacrificer. It was highly valued for its exhilarating, probably hallucinogenic, effect. The plant was believed to have been delivered to the earth from heaven by an eagle. The personified deity Soma was the master of plants, healer of disease, and bestower of riches. See also VEDIC RELIGION.

Somali \sə-'mä-lēz\ Any member of a large group of people occupying all of Somalia and parts of Djibouti, Ethiopia, and Kenya. Their language is of the Cushitic branch of the AFROASIATIC family. Numbering more than seven million, the Somalis are divided into northern, central, and southern groups. All have been Muslim since at least the 14th century. They are primarily nomadic herdsmen who, because of intense competition for scarce resources, have been extremely individualistic and frequently involved in blood feuds or wars with neighbouring clans or peoples. A second category of Somalis are the townspeople and agriculturalists of the urban centres, especially along the coast of the Horn of Africa, many of whom act as commercial middlemen between the Arab world and the nomads of the interior.

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Somalia Country, eastern Africa. Located in the Horn of Africa, it stretches from the Equator to the Red Sea. Area: 246,000 sq mi (637,000 sq km). Population (2005 est.): 8,228,000 (excluding an estimated 400,000 refugees in other countries). Capital: Mogadishu. Most of the people are nomadic or seminomadic Somali. Languages: Somali, Arabic (both official). Religion: Islam (official; predominantly Sunni). Currency: Somali shilling. Much of Somalia is semidesert. The central and southern regions are flat, while the northern region rises to form rugged mountain ranges. Only a tiny proportion of its land is arable, though more than half is grazeable. Somalia has a developing mixed economy based largely on livestock and agriculture. It is one of the poorest countries in the world. Muslim Arabs and Persians first established trading posts along the coasts in the 7th–10th centuries. By the 10th century Somali nomads occupied the area inland from the Gulf of Aden, and the south and west were inhabited by various groups of pastoral Oromo peoples. Intensive European exploration began after the British occupation of Aden in 1839, and in the late 19th century Britain and Italy set up protectorates in the region. During World War II the Italians invaded British Somaliland (1940); a year later British troops retook the area. Britain administered the region until 1950, when Italian Somaliland became a UN trust territory. In 1960 it was united with the former British Somaliland, and the two became the independent Republic of Somalia. Since then it has suffered political and civil strife, including military dictatorship, civil wars, drought, and famine. No effective central government has existed since the early 1990s. In 1991 a Republic of Somaliland was proclaimed by a breakaway group on territory corresponding to the former British Somaliland. It did not receive international recognition, but it operated more smoothly than the area of traditional Somalia. A UN peacekeeping force intervened in 1992 to secure food supplies; fighting continued, and the peacekeeping force left in 1995. The country subsequently remained in turmoil.

Somaliland \sə-'mä-lē-ˌland\ Historical name for the region of eastern Africa between the Equator and the Gulf of Aden that includes Somalia, Djibouti, and southeastern Ethiopia. It has an area of about 300,000 sq mi (777,000 sq km). The region probably formed part of the "Land of Punt" known to the ancient Egyptians. Between the 7th and 12th centuries, Muslim traders from Arabia and Iran settled on the coast and formed sultanates. The nomadic Somali, who occupied the northern part of the country between the 10th and 15th centuries, adopted Islam and served in their armies. Gradually the sultanates themselves came under Somali control. In the late 19th century, France, Italy, and Britain partitioned the region among themselves. In 1960 British Somaliland and Italian Somaliland were united to form the Republic of Somalia. French Somaliland became independent as the Republic of Djibouti in 1977. In 1991 British Somaliland announced that it was becoming an independent state, the Republic of Somaliland; it was not internationally recognized.

somatotropin See growth hormone

Somerset Administrative (pop., 2001: 498,093), geographic, and historic county, southwestern England. Its county seat is Taunton. The remains of prehistoric villages have been found in the region. The Romans mined lead and built villas there; from the 7th century AD, Somerset formed the westernmost part of the kingdom of Wessex. A large part of western Somerset is made up of Exmoor National Park, and long stretches of coastline are protected. It is mainly an agricultural county and is known for its cider. Tourism draws visitors to its Bristol Channel resorts and historic mansions.

Somerset, Edward Seymour, 1st duke of (b. c. 1500/06—d. Jan. 22, 1552, London, Eng.) English politician. After his sister, Jane Seymour, married King Henry VIII in 1536, Somerset rose rapidly in royal favour. He commanded the English forces that invaded Scotland and sacked Edinburgh in 1544, and he decisively defeated the French at Boulogne in 1545. After Henry's death (1547), he was named Protector of England during the minority of Edward VI and acted as king in all but name. When the Scots rejected his appeal for a voluntary union with England, he invaded Scotland and won the Battle of Pinkie (1547). He introduced moderate Protestant reforms, but these provoked Catholic uprisings in western England. His land reforms were opposed by landowners and the duke of Northumberland, who had Somerset deposed from the protectorate in 1549. He was imprisoned in 1551 on a flimsy charge of treason and executed the next year.

Somerville \'səm-ər-ˌvil\ **and Ross** *joint pseudonym of* **Edith Anna Oenone Somerville and Violet Florence Martin** (respectively b. May 2, 1858, Corfu, Greece—d. Oct. 8, 1949, Castlehaven, County Cork, Ire.; b. June 11, 1862, Ross House, County Galway, Ire.—d. Dec. 21, 1915, Cork, County Cork) Irish cousins and writers. Somerville and Martin met in 1886; three years later they published their first novel, *An Irish Cousin*, under the names E.Œ. Somerville and Martin Ross. They cowrote a total of 14 books, including a collection of short stories, *Some Experiences of an Irish R.M.* (1899), that, with its sequels, was their most popular work. Their works wittily and sympathetically portrayed Irish society in the late 19th century. After Martin's death, Somerville continued to write under the joint name.

Somme \'sȯm, 'säm, 'səm**, Battle of the** (July 1–Nov. 13, 1916) Allied offensive in World War I. British and French forces launched a frontal attack against an entrenched German army north of the Somme River in France. A weeklong artillery bombardment was followed by a British infantry assault on the still-impregnable German positions. Nearly 60,000 British casualties (including 20,000 killed) occurred on the first day. The offensive gradually deteriorated into a battle of attrition, hampered by torrential rains in October that made the muddy battlefield impassable. By the time it was abandoned, the Allies had advanced only 5 mi (8 km). The staggering losses included 650,000 German casualties, 420,000 British, and 195,000 French. The battle became a metaphor for futile and indiscriminate slaughter.

Somme River \'səm\ River, northern France. It rises near St.-Quentin and flows westward 152 mi (245 km) to the English Channel. Canals on its upper valley connect it with navigable waterways that link Paris and Flanders. Its upper basin was the scene of heavy fighting in World War I, particularly that of the Battle of the Somme (1916).

Somoza family \sō-'mō-sə\ Family that maintained political control of Nicaragua for more than 40 years. The dynasty's founder, Anastasio Somoza García (1896–1956), became head of Nicaragua's army in 1933 and, after deposing the elected president in 1936, ruled the country with a firm and grasping hand until he was assassinated. He was succeeded by his elder son, Luis Somoza Debayle (1922–67), and later by his younger son, Anastasio Somoza Debayle (1925–80), whose corrupt and brutal rule (1963–79) led to his overthrow by the Sandinistas. Somoza looted Nicaragua before fleeing the country; he was assassinated in Paraguay.

sonar Technique for detecting and determining the distance and direction of underwater objects by tracking acoustic echoes. The name derives from *so*und *na*vigation *r*anging. Sound waves emitted by or reflected from an object are detected by sonar apparatus and analyzed for information. In active sonar a sound wave is generated that spreads outward and is

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reflected back by a target object. Passive systems consist simply of receiving sensors that pick up the noise produced by the target (such as a submarine or torpedo). A third kind of sonar, used in communication systems, requires a projector and receiver at both ends. Sonar was first used to detect submarines in 1916. Modern nonmilitary uses include fish finding, depth sounding, mapping of the ocean floor, Doppler navigation (see DOPPLER EFFECT), and searching for wrecks or other objects in the oceans.

sonata Musical form for one or more instruments, usually consisting of three or four movements. The name, Italian for "sounded (on an instrument)," originally simply indicated nonvocal music and was used for a confusing variety of genres into the late 17th century. In the 1650s two types of ensemble sonatas began to be codified, the *sonata da chiesa* (church sonata) and *sonata da camera* (chamber sonata). The former, intended for church performance, was generally in four movements, two of them slow; the latter was usually a SUITE of dances. The so-called solo sonata (for soloist—usually violin—and CONTINUO) and the TRIO SONATA (for two soloists and continuo) became standard. In the 1740s solo keyboard sonatas began to be written. C.P.E. BACH established the three-movement keyboard sonata as the norm, a status it would retain through the classical era. Duo sonatas in the same form, usually for violin and keyboard, simultaneously became highly popular. Keyboard and duo sonatas have remained the standard types to the present day. From Bach's time onward, the first movement was generally in allegro tempo and in SONATA FORM. The second movement was usually slow. The last movement was generally a MINUET, RONDO, or theme and VARIATIONS. In a four-movement sonata, the third was usually a minuet or SCHERZO. In these respects the sonata paralleled genres such as the SYMPHONY and the STRING QUARTET.

sonata form *or* **sonata-allegro form** Form of most first movements and often other movements in musical genres such as the SYMPHONY, CONCERTO, STRING QUARTET, and SONATA. The three parts of sonata form evolved from the binary, or two-part, form prominent in the music of the 17th and early 18th centuries. In sonata form the first part, or exposition, presents the basic thematic material of the movement, which is often divided into two thematic groups, the second being in the dominant key or—if the movement is in a minor key—in the relative major key. The second section, or development, generally treats the earlier themes freely, often moving to various different keys. It leads to the final section, or recapitulation, when the tonic key returns and all the thematic material is repeated in the tonic. Sonata form was the most common form for instrumental works in Western art music from c. 1760 to the early 20th century.

Sonderbund \'zȯn-dər-ˌbu̇nt\ *German* **"Separatist League"** League formed in 1845 by the seven Roman Catholic Swiss cantons. After the Protestant cantons sought to prevent the Jesuits' takeover of religious education in Lucerne, the Catholic cantons formed the Sonderbund, which further angered the liberal cantons. In 1847 a reformist majority in the Swiss Diet voted to dissolve the Sonderbund and expel the Jesuits. In November 1847 the league took up arms, but its forces were quickly subdued. The new Swiss constitution adopted in 1848 strengthened the central government.

Sondheim \'sänd-ˌhīm**, Stephen (Joshua)** (b. March 22, 1930, New York, N.Y., U.S.) U.S. composer and lyricist. He studied piano and organ and at age 15 wrote his first musical under the tutelage of the musical comedy author OSCAR HAMMERSTEIN II, a family friend. After studies with composer MILTON BABBITT, he made his first mark on Broadway as lyricist for *West Side Story* (1957) and later *Gypsy* (1959). He wrote both music and lyrics for *A Funny Thing Happened on the Way to the Forum* (1962, Tony Award), *A Little Night Music* (1973, Tony Award), *Sweeney Todd* (1979, Tony Award), *Sunday in the Park with George* (1984, Pulitzer Prize), and *Into the Woods* (1987), among other works. His stage works are known for their intellectuality, musical complexity, and frequently dark tone.

song Short and usually simple piece of music for voice, with or without instrumental accompaniment. Folk songs—traditional songs without a known composer transmitted orally rather than in written form—have existed for millennia but have left few traces in ancient sources. Virtually all known preliterate societies have a repertory of songs. Folk songs often accompany religious ceremonies, dancing, labour, or courting; they may tell stories or express emotions; the music follows obvious conventions and is often repetitive. Songs written by a particular composer or poet generally are more sophisticated and are not attached to activities. In the West the continuous tradition of secular art songs began with the TROUBADOURS, TROUVÈRES, and MINNESINGERS of the 12th–13th centuries. Polyphonic songs, originating in the MOTET, began to appear in the 13th century. Composers of the 14th century produced a great body of polyphonic songs in the FORMES FIXES. Later the Italian MADRIGAL became the most distinguished genre. Notated accompaniments to solo songs appeared in the 16th century. The Romantic movement made the 19th century a golden age for the art song, notably the German LIED. In the 20th century the popular song displaced the more cultivated art song, and popular music is today synonymous with popular song.

Song dynasty *or* **Sung** \'sůŋ\ **dynasty** (960–1279) Chinese dynasty that united the entire country until 1127 and the southern portion until 1279, during which time northern China was controlled by the Juchen tribes. During the Song, commerce flourished, paper currency came into increasing use, and several cities boasted populations exceeding one million people. WANG ANSHI worked for more equitable taxation and state-centred solutions for China's problems. Widespread printing brought increased literacy and a broader elite, and private academies and state schools sent increasing numbers of candidates through the CHINESE EXAMINATION SYSTEM. In the 12th century, ZHU XI systemized NEO-CONFUCIANISM. The Song was also an era of scholarship: groundbreaking treatises on architecture and botany were published, as was the famous history *Zizhi tongjian* ("Comprehensive Mirror for Aid in Government") of Sima Guang. Landscape painting is said to have reached its peak during the Northern Song, which was also famous for its magnificent architecture. See also TAIZU.

Song Hong See RED RIVER

Song Huizong See HUIZONG

songbird Any oscine PASSERINE (suborder Passere), all of which have a complex vocal organ, the syrinx. Some species (e.g., THRUSHES) produce melodious songs; others (e.g., CROWS) have a harsh voice; and some do little or no singing. See also BIRDSONG.

Songhai \'sȯŋ-ˌhī\ Ethnolinguistic group chiefly inhabiting the area of the great bend in the Niger River in Mali, centred on the site of the old SONGHAI EMPIRE. Numbering some 1.5 million, the Songhai speak a NILO-SAHARAN LANGUAGE. Songhai society traditionally was highly structured, comprising a nobility, free commoners, artisans, griots (bards and chroniclers), and (formerly) slaves. They cultivate cereals in the rainy season (June to November) and also engage in cattle raising and fishing. The Songhai have traditionally prospered from caravan trade. Many young Songhai leave home for the coast, especially Ghana.

Songhai \'sȯŋ-ˌhī\ **empire** *or* **Songhay empire** Ancient Muslim state, West Africa. Centred on the middle NIGER RIVER in what is now central Mali, it eventually extended to the Atlantic coast and into Niger and Nigeria. Established by the SONGHAI people c. AD 800, it reached its greatest extent in the 16th century before falling to Moroccan forces in 1591. Its important cities were Gao and TIMBUKTU.

Songhua Jiang See SUNGARI RIVER

Songjiang \'sůŋ-'jyäŋ\ *or* **Sung-chiang** Town (population 1998 est.: 490,300), SHANGHAI municipality, eastern China. It was a superior prefecture under the MING and QING dynasties. Originally a major rice-growing centre, by the 18th century it had gained an international reputation for cotton textiles. During the TAIPING REBELLION (1850–64) it was badly damaged in the fighting to defend SHANGHAI; it is the burial place of the U.S. adventurer Frederick T. Ward, who commanded Western troops who fought the rebellion. Shanghai's phenomenal 19th-century growth took away the town's role as a commercial centre; although it remains dominated by Shanghai, it has some industry and is a tourist destination for Shanghai residents.

sonnet Fixed verse form having 14 lines that are typically five-foot iambics rhyming according to a prescribed scheme. The sonnet is unique among poetic forms in Western literature in that it has retained its appeal for major poets for five centuries. It seems to have originated in the 13th century among the SICILIAN SCHOOL of court poets. In the 14th century PETRARCH established the most widely used sonnet form. The Petrarchan (or Italian) sonnet characteristically consists of an eight-line octave, rhyming *abbaabba*, that states a problem, asks a question, or expresses an emotional tension, followed by a six-line sestet, of varying rhyme schemes, that resolves the problem, answers the question, or resolves the tension. In adapting the Italian form, Elizabethan poets gradually developed the other major sonnet form, the Shakespearean (or English) son-

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net. It consists of three quatrains, each with an independent rhyme scheme, and ends with a rhymed couplet.

Sonni 'Alī \sȯn-'ē-ä-'lē\ (d. 1492) West African monarch who initiated the imperial expansion of the SONGHAI EMPIRE. His first major conquest (1468) was the city of TIMBUKTU, one of the chief anchors of the declining MALI EMPIRE. A seven-year siege of the city of Jenné (now Djenné) resulted in its conquest in 1473. He spent most of his reign repulsing attacks on his empire by the Dendi, the FULANI, the MOSSI, and the TUAREG. Little is known about his administration, but Arab chroniclers characterized him as a cruel and capricious tyrant.

Sonora \sə-'nōr-ə\ State (pop., 2000: 2,216,969), northwestern Mexico. Bordering the U.S. and the Gulf of California, it covers 70,291 sq mi (182,052 sq km); its capital is HERMOSILLO. Explored by Spaniards in the 1530s, it became an important colonial mining district for copper, gold, and silver. It became a state in 1830, but the YAQUI Indian peoples were not finally subdued until the 20th century. It is generally arid and semi-arid, and irrigation is used to grow winter vegetables, cereals, cotton, tobacco, and corn (maize).

Sonoran Desert Arid region, western North America. Covering 120,000 sq mi (310,000 sq km), the Sonoran Desert is located in southwestern Arizona and southeastern California, U.S., and northern Baja California and western SONORA state, Mex. The desert's subdivisions include the Colorado and Yuma deserts. Irrigation has produced many fertile agricultural areas, notably the COACHELLA and IMPERIAL VALLEYS. Warm winters in the Sonoran Desert attract tourists to resorts such as PALM SPRINGS, TUCSON, and PHOENIX. Indian reservations (see PAPAGO; PIMA) are located there.

Sontag \'sän-ˌtag**, Susan** *orig.* **Susan Rosenblatt** (b. Jan. 16, 1933, New York, N.Y., U.S.—d. Dec. 28, 2004, New York) U.S. writer. She studied at the University of Chicago and Harvard University and taught philosophy at several institutions. In the early 1960s she began contributing to such periodicals as the *New York Review of Books*, *Commentary*, and *Partisan Review*, her French-influenced essays being characterized by a serious philosophical approach to aspects of modern culture rarely taken seriously at the time, including films, popular music, and "camp" sensibility. Collections of her essays include the influential *Against Interpretation, and Other Essays* (1966) and *Styles of Radical Will* (1969). Her later critical works include *On Photography* (1977), *Illness as Metaphor* (1978), and *AIDS and Its Metaphors* (1989). She also wrote screenplays and novels, including *The Volcano Lover* (1992) and *In America* (2000).

Sony Corp. Major Japanese manufacturer of consumer electronics. Founded by Ibuka Masaru and MORITA Akio in 1946 as Tokyo Telecommunications Engineering Corp., it adopted its present name in 1958. It began by making voltmeters, sound generators, and similar devices. Its first major consumer item was an audio tape recorder, introduced in 1950. Since then it has pioneered new technology for consumer products marketed worldwide, including the first pocket-sized transistor radio (1957), a colour videocassette recorder (1969), and the Walkman portable tape player (1979). In 1994 Sony released the PlayStation video game console. Its entertainment divisions include motion-picture firms Columbia TriStar and Sony Pictures and recording labels Epic and Columbia.

Soong \'sůŋ\ **family** Influential 20th-century Chinese family. Charlie Soong (1866–1918) trained in the U.S. to become a missionary. In China he made his fortune as a publisher, initially of Bibles, and became a supporter of SUN YAT-SEN, whose NATIONALIST PARTY he helped finance. His first daughter married a businessman who also provided financial support to the Nationalists; his second daughter, Soong Ch'ing-ling (Song Qingling; 1893–1981), married Sun Yat-sen; and his third daughter, Soong Mei-ling (1897–2003), became CHIANG KAI-SHEK's second wife. A son, T.V. Soong (1894–1971), established the Central Bank of China and acted as finance minister for the Nationalist government in the 1920s and foreign minister in the 1930s. The 1949 communist takeover divided the family: Ch'ing-ling, who had earlier denounced the Nationalists for betraying Sun Yat-sen's ideals, remained on the mainland and was named honorary chairman of the People's Republic shortly before her death. Mei-ling accompanied Chiang Kai-shek to Taiwan and publicized his cause in the West; as Madam Chiang, she became extremely popular in the U.S. T.V. Soong, once reputed to be the wealthiest man in the world, moved to the U.S.

sopher See SOFER

Sophia \'sō-fyə\ *Russian* **Sofya Alekseyevna** (b. Sept. 27, 1657, Moscow, Russia—d. July 14, 1704, Moscow) Regent of Russia (1682–89). Daughter of Tsar ALEXIS, she objected to the succession of her half brother PETER I (the Great) as tsar (1682) and instigated an uprising by the *STRELTSY* (household troops). She arranged to have her brother IVAN V proclaimed coruler with Peter and assumed the role of regent. With help from her chief adviser and lover, VASILY GOLITSYN, she promoted the development of industry and concluded peace treaties with Poland (1686) and China (1689). After sponsoring two disastrous military campaigns against the Crimean Tatars (1687, 1689), she tried to regain her influence by inciting the *streltsy* to oust Peter and his advisers. She was instead overthrown by Peter in 1689 and forced to enter a convent.

sophists \'sä-fists\ Group of itinerant professional teachers, lecturers, and writers prominent in Greece in the later 5th century BC. The sophistic movement arose at a time when there was much questioning of the absolute nature of familiar values and ways of life. An antithesis arose between nature and custom, tradition, or law, in which custom could be regarded either as artificial trammels on the freedom of the natural state or as beneficial and civilizing restraints on natural anarchy. Both views were represented among the sophists, though the former was the more common. Their first and most eminent representative was PROTAGORAS; other notable sophists include Gorgias of Leontini, Prodicus, Hippias, Antiphon, Thrasymachus, and Critias. A later "second sophistic school" existed in the 2nd century AD.

Sophocles \'sä-fə-ˌklēz\ (b. c. 496, Colonus, near Athens—d. 406 BC, Athens) Greek playwright. With AESCHYLUS and EURIPIDES, he was one of the three great tragic playwrights of Classical Athens. A distinguished public figure in Athens, he served successively in important posts as a treasurer, commander, and adviser. He competed in dramatic festivals, where he defeated Aeschylus to win his first victory in 468 BC. He went on to achieve unparalleled success, writing 123 dramas for dramatic competitions and achieving more than 20 victories. Only seven tragedies survive in their entirety: *Antigone*, *Ajax*, *Electra*, *The Trachinian Women*, *Philoctetes*, *Oedipus at Colonus*, and *Oedipus the King*, his best-known work. He increased the size of the CHORUS and was the first to introduce a third actor onstage. For their supple language, vivid characterization, and formal perfection, his works are regarded as the epitome of Greek drama.

soprano Highest vocal register, ranging from about middle C to the second A above it. Sopranos are normally female but may also include boy sopranos and (previously) castrati (see CASTRATO). Soprano voices are traditionally classified as dramatic (rich and powerful), lyric (lighter), and coloratura (high and very agile). The mezzo-soprano range is about a third lower.

Sopwith, Sir Thomas (Octave Murdoch) (b. Jan. 18, 1888, London, Eng.—d. Jan. 27, 1989, Compton Manor, near Winchester, Hampshire) British aircraft designer. He taught himself to fly in 1910 and won a prize for the longest flight to the European continent. In 1912 he founded Sopwith Aviation Company, Ltd., which in World War I built such planes as the Camel, the Pup, and the Triplane. His Hawker Aircraft Company produced the Hurricane fighter of World War II and later the Harrier, a vertical-takeoff jet fighter. He was chairman of the Hawker Siddeley Group, successor to his earlier company, until 1963.

Soranus of Ephesus \sȯ-'rā-nəs...'e-fə-səs\ (fl. 2nd century AD, Alexandria and Rome) Greek gynecologist, obstetrician, and pediatrician. A keen observer and unusually competent practitioner, he wrote works that influenced medical opinion for 1,500 years. His *On Midwifery and the Diseases of Women* describes contraceptive methods, obstetric techniques that were thought to be new in the 15th century, and what is now recognized as rickets. His suggested treatments for nervous disorders resemble aspects of modern psychotherapy. Soranus also wrote the first known biography of HIPPOCRATES.

Sorb See WEND

Sorby, Henry Clifton (b. May 10, 1826, Woodbourne, near Sheffield, Yorkshire, Eng.—d. March 9, 1908, Sheffield) British amateur scientist. Convinced of the value of the microscope to geology, Sorby began in 1849 to prepare thin sections of rocks, about 0.001 in. (0.025 mm) thick, for microscopic study. He developed a new type of spectrum microscope for analyzing the light of organic pigments (1865). His research on meteors led to studies of iron and steel, and his later studies included the origin of layered rocks, weathering, and marine biology. He published works

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dealing with the physical geography of geologic periods, rock breakdown and buildup, and the formation of river terraces. Sorby is considered the father of microscopical petrography and metallography.

sorcery See WITCHCRAFT AND SORCERY

Sorel \sȯ-'rel**, Georges (-Eugène)** (b. Nov. 2, 1847, Cherbourg, France—d. Aug. 30, 1922, Boulogne-sur-Seine) French author and revolutionary. Trained as a civil engineer, he was 40 before he became interested in social issues. He discovered MARXISM in 1893 but was disgusted by what he saw as the left's exploitation of the ALFRED DREYFUS affair. By 1902 he was an enthusiastic supporter of revolutionary SYNDICALISM. Sorel's thought is characterized by a moralistic hatred of social decadence and resignation. He held that human nature was not innately good; he therefore concluded that a satisfactory society was not likely to evolve but would have to be brought about by revolutionary action. After 1909 Sorel became disenchanted with syndicalism, and with some hesitation he joined the monarchist movement, which sought to reestablish a traditional morality. After the outbreak of the RUSSIAN REVOLUTION OF 1917, Sorel declared himself for the BOLSHEVIKS, who he thought might be capable of precipitating the moral regeneration of mankind. His most important work, *Reflections on Violence* (1908), develops his notion of violence as the revolutionary denial of the existing social order. Sorel's ideas were appropriated (and perverted) by BENITO MUSSOLINI, who used them in support of FASCISM.

sorghum \'sȯr-gəm\ CEREAL grain plant of the family Poaceae (or Gramineae), probably native to Africa, and its edible starchy seeds. All types raised chiefly for grain belong to the species *Sorghum vulgare*, which includes varieties of grain sorghums and grass sorghums (grown for hay and fodder), and broomcorn (used in making brooms and brushes). The strong grass usually grows 2–8 ft (0.5–2.5 m) or higher. The seeds are smaller than those of wheat. Though high in carbohydrates, sorghum is of lower feed quality than corn. Resistant to drought and heat, sorghum is one of Africa's major cereal grains. It is also grown in the U.S., India, Pakistan, and northern and northeastern China. Substantial quantities are also grown in Iran, the Arabian Peninsula, Argentina, Australia, and southern Europe. The grain is usually ground into meal for porridge, flatbreads, and cakes.

sorites \sə-'rī-tēz\ In philosophy, a chain of successive SYLLOGISMS in the first figure so related that either the conclusion of each is the minor premise of the next or the conclusion of each is the major premise of the next. If the conclusions of all the successive syllogisms (except the last) are suppressed and only the remaining premises and the final conclusion are stated, the resulting argument is a valid inference from the stated premises. (For example: Some enthusiasts show poor judgment; all who show poor judgment make frequent mistakes; none who makes frequent mistakes deserves implicit trust; therefore, some enthusiasts do not deserve implicit trust.) In general, there may be n + 1 premises, and analysis then yields a chain of n successive syllogisms.

sorites problem PARADOX presented by the following reasoning: One grain of sand does not constitute a heap; if n grains of sand do not constitute a heap, then neither do n + 1 grains of sand; therefore, no matter how many grains of sand are put together, they never constitute a heap. The problem is apt to arise in connection with any vague term.

Sorokin \'sȯr-ə-kin**, P(itirim) A(lexandrovitch)** (b. Jan. 21, 1889, Turya, Russia—d. Feb. 10, 1968, Winchester, Mass., U.S.) Russian-born U.S. sociologist. Appointed the first professor of sociology at the University of Petrograd in 1919, he was exiled in 1922 for anti-Bolshevism. He immigrated to the U.S., where he founded the sociology department at Harvard University. He distinguished two kinds of society, the sensate (empirical, supportive of natural sciences) and the ideational (mystical, anti-intellectual, dependent on authority), and believed that the study of altruistic love as a science was necessary to avert worldwide chaos.

sororate See LEVIRATE AND SORORATE

Soros \'sȯr-ōs**, George** (b. Aug. 12, 1930, Budapest, Hung.) Hungarian-U.S. financier. He left his native Hungary in 1944 and settled in London in 1947, where he studied and joined a merchant bank. He moved to New York City in 1956 and initially worked as an analyst of European securities. By 1979 his daring investments and currency speculation brought large profits, some of which he used to found Soros Foundations, dedicated to creating open societies in many eastern European countries and Russia. Other Soros programs have been dedicated to enlarging public debate on a wide range of controversial issues. In 1992 he reached new heights of wealth, making a profit of about $1 billion when Britain devalued the pound sterling, but in 1998 he suffered large losses from currency speculation in Russia.

sorrel Any of several hardy perennial herbs of the BUCKWHEAT family, widespread in temperate regions. Sheep sorrel (*Rumex acetosella*), a weed native to Europe and widespread in North America, is an attractive but troublesome invader in lawns, gardens, meadows, and grassy slopes. It has slender, triangular leaves and tiny yellow or reddish flowers. The pungent, sour leaves are used as a vegetable, as a flavouring in omelets and sauces, in soups, and, when young, in salads. Two related species are garden sorrel (*R. acetosa*) and French sorrel (*R. scutatus*), both found throughout Europe and Asia. Wood sorrels, unrelated plants, belong to the genus *Oxalis* (see OXALIS).

Sosa, Sammy *orig.* **Samuel Sosa Peralta** (b. Nov. 12, 1968, San Pedro de Macoris, Dom.Rep.) Dominican-born U.S. baseball player. Sosa came to the U.S. as a child and began playing organized baseball at age 14. In 1985 he signed with the Texas Rangers, with whom he made his professional debut in 1989; he was soon traded to the Chicago White Sox and then in 1992 to the Chicago Cubs. In 1993 the right fielder became the Cubs' first player to hit 30 home runs and steal 30 bases in one season, a feat he repeated in 1994. In 1998 he dramatically battled MARK MCGWIRE for the season home-run record (later broken by BARRY BONDS); Sosa finished the year with 66 home runs, earning him the National League's Most Valuable Player award. In 1999 he became the first player to hit more than 60 home runs in each of two seasons. Before the start of the 2005 season, he was traded to the Baltimore Orioles.

Sōseki See NATSUME SŌSEKI

Sotheby's \'sə-thə-bēz\ Art auction firm. Founded in London by the bookseller Samuel Baker in 1744, it was later managed after his death by his nephew, John Sotheby, and by his successors until 1861. In the 19th and early 20th centuries, Sotheby's concentrated on books, manuscripts, and prints. After World War I it specialized in 19th- and 20th-century works, particularly Impressionist paintings. It opened an office in New York City in 1955, and in 1964 it acquired Parke-Bernet, the premier U.S. art auction house. A. Alfred Taubman purchased a controlling share of the company in 1983 and renamed it Sotheby's Holdings, Inc. In 2002 Taubman was convicted of price-fixing with rival auction house Christie's, sentenced to a one-year jail term, and fined $7.5 million.

Sotho \'sō-ˌtō\ Cluster of Bantu-speaking peoples (numbering 10 million) occupying the high grasslands of southern Africa, mainly parts of South Africa, Botswana, and Lesotho. They are culturally and historically distinct from the NGUNI peoples. The main Sotho groups are the Pedi and Lovedu in the north, the TSWANA in the west, and the Basuto of Lesotho. Most farm and raise livestock, though Christian missionary activity and urbanization have resulted in a breakdown of traditional culture patterns.

Soto, Hernando de (b. c. 1496/97, Jerez de los Caballeros, Badajoz, Spain—d. May 21, 1542, along the Mississippi River) Spanish explorer and conquistador. He joined the 1514 expedition of Pedro Arias Dávila (1440–1531) to the West Indies, and in Panama he quickly made his mark as a trader and explorer. By 1520 he had accumulated a small fortune through his slave trading in Nicaragua and on the Isthmus of Panama. He joined FRANCISCO PIZARRO on an expedition to conquer Peru in 1532, returning to Spain in 1536 with great wealth. Commissioned by the Spanish crown to conquer what is now Florida, he departed in 1538 in command of 10 ships and 700 men. On that expedition he explored the extensive region that was to become the southeastern U.S. and discovered the Mississippi River for Europeans. Overcome by fever, he died in Louisiana and was buried in the Mississippi River.

soul Immaterial aspect or essence of a person, conjoined with the body during life and separable at death. The concept of a soul is found in nearly all cultures and religions, though the interpretations of its nature vary considerably. The ancient Egyptians conceived of a dual soul, one surviving death but remaining near the body, while the other proceeded to the realm of the dead. The early Hebrews did not consider the soul as distinct from the body, but later Jewish writers perceived the two as separate. Christian theology adopted the Greek concept of an immortal soul, adding the notion that God created the soul and infused it into the body at conception. In Islam the soul is believed to come into existence at the same time as the body but is everlasting and subject to eternal bliss or torment after the death of the body. In HINDUISM each soul, or ATMAN, was

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created at the beginning of time and imprisoned in an earthly body; at death the soul is said to pass to a new body according to the laws of KARMA. BUDDHISM negates the idea of a soul, asserting that any sense of an individual self is illusory.

soul music Style of U.S. popular music sung and performed primarily by African American musicians, having its roots in GOSPEL MUSIC and RHYTHM AND BLUES. The term was first used in the 1960s to describe music that combined rhythm and blues, gospel, JAZZ, and ROCK MUSIC and that was characterized by intensity of feeling and earthiness. In its earliest stages, soul music was found most commonly in the South, but many of the young singers who were to popularize it migrated to cities in the North. The founding of MOTOWN in Detroit, Mich., and Stax-Volt in Memphis, Tenn., did much to encourage the style. Its most popular performers include JAMES BROWN, RAY CHARLES, SAM COOKE, and ARETHA FRANKLIN.

sound Mechanical disturbance that propagates as a longitudinal wave through a solid, liquid, or gas. A sound WAVE is generated by a vibrating object. The vibrations cause alternating compressions (regions of crowding) and rarefactions (regions of scarcity) in the particles of the medium. The particles move back and forth in the direction of propagation of the wave. The speed of sound through a medium depends on the medium's ELASTICITY, DENSITY, and TEMPERATURE. In dry air at 32 °F (0 °C), the speed of sound is 1,086 feet (331 metres) per second. The FREQUENCY of a sound wave, perceived as PITCH, is the number of compressions (or rarefactions) that pass a fixed point per unit time. The frequencies audible to the human ear range from approximately 20 hertz to 20 kilohertz. Intensity is the average flow of energy per unit time through a given area of the medium and is related to loudness. See also ACOUSTICS; EAR; HEARING; ULTRASONICS.

Sound, The See ØRESUND

sound barrier Sharp rise in aerodynamic drag that occurs as an aircraft approaches the speed of SOUND. At sea level the speed of sound is about 750 miles (1,200 km) per hour, and at 36,000 feet (11,000 metres) it is about 650 miles (1,050 km) per hour. The sound barrier was formerly an obstacle to supersonic flight. If an aircraft flies at somewhat less than sonic speed, the pressure waves (sound waves) it creates outspeed their sources and spread out ahead of it. Once the aircraft reaches sonic speed the waves are unable to get out of its way. Strong local shock waves form on the wings and body; airflow around the craft becomes unsteady, and severe buffeting may result, with serious stability difficulties and loss of control over flight characteristics. Generally, aircraft properly designed for supersonic flight have little difficulty in passing through the sound barrier, but the effect on those designed for efficient operation at subsonic speeds may become extremely dangerous. The first pilot to break the sound barrier was CHUCK YEAGER (1947), in the experimental X-1 aircraft.

sound card *or* **audio card** INTEGRATED CIRCUIT that generates an audio signal and sends it to a computer's speakers. The sound card can accept an analog sound (as from a microphone or audio tape) and convert it to digital data that can be stored in an audio file, or accept digitized audio signals (as from an audio file) and convert them to analog signals that can be played on the computer's speakers. On a personal computer, the sound card is usually a separate circuit board that is plugged into the motherboard.

sound effect Artificial imitation of sound to accompany action and supply realism in a dramatic production. Sound effects were first used in the theatre, where they can represent a range of action too vast or difficult to present onstage, from battles and gunshots to trotting horses and rainstorms. Various methods were devised by backstage technicians to reproduce sounds (e.g., rattling sheet metal to create thunder); today most sound effects are reproduced by recordings. An important part of old-fashioned radio dramas, sound effects are still painstakingly added to television and movie soundtracks.

sound reception See HEARING

Souphanouvong \sü-'pä-nü-ˌvȯŋ\ (b. July 13, 1909, Luang Prabang, Laos—d. Jan. 9, 1995, Laos) Leader of the revolutionary Pathet Lao movement and president of Laos (1975–86). Half brother of SOUVANNA PHOUMA, Souphanouvong was trained in civil engineering and built bridges and roads in Vietnam (1938–45). He fought the return of French colonial rule to Laos after World War II and broke with the Free Laos government-in-exile to ally himself with the VIET MINH, founding the communist-oriented Pathet Lao, which came to power in 1974–75.

sour gum See BLACK GUM

Souris \'sůr-əs\ **River** River in Saskatchewan and Manitoba, Canada, and North Dakota, U.S. The Souris rises in southeastern Saskatchewan, then flows southeast into North Dakota, where it turns north to reenter Canada, joining the ASSINIBOINE RIVER in Manitoba after a course of 600 mi (966 km). In North Dakota it is also called the Mouse River.

Sousa \'sü-zə**, John Philip** (b. Nov. 6, 1854, Washington, D.C., U.S.—d. March 6, 1932, Reading, Pa.) U.S. bandmaster and composer known as "The March King." As a youth he learned to play the violin and various band instruments. In 1868 he enlisted in the U.S. Marine Corps as an apprentice in the Marine Band, and from 1880 to 1892 he directed the group, building it into a virtuoso ensemble. In 1892 he formed his own band, with which he toured internationally to great acclaim. He composed 136 military marches, including "Semper Fidelis" (the official march of the Marines), "The Washington Post," "The Liberty Bell," and "The Stars and Stripes Forever." He also wrote successful operettas, including *El Capitan* (1896), and dozens of other works. In the 1890s he developed a type of bass tuba now known as the SOUSAPHONE.

sousaphone *or* **helicon** Spiral circular bass or contrabass TUBA. Traditionally made of brass, it is now often made of fibreglass for lightness. The helicon was probably first developed in Russia but was perfected in Vienna in 1849 by Ignaz Stowasser, who manufactured it in various sizes. JOHN PHILIP SOUSA designed a removable and rotatable bell for the instrument in 1892, giving the new design his own name. Designed for portability, the instruments have become standard in marching bands.

Souter \'sü-tər**, David H(ackett)** (b. Sept. 17, 1939, Melrose, Mass., U.S.) U.S. jurist. He graduated from Harvard Law School and soon joined the New Hampshire attorney general's office. He was promoted to state attorney general in 1976, to the state's Superior Court in 1978, and to its Supreme Court in 1983. In 1990 he was appointed by Pres. GEORGE BUSH to the First U.S. Circuit Court of Appeals and later that year to the U.S. SUPREME COURT. Considered a conservative at the outset of his appointment, he gradually emerged as a moderate liberal, particularly on issues of civil rights.

South Africa *officially* **Republic of South Africa** *formerly* **Union of South Africa** Southernmost country on the African continent. The Kingdom of LESOTHO lies within its boundaries. Area: 470,693 sq mi

(1,219,090 sq km). Population (2005 est.): 46,888,000. Capitals: PRETORIA/Tshwane (executive), CAPE TOWN (legislative), BLOEMFONTEIN/Mangaung (judicial). Three-fourths of the population are black Africans, including the ZULU, XHOSA, SOTHO, and TSWANA; nearly all of the remainder are of European or mixed or South Asian descent. Languages: Afrikaans, English, Ndebele, Pedi (North

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Sotho), Sotho (South Sotho), Swati (Swazi), Tsonga, Tswana, Venda, Xhosa, Zulu (all official). Religions: Christianity (other [mostly independent] Christians, Protestant, Roman Catholic); also traditional beliefs, Hinduism, Islam. Currency: rand. South Africa has three major zones: the broad interior plateau, the surrounding mountainous Great Escarpment, and a narrow belt of coastal plain. It has a temperate subtropical climate. It is one of the world's major producers and exporters of gold, coal, diamonds, platinum, and vanadium. It is a multiparty republic with two legislative houses; its head of state and government is the president. San and Khoekhoe (Khoisan speakers) roamed the area as hunters and gatherers in the Stone Age, and the latter had developed a pastoralist culture by the time of European contact. By the 14th century, peoples speaking Bantu languages had settled in the area and developed gold and copper mining and an active East African trade. In 1652 the Dutch established a colony at the Cape of Good Hope; the Dutch settlers became known as Boers (Dutch: "Farmers") and later as Afrikaners (for their Afrikaans language). In 1795 British forces captured the cape. In 1836 Dutch settlers seeking new land made the Great Trek northward and established (1838) the independent Boer republics of Orange Free State and the South African Republic (later the Transvaal region), which the British annexed as colonies by 1902 following the South African War. In 1910 the British colonies of Cape Colony, Transvaal, Natal, and Orange River were unified into the new Union of South Africa, which became independent and withdrew from the Commonwealth in 1961. Throughout the 20th century, South African politics were dominated by the question of maintaining white European supremacy over the country's black majority, and in 1948 South Africa formally instituted apartheid. Faced by increasing worldwide condemnation, it began dismantling the apartheid laws in 1990. In free elections in 1994, Nelson Mandela became the country's first black president. A permanent nonracial constitution was promulgated in 1997.

South African War *or* **Boer War** War fought between Great Britain and the two Boer (see Afrikaner) republics—the South African Republic (Transvaal) and the Orange Free State—from 1899 to 1902. It was precipitated by the refusal of the Boer leader Paul Kruger to grant political rights to Uitlanders ("foreigners," mostly English) in the interior mining districts and by the aggressiveness of the British high commissioner, Alfred Milner. Initially the Boers defeated the British in major engagements and besieged the key towns of Ladysmith, Mafikeng, and Kimberley; but British reinforcements under H.H. Kitchener and F.S. Roberts relieved the besieged towns, dispersed the Boer armies, and occupied Bloemfontein, Johannesburg, and Pretoria (1900). When Boer commando attacks continued, Kitchener implemented a scorched-earth policy: Boer farms were destroyed and Boer civilians were herded into concentration camps. More than 20,000 men, women, and children (including black Africans) died as a result, causing international outrage. The Boers finally accepted defeat at the Peace of Vereeniging.

South America Continent, Western Hemisphere. The world's fourth largest continent, it is bounded by the Caribbean Sea to the northwest, the Atlantic Ocean to the northeast, east, and southeast, and the Pacific Ocean to the west. It is separated from Antarctica by the Drake Passage and is joined to North America by the Isthmus of Panama. Area: 6,895,210 sq mi (17,858,520sq km). Pop., 2002 est.: 350,977,000. Four main ethnic groups have populated South America: Indians, who were the continent's pre-Columbian inhabitants; Spanish and Portuguese who dominated the continent from the 16th to the early 19th century; Africans imported as slaves; and the postindependence immigrants from overseas, mostly Germans and southern Europeans but also Lebanese, South Asians, and Japanese. Nine-tenths of the people are Christian, the vast majority of whom are Roman Catholic. Spanish is the official language everywhere except in Brazil (Portuguese), French Guiana (French), Guyana (English), and Suriname (Dutch); some Indian languages are spoken. South America has three major geographic regions. In the west, the Andes Mountains, which are prone to seismic activity, extend the length of the continent; Mount Aconcagua, at 22,834 ft (6,960 m), is the highest peak in the Western Hemisphere. Highlands lie in the north and east, bordered by lowland sedimentary basins that include the Amazon River, the world's largest drainage basin, and the Pampas of eastern Argentina, whose fertile soils constitute one of South America's most productive agricultural areas. Other important drainage systems include those of the Orinoco and São Francisco rivers and the Paraná–Paraguay–Río de la Plata system. Four-fifths of South America lies within the tropics, but it also has temperate, arid, and cold climatic regions. Less than one-tenth of its land is arable, producing mainly corn (maize), wheat, and rice, and about one-fourth is under permanent pasture. About half is covered by forest, mainly the enormous but steadily diminishing rainforest of the Amazon basin. Almost one-fourth of all the world's known animal species live in the continent's rainforests, plateaus, rivers, and swamps. South America has one-eighth of the world's total deposits of iron and one-fourth of its copper reserves. Exploitation of these and numerous other mineral resources are important to the economies of many regions. Commercial crops include bananas, citrus fruits, sugar, and coffee; fishing is important along the Pacific coast. Trade in illegal narcotics (mostly for export) is a major source of revenue in some countries. Most countries have free-market or mixed (state and private enterprise) economies. Income tends to be unevenly distributed between large numbers of poor people and a small number of wealthy families, with the middle classes, though growing, still a minority in most countries. Asiatic hunters and gatherers are thought to have been the first settlers, probably arriving less than 12,000 years ago. The growth of agriculture from c. 2500 BC (it had begun some 6,000 years earlier) initiated a period of rapid cultural evolution whose greatest development occurred in the central Andes region and culminated with the Inca empire. European exploration began when Christopher Columbus landed in 1498; thereafter Spanish and Portuguese adventurers (see conquistadores) opened it for plunder and, later, settlement. According to terms of the Treaty of Tordesillas, Portugal received the eastern part of the continent, while Spain received the rest. The Indian peoples were decimated by this contact, and most of those who survived were reduced to a form of serfdom. The continent was free of European rule by the early 1800s except for the Guianas. Most of the countries adopted a republican form of government; however, social and economic inequalities or border disputes led to periodic revolutions in many of them, and by the early 20th century most had fallen under some form of autocratic rule. All joined the United Nations after World War II (1938–45), and all joined the Organization of American States in 1948. By the second half of the 20th century most countries had begun to integrate their economies into world markets, and by the 1990s most had embraced democratic rule. See map on opposite page.

South Asian arts Literary, performing, and visual arts of India, Pakistan, Bangladesh, and Sri Lanka. Myths of the popular gods, Vishnu and Shiva, in the *Puranas* (ancient tales) and the *Mahabharata* and *Ramayana* epics, supply material for representational and dramatic arts. The *Ramayana* is often considered the first work in the *kavya* poetic style; *kavya* compositions must convey different *rasa* (sentiments) and also induce the appropriate *rasa* in the audience. The Dravidian languages of the south, including Tamil and Telegu, provided some enduring works, particularly the devotional poems of the Tamil Alvars and Nayannars from the 7th through the 9th century. The introduction of Persian by Muslim conquerors led to the development of Urdu. Following in the Persian tradition, Urdu poets particularly favoured the *ghazal*, a love poem of great metric and rhythmic subtlety. The *Nanya-Nastra* established the rules for classical dance and drama, the most popular form of which was the *nanaka*, or heroic tale. From the 14th century onward the *nanaka* lost ground to popular folk theatre, but elements of classical drama persist. Dance traditionally requires musical accompaniment, though players and vocalists take their lead from the rhythm of the dancers' feet and not vice versa. Central to South Asian music is the concept of modes known as raga. Rhythm in South Asian music, like the construction of scales, is additive. The music is basically monodic, consisting essentially of a single melody against a drone, though the drum part may virtually constitute another voice. Music is generally for entertainment, but it is nevertheless closely linked to Hinduism. Northern India's most characteristic structure, a temple with a heavily decorated tower, reached its stylistic height in the 7th–11th centuries. The extension of Islam into India in the 11th and 12th centuries introduced typical Muslim architectural forms (e.g., the dome and pointed arch) and decoration. Such masterworks as the Taj Mahal resulted from the rule of the Muslim Mughal dynasty in the 16th–18th centuries. Traditionally, visual artists produced works for patrons, and sacred written canons guided their works' proportions, iconography, and other artistic considerations. Since early in the region's history, wall paintings and miniatures painted on palm leaves or paper were prominent, but sculpture was the favoured medium. Sculptures were largely religious and essentially symbolic and abstract. Works displaying Hindu and Buddhist imagery flourished in the Golden Age of India in the 4th–5th centuries. Islamic influences were incorporated into traditional styles after the Muslim invasions of the 12th century. At the end of the 19th century, rising Indian nationalism led to a conscious revival of native arts traditions, though more recently artists have assimilated elements of European art

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styles. See also BHARATA NATYA; GANDHARA ART; MATHURA ART; MUGHAL ARCHITECTURE; SITAR; TABLA; and such individual artists as SATYAJIT RAY; SALMAN RUSHDIE; RAVI SHANKAR; RABINDRANATH TAGORE.

South Australia State (pop., 2001: 1,514,854), south-central Australia. It covers an area of 379,720 sq mi (983,470 sq km), and its capital is ADELAIDE. The Dutch visited the coast in 1627. British explorers arrived in the early 1800s, and it was colonized as a British province in 1836. Its vast interior, a large part of which is barren, includes Lake EYRE and the FLINDERS RANGES. A major world source of opals, it also produces most of the wine and brandy consumed in Australia. It has the country's largest shipyards. It became a state of the Commonwealth of Australia in 1901. Its southeastern part has become industrialized since World War II.

South Bend City (pop., 2000: 107,789), northern Indiana, U.S. It is situated on the St. Joseph River. A fur-trading post was established at the site in 1820. The city's highly industrialized economy has roots in the pioneering companies founded there in the 19th century, including Studebaker Brothers Manufacturing Co. (later an auto plant) and SINGER Co., a sewing machine manufacturer. The city serves as the trade and financial focus of southern Michigan as well as northern Indiana, a region known as Michiana. Nearby is the University of NOTRE DAME.

South Carolina State (pop., 2000: 4,012,012), southeastern U.S. It covers 31,113 sq mi (80,583 sq km) and is an original state of the Union; its capital is COLUMBIA. South Carolina is bounded on the north by North Carolina and on the southwest by Georgia; the Atlantic Ocean is to the southeast. The state comprises a broad coastal plain with a rolling piedmont farther inland. At the time of European contact the area was inhabited by SIOUX, IROQUOIS, and Muskogean Indians. Spanish and French settlements were established and abandoned in the 16th century; the first permanent European settlement was made by the English in 1670 at Charles Town, moved to the present site of CHARLESTON in 1680. Several military campaigns were fought in South Carolina during the AMERICAN REVOLUTION. In 1788 South Carolina became the eighth state to ratify the U.S. Constitution, and in 1860 it became the first state to secede from the Union. The initial action of the AMERICAN CIVIL WAR occurred there at FORT SUMTER. It was readmitted to the Union in 1868. Constitutional revisions in 1895 disenfranchised almost all of the state's blacks, and a rigid policy of racial segregation persisted until the mid-1960s, when the national CIVIL RIGHTS MOVEMENT began to have some effect in ameliorating racist policies. South Carolina is a leader in U.S. textile manufacturing and has a large industrial base. Tourism is its second largest industry. Agriculture also contributes to the economy; major crops include tobacco, soybeans, and cotton.

South China Sea See CHINA SEA

South Dakota State (pop., 2000: 754,844), north-central U.S. It covers 77,116 sq mi (199,730 sq km); its capital is PIERRE. South Dakota is bordered on the north by North Dakota, on the east by Minnesota and Iowa, on the south by Nebraska, and on the west by Wyoming and Montana. The state has three main regions—the eastern prairie; the central GREAT PLAINS, which contain the BADLANDS; and the BLACK HILLS to the west. The MISSOURI RIVER bisects it from north to south. The French explored the area in the 18th century and sold it to the U.S. as part of the LOUISIANA PURCHASE in 1803. The LEWIS AND CLARK EXPEDITION spent about seven weeks there in 1804. The Dakota Territory was created in 1861, but settlement was sparse until the Black Hills gold rush of 1875–76 swelled the population. Intermittent wars between the Indians and immigrant whites occurred until the massacre at WOUNDED KNEE in 1890. South Dakota became the 40th U.S. state in 1889. Farming and related industries form the state's economic base. It is a leader in cattle and hog production, and its main crops are grains. Tourism is a major industry; attractions include Mount RUSHMORE, WIND CAVE NATIONAL PARK, Badlands National Park, and JEWEL CAVE NATIONAL MONUMENT.

South Georgia Mountainous, barren island, southern Atlantic Ocean. It is located about 800 mi (1,300 km) east-southeast of the FALKLAND (MALVINAS) ISLANDS. Together with the South Sandwich Islands, some 500 mi (800 km) to the southeast, it constitutes a British overseas territory. With an Antarctic climate, it has perpetual snow covering three-fourths of the island. It is home to reindeer, several penguin and seal species, and abundant marine life. Capt. JAMES COOK claimed it for Britain in 1775, and ERNEST SHACKLETON first crossed it in 1916 while in search of aid for his ill-fated expedition; Shackleton died on the island on a later expedition and was buried there. Formerly a whaling base, it is now the site of an Antarctic research station.

South Indian bronze Any of the cult images that rank among the finest achievements of Indian visual art. Most of the figures represent Hindu divinities, especially various iconographic forms of the god Shiva and Lord Vishnu, with their consorts and attendants. The images were produced in large numbers from the 8th to the 16th century, principally in the Thanjavur and Tiruchchirappalli districts of modern Tamil Nadu, and maintained a high standard of excellence for almost 1,000 years. The icons range from small household images to almost life-size sculptures intended to be carried in temple processions.

The god Shiva in the garb of a mendicant, South Indian bronze from Tiruvengadu, Tamil Nadu, early 11th century; in the Thanjavur Museum and Art Gallery, Tamil Nadu
P. CHANDRA

South Island Island (pop., 2001 prelim.: 942,213), larger and southernmost of the two principal islands of New Zealand. Separated from the NORTH ISLAND by COOK STRAIT, it has an area of 58,676 sq mi (151,971 sq km). Mountains, including the SOUTHERN ALPS, occupy almost three-quarters of the island. Its main cities are CHRISTCHURCH and Dunedin. FIORDLAND NATIONAL PARK in the southwest contains numerous coastal fjords and high lakes.

South Korea See SOUTH KOREA

South Orkney Islands Island group, southern Atlantic Ocean. Located southeast of South America, the South Orkneys are composed of two large islands (Coronation and Laurie) and many smaller islands; they form part of the British Antarctic Territory. Barren and uninhabited, the islands have a total area of 240 sq mi (620 sq km). They were part of the FALKLAND ISLANDS Dependencies until 1962. Signy Island is used as a base for Antarctic exploration.

South Platte River River, Colorado and western Nebraska, U.S. The river rises in central Colorado and flows southeast and then northeast across the Nebraska boundary to join the NORTH PLATTE RIVER and form the PLATTE RIVER. The South Platte is 442 mi (711 km) long. Its reservoirs and dams, particularly around DENVER, are used for flood control, irrigation, and power generation.

South Pole Southern extremity of the Earth's axis, located at latitude 90° S. It is the southern point from which all meridians of longitude start. The area around it is a lofty plateau in west-central ANTARCTICA, with ice as much as 8,850 ft (2,700 m) thick. It has six months of complete daylight and six months of total darkness each year. It was first reached by the Norwegian explorer ROALD AMUNDSEN in 1911, one month before the expedition led by British explorer ROBERT FALCON SCOTT; U.S. explorer RICHARD E. BYRD flew to the pole in 1929. The geographic pole does not coincide with the magnetic South Pole, which in the early 21st century was located on the Adélie Coast about 64°30′ S, 137°50′ E; it moves about 8 mi (13 km) to the northwest each year. The geomagnetic South Pole also moves; during the early 1990s it was located about 79°13′ S, 108°44′ E, in 2000 it was 65°39′ S, 140° 01′ E, and by 2005 it was back to about 79°45′ S, 108°13′ E.

South Sea Bubble (1720) Speculation mania that caused financial ruin for many British investors. Parliament's acceptance of a proposal by the South Sea Co. to take over the British national debt resulted in an immediate rise in its stock. After soaring from 128½ to over 1,000 in nine months, the bubble of overvalued stock burst and the price per share dropped to 124, dragging other stocks down and leaving many investors ruined. An inquiry by the House of Commons found collusion by several government ministers.

South West Africa See NAMIBIA

South West Africa People's Organization (SWAPO) Party in South West Africa (now Namibia) that advocated immediate independence from South Africa. Founded in 1960, it used diplomacy to attain its goals

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until 1966, when it turned to armed struggle. Led by Sam Nujoma and backed by the Angolan ruling party and the Soviet Union, SWAPO used Angola as a base for launching guerrilla attacks. From 1978 South Africa made periodic retaliatory strikes into Angola. That same year the UN recognized SWAPO as the Namibian people's sole representative. South Africa finally accepted a UN resolution requiring the withdrawal of South African troops in Namibia and the holding of free elections in 1988.

South Yorkshire Metropolitan county (pop., 2001: 1,266,337), north-central England. It lost its administrative functions in 1986 and is now only a geographic and ceremonial county; its administrative seat was Barnsley. South Yorkshire extends from the Pennine moorlands in the west to lowland marshes in the east. The Romans built roads and forts in the area, and Anglian and later Scandinavian settlers cleared woodlands. In the 19th century the region grew as a major industrial area, and the River Don valley became the focus of iron- and steelworks extending east from Sheffield. Today South Yorkshire includes most of England's coalfields; its industries produce iron, steel, and cutlery.

Southampton City and unitary authority (pop., 2001: 217,478), historic county of Hampshire, England. First settled by Romans, it was chartered (c. 1155) by King Henry II and incorporated in 1445. In the Middle Ages its location on the English Channel helped it to become a major British port. Southampton declined in the 17th–18th centuries but revived in the 19th with the arrival of railways. It is England's second largest port. Historic buildings include the 11th-century St. Michael's Church and the 12th-century King John's Palace, one of Britain's oldest domestic buildings.

Southampton, Henry Wriothesley, 3rd earl of (b. Oct. 6, 1573, Cowdray, Sussex, Eng.—d. Nov. 10, 1624, Bergen op Zoom, Neth.) English nobleman, patron of William Shakespeare. Grandson of the 1st earl of Southampton, he became a favourite of Elizabeth I. He was a liberal patron of writers, including Thomas Nashe. Shakespeare dedicated two long poems to him (1593, 1594), and he has often been identified as the noble youth addressed in most of Shakespeare's sonnets. He accompanied the 2nd earl of Essex on expeditions to Cádiz and the Azores (1596, 1597). For supporting the Essex rebellion (1601), he was imprisoned (1601–03); following James I's accession, he regained his place at court. He became a privy councillor in 1619, but he lost favour by opposing the 1st duke of Buckingham. He and his son volunteered to fight for the United Provinces against Spain, but, soon after landing in the Netherlands, they both died of fever.

Southampton, Thomas Wriothesley \'rät-slē, 'rī-əth-slē**, 1st earl of** (b. Dec. 21, 1505, London, Eng.—d. July 30, 1550, London) English politician. He followed his father, a herald, into royal service and became personal secretary to Thomas Cromwell (1533), whom he succeeded as a secretary of state to Henry VIII (1540). Wriothesley became one of Henry's leading councillors and was appointed lord chancellor of England (1544–47). After Henry's death, he was created earl of Southampton (1547) by the duke of Somerset, but he was deprived of the chancellorship. He supported Somerset's overthrow in 1549 but was excluded from the privy council in 1550.

Southampton Island Island, Keewatin region, Nunavut, Canada. Lying at the entrance to Hudson Bay, the island is roughly triangular and has an area of 15,913 sq mi (41,214 sq km). Its plateau in the northeast, with 1,000-ft (300-m) coastal cliffs, gradually slopes to lowlands in the south. Its coastal waters are noted for Arctic char fishing.

Southeast Asia Vast region of Asia lying east of the Indian subcontinent and south of China. It includes a mainland area (also called Indochina) and a string of archipelagoes to the south and east and is generally taken to include Myanmar (Burma), Thailand, Cambodia, Laos, Vietnam, Malaysia, Singapore, Indonesia, Brunei, and the Philippines. For centuries the mainland portion was the site of numerous indigenous dynasties, but in the 19th century all but Thailand (Siam) came under the control of European powers, notably France (see French Indochina); all areas became independent after 1945.

Southeast Asia Treaty Organization (SEATO) Regional defense organization (1955–77) comprising Australia, France, New Zealand, Pakistan, the Philippines, Thailand, Britain, and the U.S. It was founded as part of the Southeast Asia Collective Defense Treaty in order to protect the region from communism. Vietnam, Cambodia, and Laos were not considered for membership, and other countries in the region preferred membership in the nonaligned movement. SEATO had no standing forces, but its members engaged in combined military exercises. Pakistan withdrew in 1968, and France suspended financial support in 1975. The organization was disbanded officially in 1977.

Southeast Asian arts Literary, performing, and visual arts of Myanmar (Burma), Thailand, Laos, Cambodia, Vietnam, Malaysia, Singapore, and the Philippines. The "classical" literatures of Southeast Asia can be divided into three major regions: the Sanskrit region of Cambodia and Indonesia; the region of Burma where Pali, a dialect related to Sanskrit, was used as a literary and religious language; and the Chinese region of Vietnam. The *Mahabharata*, *Ramayana*, *Jataka*s, and local legendary tales are expounded in the performing arts of the region. Dance techniques of the region minimize the mudras (gestures) of Indian classicism to emphasize grace of movement over theme. Regional variations of temple and court dance vie with local developments. Numerous theatrical forms are vehicles for social criticism; most remarkable is *wayang*, or shadow play, in which puppetry has been fused with dance and drama in a unique form of entertainment. Music is generally coordinated with the dramatic arts, resulting in great rhythmic but slight melodic content. The earliest visual arts of the region were wood carvings featuring supernatural and animal imagery developed and shared by the various tribal peoples. A second tradition emerged after Indian artists and artisans followed traders to Southeast Asia in the first centuries AD. Within a short time, Southeast Asians were producing their own distinctive local versions of Indian styles, sometimes rivaling Indian artists with their skill, finesse, and invention on a colossal scale. With the introduction of Hinduism and Buddhism, temple building, sculpture, and painting flourished from the 1st through the 13th century. The Indian royal temple, which dominated Southeast Asian culture, typically stood on a terraced plinth, upon which towered shrines could multiply. About AD 800 the Cambodian king Jayavarman II built a brick mountain for a temple group. This plan was furthered when foundations were laid for Angkor, a scheme based on a grid of reservoirs and canals. Successive kings built more temple mountains there, culminating in Angkor Wat. Among Southeast Asia's most impressive sites is the city of Pagan in Burma, with many brick and stucco Buddhist temples and stupas built 1056–1287.

Southeast Indian Any member of the aboriginal North American Indians who inhabited what is now the southeastern U.S. The Southeast was one of the more densely populated areas of native North America, having an aboriginal population conservatively estimated at 120,000. The bulk of this population resided inland, where advantage could be taken of extensive game resources, wild plant foods, and an abundance of arable land. Only the non-horticultural peoples of south Florida appear to have satisfactorily adjusted to a basically maritime way of life. Groups within this region included the Caddo, Catawba, Cherokee, Chickasaw, Choctaw, Creek, Natchez, and Seminole.

Southend-on-Sea Town and unitary authority (pop., 2001: 160,256), geographic and historic county of Essex, southeastern England. It lies on the Thames estuary and the North Sea. The nearest seaside resort to London, it attracts millions of visitors, and there are many resident commuters. It is noted for its 1.3-mi (2.2-km) pier as well as its beaches and gardens; yachting is popular. A 12th-century priory houses a museum.

Southern Alps Mountain range, South Island, New Zealand. It extends almost the entire length of the island, and it is the highest range in Australasia. It has elevations from 3,000 ft (900 m) to over 10,000 ft (3,050 m), culminating in Mount Cook at 12,316 ft (3,754 m) high. Glaciers descend from the permanently snow-clad top of the range. The range divides the island climatically: the forested western slopes and narrow coastal plain are much wetter than the eastern slopes and wide Canterbury Plains. Much of the southwest area was designated a UNESCO World Heritage site in 1990.

Southern Christian Leadership Conference (SCLC) U.S. nonsectarian agency founded by Martin Luther King, Jr., and others in 1957 to assist local organizations working for equal rights for African Americans. Operating primarily in the South, it conducted leadership-training programs, citizen-education projects, and voter-registration drives. It played a major role in the historic March on Washington in 1963 and in the campaigns to urge passage of the Civil Rights Act of 1964 and the Voting Rights Act of 1965. After King's assassination in 1968, Ralph Abernathy became president. In the early 1970s the SCLC was weakened by several schisms, including the departure of Jesse Jackson, who founded Operation PUSH in Chicago.

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Southey \'saù-thē, 'sə-thē**, Robert** (b. Aug. 12, 1774, Bristol, Gloucestershire, Eng.—d. March 21, 1843, Keswick, Cumberland) English poet and prose writer. In youth Southey ardently embraced the ideals of the French Revolution, as did Samuel Taylor Coleridge, with whom he was associated from 1794. Like Coleridge, he gradually became more conservative. About 1799 he devoted himself to writing; later he was obliged to produce unremittingly to support both his and Coleridge's family. In 1813 he was appointed poet laureate. His poetry is now little read, but his prose style is masterly in its ease and clarity, as seen in such works as *Life of Nelson* (1813), *Life of Wesley* (1820), and *The Doctor* (1834–47), a fantastic, rambling miscellany.

Southwest Indians Any of the American Indians who inhabit what is now the southwestern U.S. Though highly diversified culturally and linguistically, the Southwest Indians divide roughly into four groupings: the Yuman tribes, the Pima and Papago, the Pueblo, and the Navajo and Apache.

Soutine \sü-'tēn**, Chaim** (b. 1893/94?, Smilovichi, near Minsk, Russian Empire—d. Aug. 9, 1943, Paris, Fr.) Russian-born French painter. After studying art in Vilnius, he went to Paris in 1913 to study at the École des Beaux-Arts. An art dealer enabled him to paint for three years in southern France, where his mature style emerged. His highly individualistic style, stimulated by Expressionism, is characterized by thick impasto, agitated brushwork, convulsive compositional rhythms, and disturbing psychological content. Best known are his studies of choirboys and cooks, his series of page boys, and his paintings of hung poultry and beef carcasses, which vividly convey the colour and luminosity of putrescence.

Souvanna Phouma \sü-'vä-nä-'pü-mä\ (b. Oct. 7, 1901, Luang Prabang, Laos—d. Jan. 10, 1984, Vientiane) Premier of Laos (1951–54, 1960, 1962, 1974–75). Nephew of King Sisavangvong of Laos, Souvanna did not support his uncle's decision to welcome back French rule after the end of World War II. With his half brother Souphanouvong, he joined the Free Laos movement and went into exile when the French reoccupied Laos. In 1949, when the French began to concede authority, he returned, and in 1951 he began his first term as premier. Civil war broke out between the communist Pathet Lao and rightist members of the government; Souvanna served as premier sporadically during that period. He tried to maintain Laotian neutrality during the Vietnam War but came to depend on U.S. military aid; Laos stabilized after the U.S. withdrawal from Vietnam. Souvanna remained an adviser to the government until his death.

Sovereign Council Administrative body that governed the colony of New France in Canada (1663–1702). The council consisted of the governor and the bishop (who together appointed the other members), five councillors, an attorney general, and a clerk. The council named judges and minor officials, controlled public funds and commerce with France, and regulated the fur trade with the Indians. Decisions were subject to the governor's veto. In 1675 a royal edict increased the number of councillors to seven, with vacancies to be filled by the king. From 1685 the intendant, a French administrative official, assumed many of the council's duties. The council was renamed the Superior Council in 1702.

sovereignty In political theory, the ultimate authority in the decision-making process of the state and in the maintenance of order. In 16th-century France Jean Bodin used the concept of sovereignty to bolster the power of the king over his feudal lords, heralding the transition from feudalism to nationalism. By the end of the 18th century, the concept of the social contract led to the idea of popular sovereignty, or sovereignty of the people, through an organized government. The Hague Conventions, the Geneva Conventions, and the United Nations all have restricted the actions of sovereign countries in the international arena, as has international law.

soviet Council that constituted the primary unit of government in the Soviet Union. The first soviet was formed in St. Petersburg during the Russian Revolution of 1905 to coordinate revolutionary activities, but it was suppressed. Socialist leaders formed the second soviet shortly before the abdication of Nicholas II, with one deputy for every 1,000 workers and every military company. After the Russian Revolution of 1917, the Bolsheviks gradually gained a dominant position in soviets across the land. In 1918 a new constitution established soviets as the formal unit of local and regional government. The 1936 constitution created a directly elected bicameral Supreme Soviet, but the single candidate per district was chosen by the Communist Party of the Soviet Union.

Soviet law Law that developed in the Soviet Union after the Russian Revolution of 1917 and that, after World War II, was assimilated by other communist states. Legislative enactments, including the constitution of the U.S.S.R., were the principal sources of law in the Soviet legal system; these were then elaborated in codes of statutes by each union republic. No distinction between public and private law existed; all legal matters involved the state. Law was generally thought of as a force for restructuring society and advancing the nation toward communism. Also known as socialist law, it was based on the writings of Karl Marx and Friedrich Engels. In addition to criminal and civil offenses, "administrative offenses" constituted a large proportion of cases and were dealt with outside the court system.

Soviet Union See Union of Soviet Socialist Republics

sow \'saù\ **bug** *or* **wood louse** Any of certain terrestrial crustaceans of the order Isopoda, especially members of the genus *Oniscus*. Native to Europe, they have been introduced into North America. Sow bugs grow to 0.7 in. (18 mm) long. The oval, gray body is rather arched and is covered with broad, armourlike plates. Two elbowed antennae extend about half the length of the body, and there are seven pairs of limbs. The sow bug lives in moist places, especially under stones, in moist leaf litter, and in cellars. See also pill bug.

Sow bug (*Oniscus asellus*).
HUGH SPENCER

Soweto \sə-'wā-tō\ Urban complex (pop., 2001: 896,995), northeastern Republic of South Africa. It adjoins Johannesburg on the southwest, and its name is an acronym derived from South-Western Townships. It was originally set aside by the South African white government for residence by blacks. The townships constituting Soweto grew out of shantytowns that arose with the arrival of black labourers from rural areas, especially between the World Wars. There is little industrial development; most of Soweto's residents commute to Johannesburg for employment. It is the country's largest black urban complex, and its residents were active in the protests that helped bring an end to apartheid by 1991.

Soya Strait See La Perouse Strait

soybean Annual legume (*Glycine max*, or *G. soja*) of the pea family (see legume) and its edible seed. The soybean plant has an erect, branching stem, white to purple flowers, and one to four seeds per pod. It was probably derived from a wild plant of East Asia, where it has been cultivated for some 5,000 years. Introduced into the U.S. in 1804, it began to be farmed widely as a livestock feed in the 1930s, and the U.S. is now the world's foremost soybean producer. Economically the world's most important bean, the soybean provides vegetable protein for millions of people and ingredients for hundreds of chemical products, including paints, adhesives, fertilizers, insect sprays, and fire-extinguisher fluids. Because soybeans contain no starch, they are a good source of protein for diabetics. Processed for food, soybean oil is made into margarine, shortening, and vegetarian cheeses and meats. Soybean meal serves as a high-protein meat substitute in many food products, including baby foods. Other food products include soybean milk, tofu, salad sprouts, and soy sauce.

Soybeans (*Glycine max*)
J.C. ALLEN AND SON

Soyinka \shò-'yiŋ-kä**, Wole** *in full* **Akinwande Oluwole Soyinka** (b. July 13, 1934, Abeokuta, Nigeria) Nigerian playwright. After studying in Leeds, Eng., he returned to Nigeria to edit literary journals, teach drama and literature at the university level, and found two theatre companies. His plays, written in English and drawing on West African folk traditions, often focus on the tensions between tradition and progress. Symbolism, flashback, and ingenious plotting contribute to a rich dramatic structure. His serious plays reveal his disillusionment with African

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authoritarian leadership and with Nigerian society as a whole. His works include *A Dance of the Forests* (1960), *The Lion and the Jewel* (1963), *Death and the King's Horseman* (1975), and *From Zia, with Love* (1992). He has written several volumes of poetry; his best-known novel is *The Interpreters* (1965). A champion of Nigerian democracy, he was repeatedly jailed and exiled. In 1986 he became the first black African to be awarded the Nobel Prize for Literature.

Wole Soyinka.
VERNON L. SMITH

Soyuz \sȯ-'yüz\ Any of several versions of Soviet/Russian manned spacecraft launched since 1967. Originally conceived for the U.S.S.R.'s Moon-landing program, which was canceled in 1974, the modular craft has served mainly as a crew ferry to and from Earth-orbiting SPACE STATIONS, specifically the SALYUT stations, MIR, and the INTERNATIONAL SPACE STATION (ISS). The first version accommodated three persons but was later modified for a crew of two to make room for additional life-support equipment. Soyuz T, introduced in 1979, restored the third crew seat. Soyuz TM, an upgrade featuring a variety of new systems, made its first manned flight in 1987 when it carried Mir's second crew to the then-embryonic station. The Soyuz TMA debuted in 2002 with a manned flight to the ISS; its design incorporated changes to meet certain NASA requirements as an ISS "lifeboat," including eased height and weight restrictions for crew members.

spa Spring or resort with thermal or mineral water for drinking and bathing. The word derives from a Belgian town whose springs reputedly had curative powers. Mineral springs usually contain various salts, trace minerals, and gases; many are naturally carbonated. Most thermal springs (see HOT SPRING) also contain minerals. Warm-water bathing aids relaxation (see HYDROTHERAPY), and high salt or sulfur content helps some skin conditions. Drinking mineral water is believed to aid digestion, and waters with specific minerals are used for particular conditions.

Spaak \'späk**, Paul-Henri** (b. Jan. 25, 1899, Schaerbeek, near Brussels, Belg.—d. July 31, 1972, Brussels) Belgian statesman. After practicing law (1921–31), he became a socialist member of the Chamber of Deputies in 1932. For most of the period from 1936 to 1966 he served as Belgium's foreign minister, and he twice served as its premier (1938–39, 1947–50). An advocate of European cooperation, he helped form the BENELUX ECONOMIC UNION (1944) and helped draft the UN charter, and in 1946 he served as the UN General Assembly's first president. He signed the BRUSSELS TREATY, helped form NATO, and served as NATO's secretary-general (1957–61). He also helped create the EUROPEAN ECONOMIC COMMUNITY and the EUROPEAN ATOMIC ENERGY COMMUNITY.

Spaatz \'späts**, Carl (Andrews)** *known as* **Tooey Spaatz** (b. June 28, 1891, Boyertown, Pa., U.S.—d. July 14, 1974, Washington, D.C.) U.S. air-force officer. He flew as a combat pilot during World War I. During World War II he commanded the U.S. Strategic Air Forces in Europe (1944), directing the strategic bombing of Germany. In 1945, though personally opposed to using atomic bombs against cities, he directed the atomic bombing of Japan under orders of Pres. HARRY TRUMAN. In 1947 he became the first chief of staff of the independent Air Force.

space contraction See LORENTZ-FITZGERALD CONTRACTION

space exploration Investigation of the universe beyond Earth's atmosphere by means of manned and unmanned SPACECRAFT. Study of the use of ROCKETS for spaceflight began early in the 20th century. Germany's research on rocket propulsion in the 1930s led to development of the V-2 MISSILE. After World War II, the U.S. and the Soviet Union, with the aid of relocated German scientists, competed in the "space race," making substantial progress in high-altitude rocket technology (see STAGED ROCKET). Both launched their first SATELLITES (see SPUTNIK; EXPLORER) in the late 1950s (followed by other satellites and unmanned lunar probes) and their first manned space vehicles (see VOSTOK; MERCURY) in 1961. A succession of longer and more complex manned space missions followed, most notably the U.S. APOLLO program, including the first manned lunar landing in 1969, and the Soviet SOYUZ and SALYUT missions. Beginning in the 1960s, U.S. and Soviet scientists also launched unmanned deep-space probes for studies of the planets and other solar system objects (see PIONEER; VENERA; VIKING; VOYAGER; GALILEO), and Earth-orbiting astronomical observatories (see, for example, HUBBLE SPACE TELESCOPE), which permitted observation of cosmic objects from above the filtering and distorting effects of Earth's atmosphere. In the 1970s and '80s the Soviet Union concentrated on the development of SPACE STATIONS for scientific research and military reconnaissance (see SALYUT; MIR). After the dissolution of the Soviet Union in 1991, Russia continued its space program, but on a reduced basis owing to economic constraints. In 1973 the U.S. launched its own space station (see SKYLAB), and since the mid 1970s it has devoted much of its manned space efforts to the SPACE SHUTTLE program and, more recently, to developing the INTERNATIONAL SPACE STATION in collaboration with Russia and other countries.

space frame Three-dimensional TRUSS based on the rigidity of the triangle and composed of linear elements subject only to compression or tension. Its simplest spatial unit is a tetrahedron having four joints and six members. A space frame forms a very strong, thick, flexible structural fabric that can be used horizontally or bent to a variety of shapes. The beauty of its open latticework web of lightweight tubular diagonals is only surpassed by its structural purity. R. BUCKMINSTER FULLER used this technology for some of his Dymaxion projects; in his Union Tank Car warehouse, Baton Rouge, La. (1958), a space frame reinforces an enormous geodesic dome.

space shuttle *formally* **Space Transportation System (STS)** Partially reusable rocket-launched vehicle developed by NASA to go into Earth orbit, transport people and cargo between Earth and orbiting spacecraft, and glide to a runway landing on Earth. The first flight of a space shuttle into orbit took place in 1981. The shuttle consists of a winged orbiter that carries crew and cargo; an expendable external tank of liquid fuel and oxidizer for the orbiter's three main rocket engines; and two large, reusable solid-propellant booster rockets. The orbiter lifts off vertically like an expendable LAUNCH VEHICLE but makes an unpowered descent similar to a glider. Each orbiter was designed to be reused up to 100 times. For manipulating cargo and other materials outside the orbiter, astronauts use a remotely controlled robot arm or exit the orbiter wearing spacesuits. On some missions, the shuttle carries a European-built pressurized research facility called Spacelab in its cargo bay. Between 1981 and 1985, four shuttle orbiters were put into service: *Columbia* (the first in orbit), *Challenger*, *Discovery*, and *Atlantis*. *Challenger* exploded in 1986 during launch, killing all seven astronauts aboard; it was replaced in 1992 by *Endeavour*. From 1995 to 1998, NASA conducted shuttle missions to the Russian space station MIR to prepare for the construction of the INTERNATIONAL SPACE STATION (ISS). Beginning in 1998, the shuttle was used extensively to ferry components, supplies, and crews to the ISS. In 2003 *Columbia* disintegrated while returning from a space mission, claiming the lives of its seven-person crew.

space station Manned artificial structure designed to revolve in a fixed orbit as a long-term base for astronomical observations, study of Earth's resources and environment, military reconnaissance, and investigations of materials and biological systems in weightless conditions. As of 2001, nine space stations have been placed in a low Earth orbit and occupied for varying lengths of time. The Soviet Union orbited the world's first space station, SALYUT 1, designed for scientific studies, in 1971. From 1974 to 1982 five more Salyut stations—two outfitted for military reconnaissance—were successfully placed in orbit and occupied. In 1986 the U.S.S.R. launched the core module of MIR, a scientific station that was expanded with five additional modules over the next decade. The U.S. orbited its first space station in 1973; called SKYLAB, it was equipped as a solar observatory and medical laboratory. In 1998 the U.S. and Russia began the in-orbit construction of the INTERNATIONAL SPACE STATION (ISS), a complex of laboratory and habitat modules that would ultimately involve contributions from at least 16 countries. In 2000 the ISS received its first resident crew. See illustration on following page.

space-time Single entity that relates space and time in a four-dimensional structure, postulated by ALBERT EINSTEIN in his theories of RELATIVITY. In the Newtonian universe it was supposed that there was no connection between space and time. Space was thought to be a flat, three-dimensional arrangement of all possible point locations, which could be expressed by Cartesian coordinates; time was viewed as an independent

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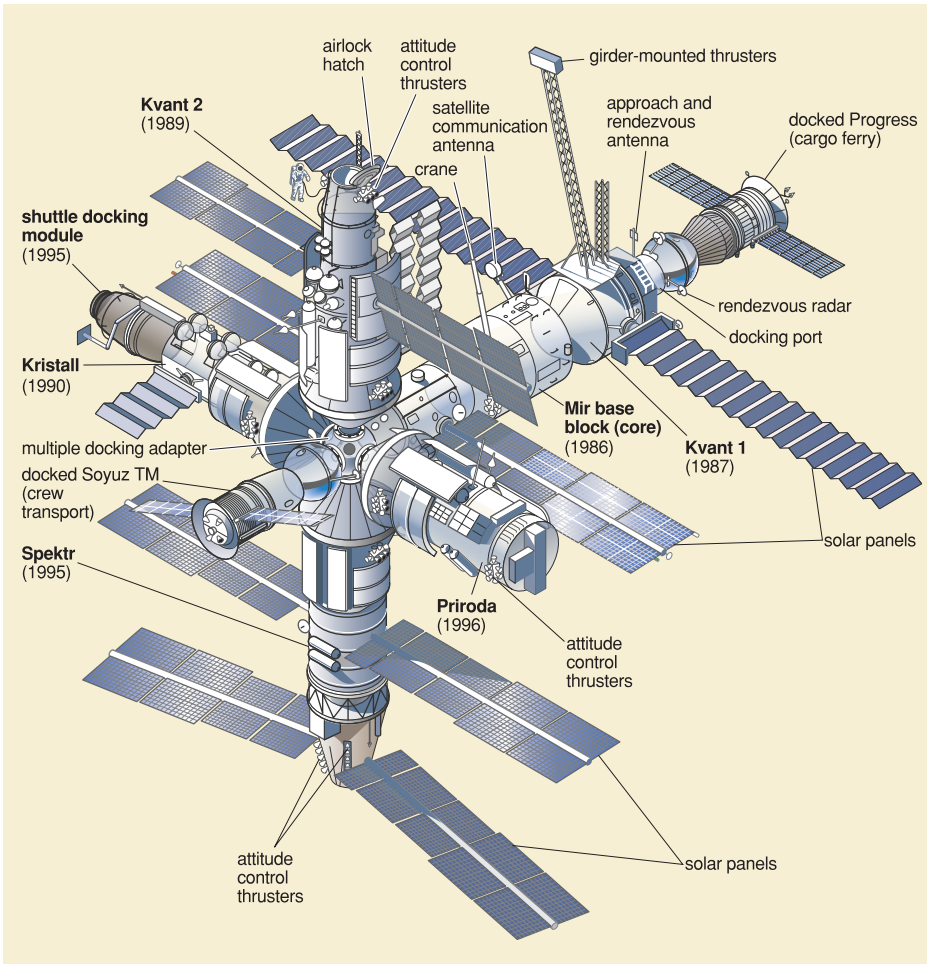

Soviet/Russian space station Mir, after completion in 1996. The date shown for each module is its year of launch. Docked to the station are a Soyuz TM manned spacecraft and an unmanned Progress resupply ferry.
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one-dimensional concept. Einstein showed that a complete description of relative motion requires equations that include time as well as the three spatial dimensions. He also showed that space-time is curved, which allowed him to account for GRAVITATION in his general theory of relativity.

spacecraft Vehicle designed to operate, with or without a crew, in a controlled flight pattern above Earth's lower atmosphere. Since streamlining is not needed in the high vacuum of this environment, a spacecraft's shape is designed according to its mission (see SPACE EXPLORATION). Most spacecraft are not self-propelled; they are accelerated to the necessary high velocity by STAGED ROCKETS, which are jettisoned when their fuel is used up. A major exception, the SPACE SHUTTLE orbiter, uses three onboard liquid-fuel main engines supplied by a disposable external tank and a pair of solid-fuel boosters to reach space. The spacecraft goes into an orbit around Earth or, if given enough velocity, it continues toward another destination in space. The craft may have its own small rocket engines for orienting and maneuvering. For internal power, Earth-orbiting spacecraft use solar cells and storage batteries, fuel cells, or a combination, whereas craft designed for deep-space missions usually carry thermoelectric generators heated by a radioactive element. The enormous complexity of design, particularly of manned spacecraft with their millions of components, requires a high degree of miniaturization and reliability. See also LAUNCH VEHICLE.

spadefish Any of about 17 species (order Perciformes) of predominantly tropical marine fishes with five or six vertical black bands on the deep, laterally compressed, silvery body. The bands may disappear with age, and adults may be solid white, black, or silver. The Atlantic spadefish (*Chaetodipterus faber*) ranges from New England to Brazil. It feeds primarily on marine invertebrates, particularly crustaceans and ctenophores.

Spagnuolo, Pietro See Pedro BERRUGUETE

Spahn, Warren (Edward) (b. April 23, 1921, Buffalo, N.Y., U.S.—d. Nov. 24, 2003, Broken Arrow, Okla.) U.S. baseball pitcher. Spahn spent most of his career with the Boston (later Milwaukee) Braves (1942, 1946–64). He amassed 2,583 career strikeouts, giving him the third highest total in baseball history when he retired. His feat of winning 20 or more games in each of 13 seasons was also a record, as was his striking out at least 100 batters each year for 17 consecutive seasons (1947–63). His total of 363 wins established a record for left-handers. He was inducted into the Baseball Hall of Fame in 1973.

Spain *officially* **Kingdom of Spain** Country, southwestern Europe. One of Europe's largest countries, it is located on the IBERIAN PENINSULA and also includes the BALEARIC and CANARY islands. Area: 195,379 sq mi (506,030 sq km). Population (2005 est.): 44,079,000. Capital: MADRID. The people are predominantly Spanish, though there are populations of BASQUES, Catalans, Galicians, Aragonese, and ROMA (Gypsies or Gitanos). Languages: Castilian Spanish (official), Catalan, Galician, Basque. Religion: Christianity (predominantly Roman Catholic). Currency: euro. Spain's large central plateau is surrounded by the EBRO RIVER valley, the mountainous CATALONIA region, the Mediterranean coastal region of VALENCIA, the GUADALQUIVIR RIVER valley, and the mountainous region extending from the PYRENEES to the Atlantic coast. Spain has a developed market economy based on services, light and heavy industries, and agriculture. Mineral resources include iron ore, mercury, and coal. Agricultural products include grains and livestock. Spain is one of the world's major producers of wine and olive oil. Tourism is also a major industry, especially along the southern Costa del Sol. Spain is a constitutional monarchy with two legislative houses; the chief of state is the king, and the head of government is the prime minister.

Remains of Stone Age populations dating back some 35,000 years have been found throughout Spain. Celtic peoples arrived in the 9th century BC, followed by the Romans, who dominated Spain from c. 200 BC until the Visigoth invasion in the early 5th century AD. In the early 8th century most of the peninsula fell to Muslims (Moors) from North Africa, and it remained under their control until it was gradually reconquered by the Christian kingdoms of CASTILE, ARAGON, and Portugal. Spain was reunited in 1479 following the marriage of FERDINAND II (of Aragon) and ISABELLA I (of Castile). The last Muslim kingdom, GRANADA, was reconquered in 1492, and about this time Spain established a colonial empire in the Americas. In 1516 the throne passed to the HABSBURGS, whose rule ended in 1700 when PHILIP V became the first BOURBON king of Spain. His ascendancy caused the War of the SPANISH SUCCESSION, which resulted in the loss of numerous European possessions and sparked revolution within most of Spain's American colonies. Spain lost its remaining overseas possessions to the U.S. in the SPANISH-AMERICAN WAR (1898). (See CUBA; GUAM; PHILIPPINES; PUERTO RICO.)

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Spain became a republic in 1931. The Spanish Civil War (1936–39) ended in victory for the Nationalists under Gen. Francisco Franco, who ruled as a dictator until his death in 1975. His successor as head of state, Juan Carlos I, restored the monarchy with his accession to the throne; a new constitution in 1978 established a constitutional monarchy. Spain joined NATO in 1982 and the European Community in 1986. The 1992 quincentennial of Christopher Columbus's first voyage from Spain to the Americas was marked by a fair in Sevilla and the staging of the Olympic Games in Barcelona. In the late 20th century and into the 21st, some Basque separatists continued to resort to violence as they pressed for independence, but it was Islamic militants who were responsible for the March 11, 2004, bombings in Madrid that killed more than 200 people—the worst terrorist incident in Europe since World War II.

Spalatin \'spä-lə-tən**, Georg** *orig.* **Georg Burkhardt** (b. Jan. 17, 1484, Spalt, Bavaria—d. Jan. 16, 1545, Altenburg, Saxony) German humanist. He studied at the University of Erfurt and then joined a band of humanist scholars in 1505. Ordained a priest in 1508, he was appointed tutor to the heir of Frederick the Wise, elector of Saxony. In 1511 he befriended Martin Luther at Wittenberg, and, as librarian at Frederick's court from 1512, he influenced the elector to protect Luther during the controversy over indulgences. He championed the Reformation at the Diet of Worms (1521) and under two subsequent electors of Saxony. In 1530 he helped Philipp Melanchthon prepare the text of the Augsburg Confession. He was also influential in forming the Schmalkaldic League in 1531. He wrote many historical works, including *Annales Reformationis* (1718).

Spalding, A(lbert) G(oodwill) (b. Sept. 2, 1850, Byron, Ill., U.S.—d. Sept. 9, 1915, Point Loma, Calif.) U.S. baseball player, executive, and sporting-goods manufacturer. Spalding played with the Boston Red Stockings and later the Chicago White Stockings; he served as president for the latter team (1882–91). In 1876 he and his brother founded, in Chicopee, Mass., the firm that, as A.G. Spalding & Bros., would become one of the premier American sporting-goods companies. He also founded the annual *Spalding's Official Baseball Guide* and wrote the history *America's National Game* (1911). He was elected to the Baseball Hall of Fame in 1939.

spandrel Roughly triangular area on either side of an arch, bounded by a line running horizontally through its apex, a line rising vertically from the springing of the arch, and the exterior curve of the arch. When arches adjoin, the entire area between their crowns and springing line is a spandrel. If filled in, as is ordinarily the case, the result is a spandrel wall; in medieval architecture this was usually ornamented. In buildings of more than one story, the spandrel is the area between the sill of a window and the head of the window below it. In steel or reinforced-concrete structures, a deep spandrel beam may span across this area. The triangular area of space beneath a stair is also known as a spandrel.

spaniel Any of several breeds of dogs used to flush game. Spaniels originated in Spain, but most modern breeds were developed in Britain. Breeds range from 14 to 20 in. (36–51 cm) and from 22 to 55 lbs (10–25 kg). The larger breeds are called springers, the smaller ones cockers. Breeds include the cocker spaniel, a round-headed, floppy-eared dog; the English and Welsh springer spaniels; the American water spaniel, a curly-coated, dark brown dog; the Brittany spaniel, a short-tailed French dog and the only spaniel that points; the Clumber spaniel, a low-slung, long-bodied dog; the Irish water spaniel, a water retriever; the Japanese spaniel; and the English toy spaniel.

Cocker spaniel.
SALLY ANNE THOMPSON-EB INC.

Spanish-American War (1898) Conflict between the U.S. and Spain that ended Spanish colonial rule in the New World. The war originated in Cuba's struggle for independence. The newspapers of William Randolph Hearst fanned U.S. sympathy for the rebels, which increased after the unexplained destruction of the U.S. warship *Maine* on Feb. 15, 1898. Congress passed resolutions declaring Cuba's right to independence and demanding that Spain withdraw its armed forces. Spain declared war on the U.S. on April 24. Commo. George Dewey led the naval squadron that defeated the Spanish fleet in the Philippines (see Battle of Manila Bay) on May 1, and Gen.William Shafter led regular troops and volunteers (including future U.S. president Theodore Roosevelt and his Rough Riders) in the destruction of Spain's Caribbean Sea fleet near Santiago, Cuba (July 17). In the Treaty of Paris (December 10), Spain renounced all claim to Cuba and ceded Guam, Puerto Rico, and the Philippines to the U.S., marking the U.S.'s emergence as a world power.

Spanish Armada See Spanish Armada

Spanish Civil War (1936–39) Military revolt against the government of Spain. After the 1936 elections produced a Popular Front government supported mainly by left-wing parties, a military uprising began in garrison towns throughout Spain, led by the rebel Nationalists and supported by conservative elements in the clergy, military, and landowners as well as the fascist Falange. The ruling Republican government, led by the socialist premiers Francisco Largo Caballero and Juan Negrín (1894–1956) and the liberal president Manuel Azaña y Díaz, was supported by workers and many in the educated middle class as well as militant anarchists and communists. Government forces put down the uprising in most regions except parts of northwestern and southwestern Spain, where the Nationalists held control and named Francisco Franco head of state. Both sides repressed opposition; together, they executed or assassinated more than 50,000 suspected enemies to their respective causes. Seeking aid from abroad, the Nationalists received troops, tanks, and planes from Nazi Germany and Italy, which used Spain as a testing ground for new methods of tank and air warfare. The Republicans (also called loyalists) were sent matériel mainly by the Soviet Union, and the volunteer International Brigades also joined the Republicans. The two sides fought fierce and bloody skirmishes in a war of attrition. The Nationalist side gradually gained territory and by April 1938 succeeded in splitting Spain from east to west, causing 250,000 Republican forces to flee into France. In March 1939 the remaining Republican forces surrendered, and Madrid, beset by civil strife between communists and anticommunists, fell to the Nationalists on March 28. About 500,000 people died in the war, and all Spaniards were deeply scarred by the trauma. The war's end brought a period of dictatorship that lasted until the mid-1970s.

Spanish Guinea See Equatorial Guinea

Spanish Influenza Epidemic See Influenza Epidemic of 1918–19

Spanish Inquisition See Inquisition

Spanish language Romance language spoken in Spain and in large parts of the New World. It has more than 332 million speakers, including more than 23 million in the U.S. Its earliest written materials date from the 10th century, its first literary works from c. 1150. The Castilian dialect, the

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source of modern standard Spanish, arose in the 9th century in north-central Spain (Old Castile) and spread to central Spain (New Castile) by the 11th century. In the late 15th century the kingdoms of Castile, León, and Aragon merged, and Castilian became the official language of all Spain, with CATALAN and Galician (effectively a dialect of PORTUGUESE) becoming regional languages and Aragonese and Leonese reduced to a fraction of their original speech areas. Latin American regional dialects are derived from Castilian but differ from it in PHONOLOGY.

Spanish Main Northern coast of South America. The term refers to an area that was once under Spanish control and spanned roughly between the Isthmus of PANAMA and the delta of the ORINOCO RIVER. The term can also refer to the Caribbean Sea and adjacent waters, especially when referring to the period when the region was troubled by pirates.

Spanish Mission style See MISSION STYLE

Spanish moss EPIPHYTE (*Tillandsia usneoides*) in the PINEAPPLE family, found in southern North America, the West Indies, and Central and South America. It often hangs in large, beardlike, silvery-gray masses from trees and other plants and even on telephone poles, but it is not parasitic or structurally intertwined with its host. It takes in carbon dioxide and rainwater or dew for PHOTOSYNTHESIS through tiny, hairlike scales that cover its threadlike leaves and long, threadlike stems. It absorbs nutrients from dust and solvents in rainwater, or from decaying organic matter around its aerial roots. Stalkless yellow flowers appear rarely. Spanish moss is sometimes used as a filler in packing boxes and upholstery, and around potted plants or floral arrangements.

Spanish Netherlands Spanish-held provinces in the southern Low Countries (roughly corresponding to modern Belgium and Luxembourg). In 1578 the diplomat ALESSANDRO FARNESE was sent to represent Spain in the Netherlands, and by 1585 he had reestablished Spanish control over the southern provinces, ending the union with the northern provinces that followed the Pacification of GHENT. In the 17th century the region saw a resurgence of economic and intellectual growth. As a buffer between Protestant and Catholic states, the region was the scene of constant warfare; areas were ceded to the Dutch Republic (1648) and France (1659). The territory began to decline in the late 17th century. Spanish control was lost after the War of the SPANISH SUCCESSION, when the region passed to Emperor CHARLES VI and became the AUSTRIAN NETHERLANDS.

Spanish Sahara See WESTERN SAHARA

Spanish Succession, War of the (1701–14) Conflict arising from the disputed succession to the throne of Spain after the death of the childless CHARLES II. The Habsburg Charles had named the Bourbon Philip, duke d'Anjou, as his successor; when Philip took the Spanish throne as PHILIP V, his grandfather LOUIS XIV invaded the SPANISH NETHERLANDS. The former anti-French alliance from the War of the GRAND ALLIANCE was revived in 1701 by Britain, the Dutch Republic, and the Holy Roman emperor, who had been promised parts of the Spanish empire by earlier treaties of partition (1698, 1699). The English forces, led by the duke of MARLBOROUGH, won a series of victories over France (1704–09), including the Battle of BLENHEIM, which forced the French out of the Low Countries and Italy. The imperial general, EUGENE OF SAVOY, also won notable victories. In 1711 conflicts within the alliance led to its collapse, and peace negotiations began in 1712. The war concluded with the Peace of UTRECHT (1713), which marked the rise of the power of Britain at the expense of both France and Spain, and the Treaties of RASTATT and Baden (1714).

spanner See WRENCH

spark plug Device that fits into the cylinder head of an INTERNAL-COMBUSTION ENGINE and carries two ELECTRODES separated by an air gap, across which current from a high-tension IGNITION SYSTEM discharges, creating a spark and igniting the fuel. The electrodes and the insulator separating them must withstand high temperatures, as well as an electric stress of up to several thousand volts. Spark-gap length affects the energy of the spark, and the shape of the insulator affects the temperature of operation.

Spark, Muriel (Sarah) *orig.* **Muriel Sarah Camberg** (b. Feb. 1, 1918, Edinburgh, Scot.) British writer. She spent several years in Central Africa, returning to Britain during World War II. Until 1957 she published only poetry and criticism, including studies of MARY SHELLEY and the BRONTË SISTERS. Her fiction uses satire and wit to present serious themes, often questions about good and evil. *Memento Mori* (1959) is her most widely praised novel; the best-known is *The Prime of Miss Jean Brodie* (1961; film, 1969). Her later novels, often more sinister in tone, include *The Abbess of Crewe* (1974), *A Far Cry from Kensington* (1988), and *Reality and Dreams* (1997).

sparrow Any of numerous species of small, chiefly seed-eating songbirds having a conical bill, particularly members of the Old World family Ploceidae, the HOUSE SPARROW, and most members of the New World family Fringillidae. Some species of Fringillidae are common. The trim-looking chipping and tree sparrows have a reddish brown cap. The finely streaked savanna and vesper sparrows inhabit grassy fields. The heavily streaked song and fox sparrows are woodland dwellers. The white-crowned and white-throated sparrows are larger than most species and have black-and-white crown stripes.

White-throated sparrow (*Zonotrichia albicollis*).
WILLIAM D. GRIFFIN

sparrow hawk Small HAWK (usually genus *Accipiter*, family Accipitridae), found in Africa, Europe, and Asia. Sparrow hawks are gray above, barred-white below, and sometimes have white tail bars. They eat insects and small birds and mammals. The American KESTREL is also called sparrow hawk.

Sparta *or* **Lacedaemon** \ˌla-sə-'dē-mən\ Ancient Greek city-state, capital of Laconia and chief city of the PELOPONNESE. Of DORIAN origin, it was founded in the 9th century BC and developed as a strictly militaristic society. In the 8th–5th centuries BC it subdued neighbouring Messenia. From the 5th century BC the ruling class of Sparta devoted itself to war and forged the most powerful army in Greece. After a long contest with ATHENS in the PELOPONNESIAN WAR (460–404 BC), it attained dominance over all of Greece. Sparta's power was broken by THEBES at the battle of Leuctra in 371 BC. It lost its independence c. 192 BC when it was defeated by and forced to join the ACHAEAN LEAGUE. It was made part of the Roman province of Achaea in 146 BC. The Visigoths captured and destroyed the city in AD 396. The ruins of its acropolis, agora, theatre, and temples remain.

Spartacists \'spär-tə-səsts\ *or* **Spartacus League** Revolutionary socialist group active in Germany (1914–18). It developed as an offshoot of the SOCIAL DEMOCRATIC PARTY and was officially founded in 1916 by KARL LIEBKNECHT, ROSA LUXEMBURG, and others who violently opposed Germany's role in World War I and called for a socialist revolution. The group encouraged demonstrations in December 1918 that led to the abortive Spartacus Revolt in January 1919, after which the leaders were murdered by members of the FREIKORPS. The league was then transformed into the Communist Party of Germany.

Spartacus \'spär-tə-kəs\ (d. 71 BC) Leader in the Gladiatorial War against Rome (73–71). A Thracian, he served in the Roman army. He became a bandit and was sold as a slave when caught. He escaped a gladiatorial school, where he had plotted a revolt with other gladiators, and set up camp on Mount Vesuvius, where he was joined by other runaway slaves and some peasants. With a force of 90,000, he overran most of southern Italy, defeating two consuls (72). He led his army north to the Cisalpine Gaul, where he hoped to release them to find freedom, but they refused to leave, preferring to continue the struggle. Returning south, he attempted to invade Sicily but could not arrange the passage. The legions of Marcus Licinius CRASSUS caught the slave army in Lucania and defeated it; Spartacus fell in pitched battle. Pompey's army intercepted and killed many of those escaping north, and Crassus crucified 6,000 prisoners along the Appian Way.

Spartan Alliance See PELOPONNESIAN LEAGUE

Spassky, Boris (Vasilyevich) (b. Jan. 30, 1937, Leningrad, Russia, U.S.S.R.) Russian chess master. Spassky attained the rank of international grand master in chess in 1955. After a period of intermittent involvement with the game, he beat Tigran Petrosyan for the world title in 1969. In 1972 Spassky lost it to BOBBY FISCHER.

spatial disorientation Inability to determine one's true body position, motion, and altitude (or, in water, depth) relative to the Earth or one's surroundings. It may result from a brain or nerve disorder or from limitations in the normal sensory apparatus. Most clues to orientation are

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relayed from the eyes, ears, muscles, and skin. The senses may not perceive gradual changes in motion and may overestimate the degree of abrupt changes and overcompensate when motion stops. Airplane pilots and divers also contend with apparent changes in gravitational pull, which can lead to dangerous situations and must be overcome by training. See also INNER EAR; PROPRIOCEPTION.

speaker See LOUDSPEAKER

Spearman, Charles E(dward) (b. Sept. 10, 1863, London, Eng.—d. Sept. 17, 1945, London) British psychologist. He is known for his studies on human mental abilities, particularly INTELLIGENCE, and especially for the statistical technique (factor analysis) he utilized to examine individual differences in psychological testing and identify the underlying sources of these differences. His works include *Abilities of Man* (1927), *Creative Mind* (1931), and *Human Abilities* (1950).

spearmint Aromatic herb (*Mentha spicata*) of the MINT family, the common garden mint widely used for culinary purposes. It has lax, tapering spikes of reddish lilac flowers similar to peppermint flowers and sharply serrated leaves that are used fresh or dried to flavour many foods. The aroma and taste of spearmint are similar to those of peppermint but not as strong. Native to Europe and Asia, spearmint has been naturalized in North America.

special education Education for students (such as the physically or mentally disabled) with special needs. An early proponent of education for the blind was Valentin Haüy, who opened a school in Paris in 1784; his efforts were followed by those of LOUIS BRAILLE. Attempts to educate deaf children predate Haüy, but not until Friedrich Moritz Hill (1805–74) developed an oral method of instruction did teaching to the deaf become established. The development of standardized SIGN LANGUAGES further advanced instruction of the deaf. Scientific attempts to educate mentally retarded children began with the efforts of Jean-Marc-Gaspard Itard (1775–1838) to train a feral child known as the Wild Boy of Aveyron; Itard's work influenced such later theorists as Édouard Séguin (1812–80) and MARIA MONTESSORI. Children with motor disabilities, once considered subjects for special education, are usually integrated into the standard classroom, often by means of wheelchairs and modified desks. Children with LEARNING DISABILITIES and SPEECH problems usually require specialized techniques, often on an individual basis. For children with behavioral and emotional disorders, special therapeutic and clinical services may be provided.

special effects Artificial visual or mechanical effects introduced into a movie or television show. The earliest special effects were created through special camera lenses or through tricks such as projecting a moving background behind the actors. Greater flexibility came with the development of the optical printer, which made it possible to combine separate pieces of film and replace part of an image, thus allowing for effects such as characters flying through the air. Special effects have also been created mechanically on the set through the use of devices such as wires, explosives, and puppets and by building miniature models to simulate epic scenes such as battles. The growing use of computer animation and computer-generated imagery has produced increasingly elaborate and realistic visual effects. Though each movie studio formerly had its own special-effects department, effects are now created by private companies such as GEORGE LUCAS's Industrial Light and Magic, formed to provide the revolutionary effects seen in *Star Wars* (1977) and later movies.

Special Forces See GREEN BERETS

Special Olympics International sports program for people with mental retardation. It provides year-round training and athletic competition in a variety of Olympic-type summer and winter sports for participants. Inaugurated in 1968 through the efforts of Eunice Kennedy Shriver and the Chicago Park District, the Special Olympics was officially recognized by the International Olympic Committee in 1988. Games are held every two years, alternating between winter and summer sports. International headquarters are in Washington, D.C.

special prosecutor See INDEPENDENT COUNSEL

speciation \ˌspē-shē-ˈā-shən\ Formation of new and distinct SPECIES, whereby a single evolutionary line splits into two or more genetically independent ones. One of the fundamental processes of EVOLUTION, speciation may occur in many ways. Investigators formerly found evidence for speciation in the fossil record by tracing sequential changes in the structure and form of organisms. Genetic studies now show that such changes do not always accompany speciation, since many apparently identical groups are in fact reproductively isolated (i.e., they can no longer produce viable offspring through interbreeding). Polyploidy (see PLOIDY) is a means by which the beginnings of new species are created in just two or three generations.

Specie Circular \ˈspē-ˌshē\ (July 11, 1836) Executive order issued by Pres. ANDREW JACKSON. It required payment for purchases of public lands in gold or silver (specie means "money in coin"). The circular attempted to reduce the amount of paper money in circulation and limit land speculation. The result was deflationary and partly contributed to the economic crisis called the Panic of 1837. The U.S. Congress repealed the circular in 1838.

species \ˈspē-ˌshēz, ˈspē-ˌsēz\ Subdivision of biological classification composed of related organisms that share common characteristics and can interbreed. Organisms are grouped into species according to their outer similarities, but more important in classifying organisms that reproduce sexually is their ability to interbreed successfully. To be members of the same species, individuals must be able to mate and produce viable offspring. Because genetic variations originate in individuals which then pass on their variations only within the species, it is at the species level that EVOLUTION takes place (see SPECIATION). The international system of BINOMIAL NOMENCLATURE assigns new species a two-part name.

specific gravity *or* **relative density** Ratio of the DENSITY of a substance to that of a standard substance. For solids and liquids, the standard substance is usually water at 39.2°F (4.0°C), which has a density of 1.00 kg/liter. Gases are usually compared to dry air, which has a density of 1.29 g/liter at 32°F (0°C) and 1 atmosphere pressure. Because it is a ratio of two quantities that have the same dimensions (mass per unit volume), specific gravity has no dimension. For example, the specific gravity of liquid mercury is 13.6, because its actual density is 13.6 kg/liter, 13.6 times that of water.

specific heat Ratio of the quantity of heat required to raise the temperature of a body one degree to that required to raise the temperature of an equal mass of water one degree. The term is also used to mean the amount of heat, in calories, required to raise the temperature of one gram of a substance by one Celsius degree.

speckled trout See BROOK TROUT

spectacled bear *or* **Andean bear** Only South American species of BEAR (*Tremarctos ornatus*, family Ursidae), found in mountain forests, especially in the Andes. It feeds mainly on shoots and fruit and is an agile climber. It stands about 2 ft (60 cm) at the shoulder, is 4–6 ft (1.2–1.8 m) long, and has a 3-in. (7-cm) tail. Its shaggy coat is dark brown to black. Whitish to yellowish marks form its "spectacles" and often extend down the neck to the chest.

Spectator, The Daily periodical published in London by RICHARD STEELE and JOSEPH ADDISON from March 1, 1711, to Dec. 6, 1712, and revived by Addison in 1714 (for 80 issues). It succeeded *The Tatler*, launched by Steele in 1709. Aiming to "enliven morality with wit, and to temper wit with morality," *The Spectator* presented a fictional club whose imaginary members expressed the writers' ideas about society. It made serious discussion of letters and politics a normal pastime of the leisured class, set the pattern and established the vogue for the periodical in the 18th century, and helped create a receptive public for novelists.

spectrochemical analysis Any of a group of chemical ANALYSIS methods that depend on measurement of the WAVELENGTH and intensity of ELECTROMAGNETIC RADIATION. It is used chiefly to determine the arrangement of atoms and electrons in molecules on the basis of the amounts of ENERGY absorbed during changes in their structure or motion. In more common usage, it usually refers to ultraviolet (UV) and visible emission SPECTROSCOPY or to UV, visible, and infrared (IR) absorption SPECTROPHOTOMETRY.

spectrometer \spek-ˈträ-mə-tər\ Device for detecting and analyzing WAVELENGTHS of ELECTROMAGNETIC RADIATION, commonly used for molecular SPECTROSCOPY; more broadly, any of various instruments in which an emission (as of electromagnetic radiation or particles) is spread out according to some property (as ENERGY or MASS) into a SPECTRUM and measurements are made at points or regions along the spectrum. As used in traditional laboratory ANALYSIS, a spectrometer includes a radiation source and detection and analysis equipment. Emission spectrometers excite MOLECULES of a

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sample to higher ENERGY states and analyze the radiation emitted when they decay to the original energy state. Absorption spectrometers pass radiation of known wavelength through a sample, varying the wavelengths to produce a spectrum of results; the detector system reveals to what extent each wavelength is absorbed. FOURIER-TRANSFORM spectrometers resemble absorption spectrometers but use a broad band of radiation; a computer analyzes the output to find the absorption spectrum. Different designs allow study of various kinds of samples over many frequencies, at different temperatures or pressures, or in an electric or magnetic field. Mass spectrometers (see MASS SPECTROMETRY) spread out the atomic or molecular components in a sample according to their masses and then detect the sorted components.

spectrophotometry \ˌspek-trō-fə-ˈtä-mə-trē\ Branch of SPECTROSCOPY dealing with measurement of radiant ENERGY transmitted or reflected by a body as a function of WAVELENGTH. The measurement is usually compared to that transmitted or reflected by a system that serves as a standard. In chemistry and physics, different types of spectrophotometers cover wide ranges of the ELECTROMAGNETIC SPECTRUM: ULTRAVIOLET (UV), visible LIGHT, INFRARED (IR), or MICROWAVE. UV spectrophotometry is particularly useful in detecting and quantifying colourless substances in SOLUTION. IR spectrophotometry is used mostly to study the molecular structures of complex organic compounds. In astronomy and astrophysics, spectrophotometric studies also include the X-RAY and GAMMA RAY ranges of the spectrum. See also COLORIMETRY.

spectroscopy \spek-ˈträ-skə-pē\ Branch of ANALYSIS devoted to identifying ELEMENTS and compounds and elucidating atomic and molecular structure by measuring the radiant ENERGY absorbed or emitted by a substance at characteristic WAVELENGTHS of the ELECTROMAGNETIC SPECTRUM (including GAMMA RAY, X-RAY, ULTRAVIOLET, visible LIGHT, INFRARED, MICROWAVE, and RADIO-frequency radiation) on excitation by an external energy source. The instruments used are spectroscopes (for direct visual observation) or spectrographs (for recording spectra). Experiments involve a light source, a PRISM or grating to form the SPECTRUM, detectors (visual, photoelectric, radiometric, or photographic) for observing or recording its details, devices for measuring wavelengths and intensities, and interpretation of the measured quantities to identify chemicals or give clues to the structure of atoms and molecules. HELIUM, CESIUM, and rubidium were discovered in the mid-19th century by spectroscopy of the Sun's spectrum. Specialized techniques include Raman spectroscopy (see CHANDRASEKHARA VENKATA RAMAN), nuclear magnetic resonance (NMR), nuclear quadrupole resonance (NQR), dynamic reflectance spectroscopy, microwave and gamma ray spectroscopy, and ELECTRON SPIN RESONANCE (ESR). Spectroscopy now also includes the study of particles (e.g., ELECTRONS, IONS) that have been sorted or otherwise differentiated into a spectrum as a function of some property (such as energy or MASS). See also MASS SPECTROMETRY; SPECTROMETER; SPECTROPHOTOMETRY.

spectrum Arrangement according to WAVELENGTH (or FREQUENCY) of ELECTROMAGNETIC RADIATION. The visible, "rainbow" spectrum is the portion of the ELECTROMAGNETIC SPECTRUM that is visible as light to the human eye. Some sources emit only certain wavelengths and produce an emission spectrum of bright lines with dark spaces between. Such line spectra are characteristic of the elements that emit the radiation. A band spectrum consists of groups of wavelengths so close together that the lines appear to form a continuous band. Atoms and molecules absorb certain wavelengths and so remove them from a complete spectrum; the resulting absorption spectrum contains dark lines or bands at these wavelengths.

speech Human communication through audible LANGUAGE. Speech sounds are made with air exhaled from the lungs, which passes between the vocal cords in the LARYNX and out through the vocal tract (PHARYNX and oral and nasal cavities). This airstream is shaped into different sounds by the articulators, mainly the TONGUE, PALATE, and lips (see ARTICULATION). Articulatory PHONETICS describes each sound in terms of the position and action of the articulators used to make it. Speech is also described in terms of SYNTAX, lexicon (inventory of words or MORPHEMES), and PHONOLOGY (sounds).

speech, figure of See FIGURE OF SPEECH

speech act theory Theory of meaning that holds that the meaning of linguistic expressions can be explained in terms of the rules governing their use in performing various speech acts (e.g., admonishing, asserting, commanding, exclaiming, promising, questioning, requesting, warning). In contrast to theories that maintain that linguistic expressions have meaning in virtue of their contribution to the truth conditions of sentences where they occur, it explains linguistic meaning in terms of the use of words and sentences in the performance of speech acts. Some exponents claim that the meaning of a word is nothing but its contribution to the nature of the speech acts that can be performed by using it. LUDWIG WITTGENSTEIN and J. L. AUSTIN provided important stimuli for the theory's development.

speech recognition *or* **voice recognition** Ability of COMPUTER systems to accept speech input and act on it or transcribe it into written language. Current research efforts are directed toward applications of automatic speech recognition (ASR), where the goal is to transform the content of speech into knowledge that forms the basis for linguistic or cognitive tasks, such as translation into another language. Practical applications include DATABASE-query systems, INFORMATION RETRIEVAL systems, and speaker identification and verification systems, as in telebanking. Speech recognition has promising applications in ROBOTICS, particularly development of robots that can "hear." See also PATTERN RECOGNITION.

speech synthesis Generation of speech by artificial means, usually by COMPUTER. Production of sound to simulate human speech is referred to as low-level synthesis. High-level synthesis deals with the conversion of written text or symbols into an abstract representation of the desired acoustic signal, suitable for driving a low-level synthesis system. Among other applications, this technology provides speaking aid to the speech-impaired and reading aid to the sight-impaired.

speech therapy Therapeutic treatment to correct defects in speaking. Such defects may originate in the brain, the ear (see DEAFNESS), or anywhere along the vocal tract and may affect the voice, ARTICULATION, language development, or ability to speak after language is learned. Therapy begins with diagnosis of underlying physical, physiological, or emotional dysfunction. It may involve training in breathing, use of the voice, and/or speaking habits. Some abnormalities that cause speech disorders (e.g., CLEFT PALATE, STROKE) can be corrected to various degrees before a speech therapist's work begins. See also APHASIA, STUTTERING.

speed skating Sport of racing on ice skates. The blade of the speed skate is longer and thinner than that of the hockey or figure skate. Two types of track are used in international competition. The long track is a 400-m (about one-quarter mile) flattened oval (straight sides and curved ends) on which two skaters race simultaneously. In long track the race is against the clock rather than the opponent. The short track, a more recent development, is a 111-m (364-ft) oval on which four to six skaters race during each heat. Short track is a race to the finish line. Long-track speed skating was included in the first Winter Olympics in 1924; short-track skating was added in 1992.

Speer \ˈshpār**, Albert** (b. March 19, 1905, Mannheim, Baden, Ger.—d. Sept. 1, 1981, London, Eng.) German Nazi official. He became an architect in 1927 and an active member of the NAZI PARTY in 1931. He impressed ADOLF HITLER with his efficiency and talent and was appointed chief architect of the Third Reich in 1933. He designed the parade grounds and banners of the Nazi rallies held for the party congresses, including the 1934 Nürnberg Rally (see NÜRNBERG RALLIES) filmed by LENI RIEFENSTAHL. In 1942 he became minister for armaments and war production and expanded the system of conscript and slave labour that maintained Germany's wartime productivity. Speer confessed his guilt at the NÜRNBERG TRIALS, and he served 20 years in prison. His published works include *Inside the Third Reich* (1969) and *Spandau* (1975).

Speke \ˈspēk**, John Hanning** (b. May 3, 1827, Bideford, Devon, Eng.—d. Sept. 15, 1864, Corsham, Wiltshire) British explorer. He was a member of RICHARD BURTON's expedition, and in 1858 Speke and Burton became the first Europeans to reach Lake TANGANYIKA. On the return trip he left Burton and struck out northward alone. In July 1858 he reached a great lake, which he named Lake VICTORIA, for the queen. His claim that it was the source of the NILE was questioned, but on a second expedition (1860–63) he found the Nile's exit from the lake. Speke's claim to have found the Nile's source was again challenged in England. He was killed by his own gun while hunting on the very day he was to debate Burton publicly.

spelling and grammar checkers Components of WORD-PROCESSING programs for PERSONAL COMPUTERS that identify apparent misspellings and grammatical errors by reference to an incorporated dictionary and a list of rules for proper usage. Spelling checkers cannot identify spelling errors

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that result in another legitimate word (e.g., "form" typed for "from") and are hard to use on documents that contain numerous words (e.g., foreign terms) not entered in the incorporated dictionary. Grammar checkers—which also generally check punctuation, sentence length, and other aspects of style—have been criticized for their reliance on oversimplified rules.

Spelman College Private, historically black, women's liberal arts college in Atlanta, Ga. Its history is traced to 1881, when two Boston women began teaching 11 black women, mostly ex-slaves, in an Atlanta church basement. Donations from JOHN D. ROCKEFELLER, beginning in 1884, assured the school's growth; the school is named for Rockefeller's mother-in-law. Spelman offers bachelor's degrees in more than 20 academic fields. It is one of six African American institutions in the Atlanta area that share students, faculty, facilities, and curricula. Spelman's alumnae include attorney and children's rights activist Marian Wright Edelman and author ALICE WALKER.

spelt Subspecies (*Triticum aestivum spelta*) of WHEAT that has lax spikes and spikelets containing two light-red kernels. *Triticum dicoccon* was cultivated by the ancient Babylonians and the ancient Swiss lake dwellers; it is now grown for livestock forage and used in baked goods and cereals.

Spence, A. Michael (b. 1943, Montclair, N.J., U.S.) U.S. economist. He studied at Yale (B.A., 1966), Oxford (B.A./M.A., 1968), and Harvard (Ph.D., 1972) and taught at Harvard and Stanford, serving as dean of the latter's business school from 1990 to 1999. He is known for refining the theory of asymmetric information in the marketplace. His research demonstrated that in certain situations those who are better informed can improve their market return by transmitting information to those who know less; for example, auto dealers can convey the superior quality of their cars by offering warranties. For his work on "market signaling," Spence shared the 2001 Nobel Prize in Economic Sciences with GEORGE A. AKERLOF and JOSEPH E. STIGLITZ.

Spencer, Herbert (b. April 27, 1820, Derby, Derbyshire, Eng.—d. Dec. 8, 1903, Brighton, Sussex) English sociologist and philosopher, advocate of the theory of SOCIAL DARWINISM. His *System of Synthetic Philosophy*, 9 vol. (1855–96), held that the physical, organic, and social realms are interconnected and develop according to identical evolutionary principles, a scheme suggested by the evolution of biological species. This SOCIOCULTURAL EVOLUTION amounted to, in Spencer's phrase, "the survival of the fittest." The free market system, without interference by governments, would weed out the weak and unfit. His controversial laissez-faire philosophy was praised by social Darwinists such as William Graham Sumner and opposed by sociologists such as Lester Frank Ward. Liked or loathed, Spencer was one of the most discussed Victorian thinkers.

Spender, Sir Stephen (Harold) (b. Feb. 28, 1909, London, Eng.—d. July 16, 1995, London) English poet and critic. While an undergraduate at Oxford, Spender met the poets W.H. AUDEN and C. DAY-LEWIS. In the 1930s they became identified with politically conscious, leftist "new writing." His poems, expressing a self-critical, compassionate personality, appear in volumes from *Poems* (1933) to *Dolphins* (1994). He was better known for his perceptive criticism, as in *The Destructive Element* (1935), *The Making of a Poem* (1955), and *The Struggle of the Modern* (1963), and for his association with the influential review *Encounter* (1953–67). He also wrote short stories, essays, and autobiography.

Spengler, pencil drawing by K. Grossmann, 1920; in a private collection
DEUTSCHE FOTOTHEK, DRESDEN

Spengler \'shpeŋ-glər**, Oswald** (b. May 29, 1880, Blankenburg, Ger.—d. May 8, 1936, Munich) German philosopher. A schoolmaster before he turned to writing, Spengler is remembered for his influential *The Decline of the West*, 2 vol. (1918–22), a study in the philosophy of history. He contended that civilizations pass through a life cycle, blossoming and decaying like natural organisms, and that Western culture is irreversibly past its creative stage and headed into eclipse. Though acclaimed by a public disillusioned in the wake of World War I, his work was criticized by both professional scholars and the Nazi Party, despite some affinities with its dogma.

Spenser, Edmund (b. 1552/53, London, Eng.—d. Jan. 13, 1599, London) English poet. Little is known for certain about his life before he entered the University of Cambridge. His first important publication, *The Shepheardes Calender* (1579), can be called the first work of the English literary Renaissance. By 1580 he was apparently serving the Earl of Leicester and was part of a literary circle led by SIR PHILIP SIDNEY. In 1580 he became secretary to the lord deputy of Ireland, where he spent much of his remaining life; in 1588 or 1589 he took over a large property at Kilcolman, near Cork. In 1590 he published the first part of the long allegorical poem *The Faerie Queene* (first folio ed., 1609), an imaginative vindication of Protestantism and Puritanism and a glorification of England and Elizabeth I. The central poem of the Elizabethan period and one of the greatest poems in English, it was composed in a revolutionary nine-line stanzaic pattern, the "Spenserian stanza," that was used by many later poets. Of the 12 books he planned for the poem, he completed just over half. *Amoretti* (1595), a sonnet sequence, and *Epithalamion* (1595), a marriage ode, are among his other works. In the Irish uprising of 1598, Kilcolman was burned; Spenser, probably in despair, died shortly after.

Speransky \spyi-'rȧn-skē**, Mikhail (Mikhaylovich), Count** (b. Jan. 12, 1772, Cherkutino, Russia—d. Feb. 23, 1839, St. Petersburg) Russian politician. After teaching at the seminary in St. Petersburg, he entered government service. He served as an assistant to Tsar ALEXANDER I (1807–12), but his proposed financial and administrative reforms angered the nobles, who had him exiled (1812–16). He returned to government service, serving as governor-general of Siberia (1819–21). A member of the state council from 1821 under NICHOLAS I, he compiled the first complete collection of Russian law (1830). He was given the title of count in 1839.

sperm *or* **spermatozoon** \spər-ˌma-tə-'zō-ən\ Male reproductive CELL. In mammals, sperm are produced in the TESTES and travel through the REPRODUCTIVE SYSTEM. At FERTILIZATION, one sperm of the roughly 300 million in an average ejaculation (see SEMEN) fertilizes an EGG (see OVARY) to produce an offspring. At PUBERTY, immature cells (spermatogonia) begin a maturation process (spermatogenesis). A mature human sperm has a flat, almond-shaped head, with a cap (acrosome) containing chemicals that help it penetrate an ovum. It is essentially a cell NUCLEUS, with 23 CHROMOSOMES (including either the X or Y that determines the child's sex). A FLAGELLUM propels the sperm, which may live in a woman's reproductive tract for two to three days after SEXUAL INTERCOURSE, to the egg. Sperm may be frozen and stored for ARTIFICIAL INSEMINATION.

sperm whale *or* **cachalot** \'ka-shə-ˌlät, 'ka-shə-ˌlō\ Thickset, blunt-snouted TOOTHED WHALE (*Physeter catodon*, family Physeteridae) with small, paddlelike flippers and rounded humps on the back. Sperm whales have an enormous head, squarish in profile, and a narrow, underslung lower jaw with large conical teeth that fit into sockets in the toothless upper jaw when the mouth is closed. They are dark blue-gray or brownish. (HERMAN MELVILLE's Moby-Dick was presumably an albino.) The male grows to 60 ft (18 m). Herds of 15–20 live in temperate and tropical waters worldwide. They commonly dive to 1,200 ft (350 m), feeding primarily on cephalopods. The whales have been hunted for their spermaceti (a waxy substance in the snout, used in ointments and cosmetics) and for AMBERGRIS. The pygmy sperm whale (genus *Kogia*) is a black dolphinlike whale, about 13 ft (4 m) long, of the Northern Hemisphere that lacks commercial value.

spermatophyte See SEED PLANT

Sperry, Elmer (Ambrose) (b. Oct. 12, 1860, Cortland, N.Y., U.S.—d. June 16, 1930, Brooklyn, N.Y.) U.S. inventor and industrialist. He opened his own factory in Chicago at the age of 20 to make dynamos and arc lamps. He designed an electrical industrial locomotive and motor transmission machinery for streetcars and later made electric automobiles powered by his patented battery. He invented processes for salvaging tin and producing white lead and for manufacturing fuse wire. His greatest inventions sprang from the GYROSCOPE (until then considered only a toy), which, once properly aligned, always points to true north. His gyrocompass was first installed on the battleship *Delaware* in 1911. He extended the gyro principle to guidance of torpedoes, to gyropilots for the steering of ships and for stabilizing airplanes, and finally to a ship stabilizer. In all, he founded eight manufacturing companies and took out more than 400 patents.

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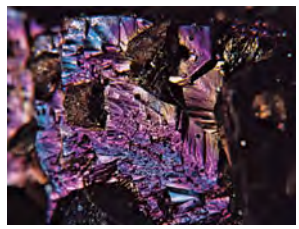
Sperry, Roger (b. Aug. 20, 1913, Hartford, Conn., U.S.—d. April 17, 1994, Pasadena, Calif.) U.S. neurobiologist. He earned a doctorate in zoology from the University of Chicago. He studied functional specialization in the hemispheres of the cerebral cortex, examining animals and then humans with epilepsy in whose brains the corpus callosum had been severed. His research showed that the left side of the brain is normally dominant for analytical and verbal tasks and the right for spatial tasks, music, and certain other areas. His techniques laid the groundwork for much more specialized explorations. He shared a 1981 Nobel Prize with David Hubel and Torsten Wiesel.

Spey \'spā**, River** River, northeastern Scotland. It rises in the Corrieyairack Forest and flows 107 mi (172 km) northeast across the Highlands into the North Sea. It is noted for salmon fishing, and its valley is the site of high-quality whisky distilleries.

sphagnum See peat moss

sphalerite \'sfa-lə-ˌrīt\ *or* **blende** *or* **zincblende** Zinc sulfide (ZnS), the chief ore mineral of zinc. It is found associated with galena in most important lead-zinc deposits. The most important deposits are in the Mississippi River valley (U.S.), Poland, Belgium, and North Africa. See also sulfide mineral.



Sphalerite from Baxter Springs, Kan.
COURTESY OF THE TED AND ELSIE BOENTE COLLECTION; PHOTOGRAPH, JOHN H. GERARD—EB INC.

sphere In geometry, the set of all points in three-dimensional space lying the same distance (the radius) from a given point (the centre), or the result of rotating a circle about one of its diameters. The components and properties of a sphere are analogous to those of a circle. A diameter is any line segment connecting two points of a sphere and passing through its centre. The circumference is the length of any great circle, the intersection of the sphere with any plane passing through its centre. A meridian is any great circle passing through a point designated a pole. A geodesic, the shortest distance between any two points on a sphere, is an arc of the great circle through the two points. The formula for determining a sphere's surface area is $4\pi r^2$; its volume is determined by $(\frac{4}{3})\pi r^3$. The study of spheres is basic to terrestrial geography and is one of the principal areas of Euclidean geometry and elliptic geometry.

sphere, celestial See celestial sphere

sphere of influence In international politics, a state's claim to exclusive or predominant control over a foreign area or territory. Beginning in the late 1880s, European colonial powers undertook legal agreements consisting of promises not to interfere with each other's actions in mutually recognized spheres of influence in Africa and Asia. After colonial expansion ceased, geopolitical rather than legal claims to spheres of influence became common, examples being the U.S. claim to dominance in the Western Hemisphere under the much-earlier Monroe Doctrine and the Soviet Union's expansion of its sphere of influence to eastern Europe following World War II. See also Iron Curtain.

spherical coordinate system In geometry, a coordinate system in which any point in three-dimensional space is specified by its angle with respect to a polar axis and angle of rotation with respect to a prime meridian on a sphere of a given radius. In spherical coordinates a point is specified by the triplet (r, θ, φ), where r is the point's distance from the origin (the radius), θ is the angle of rotation from the initial meridian plane, and φ is the angle from the polar axis (analogous to a ray from the origin through the North Pole).

sphinx Mythological creature with a lion's body and a human's head. It figures prominently in Egyptian and Greek art and legend. The winged sphinx of Thebes was said to have terrorized people by demanding the answer to a riddle taught to her by the Muses—What is it that has one voice and yet becomes successively four-footed, then two-footed, then three-footed?—and devoured every person who answered incorrectly. When Oedipus correctly answered "man"—who crawls on all fours in infancy, walks on two feet when grown, and leans on a staff in old age—the sphinx killed herself. The earliest and most famous example in art is the Great Sphinx at Giza in Egypt, built c. 2500 BC. The sphinx appeared in the Greek world c. 1600 BC and in Mesopotamia c. 1500 BC. See photograph above.

The Great Sphinx at Giza, 4th dynasty
E. STREICHAN/SHOSTAL ASSOCIATES

sphinx moth See hawk moth

sphynx cat \'sfiŋks\ Breed of hairless domestic cat, founded on two spontaneous mutations in shorthaired cats. The first occurred in 1975 when Jezabelle, a stray, produced a hairless female kitten, Epidermis, followed by another the next year. The second occurred in 1978, when a male and two female hairless kittens were rescued from the streets of Toronto. Sphynx cats must be bathed regularly to keep the skin free of the oils that the coat on a normal cat absorbs, and the very large ears must be cleaned regularly to rid them of dust and dirt and prevent wax buildup.

spice and herb Dried parts of various plants cultivated for their aromatic, savory, medicinal, or otherwise desirable properties. Spices are the fragrant or pungent products of such tropical or subtropical species as cardamom, cinnamon, clove, ginger, and pepper; spice seeds include anise, caraway, cumin, fennel, poppy, and sesame. Herbs are the fragrant leaves of such plants as basil, marjoram, mint, rosemary, and thyme. The most notable uses of spices and herbs in very early times were in medicine, in the making of holy oils and unguents, and as aphrodisiacs; they were also used to flavour food and beverages and to inhibit or hide food spoilage. Trade in spices has played a major role in human history. Important early trade routes, including those between Asia and the Middle East and between Europe and Asia, were initially forged to obtain exotic spices and herbs. The 15th-century voyages of discovery were launched largely as a result of the spice trade, and in the 17th century Portugal and the British, Dutch, and French East India companies battled furiously for dominance (see British East India Co.; Dutch East India Co.; French East India Co.).

spicebush Deciduous, dense shrub (*Lindera benzoin*, or *Benzoin aestivale*) of the laurel family, native to eastern North America. Found most often in damp woods, it grows 5–20 ft (1.5–6 m) tall. The shiny, oblong leaves (3–5 in., or 8–13 cm, long) are wedge-shaped near the base. Small, yellow flowers crowded in small, nearly stalkless clusters are followed by fleshy red fruit with a stony covering around the seed. Tea is sometimes brewed from young twigs, leaves, and fruit.

Spicebush (*Lindera benzoin*).
WALTER CHANDOHA

spider Any of some 34,000 predatory arachnid species, mostly terrestrial, in the order Araneida, abundant worldwide except in Antarctica. Spiders have two main body parts, eight legs, two pincerlike venomous appendages, and three pairs of spinnerets. Species range in length from 0.5 to about 90 mm (0.02 to 3.5 inches). The venom of a few species (e.g., brown recluse) is harmful to humans. Most species catch insect prey in a web of silk extruded from the spinnerets. Spiders change little during growth, except in size. Species are classified largely on the basis of the number and arrangement of eyes and the type of web. See also black widow; tarantula; wolf spider.

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spider crab Any species of sluggish marine CRAB in the widely distributed family Majidae (or Maiidae). Spider crabs have a beak-shaped head; thick, rounded body; and long, spindly legs. They use a mucuslike mouth secretion to fasten algae, sponges, and other organisms to the hairs, spines, and knobby projections covering the body. Most species are scavengers, especially of carrion. Their size varies greatly. The body of the European long-beaked spider crab (*Macropodia rostrata*) is less than 0.5 in. (1 cm) in diameter, whereas the Japanese giant crab (*Macrocheira kaempferi*), whose outstretched claws can measure 13 ft (4 m) from tip to tip, is perhaps the largest known arthropod.

Spider crab (*Libinia*)
WALTER DAWN

spider mite *or* **red spider** Any plant-feeding MITE in the family Tetranychidae, common pests on houseplants and agriculturally important plants. Adult spider mites are tiny, about 0.02 in. (0.5 mm) long, and often red. They spin a loose silk webbing on infested plants. A heavy infestation can cause complete defoliation. Because of their increasing resistance to pesticides, they are difficult to control. One effective control is the use of another, predatory, mite species.

spider monkey Any of four species (family Cebidae) of diurnal, arboreal NEW WORLD MONKEYS found from Mexico to Brazil. Long-limbed and somewhat potbellied, they are 14–26 in. (35–66 cm) long and have thumbless hands and a heavily furred, prehensile 24–36-in. (60–92-cm) tail. The coat is gray, reddish, brown, or black. They swing through branches, using their tails and hands, or leap or drop spread-eagled from tree to tree. They eat fruit, nuts, flowers, and buds. They are used in laboratory studies of malaria, to which they are susceptible. Though sometimes kept as pets, adults are likely to throw tantrums and may be dangerous.

spider plant African plant of genus *Chlorophytum* (LILY FAMILY). This popular houseplant has long, narrow, grassy green-and-white-striped leaves. Periodically a flower stem emerges, and tiny white flowers (not always produced) are replaced by young plantlets, which can then be detached and rooted.

spiderwort Any of 20 or more erect to trailing, weak-stemmed herbs native to North and South America that make up the genus *Tradescantia* (family Commelinaceae). Several species are grown as indoor plants in baskets, especially the wandering Jews (*T. albiflora*, with green leaves, and *T. fluminensis*, with purplish underleaves). White velvet, or white-gossamer (*T. sillamontana*), has leaves and stems covered with a whitish fuzz. Chain plant (*T. navicularis*) has fleshy, narrow, lengthwise-folded leaves. Common spiderwort, or widow's tears (*T. virginiana*), is an upright, juicy-stemmed garden plant with white to purple flowers. Because they are easy to propagate, spiderworts are very popular indoor plants.

Spiegel, Der \der-'shpē-gəl\ *German* **"The Mirror"** Weekly newsmagazine, preeminent in Germany and one of the best and most widely circulated in Europe. Founded in 1946 as *Diese Woche* ("This Week") and published in Hamburg since 1947, it is respected both for its news coverage and analysis and for its concise writing. It is especially renowned for its aggressive exposés of government malpractice and scandals and for its photography. It resembles TIME and NEWSWEEK in format but is usually much thicker.

Spielberg, Steven (b. Dec. 18, 1947, Cincinnati, Ohio, U.S.) U.S. film director and producer. He attracted the attention of Universal Pictures with a short film he made about the time of his graduation from California State College, Long Beach (1970). As a director of television movies, he made the thriller *Duel* (1971), and in 1974 he directed the feature film *The Sugarland Express*. His shark-attack thriller *Jaws* (1975) became one of the highest-grossing movies ever, and he went on to direct huge successes such as *Close Encounters of the Third Kind* (1977), *Raiders of the Lost Ark* (1981), and *E.T.—the Extraterrestrial* (1982). He received Academy Awards for directing *Schindler's List* (1993), which tells the story of a group of Polish Jews who avoided Nazi extermination camps through the heroic actions of a German industrialist, and *Saving Private Ryan* (1998), which followed American soldiers in the days after the Normandy invasion of 1944. His other movies include *The Color Purple* (1985), *Empire of the Sun* (1987), *Jurassic Park* (1993), *A.I.: Artificial Intelligence* (2001), and *Minority Report* (2002). In 1994 he cofounded DreamWorks SKG, a film, animation, and television production company.

Spillane, Mickey *orig.* **Frank Morrison Spillane** (b. March 9, 1918, Brooklyn, N.Y., U.S.) U.S. writer of pulp detective fiction. He initially wrote for pulp magazines and comic books in order to pay for his schooling. His first novel, *I, The Jury* (1947), introduced the detective Mike Hammer, who later appeared in works from *My Gun Is Quick* (1950) to *Black Alley* (1996). His other novels, all characterized by violence and sexual licentiousness, include *The Deep* (1961), a series with the international agent Tiger Mann beginning with *Day of the Guns* (1964), and *The Killing Man* (1989). Spillane claimed to write solely for monetary gain and flouted literary taste with recurring elements of sadism that disturbed some readers, but the captivating vigour of his narrative and of his central characters brought him popular success.

spin Amount of ANGULAR MOMENTUM associated with a SUBATOMIC PARTICLE or NUCLEUS. It is measured in multiples of $\hbar$ (h-bar), equal to Planck's constant divided by 2π. ELECTRONS, NEUTRONS, and PROTONS have a spin of ½, for example, while pions and helium nuclei have zero spin. The spin of a complex nucleus is the vector sum of the orbital angular momentum and intrinsic spins of the constituent nucleons. For nuclei of even mass number, the multiple is an integral; for those of odd mass number, it is a half-integer. See also BOSE-EINSTEIN STATISTICS, FERMI-DIRAC STATISTICS.

spinach Hardy, leafy annual (*Spinacia oleracea*) of the goosefoot family (Chenopodiaceae), used as a vegetable. The edible leaves, somewhat triangular and either flat or puckered, are arranged in a rosette, from which a seedstalk emerges. Spinach requires cool weather and deep, rich, well-limed soil to give quick growth and maximum leaf area; sowing seed every two weeks from early spring to late summer provides a steady supply. A nutritious vegetable, spinach is rich in iron and vitamins A and C.

spinal cord In vertebrates, the body's major nerve tract. In humans it is about 18 in. (45 cm) long, running from the base of the BRAIN through the VERTEBRAL COLUMN. It is covered by the MENINGES and cushioned by CEREBROSPINAL FLUID. It connects the peripheral nervous system (outside the brain and spinal cord) to the brain. The spinal cord and the brain constitute the central NERVOUS SYSTEM. Sensory impulses reach the brain via the spinal cord, and impulses from the brain travel down the spinal cord to motor neurons, which reach the body's muscles and glands via the peripheral nerves. The peripheral nerves are connected to the spinal cord via the spinal nerves. In humans there are 31 pairs of spinal nerves containing both sensory and motor fibres, which originate in the spinal cord and pass out between the vertebrae. These nerves branch and relay motor impulses to all parts of the body. Injury to the spinal cord may result in loss of communication between the brain and outlying parts and cause paralysis, loss of sensation, or weakness in the parts of the body served by areas below the injured region. Because nerve cells and fibres are unable to regenerate themselves, the effects are usually permanent. See illustration on following page.

spindle and whorl *or* **drop spindle** Earliest device for spinning fibres into thread or yarn. The spinster lets the spindle fall to draw out the fibres while the whorl keeps it rotating to apply the necessary twist. The spindle and whorl was replaced by the SPINNING WHEEL.

spinel \spə-'nel\ Mineral composed of magnesium aluminum oxide ($MgAl_2O_4$). Also called magnesia spinel, its colour, due to various impurities, ranges from blood-red to blue, green, brown, and colourless. Spinel is found in basic igneous rocks, granite pegmatites, and contact metamorphic limestone deposits, often in association with CORUNDUM. Synthetic spinel has been manufactured since the early 20th century for use as imitation gem stones. Spinel may also refer more broadly to any of various mineral oxides of magnesium, iron, zinc, or manganese in combination with aluminum, chromium, or iron.

spinning In METALWORK, a technique for making hollow metal utensils and artifacts. Developed in the 19th century, the method can be used for most metals. A metal disk is set on a LATHE behind an appropriately shaped metal or wooden chuck; while the lathe is rotating, the metal is pressed onto the chuck with a tool. A typical modern spun object is the aluminum saucepan. As in most metalworking techniques, the metal is periodically softened by ANNEALING, or heating, when it has become hardened by being worked (see HARDENING).

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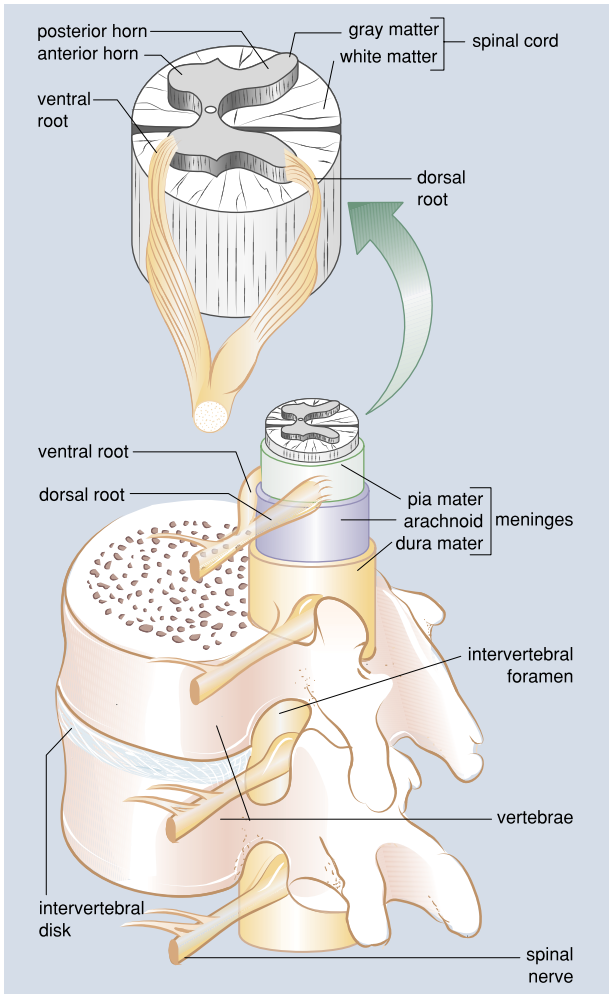

Section of a spinal cord. The anterior horn of the gray matter contains cell bodies from which the motor fibres of the spinal nerves arise. The posterior horn contains cell bodies from which fibres pass to the brain carrying impulses brought by sensory fibres entering from the spinal nerves. Interneurons in the gray matter transmit impulses within the cord. The white matter contains tracts of fibres that ascend to the brain with sensory impulses and descend from the brain carrying motor impulses. Nerve fibres emerge from the spinal cord through the foramina and form a dorsal root (containing fibres of sensory neurons) and a ventral root (containing fibres of motor neurons), which merge to form the spinal nerves.

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spinning frame See DRAWING FRAME

spinning jenny Early multiple-spindle machine for spinning WOOL or COTTON. The hand-powered spinning jenny was patented by JAMES HARGREAVES in 1770. The development of the SPINNING WHEEL into the spinning jenny was a significant factor in the industrialization of the TEXTILE industry, though its product was inferior to that of R. ARKWRIGHT's WATER FRAME.

spinning mule Multiple-spindle spinning machine invented by SAMUEL CROMPTON (1779), which permitted large-scale manufacture of high-quality THREAD for the textile industry. Crompton's machine made it possible for a single operator to work more than 1,000 spindles simultaneously, and was capable of spinning fine as well as coarse YARN.

spinning wheel Early machine for turning TEXTILE fibre into THREAD or YARN, which was then woven into cloth on a LOOM. The spinning wheel was probably invented in India, though its origins are unclear. It reached Europe via the Middle East in the Middle Ages. The improvement of the loom in 18th-century England created a yarn shortage and a demand for mechanical spinning. The result was a series of inventions that converted the spinning wheel into a powered, mechanized component of the INDUSTRIAL REVOLUTION (see DRAWING FRAME; SPINNING JENNY; WATER FRAME).

Spinoza \spi-'nō-zə**, Benedict de** *Hebrew* **Baruch Spinoza** (b. Nov. 24, 1632, Amsterdam—d. Feb. 21, 1677, The Hague) Dutch Jewish philosopher, a major exponent of 17th-century RATIONALISM. His father and grandfather had fled persecution by the INQUISITION in Portugal. His early interest in new scientific and philosophical ideas led to his expulsion from the synagogue in 1656, and he thereafter made his living as a lens grinder and polisher. His philosophy represents a development of and reaction to the thought of RENÉ DESCARTES; many of his most striking doctrines are solutions to difficulties created by CARTESIANISM. He found three unsatisfactory features in Cartesian metaphysics: the transcendence of God, mind-body DUALISM, and the ascription of free will both to God and to human beings. To Spinoza, those doctrines made the world unintelligible, since it was impossible to explain the relation between God and the world or between mind and body or to account for events occasioned by free will. In his masterpiece, *Ethics* (1677), he constructed a monistic system of metaphysics and presented it in a deductive manner on the model of the *Elements* of EUCLID. He was offered the chair of philosophy at the University of Heidelberg but declined it, seeking to preserve his independence. His other major works are the *Tractatus Theologico-Politicus* (1670) and the unfinished *Tractatus Politicus*.

spiny anteater See ECHIDNA

spire Steeply pointed termination to a tower or roof. In GOTHIC ARCHITECTURE, the spire is a spectacular visual culmination of the building as well as a symbol of heavenly aspiration. The church spire originated in the 12th century as a simple, four-sided pyramidal roof capping a tower. Methods used to integrate an octagonal spire with a square tower below include broaches (sloping triangular sections of masonry added to the bottom of the four spire faces not coinciding with the tower sides), gabled dormers added to spire faces, and steep pinnacles (vertical ornaments of pyramidal or conical shape) added to tower corners. During the Decorated period (14th century) in England, a slender needle spire set in from the edge of the tower was popular; corner pinnacles and a low parapet around the tower's edge became customary. In the 20th century, architects tended to limit spires to rather elementary geometric shapes.

spirea \spī-'rē-ə\ Any of nearly 100 species of flowering shrubs in the genus *Spirea* (ROSE family), native to the northern temperate zone and commonly cultivated for their pleasing growth habit and attractive flower clusters. The most commonly grown, and possibly the most popular of all cultivated shrubs, is the Vanhouttei spirea, also called bridal wreath (a cross between *S. cantoniensis* and *S. trilobata*), which grows up to 6 ft (2 m) tall and has graceful arching branches that bear numerous white flowers in spring. Plants that resemble spirea are the shrubby false spireas (*Sorbaria* species, also rose family) and the perennial herbaceous spireas (*Astilbe* species, SAXIFRAGE family).

Spiraea
E.R. DEGGINGER—EB INC.

spirillum \spi-'ril-əm\ Any of the spiral-shaped BACTERIA that make up the genus *Spirillum*, which are aquatic except for one species that causes a type of rat-bite fever in humans. The term is used generally for any corkscrewlike species of bacteria (see SPIROCHETE). Spirilla are gram-negative (see GRAM STAIN) and move by means of tufts of flagella at each end.

spirits See DISTILLED LIQUOR

spiritual In North American white and black FOLK MUSIC, an English-language folk hymn. White spirituals derived variously, notably from the "lining out" of psalms, dating from at least the mid-17th century. Where congregations could not read, a leader intoned the psalm one line at a time, alternating with the congregation's singing of each line to a familiar melody; the tune, sung slowly, was ornamented with passing notes,

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turns, and other graces. A second source was the singing of hymns set to borrowed melodies, often secular folk tunes. Themes included going home to the promised land and gaining ground against sin; typical refrains were "Roll, Jordan" and "Glory Hallelujah." The songs survive in oral tradition in isolated areas and also in the form of SHAPE-NOTE SINGINGS. African American spirituals developed in part from white rural folk hymnody but differ greatly in voice quality, vocal effects, rhythm, and type of rhythmic accompaniment. They were sung not only in worship but also as work songs, and the text imagery often reflects concrete tasks. Like the white gospel song, the modern African American gospel song derives from the spiritual.

spiritualism Belief that the SOULS of the dead can make contact with the living, usually through a medium or during abnormal mental states such as trances. The basis of spiritualism is the conviction that spirit is the essence of life and that it lives on after the body dies. A medium is a person sensitive to vibrations from the spirit world, who may hold meetings known as séances in order to seek messages from spirits. A "control" is a spirit that gives messages to the human medium, who in turn gives them to other people. Spirits are also thought to manifest themselves through such means as rapping or levitating objects. Some spiritualists claim powers of paranormal healing. Scientific study of spiritualist phenomena has been the focus of the Society for Psychical Research, founded in Britain in 1882. See also THEOSOPHY.

spirochete \'spī-rə-ˌkēt\ Any of an order (Spirochaetales) of spiral-shaped BACTERIA. Some are serious pathogens for humans, causing such diseases as SYPHILIS, YAWS, and RELAPSING FEVER. Spirochetes are gram-negative (see GRAM STAIN) and motile. They are unique in that their flagella, which number between two and more than 200 per organism, are contained within the cell. Most spirochetes are found in a liquid environment (e.g., mud and water, blood and lymph). Several species are borne by lice and ticks, which transmit them to humans.

Scanning electron micrograph of the spirochete *Treponema pallidum* attached to testicular cell membranes. ASM/SCIENCE SOURCE

spirulina \ˌspir-ù-'lē-nə\ Any CYANOBACTERIA in the genus *Spirulina*. A traditional food source in parts of Africa and Mexico, spirulina is an exceptionally rich source of vitamins, minerals, and protein, and one of the few nonanimal sources of vitamin B_{12}. It is now being widely studied for its possible antiviral, anticancer, antibacterial, and antiparasitic properties, and has been used for such medical conditions as allergies, ulcers, anemia, heavy-metal poisoning, and radiation poisoning. It is also used in weight-loss programs.

Spitfire *or* **Supermarine Spitfire** British FIGHTER AIRCRAFT in World War II. A low-wing monoplane first flown in 1936, it was adopted by the RAF in 1938. At that time one of the war's fastest single-seat fighters, it was used effectively during the Battle of BRITAIN. Later models allowed it to serve as a fighter-bomber and a photoreconnaissance plane. The 1938 version had a top speed of about 360 mph (580 kph) and was armed with eight .303-in. (7.7-mm) machine guns. The Spitfire XIV, one of the last models of the war, had a ceiling of 40,000 ft (12,200 m) and a top speed of 440 mph (710 kph). The RAF retired its last Spitfires in 1954.

Spitsbergen Main island within the SVALBARD archipelago, Norway. Spitsbergen lies 360 mi (580 km) north of the Norwegian mainland in the Arctic Ocean. It was formerly known as West Spitsbergen. The terrain is mountainous, and most of the island is covered with glaciers. It is also deeply indented by fjords. Spitsbergen has extensive coal deposits.

Spitteler \'shpit-ə-lər**, Carl** (b. April 24, 1845, Liestal, Switz.—d. Dec. 29, 1924, Lucerne) Swiss poet. He was a private tutor in Russia and Finland before he wrote his first great poetic work, the mythical epic *Prometheus und Epimetheus* (1881). His second great work was the epic *The Olympic Spring* (1900–05), in which he found full scope for bold invention and vividly expressive power. Late in life he rewrote his first epic as *Prometheus the Long-Suffering* (1924). Though known for his pessimistic yet heroic verse, he also wrote lyrical poems, stories, novels, and essays. He received the Nobel Prize for Literature in 1919.

spittlebug *or* **froghopper** Any of some 2,000 species of hopping insects (family Cercopidae, order Homoptera) with whitish nymphs that use a special abdominal valve to aerate an anal fluid secretion. The resulting frothy spittle protects the nymphs from enemies and desiccation. Adults are less than 0.6 in. (1.5 cm) long. The meadow spittlebug (*Philaenus leucophthalmus*), of Europe and North America, resembles a frog and is a powerful leaper. It feeds extensively on clover and alfalfa, causing severe stunting that can result in the loss of up to 50% of a crop. Some African species occur in such enormous numbers that their spittle drips from tree branches like rain.

spitz Any of several northern dogs, including the CHOW CHOW, POMERANIAN, and SAMOYED, characterized by a dense, long coat, erect pointed ears, and a tail that curves over the back. In the U.S., the name is often given to any small, white, long-haired dog; it is also used for the American ESKIMO DOG. European breeds include the Finnish spitz, with a bright reddish brown coat, and the Lapland spitz, which has a white, brown, or blackish coat.

Spitz, Mark (Andrew) (b. Feb. 10, 1950, Modesto, Calif., U.S.) U.S. swimmer. He swam in college for Indiana University. At the 1968 Olympic Games he won two gold medals in team relay races. In the 1972 Olympics he won four individual men's events (setting world records in all four) and three team events (one world record); Spitz's feat of winning seven gold medals in a single Olympic Games remains unmatched.

spleen Lymphoid organ, located in the left side of the abdomen behind the stomach. The spleen is the primary filtering element for the blood, and it is a storage site for red blood cells (ERYTHROCYTES) and PLATELETS. It is one of four places where reticuloendothelial cells are found (see RETICULOENDOTHELIAL SYSTEM). Two types of tissue, red pulp and white pulp, are intermixed. The white pulp is LYMPHOID TISSUE containing LYMPHOCYTE production centres. The red pulp is a network of channels filled with blood where most of the filtration occurs and is the major site of destruction of deteriorating erythrocytes and recycling of their HEMOGLOBIN. Both contain cells (see LEUKOCYTE) that remove foreign material and initiate an ANTIBODY-producing process. The spleen becomes enlarged in some infections. Its rupture in high-impact injuries may require surgical removal, which leaves the patient more susceptible to overwhelming infection.

Split *ancient* **Spalatum** Seaport (pop., 2001: 188,694), DALMATIA, Croatia. The Romans established the colony of Salonae nearby in 78 BC, and the emperor DIOCLETIAN lived at Split until his death in AD 313. After the AVARS sacked the town in 615, the inhabitants built a new town within Diocletian's 7-acre (3-hectare) palace compound; this "old town" has been continuously inhabited since that time. Split came under Byzantine rule in the 9th century, shifted to Venetian control in 1420, and was held by Austria in the 18th and 19th centuries. It came under Yugoslavian rule in 1918, finally becoming part of independent Croatia in 1992. The port facilities were destroyed in World War II, but the old city was little-damaged, and repairs were subsequently made. Split is a commercial, educational, and tourist centre. Collectively with the historic royal residences, fortifications, and churches in the city, the palace was designated a UNESCO WORLD HERITAGE SITE in 1979.

Spock, Benjamin (McLane) (b. May 2, 1903, New Haven, Conn., U.S.—d. March 15, 1998, La Jolla, Calif.) U.S. pediatrician. He received his M.D. from Columbia University and later practiced pediatrics and taught psychiatry and child development. His *Common Sense Book of Baby and Child Care* (1946; 7th ed., 1998, *Dr. Spock's Baby and Child Care*), which urged parental flexibility and reliance on common sense and discouraged corporal punishment, influenced generations of parents. Continually revised and updated to address new social and medical issues, it has sold over 50 million copies in 39 languages. In 1967 he ceased his medical practice to devote himself to the anti-Vietnam War movement. His advocacy late in life of a vegan (see VEGETARIANISM) diet for children aroused great controversy.

spoils system *or* **patronage system** In U.S. politics, the practice by political parties of rewarding partisans and workers after winning an election. Proponents claim it helps maintain an active party organization by offering supporters jobs and contracts. Critics charge that it awards appointments to the unqualified and is inefficient because even jobs unrelated to public policy change hands after an election. In the U.S., the PENDLETON CIVIL SERVICE ACT (1883) was the first step in introducing the merit system in the hiring of government workers. The merit system has almost completely replaced the spoils system. See also CIVIL SERVICE.

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Spokane \spō-'kan\ City (pop., 2000: 195,629), eastern Washington, U.S. Situated at the falls of the Spokane River, the city was settled on the site of a trading post established in 1810. It was incorporated in 1881 after the arrival of the NORTHERN PACIFIC RAILWAY. A fire in 1889 destroyed much of the city, but it soon was rebuilt and developed into a trade and shipping hub for the surrounding region. Completion of the Grand Coulee Dam Project (1941) assured industrial growth. Spokane is home to Gonzaga University (1887) and is a gateway to the resorts of Mount Spokane and several national forests.

sponge Any of some 5,000 species (phylum Porifera) of permanently affixed (sessile), mostly marine, solitary or colonial INVERTEBRATES, found from shallow to deep (more than 30,000 ft, or 9,000 m) waters. Simple sponges are hollow cylinders with a large opening at the top through which water and wastes are expelled. A thin, perforated outer epidermal layer covers a porous skeleton, which is composed of interlocking spicules of calcium carbonate, silica, or spongin (found in 80% of all sponges), a proteinaceous material. The body, ranging in diameter or length from 1 in. (2.5 cm) to several yards, may be fingerlike, treelike, or a shapeless mass. Sponges lack organs and specialized tissue; flagellated cells move water into the central cavity through the perforations, and individual cells digest food (bacteria, other microorganisms, and organic debris), excrete waste, and absorb oxygen. Sponges can reproduce asexually or sexually. Larval forms are free-swimming but all adults are sessile. Since antiquity, sponges have been harvested for use in holding water, bathing, and scrubbing; because of overharvesting and newer technologies, most sponges sold today are synthetic. See illustration opposite.

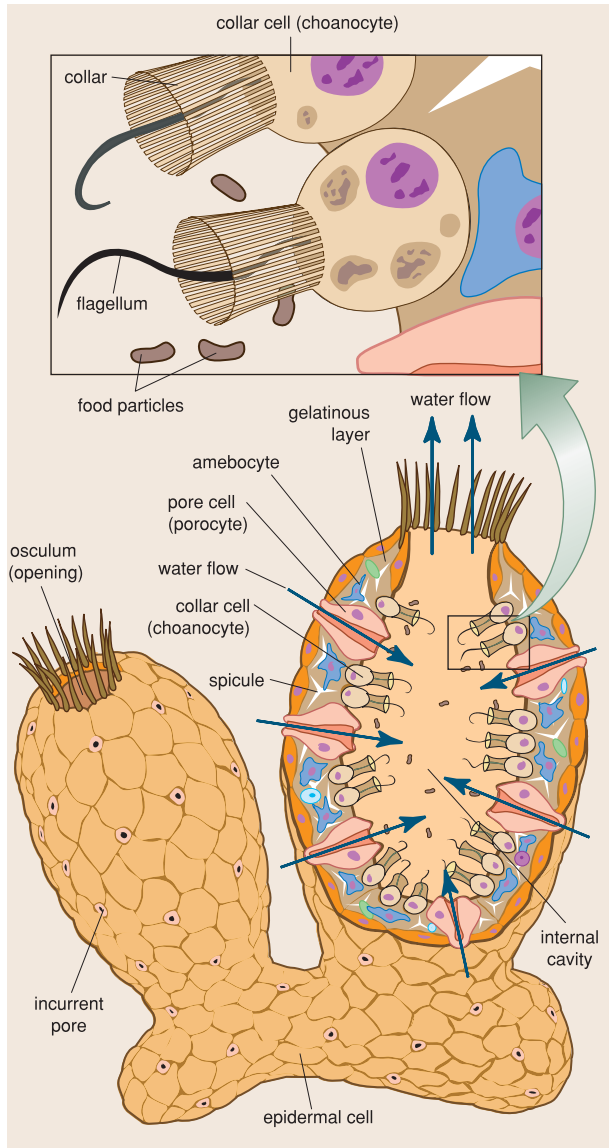
spoonbill Any of six species (family Threskiornithidae) of long-necked, long-legged wading birds, inhabitants of Old and New World estuaries, saltwater bayous, and lakes. They are 24–32 in. (60–80 cm) long and have a short tail and a long, straight bill that is spatulate at the tip. Most species are white, sometimes rose-tinged; the roseate spoonbill (*Ajaia ajaja*) of North and South America is deep pink and strikingly beautiful. With a side-to-side motion of the bill, they sweep mud and shallow water for fishes and crustaceans. They fly with neck and legs extended and wings flapping steadily. Breeding colonies build stick nests in low bushes and trees. Some species, including the black-billed spoonbill, are endangered. See also IBIS.

spoonerism Reversal of the initial letters or syllables of two or more words, such as "I have a half-warmed fish in my mind" (for "half-formed wish") and "a blushing crow" ("a crushing blow"). The word is derived from the name of William Archibald Spooner (1844–1930), a distinguished Anglican clergyman and warden of New College, Oxford, a nervous man who committed many "spoonerisms." Such transpositions are often made intentionally for comic effect.

spore Reproductive cell capable of developing into a new individual without fusing with another reproductive cell. Spores thus differ from gametes, which must fuse in pairs in order to create a new individual. Spores are agents of nonsexual reproduction; gametes are agents of sexual reproduction. Spores are produced by BACTERIA, fungi (see FUNGUS), and green plants. Bacterial spores serve largely as a resting, or dormant, stage in the life cycle, preserving the bacterium through periods of unfavorable conditions. Many bacterial spores are highly durable and can germinate even after years of dormancy. Fungal spores serve a function similar to that of SEEDS in plants; they germinate and grow into new individuals under suitable conditions of moisture, temperature, and food availability. Among green plants (all of which have a life cycle characterized by ALTERNATION OF GENERATIONS), spores are the reproductive agents of the nonsexual generation (SPOROPHYTE), giving rise to the sexual generation (GAMETOPHYTE).

sporophyte \'spōr-ə-ˌfīt\ In many plants and algae, the nonsexual phase in the ALTERNATION OF GENERATIONS, or an individual representing the phase. The alternate, sexual phase is the GAMETOPHYTE. In the sporophyte phase, a diploid (see PLOIDY) plant body grows and eventually produces SPORES through MEIOSIS. These spores divide by MITOSIS to produce haploid gametophytes, which then can carry out sexual reproduction.

sports and games Recreational or competitive activities that involve physical skill, intellectual acumen, and often luck (especially in the case of games of chance). PLAY is an integral part of human nature. Throughout history, humans have invented sporting and gaming activities as a means to socialize, to display skills and prowess, and to entertain or offer excitement. The earliest games may have been based on hunting and gathering activities. In modern times, with the emergence of professional sports, games continue to serve as physical and emotional outlets, as diversions, and as enrichments to daily life while also playing a pronounced economic role.



A simple saclike sponge. Its surface is perforated by small openings (incurrent pores) formed by tubelike cells (porocytes), which open into the internal cavity. A gelatinous middle layer contains the skeletal elements (spicules and spongin fibers) as well as amebocytes active in digestion, waste removal, and spicule and spongin formation. Flagellated collar cells (choanocytes) line the internal cavity, create currents to move water containing oxygen and food into the sponge, and engulf and digest food particles. Water and wastes are expelled through the ostium opening, whose size can be altered to regulate water flow through the sponge.
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sports-car racing Form of motor racing involving small, two-passenger automobiles. The cars are designed for quick response, easy maneuverability, and high-speed driving. Unlike the cars used in GRAND PRIX RACING, the sports car is usually series-produced, seldom handmade, and the reputation of the car maker (Porsche, Jaguar, etc.) is thus put at stake. The most famous international sports-car race is that at LE MANS, FRANCE.

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sports medicine Medical and paramedical supervision and treatment of athletes. It has four aspects. Preparation (conditioning) uses diet, exercises, and monitoring of practice sessions to improve performance. Prevention identifies any predisposition to injury or illness and covers warmup, stretching, and design and use of protective equipment. Many surgical techniques developed in sports medicine, particularly for knee injuries, are now used for the general population. Rehabilitation (see PHYSICAL MEDICINE AND REHABILITATION) prepares an injured or ill athlete to return to activity after initial treatment.

spotted fever See ROCKY MOUNTAIN SPOTTED FEVER

sprat *or* **brisling** Species (*Sprattus sprattus*) of edible fish in the HERRING family. Sprats are silver marine fishes that form enormous schools in western European waters. Less than 6 in. (15 cm) long, they are especially valuable for canning as SARDINES. They are eaten fresh, tinned in oil, pickled, or smoked. The term also refers to a small or young herring or similar fish (e.g., ANCHOVY).

Spratly Islands Group of several dozen small islands and reefs, south-central South CHINA SEA. Located about midway between Vietnam and the Philippines, the group is claimed variously by Vietnam, China, Taiwan, Malaysia, and the Philippines. Of the 12 main islets, the largest is the 90-acre (36-hectare) Itu Aba. Turtles and seabirds are the only permanent inhabitants. After World War II, China established a garrison on Itu Aba, which has been maintained by the Chinese government on Taiwan. All other claimants also have small military forces on several of the islands.

spraying and dusting Standard methods of applying pest-control chemicals and other compounds to plants, animals, soils, or agricultural products. For spraying, chemicals are dissolved or suspended in water or, less commonly, in an oil-based carrier. The mixture is then applied as a fine mist. In dusting, dry, finely powdered chemicals may be mixed with an inert carrier and applied with a blower. In fumigation, gases or the vapours of volatile compounds are held in contact with the materials to be treated. Sprays and dusts are used to control insects, mites, fungi, and bacterial diseases of plants; disease-spreading insects, such as lice and flies, on animals; and weeds. They are also used to apply mineral fertilizers, to increase or decrease fruit set, to delay the dropping of nearly mature fruits, and to defoliate plants to facilitate harvesting (e.g., of cotton; see DEFOLIANT). Sprays adhere to treated surfaces better than dusts do. Fumigation may be used to control insects and some diseases in stored products or to control insects and sometimes fungi and weeds in soil. Increasing use of spraying and dusting has prompted concern over their impact on the environment, the food chain, the water supply, and public health. New chemicals and precautions have only partially allayed these concerns. See also CROP DUSTER; FUNGICIDE; HERBICIDE; INSECTICIDE.

spreadsheet Computer SOFTWARE that allows the user to enter columns and rows of numbers in a ledgerlike format. Any cell of the ledger may contain either data or a formula that describes the value that should be inserted therein based on the values in other cells. When a change is made in one cell, the program recalculates the contents of all cells affected by the change. Spreadsheets are widely used for performing business calculations on PERSONAL COMPUTERS.

Spree River \'shprā\ River, northeastern Germany. Rising in the Lusatian Mountains near the Czech border, it flows north passing through BERLIN, where it joins the HAVEL RIVER after a course of 250 mi (403 km). Between Cottbus and Lübben it divides into a network of channels that form a marshy wooded region known as the Spree Forest. Much of this region is cultivated. It is a popular excursion area.

spring In hydrology, an opening at or near the Earth's surface where water from underground sources is discharged. Springs discharge either at ground level or directly into the bed of a stream, lake, or sea. Water that emerges at the surface without a perceptible current is called a seep.

spring Elastic machine component able to deflect under load in a prescribed manner and to recover its initial shape when unloaded. The combination of force and displacement in a deflected spring is ENERGY, which may be stored when moving loads are being stopped or when the spring is wound up for use as a power source (e.g., in a WATCH). Though most springs are mechanical, hydraulic (liquid) and air springs exist.

Spring and Autumn Annals See CHUNQIU

Spring and Autumn period (770–476 BC) Period of the Chinese ZHOU DYNASTY named for one of the Confucian Classics, the *CHUNQIU* ("Spring and Autumn Annals"). During the period the imperial house's authority diminished as local nobles struggled for power in states that formed political and economic coalitions for military purposes as well as for drainage projects, canals, and other civil engineering projects. Merchants and artisans began to assume some societal significance as well. Classical Chinese thought originates in this period. See also CONFUCIUS; FIVE CLASSICS.

spring balance Weighing device that uses the relation between the applied load and the deformation of a SPRING. This relationship is usually linear; that is, if the load is doubled, the deformation is doubled. Spring balances are widely used commercially. Those with high load capacities are frequently suspended from crane hooks and are known as crane scales.

spring peeper Species (*Hyla crucifer*) of TREE FROG found in ponds, marshes, and other damp areas in the U.S. During the breeding season it can be found in woodland ponds; at other times it is seldom seen. It has a high, whistling call and is one of the first frogs to vocalize in spring. It is tiny (only 0.75–1.3 in. or 2–3.5 cm, long) and grayish, tan, or olive-brown, with an X-shaped or irregular brown mark on its back.

springbok *or* **springbuck** Species of ANTELOPE (*Antidorcas marsupialis*), native to treeless plains of southern Africa, the national emblem of South Africa. It stands about 30 in. (80 cm) high at the shoulder, and both sexes have ringed, lyre-shaped horns. A fold of skin from midback to rump can be opened to display a crest of white hair. The reddish brown upper body has a broad horizontal dark-brown band on each side; the underparts, head, tail, and rump are white. When excited, the springbok, with head down, hooves bunched, and back arched, makes a series of stiff-legged, vertical leaps up to 12 ft (3.5 m) high, an action called pronking.

Springfield City (pop., 2000: 111,454), capital of Illinois, U.S. Springfield lies along the Sangamon River in the central part of the state. The first settler there built a cabin in 1818; in 1837, largely through the efforts of ABRAHAM LINCOLN and other members of the Illinois legislature, the state capital was transferred there. Lincoln lived in Springfield until he became president in 1861; he is buried there. An educational and government services centre, it also is a market centre for a rich farming area.

Springfield City (pop., 2000: 152,082), southwestern Massachusetts, U.S. Located on the CONNECTICUT RIVER, Springfield was settled in 1636 and was incorporated in 1641. It was burned during KING PHILIP'S WAR (1675). In 1786 it was the site of an arsenal targeted by SHAYS' REBELLION; during the AMERICAN CIVIL WAR the U.S. Armory (see SPRINGFIELD ARMORY) there produced the Springfield musket. Springfield is home to several colleges and the Basketball Hall of Fame. It was the birthplace of THEODOR GEISEL (Dr. Seuss).

Springfield City (pop., 2000: 151,580), southwestern Missouri, U.S. Settled in 1829, Springfield grew slowly until the period of heavy westward migration began in the U.S. Confederate forces held it briefly during the AMERICAN CIVIL WAR, and Wild Bill HICKOK lived there in the 1860s. Its agriculture-based economy is augmented by its educational institutions. The international headquarters of the ASSEMBLIES OF GOD church is in the city.

Springfield Armory Weapons factory established at SPRINGFIELD, Mass., by the U.S. Congress in 1794. It grew out of an arsenal established in Springfield by the Revolutionary government in 1777, the site being chosen partly for its inaccessibility to British forces. The armoury pioneered mass-production manufacturing techniques and produced weapons ranging from smoothbore muskets in its earliest days to the SPRINGFIELD RIFLE and the M1 rifle of World War II, designed by JOHN GARAND. It closed in 1968 and is now a national historic site. See also ARMOURY PRACTICE; THOMAS BLANCHARD.

Springfield rifle Any of several RIFLES that were standard infantry weapons of the U.S. Army from 1873 to 1936, all taking their name from the SPRINGFIELD ARMORY. The most famous began as the Model 1903 Springfield, an adaptation of the German Mauser. After modifications to accommodate Model 1906 ammunition, it entered history as the Springfield .30-06, one of the most reliable and accurate military firearms ever. The principal U.S. infantry weapon until 1936, it was replaced by the Garand (M1) rifle of World War II, also designed at the Springfield Armory. When the Springfield .30-06 was retired, it was widely modified into a sporting rifle that is still prized for its accuracy. See also M16 RIFLE.

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Springsteen, Bruce (Frederick Joseph) (b. Sept. 23, 1949, Freehold, N.J., U.S.) U.S. singer and songwriter. He played guitar in several bar bands on the Jersey Shore before forming the E Street Band in the early 1970s. His third album, *Born to Run* (1975), was a huge success and landed "the Boss" on the covers of *Time* and *Newsweek* magazines. Even more successful was his *Born in the USA* (1984). Springsteen's sensitive lyrics, often voicing his working-class sympathies, and marathon concerts won him a devoted following. He addressed Americans' concerns over the terrorist attacks of Sept. 11, 2001, in *The Rising* (2002).

spruce Any of about 40 species of evergreen ornamental and timber trees that make up the genus *Picea* (PINE family), native to temperate and cold regions of the Northern Hemisphere. These pyramid-shaped trees have whorled branches and thin, scaly bark. The needlelike, spirally arranged leaves connect to their stems via a peglike woody base, which remains on the twig when the leaf falls. Tough, finely grained, resonant, and pliable, spruce wood is used for sounding boards in pianos and bodies of violins, as well as in construction, for boats and barrels, and as pulpwood. Common species throughout most of northern North America are black spruce (*P. mariana*), a source of spruce GUM, and white spruce (*P. glauca*), a source of good timber. Blue, or Colorado spruce (*P. pungens*) is used as an ornamental because of its bluish leaves and symmetrical growth habit.

Black spruce (*Picea mariana*)
GRANT HEILMAN—EB INC.

spruce budworm LARVA of a leaf roller MOTH (*Choristoneura fumiferana*), one of the most destructive North American pests. It attacks evergreens, feeding on needles and pollen, and can completely defoliate spruce and related trees, causing much loss for the lumber industry and damaging landscapes.

sprung rhythm Poetic rhythm designed to approximate the natural rhythm of speech. It is characterized by the frequent juxtaposition of single accented syllables and by the occurrence of feet with varying numbers of syllables whose sequence is interrupted by unstressed syllables that are not counted in the scansion. Because stressed syllables often occur sequentially, the rhythm is said to be "sprung." This system of PROSODY was developed by GERARD MANLEY HOPKINS, who saw it as the basis of such early English poems as WILLIAM LANGLAND's *Piers Plowman*.

spurge One of the largest flowering-plant genera (*Euphorbia*), with more than 1,600 species. It takes its common name from a group of annual herbs used as purgatives, or spurges. Many spurges are important as ornamentals or as sources of drugs; many others are weeds. One of the best-known is the POINSETTIA. *Euphorbia* is part of the family Euphorbiaceae, which contains about 7,500 species of flowering annual and perennial herbs and woody shrubs or trees in 275 genera; most are found in temperate and tropical regions. Flowers usually lack petals; those of *Euphorbia* are borne in cup-shaped clusters. The fruit is a CAPSULE. Leaves are usually simple. The stems of many species contain a milky latex. In addition to *Euphorbia*, economically important family members include the CASTOR-OIL PLANT, CROTON, CASSAVA, and RUBBER TREE.

Spurge (*Euphorbia venata*)
VALERIE FINNIS

Sputnik \'spůt-nik\ Any of a series of Earth-orbiting SPACECRAFT whose launching by the Soviet Union inaugurated the space age. Sputnik 1, the world's first artificial SATELLITE (October 1957), remained in orbit until early 1958, when it reentered Earth's atmosphere and burned up. Sputnik 2 carried a dog, Laika, the first living creature to orbit Earth; since Sputnik 2 was not designed to sustain life, Laika did not survive the flight. Eight more missions with similar satellites carried out experiments on various animals to test life-support systems and reentry procedures and to furnish data on space temperatures, pressures, particles, radiation, and magnetic fields.

Spyri \'shpē-rē**, Johanna** *orig.* **Johanna Heusser** (b. June 12, 1829, Hirzel, Switz.—d. July 7, 1901, Zürich) Swiss writer. Living in Zürich with her lawyer husband, Spyri wrote books, many widely translated, that are imbued with her love of her homeland, feeling for nature, unobtrusive piety, and cheerful wisdom. She is best remembered for her popular novel *Heidi* (1880–81), a classic of children's literature about an orphan sent to live with her grandfather in the Swiss mountains.

SQL *in full* **Structured Query Language.** Computer PROGRAMMING LANGUAGE used for retrieving records or parts of records in DATABASES and performing various calculations before displaying the results. SQL is particularly suitable for searching RELATIONAL DATABASES. It has a formal, powerful syntax and is able to accommodate logical operators. Its sentence-like structure resembles natural language except that its syntax is limited and fixed.

Squanto (d. November 1622, Chatham Harbor, Plymouth Colony) Pawtuxet Indian interpreter and guide. Squanto learned English after escaping an attempt to sell him into slavery and joining the Newfoundland Company. In Plymouth colony he was made Gov. WILLIAM BRADFORD's Indian emissary. He also served as interpreter for EDWARD WINSLOW, the Pilgrim representative, during his negotiations with MASSASOIT, chief of the Wampanoag.

square In measurement, a device consisting of two straightedges set at a right angle. It is used by carpenters and machinists to check the correctness of right angles, as a guide when drawing lines on materials before cutting, or for locating holes. In mechanical drawing or drafting, a T-shaped instrument known as a T square is used to establish a horizontal reference on the drafting board.

square dance Dance for sets of four couples standing in square formation. The most popular type of U.S. folk dance, it derived from the QUADRILLE and was originally called a square dance to distinguish it from the contra, or longways, dance (for a double line of couples) and the round dance (for a circle of couples). The U.S. square dance progresses through specific patterns called or sung out to the dancers by a caller and accompanied by lively music played on instruments such as fiddle, banjo, accordion, guitar, and piano.

Square Deal Term used by Pres. THEODORE ROOSEVELT to describe his approach to social problems. It embraced his idealistic view of labour, citizenship, parenthood, and Christian ethics. He first used the term after the settlement of a mining strike in 1902 to describe the ideal of peaceful coexistence between big business and labour unions. The concept became part of the BULL MOOSE PARTY platform when Roosevelt became its candidate in 1912.

square of opposition See square of OPPOSITION

squash Any of various fruits of the genus *Cucurbita* in the GOURD family, widely cultivated as vegetables and for livestock feed. The principal species are *C. maxima* and certain varieties of *C. pepo*. Summer squash is a quick-growing, small-fruited, nontrailing or bush type of *C. pepo*. Diverse in form, colour, and surface texture, the fruits do not store well and must be used soon after harvest (see ZUCCHINI). Winter varieties of squash, *C. maxima*, are long-vining, generally large-fruited, long-season types. Harvested fruits, in a wide range of sizes, shapes, and colours, can be stored many months if kept dry and well above freezing. The rinds are harder than those of summer squash and usually inedible. Examples include acorn squash and PUMPKIN. Native to the Americas, squash was widely cultivated by American Indians before Europeans arrived.

squash (rackets) Singles or doubles game played in a four-walled court with a long-handled racket and a rubber ball. A descendant of RACKETS, it probably originated in the mid-19th century at England's HARROW SCHOOL. The standard international game uses a relatively soft, slow ball; hardball squash, popular in the U.S., is played on a narrower court with a harder, faster ball. The object of squash is to bounce, or rebound, the ball off the front wall in such a way as to defeat an opponent's attempt to reach and return it.

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squash bug *or* **leaf-footed bug** Any of more than 2,000 widely distributed insect species (family Coreidae), including many important plant pests. Most species are dull-coloured and more than 0.4 in. (10 mm) long. Many have enlarged, flattened extensions on the legs. The North American squash bug (*Anasa tristis*) is an important pest of squash, melon, and pumpkin (plants in the GOURD family). It is basically yellow but is covered with black pits that make it look black. The larvae feed underground, and the piercing and sucking mouthparts of the adults enable them to attack the parts of plants that insecticides rarely penetrate.

squash tennis Singles racket game resembling SQUASH rackets, played with an inflated ball the size of a tennis ball. Played in virtually the same court as squash rackets, squash tennis makes fewer demands on the legs in pursuing the ball but puts a greater premium on agility and quickness of foot and reflexes in turning and spinning.

squatter sovereignty See POPULAR SOVEREIGNTY

Squaw Valley Valley, eastern California, U.S. Squaw Valley is located in the SIERRA NEVADA range on the eastern slope of Squaw Peak, northwest of Lake TAHOE. A world-famous winter sports area, it has ice-skating facilities, ski lifts, and trails, and it was the site of the 1960 Winter OLYMPIC GAMES.

Squibb, E(dward) R(obinson) (b. July 4, 1819, Wilmington, Del., U.S.—d. Oct. 25, 1900, Brooklyn, N.Y.) U.S. pharmaceutical manufacturer. He earned a medical degree and later worked on U.S. Navy ships; his work alerted him to the poor quality of the medicines supplied to the Navy, which he persuaded to manufacture its own drugs. At the Brooklyn Naval Hospital (from 1851) he devised a safe method for making anesthetic ether and also discovered processes for making chloroform, fluid extracts, and bismuth salts. In 1858 he set up his own Brooklyn laboratory; the Union Army during the Civil War relied heavily on his drugs, and by 1883 he was manufacturing 324 products and selling them around the world. A Quaker idealist, he refused to patent his medicines, and he crusaded for purity in drug manufacture. He did not live to see the culmination of his work: the Pure Food and Drug Act of 1904.

squid Any of nearly 400 species of 10-armed CEPHALOPODS, found in both coastal and oceanic waters, that prey on fishes and crustaceans. They range from less than 0.75 in. (1.5 cm) to more than 65 ft (20 m) long (in the case of the giant squid). Two of the 10 arms are long, slender tentacles; each has an expanded end and four rows of suckers with toothed, hard-edged rings. An internal shell supports the slender tubular body of most species. Squid eyes, almost as complex as human eyes, are usually set into the sides of the head. Squids may be swift swimmers (propelling themselves by contracting and relaxing their mantle or by undulating their two fins) or mere drifters; water expelled from a funnel below the head can propel the squid backward. Like the OCTOPUS, the squid may emit an inky cloud from its ink sac when in danger from sperm whales, fishes, or humans, among other predators.

Squid (*Illex coindeti*) swimming forward
DOUGLAS P. WILSON

squirrel Any of about 260 species in 50 genera (family Sciuridae) of mostly diurnal RODENTS found almost worldwide. Many species are arboreal; some are terrestrial. All species have strong hind legs and a hairy tail. They vary widely in colour and form and range in total length from the 4-in. (10-cm) African pygmy squirrel to the giant squirrels of Asia, about 35 in. (90 cm) long. Tree dwellers live in a tree hollow or nest, and most are active year-round. Ground dwellers live in burrows, and many become dormant in winter (hibernate) or summer (estivate). Most species are primarily vegetarian and are fond of seeds and nuts; some eat insects or supplement their diet with animal protein. See also CHIPMUNK; FLYING SQUIRREL; GROUND SQUIRREL; MARMOT; PRAIRIE DOG.

squirrel monkey Any of several species (genus *Saimiri*, family Cebidae) of arboreal NEW WORLD MONKEYS, found in groups of up to several hundred during the day in riverside forests of Central and South America. They eat fruit, insects, and small animals. They are 10–16 in. (25–40 cm) long and have a heavy, nonprehensile, black-tipped tail, 15–19 in. (37–47 cm) long. They have a small white face, large eyes, and large, usually tufted, ears. The short, soft coat is grayish to greenish, with yellow or orange arms, hands, and feet. The crown of the common squirrel monkey (*S. sciureus*) is olive or grayish; the red-backed squirrel monkey (*S. oerstedii*) has a black crown and reddish back.

Common squirrel monkey (*Saimiri sciureus*).
© GERRY ELLIS NATURE PHOTOGRAPHY

Sraosha \sraů-'shä\ In ZOROASTRIANISM AND PARSIISM, the divine being who is the messenger of AHURA MAZDA and the embodiment of the divine word. He serves as the mediator between the human and the divine. Zoroastrians believe that no ritual is valid without his presence. He is depicted as a strong and holy youth who lives in a celestial thousand-pillared house. He chastises the demons that harass people every night, and he leads the righteous soul through the ordeal of judgment three days after death. At the end of time, he will be the agent of the extermination of evil.

Sravasti \shrä-'vəs-tē\ Ancient city, northeastern UTTAR PRADESH, northern India. In Buddhist times (6th century BC–6th century AD), it was the capital of KOSALA and a prosperous trading centre. It was also closely associated with the life of the BUDDHA and with figures significant in later Buddhist history. Its ruins include those of a monastery.

Sri Lanka \ˌsrē-'läŋ-kə\ *officially* **Democratic Socialist Republic of Sri Lanka** *formerly* **Ceylon** Island country in the Indian Ocean, off the southeastern coast of India. Area: 25,332 sq mi (65,610 sq km). Population (2005 est.): 20,743,000. Capitals: COLOMBO (executive), Sri Jayewardenepura Kotte (legislative and judicial). About three-fourths of the population is SINHALESE; other ethnic groups include TAMILS and Muslims. Languages: Sinhala, Tamil (both official); also English. Religions: Buddhism; also Hinduism, Islam, Christianity. Currency: Sri Lanka rupee. Highlands make up Sri Lanka's south-central region and core, with narrow gorges and deep river valleys. The surrounding lowlands include hills and fertile plains. The developing mixed economy is largely based on agriculture, services, and light industries. Clothing, tea, gemstones, and rubber are exported. The island is world-famous for its gemstones, which include sapphires, rubies, and topaz. It is also a major producer of high-grade graphite. Sri Lanka is a republic with one legislative house; its head of state and government is the president, assisted by the prime minister. The Sinhalese people are probably the result of aboriginal inhabitants mixing with Indo-Aryans who began migrating from India c. the 5th century BC. The Tamils were later immigrants from Dravidian India, migrating over a period from the early centuries AD to c. 1200. Buddhism was introduced during the 3rd century BC. As Buddhism spread, the Sinhalese kingdom extended its political control over the island but lost it to invaders from southern India in the 10th century. Between 1200 and 1505, Sinhalese power gravitated to southwestern Sri Lanka, while a southern Indian dynasty seized power in the north and established the Tamil kingdom in the 14th century. Foreign invasions from India, China, and Malaya occurred in the 13th–15th centuries. In 1505 the Portuguese arrived, and by 1619 they controlled most of the island. The Sinhalese enlisted the Dutch to help oust the Portuguese, and the island eventually came under the control of the Dutch EAST INDIA COMPANY, which relinquished it in 1796 to the British. In 1802 it became the British crown colony of Ceylon, which gained independence in 1948. It became the Republic of Sri Lanka in 1972 and took its present name in 1978. Civil strife between Tamil and

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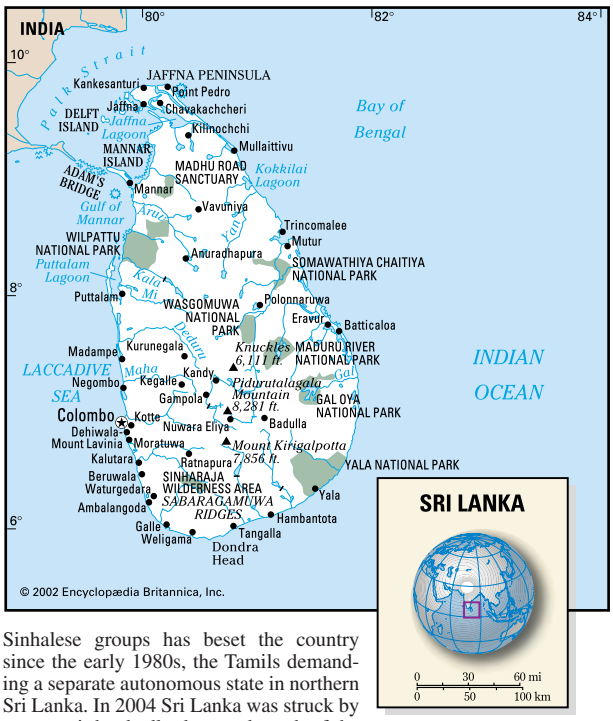

Sinhalese groups has beset the country since the early 1980s, the Tamils demanding a separate autonomous state in northern Sri Lanka. In 2004 Sri Lanka was struck by a tsunami that badly damaged much of the coastline and killed tens of thousands of people.

Srinagar \srē-'nə-gər\ City (pop., 2001 prelim.: 894,940), summer capital of Jammu and Kashmir state, northwestern India. It lies on the banks of the Jhelum River in the Vale of Kashmir. Situated amid clear lakes and lofty mountains, it has long had a considerable tourist economy. Seven wooden bridges span the river, and the gondolas of Kashmir ply the adjacent canals and waterways. The floating gardens of Dal Lake are a famous attraction.

Srivijaya \ˌsrē-wi-'jò-yə\ **empire** (fl. 7th–13th centuries) Maritime and commercial kingdom in the Malay Archipelago. It originated on the island of Sumatra and soon came to control the Strait of Malacca. Its power was based on its control of international sea trade; it had relations with other island states and with China and India. It was also a centre for Mahayana Buddhism and a stopping place for Chinese pilgrims traveling to India. It was overcome by forces of the Cola dynasty in 1025 and lost power gradually thereafter.

SS *German in full* **Schutzstaffel ("Protective Echelon")** Paramilitary corps of the Nazi Party. Founded in 1925 by Adolf Hitler as a personal bodyguard, it was directed from 1929 by Heinrich Himmler, who enlarged its membership from fewer than 300 to more than 250,000. Wearing black uniforms and special insignia (lightning-like runic S's, death's-head badges, and silver daggers), the SS considered itself superior to the SA, whom they purged on Hitler's orders in 1934. The corps was divided into the General SS (Allgemeine-SS), which dealt with police matters and included the Gestapo, and the Armed SS (Waffen-SS), which included the concentration-camp guards and the 39 regiments in World War II that served as elite combat troops. SS men were schooled in racial hatred and absolute obedience to Hitler. They carried out massive executions of political opponents, Roma (Gypsies), Jews, communists, partisans, and Russian prisoners. In 1946 the SS was declared a criminal organization at the Nürnberg trials.

St. Denis \ˌsānt-'den-əs**, Ruth** *orig.* **Ruth Dennis** (b. Jan. 20, 1877, Newark, N.J., U.S.—d. July 21, 1968, Los Angeles, Calif.) U.S. modern-dance innovator and teacher. She was a vaudeville performer before developing her dramatic dance act based on Asian dance forms. From 1906 to 1909 she toured in Europe to wide acclaim. In 1915 she and her husband, Ted Shawn, established the Denishawn dance company and school to present a new choreographic style of abstract "music visualization." The company frequently toured until it disbanded in 1931 when St. Denis and Shawn separated. Her interest in the use of dance in religion led her to found the Society of Spiritual Arts. She continued to perform, teach, and lecture into the 1960s.

stability In mathematics, a condition in which a slight disturbance in a system does not produce a significant disrupting effect on that system. A solution to a differential equation is said to be stable if a slightly different solution that is close to it when $x = 0$ remains close for nearby values of x. Stability of solutions is important in physical applications because deviations in mathematical models inevitably result from errors in measurement. A stable solution will be usable despite such deviations.

stabilizer, economic See economic stabilizer

stadium Enclosure that provides a broad space for sports events and tiers of seats for a large number of spectators. The name derives from a Greek unit of measurement, the stade (about 607 ft, or 185 m), the length of the footrace in the ancient Olympics. Shapes of stadiums have varied depending on use: Some are rectangular with curved corners; others are elliptical or U-shaped. As a type of long-span structure, the stadium played a significant role in 20th-century construction technology. The building of large stadiums has been greatly facilitated by the use of reinforced concrete, steel, and membrane structures, which have made possible daring new designs. The Houston Astrodome was the first major fully roofed stadium. Cables contributed significantly to speed of construction, lightness of roof, and economy in covered stadiums. The enormous Hubert H. Humphrey Metrodome in Minneapolis (opened 1982) was built using a cable system.

Staël \'stäl**, Germaine de** *orig.* **Anne-Louise-Germaine Necker, Baroness de Staël-Holstein** *known as* **Madame de Staël** (b. April 22, 1766, Paris, France—d. July 14, 1817, Paris) French-Swiss writer, political propagandist, and salon hostess. She early gained a reputation as a lively wit. She first became known for *Letters on the Works and the Character of J.-J. Rousseau* (1788). The most brilliant period of her career began in 1794, when she returned to Paris after the Reign of Terror; her salon, known for its literary and intellectual figures, flourished, and she published political and literary essays, notably *A Treatise on the Influence of the Passions upon the Happiness of Individuals and of Nations* (1796), an important document of European Romanticism. In 1803 Napoleon, who resented her opposition, had her banished from Paris, and she made the family residence in Coppet, Switz., her headquarters. Probably her most important work is *Germany* (1810), a serious study of German manners, literature and art, philosophy and morals, and religion. Her other writings include novels, plays, moral essays, history, and memoirs.

Germaine de Staël, portrait by Jean-Baptiste Isabey, 1810; in the Louvre, Paris
GIRAUDON/ART RESOURCE, NEW YORK

Stafford Town and borough (pop., 2001: 120,653), county seat of Staffordshire, west-central England. Founded by the daughter of Alfred the Great, the town had its own mint from the reign of Aethelstan to that of Henry II. After being chartered in 1206, it grew as a market town. Parliamentarians demolished its 11th-century walls and castle in 1643 during the English Civil Wars. It is situated on the London-Birmingham-Manchester road and rail routes; its industries include electrical and mechanical engineering. It was the birthplace of Izaak Walton, and its Swan Hotel was associated with Charles Dickens. The borough of Stafford includes a large rural agricultural area and the towns of Stone and Stafford.

Staffordshire \'sta-fərd-ˌshir\ Administrative (pop., 2001: 806,737), geographic, and historic county, west-central England. Staffordshire's northern moorlands form the southern tip of the Pennines, and it encompasses the coalfield region known as The Potteries. Traces of Neolithic, Bronze Age, and Iron Age settlements remain. The Romans built roads through the area; it was the centre of the kingdom of Mercia in the 7th–9th centuries. The Danes ravaged it at the end of the 9th century. Stafford-

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shire has mined coal and iron since the 13th century. Its pottery industry became famous in the 18th century with the innovations of Josiah Wedgwood. The seat of the administrative county of Staffordshire is Stafford.

Staffordshire figure Type of pottery figurine made in Staffordshire, Eng., beginning c. 1740. The figurines were made first in salt-glazed stoneware, later in lead-glazed earthenware. Subjects included musicians, animals, shepherds, classical deities, allegorical figures, portraits, theatrical and political personages, and even criminals. Staffordshire artists included the Wood family of potters.

Staffordshire lead-glazed earthenware figure, c. 1780; in the Victoria and Albert Museum, London
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, EB INC.

Staffordshire terrier See pit bull terrier

stage design Aesthetic composition of a dramatic production as created by lighting, scenery, costumes, and sound. While elements such as painted screens and wheeled platforms were used in the Greek theatre of the 4th century BC, most innovations in stage design were developed in the Italian Renaissance theatre, where painted backdrops, perspective architectural settings, and numerous changes of scenery were common. Italian staging was introduced in England in 1605 by Inigo Jones for court masques. In the late 19th century staging was influenced by the new naturalism, which called for historically accurate sets. In the 20th century simplified stage design focused attention on the actor. Stage design has been greatly affected by advances in lighting, from the use of candles in the Renaissance to oil lamps in the 18th century and gas and electric lights in the 19th century. Modern stage lighting, which employs computerized control boards to achieve complex effects, can unify all the visual elements of a stage production. See also stage machinery.

stage machinery Devices designed for the production of theatrical effects, including rapid scene changes, lighting, sound effects, and illusions. Such devices have been in use since the 5th century BC, when the Greeks developed a crane to lower to the stage an actor playing a god (see deus ex machina), as well as movable scenery mounted on wheels. Medieval mystery plays used trapdoors to allow the emergence of devils and used flying machines for angels. In the Italian Renaissance, elaborate machinery was used for spectacles produced in the churches on holy days. In the 17th century the Italian Giacomo Torelli (1608–78) invented a system for moving the stage wings that made it possible to change scenery quickly. In the 19th century magical illusions were created with mirror devices and refined trapdoors. By the late 20th century spectacle had fallen out of fashion except in musical theatre, but hydraulic stage machinery allowed for swift and soundless scene changes. See also stage design.

stagecoach Public coach pulled by horses regularly traveling a fixed route between stations or stages. Stagecoaches appeared in London by 1640 and in Paris by 1660. In the 19th century they were most widely used in the U.S. and in England, where in 1828 stagecoaches ran 12 times a day from Leicester to London. In the U.S. they were the only means of travel for long distances overland, carrying passengers and mail to locations especially in the West. As railroad travel became more common, stagecoach travel diminished except to remote locations.

staged rocket Launch vehicle driven by several rocket systems mounted in vertical sequence. The lowest, or first, stage ignites and lifts the vehicle (sometimes assisted by attached booster rockets) at increasing speed until its propellants have been used up. The first stage then drops off, which makes the vehicle lighter, and the second stage ignites and accelerates the vehicle further. The use of additional stages generally follows the same pattern until the payload—the spacecraft—has reached the velocity needed to achieve orbit or leave the vicinity of Earth. The number of stages required depends on the details of the mission, the launch vehicle's characteristics, and other factors. Some early vehicles needed five stages to reach orbit; most current launch vehicles need only two.

Stagg, Amos Alonzo (b. Aug. 16, 1862, West Orange, N.J., U.S.—d. March 17, 1965, Stockton, Calif.) U.S. college gridiron football coach. Stagg played end for Yale University and was chosen for the first All-America team in 1889. During his 41-year tenure at the University of Chicago (1892–1932), he devised the end-around play, the man in motion, the huddle (also credited to another), the shift play, and the tackling dummy. He later coached at three other colleges, not retiring until 1960. His 71 years of coaching represent the longest coaching career in the history of the sport. He died at age 102.

Stahl, Franklin W(illiam) (b. Oct. 8, 1929, Boston, Mass., U.S.) U.S. geneticist. Educated at Harvard University and the University of Rochester, he worked primarily at the University of Oregon. With Matthew Stanley Meselson he discovered and described (1958) the mode of replication of DNA. They found that the double-stranded helix breaks apart to form two strands, each of which directs the construction of a new sister strand.

stained glass Coloured glass used to make decorative windows and other objects through which light passes. Stained glass is often made in large, richly detailed panels that are set together in a framework of lead. Like all coloured glass, it acquires its colour by the addition of metallic oxides to molten glass. A purely Western phenomenon, stained glass originated as a fine art of the Christian church, beginning in the 12th–13th century, when it was combined with Gothic architecture to create brilliant, moving effects. A decline set in after the 13th century, when stained-glass artists began to seek the realistic effects sought by Renaissance painters, effects to which the technique was less suited and which diverted artists from exploiting the all-important light-refracting quality of glass. More recently, stained-glass artists have again achieved high quality: during the 19th-century Gothic revival, in the Art Nouveau designs of Louis Comfort Tiffany, and in the work of such 20th-century artists as Marc Chagall.

stainless steel Any of a family of alloy steels usually containing 10–30% chromium. The presence of chromium, together with low carbon content, gives remarkable resistance to corrosion and heat. Other elements, such as nickel, molybdenum, titanium, aluminum, niobium, copper, nitrogen, sulfur, phosphorus, and selenium, may be added to increase corrosion resistance to specific environments, enhance resistance to oxidation (see oxidation-reduction), and impart special characteristics.

stairway *or* **staircase** Series or flight of steps that provides a means of moving from one level to another. The earliest stairways seem to have been built with walls on both sides, as in Egyptian pylons dating from the 2nd millennium BC. The Romans were noted for their monumental stairs. The modern use of steel and reinforced concrete has made possible the curves and sweeps of contemporary design. Staircases have traditionally been built of wood, marble or stone, and iron or steel. A step's horizontal surface is called its tread, the vertical front its riser. Traditional wooden staircases are constructed with stringers, beams inclined to the angle of the staircase. Stringers are supported by newel posts, which also support the handrail, forming a balustrade.

Staked Plain See Llano Estacado

stalactite and stalagmite \stə-'lak-ˌīt...stə-'lag-ˌmīt\ Elongated forms of various minerals deposited from solution by slowly dripping water. A stalactite hangs like an icicle from the ceiling or side of a cavern. A stalagmite rises from the floor of a cavern. The two are not necessarily paired; when they are, continual elongation of one or both may eventually join them into a column. The dominant mineral in such deposits is calcite (calcium carbonate), and the largest displays are formed in caves of limestone and dolomite.

stalactite work *or* **muqarnas** \mù-'kär-näs\ Honeycomb-like Islamic architectural ornamentation formed by the intricate corbeling (see corbel) of squinches (see Byzantine architecture), brackets, and inverted pyramids in overlapping tiers. It appeared in the early 12th century throughout the Islamic world; a frequent use was to overlay the transitional zone between domes and their supports. It reached its highest development in the 14th–15th century, when it became the usual decoration for door heads, niches, and the bracketing under cornices and minaret galleries. Rich examples are found in the Alhambra and other Moorish works in Spain.

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Stalin, Joseph *orig.* **Iosif Vissarionovich Dzhugashvili** (b. Dec. 21, 1879, Gori, Georgia, Russian Empire—d. March 5, 1953, Moscow, Russia, U.S.S.R.) Soviet politician and dictator. The son of a cobbler, he studied at a seminary but was expelled for revolutionary activity in 1899. He joined an underground revolutionary group and sided with the Bolshevik faction of the Russian Social-Democratic Workers' Party in 1903. A disciple of Vladimir Lenin, he served in minor party posts and was appointed to the first Bolshevik Central Committee (1912). He remained active behind the scenes and in exile (1913–17) until the Russian Revolution of 1917 brought the Bolsheviks to power. Having adopted the name Stalin (from Russian *stal*, "steel"), he served as commissar for nationalities and for state control in the Bolshevik government (1917–23). From 1922 he became secretary-general of the party's Central Committee, a post that later provided the power base for his dictatorship, and was also a member of the Politburo. After Lenin's death (1924), Stalin overcame his rivals, including Leon Trotsky, Grigory Zinovyev, Lev Kamenev, Nikolay Bukharin, and Aleksey Rykov, and took control of Soviet politics. In 1928 he inaugurated the Five-Year Plans that radically altered Soviet economic and social structures and resulted in the deaths of many millions. In the 1930s he contrived to eliminate threats to his power through the purge trials and through widespread secret executions and persecution. In World War II he signed the German-Soviet Nonaggression Pact (1939), attacked Finland (see Russo-Finnish War), and annexed parts of eastern Europe to strengthen his western frontiers. When Germany invaded Russia (1941), Stalin took control of military operations. He allied Russia with Britain and the U.S.; at the Tehrān, Yalta, and Potsdam conferences, he demonstrated his negotiating skill. After the war he consolidated Soviet power in eastern Europe and built up the Soviet Union as a world military power. He continued his repressive political measures to control internal dissent; increasingly paranoid, he was preparing to mount another purge after the so-called Doctors' Plot when he died. Noted for bringing the Soviet Union into world prominence, at terrible cost to his own people, he left a legacy of repression and fear as well as industrial and military power. In 1956 Stalin and his personality cult were denounced by Nikita Khrushchev.

Stalin Peak See Imeni Ismail Samani Peak

Stalinabad See Dushanbe

Stalingrad See Volgograd

Stalingrad, Battle of (1942–43) Unsuccessful German assault on the Soviet city in World War II. German forces invaded the Soviet Union in 1941 and had advanced to the suburbs of Stalingrad (now Volgograd) by the summer of 1942. Met by a determined Red Army defense commanded by Vasily Chuikov, they reached the city's centre after fierce street fighting. In November the Soviets counterattacked and encircled the German army led by Friedrich Paulus, who surrendered in February 1943 with 91,000 troops. The Axis forces (Germans, Romanians, Italians, and Hungarians) suffered 800,000 deaths; in excess of 1,000,000 Soviet soldiers died. The battle marked the farthest extent of the German advance into the Soviet Union.

Stalinism Method of rule, or policies, of Joseph Stalin in the Soviet Union and his imitators elsewhere in the Soviet bloc. On taking power, Stalin brooked no dissent from party policies, of which he assumed the role of sole infallible interpreter. He postponed the struggle for world proletarian revolution, focusing instead on "socialism in one country." He decreed the wholesale collectivization of Russian agriculture and a program of rapid industrialization, which, though broadly effective, resulted in the deaths of many millions. Purges in the 1930s (see Purge Trials) resulted in the deaths of millions more, as opponents were branded traitors and executed or sent to the Gulag. After Stalin's death Nikita Khrushchev repudiated Stalinism (1956) as an aberration. See also Leninism, Trotskyism.

Stalino See Donetsk

Stamboliyski \ˌstäm-bō-ˈlē-skē**, Aleksandŭr** (b. March 1, 1879, Slavovitsa, Bulg.—d. June 14, 1923, near Slavovitsa) Bulgarian politician and premier (1919–23). Editor of the Agrarian League's newspaper, he entered the National Assembly in 1908 as head of the Agrarian Union (Peasant Party). He opposed the pro-German king Ferdinand and supported the Allies in World War I, for which he was imprisoned (1915–18). He led the 1918 insurrection that forced Ferdinand's abdication, and he was chosen premier of the new Bulgarian republic in 1919. Favouring a pro-agrarian policy, he redistributed land to the peasants and reformed the judicial system. Stamboliyski's pacifist leanings and advocacy of a militia alienated the army, and he was overthrown in a military coup and executed.

stamen Male reproductive part of a flower. Stamens produce pollen in terminal saclike structures called anthers. The number of stamens is usually the same as the number of petals. Stamens usually consist of a long slender stalk, the filament, with the anthers at the tip. Some stamens are similar to leaves, with the anthers at or near the margins. Small secretory structures called nectaries are often found at the base of the stamens and provide food rewards for insect and bird pollinators (see pollination). See also pistil.

Stamford City (pop., 2000: 117,083), southwestern Connecticut, U.S. Stamford lies at the mouth of the Rippowam River on Long Island Sound. Founded in 1641, it was a farming community until the railroad reached it in the 1840s. It was essentially a residential suburb of New York City until the early 1970s, when several major corporations moved their headquarters there, revitalizing the city's economic life. Its decaying downtown was razed and rebuilt with modern skyscrapers; today Stamford has one of the largest concentrations of corporate headquarters in the U.S.

Stamitz \'shtä-mits**, Johann (Wenzel Anton)** (b. June 19, 1717, Deutschbrod, Bohemia—d. March 27, 1757, Mannheim, Palatinate) Bohemian-born German composer and violinist. He joined the elector's court in Mannheim c. 1741, and he soon became director of its orchestra, which he built into the finest in Europe. He wrote some 75 symphonies, in which he helped establish the four-movement form as the standard and introduced the orchestral crescendo to Germany from Italian music. He and his students (including his sons) made up what is called the "Mannheim School." His son Carl (1745–1801), also a composer and violinist, played in Mannheim, toured widely as a soloist, and wrote more than 50 symphonies.

stammering See stuttering

Stamp Act (1765) British parliamentary measure to tax the American colonies. To pay for costs resulting from the French and Indian War, the British sought to raise revenue through a stamp tax on printed matter. A common revenue device in England, the tax was vigorously opposed by the colonists, whose representatives had not been consulted. Colonists refused to use the stamps, and mobs intimidated stamp agents. The Stamp Act Congress, with representatives from nine colonies, met to petition Parliament to repeal the act. Faced with additional protests from British merchants whose exports had been reduced by colonial boycotts, Parliament repealed the act (1766), then passed the Declaratory Act.

"An Emblem of the Effects of the STAMP," a warning against the Stamp Act published in the Pennsylvania *Journal*, October 1765; in the New York Public Library.
RARE BOOKS AND MANUSCRIPTS DIVISION, THE NEW YORK PUBLIC LIBRARY, ASTOR, LENOX AND TILDEN FOUNDATIONS

stamp collecting See philately

Standard Generalized Markup Language See SGML

standard model In physics, the combination of two theories of particle physics into a single framework to describe all interactions of subatomic particles except those due to gravity (see gravitation). The two theories, the electroweak theory and the theory of quantum chromodynamics, describe the interactions between particles in terms of the exchange of intermediary particles. The model has proved highly accurate in predicting certain interactions, but it does not explain all aspects of subatomic particles. For example, it cannot say how many particles there should be or what their masses are. The search goes on for a more complete theory, and in particular a unified field theory describing the strong, weak, and electromagnetic forces.

standard of living Level of material comfort that an individual or group aspires to or may achieve. This includes not only privately purchased goods and services but collectively consumed goods and services such as those provided by public utilities and governments. A standard of

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living determined for a group such as a country must be examined critically in terms of its constituent values. If the mean value increases over time, but at the same time the rich become richer and the poor poorer, the group may not be collectively better off. Various quantitative indicators can be used as measuring rods, including life expectancy, access to nutritious food and a safe water supply, and availability of medical care.

Standard Oil Company and Trust U.S. company and corporate trust that held a near monopoly over the U.S. oil industry from 1870 to 1911. The company originated in 1863, when John D. Rockefeller started a Cleveland, Ohio, refining firm, which, with other facilities, was incorporated as the Standard Oil Company in 1870. By 1880, through elimination of competitors, mergers, and use of favourable railroad rebates, it controlled the refining of 90–95% of all oil produced in the U.S. In 1882 Standard Oil and affiliated oil companies were combined in the Standard Oil Trust, which eventually included some 40 corporations. In 1892 the Ohio Supreme Court ordered the trust dissolved, but it continued to operate from headquarters in New York and later New Jersey. Its monopolistic practices were exposed in Ida Tarbell's *History of the Standard Oil Company* (1904), and after a lengthy antitrust suit by the U.S. government (see antitrust law), the Standard Oil empire was broken up in 1911. Although eight companies retained "Standard Oil" in their names after 1911, by the late 20th century the name had all but disappeared, even though former Standard Oil divisions continued to dominate the U.S. petroleum business. In 1931 Standard Oil Company of New York merged with Vacuum Oil Company (another trust company) to form Socony-Vacuum, which in 1966 became Mobil Oil Corp. Standard Oil (Indiana) absorbed Standard Oil of Nebraska in 1939 and Standard Oil of Kansas in 1948 and was renamed Amoco Corp. in 1985. Standard Oil of California acquired Standard Oil of Kentucky in 1961 and was renamed Chevron Corp. in 1984. Standard Oil Company (New Jersey) changed its name to Exxon Corp. in 1972. In 1987 British Petroleum Company PLC (BP) completed the purchase of Standard Oil Company (Ohio). Further consolidation occurred in 1998, when BP merged with Amoco, and in 2002, when Exxon merged with Mobil.

standard time Official local time of a region or country. Local mean solar time depends on longitude; it advances by four minutes per degree eastward. The Earth can thus be divided into 24 standard time zones, each approximately 15° in longitude. The actual boundaries of each time zone are determined by local authorities and in many places deviate considerably from 15°. The times in different zones usually differ by an integral number of hours; minutes and seconds are the same. See also Greenwich Mean Time.

Standardbred Breed of light horse developed in the U.S., primarily for harness racing. The foundation sire was an English Thoroughbred imported in 1788; his progeny were bred with other breeds, especially the Morgan, to produce speedy trotters and pacers. The Standardbred's height is 15–16 hands (60–64 in. [152–163 cm]); its weight is 900–1,000 lb (410–450 kg). Colour varies, but the most common is bay. "Standard" refers to a requirement imposed in 1871 that, to be registered, a horse must meet certain standards of speed (e.g., trotting a mile in 2.5 minutes).

standardization In industry, the development and application of standards that make it possible to manufacture a large volume of interchangeable parts. Standardization may focus on engineering standards, such as properties of materials, fits and tolerances, and drafting practices; or on product standards, which detail the attributes of manufactured items and are embodied in formulas, descriptions, drawings, or models. Adoption of standards makes it easier for firms to communicate with their suppliers. Standards are also used within industries to prevent conflict and duplication of effort. Governmental departments, trade associations, and technical associations help to set standards within industries; these are coordinated and promoted by organizations such as the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO).

Standards and Technology, National Institute of See Bureau of Standards

standing In law, the status of being qualified to bring a legal matter before a court because one has a sufficient and protectable interest in its outcome. The courts have ruled that a plaintiff who has suffered or is threatened with actual injury (physical, economic, or other) clearly has standing. A plaintiff who cannot demonstrate such injury will lack standing and therefore be unable to bring a case.

Standish, Myles (b. c. 1584, Lancashire, Eng.—d. Oct. 3, 1656, Duxbury, Mass.) British-American colonist. He fought in the Netherlands, where he met the Pilgrims, with whom he later sailed to North America on the *Mayflower* (1620). As the Plymouth colony's military leader, he led several expeditions against hostile Indian tribes. He served as the colony's assistant governor and treasurer (1644–49). There is no historical evidence for the story that he asked John Alden to propose marriage for him to Priscilla Mullins, as mythologized in Henry W. Longfellow's poem *The Courtship of Miles Standish* (1858).

Stanford, (Amasa) Leland (b. March 9, 1824, Watervliet, N.Y., U.S.—d. June 21, 1893, Palo Alto, Calif.) U.S. entrepreneur, a builder of the first transcontinental railroad. He practiced law in Wisconsin before settling in Sacramento, Calif., where he built a successful retail business in mining supplies and became active in local politics. He served as governor of California (1861–63). He invested heavily in the plan to build a transcontinental railroad, and when the Central Pacific Railroad was organized in 1861 he became its president (1863–93). During his tenure its track was built eastward to join that of the Union Pacific at Promontory, Utah (1869), and he played a major role in further railroad development in California and the Southwest. From 1885 to 1893 he served in the U.S. Senate. He and his wife, Jane, founded Stanford University in 1885.

Stanhope, Charles Stanhope, 3rd Earl (b. Aug. 3, 1753, London, Eng.—d. Dec. 15, 1816, Chevening, Kent) English politician and inventor. A member of the House of Commons (1780–86), where he was known as Lord Mahon until inheriting his father's title, he became chairman of the Revolution Society and favoured parliamentary reform. He sympathized with the French republicans and opposed Britain's war with Revolutionary France. He was also an experimental scientist and invented calculating machines, a printing press and a microscope lens named for him, a stereotyping machine, and a steam carriage.

Stanhope, James Stanhope, 1st Earl (b. 1673, Paris, France—d. Feb. 5, 1721, London, Eng.) English soldier and statesman. He began a military career in 1691 and rose rapidly to become commander in chief of the English army in Spain in 1708 in the War of the Spanish Succession. He was defeated and captured by the French (1710), then returned to England (1712) and regained his seat in the House of Commons (1701–21). He served in the Whig government as secretary of state and negotiated the Quadruple Alliance against Spain (1718). Stanhope served as first lord of the treasury (1717–18), but his ministry was discredited by the South Sea Bubble scandal.

Stanislavsky \ˌsta-ni-'slȧf-skē**, Konstantin (Sergeyevich)** *orig.* **Konstantin Sergeyevich Alekseyev** (b. Jan. 17, 1863, Moscow, Russia—d. Aug. 7, 1938, Moscow) Russian director and actor. From age 14 he acted with his family's amateur dramatic group, and in 1888 he cofounded a permanent dramatic company. He won praise in 1891 for his first independent production, *The Fruits of Enlightenment*. In 1898 he and Vladimir Nemirovich-Danchenko (1858–1943) founded the Moscow Art Theatre; that year it restaged Anton Chekhov's *The Seagull* to great acclaim. Stanislavsky continued to direct and act in many Russian plays, including Chekhov's *Uncle Vanya* (1899) and *The Cherry Orchard* (1904). He trained his actors to achieve greater realism by identifying deeply with their characters, a technique that became known as the Stanislavsky method. His company toured Europe and the U.S. (1922–24), where his method influenced the later development of the Group Theatre and the Actors Studio.

Stanislavsky method *or* **method acting** Influential system of dramatic training developed by the Russian actor, producer, and theoretician Konstantin Stanislavsky. The method was developed over years of trial and error, beginning c. 1898. It requires that an actor use his emotion memory (i.e., his recall of past experiences and emotions) to identify with the character's inner motivation. The technique was developed in reaction to the histrionic acting styles of the 19th century. Noted American practitioners began using the method in the 1920s; they have included Lee Strasberg, Marlon Brando, Dustin Hoffman, and Eli Wallach.

Stanisław \stȧ-'nē-slȧf\ **I** *orig.* **Stanisław Leszczyński** (b. Oct. 20, 1677, Lwów, Pol.—d. Feb. 23, 1766, Lunéville, France) King of Poland (1704–09, 1733). The son of a Polish noble, he became king when Charles XII of Sweden invaded Poland (1702), deposed King Augustus II, and placed Stanisław on the throne (1704). When Sweden was defeated by the Russians in 1709, Augustus regained the throne, and Stanisław settled in France, where his daughter Marie married Louis XV. After Augustus's

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death (1733), Stanisław was elected king of Poland, but Russia invaded to prevent an alliance with France, causing the War of the Polish Succession. Deposed again, Stanisław was granted the provinces of Lorraine and Bar, where he promoted economic development and made his court at Lunéville a cultural centre.

Stanisław II August Poniatowski \'pȯn-yä-'tȯf-skē\ *orig.* **Stanisław Poniatowski** (b. Jan. 17, 1732, Wołczyn, Pol.—d. Feb. 12, 1798, St. Petersburg, Russia) King of Poland (1764–95). Son of a Polish noble, he was sent in 1757 to Russia to win support for Polish interests and became the lover of the future Empress Catherine II. In 1764 Catherine used Russian troops and influence to ensure Stanisław's election as king. He tried to introduce administrative reforms, but opposition from Polish nobles and from Catherine forced him to continue his rule as a pawn of Russia. He attempted to pass a new constitution but could not stop the partitions of Poland (1772, 1793, 1795), after which he abdicated.

Stanley, Francis Edgar; and Stanley, Freelan O. (respectively b. June 1, 1849, Kingfield, Maine, U.S.—d. July 31, 1918, Ipswich, Mass.; b. June 1, 1849, Kingfield, Maine, U.S.—d. Oct. 2, 1940, Boston, Mass.) U.S. inventors of the steam-driven automobile. In 1883 the twin brothers invented a dry-plate photographic process and conducted experiments with steam engines. In 1897 they built a steam-powered car, and in 1902 they established a company to manufacture their "Stanley Steamers." In 1906 they set a world record for the fastest mile, in 28.2 seconds. They retired in 1917; their company continued to manufacture cars until 1924, declining as gasoline-powered cars became easier to start and operate and steam cars became less popular.

Stanley, Sir Henry Morton *orig.* **John Rowlands** (b. Jan. 28, 1841, Denbigh, Denbighshire, Wales—d. May 10, 1904, London, Eng.) British-U.S. explorer of central Africa. An illegitimate child, Stanley grew up partly in a British workhouse; he sailed to the U.S. as a cabin boy in 1859. After becoming a journalist for the *New York Herald* in 1867, he embarked (1871) on a journey to locate David Livingstone, of whom little had been heard since his departure for Africa in 1866. On finding him at Ujiji on Lake Tanganyika, Stanley uttered the famous words "Dr. Livingstone, I presume?" He further explored central Africa for extended periods between 1874 and 1884, often in the service of Leopold II of Belgium, for whom he paved the way for the creation of the Congo Free State. Stanley's last expedition (1888) was for the relief of Mehmed Emin Pasha, who had been cut off by the Mahdist revolt in the Sudan; he escorted Emin and 1,500 others to the eastern coast. His highly popular books include *Through the Dark Continent* (1878) and *In Darkest Africa* (1890).

Sir Henry Morton Stanley, detail of a portrait by Sir Hubert von Herkomer; in the City Museum & Art Gallery, Bristol, Gloucestershire, England.
COURTESY OF THE CITY MUSEUM & ART GALLERY, BRISTOL, ENGLAND

Stanley, Wendell Meredith (b. Aug. 16, 1904, Ridgeville, Ind., U.S.—d. June 15, 1971, Salamanca, Spain) U.S. biochemist. He taught at the University of California at Berkeley from 1948 until his death. He is known for his work in the purification and crystallization of viruses to demonstrate their molecular structure. He crystallized the tobacco mosaic virus and did important work on the influenza virus, for which he developed a vaccine. He shared a Nobel Prize in 1946 with John Howard Northrop and James Sumner.

Stanley brothers U.S. bluegrass duo. The duo consisted of Ralph (Edmund) Stanley (b. Feb. 25, 1927, Stratton, Va., U.S.) on banjo and Carter (Glen) Stanley (b. Aug. 27, 1925, McClure, Va.—d. Dec. 1, 1966, Bristol, Va.) on lead guitar. The brothers rose to fame performing traditional religious songs in a traditional Appalachian bluegrass style marked by tight, high-pitched harmonies and strongly influenced by Bill Monroe. With their band, the Clinch Mountain Boys, they had several hit recordings. After Carter's death, Ralph reorganized the band. He has recorded more than 150 albums.

Stanley Cup Trophy awarded annually to the winning team of the National Hockey League championship. Named for its donor, the Canadian governor-general Frederick Arthur Stanley, Lord Stanley of Preston (1841–1908), the Stanley Cup was first awarded in the 1893–94 season. It is the oldest trophy that can be won by professional athletes in North America.

Stanleyville See Kisangani

Stanovoy \ˌstä-nə-'vȯi\ **Mountains** Mountain range, eastern Russia, in Asia. It is part of the watershed between the Pacific and Arctic oceans. The mountains are generally not high, although they reach about 8,000 ft (2,400 m) in the east. They contain deposits of gold, coal, and mica.

Stanton, Edwin M(cMasters) (b. Dec. 19, 1814, Steubenville, Ohio, U.S.—d. Dec. 24, 1869, Washington, D.C.) U.S. secretary of war (1862–68). A lawyer and abolitionist, he was appointed U.S. attorney general in 1861 and secretary of war in 1862. He ably administered the Union military effort in the American Civil War, and he later helped lead the investigation of Pres. Abraham Lincoln's assassination. Conflict with Pres. Andrew Johnson over Reconstruction policy and his alliance with the Radical Republicans led to Stanton's dismissal by Johnson, in deliberate violation of the Tenure of Office Act. Stanton refused to leave office, but he resigned after Johnson was acquitted in the impeachment trial.

Stanton, Elizabeth Cady *orig.* **Elizabeth Cady** (b. Nov. 12, 1815, Johnstown, N.Y., U.S.—d. Oct. 26, 1902, New York, N.Y.) U.S. social reformer and women's suffrage leader. She graduated from Troy Female Seminary (1832), and in 1840 she married the abolitionist Henry B. Stanton and began working to secure passage of a New York law giving property rights to married women. She and Lucretia Mott organized the 1848 Seneca Falls Convention. She joined forces in 1850 with Susan B. Anthony in the woman suffrage movement, and later she coedited the women's-rights newspaper *The Revolution* (1868–70). In 1869 she became the founding president of the National Woman Suffrage Association.

Stanwyck, Barbara *orig.* **Ruby Stevens** (b. July 16, 1907, Brooklyn, N.Y., U.S.—d. Jan. 20, 1990, Santa Monica, Calif.) U.S. film actress. She made her screen debut in 1927 and went on to appear in over 80 films, often portraying strong-willed, independent women. Her movies include *Stella Dallas* (1937), *Union Pacific* (1939), *Ball of Fire* (1942), *Double Indemnity* (1944), *Sorry, Wrong Number* (1948), and *Executive Suite* (1954). She later starred in the television series *The Big Valley* (1965–69), and she appeared in the popular miniseries *The Thorn Birds* (1983). She received several Academy Award nominations, but she failed to win an award until she was granted an honorary award in 1981.

staphylococcus \ˌsta-fə-lō-'kä-kəs\ Any of the spherical bacteria that make up the genus *Staphylococcus*. The best-known species are present in great numbers on the mucous membranes and skin of all humans and other warm-blooded animals. The cells characteristically group together in grapelike clusters. Staphylococci are gram-positive (see gram stain) and stationary and do not require oxygen. Of significance to humans is the species *S. aureus*, an important agent of wound infections, boils, and other human skin infections, and one of the most common causes of food poisoning. It also causes udder inflammation in domestic animals and breast infections in women. The largest cause of hospital infections (accounting for almost 15%), "staph" is often difficult to treat because of its increasing resistance to antibiotics.

star Any massive celestial body of gas that shines by radiant energy generated inside it. The Milky Way Galaxy contains hundreds of billions of stars; only a very small fraction are visible to the unaided eye. The closest star is about 4.2 light-years from the Sun; the most distant are in galaxies billions of light-years away. Single stars such as the Sun are the minority; most stars occur in pairs, multiple systems, or clusters (see binary star; globular cluster; open cluster). Constellations consist not of such groupings but of stars in the same direction as seen from Earth. Stars vary greatly in brightness (magnitude), colour, temperature, mass, size, chemical composition, and age. In nearly all, hydrogen is the most abundant element. Stars are classified by their spectra (see spectrum), from blue-white to red, as O, B, A, F, G, K, or M; the Sun is a spectral type G star. Generalizations on the nature and evolution of stars can be made from correlations between certain properties and from statistical results (see Hertzsprung-Russell diagram). A star forms when a portion of a dense interstellar cloud of hydrogen and dust grains collapses from its own gravity. As the cloud condenses, its density and internal temperature increase until

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it is hot enough to trigger NUCLEAR FUSION in its core (if not, it becomes a BROWN DWARF). After hydrogen is exhausted in the core from nuclear burning, the core shrinks and heats up while the star's outer layers expand significantly and cool, and the star becomes a red giant. The final stages of a star's evolution, when it no longer produces enough energy to counteract its own gravity, depend largely on its mass and whether it is a component of a close binary system (see BLACK HOLE; NEUTRON STAR; NOVA; PULSAR; SUPERNOVA; WHITE DWARF STAR). Some stars other than the Sun are known to have one or more planets (see PLANETS OF OTHER STARS). See also CEPHEID VARIABLE; DWARF STAR; ECLIPSING VARIABLE STAR; FLARE STAR; GIANT STAR; POPULATIONS I AND II; SUPERGIANT STAR; T TAURI STAR; VARIABLE STAR.

Star Chamber British PREROGATIVE COURT that exercised wide civil and criminal jurisdiction and was marked by secrecy, the absence of juries, and an inquisitorial rather than accusatorial system of justice. It met in a room in the palace of Westminster whose ceiling was decorated with stars. It was employed extensively under HENRY VIII because of its ability to enforce the law when other courts were unable to do so because of corruption and influence. When CHARLES I used it to enforce unpopular political and ecclesiastical policies, it became a symbol of oppression to his and Archbishop WILLIAM LAUD's parliamentary and Puritan opponents (though it never imposed the death penalty), and it was abolished by the Long Parliament in 1641.

Star of David See Star of DAVID

Star Wars See STRATEGIC DEFENSE INITIATIVE

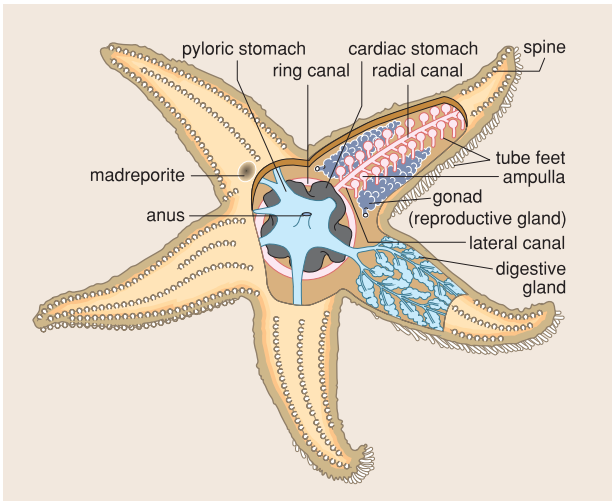
starch Any of several white, granular organic compounds produced by all green plants. They are POLYSACCHARIDES with the general chemical formula $(C_6H_{10}O_5)_n$, where *n* may range from 100 to several thousand; the constituent MONOSACCHARIDES are GLUCOSE units made in PHOTOSYNTHESIS. The glucose chains are unbranched in amylose and branched in amylopectin, which occur mixed in starches. Starch consumed by animals is broken down into glucose by ENZYMES during DIGESTION. Commercial starch is made mainly from corn, though wheat, tapioca, rice, and potato starch are also used. Starch has many uses in foods and the food industry, as well as in the paper, textile, and personal-care products industries and in adhesives, explosives, and oil-well drilling fluids and as a mold-release agent. Animal starch is another name for GLYCOGEN. See also CARBOHYDRATE.

stare decisis \ˌster-ē-di-ˈsī-səs\ *Latin* **"let the decision stand"** In COMMON LAW, the doctrine under which courts adhere to precedent on questions of law in order to ensure certainty, consistency, and stability in the administration of justice. Since no court decision can have universal application, the courts, in practice, must often decide that a previous decision does not apply to a particular case even though the facts and issues appear to be closely similar. A strict application of stare decisis may lead to rigidity and to legal hairsplitting, whereas too much flexibility may result in uncertainty.

starfish *or* **sea star** Any of 1,800 ECHINODERM species (class Asteroidea) that have regenerable arms surrounding an indistinct disk and that inhabit all oceans. Species range from 0.4 to 25 in. (1–65 cm) across, but most are 8–12 in. (20–30 cm) across. Their arms, usually five, are hollow and, like the disk, covered with short spines and pincerlike organs; on the lower side are tube feet, sometimes sucker-tipped, used for creeping or clinging to steep surfaces. Some species sweep organic particles into the mouth on the underside of the disk. Others either evert the stomach upon their prey for external digestion or swallow the prey whole. See illustration above.

Starhemberg \ˈshtär-əm-ˌberk**, Ernst Rüdiger, prince von** (b. May 10, 1899, Eferding, Austria—d. March 15, 1956, Schruns) Austrian politician. In 1930 he became leader of the fascist Austrian Heimwehr, a paramilitary defense force, and in 1932 he helped ENGELBERT DOLLFUSS form the right-wing coalition called the Fatherland Front. Appointed vice chancellor in 1934, he sought to maintain a fascist Austrian state that was independent of Nazi Germany. Differences with Chancellor KURT VON SCHUSCHNIGG resulted in Starhemberg's expulsion from the government (May 1936). He fled Austria after the ANSCHLUSS (1938). Following a brief period of service early in World War II in the British and Free French air forces, he lived in Argentina (1942–55) before returning to Austria.

Stark, John (b. Aug. 28, 1728, Londonderry, N.H.—d. May 8, 1822, Manchester, N.H., U.S.) American Revolutionary officer. He served in the French and Indian War with ROBERT ROGERS's Rangers (1754–59). In the AMERICAN REVOLUTION he fought at the Battle of BUNKER HILL and in New Jersey. He commanded the militia that defeated the British at the Battle of Bennington, Vt. Promoted to brigadier general of the Continental Army, he helped force the British surrender at the Battle of SARATOGA and then served in Rhode Island. In 1780 he was a member of the court-martial that condemned Maj. JOHN ANDRÉ, who had spied for the British. In 1783 he was made a major general.



Principal features of a starfish. Water for the water vascular system enters through the madreporite and passes into a ring canal and on to radial and lateral canals, from which it enters the tube feet, which are connected to saclike ampullae on top. Contraction of the tube feet forces water into the ampullae, creating suction that allows suckers at the ends of the feet to hold to a surface. When the ampullae contract, water is forced into the feet, extending them and releasing the suction. These coordinated actions permit movement, attachment, and capture of prey. In many starfish, the cardiac stomach is everted through the mouth on the body's undersurface to envelop prey, and digestion may begin outside the body before the stomach is drawn back in.

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starling Any of about 168 species (family Sturnidae) of songbirds of temperate Eurasia, Africa, and Australia. The best-known is *Sturnus vulgaris*, an 8-in. (20-cm), chunky, iridescent black bird with a long sharp bill. It has been introduced from Eurasia to most parts of the world, except South America. The millions in North America are descendants of 100 birds released in New York City in 1890. Starlings search the ground for a wide range of plant and animal foods and fly in a tight flock. They are vocal year-round, mimicking other birds' notes and uttering wheezy sounds of their own.

Common starling (*Sturnus vulgaris*).
GEORGE W. ROBINSON—ROOT RESOURCES/EB INC.

Starling, Ernest Henry (b. April 17, 1866, London, Eng.—d. May 2, 1927, Kingston Harbour, Jam.) British physiologist. His studies of lymph secretion clarified the roles of different pressures in fluid exchanges between vessels and tissues. Starling and WILLIAM BAYLISS showed how nerve impulses control peristalsis and coined the term *hormone*. Starling also found that water and necessary chemicals filtered out by the kidneys are reabsorbed at the lower end of the nephron. His *Principles of Human Physiology* (1912), continually revised, was a standard international text.

Starr, Belle *orig.* **Myra Belle Shirley** (b. Feb. 5, 1848, Washington county, Mo., U.S.—d. Feb. 3, 1889, near Briartown, Okla.) U.S. outlaw. She grew up in Missouri and later moved to a farm at Scyene, near Dallas, Texas. She bore a child by the outlaw Cole Younger (1844–1916) and another by Jim Reed, with whom she rustled cattle and horses in Texas in 1869. She fashioned herself the "bandit queen," dressing in velvet and feathers or buckskin and moccasins. In 1880 she became the common-

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law wife of Sam Starr, and their Oklahoma ranch became an outlaws' hideout. Sam was killed in a gunfight in 1886, and Belle herself was later shot down near her ranch.

Stars and Stripes, The Newspaper for U.S. military personnel. It first appeared in single editions during the American Civil War and was revived as a weekly for troops in Europe at the end of World War I. Reestablished in 1942, first as a weekly and then a daily, it has been published since then in a European edition and since 1945 in a Pacific edition. It has carried the work of many outstanding writers, editors, cartoonists, and photographers. An authorized, unofficial publication of the Department of Defense, it is relatively free of military censorship and control.

START See Strategic Arms Reduction Talks

Stasi \'shtä-zē\ *officially* **Staatssicherheit ("State Security")** Secret police of East Germany (1950–90), established with Soviet help by German communists in Soviet-occupied Germany after World War II. It was responsible for both domestic political surveillance and espionage. At its peak, it employed 85,000 officers full-time. Using hundreds of thousands of informers, it monitored one-third of the population. Most of its foreign operations were focused on West Germany—whose governing circles and military and intelligence services it successfully penetrated—and West Germany's NATO allies. The Stasi was disbanded after German reunification. In 1991 the newly reunified German government passed the Stasi Records Law, under which East German citizens and foreigners were granted the right to view their Stasi files. By the early 21st century, more than 1.5 million individuals had done so.

state Political organization of society, or the body politic, or, more narrowly, the institutions of government. The state is distinguished from other social groups by its purpose (establishment of order and security), methods (its laws and their enforcement), territory (its area of jurisdiction), and sovereignty. In some countries (e.g., the U.S.), the term also refers to nonsovereign political units subject to the authority of the larger state, or federal union.

state, equation of Any of a class of equations that relate the pressure P, volume V, and temperature T of a given substance in thermodynamic equilibrium. For example, the equation $PV = nRT$, where n is the number of moles of gas and R is the universal gas constant, relates the pressure, volume, and temperature of a perfect gas. Real gases, solids, and liquids have more complicated equations of state. See also thermodynamics.

Staten Island Island in New York Harbor, a borough (pop., 2000: 443,728) of New York, New York, U.S. It has an area of almost 60 sq mi (155 sq km) and is connected to Brooklyn by the Verrazano-Narrows Bridge and to New Jersey by several bridges; it is accessible to Manhattan by the Staten Island Ferry. The Dutch attempted to colonize the island in 1630 but were thwarted by the Delaware Indian inhabitants until 1661, when the Dutch West India Co. granted the island to the French and settlements were established. Following the acquisition of New Netherland in 1664 by Great Britain, English and Welsh farmers established homes and farms on the island. As Richmond, it became a borough of New York City in 1898; Staten Island was made the official name in 1975. Mostly residential, the island has some industry, including shipbuilding yards, printing plants, and oil-storage tanks and refineries. It is the seat of Wagner College (1883, moved from Rochester in 1918).

States General See Estates General

states' rights Rights or powers retained by the regional governments of a federal union under the provisions of a federal constitution. In the U.S., Switzerland, and Australia, the powers of the regional governments are those that remain after the powers of the central government have been enumerated in the constitution. The powers of both the state or regional and national levels of government are defined clearly by specific provisions of the constitutions of Canada and Germany. The concept of states' rights is closely related to that of the 18th-century European concept of state rights, which was invoked to legitimate the powers vested in sovereign national governments. In the U.S. before the mid-19th century, some Southern states claimed the right to annul an act of the federal government within their boundaries (see nullification), as well as the right to secede from the Union. The constitutional question was resolved against the South by the North's victory in the American Civil War. In the civil rights era, states' rights were invoked by opponents of federal efforts to enforce racial integration in public schools. The federal government can influence state policy even in areas that are constitutionally the purview of the states (e.g., education, local road construction) through withholding funds from states that fail to comply with its wishes. In the late 20th century the term came to be applied more broadly to a variety of efforts aimed at reducing the powers of national governments.

statistical mechanics Branch of physics that combines the principles and procedures of statistics with the laws of both classical mechanics and quantum mechanics. It considers the average behaviour of a large number of particles rather than the behaviour of any individual particle, drawing heavily on the laws of probability, and aims to predict and explain the measurable properties of macroscopic (bulk) systems on the basis of the properties and behaviour of their microscopic constituents.

statistics Branch of mathematics dealing with gathering, analyzing, and making inferences from data. Originally associated with government data (e.g., census data), the subject now has applications in all the sciences. Statistical tools not only summarize past data through such indicators as the mean (see mean, median, and mode) and the standard deviation but can predict future events using frequency distribution functions. Statistics provides ways to design efficient experiments that eliminate time-consuming trial and error. Double-blind tests for polls, intelligence and aptitude tests, and medical, biological, and industrial experiments all benefit from statistical methods and theories. The results of all of them serve as predictors of future performance, though reliability varies. See also estimation, hypothesis testing, least squares method, probability theory, regression.

Statue of Liberty National Monument Historic site in New York Harbor, New York and New Jersey, U.S. Covering 58 ac (23 ha), it includes the Statue of Liberty (on Liberty Island [formerly Bedloe's Island]) and nearby Ellis Island. The colossal statue, *Liberty Enlightening the World*, was sculpted by Frédéric-Auguste Bartholdi and dedicated in 1886. This 305-ft (93-m) statue of a woman holding a tablet and upraised torch was given to the U.S. by France and commemorates the friendship of the two countries; a plaque at the pedestal's entrance is inscribed with the sonnet "The New Colossus" by Emma Lazarus. The Statue of Liberty was declared a national monument in 1924 and a UNESCO World Heritage site in 1984; Ellis Island, containing the Ellis Island Immigration Museum, was added to the monument in 1965.

Statute of Provisors See Statute of Provisors

Staubach \'stȯ-ˌbäk**, Roger (Thomas)** (b. Feb. 5, 1942, Cincinnati, Ohio, U.S.) U.S. football player. He compiled a notable record at the U.S. Naval Academy (1962–65), where he made All-American and won the Heisman Trophy (1963). His professional career was spent as quarterback with the Dallas Cowboys (1969–79), which he helped make into a dominant team, leading them to the play-offs in every year but one (1974) and to four Super Bowls (won 1972, 1978; lost 1976, 1979).

Staupers, Mabel (Keaton) *orig.* **Mabel Doyle** (b. Feb. 27, 1890, Barbados, West Indies—d. Nov. 29, 1989, Washington, D.C., U.S) Caribbean-born U.S. nurse and executive. She joined two physicians to establish the first hospital in Harlem to treat U.S. blacks with tuberculosis (1920). As executive secretary of the National Association of Colored Graduate Nurses (NACGN), she campaigned to integrate the Armed Forces Nurse Corps; overwhelming public support led to full integration in 1945, and in 1948 NACGN succeeded in integrating the American Nurses Association.

staurolite \'stȯr-ə-ˌlīt\ Silicate mineral produced by regional metamorphism in rocks such as mica schists, slates, and gneisses, where it is generally associated with other minerals. Staurolite is a brittle, hard mineral that has a dull lustre. Its crystals are usually dark brown and are often twinned in cruciform patterns (known as fairy crosses) that can be made into ornaments. Staurolite occurs especially in Canada, Brazil, France, Switzerland, and the U.S. (North Carolina, Virginia, and Georgia).

stave church Type of medieval Norwegian wooden church. The stone foundation supports four horizontal wooden members, from which rise four corner posts, or staves, which are joined together by four upper crossbeams. From this boxlike frame, timbers extend outward, supporting a series of uprights, or masts. There may be four or more ranks of masts, with an equal number of triangular frames of diminishing size rising above them. The church at Borgund (c. 1150) is one of about 24 surviving examples. Its six tiers of double-sloped roofs, shell-like exterior shingles, and elaborate carvings of dragons and other motifs give it its remarkably picturesque and vigorous appearance.

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Stavisky affair (1934) French financial and political scandal. When bonds sold to working-class citizens by a credit organization run by the Russian-born swindler Serge A. Stavisky (1886–1934) were found to be worthless, Stavisky fled to Chamonix and allegedly committed suicide. Members of the right believed he had been murdered to cover up complicity with corrupt government officials. Demonstrations against the government by antirepublican groups, including the ACTION FRANÇAISE and the CROIX DE FEU, culminated in a riot on Feb. 6, 1934, which killed 15 people. Two successive prime ministers were forced to resign; a centrist coalition was eventually formed to restore confidence.

STD See SEXUALLY TRANSMITTED DISEASE

Stead, Christina (Ellen) (b. July 17, 1902, Rockdale, Sydney, Austl.—d. March 31, 1983, Sydney) Australian novelist. She traveled widely and at various times lived in London, Paris, and the U.S., where in the early 1940s she worked as a screenwriter for MGM. She returned to Australia in 1974. Her first published work was a collection of short stories, *The Salzburg Tales* (1934). She is best remembered for her novel *The Man Who Loved Children* (1940), the story of a disintegrating family.

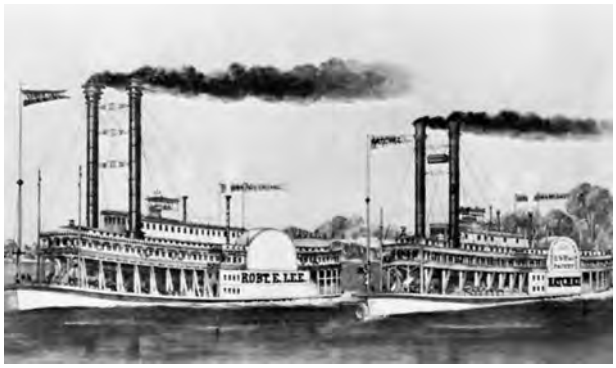
steady-state theory Concept of an EXPANDING UNIVERSE whose average density remains constant, matter being continuously created throughout it to form new stars and galaxies at the same rate that old ones recede from sight. A steady-state universe has no beginning or end, and its average density and arrangement of galaxies are the same as seen from every point. Galaxies of all ages are intermingled. The theory was first put forward by William Macmillan (1861–1948) in the 1920s and modified by FRED HOYLE to deal with problems that had arisen in connection with the BIG-BANG model. Much evidence obtained since the 1950s contradicts the steady-state theory and supports the big-bang model.

stealth Any military technology intended to make vehicles or missiles nearly invisible to enemy RADAR or other electronic detection. Research in antidetection technology began soon after radar was invented. In World War II the Germans coated their U-boat snorkels with radar-absorbent material. By the end of the 20th century the U.S. had developed models of stealth technology, including the F-117 Nighthawk fighter-bomber and the B-2 Spirit strategic bomber. The aircraft featured surface materials and coatings that absorbed radar transmissions, faceted or rounded surfaces that reduced radar reflections, and shielded engine exhausts that reduced infrared radiation. Stealth technology has also been incorporated into the design of naval submarines and surface vessels.

steam Invisible GAS consisting of vaporized WATER. When mixed with minute droplets of water, it has a white, cloudy appearance. In nature, steam is produced by the heating of underground water by volcanic processes and is emitted from HOT SPRINGS, GEYSERS, FUMAROLES, and some VOLCANOES. Steam also can be generated on a large scale by technological systems, such as those using fossil-fuel-burning BOILERS and nuclear reactors. Modern industrial society relies on steam power; water is heated to steam in power plants, and the pressurized steam drives TURBINES that produce ELECTRIC CURRENT: thermal energy is converted to mechanical energy, which is converted into electricity.

steam engine Machine that uses steam power to perform mechanical work through the agency of heat (hence a prime mover). In a steam engine, hot STEAM, usually supplied by a BOILER, expands under pressure, and part of the heat energy is converted into work. The rest of the heat may be allowed to escape, or, for maximum engine efficiency, the steam may be condensed in a separate apparatus, a CONDENSER, at comparatively low temperature and pressure. For high efficiency, the steam must decrease substantially in temperature as it expands within the engine. The most efficient performance (i.e., the greatest output of work in relation to the heat supplied) is obtained by using a low condenser temperature and a high boiler pressure. See also THOMAS NEWCOMEN, JAMES WATT.

steamboat *or* **steamship** Watercraft propelled by steam; more narrowly, a shallow-draft paddle-wheel steamboat widely used on rivers in the 19th century, particularly the Mississippi River and its tributaries. Though U.S. experiments with steam-powered boats began in 1787, the first regular steamboat service, operating on the Mississippi, was not established until 1812. Until c. 1870 the steamboat dominated the economy, agriculture, and commerce of the middle of the U.S. Because the paddle wheel created turbulence that eroded the banks of narrow channels, river steamboats worked best on broad rivers. The first ocean voyage of a steamboat occurred along the eastern coast of the U.S. in 1809, and Europeans soon developed steamboats capable of crossing Europe's stormy, narrow seas. The first transatlantic steamboat journey was made by the *Savannah* in 1819, and the first commercial shipping line, the Cunard Line (see SAMUEL CUNARD), was established in 1840. The screw propeller replaced the paddle wheel in oceanic steamers in the later 19th century. See also OCEAN LINER.



Steamers *Robert E. Lee* and the *Natchez* in the race from New Orleans to St. Louis, lithograph by Currier and Ives
BBC HULTON PICTURE LIBRARY

Stebbins, G(eorge) Ledyard (b. Jan. 6, 1906, Lawrence, N.Y., U.S.—d. Jan. 19, 2000, Davis, Calif.) U.S. botanist. He received his Ph.D. from Harvard University and later taught in the University of California system. In *Variation and Evolution in Plants* (1950) he became the first biologist to apply the modern synthetic theory of evolution—a theory that distinguishes the basic processes of gene mutation and recombination, natural selection, changes in structure and number of chromosomes, and reproductive isolation—to higher organisms. Working with polyploid plants (new species that originated by a spontaneous doubling of the chromosomes of an existing species), he employed a technique for doubling a plant's chromosomal number artificially to produce successful artificial polyploids from wild-grass species, becoming the first person to artificially hybridize a plant species that could thrive under natural conditions.

Stedinger Crusade (1229–34) Crusade against the Stedinger, a body of peasants labeled as heretics by the archbishop of Bremen, who secured papal support for a crusade. In fact, the charge of heresy was unsubstantiated, and the "crusade" was an attack led by the archbishop's brother and other nobles of the region. In 1234 Pope Gregory IX was persuaded to summon a crusade with full privileges.

steel ALLOY of IRON and about 2% or less CARBON. Pure iron is soft, but carbon greatly hardens it. Several iron-carbon constituents with different compositions and/or crystal structures exist: austenite, ferrite, pearlite, cementite, and martensite can coexist in complex mixtures and combinations, depending on temperature and carbon content. Each microstructure differs in hardness, strength, toughness, corrosion resistance, and electrical resistivity, so adjusting the carbon content changes the properties. HEAT TREATING, mechanical working at cold or hot temperatures, or addition of alloying elements may also give superior properties. The three major classes are CARBON STEELS, low-alloy steels, and high-alloy steels. Low-alloy steels (with up to 8% alloying elements) are exceptionally strong and are used for machine parts, aircraft landing gear, shafts, hand tools, and gears, and in buildings and bridges. High-alloy steels, with more than 8% alloying elements (e.g., STAINLESS STEELS) offer unusual properties. Making steel involves melting, purifying (refining), and alloying, carried out at about 2,900°F (1,600°C). Steel is obtained by refining iron (from a BLAST FURNACE) or scrap steel by the BASIC OXYGEN PROCESS, the OPEN-HEARTH PROCESS, or in an ELECTRIC FURNACE, then by removing excess carbon and impurities and adding alloying elements. Molten steel can be poured into MOLDS and solidified into INGOTS; these are reheated and rolled into semifinished shapes which are worked into finished products. Some steps in ingot pouring can be saved by continuous CASTING. Forming semifinished steel into finished shapes may be done by two major methods: hot-working consists primarily of hammering and pressing (together called FORGING), EXTRUSION, and ROLLING the steel under high heat; cold-working, which includes rolling, extrusion, and drawing (see WIRE drawing), is generally

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used to make bars, wire, tubes, sheets, and strips. Molten steel can also be cast directly into products. Certain products, particularly of sheet steel, are protected from CORROSION by ELECTROPLATING, GALVANIZING, or TINPLATING.

steel drum Tuned gong made from the end, and part of the wall, of an oil barrel. The barrel's end surface is hammered into a concave shape, and several areas are outlined by chiseled grooves. It is heated and tempered, and bosses or domes are hammered into the outlined areas; the depth, curvature, and size of each boss determines its pitch. Melodies, complex accompaniments, and COUNTERPOINT can be played with rubber-tipped mallets on a single drum. The steel drum originated in Trinidad in the 1940s. It is usually played in ensembles, called steel bands, of widely varying sizes.

Steele, Sir Richard (b. 1672, Dublin, Ire.—d. Sept. 1, 1729, Carmarthen, Carmarthenshire, Wales) English journalist, dramatist, essayist, and politician. He began his long friendship with JOSEPH ADDISON at school and attempted an army career before turning to writing. He launched and was the principal author (under the name Isaac Bickerstaff) of the essay periodical *The Tatler* (April 1709–January 1711), in which he created the mixture of entertainment and instruction in manners and morals that he and Addison would perfect in *The* SPECTATOR. His attractive, often casual writing style was a perfect foil for Addison's more measured, erudite prose. He made many later ventures into journalism, some politically partisan, and held several government posts. In 1714 he became governor of DRURY LANE THEATRE, where he produced *The Conscious Lovers* (1723), one of the century's most popular plays and perhaps the best example of English sentimental comedy.

Steen \'stān**, Jan (Havickszoon)** (b. c. 1626, Leiden, Neth.—d. Feb. 3, 1679, Leiden) Dutch painter. A brewer's son, he was enrolled at the University of Leiden in 1646 and in 1648 became a founding member of the Leiden painters' guild. One of the greatest Dutch genre painters, he is known for his humour and ability to capture subtle facial expressions, especially of children. His figures, which became larger and more individually characterized in his later works, were often shown playing cards or skittles, or carousing in inns and taverns. His paintings show great technical skill, particularly with colour. His late paintings, which anticipated the ROCOCO STYLE, became increasingly elegant and somewhat less energetic.

steeplechase Either of two distinct sporting events: (1) a horse race over a closed course with obstacles, including hedges and walls; or (2) a footrace of 3,000 m over hurdles and a water jump. The name derives from impromptu races by fox hunters in 18th-century Ireland over natural country in which church steeples served as course landmarks. Equestrian steeplechase is popular in England, France, and Ireland, and to a lesser extent in the U.S. The most famous equestrian steeplechase is the GRAND NATIONAL. Track-and-field steeplechase dates back to a cross-country race at the University of Oxford in 1850. The course and distance were standardized at the 1920 Olympic Games.

Stefan Decansky \'ste-vän-de-'kän-skē\ *or* **Stefan Uroš III** (b. 1280—d. 1331) King of Serbia (1322–31). After rebelling against his father, Stefan Uroš II (r. 1282–1321), he was blinded, so that he would be unfit to rule, and exiled (1314–20). He then showed he was not blind, claiming a miraculous cure, and was made king. He allied with the losing ANDRONICUS II PALAEOLOGUS in the civil war with ANDRONICUS III PALAEOLOGUS (1327–28) and was deposed by his son, STEFAN DUŠAN.

Stefan Dušan \'dü-shän\ *or* **Stefan Uroš IV** (b. 1308—d. Dec. 20, 1355) King of Serbia (1331–46) and emperor of the Serbs and Greeks (1346–55). He deposed his father, STEFAN DECANSKY, in 1331. The greatest ruler of medieval Serbia, he began a war of conquest against Byzantium in 1334, gaining control of Albania and Macedonia by 1346 and Epirus and Thessaly by 1348. Dušan reformed the Serbian administration on the Byzantine model and introduced a law code. His rule over former Byzantine lands was threatened by JOHN VI CANTACUZENUS, and his empire broke apart soon after his death.

Stefan Nemanja *or* **Stephen Nemanja** \'ne-män-yä\ (d. 1200) Founder of the Serbian state. He was grand *župan* (clan leader) under Byzantine rule in 1169. He allied himself with Venice and was defeated by the avenging Byzantines, though he was later pardoned. After expanding Serbian territory, he abdicated in 1196 and entered a monastery.

Steffens, (Joseph) Lincoln (b. April 6, 1866, San Francisco, Calif., U.S.—d. Aug. 9, 1936, Carmel, Calif.) U.S. journalist and reformer. He worked for New York City newspapers (1892–1901) and was managing editor of *McClure's Magazine* (1901–06), where he began his famous muckraking articles—later published as *The Shame of the Cities* (1904)—exposing corruption in politics and big business. He lectured widely and aroused public interest in seeking solutions and taking action. He later supported revolutionary activities in Mexico and Russia and lived in Europe (1917–27). The success of his *Autobiography* (1931) returned him to the lecture circuit.

Stegner, Wallace (Earle) (b. Feb. 18, 1909, Lake Mills, Iowa, U.S.—d. April 13, 1993, Santa Fe, N.M.) U.S. writer. Stegner studied at the University of Iowa and later taught at several universities, notably Stanford. *The Big Rock Candy Mountain* (1943), a novel about a family traveling around the West seeking their fortune, was his first critical and popular success. His later novels include *A Shooting Star* (1961), *Angle of Repose* (1971, Pulitzer Prize), and *The Spectator Bird* (1976, National Book Award). His nonfiction includes two histories of the settlement of Utah, *Mormon Country* (1942) and *The Gathering of Zion* (1964), and *Beyond the Hundredth Meridian* (1954), a biography of JOHN WESLEY POWELL.

stegosaur Any of the plated DINOSAUR species, including *Stegosaurus*, of the Late JURASSIC Epoch (159–144 million years ago). Stegosaurs were four-legged herbivores that reached a maximum length of about 30 ft (9 m). The skull and brain were very small. The forelimbs were much shorter than the hind limbs, the back was arched, and the feet were short and broad. Stegosaurs had double rows of large, triangular, bony plates along their backs and tail that may have been a temperature-regulating system. Pairs of long, pointed, bony spikes on the end of the tail were probably defensive weapons.

Steichen \'stī-kən**, Edward (Jean)** *orig.* **Édouard Jean Steichen** (b. March 27, 1879, Luxembourg—d. March 25, 1973, West Redding, Conn., U.S.) Luxembourg-born U.S. photographer. His family immigrated to the U.S. in 1881. His early photographs were influenced by his training as a painter. He frequently used chemicals to achieve prints that resembled soft, fuzzy mezzotints or wash drawings. In 1902 he joined ALFRED STIEGLITZ in forming the PHOTO-SECESSION, a group dedicated to promoting photography as a fine art. His style evolved from painterly IMPRESSIONISM to sharp realism after World War I. His portraits of artists and celebrities from the 1920s and '30s are remarkable evocations of character. At the outbreak of World War II, Steichen was commissioned by the U.S. Navy to organize a department to photograph the war at sea. In 1955 he organized the *Family of Man* exhibition of 503 photographs (selected from over two million), which was seen by more than nine million people worldwide.

Edward Steichen, 1960.
JOANNA T. STEICHEN

Steiermark \'shtī-ər-ˌmärk\ *English* **Styria** \'stir-ē-ə\ State (pop., 2001: 1,183,303), southeastern Austria. Inhabited since the Stone Age, the region came under Roman rule as part of the Celtic kingdom of NORICUM. It was ruled by the Bavarians in the 8th century, belonged to the duchy of CARINTHIA after 976, and was made a frontier territory of the Frankish empire in the 11th century. The area became a duchy in 1180 and a HABSBURG crown land in 1282. After World War I, 2,329 sq mi (6,032 sq km) of southern Steiermark were ceded to Yugoslavia. Steiermark has been a state of Austria since that time, except for the years 1938–45, when most of it formed a *Reichsgau* (party district) under the *Anschluss* (incorporation into Germany). Steiermark has an area of 6,327 sq mi (16,387 sq km), and its capital is GRAZ.

Stein, Gertrude (b. Feb. 3, 1874, Allegheny City, Pa., U.S.—d. July 27, 1946, Neuilly-sur-Seine, France) U.S. avant-garde writer. Born to a wealthy family, Stein studied at Radcliffe College before moving to Paris, where from 1909 she lived with her companion Alice B. Toklas (1877–1967). Their home was a salon for leading artists and writers, including PABLO PICASSO, HENRI MATISSE, GEORGES BRAQUE, SHERWOOD ANDERSON, and

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Ernest Hemingway. An early supporter of Cubism, she tried to parallel its theories in her work, including the poetry volume *Tender Buttons* (1914). Her prose was characterized by a unique style employing repetition, fragmentation, and use of the continuous present, especially in the immense novel *The Making of Americans* (written 1906–11, published 1928). Her only book to reach a wide public was *The Autobiography of Alice B. Toklas* (1933), actually Stein's own autobiography. Her other works include *Four Saints in Three Acts* (1934) and *The Mother of Us All* (1947), opera librettos scored by Virgil Thomson.

Gertrude Stein, oil painting by Pablo Picasso, about 1906; in the Metropolitan Museum of Art, New York City
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, BEQUEST OF GERTRUDE STEIN, 1946

Stein \'shtīn**, (Heinrich Friedrich) Karl, imperial baron vom und zum** (b. Oct. 26, 1757, Nassau an der Lahn, Nassau—d. June 29, 1831, Schloss Cappenberg, Westphalia) Prussian statesman. Born into the imperial nobility, he entered the civil service in 1780. As minister of economic affairs (1804–07) and chief minister (1807–08) to Frederick William III, he introduced wide-ranging reforms in administration, taxation, and the civil service that modernized the Prussian government. He abolished serfdom, reformed the laws on land ownership, and helped reorganize the military. Anticipating war with France, he was forced to resign under pressure from Napoleon (1808) and fled to Austria. As an adviser to Tsar Alexander I (1812–15), he negotiated the Russo-Prussian Treaty of Kalisz (1813) that formed the last European coalition against Napoleon.

Stein-Leventhal syndrome See polycystic ovary syndrome

Steinbeck, John (Ernst) (b. Feb. 27, 1902, Salinas, Calif., U.S.—d. Dec. 20, 1968, New York, N.Y.) U.S. novelist. Steinbeck intermittently attended Stanford University and worked as a manual labourer before his books attained success. He spent much of his life in Monterey county, Calif. His reputation rests mostly on the naturalistic novels on proletarian themes that he wrote in the 1930s. Among them are *Tortilla Flat* (1935), *In Dubious Battle* (1936), *Of Mice and Men* (1937), and the acclaimed *The Grapes of Wrath* (1939, Pulitzer Prize), which aroused widespread sympathy for the plight of migratory farm workers. In World War II he served as a war correspondent. His later novels include *Cannery Row* (1945), *The Pearl* (1947), *The Wayward Bus* (1947), and *East of Eden* (1952). He received the Nobel Prize for Literature in 1962.

John Steinbeck.
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Steinberg, Saul *orig.* **Saul Jacobson** (b. June 15, 1914, Râmnicu Sărat, Rom.—d. May 12, 1999, New York, N.Y., U.S.) Romanian-born U.S. cartoonist and illustrator. He studied architecture in Milan, meanwhile publishing cartoons in Italian magazines. Settling in New York City in 1942, he worked as a freelance artist, illustrator, and cartoonist, mainly for *The New Yorker*. His extraordinarily original and instantly recognizable works are often surrealistic or whimsically nightmarish visions of contemporary America and frequently employ odd versions of pop-culture icons. His subject matter ranges from the whimsical (e.g., a wicker chair overtaken by its curlicues) to the satirical (sinister, overgrown gadgets) to the philosophical (a tiny figure perched on a giant question mark balanced at the edge of an abyss). See photograph above.

Steinem, Gloria (b. March 25, 1934, Toledo, Ohio, U.S.) U.S. political activist, feminist, and editor. She began her career as a writer and journalist in New York and became deeply involved in the women's liberation movement in the late 1960s. In 1971 she was a founder of the National Women's Political Caucus, and in 1972 she founded *Ms.*, a trendsetting magazine that she subsequently edited, to treat contemporary issues from a feminist perspective. In the 1970s and '80s she founded or cofounded other women's organizations, including the National Organization for Women. Her books include *Outrageous Acts and Everyday Rebellions* (1983), *Marilyn* (1986), and *Revolution from Within* (1992).

Saul Steinberg, photograph by Arnold Newman, 1951.
© ARNOLD NEWMAN

Steiner, (Francis) George (b. April 23, 1929, Paris, France) French-born U.S.-Swiss critic. Steiner became a U.S. citizen in 1944 but spent much of his time in Europe, teaching principally at Cambridge University and the University of Geneva. He studied the relationship between literature and society, particularly in light of modern history, and his writings on language and the Holocaust reached a wide nonacademic audience. Among his works are *The Death of Tragedy* (1960), *Language and Silence* (1967), essays on the dehumanizing effects of World War II on literature, *After Babel* (1975), on the intersection of culture and linguistics, *In Bluebeard's Castle* (1971), and several works of fiction.

Steiner, Max(imilian Raoul Walter) (b. May 10, 1888, Vienna, Austria—d. Dec. 28, 1971, Hollywood, Calif., U.S.) Austrian-born U.S. composer and conductor. A prodigy, he wrote an operetta at age 14 that ran in Vienna for a year. He immigrated to the U.S. in 1914 and worked in New York City as a theatre conductor and arranger, and then he moved to Hollywood in 1929. He became one of the first and finest (if not subtlest) movie composers, establishing many techniques that became standard, with his scores for *King Kong* (1933), *The Informer* (1935, Academy Award), *Gone with the Wind* (1939), *Now, Voyager* (1942, Academy Award), *Since You Went Away* (1944, Academy Award), *The Big Sleep* (1946), *The Fountainhead* (1949), and many others.

Steiner \'shtī-nər**, Rudolf** (b. Feb. 27, 1861, Kraljević, Austria—d. March 30, 1925, Dornach, Switz.) Austrian-Swiss social and spiritual philosopher, founder of anthroposophy. He edited the scientific works of Johann W. von Goethe and contributed to the standard edition of Goethe's complete works. During this period he wrote *The Philosophy of Freedom* (1894). Coming gradually to believe in spiritual perception independent of the senses, he called the result of his research "anthroposophy," centring on "knowledge produced by the higher self in man." In 1912 he founded the Anthroposophical Society. In 1913 he built his first Goetheanum, a "school of spiritual science," in Dornach, Switz. In 1919 he founded a progressive school for workers at the Waldorf Astoria factory, which led to the international Waldorf School movement. Steiner's other writings include *The Philosophy of Spiritual Activity* (1894), *Occult Science* (1913), and *Story of My Life* (1924).

Steinmetz \'shtīn-ˌmets,\ *English* \'stīn-ˌmets**, Charles Proteus** *orig.* **Karl August Rudolf Steinmetz** (b. April 9, 1865, Breslau, Prussia—d. Oct. 26, 1923, Schenectady, N.Y., U.S.) German-born U.S. electrical engineer. Forced to leave Germany because of his socialist activities, he emigrated to the U.S. in 1889 and began working for General Electric Co. in 1893. He taught at Union College from 1902. His experiments led to the law of hysteresis, which deals with power loss in electrical machinery when magnetic action is converted to unusable heat; the constant he calculated (by age 27) has remained a part of electrical engineering vocabulary. In 1893 he developed a simplified symbolic

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method of calculating alternating-current phenomena. He also studied electrical transients (changes of very short duration in electrical circuits; e.g., lightning); his theory of traveling waves led to development of devices to protect high-power transmission lines from lightning bolts and to the design of a powerful generator. He patented over 200 inventions.

Charles Steinmetz.
COURTESY OF UNION COLLEGE, SCHENECTADY, NEW YORK

Steinway German-U.S. piano manufacturing firm. Henry E. Steinway, born Heinrich Engelhard Steinweg (1797–1871), was trained as an organ builder in his native Germany and began building pianos in 1836. He and most of his family followed one of his sons to the U.S. in 1850. After working for other piano firms for several years to learn the American business, in 1853 father and sons founded their own company in New York City, which came to dominate the market. In 1865 he brought to the U.S. the sons who had kept the German business going. He himself became involved in research and development, and his improvements set the standard for the modern grand piano.

stele \'stē-lē, 'stēl\ *or* **stela** \'stē-lə\ Standing stone tablet used in the ancient world primarily as a grave marker but also for dedication, commemoration, and demarcation. Though the stele's origin is unknown, a stone slab was commonly used as a tombstone in Egypt, Greece, Asia, and the Mayan empire. In Babylon, the Code of HAMMURABI was engraved on a tall stele. The largest number of stelae were produced in ATTICA, chiefly as grave markers. The dead were represented on the stelae as they were in life: men as warriors or athletes, women surrounded by their children, and children with their pets or toys.

Stella, Frank (Philip) (b. May 12, 1936, Malden, Mass., U.S.) U.S. painter. He moved to New York City after studying history at Princeton University and there began his innovative "black paintings" (1958–60), incorporating symmetrical series of thin white stripes that replicated the canvas shape when seen against their black backgrounds. As a leading figure of MINIMALISM, in the mid 1960s he began using polychromy in an influential series marked by intersecting geometric curvilinear shapes and plays of vivid and harmonious colours. In the 1970s he began producing sensuously coloured, mixed-media reliefs featuring more organic shapes. He was given retrospective exhibitions at the Museum of Modern Art in 1970 and 1987.

Steller's sea cow See SEA COW

stem Plant axis that emerges from the roots, supports the branches, bears buds and shoots with leaves, and contains the vascular (conducting) tissues (XYLEM and PHLOEM) that transport water, minerals, and food to other parts of the plant. The pith (a central core of spongy tissue) is surrounded by strands (in dicots; see COTYLEDON) or bundles (in monocots) of conducting xylem and phloem, then by the cortex and outermost epidermis, or BARK. The CAMBIUM (an area of actively dividing cells) lies just below the bark. Lateral buds and leaves grow out of the stem at intervals called nodes; the intervals on the stem between the nodes are called internodes. In flowering plants, various stem modifications (RHIZOME, CORM, TUBER, BULB, STOLON) let the plant survive dormantly for years, store food, or sprout asexually. All green stems perform PHOTOSYNTHESIS, as do leaves; in plants such as the cacti (see CACTUS) and ASPARAGUS, the stem is the chief site of photosynthesis.

stem cell In living organisms, an undifferentiated cell that can produce other cells that eventually make up specialized tissues and organs. There are two major types of stem cells, embryonic and adult. Embryonic stem cells are located in the inner mass of a blastocyst (an embryo at a very early stage of development), and they eventually give rise to every cell type of the adult organism. Adult stem cells are found in some tissues in the adult body, such as the epidermis of the skin, the lining of the small intestine, and the bone marrow, where they serve in the regeneration of old or worn tissue. In cancer treatment, blood-forming adult stem cells are routinely harvested from bone marrow, stored, and then reinfused into patients to replace blood cells destroyed by chemotherapy or radiation therapy. This potential for replacing damaged tissues has aroused great interest in using embryonic stem cells to treat a number of other conditions, such as Parkinson disease, severe burns, and damage to the spinal cord. Mouse embryonic stem cells are widely used to create genetically modified mice that serve as models for investigating human disease. However, the use of human embryonic stem cells, which requires destroying the blastocysts from which they are obtained, has raised objections by those who feel blastocyst-stage embryos are human beings. The first human stem cell line was created in 1998, using cells harvested from embryos produced through in vitro fertilization. The use of human embryonic stem cells is allowed in some countries and prohibited or restricted in others.

Stendhal \sta^{n}-'dȧl,\ *English* \sten-'dȧl\ *orig.* **Marie-Henri Beyle** (b. Jan. 23, 1783, Grenoble, France—d. March 23, 1842, Paris) French novelist. He left for Paris in 1799 partly to escape his father's rule. By 1802 he was keeping a diary (posthumously published as his *Journal*) and writing other texts dealing with his intimate thoughts. From 1806 he served in Napoleon's army; after the French empire fell in 1814, he settled in Italy. As a result of political and romantic disappointments, he returned to Paris. During 1821–30, while leading an active social and intellectual life, he wrote works including the masterpiece *The Red and the Black* (1830), a powerful character study of an ambitious young man that is also an acute picture of Restoration France. His other major work, *The Charterhouse of Parma* (1839), is remarkable for its sophisticated rendering of human psychology and its subtly drawn portraits. His unfinished autobiographical works, *Memoirs of an Egotist* (1892) and *The Life of Henry Brulard* (1890), are among his most original achievements.

Stendhal, oil painting by Pierre-Joseph Dedreux-Dorcy; in the Bibliothèque Municipale de Grenoble, France.
COURTESY OF THE BIBLIOTHEQUE MUNICIPALE DE GRENOBLE, FR.; PHOTOGRAPH, STUDIO PICCARDY

Stengel, Casey *orig.* **Charles Dillon Stengel** (b. July 30, 1891, Kansas City, Mo., U.S.—d. Sept. 29, 1975, Glendale, Calif.) U.S. baseball player and manager. Stengel played outfield with the Brooklyn Dodgers (1912–17), Pittsburgh Pirates (1918–19), Philadelphia Phillies (1920–21), New York Giants (1921–23), and Boston Braves (1924–25). He became a coach and manager of the Dodgers and Braves but achieved his greatest success with the New York Yankees (1949–61), leading the team to 10 pennants (5 in consecutive years) and 7 World Series championships (5 in consecutive years) in 12 years. He later served as vice president and manager of the newly formed New York Mets (1962–65), a team that became noted for its dismal performance during these early years. Throughout his career Stengel was known for his showmanship and his idiosyncratic use and misuse of English, called "Stengelese" (for example, "I've always heard it couldn't be done, but sometimes it don't always work").

Stenmark, Ingemar (b. March 18, 1956, Josesjö, Lapland, Swed.) Swedish Alpine skier. Stenmark trained with Sweden's junior national team from age 13 and won his first World Cup race in 1974. In 1976, 1977, and 1978 he was the overall victor in the World Cup (SLALOM, giant slalom, and downhill). In the 1980 Olympic Games he won gold medals in slalom and giant slalom. He turned professional later that year, and he retired in 1989. His lifetime total of 86 World Cup victories still stands as a record, and he is perhaps the greatest slalom and giant slalom skier of all time.

Steno \'stā-nō**, Nicolaus** *Danish* **Niels Steensen** *or* **Niels Stensen** (b. Jan. 10, 1638, Copenhagen, Den.—d. Nov. 26, 1686, Schwerin, Prussia) Danish geologist and anatomist. An eminent physician, in 1660 he discovered the parotid salivary duct (Stensen's duct). In his geologic observations, he was the first to realize that the Earth's crust contains a chronological history of geologic events that might be deciphered by careful study of rock strata and FOSSILS, which he identified as the remains of ancient living organisms. In 1669 he made the fundamental crystallographic discovery that all quartz crystals have the same angles between corresponding faces. He later abandoned science for religion and became a priest in 1675.

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stenography See SHORTHAND

stenotypy \'ste-nə-ˌtī-pē\ System of machine SHORTHAND in which letters or groups of letters phonetically represent SYLLABLES, words, phrases, and PUNCTUATION marks. The machine, usually the commercial Stenotype or Stenograph, is often used in court reporting. Virtually noiseless, it can be operated at more than 250 words per minute. Several keys may be struck simultaneously to print a complete word with one stroke.

Stephen *or* **Stephen of Blois** \'blwä\ (b. c. 1097—d. Oct. 25, 1154) King of England (1135–54). The nephew of HENRY I, he pledged to support MATILDA but claimed the throne himself. In the civil strife that followed, he was unable to win the loyalty of all the barons. Matilda invaded (1139), and, in a display of chivalry, Stephen had her escorted to Bristol. She gained control of most of western England and captured Stephen in battle (1141), but her arrogance provoked a rebellion, and she was forced to leave England (1148). An agreement was reached whereby Matilda's son Henry of Anjou (later HENRY II), who invaded England in 1153, was named as Stephen's successor.

Stephen *known as* **Stephen the Great** (b. 1435—d. July 2, 1504) Prince of MOLDAVIA (1457–1504). With the help of the Walachian prince Vlad III Ţepeş, Stephen secured the throne of Moldavia. He repelled a Hungarian invasion (1467) and later attacked Walachia (1471), by then under Turkish vassalage. He defeated invading Turks (1475, 1476) and contended with Polish and Hungarian designs on Moldavia. In 1503 Stephen signed a treaty preserving Moldavian independence at the cost of an annual tribute to the Turks.

Stephen, Sir James Fitzjames, 1st Baronet (b. March 3, 1829, London, Eng.—d. March 11, 1894, Ipswich, Suffolk) British legal historian and judge. His *General View of the Criminal Law of England* (1863) was the first attempt to explain the principles of English law since the work of WILLIAM BLACKSTONE. As a member of the British viceroy's council in India (1869–72), he helped codify and reform INDIAN LAW. He later taught at the INNS OF COURT (1875–79) and served as a judge of the High Court of Justice (1879–91). His Indictable Offenses Bill, though never enacted, greatly influenced the reformation of criminal law in English-speaking countries.

Stephen, Sir Leslie (b. Nov. 28, 1832, London, Eng.—d. Feb. 22, 1904, London) English critic and man of letters. After attending Eton College and Cambridge University, he gained entry to literary circles and in 1871 began an 11-year tenure as editor of *The Cornhill Magazine*, for which he wrote literary criticism. His greatest learned work was his *History of English Thought in the Eighteenth Century* (1876), but his most enduring legacy is the *Dictionary of National Biography*, which he edited from 1882 to 1891, personally writing many hundreds of its meticulous articles. He was the father of VIRGINIA WOOLF and the painter Vanessa Bell (1879–1961).

Stephen, Saint (d. c. AD 36, Jerusalem) First Christian martyr. As told in the Acts of the Apostles, he was a foreign-born Jew who lived in Jerusalem and joined the church at an early date. He was one of seven deacons appointed by the Apostles to care for elderly women, widows, and orphans. As a Hellenized Jew, he was strongly opposed to the Temple cult of Judaism. For expressing his opposition, he was brought before the SANHEDRIN. His defense of Christianity so outraged his hearers that he was condemned to be stoned to death. One of those who assented to the execution was Saul of Tarsus (St. PAUL).

Stephen I *or* **Saint Stephen** *orig.* **Vajk** (b. 970/975, Esztergom, Hung.—d. Aug. 15, 1038, Esztergom; canonized 1083; feast day August 16) First king of Hungary (1000–38) and founder of the Hungarian state. The son of a MAGYAR chieftain, he was born a pagan but was later baptized as a Christian. After defeating his cousin to claim the throne, Stephen was crowned; his royal crown was a gift of Pope SYLVESTER II. His rule was peaceful except for an invasion by CONRAD II (1030) and minor disputes with Poland and Bulgaria, and he organized Hungarian government and church administration on German models. He is the patron saint of Hungary.

Stephen II (b. Rome—d. April 26, 757, Rome) Pope (752–757). He freed the papacy from Byzantium and allied it with the Franks against the Lombards, who were threatening Rome. In Gaul he anointed PIPPIN III, CHARLEMAGNE, and Carloman as kings of the Romans, and in return Pippin led his army against the Lombardic king Aistulf (754, 756). The victorious Franks granted the pope territory in Ravenna, Rome, Venetia, and Istria, thus establishing the PAPAL STATES under Stephen's rule. (See DONATION OF PIPPIN)

Stephen Báthory \'bä-tȯr-ē\ *Hungarian* **István Báthory** *Polish* **Stefan Batory** (b. Sept. 27, 1533, Szilágysomlyó, Transylvania —d. Dec. 12, 1586, near Grodno, grand duchy of Lith.) Prince of Transylvania (1571–76) and king of Poland (1575–86). In 1571 he was elected prince of Transylvania by the Hungarians, and in 1575, as son-in-law of the late SIGISMUND I, he was elected king of Poland by the Polish nobility. A forceful and ambitious monarch, he successfully defended Poland's eastern Baltic provinces against Russian incursion and forced the cession of Livonia to Poland in 1582. He planned to unite Poland, Muscovy, and Transylvania and was preparing to renew the war against Russia when he died.

Stephen Decansky See STEFAN DECANSKY

Stephen Dusan See STEFAN DUSAN

Stephen Nemanja See STEFAN NEMANJA

Stephens, Alexander H(amilton) (b. Feb. 11, 1812, Wilkes county, Ga., U.S.—d. March 4, 1883, Atlanta, Ga.) U.S. politician. He served in the U.S. House of Representatives (1843–59), where he defended slavery but opposed dissolution of the Union. When Georgia seceded, he was elected vice president of the Confederacy. He supported constitutional government, opposed attempts by JEFFERSON DAVIS to infringe on individuals' rights, and advocated a program of prisoner exchanges. He led the delegation to the HAMPTON ROADS CONFERENCE (1865). After the war he was held in Boston for five months. He served again in the House (1873–82) and as governor of Georgia (1882–83).

Stephens, John Lloyd (b. Nov. 28, 1805, Shrewsbury, N.J., U.S.—d. Oct. 12, 1852, New York, N.Y.) U.S. traveler and archaeologist. Stephens's travels in the Middle East resulted in two books. With his illustrator friend Frederick Catherwood he embarked for Honduras in 1839 to explore ancient MAYA ruins rumoured to exist. At COPÁN, UXMAL, PALENQUE, and elsewhere, they identified major new sites. They described their findings in *Incidents of Travel in Central America, Chiapas, and Yucatan* (1841) and recounted a second trip in *Incidents of Travel in Yucatan* (1843). Their books created a storm of popular and scholarly interest in the region.

Stephens, Uriah Smith (b. Aug. 3, 1821, Cape May, N.J., U.S.—d. Feb. 13, 1882, Philadelphia, Pa.) U.S. labour leader. Apprenticed as a tailor, he became involved in reform movements such as abolitionism and UTOPIAN SOCIALISM, and in 1862 he helped organize the Garment Cutters' Association of Philadelphia. In 1869 he cofounded the Noble Order of the KNIGHTS OF LABOR, the first national LABOUR UNION in the U.S., and became its first leader (or grand master workman). The high calling of the union and the hostility of union-busters led Stephens to favour secrecy and ritual in its meetings, which became increasingly controversial, as did Stephens's opposition to STRIKES. In 1878 he resigned his post.

Stephenson, George (b. June 9, 1781, Wylam, Northumberland, Eng.—d. Aug. 12, 1848, Chesterfield, Derbyshire) English engineer, principal inventor of the LOCOMOTIVE. Son of a coal-mine mechanic, he himself became chief mechanic at a coal mine, where his interest in steam engines led to experiments on a machine to pull coal-filled cars out of the mines. In 1815 he devised a powerful "steam blast" system that made the locomotive practical. In 1825 he built a steam locomotive for the first passenger railway, from Stockton to Darlington, which could carry 450 people at 15 mph (24 km/hr). In 1829, assisted by his son ROBERT STEPHENSON, he built his improved locomotive, the *Rocket*, which won a speed competition at 36 mph (58 km/hr) and became the model for later locomotives. His company built all eight locomotives for the new Liverpool-Manchester railway (1830).

George Stephenson, detail of a mezzotint by Charles Turner after Henry Perronet Briggs, 1838.
COURTESY OF THE SCIENCE MUSEUM, LONDON

Stephenson, Robert (b. Oct. 16, 1803, Willington Quay, Northumberland, Eng.—d. Oct. 12, 1859, London) British civil engineer and

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builder of long-span railroad bridges. The son of George Stephenson, he assisted his father in constructing the *Rocket* and several railways. Building a railway from Newcastle to Berwick, he spanned the River Tyne with a six-arch iron bridge. Called on to build a secure railroad bridge over the Menai Strait to the Welsh mainland, Stephenson conceived a unique tubular design, the success of which led to his building other tubular bridges in England and elsewhere.

Steptoe, Patrick (Christopher); and Edwards, Robert (Geoffrey) (respectively b. June 9, 1913, Witney, Oxfordshire, Eng.—d. March 21, 1988, Canterbury, Kent; b. Sept. 27, 1925, Yorkshire) British medical researchers. They perfected human in vitro fertilization, leading to the birth of the first "test-tube baby" in 1978. Steptoe had conducted research on sterilization and infertility and published *Laparoscopy in Gynaecology* (1967). Edwards succeeded in 1968 in fertilizing human ova outside the uterus. Their partnership, begun in 1968, resulted in the birth of more than 1,000 babies.

stereochemistry Term originated c. 1878 by Viktor Meyer (1848–97) for the study of stereoisomers (see isomer). Louis Pasteur had shown in 1848 that tartaric acid has optical activity and that this depends on molecular asymmetry, and Jacobus H. van't Hoff and Joseph-Achille Le Bel (1847–1930) had independently explained in 1874 how a molecule with a carbon atom bonded to four different groups has two mirror-image forms. Stereochemistry deals with stereoisomers and with asymmetric synthesis. John Cornforth (b. 1917) and Vladimir Prelog (1906–98) shared a 1975 Nobel Prize for work on stereochemistry and stereoisomerism of alkaloids, enzymes, antibiotics, and other natural compounds.

sterilization Any surgical procedure intended to end fertility permanently (see contraception). Such operations remove or interrupt the anatomical pathways through which the cells involved in fertilization travel (see reproductive system). They are relatively simple and more than 99% effective. The operations used in humans are vasectomy in men and tubal ligation (tying off and blocking or cutting of the fallopian tubes) in women. Though these operations are considered permanent, the development of microsurgery has improved the chances of reversal. Animals are sterilized by castration in males and spaying (removal of the ovaries) in females.

Sterkfontein \'sterk-fən-ˌtān\ One of three neighbouring South African sites (the others being Kromdraai and Swartkrans) at which the remains of fossil hominids have been found. The fossils found include those of *Australopithecus africanus*, *A. robustus* (see Australopithecus), and *Homo erectus*. In 1996 researchers uncovered the most complete australopithecine fossil skeleton since Lucy, that of an *A. africanus* individual with a humanlike pelvis but with limb proportions similar to those of a modern chimpanzee. At Makapansgat, 150 mi (240 km) to the north, the remains of about 40 individuals of *A. africanus* have been found.

Sterling, Bruce (b. April 14, 1954, Brownsville, Texas, U.S.) U.S. science-fiction writer. He graduated from the University of Texas in 1976, the year his first story, "Man-Made Self," was published. A principal proponent of cyberpunk, science fiction dealing with harsh future urban societies dominated by computer technology, he edited *Mirrorshades: The Cyberpunk Anthology* (1986) and published novels such as *Schismatrix* (1985), *Islands in the Net* (1988), *The Difference Engine* (1990; with William Gibson), and *Distraction* (1999).

Stern \'shtern\ German weekly newsmagazine. Founded in 1948, it quickly became known for its outstanding photography and its blend of light and serious material. The magazine's lively treatment of many topics helped it achieve wide popularity in the 20th century. With a weekly circulation of roughly one million, *Stern* features pictorial essays, celebrity profiles, interviews, and other material and combines provocative photographs of violence and sexual imagery with conventional pictures of current events. In the early 21st century, *Stern* took an influential stand against neo-Nazi activities by launching a campaign to prevent right-wing violence.

Stern, Isaac (b. July 21, 1920, Kremenets, Ukraine, Russian Empire—d. Sept. 22, 2001, New York, N.Y., U.S.) Ukrainian-born U.S. violinist. His family came to the U.S. when he was an infant. He first performed with the San Francisco Symphony in 1936, and he made his New York City debut at age 17. After World War II, he began to tour extensively (including the Soviet Union in 1956). In 1960 he formed a famous trio with pianist Eugene Istomin (b. 1925) and cellist Leonard Rose (1918–84). He was instrumental in saving Carnegie Hall from demolition, helped establish the National Endowment for the Arts, and was a key presence in the musical life of Israel.

Sternberg, Josef von *orig.* **Jonas Stern** (b. May 29, 1894, Vienna, Austria—d. Dec. 22, 1969, Hollywood, Calif., U.S.) Austrian-born U.S. film director. He immigrated with his Orthodox Jewish family to New York as a boy. By 1923 he was a scriptwriter and cameraman in Hollywood. In 1927 he made the first serious gangster movie, *Underworld*. His films became noted for their striking visual effects and atmospheric use of light and dark. In Germany he directed *The Blue Angel* (1930), which made actress Marlene Dietrich an international star. She returned with Sternberg to Hollywood, where he directed her in *Morocco* (1930), *Shanghai Express* (1932), *Blonde Venus* (1932), *The Scarlet Empress* (1934), and *The Devil Is a Woman* (1935). His career thereafter declined, though his late films *Macao* (1952) and *The Saga of Anatahan* (1953) were admired.

Josef von Sternberg editing a film.
CULVER PICTURES

Sterne, Laurence (b. Nov. 24, 1713, Clonmel, County Tipperary, Ire.—d. March 18, 1768, London, Eng.) English novelist and humorist. Sterne was a clergyman in York for many years before his talents became apparent when he wrote a Swiftian satire in support of his dean in a church squabble. Turning his parishes over to a curate, he began to write *Tristram Shandy* (1759–67), an experimental novel issued in nine parts in which the story is subordinate to its narrator's free associations and digressions. It is considered one of the most important ancestors of psychological and stream of consciousness fiction. Long afflicted with tuberculosis, Sterne fled the damp air of England and undertook the travels that inspired his unfinished *Sentimental Journey Through France and Italy* (1768), a comic novel that defies conventional expectations of a travel book.

Laurence Sterne, detail of an oil painting by Sir Joshua Reynolds, 1760; in the National Portrait Gallery, London.
NATIONAL PORTRAIT GALLERY, LONDON

steroid Any of a class of natural or synthetic organic compounds with a molecular core, or nucleus, of 17 carbon atoms in a characteristic three-dimensional arrangement of four rings. The configuration of the nucleus, the nature of the groups attached to it, and their positions distinguish different steroids. Hundreds have been found in plants and animals and thousands more synthesized or made by modifying natural steroids. Steroids are important in biology, chemistry, and medicine. Examples include many hormones (including the sex hormones), bile acids, sterols (including cholesterol), and oral contraceptives (see contraception). Digitalis was the first steroid widely used in Western medicine. Corticosteroids (see cortisone) and their synthetic analogs are used to treat rheumatism and other inflammatory ailments. See also anabolic steroid.

Stettin See Szczecin

Stettinius \ste-'ti-nē-əs**, Edward Reilly, Jr.** (b. Oct. 22, 1900, Chicago, Ill., U.S.—d. Oct. 31, 1949, Greenwich, Conn.) U.S. industrialist and statesman. He worked for General Motors Corp., becoming a vice president in 1931. Joining U.S. Steel Corp. in 1934, he became chairman of the board in 1938. He was appointed chairman of the War Resources Board (1939–40) and administrator of lend-lease (1941–43). As U.S. secretary of state (1944–45), he advised Pres. Franklin D. Roosevelt at the Yalta Conference. He led the U.S. delegation to the UN organizing conference in San Francisco and was the first U.S. delegate to the UN (1945–46).

Steuben \'stü-bən**, Frederick William (Augustus), Baron, von** (b. Sept. 17, 1730, Magdeburg, Prussia—d. Nov. 28, 1794, near

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Remsen, N.Y., U.S.) German-born American Revolutionary officer. He joined the Prussian army at 16 and was a captain in the Seven Years' War. After the war he retired from the army and became court chamberlain for the prince of Hohenzollern-Hechingen; at some unknown date he apparently was created a baron. Recommended to GEORGE WASHINGTON, he arrived in America in 1777. Appointed to train the Continental forces at Valley Forge, Pa., he produced a disciplined fighting force that became the model for the entire Continental Army. He was appointed inspector general of the army and was promoted to major general (1778), and he helped command the Siege of YORKTOWN.

Stevens, George (b. Dec. 18, 1904, Oakland, Calif., U.S.—d. March 8, 1975, Lancaster, Calif.) U.S. film director. Both of his parents were actors, and Stevens was the stage manager of his father's company until 1921, when he went to Hollywood to become a cameraman. He photographed many of Laurel and Hardy's (see LAUREL, STAN; AND HARDY, OLIVER) comedies before turning to directing in 1933. Noted for his brilliant camera techniques, careful craftsmanship, and a romanticized view of life, he achieved fame with *Alice Adams* (1935) and *Swing Time* (1936). His later films include *Woman of the Year* (1942), *I Remember Mama* (1948), *A Place in the Sun* (1951, Academy Award), the classic western *Shane* (1953), and *Giant* (1956, Academy Award).

Stevens, John (b. 1749, New York, N.Y.—d. March 6, 1838, Hoboken, N.J., U.S.) U.S. lawyer, engineer, and inventor. He served as a colonel in the American Revolution. To protect his boiler and engine designs, he submitted his outline for a PATENT law; the resulting Patent Law of 1790 formed the basis of the U.S. patent system. In 1802 he became the first person to employ a powered screw to propel a ship. In 1809 his steamship *Phoenix* became the world's first seagoing steamboat. In Philadelphia in 1811 he inaugurated the world's first steam-ferry service. In 1825 he built the first American steam LOCOMOTIVE. He developed his New Jersey estate into the city of Hoboken. He was the father of ROBERT L. STEVENS. Another son, Edwin Augustus Stevens (1795–1868), was the inventor of the Stevens plow and a pioneer builder of ironclad warships and established the Stevens Institute of Technology by a bequest. A third son, John Cox Stevens (1785–1857), headed the group that sent the yacht *America* to Britain, where it won the race that established the AMERICA'S CUP.

Stevens, John Paul (b. April 20, 1920, Chicago, Ill., U.S.) U.S. jurist. He studied law at Northwestern University and clerked at the SUPREME COURT OF THE UNITED STATES before joining a Chicago law firm, where he specialized in antitrust law while also teaching and serving on various public commissions. He was appointed to the U.S. Circuit Court of Appeals (1970) by Pres. RICHARD NIXON and to the Supreme Court by Pres. GERALD FORD (1975). Though initially perceived as a conservative, he proved to be a moderate liberal; indeed, as the court became more conservative in the 1980s and early '90s, after appointments by Pres. RONALD REAGAN and Pres. GEORGE BUSH, Stevens became perhaps the court's most liberal member.

Stevens, Robert Livingston (b. Oct. 18, 1787, Hoboken, N.J., U.S.—d. April 20, 1856, Hoboken) U.S. engineer and ship designer. The son of JOHN STEVENS, he tested the first steamboat to use screw propellers. He designed the railway T-rail in 1830, and later the railroad spike. He found that rails laid on wooden ties, with crushed stone or gravel beneath, provided a roadbed superior to any known before; his construction remains in universal use.

Stevens, Thaddeus (b. April 4, 1792, Danville, Vt., U.S.—d. Aug. 11, 1868, Washington, D.C.) U.S. politician. He practiced law in Pennsylvania, defending fugitive slaves without fee. In the U.S. House of Representatives (1849–53, 1859–68), he opposed the extension of slavery into the western territories. After the American Civil War, as a leader of the RADICAL REPUBLICANS, he demanded strict conditions for readmission of the seceded states. He helped establish the FREEDMEN'S BUREAU and secured passage of the 14th Amendment to the Constitution. He opposed the moderate RECONSTRUCTION policies of Pres. ANDREW JOHNSON and introduced the resolution for his impeachment.

Stevens, Wallace (b. Oct. 2, 1879, Reading, Pa., U.S.—d. Aug. 2, 1955, Hartford, Conn.) U.S. poet. Stevens practiced law in New York City before joining an insurance firm in Hartford in 1916; he rose to vice president, a position he held until his death. His poems began appearing in literary magazines in 1914. In *Harmonium* (1923), his first and most verbally brilliant book, he introduced the theme that occupied his creative lifetime and unified his thought: the relationship between imagination and reality. His later poetry, in collections such as *Ideas of Order* (1936), *The Man with the Blue Guitar* (1937), and *The Auroras of Autumn* (1950), continued to explore this theme with greater depth and rigour. Not until his late years was he widely read or recognized as a major poet by more than a few; he received a Pulitzer Prize only with his *Collected Poems* in 1955. He is now often considered one of America's greatest 20th-century poets.

Wallace Stevens, 1952.
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Stevenson, Adlai E(wing) (b. Feb. 5, 1900, Los Angeles, Calif., U.S.—d. July 14, 1965, London, Eng.) U.S. politician and diplomat. The grandson of a vice president of the U.S., he practiced law in Chicago from 1926. During World War II he was assistant to the secretary of the navy (1941–44) and to the secretary of state (1945). He served as a U.S. delegate to the UN (1946–47). As governor of Illinois (1949–53), he introduced liberal reforms. Noted for his eloquence and wit, he was twice the Democratic candidate for president (1952, 1956) but lost both times to DWIGHT D. EISENHOWER. He later served as chief U.S. representative to the UN (1961–65).

Stevenson, Robert Louis (Balfour) (b. Nov. 13, 1850, Edinburgh, Scot.—d. Dec. 3, 1894, Vailima, Samoa) Scottish essayist, novelist, and poet. He prepared for a law career but never practiced. He traveled frequently, partly in search of better climates for his tuberculosis, which would eventually cause his death at age 44. He became known for accounts such as *Travels with a Donkey in the Cévennes* (1879) and essays in periodicals, first collected in *Virginibus Puerisque* (1881). His immensely popular novels *Treasure Island* (1883), *Kidnapped* (1886), and *Dr. Jekyll and Mr. Hyde* (1886), and *The Master of Ballantrae* (1889) were written over the course of a few years. *A Child's Garden of Verses* (1885) is one of the most influential children's works of the 19th century. In his last years he lived in Samoa and produced works moving toward a new maturity, including the story "The Beach of Falesá" (1892) and the novel *Weir of Hermiston* (1896), his unfinished masterpiece.

Stevin \'stā-vin**, Simon** (b. 1548, Bruges, Flanders—d. 1620, The Hague, Holland) Flemish mathematician. In 1585 Stevin published a small pamphlet, *La Thiende* ("The Tenth"), in which he presented an account of decimal fractions and their daily use. Though he did not invent decimal fractions and his notation was clumsy, he established the use of decimals in day-to-day mathematics.

Stewart See House of STUART

Stewart, Ellen (b. c. 1920, Alexandria, La., U.S.) U.S. theatre director. In the 1950s she moved to New York City to become a fashion designer. In 1961 she founded Café La Mama, an experimental theatre specializing in total integration of music, dance, and drama. There she gave a start to many young actors and playwrights, including Bette Midler and SAM SHEPARD. Stewart became known as the mother of Off-Off-Broadway theatre. A European tour in 1965 made La Mama a mecca for European avant-garde directors. Its frequently distinguished productions have made La Mama a venerated institution and have won more than 50 Obie Awards.

Stewart, Henry See Lord DARNLEY

Stewart, J(ohn) I(nnes) M(ackintosh) (b. Sept. 30, 1906, Edinburgh, Scot.—d. Nov. 12, 1994, Coulsdon, Surrey, Eng.) Scottish-born English novelist, literary critic, and educator. Stewart began writing while working as a college professor. In his mystery novels, he created the character of Inspector John Appleby, a British detective known for his suave humour and literary finesse. Among the best of these mysteries, all published under the pseudonym of Michael Innes, are *Lament for a Maker* (1938), *The Journeying Boy* (1949), and *An Awkward Lie* (1971). Stewart wrote other works of fiction under his own name, as well as several works of literary criticism. His autobiography, *Myself and Michael Innes*, was published in 1987.

Stewart, James (Maitland) (b. May 20, 1908, Indiana, Pa., U.S.—d. July 2, 1997, Beverly Hills, Calif.) U.S. film actor. He made his

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film debut in 1935, but at first, Stewart's slow, halting line delivery (perhaps his most readily identifiable trademark) and angular features made him difficult to cast. His engaging manner, however, led to quick acceptance by the movie-going public, and he played endearingly simple and idealistic characters in Frank Capra's *You Can't Take It with You* (1938) and *Mr. Smith Goes to Washington* (1939). He won an Academy Award for best actor for his performance in *The Philadelphia Story* (1940). After serving as a bomber pilot in World War II, he starred in *It's a Wonderful Life* (1946), which became a Christmas classic. He was known for his portrayals of diffident but morally resolute characters. His many movies include *Destry Rides Again* (1939), *The Glenn Miller Story* (1954), *The Man from Laramie* (1955), *Anatomy of a Murder* (1959), and Alfred Hitchcock's *Rope* (1948), *Rear Window* (1954), *The Man Who Knew Too Much* (1955), and *Vertigo* (1958).

James Stewart in *It's a Wonderful Life* (1946).
CULVER PICTURES

Stewart, Potter (b. Jan. 23, 1915, Jackson, Mich., U.S.—d. Dec. 7, 1985, Hanover, N.H.) U.S. jurist. He studied law at Yale University and was admitted to the bar in New York and Ohio in 1941. After settling in Cincinnati, Ohio, he served on the city council and as vice mayor before his appointment to the U.S. Court of Appeals in 1954. In 1958 Pres. Dwight D. Eisenhower appointed him to the Supreme Court of the United States, where he served until 1981. A moderate, he wrote the majority opinion in the *Shelton* v. *Tucker* case, which held unconstitutional the requirement that teachers list all the associations to which they belong, and also wrote a memorable dissent in *Miranda* v. *Arizona*, in which he argued that the court's decision provided too much protection to defendants and undermined the ability of the police to enforce the law. He is perhaps best remembered for summarizing the difficulty in defining obscenity, writing in a concurring opinion that "I know it when I see it."

Stibitz, George Robert (b. April 20, 1904, York, Pa., U.S.—d. Jan. 31, 1995, Hanover, N.H.) U.S. mathematician and inventor. He received a Ph.D. from Cornell University. In 1940 he and Samuel Williams, a colleague at Bell Labs, built the Complex Number Calculator, considered a forerunner of the digital computer. He accomplished the first remote computer operation by inputting problems via Teletype, and he pioneered computer applications in biomedical areas, such as the movement of oxygen in the lungs, brain cell structure, diffusion of nutrients and drugs in the body, and capillary transport. The holder of 38 patents, he was inducted into the Inventors Hall of Fame in 1983.

stibnite Antimony sulfide (Sb_2S_3), the principal ore of antimony. This sulfide mineral has a brilliant metallic lustre, is lead or steel gray in colour, and fuses (melts) readily. Stibnite occurs in low-temperature hydrothermal veins (see hydrothermal ore deposits) and in replacement deposits. Significant deposits have been found in China, Japan, and the U.S. (Idaho, California, and Nevada). Stibnite is used in making matches, fireworks, and percussion caps and was used by the ancients as a cosmetic (called kohl) to increase the apparent size of the eye.

Stick style Style of residential design popular in the U.S. in the 1860s and '70s, a precursor to the Shingle style. The Stick style favoured an imitation half-timbered effect, with boards attached to the exterior walls in grids suggestive of the underlying frame construction. Other characteristic features included attached open stickwork verandas, projecting square bays, steeply pitched roofs, and overhanging eaves. Angular and vertical elements were emphasized. Though associated with Carpenter Gothic, the Stick style made less use of gingerbread. The style also marked the beginning of greater openness of the floor plan. Charles S. and Henry M. Greene succeeded admirably in reinterpreting the style in the early 20th century.

stickleback Any of about 12 species (family Gasterosteidae) of slender, scaleless fishes inhabiting temperate fresh and salt waters of the Northern Hemisphere. Sticklebacks grow to 6 in. (15 cm) long. They have a row of spines on the back, in front of a soft-rayed dorsal fin, and a sharp spine in each of the pelvic fins. They also have a slender tail base, a squared tail, and hard armour plates on their sides. The male builds a nest of plant materials and coaxes one or more females into it to lay eggs, fertilizes the eggs in the nest, and aggressively defends eggs and young.

Stickley, Gustav (b. March 9, 1858, Osceola, Wis., U.S.—d. April 21, 1942, Syracuse, N.Y.) U.S. furniture designer and maker. He learned to make furniture at a chair factory owned by an uncle. After taking over the factory, he moved it to New York state, first to Binghamton and then to Syracuse. Influenced by the Arts and Crafts Movement and by visits to old missions in the American Southwest, he introduced c. 1900 a highly original line of sturdy oak furniture. To spread his ideas and designs, he published the influential magazine *The Craftsman* (1901–16). In 1916 two younger brothers established a firm to produce furniture from his designs and gave the style the name Mission, by which name it is still popular today.

Stiegel \'stē-gəl,\ *German* \'shtē-gəl**, Henry William** *orig.* **Heinrich Wilhelm Stiegel** (b. May 13, 1729, near Cologne—d. Jan. 10, 1785, Charming Forge, Pa., U.S.) German-born U.S. ironmaster and glassmaker. After arriving in Philadelphia in 1750, he quickly became a prosperous ironmaster. In 1762 he bought a huge tract of land in Lancaster County and built the town of Manheim, where he established American Flint Glassworks; there he imported Venetian, German, and English glassworkers to make utilitarian vessels and high-quality blue, purple, green, and clear tableware. He owned three mansions, where his comings and goings were announced by a cannon salute and band music, but his lavish style and adverse economic conditions eventually bankrupted him.

Stieglitz \'stēg-lits**, Alfred** (b. Jan. 1, 1864, Hoboken, N.J., U.S.—d. July 13, 1946, New York, N.Y.) U.S. photographer and exhibitor of modern art. He was taken to Europe by his wealthy family to further his education in 1881. In 1883 he abandoned engineering studies in Berlin for a photographic career. Returning to the U.S. in 1890, he made the first successful photographs in snow, in rain, and at night. In 1902 he founded the Photo-Secession group to establish photography as an art. His own best photographs are perhaps two series (1917–27), one of portraits of his wife, Georgia O'Keeffe, and the other of cloud shapes corresponding to emotional experiences. His photographs were the first to be exhibited in major U.S. museums. He also was the first to exhibit, at his "291" gallery in New York City, works of modern European and U.S. painters, five years before the Armory Show.

Alfred Stieglitz at his gallery "291" in 1934; behind him is a painting by his wife, Georgia O'Keeffe.
IMOGEN CUNNINGHAM

Stiernhielm \'shern-,yelm**, Georg** *orig.* **Jöran Olofsson** *or* **Georgius Olai** *or* **Göran Lilia** (b. Aug. 7, 1598, Vika, Swed.—d. April 22, 1672, Stockholm) Swedish poet and scholar, often called "the father of Swedish poetry." Beginning about 1640 he was poet in attendance at the court of Queen Christina. His most important work is the allegorical, didactic epic *Hercules* (1658), a sermon on virtue and honour and a fine example of late-Renaissance Classicism; it greatly influenced the development of Swedish poetry. His poems were collected in *Swedish Muses* (1668).

Stigand \'sti-gənd\ (d. Feb. 22, 1072) Archbishop of Canterbury (1052–70). He mediated the peace between Edward the Confessor and Earl Godwine (1052) and was made archbishop of Canterbury when the Norman archbishop fled. He was not accepted until 1058, and then only by the antipope Benedict X, after whose deposition Stigand was excommunicated by Pope Nicholas II. Stigand's continuance in office was one of the reasons for papal support of the Norman Conquest (see William I) in 1066.

Stigler, George J(oseph) (b. Jan. 17, 1911, Renton, Wash., U.S.—d. Dec. 1, 1991, Chicago, Ill.) U.S. economist. He received his Ph.D. from

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the University of Chicago. He taught at various institutions and in 1977 founded the Center for the Study of the Economy and the State at the University of Chicago. Stigler studied the economics of information, elaborating on the traditional understanding of how efficient markets operate. He also studied public regulation, concluding that it is usually detrimental to consumer interests. He won the Nobel Prize in Economic Sciences in 1982.

Stiglitz, Joseph E. (b. Feb. 9, 1943, Gary, Ind., U.S.) U.S. economist. He received a Ph.D. (1967) from the Massachusetts Institute of Technology and taught at several universities, including Yale, Harvard, Stanford, and Columbia. From 1997 to 2000 he was the World Bank's chief economist but often disagreed with the organization's policies. Stiglitz helped found modern development economics, and he changed how economists think about the way markets work. His studies on asymmetric information in the marketplace showed that the poorly informed can obtain information from the better informed through a screening process, for example, when insurance companies determine the risk factors of their clients. He shared the 2001 Nobel Prize in Economic Sciences with GEORGE A. AKERLOF and A. MICHAEL SPENCE.

stigmata \stig-'mä-tə\ In Christian MYSTICISM, bodily marks, scars, or pains suffered in places corresponding to those of the crucified JESUS—on the hands and feet, near the heart, and sometimes on the head (from the crown of thorns) or shoulders and back (from carrying the cross and being whipped). They are often presumed to accompany religious ecstasy and are taken as signs of holiness. The first to experience stigmata was St. FRANCIS OF ASSISI (1224). Of the more than 330 persons identified with stigmata since the 14th century, more than 60 were canonized or beatified by the ROMAN CATHOLIC church (see CANONIZATION).

Stijl \'stīl, 'stāl**, De** *Dutch* **The Style** Group of Dutch artists founded in 1917, including THEO VAN DOESBURG and PIET MONDRIAN. The group advocated a utopian style: "the universal harmony of life." Its ideal of purity and order in life and society as well as art reflects the Calvinist background of its members. Through its journal, *De Stijl* (1917–31), it influenced painting, the decorative arts (including furniture design), typography, and especially architecture, where its aesthetic found expression at the BAUHAUS and in the INTERNATIONAL STYLE.

"Card Players," oil painting by De Stijl artist Theo van Doesburg, 1917; in the collection of the Haags Gemeentemuseum, The Hague

COURTESY OF THE HAAGS GEMEENTEMUSEUM, THE HAGUE

Stikine \sti-'kēn\ **River** River, northwestern British Columbia, Canada, and southeastern Alaska, U.S. The river rises in the Stikine Ranges of British Columbia and flows in a wide arc west and southwest before emptying into the Pacific Ocean after a course of 335 mi (540 km). It served as a major access route during the KLONDIKE GOLD RUSH of 1896. Navigable for 168 mi (270 km), it is a chief route to the Cassiar Mountains mining region.

Still, Clyfford (b. Nov. 30, 1904, Grandin, N.D., U.S.—d. June 23, 1980, Baltimore, Md.) U.S. painter. He studied at Spokane University and Washington State College. After experimenting with several styles, he became involved in ABSTRACT EXPRESSIONISM and was a pioneer of very large, monochromatic painting. His work is often characterized within the "colour-field" subset of Abstract Expressionism. He used thickly applied, opaque paint (impasto) in expressively modulated, jagged forms to portray raw, aggressive power.

Still, William Grant (b. May 11, 1895, Woodville, Miss., U.S.—d. Dec. 3, 1978, Los Angeles, Calif.) U.S. composer. He initially intended to be a doctor but instead studied music at Oberlin College, learning clarinet, oboe, and violin. He studied composition with George Chadwick (1854–1931) and EDGARD VARÈSE. In the 1920s he worked as an arranger for the dance-band leader PAUL WHITEMAN and for the BLUES composer W.C. HANDY. Still's early style was avant-garde (*From the Black Belt*, 1926), but from c. 1930 he sought to develop a distinctive African American art music in five symphonies (including his *Afro-American Symphony*, 1931), ballets, operas, and choral and solo vocal works.

still-life painting Depiction of inanimate objects for the sake of their qualities of form, colour, texture, composition, and sometimes allegorical or symbolical significance. Still lifes were painted in ancient Greece and Rome. In the Middle Ages they occur in the borders of illuminated manuscripts. The modern still life emerged as an independent genre in the Renaissance. Netherlandish still lifes often depicted skulls, candles, and hourglasses as allegories of mortality, or flowers and fruits to symbolize nature's cycle. Several factors contributed to the rise of still life in the 16th–17th century: an interest in realistic representation, the rise of a wealthy middle class that wanted artworks to decorate its homes, and increased demand for paintings of secular subjects other than portraits in the wake of the Reformation. Dutch and Flemish painters were the masters of still life in the 17th century. From the 18th century until the rise of nonobjective painting after World War II, France was the centre of still-life painting.

Stillman, James (b. June 9, 1850, Brownsville, Texas, U.S.—d. March 15, 1918, New York, N.Y.) U.S. financier and banker. He began his career in a New York mercantile house. He became president of the National City Bank (see CITIGROUP) in 1891, shortly after the Rockefeller family obtained a controlling interest in the bank. Under his leadership the bank prospered during the panic of 1893, more than doubling its deposits and becoming the leading U.S. bank. In 1897 it was the only bank capable of financing the reorganization of the UNION PACIFIC Railroad. At his death he left a huge personal fortune.

stilt Any of certain species of shorebirds (family Recurvirostridae) that have long thin legs and a long slender bill and inhabit warm regions worldwide. Stilts, 14–18 in. (35–45 cm) long, live around ponds, probing in mud and weedy shallows for crustaceans and other small aquatic animals. The common stilt (*Himantopus himantopus*) is variably black-and-white with pink legs and red eyes.

Black-necked stilt (*Himantopus himantopus mexicanus*)

G.W. ROBINSON—ROOT RESOURCES

Stilwell, Joseph W(arren) (b. March 19, 1883, Palatka, Fla., U.S.—d. Oct. 12, 1946, San Francisco, Calif.) U.S. army officer. He graduated from West Point and served in World War I. He studied Chinese and served in Tianjin (1926–29) and as a military attaché in Beijing (1935–39). At the outbreak of World War II, he became chief of staff to Gen. CHIANG KAI-SHEK and commanded Chinese armies in Burma (1939–42). He became commander of U.S. forces in China, Burma, and India and oversaw construction of the Ledo, or STILWELL, ROAD, a strategic military link with the Burma Road. Promoted to general (1944), he commanded the U.S. 10th Army in the Pacific (1945–46).

Stilwell Road *formerly* **Ledo Road** Former military highway, Asia. It was 478 mi (769 km) long and linked northeastern India with the BURMA ROAD. In World War II, U.S. Army engineers and Chinese troops constructed it to link the railheads of Ledo, India, and Mogaung, Burma. Named for Gen. JOSEPH STILWELL, it crossed into Burma (Myanmar) through the difficult Pangsau Pass of the Patkai Range.

Stimson, Henry L(ewis) (b. Sept. 21, 1867, New York, N.Y., U.S.—d. Oct. 20, 1950, Huntington, N.Y.) U.S. statesman. A lawyer, he served as U.S. secretary of war (1911–13), governor of the Philippines (1927–29), and U.S. secretary of state (1929–33). After the Japanese occupation of Manchuria (1931), he sent to Japan a diplomatic note, the contents of which became known as the Stimson Doctrine, refusing to recognize territorial changes and reaffirming U.S. treaty rights. As secretary of war (1940–45), he oversaw the expansion and training of U.S. forces in World War II. He was the chief adviser on atomic policy to FRANKLIN D. ROOSEVELT and HARRY TRUMAN and recommended use of the atomic bomb on Hiroshima and Nagasaki.

stimulant Any DRUG that excites any bodily function; usually one that stimulates the central NERVOUS SYSTEM, inducing alertness, elevated mood, wakefulness, increased speech and motor activity, and decreased appetite. Their mood-elevating effects make some stimulants (e.g., AMPHETAMINES, CAFFEINE and its relatives, COCAINE, NICOTINE) potent drugs of abuse (see DRUG ADDICTION). RITALIN, prescribed for ATTENTION DEFICIT DISORDER in children, is a mild stimulant.

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stingray *or* **whip-tailed ray** Any of various species (family Dasyatidae) of RAYS noted for their slender, whiplike tail with barbed, usually venomous spines. Most species inhabit warm seas; a few live in the rivers of South America. Species range in width from 10 in. (25 cm) to 7 ft (2 m). Stingrays eat worms, mollusks, and other invertebrates. These bottom-dwellers often lie partially buried in the shallows, lashing their tail when disturbed. Large stingrays can drive their tail spines into a wooden boat. The spines cause serious, extremely painful wounds that, if abdominal, may be fatal.

Stirling Town and council area (pop., 2001: 86,212), south-central Scotland. Located on the River FORTH, Stirling has evidence of early settlement by the British PICTS. Made a royal burgh c. 1130 and a royal residence in 1226, it was the birthplace of JAMES II of Scotland and site of the coronations of MARY, QUEEN OF SCOTS, and James VI of Scotland (later JAMES I of England). Two battles were fought nearby: the Battle of Stirling Bridge (1297), where Scottish troops routed the English, and the Battle of BANNOCKBURN (1314). The town flourished until the mid-16th century and shared with EDINBURGH the privileges of a capital city. After the union of the Scottish and English crowns in 1603, it ceased to play an important national role. The town is now a commercial centre for an agricultural region. The council area is a centre for electronics manufacture, and there are also papermaking, malting, brewing, and distilling industries. Stirling is the council area's administrative centre and largest town.

Stirling, Sir James (Frazer) (b. April 22, 1926, Glasgow, Scot.—d. June 25, 1992, London, Eng.) Scottish architect. He began working (1956–63) in the New Brutalist style with his partner James Gowan (see BRUTALISM). His engineering building at Leicester University (1963), with its precise crystalline forms, brought him early fame. From 1971 he worked with Michael Wilford. In the 1970s Stirling developed his own brand of POSTMODERNISM that made use of complex geometric abstraction, bold colours, and Classical elements. The Neue Staatsgalerie (1977–84) in Stuttgart, Ger., is among his finest statements. In 1981 Stirling received the Pritzker Architecture Prize.

Stirling, William Alexander, 1st earl of (b. c. 1576, Menstrie, Clackmannan, Scot.—d. Feb. 12, 1640, London, Eng.) Scottish poet and colonizer of Canada. He was a member of the court of JAMES I, where he wrote his sonnet sequence *Aurora* (1604). In 1621 he obtained a grant for territory in North America that he named New Scotland (Nova Scotia), despite French claims to part of the land. He offered baronetcies to Scotsmen who would sponsor settlers, but the region was not colonized until his son established a settlement at Port Royal (Annapolis Royal). Alexander was compelled to surrender the territory under the Treaty of Susa (1629), which ended an Anglo-French conflict. Scottish settlers were ordered to withdraw by 1631.

stoa \'stō-ə\ In Greek architecture, a freestanding COLONNADE or covered walkway; also, a long open building with its roof supported by one or more rows of columns parallel to its rear wall. Stoas lined marketplaces and sanctuaries and formed places of business and public promenades. Rooms might back onto the colonnade, and a second story was sometimes added. The Stoa of Attalus in Athens (2nd century BC), a large, elaborate, two-story building with a row of shops at the rear, was a prime example.

stochastic process \stə-'kas-tik\ In PROBABILITY THEORY, a family of RANDOM VARIABLES indexed to some other set and having the property that for each finite subset of the index set, the collection of random variables indexed to it has a joint probability distribution. It is one of the most widely studied subjects in probability. Examples include Markov processes (in which the present value of the variable depends only upon the immediate past and not upon the whole sequence of past events), such as stock-market fluctuations, and time series (in which temperature or rainfall measurements, for example, are taken at the same time each day over several days).

stock In finance, the subscribed capital of a corporation or limited-liability company, usually divided into shares and represented by transferable certificates. Many companies have only one class of stock, called common stock. Common stock, as a share of ownership in the company, entitles the holder to an interest in the company's earnings and assets. It carries voting rights that enable the holder to participate in the running of the company (unless such rights are specifically withheld, as in special classes of nonvoting shares). DIVIDENDS paid on common stock are often unstable because they vary with earnings; they are also usually less than earnings, the difference being used by the management to expand the firm. To appeal to investors who want to be sure of receiving dividends regularly, some companies issue preferred stock, which has a prior claim to dividends paid by the company and, in most cases, to the company's assets in case of its dissolution. Preferred-stock dividends are usually set at a fixed annual rate that must be paid before dividends are distributed to common stockholders. See also SECURITY, STOCK EXCHANGE.

stock-car racing Form of automobile racing. Popular in the U.S., it features cars that conform externally to standard U.S. commercial models and are raced usually on oval, paved tracks. The National Association for Stock Car Auto Racing (NASCAR), founded in 1947 in Daytona Beach, Fla., gave the sport its first formal organization. The Daytona 500 is the sport's premier race.

stock exchange *or* **stock market** *or (in continental Europe)* **Bourse** Organized market for the sale and purchase of securities (see SECURITY) such as STOCKS and BONDS. Trading is done in various ways: it may occur on a continuous auction basis, it may involve brokers buying from and selling to dealers in certain types of stock, or it may be conducted through specialists in a particular stock. Some stock exchanges, such as the NEW YORK STOCK EXCHANGE (NYSE), sell seats (the right to trade) to a limited number of members who must meet eligibility requirements. Stocks must likewise meet and maintain certain requirements or risk being delisted. Stock exchanges differ from country to country in eligibility requirements and in the degree to which the government participates in their management. The LONDON STOCK EXCHANGE, for example, is an independent institution, free from government regulation. In Europe, members of the exchanges are often appointed by government officials and have semigovernmental status. In the U.S., stock exchanges are not directly run by the government but are regulated by law. Technological developments have greatly influenced the nature of trading. In a traditional full-service brokerage, a customer placed an order with a broker or member of a stock exchange, who in turn passed it on to a specialist on the floor of the exchange, who then concluded the transaction. By the 21st century, increased access to the Internet and the proliferation of electronic communications networks (ECNs) altered the investment world. Through e-trading, the customer enters an order directly on-line, and software automatically matches orders to achieve the best price available without the intervention of specialists or market makers. In effect, the ECN is a stock exchange for off-the-floor trading.

Stock Market Crash of 1929 Economic event in the U.S. that precipitated the GREAT DEPRESSION. The U.S. stock market expanded rapidly in the late 1920s and reached a peak in August 1929, when prices began to decline while speculation increased. On October 18 the stock market began to fall precipitously. On the first day of real panic, October 24, known as "Black Thursday," a record 12,894,650 shares were traded. Banks and investment companies bought large blocks of stock to stem the PANIC, but on October 29, "Black Tuesday," 16 million shares were traded and prices collapsed. The crash began a 10-year economic slump that affected all the Western industrialized countries.

stock option Contractual agreement entitling the holder to buy or sell a share of STOCK at a designated price for a specified period of time, regardless of changes in its market price during that period. The various kinds of stock options include put and call options, which may be purchased in anticipation of changes in stock prices, as a means of speculation or HEDGING. A put gives its holder an option to sell, or put, shares to another party at a fixed price even if the market price declines. A call gives the holder an option to buy, or call for, shares at a fixed price even if the market price rises. U.S. corporations often issue stock options to executives as a form of compensation in addition to salary, on the theory that an option is an incentive to improve the company's business and thus raise the value of its stock; at times such options have been far more valuable than the salary itself.

Stockhausen \'shtȯk-ˌhaù-zən**, Karlheinz** (b. Aug. 22, 1928, Mödrath, near Cologne, Ger.) German composer. Orphaned during World War II, he supported himself with odd jobs (including jazz pianist) before entering Cologne's State Academy for Music in 1947. After hearing OLIVIER MESSIAEN's music at Darmstadt in 1951, he began studying with the composer and experimenting with SERIALISM. His early works include *Kontrapunkte* and *Klavierstücke I–IV* (1952–53). He also became involved with *musique concrète*, a technique using recorded sounds as raw material; his remarkable *Song of the Youths* (1956) used a highly processed

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recording of a boy soprano mixed with electronic sounds. His extensions of serialism continued in pieces such as *Zeitmasse* (1956) and *Gruppen* (1957), and he became a leading avant-garde spokesman. His *Momente* (1964) influentially applied serialism to groups of sounds rather than single pitches, and he began incorporating aleatory (chance) elements as well. From the late 1960s he conceived ever grander schemes, some incorporating literature, dance, and ritual, as in the *Light* series (from 1977).

Stockholm City (pop., 2000 est.: city, 750,348; urban agglom.: 1,660,700), capital of Sweden. Built on numerous islands and peninsulas connected by old bridges and modern overpasses, Stockholm is regarded as one of the most beautiful capitals in the world. According to tradition, Swedish ruler Birger Jarl founded Stockholm c. 1250. In the Middle Ages it became Sweden's chief trade port, and in 1436 the capital. After years of conflict between the Swedes and Danes, Gustav I Vasa liberated the city from Danish rule in 1523. It developed rapidly in the mid-17th century as Sweden became a great power, and it was Sweden's cultural centre by the 18th century. It was extensively redeveloped in the 19th century. The second largest port in Sweden (Göteborg being the first), it is the country's leading cultural, commercial, financial, and educational centre.

stocking frame Knitting machine invented in 1589 that produced a stocking stitch. Knitted fabrics are constructed by the interlocking of a series of loops made from one or more yarns, with each row of loops caught into the previous row; the stocking frame allowed production of a complete row of loops at one time. The modern knitting industry, with its highly sophisticated machinery, has grown from this simple device.

Stockport City and metropolitan borough (pop., 2001: 284,544), northwestern England. First chartered in 1220, the original settlement was built in a gorge where the Rivers Tame and Goyt meet to form the River Mersey; the modern town has spread over higher ground. Cotton spinning was important in the 19th century; in the 20th century diversification brought electronics and heavy engineering industries. Part of the metropolitan area of Greater Manchester, the metropolitan borough includes, in addition to Stockport proper, the urban area of Cheadle, the towns of Bramhall, Romiley, and Marple, and areas of open countryside.

Stockton City (pop., 2000: 243,771), central California, U.S. Located on the San Joaquin River, Stockton is connected to San Francisco Bay by the San Joaquin's 78-mi (126-km) deepwater channel; it is one of the state's two inland ports. Stockton was founded in 1847 and grew rapidly as a miners' supply point during the 1849 gold rush. With the introduction of irrigation and the arrival of the railroad, it grew as a market for farm produce and wines. The completion of the channel in 1933 made it a major port as well as a supply depot for U.S. Pacific military operations.

Stockton, Robert F(ield) (b. Aug. 20, 1795, Princeton, N.J., U.S.—d. Oct. 7, 1866, Princeton) U.S. naval officer. He joined the U.S. navy and rose to the rank of commander (1838). When the Mexican War broke out, he took command of U.S. land and naval forces in present-day California and proceeded to capture Los Angeles, a Mexican stronghold, on Aug. 13, 1846. Four days later, he set up a civil government and formally annexed California to the U.S., naming himself governor. Along with Col. Stephen Kearny and his troops he defeated an uprising by native Mexicans and ceded the entire province to the U.S. In 1850 he resigned from the navy and was elected to the U.S. Senate. Stockton, Calif., is named in his honour.

stoichiometry \ˌstȯi-kē-'ä-mə-trē\ Determination of the proportions (by weight or number of molecules) in which elements or compounds react with one another. The rules for determining stoichiometric relationships are based on the laws of conservation (see conservation law) of mass and energy and the law of combining weights (see equivalent weight) or volumes. The tools used are chemical formulas, chemical equations, atomic weights, and molecular weights or formula weights.

Stoicism \'stō-ə-ˌsi-zəm\ School of philosophy in Greco-Roman antiquity. Inspired by the teaching of Socrates and Diogenes of Sinope, Stoicism was founded at Athens by Zeno of Citium c. 300 BC and was influential throughout the Greco-Roman world until at least AD 200. It stressed duty and held that, through reason, mankind can come to regard the universe as governed by fate and, despite appearances, as fundamentally rational, and that, in regulating one's life, one can emulate the grandeur of the calm and order of the universe by learning to accept events with a stern and tranquil mind and to achieve a lofty moral worth. Its teachings have been transmitted to later generations largely through the surviving books of Cicero and the Roman Stoics Seneca, Epictetus, and Marcus Aurelius.

Stoker, Bram *orig.* **Abraham Stoker** (b. Nov. 8, 1847, Dublin, Ire.—d. April 20, 1912, London, Eng.) Irish writer. Though bedridden until he was seven years old, Stoker later became an outstanding athlete. He was in the civil service for 10 years and the manager of actor Henry Irving for 27 years, writing letters for his employer and accompanying him on tours. During this period he began writing fiction; his masterpiece was the immensely successful gothic novel *Dracula* (1897). Derived from vampire legends, the tale became the basis for a whole genre of literature and film. None of his other works, including *The Lair of the White Worm* (1911), approached its popularity or quality.

Stokes, William (b. Oct. 1, 1804, Dublin, Ire.—d. Jan. 10, 1878, Howth, near Dublin) Irish physician. He received his M.D. from the University of Edinburgh and returned to Dublin, where he encouraged students to work, under faculty supervision, in hospital wards and to acquire a general as well as a medical education. He succeeded his father as Regius Professor of Physic at the University of Dublin. His publications included *A Treatise on the Diagnosis and Treatment of Diseases of the Chest* (1837), *The Diseases of the Heart and Aorta* (1854), and one of the first English works on the stethoscope.

Stokowski, Leopold (Anthony) *orig.* **Antoni Stanislaw Boleslawawicz Stokowski** (b. April 18, 1882, London, Eng.—d. Sept. 13, 1977, Nether Wallop, Hampshire) British-born U.S. conductor and organist. He studied at the Royal College of Music and the University of Oxford. After holding organist positions and conducting a handful of concerts, he became conductor of the Cincinnati Symphony (1909–12), with great success. From there he moved to the Philadelphia Orchestra, and in the years 1912–38 he made it a world-class ensemble, creating the lush "Philadelphia sound." He programmed much contemporary music, and he grasped very early the importance of recording. He made three films with the Philadelphia Orchestra, including Walt Disney's *Fantasia* (1940), and he used his fame to help foster fledgling music organizations, including the American Symphony Orchestra, which he formed in 1962. His strong advocacy of new music did much to broaden American musical taste.

Stoller, Mike See Jerry Leiber

stolon \'stō-lən\ *or* **runner** Slender stem that grows horizontally along the ground, giving rise to roots and aerial (vertical) branches at specialized points called nodes. Many annual and perennial grasses have creeping stolons (e.g., bent grass).

Stolypin \stȯ-'lē-pyin**, Pyotr (Arkadyevich)** (b. April 14, 1862, Dresden, Saxony—d. Sept. 18, 1911, Kiev, Ukraine, Russian Empire) Russian politician. Appointed governor of the provinces of Grodno (1902) and Saratov (1903), he improved the welfare of the peasants while also subduing their rebellions. He gained the favour of Tsar Nicholas II and was appointed minister of the interior and prime minister in 1906. He initiated agrarian reforms that gave the peasants greater freedom to choose representatives to the zemstvo councils and to acquire land, which he believed would create a loyal and conservative class of farmers. His repressive measures against rebels and terrorists earned him the enmity of liberals. He dissolved the Duma when it opposed his reforms, but he later won support from moderates. He was assassinated by a revolutionary in 1911.

stoma *or* **stomate** Any of the microscopic openings or pores in the epidermis of leaves and young stems. They are generally more numerous on the undersides of leaves. They provide for the exchange of gases between the outside air and the interconnecting air canals within the leaf. A stoma opens and closes in response to turgor pressure within its two surrounding guard cells. Because the inner wall of each of these sausage- or bean-shaped cells is thicker than the outer wall, when they fill with water and become turgid they balloon outward, enlarging the stoma. A drop in carbon-dioxide levels to lower than normal also causes the guard cells to become turgid. Guard cells control excessive water loss from the plant, closing on hot, dry, or windy days and opening when conditions are more favorable.

stomach Digestive sac in the left upper abdominal cavity, which expands or contracts with the amount of food in it. It has four regions: the cardia leads down from the esophagus; the fundus curves above it; the body is the largest part; and the antrum narrows to join the duodenum at the pyloric valve. Iron and very fat-soluble substances (e.g., alcohol, some drugs) are absorbed in the stomach. Peristalsis mixes food with enzymes and hydrochloric acid from glands in its lining and moves the resulting chyme toward

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the SMALL INTESTINE. The vagus nerve and sympathetic nervous system control the stomach's secretions and movements. Emotional stress affects its function. Common disorders include GASTRITIS, PEPTIC ULCER, hiatal HERNIA, and cancer. See also DIGESTION, GASTRECTOMY.

stomach cancer Malignant TUMOUR of the STOMACH. The main risk factors include a diet high in salted, smoked, or pickled foods; *Helicobacter pylori* infection; tobacco and alcohol use; age (over age 60); and a family history of stomach cancer. Males develop stomach cancer at approximately twice the rate of females. Symptoms may be abdominal pain or swelling, unexplained weight loss, vomiting, and poor digestion. Surgery is the only method for treating stomach cancer, although radiation therapy or chemotherapy may be used in conjunction with surgery or to relieve symptoms.

stone In building construction, rock cut into blocks and slabs or broken into pieces. It comes as hard as granite and as soft as limestone or sandstone. Where available, stone has generally been the preferred material for monumental structures. Its advantages are durability, adaptability to sculpting, and the fact that it can be used in its natural state. But it is difficult to quarry, transport, and cut, and its weakness in tension limits its use. The simplest stonework is rubble, roughly broken stones bound in mortar. Ashlar work consists of regularly cut blocks with squared edges. Building stone is quarried by sawing if it is soft, and split apart with wedges or by blasting if hard. Many devices are used to shape and dress stone, from handheld tools to circular saws, surfacing machines, and lathes. Some stones are strong enough to act as monolithic (one-piece) supports and beams; and in some styles (e.g., ancient Egyptian temples) stone slabs are employed even for roofing, supported by many closely spaced columns. Before the ARCH, builders were handicapped by the tendency of stone to break under its own weight. But stone in compression has great strength, and the Romans built huge stone bridges and aqueducts. Though stone has generally been abandoned for structural use in the 20th century, it is widely used as a thin, nonbearing surface cladding. See also MASONRY.

Stone, Edward Durell (b. March 9, 1902, Fayetteville, Ark., U.S.—d. Aug. 6, 1978, New York, N.Y.) U.S. architect. He earned architecture degrees and traveled in Europe before joining the New York City firm that designed Radio City Music Hall. In 1936 he organized his own architectural firm. A leading exponent of the INTERNATIONAL STYLE, he designed El Panamá Hotel in Panama City (1946), the U.S. embassy in New Delhi (1954), the U.S. pavilion at the Brussels World's Fair (1958), the KENNEDY CENTER FOR THE PERFORMING ARTS in Washington, D.C. (1964), and the Amoco Building in Chicago (1969). He also taught at New York University (1927–42) and Yale University (1946–52).

Stone, Harlan Fiske (b. Oct. 11, 1872, Chesterfield, N.H., U.S.—d. April 22, 1946, Washington, D.C.) U.S. jurist. He studied at Columbia Law School and later practiced law while serving as dean (1910–23). Pres. CALVIN COOLIDGE appointed him U.S. attorney general in 1924; during his tenure he reorganized the FEDERAL BUREAU OF INVESTIGATION after its reputation had been tarnished by the TEAPOT DOME and other scandals. In 1925 Coolidge appointed him to the SUPREME COURT OF THE UNITED STATES, and in 1941 Pres. FRANKLIN D. ROOSEVELT promoted him to chief justice, a position he retained until his death. He wrote more than 600 opinions, many on important constitutional questions. He was often less successful, however, in building a consensus among his associate justices, with the result that the court during his chief justiceship was often a bitterly divided body.

Harlan Fiske Stone, 1929.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Stone, I(sidor) F(einstein) *orig.* **Isidor Feinstein** (b. Dec. 24, 1907, Philadelphia, Pa., U.S.—d. June 18, 1989, Boston, Mass.) U.S. journalist. He worked on newspapers in his native Philadelphia and in New York and wrote for the leftist newspaper *PM* before starting his own investigative newsletter. From the outset *I. F. Stone's Weekly* (1953–67; *I. F. Stone's Bi-Weekly,* 1967–71) had an influence far greater than the size of its readership, which included some of the nation's most prominent politicians, academicians, and journalists. The sole author, Stone created a unique blend of wit, erudition, and pointed political commentary, and he became known for his espousal of unpopular causes long before they were taken up by the liberal establishment.

Stone, Lucy (b. Aug. 13, 1818, West Brookfield, Mass., U.S.—d. Oct. 18, 1893, Dorchester, Mass.) U.S. pioneer in the WOMAN SUFFRAGE movement. A graduate of Oberlin College (1847), she became a lecturer for the Massachusetts Anti-Slavery Society. She soon began speaking for women's rights and helped organize women's-rights conventions in the 1850s. She retained her own name after her marriage to Henry Blackwell (1825–1909) as a protest against the unequal laws applicable to married women; other women who later chose to do the same called themselves "Lucy Stoners." In 1869 she and Blackwell helped establish the American Woman Suffrage Association and founded the influential suffrage magazine *Woman's Journal*, which they edited until their deaths. They were assisted by their daughter Alice Stone Blackwell (1857–1950), who served as chief editor (1893–1917).

Stone, Oliver (b. Sept. 15, 1946, New York, N.Y., U.S.) U.S. film director. He attended Yale University and served in Vietnam before studying filmmaking at New York University. He made his directorial debut with *Seizure* (1974) and wrote screenplays for several films marked by their rapid pace and violence, including *Midnight Express* (1978). He wrote and directed *Platoon* (1986, Academy Award), drawing on his Vietnam experience; it was followed by movies such as *Wall Street* (1987), *Born on the Fourth of July* (1989, Academy Award), *JFK* (1991), *Natural Born Killers* (1994), and *Nixon* (1995), some of them noted for their anti-establishment and often controversial interpretations of history.

Stone, Robert (Anthony) (b. Aug. 21, 1937, New York, N.Y., U.S.) U.S. novelist. He served in the U.S. Navy before attending New York and Stanford universities. *Dog Soldiers* (1974, National Book Award), his second novel, brought home the corruption of the Vietnam War. His later works include the novels *A Flag for Sunrise* (1981), *Outerbridge Reach* (1992), and *Damascus Gate* (1998) and the short-story collection *Bear and His Daughter* (1997).

Stone Age First known period of prehistoric human culture, characterized by the use of stone tools. The term is little used by specialists today. See PALEOLITHIC PERIOD; MESOLITHIC PERIOD; NEOLITHIC PERIOD; STONE-TOOL INDUSTRY. See also BRONZE AGE; IRON AGE.

Stone of Scone See Stone of SCONE

stone tool industry Any of several assemblages of artifacts that display the earliest technology used by humans. These stone tools have survived in great quantities and now serve as the major means of determining HOMININ activities. Archaeologists have classified distinct stone tool industries on the basis of style and use and named them after the site of their original identification. The major industries include (in chronological order) the OLDOWAN, ACHEULEAN, MOUSTERIAN, AURIGNACIAN, SOLUTREAN, and MAGDALENIAN industries.

stonefish See ROCKFISH

stonefly Any of some 1,550 INSECT species (order Plecoptera) with adults, about 0.25–2.5 in. (6–60 mm) long, that are generally gray, black, or brown. They have long antennae; weak, chewing mouthparts; and two pairs of membranous wings that, at rest, fold like a fan. The hind wings are generally broader but shorter than the forewings. Despite their well-developed wings, stoneflies are poor fliers. The female drops a mass of up to 6,000 eggs into a stream. Nymphs resemble adults but are wingless and may have external gills; they feed on plants, decaying organic matter, and insects. The nymphal stage lasts one to four years; adults live several weeks.

Stonefly (Plecoptera)
WILLIAM E. FERGUSON

Stonehenge Monumental circular arrangement of standing stones built in prehistoric times and located near Salisbury, Wiltshire, Eng. The stones are believed to have been put in place in three main phases c. 3100–c. 1550 BC. The reasons for the building of Stonehenge are unknown, but it

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is believed to have been a place of worship and ritual. Many theories have been advanced as to its specific purpose (e.g., for the prediction of ECLIPSES), but none has been proved. Stones erected during the second phase of construction (c. 2100 BC) were aligned with the sunrise at the summer SOLSTICE, suggesting some ritual connection with that event.

Stonewall riots (June 28, 1969) Series of violent confrontations between police and gay rights activists in New York City. In response to the second raid in a week by police on the Stonewall Inn, a popular gay bar in Greenwich Village that had been selling liquor without a license, about 1,000 transvestites, gays, and lesbians taunted police and threw debris; police responded with violence. Similar riots occurred on succeeding nights and were followed by protest rallies. The event marked the awakening of gay rights organizations throughout the U.S.; it is commemorated annually in Gay and Lesbian Pride Week. In 1999 the U.S. National Park Service placed the Stonewall Inn on the National Register of Historic Places. See also GAY RIGHTS MOVEMENT.

stoneware POTTERY fired at a high temperature (about 2,200 °F, or 1,200 °C) until vitrified (made glasslike and impervious to liquid). Because stoneware is nonporous, glaze is applied only for decoration. Stoneware originated in China c. 1400 BC and was exported to Europe in the 17th century. This red to dark-brown stoneware was copied in Germany, England, and the Netherlands. See also BONE CHINA, PORCELAIN.

Salt-glazed stoneware *Bartmannkrug* with applied relief decoration, Cologne, *c.* 1540; in the Victoria and Albert Museum, London
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, WILFRID WALTER—EB INC.

Stono rebellion (1739) Largest slave uprising in early America. On the morning of September 9, near the Stono River, 20 mi (30 km) from Charleston, S.C., slaves gathered, raided a firearms shop, and headed south, killing more than 20 whites as they went. Other slaves joined the rebellion until the group was about 60 strong. Whites set out in armed pursuit, and by dusk half the slaves were dead and half had escaped; most were eventually captured and executed. The slaves may have hoped to reach St. Augustine, Fla., where the Spanish were offering freedom and land to any fugitive. White colonists quickly passed a Negro Act that further limited slave privileges.

stools See FECES

Stoppard, Sir Tom *orig.* **Tomas Straussler** (b. July 3, 1937, Zlín, Czech.) Czech-born British playwright. After living in East Asia with his family during World War II, he moved to England and adopted his stepfather's surname. His first play, *A Walk on the Water*, was televised in 1963, and he won fame with the absurdist *Rosencrantz and Guildenstern Are Dead* (1966; film, 1990). His later plays, marked by verbal brilliance, ingenious plotting, and a playful interest in pivotal historical moments, include *Jumpers* (1972), *Every Good Boy Deserves Favour* (1977; with music by ANDRÉ PREVIN), *The Real Thing* (1982), and *Arcadia* (1993). He has also written radio plays and screenplays for films such as *Empire of the Sun* (1987) and *Shakespeare in Love* (1998, Academy Award). Stoppard was knighted in 1997.

stored-program concept Storage of instructions in computer MEMORY to enable it to perform a variety of tasks in sequence or intermittently. The idea was introduced in the late 1940s by JOHN VON NEUMANN, who proposed that a program be electronically stored in binary-number format in a memory device so that instructions could be modified by the computer as determined by intermediate computational results. Other engineers, notably JOHN W. MAUCHLY and J. PRESPER ECKERT, contributed to this idea, which enabled DIGITAL COMPUTERS to become much more flexible and powerful. Nevertheless, engineers in England built the first stored-program computer, the Manchester Mark I, shortly before the Americans built EDVAC, both operational in 1949.

stork Any of 17 species (family Ciconiidae) of voiceless, long-necked, mainly Old World birds. Storks are 2–5 ft (60–150 cm) tall, often with a totally or partially bald, brightly coloured head and upper neck. They fly by alternately flapping and soaring, with neck outstretched and legs trailing. Most species are diurnal, feeding on small animals in shallow water and fields; some eat carrion. Usually found in flocks, storks pair off during the breeding season, and both parents incubate the eggs. Typical storks have a straight or nearly straight bill; the four species of wood stork have a curved bill. The only U.S. stork, the wood ibis (*Mycteria americana*), is white, with black wings and tail and a curved bill. See also IBIS; MARABOU.

storm petrel Any of about 20 species (family Hydrobatidae) of PETRELS that vary from 5 to 10 in. (13–25 cm) long. All are dark gray or brown, sometimes lighter below, often with a white rump. The relatively short wings are rounded at the tips. The toes are webbed, except for the small hind toe; the tail is square, forked, or wedge-shaped. Most species breeding in southern oceans "walk" over the water with wings spread, picking up minute marine organisms. Most northern species swoop over the water like tiny terns, occasionally alighting on the surface.

Storm Troopers See SA

Stornoway *Gaelic* **Steornabhagh** Burgh and largest town and port (pop., 1991: 5,975), Outer HEBRIDES ISLANDS, Scotland. Located on the island of Lewis and Harris, Stornoway grew from the 18th century as a fishing town; the chief industry now is the manufacture of Harris tweed. It is the headquarters of the Western Isles council area.

Story, Joseph (b. Sept. 18, 1779, Marblehead, Mass., U.S.—d. Sept. 10, 1845, Cambridge, Mass.) U.S. jurist. After graduating from Harvard University, he practiced law in Salem, Mass. (1801–11) and served in the state legislature and U.S. Congress (1805–11). In 1811, though he was only 32 and lacked any judicial experience, he was appointed to the SUPREME COURT OF THE UNITED STATES by Pres. JAMES MADISON. There he joined JOHN MARSHALL in interpreting the U.S. Constitution in a manner favouring the expansion of federal power. His opinion in *Martin* v. *Hunter's Lessee* (1816) established the court's appellate authority over the highest state courts. During his tenure on the court, he taught at Harvard (1829–45), where he became the first Dane Professor of Law and whose endowment funded his influential series of commentaries, including *Commentaries on the Constitution of the United States* (1833), *The Conflict of Laws* (1834), and *On Equity Jurisprudence* (1836). He and JAMES KENT are considered the founders of U.S. equity jurisprudence.

Stoss \'shtōs**, Veit** (b. 1438/47, Swabia—d. 1533, Nürnberg) German sculptor and wood carver. He worked mainly in Poland from 1477 to 1496; among his principal works is the majestic high altar in the Church of the Virgin Mary in Kraków (1477–89). After his return to Germany, he settled in Nürnberg and produced important wood and stone sculptures in churches there and in Bamberg. His nervous, angular forms, realistic detail, and virtuoso wood carving synthesized the sculptural styles of Flemish and Danubian art, and he exercised great influence on German late Gothic sculpture.

The Archangel Raphael, wood sculpture by Veit Stoss, 1516–18; in the German National Museum, Nürnberg.
COURTESY OF THE GERMANISCHES NATIONALMUSEUM, NURNBERG

Stour \'staůr, 'stůr**, River** River, eastern England. It rises in eastern CAMBRIDGESHIRE and flows eastward through East Anglia, forming most of the boundary between SUFFOLK and ESSEX, through country made famous by the paintings of JOHN CONSTABLE. After a course of 47 mi (76 km), it enters the North Sea at Harwich.

Stout, Rex (Todhunter) (b. Dec. 1, 1886, Noblesville, Ind., U.S.—d. Oct. 27, 1975, Danbury, Conn.) U.S. writer. He worked odd jobs until 1912, when he began to write. From 1927 he earned his living exclusively by writing. He is remembered for 46 genteel mystery novels and novelettes, beginning with *Fer-de-Lance* (1934), that revolve around Nero Wolfe, a brilliant, obese aesthete who

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solves crimes without leaving his New York City apartment. Stout endowed his detective with his own passions for haute cuisine and the growing of orchids.

Stowe \'stō**, Harriet Beecher** *orig.* **Harriet Elizabeth Beecher** (b. June 14, 1811, Litchfield, Conn., U.S.—d. July 1, 1896, Hartford, Conn.) U.S. writer and philanthropist. Stowe was the daughter of the famous Congregationalist minister Lyman Beecher (1775–1863) and the sister of Henry Ward Beecher and Catharine Esther Beecher. She taught school in Hartford and in Cincinnati, where she came into contact with fugitive slaves and learned about life in the South, and later settled in Maine with her husband, a professor of theology. Her antislavery novel *Uncle Tom's Cabin* (1852) had so great an impact that it was often cited (by Abraham Lincoln, among others) among the causes of the American Civil War. Her other works include the novels *Dred* (1856), also against slavery, and *The Minister's Wooing* (1859).

Strabane \strə-'ban\ *Irish* **An Srath Bán** Town, seat, and district (pop., 1995 est.: 36,000), Northern Ireland. Strabane is composed of river valleys, rolling lowlands, and moorlands of the Sperrin Mountains. Originally inhabited by the O'Neill clan of Ulster, the district was settled in the 17th century by Scots Protestants. Livestock grazing in the lowlands, salmon fishing in the many rivers, and textile manufacturing contribute to the economy. The market town of Strabane (pop., 1991: 12,000), located on the River Mourne, is the district's administrative seat.

strabismus \strə-'biz-məs\ *or* **squint** *or* **heterotropia** \ˌhet-ə-rə-'trō-pē-ə\ Failure of the eyes to align properly to focus on an object. The affected eye may deviate in any direction, including inward (cross-eye) or outward (walleye). Problems with photoreception or the nerves that relay images to the brain cause a constant degree of deviation (comitant); defects in the nerves that control the muscles that move the eyes cause deviation that varies with the direction of gaze (noncomitant). Both types impede development of a child's ability to focus the eyes and merge images from the two retinas into one (fusional reflex). The brain suppresses the image from the deviant eye, which may become functionally blind. Treatment may involve exercises to strengthen the weak eye or surgery or both.

Strabo \'strā-bō\ (b. c. 64 BC, Amaseia, Pontus, Asia Minor—d. after AD 21) Greek geographer and historian. Born to a well-connected family, he studied under Aristodemus before moving to Rome (44 BC) to study with the Aristotelian school, then became a Stoic. Of his 47-volume *Historical Sketches*, covering the years 145–31 BC (published c. 20 BC), only a few quotations remain. His *Geographical Sketches* (after c. AD 14) is the only extant work on the range of peoples and countries known to Greeks and Romans during the reign of Caesar Augustus.

Strachey \'strā-chē**, (Giles) Lytton** (b. March 1, 1880, London, Eng.—d. Jan. 21, 1932, Ham Spray House, near Hungerford, Berkshire) English biographer and critic. After studying at Cambridge, he became a leader in the Bloomsbury group. Though a self-identified homosexual, he was engaged very briefly to Virginia Woolf. Adopting an irreverent attitude to the past, he opened a new era of biographical writing with his *Eminent Victorians* (1918), consisting of four sketches of Victorian idols whom he portrayed as multifaceted, flawed human beings. Fascinated by personality and motive, he treated his subjects idiosyncratically and somewhat cynically. He also published *Queen Victoria* (1921), *Elizabeth and Essex* (1928), *Portraits in Miniature* (1931), and critical writings, especially on French literature.

Stradivari \ˌsträ-dē-'vär-ē**, Antonio** (b. 1644?, Cremona, Duchy of Milan—d. Dec. 18, 1737, Cremona) Italian musical-instrument maker. An apprentice of Nicolò Amati (from c. 1666), he established his own business in Cremona, eventually working with his sons Francesco (1671–1743) and Omobono (1679–1742). Though he made other instruments (including harps, lutes, mandolins, and guitars), few survive, and after 1680 he concentrated on violins. Moving away from the Amati style, he developed (c. 1690) the "long Strad." The Stradivari method of violin making created a standard for subsequent times; he devised the modern form of the violin bridge and set the proportions of the modern violin, with its shallower body that yields a more powerful and penetrating tone than earlier violins. The period 1700–20 is considered the peak of his productivity and quality.

Strafford, Thomas Wentworth, 1st earl of (b. April 13, 1593, London, Eng.—d. May 12, 1641, London) English politician and leading adviser to Charles I. Although an outspoken member of the opposition, he switched his support to the crown when offered a barony in 1628. As lord president of the north (1628–33), he quelled defiance to the crown. As lord deputy of Ireland (1633–39), he consolidated the royal authority, extended English settlement, reformed the administration, and increased revenues for the crown. He was recalled to command Charles's army against a Scottish revolt, but the costly war was opposed by the Long Parliament; as a target representing the king's authority, he was impeached by the Parliament in 1640. Strafford was accused of subverting the laws (he had offered to bring over the Irish army to subdue the king's opponents in England); when it looked as though he might be acquitted, John Pym, the leader of the House of Commons, had a bill of attainder passed that condemned Strafford to death. Strafford released the king from his promise of protection, and Charles gave his consent to the bill. Strafford was subsequently beheaded in the presence of an immense and jubilant crowd.

strain In the physical sciences and engineering, a number that describes the relative deformation of elastic, plastic, and fluid materials under applied forces. It arises throughout the material as the particles of the material are displaced from their usual position. Normal strain is caused by forces perpendicular to planes or cross sections of the material, such as in a volume that is under pressure on all sides. Shear strain is caused by forces that are parallel to, and lie in, planes or cross sections, such as in a short metal tube that is twisted about its longitudinal axis. See also deformation and flow.

strain gauge Device for measuring the changes in distances between points in solid bodies that occur when the body is deformed. Strain gauges are used either to obtain information from which stresses in bodies can be calculated or to act as indicating elements on devices for measuring such quantities as force, pressure, and acceleration.

Straits Question Recurrent controversy in the 19th–20th centuries over the passage of warships through the Bosporus and Dardanelles straits between the Black Sea and the Aegean and Mediterranean seas. Both straits were in Turkish territory, but when Russia gained control of the northern shore of the Black Sea, its ships were given free passage. Russia sought to control the passage of non-Turkish ships with the Treaty of Hünkâr İskelesi (1833), but it was reversed by the London Straits Convention (1841). The Treaty of Lausanne (1923) allowed free passage to all warships, until it was revised by the Montreux Convention (1936) to reestablish Turkey's right to restrict access by navies of non-Black Sea states.

Straits Settlements Former British crown colony, on the Strait of Malacca in Southeast Asia. It comprised three trade centres, Penang, Singapore, and Malacca, which were established or taken over by the British East India Company. United in 1826 under Indian control, they were made a crown colony by the British in 1867. Cocos Islands, Christmas Island, and Labuan were added in the early 20th century. Occupied by the Japanese during World War II, the colony was broken up in 1946 when Singapore became a separate colony. The remaining parts were ultimately ceded to Australia and Malaysia.

Strand, Mark (b. April 11, 1934, Summerside, P.E.I., Can.) Canadian-born U.S. poet and writer of short fiction. Educated in the U.S., he taught at several American universities. His poetry, influenced by Latin American surrealism and European writers such as Franz Kafka, is known for its symbolic imagery and its minimalist sensibility. His volumes include the collections *Sleeping with One Eye Open* (1964), *The Story of Our Lives* (1973), and *Blizzard of One* (1998); *Dark Harbor* (1993), a book-length poem; and *Mr. and Mrs. Baby and Other Stories* (1985). He was named U.S. poet laureate in 1990.

Strand, Paul (b. Oct. 16, 1890, New York, N.Y., U.S.—d. March 31, 1976, Oregeval, France) U.S. photographer. He studied photography with Lewis Hine. At Hine's urging, he frequented Alfred Stieglitz's "291" gallery; the avant-garde paintings by Pablo Picasso, Paul Cézanne, and Georges Braque that he saw there led him to emphasize abstract form and pattern in his photographs, such as *Wall Street* (1915). He rejected soft-focus Pictorialism in favour of the

White Fence, photograph by Paul Strand, 1916.
COURTESY OF PAUL STRAND

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minute detail and rich tonal range afforded by the use of large-format cameras. Much of his later work was devoted to North American and European scenes and landscapes. He collaborated on documentary films with Charles Sheeler and Pare Lorentz.

Strasberg, Lee *orig.* **Israel Strassberg** (b. Nov. 17, 1901, Budzanów, Pol., Austria-Hungary—d. Feb. 17, 1982, New York, N.Y., U.S.) Russian-born U.S. theatre director and teacher. At age seven he immigrated to New York City with his family. After acting lessons with teachers who had studied under Konstantin Stanislavsky, he became an actor and stage manager with the Theatre Guild. In 1931 he cofounded the Group Theatre, where he directed brilliant experimental plays such as *Men in White* (1933). After working in Hollywood (1941–48), he returned to New York City to become artistic director of the Actors Studio, where he expanded Stanislavsky's teachings to further develop method acting, in which actors use their own emotional memory for the purpose of dramatic motivation. He trained actors such as Marlon Brando, Marilyn Monroe, Dustin Hoffman, Geraldine Page, and Julie Harris.

Strasbourg \'sträs-ˌbůrg\ *German* **Strassburg** \'shträs-ˌbůrk\ City (pop., 1999: 264,115), eastern France. Located on the Franco-German border, Strasbourg was originally a Celtic village; it became a garrison under the Romans. The Franks captured it in the 5th century, and in 842 the Oath of Strasbourg, uniting the western and eastern Franks, was concluded there. It became a free city within the Holy Roman Empire in 1262. It was seized by the French in 1681 and captured by Germany in the Franco-Prussian War (1870–71). It reverted to France after World War I but was occupied by Germany again during World War II, when it suffered considerable damage. A major river port and industrial centre, it is the seat of the Council of Europe and an international communications centre. Notable buildings include the restored medieval cathedral with its 14th-century astronomical clock. The parliament of what is now the European Union has met there since 1979.

Strasser \'shträ-sər**, Gregor; and Strasser, Otto** (respectively b. May 31, 1892, Geisenfeld, Ger.—d. June 30, 1934, Berlin; b. Sept. 10, 1897, Windsheim, Ger.—d. Aug. 27, 1974, Munich) German politicians. The brothers joined the Nazi Party in the early 1920s. Gregor became the party's leader in the north and built a mass movement with the help of Otto and the young Joseph Goebbels, appealing to the lower middle classes and workers by advocating a socialism couched in nationalist and racist terminology. Otto resigned in 1930, disillusioned by Adolf Hitler's nonsocialist goals. Gregor became head of the Nazi political organization, second only to Hitler in power, but he came to share his brother's disillusionment and resigned in 1932. Gregor was murdered on Hitler's orders in 1934; Otto escaped into exile in Canada, then returned to Germany in 1955.

Strassmann, Fritz (b. Feb. 22, 1902, Boppard, Ger.—d. April 22, 1980, Mainz, W.Ger.) German physical chemist. He helped develop the method of rubidium-strontium dating widely used in geochronology. Beginning in 1934, he joined Otto Hahn and Lise Meitner in their investigations of the radioactive products formed when uranium is bombarded by neutrons. In 1938 they discovered lighter elements produced from the neutron bombardment, which were the result of the splitting of the uranium atom into two lighter atoms (nuclear fission). In 1946 he joined the faculty at the University of Mainz, where he established the Institute of Inorganic Chemistry (later the Institute of Nuclear Chemistry), and he directed the chemistry department at the Max Planck Institute for Chemistry (1945–53).

Strategic Arms Limitation Talks (SALT) Negotiations between the U.S. and the Soviet Union aimed at curtailing the manufacture of strategic nuclear missiles. The first round of negotiations began in 1969 and resulted in a treaty regulating antiballistic missiles and freezing the number of intercontinental ballistic missiles and submarine-launched ballistic missiles. It was signed by Leonid Brezhnev and Richard Nixon in 1972. A second round of talks (1972–79), known as SALT II, addressed the asymmetry between the two sides' strategic forces and ended with an agreement to limit strategic launchers (see MIRV). Signed by Brezhnev and Jimmy Carter, it was never formally ratified by the U.S. Senate, though its terms were observed by both sides. Subsequent negotiations took the name Strategic Arms Reduction Talks (START). See also intermediate-range nuclear weapons; Nuclear Test-Ban Treaty.

Strategic Arms Reduction Talks (START) Negotiations between the U.S. and the Soviet Union aimed at reducing those countries' nuclear arsenals and delivery systems. Two sets of negotiations (1982–83, 1985–91) concluded in an agreement signed by George Bush and Mikhail Gorbachev that committed the Soviet Union to a reduction from 11,000 to 8,000 nuclear weapons and the U.S. to a reduction from 12,000 to 10,000. After the Soviet Union's collapse (1991), a supplementary agreement (1992) obligated Ukraine, Belarus, and Kazakhstan to destroy the nuclear weapons on their soil or to give them to Russia. Subsequent U.S. efforts to develop an antimissile defense system threatened new complications for the arms control regime. See also Strategic Arms Limitation Talks.

Strategic Defense Initiative (SDI) *also called* **Star Wars** Proposed U.S. strategic defense system against nuclear attacks. Announced as a 20-year, $20 billion effort by Pres. Ronald Reagan in 1983, SDI was intended to defend the U.S. from a full-fledged Soviet attack by intercepting ICBMs in flight. The interception was to be effected by technology not yet developed, including space- and ground-based laser stations and air- and ground-based missiles. The space component of SDI led to its being derisively dubbed "Star Wars" after the popular film. Though the program was roundly criticized by opposition politicians and arms-control advocates as unworkable and as a dangerous violation of the Antiballistic Missile (ABM) Treaty of 1972, Congress granted initial funding for it. Early development efforts were largely unsuccessful, and with the fall of the Soviet Union in 1991 the concept lost urgency. During the Bush and Clinton administrations, ballistic missile defense was scaled back to focus on protecting the U.S. from limited attack by a "rogue" state or a single accidentally launched missile. In 2002 the U.S. withdrew from the ABM treaty to begin active testing of a limited antimissile program. See also antiballistic missile.

strategus \strə-'tē-gəs\ In ancient Greece, a general, often functioning as a magistrate with wide powers. Cleisthenes introduced an annual board of 10 *strategi* in Athens to be commanders of the army; one or more, all equal, were responsible for each operation. In the 5th century BC they gained political influence, in part because they were elected and could be reelected, thus were able to entrench themselves in office. In the Hellenistic Age they were the supreme magistrates in most federations and leagues. In Egypt (3rd century BC–4th century AD) they were civil governors.

strategy In warfare, coordinated application of all the forces of a nation to achieve a goal. In contrast to tactics, strategy's components include a long-range view, the preparation of resources, and planning for the use of those resources before, during, and after an action. The term has expanded far beyond its original military meaning. As society and warfare have steadily grown more complex, military and nonmilitary factors have become more and more inseparable in the conduct of war and in programs designed to secure peace. In the 20th century, the term grand strategy, meaning the art of employing all the resources of a nation or coalition of nations to achieve the objects of war (and peace), steadily became more popular in the literature of warfare and statecraft.

Stratemeyer \'stra-tə-ˌmī-ər**, Edward** (b. Oct. 4, 1862, Elizabeth, N.J., U.S.—d. May 10, 1930, Newark, N.J.) U.S. writer of popular juvenile fiction. He began writing stories in imitation of Horatio Alger and other adventure writers, and he later edited several publications and began writing series of books. In 1906 he founded the Stratemeyer Literary Syndicate, which would publish the Rover Boys, Hardy Boys, Tom Swift, Bobbsey Twins, and Nancy Drew series, written by himself and a stable of hack writers under a variety of names. After his death his company was largely directed by his daughter, Harriet Stratemeyer Adams (1893?–1982), who also wrote many books in several series.

Stratford, Viscount See Stratford Canning

Stratford Festival Canadian summer theatrical festival. The foremost classical repertory theatre in North America, it was founded by Tom Patterson in Stratford, Ontario, in 1953. It includes three permanent theatres: the 220° open-stage Festival Theatre, the Avon Theatre, and the Tom Patterson Theatre, which is reserved for experimental works. The festival features productions of William Shakespeare's plays (Stratford was chosen as its locale because the town's name matched that of Shakespeare's birthplace) but also performs other classic dramatic works.

Stratford-upon-Avon Town (pop., 1995 est.: 28,000), Warwickshire, England. It is located on the River Avon. The town's first royal charter was granted in 1553. For centuries a country market town, it became a tourist centre because of its association with William Shakespeare, who was born and died there; his grave is in the parish church of Holy Trinity. The

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Shakespeare Centre in Stratford includes a library and art gallery (opened 1881) and a theatre (opened 1932). Every year from March until October, Shakespeare's plays are performed in the Royal Shakespeare Theatre.

Strathclyde Medieval Celtic kingdom, Scotland. Located south of the River Clyde, it was established in the 6th century. Its capital was Dumbarton. The Picts and Vikings ravaged the kingdom in the 8th–9th centuries. It suffered several defeats by the English, who took it over in the early 10th century. The Anglo-Saxon King Edmund I leased it in 945 to the Scots king Malcolm I. It became a province of Scotland in the 11th century after the death of its king, who had helped Malcolm II defeat the English at Carham.

stratification Layering that occurs in most sedimentary rocks and in igneous rocks that are formed at the Earth's surface, such as from lava flows and volcanic deposits. The layers (strata) may range from thin sheets that cover many square miles to thick lenslike bodies that are only a few feet wide.

stratigraphy \strə-'ti-grə-fē\ Scientific discipline concerned with describing rock successions and interpreting them in terms of a general time scale. It provides a basis for historical geology, and its principles and methods are applied in such fields as petroleum geology and archaeology. Stratigraphic studies deal primarily with sedimentary rocks but may also encompass layered igneous rocks (e.g., those resulting from successive lava flows) or metamorphic rocks formed either from such extrusive igneous material or from sedimentary rocks.

Stratofortress See B-52

stratosphere Layer of the atmosphere that is located above the troposphere. The stratosphere extends from a lower boundary of about 11 mi (17 km) altitude to an upper boundary (the stratopause) at about 30 mi (50 km). The ozone layer is a part of the stratosphere.

Straus \'straůs\ **family** German-U.S. merchandising family that distinguished itself in public service and philanthropy. The family originated in Bavaria, and the patriarch, Lazarus Straus, immigrated to the U.S. in 1852, followed by his wife and three sons: Isidor (1845–1912), Nathan (1848–1931), and Oscar Solomon (1850–1926). They established a merchandising firm that allowed them to gain an interest in Macy and Co., which led to complete ownership in 1896. Isidor established the department store chain of Abraham & Straus, served briefly in the U.S. Congress, and engaged in philanthropic works; he and his wife perished aboard the *Titanic* after giving Mrs. Straus's place in a lifeboat to their maid. Nathan was noted for his philanthropy; he distributed food and coal in New York and supplied pasteurized milk to children in 36 cities during the 1892 depression, built the first tuberculosis preventorium for children (1909), and provided food for New York's poor during the harsh winter of 1914–15. He devoted the last years of his life to public-health work in Palestine. Oscar was appointed Secretary of Commerce and Labor by Pres. Theodore Roosevelt, becoming the first Jewish Cabinet member (1906–09); he also served as emissary to Ottoman Turkey and as an adviser to Pres. Woodrow Wilson, and he was a strong advocate for the protection of Jewish minorities in Europe.

Strauss \'shtraůs**, Franz Josef** (b. Sept. 6, 1915, Munich, Ger.—d. Oct. 3, 1988, Regensburg, W.Ger.) German politician. Strauss studied at the University of Munich and was an active member of a Roman Catholic youth organization that clashed with the Nazis. Called up for military service in 1939, he was captured by U.S. forces near the end of World War II. After his release in 1945, he served as councillor to the Bavarian Ministry of the Interior and in 1946 was appointed deputy county director in the Schongau district by the U.S. occupation authorities. He helped found the Bavarian Christian Social Union (CSU) in 1945 and was elected to the Bundestag in 1949. He served as minister of defense (1956–62) and minister of finance (1966–69). Head of the CSU from 1961, he was the party's unsuccessful candidate for chancellor in 1980. As premier of Bavaria (1978–88), he pursued economic policies that made it one of Germany's most prosperous states.

Strauss \'shtraůs,\ *English* \'straůs**, Johann (Baptist)** (b. Oct. 25, 1825, Vienna, Austria—d. June 3, 1899, Vienna) Austrian composer. His father, Johann Strauss the Elder, was a self-taught musician who established a musical dynasty in Vienna. A violinist, he played in a dance orchestra from 1819; when it split in two (1824), he took over the second group, for which he began to write waltzes, galops, polkas, and quadrilles, eventually publishing more than 250 works. As bandmaster of a local regiment, he also wrote marches, including the *Radetzsky March*. Johann the Younger left his family in 1842 and soon surpassed his father's popularity and productivity, becoming known as the "Waltz King." By inducing his brothers, Josef and Eduard, to take over his conducting duties, he gained more time to compose the symphonic waltzes for which he is best known, including *The Blue Danube* (1867) and *Tales from the Vienna Woods* (1868). His operettas include the popular *Die Fledermaus* (1874) and *The Gypsy Baron* (1885). Eduard's son Johann, a conductor and composer in Berlin, was the last of the dynasty.

Strauss, Richard (Georg) (b. June 11, 1864, Munich, Ger.—d. Sept. 8, 1949, Garmisch-Partenkirchen) German composer and conductor. Son of a horn player, he began composing at age six. Before he was 20, he had already had major premieres of two symphonies and a violin concerto. In 1885 the conductor of the Meiningen Orchestra, Hans von Bülow, made Strauss his successor. Strongly influenced by the work of Richard Wagner, he began to write programmatic orchestral tone poems, including *Don Juan* (1889), *Till Eulenspiegel's Merry Pranks* (1894–95), and *Also sprach Zarathustra* (1896). After 1900 he focused on operas; his third such work, *Salome* (1903–05), was a succès de scandale. *Elektra* (1906–08) marked the beginning of a productive collaboration with the poet Hugo von Hofmannsthal, with whom Strauss wrote his greatest operas, including *Der Rosenkavalier* (1909–10). He remained in Austria through World War II and held a music post in the German government, but he was later cleared of wrongdoing in connection with the Nazi regime. After many years writing lesser works, he produced several remarkable late pieces, including *Metamorphosen* (1945) and the *Four Last Songs* (1948).

Richard Strauss, portrait by Max Liebermann, 1918; in the National-Galerie, Berlin
COURTESY OF THE STAATLICHE MUSEEN ZU BERLIN, GERMANY

Stravinsky, Igor (Fyodorovich) (b. June 17, 1882, Oranienbaum, Russia—d. April 6, 1971, New York, N.Y., U.S.) Russian-born U.S. composer. Son of an operatic bass, he decided to be a composer at age 20 and studied privately with Nikolay Rimsky-Korsakov (1902–08). His *Fireworks* (1908) was heard by the impresario Sergey Diaghilev, who commissioned Stravinsky to write the *Firebird* ballet (1910); its dazzling success made him Russia's leading young composer. The great ballet score *Petrushka* (1911) followed. His next ballet, *The Rite of Spring* (1913), with its shifting and audacious rhythms and its unresolved dissonances, was a landmark in music history; its Paris premiere caused an actual riot in the theatre, and Stravinsky's international notoriety was assured. In the early 1920s he adopted a radically different style of restrained Neoclassicism—employing often ironic references to older music—in works such as his *Octet* (1923). His major Neoclassical works include *Oedipus rex* (1927) and the *Symphony of Psalms* (1930) and culminate in the opera *The Rake's Progress* (1951). From 1954 he employed serialism, a compositional technique. His later works include *Agon* (1957)—the last of his many ballets choreographed by George Balanchine—and *Requiem Canticles* (1966).

straw Stalks of grasses, particularly cereal grasses such as wheat, oats, rye, barley, and buckwheat. Used collectively, the term means stalks aggregated into bales or piles after the drying and threshing of grain. Since ancient times, humans have used straw as litter and fodder for cattle, as a covering for floors, for coarse bedding, and even as clothing. It can also be woven into baskets, hats, floor mats, and furniture coverings. Thatched roofs consist of straw laid down approximately 1 ft (30 cm) thick and secured by strong cords, with the fibers running in the direction to be taken by rainwater. Chemically pulped straw is used in the manufacture of coarse paper and strawboard, a cardboard for cheap paper boxes.

strawberry Fruit plant of eight main species of the genus *Fragaria* (rose family), the chief cultivated varieties of which are *F. virginiana* and *F. chiloensis*, native to the Americas. The low-growing, herbaceous plant has a fibrous root system and a crown from which basal leaves arise. The

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leaves are compound, with three leaflets, sawtooth-edged and hairy. Small clusters of white flowers grow on slender stalks. Botanically, the strawberry fruit is not a BERRY or a single fruit, but is instead a greatly enlarged stem end that contains many partially embedded true fruits (achenes), popularly called seeds. The plant propagates by STOLONS as it ages. Strawberries are very perishable and require cool, dry storage. They are eaten fresh or prepared for use in desserts or preserves. Rich in vitamin C, they also provide iron and other minerals.

Strayhorn, Billy *orig.* **William Thomas Strayhorn** (b. Nov. 29, 1915, Dayton, Ohio, U.S.—d. May 31, 1967, New York, N.Y.) U.S. pianist, composer, and arranger. Strayhorn approached JAZZ composer and bandleader DUKE ELLINGTON with a composition in 1938, and he was soon contributing arrangements and original works to Ellington's band. His "Take the 'A' Train," recorded in 1941, became the band's theme song. His work so complemented Ellington's that it is often impossible to distinguish their respective contributions. Strayhorn made expressive ballads his specialty and became noted for the structural and harmonic sophistication of pieces such as "Lush Life," "Something to Live For," "Passion Flower," and "Day Dream."

streak Colour of a mineral in its powdered form, usually obtained by rubbing the mineral on a hard, white surface (e.g., a tile of unglazed porcelain) to yield a streak of fine powder. The streak's colour is usually constant for a given mineral, even if the mineral varies in colour as it occurs in the field or if the streak is different from the colour of the unpowdered mineral. Streak is diagnostically useful because it may distinguish between mineral species that are otherwise similar in appearance.

stream of consciousness Narrative technique in nondramatic fiction intended to render the flow of myriad impressions—visual, auditory, tactile, associative, and subliminal—that impinge on an individual consciousness. To represent the mind at work, a writer may incorporate snatches of thought and grammatical constructions that do not seem coherent because they are based on the free association of ideas and images. The term was first used by WILLIAM JAMES in *The Principles of Psychology* (1890). In the 20th century, writers attempting to capture the total flow of their characters' consciousness commonly used the techniques of interior monologue, which represents a sequence of thought and feeling. Novels in which stream of consciousness plays an important role include JAMES JOYCE's *Ulysses* (1922), WILLIAM FAULKNER's *The Sound and the Fury* (1929), and VIRGINIA WOOLF's *The Waves* (1931).

streambed *or* **stream channel** Any long, narrow, sloping depression on land that had been shaped by flowing water. Streambeds can range in width from a few feet for a brook to several thousand feet for the largest rivers. The channel may or may not contain flowing water at any given time; some carry water only occasionally. Streambeds may be cut in bedrock or through sand, clay, silt, or other unconsolidated materials.

streaming Method of transmitting a media file in a continuous stream of data that can be processed by the receiving computer before the entire file has been completely sent. Streaming, which typically uses DATA COMPRESSION, is especially effective for downloading large multimedia files from the INTERNET; it permits, for example, a video clip to begin playing on a user's computer as soon as it begins to be downloaded from a Web site. Even with improved modems and connection speeds, downloading and playing large audio and video files without the use of streaming techniques still takes an inconveniently long time. To accept streaming data, the receiving computer needs to be running a player, a program that decompresses the incoming data and sends the resulting signals to the display and speakers. The audio and video files may be prerecorded, but streaming can also accommodate a live feed over the Internet.

streamline In FLUID MECHANICS, the path of imaginary particles suspended in the fluid and carried along with it. In steady flow, the fluid is in motion but the streamlines are fixed. Where streamlines crowd together, the fluid speed is relatively high; where they open out, the fluid is relatively still. See also LAMINAR FLOW, TURBULENT FLOW.

Streep, Meryl *orig.* **Mary Louise Streep** (b. June 22, 1949, Summit, N.J., U.S.) U.S. film actress. She studied at Vassar College and the Yale School of Drama before appearing on Broadway and in the television films *The Deadliest Season* (1977) and *The Holocaust* (1978, Emmy Award). An unusually versatile and expressive actress, she won stardom in *The Deer Hunter* (1978), *Manhattan* (1979), and *Kramer vs. Kramer* (1979, Academy Award). Her later films include *Sophie's Choice* (1982, Academy Award), *Silkwood* (1983), *Out of Africa* (1985), *A Cry in the Dark* (1988), *The Bridges of Madison County* (1995), and *The Hours* (2002).

streetcar *or* **trolley car** Passenger-carrying vehicle that runs on rails laid in city streets. Streetcars in the 1830s were pulled by horses. Electric motors later supplied the power, with electricity transmitted by a trolley from overhead electric lines. From the 1890s to the 1940s, streetcars were widely used in cities around the world; they were gradually replaced by the AUTOMOBILE, the BUS, and the SUBWAY, and by the 1950s few remained. A variant, the cable car, invented in 1873 for use on San Francisco's steep hills, is drawn by a continuous cable set in a slot between the tracks.

Streicher \'shtrī-k̲ər**, Julius** (b. Feb. 22, 1885, Fleinhausen, Ger.—d. Oct. 16, 1946, Nürnberg, W.Ger.) German Nazi demagogue and politician. He joined the NAZI PARTY in 1921 and became a friend of ADOLF HITLER. In 1923 he founded the anti-Semitic weekly *Der Stürmer*, which provided a focus for Hitler's racial policies. As one of the most virulent advocates of persecution of the Jews, Streicher initiated the campaign that led to the passage of the NÜRNBERG LAWS in 1935. He was appointed *gauleiter* (district leader) of Franconia, but his sadistic excesses alienated party officials, and he was stripped of his posts in 1940; he remained editor of *Der Stürmer*, however, owing to Hitler's protection. In 1945 he was arrested by the Allies, prosecuted at the NÜRNBERG TRIALS, and hanged as a war criminal.

Streisand, Barbra *orig.* **Barbara Joan Streisand** (b. April 24, 1942, Brooklyn, N.Y., U.S.) U.S. singer and actress. She sang in nightclubs before appearing on Broadway in *I Can Get It for You Wholesale* (1962), and she became a major star with *Funny Girl* (1964; film and Academy Award, 1968). Her richly beautiful voice made her one of the world's most popular singers in the 1970s and '80s. An exuberant comic and dramatic actress, she starred in movies such as *Hello, Dolly!* (1969), *What's Up Doc?* (1972), *The Way We Were* (1973), and *A Star Is Born* (1976), and she later directed and starred in *Yentl* (1983) and *The Prince of Tides* (1991). She avoided live performances for several years, but in the 1990s she appeared in a series of concerts that broke box office sales records. In 1995 she received a Grammy Award for lifetime achievement.

streltsy *Russian* **"musketeers"** Russian military corps. Established in the mid-16th century, the *streltsy* formed the bulk of the Russian army for about 100 years and provided the tsar's bodyguard. A hereditary military caste by the mid-17th century, they numbered about 55,000 and performed police and security duties in Moscow and the garrisoned border towns. In 1682 the corps became involved in the succession struggle that led to the regency of SOPHIA. When she was displaced (1689), they were forcibly disbanded by PETER I; hundreds were executed or deported. The corps was gradually absorbed into the regular army.

strength of materials ENGINEERING discipline concerned with the ability of a material to resist mechanical FORCES when in use. A material's strength in a given application depends on many factors, including its resistance to deformation and cracking, and it often depends on the shape of the member being designed. See also FRACTURE, IMPACT TEST, MATERIALS SCIENCE, TENSILE STRENGTH, TESTING MACHINE.

streptococcus \ˌstrep-tə-'kä-kəs\ Any of the spheroidal BACTERIA that make up the genus *Streptococcus*. The cells characteristically group together in chains resembling a string of beads. Streptococci are gram-positive (see GRAM STAIN) and stationary and do not require oxygen. Some species cause infections, including RHEUMATIC FEVER, SCARLET FEVER, strep throat, and TONSILLITIS. Others are used in commercial starters for the production of butter, cultured buttermilk, and certain cheeses. See also PNEUMOCOCCUS.

streptomyces \ˌstrep-tə-'mī-sēz\ Any of the threadlike BACTERIA that make up the genus *Streptomyces*, occurring in soil and water. These gram-positive (see GRAM STAIN), oxygen-requiring bacteria form a branching net called a mycelium that bears chains of SPORES at maturity. Many species are important in the decomposition of organic matter in soil, contributing in part to the earthy odour of soil and decaying leaves and to the fertility of soil. Certain species produce ANTIBIOTICS such as TETRACYCLINE and STREPTOMYCIN. See also ACTINOMYCETE.

streptomycin \ˌstrep-tə-'mī-sen\ ANTIBIOTIC synthesized by the ACTINOMYCETE *Streptomyces griseus*, found in soil. It was among the first antibiotics discovered (1943, by SELMAN WAKSMAN), after PENICILLIN, gramicidin, and tyrocidine. The first antibiotic effective against TUBERCULOSIS, it inter-

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feres with the tubercle bacillus's ability to synthesize certain vital proteins. It still has some use in combination with penicillin for treating endocarditis and with tetracyclines in the treatment of plague, tularemia, and brucellosis.

Stresa Front \'strā-zä\ (1935) Coalition of France, Britain, and Italy formed at Stresa, Italy, to oppose ADOLF HITLER's announced intention to rearm Germany, which violated terms of the Treaty of VERSAILLES. When Italy invaded Ethiopia, France and Britain tried to reconcile the action with the need to remain united against Germany, but the coalition soon dissolved.

Stresemann \'shtrā-zə-ˌmän**, Gustav** (b. May 10, 1878, Berlin, Ger.—d. Oct. 3, 1929, Berlin) German chancellor and foreign minister of the WEIMAR REPUBLIC. Noted as an expert on municipal affairs and a writer on economics, he was elected to the Reichstag (1907) as a member of the National Liberal Party. In 1918 he founded the GERMAN PEOPLE'S PARTY and sought to form coalitions with other democratic parties. As chancellor (1923) and foreign minister (1923–29), he worked to restore Germany's international status, pursuing a conciliatory policy with the Allied Powers. He negotiated the Pact of LOCARNO, supported the reparations revisions in the DAWES and YOUNG plans, and secured Germany's admission to the League of Nations. He shared the 1926 Nobel Prize for Peace with ARISTIDE BRIAND.

Gustav Stresemann.
COURTESY OF BILDARCHIV PREUSSISCHER KULTURBESITZ BPK, BERLIN

stress In PHONETICS, an emphasis given to a SYLLABLE of speech by making it louder than the rest of the word. This emphasis may have no meaning; for example, Czech words are regularly stressed on the first syllable. It may, however, distinguish the meanings of similarly spelled but differently pronounced words; for example, *permit* is stressed on the first syllable as a noun and on the second as a verb. It may also be applied to a word to express its importance in a sentence. See also INTONATION.

stress In the physical sciences and engineering, the force per unit area within materials that arises from externally applied forces, uneven heating, or permanent deformation. Normal stress refers to the stress caused by forces that are perpendicular to a cross-section area of the material. Shear stress arises from forces that are parallel to the plane of the cross section. Stress is expressed as the quotient of a force divided by an area.

stress In psychology, a state of bodily or mental tension resulting from factors that tend to alter an existent equilibrium. Stress is an unavoidable effect of living and is an especially complex phenomenon in modern technological society. It has been linked to CORONARY HEART DISEASE, PSYCHOSOMATIC DISORDERS, and various other mental and physical problems. Treatment usually consists of a combination of COUNSELING or PSYCHOTHERAPY and medication.

strike Collective refusal by employees to work under the conditions set by employers. Strikes may arise from disputes over wages and working conditions. They may also be conducted in sympathy with other striking workers, or for purely political goals. Many strikes are organized by LABOUR UNIONS; strikes not authorized by the union (wildcat strikes) may be directed against union leadership as well as the employer. The right to strike is granted in principle to workers in nearly all industrialized countries, and its use has paralleled the rise of labour unions since the 19th century. Most strikes are intended to inflict a cost to employers for failure to meet specific demands. Among Japanese unions, strikes are not intended to halt production for long periods of time and are more akin to demonstrations. In western Europe and elsewhere, workers have carried out GENERAL STRIKES aimed at winning changes in the political system rather than concessions from employers. The decision to call a strike does not come easily, because union workers risk a loss of income for long periods of time. They also risk the permanent loss of their jobs, especially when replacement workers hired to continue operations during the strike stay on as permanent employees. See also BOYCOTT; LOCKOUT.

strike In geology, the direction of the line formed by the intersection of a fault, bed, or other planar feature and a horizontal plane. Strike indicates the orientation of planar structural features such as faults, beds, joints, and folds.

Strindberg \'strin-ˌbərʸ,\ *English* \'strind-ˌbərg**, (Johan) August** (b. Jan. 22, 1849, Stockholm, Swed.—d. May 14, 1912, Stockholm) Swedish playwright and novelist. While working as a journalist, he wrote the historical drama *Mäster Olof* (1872); though rejected by the national theatre and not produced until 1890, it is now considered the first modern Swedish drama. He won fame with his novel *The Red Room* (1879), which satirized the Stockholm art world. His unhappy life included three marriages and episodes of mental instability. In his most creative period he moved restlessly around Europe for six years, writing his three major plays: *The Father* (1887), *Miss Julie* (1888), and *The Creditors* (1890). These iconoclastic works portrayed the battle of the sexes using a combination of dramatic naturalism and psychology. During this period he also wrote three novels. After a mental breakdown he experienced a religious conversion that inspired symbolic dramas such as *The Dance of Death* (1901), *A Dream Play* (1902), and five "chamber plays," including *The Ghost Sonata* (1907).

Strindberg, lithograph by Edvard Munch, 1896
COURTESY OF THE MUNCH-MUSEET, OSLO; PHOTOGRAPH, O. VAERING

string quartet Ensemble consisting of two violins, viola, and cello, or a work written for such an ensemble. Since c. 1775 such works have been perhaps the predominant genre of CHAMBER MUSIC. It was principally developed (if not quite invented) by JOSEPH HAYDN, who wrote some 70 quartets between 1757 and 1803. WOLFGANG AMADEUS MOZART, LUDWIG VAN BEETHOVEN, FRANZ SCHUBERT, BÉLA BARTÓK, and DMITRY SHOSTAKOVICH are the preeminent subsequent quartet composers. Works called string quartets have traditionally observed the four-movement design of the SONATA and SYMPHONY. Like most chamber music genres, quartet music was traditionally intended primarily for the private enjoyment of amateur musicians rather than for public performance.

string theory Any of a number of theories in PARTICLE PHYSICS that treat elementary particles (see SUBATOMIC PARTICLE) as infinitesimal one-dimensional "stringlike" objects rather than dimensionless points in SPACETIME. Different vibrations of the strings correspond to different particles. Introduced in the early 1970s in attempts to describe the STRONG FORCE, string theories became popular in the 1980s when it was shown that they might provide a fully self-consistent QUANTUM FIELD THEORY that could describe GRAVITATION as well as the WEAK, strong, and ELECTROMAGNETIC forces. The development of a unified quantum field theory is a major goal in theoretical particle physics, but inclusion of gravity usually leads to difficult problems with infinite quantities in the calculations. The most self-consistent string theories propose 11 dimensions; 4 correspond to the 3 ordinary spatial dimensions and time, while the rest are curled up and not perceptible.

stringed instrument Any musical instrument that produces sound by the vibrations of strings. The strings may be of gut, metal, fibre, or plastic, and may be plucked, bowed, or struck. The orchestral stringed instruments include the VIOLIN, VIOLA, CELLO, DOUBLE BASS, and HARP. Keyboard stringed instruments include the CLAVICHORD, HARPSICHORD, PIANO, and VIRGINAL. See also AEOLIAN HARP; BALALAIKA; DULCIMER; GUITAR; KITHARA; KOTO; LUTE; LYRE; MANDOLIN; PIPA; SITAR; ʿŪD; UKULELE; VIOL; ZITHER.

strip mining Technique for the surface mining of COAL by removing the soil and rock overburden above a seam and extracting the exposed mineral. The method is used to best advantage where the coal seam is thin and not deeply buried. (Thicker and deeper seams would be extracted by open-pit or underground mining.) Strip mining is most economical where flat terrain and horizontal seams permit a large area to be stripped. Where deposits occur in rolling or mountainous terrain, a contour method is used that creates a shelf with a slope on one side and an almost vertical wall

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on the other. A variety of equipment is used, including dozers, scrapers, hydraulic shovels, draglines, and bucket-wheel excavators. Concern over the environmental effects of strip mining have resulted in numerous requirements for the reclamation of excavated land.

strobilus See CONE

stroboscope Instrument that repeatedly illuminates a rotating or vibrating object in order to study the motion of the object or to determine its rotation speed or vibration frequency. The effect is achieved by producing light in very short bursts timed to occur when the moving part is in the same phase of its motion. By use of the stroboscope, a machine part, for example, may be made to appear to slow down or stop.

Stroessner \'stres-nər**, Alfredo** (b. Nov. 3, 1912, Encarnación, Para.) Military leader and president of Paraguay (1954–89). The son of a German immigrant, Stroessner joined the army in 1932 and rose to become commander in chief in 1951. He deposed Pres. Federico Chávez (b. 1881?—d. 1978) and was the sole candidate in the 1954 presidential elections. He stabilized the currency, moderated inflation, and provided some new schools and public health facilities, but he spent half the national income on the military establishment in order to preserve his authority and harshly suppressed his political opponents. After his election to an eighth successive term, he was deposed in a coup d'état and went into exile.

Stroganov \'strȯ-gə-nəf\ **school** School of ICON painting named for its original patrons, the Stroganov family, that flourished in Russia in the late 16th and 17th century. The artists perfected their work in the service of the tsar in Moscow. The paintings, designed for private use, were produced in a muted colour range dominated by golden browns with gold and silver linear highlights. Small and exquisitely detailed and embellished with frames and halos of beaten gold and silver, they represent the last vital stage of Russian medieval painting before the westernization of Russian art at the end of the 17th century.

"SS. Boris and Gleb," icon by a follower of Prokopy Chirin, Stroganov school, 17th century; in the State Tretyakov Gallery, Moscow
NOVOSTI PRESS AGENCY, MOSCOW

Stroheim \'shtrō-ˌhīm,\ *English* \'strō-ˌhīm**, Erich von** *orig.* **Erich Oswald Stroheim** (b. Sept. 22, 1885, Vienna, Austria—d. May 12, 1957, near Paris, France) Austrian-U.S. film director and actor. He was the son of a Jewish hatmaker, and he immigrated to the U.S. after his military service. He arrived in Hollywood in 1914, where he worked for D.W. GRIFFITH and performed his trademark role as a Prussian officer. His directorial debut, *Blind Husbands* (1919), was followed by *The Devil's Passkey* (1920) and *Foolish Wives* (1922). *Greed* (1924), his masterpiece, was a landmark in film realism; however, it was cut from 9 hours to 140 minutes—without his approval—before its release. It was followed by *The Merry Widow* (1925), *The Wedding March* (1928), and *Queen Kelly* (1928). His extravagance and demand for artistic control scuttled his directing career, and he returned to acting, notably in *Grand Illusion* (1937) and *Sunset Boulevard* (1950).

Erich von Stroheim in *Foolish Wives*, 1922.
BROWN BROTHERS

stroke *or* **cerebrovascular accident (CVA)** Sudden impairment of BRAIN function due to HYPOXIA, which may cause death of brain tissue. HYPERTENSION, ATHEROSCLEROSIS, SMOKING, high CHOLESTEROL, DIABETES, old age, ATRIAL FIBRILLATION, and genetic defects are risk factors. Strokes due to THROMBOSIS (the most common cause), EMBOLISM, or arterial spasm, which cause ischemia (reduced blood supply), must be distinguished from those due to hemorrhage (bleeding), which are usually severe and often fatal. Depending on its site in the brain, a stroke's effects may include APHASIA, ATAXIA, local PARALYSIS, and/or disorders of one or more senses. A massive stroke can produce one-sided paralysis, inability to speak, coma, or death within hours or days. ANTICOAGULANTS can arrest strokes caused by clots but worsen those caused by bleeding. If the cause is closure of the major artery to the brain, surgery may clear or bypass the obstruction. Rehabilitation and speech therapy should begin within two days to retain and restore as much function as possible, since survivors may live many more years. Transient ischemic attacks ("mini strokes"), with short-term loss of function, result from blockage of blood flow to small areas. They tend to recur and may worsen, leading to multi-infarct dementia or stroke.

stromatolite \strō-'ma-tᵊl-ˌīt\ Layered deposit, mainly of LIMESTONE, formed by the growth of blue-green algae (see CYANOBACTERIA). These structures are usually characterized by thin, alternating light and dark layers that may be flat, hummocky, or dome-shaped. Stromatolites were common in PRECAMBRIAN TIME (more than 543 million years ago). Some of the first forms of life on Earth are recorded in stromatolites in rocks 3.5 billion years old. Stromatolites continue to form in certain areas today, most abundantly in Shark Bay in western Australia.

Stromboli \'sträm-bō-(ˌ)lē\ Volcano, Stromboli Island, off northeastern SICILY, Italy. One of Europe's most active volcanoes, it is 3,038 ft (926 m) high. Though the last serious eruption was in 1921, lava flows continuously from its crater to the sea. Tourists are attracted to the island by its volcano, climate, and beaches.

Strong, William (b. May 6, 1808, Somers, Conn., U.S.—d. Aug. 19, 1895, Lake Minnewaska, N.Y.) U.S. jurist. He served in the U.S. House of Representatives (1847–51) and on the Pennsylvania state supreme court (1857–68). In 1870 he was appointed to the U.S. SUPREME COURT by ULYSSES S. GRANT. In 1871 he spoke for the majority as the court overturned the *Hepburn* decision of the previous year, a reversal that allowed Congress the power to issue paper money as legal tender, a position favoured by Grant. Strong retired from the court in 1880.

strong force *or* **strong nuclear force** Fundamental force acting between elementary particles of matter, mainly QUARKS. The strong force binds quarks together in clusters to form PROTONS and NEUTRONS and heavier short-lived particles. It holds together the atomic NUCLEUS and underlies interactions among all particles containing quarks. In strong interactions, quarks exchange gluons, carriers of the strong force, which are massless particles with one unit of intrinsic SPIN. Within its short range (about 10^{-15} m), the strong force appears to become stronger with distance. At such distances, the strong interaction between quarks is about 100 times greater than the ELECTROMAGNETIC FORCE.

strontium \'strän(t)-shē-əm, 'strän-tē-əm\ Chemical ELEMENT, one of the ALKALINE EARTH METALS, chemical symbol Sr, atomic number 38. A soft metal, it has a silvery lustre when freshly cut but reacts rapidly with air. In both the metal and the compounds (in which it has VALENCE 2), strontium resembles CALCIUM and BARIUM so closely that it has few uses that the other two elements cannot supply more cheaply. The nitrate and chlorate, very volatile, give off brilliant crimson flames and are used in flares, fireworks, and tracer bullets. The radioactive ISOTOPE strontium-90 (see RADIOACTIVITY), produced in nuclear explosions, is the principal health hazard in FALLOUT; it can replace some of the calcium in foods, concentrate in bones and teeth, and cause RADIATION INJURY.

structural geology Scientific discipline concerned with rock deformation on both small and large scales. Its scope ranges from submicroscopic lattice defects in crystals to fault structures and fold systems of the Earth's crust. Depending on the scale, the general techniques used are the same as those used in PETROLOGY, field geology, and GEOPHYSICS. Furthermore, since the processes that cause rocks to deform can rarely be observed directly, computer models are also used.

structural system In building construction, the particular method of assembling and constructing structural elements of a building so that they support and transmit applied loads safely to the ground without exceeding the allowable stresses in the members. Basic types of systems include BEARING-WALL, post-and-beam, frame, membrane, and suspension. They fall into three major categories: low-rise, high-rise, and long-span. Systems for long-span buildings (column-free spaces of over 100 ft, or 30 m) include tension and compression systems (subject to bending) and funic-

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ular systems, which are shaped to experience either pure tension or pure compression. Bending structures include the GIRDER and two-way grids and slabs. Funicular structures include CABLE STRUCTURES, MEMBRANE STRUCTURES, and vaults and domes. See also FRAMED STRUCTURE; POST-AND-BEAM SYSTEM; SHELL STRUCTURE.

structuralism European critical movement of the mid-20th century. It is based on the linguistic theories of FERDINAND DE SAUSSURE, which hold that language is a self-contained system of signs, and the cultural theories of CLAUDE LÉVI-STRAUSS, which hold that cultures, like languages, can be viewed as systems of signs and analyzed in terms of the structural relations among their elements. Central to structuralism is the notion that binary oppositions (e.g., male/female, public/private, cooked/raw) reveal the unconscious logic or "grammar" of a system. Literary structuralism views literary texts as systems of interrelated signs and seeks to make explicit their hidden logic. Prominent figures in the structuralist movement are MICHEL FOUCAULT, JACQUES LACAN, ROMAN JAKOBSON, and ROLAND BARTHES. Areas of study that have adopted and developed structuralist premises and methodologies include SEMIOTICS and narratology. See also DECONSTRUCTION.

Structured Query Language See SQL

Struma River River, western Bulgaria and northeastern Greece. Rising in the RHODOPE MOUNTAINS southwest of SOFIA, Bulg., it courses 258 mi (415 km) southeast to the Aegean Sea. Its upper valley is a major source of brown coal for Bulgaria, and its lower course flows through a wide agricultural valley.

Struve \'shtrü-və**, Friedrich Georg Wilhelm von** (b. April 15, 1793, Altona, Den.—d. Nov. 23, 1864, St. Petersburg, Russia) German-born Russian astronomer. He left Germany for Russia in 1808 to avoid conscription in the Napoleonic armies; he subsequently joined the faculty at the University of Dorpat and became director of its observatory. The founder of the modern study of BINARY STARS, he measured some 3,000 binaries in his survey of more than 120,000 stars. He was also among the first to measure stellar PARALLAX. In 1835, at the request of Tsar NICHOLAS I, he went to Pulkovo to supervise construction of a new observatory, becoming its director in 1839. His son, Otto Struve (1819–1905), served as director of Pulkovo Observatory (1862–89); his grandson Gustav Wilhelm Ludwig Struve (1858–1920) was director of University of Kharkov observatory; OTTO STRUVE was his great-grandson.

Struve \\ *English* \'strü-vē**, Otto** (b. Aug. 12, 1897, Kharkov, Ukraine, Russian Empire—d. April 6, 1963, Berkeley, Calif., U.S.) Russian-born U.S. astronomer. The great-grandson of FRIEDRICH G.W. VON STRUVE, he suspended his studies to serve in the Russian army in World War I before immigrating to the U.S. On the staff of Yerkes Observatory, he made important contributions to stellar spectroscopy and astrophysics, notably the discovery of the widespread distribution of hydrogen and other elements in space. He served as director of Yerkes (beginning 1932) and later of McDonald Observatory in Texas, which he organized. He later taught at the University of Chicago (beginning 1947) and UC-Berkeley, and he directed the National Radio Astronomy Observatory in Green Bank, W.V. (1959–62). A prolific writer, he published about 700 papers and several books.

Struve \'strü-və**, Pyotr (Berngardovich)** (b. Feb. 7, 1870, Perm, Russia—d. Feb. 26, 1944, Paris, France) Russian economist and journalist. In 1894 he wrote a well-regarded Marxist analysis of Russian capitalism and in 1898 a manifesto for the newly formed RUSSIAN SOCIAL-DEMOCRATIC WORKERS' PARTY. After his arrest and exile in 1901, he broke with revolutionary Marxism; from 1902 to 1905 he edited the illegal but widely read journal *Osvobozhdeniy* ("Liberation"), in which he called for a constitutional monarchy. He returned to Russia in 1905, joined the CONSTITUTIONAL DEMOCRATIC PARTY, and edited the moderate journal *Russkaya mysly* ("Russian Thought"). In 1917 he opposed the Bolshevik takeover and left Russia for Paris and (after 1928) Belgrade.

strychnine \'strik-ˌnīn\ Organic compound, a poisonous ALKALOID obtained from seeds of the nux vomica tree of India and related plants of the genus *Strychnos*. It does not dissolve in water nor well in alcohol, and it has an intense bitter taste. It has been used in rodent POISONS. Within 20 minutes after ingestion, it causes painful muscle contractions and convulsions, pulling the head back and arching the back; death usually results from respiratory muscle spasms. It is used in small doses by veterinarians as a stimulant.

Stuart, Charles Edward See CHARLES EDWARD, the Young Pretender

Stuart, Gilbert (Charles) (b. Dec. 3, 1755, North Kingston, R.I., U.S.—d. July 9, 1828, Boston, Mass.) U.S. painter. He went to London in 1775 and worked six years with BENJAMIN WEST. He opened his own London studio in 1782 and enjoyed great success but fled to Dublin in 1787 to escape his creditors. After six years there, he returned to the U.S. He developed a distinctively American portrait style and quickly established himself as the nation's leading portraitist. Critics have praised his painterly brushwork, luminous colour, and psychological penetration. Of his nearly 1,000 portraits, the most famous is an unfinished head of GEORGE WASHINGTON (1796).

Mrs. Richard Yates, oil painting by Gilbert Stuart, 1793–94; in the National Gallery of Art, Washington, D.C.
COURTESY OF THE NATIONAL GALLERY OF ART, WASHINGTON, D.C., ANDREW MELLON COLLECTION

Stuart, house of *or house of* **Stewart** *or* **Steuart** Royal house of Scotland (1371–1714) and of England (1603–49, 1660–1714). The earliest members of the family were stewards in 11th-century Brittany; in the 12th century a member entered the service of DAVID I (r. 1124–53) in Scotland and received the title of steward. The 6th steward married the daughter of King ROBERT I the Bruce, and in 1371 their son became King ROBERT II, the first Stewart king of Scotland (r. 1371–90). His descendants in the 15th–17th centuries included the Scottish monarchs JAMES I, JAMES II, JAMES III, JAMES IV, MARY, QUEEN OF SCOTS, and James VI (who inherited the English throne as JAMES I). The Stuarts (who eventually adopted the French-influenced spelling of their name) were excluded from the English throne after CHARLES I until the restoration of CHARLES II in 1660. He was followed by JAMES II, WILLIAM III and MARY II, and ANNE. The Stuart royal line ended in 1714, and the British crown passed to the house of HANOVER, despite later claims by James II's son JAMES EDWARD (the Old Pretender) and grandson CHARLES EDWARD (the Young Pretender).

Stuart, James Edward See JAMES EDWARD, the Old Pretender

Stuart, Jeb *orig.* **James Ewell Brown Stuart** (b. Feb. 6, 1833, Patrick county, Va., U.S.—d. May 12, 1864, Yellow Tavern, near Richmond, Va.) U.S. army officer. He graduated from West Point and was an aide to Col. ROBERT E. LEE in the defeat of JOHN BROWN's raid on Harpers Ferry. In 1861 he joined the Confederate army, becoming brigadier general of a cavalry brigade. On scouting raids he obtained information on Union troop movements that contributed to Confederate victories at the Seven Days' Battle and the Second Battle of BULL RUN; Lee called Stuart the "eyes of the army." As major general, he helped win the battles of Fredericksburg and Chancellorsville. Before the Battle of GETTYSBURG, he was instructed by Lee to gather information on Union troop movements; he was delayed on a raid and arrived after the battle had begun. Though criticized for his action, he continued to provide intelligence to Confederate forces. He was mortally wounded in the Confederate defeat at Spotsylvania Courthouse.

Stuart style Style of visual arts produced in Britain during the reign of the house of STUART (1603–1714, excepting the interregnum of OLIVER CROMWELL). Though the period encompassed several specific stylistic movements, artists through much of the period looked for inspiration to contemporary movements (primarily the Baroque) on the Continent, especially in Italy, Flanders, and France. Masters of the Stuart style included the architects INIGO JONES and CHRISTOPHER WREN. See also JACOBEAN AGE; QUEEN ANNE STYLE.

Stubbs, George (b. Aug. 24, 1724, Liverpool, Eng.—d. July 10, 1806, London) British animal painter and anatomical draftsman. Son of a prosperous tanner, he was briefly apprenticed to a painter but was basically self-taught. His masterly depictions of hunters and racehorses brought him innumerable commissions. Perhaps more impressive than the single portraits are his pictures of informal groups of horses, such as *Mares and Foals in a Landscape* (c. 1760–70). He also painted many other animals, including lions, tigers, giraffes, monkeys, and rhinoceroses, which he was able to observe in private menageries. His book *The Anatomy of the Horse* (1762), containing 18 masterfully engraved plates, was widely acclaimed.

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stucco Exterior or interior plasterwork used as three-dimensional ornamentation, as a smooth paintable surface, or as a wet ground for fresco painting. Today the term is most often restricted to the rough plaster coating of exterior walls. Examples occur worldwide; stucco was applied to the temple walls of ancient Greece as early as 1400 BC. Roman architects stuccoed the rough stone or brick walls of monuments such as the baths at HADRIAN'S VILLA. Stucco was widely used in Baroque and Renaissance architecture. Because of the many ways in which it can be treated, stuccowork has remained popular. In the warmer regions of the U.S., the 1920s stucco bungalow became virtually ubiquitous.

Studebaker family U.S. automobile manufacturers whose firm became the world's largest producer of horse-drawn vehicles and a leader in automobile manufacturing. In 1852 Clement Studebaker (1831–1901) started a blacksmith and wagon shop in South Bend, Ind., with his brother Henry (1826–1895). Later joined by their brothers John, Peter, and Jacob, the family business supplied vehicles to the U.S. government during the American Civil War and later helped outfit settlers moving west. By 1902 the company had built its first electric cars and, by 1904, gasoline-powered cars. In 1954 the Studebaker Corp. merged with the Packard Motor Car Co.; in 1966 it ceased production.

Students for a Democratic Society (SDS) Activist student organization in the U.S. Founded at the University of Michigan in 1960, its chapters were initially principally involved in the CIVIL RIGHTS MOVEMENT. Its "Port Huron Statement" of principles (1962) called for a new "participatory democracy." After organizing a national march in 1965 to protest U.S. involvement in the VIETNAM WAR, it became more militant, organizing student sit-ins to protest universities' participation in defense-related research. By 1969 the SDS had split into factions; the most notorious was the terrorist-oriented Weathermen, or Weather Underground. By the mid-1970s the group was defunct.

studio system System whereby U.S. movie companies controlled all aspects of production, distribution, and exhibition. In the 1920s film studios such as PARAMOUNT and MGM acquired theatre chains to strengthen their vertical control of the industry, and WARNER BROTHERS, RKO, and TWENTIETH CENTURY-FOX built similar empires soon thereafter. Studio heads exerted control over the types of movies to be made and the directors and actors to be hired; only a few directors maintained some independent control over their films. The studio system also developed the "star system," by which certain actors and actresses were groomed for stardom, with studio executives choosing their roles, publicizing their glamorized offscreen lives, and keeping them under control through long contracts. The system declined after a 1948 Supreme Court decision forced the large studios to sell their theatre chains and increasing competition from television forced studios to limit their staffs, and by the 1960s it had effectively ended.

stupa Monument erected in memory of the BUDDHA or a Buddhist saint, often marking a sacred spot, commemorating an event, or housing a relic. Stupas are architectural symbols of the Buddha's death. A simple stupa may consist of a circular earthenware base supporting a massive solid dome from which projects an umbrella, symbolizing protection. This basic design is the inspiration for other types of Buddhist monuments, including PAGODAS, seen throughout Asia. Worship consists of walking clockwise around a stupa. Many important stupas have become places of PILGRIMAGE.

Stupa III and its single gateway, Sanchi, Madhya Pradesh state, India
HOLLE BILDARCHIV

sturgeon Any of about 20 species (family Acipenseridae) of large, primitive fishes that live mainly in southern Russia, Ukraine, and North America. Most species live in the sea and ascend rivers to spawn; a few live permanently in fresh water. Four tactile barbels near the toothless mouth detect invertebrates and small fishes on the mud bottom. Sturgeon flesh and eggs, or roe (CAVIAR), are sold for food. The swim bladder is used in isinglass, a gelatin. The Baltic sturgeon (*Acipenser sturio*) and several other species are endangered. The Atlantic sturgeon (*A. oxyrhynchus*),however, is common along the eastern coast of North America and generally is about 10 ft (3 m) long and weighs about 500 lb (225 kg). See also BELUGA.

Sturges \'stər-jəs**, Preston** *orig.* **Edmond Preston Biden** (b. Aug. 29, 1898, Chicago, Ill., U.S.—d. Aug. 6, 1959, New York, N.Y.) U.S. film director. Initially a playwright, he wrote the Broadway hits *Strictly Dishonorable* (1929) and *Child of Manhattan* (1931). After moving to Hollywood, he became a noted screenwriter and won an Academy Award for *The Great McGinty* (1940), the first film he directed. He went on to write and direct distinctive satirical comedies such as *The Lady Eve* (1941), *Sullivan's Travels* (1941), *The Palm Beach Story* (1941), *The Miracle of Morgan's Creek* (1944), *Hail the Conquering Hero* (1944), and *Unfaithfully Yours* (1948), characterized by their witty dialogue, rapid pace, and memorable minor characters.

Sturm und Drang \ˌshtůrm-ůnt-'dräŋ, ˌstůrm-ənt-'dräŋ\ *German* **"storm and stress"** German literary movement of the latter half of the 18th century characterized by a revolt against what the writers saw as the ENLIGHTENMENT cult of rationalism and the sterile imitation of French literature. It exalted nature, intuition, impulse, instinct, emotion, fancy, and inborn genius as the wellsprings of literature. Influenced by Jean-Jacques ROUSSEAU, JOHANN GOTTFRIED HERDER, and others, it took its name from the title of a play by Friedrich von Klinger (1752–1831). Dramatic works were the movement's most characteristic product. Its most gifted representatives were FRIEDRICH SCHILLER and JOHANN WOLFGANG VON GOETHE, whose *Sorrows of Young Werther* (1774) epitomizes its spirit.

Sturtevant \'stərt-ə-vənt**, Alfred (Henry)** (b. Nov. 21, 1891, Jacksonville, Ill., U.S.—d. April 5, 1970, Pasadena, Calif.) U.S. geneticist. He received his Ph.D. from Columbia University and taught principally at California Institute of Technology (1928–70). In 1912 he developed a technique for mapping the location of specific genes of the chromosomes in *Drosophila*. He later proved that crossing-over (the exchange of genes between chromosomes) could be prevented in *Drosophila*. He was one of the first to warn against the hazards of fallout as a consequence of nuclear bomb testing.

Sturzo \'stůrt-sō**, Luigi** (b. Nov. 26, 1871, Caltagirone, Sicily—d. Aug. 8, 1959, Rome, Italy) Italian priest and political leader. Ordained a priest in 1894, he earned a doctorate in Rome, then returned to his native Sicily to help the oppressed miners and peasants. As mayor of Caltagirone (1905–20), he built community housing and other public works. In 1919 he founded the ITALIAN POPULAR PARTY and became its political secretary. Refusing to support BENITO MUSSOLINI, he went into exile in 1924. He returned in 1946, when his political movement was revived as the Christian Democratic Party. In 1952 he was appointed senator for life. He wrote several works of Christian social philosophy, including *Church and State* (1939) and *Italy and the Coming World* (1945).

stuttering *or* **stammering** *or* **dysphemia** \dis-'fē-mē-ə\ Speech defect affecting the rhythm and fluency of speech, with involuntary repetition of sounds or SYLLABLES and intermittent blocking or prolongation of sounds, syllables, and words. Stutterers consistently have trouble with words starting with CONSONANTS, first words in sentences, and multisyllable words. Stuttering has a psychological, not a physiological, basis, tending to appear in children pressured to speak fluently in public. In earlier times, stutterers were subjected to often torturous efforts to cure them. Today it is known that about 80% recover without treatment, usually by early adulthood. This probably results from increased self-esteem, acceptance of the problem, and consequent relaxation. See also SPEECH THERAPY.

Stuttgart \'shtůt-ˌgärt\ City (pop., 2002 est.: city, 587,152; urban agglom., 2,529,675), southwestern Germany. Located on the NECKAR RIVER, Stuttgart was originally a 10th-century stud farm. It became a town in the 13th century and passed to the counts of WÜRTTEMBERG, serving as their capital until the 19th century. The THIRTY YEARS' WAR, French invasions in the 17th century, and heavy bombing during World War II took a toll on the city. Many historic buildings have been rebuilt, including the 13th-century castle. It is a cultural, transportation, industrial, and publishing centre. The University of Stuttgart was founded in 1829.

Stuyvesant \'stī-və-sənt**, Peter** (b. c. 1592, Scherpenzeel, Friesland, Neth.—d. February 1672, near New York, N.Y.) Dutch colonial governor. In 1643 he became director of the Dutch West India Co.'s Caribbean colonies and in 1645 director general of all Dutch possessions in North America, including New Netherland and the Caribbean. He arrived in New Amsterdam (later New York City) in 1647 and soon faced the burghers' demands for self-government. He established a municipal government but continued to control it. He settled the boundary with Connecticut (1650), expelled the Swedes from New Sweden on the Delaware River,

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and incorporated the colony into Dutch territory (1655). Incursions from the New England colonies and a squadron sent by Charles II forced him to surrender New Netherland to the British (1664).

sty *or* **hordeolum** \hȯr-'dē-ə-ləm\ Infection of an eyelid gland. An external sty results from infection of a SEBACEOUS GLAND at the edge of the eyelid; tears flow and the eye feels tender, as if something is in it. The sty reddens and swells. Warm compresses help it break sooner. An internal sty is caused by infection of a meibomian gland under the eyelid lining. More painful than an external sty, it usually breaks through the inner lining of the lid when it discharges and may leave a painless cyst (chalazion) at the site. See also BOIL.

Style Moderne See ART DECO

stylistics Aspect of literary study that emphasizes the analysis of various elements of style (such as METAPHOR and diction). The ancients saw style as the proper adornment of thought. In this view, which prevailed throughout the Renaissance, devices of style can be catalogued and ideas can be framed with the help of model sentences and prescribed types of figures suited to the mode of discourse. In more recent theories, the relationship of style and the individual writer's unique vision of reality is emphasized.

stylolite \'stī-lə-ˌlīt\ Sedimentary structure consisting of a series of relatively small, alternating, interlocked, toothlike columns of stone; it is common in LIMESTONE, MARBLE, and similar rock. The individual columns never appear singly but occur as a succession of interpenetrations that in cross section make a zigzag suture across the face of the stone. Most geologists believe that they are of secondary origin; that is, they result from differential chemical solution as groundwater circulates along a parting in hardened rock.

Styne, Jule *orig.* **Julius Kerwin Stein** (b. Dec. 31, 1905, London, Eng.—d. Sept. 20, 1994, New York, N.Y., U.S.) British-born U.S. songwriter. Born to Ukrainian Jewish parents, he and his family settled in Chicago, Ill., U.S., in 1912. His first hit song was published in 1926. In the early 1930s he changed his name to avoid confusion with another performer. He moved to Hollywood, Calif., in 1937 to write film musicals. In the 1940s he worked with lyricist SAMMY CAHN, writing ballads for FRANK SINATRA, the film musical *Anchors Aweigh* (1945), and the Broadway musical *High Button Shoes* (1947). He collaborated with other lyricists on musicals such as *Gentlemen Prefer Blondes* (1949), *Bells Are Ringing* (1956), *Gypsy* (1959), and *Funny Girl* (1964). His songs include "Let It Snow," "The Party's Over," and "People."

Styron, William (b. June 11, 1925, Newport News, Va., U.S.) U.S. novelist. Educated at Duke University, Styron became part of the American expatriate community in Paris in the 1950s. His first novel, *Lie Down in Darkness* (1951), tells of a disturbed young woman who commits suicide. His fourth, the controversial *Confessions of Nat Turner* (1967, Pulitzer Prize), vividly evokes the slavery era. His later work includes *Sophie's Choice* (1979), examining ramifications of the Holocaust; and *Darkness Visible* (1990), a nonfiction account of his depression. His works often treat violent themes in a rich, Faulknerian style.

Styx \'stiks\ In GREEK MYTHOLOGY, a river of the underworld. The name comes from a Greek word that denotes both hatred and extreme cold, and it expresses loathing of death. In the epics of HOMER, the gods swore by the water of Styx as their most binding oath. HESIOD personified Styx as the daughter of Oceanus and the mother of Emulation, Victory, Power, and Might. The ancients believed that its water was poisonous and would dissolve any vessel except one made of the hoof of a horse or an ass.

Su Song *or* **Su Sung** \'sü-'sùŋ\ (b. 1020, Fujian Province, China—d. 1101, Kaifeng) Chinese scholar and administrative and financial expert in the imperial bureaucracy. His *Illustrated Pharmacopoeia* (1070) revealed his knowledge of drugs, zoology, metallurgy, and related technology. An armillary clock that he built to serve as the basis of calendrical reform was housed in a 35-ft (11-m) tower and powered by a waterwheel and chain drive; its mechanism anticipated techniques that would not be used in Europe for hundreds of years.

Suárez \'swä-rāth**, Francisco** (b. Jan. 5, 1548, Granada, Spain—d. Sept. 25, 1617, Lisbon) Spanish theologian and philosopher. In his *Metaphysical Disputations* (1597), he drew on the works of ARISTOTLE, St. THOMAS AQUINAS, John DUNS SCOTUS, and Luis de Molina (1535–1600) to discuss the FREE WILL PROBLEM and other metaphysical topics. He is widely considered the greatest Scholastic philosopher after Aquinas (see SCHOLASTICISM) and the major JESUIT theologian. His departures from Aquinas's positions have been considered significant enough to warrant the separate designation of his system as Suárezianism.

Suárez, Hugo Bánzer See Hugo BÁNZER SUÁREZ

subatomic particle *or* **elementary particle** Any of various self-contained units of matter or energy. Discovery of the ELECTRON in 1897 and of the atomic NUCLEUS in 1911 established that the ATOM is actually a composite of a cloud of electrons surrounding a tiny but heavy core. By the early 1930s it was found that the nucleus is composed of even smaller particles, called PROTONS and NEUTRONS. In the early 1970s it was discovered that these particles are made up of several types of even more basic units, named QUARKS, which, together with several types of LEPTONS, constitute the fundamental building blocks of all matter. A third major group of subatomic particles consists of BOSONS, which transmit the forces of the universe. More than 200 subatomic particles have been detected so far, and most appear to have a corresponding antiparticle (see ANTIMATTER).

subbituminous coal Dark-brown to black COAL, intermediate in rank between LIGNITE and BITUMINOUS COAL. It contains less water and is harder than lignite, making it easier to transport, store, and use. It has lower heating value than bituminous coal, but its sulfur content is often low, so that a number of coal-fired electric-power plants have switched from bituminous to subbituminous coal and lignite (which also tends to have relatively low sulfur). Subbituminous deposits are found in the U.S., Canada, Brazil, Germany, Russia, Ukraine, Australia, and China.

subconscious See UNCONSCIOUS

subduction zone Oceanic trench area in which, according to the theory of PLATE TECTONICS, the seafloor underthrusts an adjacent plate, dragging the accumulated trench sediments downward into the Earth's upper mantle. See also DEEP-SEA TRENCH.

Subic Bay Inlet of the South CHINA SEA, southwestern LUZON, Philippines. From 1901 it was the site of the U.S.-operated Subic Bay Naval Station, the largest naval installation in the Philippines. The area suffered heavy damage in World War II and was occupied by the Japanese in 1942–44. The base played a prominent supply and maintenance role in the VIETNAM WAR (1955–75). Control of the bay was transferred to the Philippines in 1992, and it subsequently was redeveloped as a free-trade zone and recreational and tourist destination.

sublimation In physics, the change of state of a substance from a solid to a gas without first becoming liquid. One example is the vaporization of frozen carbon dioxide, or dry ice, at ordinary atmospheric pressure and temperature. The phenomenon occurs at pressures and temperatures (both relatively low) where solid and vapour PHASES coexist in equilibrium. Preservation of food by freeze-drying involves sublimation of water from the food in a frozen state under vacuum.

submachine gun Lightweight automatic small-arms weapon chambered for relatively low-energy pistol cartridges and fired from the hip or shoulder. Submachine guns usually have box-type magazines that hold 10–50 cartridges, or occasionally drums holding more rounds. A short-range weapon, they are rarely effective at more than 200 yards (180 m). They can fire 650 or more rounds per minute and weigh 6–10 lbs (2.5–4.5 kg). Important types include the Thompson submachine gun, or tommy gun (patented 1920), the British Sten gun of World War II, and the later Israeli UZI.

submarine Naval vessel capable of operating underwater for sustained periods. In the 18th and 19th centuries, American inventors such as David Bushnell (1742?–1824) and ROBERT FULTON experimented with hand-powered submarines. In 1898 John P. Holland (1840–1914) launched the *Holland*, which had both a gasoline engine for surface locomotion and a battery-powered electric motor for submerged cruising; it was purchased by the U.S. government in 1900. The innovations of Simon Lake (1866–1945) were adopted first in Europe and later in the U.S. By the eve of World War I, all major navies had diesel-electric submarines. German U-BOATS were an especially potent threat; through World War II they introduced such innovations as the snorkel, which supplied fresh air to the diesel engine without having to surface the boat. Nuclear-powered submarines began service with the launching of the USS *NAUTILUS* in 1954. The abundant power provided by uranium-fueled reactors means that nuclear submarines can remain submerged and operate at high speed

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indefinitely. Only the navies of the U.S., Russia, Britain, France, and China have nuclear-powered submarines; other navies rely on conventional diesel-electric power. Subs may be armed with torpedoes, cruise missiles, or ballistic missiles fitted with nuclear warheads. Because they are so difficult to locate, they are of great importance in the forces of almost all maritime states. See also DEPTH CHARGE; SONAR; TRIDENT MISSILE.

submarine canyon Narrow, steep-sided underwater valley cut into a CONTINENTAL SLOPE. Submarine canyons resemble river canyons on land, usually having steep, rocky walls. They are found along most continental slopes. Those of the Grand Bahama Canyon, which are thought to be the deepest, cut nearly 3 mi (5 km) deep into the continental slope. Most submarine canyons extend only about 30 mi (50 km) or less, but a few are more than 200 mi (300 km) long.

submarine fan Accumulation of land-derived sediment on the seafloor; a fan is shaped like the section of a cone, with its apex at the mouth of a SUBMARINE CANYON. The sediments consist largely of sandy material that drops from the canyon current in successively finer layers. Submarine fan valleys, with low relief and natural levees, often occur on submarine fans. Several fans may coalesce laterally.

submarine fracture zone Long, narrow, and mountainous submarine lineation that generally separates ocean-floor ridges differing in depth by as much as 1 mi (1.6 km). The largest fracture zones, in the eastern Pacific, are more than 1,000 mi (1,600 km) long and 60–125 mi (100–200 km) wide. Numerous shorter fracture zones in the Atlantic are associated with the MID-ATLANTIC RIDGE.

submarine mine In military and naval operations, a stationary explosive device placed in the water and designed to destroy ships that touch or approach it. Submarine mines have been used since the mid-19th century. They consist of an explosive charge fitted with a device that detonates the charge when a ship or submarine is nearby. Placed by vessels called minelayers or dropped by aircraft, they are anchored to the sea floor by a cable. Various types of submarine mines are detonated by contact, by an approaching ship's magnetic field, by changes in water pressure, or by the sound of a ship's propellers. The mine was the most effective antisubmarine weapon in World War I. Its role was even greater in World War II, when mines sank 1,118 Allied ships and 1,316 Axis ships. See also LAND MINE, MINESWEEPER.

submarine plateau See OCEANIC PLATEAU

submarine slump In a SUBMARINE CANYON or on a CONTINENTAL SLOPE, a relatively rapid and sporadic downslope moving mass composed of sediment and organic debris that has built up slowly into an unstable or marginally stable mass. After an individual slump in a canyon, however, the material tends to continue falling in a series of slumps until the sediment mass attains a shallower, more stable slope. A slumping episode may also trigger other slumps farther down the canyon.

subpoena \sə-'pē-nə\ In law, a WRIT commanding the person upon whom it has been served to appear in court or before a congressional committee, GRAND JURY, or some other body, under a penalty for failure to comply. Unlike a SUMMONS, a subpoena may command the recipient to produce evidence necessary to the resolution of a legal matter or controversy.

subsidy Financial assistance, either through direct payments or through indirect means such as price cuts and favourable contracts, to a person or group in order to promote a public objective. Subsidies to transportation, housing, agriculture, mining, and other industries have been instituted on the grounds that their preservation or expansion is in the public interest. Subsidies to the arts, sciences, humanities, and religion also exist in many nations where the private economy is unable to support them. Examples of direct subsidies include payments in cash or in kind, while more-indirect subsidies include governmental provision of goods or services at prices below the normal market price, governmental purchase of goods or services at prices above the market price, and tax concessions. Although subsidies exist to promote the public welfare, they result in either higher taxes or higher prices for consumer goods. Some subsidies, such as protective TARIFFS, may also encourage the preservation of inefficient producers. A subsidy is desirable only if its effects increase total benefits more than total costs (see COST-BENEFIT ANALYSIS).

subsistence farming Form of farming in which nearly all the crops or livestock raised are used to maintain the farmer and his family, leaving little surplus for sale or trade. Preindustrial agricultural peoples throughout the world practiced subsistence farming. As urban centers grew, agricultural production became more specialized and commercial farming developed, with farmers producing a sizable surplus of certain crops, which they traded for manufactured goods or sold for cash. Subsistence farming persists today in sub-Saharan Africa and other developing areas.

subsoil Layer (stratum) of earth immediately below the surface soil, consisting predominantly of minerals and leached materials such as iron and aluminum compounds. HUMUS remains and clay accumulate in subsoil, but the teeming macroscopic and microscopic organisms that make the topsoil rich with organic matter spend little time in the subsoil layer. Below the subsoil is a layer of partially disintegrated rock, and underlying bedrock. Stripping topsoil while clearing land for crop growth or commercial development exposes the subsoil and increases the rate of EROSION of soil minerals.

substantive law See PROCEDURAL LAW

subsurface water See GROUNDWATER

Subud \'sü-büd\ Indonesian religious movement based on spontaneous and ecstatic exercises. Founded in 1933 by Muḥammad Subuh, a student of SUFISM who underwent a mystical experience in 1925, the movement was largely confined to Indonesia until it spread to Europe and the U.S. in the 1950s, chiefly because of the work of GEORGE GURDJIEFF. The central feature of Subud is the *latihan*, a group spiritual activity in which practitioners allow the power of God to express itself through unrestrained spontaneous activity. Unprogrammed singing, dancing, shouting, and laughter are thought to give rise to feelings of rapture and release and to promote psychological and physical healing.

subway Underground railway system used to transport passengers within urban and suburban areas. The first subway line, 3.75 mi (6 km) long, opened in London in 1863 and carried 9½ million passengers in its first year. The first electrified subway opened in 1890 in London (where it is called the underground or tube). Subways opened in Budapest in 1896 (the first on the European continent), Boston in 1897, Paris in 1900 (where it is called the *métro*), Berlin in 1902, New York in 1904, and later in Madrid (1919), Tokyo (1927), and Moscow (1935). Improvements in systems built from the 1970s on (including San Francisco, Washington, D.C., and Los Angeles) include computer technology to run subway trains by remote control, and refinements in track and car construction for faster, smoother, and quieter rides.

succubus See INCUBUS AND SUCCUBUS

succulent Any plant with fleshy, thick tissues adapted to water storage. Some succulents (e.g., the CACTUS) store water only in the stem and have no leaves or very small leaves; others (e.g., AGAVES) store water mainly in the leaves. Most have deep or broad root systems and are native to either deserts or regions that have a semiarid season. In succulents, the stomata (see STOMA) close during the day and open at night—the opposite of the usual pattern—in order to minimize TRANSPIRATION.

Suchow See YIBIN

sucker Any of 80–100 species (family Catostomidae) of freshwater food fishes found mostly in North America. Suckers can be distinguished from MINNOWS by the sucking mouth, with protrusible lips, on the underside of the head. Generally sluggish, they suck up detritus, invertebrates, and plants from the bottom of lakes and slow streams. The species vary greatly in size. The lake chubsucker (*Erimyzon sucetta*) grows to 10 in. (25 cm) long; the bigmouth buffalo fish (*Ictiobus cyprinellus*) grows to 35 in. (90 cm) and over 70 lbs (32 kg).

Sucker (*Catostomus*)
GRANT HEILMAN

suckerfish See REMORA

suckering Vegetative formation of a new stem and root system from an adventitious bud of a stem or root, either naturally or by human action. Such asexual reproduction is based on the ability of plants to regenerate tissues and parts. Examples of plants that spread by suckers include red

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RASPBERRY, FORSYTHIA, and LILAC. Suckering allows horticulturists and agriculturists to reproduce a desired plant over and over without significant variation.

sucking louse Any of more than 400 species (suborder Anoplura, order Phthiraptera) of small, wingless, flat ectoparasitic insects found worldwide. They have piercing and sucking mouthparts for extracting their food of mammals' blood and tissue fluids. The NYMPHS mature after several molts. Species are host-specific: *Pediculus* infests humans (see human LOUSE), whereas other sucking lice (genera *Haematopinus* and *Linognathus*) attack domestic animals, such as hogs, cattle, horses, and dogs.

suckling In MAMMALS, the drawing of milk into the mouth from the nipple of a mammary gland. In human beings, it is referred to as nursing or breast-feeding. The word also denotes an animal that has not yet been weaned—that is, whose access to milk has not yet been withdrawn, a process that gradually accustoms the young to accept an adult diet.

Suckling, Sir John (b. February 1609, Whitton, Middlesex, Eng.—d. 1642, Paris, France) English CAVALIER POET, dramatist, and courtier. He inherited his father's considerable estates at age 18 and became prominent at court as a gallant and a gamester; he is credited with inventing CRIBBAGE. After participating in a foiled plot to rescue the Earl of Strafford from the Tower of London, he fled to France and is believed to have committed suicide. He wrote four plays, the best being the lively comedy *The Goblins* (1638). His reputation as a poet rests on his lyrics, the best of which are easy and natural. His masterpiece is "A Ballad upon a Wedding," written in the style and metre of the contemporary street ballad.

Sucre \'sü-krā\ Judicial capital (pop., 2001: 193,873), Bolivia. Founded by the Spanish (c. 1539) on the site of a Charcas Indian village, it became the capital of the Charcas territory of Upper Peru in 1561 and in 1609 the seat of an archdiocese. Many of its colonial churches survive. It was an early scene (1809) of the revolt against Spain. The Bolivian declaration of independence was signed there in 1825, and it became the capital in 1839. An effort to move the capital to LA PAZ in 1898 precipitated a civil war, which left the two cities sharing capital status. Sucre is also the seat of the national supreme court. It is a growing commercial centre. The University of San Francisco Xavier, one of the oldest universities in South America, was founded there in 1624.

Sucre \'sü-krā\ **(Alcalá), Antonio José de** (b. Feb. 3, 1795, Cumaná, New Granada—d. June 4, 1830, Berruecos, Gran Colombia) Liberator of Ecuador and first president of Bolivia (1826–28). A close ally of SIMÓN BOLÍVAR, Sucre fought in the revolutionary struggles of Venezuela, Colombia, GRAN COLOMBIA (now Ecuador), Peru, and Upper Peru (now Bolivia), defeating royalist forces throughout the region. In 1826 he set up a Bolivian government and briefly served as president, but he soon retired to Gran Colombia. In 1829 he was called back into service to defend Gran Colombia against a Peruvian invasion. He was assassinated in 1830 at age 35. He is remembered as one of the most respected leaders of the Latin American wars for independence.

sucrose \'sü-ˌkrōs\ *or* **table sugar** Organic compound, colourless, sweet-tasting crystals that dissolve in water. Sucrose ($C_{12}H_{22}O_{11}$) is a disaccharide; HYDROLYSIS, by the ENZYME invertase, yields "invert sugar" (so called because the hydrolysis results in an inversion of the rotation of plane polarized light), a 50:50 mixture of FRUCTOSE and GLUCOSE, its two constituent MONOSACCHARIDES. Sucrose occurs naturally in sugarcane, sugar beets, sugar-maple sap, dates, and honey. It is produced commercially in large amounts (especially from sugarcane and sugar beets) and is used almost entirely as food. See also SUGAR.

Sudan Vast tract of open savanna plains, north-central Africa. Extending across 2,000,000 sq mi (5,000,000 sq km), it lies between the southern limits of the SAHARA and LIBYAN deserts and the northern limits of the equatorial rainforests. It extends from the western coast more than 3,500 mi (5,500 km) to the mountains of Ethiopia and the Red Sea. The SAHEL comprises the northern reaches.

Sudan \sü-'dan**, The** *officially* **Republic of the Sudan** Country, northeastern Africa. Area: 966,757 sq mi (2,503,890 sq km). Population (2005 est.): 36,233,000. Capitals: KHARTOUM (executive), Omdurman (legislative). Muslim Arab and other ethnic groups live in the northern and central two-thirds of the country, while non-Muslim Dinka, Nuer, and Zande peoples live in the south. Languages: Arabic (official), Dinka, Nubian languages, Beja, Zande, English. Religions: Islam (official; predominantly Sunni); also Christianity, traditional beliefs. Currency:

Sudanese dinar. The largest country in Africa, The Sudan encompasses an immense plain with the SAHARA Desert in the north, sand dunes in the west, semiarid shrub lands in the south-central belt, and enormous swamps and tropical rainforests in the south. The NILE RIVER flows through the entire length of the country. Wildlife includes lions, leopards, elephants, giraffes, and zebras. The Sudan has a developing mixed economy based largely on agriculture. One of the largest irrigation projects in the world provides water to farms between the White Nile and the Blue Nile. Chief cash crops are cotton, peanuts, and sesame; livestock is also important. Major industries include food processing and cotton ginning, and petroleum is the main export. The country is ruled by an Islamic military regime; the head of state and government is the president. Evidence of human habitation dates back tens of thousands of years. From the end of the 4th millennium BC, NUBIA (now northern Sudan) periodically came under Egyptian rule, and it was part of the kingdom of CUSH from the 11th century BC to the 4th century AD. Christian missionaries converted the Sudan's three principal kingdoms during the 6th century AD; these black Christian kingdoms coexisted with their Muslim Arab neighbours in Egypt for centuries, until the influx of Arab immigrants brought about their collapse in the 13th–15th centuries. Egypt had conquered all of the Sudan by 1874 and encouraged British interference in the region; this aroused Muslim opposition and led to the revolt of the MAHDĪ, who captured Khartoum in 1885 and established a Muslim theocracy in the Sudan that lasted until 1898, when his forces were defeated by the British. The British ruled, generally in partnership with Egypt, until the region achieved independence as The Sudan in 1956. Since then the country has fluctuated between ineffective parliamentary government and unstable military rule. The non-Muslim population of the south began rebellion against the Muslim-controlled government of the north in the early 1980s, leading to famines and the displacement of millions of people; a peace agreement was signed in 2005. Meanwhile, fighting broke out in 2003 between non-Arab Muslims in the Darfur region of western Sudan and government-backed Arab militias; tens of thousands of people were killed and hundreds of thousands were displaced.

sudden infant death syndrome (SIDS) *or* **crib death** Unexpected death of an apparently well infant. It occurs almost always during sleep at night and usually at 2–4 months of age. Sleeping facedown and exposure to cigarette smoke have been implicated. It is more common in cases of premature birth, low birth weight, and poor prenatal care. Many cases that would once have been labeled SIDS prove to be due to suffocation in bedding or overheating. Some babies who die of SIDS have been found to have brain stem abnormalities that interfere with their response to high levels of carbon dioxide in the blood.

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Sudetenland \sü-'dā-tᵊn-ˌland\ Sections of northern and western Bohemia and northern Moravia around the Sudeten mountain ranges. Formerly part of Austria, the predominantly German-speaking area was incorporated into Czechoslovakia after World War I. Discontent among the Sudeten Germans was exploited in the mid-1930s by the Nazi Party and its local leader Konrad Henlein. The inflammatory situation convinced Britain and France that, to avoid war, Czechoslovakia must be persuaded to give the region autonomy. Adolf Hitler's demand that the region be ceded to Germany was initially rejected, but the cession was later accomplished by the Munich agreement. After World War II the region was restored to Czechoslovakia, which expelled its German inhabitants and repopulated the area with Czechs.

Sudra See Shudra

Suetonius \swē-'tō-nē-əs, ˌsü-ə-'tō-nē-əs\ *Latin* **Gaius Suetonius Tranquillus** (b. AD 69, probably Rome—d. after 122) Roman biographer and antiquarian. Suetonius's family was of the knightly class. His writings include *Concerning Illustrious Men*, short biographies of literary figures that were the ultimate source of nearly all that is known about the lives of eminent Roman authors. *Lives of the Caesars*, his other major work, is seasoned with bits of gossip and scandal related to the first 11 emperors; it is largely responsible for the vivid picture of Roman society and its decadent leaders that dominated historical thought until modified in modern times by the discovery of nonliterary evidence.

Suez, Gulf of Northwestern extension of the Red Sea. It is located between Africa and the Sinai Peninsula and is roughly 195 mi (314 km) long and 12–20 mi (19–32 km) wide. Linked to the Mediterranean Sea by the Suez Canal, it is an important shipping route. In the 1970s and '80s, oil was discovered at numerous locations in the gulf.

Suez Canal Ship canal, Isthmus of Suez, Egypt. Connecting the Red Sea with the eastern Mediterranean Sea, it extends 100 mi (160 km) from Port Said to the Gulf of Suez and allows ships to sail directly between the Mediterranean and the Indian Ocean. Built by the French-owned Suez Canal Co., it was completed in 1869 after 11 years of construction. Its ownership remained largely in French and British hands until Egypt nationalized it in 1956, setting off an international crisis (see Suez Crisis). It has a minimum width of 179 ft (55 m) and a depth of about 40 ft (12 m) at low tide. Though protected by international treaty, the canal has been closed twice. The first closing was during the Suez Crisis. The canal again was closed by the Six-Day War (1967) and remained inoperative until 1975. It is one of the world's most heavily used shipping lanes.

Suez Crisis (1956) International crisis that arose when Egyptian president Gamal Abdel Nasser nationalized the Suez Canal after Western countries withdrew promised financial aid to build the Aswan High Dam. The French and British, who had controlling interests in the company that owned the canal, sent troops to occupy the canal zone. Their ally Israel seized the Sinai Peninsula. International opposition quickly forced the French and British out, and Israel withdrew in 1957. The incident led to the resignation of Britain's prime minister, Anthony Eden, and was widely perceived as heralding the end of Britain as a major international power. Nasser's prestige, by contrast, soared within the developing world. See also Arab-Israeli Wars.

Suffolk Administrative (pop., 2001: 668,548) and historic county, eastern England, on the North Sea. There are prehistoric flint mines in the north of the county. During Anglo-Saxon times Suffolk formed part of the kingdom of East Anglia; the Sutton Hoo ship burial dates from this time. Its medieval prosperity was based largely on the woolen cloth industry. Since then, agriculture has been the major economic activity; crops include cereals, sugar beets, and vegetables. The Suffolk town of Newmarket is famous for its racing stables, and the Suffolk coast is dotted with holiday resorts. The county seat is Ipswich.

Suffolk Breed of medium-wool, dark-faced, hornless sheep developed in England in the early 19th century by mating Norfolk horned ewes (females) with Southdown rams (males). Suffolks are prolific, early-maturing sheep with excellent mutton carcasses. They are energetic and have an alert carriage and great stamina. Introduced into the U.S. in 1888, the Suffolk is a popular lamb producer.

Suffolk, Thomas Howard, 1st earl of (b. Aug. 24, 1561—d. May 28, 1626, London, Eng.) English naval officer and politician. Son of the 4th duke of Norfolk, Howard held naval commands and distinguished himself in the attack on the Spanish Armada (1588). He led naval forays against the Spanish in the reign of Elizabeth I. Created earl of Suffolk in 1603, he served James I as lord chamberlain (1603–14) and lord high treasurer (1614–18). In 1618 he was deprived of his office on charges of embezzlement and was briefly imprisoned with his wife, who had taken bribes from Spain.

Sufism \'sü-ˌfi-zəm\ Mystical movement within Islam that seeks to find divine love and knowledge through direct personal experience of God. It consists of a variety of mystical paths that are designed to ascertain the nature of mankind and God and to facilitate the experience of divine love and wisdom in the world. Sufism arose as an organized movement after the death of Muhammad (AD 632), among different groups who found orthodox Islam to be spiritually stifling. The practices of contemporary Sufi orders and suborders vary, but most include the recitation of the name of God or of certain phrases from the Qu'rān as a way to loosen the bonds of the lower self, enabling the soul to experience the higher reality toward which it naturally aspires. Though Sufi practitioners have often been at odds with the mainstream of Islamic theology and law, the importance of Sufism in the history of Islam is incalculable. Sufi literature, especially love poetry, represents a golden age in Arabic, Persian, Turkish, and Urdu languages. See also Aḥmadiyyah; dervish; Malāmatiyyah; tariqa.

sugar Any of numerous sweet, colourless organic compounds that dissolve readily in water and occur in the sap of seed plants and the milk of mammals. Sugars (whose names end in *-ose*) are the simplest carbohydrates. The most common is sucrose, a disaccharide; there are numerous others, including glucose and fructose (both monosaccharides); invert sugar (a 50:50 mixture of glucose and fructose produced by enzyme action on sucrose); and maltose (produced in the malting of barley) and lactose (both disaccharides). Commercial production of sugars is almost entirely for food.

Sugar Act (1764) British legislation to raise revenue from North American colonies. A revision of the unenforced Molasses Act of 1733, it imposed new duties on sugar and molasses imported into the colonies from non-British Caribbean sources and provided for the seizure of cargoes violating the new rules. The act was the first attempt to recoup from the colonies the expenses of the French and Indian War and the cost of maintaining British troops in North America. The colonists objected to the act as taxation without representation, and some merchants agreed not to import British goods. Protests increased with passage of the Stamp Act.

sugar beet Variety of beet (*Beta vulgaris*) that accounts for about two-fifths of global sugar production, making it second only to sugarcane as a source of the world's sugar. Unlike sugarcane, sugar beets can be grown in temperate or cold climates in Europe, North America, and Asia; that is, within the densely populated, well-developed areas where much of the product is consumed. The sugar beet was grown as a garden vegetable and for fodder long before it was valued for its sugar content.

Sugar beet (*Beta vulgaris*).
GRANT HEILMAN

sugarcane Giant, thick, perennial grass (*Saccharum officinarum*; family Poaceae, or Gramineae), cultivated in tropical and subtropical regions worldwide for its sweet sap, a major source of sugar and molasses. The plant grows in clumps of solid stalks with regularly spaced nodes or joints, each with a bud that can be planted for commercial asexual propagation. Graceful, sword-shaped leaves, similar to those of the corn plant, fold in a sheath around the stem. Mature canes may be 10–20 ft (3–6 m) tall and 1–3 in. (2.5–7.5 cm) in diameter. Molasses, the syrup remaining after sugar is crystallized out of the juice, is used in cooking, in

Sugarcane (*Saccharum officinarum*)
RAY MANLEY—SHOSTAL ASSOC.

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making rum, and as feed for farm animals. Residual cane fibre (BAGASSE) is burned as fuel or used as filler for paper and particleboard.

Sugawara Michizane \sù-'gä-wä-rä-ˌmē-chə-'zä-nā\ (b. 845, Japan—d. March 26, 903, Dazaifu) Japanese scholar of Chinese literature during the HEIAN PERIOD, later deified as Tenjin, patron of scholarship and literature. He was given important government posts by the emperor Uda, who saw him as a counterbalance to the powerful FUJIWARA FAMILY. When Uda's son took the throne, Michizane's fortunes were reversed, and he was sent into exile when the new emperor was persuaded that Michizane was plotting against him. Following his death in exile, calamities in the capital were attributed to his vengeful spirit, and he was posthumously reinstated. At shrines dedicated to Tenjin, schoolchildren often buy amulets for good luck on school entrance exams.

Suger \sū̄-'zher\ (b. 1081, near Paris—d. Jan. 13, 1151) Abbot of Saint-Denis and adviser to LOUIS VI and LOUIS VII. A peasant boy educated at the abbey of Saint-Denis, he was a schoolmate and close friend of the future Louis VI. In 1122 he was elected abbot, and he used popular veneration for the saint and for the church's banner to rally military support for the king. Suger's work on the church of Saint-Denis was instrumental in the development of GOTHIC ARCHITECTURE. He arranged a treaty ending the civil war between Louis VII and his vassal Thibaut, and he served as regent (1147–49) while the king was away on the Second CRUSADE.

Suharto (b. June 8, 1921, Kemusu Argamulja, Java, Dutch East Indies) Second president of Indonesia (1967–98). Suharto initially served in the Dutch colonial army, but after the Japanese conquest (1942) he joined a Japanese-sponsored defense corps. After Japan's surrender he joined the guerrilla forces seeking independence from the Dutch. When Indonesia became independent (1950), he was a lieutenant colonel. A strong anticommunist, he crushed what was purported to be an attempted communist coup d'état in 1965 with a ruthless purge of communists and leftists throughout the country that left as many as 1,000,000 dead. He deposed the sitting president, SUKARNO, and was himself appointed president in 1967. He established authoritarian rule and was repeatedly elected without opposition. In 1975 he brutally annexed the former Portuguese colony of EAST TIMOR. A severe economic downturn focused public attention on his government's corruption, and this led to massive demonstrations that prompted his resignation in 1998, after 31 years in power.

Suharto
AP/WIDE WORLD PHOTOS

Suhrawardī \ˌsùh-rä-'wär-dē**, al-** *in full* **Shihāb al-Dīn Yaḥyā ibn Ḥabash ibn Amīrak al-Suhrawardī** *or* **al-Maqtūl** (b. c. 1155, Suhraward, Iran—d. 1191, Aleppo, Syria) Muslim theologian and philosopher. He studied in Eṣfahān, a leading centre of Islamic scholarship. His works fell into two categories: doctrinal and philosophical tracts, many of which took account of the ancient Greek philosophers, and shorter treatises intended to guide the mystic toward esoteric knowledge. His best-known work, *The Wisdom of Illumination*, held that existence is a single continuum that culminates in pure light, representing God. Charged with heresy by rivals in the Muslim clergy, he was executed by the Ayyūbid prince Malik al-Ẓāhir—thus earning himself the appellation al-Maqtūl ("the Killed").

Sui \'swē\ **dynasty** (581–618) Short-lived Chinese dynasty that unified northern and southern China after centuries of division. Under the Sui, the cultural and artistic renaissance that was to reach its height under the succeeding TANG DYNASTY was set in motion. The first Sui emperor, WENDI, established uniform institutions of government throughout the country, promulgated a new legal system, conducted a census, recruited officials through examinations, and reestablished Confucian rituals. The Sui conducted three costly and unsuccessful campaigns against the Korean kingdom of KOGURYŌ. The Sui capital at CHANG'AN was, in design, six times the size of the modern city of Xi'an at the same site.

suicide Act of intentionally taking one's own life. Suicide may have psychological origins such as the difficulty of coping with DEPRESSION or other MENTAL DISORDERS; it may be motivated by the desire to test the affection of loved ones or to punish their lack of support with the burden of guilt. It may also stem from social and cultural pressures, especially those that tend to increase isolation, such as bereavement or estrangement. Attitudes toward suicide have varied in different ages and cultures; convicted criminals in ancient Greece were permitted to take their own lives, and the Japanese custom of SEPPUKU (also called hara-kiri), or self-disembowelment, allowed SAMURAI to commit ritual suicide as a way of protecting honour and demonstrating loyalty. Jews committed suicide rather than submit to ancient Roman conquerors or crusading knights who intended to force their conversion. In the 20th century, members of new religious movements, notably the Peoples Temple and Heaven's Gate, committed mass suicide. Buddhist monks and nuns have also committed sacrificial suicide by self-immolation as a form of social protest. Japan's use of KAMIKAZE suicide bombers during World War II was a precursor to the suicide bombing that emerged in the late 20th century as a form of TERRORISM, particularly among Islamic extremists. Suicide, however, is generally condemned by Islam, Judaism, and Christianity, and attempts to commit suicide are still punishable by law in many countries. Some communities around the world have sought to legalize physician-assisted suicide for the terminally ill. Euthanasia was legalized in The Netherlands in 2001 and Belgium in 2002, and it is openly practiced in Colombia. Since the 1950s suicide-prevention organizations have been established in many countries, with telephone hot lines serving as a source of readily available counseling.

Suir \'shůr**, River** River, southeastern Ireland. It rises in northern County Tipperary and flows south and east. It is joined by the Barrow and the Nore before entering Waterford Harbour 114 mi (183 km) later. In the 1760s the river was made navigable to Clonmel.

suite Set of instrumental dances or dancelike movements. The suite originated in the paired dances of the 14th–16th centuries (pavane-galliard, basse danse-saltarello, etc.). In the 16th–17th centuries German composers began to write sets of three or four dances, as in JOHANN HERMANN SCHEIN's *Banchetto musicale* (1617). In the late 17th century a basic ordering of four dances—ALLEMANDE, COURANTE, SARABANDE, and GIGUE—became established as standard; other dances came to be interpolated between the sarabande and gigue. In the 19th century *suite* came to refer to sets of instrumental excerpts from operas and ballets.

Sukarno (b. June 6, 1901, Surabaja, Java, Dutch East Indies—d. June 21, 1970, Jakarta, Indon.) First president of Indonesia (1949–67). Son of a Javanese schoolteacher, he excelled in languages, mastering Javanese, Sundanese, Balinese, and modern Indonesian, which he did much to create. He emerged as a charismatic leader in the country's independence movement. When the Japanese invaded in 1942, he served them as a chief adviser, while pressuring them to grant Indonesia independence. Immediately following Japan's defeat, he declared independence; the Dutch did not transfer sovereignty until 1949. Once he became president, Indonesia made gains in health, education, and cultural self-awareness, but democracy and the economy foundered. His government was corrupt, inflation soared, and the country experienced a continuous state of crisis. An attempted coup, purportedly by communists, in 1965 led to a military takeover by SUHARTO and a purge of alleged communists. Stripped of his power in 1966, Sukarno resigned in 1967 and lived under house arrest until his death.

Sukhothai \'sù-kə-'tī\ **kingdom** Former kingdom, north-central Thailand. It was founded in the mid-13th century when a local Tai ruler led a revolt against Khmer rule. It remained only a small local power until its third ruler, RAMKHAMHAENG, inherited the kingdom c. 1279. He extended its power to the south onto the MALAY PENINSULA, to the west into what is now Myanmar (Burma), and to the northeast into modern Laos. On his death in 1298 the kingdom began to lose its power, and in 1438 it was absorbed into the kingdom of AYUTTHAYA.

Sukhothai style \'sü-kə-'tī\ Canonical style for Buddha icons developed probably in the kingdom of Sukhothai (modern Thailand), beginning in the 14th century. The Sukhothai Buddhas—typically either seated in the half-lotus posture with right hand performing the earth-touching gesture or walking with one foot forward and the right hand raised to the chest—have a boneless, weightless elegance. The parts of the body follow abstract ideals based on analogy with natural forms (e.g., shoulders like an elephant's trunk, torso like a lion). The head typically bears a flamelike protuberance above a cranial bump, which the faithful believe contains an extra brain cavity.

Sukhoy *officially* **OKB imeni P.O. Sukhoy** *formerly* **OKB-51** Russian aerospace design bureau that is the country's second most important producer of jet fighters (after MiG). The origin of Sukhoy dates to

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1953, when the Soviet government allowed Pavel Sukhoy to reassemble his World War II aircraft-design team into a new bureau, which was designated OKB-51. In the 1950s and '60s OKB-51 planned and built a series of supersonic jet fighters, including the Su-7 and Su-9, which were later modified and used extensively by the U.S.S.R. and other Warsaw Pact countries. It improved the Su-9 into the Su-11 and Su-15 fighter-interceptors. After Sukhoy's death (1975) his name was added to that of the bureau. Perhaps the best known Sukhoy design was the versatile Su-27 air-superiority fighter (first flown 1977). In the 1990s the bureau introduced the Su-34 fighter-bomber and the redesigned Su-39 ground-attack aircraft. Its fifth-generation multirole S-37 Berkut air-superiority fighter (1997), had state-of-the-art electronics, forward-swept wings, and thrust vector control. In 1997 Russia formed the partially state-owned AVPK Sukhoy by combining the design bureau with its production plant and other affiliates. At the start of the 21st century Sukhoy began diversifying into the civilian market with sports aircraft, freight vehicles, and passenger aircraft.

sukiya \sü-ˈkē-ə\ **style** Japanese architectural style developed in the Azuchi-Momoyama (1574–1600) and Tokugawa (1603–1867) periods, originally used for teahouses and later also for private residences and restaurants. Based on an aesthetic of naturalness and rustic simplicity, buildings in this style are intended to harmonize with their surroundings. Timber construction is employed, with wood left in a natural state, sometimes with the bark still attached. Walls are typically made of clay. Great attention is paid to detail and proportions, and the effect is one of refined simplicity. The architect Yoshida Isoya (1894–1974) pioneered a modern *sukiya* style using contemporary materials.

Sulaiman Range \ˈsü-lī-ˌmän\ Mountain range, central Pakistan, west of the Indus River. It extends about 280 mi (450 km), with summits averaging 6,000–7,000 ft (1,800–2,100 m) tall. The highest peaks, at the northern end, are the twin peaks called Solomon's Throne. The higher of the two, at 18,481 ft (5,633 m), is the site of a popular shrine.

Sulawesi See Celebes

Süleyman \sǖ-lā-ˈmän\ **I** *or* **Süleyman the Magnificent** (b. November 1494?/April 1495?—d. Sept. 5/6, 1566, near Szigetvár, Hung.) Ottoman sultan (r. 1520–66). He became sultan of the Ottoman Empire after serving as a provincial governor under his grandfather Bayezid II and his father, Selim I (r. 1512–20). He immediately began leading campaigns against the Christians, taking Belgrade (1521) and Rhodes (1522). At the Battle of Mohács (1526) he broke the military strength of Hungary. In 1529 he laid siege to Vienna but failed to capture it. Further campaigns in Hungary (1541, 1543) left the region divided between Habsburg- and Ottoman-dominated areas. Iraq and eastern Anatolia were captured during his first campaign (1534–35) against the Persian Ṣafavid dynasty; his second (1548–49) brought conquests in southern Anatolia around Lake Van; but his third (1554–55) was unsuccessful. His navy, under Barbarossa, controlled the Mediterranean Sea. He built mosques, bridges, and aqueducts and surrounded himself with great poets and legal scholars. His reign is considered a high point of Ottoman civilization.

sulfa drug Common term for sulfonamide drug, any member of a class of synthetic antibacterial drugs with a particular chemical structure including both sulfur and nitrogen atoms. Their effectiveness against bacteria was discovered in 1932 by Gerhard Domagk, and they became the first chemical substances systematically used against human bacterial infections. Sulfa drugs inhibit the growth and multiplication of certain bacteria (but do not kill them) by interfering with the synthesis of folic acid. Because of their toxicity and growing bacterial resistance, sulfa drugs are no longer in common use (except for urinary-tract infections, certain forms of malaria, and preventing infection of burns), having been largely superseded by less toxic antibiotics.

sulfate Any of numerous inorganic and organic chemical compounds related to sulfuric acid (H_2SO_4). One subgroup comprises salts containing the sulfate ion (SO_4^{2-}) linked via ionic bonds with any of various cations. Another subgroup of sulfates, the esters, are organic compounds in which sulfuric acid's hydrogen atoms are replaced by organic groups (e.g., methyl, ethyl, phenyl); a carbon atom in the organic group bonds to an oxygen atom, whose second bond is to the sulfur atom. (In sulfonates, a carbon atom bonds directly to the sulfur atom.) See also bonding.

sulfide mineral *or* **sulphide mineral** Any member of a group of compounds of sulfur with one or more metals. The metals that occur most commonly are iron, copper, nickel, lead, cobalt, silver, and zinc. They are the ore minerals of most metals used by industry (e.g., antimony, bismuth, copper, lead, nickel, and zinc). Other industrially important metals such as cadmium and selenium occur in trace amounts in numerous common sulfides and are recovered in refining processes.

Pyrite from Butte, Mont.
COURTESY OF JOSEPH AND HELEN GUETTERMAN COLLECTION; PHOTOGRAPH, JOHN H. GERARD

Sulfur crystals from Sicily (greatly enlarged)
COURTESY OF THE ILLINOIS STATE MUSEUM; PHOTOGRAPH, JOHN H. GERARD

sulfur Nonmetallic chemical element, chemical symbol S, atomic number 16. It is very reactive but occurs native in deposits, as well as combined in various ores (e.g., pyrite, galena, cinnabar); in coal, petroleum, and natural gas; and in the water in sulfur springs. Sulfur is the third most abundant constituent of minerals and one of the four most important basic chemical commodities. Pure sulfur, a tasteless, odourless, brittle yellow solid, occurs in several crystalline and amorphous allotropes, including brimstone and flowers of sulfur. It combines, with valence 2, 4, or 6, with nearly all other elements. Its most familiar compound is hydrogen sulfide, a poisonous gas that smells like rotten eggs. All metals except gold and platinum form sulfides, and many ores are sulfides. The oxides are sulfur dioxide and sulfur trioxide, which when dissolved in water make sulfurous acid and sulfuric acid, respectively. Several sulfur compounds with halogen elements are industrially important. Sodium sulfite (Na_2SO_3) is a reducing agent used to pulp paper and in photography. Organic compounds with sulfur include several amino acids, the sulfa drugs, and many insecticides, solvents, and substances used in making rubber and rayon.

sulfur bacteria Any of a diverse group of bacteria that are capable of metabolizing sulfur and its compounds and are important in the sulfur cycle. Members of the genus *Thiobacillus*, widespread in marine and terrestrial habitats, react with sulfur to produce sulfates useful to plants; in deep ground deposits they generate sulfuric acid, which dissolves metals in mines and corrodes concrete and steel. *Desulfovibrio desulficans* reduces sulfates in waterlogged soils and sewage to hydrogen sulfide, a gas with the common rotten-egg odour.

sulfur butterfly See sulphur butterfly

sulfur dioxide Inorganic compound, heavy, colourless, poisonous gas (SO_2). It has a pungent, irritating odour (the smell of a just-struck match). It occurs in volcanic gases and dissolved in the waters of some warm springs. Huge quantities are made industrially for use as a bleach, as a reducing agent, and as sulfites, which are food preservatives. It is a precursor of the trioxide (SO_3), used to make sulfuric acid. Sulfur dioxide is formed when sulfur-containing fuels are burned; in the atmosphere it can combine with water vapour to form sulfuric acid, a major component of acid rain.

sulfuric \ˌsəl-ˈfyůr-ik\ **acid** *or* **oil of vitriol** Dense, colourless, oily, corrosive liquid inorganic compound (H_2SO_4). A very strong acid, it forms ions of hydrogen or hydronium (H^+ or H_3O^+), hydrogen sulfate (HSO_4^-), and sulfate (SO_4^{2-}). It is also an oxidizing (see oxidation-reduction) and dehydrating agent and chars many organic materials. It is one of the most important industrial chemicals, used in various concentrations in manufacturing fertilizers, pigments, dyes, drugs, explosives, detergents, and inorganic salts and acids, in petroleum refining and metallurgical processes, and as the acid in lead-acid storage batteries. It is made industrially by dissolving sulfur trioxide (SO_3) in water, sometimes beyond the saturation point to make oleum (fuming sulfuric acid), used to make certain organic chemicals.

Sulla (Felix), Lucius Cornelius (b. c. 138—d. 79 BC, Puteoli, near Naples) Victor in the Roman civil war (88–82) and dictator (82–79). He fought alongside Gaius Marius against Jugurtha, whose capture through Sulla's trickery led to a break with Marius. After being made consul, he

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was given command in the war against MITHRADATES VI; when Marius was named to replace him, he marched on Rome, and Marius fled. Though he succeeded in subduing Mithradates, the reigning popular party declared him a public enemy. From southern Italy he marched again successfully on Rome (83). Proclaimed DICTATOR with no time limit (at which time he took the name Felix, "Lucky"), he reestablished the power of the SENATE, increased the number of criminal courts, and passed new treason and citizen-protection laws, but he became chiefly known for his ruthlessness. He resigned in 79 and died that year.

Sulla, marble bust; in the Vatican Museum.
ALINARI/ART RESOURCE, NEW YORK

Sullivan, Sir Arthur (Seymour) (b. May 13, 1842, London, Eng.—d. Nov. 22, 1900, London) British composer. He attended the Royal Academy and the Leipzig Conservatory, then supported himself by teaching, playing organ, and composing for provincial festivals. His music for *The Tempest* (1861) achieved great success and was followed by his *Irish Symphony* (1866) and songs such as "Onward, Christian Soldiers" and "The Lost Chord." In 1871 he first collaborated in comic opera with playwright W.S. GILBERT, and in 1875 their *Trial by Jury* became a hit, setting the course for both their careers. Their collaboration continued with *The Sorceror* (1877), *H.M.S. Pinafore* (1878), *The Pirates of Penzance* (1879), *Patience* (1881), *Iolanthe* (1882), *Princess Ida* (1883), *The Mikado* (1885), *Ruddigore* (1887), *The Yeomen of the Guard* (1888), *The Gondoliers* (1889), and others, many of which would continue to delight international audiences for more than a century.

Sullivan, Ed(ward Vincent) (b. Sept. 28, 1901, New York, N.Y., U.S.—d. Oct. 13, 1974, New York City) U.S. television host. He began his career as a journalist and wrote a Broadway gossip column for the *Daily News*. Known for his talent at discovering interesting new performers, he was hired by CBS to host its variety program *Toast of the Town* (1948–55), later called *The Ed Sullivan Show* (1955–71), where he presented diverse entertainment (combining, for example, a concert pianist, a singing fireman, and a boxing referee with Hollywood celebrities in a single show) in a program that became a national institution for more than 20 years. Sullivan's terse way of introducing guest performers and distinctive mannerisms made him a popular target for comedians.

Sullivan, Harry Stack (b. Feb. 21, 1892, Norwich, N.Y., U.S.—d. Jan. 14, 1949, Paris, France) U.S. psychiatrist. He engaged in clinical research at the Pratt Hospital in Maryland (1923–30), pursuing his interest in the use of psychotherapy to treat SCHIZOPHRENIA, which he viewed as stemming from disturbed interpersonal relationships in early childhood. He asserted that psychiatric symptoms arise out of conflicts between the individual and his human environment and that personality development likewise stems from a series of interactions with other people. He helped establish the William Alanson White Psychiatric Foundation (1933) and the Washington School of Psychiatry (1936), and he also founded (1938) and served as editor of the journal *Psychiatry*. His works include *The Interpersonal Theory of Psychiatry* (1953) and *The Fusion of Psychiatry and Social Science* (1964).

John L. Sullivan.
UPI

Sullivan, John L(awrence) (b. Oct. 15, 1858, Roxbury, Mass., U.S.—d. Feb. 2, 1918, Abington, Mass.) U.S. boxer. Sullivan became the world heavyweight champion in 1882 by knocking out Paddy Ryan in nine rounds. His 75-round knockout of Jake Kilrain in 1889 was the last title bout under London Prize Ring (bare-knuckle) rules. In his only championship defense under the QUEENSBERRY RULES, he was knocked out by Jim Corbett (b. 1866—d. 1933) in 21 rounds in 1892. From 1878 to 1905 Sullivan had 35 bouts, of which he won 31, 16 by knockouts. Some boxing historians regard Sullivan only as a U.S. champion since he had only one international match of consequence and refused to fight the great black Australian heavyweight Peter Jackson.

Sullivan, Louis H(enry) (b. Sept. 3, 1856, Boston, Mass., U.S.—d. April 14, 1924, Chicago, Ill.) U.S. architect, the father of modern U.S. architecture. Sullivan was accepted at the École des Beaux-Arts in Paris but was a restless student. After working for several Chicago firms, he joined the office of Dankmar Adler (1844–1900) in 1879, becoming Adler's partner at age 24. Their 14-year association produced more than 100 buildings, many of them landmarks. Their first important work was the Auditorium Building in Chicago (1889), a load-bearing stone structure with a 17-story tower, unadorned on the arcaded exterior and dazzlingly rich on the interior. Their most important skyscraper is the 10-story steel-framed Wainwright Building, St. Louis, Mo. (1890–91); above its two-story base, the vertical elements are stressed and horizontals recessed, and it is capped by a decorative frieze and cornice. During this period the young FRANK LLOYD WRIGHT spent six years as apprentice to Sullivan, who would be a major influence on the younger architect. In 1895 Sullivan's partnership with Adler dissolved, and his practice began a steady decline. One of his few major commissions was the Carson Pirie Scott store in Chicago (1899–1904), noted for its broad windows and exuberant ornamentation. Sullivan's ornamentation was based not on precedent but on geometry and natural forms. He considered it obvious that building design should indicate a building's functions and that, where the function does not change, the form should not change; hence his influential dictum "form follows function."

Sully \sǖ-'lē**, Maximilien de Béthune, duke de** (b. Dec. 13, 1560, Mantes, France—d. Dec. 22, 1641, Villebon) French statesman. Son of a French Huguenot noble, he was sent to the court of Henry of Navarra (later HENRY IV). He fought in the Wars of RELIGION and helped negotiate the Peace of Savoy (1601). As superintendent of finances from 1598, he instituted reforms in taxation and administration. A trusted agent to the king, he was rewarded with royal offices and created duke de Sully in 1606. He promoted a system of national improvements, encouraged agriculture, and strengthened the military. His political role ended with Henry's assassination (1610), and he resigned in 1611.

Sully Prudhomme \sǖ-lē-prǖ-'dȯm\ *orig.* **René-François-Armand Prudhomme** (b. March 16, 1839, Paris, France—d. Sept. 7, 1907, Châtenay) French poet. Inspired at first by an unhappy love affair, he published fluent and melancholic verse in volumes beginning with *Stances et poèmes* (1865), containing his well-known "Le Vase brise." He later adopted the more objective approach of the PARNASSIAN poets and attempted to represent philosophical concepts in verse. Among his best-known later works are *La Justice* (1878) and *Le Bonheur* (1888). In 1901 he was awarded the first Nobel Prize for Literature, over such greatly admired figures as LEO TOLSTOY.

Sully Prudhomme.
H. ROGER-VIOLLET

sulphide mineral See SULFIDE MINERAL

sulphur butterfly *or* **sulfur butterfly** Any of several species of BUTTERFLIES (family Pieridae) that are found worldwide. Adults have a wingspan of 1.5–2.5 in. (35–60 mm). The colour and pattern of many species vary seasonally and between sexes, but they are generally bright yellow or orange. Some have two colour patterns; for example, *Colias eurytheme* is usually orange with black wing margins, but some females are white

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with black margins. Pupae are attached to a twig by a posterior spine and a girdle of silk. The larvae feed on clover and may seriously damage crops.

Sulu Archipelago Volcanic and coral archipelago, southwestern Philippines, between Mindanao and Borneo. A double island chain, it extends 170 mi (270 km) and includes about 400 named islands and more than 500 unnamed ones; they cover an area of 1,038 sq mi (2,688 sq km). The islanders were converted to Islam by Abu Bakr in the mid-15th century. The Spanish tried, at first unsuccessfully, to subdue the inhabitants, whom they called Moros. The islands finally became a Spanish protectorate in the 19th century, and in 1899 came under U.S. authority. The archipelago was ceded to the Philippines in 1940. The islands provide a haven for smugglers and pirates.

Sulzberger \'səlz-ˌbər-gər**, Arthur Hays** (b. Sept. 12, 1891, New York, N.Y., U.S.—d. Dec. 11, 1968, New York City) U.S. newspaper publisher. The son-in-law of Adolph Ochs, he joined the staff of The New York Times after marrying Iphigene Ochs in 1917. He was the paper's publisher (1935–61), overseeing the extension of its news coverage into more specialized subject areas as well as important changes in technology and a growth in circulation. He was succeeded by his son, Arthur Ochs Sulzberger.

Sulzberger, Arthur Ochs (b. Feb. 5, 1926, New York, N.Y., U.S.) U.S. newspaper publisher. Grandson of Adolph Ochs and son of Iphigene and Arthur Hays Sulzberger, he spent a dozen years as a reporter and in other newspaper posts before becoming publisher of The New York Times in 1963. During his tenure he introduced many innovations that strengthened the paper's reputation while modernizing and streamlining the organization of its staff, including the unification of the daily *Times* with the Sunday edition in 1964 and an increase in coverage of fields such as economics, the environment, medicine, law, and science. In 1992 he was succeeded by his son, Arthur Sulzberger, Jr. (b. 1951).

sumac \'shü-ˌmak, 'sü-ˌmak\ Any of certain species of shrubs and small trees in the genus *Rhus* of the family Anacardiaceae (the sumac, or cashew, family), native to temperate and subtropical zones. All sumacs have a milky or resinous sap, which in some species (e.g., poison sumac) can irritate the skin. Used in the past as a source of dyes, medicines, and beverages, sumacs are now valued as ornamentals, soil binders, and cover plants. The sumacs grown for landscape use display a graceful form, spectacular fall colour, or colourful fruit clusters. The smooth, or scarlet, sumac (*R. glabra*), native to the eastern and central U.S., is the most common.

Sumatra \sü-'mä-trə\ Island (pop., 2000 including adjoining islands: 43,309,707), western Indonesia. It is one of the Sunda Islands and the second largest island of Indonesia. It is 1,060 mi (1,706 km) long and 250 mi (400 km) wide. A chief city is Palembang. Located on the seaborne trade routes, the island had early contact with Hindu civilization. The Srivijaya empire arose in the 7th century and came to dominate much of the island. It fell under the Majapahit empire in the 14th–16th centuries. First the Portuguese, then the Dutch and English established forts there beginning in the 16th century. It was occupied by Japan in World War II and in 1950 became part of the Republic of Indonesia. Its exports include rubber, tobacco, coffee, pepper, and timber products; mineral reserves include petroleum and coal. In 2004 a large tsunami generated by a massive earthquake off the west coast of Sumatra caused widespread death and destruction in coastal areas bordering the Indian Ocean.

Sumba \'süm-bə\ *English* **Sandalwood Island** Island, Lesser Sunda Islands, Indonesia. The island, 140 mi (225 km) long and up to 50 mi (80 km) wide, is mainly a high plateau with good harbours on the northern coast. Its chieftains were brought by treaty under Dutch control in 1756. Sumba became part of independent Indonesia in 1950. It is known for the Sandalwood horse and Ongole cattle, and its woven cloth is famous for its design. Corn is the main crop; copra is exported.

Sumbawa \süm-'bä-wä\ Island, Lesser Sunda Islands, Indonesia. Its irregular coastline includes Bima Bay, one of the best harbours in Indonesia. The island, 175 mi (282 km) long and 55 mi (88 km) wide, is mountainous. Its highest point is volcanic Mount Tambora (9,354 ft [2,851 m]), which erupted in 1815, killing 50,000 people. Sumbawa was once part of the Majapahit empire. In 1674 the Sumbawanese nobility signed agreements that gave the Dutch East India Company some power over the island; the Dutch gained direct control in the early 20th century. Sumbawa became part of independent Indonesia in 1950. Agricultural products include rice, corn, coffee, and copra.

Sumer \'sü-mər\ Region of southern Mesopotamia and site of the earliest known civilization. It was first settled c. 4500–4000 BC by a non-Semitic people called the Ubaidians. They were the first civilizing force in Sumer, draining the marshes for agriculture and developing trade. The Sumerians, who spoke a Semitic language that came to dominate the region, arrived c. 3300 BC and established the world's first known cities. These polities evolved into city-states, which eventually developed monarchical systems that later came to be loosely united under a single city, beginning with Kish c. 2800 BC. Thereafter, Kish, Erech, Ur, Nippur, and Lagash vied for ascendancy for centuries. The area came under the control of dynasties from outside the region, beginning with Elam (c. 2530–2450 BC) and later Akkad, led by the Akkadian king Sargon (r. 2334–2279 BC). After the Akkadian dynasty collapsed, the city-states were largely independent until they were reunified under the 3rd dynasty of Ur (21st–20th centuries BC). That final Sumerian dynasty declined after being weakened by foreign invasions, and the Sumerians as a distinct political entity disappeared, becoming part of the Babylonia in the 18th century BC. The Sumerian legacy includes a number of technological and cultural innovations, including the first known wheeled vehicles, the potter's wheel, a system of writing (see cuneiform), and written codes of law.

Summerhill School Experimental primary and secondary boarding school in Leiston, Suffolk, England. Founded in 1921 by Alexander Sutherland Neill (1883–1973), the school is self-governing (students and staff have a voice in policy matters) and emphasizes the student's own motivation to learn (class attendance is optional). Neill's highly influential and controversial book *Summerhill* (1960) stimulated much debate about alternatives to conventional schooling, particularly in the U.S.

summons In law, written notification that one is required to appear in court. In civil (noncriminal) cases, it notifies a defendant that he or she must appear and defend (e.g., by filing an answer) within a specified time or a default judgment will be rendered for the plaintiff. The summons is also used in cases involving minor criminal offenses (e.g., traffic violations) to call defendants to appear and answer to charges against them. See also subpoena.

Sumner, Charles (b. Jan. 6, 1811, Boston, Mass., U.S.—d. March 11, 1874, Washington, D.C.) U.S. politician. He practiced law while crusading for the abolition of slavery, prison reform, world peace, and educational reform. He was elected to the U.S. Senate (1852–74) and spoke out against slavery. He denounced the Kansas-Nebraska Act as the "crime against Kansas" and scorned its authors, Sen. Stephen A. Douglas and Sen. Andrew P. Butler. In 1856 an incensed relative of Butler, Congressman Preston S. Brooks of South Carolina, invaded the Senate and severely beat Sumner with a cane. He returned to the Senate in 1859, and as chairman of the foreign relations committee (1861–71) he helped resolve the Trent Affair.

Charles Sumner
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Sumner, James (Batcheller) (b. Nov. 19, 1887, Canton, Mass., U.S.—d. Aug. 12, 1955, Buffalo, N.Y.) U.S. biochemist. He taught at Cornell University (1929–55). In 1926 he became the first researcher to crystallize an enzyme (urease); he later crystallized catalase and worked on purification of various other enzymes, which led to recognition that most enzymes are proteins. This work earned him (with John Howard Northrop and Wendell Meredith Stanley) a 1946 Nobel Prize. In 1947 he became director of Cornell's laboratory of enzyme chemistry, established in recognition of his work.

sumo \'sü-mō\ Japanese form of wrestling.A contestant loses if he is forced out of the ring (a 15-ft circle) or if any part of his body except the soles of his feet touches the ground. In sumo, a wrestler's weight, size, and strength are of the greatest importance, though speed and suddenness of attack are also useful. The wrestlers, who are fed a special protein diet and may weigh over 300 lbs (136 kg), wear only loincloths and grip each

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other by the belt. Sumo wrestling is an ancient sport with a complex system of ranking; at the top of the hierarchy is the *yokozuna* ("grand champion"). Lengthy rituals and elaborate posturings accompany the bouts, which are extremely brief, often lasting only a few seconds.

Sumter, Thomas (b. Aug. 14, 1734, Hanover county, Va.—d. June 1, 1832, South Mount, S.C., U.S.) American Revolutionary officer. He served in the French and Indian War and later moved to South Carolina. In the American Revolution he was commissioned a brigadier general and escaped to North Carolina after the fall of Charleston (1780). He led the state militia to victories over the British in several engagements. He served in the U.S. House of Representatives (1789–93, 1797–1801) and the Senate (1801–10). Fort Sumter was named for him (see FORT SUMTER NATIONAL MONUMENT).

Sun STAR around which the components of the SOLAR SYSTEM revolve. It is about five billion years old and is the dominant body of the system, with more than 99% of its mass. It converts five million tons of matter into energy every second by NUCLEAR FUSION reactions in its core, producing NEUTRINOS (see solar NEUTRINO PROBLEM) and solar radiation. The small amount of this energy that penetrates Earth's ATMOSPHERE provides the light and heat that support life. A sphere of luminous gas 864,950 mi (1,392,000 km) in diameter, the Sun has about 330,000 times the mass of Earth. Its core temperature is close to 27 million °F (15 million °C) and its surface temperature about 10,000 °F (6,000 °C). The Sun, a spectral type G (yellow) star, has fairly average properties for a main-sequence star (see HERTZSPRUNG-RUSSELL DIAGRAM). It rotates at different rates at different latitudes; one rotation takes 36 days at the poles but only 25 days at the equator. The visible surface, or PHOTOSPHERE, is in constant motion, with the number and position of SUNSPOTS changing in a regular SOLAR CYCLE. External phenomena include magnetic activity extending into the CHROMOSPHERE and CORONA, SOLAR FLARES, SOLAR PROMINENCES, and the SOLAR WIND. Effects on Earth include AURORAS and disruption of radio communications and power-transmission lines. Despite its activity, the Sun appears to have remained relatively unchanged for billions of years. See also ECLIPSE; HELIOPAUSE.

sun bear *or* **honey bear** Smallest member (*Helarctos malayanus*) of the bear family (Ursidae), found in South Asian forests. Nocturnal and tree-climbing, the sun bear weighs 60–140 lbs (27–64 kg) and is 3–4 ft (1–1.2 m) long, with a 2-in. (5-cm) tail, large forepaws, and short black fur with an orange-yellow crescent on the chest. It uses its long, curved claws to tear or dig for insect nests, particularly those of bees and termites. It also eats fruit, honey, and small vertebrates. The sun bear is shy and intelligent; legends say that its chest crescent represents the sun.

sun dance Most spectacular and important religious ceremony of the 19th-century PLAINS INDIANS. Ordinarily held by each tribe once a year in early summer, it was an occasion for purification and strengthening and an opportunity to reaffirm basic beliefs about the universe and the supernatural through rituals. The ceremony, which originated with the Lakota, was most highly developed among the ARAPAHO, the CHEYENNE, and the Oglala division of the Lakota SIOUX. The central rite involved male dancers who, to fulfill a vow or seek "power" (spiritual energy and insight), danced for several days without stopping for food, drink, or sleep, their ordeal ending in frenzy and exhaustion. Among some tribes, piercing and sun gazing were practiced.

sun worship Veneration of the sun or its representation as a deity. It appears in several early cultures, notably in ancient Egypt, Indo-Europe, and Mesoamerica, where urban civilizations were combined with a strong ideology of sacred kingship, in which kings ruled by the power of the sun and claimed descent from it. The imagery of the sun as the ruler of both the upper and the lower world, which he visits daily, was prominent. Sun heroes and deities also figure in many mythologies, including Indo-Iranian, Greco-Roman, and Scandinavian. In late Roman history, sun worship was of such importance that it was later called "solar monotheism." See also AMATERASU, RE, SHAMASH, SOL, SURYA, TONATIUH.

Sun Yat-sen \'sün-'yät-'sen\ *or* **Sun Yixian** \'sün-'ē-shē-'ən\ (b. Nov. 12, 1866, Xiangshan, Guangdong province, China—d. March 12, 1925, Beijing) Leader of the Chinese NATIONALIST PARTY, known as the father of modern China. Educated in Hawaii and Hong Kong, Sun embarked on a medical career in 1892, but, troubled by the conservative QING DYNASTY's inability to keep China from suffering repeated humiliations at the hands of more advanced countries, he forsook medicine two years later for politics. A letter to LI HONGZHANG in which Sun detailed ways that China could gain strength made no headway, and he went abroad to try organizing expatriate Chinese. He spent time in Hawaii, England, Canada, and Japan and in 1905 became head of a revolutionary coalition, the Tongmenghui ("Alliance Society"). The revolts he helped plot during this period failed, but in 1911 a rebellion in Wuhan unexpectedly succeeded in overthrowing the provincial government. Other provincial secessions followed, and Sun returned to be elected provisional president of a new government. The emperor abdicated in 1912, and Sun turned over the government to YUAN SHIKAI. The two men split in 1913, and Sun became head of a separatist regime in the south. In 1924, aided by Soviet advisers, he reorganized his Nationalist Party, admitted three communists to its central executive committee, and approved the establishment of a military academy, to be headed by CHIANG KAI-SHEK. He also delivered lectures on his doctrine, the Three Principles of the People (nationalism, democracy, and people's livelihood), but died the following year without having had the opportunity to put his doctrine into practice. See also WANG JINGWEI.

Sun Yat-sen
BROWN BROTHERS

Sunbelt Region, south and southwestern U.S. It is characterized by a warm climate, rapid population growth since 1970, and relatively conservative voting patterns. Comprising 15 states, it extends from Virginia and Florida in the southeast through Nevada in the southwest, and includes southern California.

sunburn Acute skin INFLAMMATION caused by overexposure to ULTRAVIOLET RADIATION from sunlight or other sources. More common and severe in light-skinned people, it ranges from mild redness and tenderness to intense pain, EDEMA, and blistering, sometimes with shock, fever, and nausea. The process begins after 15 minutes in the sun, but redness starts 6–12 hours later and peaks within a day. Pigment cells in the skin increase MELANIN production ("tan"). Cold compresses and ANALGESICS reduce pain. Limiting sun exposure, using sunscreen, and wearing protective clothing can prevent severe sunburn. Long-term sun exposure can eventually cause SKIN CANCER, as well as skin wrinkling and thickening.

Sunda Islands Archipelago extending from the MALAY PENINSULA to the MOLUCCAS. The islands make up most of the land area of Indonesia, with only northern and northwestern BORNEO and the eastern portion of TIMOR not under Indonesian political control. They include the Greater Sunda Islands (SUMATRA, JAVA, Borneo, SULAWESI, and adjacent smaller islands) and the Lesser Sunda Islands (BALI, LOMBOK, SUMBAWA, SUMBA, Flores, Timor, Alor, and adjacent smaller islands). Most of the islands are part of a geologically unstable and volcanically active ISLAND ARC. Malay cultures and languages predominate in the area.

Sunda Strait Channel between the islands of JAVA and SUMATRA. It is 16–70 mi (26–110 km) wide and links the Java Sea with the Indian Ocean. It contains several volcanic islands, the most famous of which is KRAKATOA (Krakatau).

Sundanese Any member of the highland people of western JAVA, Indon., distinguished from the Javanese mainly by their language and their strict adherence to Islam. First mentioned in the 8th century AD, they are one of the three principal ethnic groups on the island. They once followed Mahayana Buddhism but converted to Islam in the 16th century under the influence of Muslim trade. Sundanese villages are ruled by a headman and a council of elders. Marriage, birth, and death ceremonies conform closely to the Javanese pattern but are often mixed with Hindu elements. Modern developments have tended to erase differences between the Sundanese and other peoples of Java. The Sundanese number about 26 million.

Sunday, Billy *orig.* **William Ashley Sunday** (b. Nov. 19, 1862/63, Ames, Iowa, U.S.—d. Nov. 6, 1935, Chicago, Ill.) U.S. religious revivalist. He became a professional baseball player with the Chicago White Sox in 1883 and later played in Pittsburgh, Pa., and Philadelphia. In 1887 he underwent a conversion experience; he began preaching in 1897 and was ordained in the Presbyterian church in 1903. A flamboyant

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preacher of fundamentalist theology whose sermons reflected the social upheaval caused by the transition from a rural to an urban society, he advocated a strict morality and campaigned effectively for PROHIBITION. He conducted hundreds of revival meetings and reached an estimated 100 million people. His popularity faded in the 1920s, but he continued preaching until his death.

Sunderland Town, seaport, and metropolitan borough (pop., 2001: 280,807), northern England. Located at the mouth of the River Wear on the North Sea, the town was known as Wearmouth in Saxon times; it formerly included Monkwearmouth, site of a monastery built in 674 where the Venerable BEDE studied. Sunderland itself (named for the part of Monkwearmouth "sundered" from the monastery by the river) was chartered in the late 12th century. The port grew rapidly as the coal trade developed in the 17th century, and by the mid-18th century it was a major shipbuilding centre. Modern industries include glassware and automobile manufacturing. Within the borough are the seaside resorts of Roker and Seaburn. In addition to the town of Sunderland, the city and metropolitan borough includes the towns of Washington, Houghton-le-Spring, and Hetton-le-Hole.

Sunderland, Robert Spencer, 2nd earl of (b. Sept. 5, 1641, Paris, France—d. Sept. 28, 1702, Althorp, Northamptonshire, Eng.) English statesman and chief adviser in the reigns of CHARLES II, JAMES II, and WILLIAM III. After a period in diplomatic service, he twice served as secretary of state (1679–81, 1683) and became the chief architect of Charles's pro-French foreign policy. He converted to Roman Catholicism to maintain his influence in James's reign. After William became king, Sunderland renounced his Catholicism and became the principal intermediary between the king and Parliament. He was appointed lord chamberlain in 1697, but Whig opposition soon forced him from office.

sundew Any of about 100 species of annual and perennial flowering CARNIVOROUS PLANTS in four genera, notably *Drosera*, that make up the family Droseraceae (sundew family). Sundews are found throughout tropical and temperate regions. Their leaves are usually in a basal rosette. Both leaf surfaces are generally covered with sticky, gland-tipped hairs and sensitive tentacles that trap insects. After the trapped prey has been digested by enzymes secreted by the tentacles, the leaf reopens, resetting the trap. The best-known sundew is the VENUS'S-FLYTRAP. See also PITCHER PLANT.

Sundiata \sün-'jä-tə\ (d. 1255) Monarch of the ancient MALI EMPIRE in West Africa. After organizing a private army and consolidating his position among his own MALINKE people, Sundiata launched attacks against neighbouring states in the 1230s. In 1240 he seized and razed Kumbi, the last capital of the ancient GHANA EMPIRE. During his reign over Mali he established its territorial base and laid the foundations for its future prosperity and political unity.

sunfish Any of numerous species of brightly coloured North American carnivorous freshwater fishes placed with the CRAPPIES and BLACK BASSES in the family Centrarchidae. Usually less than 8 in. (20 cm) long, sunfishes are fine food and game fishes. The best-known are the black-banded sunfish (*Enneacanthus chaetodon*) of the eastern U.S. and the bluegill (*Lepomis macrochirus*), which has an orange belly and blue markings. The longear sunfish has orange spots and wavy, bright blue streaks. The pumpkinseed, or common sunfish, has an orange belly and a red spot on its ear. The rock bass has irregular dark markings.

Pumpkinseed sunfish (*Lepomis gibbosus*).
JACQUES SIX

sunflower Any of 60 species of annual herbaceous plants in the genus *Helianthus* (COMPOSITE FAMILY), native mostly to North and South America. The common sunflower (*H. annuus*) has a rough, hairy stem 3–15 ft (1–4.5 m) high; broad, coarsely toothed, rough leaves 3–12 in. (7.5–30 cm) long; and large (3–6 in., or 7.5–15 cm, in diameter), flat, platelike compound flowers. Disk flowers swirl in a tight brown, yellow, or purple spiral; ray flowers are yellow. The leaves are used as fodder, the flowers yield a yellow dye, and the seeds contain oil and are used for food. The oil is used for cooking, as an ingredient of soaps and paints, and as a lubricant. Only a few species are cultivated, some for their spectacular size.

Sunflower (*Helianthus annuus*).
JOHN H. GERARD

Sung-chiang See SONGJIANG

Sung dynasty See SONG DYNASTY

Sung-hua Chiang See SUNGARI RIVER

Sungari \ˌsůŋ-gə-'rē\ **River** *Chinese* **Songhua** \'sůŋ-'hwä\ **Jiang** *or* **Sung-hua Chiang** River, northeastern China. Rising in the Changbai Mountains, it is joined by its chief tributary, the NEN RIVER, before it enters the AMUR RIVER 1,197 mi (1,927 km) later. The Amur's largest tributary, it passes through a fertile plain and is navigable for much of its course.

sunna \'sů-nə\ Body of traditional social and legal custom and practice that constitutes proper observance of ISLAM. Early Muslims did not concur on what constituted sunna, because of the wide variety of pre-Islamic practices among converted peoples that had to be assimilated, reconciled, or abandoned. In the 8th century the sunna of MUHAMMAD, as preserved in eyewitness records, was codified as the ḤADĪTH by ABŪ ʿABD ALLĀH SHĀFʿĪ. Later Muslim scholars strengthened the authority of sunna by devising a system for attesting the authenticity of various practices claimed as descending from Muhammad. See also ʿILM AL-ḤADĪTH; ISNĀD; SHARĪʿAH; TAFSĪR.

Sunnite \'sů-ˌnīt\ Larger of the two major divisions of ISLAM, comprising 90% of the world's Muslims. Sunnites regard theirs as the mainstream and traditionalist branch of Islam, as distinguished from the minority branch, the SHIʿITES. Sunnites recognize the first four Umayyad caliphs (see UMAYYAD DYNASTY) as MUHAMMAD's rightful successors. Because the Sunnites understood Muhammad's theocratic state to have been an earthly, temporal dominion, they were willing to accept unexceptional and even foreign caliphs, provided order and religious orthodoxy were maintained. Sunnite orthodoxy emphasizes consensus based on the views and customs of the majority of the community, thereby enabling them to incorporate various customs and usages that arose historically but that had no roots in the QUR'ĀN. Sunnites recognize the six authentic books of the ḤADĪTH and accept the four major schools of Islamic law. In the early 21st century, Sunnite Muslims numbered about one billion.

Sunnyvale City (pop., 2000: 131,760), western California, U.S. Sunnyvale was settled in 1850 and was incorporated in 1912. It was originally a fruit-processing centre; its economic base shifted when the U.S. Navy built a dirigible base nearby in the 1930s and the Joshua Hendy Iron Works (later WESTINGHOUSE ELECTRIC CORP.) expanded in 1942. Its population grew rapidly in the 1960s. Chief manufactures include guided missiles.

Sunset Crater Volcano National Monument Preserve, north-central Arizona, U.S. Established in 1930, the monument covers 5 sq mi (13 sq km) and contains the brilliant-hued cinder cone of an extinct volcano that erupted c. 1064. It rises 1,000 ft (300 m) and has a crater 400 ft (120 m) deep and 1,280 ft (390 m) in diameter. The tract contains numerous lava flows, fumaroles, and lava beds.

sunspot Cooler-than-average region of gas on the SUN's surface associated with strong local magnetic activity. Sunspots appear as dark spots, but only in contrast with the surrounding PHOTOSPHERE, which is several thousand degrees hotter. Spots several times larger than Earth are visible to the unaided eye (viewed through a filter); very small ones are hard to see even with a telescope. They come and go as part of the SOLAR CYCLE, usually in pairs or groups, and may last for months; their cause appears to be related to the magnetic field reversals that occur every 11 years. The reality of these apparent flaws in the Sun was generally accepted only c. 1611. Periods of high sunspot activity are associated on Earth with brighter AURORAS and interference with radio signals.

SUNY See State University of NEW YORK

Sunzi *or* **Sun-tzu** \'sün-'dzü\ (fl. 5th century BC) Chinese military strategist. A general who served the state of Wu late in the SPRING AND AUTUMN PERIOD (770–476 BC), he is traditionally regarded as the author of the earliest known treatise on war and military science, *The Art of War*, though it was more likely written early in the WARRING STATES PERIOD (475–221 BC). A systematic guide to STRATEGY and TACTICS, it discusses various maneuvers

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and the effect of terrain, stresses the importance of accurate information about the enemy's forces, and emphasizes the unpredictability of battle and the need for flexible responses. Its insistence on the close relationship between political considerations and military policy influenced modern strategists, notably Mao Zedong.

Super Bowl Annual championship game of the National Football League. It is played by the winners of the league's American Football Conference and National Football Conference. The first Super Bowl competition was held in 1967. It normally falls in January, usually on the last Sunday, and is watched by more Americans than any other sporting event.

supercharger Air compressor or blower used in piston-type internal-combustion engines to increase the amount of air drawn into the cylinders by the movement of the pistons during each intake stroke. With the additional air, more fuel is burned, and the engine's power is increased. In aircraft engines, supercharging compensates for the reduced atmospheric pressure at high altitudes. Development of the gas turbine, which requires a constant flow of air and fuel, led to the turbosupercharger, a centrifugal blower driven by a small gas turbine powered by the exhaust gases from the engine cylinders.

supercomputer Any of a class of extremely powerful digital computers. The term is commonly applied to the fastest high-performance systems available at a given time; current personal computers are more powerful than the supercomputers of just a few years ago. Supercomputers are used primarily for scientific and engineering work. Unlike conventional computers, they usually have more than one CPU, often functioning in parallel (simultaneously); even higher-performance supercomputers are now being developed through use of massively parallel processing, incorporating thousands of individual processors. Supercomputers have huge storage capacity and very fast input/output capability, and can operate in parallel on corresponding elements of arrays of numbers rather than on one pair of elements at a time.

superconductivity Almost total lack of electrical resistance in certain materials when they are cooled to a temperature near absolute zero. Superconducting materials allow low power dissipation, high-speed operation, and high sensitivity. They also have the ability to prevent external magnetic fields from penetrating their interiors and are perfect diamagnets (see diamagnetism). Since it was first discovered in mercury by Heike Kamerlingh Onnes in 1911, similar behaviour has been found in some 25 other chemical elements and in thousands of alloys and compounds. Superconductors have applications in medical imaging, magnetic energy-storage systems, motors, generators, transformers, computer components, and sensitive magnetic-field measuring devices.

superego In Freudian psychoanalytic theory, one of the three aspects of the human personality, along with the id and the ego. The last of the three elements to develop, the superego is the ethical component of the personality, providing the moral standards by which the ego operates. The superego is formed during the first five years of life in response to parental punishment and approval; children internalize their parents' moral standards as well as those of the surrounding society, and the developing superego serves to control aggressive or other socially unacceptable impulses. Violation of the superego's standards gives rise to feelings of guilt or anxiety.

superfluidity Unusual property of liquid helium cooled below –455.75 °F (–270.97 °C). At such low temperatures, helium exhibits an enormous rise in heat conductivity and rapid flow through capillaries or over the rim of its container. To explain such behaviour, the substance is described in terms of a "two-fluid" mixture model consisting of normal helium and superfluid helium. In normal helium the atoms are in excited states (see excitation), whereas in superfluid helium they are in their ground state. As the temperature is lowered below –455.75 °F, more of the helium becomes superfluid. It is assumed that the superfluid component can move through the container without friction, thereby explaining the unusual behaviour.

Superfund U.S. government fund intended to pay for the cleanup of hazardous-waste dump sites and spills. The 1980 act creating it called for financing by a combination of general revenues and taxes on polluting industries. The Environmental Protection Agency was directed to create a list of the most dangerous sites; it would then compel the polluter to pay for the cleanup or would pay for the cleanup itself through the Superfund and sue for reimbursement. By the 1990s the Superfund had received billions of dollars, and work had begun on many sites. In response to widespread charges of waste, mismanagement, and inefficiency, the Superfund streamlined its procedures, and by the beginning of the 21st century cleanups at more than 750 sites had been completed. In the early 21st century, various proposals were introduced to alter the financing of the Superfund. See also Love Canal.

supergiant star Star of very great natural luminosity and relatively enormous size, typically several magnitudes brighter and several times larger than a giant star. Like other classes of stars, they are distinguished in practice by examination of certain lines in their spectra (see spectroscopy). A supergiant may have a diameter several hundred times that of the Sun and a luminosity nearly a million times as great. Supergiants live probably only a few million years, an extremely short life for a star.

Superior, Lake Lake, U.S. and Canada. The largest of the five Great Lakes, Superior is the world's largest freshwater lake. It is 383 mi (616 km) long and 160 mi (258 km) at its widest, with an area of 31,800 sq mi (82,362 sq km) and depths reaching 1,330 ft (405 m). Lake Superior is known for its picturesque coastline and its numerous shipwrecks; its islands include Isle Royale. The head of the Great Lakes–Saint Lawrence Seaway system, it is connected to Lake Huron at its southeastern end via the Sault Ste. Marie locks. Ships transport grain, flour, and iron ore during the eight-month navigation season. The French Jesuit missionary Claude-Jean Allouez charted the lake in 1667. The region came under British control (1763–83) and remained in British hands until 1817, when the American Fur Co. took over south of the Canadian border.

supermarket Large retail store operated on a self-service basis, selling groceries, produce, meat, bakery and dairy products, and sometimes nonfood goods. Supermarkets were first established in the U.S. during the 1930s as no-frills retail stores offering low prices. In the 1940s and '50s they became the major food marketing channel in the U.S.; the 1950s also saw them spread through much of Europe. Their growth is part of a trend in developed countries toward reducing cost and simplifying marketing. In the 1960s supermarkets began appearing in developing countries in the Middle East, Asia, and Latin America, where they appealed to individuals who had the necessary buying power and food storage facilities.

supernova Any of a class of violently exploding stars whose luminosity after eruption suddenly increases many millions of times above its normal level. Like novas, supernovas undergo a tremendous, rapid brightening lasting a few weeks, followed by a slow dimming, and show blue-shifted emission lines on spectroscopy, which implies that hot gases are blown outward. Unlike a nova, a supernova explosion is a catastrophic event for a star, leading to its collapse into a neutron star or black hole. Amounts of its matter equal to the mass of several Suns may be blasted into space with such energy that the exploding star outshines its entire home galaxy. Only seven supernovas are known to have been recorded before the 17th century, the most famous in AD 1054; its remnants are visible today as the Crab Nebula. The closest and most studied supernova in modern times is SN 1987A, which appeared in 1987 in the Large Magellanic Cloud. Supernova explosions release not only tremendous amounts of radio energy and X-rays but also cosmic rays; in addition, they create and fling into interstellar space many of the heavier elements found in the universe, including those forming Earth's solar system.

supervenience \ˌsü-pər-ˈvēn-yəns\ In philosophy, the asymmetrical relation of ontological dependence that holds between two generically different sets of properties (e.g., mental and physical properties) if and only if every change in an object's properties belonging to the first set—the supervening properties—entails and is due to a change in properties belonging to the second set (the base properties). Supervenience has often been appealed to by philosophers who want to uphold physicalism while rejecting the identity theory: Though it may be impossible to identify mental properties with physical properties in a one-to-one fashion, mental properties may still supervene on, and thus be grounded in, physical properties. Thus, no two things that are physically alike can be mentally (or psychologically) different, and a being's mental properties will be determined by its physical ones.

supply and demand Relationship between the quantity of a commodity that producers have available for sale and the quantity that consumers are willing and able to buy. Demand depends on the price of the commodity, the prices of related commodities, and consumers' incomes and tastes. Supply depends not only on the price obtainable for the commodity but also on the prices of similar products, the techniques of production, and the availability and costs of inputs. The function of the market

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is to equalize demand and supply through the price mechanism. If buyers want to purchase more of a commodity than is available on the market, they will tend to bid the price up. If more of a commodity is available than buyers care to purchase, suppliers will bid prices down. Thus, there is a tendency toward an equilibrium price at which the quantity demanded equals the quantity supplied. The measure of the responsiveness of supply and demand to changes in price is their elasticity.

supply-side economics Theory that focuses on influencing the supply of labour and goods, using tax cuts and benefit cuts as incentives to work and produce goods. It was expounded by the U.S. economist Arthur Laffer (b. 1940) and implemented by Pres. Ronald Reagan in the 1980s. Supporters point to the economic growth of the 1980s as proof of its efficacy; detractors point to the massive federal deficits and speculation that accompanied that growth.

suprarenal gland See adrenal gland

Supremacy, Act of (1534) English act of Parliament that recognized Henry VIII as the "Supreme Head of the Church of England." The act also required an oath of loyalty from English subjects that recognized his marriage to Anne Boleyn. It was repealed in 1555 under Mary I, but in 1559 Parliament adopted a new Act of Supremacy during the reign of Elizabeth I.

Suprematism First movement of pure geometrical abstraction in art, introduced in Russia c. 1913. Originated by Kazimir Malevich and disseminated by El Lissitzky and the Bauhaus school, it had far-reaching influence on Western art and design. Malevich aimed to convey the "supremacy of feeling in art," which he believed could be expressed through the simplest of visual forms. He exhibited the first Suprematist compositions in 1915, the year he issued the Suprematist manifesto. The purest embodiment of Suprematist ideals can be seen in his *White on White* series (1917–18).

Supreme Court of the United States Final court of appeal in the U.S. judicial system and final interpreter of the Constitution of the United States. The Supreme Court was created by the Constitutional Convention of 1787 as the head of a federal court system, though it was not formally established until Congress passed the Judiciary Act in 1789. It was granted authority to act in cases arising under the Constitution, laws, or treaties of the U.S.; in controversies to which the U.S. is a party; in controversies between states or between citizens of different states; in cases of admiralty and maritime jurisdiction; and in cases affecting ambassadors or other ministers or consuls. Its size, which is set by Congress, varied between 6 and 10 members before being set at 9 in 1869. Justices are appointed by the president but must be confirmed by the Senate. The court has exercised the power of judicial review since 1803, when it first declared part of a law unconstitutional in *Marbury v. Madison*, though the power is not explicitly granted to it by the Constitution. Though the court can sometimes serve as a trial court through its original jurisdiction, relatively few cases reach the court in this manner; most cases arise by appeal or by certiorari. Among the most important doctrinal sources used by the Supreme Court have been the commerce, due-process, and equal-protection clauses of the Constitution. It also has often ruled on controversies involving civil liberties (see civil liberty), including freedom of speech and the right of privacy. Much of its work consists of clarifying, refining, and testing the Constitution's philosophic ideals and translating them into working principles.

Supremes U.S. pop-soul vocal trio. The original Supremes—Diana Ross (byname of Diane Earle; b. 1944), Mary Wilson (b. 1944), and Florence Ballard (1943–76)—began recording for Motown (as The Primettes) on graduating from high school in Detroit, Mich. Their long string of Motown hits in the mid-1960s, many written by Brian and Eddie Holland and Lamont Dozier, began with "Where Did Our Love Go?" and included "Baby Love" and "Stop! In the Name of Love." In 1966 Ballard was replaced with Cindy Birdsong (b. 1939). Ross left the Supremes in 1969, and Wilson left in 1977. Ballard died in relative poverty of cardiac arrest. Ross's highly successful solo career included film roles (notably in *Lady Sings the Blues*, 1972) and a free 1983 Central Park concert that drew an audience of record-setting size.

Sur See Tyre

Surabaya \ˌsůr-ə-'bī-ə\ Seaport city (pop., 1995 est.: 2,701,000), northeastern coast of Java, Indonesia. It is Indonesia's second-largest city and has been eastern Java's chief trading center since the 14th century. The Dutch gained control in the 18th century and built their main East Indies naval base there. Occupied by the Japanese in World War II, it suffered heavy damage; it was damaged again during Indonesia's war for independence (1945–49). It is the site of Indonesia's main naval base and a naval college, and of Airlangga University (1954).

sūrah *or* **sura** Any chapter of the Qur'ān. According to Muslim belief, each of the 114 *sūrah*s, which vary in length from several lines (known as *āyah*s) to several pages, encompasses one or more divine revelations of Muhammad. All but three lines are in the form of a direct address from God. The tone of each varies but is generally moralistic, demanding obedience to a transcendent but compassionate God. Except for the opening *sūrah*, known as *fātiḥah* (the "opening"), they are arranged in descending order of length and numbered serially. They carry conventional names (e.g., Cow, Spider, Blood Clot) deriving from some image contained in them that is not necessarily indicative of their meaning or theme.

Surat \'sůr-ət, sə-'rat\ City (pop., 2001: 2,433,835), southeastern Gujarat state, west-central India. It is near the mouth of the Tapti River and the Gulf of Khambhat (Cambay). A major seaport from the 16th century, it was conquered by the Mughals in 1573 and was twice sacked by the Marathas in the 17th century. It became a centre for textile manufacturing and shipbuilding. The British established their first factory (trading post) in India there c. 1612, marking the beginning of the British imperial presence in India. The city declined in the 18th century but prospered again with the opening of India's railways. Surat's cottons, silks, brocades, and objects of gold and silver are still famous.

surface In geometry, a two-dimensional collection of points (flat surface), a three-dimensional collection of points whose cross section is a curve (curved surface), or the boundary of any three-dimensional solid. In general, a surface is a continuous boundary dividing a three-dimensional space into two regions. For example, the surface of a sphere separates the interior from the exterior; a horizontal plane separates the half-plane above it from the half-plane below. Surfaces are often called by the names of the regions they enclose, but a surface is essentially two-dimensional and has an area, while the region it encloses is three-dimensional and has a volume. The attributes of surfaces, and in particular the idea of curvature, are investigated in differential geometry.

surface Outermost layer of a material or substance. Because the particles (atoms or molecules) on the surface have nearest neighbours beside and below but not above, the physical and chemical properties of a surface differ from those of the bulk material; surface chemistry is thus a branch of physical chemistry. The growth of crystals, the actions of catalysts and detergents, and the phenomena of adsorption, surface tension, and capillarity are aspects of behaviour at surfaces. The appearance of the surface, whether achieved with electroplating, paint, oxidation-reduction, bleaching (see bleach), or another means, is aesthetically important.

surface integral In calculus, the integral of a function of several variables calculated over a surface. For functions of a single variable, definite integrals are calculated over intervals on the x-axis and result in areas. For functions of two variables, the simplest double integrals are calculated over rectangular regions and result in volumes. More generally, an integral calculated over a plane or curved surface results in a surface integral representing a volume, though it also has many nongeometric applications.

surface tension Property of a liquid surface that causes it to act like a stretched elastic membrane (see elasticity). Its strength depends on the forces of attraction among the particles of the liquid itself and with the particles of the gas, solid, or liquid with which it comes in contact. Surface tension allows certain insects to stand on the surface of water and can support a razor blade placed horizontally on the liquid's surface, even though the blade may be denser than the liquid and unable to float. Surface tension results in spherical drops of liquid, as the liquid tends to minimize its surface area.

surfing Sport of riding breaking waves toward the shore, especially with a surfboard. The sport originated prehistorically in the South Seas. In 1777 and 1778 Capt. James Cook first reported seeing surfers in Tahiti and on Oahu. In 1821 surfing was banned by missionaries who thought it immoral. It was revived in the 1920s by the Hawaiian swimmer Duke Kahanamoku (1890–1968). Today surfing is enjoyed on beaches with breakers throughout the world, and several international championships are held. The goal is to maneuver on the unbroken face of the wave, preferably as far back toward the curl ("tube") as possible. In addition to surfboards, surfers can use belly-boards, kneeboards, or kayaks, or they can bodysurf using no board at all.

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surgeonfish *or* **tang** Any of about 75 species (family Acanthuridae) of thin, deep-bodied, tropical marine fishes that are small-scaled, with a single dorsal fin and one or more distinctive, sharp spines on either side of the tail base. The spines resemble a surgeon's scalpel and may be either fixed or hinged at the rear so that they can be opened outward and directed forward. Surgeonfishes are mostly algae eaters and usually do not exceed 20 in. (50 cm) long. The yellow surgeon, or yellow tang (*Zebrasoma flavescens*), is an Indo-Pacific species, and the blue tang (*Acanthurus coeruleus*) is found in the Atlantic and Caribbean.

Surgeonfish (*Acanthurus leucosternon*)
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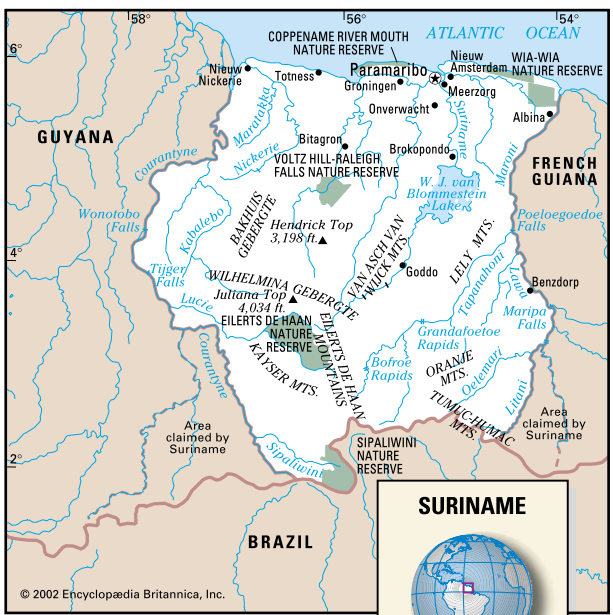
surgery Branch of medicine concerned with treatment by physical means rather than drugs. In addition to operations requiring access to the inside of the body (open surgery), it includes manipulation from outside the body (e.g., setting of a broken bone, skin grafts). Modern surgery began in the mid-19th century with use of ANESTHETICS and ANTISEPTICS. Other important advances have included DIAGNOSTIC IMAGING, BLOOD TYPING, intubation to support breathing, intravenous administration of fluids and drugs, heart-lung machines (see ARTIFICIAL HEART), ENDOSCOPY, and devices that monitor body functions. Specialized instruments used in surgery include scalpels to cut tissue, forceps to hold blood vessels closed or grasp and manipulate structures, clamps to immobilize or crush tissues, gauze sponges to absorb fluids and keep an area dry, retractors to hold incisions open, and curved needles to suture them closed. Pre- and postoperative care is crucial to the success of surgery. See also MICROSURGERY, OPEN-HEART SURGERY, ORTHOPEDICS, PLASTIC SURGERY, TRANSPLANT.

Suriname \ˌsù-rə-'nä-mə\ *officially* **Republic of Suriname** *formerly* **Dutch Guiana** Country, northern coast of South America. Area: 63,251 sq mi (163,820 sq km). Population (2005 est.): 493,000. Capital: PARAMARIBO. The population includes South Asians, Creoles, Javanese, and smaller groups of people of African, Chinese, American Indian, and Dutch descent. Languages: Dutch (official), English, Sranan (a creole language), Javanese, Sarnami (derived from Hindi and Urdu). Religions: Christianity (Roman Catholic, Protestant, other Christians), Hinduism, Islam, traditional beliefs. Currency: Suriname dollar. Suriname has a low, narrow coastal plain, inland savannas, a forested plateau region, and mountain ranges. A number of major rivers, including the COURANTYNE, MARONI, and SURINAME, cross the country to empty into the Atlantic. Bauxite mining, aluminum production, and agriculture are the largest sectors of the economy. Exports include rice, bananas, sugarcane, oranges, and shrimp. Suriname is a republic with one legislative house; its head of state and government is the president. It was inhabited by various South American Indian peoples prior to European settlement. Spanish explorers claimed Suriname in 1593, but the Dutch began to settle there in 1602, followed by the English in 1651. It was ceded to the Dutch in 1667, and in 1682 the Dutch West India Company introduced coffee and sugarcane plantations and African slaves to cultivate them. Slavery was abolished in 1863, and indentured servants were brought from China, Java, and India to work the plantations, adding to the ethnic mix of the population. Except for brief interludes of British rule (1799–1802, 1804–15), Suriname remained a Dutch colony. It gained internal autonomy in 1954 and independence in 1975. A military coup in 1980 ended civilian control until the electorate approved a new constitution in 1987. Military control resumed after a coup in 1990. Elections were held in 1992, and civilian democratic government returned.



Suriname River River, central and eastern Suriname. Rising in the highlands and flowing toward the northeast for some 300 mi (480 km), it empties into the Atlantic Ocean just north of PARAMARIBO. It was dammed at Afobaka to create W. J. van Blommestein Lake, the largest lake in Suriname.

Surma River \'sùr-mə\ River, northeastern India and eastern Bangladesh. It rises in northern MANIPUR state, India, where it is called the Barak River, and flows west into Bangladesh. There it passes through a rich tea-growing valley and eventually enters an old channel of the BRAHMAPUTRA and becomes the MEGHNA RIVER, before entering the GANGES. It is 560 mi (900 km) long.

Surrealism Movement in the visual arts and literature that flourished in Europe between World Wars I and II. Surrealism grew principally out of the earlier DADA movement, which before World War I produced works of anti-art that deliberately defied reason; Surrealism developed in reaction against the "rationalism" that had led to World War I. The movement was founded in 1924 by ANDRÉ BRETON as a means of joining dream and fantasy to everyday reality to form "an absolute reality, a surreality." Drawing on the theories of SIGMUND FREUD, he concluded that the unconscious was the wellspring of the imagination. Breton was a poet, but Surrealism's major achievements were in painting. Some artists practiced organic, emblematic, or absolute Surrealism, expressing the unconscious through suggestive yet indefinite biomorphic images (e.g., JEAN ARP, MAX ERNST, ANDRÉ MASSON, JOAN MIRÓ). Others created realistically painted images, removed from their context and reassembled within a paradoxical or shocking framework (SALVADOR DALÍ, RENÉ MAGRITTE). With its emphasis on content and free form, Surrealism provided a major alternative to the contemporary, highly formalistic CUBIST movement and was largely responsible for perpetuating in modern painting the traditional emphasis on content.

Surrey Administrative county (pop., 2001: 1,059,015) and historic county, southern England. Surrey is located southwest of LONDON. Sheep raising was an important medieval activity for the county, and by the 16th century a cloth trade was also growing. Its forested hills were a source of timber for charcoal, construction, and shipbuilding. Transport of these products, originally dependent on rivers, was facilitated in 1801 when the Surrey Iron Railway was established as the first public railway. During the 19th century the world's densest network of suburban railways developed in northern Surrey. Suburban growth continued after World War II, proceeding under planning restraints. The county seat is Guildford.

Surrey, Henry Howard, earl of (b. 1517, Hunsdon, Hertfordshire, Eng.?—d. Jan. 13, 1547, London) English poet. Because of his aristocratic birth and connections, Surrey was involved in the jockeying for place that accompanied HENRY VIII's policies. After returning to England in 1546 from a campaign abroad, he was accused of treason by his rivals. After his sister admitted he was still a Roman Catholic, he was executed at age 30. Most of his poetry was published 10 years later. With THOMAS WYAT, he introduced into England the styles and metres of the Italian humanist poets, laying the foundation of a great age in English poetry. He translated two books of VIRGIL's *Aeneid*, marking the first use in English of BLANK VERSE and was the first to develop the SONNET form used by WILLIAM SHAKESPEARE.

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surrogate motherhood Practice in which a woman (the surrogate mother) bears a child for a couple unable to produce children, usually because the wife is infertile or unable to carry a pregnancy to term. The surrogate is impregnated either through ARTIFICIAL INSEMINATION (usually with the sperm of the husband) or through the implantation of an embryo produced by in vitro fertilization. The surrogate traditionally gives up all parental rights, though this has been subject to legal challenge.

Surtees, Robert Smith (b. May 17, 1803, The Riding, Northumberland, Eng.—d. March 16, 1864, Brighton, Sussex) English novelist. Passionately addicted to riding to hounds from his youth, Surtees devoted nearly all his writings to horses and riding. In 1831 he launched *New Sporting Magazine*. His famous comic character Mr. Jorrocks, a blunt Cockney grocer entirely given over to fox hunting, appeared in *Jorrocks's Jaunts and Jollities* (1838), *Handley Cross* (1843), and *Hillingdon Hall* (1845). Among his other novels, which also portray the boredom, ill manners, discomfort, and coarse food of English provincial life, are *Hawbuck Grange* (1847) and *Mr. Facey Romford's Hounds* (1865).

Surtsey \'sərt-sē\ Volcanic island off southern Iceland. It emerged from the ocean in a fiery eruption in November 1963. Over four years its volcanic core built up an island 1 sq mi (2.5 sq km) in area, with elevations over 560 ft (170 m). Named for the fire god of Icelandic mythology, it is now a nature reserve and the site of a joint Icelandic-U.S. biological research program.

surveying Method of making relatively large-scale, accurate measurements of the earth's surfaces. Its principal modern uses are in the fields of transportation, building, land use, and communications. Surveying is divided into the categories of plane surveying (mapping small areas) and geodetic surveying (mapping large areas of the globe). The Romans are said to have used the plane table, which consists of a drawing board mounted on a tripod or other support and a straightedge along which lines are drawn. It was the first device capable of recording or establishing angles. With the publication of logarithmic tables in 1620, portable angle-measuring instruments, called topographic instruments, or theodolites, came into use; they included pivoted arms for sighting and could be used for measuring both horizontal and vertical angles. Two revolutionary 20th-century innovations were photogrammetry (mapping from aerial photographs) and electronic distance measurement, including the use of the laser.

Surveyor Any of a series of seven unmanned U.S. space probes sent to make soft landings on the MOON in 1966–68. Surveyor 2 crashed on the Moon, and radio contact with Surveyor 4 was lost minutes before landing, but the rest sent back thousands of photographs; some were equipped to sample and test lunar soil. Surveyor 6 made the first liftoff from an extraterrestrial body; Surveyor 7 landed in the lunar highlands and returned data showing that the landscape and soil there differ from those of lower areas. See also LUNA; PIONEER; RANGER.

Surya In HINDUISM, the sun and the sun god. Though once ranking with the major Hindu deities, he is now primarily worshiped only as one of the five important deities of the SMARTA sect and as the supreme deity by the small Savra sect. Nevertheless, he is still invoked by all orthodox Hindus in daily prayer, and his temples are found throughout India. He is the father of MANU, YAMA, and several other gods. The PURANAS record that the weapons of the gods were forged from pieces trimmed from Surya.

Surya, stone image from Deo-Barunarak, Bihar, India, 9th century AD. PRAMOD CHANDRA

Suryavarman \ˌsůr-yə-'vär-mən\ **II** (d. c. 1150) Khmer (Cambodian) king under whom ANGKOR WAT was built. Suryavarman established sole rule over Cambodia in c. 1113, reuniting the country after 50 years of unrest. He expanded his country to include much of what is now Thailand, portions of Vietnam, and part of the Malay Peninsula. He promulgated VAISHNAVISM (a form of Hinduism), rather than the Buddhism of his predecessors, as the official religion. Construction of Angkor Wat, the world's largest religious structure, began under Suryavarman, and he figures prominently in its decorations. He died during a campaign against the kingdom of CHAMPA; the Chams eventually ravaged Angkor.

Susanna Figure in an apocryphal book of the Bible. The History of Susanna, set in Babylon during the Jewish exile, tells of a woman falsely accused of adultery by two elders who had earlier tried to seduce her. She is saved from death by DANIEL's intervention. The tale is one of a cycle of traditions added to the book of Daniel when it was translated into Greek. The scene in which the elders spy on her at her bath was a popular subject for Renaissance artists.

Suslov \'süs-ˌlȯf**, Mikhail (Andreyevich)** (b. Nov. 21, 1902, Shakhovskoye, Russia—d. Jan. 25, 1982, Moscow, Russia, U.S.S.R.) Soviet ideologue. He joined the Communist Party in 1921 and was sent to Moscow for his education, after which he taught economics. In the 1930s he helped supervise the Stalinist purges in the Urals and Ukraine. Later a leading official in the Caucasus, he supervised the deportation of ethnic minorities in World War II. He was appointed to the Politburo in 1952, and from 1955 he held a pivotal position in the ruling clique. A political conservative, he helped NIKITA KHRUSHCHEV quell a conspiracy in the Politburo in 1957, but he organized the bloodless coup in 1964 that ousted Khrushchev and substituted LEONID BREZHNEV. Thereafter, he concentrated on relations between the Soviet Communist Party and other communist parties around the world.

suspension, automobile Elastic members designed to cushion the impact of road irregularities on a portion of an automotive vehicle. The members link the vehicle's tires with its suspended portion, and usually consist of springs and shock absorbers. Spring elements used for automobile suspension members include (in increasing order of ability to store elastic energy per unit of weight) leaf springs, coil springs, torsion bars, rubber-in-shear devices, and air springs. The springs absorb the energy of impacts of the tires along the road surface, and the shocks damp or dissipate that energy, using hydraulics, so that the suspended portion of the vehicle does not keep bouncing. See illustration on following page.

Susquehanna \ˌsəs-kwə-'ha-nə\ **River** River, central New York, Pennsylvania, and Maryland, U.S. One of the longest rivers in the eastern U.S., it is about 444 mi (715 km) long. It rises in Otsego Lake, central New York, and winds through the APPALACHIAN MOUNTAINS before flowing into northern CHESAPEAKE BAY. Though it was never an important waterway because of obstructions, including rapids, its valley was at one time a significant land route to the OHIO RIVER system and was later a coal-mining region.

Susskind \'səs-ˌkīnd**, David (Howard)** (b. Dec. 19, 1920, New York, N.Y., U.S.—d. Feb. 22, 1987, New York City) U.S. television producer and host. After being educated at the University of Wisconsin and Harvard University, he worked as a publicist before forming the agency Talent Associates in 1952. He produced numerous television programs, including *Circle Theater* (1955–63) and *Dupont Show of the Month* (1957–64), but he became best known as host of the talk shows *Open End* (1958–67) and *The David Susskind Show* (1967–86), for which he won many Emmy Awards. *Open End* began at 11:00 PM and ran until the program's participants grew too tired to continue. Noted for his provocative discussions of controversial issues such as race relations, organized crime, and the Vietnam War, he also interviewed international leaders, notably NIKITA KHRUSHCHEV (1960).

Sutherland, Graham (Vivian) (b. Aug. 24, 1903, London, Eng.—d. Feb. 17, 1980, London) British painter. After studying art in London, he taught and practiced printmaking (1926–40) at the Chelsea School of Art. His early work was characterized by an exacting representationalism that evolved into SURREALISM. He turned primarily to painting c. 1935 and served as official war artist 1940–45; his war paintings are an evocative record of desolation. His "thorn period" began with his *Crucifixion* (1946), considered to be one of the most important religious paintings of the 20th century. In such late works he incorporated anthropomorphic insect and plant forms, particularly thorns, which he transformed into powerful, frightening totemic images. Sutherland was known, too, for his expressionistic, penetrating portraits. He also designed the enormous tapestry (c. 1955–61) for the new Coventry Cathedral.

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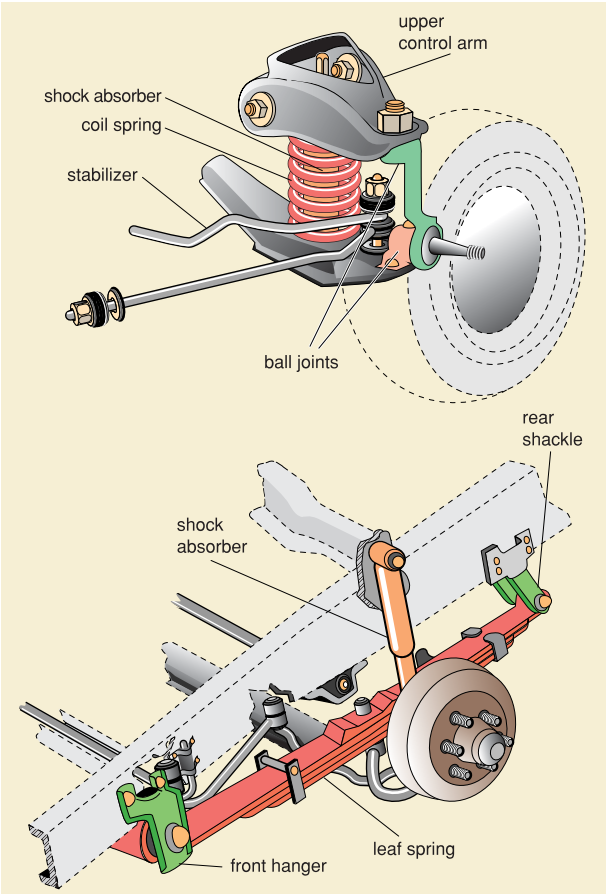

Two forms of automobile suspension. A vehicle is suspended over its wheels by springs, usually either coil or leaf springs (top and bottom, respectively). Irregularities in the road surface are transmitted mechanically to the springs. The energy in the compressed springs is dissipated by shock absorbers mounted inside or outside coil springs or beside leaf springs.
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Sutherland, Dame Joan (b. Nov. 7, 1926, Sydney, Austl.) Australian soprano. After debuting in Sydney in 1947, she moved to London. Having sung minor roles at Covent Garden from 1952, she established her status as one of the leading coloraturas of the 20th century in a 1959 performance of *Lucia di Lammermoor*. She made her Metropolitan Opera debut in 1961, and she became a favourite there and worldwide in bel canto roles until her retirement in 1991.

Sutlej River \'sət-ˌlej\ River, Asia. The longest of the "Five Rivers" that give Punjab its name, it is 900 mi (1,450 km) long. It rises in southwestern Tibet and flows west through the Himalayas, across Himachal Pradesh and Punjab, India, then southwest across Punjab province of Pakistan. It forms 65 mi (105 km) of the Indo-Pakistani border. It joins the Chenab River in Pakistan to become the Panjnad, the link between the Five Rivers and the Indus. Its middle course is used extensively for irrigation.

sutra \'sü-trə\ *Pali* **sutta** In Hinduism, a brief aphoristic composition; in Buddhism, a more extended exposition of a subject and the basic form of the scripture of both Theravada and Mahayana traditions. Since the early Indian philosophers did not work with written texts at all, and later philosophers often disdained them, there was a need for very brief explanatory works that could be committed to memory. The earliest sutras were expositions of ritual procedures, but their use spread, and eventually nearly all Indian philosophical systems had their own sutras. See also Avatamsaka-sutra, Diamond Sutra, Lotus Sutra, Tripitaka.

Sutta Pitaka \'sůt-tə-'pi-tə-kə\ Major section of the Tripitaka, the canon of Theravada Buddhism, largely attributed to the Buddha himself. It is divided into five collections, or *Nikayas*: the *Digha Nikaya* ("Long Collection"), containing 34 lengthy sutras, including some of the most important doctrinal expositions; the *Majjhima Nikaya* ("Medium Collection"), containing 152 sutras dealing with a variety of subjects; the *Samyutta Nikaya* ("Cluster Collection"), with more than 7,000 sutras arranged according to subject; the *Anguttara Nikaya* ("Gradual Collection"), a numerical arrangement, for mnemonic purposes, of 9,557 terse sutras; and the Khuddaka Nikaya ("Short Collection"). See also Abhidhamma Pitaka; Vinaya Pitaka.

suttee *or* **sati** \'sə-ˌtē, ˌsə-'tē\ Indian practice whereby a widow burns herself to death either on the funeral pyre of her husband or soon after his death. The custom may be rooted in ancient beliefs that a husband needed his companions in the afterlife, though opponents point to it as an indication of a value system deeply hostile to women. Developed by the 4th century BC, it became widespread in the 17th–18th centuries but was banned in British India in 1829. Frequent instances of suttee continued to occur for many years thereafter, and occasional instances in remote areas are still reported today.

Sutter, John (Augustus) *orig.* **Johann August Suter** (b. Feb. 15, 1803, Kandern, Baden—d. June 18, 1880, Washington, D.C., U.S.) German-born U.S. pioneer. Fleeing financial failures, he left his family in Switzerland and arrived in the U.S. in 1834. He obtained a land grant from the Mexican governor and established the colony of Nueva Helvetia (later Sacramento, Calif.). On the American River he built Sutter's Fort, a frontier trading post, in 1841. When gold was found there in 1848, he tried to keep it a secret. In the resulting gold rush, squatters and gold seekers invaded his land and stole his goods and livestock. U.S. courts denied his claim to his Mexican land grant, and Sutter was bankrupt by 1852.

Sutton Hoo Estate in Suffolk, England, the site of the grave or cenotaph of an Anglo-Saxon king. One of the richest Germanic burials ever found in Europe (1939), the Sutton Hoo site contained an 80-ft (24-m) wooden ship equipped for the afterlife (but with no body). It displayed both pagan and Christian features. The burial's grave goods demonstrate a high level of craftsmanship and included solid gold and silver objects, such as cups and bowls, and weapons, including a bejeweled sword. There were also coins from the Continent and a dish bearing the stamp of the Byzantine emperor Anastasius I, which reveal broader contacts for the people of England at the time than had been previously recognized. The burial may have been for Raedwald (d. 624?) or Aethelhere (d. 654). Parallels to Swedish finds suggest a possible Swedish origin for the East Anglian royal dynasty.

Sutton, Walter S(tanborough) (b. 1877, Utica, N.Y., U.S.—d. Nov. 10, 1916, Kansas City, Kan.) U.S. geneticist. He received a medical degree from Columbia University and practiced surgery the rest of his life. In 1902 he provided the earliest detailed demonstration that somatic chromosomes (those in cells other than sex cells) occur in distinct pairs of like chromosomes, hypothesizing that chromosomes carry the units of inheritance and that their behaviour during meiosis is the physical basis of Gregor Mendel's concept of heredity. In 1903 he concluded that chromosomes contain units of heredity (now known as genes) and that their behaviour during meiosis is random. His work formed the basis for the chromosomal theory of heredity.

Suva Seaport, (pop., 2003 est.: urban area, 210,472), capital of Fiji. Founded in 1849, it was made a city in 1952; it is now one of the largest urban centres in the South Pacific Ocean. With its fine harbour, Suva is Fiji's chief port and commercial centre and the site of educational and cultural institutions.

Suvorov \sü-'vȯ-rȯf**, Aleksandr (Vasilyevich), Count** (b. Nov. 24, 1729, Moscow, Russia—d. May 18, 1800, St. Petersburg) Russian army commander. Joining the army at age 15, he became an officer in 1754 and served in the Seven Years' War. He wrote a battle-training manual that helped Russia win the Russo-Polish conflict (1768–72) and a conflict with the Turks in 1773–74. He led the army in the Russo-Turkish War and was created a count. After crushing a revolt in Poland in 1794, he was promoted to field marshal. He commanded a Russo-Austrian force in Italy in 1799 and captured Milan, expelling most of the French army from Italy. Ordered to relieve a Russian force in Switzerland, he marched

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across the Alps; surrounded by a larger French force, he succeeded in breaking out and, repulsing the pursuing French, escaped with most of his army, a remarkable feat.

Suwannee \sə-'wä-nē\ **River** River, southeastern Georgia and northern Florida, U.S. The river rises in the Okefenokee Swamp and enters the Gulf of Mexico at Suwannee Sound after a course of 250 mi (400 km). All but 35 mi (56 km) of its course are in Florida. It is the Swanee River of Stephen Foster's famed "Old Folks at Home." In the 1780s the bays and inlets of Suwannee Sound were rendezvous points for pirates.

Suzdal \'süz-dəl\ Medieval principality, between the Oka River and the Upper Volga, northeastern Russia. Ruled by a branch of the Rurik dynasty during the 12th–14th centuries, it united with Rostov and in the 12th century with Vladimir. Suzdal-Vladimir achieved great political and economic importance, but in the 13th–14th centuries it disintegrated into small principalities, which ultimately were absorbed by Moscow. See also Vladimir-Suzdal school.

Suzman \'sùz-män**, Helen** *orig.* **Helen Gavronsky** (b. Nov. 7, 1917, Germiston, S.Af.) South African legislator. Born in the Transvaal to Lithuanian immigrants, she graduated from the University of Witwatersrand, where she later taught economic history (1945–52). Elected to Parliament in 1953, she and 11 others formed the Progressive Party to oppose apartheid. Suzman alone of the group was reelected in 196l; until 1974 she often cast the lone vote against an increasing number of apartheid measures. In 1978 she received the UN Human Rights award. Until her retirement in 1989, she remained a significant voice in the South African Parliament.

Svalbard \'sfäl-ˌbär\ Archipelago, Norway. Located in the Arctic Ocean, north of the Arctic Circle, Svalbard consists of nine main islands, the largest being Spitsbergen (formerly West Spitsbergen). The islands are mountainous, with glaciers and snowfields covering nearly 60% of the area. The islands were first visited in modern times by the Dutch in 1596. In the early 20th century many countries, including the U.S., debated ownership of mineral rights there. Officially a Norwegian possession since 1920, the islands have been the site of many scientific polar expeditions (beginning in 1773). The population changes seasonally but numbers about 3,000; there are no indigenous inhabitants. Longyearbyen is the administrative centre.

Svealand \'svā-ə-ˌländ\ Region, south-central Sweden. Stretching across the breadth of the country, it covers an area of 31,212 sq mi (80,844 sq km). Settled as early as the Stone Age, it was the original home of the Svear, a people who gave Sweden its name, and it was the political and cultural centre from which Sweden developed and later secured its independence. Its diversified economy includes agriculture, manufacturing, forestry, and mining.

Svedberg \'svād-ˌbarʸ,\ *English* \'sved-ˌbərg**, The(odor)** (b. Aug. 30, 1884, Fleräng, near Gävle, Swed.—d. Feb. 25, 1971, Örebro) Swedish chemist. He won a Nobel Prize in 1926 for his studies in the chemistry of colloids and for his invention of the ultracentrifuge (see centrifuge), which has become invaluable to research in biochemistry and other areas. Svedberg used it to determine precisely the molecular weights of highly complex proteins (e.g., hemoglobin). Later he made studies in nuclear chemistry, contributed to the improvement of the cyclotron, and helped his student Arne Tiselius (1902–71) develop electrophoresis.

Sverdlov \'svʸerd-lȯf**, Yakov (Mikhaylovich)** (b. June 3, 1885, Nizhny Novgorod, Russia—d. March 16, 1919, Moscow) Soviet politician. A Bolshevik organizer and agitator in the Urals, he was often arrested and exiled. In the Russian Revolution of 1917, he headed the Bolshevik secretariat and helped plan and execute the October coup that brought the Bolsheviks to power. As titular head of state, he worked closely with Vladimir Lenin to consolidate power in the Communist Party's Central Committee. His untimely death at age 33 from an infectious illness left a void in the party hierarchy that was filled by Joseph Stalin in 1922.

Sverdlovsk See Yekaterinburg

Svevo \'zvā-vō**, Italo** *orig.* **Ettore Schmitz** (b. Dec. 19, 1861, Trieste, Austrian Empire—d. Sept. 13, 1928, Motta di Livenza, Italy) Italian writer. Though family financial difficulties forced him to leave school and become a bank clerk, he read on his own and began to write. *A Life* (1892), revolutionary in its analytical, introspective treatment of an ineffectual hero, was ignored on publication, as was *As a Man Grows Older* (1898). He gave up writing until, encouraged by James Joyce (then living in Trieste), he produced his most famous novel, *Confessions of Zeno* (1923), a brilliant work in the form of a patient's statement for his psychiatrist. He died in an auto accident. Two short-story collections, essays, dramatic works, correspondence with Eugenio Montale, and his unfinished *Further Confessions of Zeno* (1969) were published after his death. He is regarded as a pioneer of the psychological novel.

Svyatoslav I \'svyä-tə-släf\ (d. 972) Grand prince of Kiev (945–72). The greatest of the Varangian princes of early Russian history, he defeated the Khazar and other peoples in the northern Caucasus (963–965) and conquered the Bulgars (967). Hoping to found a Russo-Bulgarian empire, he refused to cede his conquest to the Byzantines until their army defeated him and forced the surrender of Balkan territory (971). He was killed in an ambush on his way back to Kiev.

Swabia *German* **Schwaben** \'shväb-ᵊn\ Duchy, medieval Germany, and current administrative district. The duchy of Swabia was nearly coextensive with modern Baden-Württemberg, Hesse, and western Bavaria states, as well as parts of eastern Switzerland and Alsace. The Suevi and Alemanni tribes occupied the area from the 3rd century, and the region was known as Alemannia until the 11th century. In the 7th century Irish missionaries began to introduce Christianity. From c. 10th century it became one of the five great tribal duchies of early medieval Germany. It was ruled by the Hohenstaufen dynasty c. 1077–1268, after which the duchy was divided. Several alliances of cities, known as the Swabian Leagues, were formed in the 14th–16th centuries. The region was a territorial division of the Holy Roman Empire in the 16th–19th centuries. Its chief cities included Augsburg, Freiburg, Konstanz, and Ulm. Created in 1934, the administrative district is coextensive with the eastern portion of the larger historic region of Swabia and has an area of 3,859 sq mi (9,994 sq km) and a population (2002 est.) of 1,767,193.

swage \'swāj, 'swej\ Perforated cast-iron or steel block with grooved sides, used by metalworkers for shaping their work by holding it on the work (or the work on it) and striking with a hammer or sledge. Swage blocks are used in heading bolts and swaging bars by hand.

Swahili \swä-'hē-lē\ **language** Bantu language spoken in Tanzania, Kenya, Uganda, and Congo (Kinshasa). It is spoken as a first language by more than 2 million people and as a second language by some 60 million. Standard Swahili is based on the Unguja (kiUnguja) dialect of Zanzibar, which was spread far inland in the 19th century by entrepreneurs seeking ivory and slaves. Its use was perpetuated by the European colonial governments that occupied East Africa toward the end of the century. Modern Swahili is usually written in the Latin alphabet, though Swahili literature in Arabic script dates to the early 18th century. Among Bantu languages, Swahili is remarkable for the number of loanwords it has absorbed, especially from Arabic.

swallow Any of 74 species (family Hirundinidae) of songbirds found nearly worldwide. Swallows are 4–9 in. (10–23 cm) long, with long, pointed, narrow wings; a short bill; small, weak feet; and sometimes a forked tail. The dark upper plumage may have a metallic blue or green sheen. Swallows capture insects on the wing. They nest in tree holes, burrow into sandbank, or plaster mud nests to walls. Some species (e.g., the common swallow, *Hirundo rustica*) are long-distance migrants; all have a strong homing instinct. The swallows of California's San Juan Capistrano Mission are cliff swallows (*Petrochelidon pyrrhonota*). See also martin.

Common swallow (*Hirundo rustica*).
STEPHEN DALTON—NATURAL HISTORY PHOTOGRAPHIC AGENCY/EB INC.

swallowing *or* **deglutition** \ˌdē-ˌglü-'tish-ən\ Act that moves food from the mouth to the stomach. The tongue pushes liquid or chewed food mixed with saliva into the pharynx. Reflex takes over as the soft palate rises to close off the nasal cavity; the larynx rises and the epiglottis covers the trachea, interrupting breathing. Pressure in the mouth and pharynx pushes food toward the esophagus, whose upper sphincter opens to let food in and closes to prevent backflow. Breathing resumes as the lar-

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ynx lowers. As PERISTALSIS pushes food to the STOMACH, the lower esophageal sphincter opens and then closes to prevent reflux. Painful swallowing is usually caused by INFLAMMATION; other problems are caused by blockage or disorders affecting the motions of swallowing.

swallowtail butterfly Any of more than 500 species (genus *Papilio*, family Papilionidae) of BUTTERFLIES found worldwide except in the Arctic. Some have tail-like extensions of the hind wing. Colour patterns vary with species, sex, season, and sometimes location (see TIGER SWALLOWTAIL). Most adults have yellow, orange, red, green, or blue markings on an iridescent black, blue, or green background. The brightly coloured larvae eat foliage. Some have markings resembling a snake's head, and many discharge a bad-smelling substance when disturbed. The giant swallowtail (*P. cresphontes*), with a wingspan of 4–5.5 in. (10–14 cm), is the largest butterfly in the U.S. and Canada.

swami See SADHU AND SWAMI

Swammerdam \'sväm-ər-ˌdäm**, Jan** (b. Feb. 12, 1637, Amsterdam, Neth.—d. Feb. 15, 1680, Amsterdam) Dutch naturalist. An adept microscopist, in 1658 he became the first person to observe and describe red blood cells. In his *General History of Insects* he accurately described and illustrated the life histories and anatomy of many insect species and classified insects into four major divisions, three of which have been more or less retained in modern classification. He studied tadpole and adult frog anatomy and described the ovarian follicles of mammals. His improved techniques for injecting wax and dyes into cadavers had important consequences for the study of human anatomy. He showed that muscles alter in shape but not in size during contraction.

swamp Freshwater wetland ecosystem characterized by poorly drained mineral soils and plant life dominated by trees. Swamps have a sufficient water supply to keep the ground waterlogged, and the water has a high-enough mineral content to stimulate decay of organisms and to prevent the accumulation of organic materials. They are found throughout the world. See also MARSH.

swan Long-necked, heavy-bodied, big-footed WATERFOWL (genus *Cygnus*, family Anatidae). Among waterfowl, swans are the largest and fastest, both swimming and flying; at about 50 lbs (23 kg), the mute swan (*C. olor*) is the heaviest flying bird. Swans dabble in shallows for aquatic plants. Five all-white, black-legged species live in the Northern Hemisphere; a black and a black-necked species live in the Southern Hemisphere. Males (cobs) and females (pens) look alike. Swans mate for life. The cob keeps guard while the pen incubates, on average, six eggs on a heap of vegetation; the young (cygnets) are tended for several months. Their graceful form when swimming has made swans emblems of beauty for centuries.

Mute swan (*Cygnus olor*) and cygnet
ARTHUR W. AMBLER—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

Swan, Sir Joseph (Wilson) (b. Oct. 31, 1828, Sunderland, Durham, Eng.—d. May 27, 1914, Warlingham, Surrey) English physicist and chemist. By 1871 he had invented the dry photographic plate, an important improvement in photography. He had already produced an early electric lightbulb (1860), and in 1880, independently of THOMAS ALVA EDISON, he produced a carbon-filament incandescent electric lamp. He also patented a process for squeezing nitrocellulose through holes to form fibres, a process that became widely employed in the textile industry.

Swan River Ephemeral river, southwestern Western Australia. It flows 224 mi (360 km) west to the Indian Ocean. Called the Avon in its upper course, it is known as the Swan only along its lower 60-mi course. PERTH lies near its mouth. The river is dry during much of the summer and autumn. In 1829, western Australia's first free settlement was made on its banks.

Swansea \'swän-zē\ *Welsh* **Abertawe** \ˌa-bər-'taù-ə\ Seaport and county (pop., 2001: 223,293), southern Wales. Lying along the BRISTOL CHANNEL, it is the second largest city in Wales. It dates from the 12th century. Until the early 18th century it was a small market town and coal port; thereafter it grew steadily with industry, and by the mid-19th century it was the focus of the world copper trade. The city centre was almost totally destroyed by German bombing in 1941 but has been redeveloped, and Swansea is now the chief shopping and service hub for southwestern Wales. The poet DYLAN THOMAS was born there.

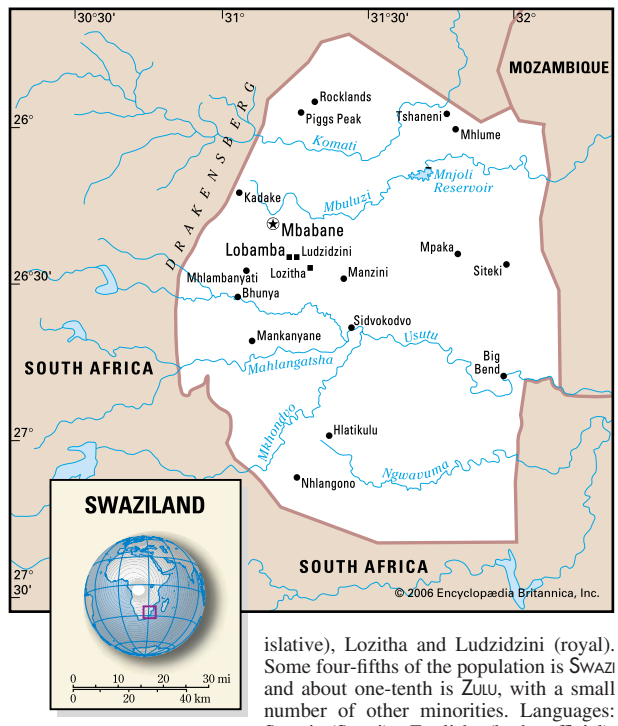
SWAPO See SOUTH WEST AFRICA PEOPLE'S ORGANIZATION

Swarthmore College Private liberal arts college in Swarthmore, Pa., near Philadelphia. It was founded by a group of Quakers in 1864. Consistently ranked as one of the best colleges in the U.S., it offers bachelor's degree programs in a wide variety of disciplines. It participates in an exchange program with BRYN MAWR and HAVERFORD colleges and the University of PENNSYLVANIA.

swastika Equilateral cross with its arms bent at right angles, all in the same rotary direction, usually clockwise. It is used widely throughout the world as a symbol of prosperity and good fortune. In India, it continues to be the most common auspicious symbol of Hindus and Jains, as well as for Buddhists, for whom it symbolizes the Buddha's feet or footprints. In China and Japan, where it traveled with the spread of Buddhism, it has been used to denote plurality, prosperity, and long life. It occurs as a motif in early Christian and Byzantine art, as well as in Maya and Navajo art. The counterclockwise swastika, suggested as a general anti-Semitic symbol in 1910 by the German poet and nationalist Guido von List, was adopted as the symbol of the NAZI PARTY at its founding in 1919–20.

Swazi \'swä-zē\ *or* **Swati** \'swä-tē\ Bantu-speaking people inhabiting the grasslands of SWAZILAND and neighbouring regions of South Africa and Mozambique. With the ZULU and the XHOSA, the Swazi (numbering more than two million) form the southern NGUNI ethnolinguistic group. They are chiefly agriculturalists and pastoralists. The highest traditional political, economic, and ritual powers are shared by a hereditary male ruler and his mother. The king's wives and children are settled in royal villages, diplomatically dispersed throughout the territory.

Swaziland *officially* **Kingdom of Swaziland** Country, southern Africa. Area: 6,704 sq mi (17,364 sq km). Population (2005 est.): 1,032,000. Capitals: MBABANE (administrative and judicial), LOBAMBA (legislative), Lozitha and Ludzidzini (royal). Some four-fifths of the population is SWAZI and about one-tenth is ZULU, with a small number of other minorities. Languages: Swazi (Swati), English (both official). Religions: Christianity (predominantly other [African, unaffiliated] Christians; also Protestant, Roman Catholic); also traditional beliefs. Currency: lilangeni. The landlocked country is composed of high, middle, and low



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velds, culminating in the Lubombo escarpment in the east. Fauna includes hippopotamuses, antelopes, zebras, and crocodiles. Four major rivers, including the Komati, flow through the country and irrigate citrus and sugarcane estates. Mineral resources include asbestos and diamonds. Swaziland is a monarchy with two legislative houses; its head of state and government is the king, assisted by the prime minister. Stone tools and rock paintings indicate prehistoric habitation in the region, but it was not settled until the Bantu-speaking Swazi people migrated there in the 18th century and established the nucleus of the Swazi nation. The British gained control in the 19th century after the Swazi king sought their aid against the Zulu. Following the South African War, the British governor of Transvaal administered Swaziland; his powers were transferred to the British high commissioner in 1906. In 1949 the British rejected the Union of South Africa's request to control Swaziland. The country gained limited self-government in 1963 and achieved independence in 1968. In the 1970s new constitutions were framed based on the supreme authority of the king and traditional government. Although the kingdom remained in place in the early 21st century, steps were being taken to establish a constitution. Swaziland has one of the highest rates of HIV infection in the world, with some two-fifths of the population infected.

sweat gland Either of two types of perspiration glands in the skin. Eccrine sweat glands, controlled by the sympathetic nervous system, use evaporation to cool the skin by secreting water when body temperature rises. Apocrine sweat glands, usually associated with hair follicles, are concentrated in the underarms and genital region. Starting at puberty, hormones stimulate them to continuously secrete a fatty sweat. Certain specialized glands, such as mammary glands and wax-secreting glands of the ear canal, probably developed from this type of gland.

sweat lodge Hut or lodge used for ritual purification. Its use originated with Native Americans—for whom it remains a significant ceremony—but it is now common among other non-Indian groups who recognize its health as well as spiritual benefits. The structure of the sweat lodge is usually made of bent saplings and skin or blanket coverings and is heated by steam from water poured on hot stones. A ceremony typically surrounds the lodge's construction and use. Some groups believe the lodge becomes a symbolic centre in which the six cardinal directions, the past and present, and the human and spiritual worlds are connected.

Sweden *officially* **Kingdom of Sweden** Country, eastern Scandinavian Peninsula, northern Europe. Area: 173,860 sq mi (450,295 sq km). Population (2005 est.): 9,024,000. Capital: Stockholm. The population is largely homogeneous, although there are Finnish and Sami (Lapp) minorities and 10% of the inhabitants are immigrants or their descendents. Language: Swedish (official). Religions: Christianity (predominantly Protestant; also Roman Catholic); also Islam. Currency: Swedish krona. Sweden has three traditional regions: mountainous Norrland covers about three-fifths of the country and has vast forests and large ore deposits; Svealand has undulating glacial ridges and contains most of the country's 90,000 lakes; and Götaland comprises the stony Småland highlands and the rich Skåne plains. About 15% of Sweden lies north of the Arctic Circle. The economy is largely based on services, heavy industries, and international trade. Sweden has large deposits of iron ore; industries include mining, lumbering, steel manufacturing, and tourism. Agricultural products include grains, sugar beets, potatoes, and livestock. One of the world's richest countries, Sweden is known for its comprehensive social welfare system. It is a constitutional monarchy and parliamentary state with one legislative house; its chief of state is the king, and the head of government is the prime minister. The first traces of human life in Sweden date from about 9000 BC. During the Viking era (9th–10th century AD), the Swedes controlled river trade in eastern Europe between the Baltic Sea and the Black Sea; they also raided western European lands. Sweden was loosely united and Christianized in the 11th–12th century. It conquered the Finns in the 12th century, and in the 14th century it united with Norway and Denmark under a single monarchy. Sweden broke away in 1523 under Gustav I Vasa. In the 17th century it emerged as a great European power in the Baltic region, but its dominance declined after its defeat in the Second Northern War (1700–21). It became a constitutional monarchy in 1809 and united with Norway in 1814; it acknowledged Norwegian independence in 1905. Sweden maintained its neutrality during both World Wars. It was a charter member of the UN but abstained from membership in NATO and did not join the European Union until 1995. A new constitution drafted in 1975 reduced the monarch's powers to those of a ceremonial chief of state. In 1997 Sweden began the controversial shutdown of its nuclear power industry. By the early 21st century it had emerged as a European centre of telecommunications and information technology.

Swedenborg, Emanuel (b. Jan. 29, 1688, Stockholm, Swed.—d. March 29, 1772, London, Eng.) Swedish scientist, theologian, and mystic. After graduating from the University of Uppsala, he spent five years abroad studying the natural sciences. On his return he began publication of Sweden's first scientific journal, *Daedelus Hyperboreas*, and Charles XII appointed him assessor with the Royal Board of Mines. His writing gradually shifted toward philosophy of nature and metaphysics, in concert with his growing belief that the universe had a basically spiritual structure. In 1744 he had a vision of Christ, and in 1745 he received a call to abandon worldly learning. He spent the rest of his career interpreting the Bible and relating what he had seen in his visions. He maintained that God was the power and life within all creatures and that the Christian Trinity represented the three essential qualities of God: love, wisdom, and activity. He believed redemption consisted in humankind's being recreated in God's image through Christ's glorification. He published more than 30 works, including *The True Christian Religion* (1771). Societies were soon founded to propagate his pantheistic teaching, notably the New Jerusalem Church, established in London in 1787. Swedenborgians came to the U.S. in the 1790s. See pantheism.

Swedenborgians See New Church

Swedish language National language of Sweden and one of two official languages of Finland, spoken by about nine million people. It belongs to the East Scandinavian group of the Germanic languages and is closely related to Norwegian and Danish. Its history from the Common Scandinavian period (600–1050) until c. 1225 is known chiefly from inscriptions in runic writing. Modern Swedish is usually dated from 1526, when a translation of the New Testament was first printed. The standard language began to emerge in the 17th century, based largely on the Svea dialects spoken in Stockholm. Swedish, like Norwegian, has two tonal word accents.

Sweet pea (*Lathyrus odoratus*)
SVEN SAMELIUS

sweet pea Annual plant (*Lathyrus odoratus*) of the pea family (see legume), native to Italy and widely

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cultivated elsewhere for its beautiful, fragrant flowers. The long (4–6 ft, or 1.2–2 m), vinelike stem climbs by means of tendrils and bears feather-like leaves. White, pink, red, violet, or purple flowers, reminiscent of butterflies in shape, are borne singly or in clusters of two to four. The fruit is a hairy pod about 2 in. (5 cm) long. Hundreds of varieties of sweet pea have been developed. The plant was the subject of important genetics experiments by Reginald Crundall Punnett and William Bateson.

sweet potato Food plant (*Ipomoea batatas*; family Convolvulaceae) native to tropical America and widely cultivated in tropical and warm temperate climates. Botanically unrelated to the white, or Irish, potato or the yam, sweet potatoes are oblong or pointed oval, tuberous roots. Skin colour ranges from light buff to brown to purplish red; the pulp may be white (highest in starch) to orange (also high in carotene) to purple. Long, trailing plant stems bear funnel-shaped flowers tinged with pink or rose violet. Sweet potatoes are served baked or mashed and used as pie filling.

sweet William Garden plant (*Dianthus barbatus*) in the pink family, grown for its clusters of small, brightly coloured flowers. It usually grows as a biennial, with seed sown the first year producing spring-flowering plants the second year. The plants grow about 2 ft (60 cm) high and produce numerous flowers with fringed petals in white, pink, or rose to violet, sometimes also bicoloured.

Sweet William (*Dianthus barbatus*)
GRANT HEILMAN

sweetbrier *or* **eglantine** Small, prickly wild rose (*Rosa eglanteria*, or *R. rubiginosa*) with fragrant foliage and numerous small pink flowers, native to Europe and western Asia. Widely naturalized in North America, it grows along roadsides and in pastures from eastern Canada southwest to Tennessee and Kansas. The shrub form, which can grow 6 ft (2 m) high, is useful for screening out traffic noise and beautifying highways.

Sweyn \'svān\ **I** *or* **Sweyn Forkbeard** (d. Feb. 3, 1014, Gainsborough, Lincolnshire, Eng.) King of Denmark (c. 987–1014) and Viking conqueror of Norway and England. He rebelled against his father, Harald Bluetooth (987), chasing him from Denmark. With Swedish and Norwegian allies, he defeated Olaf I Tryggvason (c. 1000), becoming virtual ruler of Norway. Sweyn led raids on England in 1003–04 and became king after a successful military campaign in 1013, forcing Ethelred II into exile. Norway reverted to Norwegian rule after Sweyn's death, but the Anglo-Danish empire continued under his son Canute the Great.

swift Any of about 75 species (family Apodidae) of birds found almost worldwide. The fastest of small birds, swifts can fly at 70 mph (110 kph). They are 4–9 in. (9–23 cm) long and have long wings, a chunky dark body, a broad head, and a short, wide, slightly curved bill. The tail may be short or long and deeply forked. Swifts capture insects, drink, bathe, and sometimes mate on the wing. The feet, incapable of perching, are used to cling to vertical surfaces. Swifts use their sticky saliva to glue the nest to a cave wall, the inside of a chimney, or a tree hollow.

Swift, Gustavus Franklin (b. June 24, 1839, West Sandwich, Mass., U.S.—d. March 29, 1903, Chicago, Ill.) U.S. meatpacker. Swift started as a butcher's helper at age 14 and by 1859 was operating his own butcher shop. In 1872 he became the partner of a Boston meat dealer; three years later he transferred their cattle-buying operations to Chicago. Believing profits would increase if fresh meat rather than live cattle were shipped from Chicago, he had a refrigerator car designed and made his first shipment in 1877. With his brother he formed Swift & Co. (1885). During his 18 years as president, its capitalization rose from $300,000 to $25 million. Like his rivals Philip D. Armour and Nelson Morris, Swift was a leader in byproduct utilization, entering related businesses such as soap, glue, fertilizer, and margarine.

Swift, Jonathan (b. Nov. 30, 1667, Dublin, Ire.—d. Oct. 19, 1745, Dublin) Irish author, the foremost prose satirist in English. He was a student at Dublin's Trinity College during the anti-Catholic Revolution of 1688 in England. Irish Catholic reaction in Dublin led Swift, a Protestant, to seek security in England, where he spent various intervals before 1714. He was ordained an Anglican priest in 1695. His first major work, *A Tale of a Tub* (1704), comprises three satiric sketches on religion and learning; he also became known for religious and political essays and impish pamphlets written under the name "Isaac Bickerstaff." Reluctantly setting aside his loyalty to the Whigs, in 1710 he became the leading writer for the Tories because of their support for the established church. *Journal to Stella* (written 1710–13) consists of letters recording his reactions to the changing world. As a reward for writing and editing Tory publications, in 1713 he was awarded the deanery of St. Patrick's Cathedral, Dublin. He spent nearly all the rest of his life in Ireland, where he devoted himself to exposing English wrongheadedness and their unfair treatment of the Irish. His ironic tract "A Modest Proposal" (1729) proposes ameliorating Irish poverty by butchering children and selling them as food to wealthy English landlords. His famously brilliant and bitter satire *Gulliver's Travels* (1726), ostensibly the story of its hero's encounters with various races and societies in remote regions, reflects Swift's vision of humanity's ambiguous position between bestiality and rationality.

Jonathan Swift, detail of an oil painting by Charles Jervas; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

swimming In recreation and sports, the propulsion of the body through water by combined arm and leg motions. Swimming is popular as an all-around fitness routine and as a competitive sport. It has been included in the modern Olympic Games since their inception in 1896. Events include freestyle (crawl-stroke) races at distances of 50, 100, 200, 400, 800, and 1,500 m; backstroke, breaststroke, and butterfly races at 100 and 200 m; individual medley races at 200 and 400 m; freestyle relays, 4 × 100 m and 4 × 200 m; and the medley relay, 4 × 100 m. Long-distance swimming competitions, usually of 15–37 mi (24–59 km), are generally held on lakes and inland waters.

swimming cat See Turkish van cat

Swinburne, Algernon Charles (b. April 5, 1837, London, Eng.—d. April 10, 1909, Putney, London) English poet and critic. After attending Eton and the University of Oxford, Swinburne lived on an allowance from his father. His verse drama *Atalanta in Calydon* (1865) first showed his lyric powers. *Poems and Ballads* (1866), containing some of his best work, displays his paganism and masochism and provoked controversy; a second series (1878) was less hectic and sensual. His verse is marked by emphatic rhythms, much alliteration and internal rhyme, and lush subject matter. His health collapsed in 1879 and he spent his last 30 years under a friend's guardianship. His early poetry is noted for innovations in prosody, but his later poetry is considered less important. Among his outstanding critical writings are *Essays and Studies* (1875) and monographs on William Shakespeare (1880), Victor Hugo (1886), and Ben Jonson (1889).

Algernon Charles Swinburne, watercolour by Dante Gabriel Rossetti, 1862; in the Fitzwilliam Museum, Cambridge.
COURTESY OF THE FITZWILLIAM MUSEUM, CAMBRIDGE

swine fever See hog cholera

swing Jazz played with a steady beat using the harmonic structure of popular songs and the blues as the basis for improvisations and arrangements. The popular music of the U.S. from about 1930 to 1945 (years sometimes called the swing era), swing is characterized by syncopated rhythmic momentum with equal stress accorded to the four beats of a measure. Larger jazz bands required some arranged material, and Fletcher Henderson, Duke Ellington, and Count Basie were the primary innovators

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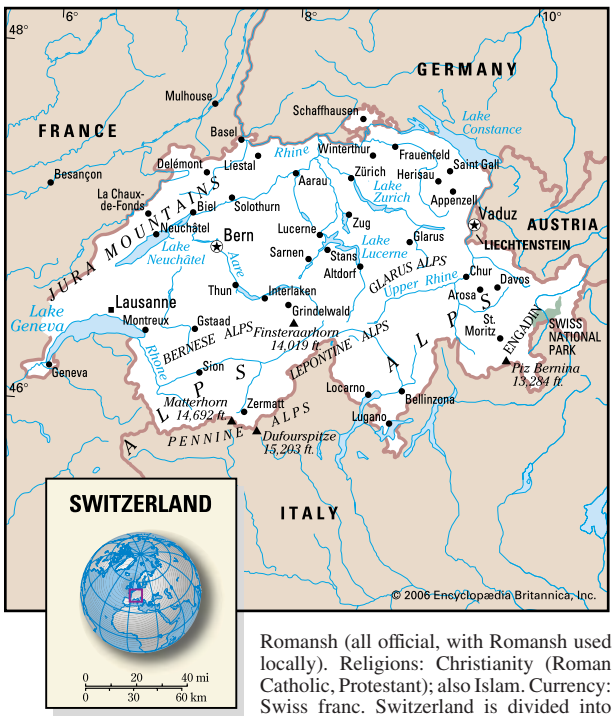
of big-band swing. In smaller ensembles, improvised instrumental solos generally follow a rendering of the melody.

Swiss chard See CHARD

switching theory Theory of CIRCUITS made up of ideal digital devices, including their structure, behaviour, and design. It incorporates Boolean logic (see BOOLEAN ALGEBRA), a basic component of modern digital switching systems. Switching is essential to telephone, telegraph, data processing, and other technologies in which it is necessary to make rapid decisions about routing information. See also QUEUING THEORY.

Switzerland *officially* **Swiss Confederation** Country, central Europe. Area: 15,940 sq mi (41,284 sq km). Population (2005 est.): 7,519,000. Capitals: BERN (administrative), Lausanne (judicial). The population is German, French, and Italian. Languages: German, French, Italian, Romansh (all official, with Romansh used locally). Religions: Christianity (Roman Catholic, Protestant); also Islam. Currency: Swiss franc. Switzerland is divided into three regions: the meadow-covered JURA MOUNTAINS; the central Mittelland, a rich agricultural and urbanized area; and the lofty crags of the ALPS. It is one of the world's major financial centres; its economy is based largely on international trade and banking, as well as light and heavy industries. Manufactures include watches, precision instruments, machinery, and chemicals. Tourism and agriculture are also important; products include grains, sugar beets, fruits and vegetables, dairy products, chocolate, and wine. Despite diverse ethnic groups, religions, and languages, Switzerland has maintained the world's oldest democracy for some 700 years. It is a federal state with two legislative houses; its head of state and government is the president of the federal council. The original inhabitants were the Helvetians, who were conquered by the Romans in the 1st century BC. Germanic tribes penetrated the region from the 3rd to the 6th century AD, and Muslim and Magyar raiders ventured in during the 10th century. It came under the rule of the FRANKS in the 9th century and the medieval empire (later the HOLY ROMAN EMPIRE) in the 11th century. In 1291 three cantons formed an anti-Habsburg league that became the nucleus of the Swiss Confederation. It was a centre of the REFORMATION, which divided the confederation and led to a period of political and religious conflict. The French organized Switzerland as the HELVETIC REPUBLIC in 1798. In 1815 the Congress of VIENNA recognized Swiss independence and guaranteed its neutrality. A new federal state was formed in 1848 with Bern as the capital. Switzerland remained neutral in both World War I and World War II and has continued to defend this neutrality. It joined the EUROPEAN FREE TRADE ASSOCIATION in 1960, but it has opted against joining the EUROPEAN UNION. It joined the UNITED NATIONS in 2002.



Swope, Gerard (b. Dec. 1, 1872, St. Louis, Mo., U.S.—d. Nov. 20, 1957, New York, N.Y.) U.S. business leader. After graduating from the Massachusetts Institute of Technology, he joined WESTERN ELECTRIC in 1895 and became a director in 1913. He was made president of GENERAL ELECTRIC CO.'s international subsidiary in 1919 and greatly increased the company's foreign business. As president of General Electric (1922–39, 1942–44), he expanded its line of consumer products and pioneered PROFIT SHARING and other employee benefit programs. He also served on the Department of Commerce's Business Advisory Council, and his ideas and support underlay such important New Deal programs as the NATIONAL RECOVERY ADMINISTRATION and SOCIAL SECURITY.

sword Hand weapon consisting of a long metal blade fitted with a handle or hilt. Roman swords had a short, flat blade and a hilt distinct from the blade. Medieval European swords were heavy and equipped with a large hilt and a protective guard, or pommel. The blade was straight, double-edged, and pointed. The introduction of firearms did not eliminate the sword but led to new designs; the discarding of body armour required the swordsman to be able to parry, and the rapier, a double-edged sword with a narrow, pointed blade, came into use. Swords with curved blades were used in India and Persia and were introduced into Europe by the Turks, whose scimitar, with its curved, single-edged blade, was modified in the West to the cavalry sabre. Japanese swords are renowned for their hardness and extreme sharpness; they were the weapon of the SAMURAI. Repeating firearms ended the value of the sword as a military weapon, though its continued use in duels led to the modern sport of FENCING. See also KENDO.

sword dance Folk dance by men, with swords or two-handled blades, expressing themes such as human and animal sacrifice for fertility, battle mime, and defense against evil spirits. It originated in Greek and Roman times. A sword dance appeared in Germany in 1350 and later was part of the court ballet when mock battles were staged. The Scottish sword dance is a descendant of the early crossed-sword dances, and the MORRIS DANCE retains remnants of the sword dance. Outside of Europe, such dances are found in India, Borneo, and the Balkans.

swordfish Species (*Xiphias gladius*) of prized food and game fish, found in warm and temperate oceans worldwide. A slender, scaleless fish, it has a tall dorsal fin and a long extension of the snout, used for slashing at prey. The "sword" is flat, rather than rounded as in MARLINS. The swordfish is also distinguished by its lack of teeth and pelvic fins. It is purplish or bluish above, silvery below, and grows as large as 15 ft (4.5 m) and 1,000 lb (450 kg). Though a popular food fish, it may have dangerous levels of mercury concentrated in its flesh.

Sybaris \'si-bə-rəs\ Ancient Greek city, southern Italy, on the Gulf of Tarentum. Founded c. 720 BC by ACHAEANS and known for its wealth and luxury (hence, the English word *sybarite*), it was one of the oldest cities of MAGNA GRAECIA. Twice razed by the Crotoniates (510 BC and c. 448 BC), it attempted rebuilding and relocating but never regained its importance.

Sycaminum See HAIFA

sycamore \'si-kə-ˌmȯr\ Any of several distinct trees called by the same name though in different genera and families. In the U.S. the term refers to the American PLANE TREE or buttonwood (*Platanus occidentalis*), a hardy street tree. The sycamore MAPLE, or mock plane (*Acer pseudoplatanus*), is sometimes also called simply sycamore. The biblical sycamore, actually the sycamore FIG (*Ficus sycomorus*), was used by the ancient Egyptians to make mummy cases.

Sydenham \'si-dᵊn-əm**, Thomas** (b. 1624, Wynford Eagle, Dorset, Eng.—d. Dec. 29, 1689, London) British physician. His *Observationes medicae* (1676) was a standard textbook for two centuries, noted for its detailed observations and the accuracy of its records. His treatise on gout (1683) is considered his masterpiece. He was among the first to explain the nature of hysteria and St. Vitus dance (Sydenham chorea) and to use iron to treat iron-deficiency anemia. Sydenham also named scarlet fever and differentiated it from measles, first used laudanum (a solution of opium in alcohol) as a medication, and helped popularize the use of quinine for malaria.

Sydney City (pop., 2001: 3,997,321), capital of NEW SOUTH WALES, Australia. Located on Australia's southeastern coast, it is the oldest and largest city in Australia and a major commercial and manufacturing centre. It was founded in 1788 as a penal colony (see BOTANY BAY) and quickly became a major trading centre. It is built on low hills surrounding one of the world's finest natural harbours, which supports extensive port facili-

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ties. It is dominated by Sydney Harbour Bridge, one of the biggest single-span bridges in the world, and the SYDNEY OPERA HOUSE. The city is widely known for its water sports, recreational facilities, and cultural life. It is the site of the Universities of Sydney (1850) and New South Wales (1949), and Macquarie University (1964). Sydney was the host of the 2000 Summer Olympic Games.

Sydney Opera House Performing-arts centre on the harbour in Sydney, Australia. Its dynamic, imaginative design by Danish architect Jørn Utzon (b. 1918) won a competition in 1957 and brought Utzon international fame. Construction posed a variety of problems, many resulting from the bold design consisting of a series of glittering white shell-shaped roofs. After several years of research, Utzon gave the vaults a more spherical geometry, making them easier and more economical to build. The roofs are made up of PRECAST CONCRETE sections held together by cables. The centre finally opened in 1973.

Sydow \'sē-dō,\ *Swedish* \'sœ-dȯv**, Max von** *orig.* **Carl Adolf von Sydow** (b. April 10, 1929, Lund, Swed.) Swedish actor. After studying at Stockholm's Royal Dramatic Theatre School (1948–51), he became a noted stage actor in Malmö and Stockholm. He is best known for his dour, brooding characterizations in INGMAR BERGMAN's films, notably *The Seventh Seal* (1957), *The Virgin Spring* (1960), *Winter Light* (1963), *Shame* (1968), and *The Passion of Anna* (1969). His numerous U.S. and international movies include *The Greatest Story Ever Told* (1965), *The Exorcist* (1973), *Pelle the Conqueror* (1988), *What Dreams May Come* (1998), and *Minority Report* (2002).

syllable Segment of speech usually consisting of a VOWEL with or without accompanying CONSONANT sounds (e.g., *a*, *I*, *out*, *too*, *cap*, *snap*, *check*). A syllabic consonant, like the final *n* sound in *button* and *widen*, also constitutes a syllable. Closed (checked) syllables end in a consonant, open (free) syllables in a vowel. Syllables play an important role in the study of SPEECH and in PHONETICS and PHONOLOGY.

syllogism \'si-lə-ˌji-zəm\ Form of argument that, in its most commonly discussed instances, has two CATEGORICAL PROPOSITIONS as premises and one categorical proposition as conclusion. An example of a syllogism is the following argument: Every human is mortal (every M is P); every philosopher is human (every S is M); therefore, every philosopher is mortal (every S is P). Such arguments have exactly three terms (human, philosopher, mortal). Here, the argument is composed of three categorical (as opposed to hypothetical) propositions, it is therefore a categorical syllogism. In a categorical syllogism, the term that occurs in both premises but not in the conclusion (human) is the middle term; the predicate term in the conclusion is called the major term, the subject the minor term. The pattern in which the terms S, M, and P (minor, middle, major) are arranged is called the figure of the syllogism. In this example, the syllogism is in the first figure, since the major term appears as predicate in the first premise and the minor term as subject of the second.

syllogistic \ˌsi-lə-'jis-tik\ Formal analysis of the SYLLOGISM. Developed in its original form by ARISTOTLE in his *Prior Analytics* c. 350 BC, syllogistic represents the earliest branch of formal logic. Syllogistic comprises two domains of investigation. Categorical syllogistic confines itself to categorical propositions and their variation with respect to modalities. Noncategorical syllogistic is a form of logical inference using whole propositions as its units, an approach traceable to the Stoics but only fully developed by John Neville Keynes (1852–1949).

Sylvester II *orig.* **Gerbert of Aurillac** (b. c. 945, near Aurillac, Auvergen, France—d. May 12, 1003, Rome) First French pope (999–1003). Renowned as a scholar of logic and mathematics, he became archbishop of Reims (991) and of Ravenna (c. 998). Appointed pope by his former student, OTTO III, Sylvester worked closely with Otto, strengthening papal authority in distant states such as Kiev and Norway as well as in Italy. He denounced SIMONY, demanded clerical celibacy, and limited the power of the bishops. He wrote textbooks on mathematics, the sciences, and music and the philosophical work *De rationali et de ratione uti* ("Concerning the Rational and the Use of Reason"). According to legends that emerged shortly after his death, his great learning was the result of magical arts or the Devil's coaching.

symbiosis Any of several living arrangements between members of two different species, including commensalism, mutualism, and PARASITISM. The species involved are called symbionts. In commensalism, one species (the commensal) obtains nutrients, shelter, support, or locomotion from the host species, which is substantially unaffected (e.g., REMORAS obtain locomotion and food from sharks). In mutualism, both species benefit. Many mutualistic relationships are obligative; neither species can live without the other (e.g., protozoans in the gut of TERMITES digest the wood ingested by the termites).

symbol Element of communication intended to represent or stand for a person, object, group, process, or idea. Symbols may be presented graphically (e.g., the red cross and crescent for the worldwide humanitarian agency) or representationally (e.g., a lion representing courage). They may involve associated letters (e.g., C for the chemical element carbon), or they may be assigned arbitrarily (e.g., the mathematical symbol ∞ for infinity). Symbols are devices by which ideas are transmitted between people sharing a common CULTURE. Every society has evolved a symbol system that reflects a specific cultural logic; and every symbolism functions to communicate information between members of the culture in much the same way as, but more subtly than, conventional language. Symbols tend to appear in clusters and to depend on one another for their accretion of meaning and value. See also SEMIOTICS.

symbolic interactionism See INTERACTIONISM

Symbolism In art, a loosely organized movement that flourished in the 1880s and '90s and was closely related to the SYMBOLIST MOVEMENT in literature. In reaction against both REALISM and IMPRESSIONISM, Symbolist painters stressed art's subjective, symbolic, and decorative functions and turned to the mystical and occult in an attempt to evoke subjective states of mind by visual means. Though aspects of Symbolism appear in the work of PAUL GAUGUIN, VINCENT VAN GOGH, and the NABIS, its leading exponents were GUSTAVE MOREAU, ODILON REDON, and PIERRE PUVIS DE CHAVANNES. Though associated primarily with France, it flourished all over Europe, had great international impact, and influenced 20th-century art and literature.

Symbolist movement Literary movement that originated with a group of French poets in the late 19th century, spread to painting and the theatre, and influenced Russian, European, and American arts of the 20th century. Reacting against the rigid conventions of traditional French poetry, as seen in the precise description favoured by the PARNASSIAN POETS, Symbolist poets sought to convey individual emotional experience through the subtle, suggestive use of highly metaphorical language. The arcane and indirect meaning of the symbol is evoked as a substitute for the increasingly attenuated sense of collective and universal meanings. Principal Symbolist poets included the Frenchmen STÉPHANE MALLARMÉ, PAUL VERLAINE, and ARTHUR RIMBAUD, and the Belgian poet ÉMILE VERHAEREN. Many Symbolists were also identified with the DECADENT movement. Just as Symbolist painters avoided concrete representation in favour of fantasy and imagination, Symbolist dramatists relied on myth, mood, and atmosphere to reveal only indirectly the deeper truths of existence.

Symington \'sī-miŋ-tən**, William** (b. October 1763, Leadhills, Lanarkshire, Scot.—d. March 22, 1831, London, Eng.) British engineer. Educated for the ministry, he became a mechanic instead. He created a working model of a steam-driven road carriage in 1786 and first used steam for marine purposes the following year. In 1801–02 he developed a successful steam-driven paddle wheel and used it to propel one of the first practical STEAMBOATS, the *Charlotte Dundas*. Though his engine was used successfully on the Forth and Clyde Canal in 1802, cautious managers caused the project to be abandoned in 1803.

symmetry In geometry, the property by which the sides of a figure or object reflect each other across a line (axis of symmetry) or surface; in biology, the orderly repetition of parts of an animal or plant; in chemistry, a fundamental property of orderly arrangements of atoms in molecules or CRYSTALS; in physics, a concept of balance illustrated by such fundamental laws as the third of NEWTON'S LAWS OF MOTION. Symmetry in nature underlies one of the most fundamental concepts of beauty. It connotes balance, order, and thus, to some, a type of divine principle.

Symonds \'si-məndz**, John Addington** (b. Oct. 5, 1840, Bristol, Gloucestershire, Eng.—d. April 19, 1893, Rome) English essayist, poet, and biographer. He traveled extensively for his health, finally settling in Switzerland. His chief work, *Renaissance in Italy* (1875–86), is a series of extended essays on cultural history. His writings include translations, travel sketches, and studies of personalities such as PERCY B. SHELLEY, BEN JONSON, SIR PHILIP SIDNEY, MICHELANGELO, and WALT WHITMAN. His poetry served primarily as a release from his difficult emotional life. *A Problem*

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in Greek Ethics (written 1871) and *A Problem in Modern Ethics* (1881) were among the first serious works treating homosexuality.

Symonds, chalk drawing by C. Orsi; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Symons \'si-mənz\, **Arthur (William)** (b. Feb. 28, 1865, Milford Haven, Pembrokeshire, Eng.—d. Jan. 22, 1945, Wittersham, Kent) English poet and critic. He contributed to *The Yellow Book*, an avant-garde journal, and edited *The Savoy* (1896). His *Symbolist Movement in Literature* (1899), the first English work championing the French SYMBOLIST MOVEMENT in poetry, summed up a decade of interpretation and influenced WILLIAM BUTLER YEATS and T.S. ELIOT. His poetry, mainly disillusioned in feeling, appears in such volumes as *Silhouettes* (1892) and *London Nights* (1895). He also translated the poetry of PAUL VERLAINE and wrote travel pieces. After a nervous breakdown in 1908, he produced little apart from *Confessions* (1930), a moving account of his illness.

symphonic poem *or* **tone poem** Musical work for orchestra inspired by an extramusical story, idea, or "program," to which the title typically refers or alludes. It evolved from the concert OVERTURE, an overture not attached to an opera or play yet suggestive of a literary or natural sequence of events. FRANZ LISZT, who coined the term, wrote 13 such works. Famous symphonic poems include BEDŘICH SMETANA's *The Moldau* (1879), CLAUDE DEBUSSY's *Prelude to the Afternoon of a Faun* (1894), PAUL DUKAS's *The Sorceror's Apprentice* (1897), RICHARD STRAUSS's *Don Quixote* (1897), and JEAN SIBELIUS's *Finlandia* (1900).

symphony Long musical composition for orchestra, usually in several movements. The term (meaning "sounding together") came to be the standard name for instrumental episodes, and especially overtures, in early Italian opera. The late-17th-century Neapolitan opera overture, or *sinfonia*, as established especially by ALESSANDRO SCARLATTI c. 1780, had three movements, their tempos being fast-slow-fast. Soon such overtures began to be performed by themselves in concert settings, like another forerunner of the symphony, the CONCERTO GROSSO. The two merged in the early 18th century in the symphonies of Giovanni Battista Sammartini (1700/01–75). In c. 1750 German and Viennese composers began to add a MINUET movement. JOSEPH HAYDN, the "father of the symphony," wrote more than 100 symphonies of remarkable originality, intensity, and brilliance in the years 1755–95; since Haydn, the symphony has been regarded as the most important orchestral genre. WOLFGANG AMADEUS MOZART wrote about 35 original symphonies. LUDWIG VAN BEETHOVEN's nine symphonies endowed the genre with enormous weight and ambition. Later symphonists include FRANZ SCHUBERT, FELIX MENDELSSOHN, ROBERT SCHUMANN, ANTON BRUCKNER, JOHANNES BRAHMS, ANTONÍN DVOŘÁK, PYOTR ILYICH TCHAIKOVSKY, and GUSTAV MAHLER; their 20th-century successors include RALPH VAUGHAN WILLIAMS, JEAN SIBELIUS, DMITRY SHOSTAKOVICH, and WITOLD LUTOSŁAWSKI.

symposium In ancient Greece, an aristocratic banquet at which men met to discuss philosophical and political issues and recite poetry. It began as a warrior feast. Rooms were designed specifically for the proceedings. The participants, all male aristocrats, wore garlands and leaned on the left elbow on couches, and there was much drinking of wine, served by slave boys. Prayers opened and closed the meetings; sessions sometimes ended with a procession in the streets. In PLATO's famous *Symposium*, an imaginary dialogue takes place between SOCRATES, ARISTOPHANES, ALCIBIADES, and others on the subject of love. ARISTOTLE, XENOPHON, and EPICURUS wrote symposium literature on other subjects.

synagogue In Judaism, a community house of worship that also serves as a place for assembly and study. Though their exact origins are uncertain, synagogues flourished side by side with the ancient Temple cult; they existed long before Jewish sacrifice and the established priesthood were terminated with Titus's destruction of the Second Temple (AD 70). Thereafter, synagogues took on even greater importance as the unchallenged focal point of Jewish life. There is no standard synagogue architecture. A typical synagogue contains an ark (where the scrolls of the Law are kept), an "eternal light" burning before the ark, two candelabra, pews, a *bimah* (see BEMA), and sometimes a ritual bath (*mikvah*).

synapse \'si-ˌnaps\ Site of transmission of electric nerve impulses between two nerve cells or between a nerve cell and a gland or muscle cell. At chemical synapses, impulses are transmitted across microscopic spaces via chemical substances called neurotransmitters. In electric synapses, direct communication between nerve cells whose membranes are fused is possible because ions flow between the cells through channels. Electric synapses are found mainly in invertebrates and lower vertebrates; they transmit messages faster than chemical synapses. Chemical transmission seems to have evolved in large, complex vertebrate nervous systems, in which multiple messages must be transmitted over long distances.

Synchromism \'siŋ-krə-ˌmi-zəm\ Art movement concerned with the purely abstract use of colour. Founded in Paris in 1912–13 by the U.S. artists Stanton Macdonald-Wright and Morgan Russell, Synchromism ("colours together") was based on theories of colour with analogies to musical patterns. It has much in common with the ORPHISM of ROBERT DELAUNAY. The first Synchromist work, Russell's *Synchromy in Green* (1913), was exhibited at the SALON DES INDÉPENDANTS in 1913. Synchromism briefly attracted several other U.S. artists, including THOMAS HART BENTON.

synchronized swimming Swimming sport in which the movements of one or more swimmers are synchronized with a musical accompaniment. The sport developed in the U.S. in the 1930s and was admitted as an Olympic event (solo and duet only) in 1984; in 1996 the rules were changed to allow only teams of eight women. Teams are judged on compulsory and optional routines.

synchrotron \'siŋ-krə-ˌträn\ Cyclic PARTICLE ACCELERATOR in which the particle is confined to its orbit by a MAGNETIC FIELD. The strength of the magnetic field increases as the particle's MOMENTUM increases. An alternating ELECTRIC FIELD in synchrony with the orbital frequency of the particle produces acceleration. Synchrotrons are named according to the particles they accelerate. The Tevatron, a proton synchrotron at the Fermi National Accelerator Laboratory in Illinois, U.S., produces the highest particle energies achieved so far.

synchrotron radiation ELECTROMAGNETIC RADIATION emitted by charged particles that are moving at speeds close to that of light when their paths are altered. It is so called because it is produced by high-speed particles in a SYNCHROTRON. Such radiation is highly polarized (see POLARIZATION) and continuous. Its intensity and FREQUENCY depend on the strength of the MAGNETIC FIELD that alters the path of the particles, as well as on the energy of those particles. Synchrotron radiation at radio frequencies is emitted by high-energy ELECTRONS as they spiral through magnetic fields in space, such as those around Jupiter. Synchrotron radiation is emitted by a variety of astronomical objects, from planets to supernova remnants to quasars.

syncope \'siŋ-kə-pē\ Effect of temporary impairment of blood circulation to a part of the body. It is often used as a synonym for fainting, which is loss of consciousness due to inadequate blood flow to the brain. Paleness, nausea, sweating, and then pupil dilation, yawning, deep rapid breathing, and rapid heartbeat usually precede it. It lasts from under a minute to several minutes and may be followed by headache, confusion, and a weak feeling. The cause may be physical (e.g., HEART FAILURE, low blood sugar) or emotional (e.g., fear, anxiety). Abnormal vagus or autonomic nerve response can cause fainting (without preceding symptoms) triggered by ordinary activities such as urination, swallowing, coughing, or standing up or by pressure on the pulse point in the neck. Local syncope is coldness and numbness in a small area, especially the fingers, from diminished blood flow.

syndicalism \'sin-di-kə-ˌli-zəm\ Movement advocating direct action by the working class to abolish the capitalist order, including the state, and to replace it with a social order based on the *syndicat*, a free association of self-governing producers. Developed as a doctrine by leaders of the French trade union movement at the end of the 19th century, syndicalism was strongly influenced by the traditional ANARCHISM and antiparliamentarianism of the French working class. Syndicalists looked forward to victory in a class war, after which society would be organized around the *syndicats*. These bodies would coordinate their activities through a labour exchange, which would function as an employment and economic planning agency. At the peak of its influence, before World War I, the movement had in excess of one million members in Europe, Latin America,

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and the U.S. After the war, syndicalists tended to drift toward the Soviet model of COMMUNISM or to be lured by the ostensible benefits offered by LABOUR UNIONS and democratic reforms. See also CORPORATISM.

Synge \'siŋ**, John Millington** (b. April 16, 1871, Rathfarnham, near Dublin, Ire.—d. March 24, 1909, Dublin) Irish playwright. After studying languages and music in Dublin and France, he met WILLIAM BUTLER YEATS, who advised Synge to go to the west coast of Ireland to draw material from life. From 1899 to 1902 he spent his summers on the Aran Islands, observing the people and learning their language; he based his first plays, *In the Shadow of the Glen* (1903) and *Riders to the Sea* (1904), on islanders' stories. His travels on the Irish west coast inspired his most famous play, *The Playboy of the Western World* (1907); its unsentimental treatment of Irish character traits caused riots at its opening at the ABBEY THEATRE. His unfinished *Deirdre of the Sorrows* was performed in 1910. A poetic dramatist of great power, he was a leading figure of the IRISH LITERARY RENAISSANCE.

synodic \sə-'nä-dik\ **period** Time required for a body in the SOLAR SYSTEM to return to the same or about the same position relative to the Sun as seen from Earth. The Moon's synodic period is the time between successive recurrences of the same phase (e.g., the period between one full moon and the next). A planet's synodic period is the time required for Earth to overtake it as both go around the Sun or (in the case of fast-moving Mercury or Venus) for the other planet to overtake Earth. See also SIDEREAL PERIOD.

syntax Arrangement of words in sentences, clauses, and phrases, and the study of the formation of sentences and the relationship of their component parts. In English, the main device for showing this relationship is word order; for example, "The boy loves his dog" follows standard subject-verb-object word order, and switching the order of such a sentence would change the meaning or make the sentence meaningless. Word order is much more flexible in languages such as Latin, in which word endings indicate the case of a noun or adjective; such inflections make it unnecessary to rely on word order to indicate a word's function in the sentence.

synthesizer Machine that electronically generates and modifies sounds, frequently with the use of a digital computer, for use in the composition of electronic music and in live performance. The synthesizer generates wave forms and then subjects them to alteration in intensity, duration, frequency, and timbre. It may use subtractive synthesis (removing unwanted components from a signal containing a fundamental and all related overtones), additive synthesis (building tones from signals for pure sine-wave tones), or other techniques, most importantly whole-sound sampling (digital recording of sounds, usually from acoustic instruments). The first synthesizer was developed c. 1955 by RCA. Compact, commercially viable synthesizers, generally with pianolike keyboards, were produced in the 1960s by Robert Moog (born 1934), Donald Buchla (born 1937), and others. With transistor technology, these soon became portable and cheap enough for practical performance use, and such instruments became fixtures in rock bands, often displacing electric pianos and organs. See also MIDI.

synthetic ammonia process See HABER-BOSCH PROCESS

syphilis \'si-fə-ləs\ SEXUALLY TRANSMITTED DISEASE caused by the SPIROCHETE *Treponema pallidum*. Without treatment, it may progress through three stages: primary, characterized by a CHANCRE and low fever; secondary (weeks to months later; only half of those infected display symptoms), with a skin and mucous-membrane rash, LYMPH NODE swelling, and bone, joint, eye, and nervous system involvement; and tertiary. The tertiary stage follows a latency period that can last years, and only one-fourth of those infected display tertiary symptoms. These can be benign or incapacitating and even fatal; almost any part of the body may be attacked. Syphilis can spread to a fetus from an infected mother. Other species of *Treponema* cause similar but milder, nonsexually transmitted forms of syphilis (see YAWS). Several blood tests can detect syphilis, even during latency. Antibiotic treatment is effective.

Syr Darya \ˌsir-dər-'yä\ *ancient* **Jaxartes River** River, Central Asia, in Uzbekistan, Tajikistan, and Kazakhstan. Formed by the confluence of two headstreams in the fertile FERGANA VALLEY, it flows west-northwest for 1,374 mi (2,212 km) to empty into the ARAL SEA. Its lower course is on the eastern edge of the KYZYLKUM desert. It is the longest river in Central Asia but carries less water than does the AMU DARYA. It is used extensively for hydroelectric power and irrigation.

Syracuse *Italian* **Siracusa** *ancient* **Syracusae** Seaport city (pop., 2001 prelim.: 121,000), eastern coast of Sicily, Italy. Founded in 734 BC by Greeks from CORINTH, it was seized by Hippocrates of Gela in 485 BC and ruled by tyrants until a revolution established a democratic government c. 465 BC. In 413 BC, during the PELOPONNESIAN WAR, Syracuse defeated an Athenian invasion force. Under the rule of DIONYSIUS I the Elder (405–367 BC), it became the most powerful of the Greek cities, fighting three wars against rival CARTHAGE. Syracuse fell to Rome in 211 BC. It was sacked by Frankish invaders in AD 280 and captured by Arabs in 878; its importance waned in medieval times. Now the commercial centre for an agricultural district, it also supports the fishing and tourist industries. It has many examples of medieval and Renaissance architecture as well as Greek and Roman ruins. It is the birthplace of THEOCRITUS and ARCHIMEDES.

Syracuse City (pop., 2001: 147,306), central New York, U.S. The site, at the southern end of Lake Oneida, was once the territory of the Onondaga Indians and the headquarters of the IROQUOIS CONFEDERACY. The area was visited by the French in the 17th century. Indian hostility and the swampy location precluded settlement until the establishment of a trading post in 1786. Soon a saltworks based on its brine springs began operation; it supplied most of the nation's salt until 1870. An important port on the ERIE CANAL, Syracuse serves as a distribution centre for the central New York agricultural region. It also manufactures pharmaceuticals and electronics. It is the site of Syracuse University (1870) and the Everson Museum of Art (founded 1896).

Syria *officially* **Syrian Arab Republic** Country, Middle East, along the eastern coast of the Mediterranean Sea. Area: 71,498 sq mi (185,180 sq km). Population (2005 est.): 17,794,000. Capital: DAMASCUS. Arabs are

the main ethnic group, and Kurds are the largest minority. Languages: Arabic (official), Kurdish, Armenian. Religions: Islam (predominantly Sunni); also Christianity, Druze. Currency: Syrian pound. Syria consists of a coastal zone with abundant water supplies, a mountain zone that includes the ANTI-LEBANON MOUNTAINS, and a portion of the SYRIAN DESERT. The EUPHRATES RIVER is its most important water source and only navigable river. Syria has a mixed economy based on agriculture, trade, and mining and manufacturing. Crops include cotton, cereals, fruits, tobacco, and livestock. The main mineral resources are petroleum, natural gas, and iron ore; manufactures include textiles, cement, and steel. Syria is a republic with one legislative house; its head of state and government is the president, who by law must be a Muslim. The legal system is based largely on Islamic law. The area that now comprises Syria has been inhabited for several thousand years. From the 3rd millennium BC it was under the control variously of Sumerians, Akkadians, Amorites, Egyptians, Hittites,

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Assyrians, and Babylonians. In the 6th century BC it became part of the Persian ACHAEMENIAN EMPIRE, which fell to ALEXANDER THE GREAT in 330 BC. SELEUCID rulers governed it (301–c. 164 BC); then Parthians and Nabataean Arabs divided the region. It flourished as a Roman province (64 BC–AD 300) and as part of the BYZANTINE EMPIRE (300–634), until Arab Muslims invaded and established control. Thereafter the region was ruled by various Muslim dynasties. It came under the OTTOMAN EMPIRE in 1516, which held it, except for brief periods, until the British invaded in World War I (1914–18). After the war it became a French mandate; it was fully independent by 1946. It united with Egypt in the United Arab Republic (1958–61). During the SIX-DAY WAR (1967), it lost the GOLAN HEIGHTS to Israel. Syrian troops frequently clashed with Israeli forces in Lebanon during the 1980s and '90s. ḤĀFIZ AL-ASSAD's long regime (1971–2000) also was marked by antagonism toward Syria's neighbours Turkey and Iraq.

Syrian Desert Arid wasteland, Middle East. It extends over much of northern Saudi Arabia, eastern Jordan, southern Syria, and western Iraq. Largely covered by lava flows, it formed a nearly impenetrable barrier between the populated areas of the LEVANT and MESOPOTAMIA until modern times; several major highways and oil pipelines now cross it.

syrinx See PANPIPE

system of equations *or* **simultaneous equations** In algebra, two or more equations to be solved together (i.e., the solution must satisfy all the equations in the system). For a system to have a unique solution, the number of equations must equal the number of unknowns. Even then a solution is not guaranteed. If a solution exists, the system is consistent; if not, it is inconsistent. A system of linear equations can be represented by a MATRIX whose elements are the coefficients of the equations. Though simple systems of two equations in two unknowns can be solved by substitution, larger systems are best handled with matrix techniques.

systems analysis In INFORMATION PROCESSING, a phase of SYSTEMS ENGINEERING. The principal objective of the systems-analysis phase is the specification of what the system needs to do to meet the requirements of end users. In the systems-design phase such specifications are converted to a hierarchy of charts that define the data required and the processes to be carried out on the data so that they can be expressed as instructions of a computer program. Many information systems are implemented with generic software, rather than with such custom-built programs.

systems ecology Branch of ecosystem ecology (the study of energy budgets, biogeochemical cycles, and feeding and behavioral aspects of ecological communities) that attempts to clarify the structure and function of ECOSYSTEMS by means of applied mathematics, mathematical models, and computer programs. It concentrates on input and output analysis and has stimulated the development of applied ecology: the application of ecological principles to the management of natural resources, agricultural production, and problems of environmental pollution.

systems engineering Technique of using knowledge from various branches of engineering and science to introduce technological innovations into the planning and development stages of a system. Systems engineering was first applied to the organization of commercial telephone systems in the 1920s and '30s. Many systems-engineering techniques were developed during World War II in an effort to deploy military equipment more efficiently. Postwar growth in the field was spurred by advances in electronic systems and by the development of computers and information theory. Systems engineering usually involves incorporating new technology into complex, man-made systems, in which a change in one part affects many others. One tool used by systems engineers is the FLOWCHART, which shows the system in graphic form, with geometric figures representing various subsystems and arrows representing their interactions. Other tools include mathematical models, probability theory, statistical analysis, and computer simulations.

systems programming Development of computer SOFTWARE that is part of a computer OPERATING SYSTEM or other control program, especially as used in computer NETWORKS. Systems programming covers data and program management, including operating systems, control programs, network software, and DATABASE MANAGEMENT SYSTEMS.

Szczecin \'shchet-ˌshēn\ *German* **Stettin** \shte-'tēn\ Seaport (pop., 2000 est.: 416,500), near the mouth of the Oder River, northwestern Poland. A Slavic fishing and commercial centre for centuries, it was annexed to Poland by MIESZKO I in the 10th century. Szczecin joined the HANSEATIC LEAGUE in 1360. It passed to Sweden in 1648 and to Prussia in 1720 and remained under German control until it was transferred to Poland after World War II. During the war the port was completely destroyed and the city greatly depopulated. Under Polish administration the port and city were rebuilt, and Szczecin is now part of Poland's largest port complex. It is a cultural hub of western Poland, and several institutions of higher education are located there.

Széchenyi \'sā-chen-yi**, István, Count** (b. Sept. 21, 1791, Vienna, Austrian Empire—d. April 8, 1860, Döbling, near Vienna) Hungarian reformer and writer. Born to an aristocratic Hungarian family, he fought against Napoleon and then traveled extensively in Europe. He returned to Budapest to found the Hungarian National Academy of Sciences (1825) and wrote several works that called for economic reforms and urged the nobility to pay taxes to modernize Hungary. He led projects that improved roads, made the Danube River navigable to the Black Sea, and built the first suspension bridge at Budapest. In the 1840s he lost his following to the more radical Lajos KOSSUTH. Entering the cabinet in 1848, Széchenyi lost his sanity when conflict with Vienna erupted; he was removed to an asylum near Vienna and later committed suicide.

Szechwan See SICHUAN

Szell \'sel, 'zel**, George** (b. June 7, 1897, Budapest, Hung., Austria-Hungary—d. July 30, 1970, Cleveland, Ohio, U.S.) Hungarian-born U.S. conductor. He made his debut as a pianist at age 11, and before his 20th birthday he had appeared with the Berlin Philharmonic as pianist, conductor, and composer. He established himself as an opera conductor in various German cities, including Berlin (1924–30) and Prague (1930–36). When World War II broke out, he settled in the U.S., conducting at the Metropolitan Opera (1942–46) and then serving as musical director of the Cleveland Orchestra (1946–70). There he imposed stern discipline but won his players' devotion by his own fierce dedication. Under his direction the orchestra became known for its precision in playing and was considered one of the world's finest.

Szent-Györgyi \sānt-'jȯrj, sānt-'jȯr-jē**, Albert** (b. Sept. 16, 1893, Budapest, Hung., Austria-Hungary—d. Oct. 22, 1986, Woods Hole, Mass., U.S.) Hungarian-born U.S. biochemist. His discoveries about the roles played by certain organic compounds, especially VITAMIN C, in the oxidation (see OXIDATION-REDUCTION) of nutrients by cells brought him a 1937 Nobel Prize. He found and isolated an organic reducing agent from plant juices and adrenal gland extracts and showed it was identical to vitamin C. His work on intermediates in the cell laid the foundation for the elucidation of the TRICARBOXYLIC ACID CYCLE by HANS ADOLF KREBS. In later years he worked on the biochemistry of muscular action (demonstrating the role of ATP) and of CELL division.

Szilard \'zi-ˌlärd**, Leo** (b. Feb. 11, 1898, Budapest, Hung., Austria-Hungary—d. May 30, 1964, La Jolla, Calif., U.S.) Hungarian-born U.S. physicist. He taught at the University of Berlin (1922–33), then fled to England (1934–37) and the U.S., where he worked at the University of Chicago from 1942. In 1929 he established the relation between entropy and transfer of information, and in 1934 he helped develop the first method of separating isotopes of artificial radioactive elements. He helped ENRICO FERMI conduct the first sustained nuclear chain reaction and construct the first nuclear reactor. In 1939 he was instrumental in establishing the MANHATTAN PROJECT, in which he helped develop the atomic bomb. After the first use of the bomb, he promoted the peaceful uses of atomic energy and the control of nuclear weapons, founding the Council for a Livable World. In 1959 he received the Atoms for Peace Award.

Szymborska \shim-'bȯr-skə**, Wisława** (b. July 2, 1923, Bnin, Pol.) Polish poet. From 1953 to 1981 Szymborska was on the staff of the weekly *Życie Literackie* ("Literary Life"), gaining a reputation as a poet, book reviewer, and translator of French poetry. Her first two volumes of poetry were attempts to conform to SOCIALIST REALISM. Later poems, notable for their precise and concrete language and ironic detachment, express her dissatisfaction with communism and explore philosophical, moral, and ethical issues. A selection of her poems was published in English translation as *View with a Grain of Sand* (1995). She received the Nobel Prize for Literature in 1996.

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T cell With the B CELL, one of the two main types of white blood cell, essential parts of the immune system. T cells originate in the bone marrow, mature in the thymus, and travel in the blood to other lymphoid tissues, such as the spleen, tonsils, and lymph nodes. Through receptor molecules on their surfaces, T cells directly attack invaders (ANTIGENS) by binding to them and helping remove them from the body. Because the body contains millions of T and B cells, many of which carry unique receptors, it can respond to virtually any antigen. See also ANTIBODY, IMMUNOLOGY.

T Tauri \'tē-'tȯr-ī\ **star** Any of a class of very young STARS with masses less than about twice the Sun's. Characterized by unpredictable changes in brightness, they represent an early stage in stellar evolution, having only recently been formed by the gravitational condensation of interstellar gas and dust. The energy by which they shine derives from the gravitational collapse itself. These young stars, though now contracting more slowly, are still relatively unstable and will remain so until their interior temperatures become high enough to support NUCLEAR FUSION for energy generation. More than 500 T Tauri stars have been observed.

T1 Type of broadband telecommunications connection (see BROADBAND TECHNOLOGY) used especially to connect INTERNET SERVICE PROVIDERS to the Internet's infrastructure. Developed by Bell Labs in the 1960s, the "T-carrier systems" offer entirely digital, full-duplex exchange of data over traditional wire, coaxial cable, optical fibre, microwave relay, or other communications media. The T1 lines carry about 1.5 megabits of data per second, while the related T3 lines carry over 40. However, such systems are generally too expensive for individual network users, who turn instead to ISDN lines, CABLE MODEMS, DSL connections, or some form of wireless or satellite system for high-speed Internet access.

Ta hsüeh See DA XUE

T'a-li-mu Ho See TARIM RIVER

Ta-lien See DALIAN

Ta-wen-k'ou culture See DAWENKOU CULTURE

Ta Yu See DA YU

Taaffe \'tä-fə**, Eduard, count von** (b. Feb. 24, 1833, Vienna, Austria—d. Nov. 29, 1895, Ellischau, Bohemia, Austria-Hungary) Austrian politician and prime minister (1868–70, 1879–93). A boyhood friend of the future emperor FRANCIS JOSEPH, he entered the civil service in 1852 and rose rapidly, serving as governor of upper Austria, minister of the interior (1867, 1870–71, 1879), governor of Tirol (1871–79), and prime minister. In his second term as premier, he forged a conservative coalition that restored a degree of order among the Austrian Empire's quarreling nationalities by granting concessions to the Polish and Czech nationalists and bringing them into the Habsburg civil service.

Taal \tä-'äl, 'täl**, Lake** *formerly* **Lake Bombon** Lake, southwestern LUZON, Philippines. It covers an area of 94 sq mi (244 sq km) and occupies a volcanic crater less than 10 ft (3 m) above sea level. Volcano Island (984 ft or 300 m), which rises from the lake and is also called Taal Volcano, contains another small crater (Yellow Lake). The volcano has erupted 25 times since 1572, most recently in 1970. Located within a national park, the lake is a major tourist attraction.

Ṭabarī \'tä-bä-rē**, al-** *in full* **Abū Ja'far Muḥammad ibn Jarīr al-Ṭabarī** (b. c. 839, Āmol, Iran—d. 923, Baghdad, Iraq) Muslim scholar, Qur'ānic commentator, and historian. After studying in Islamic centres of learning in Iraq, Syria, and Egypt, he wrote the compendious *Commentary on the Qur'ān* (see TAFSĪR), in which he annotated Islam's holy book with all of the juridical, lexicographical, and historical explanations transmitted in the ḤADĪTH. His other major work was the *History of Prophets and Kings*, which charted the history of human civilization from creation to the fall of the UMAYYAD DYNASTY.

Tabasco \tə-'bas-kō\ State (pop., 2000: 1,891,829), southeastern Mexico. It covers an area of 9,756 sq mi (25,267 sq km), and its capital is VILLAHERMOSA. Pre-Columbian Indian cultures included those of the QUICHÉ, OLMEC, Tabasca, and NAHUA peoples. The area was first visited by Europeans in 1518; in 1519 HERNÁN CORTÉS clashed with the Indians, who were partially subdued in the 1530s and '40s. Tabasco became a state in 1824. Agriculture, forestry, beekeeping, commercial fishing, and cattle-raising provided much of the state's income before petroleum exploitation began in the 1960s. The state is now a major oil producer.

Tabernacle In Jewish history, the portable sanctuary constructed by MOSES as a place of worship for the Hebrew tribes during the period of wandering that preceded their arrival in the Promised Land. Elaborately described in EXODUS, it was divided into an outer room, the "holy place," and an inner room, the HOLY OF HOLIES, which housed the ARK of the Covenant. With the erection of the Temple of JERUSALEM, the Tabernacle no longer served a purpose. In modern ROMAN CATHOLICISM and EASTERN ORTHODOXY, the tabernacle is the receptacle on the church altar in which the consecrated elements of the EUCHARIST are stored.

tabla \'tä-blə\ Pair of small drums, the principal percussion in Hindustani music of northern India. The higher-pitched *daya*, played with the right hand, is a roughly cylindrical one-skinned drum, usually wooden, normally tuned to the RAGA's tonic. The *baya*, played with the left hand, is a deep kettledrum usually of copper; its pitch varies with pressure from the heel of the player's hand. A disk of black tuning paste on the membrane of each drum gives it harmonic overtones.

table Article of furniture used in the Western world since at least the 7th century BC, consisting of a flat slab of stone, metal, wood, or glass supported by trestles, legs, or a pillar. Though tables were used in ancient Egypt, Assyria, and Greece, only during the Middle Ages, with the growing formality of life under feudalism, did tables increasingly take on social significance. Tables with attached legs appeared in the 15th century. The draw top was invented in the 16th century, making it possible to double the table length. Increasing contact with the East in the 18th century led to increasing specialization in the design of occasional tables.

Table Bay Inlet, Atlantic Ocean, forming the harbour of CAPE TOWN, South Africa. It is 12 mi (19 km) long and 8 mi (12 km) wide. Although less sheltered than other bays along the coast, it became a port of call for ships traveling to India and the East because of the availability of fresh water. The shore was permanently settled by the Dutch in 1652.

table tennis *or (trademark)* **Ping-Pong** Game similar to lawn tennis that is played on a tabletop with wooden paddles and a small, hollow, plastic ball. The object is to hit the ball so that it goes over the net and bounces on the opponent's half of the table in such a way as to defeat the opponent's attempt to reach and return it. Both singles and doubles games are played. A match consists of the best of any odd number of games, each game being won by the player or team who first reaches 11 points or who, after 10 points each, gains a two-point lead. Invented in England in the early 20th century, it soon spread throughout the world. Since the mid-1950s, East Asian countries have dominated the sport. It has been an Olympic sport for both men and women since 1988.

taboo Prohibition against touching, saying, or doing something for fear of immediate harm from a supernatural force. The term is of Polynesian origin and was first noted by Capt. JAMES COOK during his 1771 visit to Tonga, but taboos have been present in virtually all cultures. They may include prohibitions on fishing or hunting at certain seasons, eating certain foods, interacting with members of other social classes, coming into contact with corpses, and (for women) performing certain activities during menstruation. Although some taboos can be traced to evident risks to health and safety, there is no generally accepted explanation of most others; most authorities agree that they tend to relate to objects and actions that are significant for the maintenance of social order.

Tabrīz \ta-'brēz\ City (pop., 1996: 1,191,043), northwestern Iran. Earthquakes and invasions by Arabs, Turks, and Mongols have damaged the city numerous times. The Turkic ruler TIMUR conquered it in 1392. During the next 200 years control passed several times between Ṣafavid Iran and the Ottoman Empire. During the 18th–19th centuries it passed between the Ottomans and the Russian Empire, and the same powers fought over it in World War I (1914–18). In the 1850s a schismatic Shī'ite religious leader known as the BĀB ("Gateway") and 40,000 of his followers were executed there. It was damaged during the IRAN-IRAQ WAR (1980–90). Notable ancient sites include the 15th-century Blue Mosque, renowned for the splendour of its blue tile decoration, and the remains of the 12-sided tomb of Mongol leader MAḤMŪD GHĀZĀN.

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Tabrīz school School of miniaturist painting founded by the Mongol Il-Khans early in the 14th century. Reflecting the penetration of East Asian traditions into Islamic painting, early Tabrīz works were characterized by light, feathery brush strokes, gentle colouring, and an attempt to create the illusion of spatiality. The school reached its peak just as the Il-Khans were being conquered by the Islamic Timurids (1370–1506). It continued to be active in this period, though it was overshadowed by the workshops in Shiraz and Herat.

Tachism \'ta-ˌshi-zəm\ (from French, *tache*: "spot") Style of painting practiced in Paris after World War II and through the 1950s. Like its U.S. equivalent, ACTION PAINTING, it featured the intuitive, spontaneous gesture of the artist's brush stroke. The Tachists, including Hans Hartung and Georges Mathieu, produced large works of sweeping brush strokes and of drips, blots, stains, and splashes of colour. Tachism was part of the postwar movement known as Art Informel, inspired by U.S. ABSTRACT EXPRESSIONISM.

tachycardia \ˌta-ki-'kär-dē-ə\ HEART rate over 100 (as high as 240) beats per minute. When it is a normal response to exercise or stress, it is no danger to healthy people, but when it originates elsewhere, it is an ARRHYTHMIA. Symptoms include fatigue, faintness, shortness of breath, and feeling the heart thumping. It may subside within minutes or hours with no lasting ill effects, but in serious heart, lung, or circulatory disease it can precede ATRIAL FIBRILLATION or HEART ATTACK and demands immediate medical attention. Tachycardias can be treated by an electric shock to the heart, by antiarrhythmic drugs, and by pacemakers.

tachyon \'ta-kē-ˌän\ Hypothetical SUBATOMIC particle whose velocity is always greater than that of light. Its existence appears consistent with the theory of RELATIVITY. Just as an ordinary particle such as an electron can exist only at speeds less than that of light, a tachyon can exist only at speeds greater than that of light. At such speeds, its mass would be real and positive. On losing energy, a tachyon accelerates; the faster it travels, the less energy it has. The existence of tachyons has not been established experimentally.

Tacitus \'ta-sə-təs\ *in full* **Publius Cornelius Tacitus** (b. AD 56—d. c. 120) Roman orator, public official, and historian. After studying rhetoric, he began his career with a minor magistracy, eventually advancing to the proconsulate of Asia, the top provincial governorship (112–113). In 98 he wrote *De vita Julii Agricolae,* a biographical account of his father-in-law, governor of Britain; and *De origine et situ Germanorum* (known as the *Germania*), describing the people of the Roman frontier on the Rhine. His works on Roman history are the *Histories*, concerning the empire from AD 69 to 96, and the later *Annals*, dealing with the empire from AD 14 to 68; the latter effectively diagnoses the decline of Roman political freedom he had described in the *Histories*. Only parts of each are extant. Tacitus is regarded as perhaps the greatest historian and one of the greatest prose stylists to write in Latin.

Tacoma City and seaport (pop., 2000: 193,556), western Washington, U.S. Located on PUGET SOUND, Tacoma was settled in 1864 and grew to become a lumbering and port city. Docks and wharves line its waterfront. A boat-building centre, the city also has smelters, foundries, and electrochemical plants. It is a gateway to Mount RAINIER National Park and is connected by bridge to the Olympic Peninsula recreation areas. It is the seat of the University of Puget Sound (1888) and Pacific Lutheran University (1890).

Taconic Orogeny \tə-'kä-nik-ȯ-'rä-jə-nē\ Mountain-building event that affected the APPALACHIAN GEOSYNCLINE along the eastern coast of the U.S. Evidence for the OROGENY is most pronounced in the northern Appalachian Mountains, but its effects can be noted as far away as Tennessee and Georgia. Events ascribed to it include the development of New York's Taconic Range and Vermont's Green Mountains. Originally thought to have occurred at approximately the Ordovician-Silurian boundary (c. 443 million years ago), it is now generally considered to have consisted of several pulses from the mid-Ordovician to the early Silurian Period.

Taconic Range Part of the APPALACHIAN MOUNTAIN system, northeastern U.S. The range extends 150 mi (240 km) from southern Vermont to northern New York. Mount Equinox (3,816 ft [1,163 m]) in southwestern Vermont is the highest peak. In Massachusetts the mountains form the western section of the BERKSHIRE HILLS. Taconic State Park, in New York, is a popular mountain recreation area.

taconite \'ta-kə-ˌnīt\ Low-grade IRON formation (e.g., in Minnesota). Recovery of the iron requires fine grinding and concentration of iron-bearing phases (see MINERAL PROCESSING), which are then formed into pellets suitable for BLAST FURNACES. As high-grade deposits of iron ore have become depleted, taconite deposits have increased in importance.

tactics In warfare, the art and science of fighting battles. It is concerned with the approach to combat, placement of troops, use made of weapons, vehicles, ships, or aircraft, and execution of movements for attack or defense. In general, tactics deal with the problems encountered in actual fighting. Tactical thinking attempts to coordinate personnel with the existing weapons technology and apply both to the terrain and enemy forces in a way that uses the fighting force to best advantage. Deployment involves placing each type of weapon where it can do the most damage to the enemy or provide the most protection to one's own forces. Timing and direction of attack are also important considerations. At sea, direction was especially crucial in the era of wind-powered warships. In recent wars, timing has been a crucial factor in mounting airborne strikes that take advantage of the element of surprise. See also STRATEGY.

Tadema, Lawrence Alma- See Lawrence ALMA-TADEMA

Tadmor See PALMYRA

tadpole *or* **polliwog** Aquatic larval stage of FROGS and TOADS. Tadpoles have a short, oval body, broad tail, small mouth, and no external gills. Most are herbivorous, but those of some species are predatory or even cannibalistic. Tadpole METAMORPHOSIS follows a pattern of gradual development of forelimbs and hind limbs, resorption of the tail, shortening of the intestine, disappearance of the gills, and development of the lungs. On completion of metamorphosis, the young frog or toad emerges onto land.

tae kwon do \'tī-'kwän-'dō\ Korean MARTIAL ART resembling KARATE. It is characterized by the use of high standing and jump kicks as well as punches and is practiced for sport, self-defense, and spiritual development. In sparring, blows are stopped just short of contact. Based on earlier forms of Korean self-defense, tae kwon do was formalized and named in 1955. It became an Olympic sport in the year 2000.

Taegu \'ta-'gü\ Metropolitan city (pop., 2000: 2,473,990), capital of North Kyŏngsang province, southeastern South Korea. For centuries the administrative, economic, and cultural centre of South Korea, it developed during the CHOSŎN DYNASTY (1392–1910) into one of the country's three big market cities. It has important textile industries but is best known for the apples grown in the surrounding area, which are exported throughout East and Southeast Asia. The area attracts visitors to its several parks, ancient pagodas, and the 9th-century Buddhist temple containing the TRIPITAKA. It is home to many universities and colleges.

T'aejo See YI SONG-GYE

Taejon \'ta-'jȯn\ Metropolitan city (pop., 2000: 1,365,961), capital of South Ch'ungch'ŏng province, southeastern South Korea. It was a poor village until rail connections spurred development in the early 1900s. During the KOREAN WAR (1950–53) it was a temporary capital of South Korea, and 70% of the city was destroyed; it has since been rebuilt. The manufacture of cotton textiles, machinery, and chemicals has been developed. Chungnam National University and several other colleges are located there.

Taeuber \'tȯi-bər**, Conrad; and Barnes Taeuber, Irene** *orig.* **Irene Barnes** (respectively b. June 15, 1906, Hosmer, S.D., U.S.—d. Sept. 11, 1999, Nashua, N.H.; b. Dec. 25, 1906, Meadville, Mo.—d. Feb. 24, 1974, Hyattsville, Md.) U.S. demographers, statisticians, and social scientists. Working for various government agencies, the couple developed a scholarly approach to the census that helped found the science of DEMOGRAPHY and made them authorities on population movements in the U.S. Their books *The Changing Population of the United States* (1958) and *The Population of Japan* (1958) are considered classics in demography.

Taewon-gun \'tä-'wən-'gün\ (b. 1821—d. 1898) Father of the last ruling Korean king, Kojong (r. 1864–1907), and regent (1864–73). As regent, Taewon-gun inaugurated reforms to strengthen the central government. He also modernized Korea's armies. He opposed concessions to Japan or the West but was kidnapped and held in China three years, during which time his power and many of his reforms were eliminated.

Taff Vale case (1900–01) Successful trial in Britain of a suit brought by the Taff Vale Railway Company against the Amalgamated Society of

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Railway Servants (ASRS). In August 1900 the ASRS struck for higher wages but settled within two weeks when the company used strikebreakers. The company sued the union for violating the Protection of Property Act, and the courts held that a union could be sued for damages caused by a strike, effectively eliminating the strike as a weapon of organized labour. Opposition to the decision spurred the growth of the Labour Party and led to the passage of the Trade Disputes Act of 1906, which nullified the decision's effect.

Tafilalt \ˌta-fi-ˈlalt\ Oasis, southeastern Morocco. The country's largest Saharan oasis, it covers 533 sq mi (1,380 sq km). It comprises six fortified villages and palm groves stretching for some 30 mi (50 km) along the Wadi Ziz. Its old capital was the prosperous Berber stronghold of Sijilmassa, founded in AD 757 on the Saharan caravan route and finally destroyed in the 19th century. The oasis is noted for its groves of date palms.

tafsīr \tȧf-ˈsēr\ Science of explanation and interpretation of the Qur'ān. It arose after the death of Muhammad to deal with ambiguity, variant readings, defective texts, and apparent contradictions in the scripture. Starting from mere personal speculation, *tafsīr* developed into a system of systematic exegesis of the Qur'ān's text, proceeding verse by verse and sometimes word by word. Early efforts relied on the Ḥadīth, later giving rise to a more dogmatic type of *tafsīr*. The most comprehensive work was compiled by the scholar al-Ṭabarī. Some Muslim modernists have employed *tafsīr* as a vehicle for reformist ideas.

Taft, Robert A(lphonso) (b. Sept. 8, 1889, Cincinnati, Ohio, U.S.—d. July 31, 1953, New York, N.Y.) U.S. politician. The son of William H. Taft, he served in the Ohio legislature before being elected to the U.S. Senate (1939–53). He became known as a strong advocate of traditional conservativism and earned the nickname "Mr. Republican." He opposed centralizing power in the federal government and cosponsored the Taft-Hartley Act to restrict organized labour. An isolationist, he opposed U.S. involvement in postwar international organizations. He was a favourite-son candidate for president at Republican Party national conventions, especially in 1948 and 1952, but internationalists in the party opposed his conservative views. After the election of Dwight Eisenhower, Taft became Senate majority leader and Eisenhower's chief adviser in the Senate.

Taft, William Howard (b. Sept. 15, 1857, Cincinnati, Ohio, U.S.—d. March 8, 1930, Washington, D.C.) 27th president of the U.S. (1909–13). He served on the Ohio superior court (1887–90), as U.S. solicitor general (1890–92), and as U.S. appellate judge (1892–1900). He was appointed head of the Philippine Commission to set up a civilian government in the islands and was the Philippines' first civilian governor (1901–04). He served as U.S. secretary of war (1904–08) under Pres. Theodore Roosevelt, who supported Taft's nomination for president in 1908. He won the election but became allied with the conservative Republicans, causing a rift with party progressives. He was again the nominee in 1912, but the split with Roosevelt and the Bull Moose Party resulted in the electoral victory of Woodrow Wilson. Taft later taught law at Yale University (1913–21), served on the National War Labor Board (1918), and was a supporter of the League of Nations. As chief justice of the U.S. Supreme Court (1921–30), he introduced reforms that made the court more efficient. His important opinion in *Myers* v. *U.S.* (1926) upheld the president's authority to remove federal officials.

William Howard Taft, 1909.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Taft-Hartley Act *officially* **Labor-Management Relations Act** (1947) U.S. legislation that restricted labour unions. Sponsored by Sen. Robert A. Taft and Rep. Fred A. Hartley, Jr., the act amended much of the pro-union Wagner Act (1935) and was passed by a Republican-controlled Congress over the veto of Pres. Harry S. Truman. It allowed employees the right not to join unions (outlawing the closed shop) and required advance notice of a labour strike, authorized an 80-day federal injunction when a strike threatened national health or safety, narrowed the definition of unfair labour practices, specified unfair union practices, restricted union political contributions, and required union officials to take an oath pledging they were not communists. See also Landrum-Griffin Act.

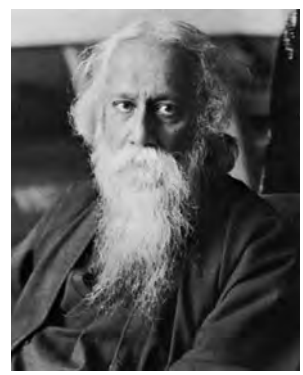
Tagalog \tə-ˈgä-ləg\ Any member of the largest cultural-linguistic group in the Philippines. They are the dominant population of Manila and of several provinces near the city. Most are Roman Catholic, and most are farmers; their main cash crops are sugarcane and coconuts. Manila's dominance has given the urban Tagalog economic leadership in the Philippines. The Tagalog language is the basis of Pilipino, the national language.

Tagalog language Austronesian language of the Philippines, spoken as a first language by about 17 million people on the island of Luzon and by at least half a million immigrant Filipinos. As the language of Manila, the capital and chief city of the Philippines, Tagalog has long had an importance outside its own speech area. With vocabulary enrichment from other Philippine languages, it has been made the basis of Pilipino, the national language; widely used in education and the media, Pilipino is now understood by more than 60% of the Philippine population. Though a script ultimately of South Asian origin was in use for Tagalog in the 16th century (see Indic writing systems), all recent literature in the language has utilized adaptations of the Latin alphabet.

Taglioni \täl-ˈyō-nē**, Marie** (b. April 23, 1804, Stockholm, Swed.—d. April 24, 1884, Marseille, Fr.) Italian ballet dancer. She trained with her dancer-choreographer father, Filippo Taglioni (1777–1871), and made her debut in Vienna in 1822. In her father's ballet *La Sylphide*, introduced at the Paris Opéra in 1832, she became one of the first to dance on pointe. She created a delicate new style, marked by floating leaps and balanced poses such as the arabesque, that typified the early 19th-century Romantic style. Her diaphanous white skirts would evolve into the tutu worn by most classical ballerinas. She toured throughout Europe and, after leaving the Opéra in 1837, danced with the Imperial Ballet in St. Petersburg; she retired from dancing in 1847.

Tagore \ˈtä-ˌgȯr,\ *English* \tə-ˈgȯr**, Debendranath** (b. May 15, 1817, Calcutta, India—d. Jan. 19, 1905, Calcutta) Hindu philosopher and religious reformer. Born into a wealthy landowning family, he was educated in both Eastern and Western philosophy. Striving to purge Hinduism of abuses, he spoke vehemently against suttee and tried to bring education within the reach of all. He was active in the Brahmo Samaj. In his zeal to erase idolatry and undemocratic practices, he rejected the Vedas as deficient in dictating guidelines for human behaviour. Failing to find a middle path between radical rationalism and Brahman conservatism, he retired from public life. He was known as the Great Sage. Rabindranath Tagore was his son.

Tagore, Rabindranath (b. May 7, 1861, Calcutta, India—d. Aug. 7, 1941, Calcutta) Bengali poet, writer, composer, and painter. The son of Debendranath Tagore, he published several books of poetry, including *Manasi*, in his 20s. His later religious poetry was introduced to the West in *Gitanjali* (1912). Through international travel and lecturing, he introduced aspects of Indian culture to the West and vice versa. He spoke ardently in favour of Indian independence; as a protest against the Massacre of Amritsar, he repudiated the knighthood he had received in 1915. He founded an experimental school in Bengal where he sought to blend Eastern and Western philosophies; it became Vishva-Bharati University (1921). He was awarded the 1913 Nobel Prize for Literature.



Rabindranath Tagore.
ENCYCLOPÆDIA BRITANNICA, INC.

Tagus River \ˈtā-gəs\ *Spanish* **Río Tajo** \ˈtä-hō\ *Portuguese* **Rio Tejo** \ˈrē-ü-ˈtā-zhü\ Longest waterway of the Iberian Peninsula. It rises in eastern central Spain and flows west across Spain and Portugal for 626 mi (1,007 km) to empty into the Atlantic Ocean near Lisbon. It covers the heart of the two nations, and is of vital economic importance. Dams har-

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ness it for irrigation and hydroelectric power, and large artificial lakes have been created. Navigable for about 100 mi (160 km) in its lower courses, it supplies a fine natural harbor at Lisbon.

Taha Hussein *or* **Taha Husayn** \'tä-hä-hů-'sān\ (b. Nov. 14, 1889, Maghāghah, Egypt—d. Oct. 28, 1973, Cairo) Egyptian writer. Though blinded by an illness at age two, he became a professor of Arabic literature at the secular University of Cairo, where his bold views often enraged Islamic religious conservatives. An outstanding figure of the modernist movement in Egyptian literature, he wrote novels, stories, criticism, and social and political essays. Outside Egypt he is best known for his autobiography, the two-part *Al-Ayyam*, published in English as *An Egyptian Childhood* (1932) and *The Stream of Days* (1943), which was the first modern Arab literary work to be acclaimed in the West.

Tahiti Island, Society Islands, French Polynesia, central South Pacific Ocean. The largest of the Society Islands, it occupies an area of 402 sq mi (1,042 sq km) in their eastern group. Papeete, the capital of French Polynesia, is on Tahiti. The island's interior is mountainous, rising to 7,339 ft (2,237 m) at Mount Orohena; its towns are located on the coastal plain. Long inhabited by Polynesians, it was visited by British Capt. Samuel Wallis in 1767 and in 1768 by Louis-Antoine de Bougainville, who claimed it for France. The first permanent European settlers were English missionaries who arrived in 1797. It became a French colony in 1880 and is now part of the self-governing overseas territory of French Polynesia. Continued French nuclear testing in the area has angered the inhabitants and brought calls for independence. Tourism is economically important.

Tahoe, Lake Lake on the California-Nevada border in the northern Sierra Nevada, U.S. The lake, which occupies a fault basin, covers 193 sq mi (500 sq km). It is 22 mi (35 km) long by 10 mi (16 km) wide and lies at an elevation of 6,229 ft (1,899 m). Its water level has varied during seasons of drought in recent decades. Fed by numerous small streams, the intensely blue lake and the surrounding national forests have been developed as popular tourist resorts.

Lake Tahoe in Toiyabe National Forest, Nevada.
JOHN F. SHRAWDER/SHOSTAL

Ṭahṭāwī \täh-'tä-ˌwē**, Rifāʿah Rāfiʿ al-** (b. 1801, Ṭahṭā, Egypt—d. 1873, Egypt) Egyptian teacher and scholar. Beginning in 1826, he spent five years in Paris as a religious teacher for a group of Egyptian students and later was appointed head of a state language school (1836) and a translation bureau (1841) in Cairo. In these capacities he played a central role in bringing Western science and methods to Egypt. Under the anti-Western administration of khedive ʿAbbās I (1848–54), he was sent to teach school in Khartoum, Sudan, but later returned to resume his work in translation and education.

Tai \'tī\ Any member of the dominant group of mainland Southeast Asia. They include the Thai, or Siamese (in Thailand), the Lao (in Laos and Thailand), the Shan (in Myanmar), the Lü (primarily in Yunnan province, China), the Yunnan Tai (in Yunnan), and the tribal Tai (in Vietnam). All speak Tai languages, and most are Buddhists of the Theravada school. The status of Tai women is high. The Tai number about 76 million.

Tai See Shan

Tai, Lake *Chinese* **Tai Hu** \'tī-'hü\ *or* **T'ai Hu** Lake, between Zhejiang and Jiangsu provinces, eastern China. Roughly crescent-shaped, it covers an area of 850 sq mi (2,200 sq km). It lies in a plain and is served by a maze of natural and man-made waterways, some dating from the 7th century AD. Several islands in the eastern section were traditionally famous Daoist and Buddhist religious sites. The area's great natural beauty attracts many tourists.

Tai Chi Chuan *Chinese* **taijiquan** *or* **t'ai-chi-ch'üan** \'tī-'jē-'chwän\ Ancient Chinese form of exercise or of attack and defense. As exercise, it is designed to provide relaxation in the process of body conditioning, which it accomplishes partly by harmonizing the principles of yin-yang. It employs flowing, deliberate movements with carefully prescribed stances and positions. As a mode of attack and defense, it resembles kung fu and is properly considered a martial art. Dating to the 3rd century AD, Tai Chi Chuan consists of two major schools, the Wu and the Yang. Depending on the school, the number of exercises varies from 24 to more than 100.

T'ai-chung \'tī-'chůŋ\ City (pop., 2002 est.: 990,041), west-central Taiwan. Most of the old town was torn down under the Japanese occupation (1895–1945) and replaced by a planned modern city. An agricultural centre since the early 19th century, it is a major market for the rice, sugar, and bananas produced in the surrounding area. In the 1970s an international seaport was developed west of the city, and T'ai-chung was designated an export-processing zone to encourage foreign investment. It is also a cultural centre, with various institutions of higher education. In 1999 it suffered one of Taiwan's worst earthquakes.

T'ai Hsü See Tai Xu

Tai languages Family of closely related languages spoken in Southeast Asia and southern China by more than 80 million people. According to a widely used classification, Tai comprises three branches. The Southwestern group includes Thai, the national language of Thailand; northeastern Thai and Lao, spoken in eastern Thailand and Laos; Pak Tay (South Thai), spoken in southern Thailand; Shan, spoken in eastern and northern Myanmar; and Tai Dam (Black Tai) and Tai Don (Tai Khaw, or White Tai), spoken mainly in North Vietnam. The Central group includes Nung and South Zhuang, a dialect chain in northern Vietnam and China's Guangxi province; and Tay (Thô), spoken in the same area. The Northern group includes Buyi and North Zhuang, a dialect chain spoken in Guangxi, Guizhou, and Yunnan, China. All Tai languages are tone languages. Most scholars believe the Tai family is related to a number of other languages spoken by minority peoples of southern China and northern Vietnam. Together with Tai, the entire group has been named the Kadai or Tai-Kadai family.

T'ai-nan \'tī-'nän\ *formerly* **Dainan** City (pop., 2002 est.: 742,574), southwestern Taiwan. It is one of the oldest urban settlements on the island. The Han Chinese settled there as early as 1590. The Dutch arrived in the city in 1623 and stayed until they were driven out in 1662 by Zheng Chenggong, who made it his capital. It remained the island's capital when the Qing dynasty reestablished Chinese control over Taiwan (1683). Under Chinese rule in the 19th century, it grew into a prosperous city and was the commercial and educational centre of Taiwan. After the transfer of the capital to Taipei in 1891, it became primarily commercial. It expanded during the Japanese occupation (1895–1945). Today it is a major market and tourism centre.

T'ai-tsu See Taizu

T'ai-tsung See Taizong

Tai Xu *or* **T'ai Hsü** \'tī-'shü\ *orig.* **Lü Peilin** (b. Jan. 8, 1890, Haining, Zhejiang province, China—d. March 17, 1947, Shanghai) Chinese Buddhist monk and philosopher. After training as a Buddhist monk near Ningbo, he helped organize the Association for the Advancement of Buddhism (1912). In 1921 he began publication of the influential journal *Haichaoyin* ("The Voice of the Sea Tide"). Heavily influenced by Sun Yat-sen and the revolution of 1911, he sought to reform the education of monks and promoted social welfare activities. From 1925 to 1941 he traveled extensively to promote the formation of national and international Buddhist organizations in Japan, Europe, the U.S., and South and Southeast Asia.

Taieri River \'tī-ə-rē\ River, southeastern South Island, New Zealand. It rises in the Lammerlaw Range and flows 179 mi (288 km) north and southeast in a great arc, across plains and around the Rock and Pillar Range, to enter the Pacific Ocean near Dunedin. Gorges are found in both the upper and lower reaches.

taiga \'tī-gə\ *or* **boreal forest** Open coniferous forest (see conifer) growing on swampy ground that is commonly covered with lichens. It is the characteristic vegetation of the subpolar region of northern Eurasia (principally Russia, including Siberia, and Scandinavia) and northern North America, bounded by the colder tundra to the north and the warmer temperate zone to the south. Spruces and pines are the dominant trees. Soil organisms are protozoans, nematodes, and rotifers; larger invertebrates (e.g., insects) that decompose plant litter are lacking, so humus accumulates very slowly. The taiga is rich in fur-bearing animals (e.g., sable, fox,

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and ermine) and is home to elks, bears, and wolves. Siberian taiga alone accounts for 19% of the world's forested area and possibly 25% of total forest volume. Despite the remoteness of the taiga, it is a major source of lumber for construction, and huge expanses have been clear-cut.

Taiga, Ike no See IKE NO TAIGA

taijiquan See T'AI CHI CH'UAN

tail Extension of the VERTEBRAL COLUMN beyond the trunk, or any slender projection resembling such a structure. In fishes and other animals living completely or partly in water, it is very important to movement through water. Many tree-dwelling animals (e.g., squirrels) use the tail for balance and as a rudder when leaping; in some (e.g., certain monkeys), it is adapted for grasping. Birds' tail feathers aid in flight maneuverability. Other animals use their tails for defense (e.g., porcupines), social signals (e.g., dogs and cats), warning signals (e.g., deer and rattlesnakes), and hunting (e.g., alligators).

Táin Bó Cúailgne See CATTLE RAID OF COOLEY, THE

Taine \tən**, Hippolyte (-Adolphe)** (b. April 21, 1828, Vouziers, Ardennes, France—d. March 5, 1893, Paris) French thinker, critic, and historian. Taine came to believe as a youth that knowledge must be based on sense experience, observation, and controlled experiment, a conviction that guided his career. Teaching at the École des Beaux-Arts in Paris (1864–83), he earned a reputation as one of the most esteemed exponents of 19th-century French POSITIVISM with his attempts to apply the scientific method to the study of the humanities. His works include a *History of English Literature* (1863–64), containing an explanation of his approach to cultural and literary history and his scientific attitude toward criticism; *On Intelligence* (1871), a study in psychology; and his monumental historical analysis *Les Origines de la France contemporaine*, 3 vol. (1876–99).

Taino \'tī-nō\ Extinct ARAWAK Indian group of the island of HISPANIOLA in the Caribbean Sea. They also inhabited Puerto Rico and the eastern tip of Cuba. They grew cassava and corn (maize), hunted birds and small animals, and fished. They were skillful at working stone and wood. Their society consisted of three tiers—nobles, commoners, and slaves—and they were ruled by hereditary chiefs and subchiefs; religious beliefs centred on a hierarchy of nature spirits and ancestors. They became extinct within 100 years of the Spanish conquest.

Taipei \'tī-'pā\ City, special (province-level) municipality (pop., 2005 est.: 2,622,472), and seat of government of the Republic of China (TAIWAN). Founded in the early 18th century, it became an important centre of overseas trade in the mid-19th century. When Taiwan was proclaimed a province of China in 1886, Taipei was later made the capital, and it retained that designation under Japanese rule (1895–1945). In 1949 it became the administrative centre of the Chinese NATIONALIST government. It was designated a special municipality in 1967. Taipei is the commercial, financial, industrial, and transportation centre of Taiwan. Its many educational institutions include the National Taiwan University (1928). The city's National Palace Museum houses one of the world's largest collections of Chinese artifacts. The Taipei 101 building became the world's tallest building upon completion of its framework in 2003.

Taiping \'tī-'piŋ\ **Rebellion** (1850–64) Large-scale rebellion against the QING DYNASTY in China. The peasants, having suffered floods and famines in the late 1840s, were ripe for rebellion, which came under the leadership of HONG XIUQUAN. Hong's visions convinced him he was the younger brother of Jesus, and he saw it as his duty to free China from MANCHU rule. He preached the brotherhood and sisterhood of all people under God; property was to be held in common. His followers' militant faith unified a fiercely disciplined army that swelled to more than a million men and women (women were treated as equals by Taiping rebels). They captured Nanjing in 1853 and renamed it Tianjing ("Heavenly Capital"). Their attempts to capture Beijing failed, but an expedition into the upper Yangtze River (Chang Jiang) valley scored many victories. Hong's idiosyncratic Christianity alienated both Western missionaries and the Chinese scholar-gentry. Without the gentry, the Taiping forces were unable to govern the countryside or supply their cities effectively. The leadership strayed from its original austerity and descended into power struggles that left Hong without competent help. In 1860 an attempt to take Shanghai was repelled by U.S.- and British-led forces, and by 1862 Chinese forces under ZENG GUOFAN had surrounded Nanjing. The city fell in 1864, but almost 100,000 of the Taiping followers preferred death to capture. Sporadic resistance continued elsewhere until 1868. The rebellion ravaged 17 provinces, took some 20 million lives, and left the Qing government unable to regain an effective hold over the country. See also LI HONGZHANG; NIAN REBELLION.

Taira Kiyomori \'tī-rä-ˌkē-yō-'mȯ-rē\ (b. 1118, Japan—d. March 21, 1181, Kyōto) Leader of the powerful Taira family and the first member of the warrior class (SAMURAI) to rule Japan. The Taira family had made itself useful to the imperial court quelling pirates on Japan's Inland Sea. In 1156, when the retired emperor Sutoku (see INSEI) enlisted the aid of the Minamoto warrior family to help in a rebellion against the reigning emperor Go-Shirakawa, Kiyomori supported Go-Shirakawa and defeated the Minamoto. The Minamoto staged a comeback in 1159–60, but Kiyomori defeated them again, executing all the Minamoto males except the children MINAMOTO YORITOMO and MINAMOTO YOSHITSUNE, who would later overthrow him. Temporarily victorious, Kiyomori received the highest court rank and manipulated the throne by marrying his daughters into the imperial family. The Taira forces took on the effete ways of the aristocrats and were no match for the frontier-hardy Minamoto, who defeated them in 1185. See also GEMPEI WAR; KAMAKURA PERIOD.

Taishō period (1912–26) Period in Japanese history corresponding to the reign of the Taishō emperor, Yoshihito (1879–1926). It followed the MEIJI PERIOD and represented a continuation of Japan's rise on the international scene and liberalism at home. Politically, the country moved toward broader representational government. The tax qualification for voting was reduced, enfranchising more voters, and was eliminated in 1925. Party politics flourished, and legislation favourable to labour was passed. Japan continued to push China for economic and political concessions and entered into treaties with Western nations that acknowledged its interests in Korea, Manchuria, and the rest of China. Rural Japan did not fare as well as urban Japan, and an economic depression at the end of the Taishō period caused much suffering. See also SHŌWA PERIOD.

Tait, Archibald C(ampbell) (b. Dec. 21, 1811, Edinburgh, Scot.—d. Dec. 3, 1882, Addington, Surrey, Eng.) English cleric. The son of Presbyterian parents, he became an Anglican while studying at the University of Oxford. In 1836 he became a deacon and for five years he was also a curate at two villages near Oxford. In 1842 he succeeded THOMAS ARNOLD as headmaster of Rugby School, and in 1849 he became dean of Carlisle Cathedral. He became bishop of London in 1856; in that position he stressed reconciliation between evangelical churchmen and those who supported the OXFORD MOVEMENT. As archbishop of Canterbury (from 1868), he oversaw the disestablishment of the Anglican Church of Ireland and the passage of the Burials Act (1880), which allowed non-Anglican burial services in Anglican churchyards.

Taiwan *formerly* **Formosa** Island, western Pacific Ocean, off southeastern China, and since 1949 the principal component of the Republic of China (which also includes Matsu and Quemoy islands and the Pescadores). Area: 13,972 sq mi (36,188 sq km), including its outlying islands. Population (2005 est.): 22,725,947. Administrative centre: TAIPEI. Han Chinese constitute virtually the entire population. Languages: Mandarin Chinese (official); Taiwanese, Fukien, and Hakka dialects also spoken. Religions: Buddhism, Daoism, Confucianism, Christianity. Currency: new Taiwan dollar. Lying 100 mi (160 km) off the Chinese mainland, Taiwan is composed mainly of mountains and hills, with densely populated coastal plains in the west. It has one of the highest population densities in the world and is a leading industrial power of the Pacific Rim, with an economy based on manufacturing industries, international trade, and services. Leading exports include nonelectrical and electrical machinery, electronics, textile products, plastic articles, and transportation equipment. Taiwan is a major producer of Chinese-language motion pictures. It is a republic with one legislative branch; its chief of state is the president, and the head of government is the premier. Known to the Chinese as early as the 7th century, the island of Taiwan was widely settled by them early in the 17th century. In 1646 the Dutch seized control of the island, only to be ousted in 1661 by a large influx of Chinese refugees, supporters of the MING DYNASTY. Taiwan fell to the MANCHU in 1683 and was not open to Europeans again until 1858. In 1895 it was ceded to Japan following the first SINO-JAPANESE WAR. A Japanese military centre in World War II, it was frequently bombed by U.S. planes. After Japan's defeat it was returned to China, which was then governed by the Nationalists. When the communists took over mainland China in 1949, the NATIONALIST PARTY government fled to Taiwan and made it their seat of government, with Gen. CHIANG KAI-SHEK as president. Since then, both the Nationalist government and the People's Republic of China (mainland China) have considered

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Taiwan a province of China. In 1954 Chiang and the U.S. signed a mutual defense treaty, and Taiwan received U.S. support for almost three decades, developing its economy in spectacular fashion. It was recognized as the representative of China in the UN until 1971, when it was replaced there by the People's Republic. Martial law in Taiwan, in effect since 1949, was lifted in 1987, and travel restrictions with mainland China were removed in 1988. In 1989 opposition parties were legalized. The relationship with the mainland grew increasingly close in the 1990s, but it again became strained over the future status of Taiwan after CHEN SHUI-BIAN (Ch'en Shui-pian) was elected president in 2000.

Taiwan Strait *or* **Formosa Strait** Arm of the northwestern Pacific Ocean. Lying between the coast of China's FUJIAN province and the island of TAIWAN, it is about 100 mi (160 km) wide. The strait connects the South CHINA SEA and East China Sea.

Taiyuan \'tī-'ywän\ *or* **T'ai-yüan** City (pop., 1999 est.: 1,768,530), capital of SHANXI province, China, lying on the FEN RIVER. Known since the time of the ZHOU DYNASTY, it was a strategic centre and administrative capital in the time of the MONGOLS (12th–14th century). It was the scene of a massacre in 1900 of foreign missionaries during the BOXER REBELLION and was one of the first areas to oppose the emperor in 1911. Invaded by the Japanese in 1937, it was again besieged by communist forces in 1948–49. One of the greatest industrial cities in China, it produces cement, iron and steel, and coal. It also is an education and research centre. There are notable cave temples from the TANG and YUAN eras in the area.

Taizong *or* **T'ai-tsung** \'tī-'dzůŋ\ *orig.* **Li Shimin** (b. 598, China—d. 649, China) Second emperor of China's TANG dynasty. In his father's campaign against the SUI dynasty, Li Shimin was responsible for the conquest of Luoyang, the eastern capital. There he built up a regional administration and an entourage of talented officials. His brothers are said to have plotted to kill him; he did away with them instead, and his father soon abdicated in his favour. He restored normal civil administration to local government and created a unified civil service. He further developed the state schools created by his father and launched the editing of the Confucian Classics. On the frontiers, he fought eastern and western Turks and began to establish sovereignty over the oasis kingdoms of Xinjiang. An invasion of the Korean KOGURYŎ kingdom failed, but he won great prestige for the Tang and came to be widely revered.

Taizu *or* **T'ai-tsu** \'tī-'dzü\ (b. 927, Luoyang, China—d. Nov. 14, 976, Kaifeng) First emperor of the SONG dynasty, who began the unification of China, which his brother would complete. Initially a general for the founder of the Later Zhou dynasty (951–960), he was induced by his troops to take over when the dynasty was left in the hands of a child successor. An upright man, Taizu forgave minor faults while holding his officials accountable in important matters. He had his ministers submit rough drafts of papers for his review, and he frequently traveled about incognito to observe conditions among his people. He reformed the CHINESE EXAMINATION SYSTEM to prevent favouritism and began to award larger numbers of degrees. He gradually moved the administration of the prefectures from the military to civil officials. At his death, a solid foundation had been laid for the future development of the dynasty.

Taj Mahal \'täzh-mə-'häl\ Mausoleum complex on the southern bank of the Yamuna River, outside Agra, India. It was built by the Mughal emperor SHAH JAHĀN in memory of his wife, Mumtāz Maḥal, who died in 1631. The Taj complex, begun c. 1632, took 22 years to complete. At its centre lies a square garden area bounded by two smaller, oblong sections, one comprising the mausoleum and the other an entrance gateway. The mausoleum, of pure-white marble inlaid with semiprecious stones, is flanked by two red sandstone buildings, a mosque on one side and an identical building for aesthetic balance on the other. It stands on a high marble plinth with a minaret at each corner. It has four identical facades, each with a massive central arch 108 ft (33 m) high, and is surmounted by a bulbous double dome and four domed kiosks. Its interior, with fine, restrained stone decoration, centres on an octagonal chamber containing the marble tombs, enclosed by a perforated marble screen, with sarcophagi below. Regarded as one of the world's most beautiful buildings, it was designated a UNESCO WORLD HERITAGE SITE in 1983. Steps have been taken since the late 1990s to reduce air pollution that has damaged the facade of the building.

Tajikistan \tä-ˌji-ki-'stan\ *officially* **Republic of Tajikistan** Country, Central Asia. Area: 55,300 sq mi (143,100 sq km). Population (2005 est.): 6,849,000. Capital: DUSHANBE. The majority of the population are Tajiks;

Uzbeks make up a large minority. Language: Tajik (official). Religion: Islam (predominantly Sunni). Currency: somoni. Tajikistan is a mountainous country; about half of its territory lies at elevations above 10,000 ft (3,000 m), with the PAMIRS dominating the east. The entire region is prone to seismic activity. The AMU DARYA and SYR DARYA rivers cross it and are used for irrigation. Cotton, cattle, fruits, vegetables, and grains are raised. Heavy industries include coal mining, petroleum and natural gas extraction, metalworking, and nitrogen fertilizer production. Notable light industries are cotton milling, food processing, and textiles. Tajikistan is a republic with two legislative houses; the chief of state is the president, and the head of government is the prime minister. Settled by Persians c. the 6th century BC, Tajikistan was part of the empires of the Persian Achaemenian

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dynasty and of Alexander the Great and his successors. In the 7th–8th century AD it was conquered by the Arabs, who introduced Islam. The Uzbeks controlled the region in the 15th–18th centuries. In the 1860s the Russian Empire took over much of Tajikistan. In 1924 it became an autonomous republic under the administration of the Uzbek S.S.R., and it gained union republic status in 1929. It achieved independence with the collapse of the Soviet Union in 1991. Civil war raged through much of the 1990s between government forces and an opposition composed mostly of Islamic militants. A peace agreement was reached in 1997.

Tajumulco \ˌtä-hü-ˈmül-kō\ **Volcano** Volcanic mountain, western Guatemala. Part of a mountain range that extends into Guatemala from southern Mexico, it is the highest peak in Central America, 13,845 ft (4,220 m) high. It is thought to sit atop the remains of an older volcano.

Takebe Katahiro (b. 1664, Edo, Japan—d. Aug. 24, 1739, Edo) Japanese mathematician of the *wasan* ("Japanese calculation") tradition who extended and disseminated the mathematical research of his teacher Seki Takakazu. He served successively two shoguns, Tokugawa Ienobu and Tokugawa Yoshimune (see Tokugawa period). Takebe became a pupil of Seki at the age of 13 and, together with his brother Kataaki, remained with him until his death in 1708. The brothers were the main craftsmen of Seki's project (launched 1683) to record mathematical knowledge in an encyclopaedia. The *Taisei sankei* ("Comprehensive Classic of Mathematics"), in 20 volumes, was finally completed by Takebe Kataaki in 1710. It gives a good picture of Seki's skill at reformulating problems, as well as Takebe Katahiro's ability to correct, perfect, and extend his master's intuitions.

Takemitsu \tä-ke-ˈmit-sü**, Tōru** (b. Oct. 8, 1930, Tokyo, Japan—d. Feb. 20, 1996, Tokyo) Japanese composer. In 1951 he founded Tokyo's Experimental Laboratory to promote an integration of Japanese music with contemporary European developments. Soon acknowledged as Japan's leading composer, he explored avant-garde techniques such as serialism, aleatory music, graphic notation, and electronic music, combining them with traditional Japanese motives and instruments (e.g., *November Steps*, 1967, for *biwa*, *shakuhachi*, and orchestra). He created an individual sound world in which silence itself is an important element.

Takfīr wa al-Hijrah \täk-ˈfēr-wäl-ˈhij-rə\ *Arabic* **"Excommunication and [Holy] Flight"** Name given by Egyptian authorities to a radical Islamic group calling itself the Society of Muslims. It was founded in 1971 by a young agronomist, Shukrī Muṣṭafā, who had been arrested in 1965 for distributing Muslim Brotherhood leaflets and was released from prison in 1971. Appealing to those who saw mainstream society—from which the group sought to flee (see Hijrah)—as weak, corrupt, and un-Islamic, it engaged in acts of terrorism and was initially thought to be behind the assassination of Anwar el-Sādāt. The group soon dissolved, partly because of the extreme rigour of its doctrine, and is noteworthy because its actions initiated the repression of fundamentalist groups by security services in Egypt in the late 1970s.

Takla Makan \ˌtä-klə-mə-ˈkän\ **Desert** *Chinese* **Taklimakan Shamo** *or* **T'a-k'o-la-ma-kan Sha-mo** Desert, forming the greater part of the Tarim Basin, west-central China. One of the world's largest sandy wastes, it is about 600 mi (965 km) across, with an area of 105,000 sq mi (272,000 sq km). It is flanked by high mountain ranges, including the Kunlun Mountains, whose rivers penetrate the desert 60–120 mi (100–200 km) before drying up in its sands. Its wind-blown sand cover is as much as 1,000 ft (300 m) thick and has formed such features as pyramidal dunes that can reach heights of 1,000 ft (300 m).

Taksin \ˈtäk-sin\ *or* **Phraya Taksin** (b. April 17, 1734, Ayutthaya—d. April 6, 1782, Thon Buri) Thai general and later king (1767–82) who reunited Siam (Thailand) after its defeat by Myanmar (Burma). While Taksin was a provincial governor, his troops were among those besieged by the forces of Myanmar in 1766–67, but he escaped and raised new troops. He drove out the invaders and defeated other contenders for the throne, then extended his power into neighbouring states. A better conqueror than ruler, he was deposed and probably executed in 1782.

Talbot, William Henry Fox (b. Feb. 11, 1800, Melbury Abbas, Dorset, Eng.—d. Sept. 17, 1877, Lacock Abbey, near Chippenham, Wiltshire) English chemist and pioneer photographer. In 1840 he developed the calotype, an early photographic process that improved on the daguerreotype; it involved the use of a photographic negative from which multiple prints could be made. In 1835 he published his first article documenting a photographic discovery, that of the paper negative. His *The Pencil of Nature* (1844–46) was the first book with photographic illustrations. Talbot also published many articles on mathematics, astronomy, and physics.

talc Common silicate mineral that is distinguished from almost all other minerals by its extreme softness. Its soapy or greasy feel accounts for the name soapstone, given to compact aggregates of talc with other rock-forming minerals. Soapstones have been used since ancient times for carvings, ornaments, and utensils. Resistant to most reagents and to moderate heat, they are especially suitable for sinks and countertops. Talc is also used in lubricants, leather dressings, toilet and dusting powders, and certain marking pencils; as a filler in ceramics, paint, paper, roofing materials, plastic, and rubber; as a carrier in insecticides; and as a mild abrasive in the polishing of cereal grains.

Talcahuano \ˌtäl-kä-ˈwä-nō\ City (pop., 2002 est.: 245,000), south-central Chile. Lying on a small peninsula that forms the southwestern shore of Concepción Bay, it is a major port and the site of Chile's main naval station. It is also an important commercial, fishing, and manufacturing centre. The Peruvian ironclad *Huáscar*, captured by Chile during the War of the Pacific (1879), is moored in the harbour.

Taliban \ˌtä-lē-ˈbän\ Political and religious faction and militia that came to power in Afghanistan in the mid-1990s. Following the Soviet Union's 1989 withdrawal from Afghanistan (see Afghan Wars), the Taliban (Persian: "Students")—whose name refers to the Islamic religious students who formed the group's main recruits—arose as a popular reaction to the chaos that gripped the country. In 1994–95, under the leadership of Mullah Mohammad Omar, the Taliban extended its control in Afghanistan from a single city to more than half the country, and in 1996 it captured Kabul and instituted a strict Islamic regime. By 1999, the Taliban controlled most of Afghanistan but failed to win international recognition of its regime because of its harsh social policies—which included the almost complete removal of women from public life—and its role as a haven for Islamic extremists. Among these extremists was Osama bin Laden, the expatriate Saudi Arabian leader of Al-Qaeda, a network of Islamic militants that had engaged in numerous acts of terrorism. The Taliban's refusal to extradite bin Laden to the U.S. following the September 11 attacks in 2001 prompted the U.S. to attack Taliban and Al-Qaeda forces in Afghanistan, driving the former from power and sending the leaders of both groups into hiding. See also Islamic fundamentalism.

Taliesin \ˌta-lē-ˈe-sin\ Home, as well as architectural school, of Frank Lloyd Wright. Located near Spring Green, Wis., it was begun in 1911 and was rebuilt after fires in 1914 and 1925. Taliesin West, near Scottsdale, Ariz., was begun in 1938 as a winter home for Wright and his students. Both structures were continually renovated and added to until Wright's death in 1959, after which they continued to be occupied by members of the Wright Foundation. Wright, of Welsh descent, named them after the renowned Welsh poet (fl. 6th century AD).

talk show Radio or television program in which a well-known personality interviews celebrities and other guests. The late-night programs hosted by Johnny Carson, Jay Leno, David Letterman, and Conan O'Brien have emphasized entertainment, incorporating interludes of music or comedy. Other talk shows have focused on politics (see David Susskind), controversial social issues or sensationalistic topics (Phil Donahue), and emotional therapy (Oprah Winfrey). See also Merv Griffin; Larry King; Jack Paar.

Tallahassee City (pop., 2000 est.: 150,624), capital of Florida, U.S. Originally an Appalachee Indian village, the area attracted Spanish settlers after the visit of Hernando de Soto in 1539. Tallahassee became the capital of the Florida Territory in 1824 and of the state in 1845. During the American Civil War it was the only capital of a Confederate state east of the Mississippi not captured by Union forces. Today it is a wholesaling and distribution point for the surrounding lumber, cotton, and cattle-raising industries. Educational institutions include Florida State University (founded 1851).

Tallahatchie River River, northern Mississippi, U.S. It rises in Tippah county and flows southwest 230 mi (370 km) to join the Yalobusha River and form the Yazoo River. The Tallahatchie is navigable for about 100 mi (160 km). Its upper section is sometimes called the Little Tallahatchie River.

Tallapoosa River River, Georgia and Alabama, U.S. Rising in northwestern Georgia, the Tallapoosa flows southwest for about 268 mi (431

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km) before joining the larger Coosa River just north of Montgomery, Ala., to form the Alabama River. Three private power dams have created reservoirs, including Lake Martin, for river control, power, and recreation.

Tallchief, Maria (b. Jan. 24, 1925, Fairfax, Okla., U.S.) U.S. ballet dancer of Native American descent. Tallchief studied with Bronislava Nijinska before joining the Ballet Russe de Monte Carlo (1942–47). She joined the New York City Ballet in 1948 and became its prima ballerina, creating leading roles in many ballets choreographed for her by George Balanchine (her husband from 1946 to 1952), including *Symphonie concertante* (1947), *Caracole* (1952), and *Pas de dix* (1955). She left the company in 1965, became artistic director of the Lyric Opera Ballet in Chicago, and founded the Chicago City Ballet in 1980.

Maria Tallchief in *Swan Lake*.
MARTHA SWOPE

Talleyrand \tȧ-le-'rän\ **(-Périgord), Charles-Maurice de** (b. Feb. 2, 1754, Paris, France—d. May 17, 1838, Paris) French statesman. Ordained a priest, he became bishop of Autun in 1788. Elected to represent the clergy at the Estates-General (1789), he became the "bishop of the Revolution" by calling for confiscation of church property to fund the new government and supporting the Civil Constitution of the Clergy. Excommunicated by the pope in 1790, he was sent to England as an envoy in 1792. He was expelled from France during the Reign of Terror, lived in the U.S. (1794–96), then returned to serve in the Directory as foreign minister (1797–99). He was forced to resign briefly for involvement in bribery scandals, including the XYZ Affair. Adept at political survival, he supported Napoleon and again became foreign minister (1799–1807) and later grand chamberlain (1804–07). He resigned in opposition to Napoleon's policy toward Russia but continued to advise him, arranging his marriage with Marie-Louise of Austria. As Napoleon faced defeat, Talleyrand secretly worked to restore the monarchy; in 1814 he was appointed foreign minister to Louis XVIII and represented France at the Congress of Vienna. Forced by ultraroyalists to resign (1815), he later became involved in the July Revolution of 1830 and served as ambassador to Britain (1830–34).

Tallinn \'ta-lən\ *formerly (until 1918)* **Revel** \'rā-vəl\ Seaport city (pop., 2001: 399,850), capital of Estonia. It is located on the Gulf of Finland. A fortified settlement existed there from the late 1st millennium BC and a town in the 12th century AD. In 1219 it was captured by the Danes, who built a new fortress. Trade flourished after it joined the Hanseatic League in 1285. In 1346 it was sold to the Teutonic Order, and in 1561 it passed to Sweden. Russia captured it in 1710, and it remained a Russian city until 1918, when it became the capital of independent Estonia. From 1940 to 1991 Estonia was a republic of the U.S.S.R. During World War II the city was occupied by German forces and was severely damaged. Rebuilt, it again became the capital of independent Estonia in 1991. It is a major commercial and fishing port, an industrial centre, and the cultural focus of Estonia, with numerous educational institutions. Historical structures include a medieval city wall and a 13th-century church.

Tallis \'ta-ləs**, Thomas** (b. c. 1505—d. Nov. 23, 1585, Greenwich, London, Eng.) British composer. An organist at abbeys and churches from 1532, by 1543 he was a gentleman of the Chapel Royal, as both organist and composer. Though a Catholic, he was one of the first to write hymns in English for the Anglican church. During Mary I's Catholic reign, he wrote Latin masses, but he remained in favour after Elizabeth I's accession. His powerful *Lamentations of Jeremiah* are regarded as his greatest body of work; his 40-part motet *Spem in alium* is his most famous piece. He also wrote three masses and about 40 other motets. In 1575 Tallis and his pupil William Byrd were given the first exclusive license to print music in England.

Talma \tȧl-'mȧ**, François-Joseph** (b. Jan. 16, 1763, Paris, France—d. Oct. 19, 1826, Paris) French actor and theatre manager. He made his debut at the Comédie-Française in 1787. Influenced by the painter Jacques-Louis David, he became an early advocate of historical costuming, and he created a sensation by appearing onstage in a Roman toga. After political dissension split the company (1789), the pro-republican Talma established a rival troupe. He developed realism in his staging and insisted on a naturalistic rather than a declamatory acting style. In 1799 his troupe was reunited with the Comédie-Française; as head of the company, he became recognized as the supreme tragedian of the era, winning the admiration of Napoleon.

Talmud \tȧl-'müd, 'tal-məd\ In Judaism, the systematic amplification and analysis of passages of the Mishna, the Gemara, and other oral law, including the Tosefta. Two Talmuds exist, produced by two different groups of Jewish scholars: the Babylonian Talmud (c. AD 600) and the Palestinian Talmud (c. AD 400). The Babylonian Talmud is more extensive and thus more highly esteemed. Both Talmuds formulate their own hermeneutics to convey their theological system by defining the Torah and by demonstrating its perfection and comprehensive character. The Talmud remains a text of central importance, particularly in Orthodox Judaism. Intensive modern Talmudic scholarship is pursued in Israel and the U.S. See also Halakhah.

Talmud Torah \tȧl-'müd-tō-'rä, 'tal-məd-'tō-rə\ Religious study of the Torah in search of the God who makes himself known in that work. It focuses on learning God's message for contemporary times through inquiry into the books of Hebrew scripture or those that record the original oral Torah of Sinai, the Mishna, Midrash, and Talmuds. Talmud Torah is also the name given to an elementary school under Jewish auspices that places special emphasis on religious education.

tamarin Any of about 25 species of long-tusked marmosets in the genera *Leontopithecus* (or *Leontideus*, according to some authorities) and *Saguinus*. Tamarins are 8–12 in. (20–30 cm) long, excluding the 12–16-in. (30–40-cm) tail. The emperor tamarin (*Saguinus imperator*) has long, grizzled, gray fur; a reddish tail, and a long white moustache. The three species of *Leontopithecus* are endangered. See also golden lion tamarin.

tamarind \'ta-mə-rənd\ Evergreen tree (*Tamarindus indica*) of the pea family (see legume), native to tropical Africa and cultivated elsewhere as an ornamental and for its edible fruit. The tree grows about 80 ft (24 m) tall and has featherlike leaves. It bears small clusters of yellow flowers and plump pods that do not split open. The soft, brownish edible pulp contains 1–12 large, flat seeds that are used in Oriental foods, beverages, and medicines.

Tamarind (*Tamarindus indica*)
WALTER DAWN

Tamaulipas \ˌtä-maù-'lē-päs\ State (pop., 2000: 2,753,222), northeastern Mexico. Located on the Gulf of Mexico, it covers 30,650 sq mi (79,384 sq km). The capital is Ciudad Victoria. Though largely mountainous, it has extensive, fertile plains in the north and a sandy, lagoon-dotted coastal zone. Large areas are irrigated, and agriculture is the main economic activity; products include sorghum, soybeans, sugarcane, cotton, coffee, and fruit. Fisheries and copper mining also are important. It produces one-third of Mexico's natural gas and large quantities of crude oil.

Tamayo \tə-'mī-ō**, Rufino** (b. Aug. 26, 1899/1900, Oaxaca, Mex.—d. June 24, 1991, Mexico City) Mexican painter and graphic artist. He studied at Mexico City's School of Fine Arts and then taught at the National Museum of Archaeology (1921–26). He preferred easel painting to the monumental proportions and political rhetoric of José Clemente Orozco, Diego Rivera, and David Alfaro Siqueiros. His distinctive style blended Cubism and Surrealism with Mexican folk-art subjects involving semiabstract figures, still lifes, and animals in vibrant colours. From 1936 he lived principally in New York City. In 1950 an exhibition at the Venice Biennale brought him international recognition. He designed murals for Mexico City's Palace of Fine Arts (1952–53) and UNESCO's Paris headquarters (1958). In 1974 he donated his collection of pre-Hispanic art to his native Oaxaca.

Tambo, Oliver (b. Oct. 27, 1917, Bizana, near Johannesburg, S.Af.) President (1969–91) of South Africa's African National Congress (ANC). In 1944, with Nelson Mandela and others, he cofounded the Youth League

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of the ANC. He became the ANC's deputy president in 1958 and was forced into exile in Zambia when it was banned in 1960. He was elected ANC president in 1969 after the death of Albert Lutuli. He returned to South Africa in ill health in 1990 and yielded the party presidency to Mandela.

tambourine Small frame drum with one skin nailed or glued to a shallow circular frame, into which jingles or pellet bells are set. It is held with one hand and struck with the other, or simply shaken. Tambourines were played in ancient Mesopotamia, Greece, and Rome, especially in religious contexts, and they have long been prominent in Middle Eastern folk and religious use. Crusaders took them to Europe in the 13th century.

Tamburlaine See Timur

Tamerlane See Timur

Tamil \'tä-məl, 'ta-məl\ Any member of a people originally of southern India who speak the Tamil language. The Tamil have a long history of achievement; sea travel, city life, and commerce seem to have developed early among them. They traded with the ancient Greeks and Romans. They have the oldest cultivated Dravidian language and a rich literary tradition. They are mostly Hindus (the Tamil area in India is a centre of traditional Hinduism). Sri Lanka has two distinct Tamil populations, the so-called Ceylon Tamil and the Indian Tamil. Tensions between the Ceylon Tamil and the Sinhalese Buddhist majority prompted a Tamil guerrilla insurgency in the 1980s that continued into the 21st century. The Tamil number about 57 million, with 3.2 million living in Sri Lanka.

Tamil language Dravidian language spoken by more than 63 million people. It is an official language of Tamil Nadu state in India and one of the official languages of Sri Lanka. Large Tamil-speaking communities also reside in Malaysia and Singapore, South Africa, and the Indian Ocean islands of Réunion and Mauritius. The earliest Tamil inscriptions date from c. 200 BC; literature in the language has a 2,000-year history. Tamil script is descended from the southern Indian Pallava script (see Indic writing systems). Tamil has several regional dialects, Brahman and non-Brahman caste dialects, and a marked division between literary and colloquial forms (see diglossia).

Tamil Nadu \'ta-məl-'nä-dü\ *formerly* **Madras** \mə-'dräs\ State (pop., 2001 prelim.: 62,110,839), southeastern India. Lying on the Bay of Bengal, its coastline includes the enclaves of Pondicherry and Karaikal (both parts of Pondicherry union territory); it is also bordered by Kerala, Karnataka, and Andhra Pradesh states. Tamil Nadu covers an area of 50,216 sq mi (130,058 sq km), and its capital is Chennai (Madras). Its interior includes the fertile Kaveri River delta. By the 2nd century AD the region was occupied by Tamil kingdoms. The Hindu kingdom of Vijayanagar ruled the southern regions from 1336 to 1565. The Portuguese entered the area in 1498, only to be displaced by the Dutch in the 16th–17th centuries. The British established a settlement in 1611, which expanded to become the separate presidency of Madras, which lasted from 1653 to 1946. The state of Tamil Nadu was formed in 1956. It is one of India's most industrialized states, manufacturing vehicles, electrical equipment, and chemicals.

Tamiris \tə-'mir-əs\, **Helen** *orig.* **Helen Becker** (b. April 24, 1905, New York, N.Y., U.S.—d. Aug. 4, 1966, New York City) U.S. choreographer, modern dancer, and teacher. In 1930 she founded her own company and school, which she directed until 1945. Many of her own works, such as *Walt Whitman Suite* (1934), drew on American themes. From 1945 to 1957 she choreographed Broadway musicals, including *Annie Get Your Gun* (1946), *Touch and Go* (1949; Tony Award for choreography), and *Fanny* (1954). In 1960 she and her dancer-husband, Daniel Nagrin, founded the Tamiris-Nagrin Dance Company.

Helen Tamiris.
COURTESY OF THE DANCE COLLECTION, NEW YORK PUBLIC LIBRARY, ASTOR, LENOX AND TILDEN FOUNDATIONS

Tammany \'ta-mə-nē\ **Hall** Executive committee of the Democratic Party in New York City. The group was organized in 1789 in opposition to the Federalist Party's ruling "aristocrats." The Society of Tammany was incorporated in 1805 as a benevolent body; its name derived from a pre-Revolutionary association named after the benevolent Indian chief Tammanend. The group became identified with the city's Democratic Party. The makeup of the society was substantially altered in 1817 when Irish immigrants, protesting Tammany bigotry, forced their right to membership and benefits. Tammany later championed the extension of the franchise to white propertyless males. Nevertheless, the society's appeal to particular ethnic and religious minorities, the doling out of gifts to the poor, and the bribing of leaders of rival political factions, among them the notorious boss William Marcy Tweed, made the name Tammany Hall synonymous with political corruption. Its power was greatest in the late 19th and early 20th century; it declined in the 1930s under the reforms of Pres. Franklin D. Roosevelt and Mayor Fiorello La Guardia.

Tammuz \'tä-ˌmüz\ Mesopotamian god of fertility. He was the son of Enki, god of water, and Duttur, a personification of the ewe. Worship of Tammuz was centered around two yearly festivals, one in the early spring in which his marriage to the goddess Inanna symbolized the fertilization of nature for the coming year, and one in summer when his death at the hands of demons was lamented. He is thought to be the precursor of several later deities associated with agriculture and fertility, including Ninsun, Damu, and Dumuzi-Abzu.

Tammuz, alabaster relief from Ashur, *c.* 1500 BC; in the Staatliche Museen zu Berlin, Germany
FOTO MARBURG—ART RESOURCE/EB INC.

tamoxifen \ta-'mäk-si-ˌfen\ Synthetic hormone, marketed as Nolvadex, that prevents the binding of estrogen to estrogen-sensitive breast cancer cells. Initially used to prevent recurrences of breast cancer after successful treatment, it was later found to prevent first occurrences in women at high risk. The most serious side effect is an increased risk of thrombosis, which may require patients to take an anticoagulant as well. Studies on its effectiveness against breast and other cancers continue.

Tampa City (pop., 2000: 303,447), west-central Florida, U.S. Located on the northeastern end of Tampa Bay, the U.S. Army established Fort Brooke on the site in 1824 to oversee the removal of the Seminole Indians. The town was incorporated in 1855. Tampa developed as a cigar-making centre after the town's first cigar factory was established (1886). It now has a wide range of industries and is a major distribution centre. It is a winter and fishing resort and major tourist destination; attractions include Busch Gardens.

Tampa Bay Inlet, Gulf of Mexico, western Florida, U.S. The bay is 25 mi (40 km) long and 7–12 mi (11–19 km) wide, and it serves the recreational and commercial activities of Saint Petersburg on the western shore and Tampa on the northeast. Hernando de Soto began his travels through the southeastern U.S. region when he reached Tampa Bay in 1539. Tampa Bay is spanned by the 15-mi (24-km) Sunshine Skyway Bridge.

Tampico \täm-'pē-kō\ Port and city (pop., 2000: 295,442), southeastern Tamaulipas state, northeastern Mexico. It lies on the Pánuco River and is almost surrounded by swampland and lagoons. It grew around a Franciscan monastery founded c. 1532. Destroyed by pirates in 1683, it was not resettled until 1823. It was occupied briefly by U.S. troops (1846) during the Mexican War and by the French in 1862. Until 1901 it was a second-rate port with a reputation for unsanitary conditions. It grew with the rapid exploitation of surrounding petroleum resources to become the most modern port in Mexico and one of the country's leading seaports. It is also a seaside resort.

Tan Cheng Lock \'tän-'cheŋ-'lȯk\ (b. April 5, 1883, Malacca, Straits Settlements—d. Dec. 8, 1960, Malacca) Malaysian Chinese community leader and politician. Born to a wealthy Chinese family, he campaigned against "pro-Malay" policies and in favour of equal rights for all ethnic groups, whether immigrant or indigenous. After World War II, he supported the British proposal for a unitary state with common citizenship, which the Malays rejected. During the Malayan Emergency, he cooperated

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with the British to promote national unity. In 1949 he was chosen to head the Malayan Chinese Association, the first full-fledged centrist Malayan Chinese political party, and he continued as its head after Malayan independence in 1957.

Tan Malaka \'tän-mä-'lä-kä**, Ibrahim Datuk** (b. 1894—d. April 16, 1949, Blitar, Java, Indon.) Indonesian communist leader. A schoolteacher, he became a communist after returning from Europe in 1919. He was exiled by the Dutch for trying to incite a general strike in 1922 but returned to Java in 1944 and, competing with SUKARNO for control of the Indonesian nationalist movement, created a coalition that briefly came to power in 1946. He was imprisoned later that year on charges of attempting a coup. In 1948, while the Dutch and Indonesians were at war, he proclaimed himself head of Indonesia. Forced to flee the invading Dutch, within a few months he was captured and executed by Sukarno's supporters.

Tana, Lake Lake, Ethiopia. The country's largest lake, its surface area covers more than 1,400 sq mi (3,620 sq km). It forms the main reservoir for the Blue Nile (see NILE RIVER), which pours from it over a lava barrier, dropping 138 ft (42 m) to form Tisisat Falls. Coptic monasteries were built on two of its islands during the Middle Ages.

Tana River \'tä-nä\ River, Kenya. The country's longest river, it rises in the Aberdare Range and flows in a curve northeast, east, and south 440 mi (708 km) to the Indian Ocean. It is navigable by small craft for about 150 mi (240 km) upstream.

Tana River \'tä-nə\ River, northeastern Norway. It flows 224 mi (360 km) north and northeast to empty into Tana Fjord, an inlet of the ARCTIC OCEAN on the northeastern coast of Norway. The river forms a section of the boundary between Norway and Finland.

tanager \'ta-nə-jər\ Any of 200–220 species (family Emberizidae) of New World songbirds inhabiting forests and gardens. Most species are 4–8 in. (10–20 cm) long and have a short neck. Bills vary in shape, but all are slightly toothed and hooked. Tanagers have brilliant plumage in reds, yellows, greens, blues, and black, sometimes strikingly patterned. Most species are arboreal; most eat fruit, and some eat insects. The scarlet, summer, and western tanagers breed in temperate North America. The hepatic tanager breeds from Arizona to central Argentina. Most other species are chiefly tropical.

Tanagra \'ta-nə-grə, tə-'na-grə\ Ancient town, BOEOTIA, eastern central Greece. First occupied by an Athenian clan, it became the chief town of the eastern Boeotians, with lands extending to the Gulf of Euboea. It was the scene of the Athenian defeat by the Spartans in 457 BC during the first PELOPONNESIAN WAR. Finely modeled terra-cotta statuettes, known as TANAGRA FIGURES, were made there c. 340–150 BC and exported to Mediterranean countries.

Tanagra figure Any of the small terra-cotta figures dating primarily from the 3rd century BC and named after the site in Boeotia, Greece, where they were found. The statuettes, mostly of well-dressed young women standing or sitting, were all formed from molds and originally were covered with a white coating and then painted. On their discovery in the 19th century, they became enormously popular and were extensively and expertly forged.

Tanaka \'tä-nä-kä**, Kakuei** (b. May 4, 1918, Kariwa, Niigata prefecture, Japan—d. Dec. 16, 1993, Tokyo) Prime minister of Japan (1972–74). As prime minister, Tanaka pushed through many government construction projects and was responsible for the economic revitalization of much of western Japan and for establishing diplomatic relations with the People's Republic of China. In 1976 he was charged with accepting, while prime minister, $2 million from Lockheed Aircraft Corp. to influence All Nippon Airways to buy Lockheed jets; he was convicted in 1983. However, he remained powerful in the Liberal-Democratic Party until he retired from politics in 1990.

Tanaka Tomoyuki (b. April 16, 1910, Ōsaka, Japan—d. April 2, 1997, Tokyo) Japanese film producer. Tanaka was associated for nearly 60 years with Japan's Toho Studios, for which he produced more than 200 films. Of these, his best known are the 22 films in the Godzilla series, beginning with *Godzilla, King of the Monsters* in 1954 and ending with *Godzilla vs. Destroyer* in 1995. He also produced films for renowned director KUROSAWA AKIRA.

Tanana \'ta-nə-ˌnȯ\ **River** River, east-central Alaska, U.S. Rising from two headstreams fed by glaciers high in the WRANGELL MOUNTAINS, the Tanana flows northwest 550 mi (885 km) to join the YUKON RIVER; it is the Yukon's chief southern tributary. The Tanana was first explored by Russian traders in the mid-19th century. Its valley was an important gold-producing area in the 1904 GOLD RUSH; it is also a lumbering district and one of Alaska's major farming regions. The ALASKA HIGHWAY follows it for nearly its entire course.

Tananarive See ANTANANARIVO

Tancred \'taŋ-krəd\ (d. Feb. 20, 1194, Palermo) King of Sicily (1190–94), the last of the Norman rulers. He rebelled twice (1155, 1161) against his uncle William I of Sicily, and he gained the Sicilian throne after the death of William II. He gave in to the demand of RICHARD I (the Lionheart) in 1191 for the legacy left him by William II and the return of the dowry of his sister Joan, William's widow, after Richard occupied Messina. Emperor HENRY VI sought to wrest the Sicilian throne from Tancred, unsuccessfully besieging Naples in 1191 and marching on Sicily again in 1194. Tancred died before his arrival, and Henry was crowned king.

Tandy, Jessica See Hume CRONYN and Jessica Tandy

Taney, Roger B(rooke) (b. March 17, 1777, Calvert county, Md., U.S.—d. Oct. 12, 1864, Washington, D.C.) U.S. jurist. A lawyer from 1801, he served in Maryland's legislature before being named state attorney general (1827–31). He was appointed U.S. attorney general in 1831 by Pres. ANDREW JACKSON and achieved national prominence by opposing the BANK OF THE UNITED STATES. In 1833 Jackson nominated him to serve as secretary of the treasury, but his appointment was rejected by the Senate. In 1835 Jackson selected him to serve as associate justice on the Supreme Court of the United States, and after the death of Chief Justice JOHN MARSHALL, Jackson sought to have him confirmed as chief justice. Despite powerful resistance led by HENRY CLAY, JOHN C. CALHOUN, and DANIEL WEBSTER, Taney was sworn in as chief justice in March 1836. His tenure (1836–64) remains the second longest in the Supreme Court's history. He is remembered principally for the DRED SCOTT DECISION (1857), in which he argued that a slave was not a citizen and could not sue in a federal court, that Congress had no power to exclude slavery from the territories, and that blacks could not become citizens. He is also noted for his opinion in *Abelman* v. *Booth* (1858), which denied state power to obstruct the processes of the federal courts, and in *Charles River Bridge* v. *Warren Bridge* (1837), which declared that rights not specifically conferred by a charter could not be inferred from the language of the document. Though he considered slavery an evil, he believed its elimination should be brought about gradually and chiefly by the states in which it existed.

Roger B. Taney, photograph by Mathew Brady.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

tang See SURGEONFISH

Tang dynasty *or* **T'ang** \'täŋ\ **dynasty** (618–907) Chinese dynasty that succeeded the short-lived SUI and became a golden age for poetry, sculpture, and Buddhism. The Tang capital of CHANG'AN became a great international metropolis, with traders and embassies from Central Asia, Arabia, Persia, Korea, and Japan passing through. A NESTORIAN Christian community also existed there, while mosques were established in Guangzhou (Canton). The economy flourished in the 8th–9th centuries, with a network of rural market towns growing up to join the metropolitan markets of Chang'an and Luoyang. Buddhism enjoyed great favour, and there were new translations of the Buddhist scriptures and growth of indigenous sects, including Chan (see ZEN). Poetry was the greatest glory of the period; nearly 50,000 works by 2,000 poets survive. Foreign music and dance became popular, and ancient orchestras were revived. The Tang government never completely controlled the northern Chinese border, where nomad tribes made constant incursions; periodic rebellions from the mid-8th century onward also weakened its power (see AN LUSHAN REBELLION). In its later years, the government's focus was on eastern and southeastern China rather than Central Asia. See also TAIZONG; WU HOU.

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Tanganyika \ˌtan-gən-'yē-kə**, Lake** Lake, central Africa. Located on the boundary between Tanzania and Congo (Kinshasa), it is the longest freshwater lake in the world, 410 mi (660 km) long, and the second deepest, 4,710 ft (1,436 m) deep. Fed by several rivers, it tends to be brackish. Oil palms and rice grow along its steep shores; hippopotamuses and crocodiles abound. It was first visited by Europeans, searching for the source of the Nile, in 1858.

Tange \'tän-gā\ **Kenzō** (b. Sept. 4, 1913, Ōsaka, Japan—d. March 22, 2005, Tokyo) Japanese architect. Tange worked in the office of Maekawa Kunio before setting out on his own. His first major commission involved the reconstruction of Hiroshima. In addition to planning the city, he helped design Hiroshima's Peace Memorial Park, and its peace centre (1950) and museum (1952) are among his best-known early works. His Kagawa prefectural offices in Takamatsu (1958) were a particularly fine blend of the modern and traditional. In 1959 Tange and his students published the Boston Harbor project, launching the Metabolist school. His work in the 1960s took on more boldly dramatic forms, and he became a master at manipulating complex geometries; his National Gymnasiums for Tokyo's 1964 Olympic Games are exemplary. During 1966–70 he designed the master plan for the Japan World Exposition (Expo 70), which was held in Ōsaka. More-recent works include the New Tokyo City Hall Complex (1991) and the Tokyo Dome Hotel (2000). Also influential as a writer, teacher, and town planner, Tange was awarded the Pritzker Architecture Prize in 1987.

tangent See trigonometric function

tangent line \'tan-jənt\ In geometry, a line that intersects a circle exactly once; in calculus, a line that touches a curve at one point and whose slope is equal to that of the curve at that point. Particularly useful as approximations of curves in the immediate vicinity of the point of tangency, tangent lines are the basis of many estimation techniques, including linear approximation. The numerical value of the slope of the tangent line to the graph of a function at any point equals that of the function's derivative at that point. This is one of the keystones of differential calculus. See also differential geometry.

tangerine Small, thin-skinned variety of the mandarin orange species (*Citrus reticulata deliciosa*) of the rue family (citrus family). Probably native to Southeast Asia, today it is cultivated in subtropical regions worldwide, especially southern Europe and the southern U.S. The tree is smaller than other orange trees, with slender twigs and lance-shaped leaves. The fruit is slightly flattened at each end and has a loose, reddish orange peel. Easily separated segments of tender, juicy, richly flavoured pulp are abundant in vitamin C. Oil from the fragrant skin is a characteristic ingredient in several flavourings and liqueurs. The tangerine crossed with the grapefruit produced the hybrid known as the tangelo.

Tangerine (*Citrus reticulata deliciosa*)
GRANT HEILMAN—EB INC.

Tangier \tan-'jir\ *French* **Tanger** \tä^{n}-'zhā\ *Arabic* **Ṭanjah** \'tän-jə\ *ancient* **Tingis** Seaport city (pop., 1994: 521,735), northern Morocco. Located at the western end of the Strait of Gibraltar, it was first known as an ancient Phoenician trading post and later became a Carthaginian and then a Roman settlement. After five centuries of Roman rule, it was captured successively by the Vandals, Byzantines, and Arabs. It fell to the Portuguese in 1471; it later passed to the British, who gave it up to Morocco in 1684. When the rest of Morocco became a French protectorate in 1912, Tangier was granted special status; in 1923 it officially became an international city, governed by an international commission. It remained an international zone until it was integrated in 1956 with the independent kingdom of Morocco. It became a free port and royal summer residence in the 1960s. The old town is dominated by a Casbah (citadel) and the Great Mosque. It is a busy port and trade centre; industries include tourism, fishing, and textiles, especially carpets.

tango Spirited Spanish flamenco dance; also a South American ballroom dance. It evolved into a ballroom dance in Buenos Aires, Arg., possibly influenced by the Cuban habanera. It was made popular in the U.S. by Vernon and Irene Castle, and by 1915 it was being danced throughout Europe. Early versions were fast and exuberant; these were later modified to the smoother ballroom step, characterized by long pauses and stylized body positions and danced to music in ¼ time.

Tango danced by Rudolph Valentino and partner from the motion picture *Four Horsemen of the Apocalypse,* 1921
COURTESY OF METRO-GOLDWYN-MAYER INC., © 1921; PHOTOGRAPH, FROM THE MUSEUM OF MODERN ART FILM STILLS ARCHIVE

Tangun \'tän-'gün\ Mythological first king of the Koreans, whose reign began in 2333 BC. According to one legend, Tangun's father descended from heaven to rule earth from a mountaintop. When a bear and a tiger expressed the wish to become human, he ordered them into a cave for 100 days; after the tiger grew impatient and left, the bear was transformed into the beautiful woman who became Tangun's mother. Buddhism and Daoism credited Tangun with establishing a national religion and originating the Korean maxim "Hongik-ingan" ("Love humanity"). His birthday is a school holiday.

Tangut \'tän-'gůt\ People historically living in southern Inner Mongolia at the terminus of the Silk Road. They engaged in irrigated agriculture and pastoralism and acted as middlemen in trade between Central Asia and China. They adopted Buddhism as their state religion, created their own writing system, and in 1038 proclaimed their kingdom of Xi Xia, which survived nearly 200 years.

Tanguy \tä^{n}-'gē**, Yves** (b. Jan. 5, 1900, Paris, France—d. Jan. 15, 1955 Waterbury, Conn., U.S.) French painter. In 1923, after serving in the merchant marine, he was inspired to start painting when he saw the works of Giorgio de Chirico, though he had no formal art training. He joined the Surrealist group in 1925 and participated in all their major exhibitions. He developed a unique style, reminiscent of Salvador Dalí's, depicting strange, amorphous creatures and unidentifiable objects set in barren, brightly lit landscapes with infinite horizons. Despite their smooth, painstaking detail, his pictures have a timeless, dreamlike quality (e.g., *The Invisibles*, 1951). He emigrated to the U.S. in 1939.

Tanimbar Islands \tə-'nim-ˌbär, 'ta-nəm-ˌbär\ Group of about 30 islands, southeastern Moluccas, Indonesia. It includes the large island of Jamdena, 70 mi (113 km) long by 28 mi (45 km) wide, and the nearby islands of Larat and Selaru. Though there is a lack of fresh water, the soil supports corn, rice, coconut palms, and fruits. The Dutch claimed the group in 1639 but did not establish rule until 1900. After World War II, the islands became part of Indonesia.

Tanis \'tā-nəs\ *biblical* **Zoan** Ancient city, Egypt. Its remains are located in the Nile River delta. Capital of a province of Lower Egypt and, under the 21st and 22nd dynasties (c. 1075–c. 700 BC), of the whole country, it was important as one of the ports nearest to the Asian seaboard. In 1939 several intact royal tombs containing silver coffins, gold masks, and gold and silver jewelry were excavated within the ancient main temple enclosure.

Tanit \'tä-nit\ Chief goddess of Carthage, the equivalent of Astarte. She first appeared around the 5th century BC. Though she seems to have had some connection with the heavens, she was also a mother goddess and symbol of fertility. She was the consort of Baal Hammon, chief god of Carthage, whose cult she eventually eclipsed. Archaeological evidence suggests that children, probably firstborn, were sacrificed both to her and to Baal Hammon. Outside Carthage, Tanit also enjoyed a following on Malta, on Sardinia, and in Spain.

Tanizaki Jun'ichirō \ˌtä-nē-'zä-kē-'jün-ē-ˌchē-rō\ (b. July 24, 1886, Tokyo, Japan—d. July 30, 1965, Yugawara) Japanese novelist. Though his earliest short stories have affinities with those of Edgar Allan Poe and the French Decadents, Tanizaki later turned to exploring more traditional Japanese ideals of beauty. His novels include *Some Prefer Nettles* (1928–29), which tells of marital unhappiness that is in fact a conflict between the new and the old, with the implication that the old will win; and his masterpiece, *The Makioka Sisters* (1943–48; film, 1983), which describes, in the leisurely style of classical Japanese literature, the inroads of the harsh modern world on traditional society. His writings are characterized by eroticism and ironic wit.

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tank Heavily armed and armoured combat vehicle that moves on two continuous metal chains called tracks. It is usually equipped with a CANNON mounted in a revolving turret as well as lighter automatic weapons. The British developed tanks during World War I to fill the need for an armoured assault vehicle that could cross the muddy, uneven terrain of the trench battle zone. They first saw combat at the BATTLE OF THE SOMME (1916). In World War II, Germany's tank force was initially the most effective in Europe because it was organized into fast-moving massed formations with great striking power. After World War II, tanks became larger and more heavily armed. Most modern main battle tanks weigh more than 50 tons yet are capable of road speeds of 30–40 mph (50–70 kph). The standard main armament is a 120-mm gun, which fires armour-piercing projectiles; laser range-finders and infrared imaging devices aid in sighting.

Tannenberg \'tä-nən-ˌberk**, Battle of** (July 15, 1410) Major Polish-Lithuanian victory over the Knights of the TEUTONIC ORDER. Fought near the villages of Grünfelde and Tannenberg in northeastern Poland (formerly East Prussia), the battle marked the end of the order's expansion along the southeastern coast of the Baltic Sea and the beginning of the decline of its power.

Tannenberg \'tä-nən-ˌberk**, Battle of** (August 26–30, 1914) Battle in WORLD WAR I between Germany and Russia in modern northeastern Poland. Two Russian armies invaded German East Prussia but became separated. German forces under PAUL VON HINDENBURG attacked one of the isolated armies and forced its retreat, inflicting Russian casualties of over 30,000 and capturing over 90,000 men. German casualties were about 13,000. The battle was disastrous for Russia, but it forced Germany to divert troops from the attack on France.

Tanner, Henry Ossawa (b. June 21, 1859, Pittsburgh, Pa., U.S.—d. May 25, 1937, Paris, France) U.S. painter. He studied under THOMAS EAKINS at the Pennsylvania Academy of the Fine Arts, where he was the only black student. He moved to Paris in 1891, and by 1894 his work was being exhibited at the annual Salons, where he was awarded honourable mention in 1896 for *Daniel in the Lions' Den* and won a medal in 1897 for his *Raising of Lazarus*. He gained international acclaim and many awards for his landscapes and his treatments of biblical themes. He was made a chevalier of the Legion of Honour in 1923, and in 1927 he became the first African American granted full membership in the National Academy of Design.

Tannhäuser \'tän-ˌhȯi-zər\ (b. c. 1200—d. c. 1270) German lyric poet and legendary hero. A professional MINNESINGER, Tannhäuser served several noble patrons; a few of his works are extant. In the legend preserved in a popular ballad, "Danhauser," he lives a life of pleasure but, torn by remorse, goes to Rome to seek remission of his sins. The pope tells him that, as his pilgrim's staff would never put on leaf again, so his sins can never be forgiven. Shortly afterward his discarded staff puts forth green leaves. The pope sends messengers to search for him, but he is never seen again. The legend, popular among 19th-century Romantic writers, was retold in RICHARD WAGNER's opera *Tannhäuser* (produced 1845).

tannin *or* **tannic acid** Any of a group of pale yellow to light brown amorphous substances widely distributed in plants and used chiefly in TANNING leather, dyeing fabric, and making ink. Their solutions are acid and have an astringent taste. They are isolated from oak bark, sumac, myrobalan (an Asian tree), and galls. Tannins give TEA astringency, colour, and some flavour. Tannins are used industrially to clarify wine and beer, reduce viscosity of oil-well drilling mud, and prevent scale in boiler water; they have also had medical uses.

tanning Chemical treatment of raw animal hides or skins to convert them into LEATHER. Vegetable tanning (using bark, wood, roots, or berries) has been practiced since prehistoric times. After removal of hair, flesh, or fat, a tanning agent displaces water from the interstices between the PROTEIN (mostly COLLAGEN) fibres in the skin and cements the fibres together. The agents most widely used are vegetable TANNIN, SALTS such as chromium sulfate, and fish or animal oil. The tanning of fair skin in humans by sunlight is completely different: ultraviolet light causes production and redistribution of the pigment MELANIN in epidermal cells.

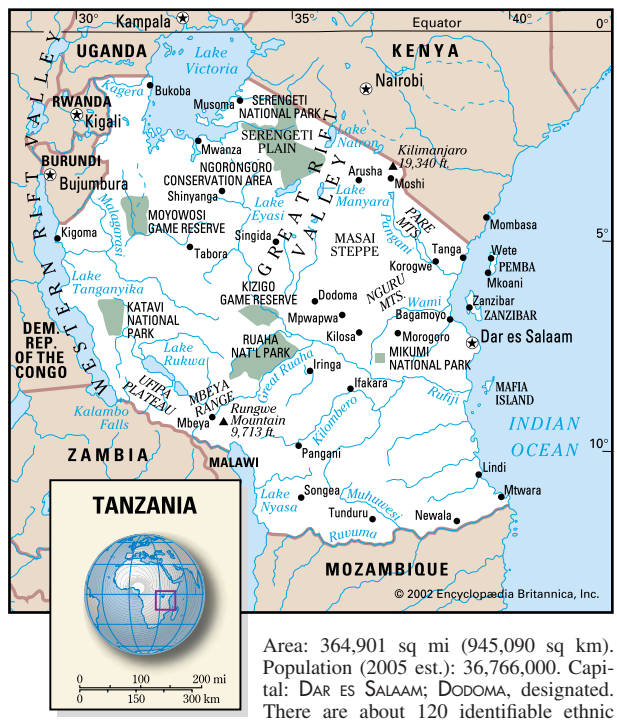
tansy \'tan-zē\ Any of about 50 species of strong-smelling, poisonous herbs, especially common tansy (*Tanacetum vulgare*, or *Chrysanthemum vulgare*), of the COMPOSITE FAMILY, native to the northern temperate zone. *T. vulgare* has button-shaped yellow flower heads of disk flowers (no ray flowers) that are arranged in a flat-topped cluster, deeply cut leaves, and many stems. It is sometimes cultivated in herb gardens and was formerly used in medicines and insecticides. See also CHRYSANTHEMUM.

tantalum \'tan-tə-ləm\ Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol Ta, atomic number 73. It is a dense, hard, unreactive, silvery gray METAL with an extremely high melting point (5,425 °F [2,996 °C]). Relatively rare, it occurs native in a few places. It is difficult to separate from niobium, the element above it in the PERIODIC TABLE, with which it shares many properties. The most important uses are in electrolytic capacitors, corrosion-resistant chemical equipment, dental and surgical instruments, tools, catalysts, components of electron tubes, rectifiers, and PROSTHESES. Its compounds are relatively unimportant commercially; tantalum carbide is used in machine tools and dies.

Tantalus \'tan-tᵊl-əs\ In GREEK MYTHOLOGY, the king of Sipylus (or Phrygia). An intimate friend of the gods, he was allowed to dine at their table until he offended them by repeating their secrets on earth. Another version of the myth held that he killed his son PELOPS and served him to the gods. In the underworld he was placed up to his neck in water, which flowed away every time he tried to drink, just as the branches overhead swung out of reach whenever he tried to pick the fruit from them.

tantra \'tən-trə\ In some Indian religions, a text that deals with esoteric aspects of religious teaching. There is considerable tantric literature and practice in HINDUISM, BUDDHISM, and, to a lesser extent, JAINISM. Because tantric practices typically represent teachings of relatively late development and incorporate elements of different traditions, they are often eschewed by orthodox practitioners. In Hinduism, tantras deal with popular aspects of the religion, such as spells, rituals, and symbols. Buddhist tantric literature, believed to date from the 7th century or earlier, has reference to numerous practices, some involving sexual activity, that have no basis in canonical literature.

Tanzania \ˌtan-zə-'nē-ə\ *officially* **United Republic of Tanzania** Country, eastern Africa. It is mostly on the African mainland but also includes the islands of ZANZIBAR, Pemba, and Mafia in the Indian Ocean.



Area: 364,901 sq mi (945,090 sq km). Population (2005 est.): 36,766,000. Capital: DAR ES SALAAM; DODOMA, designated. There are about 120 identifiable ethnic groups; the largest, the Sukuma, are about one-tenth of the population. Languages: Swahili, English (both official). Religions: Christianity (Protestant, Roman Catholic), Islam, traditional beliefs. Currency: Tanzanian shilling. Although most of Tanzania consists of plains and plateaus, it has some spectacular relief features, including KILIMANJARO and Ol Doinyo Lengai, an active volcano. All or portions of Lakes NYASA, TANGANYIKA, VICTORIA, and RUKWA lie within Tanzania, as do the head-

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waters of the Nile, Congo, and Zambezi rivers. Serengeti National Park is the most famous of its extensive game reserves. Important mineral deposits include gold, diamonds, gemstones, coal, and natural gas. The centrally planned economy is based largely on agriculture; major crops include corn, rice, coffee, cloves, cotton, sisal, cashews, and tobacco. Industries include food processing, textiles, cement, and brewing. Tanzania is a republic with one legislative house; its head of state and government is the president. Inhabited from the 1st millennium BC, it was occupied by Arab and Indian traders and Bantu-speaking peoples by the 10th century AD. The Portuguese gained control of the coastline in the late 15th century, but they were driven out by the Arabs of Oman and Zanzibar in the late 18th century. German colonists entered the area in the 1880s, and in 1891 the Germans declared the region a protectorate as part of German East Africa. During World War I, Britain captured the German holdings, which became a British mandate (1920) under the name Tanganyika. Britain retained control of the region after World War II when it became a UN trust territory. Tanganyika gained independence in 1961 and became a republic in 1962. In 1964 it united with Zanzibar under the name Tanzania and was led by Pres. Julius Nyerere until 1985. The country subsequently experienced both political and economic struggles; it held its first multiparty elections in 1995.

Tanzimat \ˌtän-zē-ˈmät\ (Turkish: "Reorganization") (1839–76) Series of reforms undertaken in the Ottoman Empire to modernize society along secular and bureaucratic lines. The first set of reforms (1839) sought to secularize the government's treatment of people and property and to reform taxation and military conscription. Later reforms (1856) established a secular school system and a new law code. Efforts to centralize government administration, however, ended by concentrating all authority in the hands of the sultan, who often abused the power. The constitution of 1876, while promising democratic reforms, actually was intended to stave off European intervention. See also Abdülhamid II; Young Turks.

tao See Dao

Tao Hongjing \ˈtau̇-ˈhůŋ-ˈjiŋ\ *or* **T'ao Hung-ching** (b. 451, Mo-ling, China—d. 536, Hua-yang) Chinese poet, calligrapher, physician, and naturalist. He became a tutor to the imperial court while still a youth. In 492 he retired to a mountain retreat at Mao Shan to devote himself to the study of Daoism. His research in proper eating and living practices led him to write one of the major pharmacological works of China. He also edited and annotated the religious writings of his major Daoist predecessors, producing *Declarations of the Perfected* and *Secret Instructions for Ascent to Perfection*.

Tao-te ching See Daodejing

Taoism See Daoism

Taos \ˈtau̇s\ Town (pop., 2000: 4,700) and resort, northern New Mexico, U.S. Located on a branch of the Rio Grande in the Sangre de Cristo Mountains, Taos is composed of three villages: Don Fernando de Taos (known as Taos), the pueblo of San Geronimo (Taos Pueblo), and the Ranchos de Taos. An early Spanish settlement, it was the scene of a revolt (1680) of Taos and other Pueblo Indians against Spain and later was an important commercial centre on the Santa Fe Trail. In the 20th century artists and writers moved there, including D.H. Lawrence. Lawrence's home and that of Kit Carson are historic sites; Carson's grave is in a memorial state park.

tap dance Style of American theatrical dance using precise rhythmical patterns of foot movement and audible foot tapping. It is derived from the traditional clog dance of northern England, the jigs and reels of Ireland and Scotland, and the rhythmic foot stamping of African dances. Popular in 19th-century minstrel shows, versions such as "buck-and-wing" (danced vigorously in wooden-soled shoes) and "soft-shoe" (danced smoothly in soft-soled shoes) developed as separate techniques; by 1925 they had merged, and metal taps were attached to shoe heels and toes to produce a more pronounced sound. The dance was also popular in variety shows and early musicals.

Tapajós \ˌtä-pä-ˈzhȯs\ **River** River, northern Brazil. Formed by the confluence of the Teles Pires and the Juruena rivers, it flows northeast to empty into the Amazon River just above Santarém after a course of about 400 mi (650 km). Though interrupted by rapids, its entire length is navigable. Several important rubber plantations lie along its banks.

tapas \ˈtə-pəs\ Ascetic practice carried out to achieve spiritual power or purification. In Hinduism, it is associated with Yoga as a way of purifying the body in preparation for the more exacting spiritual exercises leading to liberation. In Jainism, its practice is a central means of breaking the cycle of rebirths by preventing new karma from forming and by eliminating the old. Tapas can take many forms, including fasting, controlling the breath, and holding difficult and painful body postures. Extreme forms are carried out by sadhus, many of whom earn alms for their unusual abilities or deprivations.

tape recorder Recording system that makes use of electromagnetic phenomena to record and reproduce sound waves. The tape consists of a plastic backing coated with a thin layer of tiny particles of magnetic powder. The recording head of the tape deck consists of a tiny C-shaped magnet with its gap adjacent to the moving tape. The incoming sound wave, having been converted by a microphone into an electrical signal, produces a time-varying magnetic field in the gap of the magnet. As the tape moves past the recording head, the powder is magnetized in such a way that the tape carries a record of the shape of the wave being recorded.

tapestry Heavy, reversible, patterned or figured hand-woven textile, usually in the form of a hanging or upholstery fabric. Tapestries are usually designed as single panels or as sets of panels related by subject and style and intended to be hung together. The earliest known tapestries were made from linen by the ancient Egyptians. Tapestry weaving was well established in Peru by the 6th century, and outstanding silk tapestries were made in China beginning in the Tang dynasty (AD 618–907). In western Europe, tapestry making flourished from the 13th century. Among the greatest European tapestries are the 15th-century *Lady with the Unicorn* set and the 16th-century *Acts of the Apostles* set, based on cartoons by Raphael. Tapestry art was revitalized in late-19th-century Britain with the Arts and Crafts Movement. In the 20th century, abstract tapestries were produced at the Bauhaus, and many painters, including Pablo Picasso and Henri Matisse, allowed their paintings to provide the basis for tapestry art.

tapeworm Any of about 3,000 species (class Cestoda, phylum Platyhelminthes) of bilaterally symmetrical parasitic flatworms found worldwide. Tapeworms range from 0.04 in. (1 mm) to more than 50 ft (15 m) long. The head bears suckers and often hooks for attaching to the liver or digestive tract of the host. Once attached, a tapeworm absorbs food through its body wall. The body is often divided into a head, or scolex, possessing the suckers and hooks, an unsegmented neck, and a series of proglottids (units containing both male and female reproductive organs) that continually form in a growth region at the base of the neck. Following fertilization, each mature proglottid containing thousands of embryos breaks off and is eliminated in the host's feces. If these are ingested by an animal (the intermediate host) grazing on food contaminated with feces, they develop into larvae, which bore through the intestinal wall into the circulatory system and are carried to muscle tissues, which they burrow into, forming a dormant cyst. When meat is inadequately cooked, humans become infested with the larvae, which attach to the intestinal wall. Many species that infest humans belong to the genus *Taenia*; the intermediate host is implied by the name (e.g., beef tapeworm, *T. saginata*). Humans can also acquire tapeworms through fecal contamination of soil or water. See illustration on the following page.

Tapi \ˈtä-pē\ **River** *or* **Tapti River** \ˈtäp-tē\ River, west-central India. It flows west from the mountains of Madhya Pradesh to the Gulf of Khambhat and the Arabian Sea. It is about 435 mi (700 km) long and largely unnavigable.

Tápies \ˈtäp-yes**, Antoni** (b. Dec. 13, 1923, Barcelona, Spain) Catalan painter. In 1946 he abandoned the study of law to devote his time to painting, which he taught himself. His early works were influenced by Surrealism, Paul Klee, and Joan Miró. In 1953, after seeing the works of Jean Dubuffet, he developed a unique blend of abstraction, assemblage, and impasto that established his international reputation. He has produced lithographs and illustrated books; his belief in the validity of commonplace materials has had worldwide influence. In 1990 the Tàpies Foundation, housing some 2,000 of his works, opened in Barcelona.

tapir \ˈtā-pər\ Any of four extant members (genus *Tapirus*) of the family Tapiridae, heavy-bodied, odd-toed ungulates, 6–8 ft (1.8–2.5 m)

Lowland tapir (*Tapirus terrestris*)
WARREN GARST—TOM STACK & ASSOCIATES

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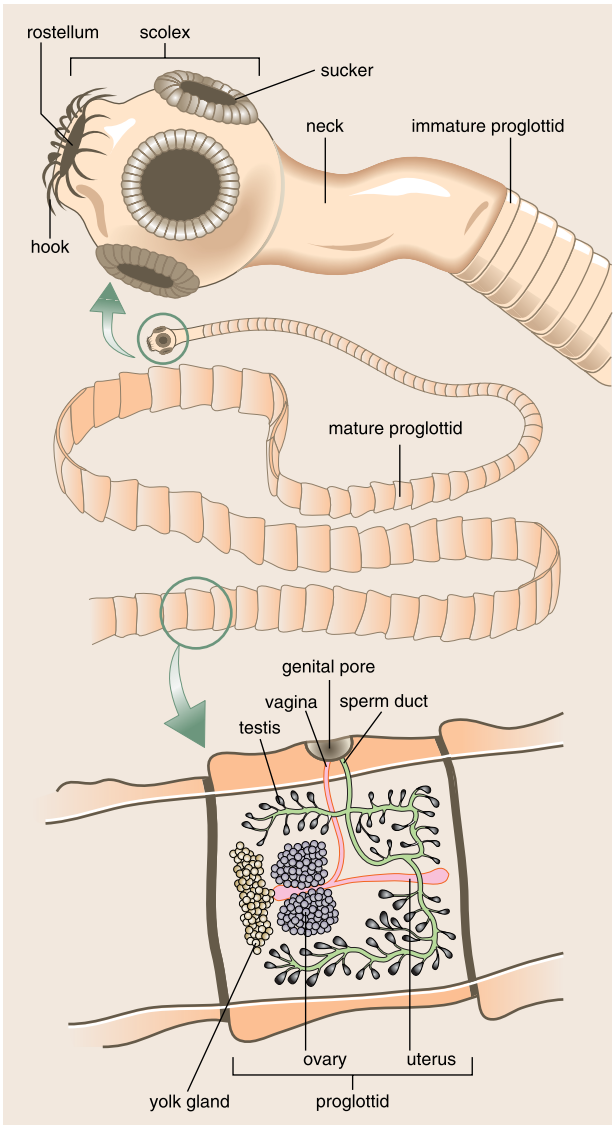

Principal features of the beef tapeworm (*Taenia saginata*). The head, or scolex, contains suckers and hooks for attaching to the host. A series of reproductive organs (proglottids) continually form at the base of the neck, and following fertilization they mature and break off. Each proglottid, eliminated in the host's feces, contains thousands of embryos to continue the life cycle.

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long and up to 3 ft (1 m) high. They have short ears and legs and a fleshy snout overhanging the upper lip. The feet have three functional toes. Body hair is usually short and sparse, but two species have a short, bristly mane. The Malayan tapir (*T. indicus*) has a black head, shoulders, and legs and white rump, back, and belly. The single Central and two South American species are plain brown or gray. Tapirs inhabit the deep forest or swamp.

Tappan \'tap-ən**, Arthur** (b. May 22, 1786, Northampton, Mass., U.S.—d. July 23, 1865, New Haven, Conn.) U.S. merchant and philanthropist. He operated various businesses, including a silk-importing firm in New York (1826–37) with his brother Lewis Tappan (1788–1873); they also founded the first commercial credit-rating service (1841). He used his wealth to support missionary societies and the abolitionist crusade, helping found the American Anti-Slavery Society and serving as its first president (1833–40). After breaking with William Lloyd Garrison, he created the American and Foreign Anti-Slavery Society (1840). The Tappan brothers later supported the Underground Railroad.

taproot Main root of a primary-root system. It grows vertically downward. From the taproot arise smaller lateral roots (secondary roots), which in turn produce even smaller lateral roots (tertiary roots). Most dicotyledonous plants (see cotyledon), such as dandelions, produce taproots. The system may be modified into a fibrous, or diffuse, system, in which the initial secondary roots soon equal or exceed the primary root in size and there is no well-defined single taproot. Fibrous root systems are generally shallower than taproot systems. Carrots and beets are tuberous roots modified from taproots.

Tapti River See Tapi River

taqiyyah \tə-'kē-ə\ In Islam, the practice of concealing one's faith and forgoing ordinary religious duties under threat of death or injury to oneself or one's fellow Muslims. Its basis is found in the Qur'ān, and Muhammad is regarded as having set its first example when he chose to make the Hijrah. It has since been practiced mostly among minority groups, particularly those of the Shīʿite branch. Various rules governing its application are meant to ensure that *taqiyyah* does not become an excuse for cowardice or for failure to take appropriate action. Consideration of community rather than private welfare is generally stressed.

taqlīd \ta-'klēd\ In Islamic canon law, the unquestioning acceptance of legal precedent. The interpretation of *taqlīd* varies widely among the major schools of Islamic law. *Taqlīd* is compulsory for Shīʿites. Of the four Sunnite legal schools, views are mixed; most scholars of the Shāfiʿī, Mālikī, and Ḥanafī schools embrace *taqlīd*, but those of the Ḥanbalī do not view the opinions of earlier scholars as necessarily binding. Support for the practice is based mainly on the belief that early Muslim scholars, being closer in time to Muhammad, were in the best position to derive authoritative legal opinions.

tar sand *or* **bituminous sand** Deposit of loose sand or partially consolidated sandstone that is saturated with highly viscous bitumen. Oil recovered from tar sands, commonly referred to as synthetic crude, is a potentially significant form of fossil fuel. The largest known deposits of tar sands occur in Canada's Athabasca River valley, where commercial projects for synthetic oil production from tar sands are being carried out.

Tara \'tä-rä\ In Buddhism, a saviour-goddess with numerous forms. Her worship is widely popular in Nepal, Tibet, and Mongolia. She is the feminine counterpart of Avalokitesvara. She came into existence when his tear fell to the ground and formed a lake; out of its waters rose a lotus, which, on opening, revealed the goddess. She is the protector of navigation and earthly travel, as well as of spiritual travel along the path to enlightenment. In art she typically holds a lotus and has a third eye. She is represented in various colours, signifying different aspects of her powers.

White Tara, gilt copper repoussé statue from Nepal, 18th century; in the Asian Art Museum of San Francisco, The Avery Brundage Collection

COURTESY OF THE ASIAN ART MUSEUM OF SAN FRANCISCO, THE AVERY BRUNDAGE COLLECTION; PHOTOGRAPH, MARTIN GRAYSON

Ṭarābulus See Tripoli (Lebanon) and Tripoli (Libya)

Tarai *or* **Terai** \tə-'rī\ Region of northern India and southern Nepal. It runs parallel to the lower ranges of the Himalayas and stretches from the Yamuna River to the Brahmaputra River. Numerous springs at its northern edge form several streams, including the Ghaghara River, that intersect the region and give it its marshy character. Much of the area's marshland, once malarial, has been drained and put under cultivation.

Tarantino, Quentin (b. March 27, 1963, Knoxville, Tenn., U.S.) U.S. director and screenwriter. He worked in a video store in California before selling two screenplays that became *True Romance* (1993) and Oliver Stone's *Natural Born Killers* (1994). He made his directing debut with *Reservoir Dogs* (1993). His controversial *Pulp Fiction* (1994) won the

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Academy Award for best screenplay and the Golden Palm at the Cannes Film Festival. His films, including *Jackie Brown* (1997), *Kill Bill: Vol. 1* (2003), and *Kill Bill: Vol. 2* (2004), are known for their stylized violence, razor-sharp dialogue, and fascination with film and pop culture. Tarantino also worked as an actor, producer, and executive of a film distribution company, Rolling Thunder.

Taranto \tä-rän-ˌtō\ *ancient* **Tarentum** Seaport (pop., 2001 prelim.: 201,349), Puglia region, southeastern Italy. Located on the Gulf of Taranto, the old city is on a small island, with newer areas on the adjacent mainland. Founded by Spartans in the 8th century BC, it was called Taras and became one of the leading cities of Magna Graecia. It reached its zenith in the 4th century BC under Archytas. It came under Rome in 272 BC. Between the 5th and the 11th centuries AD it was taken by the Goths, Byzantines, Lombards, Arabs, and Normans. By the 15th century it was part of the Kingdom of Naples. It became part of the Kingdom of the Two Sicilies from 1815 and then joined the Kingdom of Italy in 1861. Taranto was an important stronghold of the Italian navy in both world wars; it was heavily bombed in 1940 and was occupied by British forces in 1943. Still an important naval base, it is the site of extensive shipyards and a large iron- and steelworks.

tarantula \tə-ran-chə-lə\ Name that originally referred to the wolf spider but now covers any spider in the family Theraphosidae. It is found from the southwestern U.S. to South America. Many species live in a burrow, and most have a hairy body and long, hairy legs. They are nocturnal predators of insects and, occasionally, amphibians and mice. Certain South American tarantulas eat small birds. In the southwestern U.S., tarantulas of the genus *Aphonopelma* may have a body 2 in. (5 cm) long and a leg spread of nearly 5 in. (12 cm). They may inflict a painful bite if provoked. The most common U.S. species, *Eurypelma californicum*, may live up to 30 years.

Mexican red-kneed tarantula (*Brachypelma smithii*).
LYNAM/TOM STACK & ASSOCIATES

Tarasco *or* **Tarascan** Indian people of Michoacán state in central Mexico. Traditionally, they have been farmers, though they fish, hunt, trade, and work for wages as well. Each village tends to specialize in a craft (e.g., woodworking, weaving, pottery, net weaving, embroidering, or sewing). Their Roman Catholicism is only slightly influenced by pre-Columbian religion. They are gradually becoming assimilated to the mestizo culture, though their primary language remains Tarascan.

Tarawa \tə-'rä-wə, 'ta-rə-wä\ Coral atoll (pop., 1995: 32,354), Gilbert Islands, Kiribati. The site of Bairiki, the capital of Kiribati, Tarawa is made up of 15 islets along a reef 22 mi (35 km) long. Occupied by the Japanese during World War II, it was seized by U.S. Marines in 1943 after a costly battle. Now a commercial and educational centre, it exports copra and mother-of-pearl and has an extension of the University of the South Pacific. It was the capital of Gilbert and Ellice Islands until 1975.

Tarbell \'tär-bəl**, Ida M(inerva)** (b. Nov. 5, 1857, Erie county, Pa., U.S.—d. Jan. 6, 1944, Bridgeport, Conn.) U.S. investigative journalist, lecturer, and chronicler of American industry. In 1891 Tarbell went to Paris, where she supported herself by writing for U.S. magazines. She became best known for *The History of the Standard Oil Company* (1904), an account of the rise of a business monopoly that first appeared serially in *McClure's Magazine* and led to the government's epochal antitrust suit against the company. For her work Tarbell became one of the journalists Theodore Roosevelt dubbed muckrakers.

Tardieu \tär-'dyœ**, André (-Pierre-Gabriel-Amédée)** (b. Sept. 22, 1876, Paris, France—d. Sept. 15, 1945, Menton) French politician. After work in the diplomatic service, he became foreign editor of *Le Temps* and was elected to the Chamber of Deputies in 1914. A delegate to the Paris Peace Conference, he was instrumental in drafting the Treaty of Versailles. A supporter of Georges Clemenceau in his early career, he served in various government posts, and as the leader of the right-centre in the Chamber of Deputies, he twice served as premier (1929–30, 1932), advocating a policy of large national expenditure. Disillusioned with the failures of the parliamentary system, he retired in 1936.

Targum \'tär-gəm\ Any of several translations of the Hebrew scriptures or its parts into Aramaic. The earliest date from after the Babylonian Exile and were designed to meet the needs of uneducated Jews who did not know Hebrew. After the destruction of the Second Temple of Jerusalem (AD 70), Targums became established in synagogues, where scripture was read aloud with a translation in Aramaic. These readings eventually incorporated paraphrase and commentary. Targums were regarded as authoritative throughout the Talmudic period (see Talmud) and began to be committed to writing in the 5th century.

Tarhun \'tär-ˌkün\ *or* **Taru** \'tär-ˌü\ Ancient Anatolian weather god whose name appears in records as early as 1400 BCE. He was one of the supreme deities of the Hittite pantheon and was regarded as the embodiment of the state in action. He was the consort of Arinnitti, the Hittite sun goddess and principal deity. His sacred animal is the bull, and in art he may be depicted standing on one. Jupiter Dolichenus arose as a development of Tarhun.

tariff *or* **customs duty** Tax levied upon goods as they cross national boundaries, usually by the government of the importing country. The words *tariff*, *duty*, and *customs* are generally used interchangeably. Usually assessed on imports, tariffs may apply to all foreign goods or only to goods produced outside the borders of a customs union. A tariff may be assessed directly, at the border, or indirectly, by requiring the prior purchase of a license or permit to import specified quantities of the good. Examples of tariffs include transit duties and import or export taxes, which may be levied on goods passing through a customs area en route to another destination. In addition to providing a source of revenue, tariffs can effectively protect local industry by driving up the price of an imported item that competes with domestic products. This practice allows domestic producers either to charge higher prices for their goods or to capitalize on their own lighter taxes by charging lower prices and attracting more customers. Tariffs are often used to protect "infant industries" or to safeguard older industries that are in decline. They are sometimes criticized for imposing hidden costs on domestic consumers and encouraging inefficiency in domestic industries. Tariffs are subject to negotiation and treaties among nations (see General Agreement on Tariffs and Trade; trade agreement; World Trade Organization).

Tarim \'dä-'rēm\ **River** *Chinese* **Talimu** \'tä-'lē-'mü\ **He** *or* **T'a-li-mu Ho** Chief river of Xinjiang autonomous region, China. Formed by the confluence of two rivers in the far west, it follows an undefined riverbed for much of its course, flowing along the northern edge of the Takla Makan Desert before turning southeast. Because it frequently changes course, its length varies but is about 1,260 mi (2,030 km). The Tarim Basin is enclosed by the Tien Shan, the Pamirs, and the Kunlun Mountains. It is the driest region of Eurasia.

ṭarīqah \tä-'rē-kə\ In Sufism, the spiritual path toward direct knowledge of God. For early Sufi mystics, the term referred to an individual's spiritual path; later it came to mean the path advocated by a particular school or order of Sufis and then of the order itself. Each mystic order claimed a chain of spiritual descent from Muhammad. Today Sufi *ṭarīqah* number in the hundreds.

Tarkington, (Newton) Booth (b. July 29, 1869, Indianapolis, Ind., U.S.—d. May 19, 1946, Indianapolis) U.S. novelist and dramatist. He became known for satirical and sometimes romanticized pictures of Midwesterners in humorous portrayals of boyhood and adolescence that include the young-people's classics *Penrod* (1914), *Seventeen* (1916), and *Gentle Julia* (1922). The trilogy *Growth* (1927) includes *The Magnificent Ambersons* (1918, Pulitzer Prize; film, 1942), which traces the decline of a once-powerful and prominent family. *Alice Adams* (1921; film, 1923, 1935), a searching character study, is perhaps his most finished novel.

Tarkovsky \tär-'kȯf-skē**, Andrey (Arsenyevich)** (b. April 4, 1932, Moscow, Russia, U.S.S.R.—d. Dec. 29, 1986, Paris, France) Soviet film director. The son of a poet, he studied at the Soviet State Film School and won praise for his first feature film, *Ivan's Childhood* (1962). His religious and aesthetic concerns were reflected in *Andrei Rublev* (1966), about a medieval icon painter confronted with the brutality of war. His later films, noted for their striking visual images, visionary tone, and paucity of conventional plot, include *Solaris* (1972), *A Mirror* (1975), and *Stalker* (1978). Soviet authorities hindered domestic distribution of his films, and in 1984, after making *Nostalgia* (1983), he defected to the West, where he made his last film, the acclaimed *The Sacrifice* (1986).

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Tarn River River, southwestern France. Rising in the Lozère Mountains, it flows west and southwest for 233 mi (375 km) into the Garonne River. Its magnificent gorges, which extend more than 30 mi (48 km) through limestone plateaus, are popular tourist attractions.

taro \'tär-ō\ Herbaceous plant (*Colocasia esculenta*) of the arum family, probably native to Southeast Asia and taken to the Pacific islands. It is a staple crop cultivated for its large, starchy, spherical tubers, which, though poisonous raw, become edible with heating. They are consumed as a cooked vegetable or are made into puddings, breads, or Polynesian poi (a thin, pasty, highly digestible mass of fermented taro starch). Poi is a staple food in Hawaii. The large leaves (also poisonous raw) of the taro are commonly eaten stewed.

tarot \'tar-ˌō\ Sets of cards used in fortune-telling and in certain card games. The origins of tarot cards are obscure; cards approximating their present form first appeared in Italy and France in the late 14th century. Modern tarot decks consist of 78 cards, of which 22 have pictures representing forces, characters, virtues, and vices. The remaining cards are divided into four suits—(1) wands, batons, or rods, (2) cups, (3) swords, and (4) coins, pentacles, or disks—of 14 cards each. Each suit has 10 numbered cards and 4 court cards (king, queen, knight, and page). Modern playing cards evolved from these suit cards. Initially used as playing cards, tarot cards were imbued with esoteric associations in the 18th century and are now used widely for fortune-telling. Each card's basic meaning is altered by the card's position in the spread of cards laid out by the fortune-teller, by the card's orientation, and by the cards that are near it.

Moon, the eighteenth card of the Major Arcana
MARY EVANS PICTURE LIBRARY

tarpon Any of certain marine fish (family Megalopidae) having an elongated last dorsal fin ray and a bony throat plate between the sides of the protruding lower jaw. The scales are large, thick, and silvery. The Atlantic tarpon (*Tarpon atlanticus* or *Megalops atlanticus*) is found inshore in warm parts of the Atlantic Ocean, on the Pacific Ocean side of Central America, and sometimes in rivers. It habitually breaks the water's surface and gulps air. It grows to 6 ft (1.8 m) and 100 lb (45 kg) or larger and is a favourite game fish. The Pacific tarpon (*M. cyprinoides*) is similar.

Young Atlantic tarpon (*Tarpon atlanticus*)
COURTESY OF MIAMI SEAQUARIUM

Tarquinia \tär-'kwēn-yä\ *formerly (until 1922)* **Corneto** Town (pop., 1991: 14,000), northern Lazio region, central Italy. It developed out of the ancient Tárchuna, one of the chief cities of the Etruscan confederation. It was defeated by Rome in the 4th century BC and became a Roman colony (as Tarquinii) in the 1st century BC. It was moved to its present site after Lombard and Saracen invasions in the 6th–8th centuries AD. In medieval times it was called Corneto. Remains of the ancient city include the foundations of a great Etruscan temple with a group of terra-cotta winged horses that is considered a masterpiece of Etruscan art. The famous necropolis contains the most important painted tombs in Etruscan Italy.

tarragon \'tar-ə-gən\ Bushy aromatic herb (*Artemisia dracunculus*) of the composite family, the dried leaves and flowering tops of which are used to add tang to many culinary dishes. Tarragon is a common ingredient in seasoning blends, such as fines herbes. The fresh leaves are used in salads, and vinegar in which fresh tarragon has been steeped is a distinctive condiment. The plant is probably native to Siberia; a French variety is cultivated in Europe and North America.

tarsier \'tär-sē-ər, 'tär-sē-ˌā\ Any of three species (genus *Tarsius*, family Tarsiidae) of nocturnal prosimian primates found on several South Asian islands. Tarsiers have large, goggling eyes and a round head that can be rotated 180°. The ears are large, membranous, and almost constantly in motion. Tarsiers are 4–6 in. (9–16 cm) long; the thin, tufted tail of about twice that length provides balance and support. The gray to dark brown fur is thick and silky. Tarsiers cling vertically to trees and leap from trunk to trunk. They have greatly elongated hind limbs and disklike adhesive pads on the digit tips. Tarsiers prey mainly on insects. The well-furred newborn is born with eyes open.

Tarsus City (pop., 1997: 190,184), south-central Turkey. It is located near the Mediterranean Sea coast. Settled from Neolithic times, it was razed and rebuilt c. 700 BC by the Assyrian king Sennacherib. Later, Achaemenid and Seleucid rule alternated with periods of autonomy. In 67 BC it was absorbed into the new Roman province of Cilicia, becoming its principal city. It was the site of the first meeting in 41 BC between Mark Antony and Cleopatra and was the birthplace of St. Paul. It remained a leading industrial and cultural centre through the early Byzantine period. It came under various powers in the 10th–15th centuries and passed to the Ottoman Empire in the early 16th century. Modern Tarsus is a prosperous agricultural and cotton-milling centre.

tartan Cross-checkered repeating pattern (or "sett") of bands, stripes, or lines of various colours and of definite width and sequence, woven into woolen cloth, sometimes with silk added. Such patterns have existed for centuries in many cultures but have come to be regarded as fundamentally Scottish and as a quasi-heraldic Scottish family or clan emblem. Though claims of great antiquity have been made for Scottish tartans, few seem to predate the 17th or even 18th century as clan emblems. The Scottish Tartans Society (founded 1963) maintains a register of all known tartans, numbering about 1,300.

Royal Stuart (Stewart) tartan.
THE SCOTTISH TARTANS SOCIETY/MUSEUM

Tartar See Tatar

Tartarus \'tär-tə-rəs\ In Greek mythology, the lowest depths of the underworld. It was a region of eternal darkness where the evil were punished after death for having offended the gods. Here Zeus confined the Titans, who were prevented from escaping by hundred-armed giants. Later classical authors sometimes used Tartarus interchangeably with Hades to designate the entire underworld.

Tartikoff \'tär-ti-ˌkȯf**, Brandon** (b. Jan. 13, 1949, New York, N.Y., U.S.—d. Aug. 27, 1997, Los Angeles, Calif.) U.S. television executive. He successfully promoted local ABC television stations before being hired by Fred Silverman as ABC's director of dramatic development. From 1978 the two men worked together at NBC, and in 1980 Tartikoff became president of NBC entertainment (then the bottom-rated television network) and the youngest division chief in U.S. network history. He developed dramatic series such as *St. Elsewhere* and *Hill Street Blues* as well as the popular sitcoms *Family Ties*, *The Golden Girls*, *The Cosby Show*, *Cheers*, and *Seinfeld*, making NBC the top-rated network. Tartikoff later became head of Paramount Pictures and New World Entertainment.

Taru See Tarhun

tashbīh \täsh-'bē, täsh-'bē-hə\ In Islam, the comparison of God to created things. The practice of attributing human characteristics to the deity is regarded as a sin in Islamic theology, as is its opposite, *taʿtīl* (divesting God of all attributes). The difficulty of dealing with the nature of God in Islam arises from seemingly contradictory views in the Qurʾān, which describes God as unique, yet also refers to him as having eyes, ears, hands, and face. *Tashbīh* is forbidden out of the fear that its practice will lead to paganism and idolatry; *taʿtīl* is feared to lead to atheism.

Tashkent \tash-'kent, tash-'kend\ *or* **Toshkent** City (pop., 1998 est.: 2,124,000), capital of Uzbekistan. Dating from about the 1st century BC,

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it was an important trade centre on the caravan routes to Europe and East Asia. The Arabs conquered it in the early 8th century; it fell to the Mongols in the 13th century and was under Turkish control in the 14th–15th centuries. Taken by the Russians in 1865, it was made the administrative centre of Turkistan in 1867, and a new European city grew up beside the old native one. The city was heavily damaged by an earthquake in 1966. Today it is the main economic and cultural centre of Central Asia. Its many institutions of higher education include the Uzbek Academy of Sciences (1943).

Tasman \'täs-mən**, Abel Janszoon** (b. 1603?, Lutjegast, Neth.—d. probably before Oct. 22, 1659, certainly before Feb. 5, 1661) Dutch explorer. In the service of the Dutch East India Company, he made exploratory and trading voyages to East and Southeast Asia (1634–39). In 1642 he was sent by Anthony van Diemen to find the hypothetical southern continent of the Pacific and a possible route to Chile. Sailing from Batavia (modern Jakarta), he reached 49° S at 94° E, then turned north and discovered land he named Van Diemen's Land (Tasmania), then sailed along the coast of New Zealand, believing it to be the southern continent. He also discovered Tonga and the Fiji Islands. On his next voyage (1644) he sailed into the Gulf of Carpentaria and along the northern and western coasts of Australia.

Tasman Peninsula \'taz-mən\ Peninsula, southeastern Tasmania, Australia. About 26 mi (42 km) long by 20 mi (32 km) wide, it has sea cliffs and unusual rock formations. First explored in 1642, it was not settled until a penal colony was established at Port Arthur in 1830. Its partly restored ruins are now a tourist attraction, and the peninsula is part of Australia's National Estate.

Tasman Sea Part of the South Pacific Ocean, between southeastern Australia and western New Zealand. About 1,400 mi (2,250 km) wide, it has maximum depths exceeding 17,000 ft (5,200 m) in the Tasman Basin. Explored by Abel Janszoon Tasman in 1642 and by Capt. James Cook in the 1770s, it is notoriously stormy. Economic resources include fisheries and petroleum deposits.

Tasmania \taz-'mā-nē-ə\ *formerly* **Van Diemen's** \'dē-mənz\ **Land** Island (pop., 2005 est.: 485,199) and state, Australia. Located off the southeastern corner of the continent and separated from it by Bass Strait, the state has an area of 26,410 sq mi (68,400 sq km) that also includes numerous smaller islands. Hobart is the capital. Originally inhabited by Australian Aboriginals, the island was explored and named Van Diemen's Land by Abel Janszoon Tasman in 1642. Taken by the British in the early 1800s and made a colony in 1825, it was used as an auxiliary penal settlement until the 1850s. It was granted self-government and renamed Tasmania in 1856; it became a state of the Australian Commonwealth in 1901. Chief economic activities include copper, zinc, tin, and tungsten mining; livestock raising, especially sheep for wool; and tourism. Several natural areas, collectively called the Tasman Wilderness, were designated a UNESCO World Heritage site in 1982 (extended in 1989).

Tasmanian Any member of a now-extinct population of Tasmania. An isolate population of Australian Aboriginals who entered Tasmania 25,000–40,000 years ago, they were cut off from the mainland when a general rise in the sea level flooded the Bass Strait about 10,000 years ago. Subsistence was based on hunting land and sea mammals and collecting shellfish and vegetable food. The first permanent white settlement was made in Tasmania in 1803, and the settlers provoked a war in 1804. Of an estimated 4,000 Tasmanians present when the Europeans first arrived, only 200 remained by the 1830s; moved to Flinders Island for their protection, they did not survive long in their new home, and the last full-blooded Tasmanian died in 1876.

Tasmanian devil Marsupial species (*Sarcophilus harrisii* or *S. ursinus*, family Dasyuridae), now extinct on the Australian mainland, that survives in remote rocky areas of Tasmania. It is 30–40 in. (75–100 cm) long, with a stocky body, large head and jaws, and long bushy tail. The coat is usually black and brown with a white-marked breast. Named for its devilish expression and husky snarl, it is mainly a scavenger of wallaby and sheep carcasses but also eats beetle larvae and occasionally poultry. Its three or four young remain in the mother's pouch about five months.

Tasmanian devil (*Sarcophilus harrisii*).
JOHN YATES/SHOSTAL ASSOCIATES

Tasmanian wolf *or* **Tasmanian tiger** *or* **thylacine** Extinct, slender, fox-faced marsupial (*Thylacinus cynocephalus*,family Thylacinidae), 40–50 in. (100–130 cm) long. It was yellowish brown, with dark bars on the back and rump. It hunted at night for wallabies and birds. The female carried her young in a shallow pouch. Once found on the Australian mainland and New Guinea, it was confined to Tasmania in historical times, when competition with the dingo led to its disappearance from the mainland. Europeans in Tasmania hunted it to protect their sheep; the last known individual died in captivity in 1936.

Tasso \'täs-sō**, Torquato** (b. March 11, 1544, Sorrento, Kingdom of Naples—d. April 25, 1595, Rome) Italian poet. The son of a poet and courtier, Tasso became a courtier of Duke Alfonso II d'Este at Ferrara. In a period of intense poetic activity he produced the pastoral drama *L'Aminta* (1581; performed 1573), a lyrical idealization of court life. In 1575 he completed his celebrated masterpiece on the First Crusade, *Gerusalemme liberata* (1581; *Jerusalem Delivered*), a heroic epic in ottava rima that blends historical events with imaginary romantic and idyllic episodes. He developed a persecution mania and from 1579 to 1586 was incarcerated in a hospital by order of the duke. *Gerusalemme* was translated and imitated in many European languages, and Tasso was the subject of literary legend for centuries. He is regarded as the greatest Italian poet of the late Renaissance.

taste *or* **taste perception** Special sense for perceiving and distinguishing the sweet, sour, bitter, or salty quality of a dissolved substance, mediated by taste buds on the tongue. More than 9,000 taste buds on the tongue are responsible for the chemoreception of taste. Some taste buds are also found on the roof of the mouth and throat. See illustration on following page.

Tatar \'tä-tər\ *or* **Tartar** Any member of the Turkic-speaking peoples who today live mainly in west-central Russia east to the Ural Mountains, in Kazakhstan, and in western Siberia. They first appeared as nomadic tribes in northeastern Mongolia in the 5th century. Some joined the armies of Genghis Khan. Especially identified with the Golden Horde, they were converted to Islam in the 14th century. The Golden Horde soon became independent Tatar khanates (see khan). Their economy was based on mixed farming and herding, which remain central to their economy. They developed craftsmanship in wood, ceramics, leather, cloth, and metal and have been well known as traders. Today there are about six million Tatars in all regions; they constitute about half the population of the Russian republic of Tatarstan. See also Tatar language.

Tatar \'tä-tər\ **language** *formerly* **Volga Tatar language** Turkic language with some eight million speakers. Its speakers include less than half the population of Tatarstan in Russia, with the remainder scattered in enclaves across eastern European Russian, Siberia, and the Central Asian republics. Tatar, like the closely related Bashkir language, is characterized by a remarkable series of vowel shifts that distinguish it (at least in its most characteristic varieties) from all other Turkic languages. It has numerous dialect distinctions; the conventional division is between a central group that includes the Tatar of most of Tatarstan and the literary language based on Kazan speech, a western group, and an eastern group. Crimean Tatar, belonging to the southwestern group of Turkic languages, and Chulym Tatar, belonging to the northeastern group, are not closely related to Tatar.

Tatar Strait \'tä-ˌtär\ Wide passage in the northwestern Pacific Ocean, connecting the Sea of Japan (East Sea) and the Sea of Okhotsk. Located between Sakhalin Island and Russia's Far East mainland, it is generally shallow, with depths less than 700 ft (210 m). Ice impedes its ports for half the year.

Tate, (John Orley) Allen (b. Nov. 19, 1899, Winchester, Ky., U.S.—d. Feb. 9, 1979, Nashville, Tenn.) U.S. poet and novelist. While attending Vanderbilt University Tate helped found *The Fugitive* (1922–25), a poetry magazine concentrating largely on the South, and contributed to *I'll Take My Stand* (1930), a Fugitive manifesto defending the region's conservative agrarian society. From 1934 he taught at several institutions, including Princeton University and the University of Minnesota, becoming a leading exponent of the New Criticism. He emphasized the writer's need for tradition, which he found in Southern culture and later in Roman Catholicism, to which he converted in 1950. His best-known poem is "Ode to the Confederate Dead" (1926).

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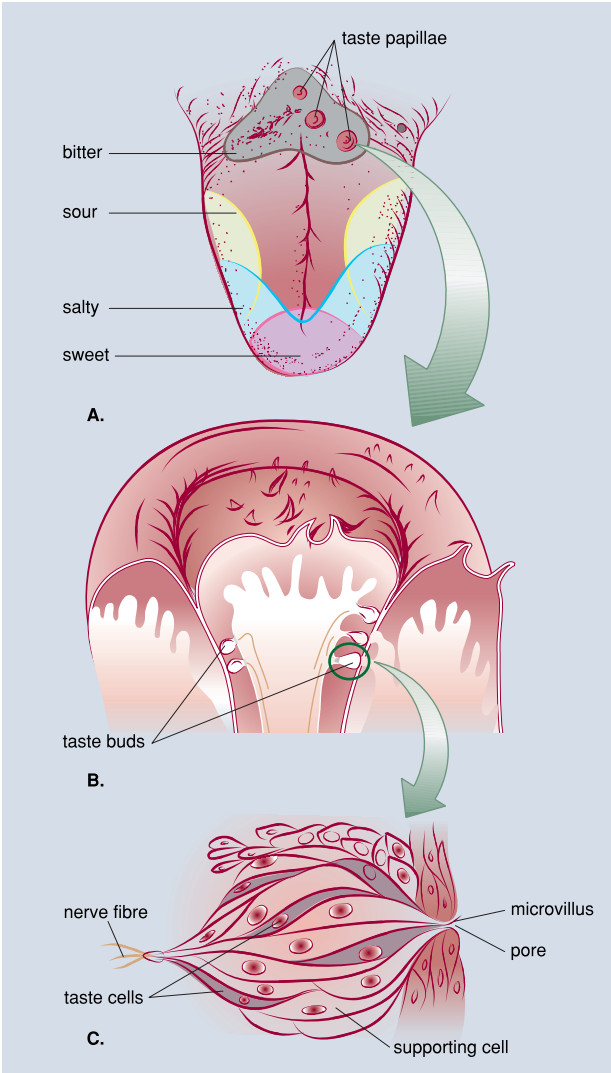

A. Taste centres on the tongue's surface. Taste buds on the tip of the tongue are most sensitive to sweet tastes, those on the sides to sour, those at the back to bitter, and those on the tip and sides to salty. B. Close-up of a papilla showing location of the taste buds. C. Structure of a taste bud. Each is composed of narrow modified epithelial taste cells with specialized hairs (microvilli) that project into a pore opening onto the tongue's surface and of broader supporting cells. Impulses from the taste cells are carried by nerve pathways to the brain.

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Tate, Nahum (b. 1652, Dublin, Ire.—d. July 30, 1715, London, Eng.) Irish-English poet and playwright. After graduating from Trinity College, Dublin, Tate moved to London. Though he wrote plays of his own, he is best known for his adaptations of Elizabethan works, notably William Shakespeare's *King Lear*, with a happy ending, which was performed well into the 19th century. He wrote the libretto for Henry Purcell's *Dido and Aeneas* (1689?) and collaborated with Nicholas Brady in *A New Version of the Psalms of David* (1696). The best of his own poems is "Panacea: A Poem upon Tea" (1700). He became England's poet laureate in 1692.

Tate Gallery Art museum in London housing the national collection of British painting and sculpture and of modern British and European art since c. 1870. It is named after Sir Henry Tate (1819–1899), a sugar refiner and inventor of the sugar cube, who donated his collection of Victorian art to the nation in 1890. The Neoclassical building, designed by Sidney R. J. Smith, opened in 1897. Originally administered by the National Gallery, the museum became completely independent only in 1954. In 1987 the Clore Gallery was built to house the principal collection of J.M.W. Turner's works. In 1988 a branch was opened in Liverpool. The Tate Modern, a converted power plant housing the modern collections, opened in 2000.

Tathagata \tə-'tä-gə-tə\ Epithet of the Buddha that he employed primarily when referring to himself. He also used it to refer to other buddhas who preceded him and who would follow. Tathagatha refers to one who has trod the path to full awakening and so reached the end of suffering and escaped samsara. The implication is that the path is open to all who would follow it. In later Mahayana Buddhism, Tathagata came to mean the essential buddha nature found in everyone.

Tati \tä-'tē**, Jacques** *orig.* **Jacques Tatischeff** (b. Oct. 9, 1908, Le Pecq, France—d. Nov. 5, 1982, Paris) French film actor and director. He became a popular music-hall entertainer in the 1930s with a pantomime act that caricatured athletes. After appearing in comedy shorts, he wrote, directed, and starred in a series of comic feature films—*Jour de fête* (1949), *Monsieur Hulot's Holiday* (1953), *Mon oncle* (1958), *Playtime* (1968), *Traffic* (1971), and *Parade* (1974)—in which he became known for his inspired physical comedy and his accident-prone alter ego, Monsieur Hulot. In his films Tati forsakes traditional narrative in favour of vignettes that use sight gags, timing, mannerisms, and physical action to reveal the humour and texture of modern living.

Tatlin \'tät-lyin**, Vladimir (Yevgrafovich)** (b. Dec. 16, 1885, Kharkov, Russian Empire—d. May 31, 1953, Moscow, U.S.S.R.) Ukrainian sculptor and painter. After a visit to Paris (1914), he became the leader of a group of Moscow artists who sought to apply engineering techniques to sculpture construction, a movement that developed into Constructivism. He pioneered the use of iron, glass, wood, and wire in nonrepresentational constructions. His *Monument to the Third International*, commissioned by the Soviet government, was one of the first buildings conceived entirely in abstract terms and was intended to be, at more than 1,300 ft (400 m), the world's tallest structure. A model was exhibited at the 1920 Soviet Congress, but the government disapproved of nonfigurative art and it was never built. After 1933 Tatlin worked largely as a stage designer.

tattoo Permanent mark or design made on the body by pigment introduced through ruptures in the skin. The term is also loosely applied to the inducement of scars (cicatrization). Tattooing has been practiced in most parts of the world, and examples have been found on Egyptian and Nubian mummies dating from 2000 BC. Decoration is perhaps the most common motive, though designs may also serve to identify rank, status, or membership and are thought by some to provide magical protection against sickness or misfortune. The word comes from Tahiti, where it was recorded by James Cook's expedition in 1769. The first electric tattooing implement was patented in the U.S. in 1891.

Tatum \'tā-təm**, Art(hur)** (b. Oct. 13, 1909, Toledo, Ohio, U.S.—d. Nov. 5, 1956, Los Angeles, Calif.) U.S. jazz pianist. Tatum was blind from birth. Influenced by Fats Waller and Earl Hines, his playing represents a synthesis of stride and swing piano traditions. He developed an unprecedented technical and harmonic control on the instrument and was capable of astonishing speed and intricate elaborations of melody. By 1937 he was recognized as the outstanding pianist in jazz. He formed a trio with guitar and bass in 1943 but frequently made solo performances that showcased his unique mastery.

Tatum, Edward L(awrie) (b. Dec. 14, 1909, Boulder, Colo., U.S.—d. Nov. 5, 1975, New York, N.Y., U.S.) U.S. biochemist. He worked with George Wells Beadle at Stanford University, where they confirmed that all biochemical processes in organisms are ultimately controlled by genes, that these processes can be broken down into a series of individual sequential chemical reactions, each controlled by a single gene, and that mutation of a single gene changes the cell's ability to carry out only a single chemical reaction. Each gene was found to determine the structure of a specific enzyme (the "one gene, one enzyme" hypothesis). With Joshua Lederberg, Tatum discovered the occurrence of genetic recombination, or "sex," between certain bacteria. Largely because of their efforts, bacteria became the main source of information about genetic control of biochemical processes in the cell. Tatum, Beadle, and Lederberg shared the Nobel Prize in 1958.

Taunton Town (pop., 1995 est.: 55,000), county seat of Somerset, England. An Anglo-Saxon king founded it c. 710. Its castle was besieged

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during the English Civil Wars and subsequently dismantled. Taunton later was the scene of the duke of Monmouth's rebellion (1685). It is in an agricultural region; tourism is also important to the economy.

Taupo \'taù-pō**, Lake** Lake, North Island, New Zealand. The largest lake in New Zealand, it is 234 sq mi (606 sq km) in area and covers the remains of several volcanic craters. The Waikato River flows into and out of it. Numerous geothermal springs on the lake's borders are used for health resorts and for generating electricity.

Taurus (Latin: "Bull") In astronomy, the constellation lying between Aries and Gemini; in astrology, the second sign of the zodiac, governing approximately the period April 20–May 20. Its symbol is a bull, a reference to the Greek myth in which Zeus transformed himself into a white bull to abduct Europa.

Taurus Mountains Mountain chain, southern Turkey, running parallel with the Mediterranean Sea coast. The system extends along a curve from Lake Egridir in the west to the upper reaches of the Euphrates River in the east. It has many peaks rising above 10,000–12,000 ft (3,000–3,700 m) in elevation. The Cilician Gates pass, 38 mi (61 km) long and used by caravans and armies since antiquity, crosses the range north of Tarsus.

Taussig \'taù-sig**, Helen Brooke** (b. May 24, 1898, Cambridge, Mass., U.S.—d. May 20, 1986, Kennett Square, Pa.) U.S. physician. She received her medical degree from Johns Hopkins in 1927. As head of a Baltimore heart clinic (1930–63), she studied "blue babies" (babies whose heart malformations cause low blood oxygen content) and pioneered use of fluoroscopy and X rays to pinpoint the defect responsible for each set of symptoms. The surgical treatment she devised with Alfred Blalock saved thousands of such infants, and her research spurred development of other surgical treatments for heart disorders. Her *Congenital Malformations of the Heart* (2 vol., 1947) comprehensively described heart defects and diagnostic tools, techniques, and findings. She also played a key role in alerting U.S. physicians to the dangers of thalidomide.

tautog See wrasse

tautology \tò-'tä-lə-jē\ In logic, a statement that cannot be denied without inconsistency. Thus, "All bachelors are either male or not male" is held to assert, with regard to anything whatsoever that is a bachelor, that it is male or it is not male. In the propositional calculus, even complicated symbolic expressions such as $[(A \supset B) \wedge (C \supset \neg B)] \supset (C \supset \neg A)$ can be shown to be tautologies by displaying in a truth table every possible combination of T (true) and F (false) of its arguments A, B, C. A tautology can be purely formal (a statement form rather than a statement), and in some usages only such formal truths are tautologies.

tautomerism \tò-'tä-mə-ˌri-zəm\ Existence of two or more chemical compounds that have the same chemical composition but different structures (isomers) and that convert easily from one to another. A major class of tautomeric reactions involves exchange of a hydrogen atom between two other atoms in the same molecule, in both cases forming a covalent bond. For example, in keto-enol tautomerism, the hydrogen atom bonded to the carbon atom in a carbonyl (keto) group (—CH—C=O; see functional group) moves to the oxygen atom, making it an enol group (—C=C—OH). The keto form predominates in many aldehydes and ketones, the enol form in phenols. Sugars (e.g., glucose) exhibit tautomerism between open (chain) forms and closed (ring) forms. See also isomerism.

Tawney, Richard Henry (b. Nov. 30, 1880, Calcutta, India—d. Jan. 16, 1962, London, Eng.) English economic historian. He was educated at Rugby School and at the University of Oxford, where he wrote his first major work, *The Agrarian Problem in the Sixteenth Century* (1912). From 1913 he taught at the London School of Economics. An ardent socialist, he helped formulate the economic and moral viewpoint of the Labour Party in the 1920s and '30s. In his most influential book, *The Acquisitive Society* (1920), he argued that the acquisitiveness of capitalist society was a morally wrong motivating principle. His *Religion and the Rise of Capitalism* (1926), which built on the work of Max Weber, also became a classic.

tax Government levy on persons, groups, or businesses. Taxes are a general obligation of taxpayers and are not paid in exchange for any specific benefit. They have existed since ancient times—property taxes and sales taxes were known in ancient Rome—but tariffs were favoured over internal taxes as a source of revenue. In modern economies, there has been a trend away from tariffs in favour of internal taxes, which provide the majority of revenues. Taxes have three functions: to cover government spending, to promote stable economic growth, and to lessen inequalities in the distribution of income and wealth. They have also been used for nonfiscal reasons, such as to encourage or discourage certain activities (e.g., cigarette consumption). Taxes may be classified as direct or indirect. Direct taxes are those that the taxpayer cannot shift onto someone else; they are mainly taxes on persons and are based on an individual's ability to pay as measured by income or net wealth. Direct taxes include income taxes, taxes on net worth, death duties (i.e., inheritance and estate taxes), and gift taxes. Indirect taxes are those that can be shifted in whole or in part to someone other than the person legally responsible for payment. These include excise taxes, sales taxes, and value-added taxes. Taxes may also be classified according to the effect they have on the distribution of wealth. A proportional tax is one that imposes the same relative burden on all taxpayers, unlike progressive taxes and regressive taxes.

Taxco \'täs-kō\ *in full* **Taxco de Alarcón** Town (pop., 2000: 50,488), Guerrero state, south-central Mexico. A silver-mining site in pre-Columbian times, it became one of the first mining centres to be inhabited by Spaniards. It prospered in the colonial period and is still renowned for its silver. Because of its colonial character, with its cobblestone streets and the baroque Church of Santa Prisca, it has been declared a national landmark.

taxidermy Practice of creating lifelike representations of animals by using their prepared skins and various supporting structures. Taxidermy began with the ancient custom of keeping trophies of the hunt. Beginning in the 18th century, a growing interest in natural history resulted in collections and exhibits of birds, beasts, and curiosities. Chemically preserving skins, hair, and feathers made it possible to recreate the appearance of live animals by stuffing the sewed-up skin with straw or hay. Constructing and sculpting anatomically correct manikins of clay and plaster are the basis of modern taxidermy.

Taxila \'tak-sə-lə\ Ancient city, northwestern Pakistan. Its ruins, including temples and a fortress, lie just northwest of Rawalpindi. It was the capital of the Buddhist kingdom of Gandhara and a centre of learning. Founded by Bharata, the younger brother of Rama, it came under Persian rule and in 326 BC was surrendered to Alexander the Great. Ruled by a succession of conquerors, including Bactrians and Scythians, the city became an important Buddhist centre under King Ashoka (c. 261 BC). The apostle Thomas reputedly visited it in the 1st century AD. Taxila's prosperity in ancient times resulted from its position at the junction of three great trade routes. When they declined, the city sank into insignificance; it was finally destroyed by the Huns in the 5th century.

taxol \'taks-ȯl\ Organic compound with a complex multi-ring molecule that occurs in the bark of Pacific yew trees (*Taxus brevifolia*). It is active against certain cancers of the lung, ovary, breast, head, and neck, disrupting cell division and interfering with separation of the nuclear chromosomes. A semisynthetic process to make it from yew needles and twigs eliminated the prospect of widespread destruction of yew forests, and total synthesis methods were later developed.

taxonomy \tak-'sä-nə-mē\ In biology, the classification of organisms into a hierarchy of groupings, from the general to the particular, that reflect evolutionary and usually morphological relationships: kingdom, phylum, class, order, family, genus, species. The black-capped chickadee, for example, is an animal (kingdom Animalia) with a dorsal nerve cord (phylum Chordata) and feathers (class Aves: birds) that perches (order Passeriformes: perching birds) and is small with a short bill (family Paridae), a song that sounds like "chik-a-dee" (genus *Parus*), and a black-capped head (species *atricapillus*). Most authorities recognize five kingdoms: monerans (prokaryotes), protists, fungi (see fungus), plants, and animals. Carolus Linnaeus established the scheme of using Latin generic and specific names in the mid-18th century; his work was extensively revised by later biologists.

Tay, River Longest river in Scotland. It rises on the northern slopes of Ben Lui and flows through Loch Tay to enter the North Sea below Dundee after a course of 120 mi (193 km). It drains 2,400 sq mi (6,200 sq km), the largest drainage area in Scotland.

Tay-Sachs \'tā-'saks\ **disease** Recessive hereditary metabolic disorder, mostly in Ashkenazi Jews, causing progressive mental and neurologic deterioration and death by age five. A lipid, ganglioside GM_2, accumulates in the brain (because of inadequate activity of the enzyme that breaks it

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down), with devastating neurological effects. Infants appear normal at birth but soon become listless and inattentive, lose motor abilities, and develop seizures. Blindness and general paralysis usually precede death. Tests can detect the disease in fetuses and the Tay-Sachs gene in carriers. There is no treatment.

Taylor, Dame Elizabeth (Rosemond) (b. Feb. 27, 1932, London, Eng.) U.S. film actress. She left London for Los Angeles with her American parents at the outset of World War II. Noted for her exceptional beauty from childhood, she was discovered by a talent scout in Beverly Hills. She made her screen debut in 1942, appeared in *Lassie Come Home* in 1943, and became a star with *National Velvet* in 1944. She was a glamorous adult star in *A Place in the Sun* (1951), *Cat on a Hot Tin Roof* (1958), and *Butterfield 8* (1960, Academy Award). In *Who's Afraid of Virginia Woolf* (1966, Academy Award) and other films, she starred opposite her husband, Richard Burton. After the mid-1970s, she appeared only intermittently in films, Broadway plays, and television films. Taylor's personal life (she was married eight times) was exceptionally well publicized and often tended to overshadow her acting career.

Taylor, Frederick W(inslow) (b. March 20, 1856, Philadelphia, Pa., U.S.—d. March 21, 1915, Philadelphia) U.S. inventor and engineer. He worked at Midvale Steel Co. (1878–90), where he introduced time-and-motion study in order to systematize shop management and reduce manufacturing costs. Though his system provoked resentment and opposition from labour when carried to extremes, it had an immense impact on the development of mass production techniques and has influenced the development of virtually every modern industrial country. Taylor is regarded as the father of scientific management. See also production management; Taylorism.

Taylor, Sir Geoffrey Ingram (b. March 7, 1886, London, Eng.—d. June 27, 1975, Cambridge) British physicist. He taught at Cambridge University from 1911 to 1952. He made important discoveries in fluid mechanics, as well as significant contributions to the theory of the elastostatic stress and displacement fields created by dislocating solids, the quantum theory of radiation, and the interference and diffraction of photons.

Taylor, John *known as* **John Taylor of Caroline** (b. Dec. 19?, 1753, Caroline county, Va.—d. Aug. 21, 1824, Caroline county, Va., U.S.) U.S. politician. He served in the Continental Army (1775–79) and the Virginia militia (1781) in the American Revolution. A strong advocate of states' rights, he opposed ratification of the U.S. Constitution. He was a member of the U.S. Senate (1792–94, 1803, 1822–24), and he introduced the Virginia and Kentucky Resolutions in the Virginia legislature (1798). A supporter of Thomas Jefferson, he wrote essays on the importance of maintaining an agrarian democracy as a defense against the development of an overly powerful central government.

Taylor, Joseph H(ooton), Jr. (b. March 24, 1941, Philadelphia, Pa., U.S.) U.S. physicist. He received his Ph.D. from Harvard University. While teaching at the University of Massachusetts (1968–81), he and Russell Alan Hulse discovered the first binary pulsar (1974). Their discovery provided evidence in support of Albert Einstein's relativistic theory of gravitation, which predicts that objects accelerated in a strong gravitational field will emit gravitational waves. With its enormous interacting gravitational fields, the binary pulsar should emit such waves, draining energy and reducing the orbital distance between the two stars. In 1978 they showed, on the basis of tiny variations in the pulsar's radio emission, that the two stars are revolving ever faster and closer around each other at a rate agreeing precisely with Einstein's prediction. Their discoveries won the two men a 1993 Nobel Prize.

Taylor, Lawrence (Julius) (b. Feb. 4, 1959, Williamsburg, Va., U.S.) U.S. football linebacker. He played for the University of North Carolina, making All-American in 1980. During his 13-year career with the New York Giants (1981–94), he was twice named Defensive Player of the Year (1981, 1982) and once named Most Valuable Player (1986), only the second defensive player to be so honoured. The prototypical linebacker of his era, he possessed the strength to defeat blocks from linemen and the speed to chase down running backs.

Taylor, Maxwell (Davenport) (b. Aug. 26, 1901, Keytesville, Mo., U.S.—d. April 19, 1987, Washington, D.C.) U.S. army officer. He graduated from West Point and helped organize the army's first airborne division early in World War II. He commanded a parachute assault in the Normandy Campaign and in the Battle of the Bulge (1944). He served as commanding general of UN forces in Korea (1953), as U.S. Army chief of staff (1955–59), and as chairman of the Joint Chiefs of Staff (1962–64). He was appointed ambassador to South Vietnam (1964–65) and was a special consultant to Pres. Lyndon B. Johnson (1965–69). He advocated the maintenance of conventional infantry as a prudent alternative to the use of nuclear weapons in war.

Taylor, Paul (Belville) (b. July 29, 1930, Wilkinsburg, Pa., U.S.) U.S. modern dancer, choreographer, and director. In 1953 he joined Martha Graham's company, where he was a leading soloist until 1960. In 1957 he established the Paul Taylor Dance Company. As a choreographer he employed a wide variety of movement styles, some of which he described as "flat" (two-dimensional in appearance), "dance scribbling" (emphasis on action rather than on shape or line), and "lyric" ("long arms"). His works include *Duet* (1957), *Aureole* (1962), *Orbs* (1966), and *Nightshade* (1979). In 1993 he formed Taylor 2, a small group of dancers who perform in smaller venues and teach the Taylor style.

Paul Taylor and Bettie de Jong in *Scudorama,* 1967
JACK MITCHELL

Taylor, Peter (Hillsman) (b. Jan. 8, 1917, Trenton, Tenn., U.S.—d. Nov. 2, 1994, Charlottesville, Va.) U.S. short-story writer, novelist, and playwright. Taylor studied in the 1930s under several poets associated with the Southern literary renaissance. He taught at various schools, including the University of Virginia. He is best known for his short stories, which are usually set in contemporary Tennessee and which reveal conflicts between the old rural society and the industrialized "New South." The novella *A Woman of Means* (1950) is perhaps his finest work; his later works include *The Old Forest and Other Stories* (1985) and *A Summons to Memphis* (1986, Pulitzer Prize).

Taylor, Zachary (b. Nov. 24, 1784, Montebello, Va., U.S.—d. July 9, 1850, Washington, D.C.) 12th president of the U.S. (1849–50). He fought in the War of 1812, the Black Hawk War (1832), and the Seminole War in Florida (1835–42), earning the nickname "Old Rough-and-Ready" for his indifference to hardship. Sent to Texas in anticipation of war with Mexico, he defeated the Mexican invaders at the battles of Palo Alto and Resaca de la Palma (1846). After the Mexican War formally began, he captured Monterrey and granted the Mexican army an eight-week armistice. Displeased, Pres. James K. Polk transferred Taylor's best troops to the command of Winfield Scott to serve in the invasion of Veracruz. Taylor ignored orders to remain in Monterrey and marched south to defeat a large Mexican force at the Battle of Buena Vista (1847). He became a national hero and was nominated as the Whig candidate for president (1848). He defeated Lewis Cass to win the election. His brief term was marked by a controversy over the new territories that produced the Compromise of 1850 and by a scandal involving members of his cabinet. He died, probably of cholera, after only 16 months in office and was succeeded by Millard Fillmore.

Taylorism System of scientific management advocated by Fred W. Taylor. In Taylor's view, the task of factory management was to determine the best way for the worker to do the job, to provide the proper tools and training, and to provide incentives for good performance. He broke each job down into its individual motions, analyzed these to determine which were essential, and timed the workers with a stopwatch. With unnecessary motion eliminated, the worker, following a machinelike routine, became far more productive. See also production management, time-and-motion study.

Taymyr \tī-'mir\ **Peninsula** Peninsula, north-central Siberia, northern Russia. It lies between the Kara Sea, the Laptev Sea, and the Vilkitsky Strait and includes Cape Chelyuskin, the northernmost point of Asia. Its central part is crossed by the Taymyra River, which is 400 mi (644 km) long. It occupies an area of approximately 150,000 sq mi (400,000 sq km). The Byrranga Mountains, in its centre, reach a height of about 3,800 ft (1,150 m).

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Tbilisi \tə-bi-'lē-sē\ *formerly* **Tiflis** City (pop., 2002: 1,081,679), capital of the Republic of GEORGIA, on the KURA RIVER. Founded c. AD 458 as the capital of the Georgian kingdom, its strategic position on trade routes between Europe and Asia led to its frequent capture. It endured under successive Persian, Byzantine, Arab, Mongol, and Turkish rulers and came under the control of the Russian Empire c. 1801. It was made the capital of the Transcaucasian S.F.S.R. by 1922, of the Georgian S.S.R. in 1936, and of independent Georgia in 1991. Some ancient structures still exist in the city, which is now a major cultural, educational, research, and industrial centre.

Tchaikovsky \chə-'kȯf-skē, chī-'kȯf-skē**, Pyotr Ilyich** (b. May 7, 1840, Votkinsk, Russia—d. Nov. 6, 1893, St. Petersburg) Russian composer. Sensitive and interested in music from his early childhood, Tchaikovsky turned to serious composition at age 14. In 1862 he began studying at the new St. Petersburg Conservatory; from 1866 he taught at the Moscow Conservatory. His *Piano Concerto No. 1* (1875) was premiered in Boston and became immensely popular. He wrote his first ballet, *Swan Lake* (first performed 1877), on commission from the BOLSHOI BALLET. In 1877 he received a commission from the wealthy Nadezhda von Meck (1831–94), who became his patron and longtime correspondent. The opera *Eugene Onegin* (1878) soon followed. Though homosexual, he married briefly; after three disastrous months of marriage, he attempted suicide. His composition was overshadowed by his personal crisis for years. His second ballet, *Sleeping Beauty* (1889), was followed by the opera *The Queen of Spades* (1890) and the great ballet *The Nutcracker* (1892). The *Pathétique Symphony* (1893) premiered four days before his death from cholera; claims that he was forced to commit suicide by noblemen outraged by his sexual liaisons are unfounded. He revolutionized the ballet genre by transforming it from a grand decorative gesture into a staged musical drama. His music has always had great popular appeal because of its tuneful, poignant melodies, impressive harmonies, and colourful, picturesque orchestration.

TCP/IP *in full* **Transmission Control Protocol/Internet Protocol** Standard INTERNET communications PROTOCOLS that allow DIGITAL COMPUTERS to communicate over long distances. The Internet is a packet-switched network, in which information is broken down into small packets, sent individually over many different routes at the same time, and then reassembled at the receiving end. TCP is the component that collects and reassembles the packets of data, while IP is responsible for making sure the packets are sent to the right destination. TCP/IP was developed in the 1970s and adopted as the protocol standard for ARPANET (the predecessor to the Internet) in 1983.

te See DE

Te Anau Lake \tā-'ä-naù\ Lake, southwestern SOUTH ISLAND, New Zealand. The largest of the Southern Lakes, it is 38 mi (61 km) long and 6 mi (10 km) wide, and a source of the Waiau River. In a superb alpine setting bordered by forested mountains, it is known for fishing and tourism.

Te Kanawa \te-'kä-nə-wə**, Dame Kiri (Janette)** (b. March 6, 1944, Gisborne, North Island, N.Z.) New Zealand-born (half-Maori) soprano. After winning various singing competitions at home, she went to London for further study in 1966 and made her Covent Garden debut in 1970. Soon moving into leading roles, she became especially admired as the Countess in *The Marriage of Figaro*. In 1974 she made a triumphal debut at the Metropolitan Opera, substituting at the last moment in GIUSEPPE VERDI's *Otello*. A glamorous and regally imperturbable presence with a rich voice, she was chosen to sing at the 1981 wedding of Prince Charles, and she has made many recordings.

tea Beverage produced by steeping in freshly boiled water the young leaves and leaf buds of the tea plant, *Camellia sinensis*, a member of the family Theaceae, which contains 40 genera of trees and shrubs. Tea cultivation is first documented in China in AD 350; according to legend, it had been known there since c. 2700 BC. It was established in Japan by the 13th century and was spread to Java by the Dutch and to India by the English in the 19th century. Today tea is the most widely consumed drink in the world, drunk (either hot or cold) by half the world's population. Major tea types are classified by processing method: fermented, or black, tea produces an amber-colored, full-flavored beverage without bitterness; semifermented, or oolong, tea yields a slightly bitter, light brownish-green liquid; and unfermented, or green, tea, results in a mild, slightly bitter, pale greenish-yellow beverage. CAFFEINE is responsible for tea's stimulating effect. Green tea, long regarded as healthful in the Far East, has in recent years attracted much favorable attention in the West for a wide range of possible beneficial effects. Infusions and decoctions of the leaves, bark, and roots of many other, unrelated plants are commonly drunk as herbal or medicinal teas.

Tea Act (1773) British legislation giving a tea monopoly in the American colonies to the British East India Co. It adjusted the duty regulations to allow the failing company to sell its large tea surplus below the prices charged by colonial competitors. The act was opposed by colonists as another example of taxation without representation. Resistance to the act resulted in the BOSTON TEA PARTY.

tea ceremony *Japanese* **chadō** *or* **cha-no-yu** Ritualized preparation and drinking of TEA developed in Japan. It involves a host and one or more guests; the tea, utensils, and movements used in preparing, serving, and drinking the tea are all prescribed. When tea was introduced from Song-dynasty China by the Zen monk Eisai (1141–1215), it was drunk by Zen monks to help them stay awake during meditation. The laity enjoyed tea-tasting competitions that developed into a more refined, meditative form among the warrior aristocracy in the 15th century. The most famous exponent of the tea ceremony was Sen Rikyū (1522–91), tea master to TOYOTOMI HIDEYOSHI, who codified a style known as *wabi*, which favoured rustic, rough-shaped tea bowls and spare, simple surroundings. Three popular schools of the tea ceremony trace their roots to Rikyū, and other schools exist as well; today mastery of the tea ceremony is one accomplishment of a well-bred young woman.

Teach, Edward See BLACKBEARD

teaching Profession of those who give instruction, especially in an elementary or secondary school or a university. The teaching profession is a relatively new one. Traditionally, parents, elders, religious leaders, and sages were responsible for teaching children how to behave and think and what to believe. Germany introduced the first formal criteria for the education of teachers in the 18th century. In the 19th century, as society became more industrialized, the concept of schooling became more universal. In industrialized nations today, most teachers are university graduates. Teacher-training programs usually include both general and specialized academic, cultural, or vocational courses; the study of educational principles; and a series of professional courses combined with practical experience in a typical school setting. Most countries also require professional certification following formal training. See also NATIONAL EDUCATION ASSOCIATION.

Teagarden, Jack *orig.* **Weldon Leo Teagarden** (b. Aug. 20, 1905, Vernon, Texas, U.S.—d. Jan. 15, 1964, New Orleans, La.) U.S. JAZZ trombonist and singer. He worked with two of the most popular bands of the early SWING era, those of Ben Pollack (1928–33) and PAUL WHITEMAN (1933–38). After leading his own group (1938–47), he joined LOUIS ARMSTRONG's All Stars and recorded and toured with them internationally until 1951. Teagarden's trademark relaxed, bluesy approach was evident in both his playing and singing, his engaging Texas accent seeming to colour both.

teak Large deciduous tree (*Tectona grandis*) of the VERBENA family, and its wood, one of the most valuable and durable timbers. Teak has been widely used in India for more than 2,000 years; some temples contain teak beams more than 1,000 years old. The tree has a straight stem, often thickened at the base, a spreading crown, and four-sided branchlets. The rough leaves are opposite or sometimes whorled, and the branches end in many small white flowers. The unseasoned heartwood has a pleasant, strong aromatic fragrance and a beautiful golden-yellow colour, which on seasoning darkens into brown, mottled with darker streaks. Resistant to the effects of water, teakwood is used for shipbuilding, fine furniture, door and window frames, wharves, bridges, cooling-tower louvers, flooring, and paneling. Its desirability has led to severe overcutting in tropical forests.

Holarctic American green-winged teal drake (*Anas crecca carolinensis*).
GORDON LANGSBURY/BRUCE COLEMAN INC.

teal Any of about 15 species (genus *Anas*, family Anatidae) of small DABBLING ducks found on the major continents and many islands. Many are popular game birds. The Holarctic

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green-winged teal, usually found in a dense flock, is 13–15 in. (33–38 cm) long. The small blue-winged teal breeds across Canada and the northern U.S. and winters south of the U.S. The Hottentot teal of Africa frequently remains immobile among vegetation even when shots are fired nearby. Teal are primarily herbivorous, but some species eat small animals. Flocks of many species take off and change direction in unison.

Teamsters Union *officially* **International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (IBT)**, *formerly (until 1940)* **International Brotherhood of Teamsters, Chauffeurs, Stablemen and Helpers of America (IBT)** Largest private-sector labour union in the U.S., representing truck drivers and workers in related industries such as aviation. It was formed in 1903 with the merger of two team-drivers' unions, and local deliverymen using horse-drawn vehicles remained the core membership until the 1930s, when intercity truck drivers became predominant. From 1907 to 1952 the union was headed by Daniel J. Tobin, who built it up from 40,000 members in 1907 to more than one million in 1950. Disclosures of corruption in the leadership led to the Teamsters' expulsion from the AFL-CIO in 1957. Between 1957 and 1988 three Teamsters presidents—Dave Beck, Jimmy Hoffa, and Roy Williams—were convicted of various criminal charges and sentenced to prison terms. (Hoffa has been missing, and presumed dead, since 1975.) While Teamsters representation of truck drivers declined with the growth of nonunion trucking companies in the 1980s, the union gained new members in clerical, service, and technology occupations. The union was readmitted to the AFL-CIO in 1987. Presidents Ron Carey (1992–99) and James P. Hoffa (1999–), son of the former president, focused on job security and family issues.

Teapot Dome scandal Secret leasing of U.S. government land to private interests. In 1922 oil reserves at Teapot Dome, Wyo., and Elk Hills, Calif., were improperly leased to private oil companies by Secretary of the Interior Albert Fall, who accepted cash gifts and no-interest loans from the companies. When the leases became known, Congress directed Pres. Warren G. Harding to cancel them. A later investigation revealed illegal actions by several government officials, some of whom later received fines and short prison sentences. The scandal became a symbol of government corruption.

tear duct and gland *or* **lachrymal** \'lak-rə-məl\ **duct and gland** Structures that produce, distribute, and carry away tears. An almond-shaped gland above the outer corner of each eye secretes tears between the upper eyelid and the eyeball. Tears moisten and lubricate the conjunctiva (the membrane that lines the eyelid and covers the white of the eye) and then flow into the barely visible openings (near the inner corners of the eyelids) of the tear ducts, which lead to the nasal cavity. Oil (from sebaceous glands on the edge of the eyelid) keeps tears from spilling out unless secretion increases because of crying or a reflex triggered by stimuli such as eye irritation, bright lights, or spicy foods.

tear gas Any of a group of substances, most often synthetic organic halogen compounds, that irritate the mucous membranes of the eyes, causing a stinging sensation and tears. They may also irritate the upper respiratory tract, causing coughing, choking, and general debility. Tear gas was first used in warfare in World War I, but since its effects are short-lasting and rarely disabling, it came into use by law-enforcement agencies as a means of dispersing mobs, disabling rioters, and flushing out armed suspects without the use of deadly force.

Teasdale, Sara *orig.* **Sara Trevor Teasdale** (b. Aug. 8, 1884, St. Louis, Mo., U.S.—d. Jan. 29, 1933, New York, N.Y.) U.S. poet. While living in St. Louis she made frequent trips to Chicago, where she eventually joined Harriet Monroe's *Poetry* magazine circle. Her collection *Rivers to the Sea* (1915) established her as a popular poet, and *Love Songs* (1917) won the first Pulitzer Prize for poetry. Over time her verse became simpler and more austere. After her marriage ended in divorce in 1929, she moved to New York City, where she lived in virtual retirement. Many of the poems in her last book, *Strange Victory* (1933), foreshadow her suicide.

teasel \'tē-zəl\ Any of about 15 species constituting the genus *Dipsacus* of the family Dipsacaceae (the teasel family), native to Europe, the Mediterranean area, and tropical Africa. Many teasels are prickly, coarse biennials with tall-domed heads of numerous, four-lobed flowers that sit on a crownlike circle of spiny, narrow bracts. The spiny, dry fruiting heads of fuller's teasel (*D. sativus*) have been used since Roman times to raise the nap of woolen fabrics in a process known as fulling.

Tebaldi \tā-'bäl-dē**, Renata** (b. Feb. 1, 1922, Pesaro, Italy—d. Dec. 19, 2004, San Marino) Italian soprano. After her debut in *Mefistofele* in 1944, she established herself at La Scala, performing with the conductor Arturo Toscanini for the 1946 reopening concert and over the next decade. Her debuts at Covent Garden (1950) and the Metropolitan Opera (1955) were both in the role of Desdemona, and she sang at the Met for 17 years in roles such as Tosca, Manon Lescaut, Mimi, and Violetta. She retired in 1976.

technetium \tek-'nē-shē-əm\ Metallic chemical element, one of the transition elements, chemical symbol Tc, atomic number 43. All its isotopes are radioactive (see radioactivity); some occur in trace amounts in nature as nuclear fission products of uranium. Its isotope technetium-97 was the first element artificially produced (1937; see cyclotron). Technetium-99, a fission product of nuclear reactors that emits gamma rays, is the most-used tracer isotope in nuclear medicine. Technetium resembles platinum in appearance and manganese and rhenium in chemical behaviour. It is also used as a metallurgical tracer and in corrosion-resistant products.

technical education Academic and vocational preparation of students for jobs involving applied science and modern technology. It emphasizes the understanding and practical application of basic principles of science and mathematics, rather than the attainment of proficiency in manual skills that is properly the concern of vocational education. The goal of technical education is to prepare graduates for occupations that are classified above the skilled crafts but below the scientific or engineering professions. People so employed are frequently called technicians. See also employee training.

techno Electronic dance music that first appeared in the U.S. in the 1980s and became globally popular in the 1990s. It originated with Detroit deejay-producers who, inspired by European electro-pop, underlaid dreamy synthesizer melodies with rapid electronic rhythms. Imported in Europe, it was adopted by the burgeoning rave scene of all-night dance parties (which often featured the hallucinogen ecstasy) and is celebrated in the annual Love Parade in Berlin.

technology Application of knowledge to the practical aims of human life or to changing and manipulating the human environment. Technology includes the use of materials, tools, techniques, and sources of power to make life easier or more pleasant and work more productive. Whereas science is concerned with how and why things happen, technology focuses on making things happen. Technology began to influence human endeavour as soon as people began using tools. It accelerated with the Industrial Revolution and the substitution of machines for animal and human labour. Accelerated technological development has also had costs, in terms of air and water pollution and other undesirable environmental effects.

tectonics Scientific study of the deformation of the rocks that make up the Earth's crust and the forces that produce such deformation. It deals with the folding and faulting associated with mountain building; the large-scale, gradual, upward and downward movements of the crust; and sudden horizontal displacements along faults. Other phenomena studied include igneous processes and metamorphism. The chief working principle of tectonics is the concept of plate tectonics. See also continental drift; seafloor spreading.

tectonism See diastrophism

Tecumseh \tə-'kəm-sə\ (b. 1768, Old Piqua, in modern Clark county, Ohio, U.S.—d. Oct. 5, 1813, near Thames River, Upper Canada) Shawnee Indian chief. As a boy during the American Revolution, Tecumseh participated in combined British and Indian attacks on American colonists. In 1794 he fought unsuccessfully against Gen. Anthony Wayne. He eventually established a confederation made up of members of the Creek and other nations. In 1811 his brother's attack on William H. Harrison's troops at Tippecanoe, Ind., ended in defeat. As the War of 1812 approached, Tecumseh assembled his followers under the British banner and captured Detroit. Several lesser successes followed, ending with his death at the Thames River in what is now Ontario, marking the end of Indian resistance in the Old Northwest (as the East North Central states were sometimes known).

Tedder (of Glenguin), Arthur William Tedder, 1st Baron (b. July 11, 1890, Glenguin, Stirling, Scot.—d. June 3, 1967, Banstead, Surrey, Eng.) British air marshal. He joined the British army in 1913, transferred to the Royal Flying Corps in 1916, and after World War I commanded a branch of the Royal Air Force (RAF). As head of the RAF

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Middle East Command in World War II, he commanded Allied air operations in North Africa and Italy, and in 1944 he was appointed head of Allied air operations in western Europe. His policy of bombing German communications and providing close air support of ground operations contributed significantly to the success of the Normandy Campaign and the Allied advance into Germany. He later became the first peacetime chief of the air staff (1946–50).

Tees River \'tēz\ River, northern England. It rises in the northern PENNINES and flows 70 mi (110 km) east to the North Sea. There are falls and reservoirs along its course. Teesside, the urban area at the river's mouth, has seen large-scale industrial development since the railroad arrived in 1825.

Teflon Trademark for a POLYMER of tetrafluoroethylene fluorocarbon (polytetrafluoroethylene [PTFE]). Teflon is a tough, waxy, nonflammable organic compound with a slippery surface, attacked by very few chemicals and stable over a wide temperature range. Its qualities make it useful in gaskets, bearings, container and pipe linings, electrical insulation, parts for valves and pumps used for corrosive fluids, and protective nonstick coatings on cooking utensils, saw blades, and other articles. A closely related fluorocarbon polymer, fluorinated ethylene-propylene (FEP), has properties and applications similar to those of Teflon.

Tegea \'tē-jē-ə\ Ancient city, eastern ARCADIA, southern Greece. It was under Spartan rule from the mid-6th century BC until THEBES' victory over SPARTA in the battle of Leuctra c. 371 BC. Afterward it joined a succession of leagues, and by the early 1st century AD was the only important town in Arcadia. It survived the Goth invasion in 395–396 and flourished under Byzantine and Frankish rule. It is the site of the Temple of Athena Alea, built by the city's traditional founder, Aleus, and rebuilt in the 4th century BC by the sculptor SCOPAS.

Tegernsee \'tā-gərn-ˌzā\ Lake, southern BAVARIA, southeastern Germany. Located in the foothills of the ALPS, it covers 3.5 sq mi (9 sq km). Surrounded by wooded mountains, it is a popular resort and recreation area. The castle of Maximilian I lies on the eastern shore.

Tegucigalpa \tā-ˌgü-sē-'gäl-pä\ City (pop., 2001: 769,061), capital of Honduras. Located on hilly terrain hemmed in by mountains, it was founded in 1578 as a gold- and silver-mining centre. It was made the permanent capital of Honduras in 1880. It produces textiles and sugar. Principal buildings include the presidential and legislative palaces, the National University of Honduras (1847), and an 18th-century cathedral.

Tehrān *or* **Teheran** \ˌtā-(ə-)'rän\ City (pop., 1996: 6,758,845), capital of Iran. It is situated on the southern slopes of the ELBURZ MOUNTAINS. It was originally a suburb of ancient RHAGAE (Rey), which was destroyed by the Mongols in 1220 and was later the home of several ṢAFAVID rulers of Persia (16th–18th centuries). It became prominent after its capture by Āghā Muḥammad Khan, founder of the QĀJĀR DYNASTY, who made it his capital in 1785. It underwent rapid modernization after 1925 and especially after World War II (1939–45). In 1943 it was the site of the TEHRAN CONFERENCE. In 1979, following the Islamic revolution in Iran, the U.S. embassy there was seized and its staff taken hostage by Iranian militants (see IRAN HOSTAGE CRISIS). A transportation and industrial centre, Tehrān produces more than half of Iran's manufactured goods. It is the seat of several educational institutions, including the University of Tehrān (1934).

Tehrān Conference (Nov. 28–Dec. 1, 1943) Meeting of FRANKLIN ROOSEVELT, WINSTON CHURCHILL, and JOSEPH STALIN in Tehrān during World War II to discuss military strategy and political issues. Stalin agreed to launch a military offensive from the east to coincide with a planned invasion of German-occupied France from the west. Also discussed but not settled were eastern Europe's postwar borders, including Poland's postwar status, and a postwar international organization.

Tehuantepec \tā-'wän-tā-ˌpek**, Gulf of** Inlet of the Pacific Ocean, southeastern Mexico. It extends 300 mi (500 km) between OAXACA and CHIAPAS states and is 100 mi (160 km) wide at its mouth. Numerous lagoons mark its shores, and the Tehuantepec River and numerous smaller streams flow into it. Its southern shore forms the Isthmus of Tehuantepec.

Teide \'tā-ˌthā**, Pico de** *or* **Pico de Tenerife** \'pē-kō-dā-ˌtān-ə-'rēf-ə\ Volcanic peak on the island of Tenerife, CANARY ISLANDS. At 12,198 ft (3,718 m) tall, it is the highest point on Spanish soil. Vents within its crater and on its slopes eject hot gases. The peak is atop a volcanic cone on the upper reaches of El Teide, a conglomeration of several volcanoes; its last eruption was in 1789. It lies within a national park. Nearby is an international solar observatory.

Teilhard de Chardin \ˌtā-yȧr-də-shȧr-'da^{n}**, (Marie-Joseph-) Pierre** (b. May 1, 1881, Sarcenat, France—d. April 10, 1955, New York, N.Y., U.S.) French philosopher and paleontologist. Ordained a Jesuit priest in 1911, he taught geology from 1918 at the Institut Catholique in Paris. In 1929 he directed the excavations at the Peking man site at ZHOUKOUDIAN. This and other geological work won him high honours, though it came to be disapproved of by the Jesuit order. His philosophy was strongly informed by his scientific work, which he believed helped prove the existence of God. He is known for his theory that mankind is evolving, mentally and socially, toward a final spiritual unity that he called the Omega point. Though his major philosophical works, *The Divine Milieu* (1957) and *The Phenomenon of Man* (1955), were written in the 1920s and '30s, their publication in his lifetime was forbidden by the Jesuits.

Teilhard de Chardin
© PHILIPPE HALSMAN

Tekakwitha \ˌtek-ə-'kwith-ə**, Kateri** (b. 1656, probably Ossernenon, New Netherland—d. April 17, 1680, Caughnawaga, Que.) First North American Indian considered for canonization. The daughter of an Algonquin Christian mother and a non-Christian Mohawk father, she was born in what is now Auriesville, N.Y., U.S., and was partially blinded by smallpox as a child. She was deeply impressed by the lives and words of three Jesuit missionaries she met at age 11, and at 20 she was baptized. Harassed and threatened with torture in her home village, she fled 200 mi (320 km) to a Christian Indian mission near Montreal, where she became known as the "Lily of the Mohawks" for her kindness, faith, and heroic suffering before her early death. She was beatified in 1980.

tektite Any of a class of small, natural glassy objects found on the Earth's surface and associated with meteorite impacts. The extremely high temperatures and enormous pressures generated when a large meteorite, comet, or asteroid hits the Earth melt the rocks at the site, producing masses of molten droplets that are blasted into and out of the Earth's atmosphere. The droplets cool quickly to a glassy form and then fall back to the Earth.

Tel Aviv–Yafo \ˌtel-ə-'vēv-'yä-fō\ *or* **Tel Aviv–Jaffa** \ˌtel-ə-'vēv-'jä-fə\ City (pop., 1999 est.: 348,100) and main port of Israel. The hub of Israel's largest urban centre, it was formed in 1950 by the incorporation of the ancient port of Jaffa with Tel Aviv, its former suburb. Tel Aviv was founded in 1909 and was the capital of Israel (1948–50). It grew with Jewish immigration in the early 20th century and by 1936 was the largest and most important city in Palestine. Jaffa was an old Canaanite city that was taken by Egypt in the 15th century BC and occupied by the Israelite kings DAVID and SOLOMON. Over the centuries it was ruled by the Ptolemies, Syrians, and Romans, captured by the Crusaders, and razed by the Mamlūks. The British occupied it in 1917; it surrendered to Jewish military forces during the first ARAB-ISRAELI WAR (1948). Israel's main business, communications, and cultural centre, it is the site of more than half of Israel's industrial plants, the country's stock exchange, Tel Aviv University (1953), and Bar-Ilan University (1953).

telecommunications Communication between parties at a distance from one another. Modern telecommunication systems—capable of transmitting TELEPHONE, FAX, data, RADIO, or TELEVISION signals—can transmit large volumes of information over long distances. Digital transmission is employed in order to achieve high reliability with minimal noise, or interference, and because it can transmit any signal type, digital or analog. For digital transmission, analog signals must be subjected to a process of analog-to-digital conversion; most television, radio, and voice communications are analog and must be digitized before transmission. Transmission may occur over cables, wireless radio relay systems, or via satellite links.

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telegraph Electromagnetic communication device. In 1832 Samuel F.B. Morse made sketches of ideas for a system of electric telegraphy, and in 1835 he developed a code to represent letters and numbers (Morse code). In 1837 he was granted a patent on an electromagnetic telegraph that transmitted signals along a wire. That same year British inventors patented a telegraph system that activated five needle pointers that could be made to point to specific letters and numbers on their mounting plate. Public use of Morse's telegraph system began in 1844 and lasted more than 100 years. By the late 20th century the telegraph had been replaced in most applications in developed countries by digital data transmission systems based on computer technology. See also Western Union Corp.

Teleki \'te-le-ki**, Pál, Count** (b. Nov. 1, 1879, Budapest, Hung., Austria-Hungary—d. April 3, 1941, Budapest) Hungarian politician. An eminent geographer, he was a member of the Hungarian Parliament from 1905 and a delegate to the Paris Peace Conference (1919) after World War I. In 1921, however, he withdrew from party politics. He then taught at Budapest University before returning to office as minister of education (1938–39) and premier (1939–41). Hoping to use Germany's power to win back territories lost through the Treaty of Trianon (1920), he initially cooperated with Adolf Hitler. In 1941, caught between German demands for support after it invaded Yugoslavia (with whom Hungary had signed a friendship treaty in 1940) and British threats against helping Germany, he committed suicide.

Telemann \'tā-lə-ˌmän**, Georg Philipp** (b. March 14, 1681, Magdeburg, Brandenburg—d. June 25, 1767, Hamburg) German composer. By age 10 he had learned several instruments, and he composed an opera at age 12, but his family discouraged his pursuit of a musical profession. While studying law at Leipzig University, he organized student music groups and became music director of the Leipzig Opera (1702), organist at the New Church (1704), and kapellmeister to a count (1705). Moving to Eisenach (c. 1708), where he met Johann Sebastian Bach, he composed French-style instrumental music and German-style sacred music. He moved to Gotha (1717) and then Hamburg (1721), where he served as musical director of the Opera (1722–38), for which he wrote several dozen Italian-influenced works. He wrote some 600 cantatas and a total of some 2,000 pieces, many of high quality.

telemetry \tə-'le-mə-trē\ Highly automated communications process by which data are collected from instruments located at remote or inaccessible points and transmitted to receiving equipment for measurement, monitoring, display, and recording. Transmission of the information may be over wires or, more commonly, by radio. The technique is used extensively for oil-pipeline monitoring and control systems and in oceanography and meteorology. Telemetry for rockets and satellites bloomed in the 1950s and has continued to grow in complexity and in breadth of application. Data can be transmitted from inside internal-combustion engines during tests, from steam turbines in operation, and from manned and unmanned spacecraft. Major scientific applications include biomedical research and remote observation of operations with highly radioactive material.

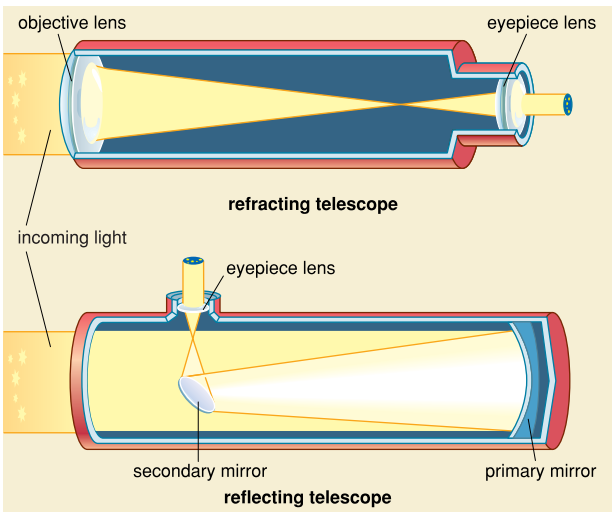
teleological argument See argument from design

teleological ethics Theory that derives duty from what is valuable as an end, in a manner diametrically opposed to deontological ethics. Teleological ethics holds that the basic standard of duty is the contribution that an action makes to the realization of nonmoral values. Teleological theories differ on the nature of the nonmoral goods that actions ought to promote. Eudaemonism emphasizes the cultivation of virtue in the agent as the end of all action. Utilitarianism holds that the end consists in the aggregate balance of pleasure to pain for all concerned. Other teleological theories claim that the end of action is survival and growth, as in evolutionary ethics (Herbert Spencer); power over others (Niccolò Machiavelli and Friedrich Nietzsche); satisfaction and adjustment, as in pragmatism (Ralph Barton Perry and John Dewey); and freedom, as in existentialism (Jean-Paul Sartre).

teleology \ˌtē-lē-'ä-lə-jē\ Causality in which the effect is explained by an end (Greek, *telos*) to be realized. Teleology thus differs essentially from efficient causality, in which an effect is dependent on prior events. Aristotle's account of teleology declared that a full explanation of anything must consider its final cause—the purpose for which the thing exists or was produced. Following Aristotle, many philosophers have conceived of biological processes as involving the operation of a guiding end. Modern science has tended to appeal only to efficient causes in its investigations. See also mechanism.

telephone Instrument designed for simultaneous transmission and reception of the human voice. It works by converting the sound waves of the human voice to pulses of electrical current, transmitting the current, and then retranslating the current back to sound. The U.S. patent granted to Alexander Graham Bell in 1876 for developing a device to transmit speech sounds over electric wires is often called the most valuable ever issued. Within 20 years, the telephone acquired a form that has remained fundamentally unchanged for more than a century. The advent of the transistor (1947) led to lightweight, compact circuitry (see cell phone). Advances in electronics have allowed the introduction of a number of "smart" features such as automatic redialing, caller identification, call waiting, and call forwarding. Telephone systems are also a primary access route for the Internet.

telescope Device that collects light from and magnifies images of distant objects, undoubtedly the most important investigative tool in astronomy. The first telescopes focused visible light by refraction through lenses; later instruments used reflection from curved mirrors (see optics). Their invention is traditionally credited to Hans Lippershey (1570?–1619?), who adapted A. van Leeuwenhoek's use of lenses in microscopes. Among the earliest telescopes were Galilean telescopes, modeled after the simple instruments built by Galileo, who was the first to use telescopes to study celestial bodies. In 1611 Johannes Kepler proposed an improved version that became the basis for modern refracting instruments. The reflecting telescope came into its own after William Herschel (see Herschel family) used one to discover the planet Uranus in 1781. Since the 1930s radio telescopes have been used to detect and form images from radio waves emitted by celestial objects. More recently, telescopes have been designed to observe objects and phenomena in other parts of the electromagnetic spectrum (see gamma-ray astronomy; infrared astronomy; ultraviolet astronomy; X-ray astronomy). Spaceflight has allowed telescopes to be launched into Earth orbit to avoid the light-scattering and light-absorbing effects of the atmosphere (e.g., the Hubble Space Telescope). See also binoculars; observatory.



Two types of telescopes. A refracting telescope forms an image by focusing light from a distant object using an objective lens. A reflecting telescope uses mirrors to focus the light. Both types use a lens in the eyepiece to magnify the image formed.
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Teletype Telegraphic instrument that was used for much of the 20th century to transmit and receive printed messages and data via telephone cables or radio relay systems. Teletypewriters (or teleprinters) became common for commercial use in the 1920s. In 1924 the Teletype Corp. introduced a series of teletypewriters so popular that the name Teletype became synonymous with teleprinters in the U.S. Coding schemes used for teleprinters included a variation of the Baudot code (1920s) and ASCII (1960s). (See Jean-Maurice-Émile Baudot.) With the advent of high-speed data transmission in the 1980s, teletype gave way to e-mail and fax.

televangelism Evangelism through religious programs on television. Such programs are usually hosted by a fundamentalist Protestant minis-

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ter, who conducts services and often asks for donations. Billy Graham became known worldwide through his TV specials from the 1950s on. Other prominent televangelists have included Oral Roberts, Jerry Falwell, and Pat Robertson.

television (TV) Electronic system for transmitting still or moving images and sound to receivers that project a view of the images on a picture tube or screen and recreate the sound. Early versions (1900–20) of the cathode-ray (picture) tube, methods of amplifying an electronic signal, and theoretical formulation of the electronic-scanning principle later became the basis of modern TV. RCA demonstrated the first all-electronic TV in 1932. Colour TV (in the 1950s), cable TV systems (introduced in the 1960s), and recording or playback machines (in the 1980s; see VCR) followed. Digital high-definition (HDTV) systems (1990s) provide sharper, clearer pictures and sound with little interference or other imperfections and have the potential to merge TV functions with those of computers.

television, cable See cable television

telex International telegraphic message-transfer service consisting of a network of teleprinters. Subscribers to a telex service can exchange textual communications and data directly with one another. Telex systems originated in Europe in the early 1930s and were widely used for several decades. The ability to conduct high-speed digital communication over regular telephone lines led to a decline in the use of telex, but it is still used as a data transmission service for applications in which high transmission speeds are not necessary or in areas where more modern data equipment is not available.

Telford, Thomas (b. Aug. 9, 1757, near Westerkirk, Dumfries, Scot.—d. Sept. 2, 1834, London, Eng.) Scottish civil engineer. He built the Ellesmere, Caledonian, and Göta canals and the St. Katherine's Docks in London. His crowning achievement was the design and construction (1819–26) of the great Menai Bridge, a suspension bridge in Wales. In all he built some 1,200 bridges, over 1,000 miles of road, and many buildings. He was the first president of the British Institution of Civil Engineers (founded 1818).

Tell, William *German* **Wilhelm Tell.** Swiss national hero whose historical existence is disputed. According to tradition, in the 13th or early 14th century he defied Austrian authority and was forced to shoot an apple from his son's head with a crossbow at a distance of 80 paces by the hated Austrian governor. He subsequently ambushed and killed the governor, an event that supposedly led to rebellion against Austrian rule. He is first mentioned in a chronicle from 1470. The marksman's test is widely found in folklore, and the story has resemblances to the founding myths of other nations.

Tell Asmar See Eshnunna

Tell el-Amarna See Tell el-Amarna

Tell Mardīkh See Ebla

Teller, Edward *orig.* **Ede Teller** (b. Jan. 15, 1908, Budapest, Hung., Austria-Hungary—d. Sept. 9, 2003, Stanford, Calif.) Hungarian-born U.S. nuclear physicist. Born to a prosperous Jewish family, he earned a Ph.D. at the University of Leipzig (1930) before leaving Nazi Germany (1933) and settled in the U.S. in 1935. In 1941 he joined Enrico Fermi's team in the effort to produce the first self-sustaining nuclear reaction, and in 1943 J. Robert Oppenheimer recruited him for the Manhattan Project. At the war's end, Teller advocated development of a fusion bomb, and he won permission after initial government resistance. With Stanislaw Ulam he developed a workable hydrogen bomb in 1952. That same year he helped establish the Lawrence Livermore Laboratory (Livermore, Calif.), which became the chief U.S. factory for nuclear weapons. In 1954 he joined the opposition to Oppenheimer's continued security clearance. A staunch anticommunist, he devoted much energy to his crusade to keep the U.S. ahead of the Soviet Union in nuclear arms; he opposed nuclear weapons treaties, and he was principally responsible for convincing Pres. Ronald Reagan of the need for the Strategic Defense Initiative. In 2003 Teller was awarded the Presidential Medal of Freedom.

Edward Teller.
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Telloh See Lagash

Telugu \'te-lə-ˌgü\ **language** Dravidian language spoken by more than 66 million people in South India and in immigrant communities elsewhere. It is the official language of the state of Andhra Pradesh. The earliest inscription entirely in Telugu is from the 6th century; literary texts begin in the 11th century. The Telugu script, derived from the writing of the Calukya dynasty, is closely akin to Kannada script (see Indic writing systems). Like other major Dravidian languages, Telugu has very marked distinctions between formal or literary and colloquial registers and between social dialects.

telum figure *or* **tellem figure** \'te-ləm\ Small, devotional image carved from wood or stone, probably used in private ancestor worship in primitive societies. Telum figures are known from northwestern New Guinea and in the Dogon art of Sudan. Extant examples are rare, perhaps because they had less intrinsic value than the more carefully executed statues used in formal ceremonies of ancestor worship.

Tempe \'tem-pē, tem-'pē\ City (pop., 2000: 158,625), southwest-central Arizona, U.S. Tempe is located on the Salt River, near Phoenix. First settled in 1872, it was renamed in 1880 for the Vale of Tempe in Greece. After World War II the city experienced rapid residential and economic growth with light-industrial development. Arizona State University (founded 1885), located there, has an auditorium designed by Frank Lloyd Wright.

Tempe \'tem-pē**, Vale of** *Greek* **Témbi** Narrow valley between Mount Olympus and Mount Ossa, northeastern Thessaly, Greece. The Pinios River flows through the 6-mi (10-km) valley before emptying into the Aegean Sea. The ancient Greeks dedicated Tempe to the cult of Apollo. Legends attribute its formation to a blow from Poseidon's trident; however, geologists believe it was carved by stream action. Because it provides access from the coast of Greece to the Thessalian plain, it has been a traditional invasion route. Ruins of castles and fortifications, from the Roman period to the Middle Ages, mark its strong points.

tempera painting Painting executed with ground pigment mixed with a water-soluble material, such as egg yolk, gum, or wax. The special ground for tempera painting is a rigid wood panel coated with thin layers of gesso, a preparation usually made of plaster of Paris and glue. Tempera paint is resistant to water and allows overpainting with more colour; the thin, transparent layers of paint produce a clear, luminous effect. The exclusive medium for panel painting in the Middle Ages and early Renaissance, it was largely superseded in the 15th century by oil paint.

temperament In the psychological study of personality, an individual's characteristic or habitual inclination or mode of emotional response. The notion of temperament in this sense originated with Galen, who developed it from an earlier theory regarding the four "humours": blood, phlegm, and black and yellow bile. The subject was taken up in the 20th century by Ernst Kretschmer and later theorists, including Margaret Mead. Today researchers emphasize physiological processes (including the endocrine and autonomic nervous systems) and culture and learning.

temperament See tuning and temperament

temperance movement International social movement dedicated to the control of alcohol consumption through the promotion of moderation and abstinence. It began as a church-sponsored movement in the U.S. in the early 19th century. It attracted the efforts of many women, and by 1833 there were 6,000 local temperance societies in the U.S. The first European temperance society was formed in Ireland in 1826. An international temperance movement began in Utica, N.Y., U.S., in 1851 and spread to Australia, Asia, Europe, India, South and West Africa, and South America. See also Carry Nation; Prohibition; Woman's Christian Temperance Movement.

temperature Measure of hotness expressed in terms of any of several arbitrary scales, such as Fahrenheit, Celsius, or Kelvin. Heat flows from a hotter body to a colder one and continues to do so until both are at the same temperature. Temperature is a measure of the average energy of the molecules of a body, whereas heat is a measure of the total amount of thermal energy in a body. For example, whereas the temperature of a cup of boiling water is the same as that of a large pot of boiling water (212°F,

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or 100°C), the large pot has more heat, or thermal energy, and it takes more energy to boil a pot of water than a cup of water. The most common temperature scales are based on arbitrarily defined fixed points. The Fahrenheit scale sets 32° as the freezing point of water and 212° as the boiling point of water (at standard atmospheric pressure). The Celsius scale defines the triple point of water (at which all three phases, solid, liquid, and gas, coexist in equilibrium) at 0.01° and the boiling point at 100°. The Kelvin scale, used primarily for scientific and engineering purposes, sets the zero point at ABSOLUTE ZERO and uses a degree the same size as those of the Celsius scale.

temperature inversion In meteorology, an increase of air temperature with altitude. Such an increase is a reversal of the normal temperature condition of the TROPOSPHERE, where temperature usually decreases with altitude. Inversions play an important role in determining cloud forms, precipitation, and visibility. An inversion acts as a lid, preventing the upward movement of the air below it. Where a pronounced inversion is present at a low level, convective clouds cannot grow high enough to produce showers and, at the same time, visibility may be greatly reduced by trapped pollutants (see SMOG). Because the air near the base of the inversion is cool, fog is frequently present there.

tempering HEAT-TREATING of metal ALLOYS, particularly STEEL, to reduce brittleness and restore DUCTILITY. In tempering, steel is slowly heated to a temperature between 300 and 1,300 °F (150 and 700 °C), depending on desired properties, in an oil or salt bath and held for about two hours and then allowed to air cool. As steel is physically worked (e.g., ROLLING, WIREDRAWING, hammering), HARDENING takes place, and it grows progressively more brittle. Similarly, but more deliberately, heating and QUENCHING increase hardness. Combined quench-and-temper heat-treating is applied at many different cooling rates, holding times, and temperatures and is a very important means of controlling the properties of steel.

Tempest, Dame Marie *orig.* **Marie Susan Etherington** (b. July 15, 1864, London, Eng.—d. Oct. 15, 1942, London) British actress. She began her career as an operetta singer, winning acclaim for her charming and high-spirited performances in *Dorothy* (1887) and touring the U.S. and Canada in the early 1890s in operettas such as *The Bohemian Girl* and *The Pirates of Penzance*. Turning to straight comedy in 1899, she appeared notably in *English Nell* (1900), *Mrs. Dot* (1908), and *Hay Fever* (1925).

Tempietto \tem-'pyet-ō\ Small monument built in 1502 to mark the crucifixion spot of St. Peter in Rome. Designed by DONATO BRAMANTE, it is a circular, domed, unadorned masterpiece of High Renaissance architecture. Its outer face is a colonnade of bare Tuscan Doric, the earliest modern use of this ORDER. Because of its proportions, the tiny temple has the majesty of a great monument.

Templar \'tem-plər\ *or* **Knight Templar** Member of a religious military order of knighthood established during the CRUSADES. At its beginning (c. 1119), the group consisted of eight or nine French knights who devoted themselves to protecting from Muslim warriors those on pilgrimage to Jerusalem. They were given quarters near the site of the former TEMPLE OF JERUSALEM, from which they derived their name. Taking vows of poverty and chastity, they performed courageous service, and their numbers increased rapidly, partly because of the propagandistic writing of St. BERNARD DE CLAIRVAUX, who also wrote their rule of life. They flourished for two centuries, expanding to other countries, growing in number to 20,000, and acquiring vast wealth and property. By 1304 rumours, probably false, of irreligious practices and blasphemies had made them the target of persecution. In 1307 PHILIP IV of France and Pope CLEMENT V initiated the offensive that culminated in the Templars' final suppression in 1312, including the confiscation of all their property and the imprisonment or execution of many members; their last leader, Jacques de Molay (1243–1314), was burned at the stake.

temple Edifice constructed for the worship of a deity. Features commonly include a sanctuary and an ALTAR. Ancient Egypt had two kinds of temple: mortuary temples for the cults of dead kings, with a chapel in which offerings were presented, and cult temples that held images of deities. The cult temple typically included a massive PYLON entrance with a court leading to a HYPOSTYLE hall and, at the heart of the temple, a shrine for the cult image. Most Classical Greek temples were rectangular and built of marble or other stone on a low stylobate (stepped platform). A gable roof was supported by columns, with a portico at each end (amphiprostyle temple), a colonnade extending all around (peripteral temple), or a double line of columns all around (dipteral temple). An inner CELLA housed the image of a deity, and an altar stood outside the temple. Roman temples were profoundly influenced by Greek style, but the altar was inside the temple and the colonnade was often reduced to a row of engaged columns. Hindu temples vary regionally, but generally consist of a towering shrine and a columned hall surrounded by an elaborate wall. Buddhist temples range from half-buried sanctuaries with richly carved entrances to single carved towers or statues. The Chinese and Japanese Buddhist temple is typically a one-story building of richly carved, painted, or tiled timber constructed around an atrium used for worship, though towering PAGODAS were sometimes built as temples over a shrine. In the Americas, Inca and Mayan temples were constructed of stone, often richly carved; they were generally stair-stepped pyramids, with the shrine at the top. See also SYNAGOGUE.

Temple, Shirley *later* **Shirley Temple Black** (b. April 23, 1928, Santa Monica, Calif., U.S.) U.S. child actress. She was selected from her dancing class for a screen test and made her debut at age four. She won notice in *Stand Up and Cheer* (1934) and was featured in *Little Miss Marker* (1934) and *Bright Eyes* (1934), in which she sang "On the Good Ship Lollipop." A precocious performer known for her dimples and golden curls, she became the country's most popular female star and Hollywood's top box office attraction in the Great Depression era. She received a special Academy Award in 1934. Her later films include *The Little Colonel* (1935), *Wee Willie Winkie* (1937), and *The Little Princess* (1939). As an adult she served as a U.S. delegate to the UN General Assembly (1969–70) and as U.S. ambassador to Ghana (1974–76) and Czechoslovakia (1989–92).

Shirley Temple.
BROWN BROTHERS

Temple, Sir William (b. April 25, 1628, London, Eng.—d. Jan. 27, 1699, Moor Park, Surrey) British statesman. As ambassador to The Hague (1668–70, 1674–79), he formulated England's pro-Dutch foreign policy and arranged the marriage between William of Orange and Princess Mary of England (later WILLIAM III and MARY II). After retiring from politics in 1681, he wrote numerous essays that were collected for publication by his secretary, JONATHAN SWIFT. He also wrote the acclaimed *Observations upon the United Provinces* (1673).

Temple of Heaven Large religious complex in the old outer city of Beijing, considered the supreme achievement of traditional Chinese architecture. Its layout symbolizes the belief that heaven is round and earth square. The three buildings are built in a straight line. The Hall of Prayer for Good Harvests (1420) has three concentric circles of massive wood columns symbolizing the four seasons, 12 months, and 12 daily hours; in a remarkable feat of engineering, they support the three roof levels and, in succession, a huge square brace (earth), circular architrave (heaven), and vast interior cupola. The Imperial Vault of Heaven (1530; rebuilt 1572) is a smaller circular building constructed without crossbeams; its dome is supported by complicated span work. The Circular Mound Altar (1530; rebuilt 1749) is a triple-tiered white stone terrace enclosed by two sets of walls that are square outside and round inside.

Ashura, dry lacquer (*kanshitsu*) sculpture in the Tempyō style, Late Nara period (724–794); in the Kōfuku-ji, Nara, Japan
ASUKA-EN, JAPAN

Tempyō style \'temp-yō\ Japanese sculptural style of the NARA period (710–784), greatly influenced by the Chinese imperial style of the

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Tang dynasty (618–907). Many supreme sculptural achievements of Japanese Buddhist art were created during this era, often in unbaked clay, solid wood, and lacquered cloth molded on a removable core (a technique called *kanshitsu*, or dry lacquer). Tempyō style shows a closer fusion of parts into a unified whole than is found in works of the Early Nara period, giving a sense of activity and realistic observation; the new realism is especially notable in portrait sculpture.

Ten Commandments List of religious precepts sacred in Judaism and Christianity. They include injunctions to honour God, the Sabbath, and one's parents, as well as bans on idolatry, blasphemy, murder, adultery, theft, false witness, and covetousness. In the book of Exodus, they are divinely revealed to Moses on Mount Sinai and engraved on two stone tablets. Most scholars propose a date between the 16th and 13th century BC for the commandments, though some date them as late as 750 BC. They were not regarded with deep reverence by Christians until the 13th century.

Ten Thousand Smokes, Valley of Volcanic region, southern Alaska, U.S. Located in Katmai National Park and Preserve, the valley covers 56 sq mi (145 sq km). It was created in 1912 when the eruption of the Novarupta and Mount Katmai volcanoes covered the valley in a flow of lava. When an expedition visited the site in 1916, it discovered tens of thousands of fissures known as fumaroles spouting smoke, gas, and steam in the valley floor. The largest was 150 ft (46 m) in diameter; some had temperatures as high as 1,200 °F (649 °C). About 60 years later there were fewer than 12 fumaroles left. In the 1960s U.S. astronauts used the scarred region to train for Moon landings.

tenant See landlord and tenant

tenant farming Agricultural system in which landowners rent their land to farmers and receive either cash or a share of the product in return. Landowners may also contribute operating capital and management. Under one arrangement, known as sharecropping, the landowner furnishes all the capital and sometimes the food, clothing, and medical expenses of the tenant and may also supervise the work. The sharecropper then pays the landowner with a portion of the output grown on the land. In other forms of tenant farming, the tenant may furnish all the equipment and have substantial autonomy in the farm's operation. Tenants and their families probably constitute two-fifths of the world's population engaged in agriculture. Tenant farming can be highly efficient, as has been shown in England and Wales. Abuses occur when landowners' power is excessive and the tenants are poor or of inferior social status.

Tendai See Tiantai

tendinitis *or* **tendonitis** \ˌten-dᵊn-ˈī-təs\ Inflammation of a tendon sheath, due to irritation of this thin, filmy tissue by overuse of the tendons, which slide within them, or to bacterial infection. It is often an occupational disease, affecting tendons used in repetitive motions on the job. The tendon becomes swollen and red, with pain that increases on motion. The swelling hampers the tendon's sliding within, causing stiffness. Treatment involves immobilization with a splint, cast, or bandage and gradually increasing motion after inflammation subsides, which may happen sooner with corticosteroid injections. Repeated episodes can permanently thicken the sheath, limiting motion.

tendon Tissue attaching a muscle to other body parts, usually bones, to transmit the mechanical force of muscle contraction to the other part. Much like ligaments, tendons are composed of dense, fibrous connective tissue with a high collagen content, which makes them remarkably tough and strong, with great tensile strength to withstand the stresses generated by muscle contraction.

tendril Plant organ specialized to anchor and support vining stems. A tendril is a slender, whiplike or threadlike strand, produced usually from the node of a stem and composed of either stem or leafstalk tissue, by which a vine or other plant may climb. Sensitive to contact, the tendril turns toward any object it brushes against, wraps about it, and clings to it for as long as the stimulation persists. Later, strong mechanical tissue develops in the tendrils, making them strong enough to support the weight of the plant. Some tendrils have enlargements at the ends that flatten and produce an adhesive that firmly cements them to their support. Common examples of tendril plants are grape, English ivy, sweet pea, gourds, and passionflowers.

Tenerife, Pico de See Pico de Teide

Teng Hsiao-p'ing See Deng Xiaoping

Teniers \tə-ˈnirs, tā-ˈnyā**, David** (baptized Dec. 15, 1610, Antwerp, Belg.—d. April 25, 1690, Brussels) Flemish painter. His father, also named David Teniers (1582–1649), was a painter of primarily religious subjects. The younger Teniers was highly prolific and is best known for his genre scenes of peasant life, many of which were used for tapestry designs in the 18th century. He was brilliant at handling crowd scenes in an open landscape and adept at characterizing his figures with a warm, human, and often humorous touch. As court painter to the archduke Leopold William, he also made many small-scale copies of paintings in the archduke's collection; engraved and published as *Theatrum Pictorium* (1660), they constitute a valuable source as a pictorial inventory of a great 17th-century collection.

Tennessee State (pop., 2000: 5,689,283), southeast-central U.S. It occupies 42,144 sq mi (109,153 sq km); its capital is Nashville. It is bordered by Kentucky and Virginia to the north, North Carolina to the east, Alabama and Mississippi to the south, and Arkansas and Missouri to the west. The Great Smoky Mountains edge the eastern part of the state, while the Mississippi River is on its western boundary. The Tennessee River valley dominates much of the state, and the Tennessee Valley Authority is the nation's largest electric-power generating system. Tennessee has a moderate climate; about half of it is forested. American Indians, including Chickasaw, Cherokee, and Shawnee, inhabited the region when Spanish, French, and English explorers visited it in the 16th–17th centuries. It was included in the British charter of Carolina and in the French Louisiana claim and was ceded to Great Britain after the French and Indian War. The first permanent settlement was made c. 1770. It was part of North Carolina until 1785, when the area's settlers broke away and formed the free state of Franklin. North Carolina relinquished its claim in 1789, and Tennessee became the 16th U.S. state in 1796. In 1861 it seceded from the Union; the hard-fought American Civil War battles of Shiloh, Chattanooga, Stones River, and Nashville occurred there. In 1866 it was the first state readmitted to the Union. During the Reconstruction era, blacks lost what little power they had gained. After World War II Tennessee became a testing ground for those involved in the civil rights movement. The state's economy is based on manufacturing.

Tennessee River Navigable river, Tennessee, northern Alabama, and western Kentucky, U.S. Formed by the confluence of the Holston and French Broad rivers in eastern Tennessee, it flows 652 mi (1,049 km) before joining the Ohio River in Kentucky. During the American Civil War it served as a strategic invasion route into the western Confederacy. Its development as one of the world's greatest irrigation and hydropower systems began with the establishment in 1933 of the Tennessee Valley Authority. The Tennessee River is linked to the Tombigbee River by the Tennessee-Tombigbee Waterway.

Tennessee Valley Authority (TVA) U.S. government agency established in 1933 to control floods, improve navigation, and generate electrical power along the Tennessee River and its tributaries. The TVA is a public corporation governed by a board of directors. It has jurisdiction over the entire basin of the river, which covers parts of seven states: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. Created by Congress as one of the major public-works projects of the New Deal, the TVA built a system of dams to control the region's chronic flooding, deepened the channel to improve navigation, and encouraged the development of port facilities along the river. The projects greatly increased traffic on the river and provided cheap electricity, spurring the industrial development of what had been a chronically depressed regional economy. See also Public Works Administration.

Tennessee Walking Horse *or* **Plantation Walking Horse** Breed of light horse with a distinctive, easy-to-sit gait, the running walk. It was developed for touring U.S. Southern plantations. It averages 15.2 hands (61 in. [154 cm]) high and weighs about 1,000 lb (450 kg). Coat colour varies. Its ancestors included any horse capable of a running walk, a natural gait that cannot be acquired, but the most influential stallion was a Standardbred. The running walk, faster than a flat-footed walk, is a low, gliding, reaching action; the front foot strikes the ground an instant before the diagonal hind foot, which then oversteps the front footprint by several inches.

Tenniel \ˈten-yəl**, Sir John** (b. Feb. 28, 1820, London, Eng.—d. Feb. 25, 1914, London) British illustrator and satirical artist. After attracting attention with his mural decorations, he was invited to contribute drawings to *Punch* magazine in 1850 and in time became its chief cartoonist.

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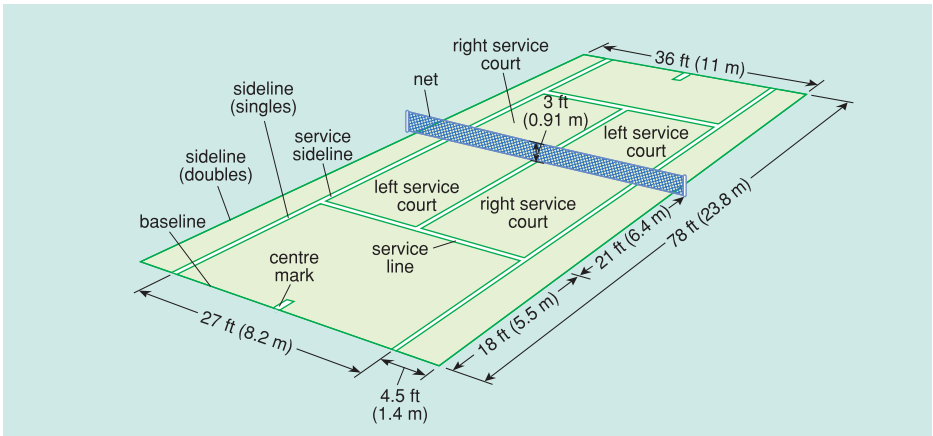
His drawings lent new dignity to the political cartoon. Of his many book illustrations, best known are those for Lewis Carroll's *Alice's Adventures in Wonderland* (1865) and *Through the Looking-Glass* (1872), which are remarkable for their subtlety and cleverness.



A professional tennis court. The person serving stands behind the baseline, alternately to the right and left of the center mark, and must land the ball alternately in the opposite left and right service court. A narrower portion of the court is used in singles tennis (one person on a side) than in doubles (two people on a side), though the size of the service court does not change. In doubles, the two partners alternate in serving, but both may otherwise roam freely over the entire court.
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tennis Game played with rackets and a light, elastic ball by two players or pairs of players on a rectangular court divided by a low net. Tennis is played indoors and outdoors, on hard-surface, clay, and grass courts. The object is to hit the ball over the net and into the opponent's half of the court in such a way as to defeat the opponent's attempt to reach and return it. Each player serves for an entire game. Points are scored as 15, 30, 40, and game (the term "love" is used for 0). A tied score ("deuce") requires continued play until a two-point margin is achieved. The first player to win six games, with a lead of two games, takes the set. A match consists of the best two out of three (or three out of five) sets. Since the early 1970s, tiebreakers have been employed to eliminate marathon sets. Tennis developed in the 1870s in Britain from earlier racket-and-ball games. The first world lawn-tennis championship was held in 1877 at Wimbledon; clay- and hard-court competitions emerged later. Current international team tournaments include the Davis Cup for men and the Federation Cup (since 1963) for women's teams. The major tournaments for individual players constitute the "Grand Slam" of tennis: the national championships of Britain (Wimbledon), the U.S., Australia, and France.

Tennis Court Oath (June 20, 1789) Oath taken by deputies of the Third Estate in the French Revolution. Believing that their newly formed National Assembly was to be disbanded, the deputies met at a nearby tennis court when they were locked out of their usual meeting hall at Versailles. They vowed never to separate until a written constitution was established for France. Their solidarity forced Louis XVI to order the clergy and the nobility to join with the Third Estate in the National Assembly.

Tennyson \'te-nə-sən**, Alfred, 1st Baron Tennyson (of Aldworth and Freshwater)** *known as* **Alfred, Lord Tennyson** (b. Aug. 6, 1809, Somersby, Lincolnshire, Eng.—d. Oct. 6, 1892, Aldworth, Surrey) English poet, the leading poet of the Victorian age. While attending Cambridge University, Tennyson developed a deep friendship with Arthur Hallam. His reputation as a poet increased at Cambridge, and he published *Poems, Chiefly Lyrical* (1830). Another volume, including "The Lotos-Eaters" and "The Lady of Shalott," was published in 1832 (dated 1833). Hallam's sudden death in 1833 prompted Tennyson to write poems that eventually became part of the vast *In Memoriam* (1850) and lyrics that later appeared in the brooding *Maud* (1855), his favourite poem. *Poems* (1842), including "Ulysses," "Morte d'Arthur," and "Locksley Hall," followed, then *The Princess* (1847), a long antifeminist fantasia that includes such lyrics as "Sweet and Low" and "Tears, Idle Tears." In 1850 he married; that year he was also named poet laureate of England. Among his subsequent works are "The Charge of the Light Brigade" (1855); *Idylls of the King* (1859), treating the Arthurian legend; and *Enoch Arden* (1864). A consummate poet who was inclined to melancholy, Tennyson was also regarded as a spokesman for the educated English middle class. His works often dealt with the difficulties of an age when traditional assumptions were increasingly called into question by science and modern progress.

Tenochtitlán \tā-ˌnȯch-tēt-ˈlän\ Ancient capital of the Aztec empire. Located at the site of modern Mexico City, it was founded c. 1325 in the marshes of Lake Texcoco. It formed a confederacy with Texcoco and Tlacopán and was the Aztec capital by the late 15th century. Originally located on two small islands in Lake Texcoco, it gradually spread through the construction of artificial islands to cover more than 5 sq mi (13 sq km). It was connected to the mainland by several causeways. The population in 1519 was estimated to be about 400,000 people, the largest residential concentration in Mesoamerican history. It contained the palace of Montezuma II, said to consist of 300 rooms, as well as hundreds of temples. It was destroyed by the Spanish conquistadores under Hernán Cortés in 1521.

tenor High male voice range, extending from about the second B below middle C to the G above it. In the polyphony of the 13th–16th centuries, the tenor was the part that held (Latin, *tenere*: "to hold") the cantus firmus. Tenor voices are often classified as dramatic, lyric, or heroic (heldentenor). In instrument families, tenor refers to the instrument in which the central range is roughly that of the tenor voice (e.g., tenor saxophone).

tenor tuba See euphonium

tenpounder See ladyfish

Tenrikyo \'ten-rē-ˌkyō\ Largest and most successful of the modern Shinto sects in Japan. Its founder, Nakayama Miki (1798–1887), was a charismatic peasant who, at age 40, claimed to be possessed by a god of divine wisdom. She developed a form of worship characterized by ecstatic dancing and shamanistic practices, and a doctrine emphasizing charity and the healing of disease through mental acts of faith. Her writings and deeds were considered divine models. Tenrikyo was one of the most powerful religious movements in Japan immediately after World War II, and its membership reached about 2.5 million in the late 20th century.

tense In grammar, an inflected form of a verb indicating the time of a narrated event in relation to the time at which the narrator is speaking. Time is often perceived as a continuum with three main divisions, past, present, and future, defined in relation to the time when the event is described. Other categories, including mood and aspect, may further specify the action as definite or indefinite, completed or not completed, lasting or nonlasting, and recurring or occurring once.

tensile \'ten-səl\ **strength** Ratio of the maximum load a material can support without fracture when being stretched to the original area of a cross section of the material. When stresses less than the tensile strength are removed, a material completely or partially returns to its original size and shape. As the stress approaches that of the tensile strength, a material that has begun to flow forms a narrow, constricted region that is easily fractured. Tensile strengths are measured in units of force per unit area. See also deformation and flow.

Tenskwatawa See The Prophet

tensor analysis Branch of mathematics concerned with relations or laws that remain valid regardless of the coordinate system used to specify the quantities. Tensors, invented as an extension of vectors, are essential to the study of manifolds. Every vector is a tensor, but tensors are more general and not easily pictured as geometrical objects. A tensor can be thought of as an abstract object defined as a set of components (like geometric coordinates) that, under a transformation of coordinates, undergo a specific type of transformation. While tensors were explored before

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Albert Einstein, the success of his general theory of relativity led to their widespread exploration and use by mathematicians and physicists.

tent caterpillar Any moth larva of the genus *Malacosoma* (family Lasiocampidae). Tent caterpillars are often brightly coloured. Congregations of the eastern tent caterpillar (*M. americanum*) of eastern North America spin huge, tent-shaped communal nests in forked tree branches. Eggs the moth deposits on a tree in midsummer hatch in spring. The hatched caterpillars migrate to a tree crotch and construct a silken tent, which they leave each day throughout the summer to feed on the surrounding leaves. The forest tent caterpillar (*M. disstria*) is common in the southern U.S.

tent structure Building that uses masts or poles and tensile membrane (e.g., fabric or animal skin) enclosures. Tent structures are prestressed by externally applied forces so that they are held taut under anticipated load conditions. Tents have been the dwelling places of most of the world's nomadic peoples, from ancient times until the present. The traditional Bedouin tent consists of a rectangular membrane of strips of woven camel hair that is strained on webbing straps and secured with guys over a rectangle of poles. The American Plains Indians developed the conical tepee. The Central Asian nomadic pole dwelling, or yurt, uses skins and textiles as its covering. See also membrane structure, pole construction.

Tenure of Office Act (1867) Law forbidding the U.S. president to remove civil officers without the consent of the Senate. Passed by the Radical Republicans over the veto of Pres. Andrew Johnson, the measure sought to prevent Johnson from removing cabinet members who supported Congress's harsh Reconstruction policies. When Johnson tried to dismiss his secretary of war, Edwin M. Stanton, an ally of the Radical Republicans, Congress began impeachment proceedings against him. The law was partially repealed in 1869 and completely repealed in 1887; in 1926 it was found unconstitutional.

Tenzing Norgay \'ten-ˌziŋ-'nȯr-gē\ (b. May 15, 1914, Tshechu, Tibet [now Tibet Autonomous Region, China]—d. May 9, 1986, Darjeeling [now Darjiling], India) Tibetan Sherpa mountaineer. Tenzing served on numerous expeditions before joining Edmund Hillary as sirdar, or organizer of porters. In 1953 he and Hillary became the first two people to reach the summit of Mount Everest. A devout Buddhist, Tenzing left an offering of food at Everest's summit.

teosinte \ˌtā-ō-'sin-tē\ Tall, stout, annual grass (*Zea mexicana* or *Euchlaena mexicana*) of the family Poaceae (or Gramineae), native to Mexico. Related to corn, teosinte grows in large clumps, producing bundles of fruiting spikes enclosed in husks and with silk hanging from the upper ends, similar to corn ears. Species of corn have recently been crossed with teosinte to produce a perennial variety of corn.

Teotihuacán \ˌtā-ō-ˌtē-wä-'kän\ Largest (though not most populous) city of pre-Columbian central Mexico, about 30 mi (50 km) northeast of modern Mexico City. Teotihuacán wielded its greatest influence in the first 900 years AD, after which it was sacked by the Toltecs. At its height, some 150,000 people lived in the city, which covered about 8 sq mi (21 sq km). Its plazas, temples, and palaces are dominated by the Pyramid of the Moon and the huge Pyramid of the Sun. Teotihuacán was the capital of one of the earliest Mesoamerican civilizations, and some consider it also to have been the centre of Toltec civilization. See also Tula.

Tepe Gawra \'te-pā-gaù-'rä\ Ancient city, Mesopotamia. Located near present-day Mosul, Iraq, it was continuously occupied from the mid-6th to the mid-2nd millennium BC and gave its name to the Gawra Period (c. 3500–2900 BC). Its remains include the earliest known temple decorated with pilasters and recesses, a style that remained dominant in Mesopotamia for centuries. Its archaeological record illustrates the transition from early Stone Age farming villages to complex settlements.

Tepe Yahya \'te-pā-'yä-yä\ Ancient trading city, southeastern Iran. Almost continuously occupied in the 5th–3rd millennia BC, it flourished as a centre for the production and distribution of soapstone before being abandoned during the 2nd millennium. It was reoccupied from c. 1000 BC to c. AD 400.

tepee *or* **tipi** Tall tent dwelling used by the Plains Indians. It was suited to their nomadic life of buffalo hunting, because it could be easily folded and dragged by a horse. It was made by stretching dressed and fitted buffalo skins over a skeleton of 20–30 wooden poles, all slanted in toward a central point and tied together near the top. A flap at the top allowed smoke to escape, and a flap at the bottom served as a doorway. The tepee became a popular symbol of all American Indians, although the wigwam, wickiup, hogan, igloo, and longhouse were at least as important.

Tepees in Banff, Alta., Can.
ALPHA

Tepic \tā-'pēk\ City (pop., 2000: 265,817), capital of Nayarit state, west-central Mexico. It lies along the Tepic River, at the foot of an extinct volcano. Founded in 1542, much of the city retains a Spanish colonial atmosphere. Its isolation limited its growth until construction of the railroad in 1912; since then it has become a commercial, industrial, and agricultural centre. Nearby are Toltec ruins.

tequila \tə-'kē-lə\ Distilled liquor, usually clear in colour and unaged, made from the fermented juice of the Mexican agave plant. (See agave family.) It contains 40–50% alcohol. It was developed soon after the Spaniards brought distillation to Mexico, and is named for the town of Tequila. It is mixed with lime juice and orange liqueur to make the margarita cocktail, which is served in a glass rimmed with salt. Mescal, a stronger-flavoured liquor, is made from a wild agave from Oaxaca.

Terborch \tər-'bȯrk\ *English* \tər-'bȯrk**, Gerard** *or* **Gerard ter Borch** (b. 1617, Zwolle, Neth.—d. Dec. 8, 1681, Deventer) Dutch painter. After travels in England, Italy, Westphalia, and Spain, he returned home in 1648 and settled in Deventer in 1654. His works consist almost equally of portraits and genre paintings. By subtlety of tonal gradations and mastery of rendering diverse textures, he achieved extraordinarily rich effects with the clothing in his portraits. His superb colour sense is seen to advantage in his interior genre pieces, in which he depicted with grace and fidelity the atmosphere of well-to-do middle-class life in 17th-century Holland.

Terbrugghen \tər-'brü-gən**, Hendrik** *or* **Hendrick ter Brugghen** (b. c. 1588, Deventer?, Neth.—buried Nov. 9, 1629, Utrecht) Dutch painter. He reportedly spent 10 years in Italy, and on his return to Utrecht in 1615 his work showed the strong influence of Caravaggio. His two versions of *The Calling of St. Matthew* (c. 1617, 1621) reflect knowledge of Caravaggio's treatment of the same subject. He is most indebted to Caravaggio for his chiaroscuro, though his own light is more atmospheric and silvery, as in *The Flute Player* (1621). His masterpiece is *St. Sebastian Attended by Irene and Her Maid* (1625). With Gerrit van Honthorst, he was a leader of the Utrecht school.

"The Flute Player," oil painting by Terbrugghen, 1621; in the Staatliche Kunstsammlungen, Kassel, Ger.
COURTESY OF THE STAATLICHE KUNSTSAMMLUNGEN, KASSEL, GER.

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Terence *orig.* **Publius Terentius Afer** (b. c. 195, Carthage, North Africa—d. 159? BC, in Greece or at sea) Roman comic dramatist. Born as a slave, he was taken to Rome, where he was educated and later freed. His six extant verse plays are *The Woman of Andros*, *The Mother-in-Law*, *The Self-Tormentor*, *The Eunuch*, *Phormio*, and *The Brothers*. Produced between 166 and 160 BC, they were based on Greek originals (including four by MENANDER); Terence eliminated their original prologues, used contemporary colloquial Latin, and introduced a measure of realism. He influenced later dramatists such as MOLIÈRE and WILLIAM SHAKESPEARE.

Teresa (of Calcutta), Blessed Mother *orig.* **Agnes Gonxha Bojaxhiu** (b. Aug. 27, 1910, Skopje, Maced., Ottoman Empire—d. Sept. 5, 1997, Calcutta, India; beatified Oct. 19, 2003) Roman Catholic nun, founder of the Order of the Missionaries of Charity. The daughter of a grocer, she became a nun and went to India as a young woman. After studying nursing, she moved to the slums of Calcutta (Kolkata); in 1948 she founded her order, which served the blind, the aged, the disabled, and the dying. In 1963 the Indian government awarded her the Padmashri ("Lord of the Lotus") for her services to the people of India, and in 1971 Pope PAUL VI awarded her the first Pope John XXIII Peace Prize. In 1979 she received the Nobel Prize for Peace. Although in her later years she suffered from a worsening heart condition, Mother Teresa continued to serve the poor and sick and also spoke out against divorce, contraception, and abortion. Her order included hundreds of centres in more than 90 countries, with some 4,000 nuns and hundreds of thousands of lay workers. She was succeeded by the Indian-born Sister Nirmala. The process to declare her a saint began within two years of her death, and Pope JOHN PAUL II issued a special dispensation to expedite the process. She was beatified on Oct. 19, 2003, reaching the ranks of the blessed in the shortest time in the church's history.

Teresa of Ávila, Saint *orig.* **Teresa de Cepeda y Ahumada** (b. March 28, 1515, Ávila, Spain—d. Oct. 4, 1582, Alba de Tormes; canonized 1622; feast day October 15) Spanish CARMELITE nun, mystic, and saint. After entering a convent around the age of 20, she fell seriously ill. She underwent a religious awakening in 1555 and, despite her frail health, initiated the Carmelite Reform, leading the order's return to its original austere practices, including poverty and seclusion from the world. Against some opposition, she opened new convents (the first in 1562) under the reformed order throughout Spain. St. JOHN OF THE CROSS joined her in her efforts, establishing reformed Carmelite monasteries. Her doctrines have been accepted as the classical exposition of the contemplative life, and her spiritual writings are still widely read today, among them *The Interior Castle* (1588). In 1970 she became the first woman elevated to the position of Doctor of the Church.

Tereshkova \ˌter-əsh-ˈkô-və**, Valentina (Vladimirovna)** (b. March 6, 1937, Maslennikovo, Russia, U.S.S.R.) Russian cosmonaut. An accomplished parachutist, she was accepted for the cosmonaut program in 1961. In 1963 she became the first woman in space, making 48 orbits in 71 hours aboard VOSTOK 6. She left the program after her flight and served in various governmental positions until the early 1990s. She was named a hero of the Soviet Union and twice awarded the Order of Lenin.

Terkel \ˈtər-kəl**, Studs** *orig.* **Louis Turkel** (b. May 16, 1912, New York, N.Y., U.S.) U.S. radio personality and author. He moved with his family to Chicago when he was eight. Terkel gave up a legal career to become a radio disk jockey and interviewer, exposure that led to his own television show in 1950. In 1953, blacklisted from television for his leftist leanings, he returned to radio, continuing at the same station for 45 years. His books include *Division Street* (1967), about Chicago; *Hard Times* (1970), about the Depression; *Working* (1974), on Americans and their jobs; *The Good War*, on World War II (1984, Pulitzer Prize); and *Race* (1992), on American feelings about race.

Terman, Lewis M(adison) (b. Jan. 15, 1877, Johnson county, Ind., U.S.—d. Dec. 21, 1956, Palo Alto, Calif.) U.S. psychologist. After joining the faculty of Stanford University in 1910, he revised the Binet-Simon intelligence scale and published the Stanford-Binet IQ test (1916), which soon was widely adopted in the U.S. During World War I he developed group intelligence testing for the U.S. Army, and in 1921 he launched a long-term program for the study of gifted children. He wrote *The Measurement of Intelligence* (1916) and coauthored *Genetic Studies of Genius* (5 vol., 1926–59).

termite Any of 1,900 species (order Isoptera) of mostly tropical, social, cellulose-eating insects that are usually soft-bodied and wingless. Intestinal microorganisms enable them to digest cellulose. Termite colonies consist of a fertile queen and king (reproductives), workers (the most numerous), and soldiers (see CASTE). Kings are less than an inch long (1–2 cm), but a queen may grow to more than 4 in. (11 cm). Workers and soldiers are sterile and blind. They survive two to five years; reproductives may live for 60–70 years. Termites live in a sealed, humid nest in wood or underground. Underground nests may be built up into a mound. Periodically, alates (winged, sighted forms) develop and leave the nest to start a new colony. Termites eat chiefly wood. Soil-dwelling termites attack wood that is in contact with the ground; wood-dwelling termites, requiring less humidity than soil-dwellers, attack trees, posts, and wooden buildings.

tern Any of about 40 species (subfamily Sterninae, family Laridae) of slender, web-footed, migratory water birds found almost worldwide. Species vary from 8 to 22 in. (20–55 cm) long. The plumage is white, black-and-white, or black; the sharply pointed bill is black, red, or yellow; and the feet are red or black. Most species have long, pointed wings and a forked tail. Terns plunge into the water to catch crustaceans and fishes. They breed colonially, usually on the ground on islands. See also ARCTIC TERN.

terneplate \ˈtərn-ˌplāt\ STEEL sheet with a coating of terne metal, an alloy of LEAD and TIN applied by dipping the steel in molten metal. The lead content gives terneplate a dull appearance, a noncorrosive surface, and solderability. The tin (12–50% of the alloy) wets the steel, making possible the union of lead and iron, which would otherwise not alloy. While it is still used for roofing, gutters and downspouts, casket linings, gasoline tanks, oil cans, and various containers, it has largely been replaced by other, more durable steel products that are easier to manufacture. See also GALVANIZING, TINPLATING.

terpene See ISOPRENOID

terra-cotta *Italian* **"baked earth"** Fairly coarse, porous clay that, when fired, assumes a colour ranging from dull ochre to red. Terra-cotta objects are usually left unglazed and are often of a utilitarian kind, because of their cheapness, versatility, and durability. Small terra-cotta figures from 3000 BC have been found in Greece and others throughout the Roman Empire from the 4th century BC. The use of terra-cotta virtually died out when the Roman Empire collapsed, but it was revived in Italy and Germany in the 15th century.

"Virgin and Child," polychromed and gilded terra-cotta relief by Andrea del Verrocchio, c. 1470; in the Metropolitan Museum of Art, New York City.
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, ROGERS FUND, 1909

Terranova Pausania See OLBIA

terrapin Any omnivorous aquatic TURTLE of the family Emydidae, especially the diamondback terrapin (*Malaclemys terrapin*). The diamondback inhabits salt marshes and coasts from New England to the Gulf of Mexico. It has raised diamond-shaped patterns on its brownish or black upper shell. The female attains a shell length of about 9 in. (23 cm); the male grows to about 6 in. (14 cm). The eight species of the turtle genus *Pseudemys* (or *Chrysemys*) are sometimes referred to as terrapins. They inhabit freshwaters from the northeastern U.S. to Argentina. The female's shell is 6–16 in. (15–40 cm) long. Infant red-eared turtles (*P. scripta elegans*) are sold in pet shops.

Red-eared turtle (*Pseudemys scripta elegans*).
LEONARD LEE RUE III FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

terrazzo \tə-ˈrät-sō, tə-ˈra-zō\ Type of flooring consisting of marble chips set in cement or epoxy resin that is poured and ground smooth when dry. Terrazzo was ubiquitous in the 20th century in commercial and institutional buildings. Available in many colours, it forms a hard, smooth, durable surface that is easily cleaned.

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terrier Any of several dog breeds developed, mostly in England, to find and kill vermin and for use in the sports of foxhunting and dog fighting. Bred to fight and kill, they often were pugnacious but are now bred for a friendlier temperament. Because terriers had to fit in rodent burrows, most breeds are small and lean and have a rough, wiry coat that requires little maintenance. They have a long head, square jaw, and deep-set eyes. All terriers are vocal and inclined to chase and confront. Most breeds were named for the place where they were developed. See also AIREDALE terrier, BEDLINGTON terrier, BOSTON TERRIER, BULL TERRIER, DANDIE DINMONT terrier, FOX TERRIER, IRISH TERRIER, PIT BULL TERRIER, SCOTTISH TERRIER, YORKSHIRE TERRIER.

territorial behaviour In zoology, the actions by which an animal, or group of animals, protects its territory from incursions by others of its species. Territorial boundaries may be marked by sounds (e.g., BIRDSONG), scents, or even piles of dung. If such advertisement does not discourage intruders, chases and fighting follow. Territories may be seasonal (usually for nesting and feeding the young) or maintained permanently (for hunting and living). Territorial behaviour benefits the species by permitting mating and rearing young without interruption and by preventing overcrowding and minimizing competition for food.

territorial waters Waters under the sovereign jurisdiction of a nation or state, including both marginal sea and inland waters. The concept originated in the 17th-century controversy over the status of the sea. Though the doctrine that the sea must be free to all was upheld, a nation's jurisdiction over its coastal waters was also recognized. Nations subscribing to the Law of the SEA observe a territorial limit of 12 nautical mi (22 km) from shore. Territorial rights include the airspace above those waters and the seabed below them. See also HIGH SEAS.

Terror, Reign of See REIGN OF TERROR

terrorism Systematic use of violence to create a general climate of fear in a population and thereby to bring about a particular political objective. It has been used throughout history by political organizations of both the left and the right, by nationalist and ethnic groups, and by revolutionaries. Although usually thought of as a means of destabilizing or overthrowing existing political institutions, terror also has been employed by governments against their own people to suppress dissent; examples include the reigns of certain Roman emperors, the French Revolution (see REIGN OF TERROR), Nazi Germany, the Soviet Union under Stalin, and Argentina during the "dirty war" of the 1970s. Terrorism's impact has been magnified by the deadliness and technological sophistication of modern-day weapons and the capability of the media to disseminate news of such attacks instantaneously throughout the world. The deadliest terrorist attack ever occurred in the United States on Sept. 11, 2001 (see SEPTEMBER 11 ATTACKS), when members of AL-QAEDA terrorist network hijacked four commercial airplanes and crashed two of them into the twin towers of the WORLD TRADE CENTER complex in New York City and one into the PENTAGON building near Washington, D.C.; the fourth plane crashed near Pittsburgh, Pa. The crashes resulted in the collapse of much of the World Trade Center complex, the destruction of part of the southwest side of the Pentagon, and the deaths of some 3,000 people.

Terry, Eli (b. April 13, 1772, East Windsor, Conn.—d. Feb. 26, 1852, Plymouth, Conn., U.S.) U.S. clockmaker. He made a specialty of one-day wooden shelf clocks, especially his "perfected wood clock" known as the Terry clock (1814). Using interchangeable parts made by mechanized techniques, production at his Plymouth factory rose to as high as 10,000–12,000 Terry clocks per year.

Terry, (Alice) Ellen (b. Feb. 27, 1847, Coventry, Warwickshire, Eng.—d. July 21, 1928, Small Hythe, Kent) English actress. Born into a family of actors, she made her stage debut at age nine. She acted with several companies before joining HENRY IRVING as his leading lady (1878–1902), playing a variety of Shakespearean roles in a notable partnership. Her warmth, gentleness, and beauty made her one of the most popular actresses in Britain and the U.S., and she continued to act until 1925. She conducted a famous correspondence with the playwright GEORGE BERNARD SHAW. The actor, stage designer, and drama theorist GORDON CRAIG was her son.

Tertiary \'tər-shē-ˌer-ē\ **Period** Interval of geologic time, 65–1.8 million years ago. It constitutes the first of the two periods of the CENOZOIC ERA, the second being the QUATERNARY. The Tertiary has five subdivisions: (from oldest to youngest) the PALEOCENE, EOCENE, OLIGOCENE, MIOCENE, and PLIOCENE epochs. During most of the Tertiary, the spatial distribution of the major continents was largely similar to that of today. Emergence and submergence of land bridges between continents critically affected the distribution of both terrestrial and marine animals and plants. Virtually all the existing major mountain ranges were formed either partly or wholly during the Tertiary.

Tertullian \tər-'təl-yən\ (b. c. 155/160, Carthage—d. after 220, Carthage) Early Christian theologian and moralist. Educated in Carthage, he became impressed by the courage, morality, and uncompromising monotheism of Christian martyrs, and he converted to Christianity. He became a leading member of the African church and one of the early APOLOGISTS. He devoted himself to writing for 20 years, producing works on such topics as defense of the faith, prayer and devotion, and morality, as well as the first Christian book on baptism, *De baptismo*. Later, dismayed by the laxity he witnessed among even his orthodox contemporaries, he joined the prophetic movement known as MONTANISM, then left it to form his own sect, which survived in Africa until the 5th century.

terza rima \'tert-sə-'rē-mə\ Verse form consisting of tercets, or three-line stanzas, in which the second line of each rhymes with the first and third lines of the next. The series ends with a separate line that rhymes with the second line of the last stanza, so that the rhyme scheme is *aba*, *bcb*, *cdc*, …, *yzy*, *z*. DANTE, in *The Divine Comedy* (c. 1310–14), was the first to use terza rima in a long poem. A demanding form, it has not been widely adopted in languages less rich in rhymes than Italian. It was introduced into England by THOMAS WYAT in the 16th century. Poets who have experimented with terza rima include PERCY B. SHELLEY, ROBERT BROWNING, ELIZABETH BARRETT BROWNING, and W.H. AUDEN; DEREK WALCOTT's book-length *Omeros* is written in modified terza rima.

Teschen \'te-shən\ Former eastern European duchy. It was originally a principality linked to the Polish duchy of SILESIA, and passed in 1526 to the HABSBURGS. Though most of Silesia was seized by PRUSSIA in 1742, Teschen remained under Habsburg rule until the end of World War I. In 1920 Poland and Czechoslovakia contested and then divided the region; Poland received the eastern district, including the city of Teschen (now Cieszyn), while Czechoslovakia received the rest. The Czechs were forced to cede their section to Poland in 1938. Germany occupied the entire region until after World War II, when the 1920 borders were restored.

Tesla, Nikola (b. July 9/10, 1856, Smiljan, Lika, Austria-Hungary—d. Jan. 7, 1943, New York, N.Y., U.S.) Serbian U.S. inventor and researcher. He studied in Austria and Bohemia and worked in Paris before coming to the U.S. in 1884. He worked for THOMAS ALVA EDISON and GEORGE WESTINGHOUSE but preferred independent research. His inventions made possible the production and distribution of alternating-current electric power. He invented an induction coil that is still widely used in radio technology, the Tesla coil (c. 1890); his system was used by Westinghouse to light the 1893 World's Columbian Exposition. Tesla established an electric power station at Niagara Falls in 1893. His research also included work on a carbon button lamp and on the power of electrical resonance. He discovered terrestrial stationary waves (1899–1900), proving that the Earth is a conductor. Due to lack of funds, many of his ideas remained only in his notebooks, which are still examined by engineers for inventive clues.

Nikola Tesla.
CULVER PICTURES

Test Act (1673) Act passed by the British Parliament that required holders of civil and military offices to profess the established religion and to receive Holy Communion according to the rites of the Church of ENGLAND. Though directed primarily against Roman Catholics, it extended in principle to all non-Anglicans; it was modified in 1689 to enable most non-Catholics to qualify. An act adopted in 1828 removed the test. In the U.S. CONSTITUTION, Article VI prescribes that "no religious test" shall be required for any officeholder. See also CATHOLIC EMANCIPATION.

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testcross Experiment in which an organism with unknown genetic makeup is mated with an organism whose entire genetic makeup for a trait is known, to determine which genes are carried by the former. In a breed of dog, for example, in which the gene for black coat colour is dominant over the gene for red coat colour (see DOMINANCE), a dog with a black coat may be pure (with two genes for black coat colour) or hybrid (with one gene for black and one for red). When its mating with a red-coated dog (which always has two genes for red coat colour only) produces only black offspring, the black-coated parent must be pure, whereas if some of the young are red, the parent must be hybrid.

testes *or* **testicles** Male reproductive organs (see REPRODUCTIVE SYSTEM). Humans have two oval-shaped testes 1.5–2 in. (4–5 cm) long that produce SPERM and ANDROGENS (mainly TESTOSTERONE), contained in a sac (scrotum) behind the PENIS. Each testis is divided into 200–400 lobes containing three to 10 very thin coiled tubes (seminiferous tubules) each, which produce the sperm and contract to expel them through a complex network of canals to another structure in the scrotum, the epididymis, for temporary storage. The cells in the testes are undeveloped in early childhood; at PUBERTY they are stimulated by hormones to develop into fertile sperm cells.

testicular cancer Malignant tumour of the TESTIS, or testicle. Although relatively rare, testicular CANCER is the most common malignancy for men between the ages of 20 and 34. It typically affects men between 15 and 39 years old. A developmental abnormality of males in which one or both testes fail to descend into the scrotum about the time of birth increases the risk of developing the cancer later in life. The most notable symptom of testicular cancer is the formation of a painless lump in either testis. Treatment usually consists of the surgical removal of the cancerous testis, followed by radiation therapy or chemotherapy if the cancer has metastasized.

testing machine Machine used in MATERIALS SCIENCE to determine the properties of a material. Machines have been devised to measure TENSILE strength, strength in compression, shear, and bending (see STRENGTH OF MATERIALS), DUCTILITY, HARDNESS, impact strength (see IMPACT TEST), FRACTURE toughness, CREEP, and FATIGUE. Standardization of machines and tests is the province of the International Organization for Standardization, American National Standards Institute, British Standards Institution, and many governmental bodies. Many industries have special-purpose testing machines for the materials they use.

testosterone \tes-'tä-stər-ˌōn\ Masculinizing sex hormone produced by the TESTES. It is responsible for the development of the male sex organs and secondary sex characteristics (e.g., facial hair, masculine musculature, deep voice, and male-pattern baldness). Testosterone can be manufactured by modifying other, less expensive STEROIDS. It is used in the treatment of hypogonadism, undescended testes (cryptorchism), and certain cancers.

tetanus \'te-tə-nəs\ *or* **lockjaw** Acute BACTERIAL DISEASE caused by *Clostridium tetani* (see CLOSTRIDIUM). Spores of this organism are common, especially in soil; it thrives away from oxygen in deep wounds, especially punctures. Its toxin stimulates nerves, causing muscle rigidity with frequent spasms. This may occur around the site of the wound or, if the toxin reaches spinal motor GANGLIA via the bloodstream, throughout the body. The jaw muscles are almost always involved (lockjaw). Vaccination every few years is the best protection; an antitoxin prevents or delays symptoms in cases of suspect wounds but has limited value once they develop. Treatment usually includes antibiotics, sedatives, and muscle relaxants. Recovered patients are not immune.

Tetley (Jr.), Glen(ford Andrew) (b. Feb. 3, 1926, Cleveland, Ohio, U.S.) American dancer, choreographer, and ballet director. He trained in modern dance with HANYA HOLM and MARTHA GRAHAM. Between 1946 and 1962 he danced in Broadway musical productions as well as with dance companies such as the AMERICAN BALLET THEATRE. He became a choreographer in 1962, forming his own company and creating *Pierrot Lunaire*. Subsequently he staged works with most of the major dance companies throughout the world. Tetley's work helped to bring about a synthesis of modern dance and classical ballet. His creative staging and daring, often sexual, subject matter were sometimes controversial, but he was praised for the passion and strong physicality of his work.

Teton \'tē-ˌtän\ **Range** Segment of the Middle ROCKY MOUNTAINS, northwestern Wyoming, U.S. The range extends 40 mi (64 km) across Wyoming, from the southern boundary of YELLOWSTONE NATIONAL PARK to Teton Pass. Some foothills reach as far as southeastern Idaho. Many peaks exceed 12,000 ft (3,700 m); the highest point is Grand Teton (13,766 ft [4,196 m]), which was first ascended in 1872. Much of the range lies within GRAND TETON NATIONAL PARK.

tetra Any of numerous attractively coloured freshwater South American and African fishes (family Characidae), often kept in home aquariums. Tetras are small, lively, hardy, and unaggressive. The slender neon tetra (*Paracheirodon*, or *Hyphessobrycon, innesi*) has gleaming red hind parts and a neonlike blue-green stripe on its sides. The glowlight tetra (*Hemigrammus erythrozonus*) has a shining red stripe along each side. The body of the silver tetra (*Ctenobrycon spilurus*) is flattened sidewise.

Glowlight tetras (*Hemigrammus erythrozonus*)
JANE BURTON—BRUCE COLEMAN LTD.

tetracycline Any of a class of broad-spectrum ANTIBIOTICS with a common basic structure, including doxycycline. They may be isolated directly from several species of ACTINOMYCETES of the genus *STREPTOMYCES* or modified from the compounds isolated. They are the drugs of choice in the treatment of CHOLERA, rickettsial infections (see RICKETTSIA), psittacosis, BRUCELLOSIS, and tularemia; tetracyclines are also used in the treatment of ACNE. Overuse of these and other antibiotics has led to DRUG RESISTANCE in microorganisms.

Tetragrammaton \ˌte-trə-'gra-mə-ˌtän\ *Greek* **"having four letters"** Four Hebrew consonants *yod*, *he*, *vav*, and *he*—variously transliterated as JHVH, JHWH, YHWH, or YHVH—that together represent the name of God. Traditionally the tetragrammaton is not pronounced; Jehovah and Yahweh are two vocalizations of it.

tetrarch *Greek* **"ruler of a quarter"** In Greco-Roman antiquity, the ruler of a principality, originally the ruler of one-quarter of a region or province. The first tetrarchs ruled the four tetrarchies of Thessaly under PHILIP II of Macedonia. Tetrarchs ruled in Galatia (in Asia Minor) before the Roman conquest (169 BC) and still later in Hellenized Syria and Palestine, where the title denoted the semi-independent ruler of a divided kingdom or minor district. HEROD THE GREAT's realm after his death (4 BC) was ruled by his three sons, two of whom were called tetrarchs.

Teutates \'tā-ü-ˌtä-tēz\ *or* **Toutates** \'tō-ˌtä-tēz\ Celtic god, one of the three mentioned by the Roman poet Lucan in the 1st century AD, the other two being Esus and Taranis. Victims sacrificed to Teutates are believed to have been killed by being plunged headfirst into a vat filled with an unspecified liquid, possibly ale. He was identified with both MERCURY and MARS. The Irish god Tuathal Techtmar, one of the legendary conquerors of Ireland, may have been another manifestation.

Teutoburg Forest \'tü-tə-ˌbərg\ *German* **Teutoburger Wald** \'tȯi-tə-ˌbůr-gər-ˌvält\ Range of forested hills, northern Germany. It was the scene of a battle in AD 9 in which German tribes defeated the Roman legions, thus establishing the RHINE RIVER as the German-Latin border. The Hermannsdenkmal, a colossal statue commemorating the battle, stands outside Detmold. There are numerous health and holiday resorts in the forest's small hill towns.

Teutonic\tü-'tä-nik\ **Order** *or* **Teutonic Knights** *officially* **House of the Hospitallers of Saint Mary of the Teutons** Religious order important in eastern Europe in the late Middle Ages. Founded in 1189–90 to nurse the sick in Palestine during the Third CRUSADE, it was militarized in 1198 and given land in Jerusalem and Germany. It transferred its base of operations to eastern Europe in the 13th century, gaining control of Prussia by 1283 and making Marienburg the centre of a military principality (1309–1525). The order extended its influence until it was defeated at the Battle of TANNENBERG (1410). Another Polish victory in 1466 forced the knights to cede lands to Poland and become vassals of the Polish king. In 1525 the grand master in Prussia converted to PROTESTANTISM, dissolved the order in Prussia, and became a duke under Polish suzerainty. In other parts of Europe, especially Austria, the order survived the REFORMATION. NAPOLEON declared the order dissolved in 1809 and redistributed most of its remaining lands. In 1834 the Austrian emperor refounded it as a charitable religious order, and it is now headquartered in Vienna.

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Tewodros II \tā-'wȯ-drȯs\ *or* **Theodore II** (b. c. 1818—d. April 13, 1868, Magela, Eth.) Emperor of Ethiopia (1855–68). Often called Ethiopia's first modern ruler, he came to the throne through the conquest of other chiefs. He reunified the various Ethiopian kingdoms into one empire, attempted to focus loyalty around the government rather than the Ethiopian church, and worked to abolish the feudal system. Though he failed in his aims, his example was followed by his successors. His reign ended when a British force under Robert Napier attacked in response to the imprisonment of several British citizens.

Texas State (pop., 2000: 20,851,820), southwestern U.S. Occupying 266,853 sq mi (691,146 sq km), it is the second largest state in both area and population. Many of Texas's boundaries are formed by water—the course of the Red River on the north makes up two-thirds of the state's boundary with Oklahoma; on the east the state is bordered in part by Arkansas, though the Sabine River forms most of Texas's eastern boundary with Louisiana; the Gulf of Mexico forms the coastal boundary to the southeast; the Rio Grande carves a shallow channel that separates Texas from Mexico on the southwest; the Panhandle section juts northward, forming a counterpart in the western part of Oklahoma; and New Mexico lies to the west. The capital of Texas is Austin. Plains and hills make up the terrain, which ranges from the fertile prairie of the Coastal Plains on the Gulf of Mexico through the central Great Plains grasslands to the arid High Plains of the Panhandle. The forerunners of West Texas Indians inhabited the area as much as 37,000 years ago. Some of the peoples later formed the Caddo confederacy. Indians, including Apaches, were living in the region when the Spanish arrived in 1528. The first settlement was attempted in 1685 by the French, who claimed the region as part of Louisiana. In 1803 the U.S. acquired the French claim in the Louisiana Purchase but relinquished it to Spain by treaty in 1819. It became part of Mexico at Mexican independence in 1821. In 1836 Texans declared independence from Mexico as the Republic of Texas (see Stephen Austin; Sam Houston). After a 10-year struggle to remain independent, Texas became the 28th U.S. state in 1845. Its boundary with Mexico was fixed after the Mexican War (1848). In the American Civil War it seceded from the Union (1861); it was readmitted in 1869. After the war, railroad building and increased shipping helped expand the economy, and the discovery of oil in 1901 transformed it. While Texas still leads all other states in oil and natural gas production and in petroleum-refining capacity, its manufacture of electronics, aerospace components, and other high-technology items is increasingly important. It is also the leading cotton, beef cattle, and sheep producer in the U.S.

Texas, University of U.S. state university system with 13 campuses throughout the state. It was founded in 1883. The main campus, at Austin, is the second most populous campus in the U.S. It is a comprehensive research and teaching institution, offering about 100 undergraduate programs and about 190 graduate degree programs. There are more than 85 organized research units on campus, including centres for biomedical research, economic geology, and cognitive science. The Lyndon B. Johnson Library and Museum is located there.

Texas Instruments, Inc. (TI) U.S. manufacturer of calculators, microprocessors, and digital signal processors. The direct antecedent to the company, headquartered in Dallas, Texas, was founded by John Karcher and Eugene McDermott in 1930 to provide seismographic data for the petroleum industry. In 1958 Jack Kilby, a researcher at TI, coinvented the integrated circuit (IC), and in 1967 he invented the basic design for handheld calculators. In 1973 TI began to manufacture dynamic random-access memory (DRAM, commonly shortened to RAM) chips for use in computers, and in 1982 it introduced the single-chip digital signal processor (DSP), which it employs in cell phones, Global Positioning System (GPS) receivers, and adapters for computer networks.

Texas Rangers Loosely organized police force in Texas. The first members were "minutemen" hired by U.S. settlers as protection against Indian attacks in the 1830s. They did not wear uniforms or salute their officers but were highly disciplined and known for their marksmanship, making the six-shooter (the Colt revolver) the weapon of the West. At their peak in the 1870s, the Rangers brought law and order to hundreds of miles of Texas frontier. In 1935 they were merged with the state highway patrol.

Texcoco \tās-'kō-kō**, Lake** Lake, central Mexico. Originally one of the five lakes of the Valley of Mexico, Texcoco has been drained by channels and a tunnel to the Pánuco River since the early 17th century. It now occupies only a small area surrounded by salt marshes just east of Mexico City. Tenochtitlán, the Aztec capital, stood on islands in old Lake Texcoco and was connected to the mainland by causeways.

textile Any filament, fibre, or yarn that can be made into fabric or cloth, and the resulting material itself. The word originally referred only to woven fabrics but now includes knitted, bonded, felted, and tufted fabrics as well. The basic raw materials used in textile production are fibres, either obtained from natural sources (e.g., wool) or produced from chemical substances (e.g., nylon and polyester). Textiles are used for wearing apparel, household linens and bedding, upholstery, draperies and curtains, wall coverings, rugs and carpets, and bookbindings, in addition to being used widely in industry.

Tezcatlipoca \ˌtās-kät-lē-'pō-kə\ Omnipotent god of the Aztec pantheon and god of the constellation Ursa Major. The protector of slaves, he severely punished masters who ill-treated them. He is said to have put an end to the Toltecs' golden age. Each year his worshipers selected a handsome prisoner of war who was allowed to live in princely luxury for a year before being sacrificed. Tezcatlipoca is represented in art with an obsidian mirror, in which he sees all, on his chest or in place of a foot.

Thackeray, William Makepeace (b. July 18, 1811, Calcutta, India—d. Dec. 24, 1863, London, Eng.) English novelist. He studied law and art but soon became a prolific writer for periodicals, using a variety of pen names. His early writings appear in such volumes as *The Book of Snobs* (1848), a collection of his articles from *Punch*; and *Miscellanies* (1855–57), which includes the historical novel *Barry Lyndon* (1844). His fame rests chiefly on the novels *Vanity Fair* (1847–48), a panoramic survey of English manners and human frailties set in the Napoleonic era, and *Henry Esmond* (1852), set in the early 18th century. *Pendennis* (1848–50) is a partly fictionalized autobiography. In his time he was regarded as the only possible rival of Charles Dickens for his pictures of contemporary life, but his popularity declined in the 20th century.

William Makepeace Thackeray, detail of an oil painting by Samuel Laurence; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Thailand \'tī-ˌland\ *officially* **Kingdom of Thailand** *formerly* **Siam** Country, mainland Southeast Asia. Area: 198,116 sq mi (513,119 sq km). Population (2005 est.): 64,186,000. Capital: Bangkok. The population is predominantly Thai, with significant Chinese, Khmer, and Malay minorities. Language: Thai (official). Religions: Buddhism (official); also Islam. Currency: Thai baht. The country encompasses forested hills and mountains, a central plain containing the Chao Phraya River delta, and a plateau in the northeast. Its market economy is based largely on services (notably trade) and light industries; agriculture employs a large proportion of the workforce. Thailand is a major producer of tungsten and tin. Among its chief agricultural products are rice, corn, rubber, soybeans, and pineapples; manufactures include clothing, canned goods, electronic equipment, and cement. Tourism is also important. Thailand is a constitutional monarchy with two legislative houses; its chief of state is the king, and the head of government is the prime minister. The region of Thailand has been continuously occupied for 20,000 years. It was part of the Mon and Khmer kingdoms from the 9th century AD. Thai-speaking peoples immigrated from China c. the 10th century. During the 13th century two Thai states emerged: the Sukhothai kingdom, founded c. 1220 after a successful revolt against the Khmer, and Chiang Mai (which evolved into the kingdom of Lan Na with Chiang Mai as its capital), founded in 1296 after defeating the Mon. In 1351 the Tai kingdom of Ayutthaya (Siam) succeeded the Sukhothai. Myanmar (Burma) was its most powerful rival, Burman armies occupying it briefly in the 16th century and destroying it in 1767. The Chakri dynasty came to power in 1782, moved the capital to Bangkok, and extended its empire along the Malay Peninsula and into Laos and Cambodia. The empire was formally named Siam in 1856. Although Western influence increased during the 19th century, Siam's rulers avoided colonization by granting concessions to European coun-

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tries; it was the only Southeast Asian country able to do so. In 1917 Siam entered World War I on the side of the Allies. Following a military coup in 1932, it became a constitutional monarchy and was officially renamed Thailand in 1939. It was occupied by Japan in World War II. It participated in the KOREAN WAR as a member of the UN forces and was allied with South Vietnam in the VIETNAM WAR. The country subsequently became a regional economic powerhouse, though serious social problems also emerged, including a growing gap between rich and poor and a major AIDS epidemic.

Thailand, Gulf of *formerly* **Gulf of Siam** Inlet of the South CHINA SEA. Mostly bordering Thailand, though Cambodia and Vietnam form its southeastern shore, it is 300–350 mi (500–560 km) wide and 450 mi (725 km) long. Thailand's main harbours lie along its shores, its waters are important fishing grounds, and beaches along its coast are popular tourist attractions.

Thalberg, Irving G(rant) (b. May 30, 1899, Brooklyn, N.Y., U.S.—d. Sept. 14, 1936, Santa Monica, Calif.) U.S. film executive. He suffered from health problems at a young age, and fearing his life would not be a long one, he threw himself into his career, joining UNIVERSAL PICTURES after completing high school. He soon became Universal's studio manager in Hollywood. Hired by MGM as head of production in 1925, he became known as the "boy wonder of Hollywood." He tightly controlled MGM's output by supervising script selection and final film editing, and he was responsible for the high quality of movies such as *The Barretts of Wimpole Street* (1934), *Mutiny on the Bounty* (1935), and *Romeo and Juliet* (1936) and for making stars of Nelson Eddy and Jeanette MacDonald with *Naughty Marietta* (1935). Thalberg was one of the founders of the Academy of Motion Picture Arts and Sciences.

Thales of Miletus \'thā-lēz...mī-'lē-təs\ (fl. 6th century BC) Greek philosopher. None of his writings survive, and no contemporary sources exist. The claim that Thales was the founder of Western philosophy rests primarily on ARISTOTLE, who wrote that he was the first to suggest a single material substratum for the universe, namely water. Thales' significance lies in his attempt to explain nature by the simplification of phenomena and in his search for causes within nature itself rather than in the caprices of anthropomorphic gods.

thalidomide \thə-'li-də-ˌmīd\ Drug formerly used as a sedative and to prevent morning sickness during pregnancy. Synthesized in 1954, it was introduced in almost 50 countries, including West Germany and Britain, where it became popular because it was effective and huge overdoses were not fatal. In 1961 it was found to cause CONGENITAL DISORDERS; when it is taken in early pregnancy, some 20% of fetuses have phocomelia (defective development of the limbs) and other deformities; 5,000–10,000 such babies were born. It was never distributed for clinical use in the U.S. (see HELEN BROOKE TAUSSIG). Thalidomide appears effective against inflammatory and autoimmune disorders, including certain late-stage AIDS symptoms, and is licensed for use in such treatments in some countries.

thallus \'tha-ləs\ Plant body of ALGAE, fungi (see FUNGUS), and similar simple, plantlike organisms. Composed of filaments or plates of cells, a thallus ranges in size from a single-celled structure to a complex treelike form. The photosynthetic and supportive cells tend to be organized linearly, but a thallus lacks such differentiated specialized structures as stem, leaves, and conducting tissue. Most thallus plants are currently classified as complex PROTISTS.

Thames \'temz**, Battle of the** (Oct. 5, 1813) Decisive U.S. victory over the British in the WAR OF 1812. After the British defeat in the Battle of Lake Erie, U.S. troops under Gen. WILLIAM H. HARRISON pursued retreating British soldiers across the Ontario peninsula. The British force of 600 regulars and 1,000 Indians under TECUMSEH met 3,500 U.S. troops at the Thames River near Moraviantown, Ont. The outnumbered British were quickly defeated, and Tecumseh was killed. The U.S. victory ended the Indian alliance with the British and made Harrison a national hero.

Thames, River *ancient* **Tamesis** Principal river of England. It rises in the Cotswolds in GLOUCESTERSHIRE and winds 205 mi (330 km) eastward across south-central England into a great estuary, through which it empties into the North Sea. It is tidal for about 65 mi (104 km). Known by the Romans and by early English chroniclers, it has been celebrated by bards throughout history. One of the world's most important commercial waterways, it is navigable by large vessels to LONDON.

thanatology \ˌtha-nə-'tä-lə-jē\ Description or study of death and dying and of the psychological mechanisms of dealing with them. One influential model proposed in 1969 by the psychiatrist Elisabeth Kübler-Ross (b. 1926) described five basic stages: denial, anger, bargaining, depression, and acceptance; however, not all dying persons follow a regular, clearly identifiable series of responses to their situation. Thanatology also examines attitudes toward death, the meaning and behaviours of bereavement and grief, and other matters.

Thanatos \'tha-nə-ˌtäs\ Ancient Greek personification of death. He was the son of Nyx, goddess of night, and brother to Hypnos, god of sleep. He appeared to humans to carry them off to the underworld when the time allotted to them by the FATES had expired. Thanatos was once defeated by HERACLES, who wrestled him to save the life of ALCESTIS, and he was tricked by SISYPHUS, who wanted a second chance at life.

Thānī \'tha-nē\ **dynasty** *also* **Āl Thānī ("Thānī family")** Ruling family of Qatar. They are from the Tamīm tribe, which migrated eastward from central Arabia to the Qatar peninsula in the mid-19th century. There have been eight leaders from 1868 to the present. The second SHEIKH, Qāsim ibn Muḥammad (1878–1913), is considered Qatar's founder. The seventh sheikh, Khalīfah ibn Ḥamad (r. 1972–95), was instramental in obtaining Qatar's independence from Britain in 1971 and became the first emir. The clan comprises about two-fifths of the native Qatari population.

Thanksgiving Day U.S. holiday. It originated in the autumn of 1621 when Plymouth governor WILLIAM BRADFORD invited neighbouring Indians to join the Pilgrims for a three-day festival of recreation and feasting in gratitude for the bounty of the season, which had been partly enabled by the Indians' advice. Neither the standard Thanksgiving meal of turkey, cranberry sauce, and pumpkin pie nor the family orientation of the day reflects the Plymouth event, however. Proclaimed a national holiday in 1863, Thanksgiving is celebrated on the fourth Thursday in November (though it was moved back one week in 1939–41 to extend the Christmas shopping season). Canada adopted Thanksgiving as a national holiday in 1879; since 1957 it has been celebrated on the second Monday in October.

Thant, U (b. Jan. 22, 1909, Pantanaw, Burma—d. Nov. 25, 1974, New York, N.Y., U.S.) Third secretary-general of the UNITED NATIONS (1961–71), the first Asian to hold the post. He entered the University of Yangôn, but the death of his father forced him to discontinue his education before he was able to graduate. He taught high school before entering government service. Posted to the UN in 1952, he became Burma's UN ambassador in 1957. In 1961 he became acting secretary-general after the death of DAG HAMMARSKJÖLD; he became permanent secretary-general in 1962.

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While secretary-general, he played a diplomatic role in the CUBAN MISSILE CRISIS, devised a plan to end the Congolese civil war (1962), and sent peacekeeping forces to Cyprus (1964).

Thapsus \'thap-səs**, Battle of** (46 BC) Decisive battle in North Africa in the Roman civil war between Julius CAESAR and POMPEY (49–46). Caesar had laid siege to the seaport of Thapsus, near present-day Teboulba, Tunisia. Pompey was supported by the legions of his father-in-law, Quintus Metellus Scipio. When Caesar could not restrain his troops, they surged forward and overwhelmed the enemy, slaughtering about 10,000. It was the final blow delivered by Caesar against the forces of Pompey.

Thar \'tär, 'tər\ **Desert** *or* **Great Indian Desert** Region of hot, dry desert, northwestern India and southeastern Pakistan. Its undulating surface is composed of sand dunes separated by sandy plains and low, barren hills. Several saline lakes are found there. Covering some 77,000 sq mi (200,000 sq km), it is bordered by the INDUS RIVER plain, the Aravalli Range, the Arabian Sea, and the Punjab plain.

Thargelia \thär-'gē-lē-ə, thär-'jē-lē-ə\ In GREEK RELIGION, a chief Athenian festival of APOLLO, celebrated on the sixth and seventh days of Thargelion (April–May). It was named after the first fruits or the first bread from the new wheat. On the first day, one or two men acting as SCAPEGOATS were led through Athens, whipped on the genitalia, and driven across the border. An official registration of adopted people took place on the second day.

Tharp, Twyla (b. July 1, 1941, Portland, Ind., U.S.) U.S. dancer, director, and choreographer. She danced with PAUL TAYLOR's company from 1963 to 1965, when she formed her own troupe and began to choreograph works such as *Deuce Coupe* (1973), *Push Comes to Shove* (1976), *Baker's Dozen* (1979), *Nine Sinatra Songs* (1982), and *Fait Accompli* (1984). In 1988 she disbanded her company and was resident choreographer with the AMERICAN BALLET THEATRE (1988–91). She has also choreographed for the Broadway theatre (including *The Catherine Wheel*, 1981) and several films (including *Hair*, 1979, and *Amadeus*, 1984). Tharp is notable for her humour and particularly for having been one of the first American choreographers to use popular music.

Twyla Tharp.
© JACK MITCHELL

Thásos \'thä-ˌsȯs\ Island, northern AEGEAN SEA, northeastern Macedonia, Greece. It covers 146 sq mi (379 sq km). It was colonized c. 700 BC by Greeks from Páros who exploited its gold mines and founded a school of sculpture. The Persians seized Thásos in the early 5th century BC; it later came under the authority of Athens as a member of the DELIAN LEAGUE. A Macedonian dependency in 202 BC, Thásos passed to Rome in 196 BC. The Turks ruled it from the mid-15th century AD until it was ceded to Greece in 1913. Its industries include boatbuilding, fishing, and tourism, and it has been a base for offshore oil exploration since the 1970s. Many 7th–2nd-century-BC monuments have been found there.

Thatcher, Margaret, Baroness Thatcher (of Kesteven) *orig.* **Margaret Hilda Roberts** (b. Oct. 13, 1925, Grantham, Lincolnshire, Eng.) British politician and prime minister (1979–90). She earned a degree from the University of Oxford, where she was one of the first woman presidents of the Oxford University Conservative Association, then worked as a research chemist. After her marriage to Denis Thatcher (1951), she read for the bar and specialized in tax law. She was elected to Parliament in 1959 and served as secretary of state for education and science (1970–74). As a member of the Conservative Party's newly energetic right wing, she succeeded EDWARD HEATH as party leader in 1975. In 1979 she became Britain's first woman prime minister. She advocated individual initiative, confronted the labour unions, privatized national industries and utilities and attempted to privatize aspects of health care and education, pursued a strong monetarist policy, and endorsed a firm commitment to NATO. Her landslide victory in 1983 owed partly to her decisive leadership in the FALKLAND ISLANDS WAR. A split in party ranks over European monetary and political integration led to her resignation in 1990, by which time she had become Britain's longest continuously serving prime minister since 1827.

Margaret Thatcher, 1983.
AP/WIDE WORLD PHOTOS

theatre Live performance of dramatic actions in order to tell a story or create a spectacle. The word derives from the Greek *theatron* ("place of seeing"). Theatre is one of the oldest and most important art forms in cultures worldwide. While the script is the basic element of theatrical performance, it also relies in varying degrees on acting, singing, and dancing, as well as on technical aspects of production such as STAGE DESIGN. Theatre is thought to have its earliest origins in religious ritual; it often enacts myths or stories central to the belief structure of a culture or creates comedy through travesty of such narratives. In Western civilization, theatre began in ancient Greece and was adapted in Roman times; it was revived in the medieval LITURGICAL DRAMAS and flourished in the Renaissance with the Italian COMMEDIA DELL'ARTE and in the 17th–18th centuries with established companies such as the COMÉDIE-FRANÇAISE. Varying theatrical forms may evolve to suit the tastes of different audiences (e.g., in Japan, the KABUKI of the townspeople and the NŌ theatre of the court). In Europe and the U.S. in the 19th and early 20th centuries theatre was a major source of entertainment for all social classes, with forms ranging from BURLESQUE SHOWS and VAUDEVILLE to serious dramas performed in the style of the MOSCOW ART THEATRE. Though the MUSICALS of BROADWAY and the FARCES of London's West End retain their popular appeal, the rise of television and movies has eroded audiences for live theatre and has tended to limit its spectators to an educated elite. See also LITTLE THEATRE.

theatre Building or space in which performances are given before an audience. It contains an AUDITORIUM and stage. In ancient Greece, where Western theatre began (5th century BC), theatres were constructed in natural hollows between hills. The audience sat in a tiered semicircle facing the orchestra, a flat circular space where the action took place. Behind the orchestra was the SKENE. The theatres of Elizabethan England were open to the sky, with the audience looking on from tiered galleries or a courtyard. During this period the main innovation was the rectangular thrust stage, surrounded on three sides by spectators. The first permanent indoor theatre was ANDREA PALLADIO's Olimpico Theatre in Vicenza, Italy (1585). The Farnese Theatre in Parma (1618) was designed with a horseshoe-shaped auditorium and the first permanent PROSCENIUM arch. Baroque European court theatres followed this arrangement, elaborating on the interior with tiered boxes for royalty. RICHARD WAGNER's Festspielhaus in Bayreuth, Ger. (1876), with its fan-shaped seating plan, deep orchestra pit, and darkened auditorium, departed from the Baroque stratified auditorium and reintroduced Classical principles that are still in use. The proscenium theatre prevailed in the 17th–20th centuries; though still popular in the 20th century, it was supplemented by other types of theatre, such as the thrust stage and THEATRE-IN-THE-ROUND. In Asia, stage arrangements have remained simple, with the audience usually grouped informally around an open space; notable exceptions are the NŌ drama and KABUKI of Japan. See also AMPHITHEATRE; ODEUM.

Theatre Guild U.S. theatrical society. Founded in New York City in 1918 by Lawrence Langner (1890–1962) and others, the group proposed to produce high-quality, noncommercial plays. Its board of directors shared responsibility for choice of plays, management, and production. After the premiere of GEORGE BERNARD SHAW's *Heartbreak House* in 1920, the Guild became his U.S. agent and staged 15 of his plays. It also produced successful plays by EUGENE O'NEILL, MAXWELL ANDERSON, and ROBERT SHERWOOD and featured actors such as the LUNTS and HELEN HAYES. It helped develop the American MUSICAL by staging *Porgy and Bess* (1935), *Oklahoma!* (1943), and *Carousel* (1945); it also produced the radio series *Theatre Guild on the Air* (1945–53) and presented plays on television.

theatre-in-the-round *or* **arena stage** Theatre in which the stage is located in the centre of the auditorium with the audience seated on all sides. The form evolved from Greek theatre and was used in medieval

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times. From the 17th century the PROSCENIUM stage limited audience seating to the area directly in front of the stage. In the 1930s, plays at Moscow's Realistic Theatre were produced in the round and the arena stage began to gain favour in Europe and the U.S. Its advantages are its informality and the rapport it creates between audience and actors, but it requires actors to turn constantly to address new sections of the audience.

Théâtre National Populaire \tā-'ä-trᵊ-ná-syȯ-'nål-pó-pūē-'ler\ **(TNP)** French national theatre created in 1920 to bring theatre to the general public. Under the direction of its founder, Firmin Gémier (1869–1933), the TNP initially offered productions from the other national companies. In 1951 it established a permanent company under Jean Vilar (1951–63), giving 150 performances a year in and around Paris, charging ticket prices competitive with the movies. By 1959 it was as popular as the COMÉDIE-FRANÇAISE. In 1972, in an effort to decentralize the theatre, the government transferred its title to a subsidized theatre company in Lyon.

Theatre of Cruelty Theory advanced by ANTONIN ARTAUD, who believed the theatre's function was to rid audiences of the repressive effects of civilization and liberate their instinctual energy. He proposed to do so by shocking them with mythic spectacles that would include groans, screams, pulsating lights, and oversized stage puppets. He described the Theatre of Cruelty in his book *The Theatre and Its Double* (1938). Though only one of his plays, *Les Cenci*, was ever produced in accordance with his theory, his ideas influenced avant-garde movements such as the LIVING THEATRE and the THEATRE OF THE ABSURD.

Theatre of Fact *or* **documentary theatre** Movement to bring social issues to the stage by emphasizing factual information over aesthetic considerations. An outgrowth of the Living Newspaper technique employed in the 1930s by the WPA Federal Theatre Project in the U.S., the form became popular in the 1960s. In Germany Rolf Hochhuth's *The Representative* (1963), PETER WEISS's *The Investigation* (1965), and Heinar Kipphardt's *In the Matter of J. Robert Oppenheimer* (1964) examined recent historical events through authentic documentary sources such as trial transcripts and statistics. The movement influenced later political drama in Europe and the U.S.

Theatre of the Absurd Body of dramatic works of the 1950s and '60s that expressed the existentialist philosophy of meaninglessness and the absurdity of life. Playwrights such as ARTHUR ADAMOV, EDWARD ALBEE, SAMUEL BECKETT, JEAN GENET, EUGÈNE IONESCO, and HAROLD PINTER created Absurdist plays without traditional plots and with characters who engaged in circular, purposeless conversations. Beckett's *Waiting for Godot* (1953), in which two tramps wait for a mysterious man who never arrives, is a classic of the genre.

theatricalism Twentieth-century theatrical movement that emphasized artifice in reaction to 19th-century naturalism. Marked by stylized acting, a stage projecting into the audience, and frank scenic artifices and conventions, it did not strive to create the illusion of reality but rather to remind the audience of their role as viewers and critics of the artwork in progress before them. Theatricalism was found in the Expressionist, Dadaist, and Surrealist drama of the early 20th century and has continued as a current in the modern theatre.

Thebes \'thēbz\ *biblical* **No** Ancient city, EGYPT. Its remains are located on the Banks of the Nile River. In early times it also included KARNAK and LUXOR; the Valley of the KINGS is situated nearby. The earliest monuments in the city itself date from the 11th dynasty (c. 21st century BC), when the rulers of Thebes united Egypt and made Thebes the capital of Upper Egypt. It remained the capital until the end of the Middle Kingdom (c. 18th century BC). It was obscured for two centuries under the rule of various foreign invaders, after which the kings of Thebes restored Egyptian rule in the 16th century BC and again made it the capital. It flourished as Egypt's political and religious centre throughout the New Kingdom period and was well known for achievements in sculpture and architecture. It began to decline in the 12th century BC and was sacked by Assyrians in the mid-7th century BC, by Persians in the 6th–4th centuries BC, and by Romans c. 30 BC. Its ruins include great temples and tombs, including the Temple of Amon at Karnak (c. 20th century BC), the tomb of TUTANKHAMEN in the Valley of the Kings, and the great mortuary temples of RAMSES II and HATSHEPSUT. The region's antiquities were collectively designated a UNESCO WORLD HERITAGE SITE in 1979.

Thebes *Greek* **Thívai** \'thē-ve\ Ancient city, BOEOTIA, east-central Greece, one of the chief Greek city-states. Traditionally said to have been founded by CADMUS, it was the seat of the legendary OEDIPUS and the setting for many classic Greek tragedies. The building of its celebrated seven-gated wall is usually attributed to AMPHION. It was a centre of MYCENAEAN power in the Bronze Age (c. 1500–1200 BC). Hostility to ATHENS led it to side with the Persians in the PERSIAN WARS and with SPARTA in the PELOPONNESIAN WAR. Thebes and Sparta subsequently clashed, and the victorious Spartans occupied it. It revolted c. 380 BC and defeated Sparta at the battles of Tegyra (375 BC) and Leuctra (371 BC). For the next 10 years it was the chief military power in Greece. It joined Athens against PHILIP II of Macedon and shared the defeat at the Battle of CHAERONEA in 338 BC. It was sacked by ALEXANDER THE GREAT in 336 and eventually fell to Rome in the 1st century BC. Among the few ancient remains are remnants of the city walls, the Mycenaean palace (c. 1450–1350 BC), and a temple of APOLLO.

theft In law, the crime of taking the property or services of another without consent. Under most statutes, theft encompasses the crimes of larceny, robbery, and BURGLARY. Larceny is the crime of taking and carrying away the goods of another with intent to steal. Grand larceny, or larceny of property of substantial value, is a felony, whereas petty larceny, or larceny of less valuable property, is a misdemeanour. The same principle applies to grand theft and petty theft, which need not necessarily involve the "carrying away" of property and may include the theft of services. Robbery is an aggravated form of larceny involving violence or the threat of violence directed against the victim in his presence. Burglary is defined as the breaking and entering of the premises of another with an intent to commit a felony within. Two offenses usually distinguished from theft are EMBEZZLEMENT and FRAUD.

theism View that all observable phenomena are dependent on but distinct from one supreme being. The view usually entails the idea that God is beyond human comprehension, perfect and self-sustained, but also peculiarly involved in the world and its events. Theists seek support for their view in rational argument and appeals to experience. Arguments for God's existence are of four principal types: cosmological, ontological, teleological, or moral. A central issue for theism is reconciling God, usually understood as omnipotent and perfect, with the existence of evil. See also AGNOSTICISM, ATHEISM, DEISM, MONOTHEISM, POLYTHEISM, THEODICY.

Themistocles \the-'mis-tə-ˌklēz\ (b. c. 524—d. c. 460 BC) Athenian politician and naval strategist. As ARCHON (493) he built defensible harbours at Piraeus. In 483 he persuaded the assembly to increase the navy, believing it represented Athens's best chance of warding off Persian invaders. When the invasion of XERXES I did come, a Greek naval force at first yielded to Persia at Artemisium, but Themistocles lured Xerxes' remaining ships to their destruction at the Battle of SALAMIS. Despite his victory, Athens later ostracized the strongly democratic Themistocles (472) as the city's politics turned reactionary. When Sparta later accused him of complicity with Persia, he fled the Peloponnese and, until his death, served as governor of some Asian Greek cities still under Persian rule.

theocracy \thē-'ä-krə-sē\ Government by divine guidance or by officials who are regarded as divinely guided. In many theocracies, government leaders are members of the clergy, and the state's legal system is based on religious law. Theocratic rule was typical of early civilizations. The ENLIGHTENMENT marked the end of theocracy in most Western countries. Contemporary examples of theocracies include Saudi Arabia, Iran, and the Vatican. See also CHURCH AND STATE; DIVINE KINGSHIP.

Theocritus \thē-'ä-krə-təs\ (b. c. 300, Syracuse, Sicily—d. 260 BC) Greek poet. Little is known of his life. His surviving poems consist of bucolics and mimes, set in the country, and epics, lyrics, and epigrams, set in towns. The bucolics, his most characteristic and influential works, introduced the PASTORAL convention into poetry and were the sources of VIRGIL's *Eclogues* and much Renaissance poetry and drama. Theocritus's best-known IDYLLS include *Thyrsis*, a lament for Daphnis, the shepherd poet of mythology, and *Thalysia* ("Harvest Festival"), which presents the poet's friends and rivals in the guise of rustics.

theodicy \thē-'ä-də-sē\ Argument for the justification of God, concerned with reconciling God's goodness and justice with the observable facts of evil and suffering in the world. Most such arguments are a necessary component of THEISM. Under POLYTHEISM, the problem is solved by attributing evil to a conflict of wills between deities. The solution is less simple in MONOTHEISM, and it can take several forms. In some approaches, the perfect world created by God was spoiled by human disobedience or SIN. In others, God withdrew after creating the world, which then fell into decay.

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Theodora (b. c. 497—d. June 28, 548, Constantinople) Byzantine empress, wife of JUSTINIAN I. The daughter of a bear keeper at the Hippodrome in Constantinople, she became an actress and the mistress of Justinian. He married her in 525, and when he became emperor in 527 she was proclaimed empress. Probably the most powerful woman in Byzantine history, she was her husband's most trusted adviser, sponsoring legal reforms and wielding great influence in diplomacy, military appointments, and internal politics. Her impassioned speech gave Justinian the strength to order the brutal suppression of the Nika revolt (532) and save his empire. She recognized the rights of women and ended persecution of Monophysite Christians, with whom she sympathized.

Theodora, detail of a Byzantine mosaic in the church of San Vitale, Ravenna, Italy.
ANDRE HELD/J.P. ZIOLO

Theodorakis \ˌthē-ə-də-ˈrä-kis**, Mikis** (b. July 29, 1925, island of Chios, Greece) Greek composer. He studied at the Athens and Paris conservatories. A member of the wartime resistance, he remained active in politics, serving several times in the Greek parliament. As a Communist Party member, he was arrested during the 1967 military coup and only released in 1970 under international pressure. He is best known outside Greece for his film scores, including *Zorba the Greek* (1964), *Z* (1969), and *State of Siege* (1972), but he also composed much concert music, including seven symphonies, four operas, ballets (including *Antigone*, 1959), and more than 1,000 songs. He is esteemed in his homeland as a national hero.

Theodore I Lascaris \ˈlas-kə-rəs\ (b. c. 1174—d. November 1221, Nicaea, Nicaean empire) First emperor of NICAEA, the Byzantine government-in-exile during the Crusaders' occupation of Constantinople. He distinguished himself during the sieges of Constantinople in the Fourth CRUSADE (1203–04). After the Byzantine capital fell, he gathered a band of refugees, first at Brusa and then at Nicaea, and formed a new Byzantine state. He took the title of emperor in 1208 and successfully defended Nicaea against the Crusaders, the Turks, and his rival emperor David Comnenus. He signed a treaty (c. 1214) with the Latin emperor of Constantinople defining Nicaea's boundaries and betrothed his daughter to the heir to the Latin imperial throne.

Theodore II See TEWODROS II

Theodore of Canterbury, Saint (b. c. 602, Tarsus, Cilicia, Asia Minor—d. Sept. 19, 690, Canterbury, Kent, Eng.; feast day September 19) Seventh archbishop of Canterbury (668–690). He was sent from Rome to Canterbury, where he helped establish a famous school at the monastery later known as St. Augustine's. Theodore organized and centralized the English church, calling its first general synod (672) to end Celtic practices, affirm church doctrine, and divide dioceses. He deposed WILFRID as bishop of York in 677 but restored him in 686; he also made peace between King Aethelred of Mercia and King Ecgfrith of Northumbia.

Theodore of Mopsuestia \ˌmäp-sü-ˈes-chə\ (b. c. 350, Antioch, Syria—d. 428/429, Mopsuestia, Cilicia) Syrian theologian and spiritual head of the school of Antioch. He entered a monastery near Antioch, where he lived and studied until 378. He was ordained in 381 and became bishop of Mopsuestia c. 392. His exegetical writings used scientific, critical, philological, and historical methods of analysis that anticipated modern scholarship. Theologically, he believed that Christ had two natures, divine and human, in some kind of union. He stressed the literal sense of scripture and opposed allegorical interpretations. The second COUNCIL OF CONSTANTINOPLE (553) condemned his views, but he was venerated by the NESTORIAN church as "the Interpreter." He is said to have introduced into the Nestorian church the doctrine of universal SALVATION.

Theodore Roosevelt National Park Preserve, west-central North Dakota, U.S. Established in 1947, it commemorates Pres. THEODORE ROOSEVELT's interest in the American West. The 110-sq-mi (285-sq-km) park contains several sites along the LITTLE MISSOURI RIVER, including a petrified forest, Wind Canyon, eroded badlands, and Roosevelt's Elkhorn Ranch cabin.

Theodoret \thē-ˈäd-ə-rət\ **of Cyrrhus** (b. c. 393, Antioch, Syria—d. c. 458/466) Syrian theologian and bishop whose writings were a moderating influence on the 5th-century Christological disputes. First a monk, he became bishop of Cyrrhus (near Antioch) by 423. Influenced by St. John CHRYSOSTOM and THEODORE OF MOPSUESTIA, he opposed allegorical interpretations of scripture and attributed a human nature to Christ. Accused of being a NESTORIAN heretic, he made conciliatory statements accepting the term "god-bearer" for Mary (thereby stressing Jesus' divinity). He was declared a heretic nevertheless (449) and was sent into exile. He was partially vindicated by the Council of CHALCEDON (451), which agreed to declare him orthodox provided he condemn his friend NESTORIUS, and he reluctantly complied.

Theodoric *known as* **Theodoric the Great** (b. 454—d. Aug. 30, 526) King of the OSTROGOTHS and founder of the Ostrogothic kingdom in Italy. Sent by the Byzantine emperor ZENO to invade Italy in 488, he made himself sole ruler by 493 and murdered ODOACER by treachery. With Ravenna as his capital he staved off the Franks and Bulgarians, and he held sway over a kingdom that included Sicily, Dalmatia, and some German lands. An Arian (see ARIANISM), he tolerated Catholicism and promoted peace between GOTHS and Romans.

Theodosius I \ˌthē-ə-ˈdō-shē-əs\ *or* **Theodosius the Great** *in full* **Flavius Theodosius** (b. Jan. 11, 347, Cauca, Gallaecia [Spain]—d. Jan. 17, 395, Mediolanum) Roman emperor of the East (379–392) and of East and West (392–395). Born of Christian parents, he served in the military under his father, a general. He distinguished himself against the SARMATIANS and was proclaimed coemperor by GRATIAN to rule in the eastern empire (379). To settle the contentious debate over true Christianity, he adopted the NICENE CREED as the Christian norm (380). He reached a treaty with the VISIGOTHS (382). When the Spanish general Maximus overthrew the new coemperor in the western empire (387), Theodosius defeated the usurper (388) and claimed supreme authority over the whole empire (392). He argued with St. AMBROSE over the role of the church in imperial affairs but did not grant power to the church. In 392 forces advocating paganism led by Arbogast and Eugenius took power in Rome. In 394 Theodosius defeated them and claimed the Christian God victorious over the pagan gods.

Theodosius I Boradiotes \ˌbȯr-ə-ˈdī-ə-ˌtēz\ (b. Antioch—d. after 1183, Constantinople) GREEK ORTHODOX patriarch of Constantinople (1179–83). As patriarch, he upheld stringent conversion requirements for converts from ISLAM against the wishes of Emperor MANUEL I COMNENUS. He also opposed Manuel's overtures to Pope ALEXANDER III and the Latin church of the West, refusing to cooperate with a proposed reunion of the two branches of Christianity. The succeeding emperor forced Theodosius to abdicate.

Theodosius II (b. April 10, 401, Constantinople—d. July 28, 450) Eastern Roman emperor (408–450). In 402 he was made coemperor with his father, Arcadius (son of THEODOSIUS I), then became sole ruler of the East at age seven, initially under a regency. A gentle, scholarly man, he allowed relatives and ministers to dominate his government. His generals twice repelled the Persians (422, 447) but failed to evict the VANDALS from Roman Africa (429) and to prevent ATTILA's invasions (441–443, 447). The NESTORIAN heresy caused internal upheaval. Theodosius was credited with building the wall around Constantinople (413), founding the University of Constantinople (425), and promulgating the Theodosian Code (438).

Theodosius of Alexandria (fl. 6th century—d. June 566, Constantinople) Patriarch of Constantinople (535–566). A moderate Monophysite, he was opposed by more extreme Monophysites and did not accept the orthodox position expressed by the Council of CHALCEDON (451). He was prevented from administering his patriarchate by his detention in Constantinople, but he influenced the independent churches in Antioch, Syria, and Egypt. See MONOPHYSITE HERESY.

theology Study of the nature of God and the relationship of the human and divine. The term was first used in the works of PLATO and other Greek philosophers to refer to the teaching of myth, but the discipline expanded within CHRISTIANITY and has found application in all theistic religions (see THEISM). It examines doctrines concerning such subjects as SIN, faith, and GRACE and considers the terms of God's COVENANT with humankind in matters such as SALVATION and ESCHATOLOGY. Theology typically takes for

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granted the authority of a religious teacher or the validity of a religious experience. It is distinguished from PHILOSOPHY in being concerned with justifying and explicating a faith, rather than questioning the underlying assumptions of such faith, but it often employs quasi-philosophical methods.

Theophilus \thē-'ä-fə-ləs\ **(Presbyter)** *pseudonym of* **Roger of Helmarshausen** (fl. 12th century) German monk and writer. He is known for his *De Diversis Artibus* (c. 1110–40), a thorough account of the techniques of almost all the known crafts of the early 12th century. From his writings it can be deduced that he was a practicing craftsman of the Benedictine order.

theorem In mathematics or logic, a statement whose validity has been established or proved. It consists of a hypothesis and a conclusion, beginning with certain assumptions that are necessary and sufficient to establish a result. A system of theorems that build on and augment each other constitutes a theory. Within any theory, however, only statements that are essential, important, or of special interest are called theorems. Less important statements, usually stepping-stones in PROOFS of more important results, are called lemmas. A statement proved as a direct consequence of a theorem is a corollary of the theorem. Some theorems (and even lemmas and corollaries) are singled out and given titles (e.g., GÖDEL'S THEOREM, FUNDAMENTAL THEOREM OF ALGEBRA, FUNDAMENTAL THEOREM OF CALCULUS, PYTHAGOREAN THEOREM).

theosophy \thē-'ä-sə-fē\ Religious philosophy with mystical concerns that can be traced to the ancient world. It holds that God, whose essence pervades the universe as an absolute reality, can be known only through mystical experience (see MYSTICISM). It is characterized by esoteric doctrine and an interest in occult phenomena. Theosophical beliefs are found in NEOPLATONISM, GNOSTICISM, and among students of the KABBALA, but JAKOB BÖHME, who developed a complete theosophical system, is often called the father of modern theosophy. Today theosophy is associated with the Theosophical Society, founded by HELENA BLAVATSKY in 1875. See also ANNIE BESANT.

Thera See THÍRA

Theramenes \thē-'ra-mə-ˌnēz\ (d. 404/403 BC, Athens) Athenian politician. In 411 he helped install the Council of the FOUR HUNDRED. Sent to quell an insurrection at Piraeus, he instead led the mutineers in deposing the Council. In 410 he helped ALCIBIADES defeat the Peloponnesian navy at Cyzicus (see PELOPONNESIAN WAR). Under Alcibiades he taxed shipping from the Black Sea, helping the economy of Athens to recover and helping restore full constitutional government. During the siege of Athens (405/404) he was sent to deal with LYSANDER and negotiated terms of capitulation as Athens underwent three months of starvation. A leader of the THIRTY TYRANTS installed by Lysander, he fell out with Critias and was forced to drink hemlock.

Therapeutae \ˌther-ə-'pyü-tē\ *Greek* **"Worshipers"** Sect of Jewish ascetics believed to have settled along Lake Mareotis near ALEXANDRIA in the 1st century AD. Their origin and fate are unknown, and the only account of them is attributed to PHILO JUDAEUS. They shared with the ESSENES a dualistic view of the body and soul (see DUALISM) but differed from them in that their objective was "wisdom." They viewed the scriptures as allegorical. Devoting themselves entirely to prayer and spiritual exercise, members lived in isolation for six days of the week and met on the SABBATH for discourse and a common meal.

therapeutics \ˌther-ə-'pyü-tiks\ Treatment and care to combat disease or alleviate pain or injury. Its tools include drugs, surgery, radiation therapy, mechanical devices, diet, and psychiatry. Treatment may be active, to cure a disease (requiring no further treatment after recovery), treat it long-term, or heal a wound; symptomatic, to relieve symptoms until the IMMUNE SYSTEM heals the body; supportive, to keep body functions going until the disease clears; or palliative, to minimize discomfort for patients with no chance of recovery. It almost always includes prevention, usually tertiary (see PREVENTIVE MEDICINE). Therapeutic measures can be chosen, combined, and tailored based on accurate diagnosis to fit each patient. See also ALTERNATIVE MEDICINE; CHEMOTHERAPY; HOLISTIC MEDICINE; HYDROTHERAPY; NUCLEAR MEDICINE; OCCUPATIONAL THERAPY; PHYSICAL MEDICINE AND REHABILITATION; PSYCHOTHERAPY; RESPIRATORY THERAPY.

Theravada \ˌter-ə-'vä-də\ Major form of BUDDHISM, prevalent in Myanmar, Sri Lanka, Thailand, Cambodia, and Laos. It is the only survivor among the HINAYANA schools of Buddhism, and it is generally regarded as the oldest, most orthodox, and most conservative form of Buddhism. It is relatively uninfluenced by other indigenous belief systems. It is believed to have survived intact from the 500 Elders, who followed in the tradition of the monks of the first Buddhist SANGHA. Theravada has no hierarchical authority structure, though seniority is respected in the sangha. It accepts the Pali canon (see TRIPITAKA) as authoritative scripture. Theravadins revere the historical BUDDHA but do not recognize the various celestial buddhas and ancillary gods associated with MAHAYANA Buddhism.

Thérèse of Lisieux \lēz-'yœ**, Saint** *orig.* **Marie-Françoise-Thérèse Martin** (b. Jan. 2, 1873, Alençon, France—d. Sept. 30, 1897, Lisieux; canonized May 17, 1925; feast day October 1) French CARMELITE nun and Doctor of the Church. Born into a devout Roman Catholic family, she entered the convent at Lisieux at age 15, where she was plagued by depression and guilt but was known for her sweetness of temper. At the insistence of the prioress, she wrote an account of her spiritual development, in which she called for an absolute and childlike surrender to God, which she called the Little Way. After her death from tuberculosis at age 24, the book was published as *Story of a Soul* (1898) and became widely popular, and her burial site at Lisieux became a place of pilgrimage.

Theresienstadt \te-'rā-zē-ən-ˌshtät\ Nazi CONCENTRATION CAMP in WORLD WAR II. Originally a town in northern Bohemia (now in the Czech Republic), it became a walled ghetto for Jews in 1941. After the small non-Jewish population was evacuated in 1942, Jewish captives were shipped there from Germany, Austria, Czechoslovakia, Denmark, and The Netherlands. Of the approximately 144,000 Jews sent to Theresienstadt, some 33,000 died in the dense crowding of the ghetto, and 88,000 were shipped on to extermination camps, especially AUSCHWITZ. By the end of World War II, only 19,000 were alive. After the war, the town was resurrected under its Czech name, Terezín.

thermae \'thər-mē\ Public bathing complex of ancient Rome, designed for relaxation and social activity as well as bathing. The Romans developed public baths to a high degree of sophistication and standardization. They consisted of a large open garden surrounded by subsidiary club rooms and a main block that contained three large bath chambers—hot room, steam room, and warm room—and smaller bathrooms, cold room, and courts for exercise. Imperial thermae, such as the Baths of Caracalla (AD 216), were immense and opulently furnished. Service was supplied by slaves moving through underground passageways. Heating was accomplished by circulating heated air from a fire under the floor. Lighting of the enormous rooms was provided by an ingenious system of CLERESTORY windows.

thermal conduction Transfer of HEAT energy resulting from differences in temperature between adjacent bodies or adjacent parts of a body. In the absence of a HEAT PUMP, the energy will flow from a region of higher temperature to a region of lower temperature. The transfer of energy occurs as a result of collision among the particles of the matter involved. The rate of transfer of energy is proportional to the cross-sectional area of contact and to the difference in temperature between the two regions. A substance of high thermal conductivity, such as copper, is a good thermal CONDUCTOR; one with low thermal conductivity, such as wood, is a poor thermal conductor. See also CONVECTION, RADIATION.

thermal energy Internal energy of a system in thermodynamic equilibrium (see THERMODYNAMICS) by virtue of its temperature. A hot body has more thermal energy than a similar cold body, but a large tub of cold water may have more thermal energy than a cup of boiling water. Thermal energy can be transferred from one body, usually hotter, to a second body, usually colder, in three ways: conduction (see THERMAL CONDUCTION), CONVECTION, and RADIATION.

thermal expansion Increase in volume of a material as its temperature is increased, usually expressed as a fractional change in dimensions per unit temperature change. When the material is a solid, thermal expansion is usually described in terms of change in length, height, or thickness. If a crystalline solid has the same structural configuration throughout, the expansion will be uniform in all dimensions. Otherwise, there may be different expansion coefficients and the solid will change shape as the temperature increases. If the material is a fluid, it is more useful to describe the expansion in terms of a change in volume. Because the bonding forces among atoms and molecules vary from material to material, expansion coefficients are characteristic of elements and compounds.

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thermal radiation Process by which energy is emitted by a warm surface. The energy is ELECTROMAGNETIC RADIATION and so travels at the speed of light and does not require a medium to carry it. Thermal radiation ranges in FREQUENCY from infrared rays through visible light to ultraviolet rays. The intensity and frequency distribution of the emitted rays are determined by the nature and temperature of the emitting surface; in general, the hotter the object, the shorter the wavelength. A hotter object is a better emitter than a cooler one, and a blackened surface is a better emitter than a silvered one. An example of thermal radiation is the heating of the Earth by the Sun.

thermal spring See HOT SPRING

Thermidorian Reaction (1794) Revolt in the FRENCH REVOLUTION against the REIGN OF TERROR that was initiated on 9 Thermidor (July 27). Weary of the mounting executions (1,300 in June alone), deputies in the NATIONAL CONVENTION decreed the arrest of MAXIMILIEN ROBESPIERRE, LOUIS DE SAINT-JUST, and other members of the COMMITTEE OF PUBLIC SAFETY. They and others were guillotined, inaugurating a brief "White Terror" against the radical JACOBIN CLUB. The DIRECTORY period followed soon afterward.

thermocouple *or* **thermal junction** *or* **thermoelectric thermometer** Temperature-measuring instrument consisting of two wires of different metals joined at each end. One junction is placed where the temperature is to be measured, and the other is kept at a constant lower (reference) temperature. A measuring instrument is connected in the electrical circuit. The temperature difference causes the development of an ELECTROMOTIVE force that is approximately proportional to the difference between the temperatures of the two junctions. Temperature can be read from standard tables, or the instrument can be calibrated to display temperature directly.

thermodynamics Study of the relationships among HEAT, WORK, TEMPERATURE, and ENERGY. Any physical system will spontaneously approach an EQUILIBRIUM that can be described by specifying its properties, such as PRESSURE, temperature, or chemical composition. If external constraints are allowed to change, these properties generally change. The three laws of thermodynamics describe these changes and predict the equilibrium state of the system. The first law states that whenever energy is converted from one form to another, the total quantity of energy remains the same. The second law states that, in a closed system, the ENTROPY of the system does not decrease. The third law states that, as a system approaches ABSOLUTE ZERO, further extraction of energy becomes more and more difficult, eventually becoming theoretically impossible.

thermoluminescence Emission of light from certain heated substances as a result of previous exposure to high-energy RADIATION. The radiation causes displacement of ELECTRONS within the CRYSTAL LATTICE of the substance. Upon heating, the trapped electrons return to their normal, lower-energy positions, releasing energy in the process. The longer the substance is exposed to radiation, the greater is the energy released. By measuring the amount of light given off, the duration of exposure to radiation can be determined; thus, thermoluminescence has been used to determine the age of various minerals and archaeological artifacts.

thermometry \thər-'mä-mə-trē\ Science of measuring the TEMPERATURE of a system or the ability of a system to transfer HEAT to another system. Temperature measurement is important to a wide range of activities, including manufacturing, scientific research, and medicine.

thermonuclear bomb See HYDROGEN BOMB

thermonuclear weapon See NUCLEAR WEAPON

Thermopylae \thər-'mä-pə-lē**, Battle of** Battle in northern Greece (480 BC) in the PERSIAN WARS. The Greek forces, mostly Spartan, were led by LEONIDAS. After three days of holding their own against the Persian king XERXES I and his vast southward-advancing army, the Greeks were betrayed, and the Persians were able to outflank them. Sending the main army in retreat, Leonidas and a small contingent remained behind to resist the advance and were killed to the last man.

thermoreception Sensory capacity (see SENSE) to detect the temperature of the environment and the body. It helps keep body temperature stable by regulating autonomic responses to temperature changes (see HOMEOSTASIS). Temperature sensations are generated by separate heat and cold receptors (nerve endings) in the skin. Blood-sucking insects and some snakes (e.g., the PIT VIPER) locate prey by its thermal radiation.

thermostat Device that detects TEMPERATURE changes for the purpose of maintaining the temperature of an enclosed area essentially constant. The thermostat generates signals, usually electrical, to activate relays, valves, switches, and so on when the temperature rises above or falls below the desired value. Thermostats are used to control the flow of fuel to a burner, of electric current to a heating or cooling unit, or of a heated or cooled gas or liquid into the area it serves. They are also used in fire-detection warning systems.

theropod \'thir-ə-ˌpäd\ Any species of bipedal, carnivorous SAURISCHIAN in the suborder Theropoda. The chicken-sized *Compsognathus*,the smallest known adult dinosaur, probably weighed 2–4 lb (1–2 kg); the TYRANNOSAURS weighed tons. The theropods also included ALLOSAURUS, DEINONYCHUS, Megalosaurus, Oviraptor, and VELOCIRAPTOR. Theropod remains recovered have been from the Late TRIASSIC through the Late CRETACEOUS Epoch (227–65 million years ago) from all continents except Antarctica. Their well-developed hind legs provided support and locomotion; their short forelimbs had mobile hands, probably for grasping and tearing prey. Despite the group's name, which means "beast (i.e., mammal) foot," theropod feet usually resembled those of birds. It is widely believed that all modern birds are descended from one line of small theropods.

Theseum \thi-'sē-əm\ Temple in Athens dedicated to HEPHAESTUS and ATHENA as patrons of the arts and crafts. Built c. 450 BC, it is slightly older than the PARTHENON. Some of its sculptures represent the exploits of THESEUS (the source of its traditional name), though reconstructed fragments of its ornamentation reveal that its theme was actually the apotheosis of HERACLES. It is surrounded by a single row of Doric columns, with 13 at the sides and six at the ends. It is the world's best-preserved ancient Greek temple, largely because of its medieval conversion to a Christian church.

Theseus \'thē-sē-əs, 'thēs-ˌyüs\ Hero of ancient Greek legend. He was the son of Aegeus, king of Athens. On his journey to Athens, he slew many legendary villains, including Sinis, Sciron, and Procrustes. In Athens he found Aegeus married to MEDEA; she recognized him before her husband did and tried to poison him but failed, and Aegeus declared him heir to the throne. In CRETE Theseus met ARIADNE and slew the MINOTAUR; on returning to Athens, he forgot to replace the ship's black sail with a white one signaling his victory, and Aegeus threw himself from the Acropolis in grief. Theseus went on to unite and extend the borders of ATTICA. He captured the AMAZON princess Antiope (Hippolyte), with the result that the Amazons attacked Athens and Antiope was killed while defending it. He abducted the child HELEN and attempted to steal PERSEPHONE from HADES, but he was confined in the underworld until his rescue by HERACLES. He died when the king of Scyros threw him from a cliff.

Theseus killing the Minotaur, detail of a vase painting by the Cleophrades Painter, 6th century BC; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

thesis play See PROBLEM PLAY

Thesmophoria \ˌthez-mə-'fōr-ē-ə\ In GREEK RELIGION, a festival held in honor of Demeter Thesmophoros. The celebrants were free married women who had observed chastity for several days and abstained from certain foods. Pigs were thrown into an underground chamber, where they were eaten by snakes. The uneaten, rotted remains were brought up and laid on an altar; if mixed with seeds they were believed to ensure a good crop.

Thespiae \'thes-pē-ˌē\ Ancient town, BOEOTIA, eastern central Greece. It was the site of temples and festivals of the MUSES and of PRAXITELES' famous statue of Eros. It is important in Greek history chiefly as an enemy of nearby THEBES. Its citizens fought the Persians with Spartan forces under LEONIDAS at the battles of THERMOPYLAE in 480 BC and PLATAEA in 479. It served SPARTA as a base against Thebes 379–372 BC. The Thebans destroyed it in 371 BC, but it was soon rebuilt. It was an important Boeotian town under the Roman empire.

Thespis \'thes-pəs\ (fl. 6th century BC, Athens) Greek poet, often considered the "inventor of TRAGEDY." He is the first recorded winner (c. 534

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BC) of a prize for tragedy at the Great Dionysia, a drama festival. According to the rhetorician Themistius, ARISTOTLE said that tragedy in its earliest stage was entirely choral until the prologue and speeches were first introduced by Thespis. Thespis, according to Themistius's account, was thus the first "actor," and tragic dialogue began when he exchanged words with the leader of the chorus.

Thessaloníki \ˌthe-sä-lō-ˈnē-kē\ *formerly* **Salonika** \sə-ˈlä-ni-kə\ Seaport (pop., 2001: 363,987), Macedonia, Greece. Founded in 316 BC, it became the capital of the Roman province of Macedonia in 146 BC and grew to great importance. The apostle Paul (see St. PAUL) visited c. AD 49–50, and he later addressed epistles to converts there. During the time of the Byzantine Empire, it prospered despite repeated attacks by Avars and Slavs. It was part of the Ottoman Empire from 1430 to 1912. Thessaloníki was the headquarters of the YOUNG TURK movement in 1908 and was returned to Greece in 1913. It was an important Allied base in World War I and was occupied by the Germans in World War II. It is Greece's second largest city.

Thessaly \ˈthe-sə-lē\ Historical region and current administrative region (pop., 2001: 754,893), east-central Greece. The ancient region corresponded roughly to the modern one. Mount OLYMPUS rises in the northeast. Thessaly is drained by the PINIÓS RIVER. It was the site of many cultures in the 3rd–2nd millennia BC; by c. 1000 BC Greeks had established power there. Incorporated into the Roman province of Macedon in the 2nd century BC, it was made a separate Roman province in the 4th century AD. In the 7th–13th centuries it was controlled by Slavs, Saracens, Bulgars, and Normans. In the late 14th century it passed to the Turks; it was returned to Greece in 1881. It saw heavy fighting between Allied and Axis forces in 1941.

Thetis \ˈthē-təs\ In GREEK MYTHOLOGY, a NEREID loved by both ZEUS and POSEIDON. When it was revealed that Thetis was destined to bear a son who would be mightier than his father, the two gods gave her to Peleus, king of the Myrmidons. Unwilling to wed a mortal, Thetis resisted Peleus' advances by changing into various shapes, but Peleus finally captured and married her. Their child was ACHILLES. Some legends relate that she bore seven children, all of whom perished either when she tried to render them immortal or when she killed them as the offspring of a forced marriage.

thiamin \ˈthī-ə-mən\ *or* **vitamin B_1** Organic compound, part of the VITAMIN B COMPLEX, necessary in carbohydrate metabolism. It carries out these functions in its active form, as a component of the COENZYME thiamin pyrophosphate. Its molecular structure includes a substituted PYRIDINE ring and a thiazole ring. Thiamin is found most abundantly in whole cereal grains and certain other seeds. Deficiency leads to BERIBERI.

Thiers \tē-ˈer**, (Louis-) Adolphe** (b. April 18, 1797, Marseille, France—d. Sept. 3, 1877, Saint-Germain-en-Laye, near Paris) French politician and historian. He went to Paris in 1821 as a journalist and cofounded the opposition newspaper *National* in 1830. In the JULY REVOLUTION he supported LOUIS-PHILIPPE and served as minister of the interior (1832, 1834–36) and premier and foreign minister (1836, 1840). A leader of the conservative moderates, he crushed all insurrections. Following the FEBRUARY REVOLUTION, he helped elect Louis-Napoléon (later NAPOLEON III) president of the SECOND REPUBLIC. As a leader of the opposition (1863–70), he attacked Napoleon III's imperial policies. As president of the THIRD REPUBLIC (1871–73), he negotiated the end of the FRANCO-PRUSSIAN WAR and restored domestic order by crushing the PARIS COMMUNE. He also wrote major historical works, most importantly the huge *History of the French Revolution* (10 vol., 1823–27) and *History of the Consulate and the Empire* (20 vol., 1845–62).

Thimann \ˈthī-mən**, Kenneth V(ivian)** (b. Aug. 5, 1904, Ashford, Kent, Eng.—d. Jan. 15, 1997, Haverford, Pa., U.S.) British-born U.S. plant physiologist. He received his Ph.D. from Imperial College in London. In 1934 he obtained and isolated pure AUXIN, an important plant-growth hormone and, with several coworkers, proved that auxin promotes cell elongation, formation of roots, and growth of buds, discoveries that led to the development of a widely used synthetic auxin, 2,4-D. Use of this and similar chemicals can prevent the premature falling of fruit and stimulate cut stems to grow abundant roots; because high concentrations of auxins are toxic to most plants, synthetic auxins are also effective weed killers.

Thimphu \thim-ˈpü\ Town (pop., 1999 est.: 28,000), capital of Bhutan. It lies on the Raidak River in the HIMALAYAS. It was designated the official seat of government in 1962. The Tashi Chho castle, a traditional fortified monastery and one of the finest examples of traditional Bhutanese architecture, houses the offices of the royal government. The local economy is based on agriculture and lumbering.

thin-layer chromatography (TLC) Type of CHROMATOGRAPHY using as the stationary phase a thin layer (0.01 inch [0.25 mm]) of a special finely ground matrix (silica gel, alumina, or similar material) coated on a glass plate or incorporated in a plastic film. Solutions of the mixtures to be analyzed are spotted near one edge. Solutions of reference compounds are similarly applied. The edge of the plate is then dipped in a SOLVENT. The solvent travels up the matrix by CAPILLARITY, moving the components of the samples at various rates because of their different degrees of attachment to the matrix and solubility in the developing solvent. The components, visible as separated spots, are identified by comparing the distances they have traveled with those of the known reference materials. TLC is useful for biological mixtures, especially LIPIDS in animal or vegetable tissues and ISOPRENOIDS and ESSENTIAL OILS found in flowers and other parts of plants. The matrices withstand strong solvents and developers better than the paper used in PAPER CHROMATOGRAPHY.

think tank Institute, corporation, or group organized for interdisciplinary research, usually conducted for governmental and commercial clients. Projects for government clients often involve social policy planning and national defense. Commercial projects include developing and testing new technologies and new products. Funding sources include endowments, contracts, private donations, and sales of reports. See also RAND CORP.

thinking *or* **thought** Action of using one's mind to produce thoughts, or covert symbolic responses to stimuli. Theories of thought and thought processes have concentrated largely on directed thinking, including PROBLEM SOLVING. At the beginning of the 20th century, researchers focused on studying mental ASSOCIATIONS. Theorists of GESTALT psychology in the 1920s and '30s believed the elements of thought to be in the nature of patterns elicited from experience. Today these elements are often regarded as bits of information undergoing processing. See also COGNITIVE PSYCHOLOGY, INFORMATION PROCESSING.

Thíra \ˈthē-rä\ *ancient* **Thera** \ˈthir-ə\ *formerly* **Santorini** Island, southern CYCLADES, Greece. The remaining half of an exploded volcano, it surrounds a lagoon with volcanic cliffs rising to almost 1,000 ft (300 m). It was settled in the Bronze Age; MINOAN remains date to before 2000 BC. One of the largest known volcanic eruptions occurred on the island c. 1500 BC, depositing ash and pumice as far away as Egypt and Israel. The eruption has been linked to such phenomena as the miracles of the EXODUS and the sinking of ATLANTIS. Excavations have revealed a rich Minoan city buried under the volcanic debris. It was resettled by Dorian invaders c. 1000 BC.

Third Estate *French* **Tiers État** In French history, one of the three orders (with the nobility and the clergy) of the ESTATES-GENERAL before the FRENCH REVOLUTION. The unprivileged order, it represented the great majority of the people. Its transformation with the TENNIS COURT OATH into a NATIONAL ASSEMBLY in 1789 marked the beginning of the Revolution.

Third International See COMINTERN

Third Reich \ˈthīrik\ Official designation for the NAZI PARTY's regime in Germany from January 1933 to May 1945. The name reflects ADOLF HITLER's conception of his expansionist regime—which he predicted would last 1,000 years—as the presumed successor of the HOLY ROMAN EMPIRE (800–1806, the First Reich) and the German empire under the HOHENZOLLERN dynasty (1871–1918, the Second Reich).

Third Republic French government (1870–1940). After the fall of the SECOND EMPIRE and the suppression of the PARIS COMMUNE, the new CONSTITUTIONAL LAWS OF 1875 were adopted, establishing a regime based on parliamentary supremacy. Despite its series of short-lived governments, the Third Republic was marked by social stability (except for the ALFRED DREYFUS affair), industrialization, and establishment of a professional civil service. It ended with the fall of France to the Germans in 1940. Presidents of the Third Republic included ADOLPHE THIERS (1871–73), MAURICE DE MACMAHON (1873–79), JULES GRÉVY (1879–87), SADI CARNOT (1887–94), FÉLIX FAURE (1895–99), Émile Loubet (1899–1906), Armand Fallières (1906–13), RAYMOND POINCARÉ (1913–20), ALEXANDRE MILLERAND (1920–24), Gaston Doumergue (1924–31), and ALBERT LEBRUN (1932–40). Other notable leaders included LÉON BLUM, GEORGES BOULANGER, ARISTIDE BRIAND, GEORGES CLEMENCEAU, ÉDOUARD DALADIER, JULES FERRY, LÉON GAMBETTA, ÉDOUARD HERRIOT, JEAN JAURÈS, PIERRE LAVAL, PHILIPPE PÉTAIN, and PAUL REYNAUD.

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Third Section *or* **Third Department** Office created in 1826 by Tsar Nicholas I to conduct secret police operations. Designed and headed (1826–44) by Count Aleksandr Benckendorff (1783–1844), it gathered information on political dissidents and banished suspected political criminals to remote regions. It collaborated with the Corps of Gendarmes (formed in 1836), a military force that operated throughout Russia, and with a network of spies and informers. The department grew increasingly repressive, and in the 1870s it arrested many Narodniks (Populists) who agitated among the peasantry. It was abolished in 1880, and its functions were transferred to the police of the interior ministry.

third world Political designation originally used (1963) to describe those states not part of the first world—the capitalist, economically developed states led by the U.S.—or the second world—the communist states led by the Soviet Union. The third world principally consists of the developing world, former colonies of Africa, Asia, and Latin America. With the end of the Cold War and the increased economic competitiveness of some developing countries, the term has lost its analytic clarity.

Thirteen Articles of Faith *or* **Thirteen Principles of Faith** Summary of the basic tenets of Judaism. It was formulated by Moses Maimonides in his commentary on the Mishna, in an effort to put forth true concepts of God and faith as a tool in avoiding error. Though presented as dogma, his statement was a personal concept and has been much debated and revised. The articles state various doctrines concerning the nature of God, the law, and Moses, and they affirm that the messiah is coming and that the dead will rise. All versions include the hymn "Yigdal," which is part of most Jewish prayer services.

Thirty Tyrants (404–403 BC) Spartan-imposed oligarchy that ruled Athens after the Peloponnesian War. Thirty commissioners were appointed to the oligarchy, which had an extremist conservative core, led by Critias. Their oppressive regime fostered a bloody purge, in which perhaps 1,500 residents were killed. Many moderates fled the city; gathering a force, they returned to defeat the tyrants' forces in a battle at Piraeus in 403. The 30 fled and were killed off over the next few years.

Thirty Years' War (1618–48) Series of intermittent conflicts in Europe fought for various reasons, including religious, dynastic, territorial, and commercial rivalries. The overall war was mainly a struggle between the Habsburg-controlled Holy Roman Empire and the Protestant principalities that relied on the chief anti-Catholic powers of Sweden and the Netherlands. It also involved the rivalry of France with the Habsburg powers, which formed anti-French alliances. The conflicts began in 1618 when the future Emperor Ferdinand II tried to impose Roman Catholicism on his domains and the Protestant nobles rebelled; the war was sparked by the Defenestration of Prague. The battlefield centred on the principalities in Germany, which suffered severely from plundering armies. Early successes by the Catholic League were countered by military gains by Sweden. When the bloodshed ended with the Peace of Westphalia (1648), the balance of power in Europe had been radically changed. France emerged as the chief Western power, and states of the Holy Roman Empire were granted full sovereignty, establishing a framework for a modern Europe of sovereign states.

Thiruvananthapuram *formerly* **Trivandrum** \trə-'van-drəm\ Seaport (pop., 2001: 744,983), capital of Kerala state, southwestern India. The community became prominent when it was made capital of the kingdom of Travancore in 1745. A large fort contains several palaces and a Vaishnava temple, which is a noted pilgrimage centre. Its cultural amenities include the University of Kerala (1937).

thistle Weedy species of *Cirsium*, *Carduus*, *Echinops*, *Sonchus*, and other plant genera of the composite family. The term usually refers to prickly leaved species of *Carduus* and *Cirsium*, which have dense heads of small, usually pink or purple flowers. Because they have spiny stems and flower heads without ray flowers, *Carduus* species are called plumeless thistles. Canadian thistle (*Cirsium arvense*) is an attractive but troublesome weed in agricultural areas of North America. The thistle is the national emblem of Scotland.

Thjórsá River \'thyôr-ˌsaù\ River, Iceland. Carrying meltwater from several glaciers, it flows southwest for 143 mi (230 km) to discharge into the Atlantic Ocean. It is the country's longest river; its lower third flows through an extensive farming region. It is Iceland's main source of hydroelectric power.

Thocmectony See Sarah Winnemucca Hopkins

Thomas, Clarence (b. June 23, 1948, Pinpoint, near Savannah, Ga., U.S.) U.S. jurist. He graduated from Yale Law School and served as assistant attorney general in Missouri (1974–77), lawyer for Monsanto Co. (1977–79), legislative assistant to Sen. John Danforth (1979–81), assistant secretary in the U.S. Department of Education (1981–82), and chairman of the Equal Employment Opportunity Commission (EEOC) (1982–90). Pres. George Bush appointed him to the U.S. Court of Appeals in 1990 and then to the Supreme Court of the United States; he thereby became the second African American justice on the court, after Thurgood Marshall. His 1991 confirmation hearings attracted enormous public interest and media attention, largely because of accusations of sexual harassment by Anita Hill, a law professor and former colleague of Thomas at the EEOC. Thomas denied the charges, and the Senate narrowly voted to confirm him. A quiet presence on the court, he generally follows a predictable pattern in his opinions—conservative, restrained, and suspicious of the reach of the federal government into the realm of state and local politics.

Thomas, Dylan (Marlais) (b. Oct. 27, 1914, Swansea, Wales—d. Nov. 9, 1953, New York, N.Y., U.S.) Welsh poet and prose writer. He left school at age 16 to work as a reporter. His early verse, as in *The Map of Love* (1939), with rich metaphoric language and emotional intensity, made him famous. In the more accessible *Deaths and Entrances* (1946), with "Fern Hill," he often adopts a bardic, oracular voice. *In Country Sleep* (1952), containing "Do Not Go Gentle into That Good Night," and *Collected Poems* (1952) followed. Thomas's prose includes the comic *Portrait of the Artist as a Young Dog* (1940); a play for voices, *Under Milk Wood* (1954); and the reminiscence *A Child's Christmas in Wales* (1955). His sonorous recitations contributed greatly to his fame. Debt and heavy drinking began taking their toll in the late 1930s, and he died of an alcohol overdose while on tour.

Dylan Thomas, 1952.
ROLLIE MCKENNA

Thomas, George H(enry) (b. July 31, 1816, Southampton county, Va., U.S.—d. March 28, 1870, San Francisco, Calif.) U.S. general. He was a graduate of West Point. When the American Civil War broke out, he remained loyal to the Union despite his Southern birth. He commanded an independent force in eastern Kentucky, where he won the first important Union victory in the west in 1862. At the Battle of Chickamauga he organized an unyielding defense, earning promotion to brigadier general and the nickname "the Rock of Chickamauga." In 1864 he defeated the Confederate forces of Gen. John B. Hood (1831–79) in the Battle of Nashville, earning another promotion and the gratitude of Congress.

Thomas, Helen (b. Aug. 4, 1920, Winchester, Ky., U.S.) U.S. journalist. Born to Lebanese immigrant parents, she grew up in Detroit and joined the UPI news agency in Washington, D.C., in 1943. A pioneer in overcoming the limitations on women in the news media, she became known for her bold and tireless pursuit of information. Assigned to the White House in 1961, she became UPI bureau chief there in 1974. She is best known as the reporter traditionally first recognized at presidential press conferences.

Thomas, Isiah (Lord), III (b. April 30, 1961, Chicago, Ill., U.S.) U.S. basketball player, coach, and executive. He led Indiana University to a national collegiate title in 1981. As a guard for the Detroit Pistons (1981–94), he amassed 9,061 career assists and helped the team win two NBA championships (1989, 1990); he is regarded as one of the greatest point guards of all time. He subsequently worked as general manager for the Toronto Raptors and New York Knicks and coached the Indiana Pacers.

Thomas, Lewis (b. Nov. 25, 1913, Flushing, N.Y., U.S.—d. Dec. 3, 1993, New York City) U.S. physician and author. He attended medical school at Harvard and later taught at various universities. He was president of New York's Memorial Sloan-Kettering Cancer Center (1973–83). He translated his passionate interest in and wonder at the intricate mysteries of biology into lucid meditations and reflections on biology in award-winning essays. The best-known of his widely read books is *The Lives of a Cell* (1974, National Book Award).

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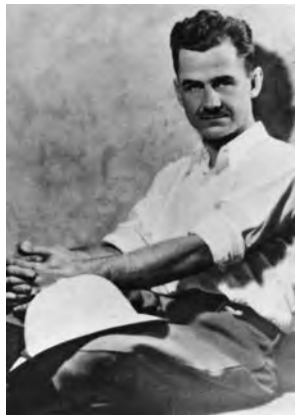
Thomas, Lowell (Jackson) (b. April 6, 1892, Woodington, Ohio, U.S.—d. Aug. 29, 1981, Pawling, N.Y.) U.S. radio commentator, journalist, and author. A war correspondent in Europe and the Middle East while in his 20s, Thomas helped make T.E. Lawrence famous with his exclusive coverage and later with the book *With Lawrence in Arabia* (1924). He was a preeminent broadcaster with CBS from 1930; his radio nightly news was an American institution for nearly two generations, and he appeared on television from its earliest days. Out of his lifelong globetrotting came lectures, travelogues, and more than 50 books of adventure and comment, including *Kabluk of the Eskimo* (1932) and *The Seven Wonders of the World* (1956).



Lowell Thomas
BROWN BROTHERS

Thomas, Norman (Mattoon) (b. Nov. 20, 1884, Marion, Ohio, U.S.—d. Dec. 19, 1968, Huntington, N.Y.) U.S. social reformer and politician. He was ordained a Presbyterian minister and became pastor of New York's East Harlem Church. He joined the Socialist Party in 1918 and left his parish post to become secretary of the pacifist Fellowship of Reconciliation. He helped found the American Civil Liberties Union and served as codirector of the League for Industrial Democracy (1922–37). He was the Socialist Party's candidate for governor (1924), for mayor of New York (1925, 1929), and for U.S. president (1928–48), and he headed the party from 1926. After World War II, as chairman of the Postwar World Council, he campaigned for nuclear disarmament.

Thomas, Saint (b. probably Galilee—d. c. AD 53, Madras, India; Western feast day December 21, feast day in Roman and Syrian Catholic churches July 3, in the Greek church October 6) One of the Twelve Apostles of Christ. He is best known for requiring physical proof of Jesus' Resurrection before he could believe it, hence the phrase "doubting Thomas." When Jesus reappeared and had Thomas touch his wounds, Thomas became the first person to explicitly acknowledge Jesus' divinity, saying "My Lord and my God." His subsequent history is uncertain; he is said to have evangelized Parthia (modern Khorāsān) and even India.

Thomas à Becket See Saint Thomas Becket

Thomas à Kempis *orig.* **Thomas Hemerken** (b. 1379/80, Kempen, near Düsseldorf, Rhineland—d. Aug. 8, 1471, Agnietenberg, near Zwolle, Bishopric of Utrecht) Christian theologian and probable author of *The Imitation of Christ*. He went to Deventer, Neth., c. 1392 and joined the Brethren of the Common Life, a community devoted to the care and education of the poor. In 1387 he entered the Augustinian monastery of canons regular at Agnietenberg. He was ordained a priest in 1413 and devoted himself to copying manuscripts and directing novices. He is credited with writing *The Imitation of Christ*, the most influential devotional work in Christian literature after the Bible. Noted for its simple language and style, it emphasizes spiritual over materialistic life and affirms the rewards of a life centred on Christ. The *Imitation* and his other treatises and sermons are the best representation of the *devotio moderna*, a new form of religious devotion that arose at the end of the 14th century.

Thomas Aquinas, Saint See Aquinas, Saint Thomas

Thomism \ˈtō-ˌmi-zəm\ Philosophical and theological system developed by St. Thomas Aquinas. It holds that the human soul is immortal and is a unique subsistent form, that human knowledge is based on sensory experience but also depends on the mind's reflective capacity, and that all creatures have a natural tendency to love God that can be perfected and elevated by grace and application. In the 20th century, Thomism was developed by Étienne Gilson (1884–1978) and Jacques Maritain. After World War II, Thomists faced three major tasks: to develop an adequate philosophy of science, to account for phenomenological and psychiatric findings, and to evaluate the ontologies of existentialism and naturalism.

Thompson, Dorothy (b. July 9, 1894, Lancaster, N.Y., U.S.—d. Jan. 30, 1961, Lisbon, Port.) U.S. journalist. After World War I she became a freelance correspondent in Europe. Her reporting on the Nazis so infuriated Adolf Hitler that in 1934 she became the first U.S. correspondent expelled from Germany. Her column "On the Record" was exceedingly popular and was syndicated from 1941 to 1958 in as many as 170 daily newspapers. Her many books include *I Saw Hitler!* (1932), *Refugees* (1938), *Let the Record Speak* (1939), and *The Courage to Be Happy* (1957). From 1928 to 1942 she was married to the novelist Sinclair Lewis.

Dorothy Thompson, 1934.
AP/WIDE WORLD PHOTOS

Thompson, E(dward) P(almer) (b. Feb. 3, 1924—d. Aug. 28, 1993, Upper Wick, Worcester, Eng.) British historian. He served in Italy in World War II and taught at the universities of Leeds (1948–65) and Warwick (1965–71). He left the Communist Party in 1956 when Soviet troops crushed the Hungarian uprising but remained a Marxist and socialist all his life. His best-known work is *The Making of the English Working Class* (1963), an acclaimed study of the period 1780–1832. Among his other books is *Whigs and Hunters* (1975). From the late 1970s he devoted much of his time to the antinuclear movement.

Thompson, Emma (b. April 15, 1959, London, Eng.) British actress and screenwriter. After graduating from the University of Cambridge, she acted on stage and television and won acclaim in the miniseries *Fortunes of War* (1987). While married to Kenneth Branagh (1989–94), she appeared in several of his films, including *Henry V* (1989), *Dead Again* (1991), and *Much Ado About Nothing* (1993). She later starred in *Howards End* (1992, Academy Award), *The Remains of the Day* (1993), *Sense and Sensibility* (1995), for which she won an Academy Award for best screenplay, and *Primary Colors* (1998).

Thompson, Hunter S(tockton) (b. July 18, 1937, Louisville, Ky., U.S.—d. Feb. 20, 2005, Woody Creek, Colo.) U.S. journalist. He had run-ins with the law as a young man and served in the U.S. Air Force. In 1965 he infiltrated the Hell's Angels motorcycle gang and published his account, *Hell's Angels*, in 1967. His psychedelic-drug romp, *Fear and Loathing in Las Vegas* (1972), is considered a contemporary classic; it was made into a film in 1998. Other books include *Fear and Loathing: On the Campaign Trail '72* (1973), *The Great Shark Hunt* (1979), and *Better Than Sex* (1994). He created the genre known as "gonzo journalism," a style created from (by his own account) accident and desperation, and his writing—idiosyncratic and subjective in the extreme, and often wildly funny—gained him a large underground following. Thompson died of a self-inflicted gunshot wound.

Thomson, J(ohn) Edgar (b. Feb. 10, 1808, Springfield Township, Pa., U.S.—d. May 27, 1874, Philadelphia, Pa.) U.S. civil engineer and railroad executive. He joined the Pennsylvania engineer corps at age 19. In 1847 he was hired as chief engineer of the newly incorporated Pennsylvania Railroad Co., which aimed to compete with trade lines to the west originating in New York and other eastern states. He became its president in 1852 and oversaw construction of a railway that crossed the Alleghenies without using inclined grades. Over the next 22 years, Thomson consolidated a network of lines from Philadelphia to Chicago, expanding the company's track from 250 to 6,000 mi (400–10,000 km).

Thomson, Sir J(oseph) J(ohn) (b. Dec. 18, 1856, Cheetham Hill, near Manchester, Eng.—d. Aug. 30, 1940, Cambridge, Cambridgeshire) English physicist. Educated at the University of Cambridge, he taught there at the Cavendish Laboratory (1884–1918), which he developed into a world-renowned institution, and was master of Trinity College (1918–40). In 1897 he showed that cathode rays are rapidly moving particles, and, by measuring their displacement by electric and magnetic fields, he determined that these particles were nearly 2,000 times less massive than the lightest known atomic particle. Originally called corpuscles by Thomson, the particles are now known as electrons. His discovery helped revolutionize the knowledge of atomic structure. In 1903 he suggested a discontinuous theory of light, foreshadowing Albert Einstein's later theory

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of photons. He later discovered isotopes and invented MASS SPECTROMETRY. In 1906 Thomson received a Nobel Prize for his research into the electrical conductivity of gases. Throughout his life he was noted as an outstanding teacher, and seven of his assistants also became Nobel laureates.

Thomson (of Fleet), Roy (Herbert) Thomson, 1st Baron (b. June 5, 1894, Toronto, Ont., Can.—d. Aug. 4, 1976, London, Eng.) Canadian-British publisher. Thomson began acquiring radio stations and newspapers in Ontario in the 1930s; later he expanded his interests to Britain and the U.S. and added television holdings. In 1952 he bought *The Scotsman* newspaper and went to Edinburgh to run it. In 1959 he purchased the Kemsley group of newspapers, the largest in Britain, which included the *Sunday Times*. In 1967 he made his most important purchase, *The* TIMES of London, and thereafter made a major investment in it, providing it with financial stability. In the 1970s Thomson joined a consortium that was successful in discovering two oil fields. It sold *The Times* in 1981 and divested interests in U.K. newspapers in 1995. The acquisition of various publishing and other interests continued into the 21st century, and the Thomson Corp. is today one of the largest publishing conglomerates in the world.

Thomson, Virgil (b. Nov. 25, 1896, Kansas City, Mo., U.S.—d. Sept. 30, 1989, New York, N.Y.) U.S. composer and critic. He attended Harvard University, intending to become a pianist and organist. Studying in Paris with NADIA BOULANGER (1921), he met the French composers known as Les SIX and their circle and began to compose. While residing in Paris (1925–40), he met GERTRUDE STEIN, with whom he wrote the operas *Four Saints in Three Acts* (1928) and *The Mother of Us All* (1946), affecting a charmingly naïve style. Back in New York City, he served as music critic of the *Herald Tribune* (1940–54); his gracefully written criticism was respected for its concern with music rather than performers. His other works include the film scores *The Plow That Broke the Plains* (1936) and *The Louisiana Story* (1949, Pulitzer Prize).

Thonet \ˈtō-net**, Michael** (b. July 2, 1796, Boppard, Trier —d. March 3, 1871, Vienna, Austria) German Austrian pioneer in the industrialization of furniture manufacture. He developed a system of steam-bent veneers c. 1830 and created light, curvilinear chairs. By 1856 he had perfected the bending of solid beechwood with heat and began mass production of BENTWOOD FURNITURE. He set up factories in Hungary and Moravia and opened salons from Moscow to Chicago. By 1870 he was producing furniture in hitherto unheard-of quantities. His furniture is still being manufactured today.

Thor Deity, common to all the early Germanic peoples, who appeared as a great, red-bearded warrior of tremendous strength. The son of ODIN (according to some legends) and Jord, the earth goddess, he was the implacable foe of the harmful race of giants but was benevolent toward humans. His name is the Germanic word for thunder. His great weapon was his hammer, MJOLLNIR. His greatest enemy was the world serpent Jörmungand, which he was destined to kill, and be killed by, in the RAGNARÖK. Thursday is named for Thor.

Thor with his hammer, Mjollnir, on his knees, bronze statuette from northern Iceland, c. AD 1000; in the National Museum of Iceland, Reykjavík.
COURTESY OF THE NATIONAL MUSEUM OF ICELAND, REYKJAVIK

Thor rocket MISSILE initially developed by the U.S. Air Force as an intermediate-range ballistic missile. It became operational in 1958 and was later modified to serve as the first stage of LAUNCH VEHICLES for several spacecraft. The Thor missile force was withdrawn in 1963. For space launching, three small auxiliary motors were strapped to a Thor rocket, and this resulted in a thrust nearly twice as powerful as the original.

thoracic \thə-ˈra-sik\ **cavity** *or* **chest cavity** Second largest hollow space of the body, enclosed by the ribs, VERTEBRAL COLUMN, and breastbone and separated from the ABDOMINAL CAVITY by the DIAPHRAGM. It contains the LUNGS and bronchi, part of the ESOPHAGUS and TRACHEA, and the HEART and major blood vessels. A membrane called the pleura lines the cavity (parietal pleura) and continues over the lung (visceral pleura) and the rest of the cavity's contents, defining a space called the mediastinum. Disorders include blood (hemothorax) or air (pneumothorax, which can lead to ATELECTASIS) in the pleural cavity and inflammation of the pleura (pleurisy).

Thoreau \thə-ˈrō**, Henry David** (b. July 12, 1817, Concord, Mass., U.S.—d. May 6, 1862, Concord) U.S. thinker, essayist, and naturalist. Thoreau graduated from Harvard University and taught school for several years before leaving his job to become a poet of nature. Back in Concord, he came under the influence of RALPH WALDO EMERSON and began to publish pieces in the Transcendentalist magazine *The Dial*. In the years 1845–47, to demonstrate how satisfying a simple life could be, he lived in a hut beside Concord's Walden Pond; essays recording his daily life were assembled for his masterwork, *Walden* (1854). His *A Week on the Concord and Merrimack Rivers* (1849) was the only other book he published in his lifetime. He reflected on a night he spent in jail protesting the Mexican-American War in the essay "Civil Disobedience" (1849), which would later influence such figures as MOHANDAS K. GANDHI and MARTIN LUTHER KING, JR. In later years his interest in TRANSCENDENTALISM waned, and he became a dedicated abolitionist. His many nature writings and records of his wanderings in Canada, Maine, and Cape Cod display the mind of a keen naturalist. After his death his collected writings were published in 20 volumes, and further writings have continued to appear in print.

Henry David Thoreau, portrait by Samuel Worcester Rowse, 1854; in the Concord Free Public Library, Massachusetts.
COURTESY OF THE CORPORATION OF THE FREE PUBLIC LIBRARY, CONCORD, MASS.

Thorez \tō-ˈrez**, Maurice** (b. April 28, 1900, Noyelles-Godault, France—d. July 11, 1964, at sea en route to Yalta) French communist politician. He began working as a coal miner at age 12. He joined the FRENCH COMMUNIST PARTY c. 1920 and was arrested several times for agitation. After becoming local party secretary (1923), he rose to secretary-general of the party (1930). He served in the Chamber of Deputies (1932–39, 1945–60) and helped form the POPULAR FRONT government in 1936. He lived in the Soviet Union (1943–44), then returned to France and served as a minister of state (1945) and deputy premier (1946, 1947). He remained a dedicated Stalinist even after NIKITA KHRUSHCHEV denounced Joseph Stalin in 1956.

thorium Metallic chemical ELEMENT, chemical symbol Th, atomic number 90. One of the ACTINIDE series of elements, natural thorium is a mixture of radioactive ISOTOPES, predominantly thorium-232 (HALF-LIFE of more than 10 billion years). It is a dense metal that is silver-white in pure form but turns gray or black on prolonged exposure to air. Although not a NUCLEAR REACTOR fuel itself, thorium-232 can be used in breeder reactors because, on capturing slow-moving NEUTRONS, it decays into fissionable uranium-233. Thorium is added to MAGNESIUM and its alloys to improve their high-temperature strength. Added to glass, it yields glasses with a high refractive index, useful for specialized optical applications. It was formerly in great demand as a component of mantles for gas and kerosene lamps and has been used in the manufacture of TUNGSTEN filaments for lightbulbs and VACUUM TUBES.

Thorndike, Edward L(ee) (b. Aug. 31, 1874, Williamsburg, Mass., U.S.—d. Aug. 9, 1949, Montrose, N.Y.) U.S. psychologist. He trained under WILLIAM JAMES and JAMES MCKEEN CATTELL and later taught at Columbia University (1904–40). A pioneer in the fields of animal learning and educational psychology, he developed a form of behaviourism known as connectionism, which holds that learning takes place through associative bonds. He contributed significantly to the development of quantitative experimental methods and to more efficient and scientifically based methods of teaching. Among his writings are *Introduction to the Theory of Mental and Social Measurements* (1904), *Principles of Teaching Based on Psychology* (1906), *Animal Intelligence* (1911), and *The Psychology of Wants, Interests, and Attitudes* (1935).

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Thorndike, Dame (Agnes) Sybil (b. Oct. 24, 1882, Gainsborough, Lincolnshire, Eng.—d. June 9, 1976, London) British actress. As a member of the Old Vic company in London (1914–18), she became a leading tragic actress. Noted for her versatility in modern and classic plays, she originated the title role in George Bernard Shaw's *Saint Joan* (1924). She managed several London theatres, and she often costarred with her husband, the actor-director Lewis Casson, in her more than five decades in the theatre.

Thoroughbred Light breed of racing and jumping horse descended from three desert stallions brought to England between 1689 and 1724. Thoroughbreds have a delicate head, slim body, broad chest, and short back. Most are bay, chestnut, brown, black, or gray. They stand about 16 hands (64 in., 163 cm) high and weigh about 1,000 lbs (450 kg). They are sensitive and high-spirited and are often used to improve other stock.

Thorp, John (b. 1784, Rehoboth, Mass., U.S.—d. Nov. 15, 1848, Providence, R.I.) U.S. inventor. He invented the ring spinning machine in 1828. By the 1860s it had largely replaced Samuel Crompton's spinning mule in the world's textile mills because of its greater productivity and simplicity.

Thorpe, Jim *in full* **James Francis Thorpe** (b. May 28, 1888, near Prague, Indian Territory—d. March 28, 1953, Lomita, Calif., U.S.) U.S. athlete. Of predominantly American Indian (Sauk and Fox) descent, he trained as a football halfback under Pop Warner while attending the Indian Industrial School in Carlisle, Pa. (1908–12), where he also excelled at baseball, basketball, boxing, lacrosse, swimming, and hockey. In 1912 he won the Olympic decathlon and pentathlon by wide margins, but he was deprived of his medals in 1913 after it was discovered he had played semiprofessional baseball. He later played professional baseball and football, and in 1920–21 he served as first president of what would become the National Football League. His Olympic medals were restored posthumously in 1983. Thorpe is generally regarded as the greatest American athlete of the 20th century.

Jim Thorpe demonstrating the drop kick.
THE BETTMANN ARCHIVE

Thorvaldsen \'tȯr-ˌwȯl-sən, 'tůr-ˌväl-sən**, Bertel** (b. Nov. 19, 1770, or Nov. 13, 1768, Copenhagen, Den.—d. March 24, 1844) Danish sculptor. Son of an Icelandic wood carver, he studied in Copenhagen and won a scholarship for travel to Rome, where he would remain for over 40 years and pursue one of the most successful sculpting careers of the 19th century. His return to Copenhagen in 1838 was celebrated as a national event. Most of his sculptures are reinterpretations of Classical figures and themes; he also did religious statues and portrait busts.

Thoth \'tōth, 'thōth, 'tōt\ *Egyptian* **Djhuty** *also spelled* **Djhowtey** Egyptian god of the moon and of reckoning, learning, and writing. He was the inventor of writing, the creator of languages, the representative of Re, and the scribe, interpreter, and adviser of the gods. In the myth of Osiris, Thoth protected the pregnant Isis and healed the eye of her son Horus. He judged the deceased and reported the results to Osiris. His sacred animals were the ibis and the baboon, millions of which were mummified in his honour. He was often represented in human form with the head of an ibis. The Greeks identified Thoth with Hermes; as Hermes Trismegistos he was regarded as the author of the Hermetic writings.

thought, laws of Traditionally, the three fundamental laws of logic: (1) the law of contradiction, (2) the law of excluded middle (or third), and (3) the principle of identity. That is, (1) for all propositions p, it is impossible for both p and not p to be true (symbolically, $\neg(p \wedge \neg p)$); (2) either p or not p must be true, there being no third or middle true proposition between them (symbolically $p \vee \neg p$); and (3) if a propositional function F is true of an individual variable x, then F is true of x (symbolically, $(\forall x)\ [F(x) \supset F(x)]$). Another formulation of the principle of identity asserts that a thing is identical with itself, or $(\forall x)\ (x = x)$.

Thousand and One Nights, The *or* **Arabian Nights' Entertainment** *Arabic* **Alf laylah wa laylah** Collection of Oriental stories of uncertain date and authorship. The frame story, in which the vengeful King Shahryar's plan to marry and execute a new wife each day is foiled by the resourceful Scheherazade, is probably Indian; the tales with which Scheherazade beguiles Shahryar, postponing and eventually averting her execution, come from India, Iran, Iraq, Egypt, Turkey, and possibly Greece. It is now believed that the collection is a composite work originally transmitted orally and developed over a period of several centuries. The first published version was an 18th-century European translation; Sir Richard Burton's *Book of the Thousand Nights and a Night* (1885–88) has become the best-known English translation.

Thousand Islands Group of about 1,500 small islands extending 80 mi (128 km) in the Saint Lawrence River between New York state, U.S., and Ontario, Canada. Some islands belong to Canada and some to the U.S. The Thousand Islands include summer resort facilities and the Canadian St. Lawrence Islands National Park, which was established in 1904 and covers 988 ac (400 ha). The Thousand Islands International Bridge, which contains five spans linking some of the islands and is 8.5 mi (13.7 km) long, connects New York and Ontario.

Thrace Ancient and modern region, southeastern Balkan Peninsula. Its borders have varied at different periods. In ancient Greek times it was bounded by the Danube River, the Aegean Sea, and the Black Sea. Modern Thrace corresponds to southern Bulgaria, the Greek province of Thrace, and European Turkey, including the Gallipoli peninsula. The Thracians were Indo-Europeans who settled in the region in the 2nd millennium BC; their culture was noted for its poetry and music, and their soldiers were known as superior fighters. Later colonized by Greeks in the 7th century BC, it became subject to Persia in the 6th century BC and to Macedon in the 4th century BC. Reduced to a Roman province in the 1st century AD, its northern part was annexed to Moesia. It later became part of the Byzantine empire, and in 1453 part of the Ottoman empire. The northern part was annexed by Bulgaria in 1885; the eastern part passed to Turkey in 1923. The region harvests corn, rice, grapes, oysters, and eels; the chief cash crop is Turkish tobacco.

thrasher Any of 17 species (family Mimidae) of New World songbirds that have a downcurved bill and are noted for noisily foraging on the ground in dense thickets and for loud, varied songs. Thrashers occur from northern Canada to central Mexico and the Caribbean. The brown thrasher (*Toxostoma rufum*), of North America east of the Rocky Mountains, is about 12 in. (30 cm) long and has red-brown plumage with streaked underparts. Long-tailed drab species are found in the arid southwestern U.S. and in Mexico.

Brown thrasher (*Toxostoma rufum*).
THASE DANIEL

thread Tightly twisted yarn consisting of several strands that has a circular cross-section and is used in commercial and home sewing machines and for hand sewing. Thread is usually wound on spools, with thread size (degree of fineness) indicated on the spool end. Cotton thread can be used with fabrics made from yarn of plant origin, such as cotton and linen, and with rayon (made from cellulose, a plant substance). Silk thread is suitable for silks and wools, both of animal origin. Nylon and polyester threads are appropriate for synthetics and for knits with a high degree of stretch.

thread cross Object made typically of two sticks bound together in the shape of a cross, with coloured threads wound around their ends to resemble a cobweb, used in Tibetan magical rituals to entrap evil spirits. Similar devices have been found in South Africa, Peru, Australia, and Sweden. They vary from simple diamond shapes to complex wheel- or box-shaped combinations reaching 11 ft (3 m) high. They are often highly decorated, with wool, feather, and bits of paper.

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Three Emperors' League *German* **Dreikaiserbund** Diplomatic alignment of the empires of Germany, Austria-Hungary, and Russia devised by Otto von Bismarck in 1872. Its aim was to neutralize disagreement between Austria-Hungary and Russia over spheres of influence in the Balkans and to isolate Germany's enemy France. After the first Three Emperors' League (1872–78) collapsed, Bismarck succeeded in renewing it (1881, 1884). When Russia declined a third renewal, Bismarck negotiated a separate accord with Russia, the Reinsurance Treaty (1887). See also Austro-German Alliance.

Three Gorges Dam Project Dam designed to span China's Yangtze River (Chang Jiang). On completion, scheduled for 2009, it would be the largest dam in the world, producing a vast quantity of hydroelectricity from 26 generators. It would also create an immense deepwater reservoir that would allow 10,000-ton freighters to navigate 1,400 mi (2,250 km) inland from the East China Sea. The extremely controversial project would require displacement of more than a million people and destruction of magnificent scenery and archaeological sites. Critics also fear potential pollution and silting of the reservoir and the possibility of the dam's collapse. Though construction began in 1993, a third of the National People's Congress either abstained or opposed it, and the World Bank would not advance funds, citing environmental and other concerns. Critics have contended that smaller dams on Yangtze tributaries could accomplish the same purpose with fewer risks.

Three Henrys, War of the (1587–89) Last of the Wars of Religion in France, fought between King Henry III, the ultra-Catholic Henri I de Lorraine, duke de Guise, and the Huguenot leader Henry of Navarra (later Henry IV). Early conflicts were won by the Holy League led by Guise, who forced Henry III to sign the Edict of Union in 1588, naming him lieutenant general of the kingdom. Humiliated, Henry III had Guise assassinated, but the Holy League continued to wield power, and Henry called for help from his cousin, Henry of Navarra. The royalist-Huguenot coalition forced the Holy Leaguers to retreat, but Henry III was assassinated, and, before he died, he exhorted the future Henry IV to become a Roman Catholic.

Three Kingdoms (AD 220–80) Trio of warring Chinese states that followed the demise of the Han dynasty. Cao Cao put his son on the throne of the kingdom of Wei, which controlled northern China. The kingdom of Shu-Han was established in present-day Sichuan by Liu Bei and his adviser Zhuge Liang, and the kingdom of Wu was established in the south, with its capital at Nanjing. They were all subsumed into the Jin dynasty by AD 280. The 60 years of the Three Kingdoms have inspired Chinese literature, and especially historical fiction, ever since.

Three Mile Island Nuclear power station near Harrisburg, Pa., site of the most serious accident in the history of the U.S. nuclear power industry (March 28, 1979). Mechanical failures and human errors caused a partial meltdown of the nuclear core and the release of radioactive gases. Despite assurances that there had been little risk to people's health, the accident increased public fears about the safety of nuclear power and strengthened public opposition to its use, effectively stopping construction of nuclear reactors and further development of U.S. nuclear power plants.

Three Stooges U.S. comedy team. It was originally formed as a vaudeville team in 1923 by brothers Moe and Shemp Howard (1897–1975, 1900–55), who performed with "Ted Healy and His Stooges." In 1928 the brothers added Larry Fine (1911–74) to the act, which appeared in Broadway revues. After Shemp left the act (1930), he was replaced by his brother Curly (1906–52). They appeared in several feature films, and in 1934 they began a series of comedy shorts that numbered more than 200 when they ceased in 1958. Their films were characterized by violent slapstick.

3M Co. U.S. corporation headquartered in St. Paul, Minn., manufacturing a wide range of products. It was incorporated as Minnesota Mining and Manufacturing Co. in 1902; its first product was sandpaper. It grew steadily, adding the original cellophane tape, Scotch tape, as well as masking tape to its product line. Other innovations included the widely used Post-it notes, introduced in 1980. 3M's products include photographic film, videocassettes, computer-synthesized graphics, and health-care products. It is notable among diversified U.S. corporations in that its growth has been primarily by internal means rather than by large-scale acquisitions.

threonine \'thrē-ə-ˌnēn\ One of the essential amino acids. It occurs in the proteins of egg, milk, gelatin, and other biological substances and may be synthesized or obtained by hydrolyzing casein. It is used in nutritional and biochemical research and as a dietary supplement.

thresher shark Any of five species (family Alopiidae) of sharks with a long, scythelike tail that may constitute almost half their total length. They are found in tropical and temperate seas worldwide. They eat squid and schooling fishes, attacking after circling and herding their prey into small groups. They sometimes use their tail to stun their prey or, by thrashing the water, to frighten them. They are not considered dangerous to humans. The long-tailed thresher, or fox shark (*Alopias vulpinus*), is a big, dark fish that grows about 20 ft (6 m) long.

thrips Any of some 5,000 species (order Thysanoptera) of tiny winged insects that feed chiefly on plants, inhabiting temperate and tropical areas worldwide. Many species damage cultivated plants, by either sucking the sap or transmitting viral plant diseases. A few species are predators. Thrips reach a maximum length of about half an inch (15 mm). Most have two pairs of long, narrow, hair-fringed wings.

thrombocyte See platelet

thrombosis \thräm-'bō-səs\ Formation of a blood clot (thrombus) in the heart or a blood vessel. Contributing factors include injury to a blood vessel's lining from inflammation (thrombophlebitis) or atherosclerosis, blood flow that is turbulent (e.g., from an aneurysm) or sluggish (e.g., from prolonged bed rest), or coagulation abnormalities (e.g., from high numbers of platelets or excessive fats in the blood). Thrombosis, especially in deep veins of the leg, is a particular danger after major surgery. A thrombus can block blood flow at the point of clot formation or break free to block it elsewhere (embolism).

throne Chair of state set on a dais and often surmounted by a canopy, representing the power of the dignitary who sits on it and sometimes conferring that power. In Greek history, thrones were identified as seats of the gods; soon the meaning of the word included the symbolic seats of those who held religious or secular power, a meaning common to virtually all cultures. The oldest surviving throne was built into the walls of Knossos (c. 1800 BC). Probably the most magnificent was the jewel-studded Peacock Throne of the rulers of Delhi, stolen from India by Persia in 1739 and thereafter the symbol of the Persian/Iranian monarchy. In the late 17th and 18th century, thrones were often made of silver, but later versions tend to be of gilded wood.

So-called throne of King Dagobert I, bronze, from the treasury of Saint-Denis, Paris, probably 8th century with 12th-century additions
COURTESY OF THE BIBLIOTHEQUE NATIONALE, PARIS

throttle Valve for regulating the supply of a fluid (as steam) to an engine, especially the valve controlling the volume of vaporized fuel delivered to the cylinders of an internal-combustion engine. In an automobile engine, gasoline is held in a chamber above the carburetor. Air flows down through the throat of the carburetor, past the throttle valve, and into the intake manifold. A throat is formed by the reduced diameter, and acceleration of the air through this smaller passage causes a decrease in pressure related to the amount of air flowing. This decrease in throat pressure results in fuel flow from the jet into the airstream. Any increase in airflow caused by change in engine speed or throttle position increases the pressure differential acting on the fuel and causes more fuel to flow. See also venturi tube.

thrush Any of about 300 species of songbirds (family Turdidae) that usually have a slender bill and "booted" lower legs (i.e., covered in front with one long scale instead of many short ones). Thrushes are 5–12 in. (13–30 cm) long. Most have dull plumage, often with patches of bright yellow, red, or blue. They are found virtually worldwide but are most diverse in the Old World, especially in Africa. The northern species are strong migrants. Occupying a wide range of arboreal and terrestrial habitats, thrushes eat insects and fruit; a few eat snails or earthworms. They lay three to six eggs in an open cup-shaped nest; a few occupy cavities. Some of the thrushes,

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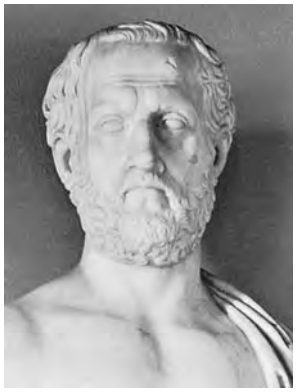
including the hermit thrush and WOOD THRUSH, have notably beautiful songs. See also BLACKBIRD, BLUEBIRD, CHAT, OUZEL, REDSTART, ROBIN.

Thuan Thien See LE LOI

Thucydides \thü-'si-də-ˌdēz\ (b. c. 460—d. c. 404 BC) Greatest of ancient Greek historians. An Athenian who commanded a fleet in the PELOPONNESIAN WAR, Thucydides failed to prevent the capture of the important city of Amphipolis and consequently was exiled for 20 years. During that period he wrote his *History of the Peloponnesian War*; evidently he did not live to complete it, for it stops abruptly in 411 BC. It presents the first recorded political and moral analysis of a nation's war policies, treating the causes of the conflict, the characters of the two states, and the technical aspects of warfare in a carefully drawn, strictly chronological narrative of events, including some in which he took an active part.



Thucydides, detail of a Roman bust after a Greek original; in Holkham Hall, Norfolk, England
COURTESY OF NATIONAL MONUMENTS RECORDS, LONDON

Thugga \'thə-gə\ *modern* **Dougga** \'dü-gə\ Ancient city, North Africa. It was an important Punic city when the Romans assimilated it c. AD 200. It is the best-preserved Roman site in Tunisia; its ruins include an arch in honour of the Roman emperor SEPTIMIUS SEVERUS, a forum, baths, villas, an aqueduct, a theatre, and a temple of Jupiter, Juno, and Minerva. There is also a pre-Roman ruin of a 2nd-century-BC mausoleum.

thumb piano See MBIRA

Thunder Bay City (pop., 2001: 109,016), west-central Ontario, Canada. It is located on the northwestern shore of Lake SUPERIOR. Its first settlement was a French fur-trading post c. 1678. In the 1870s and '80s silver strikes and the arrival of the Canadian Pacific Railway brought prosperity to the twin towns of Port Arthur and Fort William that had grown up there. Their rivalry was resolved with the unification of their harbour facilities in 1906; the towns merged in 1970 and created the city of Thunder Bay. It is one of Canada's busiest ports, with grain storage and transshipment depots; other industries include shipbuilding.

thunderbird In North American Indian mythology, a powerful spirit in the form of a bird that watered the earth and made vegetation grow. Lightning was believed to flash from its eyes or beak, and the beating of its wings was thought to represent rolling thunder. The thunderbird was often portrayed with an extra head on its abdomen, particularly on TOTEM poles, and it was frequently accompanied by lesser bird spirits. Though it is best known in North America, evidence of similar figures has been found throughout Africa, Asia, and Europe.

Wooden thunderbird of the Haida Indians, northwest coast of North America, 19th century; in the British Museum
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

Thunderbolt See P-47

thunderstorm Violent, short-lived atmospheric disturbance, almost always associated with cumulonimbus clouds (very tall, dense rain clouds) and accompanied by thunder and LIGHTNING. Such storms usually generate strong, gusty winds and heavy rain, and occasionally HAIL or TORNADOES. Thunderstorms have been known to occur in almost every part of the world, although they are rare in the polar regions. In the U.S. the areas of maximum thunderstorm activity are the Florida peninsula and the coast of the Gulf of Mexico (70–80 days per year).

Thünen \'tü̇-nən**, Johann Heinrich von** (b. June 24, 1783, Jever, Oldenburg—d. Sept. 22, 1850, Tellow, Mecklenburg) German economist and agriculturalist. After carrying out research on his own estate into the relationship between the costs of commodity transportation and the location of production, he set forth his theories in *The Isolated State* (1826). He used an imaginary city, isolated in the middle of a fertile plain, to create a model of concentric zones of agricultural production. Heavy products and perishables would be produced close to the town, lighter and durable goods on the periphery; returns on the land would diminish as transport costs to the city increased. Thünen's model influenced many later writers on the subject.

Thurber, James (Grover) (b. Dec. 8, 1894, Columbus, Ohio, U.S.—d. Nov. 2, 1961, New York, N.Y.) U.S. writer and cartoonist. He attended Ohio State University before moving to New York City in 1926. He was on *The New Yorker* staff from 1927 to 1933 and thereafter remained a leading contributor. His drawings illustrated his first book, *Is Sex Necessary?* (1929; with E.B. WHITE), and his cartoons became some of the most popular and recognizable in America. In 1940 his failing eyesight forced him to curtail his drawing; by 1952 he had to give it up altogether as his blindness became nearly total. His writings include *My Life and Hard Times* (1933), *Fables for Our Time* (1940), and the children's book *The 13 Clocks* (1950). He is noted for his vision of the befuddled urban man who, like the hero of his short story "The Secret Life of Walter Mitty" (1939; film, 1946), escapes into fantasy.

Thuringia \thù-'rin-jē-ə\ *German* **Thüringen** \'tü̇-riŋ-ən\ Historic region and state (pop., 2002 est.: 2,411,000), Germany. It includes the land around the Thuringian Forest in what was formerly southwestern EAST GERMANY and covers 6,244 sq mi (16,171 sq km). The capital is ERFURT. The Germanic Thuringians appeared after c. AD 350 and were conquered by the Huns in the mid-5th century. In 1485 Thuringia became part of SAXONY and was divided into several states; they joined the German Empire in 1871 and were reunited after World War I. Following the partition of Germany in 1945, the state became part of East Germany; it was reconstituted as a state of reunified Germany in 1990. The economy is largely industrial.

Thurmond, (James) Strom (b. Dec. 5, 1902, Edgefield, S.C., U.S.—d. June 26, 2003, Edgefield) U.S. politician and senator (1954–2003). He served as a South Carolina state senator (1933–38) and circuit court judge (1938–41). As governor (1947–51), he expanded the state educational system. At the 1948 Democratic convention Thurmond led the bolt of Southern delegates who objected to the civil-rights plank in the party platform; the so-called DIXIECRATS nominated Thurmond as their presidential candidate, and he won 39 electoral votes. In 1954 he was elected to the U.S. Senate, and in 1964 he switched party affiliation to the Republican Party. He became the Senate's longest-serving member in 1997. An arch conservative, he advocated states' rights, opposed civil-rights legislation, and supported increases in military spending.

Thurstone, L(ouis) L(eon) (b. May 29, 1887, Chicago, Ill, U.S.—d. Sept. 29, 1955, Chapel Hill, N.C.) U.S. psychologist. He taught primarily at the University of Chicago (1927–52). Concerned with the measurement of people's attitudes and intelligence, he was instrumental in the development of psychometrics. His principal work, *The Vectors of the Mind* (1935; revised as *Multiple-Factor Analysis*, 1947), presented the technique of multiple-factor analysis to explain correlations between results in psychological tests.

Thutmose \thüt-'mō-sə\ **III** (d. 1426 BC) Egyptian king of the 18th dynasty (r. 1479–1426 BC), often regarded as the greatest PHARAOH of ancient Egypt. He ascended the throne around the age of 10, but his aunt, HATSHEPSUT, ruled first as his regent and then in her own right for the next 20 years. On her death he began military campaigns to reestablish Egyptian supremacy in Syria and Palestine. Later he attacked and defeated the kingdom of MITANNI, a powerful Mesopotamian rival of Egypt. He subdued the Nubian tribes to the south and employed them in the gold mines that became the basis of Egypt's wealth. He consolidated his victories with more campaigns and established a system whereby native rulers would pay yearly tribute to Egypt and send their heirs as hostages to Egypt, where they would be educated at court. At home he enlarged the temple of Amon at KARNAK. His mummy was discovered in 1889 and his mortuary temple in 1962.

thyme \'tīm\ Pungent herb (*Thymus vulgaris*) of the MINT family, native to southern Europe, the Mediterranean, Asia Minor, and Central Asia, and

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cultivated in North America. A small, low-growing shrub, it has small, curled leaves that give off a fragrant odour when crushed. The dried leaves and flowering tops are used to flavour a wide range of foods. Bees are fond of thyme, and Sicily's thyme honey has been famous for centuries. The essential oil has antiseptic and anesthetic properties and is used as an internal medicine; it is also used in perfumes and toothpastes.

Thyme (*Thymus vulgaris*)
WALTER CHANDOHA

thymine \'thī-ˌmēn\ Organic compound of the PYRIMIDINE family, often called a base, consisting of a ring containing both nitrogen and carbon atoms, and a methyl group. It occurs in combined form in many important biological molecules, particularly DNA (where its complementary base is ADENINE). It or its corresponding NUCLEOSIDE or NUCLEOTIDE may be prepared from DNA by selective techniques of HYDROLYSIS.

thymus \'thī-məs\ Pyramid-shaped lymphoid organ (see LYMPHOID TISSUE) between the breastbone and the heart. Starting at puberty, it shrinks slowly. It has no lymphatic vessels draining into it and does not filter lymph; instead, stem cells in its outer cortex develop into different kinds of T CELLS (see LYMPHOCYTES). Some migrate to the inner medulla and enter the bloodstream; those that do not may be destroyed to prevent autoimmune reactions. This process is most active during infancy. If a newborn's thymus is removed, not enough T cells are produced, the SPLEEN and LYMPH NODES have little tissue, and the immune system fails, causing a gradual, fatal wasting disease. Thymus removal in adults has little effect.

thyroid gland Endocrine gland in the throat that secretes HORMONES vital to metabolism and growth. Secretion of thyroid hormones—mostly thyroxine (T_4)—is controlled by thyroid-stimulating hormone (TSH), released by the PITUITARY GLAND when the level of thyroid hormones in the blood drops below a certain threshold (see ENDOCRINE SYSTEM). These hormones' primary action in adults is to regulate cellular oxygen consumption (metabolic rate). They also lower blood CHOLESTEROL and are necessary for normal growth and development in children. The thyroid also produces calcitonin, a hormone that stimulates deposition of calcium from the blood into the bones, balancing the action of parathyroid hormone. See also GOITRE; GRAVES DISEASE; IODINE DEFICIENCY.

thyroxine \thī-'räk-ˌsēn\ *or* **l-tetraiodothyronine** \'el-ˌte-trə-ī-ˌō-dō-'thī-rə-ˌnēn\ *or* **T_4** One of the two major HORMONES (along with the closely related l-triiodothyronine, or T_3) secreted by the THYROID GLAND. Its principal function is to stimulate OXYGEN consumption and thus METABOLISM in all cells and tissues in the body. Thyroxine is formed by the addition of IODINE to the amino acid TYROSINE while the latter is in a protein-bound form. Thyroxine secretion is excessive in hyperthyroidism and deficient in hypothyroidism.

Thyssen \'tīs-sən\, **Fritz** (b. Nov. 9, 1873, Mülheim, Ger.—d. Feb. 8, 1951, Buenos Aires, Arg.) German industrialist and financial backer of ADOLF HITLER. Thyssen entered the family iron, steel, and coal business and inherited his father's fortune and empire in 1926 (see THYSSEN KRUPP STAHL). He created a family business trust that came to control more than 75% of Germany's ore reserves and employ 200,000 workers. Distressed by the rise of socialism in Germany, he supported Hitler and helped finance his rise to chancellor. But Thyssen opposed Hitler's later policies and fled to Switzerland in 1939, enabling Hitler to confiscate Thyssen's fortune (about $88 million). Thyssen was arrested in France (1941) and imprisoned by the Nazis. After the war, he was convicted as a "minor Nazi" and ordered to pay 15% of his property in restitution.

ThyssenKrupp AG German steel company. The Krupp firm began in 1811 when Friedrich Krupp (1787–1826) founded a steel plant in Essen, and it remained in family hands for a century and a half. Known for its high-quality steel and its cannons and other armaments, Krupp prospered with the rise of the German navy. It enjoyed a monopoly on arms manufacturing during World War I; one of its most potent weapons was "BIG BERTHA." After the war, Germany was forbidden to manufacture arms, and parts of the Krupp works were dismantled, though it remained a vast industrial empire. Krupp's factories were central to Germany's illegal rearmament under ADOLF HITLER in the 1930s. After World War II, Alfried Krupp (1907–67) was convicted of war crimes for using slave labour and ordered to forfeit all his property, but with the outbreak of the Korean War he was granted amnesty and his property restored. In 1968, after his son renounced the Krupp name and fortune, the company went public. In 1992 it merged with Hoesch AG to become Fried Krupp AG Hoesch-Krupp. Thyssen AG originated as a rolling mill founded by August Thyssen (1842–1926). It merged with seven other steelworks to become Vereinigte Stahlwerke AG, but reassumed its own identity in 1953. After the steel divisions of the rival companies were joined in 1997 to form Thyssen Krupp Stahl, the remaining segments of each company merged in 1999, creating ThyssenKrupp AG. Its products include steel, construction and automotive components, elevators, and engineering services.

Tiamat \'tē-ä-ˌmät\ In Mesopotamian mythology, a primal goddess who is a personification of salt water and the mother of the gods. When conflict between her husband, Apsu, and the other gods resulted in Apsu's death, Tiamat waged war on the other divinities, backed by an army of demons she had created. Her battle with, and defeat at the hands of, MARDUK forms the substance of the Babylonian creation epic *Enuma elish*. From her body Marduk fashioned the heavens and the earth.

Tian *or* **T'ien** \'tyen\ *Chinese* **"Heaven"** In indigenous Chinese religion, the supreme power reigning over humans and lesser gods. The term refers to a deity, to impersonal nature, or to both. As a god, Tian is an impersonal power, in contrast to the supreme ruler Shangdi, but the two are closely identified and their names are sometimes used synonymously. In later references, Tian is likened to nature or fate. Scholars generally agree that Tian was the source of moral law, but they long debated whether Tian responded to pleas and rewarded and punished human actions or whether events merely followed Tian's order and principles.

Tian Shan See TIEN SHAN

Tiananmen \'tyän-'än-'men\ **Square** One of the largest public squares in the world, originally designed and built in Beijing in 1651 and enlarged in 1958. It is named for the massive stone "Gate of Heavenly Peace" (Tiananmen) at its northern end. It contains and is surrounded by halls, museums, and monuments, including the Mao Zedong Memorial Hall, where Mao's body rests in state. Tiananmen Square has been the rallying point for political demonstrations since 1919, including the large protests in May–June 1989 that were forcibly repressed. See also FANG LIZHI.

Tiancong See HONGTAIJI

Tianjin \'tyen-'jin\ *or* **T'ien-chin** *conventional* **Tientsin** Seaport and municipality with provincial status (pop., 2003 est.: city, 4,933,100; 2002 est.: municipality, 10,070,000), northeastern CHINA. The municipality, on the BO HAI, is bordered by HEBEI province and BEIJING municipality and has an area of 4,400 sq mi (11,300 sq km). The city, China's third largest, lies at the head of the short Hai River, which flows into the Bo Hai; Tianjin is connected to the YANGTZE RIVER (Chang Jiang) by the GRAND CANAL. It has been a major transportation and trading centre since the YUAN DYNASTY in the 13th century. It was a garrison town during the MING DYNASTY (1368–1644). The British and French occupied it during the Second OPIUM WAR (1856–60); a treaty signed there in 1858 opened 11 Chinese ports to foreign trade. As a treaty port, it developed rapidly. It was the scene of heavy fighting during the BOXER REBELLION (1900), after which it was placed under an international commission and its walls razed. It is the leading port in northern China and the country's second largest manufacturing centre. Educational institutions include Tianjin University (1895) and Nankai University (1919).

Tianshi Dao See FIVE PECKS OF RICE

Tiantai \'tyän-'dī\ *Japanese* **Tendai** \'ten-'dī\ Buddhist sect founded by ZHIYI in the 6th century AD. Its chief scripture is the LOTUS SUTRA, and the school is thus known as the Lotus school. Its basic philosophical doctrine is summarized as the Triple Truth: All DHARMAS lack ontological reality; nevertheless, they have a temporary existence; and they are simultaneously unreal and temporarily existing—an absolute truth that surpasses the others. In Tiantai, all Buddhist learning is arranged in a grand hierarchical scheme. In Japan, SAICHO attempted to incorporate ZEN meditation, monastic discipline, and esoteric cults. Amalgamation of SHINTO and Buddhism was also encouraged.

Tibbett \'tib-ət\, **Lawrence** *orig.* **Lawrence Mervil Tibbet** (b. Nov. 16, 1896, Bakersfield, Calif., U.S.—d. July 15, 1960, New York,

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N.Y.) U.S. baritone. He performed as a singing actor before moving into opera. After his 1923 Metropolitan Opera debut, his first major success came in 1925, when he played Ford in Giuseppe Verdi's *Falstaff*. Over the next several years he sang most of the leading baritone roles at the Metropolitan, continuing with the company for 27 seasons. He also starred in several musical films and appeared on the popular radio show *Your Hit Parade*.

Tiber River \'tī-bər\ *Italian* **Tevere** \'tā-vā-rā\ River, Italy. The country's second-longest river, it rises in the Tuscan Apennines, and flows south for 252 mi (405 km), ultimately passing through the city of Rome before entering the Mediterranean at Ostia. It was an important navigation route for trade in Roman times. Despite sporadic dredging over the centuries, its persistent silting has limited its use in modern times.

Tiberias \tī-'bir-ē-əs\ *Hebrew* **Teverya** \tə-'ver-yə\ Town (pop., 2004 est.: 40,100) and resort, northeastern Israel. Located on Lake Tiberias (Sea of Galilee), at 689 ft (210 m) below sea level, it is one of the lowest-lying towns in the world. It was founded c. AD 20 by Herod Antipas and named for the Roman emperor Tiberius. After the destruction of Jerusalem by the Romans in AD 70, it became a centre of Jewish learning and later the seat of the Sanhedrin and rabbinical schools. The Talmud was edited there in the 3rd–6th centuries. Saladin took the town from the Crusaders in 1187. The modern town was refounded under the British mandate in 1922 and became part of independent Israel in 1948. Historic sites include the tomb of the great Jewish scholar Moses Maimonides. Along with Hebron, Jerusalem, and Ẕefat, it is one of the four holy cities of Judaism.

Tiberius *in full* **Tiberius (Julius) Caesar Augustus** *orig.* **Tiberius Claudius Nero** (b. Nov. 16, 42 BC—d. March 16, AD 37, Capreae, near Naples) Second Roman emperor (AD 14–37). He was raised by Augustus, who had married his mother, Livia Drusilla. In his first military command, at age 22, he recovered Roman legionary standards lost for decades in Parthia and returned to great acclaim. He was forced to give up his beloved wife to marry Augustus's daughter Julia (12 BC). Despite becoming tribune, he went into self-imposed exile on Rhodes (6 BC), becoming an angry recluse. By 4 BC Julia was exiled for promiscuity by Augustus, who recalled Tiberius and named him his heir. As emperor he initially ran the state efficiently and instituted some reforms, with only occasional severity, such as exiling Rome's Jewish population on a pretext. When his son Drusus died mysteriously, he gave his trust to Sejanus and was persuaded to move to Capri (27). He became increasingly violent, killing and torturing at a whim. After Sejanus became coconsul in 31, Tiberius became suspicious of his ambition and executed him, then named Caligula his heir. In 37 the Praetorian Guard declared its support for Caligula and killed Tiberius when he was on his sickbed.

Tiberius as a young man, marble bust found in Egypt in 1896; in the Ny Carlsberg Glyptotek, Copenhagen.
COURTESY OF THE NY CARLSBERG GLYPTOTEK, COPENHAGEN

Tiberias, Lake *or* **Sea of Galilee** Freshwater lake, northern Israel. It is 13 mi (21 km) long and 7 mi (11 km) wide; it lies about 700 ft (212 m) below sea level and receives most of its inflow from the Jordan River. The region has been inhabited for millennia: archaeological finds dating to some 500,000 years ago are among the oldest in the Middle East. In the 1st century AD, the region was rich and populated; Christians know it as the scene of many episodes in the life of Jesus. Today the lake's waters irrigate the surrounding agricultural region. Modern health resorts have grown up, and the baths at Tiberias are among Israel's winter resort attractions.

Tibet \ti-'bet\ *Tibetan* **Bod** \'bōd\ *Chinese* **Xizang** \'shē-'dzäŋ\ *or* **Hsi-tsang** Autonomous region (pop., 2002 est.: 2,670,000), western China. It is bordered by India (including the Kashmir region), Nepal, Bhutan, and Myanmar, the provinces of Yunnan, Sichuan, and Qinghai, and Xinjiang autonomous region. It has an area of 471,700 sq mi (1,221,600 sq km), and its capital is Lhasa. Before the 1950s it was a unique entity, with its own Buddhist culture and religion, that sought isolation from the rest of the world. Situated on a plateau averaging 15,000 ft (4,500 m) above sea level, it is the highest region in the world. Its surrounding mountain ranges include the Kunlun Mountains and the Himalayas; Mount Everest rises on its border with Nepal. Tibet emerged as a powerful Buddhist kingdom in the 7th–9th century AD. It came under the control of the Mongols in the 13th century and the Qing (Manchu) dynasty in the 18th century. After the 1911–12 Chinese revolution it gained a measure of autonomy. The Chinese People's Liberation Army entered Tibet in 1950, and Chinese authority was subsequently established over the region. The 14th Dalai Lama, Bstan-'dzin-rgya-mtsho, led an abortive rebellion in 1959, after which he fled to India and set up a government-in-exile. The Tibet Autonomous Region was established in 1965. Many of Tibet's cultural treasures were destroyed or badly damaged during the Cultural Revolution, but restoration work has been underway since then.

Tibetan Buddhism Form of Mahayana Buddhism that evolved from the 7th century in Tibet. Based on Madhyamika and Yogacara philosophies, it incorporates the rituals of Vajrayana, the monastic disciplines of early Theravada, and the shamanistic features of Bon. The predominant Tibetan sect for the past three centuries has been Dge-lugs-pa. Its spiritual head is the Dalai Lama. The Tibetan canon is divided into the *Bka'-'gyur* ("Translation of the Word"), consisting of canonical texts translated mostly from Sanskrit, and *Bstan-'gyur* ("Transmitted Word"), consisting of commentaries by Indian masters. After the Chinese communist takeover in 1959, Tibetans began a massive emigration that has spread Tibetan Buddhism around the globe.

Tibetan language Sino-Tibetan language spoken by more than five million people in Tibet (Xizang), Qinghai, Sichuan, and Gansu provinces in China; Bhutan; northern Nepal; and the Kashmir region of India and Pakistan. Since the occupation of Tibet by China in 1959, enclaves of Tibetan speakers have dispersed to India and other parts of the world. Spoken Tibetan comprises a very diverse range of dialects, conventionally divided into several groups: Western, including Balti and Ladakhi in Jammu and Kashmir; Central, including the speech of Lhasa and most of the Nepalese dialects (including Sherpa); Southern, including the dialects of Sikkim and Bhutan; Khams, or Southeastern, including the dialects of the interior plateau, southern Qinghai, eastern Tibet, and parts of western Sichuan; and Amdo or Northeastern, including the dialects of northern Qinghai, southern Gansu, and northern Sichuan. Most Tibetans share a common literary language, written in a distinctive script of disputed origin first attested in the 8th century AD.

tic Sudden rapid, recurring muscle contraction—usually a blink, sniff, twitch, or shrug—always brief, irresistible, and localized. Frequency decreases from head to foot. Unlike a spasm, a cramp, or the movements of chorea or epilepsy, it does not interfere with other movement and can be held off for a time. It can become ingrained as a habit of which the person (most often a nervous child 5–12 years old) is unaware. Most tics are probably psychological, but similar movements occur in some physical disorders (e.g., late-stage encephalitis). People with tics have some control over the movement but feel impelled to go through with it to feel better. Tension increases the movement's likelihood, and distraction reduces it. Psychotherapy, relaxation training, and biofeedback training have had some success in treating tics.

Ticino River \tē-'chē-nō\ River, Switzerland and Italy. It rises on the slopes of the St. Gotthard range, winds south through Ticino canton, traverses Lake Maggiore, and continues south to the Po River, for a total course of 154 mi (248 km). It is navigable below Lake Maggiore, and is an important source of hydroelectric power for Switzerland. Hannibal defeated the Romans on its banks in 218 BC.

Cattle tick (*Boophilus*)
E.R. DEGGINGER/EB INC.

tick Any of some 825 parasitic arachnid species (suborder Ixodida, order Parasitiformes), found worldwide. Adults may be slightly more than an inch (30 mm) long, but most species are much smaller. Hard ticks start and end each developmental

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stage—egg, larva, nymph, adult—on the ground; at the completion of each stage, they attach to a host (usually a MAMMAL), engorge on blood, then drop to the ground. Soft ticks feed intermittently, pass through several nymphal stages, and live in the host's den or nest. Hard ticks may draw large amounts of blood, secrete paralyzing or lethal neurotoxins, and transmit diseases. Soft ticks may also carry diseases. The deer tick is the principal vector of LYME disease.

Ticonderoga \ˌtī-ˌkän-də-ˈrō-gə\ Town (pop., 2000: 5,167) on Lake GEORGE, northeastern New York, U.S. In 1755 the French built Fort Carillon on nearby Lake CHAMPLAIN. Captured by the British in 1759, the fort was renamed Ticonderoga. In 1775, at the start of the AMERICAN REVOLUTION, it was seized by ETHAN ALLEN and his Green Mountain Boys. The British retook it in 1777 but abandoned it after the Battle of SARATOGA. The restored fort and the area around the town are now tourist attractions.

Ticonderoga, Battle of (1775) Engagement in the AMERICAN REVOLUTION. Held by the British since 1759, Fort Ticonderoga (in New York) was overrun on the morning of May 10, 1775, in a surprise attack by the Green Mountain Boys under ETHAN ALLEN, assisted by BENEDICT ARNOLD. The artillery seized there was moved to Boston, Mass., by HENRY KNOX for use against the British.

Ticunas See TUCUNAS

tidal flat Level muddy surface bordering an ESTUARY, alternately submerged and exposed to the air by changing tidal levels. In addition to the alternating submergence and exposure, the varying influences of fresh river water and salty marine waters cause physical conditions to vary more widely than in any other marine environment. The mud of a tidal flat is usually rich in dissolved nutrients, PLANKTON, and organic debris, and it supports large numbers of small animals such as crabs and worms. Vegetation is generally sparse, but mats of blue or blue-green algae (see CYANOBACTERIA) may be present.

tidal power Electricity produced by TURBINES operated by TIDE flow. Large amounts of power are potentially available from the tides in certain locations, such as Canada's Bay of FUNDY, where the tidal range reaches more than 50 ft (15 m), but this potential power is not continuous and varies with the seasons. The first working modern tidal power plant was built in France in 1961–67 and has 24 power units of 10,000 kilowatts each.

tidal wave See TSUNAMI

tide Regular, periodic rise and fall of the surface of the sea, occurring in most places twice a day. Tides result from differences in the gravitational forces exerted at different points on the Earth's surface by another body (such as the Moon). Although any celestial body (e.g., Jupiter) produces minute tidal effects, the majority of the tidal forces on the Earth are raised by the Sun (because of its enormous mass) and the Moon (because of its proximity to Earth). In fact, the tidal forces from the Moon are about twice as strong as those from the Sun. The largest tides (spring tides, exhibiting very large change in sea level between high and low tides) occur at the new and full moon, when the Earth, the Moon, and the Sun are aligned and the Sun's tidal forces are added to those of the Moon. The smallest tides (neap tides) occur when the Sun and Moon are at right angles (from Earth), when the tidal forces from the Sun partially cancel those from the Moon. The geometry of the coastline and of the water's basin also affects the range of the tides.

Tieck \ˈtēk**, (Johann) Ludwig** (b. May 31, 1773, Berlin, Prussia—d. April 28, 1853, Berlin) German writer and critic. He was educated at the universities of Halle, Göttingen, and Erlangen. His first works are associated with early Romanticism, the best appealing to the emotions rather than the intellect. *Volksmärchen* (1797) includes one of his best short novels, *Blond Eckbert*. This period culminated in the grotesque, lyrical plays *Life and Death of St. Genevieve* (1800) and *Emperor Octavian* (1804). Later his writing moved toward realism. While he was an adviser and critic at the Dresden theatre (1825–42), he became a great literary authority.

T'ien See TIAN

Tien Chih See DIAN CHI

T'ien-chin See TIANJIN

Tien Shan \ˈtyen-ˈshän\ *Chinese* **Tian Shan** *or* **T'ien Shan ("Celestial Mountains")** Mountain chain, Central Asia. Lying mainly in KYRGYZSTAN and northwestern China (XINJIANG autonomous region), its ranges and valleys stretch for about 1,500 mi (2,500 km) in an east-west direction. Its highest point is Victory Peak (Pik Pobeda) in Kyrgyzstan, which reaches 24,406 ft (7,439 m); the peak was discovered in 1943 by a Soviet expedition. Most of the area's population lives in the FERGANA VALLEY of Uzbekistan.

T'ien-shih Tao See FIVE PECKS OF RICE

Tientsin See TIANJIN

Tiepolo \tē-ˈā-pə-lō**, Giovanni Battista** *or* **Giambattista Tiepolo** (b. March 5, 1696, Venice—d. March 27, 1770, Madrid) Italian painter and etcher. In the 1730s and '40s the Venetian clergy and nobility vied for his works. In 1750 he went to Würzburg with his sons and collaborators, GIOVANNI DOMENICO TIEPOLO and Lorenzo Tiepolo, to decorate the prince-archbishop's palace. His Würzburg frescoes and canvases are his most boldly luminous works. In 1762 he escaped the political disequilibrium of the Seven Years' War by accepting an invitation to paint ceilings in the royal palace in Madrid, again with his sons, his last great undertaking; he remained in Spain until his death. Although he initially used a melancholic chiaroscuro style, his later work is full of bright colour and bold brushwork. His luminous, poetic frescoes both extend the tradition of Baroque ceiling decoration and epitomize Rococo lightness and elegance.

Tiepolo \ˈtye-pō-lō**, Giovanni Domenico** *or* **Giandomenico Tiepolo** (b. Aug. 30, 1727, Venice—d. March 3, 1804, Venice) Italian painter and printmaker. He was apprenticed to his father, GIOVANNI BATTISTA TIEPOLO, in Venice in the early 1740s and worked with him in Madrid from 1762 until the elder's death in 1770. His most notable early works are the chinoiserie decorations of the Villa Valmarana in Vicenza (1757). Back in Venice, he executed several frescoes and paintings of scenes from the commedia dell'arte. A talented genre painter and caricaturist, he was famous for his many engravings and etchings after his own and his father's designs.

Tierra del Fuego \tē-ˌer-ə-thel-ˈfwā-gō\ Archipelago at the southern extremity of South America. It is separated from the Antarctic Archipelago by the DRAKE PASSAGE. The southern and western parts are an extension of the ANDES MOUNTAINS, with peaks exceeding 7,000 ft (2,100 m). About two-thirds of the islands are in Chile, and the remainder are in Argentina. The main island, Tierra del Fuego, is divided roughly equally between Chile (west) and Argentina (east); the city of Ushuaia, Arg., there is the southernmost city in the world. Indigenous peoples were the sole occupants until 1880, when colonization by Chilean and Argentine nationals was prompted by the discovery of gold. Chile's only oil field is there. The region's name (Spanish: "Land of Fire") refers to its many volcanoes.

Tietê \tyā-ˈtā\ **River** River, southeastern Brazil. Rising in the mountains near the Atlantic Ocean coast, it flows northwest about 700 mi (1,130 km) through central São Paulo state to join the PARANÁ RIVER. Several of the state's large cities, including SÃO PAULO, are located on or near it, but navigation on the river is impeded by its many falls and rapids.

Tiffany, Louis Comfort (b. Feb. 18, 1848, New York, N.Y., U.S.—d. Jan. 17, 1933, New York City) U.S. painter, craftsman, philanthropist, decorator, and designer. The son of the famous jeweler Charles Louis Tiffany (1812–1902), he studied painting with American painter GEORGE INNESS and in Paris; he was a recognized painter before he began to experiment with stained glass in 1875. He founded a glassmaking factory in Queens, N.Y., in 1878. There he developed an iridescent glass he

Vase of Favrile glass made by Louis Comfort Tiffany, New York City, 1896; in the Victoria and Albert Museum, London.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

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called Favrile, which achieved widespread popularity in Europe. After 1900 Tiffany's firm ventured into lamps, jewelry, pottery, and bibelots. He is internationally recognized as one of the greatest forces of the Art Nouveau style.

Tiflis See Tbilisi

tiger Reddish tan, striped great cat (*Panthera tigris*) of forests, grasslands, and swamps in eastern Russia, South Asia, Sumatra, and a few small parts of China. Tigers are solitary, nocturnal hunters, preying on medium-sized mammals (e.g., deer). Locality and subspecies determine size, colour, and stripes. Southern tigers, such as the Bengal tiger (*P. tigris tigris*), are smaller and more brightly coloured than northern ones, such as the rare Siberian tiger (*P. tigris altaica*). Males grow to more than 3 ft (1 m) high and 7 ft (2.2 m) long, excluding the 3-ft (1-m) tail, and may weigh 350–640 lb (160–290 kg). Tigers live about 11 years. The persistent use of tiger parts as tonics or medicines, despite evidence refuting their efficacy, is rooted in the awe that the cat has inspired for millennia. Although internationally protected, tigers are seriously endangered; their populations shrank by more than 90% in the last century, and three subspecies are now extinct.

Bengal tiger (*Panthera tigris tigris*).
© SILVESTRIS/AUSTRALASIAN NATURE TRANSPARENCIES

tiger beetle Any of some 2,000 species (family Cicindelidae) of voracious beetles, found worldwide but mostly in the tropics and subtropics. The larva waits at the top of its burrow (up to 2 ft, or 0.7 m, deep) and grasps approaching insect prey with sicklelike jaws. Hooks on the abdomen anchor it so that the struggling victim cannot pull away, and the prey is dragged into the burrow and eaten. The slender, long-legged adults, less than an inch (25 mm) long, have long jaws that can inflict a painful bite. Many are iridescent blue, green, orange, or scarlet.

Tiger beetle (*Cicindela*).
WILLIAM E. FERGUSON

tiger moth Any of more than 3,500 species (family Arctiidae) of moths, many with furry or hairy larvae called woolly bears. Most adults have a thick body and white, orange, or green wings. At rest, the wings are folded rooflike over the body. The fall webworm (*Hyphantria cunea*) is a serious pest. The caterpillars construct webs over leaves, sometimes covering large areas with silken sheets. They pupate aboveground in a cocoon made of larval hairs and silk. The Isabella tiger moth (*Isia isabella*) attains a wingspan of 1.5–2 in. (37–50 mm). Black spots mark its abdomen and yellow wings.

tiger shark Potentially dangerous shark (*Galeocerdo cuvieri*, family Carcharhinidae), found worldwide in warm oceans, from the shoreline to the open sea. Up to 18 ft (5.5 m) long, the grayish tiger shark has a long, pointed upper tail lobe, and its large teeth are deeply notched along one side. This voracious shark eats fishes, other sharks, turtles, mollusks, birds, carrion, and garbage, including coal, tin cans, and clothing. It is a source of leather and liver oil. See also sand shark.

tiger swallowtail Any of several North American species of black-and-yellow swallowtail butterflies. The eastern tiger swallowtail (*Papilio glaucus*) is a large, widely distributed species. The yellow male has black margins and black stripes on the wings. The female is similarly marked in the north, where the black and distasteful pipevine swallowtail (*Battus philenor*) does not occur; in the south, where the two coexist, the female tiger swallowtail is very often all or mostly black.

tigereye *or* **tiger's-eye** Semiprecious quartz gem displaying chatoyancy, a vertical luminescent band like that of a cat's eye. Bands of parallel, blue asbestos (crocidolite) fibres are first altered to iron oxides and then replaced by silica. The gem has a rich yellow to yellow-brown or brown colour and a fine golden lustre when it is polished. The best stones come from South Africa. See also cat's-eye.

Tiglath-pileser \ˈtig-ˌlath-pī-ˈlē-zər\ **III** (fl. 8th century BC) King of Assyria (r. 745–727 BC) who led the last and greatest phase of Assyrian expansion. On taking the throne, he immediately set about strengthening Assyria. He subdivided large provinces to quash independence movements, had officials report directly to him, and resettled tens of thousands of people to ensure loyalty. He defeated his northern neighbour, Urartu (743 BC), then subjugated Syria and Palestine (734) and took over the throne of Babylon. See also Ashurbanipal; Sargon II.

Tiglath-pileser III, relief from Calah (Nimrud), 8th century BC; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

tigon \ˈtī-gən\ *or* **tiglon** \ˈtī-glən\ Zoo-bred offspring of a tiger and a lioness. The opposite cross, of a lion and a tigress, produces a liger. Differences in behavior and habitat make interbreeding of the tiger and lion unlikely in the wild. The tigon and the liger have features of both parents, in variable proportions, but are generally larger and darker than either. It is thought that most, if not all, male tigons and ligers are sterile; the females may be able to produce young.

Tigray \ˈti-ˌgrā\ Historic region of northern Ethiopia. Its dramatic landscape includes plateau regions more than 10,000 ft (3,000 m) high and plains below sea level. Though vegetation is sparse, the population engages in agriculture and stock raising. Tigray contains the core of the ancient Aksum kingdom, as well as Ethiopia's oldest known town, the 3,000-year-old Yeha. It formerly controlled trade routes from the Red Sea to the empire in the south. Its status declined when it lost control of the coast in the 16th century; it was subsequently dominated by the south and was later threatened by the Egyptian, Sudanese, British, and Italian armies. A rebellion begun in 1975 against the Ethiopian government aggravated the effects of a disastrous drought and famine in 1984–85. In 1999 Ethiopia's border war with Eritrea led to the displacement of more than 300,000 people in Tigray, and famine is a persistent threat.

Tigris \ˈtī-grəs\ **River** *Arabic* **Dijlah** \ˈdij-lə\ *Turkish* **Dicle** *biblical* **Hiddekel** River, Turkey and Iraq. It originates in the Taurus Mountains at Lake Hazar and flows 1,180 mi (1,900 km) southeast through Turkey and past Baghdad to unite with the Euphrates River at Al-Qurnah in southeastern Iraq; there it forms the Shatt al-Arab. With the Euphrates it defined the ancient region of Mesopotamia. Important for its irrigation capacity, it gave rise to sustained civilization. The ruins of many ancient cities lie on its banks, including those of Nineveh, Calah, Ashur, Ctesiphon, and Seleucia.

Tijuana \tē-ˈhwä-nä\ City (pop., 2000: 1,148,681), northwestern Baja California, Mexico. It lies on the Tecate River near the Pacific Ocean, 12 mi (19 km) south of San Diego, Calif., U.S. It originated as a ranch settlement on a land grant in 1862 and developed as a border resort with gambling casinos. In the 20th century it became the main entry point to Mexico for U.S. tourists. It has many U.S.-owned assembly plants as well as food-processing plants and breweries.

Tikal \tē-ˈkäl\ Ancient Maya city, northern Guatemala. First occupied as a small village in a tropical rainforest (c. 900–300 BC), it grew into an important ceremonial centre. It flourished c. AD 600–900, when its great

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plazas, pyramids, and palaces were built and when Maya art flowered in monumental sculpture. At its height it was the largest urban centre in the southern Maya lowlands; the core city had a population of perhaps 10,000 residents with an outlying population of about 50,000. Its main structures covered about 1 sq mi (2.5 sq km). It was abandoned by the 10th century. Major excavation began in 1956; it is now a central part of Tikal National Park, which was designated a UNESCO World Heritage site in 1979.

Tikhomirov \ˌtik̲-əm-ˈyir-ef**, Vasily (Dmitrievich)** (b. March 30, 1876, Moscow, Russia—d. June 20, 1956, Moscow) Russian ballet dancer and teacher. After training at the Bolshoi school, he joined the Bolshoi Ballet in 1893. He soon became its principal dancer and created roles in a vigorous, athletic style that he later taught to students at the Bolshoi school. He was influential there as a teacher (from 1896) and as director (1924–37). With his wife, Yekaterina Geltzer, he helped preserve the classic ballets and techniques after the Russian Revolution of 1917.

Tikunas See Tucunas

Tilak \ˈtē-läk**, Bal Gangadhar** (b. July 23, 1856, Ratnagiri, India—d. Aug. 1, 1920, Bombay) Indian scholar and nationalist. Born to a middle-class Brahman family, Tilak taught mathematics and in 1884 founded the Deccan Education Society to help educate the masses. Through two weekly newspapers, he voiced his criticisms of British rule in India, hoping to widen the popularity of the nationalist movement beyond the upper classes. In response to the Partition of Bengal (1905) he initiated a boycott of British goods and passive resistance, two forms of protest later adopted by Mohandas K. Gandhi. He left the Indian National Congress in 1907 when he was deported for sedition but rejoined in 1916, in time to sign a Hindu-Muslim accord with Mohammed Ali Jinnah. Though militant in his opposition to foreign rule, late in life Tilak advocated a measure of cooperation with the British in order to achieve reforms.

tilapia \tə-ˈlä-pē-ə\ Any of numerous, mostly freshwater, fish species (genus *Tilapia*, family Cichlidae), native to Africa. They resemble North American sunfishes; one species grows to 20 lbs (9 kg). *Tilapia* species are easy to raise and harvest for food; they grow rapidly, resist disease, and eat readily abundant algae and zooplankton. They have been used in warm-water aquaculture systems since the early Egyptian civilization and have been introduced into many freshwater habitats. See also cichlid.

Tilden, Bill *in full* **William Tatem Tilden** (b. Feb. 20, 1893, Philadelphia, Pa., U.S.—d. June 5, 1953, Hollywood, Calif.) U.S. tennis player. The dominant player of the 1920s, he won seven U.S. men's singles championships (1920–25, 1929), three Wimbledon singles championships (1920–21, 1930), and two professional titles. He also won many doubles and mixed-doubles titles and 21 of 28 Davis Cup matches. His overpowering play and temperamental personality made him one of the most colourful sports figures of his time.

Bill Tilden
CULVER PICTURES

Tilden, Samuel J(ones) (b. Feb. 9, 1814, New Lebanon, N.Y., U.S.—d. Aug. 4, 1886, Greystone, N.Y.) U.S. politician. He was a leader of New York's Democratic Party, and, as state party chairman (1865–75), he effected the overthrow of the Tammany Hall boss William Marcy Tweed. As governor (1875–76) he continued his reforms, exposing the Canal Ring, a group of politicians and contractors who had defrauded the state. In 1876 he was the Democratic nominee for president. The bitterly fought campaign ended in a popular-vote victory for Tilden, but Republicans contested the results in four states. To settle the controversy, Congress appointed the Electoral Commission, which decided in favour of the Republican candidate Rutherford B. Hayes (see also electoral college). Unwilling to cause further conflict, Tilden accepted the decision and returned to his prosperous law practice. On his death he left his large fortune to establish a free public library for New York City.

tile Thin, flat slab or block used structurally or decoratively in building. Tiles traditionally have been made of glazed or unglazed fired clay, but modern tiles are also made of plastic, glass, asphalt, and even cork. Ceramic tiles, used for walls, floors, and countertops, are usually machine-pressed, made of fine clays, and very hard. Quarry tiles (used for flooring) and terra-cotta, made of natural clays, are less hard and more porous but very popular for economic and aesthetic reasons. Structural tile, made of fired clay, is a hollow tile containing parallel cells or cores and is used for building partitions. Roof tiles of baked clay and of marble were used in ancient Greece. Tiles came to be widely used in Islamic architecture. Multicoloured, glazed tiles were common in Spain from an early period (see azulejo), and from there spread to Portugal and Latin America. By the 15th century, tilework was used widely in northern Europe; blue-painted tiles from Delft, Holland, were especially renowned. Modern clay roofing tiles may be flat or curved; in the Mediterranean countries, S-shaped tiles (pantiles), laid with alternate convex and concave surfaces uppermost, are common. Modern wall tiles may be highly glazed and semivitreous.

tilefish *or* **blanquillo** \blāŋ-ˈkē-ˌyō\ Any of 24 species (family Branchiostegidae, or Malacanthidae) of slender marine fishes found in shallow tropical and warm temperate seas. Tilefish are used as food, especially the large *Lopholatilus chamaeleonticeps*, a deepwater fish of the Atlantic and Gulf of Mexico with a fleshy appendage on the head and yellow spots on its upper body and some of its fins. Tilefish have a large oblique mouth with strong canines and one rather long dorsal fin with weak spines.

till In geology, the unsorted material deposited directly by glacial ice and showing no stratification. Till is sometimes called boulder clay because it is composed of clay, boulders of intermediate size, or both. The rock fragments are usually angular and sharp rather than rounded, because they are deposited from ice and have undergone little water transport. The pebbles and boulders may be faceted and striated from grinding while lodged in the glacier.

till-less agriculture See no-till farming

Tillich \ˈti-liⱪ,\ *English* \ˈti-lik**, Paul (Johannes)** (b. Aug. 20, 1886, Starzeddel, Brandenburg, Ger.—d. Oct. 22, 1965, Chicago, Ill., U.S.) German-born U.S. Protestant theologian. He studied at Berlin, Tübingen, and Halle and was a chaplain with the German army during World War I. He taught successively at Marburg, Dresden, and Frankfurt am Main. In 1933 the Nazi takeover prompted him to immigrate to the U.S. With the aid of Reinhold Niebuhr, he joined the faculty of New York's Union Theological Seminary. He became respected for his lucid preaching and his *Systematic Theology*, 3 vol. (1951–63). He moved to Harvard University in 1955 and to the University of Chicago in 1962. His theological system was an unusual combination of biblical, existentialist, and metaphysical elements, and he attempted to convey an understanding of God that depended neither on revelation nor on science. His other works include *The Courage to Be* (1952) and *Dynamics of Faith* (1957).

Tillman, Benjamin R(yan) (b. Aug. 11, 1847, Edgefield county, S.C., U.S.—d. July 3, 1918, Washington, D.C.) U.S. politician. He worked as a farmer and in the 1880s was a spokesman for poor rural whites. As governor (1890–94), he introduced populist reforms that expanded public education, shifted the tax burden to the wealthy, and regulated the railroads. He also supported enactment of Jim Crow laws and considered lynching an acceptable law-enforcement measure. In the U.S. Senate (1895–1918), he pressed for agrarian reform. His attacks on his opponents earned him the nickname "Pitchfork Ben."

Tilly, Johann Tserclaes, count von (b. February 1559, Tilly, Brabant, Spanish Netherlands—d. April 30, 1632, Ingolstadt, Bavaria) Bavarian general in the Thirty Years' War. He gained military experience in the Spanish Army of Flanders fighting under Alessandro Farnese (1585) against the Dutch and in 1594 joined the emperor Rudolf II's army against the Turks. Appointed by Maximilian I of Bavaria to reorganize the Bavarian army (1610), Tilly created an efficient force that became the spearhead of the Catholic League in the Thirty Years' War. He led the League's forces to victories in the Battle of White Mountain (1620) and at Lutter (1626). In 1630 he added the imperial forces to his command. In 1631 he besieged the Protestant city of Magdeburg, but its destruction proved disastrous for him. Failing to stop the Swedish advance into Germany, he was defeated at Breitenfeld (1631) and was fatally wounded in a later battle.

Tilsit \ˈtil-zit**, Treaties of** (1807) Agreements that France signed separately with Russia and Prussia at Tilsit, northern Prussia (now Sovetsk, Russia). The treaties followed Napoleon's victories in the Napoleonic

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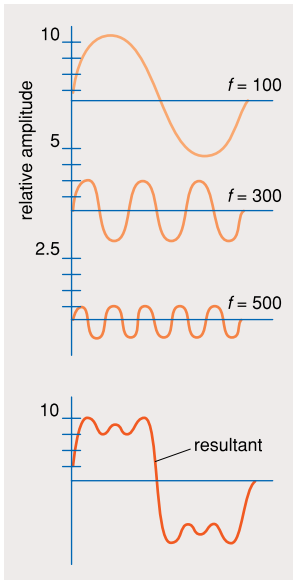
Wars and established his supremacy in western and central Europe. France and Russia became allies and divided Europe between them, reducing Prussia and Austria to helplessness. In secret provisions, Russia joined the Continental System against British trade. By 1810 Russian trade was hampered and the tsar opened Russian ports to neutral ships, causing the alliance to fail and paving the way for Napoleon's invasion of Russia in 1812.

tilth Physical condition of soil, especially in relation to its suitability for planting or growing a crop. Factors that determine tilth include the formation and stability of aggregated soil particles, moisture content, degree of aeration, rate of water infiltration, and drainage. The tilth of a soil can change rapidly, depending on environmental factors such as changes in moisture. The objective of tillage (mechanical manipulation of the soil) is to improve tilth, thereby increasing crop production; in the long term, however, conventional tillage, especially plowing, often has the opposite effect, causing the soil to break down and become compacted.

timber framing Construction of frame or post-and-beam structures using large, heavy, wood members, specifically lumber 5 in. (13 cm) or more in the least dimension. The term implies stylistic features of a heavy nature. Half-timber work, in which the spaces between the heavy visible frames of interior and exterior walls are filled in with (nonstructural) material such as brick, plaster, or mud, was common in Asia and Europe. Half-timbering found its highest expression in the Tudor style. See also framed structure, post-and-beam system.

timbre \'tam-bər\ Quality of sound that distinguishes one instrument, voice, or other sound source from another. Timbre largely results from a characteristic combination of overtones produced by different instruments. This distinctive combination (which usually varies across the range of pitches) is what principally permits a listener to distinguish a clarinet from a flute, an alto from a tenor, or even a Stradivarius violin from a Guarneri violin, when both are sounding the same pitch. One element of timbre results from the differing methods of producing the sounds (blowing, bowing, striking, etc.), especially audible at the moment a note begins.



A mixture of three pure tones (top) yields a complex resultant tone (bottom), such as might be produced by an actual instrument, whose perceived quality, or "colour," is its timbre. The strong fundamental tone (top)—which would be perceived by the listener as the only tone played—has a frequency of 100. The other tones shown, with frequencies of 300 and 500, are weaker overtones of the fundamental; their relative loudness (amplitude), reflected in the complex resultant wave form, constitutes an essential aspect of the unique timbre the wave form represents.

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Timbuktu *French* **Tombouctou** Town (pop., 1998: 32,000), Mali, on the southern edge of the Sahara near the Niger River. Founded c. AD 1100 by Tuareg nomads, it became an important post on the trans-Saharan caravan routes. After it was incorporated within the Mali empire, probably in the late 13th century, it became a centre of Islamic culture (c. 1400–1600). It reached its apex as a commercial and cultural centre under Songhai rule c. 1500 but declined rapidly after being conquered by Moroccan forces in the late 16th century. The French captured it in 1894. It became part of independent Mali in 1960. The city was designated a UNESCO World Heritage site in 1988.

time Measured or measurable period. More broadly, it is a continuum that lacks spatial dimensions. Philosophers have sought an understanding of time by focusing on the broad questions of the relation between time and the physical world and the relation between time and consciousness. Those who adopt an absolutist theory of time regard it as a kind of container within which the universe exists and change takes place, and believe that its existence and properties are independent of the physical universe. According to the rival relationist theory, time is nothing over and above change in the physical universe. Largely because of Albert Einstein, it is now held that time cannot be treated in isolation from space (see space-time). Some argue that Einstein's theories of relativity vindicate relationist theories, others that they vindicate the absolutist theory. The primary issue concerning the relation between time and consciousness is the extent, if any, to which time or aspects of time depend on the existence of conscious beings. Events in time are normally thought of in terms of notions of past, present, and future, which some philosophers treat as mind-dependent; others believe that time is independent of perception and hold that past, present, and future are objective features of the world. See also geologic time, Greenwich Mean Time, standard time, Universal Time.

Time Major U.S. weekly newsmagazine, published in New York City. It was founded in 1923 by Henry R. Luce (as business manager) and Briton Hadden (as editor). It became the most influential newsmagazine in the U.S., with a format of short articles arranged in subject "departments," which became the standard for later general newsmagazines. After Hadden's death in 1929, Luce was long the magazine's guiding force, and it reflected his moderately conservative political viewpoint. By the 1970s it had assumed a more neutral, centrist stance in its reportage. In addition to the U.S. circulation, editions are published in Canada, Europe, Asia, and the Pacific.

time-and-motion study Analysis of the time spent in going through the different motions of a job or series of jobs in the evaluation of industrial performance. Such studies were first instituted in offices and factories in the U.S. in the early 20th century. They were widely adopted as a means of improving work methods by subdividing the different operations of a job into measurable elements, and they were in turn used as aids in standardization of work and in checking the efficiency of workers and equipment.

time dilation In the theory of special relativity, the "slowing down" of a clock as perceived by an observer in relative motion with respect to that clock. Time dilation becomes noticeable only at speeds approaching that of light and has been accurately confirmed by the apparent increased lifetime of unstable subatomic particles traveling at nearly the speed of light and by the precise timing of atomic clocks carried on airplanes. See also Lorentz-FitzGerald contraction.

Time of Troubles See Time of Troubles

Time Warner Inc. Largest media and entertainment conglomerate in the world. The corporation resulted from the merger of media giant Time Warner Inc. and the online company America Online, Inc., in 2001; originally named AOL Time Warner, the corporation dropped AOL from its name in 2003. Major media outlets include the magazines *Time*, *Sports Illustrated*, and *People* and the cable and broadcast television networks HBO, CNN, TBS, and WB. From its start as a bulletin-board system in 1985, AOL grew to become the world's largest Internet service provider by the mid 1990s. The Internet "stock bubble" of the late 1990s enabled it to acquire the much larger Time Warner Inc. See also Warner Bros.

Times, The Daily newspaper published in London, one of Britain's oldest and most influential, and one of the world's greatest newspapers. Founded by John I. Walter in 1785 as *The Daily Universal Register*, it became *The Times* in 1788, publishing commercial news and notices along with some scandal. By the mid-1800s it had developed into a widely respected national journal and daily historical record. Late in the 19th century its reputation and circulation declined, but it returned to financial security after being bought by Alfred Harmsworth, 1st Viscount Northcliffe (1908), and its preeminence in editorial matters and news coverage was reestablished under the editorship of William Haley (1952–67). In 1981 it was bought by Rupert Murdoch's News Corporation.

Times Literary Supplement (TLS) Weekly literary journal long famous for its coverage of all aspects of literature. Founded in 1902 as a supplement to *The Sunday Times* of London, the TLS sets the tone and standards of excellence in the field of literary criticism. It presents reviews of major books of fiction and nonfiction published in several languages, and its essays are written with sophistication and scholarly authority and in a lively style. It is also noted for its bibliographic thoroughness, for its topical essays by the world's leading scholars, and for the erudition of its readers' published letters to the editor. See also *The* Times.

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Timiş \'tē-ˌmēsh\ **River** *Serbo-Croatian* **Tamiš** \'te-ˌmesh\ River, western Romania and northeastern Serbia and Montenegro. Rising at the western end of the Southern Carpathians, it flows in an arc to enter the Danube River just east of Belgrade after a course of 211 mi (340 km).

Timişoara \ˌtē-mē-'shwä-rä\ City (pop., 2002: 317,651), western Romania. Located near the Timiş River, it was first settled in Neolithic and Roman times. It was sacked by the Tatars in the 13th century. Its citadel was rebuilt in the 14th century and for a few years became the residence of Charles I of Hungary. The Turks held the town from 1552 until the Austrians took it in 1716. Occupied by Serbia in 1919, Timişoara was allotted to Romania by the 1920 Treaty of Trianon. Antigovernment demonstrations there in 1989 led to the execution of Pres. Nicolae Ceauşescu and the end of communist rule in Romania. It is a manufacturing, commercial, and cultural centre.

Timoleon \ti-'mō-lē-ən\ **of Corinth** (d. after 337 BC) Greek statesman and general. When the city of Syracuse called to its mother city, Corinth, for help in overthrowing its tyrant, Dionysius the Younger, Timoleon was chosen to lead the liberation force. By shrewd tactics he defeated the combined forces of the oppressor and his Carthaginian allies, who he confined to the western end of the island. He introduced constitutional safeguards and invited more Greek immigration. He retired in 337.

Timor \'tē-ˌmȯr, tē-'mȯr\ Island, southern Malay Archipelago. It is the easternmost of the Lesser Sunda Islands. Indonesian-Malay peoples live along the coast and Melanesian aboriginals in the mountains. They speak dozens of Papuan and Malayan languages, as well as Portuguese in the east and Indonesian in the west. The Portuguese began trading with Timor c. 1520. In 1613 the Dutch settled at the island's southwestern tip, and the Portuguese moved to the north and east. Treaties in 1860 and 1914 divided the island between them. Netherlands Timor (West Timor) was occupied by the Japanese in World War II; in 1950 the Dutch transferred it to Indonesia. East Timor was held by the Portuguese until 1975, when Indonesian troops invaded and annexed the area; it achieved full sovereignty in 2002 (see East Timor).

timothy Perennial grass (*Phleum pratense*) of the family Poaceae (or Gramineae), native to Europe and widely cultivated as a hay and pasture grass in North America. The stems grow in large clumps, are 1.5–3 ft (0.5–1 m) tall, and have swollen, bulblike bases. The flower clusters are long, dense, and cylindrical. Alpine, or mountain, timothy (*P. alpinum*) is about half as tall and occurs in wet areas from Greenland to Alaska, and at high altitudes in many other parts of North America and Europe.

timpani \'tim-pə-nē\ *or* **kettledrums** Large bowl-shaped drums with pedal mechanisms for altering their pitch by changing the membrane's tension. The timpani are the principal orchestral percussion instruments. Each drum usually has a range of a fifth; they are classically used in pairs. Until c. 1800 each drum was tuned to a single pitch (usually tonic or dominant) that could not be altered in performance. Primitive kettledrums, or *naker*s, were played on horseback by Middle Eastern cavalry. In Europe they were primarily associated, in tandem with the trumpets, with court ceremony and the military. They entered the orchestra in the mid-17th century.

Modern timpani with pedal-controlled tension
COURTESY OF LUDWIG INDUSTRIES, CHICAGO

Timpanogos Cave National Monument \ˌtim-pə-'nō-gəs\ Cave system, Utah, U.S. Located on the northwestern slope of Mount Timpanogos (11,750 ft [3,581 m]), the second highest peak of the Wasatch Mountains, it was established in 1922; it occupies 0.4 sq mi (1 sq km). It centres around a three-chambered limestone cave noted for its pink and white crystal-filigreed walls and tinted formations.

Timur \tē-'mür\ *or* **Tamerlane** \'ta-mər-ˌlān\ *or* **Tamburlaine** (b. 1336, Kesh, near Samarkand, Transoxania—d. Feb. 19, 1405, Otrar, near Chimkent) Turkic conqueror of Islamic faith whose conquests reached from India and Russia to the Mediterranean Sea. Timur took part in campaigns in Transoxania with Chagatai, a descendant of Genghis Khan. (Timur Lenk, or Tamerlane, means "Timur the Lame," reflecting the battle wounds he received.) Through machinations and treachery he took over Transoxania and proclaimed himself the restorer of the Mongol empire. In the 1380s he began his conquest of Iran (Persia), taking Khorāsān and eastern Iran in 1383–85 and western Iran as far as Mesopotamia and Georgia in 1386–94. He occupied Moscow for a year. When revolts broke out in Iran, he ruthlessly suppressed them, massacring the populations of whole cities. In 1398 he invaded India, leaving a trail of carnage. Next he marched on Damascus and Baghdad, deporting the artisans of the former to Samarkand and destroying all the monuments of the latter. In 1404 he prepared to march on China but died early in the march. Although Timur strove to make Samarkand the most splendid city in Asia, he himself preferred to be always on the move. His most lasting memorials are the architectural monuments of Samarkand and the dynasty he established, under which Samarkand became a centre of scholarship and science.

tin Metallic chemical element, chemical symbol Sn, atomic number 50. It is a soft, silvery white metal with a bluish tinge, employed since antiquity in the traditional form of bronze, its alloy with copper. It occurs chiefly as the dioxide (stannic oxide, SnO_2) in cassiterite. Since it is nontoxic, ductile, malleable, and easily worked, it is used to plate steel cans ("tin cans") for use as food containers and to coat and plate other items. Pure tin is too weak to be used alone, but its many alloys include soft solder, pewter, bronze, and low-temperature casting alloys. It has valence 2 or 4 in compounds, including stannous chloride (used in tin galvanizing and manufacturing polymers and dyes), stannous oxide (used to make tin salts for chemical reagents and plating), stannous fluoride (used as an anticavity ingredient in toothpastes), stannic chloride (a stabilizer for perfumes and a source of other tin salts), and stannic oxide (a catalyst and a polishing powder for steel). Tin bonds with carbon to form organotin compounds, used to stabilize PVC and in biocides and fungicides.

Tin Pan Alley Genre of U.S. popular music that arose in New York in the late 19th century. The name was coined by the songwriter Monroe Rosenfeld as the byname of the street on which the industry was based—28th Street between Fifth Avenue and Broadway in the early 20th century, around Broadway and 32nd Street in the 1920s, and ultimately on Broadway between 42nd and 50th Streets. "Tin pan" referred to the sound of pianos furiously pounded by "song pluggers" demonstrating tunes to publishers. The genre comprised the commercial music of writers of ballads, dance music, and vaudeville songs, and its name eventually became synonymous with U.S. popular music. Its demise resulted from the rise of film, audio recording, radio, and TV, which created a demand for more and different kinds of music, and the growth of commercial songwriting centres in cities such as Hollywood and Nashville.

Tinbergen \'tin-ˌber-kən**, Jan** (b. April 12, 1903, The Hague, Neth.—d. June 9, 1994, The Netherlands) Dutch economist noted for his development of econometric models. For 40 years (1933–73) he taught at The Netherlands School of Economics. As economic adviser to the League of Nations (1936–38), he studied the economic development of the U.S. from 1919 to 1932, work that provided a basis for his development of business cycle theory and methods of economic stabilization. In 1969 he shared with Ragnar Frisch the first Nobel Prize in Economic Sciences. Nikolaas Tinbergen was his brother.

Tinbergen, Nikolaas (b. April 15, 1907, The Hague, Neth.—d. Dec. 21, 1988, Oxford, Eng.) Dutch-born British zoologist, a founder (with Konrad Lorenz) of the science of ethology. Brother of Jan Tinbergen, he received his Ph.D. from the University of Leiden and taught there until 1949, when he took a position at Oxford University. He emphasized the importance of both instinctive and learned behaviour to survival and used animal behaviour as a basis for speculation on human violence and aggression. His observations of seagulls led to important generalizations on courtship and mating behaviour. From the 1970s he and his wife, Elizabeth, studied human behavioral disorders, particularly autism. With Lorenz and Karl von Frisch he shared a Nobel Prize in 1973.

tincal See borax

Ting Ling See Ding Ling

Tinguely \ta^{n}-'glē**, Jean** (b. May 22, 1925, Fribourg, Switz.—d. Aug. 30, 1991, Bern) Swiss sculptor and experimental artist. As a student of

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painting and sculpture in Basel, he showed interest in movement as an artistic medium, and in 1953 he moved to Paris and began to construct sophisticated KINETIC SCULPTURES. He created a sensation when his self-destroying *Homage to New York* (1960) failed to self-destruct at the Museum of Modern Art, New York City; his *Study for an End of the World* (1961) detonated successfully. Tinguely's art satirized the mindless overproduction of material goods in advanced industrial society and expressed his conviction that the essence of both life and art consists of continuous change, movement, and instability.

tinplating Applying a coating of TIN to thin STEEL sheet either by dipping in molten metal or by electrolytic deposition (ELECTROPLATING); almost all tinplate is now produced by the latter process, in which the tin coating is applied without heat. Essentially a sandwich in which the core is strip steel, tinplate has the strength and formability of steel combined with the noncorrosive and nontoxic properties of tin, and additionally is easy to solder. It is used for containers for food and beverages, paints, oils, tobacco, and numerous other products, as well as in toys, baking equipment, and parts for radio and other electronic equipment. Modern materials, including stainless steel and plastics, have replaced tinplate in many common applications.

Tintoretto *orig.* **Jacopo Robusti** (b. c. 1518, Venice, Republic of Venice—d. May 31, 1594, Venice) Italian painter. His father was a silk dyer (*tintore*); hence the nickname Tintoretto ("Little Dyer"). His early influences include MICHELANGELO and TITIAN. In *Christ and the Adulteress* (c. 1545) figures are set in vast spaces in fanciful perspectives, in distinctly Mannerist style. In 1548 he became the centre of attention of artists and literary men in Venice with his *St. Mark Freeing the Slave*, so rich in structural elements of post-Michelangelo Roman art that it is surprising to learn that he had never visited Rome. By 1555 he was a famous and sought-after painter, with a style marked by quickness of execution, great vivacity of colour, a predilection for variegated perspective, and a dynamic conception of space. In his most important undertaking, the decoration of Venice's Scuola Grande di San Rocco (1564–88), he exhibited his passionate style and profound religious faith. His technique and vision were wholly personal and constantly evolving. Historians of modern art recognize him as the greatest representative of MANNERISM, interpreted in accordance with the great tradition of Venice.

Tipitaka See TRIPITAKA

Tippecanoe \,ti-pə-kə-'nü**, Battle of** (Nov. 7, 1811) Victory by U.S. troops over the SHAWNEE. Gen. WILLIAM H. HARRISON led a U.S. force in pursuit of the Shawnee to destroy an intertribal alliance promoted by TECUMSEH and his brother, The PROPHET. At the Indian capital of Prophetstown on the Tippecanoe River in Indiana, the Indians attacked the troops but were repulsed. Both sides suffered equal losses, but the battle was considered a victory for Harrison and helped establish him as a national figure.

Tippett \'tip-ət**, Sir Michael (Kemp)** (b. Jan. 2, 1905, London, Eng.—d. Jan. 8, 1998, London) British composer. Tippett studied composition (1923–28) at the Royal College of Music. His early music was conservative, but in the late 1930s he developed a personal, modernistic idiom that was marked by rhapsodic lyricism, intricate COUNTERPOINT, and polyphonic rhythms that have a lilting, bounding quality. He devoted most of his energies to compositions with words (generally his own), including the cantatas *A Child of Our Time* (1941) and *The Mask of Time* (1984), and the operas *The Midsummer Marriage* (1952), *King Priam* (1961), *The Knot Garden* (1969), and *The Ice Break* (1976). Beginning with *King Priam*, his surging rhythms and lush harmonies gave way to a starker, more taut style. His instrumental works include symphonies and string quartets.

Tiranë *or* **Tirana** \ti-'rä-nə\ City (pop., 1999 est.: 279,000), capital of Albania. Founded in the early 17th century by a Turkish general, it gradually became a trading centre at the junction of roads and caravan trails. It was named the capital of Albania in 1920. In World War II Tiranë was occupied by Axis forces (1939–44). It is Albania's largest city and main industrial and cultural centre, home to the national library and theatre and site of the University of Tiranë (1957).

tire Rubber cushion that fits around a wheel and usually contains compressed air. Solid-rubber tires were used on road vehicles until they were replaced by air-filled pneumatic tires, which, although first patented by Robert Thomson (1822–1873) in 1845, came into common use only when John Dunlop (1840–1921) put them on bicycles in 1888 and the French manufacturer Michelin began to produce them for motor vehicles. The tire consisted of an inner tube containing compressed air that was covered by an outer rubber casing to provide traction. In the 1950s tubeless tires became standard on most automobiles. Improved tire construction produced the radial-ply tire.

Tiresias \tī-'rē-sē-əs\ In GREEK MYTHOLOGY, a blind Theban seer. In HOMER's *Odyssey* he retained his prophetic gifts even in the underworld, where ODYSSEUS was sent to consult him. His prophecy led to the tragedy of OEDIPUS. It was said that Tiresias lived for seven generations and that he was once turned into a woman for killing the female of two mating snakes; upon thereafter killing the male, he reverted to male. According to one legend, he was blinded by HERA for arguing, on the basis of his unique experience, that women derive greater pleasure from sex than men do; his gift of prophecy was a compensatory gesture from ZEUS.

Tirol *or* **Tyrol** \tə-'rōl, 'tī-,rōl\ State (pop., 2001: 673,504), western Austria. Covering 4,883 sq mi (12,647 sq km), it consists of North Tirol and East Tirol, separated by the state of Salzburg and the Italian region of TRENTINO–ALTO ADIGE. Tirol is a mountainous area bordered by the Bavarian Alps and the Ötztaler Alps. Its capital is INNSBRUCK. Tirol came under Roman control in the 1st century BC. In the Middle Ages it was ruled by various counts and bishops until it passed to the HABSBURGS in 1363. It was the scene of revolts in 1525 during the REFORMATION, and again in 1809 against French and Bavarian rule. The southern Tirol was transferred to Italy in 1919. Renowned for its skiing, it attracts many tourists.

Tirpitz \'tir-pəts**, Alfred von** (b. March 19, 1849, Küstrin, Prussia—d. March 6, 1930, Ebenhausen, near Munich, Ger.) German naval commander. The son of a Prussian civil servant, he enlisted in the Prussian Navy in 1865, attended the Kiel Naval School, and was commissioned in 1869. As commander of a torpedo-boat flotilla, he devised new tactical principles. Promoted to rear admiral, he commanded a cruiser squadron in East Asia (1896–97). In 1897 he became secretary of state of the imperial navy department and reorganized the German navy into a formidable high-seas fleet. Promoted to grand admiral (1911), he favoured unlimited submarine warfare in World War I, but opposition to his policy led to his resignation in 1916. In 1917 he cofounded the patriotic Fatherland Party.

Tirso de Molina \'tir-sō-dā-mə-'lē-nə\ *orig.* **Gabriel Téllez** (b. March 9?, 1584, Madrid, Spain—d. March 12, 1648, Soria) Spanish playwright. As a friar of the Mercedarian Order from 1601, he wrote its official history (1637). Inspired by LOPE DE VEGA, he drew upon a wide range of sources and styles for his dramas. Tirso wrote a vast number of works, of which only about 80 have survived. His best-known play, the tragedy *The Seducer of Seville* (1630), introduced the legendary hero-villain DON JUAN. Noted for portraying the psychological conflicts of his characters, he also wrote the tragedy *The Doubted Damned* (1635) and *Antona García* (1635), which analyzed mob emotion. Though he also excelled in comedy, he was the greatest Spanish tragedian of his time.

tirtha \'tir-tə\ In HINDUISM, a holy river, mountain, or other place made sacred through association with a deity or saint. Such sites are often the destination of pilgrims and the venue for large religious festivals. A Hindu will make such a pilgrimage as an act of devotion, to carry out a vow, to appease a deity, or to seek prosperity. On reaching a tirtha, the pilgrim will usually bathe, circle the temple or shrine, make an offering, have his name recorded by the tirtha priests, and listen to evening music and religious discourses.

Tirthankara \tir-'təŋ-kə-rə\ *or* **Jina** \'ji-nə\ In JAINISM, a saviour who has succeeded in crossing over life's stream of rebirths and has made a path for others to follow. Each cosmic age produces 24 Tirthankaras; the first are giants, but, as the age proceeds, they decrease in stature and appear after shorter intervals of time. Of the 24 Tirthankaras of the present age, each of whom is represented by a symbolic colour and emblem, only PARSHVANATHA and MAHAVIRA are considered actual historical figures. The Tirthankaras are not worshiped as gods but rather honoured as exemplars. See also ARHAT; BODHISATTVA; SAMSARA.

Tiryns \'tir-ənz, 'tīr-ənz\ Ancient city, eastern PELOPONNESE, southern Greece. Inhabited from Neolithic times, it developed as an important MYCENAEAN centre in the Bronze Age, reaching its height c. 1400 BC. It declined as ARGOS grew in power after 1100 BC. The Argives destroyed it c. 468 BC. Ruins of its palace and massive walls date from the 15th–12th centuries BC. The term *cyclopean masonry* derives from the huge stones used in its construction, supposedly by the CYCLOPS for PROTEUS. The city is also connected with PERSEUS and HERACLES.

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Tishtrya \'tish-trē-ə\ Ancient Iranian god identified with the star Sirius. His principal myth involves a battle with a demonic star named Apausha over rainfall and water. As one of the stars that cause rain, Tishtrya was intimately connected with agriculture.

tissue culture Biological research method in which tissue fragments (a cell, a population of cells, or all or part of an organ) are sustained in an artificial environment for examination and manipulation of cell behaviour. It has been used to study normal and abnormal cell structure; biochemical, genetic, and reproductive activity; metabolism, functions, and aging and healing processes; and reactions to physical, chemical, and biological agents (e.g., drugs, viruses). A tiny sample of the tissue is spread on or in a culture medium of biological (e.g., blood serum or tissue extract), synthetic, or mixed origin having the appropriate nutrients, temperature, and pH for the cells being incubated. The results are observed with a microscope, sometimes after treatment (e.g., staining) to highlight particular features. Some viruses also grow in tissue cultures. Work with tissue cultures has helped identify infections, enzyme deficiencies, and chromosomal abnormalities; classify brain tumours; and formulate and test drugs and vaccines.

Tisza \'ti-sä**, István, Count** (b. April 22, 1861, Budapest, Hung., Austrian Empire—d. Oct. 31, 1918, Budapest) Hungarian politician. He entered the Hungarian parliament in 1886 and joined his father, Tisza Kálmán, as a leader of the Liberal Party. A defender of the Austro-Hungarian dualist system of government and of Hungary's landed interests, he served as prime minister (1903–05, 1913–17). He opposed voting franchise reform and resigned over the king's 1917 decree for such reform. A supporter of the alliance with Germany in World War I, he was held responsible for his country's suffering and was assassinated by Magyar leftists.

Tisza, Kálmán (b. Dec. 16, 1830, Geszt, Hung., Austrian Empire—d. March 23, 1902, Budapest) Hungarian politician and premier (1875–90). A member of an old landowning family, he took part in the struggle for Hungarian national autonomy within the Austro-Hungarian system of dual government. After the Compromise of 1867 he formed a coalition of the nobility, business interests, and small landowners into the new Liberal Party (1875) and became prime minister. His social, political, economic, and legal reforms helped Hungary develop into a modern state. He resigned over interference from the Austrian emperor but continued as leader of the Liberal Party, with his son, István Tisza.

Tisza River *or* **Tisa** \'ti-sä\ **River** River, western Ukraine, eastern Hungary, and northern Serbia and Montenegro. Rising in the Carpathian Mountains of western Ukraine, it flows west, forming a section of the Ukraine-Romania border, then continues southwest across Hungary and into Serbia and Montenegro to empty into the Danube River above Belgrade. It is 619 mi (996 km) long. The Tiszalök Dam (1954) forms the largest reservoir in Hungary. The Tisza is navigable for light-draft boats for about 450 mi (727 km).

tit Any of several woodland and garden songbird species in the genus *Parus* (family Paridae) having a rather stout, pointed bill. The great tit (*P. major*), found in Europe, North Africa, and Asia nearly to Java, is about 6 in. (14 cm) long. It has a white face, a black head, and a black center line on its underparts, which are yellow or buffy. The best-known North American species of crested tit is the tufted titmouse (*P. bicolor*), a 7-in. (17-cm) bluish gray bird with pinkish brown flanks. See also chickadee.

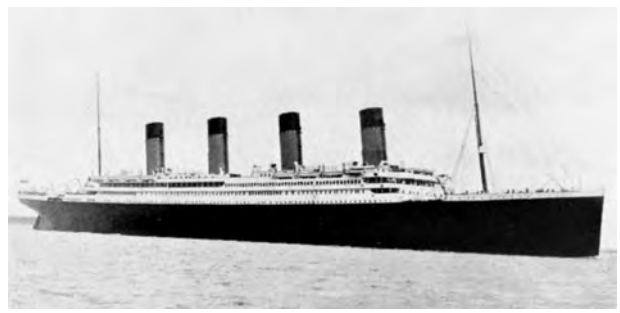
Tufted titmouse (*Parus bicolor*).
DAN SUDIA-THE NATIONAL AUDUBON SOCIETY COLLECTION

Titan \'tī-tən\ In Greek mythology, any of the children of Uranus and Gaea and their descendants. There were 12 original Titans: the brothers Coeus, Crius, Cronus, Hyperion, Iapetus, and Oceanus, and the sisters Mnemosyne, Phoebe, Rhea, Tethys, Thea, and Themis. Encouraged by Gaea, the Titans rebelled against their father. Cronus deposed Uranus by castrating him, and became king himself. Cronus' son Zeus rebelled against his father, launching a struggle in which most of the Titans sided with Cronus. Zeus and his siblings finally won after 10 years, and Zeus imprisoned the Titans in a cavity below Tartarus.

Titan \'tī-tᵊn\ Largest moon of Saturn. Titan is the only satellite in the solar system known to have clouds and a dense atmosphere. It makes one rotation on its axis (about every 16 days) for each revolution around Saturn, thus always keeping the same hemisphere toward the planet. With a diameter of 3,200 mi (5,150 km), Titan is the second largest moon in the solar system; only Jupiter's Ganymede is larger. Its density (about 1.9 times that of water) implies that its interior is a mixture of rocky and icy materials, the latter likely being mostly water ice mixed with frozen ammonia and methane. Its atmosphere is about 95% nitrogen. Its surface, veiled in a thick brownish red haze, was largely a mystery until the arrival at Saturn in 2004 of the Cassini-Huygens spacecraft, which revealed a complex topography shaped by rains, winds, flowing liquids, and other processes similar to those acting on Earth's surface.

Titan rocket Any of a series of U.S. liquid-fueled rockets originally developed as intercontinental ballistic missiles (ICBMs) but also used as space launch vehicles. Titan I missiles (used 1962–65), designed to deliver a four-megaton nuclear warhead over 5,000 mi (8,000 km) to targets in the former Soviet Union, were stored in underground silos but had to be raised to ground level and fueled for launch. By 1965 they had been replaced by the much larger Titan II, which could be launched directly from its silo. With a nine-megaton warhead, Titan II was the principal weapon in the land-based U.S. nuclear arsenal until the 1980s, when it was replaced by solid-fueled ICBMs (e.g., Minuteman missiles). NASA used the Titan II to launch Gemini spacecraft in the 1960s; deactivated Titan II missiles refurbished as space launchers continued to be used into the 21st century. The Titan IV, developed in the late 1980s, has larger engines to lift heavy space cargo such as that carried by the space shuttle. Coupled with the Centaur upper-stage vehicle, it is the largest and most powerful expendable launch vehicle in the U.S.

Titanic British luxury passenger liner that sank on April 15, 1912, en route to New York from Southampton, England, on its maiden voyage. Over 1,500 of its 2,200 passengers were lost. The largest and most luxurious ship afloat, it had a double-bottomed hull divided into 16 watertight compartments. Because four of these could be flooded without endangering its buoyancy, it was considered unsinkable. Shortly before midnight on April 14, it collided with an iceberg southeast of Cape Race, Newfoundland; five compartments ruptured and the ship sank. As a result, new rules were drawn up requiring that the number of places in lifeboats equal the number of passengers (the *Titanic* had only 1,178 lifeboat places for 2,224 passengers) and that all ships maintain a 24-hour radio watch for distress signals (a ship less than 20 mi [32 km] away had not heard the *Titanic*'s distress signal because no one had been on duty). The International Ice Patrol was established to monitor icebergs in shipping lanes. In 1985 the wreck was found lying upright in two pieces at a depth of 13,000 ft (4,000 m) and was explored by American and French scientists using an unmanned submersible (see Robert Ballard).



The *Titanic*.
THE BETTMANN ARCHIVE

titanium \tī-'tā-nē-əm\ Metallic chemical element, one of the transition elements, chemical symbol Ti, atomic number 22. A silvery gray, lightweight, high-strength, low-corrosion structural metal, it is found combined in almost all rocks and soils and in plants and animals, natural waters, and deep-sea dredgings. Its chief commercial ores are ilmenite and rutile. Its alloys are used for parts for high-speed aircraft, spacecraft, missiles, and ships; in electrodes; in chemical, desalination, and food-handling equipment; and in prostheses. Its compounds, in which it has valence 2, 3, or 4, include titanium trichloride (used as a catalyst in polypropylene pro-

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duction), titanium dioxide (extensively used as a PIGMENT—with the greatest hiding power of all white pigments—in paints, enamels, and lacquers), and titanium tetrachloride (used in skywriting, smoke screens, and as a catalyst).

Titchener, Edward Bradford (b. Jan. 11, 1867, Chichester, Sussex, Eng.—d. Aug. 3, 1927, Ithaca, N.Y., U.S.) British-U.S. psychologist. Trained in Leipzig under WILHELM WUNDT, he later taught at Cornell University (1892–1927). He helped establish experimental psychology in the U.S., and he also became the foremost proponent of structural psychology, a field concerned with the components and arrangement of mental states and processes. His principal work is *Experimental Psychology* (1901–05).

tithe Contribution of a tenth of one's income for religious purposes. The practice of tithing was established in the Hebrew scriptures and was adopted by the Western Christian church. It was enjoined by eccesiastical law from the 6th century and enforced in Europe by secular law from the 8th century. After the Reformation, tithes continued to be imposed for the benefit of both the Protestant and Roman Catholic churches. Tithes were eventually repealed in France (1789), Ireland (1871), Italy (1887), and England (1936). In Germany support for churches is collected through the personal income tax and distributed according to the individual's religious affiliation. Tithing was never part of U.S. law, but members of certain churches (e.g., the MORMONS) are required to tithe, and members of other churches may tithe voluntarily. Tithing was never accepted by the Eastern Orthodox churches.

Titian \'ti-shən\ *orig.* **Tiziano Vecellio** (b. 1488/90, Pieve di Cadore, Republic of Venice—d. Aug. 27, 1576, Venice) Italian painter active in Venice. As a young man he was taught by THE BELLINI FAMILY and worked closely with GIORGIONE. His early works are so similar in style to Giorgione's as to be indistinguishable, but soon after Giorgione's early death Titian established himself as the leading painter of the Republic of Venice. Among his most important religious paintings is the revolutionary and monumental *Assumption* (1516–18) for Santa Maria dei Frari, in which the Virgin ascends to heaven in a blaze of colour accompanied by a semicircle of angels. Titian was also interested in mythological themes, and his many depictions of Venus display his work's sheer beauty and inherent eroticism. *Bacchus and Ariadne* (1520–23), with its pagan abandon, is one of the greatest works of Renaissance art. Titian was sought after for his psychologically penetrating portraits, which include portrayals of leading Italian aristocrats, religious figures, and Emperor Charles V. He reached the height of his powers in *The Rape of Europa* (c. 1559–62), one of several paintings done for PHILIP II of Spain. He was recognized as supremely gifted in his lifetime, and his reputation has never declined.

Titicaca \ˌtē-tē-'kä-kä**, Lake** South American lake, the world's highest lake navigable to large vessels. Located in the ALTIPLANO, a high basin of the ANDES MOUNTAINS, and on the border between Peru and Bolivia, it lies at an elevation of about 12,500 ft (3,810 m). The second largest lake in South America, it covers some 3,200 sq mi (8,300 sq km) and is 120 mi (190 km) long by 50 mi (80 km) wide. A narrow strait joins the lake's two bodies of water, which have 41 islands, some densely populated. The remains of one of the oldest known American civilizations have been found in the area. Temple ruins on Titicaca Island mark the spot where, according to legend, the founders of the INCA were sent down to earth by the sun.

Tito \'tē-tō**, Josip Broz** *orig.* **Josip Broz** (b. May 7, 1892, Kumrovec, near Zagreb, Croatia, Austria-Hungary—d. May 4, 1980, Ljubljana, Yugos.) Yugoslav politician, premier (1945–53), and president (1953–80). Born to a peasant family, he fought in the Austro-Hungarian army in World War I and was captured by the Russians in 1915. While in Russia, he took part in the JULY DAYS demonstrations (1917) and joined the BOLSHEVIKS. In 1920 he returned to Croatia, where he became a local leader of the Communist Party of Yugoslavia. He rose in the party hierarchy, interrupted by a prison term (1928–34), to become its secretary-general in 1939. In World War II, Tito (a pseudonym he adopted about 1935) proved an effective leader of Yugoslav Partisans. As marshal from 1943, he strengthened communist control of Yugoslavia. As premier and president, he developed an independent form of socialist rule in defiance of the Soviet Union, pursued a policy of nonalignment, built ties with other nonaligned states, and improved relations with the Western powers. Within Yugoslavia, he established a system of "symmetrical federalism" (1974) that created equality among the six republics and Serbia's autonomous provinces (including Kosovo), while maintaining tight control to prevent separatist movements. After his death, resentment of Serbian domination led gradually to a dissolution of the federal system.

Titograd See PODGORICA

titration \tī-'trā-shən\ Process of chemical ANALYSIS in which the quantity of some constituent of a dissolved sample is determined by adding an exactly measured quantity of another dissolved substance with which it reacts in a definite, known proportion. The solution of known concentration is gradually added to the unknown solution from a burette (a long measuring tube with a valve at the bottom) until the equivalence point (end point) is reached. The amount of the unknown substance can then be calculated. The equivalence point is determined by a detectable change, for instance, of colour in an indicator substance (e.g., LITMUS) or in an electrical property. Reactions used in titration include ACID-BASE reactions, precipitations (see SOLUTION), formation of complexes, and OXIDATION-REDUCTION reactions. See also PH.

Titus *in full* **Titus Vespasianus Augustus** *orig.* **Titus Flavius Vespasianus** (b. Dec. 30, AD 39—d. Sept. 13, 81) Roman emperor (79–81). He commanded a Roman legion in Judaea under his father, VESPASIAN. After Vespasian became emperor (69), he gave Titus full command in Judaea, whereupon Titus captured and destroyed Jerusalem (70). He later took charge of the empire's general military operations. As emperor he developed goodwill in Rome for his extravagant spending; his projects included the completion of the Colosseum. He died suddenly, probably from natural causes, though there were rumours that he was poisoned by DOMITIAN.

Tiv People living along the Benue River in Nigeria. They number more than 2.5 million and speak a Benue-Congo language of the NIGER-CONGO family. The Tiv cultivate yams, millet, and sorghum. A family occupies a cluster of round huts; brothers usually live next to one another. Some Tiv have converted to Christianity, and a few have adopted Islam, but the traditional religion based on a creator-god remains strong.

Tivoli \'tē-vō-lē\ *ancient* **Tibur** Town (pop., 2001 prelim.: 46,364), LAZIO, central Italy. The site has been occupied continuously since prehistoric times. Originally an independent member of the Latin League and a rival of nearby ROME, Tivoli came under Roman influence in the 4th century BC. It received Roman citizenship in 90 BC and attained prosperity as a summer resort under the early empire. Many wealthy Romans built villas and erected temples in the vicinity, and the buildings' remains are among the most impressive to survive from antiquity. They include HADRIAN'S VILLA and the poet HORACE's Sabine farm. Tivoli is also the site of the Villa d'Este (begun AD 1550), with its magnificent gardens and unrivaled Renaissance fountains.

Tiwanaku \ˌtē-ä-wä-'nä-kō\ *or* **Tiwanacu** *Spanish* **Tiahuanaco** Major pre-Columbian ANDEAN CIVILIZATION known from the ruins of the same name near the southern shore of Lake TITICACA in Bolivia. The Tiwanaku civilization spread throughout large areas of Bolivia and Peru and parts of Argentina and Chile. The main site's earliest remains may date from c. 200 BC–c. AD 200 and its major buildings from c. AD 600 to c. 1000. Surviving artifacts include stelae, decorated pottery, and the famous Gateway of the Sun (Puerta del Sol), an ornamented doorway carved from a massive stone slab. Much of the culture's success derived from its raised-field farming technique, in which elevated planting surfaces were separated by canals that retained the sun's heat during the cold nights and kept the crops from freezing. Algae that grew in the canals was used for fertilizer. The Tiwanaku culture vanished by 1200.

tjurunga *or* **churinga** \tyů-'rəŋ-gə\ In native AUSTRALIAN RELIGION, a ritual object that is a representation or manifestation of a mythical being. They are symbols of communication between humans and the DREAMING. Most tjurunga are used in men's secret and sacred rituals, though some small objects figure in women's rituals and still smaller objects in men's love magic. At initiation, a boy is introduced to the rituals and tjurunga of his local descent group. Later, he receives his own tjurunga, with which he has a personal bond. At a person's death, the tjurunga is sometimes buried with the corpse.

tlachtli \'tläch-tlē\ Ball court or field used for the ritual ball game *ollama*, played throughout pre-Columbian Mesoamerica. Some myths mention the game as a symbolic contest between day and night deities. The object of the game, played in teams, was to use elbows, knees, and hips to drive the ball through the opponent's goal. The game was accompanied by heavy betting. It was extremely violent, and severe injuries were frequent,

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despite the players' protective clothing. Losing players were apparently sometimes sacrificed, and the ball may sometimes have consisted of a human head wrapped in latex.

Tlaloc \'tlä-lōk\ Aztec rain god, highly revered and feared for his ability to bestow or withhold prosperity. Five of the 18 months of the ritual year were dedicated to him, and children were sacrificed to him during two of the months. He could send out rain, provoke drought and hunger, and cause lightning and hurricanes. Dropsy, leprosy, and rheumatism were said to be caused by Tlaloc and his fellow deities. Those who died of such illnesses, or who had been killed by lightning, were granted an eternal and blissful life in his paradise, Tlalocan.

Tlaxcala *in full* **Tlaxcala de Xicohténcatl** Town (pop., 2000: 73,213), capital of TLAXCALA state, Mexico. It is located in a mountainous region at the foot of La Malinche volcano. Settled by a NAHUA people around the 14th century, it vied for power in the 15th–16th century with the AZTEC city of TENOCHTITLÁN (modern Mexico City). Though the inhabitants initially opposed HERNÁN CORTÉS, they later became his allies and aided him in his defeat of Azetec leader MONTEZUMA II. It was a refuge for the Spaniards when they were driven out of Tenochtitlán in 1520. Cortés established the first Christian church (San Francisco) in the Americas there in 1521. The sanctuary of Our Lady of Ocotlán and archaeological ruins are nearby.

Tlaxcala \tlä-'skä-lä\ State (pop., 2000: 962,646), central Mexico. The smallest Mexican state, it consists largely of plateau and covers 1,551 sq mi (4,016 sq km); the capital is TLAXCALA town. It occupies roughly the same area as the Indian principality of Tlaxcala, which was the main Indian ally of HERNÁN CORTÉS in his conquest of Mexico. Almost exclusively agricultural, it produces cereals, raises both dairy cows and fighting bulls, and has numerous handicrafts, notably the weaving of serapes and woolen cloth.

Tlazoltéotl \ˌtlä-sōl-'tē-ō-tˀl\ Important and complex Aztec earth-mother goddess. She was known in four guises, each associated with a different stage in life. As a young woman, she was a carefree temptress. In her second form, she was the destructive goddess of gambling and uncertainty. In middle age, she was able to absorb human wrongdoing. In her final manifestation, she was a terrifying hag preying on youths. She was thought to provoke carnal lust and illicit sexual activity, but she could also grant absolution and remove corruption from the world by eating sexual filth.

Tlingit \'tliŋ-gət\ Northernmost group of NORTHWEST COAST INDIAN peoples who inhabit the islands and coast of southern Alaska, U.S. The Tlingit language is thought to be related to ATHABASKAN. The basic social unit was the lineage, based on maternal lines of descent; clans and larger units (moieties) were also important. Each lineage had its own chief, owned and exploited lands of economic importance, and functioned as a ceremonial unit. The economy was based on salmon fishing, though sea and land mammals were also hunted. Wood, often decorated with stylized designs, was used for houses, TOTEM POLES, canoes, dishes, and other objects. The POTLATCH marked a cycle of rituals mourning the death of a chief. The Tlingit number about 20,000.

TM See TRANSCENDENTAL MEDITATION

TNT *in full* **trinitrotoluene** \ˌtrī-ˌnī-trō-'täl-yə-ˌwēn\ Pale yellow, solid organic compound made by adding NITRATE ($-NO_2$) groups to TOLUENE. Because TNT melts below the boiling point of water but explodes only above 464 °F (240 °C), it can safely be melted and poured into casings. It is relatively insensitive to shock and, for practical purposes, cannot be exploded without a detonator, making it the preferred chemical explosive, used in munitions and for demolition.

To-wang \'tō-'wäŋ\ *or* **Togtokhtör** \'tȯg-ˌtōk-'tůr\ (fl. 19th century) Mongolian prince who opposed Manchu rule and supported Mongolia's independence from China. Concerned with education, he set up a primary school open to commoners, had Buddhist scriptures translated into Mongol, and codified practical advice for herdspeople in a book he circulated among them. To diversify the economy, he encouraged agriculture and the production of textiles and woolen goods. His plan to build a central temple to replace 11 local temples turned his people against him; higher authorities decided in his favour, but the temple project was canceled.

toad Any member of 26 genera (order Anura) of mainly terrestrial, nocturnal, tailless AMPHIBIANS. Toads have a squat body, short legs, external fertilization, and teeth in the upper jaw. They eat insects or small animals. The more than 300 species of true toads (*Bufo*) are found almost worldwide. They are 1–10 in. (2–25 cm) long and have thick, dry, often warty skin. Poison secreted by glands on the back and warts irritates the eyes and mucous membranes of predators. Some species' poison can paralyze or kill animals as large as dogs, but toads do not cause warts. Toads reproduce by laying in water two long jelly tubes containing 600–30,000 eggs. The genus *Nectophrynoides* contains the only anurans that bear live young. See also FROG, HORNED TOAD.

American toad (*Bufo americanus*).
GEORGE PORTER—THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

toadfish Any of about 45 species (family Batrachoididae) of heavy-bodied, carnivorous, bottom-living fishes, found chiefly in the New World and mostly in warm seas. Toadfishes, up to 16 in. (40 cm) long, have a broad, flattened head, a large mouth, strong teeth, and small scales (if any). Most produce grunting or croaking sounds. The oyster toadfish (*Opsanus tau*) is common in shallow eastern North American coastal waters. Venomous toadfishes (genera *Thalassophryne* and *Daector*), of Central and South America, have venom-injecting spines on their dorsal fins and gill covers. Midshipmen (genus *Porichthys*), shallow-water American fishes, have rows of 600–840 buttonlike light organs along the body.

Oyster toadfish (*Opsanus tau*).
ROMAN VISHNIAC

toadflax See BUTTER-AND-EGGS

toadstool See MUSHROOM

Toba dynasty See NORTHERN WEI DYNASTY

tobacco Any of numerous species of plants in the genus *Nicotiana*, or the cured leaves of several of the species, used after processing in various ways for smoking, snuffing, chewing, and extracting of NICOTINE. Native to South America, Mexico, and the West Indies, common tobacco (*N. tabacum*) grows 4–6 ft (1–2 m) high and bears usually pink flowers and huge leaves, as long as 2–3 ft (0.6–1 m) and about half as wide. When CHRISTOPHER COLUMBUS reached the Americas, he reported natives using tobacco as it is used today, as well as in religious ceremonies. Believed to have medicinal properties, tobacco was introduced into Europe and the rest of the world, becoming the chief commodity that British colonists exchanged for European manufactured articles. Awareness of the numerous serious health risks posed by tobacco, including various cancers and a range of respiratory diseases, has led to campaigns against its use, but the number of tobacco users worldwide continues to rise. The World Health Organization estimates that smoking now causes three million deaths annually and within two decades will cause more deaths than any single disease.

Tobago See TRINIDAD AND TOBAGO

Tobey, Mark (b. Dec. 11, 1890, Centerville, Wis., U.S.—d. April 24, 1976, Basel, Switz.) U.S. painter. He studied at the Art Institute of Chicago. In 1918 he converted to the Bahā'ī religion and his work became inspired by Asian art and thought. In the 1930s he achieved notoriety with his "white writing" paintings, consisting of a web of calligraphic marks painted in white on a gray or coloured ground (e.g., *Broadway*, 1936), which soon displaced his representational work. His style is distinguished by his use of the small format and a refined execution in watercolour, tempera, or pastel. In the 1950s he exerted much influence abroad, especially on French TACHISM.

Tobit \'tō-bət\ Main character in the Bible's apocryphal book of Tobit. Tobit, a pious Jew living in exile in NINEVEH, gives alms and buries the dead in accordance with Hebrew law but is struck blind in spite of his good works. Sarah, daughter of a close relative, has had seven husbands, each of whom was killed by a demon on their wedding night. The two pray for

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deliverance, and the angel Raphael intercedes for them. Tobit regains his sight, and Sarah marries Tobit's son Tobias. The book is an effort to reconcile the evil in the world with God's justice. See also Apocrypha.

tobogganing Sport of sliding down a snow-covered hill on a toboggan, a long, flat-bottomed sled made of thin boards curved up at the front end. The word is of Algonquian origin and probably refers to a towing sled. Tobogganing as a sport appears to have originated on the slopes of Mount Royal in Montreal in the late 19th century. In the early 20th century many tobogganing chutes (3-ft-wide wood- or ice-sided channels) were built.

Tobruk *ancient* **Antipyrgos** Port city (pop., latest est.: 110,000), northeastern Libya. The site of an ancient Greek agricultural colony, it later had a Roman fortress guarding the frontier of Cyrenaica. For centuries it served as a way station on the coastal caravan route. An Italian military post by 1911, it was the scene of prolonged fighting during World War II (see North Africa campaigns). The British captured it from the Italians in 1941; it fell to a German siege in 1942 but was recaptured by the British the same year. Rebuilt after the war, it was expanded in the 1960s to include a port terminal linked by pipeline to the Sarīr oil field.

Tocantins \ˌtō-kän-ˈtēⁿs\ **River** River, east-central and northeastern Brazil. It rises in several headstreams, including the Paraná River, and flows north and west to join the Araguaia River. It again turns north and flows into the Pará River after a course of 1,677 mi (2,699 km). Frequently interrupted by rapids and waterfalls, it is mainly unnavigable.

Tocharian \tō-ˈkar-ē-ən\ **languages** *or* **Tokharian languages** Two extinct Indo-European languages, Tocharian A and Tocharian B, formerly spoken in the Tarim River Basin in China. Documents date back to ad 500–700. Tocharian literature, written in a northern Indian syllabary derived from Brahmi (see Indic writing systems), was preserved in Buddhist monasteries. Spoken at the eastern frontier of the Indo-European world, Tocharian shows the influence of Indo-Aryan and Iranian languages but seems closer to western Indo-European languages in vocabulary and grammar.

tocopherol See vitamin E

Tocqueville \ˈtōk-ˌvil, tȯk-ˈvēl**, Alexis (-Charles-Henri-Maurice Clérel) de** (b. July 29, 1805, Paris, France—d. April 16, 1859, Cannes) French political scientist, historian, and politician. Born into an aristocratic family, he entered government service by choice. After the July Revolution of 1830, his position became precarious because of his family's ties to the ousted king, and he undertook a nine-month study trip to the U.S. with his friend Gustave de Beaumont. Out of it came his best-known work, *Democracy in America*, 4 vol. (1835–40), a highly perceptive and prescient analysis of the American political and social system, as well as of the vitality, excesses, and potential future of democracy, with attention to the situation in France. He was elected to the Chamber of Deputies in 1839 and held various political offices after the Revolution of 1848. *The Old Regime and the Revolution* (1856), a pessimistic analysis of French political tendencies, was the first volume of his unfinished study of the French Revolution.

Alexis de Tocqueville, detail of an oil painting by T. Chassériau; in the Versailles Museum.
H. ROGER-VIOLLET

Tōdai Temple \ˈtō-ˌdī\ *Japanese* **Tōdai-ji** Monumental temple of the Kegon sect of Japanese Buddhism, located in Nara, Japan. The main buildings were constructed in 745–752 under the emperor Shōmu, marking the adoption of Buddhism as a state religion. The Great Buddha Hall, built within a 2-sq-mi (5-sq-km) enclosure, measured about 288 by 169 ft (88 by 52 m) and, as restored today, is the largest wooden building in the world. The 53-ft (16-m) Great Sun Buddha was installed in 752. The Shōsōin is a repository for more than 9,000 works of art from the Nara period and more than 600 personal effects of Shōmu.

Todos los Santos, Lake Lake, south-central Chile. It is located north of Puerto Montt. With neighbouring Lake Llanquihue, it is the best-known of Chilean lakes and is in a popular resort area.

tofu Soft, bland, custardlike food product made from soybeans. Believed to date from China's Han dynasty (206 bc–ad 220), tofu is today an important source of protein in the cuisines of East and Southeast Asia. It is made from dried soybeans that are soaked in water, crushed, and boiled to produce a solid pulp and liquid soy "milk." Coagulants are then added to the milk to separate the curds from the whey. The resulting soft cakes are cut into squares and stored in water.

toga Loose, draped outer garment adopted by the Romans from the Etruscans. It was originally worn by both sexes of all classes, but was gradually abandoned by women, then by labourers, and finally by patricians, but throughout the history of the empire it remained the state dress, the garment of the emperor and high officials. Made from an oval piece of fabric, the toga had voluminous folds that made activity difficult and thus became the distinctive garment of the upper classes. The colour of the toga worn depended on class, age, and the character of such special events as mourning and triumphs.

Imperial Roman toga on Tiberius (reigned ad 14–37); in the Louvre, Paris
GIRAUDON/ART RESOURCE, NEW YORK

togavirus \ˌtō-gə-ˈvī-rəs\ Any of three genera of arboviruses: *Alphavirus*, *Rubivirus* (which causes rubella), and *Pestivirus* (which infects only animals). Some *Alphavirus* species produce a severe equine encephalitis that has a mortality rate of up to 90% in horses and 10% in humans.

toggle mechanism Combination of solid, usually metallic links (bars), connected by pin (hinge) joints arranged so that a small force applied at one point can create a much larger force at another point. See also linkage.

Toghrïl Beg \tȯg-ˈrēl-ˈbeg\ (b. c. 990—d. Sept. 4, 1063, Rayy, Iran) Founder of the Seljūq dynasty. He and his brother Chagrï took refuge in Khwārezm in Central Asia after being defeated by Maḥmūd of Ghazna. Later they entered Khorāsān (northeastern Iran), where they gradually built a power base, returning to defeat Maḥmūd's son (1040). Chagrï took over Khorāsān, and Toghrïl prepared to conquer the rest of Iran. In the 1040s he extended his authority to Rayy, Hamadān, and Eṣfahān, and in 1055 he entered Baghdad, where he had been commissioned by the caliph of the ʿAbbāsid dynasty to overthrow the Shïʿite Fāṭimid dynasty. In 1060 Toghrïl crushed a rebellion in Baghdad.

Toghto \ˈtȯg-ˌtō\ (fl. 1340–55, China) High government official during the later years of China's Yuan dynasty (1206–1368). He followed his uncle as minister of the right (1340–44) and favoured a centralized approach to government. Under him, positions that had been closed to the Chinese were reopened, many literati returned to the capital, and the Chinese examination system was restored. He was called back to office for another term (1349–55), during which time he oversaw projects to reroute the Huang He (Yellow River) and to develop an apparatus for quelling the many popular uprisings of the 1350s.

Togliatti \tōl-ˈyä-tē**, Palmiro** (b. March 26, 1893, Genoa—d. Aug. 21, 1964, Yalta, Ukraine, U.S.S.R.) Italian communist leader. After serving in World War I, in 1919 he helped found the left-wing weekly *L'Ordine Nuovo* ("New Order"), which became a rallying point for the breakaway communist wing of the Socialist Party (1921). He edited the Communist Party newspaper and was a member of the party's central committee from 1924. He was in Moscow when the party was banned in Italy (1926); he remained in exile and became a member of the Comintern secretariat (1935). He returned to Italy in 1944 and served in a coa-

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lition government as vice premier (1945). He advocated a national, democratically oriented form of communism and made the Italian Communist Party the largest in western Europe. See also DEMOCRATIC PARTY OF THE LEFT.

Togo *officially* **Togolese Republic** Republic, western Africa. Area: 21,925 sq mi (56,785 sq km). Population (2005 est.): 5,400,000. Capital: LOMÉ. It has some 30 ethnic groups; the EWE is the largest. Languages:

French (official), Ewe, other indigenous languages. Religions: Christianity (mostly Roman Catholic), traditional beliefs, Islam. Currency: CFA franc. Togo occupies a strip of land about 70 mi (115 km) wide that extends about 320 mi (515 km) inland from the GULF OF GUINEA. Regions include a swampy coastal plain, a northern savanna, and a central mountain range. The developing economy is based largely on agriculture. Chief crops are cassava, yams, corn, cotton, coffee, and cocoa. It is one of the world's leading producers of phosphates; food products, beverages, and cement are also important. Togo is a republic with one legislative house; its chief of state is the president, supported by the military, and the head of government is the prime minister. Until 1884 what is now Togo was an intermediate zone between the states of ASANTE and DAHOMEY, and its various ethnic groups lived in general isolation from each other. In 1884 it became part of the TOGOLAND German protectorate, which was occupied by British and French forces in 1914. In 1922 the League of Nations assigned eastern Togoland to France and the western portion to Britain. In 1946 the British and French governments placed the territories under UN trusteeship. Ten years later British Togoland was incorporated into the GOLD COAST, and French Togoland became an autonomous republic within the French Union. Togo gained independence in 1960. It suspended its constitution from 1967 to 1980. A constitution providing for multiparty government was approved in 1992, but the political situation remained unstable.

Togoland Former German protectorate, western Africa. Now divided between Togo and Ghana, it covered an area between the British GOLD COAST colony and French Dahomey (now Benin). It was inhabited by a mixture of EWE and other peoples. Its coastal area became a political unit of Germany in 1884; hinterland boundaries were established in 1897. In 1914 it was captured by Anglo-French forces and later divided into two administrative zones. The British zone was placed under control of the Gold Coast (now Ghana), with which it merged in 1957. The French zone became the independent Republic of Togo in 1960. Lingering sentiment for the reunification of Togoland, especially among Ewe people in Ghana, has occasionally strained relations between Togo and Ghana since independence.

Togtokhtör See TO-WANG

Tōjō Hideki \'tō-jō-hē-'dā-kē\ (b. Dec. 30, 1884, Tokyo, Japan—d. Dec. 23, 1948, Tokyo) Army general and prime minister of Japan (1941–44) during most of World War II. Under his direction, great victories were initially scored throughout Southeast Asia and the Pacific, but prolonged reverses in the Pacific and the successful U.S. invasion of the Mariana Islands resulted in his removal from office in 1944. He attempted suicide after Japan's surrender but was nursed back to health to be tried and executed as a war criminal. See also WAR CRIME.

tokamak \'tō-kə-ˌmak\ Device used in NUCLEAR-FUSION research for magnetic confinement of PLASMA. It consists of a complex system of MAGNETIC FIELDS that confine the plasma of reactive charged particles in a hollow, doughnut-shaped container. The tokamak (an acronym from the Russian words for toroidal magnetic confinement) was developed in the mid-1960s by Soviet plasma physicists. It produces the highest plasma temperatures, densities, and confinement durations of any confinement device.

Tokelau \'tō-kə-ˌlaù\ *formerly (1916–46)* **Union Group** Island territory (pop., 2000 est.: 1,458) of New Zealand, South Pacific Ocean. Located north of SAMOA, Tokelau consists of three coral atolls—Fakaofu, Nukunono, and Atafu—each with numerous low-lying islets. Originally settled by Samoans, the islands were first visited by Europeans in the 18th century. In 1863 Peruvian slave raiders abducted many islanders; the abductions and outbreaks of disease reduced the population to about 200. The British established a protectorate there in 1889. Under the name Union Islands they were part of the GILBERT AND ELLICE ISLANDS colony from 1916 to 1925, after which New Zealand was granted jurisdiction. The islands became part of New Zealand in 1948. The name Tokelau Islands was adopted in 1946; this was shortened to Tokelau in 1976. In 1994 the powers that had been held by the territory's New Zealand administrator were transferred to the local government on Tokelau.

Tokharian languages See TOCHARIAN LANGUAGES

tokonoma \ˌtō-kə-'nō-mə\ In a Japanese room, an alcove with a low platform, used for the display of a flower arrangement and hanging scroll or other art objects. A feature of the SHOIN-ZUKURI style, the tokonoma is the focal point and spiritual centre of the interior of almost every traditional Japanese house. It finds its origins in the private altar space of the ZEN Buddhist monk, which contained a hanging Buddhist scroll and a narrow wooden table with an incense burner and votive candles.

Tokugawa Ieyasu \ˌtō-kù-'gä-wä-yā-'yä-sù\ (b. Jan. 31, 1543, Okazaki, Japan—d. June 1, 1616, Sumpu) Founder of the Tokugawa shogunate (see TOKUGAWA PERIOD) and ruler of Japan (1603–16). Along with ODA NOBUNAGA and TOYOTOMI HIDEYOSHI, Ieyasu was one of the three unifiers of premodern Japan. He allied himself initially with Nobunaga; that alliance allowed Ieyasu to survive the vicissitudes of endemic warfare in Japan at that time and to slowly build up his territory. By the 1580s he had become an important DAIMYO in control of a fertile and populous HAN (domain). When Nobunaga died, Ieyasu offered a vow of fealty to Hideyoshi, who was extending his control over southwestern Japan; Ieyasu, meanwhile, enlarged his vassal force and increased his domain's productivity. In the 1590s he avoided participating in Hideyoshi's disastrous expeditions to Korea, instead consolidating his position at home. When Hideyoshi died, Ieyasu had the largest and most reliable army and the most productive and best-organized domain in Japan; he emerged as victor from the ensuing power struggle. He confiscated his enemies' lands and gave them new domains away from Japan's heartland, much of which became Tokugawa property. He received the title of SHOGUN and two years later passed the title to his son, thereby establishing it as hereditary among the Tokugawa.

Tokugawa period (1603–1867) In Japanese history, period of the military government established by TOKUGAWA IEYASU with his assumption of the title of SHOGUN in 1603. The structures Ieyasu set in place were effective for governing Japan for the next 264 years. He established his capital at Edo (modern Tokyo) and assigned DAIMYO HAN (domains) according to their friendliness or hostility toward the Tokugawa: hostile daimyo received domains on the nation's periphery, while allies and collateral houses were given domains nearer to Edo. SANKIN KOTAI, a system whereby daimyo alternated residency between Edo and their domain, also helped the shogunate keep control of the daimyo. To protect Japan from outside influences, particularly Christian missionaries, a new policy of national seclusion forbade Japanese to travel abroad and forbade foreigners to visit Japan (except for Chinese and Dutch traders, who were allowed to trade

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only at the port of Nagasaki). Toyotomi Hideyoshi's division of society into four fixed classes was preserved, and the samurai (military) class became the civil bureaucrats, its members paid with stipends of rice. Increased travel to Edo and other cities stimulated urban development and urban culture (see Edo culture; Genroku period); the merchant class flourished. By the mid-18th century the shogunate began to suffer financially, as attempts at fiscal reform proved largely unsuccessful. During its last 30 years there were numerous peasant uprisings (see ikki) and evidence of samurai unrest. The shogunate was overthrown by the domains of Satsuma and Chōshū in 1867. See also Meiji Restoration; Oda Nobunaga.

Tokyo *Japanese* **Tōkyō** *formerly (until 1868)* **Edo** City (pop., 2003 est.: city, 8,083,980; metro. area, 12,310,000), capital of Japan. The country's largest city, it is located in east-central Honshu at the head of Tokyo Bay. The site has been inhabited since ancient times, and the small fishing village of Edo existed there for centuries before it became the capital of the Tokugawa shogunate in 1603 (see Tokugawa period). By the 19th century it was one of the largest cities in the world, with a population exceeding 1,000,000. Under the Meiji Restoration, in 1868 it replaced Kyōto as the imperial capital, and Edo was renamed Tokyo ("Eastern Capital"). A massive earthquake in the region in 1923 destroyed most of the city and killed at least 100,000 people, but most of it had been rebuilt by 1930. Much of it was again devastated by U.S. bombing during World War II and had to be reconstructed. The Summer Olympic Games were held there in 1964. Tokyo is the administrative, cultural, financial, commercial, and educational centre of Japan and the focus of an extensive urban complex that includes Kawasaki and Yokohama. Attractions include the Imperial Palace, encircled by stone-walled moats and broad gardens, and numerous temples and shrines. There are some 150 institutions of higher learning, including the University of Tokyo (1877).

Tokyo, University of State-financed university in Tokyo, the largest and most prestigious university in Japan. It was founded in 1877 and modeled on Western universities. It was destroyed in the great earthquake and fire of 1923 and reorganized following World War II. Today it has faculties of agriculture, economics, education, engineering, law, letters, medicine, pharmacology, and science, as well as a college of arts and sciences and a graduate school. Among its many research units are centres for the study of molecular and cellular biology, earthquakes, solid-state physics, cosmic radiation, oceanography, and Asian culture.

Tokyo Bay Inlet, western Pacific Ocean. Located off the east-central coast of Honshu, Japan, it is about 30 mi (48 km) long and 20 mi (32 km) wide. It provides a spacious harbour area for several Japanese cities, including Tokyo, Yokohama, and Kawasaki. A highway connecting Kawasaki with Kisarazu (pop., 2000: 122,766) on the opposite side of the bay was opened in 1997; it includes a bridge and an undersea tunnel that is 5.9 mi (9.5 km) long.

Tokyo Rose *orig.* **Ikuko Toguri** (b. July 4, 1916, Los Angeles, Calif., U.S.) U.S. broadcaster. She was visiting Japan when she was stranded at the outbreak of World War II. In 1943 she began radio announcing for a propaganda program beamed at U.S. troops, and eventually she became one of 13 women announcers, all native speakers of American English, collectively known as Tokyo Rose. After the war she was convicted of treason and served six years in a U.S. prison. Mitigating information later came to light, and she was pardoned in 1977.

Tokyo Stock Exchange Main stock market of Japan, located in Tokyo. It opened in 1878 to provide a market for the trading of government bonds newly issued to former samurai. Government bonds and gold and silver currencies initially formed the bulk of trade on the exchange, but the trading of stocks came to predominate by the 1920s and '30s. It was closed from 1945 to 1949, when it opened after being reorganized by the occupying U.S. authorities. Today it accounts for more than 90% of all securities transactions in Japan, and it is one of the world's largest marketplaces for securities. The Nikkei index is the key stock-market index in Tokyo.

Toland \'tō-lənd**, Gregg** (b. May 29, 1904, Charleston, Ill., U.S.—d. Sept. 28, 1948, Hollywood, Calif.) U.S. cinematographer. He got his start in the film industry at the age of 15, working as an office boy at the Fox studio, and he soon became a cameraman, working for Samuel Goldwyn and others in the 1930s and '40s. As director of photography for *Dead End* (1937), *Wuthering Heights* (1939, Academy Award), *The Grapes of Wrath* (1940), *Citizen Kane* (1941), and *The Best Years of Our Lives* (1946), he was noted for his brilliant use of chiaroscuro and his deep-focus camera work. He codirected the war documentary *December 7th* (1943, Academy Award) with John Ford.

Toledo City (pop., 2000: 313,619), northwestern Ohio, U.S. It is the principal Great Lakes port, located at the southwestern end of Lake Erie. The area was opened to white settlement after the 1794 Battle of Fallen Timbers. Formed by the consolidation of two villages in 1833, it figured in the so-called Toledo War of 1835–36, a bloodless dispute between Michigan Territory and Ohio over the location of their common boundary. Industrial development was spurred in the 1830s and '40s by the arrival of canals and railroads. Glassmaking, now a major industry, was introduced in the late 1880s. A major commercial, industrial, and transportation centre, it handles considerable foreign commerce, and its port is one of the world's largest shippers of bituminous coal. Its educational institutions include the University of Toledo (1872).

Toledo \tə-'lē-dō,\ *Spanish* \tō-'lā-<u>th</u>ō\ *ancient* **Toletum** City (pop., 2001: 68,382), capital of Castile–La Mancha autonomous community, south-central Spain. On the Tagus River, it was the stronghold of the Carpentini, a powerful Iberian tribe, when it was conquered by Rome in 193 BC. In the 6th century AD it became the Visigoths' capital in Spain. Under the Moors (712–1085) it became a centre of Hebrew and Arabic culture, and it was noted for the manufacture of swords. Taken by Alfonso VI in 1085, it became the capital of New Castile and, in 1230, of the united kingdom of Castilla y León. Toledo was noted for its policy of religious tolerance toward Jews and Arabs during the 11th–15th centuries. It lost importance after Philip II moved the capital to Madrid in 1560. The French occupied Toledo during the Peninsular War (1808–14), and Nationalist forces besieged it (1936) in the Spanish Civil War. Known for its great wealth of notable architecture, the entire urban area is a national monument. It was the home of El Greco.

Toledo, councils of Eighteen councils of the Visigothic church held in Toledo, Spain, from c. 400 to 702. Most attending were bishops, with some members of the lower clergy and the nobility. The decisions often affected civil and political affairs, and nearly all were convoked by kings. At the third Council of Toledo in 589, King Recared rejected his Arian faith and accepted Catholicism, an event that led to the unification of Visigothic Spain with Catholicism as the state religion.

Toleration Act (1689) Act of the British Parliament that granted freedom of worship to Nonconformists, allowing them their own places of worship and their own teachers and preachers. The act did not apply to Catholics and Unitarians and continued the existing social and political prohibitions, such as exclusion from political office, that applied to dissenters from the Church of England.

Tolkien \'täl-ˌkēn,\ *commonly* \'tōl-ˌkin**, J(ohn) R(onald) R(euel)** (b. Jan. 3, 1892, Bloemfontein, S.Af.—d. Sept. 2, 1973, Bournemouth, Hampshire, Eng.) South African-born English novelist and scholar. A professor of Anglo-Saxon and of English language and literature at Oxford (1925–59), Tolkien achieved fame for his heroic epic *The Lord of the Rings* (1954–56), consisting of *The Fellowship of the Ring* (film, 2001), *The Two Towers* (film, 2002), and *The Return of the King*. *The Hobbit* (1937) serves as an introduction to the series, *The Silmarillion* (1977) as a "prequel." Set in the mythical past, the richly inventive tale chronicles the struggle between good and evil kingdoms to possess a magic ring that controls the balance of power in the world. In the 1960s its popularity with young people made it a sociocultural phenomenon, and starting in 2001 the release of a series of critically acclaimed films renewed interest in the epic.

toll Sum levied on users of certain roads, canals, bridges, tunnels, and other such travel and transportation infrastructure, primarily to pay for construction and maintenance. Tolls were known in the ancient world and were widely used in medieval Europe as a means of supporting bridge construction. Canal building, which became extensive in Europe in the 18th–19th centuries, was financed chiefly by tolls, and many major roads were built by private companies with the right to collect tolls. In the U.S. the National Road, built beginning in 1806, was initially financed through the sale of public land, but maintenance problems led Congress to authorize tolls. Toll roads diminished in the latter part of the 19th century, but the idea was revived with the Pennsylvania Turnpike in the 1930s, and after World War II many states built toll expressways. In many countries tolls are also used to finance long-span bridges, major tunnels, and highways. They have also been blamed for both reducing, and abetting, rush-hour traffic congestion. Canal tolls are still charged in some parts of the world, notably on the Suez and Panama canals.

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Tolly, Mikhail Barclay de See Mikhail, Prince Barclay de Tolly

Tolman, Edward C(hace) (b. April 14, 1886, West Newton, Mass., U.S.—d. Nov. 19, 1959, Berkeley, Calif.) U.S. psychologist. He taught at the University of California at Berkeley (1918–54). Although he was a behaviourist, he considered classical behaviourism too reductive, and he therefore emphasized behavioral wholes and unmeasurable "intervening variables" over a strict focus on isolated reflexes. He also advanced the concept of "latent learning" (implicit, indirect learning). His major work was *Purposive Behavior in Animals and Men* (1932).

Tolstoy, Aleksey (Konstantinovich), Count (b. Sept. 5, 1817, St. Petersburg, Russia—d. Oct. 10, 1875, Krasny Rog) Russian poet, novelist, and dramatist. A distant relative of Leo Tolstoy, he held various court posts. In the 1850s he began to publish comic verse, often satirizing government bureaucracy. Among his popular historical novels is *Prince Serebrenni* (1862). His dramatic trilogy about the 16th and 17th centuries—*The Death of Ivan the Terrible* (1866), *Tsar Feodor Ioannovich* (1868), and *Tsar Boris* (1870)—is written in blank verse and contains some of Russia's best historical dramatic writing. His lyric poetry includes many love and nature poems, as well as *Ioann Damaskin* (1859), a paraphrase of St. John of Damascus's prayer for the dead.

Tolstoy, Aleksey (Nikolayevich), Count (b. Jan. 10, 1883, Nikolayevsk, Russia—d. Feb. 23, 1945, Moscow) Russian writer. Distantly related to the great novelist Leo Tolstoy, he supported the anti-Bolshevik White Army in the Russian Civil War, then emigrated to western Europe, where he wrote one of his finest works, the nostalgic, partly autobiographical *Nikita's Childhood* (1921). In 1923 he returned to Russia as a supporter of the Soviet regime. He wrote many works that are purely entertaining and, in wartime, patriotic articles. He won three Stalin Prizes, for the novel trilogy *The Road to Calvary* (1920–41), the novel *Peter the First* (1929–45), and the play *Ivan the Terrible* (1943).

Tolstoy, Leo *Russian* **Lev Nikolayevich, Count Tolstoy** (b. Sept. 9, 1828, Yasnaya Polyana, Tula province, Russian Empire—d. Nov. 20, 1910, Astapovo, Ryazan province) Russian writer, one of the world's greatest novelists. The scion of prominent aristocrats, Tolstoy spent much of his life at his family estate of Yasnaya Polyana. After a somewhat dissolute youth, he served in the army and traveled in Europe before returning home and starting a school for peasant children. He was already known as a brilliant writer for the short stories in *Sevastopol Sketches* (1855–56) and the novel *The Cossacks* (1863) when *War and Peace* (1865–69) established him as Russia's preeminent novelist. Set during the Napoleonic Wars, the novel examines the lives of a large group of characters, centring on the partly autobiographical figure of the spiritually questing Pierre. Its structure, with its flawless placement of complex characters in a turbulent historical setting, is regarded as one of the great technical achievements in the history of the Western novel. His other great novel, *Anna Karenina* (1875–77), concerns an aristocratic woman who deserts her husband for a lover and the search for meaning by another autobiographical character, Levin. After its publication Tolstoy underwent a spiritual crisis and turned to a form of Christian anarchism. Advocating simplicity and nonviolence, he devoted himself to social reform. His later works include *The Death of Ivan Ilich* (1886), often considered the greatest novella in Russian literature, and *What Is Art?* (1898), which condemns fashionable aestheticism and celebrates art's moral and religious functions. He lived humbly on his great estate, practicing a radical asceticism and in constant conflict with his wife. In November 1910, unable to bear his situation any longer, he left his estate incognito. During his flight he contracted pneumonia, and he was dead within a few days.

Toltec Nahuatl-speaking people who held sway over what is now central Mexico from the 10th to the 12th century. Whether their urban centre was Tula or Teotihuacán is a matter of dispute. In the 10th century they formed a number of small states of various ethnic origins into an empire. They introduced the cult of Quetzalcóatl, and other Toltec religious and military influences spread through the Yucatán region and were absorbed by the Maya. They were noted as builders and craftsmen; artifacts include fine metalwork, gigantic statues, and carved human and animal standard-bearers. They were succeeded by the Aztec. See also Mesoamerican civilization.

Toluca \tō-'lü-kä\ *in full* **Toluca de Lerdo** City (pop., 2000: 435,125), capital of México state, central Mexico. At an elevation of about 8,800 ft (2,680 m), it is one of the highest cities in North America. The site of the modern city, founded in 1530, was inhabited by the Otomi Indians by the 13th century. It is a commercial and communications centre in an agriculture and livestock region. Its oldest church was founded soon after the Spanish conquest and rebuilt in 1585. There are many archaeological sites in the area, including some Aztec and Toltec ruins.

toluene \'täl-yə-ˌwēn\ Colourless, flammable, toxic liquid hydrocarbon aromatic compound ($C_6H_5CH_3$), the methyl derivative of benzene. Found in coal-tar light oil and in petroleum, it is obtained chiefly from the processing of petroleum fractions. It is used as a solvent, diluent, and thinner; as an antiknock additive in airplane gasoline; and as a raw material for TNT, benzoic acid and its derivatives, saccharin, dyes, photographic chemicals, and pharmaceuticals.

tomato Any fruit of the numerous cultivated varieties of *Lycopersicon esculentum*, a plant of the nightshade family. The plant is generally much branched and has hairy, strongly odorous, feathery leaves. The drooping, clustered, yellow flowers are followed by red, scarlet, or yellow fruits, which hang from the many branches of one weak stem. The tomato fruit varies in shape from spherical to elongate and in size from 0.6 in. (1.5 cm) across to more than 3 in. (7.5 cm) across. The Spanish were bringing tomatoes from South America to Europe by the early 16th century; they were introduced to North America from Europe by the 1780s. Tomatoes are used raw, cooked as a vegetable or puree, and pickled, canned, and sun-dried. The term also applies to the fruit of *L. pimpinelli folium*, the tiny currant tomato.

Tomato (*Lycopersicon esculentum*). GRANT HEILMAN

tomato fruitworm See corn earworm

tomb Home or house for the dead. The term is applied loosely to all kinds of graves, funerary monuments, and memorials. Prehistoric tomb burial mounds, or barrows (artificial hills of earth and stones piled over the remains), were usually built around a hut containing personal effects for use in the afterlife. Burial mounds were a prominent feature of the Tumulus period in Japan (3rd–6th century); these often spectacular monuments consisted of earthen keyhole-shaped mounds surrounded by moats. Burial mounds, sometimes shaped like animals, were characteristic also of Indian cultures of eastern central North America c. 1000 BC–AD 700. With more advanced technology, brick and stone tombs appeared, often of imposing size. In Egypt tombs assumed great importance, especially in the form of pyramids. In medieval Christian thought, the tomb became a symbol of a heavenly home; this concept appeared in the Roman catacombs, whose walls display scenes of paradise. Since the Renaissance, the idea of the tomb as a home has died out in the West, except as a faint reminiscence in the mausoleums or vaults of modern cemeteries. See also beehive tomb, cenotaph, mastaba, stele.

Tomba, Alberto (b. Dec. 19, 1966, San Lazzaro di Savena, Italy) Italian Alpine skier. Tomba was born near Bologna and learned to ski there. He won three Olympic gold medals (1988, slalom and giant slalom; 1992, giant slalom), one Alpine World Cup championship (1995), and two World Championship of Skiing gold medals (1996, slalom and giant slalom). He had no success at the 1998 Olympics but won a slalom event at the World Cup in March of that year and then retired from skiing. He achieved a level of fame unusual for an Alpine skier because of his flamboyance on and off the slopes.

Tombigbee \täm-'big-bē\ **River** River, Alabama, U.S. Formed by the confluence of the river's eastern and western forks near Amory, Miss., it crosses the Alabama border west of Carrollton and flows south nearly 525 mi (845 km) to join the Alabama River and form the Mobile and Tensaw rivers. It is linked to the Tennessee River by the Tennessee-Tombigbee Waterway.

Tombstone City (pop., 2000: 1,504), southeastern Arizona, U.S. The site was named by Ed Schieffelin, who discovered silver there in 1877 after being told that all he would find would be his tombstone. By 1881 a silver rush had drawn prospectors such as Doc Holliday and Johnny

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Ringo, who brought the town a reputation for lawlessness. Feuds were common, including the 1881 gun battle at the O.K. Corral between the Earp (see WYATT EARP) and Clanton families. Tombstone was declared a national historic landmark in 1962.

tomography \tō-'mä-grə-fē\ Radiological technique for obtaining clear X-RAY images of internal structures by focusing on a specific plane within the body to produce a cross-sectional image. It allows the examination of structures that are obscured by overlying organs and soft tissues and do not show up clearly on conventional X-ray images. See also COMPUTED AXIAL TOMOGRAPHY.

Tompion \'täm-pē-ən**, Thomas** (baptized July 25, 1639, Northill, Bedfordshire, Eng.—d. Nov. 20, 1713, London) British clockmaker. Working closely with ROBERT HOOKE and Edward Barlow, he made one of the first English watches with a balance spring and patented the cylinder escapement. The most famous clockmaker of his time, he is remembered as the father of British clockmaking.

Bracket clock with oak case, ebony veneer, and gilt bronze mounts by Tompion, c. 1690; in the Victoria and Albert Museum, London
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON

Tompkins, Daniel D. (b. June 21, 1774, Scarsdale, N.Y., U.S.—d. June 11, 1825, Staten Island, N.Y.) U.S. politician. He served on the state supreme court (1804–07). As governor (1807–17), he initiated education and penal-code reforms and helped secure state legislation outlawing slavery. An opponent of banking interests, he blocked the chartering of a bank by calling an end to the legislature's session, the only such occurrence in New York history. He was twice elected vice president with Pres. JAMES MONROE (1817–25).

tonality Organization of music around a single pitch; more specifically, the Western system of KEYS that grew out of the modal music of the Renaissance in the 17th century. The term is often used to refer to the network of relationships implicit in the seven principal tones of a given key, each of which has the potential to become the tonic temporarily by means of MODULATION, whereby a new network of relationships arises. Because of its capacity to extend pitch relationships to remote lengths in an audibly comprehensible way, the tonal system permits the composition of music of great complexity.

Tonatiuh \tō-'nä-tē-ü\ Sun deity of the AZTECS and NAHUAS. According to most myths, there were four eras that preceded the era of Tonatiuh, each of which ended by cataclysm. He was viewed as a god constantly threatened by the awesome tasks of his daily birth at sunrise, arduous journey across the sky, and death at each sunset. He was the object of human sacrifice, which was thought necessary to sustain him. Generally represented by a colorful disk, he was depicted in the center of the Aztec calendar, with his eagle's claw hands clutching human hearts.

tone In LINGUISTICS, a variation in the pitch of the voice while speaking. The term is usually applied to languages (called tone languages) in which pitch differentiates words with an identical sequences of consonants and vowels. For example, *man* in Mandarin Chinese may mean either "deceive" or "slow," depending on its pitch. In tone languages, what matters is not absolute pitch but the pitch of one word relative to another or how pitch changes within a word.

tone See PITCH, TIMBRE

Tone, (Theobald) Wolfe (b. Jan. 20, 1763, Dublin, Ire.—d. Nov. 19, 1798, Dublin) Irish republican and rebel. In 1791 he cofounded the Society of United Irishmen to work for parliamentary reform. He organized a Catholic convention of elected delegates that forced Parliament to pass the Catholic Relief Act in 1793. In 1796, seeking to overthrow English rule in Ireland, he convinced France to send an invasion force of 43 ships and 14,000 men, but the ships were dispersed by a storm. Tone again brought an Irish invasion plan to Paris in October 1797, but the principal French military leader, Napoleon Bonaparte, took little interest. In 1798, with only 3,000 men, he again attempted an invasion; captured and sentenced to hang, he committed suicide.

tone poem See SYMPHONIC POEM

Tone \'tō-nā\ **River** River, central HONSHU, Japan. It rises in the volcanic area of northwestern Kantō region and flows 200 mi (320 km) southeast to enter the Pacific Ocean at Chōshi. No other river in Japan has been so modified by human activity; its course has been altered and its entire length is confined by dikes. It is an indispensable source for irrigation, industry, and hydroelectricity.

Tonga *officially* **Kingdom of Tonga** Island country, South Pacific Ocean. Area: 290 sq mi (750 sq km). Population (2005 est.): 98,600. Capital: NUKU'ALOFA. The people are of Polynesian ancestry. Languages: Tongan, English (both official). Religions: Christianity (mostly Protestant; also Roman Catholic, other Christians); also Bahā'ī. Currency: pa'anga. Tonga comprises an archipelago of some 170 islands that extends north-south in two parallel chains for roughly 500 mi (800 km). The eastern islands are low and formed of coral limestone; those in the west are mountainous and of volcanic origin, and four of the western islands are active volcanoes. The country has a developing free-market economy based mainly on agriculture. Chief products include fish, coconuts, sweet potatoes, and bananas. Tourism also is important. Tonga is a constitutional monarchy with one legislative house; the head of state and government is the king, assisted by the privy council. Tonga was inhabited at least 3,000 years ago by people of the LAPITA CULTURE. The Tongans developed a stratified social system headed by a paramount ruler whose dominion by the 13th century extended as far as the Hawaiian Islands. The Dutch visited in the 17th century, but effective European contact dates from 1773, when Capt. JAMES COOK arrived and named the archipelago the Friendly Islands. The modern kingdom was established during the reign (1845–93) of King George Tupou I. It became a British protectorate in 1900. This was dissolved in 1970 when Tonga, the only ancient kingdom surviving from the pre-European period in Polynesia, achieved complete independence within the COMMONWEALTH. Tonga was at the centre of a financial scandal in the early 21st century when money in a government trust fund was lost while under the management of an American investor. This added to the country's ongoing financial problems.

Tonghak See CH'ONDOGYO

Tonghak Uprising (1894) Korean peasant rebellion that sparked the SINO-JAPANESE WAR. Despite being persecuted for it, impoverished peasants turned increasingly to Tonghak ("Eastern Learning"; see CH'ŎNDOGYO), a syncretic, nationalistic religion that opposed Western culture and espoused equality of all people. When demonstrations staged by Tonghak followers calling for social reform met with a negative government response, the peasantry united with them in a rebellion that succeeded in defeating government troops in southern Korea. The government called on China for aid; Japan sent in troops without being asked, and China and Japan clashed. The rebels laid down their arms to defuse tensions; nevertheless, the Sino-Japanese War ensued. The leaders of the uprising, including CH'OE SI-HYŎNG, were executed.

tongue Muscular organ on the floor of the MOUTH. It is important in motions of eating, drinking, and swallowing, and its complex movements shape the sounds of speech. Its top surface consists of thousands of raised projections (papillae). The receptors of TASTE (taste buds) are embedded in the papillae and are sensitive to four basic flavours: sweet, salty, sour, and bitter. More specific flavours are influenced by the sense of smell. The tongue's appearance (e.g., coated or red) can give clues to disease elsewhere. Disorders of the tongue include cancer (often caused by smokeless tobacco), leukoplakia (white patches), fungal infection, and CONGENITAL DISORDERS. Different animals use the tongue to serve varied functions; for example, frogs have an elongated tongue adapted to capturing prey, the snake's tongue collects and transfers odours to a specialized sensory structure to help locate prey, and cats use their tongues for grooming and cleaning.

tongues, speaking in *or* **glossolalia** Utterances approximating words and speech that are nonetheless generally unintelligible, usually produced during states of trance or delirium. The religious interpretation of the phenomenon is that the speaker is possessed by a supernatural spirit, is in conversation with divine beings, or is the channel of a divine proclamation. Speaking in tongues occurred in ancient GREEK RELIGION and is

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mentioned in the New Testament. According to The Acts of the Apostles, it first occurred among followers of Jesus at Pentecost and reappeared wherever conversion to Christianity occurred. St. Paul claimed to have been adept at it but urged restraint in the practice. Today it is mainly associated with charismatic Protestant movements such as Pentecostalism.

Tonkin Former French protectorate, mainland Southeast Asia, now constituting the greater part of northern Vietnam. It was part of China from the 2nd century BC until the Vietnamese won independence in the 10th century AD. The French seized the area in 1883, making it a protectorate; it was joined with other regions controlled by France in 1887 to form French Indochina. It was the chief focus in the area of anti-French fighting after World War II.

Tonkin, Gulf of Arm of the South China Sea, between northern Vietnam and Hainan Island, China. It is 300 mi (500 km) long and 150 mi (250 km) wide. In 1964 the Vietnamese reportedly fired on U.S. ships there, leading the U.S. Congress to adopt the Gulf of Tonkin Resolution that supported increased U.S. involvement in the Vietnam War.

Tonkin Gulf Resolution See Gulf of Tonkin Resolution

Tonle Sap \tōn-'lā-'sap\ Lake, western Cambodia. The largest freshwater body in mainland Southeast Asia, it receives several tributaries as well as the floodwaters of the Mekong River. During the rainy season its area increases from 1,000 sq mi (2,600 sq km) to about 9,500 sq mi (25,000 sq km). At low water it is little more than a reed-infested swamp, with channels for fishing craft. A large carp-breeding and carp-harvesting industry there supports numerous floating fishing villages. The ruins of Angkor lie near its northwestern shore.

Tönnies \'tœn-yəs**, Ferdinand (Julius)** *or* **Ferdinand (Julius) Toennies** (b. July 26, 1855, near Oldenswort, Schleswig—d. April 9, 1936, Kiel, Ger.) German sociologist. From 1881 he taught principally at the University of Kiel. In *Gemeinschaft und Gesellschaft* (1887; "Community and Society"), he explored the differences between the organic conception of society, or *Gemeinschaft* ("community," a social union based on traditional rules and a shared sense of solidarity), and the social-contract conception of society, or *Gesellschaft* ("society," a social union held together by rational self-interest). In practice, he argued, all societies show elements of both kinds of organization, because human conduct is neither wholly instinctive nor wholly reasoned.

tonsil Small mass of lymphoid tissue in the wall of the pharynx. The term usually refers to the palatine tonsils on each side of the oropharynx. They are thought to produce antibodies to help prevent respiratory and digestive tract infection but often become infected themselves (see tonsillitis), mostly in children. There are also pharyngeal tonsils, better known as adenoids, and lingual tonsils, at the base of the tongue. The last have more effective drainage than the others and are rarely infected.

tonsillitis Inflammatory infection of the tonsils, usually with hemolytic streptococci (see streptococcus) or viruses. The symptoms are sore throat, trouble in swallowing, fever, and enlarged lymph nodes on the neck. The infection, which usually lasts about five days, is treated with bed rest and antiseptic gargling. Sulfa drugs or other antibiotics are prescribed in severe bacterial infections to prevent complications. Streptococcal infection can spread to nearby structures. Complications may include abscess, nephritis, and rheumatic fever. Tonsils that become chronically inflamed and enlarged require surgical removal (tonsillectomy).

Tony Awards Annual awards for distinguished achievement in the U.S. theatre. Named for the actress-producer Antoinette (Tony) Perry (1888–1946), the annual awards were established in 1947 by the American Theatre Wing and are intended to recognize excellence in plays and musicals staged on Broadway. Awards are given for best play, best musical, best play revival, and best musical revival, and in categories such as acting, directing, music, choreography, set design, and costume design.

tool Device for making material changes on other objects, as by cutting, shearing, striking, rubbing, grinding, squeezing, measuring, or other process. A hand tool is a small manual instrument traditionally operated by the muscular strength of the user; a machine tool is a power-driven mechanism used to cut, shape, or form materials such as wood and metal. Tools are the main means by which human beings control and manipulate their physical environment.

tool and die making Industrial art of manufacturing stamping dies, plastics molds, and jigs and fixtures to be used in the mass production of solid objects. The making of dies for punch presses constitutes most of the work done in tool and die shops, and most such pressworking dies are used in the manufacture of sheet-metal parts such as the panels of an automobile body. See also machine tool.

tool steel Specialty steels that are produced in small quantities, contain expensive alloys, and are often sold only by the kilogram and by their individual trade names. They are generally very hard, wear-resistant, tough, nonreactive to local overheating, and frequently engineered to particular service requirements. They must be dimensionally stable during hardening and tempering. They contain strong carbide formers such as tungsten, molybdenum, vanadium, and chromium in different combinations, and often cobalt or nickel to improve high-temperature performance. See also high-speed steel.

Toombs, Robert A(ugustus) (b. July 2, 1810, Wilkes county, Ga., U.S.—d. Dec. 15, 1885, Washington, Ga.) U.S. politician. He was a plantation owner and a lawyer. He served in the U.S. House of Representatives (1845–53) and the Senate (1853–61), but he resigned his Senate seat to help form the Confederate States of America. Disappointed at not being chosen its president, he served briefly as secretary of state (1861). He criticized Jefferson Davis's extralegal policies during the American Civil War and after the war fled to England. He returned to Georgia in 1867 to rebuild his law practice and to help revise the state constitution and restore white supremacy.

Toomer, Jean *orig.* **Nathan Eugene Toomer** (b. Dec. 26, 1894, Washington, D.C., U.S.—d. March 30, 1967, Doylestown, Pa.) U.S. poet and novelist of the Harlem Renaissance. He taught briefly before turning to writing. *Cane* (1923), considered his best work, is an experimental novel that depicts the experience of being black in the U.S.; it had a strong influence on younger black writers. He also wrote for *The Dial* and other small magazines. He visited the Gurdjieff Institute in France in 1926 and led Gurdjieff groups in Harlem and Chicago. He became a Quaker in 1940. Ambivalent about his mixed racial background and preoccupied with spiritual matters, he avoided race issues in subsequent works.

tooth Any of the hard structures in the mouth used for biting and chewing and in speech. Each consists of a crown above the gum and one or more roots below it, embedded in the jaw. Its inner pulp contains the blood and nerve supply for the bonelike dentin, covered in the crown by enamel, the hardest tissue in the body. Twenty primary (baby) teeth come in by age 2 1/2 and fall out between ages 5 and 13 to be replaced by 32 permanent teeth. The incisors, in front, are shaped mostly for biting, the pointed canines for tearing, and the premolars and molars for grinding food. The teeth are subject to caries (decay), caused by acid from bacteria in plaque, a yellowish film that builds up on teeth. Misalignment of teeth between the upper and lower jaws can grind down the teeth and cause problems in chewing. Elsewhere, it is a cosmetic problem. Both can be treated with braces. See also dentistry. See illustration on opposite page.

tooth decay See caries

toothed whale Common term for members of the cetacean suborder Odontoceti. Toothed whales have slicing teeth and a throat large enough to swallow chunks of giant squid, cuttlefish, and fish of all kinds. Included in this group are the beluga, killer whale, pilot whales, sperm whale, and mammalian dolphins, porpoises, and narwhals.

Topa See Northern Wei dynasty

topaz Aluminum silicate mineral, $Al_2SiO_4(F,OH)_2$, that is valued as a gemstone. It is formed by fluorine-bearing vapours given off during the last stages of the crystallization of igneous rocks. Pure topaz may be colourless and, when brilliant-cut, has been mistaken for diamond. It may also be various shades of yellow, blue, or brown. Imperial topaz, with vivid reddish orange colour, from Minas Gerais, Braz., is very highly valued.

Topaz from Minas Gerais state, Brazil
LEE BOLTIN

Topeka \tə-'pē-kə\ City (pop., 2000: 122,377), capital of Kansas, U.S. Situated on the Kansas River,

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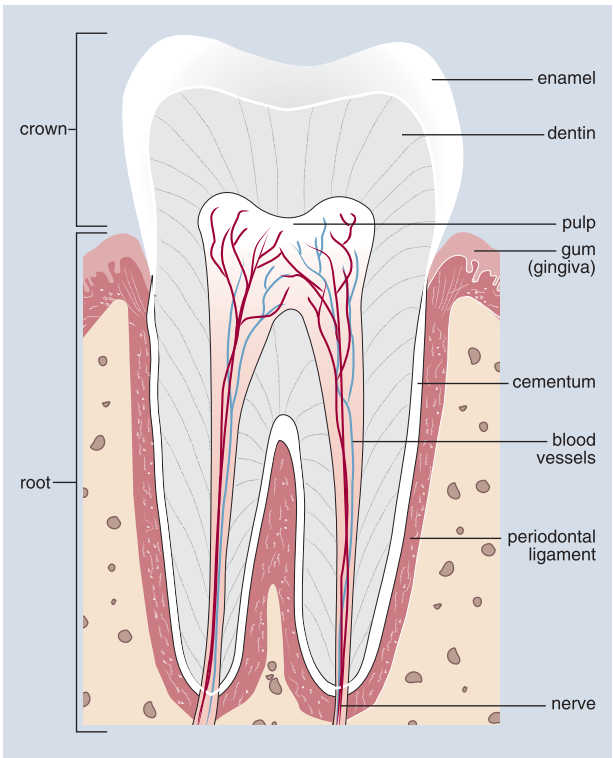

Cross section of an adult molar. The crown (the part of the tooth above the gum) is protected by a hard outer layer of enamel. The roots sit in a socket in the jawbone and are covered with cementum, a bonelike material. The periodontal ligament anchors the cementum in the jaw and cushions the tooth from the pressures of chewing. The tooth's main portion, the dentin, surrounds the soft pulp, which carries the blood vessels and nerves. Specialized cells of the pulp project threadlike extensions into the dentin through narrow channels and serve to form new dentin from minerals in the blood.
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Topeka was founded in 1854 by a group of antislavery colonists and was prominent in the political conflict between proslavery groups and the antislavery Free Soil Party. In 1859 it was the headquarters for the building of the Atchison, Topeka, and Santa Fe Railway system. It has been the state capital since Kansas was admitted to the Union in 1861. The economy is based on agriculture, manufacturing, and governmental services. The Menninger family established its clinics there, making Topeka a national centre for the treatment of mental illness.

Topeka Constitution (1855) Resolution to establish an antislavery territorial government in Kansas. To counter the proslavery government established after passage of the Kansas-Nebraska Act, antislavery settlers met in Topeka to draft a constitution that banned slavery. In January 1856 they elected a free-state governor and legislature, which created two governments. Pres. Franklin Pierce condemned the Topeka document and supported the proslavery government. The U.S. House of Representatives voted to admit Kansas under the Topeka Constitution, but the Senate blocked the move. The unresolved situation led to the conflict known as Bleeding Kansas.

topiary Art of training living trees and shrubs into artificial, decorative shapes. Topiary is known to have been practiced in the 1st century AD. The earliest topiary was probably the simple development of edgings, cones, columns, and spires to accent a garden scene. This architectural use gave way to elaborate shapes such as ships, hunters, and hounds. The fashion reached its height in Britain in the late 17th and early 18th century but was displaced by the so-called natural garden.

topology \tə-'pä-lə-jē\ In mathematics, the study of the properties of a geometric object that remains unchanged by deformations such as bending, stretching, or squeezing but not breaking. A sphere is topologically equivalent to a cube because, without breaking them, each can be deformed into the other as if they were made of modeling clay. A sphere is not equivalent to a doughnut, because the former would have to be broken to put a hole in it. Topological concepts and methods underlie much of modern mathematics, and the topological approach has clarified very basic structural concepts in many of its branches. See also algebraic topology.

Torah \tō-'rä, 'tō-rə, 'tȯr-ə\ *or* **Pentateuch** \'pen-tə-ˌtük\ In Judaism, the divine revelations to Israel; specifically, the first five books of the Bible: Genesis, Exodus, Leviticus, Numbers, and Deuteronomy. By tradition their authorship has been ascribed to Moses, but biblical scholarship has shown that they were written and compiled at a much later date, probably in the 9th–5th century BC, though drawing on much older traditions. The Scroll of the Torah (Sefer Torah) is kept in the Synagogue Ark. The term Torah (but not Pentateuch) is often applied to the whole Hebrew Scripture (i.e., the later books of the Old Testament), or, even more generally, to that and other Jewish sacred literature and oral tradition.

torana \'tōr-ə-nə\ Indian gateway, usually of stone, marking the entrance to a Buddhist shrine or stupa or to a Hindu temple. Toranas typically consist of two pillars carrying two or three transverse beams that extend beyond the pillars on either side. Strongly reminiscent of wooden construction, toranas are often covered from top to bottom with exquisite sculpture. The four toranas of the Great Stupa at Sanchi (see Sanchi sculpture) are superb examples. See also torii.

Tordesillas \ˌtȯr-dā-'sēl-yäs**, Treaty of** (June 7, 1494) Agreement between Spain and Portugal aimed at settling conflicts over lands explored by voyagers of the late 15th century. In 1493 Pope Alexander VI had granted Spain all the lands west of a line 100 leagues (about 320 miles) west of the Cape Verde Islands, in return for an agreement to Christianize the peoples of the New World; Portuguese expeditions were to keep to the east. At Tordesillas (a village in Spain), ambassadors from Spain and Portugal moved that line west, thereby allowing Portugal to claim Brazil when it was discovered in 1500.

Bronze triad of Shaka with attendant figures (left figure lost) in the Tori style, Asuka period, 623; in the Hōryū-ji, Nara, Japan
COURTESY OF THE HORYU-JI, NARA, JAPAN

Tori style In Japanese art, a style of sculpture that emerged during the Asuka period (552–645) and lasted into the Nara period (710–784). Derived from the style of the Chinese Northern Wei dynasty (AD 386–534), Tori was named after a sculptor of Chinese descent whose only known piece is a Buddhist triad (623). Works in the Tori style are characterized by slender, elegant bodies, a strong linear interest in drapery, and a tendency toward squatness in the proportion of the faces and also in the relation of the body to the feet.

torii \'tȯr-ē-ˌē\ Symbolic gateway marking the entrance to Shintō shrines or other sacred spots in Japan. It has many variations, but it characteristically consists of two cylindrical posts topped by a crosswise rectangular beam extending beyond the posts on either side and a second crosswise beam a short distance below. The top beam often curves upward. Some authorities relate the torii to the Indian torana, others to Manchurian and Chinese gates. Often painted red, the torii demarcates the boundary between sacred and ordinary space.

Torii at Itsuku Island, Japan.
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Tormé \'tȯr-ˌmā**, Mel(vin Howard)** (b. Sept. 13, 1925, Chicago, Ill., U.S.—d. June 5, 1999, Los Angeles, Calif.) U.S. singer, composer, and actor. Tormé began his career playing drums and singing with Chico Marx's band (1942–43). In 1943 he made his film debut in *Higher and Higher*; the same year he formed a quintet, Mel Tormé and His Mel-Tones. "Blue Moon," which he sang in the film *Words and Music* (1948), became his first solo hit and one of his signature tunes. Tormé was one of the great interpreters of ballads in JAZZ, capable of inspired improvised scat singing. As a songwriter, he is best known for "The Christmas Song." His smooth vocal timbre is reflected in his sobriquet, "the Velvet Fog."

tornado Violent, low-pressure storm, relatively small in diameter but with very rapidly rotating winds and an intense updraft near the centre. The relatively low pressure at the centre of a tornado's funnel-like vortex causes cooling and condensation, making the storm visible as a revolving column of cloud, called the funnel. Tornadoes normally travel at 30–40 mph (50–65 kph). The winds around the vortex average nearly 300 mph (500 kph) and have been known to reach 500 mph (800 kph). Tornadoes often occur in groups.

Torne River \'tȯr-nə\ *Swedish* **Torneälv** \ˌtȯr-nē-'elv\ Northernmost river of Sweden. Issuing from Torne Lake near the Norwegian border, it flows southeast and south for 354 mi (570 km) to the Gulf of BOTHNIA. The lower course, strewn with rapids and mostly non-navigable, forms a section of the Sweden-Finland boundary. It is known for its salmon.

Toronto City (pop., 2001: city, 2,481,494; metro. area, 4,682,897), capital of ONTARIO, Canada. Canada's most populous metropolitan area, it lies on the northern shore of Lake ONTARIO. Originally inhabited by SENECA tribes, its site was occupied by a tiny French fort in the mid-18th century. It was founded in 1793 as York by American colonists loyal to the British. U.S. troops pillaged it during the WAR OF 1812. In 1834 it received its city charter and current name. It became the capital of Ontario in 1867. In 1953–54 it joined neighbouring villages, towns, and townships to form the Municipality of Metropolitan Toronto. In 1967 those 13 municipalities were reduced to six (Toronto, ETOBICOKE, NORTH YORK, SCARBOROUGH, YORK, and the borough of EAST YORK), which amalgamated to form the City of Toronto in 1998. It is Canada's financial and commercial centre, the seat of the Toronto Stock Exchange, and a major international trading centre, with access to Atlantic shipping via the SAINT LAWRENCE SEAWAY and to major U.S. ports via the GREAT LAKES. It produces more than half of Canada's manufactured goods. Extensive immigration (1950s–70s) brought a variety of foreign cultures that transformed it into one of the liveliest cities on the continent. It is the site of the CN Tower (the world's tallest self-supporting man-made structure), the Hockey Hall of Fame, and the annual Canadian National Exhibition. Its educational institutions include the University of TORONTO (1827).

Toronto, University of Public university in Toronto, Ontario, Canada. It was founded in 1843 and reorganized in 1853 and 1887. It comprises nine undergraduate colleges, three formerly independent but now federated universities, four affiliated theological colleges, and numerous other academic units. It offers undergraduate, graduate, and professional degrees in all major disciplines. Notable among its research units are centres for the study of medieval culture and society, religion, Russia and eastern Europe, international relations, drama, comparative literature, biomedical engineering, history of science and technology, and aerospace science.

Toronto Star, The Canadian newspaper, generally ranked as the country's largest. Established in 1892 by 25 printers who had lost their jobs in a labour dispute, it became prosperous after its purchase in 1899 by a group of leading citizens and maintained a liberal editorial outlook, pressing for social change while promoting stronger Canadian nationhood and a greater presence in international affairs. It established its own radio station in 1922. Its outspoken opposition to Nazism made it the first North American newspaper to be banned in Nazi Germany.

torpedo Cigar-shaped, self-propelled underwater MISSILE, launched from a SUBMARINE, surface vessel, or airplane and designed to explode on contact with the hulls of surface vessels and submarines. It contains devices to control depth and direction as well as a detonator for the explosive-filled warhead. Originally the word referred to any explosive charge, including the weapon now known as a SUBMARINE MINE. The first modern torpedo (1866) carried an 18-lb (8-kg) charge of dynamite in its nose and was powered by a compressed-air engine driving a single propeller; its range was 200–700 yards (180–640 m). Torpedoes were used successfully by submarines in both world wars, when many merchant ships were sunk, mostly by German U-BOATS. Torpedoes are now usually propelled by battery-powered electric motors.

torque *or* **moment** In physics, the tendency of a force to rotate the body to which it is applied. Torque is always specified with regard to the axis of rotation. It is equal to the magnitude of the component of the force lying in the plane perpendicular to the axis of rotation, multiplied by the shortest distance between the axis and the direction of the force component. Torque is the force that affects rotational motion; the greater the torque, the greater the change in this motion.

Torquemada \ˌtȯr-kā-'mä-thä**, Tomás de** (b. 1420, Valladolid, Castile—d. Sept. 16, 1498, Ávila, Castile) First grand inquisitor in Spain (1487–98). A DOMINICAN prior, he became confessor and adviser to FERDINAND V and ISABELLA I. He guided the Spanish INQUISITION, directing its persecution of Jews, Moors, and others identified as heretics, sorcerers, or criminals. Torture was used to obtain evidence, and about 2,000 people were burned at the stake during Torquemada's tenure. He probably influenced Ferdinand and Isabella in their decision to expel the Jews from Spain (1492). His name has become synonymous with the cruel fanaticism of the Inquisition.

Torquemada, lithograph
COURTESY OF THE BIBLIOTECA NACIONAL, MADRID

Torre, Víctor Raúl Haya de la See Víctor Raúl HAYA DE LA TORRE

Torres Bodet \'tōr-ās-bō-'det**, Jaime** (b. April 17, 1902, Mexico City, Mex.—d. May 13, 1974, Mexico City) Mexican poet, novelist, educator, and statesman. He held various diplomatic and government posts, including minister of public education (1943–46) and foreign minister (1946–48). His verse, which early on revealed the influence of MODERNISMO, often returned to the themes of loneliness, a search for identity, and a longing for death. *Cripta* (1937) is considered to include his most important poems. His poetry was collected in *Obra poética* (1967). Of six novels published between 1927 and 1937, *Sombras* (1937) is considered his best. Afflicted by cancer, he took his own life.

Torres Strait \'tȯr-iz\ Passage between the island of NEW GUINEA and Australia's Cape YORK Peninsula. It connects the CORAL SEA and the Arafura Sea. It was discovered in 1606 by Spanish navigator Luis Vaez de Torres. About 80 mi (130 km) wide, it has many reefs, shoals, and islands, including the TORRES STRAIT ISLANDS, and is treacherous to navigate.

Torres Strait Islands Island group, in the TORRES STRAIT between AUSTRALIA and NEW GUINEA. The inhabitants are a mixture of Polynesians, Melanesians, and Aboriginals. Administratively part of QUEENSLAND, Australia, they consist of three clusters: Western (high, rocky, and barren), Central (coral), and Eastern (volcanic, with dense vegetation); each has its own local government. The islands may be remnants of a land bridge that once linked Asia and Australia. They were annexed by Queensland in the 1870s. Pearls, fishing, and tourism are the main sources of income.

Torricelli \ˌtōr-rē-'chel-lē**, Evangelista** (b. Oct. 15, 1608, Faenza, Romagna—d. Oct. 25, 1647, Florence) Italian physicist and mathematician, inventor of the BAROMETER. He served as secretary to GALILEO during the last three months of the latter's life and was appointed to succeed him at the Florentine Academy. Two years later, pursuing a suggestion by Galileo, he filled a glass tube 4 ft (1.2 m) long with mercury and inverted the tube into a dish. He observed that some of the mercury did not flow out and that the space above the mercury in the tube was a vacuum. After much observation, he concluded that the variation of the height of the mercury from day to day was caused by changes in ATMOSPHERIC PRESSURE. He never published his findings. His work in geometry aided in the eventual development of integral calculus.

Torrijos \tōr-'ē-hōs\ **(Herrera), Omar** (b. Feb. 13, 1929, Santiago de Veragua, Pan.—d. Aug. 1, 1981, near Penonomé) Virtual dictator of Panama (1968–78). He entered the national guard in 1952 after military studies in Venezuela and the U.S., rose to the rank of general, and came

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to power in 1968 in a coup d'état. A nationalist and populist, he was one of the few Latin American heads of state to visit Fidel Castro in Cuba, though he suppressed leftist labour agitators and students at home. In 1977 he achieved his supreme goal when U.S. Pres. Jimmy Carter signed two treaties agreeing to transfer the Panama Canal and Canal Zone to Panamanian sovereignty in 1999. He died in a plane crash while on a military inspection tour.

Tórshavn \'tȯrs-ˌhaùn\ Port town (pop., 2000: 16,673), capital of the Faeroe Islands, Denmark. Located on Strømø Island, it was founded in the 13th century. During World War II the British occupied Tórshavn as a defense against German forces in Denmark. It is home to about one-third of the population of the Faeroe Islands. Its main industries are fishing and knitwear.

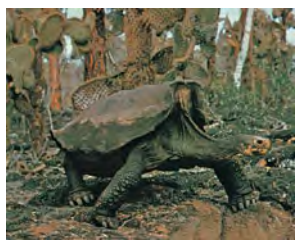
torsion \'tȯr-shən\ **balance** Device used to measure the gravitational acceleration at the Earth's surface. It consists essentially of two small masses at different elevations that are supported at opposite ends of a beam. The latter is suspended from a wire that twists because the masses are affected differently by the force of gravity. When the wire is twisted, an optical system indicates the angle of deflection, and the torque, or twisting force, can be calculated. The torque is correlated with the gravitational force at the point of observation. Torsion balance may also refer to a device used in weighing, a type of equal-arm balance.

torsion bar Rod or bar that resists twisting (see torque) and has a strong tendency to return to its original position when twisted. In an automobile, a torsion bar is a long spring-steel element with one end held rigidly to the frame and the other end twisted by a lever connected to the axle. It thus provides a spring action for the vehicle.

torsk See cusk

tort Wrongful act, other than a breach of contract, that injures another and for which the law permits a civil (noncriminal) action to be brought. Relief may be obtained in the form of damages or an injunction. The term derives from Latin *tortum*, meaning "something twisted, wrung, or crooked." Assault, defamation, malpractice, negligence, nuisance, product liability, property damage, and trespass are all (apart from their potentially criminal and contractual aspects) torts.

tortoise Any of some 40 species (family Testudinidae) of slow-moving, terrestrial, herbivorous turtles, found in the Old and New Worlds but chiefly in Africa and Madagascar. Tortoises have a high, domed shell, heavy elephantlike hind legs, and hard-scaled forelegs. The four North American species (genus *Gopherus*) have a brown shell, about 8–14 in. (20–35 cm) long, and flattened forelimbs adapted for burrowing. The common, or European, tortoise (*Testudo graeca*) has a shell about 7–10 in. (18–25 cm) long. Most species of giant tortoises on the Galápagos and other islands are now rare or extinct. One captive Galápagos tortoise had a shell 4.25 ft (1.3 m) long and weighed 300 lbs (140 kg).



Galápagos tortoise (*Geochelone elephantopus*).
FRANCISCO ERIZE-BRUCE COLEMAN LTD.

torture Infliction of intolerable physical or psychological pain. Torture has been used by governments throughout history for punishment, coercion, and intimidation and for extracting confessions and information. A common practice in ancient times, it was defended by Aristotle but eloquently opposed by Cicero, Seneca, and St. Augustine. Beginning in the 12th century, torture was increasingly used in Europe; from the mid-14th through the 18th century it was a common part of the legal proceedings of most European countries. The Roman Catholic church supported its use by the Inquisition in cases of heresy. Common instruments of torture were the strappado (for repeatedly hoisting the body by the wrists behind the back and dropping it), the rack (for stretching the limbs and body), and the thumbscrew (for crushing the thumbs). By 1800 torture was illegal in many European countries, but it became common again in the 20th century, notably in Nazi Germany and the Soviet Union, and it is still widely practiced in Latin America, Africa, and the Middle East. In 1984 the United Nations adopted an international convention against torture and other forms of cruel, inhuman, and degrading treatment. By the early 21st century some 130 countries were party to the convention. The belief that only sadists are capable of committing torture was challenged by a study in the 1960s that found that ordinary people could be easily persuaded to inflict pain on others.

Tory Member of a political group in England, especially in the 18th century. Originally an Irish term for an outlaw, the name was applied as a term of abuse to those who supported the hereditary right of James, the Catholic duke of York (later James II), to succeed to the throne of England. They were opposed by the Whigs in that struggle (1679), but the Tories later modified their doctrine of divine-right absolutism. They came to represent the resistance, mainly by the country gentry, to religious toleration and foreign entanglements. The Tories' political power diminished after Viscount Bolingbroke, a leading Tory, fled to France in 1715; Tory sentiment subsequently survived in the unsuccessful Jacobite movement. After 1784, William Pitt the Younger emerged as the leader of a new Tory party, representing the country gentry, merchants, and administrators. After 1815, the party gradually evolved into the Conservative Party, whose members are still referred to as Tories.

Tosa \'tō-sä\ Historic region of the Japanese island of Shikoku. It dates at least to the Heian period, when Ki no Tsurayuki (868?–945?), editor of Japan's first imperially commissioned poetry anthology, wrote a fictional diary drawing on his experiences as governor of Tosa. In 1571 it became a unified domain (han) whose daimyo opposed Tokugawa Ieyasu when he consolidated his control of Japan in the early 17th century; this historical enmity became important at the time of the Meiji Restoration (1868), when samurai from Tosa, like those from Satsuma and Chōshū, helped overthrow the Tokugawa shogunate. See also Itagaki Taisuke; Tokugawa period.

Toscanini \ˌtäs-kə-'nē-nē**, Arturo** (b. March 25, 1867, Parma, Italy—d. Jan. 16, 1957, New York, N.Y., U.S.) Italian conductor. Toscanini entered a conservatory at age nine, studying cello, piano, and composition. He began his professional life as a cellist. After substituting for an indisposed conductor in Giuseppe Verdi's *Aïda* (Buenos Aires, 1886), he conducted in various Italian opera houses, giving the premieres of *I Pagliacci* (1892) and *La Bohème* (1896). He was appointed musical director of La Scala, Milan, in 1898, and of the Metropolitan Opera, New York City, in 1908. Principally known for his readings of Verdi's operas and Beethoven's symphonies, he also gave remarkable performances of the music of Richard Wagner. Toscanini conducted the New York Philharmonic-Symphony Orchestra from 1928 to 1936. In 1930 he became the first non-German to conduct at Bayreuth, but he stopped performing in Germany to protest Nazi policies. The NBC Orchestra was formed for him in 1937, and he conducted it until his retirement in 1954.

Tosefta \ˌtō-sef-'tä, tō-'sef-tə\ Supplements to the Mishna compiled c. AD 300. The Tosefta consists of laws attributed to the authorities named in the Mishna and generally follows the topical program and organization of the Mishna. Both works were the effort of Jewish scholars, working mostly in Palestine, who gathered, evaluated, and correlated the most important traditions from a vast and heterogeneous mass of material that had developed since the time of Ezra (c. 450 BC). The Tosefta may have been meant to complement the Mishna by preserving material that appeared marginal or contradictory.

Tostig \'täs-tig\ (d. Sept. 25, 1066, Stamford Bridge, Yorkshire, Eng.) Anglo-Saxon earl of Northumbria. He had strong ties with Norway and became earl of Northumbria in 1055; his severity in subduing the wild northern district stirred revolt in 1065. The rebels won the support of Tostig's brother Earl Harold (later Harold II) at Oxford, and Tostig went into exile. He gave his services to William I (the Conqueror) and harried the English coast, then joined Norway's king Harald III Sigurdsson in his invasion of England. Tostig was killed when his brother Harold defeated the invading army at Stamford Bridge.

total internal reflection Complete reflection of a ray of light in a medium such as water or glass, from the surrounding surfaces back into the medium. It occurs when the angle of incidence is greater than a certain limiting angle, called the critical angle. In general, it takes place at the boundary between two transparent media when a ray of light in a medium of higher index of refraction approaches another medium of lower index of refraction at more than the critical angle. At all angles less than the critical angle, both reflection and refraction occur. Total internal reflection is responsible for rainbows, atmospheric halos, the sparkle of a diamond, and the path of light through optical fibres.

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Total Quality Control (TQC) System for optimizing production based on ideas developed by Japanese industries from the 1950s on. The system, which blends Western and Eastern ideas, began with the concept of quality circles, in which groups of 10–20 workers were given responsibility for the quality of the products they produced. It gradually evolved into various techniques involving both workers and managers to maximize productivity and quality, including close monitoring of staff and excellent customer service. The concept of *kaizen*, the notion that improvement must involve all members of a company, is central to TQC. See also PRODUCTION MANAGEMENT.

Total Quality Management (TQM) Management practices designed to improve the performance of organizational processes in business and industry. Based on concepts developed by statistician and management theorist W. EDWARDS DEMING, TQM includes techniques for achieving efficiency, solving problems, imposing standardization and statistical control, and regulating design, housekeeping, and other aspects of business or production processes. See also INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO); TOTAL QUALITY CONTROL (TQC).

total war Military conflict in which the contenders mobilize all of their civilian and military resources in order to obtain a complete victory. It is distinguished from the partial commitment of lives and resources in limited war. The modern concept of total war is traced to CARL VON CLAUSEWITZ, who stressed the importance of crushing the adversary's forces in battle and described wars as tending constantly to escalate in violence toward a theoretical absolute. The classic 20th-century work is ERICH LUDENDORFF's *The Total War* (1935). World Wars I and II are usually regarded as total wars. After World War II, especially during the COLD WAR, the prospect of an all-out nuclear war made the major powers reluctant to engage in full-scale international warfare or allow their client states to do so.

totalitarianism Form of government that subordinates all aspects of its citizens' lives to the authority of the state, with a single charismatic leader as the ultimate authority. The term was coined in the early 1920s by BENITO MUSSOLINI, but totalitarianism has existed throughout history throughout the world (e.g., QIN DYNASTY China). It is distinguished from DICTATORSHIP and AUTHORITARIANISM by its supplanting of all political institutions and all old legal and social traditions with new ones to meet the state's needs, which are usually highly focused. Large-scale, organized violence may be legitimized. The police operate without the constraint of laws and regulations. Where pursuit of the state's goal is the only ideological foundation for such a government, achievement of the goal can never be acknowledged. HANNAH ARENDT's *Origins of Totalitarianism* (1951) is the standard work on the subject.

totem pole Carved and painted vertical log, constructed by many NORTHWEST COAST INDIAN peoples. The poles display mythological images, usually animal spirits, whose significance is their association with the lineage. Each figure represents a type of family crest. Some poles relate a family legend in the form of pictographs. Poles are erected to identify the owner of a house or other property, welcome visitors, indicate a portal or passageway, mark a gravesite, and even to ridicule an important person who failed in some way. See also SYMBOL; TOTEMISM.

totemism Complex of ideas and practices based on the belief in kinship or mystical relationship between a group (or individual) and a natural object, such as an animal or plant. The term derives from the Ojibwa word *ototeman*, signifying a blood relationship. A society exhibits totemism if it is divided into an apparently fixed number of CLANS, each of which has a specific relationship to an animate or inanimate species (totem). A totem may be a feared or respected hunted animal or an edible plant. Very commonly connected with origin MYTHS and with instituted morality, the totem is almost always hedged about with TABOOS of avoidance or of strictly ritualized contact. Totem, taboo, and EXOGAMY seem to be inextricably intertwined. See also TOTEM POLE.

Totonac \ˌtō-tə-ˈnäk\ North American Indians of east-central Mexico. Some live on cool, rainy high mesas, others in the hot, humid lowlands. Both groups are farmers, but the highlanders sometimes engage in peddling and wage labour as well and often work on lowland farms in the off-season. Most farm their own land and also perform required labour on land collectively owned by the village. They profess Roman Catholicism but have adapted it to their traditional beliefs.

toucan \ˈtü-ˌkan\ Any of about 40 species (family Ramphastidae) of large-billed, long-tailed Central and South American birds. Many species are black with a bold breast colour; their thick, saw-edged bills are brightly and distinctively coloured. Bands of toucans emit loud barks, bugling calls, and harsh croaks. They eat fruit, insects, lizards, and nestling birds. Toucans deposit two to four eggs in an unlined natural tree cavity or an abandoned woodpecker hole. *Ramphastos* species are up to 24 in. (60 cm) long, a third of which may be the bill. Smaller species (toucanets) are 10–14 in. (25–35 cm) long.

Gray-breasted mountain toucan (*Andigena hypoglauca*).
PAINTING BY JOHN P. O'NEILL

touch-me-not Either of two North American IMPATIENS, also known as jewelweed or snapweed, growing in moist areas. *Impatiens capensis*, also called *I. biflora*, typically has crimson-spotted orange flowers; *I. pallida* has yellow to white flowers, sometimes spotted with brownish-red. They are common weeds native to extensive regions of eastern North America. Their juice is said to be a remedy for POISON-IVY rashes.

touch reception See MECHANORECEPTION

touchstone Black, silica-containing stone used in ASSAYING to determine the purity of GOLD and SILVER. The metal to be assayed is rubbed on the touchstone, and then a sample of metal of known purity is rubbed on the stone right next to it. The streaks of metal on the stone are treated with nitric acid, which dissolves impurities, thus increasing the contrast between the two samples when compared. Because other metals, such as copper, can be alloyed to silver without changing its colour significantly, the touchstone method is not usually used now to assay silver, though it is still used to assay gold and provides a reasonably accurate guide to quality.

Toulon \tü-ˈlōⁿ**, Siege of** (Aug. 28–Dec. 19, 1793) Military engagement in the FRENCH REVOLUTIONARY WARS. French royalists handed over the naval base and arsenal at Toulon, France, to an Anglo-Spanish fleet in August. The French Revolutionary army began a siege to recapture the port city and, after months of preparations, successfully assaulted the allied-held forts commanding the anchorage. A battery of French guns, commanded by the young NAPOLEON BONAPARTE, fired on the British fleet and forced it to evacuate the inner harbour, though British and Spanish troops blew up the arsenal and burned 42 French ships before leaving. For his key role in the victory, Napoleon was promoted to brigadier general.

Toulouse \tü-ˈlüz\ *ancient* **Tolosa** City (pop., 2004 est.: 426,700), on the GARONNE RIVER in southern France. Founded in ancient times, it was taken from its Celtic inhabitants by the Romans in the 1st century BC. After AD 778 it became the seat of the feudal countship of Toulouse. Protestants were massacred there during the 16th-century Wars of RELIGION. In 1814 it was the scene of the British victory over the French in the last battle of the PENINSULAR WAR. A rail junction and canal port, Toulouse is a centre of the French aviation industry. It has many historic buildings, including a Gothic cathedral and a Romanesque basilica, and the tomb of St. THOMAS AQUINAS. The university, founded in 1229, is one of the oldest in the world.

Toulouse-Lautrec \tü-ˈlüz-lō-ˈtrek\ **(-Monfa), Henri (-Marie-Raymond) de** (b. Nov. 24, 1864, Albi, France—d. Sept. 9, 1901, Malromé) French painter and graphic artist. Born to an old aristocratic family, he developed his interest in art during lengthy convalescence after both his legs were fractured in separate accidents (1878, 1879) that left them permanently stunted and made walking difficult. In 1881 he resolved to become an artist; after taking instruction, he established a studio in the Montmartre district of Paris in 1884 and began his lifelong association with the area's cafés, cabarets, entertainers, and artists. He captured the effect of the movement of dancers, circus performers, and other entertainers by simplifying outlines and juxtaposing intense colours; the result was an art throbbing with life and energy. His lithographs were among his most powerful works, and his memorable posters helped define the

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possibilities of the genre. His pieces are often sharply satirical, but he was also capable of great sympathy, seen most poignantly in his studies of prostitutes (e.g., *At the Salon*, 1896). His extraordinary style helped set the course of avant-garde art for decades to come. A heavy drinker, he died at 36.

Toungoo \'taůŋ-ˌgü\ **dynasty** Ruling house in Myanmar (Burma) from the 15th or 16th century to the 18th century. The founder of the empire is considered to be either King Minkyinyo (r. 1486–1531) or his son Tabinshwehti (r. 1531–50), who expanded the empire and welded it together. Tabinshwehti's brother-in-law Bayinnaung (r. 1551–81) extended the dynasty's reach to include much of Laos and Siam (Thailand). No ruler ever managed to conquer Arakan (in southern Myanmar), though Tabinshwehti, Bayinnaung, and others tried. The empire slowly disintegrated after Bayinnaung's death, but the dynasty continued until 1752.

Tour, Georges de La See Georges de La Tour

Tour de France \ˌtür-də-'frä^{n}s\ World's most prestigious and difficult bicycle race. Staged for three weeks each July—usually in some 20 day-long stages—the Tour typically comprises 20 professional teams of nine riders each and covers some 3,600 km (2,235 miles) of flat and mountainous country, mainly in France, with occasional and brief visits to Belgium, Italy, Germany, and Spain. Each stage of the race is timed, and the rider with the lowest aggregate time for all stages is the winner. Established in 1903 by Henri Desgrange (b. 1865—d. 1940), a French cyclist and journalist, the race has been run every year except during the world wars.

Touraine \tü-'ren\ Historical region, northwestern central France. It encompassed the former province of Touraine; its capital was at Tours. In Roman times it was inhabited by the Gallic Turones. In the 5th century AD it was incorporated in the Visigothic kingdom, and it passed to the Franks in 507. Contested by various powers over the succeeding centuries, it came under French influence in the early 13th century. It began to decline c. 1700, and the province was abolished in 1789 during the French Revolution. The region, which includes the Loire River valley, known for its magnificent chateaus, is sometimes called the Garden of France.

Touré \tü-'rā**, (Ahmed) Sékou** (b. Jan. 9, 1922, Faranah, French Guinea—d. March 26, 1984, Cleveland, Ohio, U.S.) First president of Guinea (1958–84) and a leading African politician. Touré, who claimed to be descended from Samory, helped lead Guinea's campaign for independence in 1958. He actively supported Kwame Nkrumah's program for African unity and gave Nkrumah asylum when he was deposed in 1966. A member of the Organization of African Unity (now African Union), he was viewed internationally as a moderate Islamic leader. After an unsuccessful invasion from neighbouring Portuguese Guinea (now Guinea-Bissau) in 1971, he imposed harsh domestic measures and ruled with an iron hand.

Tourette \tü-'ret\ **syndrome** Rare neurological disease that causes repetitive motor and vocal tics. Named for Georges Gilles de la Tourette, who first described it in 1885, it occurs worldwide, is usually inherited, generally begins at ages 2–15, and is three times more common in males. Motor tics occur first in about 80% of cases, compulsions to utter abnormal sounds in the rest. A compulsion to utter obscenities, once thought characteristic, is often absent. Repetition of words heard and spontaneous repetition of one's own words are two distinctive symptoms. Other vocal tics may include meaningless sounds. Motor tics may be virtually unnoticeable; more complex ones may appear intentional (e.g., hopping, clapping). Sleep, intense concentration, and exertion tend to suppress the tics; emotional stress worsens them. Unlike psychiatric compulsive disorders, Tourette syndrome has a neurological origin and may improve with psychogenic drugs. Brain neurotransmitter abnormalities may be involved, but the underlying cause remains uncertain.

tourmaline \'tər-mə-lən, 'tər-mə-ˌlēn\ Complex silicate mineral that is often used as a gemstone. Three types of tourmaline, distinguished by the presence of certain elements, are usually recognized: iron tourmaline (schorl) is black, magnesium tourmaline (dravite) is brown, and alkali tourmalines may be pink, green, blue, or colourless. Tourmaline is most common in granite pegmatites. Gem-quality stones are found especially in the U.S., Brazil, Russia, and Madagascar.

Tourneur \'tər-nər**, Cyril** (b. c. 1575—d. Feb. 28, 1626, Kinsale, County Cork, Ire.) English dramatist. His early years were devoted to literature; after c. 1613 he served in the government. His reputation rests largely on *The Atheist's Tragedie* (1611), a verse drama rich in macabre imagery. He may be the author of *The Revenger's Tragedie* (1607), but most recent scholarship attributes it to Thomas Middleton; though earlier than *The Atheist's Tragedie*, it is more mature in its structure and sombre brilliance. Tourneur also wrote the poetical satire *The Transformed Metamorphosis* (1600).

Tours \'tür\ City (pop., 1999: 132,820), northwest-central France. Gallic tribes inhabited the site before the Roman conquest. In the 3rd century AD it was made an episcopal see, but the Christian community remained small until St. Martin became bishop in the 4th century; a magnificent basilica was raised above his tomb in the late 5th century, attracting pilgrims for hundreds of years. In the 5th century Tours became part of the Frankish dominion; Charles Martel defeated Moorish invaders nearby at the Battle of Tours/Poitiers in 732. Under Alcuin it developed as a centre of learning. Though it prospered in the Middle Ages, it declined with the 17th-century emigration of the Protestant Huguenots. It was the seat of French government during the siege of Paris (1870) in the Franco-Prussian War. The chief tourist hub for the Loire valley, Tours still has the remains of the basilica of St. Martin. Tours is the birthplace of Honore de Balzac.

Tours/Poitiers \pwä-'tyā**, Battle of** (October 732) Victory won by the Frankish mayor of the palace Charles Martel over Muslim invaders from Spain. Charles led Frankish troops against a Muslim army seeking to gain control of Aquitaine. The Arab leader, ʿAbd-al-Raḥmān al-Ghafiqi, was killed, and the Arabs retreated. The battle itself was part of Charles's campaign against the Muslims in the south and was not decisive. It did, however, mark the end of the Muslim invasions of Frankish territory and contributed to Frankish consolidation of the region. The Frankish victory greatly enhanced Charles's prestige and that of his family, the Carolingians.

Toussaint-Louverture \'tü-ˌsa^{n}-'lü-vər-ˌtůr\ *orig.* **François Dominique Toussaint** (b. c. 1743, Bréda, near Cape François, Saint-Domingue—d. April 7, 1803, Fort-de-Joux, Fr.) Leader of the Haitian independence movement during the French Revolution. Born a slave, he was freed in 1777. In 1791 he joined a slave rebellion and soon assembled an army of his own, which he trained in guerrilla warfare. When France and Spain went to war in 1793, he and other black commanders joined the Spaniards, but in 1794 he switched his allegiance to the French because France, unlike Spain, had recently abolished slavery. His revolt created the first independent nation in Latin America. He rose from lieutenant governor to governor-general of Saint-Domingue and gradually rid himself of nominal French superiors. Treaties with the British secured their withdrawal, and he began trade with them and the U.S. In 1801 he turned his attention to Santo Domingo, the Spanish-controlled portion of Hispaniola, driving out the Spanish and freeing the slaves there. He made himself governor-general for life. He was deposed by the French in 1802 and died in custody in France. See also Jean-Jacques Dessalines.

Toutates See Teutates

Towada \tō-'wä-dä**, Lake** Lake, northern Honshu, Japan. It occupies a volcanic crater and is 27 mi (44 km) in circumference. The third deepest lake in Japan, it is 1,096 ft (334 m) deep at its centre. It lies in Towada-Hachimantai National Park, a popular recreation area.

tower Any freestanding or attached structure that is relatively tall in proportion to its base. The Romans, Byzantines, and medieval Europeans built defensive towers as part of the fortifications of their city walls (e.g., the Tower of London). Indian temple architecture uses towers of various types (e.g., the *sikhara*). Towers were an important feature of churches and cathedrals built in the Romanesque and Gothic periods. Some Gothic church towers were designed to carry a spire; others had flat roofs. The Italian campanile could either be attached to a church or freestanding. The use of towers declined somewhat during the Renaissance but reappeared in Baroque architecture. The use of steel frames enabled buildings to reach unprecedented heights; the Eiffel Tower in Paris was the first structure to reveal the true vertical potential of steel construction.

Tower, Joan (b. Sept. 6, 1938, New Rochelle, N.Y., U.S.) U.S. composer. She studied piano as a child, attended Bennington College, and completed her music studies at Columbia University. In 1969 she formed the Da Capo Chamber Players, for which she played piano and wrote many pieces; she left the group in 1984. She is chiefly known for her colourful and often whimsical orchestral compositions, including *Sequoia*

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(1981), *Fanfare for the Uncommon Woman* (1987), and *Silver Ladder* (1987). Since 1972 she has taught at Bard College.

Tower of London Royal fortress on the northern bank of the River Thames. The central keep, or donjon, known as the White Tower because of its limestone, was begun c. 1078 by WILLIAM I the Conqueror inside the Roman city wall. In the 12th–13th century the fortifications were extended beyond the wall, the White Tower becoming the nucleus of a series of concentric defenses. The only entrance from the land is at the southwestern corner; when the river was still a major highway, the 13th-century water gate was much used. Its nickname, Traitors' Gate, derives from the prisoners brought through it to the Tower, long used as a state prison; many were murdered or executed there.

towhee \'tō-ˌhē, 'tō-ˌē,\ Any of several North American songbirds (PASSERINE family Fringillidae, sometimes Emberizidae), long-tailed thicket-dwellers that noisily scratch the ground for food. The name is from the call of the rufous-sided towhee (*Pipilo erythrophthalmus*), known as chewink in the southeastern U.S.; it ranges from Canada to Central America. About 8 in. (20 cm) long, it has a dark hood, white-cornered tail, and rusty flanks; western subspecies have white-spotted wings. The brown towhee (*P. fuscus*) of the western U.S. is a plain-looking bird. The green-tailed towhee (*Chlorura chlorura*), also western, is gray, white, and greenish, with a red-brown cap.

Rufous-sided towhee (*Pipilo erythrophthalmus*)
JOHN H. GERARD FROM THE NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

town meeting Legislative assembly of a U.S. town in which all or some voters are empowered to conduct the community's affairs. Town meetings first took place in New England in the colonial era and are still largely a New England phenomenon, partly because the region's towns tend to hold powers that are granted to counties elsewhere. The meetings are normally held annually. Executive authority is usually held by a three- or five-member board. Open town meetings, which are widely regarded as an exceptionally pure form of democracy, allow all registered voters to vote on articles listed on the agenda, or warrant; representative town meetings allow only elected members to vote.

Townes, Charles H(ard) (b. July 28, 1915, Greenville, S.C., U.S.) U.S. physicist. He studied at Furman University, Duke University, and the California Institute of Technology and worked for Bell Labs before joining the faculty of Columbia University (1948). In the early 1950s he and his students constructed the first MASER and showed that a similar device producing visible light was also possible. For his role in the invention of the maser and later the LASER, he shared a 1964 Nobel Prize with Aleksandr M. Prokhorov (b. 1916) and Nikolay G. Basov (b. 1922).

Townsend family U.S. cabinetmakers in Newport, R.I., of the 17th–18th century. The brothers Job (1699–1765) and Christopher (1701–1773) were the first generation involved in furniture making. Job's daughter married his apprentice John Goddard (see GODDARD FAMILY). Five of Job's sons and two of Christopher's sons became cabinetmakers. The Goddard-Townsend group was best known for case furniture characterized by block fronts (divided into three panels, with the central panel recessed) and decorative carved shell motifs, frequently in the graceful and somewhat ornate style developed by THOMAS CHIPPENDALE.

Townshend \'taůn-zənd\ **(of Rainham), Charles Townshend, 2nd Viscount** (b. April 18, 1675, Raynham Hall, Norfolk, Eng.—d. June 21, 1738, Raynham) British politician. He succeeded to his father's title in 1687, married the sister of ROBERT WALPOLE, and served as secretary of state (1714–16). With Walpole, Townshend led the Whig Party and became president of the privy council (1720). Again secretary of state (1721–30), he formed the League of Hanover (1725), which allied Britain, France, and Prussia against Austria and Spain. He resigned when Walpole, by then the dominant minister, opposed an aggressive policy against Austria. Also interested in agricultural reform, Townshend developed the use of turnips in crop rotation, earning the nickname Turnip Townshend.

Townshend Acts (1767) British parliamentary measures to tax the American colonists. The series of four acts imposed duties on imports of lead, paint, glass, paper, and tea and established a board of customs commissioners to enforce collection. Colonial quartering of British troops was also revived. The colonists protested the new measures as taxation without representation and resisted compliance. Nonimportation agreements among colonial merchants cut British imports in half by 1769. In 1770 all the duties except the tax on tea were repealed.

toxic shock syndrome BACTERIAL DISEASE caused by a TOXIN produced by the bacterium *Staphylococcus aureus*. It was first recognized in 1978 in women using superabsorbent tampons. High fever, diarrhea, vomiting, and rash may progress to abdominal tenderness, drop in BLOOD PRESSURE, SHOCK, respiratory distress, and KIDNEY FAILURE. The syndrome also has other causes, including postsurgical infection. ANTIBIOTICS are not effective. With intensive supportive therapy, most patients recover in 7–10 days, but 10–15% die. Many patients have a milder recurrence within eight months.

toxicology Study of POISONS and their effects, particularly on living systems. It overlaps with BIOCHEMISTRY, HISTOLOGY, PHARMACOLOGY, PATHOLOGY, and other fields. Its functions have expanded from identifying poisons and searching for treatments to include forensic toxicology (see FORENSIC MEDICINE) and testing and detection of a fast-growing number of new potentially toxic substances used in workplaces, in agriculture (e.g., INSECTICIDES, other PESTICIDES, fertilizers), in COSMETICS, as food additives, and as DRUGS (see DRUG POISONING). Perhaps the area of largest expansion is the study of toxic waste in the air, water, and soil, including CHLOROFLUOROCARBONS, ACID RAIN, DIOXIN, and radioactive ISOTOPES.

toxin Any substance poisonous to an organism; often restricted to POISONS produced by living organisms. In addition to those from such microorganisms as BACTERIA (see BACTERIAL DISEASES), DINOFLAGELLATES, and ALGAE, there are toxins in fungi (MYCOTOXINS; see AFLATOXIN; MUSHROOM POISONING), higher plants (phytotoxins), and animals (zootoxins, or VENOMS). The plants include nightshade (see NIGHTSHADE FAMILY), POISON HEMLOCK, FOXGLOVE, MISTLETOE, and POISON IVY. Many plant toxins (e.g., pyrethrins, NICOTINE, rotenone) apparently protect their producers against certain animals (especially insects) or fungi. Similar defensive secretions in animals may be widely distributed or concentrated in certain tissues, often with some sort of delivery system (e.g., spines, fangs). Animals such as spiders and snakes use venoms to catch prey and often for defense. Many normally edible fishes and shellfishes become poisonous after feeding on toxic plants or algae. See also ANTIDOTE; FOOD POISONING.

toxoid \'täk-ˌsȯid\ Bacterial TOXIN that has been made inactive but can still combine with or stimulate formation of ANTIBODIES. In many BACTERIAL diseases, the bacteria produce a toxin that causes the disease manifestations. Heating the toxin or treating it chemically converts it into a harmless toxoid that can be injected into a human or a nonhuman animal to confer IMMUNITY from subsequent INFECTION. The VACCINES for TETANUS and DIPHTHERIA are toxoids.

toy Plaything for a child or infant. Toys survive from the remote past and from a great variety of cultures. They range from the simple to the complex, from a stick or piece of string that becomes a toy in a child's hands to complex mechanical and electronic devices. Perennial favorites include balls, jump ropes, dolls, drums, whistles, dice, jackstones, board games, marbles, play weapons, and costumes. In the modern era the toy industry has grown tremendously, especially with the advent of computer games.

toy dog Any of several breeds of DOGS that were bred to be small, portable, good-natured companions. Toy dogs were traditionally pampered and treasured by aristocracy around the world, and several breeds are ancient. They range from hairless (e.g., the Chinese crested dog) to profusely coated (e.g., the SHIH TZU). Some breeds, such as the PEKINGESE, could be owned only by royalty. The Cavalier King Charles spaniel was a favourite of English royalty. English toy spaniels and toy POODLES are popular in the U.S. The miniature pinscher resembles the DOBERMAN pinscher but has a different ancestry. Other toy dogs include the AFFENPINSCHER, MALTESE, PAPILLON, POMERANIAN, and YORKSHIRE TERRIER.

Toynbee, Arnold (Joseph) (b. April 14, 1889, London, Eng.—d. Oct. 22, 1975, York, North Yorkshire) English historian. Long a professor at the University of London and the Royal Institute of International Affairs, Toynbee also held positions with the British Foreign Office. He is best known for his 12-volume *A Study of History* (1934–61), which put forward a philosophy of history, based on an analysis of the development and

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decline of 26 civilizations. Criticisms of his *Study* include his use of myths and metaphors as being of comparable value to factual data and his reliance on a view of religion as a regenerative force. His other works include *Civilization on Trial* (1948), *East to West* (1958), and *Hellenism* (1959).

Toyota Motor Corp. Largest Japanese automobile manufacturer and one of the largest automotive companies in the world. It was established in 1933 as a division of the Toyoda Automatic Loom Works, Ltd., and in 1937 it was incorporated as the Toyota Motor Co., Ltd. Toyota later established many related companies, including Toyoda Machine Works, Ltd. (1941), and Toyota Auto Body, Ltd. (1945). In the 1960s and '70s the company expanded rapidly, exporting large numbers of cars to foreign markets. Following consolidations among many of its business units, the company took the name Toyota Motor Corp. in 1982. It has assembly plants and distributors in many foreign countries, and it owns subsidiaries that produce cars and car parts, trucks, steel, synthetic resins, and industrial equipment. Its brands include Toyota and Lexus.

Toyotomi Hideyoshi \ˌhē-de-ˈyō-shē\ (b. 1536/37, Nakamura, Owari province, Japan—d. Sept. 18, 1598, Fushimi) One of the three unifiers of premodern Japan (with ODA NOBUNAGA and TOKUGAWA IEYASU) who brought the nation out of its WARRING STATES period. He began life as a peasant but was raised to the rank of samurai (warrior) while a soldier for Nobunaga. After Nobunaga's death, he was appointed *kampaku* (chancellor to the emperor). Having concluded an alliance with his former rival Ieyasu, he became in 1590 the head of an alliance of DAIMYO that constituted a government of national unification. To stabilize society, he imposed the division of society into warriors, farmers, artisans, and tradesmen (an adaptation of ancient Chinese social divisions) and confiscated swords from all but the warriors. With visions of empire, he made two destructive but unsuccessful attempts to invade Korea (1592, 1597). After his death, power passed to Ieyasu.

TQC See TOTAL QUALITY CONTROL

TQM See TOTAL QUALITY MANAGEMENT

tracery In architecture, bars or ribs used decoratively in windows, especially the ornamental openwork in Gothic windows. In the earliest phase, two or three narrow, arched windows were placed close together under a single large arch, with the section of wall between the small and large arches pierced by a circular or four-lobed opening. The complexity of this plate tracery increased, reaching a climax in the magnificent windows of CHARTRES CATHEDRAL. After c. 1220 windows began to be subdivided by mullions, or upright bars, that continued at the head of the window to branch and form the patterns of bar tracery. Elaborate bar tracery soon became one of the most important elements of GOTHIC ARCHITECTURE and one of its finest achievements, as in the ROSE WINDOWS of the French RAYONNANT style. The bar tracery of the parallel English Decorated style formed netlike patterns based on the circle, arch, trefoil, and quatrefoil. By the late 14th century, the PERPENDICULAR style replaced curvilinear tracery with straight mullions extending to the top of the main arch, connected at intervals by horizontal bars.

trachea \ˈtrā-kē-ə\ *or* **windpipe** Tube in the throat and upper THORACIC cavity through which air passes in RESPIRATION. It begins at the LARYNX and splits just above heart level into the two main bronchi, which enter the LUNGS. In adults it is about 6 in. (15 cm) long and 1 in. (2.5 cm) in diameter. Its structure—a membrane strengthened by 16–20 CARTILAGE rings open in the back, with their free ends connected by muscle bands—allows the trachea to stretch and contract in breathing. An inner mucous membrane has cilia (see CILIUM) that project inward to trap particles. Muscle fibres over and alongside the trachea contract in response to cold air or irritants in inhaled air; in coughing, the airway narrows to about one-sixth of its normal size to increase the speed and force of exhalation and to dislodge foreign bodies. Such diseases as DIPHTHERIA, SYPHILIS, TUBERCULOSIS, and TYPHOID often involve the trachea.

tracheitis \ˌtrā-kē-ˈī-təs\ INFLAMMATION and infection of the TRACHEA. Inhaled irritants can injure the tracheal lining and increase the chance of infection (bacterial or viral). Acute infections, usually bacterial, produce fever, fatigue, and swelling of the tracheal lining but generally do no great damage. Chronic infections, promoted by irritants such as heavy smoking and alcohol abuse, cause progressive tissue degeneration and scarring.

tracheophyte See VASCULAR PLANT

trachyandesite See LATITE

trachyte \ˈtra-ˌkīt, ˈtrā-ˌkīt\ Light-coloured, very fine-grained IGNEOUS ROCK composed chiefly of ALKALI FELDSPAR with only minor mafic minerals (BIOTITE, HORNBLENDE, or PYROXENE). Trachyte is commonly found in volcanic regions; like many volcanic rocks, it shows a streaked or banded structure due to flowing of the congealing lava.

track and field *or* **athletics** Variety of sport competitions held on a running track and on the adjacent field. It is the oldest form of organized sports, having been a part of the ancient OLYMPIC GAMES from c. 776 BC to AD 393. Modern events include various sprint and middle- and long-distance races, RELAY races, HURDLING, STEEPLECHASE, HIGH JUMP, POLE VAULT, LONG JUMP, TRIPLE jump, SHOT put, DISCUS throw, HAMMER THROW, JAVELIN throw, DECATHLON, PENTATHLON, and HEPTATHLON. CROSS-COUNTRY RUNNING, MARATHONS, and speed WALKING, which are rarely held on a track, are usually considered adjuncts of track-and-field athletics. Events are held indoors and outdoors, and records are kept separately; some events are modified or eliminated for indoor competition.

Tractarian movement See OXFORD MOVEMENT

tractor High-power, low-speed traction vehicle. The two main types are wheeled and continuous-track. Most modern tractors are powered by internal-combustion engines running on gasoline or diesel fuel. Tractors are used in agriculture, construction, and road building, for pulling equipment such as plows and cultivators, for pushing implements such as bulldozers and diggers, and for operating stationary devices such as saws and winches. The first tractors grew out of the STEAM ENGINES used on farms in the late 19th century; in 1892 an Iowa blacksmith, John Froehlich, built the first farm vehicle powered by a gasoline engine. The tractor revolutionized farming, displacing draft animals and many farm workers. By World War I the tractor inspired the TANKS built by the British and French.

Tracy, Benjamin F(ranklin) (b. April 26, 1830, near Owego, N.Y., U.S.—d. Aug. 6, 1915, New York, N.Y.) U.S. public official. He served as a county district attorney (1853–59) and, after fighting in the American Civil War, as U.S. attorney (1866–73). Appointed secretary of the navy (1889–93) by Pres. BENJAMIN HARRISON, he continued the expansion of the navy begun by WILLIAM C. WHITNEY, authorizing construction of new battleships and cruisers. His departmental reforms and modernization contributed to eventual U.S. naval superiority.

Tracy, Spencer (Bonaventure) (b. April 5, 1900, Milwaukee, Wis., U.S.—d. June 10, 1967, Beverly Hills, Calif.) U.S. film actor. He enrolled in the American Academy of Dramatic Arts in New York City in 1922 and was soon earning roles on Broadway. He first starred on Broadway in *The Last Mile* (1930) and on film in *Up the River* (1930). Noted for his craggy features and his sincere performances, he became one of the top stars of the 1930s and '40s, winning Academy Awards in *Captains Courageous* (1937) and *Boys Town* (1938)—the first actor to win consecutive Oscars for best actor—and being nominated for seven other roles, including *Inherit the Wind* (1960) and *Judgment at Nuremberg* (1961). He had a long relationship with KATHARINE HEPBURN, with whom he costarred in nine films, including *Woman of the Year* (1942), *Adam's Rib* (1949), and *Guess Who's Coming to Dinner* (1967).

trade, balance of See BALANCE OF TRADE

Trade, Board of Organized market for the exchange of commodity contracts (see COMMODITY EXCHANGE). The Toronto Board of Trade, one of the earliest, was incorporated in 1845. The first grain-futures exchange in the U.S. was organized in Chicago in 1848. The Chicago Board of Trade (CBOT) began as a voluntary association of prominent Chicago grain merchants and was chartered by the Illinois legislature in 1859. Initially it sold grain by sample; later it introduced a system of inspection and grading to standardize the market and facilitate trading. By 1858 access to the trading floor was limited to members with seats on the exchange. It became the world's largest commodity exchange in terms of volume and value of business.

Trade, Board of *in full* **Lords Commissioners of Trade and Plantations** Advisory body that supervised American colonial affairs. Established in 1696 to replace the Lords of Trade (1675–96), it examined colonial legislation to ensure maximum benefit to British trade policies. The board nominated colonial governors, recommended laws affecting the colonies to Parliament, and heard complaints from the colonies about its administrators. It lacked executive or legislative powers, but it became the primary colonial policy-making body of the British government. It was abolished in 1782.

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trade, restraint of See RESTRAINT OF TRADE

trade, terms of Relationship between the prices at which a country sells its exports and the prices paid for its imports. If a country's export prices rise relative to import prices, its terms of trade are said to have moved in a favourable direction, since, in effect, it now receives more imports for each unit of goods exported. The terms of trade, which depend on the world supply of and demand for the goods involved, indicate how the gains from international trade will be distributed among trading countries. An abrupt change in a country's terms of trade (e.g., a drastic fall in the price of its main export) can cause serious problems in its BALANCE OF PAYMENTS. See also COMPARATIVE ADVANTAGE.

trade agreement Any contractual arrangement between STATES concerning their trade relations. Trade agreements may be bilateral or multilateral, that is, between two states or more than two. For most countries international trade is regulated by unilateral barriers, including TARIFFS, nontariff barriers, and government prohibitions. Trade agreements aim to reduce such barriers and thus provide all parties with the benefits of increased trade. RECIPROCITY is a necessary feature of trade agreements, since neither state will be willing to sign the agreement unless it expects to gain as much as it loses. Another common feature is a MOST-FAVOURED-NATION clause, which provides against the possibility that one of the parties to the current agreement will later offer lower tariffs to another country. Agreements often include clauses providing for "national treatment of nontariff restrictions," meaning that both states promise not to duplicate the properties of tariffs with nontariff restrictions such as discriminatory regulations, selective excise taxes, QUOTAS, and special licensing requirements. General multilateral agreements are sometimes easier to reach than separate bilateral agreements, since the gains to efficient producers from worldwide tariff reductions are large enough to warrant substantial concessions. The most important modern multilateral trade agreement was the GENERAL AGREEMENT ON TARIFFS AND TRADE (GATT), which reduced world tariff levels and greatly expanded world trade. Such agreements continue under the aegis of the WORLD TRADE ORGANIZATION (WTO), which replaced GATT in 1995. See also NAFTA.

trade show *or* **trade fair** Temporary market organized to promote trade, where buyers and sellers gather to transact business. Trade fairs are organized at regular intervals, generally at the same location and time of year. They are especially common in Europe and Asia, where nearly every country has at least one major annual international exposition. They range in scope from those dealing with one industry or branch of industrial production to general exhibits of goods and merchandise. Trade shows and conventions confined to a single industry or even to a specialized segment of an industry have become increasingly common.

trademark Mark used by a manufacturer or merchant to identify the origin or ownership of goods and to distinguish them from others. Trademarks may be words or groups of words, letters, numerals, devices, names, the shape or other presentation of products or their packages, or combinations of colours. A trademark (indicated by ™ or, when registered, by the symbol ®) is considered the property of the holder and is protected by law from unauthorized use by others. In most countries, registration is a prerequisite for ownership and protection of the mark. In the U.S., however, the trademark right is granted by the mere use of the mark, though registration often proves legally advantageous. See also COPYRIGHT.

Trades Union Congress (TUC) National organization of British labour unions. It was founded in 1868 to hold annual conferences of independent unions. It included only skilled workers until 1889, when unions of unskilled workers were admitted. In 1900 the TUC helped found a separate labour organization, the Labour Representation Committee, renamed the LABOUR PARTY in 1906. After World War I the TUC was governed by a General Council, which had powers to deal with interunion conflicts and intervene in disputes with employers. In the 1930s and '40s, it was the spokesman for industrial labour in dealings with the government. The organization continued to help formulate economic policy until 1979, when a Conservative government came to power, leading to a decline in TUC membership in the 1980s. In the late 1990s, under Labour prime minister TONY BLAIR, the TUC was encouraged to back "workplace partnerships" between unions and employers.

Trafalgar \trə-'fal-gər**, Battle of** (Oct. 21, 1805) Naval engagement in the NAPOLEONIC WARS that established British naval supremacy in Europe. It was fought west of Cape Trafalgar, Spain, between a Franco-Spanish fleet of 33 ships under Pierre de Villeneuve (1763–1806) and a British fleet of 27 ships under HORATIO NELSON. As Villeneuve tried to slip out of the besieged port of Cádiz, he was caught by Nelson. The French ships formed a single line and were attacked by the English at two points. After sending the famous signal "England expects that every man will do his duty," Nelson broke through the centre of the French line and in the pell-mell battle captured Villeneuve and 20 ships. Near the end of the battle, Nelson was mortally wounded by a sniper. No British ships were lost, and NAPOLEON abandoned his plan to invade England.

tragedy Drama of a serious and dignified character that typically describes the development of a conflict between the protagonist and a superior force (such as destiny, circumstance, or society) and reaches a sorrowful or disastrous conclusion. Tragedy of a high order has been created in three periods and locales, each with a characteristic emphasis and style: Attica, in Greece, in the 5th century BC; Elizabethan and Jacobean England (1558–1625); and 17th-century France. The idea of tragedy also found embodiment in other literary forms, especially the novel. See also COMEDY.

tragicomedy Literary genre consisting of dramas that combine elements of TRAGEDY and COMEDY. PLAUTUS coined the Latin word *tragicocomoedia* to denote a play in which gods and mortals, masters and slaves reverse the roles traditionally assigned to them. In the Renaissance and after, tragicomedy was mainly comic, though Elizabethan and Jacobean tragedies almost always include some comic or grotesque elements. Modern tragicomedy is sometimes used synonymously with absurdist drama, which suggests that laughter is the only response left to people faced with an empty and meaningless existence.

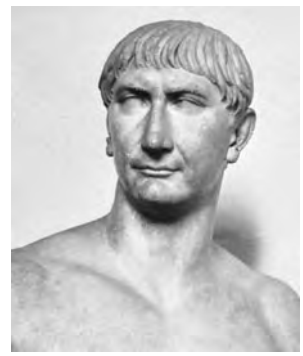
Traherne \trə-'hərn**, Thomas** (b. 1637, Hereford, Eng.—d. 1674, Teddington) English mystical poet and religious writer. He was ordained in the Anglican church in 1660. Most of his works were unknown for centuries. The discovery in 1896 in a London street bookstall of the manuscripts of *Poetical Works* (1903) and the prose *Centuries of Meditations* (1908) created a literary sensation. Later the manuscript of *Poems of Felicity* (1910) was discovered in the British Museum. His poetry, though sometimes original and intense, is overshadowed by his vivid prose.

Trail of Tears Forced migration of the CHEROKEE Indians in 1838–39. In 1835, when gold was discovered on Cherokee land in Georgia, a small minority of Cherokee ceded all tribal land east of the Mississippi for $5 million. The U.S. Supreme Court invalidated the deal, but the ruling was ignored by state officials and Pres. ANDREW JACKSON refused to enforce it. The subsequent eviction and 116-day forced march of thousands of Cherokee to Oklahoma was badly mismanaged, and inadequate food supply, frigid weather, and the cruelty of escorting troops led to the death of about 4,000 Cherokee.

trailing arbutus \är-'byü-təs\ *or* **mayflower** Trailing evergreen plant (*Epigaea repens*) of the HEATH family, native to sandy or boggy, acidic woodlands of eastern North America. Its leaves are oblong and hairy, and its white, pink, or rosy flowers grow in dense clusters. It is grown in shady wildflower gardens and as ground cover in terraria.

training, transfer of In psychology, the effect of having learned one activity on an individual's execution of other activities. Positive transfer occurs when a previously acquired skill enhances one's performance of a new one. Negative transfer occurs when the previously acquired skill impairs one's attempt to master the new one.

Trajan \'trā-jən\ *in full* **Caesar Divi Nervae Filius Nerva Traianus Optimus Augustus** *or* **Caesar Nerva Traianus Germanicus** *orig.* **Marcus Ulpius Traianus** (b. Sept. 15?, AD 53, Italica, Baetica—d. Aug. 8/9, 117, Selinus, Cilicia) Roman emperor (98–117), the first born outside Italy. He had military commands in Asia and Europe before being named CONSUL in 91. In 97 he was adopted by NERVA as his successor. After Nerva's death in 98, he deified the former emperor and named himself Jupiter's repre-



Trajan, detail of a marble bust; in the British Museum.
COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

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sentative on earth. He strengthened defenses along the northern frontier and weakened the PRAETORIAN GUARD at Rome. He gave the SENATE new authority, reduced taxes, supported the poor with government welfare, reformed provincial administration, and built public works, including a forum with Trajan's Column, a structure commemorating his Dacian Wars. He added Dacia, Mesopotamia, and Parthia to the empire. He was campaigning in Asia when revolts broke out in conquered territories. Discouraged and ill, he died on his journey to Rome.

trampoline Resilient sheet or web (often of nylon) supported by springs in a metal frame and used as a springboard and landing area in tumbling. Trampolining is an individual sport of acrobatic movements performed after rebounding into the air from the trampoline. As a competitive sport, it was included in the Pan-American Games for the first time in 1955, and a world championship was established in 1964; competitors are scored on difficulty, execution, and form.

tranquilizer DRUG used to reduce anxiety, fear, tension, agitation, and related disturbed mental states. Major tranquilizers (antipsychotic agents, or neuroleptics) are used to treat SCHIZOPHRENIA and other PSYCHOSES; phenothiazines, including chlorpromazine, are the best known. They are thought to block the activity of the NEUROTRANSMITTER DOPAMINE in the brain. Minor tranquilizers (antianxiety agents, or anxiolytics) are used to treat anxiety and tension; they are usually benzodiazepines, including diazepam (Valium) and chlordiazepoxide (Librium). They have a calming effect and reduce both physical and psychological effects of anxiety, fear, and stress by enhancing the action of the neurotransmitter gamma-aminobutyric acid (GABA) in the brain.

Trans-Alaska Pipeline *or* **Alaska Pipeline** Oil pipeline running 800 mi (1,300 km) north-south across Alaska, U.S. Completed in 1977, it transports crude oil from the oil fields of PRUDHOE BAY on the Arctic Ocean to an ice-free port at Valdez. To avoid thawing the adjacent PERMAFROST, about half of the line is elevated.

Trans-Canada Highway World's longest national road, extending east-west for 4,860 mi (7,821 km) between Victoria, British Columbia, and St. John's, Newfoundland. Completed in 1965, it links many major Canadian cities and provides access to important national and provincial parks.

Trans-Siberian Railroad Longest single rail system in Russia, running from Moscow to Vladivostok, a distance of 5,778 mi (9,198 km). Conceived by Tsar ALEXANDER III, its construction began in 1891 and proceeded simultaneously along its entire length, which traversed a section of Manchuria. It was completed in 1904, but the impending Japanese takeover of Manchuria compelled construction of a parallel section within Russian territory, completed in 1916. The railroad opened large areas of Siberia to settlement and industrialization by means of spur lines linking outlying areas with the main line. The complete trip takes about eight days.

Trans World Airlines, Inc. (TWA) Former U.S. airline acquired by the AMR Corp. Formed in 1930 as Transcontinental & Western Air, Inc., from two smaller airlines, the company established the first coast-to-coast service that same year, flying from Newark, N.J., to Los Angeles in 36 hours. In 1946 TWA began flights between New York City and Paris, and it expanded by the 1950s to routes through Europe, the Middle East, Africa, and Asia. It adopted its present name in 1950. HOWARD R. HUGHES was its principal stockholder and guiding genius from 1939 to 1960–61, when he lost control to a group of investors. Financially troubled since the 1980s, TWA continued to operate despite twice landing in bankruptcy court in the 1990s. It was acquired by AMR, the parent company of American Airlines, in 2001.

transcendental argument In philosophy, a form of argument that is supposed to proceed from a fact to the necessary conditions of its possibility. A transcendental argument is simply a form of deduction, with the typical pattern: Only if p then q; q is true; therefore, p is true. As this form of argument appears in philosophy, the interest, and the difficulty, reside not in the movement from premises to conclusions, which is routine, but in the setting up of the major premises—that is, in the kinds of things that are taken as starting points. For example, IMMANUEL KANT tried to prove the principle of causality by showing that it is a necessary condition of the possibility of making empirically verifiable statements in natural science.

transcendental function In mathematics, a FUNCTION not expressible as a finite combination of the algebraic operations of addition, subtraction, multiplication, division, raising to a power, and extracting a root. Examples include the functions $\log x$, $\sin x$, $\cos x$, e^x and any functions containing them. Such functions are expressible in algebraic terms only as INFINITE series. In general, the term *transcendental* means nonalgebraic. See also TRANSCENDENTAL NUMBER.

Transcendental Meditation (TM) Spiritual development technique developed and promoted by MAHARISHI MAHESH YOGI, a former Hindu ascetic. A movement that became popular in the West in the 1960s, it is based on specific MEDITATION techniques and is not strictly connected with any religious tradition, though the perspective behind it has roots in VEDANTA. Practice entails the mental repetition of a MANTRA in order to still the activity of thought and experience a deeper level of consciousness. Through this process, the practitioner finds deep relaxation, which can lead to inner joy, vitality, and creativity.

transcendental number Number that is not algebraic, in the sense that it is not the solution of an ALGEBRAIC EQUATION with rational-number coefficients. The numbers e and π, as well as any algebraic number raised to the power of an IRRATIONAL number, are transcendental numbers.

Transcendentalism Movement of 19th-century New England philosophers and writers. The Transcendentalists were loosely bound together by adherence to an idealistic system of thought based on a belief in the essential unity of all creation, the innate goodness of humankind, and the supremacy of vision over logic and experience for the revelation of the deepest truths. Part of the Romantic movement (see ROMANTICISM), it developed around Concord, Mass., attracting individualistic figures such as RALPH WALDO EMERSON, HENRY DAVID THOREAU, MARGARET FULLER, and BRONSON ALCOTT. Transcendentalist writers and their contemporaries signaled the emergence of a new national culture based on native materials, and they were a major part of the AMERICAN RENAISSANCE in literature. They advocated reforms in church, state, and society, contributing to the rise of free religion and the abolition movement and to the formation of various utopian communities, such as BROOK FARM. Some of the best writings by minor Transcendentalists appeared in *The Dial* (1840–44), a literary magazine.

transducer Device that converts one form of energy to another. A MICROPHONE is an acoustic transducer, converting sound waves into electrical signals. Different types of transducers act on heat, radiation, sound, strain, vibrations, pressure, and acceleration; they may output mechanical, electrical, pneumatic, or hydraulic signals. Examples include STRAIN GAUGES, LOUDSPEAKERS, PHOTOCELLS, TRANSFORMERS, and THERMOCOUPLES.

transept Area of a cruciform (cross-shaped) church lying at right angles to the principal axis. The bay at which the transept intersects the NAVE is called the crossing. The nave of a church with a cruciform plan usually extends west from the crossing, the choir and sanctuary east. The arms of the transept are designated by direction, as northern transept and southern transept.

transform See FOURIER TRANSFORM, INTEGRAL TRANSFORM, LAPLACE TRANSFORM

transformation In mathematics, a rule for changing a geometric figure or algebraic expression into another, usually accompanied by a rule for transforming it back. In geometry and TOPOLOGY, a transformation (e.g., flipping horizontally or vertically, rotating, or stretching vertically or horizontally) moves each point in a figure or graph to another position. A graph also undergoes a transformation when its COORDINATE system is changed. For example, the equations that establish a correspondence between the rectangular and polar coordinate systems constitute a transformation. In ANALYSIS, a transformation is a procedure that changes one function into another. Of special interest in many fields of mathematics are transformations forming a group, in which any two transformations applied successively produce the same result as another transformation in the group and each transformation has an inverse transformation (which undoes it) in the group. See also GROUP THEORY, INTEGRAL TRANSFORM, LINEAR TRANSFORMATION.

transformer Device that transfers electric energy from one ALTERNATING-CURRENT CIRCUIT to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage. Uses for transformers include reducing the line voltage to operate low-voltage devices (doorbells or toy electric trains) and raising the voltage from electric GENERATORS so that electric power can be transmitted over long distances.

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Transformers act through ELECTROMAGNETIC INDUCTION; current in the primary coil induces current in the secondary coil. The secondary voltage is calculated by multiplying the primary voltage by the ratio of the number of turns in the secondary coil to that in the primary.

transfusion See BLOOD TRANSFUSION

transistor SOLID-STATE SEMICONDUCTOR device for amplifying, controlling, and generating electrical signals. Invented at Bell Labs (1947) by JOHN BARDEEN, WALTER H. BRATTAIN, and WILLIAM B. SHOCKLEY, it displaced the VACUUM TUBE in many applications. Transistors consist of layers of different semiconductors produced by addition of impurities (such as arsenic or boron) to SILICON. These impurities affect the way electric current moves through the silicon. Transistors were pivotal in the advancement of electronics because of their small size, low power requirements, low heat generation, modest cost, reliability, and speed of operation. Single transistors were superseded in the 1960s and '70s by INTEGRATED CIRCUITS; present-day COMPUTER CHIPS contain millions of transistors. Today transistors perform many different functions in nearly every type of electronic equipment.

transition element Any chemical ELEMENT with VALENCE electrons in two shells instead of only one. This structure gives them their outstanding ability to form IONS containing more than one ATOM (complex ions, or coordination compounds), with a central atom or ion (often of a transition metal) surrounded by LIGANDS in a regular arrangement. Theories on the BONDING in these ions are still being refined. The elements in the PERIODIC TABLE from scandium to COPPER (atomic numbers 21–29), yttrium to SILVER (39–47), and lanthanum to GOLD (57–79, including the LANTHANIDE series) are frequently designated the three main transition series. (Those in the ACTINIDE series and beyond, 89–111, also qualify.) All are METALS, many of major economic or industrial importance (e.g., IRON, GOLD, NICKEL, TITANIUM). Most are dense, hard, and brittle, conduct heat and electricity well, have high melting points, and form ALLOYS with each other and other metals. Their electronic structure lets them form compounds at various valences. Many of these compounds are coloured and paramagnetic (see PARAMAGNETISM) and (as do the metals themselves) often act as CATALYSTS. See also RARE EARTH METAL.

transitive law Property of relationship that states that if A is in a given relation to B and B is in the same relation to C, then A is also in that relation to C. Equality, for example, is a transitive relation.

Transkei \'trans-'kā, 'trans-'kī\ Administrative region, South Africa. It borders the Indian Ocean and Lesotho. It was created by South Africa in 1959 as the first Bantu homeland, a nonindependent black state designated (together with CISKEI) for the Xhosa-speaking peoples (see XHOSA). It was made a nominally independent republic in 1976, and all black Africans with language ties to Transkei (whether or not they lived there) lost their South African citizenship and became citizens of the new country. Existing only as an element of the APARTHEID system, it never received international recognition. The region was reincorporated into South Africa in 1994 as part of Eastern Cape and KwaZulu-Natal provinces.

transmigration of souls See REINCARNATION

transmission System in an engine that transmits power generated by the engine to the point where it is to be used. Most mechanical transmissions function as rotary speed changers; the ratio of the output speed to the input speed may be either constant (as in a gearbox) or variable. On variable-speed transmissions, the speeds may be variable in individual steps (as on an automobile or some machine-tool drives) or continuously variable within a range. Step-variable transmissions, with some slip, usually use either GEARS or chains and provide fixed speed ratios with no slip; stepless transmissions use belts, chains, or rolling-contact bodies. See illustration opposite.

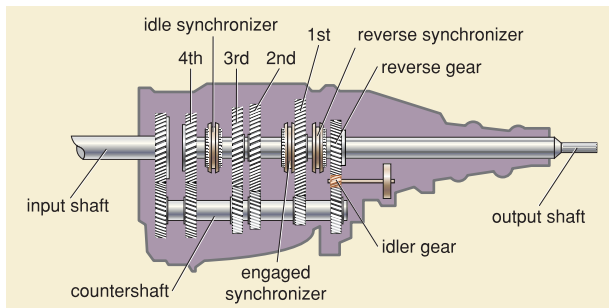
transpiration Loss of water from a plant, mainly through the stomata (see STOMA) of leaves. Darkness, internal water deficit, and extremes of temperature tend to close stomata and decrease transpiration; illumination, ample water supply, and optimum temperature cause stomata to open and increase transpiration. Its exact significance is disputed; its roles in providing the energy to transport water in the plant and in aiding dissipation of the sun's heat (by cooling through evaporation of water) have been challenged. Since stomatal openings are necessary for the exchange of gases, transpiration has been considered by some to be merely an unavoidable phenomenon that accompanies the real functions of the stomata.

transplant *or* **graft** Partial or complete organ or other body part removed from one site and attached at another. It may come from the same or a different person or an animal. One from the same person—most often a skin graft—is not rejected. Transplants from another person or, especially, an animal are rejected unless they are unusually compatible or have no blood vessels (e.g., the cornea), or if the recipient's immune reaction is suppressed by lifelong drug treatment. Transplanted tissues must match (by blood tests) more closely than BLOOD TRANSFUSIONS. Monoclonal ANTIBODIES targeting the cells that cause rejection hold great promise. Tests are now under way with monoclonal antibodies that react with antigens present only on T CELLS that are participating in rejection, sparing the rest. Rejection matters less in skin grafts, which may need to last only weeks, and bone grafts, whose structure remains after the cells die. In BONE-MARROW transplants, the donor's marrow cells may attack the recipient's tissues, often fatally. Lung transplants have greater chance of success as part of a heart-and-lung transplant. See also HEART TRANSPLANT, KIDNEY TRANSPLANT.

transport In biochemistry, the movement of MOLECULES and particles across a cell membrane, a selective barrier that allows some substances (FAT-soluble molecules and some small molecules) to pass and blocks others (IONS and large, water-soluble molecules). Transport of these vital substances occurs via several systems. Open channels allow DIFFUSION (passive transport) of ions directly into cells; facilitators use a chemical change to help substances diffuse past the membrane; "pumps" force dilute substances through even when their concentration on the other side is higher (a form of active transport). Primary active transport is powered directly by energy released in cell METABOLISM (see ATP, adenosine triphosphate). In secondary active transport, a molecule is linked to a different molecule that carries it across the membrane (cotransport) or is exchanged for a different molecule crossing in the other direction (countertransport). The membrane itself opens and closes to let larger particles in or out.

Transport and General Workers' Union (TGWU) British labour union. The Dockers' Union (founded 1889) took the lead in the merger of 14 unions to form the TGWU in 1922. The union grew rapidly under the leadership of ERNEST BEVIN (1922–40). As a general union it was able to enroll workers excluded by the craft unions, and its membership included workers engaged in transportation industries (except the railroads) as well as in the automotive, construction, chemical, and textile industries. It exerted a strong influence on British labour policy and was the largest British union during much of the 20th century, reaching a peak of more than two million members in the 1970s, though its membership declined thereafter. See also LABOUR PARTY; TRADES UNION CONGRESS.

transsexualism Self-identification with one sex by a person who has the external genitalia and secondary sexual characteristics of the other sex. Early in life, such a person adopts the behaviour characteristic of the opposite sex. Surgery and hormone therapy now allow permanent sex change, a procedure first performed in 1952. The male-to-female operation is more common because the genital reconstruction is more satisfactory. The male transsexual's penis and testes are removed and an artificial vagina created; breasts are created with implants or female sex hormones.



A four-speed manual transmission. Power from the rotating input shaft turns the countershaft (or layshaft), which meshes with all four forward gears and the reverse gear on the output shaft. Which gear drives the output shaft is determined by the positions of the synchronizer assemblies, which are controlled by the gearshift stick (here, first gear is engaged). The unengaged gears simply revolve around the output shaft without transmitting power.

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Female transsexuals may undergo mastectomy and hormone treatments to produce male secondary sexual characteristics, but attempts to create an artificial penis have not been satisfactory.

transubstantiation In CHRISTIANITY, the change by which the bread and wine of the EUCHARIST become in substance the body and blood of JESUS, though their appearance is not altered. This transformation is thought to bring the literal truth of Christ's presence to the participants. The doctrine was first elaborated by theologians in the 13th century and was incorporated into documents of the Council of TRENT. In the mid-20th century, some Roman Catholic theologians interpreted it as referring to a change of meaning rather than a change of substance, but in 1965 PAUL VI called for the retention of the original dogma.

transuranium element Any of the chemical ELEMENTS after URANIUM in the PERIODIC TABLE (with atomic numbers greater than 92). All are radioactive (see RADIOACTIVITY), with HALF-LIVES ranging from tens of millions of years to fractions of a millisecond. Only two, neptunium (93) and PLUTONIUM (94), occur in nature, and only as traces in uranium ores as a result of neutron irradiation. Transuranium elements with atomic numbers through 112, along with 114 and 116, have been produced in laboratories. Each appears to resemble the elements above it in the periodic table; in particular, the ACTINIDES, thorium (90) through lawrencium (103), are similar to the LANTHANIDES, cerium (58) through lutetium (71). The naming of the transuranium elements has been fraught with controversy regarding which laboratory first made the discovery and should propose the name and whether elements should be named for living persons. See also GLENN SEABORG.

Transvaal \trans-'väl\ *formerly (1856–77, 1881–1902)* **South African Republic** Former province, northeastern South Africa. Located between the LIMPOPO and VAAL rivers, the region was inhabited c. 1800 chiefly by various BANTU-speaking peoples. The Boers (AFRIKANERS) began migrating there during the GREAT TREK of the 1830s. They established the short-lived South African Republic in 1856. Discoveries of diamonds and gold deposits (1868–74) heightened British interest in the region, and the British annexed the republic in 1877. A Boer rebellion restored it in 1881. Further discovery of gold in 1886 brought more foreigners, who eventually outnumbered the Boers. In 1895 LEANDER STARR JAMESON attempted to incite them to overthrow the Boer government. In 1899 Transvaal joined with ORANGE FREE STATE against Britain in the SOUTH AFRICAN (BOER) WAR. It was taken in 1900, and in 1902, following the British victory, it became a crown colony. It was granted self-government in 1906 and joined the Union (now Republic) of South Africa in 1910. In 1994 the Transvaal was split into four provinces. The region is extremely rich in mineral and agricultural resources.

Transylvania Historic region, northwestern and central Romania. It comprises a plateau surrounded by the CARPATHIAN MOUNTAINS and the Transylvanian Alps. It formed the nucleus of the Dacian kingdom and was included in the Roman province of DACIA in the 2nd century AD. The MAGYARS (Hungarians) conquered the area at the end of the 9th century. When Hungary was divided between the HABSBURGS and the Turks in the 16th century, Transylvania became an autonomous principality within the Ottoman Empire. It was attached to Habsburg-controlled Hungary at the end of the 17th century. Transylvania was the scene of severe fighting in the Hungarian revolution against Austria in 1848. When Austria-Hungary was defeated in World War I, the Romanians of Transylvania proclaimed the land united with Romania. Hungary regained the northern portion during World War II, but the entire region was ceded to Romania in 1947.

Trapp family Austrian singers. Maria Augusta Kutschera (1905–87), the family's best-known member, was an orphan and novitiate in a Benedictine convent in Salzburg. Later, as a governess, she won the hearts of the seven children of the widower Baron Georg von Trapp (1880?–1947) and of the baron himself. They married in 1927, had three children, and later began singing German and liturgical music under the Reverend Franz Wasner, with whom the family fled in 1938 from Nazi-dominated Austria to Italy, and finally to Stowe, Vt., U.S. They toured the world to great acclaim, disbanding in 1955. Their story was the subject of the musical *The Sound of Music* (1959; film, 1965).

trapshooting Shooting sport with moving targets. A shotgun (usually 12-gauge) is used. The targets are clay disks (called pigeons) that are sprung into the air from a trap. A later variant is SKEET shooting. Trapshooting's origins date to the 18th century, when marksmen shot at live pigeons released from cages or box traps. The modern clay-pigeon variety has been included in Olympic Games competition since 1900. A single trap throws 25 targets at varying angles; each competitor fires four 25-target rounds.

Trasimeno \ˌträ-zē-'mā-nō\, Lake Lake, UMBRIA, central Italy. The largest lake of the Italian peninsula, it has an area of 49 sq mi (128 sq km) and is shallow, with a maximum depth of 20 ft (6 m). It is fed by small streams and has an artificial subterranean outlet (opened 1898) to the TIBER RIVER. In 217 BC HANNIBAL defeated a Roman army led by FLAMINIUS there in the Second PUNIC WAR. In World War II it was the scene of severe fighting (1944) between the British and German armies.

Travancore \'tra-vən-ˌkōr\ Former princely state, southwestern India. Now part of KERALA state, it was part of the kingdom of Kerala in the early centuries AD. In the 11th century it fell under the COLA empire; the Hindu kings of the VIJAYANAGAR empire held it briefly in the 16th century, after which it came under Muslim rule. In the mid-18th century it became the independent state of Travancore; then it was under British protection from 1795. After Indian independence, it merged with Cochin to form the state of Travancore-Cochin; boundaries were redrawn, and it was renamed Kerala in 1956.

Traven \'trā-vən\, B. (b. March 5, 1890?, Chicago, Ill., U.S.?—d. March 27, 1969, Mexico City, Mex.) German-Mexican novelist. A recluse, he refused to disclose to publishers his parentage, nationality, and general identity, but he may have been forced to leave Germany for his participation in its short-lived communist revolution in 1919. Most of his books were written in German. He is noted for adventure stories and as a chronicler of rural life in Mexico, where he settled in the 1920s. Among his novels are *The Treasure of the Sierra Madre* (1927; film, 1948) and a series tracing the lives of impoverished Indians in southern Mexico, including *The Carreta* (1931) and *The Rebellion of the Hanged* (1936). His works are harsh and his themes compelling, and his lean prose has a hypnotic immediacy. Much confusion remains about both his life and his authorship.

travertine \'tra-vər-ˌtēn\ Dense, banded rock composed of calcium carbonate, $CaCO_3$. Formed by rapid chemical precipitation of calcium carbonate from solution in surface and ground waters, it is a variety of LIMESTONE that has a light colour and takes a good polish. It is often used for walls and interior decorations in public buildings and as a paving stone. Travertine is mined extensively in Italy; in the U.S., Yellowstone's Mammoth Hot Springs are actively depositing travertine. It also occurs in limestone caves in the form of STALACTITES AND STALAGMITES.

Travis, Merle (Robert) (b. Nov. 29, 1917, Rosewood, Ky., U.S.—d. Oct. 20, 1983, Tahlequah, Okla.) U.S. COUNTRY MUSIC singer and songwriter. Travis learned banjo as a youth, later applying banjo technique to the guitar. He worked on radio in Cincinnati in the 1930s. Moving to California in 1944, he quickly rose to prominence on the strength of his guitar style and for writing and recording honky-tonk classics such as "Divorce Me C.O.D." and "No Vacancy" and the coal-mining protest songs "Sixteen Tons" and "Dark as a Dungeon."

treason Offense of attempting to overthrow the government of one's country or of assisting its enemies in war. In the U.S., the framers of the Constitution defined treason narrowly—as the levying of war against the U.S. or the giving of aid and comfort to its enemies—in order to lessen the possibility that those in power might falsely or loosely charge their political opponents with treason. See also SEDITION.

treasury bill Short-term U.S. government SECURITY with maturities ranging from one month to 26 weeks. Treasury bills are usually sold at auction on a discount basis with a yield equal to the difference between the purchase price and the maturity value. Because they are highly liquid (money not being tied up in them for long periods of time), their yield rate is normally lower than that of longer-term securities. Their prices do not usually fluctuate as much as those of other government securities but may be influenced by the purchase or sale of large quantities of bills by the CENTRAL BANK. First used extensively during World War I, treasury bills were initially regarded as an emergency source of revenue, but their flexibility and relatively low interest led to their adoption as a permanent element in the NATIONAL DEBT. From 1970 to 1998 the minimum order for treasury bills was $10,000, after which it was reduced to $1,000. In 2001 the U.S. Treasury stopped offering treasury bills with maturities of 52 weeks.

treaty Contract or other written instrument binding two or more states under INTERNATIONAL LAW. The term is generally reserved for the more

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important international agreements, usually requiring, in addition to the signatures of authorized persons, ratification by the governments involved. A treaty may be bilateral or multilateral; it usually contains a preamble, an enumeration of the issues agreed on, and clauses that discuss its ratification procedures, lifespan, and terms for termination. Treaties may be political, commercial, constitutional, or administrative, or they may relate to criminal and civil justice or codify international law.

Trebbia River \'treb-byä\ River, Emilia-Romagna region, northern Italy. Rising northeast of Genoa, it flows 71 mi (115 km) northeast across the northern Apennines and the Po lowland to enter the Po River. It was the scene of two notable battles: a Roman defeat by Hannibal in 218 BC, and a French defeat by a Russo-Austrian army in 1799.

Treblinka \tre-'bliŋ-kä\ German Nazi concentration camp during World War II. Located near the village of Treblinka, Pol., it opened in 1941 as a forced-labour camp. A larger and ultrasecret second camp a mile away, called T.II, opened in 1942 as an extermination camp for Jews. Victims were stripped and marched into "bathhouses," where they were gassed with carbon monoxide from ceiling pipes. Ukrainian guards and up to 1,500 Jewish prisoner-workers performed the executions. The total number killed has been estimated at 700,000 to 900,000. In 1943 a group of prisoner-workers rose in revolt and escaped, but most were soon killed or recaptured. The T.II camp was closed in October 1943, the labour camp in July 1944.

tree Woody perennial plant. Most trees have a single self-supporting trunk containing woody tissues, and in most species the trunk produces secondary limbs called branches. Trees provide many valuable products, especially wood, one of the world's chief building materials, and wood pulp, used in papermaking. Wood is also a major fuel source. Trees supply edible fruits and nuts. In addition, trees take in carbon dioxide and release oxygen during photosynthesis. Their root systems help retain water and soil, preventing floods and erosion. Trees and forests provide habitats for a wide variety of animals, and they beautify both natural and altered landscapes. Growth rings in the trunk indicate the age of most trees. The tallest trees are the Pacific coast redwoods; the oldest are the bristlecone pines, some of which are over 4,000 years old. See also conifer; deciduous tree; evergreen; forest; shrub; softwood.

Tree, Sir Herbert (Draper) Beerbohm (b. Dec. 17, 1853, London, Eng.—d. July 2, 1917, London) British actor-manager. A romantic actor with a gift for character roles and comedy, he made his London debut in 1878 and won favourable notice in *The Private Secretary* (1884). As manager of the Haymarket Theatre (1887–97), he directed and acted in lavish Shakespearean productions, which he continued as actor-manager of Her Majesty's Theatre (1897–1915). He produced notable stage versions of Charles Dickens's works. In 1904 he founded the Royal Academy of Dramatic Art.

tree fern Any of various ferns (especially those of the families Cyatheaceae and Marattiaceae) of treelike habit with a woody stem. Many attain heights over 50 ft (15.2 m). They are natives of humid mountain forests in the tropics and subtropics and of warm temperate regions of the Southern Hemisphere. The family Marattiaceae contains six genera; one species, *Angiopteris evecta*, has leaves (fronds) 15 ft (4.5 m) or more in length and stems of 2–6 ft (60–180 cm). Now-extinct members of the family date to the Carboniferous Period (354–290 million years ago). Members of the family Cyatheaceae are very large, terrestrial ferns with trunklike, upright rhizomes; the nearly 1,000 species are grouped into seven genera.

tree frog *or* **tree toad** Any of some 550 species (family Hylidae) of mostly arboreal frogs, found worldwide but primarily in the New World. Most species are small, slender, and long-legged and have suckerlike adhesive disks on the finger and toe tips. Some do not climb well and live in water, on land, or in a burrow. Most species lay eggs in water. Young marsupial frogs (genus *Gastrotheca*), of South America, develop in a brood pouch on the female's back.

European green tree frogs (*Hyla arborea*).
JANE BURTON/BRUCE COLEMAN LTD.

tree of heaven Rapid-growing tree (*Ailanthus altissima*) in the quassia family (Simaroubaceae), native to China and widely naturalized elsewhere, with several known varieties. Because of its resistance to pollution, freedom from insect predation and disease, and ability to grow in almost any soil, the tree of heaven is planted as a yard and street tree in urban centres. It grows to 60 ft (18 m) or more, producing long, compound leaves that emit an unpleasant odour when bruised. Male trees bear flowers with unpleasant scents. Female trees produce winged fruits which are tannish orange when ripe.

Treitschke \'trīch-kə**, Heinrich von** (b. Sept. 15, 1834, Dresden, Saxony—d. April 28, 1896, Berlin) German historian and political writer. Son of a Saxon general, Treitschke studied at Bonn and Leipzig and then taught history and politics at a number of German universities. A member of the Reichstag (1871–84), he advocated authoritarian rulers unchecked by a parliament and disparaged western European liberalism and American democracy. In 1886 he succeeded Leopold Ranke as official historiographer of Prussia. His major work is *Treitschke's History of Germany in the Nineteenth Century* (1879–94).

Trek, Great See Great Trek

trematode See fluke

trench warfare Warfare in which the opposing sides attack, counterattack, and defend from sets of trenches dug into the ground. It was developed by Sébastien Le Prestre de Vauban in the 17th century for laying siege to fortresses. Its defensive use was first institutionalized as a tactic during the American Civil War. It reached its highest development in World War I. Little used in World War II, it reappeared in the Iran-Iraq War in the 1980s. A typical construction consisted of two to four parallel trenches, each dug in a zigzag, protected by sandbags, and floored with wooden planks. The parallel trenches were connected by a series of communication trenches dug roughly perpendicular to them. The first row was fronted by barbed wire and contained machine-gun emplacements; the rear trenches housed most of the troops. Increased use of tanks marked the end of trench warfare, since tanks were invulnerable to the machine-gun and rifle fire used by entrenched soldiers.

Trent, Council of (1545–63) 19th ecumenical council of the Roman Catholic church, which made sweeping reforms and laid down dogma clarifying nearly all doctrines contested by the Protestants. Convened by Pope Paul III at Trento in northern Italy, it served to revitalize Roman Catholicism in many parts of Europe. In its first period (1545–47) it accepted the Nicene Creed as the basis of Catholic faith, fixed the canon of the Old and New Testaments, set the number of sacraments at seven, and defined the nature and consequences of original sin; it also ruled against Martin Luther's doctrine of justification by faith. In its second period (1551–52) it confirmed the doctrine of transubstantiation and issued decrees on episcopal jurisdiction and clerical discipline. In the final period (1562–63) it defined the mass as a true sacrifice and issued statements on several other doctrinal issues. By the end of the 16th century, many of the abuses that had motivated the Protestant Reformation had disappeared, and the church had reclaimed many of its European followers.

Trent, River River, central England. It rises in Staffordshire and flows northeast 168 mi (270 km) to unite with the River Ouse west of Hull to form the River Humber. It is navigable by barge for over half its length.

Trent Canal Canal, southeastern Ontario, Canada. Linking Lake Huron with Lake Ontario, the canal extends from the southeastern shore of Georgian Bay up the Severn River to Lake Simcoe, connects several lakes of the Kawartha Lake region to Rice Lake, and passes down the Trent River to the Bay of Quinte and Lake Ontario. Its 242-mi (389-km) main course consists of 33 mi (53 km) of man-made channels and 42 locks. Construction began in 1833. The waterway once served a busy lumber trade; it is now a popular tourist attraction.

Trentino–Alto Adige \tren-'tē-nō-ˌäl-tō-'ä-dē-jā\ *formerly (until 1947)* **Venezia Tridentina** Autonomous region (pop., 2001 prelim.: 937,107), northeastern Italy. Its capital is Trento. A mountainous area covering 5,258 sq mi (13,618 sq km), Trentino–Alto Adige has some of the

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highest peaks in Europe, cut through by passes into Switzerland and Austria. Historically it included the medieval ecclesiastical principalities of Trento and Bressanone. Austria annexed it in 1815. It was the scene of much fighting during World War I, and it was ceded to Italy at the end of the war. The population is a mix of German speakers in the north and Italian speakers in the south; the regional parliament alternates German-speaking and Italian-speaking chairmen. The region grows grain and grapes, raises cattle, and mines zinc, lead, and other minerals. Tourism is a major industry.

Trento *English* **Trent** *ancient* **Tridentum** City (pop., 2001 prelim.: 104,844), capital of Trentino–Alto Adige region, on the Adige River in northern Italy. Reportedly founded by the Raetians c. 4th century BC, it later became a Roman colony on the road to the Brenner Pass in the Alps. In the Christian era Trento came under the Ostrogoths, Lombards, and Franks. It was the site of the Council of Trent (1545–63). It came under the Napoleonic kingdom of Italy in the early 19th century and passed to Austria in 1814 and to Italy in 1918. An agricultural market centre, it also has some light industry.

Trenton City (pop., 2000: 85,403), capital of New Jersey, U.S. It lies at the head of navigation on the Delaware River. Settled c. 1679 by English Quakers, it was incorporated in 1745. On Dec. 25, 1776, George Washington led his army across the ice-choked Delaware River to attack Hessian troops quartered at Trenton (see battles of Trenton and Princeton). It served as temporary capital of the U.S. in 1784 and 1799 and was made the state capital in 1790. The completion of a canal and railroad line in the 1830s spurred Trenton's industrial development, and it remains an industrial city.

Trenton and Princeton, Battles of (1776–77) Engagements won by the Continental Army in the American Revolution. Defeats in New York forced the army under George Washington to retreat through New Jersey into Pennsylvania. On Dec. 25, 1776, Washington led a force of 6,000 troops across the ice-filled Delaware River to surprise the 1,400-man British-Hessian force at Trenton, N.J., and captured 900 troops. A British force of 7,000 troops under Charles Cornwallis arrived to force the American army into retreat. At night Washington led his men around the British to defeat an outpost at Princeton, causing Cornwallis to retreat to New Brunswick and enabling Washington to lead his troops into winter quarters near Morristown. The victories restored American morale and renewed confidence in Washington.

trespass In law, unlawful entry onto land. Trespass was formerly defined as wrongful conduct causing injury or loss; today it is generally confined to issues involving real property (see real and personal property). Once a trespass is proved, the trespasser is usually held liable for any damages resulting, regardless of whether the trespasser was negligent or the damage was foreseeable. Criminal trespass, trespass to property that is forbidden by statute, is punishable as a crime.

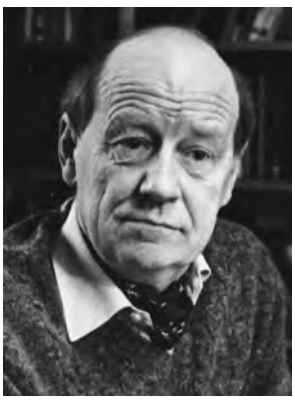
Trevelyan \tri-ˈvel-yən**, G(eorge) M(acauley)** (b. Feb. 16, 1876, Welcombe, Warwickshire, Eng.—d. July 21, 1962, Cambridge, Cambridgeshire) English historian. He is known for books accessible to general readers that often show an appreciation of the Whig tradition in English thought and reflect a keen interest in the Anglo-Saxon element in the English constitution. They include three on Giuseppe Garibaldi (1907, 1909, 1911), *England in the Age of Wycliffe* (1899), *British History in the Nineteenth Century (1782–1901)* (1922), *History of England* (1926), and *The Seven Years of William IV* (1952).

Trevino \trə-ˈvē-nō**, Lee (Buck)** (b. Dec. 1, 1939, near Dallas, Tex., U.S.) U.S. golfer. Of Mexican American descent, Trevino received a grade-school education, served in the U.S. Marine Corps, and worked as an odd-job man and assistant professional at golf courses in his native Texas. In 1967 he unexpectedly came in fifth in the U.S. Open, then won it the next year. In 1971 Trevino became the first player to win the U.S., British, and Canadian Open championships in a single year. He won the British Open in 1972 and the U.S. PGA Championship in 1974. He then underwent several back surgeries but returned to win the PGA again in 1984.

Trevithick \ˈtrev-ə-ˌthik**, Richard** (b. April 13, 1771, Illogan, Cornwall, Eng.—d. April 22, 1833, Dartford, Kent) British inventor of the first steam locomotive. With little formal education, in 1790 he became an engineer for several ore mines in Cornwall. In 1797 his experiments with high-pressure steam led him to develop a small, light engine to replace the large, low-pressure mine engines then used for hoisting ore. In 1801 he built the first steam carriage, which he later drove in London. In 1803 he built the first steam railway locomotive for an ironworks in Wales. He abandoned his locomotive projects in 1808 because the iron rails were too fragile to carry their weight. He adapted his engine to produce the first steam dredger in 1806. In 1816 he traveled to South America to deliver engines to Peruvian silver mines, hoping to become wealthy, but returned to England in 1827 penniless.

Richard Trevithick, detail of an oil painting by John Linnell, 1816; in the Science Museum, London.
COURTESY OF THE SCIENCE MUSEUM, LONDON, THE WOODCROFT BEQUEST

Trevor, William *orig.* **William Trevor Cox** (b. May 24, 1928, Mitchelstown, County Cork, Ire.) Irish writer. Educated at Trinity College, Dublin, he worked as a teacher, sculptor, and advertising copywriter before moving to England to write fiction full-time. His works, noted for their exquisite characterizations and finely tuned irony, focus largely on the psychology of eccentrics and outcasts. Trevor's second novel, *The Old Boys* (1964), tells the story of an "old boys" committee whose aging members plot against each other. His later novels include *Felicia's Journey* (1994) and *Death in Summer* (1998). He is perhaps best known for his acclaimed collections of wry and often macabre short stories.



William Trevor, 1982.
MARK GERSON

Triad Term used variously for secret societies in Qing-dynasty China (and sometimes earlier), for modern Chinese crime gangs, and for crime gangs of other Asian nationals operating in their own countries or abroad. A secret society with the name Triad started operating in the early 19th century in southern China, where it took root and spread. In the 1850s Triad rebellions threatened Shanghai and Xiamen (Amoy) and contributed to the revolution of 1911. Chinese secret societies have in common the swearing of an oath to join, strict rules, a family relationship among members, the duty of mutual help, a hierarchy of functions, and hereditary membership within families.

triage \ˈtrē-ˌäzh, trē-ˈäzh\ Division of patients for priority of care, usually into three categories: those who will not survive even with treatment; those who will survive without treatment; and those whose survival depends on treatment. If triage is applied, the treatment of patients requiring it is not delayed by useless or unnecessary treatment of those in the other groups. Triage originated in military medicine, when limited resources faced many wounded soldiers. It is used in civilian settings during disasters or epidemics and in emergency rooms. Triage decisions are made after relatively quick examination; patients in lower-priority groups should be reexamined periodically.

trial In law, a judicial examination of issues of fact or law for the purpose of determining the rights of the parties involved. Attorneys for the plaintiff and the defendant make opening statements to a judge or jury, then the attorney for the plaintiff makes his case by calling witnesses, whom the defense attorney may cross-examine. Unless the case is then dismissed for lack of sufficient evidence, the defense attorney next takes a turn calling witnesses, whom the plaintiff's attorney cross-examines. Both sides make closing arguments. In a trial before a jury, the judge instructs the jury on the applicable laws, and the jury retires to reach a verdict. If the defendant is found guilty, the judge then hands down a sentence.

trial by ordeal See ordeal

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triangle Geometric figure with three sides and three angles. Each two sides meet at a point called a vertex, and the three angles sum to 180°. A triangle with one 90° (right) angle is a right triangle. A triangle with all sides (and thus all angles) equal is equilateral, one with two sides equal is isosceles, and one with no two sides equal is scalene. Triangles are particularly useful in surveying, astronomy, and navigation. Two observation points (sight lines) form a triangle with a reference object serving as one vertex and the observation points as the other two. Knowing the angles of the sight lines and the distance between the observation points allows the calculation of the lengths of the other sides using the methods of TRIGONOMETRY.

Triangle Shirtwaist Co. fire (March 25, 1911) Industrial disaster that led to the enactment of many safety and labour laws. The fire, which started in the garment factory on the eighth floor of the Asch Building in New York City, resulted in the deaths of 146 people, mostly young immigrant women. Fire truck ladders, then able to reach only six stories, were of little help. The sweatshop had few fire escapes, and its doors were locked to prevent theft, forcing panicked workers to leap from upper-floor windows. Public outcry also led to new fire codes and child-labour laws and greater influence for the INTERNATIONAL LADIES' GARMENT WORKERS UNION.

Trianon \ˌtrē-ə-ˈnōn**, Treaty of** (June 4, 1920) Treaty at the end of WORLD WAR I between Hungary and the Allied Powers, signed at the Trianon Palace at Versailles, France. By its terms, Hungary lost two-thirds of its former territory, which was divided among Czechoslovakia, Austria, the future Yugoslavia, and Romania. Hungary's armed forces were restricted to 35,000 lightly armed men, to be used only to maintain internal order.

Triassic \trī-ˈa-sik\ **Period** Interval of geologic time, c. 248–206 million years ago, that marks the beginning of the MESOZOIC ERA. Many new vertebrates emerged during the Triassic, heralding the major changes that were to occur in both terrestrial and marine life forms during the Mesozoic Era. The seas became inhabited by large marine reptiles. On land, ancestral forms of various modern amphibians arose, as did reptiles such as turtles and crocodilians. By the Late Triassic, ARCHOSAURS were becoming more and more dominant, and the first true mammals, small shrewlike omnivores, evolved. Seed ferns dominated the flora of southern GONDWANA, and GYMNOSPERMS, including conifers, cycads, and ginkgos, were common throughout much of PANGEA.

triathlon Endurance contest involving swimming, cycling, and running. Triathlons originated in California in the 1970s and became an Olympic event in 2000. Olympic and world championship triathlons consist of a 1.5-km open water swim, a 40-km bicycle ride, and a 10-km run. The sport's most famous event, the Ironman triathlon, is held annually in Hawaii and consists of a 3.8-km (2.4-mi) swim, a 180-km (112-mi) bicycle ride, and a 42.2-km (26.2-mi) MARATHON run.

tribe Any of a variety of social units, including some defined by unilineal descent and some defined by ethnic origin. Cultural anthropologists now usually apply the term to a unit of social organization that is culturally homogeneous and consists of multiple kinship groups—such as the FAMILY, lineage, or CLAN—that prohibit marriages within themselves but endorse or require marriages with persons of the other kinship groups. (See EXOGAMY AND ENDOGAMY.) Most tribes are organized as unitary political entities, within which people share a common language and culture. Some tribes are spread across large territories, and individual members may never meet or know all of the others. Some are small groups, confined to a limited territory, sometimes a single small island, within which everyone knows everyone else very well. What unites societies of such diverse scales as being "tribal" is their own internal sense of "being a single people," but—anthropologists would add—a people that lacks the equipment of citizenship, a constitution, or a formalized legal system that would define them as a nation-state. Throughout most of the history of modern cultural anthropology, the terms *tribe* and *primitive* were usually linked; however, in recent years *primitive* has been avoided by most anthropologists because it appears to carry with it an unintended judgment of the moral or technological development of a people. See also ETHNIC GROUP.

tribe (Greek, *phylai*; Roman, *tribus*) In ancient Greece and Rome, any of a group of political and demographic subdivisions of the population. In Greece the groups divided into tribes were distinct by location, dialect, and tradition, and they included the IONIANS, DORIANS, ACHAEANS, and Aetolians. In Attica, CLEISTHENES replaced the 4 Ionian tribes with 10 new tribes, each of which was named after a local hero; these came to develop political and civic functions, including the election of magistrates. The DEMES developed out of the tribal system. In Rome the tribes formed the 3 (later 4, and still later 35) original divisions of Roman citizens. These were the basis of military levies, property tax, census taking, and voting units in political assemblies.

tribology \trī-ˈbä-lə-jē\ Study of the interactions of sliding surfaces. It includes three subjects: FRICTION, wear, and LUBRICATION. Many manifestations of tribology are beneficial and make modern life possible. Many others are serious nuisances, and careful design is necessary to overcome problems caused by excessive friction or wear. Friction uses up, or wastes, a substantial amount of the energy generated by humans; in addition, a great deal of productive capacity is devoted to replacing objects that have worn out.

tribune In ancient Rome, any of various military and civil officials. Military tribunes were originally infantry commanders. In the early republic there were six to a LEGION; some were appointed by CONSULS or military commanders, others elected by the people. During the Roman empire (from 27 BC), the emperor nominated military tribunes, the office of which was considered preliminary to a senatorial or equestrian career (see *EQUES*). Of the civil tribunes, the most important were the tribunes of the plebs (see PLEBEIAN), who were elected in the plebeian assembly. By 450 BC there were 10 plebeian tribunes, who were elected annually with the right to intervene in cases of unjust acts of consuls or magistrates by saying "Veto" (meaning "I forbid it"). The office became powerful; its powers were curtailed by SULLA but restored by POMPEY. Under the empire the powers of the plebeian tribunes passed to the emperor.

tricarboxylic \ˌtrī-ˌkär-bäk-ˈsil-ik\ **acid cycle** *or* **Krebs cycle** *or* **citric-acid cycle** Last stage of the chemical processes by which living cells obtain energy from foodstuffs. Described by HANS ADOLF KREBS in 1937, the reactions of the cycle have been shown in animals, plants, microorganisms, and fungi, and it is thus a feature of cell chemistry shared by all types of life. It is a complex series of reactions beginning and ending with the compound oxaloacetate. In addition to re-forming oxaloacetate, the cycle produces carbon dioxide and the energy-rich compound ATP. The enzymes that catalyze each step are located in mitochondria in animals, in CHLOROPLASTS in plants, and in the cell MEMBRANE in microorganisms. The hydrogen atoms and electrons that are removed from intermediate compounds formed during the cycle are channeled ultimately to oxygen in animal cells or to carbon dioxide in plant cells.

Triceratops \trī-ˈser-ə-ˌtäps\ genus of large, plant-eating ORNITHISCHIAN DINOSAURS of the Late CRETACEOUS Epoch (99–65 million years ago). *Triceratops* had a very long skull (some more than 6 ft [1.8 m] long); a large bony frill about the neck; a relatively short, pointed horn on the nose; a beaklike mouth; and two pointed horns, more than 3.3 ft (1 m) long, above the eyes. Adults weighed 4–5 tons (3.6–4.5 metric tons) and grew up to 30 ft (9 m) long. The limbs were very stout, and the hind limbs were more massive than the forelimbs.

trichina \tri-ˈkī-nə\ Species (*Trichinella spiralis*) of parasitic NEMATODE, found worldwide, that causes the disease TRICHINOSIS. Trichinae (or trichinas), 0.06–0.2 in. (1.5–4 mm) long, mate in the host's small intestine. Fertilized females penetrate the intestinal wall and release larvae, which the blood carries throughout the body. The larvae grow, mature, and become encysted within muscle tissue. The digestive juices of an animal that eats the muscle tissue break down the cyst, liberating the larvae for further development; the worms mature, and the cycle begins again.

Trichina encysted in muscle
RUSS KINNE-PHOTO RESEARCHERS/EB INC.

trichinosis \ˌtri-kə-ˈnō-səs\ Disorder caused by the roundworm TRICHINA, commonly acquired from undercooked infested PORK. Larval worms invade the small intestine, maturing within a week. Fertilized females deposit new larvae, which are carried by the blood, notably to the muscles (most often the diaphragm, eyes, throat, and tongue), where they encapsulate and may remain alive for years. Though trichinosis usually eventually subsides, it may be fatal if the heart and brain are involved. Few infected persons have sufficient parasites to produce symptoms (including diarrhea, nausea, and fever, followed by pain, stiffness, and swelling

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of various muscular structures). Anti-inflammatory drugs can relieve symptoms; thiabendazole may effectively destroy parasites in the intestine. There is no practical way to detect trichinous pork; the surest safeguard remains thorough cooking.

trichomonad \ˌtri-kə-'mō-ˌnad\ Any PROTOZOAN of the zooflagellate order Trichomonadida. Trichomonads have three to six flagella, and they may have one or multiple nuclei. Most inhabit the digestive systems of animals. Three species occur in humans: *T. hominis* in the intestine, *T. vaginalis* in the vagina, and *T. buccalis* in the mouth.

trickster tale In oral traditions worldwide, a story of deceit, magic, and violence perpetrated by a mythical animal-human (trickster). The trickster-hero is both creator god and innocent fool, evil destroyer and childlike prankster. Coyote, the trickster of tales from American Indian peoples in California and the Southwest, is one of the most widely known. In the Pacific Northwest, the trickster is Raven. Many African peoples also have tales about tricksters (hare, spider, tortoise, etc.), which slaves brought to the New World. Tales involving the trickster Brer Rabbit were given literary form by JOEL CHANDLER HARRIS.

Trident missile U.S.-made SUBMARINE-launched ballistic missile. The most advanced Trident missiles, deployed by the U.S. Navy since 1990 and by the Royal Navy since 1994, are more accurate than most land-based ballistic missiles. Their extended range (up to 7,000 mi [11,300 km]) allows the submarines that carry them to patrol almost anywhere, making detection extremely difficult. Each missile is capable of carrying more than 10 multiple independently targeted reentry vehicles (see MIRV), though arms-control considerations limit the actual number to as few as three.

Trieste \trē-'es-tā, trē-'est\ *in full* **Free Territory of Trieste** Former region, western ISTRIA, southern Europe, surrounding and including the city of TRIESTE. It was occupied by Yugoslavia in 1945. The UN established it as a free territory in 1947. It was divided for administrative purposes into two zones: Zone A in the north, including the city, was under the British and Americans; Zone B in the south was under the Yugoslavs. In 1954 most of the northern zone was incorporated into Italy; the southern zone went to Yugoslavia.

Trieste *ancient* **Tergeste** Seaport city (pop., 2001 prelim.: 209,520), capital of FRIULI–VENEZIA GIULIA region, northeastern Italy. It lies at the head of the ADRIATIC SEA on the Gulf of Trieste. It was under Roman control from the 2nd century BC until the collapse of the empire; then it was under episcopal rule (948–1202). It placed itself in 1382 under HABSBURG protection and later became the prosperous main port of the AUSTRO-HUNGARIAN EMPIRE. After World War I Trieste was ceded to Italy. Occupied by Germany in World War II and seized by Yugoslavia in 1945, it became the centre of the Free Territory of TRIESTE in 1947. Returned to Italy in 1954, it became the regional capital in 1963.

triggerfish Any of about 30 species (family Balistidae) of shallow-water marine fishes, found worldwide in tropical seas. Triggerfishes are deep-bodied, usually colourful fishes with large scales, high-set eyes, and three dorsal-fin spines, which they use for protection. When a triggerfish is threatened, it darts into a coral crevice and erects its large and strong first spine, which it locks in place with the second (the "trigger"); when the trigger is later withdrawn, the first snaps back down. Though generally considered edible, some cause food poisoning. The largest grow 2 ft (60 cm) long.

Triggerfish (*Balistes conspicillus*).
DOUGLAS FAULKNER

triglyceride \trī-'gli-sə-ˌrīd\ Any of an important class of naturally occurring LIPIDS, ESTERS in which three molecules of FATTY acids are linked to GLYCEROL. The three fatty acids may be all the same kind or different kinds. The types of triglycerides in animals vary with the species and the fats in their food. In mammals they are stored in ADIPOSE tissue until needed and then broken down to the glycerol and fatty acids. Many vegetable triglycerides (OILS) are liquid at room temperature, unlike those of animals, and tend to contain a greater variety of fatty acids. In ALKALI, triglycerides break down to form glycerol and three molecules of SOAP (saponification).

trigonometric function \ˌtri-gə-nə-'me-trik\ In mathematics, one of six functions (sine, cosine, tangent, cotangent, secant, and cosecant) that represent ratios of sides of right triangles. They are also known as the circular functions, since their values can be defined as ratios of the x and y coordinates (see COORDINATE system) of points on a circle of radius 1 that correspond to ANGLES in standard positions. Such values have been tabulated and programmed into scientific calculators and computers. This allows TRIGONOMETRY to be easily applied to surveying, engineering, and navigation problems in which one of a right triangle's acute angles and the length of a side are known and the lengths of the other sides are to be found. The fundamental trigonometric identity is $\sin^2\theta + \cos^2\theta = 1$, in which θ is an angle. Certain intrinsic qualities of the trigonometric functions make them useful in mathematical ANALYSIS. In particular, their DERIVATIVES form patterns useful for solving DIFFERENTIAL EQUATIONS.

trigonometry Mathematical discipline dealing with the relationships between the sides and ANGLES of triangles. Literally, it means triangle measurement, though its applications extend far beyond geometry. It emerged as a rigorous discipline in the 15th century, when the demand for accurate surveying techniques and navigational methods led to its use for the "solution" of right triangles, or the calculation of the lengths of two sides of a right triangle given one of its acute angles and the length of one side. The solution can be found by using ratios in the form of the TRIGONOMETRIC functions.

Trilling, Lionel (b. July 4, 1905, New York, N.Y., U.S.—d. Nov. 5, 1975, New York, N.Y.) U.S. literary critic and teacher. He taught at Columbia University from 1931 until his death. His collections of literary essays include *The Liberal Imagination* (1950), *Beyond Culture* (1965), *Sincerity and Authenticity* (1972), and *Mind in the Modern World* (1972). He was one of the best-known American literary critics of his time. His wife was the critic and writer Diana Trilling (1905–96).

trillium \'tri-lē-əm\ Any of about 25 species of spring-flowering perennial herbaceous plants that make up the genus *Trillium* in the LILY FAMILY, native to North America and Asia. Whorls of oval leaves, flower parts, and fruits are arranged in groups of three. Each solitary white, greenish-white, yellow, pink, or purple flower is borne on a short stalk that arises from the whorl of leaves. Many species are cultivated in wildflower gardens. Wild trillium (also called wake-robin or birthroot) is a protected species.

trilobite \'trī-lə-ˌbīt\ Any of a group of ovate ARTHROPODS (subphylum Trilobita) that came to dominate the seas c. 540 million years ago and became extinct c. 245 million years ago. Trilobites had a chitinous exoskeleton and three body lobes: a raised middle lobe with a lower lobe on each side. The head, thorax, and tail were segmented; each segment bore two appendages. The forwardmost appendages were sense and feeding organs. Most species had two compound eyes, though some were eyeless. Some were predators, others were scavengers, and still others probably ate plankton. *Paradoxides harlani*, found near Boston, grew to 18 in. (45 cm) long and may have weighed 10 lbs (4.5 kg). Other species were small.

Trilobite
LESLIE JACKMAN—NATURAL HISTORY PHOTOGRAPHIC AGENCY

Trimble, David *orig.* **William David Trimble** (b. Oct. 15, 1944, Belfast, N.Ire.) Former first minister of Northern Ireland and corecipient with JOHN HUME of the Nobel Prize for Peace in 1998. Trimble was elected to the British Parliament in 1990 and became leader of the Ulster Unionist Party (UUP) in 1995. He represented the UUP in multiparty peace talks beginning in September 1997. These talks, which included members of SINN FÉIN, the political wing of the IRISH REPUBLICAN ARMY (IRA), culminated in the Good Friday Agreement of April 1998, which aimed to restore self-government in Northern Ireland. Defying opposition from hard-line unionists, he signed the agreement and successfully campaigned for its acceptance in referenda in Northern Ireland and in Ireland. In subsequent elections to the new Northern Ireland Assembly, he was elected first minister. He resigned as first minister in 2001, following a conflict with the IRA over decommissioning (disarmament), though he returned to government later that year after decommissioning commenced; the post of

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first minister was suspended the following year. In 2005 he lost his seat in the British Parliament and subsequently resigned as leader of the UUP.

trimurti \tri-'mu̇r-tē\ In Hinduism, the triad of the three great gods: Brahma, Vishnu, and Shiva. Scholars consider the trimurti doctrine an attempt to reconcile different monotheistic approaches with one another and with the philosophic doctrine of ultimate reality. In trimurti symbolism, the three gods are collapsed into a single form with three faces. Each god is in charge of an aspect of creation, with Brahma as creator, Vishnu as preserver, and Shiva as destroyer; however, some sects ascribe all aspects of creation to their deity of choice. Though sometimes called the Hindu Trinity, trimurti has little similarity to the Holy Trinity of Christianity.

Trinidad and Tobago \'tri-nə-ˌdad...tə-'bā-gō\ *officially* **Republic of Trinidad and Tobago** Island country, West Indies. The islands of Trinidad and Tobago—the two southernmost links in the Antilles island

chain—lie northeast of Venezuela and northwest of Guyana. Area: 1,980 sq mi (5,128 sq km). Population (2005 est.): 1,298,000. Capital: Port of Spain. The people are mainly of South Asian or African ancestry. Language: English (official). Religions: Christianity (Protestant, Roman Catholic), Hinduism, Islam. Currency: Trinidad and Tobago dollar. The islands are mostly flat or rolling, with narrow belts of mountainous highlands and luxuriant rain forests. The Caroni Swamp, an important bird sanctuary on Trinidad, supports flamingo, egret, and scarlet ibis populations. The country has large reserves of petroleum and natural gas, as well as one of the world's largest supplies of natural asphalt. Other industries include agriculture, fishing, and tourism. Chief crops include sugarcane, citrus fruits, cocoa, and coffee. It is a republic with two legislative houses; its chief of state is the president, and the head of government is the prime minister. When Christopher Columbus visited Trinidad in 1498, it was inhabited mostly by Arawak Indians, though there were probably some Carib speakers as well; Caribs inhabited Tobago. The islands were settled by the Spanish in the 16th century. In the 17th–18th centuries African slaves were imported for plantation labour to replace the original Indian population, which had been decimated by the impact of slavery and diseases introduced by the Europeans. Trinidad was surrendered to the British in 1797. The British attempted to settle Tobago in 1721, but the French captured the island in 1781 and transformed it into a sugar-producing colony. The British acquired it in 1802. After slavery ended in the islands (1834–38), immigrants from India were brought in to work the plantations. Trinidad and Tobago were administratively combined in 1889. Granted limited self-government in 1925, the islands became an independent state within the Commonwealth in 1962 and a republic in 1976. There occurred some political unrest and in 1990 a failed Muslim-fundamentalist coup against the government.

Trinity, Holy In Christian doctrine, the unity of the Father, Son, and Holy Spirit as one God in three persons. The word Trinity does not appear in the Bible. It is a doctrine formulated in the early church to interpret the way God revealed himself, first to Israel, then in Jesus as Saviour, and finally as Holy Spirit, preserver of the church. The doctrine of the Trinity developed in the early centuries of the church and was explicitly stated at the Council of Nicaea in 325.

Trinity College See University of Dublin

Trintignant \tra^{n}-tēn-'yä^{n}**, Jean-Louis** (b. Dec. 11, 1930, Piolenc, France) French film actor. After leaving law school to study acting, he made his stage debut in 1951 and his film debut in 1956. He won favourable notice in *And God Created Woman* (1956) and gained international fame for his role as a race-car driver in *A Man and a Woman* (1966). Known for his reserved but intense screen persona, he conveyed the psychic conflicts of repressed characters in *My Night at Maud's* (1969), *Z* (1969), and, most strikingly, *The Conformist* (1970), among many other films. He worked sparingly in the 1980s and '90s because of poor health, but his role in *Three Colours: Red* won him acclaim.

trio sonata Principal chamber music genre of the Baroque era. Despite its name, it requires four performers: two melody instruments and continuo (usually a keyboard instrument and a bass instrument). It arose early in the 17th century as an instrumental version of the Italian vocal-duet ensemble. The two upper instruments, usually violins, generally wove their melodic, quasi-vocal lines high above the accompanying parts. Two standard forms emerged after 1750: the *sonata da chiesa*, or church sonata, standardized as a four-movement form (in slow-fast-slow-fast order); and the suite-like *sonata da camera*, or chamber sonata. By 1770 the genre had been abandoned in favour of the solo sonata.

Tripitaka \tri-'pi-tə-kə\ *Pali* **Tipitaka** Collective term for the three major divisions of the Pali canon, the canon of Theravada Buddhism. (The term means "Triple Basket.") It consists of the Abhidhamma Pitaka, the Sutta Pitaka, and the Vinaya Pitaka, which were transmitted orally by the sangha until they were committed to writing about 500 years after the Buddha's death. The texts appeared in two languages, Sanskrit and Pali, the Pali version being the better preserved. Sanskrit versions were translated into Tibetan, Chinese, and other languages.

Triple Alliance (1882) Secret agreement between Germany, Austria-Hungary, and Italy. It provided that Germany and Austria-Hungary would support Italy if it was attacked by France, that Italy would similarly assist Germany, and that Italy would remain neutral if Austria-Hungary was attacked by Russia. The alliance advanced Otto von Bismarck's efforts to isolate France. Conflicts between Italy and Austria-Hungary over their interests in the Balkans led Italy to reach an understanding of neutrality with France in 1902, which effectively nullified Italy's pledge to the members of the Triple Alliance, though the alliance was renewed in 1907 and 1912. See also Austro-German Alliance.

Triple Alliance, War of the *or* **Paraguayan War** (1864/65–70) Bloodiest conflict in Latin American history, fought between Paraguay and the allied countries of Argentina, Brazil, and Uruguay. The Paraguayan dictator Francisco Solano López (1827–70), objecting to Brazil's interference in the politics of neighbouring Uruguay, declared war on Brazil in 1864. The next year Argentina organized the Triple Alliance with Brazil and Uruguay. After three years of fighting, the allies annihilated the Paraguayan forces, but Solano López carried on a guerrilla war until he was killed. Paraguay was devastated by the war; its population was reduced by half, and territory covering some 55,000 sq mi (140,000 sq km) was annexed by Brazil and Argentina.

Triple Crown In U.S. horse racing, an unofficial championship attributed to a Thoroughbred horse that in a single season wins the Kentucky Derby, the Preakness Stakes, and the Belmont Stakes. First won in 1919 by Sir Barton, it has since been won 10 times, most recently by Secretariat (1973), Seattle Slew (1977), and Affirmed (1978).

Triple Entente \än-'tänt\ (1907) Association between Britain, France, and Russia. It developed from the Franco-Russian Alliance of 1894, the Anglo-French Entente Cordiale of 1904, and the Anglo-Russian Entente of 1907. Formed to settle mutual colonial disputes, the alignment became the nucleus of the Allied Powers in World War I.

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triple jump *or* **hop, step, and jump** TRACK-AND-FIELD distance jump. It incorporates three distinct, continuous movements: a hop, in which the athlete takes off and lands on the same foot; a step, in which he lands on the other foot; and a jump, in which the athlete lands in any manner, usually with both feet together. It has been a modern Olympic event since the first games in 1896.

Tripoli \'tri-pə-lē\ *Arabic* **Ṭarābulus al-Shām** \tə-'rä-bə-ləs-al-'sham\ Seaport city (pop., 1998 est.: 160,000), northwestern Lebanon. Founded c. 700 BC, it became the capital of a federation of three PHOENICIAN city-states: SIDON, TYRE, and Arvad. It was controlled by the Seleucids and Romans and taken by the Muslims in the mid-7th century AD. Besieged and partially destroyed by crusaders in the early 12th century, it was rebuilt by the later Crusaders (see CRUSADES). It was occupied by the Egyptians in the 1830s, the British in 1918, and the British and Free French in 1941. It became part of the Republic of Lebanon in 1946. It has sometimes been a centre of Christian-Muslim conflict during Lebanon's history. It was also the scene of a siege in 1983 by Palestine Liberation Organization (PLO) rebels against PLO leader YĀSIR ʿARAFĀT. It is a major port, a commercial and industrial centre, and a popular beach resort. At the terminus of an oil pipeline from Iraq, it is an important oil storage and refining centre.

Tripoli *Arabic* **Ṭarābulus al-Gharb** \tə-'rä-bə-ləs-al-'gärb\ City (pop. 2003 est.: city, 1,150,000; urban agglom., 2,006,000), capital of LIBYA. Located on the MEDITERRANEAN SEA, it is the country's largest city and chief seaport. Founded by the PHOENICIANS c. 7th century BC, it was known as Oea in ancient times and was one of the three cities of the region of TRIPOLITANIA. It was controlled by the Romans from the 1st century BC and later by the Byzantines. It was taken by the Arabs in 645. Conquered by the OTTOMAN EMPIRE in 1551, it was made an Ottoman colonial capital. It was under Italy's control (1911–43), after which it was occupied by the British until Libya's independence in 1951. U.S. warplanes bombed targets within the city in 1983 in response to Libya's alleged support of terrorist activity. Historical structures include numerous mosques and a Roman triumphal arch. In 1973 Al-Fateh University replaced the former University of Libya.

Trípolis \'tri-pə-ləs\ City (pop., 2001: 28,976), southern Greece, the commercial centre of the central PELOPONNESE. It was founded in the 14th century AD as Drobolitza to replace the ancient cities of Pallantium, TEGEA, and MANTINEA. Rebuilt in 1770, it became the seat of the local Ottoman pasha. The city prospered until 1828, when it was destroyed in the War of GREEK INDEPENDENCE. It was rebuilt after 1834.

Tripolitan \tri-'pä-lə-tᵊn\ **War** (1801–05) Conflict between the U.S. and Tripoli. The U.S. refused to continue paying tribute to the rulers of the North African BARBARY COAST states, which had bought immunity from pirate attacks in the Mediterranean. The pasha of Tripoli demanded greater tribute and then declared war on the U.S. (1801). A U.S. naval squadron was sent to Tripolitan waters and fought several skirmishes, including a raid by STEPHEN DECATUR. A U.S. naval blockade and an overland expedition from Egypt ended the war with a peace treaty favourable to the U.S.

Tripolitania \tri-ˌpä-lə-'tā-nē-ə\ Historical region, North Africa. It is now part of northwestern Libya. Colonized by the PHOENICIANS in the 7th century BC, it was named for its three chief cities—LEPTIS MAGNA, Oea (TRIPOLI), and SABRATA. It comprised the eastern part of Carthaginian territory by the 3rd century BC and came under Numidian chieftains in the mid-2nd century BC. After the Numidian War (46 BC), it was attached to the Roman province of Africa Nova (see Roman AFRICA). It fell under the Islamic caliphate in the 7th century AD and was ruled by successive Arab and Berber dynasties before becoming part of the Ottoman Empire in 1551. The region gained its independence in 1711. As part of the BARBARY COAST, corsairs operating from there plundered shipping in the Mediterranean Sea, leading to the TRIPOLITAN WAR with the U.S. (1801–05). It came under Ottoman administration again in 1835. The Italians acquired the region in 1912, and it was the scene of fierce fighting between British and German forces during the NORTH AFRICA CAMPAIGNS (1940–43) of World War II. In 1951, with the provinces of CYRENAICA and FEZZAN, it formed the independent kingdom of Libya; the provinces were dissolved in 1963.

Trippe, Juan T(erry) (b. June 27, 1899, Seabright, N.J., U.S.—d. April 3, 1981, New York, N.Y.) U.S. airline founder. He served as a pilot in World War I. After graduating from Yale University in 1922, he promptly established an air taxi service using government-surplus aircraft. He next formed Colonial Air Transport, which began the first airmail route between New York City and Boston. In 1927 he founded PAN AMERICAN WORLD AIRWAYS. Under him the company introduced the first round-the-world air service (1947) and the first commercial jets (1955). He retired in 1968.

Tripura \'tri-pə-rə\ State (pop., 2001 prelim.: 3,191,168), northeastern India. It is bordered on three sides by BANGLADESH and by MIZORAM state; it has an area of 4,049 sq mi (10,486 sq km), and its capital is AGARTALA. It was an independent Hindu kingdom for more than 1,000 years before it became part of the Mughal Empire in the 17th century. After 1808 it was under the influence of the British government. Tripura became a union territory in 1956 and acquired full status as a state in 1972. The main economic activity is agriculture, with rice and jute the major crops.

trireme \'trī-ˌrēm\ Oar-powered warship. Light, fast, and maneuverable, it was the principal naval vessel with which Persia, Phoenicia, and the Greek city-states vied for mastery of the Mediterranean from the Battle of SALAMIS (480 BC) through the end of the PELOPONNESIAN WAR (404). The Athenian trireme was about 120 ft (37 m) long, and was rowed by 170 oarsmen seated in three tiers along each side; it could reach speeds of more than 7 knots (8 mph, or 13 kph). Square-rigged sails were used when the ship was not engaged in battle. Armed with a bronze-clad RAM, it carried spearmen and bowmen to attack enemy crews. By the late 4th century BC, armed deck soldiers had become so important in naval warfare that it was superseded by heavier ships. See also GALLEY.

Tristan and Isolde Lovers in a medieval romance based on Celtic legend. The hero Tristan goes to Ireland to ask the hand of the princess Isolde for his uncle, King Mark of Cornwall. On their return the two mistakenly drink a love potion prepared for the king and fall deeply in love. After many adventures, they make peace with Mark, who marries Isolde. The distraught Tristan goes to Brittany, where he marries another noble Isolde. When he is wounded by a poisoned arrow, he sends for the first Isolde. His jealous wife tells him his true love has refused to come; he dies just before she arrives, and she dies in his arms. The original poem has not survived, but it exists in many later versions and even became part of ARTHURIAN LEGEND. GOTTFRIED von Strassburg's 13th-century version, considered the masterpiece of medieval German poetry, was the basis for RICHARD WAGNER's opera *Tristan und Isolde* (first performed in 1865).

Tristano, Lennie *orig.* **Leonard Joseph Tristano** (b. March 19, 1919, Chicago, Ill., U.S.—d. Nov. 18, 1978, New York, N.Y.) U.S. JAZZ pianist. Blind from childhood, Tristano performed and taught in New York City from the 1940s. His recordings featured players who had studied with him, including saxophonists Lee Konitz (b. 1927) and Warne Marsh (1927–87). Although resistant to classification, Tristano's music displayed a rigour and virtuosity appropriate to BEBOP while its aesthetic foreshadowed much of cool jazz.

triticale \ˌtri-tə-'kā-lē\ WHEAT-RYE hybrid that has a high yield and rich protein content. The first cross was reported in 1875, the first fertile cross in 1888. The name triticale first appeared in scientific literature in 1935 and is attributed to Erich TSCHERMAK VON SEYSENEGG. In favourable environmental conditions its yield equals that of wheat; under poor conditions its yield exceeds that of wheat. Its flour is not very suitable for breadmaking but can be blended with wheat flour. Major producers are Russia, the U.S., and Australia.

tritium \'tri-tē-əm, 'tri-shē-əm\ Isotope of HYDROGEN, chemical symbol written as ^{3}H or T, with atomic number 1 but ATOMIC WEIGHT approximately 3. Its nucleus contains one PROTON and two NEUTRONS. Tritium is radioactive (see RADIOACTIVITY), with a HALF-LIFE of 12.32 years. Its occurrence in natural water in an amount 10^{-18} that of ordinary hydrogen is believed to be due to the action of COSMIC RAYS. Some tritium is used in self-luminous materials (e.g., for watch dials) and as a radioactive tracer in chemical and biochemical studies. NUCLEAR FUSION of DEUTERIUM and tritium at high temperatures releases enormous amounts of ENERGY. Such reactions have been used in NUCLEAR WEAPONS and experimental power reactors. See also HEAVY WATER.

Triton \'trī-tᵊn\ In GREEK MYTHOLOGY, a merman and a demigod of the sea. He was the son of POSEIDON and Amphitrite. According to HESIOD, Triton lived in a golden palace in the depths of the sea. He was represented as human down to the waist, which tapered into a fish tail, and he had a spiral conch shell that he blew to calm or raise the waves. Some traditions held that there were many Tritons.

Triton \'trī-tᵊn\ Largest of NEPTUNE's moons. Its diameter is about 1,680 mi (2,700 km), nearly 80% that of Earth's Moon. Unique among the large

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moons of the solar system, Triton moves in a retrograde orbit, opposite the direction of Neptune's rotation. Its orbital period of 5.9 Earth days is the same as its rotation period; as a result it always keeps the same face toward Neptune. It has a very thin atmosphere of nitrogen and methane and a surface temperature of −390 °F (−235 °C). Its surface is covered with enormous expanses of ice sculpted with fissures, puckers, and ridge-crossed depressions. Geyser-like plumes observed by the VOYAGER 2 spacecraft may be gas venting through fissures when the surface is warmed by sunlight. Triton appears to have formed elsewhere in the solar system and to have been gravitationally captured by Neptune in the planet's early history.

triumph Ancient Roman ritual procession honouring a general who had won a major battle and killed at least 5,000 of the enemy. Senators and magistrates were followed by sacrificial animals, captured loot, and captives in chains. The general, in a purple-and-gold tunic, rode in a chariot, holding a laurel branch in his right hand and an ivory sceptre in his left, while a slave held a golden crown over his head. Lastly came the soldiers, who sang songs. Under the empire only the emperor and members of his family celebrated triumphs.

triumphal arch Monumental structure, originating in Rome, pierced by at least one arched passageway and erected to honour an important person or commemorate a significant event. It usually spanned a street or roadway and was built astride the line of march of a victorious army during its triumphal procession. Most were built during the empire period. The basic form consisted of two piers connected by an arch and crowned by a superstructure, or attic, that served as a base for statues and bore inscriptions. The large central arch could also be flanked by two smaller arches. The Roman triumphal arch had a facade of marble columns, and the archway and sides were adorned with relief sculpture. Among those built since the Renaissance is the ARC DE TRIOMPHE in Paris.

triumvirate \trī-'əm-vir-ət\ In ancient Rome, usually a board of three officials who assisted higher magistrates in judicial functions, oversaw festival banquets, or ran the mint. The First Triumvirate (60 BC) of POMPEY, Julius CAESAR, and CRASSUS was an informal group of three strong leaders with no sanctioned powers. The Second Triumvirate (43 BC), consisting of Mark ANTONY, LEPIDUS, and Octavian (later AUGUSTUS)—formally *tresviri rei publicae constituendae* ("triumvirate for organizing the state")—held absolute dictatorial power.

Troas \'trō-ˌas\ *or* **the Troad** Ancient region surrounding the city of TROY. It consisted mainly of the northwestern projection of Anatolia into the Aegean Sea. It extended from the Gulf of Edremit to the Sea of MARMARA and the DARDANELLES and from the Ida mountain range to the Aegean. St. PAUL visited the region on his missionary journeys.

Trobriand Islands \'trō-brē-ˌand\ *or* **Kiriwina Islands** \ˌkir-ə-'wē-nə\ Group of small coral islands, Solomon Sea, South Pacific Ocean, PAPUA NEW GUINEA. The islands are low-lying with coral reefs. The group has a total land area of about 170 sq mi (440 sq km). The largest, Kiriwina, is an atoll 30 mi (48 km) long and 3–10 mi (5–16 km) wide, covered largely with swamp; it served as an air and naval base for the Allies in 1943. Anthropologist BRONISLAW MALINOWSKI conducted research among the Trobriand islanders 1915–18.

Trobriander Any of the Melanesian people of the Kiriwina (TROBRIAND) Islands, lying off eastern New Guinea. Their subsistence is based on yams and other vegetables, domesticated pigs, and fish. Trobrianders are noted for their elaborate intertribal trading system, the *kula*, by which red shell necklaces are traded between permanent trading partners in a clockwise direction around a ring of islands; white shell bracelets are traded counterclockwise. Among the Trobrianders, wealth is extremely important as a sign of power. They were the subject of highly influential studies by BRONISŁAW MALINOWSKI.

Troilus and Cressida \'trȯi-ləs...'kre-si-də\ Lovers in medieval romance, based on characters from GREEK MYTHOLOGY. In the *Iliad*, Troilus, son of PRIAM and HECUBA, is dead before the TROJAN WAR starts. In non-Homeric legends he was said to have been killed during the war by ACHILLES. He was first turned into a romantic figure in the Middle Ages, when he was portrayed as an innocent young lover betrayed by the faithless Cressida, who abandoned him for the Greek warrior Diomedes. The first version of the story was written by the 12th-century TROUVÈRE Benoît de Sainte-Maure in the poem "Roman de Troie." More famous versions include GIOVANNI BOCCACCIO's "Il Filostrato," GEOFFREY CHAUCER's "Troilus and Criseyde," and WILLIAM SHAKESPEARE's drama *Troilus and Cressida.*

Trojan asteroids Two groups of ASTEROIDS named for heroes of Greece and Troy in Homer's *Iliad*. These objects revolve around the Sun at the Lagrangian points (see Joseph-Louis LAGRANGE) in Jupiter's orbit. Achilles, the first, was discovered in 1906. About 650 are known, but their actual number is estimated in the thousands. The term Trojan also applies to objects occupying the corresponding Lagrangian points in the orbits of other planets. Two such asteroids were discovered in Mars's orbit in the 1990s.

Trojan War Mostly legendary conflict between the Greeks and the people of TROY in western Asia Minor. It was dated by later Greeks to the 12th or 13th century BC. It is celebrated in HOMER's *Iliad* and *Odyssey*, in Greek tragedy, and in Roman literature. In Homer's account the Trojan prince PARIS ran off with the beautiful HELEN, wife of MENELAUS of Sparta, whose brother AGAMEMNON then led a Greek expedition to retrieve her. The war lasted 10 years; its participants included HECTOR, ACHILLES, PRIAM, ODYSSEUS, and AJAX. Its end resulted from a ruse: The Greeks built a large wooden horse in which a raiding party hid. When the Greeks pretended to leave, the Trojans brought the horse into the walled city and the Greeks swarmed out, opening the gates to their comrades and sacking Troy, killing the men and enslaving the women. The extent of the legend's actual historical content is not known; excavations have revealed human habitation from 3000 BC to AD 1200, and there is evidence of violent destruction about 1250 BC.

trolley car See STREETCAR

Trollope \'trä-ləp**, Anthony** (b. April 24, 1815, London, Eng.—d. Dec. 6, 1882, London) English novelist. He worked for the post office in England and Ireland from 1834 to 1867. Beginning in 1844 he produced 47 novels, writing mainly before breakfast at a fixed rate of 1,000 words an hour. His best-loved and most famous works are the six interconnected Barsetshire novels, including *Barchester Towers* (1857) and *The Last Chronicle of Barset* (1867). Depicting the social scene in an imaginary English county, they abound in memorable characters and atmosphere. The Palliser novels, dealing with political issues and featuring the character Plantagenet Palliser, include the sharply satirical *The Eustace Diamonds* (1872). Other works, such as *He Knew He Was Right* (1869), show great psychological penetration. *The Way We Live Now* (1875), with its ironic view of the Victorian upper classes, is especially highly regarded.

Anthony Trollope, oil painting by S. Laurence, 1865; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

trombone BRASS INSTRUMENT with an extendable slide with which the length of its tubing can be increased. It has a mostly cylindrical bore and a cup-shaped mouthpiece. The slide performs the same function as the valves in other brass instruments. Valve trombones, both with and without slides, were developed in the early 19th century; they provide increased agility but diminished tone quality. The trombone exists in several sizes; the tenor trombone in B-flat is the standard instrument, but the bass trombone is also used orchestrally. The trombone (long known as the sackbut) developed in the 15th century and has changed little over 400 years. By the 16th century it had been adopted by town, court, church, and military bands; it was employed in early opera orchestras, but it only began to be used in the symphony orchestra c. 1800. In the 20th century it became important in dance and jazz bands.

trompe l'oeil \trōⁿp-'lœi,\ *English* \ˌtrȯmp-'ləi\ *French* **"deceive the eye"** Style of representation in which a painted object is intended to deceive the viewer into believing it is the object itself. First employed by the ancient Greeks, trompe l'oeil was also popular with Roman muralists. Since the early Renaissance, European painters have used trompe l'oeil to create false frames from which the contents of still lifes or portraits seemed to spill and to paint windowlike images that appeared to be actual openings in a wall or ceiling.

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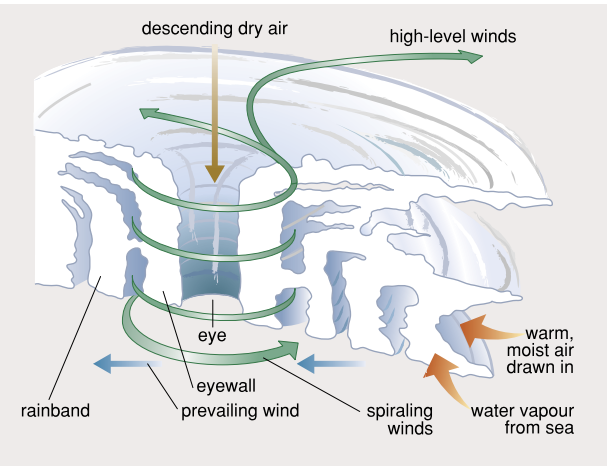
Trondheim \'trȯn-ˌhām\ City (pop., 2000: 148,859), central Norway. It is located on Trondheim Fjord, an inlet of the Norwegian Sea that extends 80 mi (130 km) inland. Trondheim was founded by King Olaf I Tryggvason in 997, and it prospered as a trade centre until the Hanseatic League made Bergen its chief port. The city declined until the late 19th century, when it was linked by rail to Oslo. Norway's third largest city, it is a major Norwegian land and sea transport link and a manufacturing centre.

Tropic of Cancer Parallel of latitude approximately 23°27' north of the terrestrial Equator. It is the northern boundary of the tropics and marks the northernmost latitude at which the Sun can be seen directly overhead at noon.

Tropic of Capricorn Parallel of latitude approximately 23°27' south of the terrestrial Equator. It is the southern boundary of the tropics and marks the southernmost latitude at which the Sun can be seen directly overhead at noon.

tropical cyclone Severe atmospheric disturbance in tropical oceans. Tropical cyclones have very low atmospheric pressures in the calm, clear centre (the eye) of a circular structure of rain, cloud, and very high winds. In the Atlantic and Caribbean they are called hurricanes; in the Pacific they are known as typhoons. Because of the Earth's rotation, tropical cyclones rotate clockwise in the Southern Hemisphere and counterclockwise in the Northern. They may be 50–500 mi (80–800 km) in diameter, and sustained winds in excess of 100 mph (160 kph) are common. In the eye, however, the winds drop abruptly to light breezes or even complete calm. The lowest sea-level pressures on Earth occur in or near the eye.



Cross section of a tropical cyclone. A cyclone derives its power from the warm air and water found at tropical latitudes. Its winds rotate around the low-pressure centre, or "eye," where relative calm prevails. Wind and rain are usually most severe in or near the eyewall.
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tropical fish Any of various small fishes of tropical origin often kept in aquariums. They are interesting for their behaviour or showiness or both. Popular varieties include the angelfish, guppy, kissing gourami, sea horse, Siamese fighting fish, and tetra.

tropical medicine Science of diseases seen primarily in tropical or subtropical climates. It arose in the 19th century when European colonial doctors encountered infectious diseases unknown in Europe. The discovery that many tropical diseases (e.g., malaria, yellow fever) were spread by mosquitoes led to discovery of other vectors' roles (see sleeping sickness, plague, typhus) and to efforts to destroy vector breeding grounds (e.g., by draining swamps). Later, antibiotics came to play an increasingly important role. Research institutes and national and international commissions were organized to control common tropical illnesses, at least in areas with Europeans. As colonies became independent, their governments took over most of these efforts, with help from the World Health Organization and the former colonizing countries.

troposphere \'trō-pə-ˌsfir\ Lowest region of the atmosphere, bounded by the Earth below and the stratosphere above, with the upper boundary being about 6–8 mi (10–13 km) above the Earth's surface. The troposphere is marked by decreasing temperature with height, which distinguishes it from the stratosphere. Most clouds and weather systems occur in the troposphere.

Troppau \'trȯ-ˌpaů**, Congress of** (1820) Meeting of the Holy Alliance powers held at Troppau in Silesia (modern Opava, Czech Rep.). Attended by representatives of Austria, Russia, and Prussia and by observers from Britain and France, the alliance signed a declaration of intention (the Troppau protocol) to take collective action against revolution. The congress agreed that states having undergone revolutions would be excluded from the European alliance. They invited the king of the Two Sicilies to meet at the Congress of Laibach to discuss intervention against the revolution in Naples. Britain and France did not accept the protocol, demonstrating the division between the eastern and western members of the alliance and seriously weakening it.

Trotsky, Leon *orig.* **Lev Davidovich Bronshtein** (b. Nov. 7, 1879, Yanovka, Ukraine, Russian Empire—d. Aug. 20, 1940, Coyoacán, Mex., near Mexico City) Russian communist leader. Born to Russian Jewish farmers, he joined an underground socialist group and was exiled to Siberia in 1898 for his revolutionary activities. He escaped in 1902 with a forged passport using the name Trotsky. He fled to London, where he met Vladimir Lenin. In 1903, when the Russian Social-Democratic Workers' Party split, Trotsky became a Menshevik, allying himself with Lenin's opponents. He returned to St. Petersburg to help lead the Russian Revolution of 1905. Arrested and again exiled to Siberia, he wrote *Results and Prospects*, setting forth his theory of "permanent revolution." He escaped to Vienna in 1907, worked as a journalist in the Balkan Wars (1912–13), and moved around Europe and the U.S. until the Russian Revolution of 1917 brought him back to St. Petersburg (then Petrograd), where he became a Bolshevik and was elected leader of the workers' soviet. He played a major role in the overthrow of the provisional government and the establishment of Lenin's communist regime. As commissar of war (1918–24), Trotsky rebuilt and brilliantly commanded the Red Army during the Russian Civil War. Although favoured by Lenin to succeed him, Trotsky lost support after Lenin's death (1924) and was forced out of power by Joseph Stalin. After a campaign of denunciation, he was expelled from the Politburo (1926) and Central Committee (1927), then banished from Russia (1929). He lived in Turkey and France, where he wrote his memoirs and a history of the revolution. Under Soviet pressure, he was forced to move around Europe and eventually found asylum in 1936 in Mexico, where, falsely accused in the purge trials as the chief conspirator against Stalin, he was murdered in 1940 by a Spanish communist.

Trotsky
H. ROGER-VIOLLET

Trotskyism Marxist ideology based on the theory of permanent revolution first expounded by Leon Trotsky. Trotsky believed that because all national economic development was affected by the laws of the world market, a revolution depended on revolutions in other countries for permanent success, a position that put him at odds with Joseph Stalin's "socialism in one country." After Trotsky's exile in 1929, Trotskyists continued to attack the Soviet bureaucracy as "Bonapartist" (based on the dictatorship of one man). In the 1930s Trotskyists advocated a united front with trade unions against fascism. After Trotsky's murder (1940), Trotskyism became a generic term for various revolutionary doctrines that opposed the Soviet form of communism. See also Leninism, Marxism, Stalinism.

troubadour \'trü-bə-ˌdȯr, 'trü-bə-ˌdůr\ One of a class of lyric poets and poet-musicians, often of knightly rank, that flourished from the 11th through the 13th century, chiefly in Provence and other regions of southern France, northern Spain, and northern Italy. They wrote in the *langue d'oc* of southern France (see Languedoc) and cultivated a lyric poetry intricate in metre and rhyme and usually of a romantic amatory strain reflecting the ideals of courtly love. Favoured at courts, troubadours had great freedom of speech and were charged with creating around the court ladies an aura of pleasant cultivation. Their poetry, often set to music, was to influence all later European lyrical poetry. See also trouvère.

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Troubles, Time of (1606–13) Period of political crisis in Russia. After the death of Fyodor I and the end of the Rurik dynasty (1598), the boyars opposed the rule of Boris Godunov and after his death placed the nobleman Vasily Shuysky (1552–1612) on the throne in 1606. Shuysky's rule was weakened by revolts, challenges by the second False Dmitry, and the invasion of Russia by the Polish king Sigismund III Vasa in 1609–10. The Russians finally rallied against the Polish invaders and succeeded in ousting them from their control of Moscow in 1612. A new representative assembly met in 1613 and elected Michael Romanov as tsar, commencing the 300-year reign of the Romanov dynasty.

trout Any of several prized game and food fishes of the family Salmonidae, native to the Northern Hemisphere but widely introduced elsewhere. Though most species inhabit cool fresh waters, a few (called sea trout; e.g., cutthroat trout) migrate to the sea between spawnings. Some weakfish are also called sea trout. The genus *Oncorhynchus* includes salmon and several trout species; *Salvelinus* contains trout species regarded as chars. Trout species vary greatly in anatomy, colour, and habits. Most live among submerged objects or in riffles and deep pools, eating insects, small fishes and their eggs, and crustaceans. See also brook trout; brown trout; lake trout; rainbow trout.

trouvère \trü-ˈver\ One of a school of poets that flourished in northern France from the 11th to the 14th century. Trouvères were the counterparts in the language of northern France (the *langue d'oïl*) to the Provençal troubadour. Of either aristocratic or humble origins, they were originally connected with feudal courts but later found middle-class patrons. Noted for such forms as the chanson de geste, their works are generally narratives; their basic subject was courtly love. Trouvères pleased their audiences by combining stylized themes and traditional metrical forms rather than by originality of expression. The lyrics were intended to be sung, by the poet alone or accompanied by a hired musician.

Trowbridge \ˈtrō-ˌbrij\ Town (pop., 1995 est.: 30,000), county seat of Wiltshire, southern England. Trowbridge has some notable buildings, including St. James's parish church, which dates from the 14th century. George Crabbe was rector there toward the end of his life. The town is famous for its fine woolen cloth.

Troy *or* **Ilium** Ancient city in Troas, northwestern Anatolia. It holds an enduring place in both literature and archaeology. In literature, it is well known as the location of the Trojan War. The archaeological site, a huge mound at modern Hisarlık, Tur., on the Menderes (Scamander) River, was first excavated by archaeologist Heinrich Schliemann (1870–90). It consists of nine major layers dating from the early Bronze Age to Roman times (c. 3000 BC–4th century AD). In Greek legend, the city was besieged by the Greeks for 10 years and finally destroyed. Its story is told in Homer's *Iliad* and *Odyssey* and in Virgil's *Aeneid*. Whether the site is the actual city of these works is still debated, but the archaeological evidence indicates that a city (Troy VIIa) was destroyed at that location c. 1260–40 BC and likely was the Homeric Troy. The ruins were designated a UNESCO World Heritage site in 1998.

Trubetskoy \ˌtrü-byit-ˈskȯi**, Nikolay (Sergeyevich)** (b. April 16, 1890, Moscow, Russia—d. June 25, 1938, Vienna, Austria) Russian linguist. Born into a family of scholars, he held professorships in Russia and (from 1922) at the University of Vienna. One of the founders of the Prague school of linguistics, he was noted as the author of the school's most important work on phonology, *Principles of Phonology* (1939). Influenced by Ferdinand de Saussure, Trubetskoy redefined the phoneme functionally as the smallest distinctive unit within the structure of a language. He died of a heart attack after being persecuted by the Nazis for criticizing racist theory.

Truce of God Measure by the medieval Roman Catholic Church to suspend warfare on certain days of the week and for certain church festivals and Lent. It was instituted in France as early as 1027, and elsewhere in Europe (excluding England) during the next several decades. The popes later took its direction into their own hands, and the first decree of the Council of Clermont (1095) proclaimed a weekly truce for all Christendom, with an oath of adherence to be taken by all men over age 12. The truce was most powerful in the 12th century but was never entirely effective.

Trucial States See United Arab Emirates

truck *or* **lorry** Motor vehicle designed to carry freight or heavy articles. The first truck was built in Germany in 1896 by Gottlieb Daimler. By the 1920s trucks had become a major means of freight transport. Gasoline engines for trucks were common until the 1940s, when diesel engines generally replaced them. Trucks may be either straight (all axles attached to the frame) or articulated (two or more frames connected by couplings); large articulated trucks consist of a towing tractor and a connected semitrailer. Air brakes were added to trucks in 1918 and four-wheel brakes in 1925; later improvements included power steering.

Trudeau, Pierre (Elliott) (b. Oct. 18, 1919, Montreal, Que., Can.—d. Sept. 28, 2000, Montreal) Prime minister of Canada (1968–79, 1980–84). He practiced law before being elected to the Canadian House of Commons (1966–84). He was minister of justice (1967–68) in Lester Pearson's administration. He became leader of the Liberal Party and prime minister in 1968. A determined antiseparatist, he advocated a strong federal government and took a determined stand against separatist terrorists. After nine months out of office, he returned in 1980 to initiate reforms that called for the constitutional "patriation," or transfer, of the amending authority from the British Parliament to Canada. To this end, he effected passage of the Canada Act, which precipitated Canada's official independence from Britain. His term saw the adoption of official bilingualism. He spent his final years in office seeking greater economic independence for Canada, forming better trade relations between industrialized democracies and developing countries, and urging further international disarmament talks. He resigned as leader of the Liberal Party and retired from politics in 1984, by which time he was the longest-serving leader of any Western democracy.

Truffaut \trüē-ˈfō,\ *English* \trü-ˈfō**, François** (b. Feb. 6, 1932, Paris, France—d. Oct. 21, 1984, Neuilly-sur-Seine, near Paris) French film director and critic. As a film critic for the avant-garde *Cahiers du Cinéma*, he advocated the auteur theory and helped establish the New Wave movement. His first feature film was the semi-autobiographical *The 400 Blows* (1959), a portrait of a delinquent boy, that won him international acclaim. Influenced by Jean Renoir and Alfred Hitchcock, he made varied and admired movies such as *Shoot the Piano Player* (1960), *Jules and Jim* (1961), *Fahrenheit 451* (1966), *Stolen Kisses* (1968), *The Wild Child* (1969), *Day for Night* (1973, Academy Award), *The Story of Adèle H.* (1975), and *The Last Metro* (1980). His films record life's grayness and flatness with a sense of resignation quite distinct from platitude or petulant nihilism.

truffle Edible, underground fungus in the genus *Tuber* (class Ascomycetes, division Mycota), prized as a food delicacy since antiquity. Native mainly to temperate regions, truffles flourish in open woodlands on calcium-rich soil. The different species range from pea-sized to orange-sized. Truffles usually are associated with tree roots and are found up to about 1 ft (30 cm) below the soil surface. Experienced gatherers occasionally detect mature truffles by scent or by the morning and evening presence of hovering columns of small yellow flies, but more often with the help of trained pigs or dogs. The truffle is important in French cookery, and truffle gathering is an important industry in France. Truffles are among the most highly valued foods in the world. False truffles (genus *Rhizopogon*) form small, underground, potato-like structures under coniferous trees in parts of North America.

English truffle (*Tuber aestivum*).
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Trujillo \trü-ˈhē-yō\ **(Molina), Rafael (Leónidas)** (b. Oct. 24, 1891, San Cristóbal, Dom.Rep.—d. May 30, 1961, Ciudad Trujillo, near San Cristóbal) Dictator of the Dominican Republic (1930–61). He entered the army in 1918 and rose through the ranks to become a general in 1927. In 1930 he seized power from Pres. Horacio Vásquez, and from then until his assassination he remained in absolute control of the country. Though he introduced a degree of economic modernization, its benefits were distributed inequitably, government corruption was rife, and Dominicans suffered the loss of civil and political liberties under his regime.

trullo Circular stone building roofed with a conical construction of dry stone masonry, unique to the region of Puglia in southeastern Italy and especially to the town of Alberobello, where trulli are used as dwellings. Trulli were built by piling circular courses of gray stone to a pinnacle on

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a whitewashed cylindrical wall. No mortar was used; the stones were held in place by gravity and pressure against one another.

Truman, Harry S. (b. May 8, 1884, Lamar, Mo., U.S.—d. Dec. 26, 1972, Kansas City, Mo.) 33rd president of the U.S. (1945–53). He worked at various jobs before serving with distinction in World War I. He became a partner in a Kansas City haberdashery; when the business failed, he entered Democratic Party politics with the help of Thomas Pendergast. He was elected county judge (1922–24), and he later became presiding judge of the county court (1926–34). His reputation for honesty and good management gained him bipartisan support. In the U.S. Senate (1935–45), he led a committee that exposed fraud in defense production. In 1944 he was chosen to replace the incumbent Henry Wallace as the Democratic Party vice presidential nominee, and he won election with Pres. Franklin D. Roosevelt. After only 82 days as vice president, he became president on Roosevelt's death (April 1945). He quickly made final arrangements for the San Francisco charter-writing meeting of the UN, helped arrange Germany's unconditional surrender on May 8, which ended World War II in Europe, and in July attended the Potsdam Conference. The Pacific war ended officially on September 2, after he ordered atomic bombs dropped on Hiroshima and Nagasaki; his justification was a report that 500,000 U.S. troops would be lost in a conventional invasion of Japan. He announced what would become known as the Truman Doctrine, which entailed aid for Greece and Turkey (1947); established the Central Intelligence Agency; and pressed for passage of the Marshall Plan to aid the economic recovery of western Europe. In the 1948 presidential election he defeated Thomas Dewey despite widespread expectation of his own defeat. On July 26, 1948, Truman issued an executive order banning segregation in the armed forces. He initiated a foreign policy of containment to restrict the Soviet Union's sphere of influence, pursued his Point Four Program, and initiated the Berlin airlift (see Berlin blockade and airlift) and the NATO pact of 1949. He sent troops under Gen. Douglas MacArthur to fight in the Korean War. Problems of pursuing the war occupied his administration until he retired. Though he was often criticized during his presidency, his reputation grew steadily in later years.

Truman Doctrine Pronouncement by Pres. Harry Truman. On March 12, 1947, he called for immediate economic and military aid to Greece, which was threatened by a communist insurrection, and to Turkey, which was under pressure from Soviet expansion in the Mediterranean. Engaged in the Cold War with the Soviet Union, the U.S. sought to protect those countries from falling under Soviet influence after Britain announced that it could no longer give them aid. In response to Truman's message, Congress appropriated $400 million in aid.

Trumbull, John (b. June 6, 1756, Lebanon, Conn.—d. Nov. 10, 1843, New York, N.Y., U.S.) U.S. painter, architect, and author. The son of Gov. Jonathan Trumbull (1710–85), he served as an aide to George Washington during the American Revolution and later as secretary to John Jay in London. In 1784 he studied painting in London with Benjamin West, and with West's encouragement he began the celebrated series of historical paintings and engravings he would work on throughout his life. In 1817 he was commissioned by Congress to paint the four large pictures that decorate the Capitol rotunda (completed 1826); most of the figures in the often-reproduced *Declaration of Independence* were painted from life.

Trump, Donald J(ohn) (b. 1946, New York, N.Y., U.S.) U.S. real-estate developer. He joined his father's Trump Organization (1968) and expanded its holdings of rental housing. By the 1990s Trump's business empire encompassed a number of high-rises (including the Empire State Building), hotels, and condominiums, including Trump Tower; more than 25,000 rental and co-op apartment units in Queens and Brooklyn; and several hotel-casino complexes in the nearby gambling centre of Atlantic City, N.J. An economic slump in the late 1980s forced him to cede partial control of his properties to creditors, but his fortunes rebounded in the 1990s, and he embarked on a vast building project on New York's West Side. His political ambitions and enjoyment of publicity combined to keep him in the public eye.

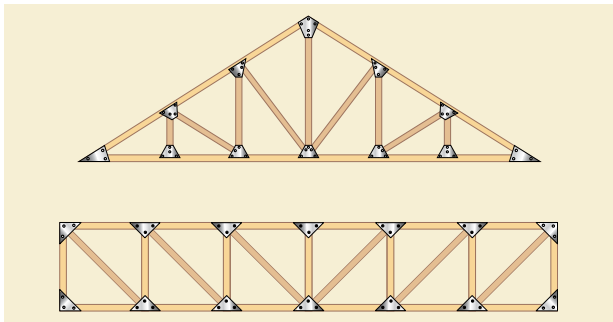
trumpet Brass instrument with tubing twice-folded in an elongated shape. (In its broad sense, trumpet may refer to any lip-vibrated instrument.) The modern trumpet has a mostly cylindrical bore, three valves, and a cup-shaped mouthpiece, and it is usually a B-flat or C instrument. The trumpet had taken its basic modern shape, with its ovoid loop, by c. 1500. In the 17th–18th centuries it employed crooks (removable lengths of tubing) to enable playing in different keys. The valved trumpet was developed in the 1820s. The trumpet has been associated with ceremonial and military uses since the 16th century. It joined the standard orchestra by c. 1700, though it was only selectively used, usually with the timpani. Its brilliant sound has since made it indispensable in a wide variety of ensembles. See also cornet; flügelhorn.

trumpeter swan Black-billed species (*Cygnus cygnus buccinator*) of swan, named for its far-carrying, low-pitched call. About 6 ft (1.8 m) long, with a 10-ft (3-m) wingspan, it is the largest swan, though it weighs less than the mute swan. Once threatened with extinction (fewer than 100 were counted in the U.S. in 1935), it has made a strong comeback; though still listed as vulnerable, its population in western Canada and the northwestern U.S. now exceeds 5,000.

Truong Chinh \trü-'ȯŋ-'chin\ *orig.* **Dang Xuan Khu** (b. Feb. 9, 1907, Ha Nam Ninh province, Viet.—d. Sept. 30, 1988, Hanoi) Vietnamese statesman, writer, and communist intellectual. He was an anticolonialist activist as a youth, joining Ho Chi Minh in 1928. He became a teacher and joined the Indochinese Communist Party, becoming its secretary-general in 1941. With Vo Nguyen Giap he developed the strategy that led to a Vietnamese victory over the Japanese occupation forces in 1945. With Le Duan (1908–86) and Pham Van Dong (1906–2000) he ruled North Vietnam after Ho's death in 1969.

Truro City (pop., 1995 est.: 25,000), county seat of Cornwall, southwestern England. It is located on the River Truro at the head of Falmouth Harbor. Industries include food processing and light engineering.

truss In building construction, a structural frame usually fabricated from pieces of metal or timber to form a series of triangles lying in a single plane. The linear members are subject only to compression or tension. The horizontal pieces forming the top and bottom of the truss are called the chords, and the sloping and vertical pieces connecting the chords are collectively called the web. Unlike a vault, the truss exerts no thrust but only downward pressure; supporting walls require no buttressing or extra thickening. Trusses have been used extensively in roofing and bridges. Wood trusses were probably first used in primitive dwellings c. 2500 BC. Wood was replaced by iron, which in turn was succeeded by steel.



A truss's outer members are called the chords, its interior members are called the web members, and each triangular section is called a panel. A pitched truss (top) has inclined top chords; a flat truss (bottom) has parallel top and bottom chords.
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trust In law, a relationship between parties in which one, the trustee or fiduciary, has the power to manage property, and the other, the beneficiary, has the privilege of receiving the benefits from that property. Trusts are used in a variety of contexts, most notably in family settlements and in charitable gifts. The traditional requirements of a trust are a named beneficiary and trustee, an identified property (constituting the principal of the trust), and delivery of the property to the trustee with the intent to create a trust. Trusts are often created for the sake of advantageous tax treatment (including exemption). A charitable trust, unlike most trusts, does not require definite beneficiaries and may exist in perpetuity. See also trust company.

trust company Company, often a commercial bank, acting as trustee for individuals and businesses and providing related financial or estate-planning services. Trust services for individuals commonly include the administration of estates, living trusts (trusts that become effective during the lifetimes of their makers, or settlors), and testamentary trusts (trusts originating in a will). Services for businesses include the admin-

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istration of corporate bond indentures and corporate pension funds. Trust companies may also serve as corporate stock registrars and as paying agents for the distribution of dividends.

trust fund Property (e.g, money or securities) held in a trust; that is, property held legally by one party (the legal owner) for the benefit of another party (the equitable owner). The legal owner, or trustee, has the right of possession and the right of use of the property, but must exercise those rights to the benefit of the equitable owner, or beneficiary. In Anglo-American law, trust funds are set up principally for family settlements and for charitable giving. In the commercial sector, trust funds are often set up to provide for employee pensions and profit-sharing programs.

truth In philosophy, the property of statements, thoughts, or propositions that are said, in ordinary discourse, to agree with the facts or to state what is the case. At least four major types of truth theory have been proposed: correspondence theories (see REALISM), coherence theories (see COHERENTISM, IDEALISM), pragmatic theories (see PRAGMATISM), and deflationary theories. The latter group encompasses a wide variety of views, including the redundancy theory, the disquotation theory, and the prosentential theory.

Truth, Sojourner *orig.* **Isabella Van Wagener** (b. c. 1797, Ulster county, N.Y., U.S.—d. Nov. 26, 1883, Battle Creek, Mich.) U.S. evangelist and social reformer. The daughter of slaves, she spent her childhood as an abused chattel of several masters. After being freed in about 1827, she worked as a domestic in New York City (1829–43) and began preaching on street corners with the evangelical missionary Elijah Pierson. Adopting the name Sojourner Truth, she left New York to obey a "call" to travel and preach. Adding ABOLITIONISM and women's rights to her religious messages, she traveled in the Midwest, where her magnetism drew large crowds. At the start of the AMERICAN CIVIL WAR she gathered supplies for black volunteer regiments. In 1864 she went to Washington, D.C., where she helped integrate streetcars and was received at the White House by Pres. ABRAHAM LINCOLN. After the war she worked for the freedmen's relief organization and encouraged migration to Kansas and Missouri.

Sojourner Truth.
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TRW Inc. U.S. manufacturer of advanced equipment and systems for industry and government. Founded in 1901 as a maker of cap screws, it was incorporated in 1916 as the Steel Products Co. The name was changed to Thompson Products, Inc., in 1926, then to Thompson Ramo Wooldridge Inc. after a merger in 1958, and to TRW Inc. in 1965. Through its various divisions and subsidiaries, TRW designed and manufactured a wide range of automotive parts, electronic systems for military aircraft, and spacecraft. Its information systems and services segments maintain databases for screening credit histories. In 2002 defense contractor Northrop Grumman acquired TRW for its aerospace division.

tryptophan \'trip-tə-ˌfan\ One of the essential AMINO ACIDS. It is a HETEROCYCLIC COMPOUND that is found in small amounts in most PROTEINS. It plays an important role in the growth and development of infants and in the biosynthesis of SEROTONIN and NIACIN (thus, deficiency of niacin or tryptophan can cause PELLAGRA). Its occurrence in milk has been suggested as the reason that drinking milk before bedtime helps people sleep. It is used in medicine and nutrition research, in enriched foods, and as a dietary supplement.

Ts'ai-shen See CAISHEN

Ts'ao Chan See CAO ZHAN

Ts'ao Ts'ao See CAO CAO

tsar *or* **czar** \'zär, '(t)sär\ Byzantine or Russian emperor. The title, derived from *caesar*, was used in the Middle Ages to refer to a supreme ruler, particularly the Byzantine emperor. With the fall of the BYZANTINE EMPIRE in 1453, the Russian monarch became the only remaining Orthodox monarch, and the Russian Orthodox clergy considered him a possible new supreme head of Orthodox Christianity. IVAN IV (the Terrible) was the first to be crowned tsar, in 1547. Though theoretically wielding absolute power, he and his successors were limited by the power of the Orthodox church, the Boyar Council, and the successive legal codes of 1497, 1550, and 1649. In 1721 PETER I changed his title to "Emperor of All Russia," but he and his successors continued to be popularly called tsars.

Tsaritsyn See VOLGOGRAD

Tsavo \'tsä-ˌvō\ **National Park** Park, southeastern Kenya, east of Mount KILIMANJARO. Established in 1948, it covers 8,036 sq mi (20,812 sq km) and is Kenya's largest national park. It comprises semiarid plains covered by dormant vegetation (which blooms after a light rain) and acacia and baobab trees. Wildlife includes elephants, lions, rhinoceroses, hippopotamuses, hartebeests, and hundreds of bird species. Poaching and brush fires are constant problems.

Tschermak von Seysenegg \'cher-ˌmäk-fȯn-'zī-zə-ˌnek**, Erich** (b. Nov. 15, 1871, Vienna, Austria—d. Oct. 11, 1962, Vienna) Austrian botanist. He was one of the codiscoverers of GREGOR MENDEL's classic papers on heredity and the garden pea. Before running across Mendel's papers he had conducted his own breeding experiments with the garden pea, but he found that Mendel's work duplicated and in some ways surpassed his own. In the same year that he reported his findings (1900), HUGO DE VRIES and CARL ERICH CORRENS also reported their discovery of Mendel's papers. See also WILLIAM BATESON.

Tselinograd See ASTANA

Tseng Kuo-fan See ZENG GUOFAN

tsetse fly \'tset-sē, 'tsē-tsē\ Any of about 21 species (genus *Glossina*, family Muscidae) of African bloodsucking DIPTERANS that are robust, sparsely bristled, and usually larger than a HOUSEFLY. They have stiff, piercing mouthparts. Only two species commonly transmit the protozoan parasites (trypanosomes) that cause human SLEEPING sickness: *G. palpalis*, found primarily in dense streamside vegetation, and *G. morsitans*, found in more open woodlands. The female requires a sufficient blood meal to produce viable larvae, but both sexes suck blood almost daily.

Tshombe \'chȯm-bā**, Moise (-Kapenda)** (b. Nov. 10, 1919, Musumba, Belgian Congo—d. June 29, 1969, Algiers, Alg.) President of the secessionist African state of Katanga (1960–63) and premier of the united Congo Republic (1964–65). After losing national elections to PATRICE LUMUMBA in 1960, Tshombe declared his Katanga province independent. When the UN intervened in 1963, he was forced into exile; he returned the following year as premier in JOSEPH KASAVUBU's government but was dismissed in 1965. See also MOBUTU SESE SEKO.

Tsimshian \'chim-shē-ən\ One of the peoples of the NORTHWEST COAST INDIANS living in the Skeena and Nass river area in west-central British Columbia, Can., and southern Alaska, U.S. The Tsimshian dialects belong to the family of PENUTIAN LANGUAGES. The traditional economy was based on fishing, with some hunting in winter. Large winter houses, made of wood and often carved and painted, symbolized family wealth. Descent was traced through the maternal line. Lineages functioned largely independently, but all participated in major ceremonies and in warfare. Various important events were marked by a POTLATCH. At the turn of the 21st century the Tsimshian numbered in the thousands.

Tsinan See JINAN

Tsinghai See QINGHAI

Tso chuan See ZUO ZHUAN

Ts'u-hsi See CIXI

Tsugaru \tsü-'gär-ü\ **Strait** Strait, northwestern Pacific Ocean. It extends from the Sea of JAPAN (East Sea) to the open ocean between the islands of HONSHU and HOKKAIDO, Japan. It is 15–25 mi (24–40 km) wide. The Seikan Tunnel linking Aomori and Hakodate cities runs beneath the strait. Completed in 1988, it is the longest railway tunnel in the world; 14.5 mi (23.3 km) of its 33.5 mi (53.9 km) length lie under the strait.

tsunami \tsù-'nä-mē\ *or* **seismic sea wave** *or* **tidal wave** Catastrophic ocean WAVE, usually caused by a submarine earthquake. Underwater or coastal landslides or volcanic eruptions also may cause tsunamis. The term *tsunami* is Japanese for "harbour wave." The term *tidal wave* is a misnomer, because the wave has no connection with the tides. Perhaps

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the most destructive tsunami ever occurred in 2004 in the Indian Ocean, after an earthquake struck the seafloor off the Indonesian island of Sumatra. More than 200,000 people were killed in Indonesia, Thailand, India, Sri Lanka and other countries as far away as Somalia on the Horn of Africa.

Tsvet \ˈtsvet**, Mikhail (Semyonovich) Tsvet** *also spelled* **Tsvett** *or* **Tswett** (b. May 14, 1872, Asti, Italy—d. June 26, 1919, Voronezh, Russian S.F.S.R.) Italian-born Russian botanist and chemist. He is credited with the discovery (in 1903) and application of CHROMATOGRAPHY. In 1910 he described how he extracted plant PIGMENTS with ether and alcohol and percolated the solution through columns of calcium carbonate or powdered sugar; the different pigments appeared as separate coloured bands. Tsvet discovered several new CHLOROPHYLLS and coined the words *chromatography* and *carotenoid*. His work was not discovered by mainstream Western scientists for nearly 30 years.

Tsvetayeva \tsvʸi-ˈtå-yə-və**, Marina (Ivanovna)** (b. Oct. 8, 1892, Moscow, Russia—d. Aug. 31, 1941, Yelabuga) Russian poet. After spending most of her youth in Moscow, she began studies at the Sorbonne in Paris at age 16. She published her first poetry collection in 1910. Her verses on the Russian Revolution glorify the anti-Bolshevik resistance, of which her husband was a part. She lived abroad from 1922 to 1939, mostly in Paris, writing varied works including poetry that increasingly reflected nostalgia for her homeland. Many of her best and most typical poetic qualities are displayed in the long verse fairy tale *Tsar-devitsa* (1922; "Tsar-Maiden"). Separated from her husband and daughter and isolated from friends after the evacuation of Moscow, she committed suicide. Though little known outside Russia, she is considered one of the finest 20th-century poets in Russian.

Tswana \ˈtswä-nə\ Westerly division of the SOTHO peoples of South Africa and Botswana. The Tswana, numbering 4.1 million, live in a grassland environment in which they raise livestock and grow corn and sorghum. There is a seasonal migration of Tswana men, many of whom work in the mining and industrial centres of South Africa.

Tu Fu See DU FU

t'u-ti See TUDI

Tuamotu \ˌtü-ə-ˈmō-tü\ **Archipelago** Group of about 80 islands (pop., 1996: 14,283), FRENCH POLYNESIA. The archipelago comprises 75 atolls, one raised coral atoll (Makatea), and innumerable coral reefs, roughly dispersed northwest-southeast as a double chain for over 900 miles (1,450 km). Europeans visited the islands in the 16th–17th centuries. France occupied them in 1844 and annexed them in 1880 as a Tahitian dependency. They now form, with the GAMBIER ISLANDS, an administrative division of French Polynesia. In 1947 THOR HEYERDAHL's Kon-Tiki expedition ended on Raroia—one of Tuamotu's many reefs. France has used some uninhabited atolls in the archipelago for nuclear testing.

Tuareg \ˈtwä-ˌreg\ A member of a nomadic Berber-speaking people of the southwestern Sahara in Africa. Their feudal, matrilineal culture divides society into nobles, clergy, vassals, artisans, and labourers (once slaves). Northern Tuareg live mainly in true desert; southern Tuareg live in steppe and savanna. They have traditionally engaged in herding, agriculture, convoying caravans across their territories, and raiding neighbouring tribes. They combine many pre-Islamic rituals and customs with Sunnite Muslim beliefs. Droughts in the 1970s and '80s reduced their numbers and eroded their traditional way of life.

tuatara \ˌtü-ə-ˈtä-rə\ Either of two species (*Sphenodon punctatus* and *S. guntheir*) of lizardlike, nocturnal REPTILES of the order Rhynchocephalia, found on certain islets of New Zealand. Up to 2 ft. (60 cm) long and weighing over 2 lbs (1 kg), tuataras have two pairs of well-developed limbs, a scaly crest down the neck and back, a third eyelid that closes horizontally, and a pineal eye between the two normal eyes. A bony arch behind the eyes distinguishes tuataras from lizards. They eats insects, other small animals, and birds' eggs. In spring, they lay 8–15 eggs away from their burrow. Tuataras may live about 100 years.

Tuatha Dé Danann \ˈtü-ə-hə-ˈdʸā-ˈdå-nən\ In Celtic mythology, a race inhabiting Ireland before the arrival of the Milesians, the ancestors of the modern Irish. Skilled in magic, they were banished from heaven because of their knowledge and descended on Ireland in a cloud of mist. They were thought to have disappeared into the hills when overcome by the Milesians. They were regarded as actual people by native historians up to the 17th century. Representative of the Celtic pantheon, they have become associated in popular legend with the numerous fairies still said to inhabit the Irish landscape.

tuba Deep-pitched valved BRASS INSTRUMENT with a widely expanding conical bore. Tubas vary in size and pitch. The tubing is coiled in an oblong shape, and the bell points upward or forward. Patented in Berlin in 1835, the tuba displaced the ophicleide to become the foundation of the brass section in the orchestra and in military and brass bands. See also EUPHONIUM, SOUSAPHONE.

Tubb, Ernest (Dale) (b. Feb. 9, 1914, Crisp, Texas, U.S.—d. Sept. 6, 1984, Nashville, Tenn.) U.S. COUNTRY MUSIC singer and songwriter. His first musical influence was the yodeling of JIMMIE RODGERS. He became one of the earliest exponents of honky-tonk with hits such as "I'm Walking the Floor over You" (1941). He joined the GRAND OLE OPRY in 1942, and he became one of the first musicians to record in Nashville. He was a pioneer of the electric guitar in the early 1950s. His Nashville radio program, *Midnight Jamboree* (from 1947), helped launch many stars, including the Everly Brothers and ELVIS PRESLEY. In 1947 he starred in the first country music show at Carnegie Hall.

tube worm Any of numerous species of sedentary, solitary or colonial, marine WORMS that spend their entire life in a tube made from special secretions or from sand grains glued together. Found worldwide, tube worms range from less than an inch (25 mm) to more than 20 ft (6 m) long. The bottom of the tube is attached to the seafloor; the mouth and tentacles are at the upper, open end. The worm breathes through gills, the tentacles, or the body wall. The tentacles, variously arranged, are used to filter-feed aquatic plants and animals. Tube worms occur in the ANNELID class Polychaeta and in the phyla Phoronida and Pogonophora. Many, mostly unnamed, forms live in deep-ocean vent communities.

tuber Short, thickened, mostly underground STEM that constitutes the resting stage of certain seed plants. It is often an organ of food storage, reproduction, or both. It bears minute scale leaves, each with a bud that has the potential for developing into a new plant. The common POTATO is a typical tuber; the much-reduced leaves and associated buds form its "eyes." The term is also used imprecisely but widely for fleshy roots or RHIZOMES that resemble tubers (e.g., the "tuber" of the DAHLIA, actually a tuberous root).

tuberculosis \tü-ˌbər-kyə-ˈlō-səs\ **(TB)** *formerly* **consumption** BACTERIAL DISEASE caused by some species of MYCOBACTERIUM (tubercle BACILLUS). Mentioned in ancient Egyptian records and by HIPPOCRATES, it has occurred throughout history worldwide. In the 18th–19th centuries it reached near-epidemic proportions in the rapidly industrializing and urbanizing Western world, where it was the leading cause of death until the early 20th century. TB resurged in the 1980s, spreading from AIDS patients to others, especially in prisons, homeless shelters, and hospitals, since enclosed settings promote spread. It occurs worldwide and is still a major cause of death in many countries. The body isolates the bacilli by forming tiny tubercles (nodules) around them. This often arrests TB's progress and no symptoms occur, but if the disease is not treated, it may become active—and contagious—later in life, most often when the immunity of the infected individual is suppressed (e.g., AIDS, after organ TRANSPLANT). The original tubercle breaks down, releasing still viable bacilli into the bloodstream to cause a new infection, which starts with loss of energy and weight and persistent cough. Health deteriorates, with increasing cough and possibly pleurisy (see THORACIC CAVITY) and spitting up blood. Growing tubercle masses may destroy so much lung tissue that RESPIRATION cannot supply the body with enough oxygen. Other organs can be affected, with complications including MENINGITIS. A VACCINE with weakened bacteria has helped control infection, but preventing exposure by recognizing and treating active TB early is more effective. Because many strains are resistant to drugs, treatment requires at least two drugs to which the patient's strain is sensitive and at least six months; inadequate treatment lets resistant bacilli multiply. The acute disease caused by multidrug-resistant strains is very hard to cure and usually fatal.

Tubman, Harriet *orig.* **Arminta Ross** (b. c. 1820, Dorchester county, Md., U.S.—d. March 10, 1913, Auburn, N.Y.) U.S. abolitionist. Born into slavery, she escaped to the North by the UNDERGROUND RAILROAD in 1849. She made frequent trips into the South to lead over 300 slaves to freedom, despite large rewards offered for her arrest. Known as the "Moses of her people," she was admired by abolitionists such as JOHN

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Brown, who called her General Tubman. In the American Civil War, she served as a nurse, laundress, and spy for Union forces in South Carolina. She later settled in Auburn, N.Y., and was eventually granted a federal pension for her war work.

Tubman, William V(acanarat) S(hadrach) (b. Nov. 29, 1895, Harper, Liberia—d. July 23, 1971, London, Eng.) President of Liberia (1944–71). Tubman educated himself in law before entering public service, eventually ascending to the Supreme Court (1937–44). As president, Tubman enacted suffrage and property rights for women, authorized participation in government by all ethnic groups, and established a nationwide public-school system.

Tuchman \'tək-mən**, Barbara** *orig.* **Barbara Wertheim** (b. Jan. 30, 1912, New York, N.Y., U.S.—d. Feb. 6, 1989, Greenwich, Conn.) U.S. historian. She wrote for *The Nation* and other publications before beginning to write most of the books that made her a leading popular historian. Marked by a masterly literary style and a powerful grasp of complex issues, they include *The Zimmermann Telegram* (1958); *The Guns of August* (1962, Pulitzer Prize), on the first month of World War I; *Stilwell and the American Experience in China, 1911–45* (1970, Pulitzer Prize), a study of the China-U.S. relationship; and *A Distant Mirror* (1978), concerning 14th-century France.

Barbara Tuchman.
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Tucson \'tü-ˌsän\ City (pop., 2000: 486,699), southeastern Arizona, U.S. It lies along the Santa Cruz River on a hilly plain of the Sonoran Desert rimmed by mountains. In 1700 the Spanish founded several missions nearby, and in 1776 the small walled pueblo of Tucson was made a Spanish presidio (fort). It remained the province's military headquarters under Mexican rule. The U.S. acquired the territory through the Gadsden Purchase (signed in 1853). Tucson was the territorial capital from 1867 to 1877. It grew with the arrival of the railroad in 1880 and the discovery of silver at nearby Tombstone and copper at Bisbee. Its dry, sunny climate and desert locale have made it a popular tourist and health resort and retirement community. It is the seat of the University of Arizona (1885).

Tucuna *or* **Ticuna** *or* **Tikuna** \tə-'kü-nəs\ South American Indian people living in Brazil, Peru, and Colombia. Traditional Tucunas live in the rainforest of the northwestern Amazon basin, cultivating cassava and corn (maize), raising chickens, and hunting and gathering in the forest. They make baskets, pottery, and bark cloth and trade animal hides and handmade canoes for money and manufactured goods. They were once skilled hunters with blowguns, spears, and snares, but depletion of animal populations has altered old hunting patterns.

Tudjman \'tůj-män**, Franjo** (b. May 14, 1922, Veliko Trgovisce, Kingdom of Serbs, Croats, and Slovenes—d. Dec. 10, 1999, Zagreb, Cro.) Croatian politician and president of Croatia (1990–99). He served with the partisans under Marshal Tito in World War II. He taught political science and history at the University of Zagreb (1963–67) and later wrote numerous books on history and politics. He was expelled from the Yugoslav Communist Party in 1967 for his nationalist writings, and he was imprisoned in 1972 and 1981. In 1989 Tudjman founded the Croatian Democratic Union, which won Croatia's first free parliamentary elections in 1990. Named president, he pressed for the creation of a homogenous Croatian state. When Serbian areas of Eastern and Western Slavonia and the Krajina revolted, they were occupied by the Yugoslav army. Beginning in 1995, Tudjman reasserted control over these areas and established virtual control over portions of Bosnia and Herzegovina with majority Croatian populations. His authoritarian style, along with his refusal to cooperate with the International Criminal Tribunal for the Former Yugoslavia, led to the international isolation of Croatia, and his excesses in the Bosnian conflict and his autocratic rule earned Tudjman a reputation for brutality.

Tudor, Antony *orig.* **William Cook** (b. April 4, 1908, London, Eng.—d. April 20, 1987, New York, N.Y., U.S.) British-born U.S. dancer, teacher, and choreographer. In 1927 he joined Marie Rambert's company, where he choreographed and danced such works as *The Planets* (1934) and *The Lilac Garden* (1936). In 1940 he moved to New York City, joining the new Ballet Theatre (later American Ballet Theatre), for which he created many of his signature psychological ballets, including *Pillar of Fire* (1942) and *Shadow of the Wind* (1948). In these works he sought to convey emotional conflict and aspects of character and motivation. In 1974 he became associate director of American Ballet Theatre.

Tudor, Henry See Henry VII (England)

Tudor, house of English royal dynasty that gave five sovereigns to England (1485–1603). The Tudors originated in the 13th century, but the dynasty's fortunes were established by Owen Tudor (c. 1400–61), a Welsh adventurer who took service with Henry V and married Henry's widow, Catherine of Valois (1401–37). Owen and Catherine's son Edmund Tudor (c. 1430–56) was created earl of Richmond and married Lady Margaret Beaufort (1443–1509), a descendant of John of Gaunt of the house of Lancaster. Their son Henry Tudor claimed the English throne as Henry VII in 1485 and cemented his claim with his marriage to Elizabeth of the house of York, daughter of Edward IV. The Tudor rose symbolized the union between the red rose of the Lancastrians and the white rose of the Yorkists. The Tudor dynasty continued in the 16th century with the reigns of Henry VIII and his children Edward VI, Mary I, and Elizabeth I. In 1603 the dynasty was succeeded by the house of Stuart.

Tudor, Margaret See Margaret Tudor

Tudor, Mary See Mary I

Tudor style Architectural style in England (1485–1558) that made lavish use of half-timbering (see timber framing), as well as oriels, gables, decorative brickwork, and rich plasterwork. Exposed diagonal bracing usually occurs at building corners, with the second story often sporting a picturesque overhang; this cantilevered construction partially counterbalances the load carried by the spanning portions of the beams.

tuff Relatively soft, porous rock that is usually formed by the compaction and cementation of volcanic ash or dust. Tuff may vary greatly not only in texture but also in chemical and mineralogical composition. In some eruptions, foaming magma wells to the surface as an emulsion of hot gases and incandescent particles; the shredded pumice-like material spreads swiftly, even over gentle slopes, as a glowing avalanche (nuée ardente) that may move many miles at speeds of 100 mph (160 kph).

Tugela River \tü-'gā-lə\ Principal river, KwaZulu-Natal province, South Africa. It rises in the Mont-aux-Sources plateau and hurtles 3,110 ft (948 m) down a series of waterfalls to cut through Tugela Gorge. It ends its 312-mi (502-km) course at the Indian Ocean. It was the scene of battles in the South African War in 1899–1900. Historically, the Tugela marked the southern boundary of Zululand.

Tugwell, Rexford G(uy) (b. July 10, 1891, Sinclairville, N.Y., U.S.—d. July 21, 1979, Santa Barbara, Calif.) U.S. economist. He joined the economics faculty of Columbia University in 1920, and in 1932 he became a member of the Brain Trust that advised Franklin D. Roosevelt. Appointed undersecretary of agriculture, he helped formulate farm policy and other New Deal economic reforms (1933–36). He chaired the New York City Planning Commission (1938–41), served as governor of Puerto Rico (1941–46), and taught at the University of Chicago (1946–57).

Tuileries Palace \'twē-lə-ˌrēz\ French royal residence, adjacent to the Louvre in Paris, destroyed by arson in 1871. The original palace, commissioned by Catherine de Médicis, was begun in 1564 by Philibert Delorme (c. 1515–1570); the next 200 years saw numerous additions and alterations by Jean Bullant (1520?–1578), Jacques du Cerceau (c. 1520–1585), Louis Le Vau (1612–1670), and others. The Tuileries Gardens have changed little since Andre Le Notre redesigned them in 1664. His design extended the central walkway beyond the gardens and out into the countryside to the hilltop west of the palace, where the Arc de Triomphe now stands.

Tukhachevsky \ˌtůk-ə-'chef-skē**, Mikhayl (Nikolayevich)** (b. Feb. 16, 1893, near Slednevo, Russia—d. June 11, 1937) Soviet Red Army officer. In the Russian Civil War, he commanded the recapture of Siberia from Aleksandr Kolchak and led the Cossack forces against Anton Denikin (1920). He thereafter played a leading role in military reform; from 1931 he directed the rearmament of the Soviet Union. He served as Soviet chief of staff (1925–28) and later as deputy commissar for defense (1931–

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37); he was made a marshal of the Soviet Union in 1935. A victim of the PURGE TRIALS in 1937, he was tried and executed with other top Red Army commanders. In 1988 he was cleared judicially and rehabilitated by official decree.

Tukulor \ˌtü-kü-ˈlər\ Muslim people of Senegal and western Mali. Because of extended contacts with the FULANI, the Tukulor speak a dialect of Fula, an Atlantic language of the NIGER-CONGO family. In the 10th–18th centuries they were dominated by a succession of non-Tukulor groups in the kingdom of Tekrur. About 1850 they established an empire and conquered the BAMBARA kingdoms of Kaarta and Segu and extended their empire to TIMBUKTU before it was destroyed by the French in 1890. Today the Tukulor raise livestock, fish, and cultivate millet and sorghum.

Tula Ancient city in Mexico, the capital of the TOLTECS, which flourished in the 10th–12th centuries. Its exact location is uncertain; the archaeological site now designated Tula, near the town of that name in Hidalgo state, has been the choice of historians, but other scholars identify Tula with what is now usually called TEOTIHUACÁN. The Tula site suggests a city that had a population in the tens of thousands. The major civic centre consists of a plaza bordered by a five-stepped pyramid, two other pyramids, and two ball courts. Tula's art and architecture are strikingly similar to those of the AZTEC capital, TENOCHTITLÁN, and its artistic themes suggest that the Aztecs' concept of themselves as warrior-priests of the sun god was borrowed directly from Tula.

tulip Any of almost 4,000 varieties of about 100 species of cultivated bulbous herbaceous plants making up the genus *Tulipa* in the LILY FAMILY, native to Eurasia. Among the most popular of all garden flowers, the tulip produces two or three thick, bluish-green leaves clustered at the base of the plant. The usually solitary inverted bell-shaped flowers have three petals and three sepals. Colors range from white through yellows and reds to brown and deep purple to almost black. Streaked blossoms get their streaks from a harmless virus infection that causes the color to disappear in patterns, letting white or yellow show through.

tulip tree *or* **tulip poplar** *or* **yellow poplar** Lofty North American ornamental and timber tree (*Liriodendron tulipifera*) of the MAGNOLIA family, not related to true POPLARS. It occurs in mixed HARDWOOD stands in eastern North America. It is taller than all other eastern broad-leaved trees (up to 197 ft, or 60 m), and its trunk often has a diameter greater than 7 ft (2 m). Long-stemmed, bright-green leaves have two to four side lobes and blunted tips. Yellowish-green tuliplike flowers have six petals, orange at their bases, and three bright-green sepals. Other characteristics include conelike clusters of winged fruits; aromatic, purplish-brown twigs; stunning golden-yellow autumn leaves; winter buds resembling a duck's bill; and resistance to pests and diseases. The wood is used to manufacture furniture parts, plywood panels, paper, boxes, and crates.

Tull, Jethro (b. 1674, Basildon, Berkshire, Eng.—d. Feb. 21, 1741, Prosperous Farm, near Hungerford, Berkshire) British agronomist and inventor. He was educated at Oxford. Around 1701 he perfected a horse-drawn seed drill that economically sowed the seeds in neat rows, and later a horse-drawn hoe. He stressed the use of manure and the importance of breaking up the soil into small particles. Tull's methods, though initially attacked, were eventually adopted by many large landowners, and they helped form the basis of modern agriculture.

Tulsa City (pop., 2000: 393,049), northeastern Oklahoma, U.S. On the ARKANSAS RIVER, Tulsa originated in 1836 as a settlement of CREEK Indian immigrants; white settlement began in 1882 after the arrival of the railway. The discovery of oil nearby in the early 20th century launched an oil and gas boom, and phenomenal growth followed. Many major oil companies now have plants and offices in the city. It is the head of navigation for the Arkansas River Navigation System, a waterway that stretches 440 mi (708 km) to the junction of the Arkansas and MISSISSIPPI rivers. The commercial and financial centre of a rich agricultural area, it is the seat of the University of Tulsa (1894) and Oral Roberts University (1965).

tumbleweed Plant that breaks away from its roots and is driven about by the wind as a light rolling mass, scattering seeds as it goes. Examples include pigweed (*Amaranth retroflexus*, a widespread weed in the western U.S.) and other AMARANTHS, tumbling mustard, Russian thistle, the steppe plant *Colutea arborea*, and the grass *Spinifex* of Indonesian shores and Australian steppes.

Tumen \ˈtü-ˈmən\ **River** River, eastern Asia. It forms the northeastern frontier of North Korea with China and Russia. It originates on Mount Paektu, North Korea's highest mountain, and flows generally north and northeast before turning southeast to enter the Sea of JAPAN (East Sea). It is 324 mi (521 km) long but navigable for only 53 mi (85 km). Many historic battle sites lie along its banks.

tumour *or* **neoplasm** Mass of abnormal tissue that arises from normal cells, has no useful function, and tends to grow. Cell abnormalities may include increased size or number or loss of characteristics that differentiate their tissue of origin. Cells in malignant tumours (see CANCER) have a distorted size, shape, and/or structure. Less differentiated cells tend to grow faster. Malignant tumours invade tissues locally and spread (metastasize) in blood or lymph: the stronger the tendency to metastasize, the more malignant the tumour. Tumours may not cause pain until they press on or invade nerves. Both benign and malignant tumours can press on nearby structures, block vessels, or produce excess hormones, all of which can cause death. Benign tumours remain as a solid mass that can be removed by surgery if accessible; they can consist of various tissues and may become malignant; malignant tumours, though they may remain quiescent for a time, never become benign.

tuna Any of seven species (genus *Thunnus*, family Scombridae) of commercially valuable food fishes. Species range from the 80-lb (36-kg) ALBACORE to the bluefin tuna (*T. thynnus*), which grows to 14 ft (4.3 m) long and weighs up to 1,800 lbs (800 kg). Tunas have a slender, streamlined body and a forked or crescent-shaped tail. They are unique among fishes in having a vascular system modified to maintain a body temperature above the water temperature. Though slow swimmers, they migrate long distances over all the world's oceans. They eat fishes, squid, shellfish, and plankton.

tundra Treeless, level or rolling ground above the TAIGA in polar regions (Arctic tundra) or on high mountains (alpine tundra), characterized by bare ground and rock or by such vegetation as mosses, lichens, small herbs, and low shrubs. Animal species are limited by harsh environmental conditions. In the Arctic tundra they include lemmings, the Arctic fox, the Arctic wolf, caribou, reindeer, and musk-oxen. In the alpine tundra many animals, including mountain sheep and wildcats, descend to warmer zones during winter. The climate of alpine tundra is more moderate and has a higher amount of rainfall than does Arctic tundra. The freezing climate of the Arctic produces a layer of permanently frozen soil (PERMAFROST). An overlying layer of soil alternates between freezing and thawing with seasonal temperature variations. Alpine tundras have a freeze-thaw layer but no permafrost. Because Arctic tundras receive extremely long periods of daylight and darkness (lasting between one and four months), BIOLOGICAL RHYTHMS tend to be adjusted more to variations in temperature than to variations in sunlight. Arctic tundra covers about one-tenth of the earth's surface. Alpine tundras begin above the timberline of spruce and firs. Because of the small number of plant and animal species and the fragility of the food chains in tundra regions, natural or mechanical damage to any element of the habitat affects the whole ecosystem.

tuned circuit Electrically conducting pathway containing both INDUCTANCE and CAPACITANCE elements. When these elements are connected in series, the CIRCUIT presents low ELECTRICAL IMPEDANCE to ALTERNATING CURRENT of the same frequency as the resonance frequency of the circuit and high impedance to current of other frequencies. The circuit's resonance frequency is determined by the values of inductance and capacitance. When the circuit elements are connected in parallel, the impedance is high at the resonance frequency and low at other frequencies. With their ability to pass only certain frequencies, tuned circuits are important in, for example, radio and television receivers.

Tung Ch'i-ch'ang See DONG QICHANG

Tung Chung-shu See DONG ZHONGSHU

Tung-lin Academy See DONGLIN ACADEMY

Tung-Pei See MANCHURIA

Tung-ting Hu See DONGTING HU

tungsten *or* **wolfram** \ˈwůl-frəm\ Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol W, atomic number 74. Exceptionally strong, white to grayish, and brittle, it has the highest melting point (6,170 °F [3,410 °C]), greatest high-temperature strength, and lowest THERMAL EXPANSION coefficient of any METAL. Its chief uses are in STEELS to increase hardness and strength and in lightbulb filaments (see INCANDESCENT LAMP). It is also used in electrical contacts, rocket nozzles, chemical

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apparatus, high-speed rotors, and SOLAR-ENERGY devices. Tungsten is relatively inert, but compounds (in which it has various VALENCES) are known. The most important, tungsten CARBIDE, noted for its hardness, is used to increase the wear-resistance of cast iron and of tools' cutting edges.

tungsten-halogen lamp See HALOGEN LAMP

Tungusic languages See MANCHU-TUNGUS LANGUAGES

Tunguska event \tůŋ-'gü-skə\ (June 30, 1908) Enormous aerial explosion that flattened about 500,000 ac (2,000 sq km) of pine forest near the Stony Tunguska River in central Siberia. Its energy is estimated to have been equivalent to that of about 15 megatons of TNT. Uncertain evidence suggests that a meteoroid (see METEOR) 150–300 ft (45–90 m) in diameter or, less likely, a COMET disintegrated in the atmosphere high above Earth's surface, creating a fireball and blast wave but no crater. Eyewitnesses spoke of a fireball lighting the horizon, initially visible from about 500 mi (800 km) away, followed by trembling ground and hot winds strong enough to throw people down and shake buildings. The object's vaporization scattered dust high into the atmosphere, causing abnormally bright nighttime skies in Siberia and Europe for some time afterward.

tunicate \'tü-ni-kət\ Any of some 2,000 species (CHORDATE subphylum Tunicata, or Urochordata) of small marine invertebrates that are abundant worldwide. Tunicates are either sessile (permanently attached), free-swimming, or planktonic (floating). The name tunicate derives from a secreted protective covering (the tunic) containing cellulose. Floating species often form colonies that may be 13 ft (4 m) long. Some free-swimming species are too small to see. Adults filter feed on microorganisms. Sessile forms growing on ships' hulls may be a nuisance, but some species are pharmaceutically useful. See also SEA SQUIRT.

tuning and temperament In music, the adjustment of one sound source, such as a voice or string, to produce a desired pitch in relation to a given pitch, and the modification of that tuning to lessen dissonance. Tuning assures a good sound for a given pair of tones; temperament compromises the tuning to assure a good sound for any and all pairs of tones. Two vibrating strings sound best together if the ratio between their lengths can be expressed by two small whole numbers. If two strings vibrate in a ratio of 2:1, the vibrations will always coincide and so reinforce each other. But if they vibrate in a ratio of 197:100 (very close to 2:1), they will cancel each other out three times per second, creating audible "beats." These beats are what make something sound "out of tune." Since a tone produced by one ratio will not necessarily agree with the same tone created by repeatedly applying another ratio, either some INTERVALS must be mistuned to allow for the perfect tuning of others or all intervals must be slightly mistuned. Before 1700, several systems were used based on the former compromise, including "just intonation"; since then, the compromise known as "equal temperament," in which the ratios represented by each pair of adjacent notes are identical, has prevailed.

Tunis \'tü-nəs\ City (pop., 2004: 728,453), capital of TUNISIA. It is situated on Tunis Lake, an inlet of the Gulf of Tunis; its port, La Goulette (Ḥalq al-Wādī), is 6 mi (10 km) to the northeast. Founded by Libyans, it was later a small town under CARTHAGE; it became important after the Muslim conquest in the 7th century AD. It was a religious centre during the AGHLABID DYNASTY (9th century) and reached its greatest prosperity under the HAFṢID DYNASTY (13th century). The Spanish and Ottomans controlled it during the 16th century, and it was occupied by the Germans in 1942. It was made the national capital when Tunisia gained independence from France in 1956. It produces textiles, carpets, and olive oil and has metallurgical industries. Tourism is also important. The city's historic centre was designated a UNESCO WORLD HERITAGE SITE in 1979.

Tunisia \tü-'nē-zhə\ *officially* **Tunisian Republic** Country, North Africa. Area: 63,170 sq mi (163,610 sq km). Population (2005 est.): 10,038,000. Capital: TUNIS. The population is of Arab and Berber (Amazigh) ancestry. Languages: Arabic (official), French. Religion: Islam (official; predominantly Sunni). Currency: Tunisian dinar. Tunisia comprises a coastal region, mountains, an extensive hilly steppe, a marshy area with shallow salt lakes, and a tract of the SAHARA. The Majardah is its longest (about 290 mi [460 km]) and only perennial river. Tunisia contains some of the largest phosphate and natural gas reserves in Africa, as well as substantial oil reserves. Major economic activities are services, agriculture, light industries, and the production and export of petroleum and phosphates. Tourism, focusing on Tunisia's beaches and Roman ruins, is also important. Tunisia is a republic with one legislative house; its chief

of state is the president, and the head of government is the prime minister. From the 12th century BC the Phoenicians had a series of trading posts on the North African coast. By the 6th century BC the Carthaginian kingdom encompassed most of present-day Tunisia. The Romans ruled from 146 BC. It was part of the Byzantine Empire until the Muslim Arab invasions in the mid-7th century AD. The area was fought over, won, and lost by many, including the ʿABBĀSID DYNASTY, the ALMOHAD DYNASTY, Spain, and the Ottoman Empire, which conquered it in 1574 and held it until the late 19th century. For a time it maintained autonomy as the French, British, and Italians contended for the region. In 1881 it became a French protectorate. During World War II (1939–45) U.S. and British forces captured it (1943), putting an end to a brief German occupation. France granted it full independence in 1956; HABIB BOURGUIBA assumed power and remained in power until he was forced from office in 1987. His successor, Zine al-Abidine Ben Ali, continued his authoritarian-style rule.

tunnel Horizontal or nearly horizontal underground or underwater passageway. Tunnels are used for mining, as passageways for trains and motor vehicles, for diverting rivers around damsites, for housing underground installations such as power plants, and for conducting water. Ancient civilizations used tunnels to carry water for irrigation and drinking, and in the 22nd century BC the Babylonians built a tunnel for pedestrian traffic under the Euphrates River. The Romans built AQUEDUCT tunnels through mountains by heating the rock face with fire and rapidly cooling it with water, causing the rock to crack. The introduction of gunpowder blasting in the 17th century marked a great advance in solid-rock excavation. For softer soils, excavation is accomplished using devices such as the tunneling mole, with its rotating wheel that continuously excavates material and loads it onto a conveyor belt. Railroad transportation in the 19th–20th century led to a tremendous expansion in the number and length of tunnels. Brick and stone were used for support in early tunnels, but in modern tunneling steel is generally used until a concrete lining can be installed. A common method of lining involves spraying SHOTCRETE onto the tunnel crown immediately after excavation.

tunneling *or* **barrier penetration** In physics, the passage of a particle through a seemingly impassable energy barrier. Though a particle's energy may be too low to surmount a barrier in classical physics, the particle may still cross the barrier as a consequence of its quantum-mechanical wave properties. An important application of this phenomenon is in the operation of the scanning tunneling microscope.

Tunney, Gene *orig.* **James Joseph Tunney** (b. May 25, 1898, New York, N.Y., U.S.—d. Nov. 7, 1978, Greenwich, Conn.) U.S. boxer. Tunney boxed in the Marine Corps, earning the nickname "the Fighting

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Marine." He defeated JACK DEMPSEY in 1926 to become the world heavyweight champion. In a controversial rematch in Chicago in 1927, Dempsey knocked Tunney to the canvas in the seventh round but failed to retire immediately to a neutral corner, thus delaying the count; the "long count" allowed Tunney to rise and win the 10-round fight. He retired the next year with a record of 65 wins in 77 bouts.

Tupac Amarú \tü-'päk-ä-'mär-ü\ Peruvian revolutionary group. Founded in 1983, the group is best known for holding 490 people hostage in the Japanese embassy in Lima (1996) in an effort to gain the release of jailed comrades. After a standoff of several weeks, Peruvian troops stormed the embassy and killed all the guerrillas. Defections have apparently since decreased its membership. The group takes its name from the Indian revolutionary Tupac Amarú II (orig. José Gabriel Condorcanqui, 1742?–81), who in 1780 led Peruvian Indian peasants in the last widespread rebellion against Spain before independence. The Indians identified him with his ancestor Tupac Amarú, the last leader of the INCA, who was executed by the Spaniards in 1572.

Tupamaro \ˌtü-pə-'mä-rō\ Member of the National Liberation Movement, a Uruguayan leftist urban guerrilla organization founded c. 1963 and named for Tupac Amarú II, an 18th-century Peruvian revolutionary. The earliest Tupamaro efforts involved robbing banks and businesses and distributing the goods to the poor, but in the late 1960s they mounted a wave of violence aimed at the authorities. The military government that seized power in 1973 launched an offensive against them, killing some 300 and imprisoning 3,000 others. When democratic rule returned in 1985, the Tupamaros were reorganized as a political party.

tupelo \'tü-pə-ˌlō\ Any of about seven species of trees that make up the genus *Nyssa* in the sour gum family (Nyssaceae). Five are found in moist or swampy areas of eastern North America, one in eastern Asia, and one in western Malaysia. They all have horizontal or hanging branches, broad leaves, and male and female flowers on different plants. North American species bear greenish-white flowers and small bluish-black or purple berries. The most widespread North American species is the BLACK GUM. Tupelo wood, most of which comes from the water tupelo (*N. aquatica*), is pale yellow to light brown, fine-textured, and strong. It is used for crates and boxes, flooring, wooden utensils, and veneers.

Tupian \tü-'pē-ən\ **languages** Family of South American Indian languages with at least seven subgroups, spoken or formerly spoken in scattered areas from the Andes Mountains to the Atlantic Ocean and (with two exceptions) south of the Amazon River to southernmost Brazil and Paraguay. About one half of the 50 attested Tupian languages are extinct. The largest subgroup, Tupí-Guaraní, includes the extinct language Tupinambá, the source for borrowings of many New World flora and fauna terms into Portuguese and hence other European languages. Another language of the subgroup, Guaraní, is spoken as a first or second language by more than 90% of Paraguayans, who consider it a token of Paraguayan identity.

Tupolev *officially* **ANTK imeni A.N. Tupoleva** *formerly* **OKB-156** Russian aerospace design bureau that is a major producer of passenger airliners and military bombers. It originated in 1922 as a group within the U.S.S.R.'s Central Aerohydrodynamics Institute to develop military aircraft. Under ANDREI TUPOLEV, it created the TB-1 (ANT-4) all-metal, cantilever-wing bomber (first flights 1925–26). After several years' confinement for political reasons, Tupolev was freed, and in 1943 he reestablished his team as the design bureau OKB-156. At the end of World War II, the bureau built the Tu-4 strategic bomber, a copy of the U.S. B-29. In the 1950s it produced the turboprop Tu-95 heavy bomber (NATO, "Bear"), which became a Soviet mainstay, and the first Soviet jetliner, the Tu-104 (first flown 1955). Between the late 1950s and early '80s, it introduced new supersonic bombers, including the variable-wing Tu-22M ("Backfire") and Tu-160 ("Blackjack"), and airliners such as the Tu-114 turboprop, Tu-154 trijet, and Tu-144 supersonic transport. In 1989, in honor of Tupolev (died 1972), the bureau was renamed ANTK imeni A.N. Tupoleva. After the dissolution of the U.S.S.R. in 1991, it became a joint stock company with the Russian government holding a limited financial interest. In the 1990s its projects involved jetliners such as the Tu-204 (in service 1996) and Tu-324.

Tupolev \'tü-pəl-yif**, Andrei (Nikolayevich)** (b. Nov. 10, 1888, Pustomazovo, Russia—d. Dec. 23, 1972, Moscow) Russian aircraft designer. In 1918 he cofounded the U.S.S.R.'s Central Aerohydrodynamics Institute, and in 1922 he became head of its design bureau (see TUPOLEV), producing airplanes of all-metal construction. Arrested in 1937 on charges of activities against the state, he was assigned to work on the design of military aircraft. Under confinement, he led a team that produced the Tu-2 twin-engine tactical bomber, which was widely used in World War II. Freed during the war, Tupolev and his reestablished design bureau replicated the U.S. B-29; the resulting Tu-4 became the Soviet Union's principal strategic bomber until the mid-1950s. After adapting jet propulsion to several piston-engine airframes, Tupolev introduced the swept-wing Tu-16 (NATO, "Badger") jet bomber (first flown 1952) and its civilian derivative Tu-104 (1955), one of the first jet transports to provide regular passenger service. Tupolev and his son Alexei headed the effort that produced the Tu-144 supersonic transport, the first passenger jet to exceed Mach 1 (1969).

Tura \'tü-rä**, Cosimo** *or* **Cosmè Tura** (b. c. 1430, Ferrara—d. 1495, Ferrara) Italian painter. Court painter to the ESTE FAMILY at Ferrara, his early Renaissance style was influenced by ANDREA MANTEGNA and PIERO DELLA FRANCESCA. A master of allegory and decorative painting, he was the founder and first significant figure of the school of Ferrara. His work is characterized by a mannered, nervous, and wiry line, carefully rendered detail, and brilliant colour.

Turābī \tù-'rä-bē**, Ḥasan al-** (b. 1932, The Sudan) Sudanese Muslim religious scholar and lawyer. After receiving a traditional Muslim education, he studied at the University of London and the Sorbonne in Paris. In the early 1950s he joined the Sudanese branch of the MUSLIM BROTHERHOOD. While teaching law at the University of Khartoum (1957–65), he participated in the 1958 revolution that ended military rule. He later served in the national legislature (1965–67). He supported the 1985 overthrow of Gaafar Mohamed el-NIMEIRI. That same year he formed the National Islamic Front (NIF), an incarnation of the Muslim Brotherhood. In 1989 the NIF supported a coup that brought ʿUmar Ḥasan al-Bashīr to power. He later served as speaker of the National Assembly (1996–98) and was arrested in 2001 during a power struggle with al-Bashīr.

turbidity current Underwater current of abrasive sediments. Such currents appear to be relatively short-lived, transient phenomena that occur at great depths. They are thought to be caused by the slumping of sediment that has piled up at the top of the continental slope, particularly at the heads of SUBMARINE CANYONS. Slumping of large masses of sediment creates a dense slurry, which then flows down the canyon to spread out over the ocean floor and deposit a layer of sand in deep water. Repeated deposition forms SUBMARINE FANS, analogous to the alluvial fans found at the mouths of river canyons.

turbine \'tər-bən, 'tər-ˌbīn\ Any of various devices that convert the ENERGY in a stream of fluid into mechanical energy by passing the stream through a system of fixed and moving fanlike blades and causing the latter to rotate. A turbine looks like a large wheel with many small radiating blades around its rim. There are four broad classes of turbine: water (hydraulic), steam, wind, and gas. The most important application of the first three is the generation of electricity; gas turbines are most often used in aircraft.

turbojet JET ENGINE in which a TURBINE-driven COMPRESSOR draws in and compresses air, forcing it into a combustion chamber into which fuel is injected. Ignition causes the gases to expand and to rush first through the turbine and then through a nozzle at the rear. Forward thrust is generated as a reaction to the rearward momentum of the exhaust gases. The turbofan or fanjet, a modification of the turbojet, came into common use in the 1960s. In the turbofan, some of the incoming air is bypassed around the combustion chamber and is accelerated to the rear by a turbine-operated fan. It moves a much greater mass of air than the simple turbojet, providing advantages in power and economy. See also RAMJET.

turboprop Hybrid engine that provides jet thrust and also drives a propeller. It is similar to the TURBOJET except that an added TURBINE, behind the combustion chamber, works through a shaft and speed-reducing gears to turn a propeller at the front of the engine. Because of improvements in turbojet design, the turboprop, which is less efficient at high speeds, lost much of its importance in the 1960s, though it is still used for relatively short-range aircraft.

turbot \'tər-bət\ Species (*Scophthalmus maximus*, family Scophthalmidae or Bothidae) of broad-bodied European FLATFISH, a highly valued food fish. It lives along sand and gravel shores. It is left-sided (with eyes normally on the left side of the head) and scaleless; the head and body are

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studded with numerous bony knobs. Turbots grow to, at most, 40 in. (1 m) long and weigh about 55 lb (25 kg). Colour varies with the surroundings but is usually gray-brown or light brown with darker markings. A related species is the Black Sea turbot (*S. maeoticus*). Certain right-sided Pacific flatfish (genus *Pleuronichthys*, family Pleuronectidae) are also called turbot.

turbulence In FLUID MECHANICS, a flow condition (see TURBULENT flow) in which local speed and pressure change unpredictably as an average flow is maintained. Common examples are wind and water swirling around obstructions, or fast flow (REYNOLDS NUMBER greater than 2,100) of any sort. Eddies, vortices, and a reduction in DRAG are characteristics of turbulence. Lowered drag enables golf balls to travel farther than they would do otherwise, and the dimpled surface of golf balls is meant to encourage turbulence in the BOUNDARY layer. If swimsuits with rough surfaces help swimmers to move faster, as has been claimed, the same explanation may apply.

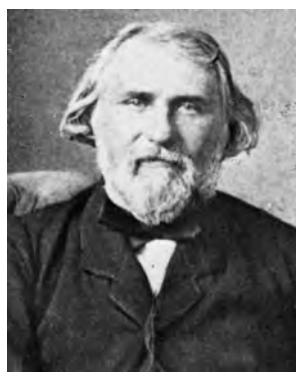
Turcoman See TURKMEN

Turenne \tu̇-'ren**, Henri de La Tour d'Auvergne, viscount de** *orig.* **Henri de La Tour d'Auvergne** (b. Sept. 11, 1611, Sedan, France—d. July 27, 1675, Sasbach, Baden-Baden) French military leader. He earned his reputation as a military leader in the THIRTY YEARS' WAR, especially with the capture of Turin (1640). Made a marshal of France (1643), he commanded the French army in Germany and joined the Swedish army in conquering Bavaria (1648). In France he joined the aristocrats in the FRONDE (1649), but later he skillfully commanded the royal army to defeat the forces led by the prince de CONDÉ, who had allied himself with Spain, and to bring about the Peace of the PYRENEES (1659), which ended France's war with Spain. Appointed marshal-general (1660), Turenne marched alongside LOUIS XIV in joint command of the French armies in the War of DEVOLUTION (1667–68). His bold strategies won numerous victories against the imperial army in Germany (1672–75), but he was killed in action at Sasbach. He was buried with the kings of France at Saint-Denis and later moved to the Invalides by NAPOLEON, who esteemed Turenne as the greatest military leader in history.

Turenne, detail of a portrait by Charles Le Brun; in the Musée National de Versailles et des Trianons.
CLICHE DES MUSEES NATIONAUX, PARIS

turf In horticulture, the surface layer of soil with its matted, dense vegetation, usually GRASSES grown for ornamental or recreational use. Such turf grasses include Kentucky BLUEGRASS, creeping BENT grass, fine or red fescue, and PERENNIAL ryegrass among the popular cool-season types, and Bermuda grass, zoysia grass, and St. Augustine grass among the warm-season types. Turf grasses are often grown on turf, or sod, farms. Plugs, blocks, squares, or strips are cut and transplanted to areas where they quickly establish and grow. Lawns are fine-textured turfs that are mowed regularly and closely to develop into dense, uniformly green coverings that beautify open spaces and provide sports playing surfaces (e.g., tennis lawns, golf and bowling greens, and racing turfs).

Turgenev \tu̇r-'gʸā-nʸif**, Ivan (Sergeyevich)** (b. Nov. 9, 1818, Oryol, Russia—d. Sept. 3, 1883, Bougival, near Paris, France) Russian novelist, poet, and playwright. His years at the University of Berlin convinced him of the West's superiority and the need for Russia to Westernize. He lived in Europe after c. 1862. He is known for realistic, affectionate portrayals of the Russian peasantry and for penetrating studies of the Russian intelligentsia who were attempting to move the country into a new age. His most famous early work is "The Diary of a Superfluous Man" (1850), which supplied the epithet "superfluous man" for the weak-willed intellectual protagonist common in 19th-century Russian literature. He gained fame with the short-story cycle *A Sportman's Sketches* (1852), which criticizes serfdom. His dramatic masterpiece, *A Month in the Country* (1855), and the novel *Rudin* (1856) followed. His interest in change and intergenerational differences is reflected in the controversial *Fathers and Sons* (1862), his greatest novel. Turgenev's work is distinguished from that of his contemporaries by its sophisticated lack of hyperbole, its balance, and its concern for artistic values. His greatest work was always topical, committed literature, having universal appeal in the elegance of the love story and the psychological acuity of the portraiture.



Ivan Turgenev.
FROM THE COLLECTION OF DAVID MAGARSHACK

turgor \'tər-gər\ Pressure exerted by fluid in a cell that presses the cell membrane against the cell wall. Turgor is what makes living plant tissue rigid. Loss of turgor, resulting from the loss of water from plant cells, causes flowers and leaves to wilt. Turgor plays a key role in the opening and closing of stomata (see STOMA) in leaves.

Turgot \tu̇r-'gō**, Anne-Robert-Jacques, baron de l'Aulne** (b. May 10, 1727, Paris, France—d. March 18, 1781, Paris) French administrator and economist. He entered the royal administrative branch of the magistracy in 1753, then became intendant (governor) of Limoges (1761–74), where he instituted economic and administrative reforms. A PHYSIOCRAT, in 1766 he wrote his best-known work, *Reflections on the Formation and Distribution of Wealth*. In 1774 he was appointed comptroller general by LOUIS XVI and introduced his Six Edicts to expand economic reforms. His effort to abolish the CORVÉE (unpaid forced labour by peasants) was opposed by the privileged classes, and he was dismissed in 1776.

Turin *Italian* **Torino** City (pop., 2001 prelim.: 857,433), PIEDMONT region, northwestern Italy. Located on the PO RIVER, it was founded by the Taurini. It was partly destroyed by HANNIBAL in 218 BC. It was made a Roman military colony under Emperor AUGUSTUS. A part of the Lombard duchy in the 6th century AD, it became the seat of government under CHARLEMAGNE (742–814). It passed to the house of SAVOY in 1046. The capital of the kingdom of SARDINIA in 1720, Turin was occupied by the French during the NAPOLEONIC WARS. The political and intellectual centre of the RISORGIMENTO movement, it served as the first capital of united Italy (1861–65). During World War II Turin sustained heavy damage from Allied air raids but was rebuilt. It is the focus of Italy's automotive industry and an international fashion centre. The Shroud of TURIN has been housed in the 15th-century cathedral there since the 16th century.

Turin, Shroud of Linen fragment said to be the burial garment of JESUS. It has been preserved since 1578 in the royal chapel of the Cathedral of San Giovanni Battista in Turin, Italy. Measuring 14.5 by 3.7 ft (4.42 by 1.13 m), it appears to portray images of the back and front of a gaunt, sunken-eyed man. The images contain markings that correspond to the STIGMATA and stains presumed to be blood. The cloth emerged historically in 1354 and went on exhibition in 1389, first as a representation of the shroud and eventually as the shroud itself. In 1988 independent tests using radiocarbon dating techniques indicated that the cloth had been made c. 1260–1390. Subsequent chemical analyses and other tests, however, suggested a much older date, possibly even the 1st century.

Turing \'tu̇r-iŋ**, Alan (Mathison)** (b. June 23, 1912, London, Eng.—d. June 7, 1954, Wilmslow, Cheshire) English mathematician and logician. He studied at the University of Cambridge and at Princeton's Institute for Advanced Study. In his seminal 1936 paper "On Computable Numbers," he proved that there cannot exist any universal algorithmic method of determining truth in mathematics and that mathematics will always contain undecidable (as opposed to unknown) propositions. That paper also introduced the TURING MACHINE. He believed that computers eventually would be capable of thought indistinguishable from that of a human and proposed a simple test (see TURING TEST) to assess this capability. He did valuable work in CRYPTOGRAPHY during World War II, playing an important role in breaking the Enigma code used by Germany for radio communications. After the war he taught at the University of Manchester and began work on what is now known as ARTIFICIAL INTELLIGENCE.

Turing machine Hypothetical computing device proposed by ALAN M. TURING (1936). Not actually a machine, it is an idealized mathematical model that reduces the logical structure of any computing device to its essentials. It consists of an infinitely extensible tape, a tape head that is

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capable of performing various operations on the tape, and a modifiable control mechanism in the head that can store instructions. As envisaged by Turing, it performs its functions in a sequence of discrete steps. His extrapolation of the essential features of INFORMATION PROCESSING was instrumental in the development of modern DIGITAL COMPUTERS, which share his basic scheme of an input/output device (tape and tape reader), central processing unit (CPU, or control mechanism), and stored MEMORY.

Turing test Test proposed by ALAN M. TURING to determine whether a computer can be said to "think." Turing suggested the "imitation game," wherein a remote human interrogator, within a fixed time frame, must distinguish between a computer and a human subject based on their replies to questions posed by the interrogator. A series of such tests would measure the computer's success at "thinking" by the probability of its being misidentified as the human subject. The test is performed today in competitions that test the success of ARTIFICIAL INTELLIGENCE.

Turkana, Lake See LAKE RUDOLF

Turkana remains See LAKE TURKANA REMAINS

Turkey *officially* **Republic of Turkey** Country, western Asia and southeastern Europe. Area: 299,158 sq mi (774,815 sq km), nearly all of which lies in Asia. Population (2005 est.): 72,083,000. Capital: ANKARA.

Ethnic groups include the Turks and Kurds. Languages: Turkish (official), Kurdish, Arabic. Religion: Islam (mostly Sunni). Currency: Turkish lira. Turkey is a mountainous country with an extensive plateau covering central ANATOLIA. The highest peak is Mount ARARAT (16,853 ft [5,137 m]). The TAURUS MOUNTAINS lie in the south. Rivers include the TIGRIS, EUPHRATES, KIZIL, and MENDERES. Turkey is a major producer and exporter of chromite and also mines iron ore, coal, lignite, bauxite, and copper. It is the Middle East's leading steel producer. Chief agricultural products include wheat, barley, olives, and tobacco. Tourism also is important. Turkey is a republic with one legislative house; its chief of state is the president, and the head of government is the prime minister. Turkey's early history corresponds to that of Anatolia, the BYZANTINE EMPIRE, and the OTTOMAN EMPIRE. Byzantine rule emerged when CONSTANTINE THE GREAT made Constantinople (modern ISTANBUL) his capital. The Ottoman Empire, begun in the 12th century, dominated for more than 600 years; it ended in 1918 after the YOUNG TURK revolt (1908) precipitated its demise. Under the leadership of MUSTAFA KEMAL ATATÜRK, a republic was proclaimed in 1923. Turkey remained neutral throughout most of World War II (1939–45), siding with the Allied powers in 1945. Since the war it has alternated between civil and military governments and has had several conflicts with Greece over CYPRUS. The country has developed a strong, diversified economy, but it has also experienced periods of political and civic turmoil between Islamists and secularists and ongoing ethnic tension with Kurdish separatists.

turkey Either of two species of birds in the family Meleagrididae. The North American common turkey (*Meleagris gallopavo*) has been domesticated since pre-Columbian times. The adult male has a featherless, bright-red head, a fleshy red ornament (snood) growing over the bill, and a similar wattle on the throat. The male (gobbler or tom) may be 50 in. (1.3 m) long and may weigh over 20 lb (10 kg). Wild turkeys inhabit woodlands near water, eating seeds, insects, and an occasional frog or lizard. Males assemble a harem, and each hen lays 8–15 eggs in a hollow in the ground. An excellent source of meat and easily shot, the wild turkey was practically exterminated by European settlers; conservation efforts have reestablished it in much of its former range. The ocellated turkey (*Agriocharis,* or *Meleagris, ocellata*) of Central America has never been domesticated.

Male common turkey (*Meleagris gallopavo*), displaying.
S.C. BISSEROT—BRUCE COLEMAN INC.

turkey vulture *or* **turkey buzzard** Species (*Cathartes aura*) of long-winged, long-tailed VULTURE (family Cathartidae), about 30 in. (75 cm) long, with dark plumage, whitish beak and legs, bare red head covered with whitish bumps, and a 6-ft (1.8-m) wingspread. It uses its keen sense of smell to find carrion. It occurs throughout the Americas except in northern Canada; the northerly and southernmost populations are migratory.

Turkic languages Family of more than 20 ALTAIC languages spoken by some 135 million people from the Balkans to central Siberia. The traditional division of Turkic is into four groups. The southeastern or Uighur group comprises Uighur, spoken mainly in Xinjiang, China; and Uzbek, spoken mainly in Uzbekistan, other Central Asian republics, and northern Afghanistan. The southwestern, or Oguz, group includes TURKISH; Azerbaijani (Azeri), spoken in Azerbaijan and northwestern Iran; Crimean Tatar, spoken mostly in Ukraine and Uzbekistan; and Turkmen, used in Turkmenistan, northern Iran, and northern Afghanistan. The northwestern, or Kipchak, group includes Kazakh, spoken in Kazakhstan, other Central Asian republics, and western China and Mongolia; Kyrgyz, spoken in Kyrgyzstan, other Central Asian republics, and western China; TATAR; Baskhir, spoken in Bashkortostan and adjacent areas in Russia; Karachay-Balkar and Kumyk, spoken in the Russian Caucasus; and Karaim, with a few speakers in Lithuania and parts of southwestern Ukraine. The northeastern, or Altai, group comprises languages and dialects spoken in Siberia northeast of the Irtysh River and in adjacent parts of Mongolia, including Altai, Khakas, Shor, and Tuvan; and Sakha, spoken in Sakha (Yakutia) republic of Russia and adjacent areas. Distinct from all the other languages is Chuvash, spoken in Russia's Chuvash republic and adjacent areas. The earliest attestations of Turkic are a group of 8th-century funerary inscriptions of northern Mongolia, in a distinctive writing system called runic script, or Turkic runes. With the Islamization of nearly all Turkic peoples southwest of the Irtysh beginning c. 900, Turkic languages began to adopt the ARABIC ALPHABET. Today the LATIN ALPHABET and CYRILLIC ALPHABET are more extensively used.

Turkic peoples Any of various peoples who speak one of the TURKIC languages. They are connected with the Tuque (T'u-chüeh), nomadic people who in the 6th century AD founded an empire stretching from Mongolia to the Black Sea (see TURKISTAN). In the 11th century the SELJŪQS created an extensive empire after defeating the Byzantines at the Battle of MANZIKERT (1071), an event that opened Anatolia to settlement by Turkic-speaking peoples (and eventually led to the establishment of the Republic of TURKEY in the 20th century). Though overrun by the MONGOLS in the 13th century, the Turks succeeded in absorbing them after GENGHIS KHAN's death (1227). In the 14th century TIMUR, who was of mixed Mongolian and Turkic ancestry, held most of Central Asia and some of South Asia. In the 15th century Russian expansion drove the Turkic peoples eastward into what is now Kazakhstan. Today Turkic peoples live mostly in Turkey, Uzbekistan, Afghanistan, Kazakhstan, and Turkmenistan.

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Turkish Angora cat Breed of longhaired DOMESTIC CAT that probably arose from a domesticated cat of Tatars who migrated to Turkey, where it is now regarded as a national treasure. It has a long body, fine bones, a pointed face, and a silky, medium-length coat. White is the most popular colour, but it may be any of several solid colours or any pattern of two or more colours.

Turkish bath Bath originating in the Middle East, combining exposure to warm air, steam immersion, massage, and a cold bath or shower. The Turkish bath (*ḥammām*) reflects the fusion of the massage and cosmetic aspects of the Eastern bath tradition and the plumbing and heating techniques of the Romans. Turkish baths were smaller than the Roman THERMAE and more sparsely lit. The baths at Constantinople were domed, and rooms were richly decorated with marble or mosaics. Used for socializing and relaxation as well as bathing, the *ḥammām* was popular throughout the Islamic world; some baths are still in use. In the 19th century, the Turkish bath was adapted and exported to Europe and the U.S.

Turkish language TURKIC language of Turkey, spoken by about 90% of its population. Turkish has about 59 million speakers, with many enclaves in the Balkans and Cyprus (dating from Ottoman times) and in western Europe. Turkish was introduced into Anatolia with the invasion of Turkmen tribes in the 13th–14th centuries. Anatolian Turkish, written in the ARABIC ALPHABET, is first attested in the 13th century. Ottoman Turkish was so heavily influenced by Persian and Arabic that it lost some of its Turkic characteristics and was incomprehensible to lower social strata. Efforts to re-Turkicize the language began in the 18th century but did not make serious gains until the 20th century and the founding of the Turkish republic. Much Perso-Arabic vocabulary was removed, and the LATIN ALPHABET was adopted with the addition of diacritics to symbolize sounds peculiar to Turkish.

Turkish van cat Breed of semi-longhaired DOMESTIC CAT distinguished mainly by its unusual colour pattern: white, with coloured markings only on the head and tail. "Van" is a common term in the breed's native region, Central and South Asia, used also to describe other cats with similar markings. The breed was brought to Europe by returning Crusaders. A unique feature is its cashmere-like, waterproof coat; it loves water, and in its native region it has been called the swimming cat. It is large, active, and intelligent.

Turkistan *or* **Turkestan** Historical region, Central Asia. This somewhat broad geographic region—situated between Siberia to the north and Tibet, India, Afghanistan, and Iran to the south—derived its name from its inhabitants, who were predominantly of Turkic ancestry. The total area of more than 1,000,000 sq mi (2,600,000 sq km) was bisected by the PAMIR and TIEN SHAN ranges, forming West and East Turkistan. West Turkistan, which included what is now Turkmenistan, Uzbekistan, Tajikistan, Kyrgyzstan and southern Kazakhstan, came under Russian rule in the 19th century. East Turkistan was annexed by China in the 8th century; it included what is now the Uygur Autonomous Region of XINJIANG.

Turkmen Member of a Central Asian people belonging to the southwestern branch of the Turkic linguistic group. At the beginning of the 21st century, they numbered more than six million, and most lived in Turkmenistan and adjacent parts of Central Asia. A significant number also live in Iran and parts of Turkey and Afghanistan, and there are pockets of Turkmen in northern Iraq and Syria. Initially a nomadic pastoral people living in tent villages, many took up agriculture while under Soviet rule. Most are Muslim, and they have traditionally divided themselves by economic function. They are patrilineal, and each family or tribal group is headed by a KHAN.

Turkmenistan Country, Central Asia. Area: 188,500 sq mi (488,100 sq km). Population (2005 est.): 4,833,000. Capital: ASHGABAT. Turkmen make up three-fourths of the population, with small groups of Uzbeks, Russians, Kazakhs, and Tatars. Language: Turkmen (official). Religions: Islam (predominantly Sunni); also Eastern Orthodox. Currency: manat. There are some hills and low mountains. About nine-tenths of Turkmenistan is desert, chiefly the KARAKUM. The main rivers are the AMU DARYA and MORGHĀB. Many irrigation canals and reservoirs have been built, including the Karakum Canal, which runs 870 mi (1,400 km) between the Amu Darya and the CASPIAN SEA. The country's chief products are petroleum and natural gas, cotton, silk, carpets, fish, and fruit. It is a republic with one legislative house; its head of state and government is the president, assisted by the People's Council. The earliest traces of human settlement in Central Asia, dating to Paleolithic times, have been found in Turkmenistan. The nomadic, tribal Turkmen probably entered the area in the 11th century AD. They were conquered by the Russians in the early 1880s, and the region became part of Russian Turkistan. It was organized as the Turkmen S.S.R. in 1924 and became a constituent republic of the U.S.S.R. in 1925. The country gained full independence from the Soviet Union in 1991 under the name Turkmenistan. It experienced years of economic difficulty until oil and gas production was more fully developed and was subject to the highly authoritarian rule of Saparmurad Niyazov.

Turks and Caicos \'kā-ˌkōs, 'kā-kəs\ **Islands** British dependency (pop., 2002 est.: 18,738), WEST INDIES. It comprises two small island groups at the southeastern end of The BAHAMAS. The Turks group includes Grand Turk, Salt Cay, and lesser cays. The Caicos group includes South Caicos, East Caicos, Middle (or Grand) Caicos, North Caicos, Providenciales, West Caicos, and several smaller cays. The seat of government is at Cockburn Town on Grand Turk Island. When Spanish explorer Juan PONCE DE LEÓN visited in 1512, the islands were inhabited by Indians. British colonists from BERMUDA arrived in 1678. The islands were at first placed under the government of The Bahamas, but in 1874 they were annexed to the colony of Jamaica. The Turks and Caicos Islands became a crown colony in 1962 and shared a governor with The Bahamas from 1965 to 1973. A new constitution was adopted in 1988. The chief industries are tourism and offshore financial services.

turmeric \'tər-mə-rik\ Perennial herbaceous plant (*Curcuma longa*; family Zingiberaceae), native to southern India and Indonesia. Its tuberous RHIZOMES have been used from antiquity as a condiment, as a textile dye, and medically as an aromatic stimulant. The rhizome has a pepperlike aroma and a somewhat bitter, warm taste. It colours and flavours prepared mustard and is used in curry powder, relishes, pickles, spiced butters, and numerous culinary dishes. Paper tinged with turmeric turns from yellow to reddish brown when an alkali is added to it, thus providing a test for alkalinity.

Turmeric (*Curcuma longa*).
W.H. HODGE

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Turner, Frederick Jackson (b. Nov. 14, 1861, Portage, Wis., U.S.—d. March 14, 1932, San Marino, Calif.) U.S. historian. He taught at the University of Wisconsin and at Harvard University. Deeply influenced by his Wisconsin childhood, Turner rejected the doctrine that U.S. institutions could be traced mainly to European origins, and he demonstrated his theories in a series of essays. In "The Significance of the Frontier in American History" (1893) he asserted that the American character had been shaped by frontier life and the end of the frontier era. Later he focused on sectionalism as a force in U.S. development. His essays were collected in *The Frontier in American History* (1920) and *Significance of Sections in American History* (1932, Pulitzer Prize).

Turner, J(oseph) M(allord) W(illiam) (b. April 23, 1775, London, Eng.—d. Dec. 19, 1851, London) British landscape painter. The son of a barber, he entered the Royal Academy school in 1789. In 1802 he became a full academician and in 1807 was appointed professor of perspective. His early work was concerned with accurate depictions of places, but he soon learned from Richard Wilson to take a more poetic and imaginative approach. *The Shipwreck* (1805) shows his new emphasis on luminosity, atmosphere, and Romantic, dramatic subjects. After a trip to Italy in 1819, his colour became purer and more prismatic, with a general heightening of key. In later paintings, such as *Sunrise, with a Boat Between Headlands* (1845), architectural and natural details are sacrificed to effects of colour and light, with only the barest indication of mass. His compositions became more fluid, suggesting movement and space. In breaking down conventional formulas of representation, he anticipated French Impressionism. His immense reputation in the 19th century was due largely to John Ruskin's enthusiasm for his early works; 20th-century critics celebrated the abstract qualities of his late colour compositions.

Detail of a self-portrait by J.M.W. Turner, oil on canvas, 1798; in the Tate Gallery, London.
COURTESY OF THE TRUSTEES OF THE TATE GALLERY, LONDON

Turner, Nat (b. Oct. 2, 1800, Southampton county, Va., U.S.—d. Nov. 11, 1831, Jerusalem, Va.) U.S. insurrectionist. Born into slavery, he became convinced of his mission to lead American slaves out of bondage and developed a scheme to capture the armoury at Jerusalem, Va. He took an eclipse of the sun as a sign to act (1831) and began his insurrection by killing his master's family. He led 75 slaves as they killed about 60 whites on a two-day march to Jerusalem. About 3,000 state militia and local whites defeated the insurrectionists, who were captured or killed. Turner eluded arrest for six weeks but was found, tried, and hanged. Alarmed by the uprising, Southern states passed legislation forbidding the education, movement, or assembly of slaves.

Turner, Ted *orig.* **Robert Edward Turner, III** (b. Nov. 19, 1938, Cincinnati, Ohio, U.S.) U.S. broadcasting entrepreneur. He took over his father's Atlanta-based advertising firm after the latter's 1963 suicide and restored it to profitability. In 1970 he bought the Atlanta television station WJRJ (later WTBS), which in 1975 became the superstation of the Turner Broadcasting System, broadcasting via satellite to cable systems nationwide. An avid sportsman, he purchased professional baseball and basketball franchises in Atlanta, and in 1977 he piloted his yacht, *Courageous*, to victory in the America's Cup race. He expanded his broadcasting empire with the 1980 launch of the Cable News Network (CNN) and the 1986 purchase of MGM/UA Entertainment (MGM) and its library of more than 4,000 movies. He married Jane Fonda in 1991 (divorced 2001). In 1996 he merged his broadcasting system with Time Warner and became its vice-chairman (see AOL Time Warner). In 2003 he resigned as vice-chairman of AOL Time Warner.

Turner syndrome Chromosomal disorder (from the presence of only one sex chromosome, X, in all or some of the body's cells) that causes abnormal sexual development in females. The syndrome may include absent or undeveloped ovaries, underdeveloped secondary sex characteristics, low hairline, webbed neck, shield-shaped chest with wide-spaced nipples, and kidney and heart malformations with coarctation (narrowing) of the aorta. It may not be recognized until a girl fails to undergo puberty at a normal age. Estrogen treatment results in puberty, adult appearance, and normal sex drive but not fertility. Surgery can correct malformations.

turnip Hardy biennial plant in the mustard family, cultivated for its fleshy roots and tender leaves. There are two species, the turnip proper (*Brassica rapa*) and the Swedish turnip, or rutabaga. The true turnip probably originated in middle and eastern Asia and spread by cultivation throughout the temperate zone. Both species are cool-season crops. Turnips develop rapidly enough to have an early-spring or late-summer seeding produce a crop before, respectively, extremes of summer or late-fall weather occur.

turpentine Any resinous exudate or extract from conifers, especially pines; now also commonly a term for its volatile fraction, oil (or spirits) of turpentine. Semifluid mixtures of organic compounds consisting of resins dissolved in a volatile oil, turpentines can be distilled (see distillation) into the volatile oil of turpentine and the nonvolatile rosin. The oil, a mixture of monoterpenes (see isoprenoid), chiefly pinene, is a colourless, odorous, flammable liquid that does not mix with water but is a good solvent for many substances. Oil of turpentine is favoured over petroleum solvents as an oil-paint thinner, varnish solvent, and brush cleaner. Its chief use is now as a raw material for resins, insecticides, oil additives, and synthetic pine oil and camphor and as a solvent.

turquoise Hydrated copper and aluminum phosphate mineral, $CuAl_6(PO_4)_4(OH)_8 \cdot 4H_2O$, that is used extensively as a gemstone. The colour of turquoise ranges from blue through various shades of green to greenish and yellowish gray. A delicate sky-blue, which provides an attractive contrast with precious metals, is most valued for gem purposes. Numerous deposits of turquoise in the southwestern U.S. have been worked for centuries by American Indians. The mineral also occurs in Iran, northern Africa, Australia, and Siberia.

turtle Any of more than 250 species (order Chelonia) of reptiles having a bony shell overlaid with horny shields; found in most parts of the world. Turtles have existed for 200 million years, making them the oldest of all surviving reptiles. Most species are aquatic or semiaquatic; some are terrestrial. Turtles eat plants, animals, or both. They are toothless, have a horny beak, and range from less than 4 in. (10 cm) to more than 7 ft (2 m) long. They have sturdy, sprawling limbs with short feet or paddlelike flippers (marine turtles). Some species bend the neck sideways, but most pull the head and neck backward into the shell. Almost half the known turtle species are rare, threatened, or endangered. See also box turtle, painted turtle, snapping turtle, softshell turtle, terrapin, tortoise.

turtledove Species (*Streptopelia turtur*, family Columbidae) of migratory European pigeon that winters in northern Africa. It is about 11 in. (28 cm) long and has a reddish brown body, blue-gray head, and white-tipped tail. A ground feeder, it eats prodigious amounts of small seeds. The name is applied to other temperate and tropical Old World *Streptopelia* species of slim, fast-flying game birds. The ringed turtledove, or ringdove, has feral populations in California and Florida, U.S.; the laughing and spotted doves have also been introduced outside their native habitats.

Tuscany *Italian* **Toscana** Region (pop., 2001 prelim.: 3,460,835), west-central Italy. It covers 8,877 sq mi (22,992 sq km), and its capital is Florence. Originally settled by Etruscans c. 1000 BC, Tuscany came under Roman rule in the 3rd century BC. It was a Lombard duchy in the 6th century AD. It comprised several independent city-states in the 12th–13th centuries, which were subsequently united under the Medici family of Florence. Tuscany passed to the house of Lorraine in 1737 and to Sardinia and the Kingdom of Italy in the 1860s. The region suffered severe damage in World War II and extensive floods in 1966. Its mineral resources include the world-famous Carrara marble. Its agricultural products include olives, olive oil, wines, and livestock. Tourism is important at its historical centres, including Florence and Pisa.

Tusculum \'təs-kyə-ləm\ Ancient town, Latium, Italy. Located near Rome, it was a Latin settlement as early as the 1st millennium BC and probably was under the influence of the Etruscans. It was a favourite resort of wealthy Romans (1st century BC–4th century AD), and it was the home of orator Marcus Tullius Cicero. Tourist attractions include a Roman forum, a 2nd-century amphitheatre, and a medieval castle.

Tuskegee Airmen \tə-'skē-gē\ Black servicemen of the U.S. Army Air Forces (USAAF) who trained at Alabama's Tuskegee Army Air Field in

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World War II. They constituted the first African American flying unit in the U.S. military. The first class trained at Tuskegee in 1941 became the 99th Pursuit Squadron, commanded by Lt. Col. Benjamin O. Davis, Jr. They flew their first mission in the Mediterranean in 1943. Later that year the army activated three more squadrons; joined with the 99th in 1944, they constituted the 332nd Fighter Group. The latter was the USAAF's only escort group that did not lose a bomber to enemy planes. A second black flying group, the 477th Bombardment Group, was established near the end of the war. In all, the Tuskegee Airmen flew 1,578 missions, destroyed 261 enemy aircraft, and won over 850 medals.

Tuskegee University Private university in Tuskegee, Alabama, U.S. Booker T. Washington founded the school in 1881 as a teachers' college for blacks, and it still has a predominantly African American student body. George Washington Carver conducted most of his research (1896–1943) at Tuskegee, and Frederick D. Patterson, founder of the United Negro College Fund (1944), served as the school's president (1935–53). The infamous Tuskegee syphilis study, a U.S. Public Health Service project examining the course of untreated syphilis in black men, was based there from the 1930s. Today the university comprises schools of arts and sciences, agriculture, business, education, engineering and architecture, nursing, and veterinary medicine.

Tussaud \tù-'sō**, Marie** *orig.* **Marie Grosholtz** (b. Dec. 1, 1761, Strasbourg, France—d. April 16, 1850, London, Eng.) French British founder of Madame Tussaud's museum of wax figures in London. From 1780 until the French Revolution, she served as art tutor to Louis XVI's sister. During the Reign of Terror she made death masks from heads—frequently those of her friends—freshly severed by the guillotine. In 1802 she moved to Britain with her collection of wax models. Her museum contains a variety of historical figures, including the original models she made of her great contemporaries, including Voltaire and Benjamin Franklin. By the turn of the 21st century, branches of her museum were located throughout the world.

tussock moth Typical member of the small European and New World lepidopteran family Liparidae (formerly Lymantriidae). The large, hairy larvae of most species have hair tufts, or tussocks; many have stinging hairs. Several species, including the gypsy moth, browntail moth, satin moth, and nun moth, damage trees. The larvae feed on foliage, sometimes foraging from a silken tent or a colonial nest of webbed leaves. Larvae pupate in a cocoon attached to a tree branch or trunk. Adult females range from white to brown; some, such as the white-marked tussock moth, are wingless. See also moth.

Tutankhamen \ˌtü-ˌtäŋ-'kä-mən\ *orig.* **Tutankhaten** (fl. 14th century BC) Egyptian pharaoh (r. 1333–23 BC) of the 18th dynasty. When he took the throne at about age eight, he was advised to move back to Memphis from Akhetaton, the city of his father-in-law and predecessor, Akhenaton. During his reign the traditional religion was restored after the changes made by Akhenaton. Shortly before he died, while still in his teens, he sent troops to Syria to aid an ally against a group connected with the Hittites. Because his name was among those stricken from the royal lists during the 19th dynasty, his tomb's location was forgotten and his burial chamber was not opened until 1922, when it was discovered by Howard Carter (1873–1939). Its treasures made Tutankhamen perhaps the best-known of the pharaohs despite his early death and limited accomplishments.

Tutankhamen, gold funerary mask found in the king's tomb, 14th century BC; in the Egyptian Museum, Cairo.
© LEE BOLTIN

Tutsi \'tüt-sē\ People of Rwanda and Burundi who are traditionally considered Nilotic. They speak Rundi or Rwanda (mutually intelligible languages of the Niger-Congo family) and number some 1.5 million. The Tutsi represent a traditional aristocratic minority, which has dominated the more populous Hutu. Originally warrior-herders, the Tutsi entered the area in the 14th or 15th century and later, assisted by German and Belgian colonial regimes, cultivated a lord-vassal relationship with the Hutu. At the head of the pyramidal political structure was the *mwami* ("king"), considered to be of divine origin. Today Hutu and Tutsi cultures have largely become integrated. In addition to sharing languages, they both adhere to similar traditional and/or Christian religious beliefs. The Tutsi retained their dominant position over the Hutu in Rwanda until 1961, when the monarch was overthrown. An unsuccessful Hutu revolt in Burundi in 1972 led to 100,000 deaths, mostly Hutu. In 1993 in Burundi and in 1994 in Rwanda, further clashes occurred, the latter including a genocidal campaign by Hutu militia and civilians in which more than a million Tutsi and their Hutu allies were killed and one to two million Hutu fled to refugee camps in Congo (Kinshasa; then Zaire) and Tanzania.

Tutu, Sir Desmond (Mpilo) (b. Oct. 7, 1931, Klerksdorp, S.Af.) South African Anglican cleric. He studied theology at the University of South Africa and King's College, London. He became an Anglican priest in 1961 and bishop of Lesotho in 1976. In 1978 he became general secretary of the South African Council of Churches and an eloquent and outspoken advocate for the rights of black South Africans. He emphasized nonviolent protest and encouraged other countries to apply economic pressure to South Africa. In 1984 he received the Nobel Prize for Peace for his role in opposing apartheid. In 1986 he was elected the first black archbishop of Cape Town and titular head of South Africa's 1.6-million-member Anglican Church. He retired from the primacy in 1996 and became chairman of the Truth and Reconciliation Commission, charged with hearing evidence of human-rights violations under white rule. Since 1988 he has been chancellor of the University of the Western Cape in Bellville, S.Af.

Tutuola \ˌtü-tü-'wō-lä**, Amos** (b. 1920, Abeokuta, Nigeria—d. June 8, 1997, Ibadan) Nigerian writer. He had only six years of formal schooling and wrote in English and outside the mainstream of Nigerian literature. His stories incorporated Yoruba myths and legends into loosely constructed prose epics that improvised on traditional themes. His best-known work is *The Palm-Wine Drinkard* (1952), a classic quest tale that was the first Nigerian book to achieve international fame. His later works include the tale *The Witch-Herbalist of the Remote Town* (1981), *Yoruba Folktales* (1986), and *Village Witch Doctor* (1990).

Tuvalu \tü-'vä-lü\ Island country, west-central South Pacific Ocean. Area: 9.9 sq mi (25.6 sq km). Population (2005 est.): 9,700. Capital: Vaiaku, Fongafale islet (of Funafuti atoll). The majority of the people are Polynesian. Languages: Tuvaluan; English is widely used. Religion: Christianity (predominantly Protestant). Currency: Tuvalu dollar (equivalent to the Australian dollar). Tuvalu is an island group comprising five atolls and four coral islands, all of them low-lying, with maximum elevations below 20 ft (6 m), and covered mainly with coconut palms, breadfruit trees, and grasses. The economy is based on subsistence agriculture and livestock raising. Tuvalu is a constitutional monarchy with one legislative house; its chief of state is the British monarch represented by the governor-general, and the head of government is the prime minister. The original Polynesian settlers probably came mainly from Samoa or Tonga. The islands were sighted by the Spanish in the 16th century. Europeans settled there in the 19th century and intermarried with Tuvaluans. During this period Peruvian slave traders known as "blackbirders" decimated the population. In 1856 the U.S. claimed the four southern islands for guano mining. Missionaries from Europe arrived in 1865 and rapidly converted the islanders to Christianity. In 1892 Tuvalu, then known as the Ellice Islands, joined the British Gilbert Islands, a protectorate that became the Gilbert and Ellice Islands colony in 1916. Tuvaluans voted in 1974 for separation from the Gilberts (now Kiribati), whose people are Micronesian. Tuvalu gained independence in 1978, and in 1979 the U.S. relinquished its claims. Elections were held in 1981, and a revised constitution was adopted in 1986. The government subsequently has tried to improve Tuvalu's economy, including finding overseas job opportunities for its citizens.

Tuxtla \'tüst-lä\ *in full* **Tuxtla Gutiérrez** City (pop., 2000: 424,579), capital of Chiapas state, southeastern Mexico. The Spanish who arrived there in the 16th century were frequently beset by Indians, and the town grew slowly. In 1892 it was made the state capital. It is now the major commercial and manufacturing centre in the state and an agricultural distributing point. There are archaeological remains of pre-Columbian culture in the region.

Tuzla \'tüz-lä\ Town (pop., 1991: 83,770), northeastern Bosnia and Herzegovina. Deposits of rock salt are located nearby; in the 10th cen-

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tury the town was called Soli (meaning "salts"), and its present name is from the Turkish *tuz*, "salt." It was a Turkish garrison town from 1510 until it passed to the Austro-Hungarian Empire in the 19th century. It was incorporated into Yugoslavia in 1918. It is the centre for a mining region and an agricultural district. It was a target during the war in Bosnia in the 1990s (see BOSNIAN CONFLICT).

TVA See TENNESSEE VALLEY AUTHORITY

TWA See TRANS WORLD AIRLINES, INC.

Twain, Mark *orig.* **Samuel Langhorne Clemens** (b. Nov. 30, 1835, Florida, Mo., U.S.—d. April 21, 1910, Redding, Conn.) U.S. humorist, writer, and lecturer. He grew up in Hannibal, Mo., on the Mississippi River. At age 13 he was apprenticed to a local printer. In 1856 he signed on as an apprentice to a steamboat pilot. He plied the Mississippi for almost four years before going to Nevada and California. In 1863 he took his pseudonym, the riverman's term for water "two fathoms deep." In a California mining camp he heard the story that he would make famous as "The Celebrated Jumping Frog of Calaveras County" (1865). He traveled widely, using his travels as subject matter for lectures and books, including the humorous narratives *The Innocents Abroad* (1869) and *Roughing It* (1872). He won a worldwide audience for his stories of youthful adventures, especially *Tom Sawyer* (1876), *The Prince and the Pauper* (1881), *Life on the Mississippi* (1883), and *Huckleberry Finn* (1884), one of the masterpieces of American fiction. The satirical *A Connecticut Yankee in King Arthur's Court* (1889) and increasingly grim works including *Pudd'nhead Wilson* (1894) and *The Man Who Corrupted Hadleyburg* (1900) followed. In the 1890s financial speculations bankrupted him, and his eldest daughter died. After his wife's death (1904), he expressed his pessimism about human character in such late works as the posthumously published *Letters from the Earth* (1962).

tweed Medium- to heavy-weight fabric, rough in surface texture, produced in a great variety of colour and weave effects (see WEAVING). Most tweeds are made entirely of WOOL, but an increasing number are blends of wool with cotton, rayon, or other synthetic fibres. Most are woven from dyed YARNS, but some are dyed after being woven. Technical advances in dyeing raw stock, yarns, and fabrics, together with new techniques in finishing, have resulted in a wide variety of durable cloths.

Tweed, River River, southeastern Scotland and northeastern England. It rises in the Borders region of southeastern Scotland and flows east, forming a section of the border between Scotland and England. It then crosses into England and empties into the NORTH SEA at Berwick. It is 97 mi (156 km) long.

Tweed, William Marcy *known as* **Boss Tweed** (b. April 3, 1823, New York, N.Y., U.S.—d. April 12, 1878, New York City) U.S. politician. He worked as a bookkeeper and volunteer firefighter. As city alderman (1851–56), he gained influence in TAMMANY HALL and obtained important positions in city government. He appointed political cronies to key city posts and built a group later called the Tweed ring. As head of Tammany's general committee (from 1860), he controlled the Democratic Party's nominations to all city positions. He opened a law office to receive payments for "legal services" from city contractors and corporations. Elected to the state senate (1868), he also became Tammany's grand sachem (leader) and controlled city and state political patronage. He gained control of the city treasury and plundered sums estimated at between $30 million and $200 million. Reformers and exposure by the press, including THOMAS NAST's cartoons in *Harper's Weekly*, brought prosecution, led by SAMUEL TILDEN, that resulted in Tweed's conviction and imprisonment (1873–75, 1876–78).

Boss Tweed
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Twelve Tables, Law of the Earliest codification of ancient ROMAN LAW, traditionally dated to 451–450 BC. They were purportedly written at the demand of the plebeians, who felt that their legal rights were hampered by the fact that court judgments were rendered according to unwritten custom preserved only within a small group of learned patricians. The Twelve Tables were not a reform or a liberalizing of old custom; they recognized the prerogatives of the patrician class and of the patriarchal family, the validity of enslavement for unpaid debt, and the interference of religious custom in civil cases. Because only random quotations from the Twelve Tables are extant, knowledge about their contents is largely derived from references in later juridical writings. Venerated by the Romans as a prime legal source, the Twelve Tables were superseded by later changes in Roman law but were never formally abolished.

Twentieth Century-Fox Film Corp. U.S. movie studio. It was formed in 1935 by the merger of Twentieth Century Pictures (founded in 1933 by Joseph Schenck and DARRYL F. ZANUCK) and the Fox Film Corp. (founded in 1915 by William Fox). The new studio produced mainly westerns and musicals into the 1940s, as well as notable films such as *The Grapes of Wrath* (1940) and *The Snake Pit* (1948). In 1953 it introduced CinemaScope with *The Robe*, and later in the decade it made hits such as *The King and I* (1956) and *South Pacific* (1958). After the expensive failure of *Cleopatra* (1963), the studio recouped with *The Sound of Music* (1965), *Patton* (1970), *M*A*S*H* (1970), and *Star Wars* (1977), the film industry's most profitable movie to that time. In 1981 the company was bought by the oil magnate Marvin Davis, who resold it in 1985 to RUPERT MURDOCH. Murdoch consolidated his American film and television companies under a holding company, Fox, Inc.

Twentieth Congress of the Communist Party of the Soviet Union (Feb. 14–25, 1956) Meeting at which NIKITA KHRUSHCHEV repudiated JOSEPH STALIN and STALINISM. Khrushchev's secret speech denouncing the former Soviet leader was accompanied by his Report of the Central Committee to the Congress, which announced a new line in Soviet foreign policy. He based his new policy on "the Leninist principle of coexistence of states with different social systems." Khrushchev also used the Congress to promote his loyal supporters to high party office and to take control of the party from the Stalinist old guard.

twenty-one See BLACKJACK

twill One of the three basic TEXTILE weaves (see WEAVING), distinguished by diagonal lines. In the simplest twill, the weft crosses over two warp YARNS, then under one, the sequence being repeated in each succeeding shot (row), but stepped over, one warp either to the left or right. In regular twill, the diagonal line is repeated regularly, usually running upward from left to right at 45°. The weave can be varied in many ways—for example, by changing the direction of the twill line (as in herringbone twill) or its angle. Twill is much used for men's wear and many other clothing applications because it has stretch on both diagonals, which makes clothes comfortable even if closely fitted. DENIM and many TWEEDS are of twill weave.

Twining, Nathan F(arragut) (b. Oct. 11, 1897, Monroe, Wis., U.S.—d. March 29, 1982, Lackland Air Force Base, near San Antonio, Texas) U.S. air force officer. He graduated from West Point and served as an army pilot from 1924. In World War II he commanded the air force in the South Pacific and directed the air war against Japan in the Solomon Islands and New Guinea (1943) and Japan (1945). In 1944–45 he led the strategic bombing campaign against Germany and the Balkans. He later became chief of staff of the U.S. Air Force (1953–57) and chairman of the Joint Chiefs of Staff (1957–60).

Two Sicilies See TWO SICILIES

Two Sicilies, Kingdom of the Former kingdom, Italy. It united the southern part of the Italian peninsula with the island of SICILY. The region was conquered by the Normans in the 11th century; the two areas were divided in 1282 between the Angevin (French) dynasty on the mainland and the Aragonese (Spanish) dynasty on the island, both of which claimed the title of King of Sicily. In 1442 ALFONSO V of Aragon reunited the two areas and took the title of King of the Two Sicilies. This title was sometimes used during the Spanish and Bourbon rule of the region in the 16th–19th centuries; it became official in 1816, when the administration of both areas was combined and Sicily lost its autonomy. Conquered by Giuseppe de GARIBALDI in 1860, the Two Sicilies became part of the Kingdom of Italy.

Tycho Brahe See Tycho BRAHE

Tyler, Anne (b. Oct. 25, 1941, Minneapolis, Minn., U.S.) U.S. writer. Tyler worked as a bibliographer and librarian before settling in Baltimore

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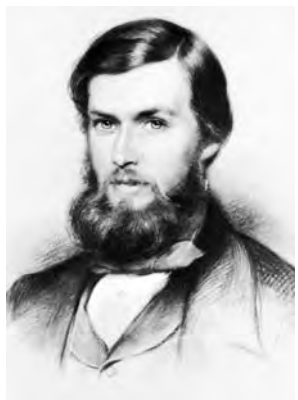
in 1967 and beginning to write full-time. Her novels, comedies of manner marked by compassionate wit and precise details of domestic life, include *Dinner at the Homesick Restaurant* (1982), *The Accidental Tourist* (1985; film, 1988), *Breathing Lessons* (1988, Pulitzer Prize), and *A Patchwork Planet* (1998). Several focus on eccentric middle-class people living in chaotic, disunited families in Baltimore.

Tyler, John (b. March 29, 1790, Charles City county, Va., U.S.—d. Jan. 18, 1862, Richmond, Va.) 10th president of the U.S. (1841–45). He practiced law before serving in the Virginia legislature (1811–16, 1823–25, 1839) and as governor of Virginia (1825–27). In the U.S. House of Representatives (1817–21) and Senate (1827–36), he was a supporter of STATES' RIGHTS. Though a slaveholder, he sought to prohibit the slave trade in the District of Columbia, provided Maryland and Virginia concurred. He resigned from the Senate rather than acquiesce to state instructions to change his vote on a censure of Pres. ANDREW JACKSON. After breaking with the Democratic Party, he was nominated by the WHIG PARTY for vice president under WILLIAM H. HARRISON. They won the 1840 election, carefully avoiding the issues and stressing party loyalty and the slogan "Tippecanoe and Tyler too!" Harrison died a month after taking office, and Tyler became the first to attain the presidency "by accident." He vetoed a national bank bill supported by the Whigs, and all but one member of the cabinet resigned, leaving him without party support. Nonetheless, he reorganized the navy, settled the second of the SEMINOLE WARS in Florida, and oversaw the annexation of Texas. He was nominated for reelection but withdrew in favour of JAMES K. POLK and retired to his Virginia plantation. Committed to states' rights but opposed to SECESSION, he organized the Washington Peace Conference (1861) to resolve sectional differences. When the Senate rejected a proposed compromise, Tyler urged Virginia to secede.

Tyler, Wat See PEASANTS' REVOLT

Tylor, Sir Edward Burnett (b. Oct. 2, 1832, London, Eng.—d. Jan. 2, 1917, Wellington, Somerset) British anthropologist, often called the founder of CULTURAL ANTHROPOLOGY. He taught at Oxford University (1884–1909), where he became the first professor of anthropology. His *Primitive Culture*, 2 vol. (1871), influenced by CHARLES DARWIN, developed the theory of an evolutionary relationship between what he called primitive and modern cultures, stressing the cultural achievements that marked the progression of all humanity from a "savage" to a "civilized" state. At a time when there was still controversy over whether all human races belonged to a single species, Tylor was a powerful advocate of the unity of all humankind. He was instrumental in establishing anthropology as an academic discipline. See also ANIMISM; SOCIOCULTURAL EVOLUTION.



Tylor, detail of a chalk drawing by G. Bonavia; in the National Portrait Gallery, London

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Tyne, River River, NORTHUMBERLAND, northern England. Formed by the confluence of the North Tyne and the South Tyne, it flows east into the North Sea. The Tyne is 62 mi (100 km) long. It has shipped coal for at least six centuries. Its estuary is now lined with industry and large urban communities.

Tyne and Wear \'tīn...'wir\ Metropolitan county (pop., 2001: 1,075,979), northeastern England. It was named for its two main rivers, the TYNE and the Wear. Settled since prehistoric times, the area was occupied by the Romans, who built HADRIAN'S WALL. Saxon, then Norman settlement followed. From the 13th century to recent times, the economy was based on local coal reserves and on such coal-dependent industries as glass, pottery, and chemicals. The main industries now include shipbuilding and heavy electrical engineering.

typeface See FONT

types, theory of In LOGIC, a theory introduced by BERTRAND RUSSELL and ALFRED NORTH WHITEHEAD in their *Principia Mathematica* (1910–13) to deal with logical PARADOXES arising from the unrestricted use of PROPOSITIONAL FUNCTIONS as variables. The type of a propositional function is determined by the number and type of its arguments (the distinct variables it contains). By not allowing propositional functions to be applied to arguments of equal or higher type, contradictions within the system are avoided.

typesetting Setting of type for use in any of various PRINTING processes. Type for printing, using woodblocks, was invented in China in the 11th century, and movable type using metal molds had appeared in Korea by the 13th century. It was reinvented in Europe in the 1450s by JOHANNES GUTENBERG. For much of its history, typesetting and printing were often performed by the same person, who arranged movable type, one character at a time, in rows corresponding to the individual lines in the publication and operated the hand press to imprint the image on paper. Typesetting was revolutionized in the 1880s with the invention of the "hot-metal" processes: LINOTYPE (1884), in which the lines of type were assembled by use of a typewriter-like keyboard and each line was cast as a single slug of molten metal, and MONOTYPE (1887), which also used a keyboard but cast each character separately. Photocomposition—the composition of text directly on film or photosensitive paper using a rotating drum or disk with cutout type characters through which light could be directed onto the receiving surface—appeared in the early 20th century. By the late 20th century, computers and publishing software generated characters and handled most hyphenation, layout, and other page-makeup decisions, with the resulting electronic file, including any graphics, passed to a laser printer for paper or film reproduction.

typewriter Machine for writing characters similar to those made by printers' types, especially a machine in which the characters are produced by steel types striking the paper through an inked ribbon, the types being activated by corresponding keys on a keyboard and the paper being held by a roller (the platen) that is automatically moved along with a carriage when a key is struck. The first practical typewriter was patented in 1868 by CHRISTOPHER L. SHOLES; commercial production began at the Remington firearms company in 1874. By the end of the century the typewriter had come to dominate the American office. The first electric typewriter for office use was introduced in 1920. From the 1970s typewriters began to be replaced by PERSONAL COMPUTERS and their associated printers.

typhoid *or* **typhoid fever** Acute infectious disease resembling TYPHUS (and distinguished from it only in the 19th century). *Salmonella typhi*, usually ingested in food or water, multiplies in the intestinal wall and then enters the bloodstream, causing SEPTICEMIA. Symptoms begin with headache, aching, and restlessness. High fever gradually develops, with delirium. A rash appears on the trunk. The sites where the bacilli multiplied become inflamed and may ulcerate, leading to intestinal bleeding or PERITONITIS. Patients become exhausted and emaciated; up to 25% die if not treated. ANTIBIOTIC treatment is effective. Patients can carry typhoid for weeks to months or years. Carriers can contaminate the food they handle. Prevention depends mainly on water and sewage treatment and excluding carriers from food-handling jobs.

Typhoid Mary *byname of* **Mary Mallon** (b. 1870?—d. Nov. 11, 1938, North Brother Island, N.Y., N.Y., U.S.) U.S. carrier of TYPHOID. A 1904 typhoid epidemic on Long Island was traced to households where she had been a cook. She fled, but authorities finally caught up with her and isolated her on an island off the Bronx. In 1910 she was released after agreeing not to take a food-handling job, but she did, causing more typhoid outbreaks. She was returned to the island for the rest of her life. Three deaths and 51 original cases were directly attributed to her.

Typhon In GREEK MYTHOLOGY, the youngest son of GAEA and TARTARUS. A grisly monster with a hundred dragons' heads, he was conquered and cast into the underworld by ZEUS but continued to be the source of destructive winds. In other accounts, he was confined in the land of the Arimi in Cilicia or under Mount ETNA, where he caused eruptions and was thus the personification of volcanic forces. Among his children were CERBERUS, CHIMERA, and the multiheaded Hydra. Later writers identified him with the Egyptian god SETH.

typhoon See TROPICAL CYCLONE

typhus Any of a group of related diseases caused by various species of RICKETTSIA that release TOXINS into the blood. Headache, chills, fever, and general pains begin suddenly and a rash soon after. The bacteria are transmitted by lice, fleas, mites, and ticks. Epidemic typhus, spread by the body louse, is the most severe. It is one of the great scourges of history, associated with crowded, filthy conditions. Improved hygiene has nearly

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eliminated it from the Western world, but it persists in many countries, despite modern vaccines and pesticides. Endemic typhus, spread by fleas on rats and other rodents, is milder (mortality under 5%). Scrub typhus, carried by mites, is usually classed as a separate disease. See also ROCKY MOUNTAIN SPOTTED FEVER; HANS ZINSSER.

typographic printing See LETTERPRESS PRINTING

typography Design or selection of letter forms to be organized into words and sentences and printed or displayed electronically. Typography originated after the invention of printing from movable type in the mid 15th century. The three major type families in the history of Western printing are ROMAN, italic, and BLACK LETTER (Gothic). All had their origin in the scripts of the calligraphers whose work was ultimately replaced by printing. In the succeeding centuries typographers have created some 10,000 typefaces (a complete set of letter forms of a particular design). Depending on the style of their letters, typefaces are categorized as old style, transitional, and modern. Commonly used typefaces include Caslon, Baskerville, Bodoni, Garamond, and Times New Roman. See also JOHN BASKERVILLE; GIAMBATTISTA BODONI; STANLEY MORISON. The selection of a typeface is an important part of the aesthetic process in GRAPHIC DESIGN.

tyrannosaur Any of a group of related carnivorous dinosaurs similar to the ALLOSAURS. *Tyrannosaurus rex* is the largest and best known, found as fossils in Late Cretaceous (99–65 million years ago) deposits of North America and eastern Asia. Some adults were more than 40 ft (12 m) long and 16–18 ft (over 5 m) tall and weighed 6 tons (5.4 metric tons) or more. Tyrannosaurs walked with a stooped posture, carrying the body forward and the long tail off the ground. They had a short, thick neck, a very large skull, and pointed teeth, up to 6 in. (15 cm) long, with serrated edges. Each small forelimb had two claws, perhaps for holding struggling prey. A nearly complete skeleton of *T. rex* called "Sue" is on display at the Field Museum in Chicago. Other tyrannosaurs include *Albertosaurus, Alectrosaurus,* and *Nanotyrannus*.

tyrant In ancient Greece, a cruel and oppressive absolute ruler. The Greek *tyrannos* was a ruler who seized power unconstitutionally or inherited such power. Though tyrants often replaced aristocratic regimes that were themselves unpopular, the Greeks resented their illegal autocracy, and those who killed tyrants received high honours. CYPSELUS and PERIANDER of Corinth and DIONYSIUS I of Syracuse were among the most famous tyrants.

Tyre \'tīr\ *Arabic* **Ṣūr** \'sür\ City (pop., 2003 est.: 117,100), southern Lebanon. It was a major PHOENICIAN port from c. 2000 BC through Roman times and later was noted for its silken garments and Tyrian purple dye. Probably founded as a colony of SIDON, it was first mentioned in the 14th century BC; it is frequently mentioned in the Bible. Tyre successfully resisted a 6th-century-BC siege of 13 years by the Babylonian king NEBUCHADREZZAR II, but it fell to ALEXANDER THE GREAT in 332 BC. Ruled later by the SELEUCID DYNASTY and then by the Romans, it passed to the Muslims in the 7th century AD. After its capture by the Crusaders in 1124, it became a chief city of the kingdom of Jerusalem (see CRUSADES). It fell again to the Muslims in 1291 and was destroyed. The modern city was included in Lebanon in 1920 and was occupied by Israeli forces (1982–85). Its main economic activity is fishing. Tyre's ruins were designated a UNESCO WORLD HERITAGE SITE in 1984.

Tyrol See TIROL

Tyrone \tī-'rōn\ Former county, western central Northern Ireland. In the 1973 administrative reorganization of Northern Ireland, the county was divided into several smaller districts. The O'Nialls (or O'Neills) ruled the territory from the 5th to the 16th century AD. Subsequently the vast estates passed to the English crown and were divided and granted by the king under the scheme for the Plantation of Ulster. Royalist forces established fortifications, and the area was colonized.

Tyrone \'tī-rən**, Hugh O'Neill, 2nd earl of** (b. c. 1540—d. July 20, 1616, Rome, Papal States) Irish rebel. Born into the powerful O'Neill family of Ulster, he grew up in London, then returned to Ireland (1568) to assume his grandfather's title of earl of Tyrone. As chieftain of the O'Neills from 1593, he led skirmishes against the English and won the Battle of the Yellow Ford on the River Blackwater, Ulster, which sparked a countrywide revolt (1598). He received aid and troops from Spain (1601) but was defeated by the English at Kinsale and forced to surrender (1603). In 1607 he fled with about 100 chieftains and lived in Rome the rest of his life. The so-called "flight of the earls" brought an end to Gaelic Ulster, and the province was rapidly Anglicized.

tyrosine \'tī-rə-ˌsēn\ One of the AMINO ACIDS, not essential for humans unless they have the hereditary disorder PHENYLKETONURIA. It is the biochemical precursor of many important CATECHOLAMINES. It is found in small amounts in most PROTEINS, especially INSULIN and papain (found in PAPAYA). It is used in biochemical research and as a dietary supplement.

Tyrrhenian Sea \tə-'rē-nē-ən\ *Italian* **Mare Tirreno** \'mä-rā-tē-'re-nō\ Arm of the MEDITERRANEAN SEA. It is located between the western coast of Italy and the islands of CORSICA, SARDINIA, and SICILY. It is connected with the Ligurian Sea on the northwest through the Tuscan Archipelago and with the Ionian Sea on the southeast through the Strait of MESSINA. Chief inlets include the Bay of NAPLES.

Tyson, Mike *in full* **Michael Gerald Tyson** (b. June 30, 1966, Brooklyn, N.Y., U.S.) U.S. boxer. A member of street gangs in his youth, Tyson was sent to reform school, where his boxing talent was discovered. He turned professional in 1985 and won the heavyweight title in 1986 by defeating Trevor Berbick, becoming, at age 20, the youngest heavyweight champion in history. He defended the title against LARRY HOLMES, Michael Spinks, and eight others before losing in an upset to James ("Buster") Douglas in 1990. In 1992 he was convicted of rape and sentenced to six years in prison; he was released on parole in 1995. In 1996 he challenged but lost to EVANDER HOLYFIELD; in a 1997 rematch he was disqualified for biting off a piece of Holyfield's ear, and his license was revoked. In 1999 Tyson regained his boxing license and returned to the ring. In his bout against British heavyweight champion LENNOX LEWIS in 2002, Lewis twice knocked Tyson to the canvas before knocking him out in the eighth round.

tzaddiq \'tsä-dik, tsä-'dēk\ *or* **zaddik** One who embodies the religious ideals of Judaism. The term is used repeatedly in the OLD TESTAMENT and in the TALMUD, which asserts that the continued existence of the world is due to the merits of 36 righteous men. In HASIDISM it came to refer to a religious leader who was viewed as a mediator between humankind and God. Initially the zaddikim traveled widely and engaged in social activities to strengthen the community's spiritual life. Toward the end of the 18th century, they ceased this practice and became available at home for those seeking advice.

Tzeltal \tsel-'täl\ Mayan Indian group of central Chiapas state in southern Mexico. Traditionally an agricultural people, they cultivate corn (maize), beans, chiles, squash, manioc, and peanuts with digging sticks and hoes. Their major crafts are pottery, weaving, and basketry. They profess Roman Catholicism, though pre-Columbian rituals are also practiced.

Tzotzil \tsōt-'sēl\ Mayan Indian group of central Chiapas state in southern Mexico. They live at high elevations where the climate is cool and precipitation is heavy during the rainy season. They raise sheep, primarily for wool, which they weave into ponchos for men and shawls for women. They practice shifting cultivation and grow peaches and other crops for the market. Some make pottery, leather, and fibre products or practice carpentry or stonework. Christian and native beliefs are intertwined in all Tzotzil areas.

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U-2 Affair (1960) Confrontation between the U.S. and the Soviet Union. On May 1, 1960, the Soviet Union shot down a U.S. U-2 reconnaissance plane and called the flight an "aggressive act." The U.S. denied Soviet claims that the pilot, F. Gary Powers, had stated that his mission was to collect Soviet intelligence data. Nikita Khrushchev declared that the Soviet Union would not take part in a scheduled summit conference with the U.S., Britain, and France unless the U.S. immediately stopped flights over Soviet territory, apologized, and punished those responsible. Pres. Dwight D. Eisenhower agreed only to the first stipulation, and the conference was adjourned. Powers was tried in the Soviet Union and sentenced to 10 years in prison; in 1962 he was exchanged for the Soviet spy Rudolf Abel.

U-boat *German* **Unterseeboot ("undersea boat")** German submarine. The first German submarine, the U-1, was built in 1905. During World War I Germany became the first country to employ submarines in war, and during World War II its U-boats dominated the Battle of the Atlantic until the Allies developed new antisubmarine tactics. The principal German U-boat was the type VII; the VIIC variant was 220.25 ft (66 m) long, displaced 769 tons on the surface, carried one 90-mm deck gun and five torpedo tubes, and was manned by a crew of 44. Modern German U-boats are built for the German navy and navies of allied countries; their sophisticated structures, electonics, and propulsion systems allow them to be used for intelligence gathering and special operations in addition to defending sea lanes and threatening enemy forces.

Uaxactún \ˌwä-shäk-'tün\ Ancient Maya ruins, north-central Guatemala. One of the oldest known centres of Maya civilization, it was occupied in the 1st millennium BC; by c. 300 BC–c. AD 100 a number of ceremonial buildings had been erected, including a temple reminiscent of the more ancient Olmec civilization. Major remains predate the Classic period (AD 100–900). In the 9th century it declined, as did other southern lowland Maya centres, and was abandoned in the 10th century.

Ubangi \ü-'baŋ-gē\ **River** River, central Africa. Formed by the Bomu River and the Uele River on the northern border of the Democratic Republic of the Congo, it flows west and south, forming part of the boundary with the Central African Republic and with the Republic of the Congo. It then empties into the Congo River. It is 700 mi (1,126 km) long; with its longest headstream, it is double that length.

Ubasti See Bastet

UC See University of California

Ucayali \ˌü-kä-'yä-lē\ **River** River, central and northern Peru. The chief headstream of the Amazon River, it is formed by the junction of the Apurímac and Urubamba rivers. It then meanders north to unite with the Marañón River and form the Amazon. It is navigable for about two-thirds of its 1,000-mi (1,610-km) length.

Uccello \ü-'che-lō**, Paolo** *orig.* **Paolo di Dono** (b. 1397, Pratovecchio, near Florence—d. Dec. 10, 1475, Florence) Italian painter. Though apprenticed to the sculptor Lorenzo Ghiberti, he is not known to have worked in sculpture, and at 18 he was admitted to the painters' guild in Florence. *The Deluge*, one of his frescoes in the Chiostro Verde of Santa Maria Novella, demonstrates his intense study of perspective. He became so firmly identified with perspective that John Ruskin thought he had invented it. His three panels depicting the Battle of San Romano, like all the extant works of his mature years, combine the decorative late Gothic style with the new heroic style of the early Renaissance.

UCLA See University of California

'ūd \üd\ Stringed instrument prominent in medieval and modern Islamic music, forerunner of the European lute. Dating from the 7th century, it has a pear-shaped body, a fretless fingerboard, a short neck, and a bent-back pegbox with the tuning pegs set in the sides. The gut strings, of which there are often four pairs, are plucked with a plectrum.

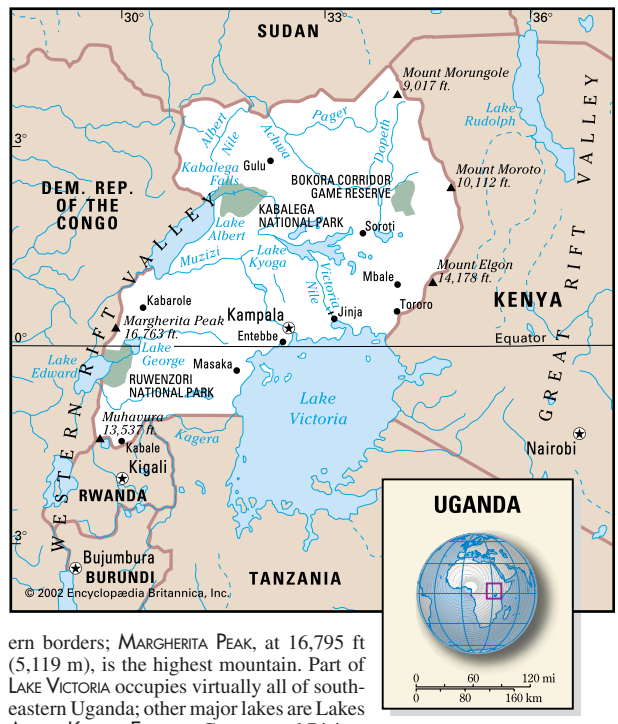
Udall \'yü-dəl, 'yü-ˌdȯl**, Nicholas** (b. December 1505?, Southampton, Hampshire, Eng.—d. December 1556, Westminster) English playwright, translator, and schoolmaster. The headmaster of Eton College from 1534 and of Westminster from 1555, Udall was well known as a translator. He is credited with writing many plays, of which only one is extant, *Ralph Roister Doister* (performed c. 1553), the first known English comedy. About a braggart soldier-hero who is finally shown to be an arrant coward, it marks the emergence of comedy from the medieval morality plays, interludes, and farces.

Ufa \ü-'fä\ City (pop., 2001 est.: 1,088,800), western Russia. Lying at the confluence of the Belaya and Ufa rivers, it was founded as a fortress in 1574 to protect the trade route across the Ural Mountains from Kazan to Tyumen. It became a town in 1586. It developed as an industrial centre from the late 19th century and especially after World War II. Chief industries include electrical equipment, lumber and veneer, and oil refining.

Uffizi \ü-'fēt-sē\ **Gallery** Art museum in Florence, housing the world's finest collection of Italian Renaissance painting. The core collection derives from the Medici family of Tuscany. In 1559 Cosimo I hired Giorgio Vasari to design the Uffizi Palace (1560–80), originally for use as government offices (*uffizi*). In 1565 Vasari built the corridor over the Ponte Vecchio connecting the Uffizi with the Pitti Palace. In 1737 Maria Ludovica, last of the Medici, bequeathed the family collections to Tuscany; the collection was given museum status and opened to the public in 1769. The building was restored and enlarged after bomb damage in World War II and flooding in 1966. In addition to Florentine paintings, the Uffizi houses outstanding works of other Italian and non-Italian schools, antique sculpture, a gallery of self-portraits, and 100,000 prints and drawings.

UFO See unidentified flying object

Uganda \yü-'gan-də, yü-'gän-də\ *officially* **Republic of Uganda** Country, eastern Africa. Area: 93,065 sq mi (241,038 sq km). Population (2005 est.): 27,269,000. Capital: Kampala. Uganda is home to dozens of African ethnic groups, as well as a small Asian community. Languages: English (official), Swahili. Religions: Christianity (mostly Roman Catholic; also Protestant); also Islam, traditional beliefs. Currency: Uganda shilling. A landlocked country on the Equator, Uganda is largely situated on a plateau, with volcanic mountains edging its eastern and western borders; Margherita Peak, at 16,795 ft (5,119 m), is the highest mountain. Part of Lake Victoria occupies virtually all of southeastern Uganda; other major lakes are Lakes Albert, Kyoga, Edward, George, and Bisina. The Nile River traverses the country. Huge tracts of land are devoted to national parks and game reserves. The economy is based largely on agriculture and food processing. Livestock raising and fishing are also impor-



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tant, and there is some manufacturing and mining. Uganda is a republic with one legislative house; its head of state and government is the president. By the 19th century the region was divided into several separate local kingdoms inhabited by various Bantu- and Nilotic-speaking peoples. Arab traders reached the area in the 1840s. The kingdom of Buganda was visited by the first European explorers in 1862. Protestant and Catholic missionaries arrived in the 1870s, and the development of religious factions led to persecution and civil strife. In 1894 Buganda was formally proclaimed a British protectorate. As Uganda, it gained independence in 1962, and in 1967 it adopted a republican constitution. The civilian government was overthrown in 1971 and replaced by a military regime under Idi Amin. His invasion of Tanzania in 1978 resulted in the collapse of his regime. The civilian government was again deposed by the military in 1985, but the military government was in turn overthrown in 1986. A constituent assembly enacted a new constitution in 1995.

Ugarit \yü-'gär-it, 'yü-gə-rit\ *modern* **Ra's Shamrah** Ancient city, Middle East. It was located on the eastern coast of the Mediterranean Sea in modern Syria. The earliest settlement was a small fortified town in the 7th millennium BC. It flourished in the 15th–12th centuries BC, when great royal palaces, temples, shrines, and libraries were built there. It was destroyed c. 1200 BC. Remains at the site include ancient records in cuneiform writing.

Uí Néill \ü-'nēl\ Major dynasty of medieval Ireland, which long dominated Ulster. It was founded by a shadowy figure known as Niall of the Nine Hostages (r. 379–405). Divided into northern and southern branches, the Uí Néill ruled as high kings, to whom all other Irish kings owed deference. In the early 11th century the king of Munster, Brian Boru, challenged the high kings of the Uí Néill dynasty and ended their dominance.

Uighur *or* **Uygur** \'wē-ˌgůr\ A Turkic-speaking people of Central Asia who live largely in northwestern China. About 8,000,000 Uighurs live in China today, and some 300,000 in Uzbekistan, Kazakhstan, and Kyrgyzstan. They are among the oldest Turkic-speaking peoples of Central Asia, first mentioned in Chinese records from the 3rd century AD. In the 8th century they established a kingdom, which was overrun in 840. A Uighur confederacy (745–1209), established around the Tien Shan, was overthrown by the Mongols. This confederacy came to the aid of China's Tang dynasty during the An Lushan Rebellion. The Uighurs of that time professed a Manichaean faith.

Uinta \yü-'in-tä\ **Mountains** Mountain range, south-central Rocky Mountains, U.S. They extend east more than 100 mi (160 km) from the Wasatch Mountains across northeastern Utah and slightly into southwestern Wyoming. Many of the range's summits exceed 13,000 ft (4,000 m), including Kings Peak (13,528 ft [4,123 m]), the highest point in Utah.

Ujung Pandang \'ü-ˌjůŋ-'pän-ˌdäŋ\ *formerly* **Macassar** \mə-'ka-sər\ City (pop., 1995 est.: 1,060,257), Celebes (Sulawesi), Indonesia. Already a thriving port when the Portuguese arrived in the 16th century, it came under control of the Dutch, who built a trading station there in 1607 and finally deposed the sultan in 1667. It was made a free port in 1848 and the capital of the Dutch-sponsored state of Indonesia Timur (East Indonesia) in 1946. In 1949 it became part of the Republic of Indonesia. It is the home of Hasanuddin University (founded 1956).

ukiyo-e \ü-ˌkē-ō-'ā\ *Japanese* **"pictures of the floating world"** Dominant art movement of the Edo culture in Japan. Screen paintings were the first works to be done in the style, which depicted aspects of the entertainment quarters ("floating world") of Edo (modern Tokyo) and other cities. Ukiyo-e artists switched their focus to wood-block prints, which were mass-produced for an eager public. Favourite ukiyo-e subjects included famous courtesans and prostitutes, kabuki actors in famous roles, and erotica; they were executed in flat, decorative colours and expressive patterns. Hishikawa Moronobu is generally accredited as the first master of ukiyo-e. The transition from single- to two-colour prints was made by Okumura Masanobu; in 1765 polychrome prints using numerous blocks were introduced by Suzuki Harunobu. The essence of the ukiyo-e style was embodied in the works of Utamaro, Hokusai, and Hiroshige. The prints attracted much attention in Europe in the 19th century and had a great influence on avant-garde French artists such as the Impressionists and Post-Impressionists.

Ukraine \yü-'krān\ Country, eastern Europe. Area: 233,062 sq mi (603,628 sq km). Population (2005 est.): 47,075,000. Capital: Kiev. Ukrainians make up more than three-fourths of the population; there is a significant minority of Russians. Languages: Ukrainian (official), Russian, Romanian, Polish, Hungarian. Religions: Christianity (mostly Eastern Orthodox; also other Christians, Roman Catholic, Protestant), Islam. Currency: hryvnya. Ukraine consists of level plains and the Carpathian Mountains, which extend through the western region for more than 150 mi (240 km). The Bug (Western Bug), Dnieper (Dnipro), Donets, and Dniester (Dnistro) are the major rivers. The Donets Basin in the east-central region is one of the major heavy-industrial and mining-metallurgical complexes of Europe. There iron ore and coal are mined, and natural gas, petroleum, iron, and steel are produced. Ukraine is a major producer of winter wheat and sugar beets. It is a republic with one legislative body; its head of state is the president, and the head of government is the prime minister. Different parts of the area were invaded and occupied in the 1st millennium BC by the Cimmerians, Scythians, and Sarmatians and in the 1st millennium AD by the Goths, Huns, Bulgars, Avars, Khazars, and Magyars. Slavic tribes settled there after the 4th century. Kiev was the chief town. The Mongol conquest in the mid-13th century decisively ended Kievan power. Ruled by Lithuania in the 14th century and Poland in the 16th, the area fell to Russian rule in the 18th century. After the Russian Revolution of February 1917, Ukrainian and Bolshevik forces struggled for control of Ukraine until 1921, when the Bolsheviks prevailed. In 1924 the Ukrainian S.S.R. became a republic of the Soviet Union. The northwestern region of present-day Ukraine, however, was held by Poland (1919–39). Ukraine suffered a severe famine in 1932–33 under Soviet leader Joseph Stalin; more than five million Ukrainians died of starvation in an unprecedented peacetime catastrophe. Overrun by Axis armies in 1941 during World War II, it was further devastated before being retaken by the Soviets in 1944. In 1986 it was the site of the Chernobyl accident at a Soviet-built nuclear power plant. Ukraine declared independence in 1991. The turmoil it experienced in the 1990s as it attempted to implement economic and political reforms culminated in the disputed presidential election of 2004; invalidated by the Supreme Court after mass protests, it ultimately led to a new runoff election that brought opposition leader Viktor Yushchenko into office.

Ukrainian \yü-'krā-nē-ən\ **language** *formerly* **Ruthenian** \rü-'thē-nē-ən\ **language** Slavic language spoken by about 41 million people in Ukraine, Poland, Slovakia, Russia, and in enclaves around the world. Only about three-quarters of Ukrainians are first-language speakers of Ukrainian, but there are millions of first-language speakers in Russia, Belarus, and the Central Asian republics. Ukraine's premodern literary language was Church Slavonic (see Old Church Slavonic language). Ukrainian was one component in the chancery language of the Grand Duchy of Lithuania, which also mixed Church Slavonic, Belaru-

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SIAN, and POLISH. With the fall of the Zaporizhzhya COSSACKS in the 18th century, Ukrainian speakers were stateless and the status of the language, thought of as peasant speech by the nobility, was low. The language and orthography (using a form of the CYRILLIC ALPHABET) were gradually standardized in the 19th century.

ukulele \ˌyü-kə-ˈlā-lē\ Small Hawaiian four-stringed guitar. It developed out of a similar Portuguese instrument introduced to Hawaii by sailors in the 1870s. It became highly popular in the U.S. after World War I, when it was used in JAZZ and BLUEGRASS ensembles and more widely as an amateur solo instrument.

Ulaanbaatar *or* **Ulan Bator** \ˌü-ˌlän-ˈbä-ˌtȯr\ City (pop., 2002 est.: mun., 812,500), capital of MONGOLIA. Situated on a windswept plateau, it was founded in the mid-17th century as the residence of the *bodgo-gegen*, the high priest of Tibetan Buddhism. It subsequently became a trading centre on caravan routes between Russia and China; it remains the principal junction of Mongolian transportation routes. The Outer Mongolian revolt for independence was centred there in 1911. Ulaanbaatar became the capital when the Mongolian People's Republic was established in 1924 and remained the capital when the country's name was changed to Mongolia in 1992. It is the country's main industrial centre.

Ulaid cycle See ULSTER CYCLE

Ulam \ˈü-ləm**, Stanislaw M(arcin)** (b. April 13, 1909, Lemberg, Pol., Austria-Hungary —d. May 13, 1984, Santa Fe, N.M., U.S.) Polish-born U.S. mathematician and atomic physicist. He received his doctoral degree in 1933 and was invited by John von NEUMANN to Princeton University's Institute for Advanced Study in 1936. In 1943 he moved to LOS ALAMOS, N.M., where his early work included development (with von Neumann) of the MONTE CARLO METHOD of finding approximate solutions to problems. Later, while working on a fusion bomb, he and EDWARD TELLER developed a two-stage radiation implosion design (the "Teller-Ulam configuration") that could generate an explosion capable of initiating nuclear fusion, a design that led to the creation of the HYDROGEN BOMB.

Ulan Bator See ULAANBAATAR

Ulanova \ü-ˈlä-nə-və**, Galina (Sergeyevna)** (b. Jan. 8, 1910, St. Petersburg, Russia—d. March 21, 1998, Moscow) Russian ballet dancer, the first *prima ballerina assoluta* of the Soviet Union. She trained with AGRIPPINA VAGANOVA in Leningrad and in 1928 joined the Kirov Theatre (formerly MARIINSKY THEATRE) company, where she began to dance leading roles and to develop the unique lyrical, dramatic style that won her wide acclaim. In 1944 she moved to the BOLSHOI BALLET, and during the 1950s she toured to great acclaim with the company in Europe and the U.S. She retired from dancing in 1962 but continued as ballet mistress and coach at the Bolshoi.

Ulbricht \ˈůl-ˌbri̲kt,\ *English* \ˈůl-ˌbrikt**, Walter** (b. June 30, 1893, Leipzig, Ger.—d. Aug. 1, 1973, East Berlin, E.Ger.) German communist leader and head of East Germany (1960–73). He joined the German Communist Party after World War I and was elected to its central committee in 1923. He led the party in Berlin (1929–33), then fled abroad after the Nazi takeover. As an agent for the COMINTERN, he persecuted Trotskyites and other deviationists. In 1945 he returned to the Soviet-occupied zone of Germany, helped form the Socialist Unity Party (SED) in East Germany, and served as its general secretary (1950–71). He served as deputy premier of East Germany (1949–60) and as chairman of its council of state (1960–73). A constant foe of West Germany, he built the BERLIN WALL in 1961. He exercised rigid control over East Germany while developing its industrial strength. He was forced to retire as first secretary of the SED in 1971 when the Soviet Union opened new relations with West Germany, but he retained his position as head of state until his death.

ulcer Concave sore on the skin or lining of an organ, with well-defined, sometimes raised edges. Erosion of surface tissue may extend to deeper layers. The main symptom is pain. The term most often refers to PEPTIC ULCER but also includes skin ulcer, common on legs with VARICOSE VEINS and the feet of people with DIABETES MELLITUS (when nerve damage has reduced sensation), and decubitus ulcer (bedsore or pressure sore). Other causes include INFECTION, trauma (e.g., BURN, FROSTBITE), improper nutrition (e.g., THIAMINE deficiency), and CANCER (likely in ulcers hard to the touch). Skin ulcers over a month old should be checked for cancer, especially after middle age.

ulcerative colitis \kō-ˈlī-təs\ Inflammation of the COLON, especially of its mucous membranes. The inflamed membranes develop patches of tiny ulcers, and the diarrhea contains blood and mucus. It often becomes chronic, with sustained fever and weight loss; complications and death may result. Specific causes, such as amoebic or bacillary dysentery, are rarer than unknown or multiple causes. If treatment with sulfasalazine, corticosteroids, immunosuppressive drugs, or antibiotics does not control it, part or all of the colon may have to be removed.

Ullmann, Liv (b. Dec. 16, 1939, Tokyo, Japan) Norwegian film actress. Raised mainly in Canada and the U.S., she returned to Norway and made her stage debut in Oslo. She became internationally famous in the films of Swedish director INGMAR BERGMAN, including *Persona* (1966), *The Passion of Anna* (1969), *Cries and Whispers* (1972), *Scenes from a Marriage* (1973), and *Autumn Sonata* (1978). Noted for her expressive face, natural beauty, and intelligent performances, she also starred in other Swedish and international films, including *The Emigrants* (1971) and *The New Land* (1973), and appeared on stage in the U.S. and Europe. She directed and cowrote *Sofie* (1993) and directed *Private Confessions* (1999) from Bergman's screenplay.

Ulm, Battle of (Sept. 25–Oct. 20, 1805) Major victory by France over Austria at Ulm, Bavaria. In August 1805 Austria joined the Anglo-Russian alliance against NAPOLEON and on September 11 sent 72,000 troops under Baron Karl Mack (1752–1828) into Bavaria, an ally of France. Napoleon, hoping to crush the Austrians before Russian troops could join them, sent his Grand Army of 210,000 French troops across the Rhine River, marching 18 mi (29 km) a day to reach the Danube River on September 25. After several battles, he encircled the Austrians and forced them into the city of Ulm, where they faced French artillery attacks. Seeing little chance that his troops could hold out until Russian reinforcements arrived, Baron Mack surrendered on October 20 with about 50,000 men.

Ulmanis \ˈůl-mä-nis**, Kārlis** (b. Sept. 4, 1877, Berze, Latvia, Russian Empire—d. 1942) Latvian independence leader and premier of Latvia (1918, 1919–21, 1925–26, 1931–32, 1934–40). An agronomist, he worked to improve farming in Latvia while becoming active in the Latvian independence movement. In 1905 he was forced into exile to the U.S., where he taught agriculture at the University of Nebraska until 1913. Returning to Latvia, he founded the Latvian Farmers' Union (1917) to press for independence from Russia. In 1918 he became premier of the newly independent republic. In his various terms of office he worked to resist internal dissension—instituting authoritarian rule in 1934—and military threats from Russia. Soviet occupation forced his resignation in 1940, and he was arrested and deported to Russia, where he died.

Ulster Historical province, northern IRELAND. It now forms Northern Ireland and Ulster province of Ireland. The ancient province was home to the Roman Catholic O'Neills (earls of TYRONE), who rebelled against English rule c. 1600. After they fled, most of the land was confiscated by British King JAMES I and settled with Protestant Scots, Welsh, and English. It was further colonized after Cromwellian settlement in the mid-17th century. In the early 20th century its opposition to Irish HOME RULE led to the formation of Northern Ireland.

Ulster cycle *or* **Ulaid** \ˈü-ləthʸ, ˈü-ləgʸ\ **cycle** In early Irish literature, a group of legends and tales dealing with the heroic age of the Ulaid, a people of northeast Ireland from whom the modern name Ulster derives. The stories, set in the 1st century BC, were recorded from oral tradition between the 8th and 11th century and are preserved in the 12th-century manuscripts *The Book of the Dun Cow* and *The Book of Leinster* and later compilations. Reflecting the customs of a free pre-Christian aristocracy, they combine mythological and legendary elements. Among the stories are "Bricriu's Feast," containing a beheading game that appeared in medieval narratives, and "The Tragic Death of the Sons of Usnech," dramatized in the 20th century by WILLIAM BUTLER YEATS and JOHN MILLINGTON SYNGE.

ultra Member of the extreme right (ultraroyalist) wing of the royalist movement in the French BOURBON RESTORATION (1815–30). The ultras included large landowners, clericalists, and the former ÉMIGRÉ nobility. Opposed to the FRENCH REVOLUTION's secular and egalitarian principles, they called for restrictions on the press and greater power for the Catholic church. They controlled the Chamber of Deputies and the cabinet for most of the 1820s, especially during the reign of their leader CHARLES X. Their policies proved unpopular, and they lost power after 1827; with the JULY REVOLUTION (1830), the faction ceased to exist.

Ultra Allied intelligence project that, in tapping the very highest-level communications among the armed forces of Germany and Japan, contrib-

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uted to the Allied victory in World War II. In the early 1930s Polish cryptographers first broke the code of Germany's cipher machine ENIGMA. In 1939 they turned their information over to the Allies, and Britain established the Ultra project at Bletchley Park to intercept and decipher Enigma messages. The Japanese also had a modified version of the Enigma, known as "Purple" by the Americans, who were able to duplicate it well before Pearl Harbor. The intercept of signals helped Allied forces win the Battle of Britain and the battles of the Coral Sea and Midway and led to the destruction of a large part of the German forces following the Allied landing in Normandy.

ultrasonics Vibrational or stress waves in elastic media that have a FREQUENCY above 20 kilohertz, the highest frequency of sound waves that can be detected by the human ear. They can be generated or detected by piezoelectric transducers (see PIEZOELECTRICITY). High-power ultrasonics produce distortion in a medium; applications include ultrasonic welding, drilling, irradiation of fluid suspensions (as in wine clarification), cleaning of surfaces (such as jewelry), and disruption of biological structures. Low-power ultrasonic waves do not cause distortions; uses include SONAR, structure testing, and medical imaging and diagnosis. Some animals, including BATS, employ ultrasonic ECHOLOCATION for navigation.

ultrasound *or* **ultrasonography** Use of ultrasonic waves to produce images of body structures. The waves travel through tissues and are reflected back where density differs (e.g., the border between a hollow organ's wall and its inside). The reflected echoes are received by an electronic apparatus that measures their intensity level and the position of the tissue reflecting them. The results can be displayed as still images or as a moving picture of the inside of the body. Unlike X-RAYS or other ionizing radiation, ultrasound carries minimal, if any, risk. Most often used during pregnancy to examine the fetus, ultrasound imaging is also used on internal organs and on the eye, breast, and major blood vessels. It can often show whether a growth is benign or malignant. See also DIAGNOSTIC IMAGING.

ultraviolet astronomy Study of astronomical objects and phenomena by observing the ULTRAVIOLET RADIATION (UV radiation) they emit. It has yielded much information about chemical abundances and processes in interstellar matter, the Sun, and other stellar objects, such as hot young stars and white DWARF STARS. Ultraviolet astronomy became feasible once rockets could carry instruments above Earth's atmosphere, which absorbs most ELECTROMAGNETIC RADIATION of UV wavelengths. Since the early 1960s, a number of unmanned space observatories carrying UV telescopes, including the HUBBLE SPACE TELESCOPE, have collected UV data on objects such as COMETS, QUASARS, NEBULAE, and distant star clusters. The Extreme Ultraviolet Explorer, launched in 1992, was the first orbiting observatory to map the sky in the shortest UV wavelengths, at the boundary with the X-ray region of the ELECTROMAGNETIC SPECTRUM.

ultraviolet radiation Portion of the ELECTROMAGNETIC SPECTRUM extending from the violet end of visible light to the X-RAY region. Ultraviolet (UV) radiation lies between wavelengths of about 400 nanometres and 10 nanometres, corresponding to frequencies of 7.5×10^{14} Hz to 3×10^{16} Hz. Most UV rays from the Sun are absorbed by the Earth's OZONE LAYER. UV has low penetrating power, so its effects on humans are limited to the skin. These effects include stimulation of production of VITAMIN D, SUNBURN, suntan, aging signs, and carcinogenic changes. UV radiation is also used to treat jaundice in newborns, to sterilize equipment, and to produce artificial light.

Ulysses See ODYSSEUS

ʿUmar ibn al-Khaṭṭāb \ˈü-mär-ˌib-nůl-ˌkät-ˈtäb\ (b. c. AD 586, Mecca, Arabian Peninsula—d. Nov. 3, 644, Medina) Second Muslim caliph (634–644). He initially opposed the Prophet MUHAMMAD but became a Muslim c. 615. His daughter Ḥafṣah married Muhammad in 625. He was nominated by ABŪ BAKR as his successor. As caliph he spread Islam to Egypt, Syria, and Persia. His innovations affected taxation, social welfare, and the empire's entire financial and administrative fabric, and he was noted for his justice, social ideals, and candour.

ʿUmar Tal \ˌü-mär-ˈtäl\ *in full* **al-Ḥājj ʿUmar ibn Saʿīd Tal** (b. c. 1797, Halvar, Fouta-Toro [Senegal]—d. Feb. 12, 1864, near Hamdalahi, Tukulor empire [Mali]) West African founder of the Tukulor empire. Born in the Sénégal River valley, he became a mystic and set out to Mecca on a pilgrimage at age 23. Through political and religious connections he made during and after his journey, he was appointed caliph for black Africa by the head of the Tijānī brotherhood. He returned to Africa in 1833, and in 1854, in the area of upper Guinea, eastern Senegal, and western and central Mali, he ordered a jihad to sweep away the pagans and bring back lapsed Muslims. He defeated the BAMBARA pagans of Mali, but they soon rebelled. Attacked by the TUAREGS, MOORS, and FULANI in 1863, ʿUmar's army was destroyed, and he was pursued and killed in an explosion. His empire lasted under his son AḤMADU SEKU until 1897, when it was annexed by the French.

Umayyad \ü-ˈmä-yəd\ **dynasty** (661–750) First great Muslim dynasty. It was founded by MUʿĀWIYAH I, who triumphed over the Prophet Muhammad's son-in-law, ʿAlī, to become the fifth caliph. He moved the capital from Medina to DAMASCUS and used the Syrian army to extend the Arab empire. The Umayyads' greatest period was under ʿABD AL-MALIK (r. 685–705), when their empire extended from Spain to Central Asia and India. Their decline began with a defeat by the BYZANTINE EMPIRE in 717; intertribal feuding, discontent among non-Arab Muslim converts, and the failure of financial reforms eventually led to their unseating by the ʿABBĀSID DYNASTY. See also ʿABD AL-RAḤMĀN III; ABŪ MUSLIM; al-ḤUSAYN IBN ʿALĪ.

Umberto I (b. March 14, 1844, Turin, Piedmont, Kingdom of Sardinia—d. July 29, 1900, Monza, Italy) King of Italy (1878–1900) and duke of Savoy. The son of VICTOR EMMANUEL II, he fought in the wars against Austria (1866). After ascending the throne in 1878, he led his country out of its isolation and into the TRIPLE ALLIANCE (1882). However, a tariff war with France led to economic difficulties (1888), and Umberto's colonial policy in Africa was ended by Italy's defeat by Ethiopia (1896). Facing increasing social unrest, he supported the imposition of martial law (1898) and created a period of turmoil that culminated in his assassination by an anarchist.

Umberto II (b. Sept. 15, 1904, Racconigi, Italy—d. March 18, 1983, Geneva, Switz.) Prince of Savoy and briefly king of Italy (1946). Son of VICTOR EMMANUEL III, he commanded an Italian army division in World War II. In May 1946 his father abdicated in his favour, but Umberto was himself forced to abdicate in June after the Italian people voted for a republic. He and his male heirs were permanently banished from Italy (though the ban was lifted in 2002), and he settled in Portugal.

Umbria Region (pop., 2001 prelim.: 815,588), central Italy. It is located on 3,265 sq mi (8,456 sq km) in the APENNINES; its capital is PERUGIA. Originally inhabited by the ancient Italic Umbrian tribe, it came under Rome c. 300 BC and was made one of its administrative regions in the 1st century AD. During the Christian era it became part of the PAPAL STATES. It was the seat of the 15th–16th-century Umbrian school of painting, which included PERUGINO and PINTURICCHIO, and was the home of St. FRANCIS OF ASSISI. Agriculture is an economic mainstay, while its industries produce steel, chemicals, and textiles.

Umbrian Any member of an ancient pre-Etruscan people pushed into central Italy (Umbria) by the ETRUSCANS and GAULS. They never fought an important war with the Romans. In the SOCIAL WAR they were among the first to make peace with Rome. They are described by ancient authors as being similar to their Etruscan enemies in culture. The Umbrian alphabet is undoubtedly of Etruscan origin. Their dialect was Indo-European.

Umbrian \ˈəm-brē-ən\ **language** Ancient ITALIC LANGUAGE spoken in central Italy in the last few centuries BC. Umbrian was related closely to OSCAN and Volscian and more distantly to LATIN. It was displaced by Latin at an unknown date. Modern knowledge of the language is derived almost entirely from the IGUVINE TABLES (c. 300–90 BC).

UN See UNITED NATIONS

Un-American Activities Committee, House See HOUSE UN-AMERICAN ACTIVITIES COMMITTEE

Unabomber See Theodore KACZYNSKI

Unamuno \ˌü-nä-ˈmü-nō\ **(y Jugo), Miguel de** (b. Sept. 29, 1864, Bilbao, Spain—d. Dec. 31, 1936, Salamanca) Spanish philosopher and writer. He served twice as rector of the University of Salamanca (1901–14; 1931–36); he was dismissed first for espousing the Allied cause in World War I and later for denouncing FRANCISCO FRANCO's Falangists. Though he also wrote poetry and plays, he was most influential as an essayist and novelist. In *The Tragic Sense of Life in Men and Peoples* (1913), he stressed the role spiritual anxiety plays in driving one to live the fullest possible life. His most famous novel is *Abel Sánchez* (1917), a modern re-creation of the biblical story of Cain and Abel. *The Christ of Velázquez* (1920), a study in poetic form of the great Spanish painter, is a superb example of modern Spanish verse.

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uncertainty principle *or* **Heisenberg uncertainty principle** *or* **indeterminacy principle** Principle that states that the position and velocity of an object cannot both be measured exactly at the same time, and that the concepts of exact position and exact velocity together have no meaning in nature. Articulated by Werner Heisenberg in 1927, it applies only at the small scales of atoms and subatomic particles and is not noticeable for macroscopic objects, such as moving vehicles. Any attempt to measure the velocity of a subatomic particle precisely will displace the particle in an unpredictable way, thus invalidating any simultaneous measurement of its position. This displacement is a result of the wave nature of particles (see wave-particle duality). The principle also applies to other related pairs of variables, such as energy and time.

Uncle Sam Popular U.S. symbol, usually associated with a cartoon figure having long white hair and chin whiskers and dressed in a swallow-tailed coat, vest, tall hat, and striped trousers. The name probably originated with "Uncle Sam" Wilson, a businessman who provided beef to the army during the War of 1812. The "U.S." stamp on his barrels, meant to indicate government property, came to be associated with his nickname, which in time came to symbolize the U.S. government. The Uncle Sam figure evolved in the hands of British and U.S. cartoonists; its most familiar treatment appeared on recruiting posters during World Wars I and II with the caption "I want you."

Army recruiting poster featuring "Uncle Sam," designed by James Montgomery Flagg, 1917.
Library of Congress, Washington, D.C.

unconscious *or* **subconscious** In psychoanalysis, the part of the psychic apparatus that does not ordinarily enter the individual's awareness but may be manifested by slips of the tongue, dreams, or neurotic symptoms (see neurosis). The existence of unconscious mental activities was first elaborated by Sigmund Freud and is now a well-established principle of psychiatry. The origin of many neurotic symptoms is said to depend on conflicts that have been removed from consciousness by repression and maintained in the unconscious through various defense mechanisms. Recent biopsychological explorations have shed light on the relationship between brain physiology and the levels of consciousness at which people retain memories.

underground See subway

Underground See Resistance

Underground Railroad Secret system in northern U.S. states to help escaping slaves. Its name derived from the need for secrecy and the railway terms used in the conduct of the system. Various routes in 14 states, called lines, provided safe stopping places (stations) for the leaders (conductors) and their charges (packages) while fleeing north, sometimes to Canada. The system developed in defiance of the Fugitive Slave Acts and was active mainly from 1830 to 1860. An estimated 40,000 to 100,000 slaves used the network. Assistance was provided mainly by free blacks, including Harriet Tubman, and philanthropists, church leaders, and abolitionists. Its existence aroused support for the antislavery cause and convinced Southerners that the North would never allow slavery to remain unchallenged.

Undset \'ün-set**, Sigrid** (b. May 20, 1882, Kalundborg, Den.—d. June 10, 1949, Lillehammer, Nor.) Norwegian novelist. Her father was an archaeologist, and her home life was steeped in legend, folklore, and Norwegian history. Her early novels deal with the position of women in the contemporary lower middle class. She then turned to the distant past and created her masterpiece, the trilogy *Kristin Lavransdatter* (1920–22), which is set in medieval Norway and depicts the spiritual growth of a strong woman. Undset converted to Roman Catholicism in 1924. Her later works, including the historical novel *The Master of Hestviken* (1925–27) and novels on contemporary themes, reflect her interest in religion. She received the Nobel Prize for Literature in 1928.

unemployment Condition of a person who is able to work, is actively seeking work, but is unable to find any. Statistics on unemployment are collected and analyzed by government labour offices in most countries and are considered an important indicator of economic health. Since World War II full employment has been a stated goal of many governments. Full employment is not necessarily synonymous with a zero unemployment rate, since at any given time the unemployment rate will include some people who are between jobs and not unemployed in any long-term sense. Underemployment is the term used to describe the situation of those who are able to find employment only for shorter than normal periods—for example, part-time workers and seasonal workers—and may also describe the condition of workers whose education or training makes them overqualified for their jobs.

unemployment insurance Form of social insurance designed to compensate workers for short-term, involuntary unemployment. It was created primarily to provide financial assistance to laid-off workers during a period deemed long enough to allow them to find another job or to be rehired at their original job. In most countries, workers who are permanently disabled or who have been unemployed for a long period of time are covered under other plans. In countries such as Canada and Britain, workers in any occupation may qualify for unemployment insurance; the U.S. denies coverage to certain workers, such as government employees and the self-employed. In most countries, benefits are related to earnings and are paid for a limited period of time. Funding may come out of general government revenues or from specific taxes placed on employers or employees.

UNESCO *in full* **United Nations Educational, Scientific and Cultural Organization** Specialized agency of the UN, created in 1946 to aid peace by promoting international cooperation in education, science, and culture. It supports member states' efforts to eliminate illiteracy, encouraging the extension of free education, and acts as a clearinghouse for the exchange of ideas and knowledge. In 1972 it sponsored an international agreement to establish a World Heritage list of cultural sites and natural areas that would enjoy government protection (see World Heritage site). In 1984 the U.S. withdrew from UNESCO to protest what it considered the agency's anti-Western approach to cultural issues; the United Kingdom and Singapore withdrew a year later. The United Kingdom rejoined in 1997, and the U.S. followed suit in 2003.

uneven parallel bars Event in women's gymnastics in which a pair of wooden bars supported horizontally above the floor at different heights is used to perform acrobatic feats. The apparatus allows a great variety of movements, but hanging and swinging exercises predominate. It became an Olympic event in 1936. See also parallel bars.

Ungaretti \ˌüŋ-gä-'rät-tē**, Giuseppe** (b. Feb. 10, 1888, Alexandria, Egypt—d. June 1, 1970, Milan, Italy) Egyptian-Italian poet. He lived in Alexandria until he was 24, and the desert regions of Egypt provide recurring images in his work. While studying in Paris, he was strongly influenced by the poets of the Symbolist movement. He was the founder of Hermeticism, which began with his *Il porto sepolto* (1916; "The Buried Port") and brought about a reorientation in modern Italian poetry. Though experimental, his poetry developed in a coherent direction in *Allegria di naufragi* (1919; "Gay Shipwrecks") and later collections. After World War II his works became more structured and acquired a more straightforward tone.

Ungava \ən-'gä-və-\ **Bay** Inlet, southern Hudson Strait, northeastern Quebec, Canada. It is about 200 mi (320 km) long and 160 mi (260 km) wide at its mouth, with a maximum depth of 978 ft (298 m). Fed by several large rivers, including the Koksoak, Leaf, and Payne, it is ice-free only four months a year. At its mouth, Akpatok Island (551 sq mi [1,427 sq km]) rises to 930 ft (283 m).

Ungava Peninsula Northern part of New Quebec district, northern Quebec, Canada. It is bounded by the Hudson Strait, Ungava Bay, Labrador, the Eastmain River, and Hudson Bay. Physiographically, it is part of the Canadian Shield.

ungulate \'əŋ-gyə-lət\ Any hoofed, herbivorous, quadruped, placental mammal in three or four orders: Artiodactyla, the even-toed ungulates (including pigs, camels, deer, and bovines); Perissodactyla, the odd-toed ungulates (including horses, tapirs, and rhinoceroses); Proboscidea (elephants); and, by some authorities, Hyracoidea (see hyrax). There are ten orders of extinct ungulates. The hoof is dermal tissue, comparable to the human fingernail, that extends over the end of a broadened terminal digit. See also ruminant.

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UNICEF *in full* **United Nations Children's Fund** *formerly (1946–53)* **United Nations International Children's Emergency Fund** Special United Nations program for aiding national efforts to improve the health, nutrition, education, and general welfare of children. Its original purpose was to provide relief to children in countries devastated by World War II. After 1950 it turned to general programs for the improvement of children's welfare. It was awarded the Nobel Prize for Peace in 1965. UNICEF has focused its efforts on areas in which relatively small expenditures can have a significant impact on the lives of the most disadvantaged children, such as the prevention and treatment of disease. UNICEF also provides funding for health services, educational facilities, and other welfare services. It is headquartered in New York City.

Unicode International character-encoding system designed to support the electronic interchange, processing, and display of the written texts of the diverse languages of the modern and classical world. The Unicode Worldwide Character Standard includes letters, digits, diacritics, punctuation marks, and technical symbols for all the world's principal written languages, using a uniform encoding scheme. The first version of Unicode was introduced in 1991; the most recent version contains almost 50,000 characters. Numerous encoding systems (including ASCII) predate Unicode. With Unicode (unlike earlier systems), the unique number provided for each character remains the same on any system that supports Unicode.

unicorn Mythological animal resembling a white horse with a single horn on its forehead. The unicorn was depicted in Mesopotamian art and was referred to in the ancient myths of India and China. Its earliest description in Greek literature dates from c. 400 BC and probably refers to the Indian rhinoceros. The unicorn was believed to be fierce and difficult to capture, but if a virgin were brought before it, it would lay its head in the virgin's lap. Its horn was thought to offer protection against poison. Medieval writers associated the unicorn with Jesus, and the hunt for the unicorn was often represented in medieval art.

Unicorn, detail from "The Lady and the Unicorn" tapestry, late 15th century; in the Musée de Cluny, Paris
GIRAUDON/ART RESOURCE

unidentified flying object (UFO) Aerial object or optical phenomenon not readily explainable to the observer. Interest in UFOs increased with developments in aeronautics and astronautics after World War II. A U.S. government panel investigating sightings in the 1950s reported that 90% coincided with astronomical or meteorological phenomena or sightings of aircraft, birds, or hot gases, sometimes under unusual weather conditions. Some remained unexplained, however, and in the mid 1960s a few scientists concluded that a small percentage indicated the presence of extraterrestrial visitors. This sensational hypothesis, promoted in the press, met with prompt resistance from other scientists. A U.S. Air Force UFO study begun in 1968 firmly rejected the extraterrestrial hypothesis, but a large fraction of the public, and a few scientists, continued to support it. UFO reports vary widely in reliability. The unaided eye is easily fooled; radar sightings of UFOs, more reliable in some ways, may fail to distinguish physical objects from meteor trails, rain, or thermal discontinuities and are subject to radio interference. See also SETI.

Unification Church *officially* **Holy Spirit Association for the Unification of World Christianity** Religious movement founded (1954) in South Korea by Sun Myung Moon. Influenced by yin-yang principles and Korean shamanism, it seeks to establish divine rule on earth through the restoration of the family, based on the union of the Lord and Lady of the Second Advent (believed to be Moon and his wife, Hak Ja Han). It strives to fulfill what it asserts to be the uncompleted mission of Jesus—procreative marriage. The church has been criticized for its recruitment policies (said to include brainwashing) and business practices. Its mass marriage ceremonies have gained press attention. Its worldwide membership is about 200,000 in more than 100 countries.

unified field theory Attempt to describe all fundamental interactions between elementary particles in terms of a single theoretical framework (a "theory of everything") based on quantum field theory. So far, the weak force and the electromagnetic force have been successfully united in electroweak theory, and the strong force is described by a similar quantum field theory called quantum chromodynamics. However, attempts to unite the strong and electroweak theories in a grand unified theory have failed, as have attempts at a self-consistent quantum field theory of gravitation.

unified science *or* **unity-of-science view** In the philosophy of logical positivism, the doctrine holding that all sciences share the same language, laws, and method. The unity of language has been taken to mean either that all scientific statements could be restated as a set of protocol sentences describing sense-data or that all scientific terms could be defined using physics terms. The unity of law means that the laws of the various sciences must be deduced from some set of fundamental laws (e.g., those of physics). The unity of method means that the procedures for supporting statements in the various sciences are basically the same. The unity-of-science movement that arose in the Vienna Circle held to those three unities, and Rudolf Carnap's "physicalism" supported the notion that all the terms and statements of empirical science could be reduced to terms and statements in the language of physics.

uniform circular motion Motion of a particle moving at a constant speed on a circle. Though the magnitude of the velocity of such an object may be constant, the object is constantly accelerating because its direction is constantly changing. At any given instant its direction is perpendicular to a radius of the circle drawn to the point of location of the object on the circle. The acceleration is strictly a change in direction and is a result of a force directed toward the centre of the circle. This centripetal force causes centripetal acceleration.

Uniform Resource Locator See URL

uniformitarianism Doctrine in geology that physical, chemical, and biologic processes now at work on and within the Earth have operated with general uniformity (in the same manner and with essentially the same intensity) through immensely long periods of time and are sufficient to account for all geologic change. In other words, the present is the key to the past. Although the term is no longer much used, the principle, originated by James Hutton, is fundamental to geologic thinking and underlies the whole development of the science of geology. See also Charles Lyell.

Unilever \'yü-nə-ˌlē-vər\ Either of two linked companies, Unilever PLC (based in London) and Unilever NV (based in Rotterdam). They are the holding companies for more than 500 firms worldwide that manufacture and sell soaps, foods, and other products. The modern Unilever was established in 1929 as an association between the British manufacturer Lever Bros. and several other European soap and margarine manufacturers. Today most Unilever sales are in household products, including soaps and detergents, margarines, cooking fats, dairy products, toiletries, and packaged and processed foods. The group also produces paper and plastic products, industrial chemicals, and animal feeds.

union See labor union

Union, Act of (May 1, 1707) Treaty that effected the union of England (and Wales) and Scotland under the name of Great Britain. The union benefited England's need for political safeguards against a possible Jacobite restoration through Scotland, and it gave Scotland economic security by freedom of trade with England. Under the treaty, initiated by Queen Anne, the two kingdoms adopted the Protestant succession, preserved Scots law and the law courts, and agreed to uniform taxation.

Union, Act of (Jan. 1, 1801) Legislative agreement uniting Great Britain and Ireland under the name of the United Kingdom of Great Britain and Ireland. After the unsuccessful Irish revolt of 1798, the British prime minister, William Pitt the Younger, decided that the best solution to the Irish problem was a union to strengthen the connection between the two countries. The Irish parliament resisted the proposal, which called for its abolition, but votes bought by cash or honours ensured passage of the agreement in 1800. The union remained until the recognition of the Irish Free State (excluding six of the counties of the northern province of Ulster) by the Anglo-Irish treaty concluded on Dec. 6, 1921; the union officially ended on Jan. 15, 1922.

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Union Islands See TOKELAU

Union League Association formed to inspire loyalty to the Union cause in the AMERICAN CIVIL WAR. Ohio Republicans formed the first Union League of America (1862) to counteract the antiwar COPPERHEADS. Leagues formed in other states to support the war effort and to revitalize the REPUBLICAN PARTY. They also acted as social organizations, and some remain as clubs in cities such as New York and Washington. After the Civil War, leagues formed in the South to promote the Republican cause among free blacks.

Union of Soviet Socialist Republics (U.S.S.R.) *or* **Soviet Union** Former republic, eastern Europe and northern and central Asia. It consisted, in its final years, of 15 soviet socialist republics that gained independence at its dissolution: ARMENIA, AZERBAIJAN, Belorussia (now BELARUS), ESTONIA, Georgia (now Republic of GEORGIA), KAZAKHSTAN, Kirgiziya (now KYRGYZSTAN), LATVIA, LITHUANIA, Moldavia (now MOLDOVA), RUSSIA, TAJIKISTAN, TURKMENISTAN, UKRAINE, and UZBEKISTAN. It also contained 20 autonomous soviet socialist republics: 16 within Russia, 2 within Georgia, 1 within Azerbaijan, and 1 within Uzbekistan. Capital: MOSCOW. Stretching from the Baltic and Black seas to the Pacific Ocean and encompassing some 8,650,000 sq mi (22,400,000 sq km), the Soviet Union constituted the largest country on Earth, having a maximum east-west extent of about 6,800 mi (10,900 km) and a maximum north-south extent of about 2,800 mi (4,500 km). It encompassed 11 time zones and had common boundaries with 6 European countries and 6 Asian countries. Its regions contained fertile lands, deserts, tundra, high mountains, some of the world's longest rivers, and large inland waters, including most of the CASPIAN SEA. The coastline on the Arctic Ocean extended 3,000 mi (4,800 km), while that on the Pacific was 1,000 mi (1,600 km) long. The U.S.S.R. was an agricultural, mining, and industrial power. Following the RUSSIAN REVOLUTION OF 1917, four socialist republics were established on the territory of the former Russian Empire: the Russian Soviet Federated Socialist Republic, the Transcaucasian Soviet Federated Socialist Republic, the Ukrainian Soviet Socialist Republic, and the Belorussian Soviet Socialist Republic. These four constituent republics established the Union of Soviet Socialist Republics in 1922, to which other republics subsequently were added. A power struggle begun in 1924 with the death of communist leader VLADIMIR LENIN ended in 1927 when JOSEPH STALIN gained victory. Implementation of the first of the FIVE-YEAR PLANS in 1928 centralized industry and collectivized agriculture. A purge in the late 1930s resulted in the imprisonment or execution of millions of persons considered dangerous to the state (see PURGE TRIALS). After World War II, with their respective allies, the U.S.S.R. and the U.S. engaged in the COLD WAR. In the late 1940s the U.S.S.R. helped to establish communist regimes throughout most of eastern Europe. The U.S.S.R. exploded its first atomic bomb in 1949 and its first hydrogen bomb in 1953. Following Stalin's death, it experienced limited political and cultural liberalization under NIKITA KHRUSHCHEV. It launched the first manned orbital spaceflight in 1961. Under LEONID BREZHNEV liberalization was partially reversed, but in the mid-1980s Soviet leader MIKHAIL GORBACHEV instituted the liberal policies called GLASNOST and PERESTROIKA. By the end of 1990 the communist government had toppled, and a program to create a market economy had been implemented. The U.S.S.R. was officially dissolved on Dec. 25, 1991.

Union Pacific Corp. Company that extended the U.S. railway system to the Pacific Coast. Incorporated by an act of Congress in 1862, it was built westward 1,006 mi (1,620 km) from Omaha, Neb., to meet the CENTRAL PACIFIC RAILROAD, which was being built eastward from Sacramento, Calif. The two railroads were joined at Promontory, Utah, in 1869. The Union Pacific was largely financed by federal loans and land grants, but its involvement in the CRÉDIT MOBILIER SCANDAL left it badly in debt, and the company went into receivership in 1893. It was reorganized in 1897 by EDWARD H. HARRIMAN, under whose leadership the railroad took part in the economic development of the West. In 1982 it merged with the Missouri Pacific Railroad Co. and the Western Pacific Railroad Co. Its acquisition of the Southern Pacific Rail Corp. in 1996 made it the largest railroad in the U.S., with control of almost all rail-based shipping in the western two-thirds of the country.

union shop Arrangement under which workers are required to join a particular union within a specified period of time after beginning employment. Such an arrangement differs from the CLOSED SHOP in that the employer's choice of new employees is not restricted to union members. Advocates of the union shop argue that it prevents workers from enjoying the benefits of unionism without bearing their share of the costs. Union shops are uncommon in most countries, but they are both legal and common in the U.S. and Japan. In the U.S., workers in an enterprise usually choose, by majority vote, a single union to represent them, though in some states RIGHT-TO-WORK LAWS prohibit requiring union membership as a condition of employment, thus forbidding both the union shop and the closed shop.

unit trust See MUTUAL FUND

Unitarianism Religious movement that stresses free use of reason in religion, holds that God exists in only one person, and denies the divinity of JESUS and the doctrine of the Holy TRINITY. Its modern roots are traced to several liberal, radical, and rationalist thinkers of the Protestant REFORMATION, who were in turn inspired by ARIUS. The mainstream of British and American Unitarianism grew out of Calvinist PURITANISM. The scientist JOSEPH PRIESTLEY was a founder of the English Unitarians, who became a force in Parliament and were noted advocates of social reform. In the U.S., Unitarianism developed out of New England CONGREGATIONALISM that rejected the 18th-century revival movement. TRANSCENDENTALISM injected Unitarianism with a new interest that attracted many more followers. See also CALVINISM, UNIVERSALISM.

Unitas \yü-'nī-təs**, Johnny** *in full* **John Constantine Unitas** (b. May 7, 1933, Pittsburgh, Pa., U.S.—d. Sept. 11, 2002, Timonium, Md.) U.S. football quarterback. After playing for the University of Louisville, he was selected in the NFL draft, though he played semiprofessionally before signing with the Baltimore Colts. From 1956 to 1972, he led the Colts to five league championship games (1958, 1959, 1964, 1968, 1970) and two Super Bowl games (1969, 1971); the Colts won titles in 1958, 1959, and 1971. After one season with the San Diego Chargers (1973), Unitas retired with 22 NFL records to his name. Considered by many to be the league's greatest quarterback, he was inducted into the Pro Football Hall of Fame in 1979.

Unité d'Habitation \ǖ-nē-'tā-dȧ-bē-tȧ-'syō^{n}\ Residential block (18 stories high) in Marseille, France, that expressed LE CORBUSIER's ideal of urban family lodging. Completed in 1952, it is a vertical mixed-use community, with a shopping floor halfway up and other communal facilities on the roof. Two-story living rooms make for efficient use of volumes and permit the use of a "skip-stop" system in which elevators stop on every other floor. Each unit has front and rear balconies with sun protection provided by Le Corbusier's BRISE-SOLEIL. The concrete screen pierced with differently sized openings evokes tracery.

United Airlines *a division of* **UAL Corp.** U.S. international airline. It began as United Aircraft and Transport Corp., which first operated transcontinental passenger flights in 1929. It was the first airline to introduce stewardesses, in 1930. United Airlines, Inc., was established in Chicago in 1931 as a HOLDING COMPANY for the corporation's four constituent airlines. United expanded rapidly after World War II and became the largest air carrier in the Western world when it merged with Capital Airlines in 1961. United acquired PAN AMERICAN WORLD AIRWAYS' transpacific routes in 1986 and its Latin American and Caribbean routes in 1991. The parent company took the name UAL Corp. in 1988. When United employees held a controlling share of the airline company (1994–2003), UAL was the largest employee-owned company in the U.S.

United Arab Emirates (UAE) *formerly* **Trucial** \'trü-shəl\ **States** Country, Middle East, southwestern Asia. It is a federation of seven states on the eastern coast of the ARABIAN PENINSULA. They are the emirates of ABŪ ẒABĪ (Abu Dhabi), DUBAYY (Dubai), 'Ajmān, Al-Shāriqah (Sharjah), Umm al-Qaywayn, Ra's al-Khaymah, and Al-Fujayrah. Area: 32,280 sq mi (83,600 sq km). Population (2005 est.): 4,690,000. Capital: ABU DHABI. The indigenous inhabitants are Arabs, but there are a large number of South Asian and Iranian migrant workers. Languages: Arabic (official), English, Persian, Urdu, Hindi. Religions: Islam (official; predominantly Sunni); also Christianity, Hinduism. Currency: UAE dirham. The UAE's low-lying desert plain is broken by the Ḥajar Mountains along the MUSANDAM PENINSULA. Three natural deepwater harbours are located along the Gulf of OMAN. The UAE (mainly Abū Ẓabī) has roughly one-tenth of the world's petroleum reserves and significant natural gas deposits, the production of which are the federation's principal industries. Other important economic activities include fishing, livestock herding, and date production. The federation has one appointive advisory board; its chief of state is the president, and the head of government is the prime minister. In 1820 the British signed a peace treaty with the region's coastal rulers. The area, formerly called the Pirate Coast, became known as the Trucial Coast. In 1892 the

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rulers agreed to entrust foreign relations to Britain, but the British never assumed sovereignty; each state maintained full internal control. The states formed the Trucial States Council in 1960 and in 1971 terminated defense treaties with Britain and established the six-member federation. Ra's al-Khaymah joined it in 1972. The UAE aided coalition forces against Iraq in the First Persian Gulf War (1991).

United Arab Republic See Egypt

United Artists Corp. U.S. film company. It was founded in 1919 by Charlie Chaplin, Mary Pickford, Douglas Fairbanks, and D.W. Griffith so that they could produce and distribute their own movies and distribute other independently produced movies. The first major production company controlled by its artists, it prospered with the films of its founders, including *The Gold Rush* (1925), and those of producers such as Samuel Goldwyn, Howard R. Hughes, and Alexander Korda. After 1951 it became mainly a distributor, releasing successful movies such as *High Noon* (1952), *Some Like It Hot* (1959), and *West Side Story* (1961). It was sold to TransAmerica Corp. in 1967 and resold to MGM in 1981. By the late 20th century United Artists was a specialty films division of MGM, producing movies such as *Leaving Las Vegas* (1995), *The Birdcage* (1996), and *Tea with Mussolini* (1999).

United Automobile Workers (UAW) *in full* **International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America** U.S.-based industrial union representing automotive and other vehicular workers in the U.S., Canada, and Puerto Rico. The UAW was founded in Detroit, Mich., in 1935, when the Committee for Industrial Organization (see AFL-CIO) began to organize automotive workers. The union successfully countered automakers' initial resistance with sit-down strikes and a 1937 Supreme Court decision upholding the right to organize as declared in the Wagner Act. General Motors Corp. was the first to recognize the UAW, and most other automakers followed suit, though Ford Motor Co. continued to resist until 1941. Under Walter Reuther, the union won contracts providing for cost-of-living adjustments, health plans, and paid vacations. Reuther's friction with George Meany led the UAW to withdraw from the AFL-CIO in 1968. A short-lived alliance with the Teamsters was dissolved in 1972, and the UAW rejoined the AFL-CIO in 1981. Toward the end of the 20th century, the union's bargaining strength was eroded by an increasingly global labour market, effectively reducing the wages and benefits manufacturers were willing to pay American workers.

United Fruit Co. Historic U.S.-based produce company that became Chiquita Brands International, Inc., in 1990. It was founded in 1899 when the Boston Fruit Co. merged with other companies selling bananas grown in Central America, Colombia, and the Caribbean. Minor C. Keith, its principal founder, gained extensive land rights in Costa Rica in return for constructing railroads. United Fruit became the largest employer in Central America, developing vast tracts of jungle lands and building one of the largest private merchant navies in the world. Its exploitation of corrupt Central American politicians dependent on income from the banana business led to the term *banana republic*. Attacked in the Latin American press as *el pulpo* ("the octopus"), the company was widely accused of exploiting workers and influencing governments during the era of "dollar diplomacy" in the early to mid-20th century. United Fruit later transferred portions of its landholdings to individual growers. "Miss Chiquita," its well-known trademark, was introduced in 1944. The familiar blue Chiquita stickers were first applied to the company's bananas in 1963. In 1970 United Fruit merged with AMK Corp. to form United Brands Co., which took the Chiquita name in 1990. In the early 21st century the company concentrated its efforts on produce, notably bananas and packaged salads.

United Kingdom of Great Britain and Northern Ireland *or* **United Kingdom** *or* **Great Britain** Island country, western Europe, North Atlantic Ocean. It comprises Great Britain (England, Scotland, and

Wales) and Northern Ireland. Area: 93,788 sq mi (242,910 sq km). Population (2005 est.): 60,020,000. Capital: London. The population is composed of English (major ethnic group), Scots, Irish, and Welsh and immigrants and their descendants from India, the West Indies, Pakistan, Bangladesh, and Africa. Languages: English (official); also Welsh, Scot-

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tish Gaelic. Religions: Christianity (Protestant [Church of England—established; Church of Scotland—national], Roman Catholic, other Christians); also Islam, Hinduism, Sikhism, Judaism. Currency: pound sterling. The country has hill, lowland, upland, highland, and mountain regions. Tin and iron ore deposits, once central to the economy, have become exhausted or uneconomical, and the coal industry, long a staple of the economy, began a steady decline in the 1950s that worsened with pit closures in the 1980s. Offshore petroleum and natural gas reserves are significant. Chief crops are barley, wheat, sugar beets, and potatoes. Major manufactures include motor vehicles, aerospace equipment, electronic data-processing and telecommunication equipment, and petrochemicals. Fishing and publishing also are important economic activities. The U.K. is a constitutional monarchy with two legislative houses; its chief of state is the sovereign, and the head of government is the prime minister.

The early pre-Roman inhabitants of Britain (see STONEHENGE) were Celtic-speaking peoples, including the Brythonic people of Wales, the Picts of Scotland, and the Britons of Britain. Celts also settled in Ireland c. 500 BC. JULIUS CAESAR invaded and took control of the area in 55–54 BC. The Roman province of Britannia endured until the 5th century AD and included present-day England and Wales. Germanic tribes, including Angles, Saxons, and Jutes, invaded Britain in the 5th century. The invasions had little effect on the Celtic peoples of Wales and Scotland. Christianity began to flourish in the 6th century. During the 8th and 9th centuries, Vikings, particularly Danes, raided the coasts of Britain. In the late 9th century ALFRED the Great repelled a Danish invasion, which helped bring about the unification of England under Athelstan. The Scots attained dominance in Scotland, which was finally unified under MALCOLM II (1005–34). William of Normandy (see WILLIAM I) took England in 1066. The Norman kings established a strong central government and feudal state. The French language of the Norman rulers eventually merged with the Anglo-Saxon of the common people to form the English language. From the 11th century, Scotland came under the influence of the English throne. HENRY II conquered Ireland in the late 12th century. His sons RICHARD I and JOHN had conflicts with the clergy and nobles, and eventually John was forced to grant the nobles concessions in the MAGNA CARTA (1215). The concept of community of the realm developed during the 13th century, providing the foundation for parliamentary government. During the reign of EDWARD I (1272–1307), statute law developed to supplement English COMMON LAW, and the first PARLIAMENT was convened. In 1314 Robert the Bruce (see ROBERT I) won independence for Scotland. The house of TUDOR became the ruling family of England following the Wars of the ROSES (1455–85). HENRY VIII (1509–47) established the Church of England and incorporated Wales as part of England.

The reign of ELIZABETH I (1558–1603) began a period of colonial expansion; in 1588 British forces defeated the "invincible" Spanish ARMADA. In 1603 James VI of Scotland ascended the English throne, becoming JAMES I, and established a personal union of the two kingdoms. The ENGLISH CIVIL WARS erupted in 1642 between Royalists and Parliamentarians, ending in the execution of CHARLES I (1649). After 11 years of Puritan rule under OLIVER CROMWELL and his son (1649–60), the monarchy was restored with CHARLES II. In 1689, following the GLORIOUS REVOLUTION, Parliament proclaimed the joint sovereigns WILLIAM III and MARY II, who accepted the British BILL OF RIGHTS. In 1707 England and Scotland assented to the Act of UNION, forming the kingdom of Great Britain. The Hanoverians ascended the English throne in 1714, when George Louis, elector of HANOVER, became GEORGE I of Great Britain. During the reign of GEORGE III, Great Britain's North American colonies won independence (1783). This was followed by a period of war (1789–1815) with Revolutionary France and later with the empire of NAPOLEON. In 1801 legislation united Great Britain with Ireland to create the United Kingdom of Great Britain and Ireland. Britain was the birthplace of the INDUSTRIAL REVOLUTION in the late 18th century, and it remained the world's foremost economic power until the late 19th century. During the reign of Queen VICTORIA (1837–1901), Britain's colonial expansion reached its zenith, though the older dominions, including Canada and Australia, were granted independence (1867 and 1901, respectively).

The U.K. entered WORLD WAR I allied with France and Russia in 1914. Following the war, revolutionary disorder erupted in Ireland, and in 1921 the Irish Free State (see IRELAND) was granted dominion status. Six counties of ULSTER, however, remained in the U.K. as Northern Ireland. The U.K. entered WORLD WAR II in 1939. Following the war, the Irish Free State became the Irish republic and left the COMMONWEALTH. India also gained independence from the U.K. Throughout the postwar period and into the 1970s, the U.K. continued to grant independence to its overseas colonies and dependencies. With UN forces, it participated in the KOREAN WAR (1950–53). In 1956 it intervened militarily in Egypt during the SUEZ CRISIS. It joined the EUROPEAN ECONOMIC COMMUNITY, a forerunner of the EUROPEAN UNION, in 1973. In 1982 it defeated Argentina in the FALKLAND ISLANDS WAR. As a result of continuing social strife in Northern Ireland, it joined with Ireland in several peace initiatives, which eventually resulted in an agreement to establish an assembly in Northern Ireland. In 1997 referenda approved in Scotland and Wales devolved power to both countries, though both remained part of the U.K. In 1991 the U.K. joined an international coalition to reverse Iraq's conquest of Kuwait (see First PERSIAN GULF WAR). In 2003 the U.K. and the U.S. attacked Iraq and overthrew the government of ṢADDĀM ḤUSSEIN (see Second PERSIAN GULF WAR). Terrorist bombings in London in July 2005 killed more than 50 people.

British Sovereigns

Kings of Wessex	
Egbert (S)	802–39
Aethelwulf (S)	839–56/58
Aethelbald (S)	855/56–60
Aethelberht (S)	860–65/66
Aethelred I (S)	865/66–71
Alfred the Great (S)	871–99
Edward the Elder (S)	899–924
Sovereigns of England	
Athelstan[1] (S)	925–39
Edmund I (S)	939–46
Eadred (S)	946–55
Eadwig (S)	955–59
Edgar (S)	959–75
Edward the Martyr (S)	975–78
Ethelred II the Unready (S)	978–1013
Sweyn Forkbeard (D)	1013–14
Ethelred II the Unready[2] (S)	1014–16
Edmund II Ironside (S)	1016
Canute (D)	1016–35
Harold I Harefoot (D)	1035–40
Hardecanute (D)	1040–42
Edward the Confessor (S)	1042–66
Harold II (S)	1066
William I the Conqueror (N)	1066–87
William II (N)	1087–1100
Henry I (N)	1100–35
Stephen (B)	1135–54
Henry II (P)	1154–89
Richard I (P)	1189–99
John (P)	1199–1216
Henry III (P)	1216–72
Edward I (P)	1272–1307
Edward II (P)	1307–27
Edward III (P)	1327–77
Richard II (P)	1377–99
Henry IV (P:L)	1399–1413
Henry V (P:L)	1413–22
Henry VI (P:L)	1422–61
Edward IV (P:Y)	1461–70
Henry VI[2]	1470–71
Edward IV[2]	1471–83
Edward V (P:Y)	1483
Richard III (P:Y)	1483–85
Henry VII (T)	1483–1509
Henry VIII (T)	1509–1547
Edward VI (T)	1547–53
Mary I (T)	1553–58
Elizabeth I (T)	1558–1603
Sovereigns of Great Britain and the United Kingdom	
James I (VI of Scotland) (St)	1603–25
Charles I (St)	1625–49
Commonwealth	
Oliver Cromwell	1653–58
Richard Cromwell	1658–59
Charles II (St)	1660–85
James II (St)	1685–88
William III & Mary II (O/St)	1689–1702[3]
Anne (St)	1702–14
George I (H)	1714–27
George II (H)	1727–60
George III (H)	1760–1820
George IV (H)	1820–30
William IV (H)	1830–37
Victoria (H)	1837–1901
Edward VII (SCG)	1901–10
George V (W)	1910–36
Edward VIII (W)	1936[4]
George VI (W)	1936–52
Elizabeth II (W)	1952–

Dynasty or house: S=Saxon, D=Danish, N=Norman, B=Blois, P=Plantagenet, L=Lancaster, Y=York, T=Tudor, St=Stuart, O=Orange, H=Hanover, SCG=Saxe-Coburg-Gotha, W=Windsor
[1]Athelstan was king of Wessex and the first king of all England.
[2]restored
[3]William and Mary, as husband and wife, reigned jointly until Mary's death in 1694.
[4]Edward VIII succeeded on the death of his father on January 20, 1936, but abdicated on December 11 before his coronation.

United Mine Workers of America (UMWA) U.S. labour union. Founded in 1890, the UMWA grew rapidly under the leadership of John Mitchell (president 1898–1908) despite determined opposition from coal-mine operators. By 1920, when JOHN L. LEWIS took over, the union had half a million members. Lewis capitalized on the pro-labour climate of the NEW DEAL and led numerous strikes to win fair pay, safe working conditions, and benefits. The UMWA was a mainstay of the Congress of Industrial Organizations (see AFL-CIO) in its early years, but Lewis withdrew the union from the CIO in 1942. Unaffiliated for decades, the UMWA finally joined the AFL-CIO in 1989. The UMWA's importance declined

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in the later 20th century with the waning of the labour movement and the rise of alternative sources of fuel, and by the 1990s it had fewer than 200,000 members.

United Nations (UN) International organization founded (1945) at the end of World War II to maintain international peace and security, develop friendly relations among nations on equal terms, and encourage international cooperation in solving intractable human problems. A number of its agencies have been awarded the Nobel Prize for Peace, and the UN was the corecipient, with Kofi Annan, of the prize in 2001. The term originally referred to the countries that opposed the Axis powers. An international organization was discussed at the Yalta Conference in February 1945, and the UN charter was drawn up two months later at the UN Conference on International Organization. The UN has six principal organs: the Economic and Social Council, the United Nations General Assembly, the International Court of Justice, the Secretariat, the United Nations Security Council, and the United Nations Trusteeship Council. It also has 14 specialized agencies—some inherited from its predecessor, the League of Nations (e.g., the International Labour Organization)—and a number of special offices (e.g., the Office of the United Nations High Commissioner for Refugees), programs, and funds (e.g., UNICEF). The UN is involved in economic, cultural, and humanitarian activities and the coordination or regulation of international postal services, civil aviation, meteorological research, telecommunications, international shipping, and intellectual property. Its peacekeeping troops have been deployed in several areas of the world, sometimes for lengthy periods (e.g., they have been in Cyprus since 1964). The UN's world headquarters are in New York City; its European headquarters are in Geneva. In 2005 the UN had 191 member countries. The principal administrative officer of the UN is the secretary-general, who is elected to a five-year renewable term by the General Assembly on the recommendation of the Security Council. The secretaries-general of the UN have been Trygve Lie (1946–53), Dag Hammarskjöld (1953–61), U Thant (1961–71), Kurt Waldheim (1972–81), Javier Pérez de Cuéllar (1982–91), Boutros Boutros-Ghali (1992–96), and Kofi Annan (from 1997).

U.N. Member States

1945	Argentina, Belarus, Brazil, Chile, China, Cuba, Denmark, Dominican Republic, Egypt, El Salvador, France, Haiti, Iran, Lebanon, Luxembourg, New Zealand, Nicaragua, Paraguay, Philippines, Poland, Russian Federation[3], Saudi Arabia, Syria, Turkey, Ukraine, United Kingdom, United States of America, Yugoslavia, Greece, India, Peru, Australia, Costa Rica, Liberia, Colombia, Mexico, S. Africa, Canada, Ethiopia, Panama, Bolivia, Venezuela, Guatemala, Norway, Netherlands, Honduras, Uruguay, Ecuador, Iraq, Belgium
1946	Afghanistan, Iceland, Sweden, Thailand
1947	Pakistan, Yemen[6]
1948	Burma (Myanmar)
1949	Israel
1950	Indonesia
1955	Albania, Austria, Bulgaria, Cambodia, Finland, Hungary, Ireland, Italy, Jordan, Laos, Libya, Nepal, Portugal, Romania, Spain, Sri Lanka
1956	Morocco, Sudan, Tunisia, Japan
1957	Ghana, Malaysia
1958	Guinea
1960	Benin, Upper Volta (Burkina Faso), Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Ivory Coast, Cyprus, Gabon, Madagascar, Niger, Somalia, Togo, Mali, Senegal, Nigeria
1961	Sierra Leone, Mauritania, Mongolia, Tanzania[5]
1962	Burundi, Jamaica, Rwanda, Trinidad and Tobago, Algeria, Uganda
1963	Kuwait, Kenya
1964	Malawi, Malta, Zambia
1965	Gambia, Maldives, Singapore
1966	Guyana, Botswana, Lesotho, Barbados
1968	Mauritius, Swaziland, Equatorial Guinea
1970	Fiji
1971	Bahrain, Bhutan, Qatar, Oman, United Arab Emirates
1973	Bahamas, Germany[2]
1974	Bangladesh, Grenada, Guinea-Bissau
1975	Cape Verde, Mozambique, São Tome and Principe, Papua New Guinea, Comoros, Suriname
1976	Seychelles, Angola, Samoa
1977	Djibouti, Vietnam
1978	Solomon Islands, Dominica
1979	Saint Lucia
1980	Zimbabwe, Saint Vincent and the Grenadines
1981	Vanuatu, Belize, Antigua and Barbuda
1983	Saint Kitts and Nevis
1984	Brunei Darussalam
1990	Namibia, Liechtenstein
1991	Estonia, N. Korea, S. Korea, Latvia, Lithuania, Marshall Islands, Micronesia
1992	Armenia, Kazakstan, Kyrgyzstan, Moldova, San Marino, Tajikistan, Turkmenistan, Uzbekistan, Azerbaijan, Bosnia and Herzegovina, Croatia, Slovenia, Georgia
1993	Czech Republic[1], Slovakia[1], Macedonia[4], Eritrea, Monaco, Andorra
1994	Palau
1999	Kiribati, Nauru, Tonga
2000	Tuvalu
2002	East Timor (Timor-Leste), Switzerland

[1]Czechoslovakia was an original member from 1945. The Czech Republic and the Slovak Republic obtained separate memberships in 1992.
[2]E. Germany and W. Germany were admitted as separate members in 1973; the two countries reunified in 1990.
[3]The seat held by the Soviet Union, a member from 1945, was assumed by Russia in 1991.
[4]Macedonia is referred to in the U.N. as "The former Yugoslav Republic of Macedonia" pending settlement of a dispute over its name.
[5]Tanganyika, a member from 1961, merged in 1964 with Zanzibar, a member from 1963, to form the new country of Tanzania.
[6]N. Yemen, a member from 1947, merged in 1990 with S. Yemen, a member from 1967.

United Nations Children's Fund See UNICEF

United Nations Conference on Trade and Development (UNCTAD) Organ of the United Nations General Assembly, created in 1964 to promote international trade. Its highest policy-making body, the Conference, meets every four years; when the Conference is not in session, the organization is run by its executive body, the Trade and Development Board. UNCTAD's principal functions include the promotion of trade between countries in different stages of development and with different economic systems, initiation of negotiations for trade agreements, and the formulation of international trade policies. In the late 20th and early 21st centuries, UNCTAD's efforts were directed toward the problems created in developing countries by economic globalization, and special attention was given to measures to help the poorest and least-developed countries become integrated into the world economy.

United Nations Development Programme (UNDP) UN organization formed in 1965 to promote environmentally sustainable human development in low-income countries. Based in New York City, the UNDP is headed by an administrator who oversees a 36-member Executive Board representing both developing and developed countries. Recent programs have focused on reducing poverty, developing strategies to treat and combat the spread of HIV/AIDS, promoting environmentally sound energy and economic policies, and expanding communications and technology infrastructure. UNDP resident representatives in more than 125 developing countries help to coordinate the local activities of other UN agencies and programs, as well as those of nongovernmental organizations.

United Nations General Assembly One of six principal components of the United Nations and the only one in which all UN members are represented. It meets annually or in special sessions. It acts primarily as a deliberative body; it may discuss and make recommendations about any issue within the scope of the UN charter. Its president is elected annually on a rotating basis from five geographic groups of members.

United Nations High Commissioner for Refugees, Office of the (UNHCR) Office established in 1951 to give legal, social, economic, and political aid to refugees. The UNHCR is the successor of the International Refugee Organization. Its first efforts focused on Europeans displaced by World War II; it has since assisted refugees in Africa, Asia, Latin America, and Yugoslavia. It is based in Geneva and is financed by voluntary government contributions. The office won the Nobel Prize for Peace in 1954 and 1981.

United Nations Office for the Coordination of Humanitarian Affairs (OCHA) *formerly (1972–92)* **Office of the United Nations Disaster Relief Coordinator,** *(1992–98)* **United Nations Department of Humanitarian Affairs** Agency of the United Nations Secretariat, established in 1972 to coordinate international relief to countries struck by natural or other disaster. Responding to requests from stricken states for disaster assistance, the OCHA directs UN

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assistance and mobilizes aid from nongovernmental organizations such as the International Red Cross. Since the 1980s it has emphasized disaster preparedness and prevention, and it has assisted in executing projects of the United Nations Development Programme.

United Nations Relief and Rehabilitation Administration Administrative body (1943–47) for an extensive social-welfare program for war-ravaged nations. It distributed relief supplies and services, including shelter, food, and medicine, and helped with agricultural and economic rehabilitation. Its functions were later taken over by the International Refugee Organization, the World Health Organization, and UNICEF.

United Nations Resolution 242 Resolution of the United Nations Security Council that ended the 1967 Six-Day War. The Israelis supported the resolution because it called on the Arab states to accept Israel's right "to live in peace within secure and recognized boundaries free from threats or acts of force." All Arab states eventually accepted it (Egypt and Jordan accepted the resolution from the outset) because of its clause calling for Israel to withdraw from the territories conquered in 1967. The Palestine Liberation Organization rejected it until 1988 because it lacked explicit references to Palestinians. Though never fully implemented, it was the basis of diplomatic efforts to end Arab-Israeli conflicts until the Camp David Accords and remains an important touchstone in any negotiated resolution to the Arab-Israeli conflict.

United Nations Secretariat Administrative body that coordinates United Nations activities. Its staff, recruited on the basis of merit, is composed of several thousand permanent professional experts from member states, including translators, clerks, technicians, administrators, project directors, and negotiators, who carry out the UN's day-to-day operations and administer the policies and programs set by the other divisions. They are required to swear an oath of loyalty to the UN and must not take instructions from their home governments.

United Nations Security Council Division of the United Nations whose primary purpose is to maintain international peace and security. The Security Council originally consisted of five permanent members—Taiwan (succeeded in 1971 by China), France, the United Kingdom, the U.S., and the Soviet Union (succeeded in 1991 by Russia)—and six rotating members elected by the United Nations General Assembly for two-year terms. In 1965 the number of nonpermanent members was increased to 10. UN members agree to abide by the Security Council's resolutions when they join. The Security Council investigates disputes that threaten international peace and advises on how to resolve them. To prevent or halt aggression, it may impose diplomatic or economic sanctions or authorize the use of military force. Each of the permanent members holds veto power in decisions on substantive matters, such as the application of sanctions. Decisions on both substantive and procedural matters require nine affirmative votes, including the affirmative vote of all five permanent members (though in practice a permanent member may abstain without impairing the validity of a decision).

United Nations Trusteeship Council One of the main organs of the UN, composed of the five permanent members of the Security Council. It supervised the administration of trust (non-self-governing) territories, including former colonies in Africa and the Pacific. The council's job was to send inspection missions to the territories, examine petitions, review reports, and make recommendations. It suspended operations after the last trust territory, Palau, gained its sovereignty in 1994.

United Netherlands, Republic of the See Dutch Republic

United Provinces See Uttar Pradesh

United States *officially* **United States of America** Country, North America. It comprises 48 conterminous states occupying the midcontinent, Alaska at the northwestern extreme of North America, and the island state of Hawaii in the mid-Pacific Ocean. Area, including the U.S. share of the Great Lakes: 3,676,487 sq mi (9,522,058 sq km). Population (2005 est.): 296,748,000. Capital: Washington, D.C. The population includes people of European and Middle Eastern ancestry, African Americans, Hispanics, Asians, Pacific Islanders, American Indians (Native Americans), and Alaska Natives. Languages: English (predominant), Spanish. Religions: Christianity (Protestant, Roman Catholic, other Christians, Eastern Orthodox); also Judaism, Islam, Buddhism, Hinduism. Currency: U.S. dollar. The country encompasses mountains, plains, lowlands, and deserts. Mountain ranges include the Appalachians, Ozarks, Rockies, Cascades, and Sierra Nevada. The lowest point is Death Valley, Calif. The highest point is Alaska's Mount McKinley; within the conterminous states it is Mount Whitney, Calif. Chief rivers are the Mississippi system, the Colorado, the Columbia, and the Rio Grande. The Great Lakes, the Great Salt Lake, Iliamna Lake, and Lake Okeechobee are the largest lakes. The U.S. is among the world's leading producers of several minerals, including copper, silver, zinc, gold, coal, petroleum, and natural gas; it is the chief exporter of food. Its manufactures include iron and steel, chemicals, electronic equipment, and textiles. Other important industries are tourism, dairying, livestock raising, fishing, and lumbering. The U.S. is a federal republic with two legislative houses; its head of state and government is the president.

The territory was originally inhabited for several thousand years by numerous American Indian peoples who had probably emigrated from Asia. European exploration and settlement from the 16th century began displacement of the Indians. The first permanent European settlement, by the Spanish, was at Saint Augustine, Fla., in 1565. The English settled

U.S. Presidents and Vice Presidents

President	Term	Vice president	Term
George Washington	1789–97	John Adams	1789–97
John Adams	1797–1801	Thomas Jefferson	1797–1801
Thomas Jefferson	1801–9	Aaron Burr	1801–5
		George Clinton	1805–9
James Madison	1809–17	George Clinton	1809–12*
		Elbridge Gerry	1813–14*
James Monroe	1817–25	Daniel D. Tompkins	1817–25
John Quincy Adams	1825–29	John C. Calhoun	1825–29
Andrew Jackson	1829–37	John C. Calhoun	1829–32**
		Martin Van Buren	1833–37
Martin Van Buren	1837–41	Richard M. Johnson	1837–41
William Henry Harrison	1841*	John Tyler	1841
John Tyler	1841–45		
James K. Polk	1845–49	George Mifflin Dallas	1845–49
Zachary Taylor	1849–50*	Millard Fillmore	1849–50
Millard Fillmore	1850–53		
Franklin Pierce	1853–57	William Rufus de Vane King	1853*
James Buchanan	1857–61	John C. Breckinridge	1857–61
Abraham Lincoln	1861–65*	Hannibal Hamlin	1861–65
		Andrew Johnson	1865
Andrew Johnson	1865–69		
Ulysses S. Grant	1869–77	Schuyler Colfax	1869–73
		Henry Wilson	1873–75*
Rutherford B. Hayes	1877–81	William A. Wheeler	1877–81
James A. Garfield	1881*	Chester A. Arthur	1881
Chester A. Arthur	1881–85		
Grover Cleveland	1885–89	Thomas A. Hendricks	1885*
Benjamin Harrison	1889–93	Levi Parsons Morton	1889–93
Grover Cleveland	1893–97	Adlai E. Stevenson	1893–97
William McKinley	1897–1901*	Garret A. Hobart	1897–99*
		Theodore Roosevelt	1901
Theodore Roosevelt	1901–9	Charles Warren Fairbanks	1905–9
William Howard Taft	1909–13	James Schoolcraft Sherman	1909–12*
Woodrow Wilson	1913–21	Thomas R. Marshall	1913–21
Warren G. Harding	1921–23*	Calvin Coolidge	1921–23
Calvin Coolidge	1923–29	Charles G. Dawes	1925–29
Herbert Hoover	1929–33	Charles Curtis	1929–33
Franklin D. Roosevelt	1933–45*	John Nance Garner	1933–41
		Henry A. Wallace	1941–45
		Harry S. Truman	1945
Harry S. Truman	1945–53	Alben W. Barkley	1949–53
Dwight D. Eisenhower	1953–61	Richard M. Nixon	1953–61
John F. Kennedy	1961–63*	Lyndon B. Johnson	1961–63
Lyndon B. Johnson	1963–69	Hubert H. Humphrey	1965–69
Richard M. Nixon	1969–74**	Spiro T. Agnew	1969–73**
		Gerald R. Ford	1973–74
Gerald R. Ford	1974–77	Nelson A. Rockefeller	1974–77
Jimmy Carter	1977–81	Walter F. Mondale	1977–81
Ronald Reagan	1981–89	George Bush	1981–89
George Bush	1989–93	Dan Quayle	1989–93
William J. Clinton	1993–2001	Albert Gore	1993–2001
George W. Bush	2001–	Richard B. Cheney	2001–

*Died in office. **Resigned from office.

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Jamestown, Va. (1607); Plymouth, Mass. (1620); Maryland (1634); and Pennsylvania (1681). The English took New York, New Jersey, and Delaware from the Dutch in 1664, a year after English noblemen had begun to colonize the Carolinas. The British defeat of the French in 1763 (see French and Indian War) assured Britain political control over its 13 colonies. Political unrest caused by British colonial policy culminated in the American Revolution (1775–83) and the Declaration of Independence (1776). The U.S. was first organized under the Articles of Confederation (1781), then finally under the Constitution (1787) as a federal republic. Boundaries extended west to the Mississippi River, excluding Spanish Florida. Land acquired from France by the Louisiana Purchase (1803) nearly doubled the country's territory. The U.S. fought the War of 1812 against the British and acquired Florida from Spain in 1819. In 1830 it legalized the removal of American Indians to lands west of the Mississippi River. Settlement expanded into the Far West in the mid-19th century, especially after the discovery of gold in California in 1848 (see gold rush). Victory in the Mexican War (1846–48) brought the territory of seven more future states (including California and Texas) into U.S. hands. The northwestern boundary was established by treaty with Britain in 1846. The U.S. acquired southern Arizona by the Gadsden Purchase (1853). It suffered disunity during the conflict between the slavery-based plantation economy in the South and the industrial and agricultural economy in the North, culminating in the American Civil War and the abolition of slavery under the 13th Amendment. After Reconstruction (1865–77) the U.S. experienced rapid growth, urbanization, industrial development, and European immigration. In 1887 it authorized allotment of American Indian reservation land to individual tribesmen, resulting in widespread loss of land to whites. Victory in the Spanish-American War brought the U.S. the overseas territories of the Philippines, Guam, and Puerto Rico. By the end of the 19th century, it had further developed foreign trade and acquired other outlying territories, including Alaska, Midway Island, the Hawaiian Islands, Wake Island, American Samoa, and the Panama Canal Zone.

The U.S. participated in World War I in 1917–18. It granted suffrage to women in 1920 and citizenship to American Indians in 1924. The stock market crash of 1929 led to the Great Depression, which New Deal legislation combated by increasing the federal government's role in the economy. The U.S. entered World War II after the Japanese bombing of Pearl Harbor (Dec. 7, 1941). The explosion by the U.S. of an atomic bomb on Hiroshima (Aug. 6, 1945) and another on Nagasaki (Aug. 9, 1945), Japan, brought about Japan's surrender. Thereafter the U.S. was the military and economic leader of the Western world. In the first decade after the war, it aided the reconstruction of Europe and Japan and became embroiled in a rivalry with the Soviet Union known as the Cold War. It participated in the Korean War from 1950 to 1953. In 1952 it granted autonomous commonwealth status to Puerto Rico. Racial segregation in schools was declared unconstitutional in 1954. Alaska and Hawaii were made states in 1959. In 1964 Congress passed the Civil Rights Act and authorized U.S. entry into the Vietnam War. The mid- to late 1960s were marked by widespread civil disorder, including race riots and antiwar demonstrations. The U.S. accomplished the first manned lunar landing in 1969. All U.S. troops were withdrawn from Vietnam in 1973. With the dissolution of the Soviet Union in 1991, the U.S. assumed the status of sole world superpower. The U.S. led a coalition of forces against Iraq in the First Persian Gulf War (1991). Administration of the Panama Canal was turned over to Panama in 1999. After the September 11 attacks on the U.S. in 2001 destroyed the World Trade Center and part of the Pentagon, the U.S. attacked Afghanistan's Taliban government for harbouring and refusing to extradite the mastermind of the terrorism, Osama bin Laden. In 2003 the U.S. attacked Iraq, with British support, and overthrew the government of Ṣaddām Ḥussein (see Second Persian Gulf War). See map on following pages.

United States, Bank of the See Bank of the U.S.

United States Air Force (USAF) Major component of the U.S. military organization, with primary responsibility for air warfare, air defense, and military space research. It also provides air services in coordination with the other military branches. U.S. military activities in the air began with army use of balloons for reconnaissance during the Civil War and the Spanish-American War; in 1907 the Aeronautical Division of the Signal Corps was created. In 1920 the Army Reorganization Act created the Air Service (after 1926, Air Corps) as a unit of the Army; in 1941 it became the Army Air Forces. In 1947 the independent U.S. Air Force was created and became part of the newly created Department of Defense in 1949. The Department of the Air Force is headquartered at the Pentagon. Separate operating agencies of the Air Force include the Air Force Reserve, the Air Force Intelligence Service, and the U.S. Air Force Academy. In 2000 there were over 350,000 Air Force personnel on active duty.

United States Air Force Academy Institution for the training of commissioned officers for the U.S. Air Force, located in Colorado Springs, Colorado. Created by an act of Congress in 1954, it opened in 1955. Graduates receive a bachelor's degree and a second lieutenant's commission. Most physically qualified graduates go on to Air Force pilot-training schools. Candidates may come from the ranks of the U.S. Army or Air Force, may be children of deceased veterans of the armed forces, or may be nominated by U.S. senators or representatives or by the president or vice president. All applicants must take a competitive entrance examination.

United States Army Major branch of the U.S. military forces, charged with preserving peace and security and defending the nation. The first regular U.S. fighting force, the Continental Army, was organized by the Continental Congress on June 14, 1775, to supplement local militias in the American Revolution. It was placed under the control of a five-member civilian board, and U.S. military forces have remained in civilian control ever since. The U.S. Constitution named the president as commander in chief, and in 1789 the civilian Department of War was established to administer the armed forces. The Continental Army was officially disbanded in 1783, and a small regular army was established. Thereafter, the army's size increased during times of crisis, swelled by conscription, and decreased during peacetime. The Department of the Army is organized as a military section of the Department of Defense and is headed by the Secretary of the Army. The Army Staff gives advice and assistance to the secretary and administers civil functions, including the civil-works program of the Corps of Engineers. The army also administers the U.S. Military Academy at West Point. In 2000 there were about 400,000 soldiers on active duty.

United States Coast Guard U.S. military service that enforces maritime laws. It is under the jurisdiction of the Department of Homeland Security; in wartime it functions as part of the U.S. Navy. The Coast Guard enforces federal laws on the high seas and waters within U.S. territorial jurisdiction, develops and operates aids to navigation, and maintains a network of lifeboat and search-and-rescue stations using surface vessels and aircraft. It assists in the interdiction of illegal narcotics bound for the U.S. on or over coastal waters. It operates the International Ice Patrol (which maintains surveillance of icebergs in the North Atlantic shipping lanes), gathers data for the National Weather Service, and assists distressed ships and planes. Its wartime duties include ship escort, port security, and transport duty. In 2000 there were some 35,000 Coast Guard personnel on active duty. Cadets are trained at the Coast Guard Academy in New London, Conn.

United States Courts of Appeals In the U.S., the intermediate appellate courts included in the federal judicial system and created by act of Congress. There are 13 courts of appeal, including 12 courts whose jurisdictions are geographically apportioned, and the U.S. Court of Appeals for the Federal Circuit, whose jurisdiction is subject-oriented and nationwide. The Federal Circuit court, located in Washington, D.C., was created by an act of Congress in 1982 and hears appeals from U.S. district and territorial courts primarily in patent and trademark cases, though it also hears appeals in cases in which the United States or its agencies is a defendant, as in alleged breaches of contract or in tax disputes. The courts are empowered to review the decisions of federal district courts (see United States District Court), as well as the decisions of the divisions of the U.S. Tax Court within their jurisdictions and those of the U.S. Bankruptcy Courts. All decisions of the courts are subject to review by the Supreme Court of the United States.

United States District Court In the U.S., any of the 94 trial courts of general jurisdiction in the federal judicial system. Each state, as well as the District of Columbia and the Commonwealth of Puerto Rico, has at least one federal district court. Each court has at least one district judge and can have more than a score of them, as well as a clerk, a U.S. attorney, a U.S. marshal, one or more U.S. magistrates, bankruptcy judges, probation officers, and other staff. Decisions of the district courts are normally subject to appeal, typically to the United States Court of Appeals for the region in which the district court is located.

United States Marine Corps (USMC) Separate military service within the U.S. Department of the Navy (see U.S. Navy), charged with

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providing marine troops for seizure and defense of advanced bases and with conducting operations on land and in the air in connection with naval campaigns. It is also responsible for providing detachments for service aboard certain types of naval vessels, as well as security forces for naval shore installations and U.S. diplomatic missions in foreign countries. The corps specializes in amphibious landings, such as those on Japanese-held islands in World War II. Marines have served in every major U.S. naval action since 1775, usually being the first or among the first to fight. In 2000 there were some 175,000 Marines on active duty.

United States Military Academy *known as* **West Point** Institution for the training of commissioned officers for the U.S. Army. Founded in 1802 at the fort at West Point, N.Y., it is one of the oldest service academies in the world. It was established as an apprentice school for military engineers and was, in effect, the first U.S. school of engineering. It was reorganized in 1812, and in 1866 its educational program was expanded considerably. Women were first admitted in 1976. The four-year course of college-level education and training leads to a bachelor of science degree and a commission as second lieutenant in the Army. West Point has trained such leaders as Ulysses S. Grant, William T. Sherman, Robert E. Lee, Stonewall Jackson, Jefferson Davis, John Pershing, Dwight D. Eisenhower, Douglas MacArthur, Omar Bradley, and George Patton.

United States Naval Academy *known as* **Annapolis** Institution for the training of commissioned officers for the U.S. Navy and U.S. Marine Corps. It was founded at Annapolis, Md., in 1845 and reorganized in 1850–51. Women were first admitted in 1976. Graduates are awarded the degree of bachelor of science and a commission as ensign in the Navy or as second lieutenant in the Marine Corps. Annapolis has produced many notable Americans, including George Dewey, Richard E. Byrd, Chester Nimitz, William F. Halsey, Jr., A.A. Michelson, Hyman Rickover, Jimmy Carter, Ross Perot, and several astronauts.

United States Navy Major branch of the U.S. military forces, charged with defending the nation at sea and maintaining security on the seas wherever U.S. interests extend. The Continental Navy was established by the Continental Congress in 1775. It was disbanded in 1784, but the harassment of U.S. merchant ships by Barbary pirates prompted Congress to establish the Department of the Navy in 1798. The navy took part in the War of 1812 and was later important in the Union victory in the American Civil War. Sea victories during the Spanish-American War (1898) led to a period of steady growth. In World War I, its duties were limited to troop transport, minelaying, and escorting merchant ships. The Japanese attack on the naval base at Pearl Harbor (1941) led to U.S. entry into World War II, in which, in addition to antisubmarine and troop transport duties, the navy conducted amphibious assaults in the Pacific theater and along the European coast. Aircraft carriers proved decisive in battles with Japanese forces in the Pacific, and they are still the backbone of the navy's fleets. Since World War II it has remained the largest and most powerful navy in the world. The Department of the Navy, a branch of the Department of Defense, is headed by a secretary of the navy. The navy includes the U.S. Marine Corps and, during wartime, the U.S. Coast Guard. In 2000 there were almost 400,000 Navy personnel on active duty, excluding the Marine Corps and Coast Guard. See also U.S. Naval Academy.

United States Steel Corp. Leading U.S. producer of steel and related products. It was founded in 1901 by Charles M. Schwab, Elbert H. Gary, and J.P. Morgan to consolidate Andrew Carnegie's Carnegie Steel Co., Gary's Federal Steel Co., and other steel and metal companies. As chairman of the board, Gary dominated the corporation in its early years, organizing price agreements among steel producers and opposing unions. An antitrust suit against U.S. Steel went as far as the Supreme Court, which ruled in 1920 that it was not a monopoly in restraint of trade. The corporation recognized the United Steelworkers of America in 1936. The largest U.S. steel producer, U.S. Steel diversified into oil and gas in the later 20th century as well as into chemicals, mining, construction, and transportation. In 1986 the holding company USX Corp. was established to oversee it and other operating units. U.S. Steel Group was spun off from USX in 2002 and again became an independent, publicly traded corporation.

United Steelworkers (USW) historic labour union representing workers in steel, aluminum, and other metallurgical industries for much of the 20th century. In the U.S. it grew out of the Steel Workers Organizing Committee (SWOC), established jointly in 1936 by the Committee for Industrial Organization (see AFL-CIO) and the Amalgamated Association of Iron, Steel, and Tin Workers. Under Philip Murray it developed into a powerful union. In 1942 SWOC became the United Steelworkers of America (USWA), of which Murray served as president until his death in 1952. The USWA absorbed the Aluminum Workers of America in 1944 and by the mid-1950s had more than one million members. It won unprecedented benefits in the postwar period but saw its membership and power decline as the U.S. steel industry shrank from the 1970s onward. In 2005 the USWA combined with the Paper, Allied-Industrial, Chemical and Energy Workers International Union (PACE) and was renamed the United Steel, Paper and Forestry, Rubber, Manufacturing, Energy, Allied Industrial and Service Workers International Union (USW). The USW represents workers in the United States and Canada.

Unity (School of Christianity) Religious movement founded in 1889 by Charles Fillmore (1854–1948) and his wife, Myrtle Fillmore (1845–1931), in Kansas City, Mo., U.S. Believing that spiritual healing had cured Myrtle of tuberculosis, the couple began to endorse spiritual healing. Until 1922, Unity was a member of the International New Thought Alliance. Unlike some New Thought groups, Unity embraces practical Christianity and modern medicine. It has no definite creed and is interdenominational. Its Silent Unity service helps people through counseling and prayer, responding to 2.5 million requests for aid a year via mail, telephone, and Internet. Unity publishes magazines and books, and it conducts classes for prospective Unity ministers.

unity-of-science view See unified science

universal In metaphysics, epistemology, and logic, a general category, such as a property or relation, considered as distinct from the particular things that instantiate or exemplify it. The problem of universals concerns the question of what sort of being should be ascribed to such categories (e.g., is there any such thing as redness apart from particular red things?). The debate over the status of universals stems from Plato's theory of forms. Whereas Plato held that forms (universals) exist independently of particulars, Aristotle argued that forms exist only in the particulars in which they are exemplified. See also realism.

Universal Declaration of Human Rights Declaration adopted by the United Nations General Assembly in 1948. Drafted by a committee chaired by Eleanor Roosevelt, it was adopted without dissent but with eight abstentions. Among its 30 articles are definitions of civil and political rights (including the rights to life, liberty, and a fair trial) as well as definitions of economic, social, and cultural rights (including the right to social security and to participation in the cultural life of one's community), all of which are owed by UN member states to those under their jurisdiction. It has acquired more juridical status than originally intended and has been widely used, even by national courts, as a means of judging compliance with member states' human-rights obligations. The declaration has been the foundation of the work of nongovernmental organizations such as Amnesty International.

Universal Negro Improvement Association (UNIA) Organization founded by Marcus Garvey in 1914. Organized in Jamaica, it was influential in urban African American neighbourhoods in the U.S. after Garvey's arrival in New York City in 1916. It was dedicated to racial pride, economic self-sufficiency, and the formation of an independent black nation in Africa. After Garvey's 1923 conviction on charges of fraud, the UNIA lost influence, but it proved to be a forerunner of black nationalism.

Universal Pictures U.S. film studio. Formed by Carl Laemmle in 1912, it became a top producer of popular, low-budget serials in the 1920s and of horror movies in the 1930s. Its later films include the Abbott and Costello comedies and the Doris Day-Rock Hudson bedroom farces. The studio was bought by MCA in 1962, and in 1966 it became a division of Universal City Studios (now simply Universal Studios), the largest packager of television series.

Universal Product Code (UPC) Standard bar code used to identify grocery and other retail merchandise. In the UPC system, the five digits on the left are assigned to a particular manufacturer or maker and the five digits on the right are used by that manufacturer to identify a specific type or make of product.

Universal Resource Locator See URL

Universal Serial Bus See USB

Universal Time Mean (solar) time of the Greenwich meridian (0° longitude). Universal Time replaced the designation Greenwich Mean Time in 1928; since 1972 it has been based on international atomic time, a uni-

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form time derived from the frequences of certain atomic transitions and measured by an atomic clock. For most purposes, it is now identical to Greenwich Mean Time.

Universalism Belief in the SALVATION of all SOULS. Arising as early as the time of ORIGEN and at various points in Christian history, the concept became an organized movement in North America in the mid-18th century. It maintains the impossibility that a loving God would bestow salvation on only a portion of humankind while dooming the rest to eternal punishment. It stresses the use of reason in religion and the modification of belief in light of the discoveries of science. Thus, the miraculous elements of traditional CHRISTIANITY are rejected, and JESUS, while a worthy teacher and model, is not held to be divine. Universalist and Unitarian churches in the U.S. merged in 1961 (see UNITARIANISM).

universe Whole cosmic system of matter and energy of which Earth is a part. Its main constituents are the GALAXIES, within which are STARS and stellar groupings and nebulae (see NEBULA). Earth's Sun is one star among the billions of stars in the MILKY WAY GALAXY. All atoms, subatomic particles, and everything they compose are also part of the universe. The universe is governed by four fundamental forces: the STRONG FORCE, the WEAK FORCE, the ELECTROMAGNETIC FORCE, and GRAVITATION. Numerous theories have been proposed for the origin and structure of the universe. See also BIG BANG; COSMOLOGY; EXPANDING UNIVERSE; STEADY-STATE THEORY.

university Institution of higher education, usually comprising a liberal arts and sciences college and graduate and professional schools that confer degrees in various fields. A university differs from a COLLEGE in that it is usually larger, has a broader curriculum, and offers advanced degrees in addition to undergraduate degrees. The first true university was the University of BOLOGNA, founded in the 11th century; the first in northern Europe was the University of PARIS, which served as a model for the universities of OXFORD, CAMBRIDGE, HEIDELBERG, and others. One of the first modern universities, in which secular objectivity and RATIONALISM replaced religious orthodoxy, was the University of Halle (founded 1694 in Halle, Ger.). The liberalism of Halle was adopted by GÖTTINGEN, BERLIN, and many other German universities. The German model of the university as a complex of schools and research institutes also exerted a worldwide influence. The growth of universities in the U.S., where most colleges had been established by religious denominations, was greatly spurred by the MORRILL ACT of 1862.

UNIX \'yü-niks\ OPERATING SYSTEM for DIGITAL COMPUTERS, developed by Ken Thompson of Bell Laboratories in 1969. It was initially designed for a single user (the name was a pun on the earlier operating system Multics). The C language was subsequently developed specifically for UNIX, and the system was rewritten almost entirely in C; it was improved by the addition of multiprogramming and time-sharing capabilities and enhanced portability. UNIX is very popular in universities, where it is used mostly on scientific and engineering workstations, and it is used on most of the SERVERS of INTERNET SERVICE PROVIDERS. Because its modular construction allows it to be easily modified, it has been improved in many ways by academic and industrial institutions (see LINUX).

Unkei \'ün-ˌkā\ (b. 1148?—d. 1223) Japanese sculptor. He established a style of realistic and dynamic Buddhist sculpture that had an immense impact on Japanese art for centuries. Commissioned by the KAMAKURA SHOGUNATE, he made statues for the Kōfuku and Tōdai temples in Nara and is best remembered for the nearly 26-ft (8-m) tall guardian figures at Tōdai temple's Great South Gate. He later produced many portrait sculptures.

Unkiar Skelessi, Treaty of See Treaty of HÜNKÂR İSKELESI

Unser, Bobby and Al *in full* **Robert William Unser** *and* **Alfred Unser** (respectively b. Feb. 20, 1934, Albuquerque, N.M., U.S.; b. May 29, 1939, Albuquerque, N.M., U.S.) U.S. automobile-racing drivers. The Unser brothers were born into a family of drivers and began driving at an early age. Both won the Pikes Peak hill climb and various U.S. Automobile Club races before competing in the INDIANAPOLIS 500, which Bobby won in 1968, 1975, and 1981, and Al in 1970, 1971, 1978, and 1987. Al's son Al Unser, Jr. (b. 1962), won the same race in 1992 and 1994.

Unterwalden \'ün-tər-ˌväl-dən\ Former canton, central Switzerland. It was ruled after 1173 by the HABSBURG counts. In 1291, with Uri and Schwyz, it formed the Everlasting League, which became the nucleus of the Swiss Confederation. In 1340 it divided into two sovereign half cantons, Nidwalden and Obwalden; in 1803 they became demicantons having equal rights.

untouchable Former classification of various low-status persons and those outside the Hindu CASTE system in Indian society. The term Dalit is now used for such people (in preference to MOHANDAS K. GANDHI's term, Harijan, which was considered condescending by the Dalit themselves), and their plight is recognized by the Indian constitution and by legislation. The groups traditionally considered untouchable included people whose occupations or habits of life involved activities considered to be polluting, such as taking life for a living (e.g., fishermen); killing or disposing of dead cattle or working with their hides; coming into contact with human waste (e.g., sweepers); and eating flesh of cattle, pigs, or chickens. Many untouchables converted to other religions to escape discrimination. Indian law now categorizes the Dalit under the term *scheduled castes* and accords them certain special privileges.

upanayana \ˌü-pə-'nə-yə-nə\ Hindu initiation ritual, restricted to the three upper VARNAS. It marks a male's entrance into the life of a student and his acceptance as a full member of the religious community. After a ritual bath, the boy, aged 5–24, is dressed as an ascetic and brought before his GURU, who invests him with various symbolic articles. The initiate receives a sacred thread, worn throughout his life, that identifies him as twice-born, the second birth being effected by receipt of a MANTRA. Observance of upanayana is decreasing and is now largely confined to the BRAHMAN class.

Upanishad \ü-'pä-ni-ˌshäd\ Any of 108 speculative texts of the VEDAS that contain elaborations in poetry and verse. They are believed to have been composed since 500 BC, based on teachings circulated since 1000 BC. They represent the final stage in the tradition of the Vedas, and the teaching based on them is called VEDANTA. Generally the Upanishads are concerned with the nature of reality, the individual soul (ATMAN), and the universal soul (BRAHMAN) and with the theory of the transmigration of souls and the nature of morality.

upasaka \ü-'pä-sə-kə\ Lay devotee of the BUDDHA. Originally the term applied to followers of the Buddha who were not ordained as BHIKSUS; today it is normally applied, mainly in Southeast Asia, to pious individuals who visit the local monastery on the weekly holy days and who undertake special vows. They support the SANGHA with regular offerings and observe the five precepts expected of all Buddhists: to abstain from killing, stealing, sexual misconduct, lying, and using intoxicants.

UPC See UNIVERSAL PRODUCT CODE

Updike, John (Hoyer) (b. March 18, 1932, Shillington, Pa., U.S.) U.S. writer. He attended Harvard University and in 1955 began a long association with *The New Yorker*. His works are known for careful craftsmanship and for their subtle depiction of American middle-class life. His famous "Rabbit" tetralogy—*Rabbit, Run* (1960), *Rabbit Redux* (1971), *Rabbit Is Rich* (1981, Pulitzer Prize), and *Rabbit at Rest* (1990, Pulitzer Prize)—follows a very ordinary American man through the decades of the later 20th century. A Jewish novelist named Bech is the subject of three other novels. Updike's other fiction includes *The Centaur* (1963), *Of the Farm* (1965), *Couples* (1968), *The Witches of Eastwick* (1984; film, 1987), and *In the Beauty of the Lilies* (1996). He has also published short-story collections, including *Pigeon Feathers* (1962), several volumes of reviews and essays, and light verse.

Upper Canada See CANADA WEST

Upper Volta See BURKINA FASO

Uppsala \'üp-ˌsä-ˌlä\ City (pop., 2001 est.: 191,110), Sweden. Located north of STOCKHOLM, it lies near a village which was originally the capital of the ancient pre-Christian kingdom of Svea. By the 13th century it was an important commercial centre. Relinquishing its political primacy to Stockholm, it remained the seat of the archbishop of Sweden; its Gothic cathedral (erected from the 13th–15th centuries) is Sweden's largest. It is also an educational centre, the site of Sweden's oldest university, Uppsala University (founded 1477). It is now an industrial city and transportation hub. CAROLUS LINNAEUS lived there.

ʿUqāb, Battle of Al- See Battle of LAS NAVAS DE TOLOSA

Uqṣūr, Al- See LUXOR

Ur \'ər, ůr\ Ancient city and district, SUMER, southern MESOPOTAMIA. It was situated on a former channel of the EUPHRATES RIVER in what is now southern IRAQ. One of the oldest cities of Mesopotamia, it was settled sometime in the 4th millennium BC. In the 25th century BC it was the capital of

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southern Mesopotamia under its first dynasty. Though it later declined, it again became important around the 22nd century BC. It is mentioned in the Bible (as Ur of the Chaldees) as the early home of Hebrew patriarch ABRAHAM (c. 2000 BC). In subsequent centuries it was captured and destroyed by many groups, including the Elamites and Babylonians. Nebuchadrezzar II restored it in the 6th century BC. Excavations, especially in the 1920s and '30s, uncovered remains of great archaeological value.

Northeastern facade (the ascents partly restored) of the ziggurat at Ur, southern Iraq.
HIRMER FOTOARCHIV, MÜNCHEN

uracil \'yůr-ə-ˌsil\ Organic compound of the PYRIMIDINE family, often called a base, consisting of a ring containing both nitrogen and carbon atoms. It occurs in combined form in many important biological molecules, including RNA and several COENZYMES active in CARBOHYDRATE metabolism. During synthesis of an RNA strand from DNA, uracil pairs with ADENINE. It or its corresponding NUCLEOSIDE or NUCLEOTIDE may be prepared from RNA by selective techniques of HYDROLYSIS.

Ural \'yůr-əl\ **Mountains** Mountain range, RUSSIA and KAZAKHSTAN. Generally held to constitute the boundary between Europe and Asia, the range extends north-south for some 1,550 mi (2,500 km) from just south of the Kara Sea to the URAL RIVER. The mountains average 3,000–4,000 ft (915–1,220 m) in elevation; the highest peak is Mount Narodnaya at 6,217 ft (1,895 m). The Central and Southern Urals contain one of the largest industrial regions of Russia, producing metal goods, chemicals, and machinery; that region developed rapidly during World War II (1939–45), when many industrial plants were moved from the western part of the Soviet Union to prevent their destruction by the Germans.

Ural River River, Russia and Kazakhstan. Rising at the southern end of the URAL MOUNTAINS, it flows southwest to cross through western Kazakhstan to the CASPIAN SEA at Atyrau. It is 1,509 mi (2,428 km) long and drains an area of 91,500 sq mi (237,000 sq km). Its lower course is navigable.

Uralic \yů-'ra-lik\ **languages** Family of more than 30 languages spoken by some 25 million people in central and northern Eurasia. A primary division is between the FINNO-UGRIC LANGUAGES, which account for most of the languages and speakers, and the Samoyedic languages. The latter languages have historically been spoken in the forest region of northern Siberia and in the tundra and coastal zones from the Ob to the White Sea and east into the Taymyr Peninsula. The known languages are Nganasan, Enets, Nenets, Selkup, Kamas (which became extinct in the late 20th century), and Mator (which became extinct in the 19th century). Of the other languages that are still spoken, Nenets, which has 25,000 speakers and is still being learned by children, is the most viable. The Samoyedic languages share little vocabulary with Finno-Ugric. At its very earliest stages Uralic most probably included the ancestors of the Yukaghir languages, still sometimes included with the PALEO-SIBERIAN LANGUAGES.

uraninite \yů-'rā-nə-ˌnīt\ Uranium dioxide (UO_2), a major OXIDE MINERAL of URANIUM. Uraninite is radioactive and usually forms black, gray, or brown crystals that are moderately hard and generally opaque. The elements uranium and radium were first extracted from uraninite ore from what is now the Czech Republic. It has also been mined in Germany and Canada, and in the Colorado Plateau (U.S.). See also PITCHBLENDE.

Uraninite in pitchblende from Great Bear Lake, Northwest Territories, embedded (for display) in a larger mass of feldspar from Grafton Center, N.H.
COURTESY OF THE FIELD MUSEUM OF NATURAL HISTORY, CHICAGO; PHOTOGRAPH, JOHN H. GERARD

uranium Chemical ELEMENT of the ACTINIDE series (with many TRANSITION ELEMENT properties), chemical symbol U, atomic number 92. A dense, hard, silvery white METAL that tarnishes in air, it is isolated from such ores as PITCHBLENDE. Until the discovery of the first TRANSURANIUM ELEMENT in 1940, uranium was believed to be the heaviest element. RADIOACTIVITY was discovered in uranium by A.-H. BECQUEREL. All its ISOTOPES are radioactive; several have HALF-LIVES long enough to permit determination of the age of the Earth by URANIUM-THORIUM-LEAD DATING and URANIUM-234–URANIUM-238 DATING. NUCLEAR FISSION was discovered in 1938 in uranium bombarded with NEUTRONS, and the self-sustaining nuclear CHAIN REACTION, the ATOMIC BOMB, and the generation of NUCLEAR POWER followed. Uranium has various VALENCES in compounds, some of which have been used as colours in ceramic glazes, in lightbulb filaments, in photography, and as dyes and mordants.

uranium-234–uranium–238 dating Method of age determination that makes use of the radioactive decay of uranium-238 to uranium-234; the method can be used for dating sediments from either a marine or a PLAYA lake environment. Because this method is useful for the period c. 100,000–1.2 million years before the present, it helps in bridging the gap between the CARBON-14 DATING method and the POTASSIUM-ARGON DATING method.

uranium-thorium-lead dating *or* **common-lead dating** Method of dating very old rocks by means of the amount of common lead they contain. Common lead is any lead from a rock or mineral that contains a large amount of lead and a small amount of the radioactive precursors of lead (i.e., the isotopes uranium-235, uranium-238, and thorium-232). By this method, the age of the Earth has been estimated to be c. 4.6 billion years. This figure is in good agreement with the age of meteorites and the age of the Moon as determined independently.

Uranus *or* **Ouranus** \'yůr-ə-nəs, yů-'rā-nəs\ Ancient Greek personification of HEAVEN. When GAEA emerged from CHAOS, she produced Uranus, the mountains, and the sea. Her subsequent union with Uranus produced the TITANS, the Cyclopes, and the Hecatoncheires. Uranus despised his offspring and hid them in Gaea's body. In response to her appeal for vengeance, CRONUS castrated Uranus. From the drops of blood that fell on Earth were born the FURIES, the Giants, and the ash-tree NYMPHS called Meliai. His severed genitals floated on the sea, producing a white foam from which sprang APHRODITE. Uranus also consorted with Clymene, Hemera, HESTIA, and Nyx.

Uranus Seventh planet from the Sun. It was discovered in 1781 by William Herschel (see HERSCHEL FAMILY) and named for the Greek god personifying heaven. A blue-green gas giant, it has almost 15 times the mass of Earth and over 50 times its volume. It is less dense than Earth; the gravity at the top of its atmosphere is 11% weaker. Its equatorial diameter is 31,800 mi (51,100 km). Uranus has 10 sharply defined narrow, dark rings, with broad dust bands between them; the rings consist mainly of boulder-size chunks of dark material. Uranus also has at least 27 moons (most named after Shakespearean characters) and a magnetic field about as strong as Earth's. The planet rotates once every 17 hours around an axis that, unusually, is almost parallel to the ECLIPTIC; from Earth it appears to spin on its side. It takes 84 years to orbit the Sun, at a mean distance of 1.78 billion mi (2.87 billion km). It has no solid surface; its fluid interior is thought to consist of a mixture of rock, ices, and gas, with little or no rocky core. Its upper atmosphere is mostly hydrogen and helium; the blue-green colour comes from absorption of red light by the small amount of methane present.

Urartu \ů-'rär-ˌtů\ Ancient kingdom around Lake VAN, southwestern Asia. Today the region is divided among Armenia, eastern Turkey, and northwestern Iran. The kingdom flourished c. 13th–7th century BC, enjoying considerable power in the Middle East in the 9th–8th century. Archaeological finds date from the time of King Shalmaneser I (c. 1274–45) of Assyria. Repeatedly attacked by Assyrian kings, Urartu declined in the late 8th century. It ceased to exist after invasions by Cimmerians, Scythians, and Medes in the 7th century BC.

Urban II *orig.* **Odo of Châtillon-sur-Marne** (b. c. 1035, Châtillon-sur-Marne, or Lagery, or Lagny, Champagne, France—d. July 29, 1099, Rome) Pope (1088–99). The prior of a Cluniac monastery, he was made

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cardinal by Pope Gregory VII, whose reforms he furthered. Elected pope in 1088, Urban secured his authority against the antipope Clement III and strengthened the role of the papacy in the reform movement. He called for the First Crusade at the Council of Clermont (1095) in response to the appeal of Alexius I Comnenus, promoted the union of the Eastern and Western churches, and supported the Christian reconquest of Spain from the Moors.

Urban VI *orig.* **Bartolomeo Prignano** (b. 1318, Naples—d. Oct. 15, 1289, Rome) Pope (1378–89). Archbishop of Acerenza (1363) and Bari (1377), he became papal chancellor for Gregory XI, whom he was chosen to succeed. This election of an Italian appeased the Romans, who wanted to end the French-dominated Avignon papacy, but his harsh reforms soon angered the French cardinals, prompting them to elect the antipope Clement VII, beginning the Western Schism (1378). Europe was divided in its loyalties, and Urban warred with Naples when its queen backed Clement. Strife over the schism reduced the Papal States to anarchy, and Urban's death may have been from poisoning.

urban climate Any set of climatic conditions that prevails in a large metropolitan area and that differs from the climate of its rural surroundings. Urban climates are distinguished from those of less built-up areas by differences of air temperature, humidity, wind speed and direction, and amount of precipitation. These differences are attributable in large part to the altering of the natural terrain through the construction of artificial structures and surfaces. For example, tall buildings, paved streets, and parking lots affect wind flow, precipitation runoff, and the local energy balance.

urban planning Programs pursued as a means of improving the urban environment and achieving certain social and economic objectives. Evidence of urban planning can be found in the ruins of ancient cities, including orderly street systems and conduits for water and sewage. During the Renaissance, European city areas were consciously planned to achieve circulation of the populace and provide fortification against invasion. Such concepts were exported to the New World, where William Penn, in founding the city of Philadelphia, developed the standard gridiron plan—the laying out of streets and plots of land adaptable to rapid change in land use. Modern urban planning and redevelopment arose in response to the disorder and squalor of the slums created by the Industrial Revolution. The urban planner best known for his transformation of Paris was Georges-Eugène Haussmann. City planners imposed regulatory laws establishing standards for housing, sanitation, water supply, sewage, and public health conditions, and introduced parks and playgrounds into congested city neighbourhoods. In the 20th century, zoning—the regulation of building activity according to use and location—came to be a key tool for city planners. See also Pierre-Charles L'Enfant.

Urbino majolica \mə-'jä-li-kə\ Italian tin-glazed earthenware made in the city of Urbino, which dominated the market from c. 1520. Early wares, mostly dishes, are painted in a range of colours, dominated by brilliant yellow, orange, and brown, and decorated with narrative scenes typically covering the entire surface, a style known as *istoriato*. Scenes are taken from the Bible, mythology, Classical and contemporary history, and poetry. Later wares were decorated in a style called grotesque, adapted from motifs found in Roman excavations. Production declined in the late 17th century. See also majolica.

Urdu \'ür-dü\ **language** Indo-Aryan language used by Muslims in India and Pakistan. In the sociopolitical realm, Urdu and Hindi are different languages, but the colloquial basis of both is identical, and as a written language Urdu differs from Hindi principally in its greater acceptance of Persian-Arabic vocabulary and in some syntactic features. It is written in the Arabic alphabet with modification of some letters to denote specifically Indo-Aryan sounds. As Pakistan's official language, Urdu has been promoted as a token of national unity, though less than 8% of Pakistanis—mainly immigrants and descendants of immigrants from India after the 1947 partition—speak it as a first language.

urea \yù-'rē-ə\ *or* **carbamide** One of the simplest organic compounds and the first synthesized from inorganic raw materials (see inorganic compound), by Friedrich Wöhler (1800–82) in 1828. It is the diamide of carbonic acid (H_2NCONH_2; see amide; carbon dioxide). The chief nitrogenous end product of protein breakdown in mammals and some fishes, it occurs not only in urine but also in blood, bile, milk, and perspiration. It is one of the industrial chemicals produced in vast amounts. With its high nitrogen content and low price, it is a major agricultural fertilizer and animal-feed ingredient. It is also used to make urea-formaldehyde plastics (including foamed plastics; see polyurethanes), to synthesize barbiturates, as a stabilizer in explosives, and in adhesives, hydrocarbon processing, and flameproofing.

uremia \yù-'rē-mē-ə\ Excess nitrogenous waste products in the blood and their toxic effects. Kidney impairment (see Bright disease; diabetes mellitus; hypertension; kidney failure; nephritis) or disorders that hinder urine excretion (e.g., prostatic disorders) allow urea and other protein waste products to accumulate. Symptoms usually start with fatigue and loss of concentration. They may include itching and muscle twitches; dry, flaky, yellowish skin; dry mouth, metallic taste, and ammonia breath; and nausea, vomiting, diarrhea, and constipation. Advanced stages affect the nervous, cardiovascular, and respiratory systems and can lead to hypertension, seizures, heart failure, and death. If the underlying disorder cannot be treated, dialysis or kidney transplant may be required.

Urey \'yůr-ē**, Harold C(layton)** (b. April 29, 1893, Walkerton, Ind., U.S.—d. Jan. 5, 1981, La Jolla, Calif.) U.S. scientist. He received his doctorate from the University of California at Berkeley and thereafter taught at various universities. He was awarded a Nobel Prize in 1934 for discovering deuterium and heavy water. He was a key figure in the development of the atomic bomb; his group worked on the gaseous diffusion process for separation of uranium-235. He devised methods for estimating the temperature of ancient oceans, theorized on the compositions of primordial atmospheres, and studied the relative abundances of the elements, making fundamental contributions to a widely accepted theory of the origin of the Earth and other planets in *The Planets*, (1952).

Uriburu \ˌü-rē-'bü-rü**, José Félix** (b. July 20, 1868, Salta, Arg.—d. April 29, 1932, Paris, Fr.) Argentine soldier and dictator. Nephew of a former president, he was a firm believer in class privileges. A visit to Germany made him an ardent admirer of Prussian militarism. In 1930 he led a coup against Hipólito Irigoyen's liberal regime, replacing the governing class with an elite representing the landed oligarchy, dissolving the legislature, and revising the laws to prohibit liberal-radicals from political participation. In 1931 he arranged a fraudulent election to ensure the oligarchy's continued control and stepped down in favour of a fellow officer, Agustín Justo.

uric acid \'yůr-ik\ Heterocyclic compound of the purine type, the end product of metabolism of the purines in nucleic acids in many animals, including humans. It is excreted by reptiles and birds as the chief nitrogenous end product of protein breakdown. Small quantities are normally found in human blood; in gout, levels are abnormally high. Uric acid is used industrially in organic synthesis.

urinalysis \ˌyůr-ə-'na-lə-səs\ Laboratory examination of a urine sample for clinical information. Abnormal concentrations of substances normally found in urine or presence of those that are not may indicate a disorder. Colour, specific gravity, or volume changes may reveal a specific disease or injury. Significant findings include high glucose and acetone in diabetes mellitus; various nitrogen compounds, pigments, amino acids, and their metabolic products in disorders of the enzymes that act on them; uric acid in gout; and urea, albumins, and globulins in kidney disease. Hormones may be evidence of pregnancy or endocrine imbalance. Urinalysis can also detect poisons and drugs.

urinary system *or* **renal** \'rē-nəl\ **system** System that produces and discharges urine to rid the body of waste products. It consists of the kidneys, which balance electrolytes in blood, retaining and adding needed ones and removing unneeded or dangerous ones for excretion; the ureters, two thin muscular tubes 10–12 in. (25–30 cm) long that move the urine by peristalsis; the hollow, muscular bladder, which receives and stores it; and the urethra, through which it leaves the body. In women the urethra is 1.5 in. (4 cm) long. In men it is longer (since it passes through the penis), about 8 in. (20 cm), and carries semen from the prostate gland as well as urine. Urinary disorders, which can lead to dehydration or edema and to a dangerous buildup of waste and toxic substances, include kidney failure, tumours, and bladder and kidney stones.

urination Process of excreting urine from the bladder (see urinary system). Nerve centres in the spinal cord, brain stem, and cerebral cortex control it through involuntary and voluntary muscles. The need to void is felt when the bladder holds 3.5–5 oz (100–150 ml) of urine and becomes uncomfortable at a volume of 14–15 oz (350–400 ml). The detrusor contracts and the sphincter (muscular constriction) of the urethra relaxes to

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empty the bladder. Normally it empties completely, but bladder stones or PROSTATIC DISORDERS can block outflow; poor muscle tone (especially in older women) or certain nervous system disorders can cause loss of control of urination (INCONTINENCE).

urine Liquid solution of metabolic wastes and other, often toxic, substances filtered from PLASMA. The fluid in the Bowman capsule at the start of each NEPHRON is essentially plasma without the large molecules (e.g., proteins). The concentrated fluid (final urine) that exits the KIDNEY consists of water, UREA, inorganic SALTS, URIC ACID, creatinine, AMMONIA, and broken-down blood pigments, including urochrome, which makes urine yellow, plus any unusual substances not reabsorbed into the blood. This is then excreted. See also HEMATURIA; URINALYSIS; URINARY SYSTEM; URINATION.

URL *in full* **Uniform Resource Locator** Address of a resource on the INTERNET. The resource can be any type of file stored on a server, such as a WEB page, a text file, a graphics file, or an application program. The address contains three elements: the type of PROTOCOL used to access the file (e.g., HTTP for a Web page, ftp for an FTP site); the DOMAIN NAME or IP address of the server where the file resides; and, optionally, the pathname to the file (i.e., description of the file's location). For example, the URL http://www.britannica.com/heritage instructs the browser to use the HTTP protocol, go to the www.britannica.com Web server, and access the file named heritage.

Urmia, Lake *Persian* **Daryācheh-ye Orūmiyyeh** \ˌdär-yä-'che-ye-ù-ˌrü-'mē-yə\ Shallow, saline lake, northwestern Iran. The largest lake in the Middle East, it covers an area that varies from 2,000 to 2,300 sq mi (5,200 to 6,000 sq km). It is about 87 mi (140 km) long and 25–35 mi (40–55 km) wide, with a maximum depth of 53 ft (16 m). There is a cluster of about 50 tiny islands at its southern part. Fed by three rivers, it has no outlet. It has been protected since 1967.

Urnfield culture Late BRONZE AGE culture of Europe, so called because its people placed their cremated dead in urns. This culture spread from east-central Europe and northern Italy in the 12th century BC and later to Ukraine, Sicily, Scandinavia, France, and Spain. In some areas barrows marked the graves. The culture was warlike, with fortified settlements and bronze weapons, including the slashing sword. The uniformity of the culture and the persistence of certain pottery and metal forms apparently had great influence on Early IRON AGE culture.

urogenital malformation Defect in the organs or tissues of the URINARY SYSTEM or in the sex organs (genitals). In polycystic kidney disease (an inherited disease), CYSTS of varying size enlarge one or both KIDNEYS. Kidneys may have abnormal shapes or may be fused. In megaloureter, the ureter's diameter is enlarged. Males may have epispadias or hypospadias, in which the urethra opens on the upper surface or the underside, respectively, of the PENIS, or cryptorchidism (undescended testicles), in which one or both TESTES have not descended from the abdomen into the scrotum before birth. Female genital system malformations include AGENESIS of the OVARIES, VAGINA, or UTERUS and abnormally shaped uterus.

urology \yù-'rä-lə-jē\ Medical specialty dealing with the URINARY SYSTEM and male reproductive organs. It traces its origin to medieval lithologists, itinerant healers who specialized in surgical removal of bladder stones. The Spanish surgeon Francisco Díaz wrote the first treatises on urinary-tract disease (1588) and is regarded as the founder of modern urology. Most modern urological procedures originated in the 19th century. Today, urologists use bladder catheters (see CATHETERIZATION), the cystoscope (to view the inside of the bladder), and various DIAGNOSTIC IMAGING techniques; treat PROSTATIC DISORDERS; perform VASECTOMIES; and may surgically remove stones in the urinary tract and cancers of the kidneys, bladder, and testicles. Urology deals mostly with male patients; the urinary tract in females may be treated by gynecologists (see OBSTETRICS AND GYNECOLOGY).

Urquiza \ür-'kē-sä**, Justo José de** (b. Oct. 18, 1801, Arroyo Urquiza, Viceroyalty of the Río de la Plata—d. April 11, 1870, Entre Ríos province, Arg.) Argentinian soldier and statesman who helped overthrow JUAN MANUEL DE ROSAS. He became governor of Entre Ríos province in 1841 and allied himself with other provincial leaders to overthrow the dictatorial Rosas in 1852. As provisional dictator, he called a constitutional convention that sanctioned a constitution modeled on that of the U.S. All provinces accepted it, but the province of Buenos Aires, determined to lead the nation, refused to join the new union until 1859. Urquiza stepped down in 1860 and led the Argentinian army in the PARAGUAYAN WAR. He and his sons were assassinated by a political rival. See also BARTOLOMÉ MITRE.

Ursula \'ər-syù-lə**, Saint** (fl. 4th century, Rome; feast day October 21) Legendary leader of a band of virgins martyred by the Huns. The number of virgins was originally 11, but, as the story was retold over the years, it increased to 11,000. According to the 13th-century *Golden Legend*, Ursula was an English princess who went on a pilgrimage to Rome with 11,000 virgins and was martyred with them on the homeward journey. Ursula is the patron saint of the order of St. Ursula (Ursulines), a congregation of nuns dedicated to educating girls.

Urubamba \ˌü-rü-'bäm-bä\ **River** River, central Peru. Part of the AMAZON RIVER drainage system, it rises in the ANDES MOUNTAINS and flows northwest for about 450 mi (725 km) to its junction with the APURÍMAC RIVER, the two then forming the UCAYALI RIVER. In the Gorge of Torontoy, the river plunges from about 11,000 ft (3,400 m) above sea level to about 8,000 ft (2,400 m) in 20 mi (32 km).

Uruguay \ˌü-rü-'gwī,\ *English* \'yùr-ə-ˌgwā\ *officially* **Oriental Republic of Uruguay** Country, southeastern South America. Area: 68,037 sq mi (176,215 sq km). Population (2005 est.): 3,256,000. Capital: MONTEVIDEO. People of European ancestry (mostly Spanish and Italian) make up about nine-tenths of the population; most of the remainder are mestizos or people of African-European descent. Few Indians remain. Language: Spanish (official). Religions: Christianity (predominantly Roman Catholic; also other Christians, Protestant), Judaism. Currency: Uruguayan peso. Uruguay is the only South American country lying entirely outside the tropics. Its topography consists mainly of low plateaus and low hilly regions. The principal waterway is the NEGRO RIVER; the URUGUAY RIVER forms the country's entire western border with Argentina. Mineral and energy resources are limited. Pastures, covering almost four-fifths of the land area, support large herds of livestock raised for meat, leather goods, and wool. Chief crops include rice, sugarcane, oranges, wheat, and corn. Other important economic activities are tourism, fishing, and the manufacture of textiles and chemicals. Uruguay is a republic with two legislative houses; its head of state and government is the president. Prior to European settlement, it was inhabited mainly by the Charrúa and Guaraní Indians. The Spanish navigator Juan Díaz de Solís sailed into the Río de la PLATA estuary in 1516. The Portuguese established Colonia in 1680. Subsequently the Spanish established Montevideo in 1726, driving the Portuguese from their settlement; 50 years later Uruguay became part of the Viceroyalty of the RÍO DE LA PLATA. It gained independence from Spain in 1811. The Portuguese regained it in 1821, incorporating it into Brazil as a province. A revolt against Brazil in 1825 led to its being recognized as an independent country in 1828. It sided with Brazil and Argentina against Paraguay in the War of the TRIPLE

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Alliance (1864/65–70). The economy benefited from a demand for raw material during World War II (1939–45) and the Korean War (1950–53). The office of the president was abolished in 1951 and replaced with a nine-member council. The country adopted a new constitution and restored the presidential system in 1966. A military coup occurred in 1973, but the country returned to civilian rule in 1985. The 1990s brought a general upturn in the economy, largely the result of reform measures and membership in Mercosur, the Southern Common Market (1991).

Uruguay River River, southeastern South America. Rising in southern Brazil, it forms the border between Argentina and Brazil and between Argentina and Uraguay. Above Buenos Aires, it combines with the Paraná River to form the great estuary of the Río de la Plata. Its 990-mi (1,593-km) course is interrupted by rapids, but it is navigable by ocean vessels for about 130 mi (210 km) upriver from its mouth.

Uruk See Erech

Ürümqi \ˌœ-ˈrœm-ˈchē\ *or* **Urumchi** \ˈù-ˈrùm-ˈchē\ *or* **Wu-lu-mu-ch'i** \ˈwü-ˈlü-ˈmü-ˈchē\ City (pop., 1999 est.: 1,258,457), capital of Xinjiang autonomous region, northwestern China. Situated along the northern face of the Tien Shan, it first came under Chinese control in the 7th–8th centuries and became an important centre for caravans en route to Turkistan. The Uighurs had control from c. 750 until the resumption of Chinese rule in the 18th century. The city was held by Muslim rebels in 1864–76. When the province of Xinjiang was established in 1884, Ürümqi became its capital. It grew rapidly into the greatest city and centre of trade in Central Asia. It is located in a coal-mining and petroleum-producing area; its chief manufactures include iron and steel, agricultural machinery, and chemicals.

Urundi See Ruanda-Urundi

U.S. See United States

U.S. News & World Report Weekly newsmagazine published in Washington, D.C. *U.S. News* was founded in 1933 by David Lawrence (1888–1973) to cover important domestic events; he founded *World Report* in 1945 to treat world news. The two magazines were merged in 1948. From its start, *U.S. News & World Report* had a somewhat more conservative editorial viewpoint than its larger rivals, *Time* and *Newsweek*, and it paid less attention to sports and the arts. In 1984 it was bought by real-estate developer Mortimer B. Zuckerman, who later purchased the *New York Daily News*. Surveys of higher education are published annually in the popular "America's Best Colleges" rankings.

U.S.S.R. See Union of Soviet Socialist Republics

USA Today National U.S. daily general-interest newspaper, the first of its kind. Launched in 1982 by Allen Neuharth, head of the Gannett newspaper chain, it reached a circulation of one million within a year and surpassed two million in the 1990s. Initially considered gimmicky and insubstantial, it gradually developed a reputation for higher quality while increasing its circulation and advertising revenues at a time when few papers were experiencing growth. The features that originally set it apart—abundant colourful graphics, very brief stories, and a concentration on sports and celebrity—have influenced other newspapers.

USB *in full* **Universal Serial Bus** Type of serial bus that allows peripheral devices (disks, modems, printers, digitizers, data gloves, etc.) to be easily connected to a computer. A "plug-and-play" interface, it allows a device to be added without an adapter card and without rebooting the computer (the latter is known as hot-plugging). The USB standard, developed by several major computer and telecommunications companies, supports data-transfer speeds up to 12 megabits per second, multiple data streams, and up to 127 peripherals.

Usman dan Fodio \ˈù-ˈsmän-ˈdän-ˈfō-ˈdē-ō\ (b. December 1754, Maratta, Gobir, Hausaland—d. 1817, Sokoto, Fulani empire) Fulani mystic, philosopher, and revolutionary reformer. In a jihad (holy war) between 1804 and 1808, he created a new Muslim state, the Fulani empire, in what is now northern Nigeria. He stimulated the growth of Islam throughout the region and founded the important Sokoto caliphate. He also produced a large body of writings in Arabic and Fula that continue to enjoy wide circulation and influence.

Ussuri \ˈù-ˈsůr-ē\ **River** *Chinese* **Wusuli Jiang** *or* **Wu-su-li Chiang** River, eastern Asia. Formed by the confluence of two rivers rising in the Sikhote-Alin Mountains of extreme southeastern Siberia (Russia), it flows north, marking part of the border between Russia and China and joining the Amur River near Khabarovsk. It is 565 mi (909 km) long. In the 1960s, and especially in 1969, Soviet and Chinese forces clashed over large sections of the river border. A limited agreement was reached on navigational use of the river in 1977.

Ustinov \ˈyüs-tə-ˌnȯf**, Sir Peter (Alexander)** (b. April 16, 1921, London, Eng.—d. March 28, 2004, Genolier, Switz.) British actor, director, author, and playwright. He made his professional stage debut at age 17, in which he displayed his talents for vocal mimicry and age affectation, and landed his first major screen role in *The Goose Steps Out* (1942). His film appearances include *Lola Montès* (1955), *Spartacus* (1960, Academy Award), *Topkapi* (1964, Academy Award), and a recurring role as Hercule Poirot in movies based on Agatha Christie's mysteries, beginning with *Death on the Nile* (1978). He both starred in and directed *Billy Budd* (1962), among other films. *Lady L* (1965), with Sophia Loren and Paul Newman, was probably his best-received directorial effort. He wrote successful plays such as *The Love of Four Colonels* (1951) and *Romanoff and Juliet* (1956) and won Emmy Awards for his television performances in *The Life of Samuel Johnson* (1957), *Barefoot in Athens* (1966), and *A Storm in Summer* (1970). Ustinov also wrote several novels and the autobiographical works *Dear Me* (1977), *Ustinov at Large* (1993), and *Ustinov Still at Large* (1994). Noted for his humanitarian efforts, he served as ambassador at large for UNICEF from 1969 until his death. Ustinov was knighted in 1990.

Usumacinta River \ˌü-sü-mä-ˈsēn-tä\ River, southeastern Mexico and northwestern Guatemala. Rising in northwestern Guatemala, it is formed by the confluence of the Salinas (or Chixoy) and Pasión rivers. It flows northwest and forms a section of the border between Guatemala and Mexico. It then empties into the Grijalva River in Mexico. With the Salinas River, it is about 600 mi (1,000 km) long.

Usumbura See Bujumbura

usury \ˈyü-zhə-rē\ In law, the crime of charging an unlawfully high rate of interest. In Old English law, the taking of any compensation whatsoever was termed usury. With the expansion of trade in the 13th century, the demand for credit increased, necessitating a modification in the definition of the term. In 1545 England fixed a legal maximum interest, a practice later followed by other Western nations.

Utah State (pop., 2000: 2,233,169), western U.S. It covers 84,904 sq mi (219,901 sq km); its capital is Salt Lake City. Utah is bordered by Idaho to the north, Wyoming to the northeast, Colorado to the east, Arizona to the south, and Nevada to the west. At Four Corners, in the southeast, Utah meets Colorado, New Mexico, and Arizona at right angles, the only such meeting of states in the nation. Utah contains the Great Salt Lake and parts of the middle Rocky Mountains and Uinta Mountains. The western third of the state is a broad desert-like area. About 70% of the land is owned by either the federal or the state government. The region was inhabited as early as 10,000 BC. In c. AD 400 the Pueblo Indians lived throughout Utah; they were followed by other groups, including the Shoshone, Ute, and Paiute Indians. Spanish missionaries visited there in the late 18th century. It passed to Mexico in 1821. U.S. pioneer Jim Bridger was the first white man to see the Great Salt Lake, in 1824. The area's first permanent settlers were Mormons, who were led to the valley of the Great Salt Lake in 1847 by Brigham Young. Acquired by the U.S. after the Mexican War, the region was organized as the Utah Territory in 1850; it had been reduced to the area of the present state by 1868. A conflict between Mormon authorities and the U.S. government known as the Utah War occurred in 1857–58, and statehood was denied until the Mormons renounced polygamy. When they did, Utah entered the Union in 1896 as the 45th state. The Mormon church has officially been politically neutral since the early 20th century, and the influence of economic blocs has become more important. Utah has large reserves of coal and petroleum and is the world's largest producer of beryllium. Major industries include agriculture and tourism.

Utamaro \ˈù-tä-ˈmä-rō\ *orig.* **Kitagawa Nebsuyoshi** (b. 1753, Japan—d. Oct. 31, 1806, Edo) Japanese printmaker and painter. He moved from a provincial town to Edo (now Tokyo) in his youth; his early work included many illustrated books. One of the greatest *ukiyo-e* artists, he is known especially for his masterfully composed portraits of sensuous female beauties. Unlike other *ukiyo-e* artists, who favoured prints of women in groups, Utamaro concentrated on half-length single portraits.

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Ute \'yüt\ North American Indians living mostly in Colorado and Utah, U.S. Their language belongs to the Numic branch of the Uto-Aztecan language family, and their name means "hill people." Their traditional homeland included western Colorado, eastern Utah (whose name derives from Ute), and parts of New Mexico. They eventually joined into a loose confederation of seven bands. Until the 19th century, the Ute had no horses and lived in small family clusters, subsisting by food collecting. They were virtually indistinguishable from the Southern Paiute. When the Ute acquired horses in the early 1800s, they became organized as loose bands of hunters, often targeting livestock. After the Indian wars of 1864–70, most Ute were settled on reservations. At the turn of the 21st century, they numbered more than 5,000.

uterine \'yü-tə-rən\ **bleeding** Abnormal bleeding from the uterus not related to menstruation. Most common in the first few years after menarche and as menopause approaches, it is thought to occur when malfunctioning ovaries reduce blood estrogen levels. A malfunctioning hypothalamus or pituitary gland may also cause hormonally induced uterine bleeding, as can birth-control pills or hormone-replacement therapy. Some tumours produce estrogen and can alter the menstrual cycle, causing bleeding. Tumours in the uterus often bleed easily. Other causes include injury to the uterus, stress, obesity, chronic illness, psychological problems, and blood and cardiovascular disorders. Treatment is directed toward the underlying cause.

uterine cancer Malignant tumour of the uterus. Cancers affecting the lining of the uterus (endometrium) are the most common cancers of the female reproductive tract. Risk factors include absence of pregnancy, early age of first menstruation (before age 12), late onset of menopause (after age 52), obesity, diabetes, and estrogen replacement therapy. Additional risk factors are a personal history of breast or ovarian cancer, age (over age 40), and a family history of uterine cancer. Whites are more likely to develop uterine cancer than are blacks. The major symptom is vaginal bleeding or discharge. Treatment may begin with simple or radical hysterectomy. Some uterine cancers are treated in part by hormonal therapy, radiation therapy, or chemotherapy.

uterus *or* **womb** Inverted-pear-shaped organ of the female reproductive system, in which the embryo and fetus develop during pregnancy. Lying over and behind the bladder, it is 2.5–3 in. (6–8 cm) long and about 2.5 in. (6 cm) across at the top, where the fallopian tubes enter it; at the other end, the cervix extends down into the vagina. The uterine lining (endometrium), a moist mucous membrane, changes in thickness during the menstrual cycle (see menstruation), being thickest at ovulation in readiness for a fertilized egg. The uterine wall, about 1 in. (2.5 cm) thick, expands and becomes thinner as a fetus develops inside. The cervix expands to about 4 in. (10 cm) for delivery. Disorders of the uterus include infections, benign and malignant tumours, prolapse, endometriosis, and fibroids (leiomyomas; see muscle tumour).

ʿUthmān ibn ʿAffān \ùth-'män-ˌi-bən-af-'fän\ (d. June 17, 656, Medina, Arabia) Third caliph of the Umayyad dynasty. Born into the powerful Umayyad clan of Mecca, he became a wealthy merchant before converting to Islam; he was the first convert of high social and economic standing. He married a daughter of Muhammad. On the death of ʿUmar ibn al-Khaṭṭāb (644), ʿUthmān was chosen as his successor. His reign as caliph was marked by nepotism and personal profit, and he made many enemies. His accomplishments included centralizing the administration of the caliphate and establishing an official version of the Qu'rān. His death at the hands of rebels marked the beginning of the first fitnah.

Utica \'yü-ti-kə\ Ancient Phoenician settlement, North Africa. Considered the oldest Phoenician settlement, it was located in what is now modern Tunisia. After its founding (c. 8th century BC), it grew rapidly and was second in importance only to Carthage. Made the capital of the Roman province of Africa after the Third Punic War (149–146 BC), it later declined after the emperor Augustus rebuilt Carthage. Excavations have uncovered Phoenician graves dating from the 8th century BC and a substantial residential section of the Roman city. See also Punic Wars.

utilitarianism Ethical principle according to which an action is right if it tends to maximize happiness, not only that of the agent but also of everyone affected. Thus, utilitarians focus on the consequences of an act rather than on its intrinsic nature or the motives of the agent (see consequentialism). Classical utilitarianism is hedonist, but values other than, or in addition to, pleasure (ideal utilitarianism) can be employed, or—more neutrally, and in a version popular in economics—anything can be regarded as valuable that appears as an object of rational or informed desire (preference utilitarianism). The test of utility maximization can also be applied directly to single acts (act utilitarianism), or to acts only indirectly through some other suitable object of moral assessment, such as rules of conduct (rule utilitarianism). Jeremy Bentham's *Introduction to the Principles of Morals and Legislation* (1789) and John Stuart Mill's *Utilitarianism* (1863) are major statements of utilitarianism.

Uto-Aztecan \ˌyü-tō-'az-ˌte-kən\ **languages** Family of more than 30 American Indian languages spoken in pre-Columbian times from the northern Great Basin to Central America. Geographically, Uto-Aztecan can be divided into a northern and a southern branch. The northern branch, spoken from Oregon and Idaho to southern California and Arizona, includes the languages of the Northern and Southern Paiutes, Utes, Northern and Eastern Shoshone, Comanche, and Hopi. The southern branch includes the languages of the O'odham (Pima and Papago) in Arizona, and of a number of Mexican Indian peoples, including the Tarahumara of Chihuahua, the Yaqui of northwestern Mexico and Arizona, and the Cora and Huichol of Nayarit and Jalisco; its southernmost extension includes Nahuatl.

utopian socialism Political and social idea of the mid-19th century. Adapted from such reformers as Robert Owen and Charles Fourier, utopian socialism drew from early communist and socialist ideas. Advocates included Louis Blanc, noted for his theory of worker-controlled "social workshops," and John Humphrey Noyes, founder of the Oneida Community in the U.S. Utopian settlements were also attempted by religious groups such as the Mennonites, Shakers, and Mormons. See also Brook Farm.

Utrecht \'ü-ˌtrekt, 'yü-ˌtrekt\ City (pop., 2001 est.: 256,420), central Netherlands. The site of successive Roman, Frisian, and Frankish fortresses, it became an episcopal see in 696 under St. Willibrord. It was most prosperous during the 11th and 12th centuries, when it was an important commercial centre. In 1527 it was transferred to Holy Roman Emperor Charles V and became part of the Habsburg dominions. It was ruled by Spain until the 1570s, when it became a centre of Protestant resistance. It was the site of the signing of the Union of Utrecht (1579), which established a league of northern Dutch provinces against Spain; the league was the basis of the future Netherlands kingdom. Occupied by the French (1795–1813), it was the residence of Louis Bonaparte, king of Holland (1806–10). The only Dutch pope, Adrian VI, was born in Utrecht. It is a transportation, financial, and insurance centre.

Utrecht, Peace of (1713–14) Series of treaties concluding the War of the Spanish Succession. One series was signed between France and other European powers; another series was signed between Spain and other powers. France concluded treaties with Britain, the Dutch Republic, Prussia, Portugal, and Savoy, in which it ceded various territories, including regions in Canada, to Britain. France also recognized Queen Anne as the British sovereign, acknowledged Frederick I's royal title, and recognized Victor Amadeus II as king of Sicily. Spain ceded Gibraltar to Britain. In a separate accord, the *asiento* agreement, Spain gave Britain the exclusive right to supply the Spanish colonies with African slaves for 30 years. Emperor Charles VI concluded a separate peace with France in the Treaty of Rastatt and Baden. The Spanish succession was settled in favour of the Bourbon Philip V. The treaties gave Britain the largest portion of colonial and commercial spoils and made it the leader in world trade.

Utrecht school Principally a group of three Dutch painters from Utrecht—Dirck van Baburen (c. 1590–1624), Gerrit van Honthorst, and Hendrik Terbrugghen—who were greatly influenced by Caravaggio's art during travels to Rome. They used their newly learned technique in artwork with primarily religious subject matter, but also produced brothel scenes and pictures in sets, such as five works devoted to the senses. The numerous candles, lanterns, and other sources of artificial light in their paintings also differentiate them from Caravaggio, who never used such devices. Honthorst enjoyed the widest reputation at the time, but Terbrugghen is now considered the most talented and versatile of the group.

Utrillo \ü-trē-'yō,\ *English* \yü-'tri-lō**, Maurice** (b. Dec. 25, 1883, Paris, Fr.—d. Nov. 5, 1955, Le Vésinet) French painter. When he became an alcoholic in his teens, his mother, the painter and model Suzanne Valadon, encouraged him to take up painting as therapy; it soon became his obsession. He had no formal artistic training and was interested primarily in reproducing what he saw as faithfully as possible. Most of his compositions depict the old, deteriorating houses and streets of the Montmartre district of Paris. His best work is that of his "white period" (c. 1908–14), so called for his lavish use of zinc white in heavy layers to build up aging, cracked walls. See photograph on opposite page.

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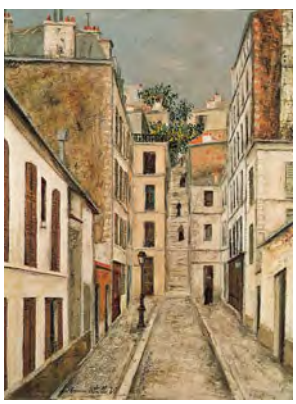
Uttar Pradesh \'ù-tər-prə-'dāsh\ *formerly* **United Provinces of Agra and Oudh** State (pop., 2001: 166,197,921), north-central India. It is bordered by Nepal, the states of Bihar, Jharkhand, Madhya Pradesh, Rajasthan, Haryana, and Uttaranchal, and Delhi national capital territory and covers an area of 93,933 sq mi (243,286 sq km); its capital is Lucknow. The state, the most populous in the country, lies largely in the plains formed by the Ganges and Yamuna rivers. The region was the setting of two great Sanskrit epics, the Mahabharata and Ramayana, and the scene of the rise of Buddhism after the 6th century BC. It was ruled by the Mauryan emperor Ashoka in the mid-3rd century BC, the Gupta dynasty (c. AD 320–c. 415), and King Harsa (606–647). The Mughals gained control in the 16th century, at which time the city of Agra became a chief centre. The British arrived in the late 18th century; by the 1830s they held sway and eventually formed the North-Western Provinces, to which Oudh was later annexed. The area was the main scene of the Indian Mutiny of 1857. The current province was formed in 1902 and became a state of India in 1947. In 2000 the northern portion of it was made into the state of Uttaranchal. Uttar Pradesh is a major silica-producing state, yet agriculture is its most important economic sector. Its noted tourist meccas are Agra and Varanasi.

Uttaranchal State (pop., 2001 prelim.: 8,479,562), northern India. It is bordered by Tibet (China) and Nepal and the states of Uttar Pradesh, Haryana, and Himachal Pradesh and covers an area of 19,739 sq mi (51,125 sq km); its capital is Dehra Dun. The state lies in the Himalayas, and some of India's highest peaks rise in its northern areas. The upper reaches of the Ganges (Ganga) and Yamuna rivers flow southward through the state. In the south are hill resorts such as Mussoorie, Naini Tal, and Ranikhet. The area now constituting Uttaranchal was a part of Uttar Pradesh state after Indian independence in 1947 until it was made into a separate state in 2000. The population is mostly engaged in agriculture, although tourism is also important.

Uvarov \ü-'vär-əf**, Sergey (Semyonovich), Count** (b. Sept. 5, 1786, Moscow, Russia—d. Sept. 16, 1855, Moscow) Russian administrator. Uvarov served as a diplomat (1806–10), head of the St. Petersburg educational district (1811–22), and deputy minister of education (1832) before being named minister of education in 1833 under Tsar Nicholas I. In an influential report, Uvarov declared that education must adhere to the "principles of orthodoxy, autocracy, and nationality," which was adopted as an ideology rooted in loyalty to dynastic rule, traditional religious faith, and glorification of the Russian homeland. Uvarov was also president of the Academy of Science from 1818 until his death.

uveitis \ˌyü-vē-'ī-təs\ Inflammation of the uvea, the middle coat of the eyeball. Anterior uveitis, involving the iris or ciliary body (containing the muscle that adjusts the lens) or both, can lead to glaucoma and blindness. Posterior uveitis, involving the choroid (which contains the eye's blood supply), can cause bleeding, lens clouding, and eyeball atrophy. Granulomatous uveitis (persistent inflammation with a grainy surface) causes vision impairment, pain, watery eyes, and sensitivity to light; nongranulomatous uveitis causes less pain and sensitivity, with a better chance of recovery. Causes include generalized infections and other diseases, allergic reactions, and injury. Rarely, the uninjured eye also has symptoms, with a risk of blindness in both eyes. Treatment aims to eliminate infection, reduce inflammation, and preserve vision.



Impasse Cottin, oil on cardboard by Maurice Utrillo, c. 1910; in the National Museum of Modern Art, Paris.

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Uxmal \üz-'mäl, üsh-'mäl\ Ancient city, Yucatán state, southeastern Mexico. It was the chief city of the later Maya empire (600–c. 900 AD). After c. 1000, major construction in the city ceased, although it continued to be occupied and was a participant in the political League of Mayapan. When the league ended, Uxmal, like the other great cities of the north, was abandoned (c. 1450). Maya ruins include a pyramid, palace, and quadrangle.

Uygur See Uighur

Uzbekistan \ùz-ˌbe-ki-'stan\ *officially* **Republic of Uzbekistan** Country, Central Asia. The autonomous republic of Qoraqalpoghiston (Karakalpakstan) is within its borders. Area: 172,700 sq mi (447,400 sq km). Population (2005 est.): 26,593,000. Capital: Tashkent. The Uzbeks constitute three-fourths of the population; Russians, Tajiks, Kazakhs, Tatars, and Karakalpaks make up the remainder. Languages: Uzbek (official), Russian, Tajik, Kazakh. Religions: Islam (predominantly Sunni); also Eastern Orthodox. Currency: sum. Uzbekistan lies largely between the Amu Darya and Syr Darya rivers. Although it contains fertile oases and high mountain ranges in the south and east, almost four-fifths of the country consists of flat, sunbaked lowlands. Two-thirds of the Aral Sea extends into Uzbekistan. It is a major producer and exporter of natural gas and has sizable reserves of petroleum, coal, and various metallic ores. It is a leading grower of cotton and also produces fruits and vegetables and Karakul sheep. It is the main manufacturer of machinery and heavy equipment in Central Asia. It is a republic with one legislative body; its head of state is the president, and the head of government is the prime minister. A grandson of Mongol leader Genghis Khan received the territory as his inheritance in the 13th century. The Mongols ruled over a number of Turkic tribes, who would eventually intermarry with the Mongols to form the Uzbeks and other Turkic peoples of Central Asia. In the early 16th century a federation of Mongol-Uzbeks invaded and occupied settled regions, including an area called Transoxania that would become the permanent Uzbek homeland. By the early 19th century the region was dominated by the khanates of Khiva, Bukhara, and Kokand, all of which eventually succumbed to Russian domination. The Uzbek S.S.R. was created in 1924. In June 1990 Uzbekistan became the first Central Asian republic to declare sovereignty. It achieved full independence from the Soviet Union in 1991. Its economy subsequently became the strongest in Central Asia.

Uzi submachine gun \'ü-zē\ Compact automatic weapon used throughout the world as a police and special-forces firearm. It was named for its designer, Uziel Gal, an Israeli officer who developed it after the Arab-Israeli War of 1948. It is 25.6 in. (650 mm) long with its folding metal butt fully extended. The barrel is only 10 in. (260 mm) long. When loaded with a 25- or 32-round magazine of 9-mm pistol ammunition, it weighs about 9 lbs (4 kg). It has also been made in miniature versions as short as 18 in. (460 mm).

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V-1 missile *or* **flying bomb** *or* **buzz bomb** German MISSILE of World War II. The forerunner of modern CRUISE MISSILES, it was about 25 ft (8 m) long and had a wingspan of about 18 ft (5.5 m). It was launched from catapult ramps or sometimes from aircraft; it carried an explosive warhead of almost 1,900 lbs (850 kg) and had an average range of 150 mi (240 km). More than 8,000 V-1s were launched against London in 1944–45, and a smaller number against Belgium. See also V-2 MISSILE.

V-2 missile German liquid-fueled ballistic MISSILE of World War II, forerunner of modern space LAUNCH VEHICLES (see also ROCKET) and long-range missiles. Developed starting in 1936 under WERNHER VON BRAUN, it was fired against Paris, Great Britain, and Belgium in 1944 and 1945. After the war, the U.S. and the Soviet Union captured large numbers of V-2s and used them in research that led to the development of their missile and space-exploration programs. See also V-1 MISSILE.

Vaal \'väl\ **River** River, South Africa. Rising in Mpumalanga province, it flows west 750 mi (1,210 km), forming part of the boundary between Mpumalanga and Free State provinces, to empty into the ORANGE RIVER in Northern Cape province. It is primarily used for irrigation.

vaccine Preparation containing either killed or weakened live microorganisms or their toxins, introduced by mouth, by injection, or by nasal spray to stimulate production of ANTIBODIES against an infectious agent. This confers IMMUNITY to that agent, since the B LYMPHOCYTES remain sensitized to it and respond to later INFECTION by producing more antibodies. The first vaccine, against SMALLPOX, was introduced by EDWARD JENNER in 1798. Vaccines have been developed against diseases caused by BACTERIA (e.g., TYPHOID, WHOOPING COUGH, TUBERCULOSIS) and by VIRUSES (e.g., MEASLES, INFLUENZA, RABIES, POLIOMYELITIS). Effectiveness varies, and a small percentage of people have adverse reactions. Those with IMMUNODEFICIENCY disorders should not receive live vaccines.

vacuole \'vak-yə-ˌwōl\ Space within a cell that is empty of CYTOPLASM, lined with a membrane, and filled with fluid. Especially in PROTOZOANS, vacuoles perform functions such as storage, ingestion, digestion, excretion, and expulsion of excess water. The large central vacuoles often found in plant cells enable them to attain a large size without accumulating the bulk that would make metabolism difficult.

vacuum Space in which there is no MATTER or in which the PRESSURE is so low that any particles in the space do not affect any processes being carried on there. It is a condition well below normal ATMOSPHERIC PRESSURE and is measured in units of pressure (the pascal). A vacuum can be created by removing air from a space using a vacuum pump or by reducing the pressure using a fast flow of fluid, as in BERNOULLI'S PRINCIPLE.

vacuum tube Electron tube consisting of a sealed glass or metal enclosure from which the air has been withdrawn. It was used in early electronic circuitry to control a flow of electrons. In the first half of the 20th century, vacuum tubes allowed the development of radio broadcasting, long-distance telephone service, television, and the first electronic digital computers, which were the largest vacuum-tube systems ever built. TRANSISTORS have replaced them in virtually all applications, but they are still occasionally used in display devices for television sets and computers (CATHODE-RAY TUBES), in microwave ovens, and as high-frequency transmitters on space satellites.

Vadim \vä-'dēm\ **(Plemiannikov), Roger** (b. Jan. 26, 1928, Paris, France—d. Feb. 11, 2000, Paris) French film director. After working briefly as a stage actor in the mid-1940s, he began his film career as an assistant on *Juliette* (1953). He directed and cowrote the highly successful erotic film *And God Created Woman* (1956), which established his wife, BRIGITTE BARDOT, as a sex symbol. He duplicated this winning formula with two later wives, Annette Stroyberg in *Dangerous Liaisons* (1959) and JANE FONDA in *Barbarella* (1968), and his lover, CATHERINE DENEUVE, in *Vice and Virtue* (1962).

Vadodara \və-'dō-də-ˌrä\ *or* **Baroda** \bə-'rō-də\ City (pop., 2001 prelim.: 1,306,035), southeastern GUJARAT state, west-central India. It was known by many different names before receiving its present one in 1971. The earliest record of the city dates from a charter of AD 812, and during the succeeding centuries it came under various rulers, including those of the Muslim Delhi sultanate and the MUGHAL DYNASTY. Its varied products include cotton textiles, chemicals, machinery, and furniture.

Vaduz \fä-'düts\ City (pop., 1997 est.: 5,000), capital of Liechtenstein. Located on the RHINE RIVER, it was greatly damaged in 1499 in a war between the Swiss and Holy Roman Emperor MAXIMILIAN I, but it was subsequently rebuilt. The Liechtenstein family gained possession in the early 18th century. It is a flourishing tourist centre and the residence of the ruling prince, whose castle overlooks the town. The town's Fürst Liechtensteinische Gemäldegalerie displays parts of the world-famous art collection of the princes of Liechtenstein.

Vaganova \və-'gä-nə-və**, Agrippina (Yakovlevna)** (b. July 6, 1879, St. Petersburg, Russia—d. Nov. 5, 1951, Leningrad) Russian ballet dancer and teacher. In 1897 she joined the MARIINSKY THEATRE company, where she worked until 1917. She began teaching at the Leningrad Choreographic (formerly Imperial Ballet) school in 1921 and became its director in 1934. Her system of ballet instruction combined classic technique with the athletic, acrobatic post-Revolution style. She wrote the widely used textbook *Fundamentals of the Classic Dance* (1934).

vagina \və-'jī-nə\ Genital canal in females. Together with the cavity of the UTERUS, it forms the birth canal. In most virgins, its external opening is partially closed by a thin fold of tissue (hymen), which has various forms, not all of which significantly obstruct the opening. The vagina's lining thickens and thins during the menstrual cycle (see MENSTRUATION) in response to ESTROGEN from the OVARIES, being thickest and most elastic during ovulation and pregnancy. Its normally slightly acid environment discourages disease-causing microorganisms. Thick, elastic muscle walls accommodate movement of the penis during intercourse and passage of a child during delivery. A mucuslike fluid seeps through them for lubrication during sexual arousal. Vaginal disorders include bacterial and fungal infections (e.g., SEXUALLY TRANSMITTED DISEASES, CANDIDA), VAGINITIS, sores (see ULCER), and PROLAPSE.

vaginitis \ˌva-jə-'nī-təs\ INFLAMMATION of the VAGINA. The chief symptom is a whitish or yellowish vaginal discharge. Treatment depends on the cause: appropriate drugs for SEXUALLY TRANSMITTED DISEASES (often from *Gardnerella* bacteria or TRICHOMONADS) or YEAST infections; ESTROGEN cream for atrophy of the vaginal lining, which may dry out after MENOPAUSE; and avoidance of any chemicals found to trigger irritation or allergy.

vagrancy Act of wandering about without employment or identifiable means of support. Traditionally a vagrant was thought to be one who was able to work for his maintenance but preferred instead to live idly, often as a beggar. Punishment ranged from branding and whipping to conscription into the military services and transportation to penal colonies. In the U.S., laws against vagrancy were used by police and prosecutors to proscribe a wide range of behaviours. Many such laws were struck down as unconstitutionally vague, thus largely decriminalizing vagrancy, though in the 1990s many local laws were implemented to curtail aggressive panhandling, begging, and other activities by vagrants on city streets.

Váh \'väk\ **River** River, western Slovakia. Rising in the Tatra Mountains, it flows west and south for 242 mi (390 km) before entering the DANUBE RIVER at Komárno. There are numerous hydroelectric-power stations along it.

Vail Town (pop., 2000: 4,531), west-central Colorado, U.S. Located in the ROCKY MOUNTAINS west of DENVER, it was founded as a resort town in 1962 and built in the style of an Alpine village. The skiable terrain around Vail Mountain extends for 15 sq mi (39 sq km), making Vail the largest ski resort in North America.

Vairocana \vī-'rō-chə-nə\ In MAHAYANA and tantric BUDDHISM, the supreme buddha who is the cosmic counterpart of SAKYAMUNI in his teaching mode. He is the most prominent of the five self-born bud-

Dainichi Nyorai ("Great Sun Buddha") by Unkei, lacquered wood sculpture, 1175; in the Enjō-ji, Nara, Japan
ASUKA-EN

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dhas, those who were born as humans to propagate the DHARMA. Though without canonical basis, Vairocana holds a special place in Tibetan BUDDHISM and has a special role in the AVATAMSAKA-SUTRA, in which he is the solar buddha who is both the ultimate reality of the cosmos and the one who pervades its component parts.

Vaisheshika \vī-'shā-shi-kə\ One of the six orthodox systems, or DARSHANS, of Indian philosophy. Founded c. 2nd–3rd century AD, it fused with NYAYA in the 11th century, forming the Nyaya-Vaisheshika school. Vaisheshika attempts to identify, inventory, and classify the entities that present themselves to human perception. It lists seven categories of being. It holds that the universe's smallest, indivisible, indestructible unit is the atom, which is made active through God's will, and that all physical things are a combination of the atoms of earth, water, fire, and air.

Vaishnavism \'vīsh-nə-ˌvi-zəm\ Worship of VISHNU as the supreme deity, as well as of his incarnations, mainly RAMA and KRISHNA. Vaishnavism is one of the major forms of modern HINDUISM, along with SHAIVISM and SHAKTISM, and is probably the most popular and most widely practiced. Characterized by an emphasis on BHAKTI, its goal is to escape from the cycle of birth and death in order to enjoy the presence of Vishnu. The philosophical schools into which Vaishnavism is divided are distinguished by their varying interpretations of the relationship between individual souls and God, and include aspects of MONISM and DUALISM.

Vaishya \'vīsh-yə\ Third highest of the four VARNAS of India. Traditionally described as commoners, Vaishyas are connected with productive labour, such as trade, agriculture, and pastoralism. According to legend, they sprang from the thighs of PRAJAPATI, after the BRAHMANS and the KSHATRIYAS but before the SHUDRAS. Like the two higher classes, they are "twice-born" (see UPANAYANA). They are credited historically with favouring the rise of the reformist religious beliefs of BUDDHISM and JAINISM. In modern times they have become a symbol of middle-class prestige, and many rise to higher classes.

Vajiravudh \ˌvä-jē-rä-'vüd\ *or* **Phramongkutklao** \ˌprä-ˌmȯŋ-kůt-'klaů\ *or* **Rama VI** (b. Jan. 1, 1881, Bangkok, Siam—d. Nov. 26, 1925, Bangkok) King of Siam (Thailand; 1910–25). Educated at Oxford, Vajiravudh undertook numerous social reforms as king, including making monogamy the only legal form of marriage. In 1921 he made primary education free and compulsory. He alienated both liberals and conservatives at home but was successful in foreign policy, restoring full fiscal autonomy to Siam. A prolific writer and translator, he introduced Western forms to Thai literature, translated WILLIAM SHAKESPEARE's works, and composed about 50 original plays.

Vajpayee, Atal Bihari (b. Dec. 15, 1924, Gwalior, Madhya Pradesh, India) Leader of India's pro-Hindu BHARATIYA JANATA PARTY (BJP) and prime minister of India in 1996 and from 1998 to 2004. Politically active as a teenager, he was briefly jailed by British colonial authorities. He was first elected to parliament in 1957 as a member of the Bharatiya Jana Sangh, a forerunner of the BJP. He served as foreign minister in the late 1970s and helped formally establish the BJP in 1980. In 1992 he was one of the few Hindu leaders to speak out against the destruction of the historic Babri Masjid mosque by anti-Muslim extremists. Elected prime minister in May 1996, he was unable to form a government and resigned after 13 days. In 1998 and 1999 he was again elected prime minister as head of a BJP-led coalition. In May 1998 nuclear weapons tests ordered by Vajpayee drew international condemnation and economic sanctions. In 2000 his government began an extensive program of divestment of public funds from several key state-run industries. Under his leadership India achieved steady economic growth and became a world leader in information technology. In 2004 his coalition was defeated in parliamentary elections, and he resigned from office.

vajra \'vəj-rə\ Five-pronged ritual object extensively employed in the ceremonies of TIBETAN BUDDHISM. It is fashioned out of brass or bronze, the four prongs at each end curving around the central fifth to form a lotus-bud shape. In Sanskrit the word means both thunderbolt and diamond: like a thunderbolt it cuts through ignorance, and like a diamond it destroys but is itself indestructible. Originally a symbol of INDRA, it was used to conquer the non-Buddhist deities of Tibet. In ritual use, it is often employed in conjunction with a bell in the execution of MUDRAS.

Vajrayana \ˌvəj-rə-'yä-nə\ Form of tantric BUDDHISM that emerged in India in the first millennium AD and spread to Tibet, where it is the predominant tradition in TIBETAN BUDDHISM. Philosophically, Vajrayana is a blend of the YOGACARA and MADHYAMIKA disciplines. It aims to recapture the enlightenment experience of the BUDDHA Gautama, and it places special emphasis on the notion that enlightenment arises from the realization that seemingly opposite principles are in truth one. It introduced innovations involving the use of MANTRAS and MANDALAS as aids to meditation, and, in rare cases, the use of yogically disciplined sexual activities.

Vakataka \'vä-kə-tə-kə\ **dynasty** Indian ruling house that originated in the central Deccan in the mid-3rd century AD. The Vakataka empire is believed to have extended from Malwa and Gujarat in the north to the Tungabhadra in the south and to have spanned the peninsula from west to east. In the 4th century the Vakatakas were allied by marriage to the GUPTA DYNASTY, and Gupta cultural influence was significant. The Vakatakas are noted for having encouraged arts and letters.

Valdemar \'väl-də-mär\ **I** *known as* **Valdemar the Great** (b. Jan. 14, 1131, Denmark—d. May 12, 1182, Denmark) King of Denmark (1157–82). On ascending the throne, he ended more than 25 years of civil wars, and he defeated the Wends (Slavs) by 1169, freeing Danish ships from piracy. He acknowledged the overlordship of FREDERICK I Barbarossa and accepted his antipope Victor IV; he later acknowledged Pope ALEXANDER III (c. 1165) and rejected Frederick. He gained church approval for hereditary rule by his dynasty, the Valdemars, and in 1181 he allied with Frederick as an equal, aided by the marriage of their children.

Valdemar IV Atterdag \'ät-tər-ˌdȧg\ (b. c. 1320, Denmark—d. Oct. 24, 1375, Schleswig) King of Denmark (1340–75). A son of King Christopher II, he sought to free Danish lands from foreign domination. He sold Estonia (1346), gained control of Zealand (1349), and subdued a revolt in Jutland (1350). By regaining Skåne from Sweden, he completed the reunification of his father's kingdom (1360). His aggressive foreign policy led to conflict with Sweden, North German principalities, and the HANSEATIC LEAGUE, which defeated him in 1368, forcing him to concede trading privileges but allowing his kingdom to remain intact. The marriage of his daughter Margaret to the Norwegian king Haakon VI made possible the unification of Denmark and Norway.

Valdes \väl-'des\ *or* **Peter Waldo** (d. c. 1205) French religious leader. A successful merchant, Valdes (Peter Waldo was a later form of his name) underwent a religious conversion, gave away his wealth, and began to preach a doctrine of voluntary poverty in Lyon around 1170. In 1179 his vow of poverty was confirmed by Pope ALEXANDER III, but he was subsequently forbidden to preach by Pope Lucius III. In 1182 or 1183 Valdes and his followers—called the Poor, or the Poor of Lyon—were excommunicated for violating the ban on preaching and were banished from the city. They were formally condemned at a church council in 1184 along with other heretics, including the CATHARI, against whom Valdes had earlier preached. The severe persecution of the so-called WALDENSES in the 13th century forced them to begin traveling and teaching in secret. During the Protestant REFORMATION, the Waldenses accepted Genevan forms of worship and church organization.

Valdés Leal \bäl-'dās-lē-'äl**, Juan de** (b. May 4, 1622, Sevilla, Spain—d. Oct. 15, 1690, Sevilla) Spanish painter. Son of a Portuguese father, he was educated in Córdoba and worked there and in Sevilla. After the death of BARTOLOMÉ ESTEBAN MURILLO, he was Sevilla's leading painter. His early works are marked by exotic colours, dramatic lighting, and vigorous brushstrokes. Later paintings such as *Vanitas* (1660) and *Triumph of Death* (1672) are characterized by their macabre subject matter, dynamic energy, and theatrical violence.

Valdivia \val-'dē-vē-ə**, Pedro de** (b. c. 1498, Extremadura, Spain—d. January 1554, Tucapel, Viceroyalty of Peru) Spanish conquistador. After serving with the Spanish army in Italy and Flanders, he was sent to South America in 1534, where he served under FRANCISCO PIZARRO in Peru. In 1540 he led an expedition of 150 Spaniards into Chile, where he defeated a large force of Indians and founded Santiago in 1541. He extended Spanish rule south to the Bío-Bío River in 1546, fought again in Peru (1546–48), and returned to Chile as governor in 1549. He began to conquer Chile south of the Bío-Bío and founded Concepción in 1550. He was killed in a campaign against the Araucanian Indians.

Vale of Tempe See Vale of TEMPE

Vale of the White Horse See Vale of the WHITE HORSE

valence \'vā-lənsˌ\ Number of bonds (see BONDING) an ATOM can form. Hydrogen (H) always has valence 1, so other ELEMENTS' valences equal the

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number of hydrogen atoms they combine with. Thus, oxygen (O) has valence 2, as in water (H_2O); nitrogen (N) has valence 3, as in ammonia (NH_3); and chlorine (Cl) has valence 1, as in hydrochloric acid (HCl). The valence depends on the number of unpaired ELECTRONS in the outermost (and, in TRANSITION ELEMENTS, the next) shell of the atom's structure. The sharing of the unpaired (valence) electrons in a bond mimics the stable configuration of the NOBLE GASES, whose outer shells are full. Elements that can achieve stable configurations by various combinations have more than one valence.

Valencia Autonomous community (pop., 2001: 4,162,776), eastern Spain. Encompassing the provinces of Alicante, Castellón, and Valencia, it covers 8,979 sq mi (23,255 sq km); its capital is the city of VALENCIA. A generally mountainous region with salt lagoons on the coast, the area was conquered successively by Romans, Visigoths, and Moors. Part of the caliphate of CÓRDOBA (11th century), it subsequently became an independent Moorish kingdom. It was held by the Spanish commander the CID (1094–99); after the Cid's death Valencia again was lost to the Moors, until King James I of ARAGON took it in 1238. One of the richest farming regions in the Mediterranean basin, it produces oranges, rice, grapes, and olives; it also has many manufacturing facilities.

Valencia City (pop., 2001: city, 738,441; metro. area, 1,397,809), capital of the autonomous community of VALENCIA, eastern Spain. First mentioned as a Roman settlement in 138 BC, it was later taken by the Visigoths in AD 413 and the Moors in 714. It became the seat of the newly established independent Moorish kingdom of Valencia in 1021. After 1238 it was part of the dominions of ARAGON. The first Spanish printing press was established in Valencia in 1474; during the next two centuries the city was the seat of the Valencian school of painting. It was severely damaged in the PENINSULAR WAR, during the SPANISH CIVIL WAR, and by flood in 1957. Its port ships agricultural produce and manufactured items.

Valencia City (pop., 2000 est.: 1,338,833), northwestern Venezuela. It is located near the western shore of Lake VALENCIA. Founded in 1555, it rivaled CARACAS as the region's major city well into the 19th century. In 1814, during the struggle for Venezuela's independence, it was the site of a bloody battle between Spanish and opposition forces. It served as national capital in 1812, 1830, and 1858. One of Venezuela's principal industrial and transportation centres, it produces textiles, pharmaceuticals, and automobiles.

Valencia, Lake *formerly* **Tacarigua** \ˌtä-kä-ˈrē-gwä\ Lake, Carabobo and Aragua states, northern Venezuela. Its total area of 141 sq mi (364 sq km) makes it the second largest natural lake in Venezuela, after Lake MARACAIBO. It lies in an agricultural region and popular resort area.

Valens (b. c. AD 328—d. Aug. 9, 378) Eastern Roman emperor (364–378). His older brother, VALENTINIAN I, appointed Valens to be coemperor and assigned him to rule the eastern part of the empire, while Valentinian took the throne in the West. An Arian Christian, Valens persecuted Catholics and waged war on the pagan Procopius (366), the VISIGOTHS (367–369), and the Persians (c. 376). When the Visigoths again rebelled against the Romans, Valens's poor tactics led to his defeat and death in the great Battle of ADRIANOPLE.

Valentine, Saint (d. 3rd century, Rome; feast day February 14) Christian martyr whose legend inspired the lover's holiday Valentine's Day. According to tradition, he was a Roman priest and physician who died during the persecution of Christians by the emperor Claudius II Gothicus and was buried on the Via Flaminia. The priest signed a letter to his jailer's daughter, whom he had befriended and with whom he had fallen in love, "from your Valentine." The legend of the bishop of Terni, Italy—also called Valentine and also martyred in Rome—may refer to the same person.

Valentine's Day Lovers' holiday celebrated on February 14, the feast day of St. Valentine, one of two 3rd-century Roman martyrs of the same name. St. Valentine is considered the patron of lovers and especially of those unhappily in love. The feast day became a lovers' festival in the 14th century, probably as an extension of pagan love festivals and fertility rites celebrated in mid-February. Today it is marked by the exchange of romantic cards (valentines), flowers, and other gifts.

Valentinian I \ˌva-lən-ˈti-nē-ən\ *in full* **Flavius Valentinianus** (b. AD 321, Cibalae, Pannonia—d. Nov. 17, 375, Brigetio, Pannonia Inferior) Roman emperor (364–375). He served in the military in Africa under his father. Proclaimed emperor by the army, he made his brother VALENS ruler in the East while he ruled the West. Both showed religious toleration. Valentinian defeated the Alemanni in Gaul in 365, then moved to support the defense of Britain. He named his nine-year-old son GRATIAN coemperor (367) to ensure succession. In Germany he fortified the Rhine; he went on to fight the Quadi in Pannonia, where he fell sick and died. Despite his achievements, he was known for his cruelty and poor choice of ministers.

Valentino, Rudolph *orig.* **Rodolfo Guglielmi di Valentina d'Antonguolla** (b. May 6, 1895, Castellaneta, Italy—d. Aug. 23, 1926, New York, N.Y., U.S.) Italian-born U.S. film actor. He immigrated to the U.S. in 1913 and worked as a dancer before moving to Hollywood in 1918. He played small parts in movies until his role in *The Four Horsemen of the Apocalypse* (1921) made him a star. His popularity, promoted by skillful press agents, soared among women as he played the handsome, mysterious lover in romantic dramas such as *The Sheik* (1921), *Blood and Sand* (1922), *The Eagle* (1925), and *The Son of the Sheik* (1926). His sudden death at 31 from a ruptured ulcer caused worldwide hysteria, several suicides, and riots at his funeral.

Valera, Eamon de See Eamon DE VALERA

Valerian *Latin* **Publius Licinius Valerianus** (d. AD 260) Roman emperor (253–260). He served as consul under SEVERUS ALEXANDER (r. 222–235). Later a commander on the upper Rhine, he supported the emperor Gallus (r. 251–253) in the conflict with a rival emperor but arrived with his legions too late to save Gallus from death at the hands of his own troops. Elected emperor by his soldiers (253), Valerian renewed the persecution of the Christians and executed Pope Sixtus II in 258. After appointing his son PUBLIUS LICINIUS GALLIENUS to rule the western part of the empire, he marched east to repel the Persian invasion. At first successful, he was later defeated by the Persian king Shapur I and died in captivity.

valerian Any of the more than 400 species of annual and perennial herbaceous plants in about 10 genera that make up the family Valerianaceae. A few are outstanding as ornamentals, salad or potherbs, or as sources of medicines and perfumes. Greek valerian is Jacob's ladder (*Polemonium caeruleum*), in the family Polemoniaceae. The true valerians (native to the temperate zones, the Andes Mtns., and Africa) have tubular flowers, often spurred at the base and clustered in tight heads. The largest genus, *Valeriana*, contains about 200 species and is best known for common valerian (*V. officinalis*), used by modern herbalists to calm the nerves.

Valéry \ˌva-lə-ˈrē**, (Ambroise-) Paul (-Toussaint-Jules)** (b. Oct. 30, 1871, Sète, France—d. July 20, 1945, Paris) French poet, essayist, and critic. A student of law, Valéry wrote many poems during 1888–91, some published in magazines of the SYMBOLIST MOVEMENT. After 1894 he wrote daily in his notebooks, later published as the famous *Cahiers*. He revised his early work to create his greatest poem, *La Jeune Parque* (1917). It was followed by *Album de vers anciens, 1890–1900* (1920) and *Charmes ou poèmes* (1922), containing "Le Cimetière marin," which established him as the outstanding French poet of his time. His works are typically variations on the theme of the tension within the human consciousness between the desire for contemplation and the will to action. He later became a prominent public personage, writing many essays and occasional papers on literary topics and taking a great interest in science and political problems.

Paul Valéry.
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Valhalla \val-ˈha-lə, väl-ˈhä-lə\ In GERMANIC RELIGION, the hall of slain warriors who live blissfully under the leadership of ODIN. Valhalla is depicted as a splendid palace, roofed with shields, where the warriors feast on the flesh of a boar slaughtered daily and made whole again each evening. They drink liquor that flows from the udders of a goat, and their sport is to fight one another every day, with the slain being revived in the evening. Thus they will live until the RAGNAROK, when they will leave Valhalla to fight at the side of Odin against the Giants. See also ASGARD, FREYJA, VALKYRIE.

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validity In LOGIC, the property of an argument consisting in the fact that the truth of the premises logically guarantees the truth of the conclusion. Whenever the premises are true, the conclusion must be true, because of the form of the argument. Some arguments that fail to be valid are acceptable on grounds other than formal logic (e.g., inductively strong arguments), and their conclusions are supported with less than logical necessity. Where the support yields high probability of the conclusion relative to the premises, such arguments are sometimes called inductively valid. In other purportedly persuasive arguments, the premises actually provide no rational grounds for accepting the conclusion; such defective forms of argument are called fallacies (see FALLACY, FORMAL AND INFORMAL).

valine \'va-ˌlēn, 'vā-ˌlēn\ One of the essential AMINO ACIDS, found in most PROTEINS. Produced industrially by HYDROLYSIS of proteins or by chemical synthesis, it is used in biochemical and nutritional research and as a dietary supplement.

Valium Trademark for a preparation of diazepam. A tranquillizing drug used to treat anxiety and tension states and as an aid in sedation, first introduced in 1963, it belongs to the group of chemically related compounds called benzodiazepines, the first of which was synthesized in 1933. Side effects include drowsiness and muscular incoordination; physical dependence can result after prolonged use. The discovery of Valium and similar drugs led to a new era in psychopharmacology.

Valkyrie \val-'kir-ē, 'val-kə-rē\ In GERMANIC RELIGION, any of a group of maidens sent by ODIN to select slain warriors worthy of a place in VALHALLA. They rode to the battlefield on horses or, in some accounts, flew through the air and sea. Some had the power to cause the death of warriors they disliked; others guarded the lives and ships of those they favoured. According to various myths, they were either purely supernatural or human with supernatural powers; they were associated with fairness, brightness, and gold as well as with bloodshed.

Valla \'väl-lä**, Lorenzo** (b. 1407, Rome, Papal States—d. Aug. 1, 1457, Rome) Italian humanist, philosopher, and literary critic. Unable to find a post as a papal secretary, Valla left Rome in 1430 and spent five years traveling in northern Italy. He was royal secretary and historian for ALFONSO V of Aragon (1435–48). In his polemical style, he criticized the works of BOETHIUS (for his viewpoint), ARISTOTLE (for his "barbarisms," among other things), and CICERO (for his prose style). Found heretical by the INQUISITION for his refusal to believe that the Apostles' Creed was composed by the 12 Apostles, he narrowly avoided being burned at the stake. His *Elegantiae linguae Latinae* (printed 1471; "Elegances of the Latin Language") was the first textbook of Latin grammar written since late antiquity. His *Annotations on the New Testament* (printed 1505) was his last major work.

Valladolid \ˌva-lə-də-'lid,\ *Spanish* \ˌbäl-yä-thō-'lēth\ City (pop., 2001: 316,580), capital of the autonomous community of CASTILE-LEÓN, Spain. First mentioned in 1074, it was the seat of the Castilian court until c. 1600. The Catholic Monarchs, ISABELLA of Castile and FERDINAND of Aragon, were married there in 1469. It suffered heavy damage by fire in 1561 and by the French during the PENINSULAR WAR. Industry and commerce are economic mainstays. It has many medieval buildings, and its university (founded 1346) is one of Spain's oldest. CHRISTOPHER COLUMBUS died in Valladolid in 1506.

Vallandigham \və-'lan-di-gəm**, Clement L(aird)** (b. July 29, 1820, Lisbon, Ohio, U.S.—d. June 17, 1871, Lebanon, Ohio) U.S. politician. He served in the U.S. House of Representatives (1857–63), where he became a leader of the antiwar COPPERHEADS and the secret Knights of the Golden Circle (later Sons of LIBERTY). As a result of his vociferous criticism of Pres. ABRAHAM LINCOLN's administration and its pursuit of the American Civil War, he was arrested and found guilty of treasonable sentiments (1863) and was sentenced to exile in the South. He soon made his way to Canada and later illegally to Ohio. While in Canada he was nominated for governor by the Ohio Peace Democrats, but he was easily defeated. He later criticized the RECONSTRUCTION policy of the Republicans as both unconstitutional and tyrannical.

Valle d'Aosta \ˌvä-lā-dä-'ōs-tə\ Autonomous region (pop., 2001 prelim.: 119,356), northwestern Italy. Covering an area of 1,259 sq mi (3,262 sq km), it is enclosed on three sides by the ALPS; the capital is AOSTA. Originally the territory of the Celtic Salassi, it was annexed by the Romans. After the fall of the Western Roman Empire in the 5th century, it formed part of the Burgundian and Frankish kingdoms. It was acquired in the 11th century by the house of SAVOY. The autonomous region of Valle d'Aosta was created in 1945, in recognition of the area's special French linguistic and cultural orientation. It is important for dairy products and tourism.

Valle-Inclán \'bäl-yā-ēŋ-'klän**, Ramón María del** *orig.* **Ramón Valle y Villanueva de Arosa** (b. Oct. 28, 1866, Villanueva de Arosa, Spain—d. Jan. 5, 1936, Santiago de Compostela) Spanish novelist, playwright, and poet. Early on he was influenced by the SYMBOLIST MOVEMENT, and his first four works, collectively called the *Sonatas* (1902–05), are evocatively written in a tone of refined and elegant decadence. Some later plays and novels take an intentionally absurdist and cruelly satiric tone to express what he saw as the Spanish deformation of European civilization; representative are the play *Bohemian Lights* (1921) and the novel *The Court of Miracles* (1927).

Vallee \'val-ē**, Rudy** *orig.* **Hubert Prior Vallée** (b. July 28, 1901, Island Pond, Vt., U.S.—d. July 3, 1986, North Hollywood, Calif.) U.S. singer and entertainer. He performed as a musician while at Yale University and in 1928 formed a dance band, the Yale Collegians (later the Connecticut Yankees). A singing bandleader, he used his trademark megaphone to amplify his suave, light-toned voice. He made his screen debut in *The Vagabond Lover* (1929) and evolved into a light comedian and character actor. On radio he hosted the first major network variety hour, *The Rudy Vallee Show* (1929–43), and discovered new talent such as Alice Faye and EDGAR BERGEN.

Vallejo \və-'lā-ō\ City (pop., 2000: 116,760), western California, U.S. It is located on San Pablo Bay, near OAKLAND. Settled in 1850, it served as the state capital for seven days in January 1852 and for a month in 1853. The Mare Island Naval Shipyard (established 1854; closed 1996) ensured the city's survival. It is now a commuter and transportation hub for the North Bay Area. It is home to the California Maritime Academy (founded 1929).

Valletta \və-'le-tə\ Seaport city (pop., 1999 est.: 7,100), capital of MALTA. It is located on a rocky promontory with harbours on either side. Built after the Great Siege of Malta (1565), which checked the advance of OTTOMAN power in southern Europe, it was named after Jean Parisot de la Valette, grand master of the KNIGHTS OF MALTA. It became the Maltese capital in 1570. After 1814 it was made the principal base of the British Mediterranean naval fleet and remained important through World War II, during which it suffered heavy damage from bombing raids. Several 16th-century buildings still exist. The city's economy relies mainly on trade and tourism.

valley Elongate depression of the Earth's surface. Valleys are commonly drained by rivers and may be in a relatively flat plain or between ranges of hills or mountains. Valleys formed by rivers and slope denudation are typically V-shaped; those formerly occupied by glaciers are characteristically U-shaped. Valley evolution is controlled mainly by climate and rock type. Very narrow, deep valleys cut in resistant rock and having steep, almost vertical sides are called canyons. Smaller valleys of similar appearance are called gorges.

Valley Forge National Historical Park Preserve, southeastern Pennsylvania, U.S. The 3,468-ac (1,404-ha) park commemorates the site where Gen. GEORGE WASHINGTON camped with his Continental Army in the winter of 1777–78 during the AMERICAN REVOLUTION. The park was established in 1976.

Valley of Ten Thousand Smokes See Valley of TEN THOUSAND SMOKES

Valley of the Kings See Valley of the KINGS

Valois \val-'wä\ Medieval county and duchy, northern France. It corresponds to the southeastern quarter of the modern *département* of Oise, with an adjacent portion of Aisne. It was under the Merovingian kings (c. 500–751) and their successors, the Carolingians, until it became a hereditary countship. In 1214 King PHILIP II AUGUSTUS annexed it to the royal domain. The duchy's last representative, Henry III, was succeeded in 1589 by the house of BOURBON. In 1790 it was abolished in the redivision of France into *départements*.

Valois, Ninette de See Ninette DE VALOIS

Valparaíso \ˌval-pə-'rī-zō\ City (pop., 2002 est.: 262,000) and port, central Chile. It was founded by the Spanish in 1536; few of its colonial

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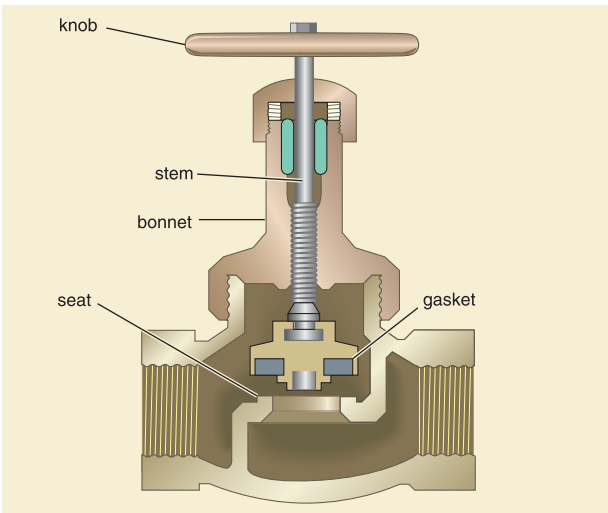
buildings have survived a succession of pirate raids, storms, fires, floods, and earthquakes. After Chilean independence in 1818, the city's port developed with the growth of the Chilean navy. In 1884 a treaty was signed there by which Bolivia ceded to Chile a coastal region containing principal nitrate deposits (see War of the Pacific). As Chile's principal seaport, it handles the bulk of the country's imports, and it is still a naval facility. It also produces chemicals and textiles. Chile's bicameral parliament, the National Congress, has been situated there since it was reestablished in 1990.

value-added tax (VAT) Government levy on the amount a firm adds to the price of a goods or services as value is added—that is, at each step of their production and distribution. In the most common method of calculation, the seller subtracts the sum of taxes paid on items being purchased from the sum of all taxes that have been collected on the items being sold; the net tax liability is the difference between the tax collected and the tax paid. The burden of the value-added tax, like that of other sales taxes, tends to be passed on to the consumer. To limit the VAT's regressiveness, most countries set lower rates for consumer necessities than for luxury items. In 1954 France became the first country to adopt the value-added tax on a large scale. Though complex to calculate, the tax served as an improvement on earlier systems by which a product was taxed repeatedly at every stage of production and distribution. It has since been adopted throughout much of Europe and in many countries in South America, Asia, and Africa. All European Union member countries have a VAT. See also regressive tax.

valve In mechanical engineering, a device for controlling the flow of fluids (liquids, gases, slurries) in a pipe or other enclosure. It exerts control by means of a movable element that opens, shuts, or partially blocks an opening in a passageway. Valves are of seven main types: globe, gate, needle, plug (cock), butterfly, poppet, and spool. Some valves operate automatically; check (or nonreturn) valves, for example, are self-acting valves that permit flow in only one direction. Safety valves open at a predetermined pressure; the movable element usually has a weighted lever or a spring strong enough to hold the valve closed until a particular pressure is reached.



A globe valve controls the flow of a fluid through a pipe, inlet, or outlet. To stop the flow completely, the threaded stem is turned to lower a sealing gasket onto the seat.
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vampire In popular legend, a bloodsucking creature that rises from its burial place at night, sometimes in the form of a bat, to drink the blood of humans. By daybreak it must return to its grave or to a coffin filled with its native earth. Tales of vampires are part of the world's folklore, most notably in Hungary and the Balkan Peninsula. The disinterment in Serbia in 1725 and 1732 of several fluid-filled corpses that villagers claimed were behind a plague of vampirism led to widespread interest and imaginative treatment of vampirism throughout western Europe. Vampires are supposedly dead humans (originally suicides, heretics, or criminals) who maintain a kind of life by biting the necks of living humans and sucking their blood; their victims also become vampires after death. These "undead" creatures cast no shadow and are not reflected in mirrors. They can be warded off by crucifixes or wreaths of garlic and can be killed by exposure to the sun or by an oak stake driven through the heart. The most famous vampire is Count Dracula from Bram Stoker's novel *Dracula* (1897).

Bela Lugosi with Frances Dade in *Dracula* (1931).
COURTESY OF UNIVERSAL PICTURES; PHOTOGRAPH, THE BETTMANN ARCHIVE

vampire bat Any of three species (family Desmodontidae) of tailless, brown, blood-eating bats native to the New World tropics. They grow to 2–3.5 in. (6–9 cm) long and weigh 0.5–2 oz (15–50 g). They run swiftly and leap with agility. They live in colonies in caves, hollow trees, and culverts, leaving after dark to forage low on the ground. They feed on quietly resting birds and mammals, including the occasional human, making a small cut with their sharp incisor teeth, often without disturbing the prey, and lapping the blood. The wounds are not serious but may transmit rabies or other diseases.

Van City (pop., 1997: 226,965), eastern Turkey, on the eastern shore of Lake Van. The ruins of stone buildings there date from the 8th century BC, when it was the chief centre of the kingdom of Urartu. After the fall of Nineveh (612 BC), it was occupied in succession by the Medes, the kings of Pontus, Arabs (7th century AD), and Armenians (8th century AD). It fell to the Seljūq dynasty after 1071 AD and to the Ottoman Empire in 1543. Russian forces held it (1915–17) during World War I. It has a large Kurdish population. It once had a large Armenian population that was brutally expelled following the war (see Armenian massacres). Van is a shipping point for hides, grains, fruits, and vegetables.

Van, Lake Salt lake, eastern Anatolia. The largest lake in Turkey, it covers an area of 1,434 sq mi (3,713 sq km) and is more than 74 mi (119 km) across at its widest point. Its greatest depth exceeds 330 ft (100 m). It is fed by precipitation and meltwater as well as by several small tributaries. It has no apparent outlet, and its brackish waters are unsuitable for either drinking or irrigation.

Van Allen radiation belts Two doughnut-shaped zones of highly energetic charged particles (see electric charge) trapped at high altitudes in Earth's magnetic field. Named for James A. Van Allen (b. 1914), who discovered them in 1958, they are most intense over the Equator and effectively absent above the poles. The two zones merge gradually, with the flux of charged particles showing two regions of maximum density. The inner one, mostly protons thought to be produced by primary cosmic rays striking the atmosphere, is centred about 3,700 mi (6,000 km) above Earth's surface. The outer region includes some helium ions from the solar wind and is centred about 12,500 mi (20,000 km) above Earth's surface. Intense solar activity (see solar cycle) causes disruptions of the belts, linked in turn with such phenomena as auroras and magnetic storms.

Van Buren, Martin (b. Dec. 5, 1782, Kinderhook, N.Y., U.S.—d. July 24, 1862, Kinderhook) Eighth president of the U.S. (1837–41). He served in the New York Senate (1812–20) and as state attorney general (1816–19). An informal group of his political supporters came to be known as the Albany Regency because they dominated state politics even while Van Buren was in Washington. He was elected to the U.S. Senate (1821–28), where he supported states' rights and opposed a strong central government. After John Quincy Adams became president, he joined with Andrew Jackson and others to form a group that later became the Democratic Party. He was elected governor of New York (1828) but resigned to become U.S. secretary of state (1829–31). He was nominated for vice president at the first Democratic Party convention (1832) and served under Jackson (1833–37). As Jackson's chosen successor, he defeated William H. Harrison to win the 1836 election. His presidency was marked by an economic depression, the Maine-Canada border dispute (see Aroostook War), the Seminole Wars in Florida, and debate over the annexation of Texas. He was defeated in his bid for reelection and failed to win the Democratic nomination in 1844 because of his antislavery views. In 1848 he was nominated for president by the Free Soil Party but failed to win the election and retired.

Van Cortlandt, Stephanus (b. May 7, 1643, New Amsterdam—d. Nov. 25, 1700, New York City) American colonial official. He was a

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wealthy merchant in New Amsterdam. After the colony came under British rule (1664), he was appointed to the governor's council (1674). He became the first native-born mayor of New York City (1677, 1686–87) and later served as associate justice and chief justice of the New York supreme court (1691–1700).

Van de Graaff, Robert J(emison) (b. Dec. 20, 1901, Tuscaloosa, Ala., U.S.—d. Jan. 16, 1967, Boston, Mass.) U.S. physicist. He worked as an engineer, then as a physics researcher at the University of Oxford (1925–29). From 1931 he continued his research at MIT, as a professor (1934–60). He developed a high-voltage electrostatic generator (later called the Van de Graaff generator) that served as a type of PARTICLE ACCELERATOR. In 1946 he cofounded the High Voltage Engineering Corp. to manufacture his accelerator. Widely used in atomic research, the device was also adapted to produce high-energy X rays for medical and industrial uses.

van de Velde, Henri See Henri van de VELDE

van de Velde, Willem, the Elder See Willem van de VELDE THE ELDER

van der Goes, Hugo See Hugo van der GOES

van der Rohe, Ludwig Mies See Ludwig MIES VAN DER ROHE

van der Waals \'van-dər-ˌwȯlz**, Johannes Diederik** (b. Nov. 23, 1837, Leiden, Neth.—d. March 9, 1923, Amsterdam) Dutch physicist. As professor at the University of Amsterdam (1877–1907), he extended the classical ideal-gas law (see GAS LAWS) to describe the behaviour of real gases, deriving the van der Waals EQUATION OF STATE in 1881. His work led to the liquefying of several common gases and made possible the study of temperatures near absolute zero. The VAN DER WAALS FORCES were named in his honour. He received a 1910 Nobel Prize.

van der Waals forces Relatively weak electrical forces that attract neutral (uncharged) MOLECULES to each other in GASES, liquefied and solidified gases, and almost all organic LIQUIDS and SOLIDS. Solids held together by van der Waals forces typically have lower MELTING POINTS and are softer than those held together by IONIC, COVALENT, or metallic bonds (see BONDING). The forces arise because neutral molecules, though uncharged, are usually ELECTRIC DIPOLES, which have a tendency to align with each other and to induce further polarization in neighbouring molecules, resulting in a net attractive force. They are somewhat weaker than the forces involved in HYDROGEN BONDING. See also JOHANNES D. VAN DER WAALS.

van der Weyden, Rogier See Rogier van der WEYDEN

Van Der Zee, James (Augustus Joseph) (b. June 29, 1886, Lenox, Mass., U.S.—d. May 15, 1983, Washington, D.C.) U.S. photographer. In 1906 he moved with his family to Harlem in New York City. After a brief stint at a portrait studio in Newark, N.J., he returned to Harlem to set up his own studio. The portraits he took from 1918 to 1945 chronicled the HARLEM RENAISSANCE; among his many renowned subjects were COUNTEE CULLEN, BILL ROBINSON, and MARCUS GARVEY. After World War II his fortunes declined until the Metropolitan Museum of Art exhibited his photographs in 1969.

van Doesburg, Theo See Theo van DOESBURG

Van Doren, Carl (Clinton) and Mark (respectively b. Sept. 10, 1885, Hope, Ill., U.S.—d. July 18, 1950, Torrington, Conn.; b. June 13, 1894, Hope, Ill.—d. Dec. 10, 1972, Torrington, Conn.) U.S. writers and teachers. Carl, who taught at Columbia University from 1911 to 1930, edited the *Cambridge History of American Literature* (1917–21) and journals. His critical works include the biography *Benjamin Franklin* (1938, Pulitzer Prize). Mark taught at Columbia from 1920 to 1959. He published more than 20 volumes of verse, including *Spring Thunder* (1924) and *Collected Poems (1922–38)* (1939, Pulitzer Prize). He wrote three novels and several volumes of short stories and edited anthologies. His literary criticism includes works on JOHN DRYDEN, WILLIAM SHAKESPEARE, and NATHANIEL HAWTHORNE as well as *Introduction to Poetry* (1951), which examines shorter classic poems of English and American literature.

Van Dyck \van-'dīk**, Sir Anthony** (b. March 22, 1599, Antwerp, Belg.—d. Dec. 9, 1641, London, Eng.) Flemish painter. Son of a well-to-do silk merchant, he was apprenticed to an Antwerp painter at 10. He soon came under the influence of PETER PAUL RUBENS, for his early works are painted in Rubens's Baroque style, though with darker and warmer colour, more abrupt chiaroscuro, and more angular figures. He was a master in the Antwerp artists' guild by 19, at which time he was also working with Rubens. He spent over five years in Italy (1621–27); on his return, he received many commissions for altarpieces and portraits. He also executed works on mythological subjects and was a fine draftsman and etcher, but he is chiefly known for his portraits, in which he idealized his models without sacrificing their individuality. In Britain in 1632, he was appointed court painter by CHARLES I. He gained a comfortable income from the many portraits he painted in Britain, and his life matched his clients' in luxury. His influence was pervasive and lasting; Flemish, Dutch, and German portraitists imitated his style and technique, and the 18th-century English portraitists, especially THOMAS GAINSBOROUGH and JOSHUA REYNOLDS, were deeply indebted to him.

Van Dyke, Dick *orig.* **Richard Wayne Van Dyke** (b. Dec. 13, 1925, West Plains, Mo., U.S.) U.S. actor and comedian. In 1947–53 he played in nightclubs with his pantomime act, "The Merry Mutes," before making his Broadway debut in 1959. He starred in the musical *Bye Bye Birdie* (1960–61, Tony Award; film, 1963), and then in the successful television comedy series *The Dick Van Dyke Show* (1961–66)—winning several Emmy Awards—*The New Dick Van Dyke Show* (1971–74), and the drama series *Diagnosis Murder* (1993–2001). He has starred in such movies as *Mary Poppins* (1964) and *Chitty, Chitty, Bang, Bang* (1968).

van Eyck, Jan See Jan van EYCK

van Gogh, Vincent See Vincent van GOGH

Van Heusen \van-'hyü-zən**, Jimmy** *orig.* **Edward Chester Babcock** (b. Jan. 26, 1913, Syracuse, N.Y., U.S.—d. Feb. 7, 1990, Rancho Mirage, Calif.) U.S. songwriter. He began working in radio in his teens. In the early 1930s he worked in TIN PAN ALLEY and later collaborated on songs such as "Darn That Dream" and "Polka Dots and Moonbeams." With Johnny Burke he wrote the songs for 23 BING CROSBY films. In 1954 he began collaborating with SAMMY CAHN. He composed 76 songs for his friend FRANK SINATRA, including "The Tender Trap" and "Come Fly with Me," and won Academy Awards for "Swinging on a Star," "All the Way," "High Hopes," and "Call Me Irresponsible."

van Ostade, Adriaen See Adriaen van OSTADE

vanadium \və-'nā-dē-əm\ Metallic chemical ELEMENT, one of the TRANSITION ELEMENTS, chemical symbol V, atomic number 23. A silvery white, soft METAL found (always combined) in various minerals, coal, and petroleum, it is used in alloys with steel and iron for high-speed tool steel, high-strength low-alloy steel, and wear-resistant CAST IRON. Unalloyed, it is used in high-temperature applications, as a target in X-ray applications, and as a catalyst. Its compounds, in which it has various VALENCES, have many beautiful colours in solution and are used as catalysts and mordants (see DYE).

Vanbrugh \'van-ˌbrük, van-'brü**, Sir John** (baptized Jan. 24, 1664, London, Eng.—d. March 26, 1726, London) English dramatist and architect. He began writing while serving as a soldier. He specialized in the COMEDY OF MANNERS; his successful plays include *The Relapse* (1696) and *The Provok'd Wife* (1697). He also wrote lively adaptations from the French, more farce than comedy, including *The Country House* (performed 1703) and *The Confederacy* (1705). In 1702 he designed Castle Howard, Yorkshire, with Nicholas Hawksmoor (1661–1736). His masterpiece, again with Hawksmoor, was Blenheim Palace (1705–16), Oxfordshire, which brought the English baroque style to its culmination.

Vance, Cyrus (Roberts) (b. March 27, 1917, Clarksburg, W.Va., U.S.—d. Jan. 12, 2002, New York, N.Y.) U.S. public official. After receiving his law degree from Yale University in 1942, he enlisted in the navy and served until 1946, when he joined a law firm in New York City. He was appointed general counsel for the U.S. Department of Defense in 1960. In 1962 he became secretary of the army, and in 1963 Pres. LYNDON B. JOHNSON named him deputy secretary of defense. Initially a vigorous supporter of U.S. involvement in the VIETNAM WAR, his viewed changed after his resignation in 1967, and by 1968 he was urging Johnson to stop the bombing of North Vietnam. In that year he was sent to Paris with W. AVERELL HARRIMAN to negotiate peace with the North Vietnamese. As secretary of state (1977–80) under Pres. JIMMY CARTER, he worked to obtain the STRATEGIC ARMS LIMITATION TALKS II (SALT II) arms-control treaty and was instrumental in the CAMP DAVID ACCORDS. He resigned in 1980 in protest of Carter's plan to send a secret military mission to rescue American hostages held in Tehrān, Iran (see IRAN HOSTAGE CRISIS).

Vancouver City (pop., 2001: metro. area, 1,986,965), southwestern British Columbia, Canada. Located on a fine natural harbour, it originated as a lumber-processing settlement in the 1870s. It recovered from a disas-

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trous fire (1886) to become Canada's principal seaport. Its development was aided by completion of the transcontinental railroad in 1887 and the opening of the Panama Canal in 1914, which made it economically feasible to export grain and lumber from Vancouver to the North American east coast and Europe. Economic activities include producing lumber and plywood, oil refining, fishing, and shipbuilding.

Vancouver, George (b. June 22, 1757, King's Lynn, Norfolk, Eng.—d. May 10, 1798, Richmond, Surrey) English navigator. He entered the Royal Navy at age 13 and sailed with James Cook on his second and third voyages (1772–75, 1776–79) to the Pacific. In 1791 he commanded an expedition that explored the coasts of Australia, New Zealand, Tahiti, and Hawaii before reaching the Pacific coast of North America in 1792; over the next two years he meticulously mapped a major portion of the coast. His maps and a lengthy account of his voyages were published in 1798.

Vancouver \'van-'kü-vər\ **Island** Island (pop., 2001: 705,000) off southwestern British Columbia, Canada. It is the largest island (12,079 sq mi [31,285 sq km]) on the Pacific coast of North America. It has several peaks of more than 7,000 ft (2,100 m), as well as several fine harbours. The chief city is Victoria. It was inhabited by coastal Indians for several millennia before it was visited by early Spanish and English explorers, including Capt. James Cook in 1778. It was surveyed in 1792 by George Vancouver and was held by the Hudson's Bay Co. until it was made a British crown colony in 1849. It united with British Columbia in 1866. The island's main industries include lumbering, fishing, agriculture, and tourism.

Vandal Any member of a Germanic people who ruled a kingdom in North Africa from 429 to 534 and who sacked Rome in 455. Fleeing westward from the Huns, they invaded Gaul before settling in Spain (409). Under King Gaiseric (r. 428–477) they migrated to North Africa and became federates of Rome (435). Four years later Gaiseric threw off Roman overlordship and captured Carthage. The Vandals later annexed Sardinia, Corsica, and Sicily, and their pirate fleets controlled much of the western Mediterranean. When they invaded Italy and captured Rome (455), they plundered the city and its artworks, and their name has remained a synonym for willful desecration and destruction. The Vandals were Arian Christians (see Arianism) who persecuted Roman Catholics in Africa. They were conquered when the Byzantines invaded North Africa (533–534).

Vandenberg, Arthur H(endrick) (b. March 22, 1884, Grand Rapids, Mich., U.S.—d. April 18, 1951, Grand Rapids) U.S. politician. Editor of the *Grand Rapids Herald* (1906–28), he was elected as a Republican to the U.S. Senate (1928–51). He was a critic of Pres. Franklin D. Roosevelt's foreign policy but revised his isolationist position after the attack on Pearl Harbor. In a 1945 Senate speech he advocated U.S. participation in international alliances, and he was a delegate to the UN organizing conference. He led Republican congressional support for legislative measures introduced by Pres. Harry Truman, including the Marshall Plan, the Truman Doctrine, and NATO.

Vanderbilt, Cornelius (b. May 27, 1794, Port Richmond, Staten Island, N.Y., U.S.—d. Jan. 4, 1877, New York, N.Y.) U.S. shipping and railroad magnate. He began a passenger ferry business in New York harbour in 1810 with one boat; he added several others during the War of 1812 in order to supply government outposts. He sold his boats to work as a steamship captain (1818–29), then started his own steamship company on the Hudson River. By cutting fares and offering luxurious accommodations, he soon controlled the river traffic. He then provided transportation along the eastern seacoast. By 1846 he was a millionaire. He formed the Accessory Transit Co. to transport passengers and freight from New York to the California gold fields via Nicaragua. He again undercut his competitors, and they bought him out at a high price (1858). Turning to railroads, he acquired controlling stock in the New York and Harlem Railroad. After losing a battle for control of the Erie Railroad (1868), he bought and consolidated the Hudson River and the New York Central railroads (1869). After buying the Lake Shore and Michigan Southern Railroad (1873), he provided the first rail service between New York and Chicago. At his death, he had a fortune of more than $100 million, the largest sum accumulated in the U.S. to that date. He gave $1 million to Central University (later Vanderbilt University). He left almost all the rest to his son William H. Vanderbilt (1821–85), who greatly expanded the New York Central network, acquired other railroads, and doubled the family fortune.

Vanderbilt University Private university in Nashville, Tennessee, U.S. It was founded in 1873 and named for benefactor Cornelius Vanderbilt. Baccalaureate degrees are awarded through its college of arts and sciences, school of engineering, and school of music. Master's, doctoral, and professional degree programs are offered through these and other schools, such as Vanderbilt's graduate school, divinity school, and schools of law, management, medicine, and nursing. Research institutes include centres for the study of education and human development, public policy, and the humanities.

Vanderlyn, John (b. Oct. 15, 1776, Kingston, N.Y., U.S.—d. Sept. 23, 1852, Kingston) U.S. painter. He studied with Gilbert Stuart and later at the École des Beaux-Arts. He remained in Paris, where he enjoyed great popularity for his paintings in the Neoclassical style (including *Ariadne Asleep on Naxos*, 1812). At age 40 he returned to the U.S., but failing to receive the federal commissions he had anticipated, he retired embittered to Kingston. In 1832 he finally received a government commission for a full-length portrait of George Washington and in 1839 another for *The Landing of Columbus* in the U.S. Capitol Rotunda.

Vane, Sir Henry *known as* **Sir Henry Vane the Younger** (b. 1613—d. June 14, 1662, London, Eng.) English politician. Son of the royal adviser Henry Vane the Elder (1589–1655), he was converted to Puritanism and in 1635 sailed to New England, where he served as governor of Massachusetts (1636–37). After returning to England, he became treasurer of the navy (1639), then served with his father in the Long Parliament, where they helped secure the impeachment of Thomas Wentworth, 1st earl of Strafford. The chief English negotiator of the Solemn League and Covenant, Vane became leader of the House of Commons (from 1643) and a member of the Commonwealth's Council of State (1649–53). After the Restoration, he was arrested, imprisoned (1660–62), and executed for treason.

Vänern \'va-nərn\ Lake, southwestern Sweden. The largest lake in Sweden and the third largest in Europe, it is about 90 mi (145 km) long, as much as 322 ft (98 m) deep, and covers an area of 2,156 sq mi (5,585 sq km). Fed by numerous rivers, it drains into the Kattegat strait via the Göta River.

Vanguard Any of three unmanned U.S. experimental satellites. Vanguard I (1958), the second U.S. satellite placed in orbit around Earth (after Explorer 1), was a tiny 3.25-lb (1.47-kg) sphere with two radio transmitters. Its flight path revealed that Earth is almost imperceptibly pear-shaped, confirming earlier theories. Vanguard II (1959) carried light-sensitive photocells to provide information about Earth's cloud cover, but its tumbling motion rendered the data unreadable. Vanguard III (1959) was used to map Earth's magnetic field.

vanilla Any member of a group of tropical climbing orchids that make up the genus *Vanilla*, and the flavouring agent extracted from its seedpods. The plant has a long, fleshy climbing stem that attaches itself by aerial rootlets to trees; roots also penetrate the soil. Numerous flowers open a few at a time and last only a day. The fruit, a bean pod about 8 in. (20 cm) long at maturity, is harvested as soon as it turns golden green at the base. Curing and processing turn the pods a deep chocolate brown. Vanilla is used in a variety of sweet foods and beverages as well as in perfumery.

Vanir \'vä-ˌnir\ In Germanic religion, the group of gods responsible for wealth, fertility, and commerce. They included Njörd and his children, Freyr and Freyja, among others. They were originally subordinate to the warlike Aesir, but, after defeating the Aesir in battle, they were granted equal status. The Vanir sent Njörd and Freyr to live with the Aesir and received Hoenir and Mimir in exchange. The birth of Kvasir resulted from the peace ritual between the two groups.

Vanua Levu \ˌvän-ˌwä-'lā-vü\ Island (pop., including adjacent islands, 1996: 139,526), Fiji. Fiji's second largest island, it is 2,137 sq mi (5,535 sq km) in area. Sighted by the Dutch navigator Abel Janszoon Tasman in 1643, the volcanic Vanua Levu (meaning "Great Land") has a central mountain range, culminating at Mount Nasorolevu (3,386 ft [1,032 m]), which divides the island into wet and dry sections. The chief river is the Ndreketi.

Vanuatu \ˌvan-wä-'tü\ *officially* **Republic of Vanuatu** Island country, South Pacific Ocean. It consists of a chain of 13 principal and many smaller islands. Area: 4,707 sq mi (12,190 sq km). Population (2005 est.): 211,000. Capital: Vila. The population is nearly all indigenous Melane-

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sian. Languages: Bislama, English, French (all official); Melanesian languages and dialects. Religions: Christianity (mostly Protestant; also Roman Catholic); also traditional beliefs. Currency: vatu. Extending north-south some 400 mi (650 km), Vanuatu includes the islands of Espíritu Santo, Pentecost (Pentecôte), Malakula, Éfaté, Ambrym, Erromango, Tanna, Aoba, Épi, and Maéwo. The larger islands are volcanic in origin and mountainous; there are several active volcanoes. Some of them, especially Éfaté and Malakula, have good harbours. The highest point is Mount Tabwémasana (6,165 ft [1,879 m]) on Espíritu Santo. The developing free-market economy is based mainly on agriculture, cattle raising, and fishing. Tourism is increasingly important. Vanuatu is a republic with a single legislative house; its chief of state is the president, and the head of government is the prime minister. The islands were inhabited for at least 3,000 years by Melanesian peoples before being discovered in 1606 by the Portuguese. They were rediscovered by French navigator Louis-Antoine de Bougainville in 1768, then explored by English mariner Capt. James Cook in 1774 and named New Hebrides. Sandalwood merchants and European missionaries arrived in the mid-19th century; they were followed by British and French cotton planters. Control of the islands was sought by both the French and British, who agreed in 1906 to form a condominium government. During World War II a major Allied naval base was on Espíritu Santo; Vanuatu escaped Japanese invasion. New Hebrides became the independent Republic of Vanuatu in 1980. Much of its history since then has been marked by political instability.

vapor lamp See electric discharge lamp

vaporization Conversion of a substance from the liquid or solid phase into the gaseous (see gas), or vapour, phase. It includes boiling, in which vapour bubbles form in a liquid, and sublimation, in which a solid is converted directly to vapour. Vaporization requires that heat (the substance's latent heat of vaporization) be supplied to the liquid or solid; the same amount of heat is released by the substance in condensation, the reverse of vaporization. If the surroundings do not supply enough heat, the temperature of the remaining substance undergoing vaporization drops. See also evaporation.

Varanasi \vä-'rä-nə-sē\ *or* **Benares** \'bə-'när-əs\ City (pop., 2001 prelim.: 1,100,748), Uttar Pradesh, India. Located on the Ganges River in southeastern Uttar Pradesh, it is one of the oldest continuously inhabited cities in the world and was the site of an Aryan settlement before the 2nd millennium BC. It is one of the seven sacred cities of Hinduism and has numerous shrines, temples, and palaces and miles of steps for ritual bathing. More than a million Hindus visit the city each year. Just north of Varanasi is Sarnath, where the Buddha delivered his first sermon.

Vardan Mamikonian \'vär-dən-ˌma-mi-'kō-nē-ən**, Saint** (died 451) Armenian military commander. The Persian attempt to impose Zoroastrianism on the Armenians provoked a rebellion, which ended when Vardan and his companions were slain at the Battle of Avarayr. Despite their victory the Persians renounced their plans to convert Armenia by force, and they deposed the traitorous Armenian governor.

Vardon, Harry (b. May 9, 1870, Grouville, Jersey, Channel Islands—d. March 20, 1937, Totteridge, Hertfordshire, Eng.) British golfer. While working as a manservant for an affluent amateur golfer on the island of Jersey, Vardon learned golf, and he turned professional at age 20. A technical innovator, he won the British Open six times (1896, 1898, 1899, 1903, 1911, and 1914) and the U.S. Open once (1900). The Vardon Trophy is awarded annually by the Professional Golfers' Association of America to the professional with the best scoring average.

Edgard Varèse.
THE BETTMANN ARCHIVE

Varèse \vä-'rez**, Edgard (-Victor-Achille-Charles)** (b. Dec. 22, 1883, Paris, France—d. Nov. 8, 1965, New York, N.Y., U.S.) French-born U.S. composer. Forbidden to study music by his father, he secretly continued his studies and entered the Schola Cantorum with the help of his cousin, the pianist Alfred Cortot (1877–1962). He soon moved to Berlin, where he met Ferruccio Busoni and Richard Strauss, musicians in tune with his forward-looking ideas. His *Bourgogne* (1907) caused a scandal because of its dissonance. His budding conducting career was interrupted by World War I, and he moved to the U.S. In 1921 he cofounded the International Composers Guild. His output was small, but every piece became a classic, including *Offrandes*, *Amériques* (both 1921), *Hyperprism*, *Octandre* (both 1923), *Arcana* (1927), and *Ionisation* (1931), works remarkable for the way they used instruments, especially percussion, to create blocks of sound. After the early 1950s, when he finally gained access to the electronic sound equipment he desired, he concentrated on electronic music.

Vargas \'vär-gəs**, Getúlio (Dorneles)** (b. April 19, 1883, São Borja, Braz.—d. Aug. 24, 1954, Rio de Janeiro) President of Brazil (1930–45, 1951–54). He was elected governor of Rio Grande do Sul in 1928 and ran unsuccessfully for president in 1930, but later that year he overthrew the government to become head of state. In 1937 he abolished the constitutional government and set up the totalitarian New State, under which the previously autonomous states became dependent on central authority. He enacted labour reforms and social-security laws, introduced extensive educational reforms, enfranchised women, and granted the secret ballot. Deposed by a coup in 1945, he was elected president again in 1951; restrained by a congress and public opinion, he was unable to hold support and, faced with forced retirement, took his own life.

Vargas Llosa \'bär-gäs-'yō-sä**, (Jorge) Mario (Pedro)** (b. March 28, 1936, Arequipa, Peru) Peruvian writer. Vargas Llosa worked as a journalist and broadcaster before publishing *The Time of the Hero* (1963), his widely acclaimed first novel. It describes adolescents striving for survival in the hostile environment of a military school, the corruption of which reflects the larger malaise afflicting Peru. His commitment to social change is evident in his early novels, essays, and plays. He turned increasingly conservative, especially in the face of the Maoist Shining Path insurgency, and in 1990 he ran for president of Peru. His best-known works include *The Green House* (1965), *Aunt Julia and the Scriptwriter* (1977), and *The War of the End of the World* (1981), an account of a 19th-century Brazilian religious movement. In 1994 he won the Cervantes Prize (a prestigious literary award given for Spanish-language literature).

variable In algebra, a symbol (usually a letter) standing in for an unknown numerical value in an equation. Commonly used variables include x and y (real-number unknowns), z (complex-number unknowns), t (time), r (radius), and s (arc length). Variables should be distinguished from coefficients, fixed values that multiply powers of variables in polynomials and algebraic equations. In the quadratic equation $ax^2 + bx + c = 0$, x is the variable, and a, b, and c are coefficients whose values must be specified to solve the equation. In translating word problems into algebraic equations, quantities to be determined can be represented by variables.

variable, complex See complex variable

variable, random See random variable

variable star Star whose observed brightness varies noticeably in intensity. Pulsating variables expand and contract in cycles, pulsating rhythmically in brightness and size. Explosive variables include novas and supernovas, which brighten rapidly due to sudden outbursts of radiant energy; the increased brightness lasts a short time, followed by relatively slow dimming. Eclipsing variable stars are variable only because light from one star is blocked by another in Earth's direction. Hundreds of thousands of variable stars are known. See also binary star; Cepheid variable; flare star; pulsar; T Tauri star.

variation In biology, any difference between cells, individual organisms, or groups of organisms within a species caused either by genetic differences (variation in genotype) or by the effect of environmental factors on the expression of genetic potentials (variation in phenotype). Variation may be shown in physical appearance, metabolism, fertility, mode of reproduction, behaviour, learning and mental ability, and other obvious or measurable characters. Genotypic variations are caused by differences in number or structure of chromosomes or by differences in the genes carried by the chromosomes. Eye colour, body form, and disease resistance are genotypic variations. Phenotypic variations may result from factors such as climate, food supply, and actions of other organisms. Phenotypic variations also include stages in an organism's life cycle and seasonal variations in an individual. Because they do not involve hereditary alteration and in general are not transmitted to future generations, phenotypic variations are not important in evolution. See also polymorphism.

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variation In music, basic technique consisting of changing the music melodically, harmonically, or contrapuntally. The simplest variation type is the variation set, in which two or more sections are based on the same musical material, which is treated with different variational techniques in each section. The practice, originally involving use of a repeated bass line (basso ostinato, or ground bass), began in early 16th-century dance music in Italy and Spain. Ground-bass forms include the chaconne and passacaglia, both of which usually employ a brief bass line repeated many times. In the 17th century, organ and harpsichord variations became a standard form in Germany. Keyboard variations in the 19th century often employed popular tunes or opera melodies; variation form was also commonly used in symphonies, quartets, and sonatas. It declined in importance after the classical era but has never ceased to be employed by composers. The music of certain non-Western cultures also uses variational techniques. The art music of southern India is built on the concept of a string of pieces, each a variation on a given "theme." A somewhat different concept of multilevel variation is found in the GAMELAN (orchestra) music of Indonesia. The variations are not consecutive but are simultaneous, a technique called heterophony.

varicella See CHICKEN POX

varicose \'var-ə-ˌkōs\ **vein** *or* **varix** Twisted VEIN distended with blood. Varix also covers ARTERIES and lymphatic vessels (see LYMPHATIC SYSTEM). Varicose veins occur mostly in the legs, when malfunctioning valves let blood pool in veins near the skin. Causes include hereditary valve and vein wall weakness and internal or external pressure on veins. Varices are common in pregnancy, suggesting that hormone abnormalities play a role. Symptoms include a heavy feeling, with leg cramps and swelling after standing a long time. Complications include skin ULCERS and THROMBOSIS. Treatment involves strong support hose, injection therapy, or surgery. Varices in the ESOPHAGUS, which often occur in liver disease, can ulcerate and bleed. See also HEMORRHOID.

variety theatre See MUSIC HALL AND VARIETY THEATRE

variola See SMALLPOX

Varmus, Harold (Elliot) (b. Dec. 18, 1939, Oceanside, N.Y., U.S.) U.S. virologist. He joined the faculty of UC–San Francisco in 1970. With J. MICHAEL BISHOP, he discovered that, under certain circumstances, normal genes in healthy body cells can cause cancer. These oncogenes ordinarily control cell division and growth, but viruses or carcinogens can activate them. Their research superseded a theory that cancer is caused by viral genes, distinct from a cell's normal genetic material, that lie dormant until activated by carcinogens. For their work, the two shared a 1989 Nobel Prize. Varmus later served as director of the National Institutes of Health (1993–99) and became president of Memorial Sloan-Kettering Cancer Center.

Varna Seaport city (pop., 2001: 314,539), Bulgaria, on the Black Sea coast. Founded as Odessus by Milesian Greeks in the 6th century BC, it later was Thracian, Macedonian, and Roman. In AD 681 it became part of the first Bulgarian empire (c. 679–1018) and was named Varna. It came under OTTOMAN domination in 1391. In 1444 it was the scene of a battle between Turkish and Hungarian armies in which Władysław III, king of Poland and Hungary, was killed. Varna was ceded to Bulgaria by the 1878 Treaty of Berlin (see Congress of BERLIN). It is an important administrative, economic, cultural, and resort centre. Shipbuilding and manufacturing are important industries.

varna \'vər-nə\ Any of the four traditional social classes of Hindu India. One of the hymns of the RIGVEDA declares that the BRAHMAN, the KSHATRIYA, the VAISHYA, and the SHUDRA issued forth at creation from the mouth, arms, thighs, and feet of PRAJAPATI. Traditional lawmakers specified a set of obligations, observed mainly in theory only, to each varna: the Brahman, to study and advise; the Kshatriya, to protect; the Vaishya, to cultivate; and the Shudra, to serve. An unofficial fifth class, the *pancama*, was created to include certain UNTOUCHABLES and tribal groups falling outside this system. The relationship of the CASTE system to the class system is complex; individual castes, of which there are dozens, have sought to raise their social rank by identifying with a particular varna, demanding the associated privileges of rank and honour.

Varna, Battle of (November 10, 1444) Turkish victory over the Hungarians that marked the end of the European effort to protect Constantinople. The Hungarians under JANOS HUNYADI broke a truce and marched to Varna (in present-day Bulgaria), where they fought the Turks under Sultan Murad II and were defeated; the Hungarian king Ulászló I (also ruler of Poland) was killed in the battle. The victory enabled the Ottoman Empire to gain control of the Greek Peloponnese, conquer Constantinople (1453), and reabsorb Serbia (by 1459).

Varro \'var-ō**, Marcus Terentius** (b. 116, probably Reate [Italy]—d. 27 BC) Roman scholar and satirist. Varro was active in public life, rising to the office of praetor. He sided with POMPEY THE GREAT but later reconciled with Julius CAESAR. A prolific writer, he sought in his writings to inculcate moral virtues and to link Rome's future with its glorious past. He is best known for his *Saturae Menippeae* ("Menippean Satires"), medleys in mixed prose and verse that mock the absurdities of modern times. He wrote some 75 works in more than 600 books on a wide range of subjects—jurisprudence, astronomy, geography, education, and literary history—as well as in a variety of genres—satires, poems, orations, and letters.

Varus \'var-əs**, Publius Quintilius** (d. AD 9) Roman general. He was born a patrician; his father was one of the murderers of Julius CAESAR. Varus crushed the rebellion in Judaea (4 BC) and reestablished Roman control. Assigned to the frontiers east of the Rhine, he tried to assert Roman jurisdiction, but he was overwhelmed by a German attack in the TEUTOBURG FOREST and lost three legions. Disgraced, he killed himself by falling on his sword. His defeat led to the loss of all Roman possessions east of the Rhine.

varved deposit \'värvd\ Any form of repetitive sedimentary rock stratification that was deposited within a year. This annual deposit usually consists of paired contrasting layers (varves) of alternately finer (darker) and coarser (lighter) silt or clay, reflecting seasonal variations in SEDIMENTATION (winter and summer) within the year. Varved deposits are most commonly found in glacial lakes, but they can also be found in nonglacial lakes and marine settings.

varying hare See SNOWSHOE HARE

Vasa dynasty Swedish (and Polish) royal dynasty. Its founder was Gustav Eriksson Vasa, regent of Sweden (1521) and king (1523) as GUSTAV I VASA. His descendants reigned in Sweden until 1818, the last being CHARLES XIII. A grandson of Gustav became king of Poland (1587–1632) as SIGISMUND III VASA, also ruling Sweden in the years 1592–99. He was succeeded as king of Poland by his sons, Wladyslaw IV Vasa (r. 1632–48) and John II Casimir Vasa (r.1648–68), after which the dynasty ended in Poland.

Vasarely \ˌva-zə-'re-lē**, Victor** *orig.* **Viktor Vásárhelyi** (b. April 9, 1908, Pécs, Hung.—d. March 15, 1997, Paris, France) Hungarian French painter. Trained in Budapest in the BAUHAUS tradition, he moved to Paris in 1930 and supported himself as a commercial artist. In the 1930s he was influenced by CONSTRUCTIVISM, but by the 1940s he was painting animated surfaces of geometric forms and interacting colours. His style reached maturity in the mid 1950s and 1960s, with the use of more vibrant colours to increase the sense of movement through optical illusion, as in *Sirius II* (1954), and he became one of the leading figures of the OP ART movement.

Vasari \vä-'zä-rē**, Giorgio** (b. July 30, 1511, Arezzo—d. June 27, 1574, Florence) Italian painter, architect, and writer. Though he was a prolific painter in the MANNERIST style, he is more highly regarded as an architect (he designed the Uffizi Palace, now the UFFIZI GALLERY), but even his architecture is overshadowed by his writings. His *Lives of the Most Eminent Architects, Painters, and Sculptors* (1550) offers biographies of early to late RENAISSANCE artists. His style is eminently readable and his material is well researched, though when facts were scarce he did not hesitate to fill in the gaps. In his view, GIOTTO had revived the art of true representation after its decline in the early Middle Ages, and succeeding artists had brought that art progressively closer to the perfection achieved by MICHELANGELO. The work's second edition (1568) has proved an invaluable resource for art historians.

Vasari, self-portrait, oil painting; in the Uffizi, Florence
SCALA/ART RESOURCE, NEW YORK

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Vasconcelos \ˌbäs-kōn-ˈsā-lōs**, José** (b. Feb. 28, 1882, Oaxaca, Mex.—d. June 30, 1959, Mexico City) Mexican educator, politician, essayist, and philosopher. He campaigned for the revolutionary candidates Francisco Madero and Pancho Villa. As minister of education (1920–24) he initiated major reforms in Mexico's school system, especially expansion of the rural school program. He ran unsuccessfully for president in 1929. Vasconcelos's political activism forced him into exile several times. He regarded the indigenous Indian culture as transcending Western culture. His autobiography (5 vol., 1935–59), abridged as *A Mexican Ulysses* (1962), is one of the finest sociocultural studies of 20th-century Mexico.

vascular plant *or* **tracheophyte** \ˈtrā-kē-ə-ˌfīt\ Any plant that has a specialized conducting system consisting mostly of phloem (food-conducting tissue) and xylem (water-conducting tissue), collectively called vascular tissue. Ferns, gymnosperms, and flowering plants are all vascular plants. In contrast to the nonvascular bryophytes, the more conspicuous generation among vascular plants is the sporophyte (see alternation of generations). Because they have vascular tissues, these plants have true stems, leaves, and roots, modifications of which enable species of vascular plants to survive in a variety of habitats under diverse, even extreme, environmental conditions. This ability to flourish in so many different habitats is the primary reason that vascular plants have become dominant among terrestrial plants.

vasectomy \və-ˈsek-tə-mē\ Severing of the vas deferens, which carries sperm from the testes to the prostate gland, to cause sterility or prevent infection. This relatively simple procedure, which can be performed in a doctor's office with local anesthetics, removes the ability to father children without affecting ability to achieve erection or orgasm. The vas is cut near its beginning, in the scrotum. The cut ends may be sealed off or left open. Reversal is more likely to succeed in the latter case; microsurgery has improved the success rate.

Vasily \ˈva-sə-lē\ **I** *Russian* **Vasily Dmitriyevich** (b. 1371—d. February 1425, Moscow) Grand prince of Moscow (1389–1425). After helping the Tatar khan Tokhtamysh fight Timur, he succeeded his father as grand prince of Moscow and Vladimir. He enlarged his realm to include Nizhny Novgorod and Murom in the central Volga region, but his efforts to expand westward brought him into conflict with Lithuania and Novgorod. He prepared to fight Timur in 1395, but the Mongol leader withdrew from Russian lands without a battle. Vasily kept his state independent until the Tatars reasserted control in 1408.

Vasily II *Russian* **Vasily Varilyevich** *known as* **Vasily the Blind** (b. 1415—d. March 27, 1462, Moscow) Grand Prince of Moscow (1425–62). At age 10 he was named to succeed his father, Vasily I, but for many years his uncle and cousins struggled to wrest the throne from him. Despite being blinded by his cousin Dmitry Shemyaka, he regained power in 1447 and ruled Muscovy for another 15 years. Vasily quelled internal strife in his realm by 1452 and enlarged his state's territory by absorbing nearby principalities. During his reign the Russian church asserted its independence from the patriarch at Constantinople. Vasily signed a treaty with Lithuania (1449) but fought Tatar hordes on his southern and eastern borders.

vassal See feudalism

Vassar College Private liberal arts college in Poughkeepsie, N.Y. It was founded as a college for women by Matthew Vassar (1792–1868) in 1861 but did not open until 1865. It became coeducational in 1968. Vassar offers undergraduate studies in most major disciplines, and it has master's degree programs in biology, chemistry, and drama. The F.L. Loeb Art Center houses one of the oldest art collections in the U.S.

Vatican City *in full* **State of the Vatican City** Independent papal state, southern Europe, within the commune of Rome, Italy. Area: 109 acres (44 hectares). Population (2005 est.): 800. Its medieval and Renaissance walls form its boundaries except on the southeast at St. Peter's Square. Within the walls is the world's smallest independent nation-state, with its own diplomatic missions, newspaper, post office, radio station, banking system, army of 100 Swiss Guards, and publishing house. Extraterritoriality of the state extends to Castel Gandolfo and to several churches and palaces in Rome proper. Its independent sovereignty was recognized in the Lateran Treaty of 1929. The pope has absolute executive, legislative, and judicial powers within the city. He appoints the members of the Vatican's government organs, which are separate from those of the Holy See, the name given to the government of the Roman Catholic Church. The many imposing buildings include St. Peter's Basilica, the Vatican Palace, and the Vatican Museums. Frescoes by Michelangelo in the Sistine Chapel, by Pinturicchio in the Borgia Apartment, and by Raphael in the Stanze (rooms in the papal apartments) are also there. The Vatican Library contains a priceless collection of manuscripts from the pre-Christian and Christian eras. The pope and other representatives of the papal state travel widely to maintain international relations.

Vatican Council, First (1869–70) 20th ecumenical council of the Roman Catholic Church. It was convoked by Pope Pius IX (1846–78) to address the rising influence of rationalism, materialism, and liberalism. The council, which was never formally dissolved, promulgated two doctrinal constitutions: *Dei filius*, which deals with faith, reason, and their interrelations; and *Pastor aeternus*, which treats the authority of the pope. After long debate, the council approved the doctrine of papal infallibility. The council recessed in the summer of 1870 but was unable to reconvene because Italian troops had occupied Rome. Pius suspended the council indefinitely on Oct. 20, 1870.

Vatican Council, Second (1962–65) 21st ecumenical council of the Roman Catholic church, announced by Pope John XXIII. It has come to symbolize the church's readiness to acknowledge the circumstances of the modern world. Among the most notable of the 16 documents enacted were the "Dogmatic Constitution on the Church," which treats church hierarchy and provides for greater involvement of laypeople in the church; the "Dogmatic Constitution of Divine Revelation," which maintains an open attitude toward scholarly study of the Bible; the "Constitution on the Sacred Liturgy," which provides for the use of vernacular languages in the mass in place of Latin; and the "Pastoral Constitution on the Church in the World of Today," which acknowledges the profound changes humanity has experienced in the modern world and attempts to relate the church to contemporary culture. Observers from other Christian churches were invited to the council in a gesture of ecumenism.

Vatican Museums and Galleries Institutions and papal palaces in Vatican City housing the art collections of the popes since the beginning of the 15th century. Among the many separate museums are the 18th-century Pio-Clementino Museum, which exhibits the collection of Classical sculpture that originated in 1503–13 with Julius II; the exhibition rooms in the Vatican Library; and the Sistine Chapel. The Vatican collections are most famous for their Classical statues (including *Apollo Belvedere*, *Belvedere Torso*, and *Laocoön*) but also contain important examples of Egyptian and early Christian art. The Pinacoteca ("Picture Gallery"), founded by Pius VI in 1797, contains Italian religious paintings and Russian and Byzantine art. In 1956 a modern-art collection was begun with secular works by such artists as Pierre-Auguste Renoir, Georges Seurat, Vincent van Gogh, Henri Matisse, and Pablo Picasso. The Vatican collections are among the largest and most important in the world.

Vatican Palace Pope's residence since the late 14th century, located north of St. Peter's Basilica in the Vatican. First enclosed in 850, the irregularly walled compound contains gardens (begun by Nero), courtyards, living quarters, galleries, the Vatican Museums and Library, and other facilities. The residence, with more than 1,400 rooms, was begun in the

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13th century by Pope Nicholas III. Nicholas V founded the Vatican Library. Under Julius II, Giovanni dei Dolci built the Sistine Chapel, noted for its spectacular interior artwork including Michelangelo's ceiling; Donato Bramante completed the palace's northern facade and planned the immense Belvedere court; and Raphael painted his masterpieces in the palace. Antonio da Sangallo the Younger, employed by Paul III, designed the Sala Regia (Royal Hall) and Pauline Chapel, decorated by Michelangelo. Several chapels, along with Ottaviano Mascherino's famous Gallery of Maps, date from the late 16th century. Domenico Fontana added a wing of apartments and the present library building under Sixtus V. In the Baroque period, Urban VIII built the Matilda Chapel and, under Alexander VII, Gian Lorenzo Bernini built the Scala Regia (Royal Stairway).

Vatnajökull \'vät-nä-ˌyœ̄-kü-tˢl\ Extensive ice field, southeastern Iceland. It covers an area of 3,200 sq mi (8,400 sq km) and has an average ice thickness of more than 3,000 ft (900 m). It contains several mountains, including Hvannadalshnúkur (6,952 ft, or 2,119 m), the highest peak in Iceland. There are numerous active volcanoes throughout the ice field.

Vättern \'ve-tərn\ Lake, south-central Sweden, southeast of Lake Vänern. With a length of 81 mi (130 km), a width of about 19 mi (31 km), and an area of 738 sq mi (1,912 sq km), it is Sweden's second largest lake, though only one-third the size of Vänern. Its maximum depth is 420 ft (130 m). Known for its dangerous currents, it is connected with the Baltic Sea by the Gota Canal.

Vauban \vō-'bäⁿ**, Sébastien Le Prestre de** (b. May 15, 1633, Saint-Léger-de-Foucherest, France—d. March 30, 1707, Paris) French military engineer. After fighting with the forces of the Condé family (1651–53), he switched to the royalist side and joined the newly formed engineer corps, becoming engineer in chief at the siege of Gravelines (1658). He designed fortifications for numerous French towns and outposts and devised tactics that led to many successes in the French wars of Louis XIV's reign; his innovations revolutionized the art of siege tactics and defensive fortification. He also introduced the tactic of ricochet gunfire and invented the socket bayonet. His treatises on fortification and siege-craft were studied for more than 100 years. He was made a marshal of France in 1703.

Vaucanson \vō-käü-'sōⁿ**, Jacques de** (b. Feb. 24, 1709, Grenoble, France—d. Nov. 21, 1782, Paris) French inventor. In 1739 he constructed an automaton, "The Duck," which imitated not only the motions of a live duck but also the motions of drinking, eating, and "digesting." An inspector of silk manufacture, Vaucanson automated the loom by means of perforated cards that guided hooks connected to the warp yarns (see weaving). His innovation was ignored for decades until J.-M. Jacquard reconstructed and improved on it; the Jacquard loom became one of the most important inventions of the Industrial Revolution.

Vaucheria \vō-'kir-ē-ə\ Genus of yellow-green algae. It is characterized by oil food reserves and tubular branches that have multiple nuclei and lack cross-walls except in association with reproductive organs or an injury. *Vaucheria* reproduce both asexually and sexually. The spherical female sex organ and the slender, hook-shaped male sex organ are usually produced on branches close to each other. After fertilization, the zygote may enter a resting phase for several weeks before developing into a new plant. Though most species occur in freshwater or are terrestrial, some are marine and others live in ice.

vaudeville \'vōd-ˌvil\ Light entertainment popular in the U.S. in the late 19th and early 20th centuries. It consisted of 10–15 unrelated acts featuring magicians, acrobats, comedians, trained animals, singers, and dancers. The form developed from the coarse variety shows held in beer halls for a primarily male audience. Tony Pastor established a successful "clean variety show" at his New York City theatre in 1881 and influenced other managers to follow suit. By 1900 chains of vaudeville theatres around the country included Martin Beck's Orpheum Circuit, of which New York's Palace Theatre was the most famous (1913–32). Among the many entertainers who began in vaudeville were Mae West, W.C. Fields, Will Rogers, Buster Keaton, Charlie Chaplin, the Marx Brothers, Bud Abbott and Lou Costello, Milton Berle, and Bob Hope. See also music hall and variety theatre.

Vaugelas \vō-zhə-'lä**, Claude Favre, lord de** (b. Jan. 6, 1585, Meximieux, France—d. February 1650, Paris) French grammarian. He played a major role in standardizing the French language of literature and of polite society. His *Remarks on the French Language, Useful for Those Who Wish to Speak Well and Write Well* (1647) became an authoritative guide to French usage, and his writings formed the basis of the rules for pure and elegant French promulgated by the Académie Française, of which he was an original member.

Vaughan \'vȯn, 'vän**, Henry** (b. April 17, 1622, Llansantffraed, Breconshire, Wales—d. April 23, 1695, Llansantffraed) Anglo-Welsh poet and mystic. Vaughan studied law but from the 1650s practiced medicine. After writing two volumes of secular poems, he read the religious poet George Herbert and gave up "idle verse." He is chiefly remembered for the spiritual vision or imagination evident in his fresh and convincing religious verse and is considered one of the major practitioners of Metaphysical poetry. Works that reveal the depth of his religious convictions include *Silex Scintillans* (1650, enlarged 1655; "The Glittering Flint") and the prose *Mount of Olives* (1652). He also translated short moral and religious works and two medical works.

Vaughan, Sarah (Lois) (b. March 27, 1924, Newark, N.J., U.S.—d. April 3, 1990, Hidden Hills, Calif.) U.S. jazz singer. Vaughan won an amateur contest at Harlem's Apollo Theatre in 1942 and soon joined Earl Hines's big band as vocalist and second pianist. Joining Billy Eckstine's band in 1944, she gained exposure to the new bebop style; she was especially influenced by Dizzy Gillespie and Charlie Parker and recorded with them in 1945. Alternating between popular song and jazz, she worked as a soloist for the rest of her career. A vast range and wide vibrato in the service of her harmonic sensitivity enabled Vaughan to use her voice with a seemingly instrumental approach, often improvising as a jazz soloist.

Sarah Vaughan.
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Vaughan Williams \vȯn-'wil-yəms**, Ralph** (b. Oct. 12, 1872, Down Ampney, Gloucestershire, Eng.—d. Aug. 26, 1958, London) British composer. He attended the Royal College of Music and Cambridge University, and he also studied in Berlin with the composer Max Bruch. Having collected English folk songs for his academic work, he combined folk melody with modern approaches to harmony and rhythm, forging a musical style at once highly personal and deeply English. His nine symphonies, including *Sea Symphony* (1909), *London Symphony* (1913), and *Sinfonia Antarctica* (1952), were his most exploratory works. Other popular pieces include *The Lark Ascending* (1914) and *Serenade to Music* (1938); he also wrote five operas, including *Riders to the Sea* (1936). He conducted extensively throughout his life, and he edited *The English Hymnal* (1904–06).

vault In building construction, an arched structure forming a ceiling or roof. The masonry vault exerts the same kind of thrust as the arch, and must be supported along its entire length by heavy walls with limited openings. The basic barrel vault, in effect a continuous series of arches, first appeared in ancient Egypt and the Middle East. Roman architects discovered that two barrel vaults intersecting at right angles (a groin vault) could, when repeated in series, span rectangular areas of unlimited length. Because the groin vault's thrusts are concentrated at the four corners, its supporting walls need not be massive. Medieval European builders developed the rib vault, a skeleton of arches or ribs on which the masonry could be laid. The fan vault, popular in the English Perpendicular style, used fan-shaped clusters of tracery-like ribs springing from pendants or columns. The 19th century saw the use of large iron skeletons as frameworks for vaults of lightweight materials (see Crystal Palace). An important modern innovation is the reinforced-concrete shell vault, which, if its length is three or more times its transverse section, behaves as a deep beam and exerts no lateral thrust. See illustration opposite.

vaulting Gymnastics exercise in which the athlete leaps over a form that was originally intended to mimic a horse. At one time, the pommel horse was used in the vaulting exercise, with the pommels (handles) removed. The sanctioning body for gymnastic sport, the Fédération Internationale de Gymnastique (FIG), decreed in 2001 that a vaulting table would be introduced to replace the horse. In men's vaulting the height of the table is 1.35 m (4.43 ft) from the floor; for women, the height is 1.20 m (3.94 ft). A

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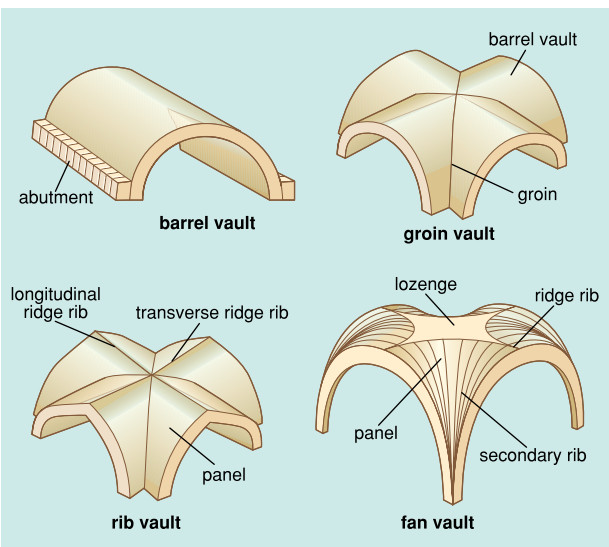
Reuther board, a type of springboard, is placed in front of the near end of the apparatus. The gymnast runs, gathers momentum while nearing the apparatus, rebounds off the springboard, and, supporting the hands on the apparatus, vaults over it and performs an acrobatic maneuver.

Vavilov \vəv-'yē-ləf**, Nikolay (Ivanovich)** (b. Nov. 25, 1887, Moscow, Russian Empire—d. Jan. 26, 1943, Saratov, Russia, U.S.S.R.) Russian plant geneticist. Through expeditions to many parts of the world, Vavilov amassed an immense plant collection and conceived the theory that a cultivated plant's centre of origin would be found in the region in which wild relatives of the plant showed maximum adaptiveness. He eventually proposed 13 world centres of plant origin. Though widely considered one of the greatest specialists in botanical populations, he was publicly condemned by TROFIM LYSENKO at successive plant-breeding congresses (1934–39) as peddling "Mendelist-Morganist genetics" (see GREGOR MENDEL; THOMAS HUNT MORGAN), and he died in a concentration camp.

vCard Electronic business card that automates the exchange of personal information typically found on a traditional business card. The vCard is a file that contains the user's basic business or personal data (name, address, phone number, URLs, etc.) in a variety of formats such as text, graphics, video clips, and audio clips. It can be attached to an E-MAIL or exchanged between computers or on the INTERNET, where, for example, the user can drag-and-drop his or her vCard to a registration or order form on a Web page so that it can automatically complete the form. It is used in such applications as voice mail, Web BROWSERS, call centres, video conferencing, pagers, faxes, and smart cards.

VCR *in full* **videocassette recorder** Electromechanical device that records, stores on a VIDEOTAPE cassette, and plays back on a TV set recorded images and sound. The first commercial VCRs were marketed by Sony Corp. in 1969. VCRs are used to record broadcast TV programs for later viewing and to play commercially recorded cassettes. They have from two to seven tape heads that read and inscribe video and audio tracks on magnetic tape. Home movies can be made with a camcorder system, a VCR connected to a simple video camera.

veal Meat of young calves. It is usually pale grayish white in colour, firm and fine-grained, with a velvety texture. Calves bred to yield veal are usually raised indoors under controlled temperatures and intensively fed on milk, high-protein calf meal, or both. Herbaceous foods are excluded, which results in an iron deficiency that produces the desirable light colour in the meat. In recent decades, animal-rights groups have denounced calf farming as cruel.



Four common types of vault. A barrel vault (also called a cradle vault, tunnel vault, or wagon vault) has a semicircular cross section. A groin (or cross) vault is formed by the perpendicular intersection of two barrel vaults. A rib (or ribbed) vault is supported by a series of arched diagonal ribs that divide the vault's surface into panels. A fan vault is composed of concave sections with ribs spreading out like a fan.
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Veblen \'veb-lən**, Thorstein (Bunde)** (b. July 30, 1857, Manitowoc county, Wis., U.S.—d. Aug. 3, 1929, near Menlo Park, Calif.) U.S. economist. He grew up in Minnesota and earned a Ph.D. in philosophy from Yale University. Although he taught economics at the University of Chicago and other universities, he was unable to keep any position for long because of his unconventional ideas and the disorder in his personal life. In 1899 he published his classic work *The Theory of the Leisure Class*, which applied Darwin's evolutionary theories to the study of modern economic life, highlighting the competitive and predatory nature of the business world. With dry humour he identified the markers of American social class, and he coined the term "conspicuous consumption" to describe the display of wealth made by the upper class. His reputation was highest in the 1930s, when the GREAT DEPRESSION was seen as a vindication of his criticism of the business system.

vector In mathematics, a quantity characterized by magnitude and direction. Some physical and geometric quantities, called scalars, can be fully defined by a single number specifying their magnitude in suitable units of measure (e.g., mass in grams, temperature in degrees, time in seconds). Quantities like velocity, force, and displacement must be specified by a magnitude and a direction. These are vectors. A vector quantity can be visualized as an arrow drawn in a specific direction, whose length is equal to the magnitude of the quantity represented. A two-dimensional vector is specified by two coordinates, a three-dimensional vector by three coordinates, and so on. Vector analysis is a branch of mathematics that explores the utility of this type of representation and defines the ways such quantities may be combined. See also VECTOR OPERATIONS.

vector operations Extension of the laws of elementary algebra to VECTORS. They include addition, subtraction, and three types of multiplication. The sum of two vectors is a third vector, represented as the diagonal of the parallelogram constructed with the two original vectors as sides. When a vector is multiplied by a positive scalar (i.e., number), its magnitude is multiplied by the scalar and its direction remains unchanged (if the scalar is negative, the direction is reversed). The multiplication of a vector $\mathbf{a}$ by another vector $\mathbf{b}$ leads to the dot product, written $\mathbf{a} \cdot \mathbf{b}$, and the cross product, written $\mathbf{a} \times \mathbf{b}$. The dot product, also called the scalar product, is a scalar real number equal to the product of the lengths of vectors $\mathbf{a}$ ($|\mathbf{a}|$) and $\mathbf{b}$ ($|\mathbf{b}|$) and the cosine of the angle (θ) between them: $\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}|\,|\mathbf{b}| \cos\theta$. This equals zero if the two vectors are perpendicular (see ORTHOGONALITY). The cross product, also called the vector product, is a third vector ($\mathbf{c}$), perpendicular to the plane of the original vectors. The magnitude of $\mathbf{c}$ is equal to the product of the lengths of vectors $\mathbf{a}$ and $\mathbf{b}$ and the sine of the angle (θ) between them: $|\mathbf{c}| = |\mathbf{a}|\,|\mathbf{b}| \sin\theta$. The ASSOCIATIVE LAW and COMMUTATIVE LAW hold for vector addition and the dot product. The cross product is associative but not commutative.

vector space In mathematics, a collection of objects called VECTORS, together with a field of objects (see FIELD THEORY), known as scalars, that satisfy certain properties. The properties that must be satisfied are: (1) the set of vectors is closed under vector addition; (2) multiplication of a vector by a scalar produces a vector in the set; (3) the ASSOCIATIVE LAW holds for vector addition, $\mathbf{u} + (\mathbf{v} + \mathbf{w}) = (\mathbf{u} + \mathbf{v}) + \mathbf{w}$; (4) the COMMUTATIVE LAW holds for vector addition, $\mathbf{u} + \mathbf{v} = \mathbf{v} + \mathbf{u}$; (5) there is a $\mathbf{0}$ vector such that $\mathbf{v} + \mathbf{0} = \mathbf{v}$; (6) every vector has an additive inverse (see INVERSE FUNCTION), $\mathbf{v} + (-\mathbf{v}) = \mathbf{0}$; (7) the DISTRIBUTIVE LAW holds for scalar multiplication over vector addition, $n(\mathbf{u} + \mathbf{v}) = n\mathbf{u} + n\mathbf{v}$; (8) the distributive law also holds for vector multiplication over scalar addition, $(m + n)\mathbf{v} = m\mathbf{v} + n\mathbf{v}$; (9) the associative law holds for scalar multiplication with a vector, $(mn)\mathbf{v} = m(n\mathbf{v})$; and (10) there exists a unit vector $\mathbf{1}$ such that $\mathbf{1v} = \mathbf{v}$. The set of all POLYNOMIALS in one variable with real coefficients is an example of a vector space.

Ved-ava \'vā-dä-vä\ Divine ruler of the waters and their bounty, common to several Baltic and Finno-Ugric peoples traditionally dependent on fishing. She was also responsible for promoting fertility in humans and in livestock. In appearance, she resembled a mermaid, having long hair, large breasts, and a fishlike lower body. Fishermen sacrificed to her the first of their catch and observed numerous taboos while fishing. Seeing Ved-ava generally boded misfortune, most often drowning. She has been regarded as the spirit of a drowned person or simply as a personification of the water itself.

Veda \'vā-də\ Any of a group of sacred hymns and verses composed in archaic Sanskrit, probably in the period 1500–1200 BC. Together they form a body of liturgical literature that grew up around the cult of the SOMA

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ritual. They extol the hereditary deities that personified various natural and cosmic phenomena. The entire corpus of Vedic literature, including the UPANISHADS, was considered the product of divine revelation. The Vedas were handed down orally for many generations before being committed to writing. Even today, several are recited with intonation and rhythm associated with the early days of VEDIC RELIGION. See also RIG VEDA, VEDANTA.

Vedanta \vā-'dän-tə\ One of the six orthodox systems (DARSHANS) of Indian philosophy and the one that forms the basis of most modern schools of HINDUISM. Its three fundamental texts are the UPANISHADS, the BHAGAVADGITA, and the Brahma Sutras, which are very brief interpretations of the doctrine of the Upanishads. Several schools of Vedanta have developed, differentiated by their conception of the relationship between the self (ATMAN) and the absolute (BRAHMAN). They share beliefs in SAMSARA and the authority of the VEDAS as well as the conviction that Brahman is both the material and instrumental cause of the world and that the atman is the agent of its own acts and therefore the recipient of the consequences of action (see KARMA).

Vedic religion \'vā-dik\ *or* **Vedism** Ancient religion of India that was contemporary with the composition of the VEDAS and was the precursor of HINDUISM. The religion of the Indo-European-speaking peoples who entered India c. 1500 BCE from the region of present-day Iran, it was a polytheistic system in which INDRA was the highest-ranked god. It involved the worship of numerous male divinities connected with the sky and natural phenomena. Ceremonies centred on ritual sacrifice of animals and on the use of SOMA to achieve trancelike states. These ceremonies, simple in the beginning, grew to be so complex that only trained BRAHMANS could carry them out correctly. Out of Vedism developed the philosophical concepts of ATMAN and Brahman. The spread (8th–5th century BCE) of the related concepts of reincarnation, KARMA, and release from the cycle of rebirth through meditation rather than sacrifice marked the end of the Vedic period and the rise of Hinduism. The Hindu initiation ceremony, UPANAYANA, is a direct survivor of Vedic tradition.

Veeck \'vek**, Bill** *in full* **William Louis Veeck** (b. Feb. 9, 1914, Hinsdale, Ill., U.S.—d. Jan. 2, 1986, Chicago, Ill.) U.S. baseball-club executive and owner. The son of a sportswriter who was also president of the Chicago Cubs (1919–33), Veeck became co-owner of the minor league Milwaukee Brewers (1941–45) and later the major league Cleveland Indians (1946–48), St. Louis Browns (1949–53), and Chicago White Sox (1959–68; 1976–81). Believing that baseball was a form of entertainment and should not be treated as a business, he introduced many innovations in promotion, was almost always able to improve a team's attendance, and usually bettered its performance.

Vega \'vā-gə**, Lope de** *in full* **Lope Félix de Vega Carpio** (b. Nov. 25, 1562, Madrid, Spain—d. Aug. 27, 1635, Madrid) Spanish playwright, the outstanding dramatist of the Spanish Golden Age. After serving with the Spanish Armada, he lived in Madrid, serving as secretary to a series of nobles, including the duke of Sessa (from 1605). Called the "Phoenix of Spain," the phenomenally prolific Vega wrote as many as 1,800 plays, of which 431 survive, and established the *comedia* (tragicomic social drama), which typified the new Golden Age drama. He wrote two major types of drama, both Spanish in setting: the historical play based on a national legend (e.g., *Peribáñez* and *The King, the Greatest Alcalde*) and the "cloak-and-sword" drama of contemporary manners and intrigue, which turned on some "point of honour" (e.g., *The Gardener's Dog*). He established the comic character, or *gracioso*, as a commentator on the follies of his social superiors. *All Citizens Are Soldiers* is his best-known work outside Spain. He also wrote 21 volumes of nondramatic works in verse and prose, including *The New Art of Writing Plays* (1609).

vegetable In the broadest sense, all plant life and plant products (vegetable matter); in common, narrow usage, the fresh edible portion of herbaceous plants (roots, stems, leaves, flowers, or fruit), either eaten fresh or prepared in some way. Almost all current vegetables were cultivated in ancient Old or New World civilizations, though some have been greatly modified. Vegetables are good sources of minerals (especially calcium and iron), VITAMINS (especially A and C), and dietary FIBER. All the amino acids needed to synthesize PROTEIN are available in vegetables. Fresh vegetables quickly age and spoil, but their storage life can be extended by such preservation methods as dehydration, canning, freezing, fermenting, and pickling.

vegetable oyster See SALSIFY

vegetarianism Theory or practice of eating only plants. The vegetarian diet includes grains, vegetables, fruits, and nuts; it excludes meat, poultry, and fish, but some vegetarians eat dairy products (lactovegetarians), egg products (ovovegetarians), or both (ovolactovegetarians). Those who eat no animal products (including honey) are called vegans. Motivations vary and include ethics (both unwillingness to kill animals and abhorrence of modern methods of raising animals for meat), self-denial or religious taboo, ecology (including concern about the wastefulness and environmental costs of beef farming), and health. Vegetarians point to the many health benefits of their diet, including low rates of heart disease, diabetes, colon cancer, and obesity. While obtaining sufficient protein is seldom a problem in affluent societies, vegetarians must be careful to consume enough iron and, especially for vegans, calcium and vitamins D and B_{12}. The most influential early proponent of vegetarianism was PYTHAGORAS, in the 6th century BC. Many Hindu sects and most Buddhists are vegetarian, and much of the world eats hardly any meat because it is unavailable. The Enlightenment led to a humane concern for animals; in the 19th century Britain became a major centre of vegetarianism, and vegetarian movements soon arose in Germany, the U.S., and other countries.

Veii \'vē-yī, 'vā-yē\ Ancient ETRUSCAN town. It was located about 10 mi (16 km) northwest of ROME, near modern Veio. An important city of the Etruscan confederation and the foremost 6th-century producer of Etruscan terra-cotta sculptures, it had hegemony over Rome in the 7th–6th centuries BC. A subsequent series of wars ended in its destruction by Rome in 396 BC after a 10-year siege. Under AUGUSTUS it was made a municipium, and up to the 3rd century AD it continued as a religious centre.

vein Vessel that carries blood to the heart. Except for the pulmonary veins, veins bear deoxygenated blood from CAPILLARIES, which converge into threadlike venules and then veins, finally emptying into the venae cavae (see CARDIOVASCULAR SYSTEM; VENA CAVA). Blood moves through veins by contraction of the surrounding muscles. Backflow is prevented by valves in most veins' inner layer (tunica intima), which lacks the elastic membrane lining of ARTERIES. The thin middle layer (tunica media) is mostly COLLAGEN fibres, and the thick outer layer (tunica adventitia) is mostly CONNECTIVE TISSUE. See also CIRCULATION; VARICOSE VEIN.

Velasco \bā-'läs-kō\ **(Alvarado), Juan** (b. June 16, 1910, Piura, Peru—d. Dec. 24, 1977, Lima) President of Peru (1968–75). Commander in chief of the army, he came to power by overthrowing Pres. Fernando Belaúnde Terry. His government was unusual among military regimes for its reformist and populist character. He nationalized transportation, communications, and electric power and converted millions of acres of private farms into workers' cooperatives. He defied the U.S. in nationalizing U.S.-owned oil fields and capturing and fining U.S. boats fishing within Peru's 200-mi (322-km) coastal limit. He was deposed in 1975 because of discontent with his restrictions on political participation.

Velasco Ibarra \bā-'läs-kō-ē-'bär-rä**, José (María)** (b. March 19, 1893, Quito, Ecua.—d. March 30, 1979, Quito) Five-time president of Ecuador. Born into a wealthy family, he was first elected to the presidency in 1933. In response to Congress's lack of support for his LAND REFORM program, he assumed dictatorial powers, imprisoning opposition leaders and censoring the press. Deposed by the army and forced into exile, he returned to the presidency in 1944, but his repressive policies alienated his liberal followers and again he was forced into exile. He returned and was elected three more times before his death in 1979, only once (1952–56) being permitted to serve out a full term.

Velázquez \və-'las-kəs,\ *Spanish* \bā-'lath-kāth**, Diego (Rodríguez de Silva)** (baptized June 6, 1599, Sevilla, Spain—d. Aug. 6, 1660, Madrid) Spanish painter. He was apprenticed to FRANCISCO HERRERA THE ELDER before being trained by Francisco Pacheco. His early works were mostly religious or genre scenes. After arriving in Madrid in 1623, he painted a portrait of PHILIP IV that won him immediate success and an appointment as court painter. His position gave him access to the royal collections, including works by TITIAN, who exerted the greatest influence on his style. In his portraits from this period, only the faces and hands of the figures are accentuated, and the dark figures stand out against a light background. A visit to Italy (1629–31) further developed his style, and on his return to Madrid he entered his most productive period. Velázquez created a new type of informal royal portrait for Philip's hunting lodge, and his portraits of court dwarfs display the same discerning eye as those of his royal subjects. On a second visit to Rome (1649–51) he painted a portrait of Pope

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Innocent X. The powerful head, brilliant combinations of crimson of the curtain, chair, and cope are painted with fluent technique and almost imperceptible brushstrokes that go far beyond the late manner of Titian and announce the last stage in Velázquez's development. This portrait was copied innumerable times and won him immediate and lasting renown in Italy. In his last years he created his masterpiece, *Las Meninas* (*The Maids of Honour*, 1656). In this casual scene, the artist is shown painting the king and queen in the presence of the infanta Margarita and her attendants; the nearly life-size figures are painted in more or less detail according to their relation to the central figure of the infanta and to the source of light, creating a remarkable illusion of reality never surpassed by Velázquez or any other artist of his age. He is universally acknowledged as one of the giants of Western art.

Velde, Henri van de (b. April 3, 1863, Antwerp, Belg.—d. Oct. 25, 1957, Zürich, Switz.) Belgian architect, designer, and teacher. Sharing the philosophy of William Morris and the Arts and Crafts Movement, van de Velde believed in creating beautiful everyday objects. Increasingly occupied by a philosophy of total design, in 1895 he designed Bloemenwerf, a house for his wife and himself outside of Brussels for which he also designed all the interiors and furnishings. In 1896 he designed furniture and interiors for the Paris art galleries of Samuel Bing; because of the curving, delicate nature of these designs, van de Velde is credited with bringing the Art Nouveau style to Paris. (Van de Velde himself is generally associated with the Jugendstil movement, which was the German branch of Art Nouveau design.) In Weimer in 1902 he reorganized the arts and crafts school and the academy of fine art and thus laid the foundations for the amalgamation of the two bodies into the Bauhaus in 1919. He designed his best-known structure, the curving, sinuous Werkbund Theatre in Cologne, in 1914. His later work includes the Belgian pavilions at the international exhibitions in Paris (1937) and New York (1939). He also created graphic design work, generally in the curvilinear Art Nouveau style, and he spread his ideas through lecturing and teaching.

Velde \'vel-də**, Willem van de, the Elder** (b. 1611, Leiden, Neth.—d. December 1693, London, Eng.) Dutch marine painter. He sailed with the Dutch fleet and painted its engagements with the English. Settling in England in 1672, he continued to paint marine subjects, often in collaboration with his son, Willem the Younger (1633–1707), who became the foremost marine painter of his time. The latter was appointed court painter by Charles II in 1677 and was commissioned to paint England's naval battles; many of his works are housed in London's National Maritime Museum.

Velikovsky \ˌve-li-'kȯf-skē**, Immanuel** (b. June 10, 1895, Vitebsk, Russia—d. Nov. 17, 1979, Princeton, N.J., U.S.) Russian-born U.S. writer. He earned various degrees in Moscow and Edinburgh before moving to the U.S. in 1939. In his first book, *Worlds in Collision* (1950), he hypothesized, relying on legends of ancient peoples, that Venus and Mars had approached Earth closely c. 1500 BC, disturbing its rotation, axis inclination, and magnetic field. His claim was widely discredited by astronomers, and the book's publication caused U.S. scientists to threaten a boycott of his publisher. Later works set out other controversial theories about ancient history and catastrophic occurrences.

Velociraptor \və-'lä-sə-ˌrap-tər\ Genus of clawed theropod dinosaur (family Dromaeosauridae) that flourished in central and eastern Asia during the Late Cretaceous Epoch (99–65 million years ago). It was related to an Early Cretaceous (144–99 million years ago) North American genus, *Deinonychus*. Both genera had a sickle-shaped claw on each foot and ossified tendon reinforcements in the tail that enabled them to keep their balance while striking and slashing at prey. Swift, agile predators of small herbivores, they grew up to 6 ft (1.8 m) long and weighed up to 100 lb (45 kg).

velocity Quantity that designates the speed and direction in which a body moves. It can be represented graphically by an arrow (pointing in the direction of the motion), the length of which is proportional to the magnitude, or speed. For an object in circular motion, the direction at any instant is tangential to the circle at that point, and so is perpendicular to the radius at that point. The instantaneous speed of a vehicle, such as an automobile, can be determined by a speedometer, or mathematically by differential calculus. The average speed is the ratio of the distance traveled in any given time interval divided by the time taken.

velvet Fabric having a short, dense pile, used in clothing and upholstery. Velvet is made in the pile weave (see weaving), of silk, cotton, or synthetic fibres and is characterized by a soft, downy surface formed by clipped yarns (see shearing). Its "wrong" side is smooth and shows the weave used. Velvets can be made water-repellent and crush-resistant. They are also occasionally patterned or embossed.

vena cava \ˌvē-nə-'kā-və\ Either of two major veins that deliver oxygen-depleted blood to the right side of the heart. The superior vena cava drains the upper body, and the inferior vena cava drains the lower body. See also cardiovascular system, circulation.

Venda Bantu-speaking people who inhabit the northeastern corner of South Africa and neighbouring Zimbabwe. The Venda, today numbering more than 750,000, were the last of the peoples in the area to come under European control. Agriculture dominates their economy; cattle raising has increased in importance. Venda chiefs are traditionally custodians of the land, while local headmen permit household groups to occupy and work tracts of land.

Venda Former black enclave, northeastern South Africa. Located near the Zimbabwe border, it attracted the Venda people, who migrated into the region in the early 1700s from what is now Zimbabwe. It was annexed to Transvaal in 1898 and was a distinct administrative unit within South Africa when the country designated it a homeland for Venda-speaking people in 1962. The territory was granted partial self-government in 1973 and became an independent republic in 1979; it never received international recognition. After apartheid was abolished, Venda was reincorporated into South Africa in 1994 as part of the newly created Northern (now Limpopo) province.

Vendée \vä^{n}-'dā**, Wars of the** (1793–96) Insurrections in the west of France during the French Revolution. In the religious and impoverished area known as the Vendée, discontent with the new government grew after it instituted strict controls over the Catholic church (1790). An uprising began in opposition to the conscription acts (1793) and spread throughout the region, where peasants were joined by royalists to form the Catholic and Royal Army. Led by the nobleman François Charette de La Contrie (1763–1796), the Vendéan army of 65,000 occupied several towns, but was defeated at Cholet by government troops and forced to retreat. After further defeats at Le Mans (about 15,000 rebels killed) and at Savenay, the general warfare ended in December 1793. Vicious reprisals by the government provoked further resistance, until an amnesty was announced (1794) and the Vendée was granted freedom from conscription (1795). Charette joined a British-backed landing of exiled French nobles in Brittany (1795), but after their defeat and his execution (1796) the counter-revolutionary struggle ended.

Vendémiaire \vä^{n}-dā-'myer\ First month in the French republican calendar. It also was the name given to the event of 13 Vendémiaire of the year IV (Oct. 5, 1795), when Gen. Napoleon Bonaparte led the French Revolutionary troops that stopped an insurrection of Parisians as they marched against the government.

vending machine Machine from which various goods may be purchased, either with coin, paper currency, or electronic payment card. The first vending machines were introduced in 18th-century England to sell snuff and tobacco. From the late 19th century they have been widely used in many countries. Vending service is typically provided by a company that owns the machines and places them in businesses, schools, and the like. These operators provide the products and service either without cost to the owner of the premises on which a machine is located or in return for a servicing charge.

Vendsyssel-Thy \'ven-ˌsu̇̄-səl-'tu̇̄\ Island, northern end of Jutland, Denmark. It is known as Vendsyssel in the east and Thy in the west. The Limfjorden separates it from the mainland, to which it was attached until 1825, when water erosion cut a channel through the narrow isthmus at Thyborøn. It has an area of 1,809 sq mi (4,686 sq km). Frederikshavn, the main port, lies on the east coast facing Göteborg, Swed. The island is a holiday resort.

veneer Extremely thin sheet of rich-coloured wood (such as mahogany, ebony, or rosewood) or precious materials (such as ivory or tortoiseshell) cut in decorative patterns and applied to the surface of a piece of furniture. Though veneering was practiced in Classical antiquity, its use lapsed in the Middle Ages. It was revived in the 17th century, reaching its apogee in France and spreading from there to other European countries. The considerable craftsmanship involved in artistic veneering is most evident in the 18th and early 19th centuries, when Thomas Chippendale, George

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Hepplewhite, and Thomas Sheraton used mahogany and satinwood veneers. By the mid-19th century mechanical saws allowed the veneering process to be used in mass production to cover defects in cheap furniture.

Venera \vyi-'nyer-ə\ *English* \və-'nar-ə\ Any of a series of unmanned Soviet planetary probes sent to Venus 1965–83. Venera 2 flew to within 25,000 mi (40,000 km) of Venus in 1966; a few days later, Venera 3 crash-landed on its surface, becoming the first spacecraft to strike another planet. Later missions analyzed Venus's atmosphere, made soft landings, detected certain long-lived radioactive isotopes (chiefly uranium and thorium), sent back the first close-up photographs of the planet's surface, and mapped the surface of the northern hemisphere with radar (by Venera 15 and 16, the last two of the series).

Venetian glass Variety of glassware made in Venice from the 13th century to the present. In the 15th century efforts were concentrated on the perfection of *cristallo* (clear glass that approximated rock crystal in appearance). By the 16th century Venetian glassmakers mastered techniques of adding colour and of removing the smoky tint produced by metal in the glass material. These and other secrets were guarded closely, and defecting workers were severely punished. But eventually many Venetian glassmakers did defect, and the techniques became common knowledge in France, Germany, The Netherlands, and England.

Ewer made of *calcedonio,* Venice, early 16th century; in the Museum für Kunsthandwerk, Frankfurt am Main, Ger.

COURTESY OF THE MUSEUM FUR KUNSTHANDWERK, FRANKFURT AM MAIN, GER.; PHOTOGRAPH, FOTO MARBURG-ART RESOURCE/EB INC.

Venetian school Renaissance artists of Venice whose work is characterized by a love of light and colour. Jacopo Bellini was the first in this influential line, followed by his son Gentile Bellini, the instructor of Venice's great High Renaissance painters, including Giorgione and Titian. In due course Titian became the dominant force in Venetian painting, and his rich colours and painterly technique were widely imitated. Other 16th-century masters included Veronese, known for his vast, brilliantly coloured, pageantlike canvases, and Tintoretto, who combined the Mannerists' rapidly receding diagonals and dramatic foreshortenings with the Venetian love of light as a means of defining form and heightening drama. Giovanni Battista Tiepolo was the last important Venetian figure painter and one of the greatest artists of the Rococo period.

Veneto \'ve-nə-ˌtō\ Region (pop., 2001 prelim.: 4,490,586), northern Italy. It covers an area of 7,090 sq mi (18,364 sq km); its capital is Venice. Bordered by Austria, the Adriatic Sea, and Lake Garda, the northern part is mountainous, while the southern part consists of a fertile plain. Parts were under Roman rule c. 2nd–1st centuries BC (see Padua and Verona) and later were subject to the Lombards. In the Middle Ages, several city-states gained importance, but most subsequently were subject to Venice. The area began to slip from Venetian hold after the French Revolution, and in the early 19th century Veneto came under Austrian rule. It was returned and joined to Italy in the 1860s. Agriculture is an economic mainstay, and industrial works are found around Veneto's major cities.

Venezia Tridentina See Trentino–Alto Adige

Veneziano, Domenico See Domenico Veneziano

Venezuela *officially* **Bolivarian Republic of Venezuela** Country, northern South America. Area: 353,841 sq mi (916,445 sq km). Population (2005 est.): 26,749,000. Capital: Caracas. About two-thirds of the people are mestizos; most of the rest are of European or African descent. Languages: Spanish (official), some 25 Indian languages. Religion: Christianity (predominantly Roman Catholic). Currency: bolívar. Mountain ranges and plains dominate Venezuela's geography. In the west, a northeastern spur of the Andes Mountains rises to Bolívar Peak. The Llanos (plains) occupy one-third of the country's central region. The Orinoco

River system drains almost the entire country and has an extensive and thickly wooded delta. The highest waterfall in the world, Angel Falls, is in Venezuela. Lakes include Maracaibo and Valencia. Principal mineral resources are petroleum and natural gas. Other mineral reserves include iron, bauxite, gold, and diamonds. Industries include steel, chemicals, textiles, and oil refining. Agricultural products—notably sugar, coffee, corn, bananas, and cacao—are important. Venezuela is a republic with a unicameral legislature; its head of state and government is the president. Venezuela has been inhabited by indigenous peoples for millennia. In 1498 Christopher Columbus sighted it; European explorers named the region Venezuela (Spanish: "Little Venice") after observing local Indian houses on stilts along the shores of Lake Maracaibo. A Spanish missionary established the first European settlement at Cumana c. 1523. In 1717 it was included in the Viceroyalty of New Granada. Venezuelan Creoles led by Francisco de Miranda and Simón Bolívar spearheaded the South American independence movement, and, though Venezuelans had declared independence from Spain as early as 1797, it was not assured until the last royalist forces surrendered in 1823. Military dictators generally ruled the country from 1830 until the overthrow of Marcos Pérez Jiménez in 1958. A new constitution adopted in 1961 marked the beginning of democracy. As a founding member of OPEC (Organization of Petroleum Exporting Countries), Venezuela enjoyed relative economic prosperity from oil production during the 1970s, but its economy has remained dependent on fluctuations in the world petroleum market. The government of Hugo Chávez promulgated a new constitution in 1999, the year in which a devastating rainstorm killed thousands in and around Caracas—one of the deadliest events in Venezuelan history. Despite an increase in oil prices in the early 21st century, the country experienced great political turmoil.

Venice *Italian* **Venezia** \vā-'nēt-syä\ City (pop., 2004 est.: 271,663), capital of Veneto region, northern Italy. Built on a lagoon, Venice encompasses some 118 islands, the whole 90-mi (145-km) perimeter of the lagoon, and two industrial mainland boroughs. Refugees from northern invasions of the mainland founded settlements in the 5th century AD that were built uniquely on islands as protection against raids. Venice was a vassal of the Byzantine Empire until the 10th century. Beginning with control of a trade route to the Levant, Venice emerged from the Fourth Crusade (1202–04) as ruler of a colonial empire which included Crete, Euboea, the Cyclades, the Ionian Islands, and footholds in Morea and Epirus. In 1381 it defeated Genoa after a century-long struggle for commercial supremacy in the Levant and eastern Mediterranean. In the 15th century, with the acquisition of neighbouring regions, the Republic of Venice became an extensive Italian state. It gradually lost its eastern possessions to Ottoman Turks, with

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whom Venice fought intermittently from the 15th to the 18th century; it gave up its last hold in the Aegean in 1715. The republic dissolved and the territory was ceded to Austria in 1797. Incorporated into Napoleon's Kingdom of Italy in 1805, it was restored to Austria in 1815. A revolt against Austria (1848–49) eventually resulted in Venice being ceded to Italy in 1866. It suffered little damage during World War II, but flooding along its many miles of canals caused severe damage in 1966. The waters of the lagoon rise and flood the city on a regular basis, complicating efforts to preserve its architecture, which includes Italian, Arabic, Byzantine, and Renaissance forms. There are some 450 palaces and homes of major historic importance in Venice. Notable among its 400 bridges is the Bridge of Sighs (built c. 800) and among its churches St. Mark's Basilica. Most of the city's workers find employment in tourism and related industries, though Venice also plays a key market role within the vibrant economic system of the Veneto region.

Venice, Gulf of Northern section of the Adriatic Sea. It extends eastward for 60 mi (95 km) from the Po River delta, Italy, to the coast of Istria. Marshes, lagoons, and sandspits border the gulf's shores as far as Trieste, Italy. A northeast wind, called the bora, causes rough seas and creates shipping hazards in the gulf.

Venice, Peace of (1177) Agreement in which Holy Roman Emperor Frederick I Barbarossa acknowledged Alexander III as the true pope. Frederick's decisive defeat by the Lombard League at the Battle of Legnano (1176) had obliged him to abandon his Italian campaign and sign a truce. In the Peace of Venice, Frederick agreed to withdraw support from the antipope and to restore church property he had seized. He received the kiss of peace from the pope in front of St. Mark's.

Venice, Treaty of (1201) Treaty negotiated between crusaders in the Fourth Crusade and Enrico Dandolo of Venice to provide transport for 85,000 marks. The crusaders' failure to fulfill their monetary obligation was a major factor in the diversion of the crusade to Zara and Constantinople.

Venice Biennale \ˌbē-en-ˈnä-lā\ International art exhibition held in the Castello district of Venice every two years and juried by an international committee. It was founded in 1895 as the International Exhibition of Art of the City of Venice to promote "the most noble activities of the modern spirit without distinction of country." The first Biennale, which achieved worldwide prestige, included artists from 16 nations; the committee included Edward Burne-Jones, Gustave Moreau, and Pierre Puvis de Chavannes. After World War II it became the leading showplace for the international avant-garde. Usually held in the summer months, it attracts many tourists and visitors.

Venizélos \ˌven-yə-ˈze-lôs**, Eleuthérios (Kyriakos)** (b. Aug. 23, 1864, Mourniés, Crete, Ottoman Empire—d. March 18, 1936, Paris, France) Greek revolutionary leader. Son of a Cretan revolutionary, he served in the government of autonomous Crete as minister of justice (1899–1901), then led an insurrection that forced the autocratic high commissioner to leave Crete (1905). In Athens, he led the Military League opposition group and effected the union of Crete with Greece. As premier of Greece (1910–15) he helped form the Balkan League. During the Balkan Wars, his policies doubled Greece's area and population. In World War I he supported the Allies; he resigned when opposed by the pro-German King Constantine, led the opposition that forced the king into exile, and again became premier (1917–20), aligning Greece with the Allies and successfully protecting Greek interests at the Paris Peace Conference. He served three more stints as premier (1924, 1928–32, 1933), but he was forced into exile when the monarchy was restored in 1935.

venom Poison secreted by an animal, produced by specialized glands often associated with spines, teeth, or stings. It may be primarily for paralyzing or killing prey or may be purely defensive. Some venoms also function as digestive fluids. Their effects can range from localized skin inflammation to almost immediate death; they include nervous-system excitation (cramps, vomiting, convulsions) or depression (paralysis, respiratory or cardiac depression or arrest), hemorrhage, red-blood-cell breakdown, circulatory collapse, and allergic reactions (including hives and inflammation). Many major groups of animals contain venomous species: snakes (cobras, mambas, vipers, pit vipers); fish (stingrays, spiny sharks, certain catfish, puffers); lizards (Gila monsters, beaded lizards); scorpions; spiders (black widow spiders, brown recluse spiders); social insects (bees, wasps, some ants); and marine invertebrates (sea anemones, fire corals, jellyfish, sea urchins). See also antidote.

ventilating Natural or mechanically induced movement of fresh air into or through an enclosed space. The hazards of poor ventilation were not clearly understood until the early 20th century. Expired air may be laden with odors, heat, gases, or dust. Mechanical ventilation systems typically include a fan and filter to remove particles. A mechanically powered inlet of air, when combined with a natural exhaust, tends to cause a slight positive pressure within an enclosed space, so that the air leakage is outward. A mechanical exhaust with a natural air inlet causes a slight negative pressure, so that air moves inward. Such systems are often used to confine fumes or smells to a particular area of a building (e.g., laboratories, kitchens, bathrooms) and exhaust them to the outside.

ventricular fibrillation Uncoordinated contraction of the muscle fibres of the heart's ventricles (see arrhythmia). Causes include heart attack, electric shock, anoxia, abnormally high potassium or low calcium in the blood, and digitalis or epinephrine poisoning (see drug poisoning). Death soon follows if circulation is not restored with electric shocks (defibrillation) or drugs supplemented by chest compressions (as in cardiopulmonary resuscitation). See also atrial fibrillation.

ventriloquism Art of "throwing" one's voice in such a way that the sound seems to come from a source other than the speaker. A dummy or doll is commonly used to assist in the deception, with the ventriloquist moving the dummy's mouth while speaking through closed lips. Ventriloquists date from ancient times and include Eurycles of Athens. Such peoples as the Maoris, Zulus, and Eskimos are adept ventriloquists. The art was long a feature of puppet shows as well as of variety entertainment such as vaudeville. Notable ventriloquists included Edgar Bergen in the U.S. and Robert Lamouret in France.

Ventris \ˈven-trəs**, Michael (George Francis)** (b. July 12, 1922, Wheathampstead, Hertfordshire, Eng.—d. Sept. 6, 1956, near Hatfield, Hertfordshire) British architect and cryptographer. At age 14 he heard a lecture on the continuing mystery of Linear B script (see Linear A and Linear B) and resolved to decipher it. In 1952 he determined that Linear B was Greek in its oldest known form, dating from c. 1400–1200 BC. He collaborated with John Chadwick (1920–98) on *Documents in Mycenaean Greek* (1956), published a few weeks after his own death in an auto accident.

Venturi, Robert (Charles) (b. June 25, 1925, Philadelphia, Pa., U.S.) U.S. architect. He studied at Princeton University and in Rome at the American Academy. After working with Eero Saarinen and Louis Kahn, he formed a partnership with his wife, Denise Scott Brown, and John Rauch. His philosophy, set forth in the influential books *Complexity and Contradiction in Architecture* (1966) and *Learning from Las Vegas* (1972), called for openness to the multiple influences of historical tradition, ordinary commercial architecture, and Pop art. He had such a profound impact on younger architects who were beginning to find similar constraints and limitations in the Modernist architectural aesthetic, that he became the unofficial dean of the postmodern movement in architecture. His buildings often exhibit ironic humour. Important commissions include buildings for Princeton and the University of Pennsylvania, the Seattle Art Museum (1985–91), and the Sainsbury Wing of London's National Gallery (1986–91). He won the 1991 Pritzker Architecture Prize.

venturi \ven-ˈtůr-ē\ **tube** Short pipe with a constricted inner surface, used to measure fluid flows and as a pump. The effects of constricted channels on fluid flow were first investigated by Giovanni Battista Venturi (1746–1822), but it was Clemens Herschel (1842–1930) who devised the instrument in 1888. Fluid passing through the tube speeds up as it enters the tube's narrow throat, and the pressure drops. There are countless applications for the principle, including the carburetor, in which air flows through a venturi channel at whose throat gasoline vapour enters through an opening, drawn in by the low pressure. The pressure differential can also be used to measure fluid flow (see flow meter).

venue In law, the place or county in which the events giving rise to a legal action take place and from which a jury may be drawn to try the case. Venue statutes usually specify that a trial must take place in the district that has jurisdiction over the matter. The grounds for a change of venue are also specified; they include fear of biased jurors due to media coverage, danger of violence, and racial prejudice.

Venus Roman goddess of cultivated fields and gardens, later associated with Aphrodite. She was the daughter of Jupiter and Dione, the wife of Vulcan, and the mother of Cupid. She was famous for her romantic intrigues and affairs with both gods and mortals, and she became asso-

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ciated with many aspects of femininity. The planet Venus, originally the star of Ishtar, came to be named for Venus through her association with Ishtar. She has been a favourite subject in art since ancient times, notably in the statue known as *Venus de Milo* (c. 150 BC)and in Sandro Botticelli's painting *The Birth of Venus* (c. 1485).

Venus Second major planet from the Sun. Named for the Roman goddess, Venus is, after the Moon, the most brilliant natural object in the night sky. Venus comes closer to Earth—about 26 million mi (42 million km)—than any other planet. Its orbit around the Sun is nearly circular at a distance of about 67 million mi (108 million km) and takes 225 days; its rotation, in retrograde motion, takes even longer (243 days). As viewed from Earth, Venus undergoes phase changes similar to the Moon's, going through one cycle of phases in 584 days. It is seen only near sunrise or sunset and has long been known as both the morning star and the evening star. Venus is a near twin of Earth in size and mass but is completely enveloped by thick clouds of concentrated sulfuric acid droplets. Its surface gravity is about 90% that of Earth. Its atmosphere is over 96% carbon dioxide, with a pressure about 95 times Earth's. The dense atmosphere and thick cloud layers trap incoming solar energy so efficiently that Venus has the highest surface temperature of any of the Sun's planets, more than 860 °F (460 °C). Radar imaging indicates that the surface is dry and rocky, consisting mostly of gently rolling plains, broad depressions, and two large elevated regions analogous to continents on Earth; Venus also has impact craters, extensive lava fields, and massive shield volcanos. The interior is thought to be similar to that of Earth, with a metal core, a dense rocky mantle, and a less-dense rocky crust. Unlike Earth, Venus has no intrinsic magnetic field.

Venus's-flytrap *or* **Venus flytrap** Flowering perennial plant (*Dionaea muscipula*), sole member of its genus, in the sundew family, notable for its unusual habit of catching and eating insects and other small animals (see carnivorous plant). Native to a small region of North and South Carolina, it is common in damp, mossy areas. Growing from a bulblike rootstock, the plant bears hinged leaves with spiny teeth along their margins and a round cluster of small white flowers at the tip of an erect stem 8–12 in. (20–30 cm) tall. When an insect alights on a leaf and stimulates its sensitive hairs, the leaf snaps shut in about half a second. Leaf glands secrete a red sap that digests the insect's body and gives the entire leaf a red, flowerlike appearance. After 10 days of digestion, the leaf reopens. The trap dies after capturing three or four insects.

Venus's-flytrap (*Dionaea muscipula*)
JACK DERMID

Veracruz \ˌver-ə-ˈkrüz\ *in full* **Veracruz Llave** City (pop., 2000: 411,582) and port on the Gulf of Mexico, east-central Veracruz state, east-central Mexico. Hernán Cortés founded La Villa Rica de la Veracruz as the first Mexican municipality in 1519, but the site was twice abandoned because of its unhealthy conditions; the present city dates from c. 1600. As the chief link between colonial Mexico and Spain, Veracruz prospered as a port and became the most "Spanish" of Mexican cities. It was attacked and captured repeatedly, first by privateers, then by French and U.S. forces (see Veracruz incident). It was renamed Veracruz Llave in honour of Gen. Ignacio de la Llave, governor of Veracruz state (1857–60). Both the 1857 and 1917 Mexican constitutions were proclaimed there. A revolt against Pres. Francisco Madero occurred there in 1912. It is one of Mexico's chief seaports and a commercial centre for the Gulf coast.

Veracruz State (pop., 2000: 6,908,975), east-central Mexico. Bordering the Gulf of Mexico, it occupies 27,683 sq mi (71,699 sq km); its capital is Jalapa. The state's low, sandy gulf area rises inland to a central plateau, where the volcano Citlaltépetl, Mexico's highest peak, reaches 18,406 ft (5,610 m) high. The area was inhabited by pre-Columbian cultures, including the Olmec. The first European landing was made by Hernán Cortés in 1519. A state since 1824, Veracruz has more than one-fourth of Mexico's petroleum reserves and several of the country's refineries. Its economy is supplemented by agriculture, forestry products, and manufacturing.

Veracruz incident (1914) Occupation of Veracruz, Mex., by U.S. marines. In April 1914, after the crew of a U.S. ship that had anchored in Tampico was briefly detained for landing in a forbidden area, Pres. Woodrow Wilson demanded an apology from the Mexican government. When Mexican president Victoriano Huerta refused, Wilson sent a fleet to the Gulf of Mexico. After learning of an arms shipment to Huerta from Germany, Wilson ordered the port of Veracruz seized. By July the invasion had caused 200 Mexican casualties and had enabled the rival Constitutionalists under Venustiano Carranza (who had denounced the seizure by the U.S.) to take over the government. Huerta was forced into exile, and the U.S. marines were withdrawn on November 14.

Veralden-radien \ˈvā-ä-ˌräl-dān-ˈrä-dē-en\ Deity believed by the Sami to be the closest to the starry heaven. Because he is associated with the pillar supporting the heavens, he is also responsible for the continuance of life. He imparts the souls of unborn children to Madderakka and takes the souls of the departed to the realm of the dead. He was also the subject of a phallic cult; each year the genitalia and blood of a bull reindeer were smeared on his statue. His worship has many Scandinavian features, which has led scholars to seek his origin in Norse mythology.

verbena \vər-ˈbē-nə\ Plant genus (*Verbena*) that contains about 250 species, almost all of them native to the New World tropics and subtropics. Two species are indigenous to the Old World. The familiar garden verbena (*V. hortensis*, or *V. hybrida*) is a creeping plant that has square stems and bears flat heads of phloxlike flowers, in a wide range of colours. Many U.S. species of *Verbena* are low-growing, small-flowered, somewhat weedy plants more commonly called vervains. The shrub lemon verbena (*Aloysia triphylla*), notable for its fragrant oil, is a member of the verbena, or vervain, family (family Verbenaceae), which contains more than 2,600 species in about 100 genera. Members of the family have opposite or whorled leaves that are usually undivided. The flowers, in spikes or clusters, usually consist of a tube flaring into four or five almost equally cut lobes. The family also includes teak.

Vercingetorix \ˌvər-sən-ˈje-tə-ˌriks\ (d. 46 BC) Chieftain of the Gallic tribe of the Arverni. Julius Caesar had almost subjugated Gaul (see Gallic Wars) when Vercingetorix, acclaimed king of his people, led the Gauls against him (52 BC), using guerrilla tactics and picking battle sites favourable to his own forces. After winning a major victory at Gergovia, his later attack on the Roman army failed; besieged at Alesia, he was forced to surrender. Taken to Rome in chains, he was displayed in Caesar's triumph and executed six years later.

Verdi \ˈver-dē**, Giuseppe (Fortunato Francesco)** (b. Oct. 9/10, 1813, Roncole, near Busseto, duchy of Parma—d. Jan. 27, 1901, Milan, Italy) Italian composer. He was the son of an innkeeper, and he showed talent early. While earning a living as an organist, he began to write operas in Milan; in 1839 his *Oberto* was successfully performed at La Scala, and it initiated Verdi's long association with the publisher Giulio Ricordi. His next opera, *Un giorno di regno* (1840), was a failure. Much worse, Verdi's two young daughters and his wife died. He overcame his despair by composing *Nabucco* (1842); it was a sensational success and was followed by the equally successful *I Lombardi* (1843). For the rest of the decade he wrote a hit opera every year. Rejecting the prevailing structure of Italian opera—a patchwork of open-ended scenes and inserted arias, duets, and trios—he began conceiving of an opera as a series of integrated scenes, then as unified acts. Specializing in stories in which people's private and public lives come into conflict, he produced a series of masterworks, including *Rigoletto* (1851), *Il trovatore* (1853), *La traviata* (1853), *Don Carlos* (1867), and *Aïda* (1871). A fervent nationalist, he was regarded as a great national figure. After composing his *Requiem* (1874), he retired, but when Ricordi brought him together with the poet and composer Arrigo Boito, initially to revise *Simon Boccanegra*, their mutual esteem led to the two great operas of Verdi's old age, *Otello* (1886) and *Falstaff* (1890).

Verdigris \ˈvər-də-grəs\ **River** River, southeastern Kansas and northeastern Oklahoma, U.S. It rises in east-central Kansas and flows south across the Oklahoma border, emptying into the Arkansas River northeast of Muskogee, Okla. It is 350 mi (560 km) long.

Verdun \vər-ˈdən**, Battle of** (Feb. 21–July 1916) Major engagement of World War I between Germany and France. As part of its strategy of war by attrition, Germany selected the fortress of Verdun as the site it believed France would defend to the last man. After a massive bombardment, the Germans advanced with little opposition for four days before the reinforced French army under Philippe Pétain slowed their advance. For two months the hills west of the Meuse River and north of Verdun were bombarded, attacked, and counterattacked. By July, Germany, which was

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also engaged in the Battle of the Somme, had abandoned its strategy of attrition, and France gradually regained its forts and territory. The devastating losses included more than 400,000 French casualties and nearly as many German casualties.

Verdun, Treaty of (843) Treaty partitioning the Carolingian empire among the three surviving sons of Louis I (the Pious). It marked a first stage in the dissolution of Charlemagne's empire and a step toward the formation of the modern countries of western Europe. The treaty was signed following three years of civil war between the three brothers. Lothar I received the imperial title and Francia Media, which included much of Italy as well as parts of several other present-day European countries. Louis the German received Francia Orientalis, the land east of the Rhine River, and Charles II (the Bald) received Francia Occidentalis, the remainder of modern France.

Verga \'vär-gä**, Giovanni** (b. Sept. 2, 1840, Catania, Sicily—d. Jan. 27, 1922, Catania) Italian writer, the most important of the *verismo* (realist) school of novelists. Born to a family of landowners, Verga left Sicily for the mainland, where he remained until 1893. There he developed a writing style noted for its terse accuracy and intensity of feeling. His best works include the short stories of *Little Novels of Sicily* (1883), the novels *The House by the Medlar Tree* (1881) and *Mastro-Don Gesualdo* (1889), and the play *Cavalleria rusticana* (1884; "Rustic Chivalry"), which became immensely popular when it was adapted as an opera by Pietro Mascagni. His influence on the post-World War II generation of Italian Neorealist writers was particularly marked (see Neorealism).

Vergennes \ver-'zhen**, Charles Gravier, count de** (b. Dec. 28, 1719, Dijon, France—d. Feb. 13, 1787, Versailles) French statesman. As ambassador to Ottoman Turkey (1754–68), he ably defended French policies during the Seven Years' War. As Louis XVI's minister of foreign affairs (1774–87), he advocated French financial and military support for the colonists in the American Revolution, concluded an alliance with them (1778), and helped negotiate the Treaty of Paris (1783). He also worked to establish a stable balance of power in Europe by mediating the peace in the War of the Bavarian Succession.

Verghina *or* **Vergina** \ver-'gē-nä\ Archaeological site and ancient capital of Macedonia, northern Greece. Built on a site in use from the Stone Age, it was first called Balla. The palace of Palatista, partly destroyed by fire, dates from the reign of Antigonus III Doson (c. 263–221 BC). An Iron Age cemetery that dates from the 10th–7th centuries BC is near the palace. The 4th-century-BC royal tomb of Philip II of Macedon also is at Verghina.

Vergil See Virgil

Verhaeren \ver-'hä-ren, ver-ä-'ren**, Émile** (b. May 21, 1855, Saint Amand lez-Puers, Belg.—d. Nov. 27, 1916, Rouen, France) Belgian poet. He wrote in French, producing more than 30 collections of poetry outstanding for its strength and range. His first book, *Les Flamandes* (1883), contains violently naturalistic poems. Later he began to show a growing concern for social problems. His major works include *The Sunlit Hours* (1896), *The Evening Hours* (1911), and *Belgium's Agony* (1915). His three main themes are Flanders, human energy, and his tender, understanding love for his wife. He also published plays and books on art. He was one of the group in Brussels who brought about the literary and artistic renaissance of the 1890s.

verifiability principle Criterion of meaningfulness associated with logical positivism and the Vienna Circle. Moritz Schlick's formulation "The meaning of a [declarative sentence] is the method of its verification" was close to the view held in pragmatism, and later in operationalism, that an assertion has factual meaning only if there is a difference in principle, open to test by observation, between the affirmation and the denial of the assertion. Thus, the statements of ethics, metaphysics, religion, and aesthetics were held to be meaningless. The verifiability criterion of meaningfulness was in part inspired by Albert Einstein's abandonment of the ether hypothesis and the notion of absolute simultaneity.

Verlaine \ver-'len**, Paul (-Marie)** (b. March 30, 1844, Metz, France—d. Jan. 8, 1896, Paris) French lyric poet. After entering the civil service, he was first associated with the Parnassian poets, contributing to the first volume of the anthology *Le Parnasse contemporain* (1866). His early collections, *Poèmes saturniens* (1866), *Fêtes galantes* (1869), *La Bonne chanson* (1870), and *Romances sans paroles* (1874), show the intense lyricism and musicality that would mark all his verse. His marriage was shattered by his infatuation with Arthur Rimbaud, and the two scandalized Paris with their behaviour in 1872–73. While in prison in Belgium (1873–75) for shooting Rimbaud when the latter threatened to leave him, he converted to Catholicism and probably composed the famous "Art poétique," adopted in 1882 by the poets of the Symbolist movement. *Sagesse* (1880) expresses his religious faith and his emotional odyssey. He later taught French and English; he spent his late years in poverty, but just before his death he was sponsored for a major international lecture tour. His *Les Poètes maudits* (1884; "The Accursed Poets") consists of short biographical studies of six poets, including Stéphane Mallarmé and Rimbaud. He is regarded as the third great member (with Charles Baudelaire and Mallarmé) of the so-called Decadents.

Vermeer \vər-'mer, vər-'mir**, Johannes** (b. Oct. 31, 1632, Delft, Neth.—d. Dec. 15, 1675, Delft) Dutch painter. His parents were tavern keepers. He twice served as head of the Delft artists' guild but seems to have depended on his activities as an art dealer to support his family. He painted mainly interior genre subjects, depicting members of aristocratic and upper-middle-class society. About half of these paintings show solitary figures of women absorbed in some ordinary, everyday activity. His interiors combine a microscopic observation of objects with a meticulous depiction of the gradations of daylight on varied shapes and surfaces. His masterpieces (none dated) include *View of Delft*, *Young Woman Reading a Letter*, and *Allegory of Painting*, his most symbolically complex work. He manages to be unique within a typically Dutch genre. Few foreign influences can be sensed in his work. His work was not widely appreciated in his own time, and he remained in obscurity until 1866, when Théophile Thoré celebrated his work and attributed 76 paintings to him; later authorities have reduced the number to between 30 and 35, while proclaiming him one of the greatest painters of all time.

Vermont State (pop., 2000: 608,827), northeastern U.S. One of the New England states, it covers 9,614 sq mi (24,900 sq km); its capital is Montpelier. On the north, Vermont borders Quebec, Can., on the south, Massachusetts, and on the west, New York. From the Canadian to the Massachusetts border, the Connecticut River separates Vermont from New Hampshire on the east. The Green Mountains extend through the centre of Vermont. The highest point is Mount Mansfield, at 4,393 ft (1,339 m). Most of the rivers drain into Lake Champlain. Settled originally by Abenaki Indians, the region was explored by Samuel de Champlain, who in 1609 discovered the lake that now bears his name. The French established the first permanent European settlement in 1666 on Isle La Motte. Both the Dutch and the British established settlements in the 18th century, but the area fell exclusively to the British in 1763. Disputes arose between New York and New Hampshire concerning jurisdiction of the area; New Hampshire had awarded grants to settlers. In 1770 Ethan Allen organized the Green Mountain Boys to repel encroachers from western New York. In 1775, at the start of the American Revolution, Allen and his group, fighting for the colonies, captured Fort Ticonderoga from the British. Vermonters created an independent republic in 1777, and in 1791 it became the 14th U.S. state. In 1864, during the American Civil War, it was the site of the only action north of Pennsylvania when a band of Confederates raided St. Albans from Canada. Dairying and the mining of granite and marble contribute to the economy. In the 1930s the first ski runs were built, and by the 1960s a winter tourist industry had developed.

vernacular architecture Common domestic architecture of a region, usually far simpler than what the technology of the time is capable of maintaining. In highly industrialized countries such as the U.S., for example, barns are still being built according to a design employed in Europe in the 1st millennium BC. Vernacular structures are characterized by inexpensive materials and straightforwardly utilitarian design.

Verne, Jules (b. Feb. 8, 1828, Nantes, France—d. March 24, 1905, Amiens) French writer. He studied law then worked as a stockbroker while writing plays and stories. The first of his romantic adventures (*voyages extraordinaires*), *Five Weeks in a Balloon* (1863), was highly successful. His subsequent *voyages*—with increasingly fantastic yet carefully conceived scientific wonders that often anticipated 20th-century technological achievements—include *A Journey to the Centre of the Earth* (1864), *Twenty Thousand Leagues Under the Sea* (1870), and *Around the World in Eighty Days* (1873). Verne's work shaped the entire development of science fiction.

Vernet \ver-'nā**, (Claude-) Joseph** (b. Aug. 14, 1714, Avignon, France—d. Dec. 3, 1789, Paris) French painter. Son of a decorative

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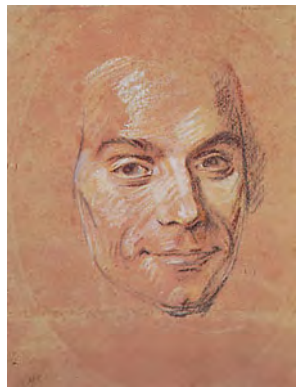
painter, he catered to a new taste for idealized, somewhat sentimentalized landscapes. His shipwrecks, sunsets, and conflagrations reveal a subtle observation of light and atmosphere. His series of 15 *Ports of France* (1754–65), his finest works, constitute a remarkable record of 18th-century life. His son Carle (1758–1836) produced vast battle scenes for Napoleon, but his real talent was for intimate genre scenes and drawing. His long series of fashionable studies, often satirizing contemporary manners and costume, were widely reproduced as engravings. After the restoration of the monarchy he became court painter to Louis XVIII. Carle's son Horace (1789–1863) developed a remarkable facility for working on a grand scale and became one of France's most important military painters.



"The Mask of Joseph Vernet," chalk and pastel portrait by Maurice-Quentin de La Tour; in the Musée des Beaux-Arts, Dijon, Fr.
LAUROS—GIRAUDON FROM ART RESOURCE/EB INC.

vernier \'vər-nē-ər\ *or* **vernier caliper** Instrument for making very accurate linear or angular measurements. Introduced in 1631 by Pierre Vernier (c. 1580–1637), it uses two graduated scales: a main scale similar to that on a ruler, and a specially graduated scale, the vernier, that slides parallel to the main scale and enables readings to be made to a fraction of a division on the main scale.

Verona City (pop., 2001 prelim.: 243,474), northern Italy. Located on the Adige River, it became a Roman colony in 89 BC and was the birthplace of the poet Catullus. It was captured by the Goths after the fall of the Roman Empire and was the site of Odoacer's defeat by the Ostrogothic king Theodoric in 489. It was occupied by Charlemagne in 774. Verona came under the della Scala family (1260–1387), the era recalled in William Shakespeare's *Romeo and Juliet*. It passed in 1405 to Venice, which held it almost continuously until 1797, when it was ceded to Austria. It became part of the Kingdom of Italy in 1866. It is noted for its ancient Roman amphitheatre (1st century AD), now used for opera, and for Romanesque and Gothic buildings.

Verona, Congress of (1822) Last of the meetings held by the Quadruple Alliance (Russia, Prussia, Austria, and Britain). The congress met in Verona, Italy, to consider a request by the alliance's ally, France, to intervene in the revolutionary situation in Spain. The congress agreed to support France if it were attacked by Spain and authorized a French expedition into Spain. However, Britain threatened to use its sea power to prevent interference with the revolts in Spanish America. Increasing discord caused a breakdown in the congress system begun by the alliance in 1815.

Veronese \ˌver-ə-'nā-sē**, Paolo** *orig.* **Paolo Caliari** (b. 1528, Verona, Republic of Venice—d. April 9, 1588, Venice) Italian painter. Son of a stonecutter from Verona, he was apprenticed at 13 to a painter. After 1553, when he received the first of many commissions in Venice, he became a major painter of the 16th-century Venetian school, a group of Renaissance artists known for their splendid use of colour and pageant-like compositions. His first works in Venice, ceiling paintings for the Doges' Palace, employ skillful foreshortenings that make figures appear to be floating in space. He decorated the villas and palaces of the Venetian nobility and received many commissions for frescoes, altarpieces, and devotional paintings, including numerous "suppers" (e.g., *The Pilgrims of Emmaus* and *Feast in the House of the Pharisees*) that allowed him to compose large groups of figures in complex Renaissance architectural settings. In decorating a villa built by Andrea Palladio at Maser (c. 1561), he brilliantly interpreted its architectural structure, breaking through the walls with illusionistic landscapes and opening the ceilings to blue skies with figures from Classical mythology. Whimsical details in his *Last Supper* (commissioned 1573) caused him to be summoned before the Inquisition. Painters from the 16th century on were inspired by his use of colour to express exuberance as well as to model form.

Verrazzano \ˌver-ə-'zä-nō**, Giovanni da** (b. 1485, Tuscany, Italy—d. 1528, Lesser Antilles) Italian navigator and explorer for France. Educated in Florence, he moved to Dieppe, France, where he entered the maritime service. In 1524 he was sent to find a westward passage to Asia and reached North America. He explored the eastern coast from Cape Fear northward and became the first European to explore the sites of present-day New York Harbor and Narragansett Bay. He sailed along the coast to Newfoundland, then returned to France. He later led expeditions to Brazil (1527) and to the Caribbean, where he was killed and eaten by cannibals.

Verres \'ver-ˌēz**, Gaius** (b. c. 115—d. 43 BC) Roman magistrate. As quaestor, Verres embezzled funds. He helped the governor of Cilicia, Gaius Dolabella, plunder the province (80–78), and then he helped convict Dolabella at Rome. He became praetor by bribery and abused his power. As governor of Sicily (73–71) his corruption was extreme; he was prosecuted so effectively by Cicero (70) that his lawyer had no reply. He fled into exile but was murdered, perhaps at the orders of Mark Antony, who then acquired his art collection.

Verrocchio \və-'rō-kē-ˌō**, Andrea del** (b. 1435, Florence—d. 1488, Venice) Italian sculptor and painter. Little is certain about his early life. His most important works were executed in his final two decades under the patronage of the Medici in his native Florence. His reputation as a master spread early, and many well-known artists studied at his studio, including Leonardo da Vinci and Perugino; the young Leonardo probably painted an angel and part of the distant landscape in Verrocchio's *Baptism of Christ* (c. 1470). Verrocchio's reputation as one of the great relief sculptors of the Renaissance was established with his cenotaph in the cathedral at Pistoia; while it remained unfinished at his death and was later changed by others, the relief's arrangement of figures into a dramatically unified composition anticipates the Baroque sculpture of the 17th century. His bronze statue of the military officer Bartolomeo Colleoni (commissioned 1483, erected in Venice 1496) is one of the greatest equestrian statues of the Renaissance.

Bartolomeo Colleoni, bronze statue by Andrea del Verrocchio, 1483–88; in Campo di Santi Giovanni e Paolo, Venice.
BROGI—ALINARI FROM ART RESOURCE

vers de société \ˌver-də-sȯs-yā-'tā\ *French* **"society verse"** Witty, typically ironic, light verse, written with polish and ease of expression to amuse a sophisticated audience. It has flourished in cultured societies, particularly in court circles and literary salons, from the time of Anacreon (6th century BC). Trivial subjects are treated in an intimate, witty manner, and even when social issues form the theme, the light mood prevails. The poetry of Ogden Nash, with its theme of self-ironic adult helplessness, is a 20th-century example.

Versace, Gianni (b. Dec. 2, 1946, Reggio Calabria, Italy—d. July 15, 1997, Miami Beach, Fla., U.S.) Italian fashion designer. He was born to a dressmaker mother. After working for several Italian ateliers in Milan, in 1978 Versace established his own company, Gianni Versace SpA. Throughout the 1980s and '90s he built a fashion empire by producing ensembles that oozed sensuality and sexuality. He staged his seasonal fashion shows like rock concerts at his lavish design headquarters in Milan. On July 15, 1997, Versace was shot and killed on the front steps of his Miami Beach, Fla., home, allegedly by the serial killer Andrew Cunanan. At the time of his death, many believed that the designer's 25-year career was at a peak.

Versailles \ver-'sī**, Palace of** Baroque palace southwest of Paris built chiefly under Louis XIV. It was the principal residence of the French kings and the seat of government from 1682 to 1789, with some 1,000 courtiers and 4,000 attendants residing there. Originally a hunting lodge, it was enlarged by Louis XIII and Louis XIV. Louis Le Vau (1612–70), with Charles Le Brun and André Le Nôtre, began work on the palace in the 1660s. A masterpiece of formal grandeur intended as the visible expression of the glory of France, Versailles became the palatial ideal throughout Europe and the Americas. Le Nôtre's inventive arrangement of earth forms, plantings, and fountains created vistas, terraces, formal gardens, and wooded areas that celebrated the delights of both open and intimate space. After Le Vau's death, Jules Hardouin-Mansart (1646–1708) was

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commissioned to triple the size of the palace and built the northern and southern wings, the Orangerie, and the Grand Trianon. Later additions include the Classically restrained Petit Trianon, built 1761–64 for Louis XV and Madame de Pompadour. The first scenes of the French Revolution were enacted at Versailles, which had become a symbol of royal extravagance. In 1837 Louis-Philippe restored the palace and turned it into a museum.

Versailles, Treaty of International agreement, signed in 1919 at the Palace of Versailles, that concluded World War I. It was negotiated primarily by the U.S., Britain, and France, without participation by the war's losers. Germany was forced to accept blame for Allied losses and to pay major reparations. Its European territory was reduced by about 10%, its overseas possessions were confiscated, and its military establishment was reduced. Although some of the treaty's terms were eased in the 1920s, the bitterness it created helped to foster an environment that led to the growth of fascism in Italy and the rise of the Nazi Party in Germany. The treaty also established the League of Nations, the International Labour Organization, and the Permanent Court of International Justice (later the International Court of Justice). See also Fourteen Points.

vertebral \vər-'tē-brəl, 'vərt-ə-brəl\ **column** *or* **spinal column** *or* **spine** *or* **backbone** Flexible column extending the length of the torso. In humans, it consists of 32–34 vertebrae, with different shapes and functions in each of five regions: 7 cervical, in the neck (including the atlas and axis, modified for free movement of the skull); 12 thoracic, in the chest; 5 lumbar, in the lower back; 5 sacral (fused into the sacrum, part of the pelvic girdle); and 3 to 5 coccygeal (vestigial tailbones fused into the coccyx). The body of each vertebra is separated from its neighbours by cushioning intervertebral disks of cartilage. Behind the body is a Y-shaped vertebral (neural) arch with structures extending up and down to form joints with the adjacent vertebrae and to the back and sides to provide attachment points for muscles and ligaments. The spine supports the torso and protects the spinal cord.

vertebrate Any animal of the chordate subphylum Vertebrata, which includes the fishes, amphibians, reptiles, birds, and mammals. Vertebrates have an internal skeleton formed of cartilage, bone, or both. The skeleton consists of a backbone (vertebral column), which partly encloses a spinal cord; a skull, which encloses the brain; and usually two pairs of limbs. Nerves extending from the spinal cord and brain permeate the skin, muscles, and internal organs. The muscular system consists primarily of bilaterally paired masses attached to bones or cartilage. Skin and scales, feathers, fur, or hair cover the outer surface. See also invertebrate.

vertical integration Form of business organization in which all stages of production of a good, from the acquisition of raw materials to the retailing of the final product, are controlled by one company. A current example is the oil industry, in which a single firm commonly owns the oil wells, refines the oil, and sells gasoline at roadside stations. In horizontal integration, by contrast, a company attempts to control a single stage of production or a single industry completely, which lets it take advantage of economies of scale but results in reduced competition.

vertigo \'vər-tə-ˌgō\ Feeling that one is spinning or that one's surroundings are spinning around one, causing confusion and difficulty keeping one's balance, sometimes accompanied by nausea and vomiting. Vertigo is normal after actual spinning, since inner-ear fluid continues to move once the body has stopped, producing a mismatch between visual and internal sensations. Lack of a stable visual reference point also contributes to this effect. Other causes include concussion and abnormalities of the inner ear (e.g., labyrinthitis; see otitis), of the nerves that carry signals from it, or of the brain centers that receive them (e.g., stroke). Vertigo is often confused with a feeling of faintness (see syncope), since both are called dizziness. See also motion sickness, proprioception, spatial disorientation.

vervain See verbena

vervet monkey *or* **vervet** Any of several African races of slim, arboreal, diurnal Old World monkeys of the guenon species *Cercopithecus aethiops* and *C. pygerythrus* (family Cercopithecidae). They have large cheek pouches. The arms and legs are long, and the nonprehensile tail is longer than the head-and-body length of 12–26 in. (30–65 cm). The soft, dense fur of many species has a speckled effect and bold markings of white or bright colours. The face, chin, hands, and feet of *C. aethiops* races are black.

Verwoerd \fər-'vürt**, Hendrik (Frensch)** (b. Sept. 8, 1901, Amsterdam, Neth.—d. Sept. 6, 1966, Cape Town, S.Af.) Dutch-born South African prime minister (1958–66). He was taken to South Africa as an infant by his missionary parents. After studying at the University of Stellenbosch, he became a professor there, and in 1937 he became editor of the Afrikaner nationalist daily in Johannesburg. Appointed senator (1948) and then minister of native affairs (1950), he was responsible for much of the country's new apartheid legislation. When he became prime minister in 1958, his apartheid program was strictly enforced, and he pushed through legislation resettling blacks in reservations. His policies provoked demonstrations, sometimes violent. In 1960 white voters approved his recommendation that South Africa leave the British Commonwealth, and his dream of a republic came true. He was stabbed to death in the parliamentary chamber by a parliamentary messenger of mixed descent.

Very Large Array (VLA) Radio telescope system consisting of 27 parabolic dishes. The most powerful radio telescope in the world, it has been operated on the plains of San Agustin near Socorro, N.M., U.S., by the National Radio Astronomy Observatory since 1980. Each dish is 82 ft (25 m) in diameter and can be moved independently by transporter along rails laid out in an enormous Y pattern whose arms are about 13 mi (21 km) long. The radio signals received by the dishes are integrated by computer, so the entire array acts as a single radio antenna (an interferometer). The VLA, which has a maximum angular resolution better than a tenth of an arc second, has been responsible for producing many of the most detailed radio images of quasars; galaxies; supernovas; and the Milky Way Galaxy's nucleus.

Vesalius \və-'sā-lē-əs**, Andreas** *Flemish* **Andries van Wesel** (b. Dec. 1514, Brussels—d. June 1564, island of Zacynthus, Republic of Venice) Flemish physician. Born into a family of physicians, he studied medicine at the University of Paris. As a lecturer in surgery, he insisted on dissecting corpses himself, instead of relying on untrained assistants, to learn anatomy. Comparing his observations with ancient texts led him to question the theories of Galen, at that time still considered authoritative. Vesalius's own complete textbook of human anatomy, the momentous *De humani corporis fabrica libri septem* (1543; "Seven Books on the Structure of the Human Body"), commonly called the *Fabrica*, was the most extensive and accurate description of the human body that had ever been published.

Vesey \'vē-zē**, Denmark** (b. c. 1767, probably St. Thomas, Danish West Indies—d. July 2, 1822, Charleston, S.C., U.S.) U.S. insurrectionist. Born into slavery, he was sold to a Bermuda slaver captain, with whom he sailed on numerous voyages. They settled in Charleston, S.C., and Vesey was allowed to purchase his freedom for $600 in 1800. After reading antislavery literature, he determined to oppose the oppression of slaves. He organized city and plantation blacks (up to 9,000 by some estimates) for an uprising in which they would attack arsenals, seize arms, kill all whites, burn Charleston, and free the slaves on surrounding plantations. After a house servant warned the authorities, the insurrection was forestalled and 130 blacks were arrested; Vesey was tried and hanged with 35 others.

Vespasian \ves-'pā-zhən\ *in full* **Caesar Vespasianus Augustus** *orig.* **Titus Flavius Vespasianus** (b. Nov. 17?, AD 9, Reate, Latium—d. June 24, 79) Roman emperor (69–79), founder of the Flavian dynasty. Although of humble birth, he won military glory in Britain and was awarded a triumph by Claudius. In 63 he became proconsul of Africa. He reconquered Judaea except for Jerusalem (67–68) but stopped fighting on the death of Nero (68). After the murder of Galba, Vespasian was proclaimed emperor by the legions, while Vitellius claimed the title in Cologne; Vespasian's forces soon defeated Vitellius in Italy. Although he claimed absolute power and took every possible office for himself and his sons, he was a

Vespasian, bust found at Ostia; in the Museo Nazionale Romano, Rome
ANDERSON-ALINARI FROM ART RESOURCE/EB INC.

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popular emperor and lived simply. He increased provincial taxation to pay for the deficits incurred by Nero and the civil wars, built the Temple of Peace and began the Colosseum, and reformed the army and Praetorian Guard. He ended the Jewish war (70) and the Rhineland revolt, adding lands in Germany and Britain and pacifying Wales. He was succeeded by his son Titus.

Vespucci \ves-'pü-chē**, Amerigo** (b. 1454, Florence—d. 1512, Sevilla) Italian-born Spanish navigator and explorer of the New World. He entered the Medici family business and in 1491 was sent to Sevilla, where he helped outfit the ships for the expeditions of Christopher Columbus. By 1496 he was manager of the Sevilla agency. He took part in two (or four—the number is disputed) voyages to the New World; he was navigator on a Spanish expedition (1499–1500) that probably discovered the mouth of the Amazon River, and he led a Portuguese expedition (1501–02) that discovered Guanabara Bay (Rio de Janeiro) and the Río de la Plata. In the accounts of the voyages (published 1507), the terms America and New World were first used to describe the lands visited by Amerigo Vespucci (in Latin, Americus Vespucius). As chief navigator for the Sevilla-based Commercial House for the West Indies (from 1508), he prepared maps of newly discovered lands from data supplied by ships' captains.

Vesta In Roman religion, the goddess of the hearth, identified with the Greek Hestia. Because maintaining a hearth fire was important in ancient times, she was worshiped in every household. Her state worship was elaborate: her temple in Rome had a perpetual fire that was attended by the Vestal Virgins. The fire was officially extinguished and renewed annually on March 1st; its extinction at any other time was viewed as a portent of disaster to Rome.

Vesta (seated on the left) with Vestal Virgins, classical relief sculpture; in the Palermo Museum, Italy
COURTESY OF THE PALERMO MUSEUM, ITALY

Vestal Virgin In Roman religion, any of six priestesses, representing the daughters of the royal house, who tended the state cult of Vesta. Chosen between the ages of 6 and 10, they served for 30 years, during which time they had to remain virgins; violation of the vow of chastity was punishable by burial alive. Their duties included tending the perpetual fire in the Temple of Vesta, fetching water from a sacred spring, preparing ritual food, caring for objects in the temple's inner sanctuary, and officiating at the public worship of Vesta. They enjoyed many honours and privileges, including emancipation from their fathers' rule.

Vestris, (Marie-Jean-) Auguste (b. March 27, 1760, Paris, Fr.—d. Dec. 5, 1842, Paris) French ballet dancer. He was trained by his father, Gaétan Vestris, before making his formal debut in 1776. His dazzlingly athletic dancing set a new style of ballet. In his last years he was a revered teacher.

Vestris, Gaétan *orig.* **Gaetano Appolino Baldassare** (b. April 18, 1729, Florence, Italy—d. Sept. 23, 1808, Paris, Fr.) French ballet dancer and teacher. His style was flamboyant while respecting traditional courtly technique. Vestris later became renowned as the most distinguished teacher of his day. His most celebrated pupil was his son Auguste Vestris.

Vesuvius Active volcano, eastern side of the Bay of Naples, southern Italy. It originated about 200,000 years ago; its current height of 4,198 ft (1,280 m) has varied considerably after each of its major eruptions; in 1900 it was 4,275 ft (1,303 m) high; in 1906, 3,668 ft (1,118 m) high; and in the 1960s, 4,203 ft (1,281 m) high. The cone is half-encircled on the northern side by Mount Somma, part of the wall of a large crater in which the present cone has formed. There have been numerous destructive eruptions; in AD 79 Pompeii and Herculaneum were destroyed, and in 1631 about 3,000 people were killed. The last major eruption occurred in 1944. More than two million people live in the area of Vesuvius, whose fertile slopes are covered with vineyards and orchards.

vetch Any of about 150 species of herbaceous plants in the genus *Vicia* of the pea family (see legume). A few species are cultivated as important fodder and cover crops and as green manure. Trailing or climbing stems grow 1–4 ft (0.3–1.2 m) tall, bearing compound leaves with several pairs of leaflets. Magenta, bluish-white, white, or yellow flowers are borne singly or in clusters. The pods contain 2–10 seeds. Like other legumes, vetches add nitrogen to the soil through nitrogen fixation. See also crown vetch.

Vetch (*Vicia cracca*)
WALTER DAWN

Veterans Day U.S. holiday celebrated on November 11, honouring veterans of the U.S. armed forces and those killed in battle. Originally called Armistice Day, it began as a commemoration of the ending of World War I on Nov. 11, 1918. After World War II it was recognized as a day to pay tribute to all service members, and in 1954 it was designated as Veterans Day. It is usually observed with parades, speeches, and flowers placed on military graves and memorials. The holiday is called Remembrance Day in Canada and Remembrance Sunday (on the Sunday nearest to November 11) in Britain.

veterinary science Medical field dealing with animals and with diseases that are contagious between animals and humans. It was a medical specialty in ancient Egypt and Babylonia but went through a period of virtual nonexistence in medieval Europe before reappearing in the mid-18th century with the founding of the first veterinary schools. Veterinarians practice internal medicine, surgery, and preventive medicine, using the same techniques used on humans. Many specialize in either small animals (pets) or large ones (livestock); a few specialize in wild animals.

Viagra First oral drug for male impotence, generic name sildenafil. Before the FDA approved Viagra in 1998, impotence was treated with surgical implants, suppositories, pumps, and drugs injected into the penis. Taken as a pill shortly before sexual intercourse, Viagra selectively dilates blood vessels in the penis, improving blood flow and allowing a natural sexual response. It works in about 70% of cases; it should not be used by anyone taking nitroglycerin or with heart problems, hypotension, hypertension, recent stroke, or certain eye disorders.

viatical settlement Arrangement by which a terminally ill patient's life-insurance policy is sold to provide funds while the insured (viator) is living. The buyer (funder), usually an investment company, pays the patient a lump sum of 50–80% of the policy's face value, pays the premiums until the patient dies, and receives the death benefit. Viatical settlements (from Latin *viaticum*, "provisions for a journey") appeared in the 1980s, when people with AIDS had high medical bills and policies nominally sufficient to cover them but whose funds would not be available until they died.

vibraphone *or* **vibraharp** Percussion instrument with tuned metal bars, arranged keyboard-style like the xylophone. Felt or wool beaters are used to strike the bars, giving a soft, mellow tone quality. Each bar has a resonating tube suspended vertically below it to sustain the tone; small electrically powered spinning disks at the top of the resonators produce a vibrato effect by rapidly closing and opening the resonators. Invented c. 1920, it soon became a popular jazz instrument.

vibration Periodic back-and-forth motion (see periodic motion) of the particles of an elastic body or medium. It is usually a result of the displacement of a body from an equilibrium condition, followed by the body's response to the forces that tend to restore equilibrium. Free vibrations occur when a system is disturbed but immediately allowed to move without restraint, as when a weight suspended by a spring is pulled down and then released. Forced vibrations occur when a system is continuously driven by an external agency, as when a child's swing is pushed on each downswing. Because all systems are subject to friction, they are also subject to damping. In the example of free vibration, damping would cause the amplitudes of the spring's vibrations to diminish until eventually the system came to rest. See also resonance.

vibrio \'vib-rē-ō\ Any of a group of aquatic, comma-shaped bacteria in the family Vibrionaceae. Some species cause serious diseases in humans and other animals. They are gram-negative (see gram stain), highly capable of movement (with one to three flagella at one end), and do not

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require oxygen. Their cells are curved rods, single or strung together in S-shapes or spirals. Two species are of significance to humans: one causes CHOLERA, the other acute bacterial diarrhea.

viburnum \vī-'bər-nəm\ Any of about 200 shrubs and small trees that make up the genus *Viburnum* in the HONEYSUCKLE FAMILY, native to temperate and subtropical Eurasia and North America. Many species are cultivated for their ornamental foliage, fragrant clusters of usually white flowers, and colourful blue-black fruits. Familiar garden shrubs in this family include Chinese snowball (*V. macrocephalum* variety *sterile*) and Japanese snowball (*V. plicatum*), each with large balls of white to greenish white flowers.

Vicente \vē-'sāⁿn-tə**, Gil** (b. c. 1465, Portugal—d. 1536/37) Portuguese playwright. His first plays were produced in 1502, and for the next 34 years he acted as court dramatist and poet laureate, staging his plays to celebrate great events and religious occasions. Regarded as the founder of Portuguese drama, he wrote in both Portuguese and Spanish. His 44 extant plays reflect the change and upheaval of his era; they may be divided into religious plays, court plays, pastoral plays, popular farces, and romantic comedy. His works include *Exhortation to War* (1513), *The Forge of Love* (1524), and *The Pilgrimage of the Aggrieved* (1533).

Vichy \'vē-shē\ **France** *officially* **French State** *French* **État Français** (July 1940–September 1944) French regime in WORLD WAR II after the German defeat of France. The Franco-German armistice (June 1940) divided France into two zones: one under German military occupation and one under nominal French control (the southeastern two-fifths of the country). The National Assembly, summoned at Vichy to ratify the armistice, was persuaded by PIERRE LAVAL to grant PHILIPPE PÉTAIN authority to assume full powers in the French State. The antirepublican Vichy government collaborated with the Germans and became increasingly a tool of German policy, especially after the Germans occupied the whole of France in 1942. By early 1944 the RESISTANCE movement against the GESTAPO and Vichy militias created a period of civil war in France, and after the liberation of Paris the Vichy regime was abolished.

Vicksburg Campaign (1862–63) Engagements fought at Vicksburg, Miss., in the AMERICAN CIVIL WAR. Confederate forces held the fortified city against Union naval bombardment from the Mississippi River (1862) and attempts to attack by land. In April 1863 ULYSSES S. GRANT used the Union ships to ferry troops across the river at night. He quickly took nearby Port Gibson and Grand Gulf to prevent Confederate forces under JOSEPH JOHNSTON from aiding those in the city. Unable to take Vicksburg directly, Grant besieged the city for six weeks. On July 4 Gen. John Pemberton (1814–1881) surrendered his force of 30,000, leaving the Mississippi River completely under Union control and splitting the Confederacy in half.

Vico \'vē-kō**, Giambattista** (b. June 23, 1668, Naples—d. Jan. 23, 1744, Naples) Italian philosopher of cultural history and law. In his major work, *New Science* (1725), he attempted to combine history and the more systematic social sciences into a single science of humanity. He described human societies as passing through stages of growth and decay. The first is a "bestial" condition, from which emerges "the age of the gods," in which man is ruled by fear of the supernatural. "The age of heroes" is the consequence of alliances formed by family leaders to protect against internal dissent and external attack; in this stage, society is rigidly divided into patricians and plebeians. "The age of men" follows, as the result of class conflict in which the plebeians achieve equal rights, but this stage encounters the problems of corruption, dissolution, and a possible reversion to primitive barbarism. His work is recognized as a forerunner of CULTURAL ANTHROPOLOGY.

Victor III *orig.* **Dauferi** (b. 1027, Benevento, principality of Benevento—d. Sept. 16, 1087, Montecassino, principality of Capua; beatified July 23, 1887; feast day September 16) Pope (1086–87). As abbot of MONTE CASSINO from 1058, he promoted manuscript illumination, established a school of mosaic, and reconstructed the abbey. He served as papal vicar in southern Italy, negotiating peace between the Normans and the papacy. He was proclaimed pope against his will and was soon driven from Rome by supporters of Emperor HENRY IV and the antipope Clement III. In 1087, after briefly retiring to his abbey, Victor resumed his papal authority and promoted the reforms of his predecessor, Pope GREGORY VII. After sending an army to defeat the Saracens at Tunis (1087), he called a synod at Benevento and excommunicated Clement. He fell ill and returned to Monte Cassino, where he died.

Victor Amadeus \ˌäm-ə-'dā-əs\ **II** *Italian* **Vittorio Amedeo** (b. May 14, 1666, Turin, Savoy—d. Oct. 31, 1732, Moncalieri, near Turin) King of Sicily (1713–20) and of Sardinia (1720–30). The son of Charles Emmanuel II, he inherited his father's title as duke of Savoy in 1675 and grew up under a regency headed by his mother, who pursued a pro-French policy. In the War of the SPANISH SUCCESSION he sided with France, but in 1703 he shifted to the Habsburg side. With the French defeat at Turin (1706) he secured his position in Italy. The Treaty of UTRECHT (1713) gave him the title of king of Sicily, which he was obliged to exchange for Sardinia in 1720. As the first king of Sardinia, which also included Piedmont and Savoy, he established the foundation for the future Italian national state.

Victor Emmanuel I *Italian* **Vittorio Emanuele** (b. July 24, 1759, Turin, Kingdom of Sardinia—d. Jan. 10, 1824, Moncalieri, near Turin) King of Sardinia (1802–21). Son of Victor Amadeus III and great-grandson of VICTOR AMADEUS II, he led Sardinian forces against the French (1792–97). He became duke of Savoy and king of Sardinia in 1802 when his brother Charles Emmanuel IV abdicated. His kingdom, except for the island of Sardinia, was occupied by France (1802–14), then restored with the addition of Genoa by the Congress of VIENNA (1815). He abdicated in 1821 in favour of his brother Charles Felix (1765–1831).

Victor Emmanuel II *Italian* **Vittorio Emanuele** (b. March 14, 1820, Turin, Piedmont, Kingdom of Sardinia—d. Jan. 9, 1878, Rome, Italy) King of Sardinia (1849–61) and first king of a united Italy (1861–78). The son of CHARLES ALBERT, he took part in the war against Austria (1848) and became king when his father abdicated in 1849. Assisted by his minister CAMILLO CAVOUR, he strengthened the kingdom and supported the RISORGIMENTO movement for unity. In the war with Austria (1859–61), he commanded troops to victories in the Battles of MAGENTA and SOLFERINO. He secretly encouraged GIUSEPPE DE GARIBALDI in the conquest of Sicily and Naples and led the invasion of the Papal States. He assumed the title of king of Italy (1861) and later acquired Venetia (1866) and Rome (1870).

Victor Emmanuel II
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Victor Emmanuel III *Italian* **Vittorio Emanuele** (b. Nov. 11, 1869, Naples, Italy—d. Dec. 28, 1947, Alexandria, Egypt) King of Italy (1900–46). Son of UMBERTO I, he came suddenly to the throne on his father's assassination (1900). He accepted a Liberal cabinet and readily agreed to Italy's war against Turkey (1911–12) and entry into World War I. After the war, he failed to prevent the rise of BENITO MUSSOLINI and the fascist seizure of power, which turned him into a figurehead sovereign. In 1943, after disastrous Italian military losses and the Allied invasion of Sicily, he had Mussolini arrested and replaced by PIETRO BADOGLIO as premier. In 1944 he relinquished power to his son Umberto and, in an unsuccessful attempt to preserve the monarchy, abdicated in Umberto's favour in 1946 (see UMBERTO II). When the Italian republic was declared in 1946, father and son went into exile.

Victoria *orig.* **Alexandrina Victoria** (b. May 24, 1819, Kensington Palace, London, Eng.—d. Jan. 22, 1901, Osborne, near Cowes, Isle of Wight) Queen of the United Kingdom of Great Britain and Ireland (1837–1901) and Empress of India (from 1876). The only child of Edward, duke of Kent, she succeeded her uncle, WILLIAM IV, in 1837. She was first guided as queen by the Whig prime minister Lord MELBOURNE and then by her husband, Prince ALBERT, whom she married in 1840. Devoted to him, she accepted his decisions on all issues in the period sometimes called the "Albertine monarchy." They had nine children, through whose marriages descended many of the royal families of Europe. From 1861 Victoria deeply mourned Albert's death and thereafter made royal decisions as she believed he would have advised. She was frequently at odds with Prime Minister WILLIAM E. GLADSTONE and welcomed his replacement by BENJAMIN DISRAELI in 1874. Her reign, called the Victorian age, was marked by a period of British expansion and a restoration of dignity and

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popularity to the monarchy, as shown by her Jubilees of 1887 and 1897. She remains the longest reigning monarch in British history.

Victoria State (pop., 2001: 4,822,663), southeastern Australia. It covers an area of 87,810 sq mi (227,420 sq km); its capital is Melbourne. The state's western and northwestern parts are sandy desert and lowland, while the central and eastern parts are highlands forming the southern end of the Australian Alps. The southwestern coastal region is known as Gippsland. The Murray River forms almost the entire boundary between the state and New South Wales. Australian Aboriginal peoples had lived in the region for at least 40,000 years before contact with Europeans. Some 60 years after Capt. James Cook first sighted its coastline (1770), the area was settled by immigrants from Tasmania, who brought in their wake diseases that decimated much of the Aboriginal population. Victoria became a separate colony in 1851. In 1901 it became a state of the Commonwealth of Australia. Boosting its economy is a highly productive agricultural hinterland.

Victoria City (pop., 2001: metro. area, 311,902), capital of British Columbia, Canada. It is located on the southeastern tip of Vancouver Island, overlooking Juan de Fuca Strait. It was founded in 1843 by the Hudson's Bay Co. as a fur-trading post known as Fort Camosun; it was later renamed Fort Victoria to honour the English queen. It was selected as the capital in 1866 when Vancouver Island united with British Columbia. It is now one of the province's largest business centres and a tourist resort and retirement community. A major port, it is the Pacific headquarters of the Canadian navy.

Victoria Seaport, urban district, administrative centre of Hong Kong special administrative region, China. It lies on the northern shore of Hong Kong Island (pop., 2001: 1,335,469). It has extensive wharves and is connected to the mainland by ferry and by automobile and railway tunnels. It is the chief administrative, commercial, and cultural centre of Hong Kong and is the headquarters for numerous international banks and corporations.

Victoria Town (pop., 1997: metro. area, 24,701), capital of the Republic of Seychelles. Located on the northeastern coast of Mahé Island in the Indian Ocean, it is the only port of the archipelago and the only town of any size in Seychelles. It is the country's business and cultural centre.

Victoria, Lake *or* **Victoria Nyanza** Largest lake in Africa and chief reservoir of the Nile River, east-central Africa. The southern half lies in Tanzania, the northern half in Uganda; it borders Kenya in the northeast. With an area of 26,828 sq mi (69,484 sq km), it is the second largest freshwater lake in the world (after Lake Superior in North America). It is about 210 mi (337 km) long, 150 mi (240 km) wide, and up to 270 ft (82 m) deep. Though the Kagera River is its largest tributary, the most important source of water for the lake is rainfall. Its only outlet is the Victoria Nile. John Hanning Speke, searching for the source of the Nile in 1858, was the first European to sight it. He named it for Queen Victoria; the Arabs had called it Ukerewe. Henry Morton Stanley circumnavigated it in 1875. It became a reservoir when the water level was raised after completion of Owen Falls Dam in 1954.

Victoria, Tomás Luis de (b. c. 1548, near Avila, Spain—d. Aug. 27, 1611, Madrid) Spanish composer. He went to Rome c. 1565 as an organist and singer, and he may have studied with Giovanni Pierluigi da Palestrina, eventually becoming kapellmeister for a Jesuit congregation (1573–77). Ordained a priest (1575), he was associated with St. Philip Neri's group (1578–85). During this time he published his books of motets, masses, Magnificats, and hymns. In 1587 he returned to Spain as chaplain to the dowager empress Maria, in whose convent he served as organist and choirmaster until his death. He wrote 21 masses (including a *Pope Marcellus Mass*), several Magnificats, and 44 motets (including *O magnum mysterium*). His music is mystical, impressive, and moving, and he was renowned as the greatest Spanish composer of the Renaissance.

Victoria, University of Public university in Victoria, British Columbia, Canada, founded in 1903. It has faculties of arts and sciences, education, engineering, fine arts, graduate studies, human and social development, and law, as well as schools of business, music, nursing, and other specializations.

Victoria and Albert Museum Museum of decorative arts in London. It was conceived by Prince Albert as a way to improve the standards of British design by making the finest models available for study. The core collection, consisting of objects purchased at the 1851 Crystal Palace exhibition, was originally called the Museum of Ornamental Art and was opened by Queen Victoria in 1857. A new building was later designed by Sir Aston Webb, and the museum was renamed when Victoria laid the cornerstone in 1899; it was opened to the public by Edward VII in 1909. It houses vast collections of European sculpture, ceramics, furniture, metalwork, jewelry, textiles, and musical instruments from medieval times to the present; remarkable Chinese ceramics, jade, and sculpture; the premier collection of Italian Renaissance sculpture outside Italy; and the outstanding national collection of British watercolours, miniatures, prints, and drawings. It is regarded as the world's greatest decorative-arts museum. Its branch museums include the Bethnal Green Museum of Childhood, the Theatre Museum, and the Wellington Museum.

Victoria Desert See Great Victoria Desert

Victoria Falls Waterfall, at the border between Zambia and Zimbabwe. Approximately twice as wide and twice as deep as Niagara Falls, the falls span the entire breadth of the Zambezi River at one of its widest points (more than 5,500 ft [1,700 m]). There the river plunges over a precipice, split by islands and promontories, to a drop of 355 ft (108 m). Two national parks, Victoria Falls in Zimbabwe and Mosi-oa-Tunya in Zambia, are adjacent to the falls. Victoria Falls was designated a World Heritage site in 1989. The first European sighting of the falls was in 1855 by David Livingstone, who named them after Queen Victoria.

Victoria Falls See Iguazú Falls

Victoria Island Second largest island of the Arctic Archipelago, Canada. About 320 mi (515 km) long and 170–370 mi (270–600 km) wide, it has an area of 83,896 sq mi (217,291 sq km). Discovered in 1838 by Thomas Simpson, it was named for Queen Victoria and was first explored by John Rae in 1851. It is divided administratively between the Northwest Territories and the territory of Nunavut.

Victoria Nile River that forms the upper section of the Nile River. Some 260 mi (420 km) long, it issues from the northern end of Lake Victoria, then flows over the Owen Falls Dam, through Lake Kyoga, and over Kabalega Falls (118 ft [36 m]) before entering the northeastern corner of Lake Albert. It is about 300 mi (480 km) long.

Victoria River Longest river in Northern Territory, Australia. The Victoria River flows northwest for about 350 mi (560 km) to enter the Joseph Bonaparte Gulf of the Timor Sea. Its last 100 mi (160 km) are tidal. Captain J.C. Wickham of HMS *Beagle* reached the river in 1839 and named it in honour of Queen Victoria.

Victoria Strait Channel of the Arctic Ocean. It is located between southeastern Victoria Island and King William Island, off the northern Canada mainland in Nunavut. At about 100 mi (160 km) long and from 50–80 mi (80–130 km) wide, it connects Queen Maud Gulf with McClintock Channel and Franklin Strait.

vicuña \vi-'kün-yə, vī-'kü-nə\ South American lamoid (see alpaca), the smallest species (*Vicugna vicugna*) in the camel family, found in semiarid grasslands of the central Andes at altitudes of 12,000–16,000 ft (3,600–4,800 m). The remarkably long, soft, lustrous coat is cinnamon to white; a dense, silky, white fleece hangs from the flanks and base of the neck. Vicuñas are about 36 in. (90 cm) high and weigh over 100 lbs (50 kg). Small bands of females, led by a male, graze on low grasses, ruminate while at rest, and spit often and noisily. They mark their territory with communal dung heaps. Vicuñas are untamable but have been hunted for centuries; they are now protected as an endangered species.

Vidal \'vē-ˌdäl, vē-'däl**, Gore** *orig.* **Eugene Luther Vidal** (b. Oct. 3, 1925, West Point, N.Y., U.S.) U.S. novelist, playwright, and essayist. Vidal began publishing his writings soon after his wartime army service. Though he wrote stage plays and television and film screenplays, he is best known for his irreverent and intellectually adroit novels. *The City and the Pillar* (1948) became notorious for its homoerotic subject matter. *Myra Breckenridge* (1968) was acclaimed for its wild satire. His other novels, many of them historical and most of them best-sellers, include *Julian* (1964), *Washington, D.C.* (1967), *Burr* (1974), *1876* (1976), and *Lincoln* (1984). He also published several essay collections and the memoir *Palimpsest* (1996). Known for his iconoclastically leftist political analyses, he twice ran unsuccessfully for Congressional office.

video card Integrated circuit that generates the video signal sent to a computer display. The card is usually located on the computer mother-

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board or is a separate circuit board, but is sometimes built into the computer display unit. It contains a digital-to-analog module, as well as MEMORY chips that store display data. All video cards (also known as video adapters, video boards, and video controllers) adhere to a display standard, such as SVGA or XGA.

videocassette recorder See VCR

videodisc Rigid circular plate of either metal or plastic used to record video and audio signals for playback. It resembles a phonograph record and can be played on a machine attached to a conventional television receiver. There are two major classes of videodiscs, magnetic and nonmagnetic. Magnetic videodiscs have an oxide-coated surface onto which input signals are recorded as magnetic patterns in spiral tracks. Nonmagnetic videodiscs use either a mechanical recording system analogous to that used in phonograph records, or optical technology that uses a laser to read data coded as a sequence of pits on the disc. The most common type of videodisc today is the DVD.

videotape Magnetic tape used to record visual images and sound, or the recording itself. There are two types of videotape recorders, the transverse (or quad) and the helical. The transverse unit uses four heads rotating on an axis perpendicular to the direction in which the tape is fed. The transverse format achieves 1,500-in.-per-minute head-to-tape speed, necessary for high picture quality. The helical unit uses tape traveling around a drum in the form of a helix. VCRs use a helical format, known as VHS (Video Home System), consisting of two helical bands and tape 1/2 in. (1 cm) wide.

Vidor \'vē-dȯr**, King (Wallis)** (b. Feb. 8, 1894, Galveston, Texas, U.S.—d. Nov. 1, 1982, Paso Robles, Calif.) U.S. film director. He worked as a prop boy, scriptwriter, newsreel cameraman, and assistant director before directing his first feature film, *The Turn in the Road* (1919). He won acclaim for *The Big Parade* (1925) and *The Crowd* (1928), considered a silent-movie classic. His films, which deal with themes such as idealism and disillusionment in contemporary life, include the first all-African American film, *Hallelujah!* (1929), as well as *Our Daily Bread* (1934) and *The Citadel* (1938). His later movies include the western epic *Duel in the Sun* (1946), *The Fountainhead* (1949), and *War and Peace* (1956).

Vieira \'vyā-ē-rə**, António** (b. Feb. 6, 1608, Lisbon, Port.—d. July 18, 1697, Salvador, Braz.) Portuguese-born Brazilian missionary, orator, diplomat, and writer. He was raised in Brazil, where he became a Jesuit priest. His sermons exhorting all races to join in repelling Dutch invaders are considered the first expression of the Brazilian concept of forming a new race of mixed blood. He worked among the Indians and black slaves until 1641, mastering several of their languages. Returning to Portugal, he became an important figure in the court of John IV, where he advocated toleration for Jewish converts to Christianity. He was imprisoned by the Inquisition (1665–67) but returned to Brazil in 1681.

Vienna *German* **Wien** City (pop., 2001: 1,550,123; metro. area, 1,825,287), capital of Austria. Located on the DANUBE RIVER, it was founded by the Celts; it became a Roman military station in the 1st century BC. Ruled by many—including the Franks in the 6th century AD and the Magyars in the 10th century—Vienna was an important trade centre during the CRUSADES. It was the seat of the HOLY ROMAN EMPIRE (1558–1806), of the Austrian (and HABSBURG) Empire (1806–67), and of the Austro-Hungarian Empire until 1918. In 1814–15 it was the seat of the Congress of VIENNA. The administrative centre of German Austria (1938–45), it was frequently bombed during World War II by the Allies, and the city was taken by Soviet troops in 1945. It was under joint Soviet-Western Allied occupation from 1945 to 1955. The STRATEGIC ARMS LIMITATION TALKS (SALT) between the U.S. and Soviet Union took place in Vienna in the 1970s. The commercial and industrial centre of Austria, it also is a cultural centre renowned for its architecture and music. It was the birthplace of the composers FRANZ SCHUBERT, JOHANN STRAUSS (the Younger), and ARNOLD SCHOENBERG, and the home of WOLFGANG AMADEUS MOZART, LUDWIG VAN BEETHOVEN, JOHANNES BRAHMS, and GUSTAV MAHLER. It also was the home of SIGMUND FREUD, GUSTAV KLIMT, OSKAR KOKOSCHKA, and JOSEF HOFFMANN. Vienna is the headquarters of many international organizations, including the International Atomic Energy Agency, the UN Industrial Development Organization, and the Organization of Petroleum Exporting Countries (OPEC).

Vienna, Congress of (1814–15) Assembly that reorganized Europe after the NAPOLEONIC WARS. The powers of the QUADRUPLE ALLIANCE had concluded the Treaty of CHAUMONT just before Napoleon's first abdication and agreed to meet later in Vienna. There they were joined by Bourbon France as a major participant and by Sweden and Portugal; many minor states also sent representatives. The principal negotiators were Klemens, prince von METTERNICH, representing FRANCIS II (Austria); ALEXANDER I (Russia); FREDERICK WILLIAM III and Karl August, prince von HARDENBERG (Prussia); Viscount CASTLEREAGH (Britain); and CHARLES-MAURICE DE TALLEYRAND (France). The Congress reduced France to its 1789 borders. A new kingdom of Poland, under Russian sovereignty, was established. To check possible future aggression by France, its neighbours were strengthened: the kingdom of The Netherlands acquired Belgium, Prussia gained territory along the Rhine River, and the Italian kingdom acquired Genoa. The German states were joined loosely in a new GERMAN CONFEDERATION, subject to Austria's influence. For its part in the defeat of NAPOLEON, Britain acquired valuable colonies, including Malta, the Cape of Good Hope, and Ceylon. The Vienna settlement was the most comprehensive treaty that Europe had ever seen, and the configuration of Europe established at the congress lasted for more than 40 years.

Vienna, Siege of (July 17–Sept. 12, 1683) Attempted capture of Vienna by Ottoman Turkey. On appeal from the Hungarian Calvinists to attack the Habsburg capital, the Turkish grand vizier, Kara Mustafa (1634–83), and his army of 150,000 laid siege to Vienna in July 1683, after capturing its outer fortifications. Pope Innocent XI convinced JOHN III SOBIESKI of Poland to lead a combined army of 80,000 to relieve the siege. On Sept. 12, 1683, Sobieski, aided by Charles of Lorraine, led the attack from the surrounding hills and after 15 hours drove the Turks from their trenches around the city. Thousands were slaughtered or taken prisoner. The event marked the beginning of the decline of Turkish domination in eastern Europe.

Vienna, University of State-financed university at Vienna, Austria. Founded in 1365 on the model of the University of PARIS, it is the oldest university in the German-speaking world. It was reorganized in 1384, becoming particularly noted for its faculties of medicine, law, and theology. It was a centre of revolution during the uprising of 1848, when Metternich was forced from power. The modern university includes faculties of theology, social sciences and economics, medicine, sciences, mathematics, and natural sciences.

Vienna Circle *German* **Wiener Kreis** \'vē-nər-'krīs\ Group of philosophers, scientists, and mathematicians formed in the 1920s that met regularly in Vienna to investigate scientific language and SCIENTIFIC METHOD. It formed around Moritz Schlick (1882–1936), who taught at the University of Vienna; its members included Gustav Bergmann, Philipp Frank, RUDOLF CARNAP, KURT GODEL, Friedrich Waismann, Otto Neurath, Herbert Feigl, and Victor Kraft. The movement associated with the Circle has been called LOGICAL POSITIVISM. Its members' work was distinguished by their attention to the form of scientific theories, their formulation of a VERIFIABILITY PRINCIPLE of meaning, and their espousal of a doctrine of UNIFIED SCIENCE. The group dissolved after the Nazis invaded Austria in 1938.

Vientiane \ˌvyen-'tyän\ *Laotian* **Viangchan** \ˌvyeŋ-'chän\ City (pop., 1999 est.: 534,000), capital of Laos. It is located north of the MEKONG RIVER. Founded in the late 13th century, it was made the administrative centre of an early Laotian kingdom in the mid-16th century. In 1778 it came under Siamese (Thai) control; in 1828 it was destroyed when the Laotian king revolted against the Siamese. The French made it the capital of their colony on their takeover of the region in the 1890s; it remained the administrative centre after Laos gained independence in 1953. It is the commercial centre of the region and Laos's principal port of entry.

Vierordt \'fēr-ˌȯrt**, Karl von** (b. July 1, 1818, Lahr, Baden—d. Nov. 22, 1884, Tübingen, Ger.) German physician. He started a medical practice in 1842 and began teaching at the University of Tübingen in 1849. He discovered a way to make an exact red-blood-cell count (see BLOOD ANALYSIS) and invented the sphygmograph, the first instrument to produce a pulse tracing, and the hemotachometer, which monitors blood flow velocity.

Viet Cong *in full* **Viet Nam Cong San** *English* **"Vietnamese Communists"** Guerrilla force that sought to reunify North and South Vietnam under communist leadership from the late 1950s through 1975. Originally a collection of various groups opposed to the government of South Vietnam's Pres. NGO DINH DIEM, the Viet Cong became the military arm of the National Liberation Front (1960) and later of the Provisional Revolutionary Government (PRG; 1969). Members were recruited largely from South Vietnam, but they received guidance, weapons, and reinforce-

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ments from the north. The Viet Cong's guerrilla war against the South Vietnamese government and its powerful U.S. allies was successful; the U.S. withdrew its troops from Vietnam between 1969 and 1973, and the PRG assumed power in South Vietnam in 1975, following a full-scale invasion. It became part of a National United Front the following year.

Viet Minh \'vyet-'min\ *in full* **Viet Nam Doc Lap Dong Minh Hoi** *English* **"League for the Independence of Vietnam"** Organization that led the struggle for Vietnamese independence from French rule. Formed in 1941 by Ho Chi Minh, it was a national organization open to people of all political leanings, though it was led by communists. In 1943 the Viet Minh began guerrilla operations against the occupying Japanese; when the Japanese surrendered to the Allies, the Viet Minh seized Hanoi and proclaimed Vietnam's independence. In the First Indochina War that followed, the Viet Minh (and the Vietnamese Workers' Party [Lao Dong] that succeeded them) defeated the French. Elements of the Viet Minh also joined the Viet Cong to fight the U.S. in the Vietnam War. See also Vo Nguyen Giap.

Vietnam *officially* **Socialist Republic of Vietnam** Country, Southeast Asia. Area: 128,379 sq mi (332,501 sq km). Population (2005 est.): 82,628,000. Capital: Hanoi. The great majority of the population is

Vietnamese; minorities include Chinese, Hmong, Thai, Khmer, and Cham. Languages: Vietnamese (official), French, Chinese, English, Khmer. Religions: Buddhism, new religions, traditional beliefs, Christianity. Currency: new dong. Vietnam is about 1,025 mi (1,650 km) long, 210–340 mi (340–550 km) wide at its widest parts, and 30 mi (50 km) wide at its narrowest part. Northern Vietnam is mountainous; Fan Si Peak, the country's highest mountain, rises to 10,312 ft (3,143 m). The Red River is the principal river. Southern Vietnam is dominated by the Mekong River delta. A long, relatively narrow coastal plain connects the two major river deltas. The densely forested Annamese Cordillera extends through west-central Vietnam. Northern Vietnam is rich in mineral resources, especially anthracite coal and phosphates. Some petroleum deposits exist off the southern coast. Significant food crops include rice, sugarcane, coffee, tea, and bananas. Food processing and fishing are important industries, as are the manufacture of steel and phosphates. Vietnam is a socialist republic with one legislative house; its head of state is the president, and its head of government is the prime minister.

A distinct Vietnamese group began to emerge c. 200 BC in the independent kingdom of Nam Viet, which was later annexed to China in the 1st century BC. The Vietnamese were under continuous Chinese control until the 10th century AD. The southern region was gradually overrun by Vietnamese from the north in the late 15th century. The area was divided into northern and southern dynasties in the early 17th century, and in 1802 these two parts were unified under a single dynasty. Following several years of attempted French colonial expansion in the region, the French captured Saigon (now Ho Chi Minh City) in 1859 and later the rest of the area, controlling it until World War II (see French Indochina). The Japanese occupied Vietnam in 1940–45 and allowed the Vietnamese to declare independence at the end of the war, a move the French opposed. The First Indochina War ensued and lasted until French forces with U.S. financial backing were defeated by the Vietnamese at Dien Bien Phu in 1954; evacuation of French troops followed. After an international conference at Geneva (April–July 1954), Vietnam was partitioned along latitude 17° N, with the northern part under the communist leadership of Ho Chi Minh and the southern part under the U.S.-supported former emperor Bao Dai; the partition was to be temporary, but the reunification elections scheduled for 1956 were never held. An independent South Vietnam (Republic of Vietnam) was declared, while the communists established North Vietnam (Democratic Republic of Vietnam). The activities of North Vietnamese guerrillas and procommunist rebels in South Vietnam led to U.S. intervention and the Vietnam War. A cease-fire agreement was signed in 1973 and U.S. troops withdrawn, but the civil war soon resumed; in 1975 North Vietnam invaded South Vietnam, and the South Vietnamese government collapsed. In 1976 the two Vietnams were united as the Socialist Republic of Vietnam. From the mid-1980s the government enacted a series of economic reforms and began to open up to Asian and Western nations. In 1995 the U.S. officially normalized relations with Vietnam.

Vietnam Veterans Memorial Monument in Washington, D.C., designed by Maya Lin. It consists of two low, black granite walls that meet to form a wide V shape. Engraved on the mirrorlike surface are the names of the more than 58,000 U.S. dead and missing-in-action who served in the Vietnam War, listed by date of casualty. When Lin's abstract design was announced, several veterans groups and others protested; eventually a traditional statue depicting three servicemen with a flag was commissioned, to stand at the entrance to the site. Since its dedication in 1982, the controversial wall has become one of the city's most visited and most affecting tourist attractions.

Vietnam War (1955–75) Protracted effort by South Vietnam and the U.S. to prevent North and South Vietnam from being united under communist leadership. After the First Indochina War, Vietnam was partitioned to separate the warring parties until free elections could be held in 1956. Ho Chi Minh's popular Viet Minh party from the north was expected to win the elections, which the leader in the south, Ngo Dinh Diem, refused to hold. In the war that ensued, fighters trained in the north (the Viet Cong) fought a guerrilla war against U.S.-supported South Vietnamese forces; North Vietnamese forces later joined the fighting. At the height of U.S. involvement, there were more than half a million U.S. military personnel in Vietnam. The Tet Offensive of 1968, in which the Viet Cong and North Vietnamese attacked 36 major South Vietnamese cities and towns, marked a turning point in the war. Many in the U.S. had come to oppose the war on moral and practical grounds, and Pres. Lyndon B. Johnson decided to shift to a policy of "de-escalation." Peace talks were begun in Paris. Between 1969 and 1973 U.S. troops were withdrawn from Vietnam, but the war was expanded to Cambodia and Laos in 1970. Peace talks, which had reached a stalemate in 1971, started again in 1973, producing a cease-fire agreement. Fighting continued, and there were numerous truce violations. In 1975 the North Vietnamese launched a full-scale invasion of the south. The south surrendered later that year, and in 1976 the country was reunited as the Socialist Republic of Vietnam. More than 2,000,000 people (including 58,000 Americans) died over the course of the war, about half of them civilians.

Vietnamese language Mon-Khmer language, the native language of 60–65 million people in Vietnam and a second language for many members of Vietnam's more than 50 minority ethnic groups, with some 2 million speakers outside the country. For much of Vietnam's history, Classical Chinese was the dominant literary language, and Chinese vocabulary given a Vietnamese pronunciation ("Sino-Vietnamese") remains a significant part of the language's lexicon. By the 13th century Chinese characters were adapted to write native Vietnamese words. In the 17th century Roman Catholic missionaries introduced a system of writing Vietnamese in the Latin alphabet with diacritics distinguishing vowel qualities and tones, a system that was widely adopted only in the 20th century.

Viganò \vē-'gä-nō**, Salvatore** (b. March 25, 1769, Naples, Kingdom of Naples—d. Aug. 10, 1821, Milan, Austrian Habsburg domain) Italian

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dancer and choreographer. He studied dance with his father and toured in Spain (1788) and Vienna (1793–95, 1799–1803), where he began to choreograph works in a style synthesizing dance and mime, similar to Jean-Georges Noverre's *ballet d'action*, which he called "coreodramma." He created more than 40 works, including *The Creatures of Prometheus* (1801), *Gli strelizzi* (1809), *Otello* (1818), and *The Titans* (1819). In 1811 he became ballet master at La Scala in Milan, where he promoted the development of ballet in Italy.

Vigée-Lebrun \vē-ˈzhā-lä-ˈbrœⁿ**, (Marie-Louise-) Élisabeth** (b. April 16, 1755, Paris, France—d. March 30, 1842, Paris) French painter. Taught first by her father, a pastel portraitist, she was also advised by Joseph Vernet. In 1779 she was summoned to Versailles to paint Marie-Antoinette, whom she would paint at least 25 more times. At the outbreak of the French Revolution, she left France and traveled abroad, painting portraits of such notables as Lord Byron and Germaine de Staël and playing a leading role in society. Her paintings are notable for their freshness, charm, and sensitivity, and she was one of the most technically fluent portraitists of her era.

Vigny \vē-ˈnyē**, Alfred-Victor, count de** (b. March 27, 1797, Loches, France—d. Sept. 17, 1863, Paris) French poet, dramatist, and novelist. Vigny embarked on a military career but turned to writing Romantic poetry; his verse was critically and popularly acclaimed. His *Cinq-Mars* (1826) was the first important historical novel in French. Growing disillusioned, he wrote *Stello* (1832), on the advisability of separating the poetic life from the political. *Chatterton* (1835), his best play and one of the finest Romantic dramas, glorifies the anguish of the misunderstood artist. His pessimism was manifest also in *The Military Necessity* (1835), whose first and third stories are his prose masterpieces. In middle age he withdrew from Paris society. His later writings include poetry collected posthumously in *Les Destinées* (1864).

Vigo \vē-ˈgō**, Jean** (b. April 26, 1905, Paris, France—d. Oct. 5, 1934, Paris) French film director. The son of a militant anarchist who died in prison under suspect circumstances, he spent an unhappy childhood in boarding schools. His first film was the satiric social documentary *À propos de Nice* (1930). He explored the subject of freedom versus authority in his celebrated *Zero for Conduct* (1933), which was branded "anti-French" by the censors and withdrawn from theatres. His last film, *L'Atalante* (1934), tells the story of an unhappy marriage and is also regarded as a masterpiece. Vigo's films blend lyricism with realism and Surrealism and distinguished him as an original talent.

Vijayanagar \ˌvi-jə-yə-ˈnə-gər\ Former Hindu kingdom, southern India, south of the Krishna River. Founded in 1336 by leaders of the Kanarese people, it became the greatest empire of southern India and for more than two centuries served as a barrier against Muslim raiders from the north. It was an important center of Brahman culture and Dravidian art. Its downfall began with the defeat at Talikota (1565) by a confederacy of Deccan Muslim sultans; the empire dissolved c. 1614. The kingdom's capital, Vijayanagar, was destroyed in 1565. Its ruined site is located at modern Hampi, in southeastern Karnataka.

Vijnanavada See Yogacara

Viking Either of two unmanned U.S. spacecraft launched by NASA in 1975. After nearly yearlong journeys, Vikings 1 and 2 entered orbits around Mars and released landers that touched down on the planet and relayed measurements of properties of its atmosphere and soil, as well as colour photographs of its surface. Experiments designed to detect evidence of living organisms provided no convincing evidence of life on the surface. The orbiters transmitted photographs of large expanses of the Martian surface.

Viking 2 lander (foreground) on Mars, photographed by one of the spacecraft's own cameras, 1976.
NASA/JPL

Viking *or* **Norseman** Member of the Scandinavian seafaring warriors who raided and colonized wide areas of Europe from the 9th to the 11th century. Overpopulation at home, ease of conquest abroad, and their extraordinary capacity as shipbuilders and sailors inspired their adventures. In 865 Vikings conquered East Anglia, Northumbria, and much of Mercia. Wessex under Alfred the Great made a truce in 878 that led to Danish control of much of England. Alfred defeated fresh Viking armies (892–899), and his son continued his reconquest, recovering lands in Mercia and East Anglia by 924; Viking Northumbria fell in 954. Renewed raids in 980 brought England into the empire of Canute, and it remained as such until 1042, when native rule was restored.The Vikings permanently affected English social structure, dialect, and names. In the western seas, Vikings had settled in Iceland by 900, whence they traveled to Greenland and North America. They invaded Ireland in 795, establishing kingdoms at Dublin, Limerick, and Waterford. The Battle of Clontarf (1014) ended the threat of Scandinavian rule. France suffered periodic Viking raids but no domination. In Russia Vikings briefly dominated Novgorod, Kiev, and other centres, but they were quickly absorbed by the Slav population. As traders they made commercial treaties with the Byzantines (912, 945), and they served as mercenaries in Constantinople. Viking activity ended in the 11th century.

Viking ship See longship

Vikramaditya See Chandra Gupta II

Vila \vē-ˈlä\ *or* **Port-Vila** \ˌpȯr-vē-ˈlä\ Seaport, capital, and largest town (pop., 2003 est.: 33,987) of Vanuatu, southwestern South Pacific Ocean. Although French in appearance, the town has a multinational population including British, French, and Vietnamese. It served as a base for the U.S. in World War II and subsequently became the commercial centre of Vanuatu.

villa Country estate, complete with house, grounds, and subsidiary buildings. The term particularly applies to the suburban summer residences of the ancient Romans and their later Italian imitators. Roman villas frequently were asymmetrical in plan and built with elaborate terracing on hillsides; they had long colonnades, towers, gardens with reflecting pools and fountains, and extensive reservoirs. In Britain the term has come to mean a small detached or semidetached suburban home. See also Hadrian's Villa, Andrea Palladio.

Villa \ˈvē-yə**, Pancho** *orig.* **Doroteo Arango** (b. June 5, 1878, Hacienda de Río Grande, San Juan del Río, Mex.—d. June 20, 1923, Parral) Mexican guerrilla leader. He was orphaned at a young age and spent his adolescence as a fugitive, having murdered a landowner in revenge for an assault on his sister. An advocate of radical land reform, he joined Francisco Madero's uprising against Porfirio Díaz. His División del Norte joined forces with Venustiano Carranza to overthrow Victoriano Huerta (1854–1916), but he soon broke with the moderate Carranza and in 1914 was forced to flee with Emiliano Zapata. In 1916, to demonstrate that Carranza did not control the north, he raided a town in New Mexico. A U.S. force led by Gen. John Pershing was sent against him, but his popularity and knowledge of his home territory made him impossible to capture. He was granted a pardon after Carranza's overthrow (1920) but was assassinated three years later. See also Mexican Revolution; Alvaro Obregon.

Villa-Lobos \ˌvē-lə-ˈlō-bōsh**, Heitor** (b. March 5, 1887, Rio de Janeiro, Braz.—d. Nov. 17, 1959, Rio de Janeiro) Brazilian composer. He was exposed to folk music as a child, and his later extensive ethnomusicological studies (1905–12) had great influence on his own works. Self-taught as a composer, he met Darius Milhaud in 1917, and Artur Rubinstein later promoted his music and helped support him. A "week of modern art" in São Paulo (1922) brought his music to national attention, and he was given a grant to go to Paris (1923–30), where his music was received enthusiastically. On his return he became a leader in musical education—founding the Ministry of Education conservatory (1942) and the Brazilian Academy of Music (1945)—and Brazil's semiofficial ambassador to the world. His many works include his 9 *Bachianas brasileiras* for various ensembles and his 14 *Chôros*, based on a popular form of street music.

Villafranca \ˌvē-lä-ˈfräŋ-kä**, Peace of** (1859) Preliminary peace treaty between France's Napoleon III and Austria's emperor Francis Joseph that ended the Franco-Piedmontese war against Austria. Napoleon III made peace after the costly Battle of Solferino without consulting the Piedmontese king, Victor Emmanuel II. By the peace terms, Lombardy was ceded to France and then to Piedmont, and the dukes of Parma, Modena, and Tuscany were restored to their thrones after being deposed by nationalists. Though decried by Italian nationalists, the peace marked the beginning of Italy's unification under Piedmontese leadership.

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Villahermosa \ˌbē-yä-er-ˈmō-sä\ City (pop., 2000: 330,846), capital of Tabasco state, southeastern Mexico. Founded in 1596 as Villa Felipe II, it has also been known as San Juan de Villa Hermosa and as San Juan Bautista; it was given its present name in 1915. The cathedral was built in 1614. The archaeological museum is one of the best in Mexico. Villahermosa is the state's chief distributing, processing, and agricultural city. There are Maya archaeological ruins in the area.

Villanovan \ˌvi-lə-ˈnō-vən\ **culture** Early Iron Age culture in Italy, named after the village where the first site was found in 1853. It appeared in the 10th or 9th century BC as a branch of the Urnfield cultures. Its dead were cremated and the ashes put in a decorated pottery two-story urn covered with a bowl or a helmet-shaped lid, or in a so-called hut urn, a terracotta vessel. Expert metalworkers, the Villanovans controlled Tuscany's copper and iron mines. In the later 8th century BC their art and burials were influenced by Greece. Their culture began to fade in the 7th century.

Villard de Honnecourt \vē-ˈlȧr-də-ȯ-nə-ˈkür\ (b. c. 1225, Picardy, France—d. c. 1250) French architect. He is remembered mainly for the sketchbook he compiled while traveling in search of work as a master mason. The book contains sketches and writings concerning architectural practices of the time. He includes sections on technical procedures and mechanical devices, as well as notes on the buildings and monuments he had seen, offering insights into the variety of interests and work of the 13th-century master mason and providing an explanation for the spread of Gothic architecture in Europe.

Villard \və-ˈlärd**, Henry** *orig.* **Ferdinand Heinrich Gustav Hilgard** (b. April 10, 1835, Speyer, Bavaria—d. Nov. 12, 1900, Dobbs Ferry, N.Y., U.S.) German-born U.S. journalist and financier. In 1853 he immigrated to the U.S., where he first found work with German-language newspapers. During the Civil War he was a correspondent for two New York City newspapers. In 1881 he purchased the *Nation* magazine and the *New York Evening Post*. In the 1870s he organized several railroads in Oregon, and from 1881 to 1884 he was president of the Northern Pacific, a transcontinental railroad completed under his management despite large cost overruns; he later served as chairman of the board (1888–93). He bought two Edison companies and created the Edison General Electric Co. in 1889, serving as president until its reorganization in 1892 as the General Electric Co.

Villars \vi-ˈlär**, Claude-Louis-Hector, duke de** (b. May 8, 1653, Moulins, France—d. June 17, 1734, Turin, Sardinia) French soldier. He distinguished himself in France's war against the Dutch (1672–78) and in the War of the Grand Alliance. After leading French forces to early victories in the War of the Spanish Succession, he was made a marshal of France (1702) and a duke (1705). He continued successful military campaigns in Germany (1705–08), inflicted heavy losses on the duke of Marlborough's forces at Malplaquet (1709), and defeated Eugene of Savoy at Denain (1712). He served on the regency council for the young Louis XV. At the outbreak of the War of the Polish Succession, he was given the exceptional title of marshal general of France (1733) and sent to attack Austrian lands in northern Italy.

Villella \vi-ˈle-lə**, Edward** (b. Oct. 1, 1936, New York, N.Y., U.S.) U.S. ballet dancer, choreographer, and director. He trained at the School of American Ballet and joined the New York City Ballet in 1957, becoming a principal dancer in 1960. He danced leading roles in many of George Balanchine's ballets, notably *The Prodigal Son* (1960), displaying a powerful technique. After retiring from dancing in 1983, he became artistic director of Ballet Oklahoma (1983–86). In 1986 he founded the Miami City Ballet, where he continues as artistic director.

Villella in *The Prodigal Son*.
MARTHA SWOPE

Villemin \vēl-ˈmaⁿ**, Jean Antoine** (b. Jan. 28, 1827, Prey, Vosges, France—d. Oct. 6, 1892, Paris) French physician. As an army doctor, he observed that healthy young men often developed tuberculosis (TB) living in the close quarters of the barracks. Aware that a similar disease in horses was transmitted by inoculation, he gave TB to rabbits by inoculating them with material from sick humans and cows, proving that it was an infectious disease. His contagion theory, published in 1867, was initially ignored but was later corroborated by other scientists' experiments.

Villiers, George See 1st Duke of Buckingham

Villon \vē-ˈyōⁿ, vē-ˈlȯn**, François** *orig.* **François de Montcorbier** *or* **François des Loges** (b. 1431, Paris, France—d. after 1463) French lyric poet. Villon was a rigorously trained scholar who led a life of criminal excess; he killed a priest in 1455, then joined a criminal organization and became involved in robbery, theft, and brawling. Incarcerated several times, in 1462 he received a death sentence that was commuted to banishment. He was never heard from again. His works, published posthumously, include the poem *Le Petit testament* (1489), which takes the form of ironic bequests to friends and acquaintances; *Le Testament* (1489), which reviews his life with great emotional and poetic depth; and various ballades, chansons, and rondeaux. His themes range from drunkenness and prostitution to a humble ballade-prayer to the Virgin written at his mother's request. Villon's verse makes a direct, unsentimental appeal to the emotions but also displays remarkable control of rhyme and disciplined composition.

Vilnius \ˈvil-nē-əs\ City (pop., 2001: 542,287), capital of Lithuania. Founded in the 10th century, it became the capital of Lithuania in 1323. It was destroyed in 1377 by the Teutonic Knights but was rebuilt. Vilnius passed to Russia in 1795, and for several centuries was a noted European centre for Jewish learning. It was occupied by the Germans in World Wars I and II and suffered heavy damage. From 1920 to 1939 it was part of Poland; taken by Soviet troops in 1939, it was restored to Lithuania, which the Soviets annexed in 1940. One result of the World War II German occupation was the decimation of the city's Jewish population, which dropped from 80,000 in 1941 to 6,000 in 1945. In 1991 it became the capital of the newly independent Lithuania. An important industrial centre, it also has many historic buildings representing Gothic, Renaissance, and Baroque styles of architecture.

Vilnius dispute Conflict between Poland and Lithuania over possession of the city of Vilnius. After World War I, the new Lithuanian government established itself at Vilnius. It was forced out by Soviet forces in 1919, and the city was then occupied by Polish forces (1919) and again by the Soviets, which ceded it to Lithuania in 1920. An armistice was arranged by the League of Nations, but Poland took Vilnius in 1920 and controlled the city and its surrounding region until they were restored to Lithuania in 1939.

Vilyuy River *or* **Viliui** \vil-ˈyü-ē\ **River** River, east-central Siberia. The longest tributary of the Lena River, it is 1,647 mi (2,650 km) long. It joins the Lena about 200 mi (320 km) northwest of Yakutsk. It is navigable for about 900 mi (1,450 km). In 1954 rich diamond deposits were discovered near the river.

Viña del Mar \ˈbēn-yä-del-ˈmär\ City (pop., 2002 prelim: 330,000), central Chile. It is a residential suburb of Valparaíso. Located on the Pacific Ocean, Viña del Mar is a resort city with a gaming casino, beaches, museums, and theatres. Army and navy garrisons and petroleum depots add to the city's economic base.

Vinaya Pitaka \ˈvi-nə-yə-ˈpi-tə-kə\ Oldest and smallest division of the Tripitaka. It lays out the 227 rules of monastic life for bhiksus, along with an account of the occasion that led the Buddha to formulate the rule. It varies less from school to school than does the Sutta Pitaka or the Abhidhamma Pitaka. It includes an exposition of the rules, which are divided into classes according to the severity of the punishment for breaking them; texts that deal with such matters as admission to and expulsion from the order; and a classified digest of the rules in the other Vinaya texts.

Vincennes \vaⁿ-ˈsen\ **ware** Pottery made at Vincennes, France, from 1740 until 1756 (three years after it had become the royal manufactory), when the enterprise moved to Sèvres, near Versailles. Typical Vincennes pottery included biscuit (white, unglazed soft-paste) figures and soft-paste flowers on wire stems or applied to vases. From 1756 to 1770 pottery continued to be made at Vincennes, both tin-glazed earthenware (officially) and soft-paste porcelain (clandestinely, in defiance of a Sèvres monopoly). See also Sèvres porcelain.

Vincent de Paul, Saint (b. April 24, 1581, Pouy, France—d. Sept. 27, 1660, Paris; canonized 1737; feast day September 27) French religious leader. Educated by the Franciscans at Dax, he was ordained in 1600 and graduated from the University of Toulouse in 1604. It is said that he

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was captured at sea by Barbary pirates but escaped. In 1625 he founded the Congregation of the Mission (also called Lazarists or Vincentians) in Paris as a preaching and teaching order. He also established the Confraternities of Charity, associations of laywomen who nursed the sick. With St. Louise de Marillac he cofounded the Daughters of Charity (Sisters of Charity of St. Vincent de Paul).

Vincent of Beauvais \bō-'vā\ (b. 1190, Beauvais?, France—d. 1264, Paris) French scholar and encyclopaedist. A Dominican priest (c. 1220), he became lector and chaplain to the court of King Louis IX. By 1244 he had compiled *Speculum majus* ("Great Mirror"), an 80-book compendium of knowledge that included human history from the Creation to the time of Louis IX, natural history and science known to the West, and a compendium of European literature, law, politics, and economics. His work influenced scholars and poets up to the 18th century. See also encyclopaedia.

Vinci, Leonardo da See Leonardo da Vinci

vine Plant whose stem requires support and that climbs by tendrils or twining or creeps along the ground, or the stem of such a plant. Examples include bittersweet, most grapes, some honeysuckles, ivy, lianas, and melons.

vinegar Sour liquid obtained by fermentation of dilute alcoholic liquids. Probably first made from wine (French *vinaigre* means "sour wine"), vinegar may also be made from malted barley, rice, cider, or other substances. The source substance, which must contain sugar, is fermented by yeast to produce alcohol. The alcohol is then aerated, which causes it to convert, through the action of *Acetobacter* bacteria, to acetic acid, water, and various other compounds. Vinegar is used in pickling meat, fish, fruits, and vegetables and in creating marinades, dressings, and other sauces.

Vingt \'vaⁿ**, Les** *or* **Les XX** *French* **The Twenty** Group of Symbolist artists, including James Ensor, Fernand Khnopff, and Henry van de Velde, who exhibited in Belgium during 1891–93. Belgian Symbolist painting employed simplified forms, heavy outlines, a subjective use of colour, and a heightened spiritual content inspired by religious, exotic, and "primitive" cultures. The styles of various members of Les Vingt eventually merged into the new Art Nouveau style.

Vinland Wooded land in North America visited and named by Leif Eriksson the Lucky c. AD 1000. It was probably located along the Atlantic coast of what is now eastern or northeastern Canada. The Vikings' visits to Vinland (named "wine land" for its wild grapes) are recorded in the Norse sagas. Leif Eriksson is said to have led the first expedition, and his brother Thorvald a second one c. 1003. A colonizing expedition of 130 Vikings c. 1004 was abandoned after warfare with the native Indians. The final expedition was led c. 1013 by Erik the Red's daughter Freydis. In 1963 the remains of a Norse settlement were discovered at L'Anse aux Meadows, at the northernmost tip of Newfoundland.

Vinson, Fred(erick Moore) (b. Jan. 22, 1890, Louisa, Ky., U.S.—d. Sept. 8, 1953, Washington, D.C.) U.S. jurist. He served in Congress for all but two years during the period 1923 to 1938. After serving on the U.S. Court of Appeals (1938–43), he held high executive positions, including secretary of the treasury under Pres. Harry Truman. He helped establish the International Bank for Reconstruction and Development and the International Monetary Fund. From 1946 to 1953 he was chief justice of the Supreme Court of the United States. During his tenure he favoured Truman's internal security policies and upheld the equal-protection rights of racial minorities.

Vinson Massif Mountain, Sentinel Range, central Ellsworth Mountains, western Antarctica. Rising 16,066 ft (4,897 m), the Vinson Massif is the highest mountain on the continent. It was discovered in 1935 by U.S. explorer Lincoln Ellsworth.

vinyl chloride *or* **chloroethylene** Colourless, flammable, toxic gas ($H_2C{=}CHCl$), belonging to the family of organic compounds of halogens. It is produced in very large quantities and used principally to make PVC, as well as in other syntheses and in adhesives. Prolonged exposure to vinyl chloride is linked to several kinds of cancer.

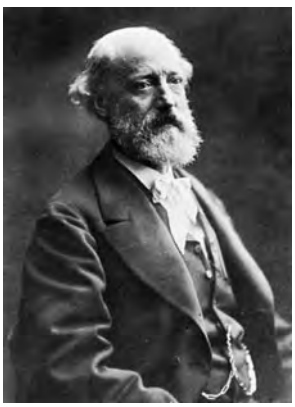
viol \'vī-əl, 'vī-ˌōl\ *or* **viola da gamba** \vē-ˌō-lə-də-'gäm-bə\ Bowed stringed instrument of the 16th–18th centuries. The viols are distinguished from the violin family particularly by a fretted fingerboard, sloping shoulders, flat back, six strings, and milder tone. They exist in four sizes: treble, tenor, bass, and double bass (violone). They are played vertically, the body of the instrument being held between the legs or rested on the knee. The viol family appeared in the late 15th century and soon became widely popular and acquired a large repertory. Throughout the Baroque era, the bass viol joined the harpsichord in the basso continuo. The contemporaneous violin family, having a more penetrating tone, gradually displaced the viols in the 18th century.

viola \vī-'ō-lə, vē-'ō-lə\ Stringed instrument, the tenor member of the violin family. In appearance it is almost identical to the violin but slightly larger; its strings are tuned a fifth lower. It is a member of many chamber music ensembles, and the modern orchestra uses 6 to 10 violas. Its tone is darker, warmer, and less powerful than the violin's, and it is rarely employed as a solo instrument. The viola d'amore is an 18th-century instrument with six or seven melody strings, under which are strung several sympathetic strings that resonate in concord with the sounded pitches.

violet Any of the approximately 500 species of herbaceous plants or low shrubs that make up the genus *Viola*, which includes the small, solid-coloured violets and the larger-flowered, often multicoloured violas and pansies. Many *Viola* species have two types of flowers: the showy spring flower is infertile; the less conspicuous summer flower is self-fertilizing. The best-known species of *Viola* have heart-shaped leaves. The popular florist's violets, consisting of several hybrids (many of them *V. odorata*), are usually called sweet violets. The family Violaceae, to which *Viola* belongs, has members worldwide; they are typically small trees and shrubs that grow as low vegetation beneath the taller trees of forests. The so-called African violet belongs to the gesneriad family. See also dogtooth violet.

violin Bowed stringed instrument. The violin is the highest-pitched member of a family of instruments that includes the viola, cello, and double bass. It has a fretless fingerboard, four strings, and a distinctively shaped wooden body whose "waist" permits freedom of bowing. The violin is held on the shoulder and bowed with the right hand. It has a wide range of more than four octaves. It evolved in Italy in the 16th century from the medieval fiddle and other instruments. Its average proportions were settled by the 17th century, but innovations in the 18th–19th centuries increased its tonal power. With its brilliance, agility, and singing tone, the violin has been immensely important in Western art music, and it has the largest and most distinguished repertoire of any stringed instrument. From the mid-17th century it has been the foundation of the symphony orchestra, which today usually includes 20–26 violins, and it is also widely used in chamber music and as a solo instrument. It is played as a folk instrument in many countries, folk violins being often called fiddles.

Viollet-le-Duc \ˌvē-ə-'lā-lə-'dük**, Eugène-Emmanuel** (b. Jan. 27, 1814, Paris, France—d. Sept. 17, 1879, Lausanne, Switz.) French Gothic Revival architect, restorer, and writer. After studying architecture and training as an archaeologist, he was placed in charge of restoring the abbey church at Vézelay (1840). He assisted in restoring the Sainte-Chapelle (1840) and Notre-Dame de Paris (1845) and supervised the restoration of many other medieval buildings, including Amiens Cathedral (1849) and the fortifications of Carcassonne (1852). In his later restorations he often added new elements of his own design, intrusions for which he was criticized in the 20th century. He is most distinguished for his writings, which include the *Dictionnaire raisonné de l'architecture française du XIe au XVIe siècle* (1854–68) and *Entretiens sur l'architecture* (1858–72). His theories of rational architectural design linked the revivalism of the Romantic period to 20th-century Functionalism and influenced the architects of the Chicago School.


Eugène-Emmanuel Viollet-le-Duc.
ARCHIVES PHOTOGRAPHIQUES, PARIS

violoncello See cello

vipassana \vi-'pä-sə-nə\ In Theravada Buddhism, a method of insight meditation. It aims at developing understanding of the nature of reality by focusing a sharply concentrated mind on physical and mental processes. The meditator comes to understand, through personal experience,

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the truths of *dukkha* (suffering), *anicca* (impermanence), and *anatta* (lack of an enduring self). It is a process of mental purification that leads to abandonment of the roots of unwholesome actions, eradication of ignorance, and attainment of NIRVANA.

viper Any of about 200 species (family Viperidae) of venomous snakes in two subfamilies: Viperinae (Old World vipers of Europe, Asia, and Africa) and Crotalinae (PIT VIPERS). Two long, hollow, venom-injecting fangs attached to the movable bones of the viper's upper jaw can be folded back in the mouth when not in use. Vipers range in length from less than 12 in. (30 cm) to more than 10 ft (3 m). They eat small animals and hunt by striking, then trailing, their prey. Many Old World vipers are terrestrial; a few are arboreal or burrowers. Most bear live young.

Viracocha \ˌbē-rä-ˈkō-chä\ Creator god of the pre-Inca inhabitants of Peru, later assimilated into the Inca pantheon. A god of rain, he was believed to have created the Sun on the waters and foam of Lake TITICACA. After forming the rest of the heavens and the earth, he wandered through the world teaching humankind the arts of civilization. At Manta (Ecuador) he walked westward across the Pacific Ocean, promising to return one day. His cult was extremely ancient, and he is probably the weeping god sculpted in the megalithic ruins at TIWANAKU.

viral \ˈvī-rəl\ **diseases** Diseases caused by VIRUSES. Long-term IMMUNITY usually follows viral childhood diseases (see chickenpox). The common COLD recurs into adulthood because many different viruses cause its symptoms, and immunity against one does not protect against others. Some viruses mutate fast enough to reinfect people after recovery (see INFLUENZA) or to keep the IMMUNE SYSTEM from fighting them off (see AIDS). Certain CANCERS are caused by viruses. VACCINES can prevent some viral diseases. Most recently developed antiviral drugs work only against specific viruses; antibiotics are ineffective against viral diseases. See also POLIOMYELITIS; SMALLPOX.

Virchow \ˈfir-kō**, Rudolf (Carl)** (b. Oct. 13, 1821, Schivelbein, Pomerania, Prussia—d. Sept. 5, 1902, Berlin) German pathologist, anthropologist, and statesman. In 1847 he cofounded the pathology journal now named for him (*Virchows Archiv*). He held the first chairs of pathological anatomy at the Universities of Würzburg (1849–56) and Berlin (1856–1902). In 1861 he was elected to the Prussian Diet and founded the Progressive Party. He coined the terms *thrombosis* and *embolism* while disproving the theory that PHLEBITIS causes most diseases. His work supported emerging ideas on cell division and metabolism, pointing out that cell division accounted for the multiplication of cells to form tissues. His rejection of the theory that bacteria cause disease and of IGNAZ SEMMELWEIS's advocacy of antisepsis delayed the use of antiseptics. Virchow also founded two anthropological societies and accompanied HEINRICH SCHLIEMANN to Troy (1879) and Egypt (1888).

vireo \ˈvir-ē-ˌō\ Any of 42 species (family Vireonidae) of New World songbirds with a stout, slightly notched, hook-tipped bill that has fine bristles at the base. Vireos are 4–7 in. (10–18 cm) long and are plain gray or greenish, with white or yellow touches. They glean insects from foliage in woodlands and thickets, repeating loud short phrases over and over. The nest is a cuplike structure suspended from a small fork in a branch. The red-eyed vireo (*Vireo olivaceus*), which breeds from southern Canada to Argentina, is 6 in. (15 cm) long and has a black-outlined, white eye stripe that contrasts with its gray crown.

Virgil *or* **Vergil** \ˈvər-jil\ *orig.* **Publius Vergilius Maro** (b. Oct. 15, 70, Andes, near Mantua—d. Sept. 21, 19 BC, Brundisium) Greatest of Roman poets. The well-educated son of a prosperous provincial farmer, Virgil led a quiet life, though he eventually became a member of the circle around Octavian (later Caesar AUGUSTUS) and was patronized by MAECENAS. His first major work, the 10 pastoral *Eclogues* (42–37), may be read as a prophecy of tranquility, and one has even been read as a prophecy of Christianity. The *Georgics* (37–30) point toward a Golden Age in the form of practical goals: the repopulation of rural lands and the rehabilitation of agriculture. His great epic, the *Aeneid* (begun c. 29, but unfinished at his death), is one of the masterpieces of world literature. A celebration of the founding of Rome by the legendary AENEAS at the request of Augustus, whose consolidation of power in 31–30 unified the Roman world, it also explores the themes of war and the pathos of unrequited love. In later centuries his works were regarded in the Roman Empire as virtually sacred. He was taken up reverently by Christians as well, including DANTE, who, in his poem *The Divine Comedy*, made Virgil his guide through hell and purgatory.

Virgin Birth Fundamental doctrine of orthodox Christianity that JESUS had no natural father but was conceived by MARY through the power of the HOLY SPIRIT. Based on the infancy narratives in the GOSPELS of Matthew and Luke, the doctrine was universally accepted in the Christian church by the 2nd century. It remains a basic article of belief in Roman Catholicism, Eastern Orthodoxy, most Protestant churches, and Islam. A corollary of its dogma is the doctrine of Mary's perpetual virginity, accepted by the Orthodox and Roman Catholic churches and by some Lutheran and Anglican theologians. See also IMMACULATE CONCEPTION.

Virgin Islands, British British overseas territory (pop., 2005 est.: 27,200), WEST INDIES. Part of the Virgin Islands chain, it consists of the islands of Tortola, Anegada, Virgin Gorda, and Jost Van Dyke and 32 smaller, mostly uninhabited islands. The chief town and port is Road Town on Tortola. The majority of British Virgin Islanders are of African or African-European descent. English is the chief language. Religion: Christianity (predominantly Protestant). The islands are generally hilly, and many have lagoons with coral reefs and barrier beaches. Tourism is the mainstay of the economy. The Virgin Islands probably were originally settled by ARAWAK Indians but were inhabited by CARIBS by the time CHRISTOPHER COLUMBUS visited in 1493. The islands were a haunt for pirates, and Tortola was held by Dutch buccaneers until it was taken by English planters in 1666; it was annexed by the British-administered LEEWARD ISLANDS in 1672. The British sugar plantations declined after slavery was abolished in the 19th century. The islands were part of the Colony of the Leeward Islands from 1872 until 1956, when the British Virgin Islands became a separate colony. Its status was changed to an overseas territory in 2002.

Virgin Islands National Park Conservation area, St. John, U.S. VIRGIN ISLANDS. Covering 14,696 acres (5,947 hectares), it has steep mountains, white beaches, and coral reefs. Though most of the tree cover was removed for sugarcane cultivation in the 17th–18th century, the land has reverted to forest. Some 100 species of birds and the only native land mammal, the bat, can be found there. It has remains of ARAWAK Indian villages.

Virgin Islands of the U.S. Unincorporated U.S. island territory (pop., 2005 est.: 108,700), WEST INDIES. Part of the Virgin Islands chain, it consists of the islands of SAINT CROIX, Saint John, and SAINT THOMAS and about 50 small islets. Area: 136 sq mi (352 sq km). Capital: CHARLOTTE AMALIE. The great majority of the population is of African descent; most of the remainder are Hispanic (mainly Puerto Rican) or recent immigrants from the U.S. The people are U.S. citizens and elect a nonvoting representative to the U.S. House of Representatives, but they do not vote in U.S. national elections. Languages: English (official), French, Spanish. Religion: Christianity (mainly Protestant; also Roman Catholic, other Christians). The islands are hilly and surrounded by coral reefs. Tourism dominates the economy. The islands probably were originally settled by ARAWAK Indians but were inhabited by the CARIBS by the time CHRISTOPHER COLUMBUS landed on St. Croix in 1493. St. Croix was occupied by the Dutch, English, French, and Spanish and at one time was owned by the Knights of Malta. Denmark occupied St. Thomas, St. John, and St. Croix and established them as a Danish colony in 1754. The U.S. purchased the Danish West Indies in 1917 for $25 million and changed the name to the Virgin Islands. They were administered by the U.S. Department of the Interior from 1931. In 1954 the Organic Act of the Virgin Islands created the current governmental structure, and in 1970 the first popularly elected governor took office. The area suffered extensive damage by a major hurricane in 1995.

English virginal (with jack rail removed) made by Robert Hatley, London, 1664; in the Benton-Fletcher Collection, the National Trust, Hampstead, London

FROM THE BENTON-FLETCHER COLLECTION AT THE NATIONAL TRUST PROPERTY, FENTON HOUSE, HAMPSTEAD, LONDON

virginal *or* **virginals** Small rectangular HARPSICHORD with a single set of strings and a single manual. The derivation of its name is uncertain. The virginal's strings run parallel to the keyboard, which occupies only a portion of the longer side. Combination virginals include a smaller portable virginal that can be placed on top of the larger keyboard to create a two-manual instrument. The vir-

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ginal was particularly popular in 16th–17th-century England, where much music was written for it by William Byrd, Thomas Morley, Thomas Weelkes, and others.

Virginia State (pop., 2000: 7,078,515), southeastern U.S. It is bordered by Maryland to the northeast, North Carolina and Tennessee to the south, Kentucky to the west, West Virginia to the northwest, and the Atlantic Ocean to the east. Located on the central Atlantic seaboard, it covers an area of 40,600 sq mi (105,154 sq km); its capital is Richmond. The coastal plain, also known as the Tidewater, lies in the east; the Piedmont province, a region of rolling hills, is in the middle of the state; and the Blue Ridge and Appalachian mountains lie to the west. The Potomac, Shenandoah, James, and Roanoke rivers flow through the state. Virginia was inhabited by American Indians when England's first American colony was founded there in 1607 at Jamestown. Virginia's citizens were among the leaders of the American Revolution, and the state later contributed four of the country's first five presidents. In 1788 it became the 10th state to ratify the U.S. Constitution. Slavery was an important part of Virginia's economy; Nat Turner's slave insurrection occurred there in 1831. In 1861, soon after the start of the American Civil War, Virginia seceded from the Union. Richmond became the capital of the Confederacy (see Confederate States of America), and Virginia was the chief battleground throughout the war. The western part of the state refused to secede; it split off to become West Virginia in 1863. Virginia was readmitted to the Union in 1870. Strife over state debt took over political life for the next decades, but after World War I the state's prosperity increased. World War II brought thousands to Virginia's military camps and caused the Norfolk area to experience rapid growth. The federal government is the state's largest employer, while manufacturing is the second largest. Hampton Roads is one of the nation's leading ports. Tourism is important; Virginia's many historical sites include Colonial Williamsburg, George Washington's Mount Vernon, Thomas Jefferson's Monticello, Civil War battlefields, and Gen. Robert E. Lee's house, located within the grounds of what is now Arlington National Cemetery. The College of William and Mary (founded 1693) is the country's second oldest college; the University of Virginia was largely the creation of Thomas Jefferson.

Virginia, University of U.S. public university founded in Charlottesville by Thomas Jefferson. It was chartered in 1819 and opened in 1825. Jefferson designed its beautiful campus and buildings, planned the curriculum, and selected the faculty. By the time of the Civil War, the university was second only to Harvard in size of faculty and student body. It first admitted women in 1970. In addition to its college of arts and sciences, it has schools of architecture, education, engineering and applied sciences, and nursing, as well as a business school, a graduate school, and schools of law and medicine.

Virginia and Kentucky Resolutions (1788–89) Measures passed by the legislatures of Virginia and Kentucky as a protest against the Alien and Sedition Acts. Drafted by James Madison and Thomas Jefferson (though their role went unknown for 25 years), the resolutions protested limitations on civil liberties and declared the right of states to decide on the constitutionality of federal legislation. Though their authors applied the resolutions to the specific issues of the day, Southern states later used the measures to support the theories of nullification and secession.

Virginia Beach City (pop., 2000: 425,257), southeastern Virginia. It is situated on the Atlantic Ocean and Chesapeake Bay. Founded in 1887, it developed as a resort after a railroad was built linking it with Norfolk. After World War I it became an important base in the national coastal defense system. In 1963 it and the former Princess Anne county merged to become the City of Virginia Beach. Its economy is based on tourism and military installations. Cape Henry Memorial is in the city and the Cape Henry Lighthouse (1791) is nearby.

Virginia Company English trading company chartered by James I in 1606 to colonize the eastern coast of North America. Its shareholders were residents of London. Approximately 105 colonists in three ships reached Virginia in 1607 and founded Jamestown. The company expanded its territory with new charters (1609, 1612) and authorized a two-house legislature (1619), including a House of Burgesses. The colony survived many hardships, but the company was divided by internecine disputes and was dissolved in 1624, whereupon Virginia became a royal colony. See also Plymouth Company.

Virginia Declaration of Rights Measure adopted by the colony of Virginia (June 12, 1776). Drafted by George Mason, it stated that "all men are by nature equally free and independent and have certain inherent rights" and specified such civil liberties as freedom of the press and freedom of religion. It became a model for the Bill of Rights.

Virginia deer See white-tailed deer

Virgo \'vər-gō\ *Latin* **"Virgin" or "Maiden"** In astronomy, the constellation lying between Leo and Libra; in astrology, the sixth sign of the zodiac, governing approximately the period August 23–September 22. Its symbol is a maiden carrying a sheaf of wheat. She has been identified with fertility goddesses such as Ishtar or with Persephone.

Virgo cluster Closest large cluster of galaxies at a distance of about 50 million light-years in the direction of the constellation Virgo. About 200 bright galaxies and thousands of faint ones reside in the cluster. In turn, the Virgo cluster lies at the approximate centre of a larger gravitationally bound structure, called the Local Supercluster, which also includes the Local Group of galaxies, to which the Milky Way Galaxy belongs. Near the centre of the Virgo cluster is the giant elliptical galaxy M87 (or Virgo A), one of the strongest radio sources in the sky and also a powerful X-ray source. Images of M87s active galactic nucleus, obtained in 1994, revealed gas orbiting at such high speeds that astronomers believe a supermassive black hole must be present.

virion \'vī-rē-ˌän\ Entire virus particle, consisting of an outer protein shell (called a capsid) and an inner core of nucleic acid (either RNA or DNA). The core gives the virus infectivity, and the capsid provides specificity (i.e., determines which organisms the virus can infect). In virions whose capsids are further encased by a fatty membrane, the virion can be inactivated by exposure to a solvent such as ether or chloroform. Many virions have capsids with 20 triangular faces and the nucleic acid densely coiled within; others have capsids consisting of surface spikes, with the nucleic acid loosely coiled within. Virions of most plant viruses are rod-shaped.

viroid \'vī-ˌrȯid\ Infectious particle that is smaller than any of the known viruses. The particle consists of an extremely small circular RNA molecule that lacks the protein coat of a virus. Viroids appear to be transmitted mechanically from one cell to another through cellular debris. They are of much interest because of their subviral nature and their unknown mode of action. Viroids are agents of certain plant diseases; whether they occur in animal cells is uncertain.

virology \vī-'rä-lə-jē\ Branch of microbiology that deals with the study of viruses. Viruses were not closely examined until 1892, when a Russian bacteriologist observed that the agent of tobacco mosaic disease could pass through a filter that did not permit the passage of bacteria. Modern virology began in the early 20th century, when the existence of bacteriophages was discovered. Direct visualization of viruses became possible after the electron microscope was introduced (c. 1940).

virtual reality Use of computer modeling and simulation to enable a person to interact with an artificial three-dimensional visual or other sensory environment. A computer-generated environment simulates reality by means of interactive devices that send and receive information and are worn as goggles, headsets, gloves, or body suits. The illusion of being in the created environment (telepresence) is accomplished by motion sensors that pick up the user's movements and adjust his or her view accordingly, usually in real time. The basis of the technology emerged in the 1960s in simulators that taught how to fly planes, drive tanks, shoot artillery, and generally perform in combat. It came of commercial age in the 1980s and is now used in games, exhibits, and aerospace simulators. It has potential for use in many fields, including entertainment, medicine and biotechnology, engineering, design, and marketing.

virtue Practical dispositions in conformity with standards of excellence or with principles of practical reason. The seven cardinal virtues of the Christian tradition include the four "natural," or cardinal, virtues, those inculcated in the old pagan world that spring from the common endowment of humanity, and the three "theological" virtues, those specifically prescribed in Christianity and arising as special gifts from God. The natural virtues are prudence, temperance, fortitude, and justice; this enumeration, said to go back to Socrates, is found in Plato and Aristotle. To these St. Paul added the theological virtues of faith, hope, and love—virtues which, in Christian teaching, do not originate naturally in humanity but are instead imparted by God through Christ and then practiced by the believer.

virtue ethics Approach to ethics that takes the notion of virtue (often conceived as excellence) as fundamental. Virtue ethics is primarily con-

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cerned with traits of character that are essential to human flourishing, not with the enumeration of duties. It falls somewhat outside the traditional dichotomy between DEONTOLOGICAL ETHICS and CONSEQUENTIALISM: It agrees with consequentialism that the criterion of an action's being morally right or wrong lies in its relation to an end that has intrinsic value, but more closely resembles deontological ethics in its view that morally right actions are constitutive of the end itself and not mere instrumental means to the end. See also EUDAEMONISM.

Virunga \vē-'rüŋ-gä\ **Mountains** Volcanic range, east-central Africa. Located north of Lake KIVU, it extends for about 50 mi (80 km) along the borders of Congo (Kinshasa), Rwanda, and Uganda. Of its eight major volcanic peaks, the highest is KARISIMBI, while NYIRAGONGO is at the western end of the chain; in 1861 JOHN HANNING SPEKE was the first European to spot them. Parts of the range are in VIRUNGA NATIONAL PARK, Volcanoes National Park (Rwanda), and Gorilla National Park (Uganda).

Virunga National Park *formerly* **Albert National Park** Game preserve and gorilla sanctuary, northeastern Congo (Kinshasa). Established in 1925, it has an area of about 3,050 sq mi (7,900 sq km). Its southern tip touches the northern shore of Lake KIVU, and much of its central region is occupied by Lake EDWARD. The VIRUNGA MOUNTAINS lie between the two lakes. The park has been a UNESCO World Heritage Site since 1979.

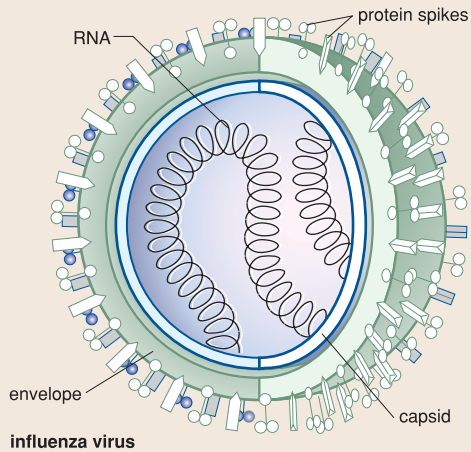
virus Microscopic, simple infectious agent that can multiply only in living cells of animals, plants, or bacteria. Viruses are much smaller than bacteria and consist of a single- or double-stranded NUCLEIC ACID (DNA or RNA) surrounded by a PROTEIN shell called a capsid; some viruses also have an outer envelope composed of LIPIDS and proteins. They vary in shape. The two main classes are RNA viruses (see RETROVIRUS) and DNA viruses. Outside of a living cell, a virus is an inactive particle, but within an appropriate host cell it becomes active, capable of taking over the cell's metabolic machinery for the production of new virus particles (VIRIONS). Some animal viruses produce latent infections, in which the virus persists in a quiet state, becoming periodically active in acute episodes, as in the case of the HERPES SIMPLEX virus. An animal can respond to a viral infection in various ways, including fever, secretion of INTERFERON, and attack by the immune system. Many human diseases, including INFLUENZA, the common COLD, and AIDS, as well as many economically important plant and animal diseases, are caused by viruses. Successful VACCINES have been developed to combat such viral diseases as MEASLES, MUMPS, POLIOMYELITIS, SMALLPOX, and RUBELLA. Drug therapy is generally not useful in controlling established viral infections, since drugs that inhibit viral development also inhibit the functions of the host cell. See also ADENOVIRUS; ARBOVIRUS; BACTERIOPHAGE; PICORNAVIRUS; PLANT VIRUS; POXVIRUS. See illustration opposite.

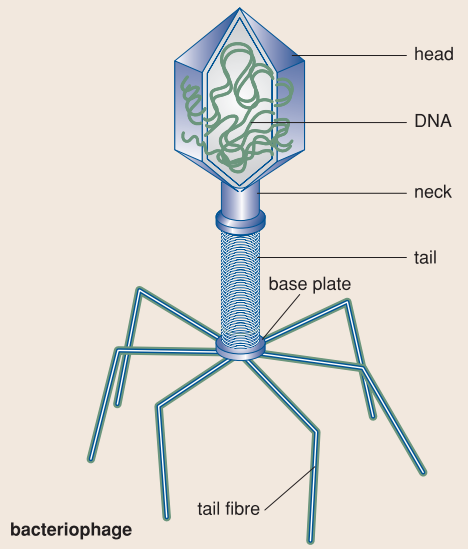
virus, computer See COMPUTER VIRUS

Visayan \vi-'sī-ən\ **Islands** Group of islands, central Philippines. Covering 23,944 sq mi (62,015 sq km), they are surrounded by the Visayan, Samar, and Camotes seas. The main islands are BOHOL, CEBU, LEYTE, MASBATE, NEGROS, PANAY, and SAMAR. These islands and their smaller neighbours make up the central group of the Ph ilippine archipelago. Agriculture and fishing are important. The major urban centres are CEBU CITY on Cebu and ILOILO City on Panay.

Visby City (pop., 1994 est.: 21,462), southeastern Sweden. Located on the northwestern coast of the island of GOTLAND, it was the site of a Stone Age settlement c. 2000 BC. By the 12th century AD it was a member of the HANSEATIC LEAGUE, and in the 13th century it was one of the leading commercial centres of Europe; the city coined its own money and developed an international maritime code. It declined after the Danish conquest of Gotland in 1361. A seaside resort, it has remains of medieval walls. Because of its remarkably well-preserved medieval ramparts and buildings, Visby was designated a protected monument in 1810 and a UNESCO WORLD HERITAGE SITE in 1995.

viscometer \vis-'kä-mə-tər\ Instrument for measuring the VISCOSITY (resistance to internal flow) of a FLUID. In one type, the time taken for a given volume of fluid to flow through an opening is recorded. In the capillary-tube viscometer, the pressure needed to force the fluid to flow at a specified rate through a narrow tube is measured. Other types depend on measurements of the time taken for a sphere to fall through the fluid, or of the force needed to rotate the inner cylinder of a pair (the space between the two cylinders being filled with the fluid under test), or of the rate at which oscillations of a disk vibrating in the fluid die out.





The influenza virus possesses both a protein shell (capsid) and a lipid and protein envelope. The protein spikes of the envelope facilitate adherence and entry into the host cell. The capsid proteins determine the influenza virus type (A, B, C), and the highly variable proteins of the spikes and envelope determine the different strains within each type. The bacteriophage (bacterial virus) shown here has a head shaped like an icosahedron (with 20 sides). The tail fibres attach the virus to the bacterium, bringing the base plate into contact with the surface. The tail contracts, and DNA from the head is injected into the host.

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Visconti \vēs-'kōn-tē**, Gian Galeazzo** *known as* **Count of Valor** (b. 1351, Milan—d. Sept. 3, 1402, Melegnano, near Milan) Leader of Milan who brought the Visconti dynasty to its height. The son of Galeazzo II Visconti, who shared the rule of Milan with his brother, Gian Galeazzo united all the Visconti lands, added the march of Treviso (1387), and became a prince of the HOLY ROMAN EMPIRE through bribery. By 1402 he held Pisa, Siena, Umbria, and Bologna. He was close to becoming ruler of all of northern Italy and was planning an attack on Florence when he died of the plague.

Visconti, Luchino *orig.* **Don Luchino Visconti, count di Modrone** (b. Nov. 2, 1906, Milan—d. March 17, 1976, Rome) Italian film and theatre director. Born into the nobility, he became an assistant to JEAN RENOIR in 1935. He directed his first film, *Ossessione* (1942), in a style foreshadowing the NEOREALISM of ROBERTO ROSSELLINI and VITTORIO DE SICA. His later films include the documentary-style drama *La terra trema*

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(1948), *Senso* (1954), *Rocco and His Brothers* (1960), *The Leopard* (1963, Golden Palm), *The Damned* (1969), and *Death in Venice* (1971). As a stage director, he introduced to Italy works by Jean Cocteau, Arthur Miller, and Tennessee Williams, and he staged operas starring Maria Callas that combined realism and spectacle.

viscosity \vis-'kä-sə-tē\ Resistance of a fluid to a change in shape, or movement of neighbouring portions relative to one another. Viscosity denotes opposition to flow. It may also be thought of as internal friction between the molecules. Viscosity is a major factor in determining the forces that must be overcome when fluids are used in lubrication or transported in pipelines. It also determines the liquid flow in spraying, injection molding, and surface coating. The viscosity of liquids decreases rapidly with an increase in temperature, while that of gases increases with an increase in temperature. The SI unit for viscosity is the newton-second per square metre ($N\text{-}s/m^2$).

viscount \'vī-ˌkaůnt\ European title of nobility, ranking immediately below a count, or earl. The wife of a viscount is a viscountess. In the Carolingian period, the *vicecomes* were deputies or lieutenants of the counts (*comes*), whose official powers they exercised by delegation. In the 11th century most of Normandy was divided into *vicomtés*, but the viscountcy was not introduced into the English peerage until nearly 400 years after the Norman conquest.

Viscount Melville \'vī-ˌkaůnt-'mel-ˌvil\ **Sound** *formerly* **Melville Sound** Body of water, northern Canada. Located in the Arctic Archipelago, between Melville and Victoria islands, the sound is 250 mi (400 km) long and 100 mi (160 km) wide. Its discovery, when reached from the east (1819–20) by William E. Parry and from the west (1850–54) by Robert McClure, proved the existence of the Northwest Passage. The sound is navigable only under favourable weather conditions.

vise Device consisting of two parallel jaws for holding a workpiece. One of the jaws is fixed, and the other can be moved by a screw, lever, or cam. Vises used for holding a workpiece during hand operations (such as filing, hammering, or sawing) are usually permanently bolted to a bench. In vises designed to hold metallic workpieces, the faces of the jaws are hardened steel plates, often removable, with teeth that grip the workpiece. Woodworking vises have smooth jaws, often of wood, and rely on friction alone rather than on teeth.

Vishnu \'vish-nü\ Principal Hindu deity worshiped as the protector and preserver of the world and restorer of dharma. He is known chiefly through his avatars, particularly Rama and Krishna. In theory, he manifests himself anytime he is needed to fight evil, and his appearances are innumerable, but in practice 10 are most common. His various names, numbering about 1,000, are repeated as acts of devotion by his worshipers.

Visigoth \'vi-zə-ˌgäth\ Western division of the Goths. Separated from the Ostrogoths (Eastern Goths) in the 4th century AD, the Visigoths were driven from Dacia by the Huns (376) and crossed the Danube into the Roman empire. Oppressed by Roman taxation, they revolted and plundered the Balkan provinces, defeating Valens and his army at the Battle of Adrianople (378). Theodosius I settled them in Moesia (382) to defend the frontier. Converted to Arian Christianity, they left Moesia in 395 under Alaric and invaded Greece and Italy, sacking Rome (410) and settling in southern Gaul and Spain (415). Recalled from Spain by Constantius III, they lost their first king, Theodoric I, in a battle against Attila (451). They were federates of Rome until King Euric declared independence (475). He extended their kingdom from the Loire to the Pyrenees and the lower Rhône, including most of Spain. In 507 they were defeated by the Franks under Clovis; retaining only Septimania (a strip from the Pyrenees to the Rhône), they held it and much of Spain until defeated by the Muslims in 711.

vision See photoreception

vision, computer See computer vision

vision quest Essential rite of passage for adolescent boys of the Eastern Woodlands and Plains Indian peoples. The youth was sent out from the camp on a solitary vigil involving fasting and prayer in order that he might gain some sign, often through a dream, of the presence and nature of his guardian spirit. Upon receiving these visions, he returned home and communicated them to a shaman or elder, who helped interpret them.

Visistadvaita \vi-'shish-täd-'vī-tə\ Principal school of Vedanta. Its seminal figure was Ramanuja, the first Vedanta thinker to establish as the cornerstone of his system the identification of a personal God with the Brahman of the Upanishads. For him, soul and matter depended on God for their existence. Exclusive devotion to God can elicit his grace, assisting the devotee in gaining release from the cycle of rebirth. After Ramanuja, a schism developed over the role of grace, giving rise to different schools. The spread of Visistadvaita was important in the devotional renaissance of Vaishnavism. In southern India the philosophy remains a major intellectual influence.

Vistula \'vis-chə-lə\ **River** *Polish* **Wisła** \'vē-swä\ River, Poland. It rises on the northern slope of the Carpathian Mountains in southwestern Poland, flows in a curve through Warsaw and Torun, then empties into the Baltic Sea at Gdańsk. Most of its 651 mi (1,047 km) are navigable. Poland's largest river, its tributaries include the Bug and Dunajec rivers.

visual-field defect Blind spot (scotoma) or area in the normal field of vision. It may be persistent or temporary and shifting, as in a migraine aura. The field may narrow, as in glaucoma. The normally small blind spot corresponding to the point where the optic nerve enters the eye can enlarge if fluid accumulates at that point (papilledema). Methanol or quinine poisoning, diseases of the nerve sheaths, deficiency diseases, and atherosclerosis can also cause blind spots. Tumours pressing on the optic nerves in different locations can cause loss of different halves or quarters of the visual field of each eye. See also macular degeneration.

visual purple See rhodopsin

visualization, scientific See scientific visualization

vitamin Organic compound required in small amounts in the diet to maintain normal metabolic functions. The term *vitamine* (1911) was changed to *vitamin* when it was realized that not all vitamins are amines (i.e., not all contain nitrogen). Many vitamins act as or are converted to coenzymes. They neither provide energy nor are incorporated into tissues. Water-soluble vitamins (vitamin B complex, vitamin C) are excreted quickly. Fat-soluble vitamins (vitamin A, vitamin D, vitamin E, and vitamin K) require bile salts for absorption and are stored in the body. The normal functions of many vitamins are known. Deficiency of specific vitamins can lead to diseases (including beriberi, neural tube defect, pernicious anemia, rickets, and scurvy). Excess amounts, especially of fat-soluble vitamins, can also be dangerous: e.g., too much vitamin A causes liver damage, an effect not seen with beta-carotene, which the body converts into vitamin A. Several vitamins are now known to support the immune system. Most vitamins are adequately supplied by a balanced diet, but people with higher requirements may need supplements.

vitamin A *also called* **retinol** Fat-soluble alcohol, most abundant in fatty fish and especially in fish-liver oils. It is not found in plants, but many vegetables and fruits contain beta-carotene (see carotene), which is readily converted in the body to vitamin A. It functions directly in vision, especially night vision. A derivative, retinaldehyde, is a component of the visual pigments, including rhodopsin, in the retina. Humans require vitamin A in very small amounts. Unlike carotenes, it is toxic in large amounts and is readily destroyed by exposure to heat, light, or air.

vitamin B complex Water-soluble organic compounds with loosely similar properties, distribution in natural sources, and physiological functions. Most are coenzymes, and all appear essential to the metabolic processes of all animal life. They include thiamin (B_1), riboflavin (B_2), niacin, vitamin B_6, pantothenic acid, folic acid, biotin, and vitamin B_{12} (cobalamin); some authorities also include choline, carnitine, lipoic acid, inositol, and *para*-aminobenzoic acid. Vitamin B_6 is needed for metabolism of amino acids and prevention of skin and nerve disorders. Vitamin B_{12} prevents pernicious anemia and is involved in nucleic-acid synthesis, fat metabolism, and conversion of carbohydrate to fat. The B complex vitamins are particularly abundant in cereal grains, meats, nuts, and some fruits and vegetables.

vitamin C *or* **ascorbic acid** Water-soluble organic compound important in animal metabolism. Most animals produce it in their bodies, but humans, other primates, and guinea pigs need it in the diet to prevent scurvy. It is essential in collagen synthesis, wound healing, blood-vessel maintenance, and immunity. Some studies have found a moderate benefit of vitamin C in reducing the duration and severity of the common cold. It works as an antioxidant in the body and is used as a preservative. It is easily destroyed by oxygen. Excellent sources are citrus fruits and fresh vegetables.

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vitamin D Any of a group of fat-soluble ALCOHOLS important in CALCIUM METABOLISM in animals to form strong bones and teeth and prevent RICKETS and OSTEOPOROSIS. It is formed by ultraviolet radiation (sunlight) of sterols (see STEROID) present in the skin. The most important of these sterols are 7-dehydrocholesterol, formed by metabolic processes in animals, and ergosterol, present in vegetable oils. The action of sunlight on the skin converts these two compounds, respectively, to cholecalciferol (vitamin D_3) and ergocalciferol (vitamin D_2). Vitamin D is added to margarine, milk, and cereals for the benefit of those who may not get enough sunlight in winter. As little as 5 micrograms each day appear adequate for children. Because the body cannot excrete it, prolonged high intake can cause a toxic reaction including fatigue, nausea, and abnormal calcium accumulation.

vitamin E *or* **tocopherol** \tō-'kä-fə-ˌrȯl\ Fat-soluble organic compound found principally in certain plant oils and leaves of green vegetables. Vitamin E acts as an ANTIOXIDANT in body tissues and may prolong life by slowing oxidative destruction of MEMBRANES. Certain rodents require it for normal reproduction. Besides uses in foods and in nutritional research and supplements, it is used to retard rancidity in FATS, especially vegetable oils.

vitamin K Any of several fat-soluble compounds essential for the clotting of blood. A deficiency of vitamin K in the body leads to an increase in clotting time. In 1929 a previously unrecognized fat-soluble substance present in green leafy vegetables was found to be required for COAGULATION of the blood; its letter name comes from the Danish word *koagulation*. A pure form was isolated and analyzed structurally in 1939; several related compounds having vitamin-K activity have since been isolated and synthesized. The form of vitamin K that is important in mammalian tissue is of microbial origin. A synthetic vitamin K precursor called menadione is used as a vitamin supplement.

Vitellius \vi-'tel-ē-əs**, Aulus** (b. AD 15—d. Dec. 20, 69, Rome) Roman emperor (69), the last of NERO's three short-lived successors. Vitellius was commander of the Lower German army when Nero died and was proclaimed emperor by his troops. When he marched on Italy, Otho, a rival emperor, committed suicide. Vitellius entered Rome but there had to contend with VESPASIAN, whose army had also proclaimed him emperor; the troops of Vitellius lost to those of Vespasian. Vitellius's PRAETORIAN GUARD prevented him from abdicating, but he was captured by troops, dragged through the streets, tortured, and killed.

Viti Levu \'vē-tē-'lā-vü\ Island (pop., including adjacent islands, 1996: 594,791), Fiji, South Pacific Ocean. The country's largest island, it has an area of 4,011 sq mi (10,388 sq km). SUVA, the Fijian capital, is situated on the island's southeastern coast. It was sighted by Capt. WILLIAM BLIGH in 1789. A central mountain range divides the island into wet and dry sections. Mount Tomanivi, the highest point in Fiji, rises 4,341 ft (1,323 m). Islanders grow sugar, pineapples, cotton, rice, and tobacco. There is a goldfield in the north-central part of the island.

vitiligo \ˌvit-ᵊl-'ī-gō\ *or* **leukoderma** Skin disorder manifested by smooth, white spots on various parts of the body. Though the pigment-making cells of the skin, or melanocytes, are structurally intact, they have lost the ability to synthesize the pigment. The reason for the condition is unclear. Individuals with vitiligo (about 1% of the adult population) are usually in good general health, but vitiligo presents a cosmetic problem that can be serious in dark-skinned individuals. Normal skin color rarely returns, and there is no known cure.

Vitória \vē-'tōr-yə\ City (pop., 2002 est.: 299,400), eastern Brazil. Located on the western side of Vitória island in Espírito Santo Bay, it was founded by the Portuguese in 1535 and was made a provincial capital in 1823. It was Brazil's leading port for exporting iron ore until the 1960s. Its economy is based now on textile factories, sugar refineries, and other small manufacturing plants as well as on the shipment of coffee.

Vitoria \vē-'tōr-ē-ə\ **-Gasteiz** City (pop., 2001: 216,852), capital of BASQUE COUNTRY autonomous community, northeastern Spain. The official name derives from the combined Spanish (Vitoria) and Basque (Gasteiz) names for the city. Founded as Victoriacum by the Visigothic king Leovigild in 581, it was granted a charter in the 12th century. In 1200 Alfonso VIII captured it and incorporated it into his kingdom. In 1813 it was the scene of a battle in which allied forces under English Gen. Arthur Wellesley (later duke of WELLINGTON) defeated the French, driving them from Spain and leading to the end of the PENINSULAR WAR. Now a manufacturing centre, it retains several medieval buildings.

vitriol, oil of See SULFURIC ACID

Vitruvius \və-'trü-vē-əs\ *in full* **Marcus Vitruvius Pollio** (fl. 1st century BC) Roman architect, engineer, and author of the celebrated treatise *De architectura*, a handbook for Roman architects. Little is known of his life except what can be gathered from his writings. The treatise is divided into 10 books covering almost every aspect of architecture and city planning. His wish was to preserve the Classical Greek tradition in the design of temples and public buildings, and his prefaces contain many pessimistic remarks about the architecture of the time. His work was the chief authority on ancient CLASSICAL ARCHITECTURE throughout the antique revival of the Renaissance, the Classical phase of the Baroque, and the Neoclassical period.

Vitsyebsk \'vēt-syipsk\ *Russian* **Vitebsk** \'vē-tipsk\ City (pop., 2001 est.: 349,000), northeastern Belarus. First mentioned in 1021, it was a major fortress and trading centre and was the chief town of an independent principality for some 200 years. It passed to Lithuania in 1320, later to Poland, and then to Russia in 1772. It was destroyed by the Poles in the 16th century, by the Swedes in the Great Northern War, by Napoleon in 1812, and by the Germans in World War II. There are two museums dedicated to MARC CHAGALL, a native of the city. A major industrial centre, it produces machine tools, electrical instruments, and a range of consumer goods.

Vittorini \ˌvēt-'tō-'rē-nē**, Elio** (b. July 23, 1908, Syracuse, Sicily, Italy—d. Feb. 13, 1966, Milan) Italian novelist, translator, and critic. He left school at age 17 and later learned English while working as a proofreader. He became, with CESARE PAVESE, a pioneer in translating the works of U.S. and English writers into Italian. His novels of NEOREALISM mirror Italy's experience of fascism and the social, political, and spiritual agonies of the 20th century. *Conversation in Sicily* (1941), which clearly expresses his antifascist feelings, is his most important novel.

Vivaldi \vi-'väl-dē**, Antonio (Lucio)** (b. March 4, 1678, Venice, Republic of Venice—d. July 28, 1741, Vienna, Austria) Italian composer. He was taught violin by his father. In 1703 he was ordained a priest (and later became known as the "Red Priest" for his red hair). He spent most of his career teaching violin and leading the orchestra at a Venetian girls' orphanage. After c. 1718 he became more involved in opera as both composer and impresario. His concertos were highly influential in setting the genre's three-movement (fast-slow-fast) form, with a returning theme (*ritornello*) for the larger group set off by contrasting material for the soloists, and he popularized effects such as pizzicato and muting. His *L'estro armonico* (1711), a collection of concerti grossi, attracted international attention. His *La stravaganza* (c. 1714) was eagerly awaited, as were its successors, including *The Four Seasons* (1725). In all he wrote more than 500 concertos. His most popular sacred vocal work is the *Gloria* (1708). Though often accused of repeating himself, Vivaldi was in fact highly imaginative, and his works exercised a strong influence on JOHANN SEBASTIAN BACH.

Vivarini \ˌvē-vä-'rē-nē\ **family** Family of 15th-century Venetian painters. Antonio Vivarini (b. c. 1415—d. c. 1480) collaborated from 1441 with his brother-in-law, Giovanni d'Alemagna (d. 1450), on altarpieces, four of which survive in the churches of San Zaccaria (1443) and San Pantalon (1444), and on a large three-part canvas in the Accademia (1446). Their large-scale polyptychs feature stiff, archaic figures and heavily ornamented frames. In 1447–50 they lived in Padua and worked with ANDREA MANTEGNA on a cycle of frescoes for the Church of the Eremitani (destroyed in World War II). Antonio's younger brother and pupil Bartolomeo (b. c. 1432—d. c. 1499) collaborated with Antonio after 1450. His work, more progressive than his brother's, was imitative of Mantegna. From 1459 he worked independently. His most distinguished works include the altarpieces in the churches of SS. Giovanni e Paolo (1473), Santa Maria dei Frari (1474), and San Giovanni Bragora (1478) and in the Accademia (1477). Antonio's son Alvise (b. c. 1445—d. c. 1505) came under the influence of the BELLINI FAMILY, with whom he worked on paintings (now lost) for the Doges' Palace (1488). The overlapping careers of Antonio, Bartolomeo, and Alvise recapitulate the overall development of Venetian painting from the late Gothic period to the threshold of the High Renaissance.

Vivekananda \'vē-vā-kə-'nən-də\ *orig.* **Narendranath Datta** (b. Jan. 12, 1863, Calcutta—d. July 4, 1902, Calcutta) Hindu spiritual leader and reformer. He received a Western education. He later joined the BRAHMO SAMAJ and became the most notable disciple of RAMAKRISHNA. By stressing the universal and humanistic aspects of the VEDA and emphasizing service over dogma, he attempted to infuse vigour into Hinduism. He was a moti-

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vating force behind the Vedānta movement in the U.S. and England, lecturing and proselytizing in both countries. In 1897 he founded the Ramakrishna Mission, which carries out extensive educational and philanthropic work in India and expounds Vedānta in Western countries.

vivisection Operation on a living animal for experimental rather than healing purposes; more broadly, all experimentation on live animals. It is opposed by many as cruelty and supported by others on the ground that it advances medicine; a middle position is to oppose unnecessarily cruel practices, use alternatives when possible, and restrict experiments to necessary medical research (as opposed, for example, to cosmetics testing). Surgery on animals without anesthesia was once common; many people, most significantly Rene Descartes, claimed that animals did not really feel pain. Testing chemicals on animals to find the lethal dose still occurs despite alternative methods (computer simulations, tissue culture tests). An antivivisection movement in the late 19th century broadened its scope to include prevention of all cruelty to animals and later gave rise to the animal rights movement.

vizier \və-'zir\ *Arabic* **wazīr** Chief minister of the ʿAbbāsid caliphs and later a high government official in various Muslim countries. The office was originally held and defined by the Barmakids in the 8th century; they acted as the caliph's representative to the public, later serving a similar function for various sultans. In the Ottoman Empire the title could be held by several people at once; under Mehmed II the position of grand vizier, the absolute representative of the sultan, was created.

Vladimir \'vla-də-mər,vlə-'dē-mir\ **I, Saint** *Russian* **Vladimir Svyatoslavich** (b. 956, Kiev, Kievan Rus—d. July 15, 1015, Berestova, near Kiev; feast day July 15) Grand prince of Kiev (980–1015). He became prince of Novgorod in 970, and after his father's death in 972 he seized Kiev from his brother. He consolidated the Kievan realm from Ukraine to the Baltic Sea by 980 and fortified its frontiers against Baltic and Eastern nomads. Originally a pagan, Vladimir made a pact (c. 987) with Basil II, providing him with military aid in exchange for marriage to Basil's sister and promising to convert to Christianity. He adopted the Byzantine rite for his realm, forcibly converting Kiev and Novgorod and ordering pagan idols cast into the Dnieper River.

Vladimir-Suzdal school \'vla-də-mər-'süz-dəl\ School of Russian medieval mural and icon painting, with origins in Kievan Byzantine art, that flourished in the 12th–13th century around the cities of Vladimir and Suzdal, in northeastern Russia. Its works, while maintaining Byzantine illusionistic modeling and solid proportions that lack the elongation that characterizes all later Russian art, move toward a more Russian expression: the emotion is intensely ascetic, the anatomy of the figures is uncertain and the hands are typically small, and the facial expressions portray a range of emotions. This brilliant artistic development ended with the mid-13th-century Mongol invasions.

"The Archangel Michael," icon by an anonymous artist of the Vladimir-Suzdal school, egg tempera on panel, c. 1300; in the State Tretyakov Gallery, Moscow
NOVOSTI PRESS AGENCY, MOSCOW

Vladivostok \ˌvla-də-və-'stäk, ˌvla-də-'väs-ˌtäk\ Seaport city (pop., 2001 est.: 598,600), southeastern Russia, in Asia. Founded in 1860 as a Russian military outpost, it became the main Russian naval base on the Pacific Ocean in 1872. It became a free commercial port in 1904 and grew rapidly as a military base after the Russian Revolution of 1917. During the Soviet era it was the home of the Pacific fleet; its military importance was such that it was closed to foreign shipping from the late 1950s. After the collapse of the U.S.S.R. in 1991, it reemerged as a commercial port, with industries such as ship repair and fish and meat processing. A cultural centre, it is the eastern terminus of the Trans-Siberian Railroad.

Vlaminck \vlə-'maŋk**, Maurice de** (b. April 4, 1876, Paris, France—d. Oct. 11, 1958, Rueil-la-Gadelière) French painter. Noted for his brash temperament as well as his flair for landscapes, he began in 1900 to share a studio with André Derain, a friend from childhood. In 1905 he first exhibited at the Salon des Indépendants. His experiments with pure, intense colour applied in thick daubs earned him an association with Fauvism, but by 1908 he had turned to painting landscapes of thickly applied whites, grays, and deep blues, and his style moved closer to that of Paul Cézanne. He began c. 1915 to develop a personal, strongly stated style that placed him solidly in the realm of French Expressionism.

Vlissingen \'vli-siŋ-ə\ Seaport city (pop., 2001 est.: 44,776), southwestern Netherlands. As a medieval trading town, its importance lay in its position controlling the approach to Antwerp. In 1572 it was the first Netherlands town to rebel against Spanish rule. It was turned into a naval base by Napoleon during the French occupation (1795–1814). The city was heavily damaged during World War II, when the area was flooded in 1944 by the Allies to clear the way to Antwerp. Since rebuilt, it is now a commercial port, fishing harbour, seaside resort, and naval base.

Vltava \'vəl-tə-və\ **River** *German* **Moldau** River, Czech Republic. The Czech Republic's longest river, it flows 270 mi (435 km). The river rises in southwestern Bohemia from two headstreams in the Bohemian Forest. It flows first southeast, then north across Bohemia and empties into the Elbe River.

Vo Nguyen Giap \'vò-'ŋwē-ən-'zyȧp,\ *English* \'vō-en-gī-'en-jē-'ap\ (b. 1912, An Xa, Viet.) Vietnamese military leader. He began to work for Vietnamese autonomy as a youth and attended the same high school as Ho Chi Minh. As a professor of history in Hanoi, he converted many colleagues and students to his political views. He fled to China in 1939 when the French banned the Indochinese Communist Party, but returned in 1941. In 1945 he led the Viet Minh forces that defeated the Japanese, who occupied Vietnam during World War II. He brought French colonial rule to an end by winning the Battle of Dien Bien Phu (1954) in the First Indochina War, and he led the North Vietnamese forces that defeated the U.S. and South Vietnam in the Vietnam War (1955–75). He served in various roles in the postwar government of Vietnam until the early 1990s.

vocal cord Either of two folds of mucous membrane that extend across the interior cavity of the larynx and are primarily responsible for voice production. Sound is produced by the vibration of the folds in response to the passage between them of air exhaled from the lungs. The pitch of sound varies with the degree of vocal-cord tension. Sounds are then modified by the tongue, palate, and lips to produce speech. When at rest, the vocal cords lie apart, forming a V-shaped opening (glottis) through which air is breathed. The folds located just above the vocal cords are termed the vestibular or false vocal cords because they are not involved in voice production. Inflammation (as from excessive use) limits the normal contraction of the vocal cords, resulting in hoarseness.

vodka Colourless distilled liquor of neutral spirits usually made from a grain mash (generally rye or wheat). Potato vodka originated in Russia in the 14th century. Today most vodka is distilled from cereal grains. It is highly neutral, most flavouring substances having been eliminated during distillation and filtration, the latter process employing charcoal purifiers. Distilled water is usually added before bottling in order to lower alcohol content to 40–43% by volume (80–86 proof). Vodka is not aged. It is traditionally consumed unmixed and chilled, in small glasses; in the U.S. and elsewhere, it is often used in mixed drinks.

Vodou \vō-'dün\ *or* **voodoo** National folk religion of Haiti. It combines theological and magical elements of African religions and ritual elements of Roman Catholicism. Practitioners profess belief in a supreme God but give more attention to a large number of spirits called the loa, which can be identified as local or African gods, deified ancestors, or Catholic saints. The loa demand ritual service and attach themselves to individuals or families. In turn, they act as helpers, protectors, and guides. In ritual services, a priest or priestess leads devotees in ceremonies involving song, drumming, dance, prayer, food preparation, and animal sacrifice. The loa possess worshipers during services, dispensing advice, performing cures, or displaying special physical feats. A well-known aspect of Vodou is the zombie. See also Macumba; Santería.

voice In grammar, the form of a verb indicating the relation between the participants (subject, object) in a narrated event and the event itself. English grammar distinguishes between the active voice ("The hunter

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killed the bear") and the passive voice ("The bear was killed by the hunter"). In the active voice, the emphasis is on the subject of the active verb (the agent performing the action named), whereas the passive voice indicates that the subject receives the action.

voice box See LARYNX

voice mail Electronic system for recording oral messages sent by telephone. Typically, the caller hears a prerecorded message and then has an opportunity to leave a message in return. The person called can then retrieve the message at a later time by entering specific codes on his or her telephone. Voice mail is distinguished from an answering machine by its ability to provide service to multiple phone lines and by the more sophisticated functions that it offers in addition to recording messages.

Voice of America Radio broadcasting network of the U.S. government. Its function is to promote understanding of the U.S. and spread democratic values. Its daily broadcasts include news reports, editorials, and discussions of U.S. political and cultural events. Its first broadcast, in German, took place in 1942 to counter Nazi propaganda. By the end of World War II, it was broadcasting 3,200 programs in 40 languages every week. During the Cold War it focused its message at the communist countries of eastern and central Europe. It became part of the U.S. Information Agency when that agency was formed in 1953.

voice recognition See SPEECH RECOGNITION

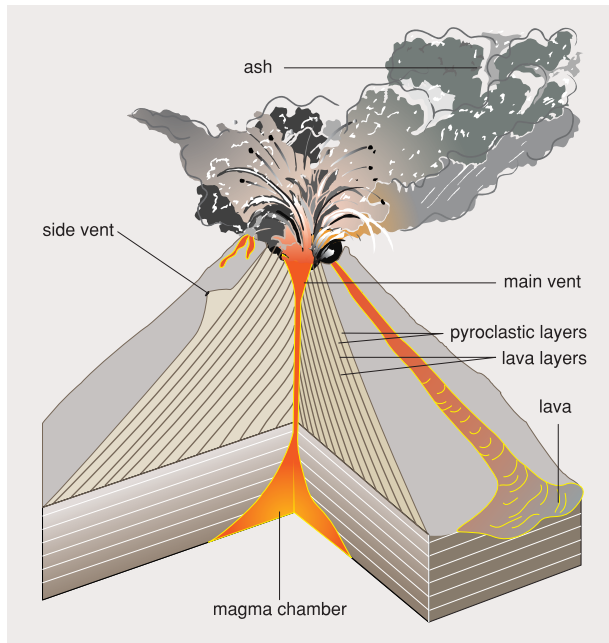
voir dire \'vwär-'dir\ *Anglo-French* **"to speak the truth"** In law, the act or process of questioning prospective jurors to determine whether they are qualified and suitable for service on a JURY. The questioning attorneys may dismiss a juror for cause, such as when bias or preconceived notions of guilt or innocence are in evidence; they also have a limited number of peremptory challenges that they can use to dismiss a juror for any or no reason.

Vojvodina \'vȯi-vȯ-ˌdē-nä\ Province (pop., 1999 est.: 1,954,432), within the republic of SERBIA, SERBIA AND MONTENEGRO. It covers 8,304 sq mi (21,506 sq km), and its chief city is NOVI SAD. Slavs settled there in the 6th and 7th centuries, followed by Hungarian nomads in the 9th and 10th centuries. Ottoman Turks controlled the region from the early 16th to the late 18th century, when it became part of the Austrian HABSBURG empire. By then it was a centre of Serbian Orthodox culture. In 1849 portions of the historic regions of Backa and Banat were united as the Vojvodina under Croatia-Slavonia. In 1867 it reverted to Hungary, and in 1918 it was made part of the Kingdom of SERBS, CROATS, AND SLOVENES (later Yugoslavia). In 1945 it became an autonomous province of the Serbian republic, but in 1989 SLOBODAN MILOŠEVIĆ rescinded this status. In 1999, after receiving tens of thousands of Serbian refugees from KOSOVO, it demanded restoration of its autonomy. Although denied full autonomy, it was granted some powers in 2002 by the Serbian parliament.

volcanic glass Any glassy rock formed from LAVA or MAGMA that has a chemical composition close to that of GRANITE. Such molten material may reach very low temperatures without crystallizing, but its viscosity may become very high. Because high viscosity inhibits crystallization, the combination of sudden cooling and loss of volatiles, as when lava extrudes from a volcanic vent, tends to chill the material to a glass rather than crystallize it.

volcanism \'väl-kə-ˌni-zəm\ *or* **vulcanism** Any of various processes and phenomena associated with the surface discharge of molten rock or hot water and steam, including VOLCANOES, GEYSERS, and FUMAROLES. Most active volcanoes occur where two plates converge and one overrides the other (see PLATE TECTONICS). Volcanism can also occur along the axis of an OCEANIC RIDGE, where the plates move apart and magma wells up from the mantle. A few volcanoes occur within plates, far from margins. Some of these are thought to occur as a plate moves over a "hot spot" from which magma can penetrate to the surface; others appear to result from an extremely slow form of plate spreading.

volcano Vent in the crust of the Earth from which molten rock, hot rock fragments, ash, gas, and steam issue. Most volcanoes are found on the boundaries of the enormous plates that make up the Earth's surface. Some of the most violent eruptions take place along convergent boundaries where one plate margin is forced beneath another. The most famous such boundary is the circum-Pacific belt bordering the Pacific Ocean; the island arcs and mountain ranges of this "Ring of Fire" have seen gigantic explosions, among them the eruptions of Mount PINATUBO in the Philippines in 1991, Mount SAINT HELENS in the U.S. state of Washington in 1980, and KRAKATOA (Krakatau) in Indonesia in 1883. Volcanic activity is also common at divergent boundaries, where two plates slowly pull apart and allow molten rock to escape to the surface; the most prominent example is the MID-ATLANTIC RIDGE, site of volcanic islands such as ICELAND, the AZORES, Ascension, SAINT HELENA, and Tristan da Cunha. Yet another type of volcanic activity is found on the island of HAWAII, located on a "hot spot" near the middle of the Pacific Plate where plumes of partially melted rock rise from below the Earth's crust; there the volcanoes KILAUEA and MAUNA LOA frequently eject streams and fountains of LAVA. Some of the best-known volcanism takes place around the Mediterranean Sea, where the eruptions of Mount ETNA, VESUVIUS, the islands of STROMBOLI and VULCANO, and other volcanoes have been observed for millennia. Some volcanoes have cultural or religious significance for the peoples around them; these include MISTI VOLCANO in Peru, Mount FUJI in Japan, and Ol Doinyo Lengai in Tanzania.



A volcano forms when magma beneath the Earth's crust forces its way to the surface. Alternating layers of solidified lava and pyroclastic materials (ash and cinders) build up the typical cone shape of a stratovolcano as they are ejected through the central vent during eruptions.

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Volcano Islands *Japanese* **Kazan-rettō** *or* **Iō-rettō** Group of three small volcanic islands, western Pacific Ocean. Administratively part of Japan, they lie south of the BONIN ISLANDS. After they were visited by Japanese fishermen and sulfur miners in 1887, the three islands of Kita Iō, Iō (IWO JIMA; the largest), and Minami Iō were claimed by Japan in 1891. Iō was the scene of heavy fighting during World War II. After the war Japan retained residual sovereignty over the islands, but the U.S. administered them from 1951 until they were returned to Japan in 1968.

volcanology *or* **vulcanology** Scientific discipline concerned with all aspects of volcanic phenomena. Volcanology deals with the formation, distribution, and classification of VOLCANOES, as well as their structure and the kinds of materials ejected during an eruption (e.g., lava, dust, ash, and gas). It also involves research on the relationships between volcanic eruptions and other large-scale geologic processes, such as mountain building and earthquakes. One of its chief aims is to determine the nature and causes of volcanic eruptions in order to predict them. Another practical concern is obtaining data that may aid in locating commercially valuable deposits of ores, particularly those of certain metallic sulfides.

Volcker, Paul A(dolph) (b. Sept. 5, 1927, Cape May, N.J., U.S.) U.S. economist. He worked as an economist for the Chase Manhattan Bank (1957–61; 1965–68). As an undersecretary at the U.S. Treasury Department (1969–74), Volcker was the chief architect of the U.S.'s abandon-

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ment of the gold-exchange standard and the devaluations of the U.S. dollar (1971, 1973). After serving as president of the Federal Reserve Bank (1975–79), he was appointed head of the Federal Reserve System in 1979 by Pres. Jimmy Carter and served until 1987. To end a period of very high inflation, he slowed the growth of the money supply and allowed interest rates to rise, causing a recession (1982–83) but dramatically reducing inflation.

vole Any burrowing rodent (family Cricetidae) with a blunt snout, small ears, and short limbs. Most species are herbivorous and are found throughout North America and Eurasia. The approximately 45 species of the genus *Microtus*, also called meadow mice, are 4–10 in. (10–26 cm) long, including the tail. Their long, shaggy fur is grayish brown. About 10 species of pine voles inhabit swamps, fields, and hardwood forests. Red-backed voles inhabit forests in cold regions. Water voles are found only in Eurasia and usually live near a stream, ditch, or lake.

Meadow vole (*Microtus pennsylvanicus*).
JUDITH MYERS

Volga River River, western Russia. Europe's longest river and the principal waterway of western Russia, it rises in the Valdai Hills northwest of Moscow and flows 2,193 mi (3,530 km) southeastward to empty into the Caspian Sea. It is used for power production, irrigation, flood control, and transportation. The river has played an important part in the life of the Russian people, and in Russian folklore it is characteristically named "Mother Volga."

Volga-Baltic Waterway Series of rivers and canals, western Russia. The navigable system links the Volga River with the Baltic Sea and includes the Neva River, a canal along the southern shore of Lake Ladoga, and the Sheksna River past Cherepovets through the Rybinsk Reservoir. Its total length is some 685 mi (1,100 km). The system was completed in 1964, replacing the antiquated Mariinsk Canal system using the same route that had been constructed originally in the 18th century and later several times enlarged and improved. The system includes seven automatic locks.

Volga Tatar language See Tatar language

Volgograd *formerly (until 1925)* **Tsaritsyn** *(1925–61)* **Stalingrad** City (pop., 2001 est.: 982,900), southwestern Russia. Located on the Volga River, it was founded as the fortress of Tsaritsyn in 1589. During the Russian Civil War (1918–20), Joseph Stalin organized the city's defense against the White Russian armies, and it was later renamed in his honour. During World War II it was reduced to rubble in the Battle of Stalingrad; it was rebuilt in the postwar era. Its manufactures include steel and aluminum, engineering products, timber goods, building materials, and foodstuffs. A major railroad junction and river port, it is the eastern terminus of the Volga-Don Ship Canal.

Volhynia \väl-'hi-nē-ə\ Historical region, northwestern Ukraine. Located around the headstreams of the Pripyat and Bug rivers, it originally was a Russian principality (10th–14th century), west of Kiev. In the 14th century it became part of the Grand Duchy of Lithuania but was ruled largely by its own aristocracy. It passed to Poland in 1569. In 1793 it was transferred to Russia under the second partition of Poland. The Treaty of Riga (1921) divided it between Poland and the U.S.S.R. The U.S.S.R. took the Polish section in 1939 and made it part of the Ukrainian S.S.R. after World War II.

Volkswagen AG (VW) Major German automobile manufacturer. It was founded in 1937 to mass-produce a low-priced "people's car" (*Volkswagen*). After World War II the company was rebuilt with Allied help, and within a decade it was producing half of West Germany's motor vehicles. U.S. sales of the small, rounded car were initially low, but a humorous advertising campaign promoting the car as "the Beetle" lifted sales in the 1960s, making it the leading auto import in the U.S. Competition from other foreign compact cars brought VW near bankruptcy by 1974, but the firm rebounded by introducing sportier models such as the Rabbit. In 1998 it launched a fully redesigned version of the Beetle. With its affiliates, VW operates plants worldwide; it also owns other auto brands, including Audi and Bentley.

volleyball Game played by two teams of six players each, in which an inflated ball is volleyed over a high net. Each team tries to make the ball touch the court within the opposing side's playing areas before it can be returned. A team is allowed to touch the ball three times before returning it. The team that first scores 15 points wins the game. Volleyball was invented in 1895 by William G. Morgan in Holyoke, Mass. It soon proved to have wide appeal for both sexes in schools, playgrounds, the armed forces, and other settings. International competition began in 1913, and volleyball became an Olympic sport in 1964. Beach volleyball, a variation with two players on a side, has grown increasingly popular and became an Olympic sport in 1996.

Volsci \'vōl-skē, 'väl-ˌsī\ Ancient Italic people prominent in the history of Roman expansion in the 5th century BC. They belonged to the Osco-Sabellian group of tribes and lived (c. 600 BC) in the valley of the upper Liris River (then in southern Latium). They fought the Romans and the Latins intermittently for about 200 years. The Romans established several colonies to stem the Volsci advance. In 340 they joined the Latin revolt against Rome but were defeated. After submitting to Rome by 304, they quickly became fully Romanized.

Volstead Act See Prohibition

Vǫlsunga saga \'vœl-sùŋ-ə, 'vōl-sùŋ-ə\ ("Saga of the Volsungs") Best of the Icelandic sagas known as *fornaldar sǫgur* ("sagas of antiquity"). Dating from roughly 1270, it is the first of the *fornaldar sǫgur* to have been written down. It contains the Northern version of the story told in the *Nibelungenlied*. The saga was based on the heroic poems in the Poetic *Edda* and is especially valuable because it preserves in prose form some of the poems from the Edda that were lost. It became one of the sources of Richard Wagner's operatic *Ring* tetralogy.

Volta \'vōl-tə**, Alessandro (Giuseppe Antonio Anastasio)** (b. Feb. 18, 1745, Como, Lombardy—d. March 5, 1827, Como) Italian scientist. In 1775 he invented the electrophorus, a device used to generate static electricity. He taught physics at the University of Pavia (1779–1804). After Luigi Galvani in 1780 produced an electric current by connecting two different metals with the muscle of a frog, Volta began experimenting in 1794 with metals alone and found that animal tissue was not needed to produce current. He demonstrated the first electric battery in 1800. In 1801 he demonstrated the battery's generation of current before Napoleon, who made him a count and senator of the kingdom of Lombardy. In 1815 he was appointed director of the philosophical faculty at the University of Padua. The volt was named in his honour in 1881.

Volta, Lake Lake, Ghana. One of the world's largest artificial lakes, it was formed in 1965 when the Akosombo Dam dammed the Volta River and created a reservoir that extends about 250 mi (400 km) upstream to beyond the former confluence of the Black Volta and White Volta rivers. It covers 3,283 sq mi (8,502 sq km), or 3.6% of Ghana's area. It is a major fishing ground and provides irrigation water for farmland in the Accra plains. The dam generates enough hydroelectric power to supply most of Ghana's electricity needs.

Volta \'väl-tə, 'vōl-tə\ **River** River, Ghana, western Africa. The nation's chief river, it flows from Lake Volta and receives the Black Volta and the White Volta rivers. It flows southward through Ghana to the Bight of Benin in the Gulf of Guinea. The river system is 1,000 mi (1,600 km) long.

Voltaic languages See Gur languages

Voltaire \vōl-'ter\ *orig.* **François-Marie Arouet** (b. Nov. 21, 1694, Paris, France—d. May 30, 1778, Paris) French writer. Voltaire studied law but abandoned it to become a writer. He became acclaimed for his tragedies and continued to write for the theatre all his life. He was twice imprisoned in the Bastille for his remarks and in 1726 was exiled to England, where his philosophical interests deepened; he returned to France in 1728 or 1729. His epic poem *La Henriade* (1728) was well received, but his lampoons of the Regency and his liberal religious opinions caused offense. *Lettres philosophiques* (1734), in which he spoke out against established religious and political systems, created an uproar. He fled Paris and settled at Cirey in Champagne with Mme du Châtelet, who became his patroness and mistress, and there he turned to scientific research and the systematic study of religions and culture. After her death he spent periods in Berlin and Geneva; in 1754 he settled in Switzerland. In addition to his many works on philosophical and moral problems, he wrote *contes* ("tales") including *Zadig* (1747), *Micromégas* (1752), and his best-known work, *Candide* (1759), a satire on philosophical optimism.

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He kept up an immense correspondence and took an interest in any cases of injustice, especially those resulting from religious prejudice. Voltaire is remembered as a crusader against tyranny and bigotry and is noted for his wit, satire, and critical capacity.

Volturno River \väl-'tůr-nō\ River, southern central Italy. It flows southeast from the Abruzzese Apennines, then turns west to empty into the Gulf of Gaeta. It is 109 mi (175 km) long and has a dam for flood control and irrigation. During the wars for Italian unity, the Italian nationalist leader Giuseppe de Garibaldi defeated a Neapolitan army there in 1860. During World War II, German forces in southern Italy used it as their line of defense after the fall of Naples; after severe fighting, the Allies crossed the river in October 1943.

volume See length, area, and volume

voluntarism \'vä-lən-tə-ˌri-zəm\ Metaphysical or psychological system that assigns a more predominant role to the will (Latin, *voluntas*) than to the intellect. Christian philosophers who have been described as voluntarist include St. Augustine, John Duns Scotus, and Blaise Pascal. A metaphysical voluntarism was propounded in the 19th century by Arthur Schopenhauer, who took will to be the single, unconscious force behind all of reality and all ideas of reality. An existentialist voluntarism was present in Friedrich Nietzsche's doctrine of the overriding "will to power" whereby man would eventually recreate himself as "superman." And a pragmatic voluntarism is evident in William James's conception of knowledge and truth in terms of purpose and practical ends.

vomiting Forcible ejection of the stomach contents from the mouth, usually following nausea. Causes include illness, motion sickness, certain drugs, inner ear disorders, and head injury. Vomiting may occur without nausea (e.g., after extreme exertion). Two centres in the brain's medulla oblongata are believed to control it; the vomiting centre initiates and controls a series of muscle contractions beginning at the small intestine and moving through the stomach and esophagus. This reaction may be set off by the chemoreceptor trigger zone, stimulated by many toxins and drugs, to rid the body of them, or by stimuli from various parts of the body that may be stressed or diseased. Severe vomiting may cause dehydration, malnutrition, or esophageal wall rupture. Vomiting of blood may be a sign of bleeding ulcer or other upper digestive tract disorders. See also bulimia.

von Neumann \vän-'nȯi-män**, John** *orig.* **János Neumann** (b. Dec. 28, 1903, Budapest, Hung.—d. Feb. 8, 1957, Washington, D.C., U.S.) Hungarian-born U.S. mathematician. After receiving his Ph.D. from the University of Budapest, he emigrated to the U.S. to teach at Princeton University (1930) and was among the original faculty of the Institute for Advanced Study (from 1933). He solved one of David Hilbert's 23 theoretical problems and collaborated on developing an algebraic ring with profound applications in quantum physics. During World War II he participated in the development of the atomic bomb. After the war he made major contributions to the development of high-speed computers; one of his computers was essential to the creation of the hydrogen bomb. As coauthor of *Theory of Games and Economic Behavior* (1944), he was one of the founders of game theory.

Vondel \'vȯn-dəl**, Joost van den** (b. Nov. 17, 1587, Cologne—d. Feb. 5, 1679, Amsterdam) Dutch poet and dramatist. Of Mennonite parents, Vondel early showed a preference for using Christian mythology as the subject matter of his plays. He also wrote lampoons and satirical poems against the Dutch church and government. His dramatic tragedies, with their lyrical language and grandeur of conception, are his most important achievement. *The Passover* (1612) is his most notable early work. He first modeled his plays on ancient Latin drama but later turned to the Greek model; plays of the latter type include his masterpiece, the trilogy comprising *Lucifer* (1654), *Adam in Exile* (1664), and *Noah* (1667), which influenced John Milton's *Paradise Lost*.

Vonnegut \'vä-nə-ˌgət**, Kurt, Jr.** (b. Nov. 11, 1922, Indianapolis, Ind., U.S.) U.S. novelist. He attended Cornell University and the University of Chicago. Captured by the Germans during World War II, he also survived the Allied firebombing of Dresden, an experience he made part of his novel *Slaughterhouse-Five* (1969; film, 1972). His pessimistic and satirical novels use fantasy and science fiction to highlight the horrors and ironies of 20th-century civilization. They include *Player Piano* (1952), *Cat's Cradle* (1963), *Breakfast of Champions* (1973), *Galápagos* (1985), and *Timequake* (1997). He also wrote plays and collections of short stories.

voodoo See vodou

Voronezh \və-'rô-nish\ City (pop., 2001 est.: 901,800), western Russia. It lies along the Voronezh River above its confluence with the Don. It was founded in 1586 as a fortress. Peter I (the Great) built a naval flotilla in Voronezh for use in his campaigns against the Turks. With the agricultural development of the region, it became a centre for the grain trade. Occupied by the Germans and largely destroyed in World War II, it was rebuilt in the postwar era. It has a range of engineering, chemical, and food-processing industries. Its university was established in 1918.

Vorontsov \və-rənt-'sȯf**, Mikhail (Illarionovich)** (b. July 23, 1714—d. Feb. 26, 1767, St. Petersburg, Russia) Russian statesman. A member of a family that became prominent in Russian court circles in the 18th century, he was appointed a page in the court of Yelizaveta Petrovna (later Elizabeth) at the age of 14. In 1742 he helped her overthrow Tsar Ivan VI and become empress. As Elizabeth's vice chancellor (1744–58) and chancellor (1758–62), he played a major role during her reign, especially in his pro-French foreign policy. When Peter III succeeded Elizabeth and abandoned her alliances with France and Austria, Vorontsov made no effort to dissuade the new emperor and even continued to support him when he was deposed by his wife, Catherine II (1762). Vorontsov was consequently placed under house arrest; only after Peter died did he swear allegiance to Catherine and resume his office as chancellor, which he held until he retired in 1763.

Voroshilov \ˌvȯr-ə-'shē-ˌlȯf**, Kliment (Yefremovich)** (b. Feb. 4, 1881, Verkhneye, Russia—d. Dec. 2, 1969, Moscow, Russia, U.S.S.R.) Soviet military and political leader. A notable military commander in World War I and later in the Russian Civil War, he led the defense of Tsaritsyn (now Volgograd). A close associate of Joseph Stalin, he was appointed people's commissar for defense (1925) and a member of the Politburo (1926). Named a marshal of the Soviet Union (1935), he reorganized the Soviet general staff, mechanized the army, and developed the air force. After the initial Soviet defeats in World War II, he was removed as defense commissar but appointed to the committee for state defense (1941–44). He later chaired the Presidium of the Supreme Soviet (1953–57).

Vorster \'fôr-stər**, John** *orig.* **Balthazar Johannes Vorster** (b. Dec. 13, 1915, Jamestown, Cape Province, S.Af.—d. Sept. 10, 1983, Cape Town) South African prime minister (1966–78). Vorster was arrested in 1942 for supporting Germany in World War II. In the 1948 elections he was rejected by the National Party as too extreme, but his support grew in the 1950s. As minister of justice (1961–66) under Hendrik Verwoerd, he rigidly enforced apartheid. When Verwoerd was assassinated, Vorster was chosen to replace him. In the 1970s he sent troops into Angola against its Soviet- and Cuban-supported government. He resigned in 1978 and took the ceremonial post of president, but a scandal forced his resignation.

Vorticism \'vȯr-ti-ˌsi-zəm\ Literary and artistic movement that flourished in England 1912–15. Founded by Wyndham Lewis, it attempted to relate art to industrialization. It opposed 19th-century sentimentality and extolled the energy of the machine and machine-made products, and it promoted something of a cult of sheer violence. In the visual arts, Vorticist compositions were abstract and sharp-planed, showing the influence of Cubism and Futurism. Artists involved in the movement included the poet Ezra Pound and the sculptor Jacob Epstein.

Võrtsjärv \'vərts-ˌyarv\ *or* **Võrts Järv** Lake, south-central Estonia. With an area of 110 sq mi (280 sq km), it is the largest lake in Estonia. It forms part of the 124-mi (200-km) course of the Ema River, which enters the lake from the south and drains it north and east into Lake Peipsi.

Vostok \vù-'stȯk,\ *English* \'väs-ˌtäk\ Any of a series of six manned Soviet spacecraft launched from 1961 to 1963. Vostok 1 (1961) carried the first human (Yury A. Gagarin) into space. Vostok 3 set a new time record in space of 94 hours. Vostoks 5 and 6 were launched two days apart and traveled very close together, at times only 3 mi (5 km) apart, setting the stage for future dockings between orbiting vehicles. The first woman in space, Valentina Tereshkova, flew aboard Vostok 6.

Voting Rights Act Act passed by the U.S. Congress in 1965 to ensure the voting rights of African Americans. Though the Constitution's 15th Amendment (passed 1870) had guaranteed the right to vote regardless of "race, color, or previous condition of servitude," African Americans in the South faced efforts to disenfranchise them, including poll taxes and literacy tests, as late as the 1960s, when the civil rights movement focused national attention on infringements of their voting rights; Congress responded with the Voting Rights Act, which prohibited Southern states

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from using literacy tests to determine eligibility to vote. Later laws prohibited literacy tests in all states and made poll taxes illegal in state and local elections.

Voto, Bernard De See Bernard De Voto

Vouet \'vwe,\ *English* \vü-'ā**, Simon** (b. Jan. 9, 1590, Paris, France—d. June 30, 1649, Paris) French painter. He formed his style in Italy, where he lived from 1614 to 1627. His early work was influenced by Caravaggio, but works done after 1620 display more idealized figures and use more evenly diffused white light. He returned to Paris in 1627 to become first painter to Louis XIII. Thereafter he won almost all the important commissions and dominated the city artistically for the next 15 years. He introduced the Italian Baroque style in France with such paintings as *St. Charles Borromeo* (c. 1640). His late works display the soft, idealized modeling, sensuous forms, and bright colours for which he is best known.

vowel Speech sound in which air from the lungs passes through the mouth with minimal obstruction and without audible friction, like the *i* in *fit*. The word also refers to a letter representing such a sound (*a*, *e*, *i*, *o*, *u*, and sometimes *y*). In articulatory phonetics (see articulation), vowels are classified by tongue and lip position; for example, high vowels like the *i* in *machine* and the *u* in *flute* are both pronounced with the tongue arched high in the mouth, but in *u* the lips are also rounded. Single vowel sounds are monophthongs; two vowel sounds pronounced as one syllable, like the *ou* in *round*, are diphthongs.

Voyager Either of two unmanned U.S. interplanetary probes launched in 1977 to gather information about the Sun's outer planets. Voyager 1 flew by Jupiter in 1979 and reached Saturn in 1980. Voyager 2 traveled more slowly, flying by Jupiter, Saturn, and Uranus to reach Neptune in 1989. Data and photographs from both probes revealed new details about these giant planets, their moons, and their rings. In 1998 Voyager 1 became the most distant human-made object in space (overtaking Pioneer 10). Both Voyagers were expected to remain operable through the first or second decade of the 21st century, periodically transmitting data on the heliopause.

Voyageurs \ˌvwä-yä-'zhər\ **National Park** National park, northern Minnesota, U.S. Located along the Canadian border, the park was established in 1975 and was named for the mostly French-Canadian fur-trading frontiersmen (voyageurs) of the 18th–19th centuries. It occupies an area of 217,892 ac (88,178 ha) and consists of a network of streams and lakes, the largest of which is Rainy Lake.

Voznesensky \vəz-nʸi-'sʸen-skē**, Andrey (Andreyevich)** (b. May 12, 1933, Moscow, Russian S.F.S.R., U.S.S.R.) Russian poet. His childhood experience of World War II was later vividly reflected in poems such as "Goya" (1960), one of his best-known works. He became a protégé of Boris Pasternak and a star attraction at poetry readings until a 1963 Soviet crackdown on "excessively experimental" artists and writers. He later returned to partial favour. His most characteristic poems are apolitical celebrations of art, freedom, and the unrestrained human spirit. His works were collected in the bilingual *An Arrow in the Wall* (1987) and in *On the Edge* (1991).

Vuillard \vwē-'yär**, (Jean-) Édouard** (b. Nov. 11, 1868, Cuiseaux, France—d. June 21, 1940, La Baule) French painter, printmaker, and decorator. With Pierre Bonnard he developed the Intimist style, characterized by small paintings of daily home life, such as *Woman Sweeping* (c. 1892). He was an original member of the Nabis; his *Public Gardens* (1894), a series of decorative panels that use pale light and neutral colours to create a mood of restful calm, are typical of his mature work as a Nabi. He received numerous commissions to decorate public buildings, including murals in the Palais de Chaillot (1937) and in the League of Nations building in Geneva (1939), and also designed for the Ballets Russes.

"Under the Trees," tempera on canvas panel from "Jardin de Paris," by Édouard Vuillard, c. 1894; in the Cleveland Museum of Art, Cleveland.
COURTESY OF THE CLEVELAND MUSEUM OF ART, OHIO, GIFT OF HANNA FUND

Vulcan Ancient Roman god of fire. He was the counterpart of the Greek Hephaestus. Vulcan was especially associated with the destructive aspects of fire, such as volcanoes or conflagrations, and for this reason his temples were usually located outside the city. His chief festival, the Volcanalia, was marked by a rite in which the heads of Roman families threw fish into the fire. Often invoked to avert fire, he was addressed with epithets such as Mulciber ("Fire Allayer").

Vulcan Hypothetical planet within the orbit of Mercury. It was predicted in 1859 by Urbain-Jean-Joseph Le Verrier (1811–77) to account for an unexplained component of the precession of Mercury's orbit. Sightings were reported between 1859 and 1878, but these were not confirmed subsequently by observations made either during solar eclipses or when the planet was predicted to cross the Sun. The anomalies of Mercury's orbit were later explained by Albert Einstein's general theory of relativity.

vulcanism See volcanism

vulcanization Chemical process, discovered by Charles Goodyear (1839), by which the physical properties of natural or synthetic rubber are improved. It consists principally of heating rubber with sulfur; other substances (accelerators, carbon black, antioxidants, etc.) are also added. The sulfur does not simply dissolve or disperse in the rubber, but rather combines chemically, mostly in the form of cross-links (bridges) between the long-chain molecules; however, the reactions are not fully understood. Vulcanized rubber has higher tensile strength and resistance to swelling and abrasion, and is elastic over a greater range of temperatures.

Vulcano \vül-'kä-nō\ Island of the Eolie Islands, off northeastern Sicily, Italy. There are three volcanoes on the island, whose area is 8 sq mi (21 sq km). Although the last major eruptions were in 1888–90, one volcano is still active.

vulcanology See volcanology

Vulci \'vəl-ˌsī\ Ancient Etruscan city, northwest of Rome. It grew out of a number of Villanovan villages and flourished chiefly in the 6th–4th centuries BC, largely as a result of trade and the manufacture of bronze objects, including jugs and tripods. The important centre of a large city-state, after the 6th century BC it gradually came under Roman rule. The site, excavated in the 1950s, is noted for its bronze and pottery, much of which has been found in a huge necropolis. There also are Roman ruins.

vulture A bare-headed, keen-sighted bird of prey in any of 22 species found mainly in warm regions. New World vultures (family Cathartidae, related to storks) are 24–31 in. (60–80 cm) long. Old World vultures (family Accipitridae, related to eagles) include the smallest (20 in. [50 cm] long) and the largest vulture species. The cinereous, or black, vulture (*Aegypius monachus*), one of the largest flying birds, grows to about 40 in. (100 cm) long, weighs almost 30 lb (13 kg), and has a 9-ft (2.7-m) wingspan. Most species eat carrion, garbage, and excrement, but some will occasionally eat a live animal. See also condor; marabou; turkey vulture.

vulvitis \vəl-'vī-təs\ Inflammation of the vulva (female external genitalia), with red, swollen, itchy skin that may turn white, crack, or blister. The vulva provides a moist, warm breeding ground for microorganisms, particularly for yeast (see candida) but also for other fungi, bacteria, or viruses, especially if underwear is tight, nonporous, and nonabsorbent and if hygiene is poor. Pantyhose, synthetic underwear, detergents, vaginal sprays, and deodorants may cause allergy or irritation. Drying and thinning of tissues after menopause makes them more susceptible to irritation and infection. Treatment ranges from wearing loose, absorbent cotton underwear to creams that kill the infective microorganisms.

Vychegda \'vi-chəg-də\ **River** River, northwestern Russia. It rises on the slopes of the Timan Ridge and joins the Northern Dvina River near Kotlas. Its 702-mi (1,130-km) course is frequently marked by marshes, lakes, and sandbanks, but it is navigable for 596 mi (960 km).

Vygotsky \vi-'gôt-skē**, L(ev) S(emyonovich)** (b. Nov. 5, 1896, Orsha, Russia—d. June 11, 1934, Moscow) Soviet psychologist. He stud-

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ied linguistics and philosophy at the University of Moscow before becoming involved in psychological research. While working at Moscow's Institute of Psychology (1924–34), he became a major figure in post-revolutionary Soviet psychology. He studied the role of social and cultural factors in the making of human consciousness; his theory of signs and their relationship to the development of speech influenced psychologists such as A.R. Luria and Jean Piaget. His best-known work, *Thought and Language* (1934), was briefly suppressed as a threat to Stalinism.

Vyshinsky \və-'shin-skē**, Andrey (Yanuaryevich)** (b. Dec. 10, 1883, Odessa, Russia—d. Nov. 22, 1954, New York, N.Y., U.S.) Soviet politician and diplomat. A public prosecutor, he taught at Moscow State University. Appointed chief prosecutor of the Soviet Union (1935), he gained worldwide notoriety for his zeal in prosecuting the purge trials. As deputy commissar of foreign affairs, he supervised the annexation of Latvia (1940) and established a communist regime in Romania (1945). He later served as Soviet foreign minister (1949–53) and representative to the UN (1949–54), where he frequently launched bitter attacks on the U.S.

Vytautas \vē-'taù-täs\ **the Great** *Lithuanian* **Vytautus Didysis** (b. 1350, Lithuania—d. Oct. 27, 1430, Trakai, Lith.) Lithuanian national leader. Continuing a family struggle for control of Lithuania, he fought his cousin Władysław II Jagiełło but made peace in 1384. His popularity grew until Władysław was obliged to make him vice regent (1392), an office that allowed him to become effective ruler of Lithuania. He subdued rebellious nobles but was defeated by Mongols in the east (1399). He and Władysław united Lithuania and Poland (1401) and waged war on the Teutonic Order, defeating them at the Battle of Tannenberg (1410). Vytautas was named king of Lithuania in 1429 but died before he could be crowned.

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W particle Electrically charged SUBATOMIC PARTICLE that transmits the WEAK FORCE, which governs radioactive decay (see RADIOACTIVITY) in some atomic nuclei. The discovery of the W particle in 1983 by teams led by Carlo Rubbia and Simon van der Meer confirmed the ELECTROWEAK THEORY, which explains that the ELECTROMAGNETIC FORCE and the weak force are manifestations of the same interaction. The weak force is exchanged via three types of particles, two charged and one neutral. The charged particles are designated W^+ and W^- according to the sign of their charge, and the neutral particle is the Z PARTICLE. The W particle has a mass about 80 times that of the proton, which gives the weak force a very short range.

Waals, Johannes Diederik van der See Johannes D. VAN DER WAALS

Wabash \'wȯ-ˌbash\ **River** River, flowing westward across Indiana, U.S. After crossing Indiana, the Wabash forms the 200-mi (320-km) southern section of the Indiana-Illinois boundary below Terre Haute, Ind. It empties into the OHIO RIVER in southwestern Indiana after a course of 475 mi (764 km). During the 18th century the French used it as a transportation link between Louisiana and Quebec. After the WAR OF 1812, its basin was rapidly developed by settlers. After the coming of the railroads in the 1850s, navigation almost disappeared except for barge traffic on its lower course.

WAC See WOMEN'S ARMY CORPS

Wace \'wās, 'wäs\ (b. c. 1100, Jersey, Channel Islands—d. after 1174) Anglo-Norman poet. He is known for his two verse chronicles, the *Roman de Brut* (1155) and the *Roman de Rou* (1160–74), named respectively after the reputed founders of the Britons and Normans. The *Brut* is a romanticized account of GEOFFREY OF MONMOUTH's *Historia regum Britanniae*, tracing the history of Britain from its founding by the legendary Brutus the Trojan. Its many fanciful additions (including the story of Arthur's Round Table) were important in the development of the ARTHURIAN LEGEND, and its literary style influenced later verse romances. The *Rou*, commissioned by Henry II of England, is a history of the Norman dukes (c. 911–1106).

Waco \'wā-kō\ City (pop., 2000: 113,726), north-central Texas, U.S. Located on the BRAZOS RIVER, it was founded in 1849 on the site of an Indian village. After 1865 it became a river-bridge crossing on cattle trails; later its economy was based on cotton. Its diversified economy now includes manufacturing and tourism. A tornado devastated Waco in 1953, killing 114 persons. On April 19, 1993, after a 51-day standoff with U.S. federal agents, some 80 members of the BRANCH DAVIDIANS religious sect perished in a fire at their compound nearby.

Wadai \wä-'dī\ Historical African kingdom, central Africa. Located east of Lake CHAD and west of DARFUR, it was founded in the 16th century. A Muslim dynasty was established there c. 1630, and, though long subordinate to Darfur, it became independent by the 1790s and began a period of rapid expansion. It came under French influence in 1899 and French control (1912–14). The area is now largely in eastern Chad.

Wade, Benjamin F(ranklin) (b. Oct. 27, 1800, Springfield, Mass., U.S.—d. March 2, 1878, Jefferson, Ohio) U.S. politician. He practiced law in Ohio before serving in the U.S. Senate (1851–69), where he opposed the extension of slavery and the KANSAS-NEBRASKA ACT. In the American Civil War he joined the RADICAL REPUBLICANS in demanding vigorous prosecution of the war and headed a joint congressional committee to investigate the Union military effort. He cosponsored the WADE-DAVIS BILL, which brought him into conflict with ABRAHAM LINCOLN. Opposed to Pres. ANDREW JOHNSON's RECONSTRUCTION policies, he voted for his removal from office at his Senate trial and, as Senate president pro tem, prepared to succeed Johnson. Disappointed by the trial's outcome, he was later defeated for reelection.

Wade-Davis Bill (1864) Measure passed by the U.S. Congress to set RECONSTRUCTION policy. It was cosponsored by Sen. BENJAMIN WADE and Rep. Henry W. Davis (1817–65) to counter Pres. ABRAHAM LINCOLN's lenient plans for readmitting Southern states after the American Civil War. Supported by the RADICAL REPUBLICANS, the bill called for provisional military government of the seceded states, an oath of allegiance from a majority of the state's whites, and new state constitutions that would abolish slavery and disqualify Confederate officials from holding office. Lincoln considered the bill too harsh and allowed it to expire by using a pocket veto.

wage-price control Setting of government guidelines to limit increases in wages and PRICES. It is one of the most extreme approaches to INCOMES POLICY. By controlling wages and prices, governments hope to control INFLATION and prevent extremes in the BUSINESS CYCLE. Countries with highly centralized methods of setting wages tend to have the greatest degree of public or collective regulation of wage and price levels. For example, wage settlements in The Netherlands must be approved by the government, and price increases are investigated by the Ministry of Economic Affairs. Other countries, including the U.S., have also made efforts at restraining wage and price increases, usually seeking the voluntary cooperation of management and labour. In the U.S., wage-price controls were instituted by Pres. FRANKLIN D. ROOSEVELT during World War II and by Pres. RICHARD M. NIXON in the early 1970s, when high inflation combined with rising unemployment to create instability.

Wagner \'wag-nər**, Honus** *orig.* **John Peter Wagner** (b. Feb. 24, 1874, Mansfield, Pa., U.S.—d. Dec. 6, 1955, Carnegie) U.S. baseball player. Wagner played principally for the Pittsburgh Pirates (1900–17) and coached the team from 1933 to 1951. The right-handed hitter led the National League in batting average in eight seasons (1900, 1903–04, 1906–09, 1911) and in stolen bases five seasons. His total of 252 three-base hits remains a National League record. Nicknamed the "Flying Dutchman" for his speed, Wagner is considered one of the greatest shortstops and all-around players in baseball history.

Wagner \'väg-nər**, Otto** (b. July 13, 1841, Penzing, near Vienna, Austrian Empire—d. April 11, 1918, Vienna) Austrian architect and teacher. In 1893 his general plan (not executed) for Vienna won a major competition, and in 1894 he was appointed professor at the Akademie der Bildenden Künste. As a teacher, Wagner soon broke with tradition by insisting on function, material, and structure as the bases of architectural design. Among his notable buildings, all in the ART NOUVEAU style, are a number of stations for the City Railway of Vienna (1894–97) and the Postal Savings Bank (1904–06). The latter, which had little decoration, is recognized as a milestone in the history of modern architecture, particularly for the curving glass roof of its central hall. Wagner's lectures were published in 1895 as *Moderne Architektur*.

Wagner \'väg-nər**, (Wilhelm) Richard** (b. May 22, 1813, Leipzig, Ger.—d. Feb. 13, 1883, Venice, Italy) German composer. His childhood was divided between Dresden and Leipzig, where he had his first composition lessons; his teacher refused payment because of his talent. His first opera, *The Fairies* (1834), was followed by *The Ban on Love* (1836); the premiere performance was so unprepared that the event was a fiasco, and he henceforth determined not to settle for modest productions. The success of *Rienzi* (1840) led him to be more adventurous in *The Flying Dutchman* (1843) and even more so in *Tannhäuser* (1845). Caught up in the political turmoil of 1848, he was forced to flee Dresden for Zürich. During this enforced vacation, he wrote influential essays, asserting (following G.W.F. HEGEL) that music had reached a limit after LUDWIG VAN BEETHOVEN and that the "artwork of the future" would unite music and theatre in a *Gesamtkunstwerk* ("total artwork"). In 1850 he saw *Lohengrin* produced. He had begun his most ambitious work, *The Ring of the Nibelung*, a four-opera cycle. The need for large-scale unity brought him to the concept of the LEITMOTIV. He ceased work on the *Ring*'s third opera, *Siegfried*, in the throes of an adulterous love with Mathilde Wesendonk and wrote an opera of forbidden love, *Tristan und Isolde* (1859), which also seemed to break the bonds of tonality. He published the *Ring* librettos in 1863, with a plea for financial support, and LOUIS II of Bavaria responded, inviting Wagner to complete the work in Munich. From the late 1860s to the early 1880s, Wagner completed work on *Die Meistersinger*, *Siegfried*, *Götterdämmerung*, and the long-deferred *Parsifal*, as he also oversaw the building of the great festival theatre at BAYREUTH (1872–76) that would be dedicated to his operas. His astonishing works made Wagner one of the most influential and consequential figures in the history of Western music and, indeed, of Western culture. In the late 20th

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century his undoubted musical stature was challenged somewhat by the strongly racist and anti-Semitic views expressed in his writings, and evidence of anti-Semitism in his operas was increasingly documented.

Wagner \'wag-nər**, Robert F(erdinand)** (b. June 8, 1877, Nastätten, Hesse-Nassau, Ger.—d. May 4, 1953, New York, N.Y., U.S.) U.S. politician. He immigrated with his family to New York City in 1885. He became active in Democratic Party politics, serving in the state legislature (1904–19) and as a justice of the state court of appeals (1919–26). In the U.S. Senate (1927–49), he became an ally of Pres. Franklin D. Roosevelt and introduced New Deal labour and social-reform legislation, including the National Industrial Recovery Act (1933), the National Labor Relations Act (known as the Wagner Act), and the Social Security Act. He cosponsored the Wagner-Steagall Act (1937), which created the U.S. Housing Authority. His son, Robert F. Wagner, Jr. (1910–91), served as mayor of New York (1954–65).

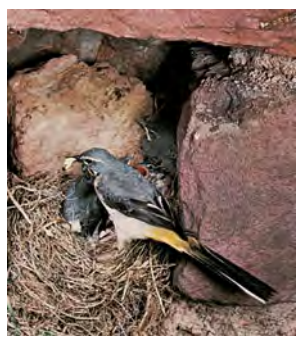
Wagner Act *or* **National Labor Relations Act** (1935) Labour legislation passed by the U.S. Congress. Sponsored by Sen. Robert F. Wagner, the act protected workers' rights to form unions and to bargain collectively. A three-member National Labor Relations Board was established to protect against unfair labour practices; it could order elections to allow workers to choose which union they wanted to represent them. The act also prohibited employers from engaging in unfair labour practices such as setting up a company union and firing or otherwise discriminating against workers who organized or joined unions. The act, considered the most important piece of labour legislation in the 20th century, helped ensure union support for Pres. Franklin D. Roosevelt in the 1936 election.

Wagner-Jauregg \'väg-nər-'yaù-rek**, Julius** *orig.* **Julius Wagner, knight von Jauregg** (b. March 7, 1857, Wels, Austria—d. Sept. 27, 1940, Vienna) Austrian psychiatrist and neurologist. Knowing that malaria could be controlled with quinine and having observed that patients with some nervous disorders improved after infections with fever, he induced malaria to treat syphilis patients who had central nervous system disorders. For thus controlling an incurable fatal disease, he was awarded a 1927 Nobel Prize. Though antibiotics replaced this treatment for syphilis, it led to the development of fever therapy.

wagon Four-wheeled vehicle designed to be drawn by draft animals. Wagons have been used from the 1st century BC; early examples used spoked wheels with metal rims, pivoted front axles, and linchpins to secure the wheels. Ninth-century improvements in suspension made the wagon preferable to the two-wheeled cart, especially for carrying freight and agricultural produce.

Wagram \'vä-ˌgräm**, Battle of** (July 5–6, 1809) Victory by French forces under Napoleon against Austria. In an attempt to break French control of Germany, Austria's 158,000 troops under Archduke Charles (1771–1847) were deployed along a 14-mi (23-km) front on either side of the village of Wagram, near Vienna. The attack by Napoleon and his 154,000 French troops split the centre of the Austrian line. By the time reinforcements arrived, Charles's army was in retreat, and four days later he asked for an armistice. Heavy use of artillery (the heaviest in any war to that time) caused more than 40,000 Austrian casualties and about 34,000 French.

wagtail Any of 7–10 passerine species in the genus *Motacilla* and the forest wagtail (*Dendronanthus indicus*) of Asia. Wagtails continually pump their long tail up and down; the forest wagtail wags its entire body from side to side. They inhabit beaches, meadows, and streamsides, nesting on the ground and roosting in trees. Males of the white, or pied, wagtail (*M. alba*), common across Eurasia, are white and gray or white and black. The only New World species, the yellow wagtail (*M. flava*), breeds in Alaska and migrates to Asia.



Gray wagtail (*Motacilla cinerea*).
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Wahhāb \wȧ-'hȧb**, Muḥammad ibn ʿAbd al-** (b. 1703, ʿUyaynah, Arabia—d. 1792, Al-Dirʿīyah) Islamic theologian and founder of the Wahhābī movement. Educated in Medina, he spent several years teaching in Iraq and Iran. He reacted against what he perceived as the extremism of various sects of Sufism, setting out his ideas in the *Book of Unity* (1736). He stressed a conservative observation of Islam, rejecting polytheism and condemning reverence of saints and the decoration of mosques. His views were controversial; eventually he settled in Nejd, where, in alliance with Ibn Saʿūd, his teachings found favour and grew dominant.

Wahhābī \wȧ-'hȧb-ē\ Member of a Muslim puritan movement founded in the 18th century by Muḥammad ibn ʿAbd al-Wahhāb. Members call themselves al-Muwaḥḥidūn, a name derived from their emphasis on the absolute oneness of God. They reject all acts implying polytheism, including the veneration of saints, and advocate a return to the original teachings of Islam as found in the Qurʾān and the Ḥadīth. They supported the establishment of a Muslim state based on Islamic canon law. Adopted by the ruling Saudi family in 1744, the movement controlled all of Nejd by the end of the 18th century. It was assured of dominance on the Arabian Peninsula with the creation of the kingdom of Saudi Arabia in 1932, and in the 20th century—supported by Saudi wealth—it engaged in widespread missionary work throughout the Islamic world.

wahoo \'wä-ˌhü\ Species (*Acanthocybium solanderi*) of swift-moving, powerful, predaceous food and game fish found worldwide, especially in the tropics. A slim, streamlined fish, it has sharp-toothed, beaklike jaws and a tapered body ending in a crescent-shaped tail. Gray-blue above and paler below, it is marked with a series of vertical bars and, like the related tunas, has a row of small finlets behind the dorsal and anal fins. It may grow to 6 ft (1.8 m) long and weigh more than 120 lb (55 kg).

Waigeo \wī-'gā-ō\ Island, northeastern Moluccas, Indonesia. Located off northwestern New Guinea, it is part of Papua (Irian Jaya) province. Waigeo is 80 mi (130 km) long and 30 mi (48 km) wide. Its rocky and generally steep coastline is almost bisected by a narrow inlet of the Dampier Strait; its central areas are mountainous, rising to 3,300 ft (1,000 m), and are heavily forested. Islanders raise cattle and export tortoiseshell and fish.

Waikato River \wī-'kä-tō\ River, North Island, New Zealand. Rising on the slopes of Mount Ruapehu as the Tongariro River, it flows north through Lake Taupo, then northwest to enter the Tasman Sea. The nation's longest river, it is 264 mi (425 km) long and is a major source of hydroelectric power. It was the scene of several skirmishes between the British and the Waikato tribes in 1863–65.

Waikiki \ˌwī-kə-'kē\ Resort area, southern coast of Oahu island, Hawaii, U.S. Located in the southeastern section of Honolulu, near Diamond Head, its famous beach is lined with luxury hotels; it has water-sports facilities as well as an aquarium, a zoo, gardens, and the International Market Place. Waikiki is also the site of Fort DeRussy, a military recreation area.

Wailing Wall See Western Wall

Wailuku Valley See Iao Valley

Waimakariri \wī-ˌmä-kə-'rir-ē\ **River** River, east-central South Island, New Zealand. It rises in the Southern Alps and flows 100 mi (160 km) southeast to Pegasus Bay of the Pacific Ocean. The river's delta constitutes a major portion of the Banks Peninsula and part of the Canterbury Plains.

Wairau River \'wī-ˌraù\ River, northern South Island, New Zealand. It rises in the Spenser Mountains and flows for 105 mi (169 km) to enter Cloudy Bay of Cook Strait. In 1843 it was the site of the Wairau Affray, a battle between the New Zealand Co. and local Maori chiefs.

Waite, Morrison (Remick) (b. Nov. 29, 1816, Lyme, Conn., U.S.—d. March 23, 1888, Washington, D.C.) U.S. jurist. The son of a justice of the Connecticut Supreme Court, he practiced law in Toledo, Ohio; in his most notable case, he prosecuted the *Alabama* claims. In 1874 he was appointed chief justice of the Supreme Court of the United States by Pres. Ulysses S. Grant; he served on the court until his death. In *U.S.* v. *Cruikshank*, Waite stated that, despite its apparently plain language, the Fifteenth Amendment had not conferred a federal right of suffrage on African Americans, because "the right to vote comes from the states." In his most famous opinion, *Munn* v. *Illinois* (1877), he upheld legislation fixing maximum rates chargeable by grain elevators and railroads, declar-

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ing that a business or private property "affected with a public interest" was subject to governmental regulation.

Waitemata \ˌwī-tə-ˈmä-tə\ **Harbour** Harbour, northern North Island, New Zealand. The harbour for Auckland, the Waitemata opens into Hauraki Gulf through Stanley Bay. Its shore has many lesser embayments; several tidal rivers empty into the western part.

waiting-line theory See queuing theory

Waitz, Grete *orig.* **Grete Andersen** (b. Oct. 1, 1953, Oslo, Nor.) Norwegian marathon runner. She set world records in the 3,000-m event (1975, 1976) and became the world women's marathon champion in 1983. She won the women's silver medal in the marathon at the 1984 Olympic Games. She won the New York marathon nine times in the years 1978–88 and was the first woman to finish that race in under 2.5 hours.

wakan \wä-ˈkän\ Among some American Indian tribes, a spiritual power of supernatural origin belonging to some natural objects, people, horses, and celestial and terrestrial phenomena. Wakan can be conceived of as weak or strong powers; the weak can be ignored but the strong must be placated. Wakan beings are the immortal supernatural powers who bestow wakan; they too may be weak or strong, but are all believed to enjoy music and smoke from pipes. Poisonous plants and reptiles can contain wakan, as can intoxicating drinks. The concept of wakan is similar to that of mana.

Wakatipu \ˌwä-kə-ˈtē-pü\ **Lake** Lake, south-central South Island, New Zealand. The S-shaped lake measures 48 mi (77 km) by 3 mi (5 km) and has an area of 113 sq mi (293 sq km) and a maximum depth of 1,240 ft (378 m). It receives the Dart, Rees, Greenstone, and Von rivers and empties by the Kawarau River, a tributary of the Clutha River.

Wake Island Atoll, central Pacific Ocean. An unincorporated territory of the U.S., Wake Island comprises three low-lying coral islets (Wilkes, Peale, and Wake) that surround a lagoon and occupy a total land area of 2.5 sq mi (6.5 sq km). The atoll was claimed by the U.S. in 1899. In 1935 it became a stopover for transpacific commercial flights. The U.S. Navy began construction of an air and submarine base in 1939, which was half-completed when Wake was attacked and occupied by Japanese forces in December 1941. After the Japanese surrendered (1945), Wake was administered by the U.S. Air Force. Commercial flights resumed, but by 1974 Wake was being used as an emergency stopover. It is also the site of weather research stations. There is no indigenous population on the island, but there is a small contingent of civilian workers.

Wakefield City and metropolitan borough (pop., 2001: 315,173), southeastern portion of the metropolitan county of West Yorkshire, historic county of Yorkshire, England. Originally part of a royal manor, it became a baronial holding after 1086. It was the scene of the Wars of the Roses at which Richard, duke of York, was captured and beheaded by Lancastrians. In the 15th century the Wakefield Plays, one of the collections of English miracle plays, were presented there. The town was attacked and taken by the Parliamentarian general Baron Fairfax in 1643 during the English Civil Wars. Known as a textile centre since the 16th century, Wakefield specializes in wool and synthetic knitting yarns.

Wakefield, Edward Gibbon (b. March 20, 1796, London, Eng.—d. May 16, 1862, Wellington, N.Z.) British colonizer of South Australia and New Zealand. After viewing the problems of the penal system, including the forcible removal of convicts to British colonies, he wrote *A Letter from Sydney* (1829) and proposed colonization by the sale of small landholdings to ordinary citizens. He influenced the founding of South Australia as a nonconvict settlement. As organizer and manager of the New Zealand Company (1838–58), he sent colonists to settle New Zealand and forced the British government to recognize the colony. As an adviser to the earl of Durham, he influenced the report that led to the union of Upper and Lower Canada. He founded a Church of England settlement at Canterbury, N.Z. (1847).

Waksman, Selman (Abraham) (b. July 22, 1888, Priluka, Ukraine, Russian Empire—d. Aug. 16, 1973, Hyannis, Mass., U.S.) Ukrainian-born U.S. biochemist. He became a U.S. citizen in 1916 and spent most of his career at Rutgers University. After the discovery of penicillin, he played a major role in initiating a calculated, systematic search for antibiotics (a term he coined in 1941) among microorganisms. His 1943 discovery of streptomycin, the first specific agent effective in the treatment of tuberculosis, brought him a 1952 Nobel Prize. Waksman also isolated and developed several other antibiotics, including neomycin, that have been used in treating many infectious diseases of humans, domestic animals, and plants.

Walachia \wä-ˈlā-kē-ə\ Former principality, south-central Europe. It lay between the Danube River and the Transylvanian Alps in what is now Romania. It was founded in 1290 by Radu Negru, a vassal of Hungary, and achieved independence from Hungary in 1330. The capital from the 14th to the 17th century was Targoviste. Walachia was ruled by the Turks in the 15th century, though some princes resisted, notably Vlad II Dracul (1436–47) and Vlad III Ţepeş, who are often cited as the historical bases for the Dracula vampire tales. Walachia briefly annexed Moldavia and Transylvania in the late 16th century. Russian influence grew in the 18th century, and in 1774 Walachia came under Russia's protection, though it continued to recognize Turkish suzerainty. Russia's protectorate ended after the Crimean War, and in 1859 Walachia united with Moldavia to form Romania.

Walcott \ˈwȯl-ˌkät**, Derek (Alton)** (b. Jan. 23, 1930, Castries, Saint Lucia) West Indian poet and playwright. Of mixed black, Dutch, and English descent, Walcott was educated in Saint Lucia and Jamaica. After 1958 he lived in Trinidad and the U.S. Most of his works explore the Caribbean cultural experience. He is best known for his poetry; in volumes such as *In a Green Night* (1962), *The Gulf* (1969), *Another Life* (1973), *The Star-Apple Kingdom* (1979), *The Fortunate Traveller* (1981), and *The Bounty* (1997), Walcott's erudition is submerged in sweeping rhythmic and sensuous sonorities. His epic poem *Omeros* (1990) is a retelling of Homer's *Odyssey* in a 20th-century Caribbean setting. Of his approximately 30 plays, the best known are *Dream on Monkey Mountain* (produced 1967), *Ti-Jean and His Brothers* (1958), and *Pantomime* (1978). In 1992 he was awarded the Nobel Prize for Literature.

Wald, George (b. Nov. 18, 1906, New York, N.Y., U.S.—d. April 12, 1997, Cambridge, Mass.) U.S. biochemist. He taught at Harvard University from 1934–77. His outstanding contributions were on the importance of vitamin A, the mechanisms of the photochemical reactions in the rod cells that enable night vision, and the identification of the colour-sensitive pigments in the cone cells (see photoreception; retina). He shared the Nobel Prize in 1967 with Haldan Keffer Hartline and Ragnar Arthur Granit. He was a prominent opponent of the Vietnam War.

Waldeck \ˈväl-ˌdek\ Former state, Germany. It is now a part of Hesse. The capital was Arolsen. A county in the Middle Ages, Waldeck became a principality in 1712 and part of Prussia in 1867. A republic and constituent state of the Weimar Republic (1918–29), it later formed part of the Prussian Hesse-Nassau province (until 1945).

Waldeck-Rousseau \väl-dek-rü-ˈsō**, (Pierre-Marie-) René** (b. Dec. 2, 1846, Nantes, France—d. Aug. 10, 1904, Corbeil) French politician. A conservative lawyer, he served in the Chamber of Deputies (1879–89) and as minister of the interior (1881–82, 1883–85). In 1884 he sponsored the law that legalized French trade unions. After returning to his prosperous law practice, he became a senator in 1894. In the upheaval over the Alfred Dreyfus affair, he was appointed premier (1899–1902) and formed a coalition cabinet that persuaded the president to pardon Dreyfus.

Waldenses \wȯl-ˈden-ˌsēz\ *French* **Vaudois** \vō-ˈdwä\ *Italian* **Valdesi** \val-ˈdā-zē\ Members of a Christian movement that originated in 12th-century France. Devotees sought to follow the example of Jesus and the Apostles by adopting lives of preaching and poverty. The movement's founder, Valdes, was condemned by the archbishop of Lyon for continuing to preach without church permission. Although placed under a ban in 1184 by Pope Lucius III (1181–85), Valdes remained orthodox and hoped for eventual acceptance by the church. His followers, however, gradually departed from Roman Catholicism by rejecting the clergy's right to administer the sacraments, the notion of purgatory, and the veneration of saints. Rome responded by actively persecuting the Waldenses, and their numbers diminished by the end of the 15th century. In the 16th century they adopted some aspects of Protestant doctrine and the church organization of Genevan Protestantism. Intermittently persecuted in later centuries, they have remained a small movement within Christianity. They survive today in Argentina, Uruguay, and the U.S.

Waldheim \ˈvält-ˌhīm**, Kurt** (b. Dec. 21, 1918, Sankt Andrä-Wördern, Austria) Fourth secretary-general of the United Nations (1972–81). After military service in the German army before and during World War II, he

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entered the Austrian foreign service and served successively as ambassador to Canada (1958–60) and the UN (1964–68, 1970–71) and as foreign minister (1968–70). Elected to succeed U Thant as UN secretary-general, he served two terms, during which he oversaw disaster relief in Bangladesh, Nicaragua, and Guatemala and peacekeeping missions in Cyprus, the Middle East, Angola, and Guinea. Denied a third term, he returned to Austria and ran for president in 1986. His candidacy became controversial when it was learned that he had been a member of the Nazi Party and had served in a German army unit that had deported most of the Jewish population of the Greek town of Salonika to Nazi death camps in 1943. Elected nonetheless, he was diplomatically isolated throughout his term (1986–92).

Waldheim, 1971
UPI

Wales *Welsh* **Cymru** \'kəm-rē\ Principality, constituting an integral part of the United Kingdom. It occupies a peninsula on the western side of the island of Great Britain. Area: 8,015 sq mi (20,758 sq km). Population (2001): 2,903,085. Capital: Cardiff. The population is of Celtic, Anglo-Saxon, and Anglo-Norman ancestry. Languages: English, Welsh. Religion: Methodism. Wales is almost entirely an upland area the core of which is the Cambrian Mountains. The highest peak in England and Wales, Mount Snowdon, is found in Snowdonia National Park. The Severn, Wye, and Dee are the longest rivers. Economic activities include mining coal (though coal mining suffered a sharp decline in the late 20th century), slate, and lead; importing and refining petroleum; and manufacturing consumer electronics. Tourism is an important industry. In prehistoric times, tribal divisions of the British Celtic speakers who dominated all of Britain south of the Firth of Forth and the Firth of Clyde inhabited the region. The Romans ruled from the 1st century AD until the 4th–5th century. Welsh Celts fought off incursions from the Anglo-Saxons. A number of kingdoms arose there, but none was successful in uniting the area. The Norman conquerors of England brought all of southern Wales under their rule in 1093. English King Edward I conquered northern Wales and made it a principality in 1284. Since 1301 the heir to the English throne has carried the title Prince of Wales. Wales was incorporated with England in the reign of Henry VIII. It became a leading international coal-mining centre during the 19th century. The Plaid Cymru, or Welsh Nationalist Party, was founded in 1925, but its influence did not gather force until the 1960s, when Welsh nationalist aspirations rose. In 1997 a referendum approved the devolution of power to an elected assembly, which first convened in 1999.

Wales, Prince of Title of the heir apparent to the British throne. In 1301 Edward I of England granted it to his son Edward after conquering Wales and executing the last native Welsh prince (1283). Since that time most of the eldest sons of English sovereigns have been given the title. The title ceases to exist when a Prince of Wales becomes king, until a monarch bestows it on a son.

Wałęsa \vä-'len-sə,\ *Polish* \vä-'we^{n}-sə**, Lech** (b. Sept. 29, 1943, Popowo, near Włocławek, Pol.) Polish labour leader and president of Poland (1990–95). An electrician, he worked in the Lenin Shipyard at Gdańsk, Pol. (1967–76), but he was fired for his antigovernment activities. In 1980 he joined workers in a strike and soon became leader of the Solidarity trade union. The union was banned in 1981, and he was detained into 1982. In 1983 he was awarded the Nobel Prize for Peace; fearing involuntary exile, he remained in Poland while his wife, Danuta, traveled to Norway to accept the prize on his behalf. He continued to direct the outlawed union until it received legal recognition in 1988. Solidarity won an overwhelming victory in free elections in June 1989, and after Wałęsa refused to form a coalition government with the communists, the Parliament was forced to accept a Solidarity-led government, though Wałęsa himself refused to serve as premier. In 1990 he won Poland's first direct presidential election by a landslide, and he helped guide Poland into a free-market economy. His confrontational style eroded his popularity, and he was narrowly defeated in his bid for reelection in 1995.

Walī Allāh \wä-'lē-ä-'lä**, Shāh** (b. 1702/03, Delhi—d. 1762, Delhi) Indian Islamic theologian. He received a traditional Islamic education, and after a pilgrimage to Mecca in 1732 he remained in the Hejaz to study theology. Living in a time of disillusionment following the death of Aurangzeb, he believed that Muslim polity could be restored only through religious reform that would harmonize Islam with India's changing social and economic conditions. He was steadfastly monotheistic but otherwise much more liberal than most Islamic theologians that had preceded him. His best-known work is *The Secrets of Belief*. His synthesis of theology, philosophy, and mysticism so reinvigorated Islam that it became prevalent among Islamic scholars in India until the 20th century.

Walker, Alice (Malsenior) (b. Feb. 9, 1944, Eatonton, Ga., U.S.) U.S. writer. After attending Spelman College and Sarah Lawrence College, Walker moved to Mississippi and became involved with the civil rights movement. She also began teaching and publishing short stories and essays. Her works are noted for their insightful treatment of African American culture. Her third and most popular novel, *The Color Purple* (1982, Pulitzer Prize; film, 1985), depicts a black woman's struggle for racial and sexual equality. Her later novels include *The Temple of My Familiar* (1989) and *Possessing the Secret of Joy* (1992). She also wrote essays, some collected in *In Search of Our Mothers' Gardens* (1983); several books of poetry; short stories; and children's books.

Walker, David (b. Sept. 28, 1785, Wilmington, N.C., U.S.—d. June 28, 1830, Boston, Mass.) U.S. abolitionist. The son of a slave father and a free mother, he was educated and traveled widely before settling in Boston, where he became an abolitionist lecturer and wrote for the anti-slavery *Freedom's Journal*. In his pamphlet *Appeal to the Colored Citizens of the World* (1829), he called for armed revolt. He smuggled the pamphlet into the South by hiding copies in clothing that he sold to sailors from his used-clothes store in Boston. Warned to flee for his life to Canada, he refused, and his body was found soon after; many believed he was poisoned. His son, Edwin G. Walker, was elected to the Massachusetts legislature in 1866.

Walker, James J(ohn) *known as* **Jimmy Walker** (b. June 19, 1881, New York, N.Y., U.S.—d. Nov. 18, 1946, New York City) U.S. politician. He entered politics after graduating from New York Law School, becoming a member of the Assembly (1909) and then of the State Senate (1914). Backed by Gov. Alfred E. Smith and Tammany Hall, he was elected mayor (1925–32). A popular figure known for his charm and wit but particularly for his enthusiastic participation in the high life typical of the era, he made improvements in sanitation, hospitals, and subways. In 1931 the state legislature, investigating the city's affairs, charged Walker with corruption; he resigned in 1932.

Walker, Sarah Breedlove *orig.* **Sarah Breedlove** (b. Dec. 23, 1867, near Delta, La., U.S.—d. May 25, 1919, Irvington, N.Y.) U.S. businesswoman and philanthropist, the first African American female millionaire. She was a widowed washerwoman with a daughter to support in 1905 when she developed a method for straightening curly hair. She founded the Madame C.J. Walker Manufacturing Co. to sell her treatment, and her door-to-door saleswomen became familiar figures in the black communities of the U.S. and the Caribbean. In 1910 she moved her company to Indianapolis, Ind. She augmented her earnings with shrewd real-estate investments, and she donated two-thirds of her fortune to charitable and educational institutions. Her daughter, A'Lelia Walker Kennedy, hosted salons where artists and cultural figures mingled during the Harlem Renaissance.

Walker, William (b. May 8, 1824, Nashville, Tenn., U.S.—d. Sept. 12, 1860, Trujillo, Hond.) U.S. military adventurer. He moved to California (1850), where his interest in colonizing Baja California developed into a filibustering (insurrection) scheme. He landed at La Paz (1853) and proclaimed Lower California and Sonora an independent republic, but Mexican resistance forced him back to the U.S. In 1855 he sailed to Nicaragua, where he effectively established himself as leader. There officers of Cornelius Vanderbilt's Accessory Transit Co. promised him financial assistance in a plot to take the company away from Vanderbilt. Walker seized the company and turned it over to them, then made himself president of Nicaragua (1856). In 1857 Vanderbilt induced five Central American republics to drive Walker out. In 1860 Walker attempted a filibuster in Honduras, where he was captured and executed.

Walker Cup Trophy awarded to the winner of a golf competition between amateur men's teams from the U.S. and Britain. It has been held biennially since 1922 on sites alternating between the two countries. The

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cup is named for the event's organizer, George H. Walker, a president of the U.S. Golf Association. Contests consist of four 18-hole foursome matches and eight 18-hole singles matches on each of two days, with one point awarded to the winning side in each match.

walking In TRACK AND FIELD, a form of racing in which the competitor's advancing foot must touch the ground before the rear foot leaves it. Walking as a sport dates from the later 19th century. Walking races of 10 mi and 3,500 m were added to the men's Olympic program in 1908, but since 1956 the Olympic distances have been 20 km and 50 km. A women's 10-km walk was introduced in 1992.

walking catfish Species (*Clarias batrachus*) of Asian and African CATFISH that can progress remarkable distances over dry land. It uses its pectoral-fin spines as anchors to prevent jackknifing as its body musculature produces snakelike movements. Treelike respiratory structures extending above the gill chambers enable it to breathe. It has been introduced into southern Florida, where it now poses a serious threat to native fauna.

walking leaf See LEAF INSECT

wall Any of various upright constructions used to divide or enclose a room or building. In traditional masonry construction, BEARING WALLS supported the weight of floors and roofs, but modern steel and reinforced-concrete frames, as well as heavy timber and other skeletal structures, require exterior walls only for shelter. Some urban buildings dispense with walls on the ground floor, extending outdoor plazas under the building and permitting easier access to elevators, escalators, and stairs. In masonry construction, all types of floors and roofs except domes are most easily supported on straight, parallel walls. Nonbearing walls, used when loads are carried by girders, beams, or other members, can be either CURTAIN WALLS or infill of brick, block, or other material. See also CAVITY WALL, RETAINING WALL, SHEAR WALL.

Wall Street Street in New York City where many major U.S. financial institutions are located. The street, in southern Manhattan, is narrow and short and extends only about seven blocks from Broadway to the East River. It was named for an earthen wall built by Dutch settlers in 1653 to repel an expected English invasion. Even before the Civil War it was recognized as the nation's financial capital, and it remains a worldwide symbol of high finance. The Wall Street, or financial, district contains the NEW YORK STOCK EXCHANGE, the AMERICAN STOCK EXCHANGE, and the Federal Reserve Bank of New York. The district is also the headquarters for many INVESTMENT BANKS, securities dealers, utilities and insurance companies, and brokerage firms.

Wall Street Journal, The U.S. daily national newspaper, the most influential American business-oriented paper and one of the most respected dailies in the world. Founded in 1889 by Charles H. Dow, founder of Dow Jones & Co., it quickly won success. Beginning in the GREAT DEPRESSION, *The Wall Street Journal* began to feature more articles, reviews, and opinion on other subjects. Published in New York City and with regional editions printed across the country, it has one of the highest daily circulations of any U.S. newspaper. It is also published in Asian, European, and other special editions.

wallaby \'wä-lə-bē\ Any of about 25 species of medium-sized KANGAROOS, found chiefly in Australia. Brush wallabies (11 species) are built like the big kangaroos but differ in dentition. Rock wallabies live among rocks, usually near water. Nail-tailed wallabies, named for a horny growth on the tail tip, rotate their forelimbs while hopping. The small hare wallabies resemble HARES in movement and some habits. The small, stocky scrub wallabies, hunted for meat and fur, have short hind limbs and pointy noses. The similar short-tailed scrub wallaby occurs only on two offshore islands of western Australia. Several wallaby species have been exterminated, and several others are endangered. See photograph opposite.

Wallace, Alfred Russel (b. Jan. 8, 1823, Usk, Monmouthshire, Wales—d. Nov. 7, 1913, Broadstone, Dorset, Eng.) British naturalist. Though trained as a surveyor and architect, he became interested in botany and traveled to the Amazon in 1848 to collect specimens. In 1854–62 he toured the Malay Archipelago, augmenting his collection. His observations of the islands led to his developing a theory of the origin of species through natural selection independently of, and simultaneously with, CHARLES DARWIN, though Darwin developed his own theory in much greater detail, provided far more evidence for it, and was mainly responsible for its acceptance. Unlike Darwin, Wallace insisted that the higher mental capacities of humans could not have arisen by natural selection but that some nonbiological agency must have been responsible. He hypothesized a boundary (Wallace's line) running between the islands of the Malay Archipelago, between the Oriental and Australasian faunal regions, many animals abundant on one side being absent on the other. In the realm of public policy he supported socialism, pacifism, land nationalization, and women's suffrage. His works include *Contributions to the Theory of Natural Selection* (1870), *Geographical Distribution of Animals* (2 vol., 1876), and *Darwinism* (1889).

Wallace, (William Roy) DeWitt and Lila Acheson *Lila Acheson Wallace orig.* **Lila Bell Acheson** (respectively b. Nov. 12, 1889, St. Paul, Minn., U.S.—d. March 30, 1981, Mount Kisco, N.Y.; b. Dec. 25, 1889, Virden, Man., Can.—d. May 8, 1984, Mount Kisco) U.S. publishers and founders of *Reader's Digest* magazine. DeWitt Wallace began an index of favourite magazine articles while he was a college student, and he developed the idea of a pocket-sized digest of popular articles while recuperating from wounds suffered in World War I. Lila Acheson, a minister's daughter, worked in social services during the war. The two were married in 1921. After various publishers rejected the digest idea, they began publishing *READER'S DIGEST* themselves on a low budget and had rapid success. DeWitt Wallace served as editor until 1965. They had no heirs but supported numerous philanthropic causes; the Lila Wallace-Reader's Digest Fund has been a major benefactor of the arts and culture.

Wallace, (Richard Horatio) Edgar (b. April 1, 1875, Greenwich, London, Eng.—d. Feb. 10, 1932, Hollywood, Calif., U.S.) British novelist, playwright, and journalist. He held odd jobs, served in the army, and was a reporter before producing his first success, *The Four Just Men* (1905). With works such as *Sanders of the River* (1911), *The Crimson Circle* (1922), *The Flying Squad* (1928), and *The Terror* (1930), he virtually invented the modern "thriller"; the plots of his detective and suspense stories are complex but clearly developed, and they are known for their exciting climaxes. His output (including 175 books) was prodigious and his rate of production so great as to be the subject of humour. His literary reputation has suffered since his death.

Wallace, George C(orley) (b. Aug. 25, 1919, Clio, Ala., U.S.—d. Sept. 13, 1998, Montgomery, Ala.) U.S. politician. He served in the Alabama state legislature (1947–53). As a circuit court judge (1953–59), he was known for his resistance to federal investigations of racial discrimination. Campaigning as a segregationist, he was elected governor in 1963 and kept his pledge "to stand in the schoolhouse door" to prevent enrollment of African American students at the University of Alabama. He yielded only in the face of the federalized National Guard. Further confrontations made him a nationwide symbol of Southern opposition to racial integration. He formed the American Independent Party and was its presidential candidate in 1968, winning 13% of the popular vote. He again served as governor (1971–79). While campaigning for the 1972 Democratic presidential nomination, he was shot in an assassination attempt and left partly paralyzed. In the 1980s he renounced his segregationist views, and he won his last term as governor (1983–87) with support from African American voters.

Bridled nail-tailed wallaby (*Onychogalea fraenata*).
© MITCH REARDON—NATIONAL AUDUBON SOCIETY COLLECTION/PHOTO RESEARCHERS

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Wallace, Henry A(gard) (b. Oct. 7, 1888, Adair county, Iowa, U.S.—d. Nov. 18, 1965, Danbury, Conn.) U.S. politician. An agricultural expert, he succeeded his father as editor of *Wallace's Farmer* (1924–33). In 1932 he helped FRANKLIN D. ROOSEVELT win Iowa. As U.S. secretary of agriculture (1933–40), he shaped the administration's farm policy, including the AGRICULTURAL ADJUSTMENT ADMINISTRATION. He served as vice president during Roosevelt's third term but was replaced in 1944 by HARRY S. TRUMAN. He was later secretary of commerce (1945–46). Very liberal in his views, he helped form the PROGRESSIVE PARTY in 1948 and was its candidate against Truman in the presidential election, receiving more than one million votes. He wrote several books, including *Sixty Million Jobs* (1945).

Wallace, Lew(is) (b. April 10, 1827, Brookville, Ind., U.S.—d. Feb. 15, 1905, Crawfordsville, Ind.) U.S. writer. The son of Indiana's governor, he served in the Mexican War and in the American Civil War, in which he rose to the rank of major general. Later he returned to law practice, interrupted by two diplomatic postings. His literary reputation rests on three historical novels: *The Fair God* (1873), on the Spanish conquest of Mexico; *The Prince of India* (1893), on the Byzantine Empire; and, above all, the enormously popular *Ben-Hur* (1880; films, 1925, 1959), a romantic tale set in the Roman Empire during the time of Christ.

Lew Wallace
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Wallace, Mike *orig.* **Myron Leon Wallace** (b. May 9, 1918, Brookline, Mass., U.S.) U.S. television interviewer and reporter. After graduating from the University of Michigan (1939), he worked as an announcer and newscaster on radio, delving into various programs, including talk shows, quiz shows, serials, and the news. He served as a naval communications officer during World War II and was subsequently hired as a radio reporter in Chicago. He began to work on television in the 1950s, hosting several television quiz shows. He joined CBS as a reporter in 1963 and was coeditor of the long-running *60 Minutes* from its first program in 1968. Noted for his aggressive, bruising style (which led some of his guests to experience "Mike fright"), he traveled the world interviewing some of the most famous and powerful figures, and he won numerous Emmy Awards.

Wallace, Sir William (b. 1279, probably near Paisley, Renfrew, Scot.—d. Aug. 23, 1305, London, Eng.) Scottish national hero. Son of a small landowner, he began his attacks on English settlements and garrisons in 1297, after EDWARD I declared himself ruler of Scotland. His army defeated a much larger English force at Stirling Bridge, captured Stirling Castle, and then ravaged northern England, for which Wallace was knighted and proclaimed guardian of the Scottish kingdom. In 1298 Edward I invaded Scotland and defeated Wallace at the Battle of Falkirk. Disgraced, Wallace resigned his guardianship and was replaced by the future ROBERT I but apparently continued to fight a guerrilla war. In 1305 he was arrested by the English and hanged, then disemboweled, beheaded, and quartered. The next year Robert raised the rebellion that eventually won independence for Scotland.

Wallack, James William (b. Aug. 24, 1795, London, Eng.—d. Dec. 25, 1864, New York, N.Y., U.S.) British-U.S. actor-manager. Born into a London stage family, he acted in Shakespearean roles from age 12 and made his U.S. debut as Macbeth in 1818. He performed in London and New York City until 1852, crossing the Atlantic 35 times. In 1837–39 he comanaged New York's National Theatre with his brother Henry John Wallack (1790–1870), the company's leading player. In 1852–62 he comanaged the Lyceum Theatre (renamed Wallack's Lyceum) with his son Lester (1820–88) as stage manager. Succeeding his father as general manager, Lester staged polished productions of English plays and trained most of the major 19th-century U.S. stage performers.

wallaroo \ˌwä-lə-ˈrü\ *or* **euro** \ˈyu̇r-ˌō\ One of the four largest species of KANGAROO. The wallaroo (*Macropus robustus*) is smaller and stockier than the other three species (also in the genus *Macropus*); its colour varies from dark gray to pinkish brown. It lives in rocky country throughout Australia except in Victoria.

Wallenberg \ˈwä-lən-ˌbərg,\ *Swedish* \ˈwä-lən-ˌber-ē**, Raoul** (b. Aug. 4, 1912, Stockholm, Swed.—d. July 17, 1947?, Moscow, Russia, U.S.S.R.) Swedish businessman and humanitarian. The scion of a family of bankers, industrialists, and diplomats, in 1936 he became the foreign representative of a Hungarian trading company whose president was Jewish. When the Nazis sent troops to round up Jews in Hungary (1944), Wallenberg asked to be sent to Budapest as a diplomat. There he rescued thousands of Hungarian Jews by sheltering them in "protected houses" under the Swedish flag or securing their passage out of Hungary through bribes or counterfeit documents. Soon after Soviet troops occupied Budapest (1945), he was arrested on suspicion of espionage. He was sent to Moscow, where he allegedly died of a heart attack in prison in 1947. Unconfirmed reports from freed Soviet prisoners reported him alive in 1951, 1959, and 1975.

Wallenda \vä-ˈlen-dä,\ *English* \wȯ-ˈlen-də**, Karl** (b. 1905, Magdeburg, Ger.—d. March 22, 1978, San Juan, P.R.) German-born U.S. circus acrobat. He founded the Great Wallendas acrobatic troupe, which achieved fame in Europe for its four-man pyramid and cycling on the high wire without a safety net. His wife, Helen Kreis (1910–96), joined the troupe in 1926 and later was balanced at the peak of the seven-person pyramid, the most famous of the Wallendas' acts. The troupe traveled with the U.S. RINGLING BROTHERS and Barnum & Bailey Circus (1928–46), then performed as freelancers. Karl's nephew Gunther (1927–96) trained on the wire from age five; when a pyramid collapsed in 1962, Gunther was the only member left standing and rescued three who were clinging to the wire; two others were killed and one was paralyzed. Two troupe members died in accidents in 1963 and 1972. Karl died in a fall from a windwhipped wire 123 ft (37 m) above a street in San Juan.

Wallenstein \ˈvä-lən-ˌshtīn,\ *English* \ˈwä-lən-ˌstīn**, Albrecht Wenzel Eusebius von, duke von Friedland** *later* **Duke von Mecklenburg** (b. Sept. 24, 1583, Heřmanice, Bohemia—d. Feb. 25, 1634, Eger) Austrian general. A noble of Bohemia, he served with the future Habsburg emperor FERDINAND II in the campaign against Venice in 1617. He remained loyal to Ferdinand when other Bohemian nobles revolted (1618–23) and was made governor of Bohemia and allowed to acquire vast holdings in confiscated estates. Created duke of Friedland (1625), he commanded the imperial armies in the Thirty Years' War. After successes in the war against Denmark (1625–29), he was awarded the principality of Sagan (1627) and the duchy of Mecklenburg (1629). Under pressure from the German princes, Ferdinand was forced to dismiss Wallenstein. Recalled to imperial command in 1631, he drove the Swedish army from Bavaria and Franconia but was defeated at the Battle of Lützen (1632). Believing he had the support of his generals, he mounted a revolt against the emperor (1634) and was assassinated.

Waller, Edmund (b. March 3, 1606, Coleshill, Hertfordshire, Eng.—d. Oct. 21, 1687, Beaconsfield, Buckinghamshire) English poet. As a member of Parliament during the political turmoil of the 1640s, he was arrested for his part in a plot to establish London as a stronghold of the king; by betraying his colleagues and by lavish bribes, he avoided death. He later wrote poetic tributes to both OLIVER CROMWELL (1655) and CHARLES II (1660). Rejecting the dense intellectual verse of METAPHYSICAL POETRY, he adopted generalizing statement, easy associative development, and urbane social comment. With his emphasis on definitive phrasing through inversion and balance, he prepared the way for the emergence of the heroic couplet. By the end of the 17th century the heroic couplet was the dominant form of English poetry. Waller's lyrics include the well-known "Go, lovely Rose!"

Waller, Fats *orig.* **Thomas Wright Waller** (b. May 21, 1904, New York, N.Y., U.S.—d. Dec. 15, 1943, Kansas City, Mo.) U.S. JAZZ pianist, singer, and composer. Waller was influenced early by stride pianist JAMES P. JOHNSON. He became an important exponent of stride piano by the late 1920s, recording solo piano pieces such as "Handful of Keys." From 1934 he recorded with a small ensemble, Fats Waller and His Rhythm, integrating his vocals and unique comic timing with instrumental finesse. His rhythmically contagious performances of his own songs, such as "Ain't Misbehavin'" and "Honeysuckle Rose," are timeless classics of jazz.

walleye *or* **walleyed pike** Species (*Stizostedion vitreum*) of pikeperch (family Percidae), carnivorous food and game fishes found in clear, cool lakes and rivers of eastern North America. Walleyes are slender and

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darkly mottled. They have two dorsal fins and generally weigh less than 10 lbs (4.5 kg), though some may weigh up to 24 lbs (11 kg). They are at most 35 in. (90 cm) long. Walleyes are not true PIKES.

Wallis, Sir Barnes (Neville) (b. Sept. 26, 1887, Ripley, Derbyshire, Eng.—d. Oct. 30, 1979, Leatherhead, Surrey) British aeronautical designer and military engineer. He invented the innovative "dambuster" bombs used in World War II by the Royal Air Force to destroy the Möhne and Eder dams in Germany's industrial Ruhr area, producing heavy floods that slowed industrial production. He also invented the 12,000-lb (5,400 kg) "Tallboy" and the 22,000-lb (10,000 kg) "Grand Slam" bombs and was responsible for the bombs that destroyed the German warship *Tirpitz*, V-rocket sites, and much of Germany's railway system. In 1971 he designed an aircraft that could fly five times the speed of sound.

Wallis and Futuna Island group, west-central South PACIFIC OCEAN. It is a self-governing overseas territory (pop., 2003 prelim.: 14,944) of France, which includes Uvea (WALLIS ISLAND), the HORNE (Futuna) Islands (Futuna and Alofi), and a number of islets. The administrative seat is the village of Matâ'utu on Uvea. Until 1961 Wallis and Futuna was a protectorate under French authority attached to NEW CALEDONIA.

Wallis Islands Island group (pop., 2003 prelim.: 10,071), forming the northeastern part of the French overseas territory of WALLIS AND FUTUNA, west-central South Pacific Ocean. It comprises the main island of Uvea (Wallis) and a number of islets, all enclosed in one coral reef, with a total land area of 23 sq mi (60 sq km). Visited in 1767 by the British navigator Capt. Samuel Wallis, the islands were occupied by the French in 1842. They became a French protectorate in 1887 and part of the overseas territory in 1961.

Hand-printed wallpaper by Jean-Baptiste Réveillon, c. 1780–90; in the Victoria and Albert Museum, London.
COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, THE COOPER-BRIDGEMAN LIBRARY, LONDON

wallpaper Ornamental and utilitarian covering for walls made from long sheets of paper that have been stenciled, painted, or printed with abstract or narrative designs. Wallpaper developed soon after the introduction of papermaking to Europe in the late 15th century, originally as a substitute for tapestry, painted cloth, and wood paneling, and the first wallpapers were esteemed for the cleverness with which they mimicked the more costly wall coverings. In the 18th century, designs such as chintz patterns and stripes began to express the medium's decorative possibilities. In the mid-19th century, the wallpapers of WILLIAM MORRIS, featuring stylized, naturalistic patterns, created a revolution in wallpaper design. Plastic coating now improves wallpaper's durability and maintenance.

walnut Any of about 20 species of DECIDUOUS TREES in the genus *Juglans*, family Juglandaceae. Black walnut (*J. nigra*) of eastern North America and English, or Persian, walnut (*J. regia*), native to Iran, are valuable timber trees that produce edible NUTS. The butternut (*J. cinerea*) of eastern North America also produces an edible nut. The walnut family contains an additional seven genera of flowering plants, found mainly in the northern temperate zone in a variety of habitats. PECAN and HICKORY are among the many family members that are prized for both their edible nuts and their strong, attractive woods, especially noted for their grain patterns and lustre. Leaves of the walnut family are feather-like; tiny, resinous scales that look like yellow dots on the undersurface of the leaflets give *Juglans* species a pungent aroma.

Walnut Canyon National Monument National monument, north-central Arizona, U.S. Established in 1915 and covering an area of 3 sq mi (8 sq km), it preserves more than 300 pre-Columbian dwellings built by the PUEBLO INDIANS in shallow caves on the canyon walls. Main occupancy was from AD 1000 to 1200.

Walpole, Horace, 4th earl of Orford *orig.* **Horatio Walpole** (b. Sept. 24, 1717, London, Eng.—d. March 2, 1797, London) English writer, connoisseur, and collector. The son of prime minister ROBERT WALPOLE, he had an undistinguished career in Parliament. In 1747 he acquired a small villa at Twickenham that he transformed into a pseudo-Gothic showplace called Strawberry Hill; it was the stimulus for the GOTHIC REVIVAL in English domestic architecture. His literary output was extremely varied. He became famous for his medieval horror tale *The Castle of Otranto* (1765), the first GOTHIC NOVEL in English. He is especially remembered for his private correspondence of more than 3,000 letters, most addressed to Horace Mann, a British diplomat. Intended for posthumous publication, they constitute a survey of the history, manners, and taste of his age.

Horace Walpole, detail of an oil painting by Sir Joshua Reynolds, 1757; in the City of Birmingham Museum and Art Gallery, England.
COURTESY OF BIRMINGHAM MUSEUMS AND ART GALLERY

Walpole, Sir Hugh (Seymour) (b. March 13, 1884, Auckland, N.Z.—d. June 1, 1941, near Keswick, Cumberland, Eng.) British novelist, critic, and dramatist. A natural storyteller, Walpole turned to writing and reviewing books after unsuccessful attempts at teaching and lay reading in the Anglican church. Among his important novels is the semiautobiographical series that includes *Jeremy* (1919), *Jeremy and Hamlet* (1923), and *Jeremy at Crale* (1927). The Herries Chronicle, about an English country family, comprises *Rogue Herries* (1930), *Judith Paris* (1931), *The Fortress* (1932), and *Vanessa* (1933). He also wrote critical works on ANTHONY TROLLOPE, WALTER SCOTT, and JOSEPH CONRAD.

Walpole, Robert, 1st earl of Orford (b. Aug. 26, 1676, Houghton Hall, Norfolk, Eng.—d. March 18, 1745, London) English statesman generally regarded as the first British PRIME MINISTER. Elected to the House of Commons in 1701, he became an active Whig parliamentarian. He served as secretary at war (1708–10) and as treasurer of the navy (1710–11). He was also a member of the KIT-CAT CLUB. The Tory government sought to remove his influence by impeaching him for corruption, and he was expelled from the Commons in 1712. With the accession of GEORGE I (1714), he regained his position and rose rapidly to become first lord of the treasury and chancellor of the Exchequer (1715–17, 1721–42). Although associated with the SOUTH SEA BUBBLE scandal, he restored confidence in the government and maintained the Whigs in office. He cultivated the support of GEORGE II from 1727 and used royal patronage for political ends, skillfully managing the House of Commons to win support for his trade and fiscal programs, including the SINKING FUND. With his consolidation of power, he effectively became the first British prime min-

Robert Walpole, detail of an oil painting by Sir Godfrey Kneller, c. 1710–15; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

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ister. He avoided foreign entanglements and kept England neutral until 1739 but was forced into the War of Jenkins' Ear. He resigned under pressure in 1742 and was created an earl. His acclaimed art collection, sold to Russia in 1779, became part of the Hermitage Museum collection.

Walpurgis Night Night before May 1. The name comes from the 8th-century St. Walburga (or Walpurgis), an English missionary who ran an important early convent in Germany, May 1 being one of her feast days. In Sweden it is celebrated with bonfires as the beginning of spring. In Germany, as Walpurgisnacht, it was the night witches were supposed to meet in the Harz Mountains (see Brocken), though the association of witches with St. Walburga is only coincidental. See also Beltane.

Walras \vål-'rå**, (Marie-Esprit-) Léon** (b. Dec. 16, 1834, Évreux, France—d. Jan. 5, 1910, Clarens, near Montreux, Switz.) French-Swiss economist. An advocate of cooperatives as an alternative to revolution, he ran a bank for producers' cooperatives with Léon Say (grandson of Jean-Baptiste Say) from 1865 to 1868. At the Academy of Lausanne, Switz. (1870–92), he began the school of economics later known (under Vilfredo Pareto) as the Lausanne school. Walras's *Elements of Pure Economics* (1874–77) was one of the first comprehensive mathematical analyses of general economic equilibrium. Assuming an environment of free competition, he constructed a mathematical model in which productive factors, products, and prices automatically adjust in equilibrium. He thus tied together the theories of production, exchange, money, and capital.

walrus Only living species (*Odobenus rosmarus*) of the pinniped family Odobenidae. Larger than the related seals, walrus males grow up to 12 ft (3.7 m) long and weigh up to 2,800 lbs (1,270 kg). Both sexes have long, downward-pointing tusks that may grow to 3 ft (1 m) long and weigh 12 lbs (5.4 kg) each. They have no external ears. The grayish skin is deeply folded over the shoulders. They live on ice floes, in groups of up to 100, on relatively shallow water in arctic seas of Eurasia and North America. They may dive to great depths in search of food, mostly shellfish. On land and ice, they move on all four limbs. They generally follow the ice line south in winter and north in summer. Traditionally important to native humans as sources of food and clothing, they have also been hunted commercially for centuries, which has resulted in serious depletion of their numbers. Commercial hunting is now generally banned.

Walrus (*Odobenus rosmarus*).
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Walsh, Raoul (b. March 11, 1887, New York, N.Y., U.S.—d. Dec. 31, 1980, Simi Valley, near Los Angeles, Calif.) U.S. film director. Walsh began acting for the stage in 1910 and on film in 1912, the same year that he began directing. He was an assistant to D.W. Griffith and appeared in *The Birth of a Nation* (1915). In his 50-year career, he directed over 200 films, usually characterized by their simplicity and quick action. His *White Heat* (1949) is a classic study of a pathological criminal, and *The Naked and the Dead* (1958) is an effective translation of Norman Mailer's novel into film. His other films include *What Price Glory?* (1926), *The Roaring Twenties* (1939), *They Drive by Night* (1940), *They Died with Their Boots On* (1941), *High Sierra* (1941), and *A Distant Trumpet* (1964).

Walsingham, Sir Francis (b. c. 1532, probably Footscray, Kent, Eng.—d. April 6, 1590, London) English statesman and adviser to Queen Elizabeth I (1573–90). A member of Parliament from 1563, he became ambassador to the French court (1570–73) and established friendly relations between France and England. He was admitted to the Privy Council in 1573 and became secretary of state to Elizabeth I. Although not allowed to pursue an independent policy, he faithfully executed Elizabeth's foreign policy. He proved invaluable in uncovering conspiracies by Catholics against Elizabeth's life, including the plots by Francis Throckmorton (1583) and Anthony Babington (1586) to free Mary, Queen of Scots.

Walter, Bruno *orig.* **Bruno Walter Schlesinger** (b. Sept. 15, 1876, Berlin, Ger.—d. Feb. 17, 1962, Beverly Hills, Calif., U.S.) German-born U.S. conductor. An associate of Gustav Mahler, he was long a faithful proponent and interpreter of Mahler's music, giving the world premieres of *Das Lied von der Erde* (1911) and the *Symphony No. 9* (1912). He held positions in Munich (1913–22) and at Covent Garden (1924–31), but thereafter he served more often as a guest conductor than a music director. After moving to the U.S. in 1939, he often conducted the New York Philharmonic (recording as the Columbia or CBS Symphony), the Metropolitan Opera, the Philadelphia Orchestra, and the Los Angeles Philharmonic, and he was admired for the warmth of his interpretations, primarily of the Viennese school.

Walter, John (b. 1739, probably in London, Eng.—d. Nov. 16, 1812, Teddington, Middlesex) English newspaper publisher. Initially a coal dealer and marine-insurance underwriter, Walter acquired the patent for a printing system in 1783 and in 1785 in London began to publish the *Daily Universal Register*. He renamed it *The Times* in 1788. Though neither outstanding nor honest as a journalist, he turned from scandal to more serious topics and organized (while in prison for libeling members of the royal family) a news service from the European continent, thereby launching *The Times* toward its later preeminence in foreign news reporting. Walter's family owned *The Times* for almost 125 years.

Walters, Barbara (b. Sept. 25, 1931, Boston, Mass., U.S.) U.S. television journalist. After brief employment in an advertising agency, she became assistant to the publicity director for New York City's NBC-affiliated television station. She worked in television as a writer-producer (1952–58), interviewer (1964–74), and cohost (1974–76) of NBC's *Today* show, for which she won an Emmy Award in 1975. In 1976–78, for an unprecedented $1 million a year, she was coanchor of the *ABC Evening News*, the first woman to anchor a network newscast in the U.S. From 1976 she hosted the series of *Barbara Walters Specials*, interviewing celebrities and world leaders Her disarmingly direct questioning drew many subjects into frequently interesting and occasionally provocative moments of self-revelation. In 1982 and 1983 she received Emmy Awards for best interviewer. From 1984 she also cohosted ABC's *20/20* news magazine program.

Walther von der Vogelweide \'väl-tər-fȯn-der-'fō-gəl-ˌvī-də\ (b. c. 1170—d. c. 1230, Würzburg?) Greatest German lyric poet of the Middle Ages. Of knightly birth, Walther was educated at a monastery school and served masters in several courts. His poetry goes far beyond the artificial conventions followed by other minnesingers by introducing an element of realism. He emphasizes the virtues of the balanced life, in both the social and the personal spheres. More than half of his approximately 200 extant poems are political, moral, or religious; the rest are love poems, among them the popular "Unter der Linden."

Walton, Izaak (b. Aug. 9, 1593, Stafford, Staffordshire, Eng.—d. Dec. 15, 1683, Winchester, Hampshire) English biographer and author. A prosperous ironmonger with only a few years of schooling, he read widely, developed scholarly tastes, and associated with men of learning. A friend and fishing companion of John Donne, he contributed "An Elegie" to the posthumous publication of Donne's poetry (1633) and wrote biographies of Donne (1640), George Herbert (1670), and others. His classic *The Compleat Angler* (1653), a pastoral discourse on the joys and stratagems of fishing, is one of the most frequently reprinted works in English literature, most often in a revision (1676) with additions by Charles Cotton (1630–87).

Walton, Sam(uel Moore) (b. March 29, 1918, Kingfisher, Okla., U.S.—d. April 5, 1992, Little Rock, Ark.) U.S. retail magnate, founder of Wal-Mart Stores, Inc. He attended the University of Missouri and then trained with the J.C. Penney Co. In 1945 he started a chain of variety stores in Arkansas, and in 1962 he opened his first Wal-Mart store in Rogers, Ark., offering a wide selection of discount merchandise. Whereas other discount-store chains were usually situated in or near large cities, Walton based his stores in small towns where there was little competition from established chains. Using this strategy his company expanded to 800 stores by 1985. In 1983 he opened the first Sam's Wholesale Club. Walton stepped down as chief executive officer of Wal-Mart Stores in 1988 but remained chairman until his death, by which time there were over 1,700 stores and Walton's family was the wealthiest in the U.S. In the 1990s Wal-Mart became controversial for depleting downtown districts of their commercial life by siting stores nearby. By the end of the 20th century it had become the world's largest retailer.

Walton, Sir William (Turner) (b. March 29, 1902, Oldham, Lancashire, Eng.—d. March 8, 1983, Ischia, Italy) British composer. His parents were musicians, and he learned to sing and play piano and violin

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early. He established his reputation at age 19 by setting to jazzy music the whimsical poetry of Edith Sitwell (see SITWELL FAMILY); *Façade* (1923) premiered with the poet reading her poetry through a megaphone. Walton's later works include *Belshazzar's Feast* (1931), two symphonies (1935, 1960), and concertos for viola, violin, and cello (1929, 1939, 1956). His scores for LAURENCE OLIVIER's films of *Henry V* (1944), *Hamlet* (1947), and *Richard III* (1955) became well known; he also wrote coronation marches for GEORGE VI and ELIZABETH II.

waltz Ballroom turning dance evolved from the LÄNDLER in the 18th century. It is characterized by a step, slide, and step in 3/4 time. It was highly popular in the 19th and early 20th century. Variations include the rapid, whirling Viennese waltz and the slower, dipping Boston waltz, modified by VERNON AND IRENE CASTLE as the hesitation waltz. Many 19th-century composers wrote waltz music, most notably FRANZ PETER SCHUBERT, FRÉDÉRIC CHOPIN, JOHANNES BRAHMS, and JOHANN STRAUSS.

Walvis Bay Town (pop., 2001 prelim.: 40,849), west-central Namibia, on the Atlantic Ocean. A mid-19th-century rush to exploit GUANO deposits on nearby islands was followed by British annexation of the bay and the adjacent land in 1878. It was incorporated into Britain's Cape Colony in 1884. In 1910 it was included in the newly united South Africa. Administered as part of South West Africa (1922–77), it was then governed directly by South Africa, which retained the enclave after Namibia reached independence in 1990. The two countries administered the enclave jointly from 1992 to 1994; then South Africa transferred it to Namibia. Its harbour serves as Namibia's chief port.

wampum Tubular shell beads assembled into strings or woven into belts or embroidered ornaments. The ALGONQUIAN word (short for *wampumpeag*) translates as "string of white (shell beads)." Before contact with white settlers, Indians used wampum primarily ceremonially or in GIFT EXCHANGES. In the early 17th century it came to be used as money in trade with whites, because of a shortage of European currency.

Wanaka \'wä-nə-kə**, Lake** Lake, west-central SOUTH ISLAND, New Zealand. It covers an area of 75 sq mi (193 sq km) and is some 1,000 ft (300 m) deep. Fed by the Makarora and Matukituki rivers, the lake is the source of the CLUTHA RIVER. Its outlet is harnessed for hydroelectric power.

Wang Anshi *or* **Wang An-shih** \'wäŋ-'än-'shir\ (b. 1021, Linchuan, Jiangsu province, China—d. 1086, Jiangning, Jiangsu) Chinese poet and government reformer of the SONG DYNASTY. His "New Policies" of 1069–76 sparked academic controversy that continued for centuries. He created a fund for agricultural loans to farmers to spare them the exorbitant demands of moneylenders; he also replaced corvée labour with a hired-service system financed by a graduated tax levied on all families. He enabled officials to purchase supplies at the cheapest price in the most convenient market. He established a village militia system (see BAOJIA), reorganized the HANLIN ACADEMY, and restructured the civil service examinations. Wang's reforms were unpopular, and he was forced to resign in 1074. He returned to government in 1075, but with less political power. After the emperor's death an antireform clique came to power and dismantled Wang's reforms by the time of his death shortly afterward. See also FAN ZHONGYEN.

Wang Chong *or* **Wang Ch'ung** \'wäŋ-'chůŋ\ (b. AD 27, Kuiji, China—d. 100?, Kuiji) Chinese philosopher of the HAN DYNASTY. A rationalistic naturalist, he paved the way for the critical spirit of the next philosophical period and prepared China for the advent of Neo-Daoism. He opposed the superstitious element of CONFUCIANISM, declaring that natural events occur spontaneously and are not influenced by the actions of humans, who have no exceptional position in the universe. He also insisted that theories be supported by concrete evidence and experimental proof. Though never greatly popular in China, he attracted new interest in the 20th century for his foreshadowing of RATIONALISM and the SCIENTIFIC METHOD.

Wang Hui (b. 1632, Jiangsu province, China—d. 1717) Chinese artist who was the paramount member of the group of Chinese painters known as the Four Wangs (including Wang Shimin, Wang Jian, and Wang Yuanqi). Wang Hui, much like the other Wangs, primarily painted landscapes. In his best works he built up an intense web of rhythmic brushwork, while at the same time maintaining a composition's sense of unity and clarity. His fame reached the court in Beijing, and in 1691–98 he was commissioned to supervise the production of a series of hand scrolls commemorating the Kangxi emperor's tour of the South.

Wang Jingwei *or* **Wang Ching-wei** \'wäŋ-'jiŋ-'wā\ (b. May 4, 1883, Sanshui, Guangdong province, China—d. Nov. 10, 1944, Nagoya, Japan) Chinese leader, head of the regime established by the Japanese in 1940 to govern their conquests in China. A leading polemicist for SUN YAT-SEN's revolutionary party, in 1910 he tried to assassinate the imperial regent and was caught; his courage in the face of execution resulted in his sentence being reduced. He was released the following year, after the republican revolution. In the 1920s he served as a major official in the NATIONALIST PARTY. After Sun's death, he chaired the party while CHIANG KAI-SHEK led the NORTHERN EXPEDITION against China's WARLORDS. Chiang and Wang vied for party control; in a compromise in 1932, Wang became president and Chiang headed the military. After war erupted with Japan, Wang flew to Hanoi, Viet., and issued a statement calling on the Chinese to work out a peaceful settlement. In 1940, in cooperation with the Japanese, he became head of a regime that governed the Japanese-occupied areas centred on Nanjing. Though Wang had hoped to be granted virtual autonomy, the Japanese continued to exercise military and economic dominance. He died while undergoing medical treatment in Japan.

Wang Mang \'wäŋ-'mäŋ\ (b. 45 BC, China—d. Oct. 6, AD 23, Chang'an) Founder of the short-lived Xin dynasty (AD 9–25), an interlude between the two halves of the HAN DYNASTY in China. Wang's family was well connected to the Han imperial family, and in 8 BC Wang was appointed regent, only to lose the position when the emperor died. When the new emperor died in 1 BC, Wang was reappointed regent and married his daughter to the subsequent emperor, Ping, who died in AD 6. Wang picked the youngest of more than 50 eligible heirs to follow Ping and was named acting emperor. In AD 9 he ascended the throne and proclaimed the Xin dynasty. His dynasty might have endured had the Huang He (Yellow River) not changed course twice before AD 11, causing massive devastation and attendant famines, epidemics, and social unrest. Peasants banded together in ever larger units. In AD 23 rebel forces set the capital, Chang'an (modern Xi'an), on fire, forced their way into the palace, and killed him.

Wang Xiaotong (fl. early 7th century) Chinese mathematician who made important advances in the solution of problems involving cubic equations. In 626 he took part in the revision of the Wuying calendar (618), which had erroneously predicted eclipses in 620. About 630 he finished his *Jigu suanjing* ("Continuation of Ancient Mathematics"). All 20 problems in this book, except for the first one dealing with astronomy, involve cubic or biquadratic equations. Thirteen of the problems involve solving for the volume or the dimensions of a polyhedron. In solving some of these problems, Wang first used the formula for the volume of a dike of varying cross section. Other problems involve right-angled triangles.

Wang Yangming *or* **Wang Yang-ming** \'wäŋ-'yäŋ-'miŋ\ (b. 1472, Yuyao, Zhejiang province, China—d. 1529, Nanen, Jiangxi) Chinese scholar and official whose idealistic interpretation of NEO-CONFUCIANISM influenced philosophical thinking in East Asia for centuries. The son of a high government official, he was both a secretary to the Ministry of War and a lecturer on Confucianism by 1505. The next year, he was banished to a post in remote Guizhou, where hardship and solitude led him to focus on philosophy. He concluded that investigation of the principles of things should occur within the mind rather than through actual objects and that knowledge and action are codependent. Named governor of southern Jiangxi in 1516, he suppressed several rebellions and implemented governmental, social, and educational reform. By the time he was appointed war minister (1521), his followers numbered in the hundreds. His philosophy spread across China for 150 years and greatly influenced Japanese thought during that time. From 1584 he was offered sacrifice in the Confucian temple under the title Wencheng ("Completion of Culture").

Wankel \'väŋ-kəl**, Felix** (b. Aug. 13, 1902, Lahr, Ger.—d. Oct. 9, 1988, Lindau, W.Ger.) German engineer and inventor. In 1954 he completed the design of his distinctive engine, with an orbiting rotor in the shape of a curved equilateral triangle, which does the work done by the pistons in traditional reciprocating internal-combustion engines. Its advantages include light weight, few moving parts, compactness, low initial cost, fewer repairs, and relatively smooth performance. The first unit was tested in 1957, and from 1967 Japanese automobile company Mazda produced and developed the engine for a series of sports cars.

Wankie National Park See HWANGE NATIONAL PARK

Wannsee \'vän-ˌzā\ **Conference** (Jan. 20, 1942) Meeting of Nazi officials in the Berlin suburb of Wannsee to plan the "final solution" to the "Jewish question." It was attended by 15 Nazi senior bureaucrats led

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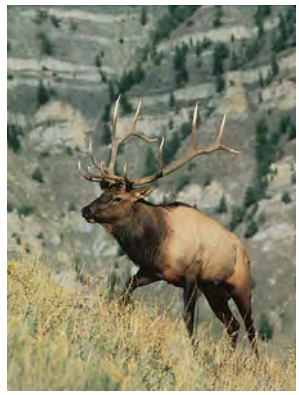
by Reinhard Heydrich, head of the SS and Gestapo, and included Adolf Eichmann, chief of Jewish affairs for the Reich Central Security Office. It marked a turning point in Nazi policy toward the Jews. An earlier idea, to deport all of Europe's Jews to Madagascar, was abandoned as impractical in wartime. Instead, the newly planned final solution would entail rounding up all Jews throughout Europe, transporting them eastward, and organizing them into labour gangs. The final protocol of the Wannsee Conference never explicitly mentioned extermination, but, within a few months after the meeting, the first gas chambers were installed at Auschwitz and Treblinka. See also Holocaust.

wapiti \'wä-pə-tē\ Species (*Cervus canadensis*) of North American deer, often considered the same species as the red deer. Once common, the wapiti is now confined to the Rocky Mountains and southern Canada. It is the second-largest living deer species (the moose is first). Males may stand taller than 5 ft (1.5 m) at the shoulder and weigh up to 1,100 lbs (500 kg). The coat is brown, pale on the rump, and long and shaggy on the shoulders and neck. The male's five-tined antlers tower almost 4 ft (1.2 m) above his head. Wapiti live in large bands in winter and in small groups in summer. See also elk.



Male wapiti (*Cervus canadensis*). ALAN CAREY

war State of conflict, generally armed, between two or more entities. It is characterized by intentional violence on the part of large bodies of individuals organized and trained for that purpose. On the national level, some wars are fought internally between rival political factions (civil war); others are fought against an external enemy. Wars have been fought in the name of religion, in self-defense, to acquire territory or resources, and to further the political aims of the aggressor state's leadership.

War Communism (1918–21) Soviet economic policy applied by the Bolsheviks during the Russian Civil War. Its chief features were the expropriation of private business and the nationalization of industry, as well as the forced requisition of surplus grain and other food products from the peasantry. These measures caused a rapid decline in agricultural production, labour productivity, and industrial output. Real wages declined by two-thirds, and uncontrolled inflation made paper currency worthless. By 1921 public discontent resulted in strikes and protests, culminating in the Kronshtadt Rebellion. In response, the Bolsheviks adopted the less-radical New Economic Policy.

war crime Any violation of the laws of war, as laid down by international customary law and certain international treaties. At the end of World War II, the part of the London Agreement signed by the U.S., Britain, the Soviet Union, and France established three categories of war crime: conventional war crimes (including murder, ill treatment, or deportation of the civilian population of occupied territories), crimes against peace, and crimes against humanity (political, racial, or religious persecution against any civilian population). The charter also provided for an international military tribunal to try major Axis war criminals. It further stated that a defendant's position as head of state would not free him from accountability, nor would having acted on orders or out of military necessity. German and Japanese war criminals were tried before Allied tribunals in Nürnberg and Tokyo in 1945–46 and 1946–48, respectively, and in the 1990s tribunals were created for the prosecution of war crimes committed in Rwanda and the territory of the former Yugoslavia. See also Geneva Convention; genocide; Hague Convention; Nürnberg trial.

War Hawk Member of the U.S. Congress who advocated war with Britain (1811). The term was applied by opponents to newly elected Southern and Western congressmen who strongly promoted U.S. expansion into the Northwest and Canada and vigorously protested British aid to Indians. The anti-British fervour of the War Hawks, who included Henry Clay and John C. Calhoun, helped cause the War of 1812.

War of 1812 U.S.-British conflict arising from U.S. grievances over oppressive British maritime practices in the Napoleonic Wars. To enforce its blockade of French ports, the British boarded U.S. and other neutral ships to check cargo they suspected was being sent to France and to impress seamen alleged to be British navy deserters. The U.S. reacted by passing legislation such as the Embargo Act (1807); Congress's War Hawks called for expulsion of the British from Canada to ensure frontier security. When the U.S. demanded an end to the interference, Britain refused, and the U.S. declared war on June 18, 1812. Despite early U.S. naval victories, notably the duel between the *Constitution* and the *Guerrière*, Britain maintained its blockade of eastern U.S. ports. A British force burned public buildings in Washington, D.C., including the White House, in retaliation for similar U.S. acts in York (Toronto), Can. The war became increasingly unpopular, especially in New England, where a separatist movement originated at the Hartford Convention. On Dec. 24, 1814, both sides signed the Treaty of Ghent, which essentially restored territories captured by each side. Before news of the treaty reached the U.S., its victory in the Battle of New Orleans led it to later proclaim the war a U.S. victory. See also Battle of Châteauguay; Chippewa; Thames; Isaac Hull; Francis Scott Key; Oliver Perry.

War of Independence, U.S. See American Revolution

War of the Three Henrys See War of the Three Henrys

War Powers Act (Nov. 7, 1973) Law passed by the U.S. Congress over the veto of Pres. Richard Nixon. The act restrained the president's ability to commit U.S. forces overseas by requiring the executive branch to consult with and report to Congress before involving U.S. forces in foreign hostilities. Widely considered a measure for preventing "future Vietnams," it was nonetheless resisted or ignored by subsequent presidents, most of whom regarded it as an unconstitutional usurpation of their executive authority.

Warbeck, Perkin (b. 1474?, Tournai, Flanders—d. Nov. 23, 1499, London, Eng.) Flemish impostor, pretender to the throne of Henry VII. The son of a local official in Flanders, while working as a servant in Ireland in 1491, he was misidentified as royalty while dressed in his master's rich silks and was soon persuaded to impersonate Richard, duke of York, who was presumed to have been murdered with his brother in the Tower of London in 1483. Encouraged by several monarchs and other Yorkist enemies in both England and Europe, he gathered forces and supporters on the continent for an invasion. After abortive attempts in 1495 and 1496, he landed in Cornwall in 1497 but was captured and hanged when he tried to escape.

warble fly Any of several dipteran species (botfly family Oestridae or the family Hypodermatidae), widespread in Europe and North America. The warble flies *Hypoderma lineatum* and *H. bovis*, also called cattle grubs or heel flies, are large, heavy, and beelike. They deposit their eggs on the legs of cattle. The larvae penetrate the skin, migrate through the body, and produce a lump, or warble, on the animal's back. Mature grubs emerge and drop to the ground to pupate. Warbles contain breathing holes, which reduce the hide's commercial value. One species (*Oedemagena tarandi*) is a reindeer pest that also causes economic losses.

warbler Any songbird of almost 350 Old World species (family Sylviidae) or about 120 New World species (family Parulidae, see wood warbler). Old World warblers, found in gardens, woodlands, and marshes, have a slender bill adapted for gleaning insects from foliage. They occur mainly from Europe and Asia to Africa and Australia, but a few (e.g., the gnatcatcher) live in the Americas. They are drab greenish, brownish, or black and 3.5–10 in. (9–26 cm) long. See also blackcap, blackpoll warbler, gnatcatcher, wood warbler.

Warburg \'vär-ˌbůrk,\ *English* \'wôr-ˌbərg**, Otto (Heinrich)** (b. Oct. 8, 1883, Freiburg im Breisgau, Ger.—d. Aug. 1, 1970, West Berlin, W.Ger.) German biochemist. In the 1920s, after earning doctorates in chemistry and medicine, he investigated the process by which oxygen is consumed in the cells of living organisms, introducing the technique of measuring changes in gas pressure for studying the rates at which slices of living tissue take up oxygen. His search for the cell components involved in oxygen consumption led to identification of the role of the cytochromes. He was awarded a 1931 Nobel Prize for his research. He was the first to observe that the growth of cancer cells requires much less oxygen than that of normal cells.

Warburg family *orig.* **Del Banco family** Family of eminent bankers, philanthropists, and scholars. A Jewish family apparently of Italian origin, they settled in the German town of Warburgum in 1559, and branches subsequently settled in Scandinavia, the U.S., and Britain.

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Simon Elias Warburg (1760–1828) founded the first Jewish community in Sweden. Among the family's bankers were Moses Marcus Warburg (d. 1830) and his brother Gerson (d. 1825), who founded the Hamburg bank of M.M. Warburg & Co. (1798), and James Paul Warburg (1896–1969), a member of Pres. Franklin D. Roosevelt's Brain Trust. The family's scholars included Nobel Prize-winning biochemist Otto Warburg. Among the U.S. philanthropists were Frieda Schiff Warburg (1876–1958) and her sons, patrons of art and music.

Ward, Barbara (Mary), Baroness Jackson (of Lodsworth) (b. May 23, 1914, York, Eng.—d. May 31, 1981, Lodsworth) British economist and writer. After studying economics at the University of Oxford, she became a writer and editor at *The Economist* (from 1939). She married Robert Jackson in 1950. She was an influential adviser to the Vatican, the UN, and the World Bank, and she wrote numerous articles and books on the worldwide threat from poverty among less-developed countries (she advocated the transfer of wealth from rich to poor countries) and the importance of conservation; her books, which reached a wide audience, included *The Rich Nations and the Poor Nations* (1962), *Spaceship Earth* (1966), *Only One Earth* (with René Dubos, 1972), and *Progress for a Small Planet* (1980).

warfare See air warfare, amphibious warfare, biological warfare, chemical warfare, economic warfare, holy war, naval warfare, psychological warfare, total war, trench warfare

warfarin \'wȯr-fə-rən\ Anticoagulant drug, marketed as Coumadin. Originally developed to treat thromboembolism (see thrombosis), it interferes with the liver's metabolism of vitamin K, leading to production of defective coagulation factors. Warfarin therapy risks uncontrollable hemorrhage, either spontaneously or from any cut or bruise; it requires frequent checks to maintain the proper level in the blood. In high concentrations, warfarin is used as a rodent poison, causing death by internal bleeding.

Warfield, Paul (b. Nov. 28, 1942, Warren, Ohio, U.S.) U.S. football player. He compiled an outstanding record at Ohio State University. As a wide receiver for the Cleveland Browns (1964–69, 1976–77), he helped lead them to four league championship games. With the Miami Dolphins (1970–74) he played in three Super Bowl games (1972–74). In his 13-year career he caught 427 passes for 8,565 yd, averaging a near-record 20.1 yd per catch.

Warhol, Andy *orig.* **Andrew Warhola** (b. Aug. 6, 1928?, Pittsburgh?, Pa., U.S.—d. Feb. 22, 1987, New York, N.Y.) U.S. artist and filmmaker. The son of Czech immigrants, Warhol graduated from the Carnegie Institute of Technology, Pittsburgh, in 1949. He then went to New York City, where he worked as a commercial illustrator. Warhol began painting in the late 1950s and received sudden notoriety in 1962, when he exhibited paintings of Campbell's soup cans, Coca-Cola bottles, and wooden replicas of Brillo soap-pad boxes. By 1963 he was mass-producing these purposely banal images of consumer goods by means of photographic silk screen prints; he then began printing endless variations of portraits of celebrities in garish colours. The silk screen technique was ideally suited to Warhol, for the repeated image was reduced to a dehumanized cultural icon that reflected both the supposed emptiness of American material culture and the artist's emotional distance from the practice of his art. Warhol's work placed him in the forefront of the emerging Pop art movement in the United States. As the 1960s progressed, Warhol devoted more of his energy to filmmaking. His "underground" films are known for their inventive eroticism, plotless boredom, and inordinate length (up to 25 hours). Throughout the 1970s and until his death he continued to produce prints depicting political and Hollywood celebrities, and he involved himself in a wide range of advertising illustrations and other commercial art projects. He was one of the most famous and important American cultural figures of the late 20th century, and the effects of his conceptions of art and celebrity continue to be felt.

warlord In China, an independent military commander in the early 20th century. Warlords, supported by provincial military interests or foreign powers, ruled various parts of China following the death of Yuan Shikai, first president of the Republic of China. In southeastern China Sun Yat-sen and the Nationalist Party gained the backing of a warlord based in Guangzhou (Canton). In northern China three leading warlords emerged: Zhang Zuolin, a Japanese-backed bandit in Manchuria; Wu Peifu, a traditionally educated officer in central China; and Feng Yuxiang, who seized Beijing in 1924. The Nationalist Party consolidated its control in the south and, under Chiang Kai-shek, swept northward, reuniting the country in 1928. Numerous local warlords continued to exert de facto power over their own domains until the Japanese invasion during what became World War II. See also Northern Expedition.

Warner, Pop *orig.* **Glenn Scobey Warner** (b. April 5, 1871, Springfield, N.Y., U.S.—d. Sept. 7, 1954, Palo Alto, Calif.) U.S. college football coach. At the Carlisle (Pa.) Indian School (1898–1904, 1906–15), he coached Jim Thorpe, one of football's greatest players. He also coached at the University of Pittsburgh (1915–23) and Stanford University (1924–32). Warner perfected the single- and double-wing formations (now rarely used); these and other innovations helped refine the modern game. In 46 seasons (1895–1940) his teams won 312 games, lost 104, and tied 32.

Warner, W(illiam) Lloyd (b. Oct. 26, 1898, Redlands, Calif., U.S.—d. May 23, 1970, Chicago, Ill.) U.S. sociologist and anthropologist. He studied with Alfred L. Kroeber and A.R. Radcliffe-Brown and later taught at the universities of Chicago and Michigan. His studies of the American class system have been widely influential. In the late 1930s he produced a five-volume study of Newburyport, Mass.; his other books include *A Black Civilization* (1937), *The Social Life of a Modern Community* (1941), and *The Living and the Dead* (1959).

Warner Bros. Inc. U.S. film studio. Beginning in Pennsylvania as movie distributors and theatre owners in 1903, the four Warner brothers started producing their own films in 1913 and moved to Hollywood in 1917. They founded Warner Brothers Pictures Inc. in 1923, with Harry Warner (b. 1881—d. 1958) as president in New York, Albert Warner (b. 1884—d. 1967) as treasurer, and Sam Warner (b. 1888—d. 1927) and Jack Warner (b. 1892—d. 1978) as studio managers in Hollywood. In the mid 1920s they helped develop the important Vitaphone sound process. With the release of *The Jazz Singer* (1927), the first feature film with synchronized music and dialogue, the studio's success was assured. Warner Brothers went on to produce gangster films starring James Cagney and Edward G. Robinson, adventure movies with Errol Flynn, and mystery dramas with Humphrey Bogart. After his brothers retired, Jack became president (1956–72). See also AOL Time Warner Inc.

warrant In law, authorization in writing empowering a person to perform an act or execute an office. Arrest warrants are necessary (except in certain circumstances) for an arrest to be considered legal. Search warrants entitle the holder to enter and search a property. Both are classes of judicial warrants. To obtain them, a complainant must provide an affidavit setting forth facts sufficient to satisfy the belief that a crime has been committed and that the accused is the guilty party (or, in the case of the search warrant, that the place to be searched will yield the expected evidence). Nonjudicial warrants include tax warrants (which provide the authority to collect taxes) and land warrants (which entitle the holder to a specific tract of public land).

Warrau \wə-'raù\ *or* **Guarauno** Group of nomadic South American Indians who in modern times inhabit the swampy Orinoco River delta in Venezuela and areas eastward into Guyana. Some live in Suriname. They subsist mainly by fishing, hunting, and gathering, though they practice some agriculture in the drier regions. The Mauritia palm is a staple: they make a fermented drink from its sap and bread from its pith, eat its fruit, and fashion its fibre into clothing and hammocks. Their priestly ceremonies and complex social classes are unusual among hunters and gatherers.

Warren Town (pop., 2000: 11,360), eastern Rhode Island, U.S. Located near Providence, it was settled in 1632 and was originally part of Massachusetts. In 1747 Rhode Island annexed it. It was pillaged and burned by the British during the American Revolution. It is now a summer resort.

Warren, Earl (b. March 19, 1891, Los Angeles, Calif., U.S.—d. July 9, 1974, Washington, D.C.) U.S. jurist and politician. He graduated from law school at the University of California, then served as a county district attorney (1925–39), state

Earl Warren, 1953.
UPI—EB Inc.

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attorney general (1939–43), and governor of the state for three terms (1943–53). He was criticized for interning Japanese citizens in camps during World War II. His only electoral defeat came in 1948, when he ran for vice president on the Republican ticket with Thomas Dewey. In 1953 Pres. Dwight D. Eisenhower appointed Warren chief justice of the Supreme Court of the United States, a post he held until 1969. This was a period of sweeping changes in U.S. constitutional law. Under his leadership the court proved to be strongly liberal. Among Warren's notable opinions are those in *Brown v. Board of Education* (1954), which held that segration in public education was unconstitutional; *Reynolds* v. *Sims* (1964), which declared the "one man, one vote" principle requiring state legislative reapportionment (1964); and *Miranda v. Arizona* (1966), which held that police must inform an arrestee of his right to remain silent and to have counsel present (appointed for him if he is indigent) and that a confession obtained in defiance of these requirements is inadmissible in court. After the assassination of Pres. John F. Kennedy, he chaired the Warren Commission.

Warren, Harry *orig.* **Salvatore Guaragna** (b. Dec. 24, 1893, Brooklyn, N.Y., U.S.—d. Sept. 22, 1981, Los Angeles, Calif.) U.S. songwriter. The youngest of 12 children, Warren was self-taught musically. He toured with brass bands and carnivals from age 15. After a few years as a song plugger in Tin Pan Alley, he began contributing tunes to Broadway musicals, including "You're My Everything" and "I Found a Million Dollar Baby in a Five-and-Ten-Cent Store." In 1932 he moved to Hollywood, where he collaborated on films such as *Gold Diggers of 1933* (1933), *42nd Street* (1933), *Down Argentine Way* (1940), and *Sun Valley Serenade* (1941; with "Chattanooga Choo-Choo"), and he received Academy Awards for the songs "Lullaby of Broadway," "You'll Never Know," and "On the Atchison, Topeka and the Santa Fe." Between 1935 and 1950 he wrote more top-10 hit songs than any other songwriter.

Warren, Joseph (b. June 11, 1741, Roxbury, Mass.—d. June 17, 1775, Bunker Hill, Mass.) American Revolutionary leader. He was a physician in Boston. He was active in patriot causes after passage of the Stamp Act (1765) and helped draft the Massachusetts colonial grievances called the Suffolk Resolves (1774). As a member of the Massachusetts Committee of Public Safety, he sent Paul Revere on his ride to Lexington. He was made a major general in the Revolutionary army and died in the Battle of Bunker Hill.

Warren, Mercy Otis *orig.* **Mercy Otis** (b. Sept. 25, 1728, Barnstable, Mass.—d. Oct. 19, 1814, Plymouth, Mass., U.S.) U.S. poet, dramatist, and historian. The sister of James Otis, she received no formal education but nevertheless became a woman of letters and a friend and correspondent of leading political figures. She commented on the issues of the day in political satires, plays, and pamphlets. Though a defender of the American Revolution, she opposed the Constitution, arguing that power should rest with the states. Her most significant work, *History of the Rise, Progress, and Termination of the American Revolution* (3 vol., 1805), covered the period from 1765 to 1800.

Warren, Robert Penn (b. April 24, 1905, Guthrie, Ky., U.S.—d. Sept. 15, 1989, Stratton, Vt.) U.S. novelist, poet, and critic. Warren attended Vanderbilt University, where he joined the Fugitives, a group of poets who advocated the agrarian way of life in the South. Later he taught at several colleges and universities and helped found and edit *The Southern Review* (1935–42), possibly the most influential American literary magazine of the time. His writings often treat moral dilemmas in a South beset by the erosion of its traditional rural values. His best-known novel is *All the King's Men* (1946, Pulitzer Prize; film, 1949). The short-story volume *The Circus in the Attic* (1948) contains the notable "Blackberry Winter." He won Pulitzer prizes for poetry in 1958 and 1979 and became the first U.S. poet laureate in 1986.

Warren Commission *officially* **President's Commission on the Assassination of President John F. Kennedy** (1963–64) Group appointed by Pres. Lyndon B. Johnson to investigate the circumstances surrounding John F. Kennedy's slaying and the shooting of his assassin, Lee Harvey Oswald. It was chaired by Earl Warren and included two U.S. senators, two U.S. congressmen, and two former public officials. After months of investigation, it reported that Kennedy was killed by Oswald's rifle shots from the Texas School Book Depository and that Oswald's murder by Jack Ruby two days later was not part of a conspiracy to assassinate Kennedy. Its findings were later questioned in a number of books and articles and in a special congressional committee report in 1979, though no conclusive contradictory evidence was found.

Warring States period *Chinese* **Zhangou** (475–221 BC) In Chinese history, a period in which small feuding kingdoms or fiefdoms struggled for supremacy. The period was dominated by seven or more small feuding Chinese kingdoms. It was the age of Confucian thinkers Mencius and Xunzi, the time when many of the government institutions and cultural patterns that would characterize China for the next 2,000 years were established. The term Warring States (Sengoku) is also used in Japan for a period (1482–1558) during the Muromachi period that was marked by almost constant warfare among rival daimyo seeking to consolidate and increase their landholdings.

Wars of the Roses See Wars of the Roses

Warsaw City (pop., 2001 est.: 1,610,471), capital of Poland, on the Vistula River. Founded c. 1300, it flourished as a trade centre, came under Polish control in 1526, and became the capital in 1596. During the late 18th century it expanded rapidly, but it was destroyed in 1794 by the Russians. In 1807 it was made the capital of the Duchy of Warsaw by Napoleon. Taken by the Russians in 1813, it was the centre of Polish insurrections in 1830–31 and 1860. It was occupied by the Germans in World War I and again in World War II, when its large Jewish population revolted in the Warsaw Ghetto Uprising (1943). The Warsaw Uprising in 1944 was unsuccessful, and the Germans virtually destroyed the city. Modern Warsaw, rebuilt after the war, now houses government bodies, including the Sejm (parliament); it is also an industrial and educational centre. Among its historic buildings are a 14th-century Gothic cathedral and a medieval castle.

Warsaw, Duchy of *or* **Grand Duchy of Warsaw** Independent Polish state (1807–15), created by Napoleon. Established by the Treaties of Tilsit in 1807 after the Poles had helped Napoleon defeat Prussia, it consisted originally of the major portion of the central Polish provinces that Prussia had taken in the 1790s. For Napoleon's second war against Russia (1812), the Duchy of Warsaw supplied nearly 98,000 men, but Napoleon's defeat in Russia also sealed the fortunes of the duchy. In 1813 the Russians assumed control of it. Later the Congress of Vienna divided it into three parts: the Grand Duchy of Poznań; the free Republic of Kraków; and the Congress Kingdom of Poland, which was joined to Russia by making the Russian emperor its king.

Warsaw Ghetto Uprising (April 19–May 16, 1943) Revolt by Polish Jews under Nazi occupation against deportation to the Treblinka extermination camp. By July 1942 the Nazis had herded 500,000 Jews from surrounding areas into the ghetto in Warsaw. Though starvation killed thousands each month, the Nazis began transferring more than 5,000 Jews a day to rural "labour camps." When word reached the ghetto in early 1943 that the destination was actually the gas chambers at Treblinka, the newly formed Jewish Fighting Organization (ŻOB) attacked the Nazis, killing 50 in four days of street fighting and causing the deportations to halt. On April 19 Heinrich Himmler sent 2,000 SS men and army troops to clear the ghetto of its remaining Jews. For four weeks the ŻOB and guerrillas fought with pistols and homemade bombs, destroying tanks and killing several hundred Nazis, until their ammunition ran out. Not until May 8 did the Nazis manage to take the ŻOB headquarters bunker. Many of the surviving ŻOB fighters took their own lives to avoid being captured. The battle raged until May 16, when the SS chief declared "The Warsaw Ghetto is no more." During the 28 days of the uprising, more than 40,000 Jews were either killed or deported.

Warsaw Pact *or* **Warsaw Treaty Organization** Military alliance of the Soviet Union, Albania (until 1968), Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Romania, formed in 1955 in response to West Germany's entry into NATO. Its terms included a unified military command and the stationing of Soviet troops in the other member states. Warsaw Pact troops were called into action to suppress uprisings in Poland (1956), Hungary (1956), and Czechoslovakia (1968). The alliance was dissolved in 1991 after the collapse of the Soviet bloc, and Soviet troops departed. Several Warsaw Pact members later joined NATO.

Warsaw Uprising (August–October 1944) Insurrection in Warsaw in World War II that failed to prevent the pro-Soviet Polish administration from gaining control of Poland. In July 1944, as Soviet troops approached Warsaw, the Polish underground was encouraged to stage an uprising against the Germans. Though wary of Soviet promises of self-government, the Polish home army of 50,000 troops attacked the weakened German force and gained control of most of Warsaw in four days.

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German reinforcements then bombarded the city with air and artillery attacks for 63 days. The approaching Red Army halted, and the Soviets refused to allow aid from the Allies to the beleaguered Poles, who were forced to surrender when their supplies ran out in October; the Germans then deported the rest of the city's population and destroyed most of the city itself. During the fighting, some 300,000 Poles died. By allowing the Polish home army to be eliminated, the Soviets diminished potential resistance to their establishing political domination of Poland in 1945.

wart *or* **verruca** \və-'rü-kə\ Well-defined growth on the skin, usually caused by a PAPILLOMAVIRUS, which triggers overproduction of epidermal cells. This may lead to a single long-standing wart, profuse local spread (especially in moist areas), or warts in various parts of the body. The most common type is a round bump with a dry, rough surface. Warts are usually painless except in pressure areas, such as the sole of the foot (plantar wart). Genital warts are merely a nuisance unless they become large or numerous enough to interfere with urination, defecation, or childbirth, but some viral strains are associated with cervical cancer. Warts are considered contagious. They may be removed by applying acids, cryotherapy, electrocautery, or surgery; they sometimes disappear spontaneously.

Warta \'vär-tä\ **River** River, west-central Poland. It rises northwest of KRAKÓW and flows northwest 502 mi (808 km) before joining the ODER RIVER. The Warta is the second longest river lying entirely in Poland; about half of its length is navigable. Its lower course, formerly in Germany, is in a region assigned to Poland by the POTSDAM CONFERENCE in 1945.

Wartenburg, Johann Yorck von See Johan, Graf YORCK VON WARTENBURG

warthog Large-headed species (*Phacochoerus aethiopicus*) of PIG (UNGULATE family Suidae), inhabiting open and lightly forested areas of Africa. Warthogs, about 30 in. (76 cm) high, are blackish or brown, with a coarse mane from the neck to the midback. The male has two pairs of bumps (warts) on the face. Both sexes have tusks. The tusks on the lower jaw are weapons; those on the upper jaw curve upward and inward in a semicircle, growing to more than 24 in. (60 cm) in some males. The long tufted tail is held high when the animal runs. Warthogs live in groups, feeding on grass and other vegetation.

Warthog (*Phacochoerus aethiopicus*)
KARL H. MASLOWSKI

Warwick \'wär-ik\ Town and district (pop., 2001: 125,962), administrative and historic county of WARWICKSHIRE, central England. Known for its historic castle, it grew up at a crossing place on the River AVON and was fortified c. 915. By 1086 it was a royal borough, and WILLIAM I ordered the castle to be enlarged. The present-day castle dates mainly from the 14th and 15th centuries. With its virtually intact structure and its fine collections of paintings and armour, the castle has become a major tourist attraction. The town, which grew around the castle, is a market centre and has light industry.

Warwick \'wär-ik**, Earl of** *orig.* **Richard Neville** (b. Nov. 22, 1428—d. April 14, 1471, Barnet, Hertfordshire, Eng.) English nobleman influential in the Wars of the ROSES. Son of the earl of Salisbury, he became through marriage (1449) the earl of Warwick and acquired vast estates. With his father, he helped the Yorkists win the Battle of St. Albans (1455). Appointed captain of Calais, in 1460 he crossed to England to defeat and capture HENRY VI at Northampton. In 1461 he was routed by the Lancastrians, but he recovered to march on London with York's son Edward, soon crowned EDWARD IV. Warwick was the virtual ruler during Edward's early reign (1461–64), but tensions between the two mounted, and in 1469 Warwick engineered a revolt in northern England that forced Edward to flee to Flanders in 1470. Warwick joined the Lancastrians and restored Henry VI to the throne, earning his later nickname "the Kingmaker." He was killed by Edward's forces at the Battle of Barnet.

Warwickshire \'wär-ik-ˌshir\ Administrative (pop., 2001: 505,885) and historic county, central England. As an administrative and geographic unit, the county dates from the 10th century, with the historic county town of WARWICK lying roughly at its centre. In Saxon times Warwickshire formed a border zone between the kingdoms of WESSEX and MERCIA. During the Middle Ages two major centres grew up in the county, at Warwick and Kenilworth. Historical structures surviving in the area include Norman and early English churches, along with buildings at STRATFORD-UPON-AVON associated with WILLIAM SHAKESPEARE. The Battle of Edgehill (1642), the first serious clash of the ENGLISH CIVIL WARS, was fought in Warwickshire near the OXFORDSHIRE border. Farming, dairy farming, fruit growing, market gardening, and coal mining are important economic activities.

Wasatch \'wȯ-ˌsach\ **Mountains** Range of the south-central ROCKY MOUNTAINS. They extend about 250 mi (400 km) from southeastern Idaho to central Utah, U.S. The highest peak is Mount Timpanogos (12,008 ft [3,660 m]). The TIMPANOGOS CAVE NATIONAL MONUMENT is within the range.

Washington State (pop., 2000: 5,894,121), northwestern U.S. Washington is bounded by the Canadian province of British Columbia to the north, Idaho to the east, Oregon to the south, and the Pacific Ocean to the west. It covers an area of 68,139 sq mi (176,479 sq km); its capital is OLYMPIA. The state contains the CASCADE RANGE, which includes Mount RAINIER and Mount SAINT HELENS, and the OLYMPIC MOUNTAINS. The Strait of JUAN DE FUCA and PUGET SOUND extend inland into the state from the Pacific Ocean. Cape Alva, the most westerly point of the coterminous U.S., is in Washington, as is the COLUMBIA RIVER. The area was inhabited by Pacific Coast Indians, including the CHINOOK and NEZ PERCÉ, when the region was visited by Spanish, Russian, British, and French explorers (1543–1792). Claimed by the Spanish and British, it was crossed by the LEWIS AND CLARK EXPEDITION in 1805. Spain surrendered to the U.S. its territories north of California in 1819. Until the 1840s, international agreement permitted citizens of both the U.S. and Britain to settle in what was known as Oregon Country. An 1846 treaty with Great Britain set the present Washington-Canada boundary; the Oregon Country was added to the U.S. and renamed the Territory of Oregon in 1848. Washington received territorial status in 1853 and was reduced to its present size in 1863. It was admitted to the Union as the 42nd state in 1889. In the late 1890s it was the main staging point for gold miners going to the Alaskan and Yukon strikes. The greatest stimulus to its 20th-century progress came with the development of hydroelectric power and the work on the Bonneville and Grand Coulee dams. Its important manufactures include aircraft building and shipbuilding. Expanding trade with Pacific Rim countries, high technology, and tourism add to the economy.

Washington, Booker T(aliaferro) (b. April 5, 1856, Franklin county, Va., U.S.—d. Nov. 14, 1915, Tuskegee, Ala.) U.S. educator and reformer. Born into slavery, he moved with his family to West Virginia after emancipation. He worked from age nine, then attended (1872–75) and joined the staff of the Hampton (Va.) Normal and Agricultural Institute. In 1881 he was selected to head the Tuskegee Normal and Industrial Institute, a new teacher-training school for African Americans, and he successfully transformed it into a thriving institution (later TUSKEGEE UNIVERSITY). He became perhaps the most prominent African American leader of his time. His controversial conviction that African Americans could best gain equality in the U.S. by improving their economic situation through education rather than by demanding equal rights was termed the ATLANTA COMPROMISE. His books include *Up from Slavery* (1901).

Washington, D.C. City (pop., 2000: 572,059), capital of the U.S. It is coextensive with the DISTRICT OF COLUMBIA. Situated at the navigational head of the POTOMAC RIVER, between Maryland and Virginia, it has an area of 69 sq mi (179 sq km). The site was chosen by GEORGE WASHINGTON in 1790 as a political compromise that satisfied both Northern and Southern states. Designed by Pierre-Charles L'ENFANT, it is one of the few cities in the world planned expressly as a national capital. The federal government occupied it in 1800. British troops burned the city (1814) during the WAR OF 1812. With the annexation of Georgetown in 1878, the city became coterminous with the District of Columbia. Significant buildings include the Capitol, WHITE HOUSE, and LIBRARY OF CONGRESS. The WASHINGTON MONUMENT, Lincoln Memorial, Jefferson Memorial, and VIETNAM VETERANS MEMORIAL are among the most famous of the city's more than 300 memorials and statues. The SMITHSONIAN INSTITUTION is in Washington, as are numerous other cultural and educational institutions and foreign embassies. The economy is based on national and international political activities, scientific research, and tourism.

Washington, Denzel (b. Dec. 28, 1954, Mount Vernon, N.Y., U.S.) U.S. film actor. A graduate of Fordham University, he began his career as a stage actor. Featured in the television series *St. Elsewhere* (1982–88),

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he also appeared in movies from 1981 and won acclaim for his roles in *Cry Freedom* (1987), *Glory* (1989, Academy Award), and *Mississippi Masala* (1991). Praised for his portrayal of the title character in Spike Lee's *Malcolm X* (1992), he became one of the most popular leading men of the 1990s in films such as *Philadelphia* (1993), *Devil in a Blue Dress* (1995), and *He Got Game* (1998). For his performance in *Training Day* (2001), Washington became only the second African American to win an Oscar for best actor. In 2002 he made his directorial debut with *Antwone Fisher*.

Washington, Dinah *orig.* **Ruth Lee Jones** (b. Aug. 29, 1924, Tuscaloosa, Ala., U.S.—d. Dec. 14, 1963, Detroit, Mich.) U.S. singer. Washington sang in church choirs as a child. She joined Lionel Hampton's band in 1943, embarking on a solo career in 1946. Her recordings encompassed a wide variety of idioms including rhythm and blues, jazz, and country music; her "What a Difference a Day Makes" (1959) was a pop hit. Known as "Queen of the Blues," she combined precise diction and intonation with an alternately gentle and brassy vocal timbre, and her voice was remarkable for its clarity and projection. She had remarkable vocal control. Even after she crossed over to the popular (pop) music market, in which she had her greatest commercial success, Washington retained many of her earlier fans because of her passionate, supple style.

Washington, George (b. Feb. 22, 1732, Westmoreland county, Va.—d. Dec. 14, 1799, Mount Vernon, Va., U.S.) American Revolutionary commander-in-chief (1775–83) and first president of the U.S. (1789–97). Born into a wealthy family, he was educated privately. In 1752 he inherited his brother's estate at Mount Vernon, including 18 slaves; their ranks grew to 49 by 1760, though he disapproved of slavery. In the French and Indian War he was commissioned a colonel and sent to the Ohio Territory. After Edward Braddock was killed, Washington became commander of all Virginia forces, entrusted with defending the western frontier (1755–58). He resigned to manage his estate and in 1759 married Martha Dandridge Custis (1731–1802), a widow. He served in the House of Burgesses (1759–74), where he supported the colonists' cause, and later in the Continental Congress (1774–75). In 1775 he was elected to command the Continental Army. In the ensuing American Revolution, he proved a brilliant commander and a stalwart leader, despite several defeats. With the war effectively ended by the capture of Yorktown (1781), he resigned his commission and returned to Mount Vernon (1783). He was a delegate to and presiding officer of the Constitutional Convention (1787) and helped secure ratification of the Constitution in Virginia. When the state electors met to select the first president (1789), Washington was the unanimous choice. He formed a cabinet to balance sectional and political differences but was committed to a strong central government. Elected to a second term, he followed a middle course between the political factions that later became the Federalist Party and the Democratic Party. He proclaimed a policy of neutrality in the war between Britain and France (1793) and sent troops to suppress the Whiskey Rebellion (1794). He declined to serve a third term (thereby setting a 144-year precedent) and retired in 1797 after delivering his "Farewell Address." Known as the "father of his country," he is universally regarded as one of the greatest figures in U.S. history.

Washington, Harold (b. April 15, 1922, Chicago, Ill., U.S.—d. Nov. 25, 1987, Chicago) U.S. politician and mayor of Chicago (1983–87). He practiced law and served as a city attorney (1954–58). He was elected successively to the Illinois legislature (1965–76), the state senate (1976–80), and the U.S. House of Representatives (1980–83). In 1983 he campaigned for mayor of Chicago on a platform of reform and an end to city patronage; with his election, he become the first African American to hold that post. He was reelected to a second term in 1987 but died soon after.

Washington, Mount Peak in the Presidential Range of the White Mountains, northern New Hampshire. Reaching an elevation of 6,288 ft (1,917 m), it is the highest point in the northeastern U.S. and is noted for its extreme weather conditions; the world's highest wind velocity (231 mph [372 kph]) was recorded there in 1934. It is the site of Mount Washington Observatory. The area is included in the White Mountain National Forest.

Washington and Lee University Private university in Lexington, Virginia, U.S. Founded as an academy in 1749, it is one of the oldest institutions of higher learning in the U.S. It is named for George Washington, who presented the academy with a gift of $50,000 in 1796, and Robert E. Lee, who served as its president from 1865 to 1870. It became coeducational in 1984. It has an undergraduate college, a law school, and a school of commerce, economics, and politics. Among its offerings are programs in engineering, environmental studies, and journalism.

Washington Birthplace National Monument, George See George Washington Birthplace National Monument

Washington Conference *officially* **International Conference on Naval Limitation** Conference held in Washington, D.C. (1921–22), to limit the naval arms race and negotiate Pacific security agreements. Several major and minor treaty agreements were drafted and signed: the Four-Power Pact (signed by Britain, Japan, France, and the U.S.) stipulated mutual consultation regarding any issue in the Pacific and affirmed respect for the Pacific territories of signatory nations. The Five-Power Naval Limitation Treaty (which Italy also signed) imposed proportional limits on the number of warships each signatory nation could maintain and mandated some actual disarmament; it lapsed in 1936 when Japan was refused equality with the U.S. and Britain. Another agreement regulated the use of submarines and outlawed poison gas in warfare. A Nine-Power Pact (with The Netherlands, Portugal, Belgium, and China) affirmed China's sovereignty.

Washington Monument Obelisk in Washington, D.C., U.S., honouring George Washington, the first president of the United States. Based on a design by Robert Mills (b. 1781—d. 1855), it was built between 1848 and 1884. It is constructed of granite faced with Maryland marble and is some 555.5 ft (169.3 m) high, the world's tallest masonry structure. Inserted in the interior walls are more than 190 carved stones presented by various individuals, cities, states, and foreign countries. It is located on grounds that are a westward extension of the Mall. The top can be reached by elevator or by an interior iron stairway. It underwent a major restoration in the 1990s and reopened in 2001.

Washington Post, The Morning daily newspaper published in Washington, D.C., the dominant paper in the U.S. capital and one of the nation's leading newspapers. Established in 1877 as a Democratic Party organ, it changed orientation and ownership several times and faced constant economic problems until financier Eugene Meyer (1875–1959) purchased it in 1933. Under the leadership of Meyer, his son-in-law Philip L. Graham (publisher from 1946 until his death in 1963), and his daughter, Katharine Graham (publisher from 1969–79), it acquired domestic and international prestige, especially in its coverage of the Watergate scandal. Donald E. Graham was named publisher in 1979. The newspaper is known for its sound and independent editorial stance and thorough, accurate reporting.

Washington University Private university in St. Louis, Mo. It was founded as a seminary in 1853 and became a university in 1857. It is a comprehensive research and teaching institution, with one of the leading medical schools in the U.S. It has a college of arts and sciences, a graduate school, and schools of architecture, business (the Olin School), engineering and applied science, fine arts, law, and social work. Research facilities include a space science centre, a centre for the study of Islamic culture and society, and an institute for the deaf.

Washita \'wä-shi-ˌtô\ **River** River, west- and south-central Oklahoma, U.S. It rises in northwestern Texas and flows east across the Oklahoma boundary, then southeast to south-central Oklahoma, and south into the Red River. It is 626 mi (1,007 km) long. The Battle of the Washita (November 1868), in which Gen. George Custer attacked a Cheyenne Indian encampment, took place near Cheyenne.

Washita River See Ouachita River

wasp Any of more than 20,000, usually winged, insect species in the order Hymenoptera. The abdomen is attached to the thorax by a slender petiole, or "waist," and the female's abdomen has a formidable stinger. Most species are solitary; about 1,000 species are highly social; and some may be either social or solitary. Adults feed primarily on nectar. Most solitary wasps nest in tunnels in the ground and feed larvae with paralyzed insects or spiders. The paperlike nest of social wasps (family Vespidae) consists of chewed plant material mixed with saliva and arranged in adjacent hexagonal cells. The female lays one egg in each cell and provisions it with a macerated caterpillar. Successive generations may enlarge the nest and care for the young.

Wassermann \'vä-sər-ˌmän,\ *English* \'wä-sər-mən**, August von** (b. Feb. 21, 1866, Bamberg, Bavaria—d. March 16, 1925, Berlin, Ger.) German bacteriologist. With Albert Neisser (1855–1916) he developed a

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test for the antibody to the spirochete that causes syphilis in 1906. That test, along with other procedures, is still used to diagnose syphilis. He is also noted for developing tests for tuberculosis. With Wilhelm Kolle he wrote *Handbook of Pathogenic Microorganisms* (6 vol., 1903–09).

Wassermann \'vä-sər-ˌmän,\ *English* \'wä-sər-mən**, Jakob** (b. March 10, 1873, Fürth, Bavaria—d. Jan. 1, 1934, Altaussee, Austria) German novelist. After an unsettled youth he achieved success with such works as *Die Juden von Zirndorf* (1897), *Caspar Hauser* (1908), and *Christian Wahnschaffe* (1919). His popularity was greatest in the 1920s and '30s, when he wrote *The Maurizius Case* (1928), treating the theme of justice with the carefully plotted suspense of a detective story, and extended the tale of a post-World War I youth into a trilogy with *Etzel Andergast* (1931) and *Kerkhoven's Third Existence* (1934). He is frequently compared to FYODOR DOSTOYEVSKY in both his moral fervour and his sensationalizing tendency.

Wasserstein \'wä-sər-ˌstīn**, Wendy** (b. Oct. 18, 1950, Brooklyn, N.Y., U.S.—d. Jan. 30, 2006, New York, N.Y.) U.S. playwright. Wasserstein earned a graduate degree at the Yale School of Drama. She won favourable notice for *Uncommon Women and Others* (1977), which was followed by *Isn't It Romantic* (1981) and *The Heidi Chronicles* (1988, Tony Award, Pulitzer Prize). She became noted for her comic gift and her portrayals of single women. Her later plays include *The Sisters Rosensweig* (1992), *An American Daughter* (1997), and *Third* (2005).

Wat Tyler's Rebellion See PEASANTS' REVOLT

watch Portable timepiece designed to be worn on the wrist or carried in the pocket. The first watches appeared shortly after 1500, when the mainspring (see SPRING) was invented as a replacement for weights in driving CLOCKS. The progressive miniaturization of electronic components in recent decades has made possible the development of all-electronic watches, in which the necessary transistors, resistors, capacitors, and other elements are all on one or several miniature INTEGRATED CIRCUITS, or chips. Such circuitry enables them to perform several timekeeping functions and also makes possible digital readouts of the time.

water Inorganic compound composed of HYDROGEN and OXYGEN (H_2O), existing in LIQUID, GAS (STEAM, water vapour), and SOLID (ICE) states. At room temperature, water is a colourless, odourless, tasteless liquid. One of the most abundant compounds, water covers about 75% of Earth's surface. Life depends on water for virtually every process, its ability to dissolve many other substances being perhaps its most essential quality. Life is believed to have originated in water (the world's oceans or smaller bodies), and living organisms use aqueous solutions (including blood and digestive juices) as mediums for carrying out biological processes. Because water molecules are asymmetric and therefore ELECTRIC DIPOLES, HYDROGEN BONDING between molecules in liquid water and in ice is important in holding them together. Many of water's complex and anomalous physical and chemical properties (high melting and boiling points, VISCOSITY, SURFACE TENSION, greater density in liquid than in solid form) arise from this extensive hydrogen bonding. Water undergoes DISSOCIATION to the IONS H^+ (or H_3O^+) and OH^-, particularly in the presence of SALTS and other solutes; it may act as an ACID or as a BASE. Water occurs bound (as water of hydration) in many salts and MINERALS. It has myriad industrial uses, including as a suspending agent (papermaking, coal slurrying), SOLVENT, diluting agent, coolant, and source of hydrogen; it is used in filtration, washing, steam generation, hydration of lime and cement, textile processing, sulfur mining, HYDROLYSIS, and HYDRAULICS, as well as in beverages and foods. See also HARD WATER; HEAVY WATER.

water bloom Dense aquatic accumulation of microscopic organisms produced by an abundance of nutrients in surface water coupled with adequate sunlight for PHOTOSYNTHESIS. The microorganisms or the toxic substances they release may discolour the water, exhaust its oxygen content, poison aquatic animals and waterfowl, and irritate the skin and respiratory tract of humans. Single species of ALGAE, DIATOMS, or DINOFLAGELLATES, reproducing every few hours, may dominate a bloom's population; the number of individuals per quart (litre) of water, normally about 1,000, can increase to 60 million. Blooms of the dinoflagellate genus *Gymnodinium* cause RED TIDES. The Red Sea is named for the occasional blooms of the alga *Trichodesmium erythraeum*. See also WATER POLLUTION.

water buffalo *or* **Indian buffalo** Any of three subspecies of oxlike BOVID (species *Bubalus bubalis*). Two have been domesticated in Asia since the earliest recorded history. The animal is named for its ability to work on waterlogged land and in humid climates. The largest breeds stand 5–6 ft (1.5–1.8 m), is up to 9 ft (2.8 m) long, and may weigh over 2,000 lb (900 kg). The dull black or dark gray body has little hair. The horns spread outward and upward, measuring up to 7 ft (2 m) across. One subspecies, the swamp buffalo, is the principal draft animal of southern China and South and Southeast Asia. Another, the river buffalo, is used for dairy and meat production and draft work in southern and South Asia and Egypt. The third subspecies is the wild water buffalo, of which only a few dozen herds remain. It is larger than domestic buffaloes and is sometimes referred to as a separate species (*B. arnee*).

water chestnut Any of several perennial water plants of the genus *Trapa* (family Trapaceae), native to Europe, Asia, and Africa, or their edible, nutlike fruit. The water caltrop (*T. natans*) has two sets of leaves—long, feathery, rootlike, submerged leaves and a loose rosette of floating leaves attached to leafstalks 2–4 in (5–10 cm) long. The small fruit usually has four spiny angles. The Chinese water chestnut (*Eleocharis tuberosus* or *E. dulcis*) is a member of the SEDGE FAMILY.

water clock *or* **clepsydra** \'klep-sə-drə\ Ancient device for measuring time by the gradual flow of water. One form, used by North American Indians and some African peoples, consisted of a small boat or floating vessel that shipped water through a hole until it sank. In another form, water escaped through a hole in a vessel marked with graduated lines; specimens from Egypt date from the 14th century BC. The Romans invented a clepsydra consisting of a cylinder into which water dripped from a reservoir; a float provided readings against a scale on the cylinder wall. GALILEO used a mercury clepsydra to time his experimental falling bodies. See also CLOCK.

water flea Any of about 450 species (order Anomopoda) of microscopic, mostly freshwater CRUSTACEANS distributed worldwide. Species in the genus *Daphnia* are ubiquitous in Europe and North America. Water fleas have a discrete head that bears antennae. The carapace (shell) encloses all or most of the body, except on the predatory giant *Leptodora* (up to 0.7 in. [18 mm] long), whose carapace is just a small brood sac. Most species swim by powerful strokes of the antennae, sometimes producing a hopping-and-sinking motion. All but a few predatory species use specialized thoracic limbs to filter organic matter from the water. See also COPEPOD.

Water flea of the genus *Daphnia* (magnified about 30×)
ERIC V. GRAVE—PHOTO RESEARCHERS

water frame In textile manufacture, a spinning machine powered by water that produced a cotton YARN suitable for warp (lengthwise threads). Patented in 1769 by R. ARKWRIGHT, it represented an improvement on JAMES HARGREAVES'S SPINNING JENNY, which produced weaker thread suitable only for weft (filling yarn).

water hyacinth Any of about five species of aquatic plants that make up the genus *Eichhornia* of the pickerelweed family (Pontederiaceae). They are native mainly to the New World tropics. Some species float in shallow water; others are rooted in muddy streambanks and lakeshores. All have slender rootstocks, feathery roots, rosettes of stalked leaves, and flowers arranged in spikes or clusters. The common water hyacinth (*E. crassipes*) is the most widespread. The leafstalk is spongy and inflated, and the upper lobes of its purple flowers have blue and yellow markings. It reproduces quickly, often clogging slow-flowing streams. It is used as an ornamental in outdoor pools and aquariums.

Common water hyacinth (*Eichhornia crassipes*)
W.H. HODGE

water lily Any of the freshwater plants in eight genera that make up the family Nymphaeaceae, native to temperate and tropical regions. All are perennial except those in the genus *Euryale*. Most have rounded, floating, waxy-coated leaves growing atop long stalks that contain many

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air spaces. Thick, fleshy, creeping underwater stems are buried in the mud. In some species the leaves are also submerged. Showy, solitary, cuplike flowers with numerous spirally arranged petals are borne at or above the water surface on the long stalks. The genus *Nymphaea* includes the water lilies proper (or water nymphs). The common North American white water lily, pond lily, or toad lily is *N. odorata*. The LOTUS of ancient Egyptian art was usually the blue lotus (*N. caerulea*). The largest water lilies are two species that make up the tropical South American genus *Victoria*; the Santa Cruz water lily (*V. cruziana*) has leaves 2–6 ft (60–180 cm) in diameter. Water lilies provide food for fish and wildlife but sometimes cause drainage problems because of their rapid growth. Many varieties have been developed for ornamental use in garden pools and conservatories.

Santa Cruz water lily (*Victoria cruziana*).
GOTTLIEB HAMPFLER

water moccasin *or* **cottonmouth** Either of two species of PIT VIPER that inhabits marshy lowlands of the southeastern U.S. and Mexico. The U.S. species (*Agkistrodon piscivorus*) is called a cottonmouth because it threatens with the mouth open, showing the white interior. It is up to 5 ft (1.5 m) long and is completely black or brown with darker crossbands. A dangerous snake with a potentially lethal bite, it tends to stand its ground or move slowly away when alarmed. It will eat almost any small animal, including turtles, fishes, and birds. See also COPPERHEAD.

water ouzel See DIPPER

water pollution State resulting when substances are released into a body of water, where they become dissolved or suspended in the water or deposited on the bottom, accumulating to the extent that they overwhelm its capacity to absorb, break down, or recycle them, and thus interfering with the functioning of aquatic ecosystems. Contributions to water pollution include substances drawn from the air (see ACID RAIN), silt from soil erosion, chemical FERTILIZERS and PESTICIDES, runoff from septic tanks, outflow from livestock feedlots, chemical wastes (some toxic) from industries, and sewage and other urban wastes from cities and towns. A community far upstream in a watershed may thus receive relatively clean water, whereas one farther downstream receives a partly diluted mixture of urban, industrial, and rural wastes. When organic matter exceeds the capacity of microorganisms in the water to break it down and recycle it, the excess of nutrients in such matter encourages algal WATER BLOOMS. When these algae die, their remains add further to the organic wastes already in the water, and eventually the water becomes deficient in oxygen. Organisms that do not require oxygen then attack the organic wastes, releasing gases such as methane and hydrogen sulfide, which are harmful to the oxygen-requiring forms of life. The result is a foul-smelling, waste-filled body of water. See also EUTROPHICATION.

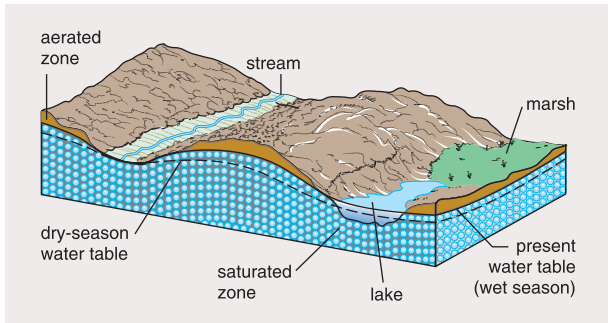
water polo Sport played in a swimming pool by teams of seven with a buoyant ball resembling a football (soccer ball). The ball may be carried or thrown, and a point is scored when the ball is placed in the opposing team's goal. The name derives from a mid-19th-century version of the sport in which players rode barrels and struck the ball with sticks. A rough and demanding game, it is played by both men and women. Modern water polo was introduced as an Olympic sport in 1900.

water resource Any of the entire range of natural waters (vapour, liquid, or solid) that occur on the Earth and that are of potential use to humans. These resources include the waters of the oceans, rivers, and lakes; groundwater and deep subsurface waters; and glaciers and permanent snowfields. Continuing increase in water use has led to growing concern over the availability and quality of water supplies.

water snake Any of 65–80 SNAKE species of the genera *Natrix* and *Nerodia*, as well as similar snakes of the family Colubridae, found worldwide except in South America. Most species have a stout body with dark blotches or streaks and ridged scales. Some are simliar in appearance to venomous species. They kill fishes and amphibians with a nonvenomous bite. The New World species live in or near water and bear live young; European species are less water-dependent and lay eggs. In defense they inflate the head, strike, and release a foul secretion. Average length is about 3 ft (1 m); some Old World species reach 6 ft (1.8 m).

water-supply system Facilities for the collection, treatment, storage, and distribution of water. Ancient systems included wells, storage reservoirs, CANALS and AQUEDUCTS, and water-distribution systems. Highly advanced systems appeared c. 2500 BC and reached their peak in the Roman aqueduct system. In the Middle Ages, water supplies were largely neglected and epidemics caused by waterborne organisms were common. In the 17th–18th century, distribution systems utilizing cast-iron pipes, aqueducts, and pumps began to be installed. The link between polluted water and disease came to be understood in the 19th century, and treatment methods such as slow sand filtration and disinfection with chlorine were introduced. Modern reservoirs are formed usually by constructing DAMS near the collection point of mountain-water runoff or across rivers. After the water reaches collection points, it is treated to improve its quality; it is then pumped either directly into a city or town's distribution system or to an elevated storage location, such as a water tank. See also PLUMBING.

water table *or* **groundwater table** Surface of a body of underground water below which the soil or rocks are permanently saturated with water. The water table separates the groundwater zone (zone of saturation) that lies below it from the zone of aeration that lies above it. The water table fluctuates both with the seasons and from year to year because it is affected by climatic variations and by the amount of precipitation used by vegetation. It also is affected by withdrawing excessive amounts of water from wells or by recharging them artificially. See also AQUIFER.



Seasonal variations in groundwater levels.
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waterbuck Species of ANTELOPE (*Kobus ellipsiprymnus*) that lives in herds, usually near water, on plains and floodplains and in woodlands and swamps of sub-Saharan Africa. Waterbucks are almost 5 ft (1.5 m) high at the shoulder. Males have long, heavily ridged horns that curve backward and then upward. The coarse, shaggy coat is grayish, and the rump has a white ring.

Waterbury City (pop., 2000: 107,271), western Connecticut, U.S. Located on the Naugatuck River, Mattatuck Plantation was settled in 1674 as part of Farmington, Conn., and was later incorporated (1686) as the town of Waterbury. The city of Waterbury, incorporated in 1853, was consolidated with the town in 1902. In the 19th century it became the nation's largest producer of brass products. Other manufactures include clocks, watches, and chemicals. It is the financial and commercial centre of western Connecticut.

watercolour Painting made with a pigment ground in gum, usually gum arabic, and applied with brush and water to a surface, usually paper. The pigment is ordinarily transparent but can be made opaque by mixing with a whiting to produce GOUACHE. Transparent watercolour allows for freshness and luminosity. Whereas oil paintings achieve their effects by a building up of colour, watercolours rely on what is left out, with empty, unpainted spaces being an integral part of the work.

watercress Perennial plant (*Nasturtium officinale*) of the MUSTARD FAMILY, native to Eurasia and naturalized throughout North America. It grows submerged, floating on the water, or spread over mud surfaces in cool, flowing streams. White flowers are followed by small, beanlike seedpods. Watercress is often cultivated in tanks for its young shoots, which are used

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in salads. The delicate, light green, peppery-flavoured leaves are rich in vitamin C. Since watercress grown near cattle and sheep feedlots can become contaminated by feces containing cysts of the liver fluke, agent of the illness fascioliasis (liver rot), regulations specify that commercial watercress beds be protected from such pollution.

Wateree River River, central South Carolina, U.S. It enters the state from North Carolina as the Catawba River but is known as the Wateree in South Carolina. It joins the Congaree River to form the Santee River. The Wateree-Catawba River is 395 mi (636 km) long. The Wateree flows through a series of lakes and reservoirs, the largest of which is Wateree Lake, 15 mi (24 km) long.

waterfall Area where flowing river water drops abruptly and nearly vertically. A waterfall may also be termed a falls, or, when large volumes of water are involved, a cataract. Waterfalls of small height and less steepness or a series of small falls are called cascades. Still gentler stretches of river that exhibit turbulent flow and white water are called rapids.

Waterford glass Heavy cut glassware, produced in Waterford, Ire., from the 1720s to the present, characterized by thick walls, deeply incised geometric cutting, and brilliant polish. Characteristic Waterford products include Rococo chandeliers, wall lamps, sconces, bowls, and vases. After c. 1770 Waterford glassmakers gradually abandoned the Rococo style in favour of the more restrained Neoclassical style popular in England.

waterfowl Any member of the family Anatidae, web-footed birds with a broad bill containing fine plates, or lamellae; usually stocky and often long-necked, including ducks, geese (see goose), and swans. Waterfowl feed by dabbling, diving, or grazing. Most species are social and have an array of formal displays and group cohesion signals. Almost all breed in water. The female usually selects the nest site, builds the nest from any vegetation within reach, and incubates the 3–12 eggs. Shortly after hatching, the young imprint on their mother (see imprinting). Many species are migratory.

Watergate scandal (1972–74) Political scandal involving illegal activities by Pres. Richard Nixon's administration. In June 1972 five burglars were arrested after breaking into the Democratic Party's national headquarters at the Watergate Hotel complex in Washington, D.C. Within a few days of their arrest at the Watergate, charges of burglary and wiretapping were brought against the five and two others, including a former White House aide and G. Gordon Liddy, general counsel for the Committee to Reelect the President. Nixon and his aides steadfastly denied that anyone in the administration had been involved, despite persistent press reports to the contrary, and in November 1972 Nixon was easily reelected. In January 1973 the trial of the burglars was held before Judge John Sirica; five pleaded guilty and two were convicted by a jury. Sirica's direct questioning of witnesses revealed details of a cover-up by H.R. Haldeman, John D. Ehrlichman, and John W. Dean. They and Attorney General Richard G. Kleindienst resigned in April. The new attorney general, Elliot L. Richardson (1920–98), appointed Archibald Cox (b. 1912) as special prosecutor. A Senate committee under Samuel Ervin held televised hearings in which the existence of tapes of conversations in the president's office was disclosed. Cox and Ervin subpoenaed the tapes, but Nixon refused to relinquish them and ordered Cox fired (Oct. 20, 1973). Richardson resigned in protest, and the public outcry eventually forced Nixon to surrender the tapes (December 8), which revealed clear signs of his involvement in the cover-up. In July 1974 the Judiciary Committee of the House of Representatives passed three articles of impeachment against Nixon. On August 5 Nixon supplied three tapes that clearly implicated him in the cover-up. Though Nixon continued to insist that he had not committed any offenses, he resigned on Aug. 8, 1974. He was pardoned a month later by his successor, Gerald Ford.

Waterloo, Battle of (June 18, 1815) Final defeat of Napoleon and French forces in the Napoleonic Wars. The battle was fought near Waterloo village, south of Brussels, during the Hundred Days of Napoleon's restoration, by Napoleon's 72,000 troops against the duke of Wellington's combined Allied army of 68,000 aided by 45,000 Prussians under Gebhard von Blücher. After the French defeated the Prussians at Ligny and held Wellington at Quatre-Bras in secondary battles on June 16, Napoleon's marshals, including Michel Ney, failed to eliminate either enemy while they were separated. Napoleon delayed his attack at Waterloo until midday, to allow the ground to dry, which enabled Blücher's main force to escape the pursuing French and join Wellington. Four French attacks on the Allied centre failed to break through, and Napoleon had to move troops to meet the Prussian flanking attack. When Ney succeeded in capturing a farmhouse at the centre of the Allied line, his call to Napoleon for reinforcements was refused. Wellington and his forces, though vulnerable after heavy losses, repulsed the final French assault and turned to advance against the French, forcing them into a disorganized retreat. The French suffered 25,000 killed and wounded, and 9,000 were captured; Wellington's casualties were 15,000, and Blücher's were about 8,000. Four days later, Napoleon abdicated for the last time.

Waterloo, University of Public university in Waterloo, Ont., Can., founded in 1957. It has faculties of applied health sciences, arts, engineering, environmental studies, mathematics, and science, as well as schools of accounting, architecture, optometry, and urban and regional planning. Special facilities include museums of optometry and of games.

watermelon Succulent fruit of *Citrullus lanatus* (formerly *C. vulgaris*), in the gourd family, native to tropical Africa and cultivated on every continent except Antarctica. The vines spread across the ground with branched tendrils, deeply cut leaves, and light-yellow flowers. Each vine bears 2–15 large, reddish, white, or yellow, sweet, very juicy fruits with flat black seeds. Varieties differ in flesh color, shape, and rind thickness. The rind may be preserved as a pickle.

waterpower Power produced by a stream of water as it turns a wheel or similar device. The waterwheel, probably invented in the 1st century BC, was widely used throughout the Middle Ages and into modern times for grinding grain, operating bellows for furnaces, and other purposes. The more compact water turbine, which passes water through a series of fixed and rotating blades, was introduced in 1827. Water turbines, used originally for direct mechanical drive for irrigation, now are used almost exclusively to generate hydroelectric power.

Waters, Ethel (b. Oct. 31, 1896/1900, Chester, Pa., U.S.—d. Sept. 1, 1977, Chatsworth, Calif.) U.S. blues and jazz singer and actress. She was a professional singer by age 17, and she recorded with jazzmen such as Duke Ellington and Benny Goodman in the 1930s. She made her Broadway debut in the *Africana* revue (1927) and later had a lead role in *Blackbirds* (1930). In 1933 she appeared in Irving Berlin's musical *As Thousands Cheer*, in which she sang "Heat Wave" and "Suppertime." Her later stage successes included *Cabin in the Sky* (1940; film, 1943) and *The Member of the Wedding* (1950; film, 1952). She also acted in films such as *Pinky* (1949) and *The Sound and the Fury* (1959).

Waters, Muddy *orig.* **McKinley Morganfield** (b. April 4, 1915, Rolling Fork, Miss., U.S.—d. April 30, 1983, Westmont, Ill.) U.S. blues guitarist and singer. He grew up in the cotton country of Mississippi and taught himself harmonica as a child. He later took up guitar, eagerly absorbing the classic delta blues styles of Robert Johnson and Son House. He was first recorded in 1941 by archivist Alan Lomax (see John Lomax). In 1943 he moved to Chicago; there he broke with the country blues style by playing over a heavy dance rhythm, adopting the electric guitar and adding piano and drums while retaining a moan-and-shout vocal style and lyrics that were by turns mournful, boastful, and risqué. The result came to be known as urban blues, from which sprang in large part later forms such as rock music and soul music. A surge in interest in the roots of popular music in the early 1960s brought Waters widespread fame, and he performed internationally into the 1970s.

waterskiing Sport of planing and jumping on water skis, broad skilike runners that a rider wears while being towed by a motorboat. The sport originated in the U.S. in the 1920s. International competitions have been held since 1946. Single-ski slalom competition is held on a course consisting of a specified number of buoys around which the skier must negotiate. Jumping competitions employ a ramp; skiers are judged for distance and style. Barefoot and trick skiing are also part of some competitions. A later development in waterskiing, wakeboarding began in the U.S. in the 1980s when surfers began riding their boards as they were pulled behind boats. Since the mid 1990s wakeboarding has been an event at both the Gravity Games and the X Games (see extreme sports) and has become the fastest-growing water sport worldwide.

Waterton Lakes National Park Mountain recreational area, western Canada. Located in southwestern Alberta, it became a national park in 1895. It covers 203 sq mi (525 sq km). It adjoins the U.S. border and Glacier National Park in the U.S.; the two parks together compose the Waterton-Glacier International Peace Park, dedicated in 1932.

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waterwheel Machine for tapping the energy of running or falling water (hence a prime mover) by means of a set of paddles or buckets mounted around a wheel. The force of the moving water against the paddles, or the weight of water poured into the buckets, rotates the wheel. The resulting power is transmitted to machinery via the shaft of the wheel. The waterwheel was perhaps the earliest source of mechanical energy to replace that of humans and animals, and it was first used for such tasks as raising water and grinding grain. See also WATERPOWER.

Watie \'wä-tē**, Stand** *orig.* **De Gata Ga** (b. Dec. 12, 1806, Rome, Ga., U.S.—d. Sept. 9, 1871) American Indian leader. He learned English at a mission school and helped publish the *Cherokee Phoenix*, a tribal newspaper. In 1835 he joined three other CHEROKEE chiefs to sign the Treaty of New Echota, which surrendered Cherokee lands in Georgia and forced the tribe to move to Indian Territory in present-day Oklahoma. In the American Civil War he raised a mounted Cherokee rifle regiment and joined the Confederate army. He directed cavalry raids on the fields and other property of Indians who backed the Union. Promoted to brigadier general (1864), he remained loyal to the Confederacy even after the tribe ended its alliance. After the war, he went to Washington, D.C., as a representative of the southern Cherokee.

Watling Street Ancient Roman road in Britain. Extending from LONDON to Wroxeter, it was one of the great arterial roads of Roman Britain. In the 9th century it divided MERCIA. Later the name was applied to other main roads, including the London-Dover road that ran through CANTERBURY.

Watson, Doc *orig.* **Arthel Lane Watson** (b. March 2, 1923, Stony Fork, near Deep Gap, N.C., U.S.) U.S. COUNTRY MUSIC singer, banjoist, and guitarist. Blind from birth, Watson grew up on a farm and learned to play guitar, banjo, and harmonica as a child. Though he did not record professionally until he was in his late 30s, he quickly rose to prominence with his renditions of traditional and popular tunes backed by his virtuoso flat-picking guitar style. He appeared at the 1963 Newport Folk Festival to great acclaim. He performed for many years with his son Merle (1949–85).

Watson, James D(ewey) (b. April 6, 1928, Chicago, Ill., U.S.) U.S. geneticist and biophysicist. He earned his Ph.D. at Indiana University in 1950. Using X-ray diffraction techniques, he began work in Britain with FRANCIS CRICK on the problem of DNA structure. In 1952 he determined the structure of the protein coat surrounding the tobacco mosaic virus. In early 1953 he determined that the essential DNA components, four organic bases, must be linked in definite pairs, a discovery that enabled Watson and Crick to formulate a double-helix molecular model for DNA. In 1962 the two scientists and MAURICE WILKINS shared the Nobel Prize. Watson's *The Double Helix* (1968), a best-selling personal account of the DNA discovery, aroused controversy. He taught at Harvard University (1955–76) and served as director of the Carnegie Institute's laboratory at Cold Spring Harbor (1968–94). See also ROSALIND FRANKLIN.

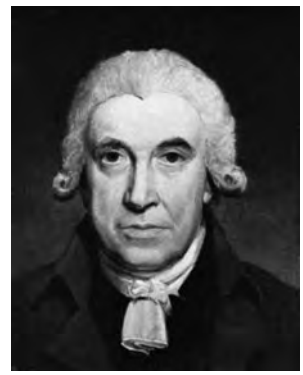
Watson, John B(roadus) (b. Jan. 9, 1878, Travelers Rest, near Greenville, S.C., U.S.—d. Sept. 25, 1958, New York, N.Y.) U.S. psychologist. Trained at the University of Chicago, Watson taught psychology at Johns Hopkins University (1908–20). He is remembered for codifying and publicizing behaviourism. In his epoch-making article, "Psychology as a Behaviorist Views It" (1913), he asserted that psychology should restrict itself to the objective, experimental study of the relations between environmental events and human behaviour. In *Behavior* (1914) he argued for the use of animal subjects in studying reflexes and conditioned responses, and in *Psychology from the Standpoint of a Behaviorist* (1919) he extended the principles and methods he employed in animal experiments. In 1920 he left academia to enter the advertising business.

Watson, Thomas J(ohn), Sr. (b. Feb. 17, 1874, Campbell, N.Y., U.S.—d. June 19, 1956, New York, N.Y.) U.S. industrialist. He went to work for the National Cash Register Co. in 1899. In 1914 he became president of the company that in 1924 became International Business Machines Corporation (IBM), which he built into the world's largest manufacturer of electric typewriters and data-processing equipment. Backing an aggressive research-and-development program, he assembled a highly motivated, well-trained, and well-paid staff, gave pep talks, enforced a strict dress code, and posted the now-famous "Think" sign in company offices. In the 1930s and '40s he pursued international trade, extending IBM's influence worldwide. Active in civic affairs, he was noted for his efforts on behalf of the arts and world peace. His son Thomas John Watson, Jr. (1914–93), succeeded him as president (1952), chairman (1961), and CEO (1972).

Watson, Tom *in full* **Thomas Sturges Watson** (b. Sept. 4, 1949, Kansas City, Mo., U.S.) U.S. golfer. Watson attended Stanford University before becoming a professional golfer in 1971. He became one of the sport's dominant figures in the 1970s and early '80s, winning the British Open (1975, 1977, 1980, 1982, 1983), the Masters (1977, 1981), and the U.S. Open (1982).

Watson-Watt, Sir Robert Alexander (b. April 13, 1892, Brechin, Scot.—d. Dec. 5, 1973, Inverness) Scottish physicist. He began as a meteorologist working on devices for locating thunderstorms. As head of the radio department of Britain's National Physical Laboratory (1935), he worked on aircraft radio location and could locate planes at a distance of about 80 mi (110 km) by beaming radio waves at them, receiving reflections of the waves, and calculating distance by elapsed time. This led to the design of the world's first practical RADAR system, a vital element in the defense of Britain against German air raids during World War II. His other contributions include a cathode-ray direction finder used to study atmospheric phenomena, research in electromagnetic radiation, and inventions used for flight safety.

Watt, James (b. Jan. 19, 1736, Greenock, Renfrewshire, Scot.—d. Aug. 25, 1819, Heathfield Hall, near Birmingham, Warwick, Eng.) Scottish engineer and inventor. Though largely self-taught, he began work early as an instrument maker and later as an engineer on the Forth and Clyde Canal. Watt's major improvement to THOMAS NEWCOMEN'S STEAM ENGINE was the use of a separate CONDENSER (1769), which reduced the loss of LATENT HEAT and greatly increased its efficiency. With MATTHEW BOULTON he began manufacture of his new engine in 1775. In 1781 he added rotary motion (a so-called sun-and-planet gear) to replace the up-and-down action of the original engine. In 1782 he patented the double-acting engine, in which the piston pushed as well as pulled. This engine required a new method of rigidly connecting the piston to the beam, a problem he solved in 1784 with an arrangement of connected rods that guided the piston rod in a perpendicular motion. His application of the centrifugal governor for automatic control of the speed of the engine (1788) and his invention of a PRESSURE GAUGE (1790) virtually completed the Watt engine, which had immense consequences for the INDUSTRIAL REVOLUTION. He introduced the concept of HORSEPOWER; the watt, a unit of power, is named for him.



James Watt, oil painting by H. Howard; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Watteau \vä-'tō,\ *English* \wä-'tō**, (Jean-) Antoine** (b. Oct. 10, 1684, Valenciennes, France—d. July 18, 1721, Nogent-sur-Marne) French painter. Son of a roof tiler in Valenciennes, he was apprenticed to a local artist. At 18 he moved to Paris, where he worked for a series of painters; one of them was a theatrical scenery painter, and much of Watteau's work consequently embraced the artifice of the theatre, particularly the COMMEDIA DELL'ARTE and the ballet. His works typified the lyrically charming and graceful ROCOCO STYLE. The greatest, his *Pilgrimage to the Island of Cythera*, depicts pilgrims setting out for (or departing from) the mythic island of love and was his presentation piece when he was inducted into the academy in 1717. The academicians, unable to fit him into any of the recognized categories, welcomed him as a painter of *fêtes galantes* ("elegant festivities"), an important new genre to which countless later Rococo pictures belong.

wattle See ACACIA

Watts, André (b. June 20, 1946, Nürnberg, Ger.) German-born U.S. pianist. Son of an African American soldier and a Hungarian mother, he made his debut at age nine at a Philadelphia Orchestra children's concert. He attracted wide attention when at age 16 he performed on television

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under conductor Leonard Bernstein. Though already a mature musician, he chose to continue study with Leon Fleischer (b. 1928). In 1976 he gave a concert that was the first live television broadcast of a solo recital in history. His surpassing technique and understated manner made him a favoured concert performer, and his popularity continued into the 21st century.

Watts, Isaac (b. July 17, 1674, Southampton, Hampshire, Eng.—d. Nov. 25, 1748, Stoke Newington, London) English Nonconformist minister, regarded as the father of English hymnody. Watts studied at the Dissenting Academy at Stoke Newington, London, and he later became pastor of Mark Lane Independent (i.e., Congregational) Chapel. His collections of sacred lyrics include *Horae Lyricae* (1706), *Hymns and Spiritual Songs* (1707), and *The Psalms of David Imitated in the Language of the New Testament* (1719). His hymns, numbering more than 600, became known throughout Protestant Christendom; they include "When I Survey the Wondrous Cross," "O God, Our Help in Ages Past," "Joy to the World," and "Jesus Shall Reign." A man of great erudition, he published books on a range of subjects.

Watusi See Tutsi

Waugh \'wȯ**, Evelyn (Arthur St. John)** (b. Oct. 28, 1903, London, Eng.—d. April 10, 1966, Combe Florey, near Taunton, Somerset) English novelist. After an Oxford education, he devoted himself to solitary, observant travel and the writing of novels, soon earning a wide reputation for sardonic wit and technical brilliance. His finest satirical novels are *Decline and Fall* (1928), *Vile Bodies* (1930), *Black Mischief* (1932), *A Handful of Dust* (1934), *Scoop* (1938), and *The Loved One* (1948). He converted to Roman Catholicism in 1930, and his Catholicism is insistently reflected in his novels from then on. After service in World War II he led a retired life, growing increasingly conservative and misanthropic. His later works, more serious and ambitious but written with less élan, include *Brideshead Revisited* (1945) and the *Sword of Honour* trilogy—*Men at Arms* (1952), *Officers and Gentlemen* (1955), and *Unconditional Surrender* (1961).

Evelyn Waugh, photograph by Mark Gerson, 1964.
CAMERA PRESS

wave Propagation of disturbances from place to place in a regular and organized way. Most familiar are surface waves that travel on water, but sound, light, and the motion of subatomic particles all exhibit wavelike properties. In the simplest waves, the disturbance oscillates periodically (see periodic motion) with a fixed frequency and wavelength. Mechanical waves, such as sound, require a medium through which to travel, while electromagnetic waves (see electromagnetic radiation) do not require a medium and can be propagated through a vacuum. Propagation of a wave through a medium depends on the medium's properties. See also seismic wave.

wave In oceanography, a ridge or swell on the surface of a body of water, normally having a forward motion distinct from the motions of the particles that compose it. Ocean waves are fairly regular, with an identifiable wavelength between adjacent crests and with a definite frequency of oscillation. Waves result when a generating force (usually the wind) displaces surface water and a restoring force returns it to its undisturbed position. Surface tension alone is the restoring force for small waves. For large waves, gravity is more important.

wave-cut platform *or* **abrasion platform** Gently sloping rock ledge that extends from the high-tide level at a steep cliff base to below the low-tide level. It develops as a result of wave abrasion; beaches protect the shore from abrasion and therefore prevent the formation of platforms. A platform is broadened as waves erode a notch at the base of the sea cliff, causing overhanging rock to fall. As the sea cliffs are attacked, weak rocks are quickly eroded, leaving the more resistant rocks as protrusions.

wave front Imaginary surface that represents corresponding points of waves vibrating in unison. As identical waves from the same source travel through a homogeneous medium, corresponding crests and troughs are in phase at any instant; that is, they have completed the same fraction of their periodic motion. Any surface drawn through all points of the same phase constitutes a wave front.

wave function Variable quantity that mathematically describes the wave characteristics of a particle. It is related to the likelihood of the particle being at a given point in space at a given time, and may be thought of as an expression for the amplitude of the particle wave, though this is strictly not physically meaningful. The square of the wave function is the significant quantity, as it gives the probability for finding the particle at a given point in space and time. See also wave-particle duality.

wave-particle duality Principle that subatomic particles possess some wavelike characteristics, and that electromagnetic waves, such as light, possess some particlelike characteristics. In 1905, by demonstrating the photoelectric effect, Albert Einstein showed that light, which until then had been thought of as a form of electromagnetic wave (see electromagnetic radiation), must also be thought of as localized in packets of discrete energy (see photon). In 1924 Louis-Victor Broglie proposed that electrons have wave properties such as wavelength and frequency; their wavelike nature was experimentally established in 1927 by the demonstration of their diffraction. The theory of quantum electrodynamics combines the wave theory and the particle theory of electromagnetic radiation.

waveguide Device that constrains the path of electromagnetic waves (see electromagnetic radiation). It can be used to transmit power or signals in the form of waves while minimizing power loss. Common examples are metallic tubes, coaxial cables, and optical fibres (see fibre optics). Waveguides transmit energy by propagating transmitted electromagnetic waves through the inside of a tube to a receiver at the other end. Metal waveguides are used in such technologies as microwave ovens, radar systems, radio relay systems, and radio telescopes.

wavelength Distance between corresponding points of two consecutive waves. "Corresponding points" refers to two points or particles that have completed identical fractions of their periodic motion. In transverse waves, wavelength is measured from crest to crest or from trough to trough. In longitudinal waves, it is measured from compression to compression or from rarefaction to rarefaction. Wavelength, λ, is equal to the speed v of a wave in a medium divided by its frequency f, or $\lambda = v/f$.

Wavell \'wā-vəl\ **(of Eritrea and of Winchester), Archibald Percival Wavell, 1st Earl** (b. May 5, 1883, Colchester, Essex, Eng.—d. May 24, 1950, London) British army officer. Recognized as an excellent trainer of troops, he became British commander in chief for the Middle East in 1939. In World War II he was noted for his defeat of the numerically superior Italian armies in North Africa (1940–41) but was unable to stop the German force under Erwin Rommel in the North Africa Campaign. As commander in chief of Southeast Asia (1941–43), he failed to stop the Japanese conquests of Malaya, Singapore, and Burma (1942). Promoted to field marshal, he served as viceroy of India (1943–47).

wax Any of a class of pliable substances, organic compounds of animal, plant, mineral, or synthetic origin, less greasy, harder, and more brittle than fats. Waxes contain mostly compounds of high molecular weight (fatty acids, alcohols, and saturated hydrocarbons). Many melt at moderate temperatures and form hard films that can take a high polish. Animal and plant waxes are esters of fatty acids and either a sterol (see steroid) or a straight-chain higher alcohol (e.g., cetyl alcohol). Animal waxes include beeswax; wool wax (lanolin), used in pharmaceuticals and cosmetics; and sperm oil and spermaceti (from sperm whales), used as lubricants. Plant waxes include carnauba wax, candelilla wax, and sugarcane wax, used in polishes. About 90% of the waxes in commerce are recovered by dewaxing petroleum. There are three main types: paraffin (used in candles, crayons, paper coating, and industrial polishes and as a protective sealant, lubricant, insulating agent, and antifrothing agent), microcrystalline wax (used in paper coating), and petrolatum (used in ointments and cosmetics). Synthetic waxes (carbowaxes), derived from ethylene glycol, are commonly blended with petroleum waxes.

wax sculpture Figures modeled or molded in beeswax, either as finished pieces or for use as forms for casting metal (see lost-wax casting) or creating preliminary models. At ordinary temperatures, beeswax can be cut and molded easily, it melts at a low temperature, it mixes with any

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colouring matter and takes surface tints well, and its texture can be modified by a variety of additives. The ancient Egyptians used wax figures of deities in their funeral rites, and the Romans used wax images as presents in the Saturnalia. MICHELANGELO used wax models in making preliminary sketches for his statues. Wax medallion portraits, popular in the 16th century, enjoyed renewed popularity in the 18th century. JOHN FLAXMAN made many wax portraits and relief figures which JOSIAH WEDGWOOD translated into pottery. Exhibitions of wax figures are still popular, the most famous being those of Madame TUSSAUD's museums in London and other international cities.

waxwing Any of three species (family Bombycillidae) of elegant-looking songbirds named for shiny red beads on the tips of the secondary wing feathers. All species are gray-brown and have a tapering crest. The common, or Bohemian, waxwing (*Bombycilla garrulus*) is 8 in. (20 cm) long and has yellow, white, and red wing markings. It breeds in northern forests of Eurasia and America. The cedar waxwing (*B. cedrorum*), smaller and less colourful, breeds in Canada and the northern U.S. Flocks of waxwings may invade city parks and gardens in winter, searching for berries. The Japanese waxwing (*B. japonica*) is restricted to northeastern Asia.

Wayne, Anthony (b. Jan. 1, 1745, near Paoli, Pa.—d. Dec. 15, 1796, Presque Isle, Pa., U.S.) American Revolutionary officer. He owned a tannery before he was commissioned a colonel in the Continental Army (1776). He aided the American retreat from Canada and was given command of Fort Ticonderoga (1776). Promoted to brigadier general (1777), he led troops in the battles of the Brandywine, Paoli, and Germantown. He led the successful storming of the British fort at Stony Point, N.Y. (1779), earning the nickname "Mad Anthony" for his boldness. He served in the Siege of YORKTOWN and later defeated the Indians allied with the British in Georgia. In 1792 Pres. GEORGE WASHINGTON sent Wayne to fight the Indians in the Ohio Territory, and he decisively ended Indian resistance at the Battle of FALLEN TIMBERS (1794).

Wayne, John *orig.* **Marion Michael Morrison** (b. May 26, 1907, Winterset, Iowa, U.S.—d. June 11, 1979, Los Angeles, Calif.) U.S. film actor. While a member of the University of Southern California football team, he worked summers at the Fox Film Corporation as a propman and developed a friendship with director JOHN FORD, who cast him in small parts from 1928. After his leading role in *The Big Trail* (1930), he played in more than 80 low-budget movies before winning acclaim for his starring role as the Ringo Kid in Ford's *Stagecoach* (1939). Noted for his image as the strong, silent man, Wayne, nicknamed "Duke," became one of the top box-office attractions in movie history. He starred in other westerns (many directed by Ford) such as *Red River* (1948), *She Wore a Yellow Ribbon* (1949), *Rio Grande* (1950), *The Searchers* (1956), *Rio Bravo* (1959), and *True Grit* (1969, Academy Award), as well as in *The Quiet Man* (1952), *The Alamo* (1960), which he also directed, *Hatari!* (1962), and *The Green Berets* (1968), which he codirected.

wazīr See VIZIER

WCTU See WOMAN'S CHRISTIAN TEMPERANCE UNION

weak force *or* **weak nuclear force** Fundamental interaction that underlies some forms of RADIOACTIVITY and certain interactions between SUBATOMIC PARTICLES. It acts on all elementary particles that have a SPIN of ½. The particles interact weakly by exchanging particles that have integer spins. These particles have masses about 100 times that of a PROTON, and it is this relative massiveness that makes the weak force appear weak at low energies. For example, in radioactive decay, the weak force has a strength about 1/100,000 that of the ELECTROMAGNETIC FORCE. However, it is now known that the weak force has intrinsically the same strength as the electromagnetic force, and the two are believed to be only different manifestations of a single electroweak force (see ELECTROWEAK THEORY).

weakfish *or* **sea trout** Any of several species (genus *Cynoscion*) in the DRUM family (Sciaenidae), carnivorous bottom-dwelling fishes along warm and tropical seashores. The name weakfish refers to their delicate mouth, which is easily torn by fishhooks. About six species inhabit North American coasts. The weakfish, or sea trout (*Cynoscion regalis*), is a sport fish but is usually less than 2 ft (60 cm) long. Weakfish are caught commercially along the Middle Atlantic coastal states and are considered the most economically important species in the family. The spotted sea trout (*C. nebulosus*) is found along Florida's Atlantic and Gulf coasts. Sea trouts resemble but are not related to true TROUTS.

weapon of mass destruction (WMD) Weapon with the capacity to inflict death and destruction indiscriminately and on a massive scale. The term has been in currency since at least 1937, when it was used to describe massed formations of bomber aircraft. Today WMDs are nuclear, biological, or chemical weapons—frequently referred to collectively as NBC weapons. Efforts to control the spread of WMDs are enshrined in international agreements such as the NUCLEAR NON-PROLIFERATION TREATY of 1968, the Biological Weapons Convention of 1972, and the Chemical Weapons Convention of 1993. See NUCLEAR WEAPON; CHEMICAL WARFARE; BIOLOGICAL WARFARE.

weapons system Any integrated system for the control and operation of a specific type of weaponry. Weapons are usually divided into two categories, strategic and tactical. Strategic weapons strike at the seat of an enemy's military, economic, and political power, targeting cities, factories, military bases, transportation and communications networks, and seats of government. Most NUCLEAR WEAPONS are part of strategic weapons systems. Tactical weapons are designed instead for offensive or defensive use at relatively short range—for example, GUIDED MISSILES intended as antiaircraft and antitank weapons, or other weapons used in aerial and naval combat.

weasel Any of several genera (CARNIVORE family Mustelidae) of voracious nocturnal predators found throughout the Americas, Africa, and Eurasia. Weasels have slender bodies and necks, small flat heads, short legs, clawed toes, dense short fur, and slim pointed tails. The size and relative length of the tail vary among species. Their total length is 7–20 in. (17–50 cm), and they may weigh 1–12 oz (30–350 g). The approximately 10 New World and Eurasian species of *Mustela* are reddish brown; in cold regions, their winter coat turns white, and the pelt, especially of the stoat (*M. erminea*), is called ERMINE. Weasels generally hunt alone, feeding on rodents, fish, frogs, and birds' eggs.

Long-tailed weasel (*Mustela longicauda*)
JOHN H. GERARD

weather State of the atmosphere at a particular place during a short period of time. It involves day-to-day changes in such atmospheric phenomena as temperature, humidity, precipitation (type and amount), air pressure, wind, and cloud cover. Most weather occurs in the TROPOSPHERE, but phenomena of the higher regions of the atmosphere, such as JET STREAMS, and geographic features, most notably mountains and large bodies of water, also affect it. See also CLIMATE.

weather forecasting Prediction of the weather through application of the principles of physics and METEOROLOGY. Weather forecasting predicts atmospheric phenomena and changes on the Earth's surface caused by atmospheric conditions (snow and ice cover, storm tides, floods, etc.). Scientific weather forecasting relies on empirical and statistical techniques, such as measurements of temperature, humidity, atmospheric pressure, wind speed and direction, and precipitation, and computer-controlled mathematical models.

weather modification Deliberate or inadvertent alteration of atmospheric conditions by human activity, sufficient to modify the weather on a local or regional scale. Deliberate alterations include covering plants to keep them warm at night, seeding clouds to induce or augment precipitation, and firing silver-iodide particles into clouds to suppress or mitigate hail and to reduce fog at airports. Inadvertent alterations are the result of industrialization and urbanization, which have added billions of tons of carbon dioxide and other gases to the atmosphere (see ACID RAIN, GLOBAL WARMING, GREENHOUSE EFFECT).

weathering Physical disintegration and chemical decomposition of rocks, minerals, and immature soils at or near the Earth's surface. Physical, chemical, and biological processes induced or modified by wind, water, and climate cause the changes. Weathering is distinguished from EROSION in that no transportation of material is involved. A broader application of erosion, however, includes weathering as a component. Weathering is also distinguished from METAMORPHISM, which usually takes place deep in the crust at much higher temperatures and elevated pressures.

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Weaver, James B(aird) (b. June 12, 1833, Dayton, Ohio, U.S.—d. Feb. 6, 1912, Des Moines, Iowa) U.S. politician. An advocate of the GREENBACK MOVEMENT, he was elected to the U.S. House of Representatives from Iowa (1879–81, 1885–89). He helped form the People's Party (see POPULIST MOVEMENT) and was its candidate for president in 1892, receiving more than 1 million popular votes and 22 electoral votes. After helping effect the party's merger with the Democratic Party, he retired to Iowa.

Weaver, John (b. July 21, 1673, Shrewsbury, Shropshire, Eng.—d. Sept. 24, 1760, Shrewsbury) English dancer and teacher, known as "the father of English pantomime." From 1700 to 1736 he performed and produced his dance dramas at the Drury Lane and Lincoln's Inn Fields theatres. His libretto for *The Loves of Mars and Venus* (1717) was the first published dance drama and displayed the integration of plot and dance that was later developed by JEAN-GEORGES NOVERRE and GASPARO ANGIOLINI as the *ballet d'action*.

Weaver, Warren (b. 1894, Reedsburg, Wisc., U.S.—d. 1978) U.S. mathematician. He studied at the University of Wisconsin, taught there (1920–32), and directed the Rockefeller Foundation's Natural Science Division (1932–55). He is considered the first person to propose using electronic computers for the translation of natural languages. In a 1949 memo, he proposed that statistical techniques from the field of information theory could be used to enable computers to translate text from one natural language to another automatically. His proposal was based on the assumption that a document in a human language can be viewed as having been written in code, which can be broken like other codes.

weaving Production of fabric by interlacing two sets of YARNS so that they cross each other, normally at right angles, usually accomplished with a hand- or power-operated LOOM. In weaving, lengthwise yarns are called warp and crosswise yarns are called weft, or filling. Most woven fabrics are made with their outer edges finished in a manner that avoids raveling (because the weft yarn turns around instead of ending in a cut end). These edges, called selvages, run lengthwise, parallel to the warp yarns. The three basic weaves are plain or tabby (weft threads go over one warp thread, then under one), TWILL, and SATIN. Fancy weaves, such as pile, Jacquard, dobby, and leno, require more complicated looms or special loom attachments. See also NAVAJO WEAVING.

Web See WORLD WIDE WEB

Web site Collection of files and related resources accessible through the WORLD WIDE WEB and organized under a particular DOMAIN NAME. Typical files found at a Web site are HTML documents with their associated graphic image files (GIF, JPEG, etc.), scripted programs (in PERL, CGI, JAVA, etc.), and similar resources. The site's files are usually accessed through HYPERTEXT or hyperlinks embedded in other files. A Web site may consist of a single HTML file, or it may comprise hundreds or thousands of related files. A Web site's usual starting point or opening page, called a home page, usually functions as a table of contents or index, with links to other sections of the site. Web sites are hosted on one or more Web SERVERS, which transfer files to client computers or other servers that request them using the HTTP protocol. Although the term "site" implies a single physical location, the files and resources of a Web site may actually be spread among several servers in different geographic locations. The particular file desired by a client is specified by a URL that is either typed into a BROWSER or accessed by selecting a hyperlink.

Webb, Sidney (James) and Beatrice *Beatrice Webb orig.* **Martha Beatrice Potter** (respectively b. July 13, 1859, London, Eng.—d. Oct. 13, 1947, Liphook, Hampshire; b. Jan. 22, 1858, Gloucester, Gloucestershire, Eng.—d. April 30, 1943, Liphook, Hampshire) English socialist economists. Sidney was a civil service clerk when GEORGE BERNARD SHAW induced him to join the FABIAN SOCIETY in 1885. He wrote the first Fabian tract, *Facts for Socialists* (1887), and took to lecturing on socialism. In 1891 he met Beatrice, author of *The Cooperative Movement in Great Britain* (1891), and they were married in 1892. Together they wrote the influential *The History of Trade Unionism* (1894) and *Industrial Democracy* (1897). As a member of the London County Council (1892–1910), Sidney effected extensive reforms in public education. The Webbs cofounded the London School of Economics and helped reorganize the University of London. As a member of the Poor Laws commission (1905–09), Beatrice wrote a report that anticipated the WELFARE STATE. In 1914 they joined the Labour Party, and Sidney wrote its influential policy statement, *Labour and the New Social Order* (1918). Sidney served in Parliament (1922–29) and as colonial secretary (1929–31), having been created Baron Passfield of Passfield Corner in 1929. Impressed by the Soviet Union after their trip in 1932, the Webbs wrote *Soviet Communism: A New Civilisation?* (1935), in which they seemed to abandon their belief in gradual social and political evolution.

Webber, Andrew Lloyd See Andrew LLOYD WEBBER

Weber \'vā-bər**, Carl Maria (Friedrich Ernst) von** (b. Nov. 18, 1786, Eutin, Holstein—d. June 5, 1826, London, Eng.) German composer. Son of a musician and a theatre manager, and first cousin to WOLFGANG AMADEUS MOZART's wife, he was born with a deformed hip and was never strong. He took composition lessons with Michael Haydn (1737–1806) and with Abbé Vogler (1749–1814), who recommended him for a post in Breslau (1804–06). His operas began to have success, and he took over direction of the Prague Opera (1813–16), which he saved from ruin, but finding little time for composition, he resigned. Showing signs of the tuberculosis that would kill him, he began to compose more prolifically. Appointed kapellmeister for life in Dresden, he began work on his masterpiece, the opera *The Freeshooter* (1821), the premiere of which made him an international star. The libretto for his next opera, *Euryanthe* (1823), was so clumsy that its admirable music never succeeded, and his final opera, *Oberon* (1826), composed for London, was a success there but not elsewhere.

Weber \'vā-bər**, Max** (b. April 21, 1864, Erfurt, Prussia—d. June 14, 1920, Munich, Ger.) German sociologist and political economist. Son of a wealthy liberal politician and a Calvinist mother, Weber was a compulsively diligent scholar who suffered occasional nervous collapses. Insights derived from his own experience inform his most famous and controversial work, *The Protestant Ethic and the Spirit of Capitalism* (1904–05), which examines the relationship between Calvinist (or Puritan) morality, compulsive labour, BUREAUCRACY, and economic success under CAPITALISM (see PROTESTANT ETHIC). Weber also wrote penetratingly on social phenomena such as charisma and mysticism, which he saw as antithetical to the modern world and its underlying process of rationalization. His efforts helped establish sociology as an academic discipline in Germany, and his work continues to stimulate scholarship. Through his insistence on the need for objectivity and his analysis of human action in terms of motivation, he profoundly influenced sociological theory. His voluminous writings, mostly published posthumously, include *Economy and Society* (2 vol., 1922–25) and *General Economic History* (1923).

Weber-Fechner law See WEBER'S LAW

Webern \'vā-bərn**, Anton (Friedrich Wilhelm von)** (b. Dec. 3, 1883, Vienna—d. Sept. 15, 1945, Mittersill, near Salzburg, Austria) Austrian composer. He learned piano and cello as a child and earned a doctorate in musicology at the University of Vienna, specializing in the music of the 15th-century Flemish composer HEINRICH ISAAC. In 1904 he and his friend ALBAN BERG began composition lessons with ARNOLD SCHOENBERG, and Webern was soon combining ATONALITY with complex COUNTERPOINT in the manner of Isaac, producing works distinctive for their extreme brevity and delicacy. While Schoenberg was developing the 12-tone method (see SERIALISM) of composition into the 1920s, Webern was independently moving in a similar direction. After Schoenberg presented the system in 1924, Webern adopted it, composing relatively extended pieces such as the *Symphony* (1928), *Concerto* (1934), and *Variations for Piano* (1936). He earned a living most of his life as a conductor. During Austria's occupation at the end of World War II, he was accidentally shot and killed by an American soldier. Though he was little appreciated during his lifetime, his works became highly influential internationally in the postwar decades.

Weber's law \'vā-bərz\ *or* **Weber-Fechner law** \'fe̱k-nər\ In PSYCHOPHYSICS, a historically important law quantifying the perception of change in a given stimulus. Originated by the German physiologist Ernst Heinrich Weber (1795–1878) in 1834 and elaborated by his student GUSTAV THEODOR FECHNER, the law states that the change in a stimulus that will be just noticeable is a constant ratio of the original stimulus. It was later shown not to hold for extremes of stimulation.

Webster, Ben(jamin Francis) (b. March 27, 1909, Kansas City, Mo., U.S.—d. Sept. 20, 1973, Amsterdam, Neth.) U.S. tenor saxophonist. Influenced by COLEMAN HAWKINS and JOHNNY HODGES, he played in several important SWING bands before joining that of DUKE ELLINGTON in 1940. After 1943 he worked mostly as the leader of small ensembles. He moved to Copenhagen, Den., in 1964. His sensual, breathy tone and wide vibrato were his trademarks, and he became one of the master interpreters of JAZZ ballads.

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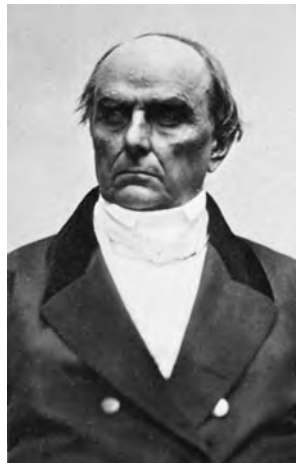
Webster, Daniel (b. Jan. 18, 1782, Salisbury, N.H., U.S.—d. Oct. 24, 1852, Marshfield, Mass.) U.S. lawyer and politician. He served in the U.S. House of Representatives (1813–17). After moving to Boston (1816), he built a prosperous law practice and represented Massachusetts in the House (1823–27). He argued several precedent-setting cases before the U.S. Supreme Court, including the Dartmouth College case, *McCulloch v. Maryland*, and *Gibbons v. Ogden*. Elected to the U.S. Senate (1827–41, 1845–50), he became famous as an orator for his speeches supporting the Union and opposing the nullification movement and its advocates, John C. Calhoun and Robert Y. Hayne. As U.S. secretary of state (1841–43, 1850–52) he negotiated the Webster-Ashburton Treaty to settle the Canada-Maine border dispute.



Daniel Webster, daguerreotype by A.S. Southworth and J.J. Hawes

COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, GIFT OF I.N. PHELPS STOKES, EDWARD S. HAWES, ALICE MARY HAWES, MARION AUGUSTA HAWES, 1937

Webster, John (b. c. 1580, London, Eng.—d. c. 1632) British playwright. Little is known of his life, but he may have been an actor who began writing plays later in his career. He collaborated with several leading dramatists, including Thomas Dekker. Webster is best remembered for the revenge tragedies *The White Devil* (1612) and *The Duchess of Malfi* (published 1623), both of which concern the murders and bloody deeds that arise out of family quarrels among the Italian nobility. They are often considered the greatest 17th-century English tragedies apart from those of William Shakespeare.

Webster, Lake See Lake Chargoggagoggmanchauggauggagoggchaubunagungamaugg

Webster, Noah (b. Oct. 16, 1758, West Hartford, Conn., U.S.—d. May 28, 1843, New Haven, Conn.) U.S. lexicographer and writer. He attended Yale University and then studied law. While working as a teacher in New York, he began his lifelong efforts to promote a distinctively American education. His first step was publishing *A Grammatical Institute of the English Language*, including *The American Spelling Book* (1783), the famed "Blue-Backed Speller" that went on to sell some 100 million copies. An ardent Federalist, he founded two pro-Federalist newspapers (1793) and wrote articles on politics and many other subjects. He produced his first dictionary in 1806; in 1807 he began work on his landmark *American Dictionary of the English Language* (1828; 2nd ed. 1840). Reflecting his principle that spelling, grammar, and usage should be based on the living, spoken language, it was instrumental in establishing the dignity and vitality of American English. In 1821 Webster cofounded Amherst College. The rights to the dictionary were purchased from his estate by George and Charles Merriam, whose firm developed the Merriam-Webster dictionary series.

Webster-Ashburton Treaty (1842) Treaty between the U.S. and Britain establishing the northeastern boundary of the U.S. Negotiated by U.S. secretary of state Daniel Webster and Britain's ambassador Lord Ashburton, it also provided for Anglo-U.S. cooperation in the suppression of the slave trade. It fixed the present boundary between Maine and New Brunswick, granted the U.S. navigation rights on the St. John River, provided for extradition in nonpolitical criminal cases, and established a joint naval system for suppressing the slave trade off the African coast.

Wedekind \'vā-də-ˌkint**, Frank** *orig.* **Benjamin Franklin Wedekind** (b. July 24, 1864, Hannover, Hanover—d. March 9, 1918, Munich, Ger.) German actor and playwright. He lived in Switzerland (1872–84) and then in Munich, where he worked at various jobs, including journalist and cabaret performer. He wrote plays from 1891, when his tragedy *The Awakening of Spring* created a scandal with its theme of awakening adolescent sexuality. In his "Lulu" cycle, *Earth Spirit* (1895) and *Pandora's Box* (1904), he extended the theme of sex to the underworld of society and introduced the amoral Lulu. His plays used episodic scenes, fragmented dialogue, distortion, and caricature, prefiguring the Theatre of the Absurd and forming a transition from realism to Expressionism.

Wedemeyer \'we-də-ˌmī-ər**, Albert C(oady)** (b. July 9, 1897, Omaha, Neb., U.S.—d. Dec. 17, 1989, Ft. Belvoir, Va.) U.S. army officer. He graduated from West Point and served in China, the Philippines, and Europe until World War II. As a staff officer in the war-plans division of the U.S. War Department (1941–43), he was the principal author of the 1941 Victory Program for U.S. entry into the war and helped plan strategies such as the Normandy Campaign. He became chief of staff to Gen. Chiang Kai-shek and commander of U.S. forces in China (1944–46). He retired in 1951 and was promoted to general in 1954.

wedge In mechanics, a device that tapers to a thin edge, usually made of metal or wood, and used for splitting, lifting, or tightening, such as to secure a hammer head onto its handle. The wedge is considered one of the five simple machines. Wedges have been used since prehistoric times to split logs and rocks; for rocks, wooden wedges, caused to swell by wetting, have been used. In terms of its mechanical function, the screw may be thought of as a wedge wrapped around a cylinder.

Wedgwood, Josiah (baptized July 12, 1730, Burslem, Staffordshire, Eng.—d. Jan. 3, 1795, Etruria, Staffordshire) British pottery designer and manufacturer. His family had been potters since the 17th century. After an apprenticeship with his elder brother, he formed a partnership with another potter and finally went into business for himself. He took a scientific approach to pottery-making and was so successful that the makers of even Meissen and Sèvres porcelain found their trade affected. His many innovations include development of a green glaze still popular today, the perfection of creamware, and the invention of the pyrometer. His daughter Susannah was the mother of Charles Darwin. See also Wedgwood ware; Wood family.

Wedgwood ware English stoneware made by Staffordshire factories originally established by Josiah Wedgwood. Creamware appealed to the middle class because of its high quality, durability, and affordability. Black basaltes (from 1768), unglazed stoneware of fine texture that was ideal for imitating antique and Renaissance objects, appealed to antiquarians. Also in the Neoclassical tradition was jasperware (from 1775), a white, matte, unglazed stoneware that could be stained. White ornaments were applied to the coloured body, achieving the look of an antique cameo. With the help of such artists as John Flaxman, Wedgwood copied many antique designs. Production of fine Wedgwood ware continues to the present day.

Wedgwood jasperware vase, Staffordshire, England, *c.* 1785; in the Victoria and Albert Museum, London

COURTESY OF THE VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPH, WILFRID WALTER—EB INC.

weed Any plant growing where it is not wanted. On land under cultivation, weeds compete with crops for water, light, and nutrients. On rangelands and in pastures, weeds are those plants that grazing animals dislike or that are poisonous. Many weeds are hosts of plant disease organisms or of insect pests. Some originally unwanted plants later were found to have virtues and came under cultivation, while some cultivated plants, when transplanted to new climates, escaped cultivation and became weeds in the new habitat.

Weed, Thurlow (b. Nov. 15, 1797, Cairo, N.Y., U.S.—d. Nov. 22, 1882, New York, N.Y.) U.S. journalist and politician. He worked on various newspapers in upstate New York and was a leader in the Anti-Masonic movement. He was the founding editor of the *Albany Evening Journal* (1830–63). He helped form the Whig Party in New York and was instru-

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mental in William Seward's election as governor (1838) and in the presidential election of William H. Harrison (1840). He later became active in the Republican Party and was a staunch supporter of Pres. Abraham Lincoln. In 1861 he was sent to England to seek support for the Union.

Weelkes \'wēlks**, Thomas** (baptized Oct. 25, 1576, Elsted, Sussex?, Eng.—d. Nov. 30, 1623, London) British composer and organist. He published his first book of madrigals in 1597 and was appointed organist at Winchester College the following year. His next two books of madrigals, his greatest, were soon published (1598, 1600), and a final volume was published in 1608. Weelkes is noted for his word painting, lively rhythms, and highly developed sense of form and structure.

weevil *or* **snout beetle** Any of about 40,000 beetle species in the largest family of beetles, Curculionidae, which is also the largest family in the animal kingdom. Most weevils have long, elbowed antennae that may fold into special grooves on the prominent snout. Many species are wingless. Most species are less than 0.25 in. (6 mm) long, are plainly coloured and marked, and feed exclusively on plants. Some species are more than 3 in. (80 mm) long. The larvae may feed on only a certain part of a plant or a single plant species; adults are less specialized. The family includes many destructive pests, including the boll weevil.

Wegener \'vā-gə-nər**, Alfred (Lothar)** (b. Nov. 1, 1880, Berlin, Ger.—d. Nov. 1930, Greenland) German meteorologist and geophysicist. After earning a Ph.D. in astronomy (1905), he became interested in paleoclimatology and traveled to Greenland to research polar air circulation. He formulated the first complete statement of the continental drift hypothesis, which he presented in *The Origin of Continents and Oceans* (1915). His theory won some adherents, but by 1930 most geologists had rejected it because of the implausibility of his postulations for the driving force behind the continents' movement. It was resurrected in the 1960s as part of the theory of plate tectonics. Wegener died during his fourth expedition to Greenland.

Wei Chung-hsien See Wei Zhongxian

Wei \'wā\ **River** River, north-central China. It rises in the mountains of southeastern Gansu province and flows east through Shaanxi province to join the Huang He (Yellow River). It is 537 mi (864 km) long. Its valley was the earliest centre of Chinese civilization and until the 10th century AD was the site of a succession of capital cities. In the 3rd century BC the area around the junction of the Ching and Wei rivers was the site of the first ambitious irrigation works in China.

Wei Zhongxian *or* **Wei Chung-hsien** \'wā-'jůŋ-shē-'ən\ (b. 1568, Suning, Heibei province, China—d. 1627, Anhui province) Eunuch who dominated the Chinese government in 1624–27. As a close companion to the nurse of the future Tianqi emperor (r. 1620–27), Wei captured the young prince's trust. Once on the throne, the weak and indecisive emperor let Wei become the actual ruler. Wei levied crushing taxes on the provinces, ruthlessly exploited the population, hounded his enemies, terrorized the official class, and filled the government with sycophants and opportunists. He fell from power when the emperor died and hanged himself to avoid trial. He is considered the most powerful eunuch in Chinese history.

Weidman \'wīd-mən**, Charles** *orig.* **Charles Edward Weidman, Jr.** (b. July 22, 1901, Lincoln, Neb., U.S.—d. July 15, 1975, New York, N.Y.) U.S. modern dancer, teacher, and choreographer. He studied at the Denishawn school and was a member of its company in the 1920s. In 1928 he cofounded with Doris Humphrey the Humphrey-Weidman school and dance company, for which he choreographed many works. His dances, often comic and satiric, employed an abstract, rhythmic pantomime. In 1945 he established his own school, and in 1948 he founded the Theatre Dance Company, for which he choreographed his major work, *Fables for Our Time*. He continued to teach, choreograph, and dance into the 1970s.

Weierstrass \'vī-ər-ˌshträs**, Karl (Theodor Wilhelm)** (b. Oct. 31, 1815, Ostenfelde, Bavaria—d. Feb. 19, 1897, Berlin) German mathematician. He taught principally at the University of Berlin (from 1856). After many years of working in isolation, an article in 1854 initiated a string of important contributions, which he disseminated mainly through lectures. He is known for his work on the theory of functions, and he is called the father of modern analysis. His greatest influence was felt through his students, many of whom went on to make important contributions to mathematics.

weight Gravitational force of attraction on an object, caused by the presence of a massive second object, such as the Earth or Moon. It is a consequence of Isaac Newton's universal law of gravitation, which states that the force of attraction between two objects is proportional to the product of their masses and inversely proportional to the square of the distance between them. For this reason, objects of greater mass weigh more on the surface of the Earth. On the other hand, an object's weight on the Moon is about one-sixth of its weight on Earth, even though its mass remains the same, because the Moon has less mass and a smaller radius than the Earth and therefore exerts less gravitational force. Weight W is the product of an object's mass m and the acceleration of gravity g at the location of the object, or $W = mg$. Since weight is a measure of force rather than mass, the units of weight in the International System of Units are newtons (N). In common usage, weight is measured by the gram in the metric system and by the ounce and pound in the U.S. and British systems.

weight lifting Sport in which barbells are lifted competitively or as an exercise. The two main events are (1) the snatch, in which the barbell is lifted from the floor to arm's length overhead in a single, continuous motion; and (2) the clean and jerk, in which it is lifted first to the shoulders and then, after a pause, to arm's length overhead. Contestants are divided into 10 body-weight categories ranging from flyweight to superheavyweight. Lifts may range to over 1,000 lbs (455 kg) in the heavyweight divisions. The origins of modern competition are to be found in 18th- and 19th-century strongman contests. The first three Olympic Games (1896, 1900, 1904) included weight lifting, as have all games after 1920.

weight training System of conditioning involving lifting weights, especially for strength and endurance. It may include the use of barbells and dumbbells, a Nautilus or similar machines, or a combination of these. Athletes use it to improve their performance, nonathletes use it for general conditioning or bodybuilding, and those recovering from an injury may use it as part of an overall rehabilitation program.

weights and measures Standard quantities by which comparisons are made between an object to be measured and a known quantity of the same kind (see measurement). Weights and measures are fundamental to the sciences, to engineering, building, and other technical matters, and to much everyday activity. See also foot; gram; International System of Units; metre; metric system; pound. See table on following page.

Weil \'vey**, Simone** (b. Feb. 3, 1909, Paris, France—d. Aug. 24, 1943, Ashford, Kent, Eng.) French mystic and social philosopher. After graduating from the École Normale Supérieure, she taught philosophy in several girls' schools from 1931 to 1938. To learn the psychological effects of heavy industrial labour, she took a job in 1934–35 in an auto factory, where she observed the spiritually deadening effect of machines on her fellow workers. She assisted the anti-Franco forces in the Spanish Civil War and aided the French Resistance from London from 1942. Born Jewish, she converted to Roman Catholicism in the 1940s. She died at age 34 of tuberculosis complicated by self-imposed starvation undertaken out of sympathy for those suffering in occupied France. Her posthumously published works, including *Gravity and Grace* (1947), *The Need for Roots* (1949), *Waiting for God* (1950), and *Notebooks* (3 vol., 1951–56) explore her own religious life and analyze the individual's relation to the state and to God, the spiritual shortcomings of modern industrial society, and the horrors of totalitarianism.

Weill \'vīl**, Kurt (Julian)** (b. March 2, 1900, Dessau, Ger.—d. April 3, 1950, New York, N.Y., U.S.) German-born U.S. composer. Son of a cantor, by age 15 he was working as a theatre accompanist. He studied composition briefly with Engelbert Humperdinck, and a conductor's post gave him wide experience. For a master class with Ferruccio Busoni (1920), he wrote his first symphony. He gained attention with his one-act opera *Der Protagonist* (1925); its sparse and spiky style prefigured that of his greatest works. In 1927 he teamed with Bertolt Brecht to write *The Threepenny Opera* (1928) in a new "cabaret" style; the musical had enormous success in Berlin and elsewhere. In 1930 the two produced *The Rise and Fall of the City of Mahagonny*. When the Nazis took power in 1933, he fled to Paris with his wife, Lotte Lenya, where he wrote *The Seven Deadly Sins* (1933). In 1935 the couple immigrated to the U.S.; there he collaborated on musicals such as *Knickerbocker Holiday* (1938) and *Lost in the Stars* (1949). Two of his songs, the "Moritat" ("Mack the Knife") from *Threepenny Opera* and "September Song" from *Knickerbocker Holiday*, have remained especially popular.

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Weights and Measurements[1] (British Imperial System/U.S. Customary System)

UNIT	ABBREVIATION OR SYMBOL	EQUIVALENTS IN OTHER UNITS OF SAME SYSTEM	METRIC EQUIVALENT
WEIGHT			
Avoirdupois[2]			
ton			
short ton		20 short hundredweight, 2000 pounds	0.907 metric ton
long ton		20 long hundredweight, 2240 pounds	1.016 metric ton
hundredweight	cwt		
short hundredweight		100 pounds, 0.05 short tons	45.359 kilograms
long hundredweight		112 pounds, 0.05 long ton	50.802 kilograms
pound	lb *or* lb avdp *also* #	16 ounces, 7000 grains	0.454 kilogram
ounce	oz *or* oz avdp	16 drams, 437.5 grains, 0.0625 pound	28.350 grams
dram	dr *or* dr avdp	27.344 grains, 0.0625 ounce	1.772 grams
grain	gr	0.037 dram, 0.002286 ounce	0.0648 gram
Troy			
pound	lb t	12 ounces, 240 pennyweight, 5760 grains	0.373 kilogram
ounce	oz t	20 pennyweight, 480 grains, 0.083 pound	31.103 grams
pennyweight	dwt *also* pwt	24 grains, 0.05 ounce	1.555 grams
grain	gr	0.042 pennyweight, 0.002083 ounce	0.0648 gram
Apothecaries'			
pound	lb ap	12 ounces, 5760 grains	0.373 kilogram
ounce	oz ap	8 drams, 480 grains, 0.083 pound	31.103 grams
dram	dr ap	3 scruples, 60 grains	3.888 grams
scruple	s ap	20 grains, 0.333 dram	1.296 grams
grain	gr	0.05 scruple, 0.002083 ounce, 0.0166 dram	0.0648 gram
CAPACITY			
U.S. liquid measure			
gallon	gal	4 quarts (231 cubic inches)	3.785 liters
quart	qt	2 pints (57.75 cubic inches)	0.946 liter
pint	pt	4 gills (28.875 cubic inches	473.176 milliliters
gill	gi	4 fluid ounces (7.219 cubic inches)	118.294 milliliters
fluid ounce	fl oz	8 fluid drams (1.805) cubic inches)	29.573 milliliters
fluid dram	fl dr	60 minims (0.226 cubic inch)	3.697 milliliters
minim	min	1/60 fluid dram (0.003760 cubic inch)	0.061610 milliliter
U.S. dry measure			
bushel	bu	4 pecks (2150.42 cubic inches)	35.239 liters
peck	pk	8 quarts (537.605 cubic inches)	8.810 liters
quart	qt	2 pints (67.201 cubic inches)	1.101 liters
pint	pt	1/2 quart (33.600 cubic inches)	0.551 liter
British imperial liquid and dry measure			
bushel	bu	4 pecks (2219.36 cubic inches)	36.369 liters
peck	pk	2 gallons (554.84 cubic inches)	9.092 liters
gallon	gal	4 quarts (277.420 cubic inches)	4.546 liters
quart	qt	2 pints (69.355 cubic inches)	1.136 liters
pint	pt	4 gills (34.678 cubic inches)	568.26 milliliters
gill	gi	5 fluid ounces (8.669 cubic inches)	142.066 milliliters
fluid ounce	fl oz	8 fluid drams (1.7339 cubic inches)	28.412 milliliters
fluid dram	fl dr	60 minims (0.216734 cubic inch)	3.5516 milliliters
minim	min	1/60 fluid dram (0.003612 cubic inch)	0.059194 milliliter
LENGTH			
mile	mi	5280 feet, 1760 yards, 320 rods	1.609 kilometers
rod	rd	5.50 yards, 16.5 feet	5.029 meters
yard	yd	3 feet, 36 inches	0.9144 meter
foot	ft *or* ′	12 inches, 0.333 yard	30.48 centimeters
inch	in *or* ″	0.083 foot, 0.028 yard	2.54 centimeters
AREA			
square mile	sq mi *or* mi^2	640 acres, 102,400 square rods	2.590 square kilometers
acre		4840 square yards, 43,560 square feet	0.405 hectare, 4047 square meters
square rod	sq rd *or* rd^2	30.35 square yards, 0.00625 acre	25.293 square meters
square yard	sq yd *or* yd^2	1296 square inches, 9 square feet	0.836 square meter
square foot	sq ft *or* ft^2	144 square inches, 0.111 square yard	0.093 square meter
square inch	sq in *or* in^2	0.0069 square foot, 0.00077 square yard	6.452 square centimeters
VOLUME			
cubic yard	cu yd *or* yd^3	27 cubic feet, 46,656 cubic inches	0.765 cubic meter
cubic foot	cu ft *or* ft^3	1728 cubic inches, 0.0370 cubic yard	0.028 cubic meter
cubic inch	cu in *or* in^3	0.00058 cubic foot, 0.000021 cubic yard	16.387 cubic centimeters

[1]For U.S. equivalents of the metric unit see Metric System table. [2]The U.S. uses the avoirdupois units as a common system of measuring weight.

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Weimar Republic \'vī-ˌmär\ Government of Germany 1919–33, so named because the assembly that adopted its constitution met at Weimar in 1919. In its early years, the Weimar Republic was troubled by postwar economic and financial problems and political instability, but it had recovered considerably by the late 1920s. Its major political leaders included presidents Friedrich Ebert (1919–25) and Paul von Hindenburg (1925–34), as well as Gustav Stresemann, who was chancellor (1923) and foreign minister (1923–29). With the Great Depression, its political and economic collapse enabled Adolf Hitler to rise to power and become chancellor (1933), after which he suspended the Weimar constitution.

weimaraner \ˌvī-mə-'rä-nər, 'wī-mə-ˌrä-nər\ Dog breed developed in the early 19th century by German nobles of the court of Weimar. First used to hunt big game, the breed was later used as a bird dog and retriever. A graceful dog, it has hanging ears; blue, gray, or amber eyes; and a short, sleek, mouse- or silver-gray coat. It stands 23–27 in. (58–69 cm) and weighs 70–85 lbs (32–39 kg). It is characterized by an alert, well-balanced stance and is valued as an aggressive hunter and a good companion and watchdog.

Weingartner \'vīn-gärt-nər**, (Paul) Felix, lord von Münzberg** (b. June 2, 1863, Zara, Dalmatia, Austrian Empire—d. May 7, 1942, Winterthur, Switz.) Austrian conductor and composer. After studies in Leipzig, he came to the attention of Franz Liszt, who arranged the premiere of Weingartner's first opera at Weimar (1884). He held conducting posts at Danzig, Hamburg, and Mannheim, and he became conductor of the Berlin Opera in 1891. He succeeded Gustav Mahler as conductor of the Vienna Opera (1908–11) and stayed on with the Vienna Philharmonic until 1927. He also directed the Basel Conservatory (1927–33) and was a distinguished writer on music.

Weiser \'vī-zər**, Johann Conrad** (b. Nov. 2, 1696, near Herrenberg, Württemberg—d. July 13, 1760, Womelsdorf, Pa.) North American colonial Indian agent. He immigrated to New York in 1710 and lived briefly among the Iroquois before becoming a farmer and an Indian interpreter. In 1729 he moved to Pennsylvania, where he worked with the colony's Indian agent. He arranged agreements between Iroquois tribes and colonial governments that helped form a British-Indian alliance against the French.

Weisgall, Hugo (David) (b. Oct. 13, 1912, Eibenschutz, Moravia—d. March 11, 1997, Manhasset, N.Y., U.S.) Czech-born U.S. composer. Born into a musical family that had produced several generations of composers and cantors, he was raised in Baltimore, Md., U.S., from 1920. He studied composition with Roger Sessions and conducting with Fritz Reiner, also earning a doctorate in German literature from Johns Hopkins University. He is considered one of the most important U.S. opera composers for the literary quality of his chosen texts and the individuality and effectiveness of his music; his works include the operas *The Tenor* (1950), *The Stronger* (1952), and *Six Characters in Search of an Author* (1956); his last completed opera, *Esther* (1993), won wide acclaim.

Weiss \'vīs**, Peter (Ulrich)** (b. Nov. 8, 1916, Nowawes, near Potsdam, Ger.—d. May 10, 1982, Stockholm, Swed.) German playwright. After fleeing Germany in 1934, his family settled in Sweden. Weiss painted and made avant-garde films in the 1950s, then turned to fiction and drama, establishing a reputation in Germany with his novel *Exile* (1962). He won international acclaim for his play *The Persecution and Assassination of Jean-Paul Marat as Performed by the Inmates of the Asylum of Charenton Under the Direction of the Marquis de Sade* (1964; usually referred to as *Marat/Sade*), which addressed themes of individualism, revolution, and violence. Associated with the Theatre of Fact movement, he also wrote the documentary dramas *The Investigation* (1965), *The Song of the Lusitanian Bogey* (1967), and *Discourse on Vietnam* (1968).

Weissmuller \'wīs-ˌməl-ər**, Johnny** *in full* **Peter John Weissmuller** (b. June 2, 1904, Freidorf, near Timişoara, Rom.—d. Jan. 20, 1984, Acapulco, Mex.) U.S. freestyle swimmer and actor. He was reared in Chicago, where he attended the University of Chicago and developed into a champion swimmer. He won five Olympic gold medals (three in 1924, two in 1928) and set 67 world records. He later became even more famous as an actor, starring as Tarzan of the Apes in 12 films (1932–48) and later creating the role of the comic-book character Jungle Jim for film and television.

Weizmann \'vīts-män**, Chaim (Azriel)** (b. Nov. 27, 1874, Motol, Pol., Russian Empire—d. Nov. 9, 1952, Reḥovot, Israel) Russian-born Israeli chemist and first president of Israel (1949–52). After studying in Germany and Switzerland, he earned a doctorate in chemistry and patented several dyestuffs before moving to England to teach in 1904. His 1912 discovery of a bacterium that could convert carbohydrate to acetone proved of great value to the British armaments industry in World War I (1914–18), and in return the government aided his negotiations for the Balfour Declaration (1917). In 1919 he obtained an agreement on Jewish-Arab coexistence in Palestine from Fayṣal I, and in 1920 he became president of the World Zionist Organization, a post from which he was ousted in 1931. He settled in Reḥovot, Palestine, in 1937. Despite conflicts with more extreme Zionists, he was sent to the U.S. to secure support for Israel in 1948, and in 1949 he was elected president.

Welch, William Henry (b. April 8, 1850, Norfolk, Conn., U.S.—d. April 30, 1934, Baltimore, Md.) U.S. pathologist. He studied pathology in Germany before returning to the U.S. to open the nation's first pathology laboratory, at Bellevue Hospital Medical College in New York City (1879). From 1893 he directed the rise of Johns Hopkins University, where he developed the country's first true university department of pathology. He recruited William Osler and William S. Halsted for the faculty and was the medical school's first dean (1893–98). His curriculum revolutionized U.S. medicine by demanding that students study physical sciences and be actively involved in clinical duties and laboratory work. Welch also demonstrated the effects of diphtheria toxin and discovered bacteria involved in wound fever and gas gangrene.

Weld, Theodore Dwight (b. Nov. 23, 1803, Hampton, Conn., U.S.—d. Feb. 3, 1895, Hyde Park, Mass.) U.S. reformer. He left divinity studies to become an agent for the American Anti-Slavery Society (1834). His pamphlets *The Bible Against Slavery* (1837) and *Slavery as It Is* (1839) helped convert figures such as James Birney, Henry Ward Beecher, and Harriet Beecher Stowe to the antislavery cause. He married his coworker Angelina Grimké (1838), and they directed schools and taught in New Jersey and Massachusetts. In 1841–43 Weld organized an antislavery reference bureau in Washington, D.C., to assist congressmen seeking to repeal the gag rule restricting the consideration of antislavery petitions in Congress.

welding Technique for joining metallic parts, usually through the application of heat. Discovered in the 1st millennium AD during attempts to manipulate iron into useful shapes, the technique produced a strong, tough blade. Welding traditionally involved interlayering relatively soft and tough iron with high-carbon material, followed by hammer forging. Modern welding processes include gas welding, arc welding, and resistance welding. More recently, electron-beam welding, laser welding, and several solid-phase processes such as diffusion bonding, friction welding, and ultrasonic joining have been developed. See also brazing, soldering.

Welensky, Sir Roy (b. Jan. 20, 1907, Salisbury, Southern Rhodesia—d. Dec. 5, 1991, Blandford Forum, Dorset, Eng.) Rhodesian politician. He worked on the railways as a youth, later becoming head of the Railway Workers Union. He held the heavyweight boxing title for Rhodesia, 1925–27. He began his political career with election to Northern Rhodesia's legislature in 1938. A strong supporter of the Federation of Rhodesia and Nyasaland (now Zambia, Zimbabwe, and Malawi), he was elected to its first parliament, became prime minister in 1956, and served until the federation broke up in 1963.

Welf dynasty \'velf\ Dynasty of German nobles and rulers. They descended from Count Welf of Bavaria (early 9th century), whose daughters married Louis I the Pious and Louis the German. The Welfs were linked to the House of Este in the 11th century. They supported the papal party against Emperor Henry IV and were rivals of the Hohenstaufens in central Europe and in Italy (where their name was Guelpho; see Guelphs and Ghibellines). As part of the House of Hanover, they became rulers of Britain.

welfare *or* **social welfare** Any of a variety of governmental programs that provide assistance to those in need. Programs include pensions, disability and unemployment insurance, family allowances, survivor benefits, and national health insurance. The earliest modern welfare laws were enacted in Germany in the 1880s (see social insurance), and by the 1920s and '30s most Western countries had adopted similar programs. Most industrialized countries require firms to insure workers for disability (see workers' compensation) so that they have income if they are injured, whether temporarily or permanently. For disability from illness unrelated to occupational injury, most industrial states pay a short-term benefit followed by a long-term pension. Many countries pay a family allowance to reduce the poverty of large families or to increase the birth rate. Survivor

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benefits, provided for widows below pension age who are left with a dependent child, vary considerably among nations and generally cease if the woman remarries. Among the world's wealthy countries, only the U.S. fails to provide national health insurance other than for the aged and the poor (see MEDICARE AND MEDICAID).

welfare economics Branch of economics established in the 20th century that seeks to evaluate economic policies in terms of their effects on the community's well-being. Early theorists defined WELFARE as the sum of the satisfactions accruing to an individual through an economic system. Believing it was possible to compare the well-being of two or more individuals, they argued that a poor person would derive more satisfaction from an increase in income than would a rich person. Later writers argued that making such comparisons with any precision was impossible. A new and more limited criterion was later developed: one economic situation was deemed superior to another if at least one person had been made better off without anyone else being made worse off. See also CONSUMER'S SURPLUS; VILFREDO PARETO.

Welfare Island See ROOSEVELT ISLAND

Welfare Party See REFAH PARTY

welfare state Concept of government in which the state plays a key role in protecting and promoting the economic and social well-being of its citizens. It is based on the principles of equality of opportunity, equitable distribution of wealth, and public responsibility for those who lack the minimal provisions for a good life. The term may be applied to a variety of forms of economic and social organization. A basic feature of the welfare state is SOCIAL INSURANCE, intended to provide benefits during periods of greatest need (e.g., old age, illness, UNEMPLOYMENT). The welfare state also usually includes public provision of education, health services, and housing. Such provisions are less extensive in the U.S. than in many European countries, where comprehensive health coverage and state-subsidized university-level education have been common. In countries with centrally planned economies, the welfare state also covers employment and administration of consumer prices. Most nations have instituted at least some of the measures associated with the welfare state; Britain adopted comprehensive social insurance in 1948, and in the U.S., social-legislation programs such as the NEW DEAL and the Fair Deal were based on welfare-state principles. Scandinavian countries provide state aid for the individual in almost all phases of life.

Welk, Lawrence (b. March 11, 1903, Strasburg, N.D., U.S.—d. May 17, 1992, Santa Monica, Calif.) U.S. bandleader and television performer. Born in a German-speaking village in North Dakota, he did not learn English until he was 21. He played the accordion and formed two musical groups that opened for bands and orchestras in the Midwest. Welk moved to Los Angeles, where his television program *The Lawrence Welk Show* (1955–71), which featured band music with vocalists, dancers, and instrumental soloists, became a huge success. The show was dropped by the network, but Welk continued it as *Memories with Lawrence Welk* (1971–82) after he was able to sign contracts with more than 250 independent television stations in the U.S. and Canada. Known for his unpretentious warmth and his trademark phrase "Wunnerful, wunnerful," he played light, nostalgic "champagne music" and featured smiling performers such as the Lennon Sisters.

well-field system Communal land organization supposedly in effect early in the ZHOU DYNASTY (1046–256 BC). It is mentioned in the writings of MENCIUS, who advocated it. In the well-field system, one unit of land was divided among eight peasant families. A shared field was surrounded by eight fields, each worked by an individual family. The field in the centre was worked jointly by the families for their lord. Later reformers referred to the concept to justify their land-redistribution systems or to criticize government land practices.

well-made play *French* **pièce bien faite** Play constructed according to strict technical principles that produce neatness of plot and theatrical effectiveness. The form was developed c. 1825 by EUGÈNE SCRIBE and became dominant on 19th-century European and U.S. stages. It called for complex, artificial plotting, a buildup of suspense, a climactic scene in which all problems are resolved, and a happy ending. Scribe's hundreds of successful plays were imitated all over Europe; other practitioners of the form included playwrights VICTORIEN SARDOU, GEORGES FEYDEAU, and ARTHUR WING PINERO, who brought the form to the level of art with *The Second Mrs. Tanqueray* (1893).

Weller, Thomas H(uckle) (b. June 15, 1915, Ann Arbor, Mich., U.S.) U.S. physician and virologist. He studied at Harvard Medical School. For culturing poliomyelitis virus, which led to the development of polio vaccines, he shared a 1954 Nobel Prize with John Enders (1879–1985) and Frederick Robbins (b. 1916). He was the first (with Franklin Neva) to culture rubella virus and to isolate chickenpox virus from human cell cultures. He served as director of Harvard University's Center for the Prevention of Infectious Diseases (1966–81).

Welles \'welz**, Gideon** (b. July 1, 1802, Glastonbury, Conn., U.S.—d. Feb. 11, 1878, Hartford, Conn.) U.S. politician. Cofounder and editor the *Hartford Times* (1826–36), he founded one of the first Republican Party newspapers in New England, the *Hartford Evening Press* (1856). In 1861 he was appointed secretary of the navy by Pres. ABRAHAM LINCOLN, and in the American Civil War he built a large Union navy from a few ships, supported development of the IRONCLADS, and helped form the strategic naval blockade. His *Diary of Gideon Welles* (published 1911) contains valuable insights into the Civil War.

Welles, (George) Orson (b. May 6, 1915, Kenosha, Wis., U.S.—d. Oct. 10, 1985, Los Angeles, Calif.) U.S. film director, actor, and producer. He began acting on stage at 16 and made his Broadway debut in 1934. He directed an all-African American cast in *Macbeth* for the Federal Theatre Project. In 1937 he and JOHN HOUSEMAN formed the Mercury Theatre, creating a series of radio dramas, attempting to mount MARC BLITZSTEIN's *The Cradle Will Rock* in the face of determined opposition, and winning notoriety with their panic-producing broadcast of *War of the Worlds* (1938). Welles then moved to Hollywood, where he cowrote, directed, produced, and acted in the classic *Citizen Kane* (1941), noted for its innovative narrative technique and atmospheric cinematography and considered among the most influential movies in film history. His other films include *The Magnificent Ambersons* (1942), *The Stranger* (1946), *The Lady from Shanghai* (1948), *Touch of Evil* (1958), and *Chimes at Midnight* (1966). His problems with Hollywood studios curtailed future productions, and he moved to Europe. He was also notable as an actor in *Jane Eyre* (1944), *The Third Man* (1949), and *Compulsion* (1959).

Wellesley (of Norragh), Richard Colley Wellesley, Marquess (b. June 20, 1760, Dangan, County Meath, Ire.—d. Sept. 26, 1842, London, Eng.) British statesman. He inherited his father's Irish title as earl of Mornington and sat in the Irish House of Lords from 1781. He served in the British House of Commons (1784–97). As governor of Madras and governor general of Bengal (1797–1805), he used military force and annexation to greatly enlarge the British Empire in India, but he was recalled by the East India Co. for his vast expenditures. In 1809 he went to Spain to make diplomatic preparations for the Peninsular War; he served as foreign secretary (1809–12). As lord lieutenant of Ireland (1821–28, 1833–34) he tried to reconcile Protestants and Catholics. Despite his own achievements, he became increasingly jealous of his younger brother, the duke of WELLINGTON.

Wellesley College Private women's college in Wellesley, Mass., chartered in 1870. Long one of the most eminent women's colleges in the U.S., it was the first to provide scientific laboratories. It grants bachelor's degrees in humanities, including Chinese, Japanese, and Russian languages; in social science, including African studies, religion, and economics; and in science and mathematics, including computer science. Among its facilities are an advanced science centre and an observatory.

Wellington City (pop., 2001 prelim.: 165,945), port, and capital of New Zealand. It is located at the southern shore of the NORTH ISLAND, on Port Nicholson. Founded in 1840, it became a municipality in 1853. In 1865 the capital was transferred there from AUCKLAND. It is the financial, commercial, and transportation centre of New Zealand. Wellington produces transportation equipment, machinery, metal products, textiles, and printed materials. It is the site of the major government buildings and the headquarters of many cultural, scientific, and agricultural organizations.

Wellington, Arthur Wellesley, 1st duke of (b. May 1, 1769, Dublin, Ire.—d. Sept. 14, 1852, Walmer Castle, Kent, Eng.) British general. Son of the Irish earl of Mornington, he entered the army in 1787 and served in the Irish Parliament (1790–97). Sent to India in 1796, he commanded troops to victories in the Maratha War (1803). Back in England, he served in the British House of Commons and as chief secretary in Ireland (1807–09). Commanding British troops in the PENINSULAR WAR, he won battles against the French in Portugal and Spain and invaded France to win the war in 1814, for which he was promoted to field marshal and

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created a duke. After Napoleon renewed the war against the European powers, the "Iron Duke" commanded the Allied armies to victory at the Battle of Waterloo (1815). Richly rewarded by English and foreign sovereigns, he became one of the most honoured men in Europe. After commanding the army of occupation in France (1815–18) and serving in the Tory cabinet as master general of ordnance (1818–27), he served as prime minister (1828–30), but he was forced to resign after opposing any parliamentary reform. He was honoured on his death by a monumental funeral and burial in St. Paul's Cathedral alongside Horatio Nelson.

Wellman, William (Augustus) (b. Feb. 29, 1896, Brookline, Mass, U.S.—d. Dec. 9, 1975, Los Angeles, Calif.) U.S. film director. He was a flying ace in World War I and later a barnstorming stunt pilot. He acted in *Knickerbocker Buckeroo* (1919) with Douglas Fairbanks before turning to directing. Known as "Wild Bill," he made the aerial dogfight classic *Wings* (1929, Academy Award), setting standards for documentary realism, and he launched a gangster movie trend with *Public Enemy* (1931), starring James Cagney. *The Ox-Bow Incident* (1942), considered one of his best films, examined frontier justice in the American West. In *Track of the Cat* (1954), Wellman experimented with the minimal use of colour. His other films include *A Star Is Born* (1937), *Nothing Sacred* (1937), *Beau Geste* (1939), *The Story of GI Joe* (1945), and *The High and the Mighty* (1954).

Wells, H(erbert) G(eorge) (b. Sept. 21, 1866, Bromley, Kent, Eng.—d. Aug. 13, 1946, London) English novelist, journalist, sociologist, and historian. While studying science under T.H. Huxley in London, Wells formulated a romantic conception of the subject that would inspire the inventive and influential science-fiction and fantasy novels for which he is best known, including the epochal *The Time Machine* (1895), *The Invisible Man* (1897), and *The War of the Worlds* (1898). He simultaneously took on a public role as an agitator for progressive causes, including the League of Nations. He later abandoned science fiction and drew on memories of his lower-middle-class early life in works including the novel *Tono-Bungay* (1908) and the comic *The History of Mr. Polly* (1910). He had a 10-year affair with the young Rebecca West. World War I shook his faith in human progress, prompting him to promote popular education through nonfiction works including *The Outline of History* (1920). *The Shape of Things to Come* (1933) was an antifascist warning. Though a sense of humour reappears in *Experiment in Autobiography* (1934), most of his late works reveal a pessimistic, even bitter outlook.

Wells, Ida B(ell) *or* **Ida Bell Wells-Barnett** (b. July 16, 1862, Holly Springs, Miss., U.S.—d. March 25, 1931, Chicago, Ill.) U.S. journalist and antilynching crusader. The daughter of slaves, she was educated at a freedmen's school in Holly Springs and later at Fisk University in Nashville, Tenn. She was a teacher until the late 1880s, when she turned to journalism, writing articles for African American-owned newspapers on issues such as the limited education available to African American children. In 1892, after three of her friends were lynched by a mob, Wells began an editorial campaign against lynching that quickly led to the destruction of her newspaper's office by whites. She continued her antilynching campaign as a lecturer and founder of antilynching societies and African American women's clubs throughout the U.S. In 1895 she married Ferdinand Barnett and began writing for his newspaper, the *Chicago Conservator*. In 1910 she founded the Chicago Negro Fellowship League. She also founded Chicago's Alpha Suffrage Club, perhaps the first African American woman-suffrage group.

Wells, Kitty *orig.* **Muriel Ellen Deason** (b. Aug. 30, 1919, Nashville, Tenn., U.S.) U.S. country music singer and songwriter. She sang gospel music in church as a child. In the 1930s she made her radio debut and took her name from a Carter family song. She married Johnny Wright in 1937, and they performed together off and on since. Her first major hit was the classic "It Wasn't God Who Made Honky Tonk Angels" (1952). Her extensive repertory made her the top-ranking female country artist for some 15 years, paving the way for later stars such as Patsy Cline and Loretta Lynn.

Wells Fargo & Co. Leading U.S. banking and financial services company formerly involved in express transport. Founded in 1852, Wells, Fargo transported gold between the west and east coasts in the wake of the California gold rush. By 1866 it had gained control of almost all stagecoach business in the West. In 1905 its banking operations were separated from its express operations. The express carrier disappeared by the mid 1920s, its domestic business taken over by the firm later known as the Railway Express Agency and its foreign express business by American Express Co. Its security services still exist under the name Wells Fargo Armored Service Corp., a subsidiary of Baker Industries. The Wells Fargo Bank's holding company, Wells Fargo & Co., was established in 1968. Headquartered in San Francisco, the bank has subsidiaries and affiliates worldwide. In 1998 Wells Fargo & Co. merged with Norwest Corp.

Welsh corgi \'kȯr-gē\ Either of two breeds of cattle dogs. The Cardigan Welsh corgi was developed from relatives of the dachshund that Celts brought to Wales c. 1200 BC. The Pembroke Welsh corgi is descended from sled-dog stock brought to Wales about 1100 by Flemish weavers. Both have short legs, a foxlike head, and erect ears, and both stand 10–12 in. (25–30 cm) tall and weigh 25–38 lb (11–17 kg). The Cardigan has a long tail and rounded ears; the Pembroke has a short tail and pointed ears. The Cardigan's coarser coat can be solid-coloured, tricoloured, or mottled; the Pembroke is solid- or bicoloured.

Welsh language Celtic language of Wales. Besieged for centuries by the English language, Welsh continues to be spoken by 18–20% of the population of Wales, or more than half a million people, though estimates of the actual number of first-language speakers vary widely. Welsh is traditionally divided into three periods: Old Welsh (c. 800–1150), attested mainly in glosses and short textual passages; Middle Welsh (c. 1150–1500), with a rich medieval literature including poetic texts originally composed much earlier; and Modern Welsh (from c. 1500). Modern literary Welsh was largely fixed by William Salesbury's Bible translation. Vernacular Welsh, split along dialectal lines, has long been diverging from literary Welsh; many modern speakers cannot write or easily understand the traditional written language. The issue of an acceptable modern standard remains unresolved.

Welsh literary renaissance Literary activity in Wales and England in the mid-18th century that attempted to stimulate interest in the Welsh language and in the classical bardic verse forms of Wales. It was centred on the Morris family of Welsh scholars, who preserved ancient texts and encouraged contemporary poets to use the strict metres of the ancient Welsh bards. The movement gave rise to many publications and helped reestablish local eisteddfods and, in the early 19th century, the National Eisteddfod. A second revival began with the establishment of the University of Wales at the end of the 19th century.

Welty, Eudora (b. April 13, 1909, Jackson, Miss., U.S.—d. July 23, 2001, Jackson) U.S. short-story writer and novelist. Welty focused her work on a small town that resembled her birthplace and the Delta country. Her main subject is the intricacies of human relationships. She first gained attention for the story collection *A Curtain of Green* (1941), containing the widely admired "Petrified Man" and "Why I Live at the P.O." Other stories appear in *The Wide Net* (1943), *The Golden Apples* (1949), and *The Bride of the Innisfallen* (1955). Her novels include *Delta Wedding* (1946), *The Ponder Heart* (1954), and *The Optimist's Daughter* (1972, Pulitzer Prize). Her works combine humour and psychological acuity with a sharp ear for regional speech patterns. She also published books of her photographs, including those she took while working for the Works Progress Administration during the Great Depression.

Wen Jiabao (b. Sept. 1942, Tianjin, China) Premier of China (from 2003). While studying at the Beijing Institute of Geology, Wen joined the Chinese Communist Party (CCP). In 1985 he was named deputy director of the General Office of the CCP Central Committee and the following year became director. While at the General Office, Wen also served as chief of staff to several general secretaries of the CCP, including Zhao Ziyang. The two men faced criticism after visiting Beijing's Tiananmen Square during a series of pro-democracy demonstrations and being photographed talking with protestors. Although Zhao was placed under house arrest, Wen escaped any lasting political damage. In 1993 he became a full member of the Secretariat of the CCP Central Committee and four years later a member of the Political Bureau. In 1998 he was appointed one of China's four vice-premiers. Aided by his experience in shaping agricultural policy, Wen succeeded Zhu Rongji as premier in 2003.

Wen Zhengming *or* **Wen Cheng-ming** (b. 1470, Suzhou, Jiangsu province, China—d. 1559) Chinese painter, calligrapher, and scholarly figure. Born to an established family, Wen Zhengming was by nature sensitive and withdrawn, and it was not until age 53 that he emerged from his scholarly isolation, receiving the recognition of the court with his appointment to the Hanlin Academy. He stayed there for only three years and then retired to produce his best-known works. He was expert at the

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four major styles of calligraphy: seal, official, regular, and "running." In all his paintings there is a spirit of studied antiquarianism and cautious consideration. In technique, Wen Zhengming's paintings range from the highly detailed to the more freely washed. Along with his teacher, Shen Zhou, he was a leading figure of the Wu school of scholar-artists.

Wenceslas (b. Feb. 26, 1361, Nürnberg—d. Aug. 16, 1419, Prague) King of Bohemia (as Wenceslas IV, 1363–96) and German king and Holy Roman emperor (1378–1400). The son of the emperor Charles IV, he was a weak ruler whose reign was plagued by wars and princely rivalries. He spent most of his time in Prague to the detriment of Germany, which suffered a decade of anarchy until peace was established by the Diet at Eger (1389). He was deposed by rebellious princes in 1400.

Wenceslas \'wen-sə-ˌslȯs\ **I** (b. 1205—d. Sept. 23, 1253) King of Bohemia (1230–53). He prevented Mongol armies from attacking Bohemia in 1241 but could not defend Moravia. He gained control of Austria and forced the Austrian estates to accept his son Přemysl Otakar II as their duke in 1251. Bohemia prospered under his reign, and an influx of German colonists and craftsmen enriched the country.

Wenceslas II (b. Sept. 17, 1271—d. June 21, 1305) King of Bohemia (1278–1305). He inherited the throne from his father at age seven, but his cousin Otto IV of Brandenburg served as his regent until 1283. Wenceslas gained full control of the country only after suppressing a dissident faction and executing his ambitious stepfather in 1290. A capable ruler who extended the boundaries of his kingdom, he annexed most of Upper Silesia and occupied Kraków (1291). He became king of Poland in 1300 but declined to become king of Hungary in 1301, instead placing his son Wenceslas on the Hungarian throne (1301–04).

Wend Any member of a group of Slavic tribes that by the 5th century AD had settled in the area between the Oder and Elbe rivers in what is now eastern Germany. They occupied the eastern borders of the domain of the Franks and other Germanic peoples. From the 6th century the Franks warred sporadically against the Wends; under Charlemagne in the early 9th century they began a campaign to subjugate the Wends and forcibly convert them to Christianity. German annexation of Wendish territories began in 929 but collapsed during a Wendish rebellion in 983. A German Crusade against the Wends in 1147, authorized by the church and led by Henry the Lion, inflicted great loss of life. The Wends thereafter offered little opposition to German colonization of the Elbe-Oder region; themselves enserfed, they were gradually assimilated by the Germans, except for a minority in the traditional region of Lusatia (in eastern Germany) who are now known as Sorbs.

Wenders \'ven-dərs**, Wim** *orig.* **Ernst Wilhelm Wenders** (b. Aug. 14, 1945, Düsseldorf, Ger.) German film director. He directed short films from 1967 and made features from 1973, including *Alice in the Cities* (1974) and *Kings of the Road* (1976), which explored themes of alienation and anxiety that are typical of Wenders's work. He won acclaim in the U.S. for *Paris, Texas* (1984) and *Wings of Desire* (1987). He later directed *Far Away, So Close* (1993), *Lisbon Story* (1994), *The End of Violence* (1997), and the documentary *Buena Vista Social Club* (1999).

Wendi *or* **Wen Ti** \'wən-'dē\ Chinese god of literature. His chief heavenly task is to keep a register of men of letters so that he can mete out rewards and punishments to each according to merit. He had 17 reincarnations, during the ninth of which he appeared on earth as Zhang Ya. His writing earned him canonization during the Tang dynasty.

Wendi *or* **Wen-ti** \'wən-'dē\ *orig.* **Liu Heng** (b. 203 BC, China—d. 157 BC, China) Fourth emperor of the Chinese Han dynasty. His long reign (180–157 BC) was one of good government and peaceful consolidation of power. Under his rule, China's economy prospered and its population expanded. To later ages Wendi epitomized the virtues of frugality and benevolence in a Chinese ruler.

Wendi *or* **Wen-ti** *orig.* **Yang Jian** (b. 541, China—d. 604, China) Founder of the Chinese Sui dynasty, which reunified China after centuries of instability. He was born into a powerful family in northern China, an area controlled by the non-Chinese Northern Zhou dynasty (557–81). When the Zhou emperor died unexpectedly, Wendi seized the throne, overcame his rivals, and in 581 proclaimed the Sui dynasty. Intending to build a strong, centralized state, he designed a huge new capital at Chang'an and attacked entrenched local interests. Families with hereditary local power were replaced with officials selected by examination, who were forbidden to serve in the areas from which they came and were rotated frequently. Wendi conquered the dynasties of southern China and broke the power of the Turkish empires in Turkistan and Mongolia. He put the equal-field system into practice and produced a new legal code. His government brought in tax revenues and maintained price-regulating granaries. In old age he became deeply involved with Buddhism, building shrines and dicating relics. See also Yang Di.

Wentworth, Thomas See Thomas Wentworth, 1st earl of Strafford

Wenwang *or* **Wen-wang** \'wən-'wäŋ\ *or* **Xibo** (fl. 12th century BC, China) Father of Wuwang (founder of the Zhou dynasty) and one of the sage rulers regarded by Confucian historians as a model king. He is traditionally credited as author of the divination formulas of the *Yijing* (*I Ching*), which he is supposed to have written during his imprisonment by the last ruler of the Shang dynasty. See also Confucianism; Five Classics.

Wenzel Anton, prince von Kaunitz \'kaù-nits\ **-Rietberg** (b. Feb. 2, 1711, Vienna, Austria—d. June 27, 1794, Vienna) Austrian state chancellor (1753–92). He entered the Austrian foreign service in 1740 and was responsible for the foreign policy of the Habsburg monarchy, serving Maria Theresa and her successors. He represented Austria at the 1748 Aix-la-Chapelle peace conference and was ambassador to Paris (1750–52). A lifelong enemy of Prussia, he managed to reverse Austria's alliances during the Seven Years' War, bringing France and Russia into the Habsburg orbit and isolating Prussia. The French Revolution terminated the system of alliances he had created, and he resigned in 1792.

werewolf In European folklore, a man who changes into a wolf at night and devours animals, people, or corpses, returning to human form by day. Some werewolves are thought to change shape at will; others, who inherited the condition or acquired it by being bitten by a werewolf, are transformed involuntarily under the influence of a full moon. Belief in werewolves is found throughout the world and was especially common in 16th-century France. Humans who believe they are wolves suffer from a mental disorder called lycanthropy.

Lon Chaney, Jr., as a werewolf in *The Wolf Man* (1941).
COURTESY OF UNIVERSAL PICTURES; PHOTOGRAPH, LINCOLN CENTER LIBRARY OF THE PERFORMING ARTS, NEW YORK PUBLIC LIBRARY

Werner \'ver-nər**, Abraham Gottlob** (b. Sept. 25, 1750, Wehrau, Saxony—d. June 30, 1817, Freiberg) German geologist. In opposition to the Plutonists, or Vulcanists, who argued that granite and many other rocks were of igneous origin, he founded the Neptunist school, which proclaimed that all rocks resulted from precipitation from oceans that had, he theorized, once completely covered the Earth. He rejected uniformitarianism. His brilliant lecturing and personal charm won him many students, who, though many eventually discarded his theories, would not renounce them while Werner lived.

Wertheimer \'vert-ˌhī-mər**, Max** (b. April 15, 1880, Prague, Czech.—d. Oct. 12, 1943, New Rochelle, N.Y., U.S.) German psychologist. He taught at the Universities of Frankfurt and Berlin (1916–29) before immigrating to the U.S. to teach at the New School for Social Research (1933–43). With Wolfgang Köhler and Kurt Koffka (1886–1941), he was instrumental in establishing Gestalt psychology. Much of his work dealt with perception, though he also explored thinking and problem solving. His *Productive Thinking* was published posthumously in 1945.

Wertmüller \'vert-ˌmü-lər**, Lina** *orig.* **Arcangela Wertmüller von Elgg** (b. Aug. 14, 1928, Rome, Italy) Italian film director. After working as a puppeteer and stage actress and director, she became an assistant to Federico Fellini and began writing and directing her own films in 1963. She achieved international fame with *The Seduction of Mimi* (1972), a satire on sexual hypocrisy, and *Love and Anarchy* (1972). Her most controversial works were the witty *Swept Away* (1974) and the morally ambiguous *Seven Beauties* (1976), about a man scrabbling to survive in a Nazi concentration camp. Her later movies, including *Ciao, Professore* (1994), were less successful.

Weser River \'vā-zər\ River, western Germany. Formed by the union of the Fulda and Werra rivers at Münden, it flows northward into the North Sea through a large estuary. It is 273 mi (440 km) long. There are several hydroelectric dams on the Weser, and it is linked with numerous canals.

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Wesley, John (1703–1791) Anglican clergyman, evangelist, and cofounder of Methodism. The 15th child of a former Nonconformist minister, he graduated from Oxford University and became a priest in the Church of England in 1728. From 1729 he participated in a religious study group in Oxford organized by his brother Charles (1707–1788), its members being dubbed the "Methodists" for their emphasis on methodical study and devotion. Its numbers grew, and it began to undertake social and charitable activities. After a largely unsuccessful mission to the North American colony of Georgia (1735–37), they returned to London, where they came under the influence of the Moravian Church. In 1738, inspired by the theology of Martin Luther, both men had a religious experience that convinced them that salvation was possible through faith alone. Zealous evangelists, they had great success in preaching to the masses in the succeeding decades. In 1784 John began ordaining ministers himself when the bishop of London refused to do so (despite Charles's disapproval) and declared his independence from the Church of England. The two wrote several thousand hymns, including "Hark, the Herald Angels Sing" and "Christ the Lord Is Ris'n Today."

Wesleyan University Private university in Middletown, Conn. It was founded in 1831 by Methodists, who named the institution for John Wesley. Its formal ties to the Methodist church ended in 1937. Wesleyan offers 50 major fields of undergraduate and graduate study, including roughly one dozen master's and doctoral programs in music and sciences. Campus facilities include centres for African American and East Asian studies, an astronomical observatory, and the Center for Humanities and Arts.

Wessex Ancient Anglo-Saxon kingdom, southern England. Its area approximated that of the counties of Hampshire, Dorset, Wiltshire, Somerset, Berkshire, and Avon. Its capital was Winchester. The kingdom is traditionally thought to have been founded by Saxon invaders of Britain c. 494. Wessex conquered Kent and Sussex, and in the 9th century, under King Alfred the Great, it prevented the Danes from conquering England south of the Danelaw. By 927 Wessex had reconquered the Danelaw, and Alfred's grandson, Athelstan, had become king of all England; thereafter all kings of Wessex were kings of England. The region figures prominently in legends of King Arthur (see Arthurian legend), and the designation "Wessex" was used by Thomas Hardy to represent the region of southwestern England in which he set his works of fiction.

West, Benjamin (b. Oct. 10, 1738, near Springfield, Pa.—d. March 11, 1820, London, Eng.) U.S.-British painter. After studying painting in his native Philadelphia, he established himself as a portraitist in New York City. He sailed to Italy in 1760 and visited most of its art centres before settling in London in 1763. The patronage of George III freed him of the need to paint portraits for a living, and he became known for historical, religious, and mythological subjects. His *Death of General Wolfe* (1771) aroused controversy for its depiction of modern dress rather than the flowing robes expected in a history painting, but it was one of his most popular works. He never returned to the U.S., but through such pupils and followers as Washington Allston, Gilbert Stuart, Charles Willson Peale, and John Singleton Copley he exerted considerable influence on the development of U.S. art in the 19th century.

West, Jerry *in full* **Jerome Alan West** (b. May 28, 1938, Cheylan, W.Va., U.S.) U.S. basketball player, coach, and manager. As a sharpshooting guard for the Los Angeles Lakers (1960–74), he compiled a career scoring average of 27 points and earned the nickname "Mr. Clutch." As the Lakers' head coach (1976–79), he led them to 145 wins and 101 losses. He later became the team's general manager and executive vice president and contributed to the team's eight NBA titles between 1980 and 2002. In 2002 he joined the front office of the Memphis Grizzlies.

West, Mae (b. Aug. 17, 1892/93, Brooklyn, N.Y., U.S.—d. Nov. 22, 1980, Los Angeles, Calif.) U.S. film actress. She performed with a Brooklyn stock company around 1901, and by 1907 she had become a performer on the national vaudeville circuit. She made her Broadway debut as a singer and dancer in 1911. In 1926 she began to write, produce, and star in her own Broadway plays, including the sensation-creating *Sex* (1926), *Diamond Lil* (1928), and *The Constant Sinner* (1931), productions that mired her in legal battles. Her frank sensuality, regal postures, and suggestive wisecracks became her trademarks in popular movies such as *She Done Him Wrong* (1933), *Belle of the Nineties* (1934), *I'm No Angel* (1933), and *My Little Chickadee* (1940). In World War II Allied soldiers called their inflatable life jackets "Mae Wests" in honour of her hourglass figure. Her films were revived in the 1960s, and she appeared in *Myra Breckenridge* (1970) and *Sextette* (1979).

West, Nathanael *orig.* **Nathan Weinstein** (b. Oct. 17, 1903, New York, N.Y., U.S.—d. Dec. 22, 1940, near El Centro, Calif.) U.S. writer. He attended Brown University and was supporting himself as a hotel manager, giving free or low-rent rooms to struggling fellow writers, when he wrote the novella *Miss Lonelyhearts* (1933), about an advice columnist whose attempts to solace his correspondents end in ironic defeat. *A Cool Million* (1934) mocks the American dream as popularized by Horatio Alger. His last novel, *The Day of the Locust* (1939), depicts the savagery lurking beneath the Hollywood dream. Though not widely read until after his death in an auto accident at age 37, West is now considered a major American novelist.

West, Dame Rebecca *orig.* **Cicily Isabel Fairfield** (b. Dec. 21, 1892, London, Eng.—d. March 15, 1983, London) British journalist, novelist, and critic. Trained as an actress, from 1911 West contributed to the left-wing press and made a name as a fighter for woman suffrage. She had a 10-year love affair (1913–23) with the novelist H.G. Wells. Her novels, including *The Judge* (1922), *The Thinking Reed* (1936), and *The Birds Fall Down* (1966), attracted less attention than her social and cultural writings. Her admired reports on the Nürnberg trials were collected in *A Train of Powder* (1955). Her history of Yugoslavia, *Black Lamb and Grey Falcon* (1942), is regarded as one of the century's finest nonfiction works. In 1946 she reported on the trial for treason of William Joyce, articles that were later published as *The Meaning of Treason* (1949).

West Atlantic languages See Atlantic languages

West Bank Area (pop., 2002 est.: 2,414,000), Palestine, west of the Jordan River and east of Jerusalem. Covering an area of about 2,270 sq mi (5,900 sq km), excluding east Jerusalem, the territory is also known within Israel by its biblical names, Judaea and Samaria. It is a region with deep history, forming the heart of historic Palestine. Populated areas include Nabulus, Hebron, Bethlehem, and Jericho. Under a 1947 UN agreement, most of what is now the West Bank was to become part of a Palestinian state. When the State of Israel was formed, the Arabs attacked Israel (see Arab-Israeli wars), and the partition plan was never adopted. Following a truce, Jordan remained in control of the area and annexed it in 1950. Israel subsequently occupied it during the Six-Day War of 1967. During the 1970s and '80s Israel established settlements there, provoking resentment among the Arab population and protest from the international community. Arab uprisings began in 1987 in the Gaza Strip and spread to the West Bank (see *intifādah*). Jordan relinquished its claims in 1988, ceding them to the Palestine Liberation Organization (PLO). Secret meetings between the PLO and Israel in 1993 led to an end of violence and an agreement granting Palestinian self-rule in parts of the West Bank and Gaza Strip. Further negotiations to resolve outstanding issues proceeded intermittently in the 1990s but broke down amid renewed violence in late 2000.

West Bengal State (pop., 2001 prelim.: 80,221,171), northeastern India. It is bordered by Nepal and Bangladesh and the states of Orissa, Jharkhand, Bihar, Sikkim, Assam, and Meghalaya and has an area of 34,267 sq mi (88,752 sq km); the capital is Kolkata (Calcutta). It encompasses two broad natural regions, the Gangetic Plain in the south and the Himalayas in the north. From the 3rd century BC it formed part of Ashoka's empire. In the 4th century AD it was absorbed into the Gupta empire. From the 13th century it was under Muslim rule, until it came under the British in 1757. At Indian independence in 1947, it was partitioned, with the eastern sector becoming East Pakistan (later Bangladesh) and the western sector becoming India's West Bengal. The state is important for its mineral output, but agriculture is its main economic activity. It is noted for its artistic endeavours, including filmmaking.

West Florida Controversy Dispute over status of American territory in a region on the Gulf of Mexico between the Apalachicola and Mississippi rivers. First claimed by Spain in 1492, it was occupied by France as part of Louisiana after 1695, then passed under various treaties to Britain (1763) and Spain (1783). The U.S. claimed it as part of the Louisiana Purchase (1803), and American frontiersmen rebelled against Spanish control in 1810. Under the Transcontinental Treaty of 1819, Spain ceded all claim to West Florida, and it became part of the U.S. in 1821.

West Indies Islands, enclosing the Caribbean Sea. Lying between southeastern North America and northern South America, they may be divided into the following groups: the Greater Antilles, including Cuba,

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Jamaica, Hispaniola (Haiti and the Dominican Republic), and Puerto Rico; the Lesser Antilles, including the Virgin Islands, Windward Islands, Leeward Islands, Barbados, and the islands in the southern Caribbean Sea north of Venezuela (generally considered to include Trinidad and Tobago); and the Bahamas. Although physiographically not a part of the West Indies, Bermuda is often included.

West Midlands Metropolitan county (pop., 2001: 2,555,596), west-central England. Its main centre is Birmingham. From 1974 to 1986 West Midlands was an administrative metropolitan county; in 1986 its administrative functions were dispersed, and it is now a geographic and ceremonial county without administrative authority. Early settlement was sparse until Saxon colonists arrived; Coventry was the region's only significant town by the late 14th century. Small metalworking industries began in Birmingham in the 16th century, and by the 18th century the area's coalfields were important for ironworking. Many of the West Midlands' traditional metallurgical and manufacturing industries persisted into the 21st century, alongside the growth of electrical engineering and the manufacture of motor vehicles, aircraft, and synthetic fibres. The West Midlands name is also applied to the western portions of the Midlands region comprising Staffordshire, Warwickshire, Shropshire, Herefordshire, and Worcestershire; this combined area constitutes one of England's so-called standard regions.

West Nile virus Virus, belonging to the family Flaviviridae, that can cause encephalitis (inflammation of the brain). West Nile is predominantly a fatal infection of birds but can be transmitted to humans by mosquitoes. Most human infections are inapparent or mild, causing a flu-like illness that lasts only a few days. A minority develop encephalitis, characterized by headache, fever, neck stiffness, and muscle weakness, that has proved fatal in some cases. There is no cure. In severe cases, intensive medical care, involving intravenous fluids and respiratory support, is necessary. The virus was originally confined to Africa, the Middle East, and Southeast Asia but has spread to Europe and North America.

West Point See United States Military Academy

West River See Xi River

West Sussex Administrative county (pop., 2001: 753,612), southeastern England. It borders the English Channel, and its administrative centre is Chichester. There is evidence of settlements dating from prehistoric times in the region. A dynasty of British chieftains was in the area just before the Roman invasion. After the Romans left, Saxon invaders conquered Sussex in the late 5th century. They were overcome by the peoples of neighbouring Wessex and later by the Normans, who built castles and monasteries. Since the beginning of the 14th century, the growth of seaside resorts has been important in the development of the area's coast; inland, much of it remains rural.

West Virginia State (pop., 2000: 1,808,344), east-central U.S. It covers an area of 24,232 sq mi (62,760 sq km); its capital is Charleston. West Virginia is bordered by Pennsylvania to the north, Maryland and Virginia to the east, Kentucky to the southwest, and Ohio to the northwest. The Ohio River forms a large section of the upper western boundary, while the Potomac River forms a section of the northern boundary. The Great Kanawha, Little Kanawha, Monongahela, and Shenandoah rivers cross the state. West Virginia is crossed by the Appalachian Mountains and is generally rugged land. The highest elevation is Spruce Knob (4,861 ft [1,482 m]). Long occupied by Indian hunters, it was home to the Adena, or Mound Builders, who left archaeological traces. They were succeeded by the Iroquois and the Cherokee. The first permanent white settlement was in the 1730s. The English controlled the region during the 1750s and 1760s. Though eastern Virginia was rapidly settled, the western area's rugged terrain restricted settlement there. After the American Revolution, largely nonslaving settlers moved west; they grew dissatisfied with the Virginia government. With the outbreak of the American Civil War, residents from western Virginia voted against the ordinance of secession in 1861. In 1863 West Virginia was admitted to the Union as the 35th state. Its industrial emergence, encouraged by railroad expansion, began in the 1870s when its natural resources, including coal and gas, contributed to the growth of the U.S. In the 20th century, recreation and tourism became an increasingly important part of the state's economy.

West Yorkshire Metropolitan county (pop., 2001: 2,079,217), northern England. Its main cities are Wakefield and Leeds. From 1974 to 1986 West Yorkshire was an administrative unit; in 1986 the metropolitan county lost its administrative powers, and its constituent boroughs became autonomous unitary authorities. Anglo-Saxons and Scandinavians from the east established the first settlements. While baronial power was strong in the medieval period, anarchic conditions often prevailed, and the area was the site of several 15th-century battles. In the same period, the wool textile industry developed. In the 18th and 19th centuries, abundant waterpower, and later steam power based on locally mined coal, stimulated factory-based industry. Worsted and woolen industries remain important, while an engineering industry has developed. Leeds, the area's largest city, is a major commercial and cultural centre.

western Genre of novels and short stories, motion pictures, and television and radio shows set in the American West, usually during 1850–1900, when the area was opened to white settlement. Though basically an American creation, it has counterparts in the gaucho literature of Argentina and in tales of the settlement of the Australian Outback. Conflicts between white pioneers and Native Americans and between cattle ranchers and fence-building farmers form two basic themes. Cowboys, the town sheriff, and the U.S. marshal are staple figures, and lawlessness and gun violence are standard. Owen Wister's *The Virginian* (1902) is regarded as the seminal western novel; the popularity of the genre peaked in the early and middle decades of the 20th century and declined somewhat thereafter.

Western Australia State (pop., 2001: 1,906,114), western Australia. Covering 976,790 sq mi (2,529,880 sq km), it constitutes one-third of the continent's area but has less than one-tenth of Australia's population; its capital is Perth. The extensive interior region has three deserts: Great Sandy, Gibson, and Great Victoria. The coast along the Timor Sea and Indian Ocean has only a few good harbours; notable inlets are Joseph Bonaparte and Exmouth gulfs. Australian Aboriginal peoples have occupied Western Australia for about 40,000 years. The western coast was first visited in 1616 by the Dutch; it was later explored by Englishman William Dampier in 1688 and 1699. In 1829 Capt. James Stirling led the first group of settlers there to establish Australia's first nonconvict colony. The discovery of gold in 1886 prompted a movement for constitutional autonomy, which was granted in 1890. In 1900 it was the last state to ratify the newly constituted Commonwealth of Australia. Initially it suffered from slow growth, but since 1960 its economy, fueled by agriculture and mining (notably of hydrocarbons), has been expanding.

Western Dvina River *Russian* **Zapadnaya** \'zä-pəd-nə-yə\ **Dvina** *Latvian* **Daugava** \'daù-gə-və\ River, north-central Europe. It rises in Russia's Valdai Hills and flows 632 mi (1,020 km) in a great arc south through Russia and into Belarus and then northwest across Latvia. It discharges into the Gulf of Riga on the Baltic Sea. An important water route since early times, connected in its upper reaches by easy portages to the Dnieper, Volga, and Lovat-Volkhov river systems, it constituted part of the great trade route from the Baltic region to Byzantium and to the Arabic east. Rapids and the presence of dams have restricted navigation on it.

Western Electric Co. Inc. Former U.S. telecommunications company. Founded in 1869 by Elisha Gray and Enos N. Barton, the firm was incorporated in Chicago, Ill., in 1872 as the Western Electric Manufacturing Co. It manufactured a series of new products, including the world's first commercial typewriters and incandescent lamps. Bell Telephone bought a controlling interest in the company in 1881; the next year it was reincorporated as Western Electric Co., becoming part of the Bell System (see AT&T Inc.). It became a major manufacturer of telephone equipment and communications satellites, in addition to producing radar and missile systems. In 1983, with the breakup of AT&T, the company was dissolved as a separate subsidiary and became part of AT&T Technologies (renamed Lucent Technologies).

Western European Union (WEU) Association of 10 European countries to coordinate matters of European security and defense. The WEU was formed in 1955 as an outgrowth of the Brussels Treaty of 1948. Composed of Belgium, France, Germany, Greece, Italy, Luxembourg, The Netherlands, Portugal, Spain, and Britain, it works in cooperation with NATO and the European Union and is administered by a council of the foreign affairs and defense ministers of the member countries. There are also several associate members, observers, and associate partners. It is headquartered in Brussels.

Western Hemisphere Part of Earth comprising North and South America and the surrounding waters. Longitudes 20° W and 160° E are often considered its boundaries.

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Western Indian bronze Style of metal sculpture that flourished in India from the 6th to the 12th century and later, mainly in the area of modern Gujarat and Rajasthan states. Most of the bronzes are associated with JAINISM; they include representations of saviour figures and ritual objects such as incense burners and lamp bearers. Most are small, as they were intended for private worship. They were made by LOST-WAX CASTING, and the eyes and ornaments are frequently inlaid with silver and gold.

Rsabhanatha, Western Indian bronze from Chahardi, western Khandesh, Maharashtra state, 9th century AD; in a private collection.
P. CHANDRA

Western Isles See HEBRIDES ISLANDS

Western Ontario, University of Public university in London, Ontario, Canada, founded in 1878. It has faculties of applied health sciences, arts, business administration, dentistry, education, engineering, graduate studies, journalism, law, library science, medicine, music, nursing, science, and social science as well as a graduate school of journalism.

Western Reserve Tract of land, northeastern Ohio, U.S. Located on the southern shore of Lake ERIE, it formed part of the western lands of Connecticut not surrendered to Congress in 1786. It covered about 3,500,000 ac (1,417,500 ha) and was sold in part to immigrants from Connecticut (1786–1800). Ceded in 1800 to Ohio, it was later divided into several counties.

Western Sahara *formerly* **Spanish Sahara** Territory, North Africa. Area: 97,344 sq mi (252,120 sq km). Population (2002 est.): 256,000. Capital: LAAYOUNE. Little is known of the area's prehistory, though rock engravings in southern locations suggest a succession of nomadic groups. In the 4th century BC there was trade across the Mediterranean Sea between the region and Europe; this did not last, and there was little European contact until the 19th century. In 1884 Spain claimed a protectorate over the RÍO DE ORO region. Boundary agreements with France were concluded in 1900 and 1912. Spain formally united the area's northern and southern parts into the overseas province of the Spanish Sahara in 1958. In 1976 Spain relinquished its claim. The region then was divided between Mauritania, which relinquished its claim in 1979, and Morocco, which later occupied the whole territory. Separatists of the POLISARIO movement, based in Algeria, declared a government-in-exile called the Saharan Arab Democratic Republic in 1976; the issue of Western Sahara's status remained unresolved. remained unresolved.Western Sahara has vast phosphate deposits and some potash and iron ore.

Western Samoa See SAMOA

Western Scheldt *or* **Westerschelde** \'ves-tər-ˌskel-də\ Estuary, southwestern Netherlands. An inlet of the North Sea at the mouth of the SCHELDE RIVER, it flows west for about 30 mi (50 km) through the Delta Islands to the North Sea. It has been an important transportation route since the 16th century, when Holy Roman Emperor CHARLES V designated VLISSINGEN as his port of embarkation from the Netherlands. It continues to operate as an important shipping route to many destinations, including ANTWERP.

Western Schism See Western SCHISM

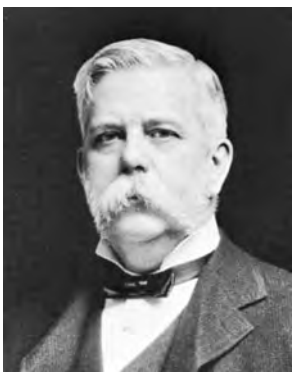
Western Union Former U.S. telegraph company and contemporary provider of electronic financial transactions. From its foundation in 1851 as a company formed to build a telegraph line from Buffalo, N.Y., to St. Louis, Mo., in 1856 the expanding business was reorganized as the Western Union Telegraph Co. By the end of 1861 Western Union had built the first transcontinental TELEGRAPH line. The company introduced singing telegrams in 1933. Western Union continued to grow, absorbing competitors such as Postal Telegraph Inc. in 1943. As telegraphy was superseded by other methods of telecommunication, Western Union diversified into teletypewriter services, money orders, and mailgrams. It launched the telecommunications satellite Westar 1 in 1974 and was operating five satellites by 1982. In 1988 the company was reorganized as Western Union Corp. to handle money transfers and related services. After declaring bankruptcy in 1993, it sold its financial services arm in 1994 to First Financial Management Corp., and in 1995 that company merged with First Data Corp. The renamed Western Union Financial Services, Inc., became a world leader in electronic (including Internet) transactions.

Western Wall *or* **Wailing Wall** Place of prayer in the Old City of JERUSALEM sacred to the Jewish people. It is the only remnant of the Second Temple of JERUSALEM. Because it now forms part of a larger area—known as the Temple Mount by Jews and as al-Ḥaram al-Sharīf by Muslims—surrounding the Muslim DOME OF THE ROCK and al-Aqṣā Mosque, the two groups have often vied for control of it. When Israel captured the Old City in the SIX-DAY WAR (1967), the Jews once more gained authority over the site.

Westernizers See SLAVOPHILES AND WESTERNIZERS

Westerschelde See WESTERN SCHELDT

Westinghouse, George (b. Oct. 6, 1846, Central Bridge, N.Y., U.S.—d. March 12, 1914, New York, N.Y.) U.S. inventor and industrialist. He served in the American Civil War. His first major invention was an air brake (patented 1869), which was eventually made compulsory on all American trains. He developed a railway signaling system and later introduced many innovations in piping natural gas. His major achievement was the adoption by the U.S. of ALTERNATING CURRENT (AC) for electric power transmission. The electrical system being developed in the U.S. in the 1880s used DIRECT CURRENT (DC), though AC systems were being developed in Europe. Westinghouse purchased the patents for NIKOLA TESLA's AC motor and hired Tesla to improve and modify the motor for use in his power system. In 1886 he incorporated the predecessor of WESTINGHOUSE ELECTRIC CORP. He eventually prevailed over powerful opposition from advocates of DC power, and in 1893 his company was hired to light the World's Columbian Exposition at Chicago. He also obtained the rights to develop the great falls of the Niagara River with AC generators. See also ELECTRIC CURRENT.



Westinghouse
COURTESY OF WESTINGHOUSE ELECTRIC CORPORATION

Westinghouse Electric Corp. U.S. television and radio broadcasting company, formerly an electrical equipment manufacturer. It was founded in 1886 as the Westinghouse Electric Co. by GEORGE WESTINGHOUSE to make and sell alternating-current electrical systems. The company became a major supplier to the electric-utility industry, producing machinery used to generate and distribute electricity. It adopted the name Westinghouse Electric Corp. in 1945. After World War II Westinghouse also manufactured nuclear reactors and defense electronics. In the 1990s it bought television and radio stations throughout the U.S., including the television network CBS Inc. in 1995 and Infinity Broadcasting Corp. in 1996. After selling its defense electronics unit to Northrop Grumman Corp. in 1996, the company changed its name to CBS Corp. in 1997 and sold its nuclear operations to British Nuclear Fuels PLC in 1998. CBS was purchased by media conglomerate Viacom Inc. in 1999 and renamed CBS TELEVISION NETWORK.

Westminster, Statute of (1931) Parliamentary statute that effected the equality of Britain and the then-dominions of Canada, Australia, New Zealand, South Africa, Ireland, and Newfoundland. It confirmed declarations made at British imperial conferences in 1926 and 1930 that the self-governing dominions were to be regarded as "autonomous communities within the BRITISH EMPIRE." United in their allegiance to the crown, the countries individually controlled their own domestic and foreign affairs as equal members of the British COMMONWEALTH of Nations.

Westminster Abbey Church in London. It was originally a Benedictine monastery. EDWARD THE CONFESSOR built a Norman-style church (consecrated 1065) on the site of an older church there; this was pulled

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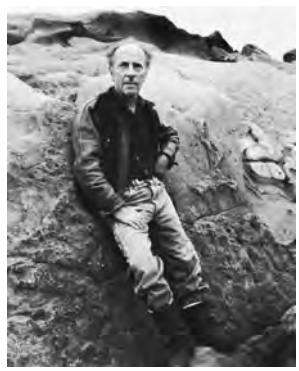
down in 1245 by Henry III (except for the nave) and replaced with the present Gothic-style abbey church. The rebuilding of the nave was begun by 1376 and continued intermittently until Tudor times. The chapel of Henry VII (begun c. 1503) is noted for its exquisite fan vaulting. Elizabeth I refounded the church as the Collegiate Church of St. Peter in Westminster (1560). The western towers (1745), by Nicholas Hawksmoor and John James, were the last addition. Every British sovereign since William the Conqueror has been crowned in the abbey except Edward V and Edward VIII. Many are also buried there, and it is crowded with the tombs and memorials to other famous Britons. Part of the southern transept is known as the Poets' Corner, while the northern transept has memorials to statesmen.

Westminster Confession Confession of faith of English-speaking Presbyterians, representing a theological consensus of international Calvinism. Produced by the Westminster Assembly, it was completed in 1646 and approved by Parliament in 1648. When the monarchy was restored in 1660, the episcopal form of church government was reinstated and the Confession lost official status in England, but it had already been adopted by the Church of Scotland (1647) and various other churches. Consisting of 33 chapters, it states that the sole doctrinal authority is scripture, restates the doctrines of the Holy Trinity and Jesus, and gives reformed views of the sacraments, the ministry, and grace. See also Presbyterianism.

Weston, Edward (b. March 24, 1886, Highland Park, Ill., U.S.—d. Jan. 1, 1958, Carmel, Calif.) U.S. photographer. A camera enthusiast from boyhood, Weston began his professional career by opening a portrait studio in Glendale, Calif. His early work was in the style of the Pictorialists, photographers who imitated Impressionist paintings. In 1915 Weston saw an exhibition of modern art that inspired him to renounce his former work: he began to create sharp and realistic pictures that convey the beauty of natural objects through skillful composition and subtleties of tone, light, and texture. After traveling and meeting luminaries such as Alfred Stieglitz and Diego Rivera, in 1927 Weston made a series of monumental close-ups of seashells, peppers, and halved cabbages, bringing out the rich textures of their sculpturelike forms. Two years later he made the first of many photographs of the rocks and trees on Point Lobos, Calif. In 1936 Weston began a series of photographs of nudes and sand dunes at Oceano, Calif., which are often considered his finest work. After being stricken by Parkinson disease, Weston realized he would soon be unable to work. He made his last photographs on Point Lobos in 1948. He is considered one of the most influential photographers of the 20th century.



Edward Weston at Point Lobos, Carmel Bay, Calif., 1945
IMOGEN CUNNINGHAM

Westphalia Former province of Prussia, now part of Germany. It comprises (with the former state of Lippe) the present German state of North Rhine–Westphalia and parts of the states of Lower Saxony and Hesse. Settled by Saxons called Westphalians c. AD 700, Westphalia was created a duchy (1180), which for several centuries was administered for the archbishop of Cologne. The Peace of Westphalia (1648) was signed at Münster. In 1807 Napoleon created for his brother, Jérôme Bonaparte, the kingdom of Westphalia; its capital was Kassel. Reorganized by the Congress of Vienna in 1815, it became a province of Prussia in 1816, with its capital at Münster. Its cities suffered severe bombings in World War II.

Westphalia, Peace of (1648) European settlements that ended the Thirty Years' War, negotiated in the Westphalian towns of Münster and Osnabrück. The deliberations began in 1644 and ended in 1648 with two assemblies that produced the treaty between Spain and the Dutch (signed January 30) and another between Emperor Ferdinand III, the other German princes, France, and Sweden (signed October 24). Territorial changes gave Sweden control of the Baltic Sea, ensured France a firm frontier west of the Rhine River, and provided their allies with additional lands. Independence was confirmed for the United Provinces of the Netherlands and for the Swiss Confederation. The treaties also confirmed the Peace of Augsburg and extended the religious toleration of Lutherans to include toleration of the Reformed (Calvinist) Church. The Holy Roman Empire was forced to recognize its German princes as absolute sovereigns in their own dominions, which greatly weakened its central authority.

Wetar \'we-ˌtär\ Island, Indonesia. Lying 35 mi (56 km) north of East Timor, it is 80 mi (130 km) long, 28 mi (45 km) wide, and has an area of 1,400 sq mi (3,600 sq km). In its interior, rugged mountains covered with tropical rain forests rise to 4,632 ft (1,412 m). Subsistence farming and fishing are the main occupations of the few islanders.

Weyden \'vī-dᵊn, 'vā-dᵊn**, Rogier van der** (b. 1399/1400, Tournai, France—d. June 18, 1464, Brussels) Flemish painter. He seems to have begun his painting career at the rather advanced age of 27, when he entered the studio of Robert Campin. In early paintings he combined Campin's bold style with the elegance and subtle visual refinements he admired in the art of Jan van Eyck. By 1435 he moved to Brussels and the next year was appointed city painter. During that period (c. 1435–40) he executed the celebrated panel of the *Descent from the Cross* for the chapel of the Archers' Guild of Louvain. His international reputation grew, his work being particularly admired in Italy. Though most of his work was religious, he produced secular paintings (now lost) and some sensitive portraits. His art affected generations of Flemish artists and introduced the Flemish style throughout Europe.

Weyerhaeuser \'wī-ər-ˌhau̇-zər**, Frederick** *orig.* **Friedrich Weyerhaeuser** (b. Nov. 21, 1834, Nieder Saulheim, Hesse—d. April 4, 1914, Pasadena, Calif., U.S.) German-born U.S. lumber magnate. He immigrated to the U.S. at age 18 and found work in an Illinois sawmill, which he and his brother-in-law bought in 1857. He traveled constantly to buy stands of timber and acquired an interest in many logging and milling operations. In 1872 he organized the Mississippi River Boom and Logging Co., a huge confederation that handled all the logs milled on the Mississippi. In 1900 he bought 900,000 acres of timberland in the Pacific Northwest and founded the Weyerhaeuser Timber Co. (now Weyerhaeuser Co.), centred in Tacoma, Wash. During his lifetime the company bought almost two million acres of land.

Weygand \vā-'gäⁿ**, Maxime** (b. Jan. 21, 1867, Brussels, Belg.—d. Jan. 28, 1965, Paris, France) Belgian-born French army officer. He was educated in France and taught at the French cavalry school. He served as chief of staff to Gen. Ferdinand Foch (1914–23), as high commissioner in Syria (1923–24), and as inspector general of the army (1931–35) before retiring in 1935. In May 1940 he was recalled to take command of the French armies; unable to prevent a German victory, he advised capitulation in June. After the Allied invasion of North Africa (1942) he sought to fly to Algiers but was caught by the Germans and imprisoned in an Austrian castle. Released by U.S. troops in 1945, he was arrested by the French under the orders of Charles de Gaulle. He was exonerated by de Gaulle in 1948.

whale Any of dozens of species of exclusively aquatic mammals found in oceans, seas, rivers, and estuaries worldwide but especially numerous in the Antarctic Ocean. Whales are commonly distinguished from the smaller porpoises and dolphins and sometimes from narwhals, but they are all cetaceans. See also baleen whale; toothed whale.

whale shark Species (*Rhincodon typus*) of gigantic but harmless shark found worldwide but mainly in the tropics. The largest of living fishes, it often grows to about 30 ft (9 m) long and may reach twice that size. It is gray or brown with a pale undersurface and is distinctively marked with small spots and narrow vertical lines of yellow or white. It has tiny teeth, and eats plankton and small fishes. A sluggish animal, it generally swims slowly near the surface and has been hit by ships.

Whales, Bay of Former inlet of the Ross Sea, Ross Ice Shelf, Antarctica. It was first seen by the British explorer James C. Ross in 1842. The bay was the continent's most southerly open harbour in summer and was the site of several important bases for Antarctic exploration. More than 10 mi (16 km) wide in 1911, it gradually narrowed as advancing ice sheets collided. It disappeared entirely in 1987 when an iceberg 99 mi (159 km) long broke off from the Ross Ice Shelf.

whaling Hunting of whales for food, oil, or both. Whaling dates to prehistoric times, when Arctic peoples used stone tools to hunt whales. They used the entire animal, a feat not accomplished by Western commercial whalers until the advent of floating factories in the 20th century. The Basque were the first Europeans to hunt whales commercially; when seaworthy oceangoing vessels began to be made, they took to the open seas

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(14th–16th century). They were followed by the Dutch and the Germans in the 17th century and the British and their colonists in the 18th century. In 1712 the first SPERM WHALE was killed; its oil proved more valuable than that of the RIGHT WHALE, which had hitherto been the object of whaling ventures. Whaling expeditions in pursuit of the free-ranging sperm whale could last for four years. The discovery of petroleum (1859), overfishing, the use of vegetable oil, and the substitution of steel for whalebones in corsets led to a steep decline in whaling in the later 19th century, but Norwegian innovations made hunting the hitherto "wrong" whales (RORQUALS, including the BLUE WHALE and the SEI WHALE; so called because they sank when killed) commercially feasible, and the number of whales killed rose from under 2,000 to over 20,000 between 1900 and 1911. The Norwegians and the British dominated whaling into the mid 20th century, when overfishing again made it unprofitable for most nations, though not Japan and the Soviet Union, which became the chief whaling nations. Concern over the near extinction of many species led to the establishment in 1946 of the International Whaling Commission. Commercial whaling was prohibited altogether in 1986, but several nations refused to comply. At the beginning of the 21st century, Norway and Japan continued to hunt hundreds of nonendangered whales annually.

Wharton, Edith (Newbold) *orig.* **Edith Newbold Jones** (b. Jan. 24, 1862, New York, N.Y., U.S.—d. Aug. 11, 1937, Saint-Brice-sous-Forêt, near Paris, France) U.S. novelist and short-story writer. Born into upper-class society, she began writing a few years after her marriage in 1885. She lived in France after 1908 and was divorced in 1913. Her works examine the barriers of social convention, especially in the upper class, that stand in the way of individual happiness. Her close friendship with the older novelist HENRY JAMES did much to support and shape her work. The critical and popular success of her novel *The House of Mirth* (1905; film, 1918, 2000; for television, 1981) established her as a leading writer. She is perhaps best known for *Ethan Frome* (1911), which exploits the grimmer possibilities of New England farm life. Her other books include the novels *The Custom of the Country* (1913), *The Age of Innocence* (1920, Pulitzer Prize), and *The Buccaneers* (1938).

wheat Any of various CEREAL GRASSES in the genus *Triticum* of the Poaceae (or Gramineae) family, one of the oldest and most important of the cereal crops. More of the world's farmland is devoted to wheat than to any other food crop; China is the largest wheat producer. The plant has long, slender leaves, hollow stems in most varieties, and flowers grouped together in spikelets. Of the thousands of varieties known, the most important are *T. aestivum*, used to make bread; *T. durum*, used in making pasta; and *T. compactum* (club wheat), a softer type used for cake, crackers, cookies, pastries, and household flours. Winter wheat (sown in fall) and spring wheat (sown in spring or, where winters are mild, sometimes fall) are the two major types. The greatest portion of wheat flour is used for breadmaking. Small quantities are used in the production of starch, malt, gluten, alcohol, and other products. Inferior and surplus wheats and various milling by-products are used for livestock feeds.

Wheatley, Phillis (b. c. 1753, present-day Senegal or The Gambia?, West Africa—d. Dec. 5, 1784, Boston, Mass., U.S.) African American poet and the first African American to publish a book. She was kidnapped, transported to America, and sold from a slave ship in 1761 to John Wheatley, a Boston merchant. The Wheatleys taught her to read and write English and Latin. At about age 14 she began writing poetry modeled on ALEXANDER POPE and other Neoclassical writers. Her verse—exceptionally mature, if conventional, poetry that was largely concerned with morality and piety—attracted much attention. *Poems on Various Subjects, Religious and Moral* (1773), published in England, spread her fame to Europe. Freed in 1773, she married a free black man in 1778. She worked as a servant in her final years and died in poverty.

wheel Circular frame of hard material capable of turning on an axle. Wheels may be solid, partly solid, or spoked. The oldest known wheel was a wooden disk of planks held together by crosspieces. A pottery wheel or turntable was developed c. 3500 BC in Mesopotamia. The spoked wheel appeared c. 2000 BC on CHARIOTS in Asia Minor. Later developments included iron hubs that turned on greased axles. Perhaps the most important invention in human history, the wheel was essential to developing civilizations, and has remained essential to power generation, transportation, industrial manufacturing, and countless other applications.

wheel lock Device for igniting the powder in a firearm such as a MUSKET. Developed c. 1515, the wheel lock struck a spark to ignite powder in the pan of a musket by means of a holder that pressed a shard of flint or a piece of iron pyrite against an iron wheel with a milled edge; the wheel rotated and sparks flew. The principle was used in the design of the flint-and-wheel cigarette lighter. See also FLINTLOCK.

whelk Any marine SNAIL of the family Buccinidae, or a snail having a similar shell; found worldwide. Some whelks are called CONCHS. The sturdy shell of most species in the family is slender and has a wide opening in the first whorl. The animal feeds on other mollusks through its long proboscis; some species also kill fishes and crustaceans caught in commercial traps. Most are cold-water species; tropical species are smaller and more colourful. The common northern whelk (*Buccinum undatum*) has a stout pale shell about 3 in. (8 cm) long and is abundant in North Atlantic waters.

Northern whelk (*Buccinum undatum*)
INGMAR HOLMASEN

Whewell \'hyü-əl**, William** (b. May 24, 1794, Lancaster, Lancashire, Eng.—d. March 6, 1866, Cambridge, Cambridgeshire) British philosopher and historian. He spent most of his career at the University of Cambridge, where he taught mineralogy (1828–32) and moral philosophy (1838–55) and served as college master (1841–66). He is remembered primarily for his work on the theory of INDUCTION. He stressed the need to see scientific progress as a historical process, asserting that inductive reasoning could be employed properly only if its use throughout history was closely analyzed. His major works on induction are *History of the Inductive Sciences* (3 vol., 1837) and *Philosophy of the Inductive Sciences* (1840). See also problem of INDUCTION.

Whewell, plaster cast of bust by Edward Hodges Baily, 1851; in the National Portrait Gallery, London
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Whig Member of a political faction in England, particularly in the 18th century. Originally a term for Scottish Presbyterians, the name came to imply nonconformity and rebellion and was applied in 1679 to those who wanted to exclude James, the Catholic duke of York (later JAMES II), from succession to the throne of England. The Whigs were opposed by the TORY faction in that struggle but later represented the aristocratic, landowning families and financial interests of the wealthy middle classes. They maintained power through patronage and connections in PARLIAMENT, but there was no distinct party until 1784, when CHARLES JAMES FOX represented the interests of religious dissenters, industrialists, and others who sought parliamentary reform. After 1815 and following various party realignments, the political group became the LIBERAL PARTY.

Whig Party (1834–54) U.S. political party. Organized by opponents of Pres. ANDREW JACKSON, whom they called "King Andrew," the party took its name from the British antimonarchist party. The U.S. Whigs favoured a program of national development. Jackson's opposition to the Second BANK OF THE UNITED STATES (see BANK WAR) and NULLIFICATION in South Carolina allowed HENRY CLAY to bring fiscal conservatives and southern STATES' RIGHTS proponents together in a coalition with those who still believed in the National Republican program of a protective tariff and federally financed internal improvements. The party also included members of the former Anti-Masonic Party. The Whig's candidate, WILLIAM H. HARRISON, won the 1840 presidential election and the party captured Congress, but Harrison's premature death halted enactment of the Whig program (his vice president and successor, JOHN TYLER, vetoed much of the Whig's agenda). Clay was the party's unsuccessful candidate in the 1844 election. In 1848 it nominated ZACHARY TAYLOR, who won the presidency. The party began to split into the "conscience" (antislavery) and "cotton" (proslavery) Whigs and was further divided by the COMPROMISE OF 1850. Its

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nominee in the 1852 election, Winfield Scott, failed to win wide support as most Southern Whigs joined the Democratic Party. In 1854 most Northern Whigs joined the new Republican Party, though some joined the Know-Nothing Party.

whip-tailed ray See stingray

whippet Breed of hound dog developed in 19th-century Britain to chase rabbits in an arena. It was developed from terriers and English and Italian greyhounds, which it resembles. It stands 18–22 in. (46–56 cm), weighs about 28 lbs (13 kg), and has a smooth coat of gray, tan, or white. Capable of speeds up to 35 mph (56 kph), it is used for racing and for hunting small game. It is typically quiet and even-tempered.

Whippet
SALLY ANNE THOMPSON/EB INC.

Whipple, George H(oyt) (b. Aug. 28, 1878, Ashland, N.H., U.S.—d. Feb. 1, 1976, Rochester, N.Y.) U.S. pathologist. He studied medicine at Johns Hopkins University. He and George Minot discovered that raw liver fed to chronically bled dogs reversed anemia; this led to introduction of raw liver in the diet to treat pernicious anemia, for which the two men shared a 1934 Nobel Prize with William Murphy (1894–1987). Whipple's study of bile pigments led to an interest in how the body makes hemoglobin (important in bile pigment production). His experiments in artificial anemia (1923–25) established iron as the most potent inorganic factor in red-blood-cell formation.

whippoorwill Species (*Caprimulgus vociferus*) of nocturnal North American bird, similar to the nightjar, named for its resonant "whip-poor-will" call (first and third syllables accented), which it may repeat 400 times without stopping. It lives in woods near open country, where it catches insects on the wing around dusk and dawn. By day it sleeps on the forest floor or perches lengthwise on a branch. About 10 in. (25 cm) long, it has mottled brownish plumage; the male has a white collar and white tail corners. It winters as far south as Costa Rica.

whiskey *or* **whisky** Any of several distilled liquors made from a fermented mash of cereal grains. Whiskeys are distinctive because of differences in raw materials and production methods. All are aged in wooden containers. The earliest direct account of whiskey making is found in Scottish records from 1494. Scotch whisky (this spelling is also used by Canadians) is usually somewhat light in body, with a distinctive smoky malt flavour; it is made primarily from malted barley that has been heated over a peat fire, fermented, distilled, and blended with similar whiskies made by different distillers. Irish whiskeys, lighter-bodied and lacking any smoky flavor, are not malt-fired and may be mixed with neutral grain spirits. Canadian whisky, light in colour and flavour, is a blend of highly flavoured and neutral grain whiskies. In the U.S., the largest producer and consumer of whiskey, both straight (at least 51% single-mash) and blended whiskeys are produced, derived from both sour and sweet mashes. (Sour mashes are fermented with both fresh and previously fermented yeast; sweet mashes employ only fresh yeast.) Bourbon, first produced in Bourbon Co., Ky., is a full-bodied unblended whiskey derived from a sour mash of corn grain. Whiskeys are consumed both unmixed and in cocktails, punches, and other beverages.

Whiskey Rebellion (1794) American uprising to protest a federal liquor tax. Farmers in western Pennsylvania rebelled against paying a tax on their locally distilled whiskey and attacked federal revenue collectors. After 500 armed men burned the home of the regional tax inspector, Pres. George Washington ordered 13,000 federal troops to the area. The rebellion quickly dissolved without further violence. The event established the authority of federal law within the states and strengthened support for the Federalists' advocacy of a strong central government.

Whiskey Ring (1875) Group of U.S. whiskey distillers who defrauded the government of taxes. The ring operated mainly in St. Louis, Milwaukee, and Chicago and kept liquor taxes after bribing Internal Revenue officials in Washington, D.C. A secret investigation by the U.S. Treasury Department resulted in 238 indictments and 110 convictions. While not involved, Pres. Ulysses S. Grant was tarnished by the scandal; his private secretary, Orville E. Babcock, was indicted but acquitted on Grant's testimony. The Republican Party allegedly received some of the illegally held tax money.

whist Card game. It belongs to a family that includes bridge whist and bridge, each of which developed in succession from the original game of whist. The essential features of card games in the whist family are: four people usually play, two against two as partners; a full 52-card deck is dealt out evenly so that each player holds 13 cards; the object of play is to win tricks, and win or loss is determined by the number of tricks taken (as distinct from games such as pinochle, in which it is determined by the value of card points taken in tricks). Whist originated in 17th-century England.

whistler See goldeneye

Whistler, James (Abbott) McNeill (b. July 14, 1834, Lowell, Mass., U.S.—d. July 17, 1903, London, Eng.) U.S.-born British painter, etcher, and lithographer. He attended West Point but soon abandoned the army for art. In 1855 he arrived in Paris to study painting and adopted a bohemian lifestyle. In 1863 he moved to London, where he had considerable success, becoming widely famous for his wit and large public presence. During the 1860s and '70s he began to use musical terms in the titles of his paintings, such as *Symphony* and *Harmony*, reflecting his belief in the "correspondences" between the arts. During this period he started to paint his "nocturnes"—scenes of London, especially of Chelsea, that have poetic intensity. For them he evolved a special technique by which paint, in a very liquid state he called a sauce, was stroked onto the canvas in fast sweeps of the brush, somewhat in the manner of Japanese calligraphy (he was an outspoken advocate of Japanese arts). From the 1870s onward he was preoccupied by the problems of portrait painting, creating a number of masterpieces, including *Arrangement in Grey and Black, No. 1: The Artist's Mother* (1871–72), known as *Whistler's Mother*. These paintings underline his aestheticism, his liking for simple forms and muted tones, and his dependence on the 17th-century Spanish painter Diego Velázquez. In 1877 he brought a libel suit against John Ruskin for attacking his *Nocturne in Black and Gold: The Falling Rocket* (1875); he won his case but received damages of only a farthing, and the costs of the suit temporarily bankrupted him. Considered one of the leading painters of his day, after his death his reputation declined. Only in the later 20th century did Whistler begin to receive serious acclaim once again.

whistling swan Species (*Cygnus columbianus*) of North American swan that calls with a soft, musical note. It has a black bill, usually with a small yellow spot near the eye. It breeds in the Arctic tundra and winters in shallow fresh or salt water, especially along eastern and western U.S. coasts.

Whitby, Synod of Meeting of the Christian church of the Anglo-Saxon kingdom of Northumbria in 664 or, possibly, 663, to decide whether to follow Celtic or Roman usages, which had been reintroduced to southern England by St. Augustine of Canterbury in 597. Though Northumbria had been mainly converted by Celtic missionaries, the king decided for Rome, believing that Rome followed the teaching of St. Peter, holder of the keys to heaven. The decision contributed to the unification of the English church and brought it into close contact with the rest of Europe.

White, Byron R(aymond) (b. June 8, 1917, Fort Collins, Colo., U.S.—d. April 15, 2002, Denver, Colo.) U.S. jurist. An accomplished athlete, he played football with the Pittsburgh Pirates (now Steelers) and the Detroit Lions. He attended the University of Oxford as a Rhodes scholar before studying law at Yale. White clerked for Fred M. Vinson and later practiced corporate law in Colorado. In 1961 he was named deputy U.S. attorney general by Pres. John F. Kennedy, and the following year he was appointed to the U.S. Supreme Court. His opinions and votes on the court were generally moderate to conservative. He retired in 1993.

White, E(lwyn) B(rooks) (b. July 11, 1899, Mount Vernon, N.Y., U.S.—d. Oct. 1, 1985, North Brooklin, Maine) U.S. essayist and literary stylist. White attended Cornell University and in 1927 joined *The New Yorker*; he would contribute to it and later to *Harper's* magazine over several decades. He collaborated with James Thurber on *Is Sex Necessary?* (1929). His novels *Stuart Little* (1945), *Charlotte's Web* (1952), and *The Trumpet of the Swan* (1970) are classics of children's literature. White's revision of *The Elements of Style* (1959) by his professor William Strunk became a standard style manual for writers. He received a Pulitzer Prize special citation in 1978.

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White, James (Springer) and Ellen (Gould) *orig.* **Ellen Gould Harmon** (respectively b. April 8, 1821, Palmyra, Me., U.S.—d. June 8, 1881, Battle Creek, Mich.; b. Nov. 26, 1827, Gorham, Me.—d. July 16, 1915, St. Helena, Cal.) Cofounders of the Seventh-Day Adventists. James was a schoolteacher and then a minister who accepted the Adventist views of William Miller (1782–1849). He married Ellen Harmon in 1846; she had become a Millerite in 1840, at 13. A visionary, Ellen had more than 2,000 visions before she died; these helped guide the Seventh-Day Adventist Church, which was formed in 1863. They preached together until James's death. Ellen continued, speaking on many subjects, notably temperance, and was regarded by some as a prophet. Of her many books, the best known is *Steps to Christ*.

White, John (fl. 1585–93) British artist, explorer, and North American colonist. He sailed on an expedition to Greenland in 1577 and returned to England with sketches of the land and its people. His 1585 trip to colonize Roanoke was sponsored by Sir Walter Raleigh. White's paintings and sketches illustrated a report of the region after the colony was abandoned (1586). He was appointed governor of a second colony and arrived at Roanoke with 100 colonists (1587). He returned to England for supplies that year but was unable to send a relief expedition to Roanoke until 1590; the expedition found no trace of the colonists, including White's granddaughter, Virginia Dare.

White, Minor (b. July 9, 1908, Minneapolis, Minn., U.S—d. June 24, 1976, Cambridge, Mass.) U.S. photographer and editor. He began to photograph seriously in 1938 when he went to work for the Works Progress Administration. In 1946 he studied with Edward Weston and Alfred Stieglitz before moving to San Francisco, where he worked closely with Ansel Adams. He succeeded Adams as head of the photography department at the California School of Fine Arts and later taught at MIT. He founded and edited (1952–76) the photography magazine *Aperture* and also edited *Image* (1953–57). His efforts to extend photography's range of expression made him one of the century's most influential photographers.

White, Patrick (Victor Martindale) (b. May 28, 1912, London, Eng.—d. Sept. 30, 1990, Sydney, N.S.W., Austrl.) Australian writer. As a youth White moved between Australia and England, where he attended Cambridge University. After serving in the Royal Air Force during World War II, he returned to Australia, which he saw as a country in a volatile process of growth and self-definition. His somewhat misanthropic novels often explore the possibilities of savagery in that context; they include *The Tree of Man* (1955), *Voss* (1957), *Riders in the Chariot* (1961), and *The Twyborn Affair* (1979). His other works include plays and short stories, the latter collected in *The Burnt Ones* (1964) and *The Cockatoos* (1974). He was awarded the Nobel Prize for Literature in 1973.

White, Stanford (b. Nov. 9, 1853, New York, N.Y., U.S.—d. June 25, 1906, New York City) U.S. architect. He trained with Henry Hobson Richardson. In 1880 he formed an architectural firm with Charles F. McKim and William R. Mead that soon became the most famous in the country, known especially for its Shingle-style country and seaside mansions. The firm later led the U.S. trend toward Neoclassical architecture. White's design for the Casino (1881) at Newport, R.I., exhibited his characteristic use of gracefully proportioned structures and Italian Renaissance ornamentation. His New York commissions included Madison Square Garden (1891) and the Washington Arch (1891). A versatile artist, he also designed jewelry, furniture, and interiors. An extrovert noted for his lavish entertainments, he was shot to death at Madison Square Garden by Harry Thaw, the husband of the showgirl Evelyn Nesbit, with whom White had had a love affair.

White, T(erence) H(anbury) (b. May 29, 1906, Bombay, India—d. Jan. 17, 1964, Piraeus, Greece) English novelist, social historian, and satirist. Educated at Cambridge University, White was working as a teacher when he attained his first critical success with the autobiographical *England Have My Bones* (1936). He later devoted himself to writing, studying subjects such as Arthurian legend while living a largely reclusive life. He is best known for his adaptation of Sir Thomas Malory's *Le Morte Darthur* in the tetralogy *The Once and Future King* (1958), comprising *The Sword in the Stone* (1938), *The Queen of Air and Darkness* (originally *The Witch in the Wood*, 1939), *The Ill-Made Knight* (1940), and *The Candle in the Wind* (1958).

White, Theodore H(arold) (b. May 6, 1915, Boston, Mass., U.S.—d. May 15, 1986, New York, N.Y.) U.S. journalist, historian, and novelist. White became one of *Time* magazine's first foreign correspondents, serving in East Asia (1939–45) and later as a European correspondent. He is best known for his accounts of two presidential elections, *The Making of the President, 1960* (1961, Pulitzer Prize) and *The Making of the President, 1964* (1965), and for associating the short-lived presidency of John F. Kennedy with the legend of Camelot. His intimate style of journalism, centring on the personalities of his subjects, strongly influenced the course of political journalism and campaign coverage.

White, William Allen (b. Feb. 10, 1868, Emporia, Kan., U.S.—d. Jan. 29, 1944, Emporia) U.S. journalist. White purchased the *Emporia Daily and Weekly Gazette* in 1895. His editorial writing was a mixture of tolerance, optimism, liberal Republicanism, and provincialism. His widely circulated 1896 editorial "What's the Matter with Kansas?" was credited with helping elect William McKinley president. He also wrote fiction, biographies, and an autobiography. His son and successor, William Lindsay White (1900–73), wrote one of the best-selling books on World War II, *They Were Expendable* (1942).

white blood cell See leukocyte

white butterfly Any of several lepidopteran species of the family Pieridae that are found worldwide. Adults have a wingspan of 1.5–2.5 in. (38–63 mm); the wings are white, with black marginal markings. The pattern and colour of many species vary with sex and season. Many of the green, slender larvae, most of which are covered with a short down, or pile, are pests of garden crops. The pupae are attached to a twig by a posterior spine and a girdle of silk. See also cabbage white.

White butterfly (*Pieris brassicae*).
CHR LEDERER-BAVARIA-VERLAG

white cedar In the lumber trade, the American arborvitae, some species of false cypress (genus *Chamaecyparis*) and McNab cypress, incense cedar (*Calocedrus decurrens*), and California juniper, all in the cypress family. Nonconiferous trees that are called white cedar include the chinaberry (*Melia azedarach*, mahogany family) and some members of the plant families Bignoniaceae (trumpet creepers), Celastraceae (staff trees), Myristicaceae (nutmegs), Burseraceae, and Dipterocarpaceae. Botanically, white cedar is *Chamaecyparis thyoides*, a picturesque tree with purple cones, native to North America and East Asia. The wood is used for carpentry, pencils, storage chests, interiors, and fence posts.

white dwarf star Any of a class of small, faint stars representing the end point of the evolution of stars without enough mass to become neutron stars or black holes. Named for the white colour of the first ones discovered, they actually occur in a variety of colours depending on their temperature. They are extremely dense, typically containing the mass of the Sun within the volume of the Earth. White dwarfs have exhausted all their nuclear fuel and cannot produce heat by nuclear fusion to counteract their own gravity, which compresses the electrons and nuclei of their atoms until they prevent further gravitational contraction. When a white dwarf's reservoir of thermal energy is exhausted (after several billion years), it stops radiating and becomes a cold, inert stellar remnant, sometimes called a black dwarf. White dwarf stars are predicted to have an upper mass limit, known as the Chandrasekhar limit (see Subrahmanyan Chandrasekhar), of about 1.4 times the Sun's mass. Dying stars that are more massive undergo a supernova explosion. As members of binary stars, white dwarf stars play an essential role in the outbursts of novas.

white-footed mouse See deer mouse

White Horse, Vale of the Valley, Oxfordshire, England. It is named for the White Horse, a gigantic (374 ft [114 m] long) prehistoric figure of a horse formed by cutting away the turf on the side of a chalk hill. A number of other prehistoric remains are in the vicinity, including the megalith known as Wayland's Smithy. Wantage, an ancient market town in the valley, is said to be the birthplace of Alfred the Great.

White House Official residence of the U.S. president, in Washington, D.C. It has been the home of every president since John Adams. In 1791 James Hoban (1762–1831) won the commission to build the presidential residence with his plan for a Georgian mansion in the style of Andrea Palladio. The structure, to be built of gray sandstone, was to have more

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than 100 rooms. The British burned it in 1814, but it was rebuilt and enlarged under Hoban's direction. In the 1820s, Hoban added eastern and western terraces as well as a semicircular southern portico and a colonnaded northern portico. The later addition of the West Wing (1902) and East Wing (1942) provided additional office space. Theodore Roosevelt adopted "White House" as the building's official name in 1902. Its public areas are toured by about 1.5 million people every year.

White Lotus Chinese Buddhist millenarian movement that was often persecuted because of its association with rebellion. The movement had roots in 4th-century worship of the Buddha Amitabha, whose devotional cult inspired Mao Ziyuan to form the White Lotus Society, a pious vegetarian group of monks and laity. By the 14th century it had developed into a millenarian sect that combined Maitreyan and Manichaean beliefs and was active in rebellions at the end of the Yuan dynasty. The society became most prominent through its role in the White Lotus Rebellion (1786–1804), a large-scale uprising in central China that contributed to the fall of the Qing dynasty. It was eventually put down by peasants organized into local militia defense corps. Later Chinese governments came to use the term White Lotus for all illegal millenarian groups. Some observers saw the Nian Rebellion of 1852 as well as the secret society behind the Boxer Rebellion as new manifestations of the White Lotus Society.

White Monk See Cistercian

White Mountain, Battle of (1620) Decisive battle near Prague at the beginning of the Thirty Years' War. The Catholic forces of Maximilian I, duke of Bavaria, commanded by count von Tilly, defeated the Protestant forces of Frederick V, king of Bohemia. By the defeat, Bohemia lost its independence, and Protestantism was exterminated until 1648.

White Mountains Segment of the Appalachian Mountains. It extends 87 mi (140 km) across north-central New Hampshire and into western Maine. Containing the highest elevations in the northeastern U.S., its loftiest peaks, mostly 5,000–6,000 ft (1,500–1,800 m) high, occur in a series of summits that are named for U.S. presidents and make up the Presidential Range. The highest point is Mount Washington. Most of the White Mountains lie within the White Mountain National Forest. It is a popular summer and winter resort area.

White Nile See Nile River

White River River, Arkansas, U.S. It rises in the Boston Mountains in northwestern Arkansas, flows north into southern Missouri, then bends southeast and reenters Arkansas. It continues south to join the Arkansas River near its confluence with the Mississippi River. It is 685 mi (1,102 km) long.

White Sands National Monument National monument, south-central New Mexico, U.S. Established in 1933, it covers 225 sq mi (583 sq km) and lies between the San Andres and the Sacramento mountains. Its white gypsum sand constantly drifts into dunes 10–60 ft (3–18 m) high. The San Andres National Wildlife Refuge, White Sands Missile Range, and Holloman Air Force Base are nearby.

White Sea Sea, extension of the Arctic Ocean, northwestern Russia. Almost landlocked, it is connected to the more northerly Barents Sea by a long, narrow strait known as the Gorlo. It covers an area of approximately 35,000 sq mi (90,000 sq km) and has a maximum depth of 1,115 ft (340 m). Rivers, including the Northern Dvina and Onega, flow into it. An important transportation route, it remains navigable year-round with the help of icebreakers in winter. Arkhangelsk is one of the principal ports.

white shark See great white shark

white-tailed deer *or* **Virginia deer** Common reddish brown deer (*Odocoileus virginianus*), an important game animal found alone or in small groups from southern Canada to South America. The tail, white on the underside, is held aloft when the deer is alarmed or running. The male has forwardly curved antlers with several unbranched tines. Northern white-tailed deer grow up to 3.5 ft (107 cm) tall and weigh up to 400 lbs (180 kg). The white-tailed deer lives in open woodlands (young and cutover forests) and on the fringes of urban areas and farmlands, and eats leaves, twigs, fruits, nuts, lichen, and fungi.

White-tailed deer buck (*Odocoileus virginianus*)
KARL H. MASLOWSKI

White Volta River River, Burkina Faso and Ghana, western Africa. It rises in Burkina Faso (where it is known as the Nakambé) and flows southwest for about 400 mi (640 km) to empty into Lake Volta in Ghana. It is a headstream of the Volta River.

whitefish Any of several silvery food fishes (family Salmonidae, or Coregonidae), inhabiting cold northern lakes of Europe, Asia, and North America. Whitefish weigh about 2–5 lbs (1–2 kg); they eat insect larvae and other small animals. The Lake Superior whitefish (*Coregonus clupeaformis*), also called whiting or shad, is the largest of the lake whitefishes. Ciscoes, or lake herring (*Coregonus artedi*), are herringlike food and sport fishes. The best sport fishes of the family are the Rocky Mountain whitefish (*Prosopium williamsoni*) and other round whitefishes.

whitefly Any sap-sucking member of the insect family Aleyrodidae (order Homoptera). Nymphs are flat, oval, and usually covered with a cottony substance. Adults, 0.08–0.12 in. (2–3 mm) long, are covered with a white opaque powder and resemble moths. Whiteflies are abundant in warm climates, on houseplants, and in greenhouses. The greenhouse whitefly is one of the most abundant and destructive members of the family. The citrus whitefly and citrus blackfly damage fruit and other crops by sucking sap and producing honeydew, a by-product of digestion on which grows a sooty fungus that ruins fruit and reduces the host plant's ability to photosynthesize.

Whitehead, Alfred North (b. Feb. 15, 1861, Ramsgate, Isle of Thanet, Kent, Eng.—d. Dec. 30, 1947, Cambridge, Mass., U.S.) British mathematician and philosopher. He taught principally at the University of Cambridge (1885–1911) and Harvard University (1924–37). His *Treatise on Universal Algebra* (1898) extended Boolean symbolic logic. He collaborated with Bertrand Russell on the epochal *Principia Mathematica* (1910–13), which attempted to establish the thesis of logicism. In *Process and Reality* (1929), his major work in metaphysics, he proposed that the universe consists entirely of becomings, each a process of appropriating and integrating the infinity of items provided by the antecedent universe and by God. His other works include "On Mathematical Concepts of the Material World" (1905), *An Introduction to Mathematics* (1911), *Enquiry Concerning the Principles of Natural Knowledge* (1919), *The Concept of Nature* (1920), *Science and the Modern World* (1925), and *Religion in the Making* (1926). He received the Order of Merit in 1945.

Whitehorse City (pop., 2001: 19,058), capital of Yukon Territory, Canada. Located on the Yukon River, it was founded during the Klondike gold rush (1897–98) as a staging and distribution centre. Robert Service got much of his inspiration for his ballads while working there. The territorial capital since 1952, it is an important transportation centre on the Alaska Highway, as well as an outfitting base for anglers and hunters.

Whiteman, Paul (b. March 28, 1890, Denver, Colo., U.S.—d. Dec. 29, 1967, Doylestown, Pa.) U.S. musician and bandleader. Whiteman made his first records in 1920. His instrumental concept, known as "symphonic jazz," featured lush harmonies and simplified jazz rhythms but little improvisation; he nevertheless became known as "The King of Jazz." Whiteman commissioned George Gershwin's *Rhapsody in Blue* and conducted its premiere in 1924. The Whiteman band featured, among others, Bing Crosby, Bix Beiderbecke, and Jack Teagarden. His popularity waned in the late 1940s, but he was a television-series host in the 1950s and occasionally led bands up to the time of his death.

whiting Species (*Merlangius merlangus*) of common marine food fish of the cod family (Gadidae), found in European waters and especially abundant in the North Sea. It feeds on invertebrates and small fishes. It has three dorsal and two anal fins; a chin barbel (a slender, fleshy feeler), if present, is very small. Whitings grow to less than 30 in. (70 cm) long. They are silvery, with a distinctive black blotch near the base of each pectoral fin. Several species of the family Sciaenidae are also called whiting. See also whitefish.

Whitman, Marcus (b. Sept. 4, 1802, Rushville, N.Y., U.S.—d. Nov. 29, 1847, Waiilatpu, Oregon Territory) U.S. missionary and pioneer. A physician and Congregational missionary, he was sent to the Oregon region after offering his services to the American Board of Commissioners for Foreign Missions. In 1836 he and his wife founded a mission among the Cayuse Indians near present-day Walla Walla, Wash. He helped the Indians build houses and a corn-grinding mill, and his wife opened a

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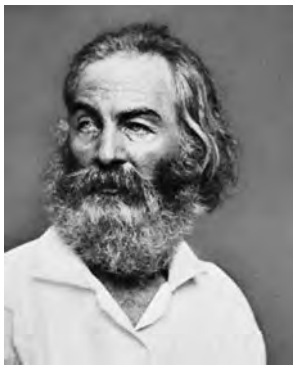
mission school. In 1842 he traveled east to encourage settlement of the Oregon country. On his return he joined a caravan of 1,000 immigrants to the Columbia River valley. He cared for Indian children in an 1847 measles epidemic, but he was accused of sorcery when many died while white children survived. The Indians attacked the whites and massacred 14, including the Whitmans. Their deaths led Congress to organize the Oregon Territory in 1848.

Whitman, Walt(er) (b. May 31, 1819, West Hills, Long Island, N.Y., U.S.—d. March 26, 1892, Camden, N.J.) U.S. poet, journalist, and essayist. Whitman lived in Brooklyn as a boy and left school at age 12. He went on to hold a great variety of jobs, including writing and editing for periodicals. His revolutionary poetry dealt with extremely private experiences (including sexuality) while celebrating the collective experience of an idealized democratic American life. His *Leaves of Grass* (1st ed., 1855), revised and much expanded in successive editions that incorporated his subsequent poetry, was too frank and unconventional to win wide acceptance in its day, but it was hailed by figures such as Ralph Waldo Emerson and exerted a strong influence on American and foreign literature. Written without rhyme or traditional metre, poems such as "I Sing the Body Electric" and "Song of Myself" assert the beauty of the human body, physical health, and sexuality; later editions included "Crossing Brooklyn Ferry," "Out of the Cradle Endlessly Rocking," and the elegies on Abraham Lincoln "O Captain! My Captain!" and "When Lilacs Last in the Dooryard Bloom'd." Whitman served as a volunteer in Washington hospitals during the Civil War. The prose *Democratic Vistas* (1871) and *Specimen Days & Collect* (1882–83) drew on his wartime experiences and subsequent reflections. His powerful influence in the 20th century can be seen in the work of poets as diverse as Pablo Neruda, Fernando Pessoa, and Allen Ginsberg.



Walt Whitman, photograph by Mathew Brady.
LIBRARY OF CONGRESS, WASHINGTON, D.C.

Whitney, Amos (b. Oct. 8, 1832, Biddeford, Maine, U.S.—d. Aug. 5, 1928, Portland, Maine) U.S. manufacturer. He was apprenticed at age 13. In 1860, with Francis Pratt, he founded the firm of Pratt & Whitney, originally to manufacture thread spoolers. It later diversified into the manufacture of innovative designs of guns, cannons, sewing machines, and typesetting machines; instruments for measurement developed there proved of great value to science and industry. Today a separate company, formed from the toolworks in 1925, produces aircraft engines and space-propulsion systems as part of the United Technologies Corporation.

Whitney, Eli (b. Dec. 8, 1765, Westboro, Mass., U.S.—d. Jan. 8, 1825, New Haven, Conn.) U.S. inventor, engineer, and manufacturer. He is best remembered as the inventor of the cotton gin (1793), which led to greatly increased production of the short-staple cotton grown in much of the South, making the region prosperous. The most important innovation credited to Whitney may be the concept of mass production of interchangeable parts. His idea of manufacturing quantities of identical parts for assembly into muskets, after undertaking in 1797 to supply the U.S. government with 10,000 muskets in two years, helped inaugurate the vastly important American System of manufacture.

Whitney, Gertrude Vanderbilt *orig.* **Gertrude Vanderbilt** (b. Jan. 9, 1875, New York, N.Y., U.S.—d. April 18, 1942, New York City) U.S. sculptor and art patron. Great-granddaughter of Cornelius Vanderbilt, she was born to great wealth and studied sculpture in New York City and Paris. Among her major works were the *Titanic Memorial* (1914–31) in Washington, D.C., and *Victory Arch* (1918–19) in New York. All her works were simple, direct, and traditional. In 1929 she offered to donate her collection of about 500 works by modern American artists to the Metropolitan Museum of Art but was refused by the traditionalist director. The next year she founded the Whitney Museum of American Art, also in New York City, which opened in 1931; today it is the foremost museum of American art.

Whitney, John Hay (b. Aug. 17, 1904, Ellsworth, Maine, U.S.—d. Feb. 8, 1982, Manhasset, N.Y.) U.S. multimillionaire and sportsman. The son of Harry Payne Whitney and Gertrude Vanderbilt Whitney, "Jock" Whitney attended Yale University and later the University of Oxford, which he left to manage the family fortune on his father's death. He became an internationally ranked polo player, his stables produced notable racehorses, he invested in successful films and Broadway plays, and he boasted one of the finest art collections in the U.S. As a combat-intelligence captain in World War II, he was captured in France but escaped; he was later awarded the Legion of Merit. He served as ambassador to Britain (1956–61). As publisher and (from 1961) editor in chief of the *New York Herald Tribune*, he tried to revitalize the paper, but it folded in 1966. He founded the John Hay Whitney Foundation in 1946.

Whitney, Mount Peak in the Sierra Nevada, southeast-central California, U.S. Located in Sequoia National Park, it is 14,494 ft (4,418 m) high, the highest point in the continental U.S. outside of Alaska. It was first climbed in 1873.

Whitney, William C(ollins) (b. July 5, 1841, Conway, Mass., U.S.—d. Feb. 2, 1904, New York, N.Y.) U.S. politician. He practiced law in New York City, where he helped Samuel Tilden overthrow the corrupt political boss William Marcy Tweed; he also served as corporation counsel for the city (1875–82). As U.S. secretary of the navy (1885–89), he rebuilt the neglected fleet with a major shipbuilding program that included the battleship *Maine* (see destruction of the *Maine*). He returned to New York, where he became co-owner of the city's first rapid-transit system.

Whittier, John Greenleaf (b. Dec. 17, 1807, near Haverhill, Mass., U.S.—d. Sept. 7, 1892, Hampton Falls, Mass.) U.S. poet and reformer. A Quaker born on a farm, Whittier had limited education but was early acquainted with poetry. He became involved in journalism and published his first volume of poems in 1831. During 1833–42 he embraced the abolitionism of William Lloyd Garrison and became a prominent antislavery crusader. Thereafter he continued to support humanitarian causes while publishing further poetry volumes. After the Civil War he was noted for his vivid portrayals of rural New England life. His best-known poem is the nostalgic pastoral "Snow-Bound" (1866); others include "Maud Muller" (1854) and "Barbara Frietchie" (1863).

Whittington, Richard *known as* **Dick Whittington** (d. March 1423, London) Lord mayor of London (1397–99, 1406–07, 1419–20). The son of a knight, he earned a vast fortune as a merchant and made loans to Henry IV and Henry V, then entered city politics and served three terms as lord mayor. In legend he is portrayed as an orphan who ventures his only possession, a cat, as an item to be sold on one of his master's trading ships. Ill-treated by the cook, he runs away, but at the edge of the city he hears the bells say, "Turn again, Whittington, lord mayor of great London." He returns to find that his cat has been sold for a great sum to a Moorish ruler plagued by rats. He becomes a wealthy merchant and later lord mayor.

Whittle, Sir Frank (b. June 1, 1907, Coventry, Warwickshire, Eng.—d. Aug. 8, 1996, Columbia, Md., U.S.) British aviation engineer and pilot who invented the jet engine. He obtained his first patent for a turbojet engine in 1930, and in 1936 he cofounded Power Jets Ltd. The outbreak of World War II spurred the British government to support Whittle's work, and the first jet-powered aircraft took off in 1941. He was knighted in 1948 and awarded the Order of Merit in 1986.

Whitworth, Sir Joseph (b. Dec. 21, 1803, Stockport, Cheshire, Eng.—d. Jan. 22, 1887, Monte-Carlo, Monaco) British mechanical engineer. Working for Henry Maudslay, he devised a scraping technique for making a true plane surface. He followed this with a measuring machine and a system of accurate dimensional standards or master gauges to go with it, and screws with standardized threads (1841), among other innovations. His machine tools became internationally known for their accuracy and quality.

WHO See World Health Organization

wholesaling Selling of merchandise to anyone other than a retail customer. The term may include sales to a retailer, wholesaler, broker, distributor, or business enterprise. Wholesaling usually involves sales in quantity and at a cost significantly lower than the average retail price. It has become an important step in the supply chain since the introduction of mass production and mass marketing techniques in the 19th century. Without wholesalers, manufacturers would have to market their products directly to a huge number of customers at high unit costs, and buyers would have to deal with an inconveniently large number of suppliers.

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There are three major categories of wholesalers. Merchant wholesalers, the most important category, are independent businesses that buy merchandise in great quantities from manufacturers and resell it to retailers. Manufacturers' sales branches are businesses founded by manufacturers to sell directly to retailers. Merchandise agents and brokers represent various manufacturers; they usually do not buy the merchandise they handle but instead arrange for shelf space and the display of merchandise. So-called warehouse stores sell large quantities of goods at near-wholesale prices. See also RETAILING.

whooping cough *or* **pertussis** Acute, very contagious childhood disease, typically with bouts of coughing followed by a long, loud inhalation (whoop) and ending with mucus expulsion and often vomiting. Caused by the bacterium *Bordetella pertussis*, it initially resembles a cold with a short dry cough. Within one or two weeks, coughing bouts begin; this phase usually lasts four to six weeks. Serious complications include bronchopneumonia (PNEUMONIA involving the bronchi), asphyxia, seizures, and signs of brain damage. Treatment is with antibiotics. The pertussis vaccine is usually combined with tetanus and diphtheria toxoids as part of routine childhood immunizations.

whooping crane Migratory North American bird (*Grus americana*) and one of the world's rarest birds, on the verge of extinction. The tallest North American bird, it is almost 5 ft (150 cm) tall and has a wingspread of about 7 ft (210 cm). It is white with black-tipped wings, black legs, and a bare red face and crown. Its shrill, whooping call can be heard for 2 miles (3 km). Almost exterminated in the early 20th century, it became the object of intensive conservation efforts; by century's end there were still fewer than 300 wild and captive individuals. See also SANDHILL CRANE.

Whooping crane (*Grus americana*).
H. WILLIAM BELKNAP

Whorf \'wôrf**, Benjamin Lee** (b. April 24, 1897, Winthrop, Mass., U.S.—d. July 26, 1941, Wethersfield, Conn.) U.S. linguist. He worked professionally as a fire-prevention authority. The concept he developed (under EDWARD SAPIR's influence) of the equation of culture and language became known as the Whorf (or Sapir-Whorf) hypothesis. He maintained that a language's structure tends to condition the ways its speakers think—for example, that the way a people views time and punctuality may be influenced by the types of verb TENSES in its language. Whorf was also noted for his studies of UTO-AZTECAN LANGUAGES, especially Hopi, and MAYAN HIEROGLYPHIC WRITING.

Whymper \'hwim-pər**, Edward** (b. April 27, 1840, London, Eng.—d. Sept. 16, 1911, Chamonix, Fr.) British mountaineer and artist. He became a mountaineer after making sketches for a book on the Alps. In 1865 he made the first ascent of the MATTERHORN; an accident on the descent caused the death of four of his companions. His *Scrambles Amongst the Alps* (1871) and *Travels Amongst the Great Andes* (1892) describe his experiences and are illustrated with his own engravings.

Wicca Modern Western witchcraft movement. Some practitioners consider Wicca the religion of pre-Christian Europe, forced underground by the Christian church. That thesis is not accepted by historians, and modern Wicca is usually dated to the work of Gerald B. Gardner (1884–1964) and Doreen Valiente (1922–1999), who, after the repeal of the last Witchcraft Act in England (1951), went public with their cult of witchcraft, which centered on a horned god of fertility and a great earth goddess. Gardner is credited with introducing the term Wicca. So-called "Dianic" Wicca focuses on the Goddess as the supreme being and usually excludes men. Wiccans share a belief in the importance of the feminine principle, a deep respect for nature, and a pantheistic and polytheistic worldview. They practice some form of ritual magic, almost always considered good or constructive. Some are solitary practitioners; others belong to covens.

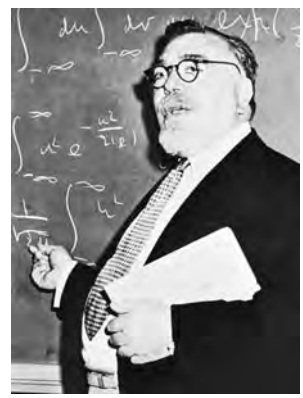
Wichita \'wi-chə-ˌtȯ\ City (pop., 2000: 344,284), south-central Kansas, U.S. On the ARKANSAS RIVER, the city was founded in 1864 as a trading post on the site of a Wichita Indian village; it developed with the Texas cattle trade along the CHISHOLM TRAIL and the rapid spread of agricultural settlement along the ATCHISON, TOPEKA AND SANTA FE Railroad Co. In the 1870s it was a major cattle-shipping centre. It developed as a centre of the aircraft industry in the 1920s. Aircraft construction continues; other economic activities include oil refining, grain processing and storage, and livestock marketing.

Wideman, John Edgar (b. June 14, 1941, Washington, D.C., U.S.) U.S. writer and educator. After graduating from the University of Pennsylvania he became the second African American to receive a Rhodes scholarship to Oxford University. He published his first novel, *A Glance Away*, in 1967. His first work of nonfiction was the acclaimed *Brothers and Keepers* (1984), in which he examines his relationship with his brother, who is serving a life sentence in prison. He won PEN/Faulkner Awards for *Sent for You Yesterday* (1983) and *Philadelphia Fire* (1990), a fictional account of the bombing of the militant black group MOVE combined with an examination of his relationship with his son, now in prison.

widgeon See WIGEON

Wieland \'vē-ˌlänt**, Heinrich Otto** (b. June 4, 1877, Pforzheim, Ger.—d. Aug. 5, 1957, W.Ger.) German chemist. He won a 1927 Nobel Prize for research on BILE acids which showed that the three acids then isolated had similar structures and were also structurally related to CHOLESTEROL. He also found that different forms of nitrogen in organic compounds can be detected and distinguished from each other, an important contribution to structural organic chemistry. Wieland's theory that oxidation in living tissues occurs through removal of hydrogen atoms, not addition of oxygen (see OXIDATION-REDUCTION), was of great importance to physiology, biochemistry, and medicine.

Wiener \'wē-nər**, Norbert** (b. Nov. 26, 1894, Columbia, Mo., U.S.—d. March 18, 1964, Stockholm, Swed.) U.S. mathematician. He earned a Ph.D. from Harvard at 18. He joined the faculty of MIT in 1919. His work on generalized harmonic analysis and Tauberian theorems (which deduce the convergence of an infinite series) won the American Mathematical Society's Bôcher Prize in 1933. The origin of CYBERNETICS as an independent science is generally dated from the 1948 publication of his *Cybernetics*. He made contributions to such areas as stochastic processes, quantum theory, and, during World War II, gunfire control. Crater Wiener on the Moon is named for him.



Norbert Wiener.
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Wiener Werkstätte \'vē-nər-'verk-ˌshtet-ə\ *English* **Vienna Workshops** Cooperative enterprise for crafts and design founded in Vienna in 1903. Inspired by WILLIAM MORRIS and the English ARTS AND CRAFTS MOVEMENT, it was founded by Koloman Moser and JOSEF HOFFMANN with the goal of restoring the values of handcraftsmanship to an industrial society in which such crafts were dying. Its members had close ties to the artists of the Vienna SEZESSION and the ART NOUVEAU movement. The Wiener Werkstätte's work in jewelry, furnishings, interior design, fashion, and other areas, which often celebrated the beauty of geometry, became widely known for elegance and innovation, and this "square style" influenced the work of the BAUHAUS craftsmen in the 1920s as well as the work of FRANK LLOYD WRIGHT.

Wiesbaden \'vēs-ˌbä-dən\ City (pop., 2002 est.: 271,276), capital of HESSE, southern Germany. It is situated on the RHINE RIVER. The Romans fortified it in the 1st century AD; it has been noted since then for its hot saline springs. Made an imperial city in 1241, it passed to the counts of Nassau in 1255. It was capital of the duchy of Nassau from 1806 to 1866, when it passed to PRUSSIA. After World War I it was the seat of the Rhineland Commission under French and British occupation (1918–29). In 1946 Wiesbaden became the capital of the newly created state of Hesse. It was particularly noted for its spa in the 18th and 19th centuries, when it was frequented by Johann W. von GOETHE, JOHANNES BRAHMS, and FYODOR DOSTOYEVSKY. It continues to be a popular resort. It has printing firms, publishing houses, and film studios, and it is noted for its *Sekt* (sparkling wine).

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Wiesel \vē-'zel**, Elie** *orig.* **Eliezer Wiesel** (b. Sept. 30, 1928, Sighet, Rom.) Romanian-born U.S. novelist. Living in a small Hasidic community, Wiesel and his family were deported in 1944 to Auschwitz and then to Buchenwald; his parents and sister were killed. All his works reflect his experiences as a survivor of the Holocaust and his attempt to resolve the ethical torment of why it happened and what it reveals about human nature. They include *Night* (1958), *A Beggar in Jerusalem* (1968), *The Testament* (1980), and *The Forgotten* (1989). A noted lecturer, he was awarded the 1986 Nobel Prize for Peace for his universal condemnation of violence, hatred, and oppression.

Wiesel \'vē-səl**, Torsten (Nils)** (b. June 3, 1924, Uppsala, Swed.) Swedish neurobiologist. After earning his medical degree in Sweden, he moved to the U.S., where he joined DAVID HUBEL in investigating brain function. By analyzing the flow of nerve impulses from the eye in laboratory animals, they detected many structural and functional details of the visual cortex, in the occipital lobes of the cerebral cortex. Their studies of the effects of visual impairments in young animals lent strong support to the view that prompt surgery is crucial to correct certain eye defects in newborn children. The two shared a 1981 Nobel Prize with ROGER SPERRY.

wig Manufactured head covering of real or artificial hair worn in the theatre, as personal adornment, disguise, or symbol of office, or for religious reasons. Ancient Egyptians, Assyrians, Phoenicians, Greeks, and Romans used wigs, often as protection from the sun. In the West the wig first became an acceptable form of adornment or corrective for nature's defects in the 16th century, and men's perukes, or periwigs, came into widespread use in the 17th century. Men's wigs were common throughout the 18th century. Women wore wigs surreptitiously in the 18th–19th centuries; after the development of inexpensive synthetic wigs in the 20th century, women's wigs increased in popularity. In East Asia wigs have been used rarely except in the Chinese and Japanese theatre.

Wigan \'wi-gən\ Town and metropolitan borough (pop., 2001: 301,417), northwestern GREATER MANCHESTER, historic county of LANCASHIRE, England. It lies along the River Douglas and the Leeds and Liverpool Canal. Coal was mined from the 14th century, and textiles were produced in the area as early as the 16th century. Industrialization in the late 18th century was accelerated by the building of canals and railways. Textiles have declined in importance, and the last coal mine closed in 1993. New industries, including food processing, paper and packaging, and electrical engineering, have broadened the economy. Tourism was spurred by GEORGE ORWELL's treatise *The Road to Wigan Pier*.

wigeon *or* **widgeon** Any of four species of DABBLING DUCKS, popular game and food birds. The male European wigeon (*Anas penelope*) has a reddish head, cream forehead, and gray back. The male American wigeon, or baldpate (*A. americana*), has a white crown, green eye stripe, and brown back. Baldpates often graze on young grasses. The Cape wigeon (*A. capensis*) of Africa is a nocturnal feeder.

Wiggin, Kate Douglas *orig.* **Kate Douglas Smith** (b. Sept. 28, 1856, Philadelphia, Pa., U.S.—d. Aug. 24, 1923, Harrow, Middlesex, Eng.) U.S. novelist and a leader of the kindergarten movement in the U.S. After moving to San Francisco she headed the Silver Street Kindergarten (1878), the first free kindergarten on the U.S. West Coast, and helped establish the California Kindergarten Training School. To help support the school she began writing novels for both adults and children. She is best remembered for the children's classic *Rebecca of Sunnybrook Farm* (1903).

Wight, Isle of Island and unitary authority (pop., 2001: 132,719), part of the historic county of HAMPSHIRE, in the ENGLISH CHANNEL off the southern coast of England. Separated from mainland Hampshire by the SOLENT, the island has an area of 147 sq mi (381 sq km). Its main town is NEWPORT. The backbone of the Isle of Wight is a chalk ridge that extends across its entire breadth, the thickest bed of chalk in the British Isles. The Needles are three detached masses of chalk that lie off the island's westernmost point and rise to about 100 ft (30 m). Three rivers, the Eastern Yar, the Medina, and the Western Yar, flow northward into the Solent. A major British maximum security prison is located at Parkhurst. Boatbuilding, marine engineering, and the aerospace, plastics, and electronics industries are economically important. The island's warm, sunny climate has made it a popular vacation spot.

Wightman, Hazel Hotchkiss *orig.* **Hazel Virginia Hotchkiss** (b. Dec. 20, 1886, Healdsburg, Calif., U.S.—d. Dec. 5, 1974, Newton, Mass.) U.S. tennis player. She was a dominant competitor in the pre-World War I years, winning nine national tennis titles in the years 1909–11 alone. She won a lifetime total of 45 U.S. titles, the last at age 68. She was instrumental in establishing an annual match between British and U.S. women's teams; the Wightman Cup competition, first held in 1923, continued until 1989. She served as captain of the U.S. team from its inception until 1948.

Wigman, Mary *orig.* **Marie Wiegmann** (b. Nov. 13, 1886, Hanover, Ger.—d. Sept. 18, 1973, West Berlin, W.Ger.) Pioneering German dancer. Wigman studied with ÉMILE JAQUES-DALCROZE and RUDOLF LABAN and made her debut in 1914. Only a few years later she began a stellar career as an innovative choreographer. Her impact on dance throughout the West was immense. Her students included HANYA HOLM, who exerted a major influence on the development of American MODERN DANCE, and thousands of other original choreographers.

Wigner, Eugene (Paul) *orig.* **Jenó Pál Wigner** (b. Nov. 17, 1902, Budapest, Hung.—d. Jan. 1, 1995, Princeton, N.J., U.S.) Hungarian-born U.S. physicist. After studies at the University of Berlin, he immigrated to the U.S. in 1930 and joined the faculty of Princeton University. He was instrumental in getting the MANHATTAN PROJECT started and was present when ENRICO FERMI initiated the first chain reaction. He determined that the nuclear force is short-range and does not involve an ELECTRIC CHARGE, using GROUP THEORY to investigate atomic structure. His name was given to several formulations, including the Breit-Wigner formula, which describes resonant nuclear reactions. He won a 1963 Nobel Prize (shared with MARIA MAYER and Hans Jensen [1907–73], who won for unrelated work) for his insights into QUANTUM MECHANICS, especially principles governing interaction of protons and neutrons in the nucleus and his formulation of the law of conservation of PARITY (see CONSERVATION LAW). In addition to his many scientific awards, he received numerous awards for his work for peace.

wigwam American Indian dwelling, characteristic of the ALGONQUIAN-speaking nomadic tribes of what is now the northeastern U.S. It is constructed of saplings driven into the ground in a circle and tied together at the top, then covered with mats of woven rushes or sewn bark. See also IGLOO; LONGHOUSE; TEPEE.

Wilberforce, William (b. Aug. 24, 1759, Hull, Yorkshire, Eng.—d. July 29, 1833, London) British politician. Entering the House of Commons in 1780, he supported parliamentary reform and Catholic emancipation. Converted to evangelical Christianity (1785), he agitated against the slave trade and cofounded the Anti-Slavery Society. His sponsorship of antislavery legislation led to the passage of a bill abolishing the slave trade in the British West Indies (1807). From 1821 he agitated for emancipation of all slaves and was joined in Parliament by Thomas F. Buxton (1786–1845), who continued to sponsor legislation after Wilberforce retired in 1825. The Slavery Abolition Act was passed one month after Wilberforce's death in 1833.

Wilbur, Richard (Purdy) (b. March 1, 1921, New York, N.Y., U.S.) U.S. poet, critic, editor, and translator. He studied literature at Harvard University and established himself as an important young poet with the collections *The Beautiful Changes* (1947) and *Ceremony* (1950). His urbane, well-crafted verse later appeared in volumes such as *Things of This World* (1956, Pulitzer Prize), *Walking to Sleep* (1969), and *The Mind Reader* (1976). He also translated plays (notably those of MOLIÈRE) and wrote criticism and children's books. He served as U.S. poet laureate in 1987–88.

Wilbye \'wil-bē**, John** (b. March 7, 1574, Diss, Norfolk, Eng.—d. September 1638, Colchester, Essex) British composer. He spent his entire life in the employ of the Kytson family, as a domestic musician at Hengrave Hall, and then in Colchester (from 1628). One of the finest of the English madrigalists, he published only two collections (1598, 1609). His MADRIGALS are less chromatic than those of his contemporary THOMAS WEELKES, but he made subtle use of varying textures for expression.

wild boar See BOAR

wild carrot See QUEEN ANNE'S LACE

wild pig See BOAR

wild rice Coarse annual GRASS (*Zizania aquatica*) of the family Poaceae (or Gramineae) whose grain, now often considered a delicacy, has long been an important food of American Indians. Despite its name, the plant is not related to RICE. Wild rice grows naturally in shallow water in marshes

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and along the shores of streams and lakes in northern central North America. Cultivated varieties are now grown in Minnesota and California. The plant, about 3–10 ft (1–3 m) tall, is topped with a large, open flower cluster. The ripened grains, dark brown to purplish-black, are slender rods 0.4–0.8 in. (1–2 cm) long.

Wild West Show Theatrical extravaganza produced by William F. (Buffalo Bill) Cody. First performed in 1883, the show reached New York City's Madison Square Garden in 1887 with a cast of 100 Native Americans, the sharpshooter Annie Oakley, other trick riders and ropers, and wild animals such as buffalo, elk, bear, and deer. The four-hour spectacle, including Native American war dances and an attack on a stagecoach, toured Europe with great success in the 1890s and continued touring the U.S. until 1916.

wildcat Wild species (*Felis silvestris*) of cat (family Felidae) native to Eurasian forests. Very similar to the domestic yellowish tabby, it will interbreed with domestic cats (of which it is presumably an ancestor). It is 20–32 in. (50–80 cm) long, excluding the 10–14-in. (25–35-cm) tail. It stands 14–16 in. (35–40 cm) and weighs 6–20 lbs (3–10 kg). Solitary and nocturnal, it preys on birds and small animals. In North America the name is used for the bobcat and lynx; in Africa it refers to the Caffre cat.

wildcat bank In the U.S., an unsound bank chartered under state law during the period of state banking control (1816–63). Such banks distributed currency backed by questionable securities and were located in inaccessible areas to discourage note redemption. Note circulation by state banks ended with the passage of the National Bank Act of 1863, which provided for the incorporation of national banks and the issue of banknotes on the security of government bonds. The term wildcat bank was later applied to any unstable bank.

Wilde, Oscar (Fingal O'Flahertie Wills) (b. Oct. 16, 1854, Dublin, Ire.—d. Nov. 30, 1900, Paris, France) Irish poet and dramatist. Son of an eminent surgeon, Wilde attended Trinity College, Dublin, and later Oxford University, becoming widely known for his wit while still an undergraduate. A spokesman for Aestheticism, in the early 1880s he gave a lecture tour in the U.S. and established himself in London circles by his wit and flamboyance. His only novel, *The Picture of Dorian Gray* (1891), combines gothic elements with mockery of bourgeois morality. His macabre play *Salomé* (1893) was later adapted as the libretto of Richard Strauss's opera; his other plays, all successes, include *Lady Windermere's Fan* (1893), *A Woman of No Importance* (1893), and *An Ideal Husband* (1895). His greatest work was the comedy *The Importance of Being Earnest* (1899), a satire of Victorian social hypocrisy. Two critical dialogues, "The Decay of Lying" and "The Critic as Artist," are admired as equally brilliant. Though happily married, in 1891 he began an intimate relationship with the young Lord Alfred Douglas, son of the marquess of Queensberry. Accused by Queensberry of being a sodomite, Wilde sued for libel and lost, then was arrested for sodomy and convicted in a trial that became internationally notorious. Imprisoned at Reading Gaol (1895–97), he wrote a recriminatory letter to his lover that was edited and published as *De Profundis* (1905). After his release, he moved to Paris; his only later work was *The Ballad of Reading Gaol* (1898), on inhumane prison conditions. He died suddenly of acute meningitis.

Oscar Wilde, 1882.
COURTESY OF THE WILLIAM ANDREWS MEMORIAL LIBRARY OF THE UNIVERSITY OF CALIFORNIA, LOS ANGELES

wildebeest See gnu

Wilder, Billy *orig.* **Samuel Wilder** (b. June 22, 1906, Sucha, Austria—d. March 27, 2002, Beverly Hills, Calif., U.S.) Austrian-born U.S. film director and screenwriter. Working as a reporter in Vienna and Berlin, he wrote screenplays for German films. He fled Germany in 1933 and arrived in Hollywood a year later. He cowrote screenplays with Charles Brackett and established his reputation as a director with *Double Indemnity* (1944). Noted for his humorous treatment of controversial subjects and his biting indictments of hypocrisy, he also directed *The Lost Weekend* (1945, Academy Award), *Sunset Boulevard* (1950, Academy Award for best screenplay), *Stalag 17* (1953), and *The Apartment* (1960, Academy Award). His acclaimed comedies include *Sabrina* (1954), *The Seven Year Itch* (1955), *Some Like It Hot* (1959), and *Kiss Me, Stupid* (1964).

Wilder, Laura Ingalls *orig.* **Laura Ingalls** (b. Feb. 7, 1867, Lake Pepin, Wis., U.S.—d. Feb. 10, 1957, Mansfield, Mo.) U.S. children's author. She led the pioneer life with her family, living in Kansas, Minnesota, Iowa, and South Dakota, where she married. With her husband she finally settled in Missouri, where she edited the *Missouri Ruralist* for 12 years before being encouraged by her daughter to write down her childhood memories, and the internationally popular *Little House* books (1932–43) were the result. They were the basis for a popular television series (1974–84).

Wilder, Thornton (Niven) (b. April 17, 1897, Madison, Wis., U.S.—d. Dec. 7, 1975, Hamden, Conn.) U.S. playwright and novelist. After attending Yale University, Wilder studied archaeology in Rome. He earned wide acclaim for his second novel, *The Bridge of San Luis Rey* (1927, Pulitzer Prize). His play *Our Town* (1938, Pulitzer Prize), which became one of the most enduringly popular of all American plays, was followed by the successful *The Skin of Our Teeth* (1942, Pulitzer Prize). In them he rejected naturalism, often discarding props and scenery, using deliberate anachronisms, and having the characters address the audience directly. His farcical play *The Matchmaker* (1954) was adapted into the musical *Hello, Dolly!* (1964). Wilder's later novels include *The Eighth Day* (1967) and *Theophilus North* (1973).

Wilderness, Battle of the (May 5–7, 1864) Engagement in the American Civil War. When Ulysses S. Grant planned a Union campaign to capture Richmond, Va., and advanced with 115,000 troops, he was met by a Confederate army of 62,000 under Robert E. Lee in dense thickets called the Wilderness. After two days of intense and inconclusive fighting, Union casualties outnumbered those of the Confederacy (burning brush killed many of the wounded), and Grant saw the futility of further hostilities in the area. He moved on to do battle at Spotsylvania Courthouse, forcing Lee back toward Richmond.

wildflower Any flowering plant that grows without intentional human aid. Wildflowers are the source of all cultivated garden varieties of flowers. A wildflower growing where it is unwanted is considered a weed. Thousands of the approximately 250,000 species of flowering plants are wildflowers. Wildflowers can be divided into three categories by location: those found in the tropics and subtropics, those in temperate regions, and those that grow on the summits of mountain chains and in the Arctic and Antarctic.

wildlife conservation Regulation of wild animals and plants in such a way as to provide for their continuance. Efforts are aimed at preventing the depletion of present populations and ensuring the continued existence of the habitats targeted species need to survive. Techniques involve establishment of sanctuaries and controls on hunting, use of land, importation of exotic species, pollution, and use of pesticides. See also biodiversity, conservation, endangered species.

Wilfrid, Saint *or* **Wilfrid of York** (b. 634, Northumbria, Eng.—d. April 24, 709/710, monastery of Oundle, Mercia) English monk and bishop who established close relations between the Anglo-Saxon church and the papacy. As abbot of the monastery at Ripon, he introduced the Benedictine Rule to the kingdom. At the Synod of Whitby, he successfully advocated the adoption of Roman over Celtic traditions. As bishop of York, he built a monastery at Hexham and traveled twice to Rome to defend the see of York in jurisdictional controversies with the see of Canterbury (679, 704). A quarrel over the division of his diocese obliged Wilfrid to take refuge in Sussex, where he Christianized the people and founded a monastery at Selsey; he later served as bishop of Lichfield in Mercia. Following his second dispute with Canterbury, Wilfrid became bishop of Hexham and spent his last years there and at his monastery in Ripon.

Wilhelmina (Helena Pauline Maria) (b. Aug. 31, 1880, The Hague, Neth.—d. Nov. 28, 1962, Het Loo, near Apeldoorn) Queen of The Netherlands (1890–1948). Daughter of King William III, she became queen on his death, under her mother's regency until 1898, and soon gained wide popular approval. She helped maintain her country's neutrality in World War I. After Germany invaded The Netherlands in 1940, she left with her

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family for London. Throughout World War II she made radio broadcasts to maintain the morale of the Dutch people, becoming a symbol of Dutch resistance to the German occupation. In 1948 she abdicated in favour of her daughter, JULIANA.

Wilkes, John (b. Oct. 17, 1725, London, Eng.—d. Dec. 26, 1797, London) English politician. The son of a successful malt distiller, he was educated at an academy at Hertford and afterward privately tutored. His marriage to Mary Meade (1747), heiress of the manor of Aylesbury, brought him a comfortable fortune and an assured status among the gentry of Buckinghamshire. A profligate by nature, he was a member of the so-called Hell-Fire Club, which indulged in debauchery and the performance of Black Masses, and he bribed voters to win election to the House of Commons (1757). For an attack on the government in his journal the *North Briton* (1763), he was prosecuted for libel and expelled from Parliament. Reelected, he continued to print his attacks on the government and was again tried for libel and expelled (1764). Regarded as a victim of persecution and a champion of liberty, he gained widespread popular support. He was again elected to Parliament and again expelled (1769). He become lord mayor of London in 1774. Back in the House of Commons (1774–90), he supported parliamentary reform and freedom of the press.

Wilkes, Maurice V(incent) (b. June 26, 1913, Dudley, Staffordshire, Eng.) British computer-science pioneer. He helped build the EDSAC computer (1949), invented MICROPROGRAMMING (1950), cowrote the first book on computer programming (1951), wrote the first paper on cache memories (1964), and pioneered CLIENT-SERVER ARCHITECTURE computing (1980). He won the Turing Award in 1967 and the Kyoto Prize in 1992. In 1995 he published *Memoirs of a Computer Pioneer*.

Wilkins, Maurice (Hugh Frederick) (b. Dec. 15, 1916, Pongaroa, N.Z.—d. Oct. 6, 2004, London, Eng.) New Zealand-born British biophysicist. Educated in Birmingham and Cambridge, he participated in the MANHATTAN PROJECT, working on the separation of uranium isotopes for use in the atomic bomb. On his return to Britain, he began a series of investigations that led ultimately to his studies of DNA. His X-ray diffraction studies of DNA proved crucial to the determination of DNA's molecular structure by JAMES D. WATSON and FRANCIS CRICK, for which the three were awarded a 1962 Nobel Prize. He later applied X-ray diffraction techniques to the study of RNA. See also ROSALIND FRANKLIN.

Wilkins, Roy (b. Aug. 30, 1901, St. Louis, Mo., U.S.—d. Sept. 8, 1981, New York, N.Y.) U.S. civil-rights leader. He was a reporter for the African American-owned *Kansas City Call* and later became its managing editor. He joined the staff of the NAACP (1931) and became editor (1934–49) of its official publication, *The Crisis*. In 1955 he began a 22-year tenure as executive director of the NAACP, which he set on a course of seeking equal rights through legal redress. He helped organize the 1963 March on Washington, and he served as chairman of the U.S. delegation to the International Conference on Human Rights in 1968.

Wilkinson, James (b. 1757, Calvert county, Md.—d. Dec. 28, 1825, Mexico City, Mex.) American army officer and double agent. He served in the AMERICAN REVOLUTION under HORATIO GATES and was involved in the THOMAS CONWAY cabal. He settled in Kentucky in 1784 and schemed to ally the Kentucky region with Spain, though he was in fact working against Spain. He served as governor of part of the Louisiana territory (1805–06). He allegedly planned to conquer the Mexican provinces of Spain and conspired with AARON BURR to establish an independent government; when he betrayed Burr's plan, he was investigated but cleared. In the War of 1812 he commanded U.S. forces on the Canadian border, but his campaign against Montreal failed.

James Wilkinson, portrait by J.W. Jarvis; in the Filson Club Collection, Louisville, Ky.
COURTESY OF THE FILSON CLUB, LOUISVILLE, KY.

Wilkinson, John (b. 1728, Clifton, Cumberland, Eng.—d. July 14, 1808, Bradley, Staffordshire) British industrialist. Known as "the great Staffordshire ironmaster," he found many new applications for iron, developed a BORING MACHINE whose precision enabled JAMES WATT to perfect his STEAM ENGINE, and used Watt's first steam engine to drive a huge air pump in his factory for the large-scale manufacture of WROUGHT IRON.

will In law, a formal declaration, usually in the form of an executed document, of a person's wishes regarding the disposal of his or her property after death. It is valid if it meets the formalities of the law, which usually requires that it be witnessed. It may be considered invalid if, among other instances, the testator was mentally incapable of disposing of his or her property, if it imposes unreasonable or cruel demands as a condition of inheritance, or if the testator did not have clear title to the bequeathed assets. Any party who contests a will must bring the claim within a time specified by statute and must bear the burden of proof in demonstrating that the will is faulty. See also PROBATE.

Willamette River River, northwestern Oregon, U.S. It flows north for 300 mi (485 km) into the COLUMBIA RIVER near PORTLAND. Oregon's most populous cities are in its valley. The Fremont Bridge, a steel arch with a main span of 1,225 ft (373 m), crosses the river at Portland.

Willemstad \'vi-ləm-ˌstät\ City (pop., 1999 est.: 123,000), capital of the NETHERLANDS ANTILLES, WEST INDIES. Located on the southern coast of CURAÇAO, it was founded in 1634. Willemstad contains many Dutch colonial buildings and is the site of the oldest (1732) synagogue in continuous use in the Western Hemisphere. It is a centre of trade, petroleum storage and refining, banking, and tourism.

William I *known as* **William the Conqueror** (b. c. 1028, Falaise, Normandy—d. Sept. 9, 1087, Rouen) Duke of Normandy (1035–87) and king of England (1066–87). Though born out of wedlock, he succeeded his father as duke of Normandy, subduing rebellions and becoming the mightiest noble in France. In 1051 EDWARD THE CONFESSOR promised to make him heir to the English throne, but on Edward's death in 1066, Harold Godwineson, earl of Wessex (HAROLD II), was accepted as king. Determined to assert his right to the throne, William sailed from Normandy with an invasion force, defeated Harold at the Battle of HASTINGS, and was crowned king. The NORMAN CONQUEST was thus completed, though English rebellions continued until 1071. To secure England's frontiers, William invaded Scotland (1072) and Wales (1081). In 1086 he ordered the survey summarized in the DOMESDAY BOOK. He divided his lands between his sons, giving Normandy and Maine to ROBERT II and England to WILLIAM II.

William I *German* **Wilhelm Friedrich Ludwig** (b. March 22, 1797, Berlin—d. March 9, 1888, Berlin) King of Prussia (1861–88) and German emperor (1871–88). Son of FREDERICK WILLIAM III of Prussia, he fought in the war against NAPOLEON (1814) and thereafter devoted himself to the Prussian army and military affairs. He advocated the use of force against the rebels in 1848. The military governor of Rhineland province from 1849, he succeeded his brother on the Prussian throne in 1861. A conservative and a supporter of military reform, William insisted on a three-year term of military conscription, which the liberal lower chamber rejected in 1862. William was ready to abdicate but was dissuaded by OTTO VON BISMARCK, whom he had installed as prime minister (1862). He cautiously supported Bismarck's policies in the SEVEN WEEKS' WAR and the FRANCO-PRUSSIAN WAR. Proclaimed German emperor in 1871, he oversaw the continued rise of Germany as a European power.

William I *Dutch* **Willem** *known as* **William the Silent** (b. April 24, 1533, Dillenburg, Nassau—d. July 10, 1584, Delft, Holland) First stadtholder of the United Provinces of the Netherlands (1572–84). Son of William, count of Nassau-Dillenburg, he inherited the principality of Orange and other vast estates from his cousin in 1544. He was educated at the Habsburg imperial court in Brussels, then appointed by PHILIP II to the council of state (1555). He helped negotiate the Treaty of CATEAU-CAMBRÉSIS, earning his byname for keeping silent about secret policy decisions, and was named stadtholder (governor) in Holland, Zeeland, and Utrecht in 1559. Increasingly opposed to Philip's strict ordinances against Protestants, he led a revolt in 1568 that proved unsuccessful, but in 1572 he succeeded in uniting the northern provinces. He was proclaimed their stadtholder, and his position was solidified by the Pacification of GHENT (1576). He sought help from France in the revolt against Spain, and in 1579 he was outlawed by Philip. A reward was offered for his assassination, and in 1584 he was shot by a fanatical Catholic.

William I *Dutch* **Willem Frederik** (b. Aug. 24, 1772, The Hague, United Provinces of the Netherlands—d. Dec. 12, 1843, Berlin, Prussia)

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King of The Netherlands and grand duke of Luxembourg (1815–40). Son of William V, prince of Orange, he married in 1791 and immigrated with his family to England after the French invasion of the Dutch Republic (1795). He sided with Prussia against Napoleon and lived in exile at the Prussian court until 1812. After the Dutch revolt against French rule, he became sovereign prince of the Dutch Republic (1813) and king of the United Netherlands (1815), which included Belgium, Liège, and Luxembourg. He led an economic recovery program that sparked a commercial revival, but his autocratic methods and imposition of Dutch as the official language provoked a revolt by Belgium (1830) that led to its independence. In 1840 he abdicated in favour of his son, William II.

William I *known as* **William the Lion** (b. 1143—d. Dec. 2, 1214, Stirling, Stirlingshire, Scot.) King of Scotland (1165–1214). He succeeded his father as earl of Northumberland (1152) but was forced to relinquish his earldom to England's Henry II in 1157. He succeeded his brother, Malcolm IV, as king of Scotland and in 1173 joined a revolt of Henry's sons in an attempt to regain Northumberland. Captured in 1174, he was released after submitting to Henry's overlordship. He bought his release from subjection in 1189. He continued to agitate for the restoration of Northumberland but was forced to renounce his claim by King John in 1209. William created many of the major burghs of modern Scotland.

William II *or* **William Rufus** (b. c. 1056—d. Aug. 2, 1100, near Lyndhurst, Hampshire, Eng.) King of England (1087–1100) and de facto duke of Normandy (1096–1100). He inherited England from his father, William I (the Conqueror), and quelled a rebellion (1088) by barons loyal to his brother Robert II. A tyrannical ruler, he brutally punished the leaders of a second revolt (1095). He forced St. Anselm, archbishop of Canterbury, to leave England and seized his lands (1097). He reduced the Scottish kings to vassals (1093), subjugated Wales (1097), and waged war on Normandy (1089–96), gaining control when Robert mortgaged the duchy. His death in a hunting accident may have been an assassination ordered by his brother Henry (later Henry I).

William II *German* **Friedrich Wilhelm Viktor Albert** *known as* **Kaiser Wilhelm** (b. Jan. 27, 1859, Potsdam, near Berlin, Prussia—d. June 4, 1941, Doorn, Neth.) German emperor (kaiser) and king of Prussia (1888–1918). Son of the future Frederick III and grandson of Britain's Queen Victoria, William succeeded his father to the throne in 1888. Two years later, he forced the resignation of Otto von Bismarck. He was characterized by his frequently militaristic manner and by his vacillating policies that undermined those of his chancellors, including Leo, count von Caprivi, and Bernhard, prince von Bülow. From 1897 he encouraged Adm. Alfred von Tirpitz to strengthen the German fleet and challenged France's position in Morocco (see Moroccan crises). He sided with Austria-Hungary in the crisis with Serbia (1914), and in World War I he encouraged the grandiose war aims of the generals and politicians. After Germany's defeat, he fled to The Netherlands, ending the monarchy in Germany, and lived in exile until his death.

William II *Italian* **Guglielmo** *known as* **William the Good** (b. 1154—d. Nov. 18, 1189, Palermo, Kingdom of Sicily) Last Norman king of Sicily (1166–89). His mother served as regent until 1171, after which he ruled alone, winning a reputation for clemency and justice. His friendship with Manuel I Comnenus ended when the Byzantine emperor thwarted William's proposed marriage to his daughter. Turning against the Byzantines, William allied with Frederick I Barbarossa. He agreed to his aunt's marriage to Frederick's son Henry (later Henry VI), giving Henry a claim to Sicily. He attacked the Byzantines (1185) with early success but was defeated within sight of Constantinople.

William II *Dutch* **Willem** (b. May 27, 1626, The Hague, United Provinces of the Netherlands—d. Nov. 6, 1650, The Hague) Prince of Orange, count of Nassau, and stadtholder of the Netherlands (1647–50). The son of Frederick Henry, prince of Orange, he married Mary Stuart, eldest daughter of Charles I of England, in 1641 and later succeeded to his father's offices (1647), which included the stadtholdership of all the provinces of the Netherlands except Friesland. Despite the treaty with Spain in 1648 that recognized the independence of the United Provinces, he planned to conquer part of the Spanish Netherlands (modern Belgium). He imprisoned members of the assembly of Holland who opposed his war policy but died of smallpox before his influence could be tested.

William II *Dutch* **Willem Frederik George Lodewijk** (b. Dec. 6, 1792, The Hague, United Provinces of the Netherlands—d. March 17, 1849, Tilburg, Neth.) King of The Netherlands and grand duke of Luxembourg (1840–49). Son of William I, he lived in exile with his family in England from 1795. He commanded Dutch troops in the Battle of Waterloo (1815). Sent by his father to Belgium in 1830 to appease the rebels, he failed to stop the independence movement. In 1840 he became king of The Netherlands on his father's abdication. As king, he helped stabilize the economy. In 1848 he oversaw passage of a new liberal constitution that expanded the authority of the ministers and assembly, established direct elections, and secured basic civil liberties.

William III *Dutch* **Willem Hendrik** (b. Nov. 14, 1650, The Hague, United Provinces of the Netherlands—d. March 19, 1702, London, Eng.) Stadtholder of the United Provinces of the Netherlands (1672–1702) and king of England (1689–1702). Son of William II, prince of Orange, and Mary Stuart, daughter of Charles I of England, he was born in The Hague soon after his father's death. The Act of Seclusion (1654) that barred the house of Orange from power in the United Provinces was rescinded in 1660, and William was appointed captain general and named stadtholder by popular acclaim in 1672. He successfully defended his country against Charles II of England and Louis XIV of France. In 1677 he married Mary (later Queen Mary II), daughter of the English duke of York (later James II). In 1688 William was invited by James's opponents to intervene against the Catholic ruler, and he landed with a Dutch army in Devon, Eng. He and Mary were proclaimed joint rulers of England in 1689; he ruled alone after Mary's death in 1694. He directed the European opposition to Louis XIV, which eventually led to the War of the Grand Alliance after William's death. In Britain he secured religious toleration and strengthened Parliament, granting independence to the judiciary in the Act of Settlement.

William III *Dutch* **Willem Alexander Paul Frederik Lodewijk** (b. Feb. 19, 1817, Brussels, Belg.—d. Nov. 23, 1890, Apeldoorn, Neth.) King of The Netherlands and grand duke of Luxembourg (1849–90). Son of William II, he succeeded to the throne on his father's death in 1849. Opposed to the liberal constitution of 1848, he adopted an anti-Catholic posture and from 1862 to 1868 was able to rule through the cabinet. He tried to sell his sovereignty over Luxembourg to France (1867) but yielded to Prussia's demand that the area be independent. Following this crisis, his influence over parliament declined. On his death, he was succeeded by his daughter, Wilhelmina.

William IV (b. Aug. 21, 1765, London, Eng.—d. June 20, 1837, Windsor Castle, near London) King of Great Britain and Ireland and of Hanover (1830–37). The son of George III, he entered the royal navy at age 13, fought in the American Revolution, and served in the West Indies, leaving the navy as a rear admiral in 1790 (he was later called "the Sailor King"). He angered his father by his numerous love affairs and fathered 10 illegitimate children by the actress Dorothea Jordan (1761–1816). In 1830 he succeeded his brother George IV as king. Opposed to parliamentary reform, William delayed consideration of the Reform Bill of 1832, but his prime minister, Earl Grey, persuaded him to promise to create enough peers in the House of Lords to carry it, forcing its passage. On William's death, the British crown passed to his niece, Victoria, and the Hanoverian crown to his brother Ernest Augustus, duke of Cumberland (1771–1851).

William and Mary, College of State-supported college in Williamsburg, Va. The second-oldest institution of higher education in the U.S. (after Harvard University), it was chartered in 1693 by King William III and Queen Mary II. Its alumni include Thomas Jefferson, John Marshall, James Monroe, John Tyler, and Gen. Winfield Scott. George Washington was the college's first American chancellor, from 1788 to 1799. The honour society Phi Beta Kappa was organized as a social fraternity there in 1776.

William of Auvergne \ō-'vern^{y}, ō-'vərn\ *French* **Guillaume d'Auvergne** (b. after 1180, Aurillac, France—d. 1249, Paris) French philosopher and theologian. Named bishop of Paris in 1228, William was a reformer who defended the rising mendicant orders against attacks by the secular clergy. After the church condemned the works of Aristotle, he became one of the first Western scholars to attempt to incorporate into Christianity whatever in Aristotle's thought was compatible with it. He was influenced by Avicenna and by the Neoplatonism of St. Augustine. His principal work, written in 1223–40, is *Magisterium divinale* ("The Divine Teaching").

William of Auxerre \ō-'ser\ *French* **Guillaume d'Auxerre** (b. c. 1150, Auxerre, bishopric of Auxerre—d. Nov. 3, 1231, Rome) French philosopher and theologian. After a long career at the University of Paris, he

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was appointed in 1231 by Pope Gregory IX to a council to censor the works of Aristotle (which in 1210 had been deemed corruptive of Christianity) included in the university's curriculum. Seeing no reason to avoid the rational analysis of Christian revelation, he was on the verge of reorganizing the curriculum when he died. In his principal work, usually called the *Summa aurea* (written 1215–20), he treated such matters as God's triune nature, the problem of human choice, and the nature of virtue.

William of Ockham See William of Ockham

William Rufus See William II (England)

William Tell See William Tell

William the Conqueror See William I (England)

William the Good See William II (Sicily)

William the Silent See William I (Netherlands)

Williams, Daniel Hale (b. Jan. 18, 1858, Hollidaysburg, Pa., U.S.—d. Aug. 4, 1931, Idlewild, Mich.) U.S. surgeon. He graduated from Chicago Medical College. In 1891 he founded Provident Hospital in Chicago, the first interracial hospital in the U.S., to provide training for black interns and nurses. There in 1893 he performed the first successful heart surgery; the patient lived at least 20 years after Williams opened the thoracic cavity, sutured a wound of the pericardium (the sac around the heart), and closed the chest. In 1913 he became the only black charter member of the American College of Surgeons.

Williams, (George) Emlyn (b. Nov. 26, 1905, Mostyn, Flintshire, Wales—d. Sept. 25, 1987, London) Welsh actor and playwright. He made his acting debut in 1927 and won acclaim in London and New York City for his performance in his own play, the macabre *Night Must Fall* (1935; film, 1964). His most popular play was the autobiographical *The Corn Is Green* (1938; film, 1945), the story of a boy and his teacher in a Welsh mining town. He also acted in many films and was renowned for his public readings from Charles Dickens, Saki, and Dylan Thomas.

Williams, Eric (Eustace) (b. Sept. 25, 1911, Port of Spain, Trin.—d. March 29, 1981, St. Anne, near Port of Spain) First prime minister of independent Trinidad and Tobago (1962–81). He received a doctorate from the University of Oxford and served on the faculty of Howard University in the U.S. before founding the People's National Movement (PNM) in 1956 and taking his nation into the Federation of the West Indies in 1958 only to withdraw in favour of independence in 1962. Oil reserves helped boost the nation's income, and Williams remained popular until 1970, when an economic downturn led to unsuccessful revolts. He served as prime minister until his death. *Capitalism and Slavery* (1944) and *From Columbus to Castro: The History of the Caribbean, 1492–1969* (1970) were among his many books.

Williams, Hank *orig.* **Hiram King Williams** (b. Sept. 17, 1923, Georgiana, Ala., U.S.—d. Jan. 1, 1953, Oak Hill, W.Va.) U.S. singer and guitarist. Williams was born into poverty. He began playing guitar at age 8, made his radio debut at 13, and formed his first band, Hank Williams and his Drifting Cowboys, at 14. With the help of Fred Rose, his "Lovesick Blues" became a smash hit in 1949, and he joined the Grand Ole Opry that year after an extraordinary debut appearance. Among his best-selling recordings were "I'm So Lonesome I Could Cry," "Jambalaya," "Your Cheatin' Heart," and "Hey, Good Lookin'." He wrote almost all the songs he recorded. His death from heart failure at 29 may have resulted from drug and alcohol abuse. He remains perhaps the most revered figure in the history of country music. His son, Hank Williams, Jr., has had an exceptional recording career, and grandson Hank Williams III is also a musician.

Williams, Jody (b. Oct. 9, 1950, Putney, Vt., U.S.) American activist who in 1992 helped found the International Campaign to Ban Landmines (ICBL). In 1997 she and the ICBL were named corecipients of the Nobel Prize for Peace. She coordinated the launch of the ICBL with the cooperation of six international organizations, with the mission to abolish the use of antipersonnel land mines, of which tens of millions lay unexploded in more than 70 countries. Her efforts bore fruit in December 1997, when the Mine Ban Treaty was signed by more than 100 countries in Ottawa. By 2003 some 130 nations had ratified the treaty, but not the major mine-producing ones, such as the United States, Russia, and China. Williams was coauthor, with Shawn Roberts, of *After the Guns Fall Silent: The Enduring Legacy of Landmines* (1995).

Williams, Joe *orig.* **Joseph Goreed** (b. Dec. 12, 1918, Cordele, Ga., U.S.—d. March 29, 1999, Las Vegas, Nev.) U.S. singer and actor. Williams worked with Coleman Hawkins and Lionel Hampton before joining Count Basie's band in 1954. The success of "Every Day I Have the Blues" established Williams as a sophisticated blues singer with a powerful bass-baritone voice. After leaving the Basie band in 1961, Williams led small ensembles singing popular songs, ballads, and blues. During the 1980s he played the role of Grandpa Al on the television series *The Cosby Show*. His album *Nothin' but the Blues* (1984) won a Grammy Award.

Williams, John (Towner) (b. Feb. 8, 1932, New York, N.Y., U.S.) U.S. composer and conductor. Williams studied music at UCLA and Juilliard. He began his career as a jazz pianist but began to compose for TV and film in the 1960s. He has scored over 75 films, including *Jaws* (1975), the *Star Wars* trilogy, *Close Encounters of the Third Kind* (1977), *E.T.* (1982), *Schindler's List* (1993), and *Harry Potter and the Sorcerer's Stone* (2001), and has won five Academy Awards. He has also written many concert works. From 1980 to 1993 he was conductor of the Boston Pops.

Williams, Mary Lou *orig.* **Mary Elfrieda Scruggs** (b. May 8, 1910, Atlanta, Ga., U.S.—d. May 28, 1981, Durham, N.C.) U.S. pianist, composer, arranger, and bandleader. A child prodigy, she had her professional debut with big bands at age 12. Beginning in 1929, Williams wrote arrangements for many swing bands, including those of Andy Kirk (1898–1992) and Duke Ellington. Her 12-movement *Zodiac Suite* was performed by the New York Philharmonic in 1946. A pianist with strong roots in the blues and early jazz, Williams embraced the innovations of bebop and later free jazz, performing with a diverse array of jazz musicians, including Dizzy Gillespie and Cecil Taylor (b. 1933). In the 1960s and '70s she composed a number of liturgical pieces for jazz ensembles, including *Music for Peace* (1970), popularly known as "Mary Lou's Mass."

Williams, Ralph Vaughan See Ralph Vaughan Williams

Williams, Roger (b. 1603?, London, Eng.—d. Jan. 27/March 15, 1683, Providence, R.I.) English clergyman, colonist, and founder of Rhode Island. He arrived in Boston in 1631 and became pastor of the separatist Plymouth colony (1632–33). Banned from the Massachusetts Bay Colony for his beliefs, including his support for religious toleration and the rights of Indians and his opposition to civil authority, he founded the colony of Rhode Island and the town of Providence (1636) on land purchased from the Narragansett Indians. The colony established a democratic government and instituted separation of church and state, and it became a haven for Quakers and others seeking religious liberty. He obtained a charter for the colony (1643) and served as its first president, maintaining friendly relations with the Indians and acting as peacemaker for nearby colonies.

Williams, Ted *orig.* **Theodore Samuel Williams** (b. Aug. 30, 1918, San Diego, Calif., U.S.—d. July 5, 2002, Inverness, Fla.) U.S. baseball player, one of the greatest hitters of all time. Williams began playing professionally at age 17. He became an outfielder with the Boston Red Sox in 1939 and remained with the team until his retirement in 1960. Tall and thin, he was dubbed "the Splendid Splinter" but was also known more simply as "the Kid." A left-handed hitter, he compiled a lifetime batting average of .344, the eighth highest on record. He batted .406 in 1941, becoming the last .400 hitter of the century. His career slugging percentage (.634) is second only to that of Babe Ruth. Williams is the only player besides Rogers Hornsby to have twice won the batting Triple Crown (best average, most home runs, and most runs batted in in the same season). Despite losing five years of his career to service as a flyer in World War II and the Korean War, he hit a total of 521 home runs, capping his career with a home run in his final at bat. After retiring as a player, he managed the Washington Senators (1969–72) and became an accomplished fisherman.

Williams, Tennessee *orig.* **Thomas Lanier Williams** (b. March 26, 1911, Columbus, Miss., U.S.—d. Feb. 25, 1983, New York, N.Y.) U.S. playwright. The son of a traveling salesman and a clergyman's daughter, he lived in St. Louis from age 12. After attending several colleges he graduated from the University of Iowa (1938). He first won recognition for his group of one-act plays *American Blues* (1939). Wider success came with *The Glass Menagerie* (1944) and mounted with *A Streetcar Named Desire* (1947, Pulitzer Prize; film, 1951), *Camino Real* (1953), and *Cat on a Hot Tin Roof* (1955, Pulitzer Prize; film, 1958). His plays, which also include *Suddenly Last Summer* (1958; film, 1959) and *The Night of*

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the Iguana (1961; film, 1964), describe a world of repressed sexuality and violence thinly veiled by gentility. He also wrote the novel *The Roman Spring of Mrs. Stone* (1950; film, 1961) and the screenplays for *The Rose Tattoo* (1955, adapted from his 1951 play) and *Baby Doll* (1956). A clear-sighted chronicler of fragile illusions, he is regarded as one of the greatest American playwrights.

Williams, Venus; and Williams, Serena (respectively b. June 17, 1980, Lynwood, Calif., U.S.; b. Sept. 26, 1981, Saginaw, Mich.) U.S. tennis players. The sisters were introduced to the sport by their father, who recognized their talent early on. Venus turned professional in 1994, and Serena followed suit a year later. Possessing powerful ground strokes and superb athleticism, the sisters were soon dominating women's professional tennis. Serena won the U.S. Open in 1999, and Venus won Wimbledon and the U.S. Open in 2000 and 2001. In 2002 Serena won the French Open, the U.S. Open, and Wimbledon, defeating Venus in the finals of each tournament. Serena captured her first Australian Open in 2003 and later in the year defended her Wimbledon title. In 2005 Serena won her second Australian Open, and Venus captured her third Wimbledon title.

Williams, William Carlos (b. Sept. 17, 1883, Rutherford, N.J., U.S.—d. March 4, 1963, Rutherford) U.S. poet. Trained as a pediatrician, Williams wrote poetry and practiced medicine in his hometown. He is noted for making the ordinary appear extraordinary through clear and discrete imagery, as in the fresh and direct impressions of the sensuous world expressed in "The Red Wheelbarrow," from *Spring and All* (1923). *Paterson* (1946–58), a five-part long poem, evokes a complex vision of modern American life. In 1963 he was awarded the Pulitzer Prize in poetry for *Pictures from Brueghel* (1962). His numerous prose works include essays, a trilogy of novels, short stories, drama, and autobiography.

Williams College Private liberal arts college in Williamstown, Mass. Established in 1793 and affiliated with the Congregational church, it has since become nondenominational. Williams has consistently rated as one of the best colleges in the U.S., offering bachelor's and master's degree programs in fine and applied arts and sciences. Campus facilities include notable collections of American, contemporary, and South Asian art and materials relating to U.S. history. Notable alumni include director Elia Kazan.

William's War, King See King William's War

Williamsburg City (pop., 2000: 11,998), southeastern Virginia, U.S. Located on a tidewater peninsula between the James and York rivers, it was settled in 1633 as Middle Plantation and served as a refuge from Indian attacks. The College of William and Mary was founded there in 1693. After the burning of nearby Jamestown in 1699, it became the capital of Virginia until 1780, when the capital was moved to Richmond. During the American Civil War, Confederate forces were defeated at the Battle of Williamsburg in 1862. Colonial Williamsburg, an extensive restoration of several hundred colonial buildings, was begun in 1926 and became part of the Colonial National Historical Park in 1936.

Willkie, Wendell L(ewis) (b. Feb. 18, 1892, Elwood, Ind., U.S.—d. Oct. 8, 1944, New York, N.Y.) U.S. politician. He moved to New York City in 1929 to become an attorney for the Commonwealth and Southern Corp., of which he was later president (1933–40). He led the opposition of utilities companies to competition from the federally funded Tennessee Valley Authority. His criticism of Pres. Franklin D. Roosevelt led to his dark-horse victory at the 1940 Republican Party presidential convention. After a vigorous campaign, he won only 10 states but received more than 22 million popular votes, the largest number received by a Republican to that time. After a worldwide tour, he wrote *One World* (1943), a best-selling plea for postwar international cooperation.

willow Any shrub or tree of the genus *Salix*, family Salicaceae, native mostly to northern temperate regions, and common in lowland and marshy areas. Willows are valued as ornamentals and for their shade, erosion control, and timber. Certain species yield salicin, the source of salicylic acid used in pain relievers. All species have alternate, usually narrow leaves, catkins, and seeds with long, silky hairs. Pussy willows, the male form of several shrubby species, have woolly catkins that form before the leaves appear and are considered one of the first signs of spring. Weeping willows have long drooping branches and leaves. Several species grow as small matted woody plants on the tundra. See photograph opposite.

willow herb Any of about 200 plants that make up the genus *Epilobium*, of the evening primrose family, especially fireweed (*E. angustifolium*; also called great willow herb). The young parts of some species can be cooked and eaten as potherbs. The plants are sometimes cultivated but must be carefully confined. The hairy willow herb, or codling-and-cream (*E. hirsutum*), is similar to fireweed but has hairy leaves and stalks and notched flower petals; in eastern North America it quickly establishes itself on cleared land. Rock fringe (*E. obcordatum*) is a low-growing form from the western U.S.

Wills, Bob *orig.* **James Robert Wills** (b. March 6, 1905, near Kosse, Texas, U.S.—d. May 13, 1975, Fort Worth, Texas) U.S. country music fiddler, singer, and songwriter. Wills learned fiddle from his father. In Tulsa, Okla., in 1934 he formed the Texas Playboys; their radio performances made him a star in the Southwest, and in 1942 the group moved to California, performing in dance halls and films. They pioneered the "western swing" genre, which blended traditional hoedown fiddling with big-band swing and blues. Wills's best-known compositions include "San Antonio Rose" and "Panhandle Rag."

Wills, Helen (Newington) *or* **Helen Wills Moody** *in full* **Helen Newington Wills Moody Roark** (b. Oct. 6, 1905, Centerville, Calif., U.S.—d. Jan. 1, 1998, Carmel, Calif.) U.S. tennis player. She won the first of seven U.S. singles titles in 1923. She took the gold medal in both singles and doubles at the 1924 Olympic Games. So overpowering was her game that from 1927 to 1932 she won every set she played in U.S. singles play. She took the Wimbledon title eight times (1927–30, 1932, 1933, 1935, 1938), a record only broken in 1990 by Martina Navratilova.

Wilmington City (pop., 2000: 72,664), northern Delaware, U.S. Located at the junction of the Delaware and Christina rivers, it is the state's largest city and its industrial, financial, and commercial centre and main port. The oldest permanent settlement in the Delaware valley, it was settled by Swedes in 1638. Called Fort Christina, it was captured by Peter Stuyvesant's Dutch forces in 1655; they were ousted by the English in 1664. A prosperous port after the Quakers moved there in the 1730s, it was renamed Wilmington in 1739. During the American Revolution the Battle of the Brandywine was fought nearby. In 1802 E.I. du Pont established a gunpowder mill there (see DuPont Co.).

Wilmot Proviso \prə-'vī-ˌzō\ (1846) Proposal in the U.S. Congress to prohibit the extension of slavery to the territories. Offered by Rep. David Wilmot (1814–68) as an amendment to a bill that purchased territory from Mexico, it prohibited slavery in the new territory. The proviso provoked a national debate that reflected the growing sectional discord between North and South. Despite repeated attempts, the Wilmot Proviso was never passed by both houses of Congress. Nevertheless, the principle became a basic tenet of the Republican Party.

Wilson, Alexander (b. July 6, 1766, Paisley, Renfrew, Scot.—d. Aug. 23, 1813, Philadelphia, Pa., U.S.) Scottish-born U.S. ornithologist. In Scotland he wrote poetry while working as a weaver and peddler; in 1792 his satiric works led to a fine and imprisonment. Impoverished, in 1794 he immigrated to the U.S., where he became a teacher. Influenced by William Bartram, he decided c. 1804 to write on North American birds, and he began studying art and ornithology in his leisure time. His pioneering work *American Ornithology* (9 vol., 1808–14) established him as a founder of the field. After publication of its first volume, he spent much of his time selling subscriptions for the expensive work and collecting specimens for the remaining volumes.

Weeping willow (*Salix babylonica*).
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Wilson, August (b. April 27, 1945, Pittsburgh, Pa., U.S.—d. Oct. 2, 2005, Seattle, Wash.) U.S. playwright. He was largely self-educated. A participant in the black aesthetic movement, he cofounded and directed Pittsburgh's Black Horizons Theatre (1968), published poetry in African American journals, and produced several plays, including *Jitney* (1982), before his *Ma Rainey's*

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Black Bottom opened on Broadway in 1984. Inspired by the colloquial language, music, folklore, and storytelling tradition of African Americans, he continued his cycle of plays, each set in a different decade of the 20th century, with *Fences* (1986, Pulitzer Prize), *Joe Turner's Come and Gone* (1988), *The Piano Lesson* (1990, Pulitzer Prize), *Two Trains Running* (1992), *Seven Guitars* (1996), *Gem of the Ocean* (first produced 2003), *King Hedley II* (2005), and *Radio Golf* (first produced 2005).

Wilson, C(harles) T(homson) R(ees) (b. Feb. 14, 1869, Glencorse, Midlothian, Scot.—d. Nov. 15, 1959, Carlops, Peeblesshire) Scottish physicist. His invention of the Wilson CLOUD CHAMBER, a device that became widely used in the study of radioactivity, X rays, cosmic rays, and other particle phenomena, also led to the later development of the BUBBLE CHAMBER. He shared the 1927 Nobel Prize for Physics with ARTHUR COMPTON.

Wilson, Colin (Henry) (b. June 26, 1931, Leicester, Leicestershire, Eng.) British writer. Born into a working-class family, he initially thought of a career in science, then gravitated toward writing. At age 24 he published *The Outsider* (1957), a study of 20th-century alienation that had phenomenal success. His next book was dismissed as unoriginal or superficial, but *Ritual in the Dark* (1960) and *Adrift in Soho* (1961) helped repair his reputation. Many of his more than 70 books deal with the psychology of crime, the occult, human sexuality, and his own existential philosophy. *Alien Dawn* (1998) discusses the UFO phenomenon.

Wilson, Edmund (b. May 8, 1895, Red Bank, N.J., U.S.—d. June 12, 1972, Talcottville, N.Y.) U.S. critic and essayist. He attended Princeton University and initially worked as a reporter and magazine editor. Much of his writing, in which he probed diverse subjects with scholarship and common sense in clear and precise prose, was published in *The New Republic* and *The New Yorker*. Among his influential critical works are *Axel's Castle* (1931), a survey of the Symbolist poets; *To the Finland Station* (1940), a study of the thinkers who set the stage for the Russian Revolution; and *Patriotic Gore* (1962), analyzing American Civil War literature. His other writings include plays, poetry, the short-story collection *Memoirs of Hecate County* (1946), and five volumes of posthumously published journals. He was widely regarded as the leading critic of his time.

Edmund Wilson
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Wilson, Edmund B(eecher) (b. Oct. 19, 1856, Geneva, Ill., U.S.—d. March 3, 1939, New York, N.Y.) U.S. cell biologist. He joined the Columbia University faculty in 1891, where he became established as a pioneer in work on cell lineage (tracing the formation of different kinds of tissues from individual cells). His interests later extended to internal cellular organization and the problem of sex determination, leading to a series of papers (1905) on the role of chromosomes. Recognizing the importance of GREGOR MENDEL's findings, he realized that the role of chromosomes went far beyond the determination of sex and envisioned their function as important components in heredity as a whole, ideas that were a powerful force in shaping future genetic research.

Wilson, Edward O(sborne) (b. June 10, 1929, Birmingham, Ala., U.S.) U.S. biologist. He received his Ph.D. from Harvard University, where he taught from 1956. Recognized as the world's leading authority on ants, he discovered their use of pheromone for communication. His *The Insect Societies* (1971) was the definitive treatment of the subject. In 1975 he published *Sociobiology*, a highly controversial and influential study of the genetic basis of social behaviour in which he claimed that even a characteristic such as unselfish generosity may be genetically based and may have evolved through natural selection, that preservation of the gene rather than the individual is the focus of evolutionary strategy, and that the essentially biological principles on which animal societies are based apply also to human social behaviour. In *On Human Nature* (1978, Pulitzer Prize) he explored SOCIOBIOLOGY's implications in regard to human aggression, sexuality, and ethics. With Bert Hölldobler he wrote the major study *The Ants* (1990, Pulitzer Prize). In *The Diversity of Life* (1992) he examined how the world's species became diverse and the massive extinctions caused by 20th-century human activities. In *Consilience: The Unity of Knowledge* (1998) he proposed that all of existence can be organized and understood in accordance with a few fundamental natural laws.

Wilson, (James) Harold, Baron Wilson (of Rievaulx) (b. March 11, 1916, Huddersfield, Yorkshire, Eng.—d. May 24, 1995, London) British politician and prime minister (1964–70, 1974–76). The son of an industrial chemist, he was educated at the University of Oxford, where he collaborated with WILLIAM H. BEVERIDGE on work that led to the latter's 1942 report. In World War II he was drafted into the civil service and produced a study of the mining industry. His book *New Deal for Coal* (1945) was the basis for the LABOUR PARTY's plan to nationalize the coal mines. He was elected to the House of Commons in 1945 and appointed president of the Board of Trade (1947–51). Elected leader of the Labour Party in 1963, he became prime minister in 1964. He widened the party's voting majority in 1966 but his popularity declined in the late 1960s, partly because of his assumption of direct responsibility for the economy shortly before the pound was devalued in 1967. In his second term, he confirmed Britain's membership in the EUROPEAN ECONOMIC COMMUNITY (1975). He resigned unexpectedly in 1976 and was created a life peer in 1983.

Wilson, Harriet E. *orig.* **Harriet E. Adams** (b. 1828?, Milford, N.H.?, U.S.—d. 1863?, Boston, Mass.?) U.S. writer, probably the first African American to publish a novel in English in the U.S. Little is known of her history until 1850. She may have been an indentured servant in Milford, N.H., before becoming a domestic in Massachusetts. In 1851 she married a fugitive slave who ran off to sea before the birth of their son. Her one book, written to make money to reclaim her son from foster care, is *Our Nig* (1859), a largely autobiographical novel that treats racism in the pre-Civil War North. After 1863 Wilson disappeared from the public record.

Wilson, J(ohn) Tuzo (b. Oct. 24, 1908, Ottawa, Ont., Can.—d. April 15, 1993, Toronto, Ont.) Canadian geologist and geophysicist. He was the first graduate of a Canadian university in the field of geophysical studies (1930). After World War II he became a professor of geophysics at the University of Toronto. He established global patterns of faulting and the structure of the continents, and in the 1960s he became the world's leading spokesman for the theory of CONTINENTAL DRIFT. His studies also were important for the hypothesis of SEAFLOOR SPREADING and the theory of convection currents within the Earth. A range of mountains in Antarctica is named for him.

Wilson, James (b. Sept. 14, 1742, Fife, Scot.—d. Aug. 21, 1798, Edenton, N.C., U.S.) American colonial lawyer, politician, and jurist. Immigrating to North America in 1765, he taught Greek and rhetoric in the College of Philadelphia and then studied law under JOHN DICKINSON. In 1774 he published a widely read treatise proposing a commonwealth of British colonies. He was a member of the Committee of Correspondence, a delegate to the Continental Congress (1775–77), and a signer of the Declaration of Independence. He helped draft the U.S. Constitution and the Pennsylvania state constitution and delivered lectures that became landmarks in American jurisprudence. He served on the U.S. Supreme Court (1789–98).

Wilson, Lanford (Eugene) (b. April 13, 1937, Lebanon, Mo., U.S.) U.S. playwright. He began writing plays in 1962 and became cofounder and director of the Circle Repertory Company (1969–95), a regional theatre in New York City. His plays, which are known for their experimental staging, simultaneous dialogue, and deferred character exposition, include *Lemon Sky* (1970), the long-running hit *The Hot l Baltimore* (1973), *The Mound Builders* (1975), *Talley's Folly* (1979, Pulitzer Prize), *Burn This* (1987), and *By the Sea* (1996).

Wilson, Richard (b. Aug. 1, 1714, Penegoes, Montgomeryshire, Wales—d. May 15, 1782, Llanberis, Carnarvonshire) Welsh landscape painter. He worked as a portraitist for many years, but after a lengthy stay in Italy (1750–57) he worked almost exclusively in landscape, except for numerous drawings of Roman sites and buildings that he used in composing Italianate landscapes. A set of drawings made for Lord Dartmouth (dated 1754) show that he tempered his delicate observation of light and distance with the discipline of such 17th-century Classicists as NICOLAS POUSSIN. The landscapes he produced after his return to Britain influenced J.M.W. TURNER and JOHN CONSTABLE.

Wilson, Robert W(oodrow) (b. Jan. 10, 1936, Houston, Texas, U.S.) U.S. radio astronomer. He joined Bell Laboratories in 1963 and

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headed its Radio Physics Research Department (1976–94). With his colleague Arno Penzias, he detected the cosmic background radiation, a discovery for which the two men shared a 1978 Nobel Prize (with Pyotr Kapitsa [1894–1984], who was honoured for research unrelated to theirs).

Wilson, Teddy *orig.* **Theodore Shaw Wilson** (b. Nov. 24, 1912, Austin, Texas, U.S.—d. July 31, 1986, New Britain, Conn.) U.S. pianist and bandleader. He began recording as the leader of small groups in 1935. These recordings, often featuring vocalist Billie Holiday, are classics of small-group swing. Wilson joined Benny Goodman's trio in 1936. After 1940 he worked primarily as a leader of small ensembles or as a solo pianist, showcasing his tasteful and refined amalgam of the styles of Fats Waller, Earl Hines, and Art Tatum.

Wilson, William Julius (b. Dec. 20, 1935, Derry Township, Pa., U.S.) U.S. sociologist. He spent 24 years on the University of Chicago faculty before moving to Harvard University in 1996. In *The Declining Significance of Race* (1978) and *The Truly Disadvantaged* (1987) he contends that entrenched black poverty stems neither from racism nor from welfare dependency but from changes in the global economy that pull low-skilled manufacturing jobs out of the inner city. In *When Work Disappears* (1996) he discusses, among other issues, how chronic joblessness erodes work skills. Wilson holds that only "race neutral" programs such as universal health care and government-financed jobs can alleviate the problems of black poverty in the inner city.

Wilson, (Thomas) Woodrow (b. Dec. 28, 1856, Staunton, Va., U.S.—d. Feb. 3, 1924, Washington, D.C.) 28th president of the U.S. (1913–21). He earned a law degree and later received his doctorate from Johns Hopkins University. He taught political science at Princeton University (1890–1902). As its president (1902–10), he introduced various reforms. With the support of progressives, he was elected governor of New Jersey. His reform measures attracted national attention, and he became the Democratic Party presidential nominee in 1912. His campaign emphasized his progressive New Freedom policy, and he defeated Theodore Roosevelt and William H. Taft to win the presidency. As president, he approved legislation that lowered tariffs, created the Federal Reserve System, established the Federal Trade Commission, and strengthened labour unions. In foreign affairs he promoted self-government for the Philippines and sought to contain the Mexican civil war. From 1914 he maintained U.S. neutrality in World War I, offering to mediate a settlement and initiate peace negotiations. After the sinking of the *Lusitania* (1915) and other unarmed ships, he obtained a pledge from Germany to stop its submarine campaign. Campaigning on the theme that he had "kept us out of war," he was narrowly reelected in 1916, defeating Charles Evans Hughes. Germany's renewed submarine attacks on unarmed passenger ships caused Wilson to ask for a declaration of war in April 1917. In a continuing effort to negotiate a peace agreement, he presented the Fourteen Points (1918). He led the U.S. delegation to the Paris Peace Conference. The Treaty of Versailles faced opposition in the Senate from the Republican majority led by Henry Cabot Lodge. In search of popular support for the treaty and its provision creating the League of Nations, Wilson began a cross-country speaking tour, during which he collapsed. He returned to Washington, D.C. (September 1919), where he suffered a massive stroke that left him partially paralyzed. In the months that followed, his wife Edith controlled access to him, made some decisions by default, and engineered a cover-up of his condition. He rejected any attempts to compromise his version of the League of Nations and urged his Senate followers to vote against ratification of the treaty, which was defeated in 1920. He was awarded the 1919 Nobel Prize for Peace.

Wilson disease *or* **hepatolenticular degeneration** \'hi-ˌpat-ə-lən-ˌtik-yə-lər\ Recessive hereditary defect (see recessiveness) that impairs one's ability to metabolize copper. In affected persons, copper accumulates in the basal ganglia (see ganglion) of the brain (involved in control of movement), causing progressive degeneration; forms a brownish ring at the margin of the cornea of the eye; and is deposited in the liver, gradually leading to cirrhosis. Other symptoms include tremor, lack of coordination, and personality changes. The disease usually appears in the person's teen years or twenties. Early diagnosis and treatment with a high-protein, low-copper diet and a substance to chelate copper can reverse the effects and prevent permanent brain and liver damage.

Wilson's Promontory Southernmost point of the Australian mainland, southern Victoria. The peninsula, 22 mi (35 km) long with a maximum width of 14 mi (23 km), projects into the Bass Strait and is almost an island. Its highest point is Mount Latrobe (2,475 ft [754 m]). Visited in 1798 by the English explorer George Bass, it was first called Furneaux Land; it was renamed for Thomas Wilson, an English merchant. In 1905 it was made a national park.

Wiltshire \'wilt-ˌshir\ Administrative (pop., 2001: 432,973), geographic, and historic county, southern England. It is located in a watershed separating the basins of the Bristol Channel, the English Channel, and the River Thames; its administrative centre is Trowbridge. Chalk uplands constitute much of the county, and in prehistoric times they were the most heavily populated parts of England; Wiltshire has many prehistoric monuments, including Stonehenge and Iron Age hill forts. The town of Salisbury, long an ecclesiastical centre, is renowned for its cathedral. There is an industrial centre at Swindon; otherwise, agriculture is the most important economic activity.

Wimbledon Municipal center in the Greater London borough of Merton, known as the site of the annual lawn-tennis All-England Championships. Held in late June and early July, the tournament is the oldest (founded 1877) and most prestigious in the world. It is one of four tournaments that make up the Grand Slam of tennis, and the only one still played on natural grass. Competition was opened to professionals in 1968.

Winchell, Walter *orig.* **Walter Winchel** (b. April 7, 1897, New York, N.Y., U.S.—d. Feb. 20, 1972, Los Angeles, Calif.) U.S. journalist and broadcaster. He entered vaudeville at age 13 and eventually began contributing tidbits to the *Vaudeville News*. Later, as a full-time gossip columnist, he moved to the *New York Daily Mirror*, where his widely syndicated column appeared until 1963. He had a weekly radio program from 1932 until the early 1950s. A prolific phrasemaker, he was noted for his slangy Broadway idiom. His opinionated news reports brought him a massive audience and great influence from the 1930s through the 1950s. He served as the unseen narrator of the television drama series *The Untouchables* (1959–63).

Winchester City and administrative district (pop., 2001: 107,213), central part of the administrative and historic county of Hampshire, England. Initially founded by Celtic peoples, it became important as Venta Belgarum under Roman rule. It was the capital of Wessex and a centre of learning under Alfred the Great; later it was the seat of the Danish king Canute's government. It remained important under the Norman kings until the emergence of London as the sole capital of England late in the 12th century. Winchester is known for its cathedral (11th–14th centuries), Britain's longest (556 ft [169 m]), and for Winchester College, founded in 1382.

Winchester, Oliver (Fisher) (b. Nov. 30, 1810, Boston, Mass., U.S.—d. Dec. 11, 1880, New Haven, Conn.) U.S. manufacturer of guns and ammunition. He initially set up a factory to manufacture dress shirts, and his success enabled him to purchase the Volcanic Repeating Arms Co. (1857), which became the Winchester Repeating Arms Co. (1867). His chief gun designer, B.T. Henry, created the lever-action Henry repeating rifle (patented 1860). Widely used in the American Civil War, it was the forerunner of a long line of Winchester guns, including the famous Model 73, a favourite weapon of settlers in the American West.

Winckelmann \'viŋ-kəl-ˌmän,\ *English* \'wiŋ-kəl-mən**, Johann (Joachim)** (b. Dec. 9, 1717, Stendal, Prussia—d. June 8, 1768, Trieste, Austria) German archaeologist and art historian. The son of a cobbler, he studied theology and medicine before he discovered Greek art. His essay *Reflections on the Painting and Sculpture of the Greeks* (1755) became a manifesto of the Greek ideal in education and art and was soon translated into several languages. After converting to Roman Catholicism, he moved to Rome (1755) and held important posts in the Vatican. There he wrote *History of the Art of Antiquity* (1764), which inaugurated the study of art history as a discipline and of archaeology as a humane science. His writings

Winckelmann, oil painting by Anton Raphael Mengs, 1758; in the Metropolitan Museum of Art, New York City
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY, HARRIS BRISBANE DICK FUND, 1948

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reawakened the popular taste for Classical art and were instrumental in generating the NEOCLASSICAL movement in the arts.

wind Movement of air relative to the surface of the Earth. Wind is an important factor in determining and controlling climate and weather. It is also the generating force of most ocean and freshwater waves. Wind occurs because of horizontal and vertical differences in atmospheric pressure. The general pattern of winds over the Earth is known as the general circulation, and specific winds are named for the direction from which they originate (e.g., a wind blowing from west to east is a westerly). Wind speeds are often classified according to the Beaufort scale.

Beaufort Scale

No.	Name	Wind speed, mph (kph)	Description
0	Calm	<1 (<1)	Calm; smoke rises vertically
1	Light air	1–3 (1–5)	Direction of wind shown by smoke but not by wind vanes
2	Light breeze	4–7 (6–11)	Wind felt on face; leaves rustle; wind vane moves
3	Gentle breeze	8–12 (12–19)	Leaves and small twigs in constant motion; wind extends light flag
4	Moderate breeze	13–18 (20–28)	Wind raises dust and loose paper; small branches move
5	Fresh breeze	19–24 (29–38)	Small-leaved trees begin to sway; crested wavelets form on inland waters
6	Strong breeze	25–31 (39–49)	Large branches move; overhead wires whistle; umbrellas difficult to control
7	Moderate gale or near gale	32–38 (50–61)	Whole trees sway; walking against wind is difficult
8	Fresh gale or gale	39–46 (62–74)	Twigs break off trees; moving cars veer
9	Strong gale	47–54 (75–88)	Slight structural damage occurs; shingles may blow away
10	Whole gale	55–63 (89–102)	Trees uprooted; or storm considerable structural damage occurs
11	Storm or violent storm	64–72 (103–117)	Widespread damage occurs
12	Hurricane	>72 (>117)	Widespread damage occurs

Wind Cave National Park National park, southwestern South Dakota, U.S. Established in 1903 to preserve limestone caverns and unspoiled prairie grassland in the BLACK HILLS, it covers an area of 28,292 ac (11,449 ha). Its caves contain 83 mi (134 km) of explored passages and have beautiful rock formations called boxwork, formed by CALCITE deposition in unique patterns. The park is also a wildlife refuge.

wind chill Still-air temperature that would have the same cooling effect on exposed skin as a given combination of temperature and wind speed. As the wind speed increases, the wind chill equivalent temperature decreases; e.g., an air temperature of 30 °F (–1.1 °C) with a wind speed of 20 mph (32.2 kph) produces a wind chill of 17 °F (–8 °C). Wind chill is often included in weather reports to describe how cold it feels. See illustration on following page.

wind power Use of the energy in winds to produce power. Though wind is irregular and spread out, it contains tremendous amounts of energy. Sophisticated wind TURBINES have been developed to convert this energy to electric power. The use of wind-energy systems grew considerably in the 1980s and '90s. Germany today produces more wind energy than any other country. Some 15,000 wind turbines are now in operation in California. See also WINDMILL.

Wind River Range Mountain range, central ROCKY MOUNTAINS, west-central Wyoming, U.S. The range extends for 100 mi (160 km) northwest-southeast to the Sweetwater River and is part of the CONTINENTAL DIVIDE. It contains many peaks above 12,000 ft (3,658 m); the highest is Gannett Peak at 13,804 ft (4,207 m). The OREGON TRAIL ran through the historic South Pass (7,743 ft, or 2,360 m). Parts of Bridger and Shoshone national forests and Wind River Indian Reservation are in the range. The Wind River flows from the eastern side into the BIGHORN RIVER; the GREEN RIVER rises on its western slopes.

wind shear Rate of change of wind velocity with distance perpendicular to the wind direction. A very narrow zone of abrupt velocity change is known as a shear line. Wind shear is observed near the ground and in jet streams, where it may be associated with clear-air turbulence. Vertical wind shear is closely associated with the vertical flux of momentum, heat, and water vapour.

wind tunnel Device for producing a controlled stream of air to study the effects on objects such as aircraft moving through air or the effects of moving air on models of stationary objects such as buildings. Applications of wind-tunnel research range from testing of airframes (the structures of aircraft and spacecraft) to research on the BOUNDARY LAYER, TURBULENCE, DRAG, and LIFT. Measurements of air pressure and other characteristics at many points on the model yield information about how the total wind load is distributed. In addition to testing the effects of wind on aircraft and spacecraft, studies in wind tunnels have been used to solve design problems in automobiles, boats, trains, bridges, and buildings. See also AERODYNAMICS.

Windermere Lake, northwestern England. Located in the southeastern LAKE DISTRICT, it is the country's largest lake, 10.5 mi (17 km) long and 1 mi (1.6 km) wide; its area is 6 sq mi (16 sq km). It has a maximum depth of 219 ft (67 m). Part of the Lake District National Park, it is a popular tourist centre.

Windhoek \'vint-ˌhůk\ Town (pop., 1997 est.: 169,000), capital of Namibia. It is located in the central part of the country, in an area originally settled by African peoples. In 1890 the site of the present town was claimed for the German government. In 1915 South African forces occupied it and initiated their claim to the country, then known as South West Africa. When Namibia became independent in 1990, Windhoek became its capital. It is the country's main commercial and transportation centre.

Windischgrätz \ˌvin-dish-'grets**, Alfred, prince zu** (b. May 11, 1787, Brussels, Austrian Netherlands—d. March 21, 1862, Vienna, Austria) Austrian field marshal. He entered the Habsburg imperial army as an officer (1804) and rose through the ranks to become military commander for Bohemia (1840). In the REVOLUTIONS OF 1848, he suppressed the Czech rebels in Prague and crushed the insurrection in Vienna, where he was noted for his harsh military rule. Appointed field marshal (1848), he occupied Budapest in 1849 and drove the Hungarian rebels beyond the Tisza River. Although he was given supreme command of all imperial troops outside Italy, his gifts as a commander were mediocre, and differences with his brother-in-law, the Habsburg prime minister, prince zu SCHWARZENBERG, resulted in his recall (1849). Thereafter Windischgrätz retired to Bohemia.

windmill Machine for harnessing the energy of the wind using sails mounted on a rotating shaft. The sails are mounted at an angle or are given a slight twist, so that the force of wind against them has two components, one of which, in the plane of the sails, causes rotation. Like WATERWHEELS, windmills were among the original prime movers that replaced human beings as a source of power. Their most important traditional use was for grinding grain, though in certain areas their use in land drainage and water pumping was equally important. Windmill use became increasingly widespread in Europe (particularly the Netherlands) from the 12th century to the early 19th century, but thereafter slowly declined. Interest in windmills for generating electric power revived in the 1970s. See also WIND POWER.

window Opening in the wall of a building for light and air, and sometimes for framing a view. Since early times, the openings have been filled with stone, wooden, or iron grilles, with panes of glass or other translucent material such as mica or, in East Asia, paper. A window in a vertically sliding frame is called a sash window: a single-hung sash has only one half that moves; in a double-hung sash, both parts slide. A casement window swings open on hinges attached to the upright side of the frame. Awning windows swing outward on hinges attached to the top of the frame; hopper windows swing inward on hinges attached to the bottom of the frame. Large, fixed (nonoperating) areas of glass are commonly called picture windows. A bay window (see ORIEL) is an exterior projection of a BAY of a building that also forms an interior recess, providing better light and view than would a window flush with the building line. See also DIOCLETIAN WINDOW; ROSE WINDOW; SHŌJI.

Windows Family of software products developed by MICROSOFT CORP., mainly for PERSONAL COMPUTERS and workstations, that began as a GRAPHICAL

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Celsius — temperature (°C)

wind speed (kph)	calm	5	0	−5	−10	−15	−20	−25	−30	−35	−40
10		3	−3	−9	−15	−21	−27	−33	−39	−45	−51
20		1	−5	−12	−18	−24	−31	−37	−43	−49	−56
30		0	−7	−13	−20	−26	−33	−39	−46	−52	−59
40		−1	−7	−14	−21	−27	−34	−41	−48	−54	−61
50		−2	−8	−15	−22	−29	−35	−42	−49	−56	−63
60		−2	−9	−16	−23	−30	−37	−43	−50	−57	−64
70		−2	−9	−16	−23	−30	−37	−44	−51	−59	−66
80		−3	−10	−17	−24	−31	−38	−45	−52	−60	−67
90		−3	−10	−17	−25	−32	−39	−46	−53	−61	−68
100		−3	−11	−18	−25	−32	−40	−47	−54	−61	−69

wind chill (°C) = $13.12 + 0.6215T - 11.37(V^{0.16}) + 0.3965T(V^{0.16})$

T = air temperature (°C) V = wind speed (kph)

Fahrenheit — temperature (°F)

wind speed (mph)	calm	40	35	30	25	20	15	10	5	0	−5	−10	−15	−20	−25	−30	−35	−40
5		36	31	25	19	13	7	1	−5	−11	−16	−22	−28	−34	−40	−46	−52	−57
10		34	27	21	15	9	3	−4	−10	−16	−22	−28	−35	−41	−47	−53	−59	−66
15		32	25	19	13	6	0	−7	−13	−19	−26	−32	−39	−45	−51	−58	−64	−71
20		30	24	17	11	4	−2	−9	−15	−22	−29	−35	−42	−48	−55	−61	−68	−74
25		29	23	16	9	3	−4	−11	−17	−24	−31	−37	−44	−51	−58	−64	−71	−78
30		28	22	15	8	1	−5	−12	−19	−26	−33	−39	−46	−53	−60	−67	−73	−80
35		28	21	14	7	0	−7	−14	−21	−27	−34	−41	−48	−55	−62	−69	−76	−82
40		27	20	13	6	−1	−8	−15	−22	−29	−36	−43	−50	−57	−64	−71	−78	−84
45		26	19	12	5	−2	−9	−16	−23	−30	−37	−44	−51	−58	−65	−72	−79	−86
50		26	19	12	4	−3	−10	−17	−24	−31	−38	−45	−52	−60	−67	−74	−81	−88
55		25	18	11	4	−3	−11	−18	−25	−32	−39	−46	−54	−61	−68	−75	−82	−89
60		25	17	10	3	−4	−11	−19	−26	−33	−40	−48	−55	−62	−69	−76	−84	−91

wind chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

T = air temperature (°F) V = wind speed (mph)

frostbite times: 30 minutes, 10 minutes, 5 minutes

Source: U.S. National Weather Service; Meteorological Services of Canada

Matching a specific air temperature (columns) with a wind speed (rows) will show the wind chill equivalent and the approximate time to frostbite.
ENCYCLOPÆDIA BRITANNICA, INC.

USER INTERFACE and developed into an OPERATING SYSTEM. Version 1.0 (1985) provided a graphical user interface, MULTITASKING, and virtual MEMORY management; it ran on top of MS-DOS and was supported on Intel-based personal computers. Version 3.1 (1992) sold over 3 million copies in its first two months and helped establish Microsoft's dominance of the operating-system market for microcomputers. Windows 95 and Windows 98 (named for the years of their release) continued its success. Windows NT (1993), which can run on RISC-based computers as well as traditional Intel-based systems, is a high-end version of Windows intended for more powerful personal computers, workstations, and servers. Windows CE (1996) is an embedded operating system for PALM PCs and other handheld devices. Microsoft continues to release new versions of its operating system: Windows 2000 for corporate-oriented computers, Windows Me (2000) for consumer-oriented computers, and in 2001 a version for both environments, Windows XP. Today Windows runs on more than 90% of all personal computers.

windpipe See TRACHEA

Windsor City (pop., 2001: 208,402), southern Ontario, Canada. Located on the southern bank of the DETROIT RIVER, opposite DETROIT, Mich., U.S., it was settled by French farmers shortly after 1701, when a fort was established at Detroit. It was known first as "the Ferry" and later as Richmond before it was renamed in 1836. With its strategic location opposite Detroit, it became an industrial centre, an important railway terminus, and a busy port in GREAT LAKES shipping. Its manufactures include motor vehicles and parts, foods and beverages, and medicines. It is Canada's leading port of entry from the U.S.

Windsor, house of *formerly (1901–17)* **House of Saxe-Coburg-Gotha** Royal house of Britain, which succeeded the house of HANOVER on the death of its last monarch, Queen VICTORIA. The dynastic name of Saxe-Coburg-Gotha was that of Victoria's German-born husband, Prince ALBERT. The dynasty has included EDWARD VII, GEORGE V, EDWARD VIII, GEORGE VI, and ELIZABETH II. In view of the anti-German atmosphere of World War I, George V proclaimed in 1917 that all British male descendants of Queen Victoria would adopt the surname of Windsor.

Windsor, Wallis Warfield, duchess of (b. June 19, 1896, Blue Ridge Summit, Pa., U.S.—d. April 24, 1986, Paris, France) U.S. socialite who became the wife of Prince Edward, duke of Windsor (EDWARD VIII), after the latter had abdicated the British throne in order to marry her. She had earlier married Earl Spencer in 1916. After their divorce (1927), she married Ernest Simpson (1928) and moved with him to London. As a member of fashionable British society, she met Edward, prince of Wales, and the two gradually fell in love. She filed for divorce in 1936 with the intention of marrying Edward (by then King Edward), but as a woman twice divorced, she was unacceptable as a prospective British queen. Edward renounced the throne, and after she received her divorce they were married in 1937. The two thereafter lived a well-publicized international social life, residing mainly in France.

Windsor Castle Principal British royal residence, on the River Thames in Windsor, Berkshire, southern England. It comprises two quadrilateral building courts, or upper and lower wards, separated by the Round Tower (erected by HENRY II), a massive structure built on a mound and visible for many miles. The present-day complex has been reworked repeatedly since WILLIAM THE CONQUEROR first constructed a stockade on the site. The lower ward includes the Albert Memorial Chapel and St. George's Chapel, the burial place of 10 sovereigns. The upper ward, part of which was damaged by fire in 1992, includes the monarch's private apartments, visitors' apartments, and the royal library.

windsurfing Sport of riding a sailboard, a modified surfboard with a movable mast. Steered from a standing position, sailboards are capable of moderately high speeds and are usually used on lakes, or close to shore—sometimes within the surf zone—on the ocean. The sport originated in the U.S. in the late 1960s and quickly grew in popularity. It was introduced at the Olympic Games in 1984.

Windward Islands Island group, Lesser ANTILLES, West Indies. Located at the eastern end of the CARIBBEAN SEA, they include DOMINICA (sometimes classified as part of the LEEWARD ISLANDS), MARTINIQUE, ST. LUCIA, ST. VINCENT, GRENADA, and the chain of small islands known as the GRENA-

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DINES. Though near the general area, TRINIDAD AND TOBAGO and BARBADOS are usually not considered part of the group.

wine ALCOHOLIC BEVERAGE made from the fermented juice of GRAPES. Wine may also be made from various fruits and plant parts. Though known by the ancients, wine was not drunk in its matured form until the development of the bottle and cork in the late 17th century. In wine manufacture, grapes are crushed and strained, and the juice (called must) is sealed in vats along with YEAST (*Saccharomyees ellipsoideus*) and often sulfur dioxide, which suppresses wild yeasts and organisms. FERMENTATION continues for several weeks, and then the wine is drawn off ("racked") into wooden barrels or other containers for a second fermentation ("aging"). It is clarified and bottled before undergoing final maturation. Wines may be classified according to colour as red, rosé (pink), or white; colour depends on whether the skins of red grapes are allowed to ferment with the juice. Wine taste is described as sweet or dry, sweet wines being high in sugar content and dry wines containing little or no sugar. Sparkling wines, such as CHAMPAGNE, contain suspended carbon dioxide, the result of bottling the wine before fermentation is complete. Fortified wines, such as PORT and SHERRY, contain added brandy. The leading wine-producing countries are France, Italy, Spain, the U.S., Argentina, Germany, Australia, South Africa, Portugal, and Romania.

Winfrey, Oprah (b. Jan. 29, 1954, Kosciusko, Miss., U.S.) U.S. television talk-show host and actress. After enduring an impoverished and troubled childhood, she became a news anchor for a local CBS television station in Tennessee at age 19. After graduating from Tennessee State University, she worked as a television reporter and anchor in Baltimore, Md., where she cohosted her first talk show (1977–83), and moved to Chicago to host *A.M. Chicago* (1984), which became that city's highest-rated morning show. The renamed *Oprah Winfrey Show* was syndicated in 1986, making her the first African American woman to host a successful national daytime talk show. Initially sensationalist, the enormously popular show gradually took on an uplifting and therapeutic tone. In 1986 she also formed her own television production company, Harpo Productions. In 1996 she introduced "Oprah's Book Club" to foster reading by endorsing certain books. She appeared in the movies *The Color Purple* (1985) and *Beloved* (1998).

wing In zoology, one of the paired structures certain animals use for flying. Bat and bird wings are modifications of the VERTEBRATE forelimb. In birds, the fingers are reduced and the forearm is lengthened. The primary flight feathers propel the bird forward, and the secondaries (on the upper wing) provide lift. Bat wings consist of a membrane stretched over slender, elongated arm and hand bones. Insect wings are folds of integument ("skin"). Most insects have two pairs of wings; DIPTERANS (flies) have only one developed pair, and BEETLES have two but use only one for flying. The two wings on a side usually move together, but DRAGONFLY wings work independently.

Winnebago \ˌwi-nə-'bā-gō\ North American Indian people who live in the Midwestern U.S., notably Iowa, Wisconsin, and Nebraska. Their language belongs to the Siouan language family, and their name is derived from a Fox name meaning "People of the Stinking Water." They call themselves Hochungra, meaning "People of the Big Speech [or Parent Speech]." Before the 17th century, the Winnebago lived in what is now eastern Wisconsin. By the early 19th century, as a result of their participation in the fur trade, they had expanded into southwestern Wisconsin and northwestern Illinois. They lived in villages of dome-shaped wigwams; there they cultivated corn, squash, beans, and tobacco and hunted bison. Their major ceremony was the medicine dance, in which both men and women participated. Membership in the 12 CLANS was determined by the father, and the clans were important units in social life. The Winnebago were involved in the BLACK HAWK War of 1832, after which most of the tribe was removed to other Midwestern states. At the turn of the 21st century they numbered some 12,000.

Winnemucca, Sarah Hopkins See Sarah Winnemucca HOPKINS

Winnipeg City (pop., 2001: metro. area, 671,274), capital of Manitoba, Canada. Located at the confluence of the RED RIVER OF THE NORTH and the ASSINIBOINE RIVER, Winnipeg was settled as a French fur-trading post in 1738. In the early 19th century THOMAS DOUGLAS founded a Scottish settlement there. Development ensued with the arrival of Canada's first transcontinental railroad in 1885. Following disastrous floods in 1950, much of the city was rebuilt. It is a cultural, financial, commercial, industrial, and government centre.

Winnipeg, Lake Lake, south-central Manitoba, Canada. Fed by many rivers, including the SASKATCHEWAN, RED RIVER OF THE NORTH, and WINNIPEG, it is drained to the northeast by the NELSON RIVER. It is 264 mi (425 km) long, up to 68 mi (109 km) wide, and has an area of 9,416 sq mi (24,387 sq km). The Canadian explorer Pierre LA VERENDRYE visited the lake in 1733. With an average depth of 50 ft (15 m), it is important for shipping, commercial fishing, and recreation.

Winnipeg River River, southeastern Manitoba and southwestern Ontario, Canada. It issues from the Lake of the WOODS and flows northwest for about 200 mi (320 km) before entering the southeastern part of Lake WINNIPEG. It served as a route for early European explorers and fur traders. There are numerous hydroelectric power plants along its course.

Winnipegosis \ˌwi-nə-pə-'gō-səs**, Lake** Lake, western Manitoba, Canada. Located west of Lake WINNIPEG, it is a remnant of glacial Lake Agassiz. Numerous streams feed the 2,075-sq-mi (5,374-sq-km) lake, which drains southeastward into Lake MANITOBA. It is more than 150 mi (240 km) long, up to 32 mi (51 km) wide, and has a maximum depth of 833 ft (254 m). It was explored in 1739 by Pierre LA VERENDRYE and later served as part of a fur-trading route. It now is important for commercial fishing.

Winnipesaukee \ˌwi-nə-pə-'sȯ-kē**, Lake** Lake, east-central New Hampshire, U.S. New Hampshire's largest lake, it covers an area of 71 sq mi (184 sq km) and is 20 mi (32 km) long by 12 mi (19 km) wide. It is dotted with 274 islands. Its outlet, the Winnipesaukee River, flows about 20 mi (32 km) southwest to enter the MERRIMACK RIVER. It is a popular summer recreation area.

Winogradsky \vyin-ə-'grät-skē**, Sergey (Nikolayevich)** (b. Sept. 1, 1856, Kiev, Russian Empire—d. Feb. 25, 1953, Brie-Comte-Robert, France) Russian microbiologist. In studying the physiology of sulfur bacteria, he showed that the colourless ones oxidize hydrogen sulfide to sulfur and then to sulfuric acid in the absence of light (1887). He discovered two groups of microbes (1889-90), each involved in one step of nitrification (oxidation of ammonia to nitrites and nitrites to nitrates), and established a new genus for each. He also proposed new ways to study soil microorganisms, particularly those symbiotic with legumes.

Winslow, Edward (b. Oct. 18, 1595, Droitwich, Worcestershire, Eng.—d. May 8, 1655, at sea, near Jamaica, British West Indies) British-American colonist. In 1620 he sailed on the *Mayflower* to New England, where he was a founder of the PLYMOUTH colony. He served on the governor's council (1624–47) and was governor of the colony (1633–34, 1636–37, 1644–45). He traded with the Wampanoag Indians and won the friendship of their chief, MASSASOIT. As a commissioner of the United Colonies of New England, he often went to England to represent the interests of the Massachusetts Bay and Plymouth colonies. In 1646 he returned to England and held minor offices under OLIVER CROMWELL. He died aboard a ship on an expedition to the West Indies.

Winslow, Josiah (b. c. 1629, Plymouth colony—d. Dec. 18, 1680, Marshfield, Plymouth colony) American colonist. The son of EDWARD WINSLOW, he succeeded MYLES STANDISH as commander of PLYMOUTH colony's military forces in 1656. He was appointed assistant governor of the colony (1657–73) and served as a member of the directorate of the NEW ENGLAND CONFEDERATION. He was the first native-born colonial governor of Plymouth colony (1673–80) and established its first public school. In KING PHILIP'S WAR he was commander in chief of the confederation's military forces (1675–76).

Winsor, engraving by J.A.J. Wilcox
COURTESY OF THE LIBRARY OF CONGRESS, WASHINGTON, D.C.

Winsor \'win-zər**, Justin** (b. Jan. 2, 1831, Boston, Mass., U.S.—d. Oct. 22, 1897, Cambridge, Mass.) U.S. librarian and historian. A freelance writer in his native Boston, Winsor was appointed a trustee of the Boston Public Library and served as its superintendent (1868–77). He was a founder of the American Library Association (1876) and its first president. From 1877 he was

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librarian of Harvard University. He edited the *Narrative and Critical History of America* (1884–89) and wrote several books.

Winston-Salem City (pop., 2000: 185,776), north-central North Carolina, U.S. With High Point and Greensboro it forms a tri-city industrial area. Salem was laid out by Moravian colonists in 1766. R.J. Reynolds founded his tobacco company there in 1875 (see R.J. Reynolds Tobacco). Winston was founded in 1849 and named for an American Revolutionary War soldier. The two towns were consolidated as Winston-Salem in 1913. Tobacco dominates its diversified industries, which include the manufacture of cigarettes, textiles, beer, rubber, leather, and petroleum.

Winter War See Russo-Finnish War

wintergreen Any of several evergreen plants in the heath order (Ericales). They grow as woodland wildflowers and are cultivated as garden ground cover. They are also grown as a source of oil of wintergreen, a volatile, pungent oil used to flavour candies and chewing gum and to soothe muscular aches. Wintergreen is an alternative common name for several woodland herbs: those of the genus *Pyrola* (shinleaf), comprising about 12 species of creeping perennials, and *Gaultheria procumbens* (also called teaberry and checkerberry; see also snowberry), with white flowers and spicy red berries.

Wintergreen (*Gaultheria procumbens*)
ROGER AND JOY SPURR—BRUCE COLEMAN INC./EB INC.

Winthrop, John (b. Jan. 22, 1588, Edwardstone, Suffolk, Eng.—d. April 5, 1649, Boston, Massachusetts Bay Colony) American colonial political leader, first governor of the Massachusetts Bay Colony. In 1629 he joined the Massachusetts Bay Co., and he was elected governor of the colony that was to be established by the company in New England. An ardent Puritan, he envisioned a colony based on his religious beliefs. He guided the colonists on his arrival in North America in 1630 and was elected governor 12 times during the period from 1631 to 1648. Though widely respected, he was criticized for opposing the formation of a representative assembly (1634), and the colony's limitations on religious freedom were decried by Roger Williams and Anne Hutchinson. His son, John Winthrop (1606–76), was an influential governor of Connecticut (1659–76).

John Winthrop, detail of an oil painting, school of Sir Anthony Van Dyck, *c.* 1625–49; in the collection of the American Antiquarian Society, Worcester, Mass.
COURTESY OF THE AMERICAN ANTIQUARIAN SOCIETY, WORCESTER, MASS.

wire drawing Making of wire, generally from a rod or bar. The wire-drawing process consists of pointing the rod, threading the pointed end through a die, and attaching the end to a drawing block. The block, made to revolve by an electric motor, pulls the lubricated rod through the die, reducing it in diameter and increasing its length. Fine wire is made by a multiple-block machine, because the reduction cannot be performed in a single draft.

wire service See news agency

wireless communications System using radio-frequency, infrared, microwave, or other types of electromagnetic or acoustic waves in place of wires, cables, or fibre optics to transmit signals or data. Wireless devices include cell phones, two-way radios, remote garage-door openers, television remote controls, and GPS receivers (see Global Positioning System). Wireless modems, microwave transmitters, and satellites make it possible to access the Internet from anywhere in the world. A Wireless Markup Language (WML) based on XML is intended for use in such narrow-band devices as cellular phones and pagers for the transfer and display of text.

Wisconsin State (pop., 2000: 5,363,675), northern Midwest, U.S. It covers an area of 56,153 sq mi (145,436 sq km), including part of Lake Michigan; its capital is Madison. Wisconsin is bordered by the western portion of Lake Superior and the Upper Peninsula of Michigan to the north; Lake Michigan to the east; Illinois to the south; and Minnesota and Iowa to the west and southwest, with the upper Mississippi River acting as border between these states and Wisconsin. With many unique landforms, including the Door Peninsula between Lake Michigan and Green Bay, its northern area has one of the greatest concentrations of lakes in the world. The Wisconsin River crosses the state. Forests cover about 45% of it. Originally inhabited by the Adena, or Mound Builders, the region was home to several different Indian tribes, including the Ojibwa, Menominee, and Winnebago, when Europeans arrived. The French explorer Jean Nicolet visited Wisconsin in 1634; the first permanent European settlement was established in 1717. The area remained under French control until 1763, when France ceded it to Great Britain after the French and Indian War. After the American Revolution the region was ceded to the U.S. The American settlers dispossessed the Indians of their land (see Black Hawk) and settled the region. It became the Wisconsin Territory in 1836. It was admitted to the Union as the 30th state in 1848. The Progressive movement (see Progressive Party) began in Wisconsin c. 1900, resulting in the passage of legislation that made the state a leader in social reform. It is a major milk, butter, and cheese producer in the U.S. Tourism and recreation also are economically important. Wisconsin ports handle much of the Great Lakes domestic freight shipping.

Wisconsin River River, central and southwestern Wisconsin, U.S. It rises near the Wisconsin-Michigan border and flows south through central Wisconsin, then turns west and enters the Mississippi River after a course of 430 mi (690 km). It is navigable for small craft for about 200 mi (320 km) from its mouth. Lake Wisconsin is formed by a hydroelectric dam on the river near Prairie du Sac.

Wise, Isaac Mayer (b. March 29, 1819, Steingrub, Bohemia, Austrian Empire—d. March 26, 1900, Cincinnati, Ohio, U.S.) Rabbi and organizer of Reform Judaism in the U.S. After emigrating from Bohemia, in 1854 he accepted a pulpit in Cincinnati, a post he held the rest of his life. He propagandized tirelessly for centralized Reform institutions and was instrumental in the formation of the Union of American Hebrew Congregations and of the Central Conference of American Rabbis, both of which he presided over. In 1857 he compiled a standard Reform prayer book, *Minhag America*. Though he failed to unite American Jews of all persuasions, he did bring about unanimity among Reform Jews.

Wise, Stephen Samuel (b. March 17, 1874, Budapest, Hung., Austria-Hungary—d. April 19, 1949, New York, N.Y., U.S.) Hungarian-born U.S. Reform rabbi, political activist, and Zionist leader. His family immigrated to the U.S. when he was an infant. He earned his Ph.D. at Columbia University in 1901 and was trained as a rabbi. In 1907, after declining a post at an influential congregation because of inadequate assurances of free speech in the pulpit, he founded the Free Synagogue. In 1898 he attended the Second Zionist Congress and helped found the Zionist Organization of America. A prominent member of the Democratic Party, he helped win U.S. government approval of the Balfour Declaration. In 1922 he founded the Jewish Institute of Religion, a seminary for liberal rabbis, which merged with Hebrew Union College in 1950.

Wister, Owen (b. July 14, 1860, Philadelphia, Pa., U.S.—d. July 21, 1938, North Kingstown, R.I.) U.S. novelist. A well-to-do Easterner who graduated from Harvard, he spent his summers in the West from 1885. After practicing law for two years, he devoted himself to a literary career. His novel *The Virginian* (1902), the story of a cattle-ranch foreman who depends for his life on a harsh code of ethics, was a great popular success and helped establish the cowboy as an American folk hero and stock fictional character; the novel became the basis of a play, numerous films, and even a television series. His other major work was *Roosevelt: The Story of a Friendship, 1880–1919* (1930), detailing his long acquaintance with his Harvard classmate Theodore Roosevelt.

Wister
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wisteria *or* **wistaria** \wis-'tir-ē-ə\ Any of the twining, usually woody vines that make up the genus *Wisteria*, of the pea family (see LEGUME), native mostly to Asia and North America. The leaves are pinnately compound (feathery). They are widely cultivated for their attractive spreading growth and beautiful, profuse flowers (blue, purple, rose, or white), which grow in large, drooping clusters. American wisteria (*W. frutescens*) and Kentucky wisteria (*W. macrostachya*) are native to the U.S.

witan \'wi-tän\ *or* **witenagemot** \'wi-tᵊn-ə-gə-ˌmōt\ Council of the Anglo-Saxon kings in medieval England. Usually attended by high-ranking nobles and bishops, the witan was expected to advise the king on all matters on which he chose to ask its opinion. It attested his grants of land to churches or laymen, consented to his issue of new laws, and helped him deal with rebels and disaffected subjects. Its composition and time of meeting were determined at the king's pleasure.

witch hazel family Family Hamamelidaceae, comprising 23 genera of shrubs and trees, native to tropical and warm temperate regions. The six species of the genus *Hamamelis* include such ornamentals as witch hazel, winter hazel, and *Fothergilla*, which are outstanding for their early flowering and fall leaf colour. Members of the family are characterized by simple leaves and by flowers with four or five petals and sepals each. American, or common, witch hazel (*H. virginiana*) flowers in fall and retains yellow, cuplike calyxes (collections of sepals) through the winter. The common name refers to the forked twigs that were sometimes used for water-witching, or DOWSING to locate underground water. The fragrant liniment witch hazel is made from the dried leaves and sometimes from twigs and bark. Brilliant autumn leaf colour is an outstanding trait of IRONWOOD (*Parrotia persica*). Another genus, *Altingia*, has seven species, all Asian and all valued for their timber. *A. excelsa* is one of the largest trees of the Asian tropics, sometimes reaching a height of 82 ft (25 m).

witchcraft and sorcery Use of alleged supernatural powers, usually to control people or events. Sorcery is sometimes distinguished from witchcraft in that sorcery may be practiced by anyone with the appropriate knowledge, using charms, spells, or potions, whereas witchcraft is considered to result from inherent mystical power and to be practiced by invisible means. Modern witches, however, claim that their craft is learned, and therefore another distinction between witchcraft and sorcery is that sorcery is always used with evil intent. Controversies over witchcraft and sorcery have been especially prevalent in close-knit communities experiencing decline or misfortune and embroiled in petty social conflict and scapegoating. In ancient Greece, witchcraft was mentioned as early as Homer (see CIRCE). The best-known sorceress in Classical times was the legendary MEDEA. The Roman Horace describes two witches in his *Satires*. The Bible contains several references to witches, notably the Witch of Endor consulted by Saul (1 Samuel 28). The early Church Fathers held that witchcraft was a delusion and denounced its practice. In the Middle Ages, witchcraft was believed to involve demonic possession. It was also associated with heresy and so came within the scope of the INQUISITION. In the witch-hunts of the 16th–17th centuries, European courts frequently regarded witches and sorcerers alike as candidates for burning. Although estimates of the number killed vary widely, it is likely that between 40,000 and 60,000 people were executed and many more were tortured and imprisoned during the witch-hunts. In the 20th century the modern witchcraft movement, WICCA, was established and promoted respect for nature and a pantheistic worldview. Belief in witchcraft is apparent in traditional societies throughout the world. The Navajo protect themselves against witches with sand or pollen paintings, and in African societies people seek aid from medical doctors and witch doctors, the former for treatment of the "external" causes of the illness and the latter for the "internal". See also MAGIC; SALEM WITCH TRIALS.

Witherspoon, John (b. Feb. 15, 1723, Gifford, East Lothian, Scot.—d. Nov. 15, 1794, Tusculum, N.J., U.S.) Scottish-American clergyman. Ordained a Presbyterian minister (1745), he served in Scottish parishes until 1768, when he was sent to North America to become president of the College of New Jersey (later Princeton University). As president, he expanded the curriculum and increased enrollment. A supporter of colonists' rights, he was a member of the local COMMITTEE OF CORRESPONDENCE (1775–76) and the Continental Congress (1776–79, 1780–82); he was the only clergyman to sign the DECLARATION OF INDEPENDENCE. He helped organize the American Presbyterian Church as a national body (1785–89).

Witt \'vit, 'wit**, Katarina** (b. Dec. 3, 1965, Karl-Marx-Stadt, E.Ger.) German figure skater. She won the first of six European championships in 1983 and went on to win two Olympic gold medals (1984, 1988) and four World Championships (1984, 1985, 1987, 1988). She was popular with audiences, who prized her grace and elegance as much as her technical abilities. She turned professional in 1988.

Witte \'vi-tə**, Sergey (Yulyevich), Count** (b. June 29, 1849, Tiflis, Georgia, Russian Empire—d. March 13, 1915, Petrograd, Russia) Russian statesman and premier (1905–06). He entered the imperial administrative service in 1871 and served as minister of finance (1892–1903). He improved communications, promoted construction of the TRANS-SIBERIAN RAILWAY, and planned to modernize the Russian Empire. He represented Russia in the negotiations that ended the RUSSO-JAPANESE WAR. Although opposed to constitutionalism, he persuaded Tsar NICHOLAS II to issue the OCTOBER MANIFESTO in 1905 and was appointed the first constitutional premier. He organized the repression of all the forces of disruption in 1905–06—e.g., the St. Petersburg Soviet, or workers' council, the troop mutinies in the Far East, strikes in South Russia, and peasant uprisings in the Baltic provinces—and he concluded arrangements with European bankers for a series of loans that restored Russian finances. In 1906 the tsar, favouring a more conservative regime, replaced him with PYOTR STOLYPIN. He never returned to office, and in 1914–15 he vainly opposed Russian entry into World War I and was sympathetic to peace feelers put out by the German government through Witte's own German banker.

Wittelsbach \'vi-təls-ˌbäk̲**, house of** German noble family that ruled in Bavaria from the 12th to the 20th century. In 1124 Otto V, count of Scheyern (d. 1155), moved the family residence to the castle of Wittelsbach and took its name. In 1180 his son Otto VI became Otto I, duke of Bavaria. In 1214 Otto II obtained the Palatinate of the Rhine. A descendant, LOUIS IV, as Holy Roman emperor, divided the lands and granted the PALATINATE to his nephew, Rupert, who obtained the title of elector (r. 1353–90). Several divisions of ducal Bavaria were reunited under Albert IV (d. 1508). The Bavarian dukes became electors from 1623, and the last direct line died out in 1777. The Palatine branch united with Bavaria in 1799 under Duke Maximilian IV Joseph, who became king of Bavaria (1806) as MAXIMILIAN I. His descendants (including LOUIS I and LOUIS II) were kings until the abdication of Louis III in 1918.

Wittgenstein \'vit-gən-ˌshtīn**, Ludwig (Josef Johann)** (b. April 26, 1889, Vienna—d. April 29, 1951, Cambridge, Cambridgeshire, Eng.) Austrian-born English philosopher, regarded by many as the greatest philosopher of the 20th century. He was born into an immensely wealthy and cultivated family. In 1908 he went to Manchester, Eng., to study aeronautics. He soon developed an obsessive interest in the philosophy of logic and mathematics, and in 1911 he went to Cambridge to study logic with BERTRAND RUSSELL. Within a year he had learned all Russell had to teach; he then went to Norway, where he worked on logic in isolation in a wooden hut he built by the side of a fjord. There he developed in embryo what became known as the "picture theory" of meaning, a central tenet of which is that a proposition can express a fact by virtue of sharing with it a common structure, or "logical form." When World War I broke out he joined the Austrian army, winning several decorations for bravery while serving on the Russian front. During the war he worked on a manuscript that was later published as *Tractatus Logico-Philosophicus* (1922). Believing that he had solved all the major problems of philosophy, he abandoned the subject after the war and spent the next 10 years as a schoolteacher and doing other odd jobs in a remote Austrian village. Meanwhile, the *Tractatus* had attracted the attention of philosophers in Cambridge and Vienna, including those of the VIENNA CIRCLE of logical positivists (see LOGICAL POSITIVISM), some of whose meetings Wittgenstein was persuaded to join. He returned to Cambridge in 1929. During the early 1930s his ideas changed rapidly, and he gradually abandoned the doctrines of the *Tractatus*; indeed, he began to conceive of philosophy in radically different terms, as not the construction of theories designed to answer philosophical questions but as the activity of clearing up conceptual confusions arising from inattention to or misunderstandings of ordinary uses of language. What became known as the works of the "later Wittgenstein"—including *Remarks on the Foundations of Mathematics* (1956), *Philosophical Grammar* (1974), *Philosophical Remarks* (1975), and especially *Philosophical Investigations* (1953)—can be considered attempts to refine and definitively express this new approach. Though he worked with fierce energy and wrote prodigiously, he would allow none of his work from this period to be published in his lifetime. In 1939 he was appointed to the chair in philosophy at Cambridge previously held by G.E. MOORE. Disliking professional philosophy, he resigned the post

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in 1947 to live in seclusion in Ireland and then with various friends. Diagnosed with terminal cancer in 1949, he continued working intensively until two days before his death. See also ANALYTIC PHILOSOPHY.

Witz \'vits**, Konrad** (b. c. 1400, Rottweil, Baden-Württemberg—d. c. 1445, Basel or Geneva, Swiss Confederation) German-born Swiss painter. In 1434 he entered the painters' guild in Basel, where he worked most of his life. Little else is known of his life. His masterpiece, *The Miraculous Draft of Fishes* (1444), from an altarpiece for the cathedral of Geneva, exemplifies such precise realism that the light reflected off the water's surface is carefully distinguished from the light reflected off the stones beneath the shallow water. He was one of the first German painters to show the influence of early Netherlandish art and one of the first European artists to incorporate realistic landscapes into religious paintings.

"The Miraculous Draft of Fishes," tempera on panel by Konrad Witz, 1444; in the Museum of Art and History, Geneva

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Władysław II Jagiełło \vlä-'dis-läf...yäg-'yel-lō\ (b. c. 1351—d. May 31/June 1, 1434, Grodek, near Lwów, Galicia, Pol.) Grand duke of Lithuania (1377–1401) and king of Poland (1386–1434), founder of the JAGIELLON DYNASTY. He had to defeat rivals, including his cousin VYTAUTAS, in order to secure his rule in Lithuania. He married the Polish queen Jadwiga (1386) after agreeing to Christianize Lithuania and unite it with Poland. He regained Ruthenia from Hungary (1387) and made the prince of Moldavia his vassal. He signed a treaty (1401) recognizing Vytautas as duke on the condition that Poland and Lithuania pursued a common foreign policy, and together they broke the power of the TEUTONIC ORDER.

Wobblies See INDUSTRIAL WORKERS OF THE WORLD

Wodehouse \'wůd-ˌhaůs**, Sir P(elham) G(renville)** (b. Oct. 15, 1881, Guildford, Surrey, Eng.—d. Feb. 14, 1975, Southampton, N.Y., U.S.) English-born U.S. novelist, short-story writer, lyricist, and playwright. He lived for long periods in the U.S. and France after 1909, and he settled in the U.S. after World War II. He is best known as the creator of the character of the young bachelor Bertie Wooster and his effortlessly superior manservant, Jeeves, who appeared in comic stories and novels from "Extricating Young Gussie" (1915) to *Much Obliged, Jeeves* (1971). Wodehouse wrote more than 90 books and 20 film scripts and collaborated on many plays and musical comedies, writing lyrics for JEROME KERN (*Leave It to Jane,* 1917; *Show Boat*, 1927), GEORGE GERSHWIN (*Oh, Kay!*, 1926), and others.

Wolcott, Oliver (b. Nov. 20, 1726, Windsor, Conn.—d. Dec. 1, 1797, Litchfield, Conn., U.S.) American public official. He was a member of the Connecticut council (1771–86), a delegate to the Continental Congress (1775–76, 1778, 1780–84), and a signer of the DECLARATION OF INDEPENDENCE. He raised a local militia to fight in the American Revolution and led troops in the defense of Connecticut (1779). As a commissioner of northern Indian affairs, he negotiated the Treaty of FORT STANWIX. He served as lieutenant governor (1787–96) and later governor (1796–97) of Connecticut.

wolf Any of three extant species of CANINE. The gray, or timber, wolf (*Canis lupus*) is the ancestor of all domestic dogs. It once had the largest distribution of any mammal except human beings, but it is now found primarily in Canada, Alaska, the Balkans, and Russia. Wolves are intelligent and social. Their primary prey are deer, moose, and caribou, though they feed on many smaller animals as well. Because wolves have killed livestock, they have been persecuted by farmers and ranchers. A male gray wolf may be 7 ft (2 m) long and weigh up to 175 lb (80 kg); it is the largest living wild canid. Gray wolves live in hierarchical packs whose territories cover at least 38 sq mi (100 sq km) and hunt mostly at night. The much smaller red wolf (*C. rufus*), once widespread in the south-central U.S., has been bred in captivity and reintroduced. The Abyssinian wolf (*C. simensis*) of Ethiopia was formerly considered a JACKAL. See also DIRE WOLF.

Wolf \'vôlf,\ *English* \'wůlf**, Christa** *orig.* **Christa Ihlenfeld** (b. March 18, 1929, Landsberg an der Warthe, Ger.) German novelist, essayist, and screenwriter. She was reared in a middle-class, pro-Nazi family; after Germany's defeat in 1945, she moved with her family to East Germany. Her work reflects her experiences during World War II and her postwar life in a communist state. Her novels include *Divided Heaven* (1963), which brought her political favour; *The Quest for Christa T.* (1968), severely attacked in East Germany; *A Model Childhood* (1976); *Cassandra* (1983), her most widely read book, linking nuclear and patriarchal power; and *What Remains* (1990), on government surveillance and her own links to the East German secret police.

Wolf \'vôlf**, Hugo (Filipp Jakob)** (b. March 13, 1860, Windischgraz, Austria—d. Feb. 22, 1903, Vienna) Austrian composer. He entered the Vienna Conservatory at age 15, but, as a rabid Wagnerian, he lost patience with his teachers' conservatism and soon left. By age 18 he probably had contracted the syphilis that would make him mentally unstable and eventually kill him. His volatile personality made it difficult for him to keep private students. As a critic (1884–87), he attracted attention for his vituperative comments. His productivity came in bursts; in 1888–89 he produced the remarkable songs of the *Mörike Lieder*, the *Eichendorff Lieder*, the *Goethe Lieder*, and much of the *Spanish Songbook*—more than half his total output. After beginning the *Italian Songbook* in 1891, he wrote nothing for three years, then quickly composed the opera *Der Corregidor* (1896) and finished the *Italian Songbook* (1896). In 1897 he suffered a complete breakdown, and he thereafter lived largely in an asylum.

wolf spider Name that originally referred to a species of southern European SPIDER (*Lycosa tarentula*) but now refers to more than 175 spider species (family Lycosidae) found in North America, Europe, and north of the Arctic Circle. The body of *L. tarentula*, the largest species, is about 1 in. (2.5 cm) long. Most species have a long, broad, hairy brown body; stout, long legs; and strong, prominent jaws. Wolf spiders chase and pounce upon their prey, hunting mostly at night. Most species build a silk-lined, tubular nest in the ground, which they dig with their heavy front legs. A few species spin webs. The bite of *L. tarentula* produces no ill effects in humans.

Wolfe, Elsie de See Elsie DE WOLFE

Wolfe \'wůlf**, James** (b. Jan. 2, 1727, Westerham, Kent, Eng.—d. Sept. 13, 1759, Quebec) British army commander. After a distinguished military career in Europe, in 1758 he helped lead Gen. JEFFERY AMHERST's successful expedition against the French on Cape Breton Island. In 1759 he was appointed commander of the British army on its mission to capture Quebec from the French. In the ensuing Battle of QUEBEC, he defeated the French in a battle lasting less than an hour. Wounded twice early in the battle, he died of a third wound, but not before he knew Quebec had fallen to his troops.

James Wolfe, painting attributed to J.S.C. Schaak; in the National Portrait Gallery, London

COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

Wolfe \'wůlf**, Thomas (Clayton)** (b. Oct. 3, 1900, Asheville, N.C., U.S.—d. Sept. 15, 1938, Baltimore, Md.) U.S. writer. Wolfe studied at the University of North Carolina and in 1923 moved to New York City, where he taught at New York University while writing plays. *Look Homeward, Angel* (1929), his first and best-known novel, and *Of Time and the River* (1935) are thinly veiled autobiographies. In *The Story of a Novel* (1936) he describes his close working relationship with the editor MAXWELL PERKINS, who helped him shape the chaotic manuscripts for his first two books into publishable form. His short stories were collected in *From Death to Morning* (1935). After his death at age 37 from tuberculosis, the novels *The Web and the Rock* (1939) and *You Can't Go Home Again* (1940) were among the works extracted from the manuscripts he left.

Wolfe, Tom *orig.* **Thomas Kennerly Wolfe, Jr.** (b. March 2, 1930, Richmond, Va., U.S.) U.S. journalist and novelist. He earned a doctorate from Yale University and then wrote for newspapers and worked as a magazine editor, becoming known as a proponent of New Journal-

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ism, the application of fiction-writing techniques to journalism. *The Electric Kool-Aid Acid Test* (1968) chronicles the life of a traveling group of hippies. *The Right Stuff* (1979; film, 1983) examines the first U.S. astronaut program. Other controversial nonfiction books attacked fashionable 1960s leftism, modern abstract art, and international architectural styles. His novel *The Bonfire of the Vanities* (1987; film, 1990), a novel of urban greed and corruption, was a best-seller. Wolfe's second novel, *A Man in Full*, was published in 1998.

Wolff \'vȯlf**, Christian, Freiherr (baron) von** (b. Jan. 24, 1679, Breslau, Silesia—d. April 9, 1754, Halle, Prussia) German philosopher, mathematician, and scientist. He was educated at the universities of Breslau, Jena, and Leipzig and was a pupil of Gottfried Wilhelm Leibniz. He wrote numerous works in theology, psychology, botany, and physics but is best known as a leading spokesman of German rationalism. His series of essays, all beginning under the title *Rational Ideas,* covered many subjects and expounded Leibniz's theories in popular form.

Wölfflin \'vœlf-lin**, Heinrich** (b. June 21, 1864, Basel, Switz.—d. July 19, 1945, Basel) Swiss art historian. He was educated at the universities of Basel, Berlin, and Munich, and his doctoral thesis already showed the approach he was later to develop: an analysis of form based on a psychological interpretation of the creative process. His chief work, *Principles of Art History* (1915), synthesized his ideas into a complete aesthetic system that was to become of great importance in art criticism. He eschewed the popular anecdotal approach and emphasized the formal stylistic analysis of drawing, composition, light, colour, subject matter, and other pictorial elements as they were handled similarly by the painters of a particular period or national school.

wolfram See tungsten

Wolfram von Eschenbach \'vȯlf-räm-fȯn-'esh-ən-ˌbäk̲\ (b. c. 1170—d. c. 1220) German poet. An impoverished Bavarian knight, Wolfram apparently served a succession of lords. The epic "Parzival," one of his eight surviving lyric poems, is one of the masterpieces of the Middle Ages; likely based on a romance by Chrétien de Troyes, it introduced the theme of the Holy Grail into German literature. Richard Wagner used it as the basis for his last opera, *Parsifal* (1882). Wolfram's influence on later poets was profound, and, with Hartmann von Aue and Gottfried von Strassburg, he is one of the three great Middle High German epic poets.

Wollaston \'wä-ləs-tən\ **Lake** Lake, northeastern Saskatchewan, Canada. It is 70 mi (113 km) long and 25 mi (40 km) wide, with an area of 1,035 sq mi (2,681 sq km). It drains through two outlets—one northwestward through the Fond du Lac River to Lake Athabasca and the Mackenzie River system, the other northeastward via the Cochrane River to Reindeer Lake and the Churchill River system. The lake was used as a link between the two river systems after its discovery by Peter Fidler in about 1800. It is noted for its fishing.

Wollstonecraft \'wəl-stənˌkraft**, Mary** (b. April 27, 1759, London, Eng.—d. Sept. 10, 1797, London) English writer. She taught school and worked as a governess and as a translator for a London publisher. Her early *Thoughts on the Education of Daughters* (1787) foreshadowed her mature work on the place of women in society, *A Vindication of the Rights of Woman* (1792), whose core is a plea for equality in the education of men and women. The *Vindication* is widely regarded as the founding document of modern feminism. In 1797 she married the philosopher William Godwin; she died days after the birth of their daughter, Mary (see Mary Shelley), that same year.

Mary Wollstonecraft (Godwin), detail, oil on canvas by John Opie, c. 1797; in the National Portrait Gallery, London.
NATIONAL PORTRAIT GALLERY, LONDON

Wolof \'wō-lȯf\ Muslim people of Senegal, The Gambia, and Mauretania. They speak a language of the Atlantic branch of the Niger-Congo family. In the 14th–16th century the Wolof maintained a powerful empire. Traditional Wolof society was highly stratified, consisting of royalty, an aristocracy, a warrior class, commoners, slaves, and members of despised artisan castes. Today most Wolof (numbering some 5 million) are farmers, but many live and work in Dakar, Senegal, and Banjul, The Gambia. Wolof women are renowned for their elaborate hair styles, abundant gold ornaments, and voluminous dresses. Nearly half the people of Senegal are Wolof.

Wolsey \'wůl-zē**, Thomas, Cardinal** (b. c. 1475, Ipswich, Suffolk, Eng.—d. Nov. 29, 1530, Leicester, Leicestershire) English prelate and statesman. He served as chaplain to Henry VII and later Henry VIII, for whom he organized the successful campaign against the French (1513). On Henry's recommendation, the pope made Wolsey successively bishop of Lincoln (1514), archbishop of York (1514), cardinal (1515), and papal legate (1518). In 1515 Henry appointed him lord chancellor of England, which added to his power and wealth. Wolsey sought to bring peace to Europe, but in 1521 he allied with Emperor Charles V against France. Although he introduced judicial and monastic reforms, he became unpopular for raising taxes. In 1529 he failed to persuade the pope to grant Henry an annulment of his marriage to Catherine of Aragon, for which he soon lost favour and was stripped of his offices except the archbishopric of York. In 1530 he was arrested for treason for corresponding with the French court, and he died on his way to face the king.

wolverine *or* **skunk bear** Solitary, voracious, nocturnal carnivore (*Gulo gulo*) that inhabits northern timberlands worldwide. Wolverines are 26–36 in. (65–90 cm) long and 14–18 in. (36–45 cm) high, and weigh 20–65 lbs (9–30 kg); the bushy tail is 5–10-in. (13–26-cm) long. They have short bowed legs, hairy soles, and long, sharp claws. Their long, coarse hair, used to trim parkas, is blackish brown, with a light horizontal strip. The anal glands secrete an unpleasant-smelling fluid. A cunning, fearless predator, the wolverine will attack almost any animal, including sheep, deer, and small bears.

Wolverine (*Gulo gulo*)
ALAN G. NELSON/ROOT RESOURCES

woman suffrage Right of women by law to vote in national and local elections. Women's voting rights became an issue in the 19th century, especially in Britain and the U.S. In the U.S. the woman suffrage movement arose from the antislavery movement (see abolitionism) and from the advocacy of figures such as Lucretia Mott and Elizabeth Cady Stanton, who believed that equality should extend to both women and African Americans. They organized the Seneca Falls Convention (1848), which issued a declaration calling for woman suffrage and for the right of women to educational and employment opportunities. In 1850 Lucy Stone held the movement's first national convention. Stanton and Susan B. Anthony formed the National Woman Suffrage Association in 1869 to secure an amendment to the Constitution granting women the right to vote, while Stone founded the American Woman Suffrage Association to seek similar amendments to state constitutions; in 1890 the two organizations merged as the National American Woman Suffrage Association. Following Wyoming's lead in 1890, states began adopting such amendments; by 1918 women had won suffrage in 15 states. After a woman suffrage amendment was passed by Congress, a vigorous campaign brought ratification, and in August 1919 the 19th Amendment became part of the Constitution. In Britain the first woman suffrage committee was formed in Manchester in 1865. In the 1870s suffragists submitted petitions bearing nearly three million signatures. Despite growing support, suffrage bills were continually defeated; in frustration, some suffragists became militant activists under the leadership of Emmeline and Christabel Pankhurst. Parliament finally passed the Representation of the People Act in 1918, by which time women had already won voting rights in New Zealand (1893), Australia (1902), Finland (1906), Norway (1913), the Soviet Union (1917), Poland (1918), Sweden (1919), Germany (1919), and Ireland (1922). After World War II woman-suffrage laws were adopted in many countries, including France, Italy, India, and Japan.

Woman's Christian Temperance Union (WCTU) U.S. temperance-movement organization. Founded in Cleveland, Ohio, in 1874, it used educational, social, and political means to promote legislation. Its president (1879–98) was Frances Willard (1839–1898), an effective

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speaker and lobbyist who also led the World's Woman's Christian Temperance Union from its founding in 1883. The WCTU was instrumental in promoting nationwide temperance and in the eventual adoption of PROHIBITION.

womb See UTERUS

wombat Either of two species (family Vombatidae) of nocturnal Australian MARSUPIALS that are heavily built, 28–47 in. (70–120 cm) long, and tailless. The single newborn develops in the mother's pouch for about five months. Wombats eat grasses, tree bark, and shrub roots. They make a grassy nest at the end of a long burrow. The common wombat (*Vombatus ursinus*) of southeastern Australia and Tasmania, considered a pest, has coarse dark hair and short ears. The rare Queensland hairy-nosed wombat (*Lasiorhinus barnardi*) has fine fur and longer ears; protected by law, the population lives principally in a national park.

Common wombat (*Vombatus ursinus*). WARREN GARST-TOM STACK AND ASSOCIATES

Women's Army Corps (WAC) U.S. Army unit. It was established (as the Women's Auxiliary Army Corps) by Congress to enlist women for auxiliary noncombat duty in WORLD WAR II. Its first head was OVETA C. HOBBY. By 1945 nearly 150,000 women had served. Women relieved thousands of men of their clerical assignments, and many performed nontraditional jobs such as radio operator, electrician, and air-traffic controller. After the war the government requested former servicewomen to reenlist to meet the staffing needs of army hospitals and administrative centres. The WAC became part of the regular army with the passage of the 1948 Women's Armed Services Integration Act. The WAC remained a separate unit of the U.S. Army until 1978, when male and female forces were integrated.

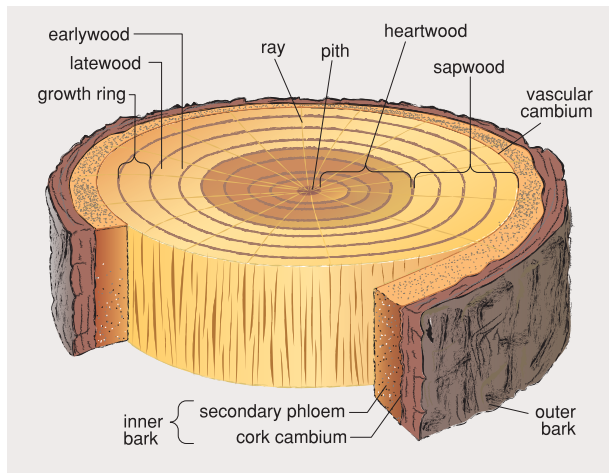
women's movement Diverse social movement, largely based in the U.S., seeking equal rights and opportunities for women in their economic activities, personal lives, and politics. It is recognized as the "second wave" of the larger feminist movement. While first-wave FEMINISM of the 19th and early 20th centuries focused on women's legal rights, such as the right to vote, the second-wave feminism of the "women's movement" peaked in the 1960s and '70s and touched on every area of women's experience—including family, sexuality, and work. A variety of U.S. women's groups, including the NATIONAL ORGANIZATION FOR WOMEN, sought to overturn laws that enforced discrimination in matters such as contract and property rights and employment and pay. The movement also sought to broaden women's self-awareness and challenge traditional stereotypes of women as passive, dependent, or irrational. An effort in the 1970s to pass the EQUAL RIGHTS AMENDMENT failed, but its aims had been largely achieved by other means by the end of the 20th century.

Wonder, Stevie *orig.* **Steveland Judkins** *later* **Steveland Morris** (b. May 13, 1950, Saginaw, Mich., U.S.) U.S. SOUL-MUSIC singer, songwriter, and musician. Blind virtually from birth, he was a skillful performer on the piano and other instruments by age eight. The family moved to Detroit, and at 10 he signed with the fledgling MOTOWN label. His first hit, "Fingertips, Part 2" (1963), was followed by many top-selling singles, including "Up-Tight" and "I Was Made to Love Her." After studying composition at USC, he continued to enjoy enormous success in the 1970s and '80s with such albums as *Talking Book* (1972) and *Songs in the Key of Life* (1976) and such hits as "Superstition," "Ebony and Ivory," and "I Just Called to Say I Love You." He has spoken out against nuclear war, worked to end apartheid in South Africa, and raised funds for his eye-disease facility, Wonderland.

Wonders of the World, Seven See SEVEN WONDERS OF THE WORLD

Wonhyŏ Daisa \'wən-'hyō-'da-ˌsä\ (b. 617, Korea—d. 686, Korea) Korean Buddhist priest. He was the first to systematize Korean Buddhism, bringing the various Buddhist doctrines into a unity that served both philosophers and laypeople. He advocated maintaining harmony between the real and the ideal in life in order to pursue spiritual goals. His works, mainly in the form of commentaries on MAHAYANA SUTRAS, had profound influence on Chinese, Japanese, and Korean Buddhists. He is considered the greatest of the ancient Korean religious teachers and one of the 10 sages of the ancient Korean kingdom of Silla.

wood Hard, fibrous material formed by the accumulation of secondary XYLEM produced by the vascular CAMBIUM. It is the principal strengthening tissue found in the stems and roots of TREES and SHRUBS. Wood forms around a central core (pith) in a series of concentric layers called GROWTH RINGS. A cross section of wood shows the distinction between heartwood and sapwood. Heartwood, the central portion, is darker and composed of xylem cells that are no longer active in the life processes of the tree. Sapwood, the lighter area surrounding the heartwood, contains actively conducting xylem cells. Wood is one of the most abundant and versatile natural materials on earth, and unlike coal, ores, and petroleum, is renewable with proper care. The most widely used woods come from two groups of trees: the CONIFERS, or SOFTWOODS (e.g., PINE, SPRUCE, FIR), and the broadleaves, or HARDWOODS (e.g., OAK, WALNUT, MAPLE). Trees classified as hardwoods are not necessarily harder than softwoods (e.g., BALSA, a hardwood, is one of the softest woods). Density and moisture content affect the strength of wood; in addition to load-bearing strength, other variable factors often tested include elasticity and toughness. Wood is insulating to heat and electricity and has desirable acoustical properties. Some identifying physical characteristics of wood include colour, odour, texture, and grain (the direction of the wood fibres). Some 10,000 different wood products are commercially available, ranging from lumber and plywood to paper, from fine furniture to toothpicks. Chemically derived products from wood and wood residues include cellophane, charcoal, dyestuffs, explosives, lacquers, and turpentine. Wood is also used for fuel in many parts of the world.



Cross section of a tree trunk. Wood is secondary xylem produced by growth of the vascular cambium tissue. Sapwood is xylem that conveys water and dissolved minerals from the roots to the rest of the tree. The darker heartwood is older xylem that has been infiltrated by gums and resins and has lost its ability to conduct water. Each growth layer is distinguished by earlywood (springwood), composed of large thin-walled cells produced during the spring when water is usually abundant, and the denser latewood (summerwood), composed of small cells with thick walls. Growth rings vary in width as a result of differing climatic conditions; in temperate climates, a ring is equivalent to one year's growth. Certain conducting cells form rays that carry water and dissolved substances radially across the xylem. Bark comprises the tissues outside the vascular cambium, including secondary phloem (which transports food made in the leaves to the rest of the tree), cork-producing cells (cork cambium), and cork cells. The outer bark, composed of dead tissue, protects the inner region from injury, disease, and desiccation.
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Wood, Grant (b. Feb. 13, 1892, near Anamosa, Iowa, U.S.—d. Feb. 12, 1942, Iowa City, Iowa) U.S. painter. He was trained as a craftsman and designer as well as a painter. On a visit to Germany in 1928, he was strongly influenced by the sharp detail of 15th-century German and Flemish paintings, and he soon abandoned his IMPRESSIONIST manner for the detailed, realistic manner for which he is known. His *American Gothic* caused a sensation when exhibited in 1930. A telling portrait of the sober, hardworking Midwestern farmer, it has become one of the best-known icons of U.S. art, though it is often misinterpreted: the woman is not the man's wife but rather the unmarried daughter designated to stay on the farm to assist her widowed father.

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Wood, Leonard (b. Oct. 9, 1860, Winchester, N.H., U.S.—d. Aug. 7, 1927, Boston, Mass.) U.S. army officer. He studied medicine and became a contract surgeon with the U.S. Army. In the Spanish-American War he and his friend THEODORE ROOSEVELT recruited and commanded the volunteer ROUGH RIDERS. Promoted to brigadier general, Wood served as military governor of Cuba (1899–1902) and organized a modern civil government. After service in the Philippines, he was chief of staff of the U.S. Army (1910–14). Though he had advocated preparedness for war, as a Republican he was passed over for a command post in World War I by the Democratic administration. He later served as governor general of the Philippines (1921–27).

Wood, Natalie *orig.* **Natasha Gurdin** (b. July 20, 1938, San Francisco, Calif.—d. Nov. 29, 1981, off Catalina Island, Calif.) U.S. film actress. She began appearing in movies at age five, and she won acclaim for her role in *Miracle on 34th Street* when she was only nine. A dark-haired beauty of Russian-French extraction, she moved easily into teenage and adult leading roles in *Rebel Without a Cause* (1955), *Splendor in the Grass* (1961), *West Side Story* (1961), *Love with the Proper Stranger* (1963), *Inside Daisy Clover* (1966), and *Bob & Carol & Ted & Alice* (1969). She drowned in a boating accident.

wood alcohol See METHANOL

Wood Buffalo National Park Park, western Canada. Situated between ATHABASCA and GREAT SLAVE lakes, it was established in 1922; it occupies an area of 17,300 sq mi (44,807 sq km). The world's largest park, it is a vast region of forests and plains, crossed by the PEACE RIVER and dotted with lakes. The habitat of the largest remaining herd of wood buffalo (BISON) on the North American continent, as well as of bear, caribou, moose, and beaver, it also provides nesting grounds for the endangered WHOOPING CRANE.

wood duck North American DUCK (*Aix sponsa*, family Anatidae); a popular game bird. Wood ducks, 17–21 in. (43–52 cm) long, nest in a tree cavity up to 50 ft (15 m) off the ground; they have long-clawed toes for perching. Both sexes have a head crest in winter. The beautifully coloured male has a purple and green head, red-brown breast flecked with white, and bronze sides; the female has a white eye ring and duller colouring. Ducklings eat aquatic insects and other small organisms; adults prefer acorns or other nuts. Hunted nearly to extinction for its flesh and feathers, it has been restored to healthy populations by strong conservation efforts.

Drake wood duck (*Aix sponsa*)
GRANT HEILMAN

Wood family English family of Staffordshire potters, a major force in the development of Staffordshire wares from peasant pottery to an organized industry. Its most prominent members were Ralph Wood (1715–72), his brother Aaron (1717–85), and his son Ralph, Jr. (1748–95). Ralph, Jr., was related through his mother to JOSIAH WEDGWOOD, and the two names were often linked professionally. The elder Ralph became famous for his extremely well-modeled figures with coloured glazes, and he is credited with introducing the Toby mug. Ralph, Jr., produced a variety of figures, colouring them with enamel rather than glazes, and supplied some of them to Wedgwood. Aaron's son William (1746–1808) was employed as a modeler by Wedgwood. His brilliant brother Enoch (1759–1840) apprenticed with Wedgwood but by 1783 was established as an independent potter in partnership with his cousin Ralph, Jr. In 1818 he continued his firm as Enoch Wood & Sons. Much of his earthenware was exported to the U.S. The firm closed in 1846. See also STAFFORDSHIRE FIGURE.

wood louse See PILL BUG, SOW BUG

wood mouse See FIELD MOUSE

wood rat *or* **pack rat** Any of 22 species (genus *Neotoma*, family Cricetidae) of RODENTS that are nocturnal vegetarians of North and Central American deserts, forests, and mountains. Wood rats are buff, gray, or reddish brown, usually with white undersides and feet. They have large ears and are 9–19 in. (23–47 cm) long, including the 3–9-in. (8–24-cm) furry tail. The nest, up to 3 ft (1 m) across and usually built of twigs or cactus, is placed in a protected spot (e.g., under a rock ledge). Wood rats are sometimes called pack rats because they collect material to deposit in their dens.

wood thrush One of the 11 species of THRUSHES (in the genus *Hylocichla*, or *Catharus*) called nightingale thrushes because of their rich songs. *H. mustelina* is common in eastern U.S. broadleaf forests; it is 8 in. (20 cm) long and has drab, spotted plumage and a rusty-colored head.

wood warbler Any of about 120 species of lively North and Central American songbirds in the family Parulidae. Wood warblers superficially resemble the true WARBLERS of the Old World but are usually more brightly coloured (at least in the breeding season) and smaller (about 5 in. [13 cm] long). They commonly inhabit woodlands and sometimes marshes and dry scrub. Their songs are buzzy and monotonous. The usual nest is a tidy cup in a bush or tree. They lay two to five speckled eggs. See also BLACKPOLL WARBLER; CHAT; REDSTART.

woodbine Any of many species of vines belonging to various flowering-plant families, especially the Virginia creeper (*Parthenocissus quinquefolia*, family Vitaceae) of North America and the Eurasian woodbine HONEYSUCKLE (*Lonicera periclymenum*, family Caprifoliaceae). The Virginia creeper, also called American ivy, attaches to walls, fences, and large tree trunks by means of disk-tipped tendrils. Its leaves display spectacular fall colour from yellow to red-purple. Woodbine honeysuckle has grayish green leaves and fragrant, yellowish white flowers.

woodchuck *or* **groundhog** Reddish brown or brown species (*Marmota monax*) of solitary MARMOT inhabiting fields and forest edges in Alaska, Canada, and the eastern and central U.S. Woodchucks are 17–20 in. (42–52 cm) long, have a 4–6-in. (10–15-cm) tail, and weigh 4–14 lbs (2–6 kg). They are good diggers, swimmers, and climbers. Their burrows have a main entrance and an escape tunnel. See also GROUNDHOG DAY.

woodcock Any of five species (family Scolopacidae) of plump, sharp-billed migratory birds of damp, dense woodlands in North America, Europe, and Asia. With eyes set far back on the head, a woodcock has a 360° field of vision. The buffy-brown, mottled plumage provides camouflage. A solitary bird, most active at dusk, it drums its feet to coax earthworms to the surface and then extracts them with its long, forceps-like bill; it may eat twice its weight in worms each day. The female American woodcock (*Scolopax*,or *Philohela, minor*) is about 11 in. (28 cm) long; the male is slightly smaller. The male's striking courtship display includes a long, repeated spiraling and dropping sequence. Woodcocks have been popular game birds.

woodcut Design printed from a plank of wood incised parallel to the vertical axis of the wood's grain. One of the oldest methods of making prints, it was used in China to decorate textiles from the 5th century. Printing from wood blocks on textiles was known in Europe from the early 14th century but developed little until paper began to be manufactured in France and Germany at the end of the 14th century. In the early 15th century, religious images and playing cards were first made from wood blocks. Black-line woodcut reached its greatest perfection in the 16th century with ALBRECHT DÜRER and his followers. In the late 19th and early 20th centuries, artists such as EDVARD MUNCH, PAUL GAUGUIN, and the German Expressionists rediscovered the expressive potential of woodcuts. Woodcuts have played an important role in the history of Japanese art (see UKIYO-E).

Woodhull, Victoria *orig.* **Victoria Claflin** (b. Sept. 23, 1838, Homer, Ohio, U.S.—d. June 10, 1927, Norton Park, Bremons, Worcestershire, Eng.) U.S. social reformer. She and her sister Tennessee Claflin (1845–1923) were raised in a family of traveling spiritualists. After Victoria's marriage (1853) to Canning Woodhull ended in 1864, the sisters opened a successful brokerage firm in New York. They founded *Woodhull and Claflin's Weekly* (1870), which advocated equal rights for women, a single standard of morality for both sexes, and free love. A splinter group of radical suffragists formed a political party in 1872 and nominated Woodhull for president with FREDERICK DOUGLASS as vice president. In 1872 the sisters published the first English translation of the *Communist Manifesto*. For printing news of an alleged adulterous affair by HENRY WARD BEECHER, they were charged with libel but acquitted (1873). They moved to England (1877), where they lectured, worked for charities, and married wealthy Englishmen. Woodhull and her daughter published the eugenics journal *Humanitarian* (1892–1910).

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Woodland culture Any of the prehistoric cultures of eastern North America dating from the 1st millennium BC. The category includes cultures such as the ADENA and HOPEWELL. Woodland cultures were characterized by the raising of corn, beans, and squash, the fashioning of distinctive pottery, the use of the bow and arrow, and the building of burial mounds. Most of these cultures were replaced by the MISSISSIPPIAN CULTURE in the 1st millennium AD.

woodpecker Any of about 180 species (family Picidae) of mostly nonmigratory, solitary birds found nearly worldwide. Woodpeckers spiral up tree trunks, probing for insects, and chisel nest holes in dead wood by means of rapidly repeating blows of the beak. Though they spend their entire life in trees, only the few ground-feeding species can perch. Some species eat fruits and berries or tree sap. Woodpeckers are usually silent, except in spring, when males call loudly and drum on hollow wood. Species range from 6 to 18 in. (15 to 46 cm) long. All have a straight, chisel-like bill, and most are patterned in black, white, or yellow and bright colours. See also FLICKER; IVORY-BILLED WOODPECKER; SAPSUCKER.

Woods, Lake of the Lake astride the Canadian-U.S. boundary, southwestern Ontario, southeastern Manitoba, and northern Minnesota. Irregular in shape, it is 70 mi (110 km) long and up to 60 mi (95 km) wide. It has an area of 1,727 sq mi (4,472 sq km), of which 642 sq mi (1,663 sq km) are in U.S territory. It has an estimated 25,000 mi (40,000 km) of shoreline and more than 14,000 islands. It receives the Rainy River from the southeast and drains north through the WINNIPEG RIVER into Lake WINNIPEG. Visited by French explorers in 1688, it became an important fur-trading route between the GREAT LAKES and western Canada. The Northwest Angle, the northernmost point of the coterminous U.S., is separated from the rest of Minnesota by a part of the lake.

Woods, Tiger *orig.* **Eldrick Woods** (b. Dec. 30, 1975, Cypress, Calif., U.S.) U.S. golfer. The child of a Thai mother and an African American father, Woods was a golf prodigy and won the first of three consecutive U.S. Junior Amateur Championships (1991–93) when he was 15 years old. In 1994 at age 18 he became the youngest winner of the U.S. Amateur competition, which he also won in 1995 and 1996. In 1997 Woods at age 21 became the youngest player and the first of African or Asian descent ever to win the MASTERS TOURNAMENT, winning by a record margin of 12 strokes. Winner of five other PGA tournaments in 1997, Woods became the youngest player ever ranked first in world golf competition. On July 23, 2000, Woods became the fifth player—after Gene Sarazen, Jack Nicklaus, Ben Hogan, and Gary Player—in golf history, and the youngest, to achieve a career grand slam of the four major championships (the Masters, U.S. Open, British Open, and PGA Championship). In 2005 he completed his second career grand slam.

Woodson, Carter G(odwin) (b. Dec. 19, 1875, New Canton, Va., U.S.—d. April 3, 1950, Washington, D.C.) U.S. historian. Born into a poor family, he supported himself as a coal miner and was unable to enroll in high school until he was 20. He went on to receive a Ph.D. from Harvard University. In 1915 he founded the Association for the Study of Negro Life and History to encourage the study of African American history; he also edited the association's *Journal of Negro History*. In the early 1920s he founded Associated Publishers to bring out books on African American life and culture. Among his works was the college text *The Negro in Our History* (1922).

Woodstock *in full* **Woodstock Music and Art Fair** ROCK MUSIC festival held near Bethel, N.Y., U.S. (its site was to have been the nearby town of Woodstock), on Aug. 15–17, 1969. It attracted about 450,000 young rock fans and featured performers such as the GRATEFUL DEAD, Jefferson Airplane, JIMI HENDRIX, the Who, and JANIS JOPLIN. The festival, the participants of which exhibited extraordinary good feeling in the face of rain and organizational chaos, marked the high point of U.S. youth counterculture in the 1960s. It was documented in the film *Woodstock* (1970). The festival was revived with mixed success on its 25th and 30th anniversaries.

Woodward, C(omer) Vann (b. Nov. 13, 1908, Vanndale, Ark., U.S.—d. Dec. 17, 1999, Hamden, Conn.) U.S. historian. He graduated from Emory University in 1930 and received his Ph.D. from the University of North Carolina. His writings on the American South and the Civil War, including *The Strange Career of Jim Crow* (1955) and *The Burden of Southern History* (1961), transformed the nation's understanding of the region. He edited *Mary Chesnut's Civil War* (1981, Pulitzer Prize) and *The Oxford History of the United States*. At his death he was professor emeritus at Yale University.

Woodward, Robert B(urns) (b. April 10, 1917, Boston, Mass., U.S.—d. July 8, 1979, Cambridge, Mass.) U.S. chemist. He attended MIT and taught at Harvard University (1938–79). Recognizing that physical measurement revealed molecular structure better than chemical reaction, in 1940–42 he developed "Woodward's rules" for determining structure by ultraviolet spectroscopy. In 1945 his methods finally clarified the structure of penicillin and of many more complex natural products. He proposed the correct biosynthetic pathway of steroid hormones. He was the most accomplished synthesist of complex organic compounds, including quinine (1944) and vitamin B_{12} (1971, in more than 100 reactions), a task that led to the fundamental concept of conservation of orbital symmetry. He received a 1965 Nobel Prize, and in 1963 the new Woodward Research Institute in Basel, Switz., was named for him.

woodwind instrument Any musical wind instrument that produces sound by either directing a stream of air against the edge of a hole or by making a reed or a double reed vibrate (see REED INSTRUMENT). In a BRASS INSTRUMENT, by contrast, the airstream passes directly from the player's vibrating lips into the air column. The orchestral woodwinds include the FLUTE, piccolo, CLARINET, OBOE, ENGLISH HORN, and BASSOON. Other woodwinds include the SAXOPHONE, RECORDER, PANPIPE, *SHAKUHACHI*, and SHAWM.

wool Animal fibre that is the protective covering, or fleece, of sheep or such other hairy mammals as goats and camels. Wool is readied by washing (lanolin is the by-product), CARDING, sometimes combing, then spinning. Coarser than such textile fibres as cotton, linen, silk, and rayon, wool is resilient after limited stretching or compression, so fabrics and garments made from wool tend to retain shape, drape well, and resist wrinkling. Wool is warm and lightweight and takes dyes well. Woolen YARNS, usually made from shorter fibres, are thick and full and are used for such items as TWEED fabrics and blankets. WORSTEDS usually are made from longer fibres.

Woolf \'wůlf**, (Adeline) Virginia** *orig.* **Adeline Virginia Stephen** (b. Jan. 25, 1882, London, Eng.—d. March 28, 1941, near Rodmell, Sussex) British novelist and critic. Daughter of LESLIE STEPHEN, she and her sister became the early nucleus of the BLOOMSBURY GROUP. She married Leonard Woolf in 1912; in 1917 they founded the Hogarth Press. Her best novels—including *Mrs. Dalloway* (1925) and *To the Lighthouse* (1927)—are experimental; in them she examines the human experience of time, the indefinability of character, and external circumstances as they impinge on consciousness. *Orlando* (1928) is a historical fantasy about a single character who experiences England from the Elizabethan era to the early 20th century, and *The Waves* (1931), perhaps her most radically experimental work, uses interior monologue and recurring images to trace the inner lives of six characters. Such works confirmed her place among the major figures of literary modernism. Her best critical studies are collected in *The Common Reader* (1925, 1932). Her long essay *A Room of One's Own* (1929) addressed the status of women, and women artists in particular. Her other novels include *Jacob's Room* (1922), *The Years* (1937), and *Between the Acts* (1941). She also wrote a biography of ROGER FRY. Her health and mental stability were delicate throughout her life; in a recurrence of mental illness, she drowned herself. Her diaries and correspondence have been published in several editions.

Woollcott \'wůl-kət**, Alexander (Humphreys)** (b. Jan. 19, 1887, Phalanx, N.J., U.S.—d. Jan. 23, 1943, New York, N.Y.) U.S. author, critic, and actor. He joined the *New York Times* in 1909 and became its drama critic in 1914. Known for his acerbic wit, he became the self-appointed leader of the Algonquin Round Table, the informal luncheon club at New York's Algonquin Hotel in the 1920s and '30s that included GROUCHO MARX, DOROTHY PARKER, ROBERT SHERWOOD, and GEORGE S. KAUFMAN. He later contributed articles to *The New Yorker* and wrote such books as *Two Gentlemen and a Lady* (1928) and *While Rome Burns* (1934). He inspired the play *The Man Who Came to Dinner* (1939).

woolly bear *or* **wooly bear** CATERPILLAR of a TIGER MOTH. The larva of the Isabella tiger moth (*Isia isabella*), known as the banded woolly bear, is brown in the middle and black at both ends. The width of the black bands is purported to predict the severity of the coming winter: the narrower the bands, the milder the weather will be.

Woolworth Co. Historic U.S. merchandising company. F.W. Woolworth (1852–1919) founded his first "five- and ten-cent" store in 1879. By 1904 there were 120 stores in 21 states. The company's New York headquarters, the Woolworth building (completed 1913), was the world's tallest skyscraper from 1913 to 1930. By 1929 Woolworth had about 2,250

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outlets. Its stores continued to proliferate in the U.S. and Britain, and it acquired other chains dealing in sportswear, shoes, and children's wear. From 1992 it began closing hundreds of stores and selling off subsidiaries; in 1998 it changed its name to Venator Group, Inc., and announced its intention to focus on sporting goods. In 2001 the company name was changed to Foot Locker, Inc.

wootz (steel) \'wüts\ STEEL produced by a method known in ancient India. The process involved preparation of porous IRON, hammering it while hot to release SLAG, breaking it up and sealing it with wood chips in a clay container, and heating it until the pieces of iron absorbed carbon from the wood and melted. The steel thus produced had a uniform composition of 1–1.6% carbon and could be heated and forged into bars for later use in fashioning articles, such as the famous medieval Damascus swords. See also BLOOMERY PROCESS.

Worcester \'wůs-tər\ City (pop., 2000: 172,648), central Massachusetts, U.S. On the BLACKSTONE RIVER, the original settlement (1673) of Worcester was disbanded during KING PHILIP'S WAR (1675–76) and a later settlement was established in 1713. Textile manufacturing began in 1789; the first corduroy cloth in the U.S. was produced there. Industrial development occurred after the opening (1828) of the Blackstone Canal. An early abolitionist centre, Worcester became an important stop on the UNDERGROUND RAILROAD. It is a commercial and industrial centre and the state's second largest city. Among its institutions of higher education are College of the Holy Cross and Clark University (1887).

Worcester City and administrative district (pop., 2001: 93,358), administrative and historic county of Worcestershire, west-central England. Located on the River SEVERN, it was settled before AD 680. During the Middle Ages it was an important wool town and also became known for its glove making. OLIVER CROMWELL and his Parliamentarian army routed CHARLES II and his Scottish army in the Battle of Worcester, effecting an end to the ENGLISH CIVIL WARS. In 1751 John Wall founded the porcelain industry for which the town became famous, and in 1838 the condiment known as Worcestershire sauce was introduced there by Lea & Perrins. The town's noted cathedral (11th–14th century) contains the tombs of King JOHN and Prince Arthur, the eldest son of HENRY VII. Cathedral Grammar School and Royal Grammar School were founded in the 16th century.

word processing Preparation of textual documents on computer. A word-processing system typically consists simply of a PERSONAL COMPUTER linked to a computer PRINTER, but it may instead employ a terminal linked to a MAINFRAME computer. Word processing differs from typewriter typing in numerous ways. Electronic text can be moved around at will; misspelled terms can be corrected throughout the document by means of a single command; spelling and grammar CHECKERS can automatically alert the user to apparent errors of spelling, punctuation, and syntax; and the document's format, layout, and type fonts and sizes can be changed repeatedly until a satisfactory design is achieved. Since all editing ideally occurs on-screen, word processing can result in decreased paper usage and simplified editing. When the final draft is ready, the document can be printed out (in multiple copies if necessary), sent as an E-MAIL attachment, shared on a computer NETWORK, or simply stored as an electronic file.

Worde \'wôrd**, Wynkyn de** *orig.* **Jan van Wynkyn** (b. Alsace—d. 1534/35) Alsatian-born British printer. He was employed at WILLIAM CAXTON's press from its founding in 1476 until Caxton's death, when he took over the concern. Unlike Caxton and many other contemporary printers, he did not edit or translate. An astute businessman, he published at least 600 titles after 1501, and he was the first printer in England to use italic type (1524).

Wordsworth, Dorothy (b. Dec. 25, 1771, Cockermouth, Cumberland, Eng.—d. Jan. 25, 1855, Rydal Mount, Westmorland) English writer. An inspiring influence on her brother WILLIAM WORDSWORTH, she lived with him from 1795 onward. Her *Alfoxden Journal 1798* (1897)—from the period when he and SAMUEL TAYLOR COLERIDGE produced *Lyrical Ballads* (1798)—and *Grasmere Journals 1800–03* (1897) are intimate records of their lives. Both are appreciated for their imaginative descriptions of nature, their perfection of style, and their revelation of her personality as well as for the light they throw on her brother. In 1829 severe illness left her an invalid, and her mind was clouded in her last 20 years.

Wordsworth, William (b. April 7, 1770, Cockermouth, Cumberland, Eng.—d. April 23, 1850, Rydal Mount, Westmorland) English poet. Orphaned at age 13, Wordsworth attended Cambridge University, but he remained rootless and virtually penniless until 1795, when a legacy made possible a reunion with his sister DOROTHY WORDSWORTH. He became friends with SAMUEL TAYLOR COLERIDGE, with whom he wrote *Lyrical Ballads* (1798), the collection often considered to have launched the English Romantic movement. Wordsworth's contributions include "Tintern Abbey" and many lyrics controversial for their common, everyday language. About 1798 he began writing *The Prelude* (1850), the epic autobiographical poem that would absorb him intermittently for the next 40 years. His second verse collection, *Poems, in Two Volumes* (1807), includes many of the rest of his finest works, including "Ode: Intimations of Immortality." His poetry is perhaps most original in its vision of the organic relation between man and the natural world, a vision that culminated in the sweeping metaphor of nature as emblematic of the mind of God. The most memorable poems of his middle and late years were often cast in elegaic mode; few match the best of his earlier works. By the time he became widely appreciated by the critics and the public, his poetry had lost much of its force and his radical politics had yielded to conservatism. In 1843 he became England's poet laureate. He is regarded as the central figure in the initiation of English ROMANTICISM.

work In economics and sociology, the activities and labour necessary for the survival of society. As early as 40,000 BC, hunters worked in groups to track and kill animals, while younger or weaker members of the tribe gathered food. When agriculture replaced hunting and gathering, the resulting surplus of food allowed early societies to develop and some of its members to pursue crafts such as pottery, weaving, and metallurgy. Historically, rigid social hierarchies caused nobles, clergy, merchants, artisans, and peasants to pursue occupations defined largely by hereditary social class. Craft GUILDS, influential in the economic development of medieval Europe, limited the supply of labour in each profession and controlled production. The establishment of towns led to the creation of new occupations in commerce, law, medicine, and defense. The coming of the INDUSTRIAL REVOLUTION, spurred by technological advances such as steam power, changed working life profoundly. Factories divided the work once done by a single craftsman into a number of distinct tasks performed by unskilled or semiskilled workers (see DIVISION OF LABOUR). Manufacturing firms grew larger in the 19th century as standardized parts and machine tools came into use, and ever-more-specialized positions for managers, supervisors, accountants, engineers, technicians, and salesmen became necessary. The trend toward specialization continued into the 21st century, giving rise to a number of disciplines concerned with the management and design of work, including PRODUCTION MANAGEMENT, INDUSTRIAL RELATIONS, personnel administration, and SYSTEMS ENGINEERING. By the turn of the 21st century, automation and technology had spurred tremendous growth in SERVICE INDUSTRIES.

work In physics, the measure of energy transfer that occurs when an object is moved over a distance by an external force, some component of which is applied in the direction of displacement. For a constant force, work W is equal to the magnitude of the force F times the displacement d of the object, or $W = Fd$. Work is also done by compressing a gas, by rotating a shaft, and by causing invisible motions of particles within a body by an external MAGNETIC FORCE. No work is accomplished by simply holding a heavy stationary object, because there is no transfer of energy and no displacement. Work done on a body is equal to the increase in energy of the body. Work is expressed in units called joules (J). One joule is equivalent to the energy transferred when a force of one newton is applied over a distance of one metre.

workers' compensation Program through which employers bear some of the cost of their employees' work-related injuries and occupational illnesses or disabilities. It was first introduced in Germany in 1884. In Britain and the U.S. in the late 19th century, there was a movement to secure the right of injured workers to compensation and to improve working conditions through court decisions, employer liability statutes, and safety codes. By the mid-20th century most countries in the world had adopted some sort of workers' compensation. Some systems take the form of compulsory SOCIAL INSURANCE; in others the employer is legally required to provide certain benefits, but insurance is voluntary. The system of workers' compensation serves as an economic incentive for employers to prevent accidents and illness among employees, since liability for medical costs and the income lost by placing workers in hazardous environments can easily exceed the costs of establishing safe working conditions.

Workers' Opposition (1920–21) Group within the Soviet Union's COMMUNIST PARTY that championed workers' rights and trade-union control

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over industry. It was formed in 1919 to resist the central party's increasing control over local party units and trade unions. In 1920 it objected to Leon Trotsky's plan to transform trade unions into state organs. Led by Aleksandra Kollontay and others, the group insisted that the unions, as true representatives of the proletariat, should control the national economy. At the 10th Party Congress (1921), its platform was rejected and it was ordered to disperse.

working dog Any of various breeds of dog bred as guard, herding, draft, or rescue animals. Breeds range from medium to large, but all are sturdy and muscular, intelligent and loyal. Guard breeds include the Akita, boxer, bullmastiff, Doberman pinscher, giant and standard schnauzers, Great Dane, mastiff, and Rottweiler. Livestock guard breeds include the Great Pyrenees, komondor (Hungary), kuvasz (Tibet), and Pyrenean mountain dogs (Britain). Herding dogs include the German shepherd, Shetland sheepdog, and Welsh corgi. Breeds developed for hauling and rescue work include the Bernese mountain dog, Portuguese water dog, Newfoundland, St. Bernard, and sled dog.

Workingmen's Party First labour-oriented U.S. political party. It was formed in Philadelphia (1828) and New York (1829) by craftsmen, skilled journeymen, and reformers who demanded a 10-hour workday, free public education, abolition of debtor imprisonment, and an end to competition from prison contract labour. Leaders included Thomas Skidmore, Fanny Wright, Robert Dale Owen, and George H. Evans, who established the *Working Man's Advocate*, the first labour newspaper, in 1829. Factional disputes split the party in the 1830s, and many in New York joined the reform Locofoco Party.

Works Progress Administration See WPA

workstation Computer intended for use by one person, but with a much faster processor and more memory than an ordinary personal computer. Workstations are designed for powerful business applications that do large numbers of calculations or require high-speed graphical displays; the requirements of CAD/CAM systems were one reason for their initial development. Because of their need for computing power, they are often based on RISC processors and generally use UNIX as their operating system. An early workstation was introduced in 1987 by Sun Microsystems; workstations introduced in 1988 from Apollo, Ardent, and Stellar were aimed at 3D graphics applications. The term workstation is also sometimes used to mean a personal computer connected to a mainframe computer, to distinguish it from "dumb" display terminals with limited applications.

World Bank Specialized agency of the United Nations system, established at the Bretton Woods Conference for postwar reconstruction. It is the principal international development institution. Its five divisions are the International Bank for Reconstruction and Development (IBRD; its main component), the International Development Association (IDA), the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA), and the International Center for Settlement of Investment Disputes (ICSID). The IDA (founded 1960) makes interest-free loans to the bank's poorest member countries. The IFC (founded 1956) lends to private businesses in developing countries. The MIGA (founded 1985) supports national and private agencies that encourage foreign direct investment by offering insurance against noncommercial risks. The ICSID (founded 1966) was developed to relieve the IBRD of the burden of settling investment disputes. See also International Monetary Fund.

World Council of Churches (WCC) Christian ecumenical organization founded in 1948 in Amsterdam. It functions as a forum for Protestant and Eastern Orthodox denominations, which cooperate through the WCC on a variety of undertakings and explore doctrinal similarities and differences. It grew out of two post-World War I ecumenical efforts, the Life and Work Movement (which concentrated on practical activities) and the Faith and Order Movement (which focused on doctrinal issues and the possibility of reunion). The impetus for these two organizations sprang from the International Missionary Conference in Edinburgh in 1910, the first such cooperative effort since the Reformation. The Roman Catholic church, though not a member of the WCC, sends representatives to its conferences. The more fundamentalist Protestant denominations have also refused to join.

World Court See International Court of Justice

World Cup Major international football (soccer) competition. The tournament brings together 32 qualifying national teams from around the world, culminating in a match between the two top teams. It has been held every fourth year since 1930 (except during World War II). Followed and watched by billions of people worldwide, it has by far the greatest audience of any single sporting event in the world. Several competitions in other sports also use the name "world cup."

World Food Programme (WFP) Organization established in 1961 by the United Nations to help alleviate world hunger. The world's largest food-aid organization (providing food aid to some 75 million people annually), the WFP aims to assist the approximately 15% of the world's population that is hungry. Its Food-for-Life program aids victims of both natural and man-made disasters by collecting and transporting food to crisis areas. Contributions of commodities, cash, and services (primarily shipping) help beneficiaries to maintain balanced diets. Its Food-for-Growth programs are directed at vulnerable groups—including children, pregnant and nursing women, and the elderly—and its Food-for-Work program encourages self-reliance by providing food in return for labour. Its headquarters are in Rome.

World Health Organization (WHO) Public-health agency of the UN, established in Geneva in 1948 to succeed two earlier agencies. Its mandate is to promote "the highest possible level of health" in all peoples. Its work falls into three categories. It provides a clearinghouse for information on the latest developments in disease and health care and establishes international sanitary standards and quarantine measures. It sponsors measures for the control of epidemic and endemic disease (including immunization campaigns and assistance in providing sources of pure water). Finally, it encourages the strengthening of public-health programs in member nations. Its greatest success to date has been the worldwide eradication of smallpox (1980).

World Heritage site Any of various areas or objects designated as having "outstanding universal value" under the Convention Concerning the Protection of the World Cultural and Natural Heritage. This convention, adopted by UNESCO in 1972, provides for international cooperation in preserving and protecting cultural and natural treasures throughout the world. Each site on the list is under strict legal protection by the government of the nation in which it is situated. Among the cultural sites are many of the world's most famous buildings. The ratio of cultural to natural sites on the list is roughly three to one. See table opposite.

world music Musical genre incorporating diverse styles from Africa, eastern Europe, Asia, South and Central America, the Caribbean, and nonmainstream Western folk sources. The term was first coined largely in response to the sudden increase of recordings in non-English languages that were released in Great Britain and the United States in the 1980s, but by the early 1990s world music had become a bona fide musical genre and counterpoint to the increasingly synthetic sounds of Western pop music. Initially, African popular music and world music were virtually synonymous, and the genre's biggest stars included the Nigerians King Sunny Ade and Fela Anikulapo Kuti and the Senegalese Youssou N'Dour. Moreover, one of its earliest advocates was the Cameroonian-born Frenchman Francis Bebey. By the 21st century world music encompassed everything from Pakistani singer Nusrat Fateh Ali Khan and the pop-flamenco of the French group the Gipsy Kings to "ambient-global" projects that merged so-called ethnic voice samples with state-of-the-art rhythm programming.

World Series Annual championship of U.S. major league baseball, played between the top team of the American League (AL) and that of the National League (NL). First held in 1903, it was canceled the following year after the New York Giants (NL) refused to play Boston (AL). The series resumed in 1905 and continued annually until a players' strike in 1994 forced its cancellation that year. A seven-game series has been standard since 1922.

World Trade Center Complex formerly consisting of seven buildings around a central plaza, near the southern tip of Manhattan. Its huge twin towers (completed 1970–72) were designed by Minoru Yamasaki (1912–86). At 1,368 ft (417 m) and 1,362 ft (415 m) tall, they were the world's tallest buildings until surpassed in 1973 by the Sears Tower in Chicago. The towers were notable for the relationship of their simple, light embellishment to their underlying structure. In 1993 a bomb planted by terrorists exploded in the underground garage, killing several people and injuring some 1,000. A much more massive attack occurred on Sept. 11, 2001, when first One World Trade Center and then Two World Trade Center were struck by hijacked commercial airliners that were deliberately flown into them. Shortly thereafter both of the heavily damaged

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Selected UNESCO World Heritage sites

site*	country	notes
Africa		
Abu Ruwaysh	Egypt	archaeological remains
Aksum	Ethiopia	historic monuments
Carthage	Tunisia	remains of ancient city
Dahshur	Egypt	pyramids and funerary complex
Giza	Egypt	pyramids and funerary complex
Gorée Island	Senegal	slave-trading depot
Great Zimbabwe	Zimbabwe	ruins of Shona capital
Hadar	Ethiopia	early hominid remains
Karnak	Egypt	Theban temple ruins
Kilimanjaro	Tanzania	montane national park and reserve
Kings, Valley of the	Egypt	Theban necropolis
Lalibela	Ethiopia	rock-hewn medieval churches
Leptis Magna	Libya	remains of Roman architecture
Luxor	Egypt	Theban ruins
Marrakech	Morocco	historic medina
Memphis	Egypt	remains of ancient city
Mount Kenya	Kenya	national park and forest reserve
Ngorongoro	Tanzania	wildlife conservation area
Olduvai Gorge	Tanzania	early hominid remains
Philae	Egypt	Nubian monuments
Saqqarah	Egypt	step pyramid and funerary complex
Serengeti	Tanzania	national park, wildlife refuge
Thebes	Egypt	ruins of ancient Egyptian capital
Timbuktu	Mali	medieval center of Islamic culture
Victoria Falls	Zambia and Zimbabwe	national parks, cataracts, Zambezi River, rainforest, and wildlife
Virunga	Congo (Kinshasa)	national park, diversity of habitats
Asia		
Ajanta Caves	India	rock-cut Buddhist monasteries
Angkor	Cambodia	archaeological remains
Ayutthaya	Thailand	ruins of capital complex
Baikal, Lake	Russia	unique freshwater environment
Borobudur	Indonesia	Buddhist temple compound
Chogha Zanbil	Iran	ruins of Elamite city
Damascus	Syria	historic city center
Delhi	India	historic monuments and tomb
Elephanta Island	India	Hindu cave temple
Ellora Caves	India	Hindu, Buddhist, Jaina cave temples
Everest, Mount	Nepal	montane national park
Forbidden City	China	imperial palace in Beijing
Great Wall of China	China	extensive fortification
Ha Long Bay	Vietnam	picturesque island group
Hatra	Iraq	ruins of Parthian city
Hiroshima	Japan	peace memorial
Horyu Temple	Japan	Buddhist monuments
Hue	Vietnam	imperial citadel
Jerusalem	Israel	Jewish, Islamic, Christian holy city
Kandy	Sri Lanka	sacred Buddhist city
Khiva	Uzbekistan	Islamic architecture
Kyoto	Japan	historic imperial capital
Lahore	Pakistan	Mughal fortress, palace, gardens
Palmyra	Syria	ruins of ancient city
Petra	Jordan	remains of ancient city
Potala Palace	China	former residence of the Dalai Lama, in Lhasa, Tibet
Qin tomb	China	archaeological site, terra-cotta army
San'a'	Yemen	historic architecture
Sundarbans	Bangladesh and India	national park (India), sanctuary, mangrove forest and wetlands
Taj Mahal	India	monumental funerary complex
Tyre	Lebanon	ruins of three millennia of habitation
Ujong-Kulon	Indonesia	national park and reserve on Java
Zhoukoudian	China	early hominid habitation
Australia and Oceania		
Great Barrier Reef	Australia	marine national park
Lord Howe Island	Australia	diversity of habitats
Rennell Island	Solomon Islands	unique island ecosystem
Shark Bay	Australia	rare marine and terrestrial life-forms
Uluru (Ayers Rock)	Australia	national park, sandstone monolith

site*	country	notes
Europe		
Acropolis of Athens	Greece	complex of monuments
Alhambra	Spain	Moorish palace and fortress
Altamira	Spain	prehistoric cave paintings
Amiens Cathedral	France	Romanesque and Gothic styles
Arles	France	Roman, Romanesque monuments
Auschwitz	Poland	Nazi concentration camp
Avebury	England	prehistoric megalith group
Bergen	Norway	Hanseatic wharf
Bern	Switzerland	medieval city center
Canterbury	England	cathedral and abbey
Chartres Cathedral	France	Gothic architecture
Delphi	Greece	remains of sanctuary complex
Ferrara	Italy	Renaissance architecture
Florence	Italy	historic city center
Fontainebleau	France	royal château and gardens
Giant's Causeway	Northern Ireland	coastal rock formations
Granada	Spain	Moorish, Andalusian structures
Hadrian's Wall	England	Roman fortification
Herculaneum	Italy	ruins of Vesuvius-destroyed town
Istanbul	Turkey	numerous historic sites
Kraków (Cracow)	Poland	medieval city center
Lascaux Grotto	France	prehistoric cave paintings
Lübeck	Germany	Hanseatic architecture
Luxembourg city	Luxembourg	fortifications and old city
Metéora	Greece	Orthodox Christian monasteries
Mont-Saint-Michel	France	medieval village and abbey
Moscow	Russia	Kremlin and Red Square
Naples	Italy	historic city center
Olympia	Greece	ruins of ancient sacred city
Palatine Chapel (Aachen Cathedral)	Germany	imperial chapel of Charlemagne, Carolingian and Gothic styles
Paris	France	banks of Seine River
Pompeii	Italy	ruins of Vesuvius-destroyed town
Porto (Oporto)	Portugal	historic city center
Prague	Czech Republic	historic city center
Reims Cathedral	France	High Gothic architecture
Rhodes	Greece	medieval city center
Rila Monastery	Bulgaria	cradle of Bulgarian "National Revival"
Saint Petersburg	Russia	historic city center and monuments
Salzburg	Austria	historic city center
Samos	Greece	ancient port and temple remains
Santiago	Spain	old city and pilgrimage route
Segovia	Spain	old town and Roman aqueduct
Split	Croatia	Roman palace, other monuments
Stonehenge	England	prehistoric megalith group
Tallinn	Estonia	historic city center
Toledo	Spain	historic structures
Transylvania	Romania	Saxon fortified churches, villages
Vatican City	Vatican City	seat of Roman Catholic church
Venice	Italy	island city and surrounding lagoon
Versailles	France	royal palace and park
Visby	Sweden	historic Hanseatic town
North America		
Banff	Canada	national park, Rocky Mountains
Chaco Canyon	United States	historical park, Pueblo ruins
Chichén Itzá	Mexico	Mayan-Toltec architecture
Cocos Island	Costa Rica	national park, forest and marine life
Copán	Honduras	remains of major Mayan city
Glacier Bay	United States	subarctic national park, preserve
Grand Canyon	United States	national park
Havana	Cuba	colonial city center
Hawaii Volcanoes	United States	national park
Jasper	Canada	national park, Rocky Mountains
Kluane	Canada	subarctic national park
Kootenay	Canada	national park, Rocky Mountains
L'Anse aux Meadows	Canada	remains of medieval Norse settlement in Newfoundland
Mammoth Cave	United States	cave system and national park
Mesa Verde	United States	prehistoric cliff dwellings
Mexico City	Mexico	historic city center
Palenque	Mexico	national park, Mayan city

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Selected UNESCO World Heritage sites (continued)

site*	country	notes
North America (continued)		
Santo Domingo	Dominican Rep.	colonial city
Statue of Liberty	United States	national monument
Teotihuacán	Mexico	extensive pre-Hispanic ruins
Tikal	Guatemala	national park, Mayan ruins
Uxmal	Mexico	Mayan city and ceremonial center
Wrangell-St. Elias	United States	subarctic national park, preserve
Xochimilco	Mexico	Aztec canals and floating gardens
Yellowstone	United States	national park, geothermal formations
Yoho	Canada	national park, Rocky Mountains
South America		
Arequipa	Peru	colonial architecture
Brasília	Brazil	urban planning and architecture
Cartagena	Colombia	colonial port, fortresses, monuments
Chan Chan	Peru	ruins of pre-Inca Chimú capital
Colonia del Sacramento	Uruguay	Portuguese, Spanish colonial architecture
Córdoba	Argentina	Jesuit institutions and estates
Coro	Venezuela	Spanish, Dutch, local architecture
Cuzco	Peru	Inca and colonial architecture
Easter Island	Chile	monumental sculptures
Galapagos Islands	Ecuador	national park, unique ecosystem
Huascarán, Mount	Peru	montane national park
Iguaçu (Iguazú)	Brazil and Argentina	national parks, waterfalls, subtropical rainforests
Los Kaitos and Darién	Colombia and Panama	national parks on the frontier, rainforest, wetlands
Machu Picchu	Peru	Inca ruins
Nazca Lines	Peru	extensive geoglyphs
Pantanal	Brazil	freshwater wetland ecosystem
Potosí	Bolivia	colonial industrial city
Quito	Ecuador	colonial city center
Valdés Peninsula	Argentina	seals, whales

*The spelling or styling of place-names in this table may differ from those given on the World Heritage List; in addition, some place-names represent one or more constituent parts of larger World Heritage sites.

towers, as well as adjacent buildings, collapsed into enormous piles of debris. The attacks claimed the lives of some 2,750 people. Thousands more were injured. See SEPTEMBER 11 ATTACKS.

World Trade Organization (WTO) INTERNATIONAL ORGANIZATION based in Geneva that supervises world trade. It was created in 1995 to replace the GENERAL AGREEMENT ON TARIFFS AND TRADE (GATT). Like its predecessor, it aims to lower trade barriers and encourage multilateral trade. It monitors members' adherence to GATT agreements and negotiates and implements new agreements. Critics of the WTO, including many opponents of economic GLOBALIZATION, have charged that it undermines national sovereignty by promoting the interests of large MULTINATIONAL CORPORATIONS and that the trade liberalization it encourages leads to environmental damage and declining living standards for low-skilled workers in developing countries. By the early 21st century, the WTO had more than 145 members.

world tree Centre of the world, a widespread motif in myths and folktales among various peoples, especially in Asia, Australia, and North America. There are two main forms. In the vertical tradition, the tree extends between and connects earth, heaven, and the underworld; oracles, judgments, and other prophetic activities are performed at its base. In the horizontal tradition, the tree is planted at the centre of the world and is protected by supernatural guardians; it is the source of terrestrial fertility and life.

World War I *or* **First World War** (1914–18) International conflict between the CENTRAL POWERS—Germany, Austria-Hungary, and Turkey—and the ALLIED POWERS—mainly France, Britain, Russia, Italy, Japan, and (from 1917) the U.S. After a Serbian nationalist assassinated Archduke FRANCIS FERDINAND of Austria in June 1914, a chain of threats and mobilizations resulted in a general war between the antagonists by mid-August. Prepared to fight a war on two fronts, based on the SCHLIEFFEN PLAN, Germany first swept through neutral Belgium and invaded France. After the FIRST BATTLE OF THE MARNE (1914), the Allied defensive lines were stabilized in France, and a war of attrition began. Fought from lines of trenches and supported by modern artillery and machine guns, infantry assaults gained little ground and were enormously costly in human life, especially at the BATTLES OF VERDUN and the SOMME (1916). On the Eastern Front, Russian forces initially drove deep into East Prussia and German Poland (1914) but were stopped by German and Austrian forces at the BATTLE OF TANNENBERG and forced back into Russia (1915). After several offensives, the Russian army failed to break through the German defensive lines. Russia's poor performance and enormous losses caused widespread domestic discontent that led to the RUSSIAN REVOLUTION OF 1917. Other fronts in the war included the DARDANELLES CAMPAIGN, in which British and Dominion forces were unsuccessful against Turkey; the Caucasus and Iran (Persia), where Russia fought Turkey; Mesopotamia and Egypt, where British forces fought the Turks; and northern Italy, where Italian and Austrian troops fought the costly BATTLES OF THE ISONZO. At sea, the German and British fleets fought the inconclusive BATTLE OF JUTLAND, and Germany's use of the submarine against neutral shipping eventually brought the U.S. into the war in 1917. Though Russia's armistice with Germany in December 1917 released German troops to fight on the Western Front, the Allies were reinforced by U.S. troops in early 1918. Germany's unsuccessful offensive in the SECOND BATTLE OF THE MARNE was countered by the Allies' steady advance, which recovered most of France and Belgium by October 1918 and led to the November ARMISTICE. Total casualties were estimated at 10 million dead, 21 million wounded, and 7.7 million missing or imprisoned. See also Battles of CAPORETTO and YPRES; FOURTEEN POINTS; LUSITANIA; PARIS PEACE CONFERENCE; Treaties of BREST-LITOVSK, NEUILLY, SAINT-GERMAIN, SÈVRES, TRIANON, and VERSAILLES; EDMUND H.H. ALLENBY, FERDINAND FOCH, JOHN FRENCH, DOUGLAS HAIG, PAUL VON HINDENBURG, JOSEPH-JACQUES-CÉSAIRE JOFFRE, ERICH LUDENDORFF, JOHN PERSHING.

World War II *or* **Second World War** (1939–45) International conflict principally between the AXIS POWERS—Germany, Italy, and Japan—and the ALLIED POWERS—France, Britain, the U.S., the Soviet Union, and China. Political and economic instability in Germany, combined with bitterness over its defeat in WORLD WAR I and the harsh conditions of the Treaty of VERSAILLES, allowed ADOLF HITLER and the NAZI PARTY to rise to power. In the mid-1930s Hitler began secretly to rearm Germany, in violation of the treaty. He signed alliances with Italy and Japan to oppose the Soviet Union and intervened in the SPANISH CIVIL WAR in the name of anticommunism. Capitalizing on the reluctance of other European powers to oppose him by force, he sent troops to occupy Austria in 1938 (see ANSCHLUSS) and to annex Czechoslovakia in 1939. After signing the GERMAN-SOVIET NONAGGRESSION PACT, Germany invaded Poland on Sept. 1, 1939. Two days later France and Britain declared war on Germany. Poland's defeat was followed by a period of military inactivity on the Western Front (see PHONY WAR). At sea Germany conducted a damaging submarine campaign by U-BOAT against merchant shipping bound for Britain. By early 1940 the Soviet Union had divided Poland with Germany, occupied the Baltic states, and subdued Finland in the RUSSO-FINNISH WAR. In April 1940 Germany overwhelmed Denmark and began its conquest of Norway. In May German forces swept through The Netherlands and Belgium on their BLITZKRIEG invasion of France, forcing it to capitulate in June and establish the VICHY FRANCE regime. Germany then launched massive bombing raids on Britain in preparation for a cross-Channel invasion, but, after losing the BATTLE OF BRITAIN, Hitler postponed the invasion indefinitely. By early 1941 Hungary, Romania, and Bulgaria had joined the Axis, and German troops quickly overran Yugoslavia and Greece in April. In June Hitler abandoned his pact with the Soviet Union and launched a massive surprise invasion of Russia, reaching the outskirts of Moscow before Soviet counterattacks and winter weather halted the advance. In East Asia Japan expanded its war with China and seized European colonial holdings. In December 1941 Japan attacked U.S. bases at Pearl Harbor and in the Philippines. The U.S. declared war on Japan, and the war became truly global when the other Axis Powers declared war on the U.S. Japan quickly invaded and occupied most of Southeast Asia, Burma, the Neth-

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erlands East Indies, and many Pacific islands. After the crucial U.S. naval victory at the Battle of Midway (1942), U.S. forces began to advance up the chains of islands toward Japan. In the North Africa Campaigns the British and Americans defeated Italian and German forces by 1943. The Allies then invaded Sicily and Italy, forcing the overthrow of the fascist government in July 1943, though fighting against the Germans continued in Italy until 1945. In the Soviet Union the Battle of Stalingrad (1943) marked the end of the German advance, and Soviet reinforcements in great numbers gradually pushed the German armies back. The massive Allied invasion of western Europe began with the Normandy Campaign in western France (1944), and the Allies' steady advance ended in the occupation of Germany in 1945. After Soviet troops pushed German forces out of the Soviet Union, they advanced into Poland, Czechoslovakia, Hungary, and Romania and had occupied the eastern third of Germany by the time the surrender of Germany was signed on May 8, 1945. In the Pacific an Allied invasion of the Philippines (1944) was followed by the successful Battle of Leyte Gulf and the costly Battles of Iwo Jima and Okinawa (1945). Atomic bombs were dropped on Hiroshima and Nagasaki in August 1945, and Japan's formal surrender on September 2 ended the war. Estimates of total military and civilian casualties varied from 35 million to 60 million killed, including about 6 million Jews who died in the Holocaust. Millions more civilians were wounded and made homeless throughout Europe and East Asia. See also Anti-Comintern Pact; Atlantic Charter; Battles of El Alamein, the Atlantic, the Bulge, Guadalcanal, and the Philippine Sea; Casablanca, Potsdam, Tehran, and Yalta conferences; Dunkirk Evacuation; lend-lease; Munich agreement; Nürnberg Trials; Siege of Leningrad; Sino-Japanese Wars; Omar Bradley, Winston Churchill, Dwight D. Eisenhower, Douglas MacArthur, Bernard Law Montgomery, Benito Mussolini, George Patton, Erwin Rommel, Franklin Roosevelt, Joseph Stalin, Yamamoto Isoroku, Georgy K. Zhukov.

World Wide Web (WWW) *or* **Web** Leading information-exchange service of the Internet. It was created by Tim Berners-Lee and his colleagues at CERN and introduced to the world in 1991. The Web gives users access to a vast array of documents that are connected to each other by means of hypertext or hyperlinks. A hypertext document with its corresponding text and hyperlinks is written in HTML and is assigned an on-line address, or URL. The Web operates within the Internet's basic client-server architecture. Individual HTML files with unique electronic addresses are called Web pages, and a collection of Web pages and related files (such as graphics files, scripted programs, and other resources) sharing a set of similar addresses (see domain name) is called a Web site. The main or introductory page of a Web site is usually called the site's home page. Users may access any page by typing in the appropriate address, search for pages related to a topic of interest by using a search engine, or move quickly between pages by clicking on hyperlinks incorporated into them. Though introduced in 1991, the Web did not become truly popular until the introduction of Mosaic, a browser with a graphical interface, in 1993. Subsequently, browsers produced by Netscape and Microsoft have become predominant.

World Wildlife Fund *or* **World Wide Fund for Nature** Largest privately supported international conservation organization in the world. Founded in 1961 by a small group of European scientists, naturalists, and business and political leaders, including Peter Markham Scott, the organization raises funds and channels them to other conservation groups. It directs its efforts toward protecting endangered environments such as coral reefs, saving endangered species, and addressing global threats such as pollution. It has helped establish and manage parks and reserves, and was instrumental in saving the giant panda (whose image it uses as its symbol) and other endangered species.

world's fair Specially constructed attraction showcasing the science, technology, and culture of participating countries and enterprises. World fairs have often featured outstanding architectural designs and introduced significant inventions. The first was held in England in 1756; more than 300 have been held since. The most notable include the 1851 Crystal Palace Exhibition (London), the 1876 U.S. International Centennial Exposition (Philadelphia), the 1893 World's Columbian Exposition (Chicago), the 1901 Pan-American Exposition (Buffalo, N.Y.), the 1904 St. Louis World's Fair, the 1910 Brussels World's Fair, the 1933–34 Century of Progress (Chicago), the 1939–40 Golden Gate Exposition (San Francisco), the 1939–40 New York World's Fair, the 1964–65 New York World's Fair, the 1967 Montreal Exposition, and the 1998 World Exposition (Lisbon).

worm Any of thousands of species of unrelated invertebrate animals that typically have a soft, slender, elongated body with no appendages. The major phyla are Platyhelminthes (flatworms), Annelida (annelids, or segmented worms), Nemertea (ribbon worms), Acanthocephala (spiny-headed worms), and Aschelminthes (nematodes and others). There are several minor phyla. Length ranges from microscopic (e.g., some aschelminths) to more than 100 ft (30 m) (some ribbon worms). Worms are found worldwide on land and in water. They may be parasitic or free-living and are important as soil conditioners, parasites, and a link in the food chain in all ecosystems. See also fluke, pinworm, polychaete, rotifer, tapeworm, tube worm.

Wormley Conference (Feb. 26, 1877) Meeting to resolve the disputed U.S. presidential election of 1876 between Samuel Tilden and Rutherford B. Hayes. Leaders of the Democratic and Republican parties met at Wormley's Hotel in Washington, D.C., to reach a compromise that would forestall the Democrats' protest of the Electoral Commission's decision to award the disputed electoral votes from three Southern states to Hayes, enabling him to defeat Tilden 185 to 184. In return for the Democrats' acquiescence in the decision, Republicans promised to withdraw troops from the South, end Reconstruction and Northern interference in Southern politics, and vote for railroad construction and other internal improvements in the South. The compromise satisfied the Southern Democrats, and Hayes was declared the winner on March 2, 1877.

Worms \'vȯrms,\ *English* \'wərmz**, Concordat of** (1122) Compromise between Pope Calixtus II and Emperor Henry V (r. 1106–25) to settle the Investiture Controversy, reached at Worms, Germany. It marked the end of the first phase of conflict between Rome and what was becoming the Holy Roman Empire and made a clear distinction between the spiritual side of a prelate's office and his position as a landed magnate and vassal of the crown. Bishops and abbots were to be chosen by the clergy, but the emperor was to decide contested elections. Those selected were to be invested first with the powers and privileges of their office as vassal (granted by the emperor) and then with their ecclesiastical powers and lands (granted by church authority).

Worms, Diet of Meeting of the Diet (assembly) of the Holy Roman Empire at Worms, Ger., in 1521, where Martin Luther defended the principles of the Reformation. Luther had already been excommunicated by Pope Leo X, but Emperor Charles V granted him safe conduct to a hearing at the Diet. On April 17, 1521, Luther refused to recant his views. Disorder broke out, the emperor adjourned the proceedings, and Luther was obliged to go into hiding. In May the Diet issued the Edict of Worms, declaring Luther an outlaw and a heretic and banning his writings.

worsted \'wůs-təd, 'wər-stəd\ Wool yarn made of long-staple fibres that have been combed to remove unwanted short fibres and make them lie parallel. In the spinning operation, which gives the necessary twist to hold the fibres together, worsted yarns are more tightly twisted than are the bulkier woolen yarns. The soft, heavy yarn is strong and durable and is often used for sweaters. Worsteds are also used for fine dress fabrics and suit material.

Worth, Charles Frederick (b. Oct. 13, 1825, Bourne, Lincolnshire, Eng.—d. March 10, 1895, Paris, France) British-born French fashion designer. In 1845 he left England, where he had been a bookkeeper, and worked in a Paris dress accessories shop. In 1858 he opened his own ladies' tailor shop and soon gained the patronage of the empress Eugénie. He was a pioneer of the "fashion show" (the preparation and showing of a collection), the first man to become prominent in the field of fashion, and the first designer to create dresses intended to be copied and distributed throughout the world. He became the dictator of Paris fashion and was especially noted for his elegant Second Empire gowns. He invented the bustle, which became standard in women's fashion in the 1870s and '80s.

Charles Frederick Worth, detail of an engraving
BBC HULTON PICTURE LIBRARY

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Wotan See Odin

Wouk \'wōk**, Herman** (b. May 27, 1915, New York, N.Y., U.S.) U.S. novelist. His experience serving aboard a destroyer-minesweeper in World War II provided material for *The Caine Mutiny* (1951, Pulitzer Prize; film, 1954), a drama of naval tradition that presented the unforgettable character Captain Queeg. *The Winds of War* (1971) and *War and Remembrance* (1978) together represent a two-volume novel of the war. His other novels include *Marjorie Morningstar* (1955) and *The Glory* (1994).

wound *or* **trauma** Break in any body tissue due to external action (including surgery). It may be closed (blunt trauma) or open (penetrating trauma). Blood vessels, nerves, muscles, bones, joints, and internal organs may be damaged. A closed wound can be caused by impact, twisting, bending, or deceleration (as in a car crash). It can range from a minor bruise or sprain to a skull fracture with brain damage or a spinal-cord injury with paralysis. In an open wound, foreign matter such as bacteria, dirt, and clothing fragments entering through broken skin or mucous membrane may result in infection. Other factors affecting severity include depth, surface area, degree of tearing, and structures damaged. Minor wounds need only first aid. For others, after examination and perhaps diagnostic imaging and exploratory surgery, treatment may include fluid replacement or drainage, sterilization and antibiotics, tetanus antitoxin, and repair of damaged structures. A closed wound may need to be opened or an open one sutured closed. See also burn, coagulation, crush injury, dislocation, scar.

Wounded Knee Hamlet and creek in southwestern South Dakota, the site of two conflicts between the Sioux Indians and the U.S. government. In 1890 the Sioux had been inspired by the Ghost Dance movement to take up arms and reclaim their heritage, but federal military intervention quelled the rebellion. On December 29 a young brave became involved in a scuffle while surrendering, and a trooper was killed. Soldiers fired at the Indians, killing more than 200 men, women, and children. Thirty soldiers also died. The so-called Battle of Wounded Knee is regarded as the final episode in the conquest of the North American Indian. In 1973 some 200 members of the American Indian Movement took the reservation hamlet by force, declared it an independent nation, and vowed to stay until the government agreed to address Indian grievances; a siege by federal marshals ended when the Indians surrendered in exchange for a promise of negotiations.

Wovoka \wō-'vō-kə\ (b. 1858?, Utah Territory, U.S.—d. October 1932, Walker River Indian Reservation, Nev.) Paiute religious leader. In 1889 Wovoka announced that during a trance God had told him that his people's ancestors would rise from the dead, buffalo would return to the plains, and the white man would vanish if the people would perform a ritual dance. The Ghost Dance cult arose and quickly spread to other tribes, notably the militant Sioux, and Wovoka was worshiped as a new messiah. After the Wounded Knee massacre, Wovoka's following dissipated and the movement died out.

Wozniak, Stephen G(ary) (b. Aug. 11, 1950, San Jose, Calif., U.S.) U.S. computer engineer. He designed electronic devices and games while still in his teens. In the 1970s he worked for Hewlett-Packard. In 1976 he and Steven Jobs founded Apple Computer, Inc. Badly injured in a 1981 plane crash, he took a leave from Apple, but he returned to work on the revolutionary Macintosh computer. He left Apple for good in 1985, the year he was awarded the National Medal of Technology. He has since taught in elementary school.

WPA *in full* **Works Progress Administration** *later (1939–43)* **Work Projects Administration** U.S. work program for the unemployed. Created in 1935 under the New Deal, it aimed to stimulate the economy during the Great Depression and preserve the skills and self-respect of unemployed persons by providing them useful work. During its existence, it employed 8.5 million people in the construction of 650,000 mi (1,046,000 km) of roads, 125,000 public buildings, 75,000 bridges, 8,000 parks, and 800 airports. The WPA also administered the WPA Federal Art Project, the Theater Project, and the Writers' Project, which provided jobs for unemployed artists, actors, and writers. In 1943, with the virtual elimination of unemployment by the wartime economy, the WPA was terminated.

WPA Federal Art Project Extensive visual-arts project, part of the Works Progress Administration established by Franklin D. Roosevelt during the Great Depression. It employed artists with a wide range of experience and styles and had great influence on subsequent U.S. movements. At its peak in 1936, it provided work for more than 5,000 artists from relief rolls. Over the eight years of its existence, its employees produced 2,566 murals, more than 100,000 easel paintings, about 17,700 sculptures, and nearly 300,000 fine prints. The project also developed an audience by establishing more than 100 community art centres and galleries in regions where art was generally unknown. The total federal investment was about $35 million. It was the first major attempt at U.S. government patronage of the visual arts.

Wrangel, Pyotr (Nikolayevich), Baron (b. Aug. 27, 1878, Novo-Aleksandrovsk, Lith., Russian Empire—d. April 25, 1928, Brussels, Belg.) Russian general who led the anti-Bolshevik forces in the Russian Civil War. A member of an old German baronial family, he served in the Russian imperial guards and commanded a Cossack division in World War I. After the Russian Revolution of 1917, he joined the anti-Bolshevik "White" forces of Anton Denikin. After capturing Tsaritsyn (now Volgograd) in 1919, he became commander of the Whites in April 1920 and tried to rally support from the peasants and Cossacks. He launched an offensive in Ukraine in June, but by November the Red Army had defeated the Whites and forced them to retreat to the Crimea. After evacuating his troops to Constantinople, he lived in exile in western Europe.

Wrangel Island Island, northeastern Russia. Located in the Arctic Ocean, it is crossed by the 180th meridian. It has an area of some 2,800 sq mi (7,300 sq km). Although it reaches an altitude of 3,596 ft (1,096 m) at Sovetskaya Mountain, there are no glaciers. The Russian explorer Ferdinand P. Wrangel, for whom the island was later named, determined its location from accounts of Siberian natives but did not land there during his mapping of the Siberian coast in the early 1820s. Russian fur traders subsequently visited the island, and it was sighted by U.S. vessels in 1867 and 1881. Survivors of a sunken Canadian ship reached Wrangel in 1914, and the leader of the expedition created an international incident in the early 1920s when he claimed Wrangel for Canada without authorization. The Soviet Union then annexed the island, and permanent occupation began in 1926. Wrangel Island State Reserve, established in 1976, occupies 1,730,000 ac (700,000 ha).

Wrangell Mountains Range, southern Alaska, U.S. It extends south for about 100 mi (160 km) from the Copper River to the Saint Elias Mountains near the Yukon border. Many peaks exceed 10,000 ft (3,000 m); the highest are Mount Blackburn (16,390 ft [4,990 m]), Mount Bona (16,500 ft [5,029 m]), and Mount Sanford (16,237 ft [4,950 m]). Most of the summits are extinct volcanoes. Snowfields drain into glaciers as long as 45 mi (72 km). The range forms a major part of Wrangell–Saint Elias National Park.

Wrangell–Saint Elias National Park National park, southeastern Alaska, U.S. Proclaimed a national monument in 1978, the area underwent boundary and name changes in 1980. The largest park in the U.S. national park system, it has an area of 12,318,000 ac (4,987,000 ha). At the convergence of the Chugach, Wrangell, and Saint Elias mountain ranges, it includes the largest assemblage of glaciers and the greatest collection of peaks above 16,000 ft (4,880 m) on the continent.

wrasse \'ras\ Any of some 300 species (family Labridae) of slender, often brilliantly coloured, fishes, found worldwide in tropical and temperate seas, often on coral reefs. Species range from 2 in. (5 cm) to 7 ft (2 m) long. Wrasses have thick lips, large scales, long fins, and large, often protruding, canine teeth. Most eat invertebrates; some species, called cleaner wrasses, pick off and eat the external parasites of larger fishes. The tautaug (*Tautoga onitis*) is an edible species.

wren Any of 59 species (family Troglodytidae) of chunky songbirds, found in the Western Hemisphere. One species, *Troglodytes troglodytes*, has spread to the Old World; typical of the family, it is about 4 in. (10 cm) long and dark-barred brown, with a short, slightly downcurved bill, short rounded wings, and short cocked tail. Common throughout the Western Hemisphere is the house wren. The largest U.S. species (8 in., or 20 cm, long) is the cactus wren of southwestern deserts. Wrens hunt insects in marshes, rocky wastes, or shrubbery, revealing their presence by chatter and loud song. They nest in holes, in thickets, or on ledges.

Wren, Sir Christopher (b. Oct. 20, 1632, East Knoyle, Wiltshire, Eng.—d. Feb. 25, 1723, London) British architect, astronomer, and geometrician. He taught astronomy at Gresham College, London (1657–61) and Oxford (1661–73), and did not turn to architecture until 1662, when

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he was engaged to design the Sheldonian Theatre at Oxford. Though Classical in form, the theatre was roofed with novel wood trusses that were the product of Wren's scholarly and empirical approach. As King's Surveyor of Works (1669–1718), he had a hand in the rebuilding of more than 50 churches destroyed in the Great Fire of London. Meanwhile, he was evolving designs for Saint Paul's Cathedral, a work that occupied him until its completion in 1710. Other works, generally in the English Baroque style, include the classical Trinity College library, Cambridge (1676–84), additions to Hampton Court (begun 1689), and Greenwich Hospital (begun 1696). Wren was buried in Saint Paul's; nearby is the famous inscription: "Reader, if you seek a monument, look around."

Sir Christopher Wren, detail of an oil painting by Sir Godfrey Kneller, 1711; in the National Portrait Gallery, London.
COURTESY OF THE NATIONAL PORTRAIT GALLERY, LONDON

wrench *or* **spanner** Tool, usually operated by hand, for tightening bolts and nuts. A wrench basically consists of a lever with a notch at one or both ends for gripping the bolt or nut so that it can be twisted by a pull at right angles to the axes of the lever and the bolt or nut. Open-end wrenches have ends with straight-sided slots that fit over the part being tightened; box-end wrenches have ends that enclose the nut and have six, eight, 12, or 16 points inside the head. A socket wrench is essentially a short pipe with a square or hexagonal hole and either a permanent or a removable handle.

wrestling Sport in which two competitors grapple with and strive to trip or throw each other down or off-balance. It is practiced in various styles, including freestyle wrestling, in which contestants can use holds above and below the waist, and Greco-Roman wrestling, which allows only holds above the waist. Sambo is a style of Russian origin employing judo techniques. Sumo wrestling is a specialized Japanese variety. U.S. professional wrestling is today among the most popular of all spectator sports, though it principally involves wildly flamboyant showmanship, including such nonclassical moves as kicks to the head that would be lethal if they were not actually pulled.

Wright, Sir Almroth Edward (b. Aug. 10, 1861, Middleton Tyas, Yorkshire, Eng.—d. April 30, 1947, Farnham Common, Buckinghamshire) British bacteriologist and immunologist. While teaching at the Army Medical School in Netley (from 1892), he developed a typhoid immunization that used killed typhoid bacilli. It made Britain the only country with troops immunized against typhoid at the start of World War I, the first war in which fewer British soldiers died of infection than from trauma. He also developed vaccines against enteric tuberculosis and pneumonia. He was well known for advancing autogenous vaccines (vaccines prepared from a patient's own bacteria).

Wright, Frances *known as* **Fanny Wright** (b. Sept. 6, 1795, Dundee, Angus, Scot.—d. Dec. 13, 1852, Cincinnati, Ohio, U.S.) Scottish-born American social reformer. After travels in the U.S., she published *Views of Society and Manners in America* (1821), which was widely read and praised. Returning to the U.S. in 1824, she bought and freed slaves and settled them at Nashoba, a socialist, interracial community she established in Tennessee (1825–28). She worked with Robert Dale Owen in New York (1829) and defied convention by lecturing widely, attacking slavery, religion, traditional marriage, and the unequal treatment of women. She was a co-leader of the Workingmen's Party. After marrying and living in France (1831–35), she returned to the U.S. and became a supporter of Andrew Jackson and the Democratic Party.

Wright, Frank Lloyd (b. June 8, 1867, Richland Center, Wis., U.S.—d. April 9, 1959, Phoenix, Ariz.) U.S. architect. After studying engineering briefly at the University of Wisconsin, he worked for the firm of Dankmar Adler (1844–1900) and Louis Sullivan in Chicago before opening his own practice there in 1893. Wright became the chief practitioner of the Prairie school, building about 50 Prairie houses from 1900 to 1910. Early nonresidential buildings include the forward-looking Larkin Building in Buffalo, N.Y. (1904; destroyed 1950), and Unity Temple in Oak Park, Ill. (1906). In 1911 he began work on his own house, Taliesin, near Spring Green, Wis. The lavish Imperial Hotel in Tokyo (1915–22, dismantled 1967) was significant for its revolutionary floating cantilever construction, which made it one of the only large buildings to withstand the earthquake of 1923. In the 1930s he designed his low-cost Usonian houses, but his most admired house, Fallingwater, in Bear Run, Pa. (1936), is an extravagant country retreat cantilevered over a waterfall. His Johnson Wax Building (1936–39), an example of humane workplace design, touched off an avalanche of major commissions. Of particular note is the Guggenheim Museum (1956–59), which has no separate floor levels but instead uses a spiral ramp, realizing Wright's ideal of a continuous space. Throughout his career he retained the use of ornamental detail, earthy colours, and rich textural effects. His sensitive use of materials helped to control and perfect his dynamic expression of space, which opened a new era in American architecture. Often considered the greatest U.S. architect of all time, his greatest legacy is "organic architecture," or the idea that buildings harmonize both with their inhabitants and with their environment.

Wright, Mickey *orig.* **Mary Kathryn Wright** (b. Feb. 14, 1935, San Diego, Calif., U.S.) U.S. golfer. Noted for her classic swing, her long drives, and her superior iron play, she won a record number of LPGA tournaments (82), including an unmatched 13 in one season (1963), and remains the only four-time winner of the LPGA Championship (1958, 1960, 1961, 1963). Twice named Woman Athlete of the Year by the Associated Press (1963, 1964), she has been called the greatest woman golfer of all time.

Wright, Richard (b. Sept. 4, 1908, near Natchez, Miss., U.S.—d. Nov. 28, 1960, Paris, France) U.S. novelist and short-story writer. Wright, whose grandparents had been slaves, grew up in poverty. After migrating north he joined the Federal Writers' Project in Chicago, then moved to New York City in 1937. He was a member of the Communist Party in the years 1932–44. He first came to wide attention with a volume of novellas, *Uncle Tom's Children* (1938). His novel *Native Son* (1940), though considered shocking and violent, became a best-seller. The fictionalized autobiography *Black Boy* (1945) vividly describes his often harsh childhood and youth. After World War II he settled in Paris. He is remembered as one of the first African American writers to protest white treatment of blacks.

Wright, Sewall (b. Dec. 21, 1889, Melrose, Mass., U.S.—d. March 3, 1988, Madison, Wis.) U.S. geneticist. He earned his doctorate at Harvard University. His earliest studies included investigation of the effects of inbreeding and crossbreeding on guinea pigs, animals he later used in studying the effects of gene action on coat and eye colour. With J.B.S. Haldane and R.A. Fisher, he developed a mathematical basis for modern evolutionary theory using statistical techniques. He originated a theory that could guide the use of inbreeding and crossbreeding in livestock improvement. He is perhaps best known for his concept of genetic drift.

Wright, Wilbur; and Wright, Orville (respectively b. April 16, 1867, near Millville, Ind., U.S.—d. May 30, 1912, Dayton, Ohio; b. Aug. 19, 1871, Dayton, Ohio, U.S.—d. Jan. 30, 1948, Dayton) U.S. inventors who achieved the first powered, sustained, and controlled airplane flight. The brothers first worked in printing-machinery design and later in bicycle manufacturing, which financed their early experiments in airplane design. To test flight control, essential to successful powered flight, they built and flew three biplane gliders (1900–02). Propeller and engine innovations led to their first powered airplane, which Orville flew successfully for 12 seconds and Wilbur later flew for 59 seconds at Kill Devil Hills, N.C. (near the village of Kitty Hawk), on Dec. 17, 1903. Their flyer of 1905 could turn, bank, circle, and remain airborne for over 35 minutes. They demonstrated their planes in Europe and the U.S.; in 1908 Wilbur gave over 100 exhibition flights in France, setting a duration record of 2 hours and 20 minutes. They established an aircraft company and produced planes for the U.S. Army. After Wilbur's death from typhoid, Orville sold his interest in the company, which later merged with the company of Glenn H. Curtiss.

Wriothesley, Thomas See 1st Earl of Southampton

writ In common law, an order issued in the name of a sovereign or court commanding a person to perform or refrain from performing a specified act. It was a vital official instrument in Old English law. A plaintiff would

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commence a suit by choosing the proper form of action and obtaining a writ appropriate to the remedy sought; its issuance forced the defendant to comply or to appear in court. Writs were also constantly in use for financial and political purposes of government. Though the writ no longer governs civil pleading and has lost many of its applications, the extraordinary writs, especially of HABEAS CORPUS, mandamus (commanding the performance of a ministerial act), prohibition (commanding an inferior court to stay within its jurisdiction), and CERTIORARI, reflect its historical importance as an instrument of judicial authority.

writing System of human visual communication using signs or symbols associated by convention with units of LANGUAGE—meanings or sounds—and recorded on materials such as paper, stone, or clay. Its precursor was PICTOGRAPHY. Logography, in which symbols stand for individual words, typically develops from pictography. Logography requires thousands of symbols for all possible words and names. In phonographic systems, the symbol associated with a word also stands for similar- or identical-sounding words. Phonographic systems may evolve to the point where symbols represent syllables, constituting a syllabary. An ALPHABET provides symbols for all the consonants and vowels.

Writs of Assistance See Writs of ASSISTANCE

Wrocław \'vrôt-ˌswäf\ *German* **Breslau** City (pop., 2000 est.: 633,857), southwestern Poland. Located on the ODER RIVER, it originated in the 10th century at the crossroads of the trade route linking the Black Sea to western Europe. In 1138 it became the first capital of SILESIA. The Tartars destroyed Wrocław in 1241. Rebuilt, it passed to BOHEMIA with the rest of Silesia in 1335 and to the HABSBURGS in 1526. In 1741 it fell to Prussia under the rule of FREDERICK II (the Great), and it eventually became part of Germany. During World War II Wrocław was besieged (1945) by Soviet troops. The city was assigned to Poland by the POTSDAM CONFERENCE of 1945. Heavily damaged during the war, it was rebuilt and is now a major commercial city.

wrought iron One of the two forms in which IRON is obtained by SMELTING. Wrought iron is a soft, easily worked, fibrous metal. It usually contains less than 0.1% CARBON and 1–2% SLAG. It is superior for most purposes to CAST IRON, which is hard and brittle because of its higher carbon content. In antiquity, iron was smelted directly by heating ore in a forge with charcoal, which served both as fuel and reducing agent. While still hot, the iron-and-slag mixture was removed as a lump and worked (wrought) with a hammer to expel most of the slag and weld the iron into a coherent mass. Wrought iron began to take the place of bronze (being far more available) in Asia Minor in the 2nd millennium BC; its use for tools and weapons was established in China, India, and the Mediterranean by the 3rd century BC. Later, in Europe, wrought iron was produced indirectly from cast iron (see PUDDLING PROCESS). With the invention of the BESSEMER PROCESS and OPEN-HEARTH PROCESS, STEEL supplanted wrought iron for structural purposes, and its use in the 20th century has been principally decorative.

wu Fundamental Daoist philosophical concept. *Wu* ("not-being"), *you* ("being"), *wuming* ("the nameless"), and *youming* ("the named") are interdependent and grow out of one another. *Wu* and *you* are two aspects of the DAO. Not-being does not mean nothingness but rather the absence of perceptible qualities; in LAOZI's view, it is superior to being. It is the void that harbours in itself all potentialities and without which even being lacks its efficacy. According to the scholar He Yan (d. 249), *wu* is beyond name and form and hence is absolute, complete, and capable of accomplishing anything. See also DAOISM.

Wu Cheng'en *or* **Wu Ch'eng-en** \'wü-'chəŋ-'ən\ (b. c. 1500, Shanyang, Huaian, China—d. c. 1582, Huaian) Chinese novelist and poet. He received a traditional Confucian education and became known for his clever poetry and prose composition in the classical style. Interested in bizarre stories, he used oral and written folktales as the basis of the novel *Xiyouji* (*Journey to the West*, also partially translated as *Monkey*), published anonymously in 1592. It relates the comic mishaps and adventures of the 7th-century monk XUANZANG, who traveled to India looking for sacred texts, and his entourage of three animal spirits: a monkey, a pig, and a fish. It satirizes Chinese society and government and contains religious and philosophical elements drawn from Buddhism, Daoism, and Neo-Confucianism. Only two volumes of his other writings have survived.

Wu-lu-mu-ch'i See ÜRÜMQI

Wu Sangui *or* **Wu San-kuei** \'wü-'sän-'gwā\ (b. 1612, Liaodong, China—d. Oct. 2, 1678, Hengzhou, Hunan province) Chinese general who invited the MANCHU into China and helped them establish the QING DYNASTY. Though he had for many years battled the Manchu on China's northeastern frontier, he turned to them for aid when the MING-DYNASTY capital at Beijing fell to rebel leader LI ZICHENG. The Manchu forces defeated Li and then set up their own dynasty, in which Wu served many years. Only when he was put in charge of eliminating the remnants of Ming resistance in southwestern China did he break away, creating his own state in the area of Yunnan and Guizhou. Two other commanders had set up similar states in neighbouring southern provinces; in 1673 Wu led the three in rebellion. After Wu's death, his grandson continued the rebellion until 1681, when it was finally crushed. See also DORGON.

Wu-ti See WUDI

Wu Zetian See WUHOU

Wuchang \'wü-'chäŋ\ *or* **Wu-ch'ang** Industrial city (pop., 1999 est.: 227,856), part of the tri-city conurbation of WUHAN, Hubei province, central China. It is the oldest of the Wuhan cities, probably dating from the HAN DYNASTY. It was the capital of the kingdom of Wu in the 3rd century AD, as well as capital of an administrative district under the YUAN DYNASTY (1279–1368) and later capital of HUBEI province (until 1950). In 1911 it was the starting point of the revolution against the imperial regime. The Japanese occupied the city in 1938–45; the Chinese communists took it in 1949. It became part of Wuhan in 1950.

Wudi *or* **Wu-ti** \'wü-'dē\ *orig.* **Liu Che** (b. 156 BC—d. March 29, 87 BC) Emperor of the Chinese HAN DYNASTY who vastly increased its authority and its influence abroad and made CONFUCIANISM China's state religion. Under Wudi, China's armies drove back the nomadic XIONGNU tribes that plagued the northern border, incorporated southern China and northern and central Vietnam into the empire, and reconquered Korea. Their farthest expedition was to Fergana (in modern Uzbekistan). Wudi's military campaigns strained the state's reserves; seeking new income, he decreed new taxes and established state monopolies on salt, iron, and wine.

Wuhan \'wü-'hän\ *or* **Wu-han** City (pop., 1999 est.: 3,911,824), capital of HUBEI province, east-central China. It is located at the confluence of the HAN and YANGTZE (Chang) rivers and is a conurbation of three cities that merged in 1950: Hankou, on the north bank of the Yangtze; Hanyang, across the Han; and WUCHANG, on the south bank of the Yangtze. The chief industrial and commercial centre of central China, it is a hub of maritime, river, rail, and road transportation. It serves as the collection and distribution point for the products of the middle Yangtze valley and for western and southwestern China. It has numerous industries, including iron- and steel-producing complexes. It is the seat of Wuhan University and the Central China Technical University.

Wuhou *or* **Wu-hou** \'wü-'hō\ *or* **Wu Zetian** \'wü-dzə-'tyan\ (b. 624, Wenshui, Shanxi province, China—d. Dec. 16, 705, Louyang) Empress of China during the TANG DYNASTY. She began her career as the concubine of the emperor TAIZONG but became the consort of his son. She eliminated her female rivals and became empress in 655. By 660, through dismissal, exile, and execution, she had eliminated those who opposed her. Because the emperor was sickly, Wuhou was able to rule in his name; after his death she ruled in the name of her sons, at last declaring herself ruler in her own name in 690. To support her reign, she claimed to be an incarnation of the bodhisattva MAITREYA. Though long vilified for her cruelty and her methods of maintaining power, she supported the development of a scholarly bureaucracy to replace rule by aristocratic families, stabilized the dynasty, and unified the empire.

Wundt \'vůnt**, Wilhelm** (b. Aug. 16, 1832, Neckarau, near Mannheim, Baden—d. Aug. 31, 1920, Grossbothen, Ger.) German physiologist and psychologist, the founder of EXPERIMENTAL PSYCHOLOGY. After earning a medical degree, he studied briefly with JOHANNES PETER MÜLLER and later assisted HERMANN VON HELMHOLTZ. At the University of Heidelberg in 1862, following publication of his *Contributions to the Theory of Sense Perception* (1858–62), he gave the first course in scientific psychology. In *Principles of Physiological Psychology* (1873–74) he claimed that psychology must be based directly on experience and that its proper method was that of controlled introspection. At the University of Leipzig (1875–1917), he established the first psychological laboratory (1879) and founded the first journal of psychology (1881). His later works include *Outline of Psychology* (1896) and *Ethnic Psychology* (10 vol., 1900–20).

Wupatki \wů-'pat-kē\ **National Monument** National monument, north-central Arizona, U.S. Situated along the Little Colorado River, the

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monument was established in 1924 and comprises more than 800 red sandstone pueblos built during the 11th–13th centuries. It has an area of 55 sq mi (142 sq km).

Wuppertal \'vu̇-pər-ˌtäl\ City (pop, 2002 est.: 364,784), northwestern Germany. Located on the Wupper River, it was formed as Barmen-Elberfeld in 1929 through the amalgamation of the towns of Barmen, Elberfeld, Beyenburg, Cronenberg, Ronsdorf, and Vohwinkel. Its name was changed to Wuppertal in 1930. The region was noted for its textile production as early as the 16th century, and the modern city remains a textile-manufacturing centre. Other industrial products include chemicals, rubber, and machinery. Wuppertal has numerous parks and public gardens and a well-known zoo.

Wurlitzer, (Franz) Rudolph (b. Jan. 30, 1831, Schöneck, Saxony—d. Jan. 14, 1914, Cincinnati, Ohio, U.S.) German-born U.S. musical instrument manufacturer. He immigrated to the U.S. in 1853 and with his brother founded the Wurlitzer Co. in 1872. His son Howard (1871–1928) introduced the innovation of automatic instruments, which led to the firm's production of self-playing ORGANS, electronically controlled organs, and finally the organs it is best known for, in which vibrating reeds rather than pipes produce the sound.

Württemberg \'vʉr-təm-ˌberk,\ *English* \'wu̇r-təm-ˌbərg\ Former state, Germany. Its territory approximated the central and eastern areas of the present-day German state of Baden-Württemberg. The capital was STUTTGART. Originally inhabited by Celts, Württemberg was occupied successively by Suevi, Romans, Alemanni, and Franks. In the Middle Ages it was part of SWABIA. Württemberg became an electorate in 1803 and a kingdom in 1806. A constitutional monarchy (1819–1918), it became an independent republic in 1918 but joined the WEIMAR REPUBLIC in 1919. Württemberg came under the control of the Third Reich in 1934. During World War II the Allies overran it (1945). It was made part of Baden-Württemberg in 1952.

Wuwang *or* **Wu-wang** \'wü-'wäŋ\ (fl. 11th century BC, China) Founder and first ruler of the ZHOU DYNASTY. After establishing the Zhou dynasty, Wuwang, assisted by his brother, ZHOUGONG, consolidated his rule by establishing a feudalistic form of government in which territory was bestowed on relatives and vassals willing to acknowledge Zhou suzerainty. He was regarded by later Confucians as a wise king.

Wyandot *or* **Huron** North American Indian people living in Lorette, north of Quebec city, Que., and in southwestern Ontario, Can.; and in Kansas and Oklahoma, U.S. Their language is of the IROQUOIAN family. At first contact, the people who mostly call themselves Wyandot lived in Ouendake (Huronia), between Georgian Bay and Lake Simcoe. Their villages, sometimes palisaded, consisted of large, bark-covered dwellings that housed several families related through maternal descent. Crops included corn, beans, squash, sunflowers, and tobacco. Hunting and fishing were of lesser importance. Villages were divided into CLANS, the chiefs of which formed councils. Women were influential in clan affairs, and clan matrons had the responsibility of selecting political leaders. The Wyandot were bitter enemies of tribes of the IROQUOIS CONFEDERACY, with whom they competed in the fur trade. Iroquois invasions in 1648–50 devastated the tribe, forcing a remnant westward. Today the Wyandot, or Wyandotte, as they are known in the U.S. number about 6,800 in the U.S. and Canada.

Wyat, Thomas *or* **Thomas Wyatt** *later* **Sir Thomas** (b. 1503, Allington, near Maidstone, Kent, Eng.—d. Oct. 6, 1542, Sherborne, Dorset) English poet. A member of the court circle of Henry VIII, he was apparently admired for his skill in music, languages, and arms. He served a number of diplomatic missions, but his reputation rests on his poetic achievements, especially his introduction into English literature of the Italian SONNET and TERZA RIMA verse form and the French RONDEAU. His works, unusual for their time in carrying a strong sense of individuality, include *Certayne Psalmes …drawen into Englyshe meter* (1549), three satires, and songs.

Wyatt, John (b. April 1700, Lichfield, Staffordshire, Eng.—d. Nov. 29, 1766, Birmingham, Warwickshire) British mechanic who contributed to the development of power spinning. He began his career as a carpenter, but by 1730, with financial support from LEWIS PAUL, he was working on machines for boring metal and making files. The spinning machine (see DRAWING FRAME), first patented in 1738, was almost certainly Paul's idea, with Wyatt providing technical skill; its principle was to draw the fibres through sets of rollers turning at different speeds. It was superseded by RICHARD ARKWRIGHT'S WATER FRAME in the 1770s.

Wycherley \'wi-chər-lē**, William** (b. 1640, Clive, near Shrewsbury, Shropshire, Eng.—d. Jan. 1, 1716, London) English dramatist. After attending Oxford and studying law, Wycherley became a man-about-town with an interest in theatre. Within the framework of the comedy of manners, he attempted to reconcile a deep-seated puritanism with his ardent physical nature. *Love in a Wood* (1671) first won him favour in the Restoration court, and *The Plain-Dealer* (1676) satirized rapacious greed. In *The Country-Wife* (1675), perhaps his best work, a satirical comment on excessive jealousy and complacency is blended with a richly comic and bawdy presentation. He eventually lost favour at court and spent seven years in debtor's prison until he was rescued by JAMES II.

Wycliffe \'wi-ˌklif**, John** (c. 1330–1384) British theologian, philosopher, and church reformer. He earned a doctor-of-divinity degree from Oxford in 1372. Named by EDWARD III to a deputation to discuss English differences with the papacy, he represented the government in its attempts to limit the church's power in England. His preaching against church policies, in which he argued that the church itself was sinful and should relinquish its possessions and return to evangelical poverty, attracted wide attention, and in 1377 the pope called for his arrest. In 1379 he began systematically attacking the foundations of Roman Catholicism, notably by repudiating the doctrine of transubstantiation and by denying that the church hierarchy represented a line of authoritative succession from Jesus. In 1380 he became involved in a translation of the Bible into English, seeking to bypass the church in making the law of God accessible to all literate people. His followers were known as LOLLARDS. He was blamed by his ecclesiastical superiors for inciting the PEASANTS' REVOLT (1381); many of his works were subsequently banned. His writings later inspired the leaders of the REFORMATION, most notably MARTIN LUTHER.

Wye, River River, eastern Wales and western England. It flows from the moorlands of central Wales southeast across the English border and continues south into the estuary of the River SEVERN. It is about 130 mi (210 km) long. The ruins of Tintern Abbey (the inspiration for WILLIAM WORDSWORTH's poem) are on its banks. It has rich salmon fisheries.

Wyeth \'wī-əth**, Andrew (Newell)** (b. July 12, 1917, Chadds Ford, Pa., U.S.) U.S. painter. He was trained by his father, N.C. WYETH. His subject matter comes almost entirely from the area around Chadds Ford and around his summer home in Cushing, Maine. Though his technique is precise and detailed, he uses it to achieve an unreal, visionary quality. His palette is restricted largely to earth colours. His famous *Christina's World* (1948), depicting a polio victim seemingly trying to climb a hill, exemplifies his mastery of unusual angles and his use of light to pinpoint time. Between 1971 and 1985 Wyeth secretly painted Helga Testorf, his neighbour in Chadds Ford, creating hundreds of images of her, including nudes. He was the first painter ever awarded the Presidential Medal of Freedom (1963) and the first artist to receive the Congressional Gold Medal (1990). His son Jamie (b. 1946) has also had a successful painting career.

Christina's World, tempera on gesso panel by Andrew Wyeth, 1948; in the Museum of Modern Art, New York City.
COURTESY OF THE MUSEUM OF MODERN ART, NEW YORK CITY

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Wyeth, N(ewell) C(onvers) (b. Oct. 22, 1882, Needham, Mass., U.S.—d. Oct. 19, 1945, Chadds Ford, Pa.) U.S. illustrator and muralist. Raised on a farm, he learned drafting and illustration in Boston before studying with the master illustrator Howard Pyle (1853–1911). He first found success in depicting the American West. During his career he contributed his memorable illustrations to more than 100 books, including a famous series of children's classics, including *Treasure Island*, *Kidnapped*, *King Arthur*, *Robin Hood*, and *The Black Arrow*, and he also produced numerous murals in public buildings. He was the teacher of his son, the painter ANDREW WYETH.

Wyler, William (b. July 1, 1902, Mulhouse, France—d. July 27, 1981, Beverly Hills, Calif., U.S.) French-born U.S. film director. After studies in France and Switzerland, he immigrated to New York in 1920. Working for Universal Pictures, he became a director of low-budget westerns, but he established a serious reputation with *Counsellor-at-Law* (1933) and went on to direct successes such as *Dodsworth* (1936), *Wuthering Heights* (1939), and *The Little Foxes* (1941). His films are noted for their clear narrative style and sensitive handling of human relationships. He won Academy Awards for *Mrs. Miniver* (1942) and *The Best Years of Our Lives* (1946), and he later directed popular movies such as *Roman Holiday* (1953), *Ben-Hur* (1959, Academy Award), and *Funny Girl* (1968).

Wynette \wī-'net**, Tammy** *orig.* **Virginia Wynette Pugh** (b. May 5, 1942, Itawamba county, Miss., U.S.—d. April 6, 1998, Nashville, Tenn.) U.S. COUNTRY MUSIC singer. Her father, a musician, died when she was an infant, and her mother left her to be raised by grandparents. She worked as a beautician before appearing on Porter Wagoner's country music television show. In 1967–68 she had hits with "Your Good Girl's Gonna Go Bad," "D-I-V-O-R-C-E," and her anthem, "Stand by Your Man." She was married to GEORGE JONES (1969–75), with whom she recorded many duet hits; despite their divorce, they continued to collaborate on recordings, including her last album, *One* (1996). She recorded 20 number-one country hits and 50 albums.

Wyoming State (pop., 2000: 493,782), western U.S. It covers an area of 97,813 sq mi (253,334 sq km); its capital is CHEYENNE. Wyoming is bordered on the north and northwest by Montana, on the east by South Dakota and Nebraska, on the south by Colorado, on the southwest by Utah, and on the west by Idaho. It contains part of the GREAT PLAINS and the BLACK HILLS. Its ranges of the ROCKY MOUNTAINS include the BIGHORN, TETONS, and WIND RIVER. Wyoming's highest point is Gannett Peak, at 13,804 ft (4,207 m). The CONTINENTAL DIVIDE crosses the state northwest to southeast. About three-fourths of its rivers drain eastward into the Missouri-Mississippi system. Its largest lake is YELLOWSTONE LAKE. Wyoming was already inhabited by Plains Indians, including the SHOSHONE, when it was first visited by European explorers during the 18th century. The OREGON and Overland trails crossed it. Most of the area was acquired by the U.S. from France in the LOUISIANA PURCHASE. The LEWIS AND CLARK EXPEDITION did not cross the area, but a member of the group, JOHN COLTER, strayed from the expedition and spent time in Wyoming. It was included in several U.S. territories before the organization of the Wyoming Territory in 1868. It adopted woman suffrage in 1869 and in 1889 was the first state to include that right in its constitution. In the years preceding statehood, it developed a thriving cattle industry. It was admitted to the Union in 1890 as the 44th state. In 1924 it elected the first U.S. woman governor, Nellie Tayloe Ross. Though livestock is still important to its modern economy, mining is increasingly influential and tourism is growing.

Wyoming Massacre (July 3, 1778) Killing of American settlers by the British in the Wyoming Valley of Pennsylvania. In the AMERICAN REVOLUTION, British Col. John Butler led a force of 1,000 LOYALISTS and Iroquois allies against 5,000 settlers in the valley, many of whom were gathered at Forty Fort. A band of men and boys left the fort to meet the attackers and was defeated; 360 settlers were killed, and others who escaped to the woods died of starvation. Butler's forces continued their raids on frontier settlements in New York, which led to American action against the Iroquois. See also IROQUOIS CONFEDERACY.

Wyszyński \vi-'shin-skē**, Stefan** (b. Aug. 3, 1901, Zuzela, near Łomża, Pol., Russian Empire—d. May 28, 1981, Warsaw, Pol.) Polish cardinal and primate of Poland. Ordained in 1924, he was assigned to the basilica at Włocławek. He founded and directed the Christian Workers University (1935–39), then joined the Polish resistance in World War II. He was appointed successively bishop of Lublin (1946), primate of Poland (1948), and cardinal (1952). For refusing to consent to communist demands, he was placed under house arrest (1953–56). After his release, he reached a compromise on church and state matters with WŁADYSŁAW GOMUŁKA that avoided a potential Soviet invasion of Poland, and he thereafter maintained the unity of the church in an uneasy coexistence with the communist government. He later lent cautious support to such Polish movements as the Workers' Defense Committee, Solidarity, and Rural Solidarity, which sought greater freedom from the late 1970s onward. A doctrinal conservative, his last major act was to negotiate with the Polish authorities over the visit of Pope JOHN PAUL II to Poland in 1979.

Wythe \'with**, George** (b. 1726, Elizabeth City county, Va.—d. June 8, 1806, Richmond, Va., U.S.) U.S. jurist and statesman. Admitted to the bar in 1746, he was a member (1754–55, 1758–68) and clerk (1769–75) of the Virginia House of BURGESSES. He practiced law in Williamsburg, Va., where he taught THOMAS JEFFERSON. At the College of William and Mary (1779–89) he became the first professor of law in the U.S.; among his pupils was JOHN MARSHALL. A delegate to the CONTINENTAL CONGRESS, he signed the DECLARATION OF INDEPENDENCE. In 1776 he was appointed, with Jefferson and two others, to revise the laws of Virginia. As a chancery judge (1778–1806), he asserted, in *Commonwealth* v. *Caton* (1782), the power of courts to refuse to enforce unconstitutional laws. He was a member of the CONSTITUTIONAL CONVENTION (1787) and of the Virginia convention (1788) that ratified the CONSTITUTION OF THE UNITED STATES.

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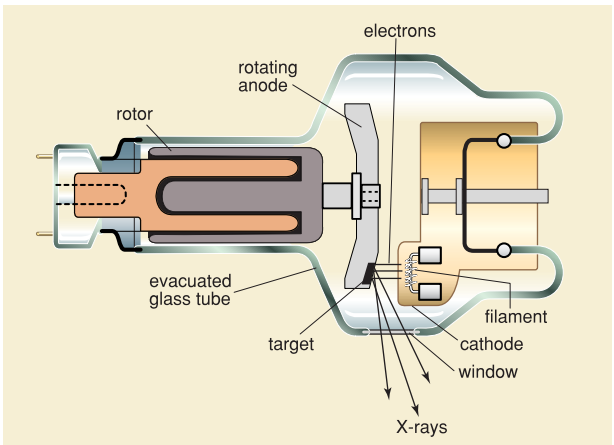
X-ray Electromagnetic radiation of extremely short wavelength (100 nanometres to 0.001 nanometre) produced by the deceleration of charged particles or the transitions of electrons in atoms. X-rays travel at the speed of light and exhibit phenomena associated with waves, but experiments indicate that they can also behave like particles (see wave-particle duality). On the electromagnetic spectrum, they lie between gamma rays and ultraviolet radiation. They were discovered in 1895 by Wilhelm Conrad Röntgen, who named them X-rays for their unknown nature. They are used in medicine to diagnose bone fractures, dental cavities, and cancer; to locate foreign objects in the body; and to stop the spread of malignant tumours. In industry, they are used to analyze and detect flaws in structures. See illustration below.

X-ray astronomy Study of astronomical objects and phenomena that emit radiation at X-ray wavelengths. Because Earth's atmosphere absorbs most X-rays, X-ray telescopes and detectors are taken to high altitudes or into space by balloons and spacecraft. In 1949 detectors aboard sounding rockets showed that the Sun gives off X-rays, but it is a weak source; it took 30 more years to clearly detect X-rays from other ordinary stars. Beginning with the Uhuru X-ray satellite (launched 1970), a succession of space observatories carried increasingly sophisticated instruments into Earth orbit. Astronomers discovered that most types of stars emit X-rays but usually as a tiny fraction of their energy output. Supernova remnants are more powerful X-ray sources; the strongest sources known in the Milky Way Galaxy are certain binary stars in which one star is probably a black hole. In addition to myriad point sources, astronomers have found a diffuse background of X-ray radiation emanating from all directions; unlike cosmic background radiation, it appears to have many distant individual sources. The Chandra X-Ray Observatory and XMM-Newton X-ray satellite (both launched 1999) have made numerous discoveries relating to the nature and quantity of black holes in the universe, the evolution of stars and galaxies, and the composition and activity of supernova remnants.

X-ray diffraction Phenomenon in which the atoms of a crystal, by virtue of their uniform spacing, cause an interference pattern of the waves in an incident beam of X-rays. The crystal's atomic planes act on the X-rays in the same way a uniformly ruled grating acts on a beam of light (see polarization). The interference pattern is specific to each substance and gives information on the structure of the atoms or molecules in the crystal. See also William Henry Bragg.

Xanthus \'zan-thəs\ *or* **Xanthos** Ancient city of Lycia, Anatolia. Situated near the mouth of the Xanthus (modern Eşen Çayı) River in present-day southwestern Turkey, its ruins include a theatre, temples, and tombs. A number of pieces were taken for the British Museum. The ancient city was twice besieged and destroyed: in 540 BC by the Persians of the Achaemenian dynasty and in 42 BC by the Romans. The ruins were designated a UNESCO World Heritage site in 1988.



An X-ray tube. Electrons "boil" off the cathode when the filament is heated by a current. A high voltage between cathode and anode causes the electrons to accelerate toward the anode, which rotates to avoid overheating of the target. When the electrons strike the anode's target area, X-rays are emitted.

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Xavier \'zā-vē-ər**, Saint Francis** (b. April 7, 1506, Xavier Castle, near Sangüesa, Navarre—d. Dec. 3, 1552, Sancian Island, China; canonized March 12, 1622; feast day December 3) Spanish-born French missionary to the Far East. Born into a noble Basque family, he was educated at the University of Paris, where he met Ignatius of Loyola and became one of the first seven members of the Jesuits. He was ordained in 1537, and in 1542 he embarked on a three-year mission to India. In 1545 he established missions in the Malay Archipelago, and in 1549 he traveled to Japan, where he was the first to introduce Christianity systematically. He returned to India in 1551 and died the following year while attempting to secure entrance to China. He is believed to have baptized about 30,000 converts; his success was partly due to adaptation to local cultures. In 1927 he was named patron of all missions.

Xenakis \zen-ä-'kēs,\ *English* \ze-'nä-kis**, Iannis** (b. May 29, 1922, Brăila, Rom.—d. Feb. 4, 2001, Paris, France) Romanian-born Greek-French composer. His Greek family returned to Greece in 1932, and he studied engineering. A wartime resistance fighter, he was forced to flee Greece in 1947 when he was denounced as a communist. He worked closely with the architect Le Corbusier (1947–59), while studying composition with Olivier Messiaen and others. Interested in expressing mathematical structures in music, he used the term "stochastic music" to refer to situations in which the number of elements precludes prediction of what each element will do but the overall behaviour of the group is determinate (see stochastic process). He often based his compositions on standard concepts of mathematics and physics, such as the Fibonacci sequence (*Metastasis*, 1954), the Boltzmann constant (*Pithoprakta*, 1956), and Markov chains (*Analogique A* and *Analogique B*, 1958–59).

Xenocrates \zi-'näk-rə-ˌtēz\ (d. 314 BC, Athens) Greek philosopher. A pupil of Plato, he succeeded Speusippus (d. 339/338 BC) as head of Plato's Academy. His writings are lost except for fragments, but his doctrines, as reported by Aristotle, appear to resemble those of Plato. He divided all of reality into three realms: the sensibles, or objects of sensation; the intelligibles, or objects of true knowledge, such as Plato's forms (see form); and the bodies of the heavens, which mediate between the sensibles and the intelligibles and are therefore objects of "opinion." A second threefold division separated gods, men, and "demons." He maintained that the origin of philosophy lies in mankind's desire to be happy, happiness being defined as the acquisition of the perfection that is peculiar and proper to mankind (see eudaemonism).

xenon \'zē-ˌnän\ Chemical element, chemical symbol Xe, atomic number 54. One of the noble gases, it is colourless, odourless, tasteless, and nearly inert, combining only with fluorine and oxygen and in complexes (see bonding). Xenon occurs in slight traces in Earth's atmosphere and in rocks. Obtained by fractional distillation of liquefied air, it is used in luminescent tubes (see electric discharge lamp), flash lamps, lasers, and tracer studies and as an anesthetic.

Xenophanes of Colophon \zi-'näf-ə-ˌnēz...'kä-lə-fən\ (b. c. 560, Colophon, Ionia—d. c. 478 BC) Greek poet, religious thinker, and reputed precursor of philosophy of the Eleatics. Though some critics consider Parmenides the founder of the Eleatic school, Xenophanes' philosophy, which found expression primarily in the poetry he recited on his travels, probably anticipated Parmenides' views. Fragments of his epics reflect his contempt for anthropomorphism and for popular acceptance of Homeric mythology.

Xenophon \'zen-ə-ˌfän\ (b. 431, Attica, Greece—d. shortly before 350 BC, Attica) Greek historian. Born of a well-to-do Athenian family, Xenophon was critical of extreme democracy and for a time was exiled as a traitor. He served with the Greek mercenaries of the Persian prince Cyrus, an experience on which he based his best-known work, the *Anabasis*. Its prose was highly regarded in antiquity and exerted a strong influence on Latin literature. His other works include *On Horsemanship*; *On Hunting*; *Cyropaedia*, a historical novel about Cyrus II; *Oeconomicus*, a treatise on estate management; and his completion of a work by the historian Thucydides.

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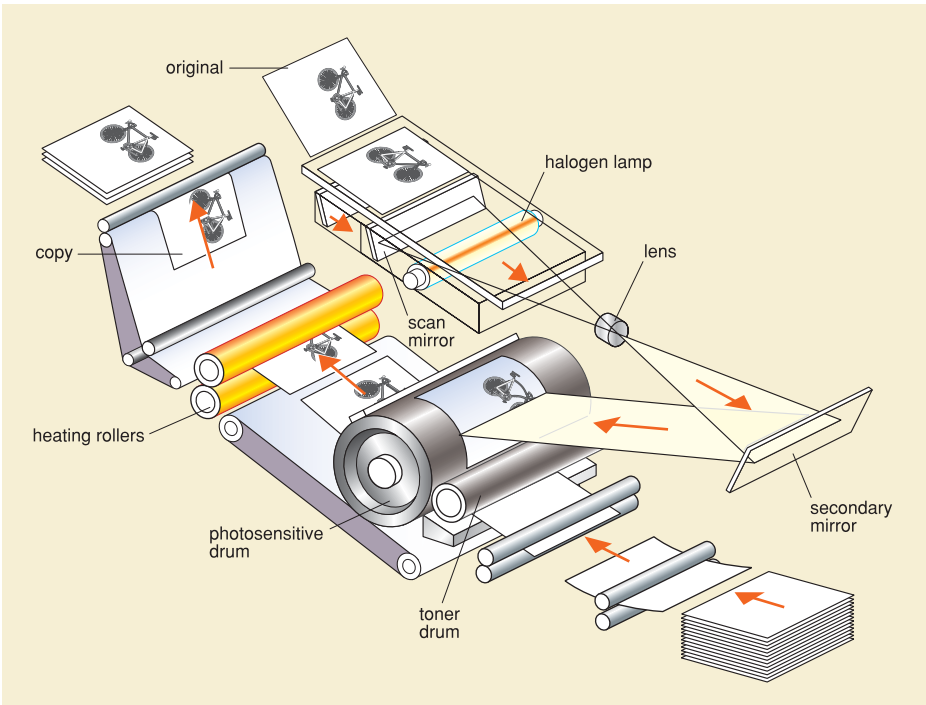

Light shining on the item to be copied is reflected off a mirror, through a lens, and off a second mirror to form an image on a photosensitive (selenium-coated) drum. The drum's surface charge varies with the light and dark areas of the image. The toner drum delivers tiny black particles (toner) to the dark, charged areas of the image. The toner-based image is then transferred to paper rolled onto the drum, the negatively charged toner particles being attracted by a positive charge under the sheet, and the paper is heated to set the toner. The copy paper itself originally provided the treated surface, but the innovation of the selenium-coated drum permitted the use of ordinary paper. Light projection permits the printed image to be enlarged or reduced by any desired percentage.

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xerography \zə-'rä-grə-fē\ Image-forming process that relies on a photoconductive substance whose electrical resistance decreases when light falls on it. Xerography is the basis of the most widely used document-copying machines (see PHOTOCOPIER). The process was invented in the 1930s by U.S. physicist Chester F. Carlson (1906–1968) and developed in the 1940s and '50s by XEROX CORP. (then called Haloid). Light passing through or reflected from a document reaches a selenium-coated drum surface onto which negatively charged particles of ink (toner) are sprayed, forming an image of the document on the drum. As a sheet of paper is passed close to the drum, a positive electric charge under the sheet attracts the negatively charged ink particles, transferring the image to the copy paper. Heat briefly applied fuses the ink particles to the paper. The first commercially successful xerographic copier was introduced in 1959.

Xerox Corp. Major U.S. corporation. It was founded as Haloid Co. in 1906 to make and sell photographic paper. It changed its name to Haloid Xerox Co. in 1958, and to Xerox Corp. in 1961. Xerox marketed the first xerographic, plain-paper copier in 1960 (see XEROGRAPHY), and the product was so successful that the company has had to wage a continuing campaign to prevent the trademark Xerox from becoming a generic term. In addition to copiers, Xerox sells scanners, FAX machines, printers, software, and servers for networked printing. Its headquarters are in Stamford, Conn.

Xerxes I \'zərk-ˌsēz\ *Persian* **Khshayarsha** (b. c. 519 BC—d. 465 BC, Persepolis) Persian king (486–465 BC) of the ACHAEMENIAN DYNASTY. The son of DARIUS I, he had been governor of Babylon before his succession. He ferociously suppressed rebellions in Egypt (484) and Babylonia (482). To avenge Darius's defeat by the Greeks at the Battle of MARATHON, he spent three years raising a massive army and navy. When a storm destroyed the bridges he had built to cross the Hellespont, he had them rebuilt and for seven days oversaw the crossing of his army, numbering 360,000 troops by modern estimates, supported by more than 700 ships. The Persians broke through at the Battle of THERMOPYLAE and pillaged Athens, but then lost their navy at the Battle of SALAMIS (480). Xerxes returned to Asia, leaving the army behind; it withdrew after its defeat at the Battle of PLATAEA (479). In Persia he began an extensive building campaign at PERSEPOLIS. Drawn unwittingly into palace intrigues, he killed his brother's family at the queen's demand. He was murdered by members of his court. His setback in Greece was regarded as the beginning of the decline of the Achaemenid dynasty. See photograph below.

Xerxes I, detail of a bas-relief of the north courtyard in the treasury at Persepolis, late 6th–early 5th century BC; in the Archaeological Museum, Tehrān.

COURTESY OF THE ORIENTAL INSTITUTE, THE UNIVERSITY OF CHICAGO

Xhosa \'k̲ō-sə\ People living primarily in East Cape province, South Africa. They form part of the southern NGUNI group of Bantu-speaking peoples. In the late 18th and early 19th centuries, the series of conflicts called the Kaffir ("Infidel") Wars engaged the Xhosa against the European settlers. Eventually the Xhosa were defeated and their territory annexed. Between 1959 and 1961 the Xhosa inhabited the nonindependent black states of TRANSKEI and CISKEI created by the white South African government. In the 1960s many Xhosa became migrant labourers. Today they number some 7.8 million. See photograph on opposite page.

Xi \'shē, 'shi\ **River** *Chinese* **Xi Jiang** *or* **Hsi Chiang** *English* **West River** River system, southern CHINA. Known as the Nanpan and then the Hongshui in its upper course, the Xi proper begins as it enters Guangdong province from eastern GUANGXI autonomous region. It flows east through Guangdong and then through the vast Pearl River delta before entering the South CHINA SEA west of HONG KONG near MACAU; the city of GUANGZHOU (Canton) is in its delta. It is about 1,200 mi (1,930 km) long, shorter than other important Chinese rivers, but its volume of flow is second only to that of the YANGTZE RIVER (Chang Jiang). It is the great commercial waterway of southern China, linking the delta cities with the interior.

Xi Xia *or* **Hsi Hsia** \'shē-shē-'ä\ Kingdom of TANGUT tribes that was established in the 11th century and flourished through the early 13th. Founded by Li Yuanhao, who named it after the ancient Chinese state of Xia, it existed in an uneasy truce with China's Southern SONG DYNASTY and the LIAO DYNASTY of the Inner Asian Khitan tribes until it was conquered by GENGHIS KHAN.

Xia dynasty *or* **Hsia dynasty** \shē-'ä\ (c. 2070–c. 1600 BC) Quasi-legendary first dynasty of China, preceding the SHANG. In Chinese histories it is said to have been founded by Yu and to have had 17 rulers. Archaeological sites in Henan and Shanxi provinces in northeastern and eastern China have been tentatively identified with Xia culture. See also ERLITOU CULTURE.

Xia Gui *or* **Hsia Kuei** (fl. 1195–1224, Qiantang, Zhejiang province, China) Chinese master of landscape painting. Xia served in the Imperial Painting Academy, and most sources

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Xhosa women dancing as they return to their village from the fields.
AUTHENTICATED NEWS INTERNATIONAL

agree that he followed the stylistic tradition of an earlier landscapist in the academy, Li Tang. Xia and his contemporary, Ma Yuan, were the most influential members of the academy, and a school of painting inspired by them came to be known as the Ma-Xia school. Most of Xia's surviving works are album leaves painted on silk. A typical work by him is exquisitely calculated and perfectly balanced, conveying with great precision a scene glimpsed through haze, sharply focused at a few points but obscured at others. Chinese writers spoke of his use of a "split brush" (i.e., the brush tip divided so as to make two or more strokes at once) in painting tree foliage and of his freehand drawing "without employing a ruler." While his influence was considerable, it was only in modern times that he came to be recognized as one of the leading masters of Chinese landscape painting and one of art's great interpreters of nature.

Xi'an \'shē-'än\ *or* **Hsi-an** *conventional* **Sian** City (pop., 2003 est.: 2,657,900), capital of Shaanxi province, east-central China. Located on the Wei River, the site served as the capital of several dynasties beginning in the 11th century BC. It became one of the most splendid cities of the ancient world during the Tang dynasty (AD 618–907) and was a thriving commercial centre. Marco Polo visited in the 13th century. It was an entry point in the 1920s for communist ideology from the Soviet Union. In 1936, after Nationalist leader Chiang Kai-shek had been kidnapped there (see Xi'an Incident), the communists and Nationalists formed a united front against Japanese invaders. It is the site of several educational institutions and numerous temples and pagodas. It became an important tourist destination after the discovery of the nearby tomb of Emperor Shihuangdi, with its army of 6,000 life-size terra-cotta warriors (designated a UNESCO World Heritage site in 1987).

Xi'an Incident *or* **Sian** \'shyan\ **Incident** (1936) Seizure of Nationalist leader Chiang Kai-shek by one of his generals, Chang Hsüeh-liang (Zhang Xueliang; 1898–2001), in order to persuade Chiang to postpone his war on the Chinese communists until the invading Japanese had been defeated. As a result of the incident, the Nationalists and communists formed an alliance that turned its attention to the Japanese in Manchuria. See also Manchukuo; People's Liberation Army.

Xiang \'shyäŋ\ **River** *or* **Hsiang River** *conventional* **Siang River** River, Hunan province, southeastern China. One of the principal tributaries of the Yangtze River (Chang Jiang), it flows 500 mi (800 km) from the mountains in northern Guangxi autonomous region, through Hunan province, into Dongting Lake, and then into the Yangtze. Large vessels from the Yangtze can reach as far as Changsha via the Xiang. The river has been a north-south trade route for centuries.

Xiang Yu *or* **Hsiang Yü** \shē-'äŋ-'yü\ (b. 232 BC, state of Chu, China—d. 202 BC, Anhui province) Chinese aristocratic general and cultural hero. He overthrew the Qin dynasty and tried to return China to a pre-Qin ruling system. His forces were overwhelmed by Liu Bang (Gaozu), founder of the Han dynasty, and Xiang Yu chose suicide over capture. His heroism has been glorified in Chinese stories and poetry.

xiao *or* **hsiao** \'shyau̇\ *Chinese* **"filial piety"** In Confucianism, the attitude of obedience, devotion, and care toward one's parents and other elders considered fundamental to moral conduct. Originally rooted in the hierarchical ideology of Chinese feudalism, it was raised to a moral precept by Confucius, who cited it as the basis of ren. It is seen as the basis not only of family harmony but of social and political stability.

Xibo See Wenwang

Xin See Wang Mang

Xingkai Hu See Lake Khanka

Xingu \'shēŋ-'gü\ **River** River, central and northern Brazil. Formed by several headstreams, it flows north through northeastern Mato Grosso state and central Pará state into the Amazon River near its mouth. Though approximately 1,300 mi (2,100 km) long, it is navigable for only about 125 mi (200 km) upstream from where it joins the Amazon; its central part is a series of rapids 400 mi (644 km) long. In the 1950s Xingu National Park was designated as a preserve for Brazil's Indians, including the Tchikao, who were threatened by extinction.

Xining \'shē-'niŋ\ *or* **Hsi-ning** City (pop., 1999 est.: 604,812), capital of Qinghai province, western China. Located in a valley of the Huang River, on what was traditionally the main trade route from northern China into Tibet, the region was a frontier county under the Han dynasty and again under the Sui and Tang. In 763 it was taken by Tibetans and called Qingtangcheng. It was recovered by the Song dynasty in 1104 and renamed Xining (meaning "peace in the west"). It became an important religious centre under the Tibetans, and Qinghai's largest lamasery was nearby. It was named provincial capital when Qinghai became an independent province in 1928. Its industries include leather processing plants and steelworks.

Xinjiang \'shin-'jyäŋ\ *or* **Hsin-chiang** *conventional* **Sinkiang** *in full* **Uygur Autonomous Region of Xinjiang** Autonomous region (pop., 2002 est.: 19,050,000), northwestern China. It is bordered by the Kashmir region, Afghanistan, Tajikistan, Kyrgyzstan, Kazakhstan, Russia, and Mongolia, Gansu and Qinghai provinces, and Tibet. China's largest political unit, it covers some 635,900 sq mi (1,646,900 sq km). The capital is Ürümqi. Inhabited since early times by nomad tribes, it is an area of rugged mountains and desert basins. The Silk Road traversed the region. It came under the control of local leaders with the fall of the Han dynasty in the 3rd century AD and was regained by China in the 7th century. It was successively subject to the Tibetans, Uighurs, and Arabs and was conquered by Genghis Khan in the 13th century. Again under Chinese rule during the Manchu dynasty, it was established as Xinjiang province c. 1884. It came under Chinese communist rule in 1949. It was reconstituted as an autonomous region in 1955. It has mineral resources, heavy industry (including iron and steel works), and some agricultural production.

Xiongnu *or* **Hsiung-nu** \shē-'u̇ŋ-'nü\ Nomadic pastoral people of Central Asia. The Xiongnu at the end of the 3rd century BC formed a great tribal league that dominated much of Central Asia for more than 500 years. Their threat to the northern Chinese frontier throughout this period led to China's eventual conquest of northern Korea and southern Manchuria during the Han dynasty. Excavation of Xiongnu graves has revealed remains of Chinese, Iranian, and Greek textiles, indicating a wide trade with distant peoples.

Xipe Totec \'shē-pā-'tō-tek, 'hē-pā-'tō-tek\ Pre-Columbian Mexican god of spring and of new vegetation; he is also the patron of precious metals. Originating with the Zapotec Indians, he was adopted by the Aztecs. A symbol of new vegetation, he is always depicted in art wearing a freshly flayed skin, representing the "new skin" that covers the earth in spring. In the second ritual month of the Aztec calendar, priests sacrificed human victims by removing their hearts or shooting them with arrows, flayed the bodies, and put on the skins, which were dyed yellow and called "golden clothes."

Xiuhtecuhtli \ˌshē-ü-'tā-kůt-lē\ Aztec god of fire and creator of all life. With Chantico, his feminine counterpart, he was believed to be a representation of Ometecuhtli. Xiuhtecuhtli's festivals coincided with the two extremes in the climatological cycle, the heat of August and the cold of January. He was also the centre of a ritual transfer of fire from temple to temple that occurred once every 52 years, at the end of the Aztec calendar cycle.

Xiwangmu \'shē-'wäŋ-'mü\ *or* **Hsi Wang-Mu** In ancient Chinese Daoist mythology, the queen of the female immortals. A former mountain spirit who had been transformed into a beautiful woman, she ruled a para-

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dise called West Flower, while her husband, Mu Gong, guarded males in his East Flower paradise. Her garden contained rare flowers and the peach of immortality, which blooms once in 3,000 years.

XML *in full* **Extensible Markup Language.** MARKUP LANGUAGE developed to be a simplified and more structural version of SGML. It incorporates features of HTML (e.g., HYPERTEXT linking), but is designed to overcome some of HTML's limitations. For example, it is designed to be extensible (i.e., designed to allow the creation of customized markup tags), which HTML is not. It is also designed to represent data by meaning rather than by layout (as it is represented in HTML). Like SGML, it is a metalanguage (a language for dealing with languages); it allows users to create a language tailored specifically to their needs.

Xochicalco \ˌsō-chē-'käl-kō\ Ancient TOLTEC city known for its impressive ruins and feathered-serpent pyramid. It is located on several hilltops near CUERNAVACA, Morelos state, Mex. Built mainly in the 8th–9th century, it became an important trading centre and religious centre, and it was turned into a defensive stronghold before the Spanish conquest (c. 1520). The main temple pyramid is known for its lower facing of intricately carved stones. The reliefs, which show a strong Mayan influence, portray plumed serpents, priests with elaborate headdresses, squatting warriors, calendar glyphs, and fire symbols.

Xu Beihong *or* **Hsü Pei-hung** (b. July 19, 1895, Yixing, Jiangsu province, China—d. Sept. 26, 1953, Beijing) Chinese artist and art educator. Xu became an itinerant professional painter in his early teens and an art teacher before reaching age 20. He first visited Shanghai in 1912, and over the next few years he studied Western-style painting. In 1918 Xu traveled to Beiping (now Beijing), where he was appointed a teacher at the Beiping University's Art Research Association. During this period Xu began to teach that only the realist approach from recent Western painting could revive Chinese painting. After studying in Paris and Berlin, Xu held a large-scale, one-person exhibition in Shanghai in 1926 that firmly established his fame as a modern Chinese master. He was best known for his history paintings, portraits, and pictures of horses, cats, and other animals, and he was competent both in Western media and in the traditional Chinese ink-and-wash method. His rigorous and stylish illustrations of horses were especially highly acclaimed by Chinese critics and connoisseurs and helped gain him an international reputation. In 1927 Xu returned permanently to China, where he continued to teach.

Xu Yue (b. c. 185, Donglai, China—d. c. 227, China) Chinese astronomer and mathematician. He wrote several books, of which only *Shushu jiyi* ("Memoir on the Methods of Numbering") is extant; some scholars question its authenticity. The treatise was used as an auxiliary mathematics textbook in the Tang (618–907) and Song (960–1279) state universities. Its first part provides three methods of assigning the powers of 10 up to $10^{4,096}$ to traditionally established terms for "large numbers" and alludes to a method of indefinite generation of even larger numbers. The second part contains descriptions of various devices for representing, if not actually manipulating, large numbers. Among them the book mentions a device resembling the ABACUS, which some scholars believe originated in China.

Xuanxue *or* **hsüan-hsüeh** \'shwän-'shwe\ *Chinese* **"Dark Learning"** Intellectual movement in China in the 3rd–4th century that arose during a period of disenchantment with CONFUCIANISM. Founded by Wang Bi (226–249), the movement drastically reinterpreted Confucian sources and incorporated aspects of DAOISM. Wang and his followers tried to determine whether the nature of ultimate reality was being or nothingness and sought to discover if the principle underlying a thing was universal or particular. The movement played an important role in the development of Chinese BUDDHISM.

Xuanzang *or* **Hsüan-tsang** \'shwän-'dzäŋ\ (b. 600, Guoshi, China—d. 664, Chang'an) Chinese Buddhist monk and pilgrim to India. He received a classical Confucian education before converting to Buddhism. Troubled by discrepancies in the sacred texts, he left for India in 629 to study the religion at its source. He traveled by foot across Central Asia and reached India in 633. After study at the famous Nalanda monastery, he returned home in 645 to a hero's welcome, bringing back hundreds of Buddhist texts, including some of the most important Mahayana scriptures, and spent the rest of his life translating. Influenced by the YOGACARA school, he established the Weishi ("Ideation Only") school of Buddhism, which won many followers in Japan as the Hossō school. The classic novel *Xiyou ji* was inspired by his life.

Xuanzong *or* **Hsüan-tsung** \'shüen-'dzuŋ\ *orig.* **Li Longji** (b. 685, Louyang, China—d. April 762, Chang'an) Sixth emperor (r. 712–756) of the TANG DYNASTY of China, which during his reign achieved its greatest prosperity and cultural brilliance. Xuanzong reformed the bureaucracy, increased tax revenues through reregistering the population, improved the transportation system, and established a permanent military force along China's northern frontiers. Toward the end of his reign, he withdrew increasingly from government and came under the influence of his consorts, including the notorious beauty Yang Guifei. The AN LUSHAN REBELLION of 755–756 forced him to flee the capital, CHANG'AN (modern Xi'an), and he abdicated in favour of the heir apparent.

Xunzi *or* **Hsün-tzu** \'shüen-'dzə̂\ (b. c. 300, Zhao kingdom, China—d. c. 230 BCE, Lanling, Chu kingdom) Chinese scholar and philosopher. He belonged to the academy of philosophy in the state of Qi before becoming magistrate of a district in Chu in 255. His major work, the *Xunzi*, taught that humanity is evil by nature and can become good only through rigorous training. This view provoked much controversy because it opposed the teachings of MENCIUS, who believed in innate human goodness. Xunzi's teachings were later eclipsed when the *Mencius* became a Confucian classic. Xunzi is regarded as one of the three great philosophers of the classical period of Confucianism in China.

XX, Les See Les VINGT

xylem \'zī-ləm\ Part of a plant's vascular system that conveys water and dissolved minerals from the roots to the rest of the plant and furnishes mechanical support. Xylem constitutes the major part of a mature woody stem or root and the wood of a tree, and consists of specialized water-conducting tissues made up mostly of several types of narrow, elongate, hollow cells. Xylem formation begins when the actively dividing cells of growing root and shoot tips give rise to primary xylem. Eventually the primary xylem is covered by secondary xylem produced by the CAMBIUM. The primary xylem cells die, forming a hard skeleton that supports the plant but loses its conducting function. Thus, only the outer part of the wood (secondary xylem) serves in water conduction.

Cross section of oak xylem
J.M. LANGHAM

xylophone PERCUSSION INSTRUMENT consisting of a set of tuned wooden bars that are struck with mallets. Primitive xylophones may consist of logs of graded length laid across two supporting logs; a pit may be dug underneath to serve as a resonator. The xylophone has long been one of the principal instruments of African music; it is also important in the Indonesian GAMELAN. The MARIMBA is a Latin American xylophone. In the modern orchestral xylophone, the bars are laid out on a stand in keyboard arrangement, with vertical resonating tubes suspended under each bar. See also GLOCKENSPIEL; VIBRAPHONE.

African log *amadinda* xylophone; property of the Uganda Museum, Kampala
HILLEGEIST/KUBIK

XYZ Affair (1797–98) Diplomatic incident between the U.S. and France. Pres. JOHN ADAMS sent special envoys ELBRIDGE GERRY and JOHN MARSHALL to France to help CHARLES C. PINCKNEY negotiate an agreement to protect U.S. shipping from French privateers. Before the three could meet with CHARLES-MAURICE DE TALLEYRAND, they were approached by three of his agents—called X, Y, and Z in diplomatic correspondence to Adams—who suggested a bribe of $250,000 to Talleyrand and a loan of $10 million to France as preconditions for negotiations. Adams rejected the French demands and reported the mission had failed. When he was forced to reveal the correspondence, public outrage was followed by calls for war with France. The ALIEN AND SEDITION ACTS were passed to restrict potential French sympathizers. The Convention of 1800 ended a period of undeclared naval warfare between the U.S. and France.

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Y2K bug *or* **Year 2000 bug** *or* **millennium bug** Potential problem in computers and computer networks at the beginning of the year 2000. Until the 1990s, most computer programs used only the last two digits to designate the year, the first two digits being fixed at 19. As the year 2000 approached, many programs had to be partly rewritten or replaced to prevent interpretation of "00" as 1900 rather than 2000. It was feared that such a misreading would lead to software and hardware failures in computers used in such important areas as banking, utilities systems, government records, and so on, with the potential for widespread chaos on and following Jan. 1, 2000. Up to $200 billion may have been spent (half in the U.S.) to upgrade computers and application programs to be Y2K-compliant. Despite international alarm, few major failures occurred, partly because these measures were effective and partly because the likely incidence of failure was exaggerated.

Ya-lung River See YALONG RIVER

yacht \'yät\ Sail- or motor-driven vessel used for racing or recreation. The term is popularly applied to large recreational engine-powered boats; the sailboats known as yachts and used for racing are usually light and comparatively small. Until the mid-19th century, yachts were designed along the lines of naval craft such as SCHOONERS and cutters. Yacht design was greatly affected by the 1851 success of the *America* in the race that established the AMERICA'S CUP. In the 20th century, notably after World War II, smaller racing and recreational craft became more common. See also SAILING.

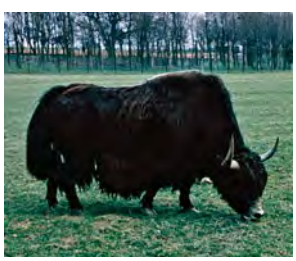
yachting See SAILING

Yagoda \yə-'gō-də**, Genrikh (Grigoryevich)** (b. 1891, Łodz, Pol., Russian Empire—d. March 15, 1938, Moscow, Russia, U.S.S.R.) Soviet politician. A leader of the Cheka secret police (1920–24) and its successor, the OGPU (1924–34), and a close associate of JOSEPH STALIN, he organized the Soviet's forced-labour camps from 1930 and became a member of the Communist Party's Central Committee in 1934. As head of the Commissariat of Internal Affairs, or NKVD, he prepared the first of the PURGE TRIALS (1936). In 1937 he was replaced as police chief by NIKOLAY YEZHOV and himself became a victim of the widespread purges. Accused of being a member of a "Trotskyite" conspiracy intent on destroying the Soviet Union through sabotage, he was convicted, sentenced to death, and executed.

yahrzeit *or* **jahrzeit** \'yär-ˌtsīt\ In JUDAISM, the anniversary of the death of a parent or close relative, commonly observed by burning a candle for an entire day. On that day, the KADDISH is recited in the synagogue, and the TORAH is read. Some mark the anniversary by studying portions of the MISHNA, choosing those sections from the sixth division that begin with letters from the name of the deceased. Yahrzeit developed from an early Jewish custom of fasting on the anniversaries of deaths of certain leaders, and some Jews still fast on yahrzeit.

Yahweh See TETRAGRAMMATON

yak Massive OX (*Bos grunniens mutus*) of high Tibetan plateaus. Bulls grow to 6 ft (1.8 m) at the shoulder hump. The wild yak's hair is black and short, except for a long, shaggy fringe on the flanks and tail. The horns spread outward and upward; the head is held low. Wild females and young live in large herds; mature bulls form smaller groups. Yaks graze on grass and require much water, eating snow in winter. Wild yaks are now endangered. Domestic yaks, which breed freely with domestic cattle, are used as pack, draft, milk, and beef animals. The hide provides leather; the tail, fly whisks; the fringe hair, ropes; the dried dung, fuel.



Yak (*Bos grunniens*).
RUSS KINNE/PHOTO RESEARCHERS

Yakima \'ya-kə-ˌmȯ, 'ya-kə-mə\ **River** River, south-central Washington, U.S. Rising in the CASCADE RANGE, it flows southeast for about 200 mi (320 km) to join the COLUMBIA RIVER near Kennewick. The Yakima and its tributaries irrigate about 460,000 acres (190,000 hectares) in the river valley.

yakuza \'yä-kù-zə\ Japanese gangsters. Yakuza, who trace their roots back to RŌNIN (masterless samurai), often adopt samurai-like rituals and identify themselves with elaborate body tattoos. They traditionally engage in such organized-crime pursuits as extortion, blackmail, smuggling, prostitution, drugs, and gambling, and they control many restaurants, bars, trucking companies, and taxi fleets in Japanese cities. In the 1980s they also became involved in land speculation, fueling the "bubble economy" that burst by the end of the decade. From a high of more than 180,000 in the early 1960s, their membership has dropped to less than half that number. They are organized into some 2,000 gangs, most affiliated under the umbrella of one of a dozen or fewer conglomerate gangs. Yakuza gangs are rigidly hierarchical and follow strict codes of behaviour.

Yale University Private university in New Haven, Conn., a traditional member of the IVY LEAGUE. Founded in 1701, it is the third-oldest institution of higher learning in the U.S. Yale's initial curriculum emphasized classical studies and strict adherence to orthodox Puritanism. Medical, divinity, and law schools were added in 1810, 1822, and 1824. The geologist Benjamin Silliman (1779–1864), who taught at Yale from 1802 to 1853, did much to expand the experimental and applied sciences. Beginning in the mid 19th century, schools of architecture, art, drama, forestry, graduate studies, management, music, and nursing were organized. Yale's library, with more than 10 million volumes, is one of the largest in the U.S. Its extensive art galleries were established in 1832. The Peabody Museum of Natural History houses important collections of PALEONTOLOGY, ARCHAEOLOGY, and ethnology. Yale is one of the most highly regarded schools in the nation; its graduates have included several U.S. presidents.

Yalong \'yä-lůŋ\ **River** *or* **Ya-lung River** River, SICHUAN province, southern China. It rises in mountains at an elevation of nearly 16,500 ft (5,000 m) in QINGHAI province and flows into the YANGTZE RIVER (Chang Jiang) on the YUNNAN border. It is 822 mi (1,323 km) long. It is torrential for most of its course and is unnavigable.

Yalow \'ya-lō**, Rosalyn (Sussman)** *orig.* **Rosalyn Sussman** (b. July 19, 1921, New York, N.Y., U.S.) U.S. medical physicist. She received a Ph.D. in physics from the University of Illinois. She developed the technique of radioimmunoassay (RIA) by combining techniques from radioisotope tracing and immunology. RIA proved a very sensitive and simple way to measure tiny concentrations of biological substances or drugs in blood or other body fluids. She originally applied RIA to study blood insulin levels in diabetes mellitus (1959), but the method soon found hundreds of other applications. In 1976 she became the first woman awarded the Albert Lasker Prize, and in 1977 she shared a Nobel Prize with ANDREW V. SCHALLY and ROGER C.L. GUILLEMIN.

Yalta City (pop., 2001: 82,000), southern CRIMEA, Ukraine. It faces the BLACK SEA on the southern shore of the Crimean Peninsula. Settlement on the site dates from prehistoric times, but modern Yalta developed only in the early 19th century, becoming a town in 1838. Its mild winters and scenic location between sea and mountains have made it one of the most popular vacation and health resorts of Ukraine. In 1945 during World War II it was the site of the Allied leaders' YALTA CONFERENCE.

Yalta Conference (Feb. 4–11, 1945) Conference of Allied leaders at Yalta to plan Germany's defeat in World War II. FRANKLIN ROOSEVELT, WINSTON CHURCHILL, and JOSEPH STALIN discussed the postwar occupation of Germany, postwar assistance to the German people, German disarmament, war-crimes trials, the fate of the defeated or liberated states of eastern Europe, voting in the future UNITED NATIONS SECURITY COUNCIL, and German reparations. Stalin agreed to enter the war against Japan after the German surrender. Roosevelt died two months later, and Stalin broke his promise to allow democratic elections in eastern Europe. See also POTSDAM CONFERENCE; TEHRĀN CONFERENCE.

Yalu \'yä-lü\ **River** *Chinese* **Yalu Jiang** *or* **Ya-lü Chiang** *Korean* **Amnok** \'äm-ˌnək\ **-kang** River, eastern Asia, between northeastern China and North Korea. Some 491 mi (790 km) long, it rises on the northern border of North Korea, then flows to Korea Bay. It is an important source of hydroelectric power and is navigable by smaller vessels for most of its course. It became a political boundary in the 14th century. During the KOREAN WAR, as UN forces battled toward it in 1950, Chinese troops crossed it, in effect marking their entry into the war.

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yam Any of several plant species of the genus *Dioscorea* (family Dioscoreaceae, or yam family), native to warmer regions of both hemispheres. A number of species are cultivated for food in the tropics; in certain tropical cultures, notably of West Africa and New Guinea, the yam is the primary agricultural commodity and the focal point of elaborate ritual. The edible tuberous roots, which vary in taste from sweet to bitter to tasteless, are eaten as cooked starchy vegetables. Often boiled and then mashed, they may also be fried, roasted, or baked. True yams are botanically distinct from the SWEET POTATO, though in the U.S. the names are commonly interchanged. *Dioscorea mexicana* contains a chemical that can suppress ovulation in humans and is used as the basis for birth-control pills. The so-called yam bean is the legume JICAMA.

Yama \'yə-mə\ In Indian mythology, the lord of death. The VEDAS describe him as the first man who died. The son of the sun god SURYA, he presides over the resting place of the dead. In the Vedas, he was a cheerful king of the departed ancestors, but in later mythology he became known as the just judge who punished the deceased for their sins.

Yamagata Aritomo \ˌyä-mə-'gä-tə-ˌär-ē-'tō-mō\ (b. Aug. 3, 1838, Hagi, Japan—d. Feb 1, 1922, Tokyo) First prime minister under Japan's parliamentary regime (1889–91, 1898–1900). As a SAMURAI youth in CHŌSHŪ province, Yamagata was among those who answered the foreign threat with the slogan "Sonnō jōi" ("Revere the emperor, expel the barbarians"). In 1864 Western gunboats bombarded the Chōshu coast, convincing him of the need for modern armaments. After participating in the MEIJI RESTORATION, he went abroad to research military institutions, returning to become commander of an imperial force of 10,000 troops. When he introduced conscription, bearing arms ceased to be the exclusive prerogative of a warrior class. His forces defeated SAIGŌ TAKAMORI's rebellion in 1877. In politics he was more conservative than his contemporary ITŌ HIROBUMI, favouring a strong executive. As prime minister, his policies were expansionist; Japan sent the largest of all foreign forces to China to quell the BOXER REBELLION. He increased the autonomy of the military and tried to suppress an incipient social-labour movement. After retirement, he continued to wield power as a GENRO (elder statesman). See also MEIJI CONSTITUTION; MEIJI PERIOD.

Yamal \yə-'mäl\ **Peninsula** Peninsula between the Kara Sea and the Gulf of Ob, northwestern SIBERIA, west-central Russia. It has a total length of 435 mi (700 km), a maximum width of 150 m (240 km), and an area of 47,100 sq mi (122,000 sq km). There are large natural gas deposits on its western coast.

Yamamoto Isoroku \ˌyä-mä-'mō-tō-ˌē-sō-'rō-kù\ (b. April 4, 1884, Nagaoka, Japan—d. April 18, 1943, Solomon Islands) Japanese naval officer. He fought in the Russo-Japanese War and thereafter rose to become commander in chief of Japan's Combined Fleet in 1941. When it was decided to go to war with the U.S., Yamamoto asserted that the only chance for a Japanese victory lay in a surprise attack that would cripple U.S. naval forces in the Pacific and conceived of the surprise attack on PEARL HARBOR. He then sought to destroy the remnants of the U.S. fleet, principally its aircraft carriers, but the Japanese lost the resulting Battle of MIDWAY in June 1942. His campaign in the Solomon Islands was also unsuccessful. He was killed when the U.S. (which had broken the Japanese communications codes) discovered his whereabouts and shot down his plane over Bougainville island.

Yamasee \'yä-mə-sē\ **War** (1715–16) Conflict between Indians and American colonists. Indian resentment of colonial settlers and traders in South Carolina led a group of Yamasee Indians to kill 90 whites in 1715. Other tribes soon joined the Yamasee in their raids on trading posts and plantations. Colonial military assistance from neighbouring colonies and war supplies from New England helped end the raids. Many defeated Indians escaped to Florida, where they joined runaway black slaves and other Indians to form what later became known as the Seminole tribe.

Yamato Takeru \yä-'mä-tō-tä-'ke-rü\ Japanese folk hero who may have lived in the 2nd century AD. The son of the 12th emperor, Keiko, he was responsible for expanding the territory of the Yamato court. In stories, he subdued two Kumaso warriors by disguising himself as a woman and killing them while they were drunk. With a miraculous sword he then cut away the burning grass fire set by the Ainu tribesmen and escaped. On the plains of Tagi, he became ill, changed into a white plover, and disappeared. His tomb at Ise is known as the Mausoleum of the White Plover.

Yamazaki Ansai \'yä-mä-ˌzä-kē-'än-ˌsī\ (b. Jan. 24, 1619, Kyōto, Japan—d. Oct. 16, 1682, Kyōto) Japanese exponent of the philosophy of the Chinese Neo-Confucianist ZHU XI. Early in life he was a Buddhist monk, but he gradually rejected Buddhism in favour of Confucianism, which he began to teach to thousands of students. He reduced NEO-CONFUCIANISM to a simple moral code, which he then blended with native Shintō religious doctrines. He equated Neo-Confucian principles and theories with Shintō legends and divinity, creating a philosophical system that took on greater authority than its sources possessed alone. His thought was one of the sources of the extreme nationalism and emperor worship that developed later in Japan.

Yamm \'yäm\ Ancient West Semitic deity who ruled the oceans, rivers, lakes, and underground springs. At the beginning of time, Yamm was awarded the divine kingship by EL, the head of the pantheon. One day, Yamm's messengers requested that the gods send BAAL to become Yamm's servant. Baal refused to go, and engaged Yamm in battle. After a furious fight, Yamm was slain and the kingship was given to Baal. Yamm may have been the same deity as Lotan (Hebrew: "Leviathan"), who was represented as a dragon or serpent.

Yamoussoukro \ˌyä-mü-'sü-krō\ Town (pop., 1995 est.: 110,000), capital designate of Côte d'Ivoire. From 1960 to 1993 it served as the country's "second capital" because it was the birthplace, home, and unofficial headquarters of Pres. FÉLIX HOUPHOUËT-BOIGNY. It was designated the official capital in 1983 and shares some of the functions of the former national capital, ABIDJAN. Fishing and forestry are important to its economy. It is the site of the basilica of Notre-Dame de la Paix, the world's largest Christian church, an almost exact replica of St. Peter's in Rome.

Yamuna \'yə-mə-nə\ **River** River, north-central India. Rising in the HIMALAYAS, it flows south and southeast 855 mi (1,376 km) into the GANGES RIVER at ALLAHABAD; their confluence is a sacred place to Hindus. The Yamuna's upper course forms a long section of the border between Uttar Pradesh and Haryana states.

Yancey, William Lowndes (b. Aug. 10, 1814, Warren county, Ga., U.S.—d. July 27, 1863, Montgomery, Ala.) U.S. politician. He was admitted to the bar and served as editor of the *Greenville Mountaineer*. During the nullification crisis, he took a firm Unionist stand. He served in the U.S. House of Representatives (1844–46), and in response to the WILMOT PROVISO he drafted the Alabama Platform (1848), which asserted slaveholders' rights to take their chattel with them to the new territories. He later added secession to the platform. He helped create the League of United Southerners (1858) and supported the Southern Democrats in their nomination of JOHN C. BRECKINRIDGE for president (1860). He drafted Alabama's secession ordinance and served in the Confederate government (1861–63).

Yang, Chen Ning *known as* **Frank Yang** (b. Sept. 22, 1922, Hofei, Anhwei, China) Chinese-born U.S. theoretical physicist. He immigrated to the U.S. in 1945 and studied with EDWARD TELLER at the University of Chicago. He showed that PARITY is violated when elementary particles decay. This and other work in PARTICLE PHYSICS earned him and Tsung-Dao Lee (b. 1926) a 1957 Nobel Prize. His research focused mostly on interactions involving the WEAK FORCE among ELEMENTARY PARTICLES. He also worked in STATISTICAL MECHANICS.

Yang Hui *literary name* **Qianguang** (fl. c. 1261–75, Qiantang, Zhejiang province, China) Mathematician active in the great flowering of Chinese mathematics during the Southern SONG DYNASTY. His books are among the few contemporary Chinese mathematics works to survive. A collected edition of his works (1378) was transmitted farther to the east, where it was particularly influential. In Korea it was reprinted during the reign of SEJONG in 1433, and it was copied again by the Japanese mathematician SEKI TAKAKAZU.

yangban \'yäŋ-ˌban\ *Korean* **"two groups"** Highest social class of the Korean CHOSŎN dynasty (1392–1910). It consisted of both *munban* (civilian officials) and *muban* (military officials). Though the term originated in the KORYŎ dynasty (935–1392), it was only later applied to the highest of four social classes. The *yangban* were granted land and stipends and were the only social class permitted to take the civil service examinations. The *yangban* system was discarded in 1894.

Yangdi *or* **Yang-ti** \'yäŋ-'dē\ *orig.* **Yang Guang** (b. 569, China—d. 618, Jiangdu, Jiangsu province) Second ruler of the Chinese SUI DYNASTY. Under Yangdi, canals were built and great palaces erected. In 608 he built a great canal linking the rice-producing areas in the south with the densely populated north, and he extended this system in 610, contributing to what

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was to become the Grand Canal network. He embarked on military campaigns in Vietnam and Inner Asia. Three expeditions to Korea were so disastrous that the Chinese people turned against him; he was assassinated in southern China. One of his former officials reunited the empire and established the Tang dynasty. See also Wendi.

Yangôn \ˌyäŋ-ˈgōn\ *formerly* **Rangoon** City (pop., 2004 est.: 4,455,500), principal port, and capital of Myanmar (Burma), on the Yangôn River. It was a fishing village until the present city was founded in the mid-1750s by King Alaungpaya; he developed it as a port. The British occupied it 1824–26 during the First Anglo-Burmese War and again took it in 1852 during the Second Anglo-Burmese War. After the British annexation of all of Burma in 1886, Rangoon became the capital city. During World War II the Japanese advanced on and occupied the city, and it suffered considerable damage. It handles more than four-fifths of Myanmar's foreign commerce. In 2005 Myanmar government offices began to be moved to a new administrative centre at Pyinmana, some 200 mi (320 km) north of Yangôn.

Yangshao culture \ˈyäŋ-ˈshaù\ (5000–3000 BC) Prehistoric culture of China's Huang He (Yellow River) basin, represented by several sites at which painted pottery has been uncovered. In Yangshao culture, millet was cultivated, some animals were domesticated, chipped and polished stone tools were used, silk was produced, and pottery was fired in kilns dug into the ground. See also Banpo.

Yangtze Gorges Dam Project See Three Gorges Dam Project

Yangtze \ˈyäŋ-ˈtsə̀\ **River** *Chinese* **Chang** \ˈchäŋ\ **Jiang** *or* **Ch'ang Chiang** River, China. Rising in the Tanggula Mountains in west-central China, it flows southeast before turning northeast and then generally east across south-central and east-central China to the East China Sea near Shanghai. It is known as the Jinsha in its upper course. It is the world's third longest river, 3,915 mi (6,300 km) long. Its chief tributaries are the Yalong, Min, Jialing, Han, and Wu rivers. Several large cities, including Shanghai, Nanjing, Wuhan, and Chongqing, lie in the river's basin, which is known as the granary of China. Large ships can sail to Wuhan, and smaller vessels can reach Yichang; it becomes harder to navigate above Yichang because of the gorges that occur between Chongqing and Yichang. Work on the controversial Three Gorges Dam Project—first discussed in the 1920s and promoted in the 1950s by Mao Zedong—was inaugurated in 1994. Located west of Yichang, it will enable freighters to navigate 1,400 mi (2,250 km) inland from the East China Sea to Chongqing.

Yanofsky \ya-ˈnȯf-skē**, Charles** (b. April 17, 1925, New York, N.Y., U.S.) U.S. geneticist. He received his Ph.D. from Yale University. He was part of the research team that first demonstrated that certain mutant genes produce inactive proteins. Later, working with *E. coli*, he showed that the sequence of the nitrogenous bases that form part of the structure of the genetic material corresponds to the amino acid sequence of proteins. Investigating the biochemical actions of suppressor mutations (changes in a gene that reverse the visible effects of mutation in a second gene), he found that suppression restored the ability to form an active enzyme in a mutant that had previously produced an inactive protein.

Yanomami *or* **Yanomamö** South American Indians who live in the remote forest of the Orinoco River basin in southern Venezuela and the northern reaches of the Amazon River basin in Brazil. They are hunters and gatherers who also grow crops in gardens by practicing shifting cultivation. Their reputation as a fierce people perpetually at war has been challenged since the late 20th century. Because their survival was threatened by incursions of Brazilian miners, in 1991 the Brazilian government set aside an area of 36,000 sq mi (93,000 sq km) as a homeland.

Yao \ˈyaù\ Various Bantu-speaking peoples inhabiting southern Tanzania, northern Mozambique, and southern Malawi. In the colonial era the Yao were prominent as slave traders. They were never completely united but lived as small groups ruled by chiefs. By 1900 they had come under German, Portuguese, or British rule. Today numbering 2.2 million, the Yao practice shifting (slash-and-burn) horticulture. Most are Muslims.

Yao \ˈyaù\ In Chinese mythology, one of three legendary emperors, along with Shun and Dayu, of the golden age of antiquity (c. 24th century BC). All three were exalted by Confucius as models of virtue, righteousness, and unselfish devotion. See photograph opposite.

Yaoundé \yaùn-ˈdā\ City (pop., 2001 est.: urban agglom., 1,481,000), capital of Cameroon. It was founded in 1888 while Cameroon was a German protectorate. The area came under French control, and it was declared the capital of French Cameroun in 1922. In 1940–46 it was replaced as the capital by Douala, but, after Cameroon achieved independence in 1960, it again became the seat. It contains several small manufacturing and processing industries (sawmills and printing presses), and it is the area's agricultural market.

Yaqui \ˈyä-kē\ American Indian people living in southern Sonora state on the west coast of Mexico. They were settled agriculturalists who offered stubborn resistance to the first Spanish invaders and only gradually came under mission influence. In the 19th century they fought against Mexican encroachment on their fertile lands, and they were finally quelled with difficulty in 1887. Thousands were subsequently deported. In the 1930s much of their land was returned to them. Irrigation projects have led to a shift from subsistence agriculture to cash cropping (wheat, cotton, and crops for vegetable oil). They number about 25,000 in Mexico and more than 9,000 in Arizona.

Yarborough \ˈyär-ˌbùr-ō**, Cale** *in full* **William Caleb Yarborough** (b. March 27, 1939, Timmonsville, S.C., U.S.) U.S. stock-car racer. He began racing stock cars in the early 1960s. He was the first to win the NASCAR championships for three consecutive years (1976–78). He also won the Daytona 500 three times (1968, 1977, 1983) and the Atlanta 500 four times (1967, 1968, 1974, 1981).

yard Unit of length equal to 36 inches, or 3 feet (see foot), in the U.S. Customary System or 0.9144 metre in the International System of Units. A cloth yard, used to measure cloth, is 37 in. long; it was also the standard length for arrows. In casual speech, a yard (e.g., of concrete, gravel, or topsoil) may refer to a cubic yard.

Yarmūk \yär-ˈmük\ **River** River, northwestern Jordan. It rises in southwestern Syria and flows southwest to its confluence with the Jordan River. For most of its total course of about 50 mi (80 km), it forms the boundary between Syria and Jordan. A major battle along the river between invading Muslim Arabs and Byzantine forces in 636 AD established Muslim dominance in Palestine. That dominance, broken only by the period of the Crusades (1099–1291), lasted until World War I (1914–18). Since the Six-Day War of 1967, the lower river valley has been under Israeli control.

yarn Continuous strand of fibres grouped or twisted together and used to construct textile fabrics. Yarns are made from both natural and synthetic fibres, in filament or staple form. Filament is very long fibre, including the natural fibre silk and the synthetic fibres. Most fibres that occur in nature are fairly short, or staple, and synthetic fibres may be cut into short, uniform lengths to form staple. Spinning is the process of drawing out and twisting a mass of cleaned, prepared fibres. Filament yarns generally require less twist than do staple yarns. More twist produces stronger yarn; low twist produces softer, shinier yarn. Two or more single strands may be twisted together to form ply yarn. Knitting yarns have less twist than weaving yarns. Thread, used for sewing, is a tightly twisted ply yarn.

Yaroslav \yə-rə-ˈslȧf\ *known as* **Yaroslav the Wise** (b. 980—d. Feb. 2, 1054) Grand prince of Kiev (1019–54). A son of Vladimir I, he defeated his brother Svyatopolk the Accursed to become ruler of Kiev. He consolidated the state through administrative reforms and military campaigns, codified laws, and promoted the spread of Christianity. He also built many fortifications and churches in the Byzantine style, including the Cathedral of St. Sophia. Yaroslav regained Galicia from the Poles and expanded Kievan possessions in the Baltic region, but his military campaign against Constantinople was a failure (1043).

Yao, imaginative portrait by an artist of the Ch'ien-lung period (1735–96); in the Metropolitan Museum of Art, New York City.
COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK, GIFT OF MRS. EDWARD S. HARKNESS, 1947

Yarqon \yär-ˈkōn\ **River** River, west-central Israel. It rises near Rosh Ha-Ayin and flows westward for about 16 mi (26 km) to the Mediterranean Sea near northern Tel Aviv-Jaffa. It marks the boundary between the Plain of Sharon and the coastal

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lowlands. Since the construction and expansion of the Yarqon-Negev Project in the 1950s (see NEGEV), the water level has gone down, and pollution has increased. During World War I (1914–18), it was the site of several important British victories over the Ottoman Empire in the Allied Powers' conquest of Palestine.

yarrow \'yar-ō\ Any of about 80 species of perennial herbs that make up the genus *Achillea* in the COMPOSITE FAMILY, native mainly to the northern temperate zone. Some species are cultivated as garden ornamentals. They have toothed, often finely cut, sometimes aromatic leaves. Many small white, yellow, or pink flowers are often grouped into flat-topped clusters, which can be dried for winter bouquets.

Yarrow (*Achillea millefolium* variety *lanulosa*)
DENNIS E. ANDERSON

Yāsīn \yä-'sēn**, 'Abd al-Salām** (b. 1928) Moroccan religious leader. A former school inspector fluent in English and French, he began practicing Sufism in the 1960s. By the early 1970s he had adopted a more political view of Islam and was influenced by the writings of the Egyptian Islamists Ḥasan al-BANNĀ and Sayyid QUṬB. After sending a letter to the king of Morocco advocating the establishment of an Islamic state—a consistent theme in his work—he was confined to a mental institution (1974–77), and in 1986 he founded a movement, Charity and Justice. From 1989 he was under house arrest.

yaws *or* **frambesia** \fram-'bē-zhə\ Contagious tropical disease, caused by a variant of the SPIROCHETE that causes SYPHILIS. Yaws spreads mainly by discharge from skin sores, not sexual activity. It is common in children, who usually become immune. In the first stage, a skin sore starts as a wartlike thickening, cracks open, leaks fluid, and bleeds easily. A month or more later, multiple sores erupt. The third stage (much rarer than in syphilis) involves destruction of skin, mucous membranes, and bones. PENICILLIN cures early-stage yaws. Prevention requires isolation and prompt treatment and personal and group hygiene.

Yayoi \'yä-ˌyȯi\ **culture** (c. 250 BC–c. AD 250) Prehistoric culture of Japan subsequent to JŌMON CULTURE. It arose on the island of Kyushu and spread northeastward across Honshu. The Yayoi people mastered bronze and iron casting, wove hemp, and employed a Chinese method of wet-paddy rice cultivation. Yayoi pottery is unglazed; early examples have incised decorations, but pieces produced in the last stage of the period are often undecorated. Chinese-style bronze mirrors and coins indicate contact with HAN DYNASTY China.

Yazīd \yä-'zēd\ **I** (b. c. 645, Arabian Peninsula—d. 683, Damascus, Syria) Second caliph (680–683) of the UMAYYAD DYNASTY. He oversaw the events at the Battle of KARBALĀʾ (680), which contributed to the eventual split of Islam into Sunnite and Shīʿite sects. He succeeded his father, MUĀʿWIYAH I, as caliph, keeping Muāʿwiyah's advisers and retaining most of his policies, while reforming the financial system, adjusting tax policy, and improving the irrigation system of the Damascus oasis. See also FITNAH; al-Ḥusayn ibn ʿAlī.

Yazīdī \'yä-zi-dē\ Middle Eastern religion, a syncretic combination of Zoroastrian, Manichaean, Jewish, Nestorian Christian, and Islamic elements. Its adherents, numbering fewer than 100,000, are found in Iraq, Turkey, Syria, Armenia, the Caucasus, and Iran. Most speak Kurdish. They believe that they were created separately from the rest of humankind and segregate themselves from the rest of society. In Yazīdī belief, seven angels, subordinate to a supreme but uninvolved God, rule the universe. The belief that God restored the Devil to his position as chief of the angels upon the Devil's repentance has earned the Yazīdī an undeserved reputation as Devil worshipers. Their chief saint is Sheikh ʿAdī, a 12th-century Muslim mystic. Their name derives from YAZĪD I (c. 645–683), from whose supporters they may be descended.

Yazoo land fraud \ya-'zü\ (1795–1814) Scheme to sell land in Georgia. After legislators were bribed to sell Georgia's western land claims around the Yazoo River to four land companies for $500,000, public anger forced a newly elected Georgia legislature to rescind the act (1796) and return the money. Much of the land had meanwhile been resold to third parties, who refused the money and maintained their claim to the property. The state ceded its claim to the U.S. in 1802. In 1810 the U.S. Supreme Court ruled that the 1796 rescinding law was an unconstitutional infringement on a contract. By 1814 the U.S. government assumed possession of the territory and awarded the claimants over $4 million.

Yazoo \ya-'zü\ **River** River, west-central Mississippi, U.S. Formed by the confluence of the TALLAHATCHIE and Yalobusha rivers north of Greenwood, Miss., it meanders 189 mi (304 km) south and southwest to join the MISSISSIPPI RIVER above Vicksburg. Its basin is protected from flooding by an extensive system of levees.

Yeager \'yā-gər**, Chuck** *orig.* **Charles Elwood Yeager** (b. Feb. 13, 1923, Myra, W.Va., U.S.) U.S. test pilot. He served as a fighter pilot in World War II and became a flight instructor and test pilot after the war. Chosen to test-fly the secret experimental X-1 aircraft, on Oct. 14, 1947, he became the first person to break the sound barrier in flight, which was approximately 662 mph (1,066 km/hr) at an altitude of 40,000 ft (12,000 m). A brash and colourful personality, he retired with the rank of brigadier general in 1975 and received the Presidential Medal of Freedom in 1985.

year Time required for the Earth to travel once around the Sun, slightly less than 365¼ days. This fractional number makes necessary the periodic adjustment of days in any calendar that is to be kept in step with the seasons. In the GREGORIAN CALENDAR, a common year contains 365 days, and every fourth year is a leap year of 366 days except for any year that is divisible by 100 but not divisible by 400 (e.g., 1900 was not a leap year).

Year 2000 bug See Y2K BUG

yeast Any of certain economically important and usually single-celled fungi (see FUNGUS), most of which are classified as ascomycetes. Found worldwide in soils and on plant surfaces, yeasts are especially abundant in sugary mediums such as flower nectar and fruits. The types commonly used in the production of bread, beer, and wine are selected strains of *Saccharomyces cerevisiae*; the small cakes and packets used contain billions of individual yeast cells, each of which can ferment approximately its own weight of glucose per hour. Dried yeast is 50% protein and is rich in B vitamins; brewer's yeast is sometimes taken as a vitamin supplement. Some yeasts are mild to dangerous pathogens of humans and other animals. *Candida albicans*, for example, irritates oral and vaginal linings, and *Histoplasma* and *Blastomyces* cause persistent lung infections.

Yeats \'yāts**, William Butler** (b. June 13, 1865, Sandymount, Dublin, Ire.—d. Jan. 28, 1939, Roquebrune-Cap-Martin, France) Irish poet, dramatist, and prose writer. The son of a well-known painter, Yeats early developed an interest in mysticism and visionary traditions as well as in Irish folklore, and both interests would continue to be sources of poetic imagery for him. His early volumes include the poetry volume *The Wanderings of Oisin* (1889) and the essay collection *The Celtic Twilight* (1893). In 1889 he fell in love with Maud Gonne, a brilliant, beautiful Irish patriot who inspired his involvement in Irish nationalism but did not reciprocate his feelings. With Lady AUGUSTA GREGORY and others, he founded the theatre that became the ABBEY THEATRE; throughout his life he would remain one of its directors. He contributed plays to its repertoire, including *The Countess Cathleen* (1899), *On Baile's Strand* (1905), and *Deirdre* (1907). His poetry changed decisively in the years 1909–14: the otherworldly, ecstatic atmosphere of the early lyrics cleared and his work gained in concreteness and complexity, often dealing with political themes, though his interest in mysticism and his passion for Maud Gonne continued unabated. With *Responsibilities* (1914) and *The Wild Swans at Coole* (1917) he began the period of his highest achievement. Some of his greatest verse appears in *The Tower* (1928), *The Winding Stair* (1929), and *Last Poems* (1939). The individual poems of the latter are largely held together by the system of symbolism he developed in *A Vision* (1925), which used astrological images to link individual psychology with the larger patterns of history. Yeats was a member of the Irish Senate (1922–28). He won the Nobel Prize for Literature in 1923, and he is regarded by some as the greatest English-language poet of the 20th century.

Yeh-lü Ch'u-ts'ai See YELÜ CHUCAI

Yekaterinburg \yi-ˌkä-ti-rən-'bůrk\ *formerly (1924–91)* **Sverdlovsk** \sfyird-'lȯfsk\ City (pop., 2001 est.: 1,256,900), west-central Rus-

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sia. An ironworks was established in 1721, and a fortress, named after Empress Catherine I, was founded there in 1722. It grew as the centre for all the ironworks of the Ural Mountains region, and its importance increased with the building of a highway (1783) and the Trans-Siberian Railroad. It achieved notoriety as the place where Tsar Nicholas II and his family were held prisoner and executed by the Bolsheviks in 1918. In 1924 it was renamed Sverdlovsk in honour of Yakov Sverdlov. The city reverted to its original name after the breakup of the U.S.S.R. in 1991. It is a major industrial centre, especially for heavy machinery.

Yelizavetpol See Gäncä

yellow bunting See yellowhammer

Yellow Emperor See Huangdi

yellow fever Acute infectious tropical disease, sometimes occurring in temperate zones. Abrupt onset of headache, backache, fever, nausea, and vomiting is followed by either recovery with immunity or by higher fever, slow pulse, and vomiting of blood. Patients may die in a week. Jaundice is common (hence the name). One of the world's great plagues for 300 years, it is caused by a virus transmitted by several species of mosquitoes. Carlos Finlay suggested and Walter Reed proved this means of spread, leading to near elimination of the disease through mosquito control (see William Gorgas). Treatment consists of supportive care, particularly fever reduction. Control of mosquitoes near cities and live-virus vaccines—developed by Max Theiler (1899–1972), who won a 1951 Nobel Prize for his work—have made yellow fever completely preventable.

yellow jacket Any of 35–40 species (genus *Dolichovespula* or *Vespula*) of social wasps, principally of the Northern Hemisphere, named for the black bands on its yellow abdomen. They differ from other wasps in having their wings folded longitudinally when at rest. *Dolichovespula* species typically build exposed nests. *Vespula* species build concealed nests underground or in protected cavities; when a nest is stepped on, the colony may erupt in an angry, stinging swarm. Nest size varies widely; some nests can be held in one hand, whereas nests in warmer climates may weigh half a ton.

yellow journalism In newspaper publishing, the use of lurid features and sensationalized news in newspaper publishing to attract readers and increase circulation. The phrase was coined in the 1890s to describe tactics employed in the furious competition between two New York papers, Joseph Pulitzer's *World* and William Randolph Hearst's *Journal*. When Hearst hired away from Pulitzer a cartoonist who had drawn the immensely popular comic strip "The Yellow Kid," another cartoonist was hired to draw the comic for the *World*; the rivalry excited so much attention that the competition was dubbed *yellow journalism*. Techniques of the period that became permanent features of U.S. journalism include banner headlines, coloured comics, and copious illustrations.

yellow poplar See tulip tree

Yellow River See Huang He

Yellow Sea *Chinese* **Huang Hai** \'hwäŋ-'hī\ Large inlet of the western North Pacific Ocean, between northeastern China and the Korean peninsula. Renowned for its fishing grounds, it connects with the East China Sea on the south; the Shandong Peninsula extends into it from the west. Two major arms of it are the Bo Hai (northwest) and Korea Bay (north). Excluding the Bo Hai, it has an area of about 161,000 sq mi (417,000 sq km) and a maximum depth of 338 ft (103 m). It derives its name from the colour of the silt-laden water discharged into it by major Chinese rivers, including the Liao and the Huang He (Yellow River), both of which flow into the Bo Hai. Leading port cities include Qingdao and Dalian in China, Inch'ŏn in South Korea, and Namp'o in North Korea.

Yellow Turbans Chinese secret society founded during a time of pestilence (2nd century AD). The rebels' yellow headdresses signified their association with the earth element, which they believed would succeed the (red) fire element that represented Han rule. The sect was Daoist in inspiration, like the contemporaneous Five Pecks of Rice sect. Its rebellion (AD 184–c. 204) against the tyrannical eunuchs who influenced the emperor contributed to the fall of the Han dynasty. See also Daoism.

yellowhammer *or* **yellow bunting** Songbird species (*Emberiza citrinella*, family Emberizidae) found from Britain to central Asia. The name is derived from the German *Ammer* ("bunting"). Yellowhammers are 6 in. (16 cm) long and have a streaked brown body, yellow-tinged head and breast, and a rapid song. In the southern U.S., the yellow-shafted flicker is called yellowhammer because of its drumming.

Yellowknife City (pop., 2001: 16,541), capital of Northwest Territories, Canada. Lying on the northwestern shore of the Great Slave Lake near the mouth of the Yellowknife River, the city was founded in 1935, one year after gold was discovered in the area. It took its name from the Yellowknife band of Athabascan Indians. Gold mining remains the chief economic activity. There are also reserves of diamonds in the region. The capital since 1967, it is the largest community and the chief administrative, commercial, and educational centre in the territories.

yellowlegs Either of two species (genus *Tringa*, family Scolopacidae) of shorebirds. They have trim, gray-brown and white streaked bodies; long bills; and long, bright yellow legs. Both species breed in Canada and winter in South America and eat small fish and other aquatic creatures. The lesser yellowlegs (*T. flavipes*), about 10 in. (25 cm) long, appears in sizable flocks on mudflats during migration; it has a flat call of one or two notes. Less common is the greater yellowlegs (*T. melanoleuca*), which is about 14 in. (35 cm) long and has a longer, stouter, slightly upturned bill; its call is a clear three-note whistle.

Lesser yellowlegs (*Tringa flavipes*)
MARY M. TREMAINE—ROOT RESOURCES

Yellowstone Lake Lake, Yellowstone National Park, northwestern Wyoming, U.S. It lies at 7,731 ft (2,356 m) above sea level, the largest body of water in North America at so high an altitude. It is fed and drained by the Yellowstone River. About 20 mi (32 km) long and 14 mi (23 km) wide, it has a maximum depth of 390 ft (119 m) and a surface area of 137 sq mi (354 sq km). It is a haven for rare species of waterbirds, including trumpeter swans, and is prized for trout fishing.

Yellowstone National Park National preserve in northwestern Wyoming, southern Montana, and eastern Idaho, U.S. The oldest national park in the U.S. (and in the world), it was established by the U.S. Congress in 1872; it covers 3,468 sq mi (8,983 sq km). The Gallatin, Absaroka, and Teton mountain ranges extend into it. Yellowstone has unusual geologic features, including fossil forests and eroded basaltic lava flows. It also has 10,000 hot springs, which erupt as steam vents, fumaroles, and geysers. Old Faithful, the park's most famous geyser, erupts every 33 to 120 minutes. There are many lakes and rivers, including Yellowstone Lake, Shoshone Lake, the Snake River, and the Yellowstone River. In 1988 an extensive series of forest fires temporarily laid waste to large areas of the park.

Yellowstone River River, northwestern Wyoming and southern and eastern Montana, U.S. The river rises in Wyoming. It enters Yellowstone National Park and feeds into Yellowstone Lake, below which it plunges 422 feet (129 m) in two spectacular waterfalls and enters the Grand Canyon of the Yellowstone River. It then continues north into Montana. There it flows northeast into the Missouri River on the Montana–North Dakota boundary. It is 692 mi (1,114 km) long and has been developed extensively for irrigation. Its principal tributaries are the Bighorn, Tongue, and Powder rivers. It was first explored in 1806 during the Lewis and Clark Expedition.

Yeltsin, Boris (Nikolayevich) (b. Feb. 1, 1931, Sverdlovsk, Russia, U.S.S.R.) Russian politician and president of Russia (1990–99). After attending the Urals Polytechnic Institute, he worked at construction projects in western Russia (1955–68). He became Communist Party leader in Sverdlovsk in 1976, and he was an ally of Mikhail Gorbachev. Gorbachev later charged Yeltsin with eliminating corruption in the Moscow party organization, and as first secretary (mayor) of Moscow (1985–87) he proved a determined reformer. His criticism of the slow pace of reform led to a break with Gorbachev, and Yeltsin lost his position. In 1989 he was elected to the new Soviet parliament by a landslide, then became president of the Russian Republic (1990) and resigned from the Communist Party. In 1991 he won the presidency again in the first popular election in Russian history. When communist hard-liners staged a coup against Gorbachev, Yeltsin successfully opposed it, facing down its leaders with a dramatic outdoor speech in Moscow. He led the establishment of the

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Commonwealth of Independent States (1991) and began to transform Russia's economy into one based on free markets and private enterprise. Hardliners staged an unsuccessful coup against Yeltsin in 1993. When Chechnya unilaterally declared independence, Yeltsin sent troops to fight the rebels (1994). The Chechnya situation and Russia's deepening economic distress lessened his popularity, but he won reelection over a Communist Party challenger in 1996. After suffering a heart attack, he spent several months recovering. Continuing poor health led to his resignation on Dec. 31, 1999. He was succeeded by Vladimir Putin.

Boris Yeltsin, 1991.
VARIO PRESS—CAMERA PRESS/GLOBE PHOTOS

Yelü Chucai *or* **Yeh-lü Ch'u-ts'ai** \'ye-'lü-'chüt-'sī\ (b. 1190—d. 1244) Chinese statesman of Khitan extraction, adviser to Genghis Khan and his son Ögödei. He established a formal bureaucracy and rationalized taxation system for the Mongol-controlled portions of China. By persuading Ögödei to spare the inhabitants of northern China in order to utilize their wealth and skills, Yelü gave the Mongols access to the Chinese weapons that later enabled them to conquer the Song dynasty. See also Mongol; Yuan dynasty.

Yemen \'ye-mən\ *officially* **Republic of Yemen** Country, Middle East, southwestern Asia. It occupies the southern tip of the Arabian Peninsula and also includes the island of Socotra in the Indian Ocean and the Kamaran island group in the Red Sea. Area: 214,300 sq mi (555,000 sq km). Population (2005 est.): 20,044,000. Capital: Sanaa. The population is mainly Arab. Language: Arabic (official). Religion: Islam (official; mostly Sunni). Currency: Yemeni rial. From the Gulf of Aden and the Red Sea, a narrow coastal plain leads to highlands that cover most of the country. The northern region extends into the southern and southwestern Rub' al-Khali desert. Mineral resources include iron ore, salt, petroleum, and natural gas, all of which are exploited. Agriculture is important; industries include petroleum and salt production. Yemen is a republic with two legislative houses; its head of state is the president, and the head of government is the prime minister. Tribal affiliations remain strong and directly affect local and national policy. Yemen was the home of ancient Minaean, Sabaean, and Ḥimyārite kingdoms. The Romans invaded the region in the 1st century AD. In the 6th century it was conquered by Ethiopians and Persians. Following the adoption of Islam in the 7th century, it was ruled nominally under a caliphate. The Egyptian Ayyūbid dynasty ruled there in the late 12th–early 13th century, after which the region passed to the Rasūlids. From c. 1520 through 1918 the Ottoman Empire maintained varying degrees of control, especially in the northwestern section. A boundary agreement was reached in 1934 between the northwestern territory (controlled by a local religious leader), which subsequently became the Yemen Arab Republic (North Yemen), and the southeastern British-controlled territory, which subsequently became the People's Democratic Republic of Yemen (South Yemen). Relations between the two Yemens remained tense and were marked by conflict throughout the 1970s and '80s. The two officially united as the Republic of Yemen in 1990. Its 1993 elections were the first free, multiparty general elections held in the Arabian Peninsula, and they were the first in which women participated. In 1994, after a two-month civil war, a new constitution was approved.

Yenişeri See Janissary

Yenisey \yi-ni-'sā\ **River** River, central Russia. One of the longest rivers in Asia, it rises in the borderland of south-central Russia and Mongolia and flows generally north along the edge of the West Siberian Plain to empty into the Kara Sea. Along its course it receives numerous tributaries, including the Angara River. Approximately 1,900 mi (3,000 km) of the river's 2,540-mi (4,090-km) course (calculated from the Great Yenisey River) are navigable.

yerba maté See maté

Yerevan *formerly* **Erivan** \,yer-ə-'vän\ City (pop., 2004 est.: 1,101,900), capital of Armenia. Fortified since the 8th century BC and part of Armenia since the 6th century BC, it developed as an important centre of the caravan trade. Over the centuries, its rulers have included the Romans, Arabs, Turks, and Russians; it fell to the latter in 1827. In 1920 it became the capital of independent Armenia and remained so during the period of Soviet rule and after independence was restored. Its industries include those producing chemicals, aluminum, automobiles, and electrical machinery.

Yermak Timofeyevich (d. Aug. 6, 1584/85, Siberia) Cossack leader. In 1579 he was enlisted by the merchant Stroganov family to defend its possessions against attacks by Siberian tribesmen. He set out with an expeditionary force of 840 Cossacks and reached the central Tatar khanate of Sibir in 1582. With their firearms, Yermak and his army defeated the numerically superior forces of Khan Kuchum and occupied the capital, Sibir. Though later killed in a revolt of Kuchum's forces, Yermak was considered the conqueror of Siberia and became a hero of Russian folklore.

Yerushalayim See Jerusalem

Yesenin \yi-'sʸenʸ-in**, Sergey (Aleksandrovich)** *or* **Sergey Esenin** (b. Oct. 3, 1895, Konstantinovo, Ryazan province, Russia—d. Dec. 27, 1925, Leningrad) Russian poet. From a peasant family, he celebrated what he called "wooden Russia" (traditional culture) over modern, industrialized society in works beginning with *Radunitsa* (1916), and he believed the Revolution of 1917 would lead to the peasant millennium he envisioned. Taking up the life of a rowdy and blasphemous exhibitionist, he wrote cynical, swaggering tavern verse such as that contained in *Ispoved khuligana* (1921; "Confessions of a Hooligan"). In 1922 he married dancer Isadora Duncan, though neither could speak the other's language. His efforts to adjust to the revolutionary era were unsuccessful, and he hanged himself at age 30. Though frowned on by the authorities, he was very popular in Russia both during his life and afterward.

yeshiva \yə-'shē-və\ Academy of higher Talmudic learning. Through its biblical and legal exegesis and application of scripture, the yeshiva has defined and regulated Judaism for centuries. Traditionally, it is the setting for the training and ordination of rabbis. Following the destruction of the Second Temple of Jerusalem, a series of yeshivas were set up around the Levant to codify and explain centuries of Jewish scholarship. In medieval times, yeshivas flourished in Europe wherever there were large populations of Jews. The first yeshiva in the U.S., 'Etz Ḥayyim (1886), later became Yeshiva University (1945).

Yeshiva University Private university in New York City. It was established in 1886 as Yeshiva Eitz Chaim; in 1915 it merged with a Jewish

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theological seminary. Today the university is independent, although its curriculum emphasizes Jewish culture and history. Yeshiva consists of a liberal arts college, a college for women, a college of Hebraic studies, and the Albert Einstein College of Medicine, as well as schools of Judaic studies, Talmudic studies, business, law (the Cardozo School), social work, education, and graduate studies, among others.

Yeti See Abominable Snowman

Yevtushenko \yif-tù-'shen-kə**, Yevgeny (Aleksandrovich)** (b. July 18, 1933, Zima, Irkutsk *oblast*, Russian S.F.S.R.) Russian poet. The descendant of Ukrainians exiled to Siberia, he grew up in Moscow and in the small town that is the setting of his first important narrative poem, *Zima Junction* (1956). He became the spokesman for the post-Stalin generation of Russian poets with his internationally publicized demands for greater artistic freedom, which signaled an easing of Soviet control over artists in the late 1950s and '60s. He revived brash, slangy language and traditions such as love lyrics and personal lyrics, frowned upon under Stalinism. His poem "Baby Yar" (1961) was an attack on lingering Soviet anti-Semitism; his most ambitious cycle of poems is *Bratsk Station* (1966). He became famous worldwide for his passionate recitations.

yew Any of about eight species of ornamental evergreens in the genus *Taxus*, family Taxaceae (the yew family), distributed throughout the Northern Hemisphere. Two species are always shrubby, but the others may reach heights of 77 ft (25 m). The plants have many branches, covered with needlelike leaves. Yew wood is hard, fine-grained, and heavy, with white or creamy sapwood and amber to brown heartwood. Once popular for cabinetwork, implements, and archery bows, it is used more today for articles either carved or turned on a lathe. Other trees called yew but not in this family are the plum-yew (family Cephalotaxaceae) and Prince Albert yew (family Podocarpaceae).

Yezhov \yi-'zhòf**, Nikolay (Ivanovich)** (b. 1895, St. Petersburg, Russia—d. after January 1939) Soviet secret-police chief. He joined the Communist Party in March 1917 and was a political commissar in the Red Army during the Russian Civil War. Thereafter he rose through political posts, and by 1927 he was a functionary for the Moscow party's central committee and a favourite of Joseph Stalin. He became a member of the party's Central Committee (1934) and succeeded Genrikh Yagoda as chief of the Soviet security police, or NKVD (1936). He instituted the most severe stage of the Great Purge (see purge trials), known as Yezhovshchina. By 1938 he had become the object of Stalin's suspicions and was replaced by Lavrenty Beria as head of the NKVD. He disappeared in 1939 and was probably executed.

Yggdrasill \'ig-drə-ˌsil\ In Norse mythology, the world tree. One of its roots extended into the underworld, another into the land of the giants, and the third into Asgard. At its base were three wells: the Well of Fate, from which the tree was watered by the Fates; the Roaring Kettle, in which dwelt Nidhogg, the monster that gnawed the tree's roots; and Mimir's Well, the source of wisdom, for whose water Odin sacrificed an eye. After the Ragnarok, Yggdrasill, though badly shaken, is to be the source of new life.

Yi dynasty See Choson dynasty

Yi Hwang \'ē-'hwäŋ\ (b. 1501—d. 1570) Korean religious leader, the foremost Korean Confucian. He helped shape the character of Korean Confucianism through his creative interpretation of Zhu Xi's teaching. His *To Become a Sage: The Ten Diagrams on Sage Learning*, an aid for educating the king, offered a depiction of all the major concepts in Song-dynasty learning. He elevated the level of Confucian dialogue to a new height of intellectual sophistication through his correspondence with Ki Taesung (1527–72). In their so-called four-seven debate, they discussed the relationship between Mencius's four basic human feelings (commiseration, shame, modesty, right versus wrong) and seven emotions.

Yi Song-gye \'yē-'sùŋ-'gye\ *or* **T'aejo** \'tī-'jō\ (b. 1335—d. 1408) Founder of the Korean Chosŏn dynasty (1392–1910). A military leader in the Koryŏ dynasty, he rose through the ranks by battling invading forces. He defeated his rivals and drove out the last king of the Koryŏ dynasty, taking the throne in 1392. He established his capital at Hanyang (now Seoul). He and his successors redistributed land, which had been concentrated in the hands of a few high-ranking bureaucrats, throughout the various levels of officialdom. In a break with the past, he made Neo-Confucianism the state religion, replacing Buddhism. Farming was made the centre of the economy. In foreign relations, he maintained a close relationship with China's Ming dynasty.

Yi Sun-shin \'yē-'sùn-'shin\ (b. April 28, 1545, Seoul, Korea—d. Dec. 16, 1598, off Noryang) Korean admiral and national hero. He worked on developing the *kŏbuksŏn* ("turtle ship"), thought to be the first ironclad battleship. As a result of Yi's preparations, his forces, unlike most of the Korean military, were ready to fight when the Japanese under Toyotomi Hideyoshi invaded in 1592. His sea victories effectively cut off the Japanese troops in Korea from their supplies. In 1597 he was falsely accused of disloyalty and demoted to the rank of common soldier. When the Japanese launched a second invasion and largely destroyed the Korean navy, Yi was reinstated and soon restored Korea's control of the seas. He was killed by a stray bullet as he pursued the retreating Japanese.

Yibin \'ē-'bin\ *or* **I-pin** *conventional* **Suchow** \'sü-'jō\ City (pop., 2003 est.: 312,462), southern Sichuan province, south-central China. It is located at the junction of the Min and Yangtze (Chang) rivers. A county administration was set up there in the 2nd century BC. It first received the name Yibin in AD 742. The Chinese hold expanded there during the Song dynasty (960–1279). By the Qing dynasty (1644–1911) it was Xuzhou (Hsü-chou) superior prefecture, known to Europeans as Suifu. In 1912 it reverted to Yibin. In 1913 steamship communication with Chongqing was opened, and Yibin grew into a major collection and distribution centre. It has long been known for its salt deposits, which now supply a large chemical plant.

Yichang \'ē-'chäŋ\ *or* **I-ch'ang** City (pop., 1999 est.: 481,277), western Hubei province, east-central China. An ancient city, it is located at the head of navigation on the Yangtze River (Chang Jiang), below the entrance to the gorges of the Daba Mountains. As the gateway to the rich province of Sichuan, it was often disputed during times of Chinese political turmoil. It was made a treaty port for foreign trade in 1877; a Western quarter grew beside it, and many Western commercial firms established branches there. It was occupied by the Japanese and badly damaged during World War II, but the city and its shipyards have been rebuilt. It is now an industrial centre and a distribution point for the region's manufactured goods.

Yiddish drama Productions of the professional Yiddish theatre. European Jewish drama originated in the Middle Ages, when dancers and jesters entertained at Purim celebrations. By the 16th century, these entertainments had become elaborate plays performed in Yiddish, the language of the majority of central and eastern European Jews. The professional Yiddish theatre dates from 1876, when Abraham Goldfaden (1840–1908) wrote a well-received musical sketch in Romania and organized a troupe to perform his songs and plays. In 1883 anti-Semitic laws in Russia that forbade Yiddish plays compelled many actors and playwrights to immigrate to England and the U.S. The playwright Jacob Gordin (1853–1909) brought new material and adaptations to the U.S. Yiddish theatre, including *The Jewish King Lear* (1892), starring Jacob P. Adler, founder of a family of Yiddish- and English-speaking actors. In 1918 Maurice Schwartz founded and directed the Yiddish Art Theatre, which trained actors such as Jacob Ben-Ami and Muni Weisenfreund (later known as Paul Muni). World War II destroyed most Yiddish culture in eastern Europe, and by the late 20th century only a few Yiddish theatres survived in New York City, London, Bucharest, and Warsaw.

Yiddish language Language of Ashkenazic Jews and their descendants (see Ashkenazi), written in the Hebrew alphabet. Yiddish developed from southeastern dialects of Middle High German carried into central and eastern Europe beginning in the 12th century; it has been strongly influenced by Hebrew and Aramaic, from which it draws 12–20% of its lexicon. The isolation of eastern European speakers from High German and their exposure to Slavic languages, particularly Polish and Ukrainian, led to a primary distinction between West and East Yiddish dialects. From the late 18th century most Jews remaining in central Europe gave up Yiddish in favour of German; it has now virtually died out. East Yiddish dialects differ markedly in realization of vowels; there are central, northeastern, and southeastern dialects. A flourishing literary language in the 19th and early 20th century, Yiddish declined dramatically due to suppression, massive migration, assimilation, and Nazi genocide. The language nevertheless continues to flourish among the ultra-Orthodox Hasidim in numerous countries and among secular students of Yiddish at leading universities, including Columbia University (New York), Hebrew University (Jerusalem), McGill University (Montreal), the University of Oxford, and the University of Paris. Yiddish is spoken by three million people worldwide.

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Yijing *or* **I Ching** \'ē-'jiŋ\ *Chinese* **"Book of Changes"** Ancient Chinese text, one of the FIVE CLASSICS of Confucianism. The main body of the work, traditionally attributed to WENWANG, contains a discussion of the divinatory system used by wizards in the ZHOU DYNASTY. A supplementary section of "commentaries," believed to date from the WARRING STATES PERIOD (475–221 BC), is a philosophical exposition that attempts to explain the world and its ethical principles. The book's cosmology, which involves humans and nature in a single system, has made it universally popular.

Yima \ya-'mä, 'yē-mə\ In ancient Iranian religion, the first man, son of the Sun, and progenitor of the human race. In one legend, Yima became king in a golden age in which need, death, disease, aging, and extremes of temperature were banished from the earth because of his virtue. This golden age ended when AHURA Mazdā foretold a terrible winter. Yima was instructed to build an underground domain, take in the best individuals from each species to preserve their seed, and then reemerge after the winter to repopulate the earth. In Zoroastrian legends, Yima was replaced by GAYŌMART.

Yin dynasty See SHANG DYNASTY

yin-yang In East Asian thought, the two complementary forces or principles that make up all aspects and phenomena of life. Yin is earth, female, dark, passive, and absorbing; it is present in even numbers and in valleys and streams and is represented by the tiger, the colour orange, and a broken line. Yang is heaven, male, light, active, and penetrating; it is present in odd numbers and mountains and is represented by the dragon, the colour azure, and an unbroken line. Together they express the interdependence of opposites.

Yinchuan \'yin-'chwän\ *or* **Yin-ch'uan** City (pop., 1999 est.: 469,180), capital of NINGXIA autonomous region, north-central China. It is located near the western end of the GREAT WALL. Originally a county in the 1st century BC, it became the capital of the XI XIA dynasty in 907 AD. In 1227 it came under the MONGOL dynasty and was later under the MING and the QING dynasties. In 1928 it became the capital of the newly formed Ningxia province. In 1954 when Ningxia province was abolished, the city became part of GANSU province. With the establishment of the Ningxia autonomous region in 1958, Yinchuan once again became the capital. Largely nonindustrial, it is the chief agricultural market and distribution centre for the area.

ylang-ylang *or* **ilang-ilang** \ˌē-ˌläŋ-'ē-ˌläŋ\ South Asian evergreen tree (*Cananga odorata*) of the CUSTARD APPLE family. The name means "flower of flowers" in the Tagalog language. Tall (77 ft, or 25 m) and slim, it has smooth bark and is covered year-round with drooping, long-stalked, rich-scented flowers that have six narrow, greenish-yellow petals. The pointed oval leaves have wavy edges. Clustered, oval black fruits hang from long stalks. Leis are made from the blooms, and a delicate fragrance is distilled from the flowers. The woody ylang-ylang vine (*Artabotrys odoratissimus*), in the same family, is popular on trellises and patios in warm, moist climates.

YMCA *in full* **Young Men's Christian Association** Nonsectarian, nonpolitical Christian lay movement that aims to develop high standards of Christian character among its members. It originated in London in 1844 when 12 young men formed a club to improve the spiritual condition of young tradesmen. The first U.S. club was formed in Boston in the 1850s. YMCA programs include sports and physical education, camping, formal and informal education, and citizenship activities. It also runs hotels, residence halls, and cafeterias. National councils are members of the World Alliance of YMCAs (established 1855), headquartered in Geneva. The YMCA was charged with sponsoring educational and recreational facilities in prisoner-of-war camps by the GENEVA CONVENTION of 1929. It now operates in dozens of countries. The Young Women's Christian Association (YWCA) was founded in Britain (1877) to address the needs of women from rural areas who came to the cities to find work; in the U.S. (founded 1906), it has championed racial equality. The Young Men's and Young Women's Hebrew Association (YM-YWHA) developed in the mid-19th century from Jewish men's literary societies in the U.S. and now exists in some 20 other countries worldwide.

Ymir See AURGELMIR

Yoga One of the six orthodox systems (DARSHANS) of Indian philosophy, which has had widespread influence on many schools of Indian thought. It is better known through its practical aspect than its intellectual content, which is largely based on the philosophy of SAMKHYA. Holding that the evolution of the world occurred in stages, Yoga attempts to reverse this order so that a person reenters his or her state of purity and consciousness. Generally, the Yoga process involves eight stages, which may require several lifetimes to pass through. The first two stages are ethical preparations emphasizing morality, cleanliness, and devotion to God. The next two stages are physical preparations that condition the body to make it supple, flexible, and healthy; the physical aspects of Yoga have been most successfully popularized in the West. The fifth stage involves control of the mind and senses to withdraw from outward objects. The remaining three stages entail the cultivation of increasingly concentrated states of awareness, which will ultimately lead to release from the cycle of rebirth. See also CHAKRA, KUNDALINI.

Yogacara \'yō-gä-'chä-rä\ *or* **Vijnanavada** \vij-ˌnä-nə-'vä-də\ Idealistic school of MAHAYANA Buddhism. It rejects the complete realism of THERAVADA Buddhism and the practical realism of the MADHYAMIKA school, preferring a more complicated position in which the reality perceived by humans does not exist but only appears to do so by virtue of the capacity of the mind to perceive patterns of continuity and regularity. Yogacara emerged in India about the 2nd century and was introduced into China in the 7th century by XUANZANG. It was transmitted to Japan in the mid-7th century as Hossō.

yogurt Semisolid, fermented, often flavoured MILK food. Yogurt is known and consumed in almost all parts of the world. It is traditionally made by adding common strains of *Streptococcus* and *Lactobacillus* bacteria to raw milk. The culture is produced by taking a portion of a previous batch. In modern commercial yogurt making, a blend of concentrated sterilized milk and milk solids is inoculated with the two bacteria; sometimes *L. acidophilus* or a lactose-fermenting YEAST is also added. The product is then incubated four or five hours at 110–112 °F (43–44 °C) until curd forms. Various flavours and sweetening may be added.

Yoho National Park National park, southeastern British Columbia, Canada. It occupies 507 sq mi (1,313 sq km) of the western and central slopes of the ROCKY MOUNTAINS and is adjacent to BANFF and KOOTENAY national parks. Known for the BURGESS SHALE archaeological site, geologic treasures, diverse wildlife, and scenic landscape, it was established as a national park in 1886. Features include glaciers, ice fields, steep mountains, and broad valleys. Black and grizzly bears, moose, mule deer, wapiti (elk), and mountain goats inhabit the park.

Yojoa \yō-'hō-ä**, Lake** Lake, central Honduras. The country's largest inland lake, it has an area of 110 sq mi (285 sq km). It is volcanic in origin and sits at an elevation of 2,133 ft (650 m). It and the surrounding region are popular tourist destinations.

Yokohama Seaport city (pop., 2003 est.: 3,466,875), east-central HONSHU, Japan. The country's principal port and second largest city, it is located on the western shore of TOKYO BAY and is part of the TOKYO urban-industrial complex. It was a small fishing village when U.S. naval officer MATTHEW PERRY visited in 1854 to negotiate Japanese trading possibilities. In 1859 it was opened for foreign settlement and trade. Yokohama was destroyed by earthquake and fire in 1923 and severely damaged by U.S. air raids in 1945 during World War II, but it was rebuilt both times. It produces textiles, chemicals, ships, machinery, petroleum products, and automobiles.

Yom Kippur \ˌyōm-kē-'půr, ˌyäm-'ki-pər\ *English* **Day of Atonement** Jewish religious holiday, observed on the 10th day of the lunar month of Tishri (in late September or early October). It concludes the 10 days of repentance that begin with ROSH HASHANAH. Its purpose is to purify the individual and community by forgiving the sins of others and by repenting one's own sins against God. Before the destruction of the Temple of JERUSALEM, the high priest performed a sacrificial ceremony that concluded with the death of a SCAPEGOAT. Today it is marked by fasting and abstention from sex. Its eve, when the KOL NIDRE is recited, and the entire day of Yom Kippur, are spent in prayer and meditation.

Yongding River *or* **Yung-ting River** River, northeastern China. It rises beyond the GREAT WALL in HEBEI province and flows southeastward through BEIJING municipality. It continues through TIANJIN municipality, where it becomes the principal stream forming the HAI RIVER, which flows from the Yongding's junction with the GRAND CANAL to its mouth at the BO HAI. About 300 mi (500 km) long, it is navigable in its lower reaches.

Yŏngjo \'yòŋ-jō\ (r. 1724–76) King of the Korean CHOSŎN DYNASTY. A reformer, Yŏngjo reinstated the universal military service tax but then

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reduced it by half, making up the deficiency with other taxes. He adopted an accounting system and reduced an onerous cloth tax. Yŏngjo upgraded the status of the offspring of commoners, but his social reforms could not keep up with the speed of societal change.

Yongle emperor *or* **Yung-lo emperor** \'yůŋ-'le\ *orig.* **Zhu Di** (b. May 2, 1360, Yingtian [Nanjing], China—d. Aug. 5, 1424, Yumuchuan, Inner Mongolia) Third emperor of China's Ming dynasty, which he raised to its greatest power. Son of the Hongwu emperor, founder of the Ming, he was his father's favourite. He was enfeoffed as the Prince of Yan (the region around present-day Beijing) and spent his youth patrolling the northern frontier and keeping the Mongols fragmented. When his nephew succeeded to the throne, Zhu Di rebelled and became emperor in 1402. As emperor, he worked to extend China's sway. He sent out ships of exploration, most notably under Zheng He; these returned with envoys bearing tribute to acknowledge China's overlordship. He became the only ruler in Chinese history to be acknowledged suzerain by the Japanese. A foray into Annam (now Vietnam), which he attempted to incorporate into China, led to years of guerrilla warfare. He five times led large armies north to the Gobi Desert, forestalling the creation of a Mongol confederation that might have threatened China. He transferred China's capital from Nanjing to Beijing. He built the Forbidden City and repaired the Grand Canal so that Beijing could be provisioned without relying on sea transport. He sponsored the compilation and publication of the Confucian Classics and the preparation of the *Yongle dadian* ("Great Canon of the Yongle Era"), an 11,000-volume compendium.

yoni \'yō-nē\ In Hinduism, a representation of the female sexual organ and feminine generative power, the symbol of the goddess Shakti (see shakti). The yoni is often associated with the phallic linga, the symbol of the god Shiva. The linga is depicted in art as resting in the yoni, their union representing the eternal process of creation and regeneration.

Yonkers City (pop., 2000: 196,086), southeastern New York, U.S. It is located on the Hudson River north of New York City. Once the site of an American Indian village, it was part of a purchase made by the Dutch West India Co. from the Indians in 1639. In 1646 it was included in a grant of land made to "Jonkheer" Adriaen van der Donck. The southern portion of old Yonkers was annexed to what later became the Bronx in 1874. Industry is well diversified and includes printing and publishing and the manufacture of elevators, chemicals, electronic components, and clothing.

Yonne \'yȯn\ **River** River, north-central France. It flows north out of Nièvre *département* into the Seine River at Montereau-faut-Yonne. The Yonne is 182 mi (293 km) long and is navigable for 70 mi (113 km) downstream from Auxerre.

Yorck von Wartenburg \'yȯrk-fȯn-'vär-tən-ˌbůrk**, Johann (David Ludwig), Count** (b. Sept. 26, 1759, Potsdam, Prussia—d. Oct. 4, 1830, Klein-Öls, Silesia) Prussian army commander. After serving with the Prussian army (1772–79) and Dutch army (1779–87), he rejoined the Prussian army and fought in Poland (1794) and later in the war against France (1806). Promoted to major general, he helped reorganize the army, developing the tactics of the infantry scout and the line of skirmishes. In 1812 he led the Prussian contingent of Napoleon's invading army into Russia. During the French retreat, he concluded an accord with Russia that opened the way for Prussia to join the Allied powers against Napoleon. He was made a count in 1814 and a field marshal in 1821.

Yoritomo See Minamoto Yoritomo

York Former city (pop., 2001: 150,255), southeastern Ontario, Canada. In 1998 it joined the cities of Toronto, Etobicoke, Scarborough, and North York and the borough of East York to become the City of Toronto. Occupying an area of 9 sq mi (23 sq km), York was established in 1967 through the amalgamation of the former township of York and the town of Weston. The original York township was formed in 1793.

York *ancient* **Eboracum** City and unitary authority (pop., 2001: 181,131), geographic county of North Yorkshire, historic county of Yorkshire, England. Located at the confluence of the Ouse and Foss rivers, it is the cathedral city of the archbishop of York and was historically the ecclesiastical capital of northern England. It was also the seat of the historic county of Yorkshire. York was a Celtic and then a Roman settlement. Constantine I was proclaimed Roman emperor in York in AD 306. It was conquered by the Danes in 867. York suffered severely in the Norman conquest of northern England in the 11th century. During the Middle Ages it was a prosperous wool-trading town and the performance site of the York plays. It has a manufacturing economy and a tourist industry fostered by its medieval sites.

York, Alvin C(ullum) (b. Dec. 13, 1887, Pall Mall, Tenn., U.S.—d. Sept. 2, 1964, Nashville, Tenn.) U.S. World War I hero. He worked as a blacksmith and was drafted into the U.S. Army in 1917 after being denied conscientious-objector status. In the Meuse-Argonne offensive (October 1918), his patrol of 17 men was ordered to attack a German machine-gun nest. Pinned down behind enemy lines, he advanced alone to attack the enemy gunners, killing 25 and forcing the others to surrender. As he marched them back to U.S. lines, he captured more German soldiers for a total of 132 prisoners. He received the Congressional Medal of Honor, and his autobiography (1928) was the basis of the movie *Sergeant York* (1941).

York, Cape Northern point of Cape York Peninsula, Queensland, Australia. Australia's northernmost point, it is about 15 mi (25 km) long and 12 mi (19 km) wide; it juts into the Torres Strait. Cape York was named in 1770 by Capt. James Cook for the duke of York, brother of King George III.

York, house of Younger branch of the Plantagenet dynasty, descended from Edward III's fifth son, Edmund of Langley (1341–1402), 1st duke of York. In the 15th century the Yorkists took the throne from the house of Lancaster; the Yorkist kings were Edward IV, Edward V, and Richard III. The Wars of the Roses between the two houses continued until Richard's death at the Battle of Bosworth Field in 1453. The marriage of Henry VII, the first Tudor king, to the daughter of Edward IV, merged the house of York with the house of Tudor.

York plays Cycle of 48 plays performed in the Middle Ages by craft guilds in York, Eng. The York cycle, which dates from the 14th century, is of unknown authorship; it covers the story of the Fall of Man and his redemption, from the creation of the angels to the Final Judgment. The plays, performed on the summer feast day of Corpus Christi, were given in chronological order, on pageant wagons proceeding from one selected place to another. See also mystery play.

York University Privately endowed university in North York, Ont., Can., founded in 1959. It has faculties of administrative studies, arts, education, environmental studies, fine arts, and graduate studies as well as schools of law, business, and of pure and applied science. Among its research units are centres for the study of refugees, atmospheric chemistry, law and public policy, and computers in education.

Yorke Peninsula Promontory, southeastern South Australia. It is located between Spencer Gulf to the west and Gulf Saint Vincent and Investigator Strait to the east and south. It extends southward 160 mi (260 km) and is 20–35 mi (32–56 km) wide. Sighted by the English in 1802, it was named for Charles P. Yorke, first lord of the Admiralty.

Yorkshire \'yȯrk-ˌshir\ Historic county, northern England. Yorkshire was divided into three administrative counties—North Riding, East Riding, and West Riding—and the city of York. For most purposes the ridings were separate administrative units for a thousand years; Yorkshire and the ridings, comprising the country's largest county, ceased to exist with the administrative reorganization of 1974. Yorkshire was an agricultural, fishing, and manufacturing centre. Its main cities and towns include Leeds, Sheffield, Kingston upon Hull, Bradford, and Wakefield.

Yorkshire terrier *or* **Yorkie** Breed of toy dog developed in the mid-19th century in Yorkshire and Lancashire, Eng. Its lineage appears to include terriers such as the Skye and Dandie Dinmont. Its outstanding feature is its straight, silky coat, parted on the back from nose to tail and long enough to sweep the ground. Its coat colour is dark blue-gray, with tan on the head and chest. It may grow to 9 in. (23 cm) tall and weigh up to 7 lb (3 kg).

Yorktown, Siege of (1781) American-French land and sea campaign against the British that virtually ended the American Revolution. About 7,500 British troops under Charles Cornwallis occupied defensive positions at the coastal port of Yorktown, Va., on Aug. 1, 1781. They were opposed by a smaller American force under the marquis de Lafayette, assisted by Anthony Wayne and Frederick Steuben. From New York, George Washington ordered Lafayette to prevent Cornwallis's escape by land. French troops under the count de Rochambeau joined Washington's forces and marched south. Linking up with a French fleet at the head of Chesapeake Bay, they joined Lafayette's forces on September 28, and the

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14,000 troops besieged the British position. Cornwallis waited for British reinforcements under Henry Clinton to arrive by sea; but now outnumbered, outgunned, and running low on food, he surrendered his 8,000 men and 240 guns on October 19. The siege ended fighting in the war and virtually guaranteed success to the American cause.

Yoruba \'yȯr-ə-bə\ One of Nigeria's three largest ethnic groups, numbering more than 22 million. The many dialects comprising the Yoruba language belong to the Benue-Congo branch of the Niger-Congo family. The Yoruba states, including the Oyo empire, were built in the 11th–16th centuries. Yorubaland remains divided into politically autonomous kingdoms, each centred on a capital city or town and headed by a hereditary king (*oba*), traditionally considered sacred. Most Yoruba men are farmers, growing yams, corn, and millet as staples; cocoa is a cash crop. Yoruba women control much of the complex market system. Craftsmen work in blacksmithing, weaving, leatherworking, glassmaking, bronze casting, and ivory- and wood-carving. Though some Yoruba are now Christians or Muslims, belief in their traditional religion continues, and it remains alive, too, in the New World countries to which may Yoruba were transported to work as slaves (see Candomblé; Macumba; Santería; vodun). The Yoruba language has an extensive literature of poetry, short stories, myths, and proverbs.

Yorubaland \'yȯr-ù-bə-ˌland\ Area of western Africa, in present-day Nigeria. It once comprised several states headed by individual Yoruba kings. It flourished for centuries before disputes between minor rulers, difficulties in maintaining trade routes, and invasions led to its decline, beginning in the late 18th century. Oyo, Ife, Ibadan, and Oshogbo are cities with historical Yoruba background.

Yosemite \yō-'se-mə-tē\ **Falls** Two waterfalls, Yosemite National Park, central California, U.S. Formed by creeks tumbling into the Yosemite River valley, the upper falls drop 1,430 ft (436 m) and the lower, 320 ft (98 m). With the cascades between, the total drop from the crest of the upper to the base of the lower is 2,425 ft (739 m), one of the world's longest cataracts.

Yosemite National Park National preserve, central California, U.S. Made a national park in 1890, it encompasses 761,320 ac (308,106 ha) in the Sierra Nevada range. Its many features include giant redwood groves with trees thousands of years old, Yosemite Falls, Bridalveil Fall (620 ft [189 m]), and huge domes and peaks; the greatest of these is El Capitan, a granite buttress that is 3,604 ft (1,098 m) high.

Yoshida Shigeru \'yō-shē-dä-shē-'ge-rù\ (b. Sept. 22, 1878, Tokyo, Japan—d. Oct. 20, 1967, Ōiso) Japanese prime minister after World War II. He served as ambassador to Britain in the 1930s. Late in the war (June 1945) he was arrested for attempting to force an early Japanese surrender; he was not freed until the start of the Allied occupation (September). He first became prime minister in 1946. Between 1946 and 1954 he formed five separate cabinets, guiding Japan back to economic prosperity and setting a course for postwar cooperation with the U.S. and Europe. In 1951 he negotiated the peace treaty that ended World War II; he also negotiated a security pact between Japan and the U.S. He retired from politics in 1955. See also Shōwa period.

Yoshida Shōin \'yō-shē-dä-'shō-ēn\ (b. Sept. 20, 1830, Nagato province, Japan—d. Nov. 21, 1859, Edo) Japanese teacher of military tactics in the domain of Chōshū. He studied "Dutch learning" (European studies) in Nagasaki and Edo (modern Tokyo) and was deeply influenced by the pro-emperor thinkers in the domain of Mito. His radical pro-emperor stance influenced young samurai in Chōshū to overthrow the Tokugawa shogunate. He was executed for an assassination plot against the shogun's representative in Kyōto. See also Kido Takayoshi; Tokugawa period.

Yoshitsune See Minamoto Yoshitsune

Youghiogheny \ˌyä-kə-'gā-nē\ **River** River in northeastern West Virginia, northwestern Maryland, and southwestern Pennsylvania, U.S. It rises in West Virginia, near the western edge of Maryland, and flows north through northwestern Maryland into Pennsylvania to enter the Monongahela River at McKeesport after a course of 135 mi (217 km). It is the only river in western Maryland that does not flow south into the Potomac River.

Youmans \'yü-mənz**, Vincent (Millie)** (b. Sept. 27, 1898, New York, N.Y., U.S.—d. April 5, 1946, Denver, Colo.) U.S. songwriter. He started writing songs while in the navy during World War I and later worked as a song plugger in Tin Pan Alley. He collaborated with lyricists such as Ira Gershwin and Oscar Hammerstein on the Broadway musicals *Wildflower* (1923), *No, No, Nanette* (1925), *Hit the Deck* (1927), *Great Day* (1928), and the first Fred Astaire-Ginger Rogers vehicle, *Flying Down to Rio* (1933). His standards include "Tea for Two," "More Than You Know," "Time on My Hands," and "Carioca."

Young, Andrew *in full* **Andrew Jackson Young, Jr.** (b. March 12, 1932, New Orleans, La., U.S.) U.S. politician. He earned a divinity degree in 1955 and became a pastor at several African American churches in the South. Active in the civil rights movement, he worked with Martin Luther King, Jr., and Ralph Abernathy in the Southern Christian Leadership Conference (1961–70). He served in the U.S. House of Representatives (1972–77). An early supporter of Jimmy Carter, he was appointed U.S. ambassador to the UN (1977–79), the first African American to hold the post. He served as mayor of Atlanta (1982–90).

Young, Brigham (b. June 1, 1801, Whitingham, Vt., U.S.—d. Aug. 29, 1877, Salt Lake City, Utah) U.S. religious leader, second president of the Mormon church. He settled in Mendon, N.Y., in 1829 and was baptized into Joseph Smith's Church of Jesus Christ of Latter-day Saints in 1832. In 1834 he joined the Mormons in Missouri, and when they were driven out in 1838, he organized their move to Nauvoo, Ill. He established a Mormon mission in England in 1839. After Smith's murder in 1844, Young took over the church. He led the persecuted Mormons from Illinois to Utah (1846–48), choosing the site of Salt Lake City for the new Mormon headquarters. Elected president of the Mormons in 1847, he became governor of the provisional state of Deseret in 1849 and of the territory of Utah in 1850. His dictatorial autonomy and legalization of polygamy led Pres. James Buchanan to replace him as governor in 1857 and send the army to assert federal supremacy in the so-called Utah War, but Young remained head of the Mormon church until his death. He took more than 20 wives and fathered 47 children.

Brigham Young
COURTESY OF UTAH STATE HISTORICAL SOCIETY

Young, Coleman (b. May 24, 1918, Tuscaloosa, Ala., U.S.—d. Nov. 29, 1997, Detroit, Mich.) U.S. politician. He moved with his family to Detroit in 1923. At Ford Motor Co. he became involved in union activities and civil rights activism. In World War II, he served with the Tuskegee Airmen. He later cofounded the National Negro Labor Council, which he disbanded in the 1950s to avoid turning over its membership list during an investigation by the House Un-American Activities Committee. He was elected to the Michigan senate in 1964, and in 1968 he became the Democratic National Committee's first African American member. As mayor of Detroit (1973–93), he focused on revitalizing the crime-ridden city by attracting new businesses and reinforcing the police department. He retired after an unprecedented five terms.

Young, Cy *orig.* **Denton True Young** (b. March 29, 1867, Gilmore, Ohio, U.S.—d. Nov. 4, 1955, Newcomerstown, Ohio) U.S. baseball pitcher. Young, 6 ft 2 in. (1.88 m) tall, was a powerful right-handed thrower. His dominating fastball earned him the nickname "Cy," short for "cyclone." He began his major league career in 1890 with the Cleveland Indians (National League); after his Cleveland years (1890–98), he pitched for the St. Louis Cardinals (1899–1900), the Boston Red Sox (1901–08), the Cleveland Indians again (American League, 1909–11), and the Boston Braves (1911). In each of 16 seasons he won more than 20 games; in five he won more than 30. Though many early records are in dispute, he won more major league games (509 or 511) than any other pitcher in history. Among his other records are games started (816 or 818), completed starts (750 or 751), and innings pitched (7,356 or 7,377). In 1904 he pitched the first perfect game (no player reaching first base). The annual Cy Young Award, instituted in 1956, originally honoured the best major league pitcher; since 1967 it has been given to the best pitcher in each league.

Young, Lester (Willis) (b. Aug. 27, 1909, Woodville, Miss., U.S.—d. March 15, 1959, New York, N.Y.) U.S. tenor saxophonist. Young joined

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Count Basie's band in 1936 and was recognized as a major new stylist on the instrument. His small-group recordings from the late 1930s with Basie and vocalist Billie Holiday are classics. He was nicknamed Prez by Holiday (short for "President of the saxophone"). Young's subtle harmonies and unconventional rhythmic independence influenced both bebop and cool-jazz musicians; his gentle tone and ethereal lyricism inspired an entire school of jazz saxophone playing.

Lester Young, c. 1955.
REPRINTED WITH PERMISSION OF *DOWN BEAT* MAGAZINE

Young, Neil (b. Nov. 12, 1945, Toronto, Ont., Can.) Canadian rock singer and songwriter. He began his career as a folksinger in Winnipeg and later moved to Los Angeles, Calif., U.S., where he formed the rock group Buffalo Springfield with Stephen Stills. In 1968 he released a solo album; in 1969 he joined Stills, David Crosby, and Graham Nash, to form Crosby, Stills, Nash and Young. His high-pitched, nasal vocals were instantly recognizable in any band. With a new band, Crazy Horse, he had great success with albums such as *Harvest* (1972) and *Comes a Time* (1978). In the 1980s he experimented with rockabilly and electronic music.

Young, Thomas (b. June 13, 1773, Milverton, Somerset, Eng.—d. May 10, 1829, London) English physicist. Trained as a physician, he practiced medicine at St. George's Hospital (from 1811 until his death) but spent much of his time on scientific research. He was the first to describe and measure astigmatism (1800–01) and the first to explain colour sensation in terms of retinal structures corresponding to red, green, and violet (1801). He established the principle of interference of light, thus resurrecting the century-old wave theory of light (1801). He explained capillarity independently of Pierre-Simon Laplace. Investigating elasticity, he proposed Young's modulus, a numerical constant that describes the elastic properties of a solid undergoing tension or compression. His other work included measuring the size of molecules and surface tension in liquids. With J.-F. Champollion, he helped decipher the inscriptions on the Rosetta Stone (1813–14).

Young Algerians Algerian nationalist group. Formed shortly before World War I (1914–18), they were a loosely organized group of French-educated workers in the modernized French sector. The Young Algerians were "assimilationists," willing to consider permanent union with France on the condition that native Algerians be given the full rights of French citizens. In the years following the war, such gradualist reformers found themselves opposed by radical nationalists demanding complete independence. See also Ferhat Abbas; Association of Algerian Reformist 'Ulamā'; National Liberation Front.

Young America movement U.S. political concept popular in the 1840s. Inspired by European youth movements of the 1830s (see Young Italy), the U.S. group was formed as a political organization in 1845 by Edwin de Leon and George H. Evans. It advocated free trade, expansion southward into the territories, and support for republican movements abroad. It became a faction in the Democratic Party in the 1850s. Sen. Stephen A. Douglas promoted its nationalistic program in an unsuccessful effort to compromise sectional differences.

Young Italy *Italian* **Giovine Italia** Movement founded by Giuseppe Mazzini in 1831 to work for a united, republican Italian nation. In contrast to earlier independence movements of the Carbonari, Young Italy was to be based on support from the Italian people, who would be educated in their political role. To propagate his ideas, Mazzini published the journal *Giovine Italia* (1832–34). The movement spread in northern Italy and by 1833 included more than 50,000 members. It staged revolts in the 1830s and '40s, but it failed to win popular support for insurrection. In 1848 Mazzini replaced Young Italy with the Italian National Committee. After 1850 his influence declined as leadership of the movement for Italian unification passed to Camillo Benso, count di Cavour. See also Risorgimento.

Young Men's Christian Association See YMCA

Young Plan (1929) Renegotiation of Germany's World War I reparations payments by a committee chaired by the U.S. lawyer Owen D. Young (1874–1962) in Paris. The Young Plan, a revision of the Dawes Plan, reduced the amount due from Germany to $26.3 billion, to be paid over 59 years, and ended foreign controls on German economic life. It went into effect in 1930, but the world depression affected Germany's ability to pay. When Adolf Hitler came to power in 1933, he repudiated the obligations of the Treaty of Versailles, including reparations.

Young Tunisians Political party formed in 1907 by French-educated Tunisian intellectuals to oppose French rule. They demanded complete control of the country's government and administration and full citizenship rights for both Tunisians and Frenchmen. They protested the Italian invasion of Libya (1911) and rioted against French actions at home. The French exiled its leaders, driving the party underground until 1920, when it reemerged and reorganized itself as the Destour Party, which remained active until 1957. See also Habib Bourguiba.

Young Turks *Turkish* **Jöntürkler** Coalition of young dissidents who ended the sultanate of the Ottoman Empire. Consisting of college students and dissident soldiers, the group succeeded in 1908 in forcing Abdülhamid II to reinstitute the 1876 constitution and recall the legislature. They deposed him the following year, reorganized the government, and began modernizing and industrializing Turkish society. They joined the Central Powers during World War I (1914–18). Facing defeat, they resigned a month before the war ended. See also Mustafa Kemal Atatürk; Enver Pasha; Midhat Pasha.

Younghusband, Sir Francis Edward (b. May 31, 1863, Murree, India—d. July 31, 1942, Lytchett Minster, Dorset, England) British army officer and explorer. He forced the conclusion of the Anglo-Tibetan Treaty (1904) that gained Britain long-sought trade concessions. His two initial attempts to negotiate trade and frontier issues with Tibet failed despite British military action; he then marched to Lhasa with British troops and forced the conclusion of a trade treaty, though the Dalai Lama, Tibet's leader, had fled. See also amban.

Youngstown City (pop., 2000: 82,026), northeastern Ohio, U.S. Located on the Mahoning River, near the Pennsylvania border, it was founded in 1797. Ohio's first furnace to produce iron was built nearby in 1805. In 1855 the Sault Sainte Marie locks were opened, making the rich iron ores from the upper Great Lakes region available; railroad lines were later built to transport ores and coal to Youngstown. By 1920 it had become one of the largest steel-producing centres in the U.S. Its products now include aluminum, rubber, and paper products. Youngstown State University was established in 1908.

Yourcenar \yür-sə-'när**, Marguerite** *orig.* **Marguerite de Crayencour** (b. June 8, 1903, Brussels, Belg.—d. Dec. 17, 1987, Northeast Harbor, Maine, U.S.) Belgian-born French-U.S. novelist, essayist, and short-story writer. Independently wealthy after her father's death, she led a nomadic life until World War II, when she settled in the U.S. with the American woman who would be her lifelong companion and translator. Her works are noted for their rigorously classical style, their erudition, and their psychological subtlety. Her masterpiece is *Memoirs of Hadrian* (1951), a historical novel of the 2nd-century Roman Empire. Other works include the novels *Coup de grâce* (1939) and *The Abyss* (1968), *Oriental Tales* (1938), and the prose poem "Fires" (1936). In 1980 she became the first woman in history to be elected to the Académie Française.

Marguerite Yourcenar, 1971.
GISÈLE FREUND 1971

youth hostel Supervised shelter providing inexpensive overnight lodging, particularly for young people. Often located in scenic or historic areas, hostels range from simple farmhouses to hotels able to house several hundred people. Guests often cook their own meals, make their own beds, and do other chores; in return they receive lodging at much less than the usual commercial rate. Hostels place limits on the length of stay and formerly set a maximum-age limit for guests. The hosteling movement was founded by Richard Schirrmann, a German schoolteacher con-

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cerned about the health of young people breathing polluted air in industrial cities. Common in Germany in the early 1900s, youth hostels spread through Europe and other parts of the world after World War I, and an international organization was formed in 1932; currently known as Hostelling International and based in London, its membership includes national federations in more than 60 countries, comprising some 4,000 hostels. Some hostels still impose age limits.

Ypres \'ēpr²**, Battles of** Three costly battles in World War I in western Flanders. In the first battle (Oct. 12–Nov. 11, 1914), the Germans were stopped on their march to the sea, but the Allied forces were then surrounded on three sides. The second battle (April 22–May 25, 1915) marked the Germans' first use of poison gas as a weapon. In the third and longest battle (July 31–Nov. 6, 1917), also called the Battle of Passchendaele, the British were initially successful in breaking through the left wing of the German lines. The seasonal rains soon turned the Flanders countryside into an impassable swamp, but Gen. Douglas Haig persisted in his offensive. On November 6 Haig's troops, including the Canadian Corps, occupied the ruins of Passchendaele, barely five miles from the start of the offensive. Total Allied and German casualties exceeded 850,000, including the deaths of 325,000 British soldiers.

Ypsilanti family \ˌip-sə-'lan-tē\ Greek family prominent in the 19th century. Early members were Greek Phanariots (residents of the Greek quarter of Constantinople) distinguished in the Ottoman imperial service. Constantine Ypsilanti (1760–1816) was governor of Moldavia (1799–1801) and Walachia (1802–6) when he encouraged Serbians to rebel against Turkey. He was forced to flee to Russia, where his son Alexander Ypsilanti (1792–1828) became an officer in the Russian imperial guard. As the leader of the secret Greek organization Philikí Etaireía (1820), he promoted the cause of Greek freedom and led an unsuccessful attack on the Turks at Dragasani (1821). His brother, Demetrios Ypsilanti (1793–1832), carried on the cause in the War of Greek Independence and served as commander of the Greek forces 1828–30.

Yrigoyen, Hipólito See Hipólito Irigoyen

Yser River \ē-'zer\ River, northern France and Belgium. Rising in northern France, it flows through western Belgium and enters the North Sea near Nieuwpoort after a course of 48 mi (77 km). Its estuary was probably as far inland as Loo into the 10th century, but gradual land reclamation has since reduced it to a narrow tidal creek. During World War I (1914) the German advance toward Calais and the English Channel coast was halted at the river when Nieuwpoort sluices were flooded; this checked the German advance and allowed the Allies to set up an impregnable position.

Ysyk \ˌi-sik**, Lake** *Russian* **Lake Issyk-Kul'** \ˌi-sik-'kəl\ Lake, northeastern Kyrgyzstan. Situated in the northern Tien Shan, it is one of the largest mountain lakes in the world, having a surface area of some 2,425 sq mi (6,280 sq km) and reaching 2,303 ft (702 m) in depth. Its name (from the Kyrgyz word for "hot lake") refers to the fact that it does not freeze during the winter. To conserve the lake's wildlife, the Issyk-Kul' Preserve was founded in 1948.

Yuan Chiang See Red River

Yuan dynasty *or* **Yüan** \yü-'än\ **dynasty** *or* **Mongol dynasty** (1206–1368) Dynasty established in China by Mongol nomads. Genghis Khan occupied northern China in 1215, but not until 1279 did Kublai Khan take control of southern China. The Mongols established their capital at Beijing (then called Dadu). They rebuilt the Grand Canal and put the roads and postal stations in good order. Paper money, which had had limited circulation under the Song, came to be used throughout the empire. Advances were made in astronomy, medicine, and mathematics, and trade was carried out throughout the Mongol empire from the plains of eastern Europe across the steppes to Mongolia and China. Many foreigners came to China (notably Marco Polo), and many Chinese traveled to Iran, Russia, and even western Europe. The Chinese resented the Mongol conquerors, whose governmental system discriminated against them. Chinese artists demonstrated passive resistance by withdrawing and turning to personal expression. Literati painting became popular; the novel developed, and new dramatic forms also appeared. Disputes over succession weakened the central government from 1300 on, and rebellions were frequent, many connected with secret societies such as the Red Turbans. The dynasty was overthrown in 1368 by the future Hongwu emperor. See also Ming dynasty.

Yuan \'ywen, 'ywän\ **River** River, southeast-central China. It rises in Guizhou province, then flows northeast in Hunan province to Dongting Lake. It is some 635 mi (1,020 km) long and is navigable for most of its course.

Yuan Shikai *or* **Yüan Shih-kai** \yü-'än-'shir-'kī\ (b. Sept. 16, 1859, Xiangcheng, Henan province, China—d. June 6, 1916, Beijing) Chinese army leader and president of the Republic of China (1912–16). He began his military career serving in Korea in the 1880s. In 1885 he was made Chinese commissioner at Seoul; his promotion of China's interests contributed to the outbreak of the Sino-Japanese War (1894–95). The war destroyed China's navy and army, and the task of training a new army fell to Yuan. When his division was the only one to survive the Boxer Rebellion (1900), his political stature increased. He played a decisive part in China's modernization and defense programs and enjoyed the support of the empress dowager Cixi. On her death he was dismissed, only to be called back following the overthrow of the Qing dynasty in 1911–12, when he became the first president of the new republic; Sun Yat-sen had previously served as the provisional president. Impatient with the new National Assembly, he ordered the assassination of Song Jiaoren, leader of the Nationalist Party in 1913. He quelled a subsequent revolt, but his efforts to found his own dynasty (1915–16) failed.

yuca See cassava

Yucatán \yü-kä-'tän\ State (pop., 2000: 1,658,210), northern Yucatán Peninsula, southeastern Mexico. It covers an area of 14,827 sq mi (38,402 sq km); its capital is Mérida. Yucatán occupied virtually the entire peninsula when it became a state in 1824, but the creation of the states of Campeche (1858) and Quintana Roo (1902) from parts of Yucatán, as well as later boundary changes, reduced it to its present size. Long occupied by rural Maya Indians who speak little Spanish, it is the site of many ancient Maya ruins.

Yucatán Peninsula Peninsula, northeastern Central America. It lies between the Gulf of Mexico and the Caribbean Sea; its 76,300-sq-mi (197,600-sq-km) territory includes the Mexican states of Campeche, Quintana Roo, and Yucatán and, in the south, large parts of Belize and Guatemala. It is about 200 mi (320 km) wide and has a coastline of about 700 mi (1,100 km). The area had long been home to many pre-Columbian civilizations before Spanish explorer Hernán Cortés traversed its inland portion in 1525. Spanish rule was subsequently established, but since that time many independent Maya Indians have kept to its inland rural areas and resisted the authority of the central government. Its coastal area, with many beaches and resorts, and its ancient archaeological sites, including Chichén Itzá, Uaxactún, and Uxmal, are major tourist destinations, as is the resort city of Cancún.

yucca \'yə-ˌkə\ Any of about 40 species of succulent plants (genus *Yucca*) of the lily family, native to southern North America. Most species lack a stem and have a rosette of stiff, sword-shaped leaves at the base and clusters of waxy white flowers. The Joshua tree (*Y. brevifolia*) has a stem more than 33 ft (10 m) high. Commonly cultivated as ornamentals for their unusual appearance and attractive flower clusters are the aptly named Spanish bayonet (*Y. aloifolia*), Spanish dagger (*Y. gloriosa*), and Adam's needle, or bear grass (*Y. filamentosa*). Yucca moths (genus *Tegeticula*) inhabit yucca bushes, each moth species adapted to a particular yucca species. The yucca can be fertilized by no other insect, and the moth can use no other plant to raise its larvae.

Yucca
COURTESY OF THE NEW MEXICO DEPARTMENT OF DEVELOPMENT

Yudenich \yü-'dye-nyich**, Nikolay (Nikolayevich)** (b. July 30, 1862, Moscow, Russia—d. Oct. 5, 1933, Saint-Laurent-du-Var, France) Russian commander of anti-Bolshevik forces in the Russian Civil War. A career army officer who joined the Imperial Army in 1879, he commanded in the Russo-Japanese War and was promoted to general in 1905. In World War I he led Russian troops in the Caucasus (1914–15, 1917). After retiring to Estonia, he organized anti-Bolshevik forces there and launched an

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unsuccessful offensive toward Petrograd (St. Petersburg). He renewed his offensive in coordination with other White forces but was stopped by the Red Army and forced to retreat to Estonia, where he disbanded his army (1920). He fled to France, where he died in exile.

Yue Fei *or* **Yüeh Fei** \yüe-'e-'fā\ (b. 1103, Tangyin, Henan province, China—d. Jan. 27, 1142, Lin'an, Zhejiang province) One of China's greatest generals and national heroes. When the Juchen overran northern China and captured the Song-dynasty capital at Kaifeng, Yue Fei accompanied the future emperor Gaozong into the south, where the Southern Song was established. Yue Fei prevented the advance of the Juchen in the south and was able to recover and secure some of the occupied territory in central China. His attempt to push north and recapture all of the lost territory was opposed by the minister Qin Hui, who had Yue executed. Yue has been extolled for his resistance to foreign domination.

yuga \'yü-gə\ Unit of the cosmic cycle in Hindu cosmology. Each yuga is progressively shorter than the preceding one, corresponding to a decline in the moral and physical state of humanity. Four such yugas make up a mahayuga; 2,000 mahayugas make up the basic cosmic cycle, the kalpa. The first yuga was an age of perfection that lasted 1,728,000 years. The fourth and most degenerate yuga began in 3102 BC and will last 432,000 years. At the close of this yuga, the world will be destroyed, to be recreated after a period of quiescence as the cycle resumes.

Yugoslavia Former federated country situated on the west-central Balkan Peninsula of southern Europe. Between 1929 and 2003, three federations bore the name Yugoslavia ("Land of the South Slavs"). After the Balkan Wars of 1912–13 ended Turkish rule in the Balkan Peninsula and Austria-Hungary was defeated in World War I, a Kingdom of Serbs, Croats, and Slovenes was established, comprising the former kingdoms of Serbia and Montenegro (including Serbian-held Macedonia), as well as Croatia, Bosnia and Herzegovina, Austrian territory in Dalmatia and Slovenia, and Hungarian land north of the Danube River. The Kingdom of Yugoslavia, officially proclaimed in 1929 by King Alexander I and lasting until World War II, covered 95,576 sq mi (247,542 sq km). The postwar Socialist Federal Republic of Yugoslavia covered 98,766 sq mi (255,804 sq km) and had a population of about 24 million by 1991. In addition to Serbia and Montenegro, socialist Yugoslavia included four other republics now recognized as independent states: Bosnia and Herzegovina, Croatia, Macedonia, and Slovenia. The "third Yugoslavia," inaugurated on April 27, 1992, had roughly 45% of the population and 40% of the area of its predecessor and consisted of the republics of Serbia and Montenegro, which in 2003 abandoned the name Yugoslavia and renamed the country Serbia and Montenegro.

Historical map of Yugoslavia showing the boundaries of the country from 1946 to 1992.

Yukaghir See Siberian peoples

Yukon *or* **Yukon Territory** Territory (pop., 2001 est.: 30,000), northwestern Canada. Bounded by Alaska, U.S., to the west, and the Canadian Northwest Territories to the east and British Columbia to the south, its capital is Whitehorse. Drained by the Yukon River system, it has some of the highest mountains in North America, notably the Saint Elias Mountains and Mount Logan, Canada's highest peak. It was originally settled by American Indians and the Inuit (Eskimo). The first European visitor (1825) was British explorer John Franklin, who was seeking the Northwest Passage. Sporadic settlement occurred thereafter. The discovery of gold in the 1870s later resulted in the Klondike gold rush. In 1898 it was separated from the Northwest Territories and given territorial status. The economic boost from the gold rush soon abated, and the exploitation of other minerals expanded and continued throughout the 20th century. Its economic mainstays, though, are government services and tourism.

Yukon River River, northwestern North America. Formed by the confluence of the Lewes and Pelly rivers in southwestern Yukon Territory, Can., it is 1,980 mi (3,190 km) long. It flows northwest across the Yukon border into Alaska, then southwest across central Alaska to the Bering Sea. It is the third longest river in North America; its entire course of 1,265 mi (2,035 km) in Alaska is navigable. It attracted attention following the rich gold strikes in 1896 on one of its Canadian tributaries, the Klondike River (see Klondike gold rush).

Yuma \'yü-mə\ Any of various North American Indian peoples living mostly in California and Arizona, U.S. Their languages belong to the Hokan language family. They once lived in the lower Colorado River valley and adjacent areas in Arizona, California, and Mexico. The river Yuma (including the Mojave, Yuma, and Maricopa) lived along the lower Colorado and middle Gila rivers; the upland Yuma (including the Hualapai, Havasupai, and Yavapai) inhabited western Arizona south of the Grand Canyon. The river Yuma were primarily farmers; the upland Yuma also practiced hunting and gathering. Both lacked settled villages. Yuma religion is characterized by belief in a supreme creator, faith in dreams, and ritual use of song narratives. At the turn of the 21st century, they numbered more than 4,000.

Yün-nan See Yunnan

Yung-lo emperor See Yongle emperor

Yung-ning See Nanning

Yungang \'yuən-'gäŋ\ **caves** *or* **Yün-kang caves** Series of magnificent Chinese Buddhist cave temples, created in the 5th century AD during the Northern Wei dynasty period. There are about 20 major cave temples and many smaller niches and caves, stretching for over half a mile. They are among the earliest remaining examples of the first flowering of Buddhist art in China. The predominant sculptural style is a synthesis of various foreign influences, including Persian, Byzantine, and Greek, with elements ultimately derived from the Buddhist art of India.

Yunnan \yüe-'nän\ *or* **Yün-nan** Province (pop., 2002 est.: 43,330,000), southern China. It is bordered by Vietnam, Laos, and Myanmar, Sichuan and Guizhou provinces, and Guangxi and Tibet autonomous regions. It has an area of 168,400 sq mi (436,200 sq km), and its capital is Kunming. Its population is one of China's most ethnically mixed, comprising more than 20 nationalities. The terrain is largely mountainous, especially in the north and west. It is crossed by three major river systems—the Yangtze (Chang; there known as the Jinsha), the Mekong, and the Salween—and is the source of two others—the Xi (there known as the Nanpan and Hongshui) and the Yuan. Because of its isolation, the region was independent during the historical development of China. The Mongols overran it in the 13th century. In 1855–73 it was the scene of the great Panthay (Muslim) rebellion. Part of the province was seized by the Japanese in World War II. Yunnan is now noted for its agricultural production, especially of rice, as well as for its extensive mining industry.

Yunnan See Kunming

YWCA See YMCA

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Z particle Electrically neutral carrier of the WEAK FORCE and the neutral partner of the electrically charged W PARTICLE. It is nearly 100 times more massive than the PROTON and has a lifetime of only about 10^{-25} second. Z particles were first observed in 1983 by Carlo Rubbia and Simon van der Meer at CERN. Further studies have shown a natural variation in mass that is related to the particle's lifetime through the UNCERTAINTY PRINCIPLE. Measurements show that when Z particles decay to neutrino-antineutrino pairs (see PAIR PRODUCTION), they produce only three types of lightweight neutrino, indicating that there are only three sets each of LEPTONS and QUARKS.

Zab \'zäb\ **River** Either of two tributaries of the TIGRIS RIVER. The Great Zab rises in the mountains of Kurdistan and flows about 260 mi (420 km) south and southwest through southeastern Turkey and northern Iraq, joining the Tigris below Mosul, Iraq. The Little Zab flows about 230 mi (370 m) through northwestern Iran and northern Iraq before entering the Tigris about 50 mi (80 km) below the Great Zab. The two rivers double the flow of the Tigris during the floods of March and April.

Zacatecas \ˌsä-kä-'tā-käs\ State (pop., 2000: 1,353,610), north-central Mexico. It covers an area of 28,283 sq mi (73,252 sq km); its capital is ZACATECAS city. Located within a central plateau, it is traversed by several mountain ranges; the state's average elevation is about 7,700 ft (2,350 m). Its mineral wealth was discovered soon after the Spanish conquest, and some of its mines date from the mid-16th century. Agriculture, livestock raising, and meat processing are also important to the economy.

Zacatecas City (pop., 2000: 113,947), capital of ZACATECAS state, Mexico. It lies in a deep, narrow ravine about 8,200 ft (2,500 m) above sea level. Founded in 1548, two years after silver was discovered in the area, it was given city status in 1585. Until the 19th century, the mines around Zacatecas yielded one-fifth of the world's silver. Mining is still important to the economy, but the city is also a commercial and manufacturing centre and is noted for its cathedral. The extensive Indian ruins of Chicomóztoc are nearby, southwest of the city.

zaddik See TZADDIQ

Zadkine \zäd-'kēn**, Ossip** (b. July 14, 1890, Smolensk, Russia—d. Nov. 25, 1967, Paris, France) Russian-born French sculptor. Educated in England, he moved to Paris in 1909 and studied at the École des Beaux-Arts. Influenced by both CUBISM and Classical Greek sculpture, he developed a unique figurative style featuring concave and convex forms, lines, and parallel planes. During World War II he taught at New York City's Art Students League. His large bronze *To a Destroyed City* (1951–53), an homage to Rotterdam, is regarded as a masterpiece. In 1950 he received the grand prize for sculpture at the Venice Biennale, and in the 1960s he received commissions for statues in Jerusalem, Amsterdam, and elsewhere.

Zadokite Fragments See DAMASCUS DOCUMENT

Zaghlūl \zag-'lül**, Sa'd** (b. July 1857, Ibyānah, Egypt—d. Aug. 23, 1927, Cairo) Egyptian statesman. He initially cooperated with the British occupation of Egypt, but his attitude changed on his election to the Legislative Assembly in 1912. Britain declared martial law, established a protectorate, and dissolved the assembly during World War I (1914–18), after which he led a delegation (Arabic: *wafd*) that demanded recognition as the people's representatives and called for abolition of the British protectorate. When these requests were turned down, widespread disorder broke out that was not quelled even when Zaghlūl, who had been deported to Malta, was brought back and was elected prime minister at the head of the Wafd party in 1924. He resigned after a year of violent unrest but later served as president of the Chamber of Deputies, where he was able to exercise some control over his more extreme followers.

Zagreb \'zä-ˌgreb\ City (pop., 2001: 691,724), capital of CROATIA. It was first mentioned in 1093, when a Roman Catholic bishopric was established there. In medieval times the area contained a civil and an ecclesiastical settlement. Rivals until the 19th century, they were joined when a spate of new building occurred and expanded onto the SAVA RIVER floodplain. At the time of the Croatian national revival in the 19th century, Zagreb was the centre of both a pan-Yugoslav movement and a Croatian independence movement. During the civil war following Croatia's secession from Yugoslavia in 1991, Zagreb sustained heavy damage. It is Croatia's principal industrial centre. It is also the seat of the Academy of Sciences and Arts and of the University of Zagreb (1669).

Zagreus \'zä-grē-əs, 'za-grē-əs\ In GREEK MYTHOLOGY, the son of ZEUS and his daughter PERSEPHONE. Zeus intended to make Zagreus his heir and bestow on him unlimited power, but a jealous HERA urged the TITANS to attack the child. They tore Zagreus to pieces and consumed all but his heart, which ATHENA managed to save and bring to Zeus, who swallowed it. Zeus then begot a son with SEMELE, and this child, made from the heart of Zagreus, was DIONYSUS.

Zaharias \zə-'har-ē-əs**, Babe Didrikson** *or* **Babe Didrikson** *orig.* **Mildred Ella Didrikson** (b. June 26, 1911, Port Arthur, Texas, U.S.—d. Sept. 27, 1956, Galveston, Texas) U.S. athlete who excelled in several sports. She became a remarkable performer in basketball and track and field and later a leading golfer. In 1930–32 she was a member of the women's All-America basketball team. During the same period she also won eight events and tied in a ninth in national championship competition in track and field. In the 1932 Olympics she won gold medals in the 80-m hurdles and javelin throw; she was deprived of the high-jump gold medal for using a then-unorthodox method. As a golfer from 1946, she won numerous championships, including the U.S. and British women's amateur tournaments (1946, 1947) and the U.S. Women's Open (1948, 1950, 1954).

zaibatsu \zī-'bät-sü\ *Japanese* **"wealthy clique"** Large capitalist enterprises of pre-World War II Japan, similar to CARTELS or trusts but usually organized around a single family. One *zaibatsu* might operate companies in many areas of economic importance; all *zaibatsu* owned their own banks, which they used as a means for mobilizing capital. After the war the *zaibatsu* were dissolved: stock owned by the parent companies was put up for sale and individual companies were freed from the control of parent companies. After the signing of the peace treaty in 1951, many companies began associating into what became known as enterprise groups; these differed from *zaibatsu* primarily in the informal manner that characterized policy coordination and in the limited degree of financial interdependency between member companies. Modern-day *keiretsu* are similar.

za'īm \zä-'ēm\ Political leader, either an officeholder or power broker. The term has been used especially in Lebanon, where it designated the power brokers of the various sectarian communities.

Zaire See Democratic Republic of the CONGO

Zaire River See CONGO RIVER

Zama \'zā-mə**, Battle of** (202 BC) Engagement in which the Romans under SCIPIO AFRICANUS THE ELDER decisively defeated the Carthaginians led by HANNIBAL, ending the Second PUNIC WAR. As the Romans marched on Carthage, Hannibal returned from Italy to defend the city. He was overwhelmed by a combined force of Romans and Numidians under MASINISSA. Carthage ceded Spain to Rome, gave up most of its ships, and began paying a 50-year indemnity to Rome.

Zambezi \zam-'bē-zē\ **River** River, south-central Africa. It rises in northwestern Zambia, flows south across eastern Angola and western Zambia to the border of Botswana, then turns east and forms the Zambia-Zimbabwe border. It then crosses central Mozambique and empties into the MOZAMBIQUE CHANNEL at Chinde. About 2,200 mi (3,500 km) long, it is navigable in three long stretches, separated by rapids and by VICTORIA FALLS. It drains the entire south-central region of the continent. Its many tributaries include the KWANDO, KAFUE, and SHIRE. It was explored by DAVID LIVINGSTONE in the early 1850s.

Zambia *officially* **Republic of Zambia** *formerly* **Northern Rhodesia** Landlocked country, south-central Africa. Area: 290,585 sq mi (752,612 sq km). Population (2005 est.): 11,262,000. Capital: LUSAKA. The population is composed almost entirely of BANTU-speaking African ethnic groups. Languages: English (official); some 80 local languages are also spoken. Religions: Christianity (Protestant, other Christians, Roman Catholic); also traditional beliefs, Islam. Currency: kwacha. The country consists of a high plateau through which the ZAMBEZI (including VICTORIA FALLS), KAFUE, and Luangwa rivers flow. Lakes MWERU and TANGANYIKA touch

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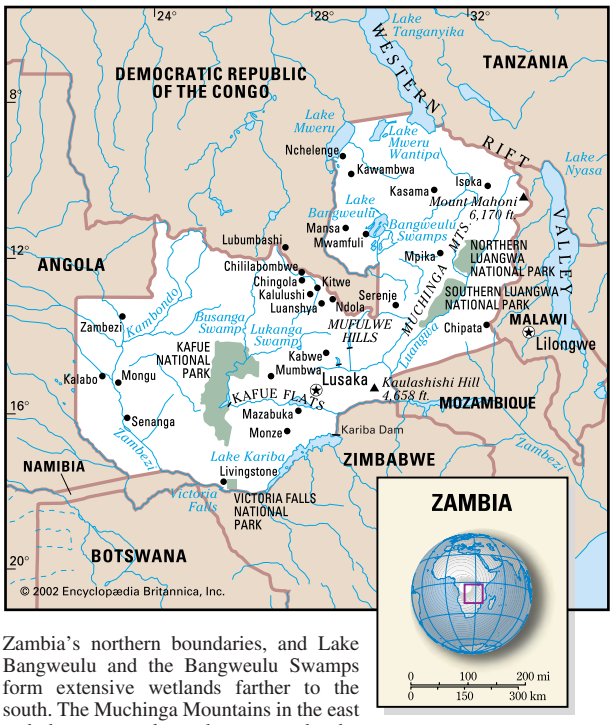

Zambia's northern boundaries, and Lake Bangweulu and the Bangweulu Swamps form extensive wetlands farther to the south. The Muchinga Mountains in the east and the ranges along the eastern border have the highest elevations in the country. There are forests of Zambezi teak in the southwest. Zambia's economy depends heavily on the production and export of copper. Other important mineral resources include lead, zinc, cobalt, coal, and gold. Agriculture also is important. There is some manufacturing. Zambia is a republic with one legislative house; its head of state and government is the president. Ancestors of the Tonga reached the region early in the 2nd millennium AD, but other peoples from Congo (Kinshasa) and Angola reached the country only in the 17th–18th century. Portuguese trading missions were established early in the 18th century. Emissaries of CECIL RHODES and the British South Africa Company concluded treaties with most of the Zambian chiefs during the 1890s. The company administered the region known as Northern Rhodesia until 1924, when it became a British protectorate. It was part of the Central African Federation of Rhodesia and Nyasaland in 1953–63. In 1964 Northern Rhodesia became independent as the Republic of Zambia. A constitutional amendment enacted in 1991 allowed opposition parties. However, the country continued to experience political tension and government corruption.

Zamboanga \ˌzäm-bō-ˈwäŋ-gä\ Port city (pop., 2000: 601,794), western MINDANAO, Philippines. Founded in 1635 as a fort by the Spanish, it later became the chief market of the southern Philippines. In World War II it was a Japanese defense headquarters and was taken by U.S. troops in 1945. It exports rubber, pearls, copra, and mahogany and is a centre for Moro brass ware and bronze ware. It is also a tourist resort.

Zamora, Niceto Alcalá See Niceto ALCALÁ ZAMORA

Zamyatin \ˌzə-ˈmya-tʲin**, Yevgeny (Ivanovich)** *or* **Yevgeny Zamiatin** (b. Feb. 1, 1884, Lebedyan, Tambov province, Russia—d. March 10, 1937, Paris, France) Russian novelist, playwright, and satirist. Educated as a naval engineer, he combined a scientific career with writing. A chronic dissenter, he was a Bolshevik before the Russian Revolution of 1917 but disassociated himself from the party afterward. His ironic criticism of literary politics kept him out of official favour. His most ambitious work, the novel *We* (1924; banned in the Soviet Union until 1989), was the first anti-utopian novel and the literary ancestor of ALDOUS HUXLEY's *Brave New World* and GEORGE ORWELL's *Nineteen Eighty-four*.

Zande \ˈzan-dē\ *or* **Azande** \ə-ˈzan-dē\ People of central Africa who live in The Sudan, Congo (Kinshasa), and Central African Republic. They speak an Adamawa-Ubangi language of the Niger-Congo family. They occupy widely scattered family homesteads, subsisting through agriculture and hunting. Patrilineal CLANS are numerous. Witchcraft, magic, and divination are major features of social life. The Zande number about 3.8 million.

Zangwill \ˈzaŋ-gwil**, Israel** (b. Feb. 14, 1864, London, Eng.—d. Aug. 1, 1926, Midhurst, West Sussex) English novelist, playwright, and Zionist leader. The son of eastern European immigrants, Zangwill drew on his own experience in *Children of the Ghetto* (1892), which aroused great interest. His *The King of Schnorrers* (1894) is a picaresque novel about an 18th-century rogue, and *Dreamers of the Ghetto* (1898) contains essays on famous Jews. The metaphor of America as a crucible wherein various nationalities are transformed into a new race comes from his play *The Melting Pot* (1908). He is remembered as one of the earliest English interpreters of Jewish immigrant life.

Zanuck \ˈza-nək**, Darryl F(rancis)** (b. Sept. 5, 1902, Wahoo, Neb., U.S.—d. Dec. 22, 1979, Palm Springs, Calif.) U.S. film producer and executive. He worked as a steelworker, garment factory foreman, and a professional boxer while pursuing his career as a writer, and in 1924 he was hired as a screenwriter for Warner Brothers. After writing scripts for more than 35 movies, he was made a producer. He promoted the conversion to sound by producing *The Jazz Singer* (1927). In 1933 he cofounded Twentieth Century Pictures, which soon merged with the Fox Film Corp. As the controlling executive of TWENTIETH CENTURY-FOX, he produced films such as *The Grapes of Wrath* (1940), *Gentleman's Agreement* (1947), and *Viva Zapata!* (1952). He resigned in 1956, but he returned as president in 1962 to effect the company's financial recovery with hits such as *The Longest Day* (1962), *The Sound of Music* (1965), and *Patton* (1970). He retired as chairman in 1971.

Zanzibar Chief island (pop., 2002: 622,459) of Tanzania. Located in the Indian Ocean off the coast of east-central Africa, it has an area of 637 sq mi (1,651 sq km). Zanzibar city (pop., 2002: 205,870), the island's principal port and commercial centre, is on the western side. Both Zanzibar and Pemba islands are believed to have once formed part of the African continent. In the late 17th century, Zanzibar came under the control of Omani Arabs, and the sultan of Oman made Zanzibar city his capital in 1832. In 1861 Zanzibar was separated from Oman and became an independent sultanate. Under Sultan Barghash (r. 1870–88), most of the mainland territories were lost to European powers. In 1890 the British proclaimed a protectorate over Zanzibar and Pemba islands. In 1963 the sultanate regained its independence and became a member of the COMMONWEALTH. The sultanate was overthrown in 1964, and a republic was established. It then joined with Tanganyika to form the Republic of Tanzania. The economy depends on agriculture and fishing.

Zapata \sä-ˈpä-tä**, Emiliano** (b. Aug. 8, 1879, Anenecuilco, Mex.—d. April 10, 1919, Morelos) Mexican revolutionary and champion of the rural poor. A mestizo peasant, he was orphaned at age 17 and took responsibility for his brothers and sisters. He led his neighbours in protests against the hacienda that had appropriated their land and eventually led them in taking the land by force. He organized a small force to help FRANCISCO MADERO unseat PORFIRIO DÍAZ. Dissatisfied with the pace of LAND REFORM under Madero, Zapata led a guerrilla campaign that took land back from the haciendas and returned it to the communal Indian *EJIDO*s. He was instrumental in the defeat of Gen. VICTORIANO HUERTA after Huerta deposed and assassinated Madero. With PANCHO VILLA he occupied Mexico City and began to implement land reform, but he was tricked, ambushed, and killed by the forces of VENUSTIANO CARRANZA, whom the U.S. had recognized as president.

Zapata, 1912
ARCHIVO CASASOLA

Zapopan \ˌsä-pō-ˈpän\ City (pop., 2000: 910,690), north-central JALISCO state, west-central Mexico. Located in the Guadalajara River valley, it is

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a commercial and manufacturing centre for an agricultural area that produces corn, sugarcane, cotton, fruits and vegetables, and livestock. Beekeeping and tourism also contribute to the economy. The 17th-century Basilica of Zapopan is the site of annual pilgrimages.

Zaporizhzhya \ˌzäp-ə-'ri-zhə\ *formerly (until 1921)* **Aleksandrovsk** City (pop., 2001: 815,000), on the Dnieper River in southeastern Ukraine. In 1770 the fortress of Aleksandrovsk was built to ensure government control over the Zaporizhzhya Cossacks, whose headquarters were nearby. The settlement became a town in 1806. The city expanded during the 1927–32 construction of the Dnieper hydroelectric station, then the largest in the world. The dam was destroyed in World War II but was later rebuilt. Zaporizhzhya has a major iron and steel plant; automobiles are also manufactured.

Zapotec \ˌzä-pə-'tek\ Indian population living in the state of Oaxaca, southern Mexico. Early Zapotec civilization, centred on Monte Albán (near the modern city of Oaxaca), produced the first writing in Mesoamerica and devised the 52-year round calendar later borrowed by other groups. Present-day traditional Zapotec society is largely agricultural, and members practice shifting cultivation. The major crafts include pottery and weaving. The Zapotecs profess Roman Catholicism, but belief in spirits and myths persists. See also Mesoamerican civilization.

Zara, Siege of (1202) Major episode of the Fourth Crusade, the first attack on a Christian city by a Crusading army. Zara (modern Zadar, Cro.), a vassal city of Venice, had rebelled and placed itself under Hungary's protection in 1186. Over the objections of Pope Innocent III, the Venetians diverted the Fourth Crusade from Palestine and Egypt, using financial pressure to persuade the Crusaders to besiege Zara. The city soon surrendered, and the army went on to attack Constantinople in 1203–04.

Zaragoza \ˌzä-rä-'gō-sä\ *or* **Saragossa** \ˌsar-ə-'gä-sə\ City (pop., 2001: 614,905), northeastern Spain. The capital of the Aragon autonomous community (*comunidad autónoma*), Zaragoza is located on the southern bank of the Ebro River. The Celtiberian town of Salduba at the site was taken by the Romans at the end of the 1st century BC and made a colony named Caesaraugusta, from which its present name derives. It became an episcopal see in the 3rd century AD, and it was taken by the Moors c. 714. It was the capital of the kingdom of Aragon from the 12th to the 15th century. It underwent two sieges (1808–09) by the French, which were commemorated in Lord Byron's *Childe Harold*. It is an industrial centre and the site of the annual National Trade Fair. Notable buildings include Romanesque and Gothic churches and palaces. Its university was founded in 1474.

Zarathustra See Zoroaster

Zaria \'zär-ē-ə\ *formerly* **Zazzau** Historic kingdom and traditional emirate, northern Nigeria. It was founded in the 11th century and was the southernmost of the original seven Hausa Bakwai states. Islam was introduced c. 1456, and there were Muslim Hausa rulers in the early 16th century. A Songhai warrior conquered Zazzau c. 1512. By the end of the century it was renamed Zaria and was in decline. It became a tributary state (c. 1734–1804) of the Bornu kingdom. In 1804 it came under the Fulani Muslims. The Zaria emirate was created in 1835. It remains one of Nigeria's largest traditional emirates, and it is one of the nation's leading producers of cotton for export.

Zarlino \dzär-'lē-nō**, Gioseffo** (b. March 22, 1517, Chioggia, Rep. of Venice—d. Feb. 14, 1590, Venice) Italian music theorist and composer. In 1541 he was ordained a deacon and moved to Venice to study music with Adrian Willaert (c. 1490–1562). He later took over as chapel master at San Marco Basilica. His influential treatise *Le institutioni harmoniche* (1558) argued for more stringent control of dissonance (while accepting several previously dissonant intervals as consonances) and stricter adherence to unity of mode in a composition. In *Dimonstrationi harmoniche* (1571) he renumbered the church modes, starting with C instead of the traditional A, thus acknowledging the growing relevance of tonality.

zarzuela \ˌzär-'zwā-lə\ Spanish musical play consisting of spoken dialogue, songs, choruses, and dances. Zarzuela originated in the 1650s as an aristocratic entertainment, the first being performed at the royal residence of La Zarzuela near Madrid. The principal early composer was Juan Hidalgo (1614–85); early librettists included Lope de Vega and Pedro Calderón de la Barca. As Italian opera rose in popularity in the 18th century, the zarzuela adopted aspects of *opera seria* style but suffered a decline. It was revived c. 1840 as a satirical treatment of everyday life incorporating folk music, dance, and improvisation. Since 1940 few new works have been written.

Zátopek \'tsä-tō-ˌpek**, Emil** (b. Sept. 19, 1922, Kopřivnice, Czech.—d. Nov. 22, 2000, Prague, Cz.Rep.) Czech long-distance runner. He won his first Olympic gold medal in 1948 in the 10,000-m race. At the 1952 Olympics he won gold medals in the 5,000-m, 10,000-m, and marathon. From the mid-1940s to the mid-1950s he set 18 world records, and he held the record for the 10,000-m from 1949 to 1954.

zazen \'zä-'zen\ Sitting meditation as practiced in Zen Buddhism. The disciple sits in a quiet room, breathing rhythmically and easily, with legs fully or half crossed, spine and head erect, hands folded one palm above the other, and eyes open. Logical, analytic thinking is suspended, as are all desires, attachments, and judgments, leaving the mind in a state of relaxed attention. The practice was brought to prominence by Dogen, who considered it not only to be a method of moving toward enlightenment but also, if properly experienced, to constitute enlightenment itself. See also koan.

Zealand See Sjaelland

Zeami \zā-'ä-mē\ *or* **Seami** *or* **Kanze Motokiyo** (b. 1363, Japan—d. Sept. 1, 1443, Kyōto?) Japanese playwright and theorist of the *nō* theatre. Under the patronage of the shogun Ashikaga Yoshimitsu, Zeami joined with his father, Kan'ami (1333–84), to create the *nō* theatre in its present form. He is credited with about 90 (and most of the greatest) of the approximately 230 plays in the present repertoire. In treatises written as manuals for his pupils, notably *Fushi kaden* (1400–18; "The Transmission of the Flower of Acting Style"), he set forth principles of *nō* theatre that were followed for centuries.

zebra Any of three species of black-and-white-striped equines that subsist almost entirely on grass. Zebras stand 47–55 in. (120–140 cm) tall. The Burchell's zebra, or bonte quagga (*Equus quagga*), of eastern and southern African grasslands, has wide, widely spaced stripes. Grevy's zebra (*E. grevyi*), of arid areas in Kenya, Ethiopia, and Somalia, has narrow, closely spaced stripes and a white belly. The small mountain zebra (*E. zebra*), of dry upland plains in Namibia and western South Africa, has a gridlike pattern on the rump. Small zebra groups consisting of a stallion and several mares and foals may coalesce into large herds but retain their identity.

Burchell's zebra, or bonte quagga (*Equus quagga*)
LEONARD LEE RUE III

zebra fish Any member of two unrelated groups of fishes: freshwater species in the genus *Brachydanio* (family Cyprinidae) and saltwater species in the genus *Pterois* (family Scorpaenidae). The zebra danio (*Brachydanio rerio*), a popular freshwater aquarium fish originally from Asia, grows to about 1.5 in. (4 cm) long and has dark blue and silvery longitudinal stripes. The distinctive saltwater zebra fishes (*Pterois*), used in marine aquariums, have extremely large pectoral fins, numerous extremely poisonous spines, and colourful vertical stripes. Some species are more commonly known as lionfish and turkeyfish.

zebra mussel Either of two species of tiny mussels (genus *Dreissena*) that are prominent freshwater pests. They proliferate quickly and adhere in

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great numbers to virtually any surface. The voracious mussels disrupt food webs by wiping out PHYTOPLANKTON, and their massive clustering on water-intake valves and pipes, bridge abutments, and other structures can cause severe commercial damage. They made their first known attack on Europe in the early 19th century and were carried (probably in ship water ballasts) to North America c. 1986; their invasion of all the Great Lakes has had devastating effects on the lakes' native mussel and fish populations.

zebu See BRAHMAN

Zechariah \ˌzek-ə-ˈrī-ə\ (fl. 6th century BC) One of the 12 Minor Prophets of the Hebrew scriptures, whose prophecies are recorded in the book of Zechariah. (The work is part of a larger book, The Twelve, in the Jewish canon.) His visions concern the return of the Jews to Jerusalem after the BABYLONIAN EXILE, the rebuilding of the Temple of JERUSALEM, and the world's recognition of Israel's God. The book also includes his apocalyptic visions of the end of time.

Zedillo \sā-ˈdē-yō\ **(Ponce de León), Ernesto** (b. Dec. 27, 1951, Mexico City, Mex.) President of Mexico (1994–2000). Raised in a working-class family, he joined Mexico's ruling party in 1971 and earned a Ph.D. in economics from Yale University. As secretary of the Ministry of Programming and Budget, he controlled Mexico's huge foreign debt, reduced inflation, and balanced the budget. Elected president after the assassination of the original PRI (Institutional Revolutionary Party) candidate, Luis Donaldo Colosio, he undertook reforms to reduce poverty, root out corruption, and continue democratizing the electoral system. His devaluation of the peso in 1994 led to an economic crisis that was turned around with massive U.S. aid. A rebellion in CHIAPAS plagued his administration, which was charged with human-rights abuses in that region.

Zee, James Van Der See James VAN DER ZEE

Zeeman \ˈzā-ˌmän\ **effect** Splitting of a spectral line (see SPECTRUM) into two or more lines of different FREQUENCIES. The effect occurs when the light source is placed in a MAGNETIC FIELD. It has helped identify the energy levels in atoms; it also provides a means of studying atomic nuclei and electron paramagnetic resonance (see MAGNETIC RESONANCE) and is used in measuring the magnetic field of the Sun and other stars. It was discovered in 1896 by Pieter Zeeman (1865–1943); he shared the second Nobel Prize for Physics (1902) with HENDRIK ANTOON LORENTZ, who had hypothesized that a magnetic field would affect the frequency of the light emitted.

Ẕefat \ˈtse-ˌfät\ City (pop., 2004 est.: 27,300), northern ISRAEL. Located near Lake TIBERIAS (Sea of Galilee), it is one of the four holy cities of JUDAISM. It was fortified in the 1st century AD by FLAVIUS JOSEPHUS and in the Middle Ages by the Crusaders (see CRUSADES). It was the seat of an important school of Jewish mysticism (see KABBALA) in the 16th century, and it became part of the modern State of Israel in 1948. It is now an artists' colony, with an economy based on light industry and tourism.

Zeffirelli \ˌze-fə-ˈre-lē**, Franco** *orig.* **Gianfranco Corsi** (b. Feb. 12, 1923, Florence, Italy) Italian director, producer, and stage designer. In 1946 he joined LUCHINO VISCONTI's Morelli-Stoppa Co. as an actor and stage director. After serving as Visconti's assistant on films such as *La terra trema* (1948), he turned to stage design. His major operatic productions, noted for their visual richness, began with *L'Italiana in Algeri* (1952–53) and include *Lucia di Lammermoor* (1959) and *La Bohème* (1963, 1981), among many others; he directed films of *La traviata* (1983) and *Otello* (1986). His other films include *The Taming of the Shrew* (1967), *Romeo and Juliet* (1968), *Endless Love* (1981), *Jane Eyre* (1996), and *Tea with Mussolini* (1999).

Zeiss \ˈtsīs,\ *English* \ˈzīs**, Carl** (b. Sept. 11, 1816, Weimar, Thuringian States—d. Dec. 3, 1888, Jena) German industrialist. In 1846 Zeiss opened a workshop for producing microscopes and other optical instruments. He later formed a partnership with the physicist and mathematician Ernst Abbe (1840–1905). The chemist Otto Schott developed about 100 new kinds of optical glass and numerous types of heat-resistant GLASS for the company. After Zeiss's death, Abbe donated the firm and his share in the glassworks to the Carl Zeiss Foundation; in 1923 Schott added his share in the glassworks.

Zemes māte \ˈze-mes-ˈmä-te\ In BALTIC RELIGION, the female aspect of nature and the source of all life. Together with DIEVS, she stimulates and protects the power of life. Libations of beer were offered to her at the opening of every festival, and bread, ale, and herbs were buried in the ground, thrown into rivers and lakes, or tied to trees in her honour. Her various functions were eventually assumed by demigoddesses of forests, fields, stones, animals, water, and, in the Christian era, by the Virgin MARY.

zemstvo \ˈzemst-və\ *plural* **zemstvos** Rural elected assembly in the Russian Empire. Established by Tsar ALEXANDER II in 1864 to provide social and economic services, the zemstvos became a liberal influence in imperial Russia. The assemblies, formed at the district and province levels, were composed of delegates representing the landed proprietors and the peasant village communes. They expanded education, improved roads, and provided health care. From the 1890s they agitated for constitutional reform, and they stimulated activity in the Russian Revolutions of 1905 and 1917 (see RUSSIAN REVOLUTION OF 1905; RUSSIAN REVOLUTION OF 1917). They were abolished after the BOLSHEVIKS came to power. The term *zemstvo* also refers to a 16th-century institution for tax collection.

Zen Important school of BUDDHISM that claims to transmit the experience of enlightenment achieved by the BUDDHA Gautama. Arising as Chan in China in the 6th century (introduced by BODHIDHARMA), it divided into two schools, the Southern school, which believed in sudden enlightenment, and the Northern school, which believed in gradual enlightenment. By the 8th century only the Northern school survived. Zen developed fully in Japan by the 12th century and had a significant following in the West by the later 20th century. Zen teaches that the potential to achieve enlightenment is inherent in everyone but lies dormant because of ignorance. It is best awakened not by the study of scripture, the practice of good deeds, rites and ceremonies, or worship of images, but by breaking through the boundaries of mundane logical thought. Methods employed vary among different schools and may emphasize the practice of ZAZEN (in the Soto school), the use of KOANS (in the Rinzai school), or the continual invocation of Amida (in the Obaku school; see AMITABHA).

Zend-Avesta See AVESTA

Zeng Guofan *or* **Tseng Kuo-fan** \ˈdzən-ˈgwō-ˈfän\ (b. Nov. 26, 1811, Xiangxiang, Hunan province, China—d. March 12, 1872, Nanjing) Chinese military leader most responsible for suppressing the TAIPING REBELLION, thus staving off the collapse of the QING DYNASTY. Having passed the highest examinations in the CHINESE EXAMINATION SYSTEM, Zeng entered the HANLIN ACADEMY and worked successfully as a bureaucrat. In 1852 he was asked to help combat the Taiping rebels, who had reached the Yangtze River (Chang Jiang) valley and were threatening the dynasty's survival. The imperial troops being weak, Zeng and other members of the scholar-gentry organized local militias. His army seized the rebels' supply areas along the upper Yangtze and besieged and captured their capital, Nanjing, in 1864. In 1865 he was called on to help suppress the NIAN REBELLION; a year later he asked that LI HONGZHANG take over the campaign. See also ZHANG ZHIDONG.

Zenger, John Peter (b. 1697, Germany—d. July 28, 1746, New York, N.Y.) German-born U.S. printer and journalist. He immigrated to New York at age 13 and was indentured to a printer before starting his own printing business (1726). In 1733 he began publishing the *New York Weekly Journal*. Arrested for libel in 1734 for his attacks on the policies of the colonial governor, he was acquitted on the grounds that his charges were based on fact (a key consideration in libel cases since that time). It was the first important victory for freedom of the press in Britain's North American colonies.

Zeno \ˈzē-nō\ *orig.* **Tarasicodissa** (b. Isauria, Diocese of the East—d. April 9, AD 491) Eastern Roman emperor (474–491). A military leader, he married the daughter of Emperor Leo I (c. 466), and their son reigned briefly as Leo II (474). On the boy's early death, Zeno became emperor. Obliged to flee to Isauria to escape a coup d'état, he returned to Constantinople in 476. He made peace with the VANDALS in Africa, put down a rebellion in Asia Minor (484), and persuaded the OSTROGOTHS to leave the Eastern Empire by making THEODORIC king of Italy (489). Seeking to reconcile orthodox Christians and MONOPHYSITES, he caused a schism with Rome (484–519).

Zeno of Citium \ˈzē-ˌnō...ˈsi-sh(ē-)əm\ (b. c. 335, Citium, Cyprus—d. c. 263 BC, Athens) Greek philosopher, founder of STOICISM. He went to Athens c. 312 BC and attended lectures by the Cynics Crates of Thebes (fl. late 4th century BC) and Stilpon of Megara (c. 380–300 BC), as well as lectures at the Academy. He began to teach in the Stoa Poikile ("Painted Colonnade"), whence the name of his philosophy. His system included logic, epistemology, physics, and ethics. He taught that happiness lies in conforming the will to the divine reason, which governs the universe. In

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logic and epistemology he was influenced by Antisthenes (c. 445–365 BC) and Diodorus Cronus (fl. 4th century BC), in physics by HERACLEITUS. Only fragmentary quotations from his many treatises have survived.

Zeno of Elea \'ē-lē-ə\ (b. c. 495—d. c. 430 BC) Greek philosopher and mathematician. He was called by ARISTOTLE the inventor of dialectic. He is best known for his paradoxes (see PARADOXES OF ZENO). As a pupil and friend of PARMENIDES, he took it upon himself to reply to those who asserted that his master's doctrine of "the one" (i.e., indivisible reality) was inconsistent (see MONISM); he tried to show that the assumption of the existence of "the many" (i.e., a plurality of things in time and space) carried with it more serious inconsistencies.

Zenobia \zə-'nō-bē-ə\ *in full* **Septimia Zenobia** (d. AD after 274) Queen of the Roman colony of PALMYRA (267/268–272). Her husband, a Roman client ruler of Palmyra, was assassinated after recapturing several of Rome's eastern provinces from the Persians. She became her son's regent but called herself queen. In 269 she seized Egypt and much of Asia Minor and declared her independence from Rome. AURELIAN defeated her armies and besieged Palmyra; she and her son were captured and taken to Rome (272), where she was paraded in Aurelian's TRIUMPH.

Zenobia, portrait bust; in the Vatican Museum, Rome
ANDERSON-GIRAUDON FROM ART RESOURCE

zeolite \'zē-ə-ˌlīt\ Any member of a family of hydrated aluminosilicate minerals that have a framework structure enclosing interconnected cavities occupied by large metal cations (positively charged ions)—generally sodium, potassium, magnesium, calcium, and barium—and water molecules. The ease of movement of ions and water within the framework allows reversible dehydration and cation exchange, properties that are exploited in water softeners and molecular sieves for pollution control, among other uses.

zeolitic facies \ˌzē-ə-'li-tik-'fā-shēz\ One of the major divisions of the mineral facies classification of METAMORPHIC ROCKS, encompassing rocks that formed at the lowest temperatures and pressures associated with regional metamorphism. Typical minerals in these facies include the ZEOLITES, ALBITE, and QUARTZ.

Zephaniah (fl. 7th century BC) One of the 12 Minor Prophets of the Hebrew scriptures, traditional author of the book of Zephaniah. (The work is part of a larger book, The Twelve, in the Jewish canon.) He prophesied in the reign of JOSIAH, denouncing the worship of foreign gods, which suggests that he preached before the reforms instituted by Josiah. His dominant theme is the coming "day of the Lord," a time of divine judgment for Judah's sins.

zeppelin Rigid AIRSHIP of a type designed by the German builder Ferdinand, Graf (count) von Zeppelin (1838–1917). It was a cigar-shaped, trussed, and covered frame supported by internal gas cells, below which hung two external cars with an engine geared to two propellers. The first zeppelin flew in 1900. In World War I zeppelins were used as bombers by Germany. In 1928 the *Graf Zeppelin* inaugurated transatlantic flight service; it had completed 590 flights by 1937, when the *HINDENBURG* DISASTER halted such flights.

zero NUMBER and numeral of critical importance in mathematics. Zero is known as the additive identity because adding it to any number does not change the number's identity, or value. The product of zero and any number is zero; for most number systems the converse is true—that is, if the product of two numbers is zero, at least one of them must equal zero. The latter property is fundamental to the solution of nearly every problem in mathematics. Division by zero is undefined; efforts to deal with such divisions led to CALCULUS. Various punctuation marks were first used in Mesopotamia beginning about 700 BC to indicate an empty space in positional notation, but never at the end of a number—the difference between, say, 78 and 780 had to be understood from the context. PTOLEMY first used 0, or the Greek letter omicron "o," as an empty placeholder, including at the end of a number, to express data in the Babylonian sexagesimal system in his astronomical treatise *Almagest* (c. 130 AD). The HINDU-ARABIC NUMERALS and treatment of zero as a number developed between the 6th and 9th centuries in India. Zero soon followed trade routes to China, the Islamic world, and Europe.

Zero *in full* **Mitsubishi A6M Zero** Japanese FIGHTER AIRCRAFT of World War II. A single-seat, low-wing monoplane made by Mitsubishi, it was introduced in 1940, the 2,600th anniversary of the crowning of Japan's legendary first emperor, JIMMU, and named for the "zero-year" celebration. It had a top speed of 350 mph (565 kph) at nearly 20,000 ft (6,000 m). When it first appeared, it could outmaneuver every plane it encountered; Allied fighters could not defeat it until 1943. Many Zeros became KAMIKAZE craft in the war's closing months.

zero-point energy Vibrational energy retained by molecules even at a temperature of ABSOLUTE ZERO. Since temperature is a measure of the intensity of molecular motion, molecules would be expected to come to rest at absolute zero. However, if molecular motion were to cease altogether, the atoms would each have a precisely known location and VELOCITY (zero), and the UNCERTAINTY PRINCIPLE states that this cannot occur, since precise values of both position and velocity of an object cannot be known simultaneously. Thus, even molecules at absolute zero must have some zero-point energy.

Zeroual \zer-'wäl**, Liamine** (b. July 3, 1941, Batna, Alg.) President of Algeria (1994–99). After a military education, he rose through the ranks to become chief of land forces in 1989 and defense minister in 1993. In 1994 he was appointed transitional president by the military-dominated High Council of State, which had taken over the government after elections were canceled in 1992 and Pres. MOHAMED BOUDIAF was assassinated. Elected for a full term in 1995, he was replaced in 1999 by Abdelaziz Bouteflika.

Zetkin \'tset-kən**, Clara** *orig.* **Clara Eissner** (b. July 5, 1857, Wiederau, Saxony—d. June 20, 1933, Arkhangelskoye, Russia, U.S.S.R.) German communist leader. She joined the Social Democratic Party in 1881, and she later married a Russian revolutionary exile, Ossip Zetkin (1848–89). From 1892 she edited the Socialist women's newspaper *Die Gleichheit* ("Equality") in Stuttgart. A friend of VLADIMIR LENIN and ROSA LUXEMBURG, Zetkin was a cofounder of the SPARTACISTS (1916) and later joined the new Communist Party of Germany (1919). In 1921 she was elected to the presidium of the Third International (see COMINTERN). Her influence waned after Lenin's death in 1924.

Zeus \'züs\ In GREEK RELIGION, the chief deity of the pantheon, a sky and weather god. His Roman counterpart was JUPITER. Zeus was regarded as the bearer of thunder and lightning, rain, and winds, and his traditional weapon was the thunderbolt. The son of CRONUS and RHEA, he was fated to dethrone his father. He divided dominion over the world with his brothers POSEIDON and HADES. As ruler of heaven, Zeus led the gods to victory against the TITANS. From his home atop Mount OLYMPUS, he dispensed justice and served as protector. Known for his amorousness—a source of perpetual discord with his wife, HERA—he had many love affairs with mortal and immortal women, giving rise to numerous offspring, including APOLLO, ARES, ARTEMIS, ATHENA, DIONYSUS, HELEN, HEPHAESTUS, and PERSEPHONE. In art he was represented as a bearded, dignified, and mature man.

Zeus hurling a thunderbolt, bronze statuette from Dodona, Greece, early 5th century BC; in the Staatliche Museen zu Berlin, Germany
COURTESY OF THE STAATLICHE MUSEEN ZU BERLIN, ANTIKENABTEILUNG

Zeuxis \'zük-səs\ (fl. late 5th century–early 4th century BC, Heraclea, Magna Graecia) Greek painter. Though none of his work survives, his style and subject matter were recorded by ancient writers. He advanced the trend toward illusionism through the use of shadow to produce a rudimentary form of CHIAROSCURO. Apparently he was a panel painter rather than a wall painter. He preferred small compositions, often a single figure; his subjects were gods and heroes and such genre figures as an old woman, an athlete, and a still life.

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Zhang Daoling *or* **Chang Tao-ling** \'jäŋ-'daù-'liŋ\ (b. AD 34?, Pei, Jiangsu province, China—d. 156?, Hanzhong) Founder and first patriarch of organized religious Daoism. Zhang composed a Daoist work that attracted many followers among Chinese and indigenous groups in Sichuan. Like contemporary Daoists, he promised longevity and physical immortality, but, unlike others, he emphasized the importance of religious organization. He founded the FIVE PECKS OF RICE movement. Zhang, his son, and his grandson are known as the Three Zhangs. While the DAODEJING was the basic text, Zhang's *Xiang'er* commentary interpreted it to suit the organization's needs.

Zhang Daqian *or* **Chang Ta-ch'ien** (b. May 10, 1899, Neijiang, Sichuan province, China—d. April 2, 1983, Taipei, Taiwan) Chinese painter and collector. As a young man, he meticulously studied and copied the works of ancient masters; he gained notoriety in Shanghai for his forgeries. Zhang extended his career to the north in the late 1920s, when he became active in the cultural circles of Beijing. He began to collaborate with the well-known Beijing painter Pu Xinyu, and together they became known as "South Zhang and North Pu." In 1940 Zhang led a group of artists to the caves of Mogao and Yulin for the purpose of copying their Buddhist wall paintings. The group completed over 200 paintings, and the experience left Zhang with a repository of religious imagery. During this period he became particularly known for his lotus paintings, inspired by works from the Tang-Song era. In reaction to the political climate, Zhang left China in the early 1950s and traveled throughout the world. He developed eye problems in the late 1950s, and, as his eyesight deteriorated, he developed his mature splashed-colour (*pocai*) style. His work in this style fetched the highest market prices for contemporary Chinese paintings at international auctions of the time.

Zhang Juzheng *or* **Chang Chü-cheng** \'jäŋ-'jü-'jəŋ\ (b. 1525, Jiangling, Hubei province, China—d. 1582, Beijing) Powerful Chinese minister of the MING DYNASTY under the Longqing and Wanli emperors. His benevolent rule and strong foreign and economic policies are considered to have brought the Ming dynasty to its peak. He is credited with centralizing government, limiting special privileges, and reclaiming tax-exempt land.

Zhang Yimou \'jäŋ-'yē-'mō\ (b. Nov. 14, 1950, Xi'an, China) Chinese film director. He began his film career as a cinematographer, and his work for Chen Kaige's *The Yellow Earth* (1983) helped launch the "Fifth Generation," filmmakers who brought back sensuality and emotion to Chinese movies. Zhang made his directorial debut with *Red Sorghum* (1987), which starred Gong Li in the first of her acclaimed roles. Noted for his technical mastery, he also directed films such as *Ju Dou* (1990), *Raise the Red Lantern* (1991), *The Story of Qiu Ju* (1992), *To Live* (1994), and *Hero* (2002).

Zhang Zai *or* **Chang Tsai** \'jäŋ-'dzī\ (b. 1020, Chang'an, China—d. 1077, China) Realist philosopher of the SONG DYNASTY. The son of a magistrate, he studied Buddhism and Daoism before being inspired by the Confucian classics. In his *Cheng-meng*, he declared the universe a unity with myriad aspects and all existence an eternal integration and disintegration. REN (humaneness) is the basic virtue, and morality consists in doing one's duty as a member of society and of the universe.

Zhang Zhidong *or* **Chang Chih-tung** \'jäŋ-jir-'dòŋ\ (b. Sept. 2, 1837, Xingyi, Guizhou province, China—d. Oct. 4, 1909) Chinese classicist and one of the foremost reformers of his time. From 1862 to 1882 he was a scholar and educational director; from 1882 to 1907 he rose from a provincial to a national leader. He supported the dowager empress CIXI, who in turn favoured him with many promotions. Concerned with rejuvenating China, he searched for a way for China to survive in the modern world that could accommodate Western knowledge but preserve traditional ways. His attempt to launch China's first iron-and-steel works failed, but he later built a railway that extended from Hankou to near Beijing, and he founded a mint, tanneries, tile and silk factories, and paper, cotton, and wool mills. In response to China's defeat in the SINO-JAPANESE WAR, Zhang turned his attention to education, encouraging study abroad for Chinese students, establishment of a school system, translation of Western and Japanese books, and acquisition of knowledge from foreign newspapers. He also urged that civil service examinations be abolished, which occurred in 1905. See also ZENG GUOFAN.

Zhang Zuolin *or* **Chang Tso-lin** \'jäŋ-dzò-'lin\ (b. March 19, 1875, Haicheng, Liaoning province, China—d. June 4, 1928, Shengyang, Liaoning) Chinese warlord. After fighting in the SINO-JAPANESE WAR (1894–95), Zhang organized a self-defense militia in his native district. By 1912 he was in command of a division, and he set out to dominate MANCHURIA (northeastern China), relying on the tacit support of the Japanese, to whom he granted concessions in Manchuria. In 1918 he became inspector general of Manchuria's three provinces, which he ruled as a virtually autonomous state. In 1920 he pushed south into China proper and in 1924 took Beijing, but his troops had to abandon their position in the face of CHIANG KAI-SHEK's 1927 NORTHERN EXPEDITION. Zhang was killed by a bomb planted by Japanese extremists who hoped his death would provoke the Japanese into occupying Manchuria.

Zhao Youqin (b. July 26, 1271, Poyang, China—d. c. 1335, Longyou Mountains, Zhejiang province) Chinese astronomer, mathematician, and Daoist philosopher. He was one of the patriarchs of the northern branch of the Quanzhen ("Complete Perfection") sect of Daoism. His astronomical treatise *Gexiang xinshu* ("New Writing on the Symbol of Alteration") presents his cosmological theory featuring a flat Earth inside a spherical Heaven, his explanation of the lunar and solar eclipses, and his experiments with a camera obscura. The book also describes his methods of remote surveying with gnomons to measure the distance from the Earth to the Sun, the Moon, and the stars, as well as his procedure for calculating the value of π. His *Xian Fo tongyuan* ("On the Common Origins of [the Teachings of] Transcendentals and Buddhas") is devoted to the "Inner Alchemy," an esoteric discipline focusing on the attainment of immortality via respiratory and meditative practices.

Zhdanov \'shtä-nòf**, Andrey (Aleksandrovich)** (b. Feb. 26, 1896, Mariupol, Ukraine, Russian Empire—d. Aug. 31, 1948, Moscow, Russia, U.S.S.R.) Soviet politician. He joined the Bolsheviks in 1915 and became a leading member of the Politburo (1939) and Communist Party secretary in Leningrad. A close associate of JOSEPH STALIN, he formulated the extreme anti-Western cultural policy known as "Zhdanovism" (1946), which imposed strict government control on art and literature and soon affected all intellectual activity in the Soviet Union. In 1947 he founded the propaganda bureau COMINFORM.

Zhejiang \'jə-'jyäŋ\ *or* **Che-chiang** *conventional* **Chekiang** Province (pop., 2000 est.: 46,770,000), eastern China. With an area of 39,300 sq mi (101,800 sq km), it is bounded by the CHINA SEA, SHANGHAI municipality, and FUJIAN, JIANGXI, ANHUI, and JIANGSU provinces; its capital is HANGZHOU. It is one of China's smallest provinces and one of the most densely populated. Its northern part lies just south of the YANGTZE RIVER (Chang Jiang) delta. Occupying parts of various kingdoms until the 13th century AD, it was divided in the 1270s into eastern and western regions. Foreign penetration began in the 1840s. After the Chinese revolution (1911–12), it became a power base for the Nationalist Party of CHIANG KAI-SHEK, who was born in the province. Occupied by the Japanese during World War II, it was little affected by the 1946–49 civil war. In addition to its agricultural importance, it has a thriving fishing industry. Its hydroelectric power plants have spurred more growth.

Zheng Chenggong *or* **Cheng Ch'eng-kung** \'jəŋ-'chəŋ-'gùŋ\ *or* **Koxinga** \käk-'siŋ-ə\ (b. Aug. 28, 1624, Hirado, Japan—d. June 23, 1662, Taiwan) Chinese military leader of the late MING and early QING dynasties. After the Ming dynasty fell to the MANCHU, Zheng refused Manchu offers of rank and power and launched a military campaign against the new dynasty in 1659, taking a large force from his base in Fujian province up the Yangtze River (Chang Jiang). Initial success turned into failure, but, undaunted, Zheng took Taiwan from the Dutch in 1662 to use as a secure rear base area. Further glory was cut short by his death later that year. He became a popular deity and cultural hero to the Chinese on Taiwan, and even the Qing court honoured him as a paragon of loyalty. In Japan the playwright CHIKAMATSU MONZAEMON celebrated him on the stage (Zheng had a Japanese mother), and in the 20th century both Chinese communists and Nationalists embraced him as a national hero.

Zheng He *or* **Cheng Ho** \'jəŋ-'he\ *orig.* **Ma Sanbao** (b. c. 1371, Kunyang, Yunnan province, China—d. April 1433, Calicut, India) Eunuch admiral and diplomat who helped extend Chinese maritime and commercial influence throughout the region bordering on the Indian Ocean.The YONGLE EMPEROR named Zheng commander in chief of missions to the "Western Oceans." He first set sail in 1405 and on this mission visited Champa (southern Vietnam), Siam (Thailand), Malacca, and Java, traveled through the Indian Ocean as far as Sri Lanka, and returned to China in 1407. Subsequent voyages took him to Arabia, the eastern coast of Africa, Southeast Asia, and India. Chinese emigration increased in the

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wake of these missions, resulting in Chinese colonization of Southeast Asia and consequent tributary trade that lasted into the 19th century.

Zhengzhou \'jəŋ-'jō\ *or* **Cheng-chou** *formerly (1913–49)* **Zhengxian** \'jəŋ-'shyen\ *or* **Cheng-hsien** City (pop., 1999 est.: 1,465,069), capital of Henan province, east-central China. Located south of the Huang He (Yellow River), it is an important rail centre. There were Neolithic settlements in the area, and the Shang Bronze Age culture (fl. c. 1500 BC) was centred there on a walled city. Zhou-dynasty tombs have also been discovered. The city was first called Zhengzhou in AD 605, and it has been known by that name virtually ever since. It achieved its greatest importance in the 6th–12th centuries, when it was the terminus of a canal that joined the Huang to the north. In the early 20th century it became a rail junction and a regional agricultural centre. Since 1950 its industrial base has greatly expanded, and its population has grown considerably.

Zhivkov \'zhiv-ˌkȯf**, Todor (Khristov)** (b. Sept. 7, 1911, Pravets, near Botevgrad, Bulg.—d. Aug. 5, 1998, Sofia) Bulgarian politician. The son of poor peasants, he drifted to the Bulgarian capital of Sofia in his youth and, in the late 1920s, joined the Komsomol, the youth league of the outlawed Communist Party. During World War II he organized a resistance movement, and after the war, he held posts in the Soviet-sponsored government, including head of the People's Militia. He became first secretary of the Bulgarian Communist Party in 1954, the youngest leader in the Soviet bloc, then served as premier (1962–71) and president (1971–89). He hewed closely to the Soviet line but encouraged industrialization and improved the country's living standard. When democratization reached Bulgaria, Zhivkov resigned (1989). Convicted of embezzlement, he was sentenced to house arrest in 1992.

Zhiyi *or* **Chih-i** \'jir-'ē\ (b. 538, Hunan province, China—d. 597, Mount Tiantai, Zhejiang province) Chinese Buddhist monk who founded the eclectic Tiantai sect. Orphaned at age 17, he studied with the Buddhist master Huisi for seven years. He was associated with the imperial governments of the Chen dynasty in southern China and the Sui dynasty, which reunified China. He reconciled the various strains of Buddhism by regarding all Buddhist doctrines as true and present in the mind of the enlightened Buddha, who unfolded his teachings in periods to accommodate his listeners' capacities. He considered the Lotus Sutra the highest teaching and helped establish it as the most popular scripture in East Asia.

Zhongyong *or* **Chung yung** \'jùŋ-'yùŋ\ *or* **Doctrine of the Mean** One of four ancient Confucian texts known as the Four Books, published together in 1190 by Zhu Xi. Its metaphysics had interested Buddhists and earlier Neo-Confucianists. Zhu Xi attributes the work to Confucius' grandson Zi Si, though it was actually part of *Liji* ("Book of Rites"), one of the Five Classics. *Zhongyong* expresses an ideal of moderation, rectitude, and lack of prejudice that should encompass virtually every relationship and activity in life.

Zhou dynasty *or* **Chou** \'jō\ **dynasty** (1046–256 BC) Ancient Chinese dynasty that gave China its historically identifying political and cultural characteristics. The period before 771 BC is known as the Western Zhou; the period from 771 BC on is called the Eastern Zhou and is further divided into the Spring and Autumn period (770–476) and the Warring States period (475–221). During the Zhou dynasty, iron, ox-drawn plows, crossbows, and horseback riding were introduced; large-scale irrigation projects were instituted; the Chinese writing system was further developed; and the great Chinese philosophers of antiquity, including Confucius, Mencius, and Zhuangzi, lived and taught. Pottery and bronzework expanded on the traditions of the earlier Shang dynasty, as did work in jade and lacquer.

Zhou Enlai *or* **Chou En-lai** \'jō-'en-'lī\ (b. March 5, 1898, Huai'an, Jiangsu province, China—d. Jan. 8, 1976, Beijing) Chinese communist leader, premier from the founding of the People's Republic of China until his death (1949–76). Zhou became a communist during his studies abroad in France and was an organizer for the Chinese Communist Party in Europe. Like other communists, he worked with the Nationalists in the early 1920s and escaped capture when Chiang Kai-shek purged his former allies in 1927. He joined Zhu De and Mao Zedong in Jiangxi province and became political commissar of the Red Army. In the 1930s he negotiated a tactical alliance with the Nationalists to resist Japanese aggression. When the communists prevailed over the Nationalists in 1949, Zhou became premier of the new People's Republic of China. During the Cultural Revolution, Zhou helped restrain extremists; as the revolution waned in the early 1970s, he sought to restore Deng Xiaoping and other moderates to power. He is credited with arranging the historic meeting between U.S. Pres. Richard Nixon and Mao that paved the way for U.S. recognition of the communist government.

Zhougong *or* **Chou-kung** \'jō-'gùŋ\ (fl. 11th century BC, China) Political figure who solidified the power of the Zhou dynasty. On the death of his brother Wuwang, founder of the Zhou, he resisted the temptation to seize the throne and chose instead to serve as counselor to his nephew, the second Zhou ruler. When Zhougong stepped down after seven years, the Zhou political and social system had been stabilized. Confucius so admired Zhougong's wisdom and virtue as a minister, that he proffered him as a model for rulers of his own time to emulate.

Zhoukoudian \'jō-kōd-yən\ *or* **Chou-k'ou-tien** Archaeological site some 26 mi (42 km) southwest of Beijing, China, where fossil remains of the extinct hominin Homo erectus have been found. So-called Peking man was identified as a new fossil human by Canadian anthropologist Davidson Black in 1927 and variously classified as *Pithecanthropus* and *Sinanthropus* before being assigned to *H. erectus*. Partial remains of about 40 individuals along with more than 100,000 artifacts have been uncovered, making Zhoukoudian one of the most important *H. erectus* sites in the world. Its strata date to 550,000–230,000 years ago. It was named a World Heritage site in 1987.

Zhu De *or* **Chu Teh** \'jü-'de\ (b. Dec. 1, 1886, Yilong, Sichuan province, China—d. July 6, 1976, Beijing) Founder of the Chinese communist force that became the People's Liberation Army. Educated at Yunnan Military Academy, Zhu began his military career in the armies of warlords in southern China. He became a communist in the early 1920s but hid his affiliation to become an officer in the Nationalist army. In 1927 he took part in the communist-led Nanchang Uprising, an event celebrated annually in China as the birth of the People's Liberation Army. When the uprising was defeated, Zhu led his troops south to join Mao Zedong's small guerrilla forces. He became commander in chief of the communist forces, a position he held through World War II and the civil war with the Nationalists, not stepping down until 1954. With Mao, Zhu is credited with elevating guerrilla warfare to a major strategic concept.

Zhu Rongji \'jü-rȯŋ-'jē\ *or* **Chu Jung-chi** (b. Oct. 23, 1928, Changsha, Hunan province, China) Premier of the State Council of China (1998–2003). In the 1950s he was denounced as a rightist, and he was purged again in the 1970s, but, once his Communist Party membership was restored, he rose rapidly. In 1988 he became mayor of Shanghai and in 1991 a deputy premier of the State Council. He was governor of the People's Bank of China (1993–95) and became director of the Institute for Economic Management at Qinghua University in 1994. He was appointed premier in 1998. In the face of the Asian economic crisis at the end of the 1990s, he worked to drastically cut back the size of the government bureaucracy. Zhu, whose economic policies have been both praised and criticized, stepped down as premier in 2003 and was replaced by Wen Jiabao.

Zhu Shijie (fl. 1300, China) Chinese mathematician who stood at the pinnacle of traditional Chinese mathematics. Zhu is known for having unified the southern and northern Chinese mathematical traditions. His fame rests on two publications, *Suanxue qimeng* (1299; "Introduction to Mathematical Science") and *Siyuan yujian* (1303; "Precious Mirror of Four Elements"). The former is an introductory mathematics textbook; following the southern Chinese tradition, it presents many rules and problems in the form of verses to facilitate their memorization. It played a central role in the development of the *wasan* ("Japanese calculation") tradition. "Precious Mirror" corresponds to the final stage in the generalization of the northern Chinese technique of *tian yuan* ("method of the celestial unknown"), a kind of algebraic computation performed with counting rods to solve problems.

Zhu Xi *or* **Chu Hsi** \'jü-'shē\ (b. Oct. 18, 1130, Yu-hsi, Fukien province, China—d. April 23, 1200, China) Chinese philosopher and proponent of Neo-Confucianism. The son of a minor government official, he was educated in the Confucian tradition and entered government service. Interested in history, he revised Sima Guang's famous history so that it would illustrate moral principles in government. In 1189 he began a commentary on the Daxue; he continued working on the *Daxue* all his life. Philosophically, his thought incorporated the ideas of Cheng Hao and Cheng Yi, Zhou Dunyi (1017–1073), and Zhang Zai, whose works he compiled. His commentaries on the Four Books, notably on the Lunyu (*Analects*) of Confucius and on *Mencius* (both 1177), were enormously influential. His philosophy emphasized logic, consistency, observance of classical authority, and the value of inquiry.

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Zhu Yuanzhang See Hongwu emperor

Zhuangzi *or* **Chuang-tzu** \'jwäŋ-'dzə̀\ (b. c. 369, Meng, China—d. 286 BCE) Most significant early Chinese interpreter of Daoism and the purported author of the Daoist classic that bears his name. A minor official and a contemporary of Mencius, he drew on the sayings of Laozi but took a broader perspective. He taught that enlightenment comes from the realization that everything is one, the DAO, but that the *dao* has no limitations or demarcations and whatever can be known or said of the *dao* is not the *dao*. He held that things should be allowed to follow their own course and that no situation should be valued over any other.

Zhuge Liang *or* **Chu-ko Liang** \'jü-'gō-lē-'äŋ\ (b. AD 181, Yangdu, Shandong province, China—d. August 234, Wuzhangyuan, Shaanxi province, China) Celebrated adviser to Liu Bei, founder of the Shu-Han dynasty of the Six Dynasties period. Liu was so impressed with Zhuge that on his deathbed he urged Zhuge to take the throne himself if his own son proved incapable. A genius in mechanics and mathematics, Zhuge is credited with inventing a bow for shooting several arrows at once and with perfecting the Eight Dispositions, a series of military tactics. Supernatural powers were often ascribed to him, and he is a favourite character in Chinese plays and stories, notably *Sanguozhi yanyi* (*Romance of the Three Kingdoms*). In 1724 he was made a Confucian saint.

Zhukov \'zhü-ˌkȯf**, Georgy (Konstantinovich)** (b. Dec. 1, 1896, Kaluga province, Russia—d. June 18, 1974, Moscow, Russia, U.S.S.R.) Soviet army commander in World War II. He joined the Red Army in the Russian Civil War and rose to become head of Soviet forces in Manchuria (1938–39). In World War II he was chief of staff of the Red Army and organized the defense of Leningrad and Moscow (1941). He directed the offensive that broke the siege in the Battle of Stalingrad (1943) and was named a marshal of the Soviet Union. After helping win the Battle of Kursk, he directed the Soviet offensive through Belorussia (now Belarus) and commanded the final assault on Berlin (1945). After the war Zhukov's great popularity caused him to be regarded as a potential threat by Joseph Stalin, who assigned him to obscure regional commands. After Stalin's death he was appointed minister of defense (1955) and attempted to make the army more autonomous, but opposition from Nikita Khrushchev caused his dismissal in 1957. He remained in relative obscurity until Khrushchev fell from power in 1964, and he was subsequently awarded the Order of Lenin (1966).

Zia (ur-Rahman), Begum Khaleda *orig.* **Khaleda Majumdar** (b. Aug. 15, 1945, Dinājpur district, India) Politician who served as prime minister of Bangladesh. In 1959 she married Zia ur-Rahman, a leader in the fight for the independence of Bangladesh, then part of India. Her husband became president of Bangladesh in 1977, and after his assassination in 1981 she became politically active. In 1984 she assumed the leadership of the Bangladesh Nationalist Party. Zia was arrested repeatedly during the dictatorship of Hossain Mohammad Ershad in the 1980s, but in 1991 she led the opposition to victory and became prime minister. Her overwhelming reelection victory in February 1996 was tainted by an opposition-led boycott of the voting, and, after a wave of strikes and protests, she resigned the following month. In 2001 Zia was again elected prime minister.

Zia-ul-Haq \'zē-ə-əl-'häk**, Mohammad** (b. Aug. 12, 1924, Jullundur, Punjab, India—d. Aug. 17, 1988, near Bahawalpur, Pak.) President of Pakistan (1978–88). He served with the British in Southeast Asia at the end of World War II; after Pakistan's independence, he held various staff and command appointments for 19 years. He became a major general in 1972 and army chief of staff in 1976. The following year he seized power from Zulfikar Ali Bhutto, and in 1978 he assumed the presidency. After having the popular Bhutto executed in 1979, he tightened his grip on the government, suspending political parties and declaring martial law, and he worked for the Islamization of Pakistan's political and cultural life. He died in an airplane crash.

Ziegfeld \'zig-ˌfeld, 'zēg-ˌfeld**, Florenz** (b. March 21, 1869, Chicago, Ill., U.S.—d. July 22, 1932, Hollywood, Calif.) U.S. theatrical producer. He worked as a publicist for Sandow the strongman before turning to theatrical management in 1896. His press releases promoting the French beauty Anna Held set a pattern of star-making publicity. In 1907 in New York City he produced the first of his *Ziegfeld Follies*, revues that combined seminudity, pageantry, and comedy in a formula that he repeated successfully for 23 years. Under the slogan "Glorifying the American Girl," he made the revue an extravagant spectacle and developed stars such as Will Rogers and Fanny Brice. He also produced the hit musical *Show Boat* (1927).

Ziegler \'tsē-glər**, Karl** (b. Nov. 26, 1898, Helsa, near Kassel, Ger.—d. Aug. 12, 1973, Mülheim, W.Ger.) German chemist. He held academic appointments at the Universities of Frankfurt am Main, Heidelberg, and Halle, and in 1943 he became director of the Kaiser Wilhelm (later Max Planck) Institute. He was the first to explain the reactions involved in the synthesis of rubber (c. 1928). His most important work, in the 1950s, led to the discovery that certain catalysts permitted the fast polymerization of ethylene at atmospheric pressure to a linear polymer of high molecular weight having valuable plastic properties. His work formed the basis of nearly all later developments in the production of long-chain polymers of hydrocarbons from such olefins as ethylene and butadiene; the resulting products came into widespread use as plastics, fibres, rubbers, and films. He shared a 1963 Nobel Prize with Giulio Natta (1903–79).

ziggurat \'zi-gə-ˌrät\ Pyramidal, stepped temple tower characteristic of the major cities of Mesopotamia between 2200 and 500 BC. It was built with a core of mud brick and an exterior covered with baked brick. It had no internal chambers and was usually square or rectangular. Some 25 ziggurats are known, located in Sumer, Babylonia, and Assyria. The best-preserved ziggurat is at Ur, and the largest is at Elam. The legendary Tower of Babel has been associated with the ziggurat of the great temple of Marduk in Babylon.

Zimbabwe \zim-'bä-bwā, zim-'bä-bwē\ *officially* **Republic of Zimbabwe** *formerly* **Rhodesia** Landlocked country, southern Africa. Area: 150,872 sq mi (390,757 sq km). Population (2005 est.): 12,161,000. Capital: Harare. The Shona make up about two-thirds of the population; most of the rest are Ndebele, Chewa, and people of European ancestry. Languages: English (official); Bantu languages of the Shona and Ndebele are much more widely spoken. Religions: Christianity (other [mostly independent] Christians, Protestant, Roman Catholic), traditional beliefs. Currency: Zimbabwe dollar. A broad ridge running southwest-northeast, reaching elevations of 4,000–5,000 ft (1,200–1,500 m), dominates Zimbabwe's landscape. The Zambezi River forms the country's northwestern boundary and contains Victoria Falls as well as the Kariba Dam (completed 1959); Lake Kariba, created by the dam, covers some 2,000 sq mi (5,200 sq km). The Limpopo and Save river basins are in the southeast. Agricultural products, livestock, and mineral reserves, including gold, are all economically important. Zimbabwe is a republic with one legislative house; its head of state and government is the president. Remains of Stone Age cultures dating to 500,000 years ago have been found in the

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area. The first Bantu-speaking peoples reached it during the 5th–10th centuries AD, driving the San inhabitants into the desert. A second migration of Bantu speakers began c. 1830. During that period the British and Afrikaners moved up from the south, and the area came under the administration of the British South Africa Company (1889–1923). Called Southern Rhodesia (1911–64), it became a self-governing British colony in 1923. The colony united in 1953 with Nyasaland (Malawi) and Northern Rhodesia (Zambia) to form the Central African Federation of Rhodesia and Nyasaland. The federation dissolved in 1963, and Southern Rhodesia reverted to its former colonial status. In 1965 it issued a unilateral declaration of independence considered illegal by the British government, which led to economic sanctions against it. The country, which proclaimed itself a republic in 1970, called itself Rhodesia from 1964 to 1979. In 1979 it instituted limited majority rule and changed its name to Zimbabwe Rhodesia. It was granted independence by Britain in 1980 and became Zimbabwe. A multiparty system was established in 1990. Since 2000 tension has increased between European farmers and government leaders as the government has pursued a program of confiscating farms.

Zimbabwe Fifteenth-century ruins, see GREAT ZIMBABWE

Zimmermann \'tsi-mər-ˌmän**, Arthur** (b. Oct. 5, 1864, Marggrabowa, East Prussia—d. June 6, 1940, Berlin, Ger.) German diplomat. He became foreign minister of Germany in 1916 during World War I. With Germany's decision to resume unrestricted submarine warfare, he planned to reduce the possible U.S. intervention in Europe by embroiling it in war with Mexico. On Jan. 16, 1917, he sent a coded telegram to the German ambassador in Mexico, proposing a German-Mexican alliance that would allow Mexico to "reconquer her lost territory in Texas, New Mexico, and Arizona." It was intercepted and decoded by British naval intelligence, then published in the U.S. on March 1, causing public outrage. The "Zimmermann telegram" became a key factor in the U.S. declaration of war against Germany on April 6. Zimmermann was forced to resign in 1917.

zinc Metallic chemical ELEMENT, chemical symbol Zn, atomic number 30. Zinc is a bluish silver METAL, ductile when very pure but brittle otherwise. It forms BRASS (with COPPER) and many other ALLOYS. Its major use is in GALVANIZING iron, steel, and other metals. Zinc is an essential trace element, particularly in red blood cells; in snails, it corresponds to iron in the blood of vertebrates. Zinc oxide is used as a PIGMENT, ultraviolet light absorber (to prevent sunburn), dietary supplement and seed treatment, and photoconductor. Zinc's many other compounds (in which it has VALENCE 2 or, rarely, 1) are used in industrial and consumer applications, including as pesticides, pigments, mordants (see DYE), fluxes, and wood preservatives.

zincblende See SPHALERITE

Zinder, Norton (David) (b. Nov. 7, 1928, New York, N.Y., U.S.) U.S. biologist. He received his Ph.D. from the University of Wisconsin. He discovered genetic transduction (the transfer of genes from one type of microorganism to another by an agent such as a bacteriophage) in *Salmonella* bacteria. Using this transduction, later researchers were able to show that bacterial genes affecting certain physiological processes were grouped together in what are now known as operons. His experiments also led to the discovery of the first bacteriophage that contained RNA as its genetic material.

Zinkernagel \'tsiŋ-kər-ˌnä-gəl,\ *English* \'ziŋ-kər-ˌnā-gəl**, Rolf M(artin)** (b. Jan. 6, 1944, Basel, Switz.) Swiss immunologist and pathologist. He received his Ph.D. from the Australian National University. Studying T CELLS in mice infected with a meningitis virus, he and PETER DOHERTY found that those from one infected mouse would destroy infected cells from another only if the mice belonged to the same genetic strain: no immune response occurs unless the T cells recognize two signals, those of the virus and those identifying the cell as "self." In 1992 he became head of the University of Zürich's Institute of Experimental Immunology. In 1996 he and Doherty shared a Nobel Prize.

Zinnemann \'zin-ə-mən**, Fred** (b. April 29, 1907, Vienna, Austria—d. March 14, 1997, London, Eng.) Austrian-born U.S. film director. After studying law in his native Vienna, he learned cinematography in Paris and worked in Berlin. In 1929 he moved to Hollywood, and in 1934 he codirected his first feature, *The Wave*, which was initially followed largely by documentaries and short subjects. His feature films, many of which focus on the crisis of moral courage, include *The Search* (1948), *The Men* (1950), the classic western *High Noon* (1952), *From Here to Eternity* (1953, Academy Award), *Oklahoma!* (1955), *The Nun's Story* (1959), *A Man for All Seasons* (1966, Academy Award), *The Day of the Jackal* (1973), and *Julia* (1977).

zinnia Any of about 22 species of herbaceous plants and shrubs that make up the genus *Zinnia* (COMPOSITE FAMILY), native mainly to North America. Where native, they are perennial; elsewhere they are annual. Zinnias have stiff, hairy stems and oval or lance-shaped leaves arranged opposite each other and often clasping the stem. The numerous garden varieties grown for their showy, solitary flowers come from the species *Z. elegans*. Garden zinnias range from dwarf compact plants (less than 1 ft, or 30 cm, tall), with flowers 1 in. (2.5 cm) in diameter, to giant forms (up to 3 ft, or 1 m, tall), with flowers up to 6 in. (15 cm) across.

Zinnia elegans
KENNETH AND BRENDA FORMANEK/EB INC.

Zinovyev \zyi-'nȯf-yif**, Grigory (Yevseyevich)** *orig.* **Ovsel Gershon Aronov Radomyslsky** (b. Sept. 23, 1883, Yelizavetgrad, Ukraine, Russian Empire—d. Aug. 25, 1936, Moscow, Russia, U.S.S.R.) Soviet politician. Born to lower middle-class Jewish parents, he received no formal education, but during travels abroad in 1902–05 he attended lectures on law at Bern University. An early activist with the BOLSHEVIKS (1903), he became VLADIMIR LENIN's close collaborator in exile (1909–17) and in the RUSSIAN REVOLUTION OF 1917, helping win public support for the Bolshevik regime. By 1921 he was head of the Petrograd (St. Petersburg) soviet and a member of the Politburo. He was chairman of the Comintern (1919–26) and helped JOSEPH STALIN oust LEON TROTSKY. He was removed from power by Stalin in 1926. Although he was subsequently readmitted to the party, he never recovered his former prestige and was expelled again on two other occasions (1932 and 1934). In 1935 he was arrested for conspiracy and sentenced to prison. The following year he was retried in the first of the PURGE TRIALS, found guilty on the fabricated charge of forming a terrorist organization to assassinate various Soviet leaders, and executed. In 1988 the Soviet Supreme Court annulled the sentence posthumously.

Zinsser, Hans (b. Nov. 17, 1878, New York, N.Y., U.S.—d. 1940) U.S. bacteriologist and epidemiologist. He taught principally at the Columbia (1913–23) and Harvard (1923–40) medical schools. He isolated the bacterium that causes the European type of typhus, developed the first anti-typhus vaccine, and, with colleagues, found a way to mass-produce it. He recognized that cases of mild typhus-like symptoms in lice-free persons are recurrences after a latent period (Brill-Zinsser disease). His best-known book, *Rats, Lice and History* (1935), recounts the effects of typhus on humankind (he believed disease had destroyed more civilizations than war) and efforts to eradicate it.

Zion Easternmost of the two hills of ancient JERUSALEM, where DAVID established his royal capital. In the OLD TESTAMENT, the name Zion frequently refers to Jerusalem as a whole; it is overwhelmingly a poetic and prophetic designation. Mount Zion is the place where Yahweh (God) dwells and is the scene of his messianic salvation. The name came to mean the Jewish homeland, symbolic of Judaism or Jewish national aspirations, and thus was the source of the term ZIONISM. Though the name is rare in the NEW TESTAMENT, it has been frequently used in Christian literature and hymns as a designation for the heavenly city or for the earthly city of Christian faith and fraternity.

Zion National Park National park, southwestern Utah, U.S. It covers an area of 229 sq mi (593 sq km); its principal feature is Zion Canyon, which was named by the MORMONS who discovered it in 1858. Part of the area was first set aside as the Mukuntuweap National Monument in 1909. Enlarged and renamed Zion National Monument in 1918, it was established as a national park in 1919. Zion Canyon was carved by the Virgin River and is about 15 mi (24 km) long and 0.5 mi (0.8 km) deep. Rocky domes dot the canyon walls, which contain an abundant fossil record. Excavation has yielded evidence that prehistoric peoples once inhabited the area.

Zionism \'zī-ə-ˌni-zəm\ Jewish nationalism movement with the goal of establishing a Jewish state in Palestine. In the 16th–17th century, a number of "messiahs" tried to persuade the Jews to return to Palestine, but by the late 18th century interest had largely faded. POGROMS in Eastern Europe led

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to formation of the "Lovers of Zion," which promoted the settlement of Jewish farmers and artisans in Palestine. In the face of persistent anti-Semitism, Theodor Herzl advocated a Jewish state in Palestine. He held the first Zionist Congress in Basel in 1897. After World War I the movement picked up momentum with the issuing of the Balfour Declaration. The Jewish population in Palestine increased from 90,000 in 1914 to 238,000 in 1933. The Arab population resisted Zionism, and the British tried unsuccessfully to reconcile Jewish and Arab demands. Zionism achieved its goal with the creation of Israel in 1948. See also Alliance Israélite Universelle, David Ben-Gurion, Hagana, Vladimir Jabotinsky, Irgun Zvai Leumi.

Zionist church Any of several prophet-healing groups in southern Africa that arose early in the 20th century from the fusion of African culture with the Christian message brought by U.S. Protestant missionaries. Their common features include: origination from a mandate received by a prophet in a dream or vision; a chieflike leader who is succeeded by his son and who is occasionally regarded as a messiah; healing through confession, repeated baptism, purification rites, and exorcism; revelation and power from the Holy Spirit through prophetic utterances and pentecostal phenomena; Africanized worship characterized by singing, dancing, clapping, and drumming; and repudiation of traditional magic, medicines, divination, and ancestor cults, though these are often replaced with Christianized equivalents.

zip code System of postal-zone codes (zip stands for "zone improvement plan") introduced in the U.S. in 1963 to improve mail delivery and exploit electronic reading and sorting capabilities. The original code, which corresponds to the postal codes used in most countries in the world, consists of five numbers. The first three identify the state and portion of the state, the last two a specific post office or zone. In 1983 a nine-digit code (created by adding a hyphen and four digits) was introduced to further speed delivery; the first two added digits specify a particular "sector," the last two an even smaller "segment" (e.g., one side of a city block, or a single floor in a large building).

zipper Device for binding the edges of an opening, as on a garment or a bag. A zipper consists of two strips of material with metal or plastic teeth along the edges, and a sliding piece that interlocks the teeth when moved in one direction and separates them again when moved in the opposite direction. The idea of a slide fastener was first exhibited by Whitcomb L. Judson (died 1909) at the World's Columbian Exposition of 1893. The modern form of the zipper began to appear on clothing in the late 1920s.

zircon Silicate mineral, zirconium silicate, $ZrSiO_4$, the principal source of zirconium. Zircon is widespread as an accessory mineral in acid igneous rocks; it also occurs in metamorphic rocks and, fairly often, in detrital deposits. It occurs in beach sands in many parts of the world, particularly Australia, India, Brazil, and Florida, and is a common heavy mineral in sedimentary rocks. Gem varieties occur in stream gravels and detrital deposits, particularly in Indochina and Sri Lanka, but also in Myanmar, Australia, and New Zealand. Zircon forms an important part of the syenite of southern Norway and occurs in large crystals in Quebec.

Zircon with quartz from Cheyenne Canyon, Colorado

COURTESY OF THE FIELD MUSEUM OF NATURAL HISTORY, CHICAGO; PHOTOGRAPH, JOHN H. GERARD—EB INC.

zirconium Metallic chemical element, one of the transition elements, chemical symbol Zr, atomic number 40. The metal is hard and brittle when impure, soft and ductile when highly purified. It is relatively abundant, occurring as zircon (also marketed as a natural gemstone) and baddeleyite. Highly transparent to neutrons, zirconium became important in the 1940s in nuclear energy applications such as fuel cladding. Other uses are in alloys, fireworks, and flashbulbs and as a scavenger for oxygen and other gases. Its compounds, in most of which it has valence 4, are important industrial materials. Zirconia (the oxide) is used in piezoelectric crystals (see piezoelectricity), high-frequency induction coils, coloured glazes and glasses, and heat-resistant fibres; zirconium carbonate is employed in preparations to treat the rash of poison ivy.

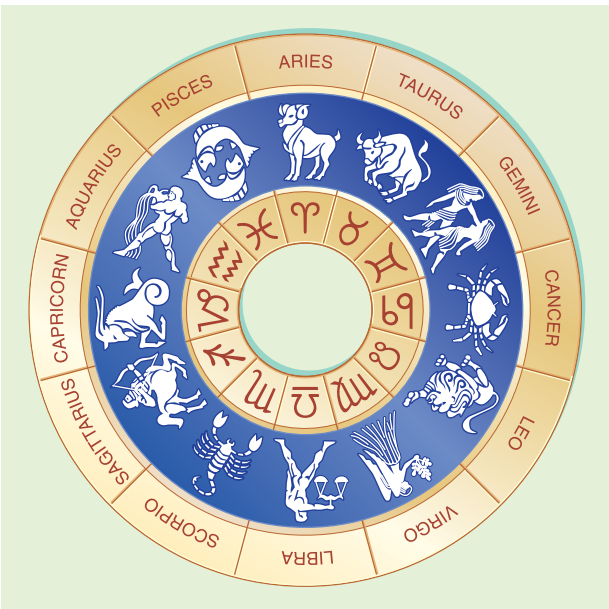
zither Plucked or struck stringed instrument with a shallow soundbox. The common Austrian zither is roughly rectangular and has 30–40 strings; it is placed on the player's knees or on a table. Several melody strings pass over a fretted fingerboard; the player's left hand stops these strings, while the right hand plucks with the fingers and a thumb plectrum. Zither is also a generic term for stringed instruments, the strings of which are fastened across a frame that lacks any projecting neck or arms. The larger zither family thus includes instruments such as the Aeolian harp, autoharp, cimbalom, dulcimer, koto, and even the clavichord, harpsichord, and piano.

Zither made in Vienna

COURTESY OF A.V. EBBLEWHITE, LONDON; PHOTOGRAPH, BEHR PHOTOGRAPHY/EB INC.

Zoan See Tanis

zodiac \'zō-dē-ˌak\ Belt around the heavens extending about 9° on either side of the ecliptic. The orbits of the Moon and the major planets (except Pluto) lie entirely within the zodiac. In astrology, each of 12 constellations along this circle is considered to occupy 1/12 (30°) of it. The positions of the Sun and planets when a person is born and their motion through these constellations are said to exert influence on his or her life, though precession of the equinoxes has shifted the constellations eastward and the Sun no longer passes through them on the traditional dates: Aries, the ram (March 21–April 19); Taurus, the bull (April 20–May 20); Gemini, the twins (May 21–June 21); Cancer, the crab (June 22–July 22); Leo, the lion (July 23–August 22); Virgo, the virgin (August 23–September 22); Libra, the balance (September 23–October 23); Scorpius (see Scorpio), the scorpion (October 24–November 21); Sagittarius, the archer (November 22–December 21); Capricornus (see Capricorn), the goat (December 22–January 19); Aquarius, the water bearer (January 20–February 18); Pisces, the fish (February 19–March 20).



The astrological images and symbols of the zodiac.

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zodiacal light \zō-ˈdī-ə-kəl\ Band of very faint light in the night sky. It is thought to be sunlight reflected from interplanetary dust grains lying mostly in the plane of the zodiac, or ecliptic. Seen in the west after twilight and in the east before dawn, it is most clearly visible in the tropics, where the ecliptic is approximately perpendicular to the horizon. In mid-northern latitudes it is best seen evenings in February and March and mornings in September and October (vice versa in midsouthern latitudes). The light can be followed visually to a point about 90° from the Sun. It continues to the region opposite the Sun, where a slight enhancement, the gegenschein, is visible.

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Zoe \'zō-ē\ (b. c. 978, Constantinople—d. 1050, Constantinople) Byzantine empress. The daughter of Constantine VIII, she married Romanus III Argyrus in 1028. He died in 1034, perhaps poisoned by her, and she married her lover and chamberlain, who became Michael IV. After his death in 1041, his successor, Michael V, banished Zoe to a convent; she was recalled by public outcry, and Michael was deposed, blinded, and exiled (1042). Zoe and her sister became uneasy corulers, and she married Constantine IX Monomachus to secure her throne.

Zog I *Albanian* **Ahmed Bey Zogu** (b. Oct. 8, 1895, Castle Burgajet, Alb.—d. April 9, 1961, Suresnes, France) President (1925–28) and king of Albania (1928–39). After serving in the Austrian army in World War I, he became a leader of Albania's reformist Popular Party. He held ministerial posts in the government (1920–24) and was elected head of the Albanian republic in 1925. Proclaimed king in 1928, he pursued a policy of close collaboration with Italy. Unable to resist Benito Mussolini's increasing control of the country's finances and army, he was forced into exile when Italy invaded and made Albania a protectorate (1939). After World War II Albania became a communist republic, and Zog formally abdicated in 1946.

Zola \'zō-lə,\ *French* \zō-'lä**, Émile (-Édouard-Charles-Antoine)** (b. April 2, 1840, Paris, France—d. Sept. 28, 1902, Paris) French novelist and critic. Raised in straitened circumstances, Zola worked at a Paris publishing house for several years during the 1860s while establishing himself as a writer. In the gruesome novel *Thérèse Raquin* (1867), he put his "scientific" theories of the determination of character by heredity and environment into practice for the first time. These ideas established him as the founder of naturalism in literature. In 1870 he began the ambitious project for which he is best known, the *Rougon-Macquart Cycle* (1871–93), a sequence of 20 novels documenting French life through the lives of the violent Rougon family and the passive Macquarts. It includes *L'Assommoir* (1877), a study of alcoholism that is among his most successful and popular novels; *Nana* (1880); *Germinal* (1885), his masterpiece; and *La Bête humaine* (1890). Among his other works are two shorter novel cycles and treatises explaining his theories on art, including *The Experimental Novel* (1880). He is also notable for his involvement in the Alfred Dreyfus affair, especially for his open letter, "J'accuse" (1898), denouncing the French army general staff. He died under suspicious circumstances, overcome by carbon-monoxide fumes in his sleep.

Zollverein \'tsȯl-ver-ˌīn\ (German: "Customs Union") Free-trade area throughout much of Germany established in 1834 under Prussian leadership. The customs union developed from the 1818 Prussian tariff law that abolished internal customs dues and the customs union set up in 1828 in southern Germany by Bavaria and Württemberg. By 1834 other German states had joined, for a total of 18 members; more joined in subsequent years. The Zollverein represented an important step in German unification. See also Friedrich List.

zombi In Vodou, a dead person who is revived after burial and compelled to do the bidding of the reviver, including criminal acts and heavy manual labour. It is believed that actual zombis are living persons under the influence of powerful drugs, including burundanga (a drug reportedly used by Colombian criminals) and drugs derived from poisonous toads and puffer fish.

zone melting Any of a group of techniques used to purify an element or a compound or to control its composition by melting a short region (called a zone) and causing this liquid zone to travel slowly through a relatively long ingot, or charge, of the solid. In zone refining, the most important of the zone-melting techniques, a solid is refined by multiple molten zones being passed through it in one direction. Each zone carries a fraction of the impurities to the end of the solid charge, thereby purifying the remainder. Zone refining is particularly important as a method of purifying crystals, especially for use in semiconductor devices.

zone of avoidance See avoidance, zone of

zoning Legislative method of controlling land use by regulating considerations such as the type of buildings that may be erected and population density. German and Swedish cities first applied zoning regulations in the late 19th century to address the problems of urban congestion and building height. The earliest U.S. zoning ordinances, which date from the beginning of the 20th century, were motivated by the need to regulate the location of commercial and industrial activities. In 1916 New York City adopted the first comprehensive zoning law; it and other early regulations were designed to protect property values and preserve light and air. Modern zoning regulations divide land use into three types: residential, commercial, and industrial. Within each designation, more specific aspects of development (e.g., building proximity, height, and type) are also determined. Zoning is often used to maintain the distinctive character of a town or city; an adverse consequence of such zoning is economic segregation. The Supreme Court of the United States ruled against such laws in 1977 when it declared the zoning regulations of one Chicago suburb discriminatory.

zoo *or* **zoological garden** Place where wild and sometimes domesticated animals are exhibited in captivity. Aquatic zoological gardens are called aquariums. The first zoos were perhaps associated with domestication. Pigeons were kept in captivity as early as 4500 BC; other animals (e.g., elephants and antelopes) have also been kept in captivity since antiquity. Animal collections were kept by Charlemagne and other European monarchs. Hernán Cortés described a zoo in Mexico (1519) so large that it required a staff of 300. Modern zookeeping started in 1752 with the founding of the Imperial Menagerie at Vienna's Schönbrunn Palace. Open-range zoos were first established in the early 1930s, some so large that visitors drive through in cars, as on an African safari. There are now more than 1,000 animal collections open to the public throughout the world (e.g., in the U.S., the Bronx Zoo and San Diego Zoo).

zoology Branch of biology concerned with members of the animal kingdom and with animal life in general. The science originated in the works of Hippocrates, Aristotle, and Pliny. The contributions of individuals such as William Harvey (the circulation of blood), Carolus Linnaeus (system of nomenclature), Georges-Louis de Buffon (natural history), Georges Cuvier (comparative anatomy), and Claude Bernard (homeostasis) greatly advanced the field. The 1859 publication of Charles Darwin's *On the Origin of Species by Means of Natural Selection* was a major turning point. Since that time, the study of genetics has become essential in zoological studies.

zooplankton \ˌzō-ə-'plaŋk-tən\ Small floating or weakly swimming animals that drift with water currents and, with phytoplankton, make up the planktonic food supply on which almost all oceanic organisms ultimately depend (see plankton). Included are many animals, from single-celled radiolarians to the eggs or larvae of herrings, crabs, and lobsters. Permanent plankton (holoplankton), such as protozoans and copepods, spend their lives as plankton. Temporary plankton (meroplankton), such as young starfish, clams, worms, and other bottom-dwelling animals, live and feed as plankton until they become adults.

Zorn, John (b. Sept. 2, 1953, New York, N.Y., U.S.) U.S. saxophonist and composer. His music incorporates influences from the most diverse elements of music and culture: free jazz, klezmer music, punk rock, cartoon music, film scores, and contemporary classical music. His "game pieces," such as *Cobra* (1984), involve rules—understood by his musicians and cued by hand signals—that determine the flow of the music, placing emphasis on the process rather than the result of the performance.

Zoroaster \'zōr-ə-ˌwas-tər\ *or* **Zarathustra** \ˌzar-ə-'thüsh-trə\ (b. c. 628, probably Rhages, Iran—d. c. 551 BCE) Iranian religious reformer and prophet, founder of Zoroastrianism and Parsiism. He was a priest in his tribal religion, with which he eventually became disillusioned. Having received a vision, he began teaching that Ahura Mazdā was the highest god and alone was worthy of worship, a concept that went against the polytheism of Iranian religion. He forbade the orgiastic rites that accompanied animal sacrifice, common in his time, but preserved the ancient cult of fire worship. After converting a king called Vishtāspa to his teachings, Zoroaster remained at the royal court. He became the subject of legends and a model for various occupations.

Zoroastrianism and Parsiism Ancient religion that originated in Iran based on the teachings of Zoroaster. Founded in the 6th century BCE, it influenced the monotheistic religions Judaism, Christianity, and Islam. It rejects polytheism, accepting only one supreme God, Ahura Mazdā. In early Zoroastrianism, the struggle between good and evil was seen as an eternal rivalry between Ahura Mazdā's twin sons, Spenta Mainyu (good) and Angra Mainyu (evil). Later Zoroastrian cosmology made the rivalry between Ahura Mazdā himself (by then called Ormizd) and Angra Mainyu (Ahriman). This later cosmology identifies four periods of history; the last began with the birth of Zoroaster. Zoroastrian practice includes an initiation ceremony and various rituals of purification intended to ward off evil spirits. Fire worship, a carryover from an earlier religion, survives in the sacred fire that must be kept burning continually and be fed at least five times a day. The chief ceremony involves a sacrifice of haoma, a sacred liquor, accompanied by recitation of large parts of the Avesta, the primary

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scripture. Zoroastrianism enjoyed status as an official religion at various times before the advent of Islam, but Zoroastrians were persecuted in the 8th–10th centuries, and some left Iran to settle in India. By the 19th century these Indian Zoroastrians, or Parsis, were noted for their wealth and education. The small group of Zoroastrians remaining in Iran are known as the Gabars.

Zorrilla \thōr-'rēl-yä\ **(y Moral), José** (b. Feb. 21, 1817, Valladolid, Spain—d. Jan. 23, 1893, Madrid) Spanish poet and dramatist. Zorrilla first gained notice in 1837 with his recitation of an elegy at the funeral of the satirist Mariano José de Larra. The major figure of the nationalist wing of the Spanish Romantic movement, he made his name with verse *leyendas* ("legends") about remote times and places, notably in *Cantos del trovador* (1841). His greatest success was *Don Juan Tenorio* (1844), the most popular play of 19th-century Spain. His works are considered quintessentially Spanish in style and tone. In 1889 he was crowned the national poet.

Zu Chongzhi (b. 429, Jiankang, China—d. 500, China) Chinese astronomer, mathematician, and engineer. About 462 he proposed a new calendar system that would provide a more precise number of lunations per year and take into consideration the precession of the equinoxes. His Daming calendar was finally adopted in 510 through the efforts of his son, Zu Gengzhi. Li Chunfeng called Zu Chongzhi the best mathematician ever and gave him credit for three approximations of π: $22/7$, $355/113$, and the interval $3.1415926 < \pi < 3.1415927$; the third result remained the best in the world until improved by the Arab mathematician al-Kashi (fl. c. 1400). He also worked on the mathematical theory of music and metrology, and he constructed several devices, such as a semilegendary "south-pointing carriage." The carriage was topped by a symbolic figure that, once properly aligned, would always point to the south.

Zu Gengzhi *also known as* **Zu Xuan** (b. c. 480, Jiankang, China—d. c. 525, China) Chinese government official, mathematician, astronomer, and son of Zu Chongzhi. Beginning in 504, he actively advocated his father's Daming calendar and finally succeeded in getting it officially adopted in 510. His astronomical observations with gnomons allowed him to measure the angular distance between Polaris and the celestial north pole. A mathematical fragment of his was appended by Li Chunfeng to the commentary on *Jiuzhang suanshu* (*Nine Chapters on the Mathematical Procedures*), a Chinese classic probably compiled in the 1st century AD. Fragments of his writings are also found in the astronomical chapter of *Suishu* ("History of the Sui Dynasty"). His fame as a mathematician rests primarily on his derivation and proof of the formula for the volume of a sphere.

Zuccaro \'tsü-kär-ō**, Federico** *or* **Federico Zuccari** \'tsü-kär-ē\ (b. c. 1540, Sant'Angelo in Vado, Duchy of Urbino—d. July 20, 1609, Ancona) Italian painter and art theorist. In 1565 he worked in Florence with Giorgio Vasari. He codified the theory of Mannerism in *The Idea of Painters, Sculptors, and Architects* (1607) and in a series of frescoes in his own house in Rome. In England in 1575 he drew or painted portraits of Elizabeth I and the earl of Leicester. He also painted the dome of the cathedral of Florence (1574), a large work in the Doges' Palace in Venice (1582), and much work for El Escorial in Spain (1585–88). At one time the central figure of the Roman Mannerist school, he lived to see Mannerism become extinct.

zucchini Subspecies of *Cucurbita pepo*, dark green elongate summer squash in the gourd family, of great abundance in U.S. home gardens and supermarkets. The creeping vine has five-lobed leaves, tendrils, and large yellow flowers.

Zuckerman \'tsůk-ər-ˌmän**, Yitzhak** *or* **Yitzhak Cukierman** \'tsůk-ər-ˌmän\ (b. 1915, Warsaw, Pol.—d. June 17, 1981, Tel Aviv, Israel) Hero of Jewish resistance to the Nazis in World War II. Active in Zionist organizations in his native Warsaw, he urged the creation and arming of a Jewish defense organization after the German takeover of Poland. He used his contacts outside the Warsaw Ghetto to smuggle in a few arms. He took command after the other leaders of the Warsaw Ghetto Uprising were killed, and eventually he led some 75 people through the sewers to safety. He continued leading Jewish resistance and alerting Jewish leaders elsewhere to the situation in Nazi Europe. At war's end he helped organize transportation for Jewish refugees to Palestine.

zuhd \'zù-həd\ Islamic asceticism. Though Islam permits unforbidden pleasure, it praises those who shun luxury in favour of a simple and pious life. *Zuhd* may have been influenced directly by the Christian hermits who had some contact with early Muslims. It was institutionalized in Islam as a result of Muslim conquests, which brought material wealth and widespread indulgence in luxurious living. Devout Muslims reacted by calling for a return to the way of life of Muhammad, who spent long periods in solitary vigil, fasting and praying. See also Sufism.

Zuiderzee \ˌzī-dər-'zā, ˌzī-dər-'zē\ *Dutch* **"Southern Sea"** Former inlet of the North Sea, northern coast of The Netherlands. From the 13th to the 20th century, it penetrated The Netherlands and occupied 2,000 sq mi (5,000 sq km), separated from the North Sea by an arc of former sand flats that are now the West Frisian Islands. Frisian peoples inhabited the sand flats from c. AD 400 and built the first sea works, considered engineering marvels, to stem rising sea levels. The control of water levels within the dikes developed into the reclamation of lowlands (polders) from the water. Between 1927 and 1932 a dam 19 mi (30 km) long was built across the Zuiderzee, separating it into the Waddenzee and the IJsselmeer. By the early 1980s four polders (of five proposed), largely agricultural land, had been created.

Zulu Nguni-speaking people living in KwaZulu-Natal province in South Africa. Numbering about 9.5 million, they are South Africa's largest ethnic group. Traditionally grain farmers, they also kept large herds of cattle. European settlers wrested grazing and water resources from the Zulu in prolonged warfare during the 19th century; with much of their wealth lost, modern Zulu depend largely on wage labour on farms owned by whites or work in the cities. The Zulu provide the main support for the Inkatha Freedom Party. Many Zulu belong to independent or separatist African churches, though the traditional religion, based on ancestor worship and belief in a creator-god, witches, and sorcerers, remains strong. See also Shaka.

Zululand Historical region, eastern South Africa. It was the home of the Zulu people when Chief Shaka established dominance over what is now KwaZulu-Natal. His state fought the Boers in the 1840s; it later lost parts of its territory to them. The British moved into nearby Natal and annexed it in 1843. The Zulu resisted British rule in 1878 but were overcome in 1879. The British made Zululand a crown colony in 1887 and annexed it to Natal in 1897. Under the apartheid system, a Bantu homeland named KwaZulu, composed of parts of the historical Zululand, was established for the Zulu in the 1970s. With the abolition of the apartheid system, KwaZulu in 1994 was reincorporated into Natal province, which was renamed KwaZulu-Natal.

Zuni \'zü-nē\ North American Pueblo Indian people living in west-central New Mexico, U.S. They call themselves Ashiwi. Their origin and early history are uncertain. When first encountered by 16th-century Spanish explorers, they were living in seven separate towns thought by the explorers to be the fabled Seven Cities of Cíbola; under the Spaniards they were crowded into a single pueblo. The traditional occupation was corn farming; basketry and pottery were also well developed. Religious life centred on gods or spirits called kachinas. Today the Zuni number about 12,000.

Zunz \'tsůnts**, Leopold** *Hebrew* **Yom-Tob Lippmann** (b. Aug. 10, 1794, Detmold, Lippe—d. March 18, 1886, Berlin) German historian of Jewish literature. After taking his doctorate at Halle, he spent much of his life in a precarious struggle with poverty. With the publication of his seminal work, *On Rabbinic Literature* (1818), he initiated (1819) the movement called Wissenschaft des Judentums ("Science of Judaism"), which stressed the analysis of Jewish literature and culture with the tools of modern scholarship. His *On History and Literature* (1845) places Jewish literary activity in the context of European literature and politics. Zunz is often considered the greatest Jewish scholar of the 19th century.

Zuo zhuan *or* **Tso chuan** \'dzwò-'jwän\ Ancient commentary on the Chunqiu ("Spring and Autumn Annals"). It provides extensive narrative accounts and background materials concerning events covered in the *Chunqiu*, as well as authentic historical documents and written evidence of the philosophical schools of the time. Finally, it provides a comprehensive account of the principal political, social, and military events of the period. It was once believed to have been written by Zuo, an ancient historian about whom virtually nothing is known, but modern scholarship attributes it to an anonymous author of the period 475–221 BCE.

Zurbarán \ˌzůr-bə-'rän**, Francisco de** (baptized Nov. 7, 1598, Fuente de Cantos, Spain—d. Aug. 27, 1664, Madrid) Spanish painter. He was apprenticed in 1614 to a painter in Sevilla (Seville), where he lived

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until 1658 when he moved to Madrid. He had a few royal commissions but remained throughout his life a provincial painter of religious pictures. His apostles, saints, and monks are painted with almost sculptural modeling, and his emphasis on the minutiae of their dress lends verisimilitude to their miracles, visions, and ecstasies. This distinctive combination of naturalism with religious sensibility conforms to the guidelines for Counter-Reformation artists outlined by the Council of Trent. He had numerous commissions from monasteries and churches throughout southern Spain, and many of his works were sent to Lima, Peru. His late devotional paintings show the influence of Bartolomé Esteban Murillo.

Zürich \'tsu̇̄-rik̲\ *or* **Zurich** \'zu̇r-ik\ City (pop., 2000: city, 363,273; 1998 est.: metro. area, 935,118), Switzerland. Located at the northwestern end of Lake Zürich, the site was occupied first by prehistoric lake dwellers and later by the Celtic Helvetii before the Romans conquered the area c. 58 BC. It subsequently was held by the Alamanni and the Franks. Zürich grew as a trade centre, and in 1218 it became a free imperial city. In 1351 it joined the Swiss Confederation. Under the leadership of Huldrych Zwingli, Zürich became the centre of the Swiss Reformation in the 16th century. Attracting refugees from the Counter-Reformation, it established a liberal democratic order during the 1830s. Long an industrial centre and Switzerland's largest city, Zürich is also an important financial centre and a major tourist destination. The city's cultural treasures include the National Museum (1833) and the Zürich Opera (1891).

Zürich, Lake *German* **Zürichsee** \'tsu̇̄-rik̲-ˌzā\ Lake, north-central Switzerland. Extending southeast from the city of Zürich, it lies at an altitude of 1,332 ft (406 m) and has an area of about 34 sq mi (88 sq km). It is 18 mi (29 km) long and has a maximum depth of 469 ft (143 m). The Linth River flows into it and emerges as the Limmat.

Zuse \'tsü-zə**, Konrad** (b. June 22, 1910, Berlin, Ger.—d. Dec. 18, 1995, Hünfeld) German engineer. In 1941 he constructed the first fully operational program-controlled electromechanical binary calculating machine, or digital computer, called the Z3. The machine predated Howard H. Aiken's Harvard Mark I but was destroyed by bombing during World War II. In 1945 he designed Plankalkül, one of the first attempts at a high-level programming language, which later influenced the development of ALGOL.

Zweig \'tsvīk**, Arnold** (b. Nov. 10, 1887, Glogau, Silesia, Ger.—d. Nov. 26, 1968, East Berlin, E.Ger.) German writer. Zweig, who was Jewish, was exiled from Germany by the Nazis in 1933. He lived as an émigré in Palestine until 1948, when he moved to East Germany. He is best known for the novel *The Case of Sergeant Grischa* (1927), which depicts the German army in World War I through a Russian prisoner's tragic encounter with the Prussian military bureaucracy. Later works, including *Education Before Verdun* (1935) and *The Crowning of a King* (1937), follow the fortunes of characters he introduced in *Sergeant Grischa*.

Zweig, Stefan (b. Nov. 28, 1881, Vienna, Austro-Hungarian Empire—d. Feb. 22, 1942, Petrópolis, near Rio de Janeiro, Braz.) Austrian writer. He was deeply influenced by Sigmund Freud, whose theories on psychology informed Zweig's analyses of historical figures and his subtle portrayal of fictional characters. His essays include studies of Honoré de Balzac, Charles Dickens, and Fyodor Dostoyevsky, in *Three Masters* (1920); and Friedrich Hölderlin, Heinrich Kleist, and Friedrich Nietzsche, in *Master Builders* (1925). He achieved popularity with *The Tide of Fortune* (1928), five historical portraits in miniature. He also wrote biographies, poetry, short stories, dramas, and a novel. Driven into exile by the Nazis in 1934, Zweig and his second wife went to England and then Brazil, where, lonely and disillusioned, they committed suicide.

Zwicky \'tsvik-ē**, Fritz** (b. Feb. 14, 1898, Varna, Bulg.—d. Feb. 8, 1974, Pasadena, Calif., U.S.) Swiss astronomer and physicist. He received his Ph.D. from the Swiss Federal Institute of Technology and moved to the U.S. in 1925 to work at Caltech, where he remained until 1972. In 1934, with Walter Baade (1893–1960), he proposed that supernovas are a class of stellar explosions completely different from novas. He conducted an extensive search of neighbouring galaxies for supernovas and discovered 18; only about 12 had been recorded previously in the entire history of astronomy. In the years 1943–46, with Theodore von Kármán and others, he helped develop early jet-propulsion systems.

Zwilich \'zwi-lik**, Ellen Taaffe** (b. April 30, 1939, Miami, Fla., U.S.) U.S. composer. She was trained as a violinist, studying with Ivan Galamian (1903–81). She studied composition with Elliott Carter and Roger Sessions at Juilliard. Her straightforward and expressive music won wide recognition; her *Symphony No. 1* (1983) was the first composition by a woman to win a Pulitzer Prize. Her orchestral work *Symbolon* premiered in Russia in 1988. She is noted for writing music that is both substantive and accessible.

Zwinger \'tsviŋ-ər\ Rococo-style building complex (1709–32), on the southern bank of the Elbe in Dresden, Germany, designed by Matthäus Daniel Pöppelmann (1662–1736). Originally planned as the forecourt for a castle, it is considered one of the finest works of its style in the world. It comprises one- and two-story buildings surrounding an immense square court. Its festive air is accented by bold, richly sculpted and ornamented facades and gates and by dramatic contrasts between its low arcades and high pavilions.

Zwingli \'zwiŋ-lē,\ *German* \'tsviŋ-lē**, Huldrych** (b. Jan. 1, 1484, Wildhaus in the Toggenburg, Sankt Gallen, Switz.—d. Oct. 11, 1531, near Kappel) Major reformer in the Protestant Reformation in Switzerland. Educated in Vienna and Basel, he was ordained a priest in 1506. An admirer of Erasmus, he began preaching reformist ideas in Zürich in 1518, shortly after Martin Luther made his break with the church in Rome, and became increasingly active in challenging the ritualism, decadence, and hierarchy of the Roman Catholic church. The main contentions of his *67 Articles* (1523) were adopted by most priests in Zürich. As his movement spread, he rejected a number of the basic teachings of the church, declaring that Jesus alone is head of the church, that the mass is an affront to Christ, and that there is no biblical foundation for the intercession of the dead or for purgatory. He also rejected the notions of priestly celibacy, and his teachings on the sacrament of communion brought him into conflict with both Luther and the Catholic church. He was killed in a battle between Protestants and Catholics while serving as an army chaplain.

Zwingli, detail of an oil portrait by Hans Asper, 1531; in the Kunstmuseum Winterthur, Switz.

COURTESY OF THE KUNSTMUSEUM WINTERTHUR, SWITZ.; PHOTOGRAPH, SCHWEIZERISCHES INSTITUT FUR KUNSTWISSENSCHAFT

Zworykin \'zvȯr^{y}-kyin,\ *English* \'zwȯr-i-kən**, Vladimir (Kosma)** (b. July 30, 1889, Murom, Russia—d. July 29, 1982, Princeton, N.J., U.S.) Russian-born U.S. electronic engineer and inventor. He immigrated to the U.S. in 1919. While with Westinghouse Electric Corp. (1920–29), he filed patent applications for his inventions of the iconoscope (a TV transmission tube, 1923) and the kinescope (TV receiver, 1924), which formed the first all-electronic TV system. He patented a colour TV system in 1928. In 1929 he became director of electronic research at RCA. His electron image tube, sensitive to infrared light, was the basis for devices first used in World War II for seeing in the dark.

zydeco \'zī-də-ˌkō\ Form of dance music from southwestern Louisiana, U.S., with roots in French, African American, and Afro-Caribbean styles. Similar to the music of the Cajuns (displaced French Canadians who settled in Louisiana), zydeco was created by the Creoles (those of African heritage in Louisianan French culture). Its name is thought to come from a modified pronunciation of the French phrase *les haricots* ("the beans") heard in a popular song. The music usually features guitar, accordion, fiddle (violin), and washboard played to a driving beat, but it may also include electric guitar, electric bass, saxophone, and keyboards. It became widely popular in the 1980s through the performances of Clifton Chenier, Queen Ida, Buckwheat Zydeco, Boozoo Chavis, and others.

zymogen \'zī-mə-jən\ *or* **proenzyme** Any of a class of proteins that are secreted by cells and are inactive precursors of enzymes. Transformation into active enzymes occurs as one or more peptide bonds in the zymogen are cleaved. Examples include trypsinogen and chymotrypsinogen, secreted by the pancreas and converted by proteolysis in the small intestine into the active enzymes trypsin and chymotrypsin; and numerous coagulation factors.

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Other Contributors: Tech-Graphics Corporation of Atlantic Highlands, N.J., produced the encyclopedia's diagrams. John Nelson provided its maps. Susana Darwin and Amor Montes de Oca selected and prepared the photographs from the Encyclopædia Britannica collection. Mark Diller drew up the religion entry list. Ellen Sullivan Farley and Loree Hany assisted in technical preparation of the art. Dale Good served as consultant on project management. Ted Atanowski provided computer assistance. The text was typeset by the Clarinda Co. of Clarinda, Iowa, under the exemplary direction of Dee Hughes. Finally, John M. Morse, publisher of Merriam-Webster, conceived the encyclopedia more than 20 years before its publication and offered indispensable support and encouragement throughout its development.

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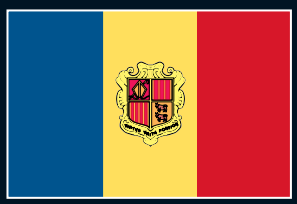
Afghanistan

Albania

Algeria


Andorra*

Angola

Antigua and Barbuda

Argentina

Armenia

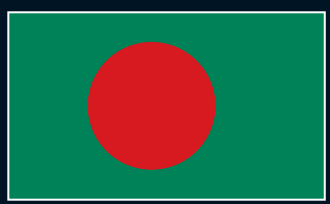
Australia

Austria*

Azerbaijan

The Bahamas

Bahrain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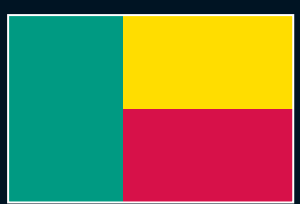
Barbados

Belarus

Belgium

Belize


Benin

Bhutan

Bolivia*

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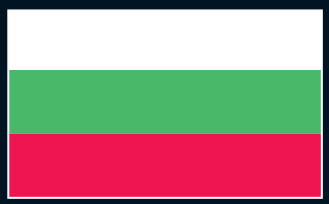
Bosnia and Herzegovina

Botswana

Brazil

Brunei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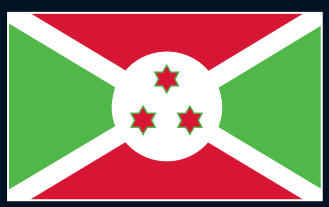
Burkina Faso


Burundi

Cambodia

Cameroon

Canada

Cape Verde

Central African Republic

Chad

Chile

China

Colombia

Comoros

Democratic Republic of the Congo

Republic of the Congo

Costa Rica*

Côte d'Ivoire

Croatia

Cuba

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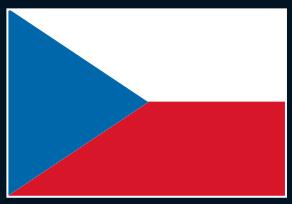
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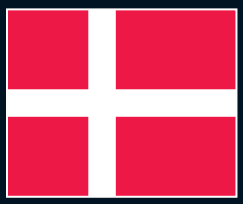
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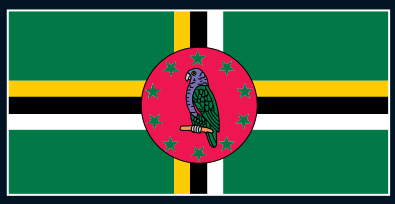
Djibouti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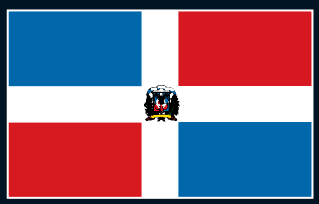
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East Timor

Ecuador*

Egypt

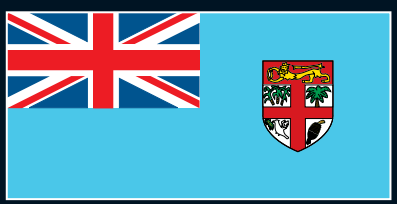
El Salvador

Equatorial Guinea

Eritrea

Estonia

Ethiopia

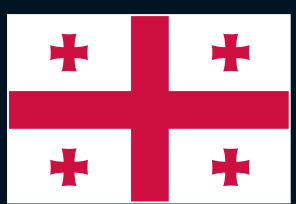

Fiji

Finland*

France

Gabon

The Gambia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Germany

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Ghana

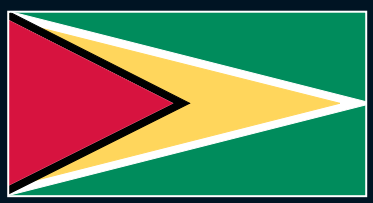
Greece

Grenada

Guatemala*

Guinea

Guinea-Bissau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Haiti*

Honduras

Hungary

Iceland

India

Indonesia

Iran

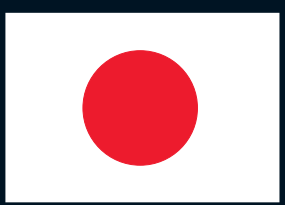
Iraq

Ireland

Israel

Italy

Jamaica


Japan

Jordan

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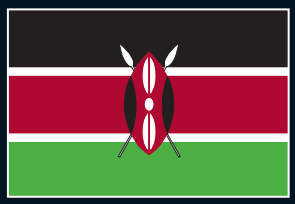
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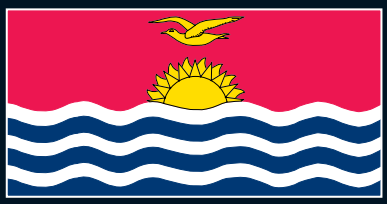
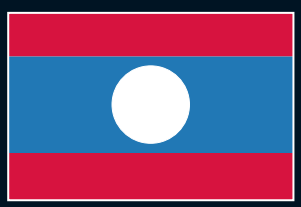

Kiribati

North Korea

South Korea

Kuwait

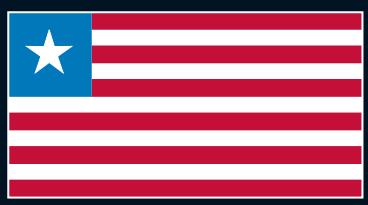
Kyrgyzstan


Laos

Latvia

Lebanon

Lesotho


Liberia

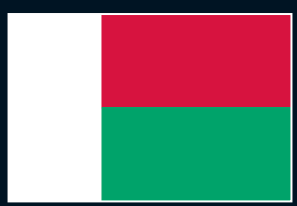
Libya

Liechtenstein

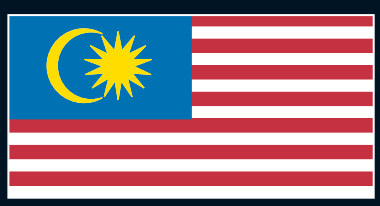
Lithuania

Luxembourg

Macedonia


Madagascar

Malaŵi


Malaysia

Maldives

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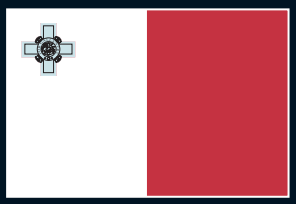
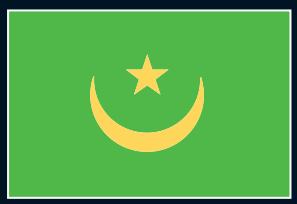
Mali


Malta

Marshall Islands


Mauritania

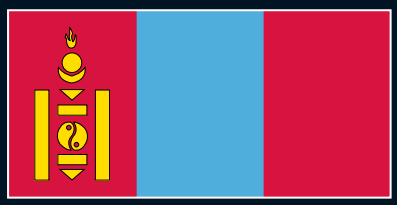
Mauritius

Mexico

Micronesia, Federated States of

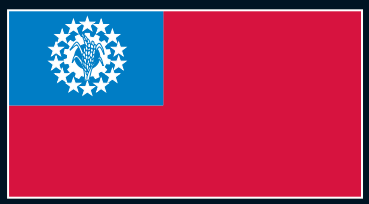
Moldova

Monaco


Mongolia

Morocco

Mozambique

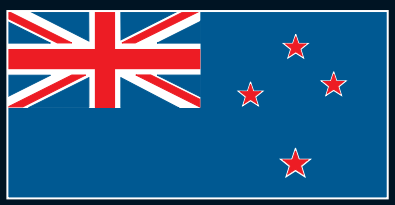

Myanmar

Namibia

Nauru

Nepal

The Netherlands


New Zealand

Nicaragua*

Niger

Nigeria

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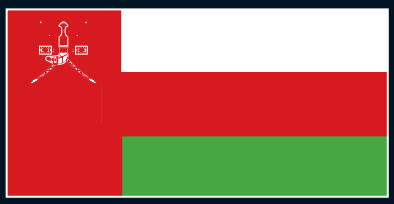
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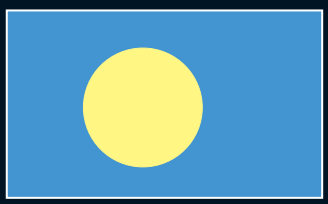
Pakistan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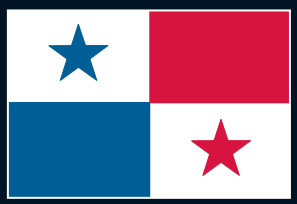
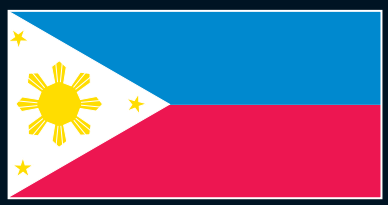

Panama

Papua New Guinea

Paraguay

Peru*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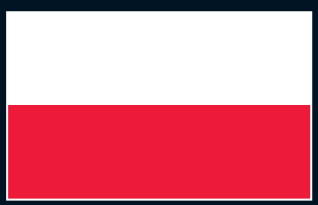

Poland

Portugal

Qatar

Romania

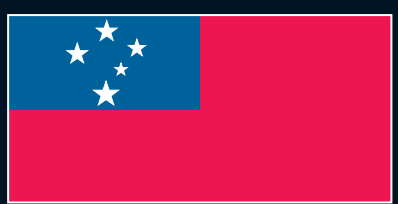
Russia

Rwanda

Saint Kitts & Nevis

Saint Lucia

Saint Vincent & the Grenadines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San Marino*

São Tomé and Príncipe

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Senegal

Serbia and Montenegro

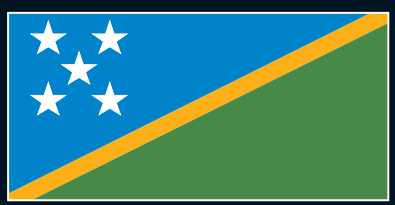
Seychelles

Sierra Leone

Singapore

Slovakia

Slovenia


Solomon Islands

Somalia

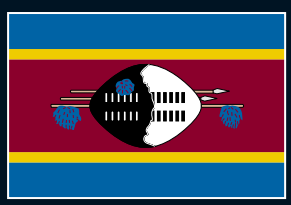
South Africa

Spain

Sri Lanka

Sudan

Suriname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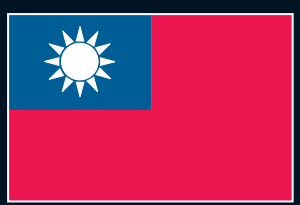
Sweden

Switzerland

Syria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Tajikistan

Tanzania

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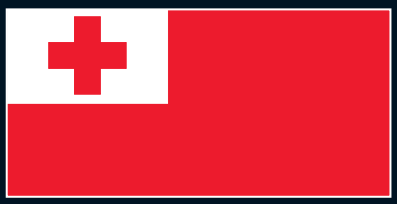
Thailand

Togo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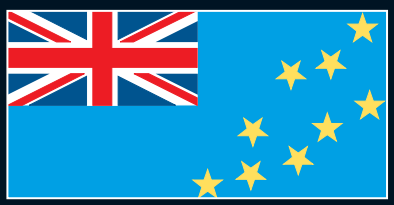
Trinidad and Tobago

Tunisia

Turkey

Turkmenistan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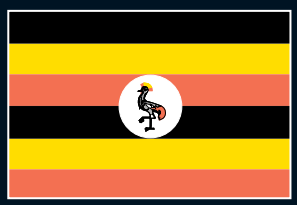
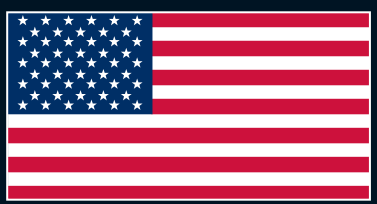

Uganda

Ukraine

United Arab Emirates

United Kingdom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Uruguay

Uzbekistan

Vanuatu

Vatican City

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Yemen

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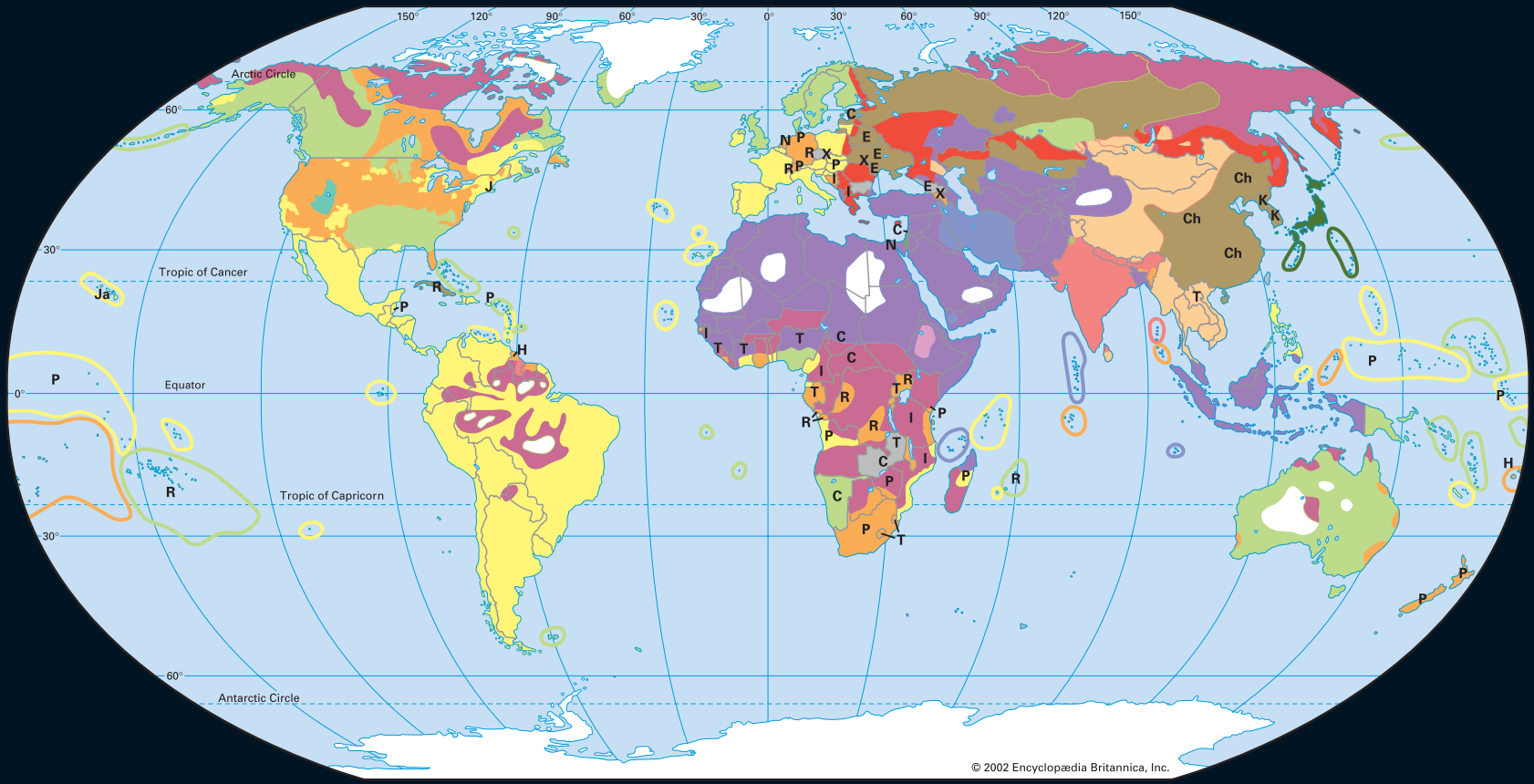

- Buddhism
- Ch Chinese religions[1]
- C Christianity, undifferentiated by branch[2]
- E Eastern Orthodoxy[3]
- H Hinduism
- N Independent churches of Eastern Christianity[4]
- T Indigenous (tribal) religions
- I Islam, predominantly Sunni
- Islam, predominantly Shi'ite
- Ja Japanese religions[1]
- J Judaism
- K Korean religions[1]
- Mormonism
- Sikhism
- P Protestantism
- R Roman Catholicism
- X Nonreligious
- No dominant religion
- Uninhabited

Footnotes:

[1] In certain eastern Asian areas, many of the people have plural religious affiliations. Chinese and Korean religions include Buddhism, Taoism, Confucianism, and folk cults. The Japanese religions include Shintō and Buddhism.

[2] Chiefly mingled Protestantism and Roman Catholicism, neither predominant.

[3] Including Greek and Russian Orthodox Christianity.

[4] Including Armenian, Coptic, Ethiopian, East and West Syrian.

Note:

The majority of the inhabitants in each of the areas colored on the map share the religious tradition indicated. Letter symbols show religious traditions shared by at least 25 percent of the inhabitants within areas no smaller than 1,000 square miles. Therefore minority religions of city dwellers have generally not been represented.

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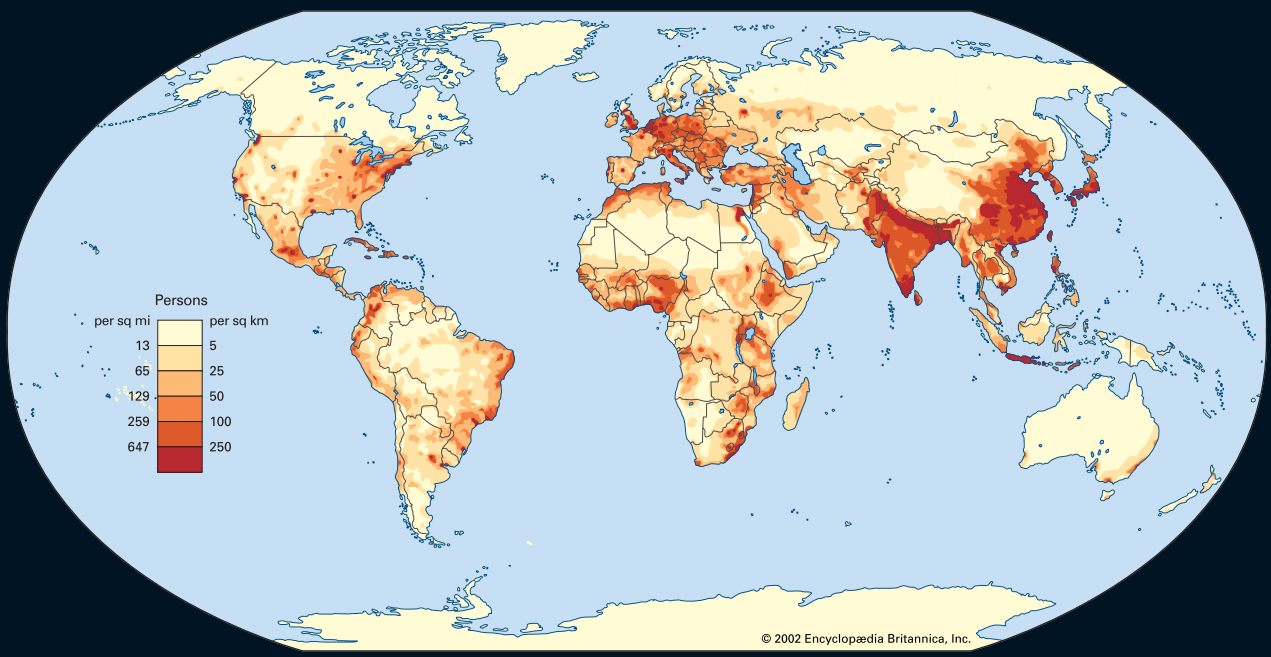
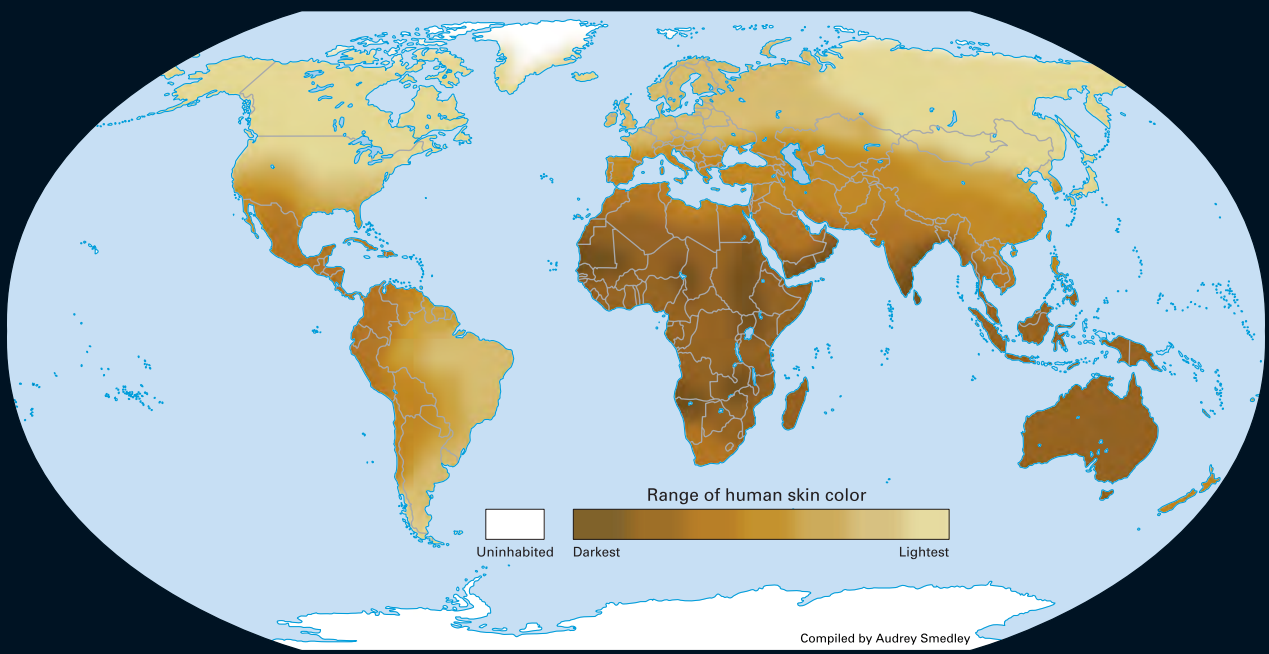
World Population Density



Indigenous Skin Color



The distribution of skin color variations of indigenous populations before colonization by Europeans.
This map represents a reconstruction of populations based on a number of sources. In some cases, areal characteristics have been estimated from descriptions (or drawings) of first contact by the earliest Europeans. In other cases, where there was little European contact or where there is scant information about native populations (as, for example, the populations of Inner Asia), skin color was estimated from surrounding populations and geographic and climatological information. On a map of this scale, it is difficult to give more than a representation of current understanding. It must also be noted that many populations, even before the modern era, were quite heterogeneous in skin color, and this heterogeneity is difficult to depict accurately on any scale. In areas of the world where the indigenous population was sparse and widely scattered (such as Australia), the map's color density can be misleading. Further, some populations, such as the Tasmanians (who are virtually extinct) and Maoris (who have been widely mixed with Europeans), present only a few examples of "unmixed" individuals in historical records.

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On this plate and the adjoining one is a sampling of official World Heritage sites, as designated by the United Nations Educational, Scientific and Cultural Organization (UNESCO).

This page (clockwise): Rose window, Notre-Dame de Paris, 13th century; terra-cotta warriors from the 3rd-century BC Qin tomb of Emperor Shihuangdi, near Xi'an, China; elephants and acacia trees on the plain near Kilimanjaro, Tanzania; abundant and colourful sea life on the Great Barrier Reef, off the northeast coast of Australia; cruciform Coptic church carved from solid rock, c. 13th century, Lalibela, Ethiopia.

Plate 14: Photographs (clockwise from top left) The Bridgeman Art Library/Getty Images; Keren Su—Taxi/Getty Images; Renee Lynn—Stone/Getty Images; Jeff Hunter—The Image Bank/Getty Images; Upperhall Ltd./Robert Harding World Imagery/Getty Images.

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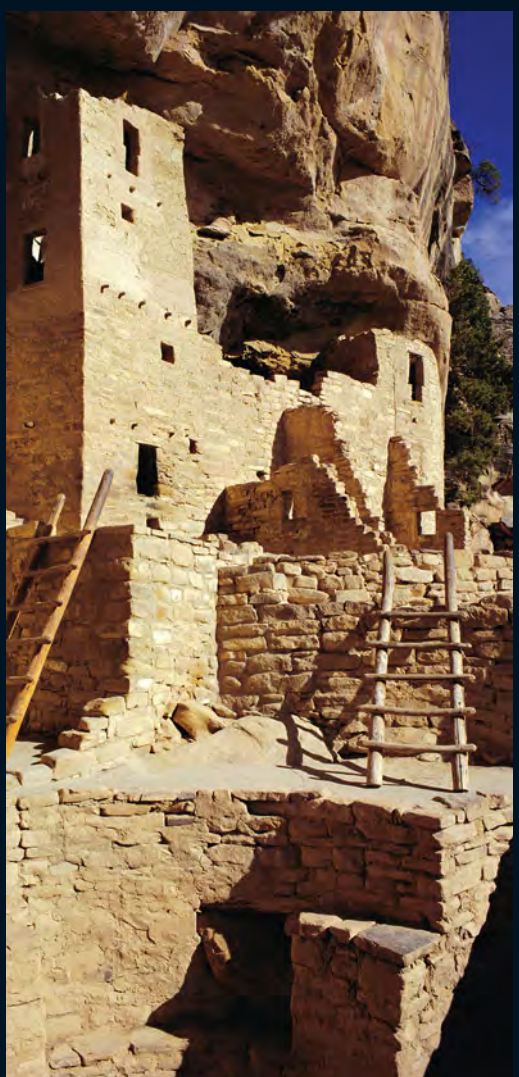

This page (clockwise from top left) the pyramid El Castillo in the Mayan city of Chichén Itzá, founded 6th century AD, Yucatán, Mexico; Temple of the Golden Pavilion, Kyōto, Japan, 14th century (rebuilt, 1955); the Taj Mahal, built mainly 1632–43 by Shah Jahan as a mausoleum for his wife Mumtaz Mahal, Agra, India; giant tortoise on Isabela Island, Galapagos Islands, off the coast of Ecuador; Anasazi cliff dwellings, c. 1200, Mesa Verde National Park, Colorado; detail of a painted ceiling in Rila Monastery, southwestern Bulgaria.

Plate 15: Photographs (clockwise from top left) © Corbis; Kaz Mori—The Image Bank/Getty Images; Gavin Hellier—Robert Harding World Imagery/Getty Images; Craig Lovell/Corbis; Walter Rawlings—Robert Harding World Imagery/Getty Images; © Corbis.

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Time is calculated from the meridian of Greenwich, England. The middle of the zero time zone passes through Greenwich with its east and west limits 7°30′ on each side. Each 15° zone east and west of the initial zone represents one hour of time. The number of hours (h) and minutes (m) that must be added to or subtracted from local time to give Greenwich time is indicated on the map for each zone and for area units that have a different time from the zone in which they are located.

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